TSTool
— Time Series Tool —

Command Reference

Version 10.21.00, 2013-04-21

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TSTool Syntax Guide

Version 10.13.00, 2012-10-23

TSTool commands use a number of syntax (notation) conventions that have been implemented over time in response to functionality requirements. This appendix provides a summary of the syntax as a guide for users and future software development. Syntax standards listed here should be used where possible to ensure consistency in software features.

Where appropriate, notation has been selected based on other efforts. For example, date/time formatting is patterned after the C language `strftime()` function, which has been available for over 30 years. In cases where notation is specific to TSTool, an attempt has been made to consider common notation standards that can be adapted for TSTool. In cases where one or more existing standards are in place, the most common or relevant standard for TSTool has been selected, with an option to implement additional standards in the future.

Although standard notation is utilized into the software design, support for notation in commands may be incomplete because some commands use older code. For example, the ability to use properties to specify command parameters is implemented only for commands that have specifically required such functionality. Future software enhancements will continue to update code to universally provide standard features.

The following sections are ordered roughly in the order that topics are likely to be encountered, with headings grouped according to major TSTool design elements.

Commands – Basic Syntax

The syntax for commands adheres to the following syntax:

```
CommandName(Parameter1=Value1,Parameter2=Value2)
```

The `CommandName` matches a command from the TSTool ***Commands*** menu and as documented in the **Command Reference** documentation, which describes command parameters. Any parameter value can be surrounded by double quotes to protect whitespace and other characters (such as characters used in the command itself including equal sign, comma, and parenthesis). However, double quotes typically are used only for parameter values that are text, dates, filenames, etc., and not simple data such as numbers.

Commands currently cannot be indented, although this may be enabled in the future.

Command names and parameters generally are case-insensitive. However, "camel" notation (mixed upper and lower-case letters) is used to improve readability. In some cases this results in an acronym being converted from uppercase to missed-case (e.g., "USGS" becomes "Usgs").

Commands – Referring to Parameters

In some cases it is necessary to set one command parameter using the value of another command parameter. This capability has been implemented for a small number of commands, for example `NewStatisticEnsemble()`. To reference a command parameter in another parameter, use the notation:

```
CommandName(Parameter1=Value1,Parameter2="${C:Parameter1}…etc")
```

This notation uses `C:` to provide a "command scope", similar to how the `TS:` notation provides a scope for time series properties (discussed below).

Commands – Comments

Command files use comments to disable commands without deleting them. A # character at the start of a line indicates a one-line comment. A group of lines that start with `/*` and end with `*/` indicate a block of comments and all intervening commands will be ignored in processing.

Commands – Time Series Identifiers

Time series identifiers (TDIDs) uniquely identify time series and are discussed in detail in the **Introduction** chapter. TSID commands, which match the syntax discussed below, are created when using the data browsing features of the TSTool main interface, are specified by some commands, and can be edited manually if the user edits a command file with a text editor. These commands are essentially "read" commands that use default parameters (e.g., the global input period and do not assign an alias).

There are two main forms of TSIDs:

```
Location.DataSource.DataType.Interval[.Scenario]~DataStore[~FileName]

Location.DataSource.DataType.Interval[.Scenario]
```

The first form of the TSID is a unique identifier for a time series, similar to a Universal Resource Indicator (URI) for a web page, and allows software to locate the data for reading. The datastore (or "input type" and corresponding filename) allow the software to find the source of the data.

The second form of the TSID is a unique identifier for a time series within TSTool and is used after reading the data. In cases where more than one time series will have the same TSID after reading, an alias can be assigned (see the **Introduction** chapter and the **Time Series – Properties** section below).

TSIDs may be more complex if, for example, the data type requires the use of multiple parts for uniqueness. In this case, a dash may be used (e.g., `Streamflow-Max`). The datastore appendices describe how time series properties from the original source are mapped into TSID notation.

Processor – Properties

TSTool commands are processed, and data managed, by a time series "processor". The processor interacts with all commands and is controlled with properties that initially have internal defaults (e.g., the default is to read all available data rather than a specified input period). Properties that control the processor are set with specific commands (e.g., `SetInputPeriod()`) and user-supplied properties can be set with the `SetProperty()` command (e.g., it is common to manage file locations and dates used in processing). The `ReadPropertiesFromFile()` and `WritePropertiesToFile()` commands can be used to save and manage properties outside of TSTool.

Processor properties can be used to specify parameters for commands using the following notation:

```
${PropertyName}
```

For example, some commands that operate on files allow the property `${WorkingDir}` to be used for the current working directory. Refer to command documentation to determine if properties are supported. Additional support is being phased in as resources allow and to satisfy requirements.

Properties internally have a specific data type. For example the input start and end use a "DateTime" object type supported by TSTool. All properties will convert to strings, for example when saved to a properties file. Some care may need to be taken to use properties of an appropriate type but a general rule is that properties used in file names or similar can simply be handled as strings.

Time Series – Properties

Time series properties are specific to individual time series. Some internal properties are handled as specific data values (e.g., data units are a string associated with a time series) whereas user-assigned properties are assigned to the time series as a list (see the `SetTimeSeriesProperty()` command). Time series properties are used by some commands to control the command functionality and output. For example, many commands that create time series allow the alias to be assigned using time series properties. The following notation is used when dealing with time series properties:

- % formatting – Many commands that create time series allow the `Alias` or other parameters to be assigned using % formatters. For example, `Alias="%L"` indicates that the time series alias should be assigned to the location part of the time series identifier, which for a read command is controlled by the rules of the command. Format specifiers are provided for fundamental time series data properties that are required for each time series (units, location, data type, etc.).
- `TS:Property` reference – Some command parameters need to specify a time series property by reference but the above formatting notation is inappropriate. In this case, the following design is being phased in (under development):
    - `TS:PropertyName`
    - `${TS:PropertyName}`

  The latter notation allows a time series property to be specified using a notation similar to processor properties, but the `TS:` prefix differentiates the property from the more generic processor notation.

Note that using time series properties in commands in some cases must be limited because TSTool uses a "discovery mode" to partially read/create time series so that they can be listed in "downstream" commands. Too much reliance on internal time series data might require reading more time series data, which can greatly decrease software performance in discovery mode.

Time Series – Data Flags

Time series data values (measurements, observations, etc.) are managed internally as lists of date/time, value, and flag data. A data flag is a string that is assigned a value based on one of the following cases:

- missing data value with a flag
- non-missing data value and no data flag
- non-missing data value with a flag

Data flags are useful for indicating the quality of a data value (e.g., `E` might indicate estimated) and for tracking how specific data values are manipulated (e.g., append to the data flag as specific actions are taken). TSTool generally does not implement a standard for data flags because flags used in input data may vary. However, some commands allow setting flags based on simple rules. For example fill

commands generally have a `FillFlag` parameter to set the data flag for filled values. The following table lists notation that is used to provide flexibility in setting data flags. The first notation option is used by most commands and the other options are being phased in (refer to command documentation to confirm available data flag functionality).

Command Parameter Notation Used When Setting Data Flag

Notation	Description
`x`	Set the data flag to `x` regardless of whether it has already been set.
`+x`	If the flag has not been set, set to `x`. If the flag has been set, append `x`. This notation is useful when there are no concerns about the order of characters in multi-character flags.
`+,x`	If the flag has not been set, set to `x`. If the flag has been set, append `,x`. This notation is useful when flags are set for each step in a process.
`Auto`	Some commands allow `Auto` or another string as the flag. In this case, the command will decide the flag value that is assigned, based on some condition. For example, the flag may be assigned based on which time series was used to fill the value.

Data points in graphs can be labeled in various ways to facilitate interpretation of the data. For example, each data point can be labeled with the data value, flag, or other information. Similar to time series property formatting, the notation `%q` in graph data point labels indicates that the points should be labeled with the data flag.

Date/Time

Date/time notation is ubiquitous when dealing with time series, and includes use for the following:

- date/time associated with specific data values
- date/time pair that indicates data period or subset of the full data period
- date/time pair indicating a window within each year

In most cases TSTool will default to displaying date/time using the ISO 8601 specification, which is essentially `YYYY-MM-DD hh:mm:ss`. Not only does this implement a global standard, but it also ensures that date/times are formatted in a way that allows sequential sorting. The precision of formatted date/times is generally consistent with the time series data interval (e.g., monthly time series will have dates that are by default formatted as YYYY-MM).

It may be desirable or necessary to specify the format of date/times, for example to indicate the format for output or parsing. When this is necessary, the notation utilizes an optional format type prefix and the format itself, as follows:

- The default is to parse the date/time string by matching ISO or other common formats (this works most of the time). The default output format is the ISO format.
- `C:%m%d%y` – Indicates that a C-style format is being used, where the formats match the UNIX `strftime()` function syntax. See the `FormatDateTimeProperty()` command documentation.

- In the future support for Microsoft Excel or other notation may be added (e.g., `MM-YYYY`).

Regular Expression – Notation

Regular expressions are strings that indicate how to match patterns, for example to match file names or time series identifiers (see: http://en.wikipedia.org/wiki/Regular_expression). Many software tools and programming languages implement regular expressions to facilitate efficient data processing; however, the notation can be confusing, especially if not used on a regular basis. Within TSTool the following regular expression notations are used:

- "globbing" – This notation was popularized by UNIX and in simple terms relies on the * character to indicate "match zero or more characters". For example, it can be used to match a list of comma-separated-value files using the expression `*.csv`.
- Regular expression syntax – True regular expression syntax provides much more power than globbing notation, but also introduces complexity in notation. TSTool is written in Java and internally relies on Java's regular expression syntax.

In most cases, TSTool commands and configuration files use the simpler globbing notation because it is easier to use and explain. However, in some cases the more powerful regular expression syntax is needed. Where confusion may result, the command documentation clearly indicates the syntax that is supported, and commands may accept the notation `glob:xxxx` or `regex:xxxx` to indicate the type of regular expression that is being specified.

Template – Syntax

Template files are used when processing is automated to iterate over one or more lists of input data. For example, the same 10 commands may be executed for each of 100 time series. TSTool uses the FreeMarker template library to process templates. See the `ExpandTemplateFile()` command documentation for an explanation of syntax.

Configuration File – TSTool Configuration File

The TSTool configuration file uses a simple notation to assign properties:

```
[Section]

Property = Value
```

The `[Section]` notation is internally used as a prefix on the property name (e.g., `Section.Property = Value`). Comments are lines that start with #. Property values can be surrounded by double quotes.

Configuration File – Datastore Properties

Datastore property files use the simple notation:

```
Property = Value
```

Comments are lines that start with #. Property values can be surrounded by double quotes. The specific property values are described in TSTool datastore appendices.

Configuration File – Time Series Product Files

Time series product configuration file uses a simple notation to assign properties:

```
[Section]

Property = Value
```

The `[Section]` notation is internally used as a prefix on the property name (e.g., `Section.Property = Value`). Comments are lines that start with #. Property values can be surrounded by double quotes. See also the **TSView Time Series Viewing Tools** appendix.

Command Glossary

Version 07.01.00, 2007-03-02, Acrobat Distiller

The following parameter names and terms are used throughout TSTool commands. A term indicated in **bold** font is a definition. A term indicated in **`bold courier`** font is a parameter name. Parameters that are infrequently used are listed with the corresponding commands. Common parameters are defined but long lists of corresponding commands are not provided.

`a1,…` – Used with the `ARMA()` command.

`b1,…` – Used with the `ARMA()` command.

Alias – A (generally) short identifier for a time series, used in place of the TSID, which simplifies commands. The Alias and TSID values are interchangeable when used as parameters to commands and may both be referred to as TSID in command editors. See also TSID.

`Alias` – A (generally) short identifier for a time series, used in place of the TSID, which simplifies commands. When used to create/read a time series, the syntax of a command is typically similar to: `TS Alias = command(…)`. See also TSID.

`AddTSID` – Time series identifiers for time series to add. See the `add()` command.

`AddValue` – A numerical value to be added to a time series. See the `addConstant()` command.

`AdjustMethod` – Indicates the method used when adjusting a time series. See the `adjustExtremes()` command.

`AllowMissingCount` – Indicate how many missing data values are allowed in an interval, in order to allow processing. See the `changeInterval()` and `newStatisticYearTS()` commands.

`AnalysisEnd` – A DateTime that indicates the end of an analysis.

`AnalysisMonth` – One or more months indicating which months should be processed in the analysis. See the `fillRegression()` command.

`AnalysisStart` – A DateTime that indicates the start of an analysis.

`ARMAInterval` – The data interval used in an ARMA analysis. See the `ARMA()` command.

`AutoExtendPeriod` – Indicate whether to autoextend the period of all time series to be the output period. See the `setAutoExtendPeriod()`command.

`AverageEnd` – A DateTime that indicates the end of an averaging analysis. See the `setAveragePeriod()` command.

`AverageMethod` – Indicate the method to use when averaging data. See the `runningAverage()` command.

AverageStart – A DateTime that indicates the start of an averaging analysis. See the `setAveragePeriod()` command.

BlendMethod – The method to use when blending time series. See the `blend()` command.

BlendTSID – Time series identifiers for time series to blend into main time series. See the `blend()` command.

Bracket – The number of days to search forward and back for a non-missing value. See the `newEndOfMonthTSFromDayTS()` and `runningAverage()` commands.

CalculateFactorHow – Indicate how to calculate the factor used when prorating values. See the `fillProrate()` command.

CommandLine – The command line for a program to run. See the `runProgram()` command.

ConstantValue – A numerical value used for filling, etc. See the `fillConstant()`, `setConstant()` and `setConstantBefore()` command.

DatabaseName – The name of a database, when making a database connection. See the `openHydroBase()` command.

DatabaseServer – The name of a database server, when making a database connection. See the `openHydroBase()` command.

DataSource – The data source to use when forming a TSID. See the `createFromList()` command.

DataType – The data source to use when forming a TSID. See the `createFromList()` command.

DateTime – A date/time value, typically represented as a string, which indicates a point in time. Date/time strings have a precision that is interpreted by the software. For example, the date/time string `1990` has a precision of year, whereas the string `1990-01-12` has a precision of day.

DateTime – A specific date/time associated with time series data. See the `setDataValue()` command.

DayTSID – Time series identifier for a daily time series. See the `newDayTSFromMonthAndDayTS()` command.

DefaultFlow – Indicate a default flow value to be used if observations or filled values cannot be found. See the `lagK()` command.

Delim – The delimiter character(s) used when processing delimited files. See the `createFromList()` command.

DependentAnalysisEnd – A DateTime that indicates the end of an analysis of dependent time series. See the `fillMOVE2()` command.

DependentAnalysisStart – A DateTime that indicates the start of an analysis of dependent time series. See the `fillMOVE2()` command.

Description – The description (name) for a time series. See the `newTimeSeries()` command.

DeselectAllFirst – Indicate whether to deselect all time series before processing the command. See the `selectTimeSeries()`command.

DiffFlag – A character flag used to indicate when time series values are different. See the `compareTimeSeries()` command.

Divisor – Indicate which time series is the divisor. See the `relativeDiff()` command.

DivisorTSID – Time series identifier for time series to divide another time series. See the `divide()` command.

ExtremeToAdjust – Indicates whether the maximum or minimum value in a time series should be adjusted. See the `adjustExtremes()` command.

ExtremeValue – The threshold value when adjusting extreme values. See the `adjustExtremes()` command.

FillDirection – Indicate which direction (`Foreward` or `Backward`) filling should occur. See the `fillProrate()` and `fillRepeat()` commands.

FillEnd – A DateTime that indicates the end of a fill process.

FillFlag – A character flag used to indicate when time series values are filled. See the `fillhistMonthAverage()`, `fillHistYearAverage()`, `fillMOVE2()`, `fillProrate()`, and `fillRegression()` commands.

FillNearest – Indicate whether missing data values should be filled with the nearest non-missing value. See the `lagK()` command.

FillStart – A DateTime that indicates the start of fill process.

FillUsingCIU – Indicate whether missing data values should be filled using "currently in use" (CIU) data from HydroBase. Additional zeros will be included in data. See the `fillUsingDiversionComments()` command.

FillUsingCIUFlag – A character flag used to indicate when time series values are filled with CIU information (see `FillUsingCIU`). See the `fillUsingDiversionComments()` command.

FillUsingDivComments – Indicate whether missing data values should be filled using diversion comments from HydroBase. Additional zeros will be included in data. See the `readHydroBase()` and `TS Alias = readHydroBase()` commands. Also see the `fillUsingDiversionComments()` command.

FillUsingDivCommentsFlag – A character flag used to indicate when time series values are filled. See the `readHydroBase()`, and `TS Alias = readHydroBase()` commands.

HandleMissingHow – Indicate how to handle missing data values when processing time series. For example, when adding time series, missing values can be ignored or can result in a missing value in the result. See the `add()`, `cumulate()`, and `subtract()` commands.

HandleMissingTSHow – Indicate how to handle missing time series during processing. See the `createFromList()` command.

ID – The identifier to match in a file. See the `createFromList()` command.

IDCol – The column number (or name) to be read from a delimited file. See the `createFromList()` command.

IgnoreLEZero – Indicate whether values less than or equal to zero should be ignored when computing historical averages for time series. See the `setIgnoreLEZero()` command.

IncludeMissingTS – Indicate whether missing time series (e.g., from a query or read) should automatically be included using default information. See the `setIncludeMissingTS()` command.

IndependentTSID – Time series identifier for the independent time series being processed. See the `fillFromTS()`, `fillMOVE2()`, `fillProrate()`, `fillRegression()`, `setFromTS()`, and `setMax()` commands.

InflowStates – The inflow states (initial states) when routing a flow time series. See the `lagK()` command.

InitialValue – Indicate an initial value needed for computations. See the `fillProrate()` and `newTimeSeries()` commands.

InputEnd – A DateTime that indicates the end of a file read or a database query.

InputFile, InputFile1, InputFile2 – The name of an input file to read, used by many commands.

InputName – The input name to use when forming a TSID. See the `createFromList()` command.

InputStart – A DateTime that indicates the start of file read or a database query.

InputType – The input type to use when forming a TSID. See the `createFromList()` command.

Intercept – The intercept to be enforced when determining a line of best fit. See the `fillRegression()` command.

Interval – The data interval to use when forming a TSID. See the `createFromList()`, `readHydroBase()`, and `shiftTimeByInterval()` commands.

K – The attenuation factor used when routing a flow time series. See the `lagK()` command.

Lag – The lag term for routing a flow time series. See the `lagK()` command.

Length – The length of a time series trace. See the `createTraces()` command.

ListFile – The name of an input or output list (delimited) file to be written or read, specified using a relative or absolute path. See the `createFromList()` command.

LogFile – The name of the log file, specified using a relative or absolute path. See the `setLogFile()` command.

LogFileLevel – The level for messages printed to the log file. See the `setDebugLevel()` and `setWarningLevel()` commands.

MatchDataType – Indicate whether the data type part of a TSID should be matched when comparing time series identifiers. See the `compareTimeSeries()` command.

MatchLocation – Indicate whether the location part of a TSID (Alias) should be matched when comparing time series identifiers. See the `compareTimeSeries()` command.

MaxIntervals – The maximum number of intervals to process, typically used to limit a fill or analysis procedure. See the `adjustExtremes()`, `fillInterpolate()`, and `fillRepeat()` commands.

MaxValue – The maximum value in an analysis. See the `normalize()` and `replaceValue()` commands.

Method – A method used when processing data, used to more specifically control how a command functions. See the `analyzePattern()` and `disaggregate()` commands.

MinValue – The minimum value in an analysis. See the `normalize()` and `replaceValue()` commands.

MinValueHow – Indicate how to determine the minimum value in an analysis. See the `normalize()` command.

MissingValue – A numerical value used for missing data in time series. See the `writeStateMod()` command.

MonthTSID – Time series identifier for a monthly time series. See the `newDayTSFromMonthAndDayTS()` command.

MonthValues – Monthly values used for filling, etc. See the `setConstant()` command.

MultiplierTSID – Time series identifier for the time series to multiply the main time series. See the `multiply()` command.

Multiplier – Value(s) to multiply time series value(s) by when processing. See the `shiftTimeByInterval()` command.

NewDataType – The data type for a new time series, typically used where the data type must be explicitly defined and is not determined from a TSID. See also `NewTSID`. See the `changeInterval()` command.

NewInterval – The data interval for a new time series, typically used where the interval must be explicitly defined and is not determined from a TSID. See also `NewTSID`. See the `changeInterval()` command.

NewTimeScale – The new time scale (`ACCM` for accumulated data, `INST` for instantaneous data, `MEAN` for mean data) for a time series. See the `changeInterval()` command.

NewTSID – The new time series identifier for a time series, used with commands that create new time series. See the `copy()` and `newDayTSFromMonthAndDayTS()` commands.

NewUnits – The new data units for a time series. See the `converDataUnits()`, `TS Alias = readDateValue()`, `TS Alias = readMODSIM()`, `TS Alias = readNWSCard()`, and `TS Alias = readRiverWare()` commands.

NewValue – The new value in an analysis. See the `replaceValue()` and `setDataValue()` commands.

NumEquations – Number of equations to use when analyzing data (typically one or monthly equations). See the `fillMOVE2()` and `fillRegression()` commands.

ObsTSID – The time series identifier for an observed time series. See the `lagK()` command.

OdbcDSN – The Open Database Connectivity (ODBC) Data Source Name (DNS) for a database connection. See the `openHydroBase()` command.

OldTimeScale – The old time scale (`ACCM` for accumulated data, `INST` for instantaneous data, `MEAN` for mean data) for a time series. See the `changeInterval()` command.

OutflowStates – The outflow states (initial states) when routing a flow time series. See the `lagK()` command.

OutputEnd – A DateTime that indicates the end of output.

OutputFile – The name of an output file to be written, specified using a relative or absolute path.

OutputStart – A DateTime that indicates the start of output.

OutputYearType – Indicate the type of year (e.g., calendar year, water year) for output. See the `setOutputYearType()` command.

PatternFile – The file name for a pattern file. See `setPatternFile()` command.

PatternID – An identifier for a pattern (e.g., WET, DRY, AVG). See the analyzePattern() and fillPattern() commands.

Percentile – Percentile value(s) used when analyzing time series. See the analyzePattern() command.

Pos – The position in the time series list. See the deselectTimeSeries() and selectTimeSeries() commands.

pP – Used with the ARMA() command.

Precision – The precision (number of digits after the decimal point) used when comparing values or formatting values for output. See the compareTimeSeries(), writeRiverWare(), and writeStateMod() commands.

QueryEnd – A DateTime that indicates the end of a database query. The InputEnd parameter is preferred and is used in new commands.

QueryStart – A DateTime that indicates the start of database query. The InputStart parameter is preferred and is used in new commands.

qQ – Used with the ARMA() command.

Read24HourAsDay – Indicate that a time series with data interval 24Hour should be automatically read as Day. See the readNwsCard() and TS Alias = readNwsCard() commands.

ReadEnd – A DateTime that indicates the end of a file read. See the readNWSCard() command. The InputEnd parameter is preferred.

ReadStart – A DateTime that indicates the start of file read. See the readNWSCard() command. The InputStart parameter is preferred.

RecalcLimits – Recalculate the data limits for a time series, usually when supplemental raw data are being supplied after an initial read. See the fillUsingDiversionComments() command (used with the State of Colorado's HydroBase input type).

ReferenceDate – The starting date for a time series trace. See the createTraces() command.

Reset – A DateTime field that indicates when to reset data values in a manipulation. For example, a time series may be set to zero at the start of each year when used with the cumulate() command. See the cumulate() command.

RunMode – Typically used to indicate whether the command should be processed in batch mode, via the GUI, or both. See the openHydroBase(), processTSProduct(), and setWorkingDir() commands.

Scale – A scale factor to be applied to data. See the writeRiverWare() command.

ScaleValue – A numerical value used for scaling time series. See the scale() command.

Scenario – The scenario to use when forming a TSID. See the `createFromList()` command.

ScreenLevel – The level for messages printed to the screen (console). See the `setDebugLevel()` and `setWarningLevel()` commands.

SelectAllFirst – Indicate whether to select all time series before processing the command. See the `deselectTimeSeries()`command.

SearchStart – A DateTime that indicates the search start date/time in an analysis. See the `newStatisticYearTS()` command.

SetEnd – A DateTime that indicates the end of a set process.

Set_scale – See the `writeRiverWare()` command.

SetStart – A DateTime that indicates the start of set process.

Set_units – See the `writeRiverWare()` command.

ShiftDataHow – Indicate how to shift time series traces. See the `createTraces()` command.

SpecifyWeightsHow – Indicate how to specify weights when processing time series. See the `TS Alias = weighTimeSeries()` command.

Statistic – A statistic to evaluate. See the `newStatisticYearTS()` command.

SubtractTSID – Time series identifiers for time series to subtract. See the `subtract()` command.

Suffix – The suffix to be automatically applied to the name of a file. See the `setLogFile()` command.

TestValue – A test value used in an analysis. See the `newStatisticYearTS()` command.

Timeout – The timeout when running an external program, after which processing will continue. See the `runProgram()` command.

Tolerance – A value (or values) used to indicate an allowable error/difference. See the `compareTimeSeries()` command.

TransferHow – Indicate how to transfer data during processing, either according to the date/time or sequentially. The latter can be used when time series do not align on date/time (e.g., due to a shift, leap year, etc.). See the `setFromTS()` command.

Transformation – Indicate whether the time series data should be transformed before processing. See the `fillInterpolate()`, `fillMOVE2()` , and `fillRegression()` commands.

TSID – Time series identifier, which is used to uniquely identify a time series. In full notation, this consists of a string similar to the following: *Location.DataSource.DataType.Interval.Scenario~InputType~InputName*. In abbreviated form, the InputType and InputName are often omitted. The InputType and InputName are typically used only by read and write commands. Because a TSID may be long (especially when file

names are used for the InputName), an Alias may be assigned to the time series. The TSID parameter is typically used in commands for the time series that is being processed. See also Alias.

TSID – When used as a command parameter the time series identifier indicates the time series to be processed. The TSID or alias can typically be specified. See also `Alias`.

TSID1 – Time series identifier for the first daily time series in a command. See the `fillDayTSFrom2MonthTSAnd1DayTS()` command.

TSID2 – Time series identifier for the first daily time series in a command. See the `fillDayTSFrom2MonthTSAnd1DayTS()` command.

TSID_D1 – Time series identifier for the first time series in a command. See the `TS Alias = relativeDiff()` command.

TSID_D2 – Time series identifier for the second daily time series in a command. See the `fillDayTSFrom2MonthTSAnd1DayTS()` command.

TSID_M1 – Time series identifier for the first monthly time series in a command. See the `fillDayTSFrom2MonthTSAnd1DayTS()` command.

TSID_M2 – Time series identifier for the second monthly time series in a command. See the `fillDayTSFrom2MonthTSAnd1DayTS()` command.

TSList – Indicates how the list of time series is determined. Typical values are `AllTS` (process all time series), `AllMatchingTSID` (process all time series having identifiers that match the TSID parameter), `SelectedTS` (process all time series that have been selected with the `selectTimeSeries()` and `deselectTimeSeries()` commands). This parameter is being phased in to allow more flexibility when processing time series.

TSProductFile – The name of a time series product (TSProduct) file. See the `processTSProduct()` command.

Units – The data units for a time series. See the `newTimeSeries()`, `TS Alias = readNWSRFSFS5Files()`, and `writeRiverWare()` commands.

Version – Indicates the file version, to allow the software to handle different data formats. See the `readStateModB()` command.

View – Indicate whether a product should be graphically previewed (as opposed to simply writing an output file). See the `processTSProduct()` command.

UseStoredProcedures – Indicates whether stored procedures should be used (versus straight SQL calls). This is being used to transition HydroBase queries to stored procedures. See the `openHydroBase()` command.

WarnIfDifferent – Indicates whether a warning should be generated if data differences are detected. See the `compareTimeSeries()` and `compareFiles()` commands.

WarnIfSame – Indicates whether a warning should be generated if data differences are NOT detected. See the `compareTimeSeries()` and `compareFiles()` commands.

Weight –Weight(s) used when processing time series. See the `TS Alias = weighTimeSeries()` command.

Where1, Where2 – Input filter information used when reading/querying data. See the `readHydroBase()` command.

Year – Specify year(s) of interest. See the `TS Alias = weighTimeSeries()` command.

Command Reference:

Comment line

Version 10.12.00, 2012-09-10

The # command indicates single-line comments. Commands can be converted to and from # comments by right-clicking on a command in TSTool and selecting from the popup menu. See also the `/*` and `*/` comment block commands, which are used to comment multiple commands.

The following table lists annotation tags that can be placed in comments to provide additional information to software that processes the commands, using notation similar to the following:

```
#@expectedStatus Failure
```

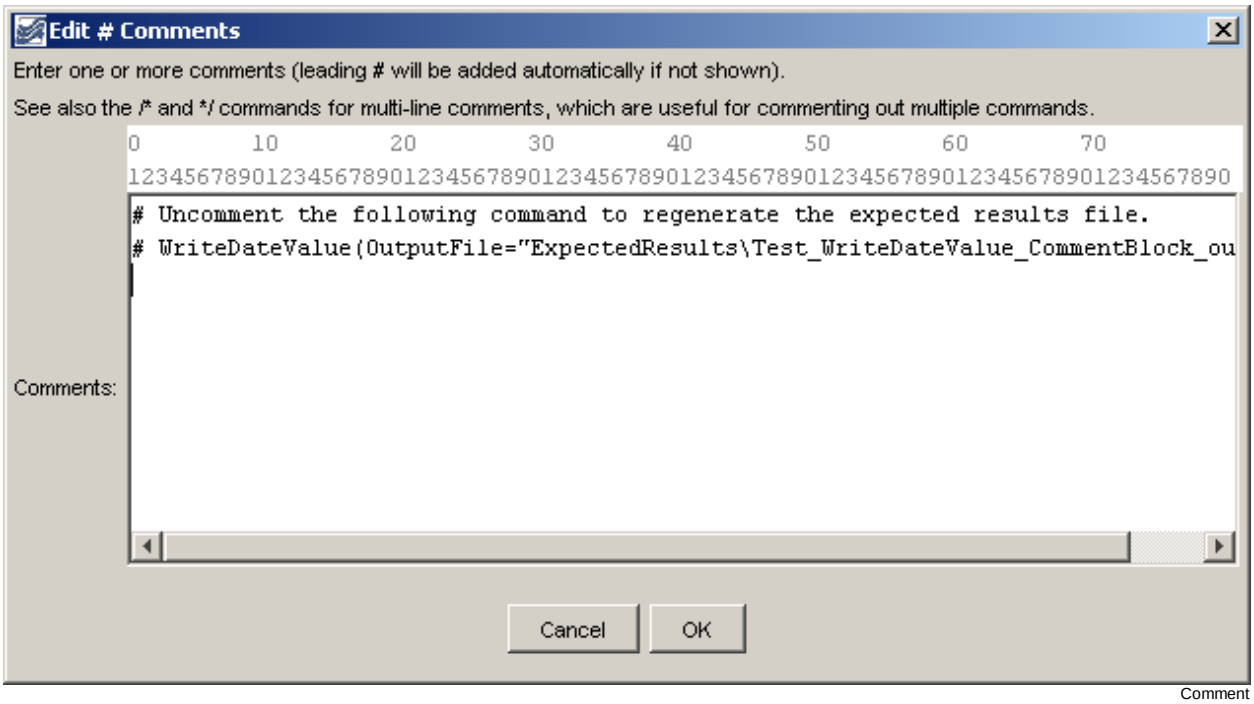
Command # Comment Tags

Parameter	Command that Uses	Description

`@expectedStatus Failure`
 	
`@expectedStatus Warning`
	`RunCommands()`	Used to help the test framework know if an error or warning is expected, in which case a passing test can occur even if the command status is not "success".

`@os Windows` `@os UNIX`	`CreateRegressionTestCommandFile()`	Used to filter out test command files that are not appropriate for the operating system. Linux is included in UNIX.
`@readOnly`	TSTool main interface and command editors	Indicates that the command file should not be edited. TSTool will update old command syntax to current syntax when a command file is loaded. However, this tag will cause the software to warn the user when saving the command file, so that they can cancel. This tag is often used with templates to protect the template from mistakenly being edited and saved in TSTool (TSTool does not currently allow editing templates within the interface).
`@testSuite ABC`	`CreateRegressionTestCommandFile()`	Used to filter out test command files that are not appropriate for the operating system.

The following dialog is used to edit the command and illustrates the command syntax:



 # Command Editor

The command syntax is as follows:

```
# Some text
```

A sample command file is as follows:

```
#
# Some comments…
#
```

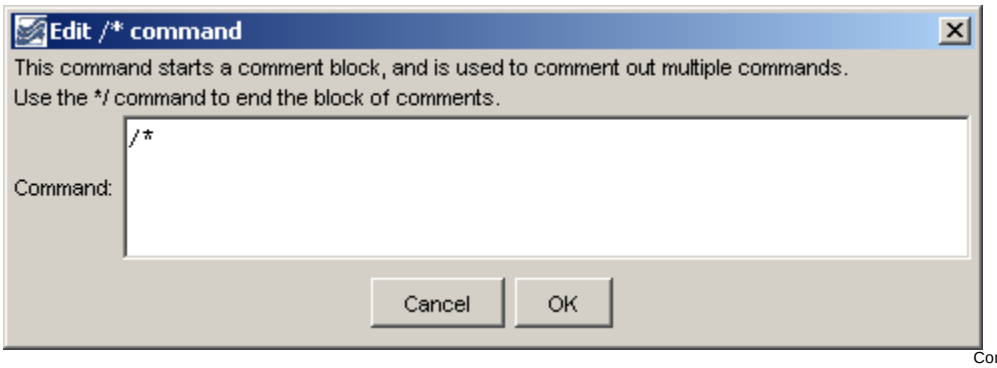
Command Reference: /*

Comment block start

Version 10.12.00, 2011-09-10

The /* command starts a multi-line comment block and is useful for inserting long comments or temporarily commenting out blocks of commands. See also the */ and # commands. Commands between the /* and */ are not converted to comments but are skipped during processing. See also the # comment documentation for information about comment @ annotations.

The following dialog is used to edit the command and illustrates the command syntax:



CommentBlockStart

/* Command Editor

The command syntax is as follows:

```
/*
```

A sample command file is as follows:

```
/*
SomeCommentedOutCommands()…
*/
```

This page is intentionally blank.

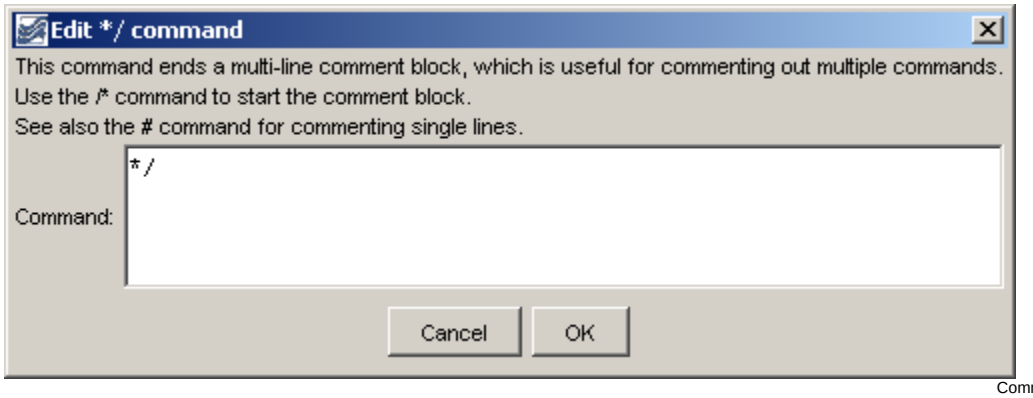
Command Reference: */

Comment block end

Version 08.17.00, 2008-10-01

The */ command ends a multi-line comment block and is useful for inserting long comments or temporarily commenting out blocks of commands. See also the /* and # commands. Commands between the /* and */ are not converted to comments but are skipped during processing.

The following dialog is used to edit the command and illustrates the command syntax:



CommentBlockEnd

***/ Command Editor**

The command syntax is as follows:

```
*/
```

A sample command file is as follows:

```
/*
SomeCommentedOutCommands()…
*/
```

This page is intentionally blank.

Command Reference: Time Series Identifier (TSID)

Read a single time series given the time series identifier

Version 09.00.03, 2009-01-15

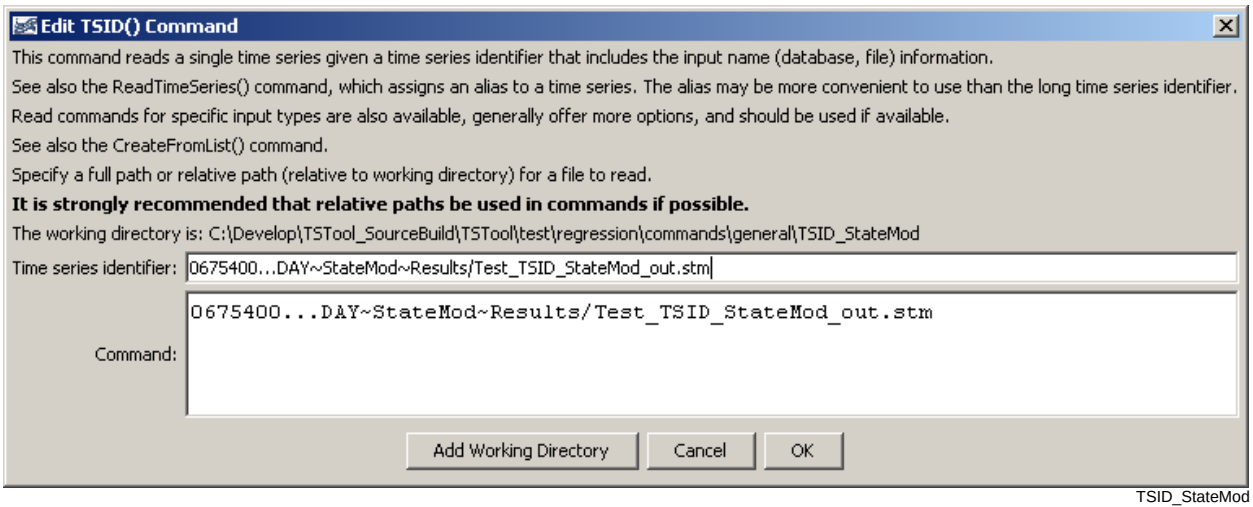
A time series identifier (TSID) command reads a single time series. In order to read the time series from a persistent format (database, file, or web site), the TSID must contain the input type, and if necessary, the input name. For example, a TSID command for the State of Colorado's StateMod model file format is of the form:

```
LocationID…Interval~StateMod~Filename
```

Refer to the **StateMod Input Type** appendix for a full description of the file format. Appendices are available for all input types. A TSID command for a StateMod file is generated as follows:

1. Select the StateMod input type and appropriate time step in the main TSTool window.
2. Press the ***Get Time Series List*** button to list time series. A dialog will prompt for the StateMod file and after selection the first year of data from the file will be read to get a list of identifiers. The interval that is specified (`Month` or `Day`) indicates whether the file is a monthly or daily format. The time series will be listed in the time series list in TSTool.
3. Select one or more time series from the list and copy to commands.

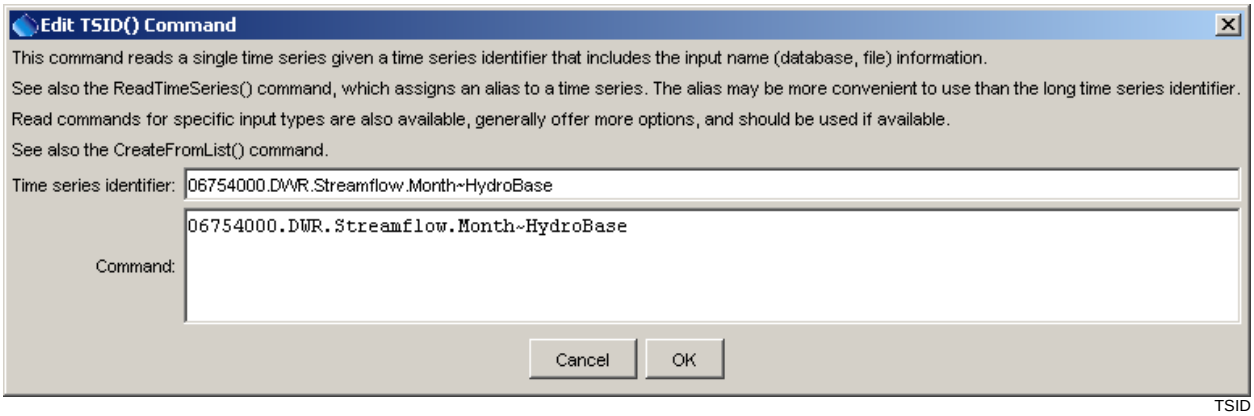
The following dialog is used to edit the command and illustrates the syntax of the command. Limited checks are done while editing the command. However, once committed, TSTool will attempt to read the time series metadata and will issue a warning if unable to read the data. Time series identifiers that include filenames should typically be adjusted to a relative path to allow the files to be moved to another location and run without errors. Use the ***Remove Working Directory*** button to remove the working directory (or ***Add Working Directory***) to add it.



TSID_StateMod

TSID Command Editor for a Time Series Read From a StateMod File

The following example is for a TSID for the State of Colorado's HydroBase database. In this case there is no filename in the identifier and therefore no need to adjust to a relative path.



TSID

TSID Command Editor for a Time Series Read From the HydroBase Database

After executing the command, the time series will have the identifier as originally requested, with no alias being assigned. Use the `TS Alias = ReadTimeSeries()` command to assign an alias to the time series, or use one of the specific read commands.

A sample command file to read time series from a StateMod file is as follows. In this case the absolute paths have been adjusted to relative paths using the command editor dialog. Note also that the data source and data type are not required because this information is not stored in the StateMod file.

```
09303000...MONTH~StateMod~whiteT.rih
09303400...MONTH~StateMod~whiteT.rih
```

A sample command file to read time series from the State of Colorado's HydroBase database is as follows:

```
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
# 06758500 - SOUTH PLATTE RIVER NEAR WELDONA
06758500.DWR.Streamflow.Month~HydroBase
```

Command Reference: Add()

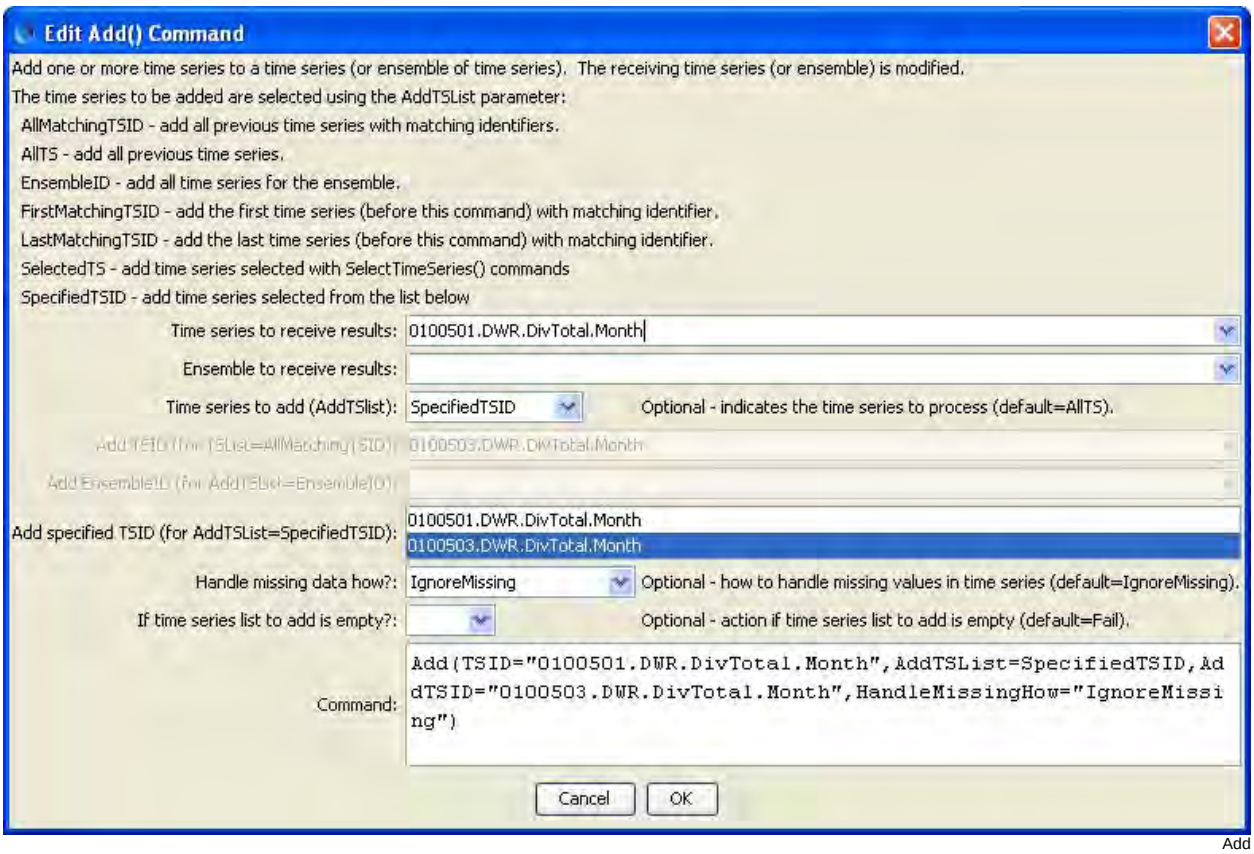
Add one or more time series to a time series (or ensemble)

Version 09.09.01, 2010-10-18

The `Add()` command adds regular interval time series. The receiving time series will be set to the sum of itself and all indicated time series. See also the `NewTimeSeries()` command, which can create an empty time series to receive a sum. If an ensemble is being processed, another ensemble can be added, a single time series can be added to all time series in the ensemble, or a list of time series can be added to the ensemble (the number in the list must match the number of time series in the ensemble).

This command will generate an error if the time series do not have compatible units. If the units are compatible but are not the same (e.g., `IN` and `FT`), then the units of the part will be converted to the units of the sum before addition. Missing data in the parts can be ignored (do not set the sum to missing) or can result in missing values in the sum. The user should consider the implications of ignoring missing data. Time series being added must have the same data interval.

The following dialog is used to edit the command and illustrates the syntax of the command.



Add

Add() Command Editor

The command syntax is as follows:

```
Add(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to receive the sum.	TSID or EnsembleID must be specified.
EnsembleID	The ensemble to receive the sum, if processing an ensemble.	TSID or EnsembleID must be specified.
AddTSList	Indicates how the list of time series is specified, one of: • AllTS – all time series before the command. • AllMatchingTSID – all time series that match the AddTSID (single TSID or TSID with wildcards) will be added. • EnsembleID – the time series from ensemble will be added. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be added. • SelectedTS – the time series are those selected with the SelectTimeSeries() command. • SpecifiedTSID – the specified list of time series given by the AddTSID parameter.	AllTS (the time series receiving the sum will not be added to itself)
AddTSID	If the AddTSList parameter is SpecifiedTSID, provide the list of time series identifiers (or alias) to add, separated by commas. If the AddTSList parameter is AllMatchingTSID, FirstMatchingTSID, or LastMatchingTSID, specify a single TSID or a TSID with wildcards.	Must be specified if TSList= SpecifiedTSID, ignored otherwise.
AddEnsembleID	If the EnsembleID parameter is specified, providing an ensemble ID will add the ensembles.	Use if an ensemble is being added to another ensemble.
Handle MissingHow	Indicates how to handle missing data in a time series, one of: • IgnoreMissing – create a result even if missing data are encountered in one or more time series – this option is not as rigorous as the others • SetMissingIfOtherMissing – set the result missing if any of the other time series values is missing • SetMissingIfAnyMissing – set the result missing if any time series value involved is missing	IgnoreMissing
IfTSListToAdd IsEmpty	Action if time series list to add is empty.	Fail

A sample command file to add two time series from the State of Colorado's HydroBase is as follows:

```
# 0100501 - EMPIRE DITCH
0100501.DWR.DivTotal.Month~HydroBase
# 0100503 - RIVERSIDE CANAL
0100503.DWR.DivTotal.Month~HydroBase
Add(TSID="0100501.DWR.DivTotal.Month",TSList="SpecifiedTSID",
AddTSID="0100503.DWR.DivTotal.Month",HandleMissingHow=IgnoreMissing)
```

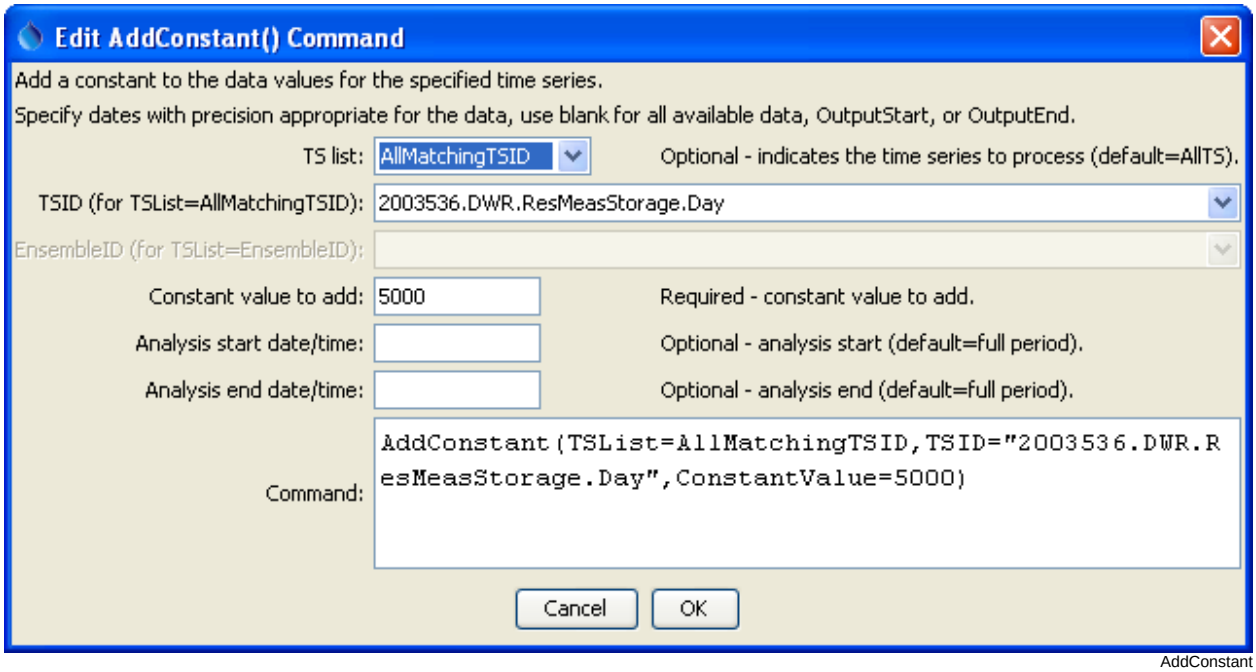
Command Reference: AddConstant()

Add a constant value to all data values in a time series (or ensemble)

Version 09.10.01, 2010-11-18

The `AddConstant()` command adds a constant value to each data value in a time series (or ensemble of time series) within the specified period. This command is useful, for example, when a time series needs to be adjusted for a constant bias. Another example is to adjust a reservoir total volume time series by the dead pool storage in order to compute the active storage (or inverse). Missing data values will remain missing in the result.

The following dialog is used to edit the command and illustrates the syntax of the command.



AddConstant

AddConstant() Command Editor

The command syntax is as follows:

```
AddConstant(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified.	TSID or EnsembleID must be specified.
EnsembleID	The ensemble to be modified, if processing an ensemble.	TSID or EnsembleID must be specified.
ConstantValue	The data value to add to the time series.	None – must be specified.
AnalysisStart	The date/time to start analyzing data.	Full period.
AnalysisEnd	The date/time to end analyzing data.	Full period.

A sample commands file to process data from the State of Colorado's HydroBase is as follows:

```
# 2003536 - CONTINENTAL RES
2003536.DWR.ResMeasStorage.Day~HydroBase
AddConstant(TSList=AllMatchingTSID,TSID="2003536.DWR.ResMeasStorage.Day",
  ConstantValue=5000)
```

CommandReference/AddConstant/Example_AddConstant_HydroBase.TSTool

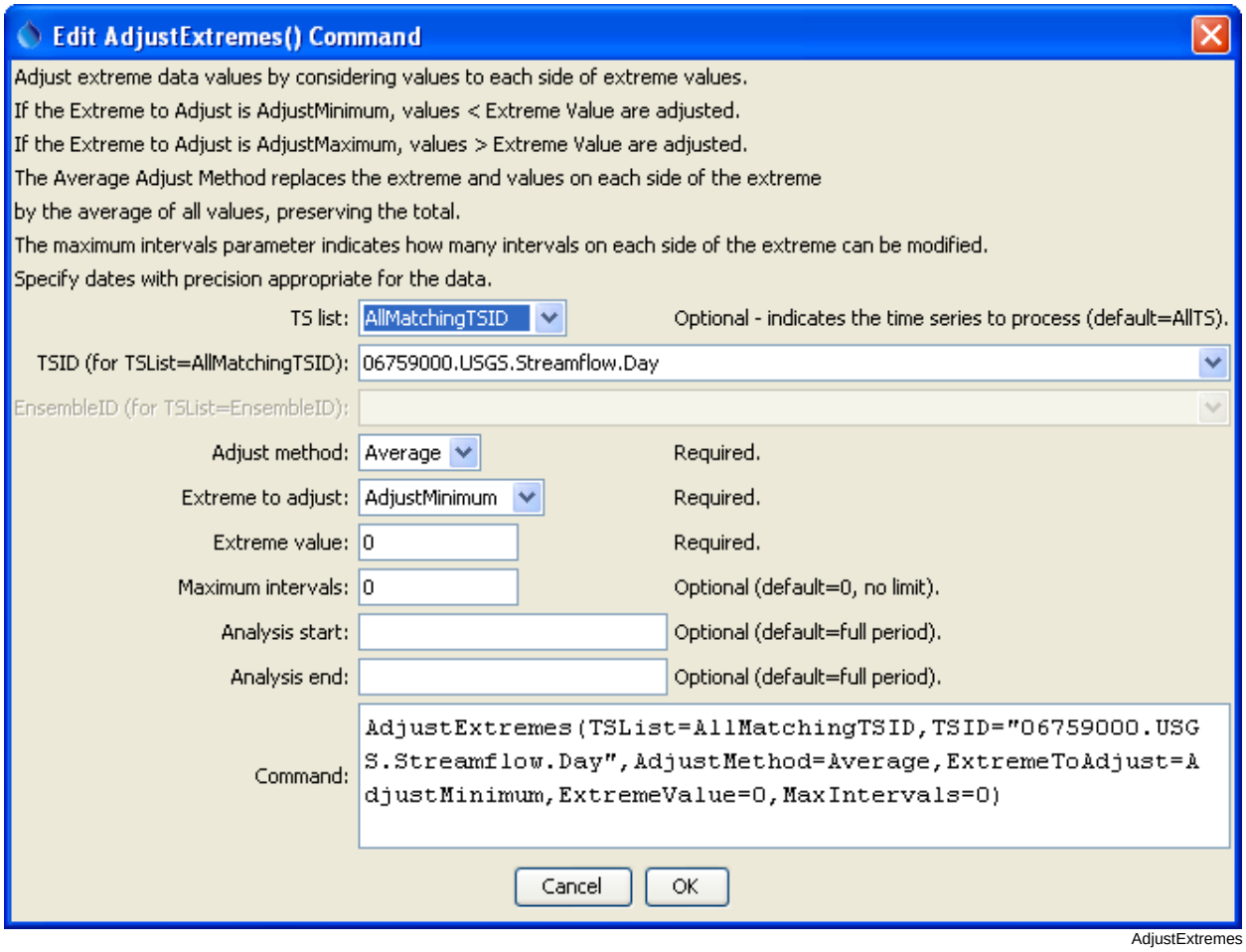
Command Reference: AdjustExtremes()

Adjust the extreme values in time series data

Version 09.10.01, 2010-11-18

The `AdjustExtremes()` command adjusts extreme values in time series (e.g., to remove negative values from a time series that can only have values greater than or equal to zero), while preserving "mass".

The following dialog is used to edit the command and illustrates the syntax of the command.



AdjustExtremes

AdjustExtremes() Command Editor

The command syntax is as follows:

```
AdjustExtremes(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID.
AdjustMethod	Only the Average adjust method is implemented, in which adjusted data values are set to the average over the adjusted period, necessary to maintain the total/mass of the original values. This method adjusts extreme values by considering neighboring values equally on each side of the point in question. When adjusting minimum values, neighboring values are added until the average is above the allowed extreme value, and all values that make up the sum are then set to the average value. Missing values remain missing and therefore this command should only be applied to filled data. If a satisfactory result cannot be reached within this limit, then the original values are not changed. Changed values are listed in the time series history, which is viewed with the time series properties. Applying the command will result in the time series having periods of constant value, with the length of the period being controlled by the magnitude of the extreme value.	None – must be specified.
ExtremeToAdjust	Indicate whether minimum (AdjustMinimum) or maximum (AdjustMaximum) values to be adjusted.	None – must be specified.
ExtremeValue	The extreme value that is the limit of acceptable values.	None – must be specified.
MaxIntervals	Indicates how many values on each side of a point are allowed to be examined.	0, indicating no limit.
AnalysisStart	The date/time to start analyzing data.	Full period.
AnalysisEnd	The date/time to end analyzing data.	Full period.

A sample command file using data from the State of Colorado's HydroBase is as follows:

```
# 06759000 - BIJOU CREEK NEAR WIGGINS, CO.
06759000.USGS.Streamflow.Day~HydroBase
AdjustExtremes(TSList=AllMatchingTSID,TSID="06759000.USGS.Streamflow.Day",
AdjustMethod=Average,ExtremeToAdjust=AdjustMinimum,ExtremeValue=0,MaxIntervals=0)
```

Command Reference: AnalyzePattern()

Determine historical average patterns for monthly time series

Version 09.05.01, 2009-10-28

The `AnalyzePattern()` command creates the pattern file for use with the `FillPattern()` command (see also `SetPatternFile()`). Each time series to be processed is analyzed as follows:

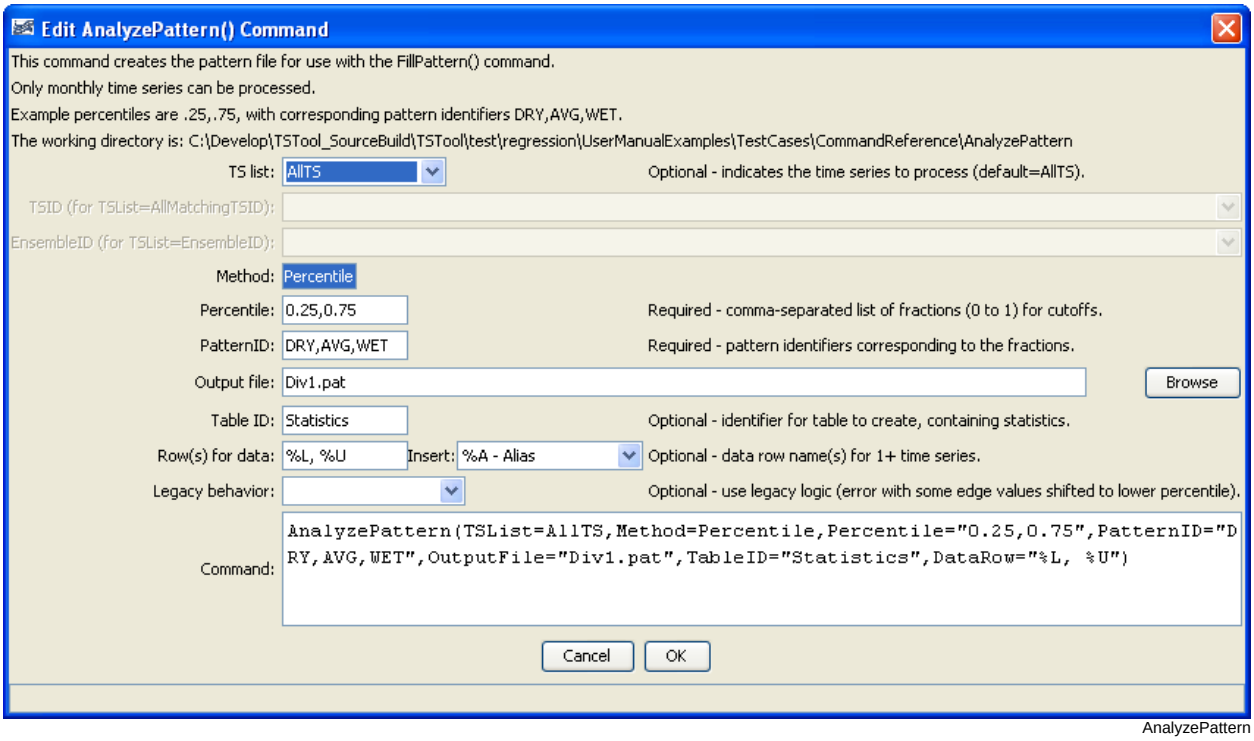
1. Create a time series to contain the pattern identifiers for each month (e.g., `DRY`, `AVG`, `WET`).
2. For each month, determine the monthly values for the time series being analyzed (e.g., find all of the January values).
3. Rank the values in ascending order.
4. Evaluate the percentile rank information for non-missing values and assign in the pattern time series an appropriate pattern identifier. For example, if the percentile values are .25 and .75, assign the first pattern identifier to values < 25% of the non-missing count, assign the second pattern identifier to non-missing values >= 25% and < 75%, and assign the third identifier to the non-missing values >= 75%.

The resulting pattern time series is then written to a file. **This command is enabled for monthly data only**. See below for an example of a fill pattern file. One or more patterns can be included in each pattern file, similar to StateMod time series files (see the **StateMod Input Type Appendix**), and multiple pattern files can be used, if appropriate.

```
#  Years Shown = Water Years
#  Missing monthly data filled by the Mixed Station Method, USGS 1989
#  Time series identifier        = 09034500.CRDSS_USGS.QME.MONTH.1
#  Description                   = COLORADO RIVER AT HOT SULPHUR SPRINGS, CO.
# -e-b----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb--------e
   10/1908  -     9/1996 ACFT  WYR
1909 09034500       AVG   AVG   AVG   WET   WET   AVG   AVG   AVG   WET   WET   WET   WET
1910 09034500       WET   WET   WET   WET   WET   WET   AVG   AVG   AVG   AVG   AVG   AVG
1911 09034500       AVG   AVG   WET   AVG   AVG   AVG   AVG   WET   WET   WET   AVG   WET
1912 09034500       WET   WET   WET   WET   WET   AVG   AVG   WET   WET   WET   WET   WET
...ommitted...
```

The pattern file will by default contain all available data for the overlapping period and will be written in calendar year. The output period can be set with the `SetOutputPeriod()` command and the output year type can be set with the `SetOutputYearType()` command.

The following dialog is used to edit the `AnalyzePattern()` command and illustrates the syntax of the command.



AnalyzePattern

AnalyzePattern() Command Editor

The command syntax is as follows:

```
AnalyzePattern(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards). • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards). • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards).	None – must be specified.

	▪ `SelectedTS` – the time series selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`Method`	Method used to determine the patterns. Currently only `Percentile` is recognized.	`Percentile`
`Percentile`	A comma-separated list of percentiles for cutoffs, used when `Method=Percentile`. Values should be `0` to `1` (e.g., `.25, .75`)	None – must be specified.
`PatternID`	The pattern identifiers to use, corresponding to the percentiles. Specify one more than the number of percentiles (e.g., `DRY,AVG,WET`).	None – must be specified.
`OutputFile`	Output file to write, which will contain the pattern information. Currently only the StateMod pattern file format is supported.	None – must be specified.
`TableID`	The identifier for a new table to be created, containing the sample values for each month adjoining the percentile positions. Each time series will be listed in the first column as per the `DataRow` parameter. For N percentile values, the first N-1 values in the table will correspond to the last value below a percentile cutoff and the Nth value will be the first value above the Nth percentile value.	Optional – table will not be created by default.
`DataRow`	The contents of the first column, indicating the time series.	Location, data type, and units, if available.
`Legacy`	Indicates whether to duplicate legacy behavior (`True`) or use current behavior (default, `False`). A bug was fixed in TSTool 9.05.02 to correct a bug where the last value in each bin sometimes should have been in the larger cutoff bin.	`False` – use current behavior.

A sample command file to analyze streamflow data from the State of Colorado's HydroBase and save statistics in a table is as follows:

```
# 06720500 - SOUTH PLATTE RIVER AT HENDERSON
06720500.DWR.Streamflow.Month~HydroBase
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
AnalyzePattern(TSList=AllTS,Method=Percentile,
  Percentile="0.25,0.75",PatternID="DRY,AVG,WET",OutputFile="Div1.pat",
  TableID="Statistics",DataRow="%L, %U")
```

The following figure illustrates the resulting statistics:

Time Series	Jan last value < 0.25	Jan first value > 0.75	Feb last value < 0.25	Feb first value > 0.75	Mar last value < 0.25	Mar first value > 0.75	Apr last value < 0.25	Apr first value > 0.75	May last value < 0.25
06720500, ACFT	5048.01	17181.08	5551.82	17524.22	7001.75	21142.13	8223.59	27411.97	21653.87
06754000, ACFT	30724.42	47526.64	28760.75	44192.38	27832.47	48764.35	18222.41	55696.68	17764.23

AnalyzePatter_Table

Command Reference: AnalyzeNetworkPointFlow()

Analyze a node/link network to calculate "point flow" for nodes

Version 10.21.00, 2013-07-13

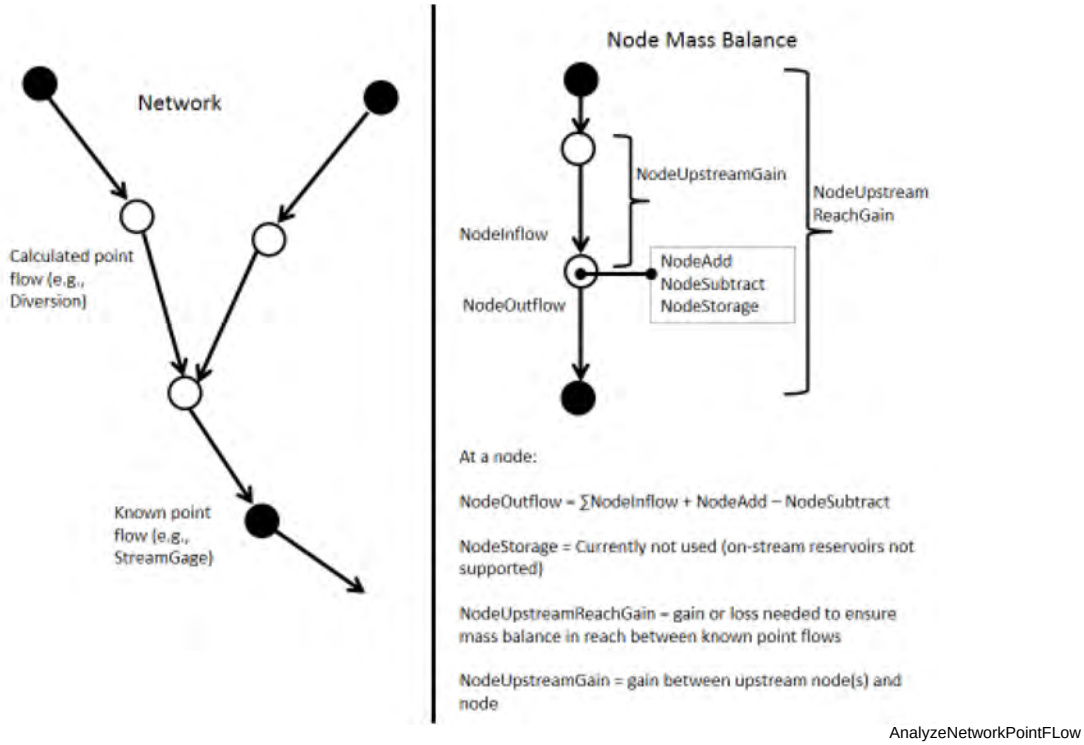
The `AnalyzeNetworkPointFlow()` command takes as input information to define a "flow network", associates input time series with each node in the network, and computes mass balance time series at each node. Although the network is intended to represent a physical network such as a stream system, it also can represent other flow networks such as transportation or other mass/energy conservation systems.

This command differs from the functionality of other network analysis tools as follows:

- Daily administration tools, such as the State of Colorado's Colorado Water Rights Administration Tool (CWRAT) perform a point flow analysis for a single day, which only requires knowing one day's input values, whereas `AnalyzeNetworkPointFlow()`analyzes time series for a specified period.
- More sophisticated models, such as the State of Colorado's StateMod water allocation model, perform allocation decisions within each time step for the full period, whereas `AnalyzeNetworkPointFlow()`performs a sequence of basic time series manipulations that can be quickly configured.

It may be possible to utilize the network data from tools such as those mentioned above with the `AnalyzeNetworkPointFlow()` command.

The following figure illustrates the network connectivity and mass balance that is performed at each node. Currently "on-channel" reservoirs with storage are not supported and gain/loss can only be computed in non-branching networks – these features and others necessary to model more complex networks will be added in the future; however, this command is not intended to replace more complex models. Consequently the command currently is suitable for analysis of a main stem river with no on-channel reservoirs.



AnalyzeNetworkPointFLow

AnalyzeNetworkPointFlow() Network and Node Mass Balance

The network is defined as a table containing a list of node identifiers with associated properties, as illustrated in the following figure.

	A	B	C	D	E	F
1	NodeID	NodeName	NodeType	NodeDist	NodeWeight	DownstreamNodeID
2	06754000	*KERSEY GAGE*	StreamGage	2.0		0103816
3	0103816	EMPIRE RESERVOIR INLET (at reservoir)	Diversion	3.0	1.0	0100503
4	0100503	RIVERSIDE CANAL (at reservoir)	Diversion	4.0	1.0	0100507
5	0100507	BIJOU CANAL	Diversion	5.0	1.0	0100513
6	0100513	JACKSON LAKE INLET	Diversion	6.0	1.0	0100511
7	0100511	WELDON VALLEY DITCH	Diversion	7.0	2.0	0100512
8	0100512	JACKSON LAKE OUTLET DITCH	Return	8.0	2.0	0100514
9	0100514	FT MORGAN CANAL	Diversion	9.0	3.0	Instream1
10	Instream1	Instream Flow 1	InstreamFlow	10.0	3.0	06758500
11	06758500	*WELDONA GAGE*	StreamGage	11.0	3.0	0102900
12	0102900	WELDON VALLEY RETURN	Return	13.0	3.0	0100517
13	0100517	DEUEL AND SNYDER	Diversion	15.0	4.0	0100515
14	0100515	UPPER PLATTE BEAVER CNL	Diversion	17.0	4.0	06759500
15	06759500	*FORT MORGAN GAGE*	StreamGage	19.0	4.0	0100518
16	0100518	LOWER PLATTE BEAVER D	Diversion	26.0	4.0	0100519
17	0100519	TREMONT DITCH	Diversion	37.0	5.0	0100687
18	0100687	NORTH STERLING CANAL	Diversion	38.0	5.0	0100688
19	0100688	UNION DITCH	Diversion	49.0	5.0	06760000
20	06760000	*BALZAC GAGE*	StreamGage	50.0	5.0	

AnalyzeNetworkPointFLow

AnalyzeNetworkPointFlow() Network Input Table

In this example the network is defined in an Excel file, the `ReadTableFromExcel()` command is used to read the table, and the table is used as input to the `AnalyzeNetworkPointFlow()` command The network definition table columns from the above figure are as follows (note, however, that the column names are user defined and are specified as parameters to the `AnalyzeNetworkPointFlow()` command:

AnalyzeNetworkPointFlow() Network Input Table Column Description

Network Table Column	Description
`NodeID`	The location ID for the network node, typically corresponding to the location ID in time series identifiers. The column is indicated to the command using the `NodeIDColumn` parameter.
`NodeName`	The node name, useful because `NodeID` is generally terse and non-descriptive, used in messages. The column is indicated to the command using the `NodeNameColumn` parameter.
`NodeType`	The node type, needed to define node behavior (e.g., whether time series values get added, subtracted, reset at node). The node types are user-defined, although types often are defined by modeling conventions. The column is indicated to the command using the `NodeTypeColumn` parameter. The behavior corresponding to node types is defined by using command parameters (`NodeAddTypes`, `NodeSubtractTypes`, `NodeOutflowTypes`, `NodeFlowThroughTypes`).
`NodeDist`	The node distance along the flow path. Typically the distance is measured relative to the lowest point on the network. The distance is used to estimate gain/loss when `GainMethod=Distance` is specified as a command

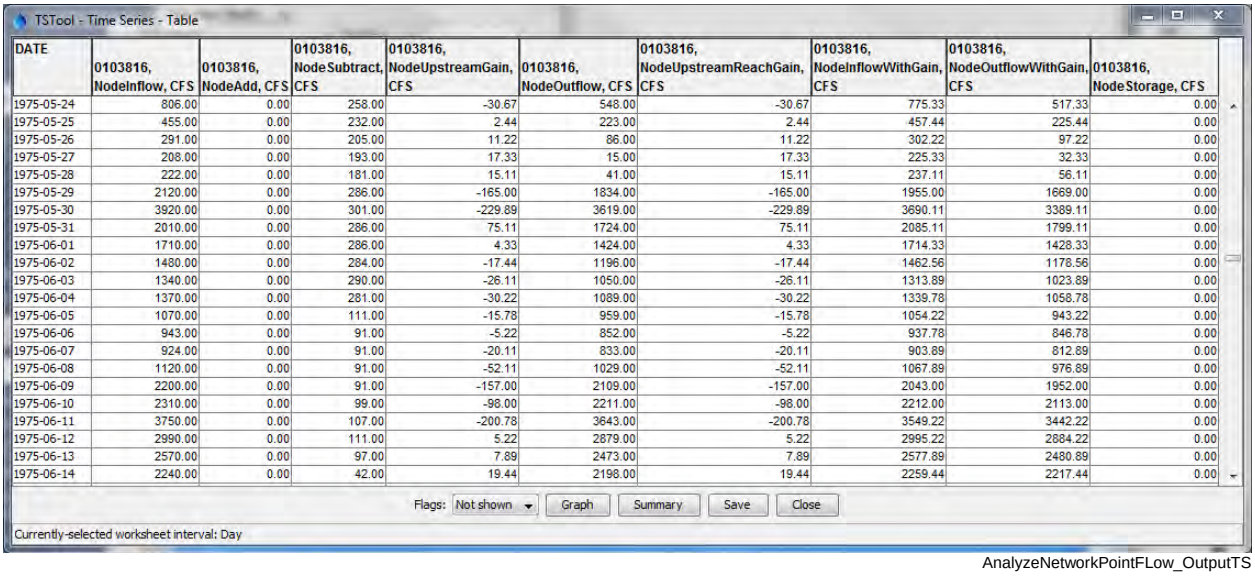
Network Table Column	Description
	parameter.
NodeWeight	Used when GainMethod=Weight. The weights indicate the relative weight of the reach gain/loss to be distributed between nodes on the reach. For example, specify a best estimate of the percentage of reach loss that occurs above each node. Or, specify as a rate of gain/loss when used with GainMethod=DistanceWeight (but in this case the distance*weight product will be normalized to ensure that the reach gain/loss is equalized between known point flows).
DownstreamNodeID	The location ID for the downstream node, needed to define network connectivity.

The AnalyzeNetworkPointFlow() command creates output time series with the data types indicated in the following table.

AnalyzeNetworkPointFlow() Network Input Table Column Description

Column	Description
NodeInflow	Sum of outflows from upstream nodes, which are consequently inflows to the current node (lagged routing currently is not implemented).
NodeAdd	Time series added at the node (for example immediately off-channel reservoir release or measured return flow).
NodeSubtract	Time series subtracted at the node (for example diversion).
NodeUpstreamGain	Gain (positive) or loss (negative) between immediate upstream node(s) and the current node (missing if gain/loss is not computed).
NodeOutflow	Outflow from the node, which takes into account inflow and any additions and subtractions at the node.
NodeUpstreamReachGain	Gain (positive) or loss (negative) between upstream known flow node(s) and the current node (missing if gain/loss is not computed).
NodeInflowWithGain	NodeInflow + NodeUpstreamReachGain (missing if gain/loss are not computed).
NodeOutflowWithGain	NodeOutflow + NodeUpstreamReachGain (missing if gain/loss are not computed).
NodeStorage	Storage at the node after additions and subtractions (currently always zero, will enhance in the future to handle on-channel reservoirs).

The following figure illustrates the output time series corresponding to the data types listed in the above table:



DATE	0103816, NodeInflow, CFS	0103816, NodeAdd, CFS	0103816, NodeSubtract, CFS	0103816, NodeUpstreamGain, CFS	0103816, NodeOutflow, CFS	0103816, NodeUpstreamReachGain, CFS	0103816, NodeInflowWithGain, CFS	0103816, NodeOutflowWithGain, CFS	0103816, NodeStorage, CFS
1975-05-24	806.00	0.00	258.00	-30.67	548.00	-30.67	775.33	517.33	0.00
1975-05-25	455.00	0.00	232.00	2.44	223.00	2.44	457.44	225.44	0.00
1975-05-26	291.00	0.00	205.00	11.22	86.00	11.22	302.22	97.22	0.00
1975-05-27	208.00	0.00	193.00	17.33	15.00	17.33	225.33	32.33	0.00
1975-05-28	222.00	0.00	181.00	15.11	41.00	15.11	237.11	56.11	0.00
1975-05-29	2120.00	0.00	286.00	-165.00	1834.00	-165.00	1955.00	1669.00	0.00
1975-05-30	3920.00	0.00	301.00	-229.89	3619.00	-229.89	3690.11	3389.11	0.00
1975-05-31	2010.00	0.00	286.00	75.11	1724.00	75.11	2085.11	1799.11	0.00
1975-06-01	1710.00	0.00	286.00	4.33	1424.00	4.33	1714.33	1428.33	0.00
1975-06-02	1480.00	0.00	284.00	-17.44	1196.00	-17.44	1462.56	1178.56	0.00
1975-06-03	1340.00	0.00	290.00	-26.11	1050.00	-26.11	1313.89	1023.89	0.00
1975-06-04	1370.00	0.00	281.00	-30.22	1089.00	-30.22	1339.78	1058.78	0.00
1975-06-05	1070.00	0.00	111.00	-15.78	959.00	-15.78	1054.22	943.22	0.00
1975-06-06	943.00	0.00	91.00	-5.22	852.00	-5.22	937.78	846.78	0.00
1975-06-07	924.00	0.00	91.00	-20.11	833.00	-20.11	903.89	812.89	0.00
1975-06-08	1120.00	0.00	91.00	-52.11	1029.00	-52.11	1067.89	976.89	0.00
1975-06-09	2200.00	0.00	91.00	-157.00	2109.00	-157.00	2043.00	1952.00	0.00
1975-06-10	2310.00	0.00	99.00	-98.00	2211.00	-98.00	2212.00	2113.00	0.00
1975-06-11	3750.00	0.00	107.00	-200.78	3643.00	-200.78	3549.22	3442.22	0.00
1975-06-12	2990.00	0.00	111.00	5.22	2879.00	5.22	2995.22	2884.22	0.00
1975-06-13	2570.00	0.00	97.00	7.89	2473.00	7.89	2577.89	2480.89	0.00
1975-06-14	2240.00	0.00	42.00	19.44	2198.00	19.44	2259.44	2217.44	0.00

AnalyzeNetworkPointFLow_OutputTS

AnalyzeNetworkPointFlow() Output Time Series Table

The following logic is used to analyze the network. Currently this logic is performed by navigating the network from most upstream to downstream and processing all timesteps for a node before moving to the next node.

1. The network is navigated from top to bottom. When a confluence is found (a node with more than one upstream node), each confluence is processed from the top down to the confluence point. Of particular importance is the concept of a "stream reach", which is the reach between known flow points, because mass balance is enforced at known flow points and gain/loss can be estimated between the known flow points.
    a. The data type for the node (see `*DataType` command parameters) is used to retrieve the relevant time series for the node. The first time series that matches the location ID, data type, and interval is used as input for the node. The time series must have been read prior to the `AnalyzeNetworkPointFlow()` command. For example, use the `CopyTable()` command to copy a subset of the network table's `NodeID` values and then use the `ReadTimeSeriesList()` command with the list of identifiers.
    b. Calculate the node's inflow:
        i. Node types that set outflow, indicated by the `NodeOutflowDataTypes` parameter (e.g., `StreamGage`):
            - `NodeInflow` = input time series for node
        ii. All other node types:
            - `NodeInflow` = sum of upstream node outflows
    c. Calculate the node's outflow:
        i. Node types that add, indicated by the `NodeAddDataTypes` parameter (e.g., `Return`, `Import`):
            - `NodeOutflow` = `NodeInflow` + added time series
        ii. Node types that subtract, indicated by the `NodeSubtractDataTypes` parameter (e.g., `Diversion`):
            - `NodeOutflow` = `NodeInflow` - subtracted time series

iii. Node types that set outflow, indicated by the `NodeOutflowDataTypes` parameter (e.g., `StreamGage`):
- `NodeOutflow` = `NodeInflow`

iv. Node types that let flow through, indicated by the `NodeFlowThroughDataTypes` parameter (e.g., `InstreamFlow`):
- `NodeOutflow` = `NodeInflow`.

d. For known flow points (e.g., `StreamGage` node type), set the reach gain/loss:
i. `NodeUpstreamReachGain` = difference between upstream node outflow and known flow at downstream node in reach

e. If gain/loss is being estimated and a known flow node encountered (e.g., `StreamGage`), gain/loss between this node and the nearest upstream node(s) is compute. **This has only been implemented for the case where all intervening nodes are in a non-branching reach**.
i. First calculate the distribution factor by which the reach gain (see previous step) will be distributed to each node in the reach:
- If the `GainMethod=None`, no adjustment to flows is made and the gain/loss upstream of the know flow node will result in a discontinuous jump because no gain/loss adjustment is made.
- If the `GainMethod=Distance`, use the node distance data from the network table to prorate the gain/loss in the stream reach. The difference in distance between the upstream node and the current node is set to weight for prorating the reach gain/loss. Use this method if the gain/loss rate is the same throughout the reach and therefore only the distance between nodes controls the gain/loss.
- If the `GainMethod=Weight`, the gain/loss is prorated by the weights specified by the `NodeWeightColumn` parameter (or weight equally if the weights are not specified in the network table). The weight of the upstream known flow node is not used. Use this method if the relative gain/loss for each node within the reach can be specified.
- If the `GainMethod=DistanceWeight`, the gain/loss is prorated by the product of the weights specified by the `NodeWeightColumn` parameter (or weight equally if the weights are not specified in the network table) and by the values from the `NodeDistanceColumn`. The weight of the upstream known flow node is not used. Use this method if the relative rate of gain/loss for each node can be specified, but overall gain/loss is also a function of the distance. Even though a rate is specified, the calculated gain/loss may be slightly different because the overall reach gain/loss must be balanced at known flow points for each time step.

- Multiply `NodeUpstreamReachGain` by the gain/loss distribution factor to calculate `NodeReadGain` for each node.
- Compute the cumulative gain/loss for the node by summing `NodeUpstreamNodeGain` for each upstream node and set to `NodeUpstreamReachGain` for the current node.

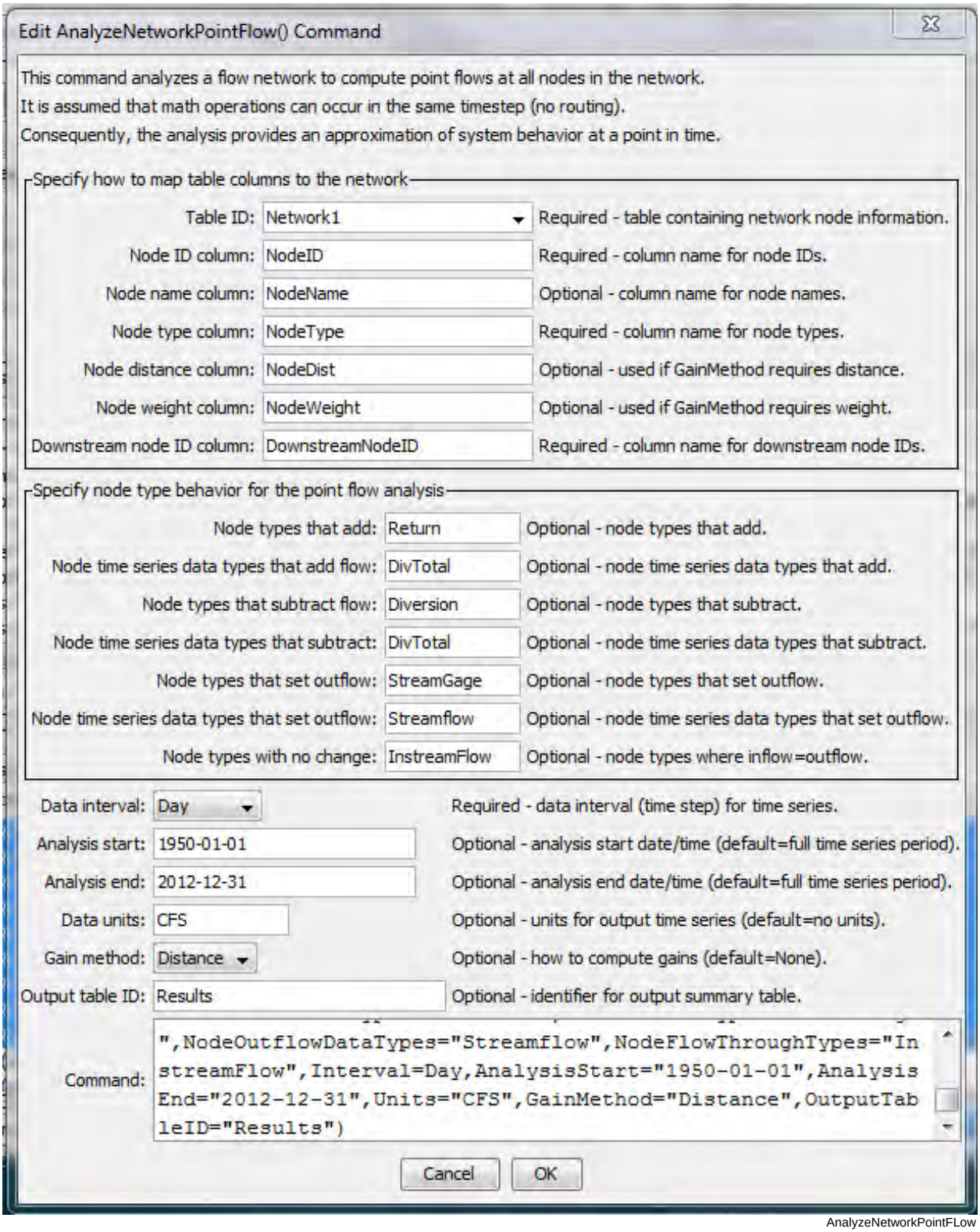
2. Analysis statistics optionally are written to an output table, which contains a row for each network node. Statistics include information such as the number of missing values in the input time series. This information can be used to evaluate the quality of the analysis. **This feature has not yet been implemented.**

Issues that need to be considered include:

1. Missing data in input result in missing data in calculated values. Use TSTool features to fill missing data in time series before using as input to the analysis. Because this may be a major effort, especially for a long analysis period, it may be appropriate to read time series from model data sets. It is envisioned that the output table will provide feedback on how much missing data there is and how it impacts the analysis.
2. TSTool's graphing tool currently does not allow graphing lines as a step function in the case where no gain/loss is computed. Instead, the line connects the data points. An enhancement to the graphing tool is needed.
3. TSTool does not provide a way to graph a stream reach where the graph values are pulled from each time series for a point in time. Ideally a visualization tool would allow "scrolling" through dates and showing the river reach with flow on the Y axis and node distance on the X axis, although it would be tedious to have to scroll through the period.
4. There may be cases where a subtraction at the node takes all of the flow resulting in a zero or negative value, essentially causing the node to be a known zero point flow. For example, in Colorado, a river call may result in a river drying up during the call. It is possible to estimate when this occurs, but the data quality may be low. Currently TSTool allows negative flows in this case, which indicates that input time series or the simple gain method calculations do not accurately represent the system. One option in this case is to use the TSTool `AdjustExtremes()` command, which maintains mass balance around the extreme values.

It is important to understand that such a point flow analysis represents a snapshot of the system at any point in time, but does not route flows through the network. Known flows at stream gages are used as fixed values from which other data are estimated. Gains and losses are representative of the network system, essentially interpolating over time and distance. This type of analysis introduces errors in cases where the lag time between nodes would result in significant differences if lagging were considered. In the physical system, changing an upstream flow would result in lagged impacts due to routing; however, the point flow analysis shows the impacts to downstream nodes in the same time step. A more sophisticated model with routing would be needed to represent actual conditions. However, the point flow analysis will be reasonably accurate if gains and losses are occurring because of fairly static phenomena (e.g., groundwater interactions that do not change rapidly within the network travel time). One way to work around these limitations is to use a longer interval, for example monthly instead of daily, in input time series or convert the point flow analysis results.

The following dialog is used to edit the command and illustrates the syntax of the command:



AnalyzeNetworkPointFLow

AnalyzeNetworkPointFlow() Command Editor

The command syntax is as follows:

```
AnalyzeNetworkPointFlow(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the table defining the network.	None – must be specified.
`NodeIDColumn`	The name of the column in the network table containing node identifiers. Node identifiers will be used for the location ID part of time series identifiers.	None – must be specified.
`NodeNameColumn`	The name of the column in the network table containing node names.	
`NodeTypeColumn`	The name of the column in the network table containing node types. The node type is used to specify what calculations will occur for the node.	None – must be specified.
`NodeDistanceColumn`	The name of the column in the network table containing node distance. The distance is the measure from the most downstream node and is used when `GainMethod=Distance` or `GainMethod=DistanceWeight`.	Must be specified when `GainMethod=Distance` or `GainMethod=DistanceWeight`.
`NodeWeightColumn`	The name of the column in the network table containing node weights, which is used to distribute gain/loss when `GainMethod=Weight` or `GainMethod=DistanceWeight` (in the latter case the weight is the rate to use).	If not specified when `GainMethod=Weight`, gain/loss will be distributed evenly for the nodes. Must be specified when `GainMethod=DistanceWeight`.
`DownstreamNodeIDColumn`	The name of the column in the network table containing downstream node identifiers. This information defines the connectivity of the network.	None – must be specified.
`NodeAddTypes`	Node types for which time series are added to the node's inflow to compute outflow, for example the `Return` node type in the above table example. The `NodeTypeColumn` table column is checked to determine the type for each node in the network.	No additions will occur.
`NodeAddDataType`	The time series data type to match for the node. The data type is used with the `NodeID` as the location ID to match available time series to use as input. This may be enhanced to allow a TSID pattern like `%L-DivTotal`, to	No additions will occur.

Parameter	Description	Default
	allow more flexibility in matching time series.	
NodeSubtractTypes	Node types for which time series are subtracted from the node's inflow, for example the Diversion node type in the above table example. The NodeTypeColumn table column is checked to determine the type for each node in the network.	No subtractions will occur.
NodeSubtractDataType	The time series data type to match for the node. The data type is used with the NodeID as the location ID to match available time series to use as input. This may be enhanced to allow to a TSID pattern like %L-DivTotal, to allow more flexibility in matching time series.	No subtractions will occur.
NodeOutflowTypes	Node types for which time series outflows are set to the node's time input time series, for example the Streamflow node type in the above table example. The NodeTypeColumn table column is checked to determine the type for each node in the network.	No known flows will be set – gain/loss cannot be computed.
NodeOutflowDataType	The time series data type to match for the node. The data type is used with the NodeID as the location ID to match available time series to use as input. This may be enhanced to allow a TSID pattern like %L-Streamflow, to allow more flexibility in matching time series.	No subtractions will occur.
NodeFlowThroughTypes	Node types for which time series outflows are set to the node's inflow, for example the InstreamFlow node type in the above table example. The NodeTypeColumn table column is checked to determine the type for each node in the network.	No known flows will be set – gain/loss cannot be computed.
Interval	The time series interval to process. The interval is used with the node identifier and data type to match input time series.	None – must be specified.
AnalysisStart	The analysis start, which defines the period for output time series. Specify to a precision consistent with Specify to a precision consistent with Interval.	Global output period.

Parameter	Description	Default
`AnalysisEnd`	The analysis end, which defines the period for output time series. Specify to a precision consistent with `Interval`.	Global output period.
`Units`	Units for output time series. Warnings will be generated if input time series for the analysis are not consistent with these units.	
`GainMethod`	The method used to prorate the gain/loss between known point flow nodes to other nodes in the reach. Currently this can be used only on non-branching networks. • `Distance` – prorate the gain/loss using distance between nodes (as a portion of the total distance). Use this method if a constant gain/loss rate applies over each reach in the network. • `None` – no gain/loss is estimated, resulting in a discontinuity in an outflow jump above each known point flow. • `DistanceWeight` – prorate the gain/loss using distance*weight as the weight for each node, where the rate is specified in the weight network table column. Use this method when the gain/loss rate varies by location and should be represented as a rate. • `Weight` – prorate the gain/loss using the weights specified for each node. Use this method if the gain/loss fraction in a reach is explicitly specified.	`None`
`OutputTable`	The identifier for the output table to receive analysis results statistics.	No output table will be created.

The following command files illustrate how to implement a point flow analysis. In this case the first command file prepares daily time series using the network as input. The time series could similarly be provided by other processing procedures, or read from other model input files.

```
# Read time series needed to perform the AnalyzeNetworkPointFlow() tests.
# Use data from HydroBase to provide realistic input.
# First read the network table
ReadTableFromExcel(TableID="Network1",InputFile="Network1.xlsx",ExcelColumnNames=FirstRowInRange)
# Get the list of streamflow gages and associated time series
# Free()
CopyTable(TableID="Network1",NewTableID="StreamflowStationList",IncludeColumns="NodeID",
```

```
  ColumnMap="NodeID:StreamGageID",ColumnFilters="NodeType:StreamGage")
ReadTimeSeriesList(TableID="StreamflowStationList",LocationColumn="StreamGageID",DataSource="DWR,USGS",
  DataType="Streamflow",Interval="Day",DataStore="HydroBase",IfNotFound=Warn)
WriteDateValue(OutputFile="Network1-StreamGage-Streamflow.dv",MissingValue=NaN,TSList=AllMatchingTSID,
  TSID="*.*.Streamflow.Day.*")
# Get the list of diversion stations and associated time series
Free()
CopyTable(TableID="Network1",NewTableID="DiversionStationList",IncludeColumns="NodeID",
  ColumnMap="NodeID:DiversionID",ColumnFilters="NodeType:Diversion")
ReadTimeSeriesList(TableID="DiversionStationList",LocationColumn="DiversionID",DataSource="DWR",
  DataType="DivTotal",Interval="Day",DataStore="HydroBase",IfNotFound=Warn)
WriteDateValue(OutputFile="Network1-Diversion-DivTotal.dv",MissingValue=NaN,TSList=AllMatchingTSID,
  TSID="*.*.DivTotal.Day.*")
# Get the list of diversion return stations and associated time series
Free()
CopyTable(TableID="Network1",NewTableID="DiversionReturnStationList",IncludeColumns="NodeID",
  ColumnMap="NodeID:DiversionID",ColumnFilters="NodeType:Return")
ReadTimeSeriesList(TableID="DiversionReturnStationList",LocationColumn="DiversionID",DataSource="DWR",
  DataType="DivTotal",Interval="Day",DataStore="HydroBase",IfNotFound=Warn)
WriteDateValue(OutputFile="Network1-Return-
DivTotal.dv",MissingValue=NaN,TSList=AllMatchingTSID,TSID="*.*.DivTotal.Day.*")
```

The second command file performs the point flow analysis. This example is from a TSTool test and fills missing data with a simple approach in order to ensure that no missing values are included in the analysis. A single command file that combines the two command file examples also could be used.

```
# Test analyzing a simple network for point flows
StartLog(LogFile="Results/Test_AnalyzeNetworkPointFlow.TSTool.log")
# Read the network
ReadTableFromExcel(TableID="Network1",InputFile="Data\Network1.xlsx",Worksheet="Network1",
  ExcelColumnNames=FirstRowInRange)
# Read the time series associated with network nodes (pregenerated)
# Fill diversion time series with zeros so there is something to analyze
# Fill stream gage time series with repeat forward and backward
SetInputPeriod(InputStart="1950-01-01",InputEnd="2013-12-31")
ReadDateValue(InputFile="Data\Network1-Diversion-DivTotal.dv")
ReadDateValue(InputFile="Data\Network1-Return-DivTotal.dv")
FillConstant(TSList=AllMatchingTSID,TSID="*.*.DivTotal.*.*",ConstantValue=0)
ReadDateValue(InputFile="Data\Network1-StreamGage-Streamflow.dv")
FillRepeat(TSList=AllMatchingTSID,TSID="*.*.Streamflow.*.*",FillDirection=Backward)
FillRepeat(TSList=AllMatchingTSID,TSID="*.*.Streamflow.*.*",FillDirection=Forward)
CheckTimeSeries(CheckCriteria="Missing")
# Analyze the network point flow.
AnalyzeNetworkPointFlow(TableID="Network1",NodeIDColumn="NodeID",NodeNameColumn="NodeName",
  NodeTypeColumn="NodeType",NodeDistanceColumn="NodeDist",NodeWeightColumn="NodeWeight",
  DownstreamNodeIDColumn="DownstreamNodeID",NodeAddTypes="Return",NodeAddDataTypes="DivTotal",
  NodeSubtractTypes="Diversion",NodeSubtractDataTypes="DivTotal",NodeOutflowTypes="StreamGage",
  NodeOutflowDataTypes="Streamflow",NodeFlowThroughTypes="InstreamFlow",Interval=Day,
  AnalysisStart="1950-01-01",AnalysisEnd="2012-12-31",Units="CFS",GainMethod="Distance",
  OutputTableID="Results")
```

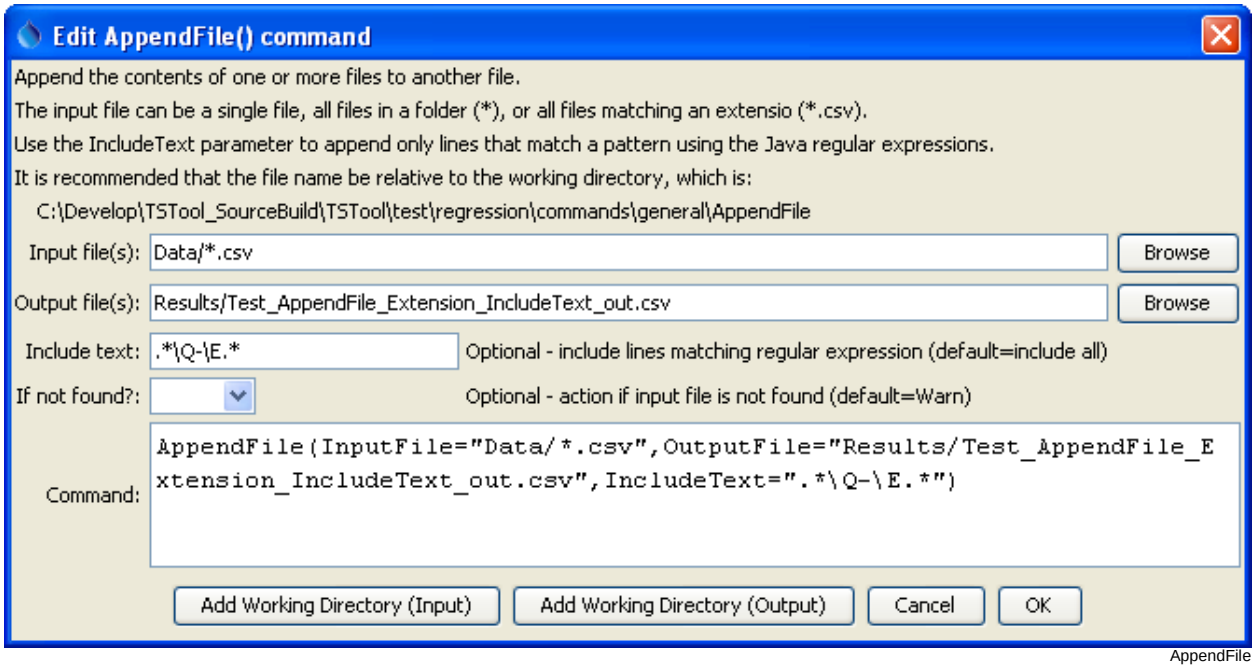
Command Reference: AppendFile()

Append 1+ files to another file

Version 10.12.00, 2012-10-12

The `AppendFile()` command appends one or more files to another file. All or only matching lines from input files can be transferred. This command is useful for appending multiple data files into a single file that can be read by TSTool.

The following dialog is used to edit the command and illustrates the syntax for the command.



AppendFile

AppendFile() Command Editor

The command syntax is as follows:

```
AppendFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of one or more files to delete, using the following conventions: • No `*` in name – match one file. • Filename of `*`– match all files in input directory (working directory by default). • Filename of `*.ext` – match all files with extension More options may be supported in the future when TSTool is updated to use Java 1.7+.	None – must be specified.
`OutputFile`	The output file that will be appended to. The file is created if it does not exist. Use the `RemoveFile()` command to remove the old file.	None – must be specified.
`IncludeText`	A regular expression pattern to include text. This uses the Java regular expressions syntax (see http://en.wikipedia.org/wiki/Regular_expression).	Transfer all lines.
`IfNotFound`	Indicate action if the file is not found, one of: • `Ignore` – ignore the missing file (do not warn). • `Warn` – generate a warning (use this if the file truly is expected and a missing file is a cause for concern). • `Fail` – generate a failure (use this if the file truly is expected and a missing file is a cause for concern).	`Warn`

The following table lists regular expression examples:

InputText Regular Expression	Description
`.*\Q-\E.*`	Match lines that start with any character, end with any character, and contain a dash. The `\Q` and `\E` characters are special characters to start and end a quoted character, and are necessary because the dash has special meaning in a regular expression.

Command Reference: AppendTable()

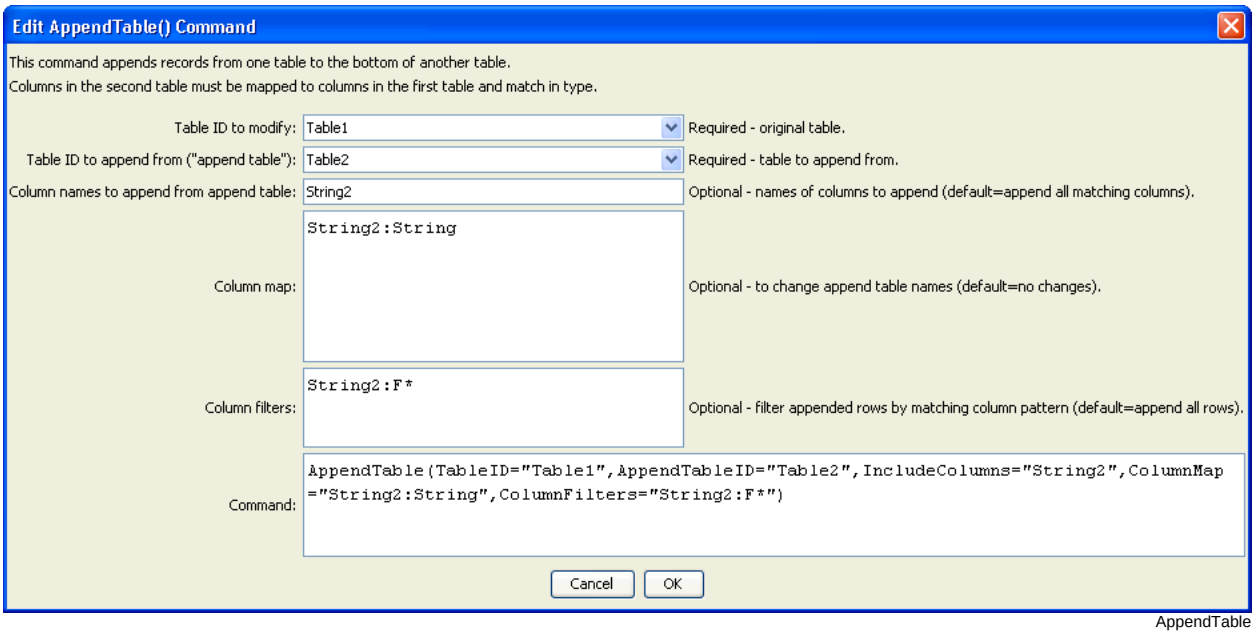
Append one table to another table

Version 10.21.00, 2013-06-28

The `AppendTable()` command appends rows from one table to another table. For appended rows:

- values in columns that are not matched are set to null in the receiving table
- values in columns where the data types do not match are set to null in the receiving table

The following dialog is used to edit the command and illustrates the syntax of the command.



AppendTable

AppendTable() Command Editor

The command syntax is as follows:

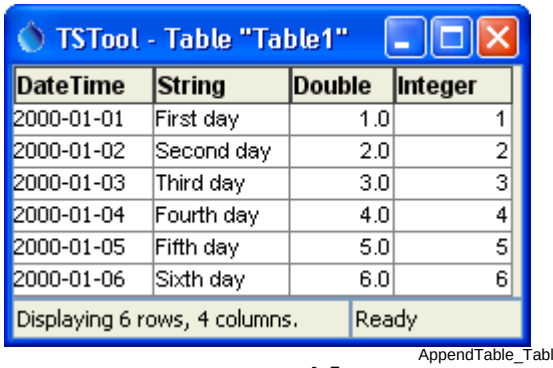
```
AppendTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the original table, to which records will be appended.	None – must be specified.
`AppendTableID`	The identifier for the table from which to append.	None – must be specified.
`IncludeColumns`	The names of columns to append from `AppendTableID`, separated by commas. See also `ColumnMap` to indicate how to map column names in the append table to the first table (necessary if the column names don't match).	Append all of the columns from `AppendTableID` that match columns in `TableID`.
`ColumnMap`	The map of the append table columns to the first table's columns, necessary when column names are not	If no map, append table column names in

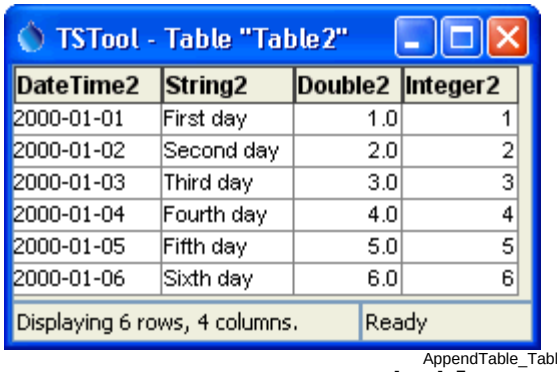
Parameter	Description	Default
	the same: `AppendColumn1:OriginalColumn1, AppendColumn2:OriginalColumn2`	`IncludeColumns` must have the same name in the first table.
`ColumnFilters`	Filters that limit the number of rows being appended from the append table, using the syntax: `FilterColumn1:FilterPattern1, FilterColumn2:FilterPattern2` Patterns can use * to indicate wildcards for matches. Only string values can be checked (other data types are converted to strings for comparison). Comparisons are case-independent. All patterns must be matched in order to append the row. In the future a command may be added to perform queries on tables, similar to SQL for databases.	No filtering.

The following figures show the input tables and results (modified first table) corresponding to the parameters shown in the editor dialog figure above. Note that the column names for "Table2" have a "2".



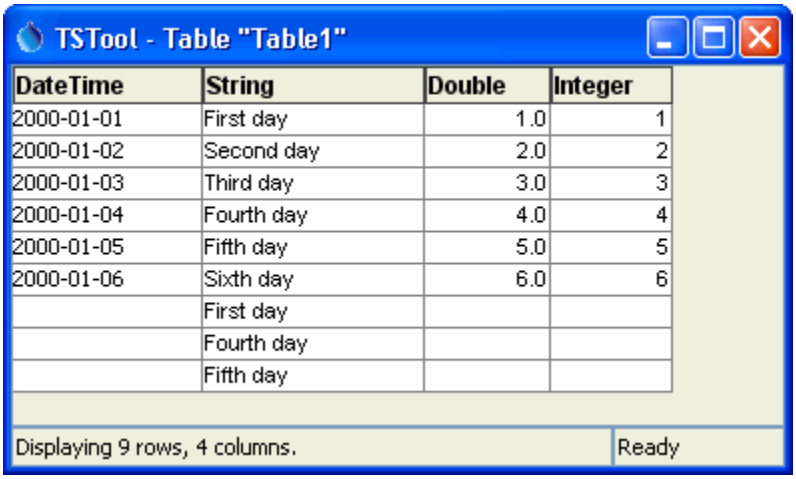
AppendTable_Table1

Table Corresponding to `TableID` in Command Editor



AppendTable_Table2

Table Corresponding to `AppendTableID` in Command Editor



AppendTable_Table1

Table Corresponding to Results from Parameters in Command Editor

Command Reference: ARMA()

Lag and attenuate a time series using AutoRegressive Moving Average

Version 10.13.00, 2012-10-25

The ARMA( ) command lags and attenuates a time series (e.g., to route a streamflow time series downstream). This approach preserves the "mass" of the data. The general equation for ARMA is:

$$O_t = a_1 * O_{t-1} + a_2 * O_{t-2} + ... + a_p * O_{t-p} + b_0 * I_t + b_1 * I_{t-1} + ... + b_q * I_{t-q}$$

Where:

t = time step

O_t = output value at time t

I_t = input value at time t

a, b = ARMA coefficients

and the p and q values indicate the degree of the equation: ARMA(p,q).

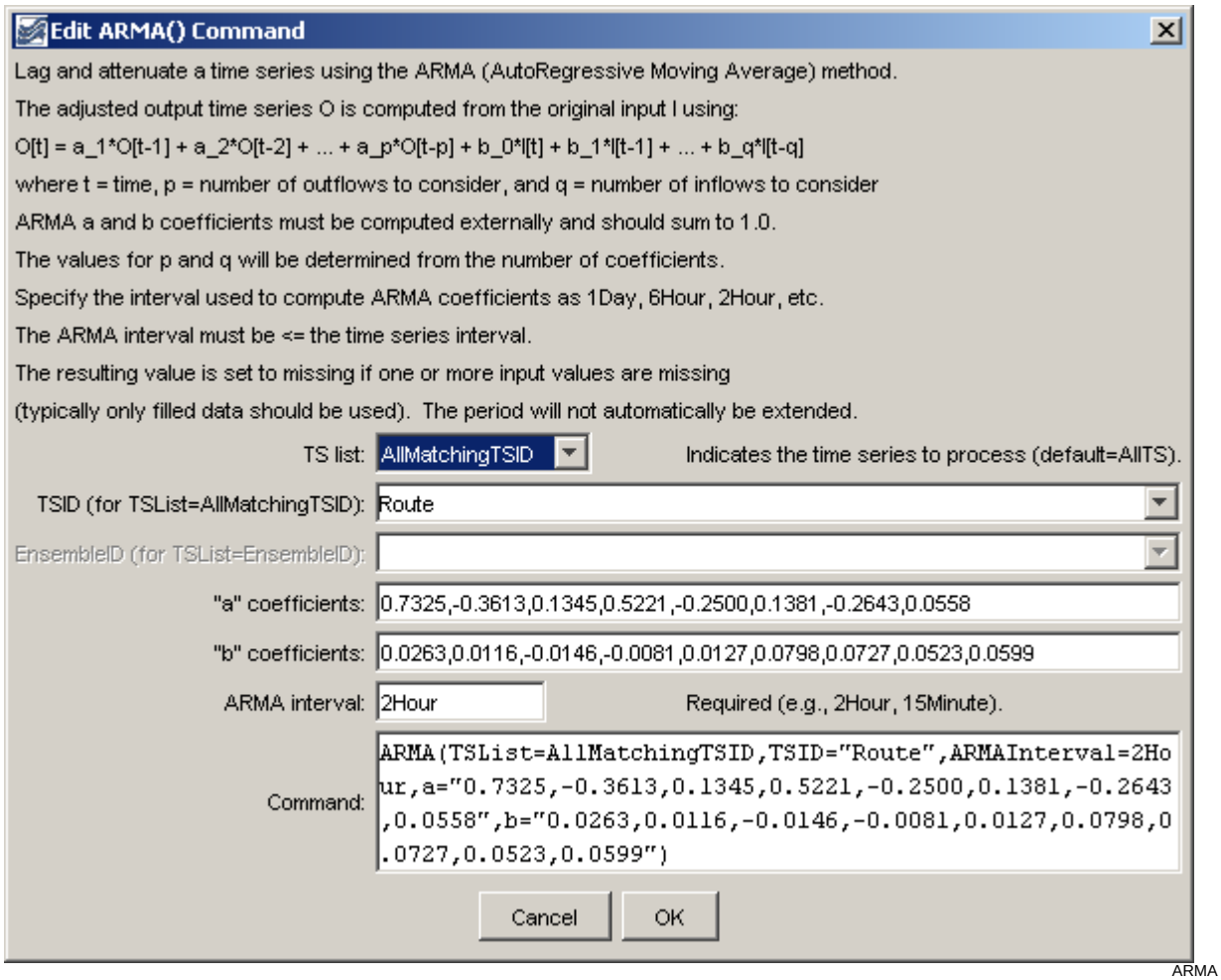
The ARMA coefficients are determined by analyzing historical data and may be developed using a data interval that is different than the data interval of the time series that is being manipulated. The coefficients are typically computed by an external analysis program (TSTool does not perform this function).

The time series to process can have any interval. The *a* and *b* coefficients are listed in the dialog from left-most to right-most in the equation. Note that there are *p a*-coefficients and *(q + 1) b*-coefficients (because there is a *b*-coefficient at time t_0). The interval used to compute the ARMA coefficients can be different from the data interval but the data and ARMA intervals must be divisible by a common interval. The ARMA algorithm is executed as follows:

1. The data and ARMA intervals are checked and if they not the same, the data are expanded by duplicating each value into a temporary array. For example, if the data interval is 6Hour and the ARMA interval is 2Hour, each data value is expanded to three data values (2Hour values). If the data interval is 6Hour and the ARMA interval is 10Hour, each data value is expanded to three data values (2Hour values).
2. The ARMA equation is applied at each point in the expanded data array. However, because the ARMA coefficients were developed using a specific interval, only the data values at the ARMA interval are used in the equation. For example, if the expanded data array has 2Hour data and the ARMA interval is 10Hour, then every fifth value will be used (e.g., *t* corresponds to the "current" value and *t – 1* corresponds to the fifth value before the current value). Because the ARMA algorithm depends on a number of previous terms in both the input and output, there will be missing terms at the beginning of the data array and in cases where missing data periods are encountered. Ideally ARMA will be applied to filled data and only the initial conditions will be an issue. In this case the output period should ideally be less than the total period so that the initial part of the routed time series can be ignored. In cases where *O* values are missing, the algorithm first tries to use the *I* values. If any values needed for the result are missing, the result is set to missing.
3. The final results are converted to a data interval that matches the original input, if necessary. If the original data interval and the ARMA interval are the same, no conversion is necessary. For example, if the original data interval is 6Hour and the ARMA interval is 10Hour, then the expanded data

interval will be 2Hour. Consequently, three sequential expanded values are averaged to obtain the final 6Hour time series.

The following dialog is used to edit the command and illustrates the command syntax.



ARMA

ARMA() Command Editor

The command syntax is as follows:

```
ARMA(Parameter=Value,…)
```

Command Parameters

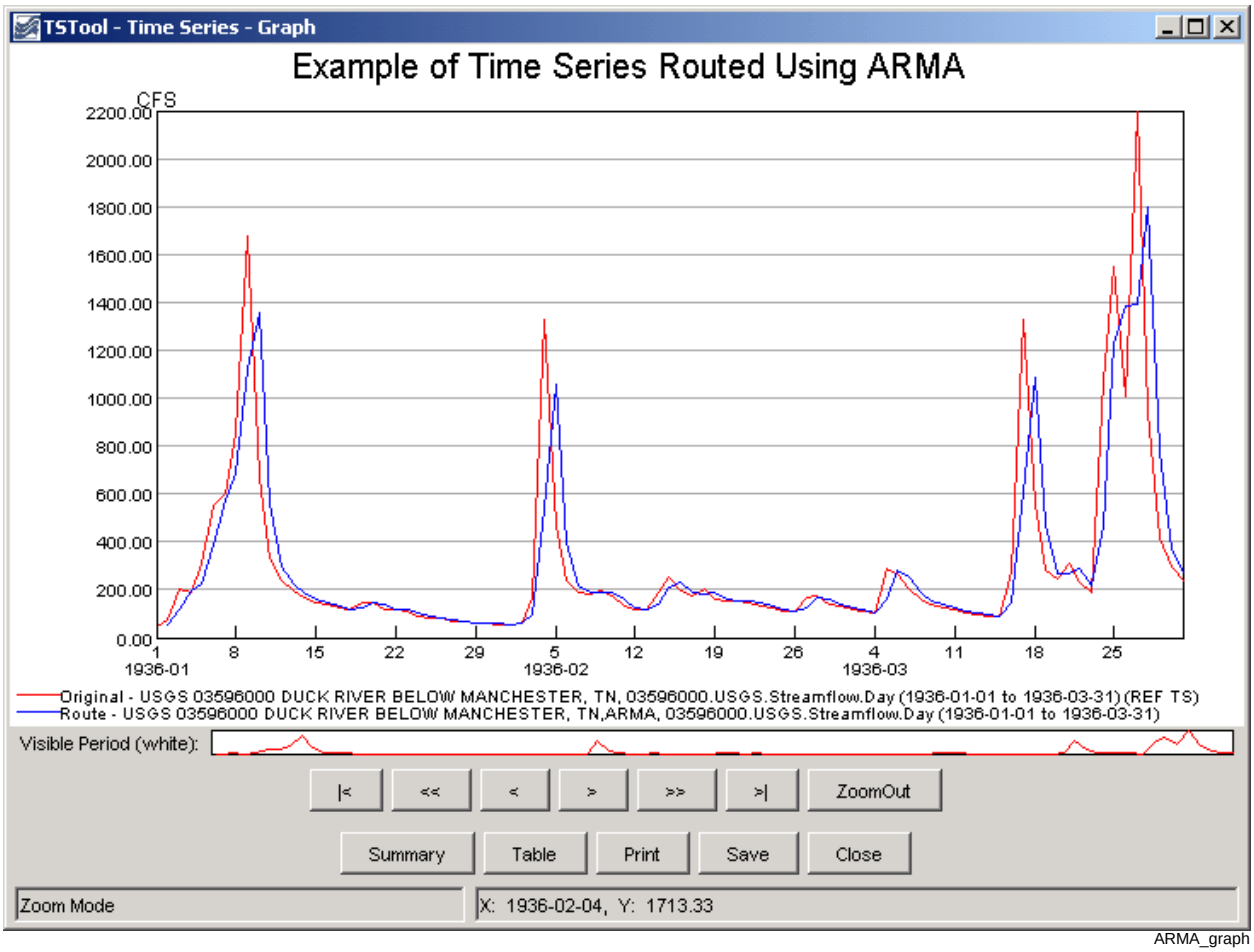
Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be modified. • `FirstMatchingTSID` – the first time series that matches the	`AllTS`

Parameter	Description	Default
	`TSID` (single TSID or TSID with wildcards) will be modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required if `TSList= EnsembleID`.
`ARMA Interval`	The ARMA interval to use in the analysis	None – must be specified.
`a`	a coefficients.	Optional.
`b`	b coefficients.	None – must be specified.

A sample command file to process streamflow data from the USGS is as follows:

```
SetOutputPeriod(OutputStart="1936-01-01",OutputEnd="1936-03-31")
ReadUsgsNwisRdb(InputFile="Data/G03596000.rdb",Alias=Original)
Copy(TSID="Original",NewTSID="03596000.USGS.Streamflow.Day.Routed",Alias=Routed)
ARMA(TSList=AllMatchingTSID,TSID="Routed",ARMAInterval=2Hour,a="0.7325,
-0.3613,0.1345,0.5221,-0.2500,0.1381,-0.2643,0.0558",b="0.0263,0.0116,
-0.0146,-0.0081,0.0127,0.0798,0.0727,0.0523,0.0599")
```

The following figure shows the original and routed time series.

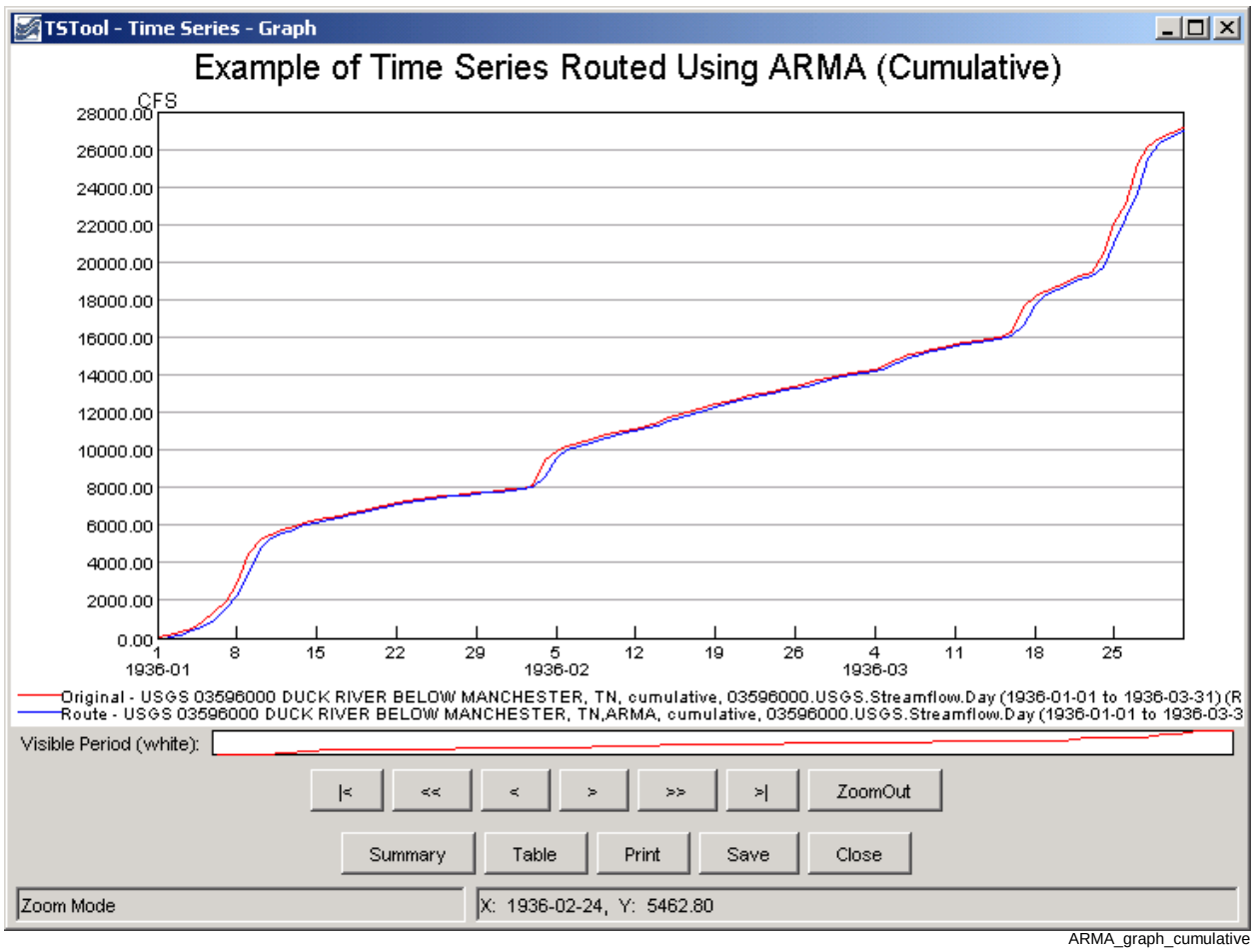


ARMA_graph

Example Graph Showing Original and ARMA-Routed Time Series

The `Cumulate()` command can be used to verify mass balance of the original and routed time series (see the `Cumulate()` command discussion below). For example, insert a `Cumulate()` command near the end of a command file.

The following figure shows the time series from the previous graph, this time as cumulative time series.



ARMA_graph_cumulative

Example Graph Showing Original and ARMA-Routed Time Series as Cumulative Values

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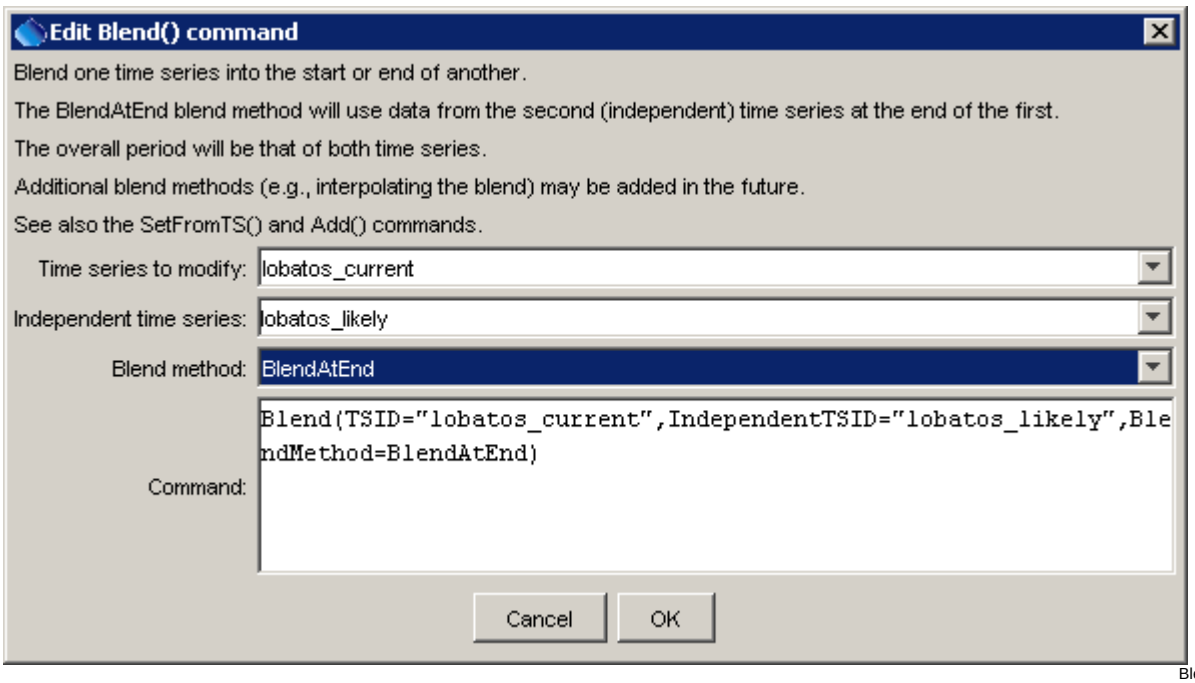
Command Reference: Blend()

Append a Time Series to the End of Another Time Series

Version 08.15.00, 2008-05-01

The `Blend()` command blends one time series into another, extending the first time series period if necessary. This is typically used for combining time series for a station that has been renamed or to blend historic and real-time data. The second (independent time series) will ALWAYS override the first time series. See also the `SetFromTS()` and `Add()` commands. The `Blend()` command ensures that single data values are used whereas `Add()` will add values if more than one value is available at the same date/time. The `SetFromTS()` does not extend the period.

The following dialog is used to edit the command and illustrates the syntax of the command.



Blend

Blend() Command Editor

The command syntax is as follows:

```
Blend(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be modified.	None – must be specified.
IndependentTSID	The time series identifier or alias for the time series to be blended to the first time series.	None – must be specified.
BlendMethod	The method used to blend the data, one of: • BlendAtEnd, resulting in the main time series having the other time series attached to the end of its period.	None – must be specified. Currently only BlendAtEnd is recognized.

A sample command file to blend two time series from the State of Colorado's HydroBase database is as follows:

```
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Month~HydroBase
Blend(TSID="08236000.DWR.Streamflow.Month",
  IndependentTSID="08236500.DWR.Streamflow.Month",
  BlendMethod="BlendAtEnd")
```

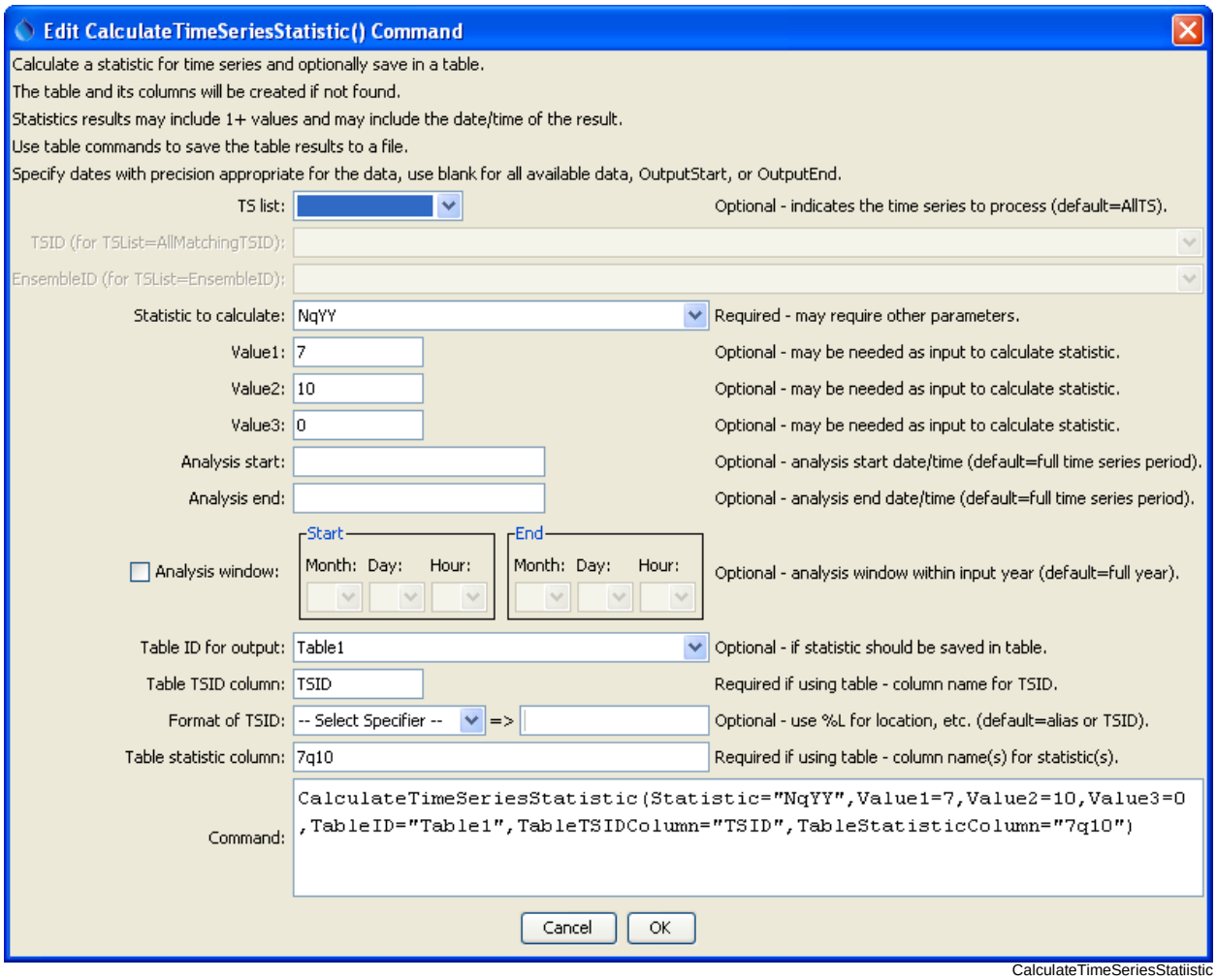
Command Reference: CalculateTimeSeriesStatistic()

Calculate time series statistic

Version 10.18.00, 2013-02-21

The `CalculateTimeSeriesStatistic()` command calculates a statistic for a time series (typically a single value, but may have multiple output values) and optionally adds the result to a table. Multiple time series can be processed. The sample from each time series consists of data values for the full period or a shorter analysis period if specified for the command. Missing values typically are ignored unless significant for the statistic (e.g., `Statistic=MissingCount`).

The following dialog is used to edit the command and illustrates the command syntax. Most statistics do not require additional input; however, those that do utilize the `Value*` parameters to specify additional information.



CalculateTimeSeriesStatiistic

CalculateTimeSeriesStatistic() Command Editor

The command syntax is as follows:

```
CalculateTimeSeriesStatistic(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards). • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards). • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards). • SelectedTS – the time series selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be processed, if processing an ensemble.	Required if TSList=EnsembleID.
Statistic	Statistic to compute as shown in the **Statistic Details** table below.	None – must be specified.
Value1	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	See **Statistic Details** table below.
Value2	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	See **Statistic Details** table below.
Value3	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	See **Statistic Details** table below.
AnalysisStart	The date/time to start analyzing data.	Full period is analyzed.
AnalysisEnd	The date/time to end analyzing data.	Full period is analyzed.
Analysis WindowStart	The calendar date/time for the analysis start within each year. Specify using the format MM, MM-DD, MM-DD hh, or MM-DD hh:mm, consistent with the time series interval precision. A year of 2000 will be used internally to parse the date/time. Use this parameter to limit data processing within the year, for example to analyze only a season. The analysis window has only been enabled for Count, GECount, GTCount, LECount, LTCount, Max,	Analyze the full year.

Parameter	Description	Default
	`Min`, `MissingCount`, `MissingPercent`, `NonmissingCount`, and `NonmissingPercent` statistics.	
`Analysis WindowEnd`	Specify date/time for the analysis end within each year. See `AnalysisWindowStart` for details.	Analyze the full year.
`TableID`	Identifier for table that receives the statistic. An existing table can be specified. If not found, a new table will be created.	Optional – table output is not required.
`TableTSIDColumn`	Table column name that is used to look up the time series. If a matching TSID is not found, a row will be added to the table. If a TSID is found, the statistic cell value for the time series is modified.	Optional – table output is not required.
`TableTSIDFormat`	The specification to format the time series identifier to insert into the TSID column. Use the format choices and other characters to define a unique identifier.	Time series alias if available, or the time series identifier.
`TableStatistic Column`	Table column name to receive the statistic value. If not found in the table, a new column is added automatically.	Optional – table output is not required.

The following table provides additional information about specific statistics, in particular to describe how the statistic is computed and whether additional input needs to be provided with `Value` command parameters.

Statistic Details

Statistic	Description	Required Values
`Count`	Number of data values total, including missing and non-missing.	
`DeficitMax`	Maximum deficit value (where deficit is mean minus value).	
`DeficitMean`	Mean deficit value (where deficit is mean minus value).	
`DeficitMin`	Minimum deficit value (where deficit is mean minus value).	
`DeficitSeqLengthMax`	Maximum number of sequential intervals where each value is less than the mean (for example maximum drought length).	
`DeficitSeqLengthMean`	Mean number of sequential intervals where each value is less than the mean (for example mean drought length).	
`DeficitSeqLengthMin`	Minimum number of sequential intervals where each value is less than the mean (for example minimum drought length).	
`DeficitSeqMin`	Maximum sum of sequential values where each value is less than the mean (for example maximum drought water volume).	
`DeficitSeqMean`	Mean of the sum of sequential values where each	

Statistic	Description	Required Values
	value is less than the mean (for example mean drought water volume).	
DeficitSeqMin	Minimum sum of sequential values where each value is less than the mean (for example minimum drought water volume).	
GECount	Count of values greater than or equal to Value1.	Value1 – criteria to check
GTCount	Count of values greater than Value1.	Value1 – criteria to check
Lag-1AutoCorrelation	Autocorrelation between values and the those that follow in the next time step, given by: $r_k = \frac{\sum_{i=1}^{N-k}(Y_i - Y_{mean})(Y_{i+k} - Y_{mean})}{\sum_{i=1}^{N}(Y_i - Y_{mean})^2}$	
Last	Last non-missing value.	
LECount	Count of values less than or equal to Value1.	Value1 – criteria to check
LTCount	Count of values less than Value1.	Value1 – criteria to check
Max	Maximum value.	
Mean	Mean value.	
Min	Minimum value.	
MissingCount	Number of missing values.	
MissingPercent	Percent of values that are missing.	
MissingSeqLengthMax	Maximum number of sequential values that are missing.	
NonmissingCount	Number of non-missing values.	
NonmissingPercent	Percent of values that are not missing.	
NqYY	This statistic is typically used to evaluate the return period of low flows and is implemented only for daily data. The N indicates the number of daily values to be averaged and YY indicates the return interval. For example, 7q10 indicates the flow corresponding to the 10-year recurrence interval for minimum average daily flow (for 7 days) in a year. This statistic is computed as follows, using 7q10 as an example: 1. Determine the number of years to be analyzed (from analysis period command parameters or time series data). 2. For each year, loop through each day from January 1 to December 31. Compute an average flow by averaging 7 days, in this case with 3 values on each side of the current day and including the current day. If at the end of the year, use 3 values from adjoining years. The number of missing data allowed is controlled by the Value3 command parameter.	Value1 – specify the number of daily values to be averaged. Currently this must be an odd number to allow bracketing the current day. Value2 – specify the return interval (e.g., 10). Value3 – specify the number of

Statistic	Description	Required Values
	3. For the year, save the minimum 7-day average. 4. Utilize the minimum values for all years, with log-Pearson Type III distribution, to determine the value for the 10-year recurrence interval. See http://pubs.usgs.gov/sir/2008/5126/section3.html for a description of NqYY and "Hydrology for Engineers, 3rd Edition," Linsley, Kohler, Paulhus for a description of log-Pearson Type III distribution.	missing values allowed in the average (e.g., 0 for most rigorous analysis). It may be useful to set this value if, for example, a single daily value is available in the time series, for example entered on the first day of the month.
`Skew`	Skew coefficient, as follows: $Cs = \frac{N \Sigma_{i=1}^{N} (Y_i - Y_{mean})^3}{(n-1)(n-2)s^3}$ where s = standard deviation	
`StdDev`	Standard deviation.	
`SurplusMin`	Maximum surplus value (where surplus is value minus mean).	
`SurplusMean`	Mean surplus value (where surplus is value minus mean).	
`SurplusMin`	Minimum surplus value (where surplus is value minus mean).	
`SurplusSeqLengthMax`	Maximum number of sequential intervals where each value is greater than the mean (for example maximum water surplus length).	
`SurplusSeqLengthMean`	Mean number of sequential intervals where each value is greater than the mean (for example mean water surplus length).	
`SurplusSeqLengthMin`	Minimum number of sequential intervals where each value is greater than the mean (for example minimum water surplus length).	
`SurplusSeqMin`	Maximum sum of sequential values where each value is greater than the mean (for example maximum water surplus volume).	
`SurplusSeqMean`	Mean of the sum of sequential values where each value is greater than the mean (for example mean water surplus volume).	
`SurplusSeqMin`	Minimum sum of sequential values where each value is greater than the mean (for example minimum water surplus volume).	
`Total`	Total of values.	
`TrendOLS`	Ordinary least squares analysis is used to compute results that are named `TableStatisticColumn`	

Statistic	Description	Required Values
	with appended _Intercept, _Slope, and _R2.	
Variance	Variance.	

The following example illustrates how to use the command to compute the 7q10 statistic for daily flow:

```
ReadDateValue(Alias="linsley",InputFile="Data\linsley.dv")
  NewTable(TableID="Table1",Columns="TSID,string;7q10,double")
CalculateTimeSeriesStatistic(Statistic="NqYY",Value1=7,Value2=10,Value3=6,
  TableID="Table1",TableTSIDColumn="TSID",TableStatisticColumn="7q10")
WriteTableToDelimitedFile(TableID="Table1",
  OutputFile="Results/Test_CalculateTimeSeriesStatistic_7q10_linsley_out.csv")
```

Command Reference: ChangeInterval()

Create new time series by changing the input time series data interval

Version 10.10.01, 2011-04-18

The `ChangeInterval()` command creates new time series by changing the data interval of each input time series. A list of one or more time series or an ensemble of time series can be processed. The majority of the original header data (e.g., description, units) are copied to the new time series; however, the new interval will be used for data management and in the new time series identifier. Time series data values have a time scale of instantaneous, accumulated (e.g., volume), or mean. Changing the interval also can result in a change in the time scale (e.g., converting instantaneous values to a mean value). Currently, the time scale for input and output time series is NOT automatically determined from the data type and interval and must be specified as ACCM, MEAN, or INST. Instantaneous values are recorded at the date/time of the value and typically apply to small intervals (e.g. minute and hour). For mean and accumulated time series, the date/time for each value is at the end of the interval for which the value applies.

Irregular time series have a date/time precision and a scale appropriate for the data. For example, irregular minute time series may be used for instantaneous temperature or accumulated precipitation. Irregular day time series may be used for "instantaneous" reservoir level. For regular time series, the data intervals must align so that each larger interval aligns with the end-points of the corresponding smaller intervals (e.g., the ends of 6-hour intervals align with the daily interval).

The following conversions are currently supported, with a description of the conversion process. Refer to the command parameter reference for an explanation of parameters. The conversion from daily and monthly interval to yearly interval (for ACCM and MEAN) utilizes a simpler algorithm.

Irregular Time Series to Regular Time Series

An irregular time series can be converted to a regular time series. The ability to change from an irregular or regular time series to an irregular time series currently is not implemented. Missing data is handled in different ways depending on the old and new time scales. Each of the follow examples demonstrates how missing data is interpreted.

The following conversion combinations are allowed.

Small Interval ACCM to Large Interval ACCM

When converting from small interval accumulated data to large interval accumulated data, values from the old time series are summed for the new interval-ending date/time from the values in the old intervals prior to this date/time.

The following illustrates the conversion from NHour to NHour (1Hour to 3Hour example):

Day 1, Hour 0 (A)	Day 1, Hour 1 (B)	Day 1, Hour 2 (Missing)	Day 1, Hour 3 (C)	Day 1, Hour 4 (Missing)	Day 1, Hour 5 (Missing)	Day 1, Hour 6 (Missing)
Day 1, Hour 0 =A	Day 1, Hour 3 =B+C			Day 1, Hour 6 = Missing		

Large Interval ACCM to Small Interval ACCM

When converting from large interval accumulated data to small interval accumulated data, values from the old time series are equally divided by the number of intervals prior to this date/time in the new time series since the previous non-missing data.

The following illustrates the conversion from NHour to NHour (3Hour to 1Hour example):

Day 1, Hour 0 (A)			Day 1, Hour 3 (B)			Day 1, Hour 6 (Missing)			Day 1, Hour 9 (C)		
Day 1, Hour 0 =A	Day 1, Hour 1 =B/3	Day 1, Hour 2 =B/3	Day 1, Hour 3 =B/3	Day 1, Hour 4 =C/6	Day 1, Hour 5 =C/6	Day 1, Hour 6 =C/6	Day 1, Hour 7 =C/6	Day 1, Hour 8 =C/6	Day 1, Hour 9 =C/6

Small Interval MEAN or INST to Large Interval MEAN

When converting from instantaneous or mean data to mean data, mean values are calculated for the new interval-ending date/time from the values in the old intervals prior to this date/time.

The following illustrates the conversion from NHour to NHour (1Hour to 3Hour example):

Day 1, Hour 0 (A)	Day 1, Hour 1 (B)	Day 1, Hour 2 (Missing)	Day 1, Hour 3 (C)	Day 1, Hour 4 (Missing)	Day 1, Hour 5 (Missing)	Day 1, Hour 6 (Missing)
Day 1, Hour 0 =A	Day 1, Hour 3 =(B+C)/2			Day 2, Hour 6 = Missing		

Large Interval MEAN or INST to Small Interval MEAN

When converting from large interval mean or instantaneous data to small interval mean data, values from the old time series are copied to the new interval-ending date/time time series.

The following illustrates the conversion from NHour to NHour (3Hour to 1Hour example):

Day 1, Hour 0 (A)			Day 1, Hour 3 (B)			Day 1, Hour 6 (Missing)			Day 1, Hour 9 (C)		
Day 1, Hour 0 =A	Day 1, Hour 1 =B	Day 1, Hour 2 =B	Day 1, Hour 3 =B	Day 1, Hour 4 =C	Day 1, Hour 5 =C	Day 1, Hour 6 =C	Day 1, Hour 7 =C	Day 1, Hour 8 =C	Day 1, Hour 9 =C

Small Interval INST to Large Interval INST

When converting from small interval instantaneous data to large interval instantaneous data, the data is copied directly from the old time series when available. If the data is missing, the most recent previous valid data is used.

The following illustrates the conversion from NHour to NHour (1Hour to 3Hour example):

Day 1, Hour 0 (A)	Day 1, Hour 1 (B)	Day 1, Hour 2 (Missing)	Day 1, Hour 3 (C)	Day 1, Hour 4 (Missing)	Day 1, Hour 5 (D)	Day 1, Hour 6 (Missing)	Day 1, Hour 7 (E)	Day 1, Hour 8 (F)
Day 1, Hour 0 =A			Day 1, Hour 3 =C			Day 1, Hour 6 =D		

Large Interval INST to Small Interval INST

When converting from large interval instantaneous data to small interval instantaneous data, values from the old time series are linearly interpolated to calculate values for the new time series.

The following illustrates the conversion from NHour to NHour (3Hour to 1Hour example):

Day 1, Hour 0 (A)			Day 1, Hour 3 (B)			Day 1, Hour 6 (Missing)			Day 1, Hour 9 (C)
Day 1, Hour 0 =A	Day 1, Hour 1 =A+ (B-A)* (1/3)	Day 1, Hour 2 =A+ (B-A)* (2/3)	Day 1, Hour 3 =B	Day 1, Hour 4 =B+ (C-B)* (1/6)	Day 1, Hour 5 = B+ (C-B)* (2/6)	Day 1, Hour 6 = B+ (C-B)* (3/6)	Day 1, Hour 7 = B+ (C-B)* (4/6)	Day 1, Hour 8 = B+ (C-B)* (5/6)	Day 1, Hour 9 =C

Regular Time Series to Regular Time Series

ACCM (Accumulation) to ACCM (Accumulation)

Small Interval ACCM (Accumulation) to Large Interval ACCM (Accumulation)

Changing the interval for small interval accumulated data to large interval accumulated data involves summing the small interval data values for the period that overlaps the large interval.

Accumulated data have a timestamp corresponding to the interval-end for the accumulation. Conversions involving time intervals that have zero values (e.g., Hour 0, Minute 0) result in a perceived shift in time because the zero occurs on the boundary between larger intervals. The following examples illustrate the accumulation for common cases. In cases where an accumulation jumps over two or more interval categories (e.g., minute to day), the accumulation occurs as if the two intermediate accumulations occurred in succession. In the following examples, the general representation is shown first, followed by an example where appropriate.

The following illustrates the conversion from NHour to Day (6Hour to Day example, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*	Day 2, Hour *0*
Day 1, Hour 0	Day 1, Hour 6 (A)	Day 1, Hour 12 (B)	Day 1, Hour 18 (C)	Day 2, Hour 0 (D)
	Day 1 accumulation (A+B+C+D)			

The following illustrates the conversion from NDay to Month (example for a month with 30 days):

Month 1, Day 1 (A1)	…		…	Month 1, Day 30 (A30)
Month 1 accumulation (A1 + … + A30)				

Large Interval ACCM (Accumulation) to Small Interval ACCM (Accumulation)

Changing from large interval accumulation data to small interval mean data involves dividing each accumulated value by the number of new values for that same period of record.

The following illustrates the conversion from Day to 6Hour (Day to 6Hour example, *i* equals the hour multiplier):

Day 1 accumulate (A)			
Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour 2*i*	Day 1, Hour *3i*
Day 1, Hour 0 = A/4	Day 1, Hour 6 = A/4	Day 1, Hour 12 = A/4	Day 1, Hour 18 = A/4

ACCM (Accumulation) to INST (Instantaneous)

Accumulated to instantaneous is not currently supported.

ACCM (Accumulation) to MEAN

Small Interval ACCM to Large Interval MEAN

See **Small Interval INST (Instantaneous) to Large Interval MEAN.**

Interval ACCM to Same Interval MEAN

Changing the interval from accumulation data to the same interval mean data involves copying the data from the old time series to the new time series (no changes to date values occur).

The following illustrates the conversion from 6Hour to 6Hour (6Hour to 6Hour example, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour 2*i*	Day 1, Hour *3i*
Day 1, Hour 0 (A)	Day 1, Hour 6 (B)	Day 1, Hour 12 (C)	Day 1, Hour 18 (D)
Day 1, Hour 0 =A	Day 1, Hour 6 =B	Day 1, Hour 12 =C	Day 1, Hour 18 =D

Large Interval ACCM to Small Interval MEAN

See **Large Interval ACCM to Small Interval ACCM.**

INST (Instantaneous) to INST (Instantaneous)

Small Interval INST (Instantaneous) to Large Interval INST (Instantaneous)

Changing the interval for small interval instantaneous data to large interval instantaneous data involves assigning each date in the new time series a value from the corresponding date in the old time series. The `HandleMissingInputHow` parameter indicates how to interpret a missing value in the old time series. `HandleMissingInputHow=KeepMissing` will simply assign a missing value for that date/time. `HandleMissingInputHow=SetToZero` will set the value to 0. `Repeat` fills the date with data from the last non-missing value. Interpolation and using a non-missing future value may be added in the future.

A special case is the ability to compute a statistic from the sample of values from the input time series, using the `Statistic` parameter. For example, instantaneous 5 minute temperature data can be converted to 1 day maximum values. In this case, each 1 day sample of values from the input time series is used to compute the statistic. The initial handling of missing data described above is supported and additionally the `AllowMissingCount` parameter is recognized to control computation of the statistic.

The following illustrates the conversion from NHour to Day (6Hour to Day example where `HandleMissingInputHow` = `Repeat`, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*	Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*
Day 1, Hour 0 (A)	Day 1, Hour 6 (B)	Day 1, Hour 12 (C)	Day 1, Hour 18 (D)	*Missing data*	Day 1, Hour 6 (E)	Day 1, Hour 12 (F)	Day 1, Hour 18 (G)
Day 1 instantaneous = A				Day 2 instantaneous = D			

Large Interval INST (Instantaneous) to Small Interval INST (Instantaneous)

Small interval instantaneous data is created from larger interval instantaneous data by linearly interpolating between the previous and current large interval data to fill each value in the new time series during that same period of time. If the value in the old time series is missing, the method specified by the user in the `HandleMissingInputHow` parameter is used.

The following illustrates the conversion from Day to NHour (Day to 6Hour example, *i* equals the hour multiplier):

Day 1 instantaneous (A)				Day 2 instantaneous (B)				Day 3 …
Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour 2*i*	Day 1, Hour *3i*	Day 2, Hour 0	Day 2, Hour i	Day 2, Hour 2i	Day 2, Hour 3i	
Day 1, Hour 0 =A	Day 1, Hour 6 =A+ (B-A)* (6/24)	Day 1, Hour 12 =A+ (B-A)* (12/24)	Day 1, Hour 18 =A+ (B-A)* (18/24)	Day 2, Hour 0 =B	Day 2, Hour 6 …	Day 2, Hour 12 …	Day 2, Hour 18 …	
These values are an interpolated value between the Day 1 instantaneous value and the Day 2 instantaneous value using a time of 24 hours.				These values are an interpolated value between the Day 2 instantaneous value and the Day 3 instantaneous value using a time of 24 hours.				

In the future, the ability to repeat input values may be added.

INST (Instantaneous) to ACCM (Accumulation)

Instantaneous to accumulated is not currently supported.

INST (Instantaneous) to MEAN

Small Interval INST (Instantaneous) to Large Interval MEAN

Changing from small interval instantaneous data to large interval mean data involves adding together all the values from the small interval time series over the larger interval for the corresponding time period and then dividing by the number of data values used within this calculation. As in other conversions, `HandleMissingInputHow` is first used to interpret missing data. If `HandleEndpointHow` = `AverageEndpoints`, the values at each end of the interval are averaged for minute and hour inputs (the parameter does not apply to day, month or year input).

The following illustrates the conversion from NHour to Day (6Hour to Day example with `HandleEndpointHow` = `IncludeFirstOnly`, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*	Day 2, Hour *0*	Day 2, Hour *i*	Day 2, Hour *2i*	Day 2, Hour *3i*
Day 1, Hour 0	Day 1, Hour 6	Day 1, Hour 12	Day 1, Hour 18	Day 2, Hour 0	Day 2, Hour 6	Day 2, Hour 12	Day 2, Hour 18
Value A	B	C	D	E	F	G	H
Day 1 mean= (A+B+C+D)/4				Day 2 mean=(E+F+G+H)/4			

The following illustrates the conversion from NHour to Day (6Hour to Day example with `HandleEndpointHow` = `AverageEndpoints`, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*	Day 2, Hour *0*	Day 2, Hour *i*	Day 2, Hour *2i*	Day 2, Hour *3i*	
Day 1, Hour 0	Day 1, Hour 6	Day 1, Hour 12	Day 1, Hour 18	Day 2, Hour 0	Day 2, Hour 6	Day 2, Hour 12	Day 2, Hour 18	
Value A	B	C	D	E	F	G	H	I
Day 1 mean= ((A+E)/2 +B+C+D) / 4				Day 2 mean=((E+I)/2+F+G+H) / 4				

Interval INST (Instantaneous) to Same Interval MEAN

If `OutputFillMethod` = `Interpolate`, see **Large Interval INST (Instantaneous) to Small Interval INST (Instantaneous).** Otherwise, the values are duplicated from the old time series directly to the new time series.

The following illustrates the conversion from 6Hour to 6Hour (6Hour to 6Hour example with `OutputFillMethod = Repeat`, *i* equals the hour multiplier):

Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour *2i*	Day 1, Hour *3i*	Day 2, Hour *0*
Day 1, Hour 0 (A)	Day 1, Hour 6 (B)	Day 1, Hour 12 (Missing)	Day 1, Hour 18 (D)	Day 2, Hour 0 (E)
Day 1, Hour 0 =A	Day 1, Hour 6 =B	Day 1, Hour 12 =B	Day 1 Hour 18 =D	Day 2, Hour 0 =E

Large Interval INST (Instantaneous) to Small Interval MEAN

If the `OutputFillMethod` = `Interpolate`, see **Large Interval INST (Instantaneous) to Small Interval INST (Instantaneous).** The time series are handled in the same way. Otherwise, the values are duplicated from the old time series directly to the new time series.

The following illustrates the conversion from Day to 6Hour (Day to 6Hour example with `OutputFillMethod = Repeat`, *i* equals the hour multiplier):

Day 1 instantaneous = A			
Day 1, Hour *0*	Day 1, Hour *i*	Day 1, Hour 2*i*	Day 1, Hour *3i*
Day 1, Hour 0 =A	Day 1, Hour 6 =A	Day 1, Hour 12 =A	Day 1, Hour 18 =A
Each of these values is equal to the instantaneous value for that day.			

MEAN to MEAN

Small Interval MEAN to Large Interval MEAN

See **Small Interval INST (Instantaneous) to Large Interval MEAN.**

Large Interval MEAN to Small Interval MEAN

Changing from large interval mean data to small interval mean data involves copying values from the old time series into the new time series for that same period of record.

The following illustrates the conversion from Month to Day (Example for a month with 30):

Month Mean (A)			
Day 1 =A	Day 2 =A	…	Day 30 =A

MEAN to ACCM (Accumulation)

Small Interval MEAN to Large Interval ACCM (Accumulation)

See **Small Interval INST (Instantaneous) to Large Interval MEAN.**

Interval MEAN to Same Interval ACCM (Accumulation)

See **Interval ACCM to Same Interval MEAN.**

Large Interval MEAN to Small Interval ACCM (Accumulation)

See **Large Interval ACCM to Small Interval ACCM.**

MEAN to INST (Instantaneous)

Small Interval MEAN to Large Interval INST (Instantaneous)

Not currently supported.

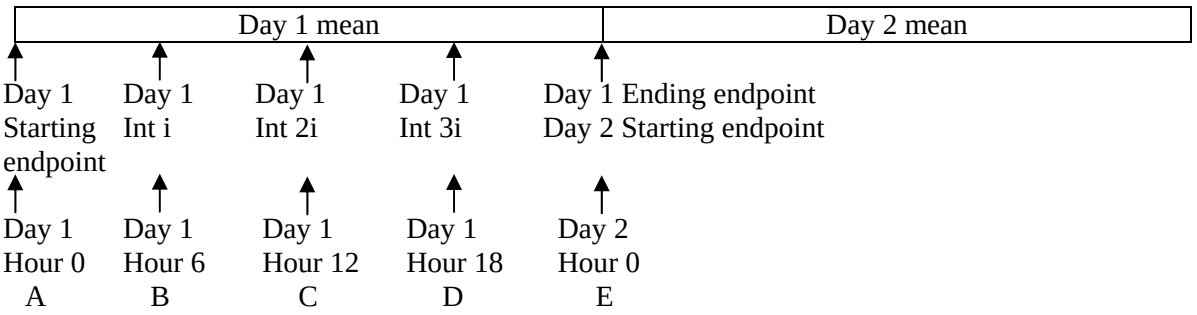
Interval MEAN to Same Interval INST (Instantaneous)

Not currently supported. The data can be treated equivalently by most commands.

Large Interval MEAN to Small Interval INST (Instantaneous)

Changing the interval for large interval mean to small interval instantaneous data involves calculating a value for each new interval based on trends found in the mean data. This approach has been adapted from the NWSRFS CHANGE-T operation (see http://www.nws.noaa.gov/oh/hrl/nwsrfs/users_manual/part5/_pdf/533changet.pdf). The following example demonstrates how the data is converted from the old interval to the new interval. A general representation is shown first followed by an example.

The following illustrates the conversion from Day to NHour (Day to 6Hour example, *i* equals the hour multiplier):



In computing instantaneous values, the volume of the original mean time series needs to be maintained. However, the value of the instantaneous endpoints affects the calculated mean value for the previous and subsequent long intervals, since the mean over a longer interval uses both endpoints in its calculation. In the above example, $Average_{new\ Day\ 1}$ = ((A+E)/2 +B+C+D) / 4

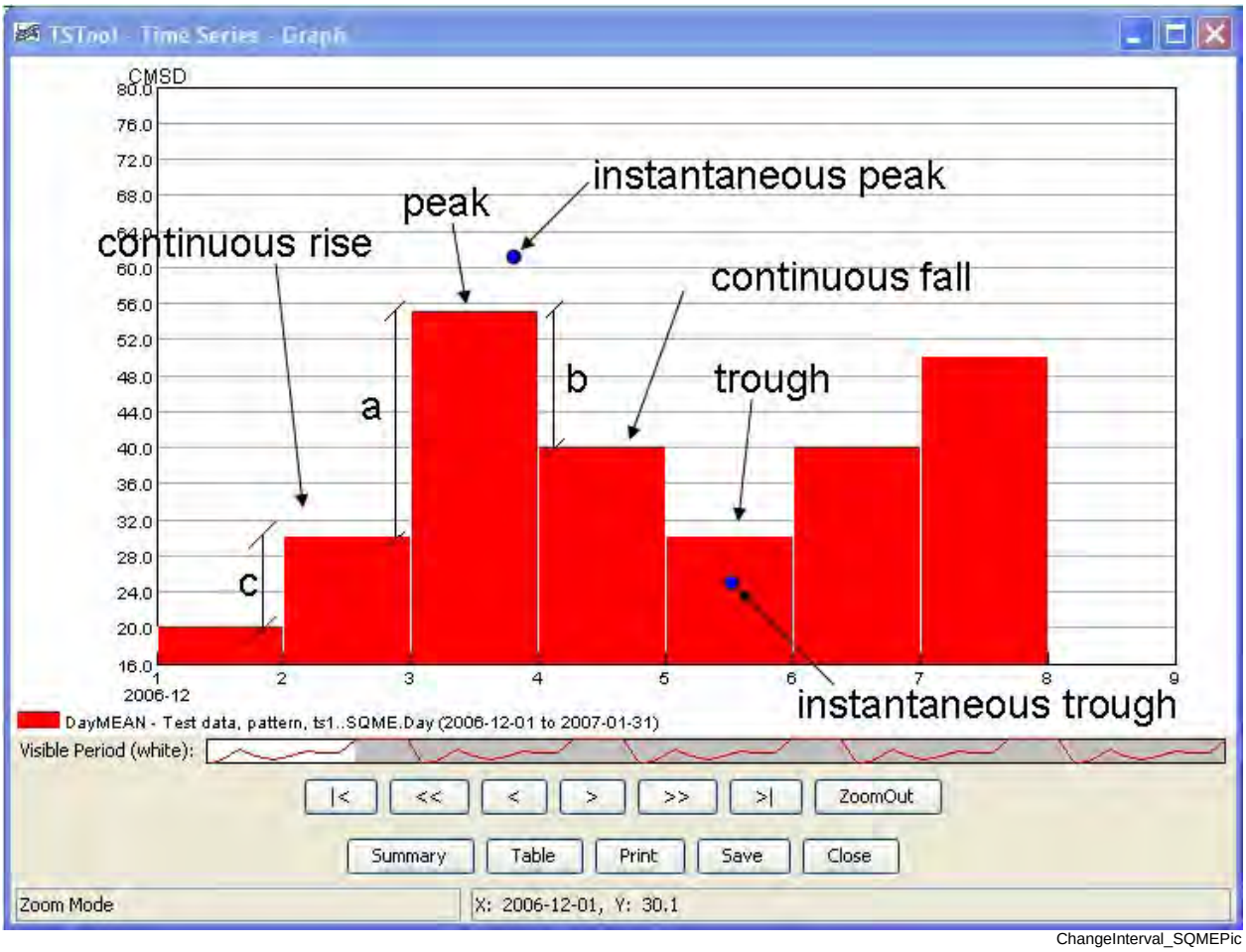
As a result, an iterative technique is required to adjust the initially computed instantaneous values to produce a time series with a volume that is within a specified tolerance of the input mean volume for each time step. The following paragraphs describe how the initial instantaneous time series values are computed, followed by a description of the volume adjustment.

Initial Instantaneous Time Series Calculations

Prior to converting from a large interval mean to small interval instantaneous, special cases are handled associated with missing data:

- Missing data is initially converted using the method specified by the user in the `HandleMissingInputHow` parameter.
- If the current input value is still missing, the instantaneous time series is also filled with missing data for each interval that falls in the larger interval.
- If the previous or next mean values are missing, the current mean value for that interval is copied directly to the instantaneous time series.

The output instantaneous values for each input interval are computed using the current, next, and previous mean values. All three values are useful because together they indicate whether the current value is part of a continuous rise or fall, a peak or trough or simply a continuation of a steady value. These conditions are illustrated in the following figure.



ChangeInterval_SQMEPic

Mean data illustration

- The first condition that may exist is a **peak or trough**. A peak exists when the current value is greater than the previous and next values. A trough is when the current value is less than the next and previous values.
    1. In this case, an *instantaneous peak* (or trough) is calculated. Referring to the above illustration, the magnitude of the peak is calculated by adding (or subtracting for a trough) *¼ (a+b)/2* to the current mean.
    2. The *time of the instantaneous peak* is initially set to the start date/time of the current interval then shifted forward in time using the following calculation. The number of instantaneous intervals per larger interval is multiplied by *b/(a+b)*. That result is added to the start date/time. The time of the instantaneous peak will not necessarily correspond to the output interval.
    3. The value for the starting endpoint of the interval is set to the *current value minus ¼ a*.
    4. The value for the ending endpoint of the interval is set to the *current value minus ¼ b*.
    5. The remaining intermediate instantaneous values for the interval are linearly interpolated between the peak (or trough) and both endpoints.
- The second condition that may exist is a **continuous rise or fall**. A continuous rise or fall exists when the current value is between the previous and next values.
    1. In the case of a continuous rise, the starting endpoint of the interval is set to the *current value minus ¼ c* (again using the above illustration). In the case of a continuous fall, ¼c is added to the current value.

2. The ending endpoint of the interval of a continuous rise is set to the *current value plus¼ c* (minus ¼ c for a continuous fall)
3. The remaining intermediate instantaneous values are calculated based on the following.
    a. The difference between the starting and ending endpoints is computed.
    b. The values *c* and *a* are calculated. The ratio of mean differences is computed: If *c* > *a*, the mean ratio = *c* / *a*. If *a* > *c*, the mean ratio = *a* / *c*.
    c. If *c* is less than *a*, then the intermediate instantaneous values are computed by adding small but increasing increments to the starting endpoint until the last point of the interval is reached. If *a* is less than *c* then the output values are computed by subtracting small but increasing increments to the last endpoint until the first point of the interval is reached. For intermediate interval *n* from the appropriate endpoint:

$Increment_n = (1/([number\ intervals] - n) * [endpoint\ difference] * [mean\ ratio])$

Instantaneous Time Series Volume Adjustment

After the instantaneous values are estimated using the above set of rules, they are adjusted so that the volume over each interval is within a specified tolerance of the input mean volume for each time step. This tolerance is specified with the `Tolerance` parameter. The volume calculation for each interval uses the average of the first and last endpoint.

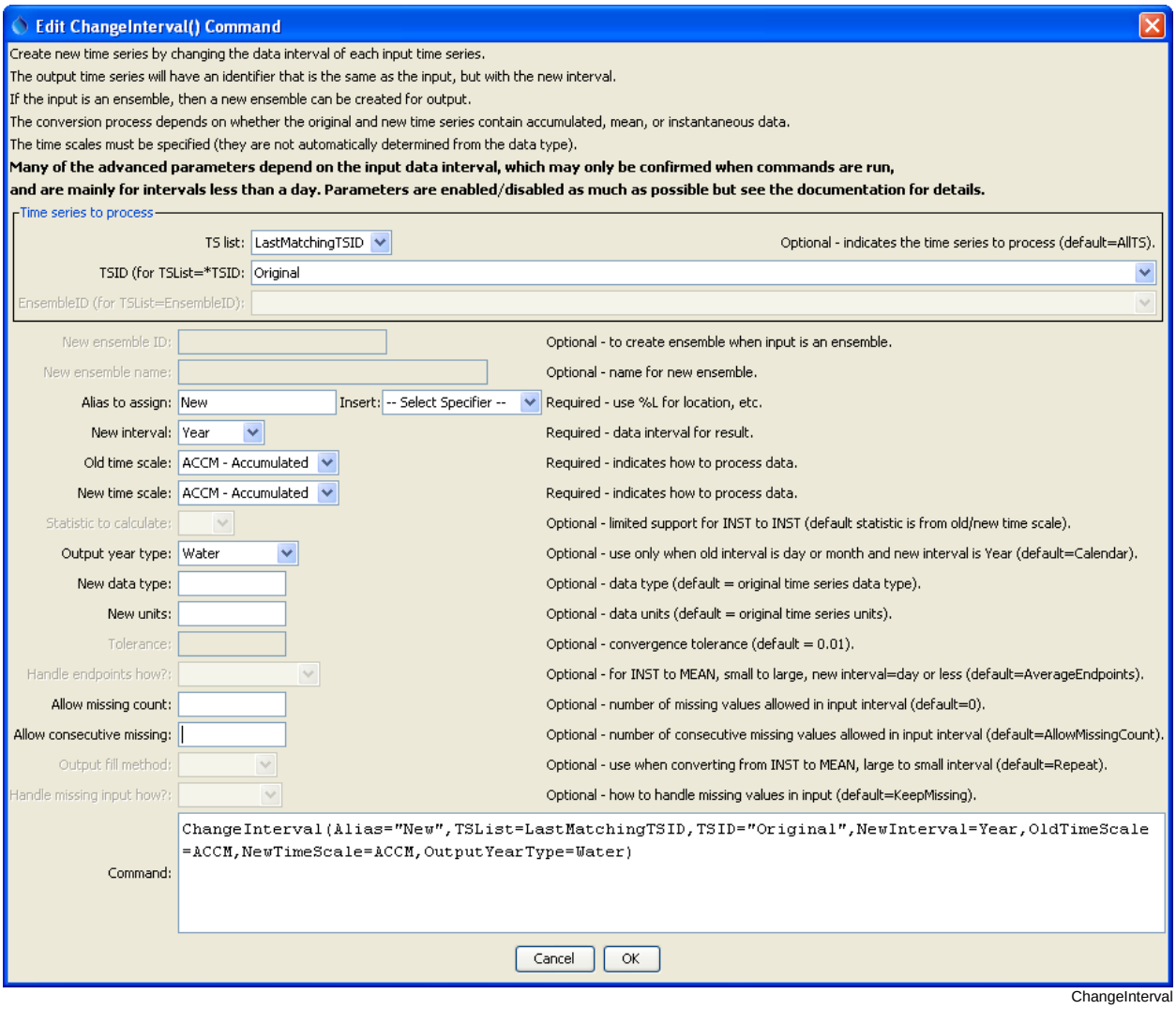
For each time step of the original mean time series, the error of each original interval is computed as:

([mean of current instantaneous values] – [original mean]) / [original mean]

If this volume error is within the tolerance, no adjustment is made for that time interval. If the error is larger than the tolerance, the ratio: *[original mean] / [mean of current instantaneous values]* is computed. For the intermediate instantaneous values, the instantaneous values are adjusted by multiplying each value by this ratio. For the instantaneous endpoint values, since these values affect the mean value of the current and the previous or following time intervals, the endpoint values are not adjusted to the above calculated ratio. Instead, the new endpoint value is computed as the average of the original endpoint value and the original endpoint value multiplied by the above ratio.

The volume error is checked for each original time step. If any adjustments were made, the process is repeated, up to 15 iterations. If the adjustment technique cannot adjust the instantaneous time series such that the corresponding mean volume is within the specified tolerance of the input mean volume within 15 iterations, a warning will be written to the log file.

The following dialog is used to edit the command and illustrates the syntax for the command. This example is converting a monthly volume time series to annual water year (October to September) volumes.



ChangeInterval

ChangeInterval() Command Editor

The command syntax is as follows:

```
ChangeInterval(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ChangeInterval(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) • `AllTS` – all time series generated before the command	`AllTS`

Parameter	Description	Default
	• `EnsembleID` – all time series in the ensemble • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) • `SelectedTS` – the time series selected with the `SelectTimeSeries()` command	
`TSID`	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`NewInterval`	The data interval for the new time series, from the provided choices. For example: `6Hour`, `Day`, `Month`, `Year`.	None – must be specified.
`OldTimeScale`	The time scale for the original time series, one of: `ACCM` – accumulated data `INST` – instantaneous data `MEAN` – mean data In the future, this parameter may be made optional if the time scale can be determined from the data type.	None – must be specified.
`NewTimeScale`	The time scale for the new time series (see `OldTimeScale` for possible values). In the future, this parameter may be made optional if the time scale can be determined from the data type.	None – must be specified.
`Statistic`	Used in the case where `INST` (small interval) to `INST` (large interval) conversion is occurring. A sample of values from the input time series, corresponding to the output interval, is determined and used to compute a statistic instead of a simple value transfer. Statistics that are currently supported are `MAX` and `MIN`. The `HandleMissingInputHow` parameter is initially used to adjust missing data and then the `AllowMissingCount` parameter is used to check whether the statistic can be computed.	The statistic is determined from the old and new time scales.
`OutputYearType`	The output year type if the output time series has an interval of `Year`. The output year type can only be specified for input time series having an interval of	`Calendar`

Parameter	Description	Default
	`Day` or `Month` and the output can have a time scale of `ACCM` (sum the input values) or `MEAN` (average the input values). The `AllowMissingCount` and `AllowMissingConsecutive` parameters are recognized.	
`NewDataType`	The data type for the new time series. This will be set in the identifier of the new time series.	Use the data type from the original time series.
`NewUnits`	The units for the new time series. This will be set in the identifier of the new time series.	Use the units from the original time series.
`Tolerance`	Currently used when converting large interval MEAN data to small interval INST data. After the new time series is created, the volume of the new time series over each old interval is compared to the old time series for that same interval. If the difference between the two is outside the specified tolerance percentage, then each value in the new time series is adjusted so the totals will match. The endpoints are averaged for this comparison. Additionally, when the adjustment is made, the new starting value is averaged with the ending value of the previous interval so that the previous interval is not overly affected by this calculation.	`0.01`
`Handle EndpointsHow`	Indicates how endpoints should be handled when changing from INST to MEAN, small interval to larger interval (daily output or finer), one of: `AverageEndpoints` – use both endpoint values for new single value `IncludeFirstOnly` – only use earlier endpoint	`Average Endpoints`
`AllowMissing Count`	The number of missing values allowed in the input interval in order to produce a result. For example, if converting daily data to monthly, a value of `5` would allow <= `5` missing daily values and still compute the result. This capability should be used with care because it may result in data that are not representative of actual conditions. This parameter is considered after the `HandleMissingHow` parameter.	`0` – do not allow any missing data in the source data when computing a result.
`AllowMissing Consecutive`	The number of consecutive missing values allowed in the input interval in order to produce a result. For example, if converting daily data to monthly, a value of 3 would allow <= 3 consecutive missing daily values and still compute the result. The value must be less than or equal to `AllowMissingCount`. This parameter is considered after the `HandleMissingHow` parameter.	If not specified, the default for the number of allowed consecutive missing values is set to `AllowMissingCount`.
`OutputFill Method`	Use to fill output when converting from INST to MEAN, large interval time series to small interval time series, one of:	`Repeat`

Parameter	Description	Default
	`Interpolate` – linearly interpolate `Repeat` – repeat values for the output	
`HandleMissing InputHow`	Indicate how to handle missing values in input, one of: `KeepMissing` – leave data missing `Repeat` – repeat last non-missing value `SetToZero` – set values to 0 The missing data is handled on input and the replacement value, if any, is applied to input and used for calculations just as if it was the actual value. The following cases do not use this parameter: • Irregular data • Day and Month input converted to ACCM and MEAN.	`KeepMissing`

Several example command files follow. The following commands creates a Day ACCM time series from a Month ACCM time series:

```
0109.NOAA.Precip.Day~HydroBase
ChangeInterval(Alias="0109Month",TSList=AllMatchingTSID,
    TSID="0109.NOAA.Precip.Day",NewInterval=Month,OldTimeScale=ACCM,NewTimeScale=ACCM)
```

The following commands create a 6Hour INST time series from a Day MEAN time series:

```
NewPatternTimeSeries(Alias="DayMEAN",NewTSID="ts1..SQME.Day",Description="Test data",
    SetStart="2006-12-01",SetEnd="2007-01-31",
    Units="CMSD",PatternValues="20,30,55,40,30,40,50,45,45,80,80,80,80")
ChangeInterval(Alias="6HourINST",TSID="DayMEAN",NewInterval=6Hour,OldTimeScale=MEAN,
    NewTimeScale=INST,NewDataType=CMS)
```

The following commands create a Day MEAN time series from a 6Hour INST time series:

```
NewPatternTimeSeries(Alias="6HourInst",NewTSID="ts2..Flow.6Hour",IrregularInterval=6Hour,
    Description="Test data",SetStart="2006-12-15 12",SetEnd="2007-01-29 00",
    Units="CFS",PatternValues="20,23,56,62,35,42")
ChangeInterval(Alias="DayMean2",TSID="6HourInst",NewInterval=Day,OldTimeScale=INST,
    NewTimeScale=MEAN,HandleEndpointsHow=IncludeFirstOnly)
```

The following commands create a 3Hour INST time series from an Irregular (1Hour) INST time series:

```
NewPatternTimeSeries(Alias="IrregularINST",NewTSID="ts1..Temp.Irregular",IrregularInterval=1Hour,
    Description="Test data",SetStart="2006-12-15 00",SetEnd="2007-01-31 23",Units="DEGF",
    PatternValues="20,23,-999,45,-999,-999,56,62,0,-3")
ChangeInterval(Alias="3HourINST",TSID="IrregularINST",NewInterval=3Hour,OldTimeScale=INST,
    NewTimeScale=INST)
```

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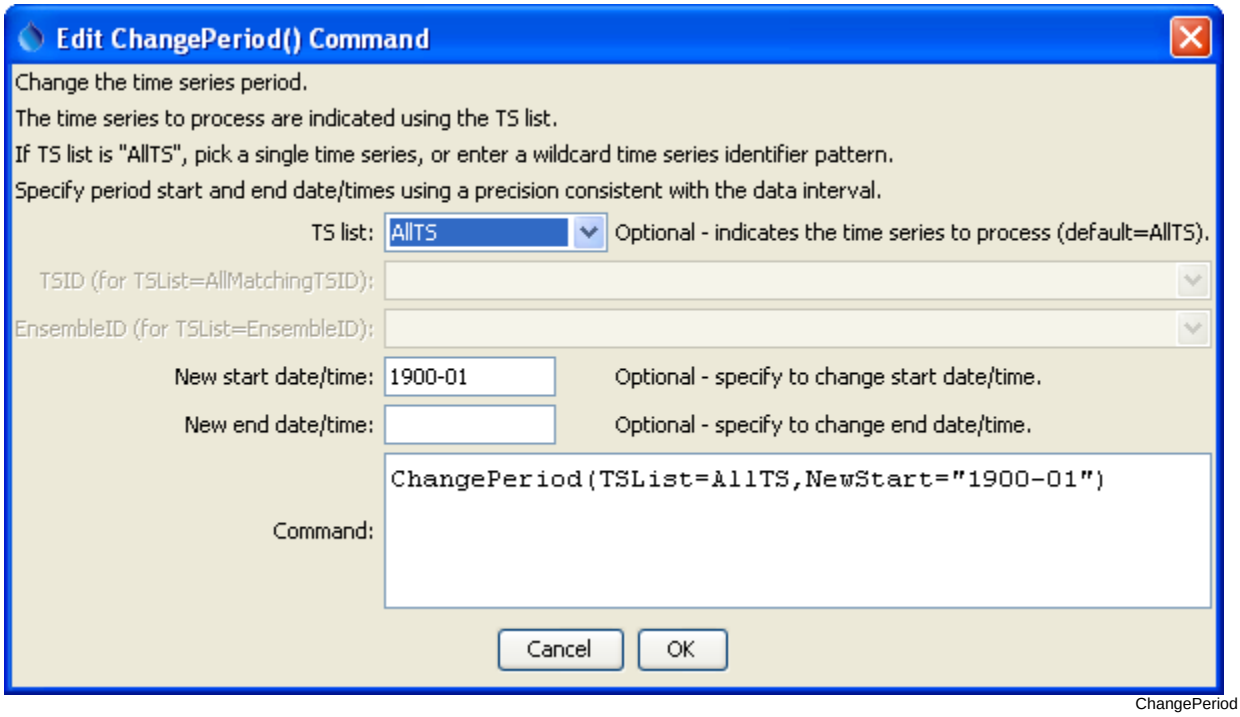
Command Reference: ChangePeriod()

Change period of record for time series

Version 09.10.01, 2010-11-18

The `ChangePeriod()` command changes the period for the given time series, for example to extend the time series. A longer period will be filled with missing values.

The following dialog is used to edit the command and illustrates the syntax of the command.



ChangePeriod

ChangePeriod() Command Editor

The command syntax is as follows:

```
ChangePeriod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID.
NewStart	The new period start, specified to precision that matches the time series data interval.	Start will remain the same.
NewEnd	The new period end, specified to precision that matches the time series data interval.	End will remain the same.

A sample command file to change the period of a time series from the State of Colorado's HydroBase is as follows:

```
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
ChangePeriod(TSList=AllTS,NewStart="1900-01")
```

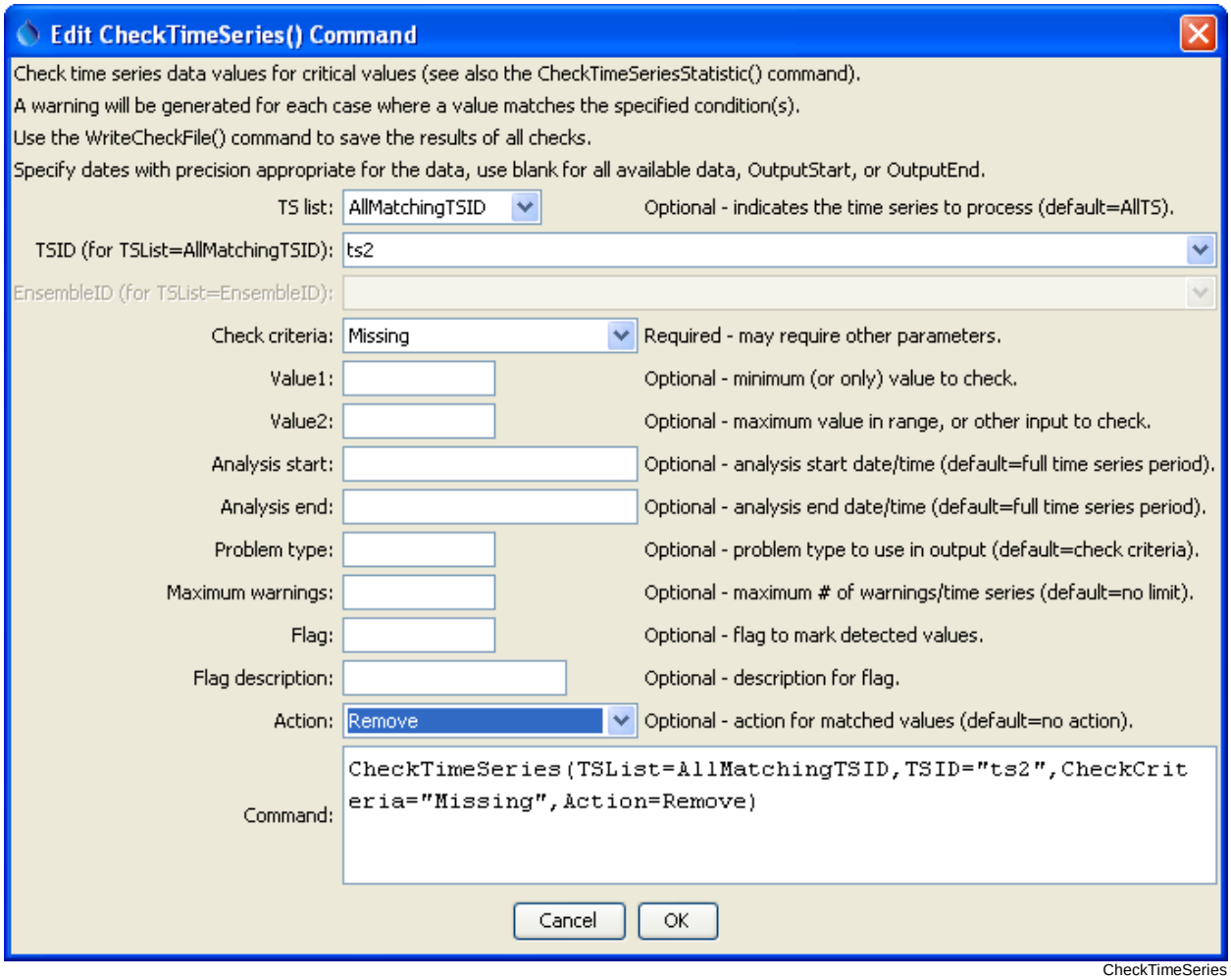
Command Reference: CheckTimeSeries()

Check time series data values against criteria and optionally take action

Version 10.03.00, 2011-12-19

The `CheckTimeSeries()` command checks time series data values against criteria, for example to identify missing, erroneous, or extreme data values. A warning is generated for each match and time series values optionally can be flagged, which allows annotation on graphs and reports. Values that meet the check criteria also can be removed (if irregular interval), or set to missing. The `WriteCheckFile()` command can be used to write a summary of the warnings. The `CheckTimeSeriesStatistic()` command checks a statistic for the entire time series (e.g., missing value count). See also the `Delta()` command, which creates new time series as the change between each value – this command may be necessary in cases where data periodically reset to a starting value, prior to using a performing a `Change>` check, for example.

The following dialog is used to edit the command and illustrates the command syntax.



CheckTimeSeries

CheckTimeSeries() Command Editor

The command syntax is as follows:

```
CheckTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command will be processed. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series selected with the SelectTimeSeries() command will be processed.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList= EnsembleID.
CheckCriteria	The criteria that is checked, one of the following. Missing values are skipped except for cases where the statistic is specific to missing values. • AbsChange> – check for absolute change from one value to the next value > Value1 • AbsChangePercent> – check for absolute change in percent from one value to the next value > Value1. • Change> – check for change > Value1. • Change< – check for change < Value1. • InRange – check for value >= Value1 and <= Value2. • OutOfRange – check for value < Value1 or > Value2. • Missing – check for missing values. • Repeat – check for Value1 repeating values (i.e., if Value1=2, then the check will detect 2 adjacent values that are the same). If the flag or action are	None – must be specified.

Parameter	Description	Default
	specified, values `Value1+` in the sequence are modified (i.e., if `Value1=2`, the 2nd and subsequent repeating values will be modified by the action). • `<` – check for values < `Value1`. • `<=` – check for values <= `Value1`. • `>` – check for values > `Value1`. • `>=` – check for values >= `Value1`. • `==` – check for values equal to `Value1`.	
`Value1`	A parameter that is used for specific `CheckCriteria` values.	
`Value2`	A parameter that is used for specific `CheckCriteria` values.	
`AnalysisStart`	The date/time to start analyzing data.	Analyze full period.
`AnalysisEnd`	The date/time to end analyzing data.	Analyze full period.
`ProblemType`	The problem type that will be shown in warning messages.	`CheckCriteria`
`MaxWarnings`	The maximum number of warnings to list for each time series, useful if analysis results in many warnings.	List all warnings.
`Flag`	A string to use for a flag on values that are detected during the check, which will be shown in the HTML summary report.	No flag.
`FlagDesc`	Description for the flag.	No description.
`Action`	Action to take for matched values, in addition to generating warnings: • `Remove` – remove the values. For irregular interval time series the values will be removed. For regular interval time series the values will be set to missing. • `SetMissing` – set the values to missing.	No action is taken.

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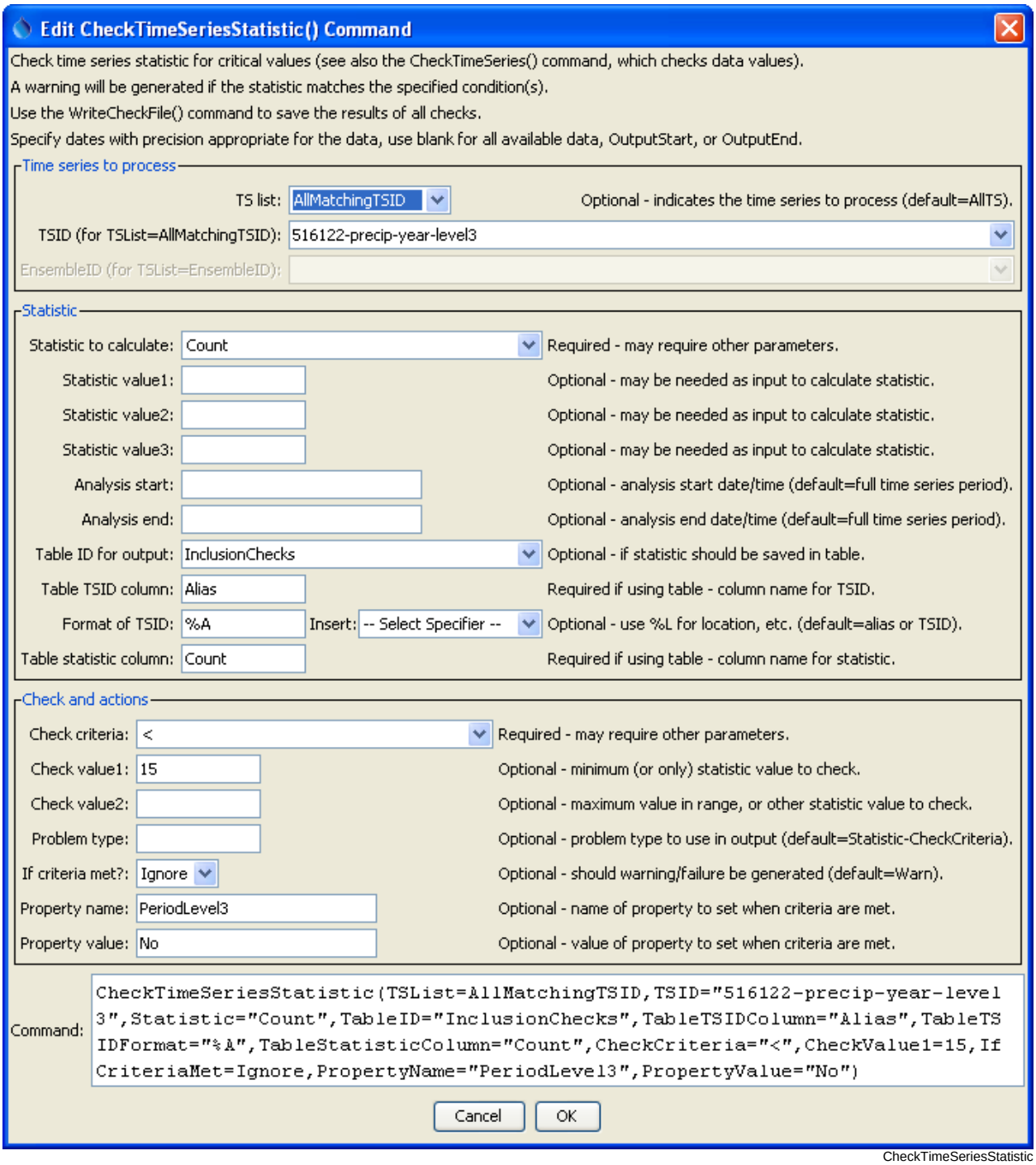
Command Reference: CheckTimeSeriesStatistic()

Check time series statistic against criteria

Version 10.00.01, 2011-04-26

The `CheckTimeSeriesStatistic()` command checks a time series statistic against criteria, for example to perform quality control using full-period statistics. This command is essentially a combination of the `CalculateTimeSeriesStatistic()` command with features similar to the `CheckTimeSeries()` command; however, the latter checks individual data values and this command checks a statistic computed from the entire time series. The `WriteCheckFile()` command can be used to write a summary of the warnings.

The following dialog is used to edit the command and illustrates the command syntax.



CheckTimeSeriesStatistic

CheckTimeSeriesStatistic() Command Editor

The command syntax is as follows:

```
CheckTimeSeriesStatistic(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command will be processed. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series selected with the SelectTimeSeries() command will be processed.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList= EnsembleID.
Statistic	Statistic to compute. Refer to the CalculateTimeSeriesStatistic() command documentation.	None – must be specified.
StatisticValue1	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	See the Calculate TimeSeries Statistic() command documentation.
StatisticValue2	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	to the Calculate TimeSeries Statistic() command documentation.
StatisticValue3	Input data required by the statistic. Currently the dialog does not check the value for correctness – it is checked when the statistic is computed.	to the Calculate TimeSeries Statistic() command documentation.
AnalysisStart	The date/time to start analyzing data.	Full period is analyzed.
AnalysisEnd	The date/time to end analyzing data.	Full period is analyzed.
TableID	Identifier for table that receives the statistic.	Optional – table output is not

Parameter	Description	Default
		required.
TableTSIDColumn	Table column name that is used to look up the time series. If a matching TSID is not found, a row will be added to the table. If a TSID is found, the statistic cell value for the time series is modified.	Optional – table output is not required.
TableTSIDFormat	The specification to format the time series identifier to insert into the TSID column. Use the format choices and other characters to define a unique identifier.	Time series alias if available, or the time series identifier.
TableStatistic Column	Table column name to receive the statistic value. If not found in the table, a new column is added automatically.	Optional – table output is not required.
CheckCriteria	The criteria that is checked, one of: • InRange – check for value >= Value1 and <= Value2. • OutOfRange – check for value < Value1 or > Value2. • < – check for values < CheckValue1. • <= – check for values <= CheckValue1. • > – check for values > CheckValue1. • >= – check for values >= CheckValue1. • == – check for values equal to CheckValue1.	None – must be specified.
CheckValue1	A parameter that is used for specific CheckCriteria values.	
CheckValue2	A parameter that is used for specific CheckCriteria values, currently only needed for InRange and OutOfRange criteria.	
ProblemType	The problem type that will be shown in warning messages.	Statistic-CheckCriteria
IfCriteriaMet	Indicate whether to set the command status if the statistic meets the criteria, one of: • Ignore – do not set the command status • Warn – set the command status to Warning • Fail – set the command status to Failure	The command status will not be changed.
PropertyName	If the statistic meets the criteria, set the property identified by PropertyName to PropertyValue.	No property is set.
PropertyValue	If the statistic meets the criteria, set the property identified by PropertyName to PropertyValue.	No property is set.

Command Reference: CompareFiles()

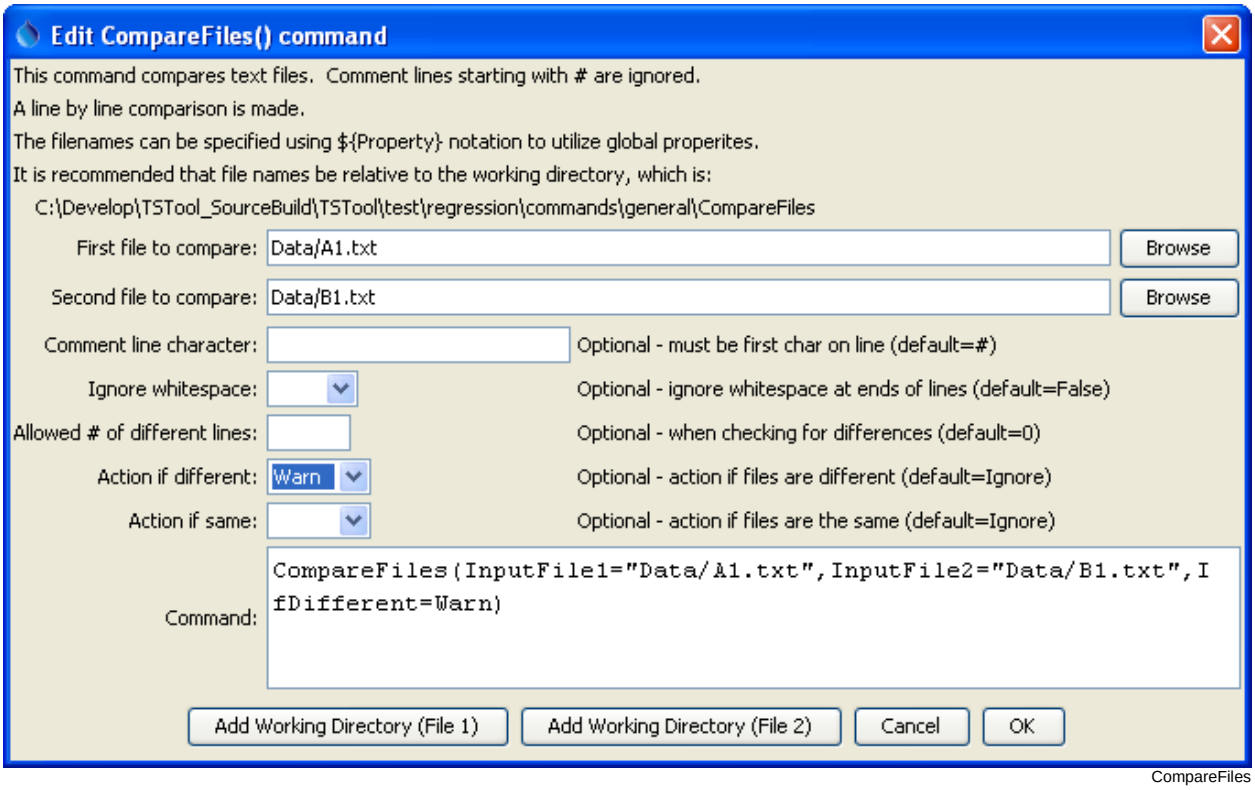
Compare text files to determine whether they are different

Version 10.01.00, 2011-11-15

The `CompareFiles()` command compares text files to determine differences. For example, the command can be used to compare old and new files produced by a software process. This command is suitable for comparing files that are similar, but is not suitable for comparing files that are very different, although it may be enhanced in the future to provide more sophisticated comparison features.

Each line in the file is compared. By default, lines beginning with # are treated as comment lines and are ignored (see `CommentLineChar` to specify the comment indicator). Therefore, only non-comment lines are compared. Comment lines in the middle of the file are simply discarded. Differences and simple statistics are printed to the log file. A warning can be generated if a difference is detected or if no differences are detected (see also the `CompareTimeSeries()and CompareTables()` commands).

The following dialog is used to edit the command and illustrates the syntax for the command.



CompareFiles

CompareFiles() Command Editor

The command syntax is as follows:

```
CompareFiles(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile1`	The name of the first file to read. Enclose the name in double quotes to protect whitespace and special characters. Global properties can be used with the `${Property}` syntax.	None – the file name is required.
`InputFile2`	The name of the second file to read. Enclose the name in double quotes to protect whitespace and special characters. Global properties can be used with the `${Property}` syntax.	None – the file name is required.
`CommentLineChar`	The character(s) that if found at the start of a line indicate comment lines. Comment lines are ignored in the comparison because they typically may include information such as date/time that changes even if the remainder of the file contents is the same.	#
`IgnoreWhitespace`	If `True`, then each line is trimmed to remove leading and trailing whitespace characters (spaces and tabs) before doing the comparison. If `False`, then whitespace is retained for the comparison.	`False`
`AllowedDiff`	The number of lines allowed to be different, when checking for differences. This is useful, for example, when a non-comment line contains the date/time when the file was generated.	`0`
`IfDifferent`	Indicates the action to be taken if the files are different: • `Ignore` – do not generate warning • `Warn` – generate a warning message • `Fail` – generate a failure message	Do not generate a warning if the files are different. Differences are printed to the log file.
`IfSame`	Indicates the action to be taken if the files are the same: • `Ignore` – do not generate warning • `Warn` – generate a warning message • `Fail` – generate a failure message	Do not generate a warning if the files are the same.

The following example illustrates how two files can be compared. For example, use similar commands to compare results from two model runs, two database queries, or when testing software:

```
CompareFiles(InputFile1="Data/A1.txt",InputFile2="Data/B1.txt",
  WarnIfDifferent=True)
```

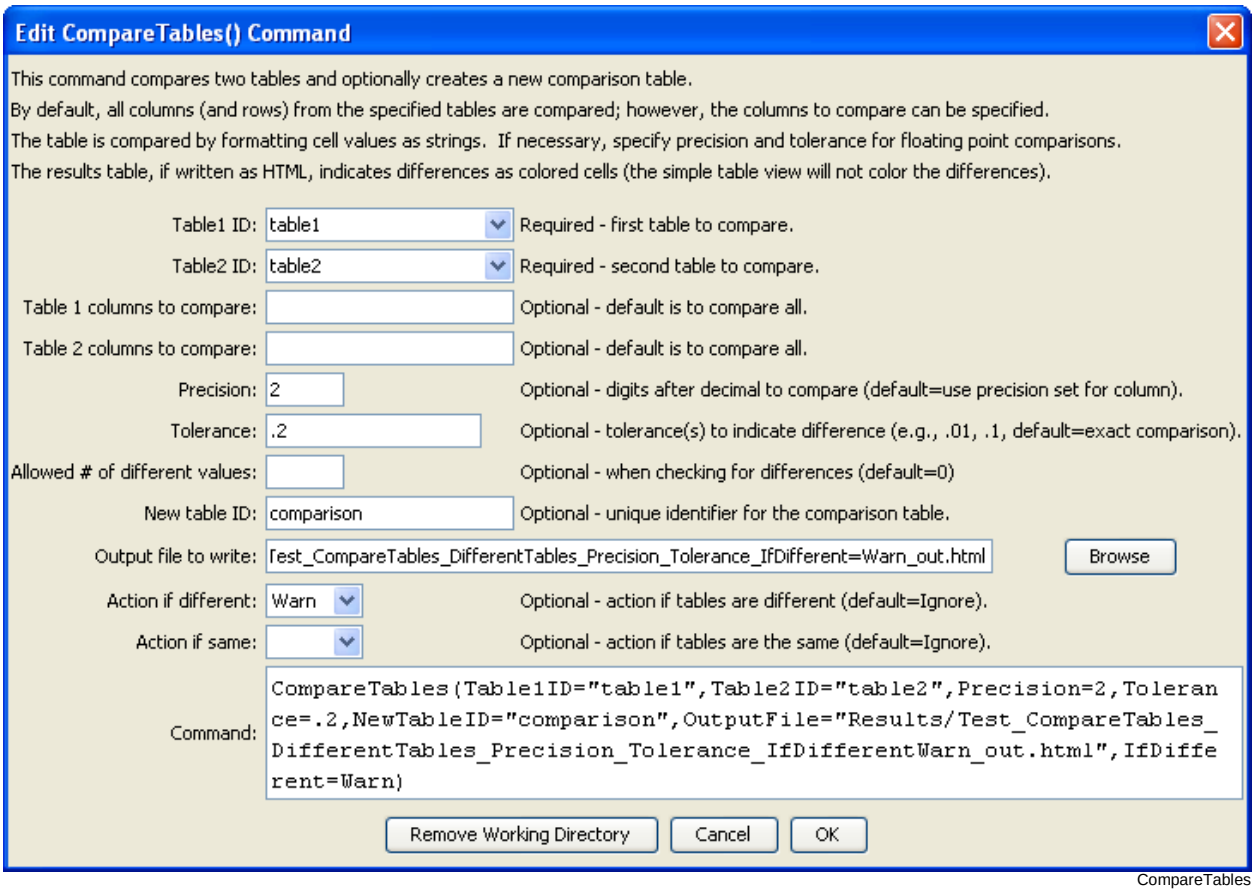
Command Reference: CompareTables()

Compare tables

Version 10.03.00, 2012-01-07

The `CompareTables()` command compares columns from two tables, saving the results in a new table. Comparisons are made using the data values formatted as strings based on the precision shown in tables. If the table was read with `ReadFromDelimitedFile()`, the precision for floating point numbers is set based on the largest number of digits after the decimal encountered in the input. Optionally, a precision and tolerance can be specified to control the comparison of floating point values. Values that are the same are shown in the new table without modification. Values that are different result in both table values being shown (as strings) to allow comparison. The command also allows the comparison table to be output to an HTML file, in which case different values are shown as red.

The following dialog is used to edit the command and illustrates the syntax of the command.



CompareTables

CompareTables() Command Editor

The command syntax is as follows:

```
CompareTables(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID1`	The identifier for the first table to be compared.	None – must be specified.
`TableID2`	The identifier for the second table to be compared.	None – must be specified.
`CompareColumns1`	The names of columns to be compared from the first table, separated by columns.	All columns will be compared.
`CompareColumns2`	The names of columns to be compared from the second table, separated by columns.	All columns will be compared.
`Precision`	The number of digits after the decimal to consider when comparing floating point values. If values are different to the specified (or default) precision, both values are shown in the comparison table.	Format floating point numbers as strings for comparison according to the table column precision.
`Tolerance`	A value indicating the allowed difference between floating point values. The tolerance should be consistent with the precision (i.e., don't specify a coarse precision and fine tolerance). If the difference is less than the tolerance, the values will not be marked as different.	Floating point values must exactly match, according to the precision.
`AllowedDiff`	The allowed number of differences before triggering a Warn/Fail message (see `IfDifferent`). A value `>= 0` indicates that the number of differences must be the same as the specified value. A negative value indicates that the number of differences can be less than or equal to the specified value. This parameter is useful for constructing tests where a specified number of differences is expected.	`0`
`NewTableID`	The identifier for the new comparison table.	`Table1ID-Table2ID-comparison`
`OutputFile`	If specified, an HTML table will be created for the comparison table, in which different values are highlighted in red.	No HTML output file will be created.
`IfDifferent`	Indicates the action to be taken if the tables are different: • `Ignore` – do not generate warning • `Warn` – generate a warning message • `Fail` – generate a failure message	Do not generate a warning if the tables are different.
`IfSame`	Indicates the action to be taken if the tables are the same: • `Ignore` – do not generate warning • `Warn` – generate a warning message • `Fail` – generate a failure message	Do not generate a warning if the tables are the same.

Command Reference: CompareTimeSeries()

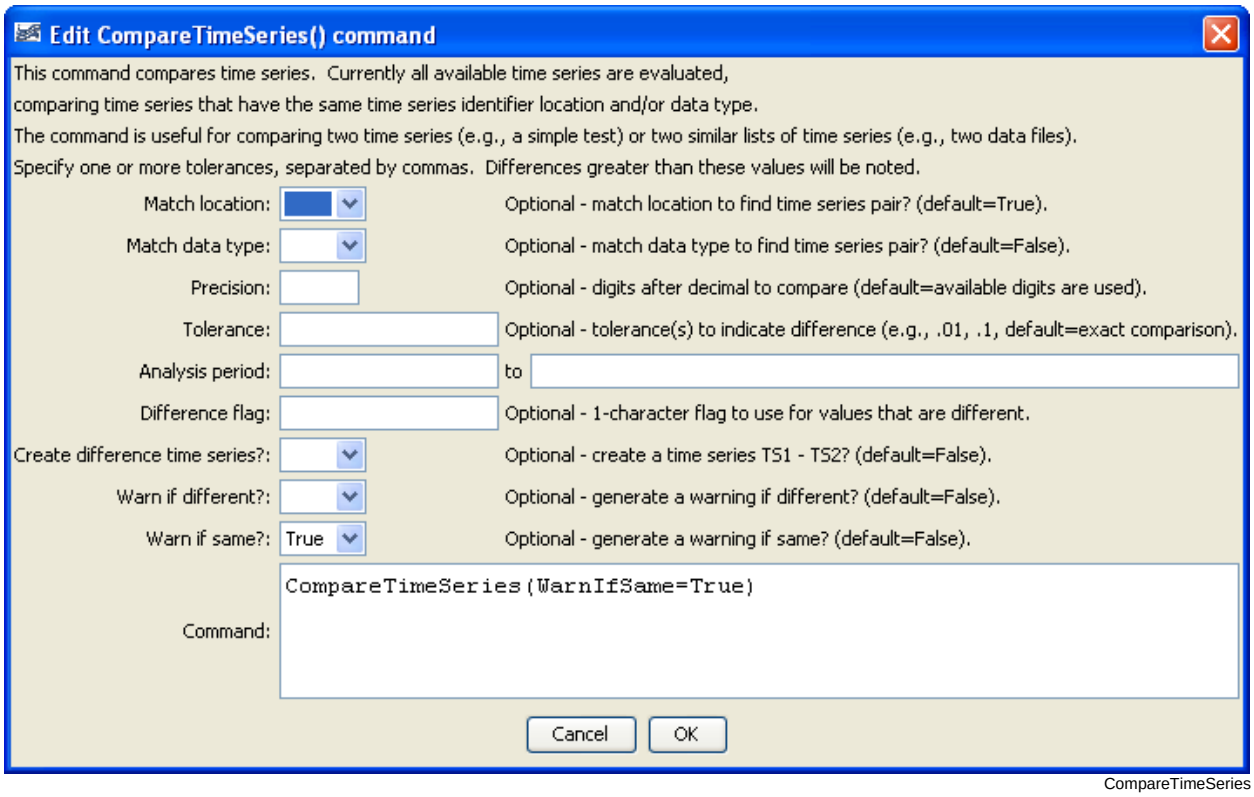
Compare time series to find data value differences

Version 08.15.00, 2008-05-04

The `CompareTimeSeries()` command compares time series to determine data differences. Currently time series header information is NOT compared – only data values are compared. It is designed to process many time series in bulk fashion. For example, read commands can be used to read time series from two different versions of a database, or from two files. Time series to compare are determined by trying to match each available time series with another time series in the list (ignoring itself); consequently, the list of time series should contain only pairs of time series.

Time series that are matched by TSID location and/or data type are compared value by value, with the differences computed as the value from the second time series minus the value from the first time series. The values can be rounded based on a specified precision. It may be important to read each set of time series from files to ensure that final round off is consistent. The checks occur by comparing the difference to one or more specified tolerances. Differences and simple statistics are printed to the log file. Values that are different can optionally be tagged with a character flag, for use with the graphing package. Time series of the differences can optionally be created. A warning can be generated if a difference is detected, or if no differences are detected (see also the `CompareFiles()` and `CompareTables()` commands).

The following dialog is used to edit the command and illustrates the syntax for the command.



CompareTimeSeries

CompareTimeSeries() Command Editor

The command syntax is as follows:

```
CompareTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`MatchLocation`	Match the location part of time series identifiers when matching time series to compare.	`True`
`MatchDataType`	Match the data type part of time series identifiers when matching time series to compare.	`False`
`Precision`	When comparing data values, round the values to the given precision. For example, a precision of 2 will round to the hundredths place. This can be used to do comparisons on the lowest precision of the available time series.	Compare the available values without rounding.
`Tolerance`	Specify a comma-separated list of values. The difference in the time series values will be compared to the tolerances and messages printed to the log file.	A tolerance of zero will be used to detect differences.
`AnalysisStart`	The starting date/time to analyze for differences. Specify a date/time of appropriate precision for the time series or `OutputStart` to use the output start.	Analyze all available data.
`AnalysisEnd`	The ending date/time to analyze for differences. Specify a date/time of appropriate precision for the time series or `OutputEnd` to use the output end.	Analyze all available data.
`DiffFlag`	Specify as a single character to append a flag to the data flags for the time series. Each value that is different is flagged in both time series that are compared. The flag can be displayed by the graphing package. This is useful for verification processes. New time series will be created with the original identifier preceded by `Diff_`.	Do not flag data.
`CreateDiffTS`	Indicate whether a time series should be created containing the differences between time series. This is useful to visually evaluate the differences and process the results with other commands.	`False`
`WarnIfDifferent`	If `True` and at least one difference is detected, a warning will be generated by the command, which will result in software like TSTool displaying a warning. If `False`, only status messages are written to the log file. The warning is useful if it is critical to detect any change in the time series.	Do not generate a warning if time series are different. Differences are printed to the log file.
`WarnIfSame`	If `True` and no differences are detected, a warning will be generated by the command, which will result in software like TSTool displaying a warning. If `False`, only status messages are written to the log file. The warning is useful if it is critical to detect that time series are the same.	Do not generate a warning if time series are the same.

The following example illustrates how time series from two files can be compared. For example, use similar commands to compare results from two model runs or two database queries:

```
# Example to compare files.  Since they are different, a warning will be generated.
ReadDateValue(InputFile="RawData1.dv")
ReadDateValue(InputFile="RawData1Scaled.dv")
CompareTimeSeries(Precision=2,WarnIfDifferent=True)
```

The following example compares matching time series for the full available period, doing checks for several tolerances:

```
CompareTimeSeries(Precision=2,Tolerance="0,.1,.5,1",DiffFlag="x")
```

The following example compares data only within the output period, as specified by the `SetOutputPeriod()` command:

```
CompareTimeSeries(Precision=2,Tolerance="0,.1,.5,1",
AnalysisStart="OutputStart",AnalysisEnd="OutputEnd",DiffFlag="x")
```

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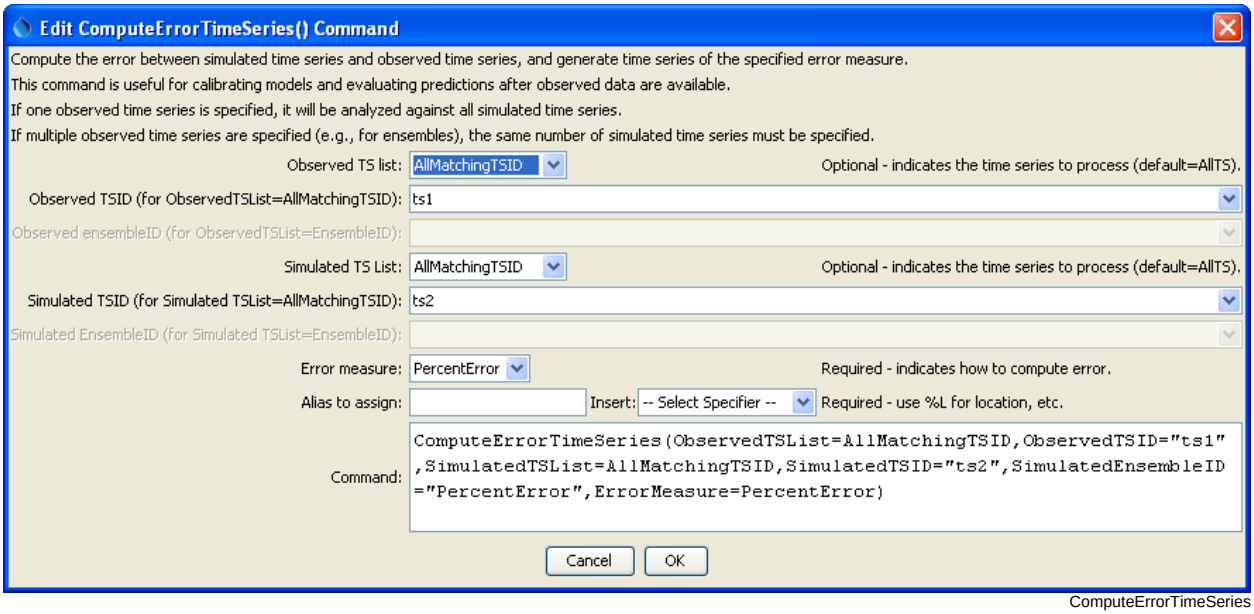
Command Reference: ComputeErrorTimeSeries()

Compute the error between time series and create new time series for the results

Version 10.00.01, 2011-05-12

The `ComputeErrorTimeSeries()` command computes the error between two time series as absolute value or percent, creating a new time series for each pair of time series that is compared. This is useful for comparing observed and simulated time series. The time series that are created have the simulated time series' metadata but an alias can be assigned. The command can be used to process multiple pairs of time series, each determined using the appropriate `*TSList` parameter.

The following dialog is used to edit the command and illustrates the command syntax.



ComputeErrorTimeSeries

ComputeErrorTimeSeries() Command Editor

The command syntax is as follows:

```
ComputeErrorTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Observed TSList`	Indicates the list of observed time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards). • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards).	`AllTS`

Parameter	Description	Default
	• `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards). • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`Observed TSID`	The time series identifier or alias for the observed time series, using the `*` wildcard character to match multiple time series.	Use when `ObservedTSList= *MatchingTSID.`
`Observed EnsembleID`	The observed ensemble to be compared, if processing an ensemble.	Use when `ObservedTSList= EnsembleID.`
`Simulated TSList`	Indicates how to determine the list of simulated time series (see the explanation of `ObservedTSList`).	`AllTS`
`Simulated TSID`	The time series identifier or alias for the simulated time series (see the explanation of `ObservedTSID`).	Use when `SimulatedTSList= *MatchingTSID.`
`Simulated EnsembleID`	The ensemble identifier for the simulated time series (see the explanation of `SimulatedEnsembleID`).	Use when `SimulateddTSList= EnsembleID`
`ErrorMeasure`	The error measure to compute, one of: • `PercentError` – Simulated minus observed, divided by observed. • `AbsoluteError` – not yet implemented.	
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	Alias will not be assigned.

A sample command file is as follows (in this case using contrived data):

```
RemoveFile(InputFile="Results\Test_ComputeErrorTimeSeries_1_out.dv",WarnIfMissing=False)
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..test.Day",Description="Test data",
  SetStart="1950-01-01",SetEnd="1951-03-12",Units="CFS",PatternValues="5,10,12,13,75")
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..test.Day",Description="Test data",
  SetStart="1950-01-01",SetEnd="1951-03-12",Units="CFS",PatternValues="6,12,14,11.5,80")
ComputeErrorTimeSeries(ObservedTSList=AllMatchingTSID,ObservedTSID="ts1",
  SimulatedTSList=AllMatchingTSID,SimulatedTSID="ts2",ErrorMeasure=PercentError)
# Uncomment the following command to regenerate the expected results file.
# WriteDateValue(OutputFile="ExpectedResults\Test_ComputeErrorTimeSeries_1_out.dv")
WriteDateValue(OutputFile="Results\Test_ComputeErrorTimeSeries_1_out.dv")
CompareFiles(InputFile1="Results\Test_ComputeErrorTimeSeries_1_out.dv",
 InputFile2="ExpectedResults\Test_ComputeErrorTimeSeries_1_out.dv",WarnIfDifferent=True)
```

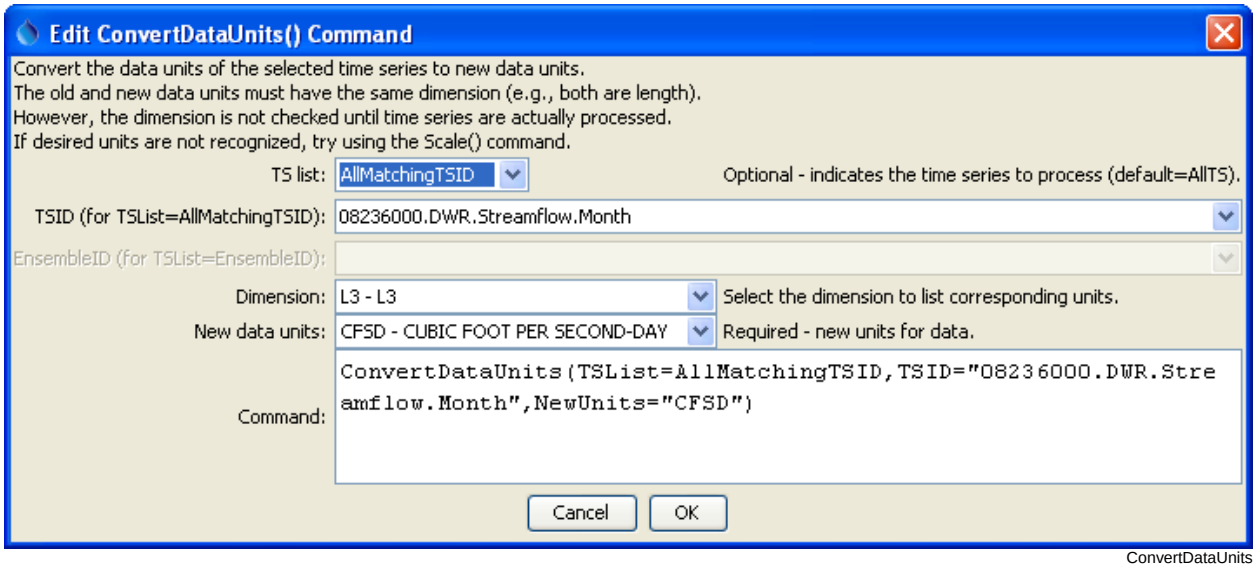
Command Reference: ConvertDataUnits()

Convert time series data units

Version 09.10.01, 2010-11-18

The `ConvertDataUnits()` command converts the data units for a time series (e.g., before output to a file). Some read and write commands also may allow units to be converted.

The following dialog is used to edit the command and illustrates the syntax of the command.



ConvertDataUnits

ConvertDataUnits() Command Editor

The ***Dimension*** choice should be selected to narrow the list of available units to the appropriate dimension. Next, select the ***New Data Units*** for the time series. The list of available data units is taken from the information described in the TSTool *DATAUNIT* file (see the TSTool **Installation and Configuration Appendix** for more information). If desired units are not available, contact the TSTool developers to suggest adding units to the *DATAUNIT* file or edit the command manually after initial creation. See also the TSTool ***View… Data Units*** menu to view the current data units.

The dialog cannot display the current units for the time series because the units are not available until time series are actually processed – commands are edited before processing.

The command syntax is as follows:

```
ConvertDataUnits(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	TSID or EnsembleID must be specified if identifiers are being matched.
EnsembleID	The ensemble to be modified, if processing an ensemble.	TSID or EnsembleID must be specified if identifiers are being matched.
NewUnits	The new data units.	None – must be specified.

A sample commands file to convert the units of a time series from the State of Colorado's HydroBase is as follows:

```
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
ConvertDataUnits(TSList=AllMatchingTSID,
  TSID="08236000.DWR.Streamflow.Month",NewUnits="CFSD")
```

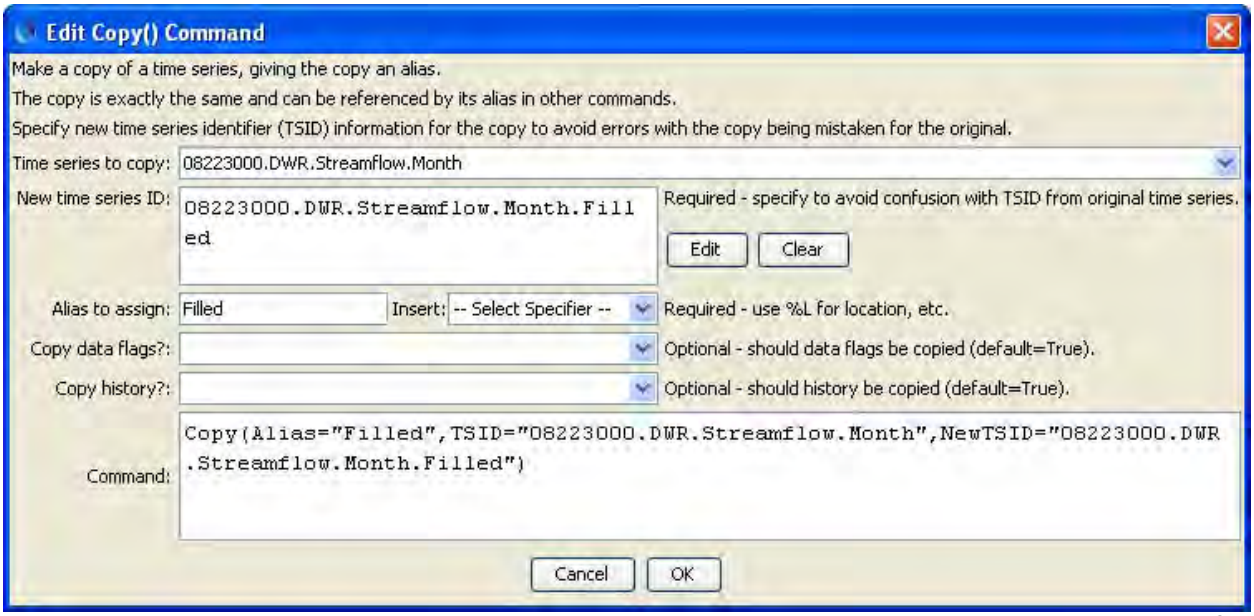
Command Reference: Copy()

Create a new time series as a copy of an existing time series

Version 10.00.00, 2011-03-27

The `Copy()` command creates a copy of an existing time series, assigning an alias to the result. The copy is an exact copy except that the alias is different (the TSID must also specified and should be defined to be unique). The alias can then be used for further time series manipulation. A copy of a time series is useful when data filling or other manipulation will occur and time series that is unique from the original is needed. For example, if adding two time series, a copy of one time series can be made, and the second time series added to the copy – this ensures that there is not confusion with the original time series. Parameters are available to control how much of the original data are copied.

The following dialog is used to edit the command and illustrates the syntax for the command.



Copy

Copy() Command Editor

The command syntax is as follows:

```
TS Alias = Copy(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = Copy(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	The time series identifier or alias of the time series to copy. The time series will be found by searching backwards from the copy command.	None – must be specified.
`NewTSID`	A new time series identifier to assign to the copy. This is useful to avoid confusion with the original time series. Use the ***Edit*** button to edit the time series identifier parts. The data interval must match that of the original time series.	Copy the original time series `TSID`. If `NewTSID` is specified but does not have a valid interval, copy the interval from `TSID`. The default cannot be determined if an alias is used for the input time series.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`CopyDataFlags`	Indicates whether data flags are copied. Specify as `False` or `True`.	`True`
`CopyHistory`	Indicates whether the time series manipulation history is copied. Specify as `False` or `True`.	`True`

A sample command file to read a time series and make a copy is as follows:

```
# 08223000 - RIO GRANDE RIVER AT ALAMOSA
08223000.DWR.Streamflow.Month~HydroBase
Copy(Alias=”Filled”,TSID="08223000.DWR.Streamflow.Month",
    NewTSID="08223000.DWR.Streamflow.Month.Filled")
```

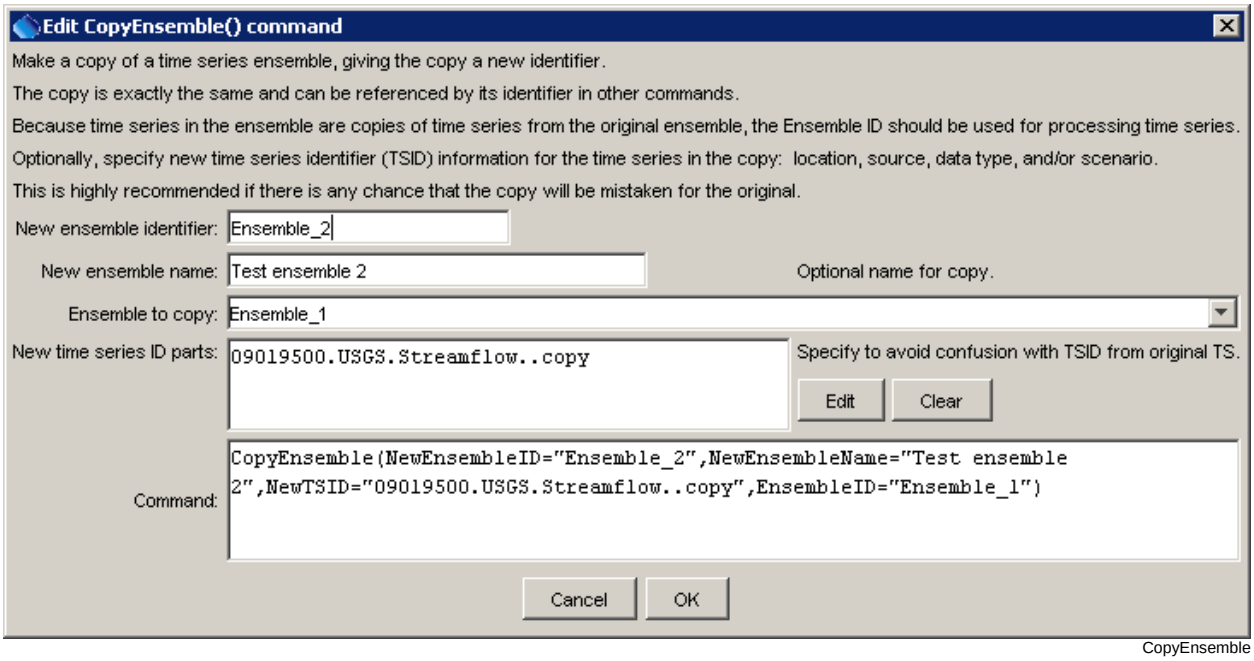
Command Reference: CopyEnsemble()

Create a new ensemble as a copy of an ensemble

Version 08.15.00, 2008-05-04

The `CopyEnsemble()` command creates a copy of an ensemble, copying all time series in the ensemble and assigning a new identifier to the result. The copy is an exact copy except that the ensemble identifier is different (the TSIDs for each ensemble time series should also specified to be unique).

The following dialog is used to edit the command and illustrates the syntax for the command.



CopyEnsemble

CopyEnsemble() Command Editor

The command syntax is as follows:

```
CopyEnsemble(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
EnsembleID	The ensemble to copy.	None – must be specified.
NewEnsembleID	The ensemble identifier for the new ensemble	None – must be specified.
NewEnsembleName	The name for the new ensemble.	Blank.
NewTSID	A new time series identifier to assign to time series in the new ensemble. This is useful to avoid confusion with the original time series. Use the ***Edit*** button to edit the time series identifier parts. The data interval and sequence number will be determined from the original time series.	Copy the original time series TSID.

A sample commands file to read a time series from the State of Colorado's HydroBase, create an ensemble from the time series, and make a copy is as follows:

```
# 09019500 - COLORADO RIVER NEAR GRANBY
09019500.USGS.Streamflow.Day~HydroBase
CreateEnsemble(TSID="09019500.USGS.Streamflow.Day",
  TraceLength=1Year,EnsembleID="Ensemble_1",EnsembleName="Test
Ensemble",ReferenceDate="2008-01-01",ShiftDataHow=ShiftToReference)
CopyEnsemble(NewEnsembleID="Ensemble_2",
  NewEnsembleName="Test ensemble 2",
  NewTSID="09019500.USGS.Streamflow..copy",EnsembleID="Ensemble_1")
```

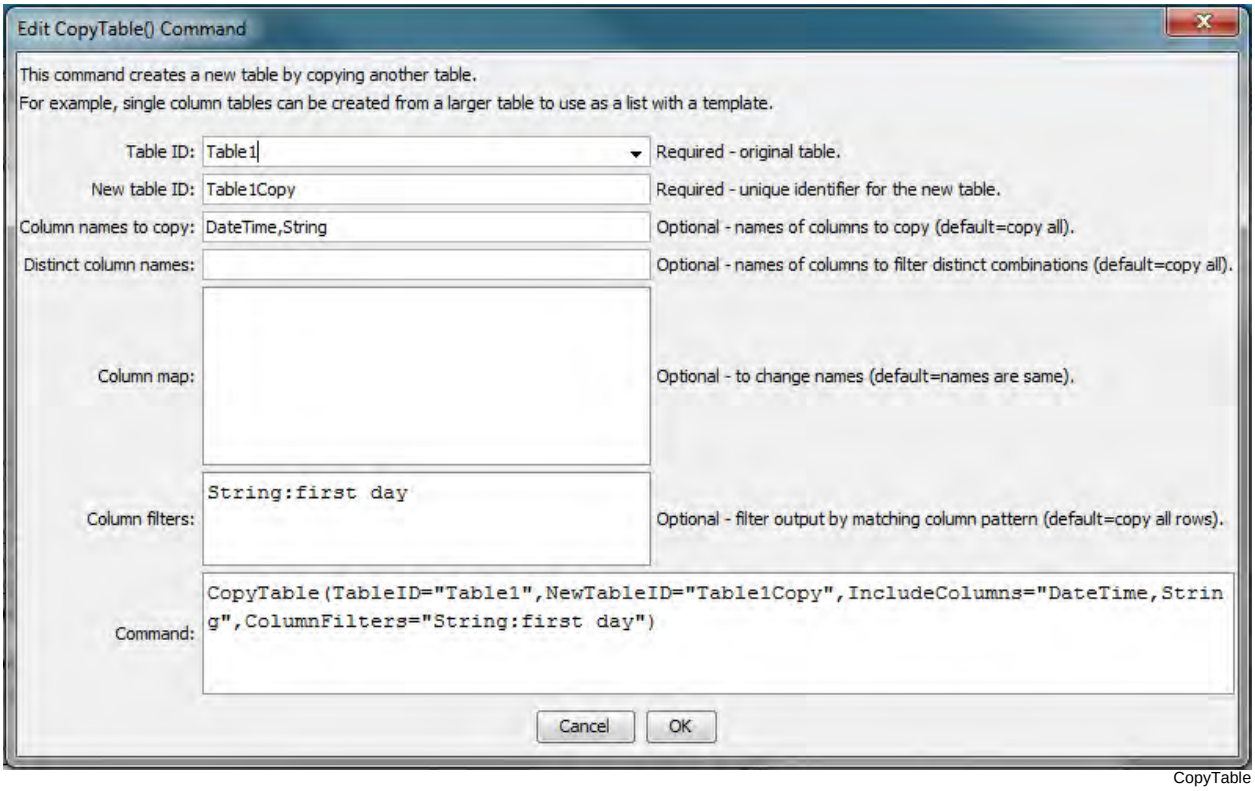
Command Reference: CopyTable()

Create a table as a (partial) copy of a table

Version 10.21.00, 2013-05-17

The `CopyTable()` command copies all or a subset of the columns from one table to create a new table. For example, this is useful to create one-column lists that can be used to expand template files with the `ExpandTemplateFile()` command, or to create a subset of columns to output to a file or write to a database.

The following dialog is used to edit the command and illustrates the syntax of the command (in this case illustrating how values in a column named `LocationID` are copied to a new table).



CopyTable

CopyTable() Command Editor

The command syntax is as follows:

```
CopyTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the original table.	None – must be specified.
`NewTableID`	The identifier for the new table.	None – must be specified.
`IncludeColumns`	The names of columns to copy, separated by commas.	Copy all of the columns.
`DistinctColumns`	The names of columns to copy, separated by commas. Only distinct values from the specified column will be copied. For example, if column `A` contains strings `X`, `Y`, `Z`, `Y`, `C`, the resulting distinct value column will have rows with `X`, `Y`, `Z`, `C`. Currently only one column name can be specified but in the future more than one column may be allowed. This parameter overrides `IncludeColumns`.	Don't do a distinct comparison.
`ColumnMap`	The new names for the output columns, using syntax: `OriginalColumn1:NewColumn1, OriginalColumn2:NewColumn2`	The column names in the copy will be the same as in the original table.
`ColumnFilters`	Filters that limit the number of rows being copied, using the syntax: `FilterColumn1:FilterPattern1, FilterColumn2:FilterPattern2` Patterns can use `*` to indicate wildcards for matches. Only string values can be checked (other data types are converted to strings for comparison). Comparisons are case-independent. All patterns must be matched in order to copy the row. In the future a command may be added to perform queries on tables, similar to SQL for databases.	No filtering.

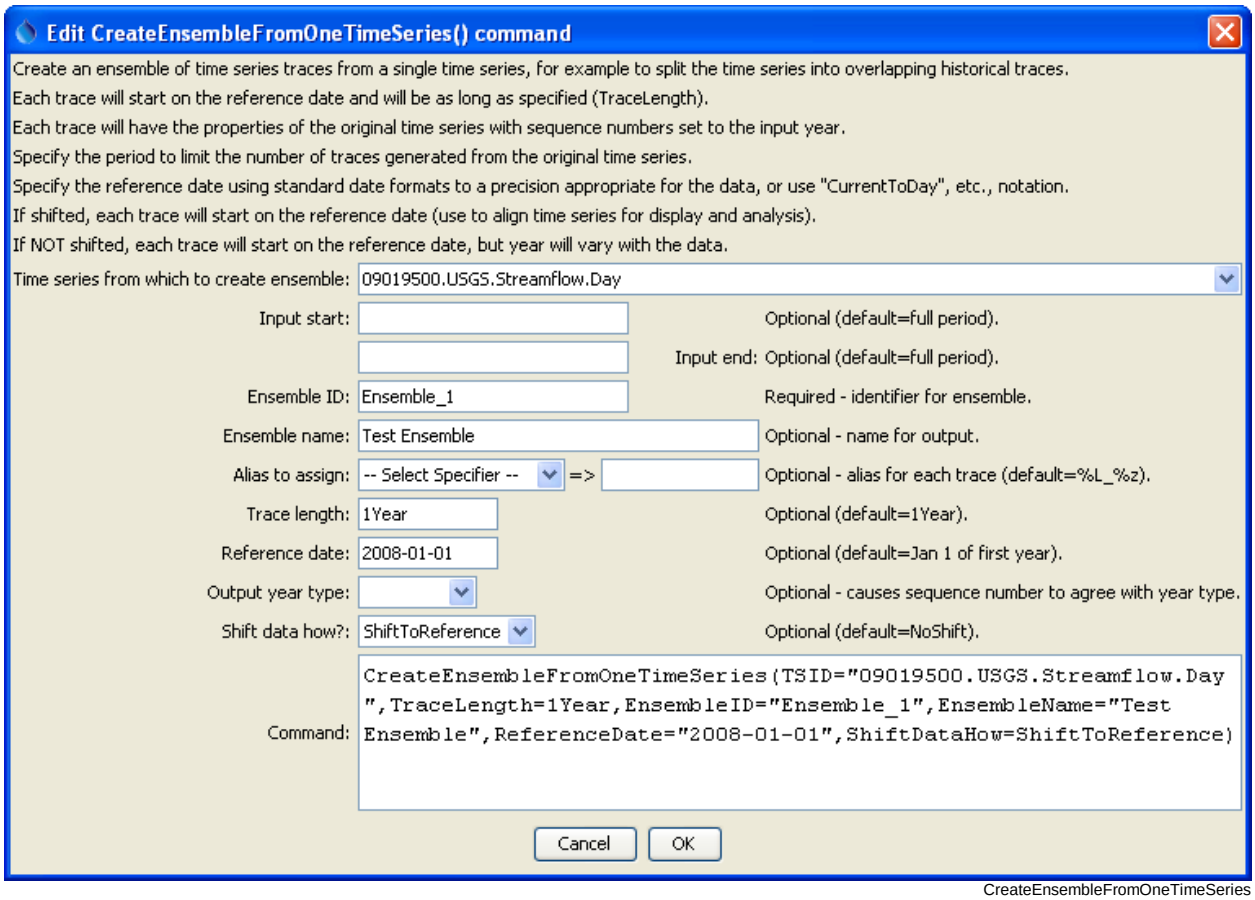
Command Reference: CreateEnsembleFromOneTimeSeries()

Create a new ensemble from a single time series

Version 10.14.00, 2012-12-12

The `CreateEnsembleFromOneTimeSeries()` command creates an ensemble by splitting up a single time series into traces. For example, a historical time series can be split into 1-year overlapping traces that are shifted to start in the current year. The sequence number part of the time series identifier for each trace is set to the input starting year and will be shown as [Year] at the end of the time series identifier.

The following dialog is used to edit the command and illustrates the syntax for the command.



CreateEnsembleFromOneTimeSeries

CreateEnsembleFromOneTimeSeries() Command Editor

The command syntax is as follows:

```
CreateEnsembleFromOneTimeSeries(Parameter=Value,…)
```

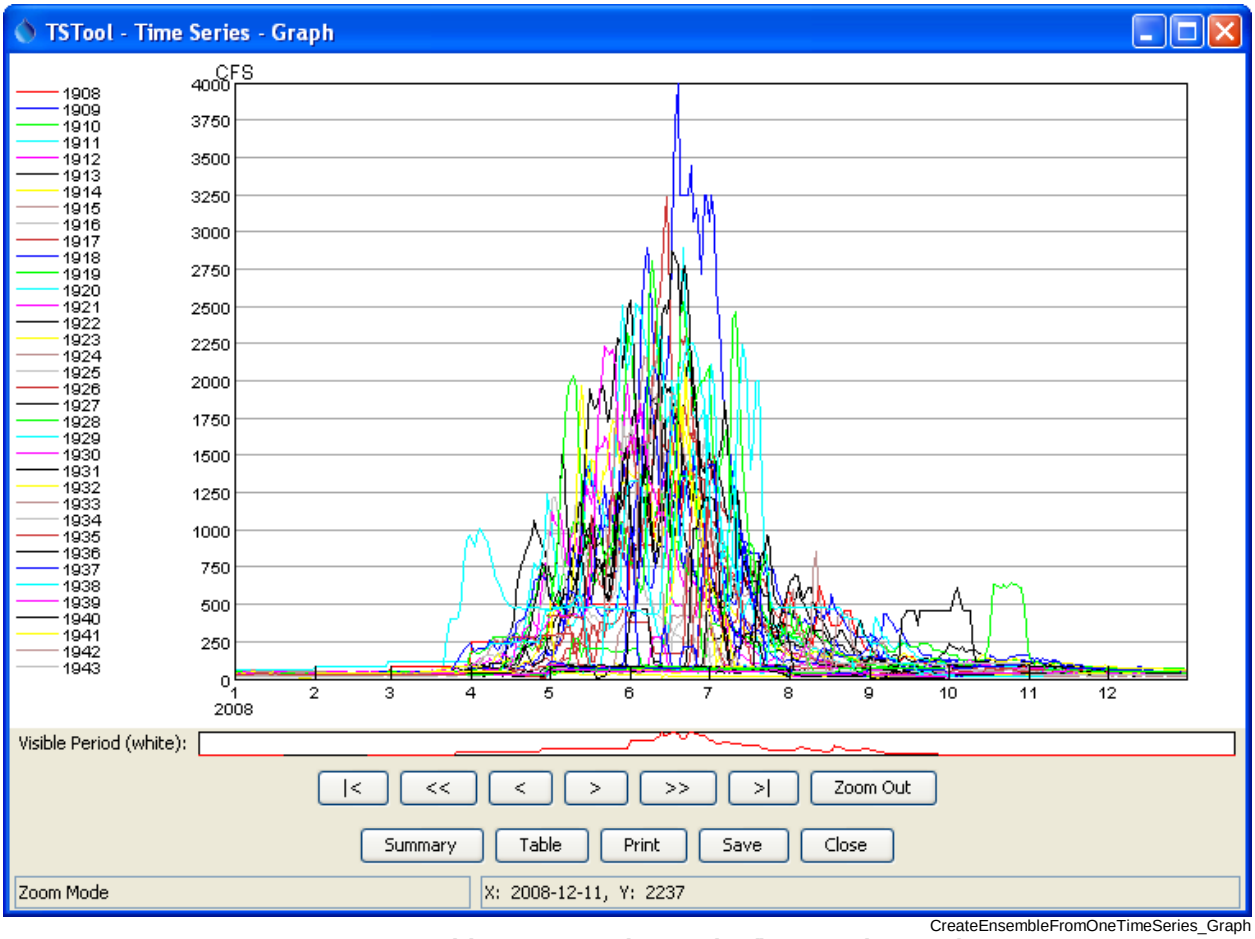
Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series used to create the ensemble.	None – must be specified.
InputStart	The date/time to start transferring data from the time series.	Use all data.
InputEnd	The date/time to end transferring data from the time series.	Use all data.
EnsembleID	The new ensemble identifier.	None – must be specified.
Ensemble Name	The name for the new ensemble.	Blank.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	%L_%z (location_ sequence Number)
TraceLength	An interval for the trace length (e.g., 1Year, #Month or, #Day).	1Year
ReferenceDate	The reference date indicates the starting date for each trace. Each trace optionally can be shifted (see ShiftDataHow), in which case the year in the ReferenceDate is used for the common starting date. The reference date can be one of: • Blank, indicating that January 1 of the current year will be used. • A date/time string (use the format 01/01/YYYY or YYYY-MM-DD). • CurrentToYear, CurrentToMonth, CurrentToDay, CurrentToHour, CurrentToMinute, indicating the current date/time to the specified precision. • A Current* value +- an interval, for example: CurrentToMinute – 7Day	January 1 of the first year in the source time series.
OutputYearType	The output year type for the ensemble traces. The only impact from this parameter is that sequence number for the time series will be set to the start of the output year. This is useful because legends on graphs that use the sequence number (%z format specifier) will use the appropriate year type. The ReferenceDate should normally be specified as the first day of the output year (e.g., ReferenceDate=2012-10-01 for OutputYearType=Water).	Calendar
ShiftDataHow	Indicates whether the traces should be shifted. Possible values are: • ShiftToReference – each trace will be shifted to the reference date, resulting in overlapping time series. • NoShift – plotting the traces will result in a total line that matches the original time series, except that each trace can be manipulated individually.	NoShift

A sample command file to read a time series from the State of Colorado's HydroBase and create an ensemble from the time series is as follows:

```
# 09019500 - COLORADO RIVER NEAR GRANBY
09019500.USGS.Streamflow.Day~HydroBase
CreateEnsembleFromOneTimeSeries(TSID="09019500.USGS.Streamflow.Day",
  TraceLength=1Year,EnsembleID="Ensemble_1",EnsembleName="Test
Ensemble",ReferenceDate="2008-01-01",ShiftDataHow=ShiftToReference)
```

The following figure illustrates a graph of the resulting ensemble:



CreateEnsembleFromOneTimeSeries_Graph

CreateEnsembleFromOneTimeSeries() Example Graph

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Command Reference: CreateFromList()

Create one or more time series from a file containing a list of identifiers

Version 10.21.00, 2013-05-17

See also the **`ReadTimeSeriesFromTable()`** command, which may replace this command in the future. The `CreateFromList()` command creates one or more time series using identifiers from a list file, an example of which is shown below:

```
# Example list file.  Comments start with the # character.
# Column headings can be specified in the first non-comment row using quotes.
“Structure ID”,”Structure Name”
500501,Ditch 501
500502,Ditch 502
# Invalid ID (see IfNotFound parameter)
509999,Ditch 9999
```

The command is typically used when reading time series from a database or binary file and can streamline processing in the following situations:

- A list of identifiers may have been generated from a database query and saved to a file.
- A list of identifiers may have been extracted from a model data set.

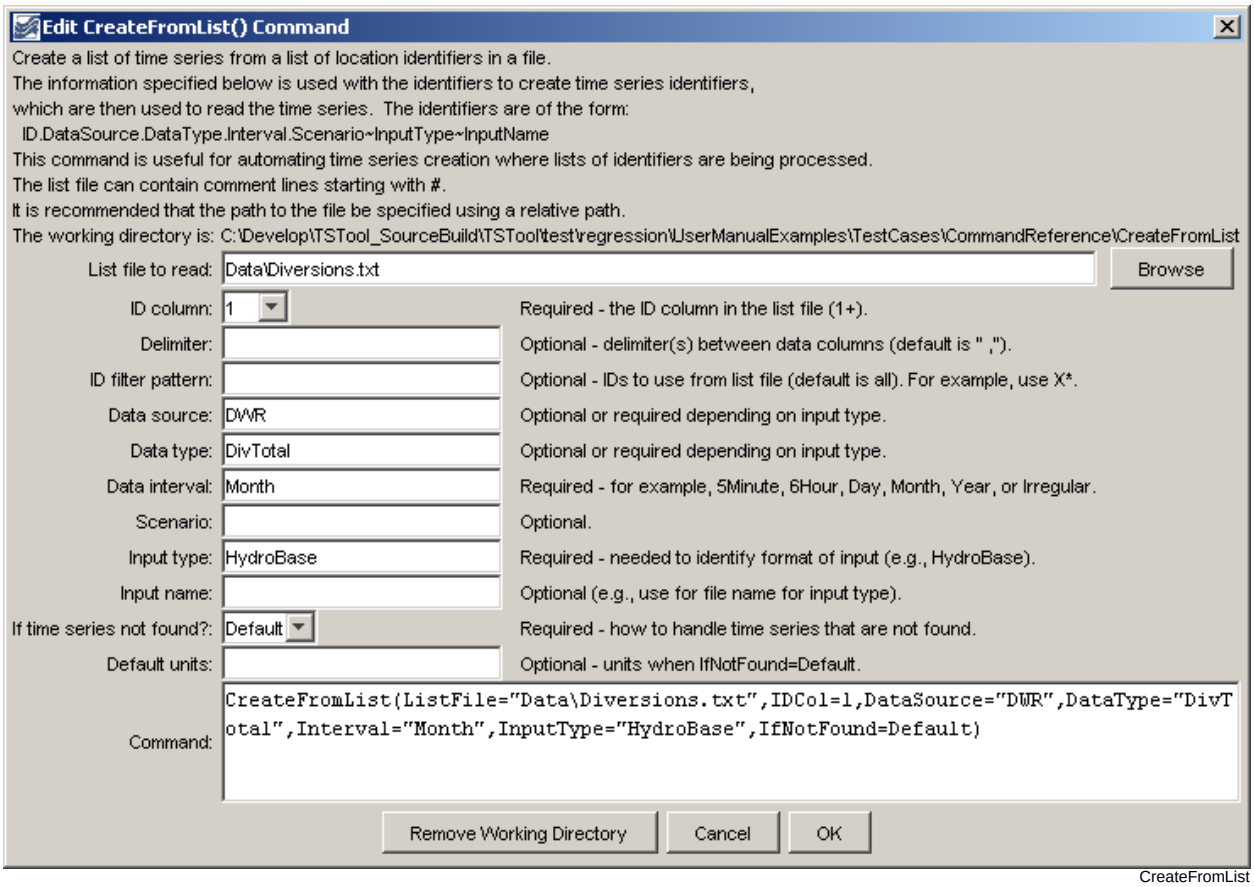
TSTool reads the list file and internally creates a list of time series identifiers. The time series are of the standard form:

```
Location.DataSource.DataType.Interval[.Scenario]~InputType[~InputName]
```

where the brackets indicate optional information. TSTool then queries each time series, which can be processed further.

Although it is possible to specify an input type that reads from files by also using the `InputName`, this is not generally recommended because the `CreateFromList()` command can only specify one input file name and the file will be reopened for each read. Instead, read commands for specific file formats should be used because these commands are typically optimized to read multiple time series from the files. In summary, the `CreateFromList()` command is useful with databases but performance may suffer when used with file input types.

The following dialog is used to edit the command and illustrates the syntax of the command.



CreateFromList() Command Editor

The command syntax is as follows:

```
CreateFromList(Parameter=Value, …)
```

Command Parameters

Parameter	Description	Default
`ListFile`	The name of the list file to read, surrounded by double quotes.	None – must be specified.
`IDCol`	The column (1+) in the list file containing the location identifiers to use in time series identifiers.	`1`
`Delim`	The delimiter characters that separate columns in the list file. If a space is used as the delimiter, surround with another delimiter characters or a character that is unlikely to be found so that the space is not discarded as white space (e.g., "~ ~").	Comma
`ID`	Indicate a pattern to filter the identifiers in the list file. For example, use `A*` to only	Process all identifiers.

Parameter	Description	Default
	process identifiers in the list file that start with A.	
DataSource	The data source in the time series identifier, appropriate for InputType. For example, if using the State of Colorado's HydroBase, USGS indicates that data are from the United States Geological Survey. See the input type appendices for more information on available data types.	May or may not be required, depending on the input type. Refer to the input type appendices.
DataType	The data type in the time series identifier, as appropriate for InputType. For example, if using the State of Colorado's HydroBase, DivTotal is used for diversion totals. See the input type appendices for more information on available data types.	Usually required for an input type. Refer to the input type appendices.
Interval	Data interval in the time series identifier, using standard values such as 15Minute, 6Hour, Day, Month, Year.	None – must be specified.
Scenario	Scenario in the time series identifier.	Usually not required.
InputType	The input type in the time series identifier. For example, use HydroBase for the State of Colorado's HydroBase database. Refer to the input type appendices or the TSTool main GUI for options.	None – must be specified.
InputName	The input name in the time series identifier.	Typically only required if the input type requires a file name.
IfNotFound	Indicates how to handle missing time series, one of: • Warn – generate fatal warnings and do not include in output. • Ignore – generate non-fatal warnings and do not include in output. • Default – generate non-fatal warnings and create empty time series for those that could not be found. This requires that a SetOutputPeriod() command be used before the command to define the period for default time series.	Warn
DefaultUnits	Default units when IfNotFound=Default.	Blank – no units.

A sample command file to process monthly diversion data from the State of Colorado's HydroBase database is as follows:

```
# Read monthly diversion total from HydroBase for the structures in the list
# file. The data source is set to DWR because data source is saved in
# HydroBase.
CreateFromList(ListFile="Data\Diversions.txt",IDCol=1,DataSource=DWR,
DataType=DivTotal,Interval=Month,InputType=HydroBase,IfNotFound=Default)
```

Command Reference: CreateRegressionTestCommandFile()

Create a command file to run software regression tests

Version 10.20.00, 2013-04-20

The `CreateRegressionTestCommandFile()` command is used for software testing and certification of processes used in operations. The command creates a command file that includes a `StartRegressionTestResultsReport()` and multiple `RunCommands()` commands. A starting search folder is provided and all files that match the given pattern (by convention *Test_*.TSTool*) are assumed to be command files that can be run to test the software. The resulting command file is a test suite comprised of all the individual tests and can be used to verify software before release. The goal is to have all tests pass before software release.

The following table lists tags (annotations) that can be placed in # comments in command files to provide information for testing, for example:

```
#@expectedStatus Failure
```

Command # Comment Tags

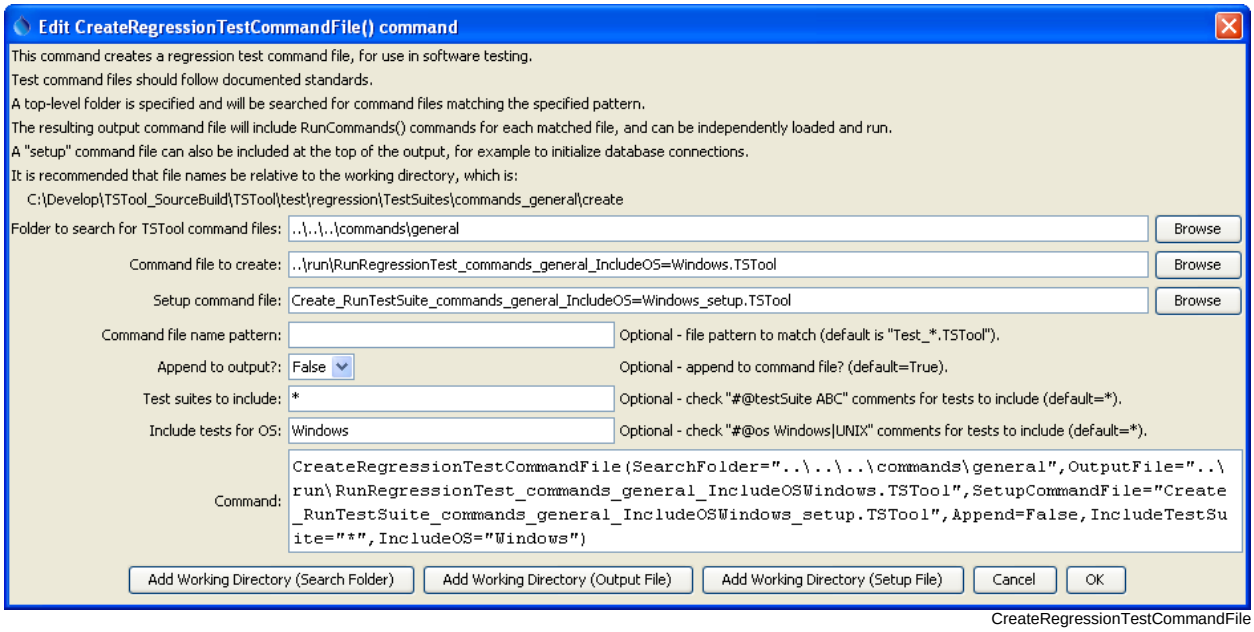
Comment Tag	Description
`@enabled False`	The `RunCommands()` command will by default run the command file that is provided. However, if the `@enabled False` tag is specified in a comment in the command file, `RunCommands()` will skip the command file. This is useful to disable a test that needs additional work.

`@expectedStatus Failure`
 	
`@expectedStatus Warning`
	The `RunCommands()` command `ExpectedStatus` parameter is by default `Success`. However, a different status can be specified if it is expected that a command file will result in `Warning` or `Failure` and still be a successful test. For example, if a command is obsolete and should generate a failure, the expected status can be specified as `Failure` and the test will pass. Another example is to test that the software properly treats a missing file as a failure.

`@os Windows` `@os UNIX`	The test is designed to work only on the specified platform and will be included in the test suite only if the `IncludeOS` parameter includes the corresponding operating system (OS) type. This is primarily used to test specific features of the OS and similar but separate test cases should be implemented for both OS types. If the OS type is not specified as a tag in a command file, the test is always included (see also the handling of included test suites).
`@readOnly`	Indicates that the command file should not be edited. TSTool will update old command syntax to current syntax when a command file is loaded. However, this tag will cause the software to warn the user when saving the command file, so that they can cancel.
`@testSuite ABC`	Indicate that the command file should be considered part of the specified test suite, as specified with the `IncludeTestSuite`

Comment Tag	Description
	parameter. The test is included in all test collections if the tag is not specified; therefore, for general tests, do not specify a test suite. This tag is useful if a group of tests require special setup, for example connecting to a database. The suite names should be decided upon by the test developer.

The following dialog is used to edit the command and illustrates the syntax for the command.



CreateRegressionTestCommandFile

CreateRegressionTestCommandFile() Command Editor

The command syntax is as follows:

```
CreateRegressionTestCommandFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`SearchFolder`	The folder to search for regression test command files. All subfolders will also be searched.	None – must be specified.
`OutputFile`	The name of the command file to create, enclosed in double quotes if the file contains spaces or other special characters. A path relative to the command file containing this command can be specified.	None – must be specified.
`SetupCommandFile`	The name of a TSTool command file that supplies setup commands, and which will be prepended to output. Use such a file to open database connections and set other global settings that apply to the entire test run.	Do not include setup commands.
`FilenamePattern`	Pattern for TSTool command files, using wildcards.	`Test_*.TStool`
`Append`	Indicate whether to append to the output file (`True`) or overwrite (`False`). This allows multiple directory trees to be searched for tests, where the first command	`True`

Parameter	Description	Default
	typically specifies `False` and additional commands specify `True`.	
`IncludeTestSuite`	If *, all tests that match `FilenamePattern` and `IncludeOS` are included. If a test suite is specified, only include tests that have `@testSuite` tag values that match a value in `IncludeTestSuite`. One or more tags can be specified, separated by commas.	* – include all test cases.
`IncludeOS`	If *, all tests that match `FilenamePattern` and `IncludeTestSuite` are included. If an OS is specified, only include tests that have `@os` tag values that match a value in `IncludeTestSuite`. This tag is typically specified once or not at all.	* – include all test cases.

See the **Quality Control** chapter of the TSTool documentation for how to set up a regression test. The following command file illustrates how to create a regression test suite.

```
CreateRegressionTestCommandFile(SearchFolder="..\..\..\commands\general",
  OutputFile="..\run\RunRegressionTest_commands_general.TSTool",Append=False)
```

An example of the output file from running the tests is:

```
# File generated by...
# program:      TSTool 10.20.00 (2013-04-10)
# user:         sam
# date:         Sat Apr 20 13:36:05 MDT 2013
# host:         AMAZON
# directory:    C:\Develop\TSTool_SourceBuild\TSTool\test\regression\TestSuites\commands_general\run
# command line: TSTool
#  -home test/operational/CDSS
#
# Command file regression test report from StartRegressionTestResultsReport() and RunCommands()
#
# Explanation of columns:
#
# Num: count of the tests
# Enabled: blank if test enabled or FALSE if "#@enabled false" in command file
# Run Time: run time in milliseconds
# Test Pass/Fail:
#    The test status below may be PASS or FAIL (or blank if disabled).
#    A test will pass if the command file actual status matches the expected status.
#    Disabled tests are not run and do not count as PASS or FAIL.
#    Search for *FAIL* to find failed tests.
# Commands Expected Status:
#    Default is assumed to be SUCCESS.
#    "#@expectedStatus Warning|Failure" comment in command file overrides default.
# Commands Actual Status:
#    The most severe status (Success|Warning|Failure) for each command file.
#
#    |       |       |Test  |Commands  |Commands   |
#    |       |Run    |Pass/ |Expected  |Actual     |
# Num|Enabled|Time   |Fail  |Status    |Status     |Command File
#----+-------+-------+------+----------+-----------+-----------------------------------------------------------------------------------------
    1|       |    141| PASS |SUCCESS   |SUCCESS    |C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ARMA\Test_ARMA_Day.TSTool
    2|       |     31| PASS |SUCCESS   |SUCCESS    |C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ARMA\Test_ARMA_Legacy.TSTool
    3|       |     31| PASS |SUCCESS   |SUCCESS    |C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ARMA\Test_ARMA_Legacy_Ast.TSTool
    4|       |     15| PASS |SUCCESS   |SUCCESS    |C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ARMA\Test_ARMA_Legacy…
…
…
…
   17|FALSE  |      0|      |SUCCESS   |UNKNOWN
|C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\WriteReclamationHDB\Test_WriteReclamationHDB_...
#----+-------+-------+------+----------+-----------+-----------------------------------------------------------------------------------------
FAIL count     = 0, 0.000%
PASS count     = 17, 100.000%
Disabled count = 1
#--------------------------------
Total          = 18
```

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Command Reference: Cumulate()

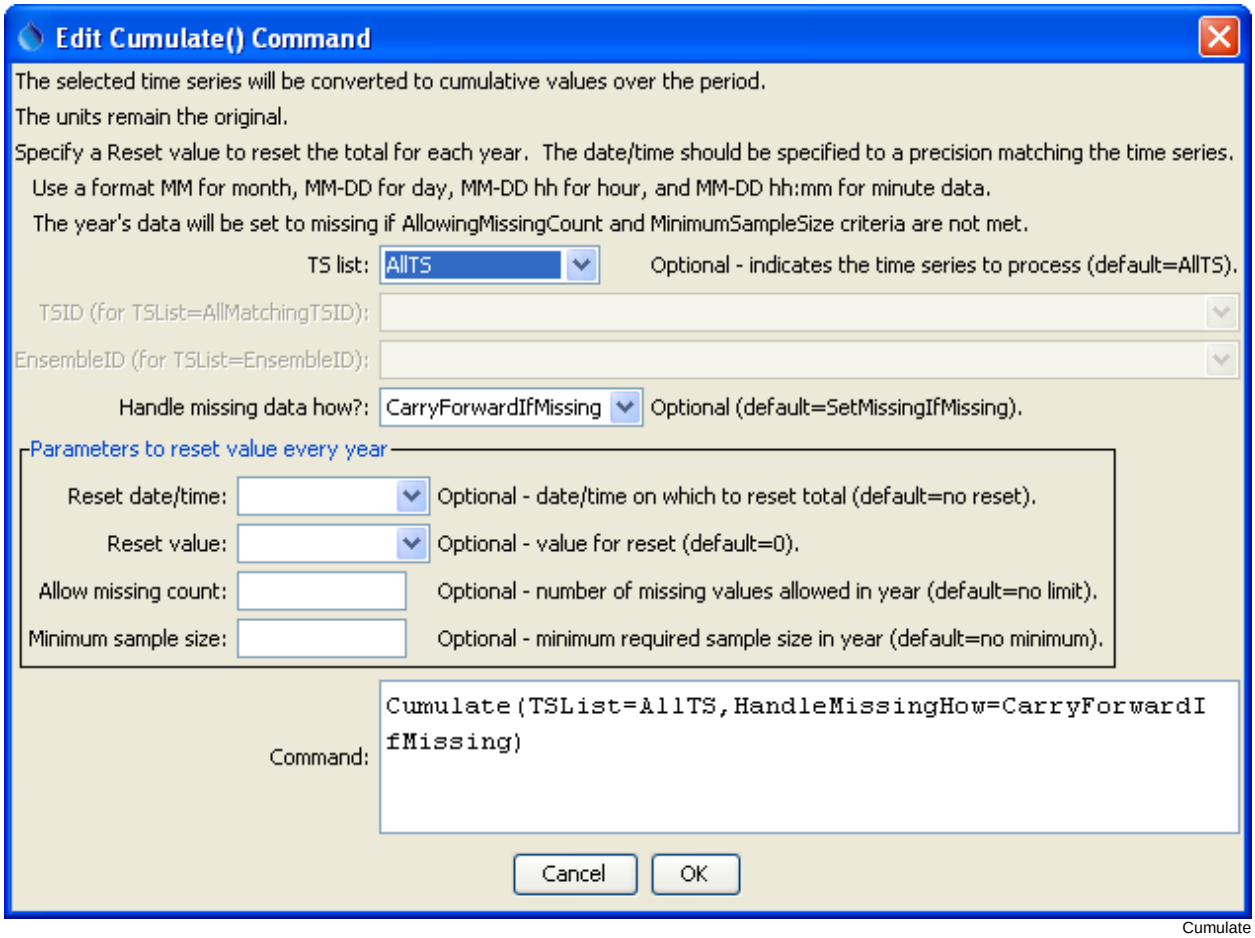
Convert time series data values to cumulative values

Version 10.12.00, 2012-07-25

The `Cumulate()` command converts a time series into cumulative values, which is useful for:

- comparing the cumulative trends of related time series (e.g., nearby gages or precipitation gages) and can serve as a substitute for the double-mass graph, which has difficulty handling missing data
- checking mass balance when routing time series (the cumulative values before and after routine will track closely)
- computing year-to-date totals such as cumulative precipitation

The following dialog is used to edit the command and illustrates the syntax of the command.



Cumulate

Cumulate() Command Editor

The command syntax is as follows:

```
Cumulate(Parameter=Value,…)
```

Command Parameters

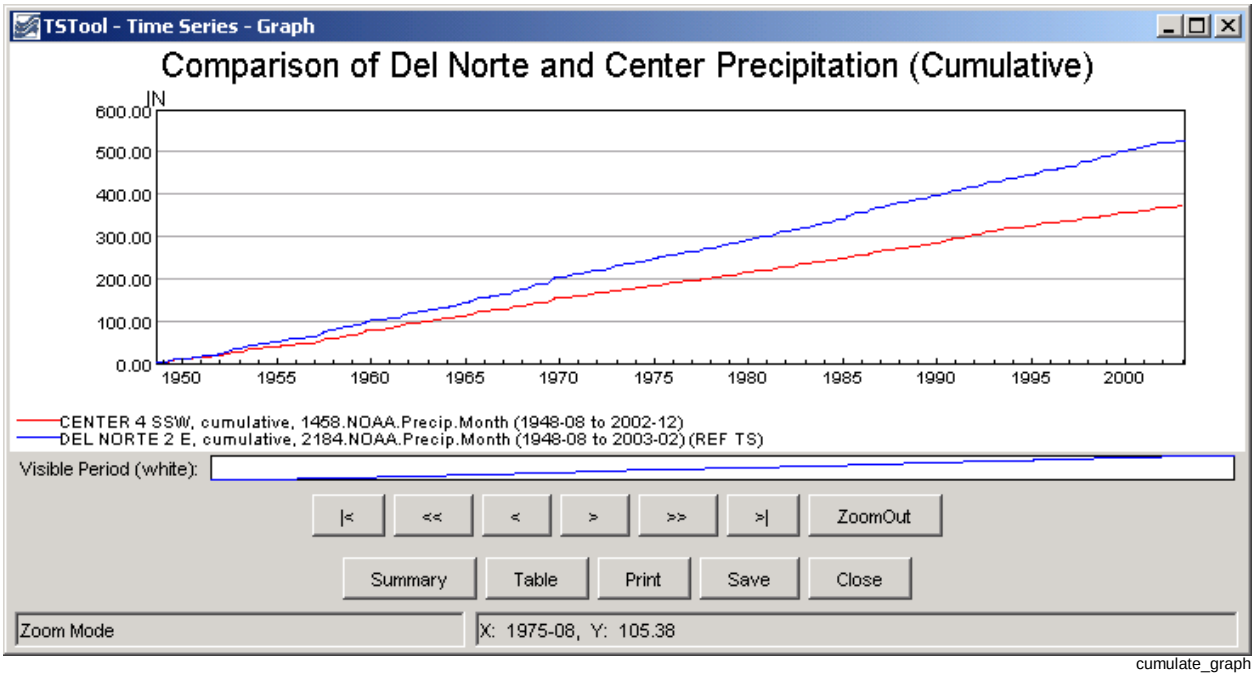
Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required for TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required for TSList=EnsembleID.
HandleMissingHow	Indicate how to handle missing data, one of: • CarryForwardIfMissing –carry forward the last non-missing value • SetMissingIfMissing – set the result to missing if the original value is missing. The only difference in output is that the period of missing data will either be blank or a horizontal line in graphs.	SetMissingIfMissing
Reset	A date to the precision of the time series (e.g., 01-01 for January 1 in a daily time series) that indicates when to reset the cumulative value to the initial value, before beginning to cumulate again. Specifying the reset effectively defines the first timestep in a new year, whether calendar or some other year is being used for the cumulative values. Use the format MM-DD, MM-DD hh, or MM-DD hh:ss.	Do not reset.
ResetValue	When Reset is specified: the value to initialize the total at the Reset date/time, one of: • DataValue – the data value from the original time series • Number – a number to use for the reset	0 (zero)

Parameter	Description	Default
`AllowMissingCount`	When `Reset` is specified: the number of values allowed to be missing in a year. If more values are missing, the entire year is set to missing. The missing value count for the first year includes the period from analysis start to `Reset`. A partial year at the end of the analysis period will not count as missing beyond the analysis end.	No limit on the number of missing values.
`MinimumSampleSize`	When `Reset` is specified: the minimum number of non-missing values required in a year to perform the computation. If fewer values are in the sample, the entire year is set to missing. The missing value count for the first year includes the period from analysis start to `Reset`. A partial year at the end of the analysis period will result in the sample size being less than the full year.	No minimum sample size is required.

A sample command file to cumulate times from the State of Colorado's HydroBase is as follows:

```
# 1458 - CENTER 4 SSW
1458.NOAA.Precip.Month~HydroBase
# 2184 - DEL NORTE 2 E
2184.NOAA.Precip.Month~HydroBase
Cumulate(TSList=AllTS,HandleMissingHow=CarryForwardIfMissing)
```

The following graph illustrates cumulative data for two precipitation gages in the same region, where missing data results in carrying forward the last known value.



cumulate_graph

Example Graph Showing Results of cumulate() Command

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Command Reference: Delta()

Create new time series where values are the difference between each value in original time series

Version 9.07.00, 2010-08-05

The `Delta()` command creates a new time series from an input time series. The resulting values are computed as the difference between each value and the previous value. Consequently, the delta result is the change from the previous value. The `CheckTimeSeries()` command can be used to check time series for changes that exceed a threshold; however, the `Delta()` command handles the complexity of time series that reset to a new starting value – the output can be used in conjunction with `CheckTimeSeries()`. The `Delta()` command will create as many output time series as there are input time series.

The output value is simply the current value minus the previous value. The result is set to missing if this value cannot be computed due to missing values, or in cases where a transition across a reset has errors.

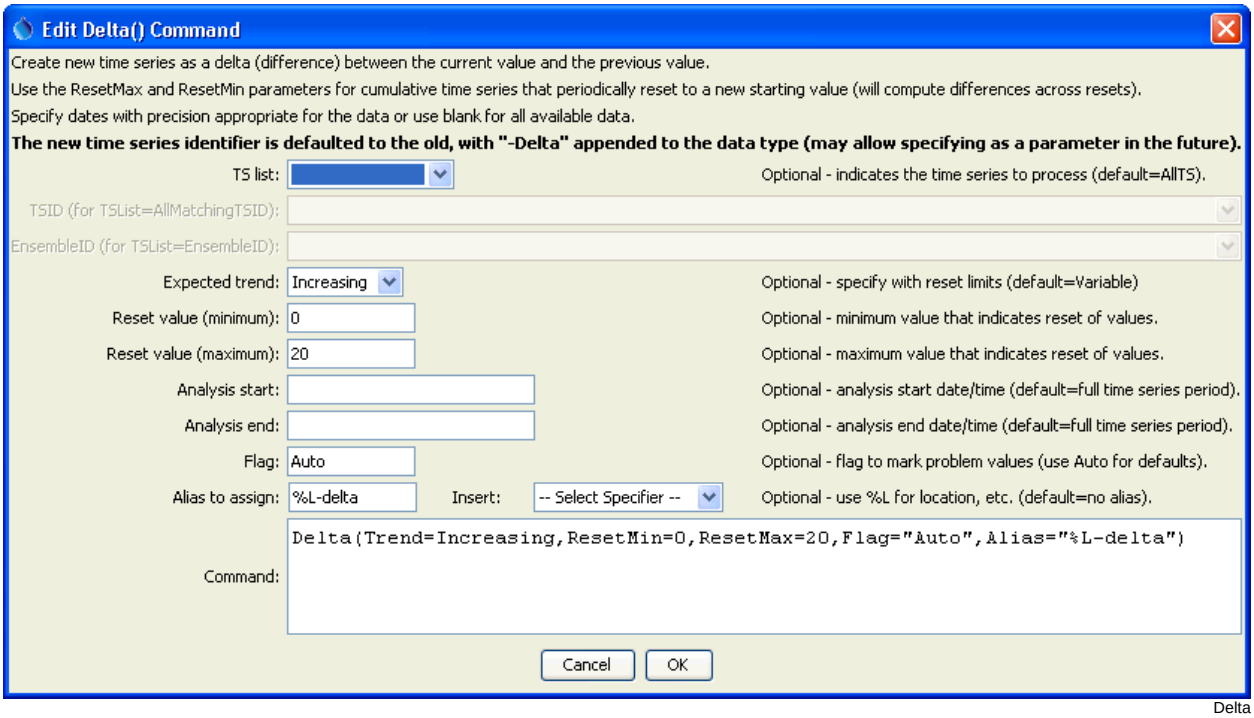
If the data do reset, then the expected trend should be specified to allow the `ResetMin` and `ResetMax` parameters to be properly interpreted. For example, if `Trend=Increasing` and a decrease is detected, it is assumed that the values have circled past the reset values. In this case the command will attempt to compute the change across the reset values. If this is not possible, then warnings will be generated and the result will be set to missing. Specific cases that are handled are:

- The previous value is out of range – in this case the contribution from the out of range previous value is added to the delta and default flag value is assigned (see `Flag` parameter description). A warning will be generated.
- The current value is out of range – in this case the difference will be decreased because the reset value has not be achieved. A warning will be generated.

The above special cases result in somewhat arbitrary difference values because the inputs do not conform to expected values. Out of range values indicate erroneous data that should be corrected before being used in further analysis.

Irregular-interval time series that result in differences not being computed will have missing values inserted at appropriate locations to maintain consistent data point spacing with the original data.

The following dialog is used to edit the command and illustrates the command syntax.



Delta

Delta() Command Editor

The command syntax is as follows:

```
Delta(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards). • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble specified by `TSID`. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards). • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards). • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	Must be specified if `TSList=*TSID`.
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Must be specified

Parameter	Description	Default
		if `TSList=EnsembleID`.
`ResetMin`	The minimum expected data value, used when data are expected to increase (or decrease) to a threshold and then reset, for example raw precipitation values that reset to zero when a container fills.	Data are not expected to reset.
`ResetMax`	The maximum expected data value, used when data are expected to increase (or decrease) to a threshold and then reset, for example raw precipitation values that reset to zero when a container fills.	Data are not expected to reset.
`ExpectedTrend`	Indicates trend of data, used when values can reset: • `Decreasing` – values should decrease and then reset • `Increasing` – values should increase and then reset	Data are variable and don't reset at fixed thresholds.
`AnalysisStart`	The date/time to start analyzing data.	Full period is analyzed.
`AnalysisEnd`	The date/time to end analyzing data.	Full period is analyzed.
`Flag`	A string to flag problem values, or `Auto` for default flags: • `R` – indicates reset transition out of range > `ResetMax` • `r` – indicates reset transition out of range < `ResetMin` • `V` – indicates value out of range > `ResetMax` • `v` – indicates value out of range < `ResetMin`	Do not flag problem values.
`Alias`	Alias to assign to created time series. A literal string can be specified or use %-specifiers to set the alias dynamically (e.g., `%L`) to use the location part of the identifier.	None (but is highly recommended).

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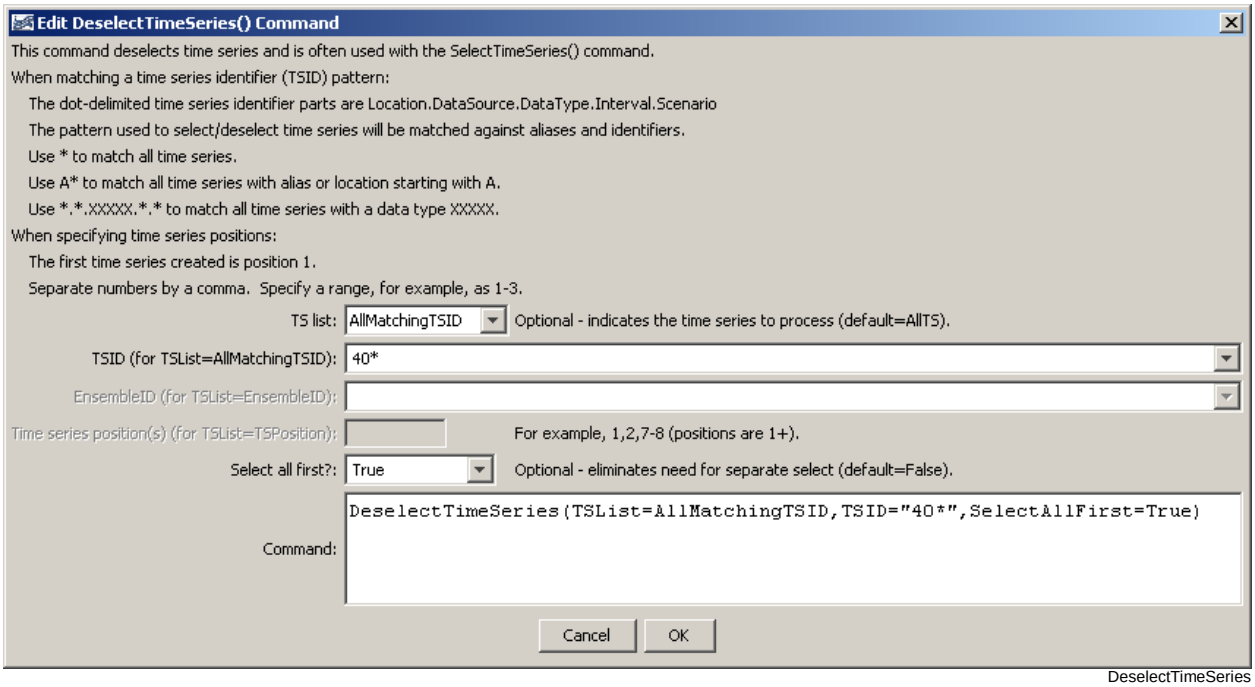
Command Reference: DeselectTimeSeries()

Deselect time series

Version 10.13.00, 2012-10-25

The `DeselectTimeSeries()` command deselects output time series, as if done interactively, to indicate which time series SHOULD NOT be operated on by following commands. The command minimizes the need for the `free()` command when used in conjunction with other commands that use a time series list based on selected time series (`TSList=SelectedTS`). See also the `SelectTimeSeries()` command.

The following dialog is used to edit the command and illustrates the command syntax.



DeselectTimeSeries

DeselectTimeSeries() Command Editor

The command syntax is as follows:

```
DeselectTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • TSPosition – time series specified by position in the results list (see TSPosition parameter below).	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	TSID or EnsembleID must be specified if identifiers are being matched.
EnsembleID	The ensemble to be modified, if processing an ensemble.	TSID or EnsembleID must be specified if identifiers are being matched.
TSPosition	A list of time series positions in output (1+), separated by commas.	Required if TSList=TSPosition.
SelectAllFirst	Indicates whether all time series should be selected before deselecting the specified time series: True or False.	False

A sample command file is as follows:

```
NewPatternTimeSeries(Alias="401234",NewTSID="401234..Precip.Day",
Description="Example data",SetStart="2000-01-01",SetEnd="2000-12-31",
    Units="IN",PatternValues="0,1,3,0,0,0")
DeselectTimeSeries(TSList=AllMatchingTSID,TSID="40*",SelectAllFirst=True)
```

Command Reference: Disaggregate()

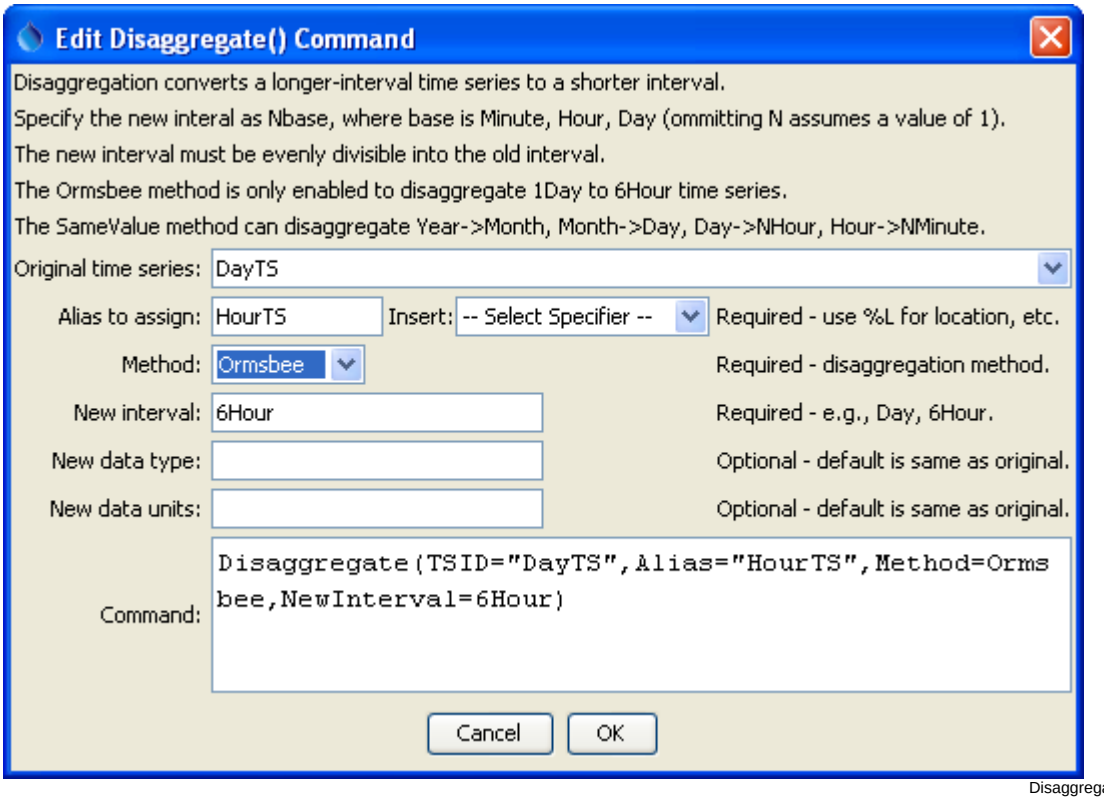
Create a new time series with shorter interval

Version 10.00.01, 2011-05-12

The `Disaggregate()` command creates a new time series by disaggregating a time series with a longer data interval into a time series with a shorter data interval. The resulting time series will have the same metadata and identifier as the original time series, with a different data interval. See also the general `ChangeInterval()` command.

Converting longer-interval data may cause a perceived shift in the time. For example, `1Day` data shifted to `24Hour` data will result in the daily values being set at hour zero of the following day. This shift is necessary to generically represent different time precision. Plots will also reflect the shift because hours are not considered when computing plot positions for daily data. It is important to understand how disaggregated data is treated with respect to time when using with other applications. If necessary, use the `ShiftTimeByInterval()` command to manipulate the resulting output time series.

The following dialog is used to edit the command and illustrates the syntax for the command.



Disaggregate_Alias

Disaggregate() Command Editor

The command syntax is as follows:

```
Disaggregate(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = Disaggregate(Parameter=Value,…)
```

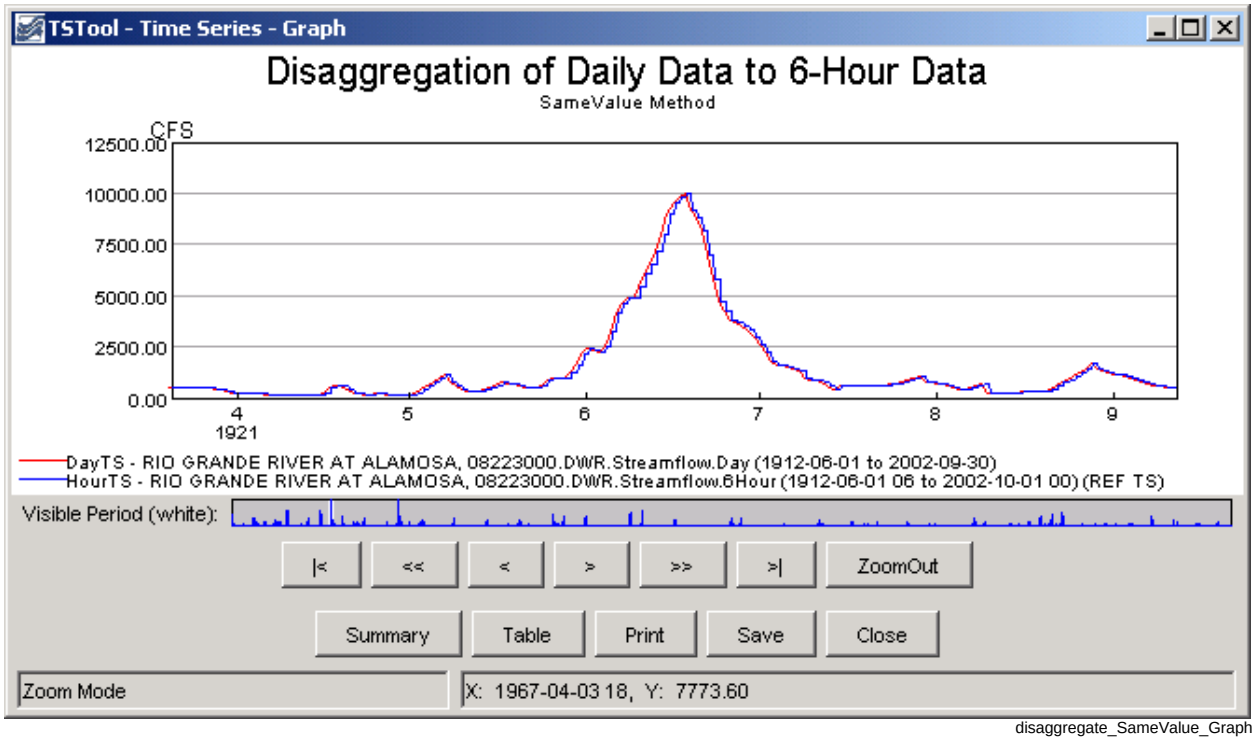
Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be disaggregated.	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
Method	The method used to perform the disaggregation, one of the following: Orsmbee – this method was presented in "Rainfall Disaggregation Model for Continuous Hydrologic Modeling," Ormsbee, Lindell E., Journal of Hydraulic Engineering, ASCE, April, 1989. Currently the method has only been enabled for disaggregating 1Day (not 24Hour) data to 6Hour data. SameValue – this simple method causes the resulting time series to have the same value as the original. For example, a monthly time series that is disaggregated to a daily time series will result in each daily value being the same as for the corresponding value in the original monthly time series. Currently the following disaggregations are supported: • Year to Month • Month to Day • Day to NHour (including 24Hour) • Hour to NMinute (including 60Minute)	None – must be specified.
NewInterval	The data interval for the disaggregated time series (NHour, NDay, etc.).	None – must be specified.
NewDataType	The data type for the disaggregated time series, if different from the original.	Same data type as the original time series.
NewUnits	The units for the disaggregated time series, if different from the original.	Same units as the original time series.

An example command file to process data from the State of Colorado's HydroBase is as follows:

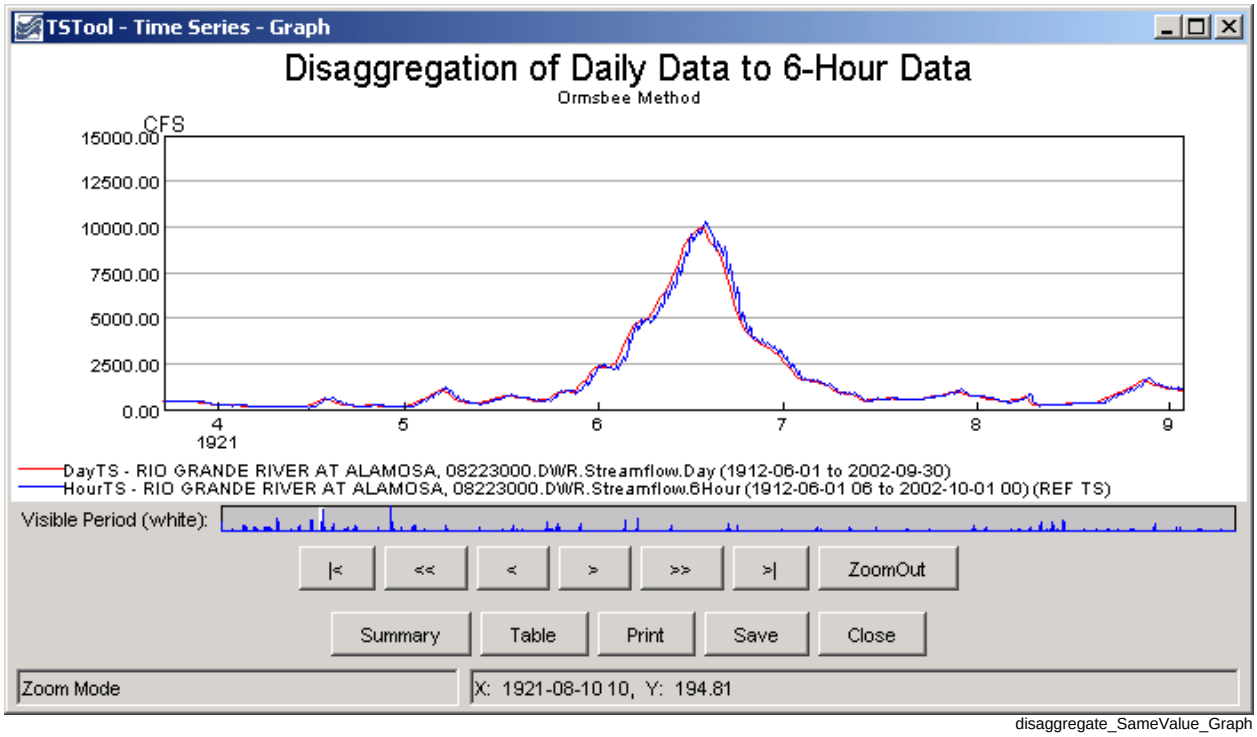
```
# 08223000 - RIO GRANDE RIVER AT ALAMOSA
ReadTimeSeries(TSID="08223000.DWR.Streamflow.Day~HydroBase",Alias="DayTS")
Disaggregate(TSID="DayTS",Alias="HourTS",Method=Ormsbee,NewInterval=6Hour)
```

Examples of graphs for the original and disaggregated data are shown below, for the two disaggregation methods:



disaggregate_SameValue_Graph

Daily Input Time Series and 6-Hour Disaggregated Time Series using SameValue Method



disaggregate_SameValue_Graph

Daily Input Time Series and 6-Hour Disaggregated Time Series using Ormsbee Method

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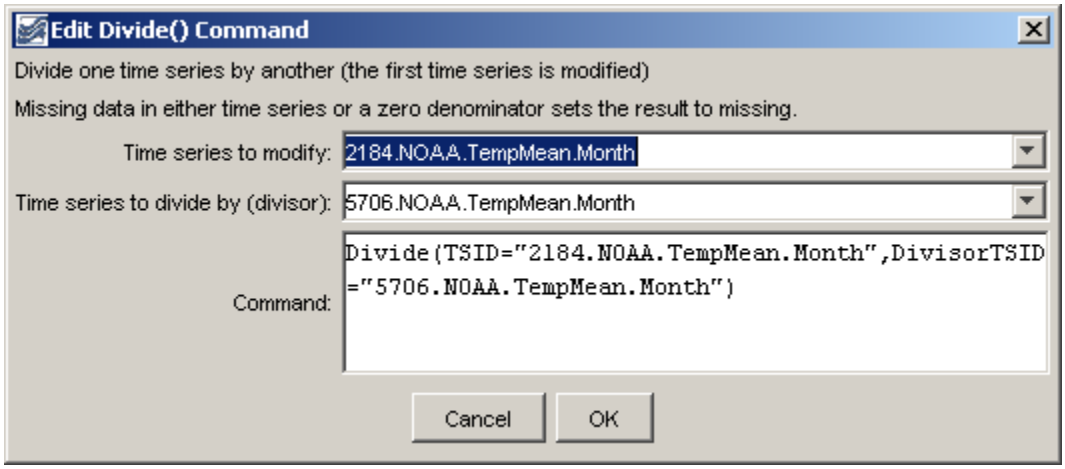
Command Reference: Divide()

Divide the data values in one time series by data values in another time series

Version 08.16.04, 2008-09-24

The `Divide()` command divides one time series by another. This is useful for comparing the relative size of time series values (see also `RelativeDiff()`). If the divisor is zero or missing, the result is set to missing. Use the `Scale()` command to divide by a numerical value.

The following dialog is used to edit the command and illustrates the syntax of the command.



Divide

Divide() Command Editor

The command syntax is as follows:

```
Divide(Parameter=Value,…)
```

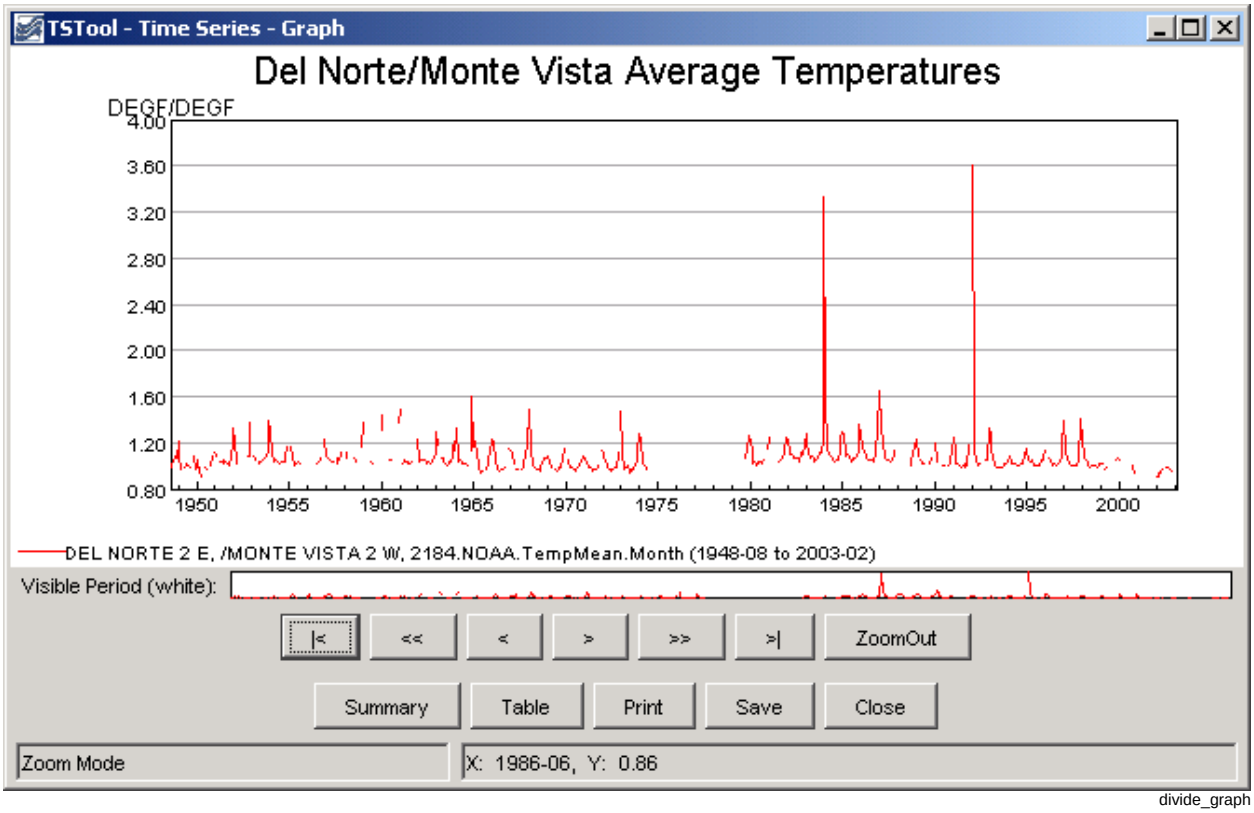
Command Parameters

Parameter	Description	Default
`TSID`	The time series identifier or alias for the time series to be modified.	None – must be specified.
`DivisorTSID`	The time series identifier or alias for the time series that is the divisor.	None – must be specified.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 2184 - DEL NORTE 2 E
2184.NOAA.TempMean.Month~HydroBase
# 5706 - MONTE VISTA 2 W
5706.NOAA.TempMean.Month~HydroBase
Divide(TSID="2184.NOAA.TempMean.Month",
  DivisorTSID="5706.NOAA.TempMean.Month")
```

The resulting graph is as follows:



divide_graph

Results from Divide() Command

Command Reference: Exit()

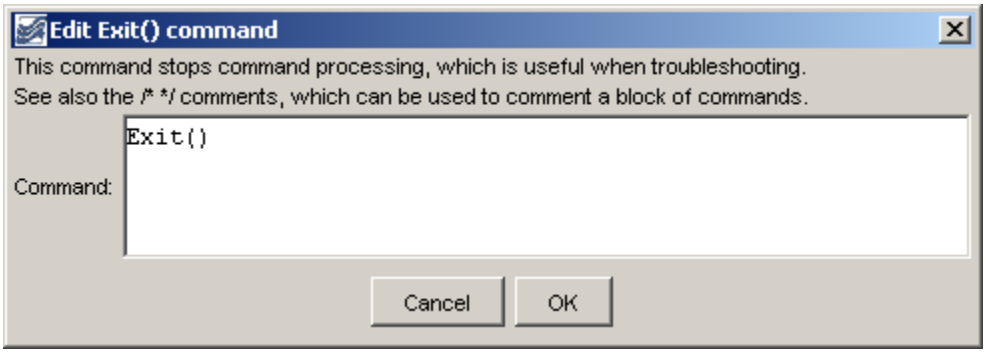
Stop processing commands

Version 08.16.04, 2008-09-25

The `Exit()` command can be inserted anywhere in a command file and causes the processing of commands to stop at that line. This is useful for temporarily processing a subset of a long list of commands. Multi-line comments (`/* */`) can also be used to temporarily disable one or more commands. It may also useful to add an `Exit()` command at the end of the file so that it is easy to insert commands above this command when the end line is selected (rather than having to deselect all commands when editing).

In the future the command may be enhanced to have parameters that more explicitly control processing shut-down.

The following dialog is used to edit the command and illustrates the command syntax:



Exit

Exit() Command Editor

The command syntax is as follows:

```
Exit(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
	There are currently no command parameters.	

A sample command file is as follows:

```
Exit()
```

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Command Reference: ExpandTemplateFile()

Process a template file to create a fully-expanded file

Version 10.21.00, 2013-06-21

The `ExpandTemplateFile()` command processes a template file (such as a command file, time series product file, or HTML but can be any text file) to create a fully-expanded file and/or processor property. Templates facilitate utilizing conditional logic, loops, and other dynamic processing functionality that is not provided directly by TSTool. For example, a template can be used to repeat commands for multiple location identifiers. One advantage of using the template approach is that problems in the expanded file are clearly indicated, whereas a problem in logic that is represented as a loop might be difficult to diagnose.

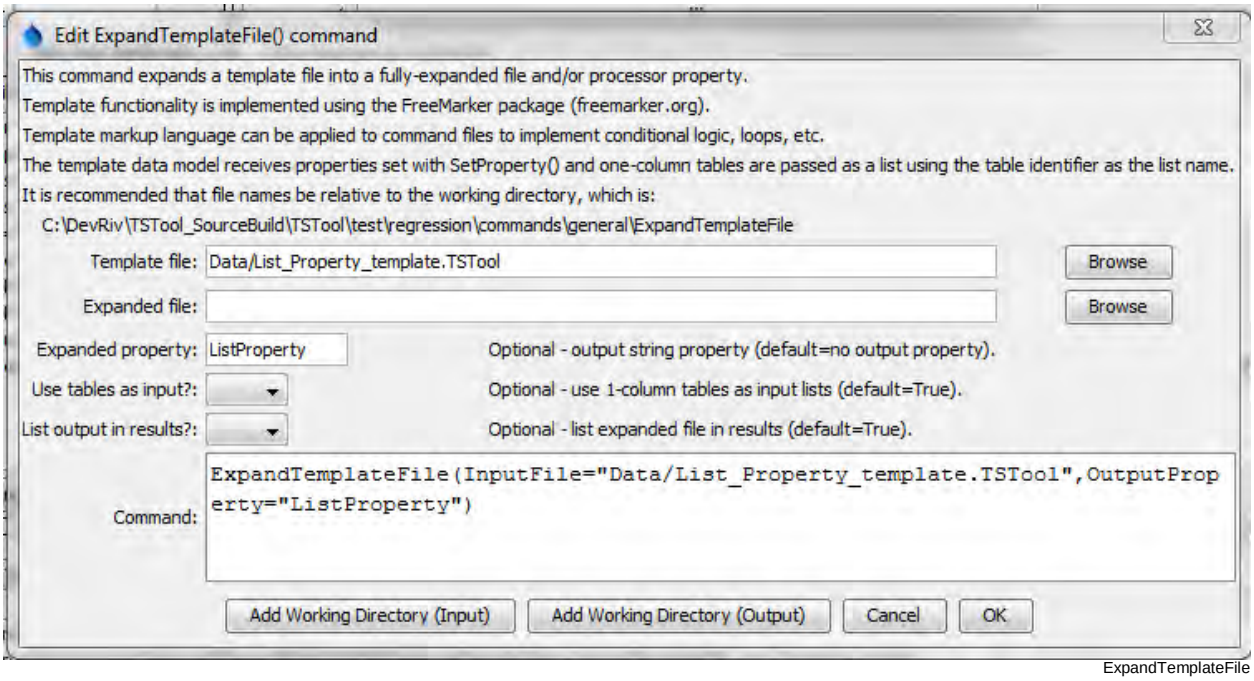
The FreeMarker software (http://freemarker.org) is used to implement templates (support for other templating engines such as Apache Velocity could be added if needed). Refer to the online Freemarker documentation for information about the markup language used to create templates. Because TSTool checks commands for errors and does not itself understand FreeMarker syntax, template files must be edited with a text editor outside the normal TSTool editing. Attempts to edit a template command file in TSTool may result in error indicators and some command editors may not allow changes to be saved, such as when template notation is used for a filename and the command expects a parent folder name to exist. TSTool may be enhanced in the future to provide template editing features. Examples below illustrate how to use common FreeMarker features.

The FreeMarker built-in `normalizeNewlines` user directive is automatically used to ensure that expanded files use newline characters appropriate for the operating system. Otherwise the results may have all lines merged together (not an issue for HTML used by web browsers but a big issue with TSTool). The `normalizeNewlines` directive leads to temporary extra first and last lines in the template during processing, which need to be accounted for when interpreting FreeMarker warning messages. For example, a FreeMarker warning about line 21 would actually be line 20 in the original template file. FreeMarker messages may be difficult to interpret. In general errors are because variable names are not spelled correctly or there is an error specifying FreeMarker syntax.

The following information is automatically passed from TSTool to the `ExpandTemplateFile()` command:

- Properties set with the `SetProperty()` command are passed to the template processor. Consequently, the property names can be referenced with ${Property} in the template without using a FreeMarker assign command.
- One-column tables are passed as FreeMarker lists, using the table identifier (TableID) as the list property name. Null values in the table are passed as an empty string so that list have the correct number of items for iteration. Use the `CopyTable()` command to create a one-column table that can be used as a list for template expansion. The `UseTables` command parameter can be used to turn off this transfer, for example in cases where an `ExpandTemplateFile()` command is being repeated many times, does not use the tables, and is slowed down by converting the tables to FreeMarker lists.

The following dialog is used to edit the command and illustrates the syntax for the command.



ExpandTemplateFile

ExpandTemplateFile() Command Editor

The command syntax is as follows:

```
ExpandTemplateFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the template file to process. It is recommended that the filename include "template" and that a comment in the file include `@readOnly`, which will cause TSTool to warn users when saving the expanded result.	None – must be specified.
`OutputFile`	The name of the expanded output file.	None – must be specified.
`OutputProperty`	The name of a property to receive the results of the template expansion. This is appropriate when templates are used to expand single-line text, for example.	No property value will be set.
`UseTables`	Indicate whether 1-column tables should be passed to the template expander. Doing so is a performance hit and should be avoided if tables are not used in the template.	`True`
`ListInResults`	Indicate whether the results of the expansion should be listed in the TSTool results area. This may be undesirable for "worker" files that users will normally not view.	`True`

Example Using Simple Variable Assignment

The following example illustrates a simple template command file and expanded result.

```
# Simple test to expand a text file using FreeMarker
#@readOnly
<#assign message="Hello World">
${message}
```

```
# Simple test to expand a text file using FreeMarker
#@readOnly
Hello World
```

Example of Passing Time Series Processor Properties to Templates

TSTool uses the `${Property}` notation to dynamically replace the string with the corresponding property value (as a string). FreeMarker uses the `${Variable}` notation to dynamically replace the string with the corresponding variable (as a string). Because the same notation is used by both software components, care must be taken to ensure that values are properly interpreted.

TSTool automatically passes all TSTool properties to the `ExpandTemplateFile()` command. Consequently, one of the main ways to avoid conflicts is to ensure that template command files do not use any of the properties defined in TSTool. One way to check property names is to insert a `WritePropertyToFile()` command at the appropriate line in a command file and review the list of properties that are shown when editing the command.

To utilize TSTool processor properties in a template, do not use the FreeMarker assign command and instead reference the property directly. The following TSTool command file illustrates how to define a property that is used by the `ExpandTemplateFile()` command:

```
# Simple test to expand a text file using FreeMarker
SetProperty(PropertyName="HelloWorldProp",PropertyType=String,
    PropertyValue="Hello World")
ExpandTemplateFile(InputFile="Data\ProcessorStringProperty.txt",
    OutputFile="Results/Test_ExpandTemplateFile_HelloWorld_out.txt")
```

The corresponding template command file is as follows:

```
# Simple test to expand a text file using FreeMarker
${HelloWorldProp}
```

The variables also can be used in assignment, similar to the following:

```
# Simple test to expand a text file using FreeMarker
<#assign message="${HelloWordProp}">
${message}
```

Example of Protecting TSTool Properties in Template with a Literal FreeMarker String

It is possible to use TSTool property notation in a template and cause FreeMarker to ignore the property. This will ensure that the property notation is present in the output, for TSTool to interpret at run-time.

The following example illustrates an input file that uses the FreeMarker `${r"…"}` raw literal string notation:

```
# Simple test to expand a text file using FreeMarker
# and also escape text so that it passes through to the expanded file
# @readOnly
<#assign message="Hello World">
${r"SomeCommand($SomeProperty)"}
```

The corresponding output file is as follows:

```
# Simple test to expand a text file using FreeMarker
# and also escape text so that it passes through to the expanded file
# @readOnly
Hello World
SomeCommand($SomeProperty)
```

Example of Using a Comment in the Template, which is Omitted from Expanded Output

It often is desirable to have comments in the template file to explain the template, but not have the comments propagated to the expanded output. The following example illustrates an input file that uses the FreeMarker `$<#-- … -->` notation for comments:

```
# Simple test to expand a text file using FreeMarker
# There should be no comment in the expanded output below this line
<#-- This is a comment in the template -->
<#assign message="Hello World">
${message}
```

The corresponding output file is as follows:

```
# Simple test to expand a text file using FreeMarker
# There should be no comment in the expanded output below this line
Hello World
```

Example Using Variable Assignment and Loop Using List

The following example illustrates a template command file repeat a command for a list of location identifiers. A block of multiple commands can be repeated, as appropriate. Long lines are indented for illustration but would exist on a single line without indentation in the template file. Note that the `loc_index` FreeMarker syntax allows the loop counter to be used.

```
# Simple template to illustrate how to repeat commands with a list of
# location identifiers
# Create a time series for each location
# The following ensures that the created template is read-only, so users
# modify the template instead:
#@readOnly
<#assign setStart = "2000-01-01">
<#assign setEnd = "2000-03-15">
<#assign units = "CFS">
<#assign locList = ["loc1", "loc2", "loc3", "loc4"]>
<#list locList as loc>
```

```
NewPatternTimeSeries(Alias="${loc}",NewTSID="${loc}..Streamflow.Day",
    SetStart="${setStart}",SetEnd="${setEnd}",Units="${units}",
    PatternValues="${loc_index + 1}",0")
</#list>
```

The expanded command file is as follows:

```
# Simple template to illustrate how to repeat commands with a list of
# location identifiers
# Create a time series for each location
# The following ensures that the created template is read-only, so users
# modify the template instead:
#@readOnly
NewPatternTimeSeries(Alias="loc1",NewTSID="loc1..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-15",Units="CFS",PatternValues="1,0")
NewPatternTimeSeries(Alias="loc2",NewTSID="loc2..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-15",Units="CFS",PatternValues="2,0")
NewPatternTimeSeries(Alias="loc3",NewTSID="loc3..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-15",Units="CFS",PatternValues="3,0")
NewPatternTimeSeries(Alias="loc4",NewTSID="loc4..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-15",Units="CFS",PatternValues="4,0")
```

Example Using a One-Column Table for a List for Looping

The following example illustrates a template command file that reads the location list from a table. Note that the list must be a one-column table. If the original table has more than one column, read the original file and then use the `CopyTable()` command to create a new one-column table. A comma-separated-value (CSV) file is used for the list:

```
# Simple list to use during template expansion
"Location"
loc1
loc2
loc3
loc4
```

The template file is similar to the previous example; however, the list of locations is now provided via the table (no `<#assign>` element for the list) rather than having to hard-code in the template, which separates data from the processing logic:

```
# Simple template to illustrate how to repeat commands with a list of
# location identifiers
# Create a time series for each location
# The following ensures that the created template is read-only,
# so users modify the template instead:
# The list is provided by the processor as a one-column table with ID
# matching the list name
#@readOnly
<#assign setStart = "2000-01-01">
<#assign setEnd = "2000-03-15">
<#assign units = "CFS">
<#list locList as loc>
NewPatternTimeSeries(Alias="${loc}",NewTSID="${loc}..Streamflow.Day",
    SetStart="${setStart}",SetEnd="${setEnd}",Units="${units}",
    PatternValues="${loc_index + 1}",0")
</#list>
```

The following command file reads the list of locations from the table and then expands the template file. Note that the `TableID` must match the list name in the `<#list…>` element in the template.

```
# Test expanding a FreeMarker template for a list of time series, using a
# one-column table as the list
# Read a one-column table that will be passed to the template as a list
ReadTableFromDelimitedFile(TableID="locList",InputFile="Data\loclist.csv")
ExpandTemplateFile(InputFile="Data\ProcessorTable.txt",
    OutputFile="Results/Test_ExpandTemplateFile_ProcessorTable_out.txt")
```

Example Using a Multiple-Column Table to Loop Through Two Lists

The previous example illustrated how a one-column table can be used to loop over a list. However, often it is necessary to loop over one list and access the corresponding items from another list. The following example illustrates how a template command file can perform this task. Note that each list must be a one-column table in TSTool. If the original table has more than one column, use the `CopyTable()` command to create as many one-column tables as are necessary. In this example, a comma-separated-value (CSV) file is used for the table:

```
# Simple list to use during template expansion
"Location","Value"
loc1,1.0
loc2,2.0
loc3,3.0
loc4,4.0
```

The template file to expand is similar to the one-column example; however, the second list is also used to provide information when expanding the commands (see bold text below):

```
# Simple template to illustrate how to repeat commands with a list of
# location identifiers
# Create a time series for each location
# The following ensures that the created template is read-only,
# so users modify the template instead:
# The location list is provided by the processor as a one-column table
# with ID matching the list name
# The value list is provided by the processor as a corresponding one-column
# table with ID "valueList"
#@readOnly
<#assign setStart = "2000-01-01">
<#assign setEnd = "2000-03-15">
<#assign units = "CFS">
# The loc_index is referenced to zero
<#list locList as loc>
<#assign value = valueList[loc_index]>
NewPatternTimeSeries(Alias="${loc}",NewTSID="${loc}..Streamflow.Day",
    SetStart="${setStart}",SetEnd="${setEnd}",Units="${units}",
    PatternValues="${value}")
NewPatternTimeSeries(Alias="${loc}",NewTSID="${loc}..Streamflow.Day",
    SetStart="${setStart}",SetEnd="${setEnd}",Units="${units}",
    PatternValues="${valueList[loc_index]}")
</#list>
```

The following command file reads the list of locations from the table and then expands the template file. Note that the `TableID` must match the list name in the `<#list…>` element and corresponding arrays in the template.

```
# Test expanding a FreeMarker template for a list of time series, using a
# two-column table as the list
# Read a one-column table that will be passed to the template as a list
ReadTableFromDelimitedFile(TableID="locList2",
    InputFile="Data\2column-table.csv")
CopyTable(TableID="locList2",NewTableID="locList",
    IncludeColumns="Location")
CopyTable(TableID="locList2",NewTableID="valueList",
    IncludeColumns="Value")
ExpandTemplateFile(InputFile="Data\ProcessorTable.txt",
    OutputFile="Results/Test_ExpandTemplateFile_ProcessorTable_out.txt")
```

Example of Expanding a Template to a Processor Property

The following example illustrates how to expand a list into a SQL "in" clause, which is used to query specific matching records. A one-column table with identifier `locList` must have been created to supply the list of identifiers. The property set with the `OutputProperty` command parameter can then be used in the SQL statement for the `ReadTableFromDataStore()` command.

```
IN (<#list locList as loc><#if (loc_index > 0)>,</#if>'${loc}'</#list>)
```

Example of Using ExpandTemplateFile() in a Loop to Expand Multiple Files

A template file cannot be expanded to multiple files using the approach illustrated above. However, by placing an `ExpandTemplateFile()` command inside a template that uses a loop (a list), it is possible to expand a template to multiple files. One example of this is the automated generation of time series product files used with TSTool graphs, where a graph is created for each location being processed. Graphs that are formatted with time series product files allow a certain amount of dynamic information to be considered. However, because the products are organized into product (page), sub-product (graph on page), and data (time series in graph), dynamic data may not be configurable at the desired level. For example, time series legend text can be configured to automatically use the time series identifier; however, this information is not appropriate for the page title because the software cannot automatically decide which time series to use for the main title.

A solution is to use a template time series product (TSP) file that has a place-holder variable for the title and then expand the TSP file as the command file is processed. For troubleshooting and data management purposes, it is recommended that the TSP files are saved in a folder separate from final output. The same TSP filename could be reused; however, the files are small and saving distinct files allows them to be used individually if necessary.

The following TSP file illustrates a simple graph:

```
# Template product file for graphs

[Product]

ProductType = "Graph"
TotalWidth = "600"
```

```
TotalHeight = "400"
MainTitleString = "${loc} Streamflow"

[SubProduct 1]

GraphType = "Line"

[Data 1.1]

TSID = "${loc}..Streamflow.Day"
TSAlias = "${loc}"
```

The following template command file illustrates how a property is set to control expansion of a template time series product file (note that templates are stored in a *Data* folder and final output in a *Results* folder for testing purposes but data management will vary by application):

```
# Simple template to illustrate how to repeat commands
# with a list of location identifiers, and produce individual graphs.
# The list is provided by the processor as a one-column table
# with ID matching the list name
# The @readOnly comment ensures that the created template is read-only,
# so users modify the template instead.
#@readOnly
<#assign setStart = "2000-01-01">
<#assign setEnd = "2000-03-15">
<#assign units = "CFS">
<#list locList as loc>
# Set the loc variable for the processor so that it can pass
# to the ExpandTemplateFile command below
SetProperty(PropertyName="loc",PropertyType="String",PropertyValue="${loc}")
# Create the time series
NewPatternTimeSeries(Alias="${loc}",NewTSID="${loc}..Streamflow.Day",
    SetStart="${setStart}",SetEnd="${setEnd}",Units="${units}",
    PatternValues="${loc_index + 1},0")
# Expand the time series product file (graph) for the time series
ExpandTemplateFile(InputFile="..\Data\ProcessorTable_TSP_template.tsp",
    OutputFile="${loc}.tsp")
# Process the graph
ProcessTSProduct(TSProductFile="${loc}.tsp",OutputFile="${loc}.tsp)
</#list>
```

The following expanded command file creates time series and graphs. Although blocks of commands are repeated, the location identifier is different in each block of commands. Any errors in processing can be pinpointed when the expanded command file is loaded and generally are due to logic errors in the original template (errors repeated throughout the expanded command file) or data availability issues in specific time series (errors in one part of the expanded command file).

```
# Simple template to illustrate how to repeat commands
# with a list of location identifiers, and produce individual graphs.
# The list is provided by the processor as a one-column table
# with ID matching the list name
# The @readOnly comment ensures that the created template is read-only,
# so users modify the template instead.
#@readOnly
# Set the loc variable for the processor so that it can pass
```

```
# to the ExpandTemplateFile command below
SetProperty(PropertyName="loc",PropertyType="String",PropertyValue="loc1")
# Create the time series
NewPatternTimeSeries(Alias="loc1",NewTSID="loc1..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-
15",Units="CFS",PatternValues="1,0")
# Expand the time series product file (graph) for the time series
ExpandTemplateFile(InputFile="..\Data\ProcessorTable_TSP_template.tsp",
    OutputFile="loc1.tsp")
# Process the graph
ProcessTSProduct(TSProductFile="loc1.tsp",OutputFile="loc1.tsp)
# Set the loc variable for the processor so that it can pass
# to the ExpandTemplateFile command below
SetProperty(PropertyName="loc",PropertyType="String",PropertyValue="loc2")
# Create the time series
NewPatternTimeSeries(Alias="loc2",NewTSID="loc2..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-
15",Units="CFS",PatternValues="2,0")
# Expand the time series product file (graph) for the time series
ExpandTemplateFile(InputFile="..\Data\ProcessorTable_TSP_template.tsp",
    OutputFile="loc2.tsp")
# Process the graph
ProcessTSProduct(TSProductFile="loc2.tsp",OutputFile="loc2.tsp)
# Set the loc variable for the processor so that it can pass
# to the ExpandTemplateFile command below
SetProperty(PropertyName="loc",PropertyType="String",PropertyValue="loc3")
# Create the time series
NewPatternTimeSeries(Alias="loc3",NewTSID="loc3..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-
15",Units="CFS",PatternValues="3,0")
# Expand the time series product file (graph) for the time series
ExpandTemplateFile(InputFile="..\Data\ProcessorTable_TSP_template.tsp",
    OutputFile="loc3.tsp")
# Process the graph
ProcessTSProduct(TSProductFile="loc3.tsp",OutputFile="loc3.tsp)
# Set the loc variable for the processor so that it can pass
# to the ExpandTemplateFile command below
SetProperty(PropertyName="loc",PropertyType="String",PropertyValue="loc4")
# Create the time series
NewPatternTimeSeries(Alias="loc4",NewTSID="loc4..Streamflow.Day",
    SetStart="2000-01-01",SetEnd="2000-03-
15",Units="CFS",PatternValues="4,0")
# Expand the time series product file (graph) for the time series
ExpandTemplateFile(InputFile="..\Data\ProcessorTable_TSP_template.tsp",
    OutputFile="loc4.tsp")
# Process the graph
ProcessTSProduct(TSProductFile="loc4.tsp",OutputFile="loc4.tsp)
```

Also note that when the expanded command file is first opened in TSTool the `ProcessTSProduct()` commands will have a failure indicated. This is because the TSP file being used by the command has not yet been created (it is created as the commands are run). After the commands are run one time, the files will exist and subsequent loads of the command file will not show the warnings. This illustrates a potential issue, which is that templates can result in large numbers of files and the files should be cleared at appropriate times to ensure that old files are not used by mistake.

The FreeMarker language provides many features beyond those illustrated in these examples, including conditional ("if") statements. However, the more complex the templates become, the more difficult they are to implement, troubleshoot, and maintain. Enhancements to TSTool may help with a solution that otherwise might require undesirable complexity.

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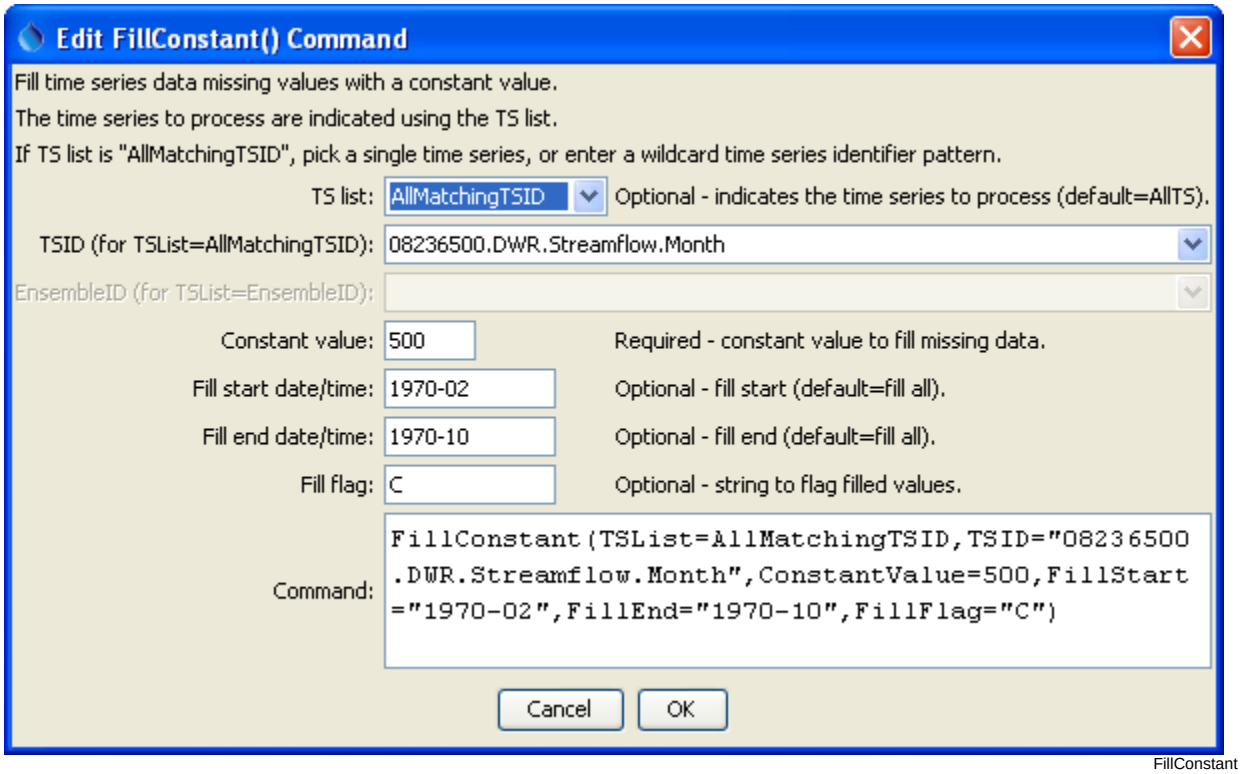
Command Reference: FillConstant()

Fill missing time series data using a constant value

Version 09.07.02, 2010-08-20

The `FillConstant()` command fills the missing data in a time series with the specified value. This fill technique is useful for filling missing data with zeros, perhaps as the last step in a sequence of filling commands.

The following dialog is used to edit the command and illustrates the command syntax.



FillConstant

FillConstant() Command Editor

The command syntax is as follows:

```
FillConstant(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required for TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required for TSList=EnsembleID.
ConstantValue	Constant value to use when filling missing data.	None – must be specified.
FillStart	Date/time indicating the start of filling, using a precision appropriate for the time series, or OutputStart.	Fill the entire time series.
FillEnd	Date/time indicating the end of filling, using a precision appropriate for the time series, or OutputEnd.	Fill the entire time series.
FillFlag	If specified, data flags will be enabled for the time series and each filled value will be tagged with the specified string. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary.	No flag is assigned.

A sample command file to fill a time series from the State of Colorado's HydroBase is as follows:

```
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Month~HydroBase
FillConstant(TSList=AllMatchingTSID,TSID="08236500.DWR.Streamflow.Month",
ConstantValue=500,FillStart="1970-02",FillEnd="1970-10",FillFlag="C")
```

Command Reference: FillDayTSFrom2MonthTSAnd1DayTS()

Fill a daily time series from monthly volumes and daily pattern

Version 08.16.04, 2008-09-19

The `FillDayTSFrom2MonthTSAnd1DayTS()` command fills a daily time series using the following relationship:

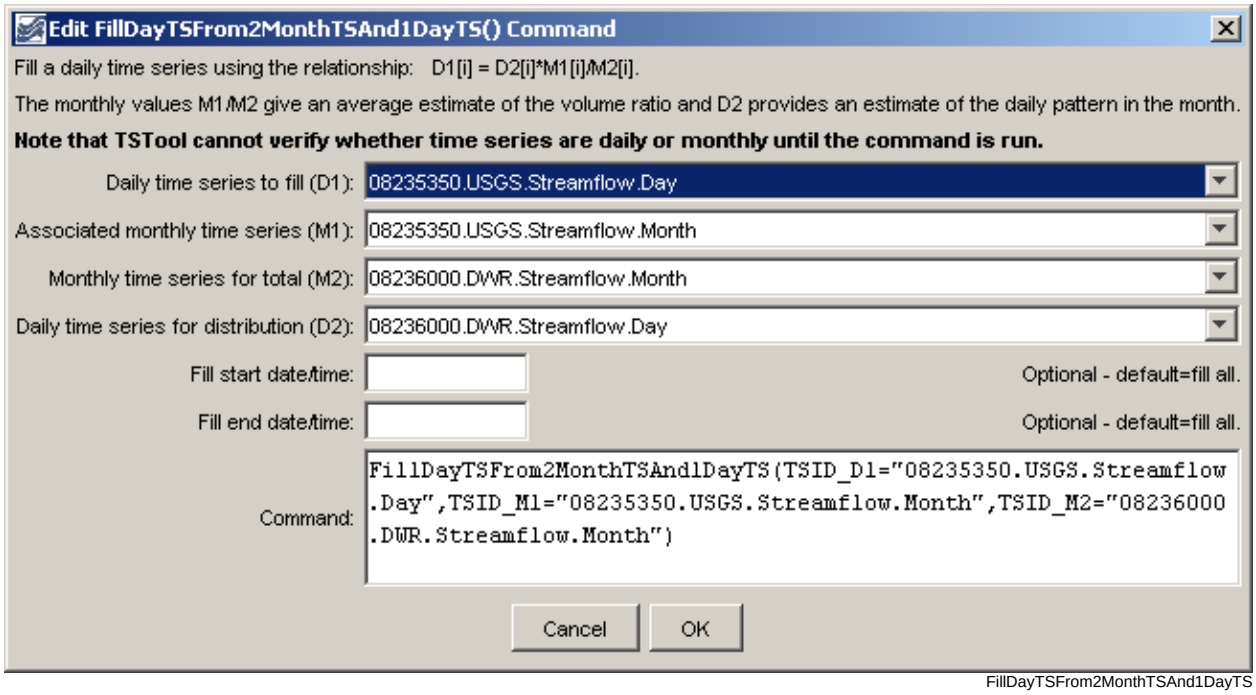
$$D1_i = D2_i*(M1_i/M2_i)$$

where:

i = day
D1 is the daily data at location 1
M1 is the monthly data at location 1 (for the month corresponding to the day)
D2 is the daily data at location 2
M2 is the monthly data at location 2 (for the month corresponding to the day)

This fill method assumes the monthly time series are filled and reasonably correlated and that the daily pattern D2 can be applied at D1. For example, use this command to fill daily streamflow where filled monthly data are available at nearby locations and filled daily data is available at the independent (D2) station.

The following dialog is used to edit the command and illustrates the syntax of the command. For all the time series identifiers, the last matching identifier before the command will be matched for processing. Currently there is no way to fill multiple time series with one command.



FillDayTSFrom2MonthTSAnd1DayTS

FillDayTSFrom2MonthTSAnd1DayTS() Command Editor

The command syntax is as follows:

```
FillDayTSFrom2MonthTSAnd1DayTS(Parameter=Value,…)
```

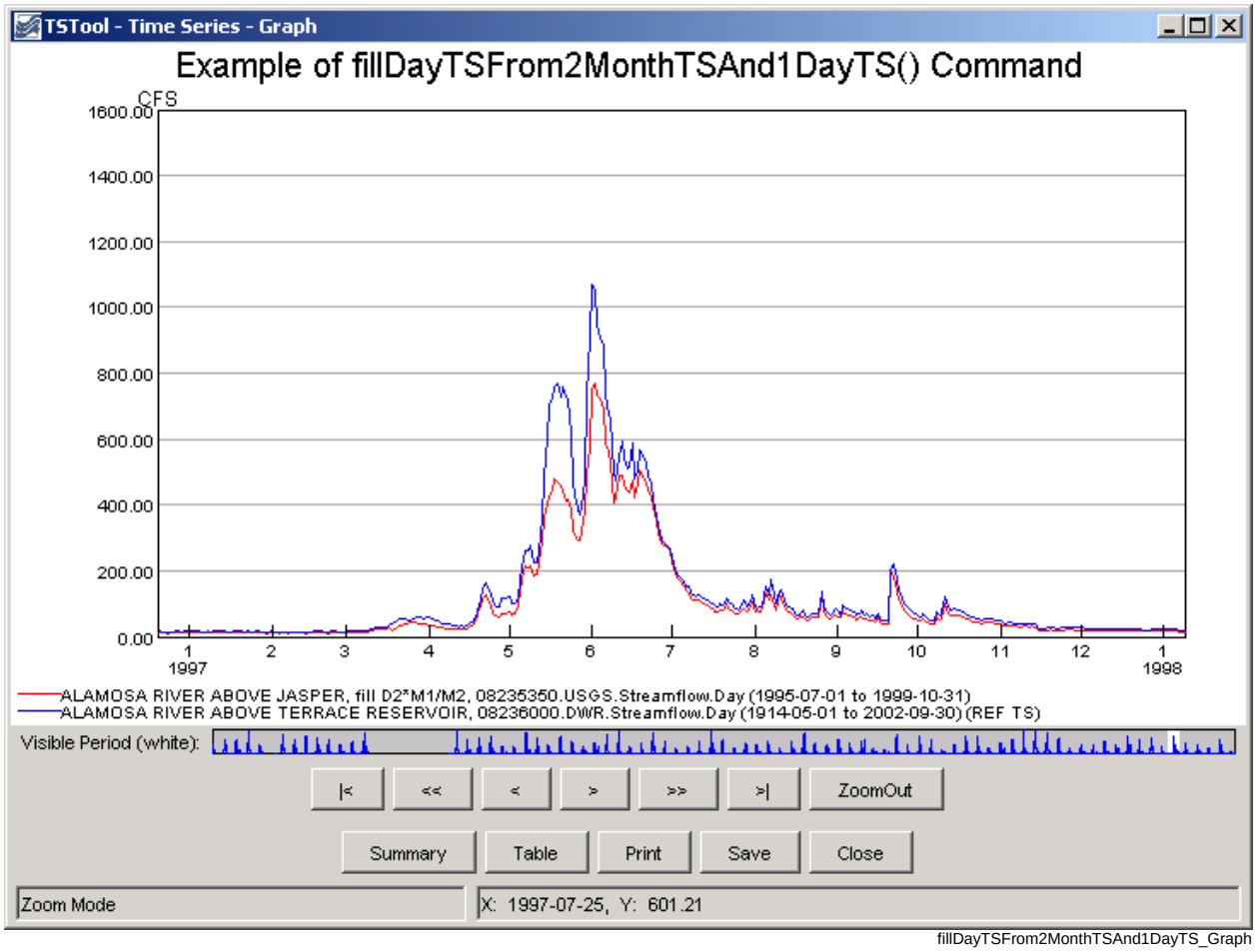
Command Parameters

Parameter	Description	Default
`TSID_D1`	The time series identifier or alias for the daily time series to be filled.	None – must be specified.
`TSID_M1`	The time series identifier or alias for the monthly time series, corresponding to `TSID_D1`, to supply the monthly values to be distributed to daily.	None – must be specified.
`TSID_M2`	The time series identifier or alias for the independent monthly time series.	None – must be specified.
`TSID_D2`	The time series identifier or alias for the independent daily time series, corresponding to `TSID_M2`.	None – must be specified.
`FillStart`	Date/time indicating the start of filling, using a precision appropriate for the time series, or `OutputStart`.	Fill the entire time series.
`FillEnd`	Date/time indicating the end of filling, using a precision appropriate for the time series, or `OutputEnd`.	Fill the entire time series.

An example command file to process data from the State of Colorado's HydroBase is shown below with the resulting graph of daily time series.

```
# The following is D1:
# (1995-1998) ALAMOSA RIVER ABOVE JASPER, CO  USGS  Streamflow  Daily
08235350.USGS.Streamflow.Day~HydroBase
# The following is M1:
# (1995-1998) ALAMOSA RIVER ABOVE JASPER, CO  USGS  Streamflow  Monthly
08235350.USGS.Streamflow.Month~HydroBase
# The following is D2:
# (1914-1998) ALAMOSA RIVER ABOVE TERRACE RESERVOIR, CO.  DWR  Streamflow  Daily
08236000.DWR.Streamflow.Day~HydroBase
# The following is M2:
# (1914-1998) ALAMOSA RIVER ABOVE TERRACE RESERVOIR, CO.  DWR  Streamflow  Monthly
08236000.DWR.Streamflow.Month~HydroBase
FillRegression(TSID="08235350.USGS.Streamflow.Month",
  IndependentTSID="08236000.DWR.Streamflow.Month",
  NumberOfEquations=OneEquation,Transformation=Linear)
FillDayTSFrom2MonthTSAnd1DayTS(TSID_D1="08235350.USGS.Streamflow.Day",
  TSID_M1="08235350.USGS.Streamflow.Month",
  TSID_M2="08236000.DWR.Streamflow.Month",TSID_D2="08236000.DWR.Streamflow.Day")
```

The following graph shows the two daily time series used in the command (zoomed in). Note that the shape of the filled time series is similar to the other time series.



fillDayTSFrom2MonthTSAnd1DayTS_Graph

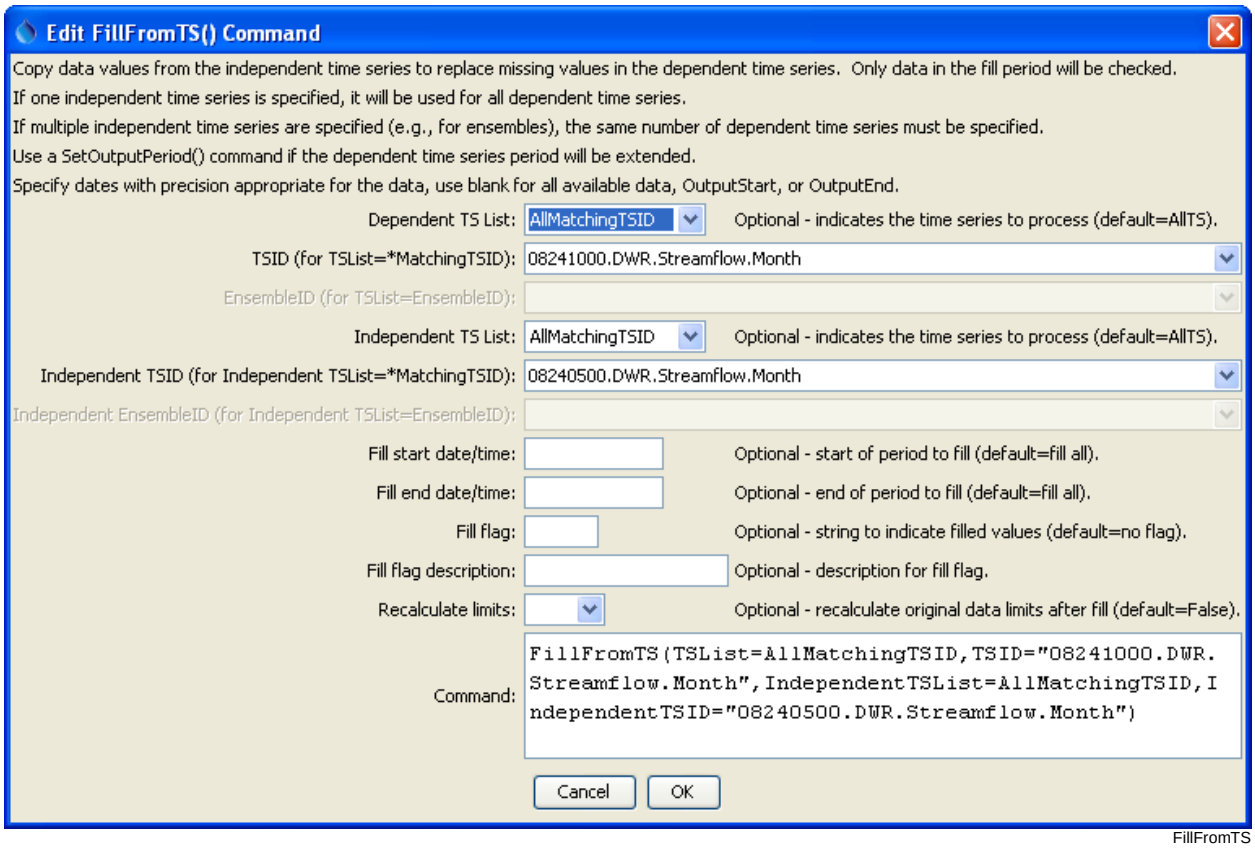
Example of Filled Data

Command Reference: FillFromTS()

Fill missing time series data using data from another time series (or ensemble)

Version 10.03.00, 2011-12-19

The `FillFromTS()` command fills missing data in a time series (or ensemble) by transferring non-missing values from another time series (or ensemble). This is useful when two time series typically have very similar values. The filled time series is not automatically extended. A period can be specified to limit the period that is checked for missing data. See also the `SetFromTS()` command, which will transfer all values. If multiple time series or an ensemble is being processed, the number of independent time series must be one or the same number as the time series being filled. Data transfer occurs by date/time, not sequentially. This may be a problem if trying to fill from a time series that has been shifted and leap years have caused an offset – an enhancement may be made in the future to address this issue. The following dialog is used to edit the command and illustrates the command syntax.



FillFromTS

FillFromTS() Command Editor

The command syntax is as follows:

```
FillFromTS(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match	`AllTS`

Parameter	Description	Default
	the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be modified. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required when a `TSList=*TSID`
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required when `TSList=EnsembleID.`
`Independent TSList`	Indicates how to determine the list of independent time series (see the explanation of `TSList`).	`AllTS`
`Independent TSID`	The time series identifier or alias for the independent time series (see the explanation of `TSID`).	Required when a `IndependentTSList=*TSID`
`Independent EnsembleID`	The ensemble identifier for the independent time series (see the explanation of `EnsembleID`).	Required when `IndependentTSList=EnsembleID.`
`FillStart`	The date/time to start filling.	Fill the entire period.
`FillEnd`	The date/time to end filling.	Fill the entire period.
`FillFlag`	If specified, data flags will be enabled for the time series and each filled value will be tagged with the specified string. The flag can then be used later to label graphs, etc. Prefix with + to append the flag.	No flag is assigned.
`FillFlagDesc`	Description for the fill flag, used in reports.	Automatically generated.
`Recalc Limits`	Available only for monthly time series. Indicate whether the original data limits for the time series should be recalculated after the filling the time series. Setting to `True` is appropriate if the independent time series provides additional data values.	`False` (only the values in the initial time series will be used for historical data).

A sample command file to fill data from the State of Colorado's HydroBase is as follows:

```
# 08241000 - TRINCHERA CREEK ABOVE MOUNTAIN HOME RESERVOIR
08241000.DWR.Streamflow.Month~HydroBase
# 08240500 - TRINCHERA CREEK ABOVE TURNER'S RANCH
08240500.DWR.Streamflow.Month~HydroBase
FillFromTS(TSList=AllMatchingTSID,TSID="08241000.DWR.Streamflow.Month",
  IndependentTSList=AllMatchingTSID,
  IndependentTSID="08240500.DWR.Streamflow.Month")
```

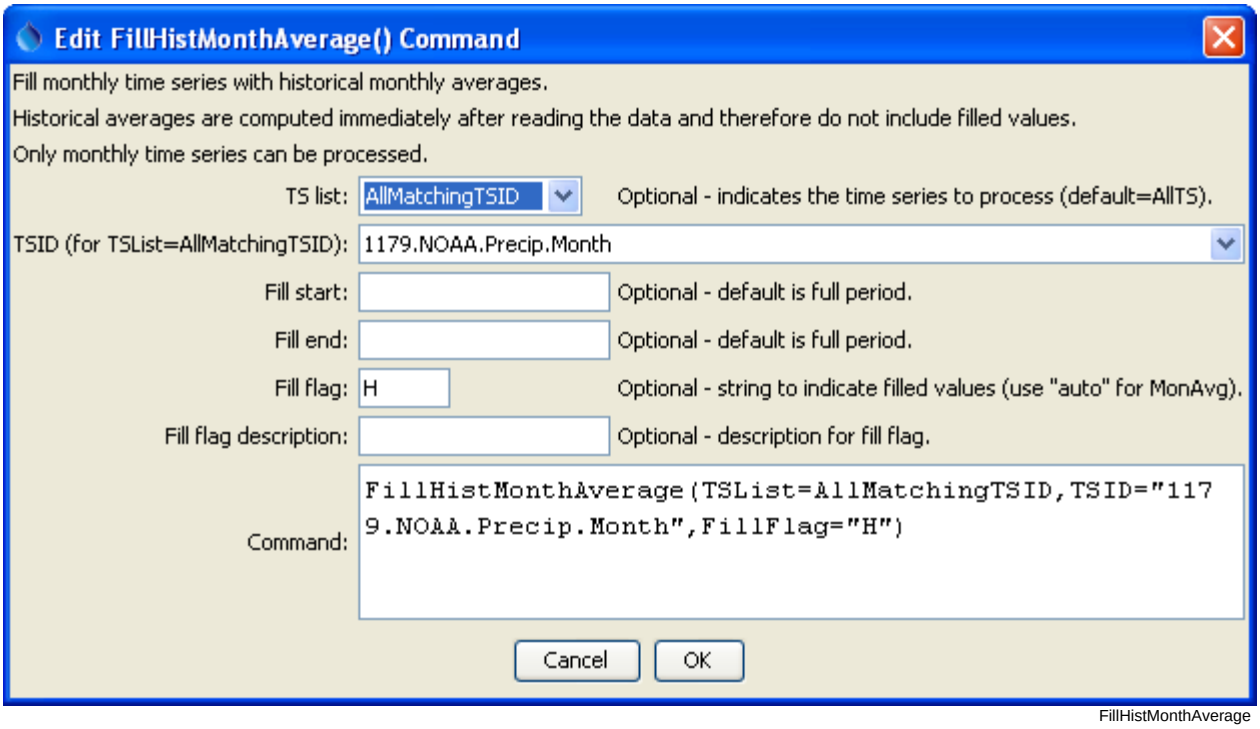
Command Reference: FillHistMonthAverage()

Fill missing time series data using historical monthly average data

Version 09.07.00, 2010-06-14

The `FillHistMonthAverage()` command fills missing data in monthly time series with the average monthly values. The average values are computed using the available data period (or specified averaging period – see the `SetAveragePeriod()` command) immediately after the time series is read and are then applied when this command is encountered.

The following dialog is used to edit the command and illustrates the syntax of the command.



FillHistMonthAverage

FillHistMonthAverage() Command Editor

The command syntax is as follows:

```
FillHistMonthAverage(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicate how to determine the list of time series to process, one of: ▪ `AllMatchingTSID` – process time series that have identifiers matching the TSID parameter. ▪ `AllTS` – process all the time series. ▪ `FirstMatchingTSID` – process the first time series that has an identifier matching the TSID parameter.	None – must be specified.

Parameter	Description	Default
	▪ `LastMatchingTSID` – process the last time series that has an identifier matching the TSID parameter. ▪ `SelectedTS` – process the time series that are selected (see `SelectTimeSeries()`).	
`TSID`	Used if `TSList=AllMatchingTSID` to indicate the time series identifier or alias for the time series to be filled. Specify * to match all time series or use a wildcard for one or more identifier parts.	Required if `TSList=AllMatchingTSID`.
`FillStart`	Date/time indicating the start of filling, using a precision appropriate for the time series, or `OutputStart`.	Fill the entire time series.
`FillEnd`	Date/time indicating the end of filling, using a precision appropriate for the time series, or `OutputEnd`.	Fill the entire time series.
`FillFlag`	If specified, data flags will be enabled for the time series and each filled value will be tagged with the specified string. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary. Use `Auto` to use a flag with the month abbreviation + `Avg`.	No flag is assigned.
`FillFlag Desc`	Description for the fill flag, used in reports.	Automatically generated.

The following command files fill a time series from the State of Colorado's HydroBase:

```
# 0125 - ALAMOSA
0125.NOAA.Precip.Month~HydroBase
FillHistMonthAverage(TSList=AllMatchingTSID,TSID="0125.NOAA.Precip.Month",
FillFlag="H")
```

```
0125.NOAA.Precip.Month~HydroBase
FillHistMonthAverage(TSList=AllMatchingTSID,TSID="019*",FillFlag="H")
```

Time series data limits for the averages are printed to the log file, similar to the following examples (note that the period for averaging is always shown and may be different than the output period).

```
Status: Historic averages for time series follow...
Time series:  0125.NOAA.Precip.Month (IN)
Monthly limits for period 1948-08 to 1949-12 are:
                                                      #      %      # Not  % Not
Month    Min    MinDate     Max    MaxDate     Sum     Miss.  Miss.  Miss.  Miss.     Mean
-------------------------------------------------------------------------------------------
Jan        0.2 1949-01        0.2 1949-01        0.2      0   0.00      1 100.00        0.2
Feb        0.1 1949-02        0.1 1949-02        0.1      0   0.00      1 100.00        0.1
Mar        0.1 1949-03        0.1 1949-03        0.1      0   0.00      1 100.00        0.1
Apr     -999.0             -999.0             -999.0      1 100.00      0   0.00     -999.0
May     -999.0             -999.0             -999.0      1 100.00      0   0.00     -999.0
Jun        0.7 1949-06        0.7 1949-06        0.7      0   0.00      1 100.00        0.7
Jul        1.5 1949-07        1.5 1949-07        1.5      0   0.00      1 100.00        1.5
Aug        0.7 1949-08        0.8 1948-08        1.5      0   0.00      2 100.00        0.8
Sep        0.1 1948-09        1.1 1949-09        1.2      0   0.00      2 100.00        0.6
Oct        0.1 1949-10        0.5 1948-10        0.7      0   0.00      2 100.00        0.3
Nov        0.0 1949-11        0.8 1948-11        0.8      0   0.00      2 100.00        0.4
Dec        0.0 1949-12        0.2 1948-12        0.2      0   0.00      2 100.00        0.1
-------------------------------------------------------------------------------------------
Period     0.0 1949-11        1.5 1949-07        6.9      2  11.76     15  88.24        0.5
-------------------------------------------------------------------------------------------
```

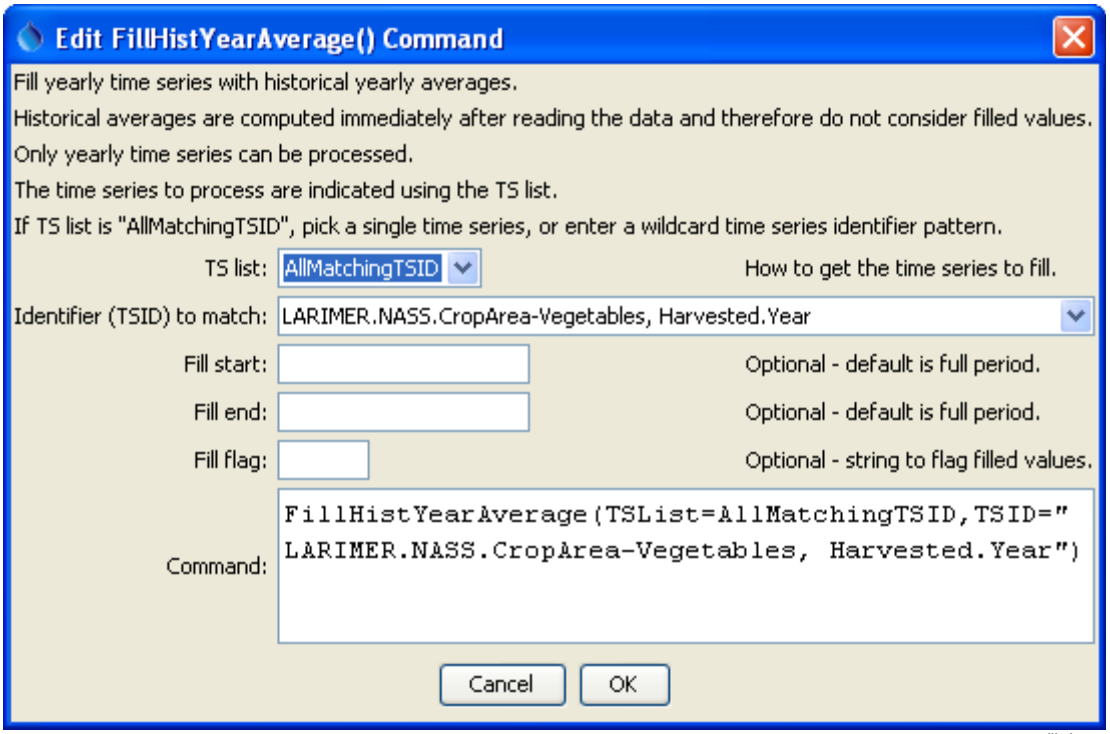
Command Reference: FillHistYearAverage()

Fill missing time series data using historical yearly average data

Version 10.00.01, 2011-05-12

The `FillHistYearAverage()` command fills missing data in yearly time series with the average annual value. The average values are computed using the available data period (or specified averaging period – see the `SetAveragePeriod()`command) immediately after the time series is read and are then applied when this command is encountered.

The following dialog is used to edit the command and illustrates the syntax of the command.



FillHistYearAverage

FillHistYearAverage() Command Editor

The command syntax is as follows:

```
FillHistYearAverage(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicate how to determine the list of time series to process, one of: ▪ `AllMatchingTSID` – process time series that have identifiers matching the TSID parameter. ▪ `AllTS` – process all the time series.	None – must be specified.

Parameter	Description	Default
	▪ `SelectedTS` – process the time series that are selected (see `selectTimeSeries()`).	
`TSID`	Used if `TSList=AllMatchingTSID` to indicate the time series identifier or alias for the time series to be filled. Specify * to match all time series or use a wildcard for one or more identifier parts.	Required if `TSList=AllMatchingTSID`.
`FillStart`	Date/time indicating the start of filling, using a precision appropriate for the time series, or `OutputStart`.	Fill the entire time series.
`FillEnd`	Date/time indicating the end of filling, using a precision appropriate for the time series, or `OutputEnd`.	Fill the entire time series.
`FillFlag`	If specified as a single character, data flags will be enabled for the time series and each filled value will be tagged with the specified character. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary.	No flag is assigned.

A sample command file to fill data from the State of Colorado's HydroBase is as follows:

```
LARIMER.NASS.CropArea-Vegetables, Harvested.Year~HydroBase
FillHistYearAverage(TSList=AllMatchingTSID,
TSID="LARIMER.NASS.CropArea-Vegetables, Harvested.Year")
```

Time series data limits for the averages are printed to the log file, similar to the following example (note that the period for averaging is always shown and may be different than the output period).

```
Min:              95.0000 ACRE on 1954
Max:            2684.0000 ACRE on 1959
Sum:           11090.0000 ACRE
Mean:           1008.1818 ACRE
Number Missing:     42 (79.25%)
Number Not Missing: 11 (20.75%)
Total period: 1945 to 1997
Non-missing data period: 1945 to 1997
```

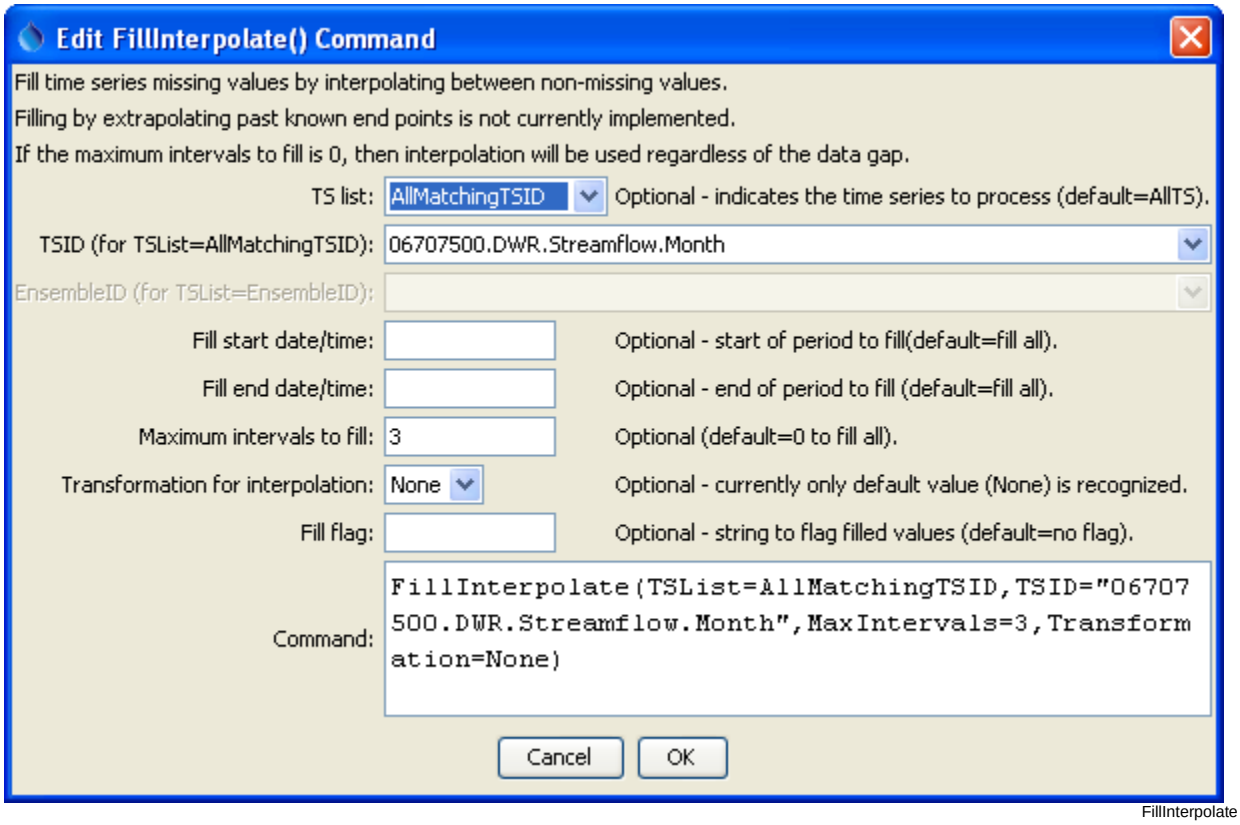
Command Reference: FillInterpolate()

Fill missing time series data by interpolating between known values

Version 09.07.02, 2010-08-20

The `FillInterpolate()` command fills missing data in a time series by interpolating between known values within the same time series. The command currently will not extrapolate past end points.

The following dialog is used to edit the command and illustrates the syntax of the command.



FillInterpolate

FillInterpolate() Command Editor

The command syntax is as follows:

```
FillInterpolate(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the	`AllTS`

Parameter	Description	Default
	command. • `EnsembleID` – all time series in the ensemble will be modified. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	Required when `TSList=*TSID`
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required when `TSList=EnsembleID.`
`FillStart`	The starting date/time for the fill.	Available period.
`FillEnd`	The ending date/time for the fill.	Available period.
`MaxIntervals`	The maximum number of consecutive intervals to fill (`0` indicates no limits on the number of consecutive intervals that can be filled).	`0`
`Transformation`	Indicate the data transformation to occur for interpolation. Currently, `None` is the only option and is the default. Earlier versions used `Linear`.	`None` (no transformation).
`FillFlag`	A string to flag data values that are filled.	None – do not flag filled data.

A sample command file using data from the State of Colorado's HydroBase is as follows:

```
# 06707500 - SOUTH PLATTE RIVER AT SOUTH PLATTE
06707500.DWR.Streamflow.Month~HydroBase
FillInterpolate(TSList=AllMatchingTSID,TSID="06707500.DWR.Streamflow.Month",
MaxIntervals=3,Transformation=None)
```

Command Reference: FillMixedStation()

Fill missing data in dependent time series using the best fit from 1+ independent time series, using OLS regression or MOVE2, data transforms, one/monthly equations

Version 10.20.00, 2013-04-21

This command is under development. It is envisioned that the FillRegression() command enhancements will be completed first. Then the FillMixedStation() analysis command will utilize much of the same logic, using the output statistics table to eliminate candidate relationships and use the remaining relationships to calculate estimated values to check against standard error of prediction, etc.

The `FillMixedStation()` command fills missing data in a time series where one or more independent time series is used to sequentially fill missing data. This approach has been developed to automate analysis of regression filling (see **Mixed Station Analysis Tool** below) and to facilitate batch filling of many related time series. This implementation is based on the Mixed Station Model implemented for Colorado's Decision Support Systems (Ayres Associates, 2000), which was based on the similarly named approach implemented by the USGS (Alley and Burns, 1981).

The time series involved in the analysis are typically related, such as being from nearby locations in a region. The main uses of the command are:

1. To automatically fill every time series in a data set, using other time series in the data set. For example, for hydrologic modeling natural flow time series may have been estimated by processing measured streamflow, diversion, and reservoir time series. The natural flow time series can be filled for use in modeling.
2. To generate a report on relationships, so that the user can configure individual `FillRegression()` and `FillMOVE2()` commands in TSTool. This may be appropriate when using `FillMixedStation()` on a list of time series is inappropriate.

Important: TSTool does not automatically exclude time series that have been filled in previous steps. Consequently, care must be taken when specifying the list of independent time series to NOT use time series that were filled in a previous step.

For each dependent time series being filled, the Mixed Station Analysis (MSA) selects the independent time series and parameters that result in the best filling results, considering combinations of the following:

- The list of independent time series being considered can be constrained to a subset of available time series.
- Filling methods include ordinary least squares (OLS) regression (see the `FillRegression()` command for details) and MOVE2 (see the `FillMOVE2()` command for details).
- One equation or monthly equations can be used. However, both options cannot be evaluated together due to the complexity of ranking and reporting results.
- The data can be transformed using $\log_{10}$, or no transformation can be applied.
- A minimum number of overlapping data points (sample size N1) can be specified to indicate a valid relationship.
- A minimum correlation coefficient *r* can be specified to indicate a valid relationship.

- A minimum confidence level for the slope of the regression line can be specified (see T-Test discussion below).
- The best fit indicator can be the correlation coefficient (*R*), or the standard error of prediction (SEP, described below).

Because extensive analysis may be necessary to evaluate all the combinations of parameters, the `FillMixedStation()` command will be slower than other commands that specifically indicate how to perform the filling. The number of combinations can also be limited by reducing the number of parameter options and using stricter limitations on the number of overlapping points and correlation coefficients that are required for a good regression result.

The full MSA process is as follows:

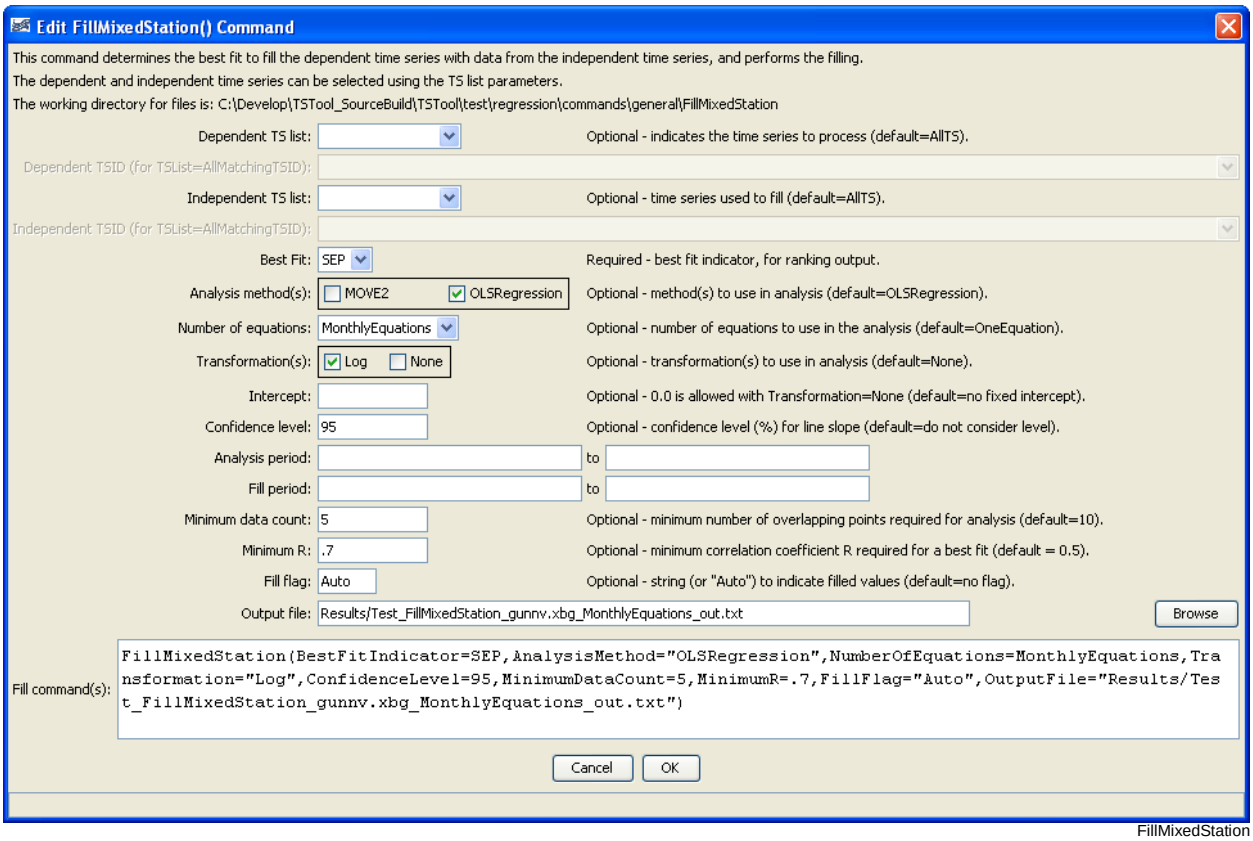
1. For each dependent time series, perform a regression analysis using a unique combination of parameters (e.g., use an independent time series, OLS regression with one equation, no data transform). This results in 1+ regression results for each dependent time series.
2. Qualifying results (those that meet the requirements of minimum number of overlapping points and correlation coefficient) are retained in a list for the dependent time series, for processing in the next step.
3. The qualifying results are used to estimate each missing value. Typically, the SEP is used to select the relationship to use (the one that has lowest SEP).
4. Missing data in the dependent time series are filled using the regression results for he selected relationship. If missing values remain, the next highest ranking regression result is used until all missing values are filled (or no additional qualifying regression results are available). Monthly filling occurs on each of the 12 months. This approach may use different stations because of the goodness of fit of the relationship and because different stations may or may not have data that overlap the period to be filled.

Implementation in Colorado's Decision Support Systems

The Mixed Station Model implemented for the State of Colorado typically used the following input:

- Log transform
- Monthly relationships
- Rank on SEP
- Ordinary lease squares regression
- Minimum concurrent values = 5
- Confidence level = 95%
- Fill all time series in data set

The following dialog is used to edit the `FillMixedStation()` command and illustrates the syntax of the command. **Note that this interface will be updated to be similar to that of the `FillRegression()` command.**



FillMixedStation

FillMixedStation() Command Editor

The command syntax is as follows:

```
FillMixedStation(Parameter=value,…)
```

Command Parameters

Parameter	Description	Default
`DependentTSList`	Indicates the list of independent time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command will be processed. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed.	None – must be specified.

Parameter	Description	Default
	• `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. ▪ `SelectedTS` – the time series selected with the `SelectTimeSeries()` command will be processed.	
`DependentTSID`	The time series identifier or alias for the dependent time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `DependentTSList=*TSID`.
`IndependentTSList`	Indicates the list of independent time series to be considered for each dependent time series, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command will be processed. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series selected with the `SelectTimeSeries()` command will be processed.	None – must be specified.
`IndependentTSID`	The time series identifier or alias for the independent time series to be compared, using the `*` wildcard character to match multiple time series.	Required if `IndependentTSList=*TSID`.

Parameter	Description	Default
BestFitIndicator	Specifies the indicator to use when determining the best fit, one of: ▪ R – correlation coefficient ▪ SEP – Standard Error of Prediction, defined as the square root of the sum of differences between the known dependent value, and the value determined from the equation of best fit at the same point. ▪ SEPTransformedpoin – same as SEP; however the data values have first been transformed as per the Transformation parameter. ▪ SEPTotal, when used with one equation, it is the same as SEP. When used with monthly equations, it is the SEP considering all months. ▪ SEPTransformedTotal, when used with one equation, it is the same as SEPTransformed. When used with monthly equations, it is the SEPTransformed considering all months.	SEP
AnalysisMethod	Specify the method(s) to analyze the data, in order to determine the best fit, including OLSRegression and/or MOVE2. If multiple methods are specified, separate with commas and surround with double quotes.	OLSRegression
NumberOfEquations	The number of equations to use for the analysis: OneEquation or MonthlyEquations. Only one may be chosen. If necessary, use more than one command to use different parameter combinations for different groups of time series.	None – must be specified.
Transformation	Indicates how to transform the data before analyzing. Specify as None (no transformation) or Log (for Log_{10}). If the Log option is used, zero and negative values in data are set to .001. Missing data are ignored. If multiple values are selected, separate with a comma and surround with double quotes.	None (no transformation)
Intercept	Specify as 0 to force the intercept of the best-fit line through the origin. This is made available only for OLS regression analysis on untransformed data, to be consistent with the FillRegression() command.	Do not force the intercept through zero.
ConfidenceLevel	Required confidence level for the T-Test on the regression slope. Relationships not passing the test are not allowed for filling.	No limit on confidence level.

Parameter	Description	Default
AnalysisStart	The date/time to start the analysis, to focus on a period appropriate for analysis. For example, specify the unregulated period for streamflow.	If blank, analyze the full period.
AnalysisEnd	The date/time to end the analysis.	If blank, analyze the full period.
FillStart	The date/time to start filling, if other than the full time series period.	If blank, fill the full period.
FillEnd	The date/time to end filling, if other than the full time series period.	If blank, fill the full period.
MinimumDataCount	The minimum number of overlapping data points that are required for a valid analysis (N1 in FillRegression() and FillMOVE2() documentation). If the minimum count is not met, then the independent time series is ignored for the specific combination of parameters. For example, if monthly equations are used, the independent time series may be ignored for the specific month; however, it may still be analyzed for other months.	10
MinimumR	The minimum correlation coefficient required for a best fit. If the minimum is not met, then the results are not considered in the best fit ranking or filling.	0.5
OutputFile	Output file for the results, either as a file name to be written to the working directory, or a full path.	If not specified, partial results of the analysis may be available in the log file.

The following example command file fills natural flow time series from a StaeMod file using one equation (not monthly):

```
# Test filling the gunnison monthly baseflow time series with
# Mixed Station Analysis (all combinations for one equation)
StartLog(LogFile="fill-baseflow.log")
ReadStateMod(InputFile="gunnv.xbg")
FillMixedStation(BestFitIndicator=SEP,AnalysisMethod="MOVE2,OLSRegression",
NumberOfEquations=OneEquation,
Transformation="Log,None",OutputFile="Results.txt")
# Check for missing data - all should be filled
CheckTimeSeries(CheckCriteria="Missing",MaxWarnings=10)
# Check for negative flows - should not be any
CheckTimeSeries(CheckCriteria="<",Value1=0,MaxWarnings=10)
```

Command Reference: fillMOVE1()

Fill Missing Time Series Data Using MOVE1 Procedure

Version 06.08.02, 2004-08-02, Color, Acrobat Distiller

The `fillMOVE1()` command has not been enabled. This documentation serves as a reference for the MOVE1 procedure. Refer to the `fillMOVE2()` command.

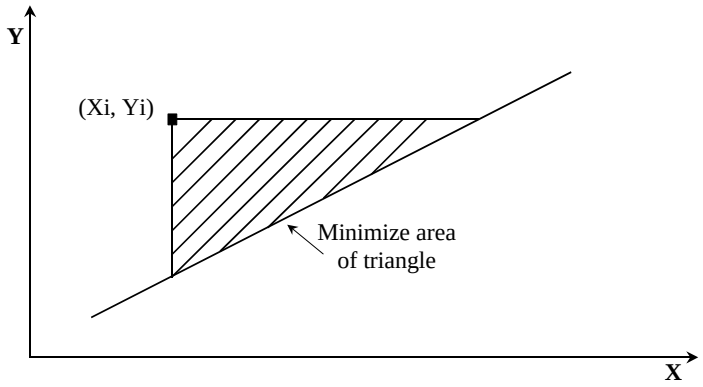
The `fillMOVE1()` command is more sophisticated than the `fillRegression()` command.

Maintenance of variance extension (MOVE) procedures are methods of fitting straight lines to data. The slope and intercept of the MOVE equations are computed differently than in ordinary least squares (OLS) regression (see the `fillRegression()` command for a discussion of OLS regression). As shown below, an area of a triangle is minimized in the MOVE procedures rather than a vertical distance as in OLS regression. The MOVE procedures do not provide the minimum-variance estimate of a single value but an ensemble of points estimated by the MOVE procedures will have the same variability as the true values.

MOVE procedures are useful in extending record at gaging stations where the extended record will be subsequently used in another analysis such as frequency analysis. MOVE procedures will provide about the same estimates as OLS regression near the mean of the data but will provide smaller and larger estimates at the extremes of the data set. The slope of the MOVE relation is steeper than OLS regression. The MOVE procedures are based on only one independent variable and the assumption is that there is a linear relation between the dependent and independent variables. If the untransformed data are not linearly related, then it is common to transform the data using a logarithmic transformation.

The MOVE.1 procedure uses just the data from the N_1 years of concurrent data. The MOVE.2 procedure (see the `fillMOVE2()` command) uses the Two-Station Comparison procedure described in **Appendix 7 of Bulletin 17B, Guidelines for Determining Flood Flow Frequency, USGS**, to compute improved estimates of the mean and variance for the dependent time series and uses all the data at the dependent time series to estimate the mean and variance of the dependent time series. The MOVE.2 procedure has been shown to be marginally better than MOVE.1.

Maintenance of Variance Extension (MOVE)



The MOVE.1 equation is used to estimate values for the dependent time series from the independent time series:

$$Y_i = \overline{Y}_1 + \frac{S_{y1}}{S_{x1}}\left[X_i - \overline{X}_1 \right]$$

or

$$Y_i = a + bX_i$$

where

N_1 = concurrent or overlapping period of record

$\overline{X}_1$ = mean for independent variable for N_1 years

$\overline{Y}_1$ = mean for dependent variable for N_1 years

S_{y1} = standard deviation for N_1 years

S_{x1} = standard deviation for N_1 years

$$b = \frac{S_{y1}}{S_{x1}}$$

$$a = \overline{Y}_1 - b\overline{X}_1$$

Note that the slope of the line does not include the correlation coefficient. This is the only difference between OLS regression and MOVE.1.

Command Reference: FillMOVE2()

Fill missing data in time series using the Maintenance of Variance Extension (MOVE.2) procedure

Version 08.15.00, 2008-05-04

The `FillMOVE2()` command fills missing data in a time series using the MOVE.2 procedure (see the `FillMOVE1()` command for background information). The MOVE.2 procedure uses the Two-Station Comparison procedure described in **Appendix 7 of Bulletin 17B, Guidelines for Determining Flood Flow Frequency, USGS**, to compute improved estimates of the mean and variance at the dependent or short-term station and uses all the data at the dependent time series to estimate the mean and variance of the dependent time series. The MOVE.2 procedure has been shown to be marginally better than MOVE.1. The following MOVE.2 equation is used to estimate values for the dependent time series from the independent time series:

$$Y_i = \overline{Y} + \frac{S_y}{S_x}\left[X_i - \overline{X} \right]$$

where

Y_i = discharge for dependent time series

X_i = discharge for independent time series

$\overline{X}$ = mean for independent time series for $N_1 + N_2$ years (N_2 is the additional years in the long-term time series)

S_x = standard deviation for independent time series for $N_1 + N_2$ years

$$\overline{Y} = \overline{Y}_1 + \frac{N_2}{N_1 + N_2}\left[b\left(\overline{X}_2 - \overline{X}_1\right)\right]$$

(Equation 7-5a for Two-Station Comparison in **Appendix 7 of Bulletin 17B**)

$$S_y^2 = \frac{1}{(N_1 + N_2 - 1)}\left[(N_1 - 1)S_{y1}^2 + (N_2 - 1)\ b^2 S_{x2}^2 + \frac{N_2(N_1 - 4)(N_1 - 1)}{(N_1 - 3)(N_1 - 2)}\ (1 - r^2)S_{y1}^2 + \frac{N_1 N_2}{N_1 + N_2}\ b^2(\overline{X}_2 - \overline{X}_1)^2\ \right]$$

(Equation 7-10 for Two-Station Comparison in **Appendix 7 of Bulletin 17B**)
where

$b = r\frac{S_{y1}}{S_{x1}}$, r = correlation coefficient (Note that b is the slope of the ordinary least squares regression line.)

N_1 = concurrent or overlapping period of record

N_2 = additional years available at long-term site

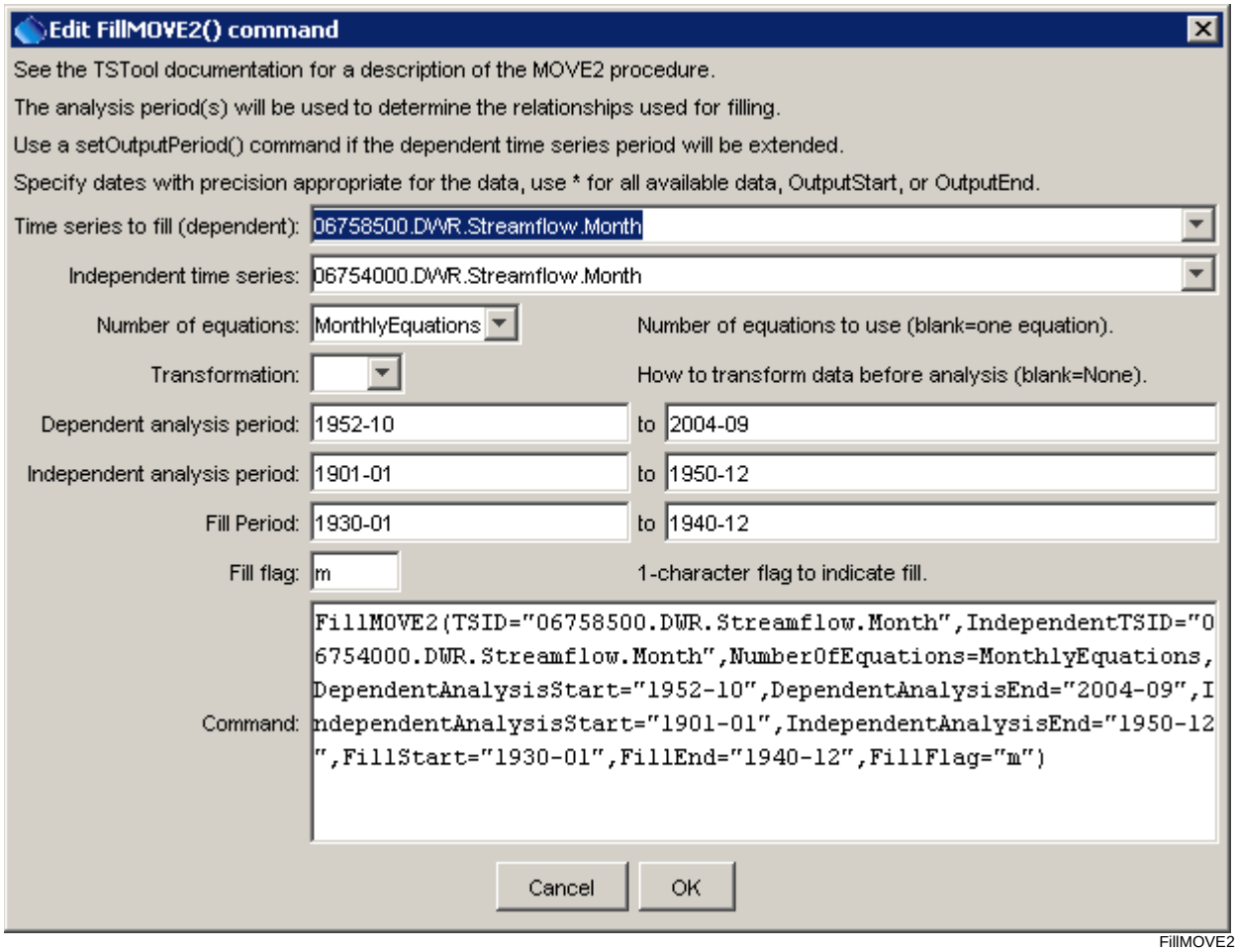
$\overline{X}_1$ = mean of independent time series for N_1 years

$\overline{X}_2$ = mean of independent time series for N_2 years

S_{y1} = standard deviation of dependent time series for N_1 years

S_{x1} = standard deviation of independent time series for N_1 years

The following dialog is used to edit the command and illustrates the command syntax.



FillMOVE2() Command Editor

The command syntax is as follows:

```
FillMOVE2(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be filled (dependent time series).	None – must be specified.
IndependentTSID	The time series identifier or alias for the independent time series, to supply data.	None – must be specified.
NumberOf Equations	OneEquation or MonthlyEquations, indicating how many relationships are to be determined.	OneEquation
Transformation	Log or None, indicating the type of data transformation. If the Log option is used, zero and negative values are set to .001 (-999 values are treated as missing data and are ignored), and the data values are transformed using log10.	None
Dependent Analysis Start/End	The period for N_1 (overlapping data) that is used to analyze the dependent time series. For example, this may be the unregulated period for streamflow data. Typically, this is longer than the independent analysis period.	Analyze the full period.
Independent Analysis Start/End	The period for N_2 (non-overlapping data) that is used to analyze the independent time series. For example, this may be the unregulated period for streamflow data.	Analyze the full period.
FillStart	The date/time to start filling.	Fill the full period.
FillEnd	The date/time to end filling.	Fill the full period.
FillFlag	A single character to be used to flag filled points on graphs and other output.	Do not flag filled data.

A sample command file illustrating how to fill time series from the State of Colorado's HydroBase is as follows (MOVE2 and ordinary least squares regression are used to allow comparing the results):

```
StartLog(LogFile="Results/commands.TSTool.log",Suffix="Date")
SetOutputPeriod(OutputStart="1901-01",OutputEnd="2004-12")
# 06758500 - SOUTH PLATTE RIVER NEAR WELDONA
06758500.DWR.Streamflow.Month~HydroBase
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
FillMOVE2(TSID="06758500.DWR.Streamflow.Month",
  IndependentTSID="06754000.DWR.Streamflow.Month",
  NumberOfEquations=MonthlyEquations,DependentAnalysisStart="1952-10",
  DependentAnalysisEnd="2004-09",IndependentAnalysisStart="1901-01",
  IndependentAnalysisEnd="1950-12",FillStart="1930-01",
  FillEnd="1940-12",FillFlag="m")
# 06758500 - SOUTH PLATTE RIVER NEAR WELDONA
06758500.DWR.Streamflow.Month~HydroBase
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
FillRegression(TSID="06758500.DWR.Streamflow.Month",
IndependentTSID="06754000.DWR.Streamflow.Month")
```

Command Reference: FillPattern()

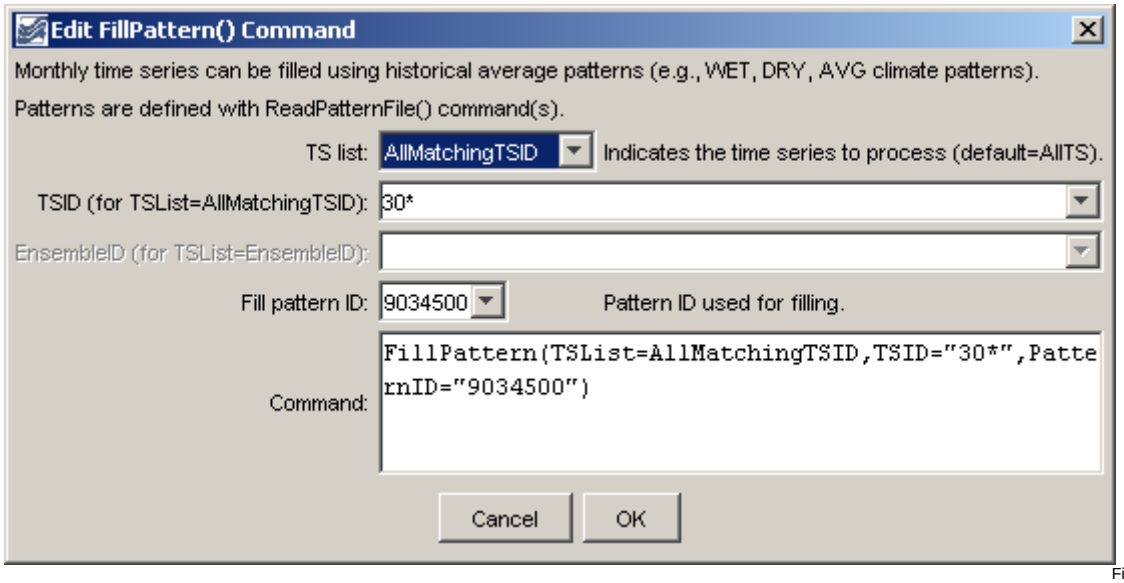
Fill missing time series data using historical average patterns

Version 08.16.04, 2008-09-19

The `FillPattern()command` fills missing data in a time series using historic averages based on a pattern file. For example, if May 1910 is missing and the pattern indicates that May 1910 is a `WET` month, then the average of all `WET` Mays is used to fill the time series. The pattern file indicates the `WET/DRY/AVG` patterns and the time series to be filled supplies data to compute averages, for use in filling. **This feature is enabled for monthly data only**. Averages are computed as described for the `FillHistMonthAverage()` command. There is currently no way to limit the fill operation to a period (the entire time series is filled). The pattern file is created with the `AnalyzePattern()` command and a saved file must be read with a `ReadPatternFile()` command. See below for an example of a fill pattern file. One or more patterns can be included in each pattern file, similar to StateMod time series files (see the **StateMod Input Type** appendix), and multiple pattern files can be used, if appropriate.

```
#  Years Shown = Water Years
#  Missing monthly data filled by the Mixed Station Method, USGS 1989
#  Time series identifier         = 09034500.CRDSS_USGS.QME.MONTH.1
#  Description                    = COLORADO RIVER AT HOT SULPHUR SPRINGS, CO.
# -e-b----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb--------e
   10/1908   -      9/1996 ACFT  WYR
1909 09034500         AVG     AVG     AVG     WET     WET     AVG     AVG     AVG     WET     WET     WET     WET
1910 09034500         WET     WET     WET     WET     WET     WET     AVG     AVG     AVG     AVG     AVG     AVG
1911 09034500         AVG     AVG     WET     AVG     AVG     AVG     AVG     WET     WET     WET     AVG     WET
1912 09034500         WET     WET     WET     WET     WET     AVG     AVG     WET     WET     WET     WET     WET
...ommitted...
```

The following dialog is used to edit the `FillPattern()` command and illustrates the syntax of the command.



FillPattern

FillPattern() Command Editor

The command syntax is as follows:

```
FillPattern(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required for TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required for TSList=EnsembleID.
PatternID	The pattern identifier, matching a pattern read with ReadPatternFile() commands.	None – must be specified.

A sample command file to process data from the State of Colorado's StateMod model is as follows:

```
# Read StateMod time series to fill
ReadStateMod(InputFile="..\StateMod\sjm_prelim.ddh")
# Read the file containing the patterns
ReadPatternFile(PatternFile="fill.pat")
# Fill time series having identifiers that start with "30"
FillPattern(TSList=AllMatchingTSID,TSID="30*",PatternID="09034500")
# Write the results
WriteStateMod(TSList=AllTS,OutputFile="..\StateMod\sjm.ddh")
```

The above example fills all diversion time series with identifier starting with 30, using the pattern 09034500 (a stream gage for the region).

Command Reference: FillPrincipalComponentAnalysis()

Fill missing time series data using principal component analysis (PCA)

Version 09.04.00, 2009-06-11

This command is under development.

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Command Reference: FillProrate()

Fill missing time series data by prorating values in another time series

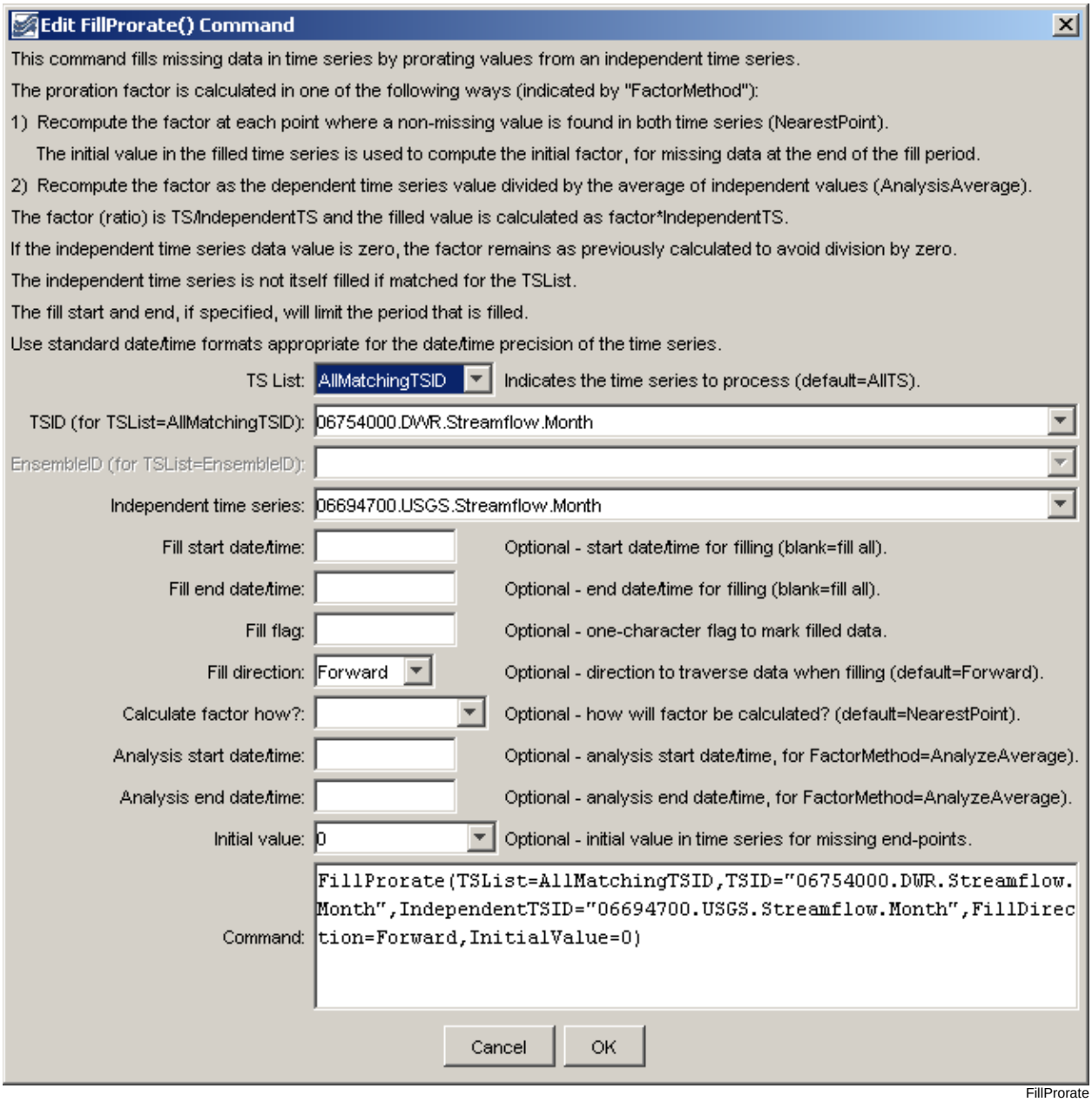
Version 08.16.04, 2008-09-30

The `FillProrate()` command fills missing data in time series by prorating values from another time series. This fill technique is useful, for example, where two time series are likely to have the same general trend and ratio of data values. The ratio can be computed two ways, as specified by the `FactorMethod` parameter:

- `NearestPoint` – causes the ratio to be recomputed each time that a non-missing value is found in both time series. The ratio computed from the nearest points in each time series is used for filling until another value can be computed.
- `AnalyzeAverage` – computes the ratio as the average ratio of the time series (numerator) and the independent time series (divisor). This was implemented to match an existing fill procedure but can lead to some bias in the results. A different overall average will be obtained depending on whether ratios are computed first and then averaged than if the sum of the numerators are added and divided by the sum of the denominators. In the former, the choice of which time series is in the denominator could impact results. More parameters may need to be added in the future to implement an analysis different from the current defaults.

The initial computation of the ratio may require specifying an initial value due to missing data on the end-points of the time series (see the `InitialValue` parameter). Alternatively, the time series can be filled in one direction first and then filled in the other direction with a second command.

The following dialog is used to edit the command and illustrates the syntax of the command:



FillProrate

FillProrate() Command Editor

The command syntax is as follows:

```
FillProrate(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified. Use the * wildcard character to match multiple time series.	Required for TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required for TSList=EnsembleID.
IndependentTSID	The time series identifier or alias for the independent time series.	None – must be specified.
FillStart	The starting date/time for the fill.	Available period.
FillEnd	The ending date/time for the fill.	Available period.
FillFlag	A one-character flag to tag data values that are filled.	None – do not flag filled data.
FillDirection	Specify the direction of the fill as Forward or Backward.	Forward
FactorMethod	Specify how to calculate the factor to use in proration, one of: • AnalyzeAverage – calculate the factor of the average of the time series divided by the independent time series, using the analysis period. • NearestPoint – calculate the factor at the nearest point where both	NearestPoint

Parameter	Description	Default
	time series have non-missing values.	
AnalysisStart	The starting date/time for the analysis, used when FactorMethod =AnalyzeAverage.	Analyze the full period.
AnalysisEnd	The ending date/time for the analysis, used when FactorMethod=AnalyzeAverage.	Analyze the full period.
InitialValue	The initial value to use for the filled time series, for cases where a value may not be available on the ends of the fill period, one of: • NearestBackward – search the time series backward for the nearest non-missing value. • NearestForward – search the time series forward for the nearest non-missing value. • Specify a number to use for the initial value.	None – filling will not occur at the end.

A sample command file to fill data from the State of Colorado's HydroBase database is as follows:

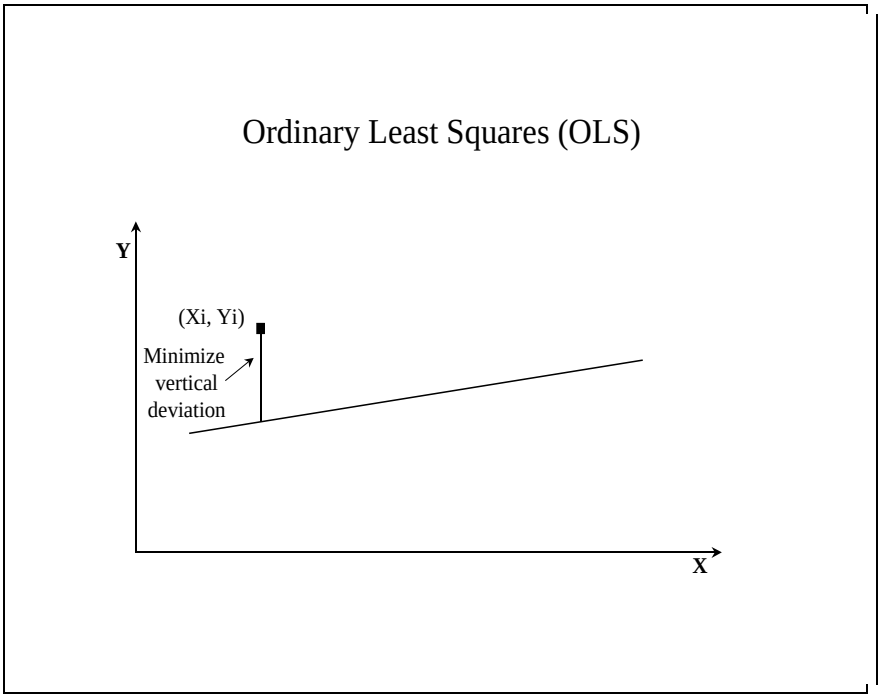
```
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
# 06694700 - FOURMILE CREEK NEAR FAIRPLAY, CO.
06694700.USGS.Streamflow.Month~HydroBase
FillProrate(TSList=AllMatchingTSID,TSID="06754000.DWR.Streamflow.Month",
  IndependentTSID="06694700.USGS.Streamflow.Month",FillDirection=Forward,
  InitialValue=0)
06754000.DWR.Streamflow.Month~HydroBase
```

Command Reference: FillRegression()

Fill missing time series data using ordinary least squares regression

Version 10.21.00, 2013-07-14

The `FillRegression()` command fills missing data in a time series using ordinary least squares (OLS) regression and provides a variety of options for transforming the data and controlling the analysis. In OLS regression, the vertical distance from the data point to the regression line is minimized. OLS regression provides the minimum-variance estimate for a single value or observation. However, if an ensemble of points is estimated from OLS regression, the estimated values will have lesser variability than the true values.



See also the `FillMOVE2()`command, which utilizes additional variance from independent time series to determine the regression relationship, and the `FillMixedStation()` command, which automates the analysis of many time series to determine a "best estimate" filling approach. Regression can be applied only to regular interval time series. The dependent time series will be filled using the independent time series. The periods of record and output period for the time series should be verified to make sure that the time series periods overlap sufficiently. Regression relationships are developed using the analysis period for the time series and are applied to the fill period. Refer to the output statistics table, log file, and time series properties for analysis details. Several parameters are available to ensure that filling uses reasonable relationships. This command has functionality that may not be needed for simple analysis but which is useful for software testing and comparison with the `FillMixedStation()` command.

Important: TSTool does allow filled values to be flagged. However, other commands do not exclude these values from computations when determining relationships for subsequent fill steps. Therefore, it is important to perform regression data filling as early in data processing as possible so that data manipulation does not introduce derived values and bias.

The following OLS equation is used to estimate values for the dependent time series from the independent time series:

$$Y_i = \bar{Y}_1 + r\frac{S_{y1}}{S_{x1}}\left[X_i - \bar{X}_1\right]$$

or

$$Y_i = a + bX_i$$

where

N_1 = concurrent or overlapping period of record (the notation N_1 is used because the MOVE2 fill technique refers to N_2, which is the number of additional points outside of N_1 in the independent time series)

$\bar{X}_1$ = mean for independent variable for N_1 years = $\frac{\sum X_{1_i}}{N_1}$

$\bar{Y}_1$ = mean for dependent variable for N_1 years = $\frac{\sum Y_{1_i}}{N_1}$

S_{y1} = standard deviation for N_1 years = $\sqrt{\frac{1}{N_1 - 1}\sum\left(Y_{1i} - \bar{Y}_1\right)^2}$

S_{x1} = standard deviation for N_1 years = $\sqrt{\frac{1}{N_1 - 1}\sum\left(X_{1i} - \bar{X}_1\right)^2}$

$r = R$ = correlation coefficient = $\frac{N_1\sum X_{1i}Y_{1i} - \sum X_{1i}\sum Y_{1i}}{\sqrt{\left[N_1\sum {X_{1_i}}^2 - \left(\sum X_{1_i}\right)^2\right]\cdot\left[N_1\sum {Y_{1i}}^2 - \left(\sum Y_{1_i}\right)^2\right]}}$

$$b = r\frac{S_{y1}}{S_{x1}}$$

$a = \bar{Y}_1 - b\bar{X}_1$

The correlation coefficient, *r*, is used to compute the slope, *b*, of the line.

A number of statistics are computed and are available for output to a table, as described below (see the `TableID` and related command parameters for how to specify the table output). Creating a statistics table and then writing the table to a file is useful for checking the analysis and software. For example, the `CompareTables()` command can be used to compare this statistics table with a verification data set that is calculated by another tool. In the following descriptions, the statistic for one equation has a name like `Mean` and monthly statistics correspondingly have a name like `Mean_1`, where `1` corresponds to January and `12` to December.

In some cases, statistics are relevant in units of the raw values, in some cases statistics are relevant in transformed (log10) units, and in some cases both are relevant. For example, if the log10 transform is used to compute the relationship, then a and b are in transformed units. However, error computations between the original data values and values that would be computed by the relationship are in the raw units (regardless of whether the data were transformed) – this allows errors to be compared between relationships using raw and transformed values (the FillMixedStation() command uses this information to compare relationships). Consequently, the third column of the following table indicates whether statistics are provided in raw (column name uses statistic only) or transformed units (additional _trans added to statistic for column name). Therefore, if the statistic is unitless, it will never have the _trans addition. If the analysis does not use a transformation, then _trans will be omitted from column headings.

Statistics From Regression Analysis

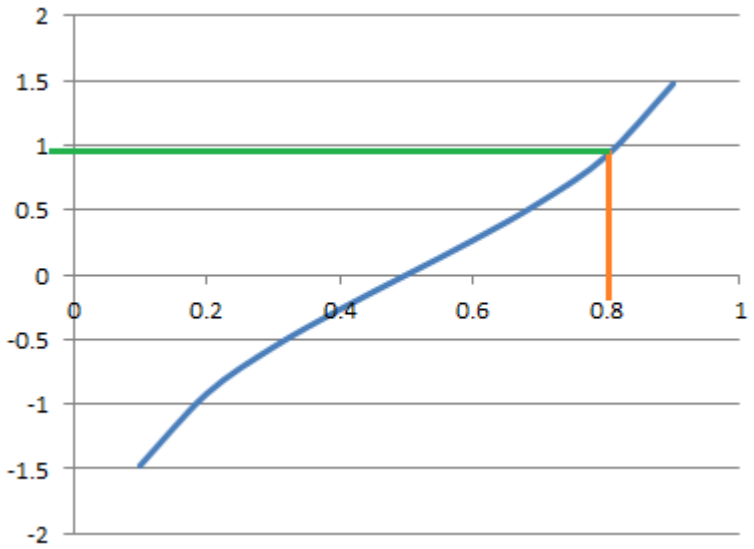
Statistic (Table Column Name)	Involves Dependent, Independent, or Both	Statistics Output in Raw or Transformed units	Description
N1	Both	N/A - unitless	The number (count) of non-missing data values overlapping in the dependent and independent time series.
MeanX1	Independent	raw, transformed	The mean of the independent N1 data values.
SX1	Independent	raw, transformed	The standard deviation of the independent N1 values.
N2	Independent	N/A - unitless	The number (count) of non-missing independent values outside of N1.
MeanX2	Independent	raw, transformed	The mean of the independent N2 values.
SX2	Independent	raw, transformed	The standard deviation of the independent N2 values.
MeanY1	Dependent	raw, transformed	The mean of the dependent N1 values.
SY1	Dependent	raw, transformed	The standard deviation of the dependent N1 values.
NY	Dependent	N/A - unitless	The total number of non-missing dependent values.
MeanY	Dependent	raw, transformed	The mean of the dependent NY values.
SY	Dependent	raw, transformed	The standard deviation of the dependent NY values.
SkewY	Dependent	raw, transformed	The skew, or non-symmetry, of the dependent NY values.
a	Both	transformed	The intercept for the relationship equation.
b	Both	transformed	The slope of the relationship equation.
R	Both	transformed	The correlation coefficient for N1 values.
R2	Both	transformed	R-squared, coefficient of determination for N1 values.
MeanY1est	Dependent	raw, transformed	The mean for N1 values computed from the relationship (estimate the dependent values where values were previously known).
SY1est	Dependent	raw, transformed	The standard deviation for N1 values computed

Statistic (Table Column Name)	Involves Dependent, Independent, or Both	Statistics Output in Raw or Transformed units	Description
			from the relationship (estimate the dependent at locations where values are known).
RMSE	Dependent	raw, transformed	The "room mean squared error" for N1 overlapping values, which is a measure of the overall error of using the regression equation to estimate values, is calculated as: $$RMSE = \sqrt{\frac{\sum\left(Y_{1_i} - Y_{1_i}'\right)^2}{N_1}}$$ where Y_{1_i} is the original dependent value and Y_{1_i}' is the value estimated with the regression relationship.
SEE	Dependent	raw, transformed	The standard error of estimate for N1 overlapping values, which is a measure of the overall error of using the regression equation to estimate values, calculated as: $$SEE = \sqrt{\frac{\sum\left(Y_{1_i} - Y_{1_i}'\right)^2}{N_1 - 2}}$$ where Y_{1_i} is the original dependent value and Y_{1_i}' is the value estimated with the regression relationship.
SEP	Both	raw	The standard error of prediction for each estimated value, calculated as: $$S_E = \sqrt{1 + \frac{1}{N_1} + \frac{(X_{1_i} - \overline{X}_1)^2}{\sum (X_{1_i} - \overline{X}_1)^2}} * S$$ where X_{1_i} is the original independent value and $\overline{X}_1$ is the mean of the N1 independent values. Note when using the mixed station analysis in the FillMixedStation() command, this value may be used to determine the relationship. The SEP is not actually output in the statistics table but may be added as an optional output time series in the future.
SESlope	Both	N/A - unitless	The standard error (SE) of the slope (b) for N1 overlapping values, calculated as:

Statistic (Table Column Name)	Involves Dependent, Independent, or Both	Statistics Output in Raw or Transformed units	Description
			$SE = \frac{\sqrt{\frac{\sum (Y_{1_i} - Y'_{1_i})^2}{N_1 - 2}}}{\sqrt{\sum (X_{1_i} - \overline{X}_1)^2}}$ where X_{1_i} is the original independent value and $\overline{X}_1$ is the mean of the `N1` independent values; Y_{1_i} is the original dependent value and Y_{1_i}' is the value estimated with the regression relationship.
`TestScore`	Both	N/A - unitless	b/SE`Slope`
`Test Quantile`	Both	N/A - unitless	The value at which the confidence interval is satisfied. Comes from the Student's T-test, which is a function of the confidence interval and degrees of freedom (DF), where DF is the degrees of freedom equal to `N1` – 2 (corresponding to the intercept and the slope of the regression equation).
`Test OK`	Both	N/A - unitless	Will be `No` if `TestScore >= TestQuantile`, indicating that the $b \neq 0$ data are related, and `Yes` if `TestScore < TestQuantile`, indicating that the data are not related. If the data are not related, then the relationship between the dependent and independent time series will not be used for filling.
`Sample SizeOK`	Both	N/A – unitless	Will be `No` if `N1 < MinimumSampleSize` and `Yes` if `N1 >= MinimumSampleSize`, indicating whether or not the number of overlapping points is greater than or equal to the number of overlapping points necessary.
`R OK`	Both	N/A – unitless	Will be `No` if `R < MinimumR`, indicating that the correlation is below the minimum threshold, and `Yes` if `R >= MinimumR`, indicating that the correlation is above the minimum threshold.
`NYfilled`	Dependent	N/A – unitless	The total number of missing points in the dependent time series that were filled through the regression.
`MeanY filled`	Dependent	Raw	The mean of the values that were used to fill missing points
`SYfilled`	Dependent	Raw	The standard deviation of the values that were used to fill missing points
`SkewY filled`	Dependent	Raw	The skew, or non-symmetry, of the values that were used to fill missing points

Student's T-distribution (http://en.wikipedia.org/wiki/Student's_t-distribution) is similar to a standard distribution, but has a higher probability of producing outliers. Using the Apache Math library

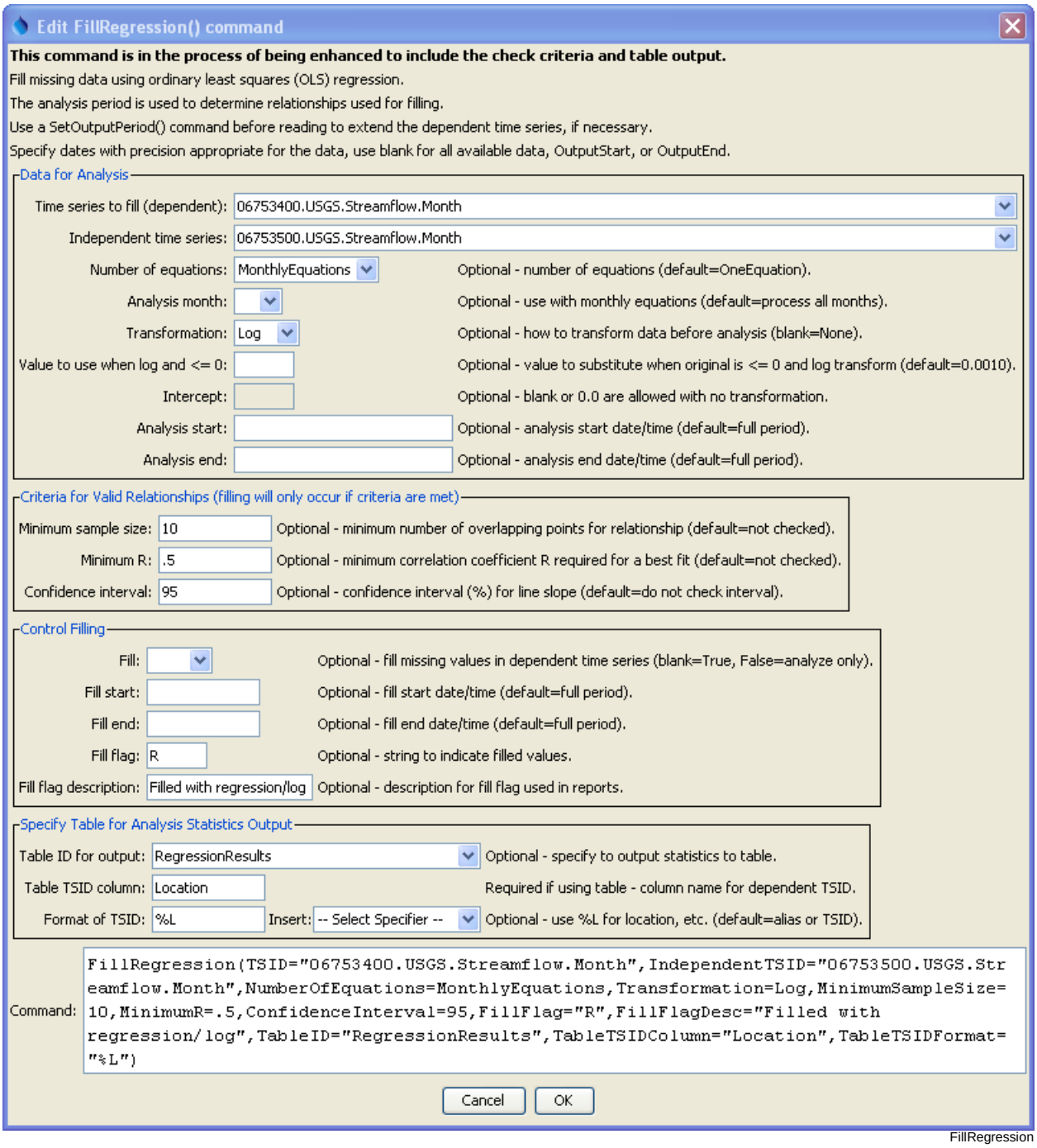
(http://commons.apache.org/proper/commons-math/javadocs/api-3.2/index.html), the appropriate distribution for the size of the dataset is generated, and the value at which the desired confidence level is satisfied is calculated. For example, if the desired confidence level is .8 and the size of the dataset is seven, then following this graph of the Student's T-distribution, values above approximately one would satisfy the confidence level.



FillRegression_StudentTTest

Student's T-Test Example

The following dialog is used to edit the command and illustrates the syntax of the command:



FillRegression

FillRegression() Command Editor

The command syntax is as follows:

```
FillRegression(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be filled.	None – must be specified.
Independent TSID	The time series identifier or alias for the independent time series.	None – must be specified.
NumberOf Equations	The number of equations to use for the analysis: OneEquation or MonthlyEquations.	OneEquation
AnalysisMonth	Indicate the month to process when using monthly equations. Currently only a single month can be specified.	Process all months.
Transformation	Indicates how to transform the data before analyzing. Specify as None (previously Linear) or Log (for Log_{10}). If the Log option is used, zero and negative values are replaced with the value specified by the LEZeroLogValue parameter value for analysis (missing data values are ignored in the analysis).	None (no transformation).
LEZeroLogValue	Value to use for data values less than or equal to zero when using a log transformation. The Log_{10} of this value will be used in calculations.	.0010
Intercept	Specify as 0 to force the intercept of the best-fit line through the origin (not available for log transformation).	Parameter is optional and if specified the default is to not force the intercept through zero.
AnalysisStart	The date/time to start the analysis – use to focus on only a period appropriate from analysis. For example specify the unregulated period for streamflow.	Analyze the full period.
AnalysisEnd	The date/time to end the analysis – use to focus on only a period appropriate from analysis.	Analyze the full period.
Minimum SampleSize	The minimum number of overlapping values required to use a relationship for filling.	2, due to requirements in calculating the statistics
MinimumR	The minimum correlation coefficient required to use a relationship for filling.	No check is performed.
Confidence Interval	A confidence interval in percent (e.g., 95) required for the slope of the relationship. The T-test is performed to ensure that the independent and dependent time series are related.	The T-test is not performed to evaluate the confidence interval.
Fill	Indicate whether fill should occur (True) or just analyze to compute statistics (False). The latter is useful for testing combinations of fill parameters prior to actually performing filling.	True
FillStart	The date/time to start filling, if other than the full time series period.	Fill the full period.
FillEnd	The date/time to end filling, if other than the full time series period.	Fill the full period.
FillFlag	A single character that will be used to flag filled data.	Filled values will not be flagged.
FillFlagDesc	Description for the fill flag, used in reports.	Automatically generated.

Parameter	Description	Default
TableID	A table identifier for a table to receive output of the regression analysis (statistics are described above).	Statistics are not written to the table. Refer to the log file for information.
TableTSIDColumn	The name of the column in the table that contains time series identifier information. This is used to match the table with time series being analyzed so that statistics can be written to the correct row.	Required if TableID is specified.
TableTSIDFormat	The specifier used to format the time series identifier in the TableTSIDColumn. The location part of the TSID, or the time series alias is typically used.	The alias will be used if available, or otherwise the full TSID will be used.
SEPTSID	The time series identifier of the SEP time series, calculated for ALL values in the analysis period. This parameter is not enabled but is envisioned to help evaluate filling and test FillMixedStation().	If not specified, no SEP time series will be generated.
SEPTSAlias	The alias to be assigned to the SEP time series. This parameter is not yet enabled.	No alias is assigned to the SEP time series.
FlagToWarn	A parameter is envisioned to warn the user if any values in the time series are flagged with a specific flag value. This will allow checks to ensure that FillRegression() is not used with data that have been filled in a previous step.	

The command logic is as follows, with reference to command parameters that control the process:

1. The dependent (TSID) and independent time series (IndependentTSID) are retrieved using the time series identifiers or aliases.
2. Data arrays of overlapping non-missing values are extracted from time series to be used as the samples for analysis, as specified by command parameters (analysis period specified by AnalysisStart and AnalysisEnd; transformation specified by Transformation, LEZeroLogValue, and Intercept; number of equations specified by NumberOfEquations and AnalysisMonth).
3. The independent and dependent statistics and relationships are calculated, computing as many of the statistics as possible (some are skipped if the sample size results in division by zero). Computing the statistics allows them to be saved in the output table for review, and is controlled by the TableID, TableTSIDColumn, and TableTSIDFormat parameters.
4. The statistics are analyzed to determine if the relationships are acceptable for filling by checking the minimum sample size (MinimumSampleSize), minimum correlation coefficient (MinimumR), and that the relationship meets the confidence interval (ConfidenceInterval). If monthly equations are used, then it is possible that some months can be filled but not others.
5. If Fill=True (the default), then the relationships that are acceptable from step 4 are used to fill the dependent time series for the period specified by the FillStart and FillEnd parameters, with FillFlag and FillFlagDesc optionally being used to indicate filled values.

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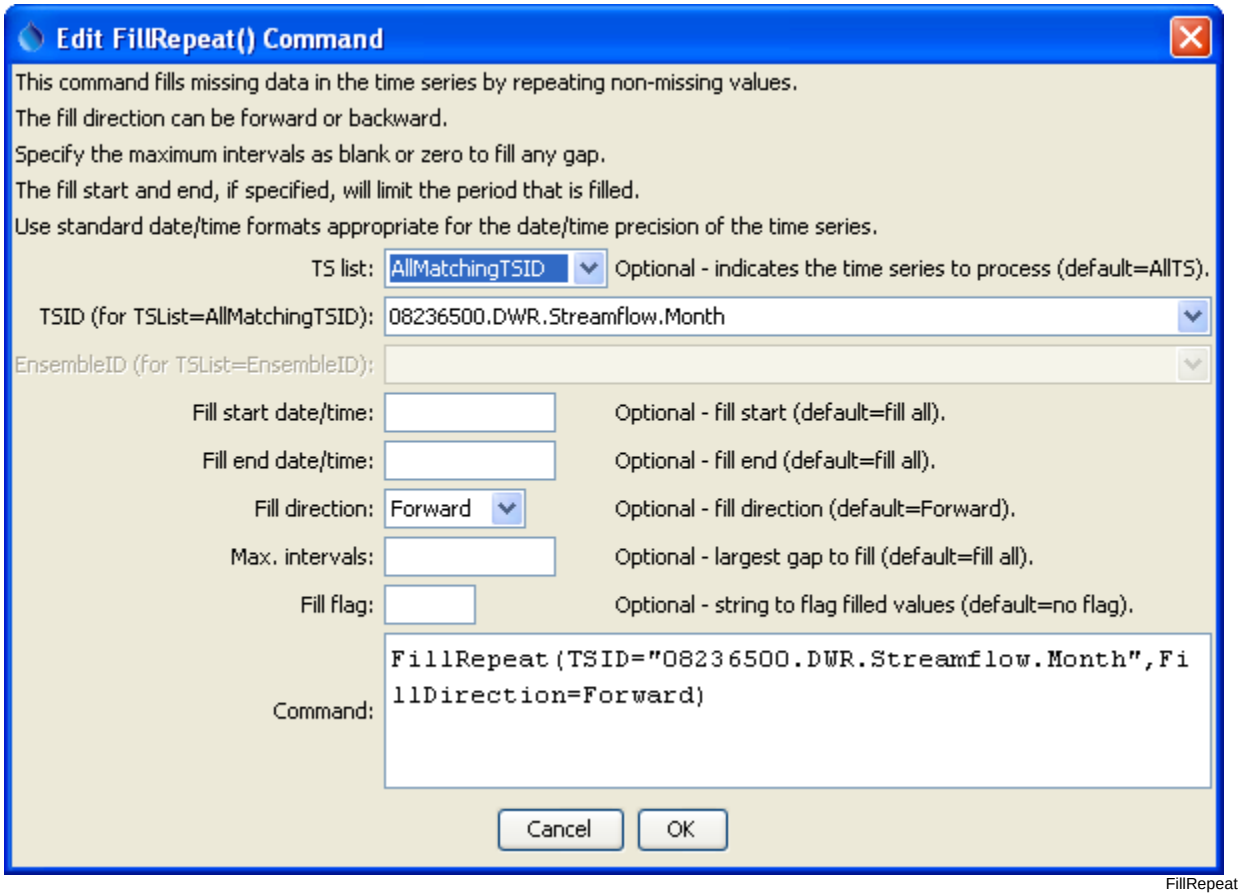
Command Reference: FillRepeat()

Fill missing time series data by repeating known data values

Version 09.09.00, 2010-09-23

The `FillRepeat()` command fills missing data in time series by repeating observations until another observation is found. This fill technique is useful, for example, where time series are likely to be step-wise or nearly constant, such as some reservoir and diversion time series.

The following dialog is used to edit the command and illustrates the syntax of the command.



FillRepeat

FillRepeat() Command Editor

The command syntax is as follows:

```
FillRepeat(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
FillStart	The starting date/time for the fill.	Available period.
FillEnd	The ending date/time for the fill.	Available period.
FillDirection	Specify the direction of the fill as Forward or Backward.	Forward
MaxIntervals	The maximum number of intervals to fill in a data gap.	Fill all gaps.
Flag	String to flag filled values. Prefix with + to append the string to existing flag values.	Do not flag filled values.

A sample command file to fill a time series from the State of Colorado's HydroBase is as follows:

```
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Month~HydroBase
FillRepeat(TSList=AllMatchingTSID,TSID="08236500.DWR.Streamflow.Month",
  FillDirection=Forward)
```

Command Reference: FillUsingDiversionComments()

Fill missing time series data using HydroBase diversion comments and structure CIU information

Version 09.07.02, 2010-08-20

This command is only appropriate for use with diversion (e.g., DivTotal, DivClass data types) and reservoir release (e.g., RelTotal, RelClass data types) time series for the HydroBase input type.

The `FillUsingDiversionComments()` command fills missing data in time series by using diversion comment and structure "currently in use" (CIU) information in HydroBase. This information is used, for example, in cases where Water Commissioners have entered annual data values rather than daily or monthly records.

Diversion Comment Not Used Flag

HydroBase contains diversion comment data with a *not_used* field. If the *not_used* value matches one of the values shown in the following table for an irrigation year (November of the previous year to October of the irrigation year), the diversion (or reservoir release) data for the specified irrigation year can be interpreted as zero (see the **State of Colorado's Water Commissioner Manual** for more information):

Diversion Comment not_used Flag Resulting in Additional Zero Values

not_used	Meaning (reason why diversion is zero)
A	Structure is not usable
B	No water is available
C	Water available, but not taken
D	Water taken in another structure

Structure Currently in Use Flag

The HydroBase structure data contains a "currently in use" (CIU) field. Unlike diversion comments, this is a single value that is consistent with the current status of a structure (it is not a time series). The following CIU values are used.

Structure CIU Flag Values and Meaning

CIU	Meaning
A	Active structure with contemporary diversion records
B	Structure abandoned by the court
C	Conditional structure
D	Duplicate; ID no longer used
F	Structure used as FROM number; located in another water district
H	Historical structure only-no longer exists or has records, but has historical data
I	Inactive structure which physically exists but no diversion records are kept
N	Non-existent structure with no contemporary or historical records
U	Active structure but diversion records are not maintained

If `UseCIU=True` is specified for this command, the following logic will be used to fill missing time series values:

1. If the HydroBase CIU value is H or I for the structure associated with the time series:
    a. Fill using the diversion comments (see above for interpretation of comments).
    b. The limits of the time series are recomputed based on diversion data and comments.
    c. Missing data at the end of the period are filled with zeros, reflecting the fact that the structure is off-line. In this case, the limits are always recomputed, regardless of the value of the `RecalcLimits` command parameter. These values are not included in historical averages because they do not occur in the active life of the structure.
    d. Missing data within the data period remain missing, and can be filled with other commands such as `fillHistMonthAverage()`.
    e. Missing data prior to the first diversion values or comments remain missing, and can be filled with other commands as appropriate, perhaps specific to each location.
2. If in HydroBase CIU=N:
    a. Fill using the diversion comments (see above for interpretation of comments).
    b. The limits of the time series are recomputed based on diversion data and comments.
    c. Missing data at the beginning of the period are filled with zeros. In this case, the limits are always recomputed, regardless of the value of the `RecalcLimits` command parameter.
    d. The remaining missing data in the active data period or at the end of the period remain missing and can be filled with other commands.

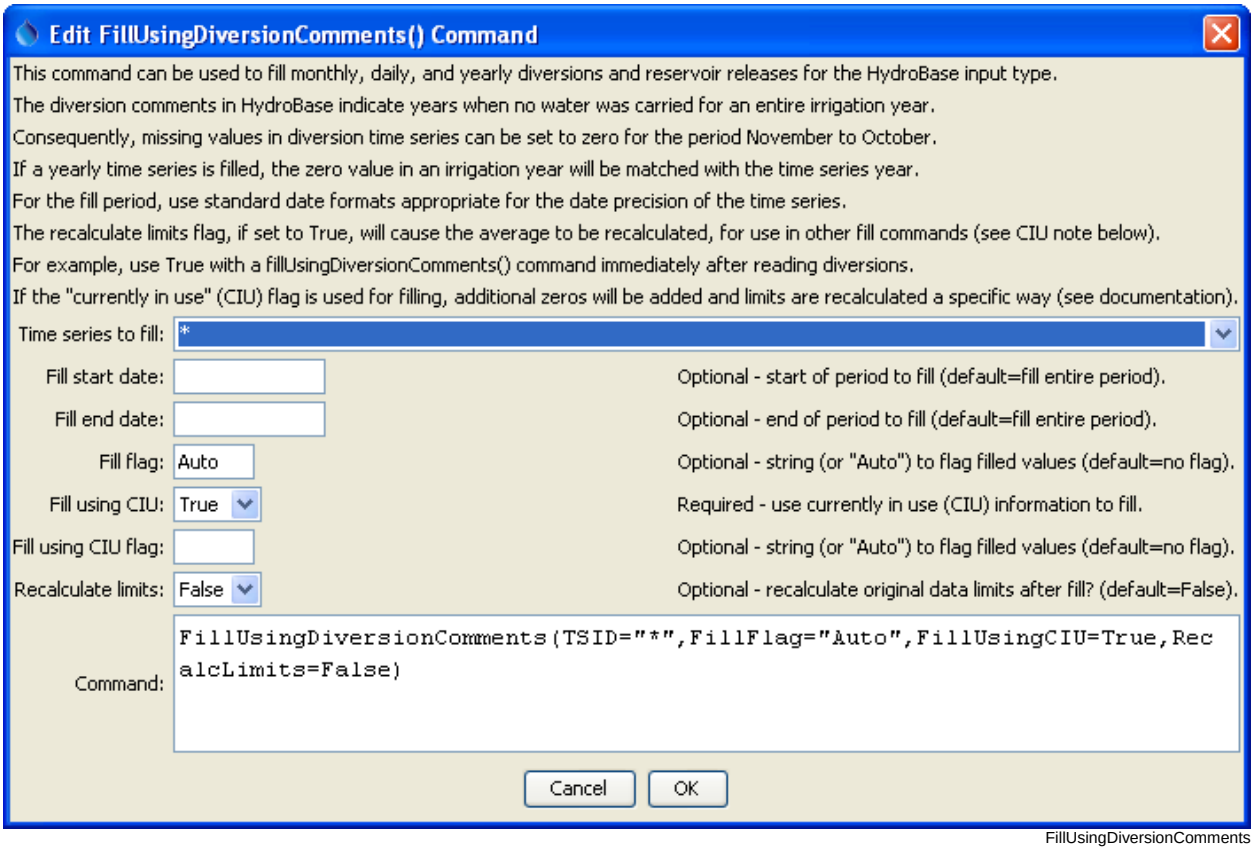
The output period for filled time series is handled as follows:

- If a global output period has been specified (e.g., with the `setOutputPeriod()` command) then the time series will NOT be extended to include diversion comments and CIU codes beyond the output period.
- If NO output period has been specified, the time series WILL be extended to include the longer period from diversion comments. CIU information does not cause the time series to be extended.

After setting additional zero values using this command, the limits of the time series can be recomputed, if appropriate, for use with the `fillHistMonthAverage()` command (see the `RecalcLimits=True` parameter). If `FillUsingCIU=true` is specified, it overrides the `RecalcLimits` parameter as per the logic described above.

See also the `ReadHydroBase()` and `TS Alias = ReadHydroBase()` commands, which allow filling with diversion comments after reading data. Refer to the **HydroBase Input Type Appendix** for more information about diversion time series.

The following dialog is used to edit the command and illustrates the syntax of the command.



FillUsingDiversionComments

FillUsingDiversionComments() Command Editor

The command syntax is as follows:

```
FillUsingDiversionComments(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	The time series identifier or alias for the time series to be filled. Specify as `*` to fill all time series.	None – must be specified.
`FillStart`	The starting date/time for the fill.	Available period.
`FillEnd`	The ending date/time for the fill.	Available period.

Parameter	Description	Default
`FillFlag`	For each value that is filled using the diversion comment *not_used* information, tag the filled value as follows: • If `FillFlag` is specified as a single character, tag filled values with the specified character. • If `FillFlag=Auto` is specified, the diversion comment *not_used* value (A, B, C, or D) from HydroBase is used for the flag. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary.	No flag is assigned.
`FillUsingCIU`	Indicates whether the "currently in use" (CIU) information is used to fill missing data. This will result in additional zeros at the beginning or end of the time series, depending on CIU value. See the description of the logic above. Note that this will cause the time series data limits to be automatically recomputed, regardless of the value of the `RecalcLimits` parameter.	`False` (CIU information is not used to fill missing data).
`FillUsingCIUFlag`	For each missing data value that is filled using the CIU information, tag the filled value as follows: • If `FillUsingCIUFlag=Auto` is specified, the CIU value (H, I, or N) from HydroBase is used for the flag. • Else if `FillUsingCIUFlag` is specified, tag filled values with the specified character. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary.	No flag is assigned.
`RecalcLimits`	Indicate whether the original data limits for the time series should be recalculated after the zero values are set. Zero values are included in the monthly and annual averages. See the discussion above related to CIU – time series that are impacted by CIU always have their limits recalculated.	`False` (additional zeros are not considered in the original data averages).

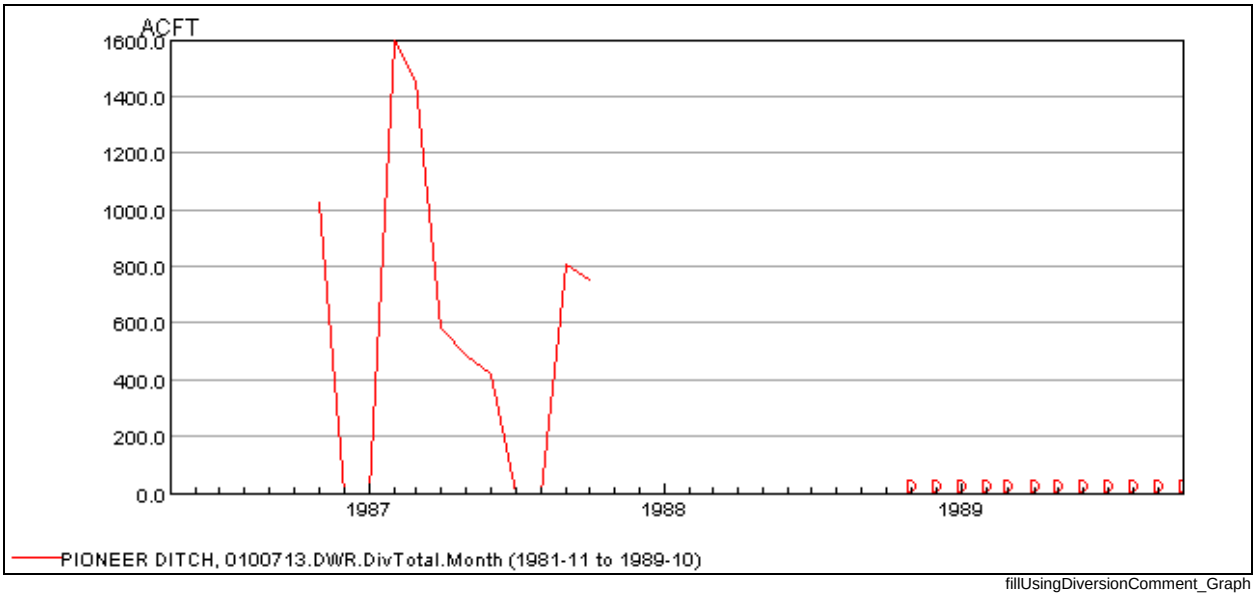
A sample commands file to fill diversion time series from the State of Colorado's HydroBase is as follows:

```
# 0100506 - PUTNAM DITCH
0100506.DWR.DivTotal.Month~HydroBase
# 0100503 - RIVERSIDE CANAL
0100503.DWR.DivTotal.Month~HydroBase
# 0100501 - EMPIRE DITCH
0100501.DWR.DivTotal.Month~HydroBase
FillUsingDiversionComments(TSID="*",RecalcLimits=True)
```

The following example fills one time series and labels the values with the flag.

```
# Set the date to cause comments NOT to automatically extend the period.
# setOutputPeriod(1950-01,1989-06)
# 0100713 - PIONEER DITCH
0100713.DWR.DivTotal.Month~HydroBase
FillUsingDiversionComments(TSID="*",FillFlag="Auto",RecalcLimits=False)
```

The corresponding graph created with data flags as labels is shown below (note the D symbols on the right). It may be necessary to change the graph properties to display the data labels above the point in order to see labels at the bottom of the graph.



fillUsingDiversionComment_Graph

Example Graph Showing Fill Flag (D labels indicate additional zero values)

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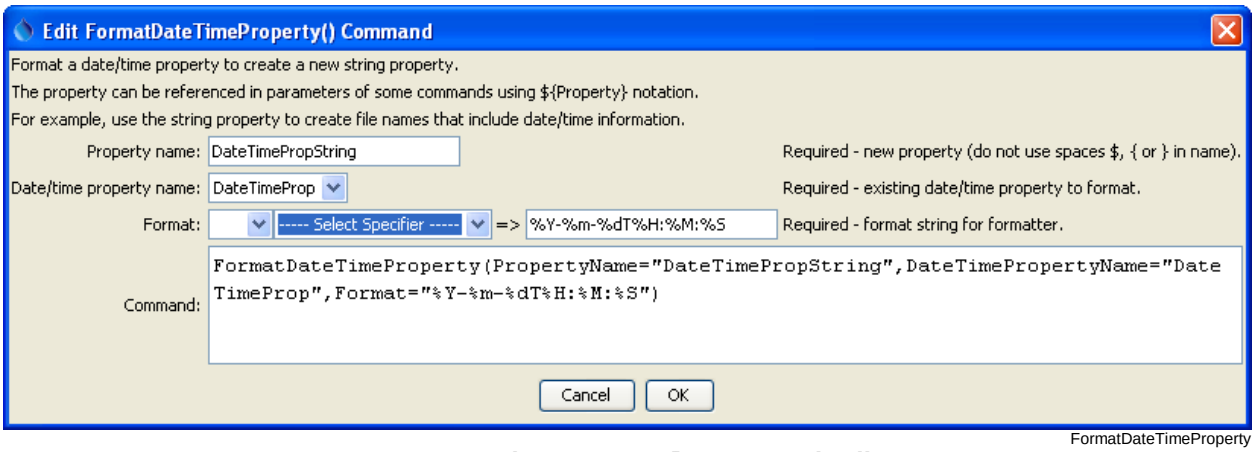
Command Reference: FormatDateTimeProperty()

Format a date/time property as a new string property

Version 10.16.00, 2013-01-15

The `FormatDateTimeProperty()` command creates a new global string property by formatting an existing date/time property. These properties are accessible to commands using `${Property}` notation. A formatted date/time string is useful when specifying filenames more dynamically. Date/time properties will by default be formatted using the ISO 8061 format (e.g., YYYY-MM-DD hh:mm:ss). Support for properties varies by command and command documentation should be consulted. This command should not be confused with the `SetTimeSeriesProperty()` command, which sets a property on specific time series.

The following dialog is used to edit this command and illustrates the syntax of the command.



FormatDateTimeProperty

FormatDateTimeProperty() Command Editor

The command syntax is as follows:

```
FormatDateTimeProperty(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`PropertyName`	The name of the string property to be created.	None – must be specified.
`DateTimePropertyName`	The name of the existing date/time property to be formatted.	None – must be specified.
`FormatterType`	The date/time formatter type, which defines the format specifiers, one of: • `C` – the C programming language strftime() function, which has been widely copied (described below). • `MS` – Microsoft convention (currently not supported but may be added in the future).	`C`

Parameter	Description	Default
`Format`	The format string for the formatter, which defines how date/time data parts are formatted into the new string property. The string is interpreted by the formatter as follows: • `Formatter=Strftime` – The string can contain literal characters and format specifiers that start with the % character.	None – must be specified.

The following table lists the supported formatting strings for `FormatterType=C`:

Supported C (Strftime) Formatting Specifiers

Format Specifier	Description
`%a`	Weekday abbreviation (e.g., `Sun`)
`%A`	Weekday (e.g., `Sunday`).
`%b`	Month abbreviation (e.g., `Jan`).
`%B`	Month (e.g., `January`).
`%d`	Day (`01-31`).
`%H`	Hour (`00-23`).
`%I`	Hour (`01-12`).
`%j`	Day of year (`001-366`).
`%m`	Month (`01-12`).
`%M`	Minute (`00-59`).
`%p`	`AM`, `PM` (noon=`PM`, midnight=`AM`).
`%S`	Second (`00-59`).
`%y`	Year (`00-99`).
`%Y`	Year (`0000-9999`).
`%Z`	Time zone (e.g., `MST`).

A sample command file is as follows:

```
SetProperty(PropertyName="DateTimeProp",PropertyType=DateTime,
    PropertyValue="CurrentToSecond")
FormatDateTimeProperty(PropertyName="DateTimePropString",
    DateTimePropertyName="DateTimeProp",Format="%Y-%m-%dT%H:%M:%S")
```

Command Reference: FormatTableString()

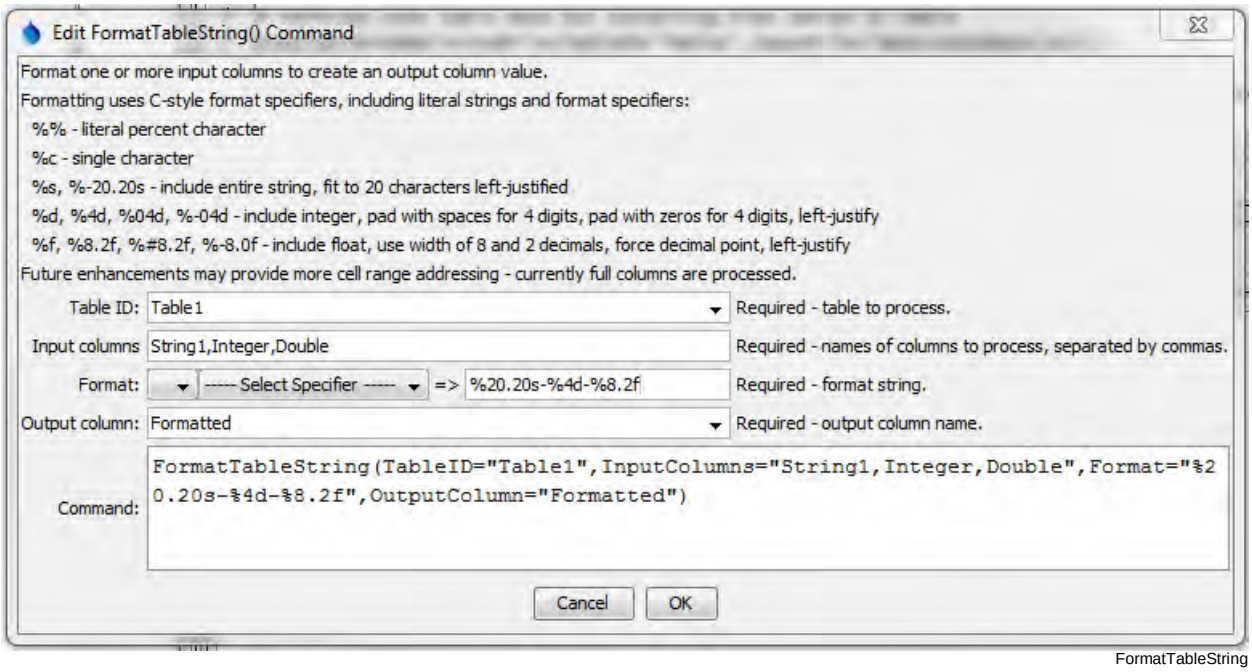
Format a string column in a table, using other columns as input

Version 10.21.00, 2013-06-26

The `FormatTableString()` used zero or more table columns as input and formats an output table column. For example, it may be necessary to concatenate information from several columns to create an identifier. It can also be used to assign a literal string to a column. See also the `ManipulateTableString()` command. Formatting occurs as follows:

- The data types for input columns control the type of formatting that can be done. For example, columns containing floating-point numbers must use the format specifiers for floating-point numbers.
- Format specifiers are consistent with the C programming language.
- Missing values in input will result in blanks in output.

The following dialog is used to edit the command and illustrates the syntax of the command.



FormatTableString

FormatTableString() Command Editor

The command syntax is as follows:

```
FormatTableString(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TableID	The identifier for the table to process.	None – must be specified.
InputColumns	The names of one or more input columns. Values from the columns will be formatted according to the Format parameter. Input columns can be omitted if the format string is a literal value.	Required if format specifiers are given.
Format	The format specifier string used to format the data values. See the editor dialog for examples and refer to "sprintf" documentation on the internet for further explanation. Specify as many format specifiers as input columns. All other characters will be transferred to the output string.	None – must be specified.
OutputColumn	The name of the column to receive the output.	None – must be specified.

Command Reference: Free()

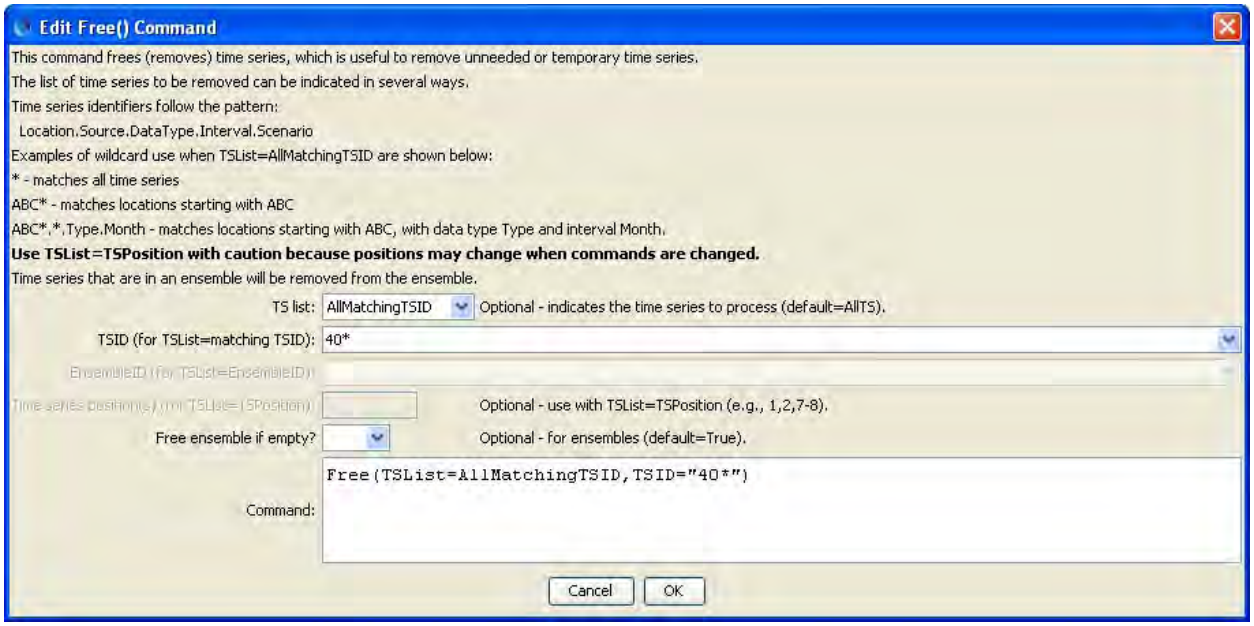
Free (remove) time series from memory

Version 09.10.01, 2010-11-18

The `Free()` command frees (removes) the selected time series from memory. The time series will therefore not be available for use after that line in the command file. This command is useful for discarding temporary time series needed for data manipulation (e.g., so that they are not written in output and are not available for interactive plots). Freed time series are also removed from any ensembles that reference the time series.

Rather than freeing time series, it may be more appropriate to use the `SelectTimeSeries()` command, which can be used in conjunction with some commands to select time series and then operate on the selected time series. This approach allows selective use of time series and minimized the need for `Free()` commands. Many commands also use a `TSList` parameter to indicate which time series should be operated on by a command.

The following dialog is used for editing the command and illustrates the command syntax.



Free

Free() Command Editor

The command syntax is as follows:

```
Free(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified (see the EnsembleID parameter). • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • TSPosition – time series specified by position in the results list (see TSPosition parameter below).	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID
TSPosition	A list of time series positions (1+) in output, separated by commas. Ranges can be specified as Start-End.	Required if TSList=TSPosition
FreeEnsembleIfEmpty	Indicate whether to free the ensemble from which time series were removed, if the ensemble is empty (has no time series remaining after the Free() command).	True

A sample command file is as follows:

```
Free(TSList=AllMatchingTSID,TSID="40*")
```

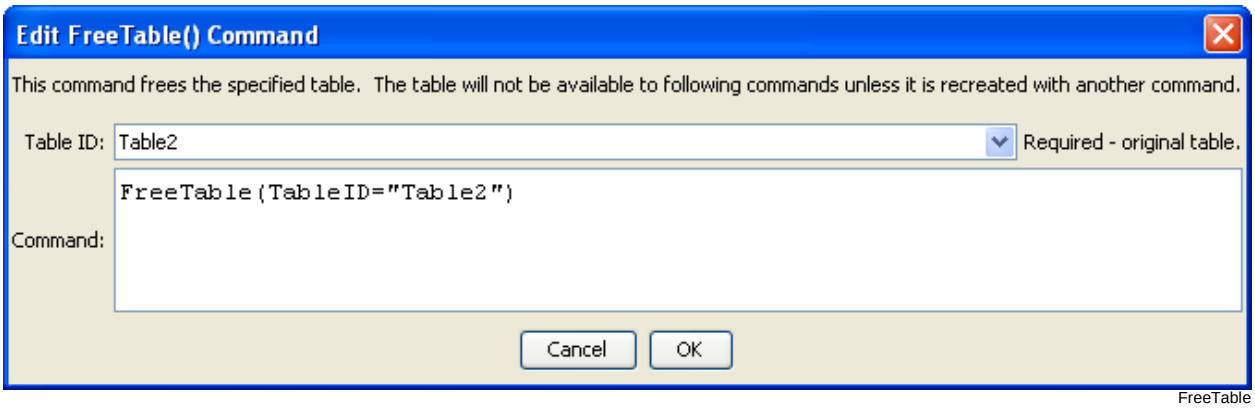
Command Reference: FreeTable()

Free a table

Version 10.16.01, 2013-02-14

The `FreeTable()` command frees a table. The table will not be available for subsequent commands, although a new table with the same name can be created and used with subsequent commands. This command is useful, for example, when looping through blocks of commands where logic is repeated and the table contents are recreated.

The following dialog is used to edit the command and illustrates the syntax of the command.



FreeTable

FreeTable() Command Editor

The command syntax is as follows:

```
FreeTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the original table.	None – must be specified.

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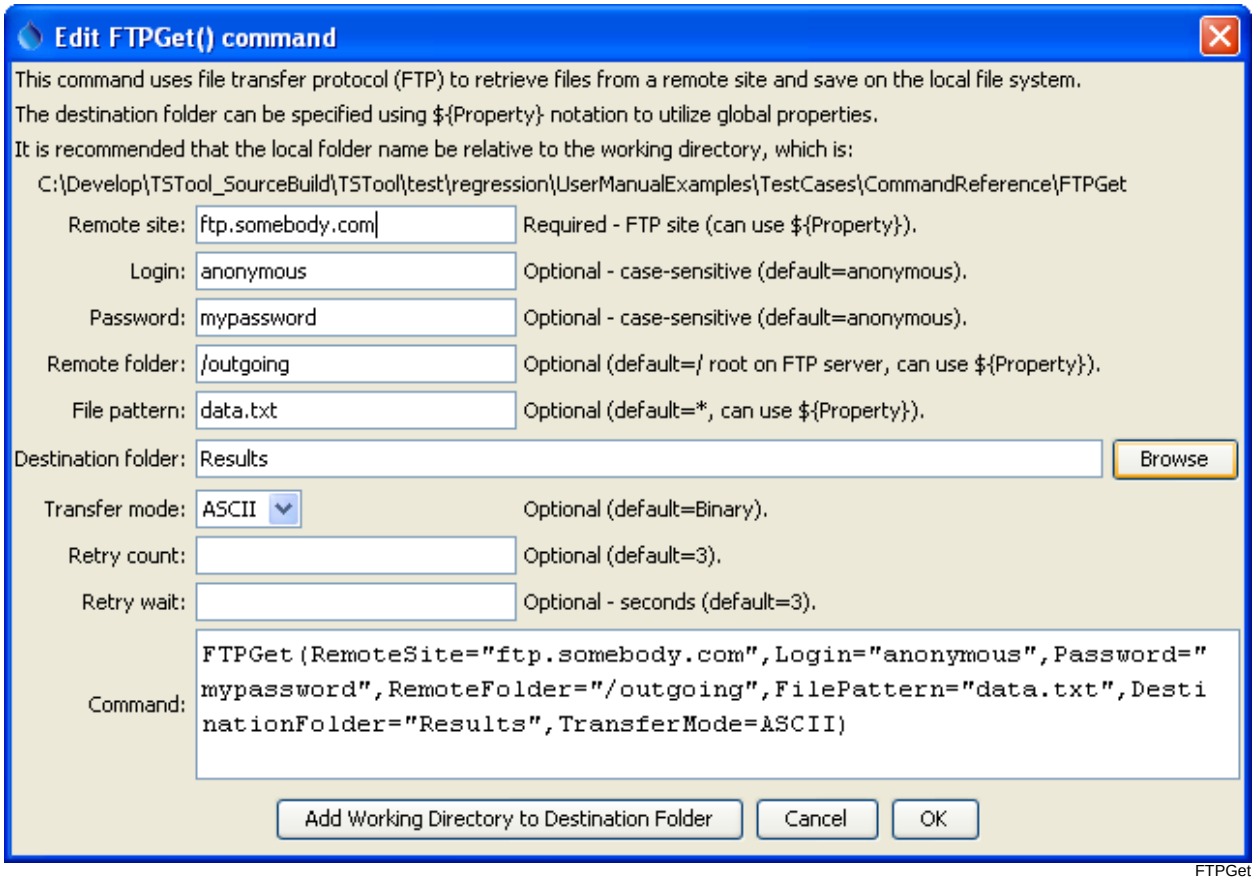
Command Reference: FTPGet()

Retrieve file(s) from a remote system using file transfer protocol (FTP)

Version 10.01.00, 2011-11-15

The `FTPGet()` command retrieves one or more files from a remote system using file transfer protocol (FTP). The retrieval is not recursive to child folders.

The following dialog is used to edit the command and illustrates the syntax for the command.



FTPGet

FTPGet() Command Editor

The command syntax is as follows:

```
FTPGet(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`RemoteSite`	The address of the remote site, for example: ftp.acme.com Global properties can be used with the `${Property}` syntax.	None – must be specified.
`Login`	The FTP login to use.	`anonymous`
`Password`	The FTP password to use.	`anonymous`
`RemoteFolder`	The folder on the remote site, for example: */outgoing/data* Global properties can be used with the `${Property}` syntax.	Root folder (/).
`FilePattern`	The pattern to use to determine which files should be transferred. Simple patterns are used, where * is a wildcard. Global properties can be used with the `${Property}` syntax.	Retrieve all files in the `RemoteFolder`.
`DestinationFolder`	The folder to receive the files, can be relative to the working directory. Global properties can be used with the `${Property}` syntax.	None – must be specified.
`TransferMode`	The transfer mode: • `ASCII` – for text files • `Binary` – for binary files	`Binary`
`RetryCount`	The number of times to retry the login if it fails (e.g., due to busy site).	3
`RetryWait`	The amount of time to wait between retries, seconds.	3

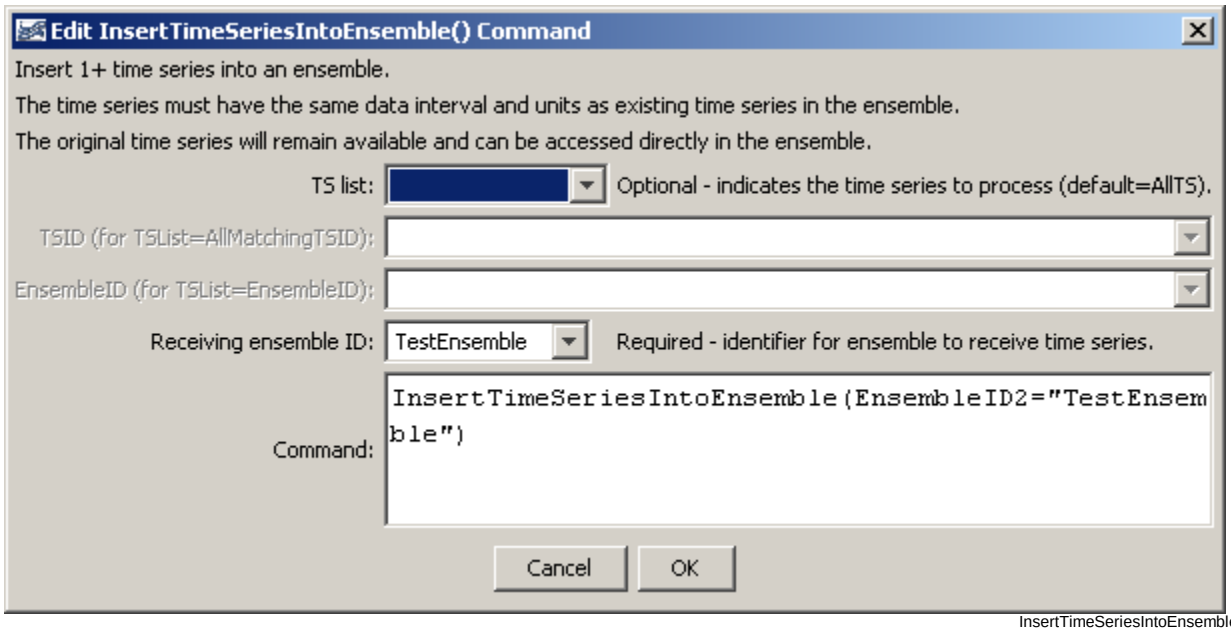
Command Reference: InsertTimeSeriesIntoEnsemble ()

Insert 1+ time series into an existing ensemble

Version 10.13.00, 2012-10-25

The `InsertTimeSeriesIntoEnsemble()` command inserts 1+ time series into an ensemble. The time series must have the same interval and data units as the time series in the ensemble. For example, use the command to insert scenario time series into an ensemble.

The following dialog is used to edit the command and illustrates the syntax for the command.



InsertTimeSeriesIntoEnsemble

InsertTimeSeriesIntoEnsemble () Command Editor

The command syntax is as follows:

```
InsertTimeSeriesIntoEnsemble (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be added to the ensemble, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards). • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards). • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards). • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required when TSList=*TSID
EnsembleID	The ensemble from which to retrieve time series, if inserting time series from an ensemble.	Required when TSList=EnsembleID.
EnsembleID2	The identifier for the ensemble that is receiving the time series.	None – must be specified.

A sample command file to create an ensemble from user-defined time series is as follows:

```
# Test inserting time series into an ensemble from year interval time series
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Flow.Year",
    SetStart="1960",SetEnd="2000",Units="ACFT",
    PatternValues="1,2,5,8,,20")
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..Flow.Year",
    SetStart="1950",SetEnd="2005",Units="ACFT",
    PatternValues="2,4,10,16,,40")
NewEnsemble(TSList=AllTS,
    NewEnsembleID="TestEnsemble",NewEnsembleName="Test Ensemble")
InsertTimeSeriesIntoEnsemble(Ensemble2=”TestEnsemble”)
```

Command Reference: LagK()

Lag and attenuate (route) a time series

Version 10.00.00, 2011-03-28

The `LagK()` command can be used to lag and attenuate an input time series, resulting in a new time series. The time series identifier for the new time series is the same as the original time series with "routed" appended to the scenario. The command is commonly used to route an instantaneous flow time series through a stretch of river (reach). `Lag` and `K` routing is a common routing method that combines the concepts of:

1. Lagging the inflow to simulate travel time in a reach and,
2. Attenuating the wave to simulate the storage-outflow relationship for the reach (see **Figure 1**).

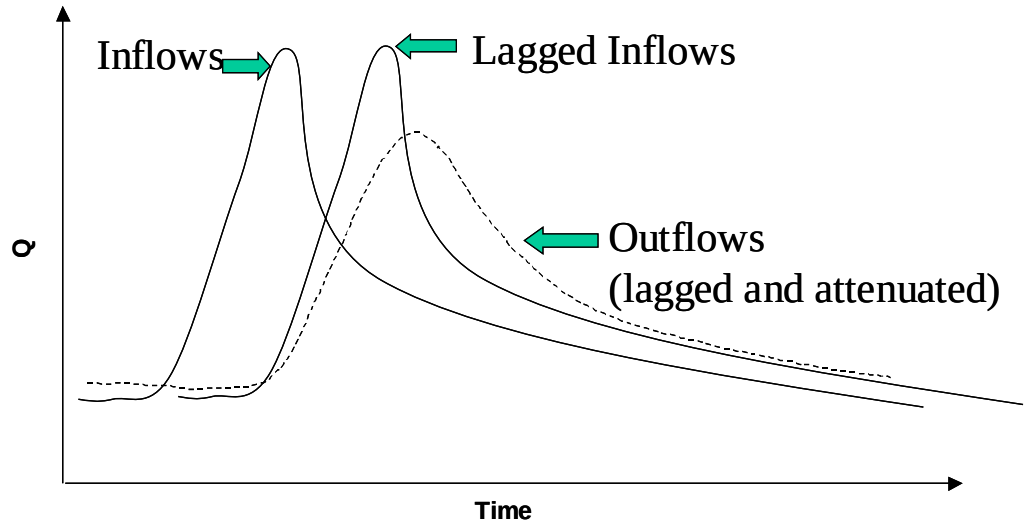


Figure 1: Lag and K Routing

At its fundamental level, the method solves the continuity equation using an approach similar to Muskingum routing (assuming that the Muskingum parameter representing wave storage is negligible). The governing equation for this routing method is given as:

$$Q_{in} - Q_{out} = \frac{\Delta S}{\Delta t}$$

where:

Q_{in} = instantaneous inflow [rate] lagged appropriately,
Q_{out} = instantaneous outflow [rate] lagged appropriately,
ΔS = change in storage in the reach [volume],
Δt = time difference.

The relationship assumes an outflow-storage relationship of the form:

$$S = k \cdot Q_{out,}$$

where:

k = attenuation for the outflow [time].

To ensure accurate results, k should be larger or equal to $\Delta t/2$. For discrete time steps these relationships translate into:

$$O_2 = \frac{I_1 + I_2 + \frac{2S_1}{\Delta t} - O_1}{\frac{2k}{\Delta t} + 1}, \qquad k \geq \frac{\Delta t}{2}$$

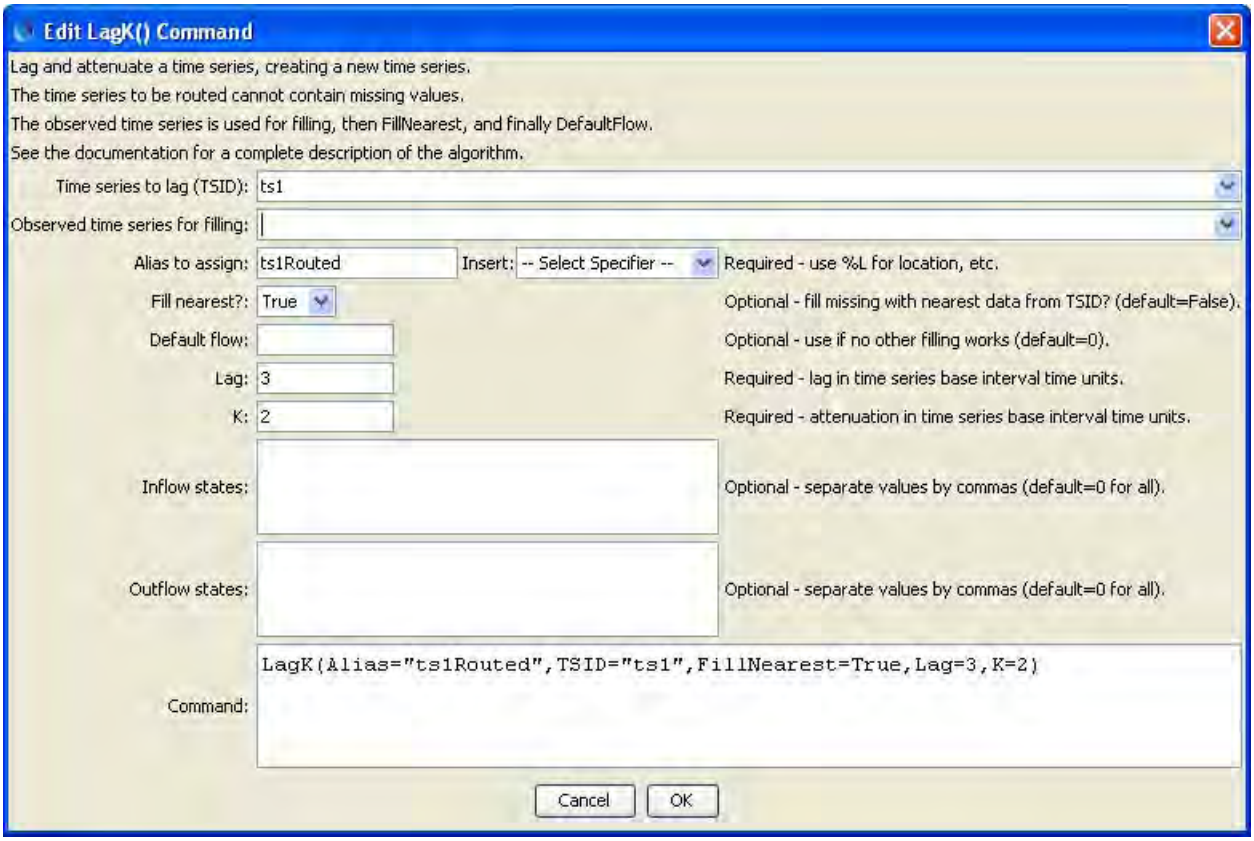
where: I_1 and I_2 are the lagged inflows into the reach at the previous and current time step, respectively,
O_1 and O_2 are the outflows out of the reach at the previous and current time step, respectively,
S_1 is the storage within the reach at the previous time step, defined as $S_1 = k \cdot O_1$, and
Δt is the time difference between the two time steps.

In the case that either I_1, I_2 or O_1 are missing, these values will be set in the following order:

1. Use data from an observed time series (see `ObsTSID` parameter below).
2. Use the nearest value in the input time series (see `FillNearest` parameter below).
3. Use the nearest value in the observed time series (see `FillNearest` parameter and the `ObsTSID` parameter below).
4. Use a defined default flow value (see `DefaultFlow` parameter below).

By default, the identifier of the resulting time series is the same as the original input time series, with the data subtype set to "routed" (e.g., `Streamflow` becomes `Streamflow-routed`)

The following dialog is used to edit the command and illustrates the syntax for the command:



LagK

LagK() Command Editor

Values for `Lag` and `K` can usually be established by comparing routed flows to downstream observations. Alternatively, the `Lag` can be estimated using the reach length and wave speed in the reach. Without any other information, `K` can be set to `Lag/2`.

The command syntax is as follows:

```
LagK(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = LagK(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	Identifier or alias for the time series to be routed. It is assumed that this series describes an instantaneous flow. Due to the lagging, the first data values required for the computation of O_2 are not available within this time series and are therefore set to values set in the `InflowStates` parameter. See also the `ObsTSID` time series, and the `FillNearest` and `DefaultFlow` parameters.	None – must be specified.
`ObsTSID`	Identifier or alias for an observed time series. If specified, the	None

Parameter	Description	Default
	missing values in the TSID time series will be taken from the observed time series if non-missing. ObsTSID can be used in conjunction with FillNearest to substitute a missing value in the TSID time series with the nearest non-missing value in ObsTSID.	
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
FillNearest	If set to True, then when a missing data value is found anywhere in the lagged period, a replacement value will be determined by searching forward and back in time in the input time series to find the nearest non-missing value. The maximum search window depends on the interval of the TSID time series: • <= Seconds: 1000 intervals • Minute, Hour: 1 day • Day: 1 Week • > Day: 1 interval only The assumption is that a flow value close in time will be representative of the missing value and will not result in significant errors. This option has lower precedence than specifying the ObsTSID data. It can also find non-missing data in the ObsTSID if ObsTSID is defined (lower precedence). Both options have a higher precedence than DefaultFlow.	False
DefaultFlow	A flow value in the units of the input time series that is substituted for missing values in the input time series. This has the lowest precedence of all missing data substitutions. It will be applied at any time in the lagged period.	0
Lag	Lag time for the modeled reach in the units of the TSID time series base interval. For example, if the input time series is 10 minutes, the units of Lag are assumed to be minutes. The Lag value is not required to be evenly divisible by the time step interval; values in the time series between time steps will be linearly interpolated.	Required
K	Attenuation factor to be applied to the wave. The units of K are time, and like the Lag value, it is assumed to have the same units as the input time series.	Required
InflowStates	Comma-delimited list of default inflow values prior to the start of the time series. The order of the values is earliest to latest. The array must specify (Lag/multiplier) + 1 values; i.e., a 10 minute interval with a LAG of 30 must be provided with 30/10 + 1 = 4 inflow carryover values. ***Note: Specifying values that are not consistent with the Lag and K parameters will result in oscillation!***	0 for each value
OutflowStates	Comma-delimited list of default outflow values prior to the start of the time series. See InflowStates for details.	0 for each value

A sample command file is as follows (commands to read time series are omitted):

```
LagK(Alias="LKPN6routed",TSID=LKPN6.USGS.QIN.1HOUR,Lag=3,K=2,FillNearest=true)
```

Command Reference: LookupTimeSeriesFromTable()

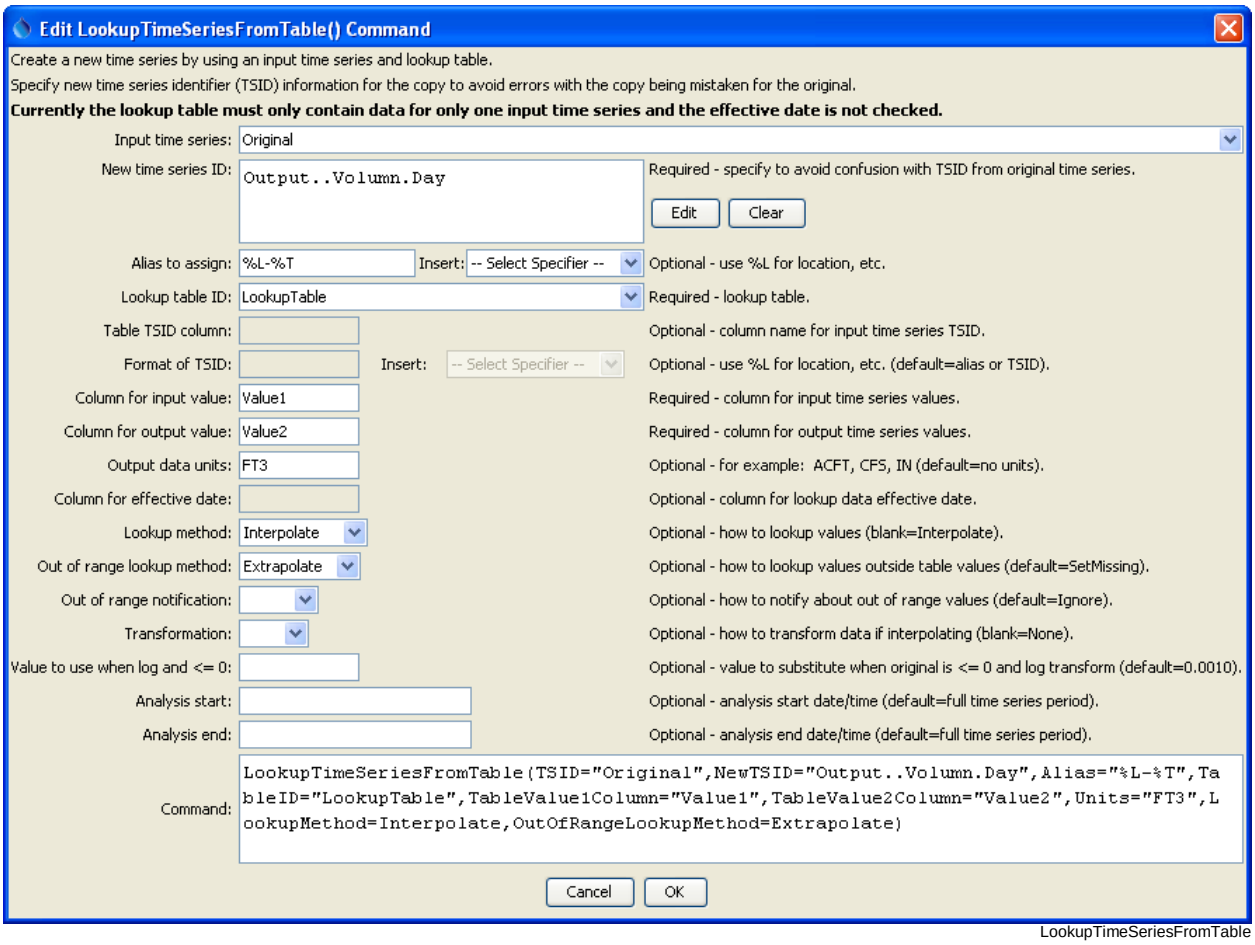
Crate new time series by using an input time series and a lookup table

Version 10.05.00, 2012-02-12

The `LookupTimeSeriesFromTable()` command uses an input time series and lookup table to create the output time series. Examples of using this command include:

- Converting reservoir elevation to storage, surface area, seepage, or other values
- Converting river stage to discharge
- Converting a time series to category values

In many cases the lookup table will apply throughout the analysis period. However, it is possible that the table will change over time (e.g., as a stream channel changes or a reservoir fills with silt). In these cases, the command allows for an effective date to be specified – the table then is applicable on and after the specified date/time, until another effective date is encountered. The values in the table should be sorted in ascending order prior to lookup. This command currently does not handle rating table shifts; however, this capability may be added in the future. The following dialog is used to edit the command and illustrates the syntax of the command:



LookupTimeSeriesFromTable

LookupTimeSeriesFromTable() Command Editor

The command syntax is as follows:

```
LookupTimeSeriesFromTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series used as input.	None – must be specified.
NewTSID	The time series identifier for the time series being created. Use the ***Edit*** button to edit the time series identifier parts.	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	No alias.
TableID	The lookup table identifier.	None – must be specified.
Table TSIDColumn	Table column name that is used to match the time series identifier for processing. **This parameter currently is not supported but will be enabled in the future.**	If not specified, it is assumed that the entire lookup table applies.
Table TSIDFormat	The specification to format the time series identifier to match the TableTSIDColumn column. **This parameter currently is not supported but will be enabled in the future.**	Time series alias if available, or otherwise the time series identifier.
Table Value1Column	Table column name for data values that correspond to the input time series (TSID).	None – must be specified.
Table Value2Column	Table column name for data values that correspond to the output (new) time series identifier (NewTSID).	None – must be specified.
Units	The data units to assign to the new time series.	No data units will be assigned.
Effective DateColumn	Table column name for the effective date. **This parameter currently is not supported but will be enabled in the future.**	The lookup data apply to the entire period.
LookupMethod	Indicate how to select the value to use for output: • Interpolate – interpolate between points if input values do not exactly align with table values; if Transformation=Log, then interpolation will use the transformed values • PreviousValue – pick the previous (lower) value in the table (exact matches use the lookup table value) • NextValue – pick the next (higher) value in the table (exact matches use the lookup table value)	Interpolate
OutOfRange LookupMethod	Indicate the value to use when estimating values that are outside the range of the rating table:	SetMissing

Parameter	Description	Default
	• `Extrapolate` – use the two known values at the end of the table to extrapolate; if `Transformation=Log`, then extrapolation will use the transformed values • `SetMissing` – set output to missing • `UseEndValue` – use the data value on the end	
`OutOfRange Notification`	Indicate the notification to generate when a value is outside the range of the lookup table: • `Ignore` – do not generate warning or failure message • `Warn` – generate a warning message • `Fail` – generate a failure message	`Ignore`
`Transformation`	Indicates how to transform the data before interpolation, used when `LookupMethod=Interpolate` and `OutOfRangeMethod=Extrapolate`). Specify as `None` to compare raw values or `Log` (for $\log_{10}$) to transform values before interpolation and extrapolation. If the `Log` option is used, zero and negative values are replaced with the value specified by the `LEZeroLogValue` parameter value for analysis (missing data values are ignored in the analysis).	`None` (no transformation).
`LEZero LogValue`	Value to use for data values less than or equal to zero when using a log transformation.	`.0010`
`AnalysisStart`	The date/time to start the analysis.	Analyze the full period.
`AnalysisEnd`	The date/time to end the analysis.	Analyze the full period.

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Command Reference: ManipulateTableString()

Manipulate string a string column in a table

Version 10.21.00, 2013-06-14

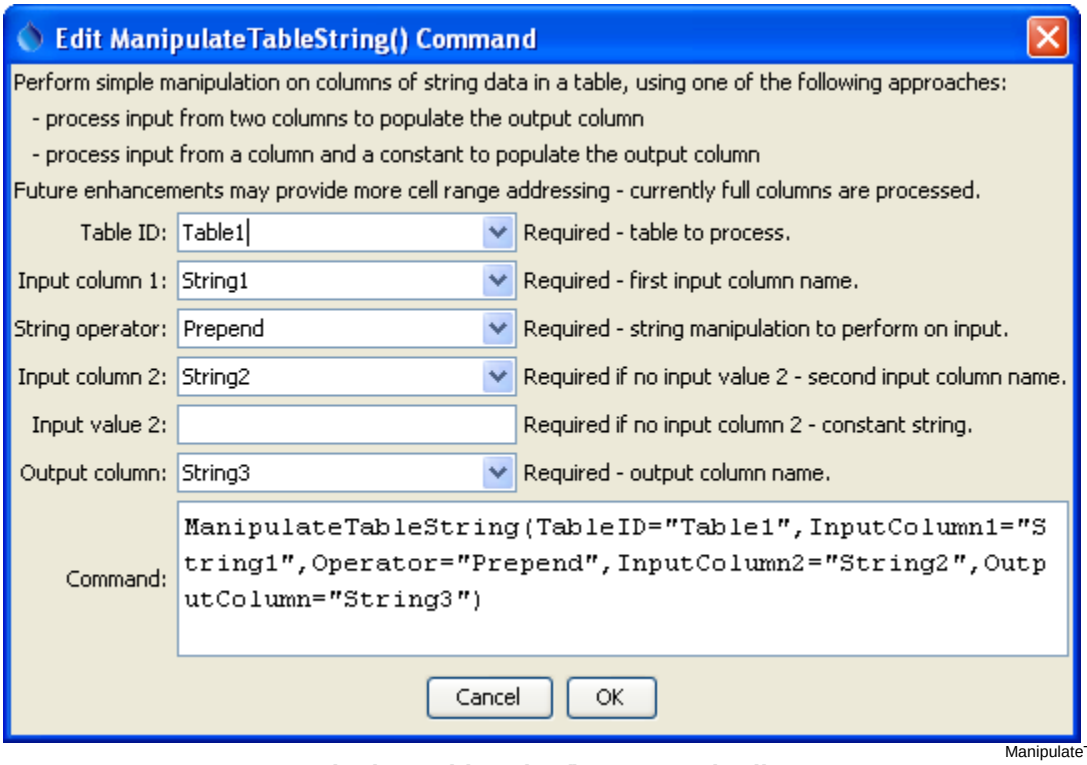
The `ManipulateTableString()` command manipulates a string column in a table. For example, it may be necessary to manipulate strings in a table in order to match time series identifier parts, so that lookups can occur.

The input is specified by:

- a table column name (`InputColumn1`)
- either a second input column name (`InputColumn2`) or a constant string value (`InputValue2`)
- optionally, some operators require an additional input value (`InputValue3`)

The result is placed in the output column (`OutputColumn`). Missing/blank input will be considered as empty strings when formatting the output. The output column can be the same as an existing table column.

The following dialog is used to edit the command and illustrates the syntax of the command (in this case illustrating how the contents of column `String2` are prepended to the contents of a column named `String1` and placed in the output column `String3`).



ManipulateTableString

ManipulateTableString() Command Editor

The command syntax is as follows:

```
ManipulateTableString(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the table to process.	None – must be specified.
`InputColumn1`	The name of a column containing strings, as the first input.	None – must be specified.
`Operator`	The operation to perform on the input strings: • `Append` – append the second input to the first input • `Prepend` – prepend the second input before the first input • `Replace` – replace in the second input in the first input, with the third input • `ToDate` – convert the first input to a DateTime object with date precision • `ToDateTime` – convert the first input to a DateTime object • `ToDouble` – convert the first input to a double precision object • `ToInteger` – convert the first input to an integer object	None – must be specified.
`InputColumn2`	The name of a column containing strings, as the second input.	Required if a second input value is needed and `InputValue2` is not specified.
`InputValue2`	A string constant, as the second input.	Required if a second input value is needed and `InputColumn2` is not specified.
`InputValue3`	A string constant, as the third input.	Required if a third input value is needed.
`OutputColumn`	The name of a column to receive the output.	None – must be specified.

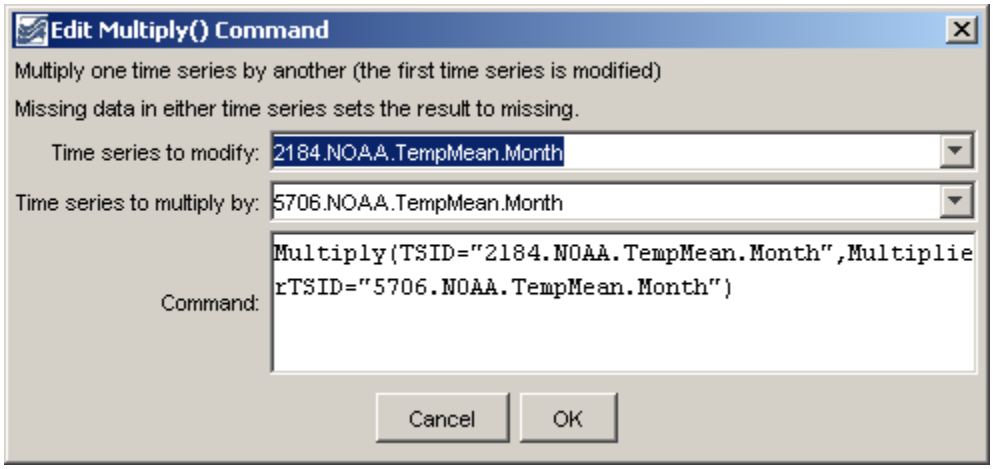
Command Reference: Multiply()

Multiply the data values in a time series by data values in another time series

Version 08.16.04, 2008-09-24

The `Multiply()`command multiplies one time series by another. Missing data in either time series causes the result to be missing. See also the `Scale()` command, which multiplies time series by a numerical value.

The following dialog is used to edit the command and illustrates the syntax of the command.



Multiply

Multiply() Command Editor

The command syntax is as follows:

```
Multiply(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be modified.	None – must be specified.
MultiplierTSID	The time series identifier or alias for the time series that is the multiplier.	None – must be specified.

A sample command file is as follows (this example does not necessarily make sense but illustrates how the Multiply() command can be used for numerical calculations in an analysis):

```
# 2184 - DEL NORTE 2 E
2184.NOAA.TempMean.Month~HydroBase
# 5706 - MONTE VISTA 2 W
5706.NOAA.TempMean.Month~HydroBase
Multiply(TSID="2184.NOAA.TempMean.Month",
  MultiplierTSID="5706.NOAA.TempMean.Month")
```

Command Reference: NewDayTSFromMonthAndDayTS()

Create a new daily time series from monthly total and daily pattern

Version 10.00.01, 2011-05-12

The `NewDayTSFromMonthAndDayTS()` command creates a new daily time series by distributing a monthly time series "volume" according to the pattern of the independent daily time series. This command currently only handles processing monthly `ACFT` and daily `CFS` time series. This command is useful where a monthly flow time series is known at a location, and a daily pattern is known at a related gage. The new time series is assigned the given identifier and alias. The following calculations are performed:

$$DayTS2_i = MonthTS2 \frac{ACFT}{NDAYS} * \left(\frac{1DAY}{86400s} \right) \left(\frac{43560FT^2}{1AC} \right) * \left(\frac{DayTS1_i}{\sum_{i=1}^{i=Nday\sin Month} DayTS1_i} \right)$$

where, for days in a month:

$DayTS2_i$ = the daily value being estimated in daily time series 2
MonthTS2 = the monthly value being used for volumes for time series 2, shown in units of ACFT/NDAYS (equivalent to ACFT/Month)
NDAYS = the number of days in the month
$DayTS1_i$ = the daily value for indicator daily time series 1
$\Sigma DayTS1_i$ = the sum of the daily values for indicator time series for the a month

In summary, the monthly volume in `ACFT/NDAYS` is first converted to an average monthly `CFS` rate by multiplying by 43560/86400 (or 1/1.9835), and finally the average `CFS` value is prorated by the ratio of the indicator daily time series daily value divided by the total daily flows for the month, to give a daily `CFS` value for each day of the month. In this case, the last term is simply a ratio (converting daily average `CFS` to daily `ACFT` and calculating the ratio would result in the same value).

Days with missing data are excluded from the summation and the estimated values. The output period is the global output period from `SetOutputPeriod()`, or if not set the period from the daily time series is used.

For example, consider May a may total for MonthTS2 = 1001.7 ACFT and daily values (CFS) as follows:

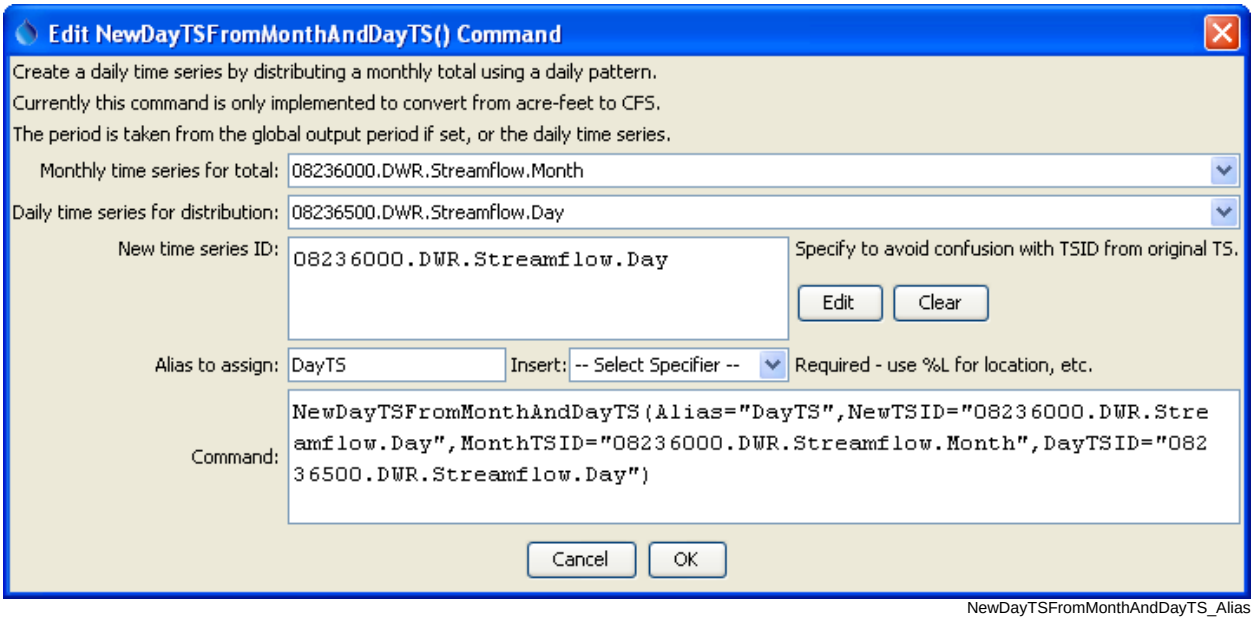
Day 1 = 14
14
13
13
14
14
15
15
15
16
17
17
16
18
18
17
18
18
18
18
17
17
17
17
16
16
17
18
18
17
Day 31 = 17

The total is 505 CFS. The estimated value for day 1 of the second daily time series would then be:

1001.7 * (1/1.9835) * (14/505) = 14 CFS

In this case, the indicator time series was the same as the time series being estimated and therefore the estimated value should be the same as the indicator.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewDayTSFromMonthAndDayTS_Alias

NewDayTSFromMonthAndDayTS() Command Editor

The command syntax is as follows:

```
NewDayTSFromMonthAndDayTS(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewDayTSFromMonthAndDayTS(Parameter=Value,…)
```

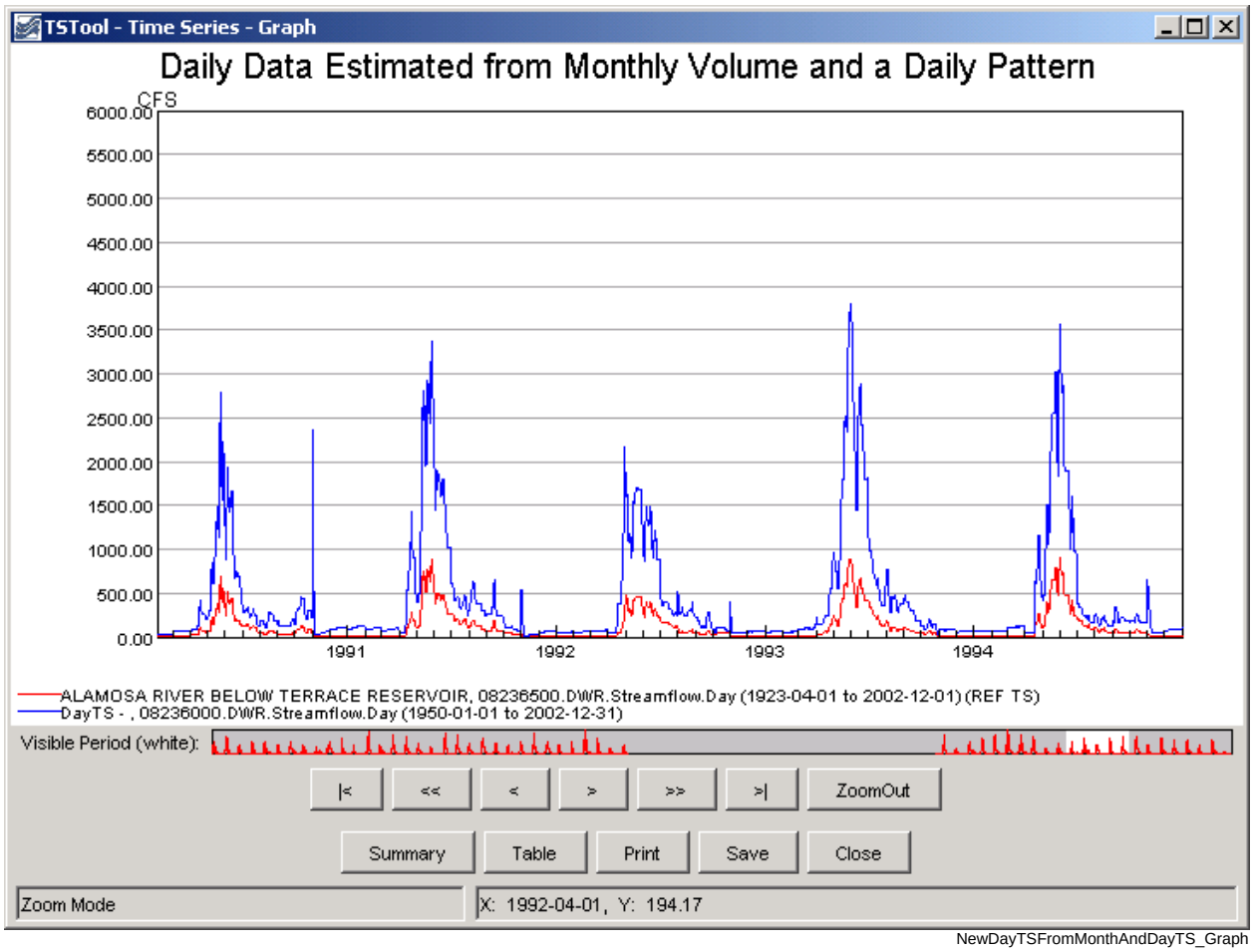
Command Parameters

Parameter	Description	Default
`MonthTSID`	The time series identifier or alias for a monthly time series supplying monthly `ACFT` values.	None – must be specified.
`DayTSID`	The time series identifier or alias for a daily time series supplying daily flow values (only the pattern is used).	None – must be specified.
`NewTSID`	The time series identifier of the new time series. The interval must be `Day`.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.

A sample command file to process data from the State of Colorado's HydroBase is as follows:

```
SetOutputPeriod(OutputStart="1950-01",OutputEnd="2002-12")
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Day~HydroBase
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
NewDayTSFromMonthAndDayTS(
    NewTSID="08236000.DWR.Streamflow.Day",
    MonthTSID="08236000.DWR.Streamflow.Month",
    DayTSID="08236500.DWR.Streamflow.Day",Alias="DayTS")
```

A graph of data resulting from this command may look similar to the following. Note that the each time series has a similar pattern, but at different levels.



NewDayTSFromMonthAndDayTS_Graph

Result of NewDayTSFromMonthAndDayTS() Command

Command Reference: NewEndOfMonthTSFromDayTS()

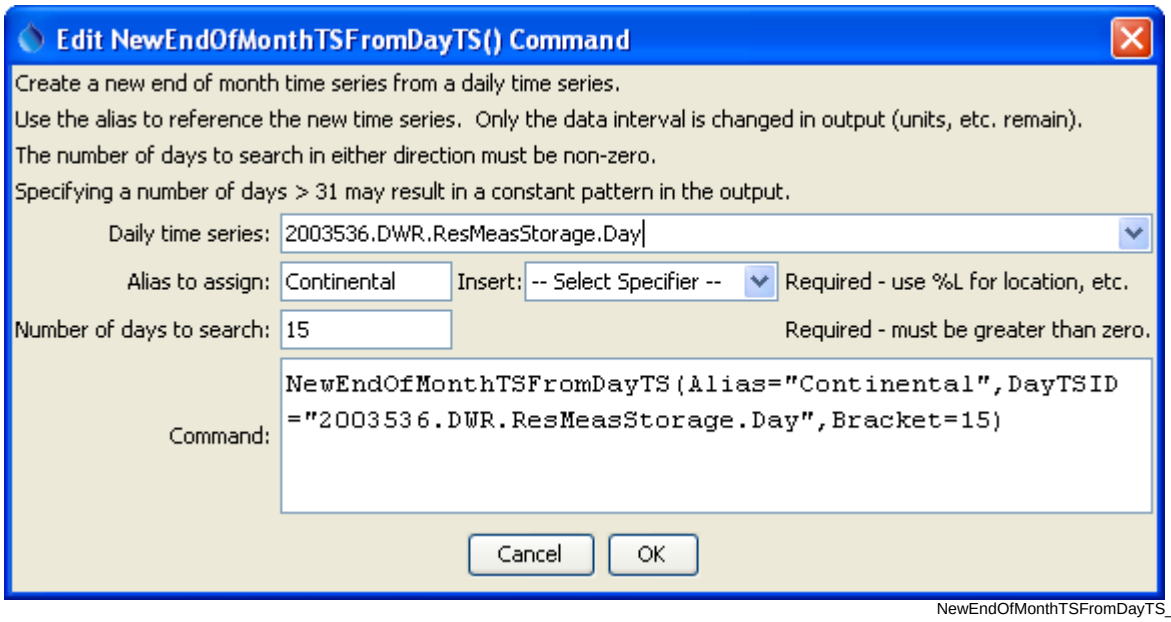
Use a daily time series to create an end of month time series

Version 10.00.00, 2011-03-27

The `NewEndOfMonthTSFromDayTS()` command is typically used to convert a daily reservoir storage time series to an end of month reservoir storage time series. The command can also be applied to other data types (e.g., measured well levels).

Changing from a daily to an end of month monthly time series is accomplished by starting on the month ending day and searching in both directions (backward then forward by expanding until the bracket is reached) for a daily measurement. The number of days to search in each direction (the bracket) should not be so large as to produce unrealistic results. It is possible that no value will be found for a particular month, with the given restraints. In this case, other fill commands (e.g., `FillInterpolate()`) can be applied to estimate the remaining missing data.

The following dialog is used to edit the command and illustrates the syntax of the command.



NewEndOfMonthTSFromDayTS_Alias

NewEndOfMonthTSFromDayTS() Command Editor

The command syntax is as follows:

```
NewEndOfMonthTSFromDayTS(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewEndOfMonthTSFromDayTS (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
DayTSID	The time series identifier or alias of the daily time series to be searched for data.	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
Bracket	The number of days to search from the end of the month, in order to find a daily value to transfer to the end of the month.	None – must be specified.

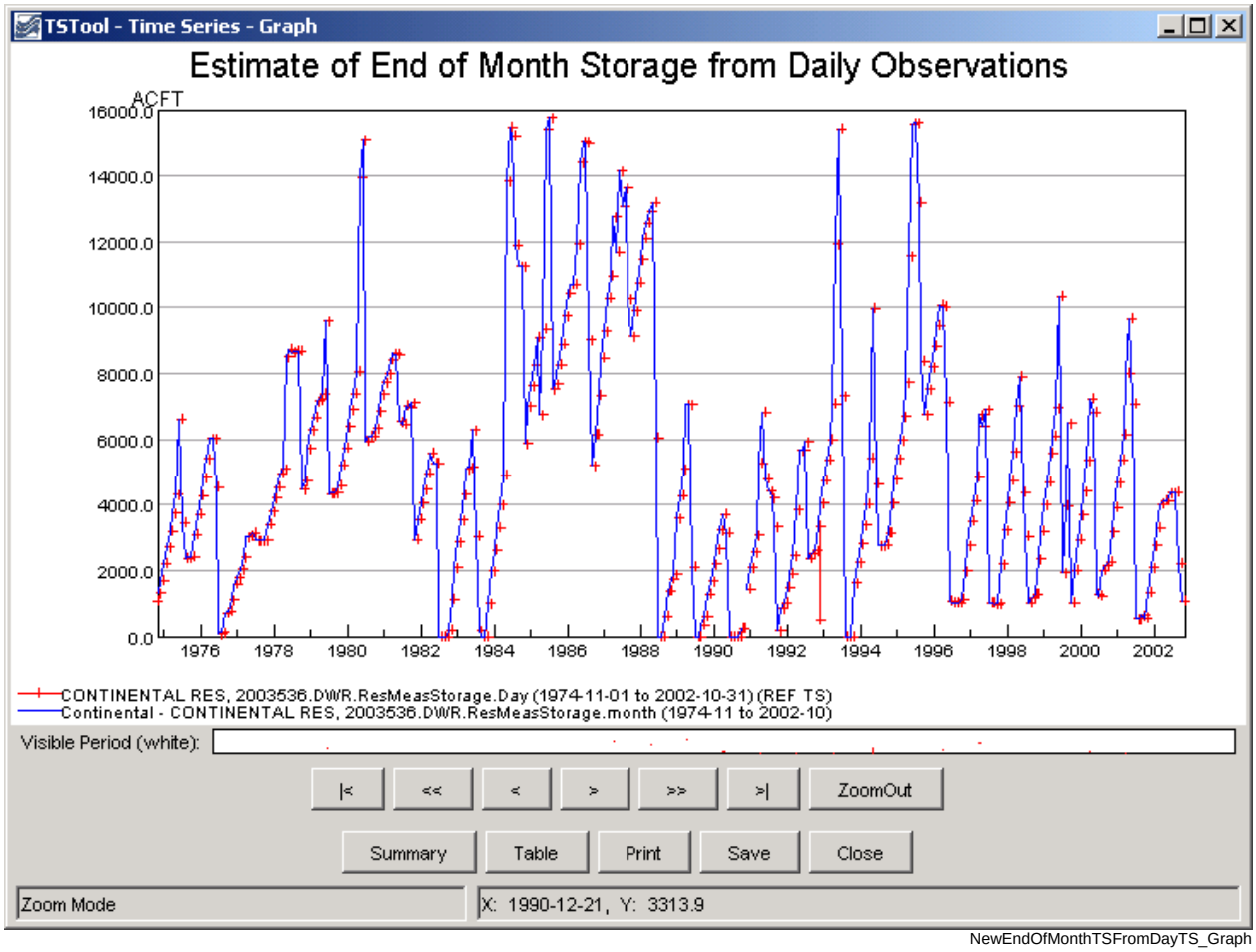
A sample command file for estimating reservoir contents, using data from the State of Colorado's HydroBase database is:

```
# 2003536 - CONTINENTAL RES
2003536.DWR.ResMeasStorage.Day~HydroBase
NewEndOfMonthTSFromDayTS(Alias="Continental",
    DayTSID="2003536.DWR.ResMeasStorage.Day",Bracket=15)
```

A sample command file for estimating well levels is:

```
# 384549104445101 - SCO1506611ABC
384549104445101.USGS.WellLevel.Day~HydroBase
NewEndOfMonthTSFromDayTS(Alias="WellMonth",
    DayTSID="384549104445101.USGS.WellLevel.Day",Bracket=30)
    FillInterpolate(TSList=AllMatchingTSID,TSID="WellMonth",
    MaxIntervals=0,Transformation=None)
```

To evaluate the results of this command, it is useful to graph both the input and results, changing the graph properties to add symbols to see the individual measurements, as shown in the following figure.



NewEndOfMonthTSFromDayTS_Graph

Results of NewEndOfMonthTSFromDayTS() Command

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Command Reference: NewEnsemble ()

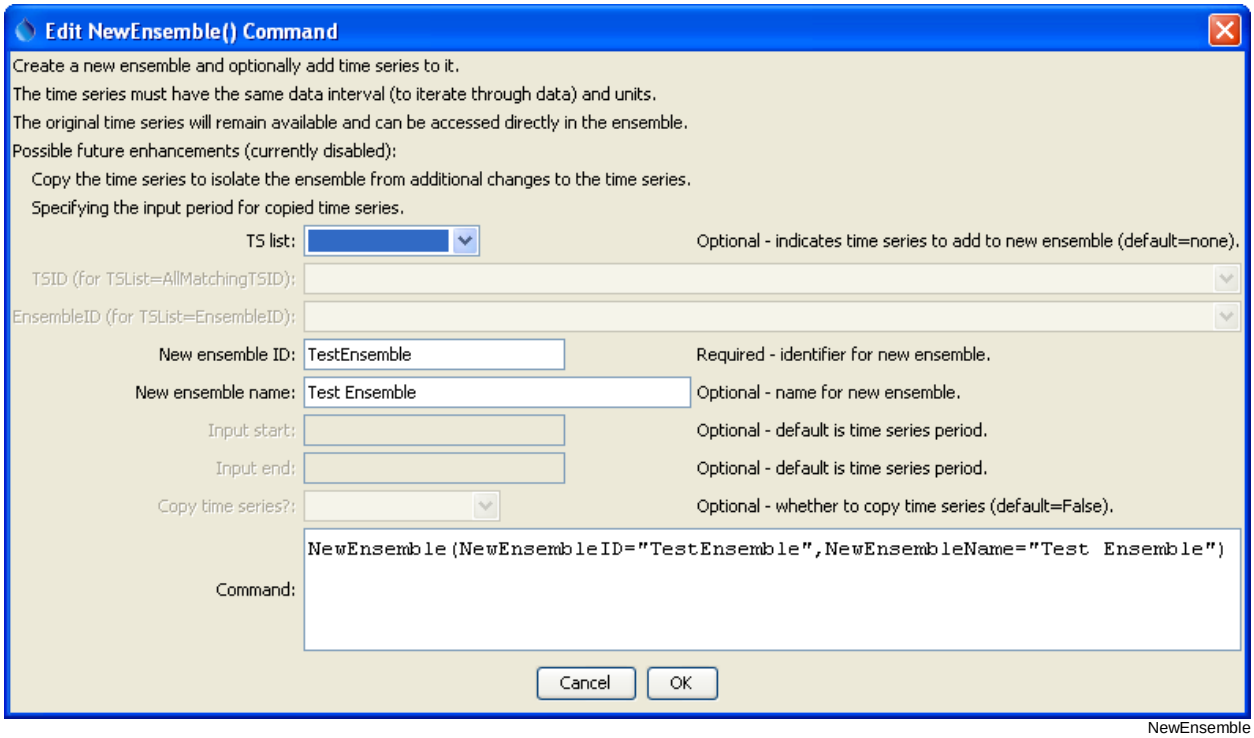
Create a new ensemble and optionally include 1+ time series

Version 10.11.00, 2012-07-18

The `NewEnsemble()` command creates a new ensemble and optionally inserts 1+ existing time series. For example, use the command to create an ensemble that includes multiple scenarios. Although it is typical that an ensemble contains time series at the same location, it is also possible to use ensembles to group time series at different locations (e.g., to group all time series for stations in a county).

It is envisioned that time series added to the ensemble can optionally be copied and the period changed, in order to isolate the data from the original time series. However, currently the time series from the main processor list are simply associated with the ensemble. Consequently, if other commands change the time series (for example free the time series), the ensemble will reflect the changes. Overcoming this issue will require design changes that need to be evaluated.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewEnsemble

NewEnsemble () Command Editor

The command syntax is as follows:

```
NewEnsemble (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of:	`AllTS`

Parameter	Description	Default
	• `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards). • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards). • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards). • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required when `TSList=*TSID`
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required when `TSList=EnsembleID.`
`NewEnsembleID`	The new ensemble identifier.	None – must be specified.
`NewEnsembleName`	The name for the new ensemble.	Blank.
`InputStart`	The date/time to start transferring data from the time series. **Envisioned as future enhancement.**	Use all data.
`InputEnd`	The date/time to end transferring data from the time series. **Envisioned as future enhancement.**	Use all data.
`CopyTimeSeries`	Copy the time series to the ensemble rather than using time series in the main time series list. This protects the data in the ensemble from general processing commands. **Envisioned as future enhancement.**	Associate time series in the main time series list with the new ensemble.

A sample command file to create an ensemble from user-defined time series is as follows:

```
# Test creating an ensemble from year interval time series
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Flow.Year",
    SetStart="1960",SetEnd="2000",Units="ACFT",
    PatternValues="1,2,5,8,,20")
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..Flow.Year",
    SetStart="1950",SetEnd="2005",Units="ACFT",
    PatternValues="2,4,10,16,,40")
NewEnsemble(TSList=AllTS,
    NewEnsembleID="TestEnsemble",NewEnsembleName="Test Ensemble")
```

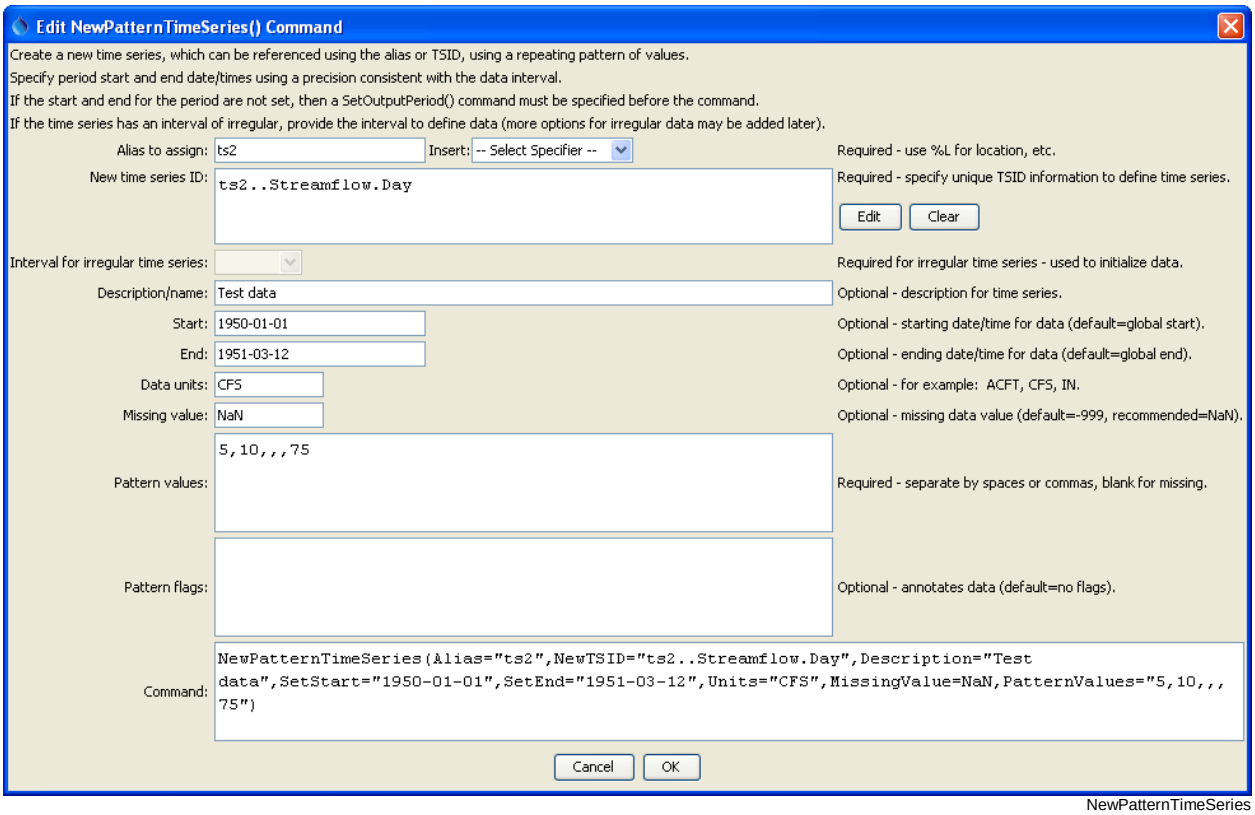
Command Reference: NewPatternTimeSeries()

Create a new time series containing a pattern of repeating values

Version 10.06.00, 2012-04-01

The `NewPatternTimeSeries()` command creates a new time series containing a repeating pattern of numbers. This command is useful for generating data to test other commands.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewPatternTimeSeries

NewPatternTimeSeries() Command Editor

The command syntax is as follows:

```
NewPatternTimeSeries(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewPatternTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`NewTSID`	The time series identifier to be assigned to the new time series, which is useful to avoid confusion with the original time series.	None – must be specified.
`IrregularInterval`	Interval to use to populate irregular time series (e.g., `1Hour`, `Month`), necessary because data need to be assigned somehow.	None – must be specified for irregular time series.
`Description`	Description for the time series.	None.
`SetStart`	Start date/time to set data.	None – must be specified.
`SetEnd`	End date/time to set data.	None – must be specified.
`Units`	Units for the data values.	None.
`MissingValue`	Value to use to indicate missing data values. `-999` is the default for historical reasons; however, `NaN` (not a number) is being phased in and should be specified if possible. Time series can be missing and be flagged.	`-999`
`PatternValues`	Data values, separated by commas. Missing values can be omitted (e.g., indicate with adjacent commas).	None – must be specified.
`PatternFlags`	Short strings to assign to the values (used to annotate graphs and other output) separated by commas. Missing flags can be omitted (e.g., indicate with adjacent commas).	No flags are assigned.

Examples

The following example command file illustrates how to create a pattern time series for testing:

```
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Streamflow.Day",
  Description="Test data",SetStart="1950-01-01",
  SetEnd="1951-03-12",Units="CFS",PatternValues="5,10,12,13,75")
WriteDateValue(OutputFile=",Example_NewPatternTimeSeries_out.dv")
```

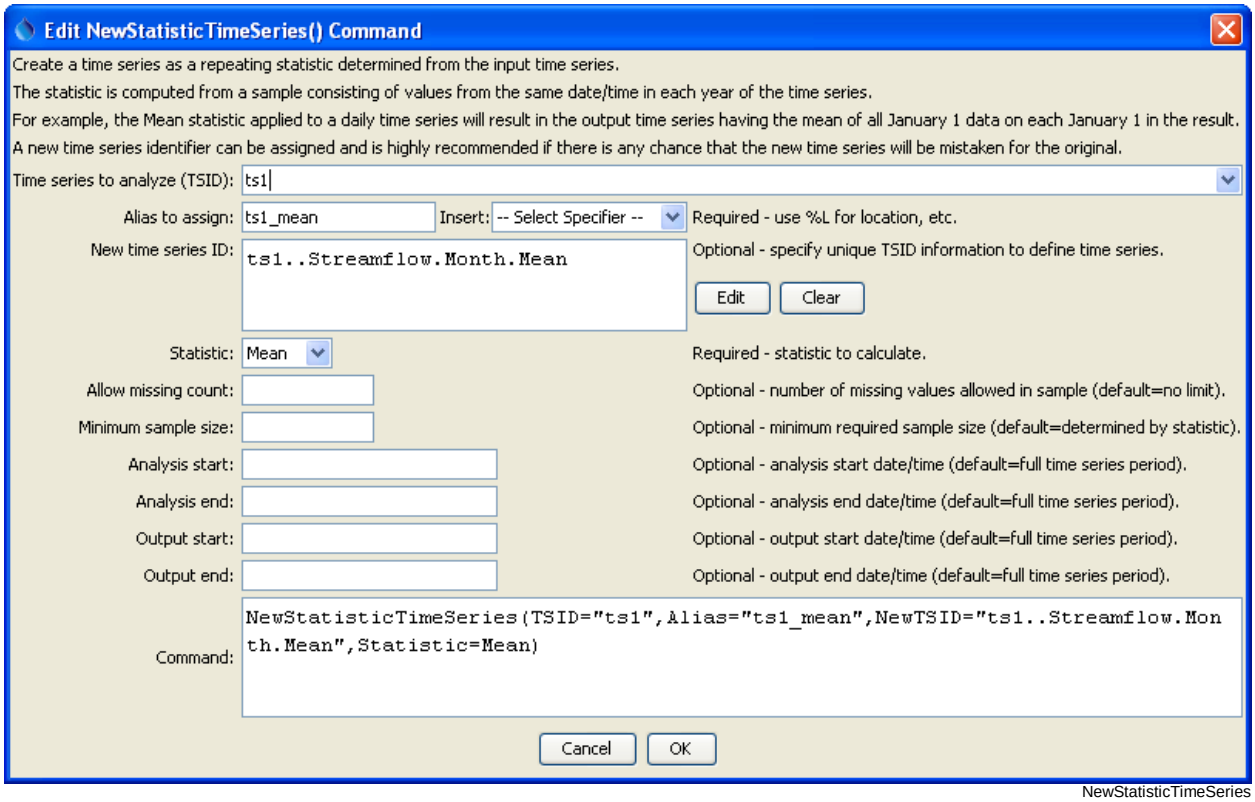
Command Reference: NewStatisticTimeSeries()

Create a time series containing a repeating year of statistics determined from a time series

Version 10.11.00, 2012-07-03

The `NewStatisticTimeSeries()` command uses data from a time series to calculate a statistic for each interval in the year, and assigns the statistic value to each corresponding interval for the full period. For example, for a statistic of `Mean` calculated from a daily time series, all January 1 values are averaged and the resulting January 1 values for the entire time series are set to the mean value. Similarly, if monthly data are analyzed, all January values in the result will be set to the mean of the January values in the original time series. This command is useful for superimposing the long-term historical statistic on the original time series or real-time conditions. Leap year statistics are computed from Feb 29 values and are visible only in leap years of the output time series. Missing data in the original time series will by default still result in the statistic being computed, but the `AllowMissingCount` and `MinimumSampleSize` parameters control the impacts of missing values.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewStatisticTimeSeries

NewStatisticTimeSeries() Command Editor

The command syntax is as follows:

```
NewStatisticTimeSeries(Parameter=value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewStatisticTimeSeries(Parameter=value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier (or alias) of the time series to analyze.	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
NewTSID	The time series identifier to be assigned to the new time series, which is needed to avoid confusion with the original time series.	Use the same identifier as the original time series with the statistic appended to the scenario.
Statistic	See the **Available Statistics** table below.	None – must be specified.
Allow Missing Count	The number of missing values allowed in the source interval(s) in order to produce a result. This capability should be used with care because it may result in data that are not representative of actual conditions.	Allow any number of missing values.
MinimumSampleSize	The minimum number of values required in the sample to compute the statistic. If the minimum sample size is not available, the result will be set to missing.	Minimum sample size is defined by the statistic.
AnalysisStart	The date/time for the analysis start, using a precision that matches the original time series. This controls the sample size.	Analyze the full period.
AnalysisEnd	The date/time for the analysis start, using a precision that matches the original time series. This controls the sample size.	Analyze the full period.
OutputStart	The date/time for the output start, using a precision that matches the original time series. The repeating statistic will fill this period.	Output the full period.
OutputEnd	The date/time for the analysis start, using a precision that matches the original time series. The repeating statistic will fill this period.	Output the full period.

Available Statistics

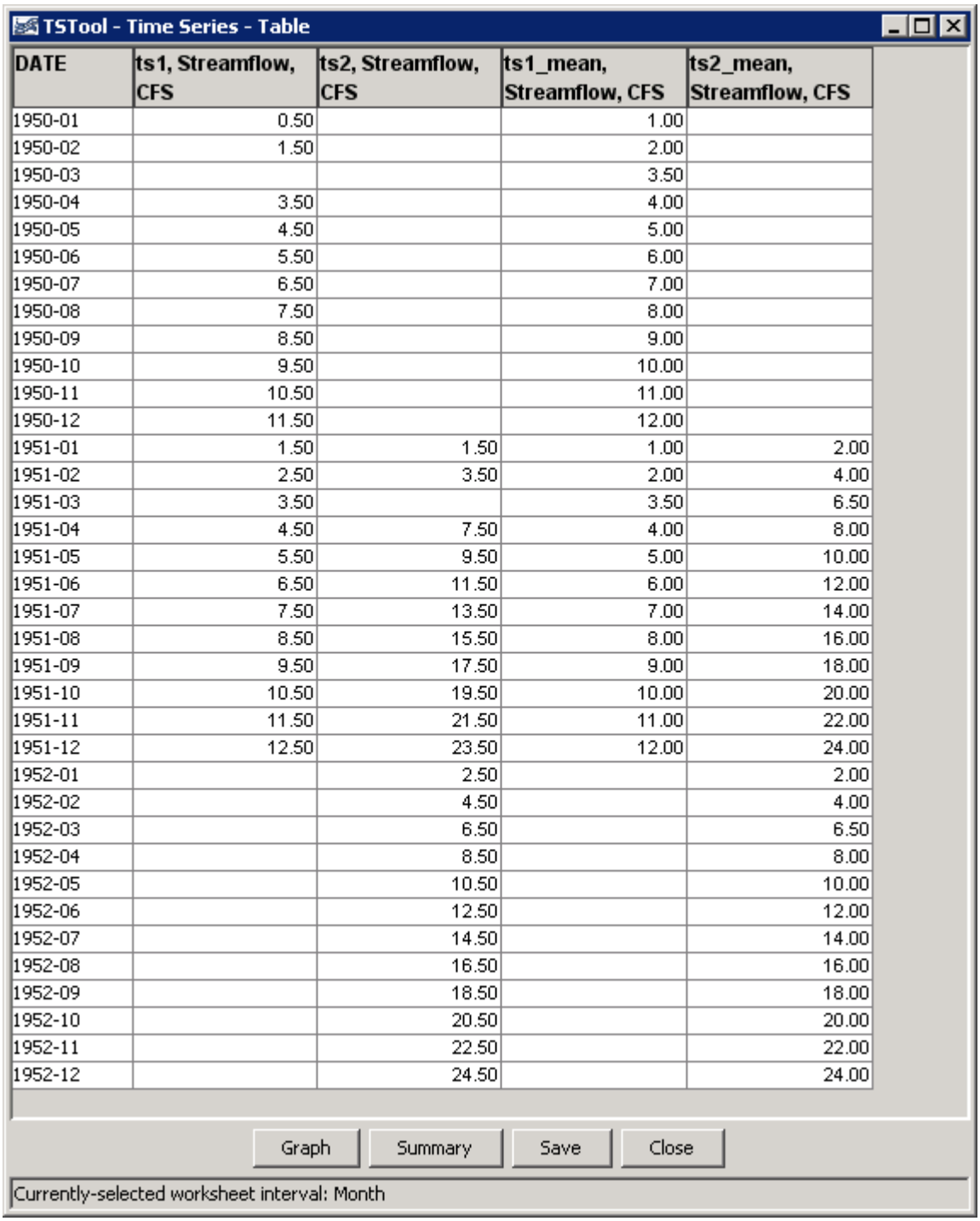
Statistic	Description	Limitations
GeometricMean	Geometric mean of all values in the sample.	All values must be >= 0.
Max	Maximum of all values in the sample.	None.
Mean	Arithmetic mean of all values in the sample.	None.
Median	Median of all values in the sample.	None.
Min	Minimum of all values in the sample.	None.

Examples

The following example command file illustrates how to generate test data and a corresponding statistics time series:

```
# Test of computing a statistic time series for monthly data,
# Assign 2 months of data so that the mean is different from any month
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Streamflow.Month",
    Description="Test data",SetStart="1950-01",SetEnd="1951-12",Units="CFS",
    PatternValues=".5,1.5,,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,1.5,2.5,3.5,
    4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,12.5")
# Double the above
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..Streamflow.Month",
    Description="Test data",SetStart="1951-01",SetEnd="1952-12",Units="CFS",
    PatternValues="1.5,3.5,,7.5,9.5,11.5,13.5,15.5,17.5,19.5,
    21.5,23.5,2.5,4.5,6.5,8.5,10.5,12.5,14.5,16.5,18.5,20.5,22.5,24.5")
NewStatisticTimeSeries(TSID="ts1",Alias="ts1_mean",
    NewTSID="ts1..Streamflow.Month.Mean",Statistic=Mean)
NewStatisticTimeSeries(TSID="ts2",Alias="ts2_mean",
    NewTSID="ts2..Streamflow.Month.Mean",Statistic=Mean)
WriteDateValue(OutputFile="Results\Test_NewStatisticTimeSeries_Month_Mean_out.dv")
```

The following figure illustrates the results. Note that by default the statistic is computed even if missing values exist in the sample. This can be controlled by the `AllowMissingCount` and `MinimumSampleSize` parameters.



TSTool - Time Series - Table

DATE	ts1, Streamflow, CFS	ts2, Streamflow, CFS	ts1_mean, Streamflow, CFS	ts2_mean, Streamflow, CFS
1950-01	0.50		1.00	
1950-02	1.50		2.00	
1950-03			3.50	
1950-04	3.50		4.00	
1950-05	4.50		5.00	
1950-06	5.50		6.00	
1950-07	6.50		7.00	
1950-08	7.50		8.00	
1950-09	8.50		9.00	
1950-10	9.50		10.00	
1950-11	10.50		11.00	
1950-12	11.50		12.00	
1951-01	1.50	1.50	1.00	2.00
1951-02	2.50	3.50	2.00	4.00
1951-03	3.50		3.50	6.50
1951-04	4.50	7.50	4.00	8.00
1951-05	5.50	9.50	5.00	10.00
1951-06	6.50	11.50	6.00	12.00
1951-07	7.50	13.50	7.00	14.00
1951-08	8.50	15.50	8.00	16.00
1951-09	9.50	17.50	9.00	18.00
1951-10	10.50	19.50	10.00	20.00
1951-11	11.50	21.50	11.00	22.00
1951-12	12.50	23.50	12.00	24.00
1952-01		2.50		2.00
1952-02		4.50		4.00
1952-03		6.50		6.50
1952-04		8.50		8.00
1952-05		10.50		10.00
1952-06		12.50		12.00
1952-07		14.50		14.00
1952-08		16.50		16.00
1952-09		18.50		18.00
1952-10		20.50		20.00
1952-11		22.50		22.00
1952-12		24.50		24.00

Graph Summary Save Close

Currently-selected worksheet interval: Month

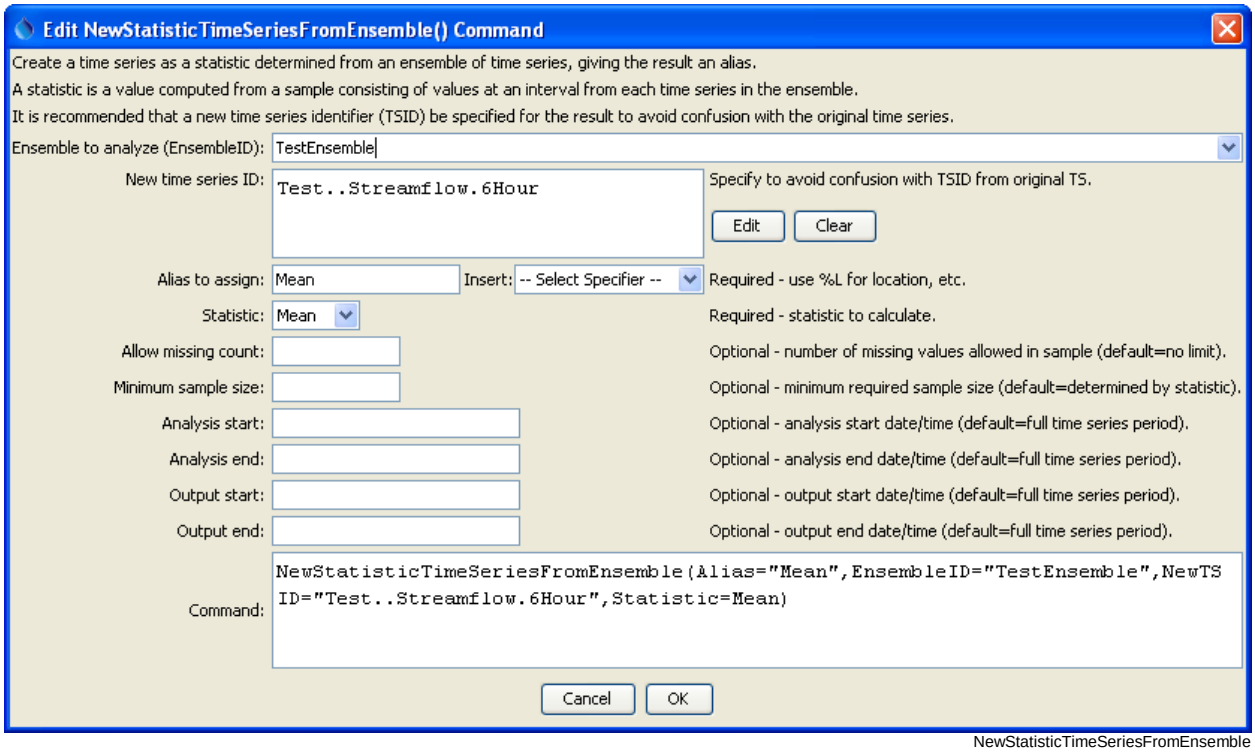
Command Reference: NewStatisticTimeSeriesFromEnsemble()

Create a time series containing a statistic determined from a time series ensemble

Version 10.18.00, 2013-02-21

The `NewStatisticTimeSeriesFromEnsemble()` command uses data from time series in an ensemble to calculate a statistic for each interval in the ensemble, and assigns the statistic value to the corresponding interval in the result. For example, for a statistic of `Mean` applied to a daily time series, all January 1, 1970 values will be used for the sample and the mean value will be assigned to January 1, 1970 in the output time series. Leap year values will be included if they are included in the period of the ensemble.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewStatisticTimeSeriesFromEnsemble

NewStatisticTimeSeriesFromEnsemble() Command Editor

The command syntax is as follows:

```
NewStatisticTimeSeriesFromEnsemble(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewStatisticTimeSeriesFromEnsemble(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
EnsembleID	The identifier for the ensemble to analyze.	None – must be specified.
NewTSID	The time series identifier to be assigned to the new time series, which is useful to avoid confusion with the original time series. **This parameter may be required in the future.**	None – use the same identifier as the original time series.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
Statistic	The statistic to compute. See the **Available Statistics** table below.	None – must be specified.
AllowMissingCount	The number of missing values allowed in the sample of values in order to produce a result. This capability should be used with care because it may result in data that are not representative of actual conditions.	Missing values are ignored in the sample used to compute the statistic.
MinimumSampleSize	The minimum number of values in the sample that are required to compute the statistic.	Use the sample with no restrictions, although some statistics may have requirements.
AnalysisStart	The date/time for the analysis start, using a precision that matches the original time series.	Analyze the full period.
AnalysisEnd	The date/time for the analysis start, using a precision that matches the original time series.	Analyze the full period.
OutputStart	The date/time for the output start, using a precision that matches the original time series. An output period longer than the analysis period will result in missing values in output.	Output the full period.
OutputEnd	The date/time for the output start, using a precision that matches the original time series. An output period longer than the analysis period will result in missing values in output.	Output the full period.

Available Statistics

Statistic	Description	Limitations
ExceedanceProbability10	The data value corresponding to a 10% chance of value being exceeded.	Small sample size will skew – see statistic details.
ExceedanceProbability30	The data value corresponding to a 30% chance of value being exceeded.	Small sample size will skew – see statistic details.
ExceedanceProbability50	The data value corresponding to a 50% chance of value being exceeded.	Small sample size will skew – see statistic details.
ExceedanceProbability70	The data value corresponding to a 70% chance of value being exceeded.	Small sample size will skew – see statistic details.
Exceedance	The data value corresponding to a 90%	Small sample size will skew –

Statistic	Description	Limitations
Probability90	chance of value being exceeded.	see statistic details.
GeometricMean	Geometric mean of all values in the sample.	All values must be >= 0.
Max	Maximum of all values in the sample.	None.
Mean	Arithmetic mean of all values in the sample.	None.
Median	Median of all values in the sample.	None.
Min	Minimum of all values in the sample.	None.
Missing Count	The count of values that are missing.	This statistic will be computed regardless of AllowMissingCount and MinimumSampleSize.
Missing Percent	The percent of values that are missing.	See above.
Nonmissing Count	The count of values that are not missing.	See above.
Nonmissing Percent	The percent of values that are not missing.	See above.
Total	Total of values in the sample.	None.

Statistic Details

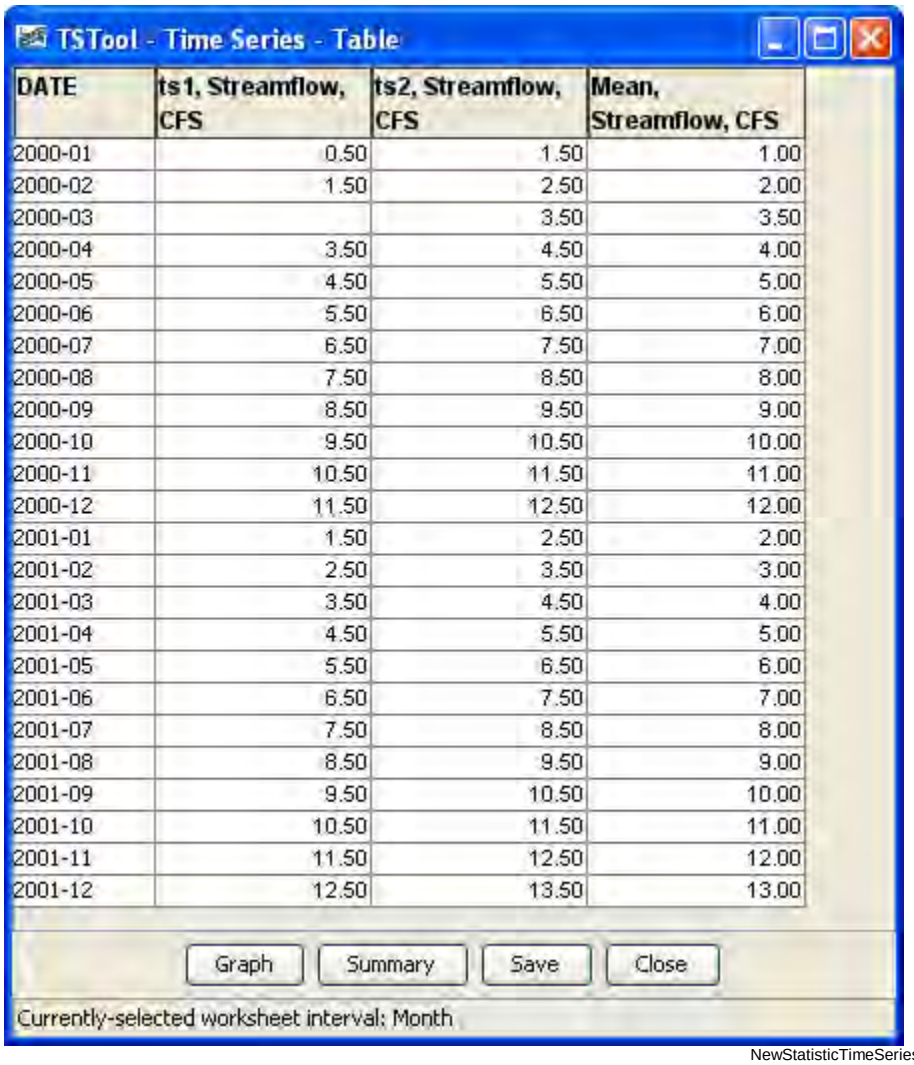
Statistic	Description
Exceedance Probability*	The statistic for each time step in the analysis period is computed as follows: 1. The data values are extracted for each trace with missing values being ignored. The sample size is *n*. 2. The data values are sorted into ascending order. 3. Exceedance probabilities are computed for the number of sample values according to Weibull plotting positions as follows (for $i=1,\ldots,n$): a. If $n = 1$, the exceedance probability $P_i=1.0$. This is an extreme case due to small sample size. b. Otherwise, $P_i=(n-(i-1))/(n+1)$. Therefore, when $i=1$, $P_i=n/(n+1)$ and when $i=n$, $P_i=1/(n+1)$. The probabilities will be listed from high to low value (the opposite order of the sorted data values). 4. The data value corresponding to the requested probability is calculated by iterating over the probabilities until the calculated probability for a value is less than the requested probability: a. If the first probability satisfies the condition, the computed value is set to the minimum value in the sample (no extrapolating past the end). b. Otherwise, the value is interpolated from the previous and current sample values. If no calculated probability is less than the requested probability, the computed value is set to the maximum value in the sample (no extrapolating past the end). To create an exceedance probability plot, use several commands with different exceedance probability levels (listed low to high). Graphing the time series in a bar graph with BarOverlap=True will draw the bars on top of each other to give the desired appearance. The edges of the colors will represent the specific exceedance probabilities and the colored areas will represent ranges of exceedance probabilities.

Examples

The following example command file illustrates how to compute the mean statistic for one monthly data:

```
# Test computing a statistic time series for Month data where Statistic=Mean
StartLog(LogFile="Results/Test_NewStatisticTimeSeriesFromEnsemble_Month_Mean.TSTool.log")
# Define 2 years of data that when averaged equal even numbers
# The 2nd time series is shifted by 1 from the first.
# Include missing values in the first time series but not the second.
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Streamflow.Month",
    Description="test data 1",SetStart="2000-01",SetEnd="2001-12",Units="CFS",
    PatternValues=".5,1.5,,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,
    1.5,2.5,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,12.5")
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..Streamflow.Month",
    Description="test data 2",SetStart="2000-01",SetEnd="2001-12",Units="CFS",
    PatternValues="1.5,2.5,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,12.5,
    2.5,3.5,4.5,5.5,6.5,7.5,8.5,9.5,10.5,11.5,12.5,13.5")
# Create an ensemble to hold the above time series
NewEnsemble(TSList=AllTS,NewEnsembleID="TestEnsemble",NewEnsembleName="Test Ensemble")
# Compute the statistic
NewStatisticTimeSeriesFromEnsemble(Alias="Mean",EnsembleID="TestEnsemble",
    NewTSID="Test..Streamflow.Month.Mean",Statistic=Mean)
```

The following figure illustrates the results:



DATE	ts1, Streamflow, CFS	ts2, Streamflow, CFS	Mean, Streamflow, CFS
2000-01	0.50	1.50	1.00
2000-02	1.50	2.50	2.00
2000-03		3.50	3.50
2000-04	3.50	4.50	4.00
2000-05	4.50	5.50	5.00
2000-06	5.50	6.50	6.00
2000-07	6.50	7.50	7.00
2000-08	7.50	8.50	8.00
2000-09	8.50	9.50	9.00
2000-10	9.50	10.50	10.00
2000-11	10.50	11.50	11.00
2000-12	11.50	12.50	12.00
2001-01	1.50	2.50	2.00
2001-02	2.50	3.50	3.00
2001-03	3.50	4.50	4.00
2001-04	4.50	5.50	5.00
2001-05	5.50	6.50	6.00
2001-06	6.50	7.50	7.00
2001-07	7.50	8.50	8.00
2001-08	8.50	9.50	9.00
2001-09	9.50	10.50	10.00
2001-10	10.50	11.50	11.00
2001-11	11.50	12.50	12.00
2001-12	12.50	13.50	13.00

NewStatisticTimeSeriesFromEnsemble_Table

NewStatisticTimeSeriesFromEnsemble() Command Results

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Command Reference: NewStatisticYearTS()

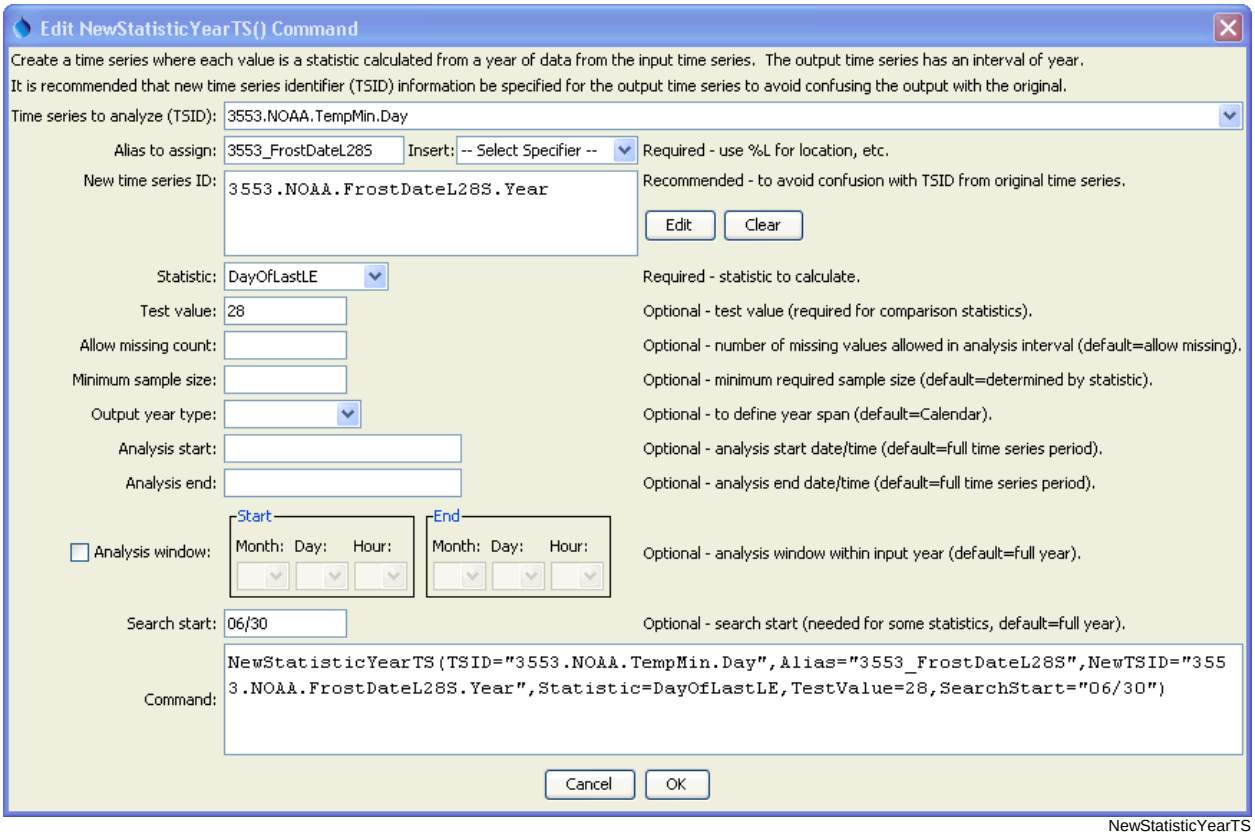
Create a new yearly time series containing a statistic determined from each year of the input time series

Version 10.12.00, 2012-07-16

The `NewStatisticYearTS()` command creates a new yearly time series, where each yearly value in the resulting time series contains a statistic determined from the sample of points from the corresponding year in the original time series. For example, if the original time series has a daily time step, then the sample that is analyzed will contain 365 or 366 values (depending on leap year). Calendar years are used by default; however, the `OutputYearType` parameter can be used to specify that different year types are analyzed. Other commands (e.g., `ChangeInterval()`) can produce a similar result for a limited number of statistics, for example converting a monthly time series to an annual total or mean. See also the `NewStatisticTimeSeries()`, `NewStatisticTimeSeriesFromEnsemble()`, `CalculateTimeSeriesStatistic()`, and `CheckTimeSeries()` commands.

For hourly and finer interval, values are considered to be in a year when the year in the date/time matches the year of interested. This may lead to some issues if the last value in a year is actually recorded at hour 0 or later of the following year.

The following dialog is used to edit the command and illustrates the syntax for the command.



NewStatisticYearTS

NewStatisticYearTS() Command Editor

The command syntax is as follows:

```
NewStatisticYearTS(Parameter=value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewStatisticYearTS (Parameter=value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier (or alias) of the time series to analyze.	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
NewTSID	The time series identifier to be assigned to the new time series, which is useful to avoid confusion with the original time series.	Use the same identifier as the original time series, with an interval of Year and a scenario matching the statistic.
Statistic	See the **Available Statistics** table below.	None – must be specified.
TestValue	A test value used when analyzing the statistic.	This parameter is required for some statistics and not used for others. See the statistics table below.
AllowMissingCount	The number of missing values allowed in the source interval(s) in order to produce a result. If an analysis window is specified (default is to analyze full years), then missing values outside of the analysis window are not considered as missing. Gaps at the end of the time series will be considered missing if within the analysis window.	Allow any number of missing values.
MinimumSampleSize	The minimum sample size in order to compute the statistic.	No minimum, although the statistic may have requirements.
OutputYearType	The output year type. For example, an output year type of NovToOct spans November of the previous calendar year to October of the current calendar year. All other parameters should still be specified in calendar year and the AnalysisWindowStart can have a month that is prior to the AnalysisWindowEnd month.	Calendar
AnalysisStart	The starting date/time for the analysis using calendar dates (e.g., 2001-01-01), with precision consistent with	Analyze the full period, extending the

Parameter	Description	Default
	the time series interval. This will limit the data being analyzed at the ends of the time series and controls the length of the output time series. The analysis period is typically set to align with years consistent with the output year type.	period to include full years.
AnalysisEnd	The ending date/time for the analysis using calendar dates (e.g., 2001-01-01) , with precision consistent with the time series interval. This will limit the data being analyzed at the ends of the time series and controls the length of the output time series. The analysis period is typically set to align with years consistent with the output year type.	Analyze the full period, extending the period to include full years.
Analysis WindowStart	The calendar date/time for the analysis start within each year. Specify using the format MM, MM-DD, MM-DD hh, or MM-DD hh:mm, consistent with the time series interval precision. A year of 2000 will be used internally to parse the date/time. Use this parameter to limit data processing within the year, for example to analyze only a season. Data will be considered missing only if missing within this analysis window. If specifying for other than calendar year, the analysis window start month may be greater than the analysis window end month.	Analyze the full year.
Analysis WindowEnd	Specify date/time for the analysis end within each year. See AnalysisWindowStart for details.	Analyze the full year.
SearchStart	Within the analysis window, this indicates the starting date/time for the search. Specify using the format MM, MM-DD, MM-DD hh, or MM-DD hh:mm, consistent with the time series interval precision. A year of 2000 will be used internally to parse the date/time. This parameter is useful in cases where the processing considers seasonal aspects of the analysis window; for example, use when determining frost dates (when temperature is less than or equal to freezing) to ensure that the search starts from the middle of the normal growing season. Searches move forward in time except for the following statistics, in which case SearchStart will be the start of the search window, but will be the last value checked: DayOfLast*, MonthOfLast*.	Use the analysis window start and end. Search forward for most statistics. Search backward for DayOfLast* and MonthOfLast* statistics.

Available Statistics

The following statistics are computed from a sample determined using the analysis window. If no analysis window is specified, then the default is to analyze complete years, where the years correspond to the OutputYearType. For example, for OutputYearType=NovToDec, November 1, 2000 to October 31, 2001 from the input corresponds to output year 2001.

Statistic	Description	Limitations
DayOfCentroid	The day of the year (1-366) that is the centroid	Input time series must be

Statistic	Description	Limitations
	of the values, computed as sum(DayOfYear*value)/sum(values).	daily or smaller interval.
DayOfFirstGE	Julian day of the year (1-366, relative to the start of the OutputYearType) for the first data value >= TestValue. Searches start at the start of the analysis window and move forward.	Input time series must be daily or smaller interval.
DayOfFirstGT	Similar to DayOfFirstGE, for values > TestValue.	Input time series must be daily or smaller interval.
DayOfFirstLE	Similar to DayOfFirstGE, for values <= TestValue.	Input time series must be daily or smaller interval.
DayOfFirstLT	Similar to DayOfFirstGE, for values < TestValue.	Input time series must be daily or smaller interval.
DayOfLastGE	Julian day of the year (1-366, relative to the start of the OutputYearType) for the last data value >= TestValue. Searches start at the start of the analysis window and move backward.	Input time series must be daily or smaller interval.
DayOfLastGT	Similar to DayOfLastGE, for values > TestValue.	Input time series must be daily or smaller interval.
DayOfLastLE	Similar to DayOfLastGE, for values <= TestValue.	Input time series must be daily or smaller interval.
DayOfLastLT	Similar to DayOfLastGE, for values < TestValue.	Input time series must be daily or smaller interval.
DayOfMax	Julian day of the year (1-366, relative to the start of the OutputYearType) for the first maximum value in the time series.	Input time series must be daily or smaller interval.
DayOfMin	Julian day of the year (1-366, relative to the start of the OutputYearType) for the first minimum value in the time series.	Input time series must be daily or smaller interval.
GECount	Count of values in a year >= TestValue.	
GEPercent	Percent of values in a year >= TestValue, based on the total number of points in the year.	
GTCount	Count of values in a year > TestValue.	
GTPercent	Percent of values in a year > TestValue, based on the total number of points in the year.	
LECount	Count of values in a year <= TestValue.	
LEPercent	Percent of values in a year <= TestValue, based on the total number of points in the year.	
LTCount	Count of values in a year < TestValue.	
LTPercent	Percent of values in a year < TestValue, based on the total number of points in the year.	
Max	Maximum value in a year.	
Mean	Mean of values in a year.	
Min	Minimum value in a year.	
MissingCount	Number of missing values in a year.	
MissingPercent	Percent of missing values in a year.	

Statistic	Description	Limitations
MonthOfCentroid	The month of the year (1-12) that is the centroid of the values, computed as sum(MonthOfYear*value)/sum(values).	Input time series must be monthly or smaller interval.
MonthOfFirstGE	Month the year (1-12, relative to the start of the OutputYearType) for the first data value >= TestValue. Searches start at the start of the analysis window and move forward.	Input time series must be monthly or smaller interval.
MonthOfFirstGT	Similar to DayOfFirstGE, for values > TestValue.	Input time series must be monthly or smaller interval.
MonthOfFirstLE	Similar to DayOfFirstGE, for values <= TestValue.	Input time series must be monthly or smaller interval.
MonthOfFirstLT	Similar to DayOfFirstGE, for values < TestValue.	Input time series must be monthly or smaller interval.
MonthOfLastGE	Month of the year (1-12, relative to the start of the OutputYearType) for the last data value >= TestValue. Searches start at the end of the analysis window and move backward.	Input time series must be monthly or smaller interval.
MonthOfLastGT	Similar to DayOfLastGE, for values > TestValue.	Input time series must be monthly or smaller interval.
MonthOfLastLE	Similar to DayOfLastGE, for values <= TestValue.	Input time series must be monthly or smaller interval.
MonthOfLastLT	Similar to DayOfLastGE, for values < TestValue.	Input time series must be monthly or smaller interval.
MonthOfMax	Month of the year (1-12, relative to the start of the OutputYearType) for the first maximum value in the time series.	Input time series must be monthly or smaller interval.
MonthOfMin	Month of the year (1-12, relative to the start of the OutputYearType) for the first minimum value in the time series.	Input time series must be monthly or smaller interval.
NonMissingCount	Number of non-missing values in a year.	
NonMissingPercent	Percent of non-missing values in a year.	
Total	Total of values in a year.	

Example

The following example commands file computes the last spring frost date for 28 degrees and 32 degrees, searching backwards from June 30 each year, and the first fall frost date for 32 and 28 degrees, searching forwards from July 1 each year:

```
StartLog(LogFile="FrostDates_HydroBase.log")
SetOutputPeriod(OutputStart="1950-01",OutputEnd="2004-12")
# 3553 - GREELEY UNC
3553.NOAA.TempMin.Day~HydroBase
NewStatisticYearTS(TSID="3553.NOAA.TempMin.Day",Alias=”3553_FrostDateL28S”,
  NewTSID="3553.NOAA.FrostDateL28S.Year",
  Statistic=DayOfLastLE,TestValue=28,SearchStart="06/30")
NewStatisticYearTS(TSID="3553.NOAA.TempMin.Day",Alias=” FrostDateL32S”,
  NewTSID="3553.NOAA.FrostDateL32S.Year",
  Statistic=DayOfLastLE,TestValue=32,SearchStart="06/30")
NewStatisticYearTS(TSID="3553.NOAA.TempMin.Day",Alias=”3553_FrostDateF32F”,
  NewTSID="3553.NOAA.FrostDateF32F.Year",
  Statistic=DayOfFirstLE,TestValue=32,SearchStart="07/01")
NewStatisticYearTS(TSID="3553.NOAA.TempMin.Day",Alias=”3553_FrostDateF28F”,
  NewTSID="3553.NOAA.FrostDateF28F.Year",
  Statistic=DayOfFirstLE,TestValue=28,SearchStart="07/01")
Free(TSID="*.*.TempMin.*")
WriteStateCU(OutputFile="Results/Test.FrostDates")
```

Command Reference: NewTable ()

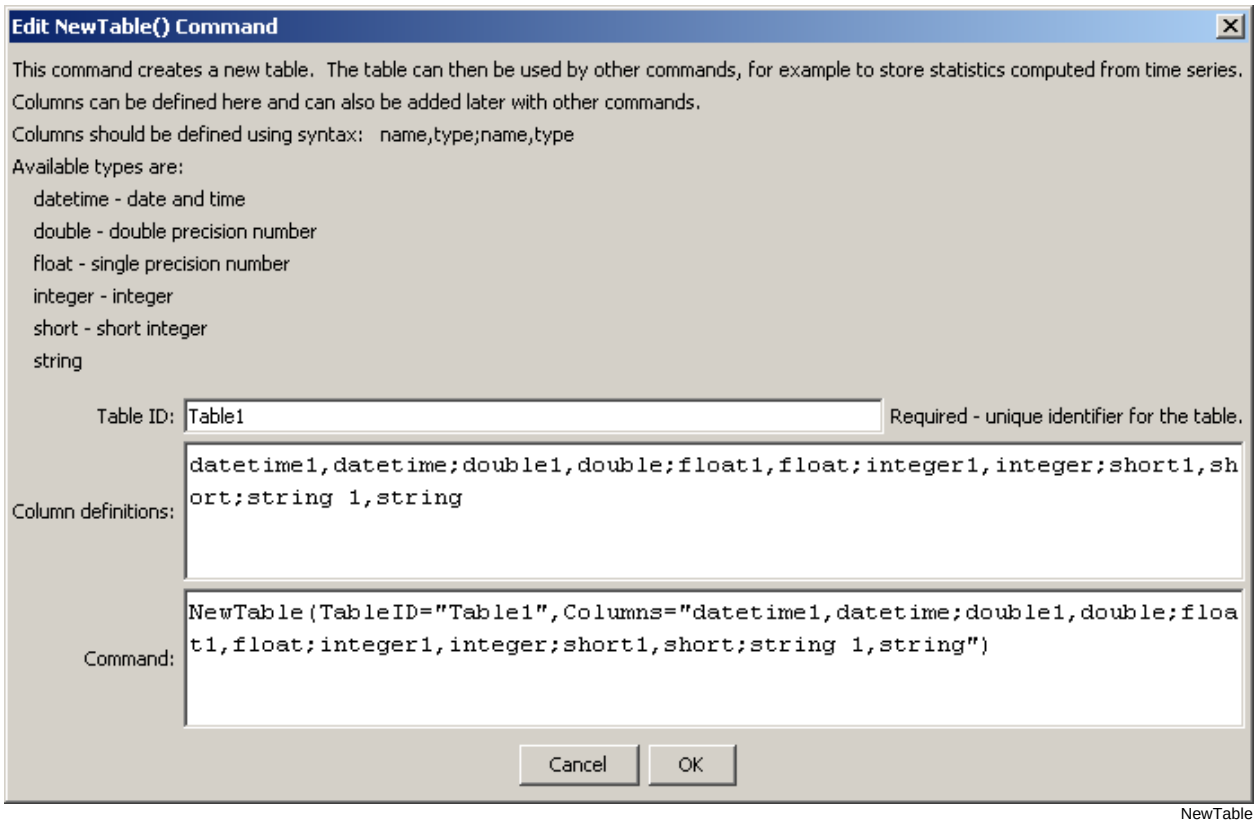
Create a new table

Version 09.04.02, 2009-07-28

The `NewTable()` command creates a table with named columns, each of which is a specified data type. Tables are used to hold information about data objects, such as statistics for time series. Commands like `CalculateTimeSeriesStatistic()` can add information to tables. Tables can be written as final data products or artifacts of processing. Characteristics of the table are as follows:

- Each column can only contain a single data type
- The default precision for numbers for display and output is 2 digits after the decimal – additional formatting features may be available in write commands and may be added later
- Tables are referenced using the `TableID`
- Cells in tables are referenced using the column name and cell values that identify rows (such as time series identifiers)

The following dialog is used to edit the command and illustrates the syntax for the command.



NewTable

NewTable () Command Editor

The command syntax is as follows:

```
NewTable (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier for the table – should be unique among tables that are defined.	None – must be specified.
`Columns`	The column names and data types are defined using the format `ColumnName,DataType; ColumnName,DataType`. Column names can contain spaces; however, simple short names are generally handled better by display features and minimize errors in referencing the columns. Data types are specified using the following strings: • `datetime` – date and time • `double` – double precision number • `float` – single precision number • `integer` – integer (-2147483648 to 2147483647) • `short` – short integer (-32768 to 32767) • `string` – Unicode string	No columns will be defined.

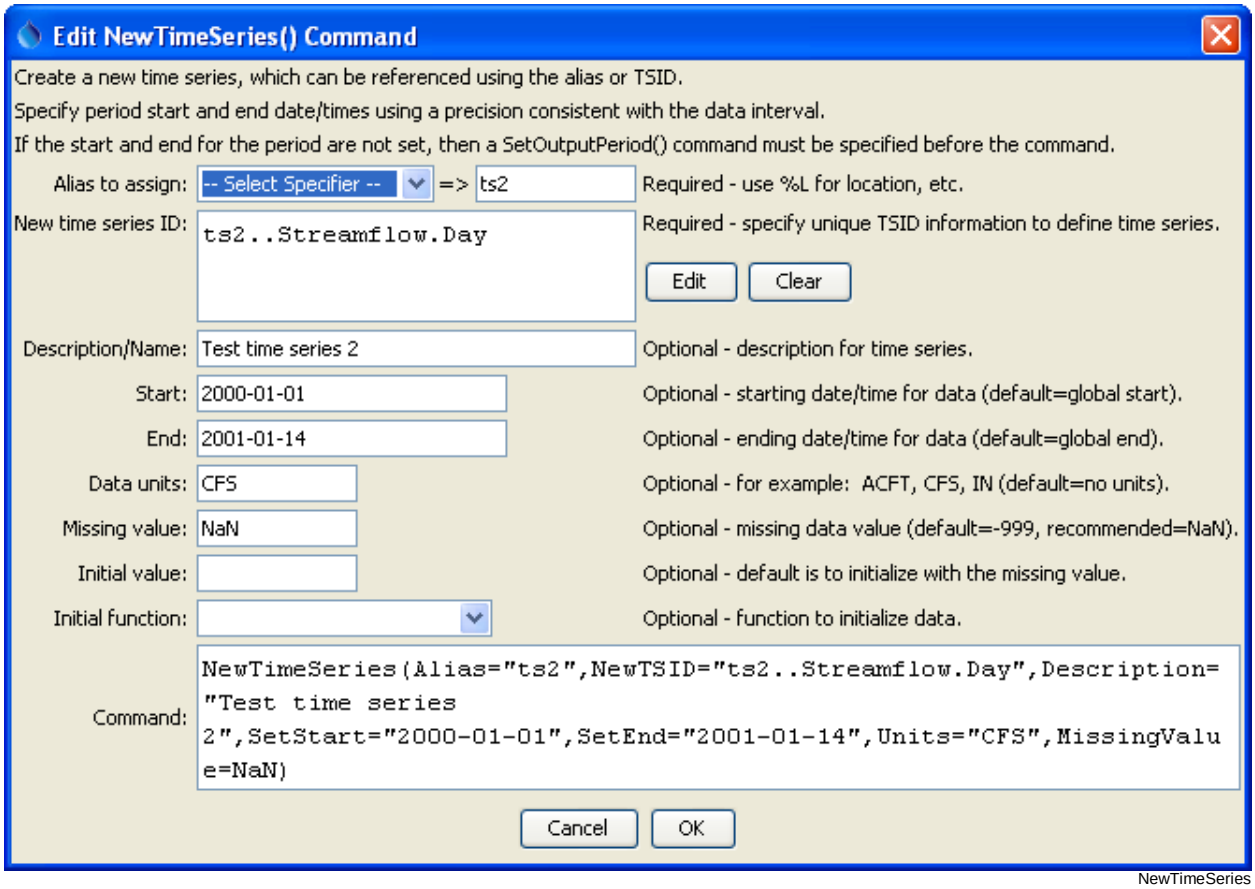
Command Reference: NewTimeSeries()

Create a new time series

Version 10.21.00, 2013-06-10

The `NewTimeSeries()` command creates a new time series and assigns it an alias. This time series then can be manipulated with other commands. The command is useful, for example, to create a new time series to receive the results of a series of manipulations, rather than having the results accumulate in the first time series. See also the `NewPatternTimeSeries()`command, which initializes a time series with a repeating pattern of values. Subsequent manipulation of the time series may require use of the `SetTimeSeriesProperty()` and other commands to ensure that the new time series properties are as desired.

The following dialog is used to edit the command and illustrates the syntax for the command. The new time series identifier, which provides critical information including the data interval, is edited by pressing the ***Edit*** button.



NewTimeSeries

NewTimeSeries() Command Editor

The command syntax is as follows:

```
NewTimeSeries(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = NewTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
NewTSID	The time series identifier of the new time series. The editor dialog formats the identifier from its parts.	None – must be specified with at least minimal information (location, data type, and interval).
Description	The description for the time series, used in output.	Blank.
SetStart	The start of the time series data period.	Use the start from SetOutputPeriod().
SetEnd	The end of the time series data period.	Use the end from SetOutputPeriod().
Units	Data units for the time series.	Blank.
MissingValue	Value for missing data values. -999 is the default for historical reasons; however, NaN (not a number) is being phased in and should be specified if possible.	-999
InitialValue	The value to initialize the time series.	Initialize the time series to missing data.
InitialFunction	The function to use to initialize time series data values. This parameter can be used to generate data for testing to simplify visual inspection of results. • DATE_YYYY – 4-digit year • DATE_YYYYMM – and month • DATE_YYYYMMDD – year, month, and day • DATE_YYYYMMDD_hh – year, month, and day, with decimal as hour • DATE_YYYYMMDD_hhmm – year, month, and day, with decimal as hour and minute • RANDOM_0_1 – random number >= 0 and < 1 • RANDOM_0_1000 – random number >= 0 and < 1000	Initialize the time series to missing data.

The example command file shown below creates a new time series and initializes it to a constant of 20 CFS. Uncommenting the first command would allow the SetStart and SetEnd parameters to be removed from the NewTimeSeries() command. The interval (Month below) must match a recognized type but the other parts of the identifier such as data type are user-defined.

```
#SetOutputPeriod(OutputStart="1950-01",OutputEnd="2002-12")
NewTimeSeries(Alias="station1",NewTSID="Station1.MyModel.Streamflow.Month",
  Description="Example Description",SetStart="1950-01",
  SetEnd="2002-12",Units="CFS",InitialValue=20)
```

Command Reference: NewTreeView()

Create a new tree view using a definition file

Version 09.07.00, 2010-07-20

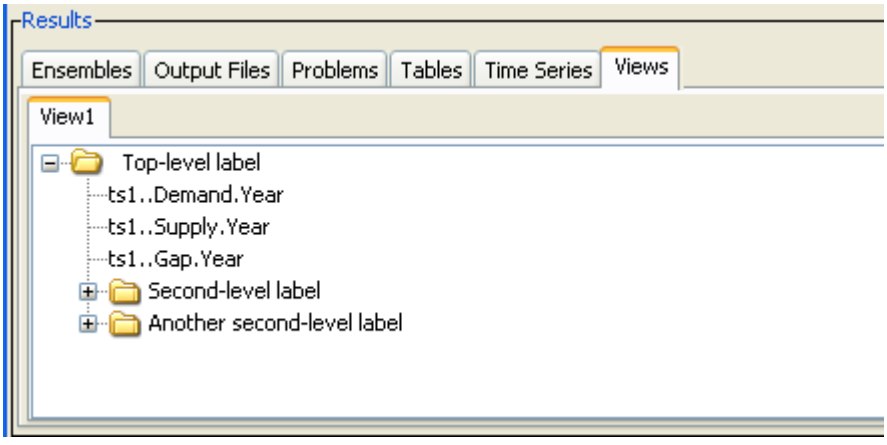
The `NewTreeView()` command creates a tree view, which is a hierarchical listing of time series. The resulting view is dispayed in the ***Views*** section of the TSTool ***Results*** area and provides interactive access to data. The view is defined using a simple text file, as shown in the following example:

```
# Test data for displaying a tree view of time series results
Label:  Top-level label
      TS:  ts1*
      Label:  Second-level label
            TS:  ts2*
      Label:  Another second-level label
            TS:  ts3*
```

Tree view definition files have the following characteristics:

- Comments are indicated by lines starting with #.
- Indentations indicate the level (branch) in the tree:
  - Use the tab character to indicate indentation
  - The indentation on one row cannot be more than 1 greater than the previous row
- The content for the tree is indicated by keywords:
  - `Label`: indicates that the string following the colon will be used to label a branch.
    - A single top-level label is required
  - `TS`: indicates that a time series identifier pattern will be used to identify time series in the tree. Wildcard conventions follow rules consistent with the `TSList=AllMatchingTSID`, `TSID=`… command parameters.

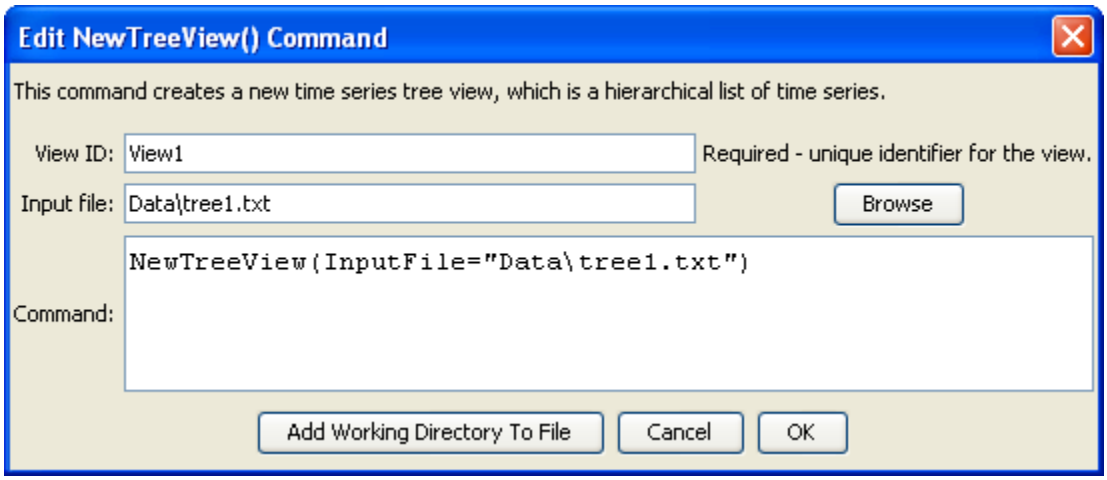
The following figure illustrates the resulting view that is displayed in TSTool for the above example, using contrived data. The time series in the tree view can be selected and a pop-up menu can be used to generate graphs. Consequently, the view allows the results of processing to be presented in a way that is more customized than a simple list. It is envisioned that additional functionality will be implemented, for example to output the view as HTML with navigation links.



NewTreeView_Results

Example of Tree View in TSTool Results

The following dialog is used to edit the command and illustrates the syntax of the command.



NewTreeView

NewTreeView() Command Editor

The command syntax is as follows:

```
NewTreeView(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`ViewID`	Identifier to assign to the view, which allows the view to be used with other commands.	None – must be specified.
`InputFile`	The name of the view definition file to read, as an absolute path or relative to the command file location.	None – must be specified.

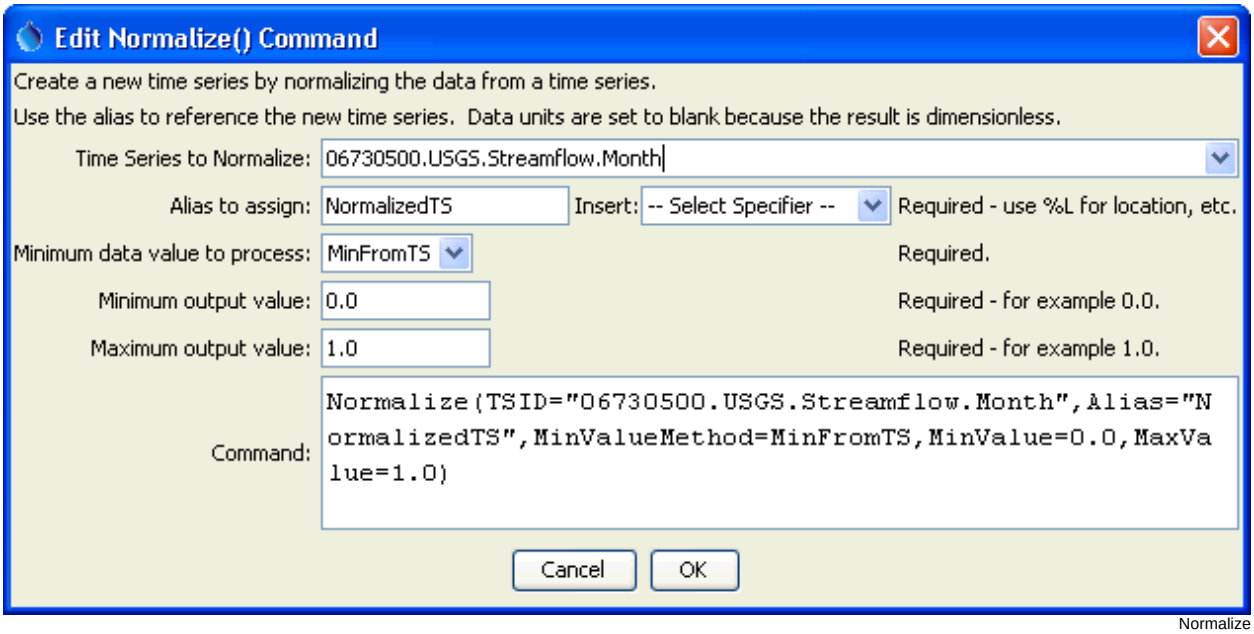
Command Reference: Normalize()

Create a normalized time series

Version 10.00.01, 2011-05-15

The `Normalize()` command creates a new normalized time series from an existing time series, assigning an alias to the result. Normalized time series are useful for analyzing trends and relationships and for allowing time series with different units to be plotted or analyzed together. For example, the range of data values can be normalized to the range 0 to 1. The alias that is assigned to the time series can be referenced by other commands.

The following dialog is used to edit the command and illustrates the syntax of the command.



Normalize

Normalize() Command Editor

The command syntax is as follows:

```
Normalize(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = Normalize(Parameter=Value,…)
```

Command Parameters

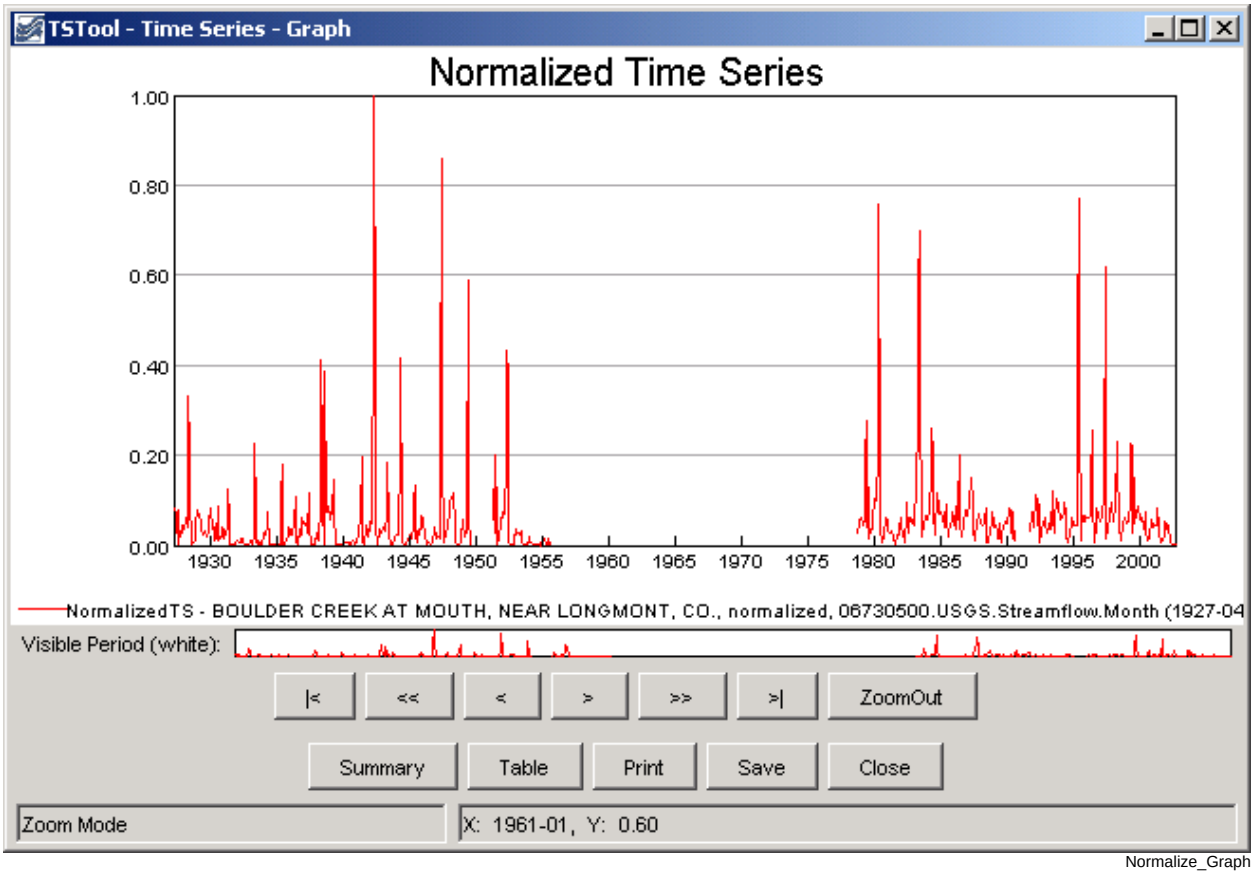
Parameter	Description	Default
`TSID`	The time series identifier or alias for the time series to be normalized.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as	None – must be specified.

Parameter	Description	Default
	an alternative to the time series identifier (TSID).	
`MinValue Method`	Indicates how to determine the minimum data value to process, one of: • `MinFromTS` – get the minimum value from the time series (typical) • `MinZero` – use zero (e.g., if negative values are to be ignored)	None – must be specified.
`MinValue`	The minimum normalized value (e.g., 0).	None – must be specified.
`MaxValue`	The maximum normalized value (e.g., 1).	None – must be specified.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 06730500 - BOULDER CREEK AT MOUTH, NEAR LONGMONT, CO.
06730500.USGS.Streamflow.Month~HydroBase
Normalize(TSID="06730500.USGS.Streamflow.Month",Alias="NormalizedTS",
  MinValueMethod=MinFromTS,MinValue=0.0,MaxValue=1.0)
```

The results are as follows:



Normalize_Graph

Results of Normalize() Command

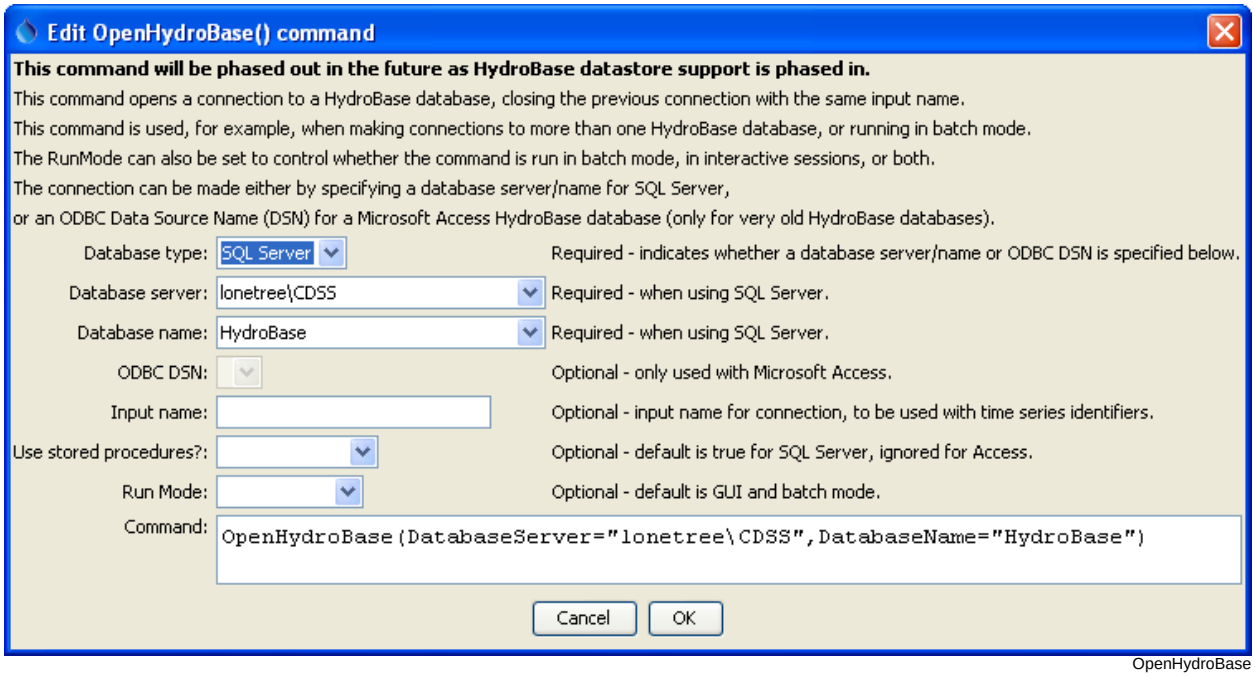
Command Reference: OpenHydroBase()

Open a connection to a HydroBase database

Version 10.13.00, 2012-09-13

This command will be phased out in the future. Instead, define HydroBase datastores (see the **HydroBase Datastore** appendix), where the datastore name is equivalent to the `InputName` parameter. The `OpenHydroBase()` command opens a connection to a HydroBase database, allowing data to be read from the database (e.g., with `ReadHydroBase()` commands and time series identifiers that have `~HydroBase` input types). This command is not typically used for interactive sessions but may be inserted to run in batch only mode to allow a specific database and commands files to be distributed. It may also be used in cases where time series are read from different HydroBase databases, perhaps to compare the contents of the databases – in this case two `OpenHydroBase()` commands would be used. When connecting to a SQL Server database, a connection will be tried for SQL Server (Express) and older MSDE databases. If both fail, a warning will be shown.

The following dialog is used to edit this command and illustrates the command syntax. The ***Database type*** is used to control settings for parameters and is not itself a parameter.



OpenHydroBase

OpenHydroBase() Command Editor

The command syntax is as follows:

```
OpenHydroBase(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Database Server`	Used with a SQL Server HydroBase. Specify the SQL Server database machine name. A list of choices will be shown, corresponding to properties in the *CDSS.cfg*	Required if a SQL Server database is used.

	configuration file. The generic value `DatabaseServer=local` will automatically be translated to the name of the local computer.	
`Database Name`	Used with a SQL Server HydroBase. The name of the database typically follows a pattern similar to: `HydroBase_CO_YYYYMMDD`. A list of choices will be shown, corresponding to properties in the *CDSS.cfg* configuration file.	`HydroBase`
`OdbcDsn`	The ODBC DSN to use for the connection, used only when working with a Microsoft Access database.	Required if a Microsoft Access database is used.
`InputName`	The input name corresponding to the `~InputType~InputName` information in time series identifiers. This is used when more than one HydroBase connection is used in the same commands file.	Blank (no input name).
`UseStored Procedures`	Used with SQL Server, indicating whether stored procedures are used. Stored procedures are the default and should be used except when testing software.	`True` (used stored procedures).
`RunMode`	Indicates when the command should be run, one of: • `BatchOnly` – run the command only in batch mode. • `GUIOnly` – run the command only in GUI mode. • `GUIAndBatch` – run the command in batch and GUI mode.	`GUIAndBatch`

The following example command file illustrates how to connect to a SQL Server database running on a machine named "sopris":

```
StartLog(LogFile="Results/Example_OpenHydroBase_DatabaseName.TSTool.log")
OpenHydroBase(DatabaseServer="sopris",DatabaseName="HydroBase_CO_20060816")
ReadHydroBase(TSID="BOXHUDCO.DWR.Streamflow.Month",Alias="ts")
```

Example_OpenHydroBase_DatabaseName

The following example command file illustrates how to make two HydroBase database connections, in this case to test whether the stored procedure and SQL queries return the same results (the `InputName` parameter is used to tell TSTool which connection to use when reading data based on time series identifiers):

```
OpenHydroBase(DatabaseServer="hbserver",RunMode=GUIAndBatch,
  UseStoredProcedures=True,InputName="SP")
OpenHydroBase(DatabaseServer="hbserver",RunMode=GUIAndBatch,
  UseStoredProcedures=False,InputName="NoSP")
ReadHydroBase(TSID="BOXHUDCO.DWR.Streamflow.Month~HydroBase~SP",Alias="ts_sp")
ReadHydroBase(TSID="BOXHUDCO.DWR.Streamflow.Month~HydroBase~NoSP",Alias="ts_nosp")
```

Example_OpenHydroBase_TwoConnections.TSTool

The following example commands file illustrates how to connect to a Microsoft Access database (although Microsoft Access databases are no longer supported):

```
OpenHydroBase(RunMode=GUIAndBatch,OdbcDsn="HydroBase_DIV1_20030701")
```

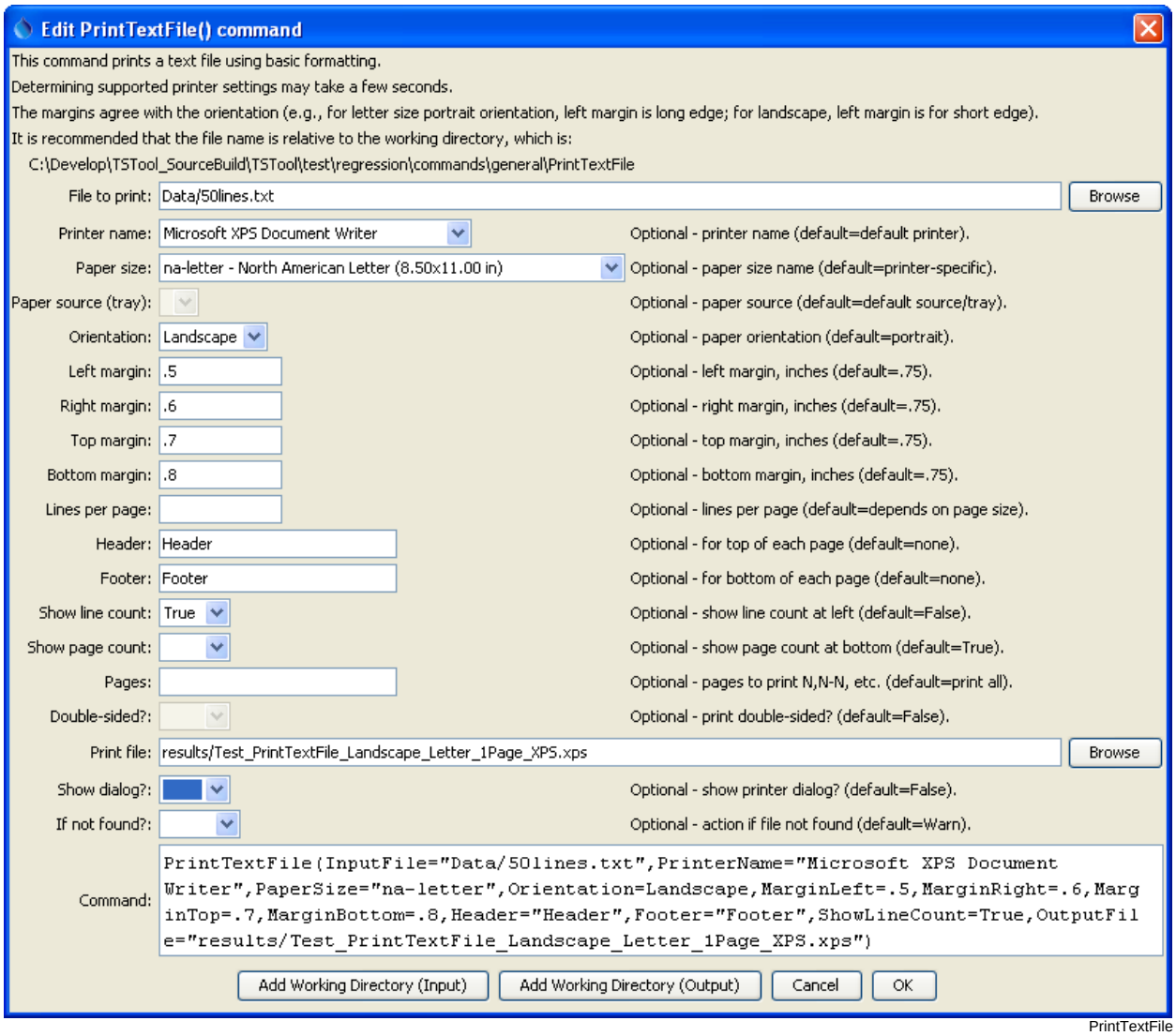
Command Reference: PrintTextFile()

Print a text file

Version 10.00.03, 2011-07-01

The `PrintTextFile()` command prints a text file to a physical or virtual (e.g., PDF file) printer. This command is used in testing to verify print features but also can be used in production to automate printing. Printing is highly dependent on the features available from a printer. The command attempts to list printer options to configure command parameters. However, some options are listed based on what a printer can do, but this may require physically changing/selecting paper trays, using manual feed, etc. The command will be enhanced in the future to specify features including tray selection but currently it is intended for use with common printer settings. If advanced settings are needed beyond the properties available in the command, use `ShowDialog=True` (displaying the dialog will pause command execution).

The following dialog is used to edit the command and illustrates the syntax for the command (in this case printing to a Microsoft XPS file).



PrintTextFile

PrintTextFile() Command Editor

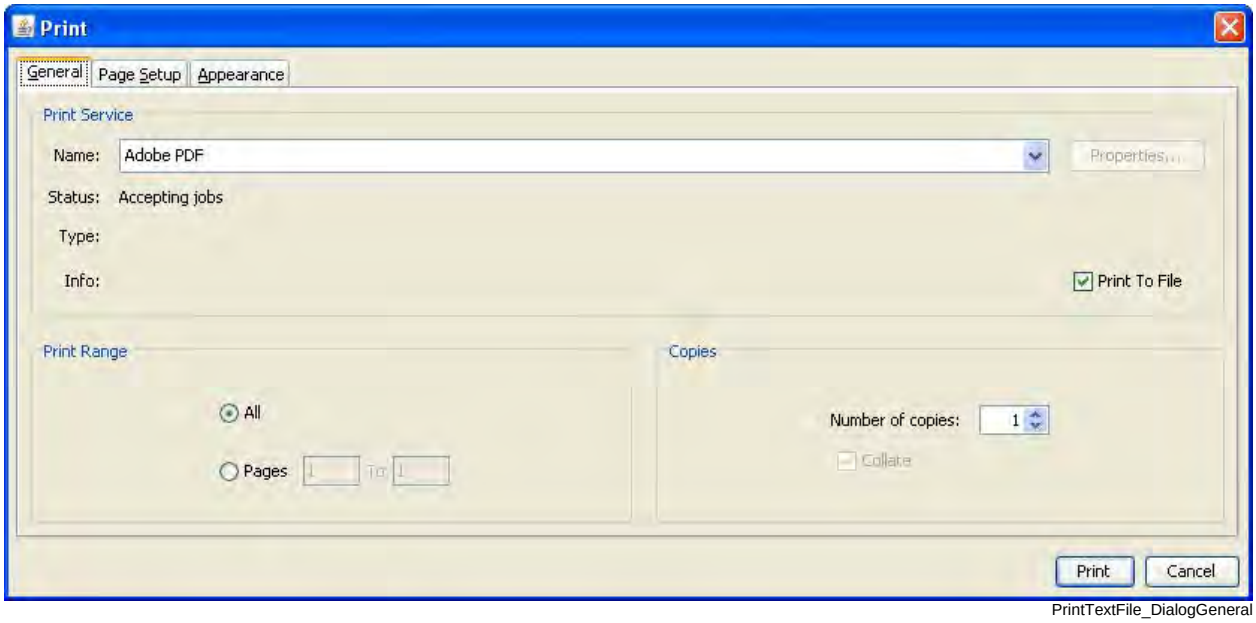
The command syntax is as follows:

```
PrintTextFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the text file to print.	None – must be specified.
`PrinterName`	The name of the printer to use (e.g., \\MyComputer\MyPrinter or Adobe PDF)	The default printer will be used.
`PaperSize`	The paper size to print. Because there are a number of standards for paper, the size is specified as standard-sizename (e.g., `na-letter` for North American Lettter). For information on paper sizes, see: http://en.wikipedia.org/wiki/Paper_size.	The default for the printer will be used.
`PaperSource`	The tray for the paper – currently not enabled. Use `ShowDialog=True` to select.	The `PaperSize` is used.
`Orientation`	The paper orientation.	The default for the printer and paper size will be used.
`MarginLeft`	The left margin for the orientation, inches.	See above.
`MarginRight`	The right margin for the orientation, inches.	See above.
`MarginTop`	The top margin for the orientation, inches.	See above.
`MarginBottom`	The bottom margin for the orientation, inches.	See above.
`LinesPerPage`	The number of lines per page to print. The font size is chosen accordingly.	An even number is chosen with font size between 7 and 12 points.
`Header`	String included in the top left of every page.	No header is shown.
`Footer`	String included in the bottom left of every page.	No footer is shown.
`ShowLineCount`	Indicate whether the line count should be shown to the left of each line.	`False`
`ShowPageCount`	Indicate whether the page count should be shown in the center of the footer.	`True`
`DoubleSided`	Indicate whether printing should be double-sided, currently not enabled. Use `ShowDialog=True` to select.	`False`
`OutputFile`	Specify an output file, in cases where the printer name corresponds to a file formatter (such as `Adobe PDF`).	Content is sent to printer device, not a file.
`ShowDialog`	Indicate whether to show the printer dialog, which allows review and editing of printer parameters. This is useful for testing and for selecting advanced printer features not handled in batch mode by this command.	`False`
`IfNotFound`	Indicate action if the file is not found, one of: • `Ignore` – ignore the missing file (do not warn). • `Warn` – generate a warning (use this if the file truly is expected and a missing file is a cause for concern). • `Fail` – generate a failure (use this if the file truly is expected and a missing file is a cause for concern).	`Ignore`

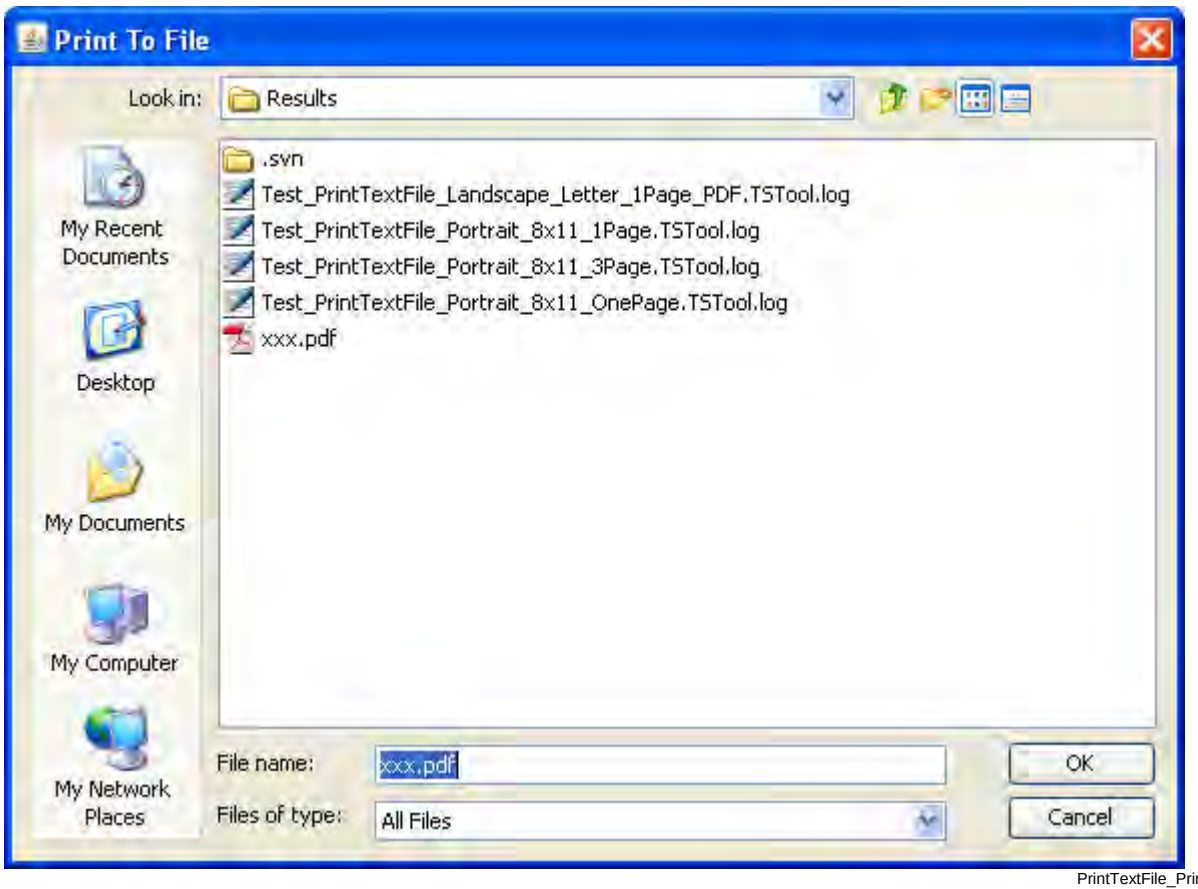
This command can be used to test print features. For example, use a printer that outputs to a PDF, XPS, or other format file rather than a physical printer. If `ShowDialog=True` and printing to a file is indicated by specifying the `OutputFile` parameter (such as with Adobe PDF), the ***General*** tab on the print dialog will be similar to the following:



PrintTextFile_DialogGeneral

Print Job Dialog General Properties

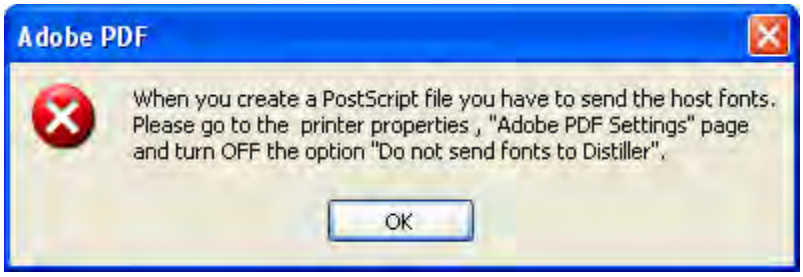
Note that ***Print to File*** is checked; however, the name of the file may not be displayed. Instead, the output file is specified by pressing ***Print***, which displays the following dialog, with the initial choice matching the value of the `OutputFile` parameter:



PrintTextFile_PrintToFile

Print To File Dialog

If running a command to write a PDF file, the following may be displayed:



PrintTextFile_DistillerFontError

Adobe PDF Error

Unfortunately, there does not seem to be any way to change the printer setting from the print dialog and consequently PDF cannot be used. An alternate approach such as iText may be implemented for PDF.

If a Microsoft XPS file is printed, the following software may need to be installed, in particular for Windows XP: http://www.microsoft.com/download/en/details.aspx?displaylang=en&id=11816

Command Reference: ProcessTSProduct()

Process a time series product file to produce output

Version 10.16.00, 2013-01-28

The `ProcessTSProduct()` command automates creation of time series data products. Products are described in time series product description (**.tsp*) files, which are typically created by using the ***Save…Time Series Product*** choice in graph windows (a future enhancements may allow creation of text products from summary or table views). See the **TSView Time Series Viewing Tools** appendix for more information about time series products. For example, the following sequence of actions can be used to define and use time series product description files:

1. Use TSTool and interactively select time series using the main window. The time series identifiers and/or aliases will be referenced in the time series product.
2. Interactively view a graph (e.g., ***Results…Graph – Line***) and edit its properties by right clicking on the graph and selecting the ***Properties*** choice (e.g., set titles and legend properties).
3. Save the graph as a time series product from the graph window using the ***Save…Time Series Product*** choice. Typically the product is saved in a location close to the command file. An example time series product file is as follows:

```
[Product]

ProductType = "Graph"

[SubProduct 1]

GraphType = "Line"
MainTitleString = "Streamflow (Monthly Total)"

[Data 1.1]

TSID = "08223000.DWR.Streamflow.Month~HydroBase"

[Data 1.2]

TSID = "08220500.DWR.Streamflow.Month~HydroBase"
```

4. Add a `ProcessTSProduct()` command to the original commands to allow the product to be created automatically. Select the time series product file created in the previous step.
5. Save the commands in a file (e.g., named *stations.TSTool*) so that they can be run again. The command file and time series product definition files must be used consistently (e.g., the time series identifiers and directory paths must be consistent).

If the product does not appear as intended, especially for complicated products, it may be necessary to edit the file and make the following corrections:

- Specify `Color` or other properties so that they are explicitly set and not defaulted.
- Verify that file paths in `TSID` properties are valid for the machine (may need to convert absolute paths to relative paths).

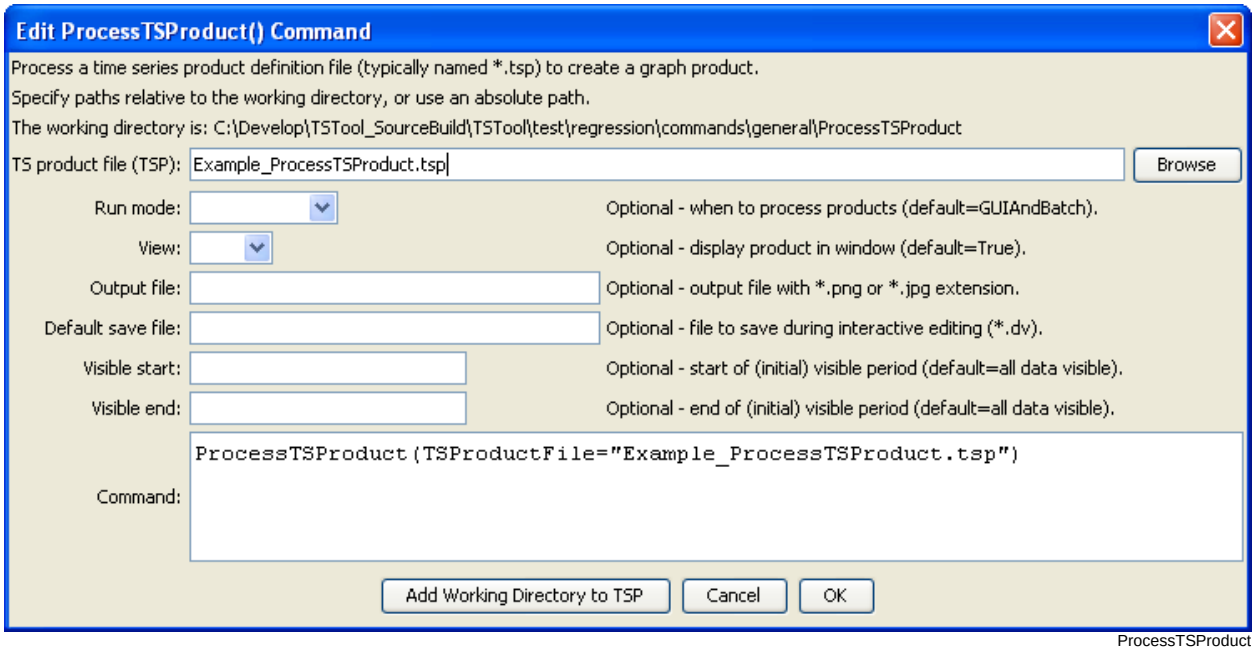
Time series identifiers in the product file are used as follows:

- If the time series are in TSTool's ***Results*** area, the time series will be used without rereading.
- Otherwise, the `TSID` is used to read the time series and must therefore contain enough information to locate and read the time series, such as the `~InputType~InputName` information on at the end of the `TSID`.

If the `TSAlias` property is found in the product file, then the time series corresponding to the alias must be processed by a command file and be available in TSTool's ***Results*** area.

It is also possible to create a template time series product file and use the `ExpandTemplateFile()` command to automate creation of large numbers of graphs, for example to create images for a website.

The following dialog is used to edit the `ProcessTSProduct()` command and illustrates the command syntax. The path to the file can be absolute or relative to the working directory. The ***Browse*** button can be used to select the time series product description file (if a relative path is desired, delete the leading path after the select or use the ***Remove Working Directory from TSP*** button).



ProcessTSProduct

ProcessTSProduct() Command Editor

The command syntax is as follows:

```
ProcessTSProduct(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSProductFile`	The time series product file to process. The path to the file can be absolute or relative to the working directory. The ***Browse*** button can be used to select the file to write (if a relative path is desired, delete the leading path after the select).	None – must be specified.
`RunMode`	Indicate the run mode to process the product, one of: • `BatchOnly` – indicates that the product should only be processed in batch mode. • `GUIOnly` – indicates that the product should only be processed when the TSTool GUI is used (useful when Preview is set to Preview). • `GUIAndBatch` – indicates that the product should be processed in batch and GUI mode.	None – must be specified.
`View`	Indicates whether the output should be previewed interactively, one of: • `True` – display the graph. • `False` – do not display the graph (specify the output file instead to automate image creation).	None – must be specified.
`OutputFile`	The absolute or relative path to an output file. Use this parameter with `View=False` to automate image processing. If the filename ends in "jpg", a JPEG image file will be produced. If the filename ends in "png", a PNG file will be produced (recommended).	Graph file will not be created.
`DefaultSaveFile`	Used with experimental feature to enabling editing in the time series table that corresponds to a graph view. Specify the default DateValue filename to save edits.	Editing is disabled.
`VisibleStart`	The starting date/time to zoom for the initial (and image file) graph.	Full period is visible.
`VisibleEnd`	The ending date/time to zoom for the initial (and image file) graph.	Full period is visible.

A sample command file to process a data product using State of Colorado HydroBase data is as follows:

```
# 08235350 - ALAMOSA RIVER ABOVE JASPER
08235350.USGS.Streamflow.Day~HydroBase
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Day~HydroBase
# 7337 - SAGUACHE
7337.NOAA.Precip.Month~HydroBase
ProcessTSProduct(TSProductFile="Example_ProcessTSProduct.tsp")
```

After using the above dialog to edit the command, the time series product can be processed from TSTool as follows:

1. Interactively load and run the command file:
    a. Open the command file, in this case containing the above commands file.
    b. Process the commands using ***Run All Commands***. The graph will be displayed for review.

2. Load and run the command file in one step:

    Use the ***Run…Process TSProduct*** File menus to select and process the product file. The time series must be in the Results area or must be specified with enough information in the product file to read the time series.

3. Run TSTool in batch mode by specifying an output file (and optionally changing the `RunMode` parameter to `BatchOnly`) using:

    `tstool –commands commands.TSTool`

    The working directory will be set to the directory for the commands file and output will be relative to that directory.

Command Reference: ProfileCommands()

Profile the commands that have executed, to evaluate performance

Version 10.17.00, 2013-02-18

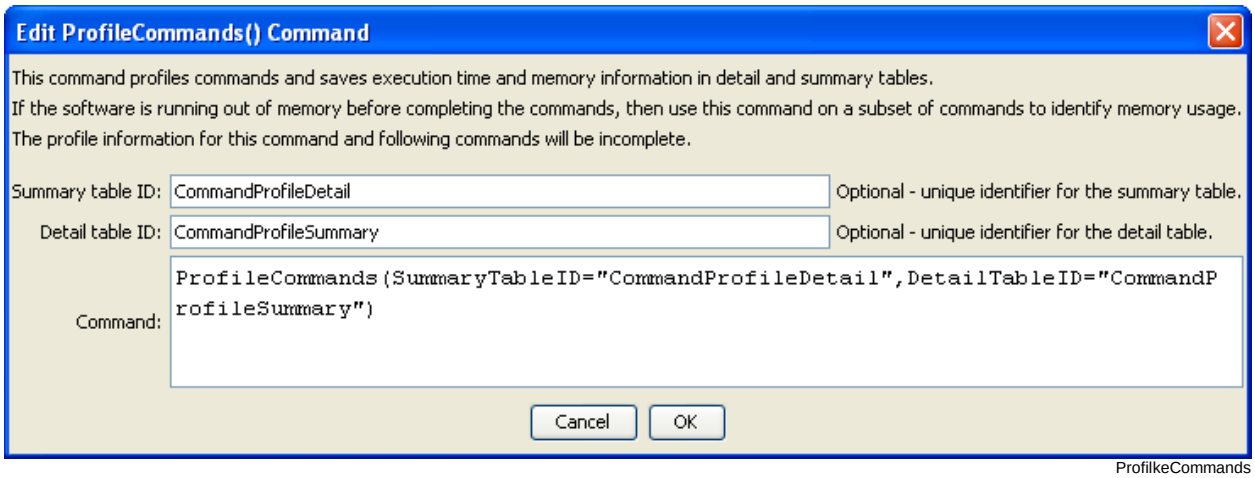
The `ProfileCommands()` command summarizes run times and memory use for each command in the command list, and outputs the information to detail (row for each command) and summary (one row for each command name) tables. This command is useful for evaluating which commands are slow or use more memory in a command workflow, so that software and command file logic improvements can occur. The command is usually placed at the end of a command file. The following apply to command profiling:

- Because the command is processed at the time it is encountered in the command list, the command itself and any subsequent commands are not included in the analysis. This generally is not an issue because the command will be used near the end of a workflow or at a strategic location where previous commands need to be examined.
- Currently the memory statistics are rough because the heap size is determined at the start and end of each command's execution and the Java runtime environment may allocate heap memory in blocks. In the future profiling data may be expanded to the estimated memory footprint of each command.
- There is a slight performance and memory hit to collect profiling information. In the future processor property commands may be implemented to control how much profiling data are collected (specifically if memory for each command object is estimated).
- If a command file is causing out of memory exceptions, then placing a `ProfileCommands()` command at the end of the command file likely will not be helpful. Instead, use a subset of the full command list so the `ProfileCommands()` command will be executed. Then evaluate the performance of the commands and determine if the command list logic can be optimized. If performance issues appear to be in the software itself, contact the developers to evaluate the software code. Also consider using the `Free()` and `FreeTable()` commands to free resources, especially if the results do not need to be available to users via the user interface.
- The runtime percent for each command is calculated as a percentage of the total runtime (ignoring the `ProfileCommands()` command and subsequent commands).
- The heap memory percentage delta for each command is calculated using the heap memory at the end of the command execution (not the heap memory at the end of the full run). Consequently, the delta reflects the memory use up to that point in time.
- Command profiling currently only applies to run mode. Commands are executed in discovery mode when a command file is loaded. For example, a subset of time series data is retrieved so that time series identifiers can be created and passed to following commands, which allows choices to be populated in command editors. Profiling discover mode is not support but should use a fraction of full runtime resources. For large command files (e.g., those generated by templates), it may be appropriate or necessary to load the commands without running discovery (see the `–nodiscovery` command line parameter and the ***File…Open…Command File (no discovery)*** menu item.
- Commands that generate many warning and failure messages will use more memory. Refer to the `NumLogRecords` column in the detail table to determine if this could be causing memory issues.
- The command currently does not allow sorting output tables by a column. This feature may be added in the future. Use the interactive table view to sort by column (this is how the tables were sorted for the figures below).

If loading or running commands are slow, the following actions might help:

- Use the `Free()` and `FreeTable()` commands to free resources. The command will still take up some resources because it has a place in the command list, but data resources used by the command will be freed.
- Review the profiling results to determine if certain commands are major resource users. Evaluate whether changes in the command logic can be implemented. Comment out blocks of commands (# commands will take fewer resources than `/* */` blocks) and try to isolate problems. It may be necessary to run smaller subsets of commands, for example by splitting up lists of input time series.
- On Windows, use the Task Manager (run taskmgr) to review memory use by the javaw.exe program. If the memory use approaches the maximum, then the Java Runtime Environment likely will be spending time dealing with short memory and runtimes will increase until memory runs out. If necessary, change the `-Xmx` parameter in the *TSTool.l4j.ini* file located in the system folder under the software install. This parameter indicates the maximum heap memory that can be used by the software. For a typical 32-bit Windows computer with at least 4GB of memory, the `-Xmx` parameter may be set to as high as `1700mb`; however, a number that is too high may not be possible due to memory being used by other applications on the computer.

The following dialog is used to edit the command and illustrates the syntax of the command.



ProfilkeCommands

ProfileCommands() Command Editor

The following figure illustrates the output summary table. Because command execution may be very fast, times are shown in milliseconds (1-1000th of a second). The table can be output to a file with other commands.

TSTool - Table "CommandProfileSummary"

Command	NumberOfOccurances	TotalTime (ms)	TotalTime (%)	AverageTime (ms)	MaximumTime (ms)	MinimumTime (ms)
ProcessTSProduct	705	88313	65.398	125	219	94
#	15525	11497	8.514	0	78	16
ReadTimeSeries	705	10375	7.683	14	140	47
ExpandTemplateFile	706	8167	6.048	11	93	15
NewStatisticYearTS	2820	7542	5.585	2	79	0
CalculateTimeSeriesStatistic	3525	5583	4.134	1	157	0
SetProperty	2115	2097	1.553	0	31	0
Free	705	919	0.681	1	78	0
WriteTableToDelimitedFile	1	265	0.196	265	265	265
ReadTableFromDelimitedFile	1	172	0.127	172	172	172
StartLog	1	94	0.070	94	94	94
CopyTable	4	16	0.012	4	16	0
ProfileCommands	1	0	0.000	0	0	0
WriteTableToHTML	2	0	0.000	0	0	0

Displaying 14 rows, 7 columns. Ready

ProfilkeCommands_Summary

ProfileCommands() Command Summary Output Table

The following figure illustrates the output detail table. Note that the heap memory is increased in blocks by the Java Runtime Environment so only large memory footprint commands trigger immediate heap memory increases.

TSTool - Table "CommandProfileDetail"

...	Command	StartTime	StartTime (ms)	EndTime	EndTime (ms)	RunTime (ms)	RunTime (%)	StartHeap (bytes)	EndHeap (bytes)	DeltaHeap (bytes)	DeltaHeap (%)	NumLogRecords
1	#	2013-02-18 ...	1361205076983	2013-02-18 ...	1361205076983	0	0.000	647929856	647929856	0	0.000	0
2	#	2013-02-18 ...	1361205076983	2013-02-18 ...	1361205076983	0	0.000	647929856	647929856	0	0.000	0
3	StartLog	2013-02-18 ...	1361205076983	2013-02-18 ...	1361205077077	94	0.070	647929856	647929856	0	0.000	0
4	#	2013-02-18 ...	1361205077077	2013-02-18 ...	1361205077077	0	0.000	647929856	647929856	0	0.000	0
5	#	2013-02-18 ...	1361205077077	2013-02-18 ...	1361205077077	0	0.000	647929856	647929856	0	0.000	0
6	#	2013-02-18 ...	1361205077077	2013-02-18 ...	1361205077077	0	0.000	647929856	647929856	0	0.000	0
7	#	2013-02-18 ...	1361205077077	2013-02-18 ...	1361205077077	0	0.000	647929856	647929856	0	0.000	0
8	#	2013-02-18 ...	1361205077077	2013-02-18 ...	1361205077077	0	0.000	647929856	647929856	0	0.000	0
9	#	2013-02-18 ...	1361205077093	2013-02-18 ...	1361205077093	0	0.000	647929856	647929856	0	0.000	0
10	#	2013-02-18 ...	1361205077093	2013-02-18 ...	1361205077093	0	0.000	647929856	647929856	0	0.000	0
11	ReadTableFromDel...	2013-02-18 ...	1361205077093	2013-02-18 ...	1361205077265	172	0.127	647929856	647929856	0	0.000	0
12	#	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077280	0	0.000	647929856	647929856	0	0.000	0
13	SetProperty	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077280	0	0.000	647929856	647929856	0	0.000	0
14	SetProperty	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077280	0	0.000	647929856	647929856	0	0.000	0
15	SetProperty	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077280	0	0.000	647929856	647929856	0	0.000	0
16	#	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077280	0	0.000	647929856	647929856	0	0.000	0
17	ReadTimeSeries	2013-02-18 ...	1361205077280	2013-02-18 ...	1361205077296	16	0.012	647929856	647929856	0	0.000	0
18	#	2013-02-18 ...	1361205077296	2013-02-18 ...	1361205077296	0	0.000	647929856	647929856	0	0.000	0
19	NewStatisticYearTS	2013-02-18 ...	1361205077296	2013-02-18 ...	1361205077311	15	0.011	647929856	647929856	0	0.000	0

Displaying 26816 rows, 13 columns. Ready

ProfilkeCommands_Detail

ProfileCommands() Command Detail Output Table

The command syntax is as follows:

```
ProfileCommand(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
SummaryTableID	The identifier for the summary table.	Summary table will not be created.
DetailTableID	The identifier for the detail table.	Detail table will not be created.

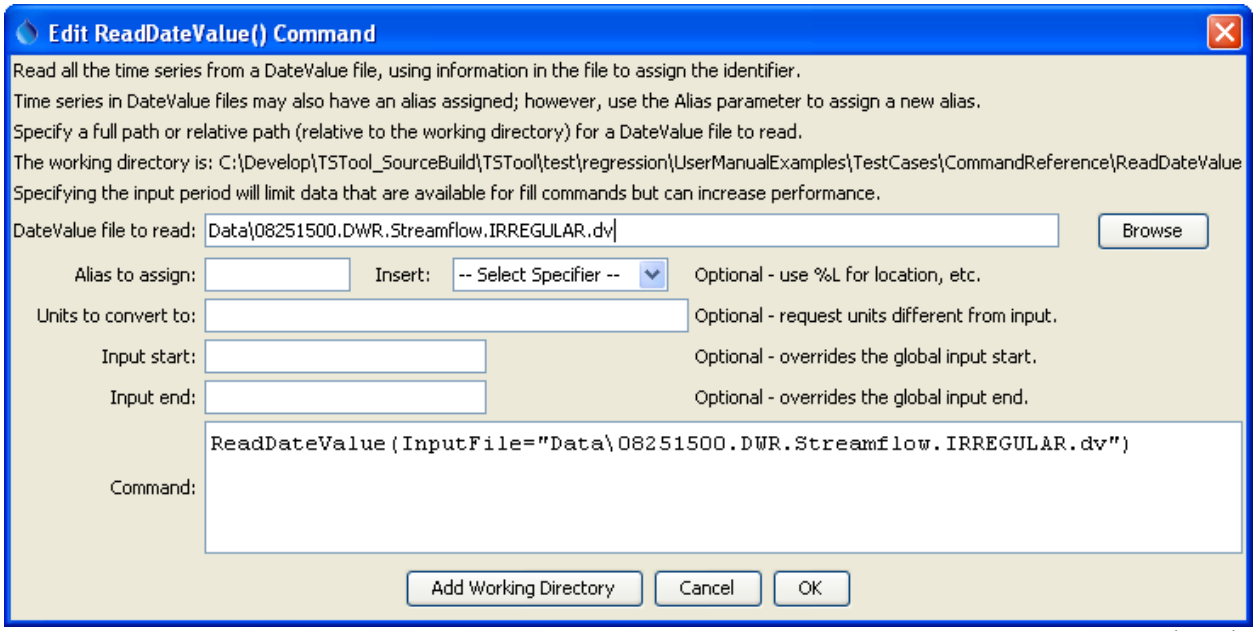
Command Reference: ReadDateValue()

Read all time series from a DateValue File

Version 10.00.01, 2011-05-15

The `ReadDateValue()` command reads all the time series in a DateValue file into memory. See the **DateValue Input Type Appendix** for information about the file format.

The following dialog is used to edit the command and illustrates the command syntax. The path to the file can be absolute or relative to the working directory. DateValue files allow each time series to have an alias in addition to the time series identifier (TSID); however, the `Alias` parameter can be used to assign a new alias as the file is read.



ReadDateValue

ReadDateValue() Command Editor

The command syntax is as follows:

```
ReadDateValue(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadDateValue(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the DateValue input file to read, surrounded by double quotes to protect whitespace and special characters. Global property values can be used with the syntax `${PropertyName}` (see also the `SetProperty()` command).	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	The alias in the file will be used if present.
`NewUnits`	Units to convert data to (must be in the *system/DATAUNIT* configuration file under the TSTool installation folder).	Use the data units from the file.
`InputStart`	Starting date/time to read data, in precision consistent with data.	Read all data.
`InputEnd`	Ending date/time to read data, in precision consistent with data.	Read all data.

A sample command file is as follows:

```
ReadDateValue(InputFile="Data\08251500.DWR.Streamflow.IRREGULAR.dv")
```

Command Reference: ReadDelimitedFile()

Read time series from a delimited file

Version 10.08.00, 2012-04-23

The `ReadDelimitedFile()` command reads one or more time series from a column-oriented delimited file, where columns contain date/time and values. This command is useful for processing comma-separated-value (CSV) files exported from spreadsheets and mining data from the web (see also the `WebGet()` and `FTPGet()` commands). The command processes files that include the following types of information:

1. Comments in the header (before data) and embedded in data records (e.g., because bad data values were commented out).
2. Column headers as non-commented line at the top of the file.
3. Data records, in column format, containing date/time strings, data values, and other information.
4. Metadata, such as station identifiers, data types, units, and interval may be read from the file or specified with command parameters.

The mapping of data in the file to data in the time series occurs first by assigning column names, using one of the following methods:

1. Read column names from a line in the file, suitable when the column headings are simple strings and agree closely with the contents of the data columns.
2. Assign column names with command parameters. The file being read may include metadata within column headings and data records; however, the information can be difficult to extract because of formatting. For example, column headings may include the data type as "Precipitation\n(in)" (where \n indicates a newline). Consequently, the command supports assigning column names via command parameters in order to ensure robust data handling.

In any case, rather than trying to automatically determine other metadata like data type and units from the column heading, the values can be assigned with the `DataType` and `Units` parameters. Additional functionality may be added in the future automate metadata discovery. Examples of use for the two cases are shown in the examples below.

The command syntax is as follows:

```
ReadDelimitedFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the delimited input file to read, surrounded by double quotes to protect whitespace and special characters. Global property values can be used with the syntax `${PropertyName}` (see also the `SetProperty()` command).	None – must be specified.
`Delimiter`	The delimiter character(s) that separate columns.	None – must be specified.
`Treat Consecutive Delimiters`	Indicate whether consecutive delimiter characters should be treated as a single delimiter, for example, when multiple spaces are used to line up columns.	`False` (columns are separated by a single delimiter

AsOne		character)
Comment	Character(s) that if found at the start of lines in the file, indicate that the line is a comment. The characters are interpreted individually (e.g., #$ indicates that lines starting with # or $ will be treated as comments).	#
SkipRows	Indicate absolute rows (1+) in the file to skip, using single numbers and ranges a-b, separated by commas. Rows are skipped prior to other processing.	No rows will be skipped.
SkipRowsAfterComments	Indicate the number of rows to skip after header comments. Use this parameter to skip column headers prior to the data lines. This parameter is typically not used if column names are read from the file.	No rows will be skipped.
ColumnNames	The user-specified names for columns in the file, used to ensure that column headings in files are properly interpreted. These names are used in other parameters to specify columns in the file. Separate column names with commas. Column names can be specified as literal strings or as FC[start:stop] to read columns from the file header (assumed to be the first row after leading comments), where start is 1+ and stop is blank to read all columns or a negative number to indicate the offset from the end column.	None – must be specified.
DateTimeColumn	The column matching a value in ColumnNames, which indicates the date/time column in the file. Date and time are in one column with no separating delimiter characters.	Required if DateColumn is not specified.
DateTimeFormat	The format for date/time strings in the date/time column. If blank, common formats such as ISO YYYY-MM-DD hh:mm and MM/DD/YYYY will automatically be detected. However, it may be necessary to specify the format to ensure proper parsing. This format will be used to parse date/times from the DateTimeColumn or the merged string from the DateColumn and TimeColumn (if specified). The format string will depend on the formatter type. Currently, only the "C" formatter is available, which uses C programming language specifiers. The resulting format includes the formatter and specifiers (e.g., C:%m%d%y).	Will automatically be determined by examining date/time strings.
DateColumn	The column matching a string in ColumnNames, which indicates the date column in the file.	Required if DateTimeColumn is not specified.
TimeColumn	The column matching a string in ColumnNames, which indicates the time column in the file. Specify this parameter when DateColumn is specified and time is specified in a separate column. The DateColumn and TimeColumn contents are merged with a joining colon character and are then treated as if DateTimeColumn had been specified.	A time column is required only when DateColumn is specified and the interval requires time.
ValueColumn	The column(s) matching a string in ColumnNames, which indicate the data value columns. Separate column names with commas. The FC[start:stop] notation discussed	None – must be specified.

	for `ColumnNames` can also be used.	
`FlagColumn`	The column(s) matching a string in `ColumnNames`, which indicate the data flag columns. Separate column names with commas. The `FC[start:stop]` notation discussed for `ColumnNames` can also be used. If specified, the number of columns must match the `ValueColumn` parameter, although blanks are allowed. Double-quotes around flags are not considered part of the flag.	Flags are not read.
`LocationID`	The location identifier(s) to assign to time series for each of the value columns (or specify one value to apply to all columns). The `FC[start:stop]` notation discussed for `ColumnNames` can also be used.	None – must be specified.
`Provider`	The data provider identifier to assign to time series for each of the value columns (or specify one value to apply to all columns).	No provider will be assigned.
`DataType`	The data type to assign to time series for each of the value columns (or specify one value to apply to all columns).	Use the value column names for the data types.
`Interval`	The interval for the time series. Only one interval is recognized for all the time series in the file. Interval choices are provided when editing the command. If it is possible that the date/times are not evenly spaced, then use the `IRREGULAR` interval.	None – must be specified.
`Scenario`	The scenario to assign to time series for each of the value columns (or specify one value to apply to all columns).	No scenario will be assigned.
`Units`	The data units to assign to time series for each of the value columns (or specify one value to apply to all columns).	No units will be assigned.
`Missing`	Strings that indicate missing data in the file (e.g., "m").	Interpret empty column values as missing data.
`Alias`	The alias to assign to time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing.	No alias will be assigned.
`InputStart`	The date/time to start reading data.	All data or global input start.
`InputEnd`	The date/time to end reading data.	All data or global input end.

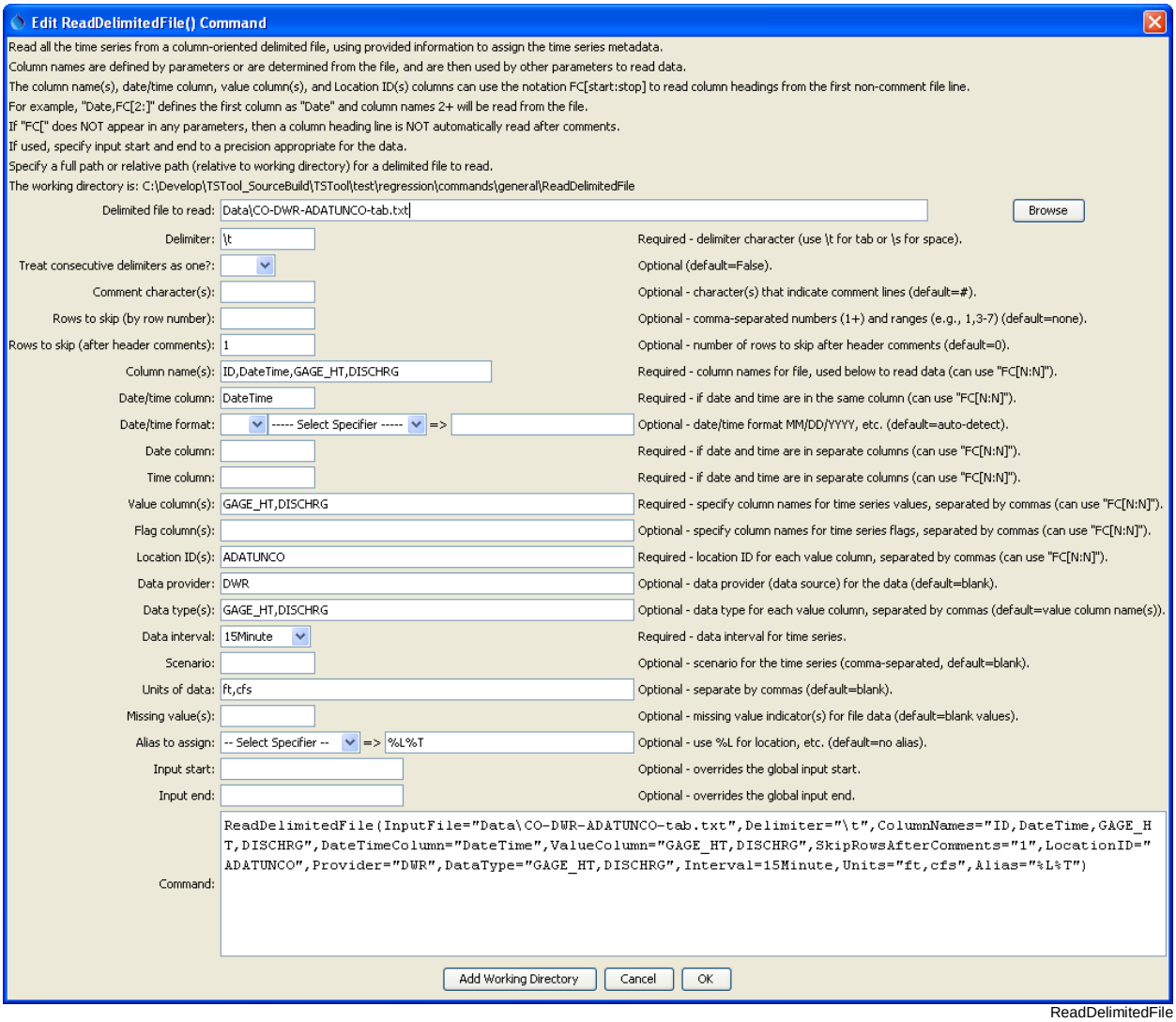
Example of Column Names Assigned with Command Parameter

The following example for two time series (gate height and discharge) illustrates a format where column headings are complex enough to require assignment of column names using a command parameter:

```
#...
#Data is returned in TAB delimited format. Data miners may find help on automating
#queries and formatting parameters at http://www.dwr.state.co.us/help
#
#Gaging Station: ALVA B. ADAMS TUNNEL AT EAST PORTAL NEAR ESTES PARK (ADATUNCO)
#Retrieved: 3/30/2010 03:04
```

```
#-------------------------------------------------------------------------------
Station Date/Time       GAGE_HT (ft)    DISCHRG (cfs)
ADATUNCO        2006-10-01 00:00        2.34    225
ADATUNCO        2006-10-01 00:15        2.34    225
…etc…
```

The following dialog is used to edit the command and illustrates the syntax for the command. The column headings are skipped because they are assigned with a command parameter. Because the delimiter is a tab, the space between date and time columns is NOT used as a delimiter and the date/time information is treated as one column.



ReadDelimitedFile

ReadDelimitedFile() Command Editor when Literally Specifying Column Names

The following example command file retrieves real-time time series data from the State of Colorado's website and reads the data:

```
WebGet(URI="http://www.dwr.state.co.us/SurfaceWater/data/export_tabular.aspx?
  IDADATUNCO&MTYPEGAGE_HT,DISCHRG&INTERVAL1&START10/1/06&END10/6/06",
  LocalFile="Data\CO-DWR-ADATUNCO-tab.txt")
ReadDelimitedFile(InputFile="Data\CO-DWR-ADATUNCO-tab.txt",
```

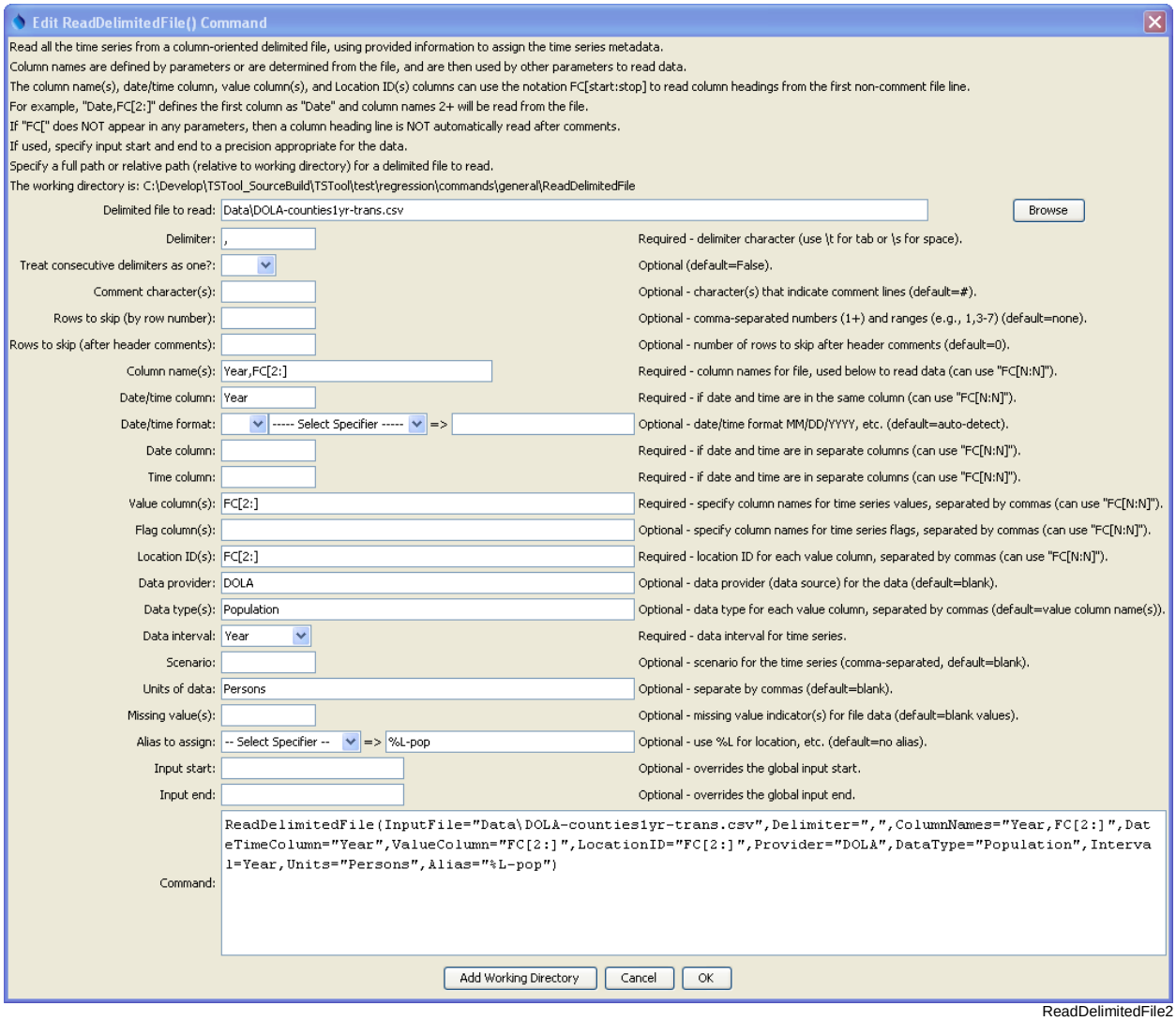
```
  Delimiter="\t",ColumnNames="ID,DateTime,GAGE_HT,DISCHRG",
  DateTimeColumn="DateTime",ValueColumn="GAGE_HT,DISCHRG",
  SkipRowsAfterComments="1",LocationID="ADATUNCO",Provider="DWR",
  DataType="GAGE_HT,DISCHRG",Interval=15Minute,Units="ft,cfs",Alias="%L%T")
```

Example of Column Names Read from the File

The following simple example of annual county population data illustrates a format that allows reading column names from the file. In this case, the rows and columns have been transposed from the original format to be compatible with this command and in the command example shown in the figure below the "County" heading is replaced with "Year" to more clearly indicate the contents.

```
County,COLORADO,Adams,Alamosa,Arapahoe,Archuleta,Baca,Bent,Boulder,Broomfield,Chaffee,…
2000,4338793,366660,15132,491134,10027,4514,5991,296018,0,16294,2229,9386,…
2001,4456408,360389,15314,502567,10532,4486,5911,282794,41529,16382,2195,9479,…
…etc..
```

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadDelimitedFile2

ReadDelimitedFile() Command Editor when Reading Column Names from the File

The following example command file retrieves population forecast data from the State of Colorado's website, transposes the rows and columns using a Python script, and reads the time series data. The Python script is not provided with this example but generates output as shown in the above data file example.

```
StartLog(LogFile="DOLA-county-pop.TSTool.log")
# This command file retrieves population data from the Colorado State Demographer
# website and processes the data into time series for use in analysis.
#
# First retrieve the data from the DOLA web site.
WebGet(URI="http://www.dola.state.co.us/dlg/demog/population/forecasts/counties1yr.csv",
  LocalFile="DOLA-counties1yr.csv")
#
# Transpose the rows/columns to match TSTool time series notation with dates in the
# first column.
SetProperty(PropertyName="ScriptDir",PropertyType=String,
RunPython(InputFile="${InstallDir}\python\table\transpose-csv.py",
  Arguments="\"${WorkingDir}\DOLA-counties1yr.csv\"
  \"${WorkingDir}\DOLA-counties1yr-trans.csv\"",Interpreter="Python")
#
# Read into time series from the delimited CSV file.
# Define column names dynamically based on the first non-comment line in the file
ReadDelimitedFile(InputFile="DOLA-counties1yr-trans.csv",Delimiter=",",
  ColumnNames="Year,FC[2:]",DateTimeColumn="Year",ValueColumn="FC[2:]",
  LocationID="FC[2:]",Provider="DOLA",DataType="Population",Interval=Year,Units="Persons",
  Alias="%L-pop")
```

Command Reference: ReadHecDss()

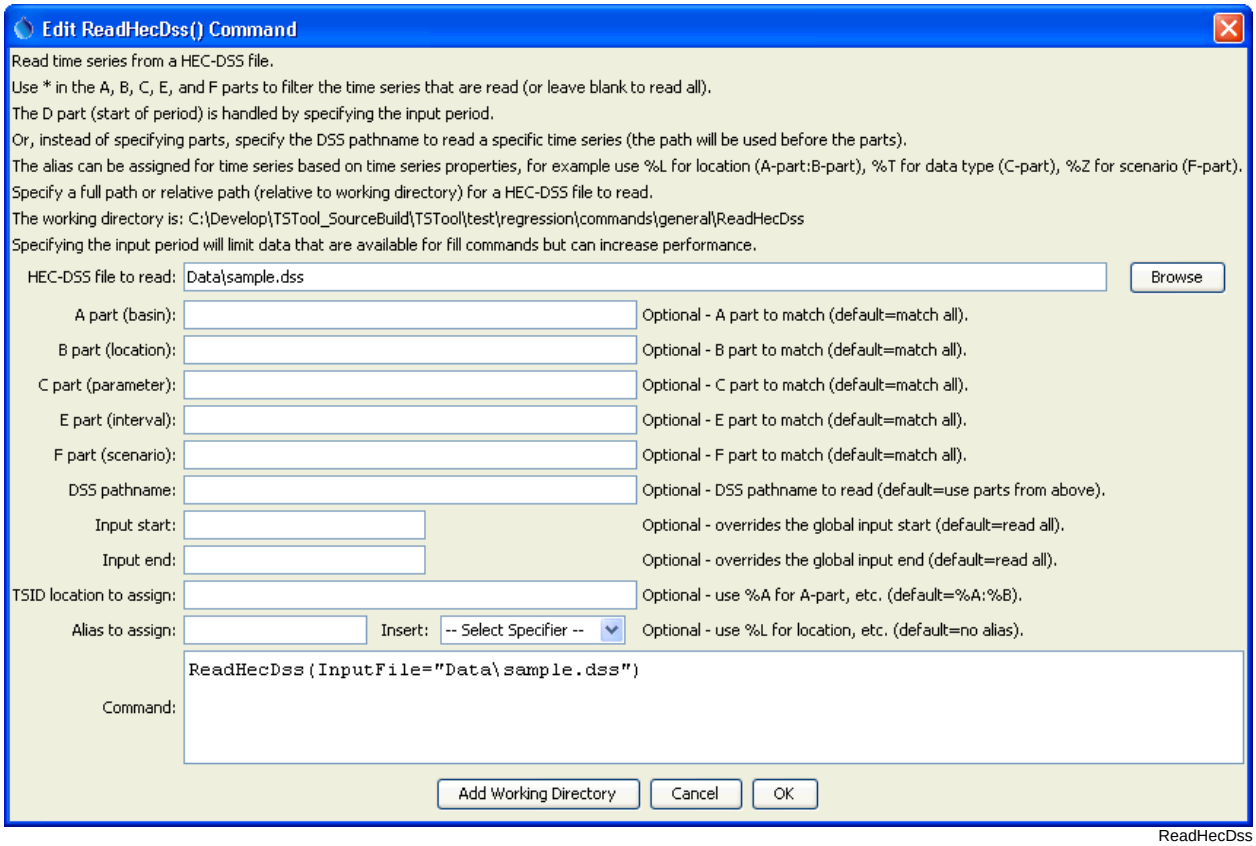
Read time series from a HEC-DSS File

Version1 0.00.01, 2011-05-15

The `ReadHecDss()` command reads time series from a HEC-DSS file. See the **HEC-DSS Input Type Appendix** for information about how time series properties are assigned using HEC-DSS file data. Current limitations for the command include:

- Irregular time series cannot be read.
- HEC-DSS uses times through 2400. However, TSTool will convert this to 0000 of the next day. Year, month, and day data are not impacted.

The following dialog is used to edit the command and illustrates the syntax for the command. In the future, it is envisioned that choices for A – F parts will be made available using data from the file.



ReadHecDss

ReadHecDss() Command Editor

The command syntax is as follows:

```
ReadHecDss(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile	The name of the HEC-DSS input file to read, surrounded by double quotes to protect whitespace and special characters.	None – must be specified.
A	The A part (basin name) to match, using * as a wildcard. The location part of the TSTool time series identifier is set to A:B.	Match all.
B	The B part (location) to match, using * as a wildcard. The location part of the TSTool time series identifier is set to A:B.	Match all.
C	The C part (parameter) to match, using * as a wildcard. The TSTool data type is set to this value.	Match all.
E	The E part (interval) to match, using * as a wildcard.	Match all.
F	The F part (scenario) to match, using * as a wildcard.	Match all.
Pathname	The HEC-DSS pathname for a time series, as specified in the HEC-DSS documentation. Currently wildcards are not allowed. If specified, this will be used instead of the A-F parameters.	Use the A-F parameters.
InputStart	Starting date/time to read data, in precision consistent with data.	Read all data.
InputEnd	Ending date/time to read data, in precision consistent with data.	Read all data.
Location	The location to assign for the time series identifier. Use %A … %F to indicate the Apart … Fpart (D part is not available). The assignment will impact the Alias assignment. This is useful when only Bpart is desired as the location identifier.	Apart:Bpart (%A:%B).
Alias	Alias to assign to the output time series. See the LegendFormat property described in the **TSView Time Series Viewing Tools** appendix. For example, %L is full location, %T is data type (parameter in HEC-DSS notation), %I is interval, and %Z is scenario.	None is assigned. However, if the location contains periods that are in conflict with time series identifier conventions, the alias is set to the identifier with periods, and the periods are replaced with spaces in the full time series identifier.

A sample command file is as follows:

```
ReadHecDss(InputFile="sample.dss",InputStart="1992-01-01",
  InputEnd="1992-12-31",Alias="%L_%T_%Z")
```

Command Reference: ReadHydroBase()

Read time series from a HydroBase database

Version 10.12.00, 2012-09-28

The `ReadHydroBase()` command reads one or more time series from the HydroBase database (see the **HydroBase Datastore Appendix**). It is designed to utilize query criteria to process large numbers of time series, for example for a specific water district and data type.

The ***Data type***, ***Data interval***, and ***Where*** command parameters and input fields are similar to those from the main TSTool interface. However, whereas the main TSTool interface first requires a query to find the matching time series list and then an interactive select for specific time series identifiers, the `ReadHydroBase()` command reads the time series list and the corresponding data for the time series. This can greatly shorten command files and simplify command logic, especially when processing many time series.

The command supports the old-style input name selection (which corresponds to selecting HydroBase via the TSTool login dialog) and the new-style datastore convention (which corresponds to datastore configuration files). In the future, support for the input name may be phased out; however, this will require resolving how the HydroBase selection dialog is migrated to support datastores. Consequently, both approaches are currently supported during the transition.

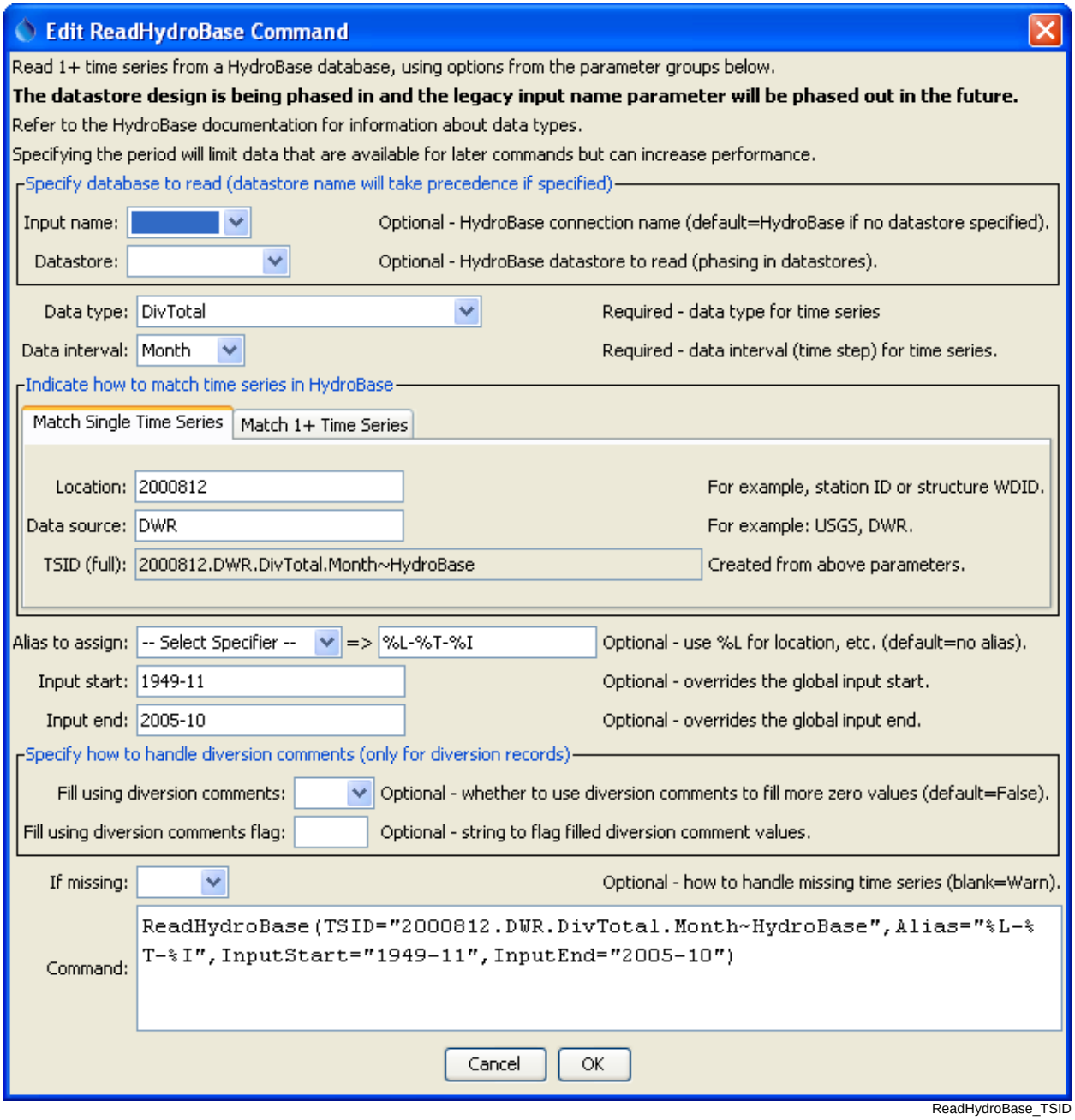
Data for the location (station, structure, well, etc.) and time series metadata, as shown in the main TSTool interface, are set as time series properties. For example, the `latdecdeg` and `longdecdeg` values from the HydroBase `vw_CDSS_StationMeasType` view are available as time series properties of the same name. These properties can be transferred to a table with the `CopyTimeSeriesPropertiesToTable()` command and processed further with other table commands.

Time series corresponding to diversion records, which also include observations for reservoirs and wells, are handled as follows:

1. Daily diversion (`DivTotal` and `DivClass`) and reservoir release (`RelTotal` and `RelClass`) time series have their values automatically carried forward to fill data within irrigation years (November to October). HydroBase only stores full months of daily diversion record data when non-zero observations or non-zero filled values occur in a month. Therefore, this filling action should only provide additional zero values in an irrigation year where a diversion or release was recorded. Irrigation years with no observations remain as missing after the read.
2. Daily, monthly, and yearly diversion and reservoir release time series optionally can be filled by the `ReadHydroBase()` command using diversion comments, which indicate when irritation years should be treated as missing. See the `FillUsingDivComments` parameter below. Note that diversion comments should not conflict with more detailed records and provide additional information. The separate `FillUsingDivComments()` command also is available for filling but may be phased out in the future.
3. It also may be appropriate to use infrequent data types (`IDivTotal`, `IDivClass`, `IRelTotal`, and `IRelClass`) to supply data; however, because such values typically are annual values, additional decisions must be made for how to distribute the values to monthly and daily time series. These data, if available, are not automatically folded into the diversion records by TSTool.

4. See the `FillHistMonthAverage()`, `FillPattern()`, and other commands, which can be used to fill (estimate) values in data gaps after the initial time series are read.

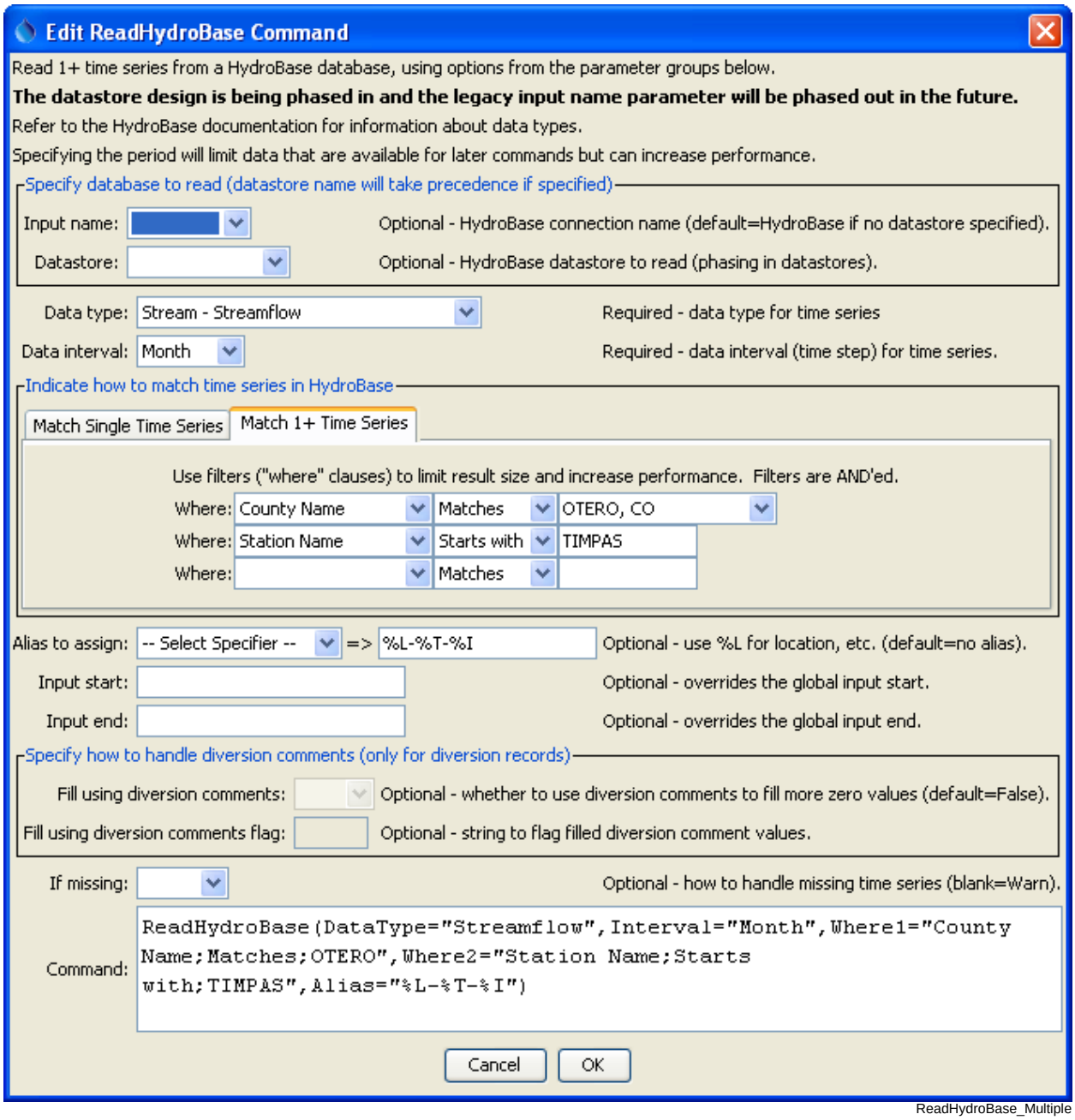
The following dialog is used to edit the command and illustrates the syntax for the command. Two options are available for matching time series, based on historical software requirements. The following example illustrates how to read a single time series by specifying the time series identifier. This approach is essentially equivalent to using the `ReadTimeSeries()` command but offers HydroBase-specific parameters such as `FillUsingDivComments`, which are not available in the more general `ReadTimeSeries()` command.



ReadHydroBase_TSID

ReadHydroBase() Command Editor to Read a Single Time Series

The following figure illustrates how to query multiple time series.



ReadHydroBase_Multiple

ReadHydroBase() Command Editor to Read Multiple Time Series

The command syntax is as follows:

```
ReadHydroBase(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadHydroBase(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputName`	The HydroBase database connection input name to use for the database connection, as initialized by the `OpenHydroBase()` command or the HydroBase login dialog shown when TSTool starts. When using this approach the TSID will end in `~HydroBase~InputName`. The input name approach for specifying a HydroBase database connection may be phased out in the future in favor of the datastore approach.	Use the default HydroBase connection.
`DataStore`	The HydroBase datastore name to use for the database connection, as per datastore configuration files (see **HydroBase Datastore** appendix). When using this approach the TSID will end in `~DataStore`. The datastore approach is being phased in as a more flexible design. Configuring a datastore with name HydroBase will take precedence over `InputName=HydroBase`.	Use the default (legacy `InputName`) HydroBase connection, if available.
`DataType`	The data type to be queried, as documented in the **HydroBase Datastore** appendix.	None – must be specified.
`Interval`	The data interval for the time series, as documented in the **HydroBase Datastore** appendix (e.g. `Day`, `Month`, `Year`), consistent with the `DataType` selection.	None – must be specified.
`TSID`	When reading a single time series, the time series identifier to read. If specified, this parameter will override the `WhereN` parameters.	Use `WhereN` parameters to read multiple time series.
`WhereN`	When reading 1+ time series, the "where" clauses to be applied. The filters matche the values in the ***Where*** fields in the command editor dialog and the TSTool main interface. The parameters should be named `Where1`, `Where2`, etc., with a gap resulting in the remaining items being ignored. The format of each value is: `"Item;Operator;Value"` Where `Item` indicates a data field to be filtered on, `Operator` is the type of constraint, and `Value` is the value to be checked when querying.	If not specified, the query will not be limited and very large numbers of time series may be queried.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`InputStart`	Start of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`InputEnd`	End of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`FillUsing DivComments`	Indicate whether to fill diversion and reservoir release time series using diversion comments.	`False`
`FillUsing DivComments Flag`	If specified as a single character, data flags will be enabled for the time series and each filled value will be tagged with the specified character. The flag can then be used later to label graphs, etc. The flag will be appended to existing flags if necessary.	No flag is assigned.

Parameter	Description	Default
IfMissing	Indicate the action to be taken if the requested time series is missing, one of: • Ignore – ignore the time series (do not warn and the time series will not be available) • Warn – generate a failure for the command	Warn

A sample command file is as follows (read all reservoir releases to structure 0300905):

```
ReadHydroBase(DataType="DivClass",Interval="Day",
    Where1="District;Equals;3",
    Where2="Structure ID;Equals;905",Where3="SFUT;Contains;s:2")
```

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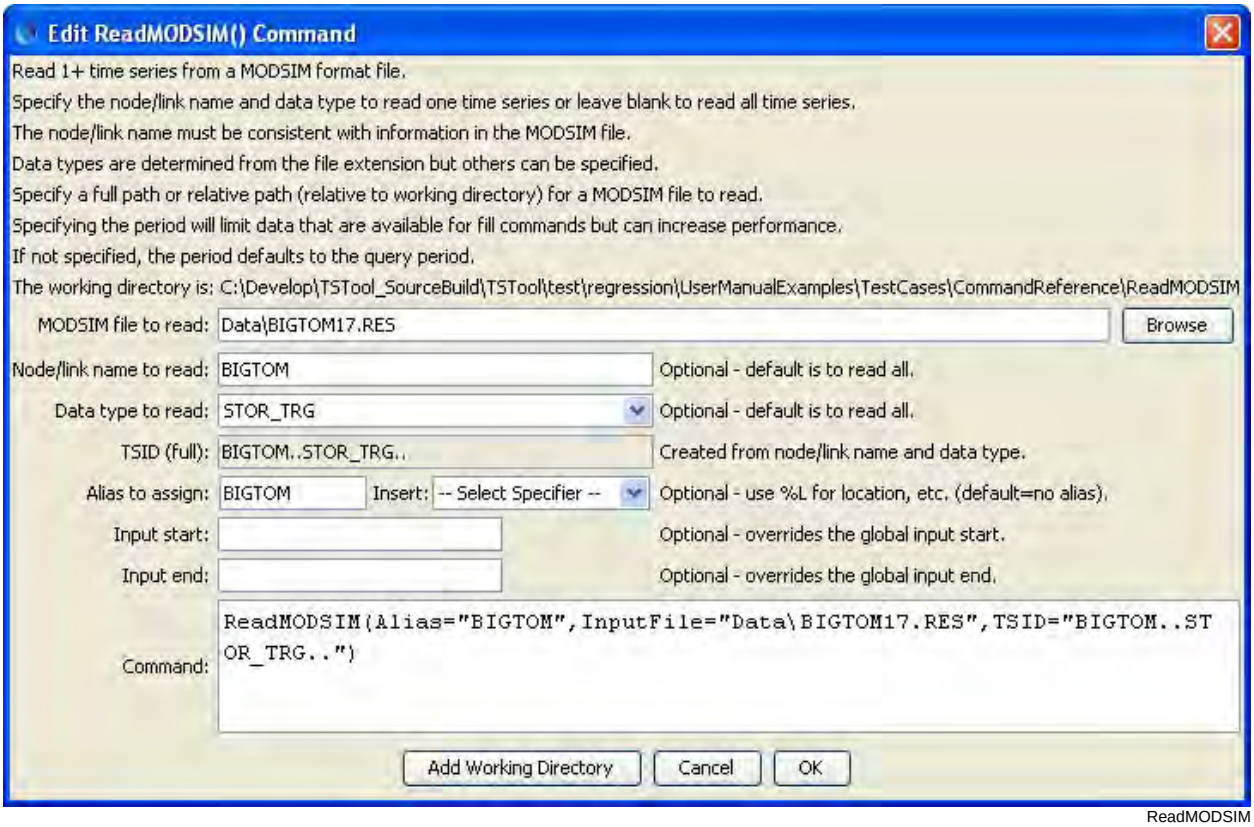
Command Reference: ReadMODSIM()

Read time series from a MODSIM output file

Version 10.00.00, 2011-03-28

The `ReadMODSIM()` command reads one or more time series from a MODSIM file. MODSIM is a node/link model used to simulate river basins (see the **MODSIM Input Type Appendix**). Specify a node/link name and data type to read a single time series – if not specified all time series from the file will be read. An alias can be assigned to each time series.

The following dialog is used to edit the command and illustrates the syntax. When a file is selected, the available data types are listed, based on the file extension (the types are not read from the file).



ReadMODSIM

ReadMODSIM() Command Editor

The command syntax is as follows:

```
ReadMODSIM(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadMODSIM(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile	The name of the MODSIM file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory.	None – must be specified.
TSID	A time series identifier pattern to filter the read – this is constructed in the editor dialog from individual identifier parts – the location and data type are specified and used in the time series identifier.	None – must be specified to match a single time series.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
InputStart	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
InputEnd	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.

A sample command file is as follows:

```
ReadMODSIM(Alias=”BIGTOM”,
    InputFile="BIGTOM17.RES",TSID="GREELEYCBT..STOR_TRG..")
```

Command Reference: ReadNrcsAwdb()

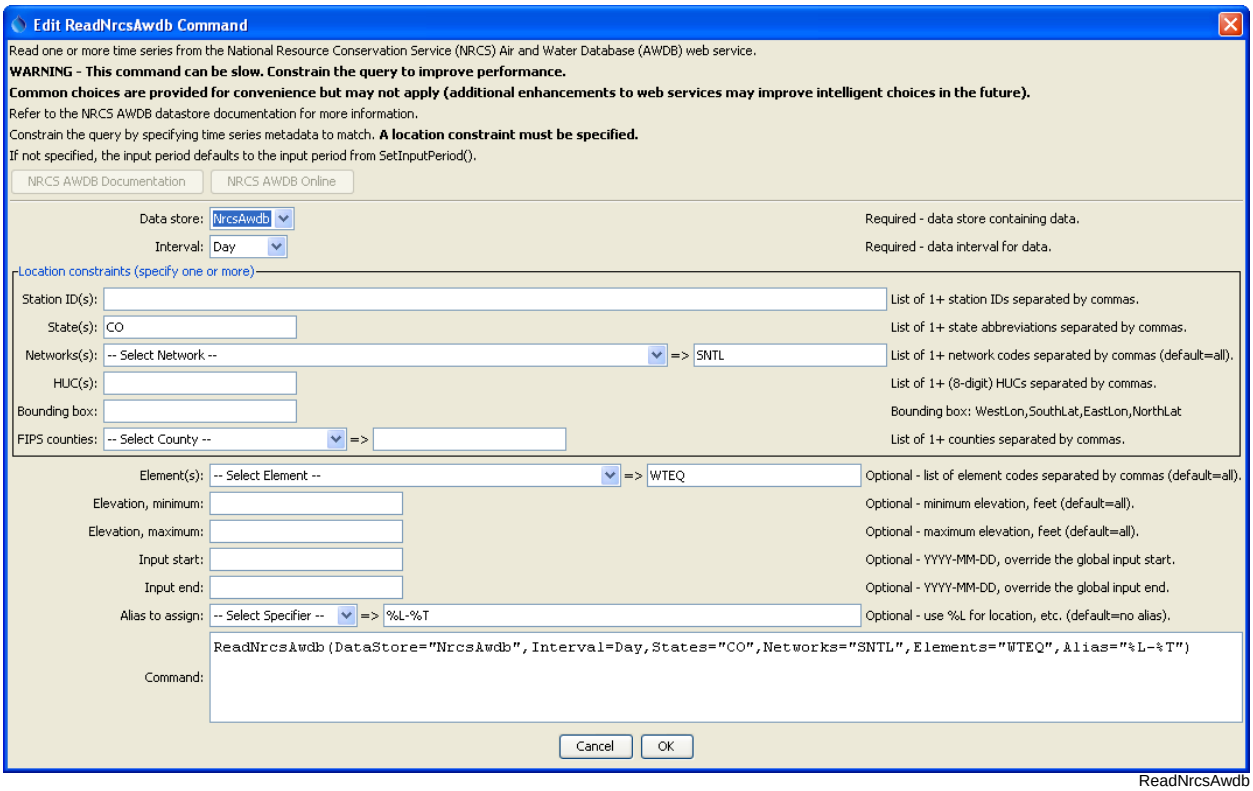
Read 1+ time series from the NRCS AWDB web service

Version 10.13.00, 2012-11-07

The `ReadNrcsAwdb()` command reads one or more time series from the Natural Resources Conservation Service (NRCS) Air and Water Database (AWDB) web service (see the **NRCS AWDB Datastore Appendix**), including SNOTEL and Snow Course data.

The NRCS AWDB web service allows station lists to be filtered, both as a convenience and to ensure reasonable web service performance. Many of the choices that are available for limiting queries allow 0+ values to be provided. For example, specifying no requested element (data type) will return all available elements for a location. Specifying a list of elements (separated by commas) will return only stations and time series that have data for the requested elements.

The following dialog is used to edit the command and illustrates the syntax. Some choices are provided as a convenience. However, full listing of choices (such as all the thousands of HUCs) is not provided due to performance issues. Additional query features will be enabled as web service integration is enhanced.



ReadNrcsAwdb

ReadNrcsAwdb() Command Editor

The command syntax is as follows:

```
ReadNrcsAwdb(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
DataStore	The NRCS AWDB datastore to use for queries.	None – must be specified.
Interval	The data interval ("duration" in NRCS AWDB terms) to query. The Irregular interval is used for instantaneous data.	None – must be specified.
Stations	A list of station identifiers to read, separated by commas.	Do not limit the query to a station list.
States	A list of state codes (e.g., AL), separated by commas.	Do not limit the query to a state list.
Networks	A list of data network codes (e.g., SNTL), separated by commas.	Do not limit the query to a network list.
HUCs	A list of 8-digit hydrologic unit codes, separated by commas.	Do not limit the query to a HUC list.
BoundingBox	A bounding box consisting of west longitude, south latitude, east longitude, and north latitude, separated by spaces. Longitudes in the western hemisphere are negative. This feature is not finalized, pending resolution of a web service issue.	Do not limit the query to a bounding box.
Counties	A list of county names, separated by commas. The state must be specified.	Do not limit the query to a county list.
Elements	Data element codes for the stations (e.g., WTEQ for snow water equivalent), separated by commas.	All available elements are returned.
ElevationMin	Minimum station elevation, feet.	Do not limit the query based on elevation minimum.
ElevationMax	Maximum station elevation, feet.	Do not limit the query based on elevation maximum.
InputStart	The start of the period to read data – specify if the period should be different from the global query period. Specify to the precision of the data using the format YYYY-MM-DD hh:mm.	Use the global query period.
InputEnd	The end of the period to read data – specify if the period should be different from the global query period. Specify to the precision of the data using the format YYYY-MM-DD hh:mm.	Use the global query period.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.

Command Reference: ReadPatternFile()

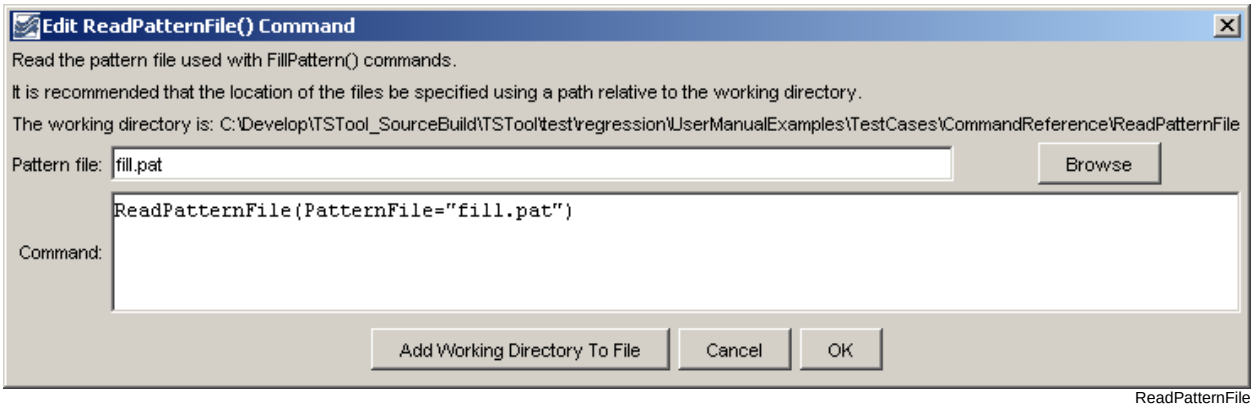
Read the pattern file to be used with FillPattern() commands

Version 08.16.04, 2008-09-19

The `ReadPatternFile()` command reads pattern time series to be used with `FillPattern()` commands (see the `FillPattern()` command for more information). The patterns indicate whether a month is wet, dry, or average, although any number of characterizations can be used. One or more patterns can be included in each pattern file, similar to StateMod time series files (see the **StateMod Input Type** appendix), and multiple pattern files can be used, if appropriate. The following example illustrates the file format. See also the `AnalyzePattern()` command, which can be used to generate the file.

```
#  Years Shown = Water Years
#  Missing monthly data filled by the Mixed Station Method, USGS 1989
#  Time series identifier         = 09034500.CRDSS_USGS.QME.MONTH.1
#  Description                    = COLORADO RIVER AT HOT SULPHUR SPRINGS, CO.
# -e-b----------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb------eb--------e
   10/1908  -      9/1996 ACFT  WYR
1909 09034500         AVG     AVG     AVG     WET     WET     AVG     AVG     AVG     WET     WET     WET     WET
1910 09034500         WET     WET     WET     WET     WET     WET     AVG     AVG     AVG     AVG     AVG     AVG
1911 09034500         AVG     AVG     WET     AVG     AVG     AVG     AVG     WET     WET     WET     AVG     WET
1912 09034500         WET     WET     WET     WET     WET     AVG     AVG     WET     WET     WET     WET     WET
...ommitted...
```

The following dialog is used to edit the command and illustrates the command syntax.



ReadPatternFile

ReadPatternFile() Command Editor

The command syntax is as follows:

```
ReadPatternFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`PatternFile`	The path to the pattern file, which can be absolute or relative to the working directory.	None – must be specified.

A sample command file is as follows:

```
ReadPatternFile(PatternFile="fill.pat")
```

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Command Reference: ReadPropertiesFromFile()

Read one or more time series processor properties from a file

Version 10.12.00, 2012-08-02

The `ReadPropertiesToFile()` command reads the values of one or more time series processor properties from a file. The corresponding `WritePropertiesToFile()` command can be used to write properties to a file. Processor properties include global defaults such as `InputStart`, `InputEnd`, `OutputStart`, `OutputEnd`, `OutputYearType`, `WorkingDir`, and also user-defined properties set with the `SetProperty()` command. Internally, properties have a name and a value, which is of a certain type (string, integer, date/time, etc.). Examples of using the command include:

- creating tests to verify that properties are being set
- passing information from another program, such as a Python script, to TSTool
- reading persistent information from a previous use, such as the date/time that data were last downloaded from a web service

A number of property formats are supported as listed in the following table.

Property File Formats

Format	Description

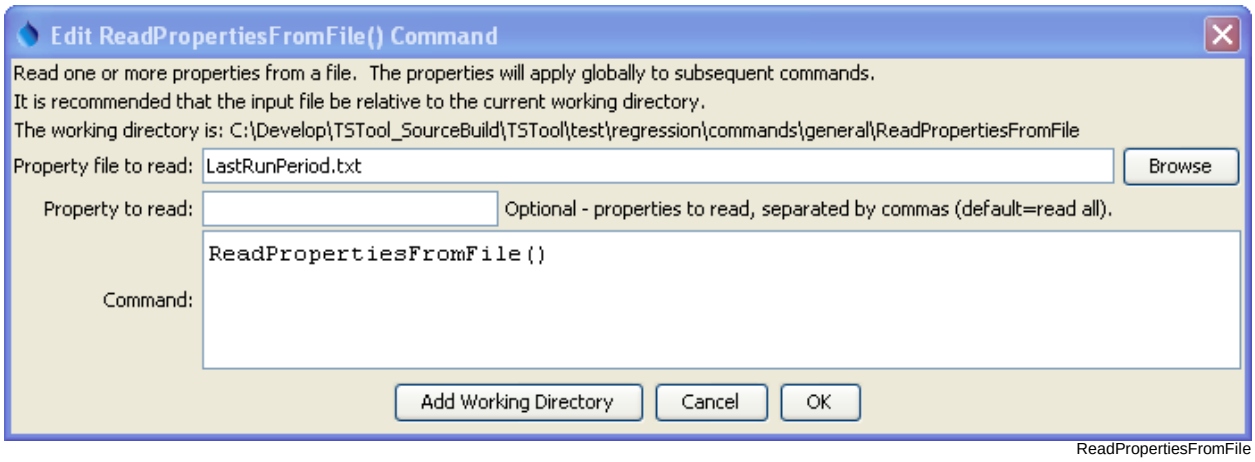
`NameValue`	Simple format, all properties handled as text:
	`PropertyName=PropertyValue`
	`PropertyName="Property value, quoted if necessary"`

`NameTypeValue`	Same as `NameValue` format, with non-primitive objects treated as simple constructors:
	`PropertyName=PropertyValue`
	`DateTimeProperty=DateTime("2010-10-01 12:30")`

`NameTypeValue Python`	Similar to the `NameTypeValue` format, however, objects are represented using "Pythonic" notation, to allow the file to be used directly by Python scripts:
	`PropertyName="PropertyValue"`
	`DateTimeProperty=DateTime(2010,10,1,12,30)`

The format of the file currently is not required when reading the file because the command detects the format for each property and creates an appropriate object type. If this becomes an issue, the command may be enhanced to add a parameter to specify the format (similar to the `WritePropertiesToFile()` command).

The following dialog is used to edit this command and illustrates the syntax of the command.



ReadPropertiesFromFile

ReadPropertiesFromFile() Command Editor

The command syntax is as follows:

```
ReadPropertiesFromFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The property file to read, as an absolute path or relative to the command file.	None – must be specified.
`IncludeProperty`	The names of properties to read, separated by commas.	If not specified, all processor properties will be written.

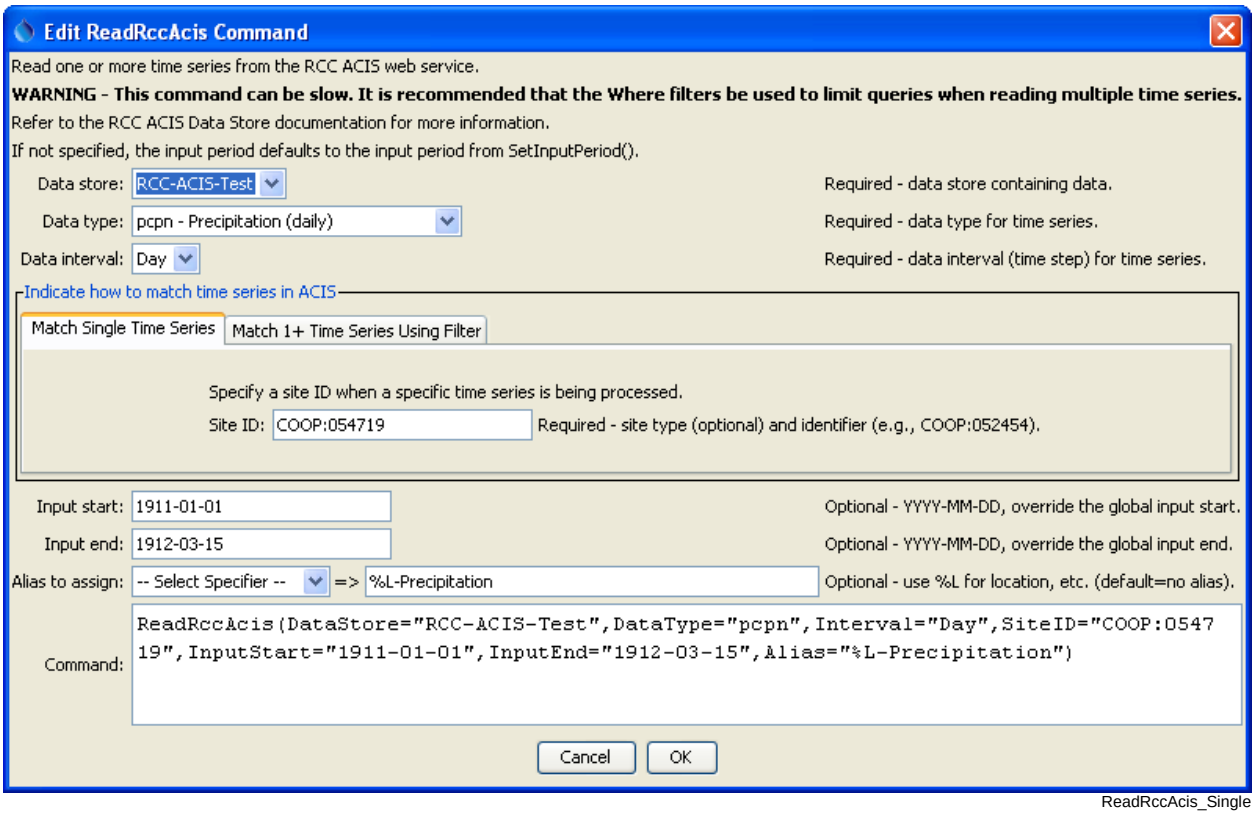
Command Reference: ReadRccAcis()

Read time series from the RCC ACIS web services

Version 10.11.00, 2012-06-28

The `ReadRccAcis()` command reads one or more time series from the Regional Climate Center (RCC) Applied Climate Information System (ACIS) web services, in particular to provide access to daily historical and real-time values from the National Climatic Data Center (NCDC). Features and limitations of ACIS are described in the **RCC ACIS Data Store** appendix. Because web services are used to access a remote database, there may be some delay in retrieving data. For data intensive processes, it may be advisable to mine the data, save to a local file or database, and then perform additional processing using the local data.

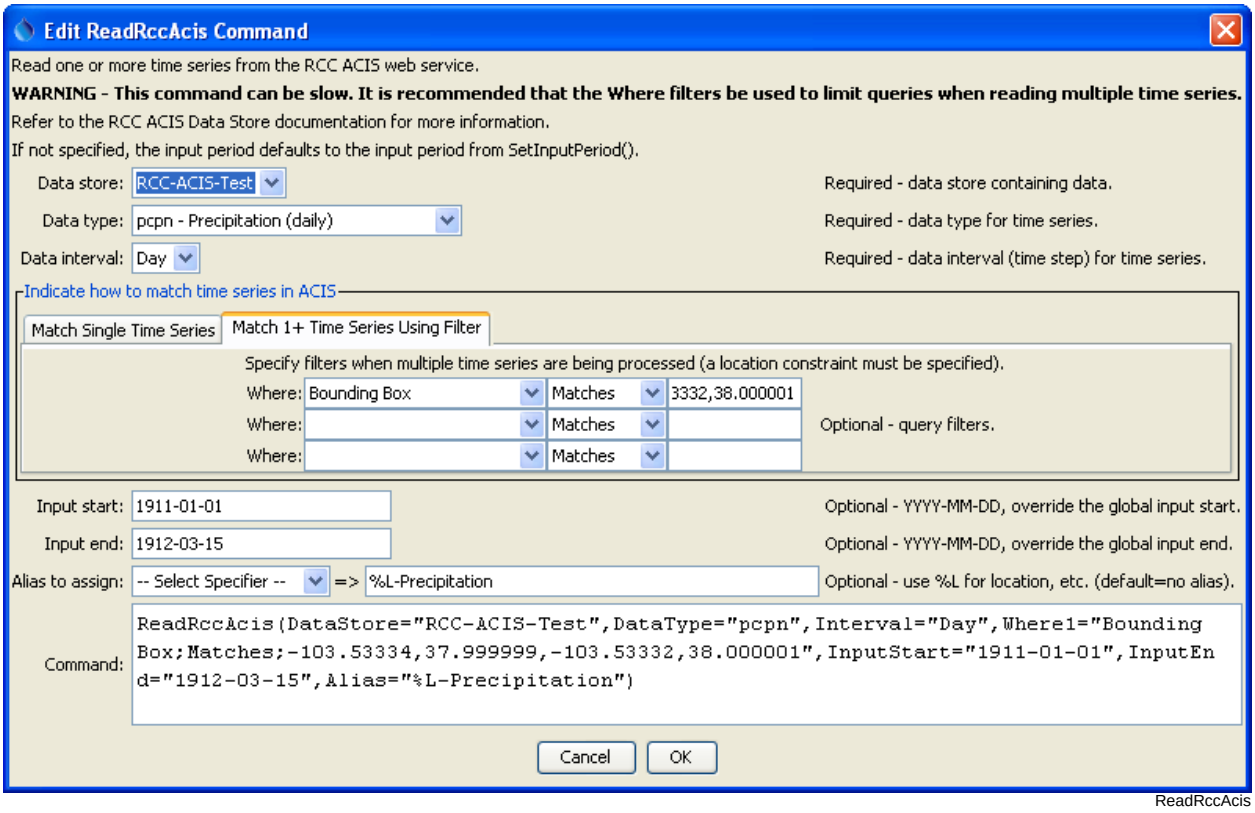
The following dialog is used to edit the command and illustrates the syntax for the command when reading a single time series. This is appropriate when a specific site is being processed.



ReadRccAcis_Single

ReadRccAcis() Command Editor for Reading Single Time Series

The following dialog is used to edit the command and illustrates the syntax for the command when reading multiple time series. This is appropriate when performing bulk processing. Mouse over the ***Where*** data entry fields to see information about choices.



ReadRccAcis() Command Editor for Reading Multiple Time Series

The command syntax is as follows:

```
ReadRccAcis(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`DataStore`	The name of the RCC ACIS data store from which to read.	None – must be specified.
`DataType`	The data type to be queried, as documented in the **RCC ACIS Data Store** appendix. For example, use pcpn to request precipitation data (for the older version 1 ACIS, the "Variable Major" number is used, for example 4 for precipitation).	None – must be specified.
`Interval`	The data interval for the time series. Currently only daily time series can be requested.	None – must be specified.
`SiteID`	Used when reading a single time series. The site ID should be specified using the station type and site identifier (e.g., `COOP:052454`). The station type can be determined by first querying the time series using the TSTool main interface or using the `WhereN` parameter and reviewing the resulting time series identifiers in returned time series. Omitting the station type will assume the	If not specified, the `WhereN` filters are used.

Parameter	Description	Default
	ACIS identifier, which is internal to the ACIS system and not typically used by users. Specifying the `SiteID` will override the `WhereN` parameter.	
`WhereN`	Used when reading 1+ time series. The "where" clauses to be applied to filter the list of stations, matching the values in the ***Where*** fields in the command editor dialog and the TSTool main interface. The parameters should be named `Where1`, `Where2`, etc., and a gap in numbering will result in the remaining items being ignored. The format of each value is: `"Item;Operator;Value"` Where `Item` indicates a data field to be filtered on, `Operator` is the type of constraint, and `Value` is the value to be checked when querying.	If not specified, the query will not be limited and very large numbers of time series may be queried.
`InputStart`	Start of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`InputEnd`	End of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.

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Command Reference: ReadReclamationHDB()

Read time series from a Reclamation HDB database

Version 10.20.00, 2013-04-21

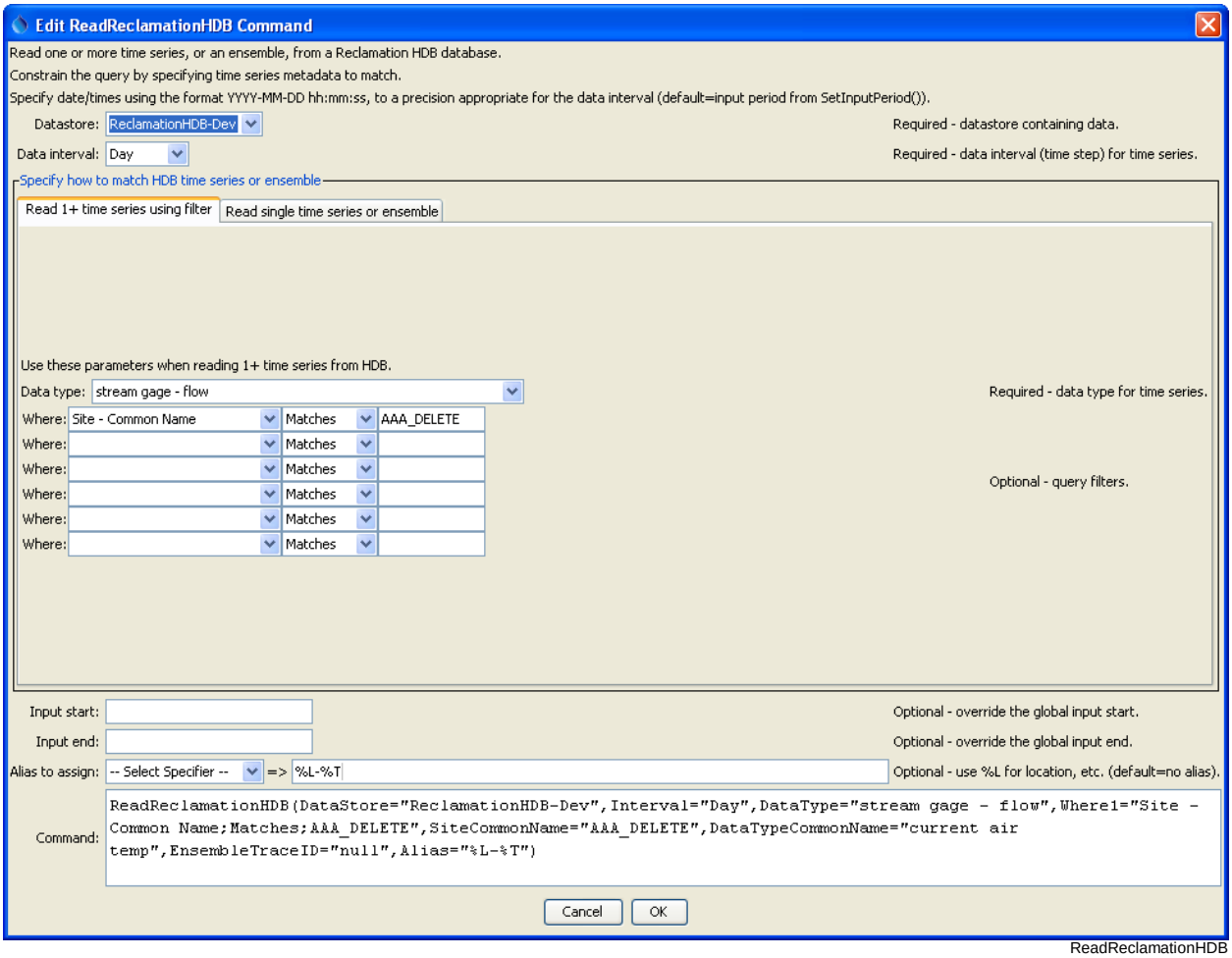
The `ReadReclamationHDB()` command reads one or more time series from a Reclamation HDB database:

- a single time series (which can be part of an ensemble), indicated by the individual time series identifier:
  - a "real" time series (observations)
  - a "model" time series (output from a model)
- all time series in an ensemble, indicated by the ensemble identifier:
  - ensemble trace time series are stored as "model" time series – individual ensemble trace time series can be queried by specifying the appropriate "hydrologic indicator" (which is set to the ensemble time series sequence number from TSTool time series)

See the `WriteReclamationHDB()` command documentation for information about writing the time series that are read by this command. See the **Reclamation HDB Data Store Appendix** for more information about the database features and limitations.

When reading a single time series or ensemble, the choices presented to the user cascade to allow only valid choices.

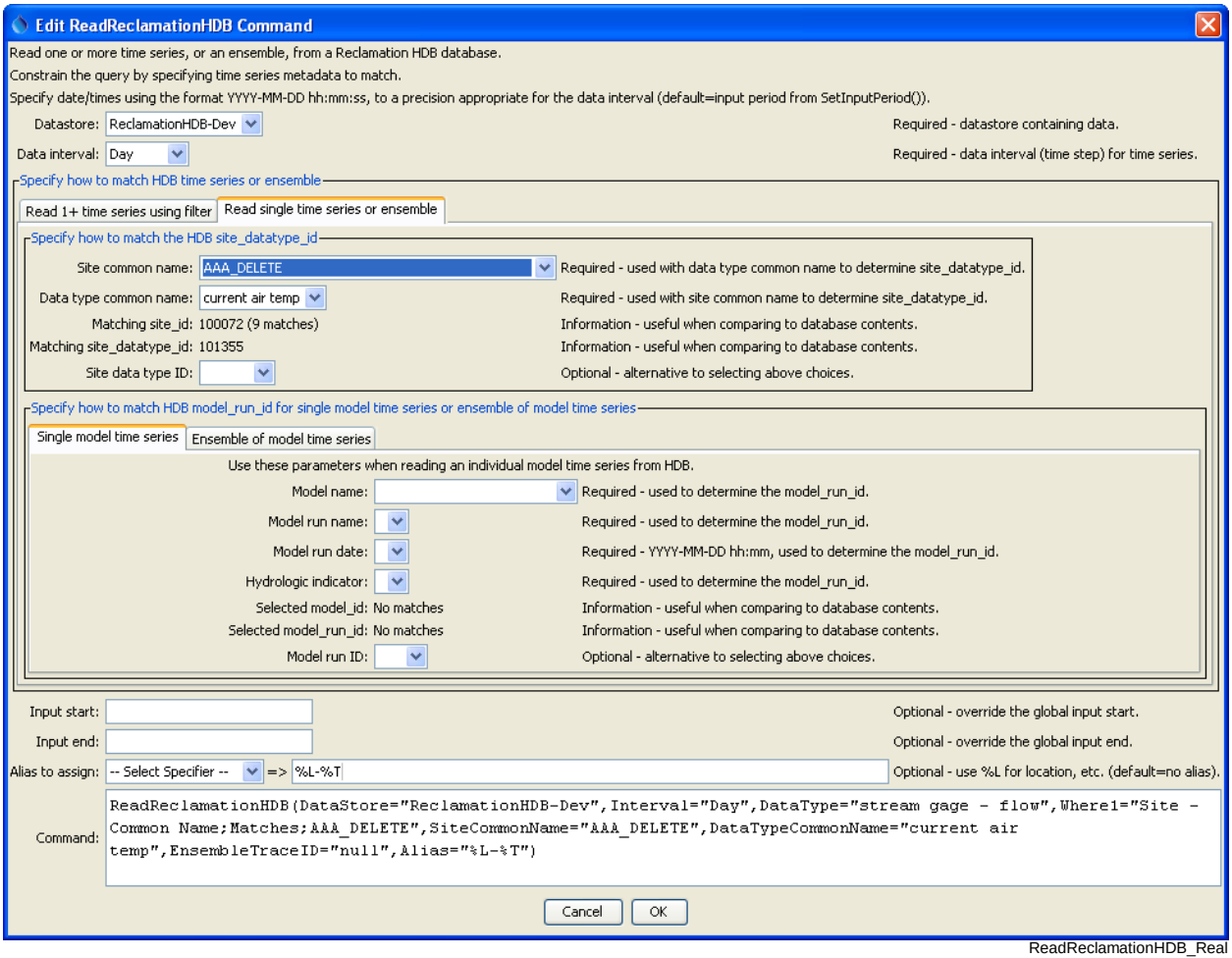
The following dialog is used to edit the command and illustrates the syntax of the command when reading "real" or "model" data using filters. This approach can be used when reading one or more time series in bulk. ***Where*** criteria should be specified in sequential order without intervening blank specifiers.



ReadReclamationHDB

ReadReclamationHDB() Command Editor When Using Filters to Read 1+ Time Series

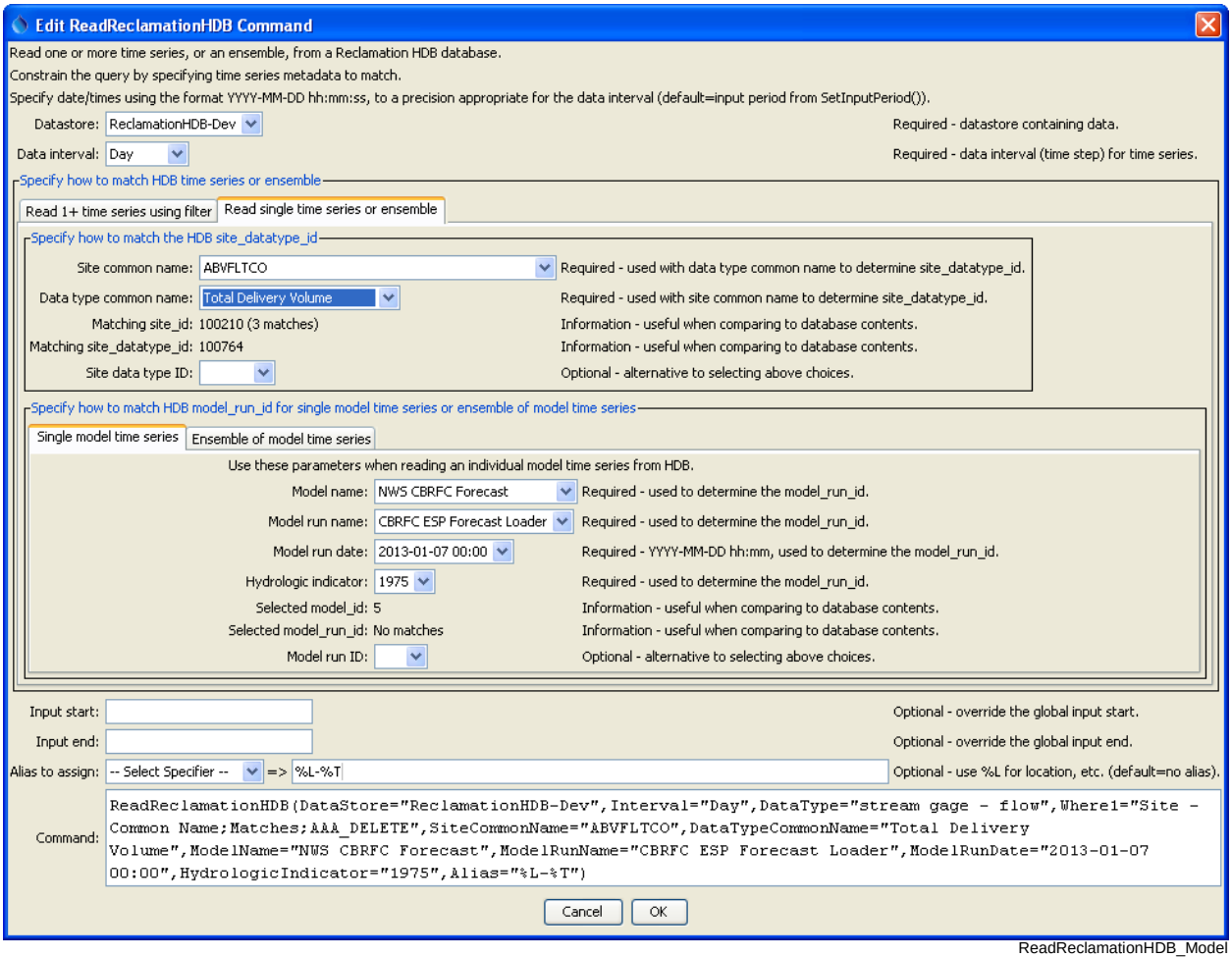
The following figure illustrates reading a single “real” time series (note that the model parameters are not specified).



ReadReclamationHDB_Real

ReadReclamationHDB() Command Editor to Read a Single Real Time Series

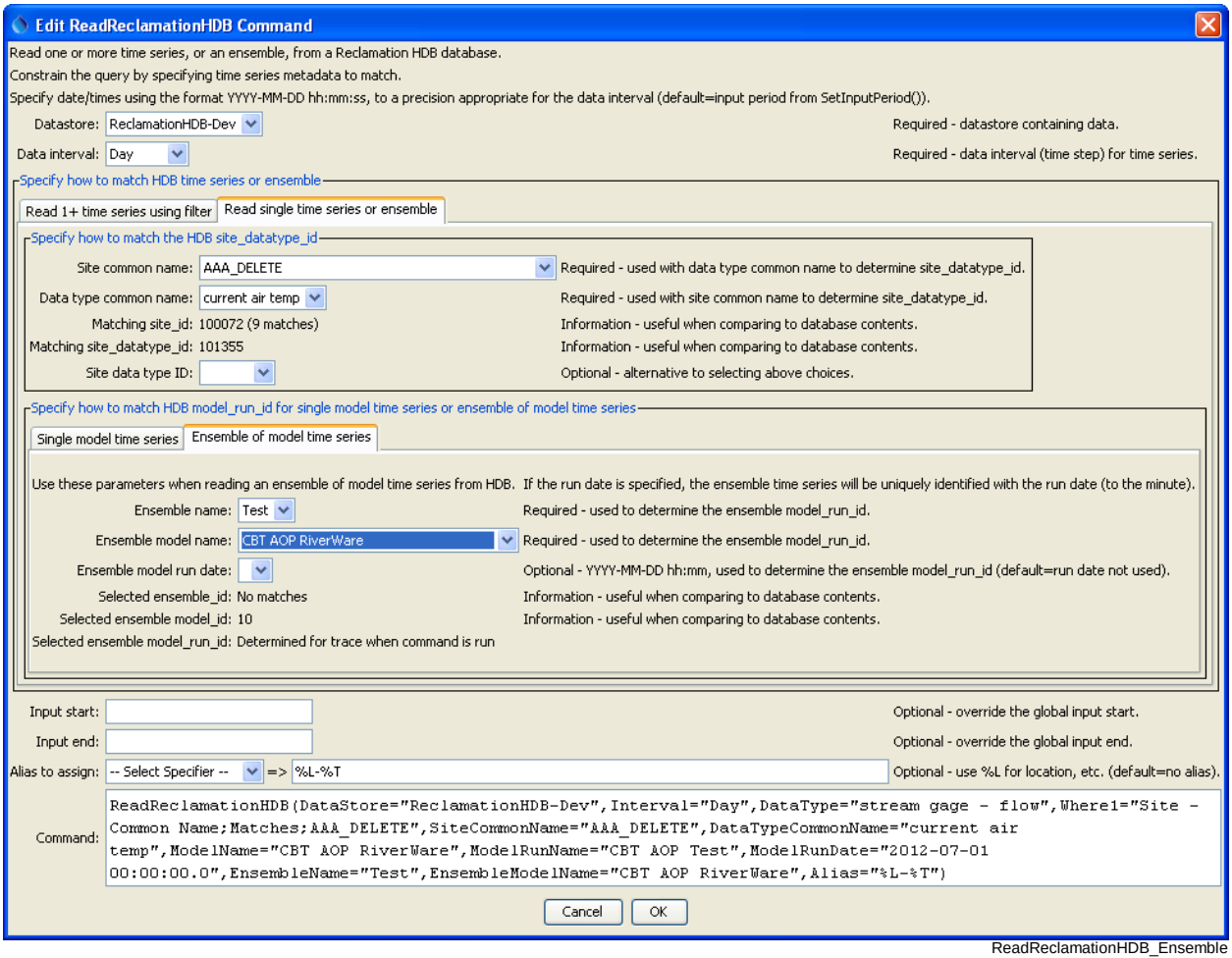
The following figure illustrates reading a single "model" time series, in which case model parameters are specified in addition to the site and data type parameters.



ReadReclamationHDB_Model

ReadReclamationHDB() Command Editor to Read a Single Model Time Series

The following figure illustrates reading n ensemble of "model" time series, in which case ensemble/model parameters are specified in addition to the site and data type parameters.



ReadReclamationHDB_Ensemble

ReadReclamationHDB() Command Editor to Read an Ensemble of Model Time Series

The command syntax is as follows:

```
ReadReclamationHDB(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`DataStore`	Reclamation HDB data store name indicating database from which to read time series.	None – must be specified.
`Interval`	The data interval to read (`Hour`, `Day`, `Month`, `Year`, `Irregular`). Irregular is used for instantaneous data and internally results in data with date/times to minute precision. 2Hour, 3Hour, 4Hour, 6Hour, 12Hour, and 24Hour can also be included, but how can HDB be queried to limit choices to these intervals? This interval is important because it tells TSTool how to allocate	None – must be specified.

Parameter	Description	Default
	memory for data values, and iterate through data.	
	Use the following parameter when reading 1+ time series using filters	
`DataType`	The data type to read as `ObjectType – DataTypeCommonName`. The object type is shown to help with selections. `*` can be specified to read all data types.	None – must be specified.
`WhereN`	The "where" clauses to be applied when querying data, which match the values in the ***Where*** fields in the TSTool main interface. The parameters should be specified as `Where1`, `Where2`, etc., with no intervening gaps in numbering. All clauses are joined as "and" and are therefore cumulative in limiting the query. The format of each parameter value is: `"Item;Operator;Value"` Where `Item` indicates a data field to be filtered on, `Operator` is the type of constraint, and `Value` is the value to be checked when querying.	If not specified, the query will not be limited and very large numbers of time series may result from the query (which may require a long time to perform the query).
	Use the following parameters when reading a single time series or an ensemble of time series.	
`Site CommonName`	The site common name for the time series location; used with the data type common name to determine the site_datatype_id in the database.	None – must be specified unless `SiteDataTypeID` is specified.
`DataType CommonName`	The data type common name for the time series; used with the site common name to determine the site_datatype_id in the database.	None – must be specified unless `SiteDataTypeID` is specified.
`SiteDataTypeID`	The site_datatype_id value to match the time series. If specified, the value will be used instead of the site_datatype_id determined from `SiteCommonName` and `DataTypeCommonName`.	
	Use the following parameters when reading a single model time series.	
`ModelName`	The model name for the time series; used with the model run name, hydrologic indicator(s), and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunName`	The model run name for the time series; used with the model name, hydrologic indicator(s), and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunDate`	The model run date (timestamp) to use for the time series; used with the model name, model run name,	None – must be specified unless

Parameter	Description	Default
	and hydrologic indicator(s) to determine the model_run_id in the database. The run date should be specified using the format `YYYY-MM-DD hh:mm` (zero-padded with hour 0-23, minute 0-59, seconds and hundredths of seconds will default to 0). **Need to implement tests to make sure this is properly handled, including formatting and listing existing values.**	`ModelRunID` is specified.
`Hydrologic Indicator`	The hydrologic indicator(s) to use for the time series; used with the model name, model run name, and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunID`	The model_run_id value to match the time series. If specified, the value will be used instead of the model_run_id determined from `ModelName` , `ModelRunName`, `ModelRunDate`, and `HydrologicIndicator.`	
	Use the following parameters when reading an ensemble of model time series.	
`EnsembleName`	The name of the ensemble to write. The `TSList=EnsembleID` and `EnsembleID` parameters also should be specified.	Must be specified if writing an ensemble.
`EnsembleTraceID`	Indicate how to identify time series trace identifiers. This parameter may be implemented in the future.	The HDB trace number is used for the TSTool ensemble trace sequence number.
`EnsembleModelName`	The model name corresponding to the ensemble.	Must be specified if writing an ensemble.
`EnsembleModel RunDate`	When writing an ensemble, the model run date for the ensemble, specified using format: • `YYYY-MM-DD hh:mm` (zero-padded with hour 0-23) • `${TS:property}` – use a run date from a time series property, truncated to minute **Need to implement tests to make sure this is properly handled, including formatting and listing existing values.**	If not specified, the ensemble identifier in HDB will not include the model run date.
	The following parameters are always appropriate.	
`InputStart`	Start of the period to query, specified in format `YYYY-MM-DD HH`, with a precision appropriate for the interval.	Read all available data.
`InputEnd`	End of the period to query, specified in format `YYYY-MM-DD HH`, with a precision appropriate for the interval.	Read all available data.
`Alias`	Indicate an alias to assign to time series, which can result in shorter identifiers for time series when referenced with other commands.	No alias is assigned.

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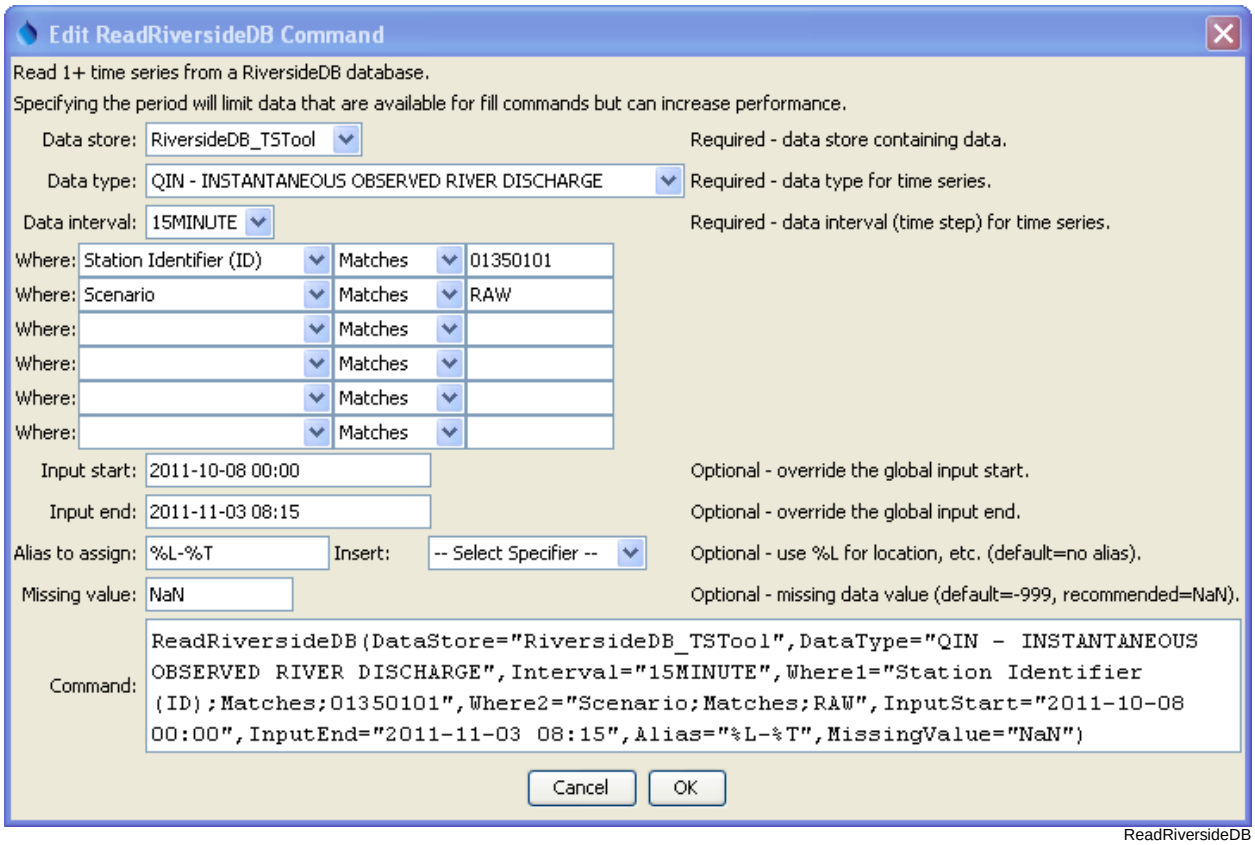
Command Reference: ReadRiversideDB()

Read time series from a RiversideDB database

Version 10.06.00, 2012-04-04

The `ReadRiversideDB()` command reads one or more time series from a RiversideDB database (see the **Riverside Data Store Appendix** for more information). It is designed to utilize query criteria to process large numbers of time series. The RiversideDB design is highly consistent with TSTool conventions and therefore time series properties in RiversideDB, including time series identifier information, map closely to TSTool internal data representations.

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadRiversideDB

ReadRiversideDB() Command Editor

The ***Data type***, ***Data interval***, and ***Where*** input fields are similar to those from the main TSTool interface. However, whereas the interactive interface first requires a query to find the matching time series list and then an interactive select for specific time series identifiers, the `ReadRiversideDB()` command reads all matching time series in one step. This can greatly shorten command files and simplify command logic, especially when processing large amounts of data. It may be necessary to specify more criteria where a single time series is needed.

The command syntax is as follows:

```
ReadRiversideDB(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`DataStore`	The data store name, indicating the RiversideDB database to query.	None – must be specified.
`DataType`	The data type to be queried, determined from time series that are available in the database.	None – must be specified.
`Interval`	The data interval for the time series, determined from time series that are available in the database matching the `DataType`.	None – must be specified.
`WhereN`	The "where" clauses to be applied when querying data, matching the values in the ***Where*** fields in the command editor dialog and the TSTool main interface. The parameters should be named `Where1`, `Where2`, etc., with a gap resulting in the remaining items being ignored. The format of each value is: `"Item;Operator;Value"` Where Item indicates a data field to be filtered on, Operator is the type of constraint, and Value is the value to be checked when querying.	If not specified, the query will not be limited and very large numbers of time series may be queried.
`InputStart`	Start of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`InputEnd`	End of the period to query, specified as a date/time with a precision that matches the requested data interval.	Read all available data.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	
`MissingValue`	Value to use to indicate missing data values within the time series. `-999` is the default for historical reasons; however, `NaN` (not a number) is being phased in and should be specified if possible. Null values in the database will be converted to the missing data value.	`-999`

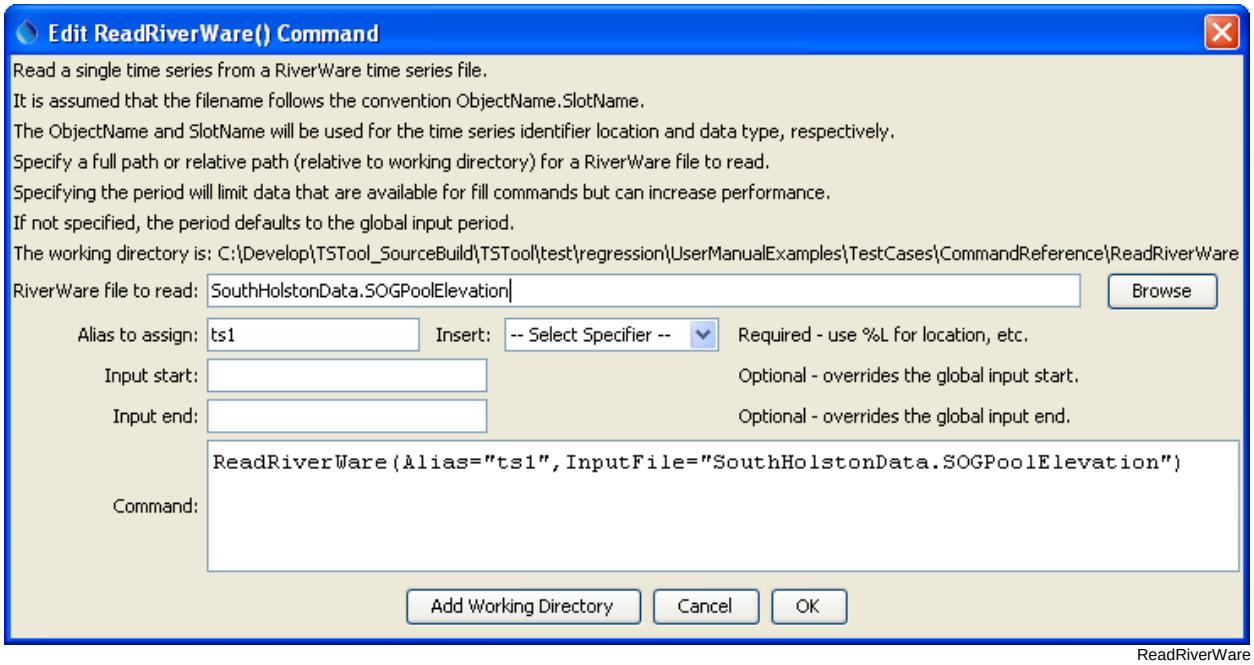
Command Reference: ReadRiverWare()

Read a single time series from a RiverWare file

Version 10.00.00, 2011-03-28

The `ReadRiverWare()` command reads a single time series from a RiverWare file (see the **RiverWare Input Type Appendix**) and assigns an alias to the result.

The following dialog is used to edit the command and illustrates the command syntax.



ReadRiverWare

ReadRiverWare() Command Editor

The command syntax is as follows:

```
ReadRiverWare(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadRiverWare(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the RiverWare file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`Units`	The units for the time series. The data values will be converted to these units. TSTool by default understands certain units abbreviations and attempting to convert to or from unknown units may not be possible. The ability to handle user-defined units is being evaluated. See the `Scale()` and `ConvertDataUnits()` commands.	Use the units read from the file. **This parameter is not yet enabled**.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.

A sample command file is as follows:

```
ReadRiverWare(Alias=”ts1”,InputFile="SouthHolstonData.SOGPoolElevation")
```

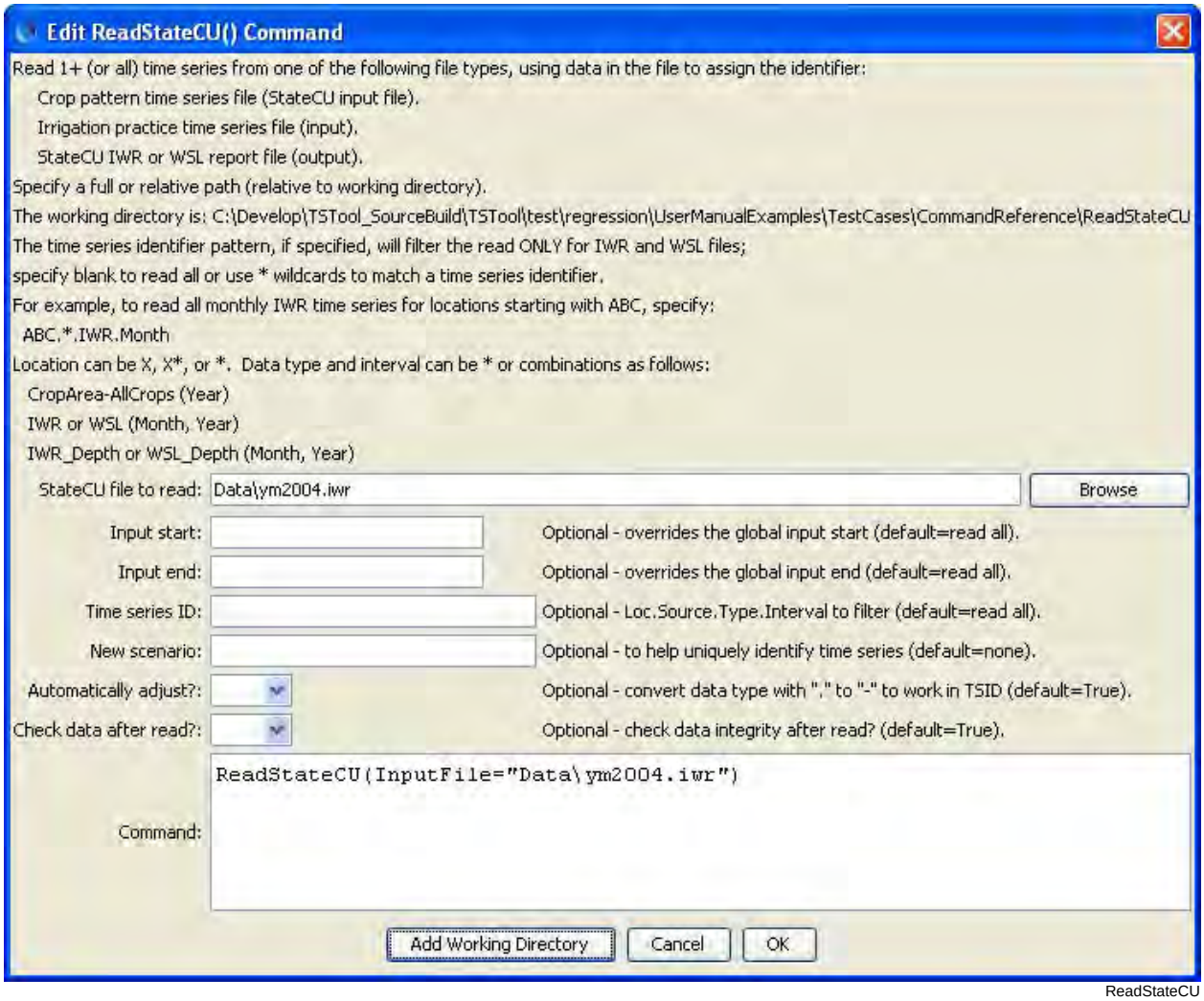
Command Reference: ReadStateCU()

Read time series from a StateCU time series or report File

Version 09.07.02, 2010-08-20

The `ReadStateCU()` command reads all the time series in a StateCU time series file (e.g., frost dates) or report file (e.g., IWR, WSL) (see the **StateCU Input Type Appendix**).

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadStateCU

ReadStateCU() Command Editor

The command syntax is as follows:

```
ReadStateCU(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile	The name of the StateCU time series or report file to read, surrounded by double quotes.	None – must be specified.
InputStart	The starting date/time to read, specified to a precision (month or year) that matches the data file.	Read all the data.
InputEnd	The ending date/time to read, specified to a precision (month or year) that matches the data file.	Read all the data.
TSID	A time series identifier pattern that will be used to filter the list of time series that are read. See the figure above for examples.	Read all time series.
NewScenario	A new scenario to use for the TSID. This is useful when reading data from multiple model runs that otherwise would have the same TSIDs.	No scenario.
AutoAdjust	Indicate whether to automatically adjust time series identifiers to use a dash "-" instead of period "." in the data type, necessary because StateCU data types (e.g., crop types that include CU method) have a period that interferes with the normal TSID convention.	True
CheckData	Indicate whether to check the data for integrity after reading. Currently only the irrigation practice time series can be checked, to verify that the acreage totals are the sum of the parts.	True

A sample commands file is as follows:

```
ReadStateCU(InputFile="Data\ym2004.iwr")
```

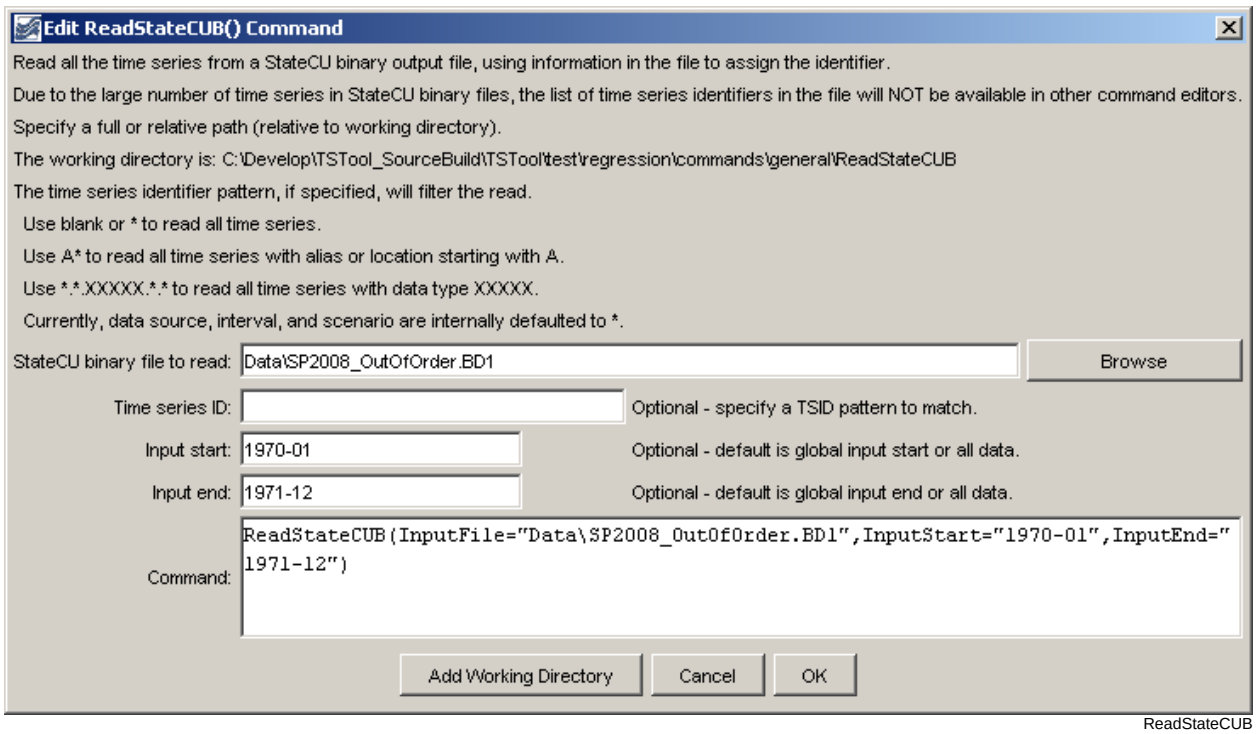
Command Reference: ReadStateCUB()

Read time series from a StateCU binary output time series file

Version 08.17.00, 2008-10-02

The `ReadStateCUB()` command reads time series from a StateCU binary output time series file (see the **StateCUB Input Type Appendix**). The actual reading occurs as the commands are being processed. For this reason and because the number of time series in the binary file is usually large, if any other commands reference the StateCU binary file time series, the time series identifiers must be specified manually or use wildcards in identifiers (identifiers are not available to list in dialogs). Only data types that contain floating point numbers will be read.

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadStateCUB

ReadStateCUB() Command Editor

The command syntax is as follows:

```
ReadStateCUB(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile	The name of the StateCU binary time series file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory.	None – must be specified.
TSID	Time series identifier pattern to filter the read.	Read all time series.
InputStart	The starting date/time to read data, specified to Month precision.	Read all data.
InputEnd	The ending date/time to read data, specified to Month precision.	Read all data.

The following example command file illustrates how to read all CU Shortage time series:

```
ReadStateCUB(InputFile="Data\farmers.BD1",TSID="*.*.CU Shortage.*.*")
```

The following example illustrates how to read all time series from a binary file with debug turned on to echo all information that is read.

```
StartLog(LogFile="commands.TSTool.log")
SetDebugLevel(LogFileLevel=1)
ReadStateCUB(InputFile="Data\farmers.BD1")
```

Command Reference: ReadStateMod()

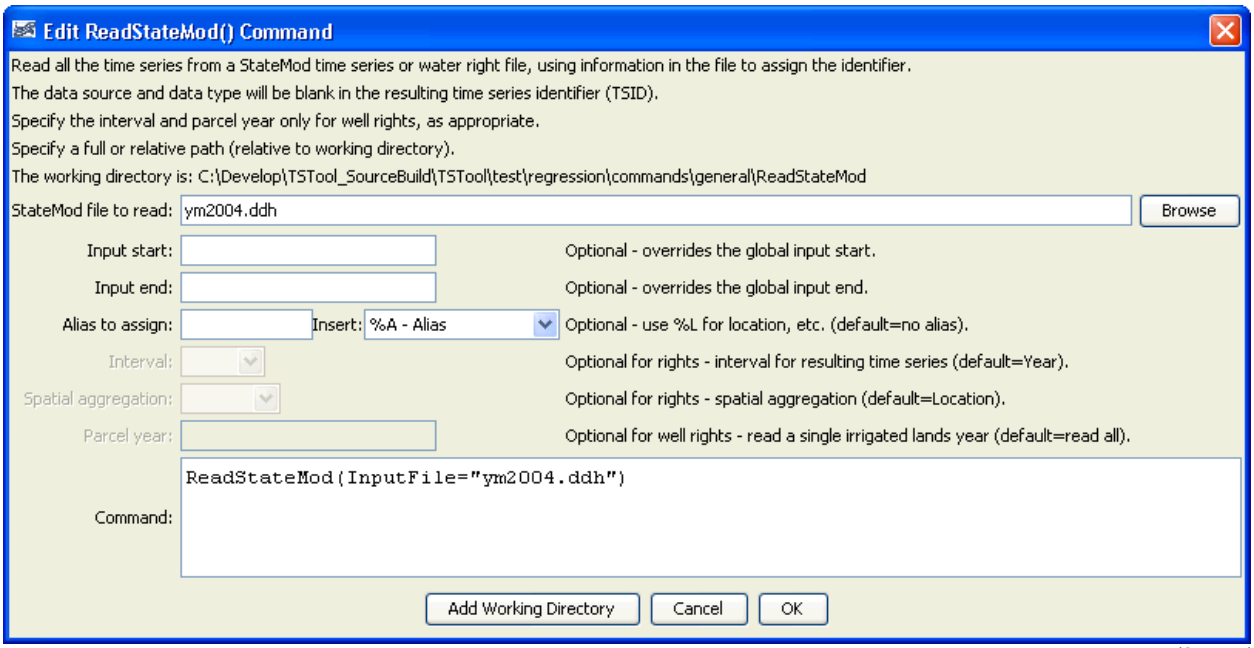
Read all the time series from a StateMod time series file

Version 09.05.03, 2009-11-17

The `ReadStateMod()` command reads all the time series in a StateMod time series file (see the **StateMod Input Type Appendix**). Single time series can be read by using time series identifier (TSID) commands.

Water rights files also can be read and converted to time series – this is useful for visualization, water supply analysis, and is used to test well right processing. Considering all water rights for a location based on the administration number results in a step function of decree over time. Monthly and yearly time series use calendar year and a right is active if it is turned on anywhere in the month or year. Free water rights (e.g., those having administration numbers > 90000.00000 are treated like other rights and therefore may not impact the results in the current period because the corresponding appropriation date is in the future (additional parameters may be added in the future to allow more ways to process these rights). If processing well rights and multiple years of parcel data are processed, this command executes the same logic as the StateDMI `MergeWellRights()` command.

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadStateMod

ReadStateMod() Command Editor

The command syntax is as follows:

```
ReadStateMod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the StateMod time series file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory. Global property values can be inserted using the syntax `${PropertyName}` (see also the `SetProperty()` command).	None – must be specified.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period. Specify to a precision that matches the data. If reading water rights, the output time series will start on this date.	Use the global query period or if not specified read all data. The default for water rights is the date of the first right.
`InputEnd`	The end of the period to read data – specify if the period should be different from the global query period. Specify to a precision that matches the data. If reading water rights, the output time series will end on this date.	Use the global query period or if not specified read all data. The default for water rights is the date of the last right.
`Alias`	The alias to assign to the time series that are read. Use the format choices and other characters to define a unique alias.	No alias is assigned.
`Interval`	When reading a water right file, specify the interval for the resulting time series, one of `Day`, `Month`, or `Year`.	`Year`
`Spatial Aggregation`	When reading a water right file, indicate how time series are to be aggregated spatially, one of: • `Location` – aggregate by the station identifier. • `Parcel` – (only used with well rights) aggregate based on the parcel number and parcel year. • `None` – do not aggregate spatially, which will result in constant value time series for each water right.	`Location`
`ParcelYear`	When processing a well water right file, indicate the year of parcel data to process. Parcel configurations change from year to year, and a single year of parcel data can be processed if desired.	Process all parcel years.

A sample command file is as follows:

```
ReadStateMod(InputFile="ym2004.ddh")
```

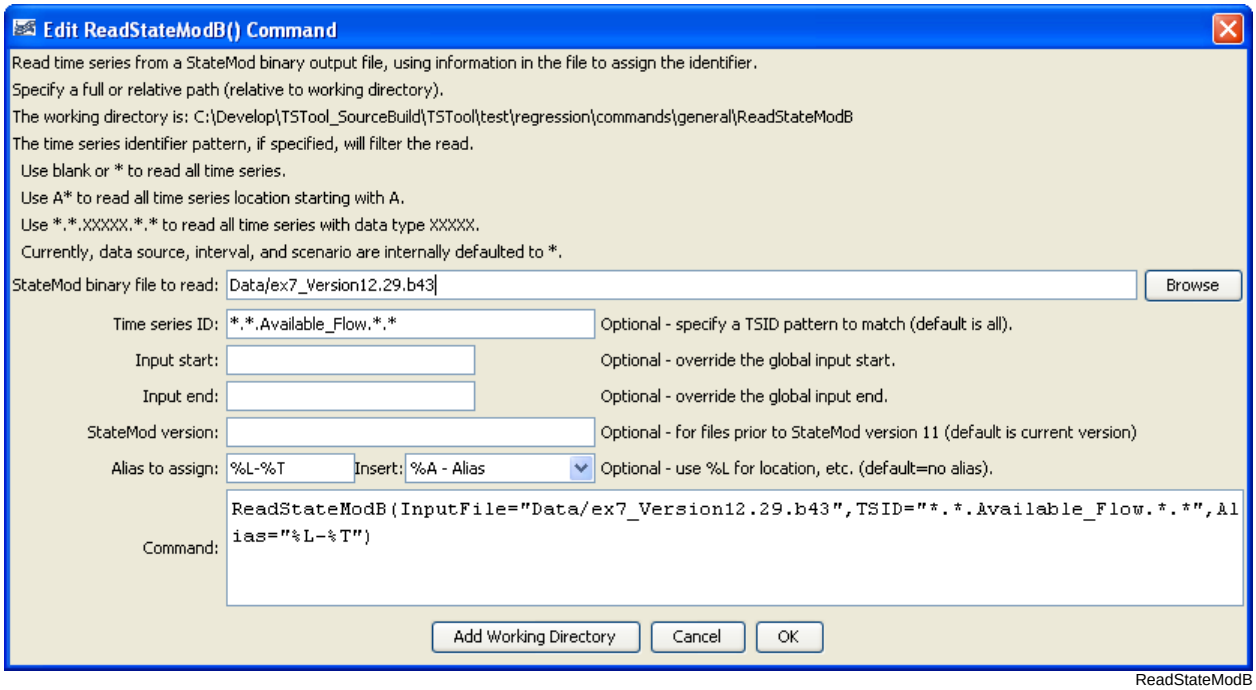
Command Reference: ReadStateModB()

Read time series from a StateMod binary output time series file

Version 09.06.00, 2010-01-05

The `ReadStateModB()` command reads time series from a StateMod binary output time series file (see the **StateModB Input Type Appendix**). The identifiers (or aliases) from the time series will be available as choices when editing other commands. If this causes performance issues due to the large number of time series that may be read, limit the time series that are read using the `TSID` parameter.

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadStateModB

ReadStateModB() Command Editor

The command syntax is as follows:

```
ReadStateModB(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the StateMod binary time series file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory. Global property values can be inserted using the syntax `${PropertyName}` (see also the `SetProperty()` command).	None – must be specified.
`TSID`	Time series identifier pattern to filter the read. Use periods to indicate separate TSID parts and use * to match patterns within the parts.	Read all time series.
`InputStart`	The starting date/time to read data, specified to `Day` or `Month` precision based on whether a daily or monthly model run.	Read all data.
`InputEnd`	The ending date/time to read data, specified to `Day` or `Month` precision based on whether a daily or monthly model run.	Read all data.
`Version`	StateMod version number using the form NN.NN (padded with leading zero for version 9) corresponding to the file, necessary because the file version number (and consequently parameters) cannot be automatically detected in older versions. Changes in binary file format occurred with version 9.01 and 9.69, mainly to add new data types. The StateMod file version for version 11+ is automatically detected.	Detect from the file if possible.
`Alias`	The alias to assign to the time series that are read. Use the format choices and other characters to define a unique alias.	No alias is assigned.

The following example command file illustrates how to read all `Available_Flow` time series for identifiers starting with 44 (e.g., to extract all such time series for a water district):

```
ReadStateModB(InputFile="..\StateMod\ym2002b.b43",TSID="44*.*.Available_Flow.*")
```

The following example illustrates how to read all time series from a binary file that was created with StateMod version 9.53. As shown in the example, debug can be turned on for the log file to evaluate issues with the file format.

```
StartLog(LogFile="commands.TSTool.log")
SetDebugLevel(0,1)
ReadStateModB(InputFile="COLOFB.B43",Version="09.53")
```

Command Reference: ReadTableFromDataStore()

Read a table from a datastore

Version 10.21.00, 2013-06-21

The `ReadTableFromDataStore()` command executes a database query for a datastore that is associated with a database, and places the result in a TSTool table, which can subsequently be processed with other TSTool commands. This command cannot be used with web service datastores because the underlying software relies on a database to perform the query. If database datastore support is not specifically provided by TSTool, a generic datastore can be used (see the **Generic Database DataStore** appendix). This command is useful when the database can provide results with a simple query and tight integration with TSTool is not required or has not been implemented. The query can be specified in the following ways:

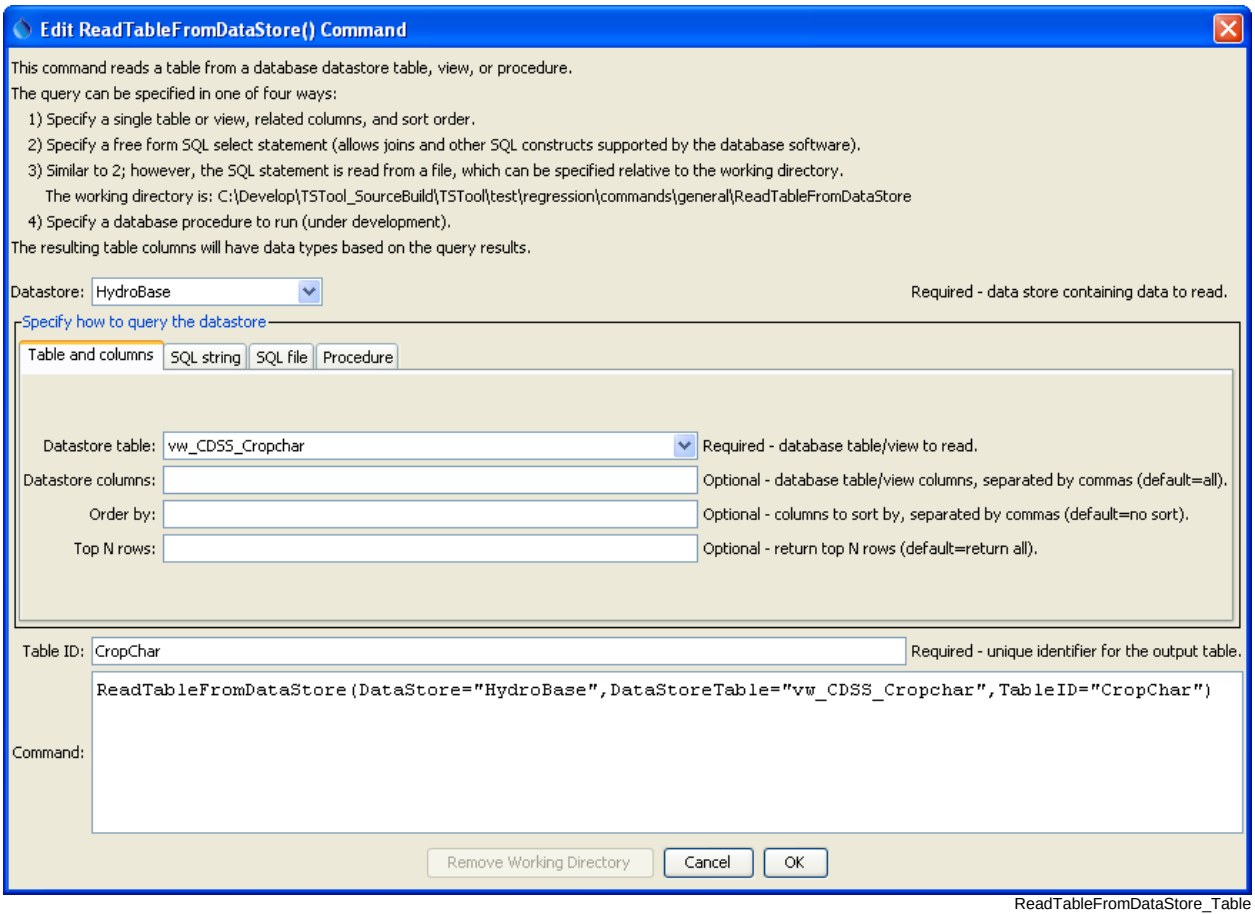
- Specify a single table/view to query:
  - the list of tables is filtered to remove internal database tables; however, this capability varies by database product and in some cases internal tables will be listed
  - the query is constructed from the provided database table/view name and column names
  - the output can be sorted by specifying column names
  - "where" clauses currently are not supported but may be added in the future
  - the top N rows of the result can be returned to allow "peeking" at tables (may not be available for all database software)
- Specify a SQL select statement:
  - SQL must be valid for the database (syntax may vary based on database software)
  - Use `${Property}` notation to insert processor property values set with `SetPropety()`.
  - SQL syntax is not checked for validity and therefore error messages from the database may be more difficult to interpret
- Specify an SQL select statement in a file:
  - Similar to the above option; however, the SQL statement is read from a file
  - Useful if the SQL statement is also used by other tools
- Specify a procedure to run:
  - Available procedures are listed and can be selected
  - Currently, only procedures that do not require parameters can be run

General constraints on the query are as follows:

- the table, views, and procedures being queried must be readable (some databases restrict direct access to data and require using stored procedures)
- the resulting table in TSTool will have columns with names that match the database query results
- data types for columns will closely match the database results:
  - data will be treated as strings if unable to match the database column type
  - the precision of floating point numbers for displays is defaulted to 6 digits
  - null values in the database will transfer to null values in the TSTool table and will display as blank table cells
  - date/time columns in the database will be represented as such in the TSTool table; however, it may not be possible to limit the precision of the date/time (i.e., hours, minutes, and seconds may be shown with default zero values in output)

Future enhancements will add additional features to intelligently map database results to TSTool tables.

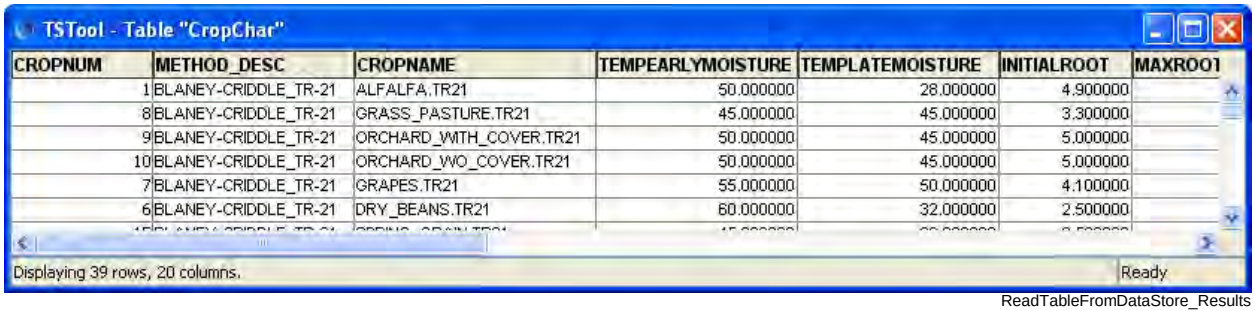
The following dialog is used to edit the command and illustrates the syntax for the command, in this case reading a small table from the State of Colorado's HydroBase.



ReadTableFromDataStore_Table

ReadTableFromDataStore() Command Editor When Querying a Single Table

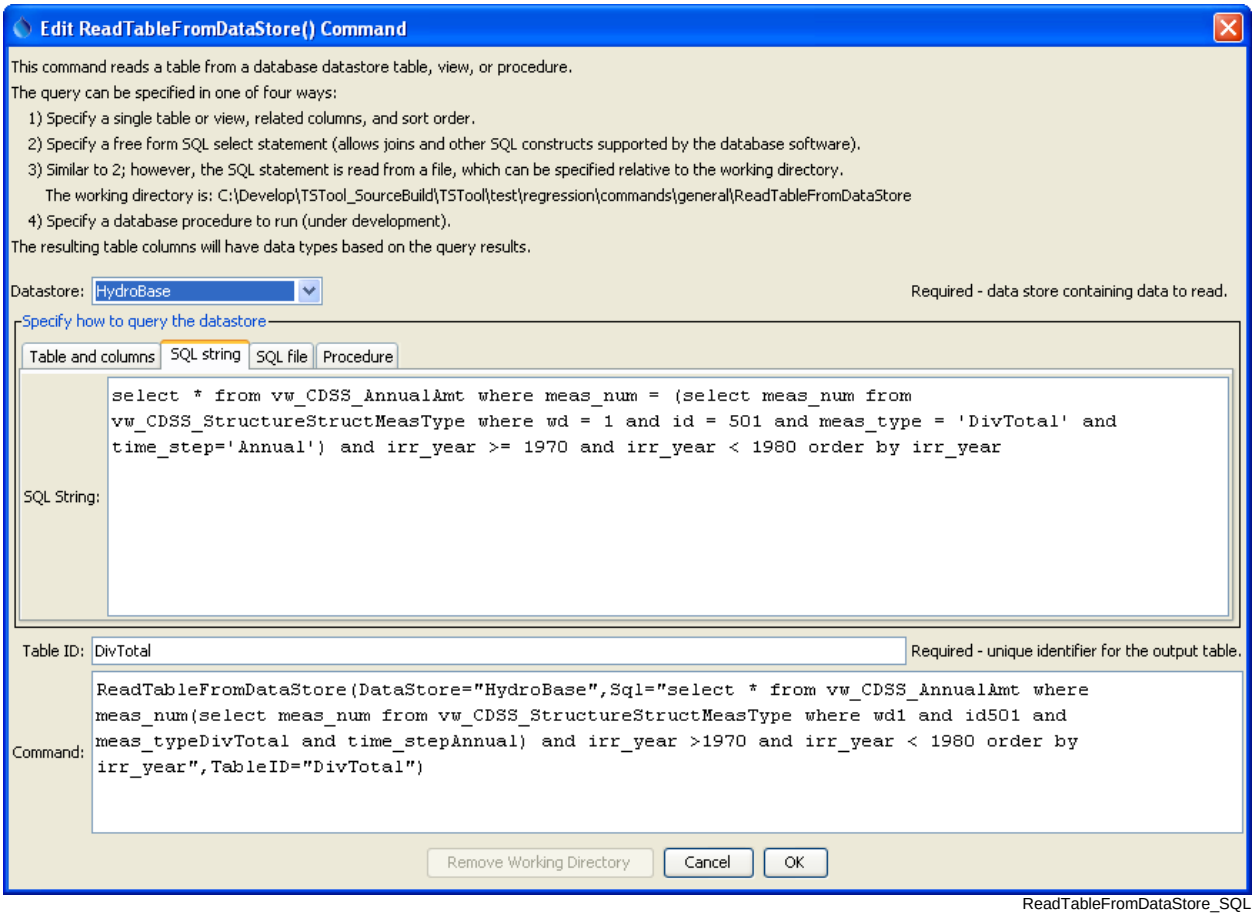
The corresponding output table is as shown below:



ReadTableFromDataStore_Results

Example ReadTableFromDataStore() Command Output Table

The following example illustrates using an SQL query string, in this case to read diversion records for a specific structure in HydroBase:



ReadTableFromDataStore_SQL

ReadTableFromDataStore() Command Editor When Specifying a SQL Query String

The command syntax is as follows:

```
ReadTableFromDataStore(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
DataStore	The name of a database datastore to read.	None – must be specified.
DataStoreTable	The name of the database table or view to read when querying a single table or view. If specified, do not specify Sql or SqlFile.	None.
DataStoreColumns	When reading a single table/view, the names of the columns to read, separated by commas.	All columns from DataStoreTable are read.
OrderBy	When reading a single table/view, a list of column names separated by commas to control the order of output.	Default database sort order will be used.
Top	Indicate that Top rows should be returned. This functionality may not be implemented for all databases (SQL is not fully standardized for this feature). This parameter is useful to determine the columns for a table prior to using the Sql or SqlFile parameters.	Return all rows.
Sql	The SQL string that will be used to query the database, optionally using ${Property} notation to insert processor property values. If specified, do not specify DataStoreTable or SqlFile.	None.
SqlFile	The name of the file containing an SQL string to execute, optionally using ${Property} notation in the SQL file contents to insert processor property values. If specified, do not specify DataStoreTable or Sql.	None.
DataStoreProcedure	The name of the database procedure to run. Currently, only procedures that do not require parameters can be run.	None.
TableID	Identifier to assign to the output table in TSTool, which allows the table data to be used with other commands. A new table will be created.	None – must be specified.

Command Reference: ReadTableFromDBF()

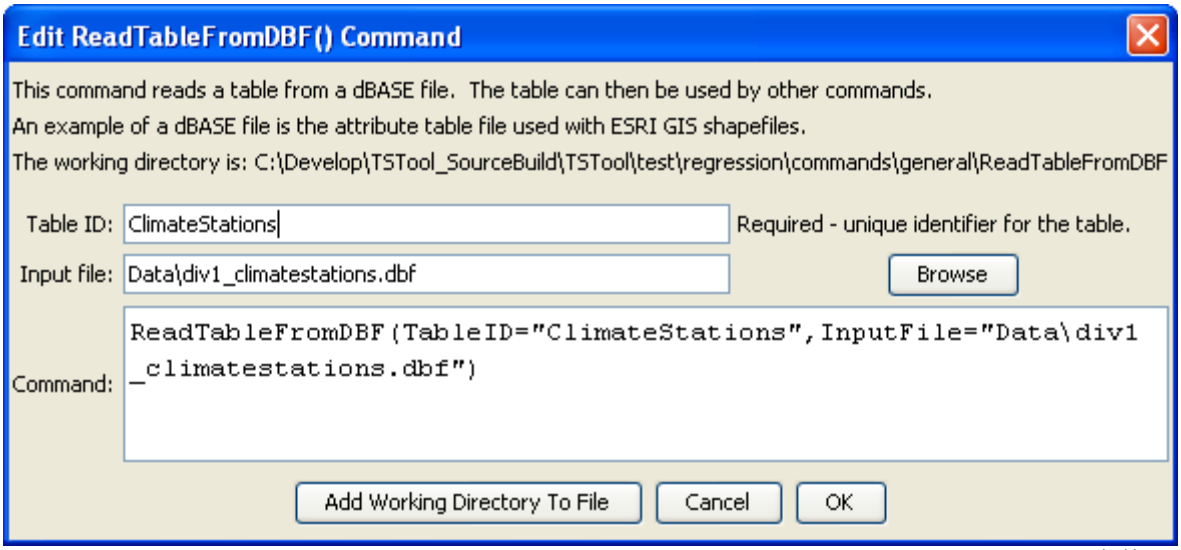
Read a table from a dBASE file

Version 09.09.00, 2010-09-23

The `ReadTableFromDBF()` command reads a table from a dBASE file, such as the files used with ESRI GIS shapefiles. dBASE files are self-contained binary database files.

Handling of dBASE files is limited and support for newer features may not be included.

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadTableFromDBF

ReadTableFromDBF() Command Editor

The command syntax is as follows:

```
ReadTableFromDBF(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier to assign to the table that is read, which allows the table data to be used with other commands.	None – must be specified.
`InputFile`	The name of the file to read, as an absolute path or relative to the command file location.	None – must be specified.

Command Reference: ReadTableFromDelimitedFile()

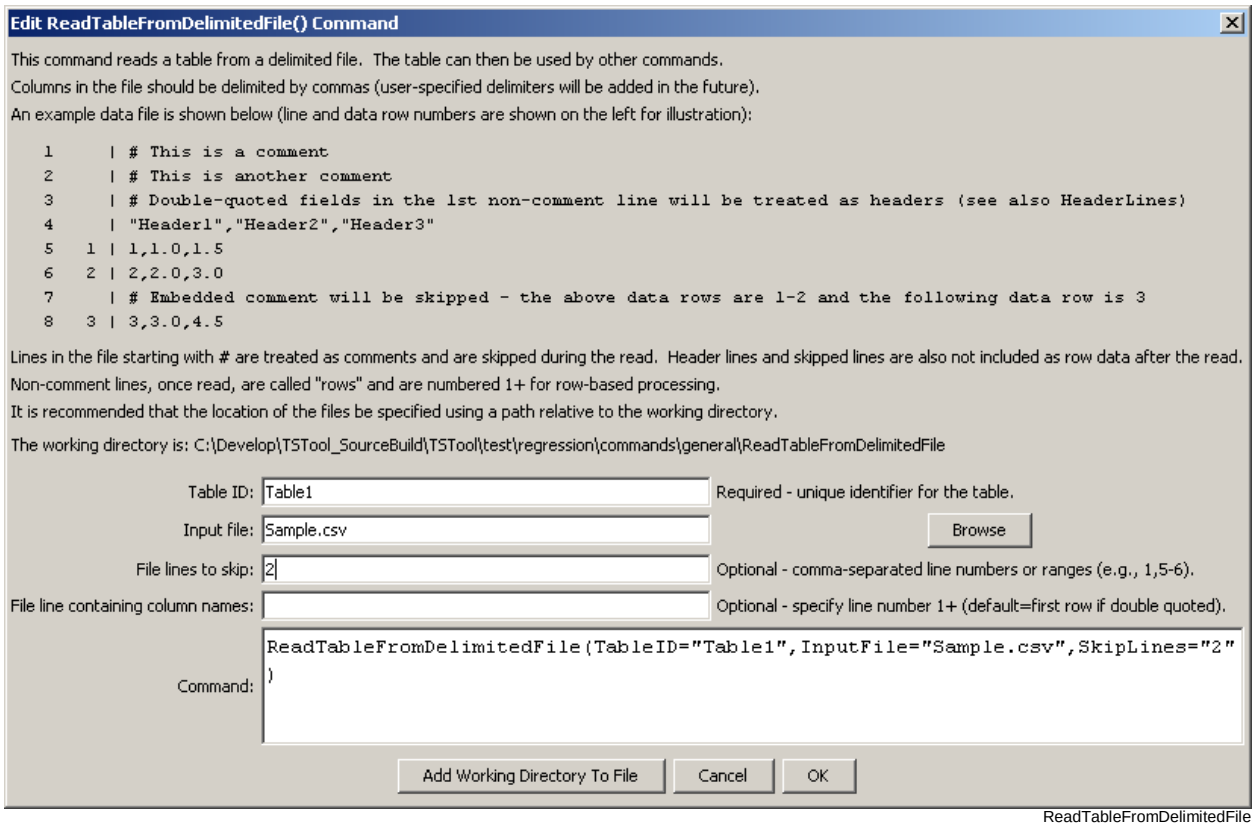
Read a table from a delimited file

Version 10.03.00, 2012-01-09

The `ReadTableFromDelimitedFile()` command reads a table from a comma-delimited file. Tables are used by other commands when performing lookups of information or generating summary information from processing. Table files have the following characteristics:

- Comments indicated by lines starting with # are stripped during the read.
- Extraneous lines in the file can be skipped during the read using the `SkipLines` parameter.
- Column headings indicated by "quoted" values in the first non-comment line will be used to assign string names to the columns. If no quoted values are present, columns will not have headings.
- Data in columns are assumed to be of consistent type (i.e., all numerical data or all text), based on rows after the header. The data type for the column will be determined automatically.
- Missing values can be indicated by blanks. However, a line ending with the delimiter may cause warnings because blank is not assumed at the end of the line (this is a software limitation that may be addressed in the future) – work around by adding an extra delimiter or ensure that the last column is not blank.
- Strings containing the delimiter should be surrounded by double quotes. This command currently does not deal with `"""text"""` notation although support may be added in the future (see information about comma-separated-value [CSV] standards: http://en.wikipedia.org/wiki/Comma-separated_values).

The following dialog is used to edit the command and illustrates the syntax for the command.



ReadTableFromDelimitedFile

ReadTableFromDelimitedFile() Command Editor

The command syntax is as follows:

```
ReadTableFromDelimitedFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier to assign to the table that is read, which allows the table data to be used with other commands.	None – must be specified.
`InputFile`	The name of the file to read, as an absolute path or relative to the command file location.	None – must be specified.
`SkipLines`	Indicates the number of lines in the file to skip, which otherwise would interfere with reading row data. Individual row numbers and ranges can be specified, for example: `1,5-6,17`	No lines are skipped.
`HeaderLines`	Indicate the rows that include header information, which should be used for column names. Currently this should only be one row, although a range may be fully supported in the future.	If the first non-comment line contains quoted field names, they are assumed to be headers. Otherwise, no headers are read.

The following example command file illustrates how to read a table from a delimited file:

```
ReadTableFromDelimitedFile(TableID="Table1",
    InputFile="Sample.csv",SkipRows="2")
```

An excerpt from a simple delimited file is:

```
# A comment
some junk to be skipped
“Header1”,”Header2”,”Header3”
1,1.0,1.0
2,2.0,1.5
3,3.0,2.0
```

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Command Reference: ReadTableFromExcel()

Read a cell range from a Microsoft Excel file and create a new Table

Version 10.18.00, 2012-02-25

The `ReadTableFromExcelFile()` command reads a table from a Microsoft Excel file, more specifically from a worksheet in an Excel workbook file. A contiguous block of cells (rectangle) must be specified in one of the following ways:

- Specify a range of cells using Excel address notation (e.g., `A1:D10`) (TODO – figure out if worksheet can be specified in this address, in which case the `Worksheet` parameter is not required).
- Specify the name of an Excel named range.
- Specify a table name (essentially a named range).

Table column types (number, text, etc.) are determined from the cells in the first data row being read (NOT the column name row) – data types must be consistent for all cells in a column, although blanks are allowed. Table column names are determined according to the `ExcelColumnNames` command parameter.

TSTool uses the Apache POI software, version 3.9 (http://poi.apache.org) to read the Excel file and consequently functionality is constrained by the features of that software package. The software reads and writes Excel files. It does not communicate with a running Excel program, as does other software tools (for example IronPython using Excel interoperability libraries). POI does not fully implement Excel functionality and consequently some formula capabilities are not available, which will generate errors getting values for some cells. One solution, for example to create test data in Excel, is to copy cells with "paste special" and then paste the values. It is expected that updates to POI will continue to add more formula support.

Table columns must contain consistent data types (all strings, all numeric, etc.). The following table describes how column types are determined and data values are transferred to the table. Column type determination uses the first data row in the specified address range. If a column is determined to be a type and then cell values in the column are different, conversions are made to maintain the intent of the values if possible. For example, a Boolean value stored in a cell will get converted to 1.0 if the table column has been determined to be for double precision numbers. Errors in processing cells may result in empty cell values in the output table.

Excel Data Type Conversion to Table

Excel Cell Format ("Number Category"	Conversion from Excel to TSTool Table
Number: • General • Number • Currency • Accounting • Percentage • Fraction • Scientific • Special • Custom	• If Excel cell is internally a "numeric", convert to a double-precision number, where the format "Decimal places" is used in the TSTool table for formatting. The number of decimal places in Excel is fixed for some of the number categories shown on the left (e.g., Special=Zip Code). Excel internally stores integers as numbers with zero decimals. Need to figure out how to get the Excel cell formatting number of decimals to similarly set in the output table – but DO NOT assume zero decimals should convert to an integer. • See the `ExcelIntegerColumns` parameter, which specifies the output table to use integers. • If Excel cell is internally a "Boolean", convert to an integer having

Excel Cell Format ("Number Category"	Conversion from Excel to TSTool Table
	values 0 or 1. Need to evaluate having a parameter `ExcelBooleanColumns` to transfer to a Boolean column in the output table. Excel seems to handle Booleans as text with values True or False.
Date: • Date • Time	TSTool does not generally deal with only time and therefore implementation is limited. The POI library does not seem to have all date/time functions implemented.
Text: • Text	Converts to a string.
Blank	• Treated as Text (may in the future scan down the column to determine data type from first non-blank cell). • Blank cells found once the column type is determined are set to empty strings in text columns, and null in number and date columns.
Error	• Treated as Text (may in the future scan down the column to determine data type from first non-error cell). • Blank cells found once the column type is determined are set to empty strings in text columns, and null in number and date columns.
Formula	Expanded internally and the resulting cell value is set in the output table. POI does not support all formulas and errors may be generated, which result in empty output table cells.

Consider the following Excel worksheet example, which is equivalent to a comma-separated-value (CSV) file that has comments at the top and four columns:

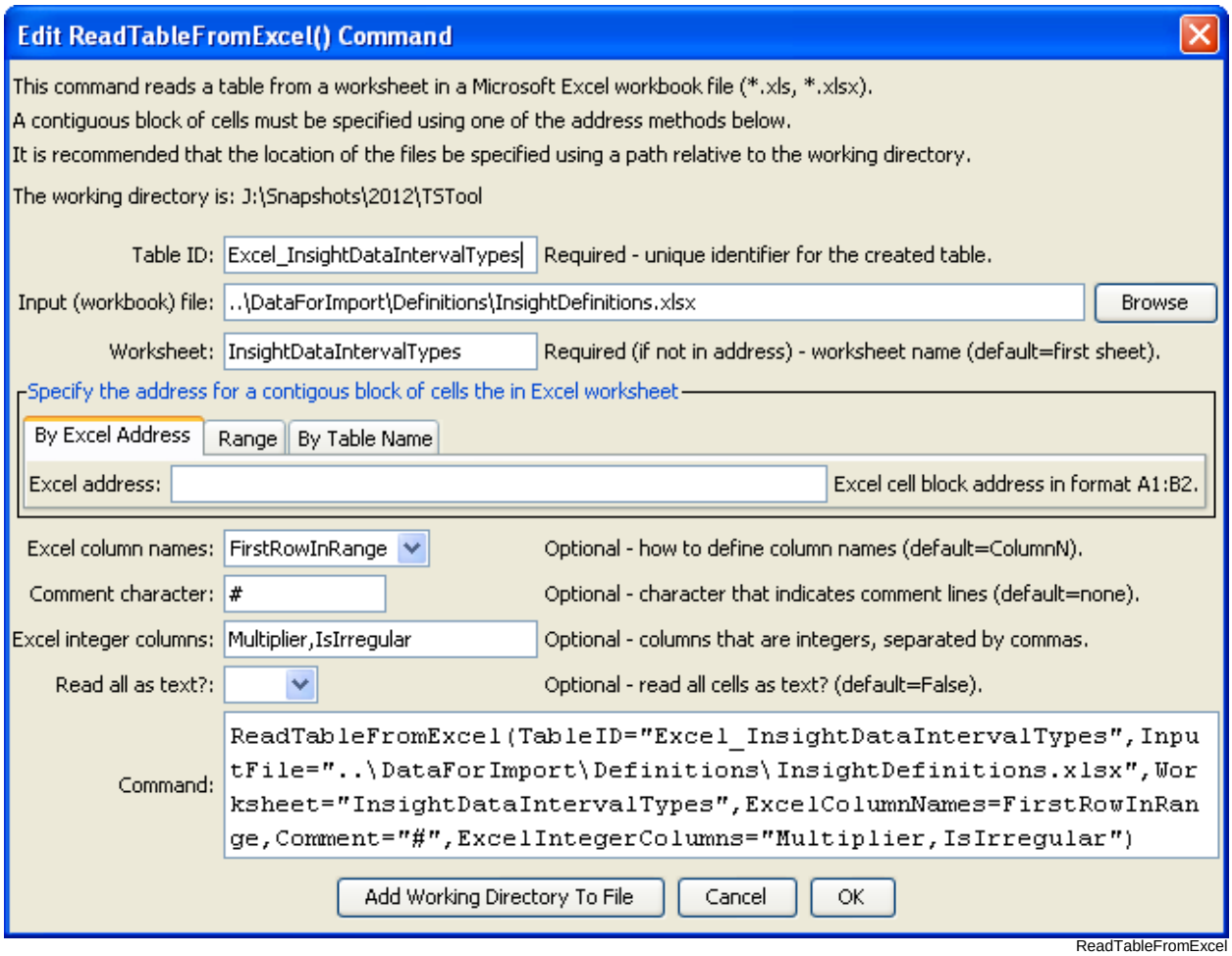
	A	B	C	D	E	F
1	# INSIGHT data interval types					
2	# Mainly used to ensure constraint on time series					
3	Abbreviation	Base	Multiplier	IsIrregular		
4	Day	Day	1	0		
5	Month	Month	1	0		
6	Year	Year	1	0		
7						

ReadTableFromExcel_SheetComments

Example Excel Workshet With Comments, Column Names, and Text and Integer Columns

Although it is possible to use comments in Excel (annotation on cells), these comments cannot be saved in simple text files like CSV files. Consequently, for transparency and automation of a full process, embedding comments in the worksheet may make sense. Note also that the numeric cells are formatted as type "Number" with 0 decimals in Excel. Internally, Excel does not have an integer data type and consequently it is difficult for the `ReadTableFromExcel()` command to know when to convert a zero-decimal number in Excel to a floating point or integer number in the output table (it therefore defaults to a floating point number in output). To make this conversion more explicit, use the `ExcelIntegerColumns` command parameter. The comment lines in the above example will be ignored in determining the headings, and any data rows that have a first cell value starting with the comment character will be ignored.

The following dialog is used to edit the command and illustrates the syntax for the command when reading the above Excel worksheet.



ReadTableFromExcel

ReadTableFromExcel() Command Editor

The command syntax is as follows:

```
ReadTableFromExcelFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier to assign to the table that is read, which allows the table data to be used with other commands.	None – must be specified.
`InputFile`	The name of the Excel workbook file (**.xls* or **.xlsx*) to read, as an absolute path or relative to the command file location.	None – must be specified.
`Worksheet`	The name of the worksheet in the workbook to read. Currently this is required if a specific sheet is read but in the future it may be made optional because	Read the first worksheet. If no address parameter is specified, read the entire worksheet.

Parameter	Description	Default
	the sheet can be determined from named range and table names (global resources in the workbook) and absolute Excel addresses that include the sheet name.	
`ExcelAddress`	Indicates the block of cells to read into the table, using Excel address notation (e.g., `A1:D10`).	Must specify address using one of available address parameters.
`ExcelNamedRange`	Indicates the block of cells to read into the table, using an Excel named range.	Must specify address using one of available address parameters.
`ExcelTableName`	Indicates the block of cells to read into the table, using an Excel named range.	Must specify address using one of available address parameters.
`ExcelColumnNames`	Indicate how to determine the column names for the table, one of: • `ColumnN` – column name will be `Column1`, `Column2`, etc. • `FirstRowInRange` – column names are taken from the first non-comment row in the address range • `RowBeforeRange` – column names are taken from the first non-comment row before the address range	`ColumnN`, or `FirstRowInRange` when `ExcelTableName` is specified?
`Comment`	Specify the character that if found at the start of the first column in a row (not just the specified address range) indicates that the row is a comment and can be ignored in transferring data to the output table. Comments are particularly useful when processing entire data sheets.	No comments are used.
`ExcelIntegerColumns`	Indicate the names of columns (separated by commas) that should be treated as integer columns in the output table.	Numeric columns are treated as double-precision values in the output table.
`ReadAllAsText`	Indicate with `True` or `False` whether all columns in the Excel address block should be treated as text columns.	`False` – set table column types using the first data row

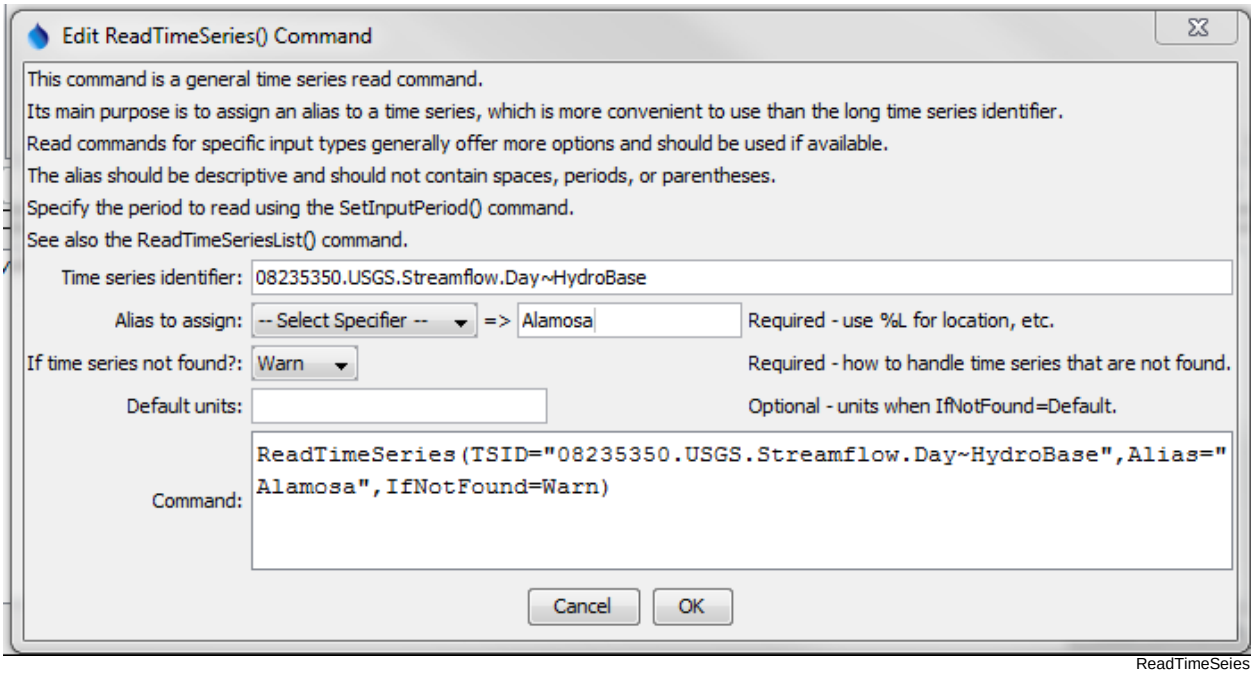
Command Reference: ReadTimeSeries()

Read a single time series using a full time series identifier

Version 10.21.00, 2013-05-17

The `ReadTimeSeries()` reads a single time series using the time series identifier to uniquely identify the time series. This generalized command is useful for converting time series identifiers from the TSTool interface into read commands that assign an alias to a time series. Because the command is generic, it does not offer specific parameters that may be found in read commands for specific input types. Use the specific read commands where available for additional functionality and more specific error handling. See also the **`ReadTimeSeriesList()`** command.

The following dialog is used to edit the command and illustrates the syntax of the command.



ReadTimeSeies

ReadTimeSeries() Command Editor

The command syntax is as follows:

```
ReadTimeSeries(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadTimeSeries (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	The time series identifier of the time series to read. The identifier should include the input type (and input name, if required). See the input type appendices for examples of time series identifiers for various input types.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`IfNotFound`	Indicates how to handle missing time series, one of: • `Warn` – generate fatal warnings and do not include in output. • `Ignore` – generate non-fatal warnings and do not include in output. • `Default` – generate non-fatal warnings and create empty time series for those that could not be found. This requires that a `SetOutputPeriod() command` be used before the command to define the period for default time series.	`Warn`
`DefaultUnits`	Default units when `IfNotFound=Default`.	Blank – no units.

A sample command file to read data from the State of Colorado's HydroBase is as follows:

```
ReadTimeSeries(TSID="08235350.USGS.Streamflow.Day~HydroBase",Alias=TS1)
```

Command Reference: ReadTimeSeriesList()

Read one or more time series using location identifiers from a table

Version 10.21.00, 2013-05-17

The `ReadTimeSeriesList()` command reads one or more time series using location identifiers from a table, an example of which is shown below as a comma-separated value file:

```
# Example list file.  Comments start with the # character.
# Column headings can be specified in the first non-comment row using quotes.
"Structure ID","Structure Name"
500501,Ditch 501
500502,Ditch 502
# Invalid ID (see IfNotFound parameter)
509999,Ditch 9999
```

The command typically is used when reading time series from a single source and can streamline processing in the following situations:

- A list of identifiers may have been generated from a database query
- A list of identifiers may have been extracted from a model data set

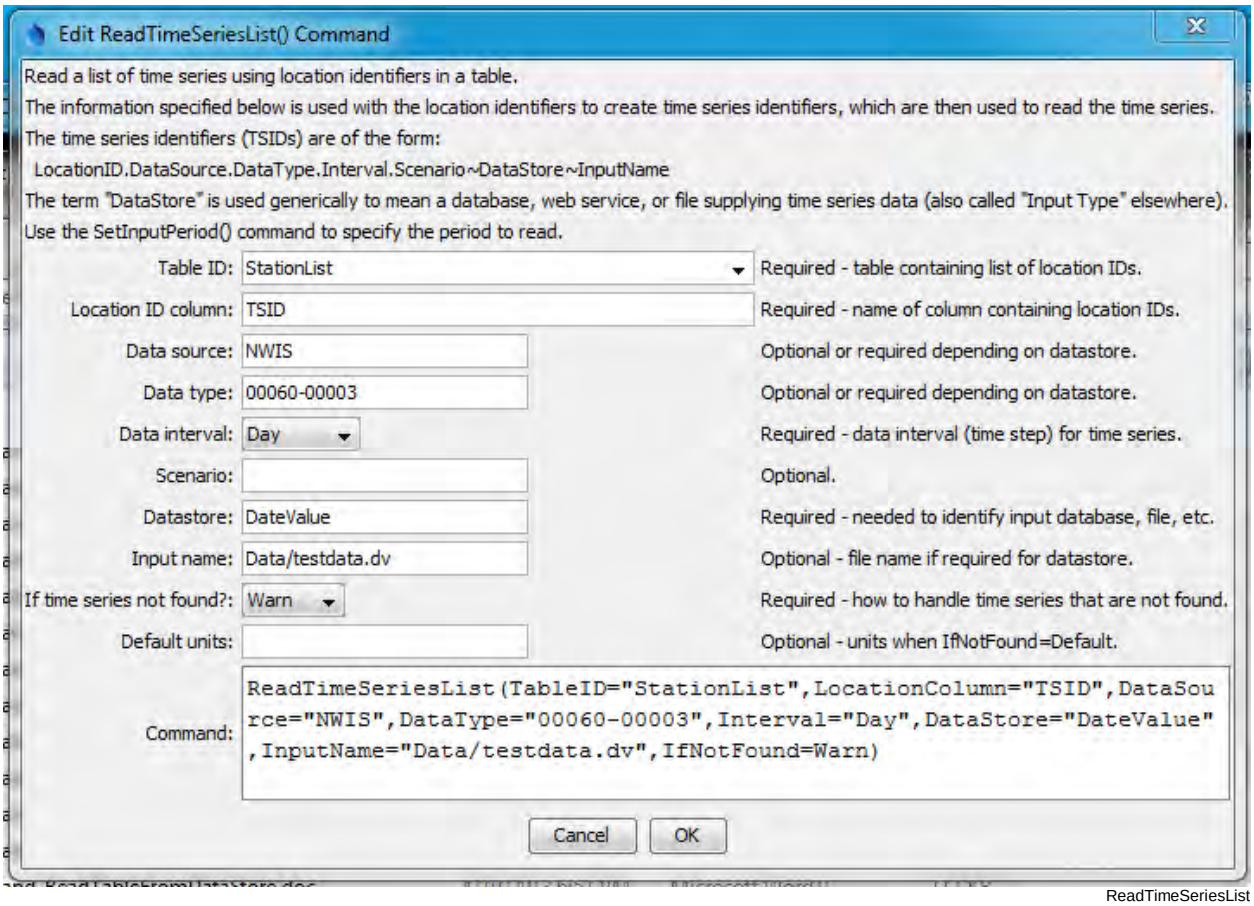
TSTool uses the location identifiers in the table with the command parameters and internally creates a list of time series identifiers. The time series are of the standard form:

```
Location.DataSource.DataType.Interval[.Scenario]~DataStore[~InputName]
```

where the brackets indicate optional information. TSTool then queries each time series, which can be processed further by other commands. See also the `ReadTimeSeries()` command, which performs essentially the same functionality but only reads one time series.

Although it is possible to specify a datastore (or "input type") that reads from files by also using the `InputName`, this is not generally recommended because the `ReadTimeSeriesList()` command can only specify one input file name and the file will be reopened for each time series read. Instead, read commands for specific file formats should be used because these commands are typically optimized to read multiple time series from the files. Use the `SetInputPeriod()` command to set the period to read.

The following dialog is used to edit the command and illustrates the syntax of the command.



ReadTimeSeriesList

ReadTimeSeriesList() Command Editor

The command syntax is as follows:

```
ReadTimeSeriesList(Parameter=Value, …)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the table that provides the list of location identifiers.	None – must be specified.
`LocationColumn`	The column in the table containing the location identifiers to use in time series identifiers.	None – must be specified.
`DataSource`	The data source in the time series identifier. For example, if using the State of Colorado's HydroBase, USGS indicates that data are from the United States Geological Survey. See the datastore and input type appendices for more information on available data types.	May or may not be required, depending on the datastore or input type. Refer to the input type appendices.
`DataType`	The data type in the time series identifier.	Usually required. Refer to the

Parameter	Description	Default
	For example, if using the State of Colorado's HydroBase, `DivTotal` is used for diversion totals. See the input type appendices for more information on available data types.	datastore and input type appendices.
`Interval`	Data interval in the time series identifier, using standard values such as `15Minute`, `6Hour`, `Day`, `Month`, `Year`.	None – must be specified.
`Scenario`	Scenario in the time series identifier.	Usually not required.
`DataStore`	The data store (or input type) in the time series identifier. Refer to the datastore and input type appendices or the TSTool main GUI for options.	None – must be specified.
`InputName`	The input name in the time series identifier, when a file name is required.	
`IfNotFound`	Indicates how to handle missing time series, one of: • `Warn` – generate fatal warnings and do not include in output. • `Ignore` – generate non-fatal warnings and do not include in output. • `Default` – generate non-fatal warnings and create empty time series for those that could not be found. This requires that a `SetOutputPeriod()` command be used before the command to define the period for default time series.	`Warn`
`DefaultUnits`	Default units when `IfNotFound=Default`.	Blank – no units.

A sample command file to process monthly diversion data from the State of Colorado's HydroBase database is as follows:

```
# Read monthly diversion total from HydroBase for the structures in the list
# file. The data source is set to DWR because data source is saved in
# HydroBase.
ReadTimeSeriesList(TableID="Diversions.csv",LocationColumn="WDID",
  DataSource=DWR,DataType=DivTotal,Interval=Month,InputType=HydroBase,
  IfNotFound=Default)
```

Command Reference: ReadUsgsNwisDaily()

Read 1+ time series from the USGS NWIS Daily Value web service

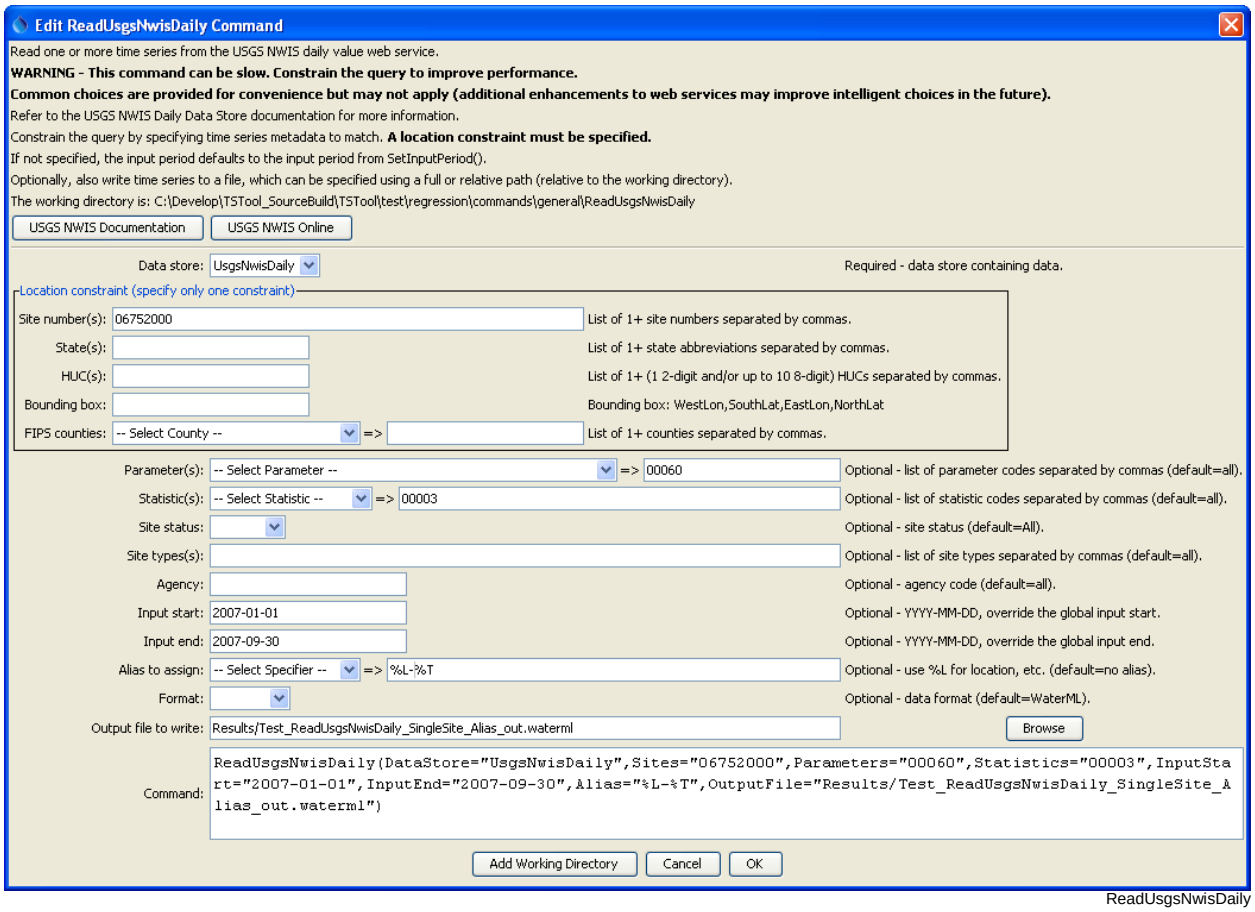
Version 10.12.00, 2012-08-06

The `ReadUsgsNwisDaily()` command reads one or more time series from the United States Geological Survey (USGS) National Water Information System (NWIS) Daily Value web service (see the **UsgsNwisDaily Data Store Appendix**). The command provides parameters to constrain the web service query and also allows the result to be saved as an output file. For example, if WaterML is chosen as the time series format, a WaterML file can be saved and can be read later using the `ReadWaterML()` command. See also the `WebGet()` command, which also can be used to retrieve data files from the USGS website.

The USGS NWIS web service allows station and time series data type information to be filtered, both as a convenience and to maintain reasonable web service performance. Many of the choices that are available for limiting queries allow 0+ values to be provided. For example, specifying no requested parameter will return all available parameters for a location. Specifying a list of parameters (separated by commas) will return only the requested parameters.

USGS codes are used in order to generate a unique time series identifier (TSID). For example, the TSID data type is formed from the parameter code, a dash, and the statistic code. The numerical codes currently are used to ensure uniqueness but in the future the string name may be allowed as an option. In order to have more human-friendly identifiers for time series, one strategy is to request only a specific parameter and statistic and then use the alias to specify a text equivalent to the numeric codes. For example, specify `Parameters=00060` (for streamflow discharge) and `Statistics=00003` and assign the alias with `Alias=%L.Streamflow-Mean`.

The following dialog is used to edit the command and illustrates the syntax. Note that some choices are provided as a convenience. However, full listing of choices (such as all the thousands of streamflow stations that are available) is not provided due to performance issues. Additional query features will be enabled as web service integration is enhanced.



ReadUsgsNwisDaily

ReadUsgsNwisDaily() Command Editor

The command syntax is as follows:

```
ReadUsgsNwisDaily(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Sites`	A list of site numbers to read, separated by commas.	None – one of the locational parameters must be provided to constrain the query.
`States`	A list of state codes (e.g., `AL`), separated by commas.	None – see above.
`HUCs`	A list of hydrologic unit codes, separated by commas. See the limitations on the NWIS site for more information.	None – see above.
`BoundingBox`	A bounding box consisting of west longitude, south latitude, east longitude, and north latitude, separated by spaces. Longitudes in the western hemisphere are negative.	None – see above.
`Counties`	A list of Federal Information Processing Standards (FIPS) county codes, separated by commas.	None – see above.
`Parameters`	Data parameter codes for the stations (e.g., `00060` for stream discharge), separated by commas.	All available parameters are returned.
`Statistics`	Statistic codes (e.g., `00003` for mean), separated by commas.	All available statistics are returned.
`SiteStatus`	Filter for stations, one of: • `All` – all stations are returned • `Active` – only active stations are returned • `Inactive` – only inactive stations are returned	`All`
`SiteTypes`	Site types to return, separated by commas.	All available site types are returned.
`Agency`	Agency code to return (e.g., `USGS`).	All available agencies are returned.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an	None – must be specified.

Parameter	Description	Default
	alternative to the time series identifier (TSID).	
`Format`	The data format for output, one of: • `JSON` – JavaScript Object Notation (currently used only for downloads but will not result in time series in TSTool) • `RDB` – tab-delimited format (also see `ReadUsgsNwisRDB()` command; currently used only for downloads but will not result in time series in TSTool). • `WaterML` – XML format (also see the `ReadWaterML()` command).	`WaterML`
`OutputFile`	The name of the output file to create. The path to the file can be absolute or relative to the working directory.	No output file will be created.

Command Reference: ReadUsgsNwisGroundwater()

Read 1+ time series from the USGS NWIS groundwater web service

Version 10.12.00, 2012-10-17

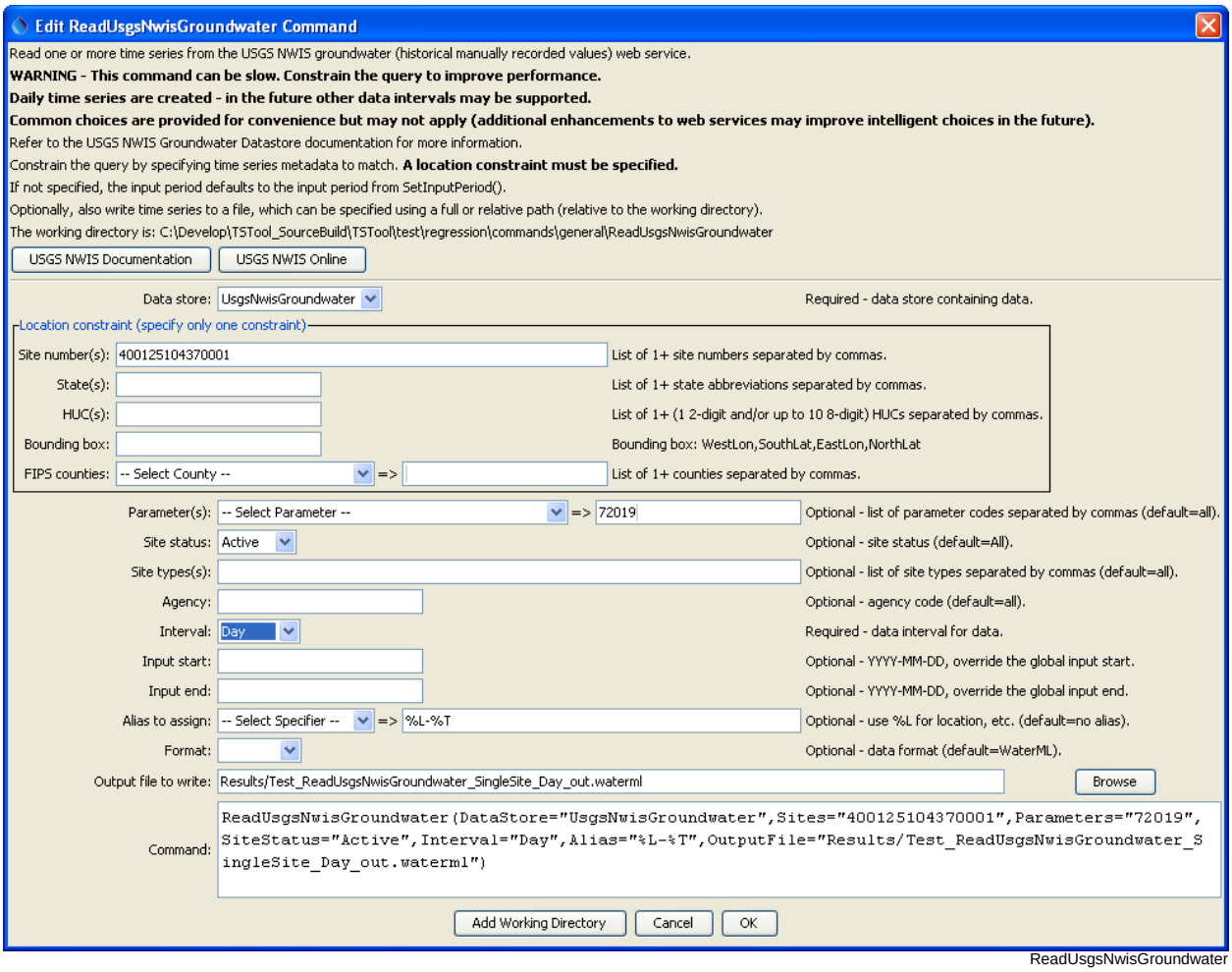
The `ReadUsgsNwisGroundwater()` command reads one or more time series from the United States Geological Survey (USGS) National Water Information System (NWIS) groundwater web service (see the **UsgsNwisGroundwater Datastore Appendix**). The USGS data are historical manually recorded values and data may be sparse over the full period. The command provides parameters to constrain the web service query and also allows the result to be saved as an output file. For example, if WaterML is chosen as the time series format, a WaterML file can be saved and can be read later using the `ReadWaterML()` command. See also the `WebGet()` command, which can be used to retrieve data files from the USGS website.

The USGS NWIS web service allows well and time series data type information to be filtered, both as a convenience and to ensure reasonable web service performance. Many of the choices that are available for limiting queries allow 0+ values to be provided. For example, specifying no requested parameter will return all available parameters for a location. Specifying a list of parameters (separated by commas) will return only the requested parameters.

USGS codes are used in order to generate a unique time series identifier (TSID). For example, the TSID data type is formed from the parameter code. The numerical codes currently are used to ensure uniqueness but in the future the string name may be allowed as an option. In order to have more human-friendly identifiers for time series, one strategy is to request only a specific parameter and then use the alias to specify a text equivalent to the numeric codes. For example, specify `Parameters=72019` (for depth to water level) and assign the alias with `Alias=%L.WaterLevel`.

Although the NWIS groundwater web service may return date/times with precision to minute, this command treats all data as daily values and returns a daily time series. The daily interval time series therefore may have many missing values, but often is easier to process with other TSTool commands. In the future, the command may be updated to allow the option of returning other data intervals, including irregular (which would have only non-missing values but typically must be converted to a regular interval to use with other commands).

The following dialog is used to edit the command and illustrates the syntax. Some choices are provided as a convenience. However, full listing of choices (such as all the thousands of wells that are available) is not provided due to performance issues. Additional query features will be enabled as web service integration is enhanced.



ReadUsgsNwisGroundwater

ReadUsgsNwisGroundwater() Command Editor

The command syntax is as follows:

```
ReadUsgsNwisGroundwater(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Sites`	A list of site numbers to read, separated by commas.	None – one of the locational parameters must be provided to constrain the query.
`States`	A list of state codes (e.g., `AL`), separated by commas.	None – see above.
`HUCs`	A list of hydrologic unit codes, separated by commas. See the limitations on the NWIS site for more information.	None – see above.
`BoundingBox`	A bounding box consisting of west longitude, south latitude, east longitude, and north latitude, separated by spaces. Longitudes in the western hemisphere are negative.	None – see above.
`Counties`	A list of Federal Information Processing Standards (FIPS) county codes, separated by commas.	None – see above.
`Parameters`	Data parameter codes for the stations (e.g., `72019` for depth to water level), separated by commas.	All available parameters are returned.
`SiteStatus`	Filter for stations, one of: • `All` – all stations are returned • `Active` – only active stations are returned • `Inactive` – only inactive stations are returned	`All`
`SiteTypes`	Site types to return, separated by commas.	All available site types are returned.
`Agency`	Agency code to return (e.g., `USGS`).	All available agencies are returned.
`Interval`	The interval to use for the created time series. Groundwater measurements in NWIS may be recorded for the day or may have more precise date/time. Using an interval of `Day` results in a regular interval time series that is easier to process by other commands, but may not be suitable when values change significantly within a day.	None – must be specified.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data – specify if the period should be different	Use the global query period.

Parameter	Description	Default
	from the global query period.	
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`Format`	The data format for output, one of: • `JSON` – JavaScript Object Notation (currently used only for downloads but will not result in time series in TSTool) • `RDB` – tab-delimited format (also see `ReadUsgsNwisRDB()` command; currently used only for downloads but will not result in time series in TSTool). • `WaterML` – XML format (also see the `ReadWaterML()` command).	`WaterML`
`OutputFile`	The name of the output file to create. The path to the file can be absolute or relative to the working directory.	No output file will be created.

Command Reference: ReadUsgsNwisInstantaneous()

Read 1+ time series from the USGS NWIS Instantaneous Values web service

Version 10.13.00, 2012-10-30

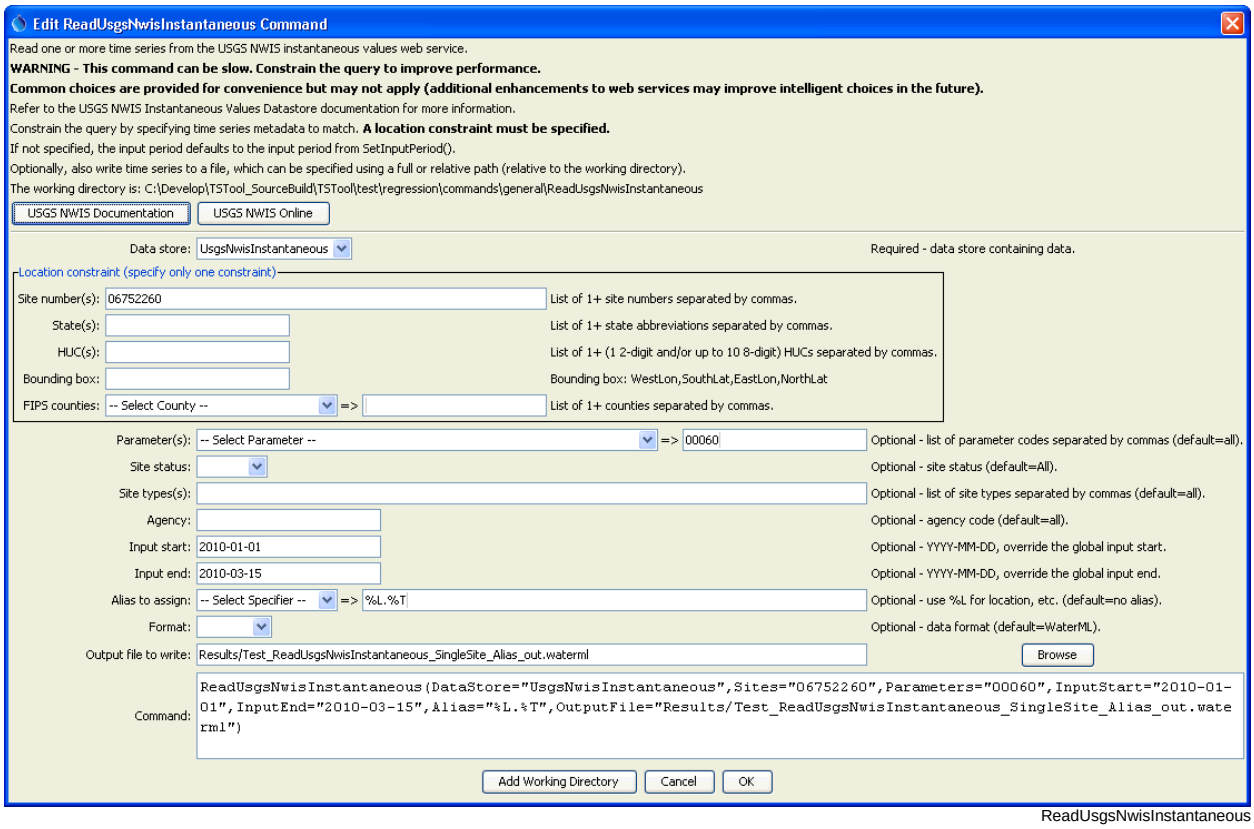
The `ReadUsgsNwisInstantaneous()` command reads one or more time series from the United States Geological Survey (USGS) National Water Information System (NWIS) Instantaneous Values web service (see the **UsgsNwisInstantaneous Datastore Appendix**). The command provides parameters to constrain the web service query and also allows the result to be saved as an output file. For example, if WaterML is chosen as the time series format, a WaterML file can be saved and can be read later using the `ReadWaterML()` command. See also the `WebGet()` command, which also can be used to retrieve data files from the USGS website.

The USGS NWIS web service allows station and time series data type information to be filtered, both as a convenience and to maintain reasonable web service performance. Many of the choices that are available for limiting queries allow 0+ values to be provided. For example, specifying no requested parameter will return all available parameters for a location. Specifying a list of parameters (separated by commas) will return only the requested parameters.

The data interval for returned time series is set to `15Min`. A check is performed to ensure that data line up with this interval. If the data do not line up, values are set by rounding time and warnings will be generated. Another option is to save the time series as a WaterML file and then use `ReadWaterML()` command, which allows the time series interval to be specified.

USGS codes are used in order to generate a unique time series identifier (TSID). For example, the TSID data type is formed from the parameter code. The numerical codes currently are used to ensure uniqueness but in the future the string name may be allowed as an option. In order to have more human-friendly identifiers for time series, one strategy is to request only a specific parameter and then use the alias to specify a text equivalent to the numeric codes. For example, specify `Parameters=00060` (for streamflow discharge) and and assign the alias with `Alias=%L.Streamflow`.

The following dialog is used to edit the command and illustrates the syntax. Note that some choices are provided as a convenience. However, full listing of choices (such as all the thousands of streamflow stations that are available) is not provided due to performance issues. Additional query features will be enabled as web service integration is enhanced.



ReadUsgsNwisInstantaneous

ReadUsgsNwisInstantaneous() Command Editor

The command syntax is as follows:

```
ReadUsgsNwisInstantaneous(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Sites`	A list of site numbers to read, separated by commas.	None – one of the locational parameters must be provided to constrain the query.
`States`	A list of state codes (e.g., `AL`), separated by commas.	None – see above.
`HUCs`	A list of hydrologic unit codes, separated by commas. See the limitations on the NWIS site for more information.	None – see above.
`BoundingBox`	A bounding box consisting of west longitude, south latitude, east longitude, and north latitude, separated by spaces. Longitudes in the western hemisphere are negative.	None – see above.
`Counties`	A list of Federal Information Processing Standards (FIPS) county codes, separated by commas.	None – see above.
`Parameters`	Data parameter codes for the stations (e.g., `00060` for stream discharge), separated by commas.	All available parameters for the sites are returned.
`SiteStatus`	Filter for stations, one of: • `All` – all stations are returned • `Active` – only active stations are returned • `Inactive` – only inactive stations are returned	`All`
`SiteTypes`	Site types to return, separated by commas.	All available site types are returned.
`Agency`	Agency code to return (e.g., `USGS`).	All available agencies are returned.
`InputStart`	The start of the period to read data to 15-minute precision – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data to 15-minute precision – specify if the period should be different from the global query period.	Use the global query period.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an	None – must be specified.

Parameter	Description	Default
	alternative to the time series identifier (TSID).	
`Format`	The data format for output, one of: • `JSON` – JavaScript Object Notation (currently used only for downloads but will not result in time series in TSTool) • `RDB` – tab-delimited format (also see `ReadUsgsNwisRDB()` command; currently used only for downloads but will not result in time series in TSTool). • `WaterML` – XML format (also see the `ReadWaterML()` command).	`WaterML`
`OutputFile`	The name of the output file to create. The path to the file can be absolute or relative to the working directory.	No output file will be created.

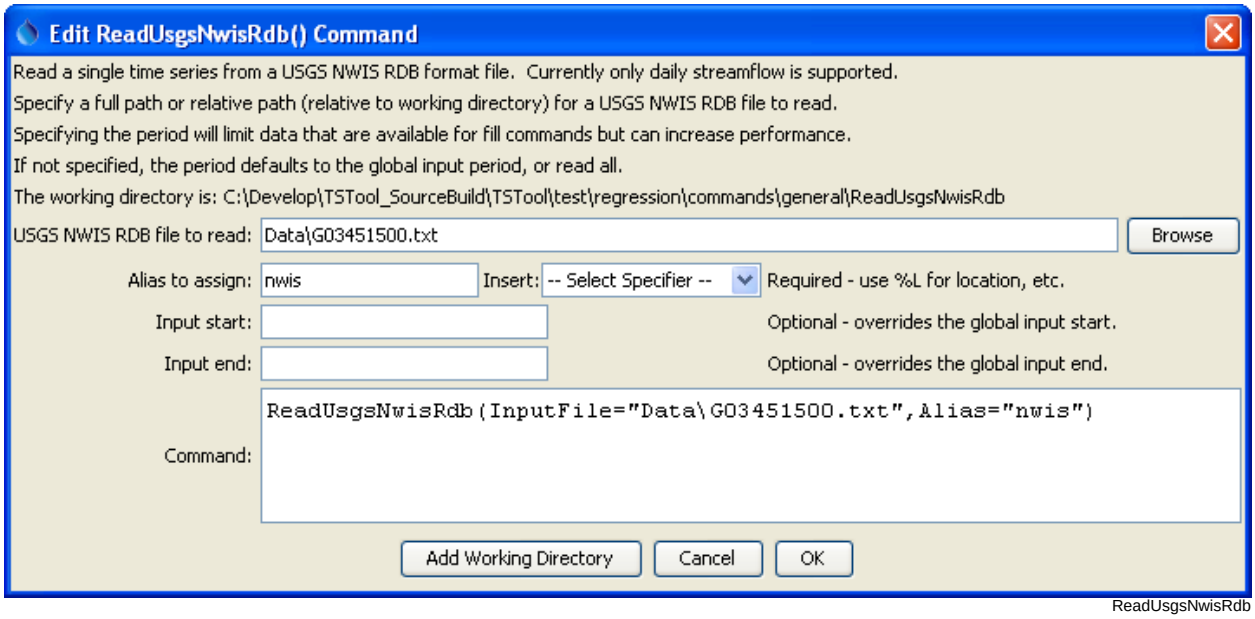
Command Reference: ReadUsgsNwisRdb()

Read a single time series from a USGS NWIS RDB file

Version 10.05.00, 2012-02-27

The `ReadUsgsNwisRdb()` command reads a single time series from a USGS NWIS RDB file (see the **UsgsNwisRdb Input Type Appendix**) and assigns an alias to the result. This command replaces the older `ReadUsgsNwis()` command – legacy `ReadUsgsNwis()` commands are automatically translated to `ReadUsgsNwisRdb()` commands. Currently only the daily streamflow format is supported and the file being read **must contain only one time series**. The data type is assigned as `Streamflow`, with units `CFS`. See also the `WebGet()` command, which can be used to retrieve data files from the USGS website. See also the `ReadUsgsNwisDaily()` and `ReadWaterML()` commands.

The following dialog is used to edit the command and illustrates the syntax.



ReadUsgsNwisRdb

ReadUsgsNwisRdb() Command Editor

The command syntax is as follows:

```
ReadUsgsNwisRdb(Parameter=Value,…)
```

The following legacy command syntax is updated to the above syntax when a command file is read:

```
TS Alias = ReadUsgsNwis (Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the USGS NWIS RDB file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.

A sample command file is as follows:

```
ReadUsgsNwisRdb(Alias=”ts1”,InputFile="G03451500.txt")
```

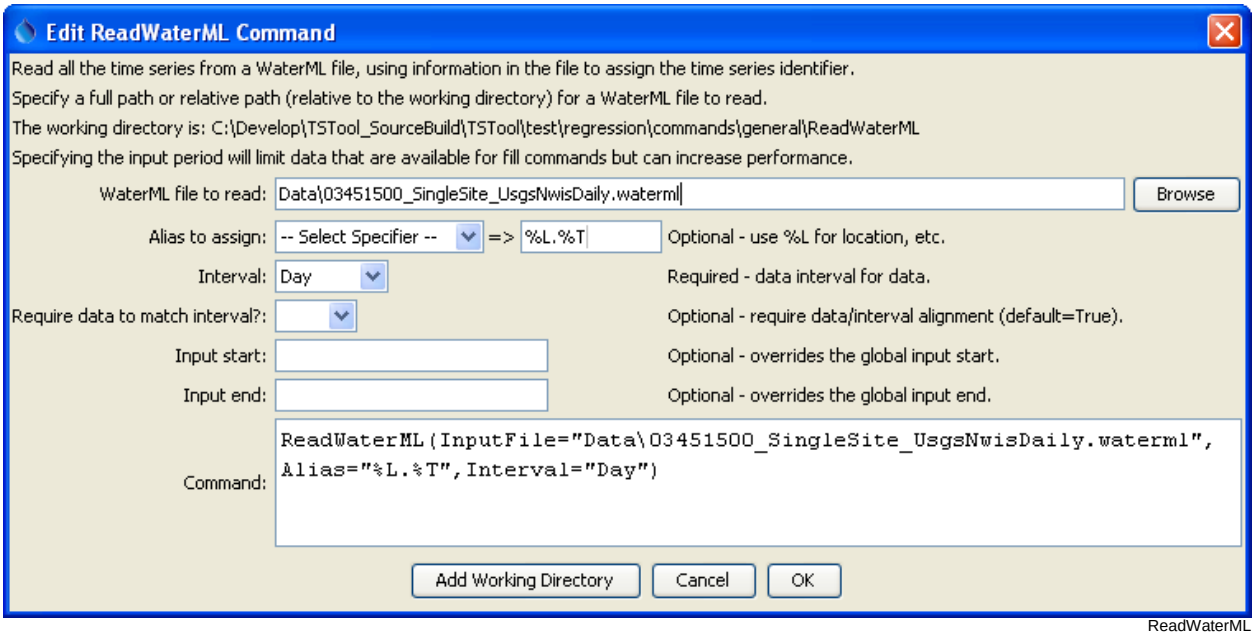
Command Reference: ReadWaterML()

Read 1+ time series from a WaterML file

Version 10.13.00, 2012-10-31

The `ReadWaterML()` command reads one or more time series from a WaterML XML time series file (see the **WaterML Input Type Appendix**). WaterML version 1.1 is supported. WaterML files can be created using the `ReadUsgsNwisDaily()`, `ReadWaterOneFlow()`, and `WriteWaterML()` commands, and can be saved from web sites that provide WaterML using the `WebGet()` command. This command may be enhanced in the future to read a subset of the time series in the WatermL file (currently all time series in the file are read), and additional WaterML versions may be supported.

The following dialog is used to edit the command and illustrates the syntax.



ReadWaterML

ReadWaterML() Command Editor

The command syntax is as follows:

```
ReadWaterML(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the WaterML file to read. The path to the file can be absolute or relative to the working directory.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	No alias is assigned.
`Interval`	The data interval for the file, necessary because WaterML 1.1 does not have a data element indicating the interval (time step for the data) and using irregular by default would be inefficient for data management. This issue is being further evaluated.	None – must be specified.
`RequireData ToMatchInterval`	Indicate whether the date/time for each data value must align with the interval: • `True` – For example, if `Interval=15Min` for USGS instantaneous data, then values a warning will be generated. • `False` – Date/times that do not align result in time series values being assigned using a truncated date/time. For example, USGS groundwater web service values read with `Interval=Day` will be assigned to the nearest day (by ignoring more precise time information). This parameter and the `Interval` parameter will continue to be evaluated.	`True` Parameter is not used for irregular data.
`InputStart`	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
`InputEnd`	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.

Command Reference: ReadWaterOneFlow()

Read 1+ time series from a WaterOneFlow web service

Version 10.06.00, 2012-03-29

This command is under development.

The `ReadWaterOneFlow()` command reads one or more time series from WaterOneFlow web service (see the **WaterOneFlow Data Store Appendix**) and optionally assigns an alias to the time series. WaterML version 1.0 is supported for time series transfer; however, the WaterML response currently cannot be saved to a file (and therefore output cannot be used with the `ReadWaterML()` command).

The following dialog is used to edit the command and illustrates the syntax.

Need to generate screen shot.

ReadWtaerOneFlow

ReadWaterOneFlow() Command Editor

The command syntax is as follows:

```
ReadWaterOneFlow(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	No alias is assigned.
InputStart	The start of the period to read data – specify if the period should be different from the global query period.	Use the global query period.
InputEnd	The end of the period to read data – specify if the period should be different from the global query period.	Use the global query period.

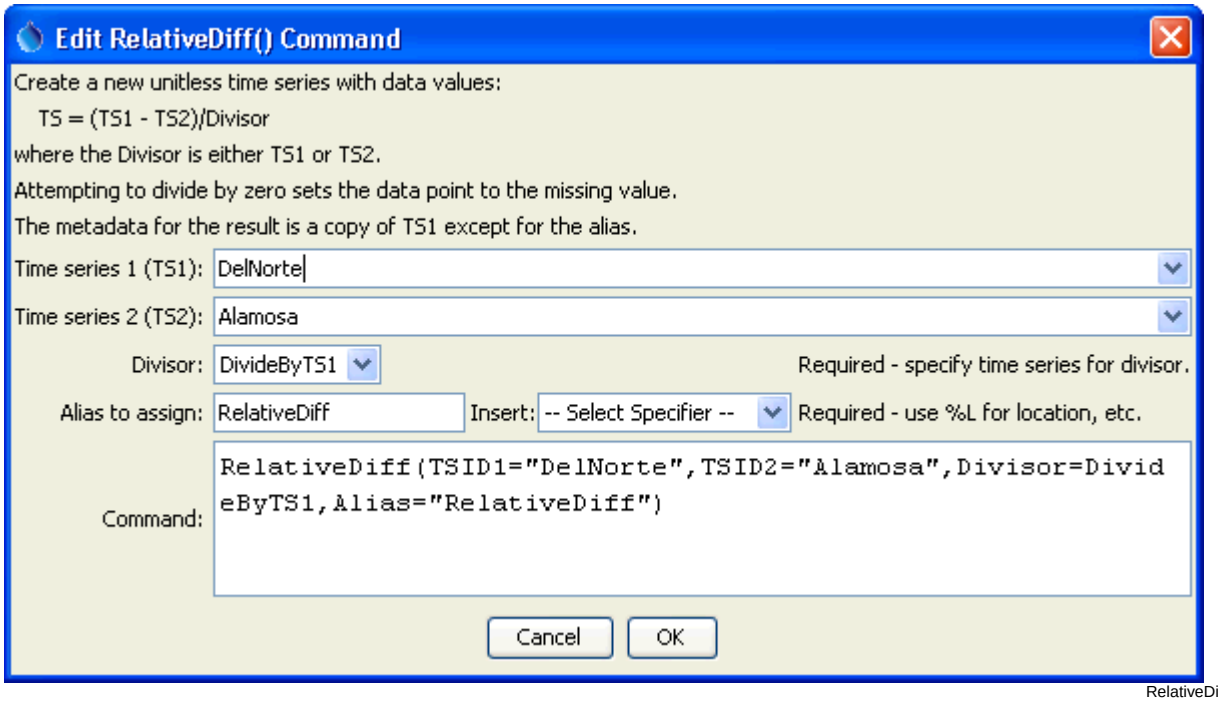
Command Reference: RelativeDiff()

Create a relative difference time series

Version 10.00.01, 2011-05-15

A `RelativeDiff()` command creates a new relative difference time series, computed by subtracting the time series and then dividing by one of the time series. This is useful when analyzing the relative magnitudes of two time series over time. Most of the properties for the new time series are the same as the first time series. The alias for the result can be referenced by other commands. The divisor can be either of the time series. The result is set to missing if either time series value is missing or the divisor is zero.

The following dialog is used to edit the command and illustrates its syntax.



RelativeDiff

RelativeDiff() Command Editor

The command syntax is as follows:

```
RelativeDiff(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = RelativeDiff(Parameter=Value,…)
```

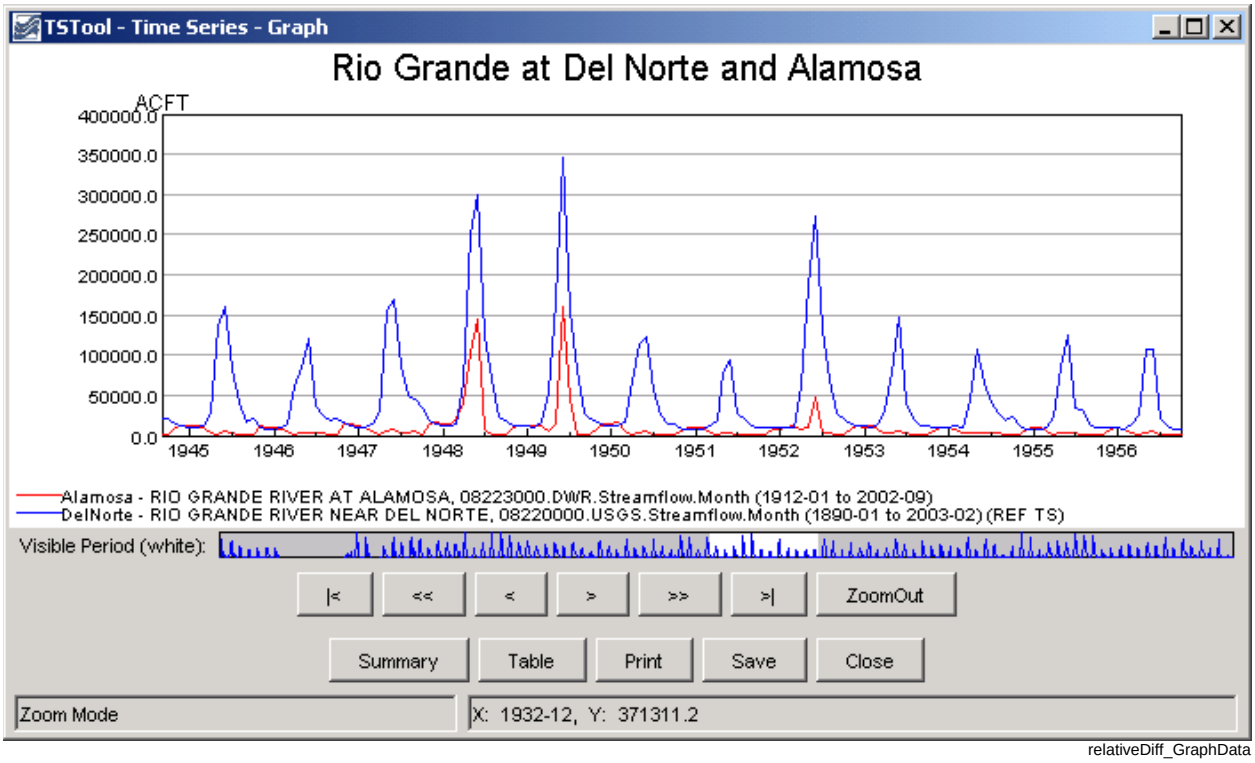
Command Parameters

Parameter	Description	Default
TSID1	The time series identifier or alias for the first time series.	None – must be specified.
TSID2	The time series identifier or alias for the second time series (subtracted from the first).	None – must be specified.
Divisor	Indicates whether the first time series is the divisor (DivideByTS1) or the second time series is the divisor (DivideByTS2).	None – must be specified.
Alias	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
StartLog(LogFile="Example_RelativeDiff.log")
SetOutputPeriod(OutputStart="01/1912",OutputEnd="12/1998")
# (1912-1998) RIO GRANDE AT ALAMOSA, CO.  DWR  Streamflow  Monthly
ReadTimeSeries(Alias=”Alamosa”,"08223000.DWR.Streamflow.Month~HydroBase")
# (1890-1998) RIO GRANDE NEAR DEL NORTE, CO.  DWR  Streamflow  Monthly
ReadTimeSeries(TSID="08220000.USGS.Streamflow.Month~HydroBase",
    Alias=”DelNorte”)
RelativeDiff(TSID1="DelNorte",TSID2="Alamosa",
    Divisor=DivideByTS1,Alias=”RelativeDiff”)
```

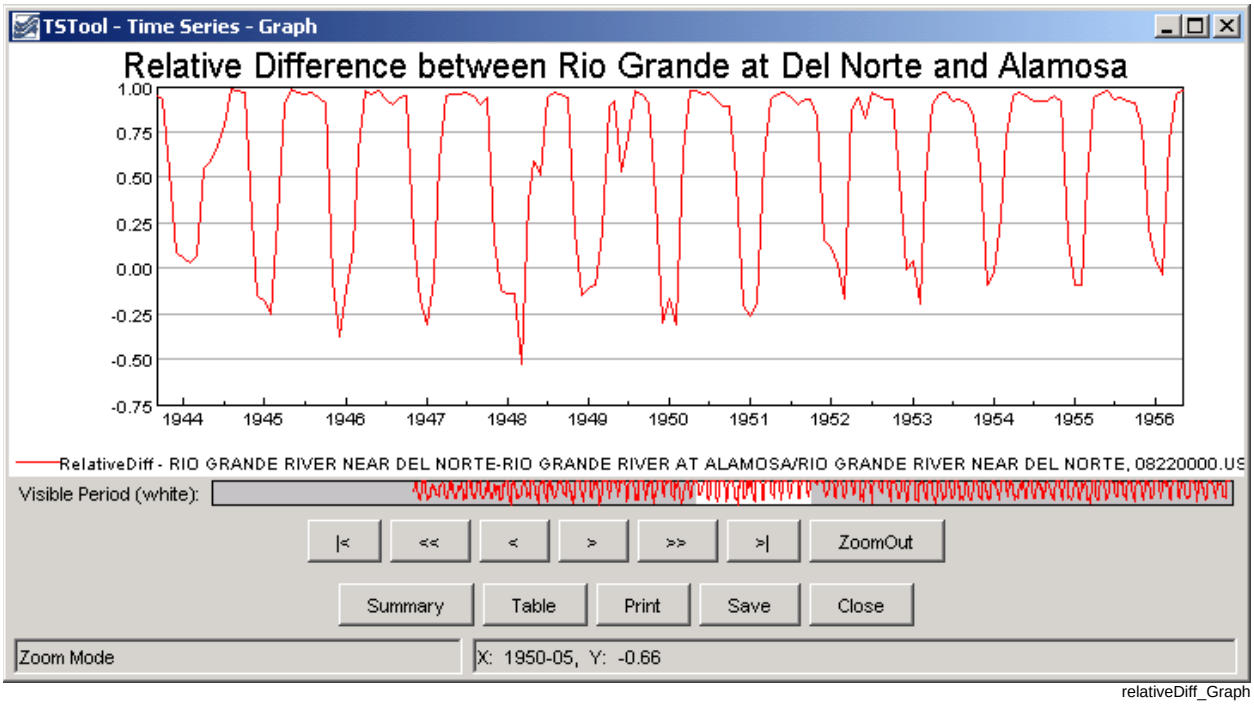
The input time series for the command are shown in the following figure:



relativeDiff_GraphData

Data for the RelativeDiff() Command

The results of processing the commands are shown in the following figure:



relativeDiff_Graph

Results of the RelativeDiff() Command

Command Reference: RemoveFile()

Remove a file

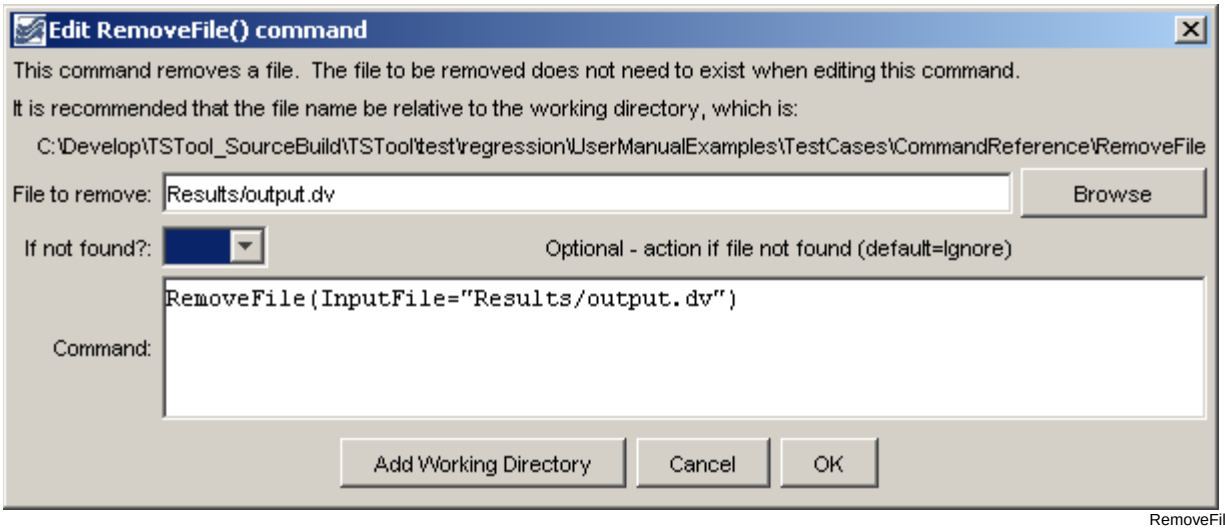
Version 09.02.00, 2009-04-03

The `RemoveFile()` command removes a file from the file system. This command is used in testing software to remove results files before attempting to regenerate the results.

A failure will be generated if the file exists and cannot be removed (e.g., due to file permissions or being locked by another process).

Even read-only files may be removed by this command, depending on how the operating system and computer environment handle access permissions.

The following dialog is used to edit the command and illustrates the syntax for the command.



RemoveFile

RemoveFile() Command Editor

The command syntax is as follows:

```
RemoveFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputFile`	The name of the file to delete.	None – must be specified.
`IfNotFound`	Indicate action if the file is not found, one of: • `Ignore` – ignore the missing file (do not warn). • `Warn` – generate a warning (use this if the file truly is expected and a missing file is a cause for concern). • `Fail` – generate a failure (use this if the file truly is expected and a missing file is a cause for concern).	`Ignore`

The following example command file illustrates how to remove a file:

```
RemoveFile(InputFile="Results/output.dv")
```

Command Reference: RemoveTableRowsFromDataStore()

Remove rows from a datastore table

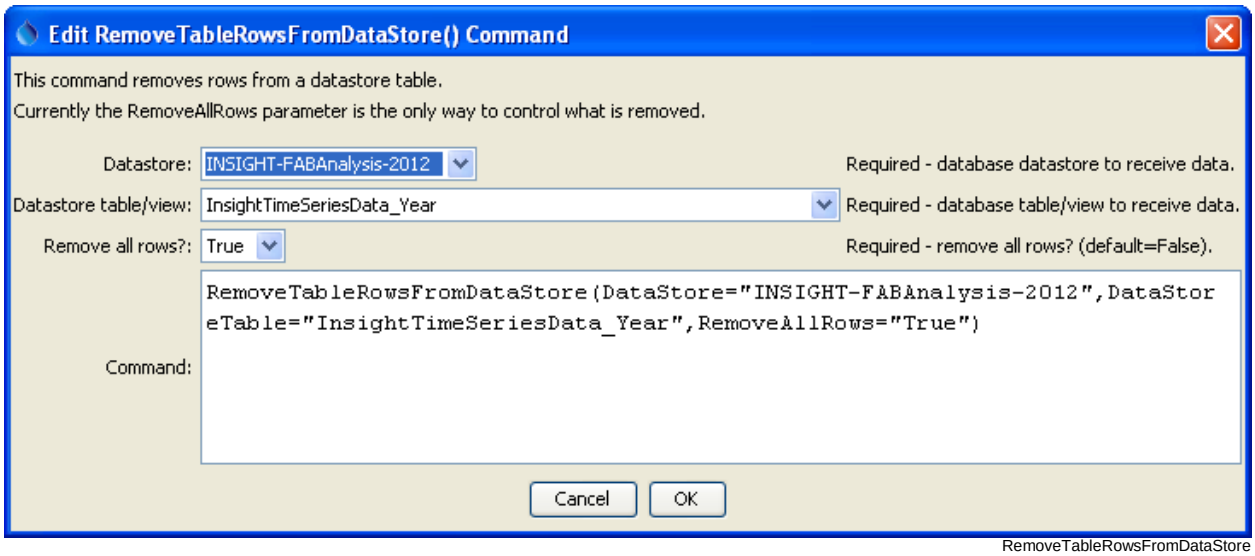
Version 10.18.00, 2013-02-26

The `RemoveTableRowsFromDataStore()` removes rows from a database datastore table by executing an SQL DELETE statement. If database datastore support is not specifically provided by TSTool, a generic datastore can be used (see the **Generic Database DataStore** appendix). This command cannot be used with web service datastores and use with Excel datastores has not been tested. This command is useful in particular for bulk data processing such as to remove records in a table before (re)loading in bulk (see `WriteTableToDataStore()` command).

General constraints are as follows:

- the table or views being processed must be writeable by the user specified for the database connection (some databases restrict direct access to data and/or require using stored procedures)
- currently, only the ability to delete all rows is supported (see `RemoveAllRows` command parameter); in the future functionality will be implemented to delete rows matching rows in a TSTool table

The following dialog is used to edit the command and illustrates the syntax for the command.



RemoveTableRowsFromDataStore

RemoveTableRowsFromDataStore() Command

The command syntax is as follows:

```
RemoveTableRowsFromDataStore(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`DataStore`	The name of a database datastore to process.	None – must be specified.
`DataStoreTable`	The name of the database table or view being processed.	None – must be specified.
`RemoveAllRows`	Indicate whether all rows should be removed (`True`) or only a subset (`False`). `False` is the default as a safeguard and future enhancements will enable removing only rows that match TSTool table rows or a constraint.	`False` – only rows matching TSTool table are removed.

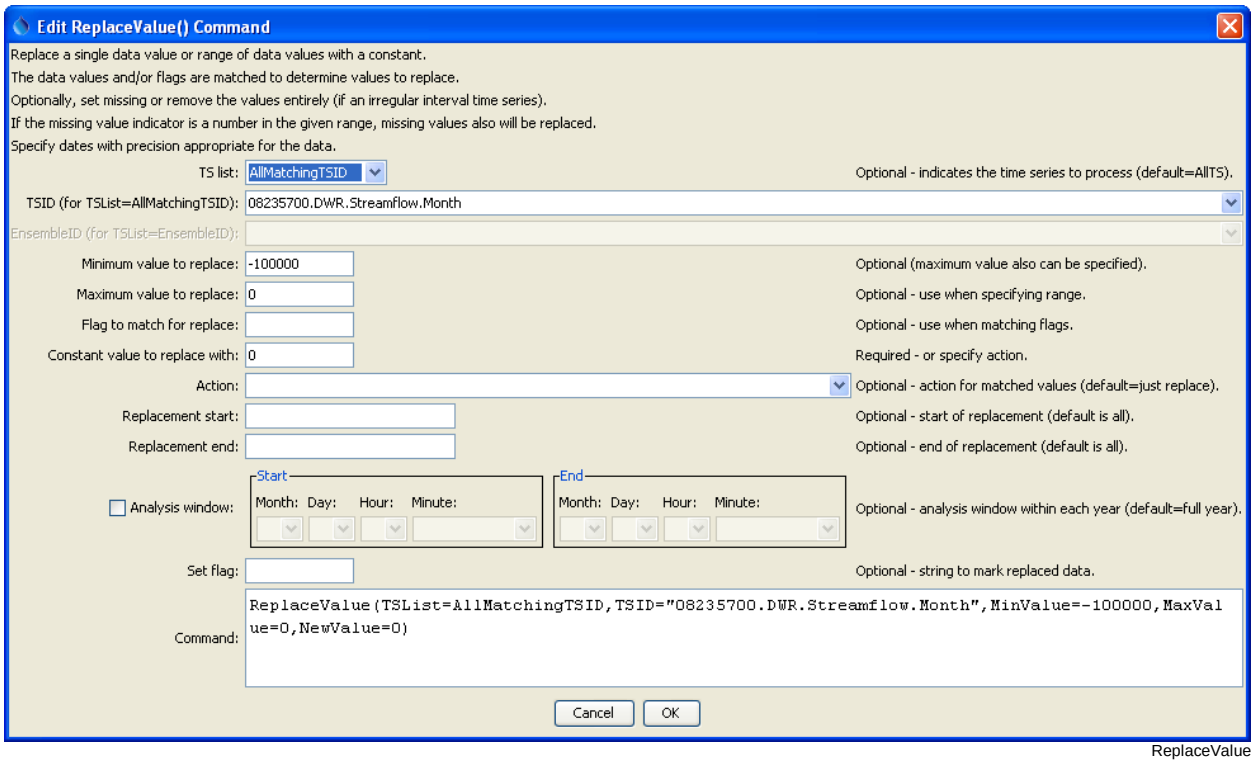
Command Reference: ReplaceValue()

Replace time series data value(s)

Version 10.06.00, 2012-03-22

The `ReplaceValue()` command replaces a range of values in a time series with a constant value, sets the values to missing, or removes the values (if an irregular time series). If the missing value indicator is a number in the range, missing values also will be replaced. The time series data flag can be checked in place of or addition to checking the numerical values. This command is useful for filtering out erroneous data values. See also the `CheckTimeSeries()` command, which provides for a variety of checks and also allows values to be set to missing or removed.

The following dialog is used to edit the command and illustrates the syntax of the command:



ReplaceValue

ReplaceValue() Command Editor

The command syntax is as follows:

```
ReplaceValue(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be processed, if processing an ensemble.	Required if TSList=EnsembleID.
MinValue	The minimum value to replace.	The minimum value and/or MatchFlag must be specified.
MaxValue	The maximum value to replace.	If not specified, only data values that exactly match the minimum value will be replaced.
MatchFlag	The flag to match. If specified in addition to MinValue, then the value and flag must be matched in order to perform the replacement. A case-sensitive comparison is made and the data value flag must exactly match MatchFlag. In the future additional flexibility may be added to match a substring, etc. If Action=SetMissing, the original data flag value will remain. Specifying SetFlag will result in the original data flag being modified.	The minimum value and/or MatchFlag must be specified.
NewValue	The new data value.	Required, unless the Action parameter is

Parameter	Description	Default
		specified.
`Action`	An additional action to take with values that are matched: • `Remove` – remove the data points. This can only be specified for irregular interval time series and will be interpreted as `SetMissing` for regular interval time series. • `SetMissing` – set values to missing.	No additional action is taken and the `NewValue` parameter must be specified.
`SetStart`	The date/time to start filling, if other than the full time series period.	Check the full period.
`SetEnd`	The date/time to end filling, if other than the full time series period.	Check the full period.
`AnalysisWindowStart`	The starting date/time within the calendar year to replace data. The window CANNOT cross calendar year boundaries (this may be allowed in the future). Use multiple commands if necessary.	Process each full year.
`AnalysisWindowEnd`	The ending date/time within the calendar year to replace data.	Process each full year.
`SetFlag`	A string to assign to data values that are replaced.	Do not assign a string flag.

A sample command file to process from the State of Colorado's HydroBase database is as follows:

```
# 08235700 - ALAMOSA RIVER BELOW CASTLEMAN GULCH NEAR JASPER
08235700.DWR.Streamflow.Month~HydroBase
ReplaceValue(TSList=AllTS,MinValue=-100000,MaxValue=0,NewValue=0)
```

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Command Reference: ResequenceTimeSeriesData()

Resequence time series data (shuffle years of data)

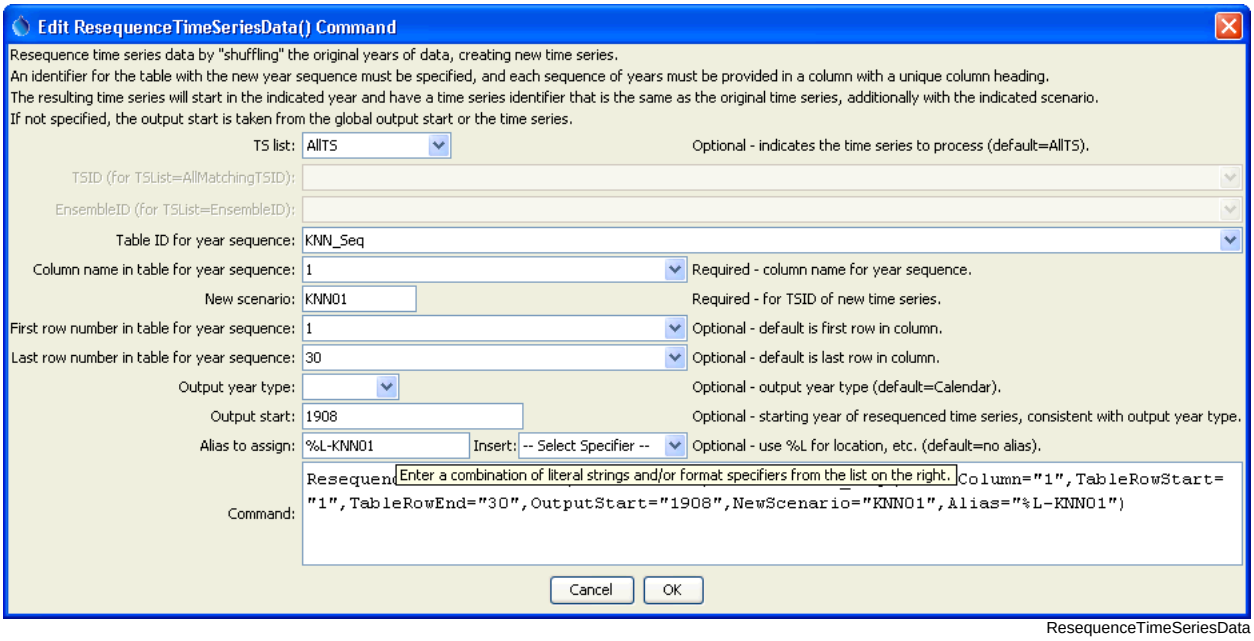
Version 10.00.01, 2011-05-15

The `ResequenceTimeSeriesData()` command resequences data in time series by shifting/shuffling/repeating values from one year to another, creating new time series for each time series. For example, January 1950 might be shifted to January 1990. This command is useful for generating synthetic time series by resequencing historical data. The following constraints apply to the command as currently implemented:

1. Processing by default occurs by calendar year, with the sequence specified as calendar years. If an alternate output year type is used (see the `OutputYearType` parameter). The `OutputStart` year is considered to be consistent with the output year type.
2. The sequence of years must currently be supplied as a column of years in a table (rows of years may be added in a future enhancement).
3. Full start and end years are required, matching the output year type.
4. Currently the command can only be applied to month interval data. For a daily data interval, several technical issues must be resolved before the feature can be implemented:
    a. If a short year (i.e., non-leap year with 365 days) is transferred to a long year (i.e., a leap year with 366 days), the first day after the short year is used for the 366th day during the transfer. What to do if the year being transferred is the last in the data set and no more years are available for the 366th day – repeat the last day?
    b. If a long year (i.e., leap year with 366 days) is transferred to a short year (i.e., a non-leap year with 365 days), the 366th day in the leap year is not transferred.
5. The original period is by default retained in the output time series. For example, if the original data are 1937 to 1997, the resequenced data will also be in a time series with a period 1937 to 1997. The `OutputStart` parameter can be used to shift the start year of output.

The command is designed to work with a table that provides sequence information. For example, see the `ReadTableFromDelimitedFile()` command and the example shown below.

The following dialog is used to edit the command and illustrates the syntax of the command.



ResequenceTimeSeriesData

ResequenceTimeSeriesData() Command Editor

The command syntax is as follows:

```
ResequenceTimeSeriesData(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command will be processed. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series selected with the `SelectTimeSeries()` command will be processed.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	Required when `TSList=*TSID`.
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required when `TSList=`

Parameter	Description	Default
		`EnsembleID`.
`TableID`	The identifier for the sequence table to use, which indicates the dates to use when resequencing data (e.g., list of years for data sequence). For example, see the `ReadTableFromDelimitedFile()` command. The years should be consistent with the `OutputYearType`.	None – must be specified.
`TableColumn`	The column name containing the sequence information. Note that the input table must have column names in a header record.	None – must be specified.
`TableRowStart`	The first data row number (1+) containing the first year in the new sequence.	Use all rows.
`TableRowEnd`	The last data row number (1+) containing the first year in the new sequence.	Use all rows.
`OutputYearType`	The output year type, indicating the year extent for the resequencing, one of: • `Calendar` – January to December • `NovToDec` – November of previous calendar year to October of current year. • `Water` – October of previous calendar year to September of current year.	`Calendar`
`OutputStart`	The output start as a four-digit year that is consistent with `OutputYearType`. For example, if processing water years, the `OutputStart` would be the first water year in the output (and start in October of the previous calendar year). The output end is relative to the output start and includes the number of years in the sequence.	Same as the original input data or use the global output start if specified. The output months will be adjusted for the output year type.
`NewScenario`	The new scenario to assign to the created time series, resulting in a unique TSID.	Not specified, but a new scenario and/or alias must be specified.
`Alias`	Alias to assign to the output time series. See the `LegendFormat` property described in the **TSView Time Series Viewing Tools** appendix. For example, `%L` is full location, `%T` is data type, `%I` is interval, and `%Z` is scenario.	Not specified, but a new scenario and/or alias must be specified.

The following example:

1. Reads a list of time series from a StateMod model file.
2. Reads a sequence of years from a delimited file.
3. Resequences the StateMod time series data.
4. Writes the resequenced file to a new StateMod file.

```
# Read all demand time series…
ReadStateMod(InputFile="..\StateMod\gunnC2005.xbm")
# Read the sequence of years to use…
Table 0001HK0101 = ReadTableFromDelimitedFile(InputFile="0001HK0101.csv")
# Resequence the StateMod time series…
ResequenceTimeSeriesData(TSList=AllTS,TableID="0001HK0101",
TableColumn="Trace1",NewScenario="KNN0101",Alias="%L-KNN0101")
# Write the resequenced data for StateMod
WriteStateMod(TSList=AllMatchingTSID,TSID="*KNN*",
  OutputFile="..\StateMod0101\gunnC2005.xbm")
```

The year sequence is specified in a file similar to the following.

```
# Some comments
"Trace1","Trace2",…
1905,1967,…
1920,1943,…
etc.
```

Variations on the example can be implemented, for example, to process output products after the run.

Command Reference: RunCommands()

Run a command file

Version 10.20.00, 2013-04-20

The `RunCommands()` command runs a command file using a separate command processor as a "child" of the main processor. This command can be used to manage workflow where multiple commands files are run, and is also used extensively for testing, where a test suite consists of running separate test case command files.

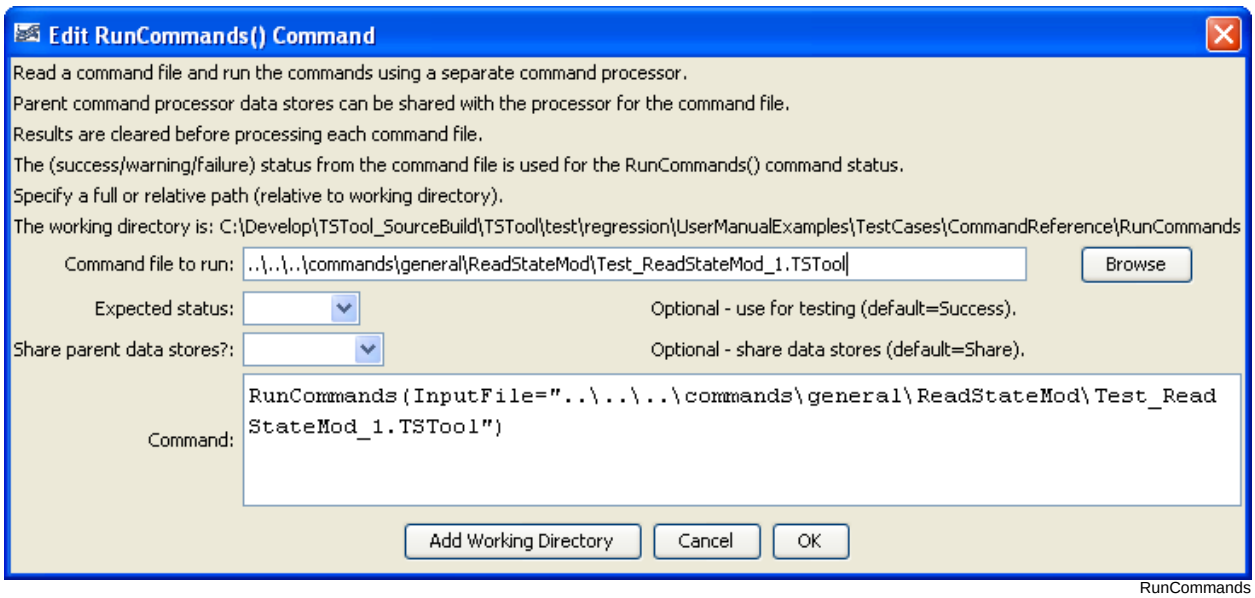
Command files that are run can themselves include `RunCommands()` commands. Each command file that is run has knowledge if its initial working directory and relative paths referenced in the command file are relative to this directory. This allows a master command file to reside in a different location than the individual command files that are being run. The current working directory is reset to that of the command file being run.

Data stores from the parent command processor are by default passed to the child command processor. Consequently, database connections can be opened once and shared between command files.

Currently the properties from the parent command file are NOT applied to the initial conditions when running the command file. Therefore, global properties like input and output period are reset to defaults before running the command file. A future enhancement may implement a command parameter to indicate whether to share the properties with the parent processor. The output from the command is also not added to the parent processor. Again, a future enhancement may be to append output so that one final set of output is generated.

There is currently no special handling of log files; consequently, if the main command file opens a log file and then a command file is run that opens a new log file, the main log file will be closed. This behavior is being evaluated.

The following dialog is used to edit the command and illustrates the syntax for the command.



RunCommands

RunCommands() Command Editor

The command syntax is as follows:

```
RunCommands(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile	The name of the command file to run, enclosed in double quotes if the file contains spaces or other special characters. A path relative to the master command file can be specified.	None – must be specified.
ExpectedStatus	Used for testing – indicates the expected status from the command, one of: • Unknown • Success • Warning • Failure	Success
ShareDataStores	Indicate whether data stores in the parent should be shared with the child command processor. Normally this should be done so that databases can be opened once. Note that opening data stores in the child command file will not make the data stores available in the parent.	Share

The following example illustrates how the RunCommands() command can be used to test TSTool software (or any implementation of commands). First, individual command files are implemented to test specific functionality, which will result in warnings if a test fails:

```
StartLog(LogFile="Results/Test_ReadStateMod_1.TSTool.log")
NewPatternTimeSeries(NewTSID="MyLoc..MyData.Day",Alias="TS",
  Description="Test data",SetStart="1950-01-01",
  SetEnd="1951-03-12",Units="CFS",PatternValues="5,10,12,13,75")
# Uncomment the following command to regenerate the expected results file.
# WriteStateMod(TSList=AllTS,
#    OutputFile="ExpectedResults\Test_ReadStateMod_1_out.stm")
ReadStateMod(InputFile="ExpectedResults\Test_ReadStateMod_1_out.stm")
CompareTimeSeries(Precision=3,Tolerance=".001",DiffFlag="X",
  WarnIfDifferent=True)
```

Next, use the RunCommands() command to run one or more tests:

```
StartRegressionTestResultsReport(
  OutputFile="RunRegressionTest_commands_general.TSTool.out.txt")
…
RunCommands(InputFile="..\..\..\commands\general\ReadStateMod\Test_ReadStateMod_1.TSTool")
…
```

Each of the above command files should produce expected results, without warnings. If any command file unexpectedly produces a warning, a warning will also be visible in TSTool. The issue can then be evaluated to determine whether a software or configuration change is necessary. See the StartRegressionTestResultsReport() command documentation for an explanation of how to disable a command file with #@enabled False or indicate its expected status for testing (e.g., @#expected Status Warning).

Command Reference: RunDSSUTL()

Run the DSSUTL and other utility programs from the US Army Corps of Engineers

Version 09.03.00, 2009-04-10

The RunDSSUTL() command runs the Army Corps of Engineers' DSSUTL program and other utility programs, which are used with HEC-DSS files. See also the **HEC-DSS Input Type** appendix. This command formats the command line for the program, runs the program, and checks the exit value. A non-zero exit value will result in a failure status for the command.

TSTool internally maintains a working directory that is used to convert relative paths to absolute paths in order to locate files. The working directory is by default the location of the last command file that was opened. The location of the program being run (e.g., *DSSUTL.EXE*) is determined by the operating system using the PATH environment variable; therefore, use the ${WorkingDir} property in the command line if the program location is not in PATH. Use \" in the command line or arguments to surround whitespace.

It is not clear whether DSSUTL and other program have limits on path or filename length, but if this appears to be the case, use shorter names. If a program is not provided with correct input, it may go into interactive mode, in which case TSTool may appear to stop when running the command. Currently there is no way to kill the process and TSTool must be stopped and restarted.

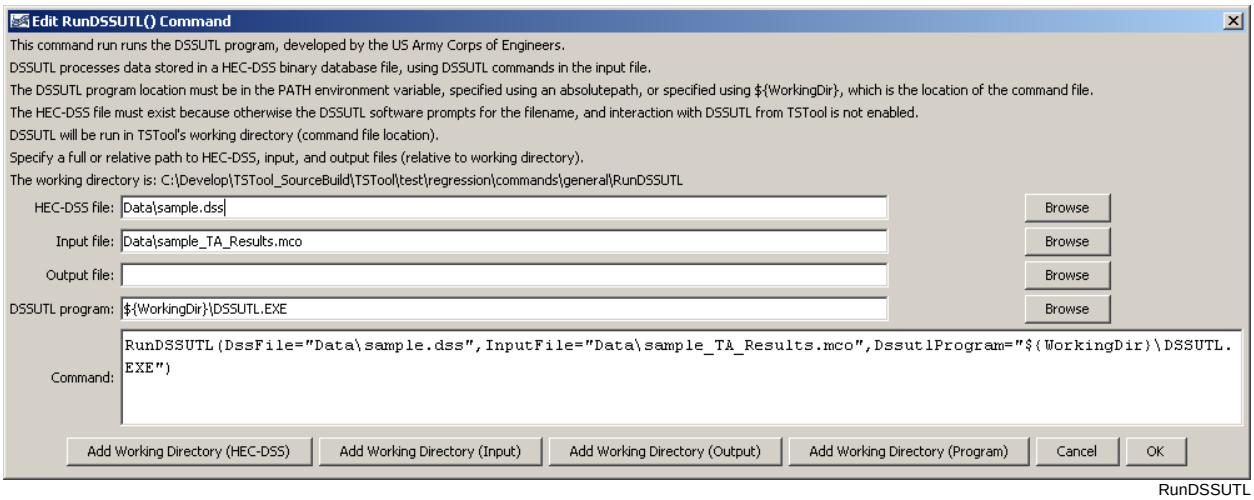
The following table summarizes how the command treats input for various utility programs. Required arguments are for the RunDSSUTL() command but may be optional if the program is run on the command line.

RunDSSUTL() Command Handling of HEC-DSS Utility Program Input

Progam	Description	DSSFILE= Argument	INPUT= Argument	OUTPUT= Argument
DSSUTL	Data Storage System Utility Program	Required	Required	Optional
DSPLAY	Data Storage System Graphics Utility	Required	Required	Optional
DSSMATH	Utility Program for Mathematical Manipulation of HEC-DSS Data	Not used – use OPEN() command.	Required	Optional
REPGEN	Report Generator – **not fully supported due to different command line argument conventions.**			
DSSTS	Regular Interval Time-Series Data Entry Program	Required	Required	Optional
DSSITS	Irregular Interval Time-Series Data Entry Program	Required	Required	Optional
DSSPD	Paired Data Entry Program	Required	Required	Optional
DSSTXT	Text Data Entry Program	Required	Required	Optional
DWINDO	Interactive Data Entry and Editing	This interactive program is not supported by RunDSSUTL() command.		
WATDSS	Watstore to DSS Data Entry Program – **not fully supported due to different command line argument**	Required	Required	Optional

Progam	Description	DSSFILE= Argument	INPUT= Argument	OUTPUT= Argument
	conventions.			
NWSDSS	National Weather Service to Data Storage System Conversion Utility – **not fully supported due to different command line argument conventions.**	Required	Required	Optional
PREAD	Functions, Macros, and Screens – **not fully supported due to interactive prompts.**			

The following dialog is used to edit the command and illustrates the command syntax. Note that the *DSSUTL.EXE* location is in this case not included in the `PATH` environment variable and is specified with the `DssutlProgram` parameter, using `${WorkingDir}`. The HEC-DSS and input files are relative to the working directory.



RunDSSUTL

RunDSSUTL() Command Editor when Specifying Command Line

The command syntax is as follows:

```
RunDSSUTL(Parameter=Value…)
```

Command Parameters

Parameter	Description	Default
DssFile	The HEC-DSS filename as an absolute path or relative to the working directory. The file must exist because TSTool does not interface with the program interactive mode prompts. The parameter is passed to the program using the DSSFILE= command line argument.	None – must be specified for most programs.
InputFile	The DSS utility program command file to run. The file must exist because TSTool does not interface with the utility program interactive mode prompts. The input file name is passed to the program using the INPUT= command line argument.	None – must be specified.
OutputFile	The DSS utility program output file, which contains logging information. This is passed to the program using the OUTPUT= command line argument. Specifying the argument will cause output to be printed to the file and not the screen. Note that some utility program commands write to other output files (controlled by the command file or other command line arguments), which should not be confused with the output file for this argument.	Not required – output will be to screen if command shell window is shown.
DssutlProgram	The DSS utility program to run. The PATH environment variable is used to locate the executable if a full path is not specified. Specify the specific DSS utility program to run if the default value is not appropriate.	If not specified, *DSSUTL.EXE* will be used and must be located in a directory listed in the PATH environment variable.

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Command Reference: RunningAverage()

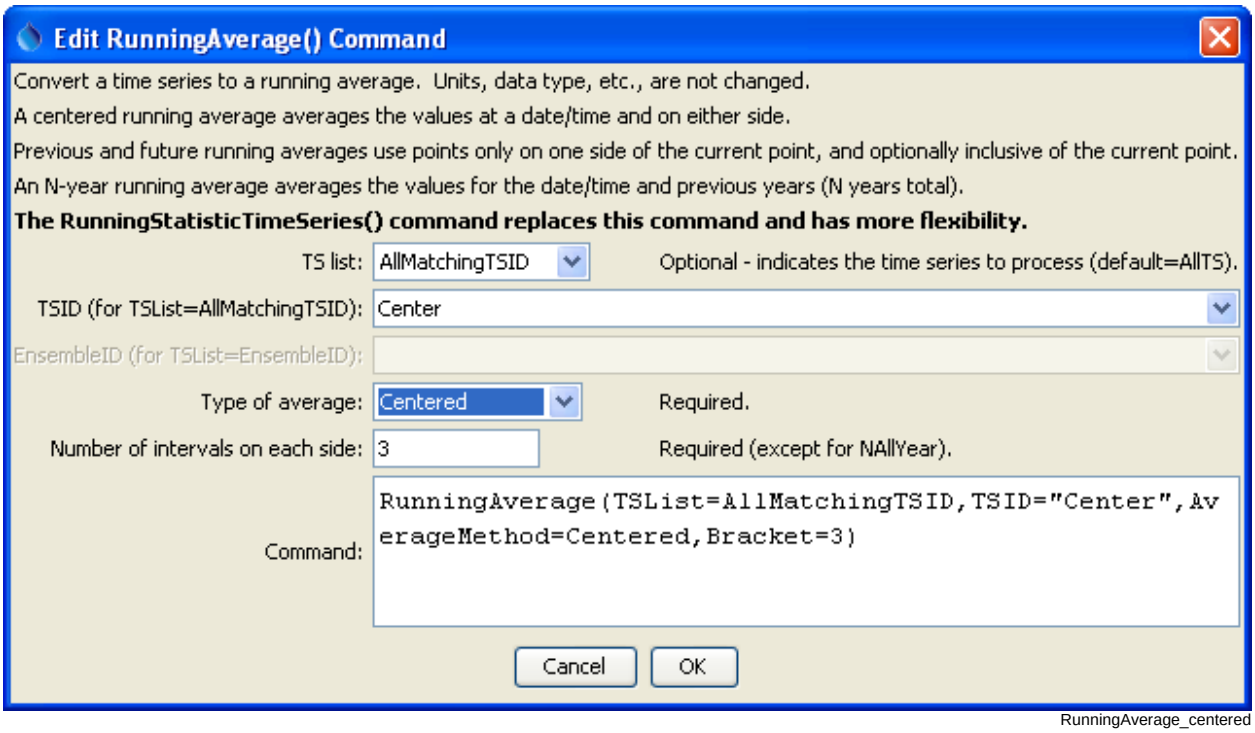
Convert time series data to running average values

Version 10.13.00, 2012-10-25

The `RunningAverage()` command converts a time series' raw data values to a running average, resulting in data that are smoothed. New time series are NOT created (**note that the newer `RunningStatisticTimeSeries()` command has more flexibility and the `RunningAverage()` command may be phased out in the future**). There are several approaches to computing the running average (as specified by the `AverageMethod` command parameter):

- The centered running average requires that the number intervals on each site of a point be specified (e.g., specifying 1 will average 3 values at each point).
- The previous/future running average requires that the number of intervals prior to or after the current point be specified.
- The N-year running average is computed by averaging the current year and N - 1 values from previous years, for a specific date. An average value is produced only if N non-missing values are available. Currently N-year running average values for Feb 29 for daily or finer data will always be missing because a sufficient number of values will not be found – an option may be added in the future to allow Feb 29 values to be computed based on fewer than N values.
- A special case of the N-year running average (NAllYear) is to use all previous years' and the current value.

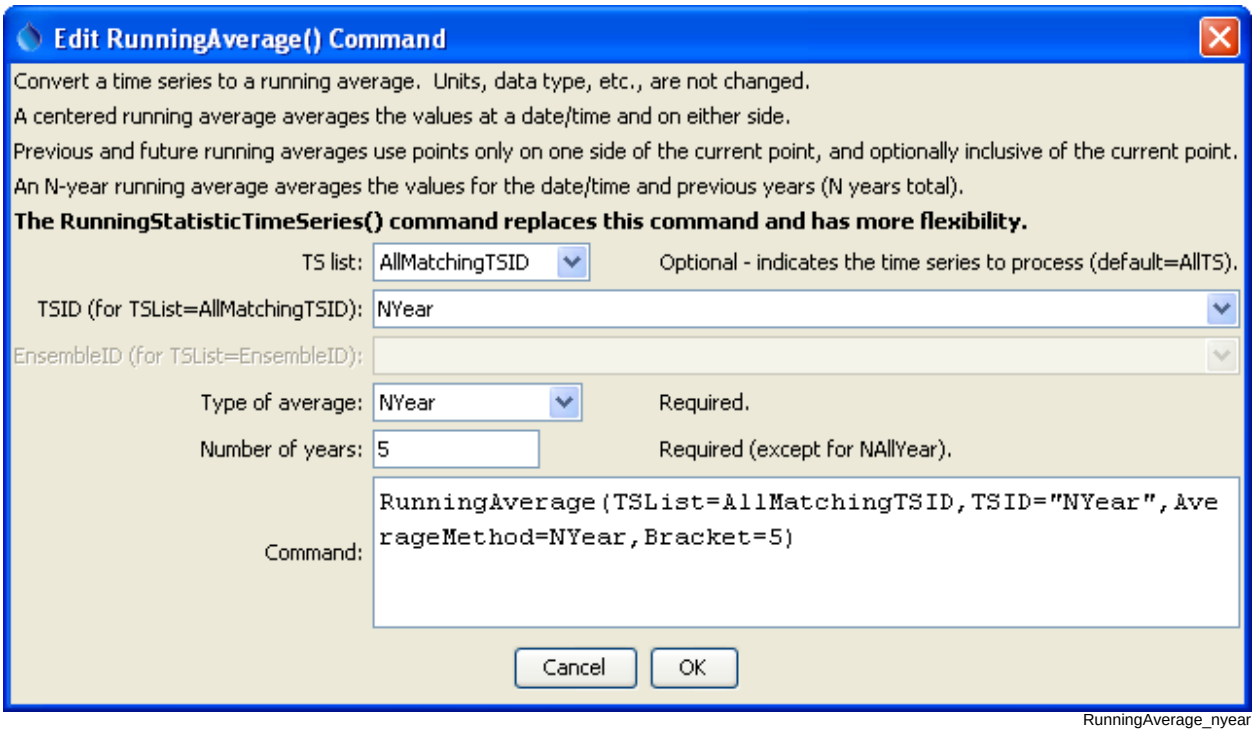
The following dialog is used to edit the command and illustrates the centered running average command syntax.



RunningAverage_centered

RunningAverage() Command Editor for Centered Running Average

The following dialog illustrates the N-year running average command syntax.



RunningAverage_nyear

RunningAverage() Command Editor for N-Year Running Average

The command syntax is as follows:

```
RunningAverage(Parameter=Value,…)
```

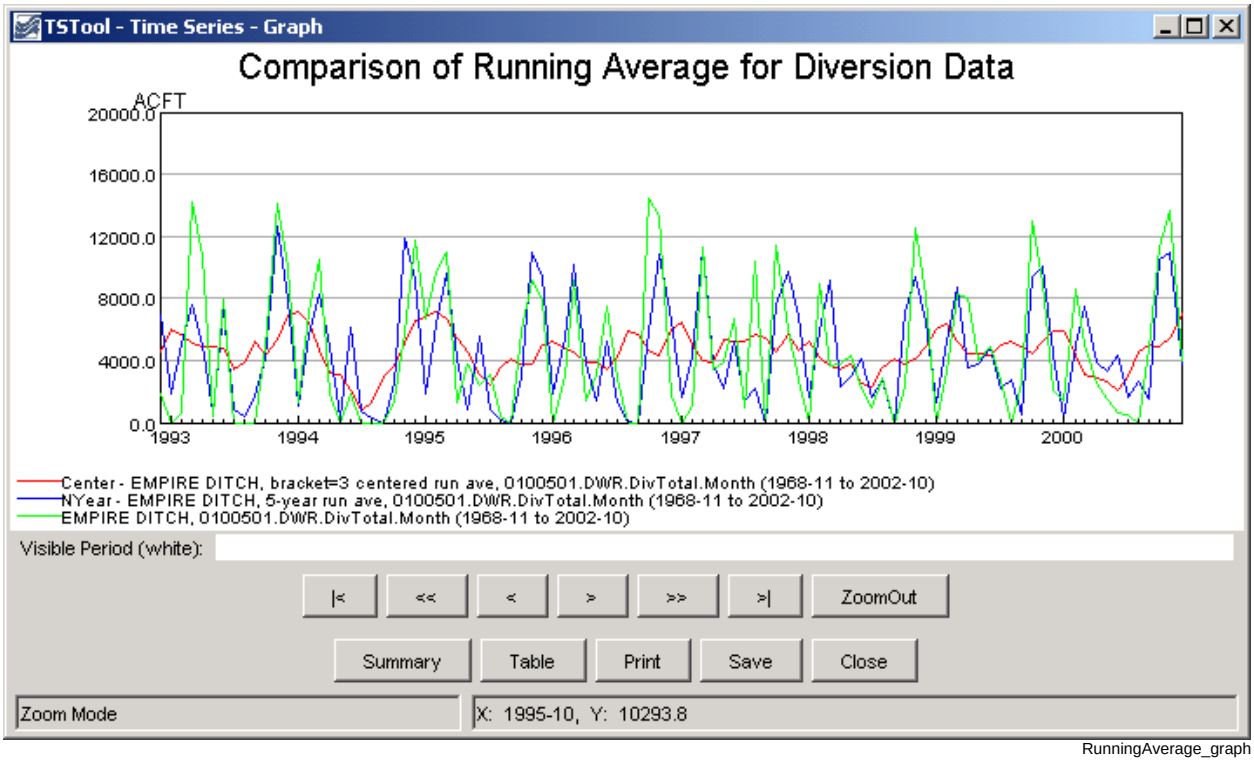
Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList= EnsembleID.
AverageMethod	The method used to create the running average, one of: • Centered – values on each side of a date/time are averaged. • Future – average the next N (bracket) values but do not include the current value. • FutureInclusive – average the next N (bracket) values and also include the current value. • NYear – values for the current year and (N – 1) preceding years, for the same date/time, are averaged. • NAllYear – values for the current year and all preceding years, for the same date/time, are averaged (missing values are allowed) • Previous – average the previous N (bracket) values but do not include the current value. • PreviousInclusive – average the previous N (bracket) values and also include the current value.	None – must be specified.
Bracket	For centered running average, the bracket is the number of points on each side of the current point (therefore a value of 1 will average 3 data values). For N-year running average, the bracket is the total number of years to average, including the current year.	None – must be specified.

A sample command file to convert State of Colorado HydroBase diversion time series to running averages is as follows:

```
# 0100501 - EMPIRE DITCH
ReadTimeSeries(Alias="Center","0100501.DWR.DivTotal.Month~HydroBase")
RunningAverage(TSList=AllMatchingTSID,TSID="Center",
  AverageMethod=Centered,Bracket=3)
ReadTimeSeries(Alias="NYear","0100501.DWR.DivTotal.Month~HydroBase")
RunningAverage(TSList=AllMatchingTSID,TSID="NYear",
  AverageMethod=NYear,Bracket=5)
0100501.DWR.DivTotal.Month~HydroBase
```

The resulting graph is as follows:



RunningAverage_graph

Results from RunningAverage() Commands

Command Reference: RunningStatisticTimeSeries()

Create a new time series containing running statistics computed from input

Version 10.12.00, 2012-07-18

The `RunningStatisticTimeSeries()` command uses a sample of values from a time series to compute a running statistic, resulting in new time series. The two main purposes of the command are:

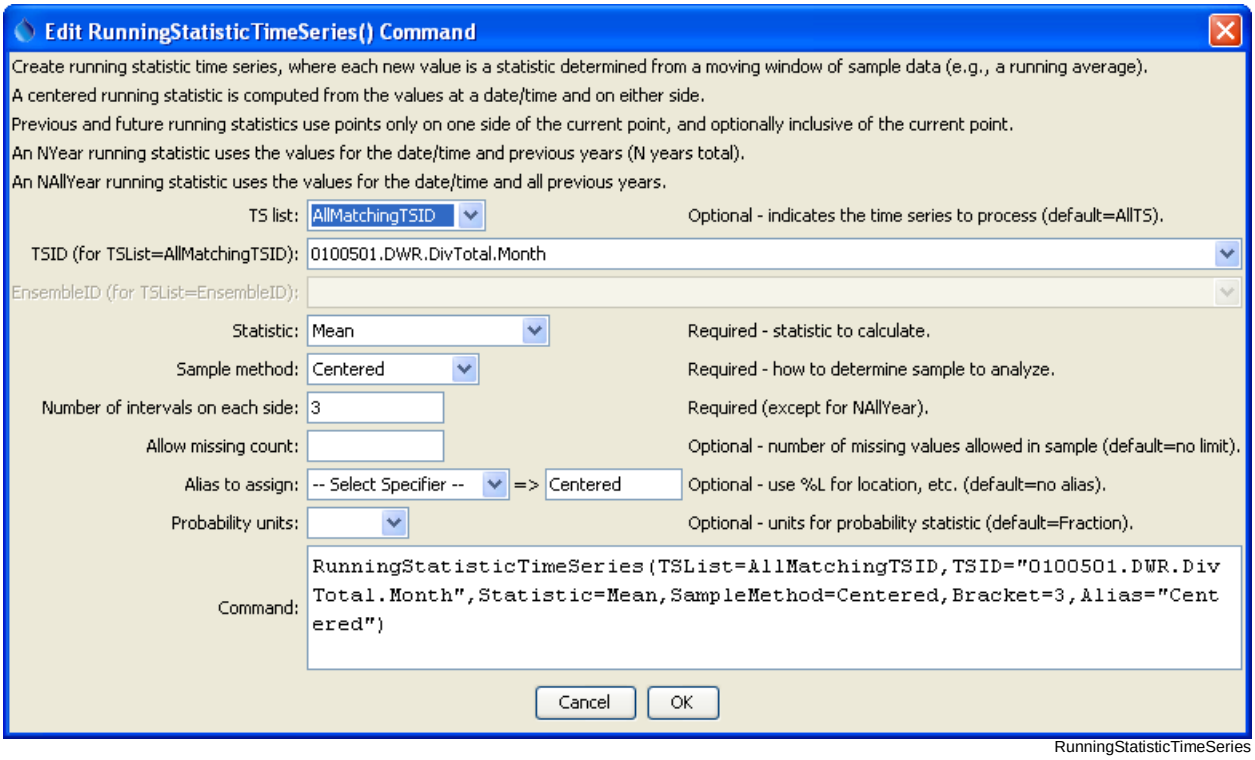
1. Compute a running statistic around a moving point, in order to smooth the time series, for example to focus on underlying short-term forcings rather than variability or noise
2. Compute a statistic by using values from the historical period, for example to illustrate how a daily value compares to historical values for the same day

The sample is computed relative to a date/time in the time series and consequently the resulting statistic may vary at each date/time in the time series. The resulting time series will have a time series identifier (TSID) that is the same as the original, with "`-Running-`" and the statistic appended to the data type (an alias can be assigned to customize the identifier that is used for processing). There are several approaches to determining the sample for the running statistic (as specified by the `SampleMethod` command parameter):

- The centered running statistic requires that the number intervals on each site of a point be specified (e.g., specifying 1 will use 3 values at each point).
- The previous/future running statistic requires that the number of intervals prior to or after the current point be specified.
- The N-year running statistic is computed by processing the current year and N - 1 values from previous years, for a specific date. A resulting value is produced only if N non-missing values are available. Currently N-year running statistic values for Feb 29 for daily or finer data will always be missing because a sufficient number of values will not be found – an option may be added in the future to allow Feb 29 values to be computed based on fewer than N values.
- A special case of the N-year running statistic (`NAllYear`) is to use all previous years' and the current value.

Statistics may be calculated directly from the sample or may be derived from an additional calculation. For example, the `Mean` statistic is computed by computing the mean of the values in the sample, and is assigned as the output time series value for the date/time that defines the sample. However, the `PercentOfMean` statistic is computed first by computing the `Mean` statistic and then dividing the original time series value by the mean, for each date/time in the time series. Derived statistics could be computed for many statistics but are provided only for cases that have common use.

The following dialog is used to edit the command and illustrates the centered running average command syntax.



RunningStatisticTimeSeries

RunningStatisticTimeSeries() Command Editor for Centered Running Average

The command syntax is as follows:

```
RunningStatisticTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: 1. `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) 2. `AllTS` – all time series generated before the command 3. `EnsembleID` – all time series in the ensemble 4. `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) 5. `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) 6. `SelectedTS` – the time series selected with the `SelectTimeSeries()` command	`AllTS`
`TSID`	The time series identifier or alias for the time series to be processed, using the * wildcard character to match	Required if `TSList=*TSID`.

Parameter	Description	Default
	multiple time series.	
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`Statistic`	The statistic to compute for each point in the created time series, one of: • `ExceedanceProbability` – the probability that the value will be exceeded, best-suited for the `N*` sample methods (see discussion below about how statistics are computed) • `GeometricMean` – geometric mean value • `Lag-1AutoCorrelation` – the autocorrelation between values and the those that follow in the next time step, given by: $r_k = \frac{\sum_{i=1}^{N-k}(Y_i - Y_{mean})(Y_{i+k} - Y_{mean})}{\sum_{i=1}^{N}(Y_i - Y_{mean})^2}$ • `Max` – maximum value • `Mean` – arithmetic mean value • `Median` – median value • `Min` – minimum value • `NonexceedanceProbability` – the probability that the value will not be exceeded, `1-ExceedanceProbability`, best-suited for the `N*` sample methods (see discussion below about how statistics are computed) • `PercentOfMax` – percent of the `Max` statistic output • `PercentOfMean` – percent of the `Mean` statistic output • `PercentOfMedian` – percent of the `Median` statistic output • `PercentOfMin` – percent of the `Min` statistic output • `Skew` – skew coefficient, as follows: $Cs = \frac{N\sum_{i=1}^{N}(Y_i - Y_{mean})^3}{(n-1)(n-2)s^3}$ where s = standard deviation • `StdDev` – standard deviation • `Total` – sum of values • `Variance` – variance	None – must be specified.
`SampleMethod`	The method used to determine the data sample for each statistic calculation, one of: • `Centered` – N (bracket) values on each side of a date/time and the center value • `Future` – average the next N (bracket) values but do not include the current value	None – must be specified.

Parameter	Description	Default
	• `FutureInclusive` – average the next N (bracket) values and also include the current value • `NYear` – values for the current year and (N – 1) preceding years, for the same date/time in each year • `NAllYear` – values for the current year and all preceding years, for the same date/time in each year (missing values are allowed) • `Previous` – the previous N (bracket) values but do not include the current value • `PreviousInclusive` – the previous N (bracket) values and also include the current value If a sample method such as `NAllYear` is desired, but including previous, current, and future values, then the `NewStatisticTimeSeries()` command can be used.	
`Bracket`	For centered `SampleMethod`, the bracket is the number of points on each side of the current point (therefore a value of 1 will average 3 data values). For future and previous `SampleMethod`, the bracket is the number of previous or future values. For N-year `SampleMethod`, the bracket is the total number of years to process, including the current year.	None – must be specified.
`AllowMissing Count`	The number of values allowed to be missing in the sample and still compute the statistic. Care should be taken to specify a value that is relatively small for the sample size.	0 – no missing values are allowed in the sample
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`ProbabilityUnits`	Units to use for calculated probability statistics.	`Fraction` (0 – 1).

The following table provides additional information about how some statistics are computed.

Statistic Computation Details

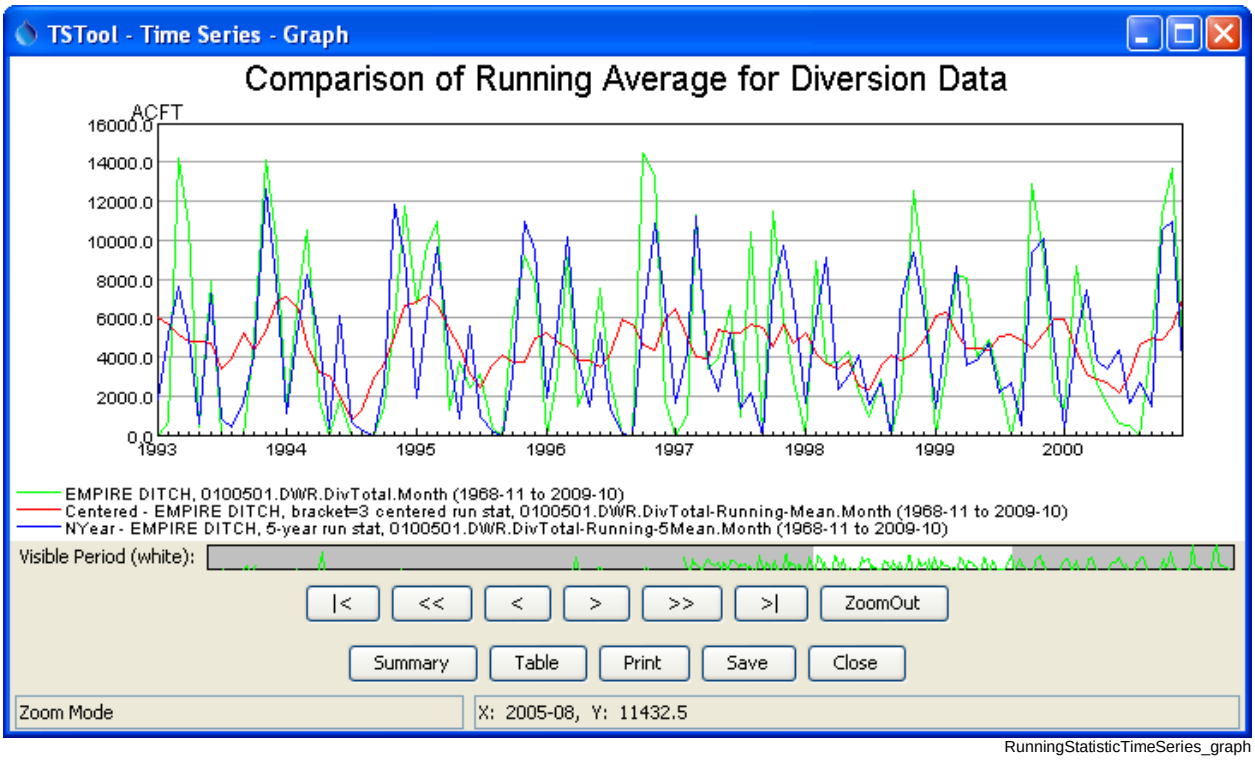
Statistic	Computation Details
`Exceedance Probability`	1. Rank the values in the sample from highest to lowest. Duplicate values are retained in the sample 2. Search the list of ranked values, starting from the largest: a. If the value exactly matches a value in the sample: i. The matched value has a position *i* (where the largest value is in position *i=1*). ii. The exceedance probability is calculated as *i/(n + 1)*, where *n* is the sample size. b. If the value is outside any values in the sample (e.g., for `Future` and

Statistic	Computation Details
	`Previous` sample methods), then the exceedance value is not calculated and warnings are generated. In this case a different sample method should be used. c. If the value does not exactly match a value in the sample (e.g., for `Future` and `Previous` sample methods): i. Find the ranked values that bound the value. ii. The exceedance probability for each bounding value is calculated as *i/(n + 1)*, where *i* is the list position (1 for the largest value) and *n* is the sample size. iii. The exceedance probability for the specific value is interpolated from the bounding values. Note that the exceedance probability is not recomputed by adding the value to the sample. If this is desired, use the `FutureInclusive` or `PreviousInclusive` sample methods. Duplicate values are handled by using the first value found in the sequence of duplicates.

A sample command file to convert State of Colorado HydroBase diversion time series to running averages is as follows:

```
# SetInputPeriod(InputStart="1993-01",InputEnd="2000-12")
# 0100501 - EMPIRE DITCH
0100501.DWR.DivTotal.Month~HydroBase
RunningStatisticTimeSeries(TSList=AllMatchingTSID,
    TSID="0100501.DWR.DivTotal.Month",Statistic=Mean,SampleMethod=Centered,
    Bracket=3,Alias="Centered")
RunningStatisticTimeSeries(TSList=AllMatchingTSID,
    TSID="0100501.DWR.DivTotal.Month",Statistic=Mean,SampleMethod=NYear,
    Bracket=5,Alias="NYear")
ProcessTSProduct(TSProductFile="Test_RunningStatisticTimeSeries_Example.tsp")
```

The resulting graph is as follows:



RunningStatisticTimeSeries_graph

Results from RunningStatisticTimeSeries() Commands

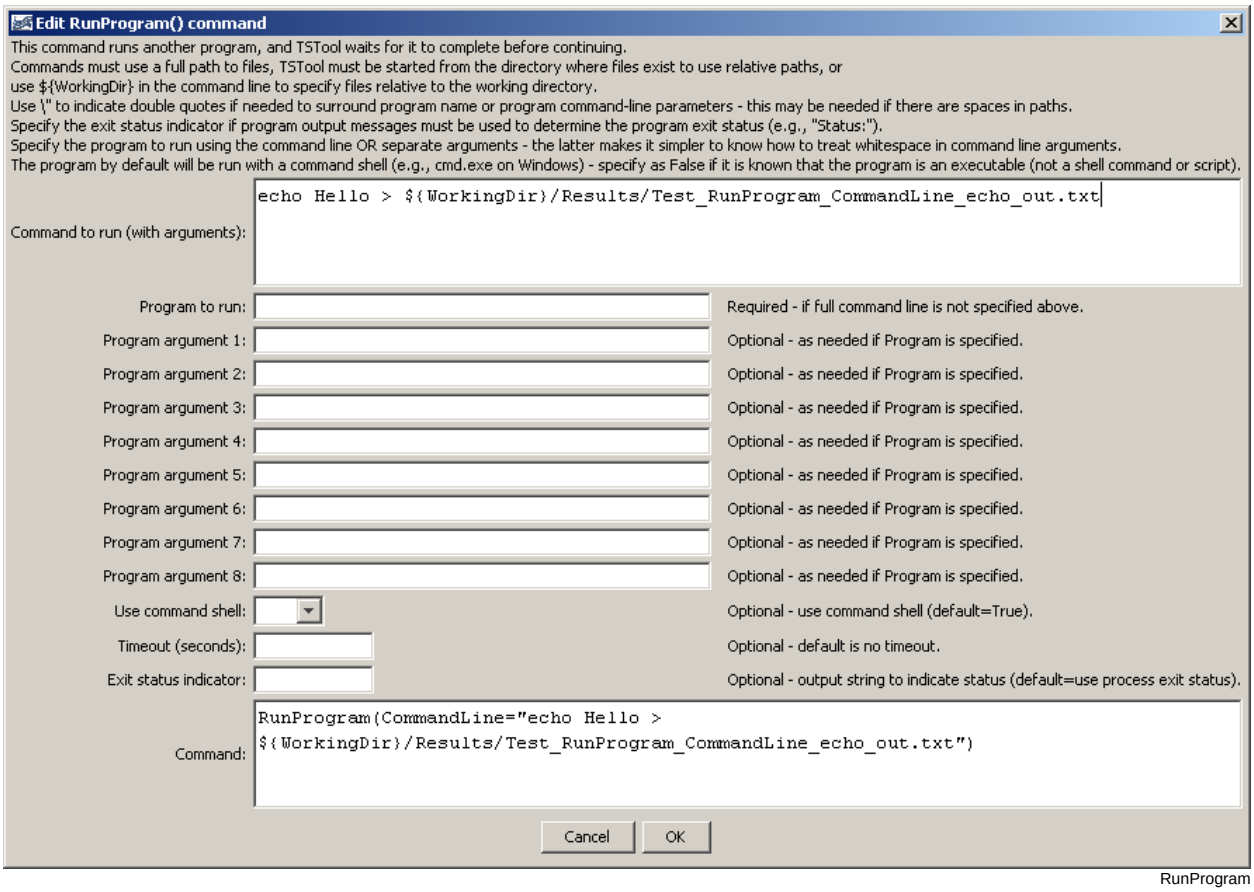
Command Reference: RunProgram()

Run an external program

Version 09.03.00, 2009-04-08

The `RunProgram()` command runs an external program, given the full command line or individual command line parts, and waits until the program is finished before processing additional commands. The TSTool command will indicate a failure if the exit status from the program being run is non-zero. It is therefore possible to call an external program that reads and/or writes recognized time series formats to perform processing that TSTool cannot. One use of this command is to create a calibration environment where a model is run and then the results are read and displayed using TSTool. It is also useful to use TSTool's testing features to implement quality control checks for other software tools.

TSTool internally maintains a working directory that is used to convert relative paths to absolute paths to locate files. The working directory is by default the location of the last command file that was opened. The external program may assume that the working directory is the location from which TSTool software was started (or the installation location if started from a menu). Therefore, it may be necessary to run TSTool in batch mode from the directory where the external software's data files exist, use absolute paths to files, or use the `${WorkingDir}` property in the command line. Use `\"` in the command line or arguments to surround whitespace. Some operating systems may have limitations on command line length. The following dialog is used to edit the command and illustrates the command syntax.



RunProgram

RunProgram() Command Editor when Specifying Command Line

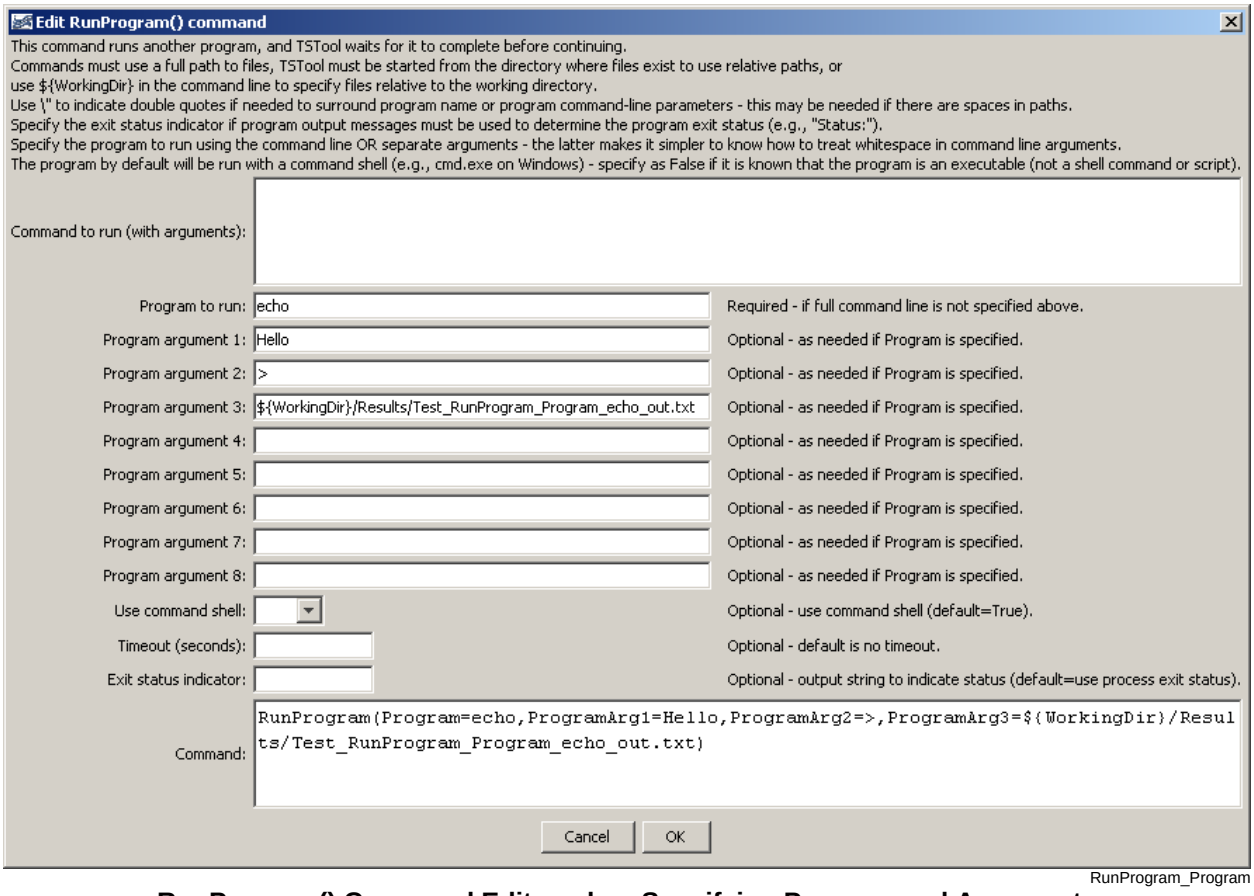
The command syntax is as follows:

```
RunProgram(Parameter=Value…)
```

Command Parameters

Parameter	Description	Default
`CommandLine`	The full program command line, with arguments. If the program executable is found in the `PATH` environment variable, then only the program name needs to be specified. Otherwise, specify an absolute path to the program or run TSTool from a command shell the same directory. The `${WorkingDir}` property can be used in the command line to indicate the working directory (command file location) when specifying file names. For Windows, it may be necessary to place a `\"` at the start and end of the command line, if a full command line is specified.	Must be specified if the `Program` parameter is not specified. The `Program` parameter will be used if both are specified.
`Program`	The name of the program to run. Program arguments are specified using the `ProgramArg#` parameter(s). See the `CommandLine` parameter for more information about parameter formatting and locating the executable.	Must be specified if the `CommandLine` parameter is not specified.
`ProgramArg1, ProgramArg2, etc.`	Command like arguments used with `Program`. If necessary, use `${WorkingDir}` to specify the working directory to locate files.	No arguments will be used with `Program`.
`UseCommandShell`	If specified as `False`, the program will be run without using a command shell. A command shell is needed if the program is a script (batch file), a shell command, or uses >, |, etc.	`True`, using `cmd.exe /C` on Windows and `/bin/sh –c` on UNIX/Linux.
`Timeout`	The timeout in seconds – if the program has not yet returned, the process will be ended. Zero indicates no timeout. **This behavior varies and is being enhanced**.	No timeout.
`ExitStatus Indicator`	By default, the program exit status is determined from the process that is run. Normally 0 means success and non-zero indicates an error. However, the program may not exit with a non-zero exit status when an error occurs. If the program instead uses an output string like `STOP 3` to indicate the status, use this parameter to indicate the leading string, which is followed by the exit status (e.g., `STOP`).	Determine the exit status from the process exit value.

The following figure illustrates how a command would be entered using the program name and parts, and use the command shell to run. Note that the output redirection character ">" is entered as a program argument. The *echo* program on Windows is actually internal to the *cmd.exe* command shell and therefore must be run using the command shell (the default behavior).

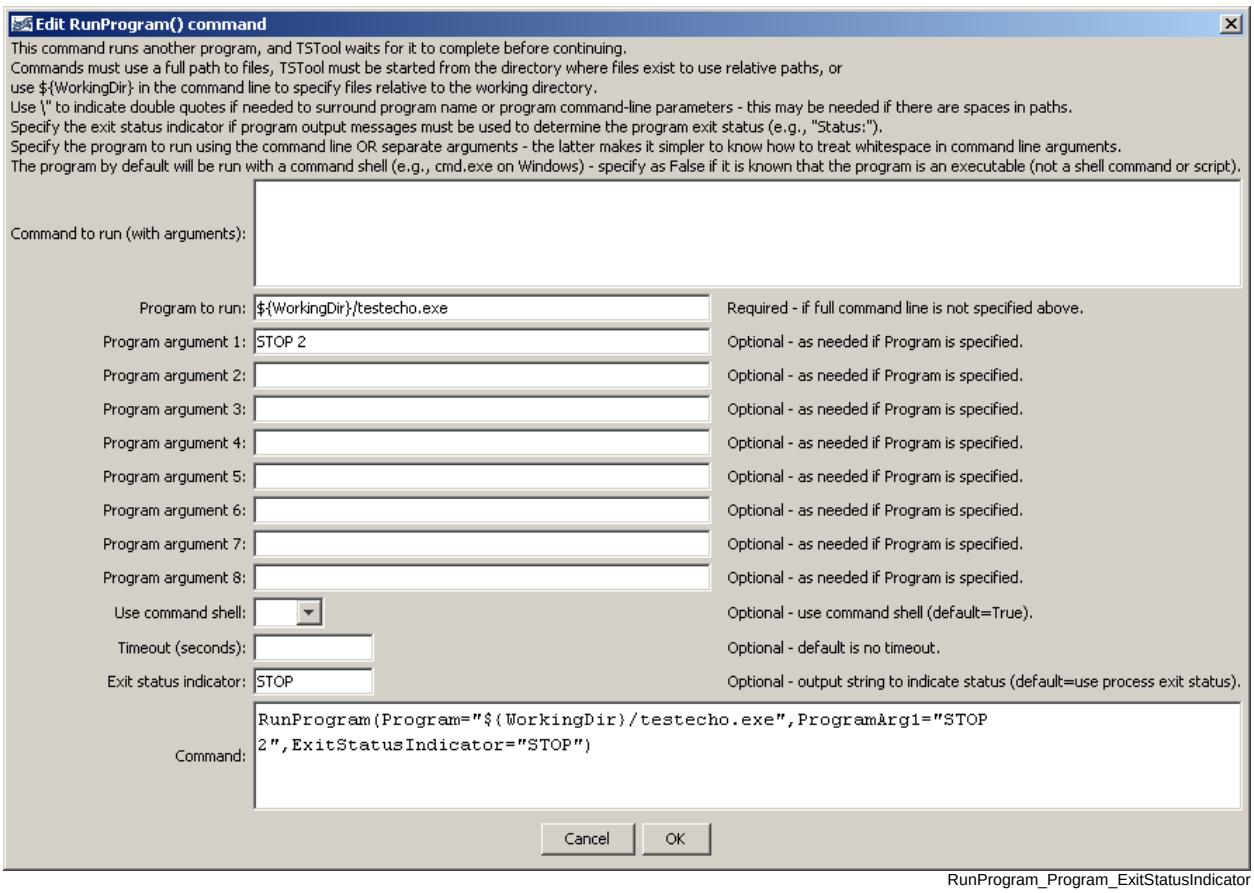


RunProgram_Program

RunProgram() Command Editor when Specifying Program and Arguments

The following figure illustrates how a command can be run without a command shell and using the program output to determine the exit status. The *testecho.exe* program is a compiled executable and can therefore be run without a command shell. Because the standard output is being evaluated for the exit value, the output cannot be redirected to a file with > (this would result in no output being available to TSTool to evaluate), and > is only recognized if running with a command shell in any case.

The following approach is suitable, for example, when running a compiled model or data analysis tool. However, if the tool is run using a script or batch file, then a command shell must be used.



RunProgram_Program_ExitStatusIndicator

RunProgram() Command Editor when Specifying Program, Arguments, and Exit Status Indicator

Command Reference: RunPython()

Run a Python script

Version 10.12.00, 2012-07-19

The `RunPython()` command runs a Python script, waiting until execution is finished before processing additional commands. Python is a powerful scripting language that is widely used (see http://www.python.org). This command allows Python scripts to be run using a variety of Python interpreters, as shown in the following table. It is assumed that Python is installed in the standard directory for the distribution. New versions of Python will reside in similar locations to those shown below.

RunPython() Supported Python Interpreters

Interpreter (Website)	Language, Program Name (Example Install Home)	Comments
IronPython (ironpython.net)	.NET, ipy (*C:\Program Files\IronPython 2.6*)	Useful for integrating with .NET applications, in particular to manipulate Microsoft Office software data files. Can use .NET assembly code (but this code in a Python script is only recognized by IronPython). Integration can occur within a running .NET application (essentially extending the functionality of the .NET application). Version 2.6 requires .NET 2.0. Version 2.6.1 requires .NET 4.0.
Jython (www.jython.org)	Java, jython (*C:\jython2.5.1*)	Useful for integrating with Java applications, such as TSTool. Can use Java code (but this code in a Python script is only recognized by Jython).
Jython embedded (www.jython.org)	Java (*C:\jython2.5.1*, but must use the installer option to create a JAR file in order to embed – this is the file that is distributed with TSTool).	Useful for integrating with Java applications, such as TSTool. Can use Java code (but this code in a Python script is only recognized by Jython). Integration can occur within a running Java application (essentially extending the functionality of the Java application).
Python (www.python.org)	C, python (*C:\Python25*)	The original Python interpreter, which defines the Python language specification.

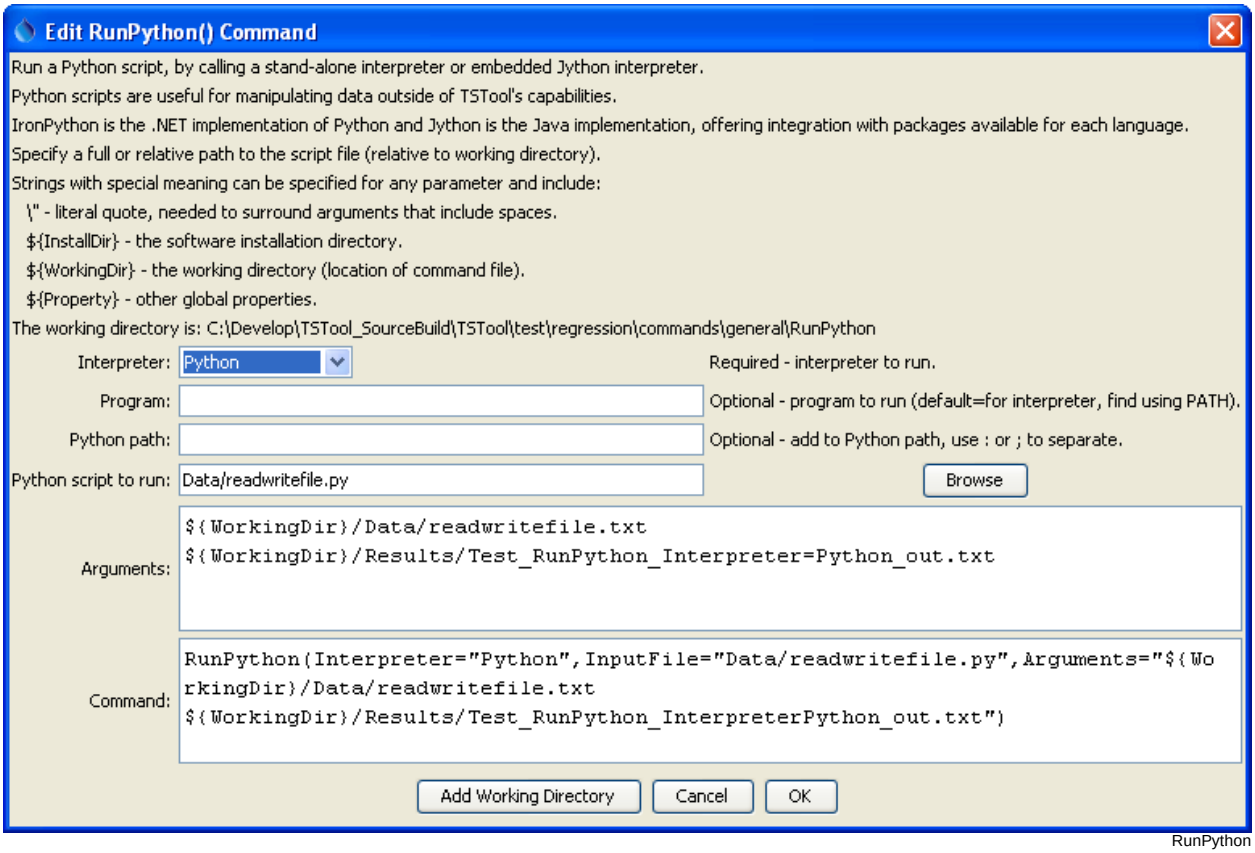
Python implementations have similar file organization, with the main executable (or batch file) residing in the main install folder. Core functionality is typically completely handled within the interpreter code and/or Python code included in the *Lib* folder under the main installation folder. Extended capabilities such as third-party add-ons are made available as module libraries that are installed in the *Lib\site-packages* folder. These folders are typically automatically included in the Python path and will be found when import statements are used in Python scripts. The folder for the main Python script that is run to start an execution is also typically included in the Python path by the interpreter at runtime. If any additional Python modules needed to be found, they can be added to the Python path at runtime (see the `PythonPath` command parameter below).

If the embedded Jython is used, then there may be no reliance on any other software if the core Python capabilities can be used. However, if third-party packages are used, it may be best to install them with the Jython distribution (e.g., in *Lib\site-packages*) so that the packages can be used for independent testing prior to use in the embedded interpreter. For example, perform a typical Jython install (e.g., into *C:\Jython2.5.1*), install the third-party packages into this location (using the installer for the package or directly copying into the *Lib\site-packages folder*), and then specify the `PythonPath=C:\Jython2.5.1\Lib\site-packages`) command parameter.

If a non-embedded approach is used, then IronPython, Jython, or Python must be installed on the computer for the appropriate `Interpreter` command parameter value. The interpreter program will be found if the installation folder is defined in the `PATH` environment variable, or use the `Program` command parameter to specify the full path to the interpreter program to run. The script is then run by running the following (see full parameter descriptions below):

```
Program InputFile Arguments
```

The following dialog is used to edit the command and illustrates the command syntax.



RunPython

RunPython() Command Editor

The command syntax is as follows:

```
RunPython(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`Interpreter`	The Python interpreter to run, one of: • `IronPython` • `Jython` • `JythonEmbedded` • `Python` Global properties can be used with the `${Property}` syntax.	None – must be specified.
`Program`	The Python interpreter program to run. Specify as a full path to the installed program, or only the program name (in which case the path to the program must be included in the `PATH` environment variable). Global properties can be used with the `${Property}` syntax.	Determined based on the `Interpreter` parameter: • IronPython: ipy • Jython: jython • Python: python
`PythonPath`	Additional locations for modules, to be added to the Python path. Specify paths separated by `;` or `:`. For embedded Jython, the `sys.path` is updated prior to running the script. For non-embedded interpreters, the `JYTHONPATH` environment variable is updated for the interpreter, which results in `sys.path` being updated. Global properties can be used with the `${Property}` syntax.	None – the core Python capabilities are available.
`InputFile`	The Python script to run, specified as an absolute path or relative to the command file. See the `Arguments` parameter for information about using properties to specify the location. Global properties can be used with the `${Property}` syntax.	None – must be specified.
`Arguments`	Arguments to pass to the script, such as the names of files to process. Use the `${WorkingDir}` property to specify the location of the command file. Use `${InstallDir}` for the TSTool install folder. Use `\"` to surround arguments that include spaces. Separate arguments by a space. Global properties can be used with the `${Property}` syntax.	None – arguments are optional.

The following command example illustrates how to run a Python script.

```
RunPython(InputFile="Data/readwritefile.py",
Interpreter="JythonEmbedded",Arguments="${WorkingDir}/Data/readwritefile.txt
${WorkingDir}/Results/Test_RunPython_Interpreter=JythonEmbedded_out.txt")
```

The corresponding Python script is as follows:

```
#
# Test command for running Python script from TSTool
#
import sys
import os
print "start of script"
print 'os.getcwd()="' + os.getcwd() + '"'
infile = None
outfile = None
if ( len(sys.argv) < 3 ):
    print "Error.  Expecting input file name as first command line argument,
output file name as second."
    sys.exit(1)
else:
    infile = sys.argv[1]
    outfile = sys.argv[2]
    print 'Input file to process is "' + infile + '"'
    print 'Output file to create is "' + outfile + '"'

inf=open(infile,'r')
outf=open(outfile,'w')
for line in inf:
    outf.write("out: " + line)
inf.close()
outf.close()
print "end of script"
```

The data file is as follows:

```
Line 1 (first line)
Line 2
Line 3
Line 4
Line 5 (last line)
```

The output file is as follows:

```
out: Line 1 (first line)
out: Line 2
out: Line 3
out: Line 4
out: Line 5 (last line)
```

The following example illustrates the use of double quotes to surround Python script command-line arguments, to ensure that spaces and equal sign characters are properly handled:

```
# Retrieve the MEI (ENSO) index
WebGet(URI="http://www.esrl.noaa.gov/psd/data/correlation/mei.data",LocalFile="mei.data")
# Convert the MEI data file to a CSV file that can be read by TSTool
RunPython(Interpreter="Python",InputFile="mei2csv.py",Arguments="\"InputFile=${WorkingDir}/mei.data\"
 \"OutputFile=${WorkingDir}/mei.csv\" \"LogFile=${WorkingDir}/mei2csv.log\"")
```

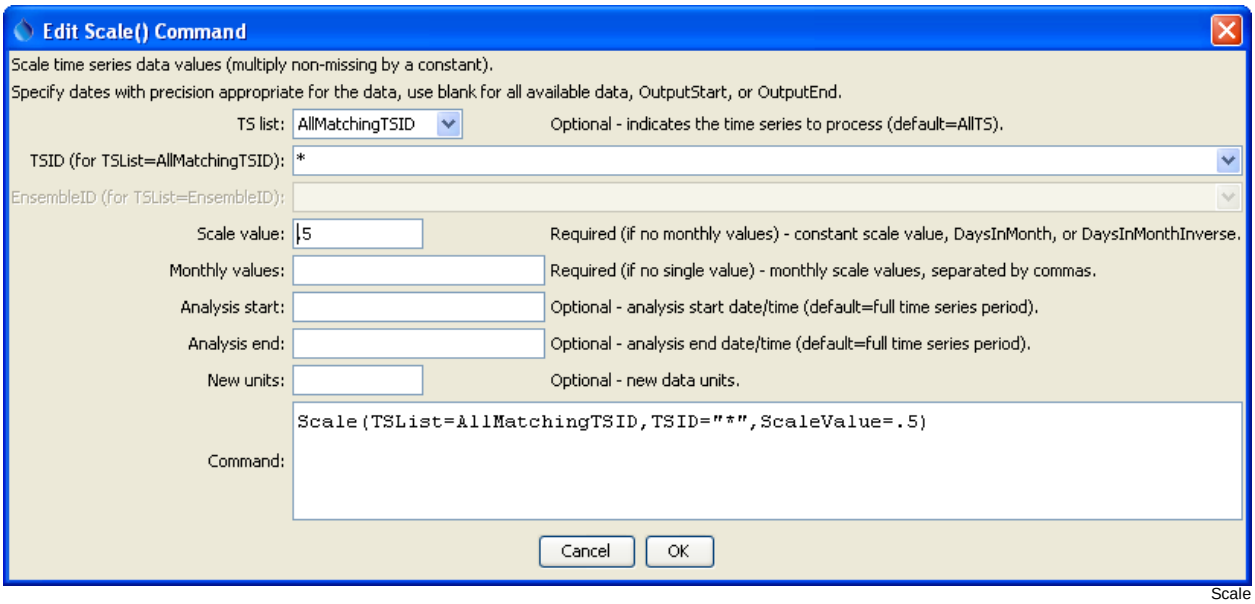
Command Reference: Scale()

Scale time series data values by a constant value

Version 10.12.00, 2012-08-13

The `Scale()` command scales each non-missing value in the specified time series. The value to use for scaling can be specified as a constant, monthly values, or special values that indicate to scale by the number of days in the month.

The following dialog is used to edit the command and illustrates the command syntax.



Scale

Scale() Command Editor

The command syntax is as follows:

```
Scale(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be modified. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be	`AllTS`

Parameter	Description	Default
	modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required if `TSList=EnsembleID`
`ScaleValue`	One of the following: • The numerical value to scale to the time series. • `DaysInMonth` to indicate a scale of the number of days in the month. • `DaysInMonthInverse` to indicate a scale of the inverse of the number of days in the month.	None – must be specified.
`MonthValues`	Monthly scale values, the fist being for January.	Use `ScaleValue`.
`AnalysisStart`	The date/time to start analyzing data.	Full period is analyzed.
`AnalysisEnd`	The date/time to end analyzing data.	Full period is analyzed.
`NewUnits`	New data units for the resulting time series.	Do not change the units.

The following example scales a precipitation time series from the State of Colorado's HydroBase by a factor of 3.5:

```
# 1458 - CENTER 4 SSW
1458.NOAA.Precip.Month~HydroBase
Scale(TSList=AllMatchingTSID,TSID="1458.NOAA.Precip.Month",ScaleValue=3.5)
```

The following example scales a monthly streamflow time series with units of ACFT (volume per month) in order to convert the data to average CFS flow values (note that two scale commands are required because the `DaysInMonthInverse` value cannot currently be combined with a numerical value in one command). See also the `ConvertDataUnits()` command for simple units conversions.

```
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
Scale(TSList=AllMatchingTSID,TSID="06754000.DWR.Streamflow.Month",
  ScaleValue=.5042)
Scale(TSList=AllMatchingTSID,TSID="06754000.DWR.Streamflow.Month",
  ScaleValue=DaysInMonthInverse,NewUnits="CFS")
06754000.DWR.Streamflow.Month~HydroBase
```

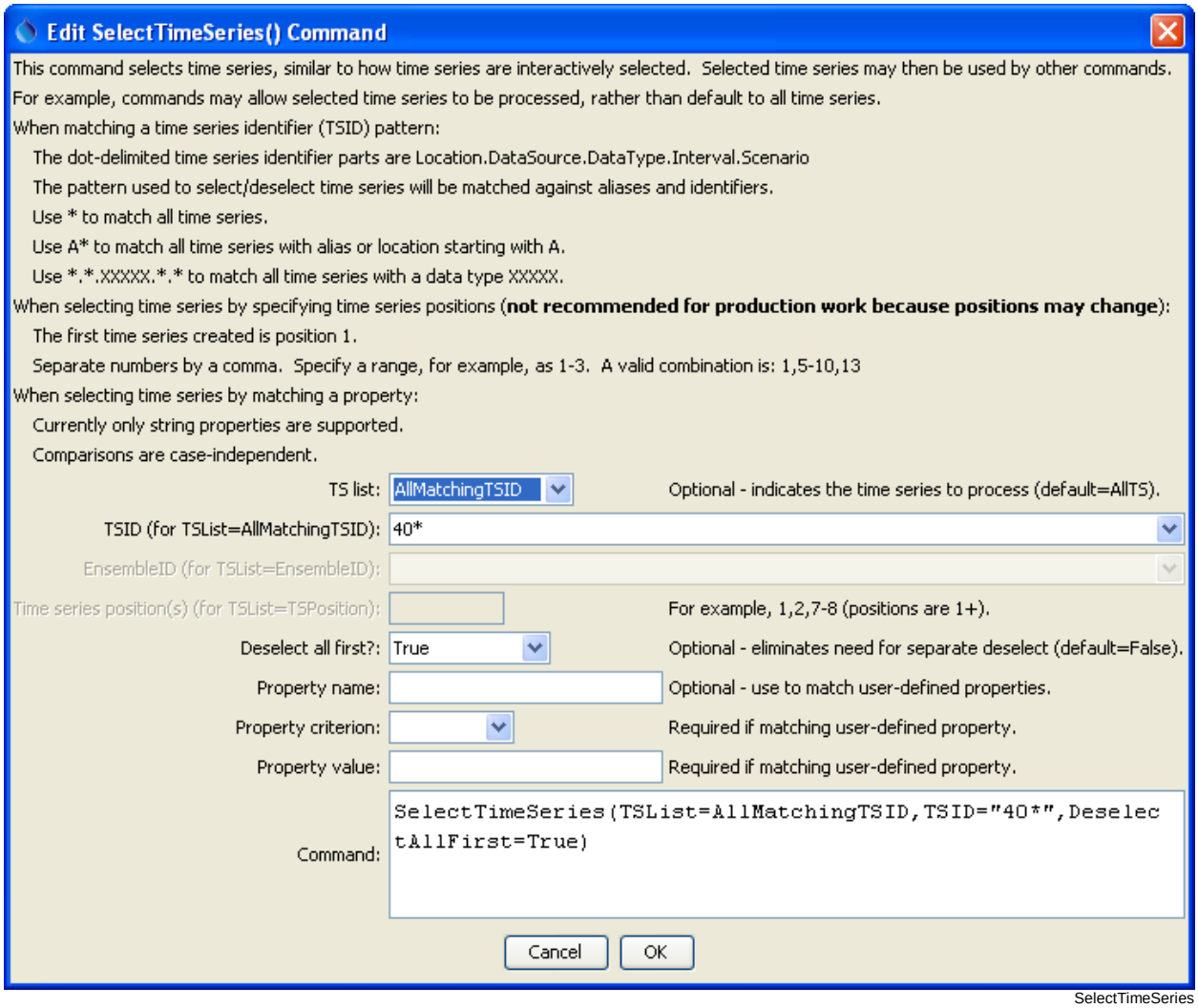
Command Reference: SelectTimeSeries()

Select time series for additional processing

Version 10.12.00, 2012-10-25

The `SelectTimeSeries()` command selects output time series, as if done interactively, to indicate which time series should be operated on by following commands. The command minimizes the need for the `Free()` command, when used in conjunction with other commands that use a time series list based on selected time series (`TSList=SelectedTS`). See also the `DeselectTimeSeries()` command.

The following dialog is used to edit the command and illustrates the command syntax.



SelectTimeSeries

SelectTimeSeries() Command Editor

The command syntax is as follows:

```
SelectTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified (see the EnsembleID parameter). • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • TSPosition – time series specified by position in the results list (see TSPosition parameter below).	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID
TSPosition	A list of time series positions (1+) in output, separated by commas. Ranges can be specified as Start-End.	Required if TSList=TSPosition
DeselectAllFirst	Indicates whether all time series should be deselected before selecting the specified time series: True or False.	False
PropertyName	Name of user-defined property to check.	
PropertyCriterion	Criterion to evaluate to determine which properties match.	Required if PropertyName is specified.
PropertyValue	Value to check against the property value, using criterion.	Required if PropertyName is specified.

A sample command file is as follows:

```
NewPatternTimeSeries(Alias="401234",NewTSID="401234..Precip.Day",
Description="Example data",SetStart="2000-01-01",SetEnd="2000-12-31",
    Units="IN",PatternValues="0,1,3,0,0,0")
SelectTimeSeries(TSList=AllMatchingTSID,TSID="40*",DeselectAllFirst=True)
```

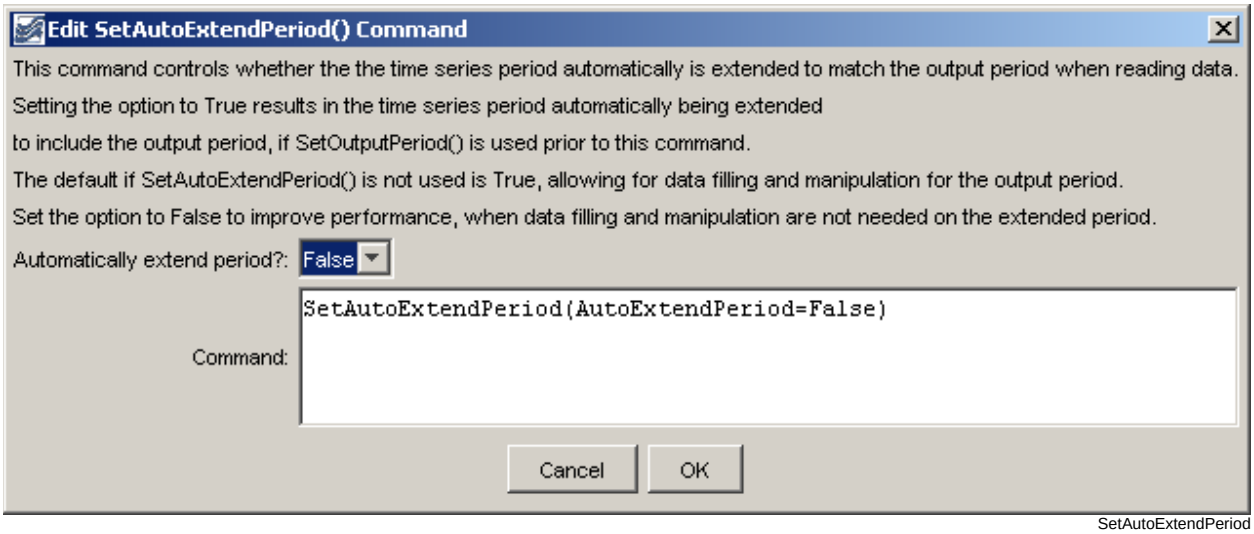
Command Reference: SetAutoExtendPeriod()

Set whether time series periods should automatically be extended to the output period

Version 08.16.03, 2008-07-29

By default, the time series period is extended to include the output period, if specified, when a time series is read. See also the `SetOutputPeriod()` command. If the extended period subsequently contains missing data, it can be filled with other commands. The `SetAutoExtendPeriod()` command can be used to change this setting if it is not desirable (e.g., for performance reasons).

The following dialog is used to edit the command and illustrates the command syntax.



SetAutoExtendPeriod

SetAutoExtendPeriod() Command Editor

The command syntax is as follows:

```
SetAutoExtendPeriod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`AutoExtendPeriod`	Indicate whether the period of time series should automatically be extended to the output period when time series are read, `True` or `False`.	None – must be specified. The default is `True` if this command is not used.

A sample command file is as follows:

```
SetAutoExtendPeriod(AutoExtendPeriod=False)
```

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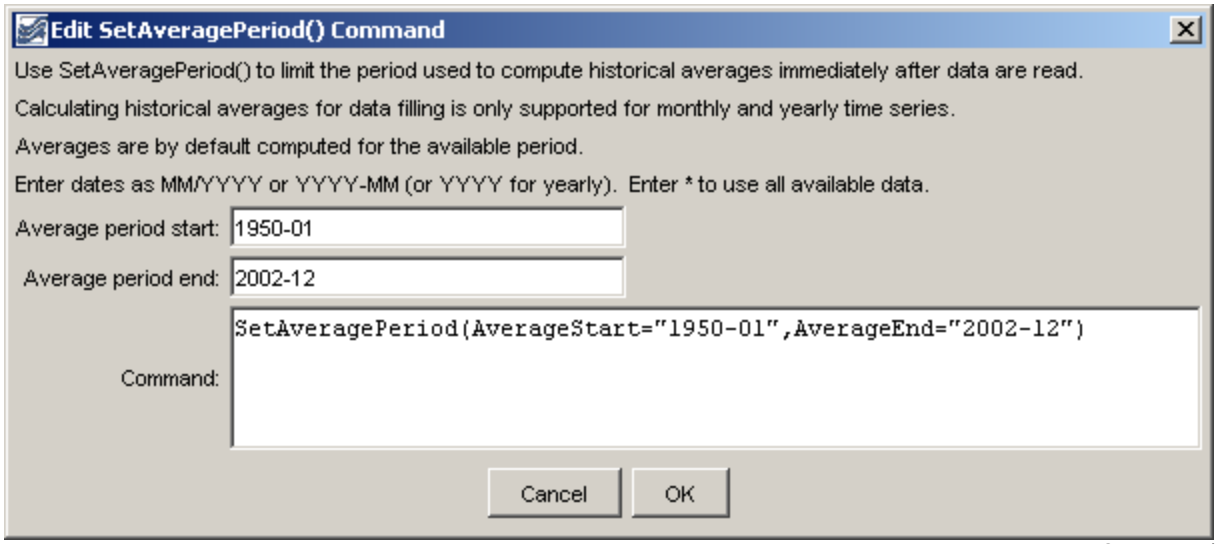
Command Reference: SetAveragePeriod()

Set the period used to compute historical averages

Version 08.16.03, 2008-07-29

The `SetAveragePeriod()` command sets the period that is used to compute historic averages used with the `FillHistMonthAverage()` and `FillHistYearAverage()` commands. If the averaging period is not specified, the available period is used. Use a `SetAveragePeriod()` command if a subset of the data should be used to compute averages.

The following dialog is used to edit this command and illustrates the command syntax.



SetAveragePeriod

SetAveragePeriod() Command Editor

The command syntax is as follows:

```
SetAveragePeriod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
AverageStart	The date for the start of the averaging period. The precision of the date should agree with that of time series to be processed, and is limited to monthly and yearly precision.	None – must be specified.
AverageEnd	The date for the end of the averaging period. The precision of the date should agree with that of time series to be processed, and is limited to monthly and yearly precision.	None – must be specified.

A sample command file is as follows:

```
SetAveragePeriod(1950-01,2002-12)
```

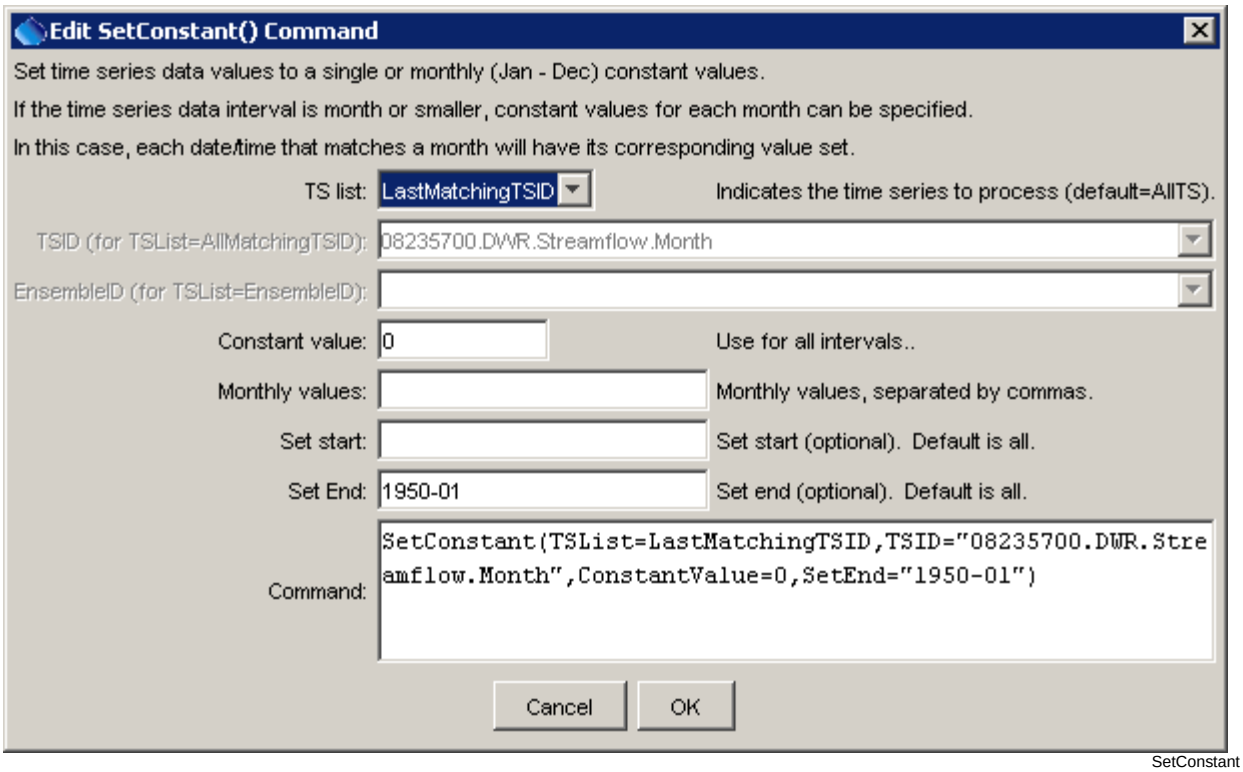
Command Reference: SetConstant()

Set time series data to a single or monthly constant values

Version 08.15.00, 2008-05-11

The `SetConstant()` command sets the values of a time series to a single or monthly constant values.

The following dialog is used to edit the command and illustrates the command syntax:



SetConstant

SetConstant() Command Editor

The command syntax is as follows:

```
SetConstant(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID.
ConstantValue	The constant value to use as the data value.	None – must be specified, or specify monthly values.
MonthValues	Monthly values to use as the data values. Twelve values can be specified, separated by commas. If the time series data interval is less than monthly, each date/time will be set for a specific month.	None – must be specified, or specify a constant value.
SetStart	The starting date/time for the data set.	Set data for the full period.
SetEnd	The ending date/time for the data set.	Set data for the full period.

A sample command file to process a time series from the State of Colorado's HydroBase is as follows (only the early period is set to zero):

```
# 08235700 - ALAMOSA RIVER BELOW CASTLEMAN GULCH NEAR JASPER
08235700.DWR.Streamflow.Month~HydroBase
SetConstant(TSList=AllMatchingTSID,TSID="08235700.DWR.Streamflow.Month",
  ConstantValue=0,SetEnd="1950-01")
```

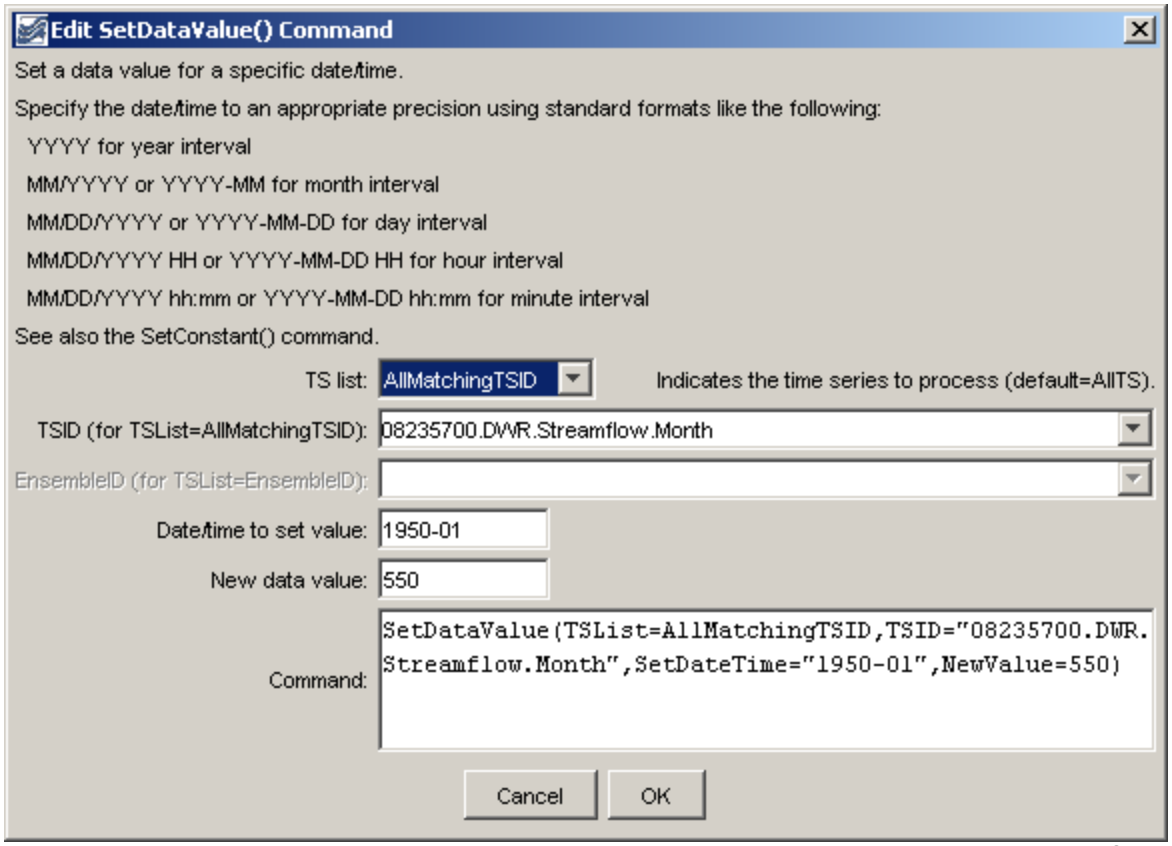
Command Reference: SetDataValue()

Set a data value at a single date/time

Version 08.16.04, 2008-09-12

The `SetDataValue()` command sets a single data value in a time series. Consequently, it can be used to condition a value for subsequent filling (e.g., with `FillRepeat()`) or to "hard-code" data that may not be available in files or databases. **It is good practice to insert comments when editing data to explain the edits.** See also the `SetConstant()` command.

The following dialog is used to edit the command and illustrates the syntax of the command.



SetDataValue

SetDataValue() Command Editor

The command syntax is as follows:

```
SetDataValue(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required if TSList=EnsembleID.
SetDateTime	The date/time at which the data value should be set. Specify the date/time precision according to the time series that is being manipulated.	None – must be specified.
NewValue	The new data value.	None – must be specified.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 08235700 - ALAMOSA RIVER BELOW CASTLEMAN GULCH NEAR JASPER
08235700.DWR.Streamflow.Month~HydroBase
SetDataValue(TSList=AllMatchingTSID,TSID="08235700.DWR.Streamflow.Month",
  SetDateTime="1950-01",NewValue=550)
```

Command Reference: SetDebugLevel()

Set level for debug messages

Version 08.16.00, 2008-07-08

The `setDebugLevel()` command sets the debug levels for screen and log file diagnostic messages. This command can be used multiple times with different debug level (e.g., to isolate a problem). Currently the debug level applies to all components. In the future logging control may be grouped by component. Levels are not completely consistent but the following guidelines can be followed:

0 = no messages
1 = important messages generated in applications
2 = important messages generated in commands
3+ = messages generated in commands that may explain other problems
10+ = messages in processing code that may still be useful to end users
30+ = low-level messages, for example generated while reading from files or databases

The following dialog is used to edit this command and illustrates the command syntax.

SetDebugLevel

SetDebugLevel() Command Editor

The command syntax is as follows:

```
SetDebugLevel(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`ScreenLevel`	The debug level for the screen (0+).	Keep previous setting.
`LogFileLevel`	The debug level for the log file (0+).	Keep previous setting.

A sample command file is as follows:

```
SetDebugLevel(ScreenLevel=0,LogFileLevel=10)
```

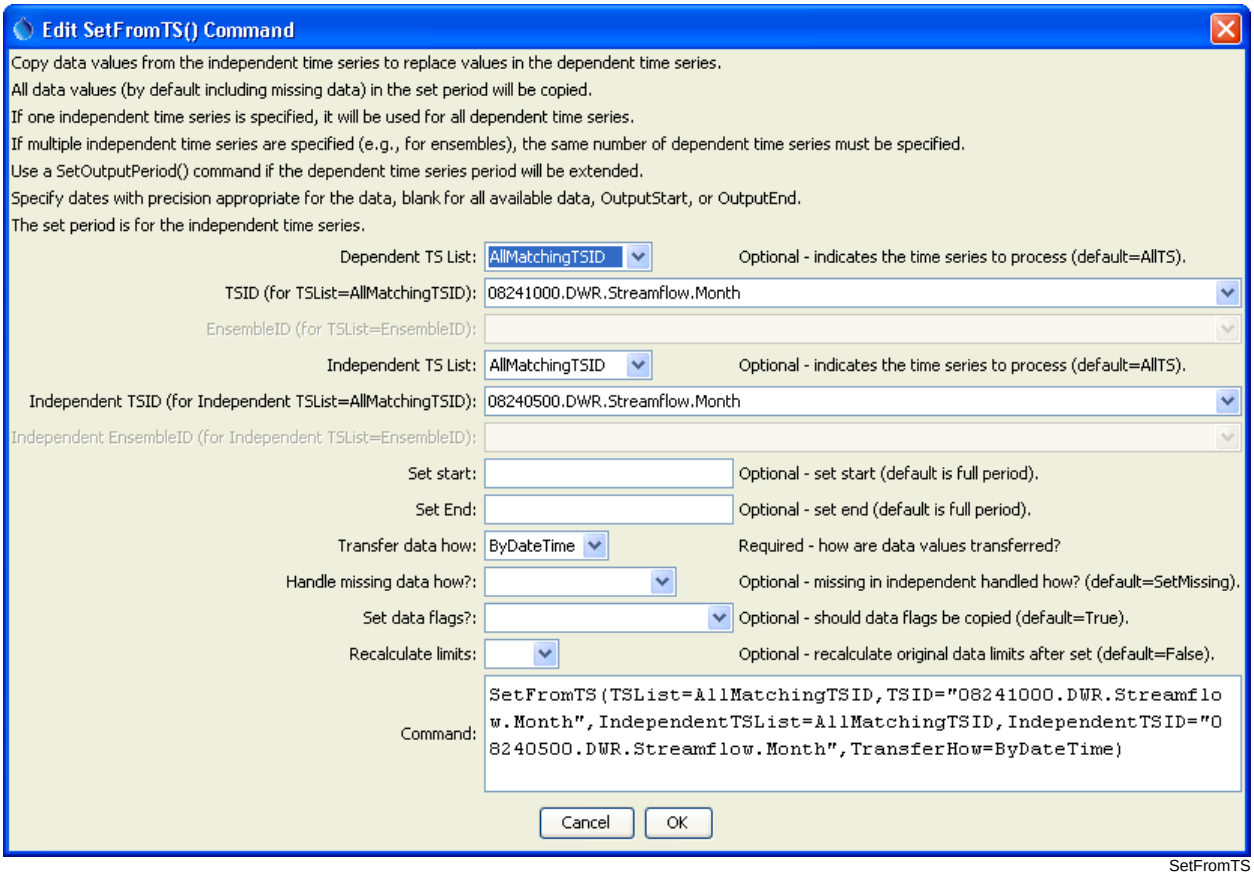
Command Reference: SetFromTS()

Set time series data using another time series

Version 10.00.01, 2011-05-11

The `SetFromTS()` command sets data in a dependent time series by transferring values from an independent time series. A period can be specified to limit the period that is processed. See also the `FillFromTS()` command, which will transfer values only when the dependent time series has missing data. Only data values are transferred – time series header information (e.g., data type, alias) will not be modified. If multiple time series or an ensemble is being processed, the number of independent time series must be one or the same number as the time series being filled.

The following dialog is used to edit the command and illustrates the command syntax.



SetFromTS

SetFromTS() Command Editor

The command syntax is as follows:

```
SetFromTS(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required when TSList=*TSID
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required when TSList=EnsembleID.
Independent TSList	Indicates how to determine the list of independent time series (see the explanation of TSList).	AllTS
Independent TSID	The time series identifier or alias for the independent time series (see the explanation of TSID).	Required when a IndependentTSList=*TSID
Independent EnsembleID	The ensemble identifier for the independent time series (see the explanation of EnsembleID).	Required when IndepndentTSList=EnsembleID.
SetStart	The date/time to start setting data, if other than the full time series period.	Full period if * is specified.
SetEnd	The date/time to end setting data, if other than the full time series period.	Full period if * is specified.
TransferHow	Indicates how to transfer data: • ByDateTime – a date/time in one time series will be lined up with the other time series. • Sequentially – data from the independent will be transferred sequentially, even if the date/time does not align (used when transferring continuous data over Feb 28/29, without gaps).	None – must be specified.

Parameter	Description	Default
HandleMissingHow	Indicates how to handle missing data in the independent time series: • IgnoreMissing – missing values in the independent time series WILL NOT be transferred to the dependent time series. • SetMissing – missing values in the independent time series WILL be transferred to the dependent time series. • SetOnlyMissingValues – only the missing values in the independent time series will be transferred, useful when a separate time series has been used to insert additional missing values.	SetMissing
SetDataFlags	Indicates if data flags should also be transferred.	True
RecalcLimits	Available only for monthly time series. Indicate whether the original data limits for the time series should be recalculated after the setting the time series values. Setting to True is appropriate if the independent time series provides observations consistent with the original data.	False (only the values in the initial time series will be used for historical data).

A sample command file to process data from the State of Colorado's HydroBase is as follows:

```
# 08241000 - TRINCHERA CREEK ABOVE MOUNTAIN HOME RESERVOIR
08241000.DWR.Streamflow.Month~HydroBase
# 08240500 - TRINCHERA CREEK ABOVE TURNER'S RANCH
08240500.DWR.Streamflow.Month~HydroBase
SetFromTS(TSList=AllMatchingTSID,TSID="08241000.DWR.Streamflow.Month",
  IndependentTSList=AllMatchingTSID,
  IndependentTSID="08240500.DWR.Streamflow.Month",
  TransferHow=ByDateTime)
```

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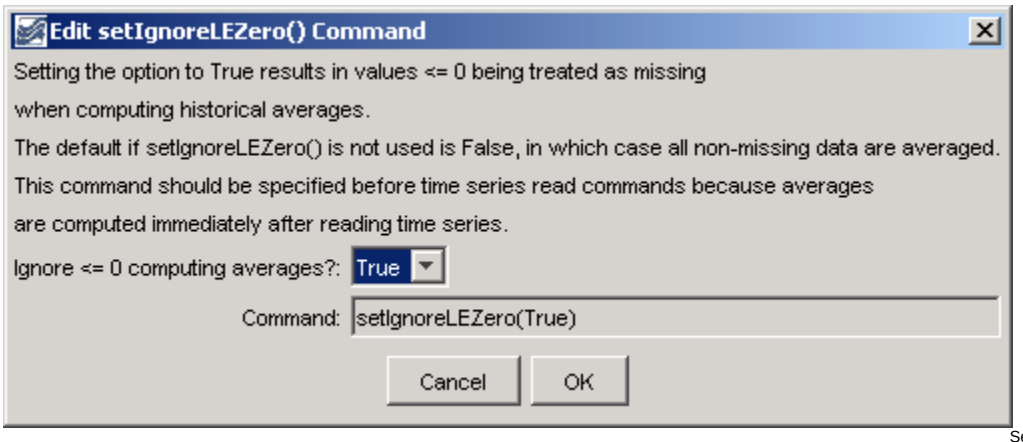
Command Reference: SetIgnoreLEZero()

Indicate whether time series data values <= zero should be ignored in historical averages

Version 08.16.00, 2008-07-09

The `SetIgnoreLEZero()` command sets the global property that indicates whether the computation of historical averages for time series should ignore values less than or equal to zero. By default, all values (other than the missing data placeholder) are used to compute averages. This command is useful when it is appropriate to ignore zero and negative values in averages, for example in cases where zero is assigned as an observation but may influence averages inappropriately. Commands that are concerned with this issue also typically provide a parameter and therefore using this global command may not be appropriate.

The following dialog is used to edit this command and illustrates the syntax of the command.



SetIgnoreLEZero

SetIgnoreLEZero() Command Editor

The command syntax is as follows:

```
SetIgnoreLEZero(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`IgnoreLEZero`	Indicates whether the computation of historical averages should ignore values less than or equal to zero, `True` or `False`.	If this command is not used, the default is `False`.

A sample command file is as follows:

```
SetIgnoreLEZero(IgnoreLEZero=True)
```

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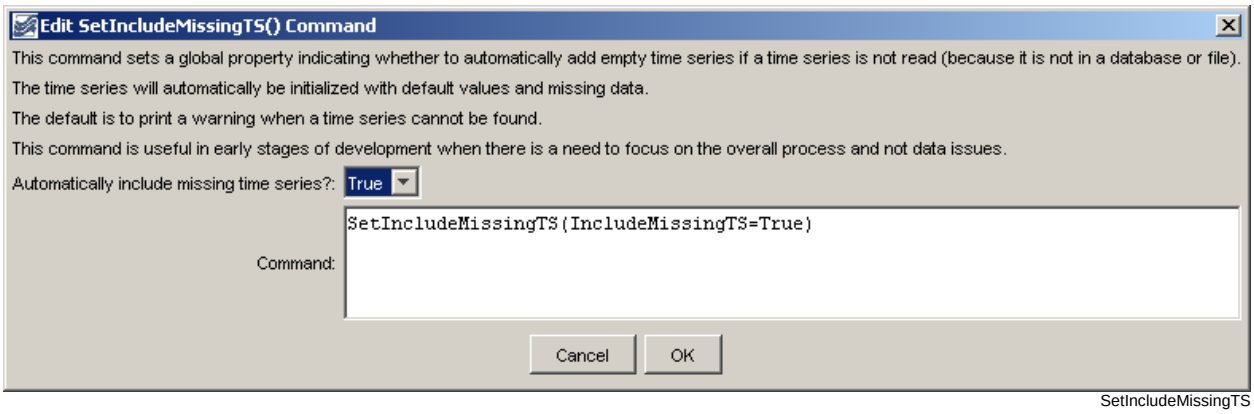
Command Reference: SetIncludeMissingTS()

Indicate whether missing time series should automatically be added as blank time series

Version 08.16.00, 2008-07-16

The `SetIncludeMissingTS()` command sets the global property that indicates whether time series that cannot be found should automatically be added as a time series with missing data. By default, time series that cannot be found generate a warning. This command is useful when processing large amounts of data, to guarantee a placeholder time series even if time series are not found. For example, use the command in the early stages of work to evaluate command sequence logic without addressing every data issue, and then remove the command when focusing on data.

The following dialog is used to edit this command and illustrates the syntax of the command.



SetIncludeMissingTS

SetIncludeMissingTS() Command Editor

The command syntax is as follows:

```
SetIncludeMissingTS(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`IncludeMissingTS`	Indicates whether time series that are not found with read commands should automatically be added with missing data.	If this command is not used, the default is `False`.

A sample command file is as follows:

```
SetIncludeMissingTS(IncludeMissingTS=True)
```

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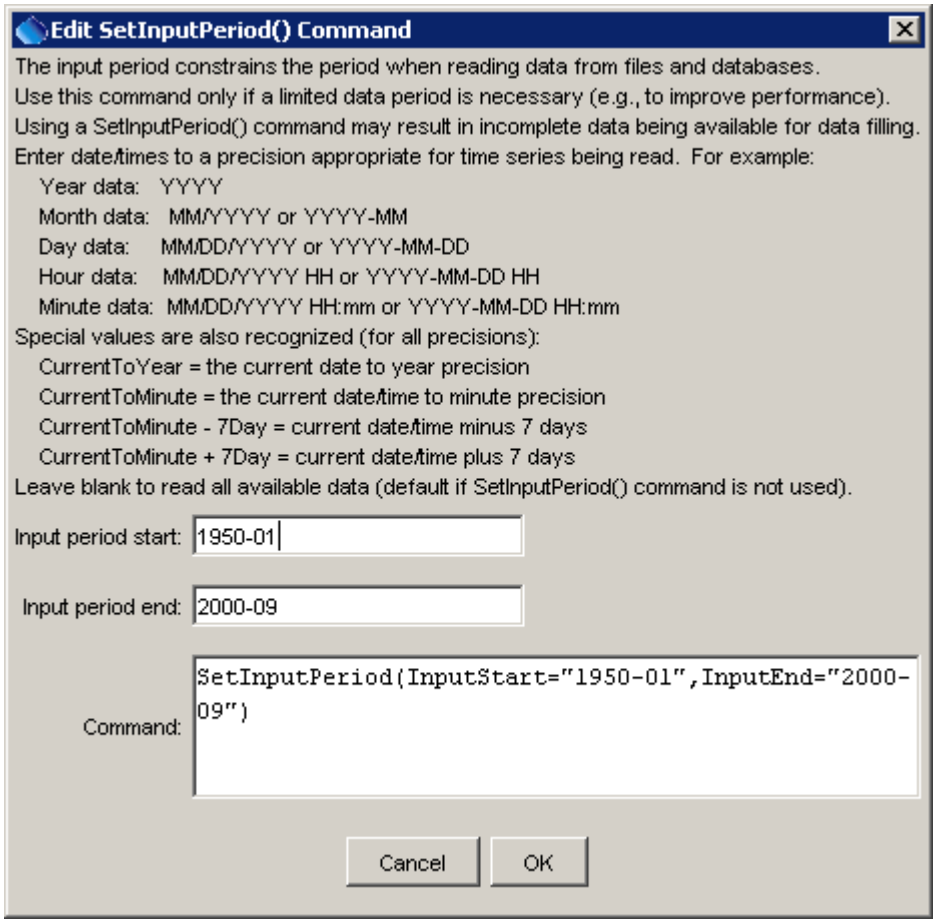
Command Reference: SetInputPeriod()

Set the period for reading time series from files and querying from databases

Version 08.15.00, 2008-05-11

The `SetInputPeriod()` command sets the period used for reading time series data from files and querying data from databases. The default is to read/query all available data so that all data are available for analysis and data filling. However, a shorter period may be desirable to increase performance (e.g., when processing real-time data) or to force matching a historical period. This command replaces the `SetQueryPeriod()` command. See also the `SetOutputPeriod()` command.

The following dialog is used to edit the command and illustrates the command syntax.



SetInputPeriod

SetInputPeriod() Command Editor

The command syntax is as follows:

```
SetInputPeriod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`InputStart`	The date/time to start reading/querying time series data, one of: • A date/time string (see dialog above for examples). • `CurrentToYear`, `CurrentToMonth`, `CurrentToDay`, `CurrentToHour`, `CurrentToMinute`, indicating the current date/time to the specified precision. • A `Current*` value +- an interval, for example: `CurrentToMinute –7Day`	None – must be specified.
`InputEnd`	The date/time to end reading/querying time series data, one of: • A date/time string (see dialog above for examples). • `CurrentToYear`, `CurrentToMonth`, `CurrentToDay`, `CurrentToHour`, `CurrentToMinute`, indicating the current date/time to the specified precision. • A `Current*` value +- an interval, for example: `CurrentToMinute –7Day` • An expression involving `InputStart`, used similar to the `Current*` values.	None – must be specified.

A sample commands file for historical data from the State of Colorado's HydroBase is as follows:

```
SetInputPeriod(InputStart="1950-01",InputEnd="2000-09")
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
```

A sample commands file for real-time data is as follows:

```
SetInputPeriod(InputStart="CurrentToMinute - 14Day",
  InputEnd="CurrentToMinute + 1Hour")
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow-DISCHRG.Irregular~HydroBase
```

Command Reference: SetOutputPeriod()

Set the output period for time series

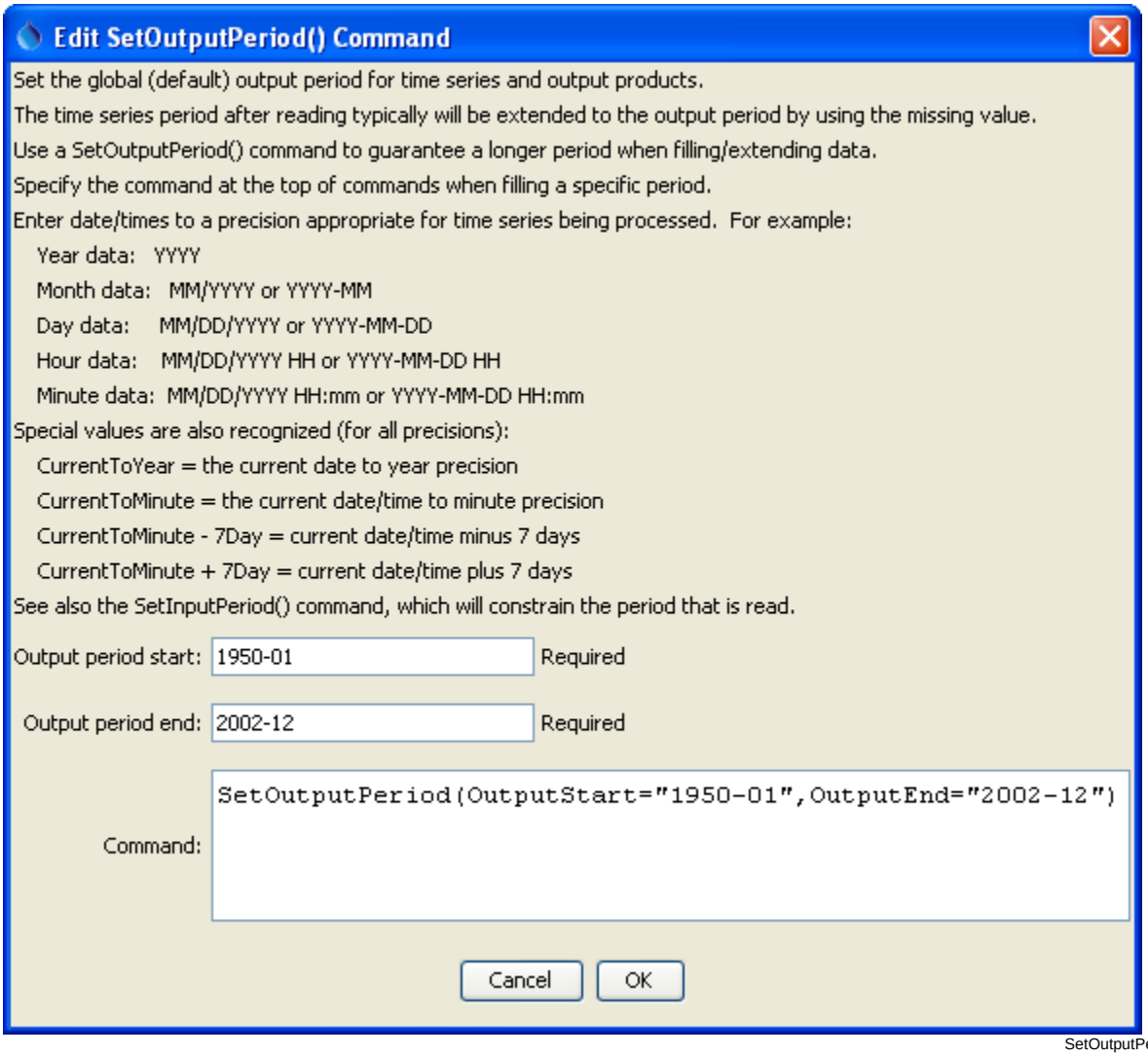
Version 09.08.01, 2010-09-14

The `SetOutputPeriod()` command sets the output period for time series. See also the `SetInputPeriod()` command. The period for a time series when read or created will be set to the maximum of the following periods, in order to satisfy output and data filling requirements:

- available data,
- output period (if specified),
- input period (if specified).

Specifying the output period is necessary when creating model files or filling an extended period (time series will not automatically be extended by fill commands).

The following dialog is used to edit this command and illustrates the syntax of the command. Note that the output period should always use calendar month and year, even if other than calendar year are used for output (see `SetOutputYearType()`).



SetOutputPeriod

SetOutputPeriod() Command Editor

The command syntax is as follows:

```
SetOutputPeriod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputStart`	The date/time to start output.	None – must be specified.
`OutputEnd`	The date/time to end output.	None – must be specified.

A sample commands file is as follows:

```
SetOutputPeriod(OutputStart="1950-01",OutputEnd="2002-12")
```

Command Reference: SetOutputYearType()

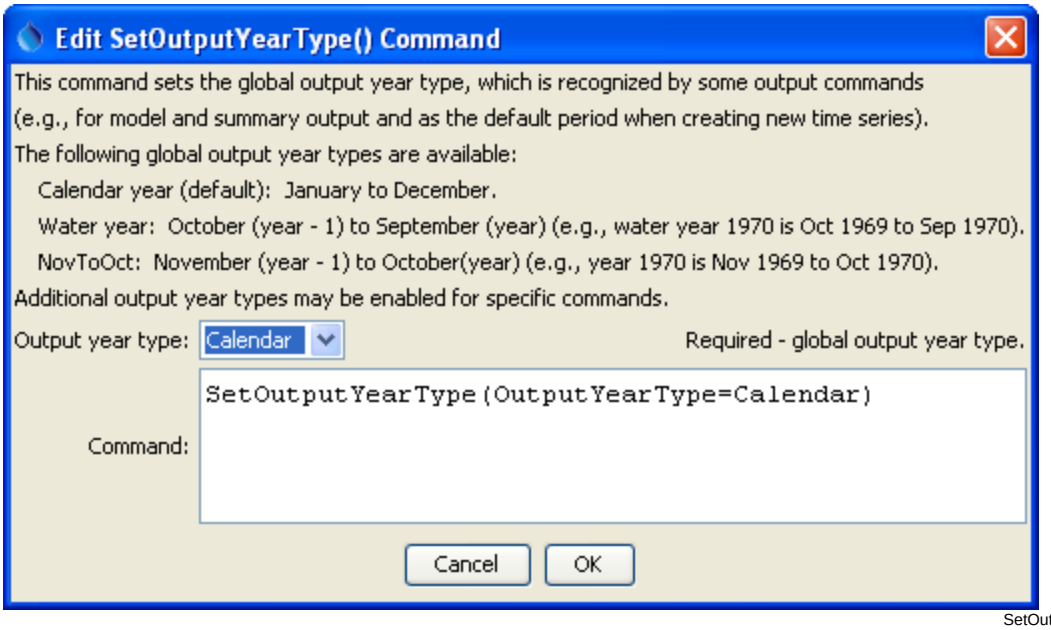
Set the output year type for time series

Version 10.00.01, 2011-04-18

The `SetOutputYearType()` command sets the global output year type for output reports and files. The default for most operations is calendar year (January through December); however, alternate year definitions may be useful. The global output year type is recognized by some common tools and commands that create output. Many write commands also allow the year type to be specified for the command. Internally, all data are managed using calendar years and are converted to different year types during output or display. The `ChangeInterval()` command also allows time series to be converted to annual values where the value corresponds to a year type.

The year type for output and analysis theoretically can be defined in many ways. Internally, TSTool allows the start and end year to have offsets from the calendar year. This allows the output year type to have a starting year previous to the calendar year or the same as the calendar year. A convention that is being implemented over time is to prepend `Year` to the year types where the start of the output year agrees with the calendar year number, and append `Year` to the year types where the end of the output year agrees with the calendar year number. For example, `YearMayToApr` would indicate that the output year is May of the calendar year to Apr of the next calendar year.

The following dialog is used to edit the command and illustrates the command syntax.



SetOutputYearType

SetOutputYearType() Command Editor

The command syntax is as follows:

```
SetOutputYearType(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputYearType`	The output year type, one of: • `Calendar` – January through December. • `NovToOct` – November of the previous calendar year to October of the current calendar year. For example, year 1970 spans Nov 1969 to Oct 1970. • `Water` – October of the previous calendar year through September of the current calendar year (and water year). For example, water year 1970 spans Oct 1969 to Sep 1970. In the future, more generic types like `NovToOct` may be implemented.	If this command is not specified, `Calendar` is the default.

A sample commands file is as follows:

```
SetOutputYearType(OutputYearType=Calendar)
```

Command Reference: SetPatternFile()

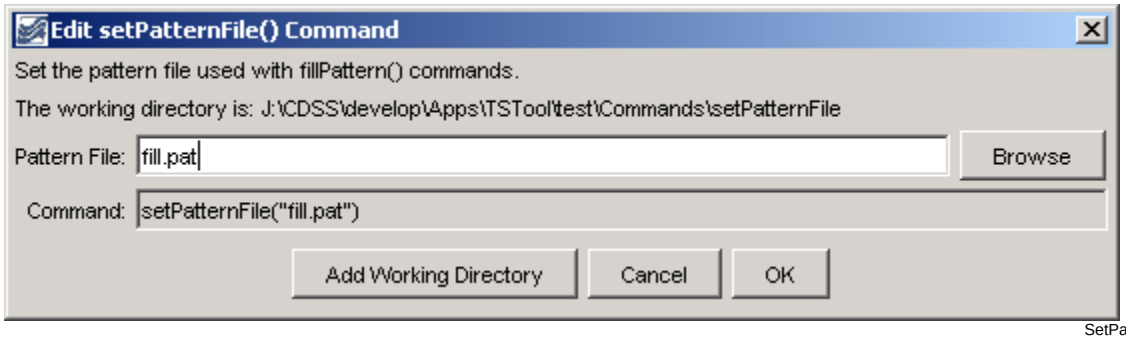
Set the pattern file to be used with FillPattern() commands

Version 08.16.04, 2008-09-19

This command has been replaced with `ReadPatternFile()` – TSTool will automatically convert the command.

The `SetPatternFile()` command specifies a pattern file to be used with `FillPattern()` commands (see the `FillPattern()` command for more information).

The following dialog is used to edit the command and illustrates the command syntax.



SetPatternFile

SetPatternFile() Command Editor

The command syntax is as follows:

```
SetPatternFile(PatternFile)
```

Command Parameters

Parameter	Description	Default
`PatternFile`	The path to the pattern file, which can be absolute or relative to the working directory. The ***Browse*** button can be used to select the pattern file (if a relative path is desired, remove the leading path after the select).	None – must be specified.

A sample commands file is as follows:

```
SetPatternFile("fill.pat")
```

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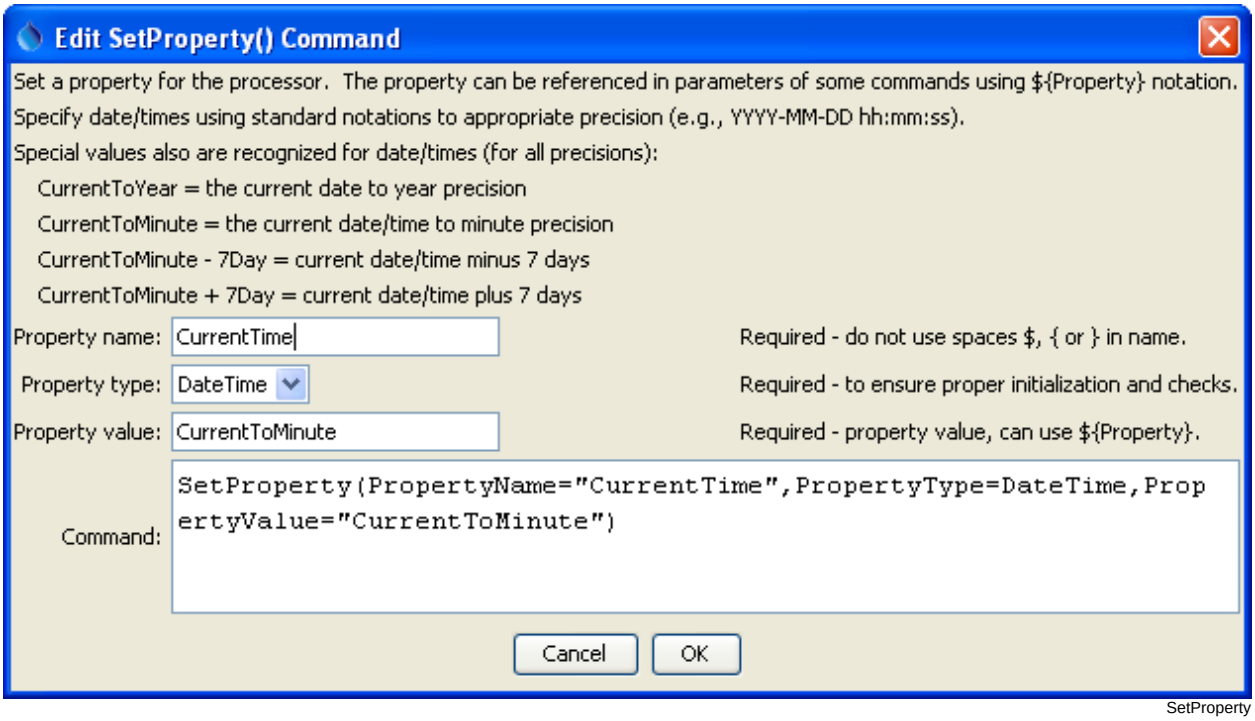
Command Reference: SetProperty()

Set a property for the time series processor

Version 10.01.00, 2011-11-15

The `SetProperty()` command sets the value of a property used by the time series processor. The property will be available to subsequent commands that support using `${Property}` notation in parameters, for example to specify filenames more dynamically. This command should not be confused with the `SetTimeSeriesProperty()` command, which sets a property on specific time series.

The following dialog is used to edit this command and illustrates the syntax of the command.



SetProperty

SetProperty() Command Editor

The command syntax is as follows:

```
SetProperty(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`PropertyName`	The property name.	None – must be specified.
`PropertyType`	The property type, used for validation, one of: • `DateTime` – a date/time. • `Double` – a floating point number • `Integer` – an integer • `String` – a string	None – must be specified.
`PropertyValue`	The value of the property, adhering to property type constraints. Date/time properties should be specified using standard formats such as "YYYY-MM-DD hh:mm:ss", to an appropriate precision. Special date/time syntax is recognized, as shown in the above figure. Global properties can be used with the `${Property}` syntax.	None – must be specified.

A sample commands file is as follows:

```
SetProperty(PropertyName="Scenario",PropertyType=String,PropertyValue="Likely")
```

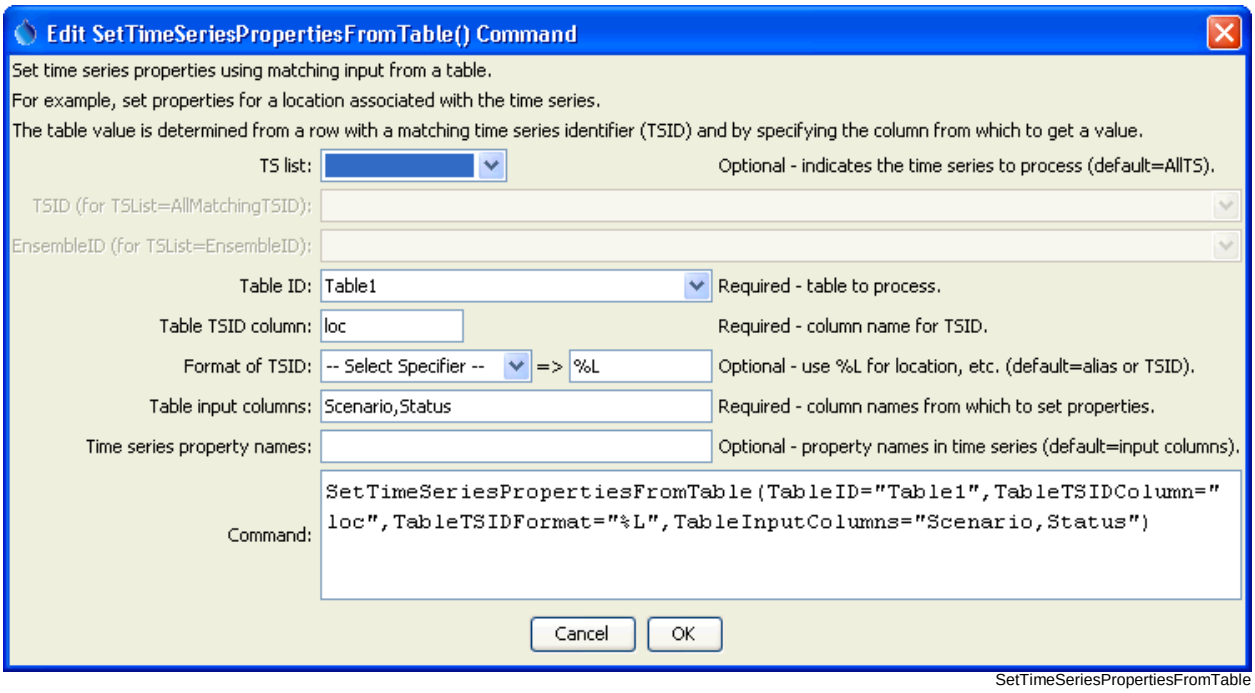
Command Reference: SetTimeSeriesPropertiesFromTable()

Set time series properties using values in a table

Version 10.07.00, 2012-04-18

The `SetTimeSeriesPropertiesFromTable()` command sets user-defined time series properties using values in a table. This is useful, for example, when additional attributes are available for locations associated with time series. The time series can then be selected for processing by matching properties with the `SelectTimeSeries()` command.

The following dialog is used to edit the command and illustrates the command syntax (in this case the location part of the time series identifier is used to match the contents of the "loc" column in the table).



SetTimeSeriesPropertiesFromTable

SetTimeSeriesPropertiesFromTable() Command Editor

The command syntax is as follows:

```
SetTimeSeriesPropertiesFromTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be modified (see the `EnsembleID` parameter). • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required if `TSList=*TSID`
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required if `TSList=EnsembleID`
`TableID`	The identifier for the table that contains properties.	None – must be specified.
`TableTSIDColumn`	Table column name that is used to match the time series identifier for processing.	None – must be specified.
`TableTSIDFormat`	The specification to format the time series identifier to match the TSID column. Use the format choices and other characters to define a unique identifier.	Time series alias if available, or otherwise the time series identifier.
`TableInputColumns`	The name(s) of the column(s) to supply properties for the matching time series. Separate column names with commas.	None – must be specified.
`TSPropertyNames`	The names(s) of the time series properties. Separate names by commas, leave blank to use the corresponding `TableInputColumns` name, or use the special value `TS:Description` to set the time series description.	Same as `TableInputColumns`.

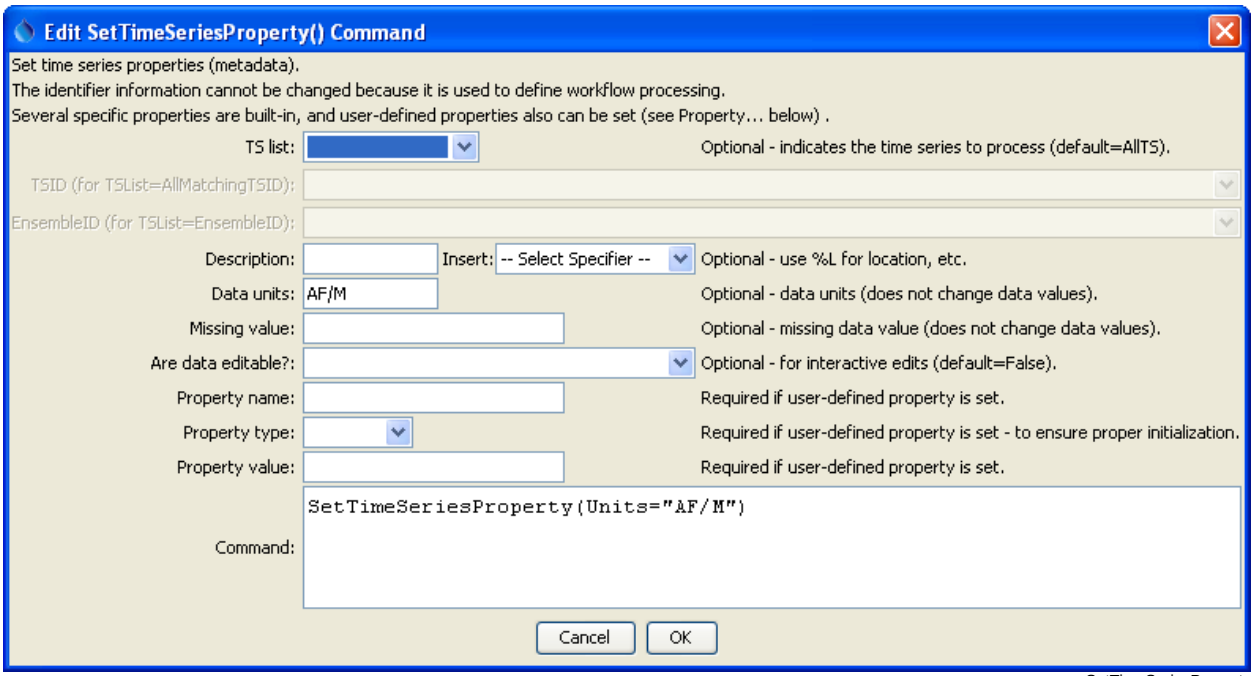
Command Reference: SetTimeSeriesProperty()

Set time series properties

Version 09.09.00, 2010-09-23

The `SetTimeSeriesProperty()` command sets the value of time series properties. Properties that are used to uniquely identify the time series cannot be set because other commands need to utilize this information to reference the time series; therefore, properties that cannot be changed include the location identifier, data source, data type, interval, and scenario. See also the `SetTimeSeriesPropertiesFromTable()` and `SelectTimeSeries()` commands.

The following dialog is used to edit this command and illustrates the syntax of the command.



SetTimeSeriesProperty

SetTimeSeriesProperty() Command Editor

The command syntax is as follows:

```
SetTimeSeriesProperty(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be modified. • `FirstMatchingTSID` – the last time	`AllTS`

	series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	Required if `TSList=EnsembleID`.
`Description`	The description to assign to the time series. Use the format choices and other characters to define a unique alias.	None.
`Units`	The data units to assign to the time series. The units should agree with the time series data values.	None.
`Editable`	If set to `True`, then graphing the time series will enable interactive editing features, including the ability to save the edited time series.	`False`
`PropertyName`	Name of user-defined property.	
`PropertyType`	Property type, to ensure proper initialization and data check.	Required if `PropertyName` is specified.
`PropertyValue`	Value for property, adhering to the property type requirements.	Required if `PropertyName` is specified.

A sample command file to set a property for time series read from a StateMod file is as follows:

```
ReadStateMod(InputFile="Data\ym2004.ddh")
SetTimeSeriesProperty(Units="AF/M")
```

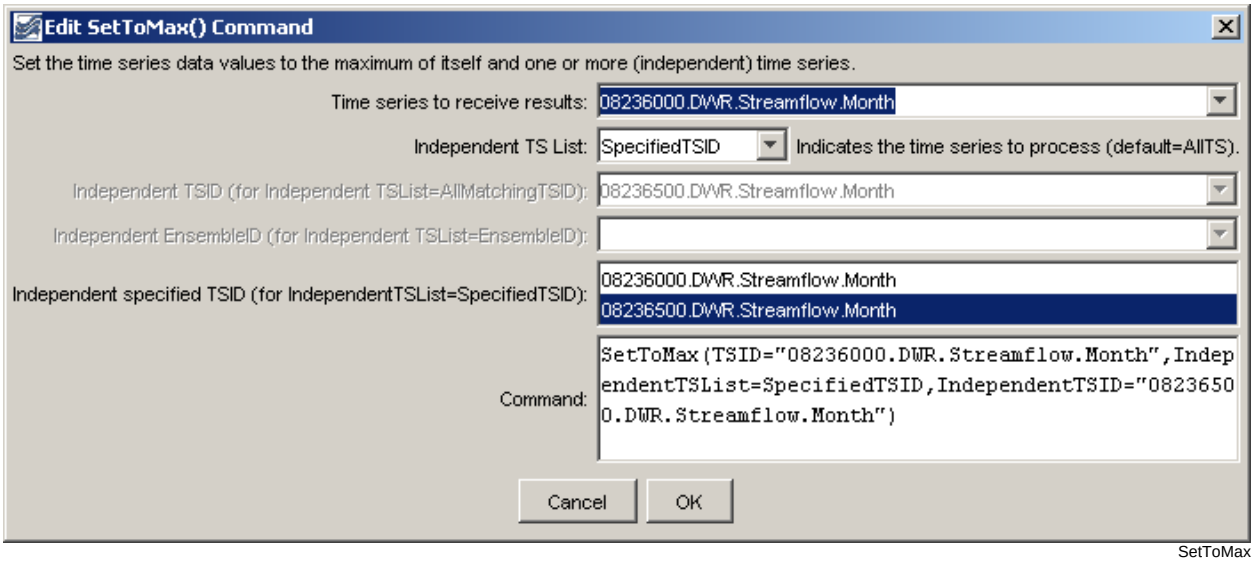
Command Reference: SetToMax()

Set data values to the maximum of values from one or more time series

Version 08.16.04, 2008-09-25

The `SetToMax()` command sets a time series to contain, for each time step, the maximum of its own values and those of one or more additional (independent) time series. This command replaces the `SetMax()` command. See also the `SetToMin()` command.

The following dialog is used to edit the command and illustrates the command syntax.



SetToMax

SetToMax() Command Editor

The command syntax is as follows:

```
SetToMax(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be modified.	None – must be specified.
IndependentTSList	Indicates how the list of time series is specified, one of: • AllTS – all time series before the command. • AllMatchingTSID – all time series that match the IndependentTSID (single TSID or TSID with wildcards). • EnsembleID – the time series from the specified ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command. • SpecifiedTSID – the specified list of time series given by the IndependentTSID parameter.	AllTS (the time series receiving the result will not be checked)
IndependentTSID	If the IndependentTSList= SpecifiedTSID, provide the list of time series identifiers (or alias) to process, separated by commas. If the IndependentTSList parameter is AllMatchingTSID, FirstMatchingTSID, or LastMatchingTSID, specify a single TSID or a TSID with wildcards.	Required if TSList=*TSID.
Independent EnsembleID	Ensemble identifier.	Required if TSList=EnsembleID.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Month~HydroBase
SetToMax(TSID="08236000.DWR.Streamflow.Month",
  IndependentTSList=SpecifiedTSID,
  IndependentTSID="08236500.DWR.Streamflow.Month")
```

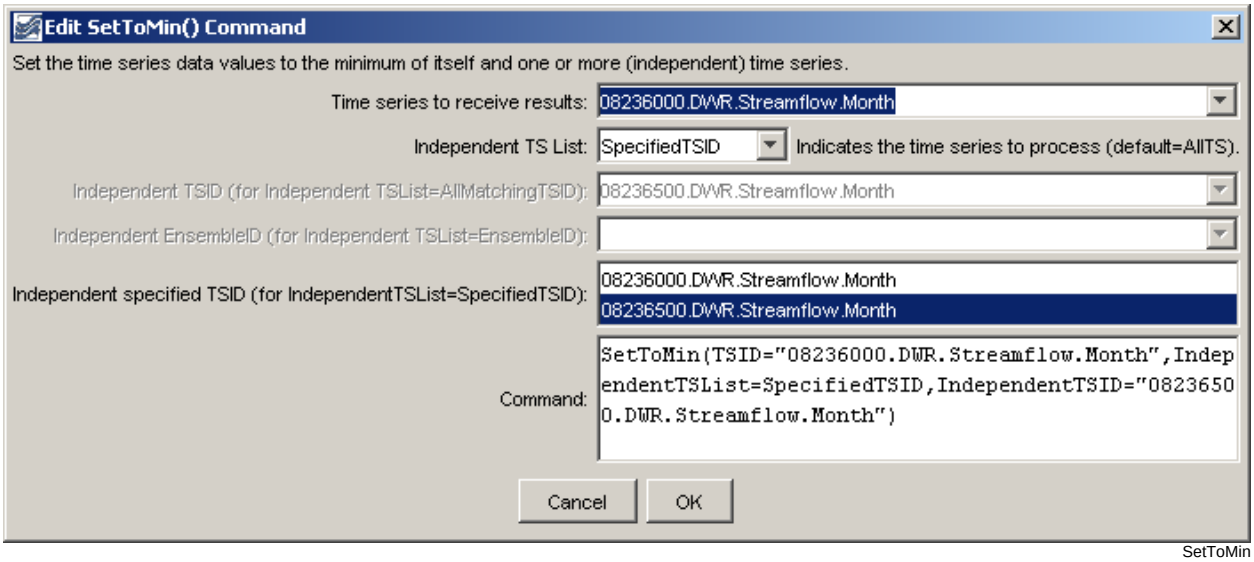
Command Reference: SetToMin()

Set data values to the minimum of values from one or more time series

Version 08.16.04, 2008-09-25

The `SetToMin()` command sets a time series to contain, for each time step, the minimum of its own values and those of one or more additional (independent) time series.

The following dialog is used to edit the command and illustrates the command syntax.



SetToMin

SetToMin() Command Editor

The command syntax is as follows:

```
SetToMin(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSID	The time series identifier or alias for the time series to be modified.	None – must be specified.
IndependentTSList	Indicates how the list of time series is specified, one of: • AllTS – all time series before the command. • AllMatchingTSID – all time series that match the IndependentTSID (single TSID or TSID with wildcards). • EnsembleID – the time series from the specified ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command. • SpecifiedTSID – the specified list of time series given by the IndependentTSID parameter.	AllTS (the time series receiving the result will not be checked)
IndependentTSID	If the IndependentTSList=SpecifiedTSID, provide the list of time series identifiers (or alias) to process, separated by commas. If the IndependentTSList parameter is AllMatchingTSID, FirstMatchingTSID, or LastMatchingTSID, specify a single TSID or a TSID with wildcards.	Required if TSList=*TSID.
Independent EnsembleID	Ensemble identifier.	Required if TSList=EnsembleID.

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 08236000 - ALAMOSA RIVER ABOVE TERRACE RESERVOIR
08236000.DWR.Streamflow.Month~HydroBase
# 08236500 - ALAMOSA RIVER BELOW TERRACE RESERVOIR
08236500.DWR.Streamflow.Month~HydroBase
SetToMin(TSID="08236000.DWR.Streamflow.Month",
  IndependentTSList=SpecifiedTSID,
  IndependentTSID="08236500.DWR.Streamflow.Month")
```

Command Reference: SetWarningLevel()

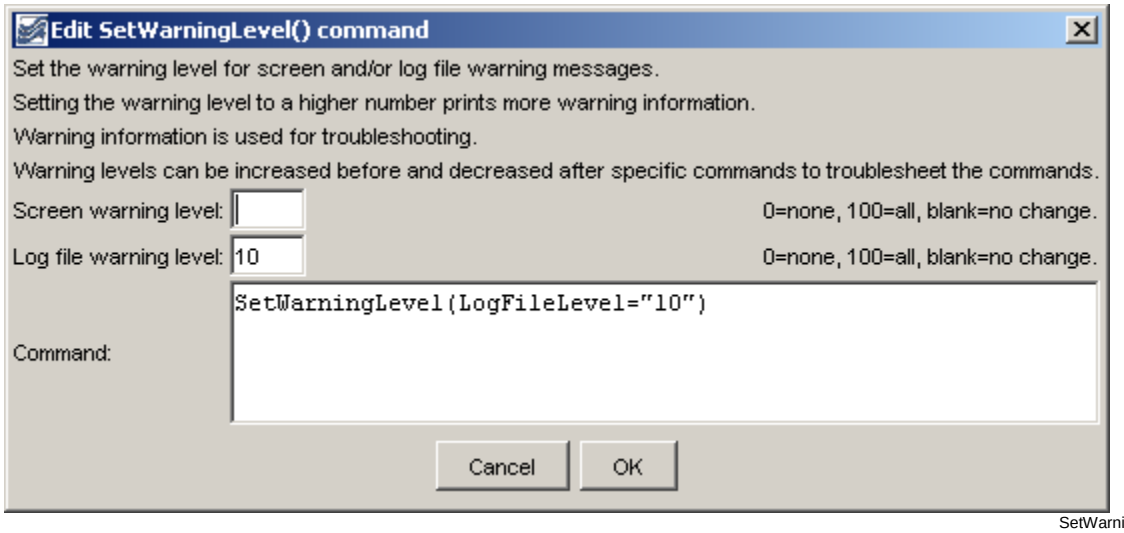
Set level for warning messages

Version 08.16.00, 2008-08-24

The `SetWarningLevel()` command sets the warning levels for the screen and log file. Higher warning levels are useful for troubleshooting commands. The higher the level, the more messages will be generated. This command can be used multiple times, for example to isolate a problem. Currently the warning level applies to all components. In the future logging control may be grouped by component. Levels are not completely consistent but the following guidelines can be followed:

0 = no messages
1 = important messages generated in applications
2 = important messages generated in commands
3+ = messages generated in commands that may explain other problems
10+ = messages in processing code that may still be useful to end users
30+ = low-level messages, for example generated while reading from files or databases

The following dialog is used to edit this command and illustrates the command syntax.



SetWarningLevel

SetWarningLevel() Command Editor

The command syntax is as follows:

```
SetWarningLevel(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`ScreenLevel`	The warning level for the screen (0+).	Keep previous setting.
`LogFileLevel`	The warning level for the log file (0+).	Keep previous setting

A sample commands file is as follows:

```
SetWarningLevel(ScreenLevel=1,LogFileLevel=10)
```

Command Reference: SetWorkingDir()

Set working directory

Version 10.00.02, 2011-05-23

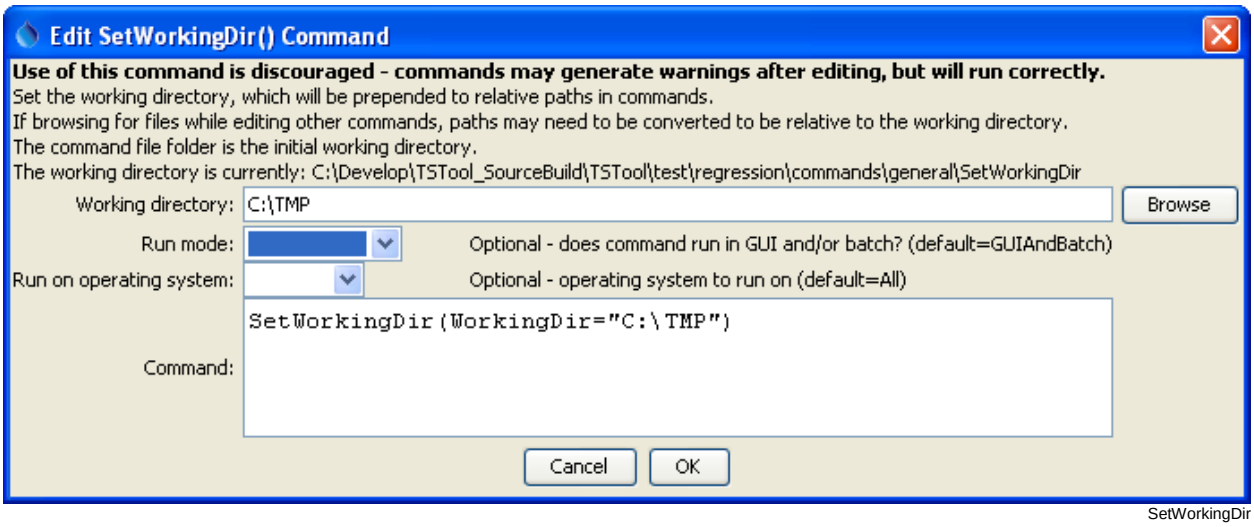
The `SetWorkingDir()` command sets the working directory for following commands. The working directory is normally set in one of the following ways, with the current setting being defined by the most recent action that has occurred:

1. The startup directory for the TSTool program,
2. The directory containing the most recently opened or saved command file.
3. The directory specified by a `SetWorkingDir()` command,
4. The directory specified by ***File…Set Working Directory***.

In most cases, a `SetWorkingDir()` command is not needed and should be avoided because it may complicate commands and troubleshooting. However, for complicated command files that process data in multiple directories, it may be useful to change the working directory during processing. Setting the working directory to an absolute path causes all relative paths for input and output files to be appended to the working directory. Relative paths that use "../" can be specified to move up and down a directory tree. The current working directory during processing is reset to the initial working directory (the location of the command file) each time that the commands are run.

In any case, it is recommended that paths used in command parameters be specified using relative paths (relative to the command file) so that command files and associated data files can be easily moved from one computer to another.

The following dialog is used to edit the command and illustrates the syntax of the command.



SetWorkingDir

SetWorkingDir() Command Editor

The command syntax is as follows:

```
SetWorkingDir(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
WorkingDir	The working directory that should be used. Specify a relative path (e.g., "..") to adjust the current working directory.	None – must be specified.
RunMode	Indicate the run mode in which the command should be applied, one of: • GUIOnly – the command applies only to interactive runs • GUIAndBatch – the command applies to interactive and batch runs • BatchOnly – the command applies to batch runs only	GUIAndBatch

A sample command file is as follows:

```
SetWorkingDir(WorkingDir="C:\temp")
```

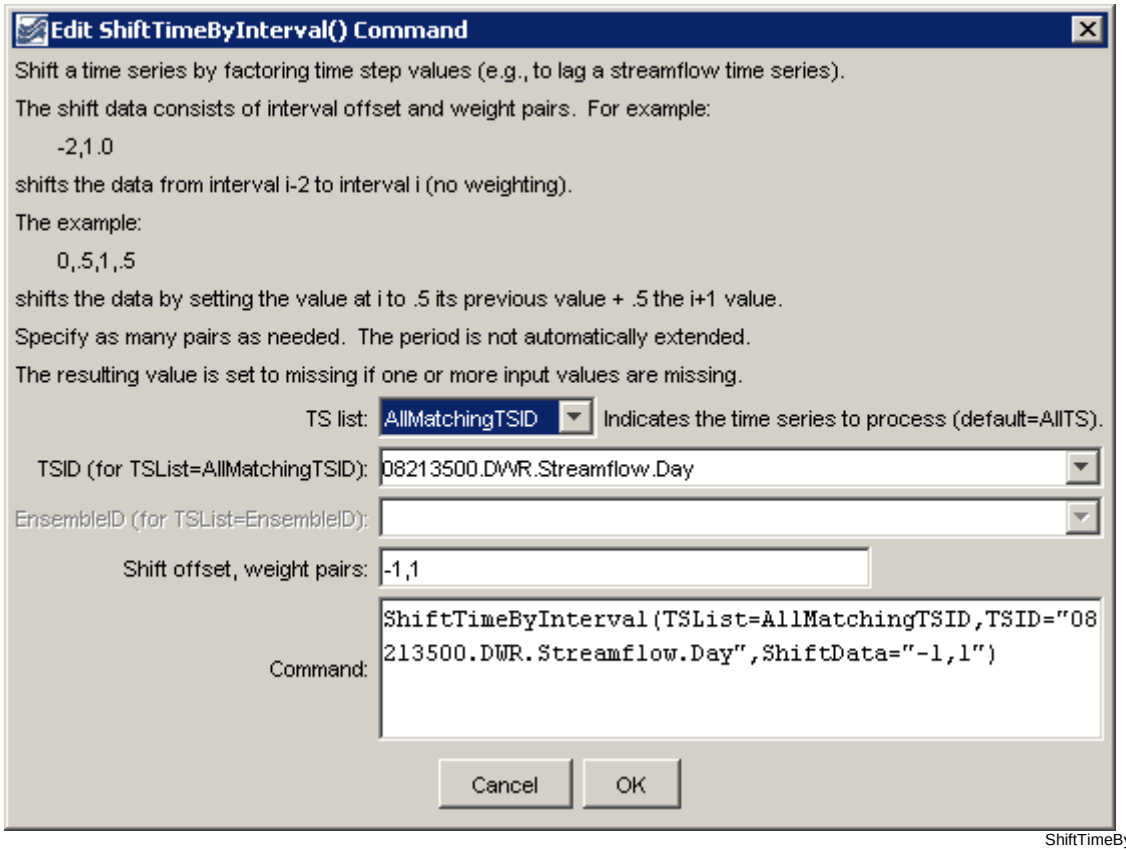
Command Reference: ShiftTimeByInterval()

Shift time series data by one or more time intervals

Version 08.15.00, 2008-05-11

The `ShiftTimeByInterval()` command shifts a time series in time. This command can be used to perform a simple shift (e.g., to shift hourly data because the `Disaggregate()` command did not result in data being set at the desired hours) and to perform simple routing.

The following dialog is used to edit the command and illustrates the command syntax.



ShiftTimeByInterval

ShiftTimeByInterval() Command Editor

The command syntax is as follows:

```
ShiftTimeByInterval(Parameter=Value,…)
```

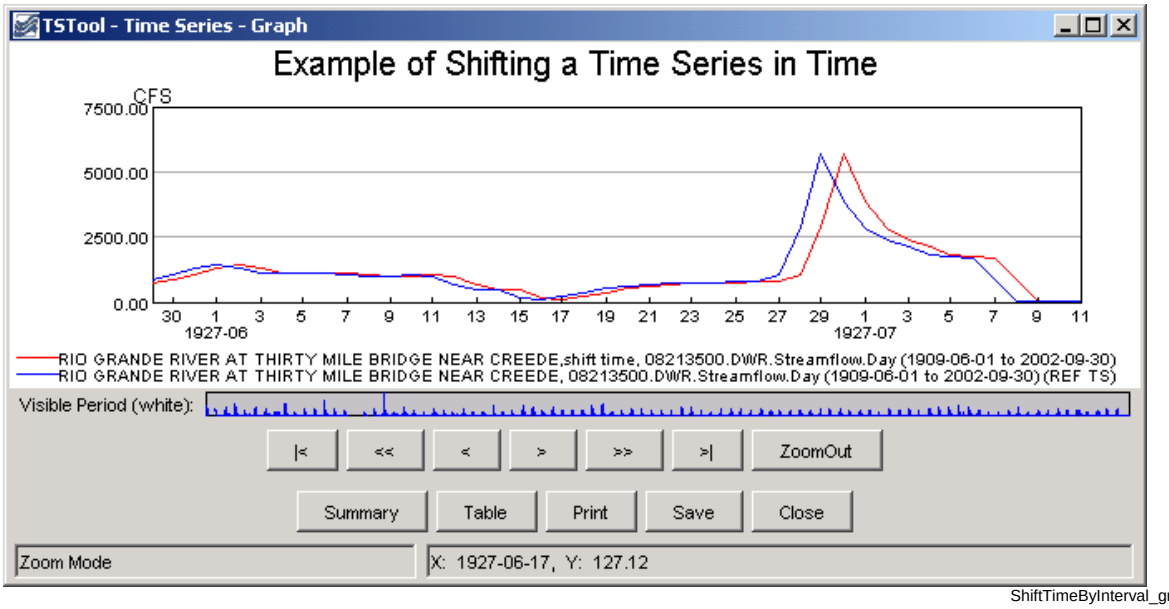
Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be modified. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be	`AllTS`

Parameter	Description	Default
	modified. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be modified. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be modified, using the `*` wildcard character to match multiple time series.	`TSID` or `EnsembleID` must be specified if identifiers are being matched.
`EnsembleID`	The ensemble to be modified, if processing an ensemble.	`TSID` or `EnsembleID` must be specified if identifiers are being matched.
`ShiftData`	Interval,multiplier tuples to apply to the data to perform the shift. All values should be separated by commas. An interval of `-1` indicates that the previous time step should be shifted to the current time step. If the interval is `-1` and the multiplier is `1`, the previous time step is shifted to the current and multiplied by `1`, effectively shifting the time series by one interval.	None – at least 1 value,multiplier tuple must be specified.

A sample command file to shift data from the State of Colorado's HydroBase is as follows:

```
# 08213500 - RIO GRANDE RIVER AT THIRTY MILE BRIDGE NEAR CREEDE
08213500.DWR.Streamflow.Day~HydroBase
ShiftTimeByInterval(TSList=AllMatchingTSID,TSID="08213500.DWR.Streamflow.Day",
  ShiftData="-1,1")
08213500.DWR.Streamflow.Day~HydroBase
```



ShiftTimeByInterval_graph

Results from ShiftTimeByInterval() Command

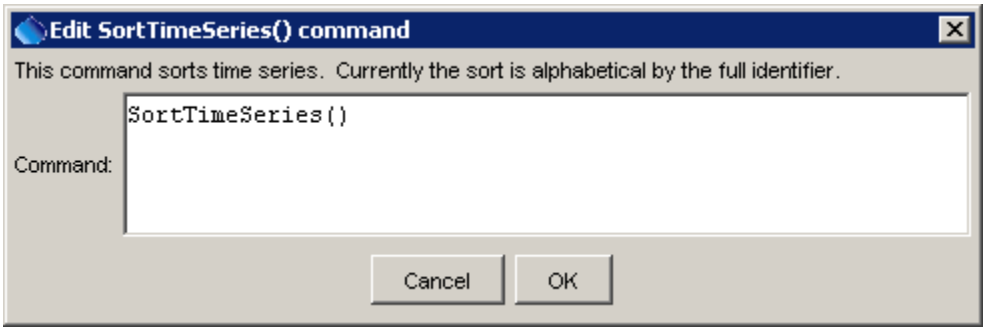
Command Reference: SortTimeSeries()

Sort time series by their identifiers

Version 08.15.00, 2008-05-11

The `SortTimeSeries()` command sorts the time series alphabetically using the time series identifier. This command is useful for ordering time series before writing output, for example to facilitate comparison with another version of the output or to be consistent with other data files.

The following dialog is used to edit the command and illustrates the syntax for the command.



SortTimeSeries

SortTimeSeries() Command Editor

The command syntax is as follows:

```
SortTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
	Currently no parameters are available for this command.	

A sample command file using data from the State of Colorado's HydroBase is as follows:

```
# 06759100 - BIJOU CREEK NEAR FT. MORGAN, CO.
06759100.USGS.Streamflow.Month~HydroBase
# 06759000 - BIJOU CREEK NEAR WIGGINS, CO.
06759000.USGS.Streamflow.Month~HydroBase
# BOXHUDCO - BOX ELDER CREEK NEAR HUDSON, CO
BOXHUDCO.DWR.Streamflow.Month~HydroBase
# 06756500 - CROW CREEK NEAR BARNSVILLE, CO.
06756500.USGS.Streamflow.Month~HydroBase
# 06758300 - KIOWA CREEK AT BENNETT, CO.
06758300.USGS.Streamflow.Month~HydroBase
# 06758000 - KIOWA CREEK AT ELBERT, CO.
06758000.USGS.Streamflow.Month~HydroBase
# 06757600 - KIOWA CREEK AT K-79 RES, NEAR EASTONVILLE, CO.
06757600.DWR.Streamflow.Month~HydroBase
# 06758200 - KIOWA CREEK AT KIOWA, CO.
06758200.USGS.Streamflow.Month~HydroBase
# 06753400 - LONETREE CREEK AT CARR, CO.
06753400.USGS.Streamflow.Month~HydroBase
# 06753990 - LONETREE CREEK NEAR GREELEY, CO.
06753990.USGS.Streamflow.Month~HydroBase
# 06753500 - LONETREE CREEK NEAR NUNN, CO.
06753500.USGS.Streamflow.Month~HydroBase
# 06759910 - SOUTH PLATTE RIVER AT COOPER BRIDGE NEAR BALZAC
06759910.DWR.Streamflow.Month~HydroBase
# 06759500 - SOUTH PLATTE RIVER AT FORT MORGAN
06759500.USGS.Streamflow.Month~HydroBase
# 06756995 - SOUTH PLATTE RIVER AT MASTERS, CO.
06756995.USGS.Streamflow.Month~HydroBase
# 06757000 - SOUTH PLATTE RIVER AT SUBLETTE, CO.
06757000.USGS.Streamflow.Month~HydroBase
# 06754000 - SOUTH PLATTE RIVER NEAR KERSEY
06754000.DWR.Streamflow.Month~HydroBase
# 06758500 - SOUTH PLATTE RIVER NEAR WELDONA
06758500.DWR.Streamflow.Month~HydroBase
# 06758100 - WEST KIOWA CREEK AT ELBERT, CO.
06758100.USGS.Streamflow.Month~HydroBase
SortTimeSeries()
```

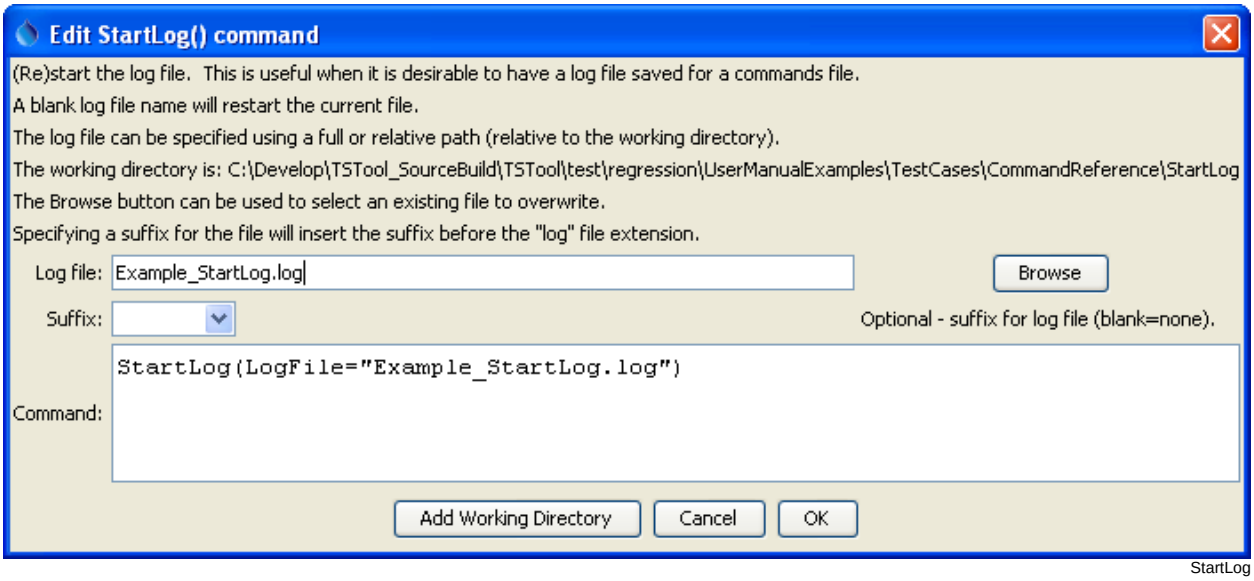
Command Reference: StartLog()

(Re)start the log file

Version 09.08.01, 2010-09-14

The `StartLog()` command (re)starts the log file. It is useful to insert this command as the first command in a command file, in order to persistently record the results of processing. A useful standard is to name the log file the same as the command file, with an additional *.log* extension, and this convention is enforced by default. A date or date/time can optionally be added to the log file name.

The following dialog is used to edit the command and illustrates the syntax for the command.



StartLog

StartLog() Command Editor

The command syntax is as follows:

```
StartLog(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
LogFile	The name of the log file to write surrounded by double quotes. The extension of *.log* will automatically be added, if not specified.	If not specified, the existing file will be restarted.
Suffix	Indicates that a suffix will be added before the *.log* extension, one of: ▪ Date – add a date suffix of the form YYYYMMDD. ▪ DateTime – add a date/time suffix of the form YYYYMMDD_HHMMSS. This is useful for automatically archiving logs corresponding to commands files, to allow checking the output at a later time. However, generating date/time stamped log files can increase the amount of disk space that is used.	Do not add the suffix.

A sample command file to process State of Colorado HydroBase data is as follows (the Add() command will generate an error because the units of the time series are incompatible):

```
StartLog(LogFile="Example_StartLog.log")
# 06753400 - LONETREE CREEK AT CARR, CO.
06753400.USGS.Streamflow.Month~HydroBase
# 1179 - BYERS 5 ENE
1179.NOAA.Precip.Month~HydroBase
Add(TSID="06753400.USGS.Streamflow.Month",AddTSList=AllTS,HandleMissingHow="IgnoreMissing")
```

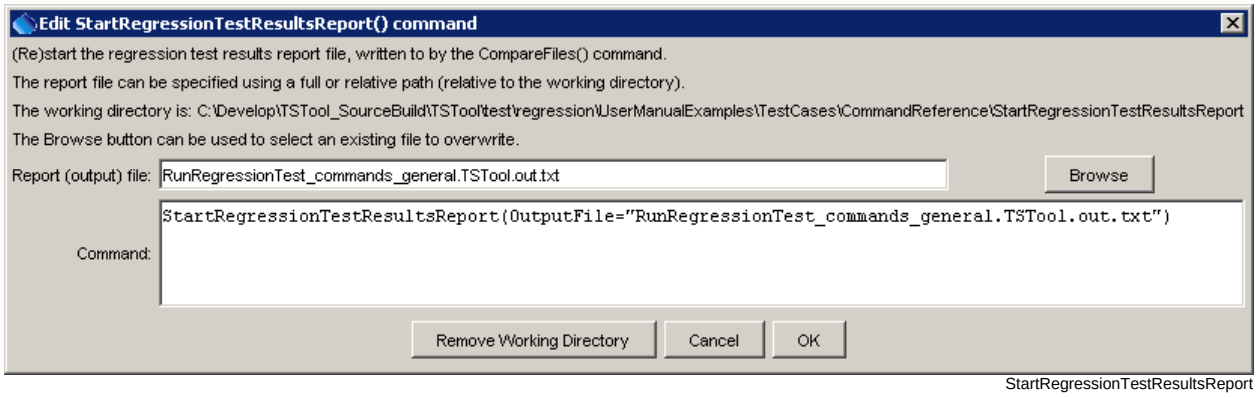
Command Reference: StartRegressionTestResultsReport()

Start a report file to contain regression test results

Version 08.15.00, 2008-05-11

The `StartRegressionTestResultsReport()` command starts a report file to be written to as regression tests are run. The `CreateRegressionTestCommandFile()` automatically inserts this command. The `CompareFiles()` and `CompareTimeSeries()` commands will write to this file if it is available.

The following dialog is used to edit the command and illustrates the syntax for the command.



StartRegressionTestResultsReport

StartRegressionTestResultsReport() Command Editor

The command syntax is as follows:

```
StartRegressionTestResultsReport(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
OutputFile	The name of the report file, enclosed in double quotes if the file contains spaces or other special characters. A path relative to the command file can be specified.	None – must be specified.

See the RunCommands() documentation for how to set up a regression test. The following command file illustrates how to start the results report:

```
StartRegressionTestResultsReport(
  OutputFile="RunRegressionTest_commands_general.TSTool.out.txt")
…
RunCommands(InputFile="..\..\..\commands\general\ReadStateMod\Test_ReadStateMod_1.TSTool")
…
```

Each of the above command files should produce expected time series results, without warnings. If any command file unexpectedly produces a warning, a warning will also be visible in TSTool. The issue can then be evaluated to determine whether a software or configuration change is necessary. An example of the output file is:

```
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\add\Test_Add_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\addConstant\Test_AddConstant_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\adjustExtremes\Test_AdjustExtremes_1.TSTool
SUCCESS
C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\analyzePattern\Test_AnalyzePattern_FromMonthDataValues.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ARMA\Test_ARMA_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\blend\Test_Blend_1.TSTool
SUCCESS
C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ChangeInterval\Test_ChangeInterval_DayMean_To_MonthMean.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\ChangePeriod\Test_ChangePeriod_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\compareTimeSeries\Test_AllDifferent.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\compareTimeSeries\Test_AllSame.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\convertDataUnits\Test_ConvertDataUnits_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\Copy\Test_Copy_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\CreateEnsemble\Test_CreateEnsemble_1.TSTool
FAILURE     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\CreateFromList\Test_CreateFromList_1.TSTool
WARNING     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\CreateTraces_Alias\Test_CreateTraces_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\cumulate\Test_Cumulate_1.TSTool
SUCCESS
C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\DeselectTimeSeries\Test_DeselectTimeSeries_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\Disaggregate_Alias\Test_Disaggregate_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\divide\Test_Divide_1.TSTool
WARNING     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\fillCarryForward\Test_FillCarryForward_1.TSTool
SUCCESS     C:\Develop\TSTool_SourceBuild\TSTool\test\regression\commands\general\fillConstant\Test_FillConstant_Day.TSTool
```

Command Reference: StateModMax()

Compute the maximum of time series in two StateMod files

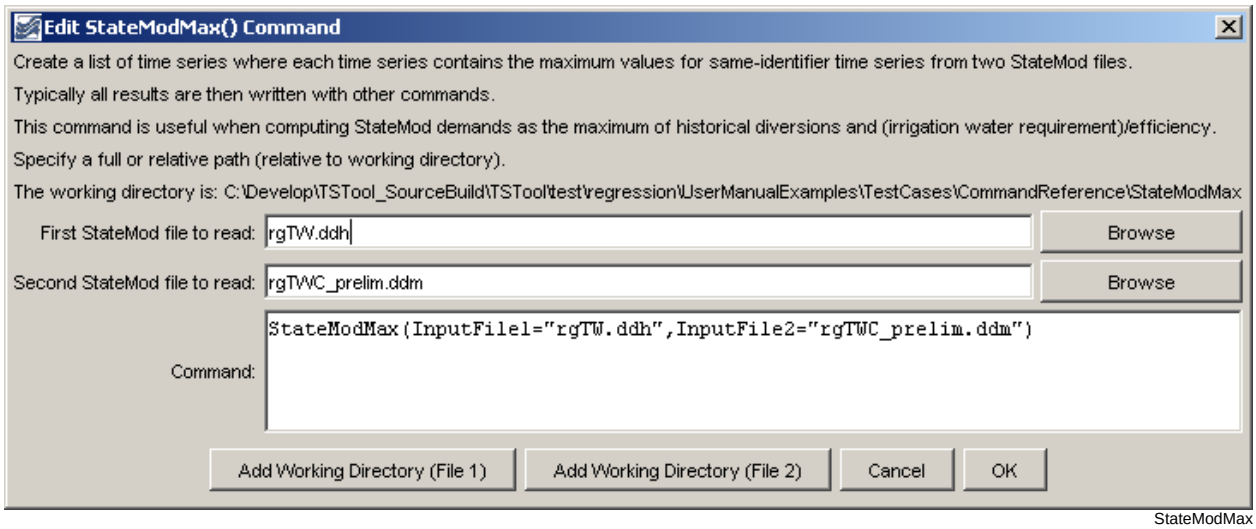
Version 08.16.04, 2008-09-23

A `StateModMax()` command performs the following actions:

1. Read all time series from one StateMod time series file,
2. Read all time series from a second StateMod time series file,
3. Generate a list of time series that contains the maximum values comparing matching time series (using the location identifier). The first list is updated and the second list is discarded.

This command is useful, for example, when creating a demand time series file that is to be the maximum of historical diversions and irrigation water requirement divided by an average efficiency. It is assumed that the specified time series have matching identifiers (the first file is used as the master list) and have consistent units and data intervals. After the time series have been processed, they can be viewed or written out as a new StateMod file (see the `WriteStateMod()` command).

The following dialog is used to edit the command and illustrates the syntax for the command.



StateModMax

StateModMax() Command Editor

The command syntax is as follows:

```
StateModMax(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
InputFile1	The name of the first StateMod time series file to read, surrounded by double quotes. The path to the file can be absolute or relative to the working directory.	None – must be specified.
InputFile2	The name of the second StateMod time series file to read, which must have the same data interval and units as the first file.	None – must be specified.

A sample command file is as follows:

```
StateModMax("rgTW.ddh","rgTWC_prelim.ddm")
WriteStateMod("rgTW.ddm",*)
```

Command Reference: Subtract()

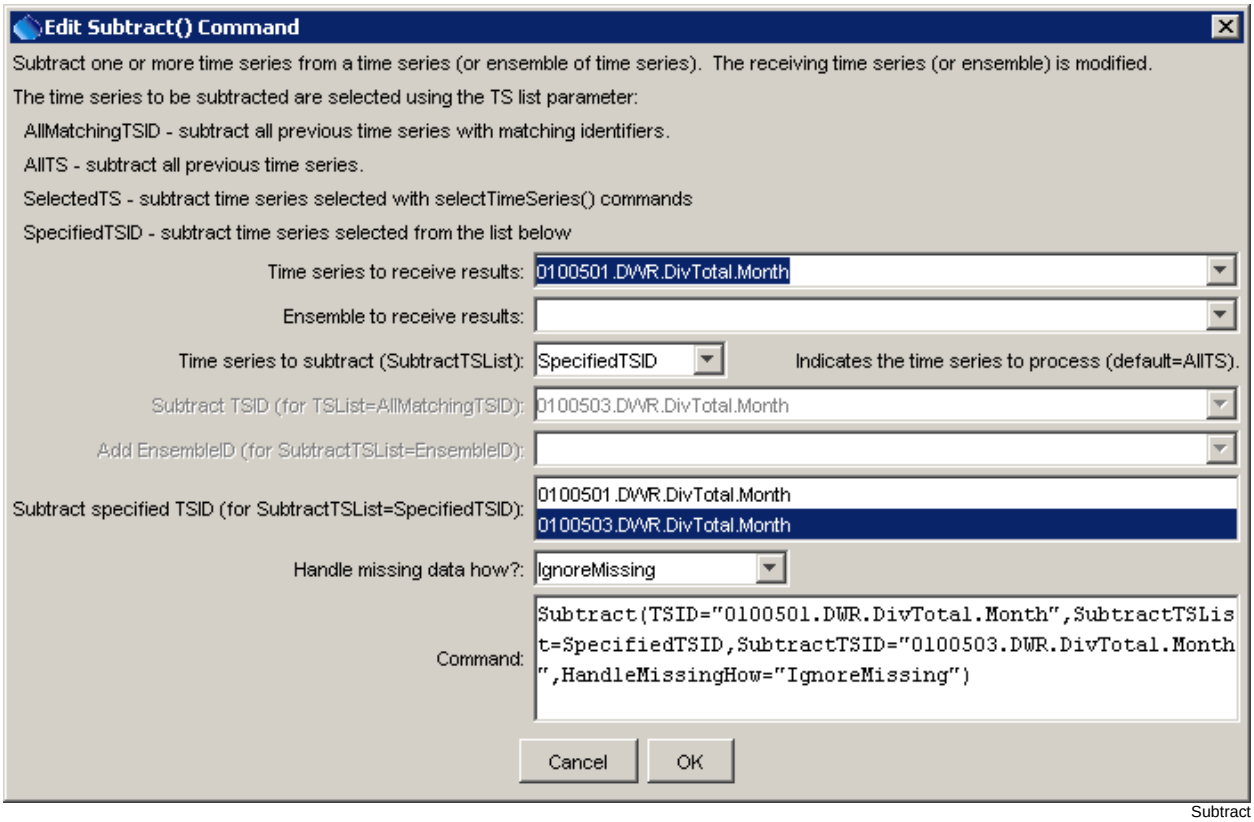
Subtract one or more time series from another time series

Version 08.15.00, 2008-05-12

The `Subtract()` command subtracts time series of the same interval. The receiving time series will have data values set to its original values minus the data values in the indicated time series. If an ensemble is being processed, another ensemble can be subtracted, a single time series can be subtracted from all time series in the ensemble, or a list of time series can be subtracted from the ensemble (the number in the list must match the number of time series in the ensemble).

This command will generate an error if the time series do not have compatible units. If the units are compatible but are not the same (e.g., `IN` and `FT`), then the units of the part will be converted to the units of the result before subtraction. Missing data in the parts can be ignored (do not set the result to missing) or can set missing values in the result. The user should consider the implications of ignoring missing data. Time series being subtracted must have the same data interval.

The following dialog is used to edit the command and illustrates the syntax of the command.



Subtract

Subtract() Command Editor

The command syntax is as follows:

```
Subtract(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	The time series identifier or alias for the time series to receive the result.	`TSID` or `EnsembleID` must be specified.
`EnsembleID`	The ensemble to receive the result, if processing an ensemble.	`TSID` or `EnsembleID` must be specified.
`Subtract TSList`	Indicates how the list of time series is specified, one of: • `AllTS` – all time series before the command. • `AllMatchingTSID` – all time series that match the `AddTSID` (single TSID or TSID with wildcards) will be subtracted. • `EnsembleID` – the time series from ensemble will be subtracted. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be subtracted. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command. • `SpecifiedTSID` – the specified list of time series given by the `SubtractTSID` parameter. **If using version 8.02.00 or earlier, use `SpecifiedTS`.**	`AllTS` (the time series receiving the sum will not be subtracted from itself)
`SubtractTSID`	If the `SubtractTSList` parameter is `SpecifiedTSID`, provide the list of time series identifiers (or alias) to subtract, separated by commas. If the `SubtractTSList` parameter is `AllMatchingTSID`, specify a single TSID or a TSID with wildcards.	Must be specified if `TSList= SpecifiedTSID`, ignored otherwise.
`Subtract EnsembleID`	If the `EnsembleID` parameter is specified, providing an ensemble ID will subtract the ensembles.	Use if an ensemble is being subtracted from another ensemble.
`Handle MissingHow`	Indicates how to handle missing data in a time series, one of: • `IgnoreMissing` – create a result even if missing data are encountered in one or more time series – this option is not as rigorous as the others • `SetMissingIfOtherMissing` – set the result missing if any of the other time series values is missing • `SetMissingIfAnyMissing` – set the result missing if any time series value involved is missing	`IgnoreMissing`

A sample command file to subtract data from the State of Colorado's HydroBase is as follows:

```
# 0100501 - EMPIRE DITCH
0100501.DWR.DivTotal.Month~HydroBase
# 0100503 - RIVERSIDE CANAL
0100503.DWR.DivTotal.Month~HydroBase
Subtract(TSID="0100501.DWR.DivTotal.Month",SubtractTSList=SpecifiedTSID,
  SubtractTSID="0100503.DWR.DivTotal.Month",
  HandleMissingHow="IgnoreMissing")
```

Command Reference: TableMath()

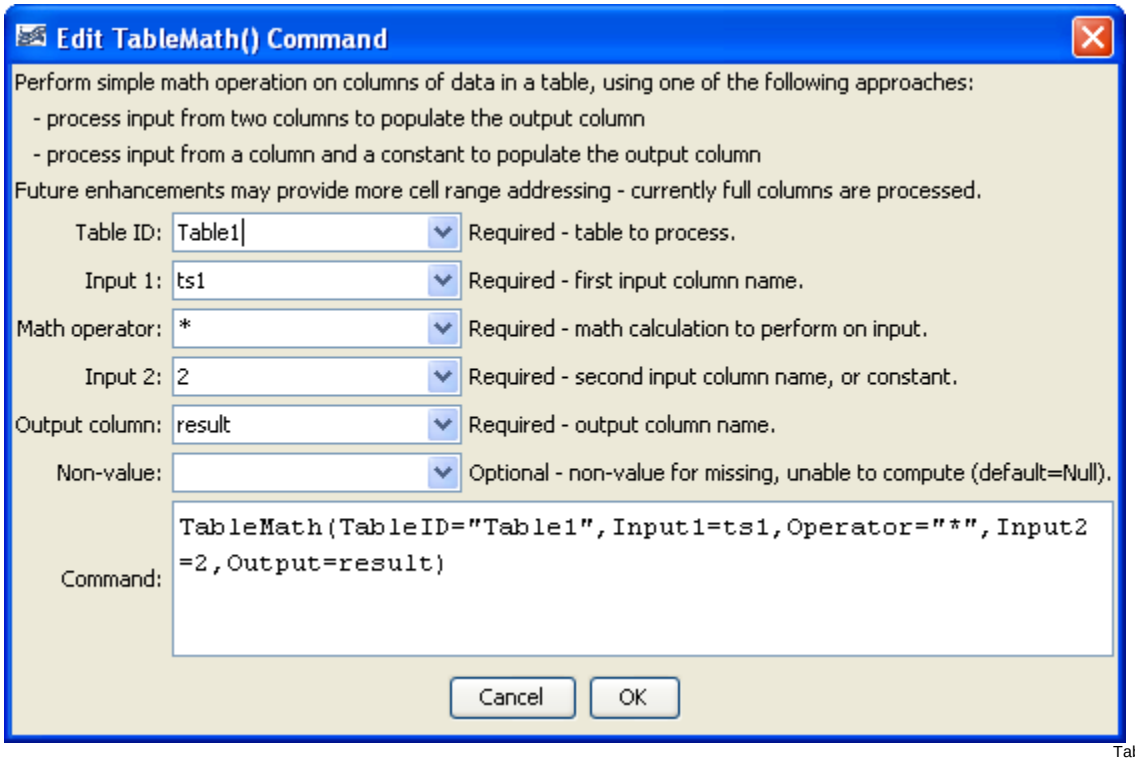
Perform simple math operation on columns in a table

Version 09.08.01, 2010-09-14

The `TableMath()` command performs a simple math operation on columns in a table. Although the design of the command could support more advanced cell range addressing schemes, it currently processes complete columns of data. For example, a table that is populated by the `CalculateTimeSeriesStatistic()` command could be manipulated to produce a new column of data. This command and related table commands are not an attempt to replace full-feature spreadsheet programs but are intended to help automate common data processing tasks.

The input is specified by a table column name (`Input1`) and either a second input column name or a constant value (`Input2`), with the result being placed in the output column (`Output`). Output that cannot be computed is set to the `NonValue` value.

The following dialog is used to edit the command and illustrates the syntax of the command (in this case illustrating how values in a column named `ts1` are multiplied by the number `2`.



TableMath

TableMath() Command Editor

The command syntax is as follows:

```
TableMath(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the table to process.	None – must be specified.
`Input1`	First input column name.	None – must be specified.

`Operator`	The operator to be applied as follows:
	`Input1 Operator Input2 = Output`
	For example:
	`Input1 * Input2 = Output`
		None – must be specified.

`Input2`	Second input column name, or a constant value to use as input.	None – must be specified.
`Output`	Output column name. If the column is not found it will be added to the table and will contain the results of processing.	None – must be specified.
`NonValue`	The value to use in cases where an output result could not be computed (missing input, division by zero). Null will result in blanks in output whereas `NaN` may be shown in some output products, depending on the specifications for the format.	`Null`

Command Reference: TableTimeSeriesMath()

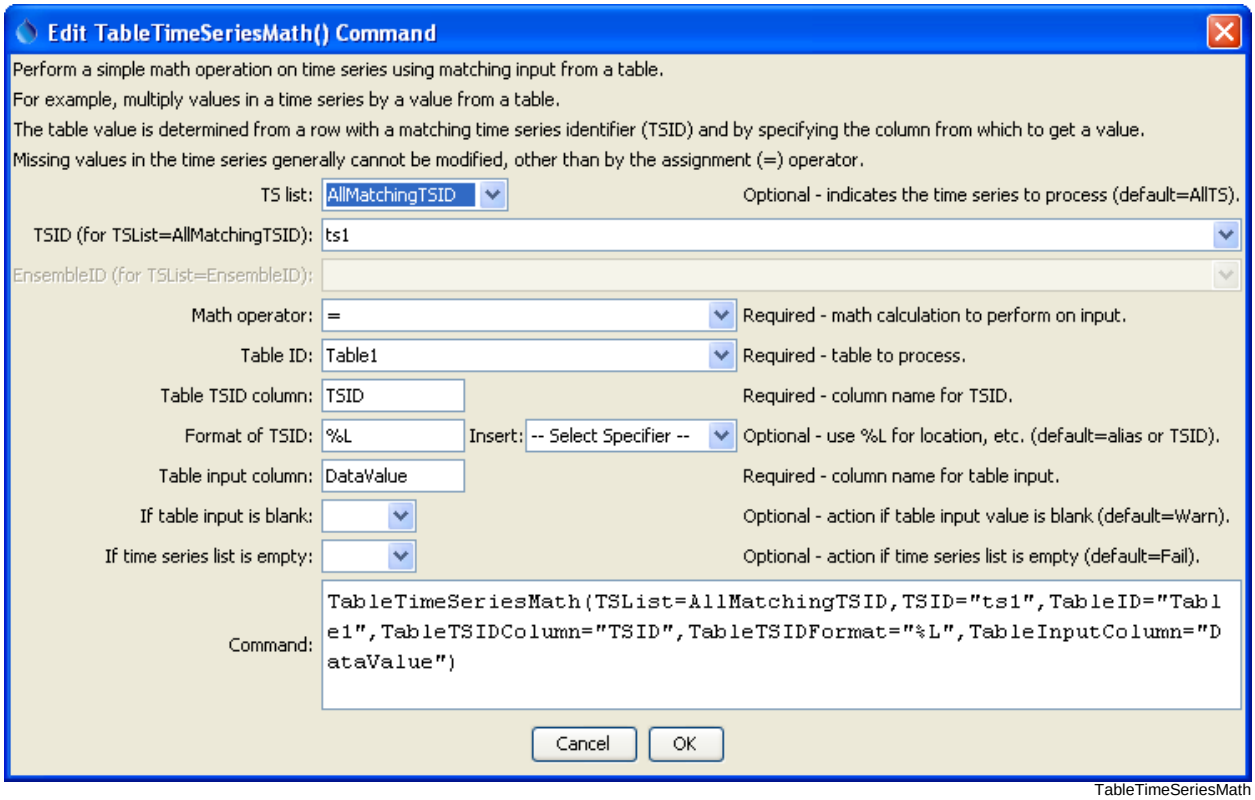
Perform simple math operation on time series using table input

Version 10.04.00, 2012-01-13

The `TableTimeSeriesMath()` command performs a simple math operation on time series using values from a table. For example, a table that is populated by the `CalculateTimeSeriesStatistic()` command or `ReadTableFromDelimitedFile()` could be used to modify time series data. See also the `TableMath()` command, which performs math on a table.

The table value is determined by matching the time series identifier (formatted according to the `TableTSIDFormat` parameter) with the TSID value in the table column specified by the `TableTSIDColumn` parameter. If necessary, use the `ManipulateTableString()` command to generate an identifier column in the table that allows that match. Missing values in the time series generally will not be updated, although the assignment (=) operator will do so.

The following dialog is used to edit the command and illustrates the syntax of the command.



TableTimeSeriesMath

TableTimeSeriesMath() Command Editor

The command syntax is as follows:

```
TableTimeSeriesMath(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards). • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards). • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards). • `SelectedTS` – the time series selected with the `SelectTimeSeries()` command.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`Operator`	The operator to be applied to the time series and table input.	None – must be specified.
`TableID`	Identifier for table that provides input.	None – must be specified.
`TableTSIDColumn`	Table column name that is used to match the time series identifier for processing.	None – must be specified.
`TableTSIDFormat`	The specification to format the time series identifier to match the TSID column. Use the format choices and other characters to define a unique identifier.	Time series alias if available, or otherwise the time series identifier.
`TableInput Column`	Table column name to retrieve the table value.	None – must be specified.
`IfTableInputIsBlank`	Action if time table input is blank during processing (no value to operate on).	`Warn`
`IfTSListIsEmpty`	Action if time series list is empty.	`Fail`

The delimited file corresponding to that used in the above dialog example is shown below. In this example, the time series identifiers have location parts with values `ts1` and `ts2`.

```
# Simple test data
"TSID","DataValue"
ts1,2
ts2,3
```

Command Reference: TableToTimeSeries()

Create time series from a table

Version 10.21.00, 2013-06-27

Note: This command may be split into two separate commands (one for single column data values and one for multiple column data values) if editing the command parameters becomes confusing.

The `TableToTimeSeries()` command creates time series from a table. This command can be used when a command to read time series from a specific file format or datastore has not been implemented. The table typically is read using one of the following commands:

- `ReadTableFromDataStore()` – for example, define an ODBC DSN connection to a database and query time series using an SQL statement.
- `ReadTableFromDelimitedFile()` – for example, read time series from a comma-separated-value (CSV) file.
- `ReadTableFromExcel()` – for example, read time series from a comma-separated-value (CSV) file
- `ReadTableFromHTML()` – envisioned for the future.

TSTool internally represents tables as a collection of columns, where a column contains values of a consistent data type (e.g., integer, string, double). A time series table requires at a minimum a date/time column (or separate date and time columns), at least one data value column, and optionally one or more columns for data flags. Data represented in one of two table designs are handled by this command:

- Data for multiple locations/series stored in a single column (common in a database or stream of data from a data logger) – specify the `LocationColumn` command parameter.
- Data for multiple locations/series stored in multiple columns (common in spreadsheets and CSV files) – do not specify the `LocationColumn` command parameter but instead specify the `ValueColumn` and optionally `LocationID` parameters.

The command provides flexibility to specify time series metadata (e.g., data source, units) as command parameters, or read from the file. However, this flexibility is limited by practical considerations in supporting likely data formats. One current limitation of the command is that TSTool does not determine table column names during discovery mode (discover mode is a partial command run that allows data such as time series and table identifiers to be provided to later commands for editing). Consequently, although this command will create time series when run, it does not produce time series information in discovery mode and the time series will not be listed in later command editors. This limitation will be addressed in future TSTool updates.

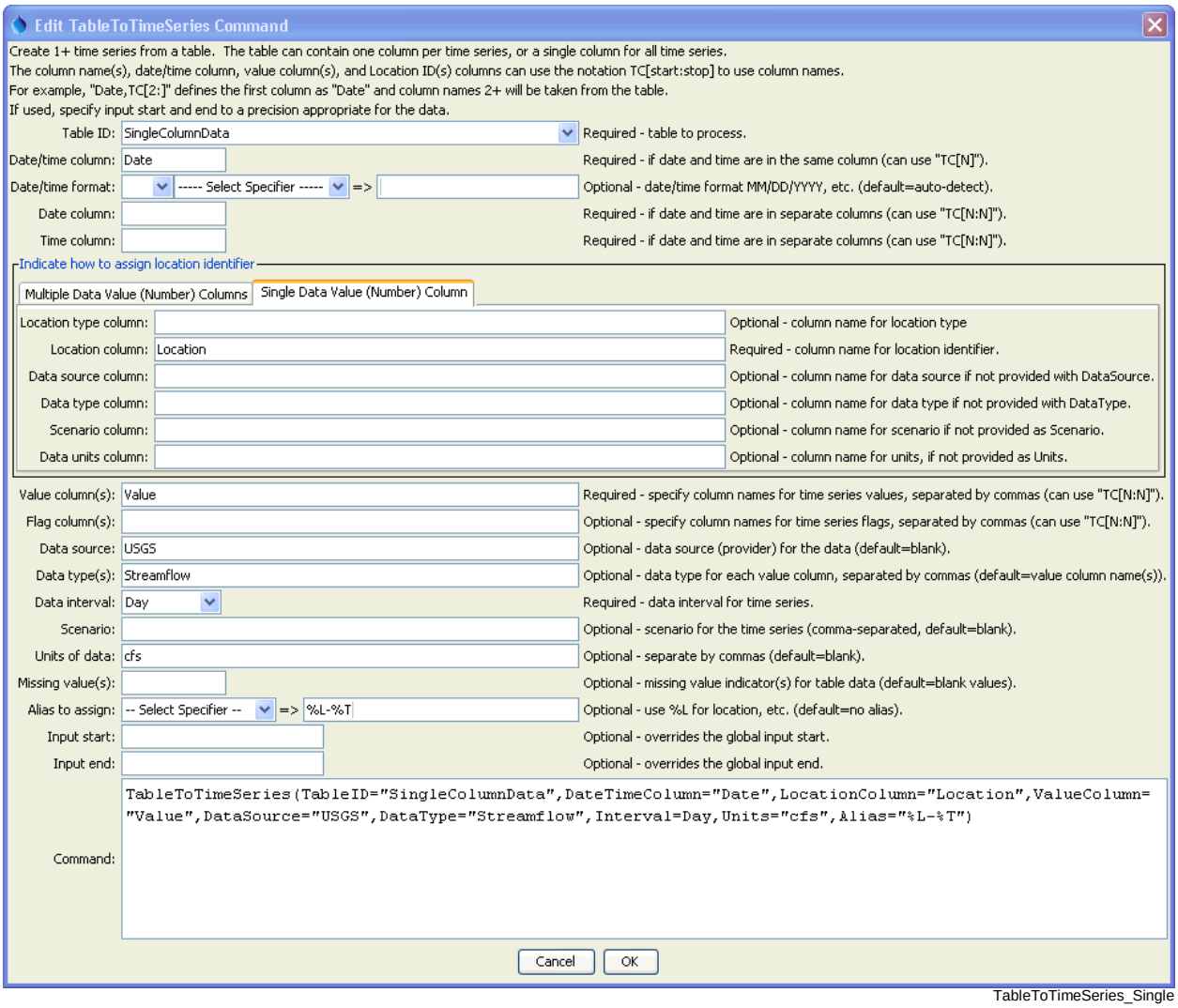
An example of a table with single data value column with flags is shown in the following figure (note that a column is used for the location identifier and that the location is different for the topmost and bottommost records).

Date	Location	Value	Flag
2000-12-26	06754000	515.00	
2000-12-27	06754000	529.00	
2000-12-28	06754000	552.00	
2000-12-29	06754000	582.00	
2000-12-30	06754000	595.00	
2000-12-31	06754000	578.00	
2000-01-01	06758500	899.00	
2000-01-02	06758500	988.00	
2000-01-03	06758500	1000.00	
2000-01-04	06758500	981.00	
2000-01-05	06758500	994.00	
2000-01-06	06758500	999.00	
2000-01-07	06758500	998.00	

TableToTimeSeries_Single_Data

Simple Table with Data Values in a Single Column

In the above example, the list of unique time series is determined by examining the location column contents. Other time series metadata such as data source and units can be assigned using the `DataSource`, `Units`, and similar parameters. The following dialog is used to edit the command and illustrates the command syntax when processing single-column data from the above example. Note that time series metadata are specified with command parameters.



TableToTimeSeries_Single

TableToTimeSeries() Command Editor for Table with Data in a Single Column

The following example is also treated as single-column because a single column of data values is present. However, metadata are taken from other columns. This data format is consistent with a database query where several tables have been joined together. Although not efficient because time series metadata is repeated for every row, the format is convenient for data translation. Use the `DataSourceColumn`, `UnitsColumn` and similar parameters to specify metadata. The unique list of time series will be determined from the combinations of location identifier and other metadata..

TSTool - Table "SingleColumnData"

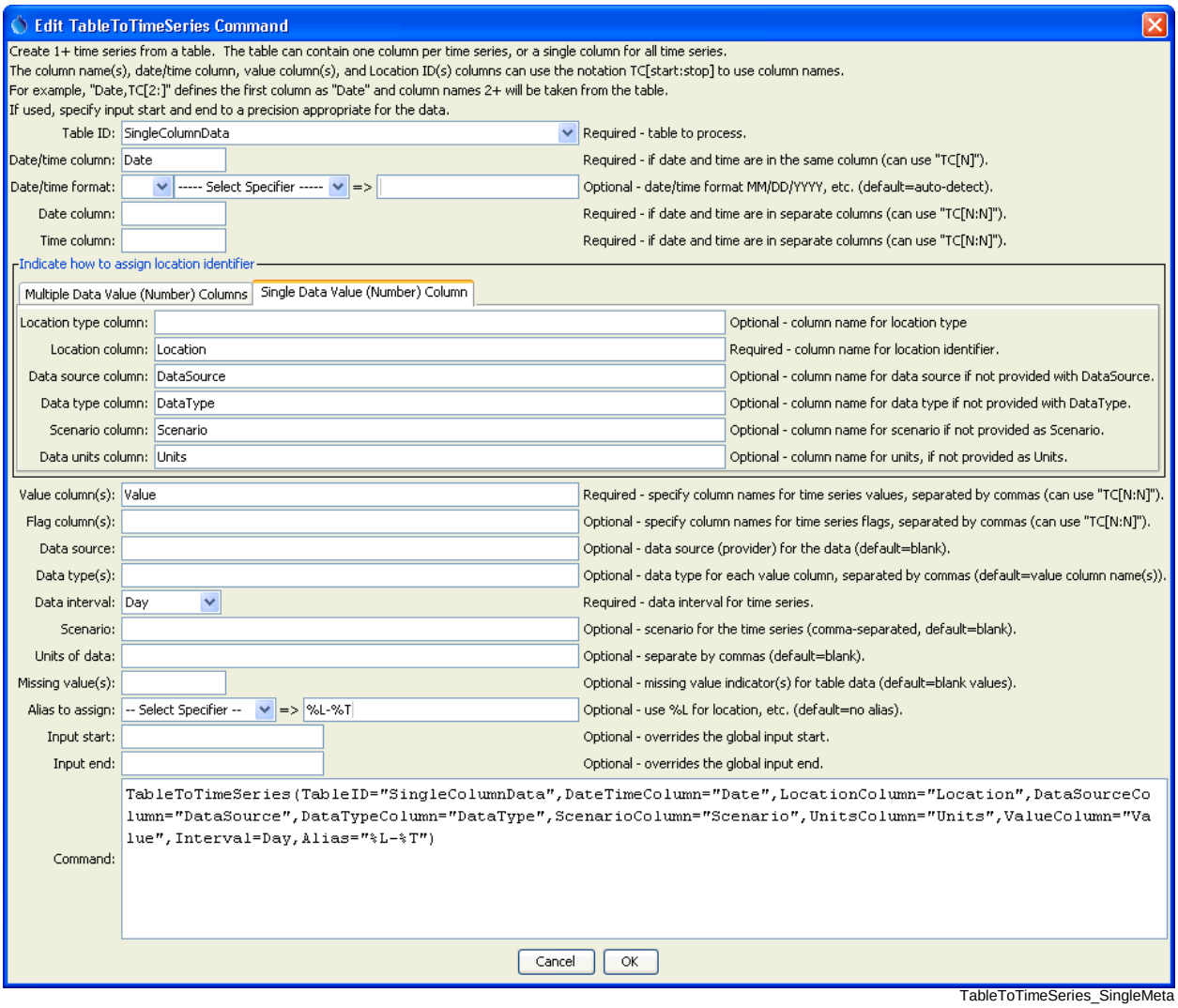
Date	Location	Value	LocationType	DataSou...	DataType	Scenario	Units
2000-12-25	06754000	520.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-26	06754000	515.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-27	06754000	529.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-28	06754000	552.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-29	06754000	582.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-30	06754000	595.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-12-31	06754000	578.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-01	06758500	899.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-02	06758500	988.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-03	06758500	1000.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-04	06758500	981.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-05	06758500	994.00	StreamGage	USGS	Streamflow	Irrig	cfs
2000-01-06	06758500	999.00	StreamGage	USGS	Streamflow	Irrig	cfs

Displaying 732 rows, 8 columns. Ready

TableToTimeSeries_SingleMeta_Data

Table with Data Values in a Single Column and Metadata Provided in Other Columns

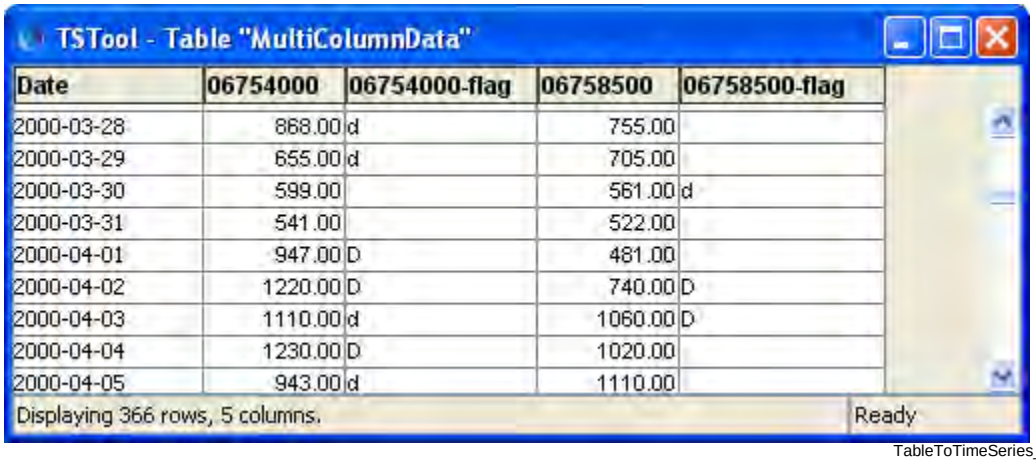
The following dialog is used to edit the command and illustrates the command syntax when processing single-column data from the above example. Note that time series metadata are specified with command parameters.



TableToTimeSeries_SingleMeta

TableToTimeSeries() Command Editor for Table with Single Data Column and Metadata Columns

An example of multi-column data with flags is shown in the following figure, where each time series has its own data and flag columns:

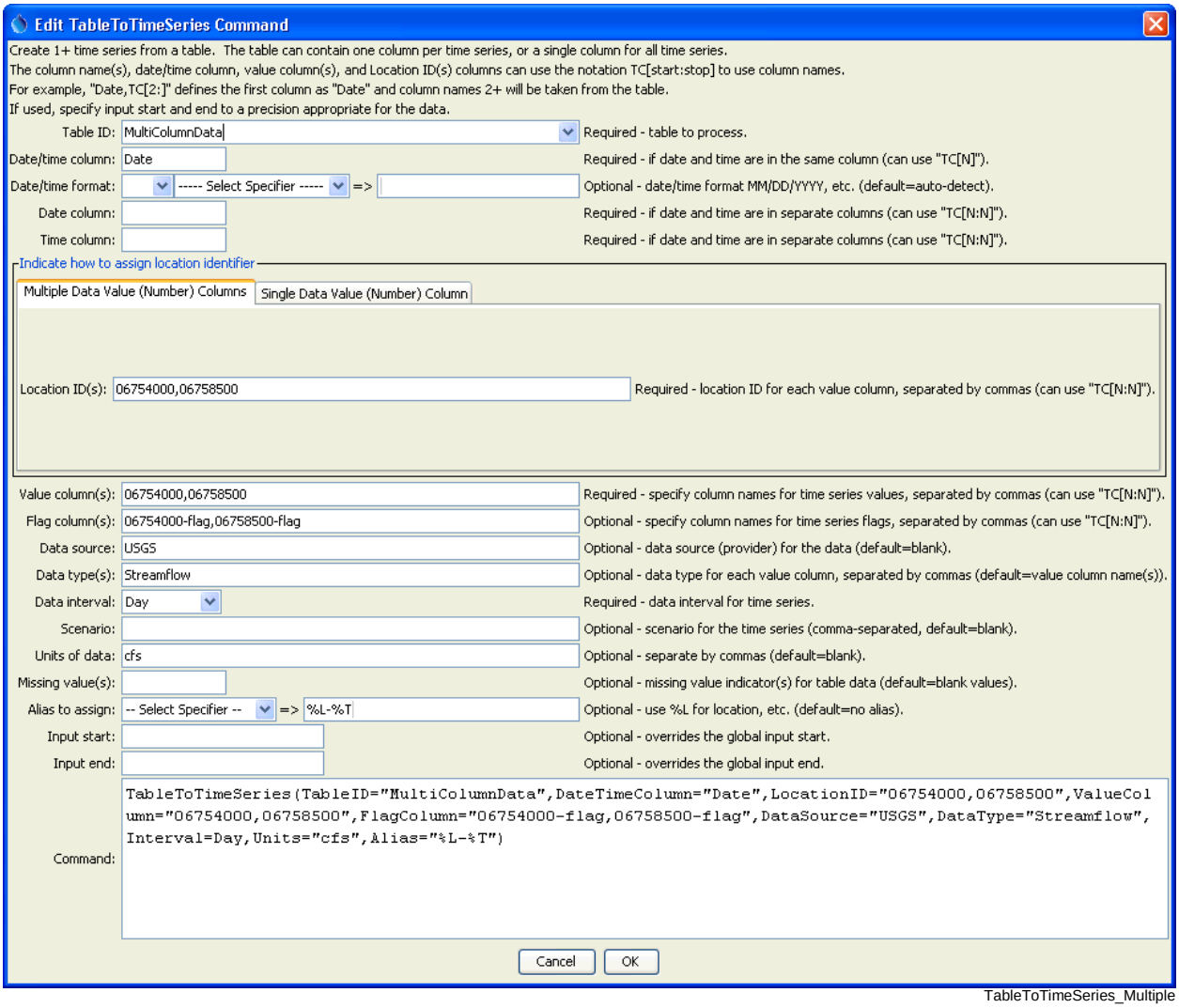


Date	06754000	06754000-flag	06758500	06758500-flag
2000-03-28	868.00	d	755.00	
2000-03-29	655.00	d	705.00	
2000-03-30	599.00		561.00	d
2000-03-31	541.00		522.00	
2000-04-01	947.00	D	481.00	
2000-04-02	1220.00	D	740.00	D
2000-04-03	1110.00	d	1060.00	D
2000-04-04	1230.00	D	1020.00	
2000-04-05	943.00	d	1110.00	

TableToTimeSeries_Multiple_Data

Table with Multiple Data Columns

The following dialog is used to edit the command and illustrates the syntax for the command when processing multi-column data from the above table.



TableToTimeSeries_Multiple

TableToTimeSeries() Command Editor For Table with Data in a Single Column

The command syntax is as follows:

```
TableToTimeSeries(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	The identifier for the table to read.	None – must be specified.
`DateTime Column`	The column for date/time, when date and time are in one column. If the table was read in a way that the column type is “date/time”, then the values are used directly. If the table was read in a way that the column type is “string”, then the string is parsed using default logic or the	Required if `DateColumn` is not specified.

Parameter	Description	Default
	`DateTimeFormat` parameter if specified.	
`DateTime Format`	The format for date/time strings in the date/time column, if strings are being parsed. If blank, common formats such as `YYYY-MM-DD hh:mm` and `MM/DD/YYYY` will automatically be detected. However, it may be necessary to specify the format to ensure proper parsing. This format will be used to parse date/times from the `DateTimeColumn` or the merged string from the `DateColumn` and `TimeColumn` (if specified). The format string will depend on the formatter type. Currently, only the "C" formatter is available, which uses C programming language specifiers. The resulting format includes the formatter and specifiers (e.g., `C:%m%d%y`).	Will automatically be determined by examining date/time strings.
`DateColumn`	The name of column that includes the date, used when date and time are in separate columns.	Required if `DateTimeColumn` is not specified.
`TimeColumn`	The name of column that includes the time, used when date and time are in separate columns. If both `DateColumn` and `TimeColumn` are specified, their contents are merged with a joining colon character and are then treated as if `DateTimeColumn` had been specified.	Required if `DateColumn` is specified and the interval requires time.
`LocationID`	**Used with multiple data column table**. The location identifier(s) to assign to time series, separated by columns if more than one column is read from the table. Column names can be specified as literal strings or as `TC[start:stop]` to match table column names, where `start` is `1+` and `stop` is blank to read all columns or a negative number to indicate the offset from the end column.	None – must be specified for multiple column data tables.
`LocationType Column`	**Used with single data column table**. The name of the column containing the location type.	Do not assign a location type.
`LocationColumn`	**Used with single data column table**. The name of the column containing the location identifier.	None – must be specified for single column data tables.
`DataSource Column`	**Used with single data column table**. The name of the column containing the data source.	Use the `DataSource` parameter, which can be blank.
`DataType Column`	**Used with single data column table**. The name of the column containing the data type.	Use the `DataType` parameter, which can be blank.
`ScenarioColumn`	**Used with single data column table**. The name of the column containing the scenario.	Use the `Scenario` parameter, which can be blank.
`UnitsColumn`	**Used with single data column table**. The name of the column containing the data units.	Use the `Units` parameter, which can be blank.
`ValueColumn`	The name(s) of column(s) containing data values.	None – must be

Parameter	Description	Default
	Separate column names with commas. The `TC[start:stop]` notation discussed for `LocationID` can be used. Only one column should be specified for single data column table.	specified.
`FlagColumn`	The name(s) of column(s) containing the data flag. Separate column names with commas. The `TC[start:stop]` notation discussed for `LocationID` can be used. If specified, the number of columns must match the `ValueColumn` parameter, although specifying blank column names is allowed to indicate that a value column does not have a corresponding flag column..	Flags are not read.
`DataSource`	The data source (provider) identifier to assign to time series for each of the value columns (or specify one value to apply to all columns).	No provider will be assigned.
`DataType`	The data type to assign to time series for each of the value columns (or specify one value to apply to all columns).	Use the value column names for the data types.
`Interval`	The interval for the time series. Only one interval is recognized for all the time series in the table. Interval choices are provided when editing the command. If it is possible that the date/times are not evenly spaced, then use the `Irregular` interval (this is difficult to do for multiple data column tables).	None – must be specified.
`Scenario`	The scenario to assign to time series for each of the value columns (or specify one value to apply to all columns).	No scenario will be assigned.
`Units`	The data units to assign to time series for each of the value columns (or specify one value to apply to all columns).	No units will be assigned.
`Missing`	Strings that indicate missing data in the table (e.g., "m"), separated by commas.	Interpret empty column values as missing data.
`Alias`	The alias to assign to time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing.	No alias will be assigned.
`InputStart`	The date/time to start reading data.	All data or global input start.
`InputEnd`	The date/time to end reading data.	All data or global input end.

Command Reference: TimeSeriesToTable()

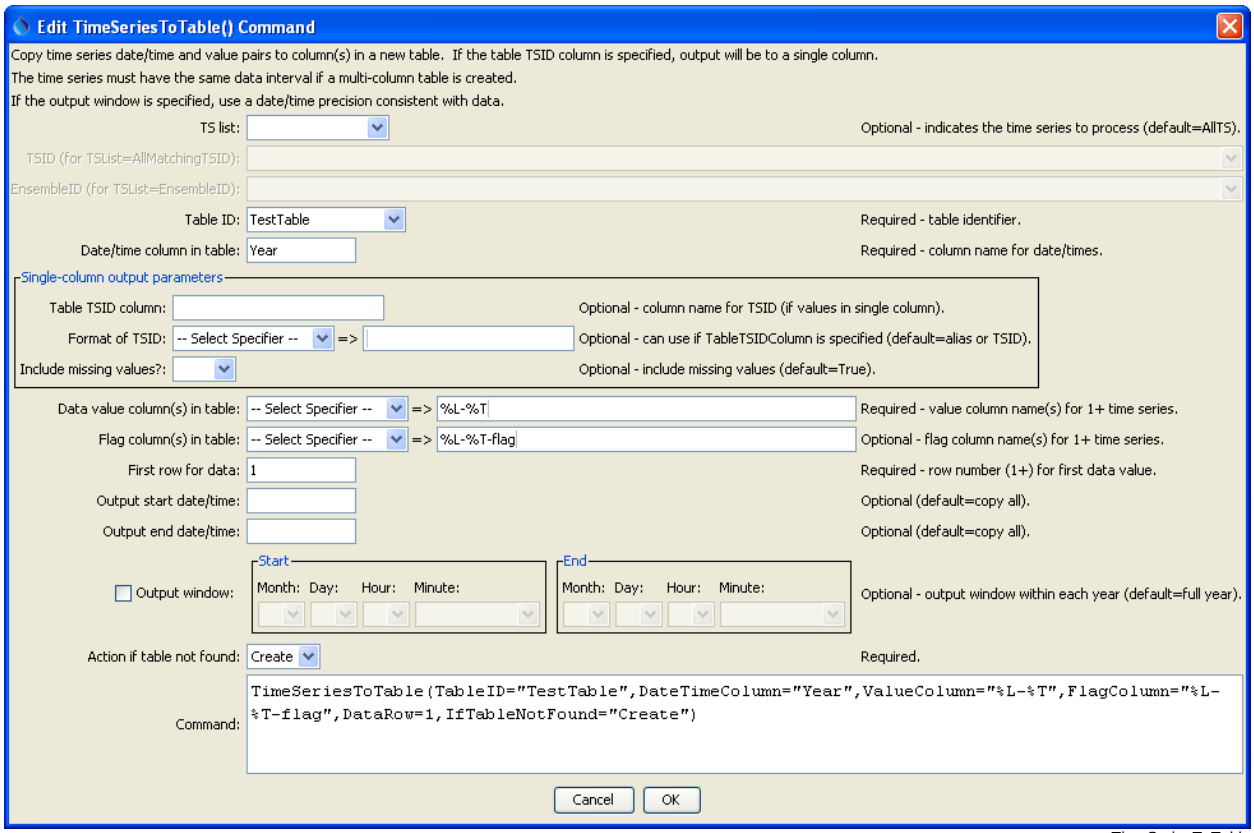
Copy one or more time series into a table

Version 10.21.00, 2013-06-26

The `TimeSeriesToTable()` command copies one or more time series into a table. This command is useful when performing table analysis processing and outputting table formats (e.g., with the `WriteTableToDelimitedFile()` or `WriteTableToHTML()` commands). The command can be configured to output one of two table forms:

- Each time series in a separate column, with shared date/time column:
  - The time series must be regular interval (no irregular interval time series) and the intervals must match in order to allow alignment of the date/times.
  - Do not specify the `TableTSIDColumn` or `TableTSIDFormat` parameters.
- All time series values in a single column (useful for converting time series to a stream of data for loading into a database)
  - Any interval is allowed although mixing time series of varying precision is discouraged.
  - Specify the `TableTSIDColumn` and optionally `TableTSIDFormat` parameters.

Currently the command can only be used to create a new table but in the future the command is envisioned to write into an existing table. The following dialog is used to edit the command and illustrates the syntax of the command when writing a multi-column data table while also outputting data flags. Note that the value columns can be specified using time series properties.



TimeSeriesToTable

TimeSeriesToTable() Command Editor to Create Multi-Column Data Table

The command syntax is as follows:

```
TimeSeriesToTable(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards). • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards). • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards). • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required when TSList=*TSID
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required when TSList=EnsembleID.
TableID	The identifier for the table to copy data into (or the identifier for the new table to create if IfTableNotFound=Create).	None – must be specified.
DateTimeColumn	The table column name to receive date/time information.	None – must be specified.
TableTSIDColumn	For single-column output, the name of the column in the table for time series identifier information. The format of the identifier can be specified using the TableTSIDFormat parameter.	Optional – if specified will indicate single-column output.
TableTSIDFormat	For single-column output, indicates how to format the time series identifier that is inserted in the column specified by the TableTSIDColumn parameter.	Optional – if not specified the alias or full TSID will be used.
IncludeMissingValues	For single-column output, indicates whether missing values should be transferred to the table. This is useful to screen out missing values from sparse time series.	True
ValueColumn	The data value column name(s) to receive time	None – must be specified.

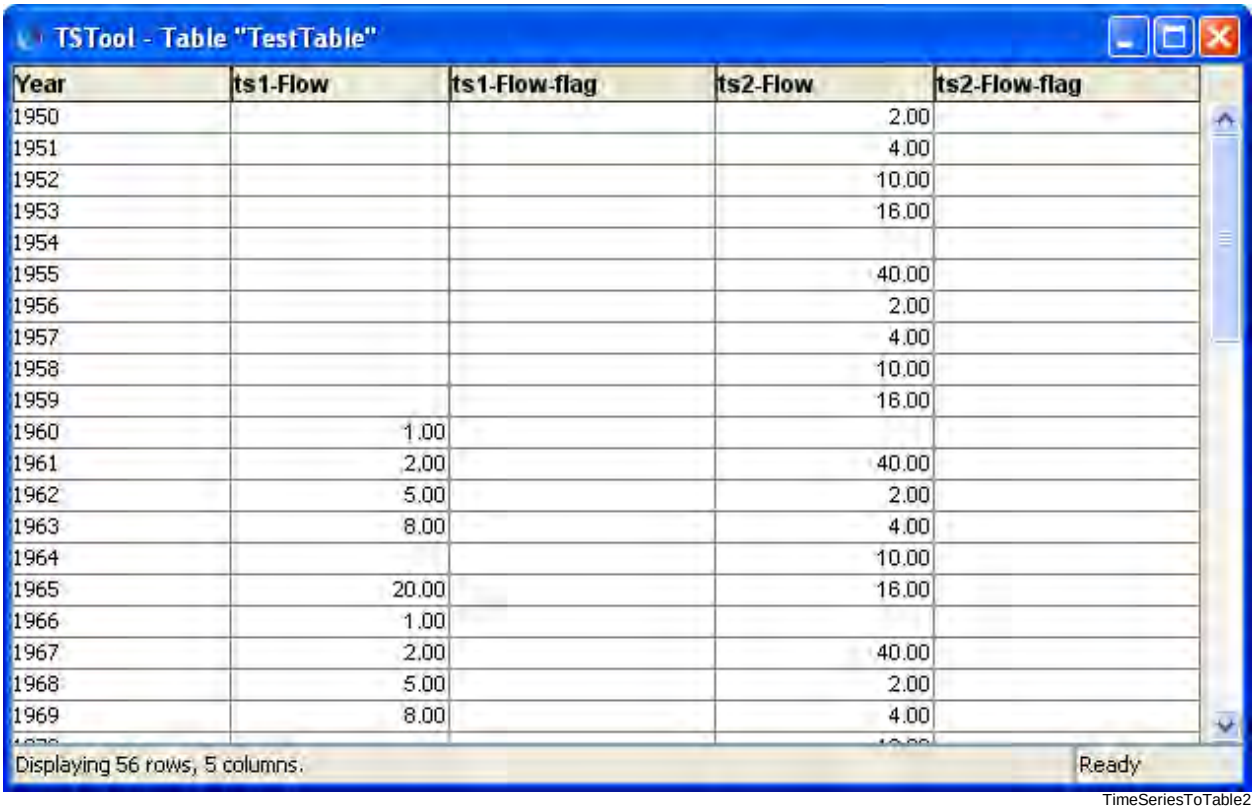
Parameter	Description	Default
	series data, specified as follows: • Multiple names separated by a comma. • Time series property format specifiers, available in a list of choices. These specifiers are consistent with other commands and the legend formatter in the graphing tool. • If a literal string is specified with multi-column output, names for columns 2+ will be generated by adding a sequential number to `ValueColumn`.	
`FlagColumn`	The data flag column name(s) to receive time series flags, specified using the same syntax as `ValueColumn`. A blank in the list will result in no transfer of flags for the specific time series.	Do not output flags to the table.
`DataRow1`	First table row for data (1+), where the row number is data only (column names are not considered a data row).	None – must be specified.
`OutputStart`	The starting date/time for the copy.	Available period.
`OutputEnd`	The ending date/time for the copy.	Available period.
`OutputWindowStart`	The calendar date/time for the output start within each year. Specify using the format `MM`, `MM-DD`, `MM-DD hh`, or `MM-DD hh:mm`, consistent with the time series interval precision. A year of `2000` will be used internally to parse the date/time. Use this parameter to limit data processing within the year, for example to output only a single month or a season.	Output the full year.
`OutputWindowEnd`	Specify date/time for the output end within each year. See `OutputWindowStart` for details.	Output the full year.
`IfTableNotFound`	Indicate action if the table identifier is not matched, one of: • `Create` – create a new table • `Warn` – warn that the table was not matched	`Warn`

A sample command file is as follows (this command file is used to verify the command during testing):

```
# Test copying annual time series to a table, and also create the table
StartLog(LogFile="Results/Test_TimeSeriesToTable_Year_Create.TSTool.log")
RemoveFile(InputFile="Results/Test_TimeSeriesToTable_Year_Create_out.csv",
    IfNotFound=Ignore)
NewPatternTimeSeries(Alias="ts1",NewTSID="ts1..Flow.Year",SetStart="1960",
    SetEnd="2000",Units="ACFT",PatternValues="1,2,5,8,,20")
NewPatternTimeSeries(Alias="ts2",NewTSID="ts2..Flow.Year",SetStart="1950",
    SetEnd="2005",Units="ACFT",PatternValues="2,4,10,16,,40")
TimeSeriesToTable(TableID=TestTable,DateTimeColumn=Year,ValueColumn=%L-%T,
    FlagColumn="%L-%T-flag",DataRow=1,IfTableNotFound="Create")
# Generate the results.
WriteTableToDelimitedFile(TableID="TestTable",
```

```
    OutputFile="Results\Test_TimeSeriesToTable_Year_Create_out.csv")
# Uncomment the following to recreate expected results
# WriteTableToDelimitedFile(TableID="TestTable",
#    OutputFile="ExpectedResults\Test_TimeSeriesToTable_Year_Create_out.csv")
CompareFiles(InputFile1="ExpectedResults/Test_TimeSeriesToTable_Year_Create_out.csv",
    InputFile2="Results/Test_TimeSeriesToTable_Year_Create_out.csv",IfDifferent=Warn)
```

The resulting table will be listed in the ***Tables*** area of the TSTool interface and clicking on the `TestTable` identifier will display the table similar to the following:

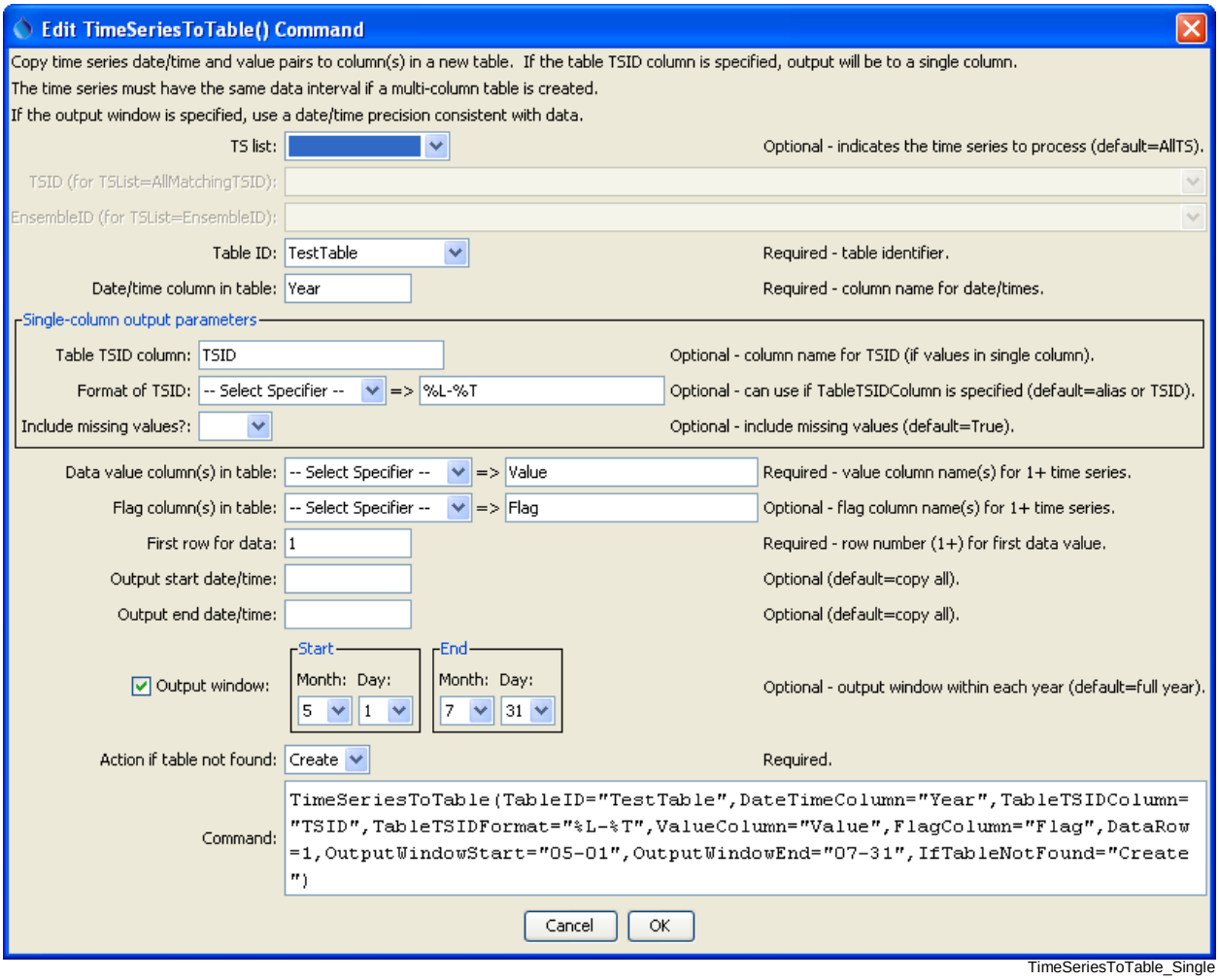


Year	ts1-Flow	ts1-Flow-flag	ts2-Flow	ts2-Flow-flag
1950			2.00	
1951			4.00	
1952			10.00	
1953			16.00	
1954				
1955			40.00	
1956			2.00	
1957			4.00	
1958			10.00	
1959			16.00	
1960	1.00			
1961	2.00		40.00	
1962	5.00		2.00	
1963	8.00		4.00	
1964			10.00	
1965	20.00		16.00	
1966	1.00			
1967	2.00		40.00	
1968	5.00		2.00	
1969	8.00		4.00	

TimeSeriesToTable2

Multi-Column Data Table

The following example illustrates how to create a single data column table. Because a single column is being used for data, the data value and corresponding data flag column names are specified literally (not as time series properties). The column and format for the TSID also must be specified.



TimeSeriesToTable_Single

TimeSeriesToTable() Command Editor to Create Single Data Column Table

The resulting table is as shown in the following figure:

TSTool - Table "TestTable"

Year	TSID	Value	Flag
2000-05-01	ts1-Flow	-2.00	b
2000-05-02	ts1-Flow	3.00	
2000-05-03	ts1-Flow	-4.00	d
2000-05-04	ts1-Flow	5.00	e
2000-05-05	ts1-Flow		
2000-05-06	ts1-Flow	7.00	
2000-05-07	ts1-Flow	-8.00	h
2000-05-08	ts1-Flow	9.00	i
2000-05-09	ts1-Flow	-10.00	j
2000-05-10	ts1-Flow	11.00	l
2000-05-11	ts1-Flow	-12.00	m
2000-05-12	ts1-Flow	1.00	a
2000-05-13	ts1-Flow	-2.00	b
2000-05-14	ts1-Flow	3.00	
2000-05-15	ts1-Flow	-4.00	d
2000-05-16	ts1-Flow	5.00	e
2000-05-17	ts1-Flow		
2000-05-18	ts1-Flow	7.00	
2000-05-19	ts1-Flow	-8.00	h
2000-05-20	ts1-Flow	9.00	i
2000-05-21	ts1-Flow	-10.00	j

Displaying 664 rows, 4 columns. Ready

TimeSeriesToTable_Single2

Single Data Column Table

Command Reference: VariableLagK()

Lag and attenuate (route) a time series with parameters that vary by rate

Version 10.00.01, 2011-05-15

The `VariableLagK()` command can be used to lag and attenuate an input time series, resulting in a new time series. The command is commonly used to route an instantaneous flow time series through a stretch of river (reach). `Lag` and `K` routing is a common routing method that combines the concepts of:

1. Lagging the inflow to simulate travel time in a reach and,
2. Attenuating the wave to simulate the storage-outflow relationship for the reach (see **Figure 1**).

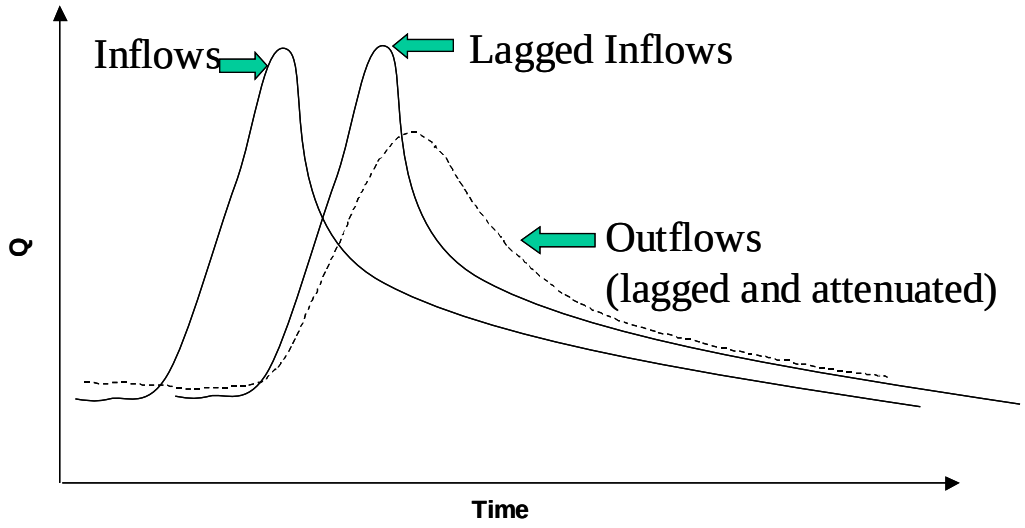


Figure 1: Lag and K Routing

At its fundamental level, the method solves the continuity equation using an approach similar to Muskingum routing (assuming that the Muskingum parameter representing wave storage is negligible). The governing equation for this routing method is given as:

$$Q_{in} - Q_{out} = \frac{\Delta S}{\Delta t}$$

where:

Q_{in} = instantaneous inflow [rate] lagged appropriately,
Q_{out} = instantaneous outflow [rate] lagged appropriately,
ΔS = change in storage in the reach [volume],
Δt = time difference.

The relationship assumes an outflow-storage relationship of the form:

$$S = k \cdot Q_{out,}$$

where:

k = attenuation for the outflow [time].

To ensure accurate results, k should be larger or equal to $\Delta t/2$. For discrete time steps these relationships translate into:

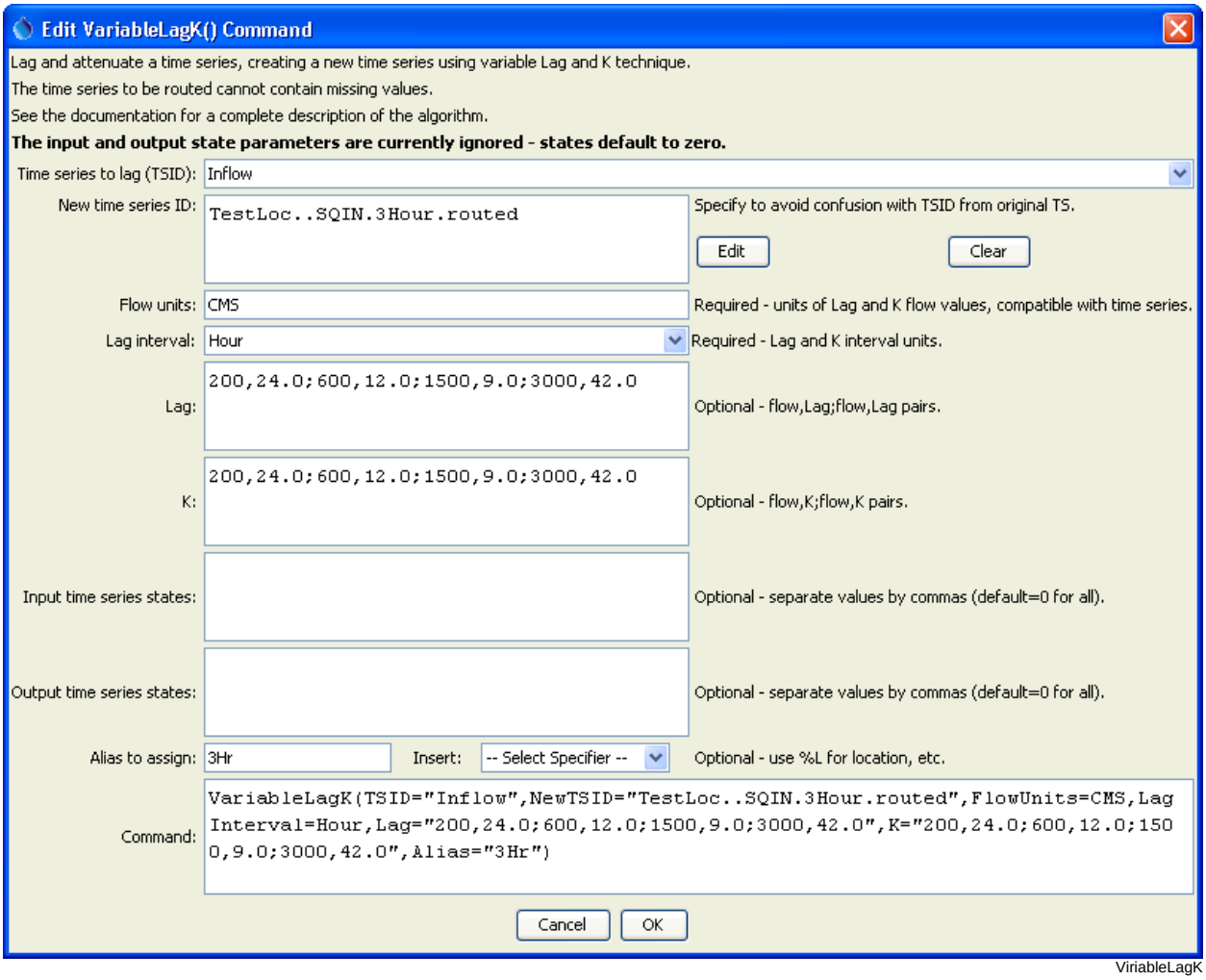
$$O_2 = \frac{I_1 + I_2 + \frac{2S_1}{\Delta t} - O_1}{\frac{2k}{\Delta t} + 1}, \qquad k \geq \frac{\Delta t}{2}$$

where: I_1 and I_2 are the lagged inflows into the reach at the previous and current time step, respectively,
O_1 and O_2 are the outflows out of the reach at the previous and current time step, respectively,
S_1 is the storage within the reach at the previous time step, defined as $S_1 = k \cdot O_1$, and
Δt is the time difference between the two time steps.

Values for `Lag` and `K` can usually be established by comparing routed flows to downstream observations. Alternatively, the `Lag` can be estimated using the reach length and wave speed in the reach. Without any other information, `K` can be set to `Lag/2`.

The above discussion applies where the Lag and K parameters are single values (as implemented in the `LagK()` command). However, there are cases where the values vary by flow, which is handled by this command. The approach that is implemented is an adaptation of that described in National Weather Service River Forecast System LAG/K documentation:
http://www.nws.noaa.gov/oh/hrl/nwsrfs/users_manual/part2/_pdf/24lagk.pdf.

The following dialog is used to edit the command and illustrates the syntax for the command:



ViriableLagK

VariableLagK() Command Editor

The command syntax is as follows:

```
VariableLagK(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSID`	Identifier or alias for the time series to be routed. It is assumed that this series describes an instantaneous flow. Due to the lagging, the first data values required for the computation of O_2 are not available within this time series and are therefore set to values set in the `InflowStates` parameter.	None – must be specified.
`NewTSID`	Identifier for the new (routed) time series. This is required to ensure that the internal identifier for the time series is unique and accurate for the data. The interval of the identifier must be the same as for the time series specified by `TSID`.	None – must be specified.

Parameter	Description	Default
FlowUnits	The units of the flow data specified in the Lag and K tables. These units must be compatible with the time series units. The table values will be converted to the time series units if the units are not the same.	None – must be specified.
LagInterval	The base interval for the time data specified in the Lag and K tables. The interval must be compatible with the time series base interval. The table values will be converted to the time series time interval if the intervals are not the same. For example, table data specified in Hour base interval will be converted to Minute if the time series being routed contains NMinute data.	None – must be specified.
Lag	Flow value and lag time pairs to control routing. The units of the data values are as specified by the FlowUnits parameter (see above). The units of the lag are time as specified by the LagInterval parameter. The Lag value is not required to be evenly divisible by the time step interval; values in the time series between time steps will be linearly interpolated. Use commas and semi-colons to separate values, for example: 100.0,10;200.0,20	None – must be specified.
K	Flow value and K time pairs to control routing. The attenuation factor K is applied to the wave. The units of K are time as specified by the LagInterval parameter. Use commas and semi-colons to separate values, for example: 100.0,5;200.0,10	None – must be specified.
InflowStates	Comma-delimited list of default inflow values prior to the start of the time series. The order of the values is earliest to latest. The array must specify (Lag/multiplier) + 1 values; i.e., a 10 minute interval with a LAG of 30 must be provided with 30/10 + 1 = 4 inflow carryover values. ***Note: Specifying values that are not consistent with the Lag and K parameters will result in oscillation!***	0 for each value CURRENTLY ALWAYS DEFAULT
OutflowStates	Comma-delimited list of default outflow values prior to the start of the time series. See InflowStates for details.	0 for each value CURRENTLY ALWAYS DEFAULT
Alias	The alias that will be assigned to the new time series.	No alias will be assigned.

A sample command file is as follows (commands to read time series are omitted):

```
# Test routing at 3 hour interval
StartLog(LogFile="Results/Test_VariableLagK_3hr.TSTool.log")
# Read NWSCard input file
ReadNwsCard(InputFile="Data\3HR_INPUT.SQIN",Alias=”Inflow”)
#
# Route using the same routing parameters used in the mcp3 input deck
# (metric units: Lag(hrs) K(hrs) Q(cms)
# Lag
# K
#    24.0   200.0    12.0  600.00     9.0  1500.0    42.0  3000.0
#    24.0   200.0    12.0  600.00     9.0  1500.0    42.0  3000.0
#
VariableLagK(TSID="Inflow",NewTSID="TestLoc..SQIN.3Hour.routed",DataUnits=CMS,
    LagInterval=Hour,Lag="200,24.0;600,12.0;1500,9.0;3000,42.0",
    K="200,24.0;600,12.0;1500,9.0;3000,42.0",Alias="3Hr")
```

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Command Reference: WebGet()

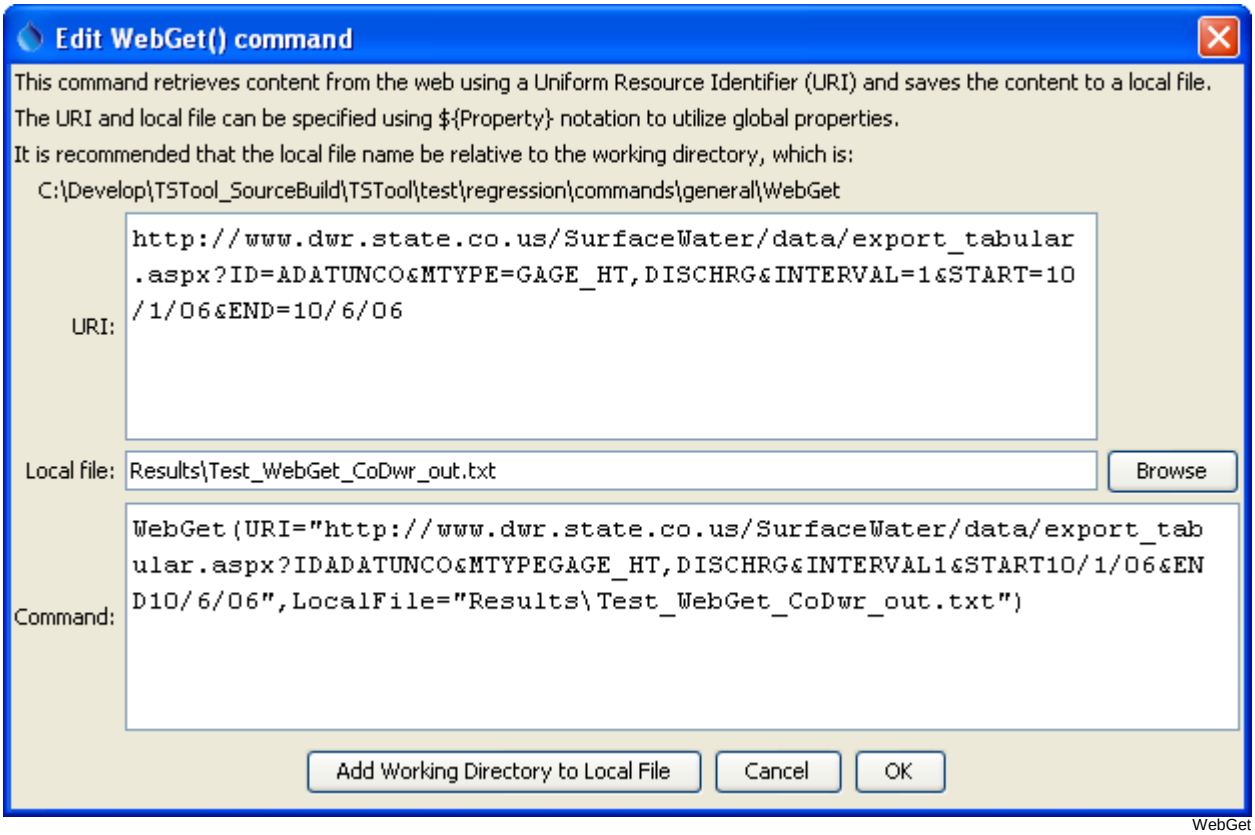
Retrieve a file from a website

Version 10.01.00, 2011-11-15

The `WebGet()` command retrieves content from a website and writes the content to a local file. The transfer occurs using binary characters and the local copy is the same as that shown by ***View…Source*** (or ***View…Page Source***) in the web browser. This command is useful for mining time series data and other content from data provider web sites. The local file can then be processed with additional commands such as `ReadFromDelimitedFile()`.

Extraneous content (such as HTML markup around text) and inconsistencies in newline characters (`\r\n` for windows and `\n` on other systems) may lead to some issues in processing the content. Additional command capabilities may be implemented to help handle these issues.

The following dialog is used to edit the command and illustrates the syntax for the command. This example reads stream gage data from the State of Colorado's website.



WebGet

WebGet() Command Editor

The command syntax is as follows:

```
WebGet(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
URI	The Uniform Resource Identifier (URI) for the content to be retrieved. This is often also referred to as the Uniform Resource Locator (URL). Global properties can be used with the ${Property} syntax.	None – must be specified.
LocalFile	The local file in which to save the content. Global properties can be used with the ${Property} syntax.	None – must be specified.

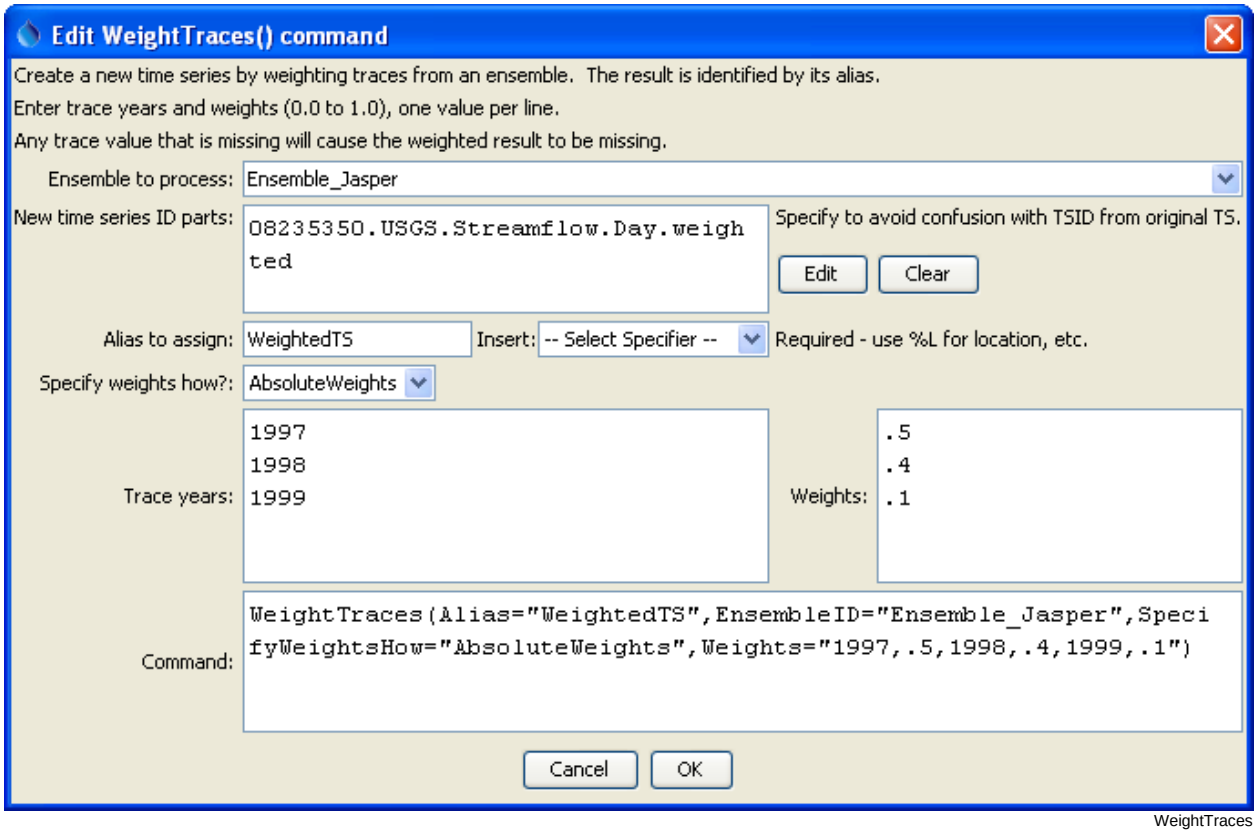
Command Reference: WeightTraces()

Create a time series by weighting data from time series ensemble traces

Version 10.00.00, 2011-03-28

The `WeightTraces()` command creates a new time series as a weighted sum of time series ensemble traces, for example as produced by a `CreateEnsemble()` command. If any trace contains missing data for a point, the resulting time series value will also be missing. Note that this approach may not be appropriate for some analyses – the user should evaluate the implications of whether the weighted result appropriately reflects the (in)dependence of input data.

The following dialog is used to edit the command and illustrates the syntax of the command.



WeightTraces

WeightTraces() Command Editor

The command syntax is as follows:

```
WeightTraces(Parameter=Value,…)
```

The following older command syntax is updated to the above syntax when a command file is read:

```
TS Alias = WeightTraces(Parameter=Value,…)
```

Command Parameters

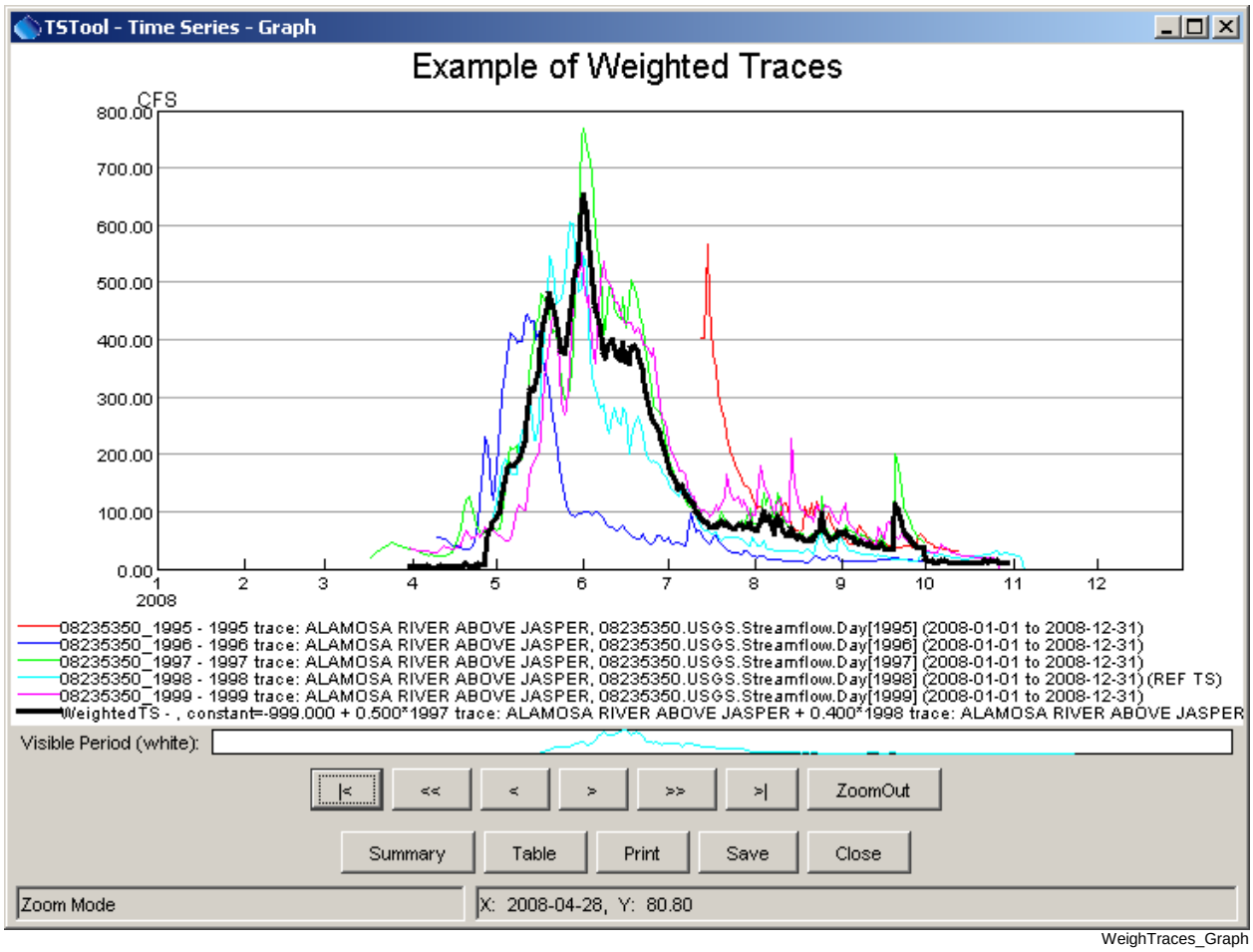
Parameter	Description	Default
`EnsembleID`	The ensemble identifier indicating time series to be processed (e.g., from a `CreateEnemble()` command). Time series matching the years specified by the `Weights` parameter will be processed.	None – must be specified.
`NewTSID`	The time series identifier for the new time series that is created. This typically uses the same information as the original time series, with an added scenario.	None – must be specified.
`Alias`	The alias to assign to the time series, as a literal string or using the special formatting characters listed by the command editor. The alias is a short identifier used by other commands to locate time series for processing, as an alternative to the time series identifier (TSID).	None – must be specified.
`SpecifyWeightsHow`	Weights are currently only applied as `AbsoluteWeights` (in the future an option may be added to normalized weights to `1.0` accounting for missing data in the traces).	Must be `AbsoluteWeights`.
`Weights`	Specify pairs of trace year and weights (0-1.0), used to create the new time series. Trace years must be manually entered because at the time that the command is edited, time series have not yet been queried. The weights do not need to add to 1. Example data are: `1995,.5,1998,.3,2005,.2`	None – must be specified.

A sample commands file is as follows (longer commands that wrap are shown indented):

```
# Create annual traces from a time series shifted to the current year
# The original time series is read from HydroBase
#
# (1995-1998) ALAMOSA RIVER ABOVE JASPER, CO  USGS  Streamflow  Day
08235350.USGS.Streamflow.Day~HydroBase
CreateEnsemble(TSID="08235350.USGS.Streamflow.Day",TraceLength=1Year,
  EnsembleID="Ensemble_Jasper",
  EnsembleName="ALAMOSA RIVER ABOVE JASPER, CO",
  ReferenceDate="2008-01-01",ShiftDataHow=ShiftToReference)
WeightTraces(Alias="WeightedTS",EnsembleID="Ensemble_Jasper",
  SpecifyWeightsHow="AbsoluteWeights",
  Weights="1997,.5,1998,.4,1999,.1",
  NewTSID="08235350.USGS.Streamflow.Day.weighted")
WriteDateValue(OutputFile="Results/WeightTraces_out.dv")
```

UserManualExamples/TestCases/CommandReference/WeightTraces/WeightTraces.TSTool

The results from the commands are shown in the following graph:



WeighTraces_Graph

Results of the WeightTraces() Command

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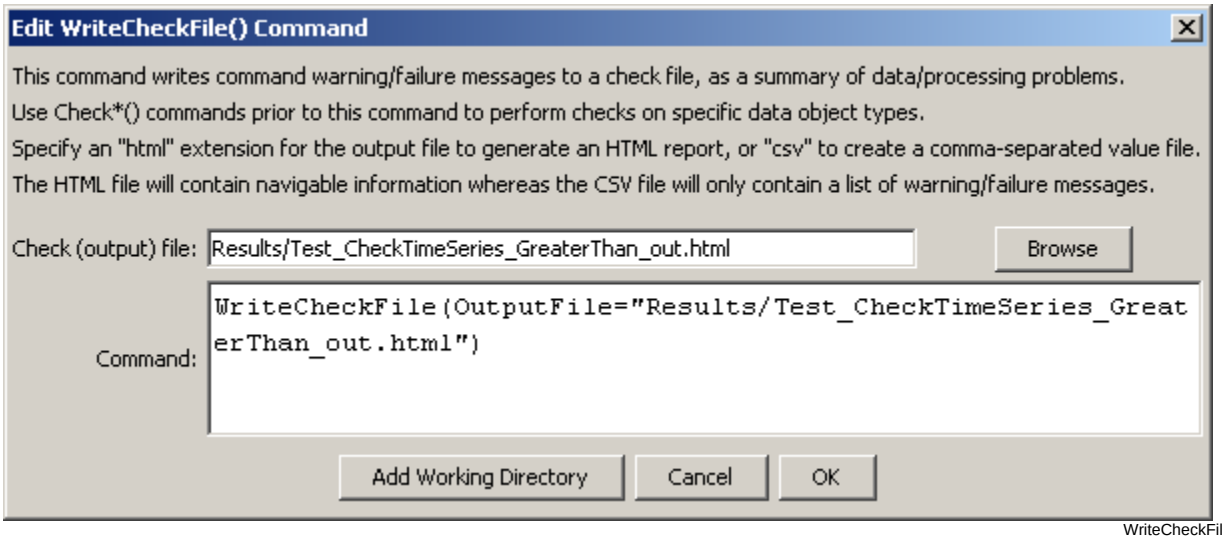
Command Reference: WriteCheckFile()

Write a check file containing a summary of data/processing problems

Version 09.03.04, 2009-04-23

The `WriteCheckFile()` command summarizes the results of command processing warning/failure messages in a "check file". This file is useful for reviewing results and for quality control. The check file is essentially a persistent record of any problems that occurred during processing, whereas a full log file contains a sequential list of processing.

The following dialog is used to edit the command and illustrates the syntax for the command.



WriteCheckFile

WriteCheckFile() Command Editor

The command syntax is as follows:

```
WriteCheckFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputFile`	The name of the check file to create, enclosed in double quotes if the file contains spaces or other special characters. A path relative to the command file containing this command can be specified. Specify a filename with *.html* extension to generate an HTML file or *.csv* to generate a comma-separated value file suitable for use with Excel. The HTML file will contain more information and include navigation links.	None – must be specified.

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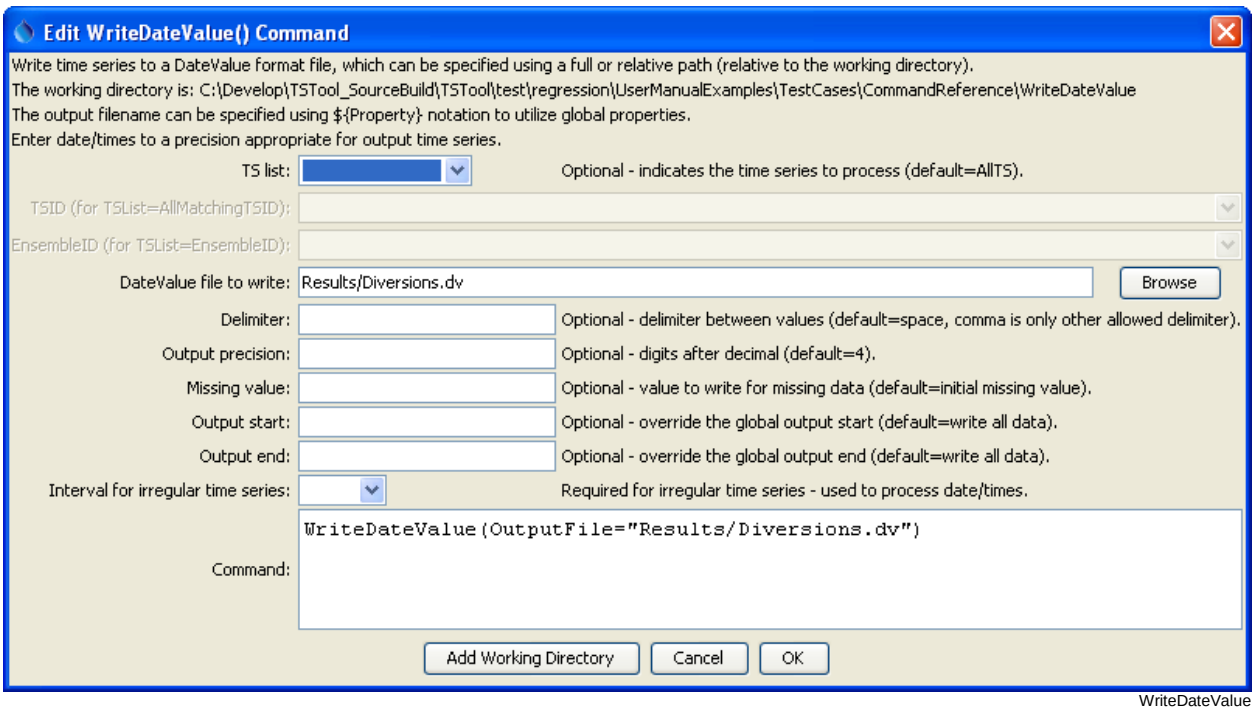
Command Reference: WriteDateValue()

Write time series to a DateValue format file

Version 10.06.00, 2012-04-05

The `WriteDateValue()` command writes time series to the specified DateValue format file. See the **DateValue Input Type Appendix** for more information about the file format. The time series being written must have the same data interval – use the `TSList` parameter to select appropriate time series.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteDateValue

WriteDateValue() Command Editor

The command syntax is as follows:

```
WriteDateValue(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID	`AllTS`

Parameter	Description	Default
	with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`OutputFile`	The DateValue output file. The path to the file can be absolute or relative to the working directory (command file location). Global properties can be used to specify the filename, using the `${Property}` syntax.	None – must be specified.
`Delimiter`	The delimiter character to use between data values. Comma is the only other allowed value other than the default space and is recommended for irregular time series, which are output as blanks when date/times don't align with other time series.	Space.
`Precision`	The number of digits after the decimal for numerical output.	`4` (in the future may default based on data type)
`MissingValue`	The value to write to the file to indicate a missing value in the time series.	As initialized when reading the time series or creating a new time series, typically `-999`, `NaN`, or another value that is not expected in data.
`OutputStart`	The date/time for the start of the output.	Use the global output period.
`OutputEnd`	The date/time for the end of the output.	Use the global output period.
`Irregular Interval`	The interval (e.g., `Day`) used when writing irregular time series, to indicate the precision of date/times. This may be necessary when it is not possible to automatically determine the date/time precision. The date/time precision to format output is assumed to be `Minute` if unknown; however, specifying the irregular interval will inform the data processing.	Determined from the period start date/time of each time series, defaulting to `Minute` where the date/time precision is set to "irregular" (unknown).

A sample command file to process data from the State of Colorado's HydroBase database is as follows:

```
# 0100503 - RIVERSIDE CANAL
0100503.DWR.DivTotal.Month~HydroBase
WriteDateValue(OutputFile="Diversions.dv")
```

Command Reference: WriteHecDss()

Write time series to a HEC-DSS File

Version 09.03.00, 2009-04-10

The `WriteHecDss()` command writes time series to a HEC-DSS file. See the **HEC-DSS Input Type Appendix** for information about how time series properties are output to HEC-DSS files. Current limitations of the command are:

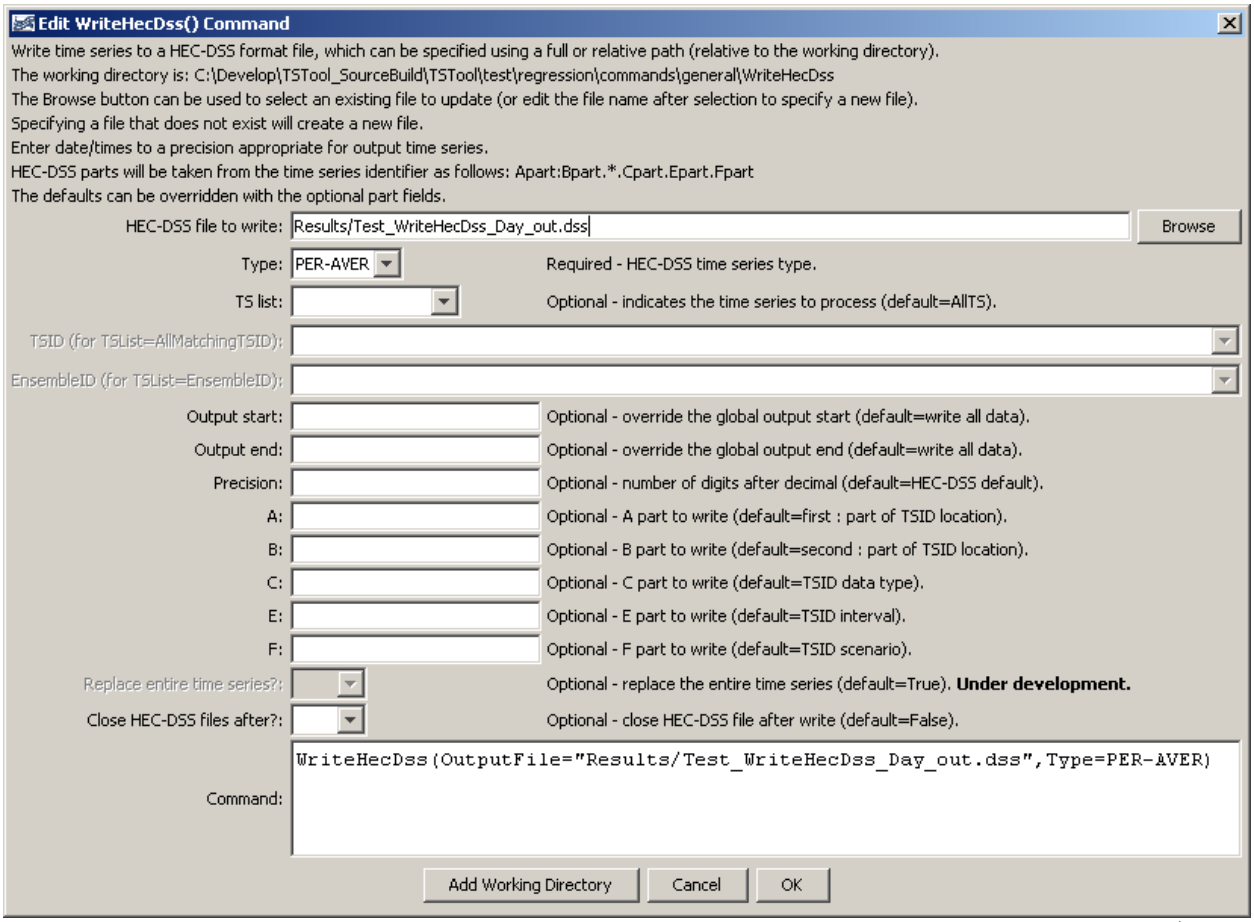
- Irregular time series are not supported – the focus of initial development has been regular interval time series.
- 24-hour time series in TSTool cannot be written to HEC-DSS because HEC-DSS only supports 1DAY interval. Therefore, the time series must be converted to a daily time series before writing. An option to convert 24-hour values to 1DAY may be added to this command in the future.
- HEC-DSS uses times through 2400. TSTool will convert this to 0000 of the next day. Year, month, and day data are not impacted. The internal TSTool values will be converted to hour 2400 when writing. Therefore, reading from a HEC-DSS file and then writing should result in no change in data.
- Time series that are written overwrite existing time series, but only for the period that is written. Therefore, previously written values may remain, even if not appropriate. A future enhancement will allow the option of removing the old data before writing new data. The work-around is to write a period that is sufficiently long to guarantee that old data values do not remain in the file, or clear the file out with another tool such as DSSUTL before writing.
- Currently the connections to the HEC-DSS file will remain open after the write, in order to minimize performance degradation for multiple write commands. However, this will lock the HEC-DSS file so that other commands or programs cannot perform file manipulation, such as removing the file. The connections will automatically time out after several minutes. A future enhancement will ensure that the file connections can be closed.

The A-F parts of the HEC-DSS time series pathname by default are taken from the time series properties, as follows:

- The A and B parts are taken from the time series identifier location, where location should be defined as `A:B`.
- The C part is taken from the time series data type.
- The D part is taken from the time series period in memory or as defined by the output period.
- The E part is taken from the time series interval.
- The F part is taken from the time series identifier scenario.

These conventions can be overruled by specifying the parts explicitly with command parameters. The parameter values will apply to all time series being written.

The following dialog is used to edit the command and illustrates the syntax for the command.



WriteHecDss

WriteHecDss() Command Editor

The command syntax is as follows:

```
WriteHecDss(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputFile`	The name of the HEC-DSS file to write, surrounded by double quotes to protect whitespace and special characters. If the file does not exist it will be created.	None – must be specified.
`Type`	The HEC-DSS time series type, indicating whether the time series is instantaneous, mean, or accumulated.	None – must be specified.
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed.	`AllTS`

Parameter	Description	Default
	• `AllTS` – all time series before the command will be processed. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time selected with the `SelectTimeSeries()` command will be processed.	
`TSID`	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`OutputStart`	The date/time for the start of the output.	Use the global output period or write all available data.
`OutputEnd`	The date/time for the end of the output.	Use the global output period or write all available data.
`Precision`	The number of digits after the decimal for numerical output.	`HEC-DSS` default.
`A`	The DSS path A-part to use for the time series as written to the HEC-DSS file.	Time series identifier location part before the : (if : is present) or the entire location if : is not present.
`B`	The DSS path B-part to use for the time series as written to the HEC-DSS file.	Time series identifier location part after the : (if : is present) or the blank if : is not present.
`C`	The DSS path C-part to use for the time series as written to the HEC-DSS file.	Time series identifier data type.
`E`	The DSS path E-part to use for the time series as written to the HEC-DSS file.	Time series identifier data interval, converted to HEC-DSS conventions.
`F`	The DSS path F-part to use for the time series as written to the HEC-DSS file.	Time series identifier scenario.
`Replace`	**Under development** – whether to replace the contents of the previous time series in the HEC-DSS file.	Only replace what is actually written.
`Close`	Indicate whether to close connections to the HEC-DSS file and allow other processes to move/rename/delete the file. Specifying as `True` may slow the software as files are repeatedly opened and closed.	`False` – let the HEC-DSS internal software close the connection after timing out.

A sample command file is as follows:

```
WriteHecDss(OutputFile="sample.dss",TYPE=PER-AVER,
  OutputStart="1992-01-01",OutputEnd="1992-12-31")
```

Command Reference: WritePropertiesToFile()

Write one or more time series processor properties to a file

Version 10.12.00, 2012-07-27

The `WritePropertiesToFile()` command writes the value of one or more time series processor properties to a file (this command replaces the older `WriteProperty()` command, which is being phased out). The `ReadPropertiesFromFile()` command can be used to read properties from a file. Processor properties include global defaults such as `InputStart`, `InputEnd`, `OutputStart`, `OutputEnd`, `OutputYearType`, `WorkingDir`, and also user-defined properties set with the `SetProperty()` command. Internally, properties have a name and a value, which is of a certain type (string, integer, date/time, etc.). Examples of using the command include:

- creating tests to verify that properties are being set
- passing information from TSTool to another program, such as a Python script
- storing persistent information for later use, such as the date/time that data were last downloaded from a web service

A number of property formats are supported as listed in the following table.

Property File Formats

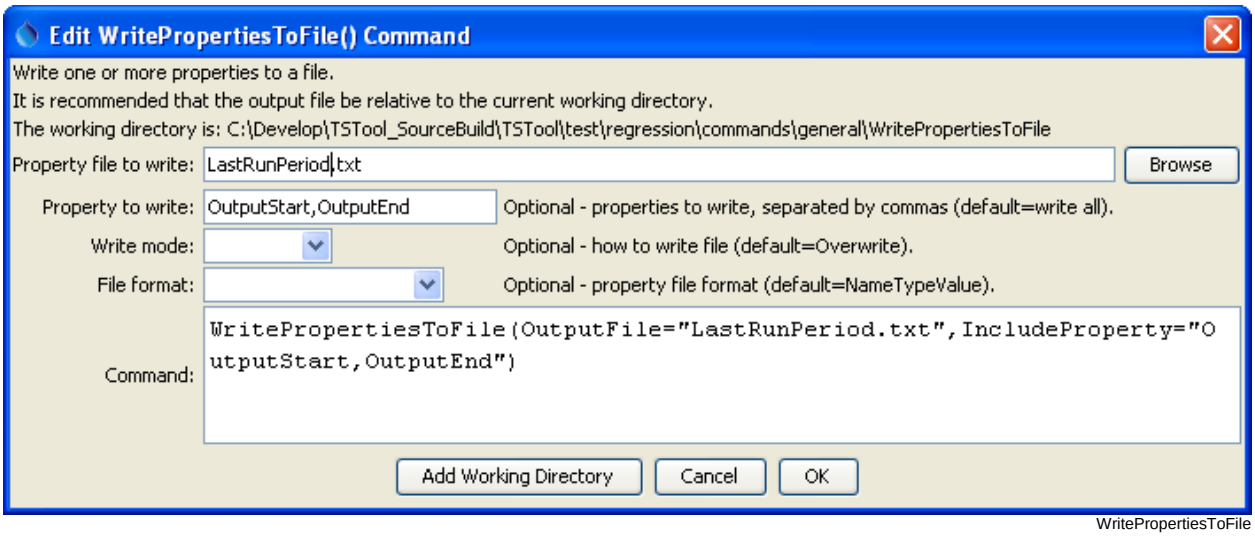
Format	Description

`NameValue`	Simple format, all properties handled as text:
	`PropertyName=PropertyValue`
	`PropertyName="Property value, quoted if necessary"`

`NameTypeValue`	Same as `NameValue` format, with non-primitive objects treated as simple constructors:
	`PropertyName=PropertyValue`
	`DateTimeProperty=DateTime("2010-10-01 12:30")`

`NameTypeValue Python`	Similar to the `NameTypeValue` format, however, objects are represented using "Pythonic" notation, to allow the file to be used directly by Python scripts:
	`PropertyName="PropertyValue"`
	`DateTimeProperty=DateTime(2010,10,1,12,30)`

The following dialog is used to edit this command and illustrates the syntax of the command.



WritePropertiesToFile

WritePropertiesToFile() Command Editor

The command syntax is as follows:

```
WritePropertiesToFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputFile`	The property file to write, as an absolute path or relative to the command file.	None – must be specified.
`IncludeProperty`	The names of properties to write, separated by commas.	If not specified, all processor properties will be written.
`WriteMode`	Indicates how the file should be written: • `Append` – append the properties to the file without checking for matches (create the file if it does not exist) • `Overwrite` – overwrite the properties file • `Update` – update the properties in the file by first checking for matching property names (which will be updated) and then appending unmatched properties (**not yet implemented**)	`Overwrite`
`FileFormat`	Format of the properties file (see descriptions in the above **Property File Formats** table): • `NameValue` • `NameTypeValue` • `NameTypeValuePython`	`NameValue`

Command Reference: WriteProperty()

Write a time series processor property to a file

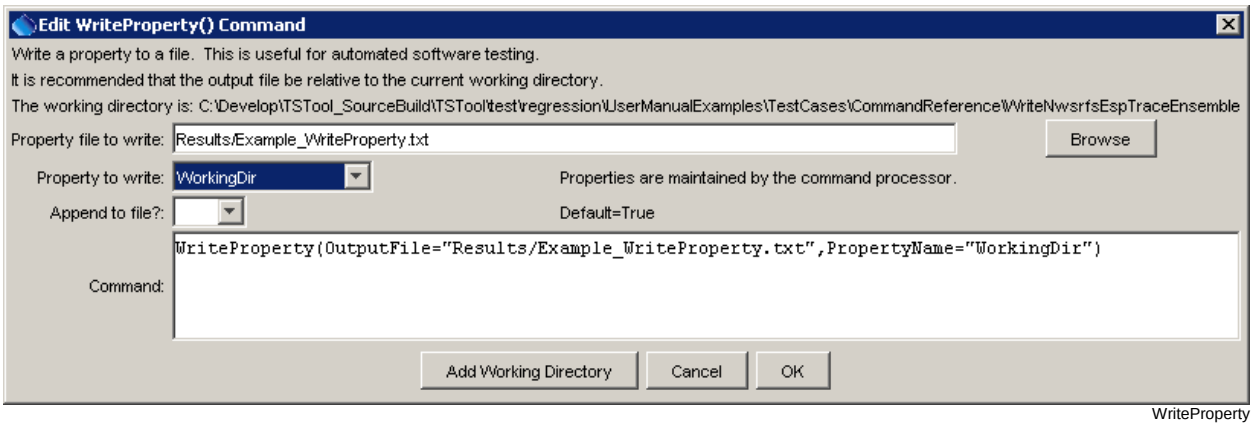
Version 10.12.00, 2012-07-30

This command has been replaced with the `WritePropertiesToFile()` command and will be removed from the software in a future release.

The `WriteProperty()` command writes the value of a time series processor property to a file. This is useful for testing that properties are being set. It could also be used to pass information from TSTool to another program. The format of the output is:

```
Property="Value"
```

The following dialog is used to edit this command and illustrates the syntax of the command.



WriteProperty

WriteProperty() Command Editor

The command syntax is as follows:

```
WriteProperty(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`OutputFile`	The property file to write, as an absolute path or relative to the command file.	None – must be specified.
`PropertyName`	The property name to write	None – must be specified.
`Append`	Indicates whether the property should be appended to the file (`True`) or overwrite the file (`False`).	`True`

A sample command file is as follows:

```
WriteProperty(OutputFile="Results/Example_WriteProperty.txt",
  PropertyName="WorkingDir")
```

Command Reference: WriteReclamationHDB()

Write a time series to a Reclamation HDB database

Version 10.20.00, 2013-04-21

The `WriteReclamationHDB()` command writes time series to a Reclamation HDB database:

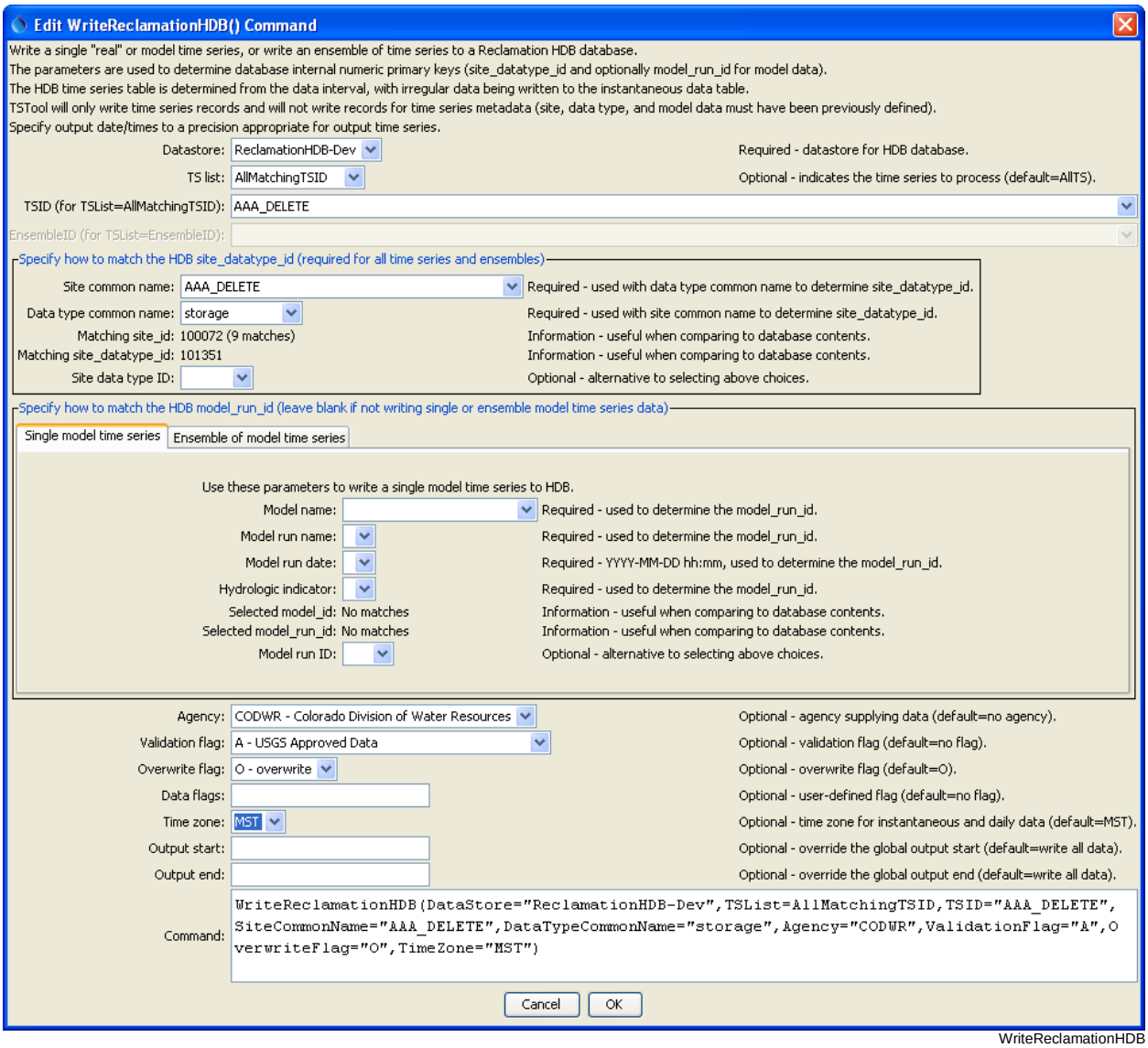
- a single time series (which can be part of an ensemble), indicated by the individual time series identifier:
  - a "real" time series (observations)
  - a "model" time series (output from a model)
- all time series in an ensemble, indicated by the ensemble identifier:
  - ensemble trace time series are stored as "model" time series (individual ensemble trace time series can then be read as single time series by specifying the appropriate "hydrologic indicator", which is set to the ensemble time series sequence number from TSTool time series)

See the `ReadReclamationHDB()` command documentation for information about reading the time series that are written by this command. See the **Reclamation HDB Data Store Appendix** for more information about the database features and limitations. Command functionality includes:

- **Time series metadata/new time series:**
  - The command will not define a new time series (site and model data). It is expected that time series previously have been defined in the database. This ensures that TSTool can perform error handling and users do not accidentally load new time series.
  - The exception is that new ensembles and corresponding trace time series can be defined by specifying ensemble name, trace number, and model run date.
- **Date/time handling**:
  - TSTool uniformly uses the time at the end of the recorded interval for data values (instantaneous time or end of interval for mean and accumulated values), whereas HDB uses the time at the beginning of the recorded interval for hourly data. See the ***ReclamationHDB Datastore*** appendix for more information.
  - Writing NNour data uses `WRITE_TO_HDB` procedure where the `SAMPLE_END_DATETIME` is set to the TSTool date/time and `SAMPLE_DATE_TIME` is set the TSTool date/time minus NHour.
  - Writing other than NHour data uses the `WRITE_TO_HDB` procedure with `SAMPLE_DATE_TIME` passed as the same value as the TSTool date/time.
- **Updating time series records:**
  - Time series data records for an existing time series will be updated if previously written.
- **Missing data**:
  - Missing data currently are not written. By convention missing values in HDB are simply not included in the database. Currently the command will not delete previous records if the new value at a date/time is missing.
- **Data units**:
  - Data units in the time series are not checked against data units in the database because the units in TSTool data may originally have come from various sources that do not use the same units abbreviations as HDB. It is the user's responsibility to ensure that time series that are being written have units that are compatible with HDB.
- **Data flags**:

    - Data flags from the time series are not written to the database. The `ValidationFlag`, `OverwriteFlag`, and `DataFlags` parameters are provided to specify HDB flags. Additional capability may be added in the future.
- **Time zone**:
    - Time zone can be indicated in TSTool time series by including in the start and end date/time information; however, time zones are difficult to standardize when data comes from different sources. The default time zone for HDB is configured for the Reclamation office that uses the database. If the time series time zone is different from the default (displayed in the note for the `TimeZone` command parameter in the command editor), it can be specified as a command parameter. It is the user's responsibility to verify that the correct time zone is being used.
- **HDB data table**:
    - The time series interval is used to determine the HDB time series table to write, with irregular data being written as instantaneous data with date/time precision to minute.
    - Irregular data also can be written to a specific output table by using the `IntervalOverride` parameter, for example in cases where a time series was read as irregular but should be treated as hourly in HDB.
    - TSTool treats year-interval data generically and does not manage water year (or other types of years) in special fashion, other than when processing data into year interval time series. Water year data can be saved in year interval data but currently there is no way to write to the water-year tables in HDB.
- **HDB database procedure**:
    - The HDB `WRITE_TO_HDB` stored procedure is used to write individual time series data records:
        - The time series is written to a model time series table if model parameters are specified.
        - The model run date, for single time series and ensembles, is truncated to minutes in time series identifiers and for query purposes.
    - When writing ensembles, the HDB procedure `ENSEMBLE.GET_TSTOOL_ENSEMBLE_MRI` is used to determine the model run identifier corresponding to model time series and then the `WRITE_TO_HDB` procedure (above) is used to write data records:
        - The ensemble name is determined from the `EnsembleName` parameter – existing names can be selected or a new name can be specified
        - The trace number is determined from the `EnsembleTraceID` command parameter, and will result in the trace being taken from specific time series properties.
        - The model name is determined from the `EnsembleModelName` parameter. Model names consistent with non-ensemble model time series are used.
        - The model run date is determined from the `EnsembleModelRunDate` parameter (if specified then the `P_IS_RUNDATE_KEY` procedure parameter is set to Y, if not specified N).

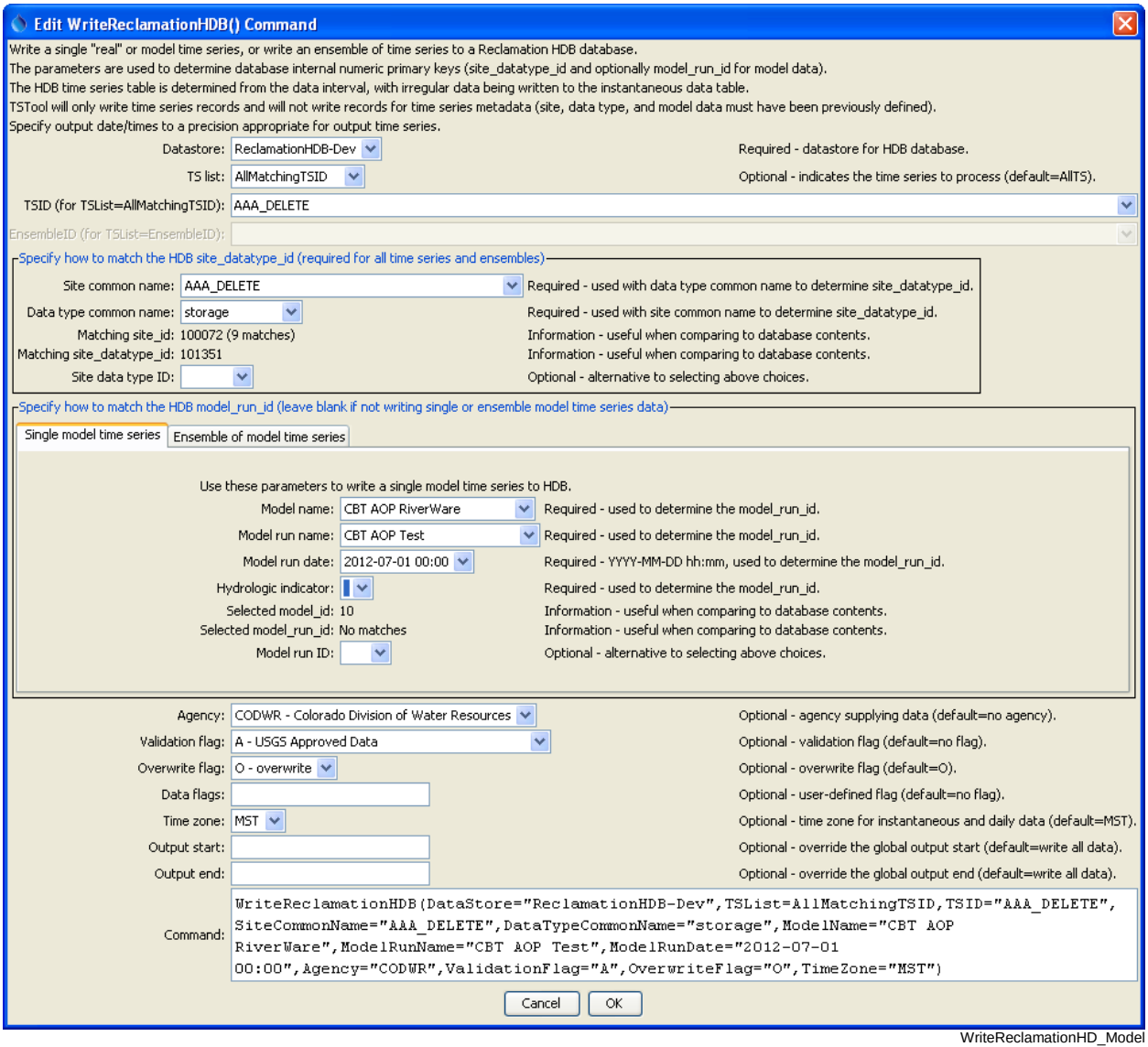
The following dialog is used to edit the command and illustrates the syntax of the command when writing "real" data, in which case model information is not specified.



WriteReclamationHDB

WriteReclamationHDB() Command Editor for "Real" Time Series

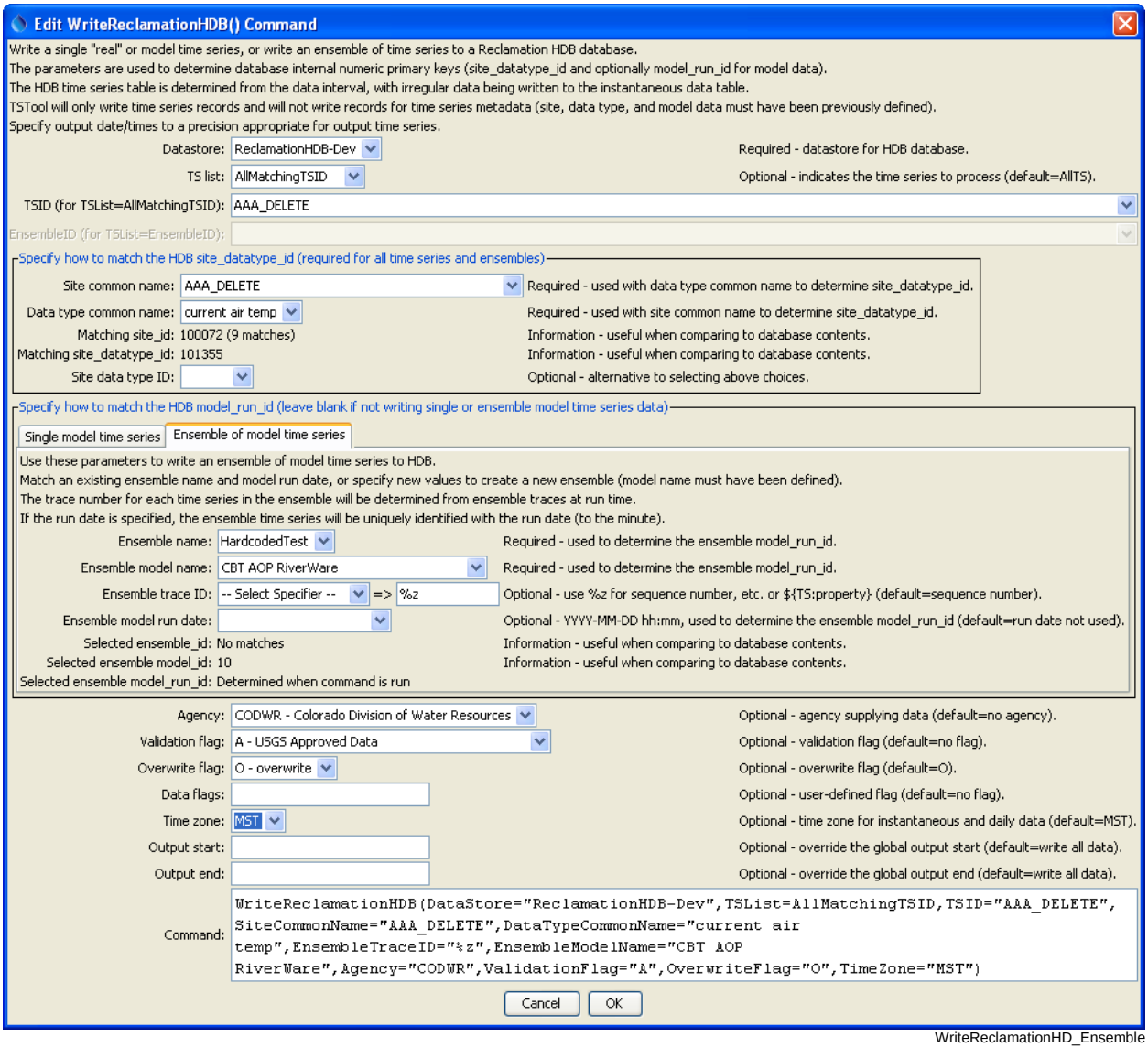
The following figure illustrates the syntax of the command when writing "model" data for a single time series, in which case the model parameters are specified via the ***Single model time series*** tab.



WriteReclamationHD_Model

WriteReclamationHDB() Command Editor for Single Model Time Series

The following figure illustrates the syntax of the command when writing an ensemble of "model" time series, in which case ensemble and related model parameters are specified via the ***Ensemble of model time series*** tab. The TSTool ensemble is specified with the `TSList=EnsembleID` and `EnsembleID` parameters.



WriteReclamationHD_Ensemble

WriteReclamationHDB() Command Editor for Ensemble of Model Time Series

The command syntax is as follows:

```
WriteReclamationHDB(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`DataStore`	The identifier for the ReclamationHDB data store to use for the database.	None – must be specified.
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The identifier for the TSTool ensemble to be processed, if processing an ensemble, not to be confused with the `Ensemble*` parameters below that match HDB data.	Required if `TSList=EnsembleID`.
`Site CommonName`	The site common name for the time series location; used with the data type common name to determine the site_datatype_id in the database.	None – must be specified unless `SiteDataTypeID` is specified.
`DataType CommonName`	The data type common name for the time series; used with the site common name to determine the site_datatype_id in the database.	None – must be specified unless `SiteDataTypeID` is specified.
`SiteDataTypeID`	The site_datatype_id value to match the time series. If specified, the value will be used instead of the site_datatype_id determined from `SiteCommonName` and `DataTypeCommonName`.	
	Use the following parameters when reading a single model time series.	
`ModelName`	The model name for the time series; used with the model run name, hydrologic indicator(s), and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunName`	The model run name for the time series; used with the model name, hydrologic indicator(s), and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunDate`	The model run date (timestamp) to use for the time series;	None – must be

Parameter	Description	Default
	used with the model name, model run name, and hydrologic indicator(s) to determine the model_run_id in the database. The run date should be specified using the format `YYYY-MM-DD hh:mm` (zero-padded with hour 0-23, minute 0-59, seconds and hundredths of seconds will default to 0). **Need to implement tests to make sure this is properly handled, including formatting and listing existing values**.	specified unless `ModelRunID` is specified.
`Hydrologic Indicator`	The hydrologic indicator(s) to use for the time series; used with the model name, model run name, and model run date to determine the model_run_id in the database.	None – must be specified unless `ModelRunID` is specified.
`ModelRunID`	The model_run_id value to match the time series. If specified, the value will be used instead of the model_run_id determined from `ModelName`, `ModelRunName`, `ModelRunDate`, and `HydrologicIndicator.`	
	Use the following parameters when writing an ensemble of model time series.	
`EnsembleName`	The name of the ensemble to write. The `TSList=EnsembleID` and `EnsembleID` parameters also should be specified.	Must be specified if writing an ensemble.
`EnsembleModelName`	The model name corresponding to the ensemble.	Must be specified if writing an ensemble.
`EnsembleTraceID`	Indicate how to identify time series trace identifiers: • `%X` – use standard time series properties to format the ensemble trace ID (see command editor for format characters) • `${TS:property}` – format the trace identifier from time series properties (e.g., properties read from original ensemble data) TSTool and the HDB `GET_TSTOOL_ENSEMBLE_MRI` procedure currently require the identifier to be an integer – additional options for identifying traces may be added in the future.	The time series sequence number (equivalent to the `%z` formatting string)
`EnsembleModel RunDate`	When writing an ensemble, the model run date for the ensemble, specified using format: • `YYYY-MM-DD hh:mm` (zero-padded with hour 0-23) • `${ts:property}` – use a run date from a time series property, truncated to minute **Need to implement tests to make sure this is properly handled, including formatting and listing existing values**.	If not specified, the ensemble identifier in HDB will not include the model run date.
	The following parameters are always appropriate.	
`Agency`	The agency abbreviation (e.g., `USBR`) for data records written to the database.	No agency is indicated in database.
`Validation`	HDB validation flag. Only uppercase characters are	No flag is used.

Parameter	Description	Default
`Flag`	supported.	
`OverwriteFlag`	HDB overwrite flag.	Overwrite (enforced by HDB stored procedure)..
`DataFlags`	User-defined flags, up to 20 characters.	No flags are used.
`TimeZone`	Three-letter time zone abbreviation for the data records written to the database.	Default HDB time zone is assumed.
`OutputStart`	The date/time for the start of the output.	Use the global output period.
`OutputEnd`	The date/time for the end of the output.	Use the global output period.

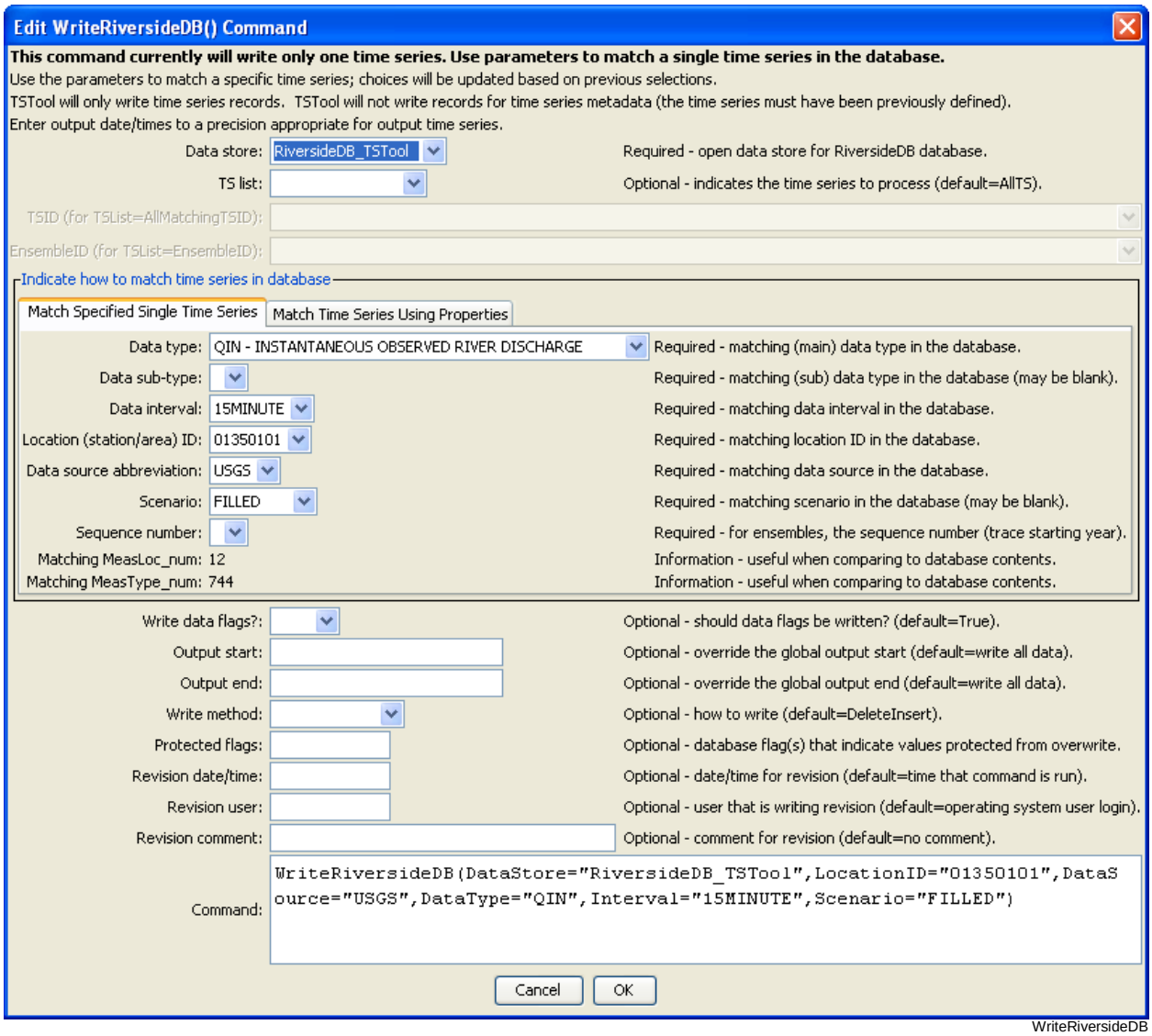
Command Reference: WriteRiversideDB()

Write time series to a RiversideDB database

Version 10.06.00, 2012-04-15

This command is under development – please provide feedback to developers. The `WriteRiversideDB()` command writes time series to a RiversideDB database. See the **RiversideDB Data Store Appendix** for more information about the database features and limitations. The command will not define a new time series but will replace or insert the data records for an existing time series. The current functionality allows a single time series to be written by matching a specific existing time series in the database; however, in the future time series properties may be used to write multiple time series with one command (e.g., use `%L` to match the location).

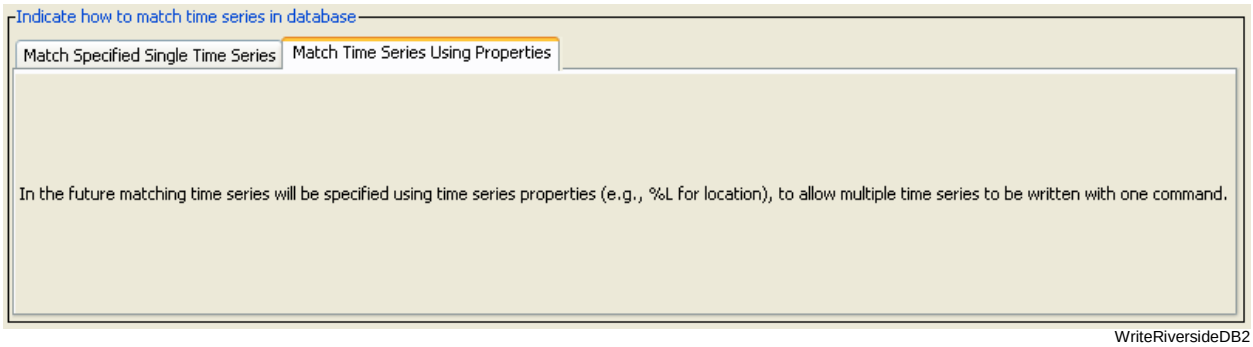
The following dialog is used to edit the command and illustrates the syntax of the command when writing a single time series to the database. In this case the choices are used to select a matching time series and only one time series can be in the list to process (otherwise a warning will result and nothing is written).



WriteRiversideDB

WriteRiversideDB() Command Editor when Matching/Writing a Single Time Series

The following figure illustrates use of the ***Match Time Series Using Properties*** tab, which is envisioned as a future enhancement. In this case, the parameter values do not match a specific time series in the database but instead use the properties from the list of time series being written to indicate how to match a time series in the database. For example, `DataType=%T` would use the data type from the time series to match the data type in the database and `Location=%L` would use the location identifier from the time series to match the location identifier in the database. Writing multiple time series requires fewer commands but the command editor will not be able to confirm that the time series are matched in the database (this can only occur when running the commands and data are actually processed).



WriteRiversideDB() Command Editor when Matching/Writing Multiple Time Series

The following technical issues apply when writing time series:

- Currently there is no authentication to prevent users from using this command. Options will be explored based on specific system requirements.
- Time series being written must have compatible units with the units of the time series in the database. The same units or conversion factor of 1.0 must be detected to allow writing.
- Missing values in time series are written as missing values (null) in the database. This allows missing values in the database to have flags.
    - Regular interval time series could be written in such a way that missing values are simply not written to the database. If this is required, then a new parameter `WriteMissingValues` could be added. However, tracking revisions might be difficult using this approach because older values would need more complex handling since no newer missing value record would be present.
    - Irregular interval time series in TSTool do not have missing value records unless they were specifically read from input.
- Irregular time series present challenges that may not be fully addressed with the current software features and may require additional enhancements. For example, `WriteMethod=TrackChanges` may not work properly if updates to irregular data have different date/times than the original values. In this case `WriteMethod=DeleteInsert` may be more appropriate; however, this does not check the `ProtectedFlags` parameter.

The command syntax is as follows:

```
WriteRiversideDB(Parameter=Value,…)
```

Command Parameters

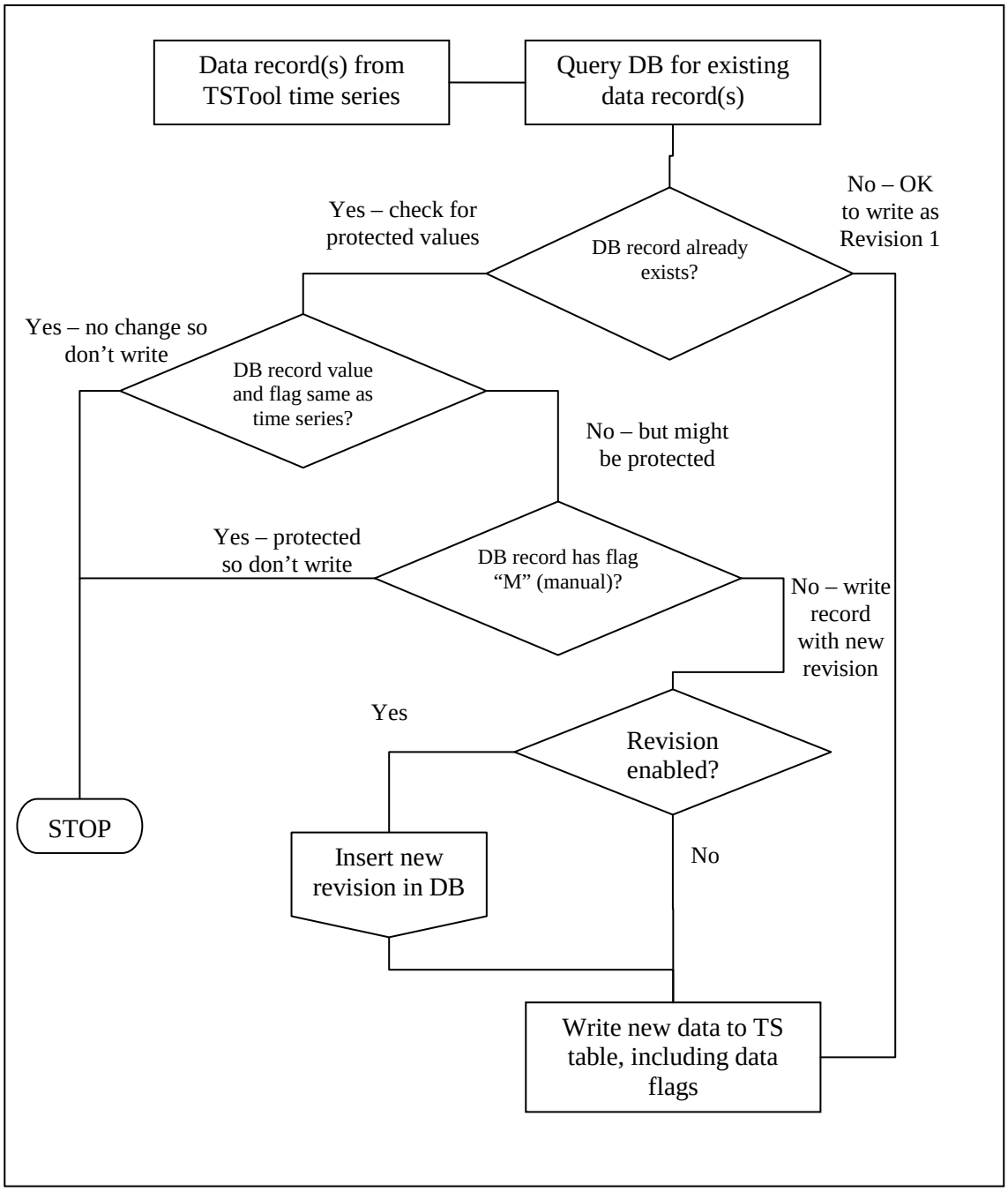
Parameter	Description	Default
`DataStore`	The identifier for the RiversideDB data store to use for the database.	None – must be specified.
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`WriteMode`	This parameter is envisioned if writing multiple time series is enabled in the future (currently only `WriteSingle` is enabled). Indicates how time series are being matched, one of: • `WriteSingle` (the only mode that is enabled), in which case the ***Match Specified Single Time Series*** tab is used to enter command parameters. • `WriteMultiple` (future enhancement), in which case the ***Match Time Series Using Properties*** tab is used to enter command parameters. Ensemble time series may fit into either of the above depending on how the sequence numbers are handled.	`WriteSingle`
`DataType`	The data type abbreviation in the database to match.	None – must be specified.
`DataSubType`	The data sub-type in the database to match (may be blank).	Not used if blank.
`Interval`	The data interval in the database to match.	None – must be specified.
`LocationID`	The location identifier in the database to match.	None – must be specified.
`DataSource`	The data source abbreviation in the database to match.	Not used if blank.
`Scenario`	The scenario in the database to match (may be blank).	Not used if blank.
`SequenceNumber`	Used for ensembles – the trace number, often the starting year of the trace (may be blank).	Not used if blank.
`WriteDataFlags`	Indicate whether data flags should be written.	`True`

Parameter	Description	Default
`OutputStart`	The date/time for the start of the output.	Use the global output period.
`OutputEnd`	The date/time for the end of the output.	Use the global output period.
`WriteMethod`	The approach for writing time series, one of: • `Delete` – delete the time series records but do not write the time series (useful for testing and database maintenance) • `DeleteInsert` – delete time series records and then insert. Revision data are not inserted into the database. • `TrackRevisions` – track revisions as per the logic described after this table.	None – must be specified.
`ProtectedFlags`	Indicate the flag values for database data records that should NOT be modified, when `WriteMethod=TrackRevisions`. Typically these records indicate that data have been validated and/or manually entered and automated processes should not overwrite the values. Currently only one flag value can be specified; however, multiple values or patterns may be supported in the future.	None – no data will be protected.
`ComparePrecision`	The number of digits after the decimal used when comparing previous database values with values in the time series. This may be required where input/output operations result in truncations or round-off.	4
`RevisionDateTime`	The date/time for a new revision, if needed, one of: • `CurrentToSecond` syntax – see `SetOuputPeriod()` command for more information. • `${Property}` – property value string • `YYYY-MM-DD hh:mm` or similar date/time string	Time from computer system clock at the time the command is run.
`RevisionUser`	User identifier for revisions. Currently this is NOT taken from the RiversideDB user table. `${Property}` notation can be used.	User's login from the operating system.
`RevisionComment`	Comment for revisions. `${Property}` notation can be used.	No comment.

Revision information will be utilized only if configured in the database. The time series data table must contain a Revision_num column and the Revision table must exist. The time series table layout information will indicate whether revision numbers are used. If `WriteMethod=DeleteInsert` and `RevisionComment` is provided, then all old data will be deleted (all revisions) and a new revision will be added corresponding to all inserted records. This ensures that the database size does not grow quickly. If `RevisionComment` is not specified, then a revision will not be added in the database (revision will be set to zero, which corresponds to the "original data" revision).

The following figure explains the logic when `WriteMethod=TrackRevisions`, which can be used when RiversideDB is configured with time series tables that use the Revision_num column. The following flow chart focuses on the case where a data record to write to the database (consisting of a date/time, a value, and a flag) already exists for the date/time. This indicates that this data record

previously has been written to the database. In this case, the existing data record in the database should be overwritten with the new record unless the existing record is flagged as protected (in this example, manually adjusted with `ProtectedFlags=M`). In this case, the manually adjusted value persists and can be overwritten only if the new data record also is flagged with `M`, indicating that an additional manual adjustment has occurred. The following figure illustrates the logic performed for each value. However, several steps are performed in bulk to improve performance.



Logic for Writing Time Series Values with Revisions (ProtectedFlags="M")

Revisions to existing data records are stored in the Revision table in RiversideDB. Original data records in the time series tables have a revision number of '1', which refers to the revision number '1' in the Revision table. Any time a new revision is needed due to changes in a data value, a new entry is created in the Revision table, populated with the pertinent information (date/time of revision, user, and a comment) and the corresponding revision number is assigned to the revised data record in the time series table. Revision numbers are not incremented for each data value but are incremented for the bulk database operation (similar to a commit in content management systems). Care should be taken in using `WriteRiversideDB()` commands in order to minimize the number of revisions that are tracked. For example, rather than relying on the default value for the `RevisionDateTime` command parameter, a better approach may be to define a property at the top of the command file using a `SetProperty()` command and then refer to that property when specifying the `RevisionDateTime` property. This will ensure that multiple `WriteRiversideDB()` commands in a single command file utilize the same revision information.

If a data revision is detected based on the logic in the above figure, the corresponding revision will be searched for in the Revision table. If not found, then a new revision record will be inserted into the Revision table and that information will be used in the time series data table.

Time Series Table

MeasType_num	Date_Time	Val	Revision_num	Quality_flag
1	2011-04-11 14:35	585.98	1	
1	2011-04-11 14:50	586.02	1	
1	2011-04-11 15:00	585.98	1	
1	2011-04-11 15:10	585.98	1	
1	2011-04-11 15:10	585.97	2	M
1	2011-04-11 15:15	585.99	1	
1	2011-04-11 15:15	585.98	3	M
1	2011-04-11 15:15	585.97	4	M
1	2011-04-11 15:25	586	1	

Revision Table

Revision_num	Date_Time	User	Comment
1			NO REVISION
2	2011-04-11 17:00	JP	Manual Change
3	2011-04-11 17:01	JP	Manual Change
4	2011-04-11 18:01	JP	Manual Change after review

TSTool commands that read RiversideDB time series, such as the `ReadRiversideDB()` command, sort time series data records by the Date_Time and revision number (Revision_num) prior to transferring the data into data objects. Consequently, the entry with the largest revision number for records at the same sensor (MeasType_num) and time (Date_Time) is used as the valid data record because the record will be processed last. In the above example, this is the record with Revision_num `4` and a value of `585.97`. This approach may result in performance degradation over time if many revisions are made to data values for the same date/time and consequently it may be appropriate to remove or archive very old revisions as part of database maintenance. The trade-off between performance and the ability to track revisions may vary between systems and in general there should be few revisions for the same data point because data loading will move forward through time without reloading the entire period.

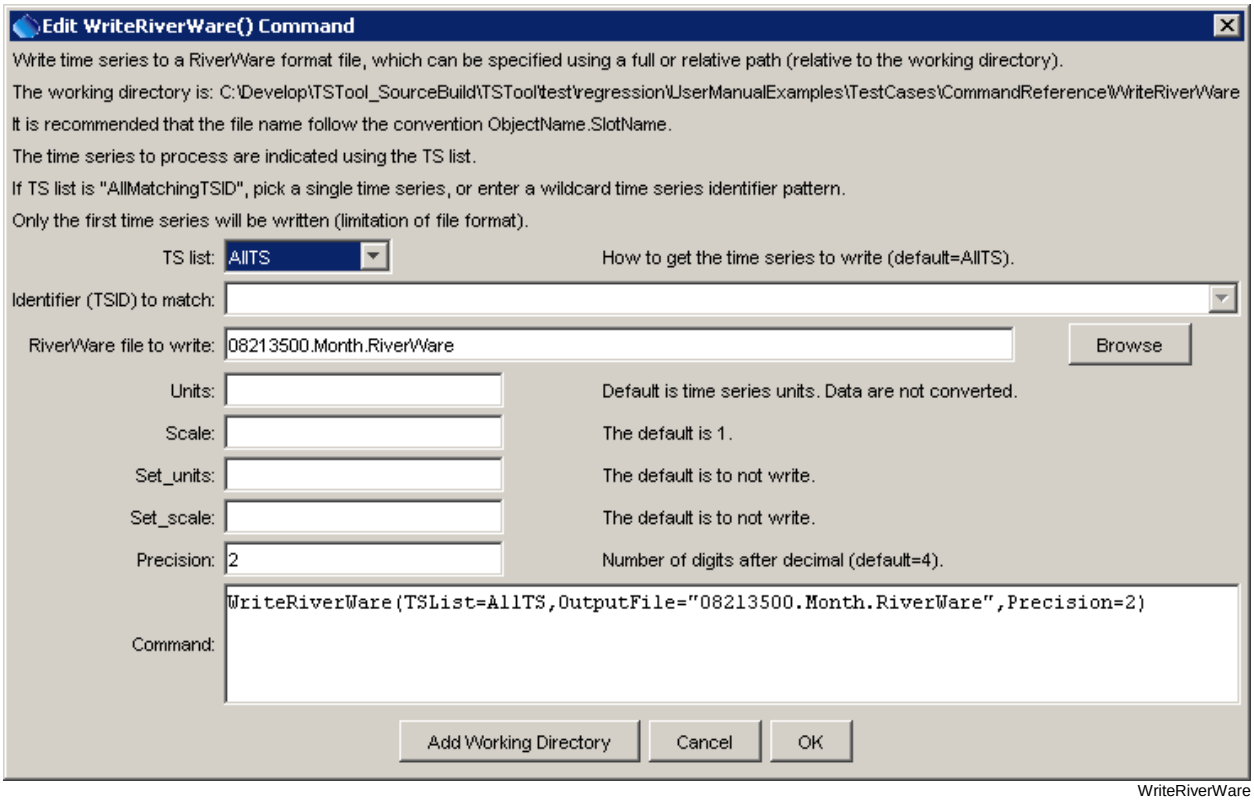
Command Reference: WriteRiverWare()

Write time series to a RiverWare format file

Version 08.15.00, 2008-05-12

The `WriteRiverWare()` command writes one time series to the specified RiverWare format file. See the **RiverWare Input Type Appendix** for more information about the file format.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteRiverWare

WriteRiverWare() Command Editor

The command syntax is as follows:

```
WriteRiverWare(Parameter=Value, …)
```

Command Parameters

Parameter	Description	Default
TSList	Indicate how to determine the list of time series to process (only first one is written), one of: ▪ AllMatchingTSID – process time series that have identifiers matching the TSID parameter. ▪ AllTS – process all the time series. ▪ SelectedTS – process the time series that are selected (see SelectTimeSeries()).	None – must be specified.
TSID	Used if TSList=AllMatchingTSID to indicate the time series identifier or alias for the time series to be filled. Specify * to match all time series or use a wildcard for one or more identifier parts.	Required if TSList=AllMatchingTSID.
OutputFile	The RiverWare file to write. The path to the file can be absolute or relative to the working directory. The ***Browse*** button can be used to select the file to write (if a relative path is desired, delete the leading path after the select).	None – must be specified.
Units	The data units to be output. Specify units that are recognized by RiverWare – the units are not actually converted but the new units string is used in the output file.	Use the units in the time series.
Scale	See the **RiverWare Input Type Appendix.**	1
Set_units	See the **RiverWare Input Type Appendix.**	Set_units are not output.
Set_scale	See the **RiverWare Input Type Appendix.**	Set_scale are not output.
Precision	The number of digits after the decimal to write.	4

A sample command file to write data from the State of Colorado's HydroBase is as follows:

```
# 08213500 - RIO GRANDE RIVER AT THIRTY MILE BRIDGE NEAR CREEDE
08213500.DWR.Streamflow.Month~HydroBase
WriteRiverWare(TSList=AllTS,OutputFile="08213500.Month.RiverWare",Precision=2)
```

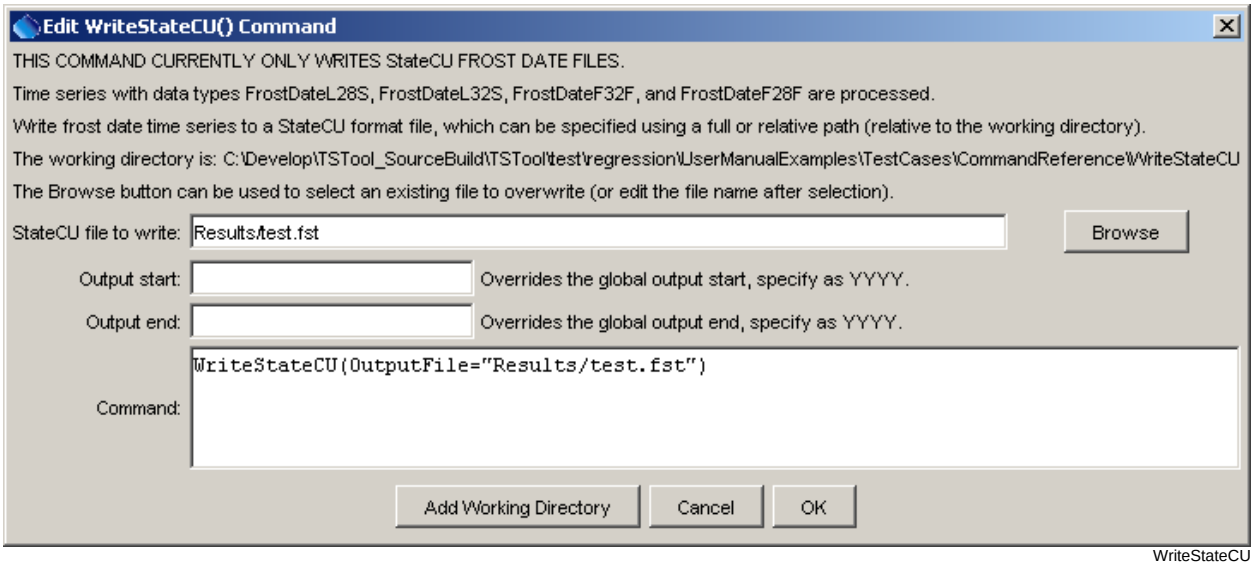
Command Reference: WriteStateCU()

Write time series to a StateCU format file

Version 08.16.04, 2008-09-04

The `WriteStateCU()` command writes time series to the specified StateCU frost dates format file. **Currently only the frost dates file can be written with this command.** See the `WriteStateMod()` command to write StateMod format files (e.g., for the precipitation, temperature, and diversion time series files used with the StateCU model). See the **StateCU Input Type Appendix** for more information about the file format. All time series matching the data types `FrostDateL28S`, `FrostDateL32S`, `FrostDateF32F`, and `FrostDateF28F` will be written (all other time series will be ignored). Other StateCU files may be supported in the future. See also the StateDMI software, which processes other StateCU files.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteStateCU

WriteStateCU() Command Editor

The command syntax is as follows:

```
WriteStateCU(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
OutputFile	The StateCU frost dates output file. The path to the file can be absolute or relative to the working directory.	None – must be specified.
OutputStart	The date/time for the start of the output.	Use the global output period.
OutputEnd	The date/time for the end of the output.	Use the global output period.

A sample command file is as follows, using data from the State of Colorado's HydroBase database:

```
# 0109 - AKRON 4 E
0109.NOAA.FrostDateL28S.Year~HydroBase
0109.NOAA.FrostDateL32S.Year~HydroBase
0109.NOAA.FrostDateF32F.Year~HydroBase
0109.NOAA.FrostDateF28F.Year~HydroBase
WriteStateCU(OutputFile="test.stm")
```

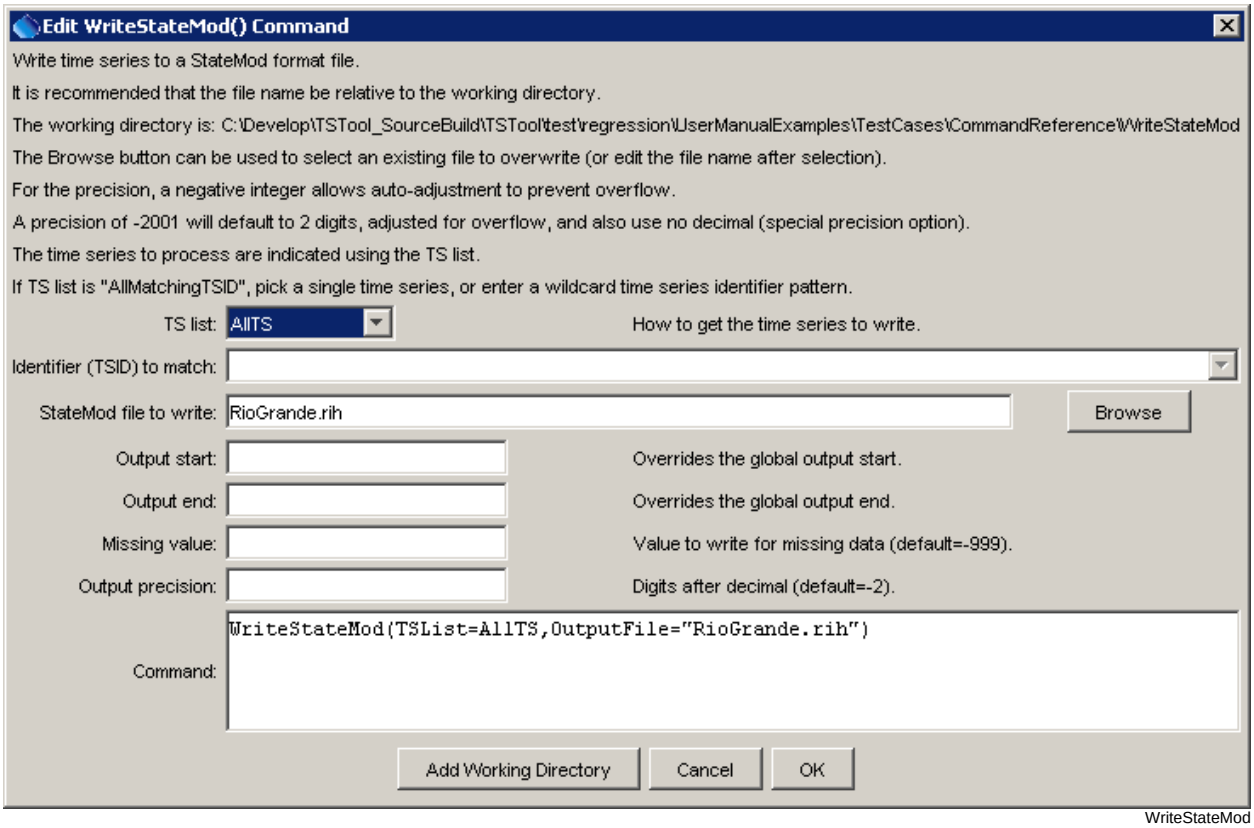
Command Reference: WriteStateMod()

Write time series to a StateMod format file

Version 08.15.00, 2008-05-12

The `WriteStateMod()` command writes the time series in memory to the specified StateMod format file. See the **StateMod Input Type Appendix** for more information about the file format. It is expected that the time series have the same interval. The time series identifier location part is written as the identifier, even if an alias is assigned to a time series.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteStateMod

WriteStateMod() Command Editor

The command syntax is as follows:

```
WriteStateMod(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicate how to determine the list of time series to process, one of: ▪ AllMatchingTSID – process time series that have identifiers matching the TSID parameter. ▪ AllTS – process all the time series. ▪ SelectedTS – process the time series that are selected (see SelectTimeSeries()).	None – must be specified.
TSID	Used if TSList=AllMatchingTSID to indicate the time series identifier or alias for the time series to be filled. Specify * to match all time series or use a wildcard for one or more identifier parts.	Required if TSList=AllMatchingTSID.
OutputFile	The StateMod file to write. The path to the file can be absolute or relative to the working directory (command file location).	None – must be specified.
OutputStart	The date/time for the start of the output.	Use the global output period.
OutputEnd	The date/time for the end of the output.	Use the global output period.
MissingValue	The value to write for missing data.	-999
Precision	The number of digits to use after the decimal point, for data values. A negative number indicates that if the formatted number is larger than the allowed output width, adjust the format accordingly by truncating fractional digits. A special value of –2001 is equivalent to –2 and additionally NO decimal point will be printed for large values.	The default output precision if not specified is -2, which is then reset based on the data units (see the *system\DATAUNIT* file).

A sample command file to process data from the State of Colorado's HydroBase is as follows:

```
SetOutputPeriod(OutputStart="1950-01",OutputEnd="2002-12")
# 08213500 - RIO GRANDE RIVER AT THIRTY MILE BRIDGE NEAR CREEDE
08213500.DWR.Streamflow.Month~HydroBase
# 08217000 - RIO GRANDE AT WASON, BELOW CREEDE, CO.
08217000.USGS.Streamflow.Month~HydroBase
WriteStateMod(TSList=AllTS,OutputFile="RioGrande.rih")
```

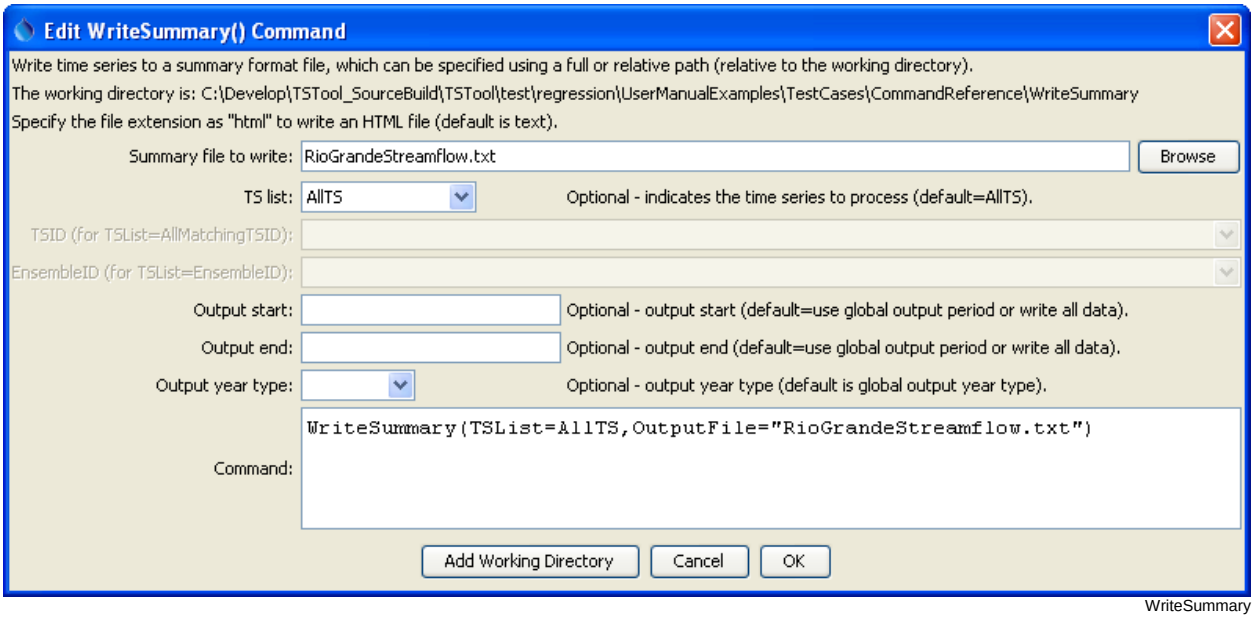
Command Reference: WriteSummary()

Write time series to a summary format file

Version 09.07.00, 2010-08-09

The `WriteSummary()` command writes time series to a summary report file, as text or HMTL. The format of the file is a default for the data interval. The total/average column in reports (if output) is based on the units – a parameter may be added in the future to allow more flexibility.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteSummary

WriteSummary() Command Editor

The command syntax is as follows:

```
WriteSummary(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
OutputFile	The summary file. The path to the file can be absolute or relative to the working directory (command file location). Specifying a filename with an "html" extension will result in HTML output, which is color-coded for missing values and has notes for flagged values.	None – must be specified.
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be processed, if processing an ensemble.	Required if TSList= EnsembleID.
OutputStart	The date/time for the start of the output.	Use the global output period.
OutputEnd	The date/time for the end of the output.	Use the global output period.
OutputYearType	The output year type, in particular for formatting monthly and daily time series.	Calendar

A sample command file to process data from the State of Colorado's HydroBase is as follows:

```
SetOutputPeriod(OutputStart="1950-01",OutputEnd="2002-12")
# 08213500 - RIO GRANDE RIVER AT THIRTY MILE BRIDGE NEAR CREEDE
08213500.DWR.Streamflow.Month~HydroBase
# 08217000 - RIO GRANDE AT WASON, BELOW CREEDE, CO.
08217000.USGS.Streamflow.Month~HydroBase
WriteSummary(TSList=AllTS,OutputFile="RioGrandeStreamflow.txt",TSList="AllTS")
```

Command Reference: WriteTableToDataStore()

Write a table to a datastore

Version 10.18.00, 2013-03-03

This command is under development and has the following limitations:

- Although some error handling has been implemented, it is not very detailed. Improvements will be made in response to exercising the command functionality.
- Write statements are created for each row of the table being written. This is inefficient and slow. Improvements will be made in future updates.
- Functionality has been tested mainly with SQL Server.
- Handling of date objects has not been tested.
- Better handling of blank rows needs to be implemented.

The `WriteTableToDataStore()` command processes each row in a table and executes an SQL statement to insert the row into a database datastore. If database datastore support is not specifically provided by TSTool, a generic datastore can be used (see the **Generic Database Datastore** appendix). This command cannot be used with web service datastores and use with Excel datastores has not been tested. This command is useful in particular for bulk data loading such as for database initialization and when tight integration with TSTool is not required or has not been implemented. In the future additional command parameters may be added to limit the rows that are being written and allow update functionality.

General constraints on the query are as follows:

- the table or views being written must be writeable by the user specified for the database connection (some databases restrict direct access to data and require using stored procedures)
- the table column names must match the database table column names (in the future a command parameter may be added to allow column names to be mapped)
- data types for table columns must closely match the database:
    - internally an SQL statement is created in which data values are formatted as per the data type (e.g., strings are quoted); consequently column types must be appropriate to generate correct formatting
    - the full precision of floating point numbers is passed to the database (formatting for display will not apply to values written to the database)
    - null values in the table will transfer to null values in the database
    - date/time columns in the table will be represented as such in the database table; however, it may not be possible to limit the precision of the date/time (i.e., hours, minutes, and seconds may be shown with default zero values in output)
- the specified table columns are written (all are written by default)
    - primary keys in the database table do not need to be specified (their values will be assigned automatically)
    - table columns that correspond to related tables in the datastore table need to be mapped using the `DataStoreRelatedColumnsMap` command parameter

An example of column mapping to a related table is as follows, using the notation `Table.Column` to fully identify columns:

- the string `TableID.DataType` column is in the input data

- an integer database table `TimeSeriesMeta.DataTypesID` column is a foreign key to `DataTypes.DataTypesID`, and `DataTypes.Abbreviation` is the string data type – in other words, the datastore column being written does not match the string data type, but uses a relationship to match the integer data type in a separate table

To handle this relationship:

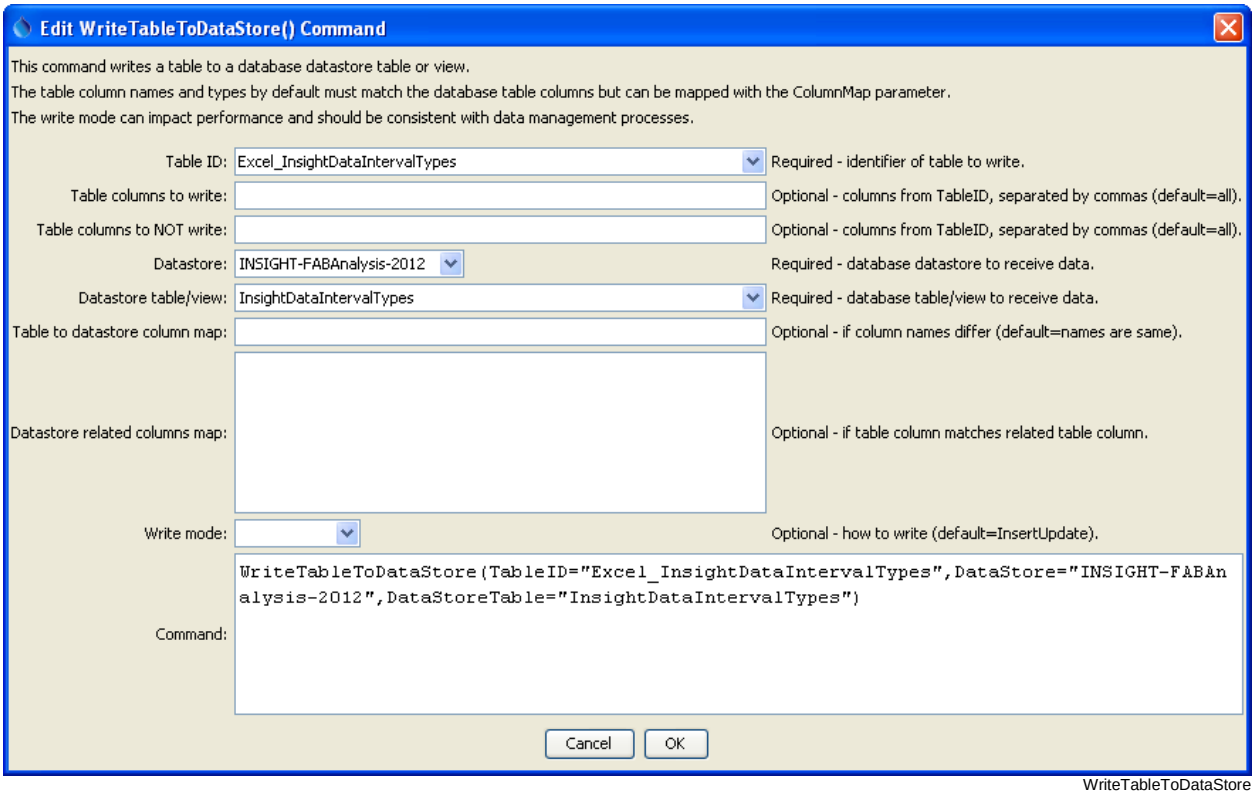
- Use the `ColumnMap` parameter to tell the command that the `DataType` column in input table maps to the `DataTypesID` column in the datastore table:

```
ColumnMap="DataType:DataTypesID"
```

- Use the `DataStoreRelatedColumnsMap` parameter to tell the command that the `DataTypesID` column should be looked up the Abbreviation column, which is a second level of column mapping:

```
DataStoreRelatedColumnsMap="DataTypesID:Abbreviation"
```

The following dialog is used to edit the command and illustrates the syntax for the command, in this case writing a table to a datastore that was defined as a GenericDatabaseDataStore.



WriteTableToDataStore

WriteTableToDataStore() Command

The command syntax is as follows:

```
WriteTableToDataStore(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier for table to write.	None – must be specified.
`IncludeColumns`	The names of the table columns to write, separated by commas.	All columns from `TableID` are written.
`ExcludeColumns`	The names of table columns NOT to write, separated by commas. This will override `IncludeColumns`.	All columns from `TableID` are written.
`DataStore`	The name of a database datastore to receive data.	None – must be specified.
`DataStoreTable`	The name of the database table or view to receive data.	None – must be specified.
`ColumnMap`	Indicate which columns in `TableID` have different names in `DataStoreTable`, using the syntax: `ColumnName:DatastoreTableName, ColumnName:DatastoreTableName, …`	`DatastoreTableName` columns are assumed to match the column names in `TableID`
`DataStoreRelated ColumnsMap`	Indicate datastore columns that need to match values in a related table in the datastore. For example, `TableID` may contain a column "Abbreviation" but the corresponding column in `DataStoreTable` may refer to a related table using a foreign key relationship (matching integer column in both tables). It is expected that the related table will have only one primary key column, which will be determined automatically. However, a column mapping must be provided to tell the command which `DataStoreTable` column should be matched with the related table. The syntax of the parameter is: `DataStoreTableCol1:RelatedTableCol1, DataStoreTableCol2:RelatedTableCol2, …` The above assumes that foreign keys have been defined in the `DataStoreTable` columns. If the database does not explicitly define a foreign key relationship in the database design, then specify the right side of the map as: `RelatedTable1.RelatedCol1`.	`DatastoreTableName` columns are assumed to match the column names in `TableID`, with no need to perform reference table value matching.
`WriteMode`	The method used to write data, recognizing the databases use insert and update SQL statements, one of: • `DeleteInsert` – delete the data first and then insert (all values will need to be matched to delete) • `Insert` – insert the data with no	`InsertUpdate`

Parameter	Description	Default
	attempt to update if the insert fails • `InsertUpdate` – try inserting the data first and if that fails try to update • `Update` – update the data with no attempt to insert if the update fails • `UpdateInsert` – try updating the data first and if that fails try to insert	

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Command Reference: WriteTableToDelimitedFile()

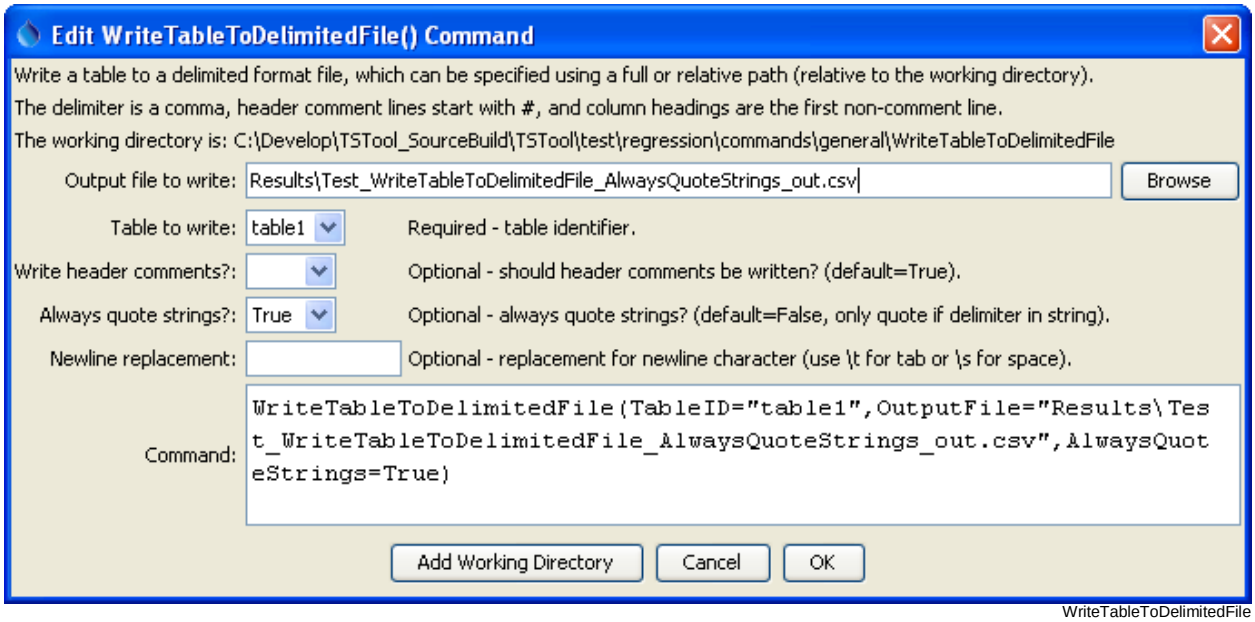
Write a table to a delimited file

Version 10.20.00, 2013-03-25

The `WriteTableToDelimitedFile()` command writes a table to a delimited file. Currently only the comma is supported as the delimiter. This command is the analog to the `ReadTableFromDelimitedFile()` command. It can be used to provide tabular data to other programs, such as spreadsheet programs and geographic information systems.

The default is to write a standard file header using comment lines that start with the # character. If available, column names will be written in double quotes as the first non-comment row. Formatting for cell values is limited and the default precision of floating point numbers may include too many digits – this will be addressed in future updates.

The following dialog is used to edit the command and illustrates the syntax for the command.



WriteTableToDelimitedFile

WriteTableToDelimitedFile() Command Editor

The command syntax is as follows:

```
WriteTableToDelimitedFile(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier for the table to write.	None – must be specified.
`OutputFile`	The name of the file to write, as an absolute path or relative to the command file location.	None – must be specified.
`WriteHeaderComments`	Indicates whether to write the header comments, `True` or `False`. Some programs, such as Esri's ArcGIS do not handle delimited files with comments.	`True`
`AlwaysQuoteStrings`	Indicates whether values in string columns should always be surrounded by double quotes: • `False` – only quote strings that contain the delimiter • `True` – always quote strings An example of using `AlwaysQuoteStrings=True` is to quote identifiers that have a leading zero (e.g., `01234567`). Not quoting may cause the values to be interpreted as integers when read from the delimited file.	`False`
`NewlineReplacement`	The string to replace newlines in string values, necessary to prevent unexpected line breaks in output rows. In order to handle newlines from various systems, the following patterns are replaced in sequence: • `\r\n` • `\n` • `\r` The following special parameter values are recognized: • `\t` – replace newline with tab • `\s` – replace newline with space	Do not replace newlines.

Command Reference: WriteTableToHTML()

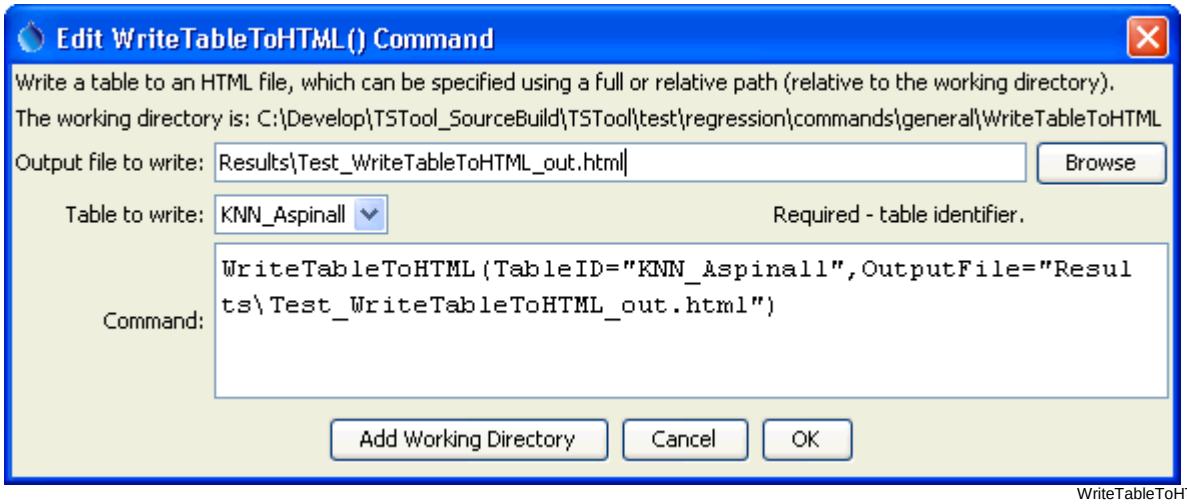
Write a table to an HTML file

Version 09.10.01, 2010-12-07

The `WriteTableToHTML()` command writes a table to an HTML file. It can be used to publish tables to the web.

Table column names are output as the HTML table column headers. Formatting for cell values is based on the precision of the original table data. Default styles are written at the top of the HTML. In the future the command may accept styles as input.

The following dialog is used to edit the command and illustrates the syntax for the command.



WriteTableToHTML

WriteTableToHTML() Command Editor

The command syntax is as follows:

```
WriteTableToHTML(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TableID`	Identifier for the table to write.	None – must be specified.
`OutputFile`	The name of the file to write, as an absolute path or relative to the command file location.	None – must be specified.

Command Reference: WriteTimeSeriesProperty()

Write a time series property to a file

Version 08.16.03, 2008-08-18

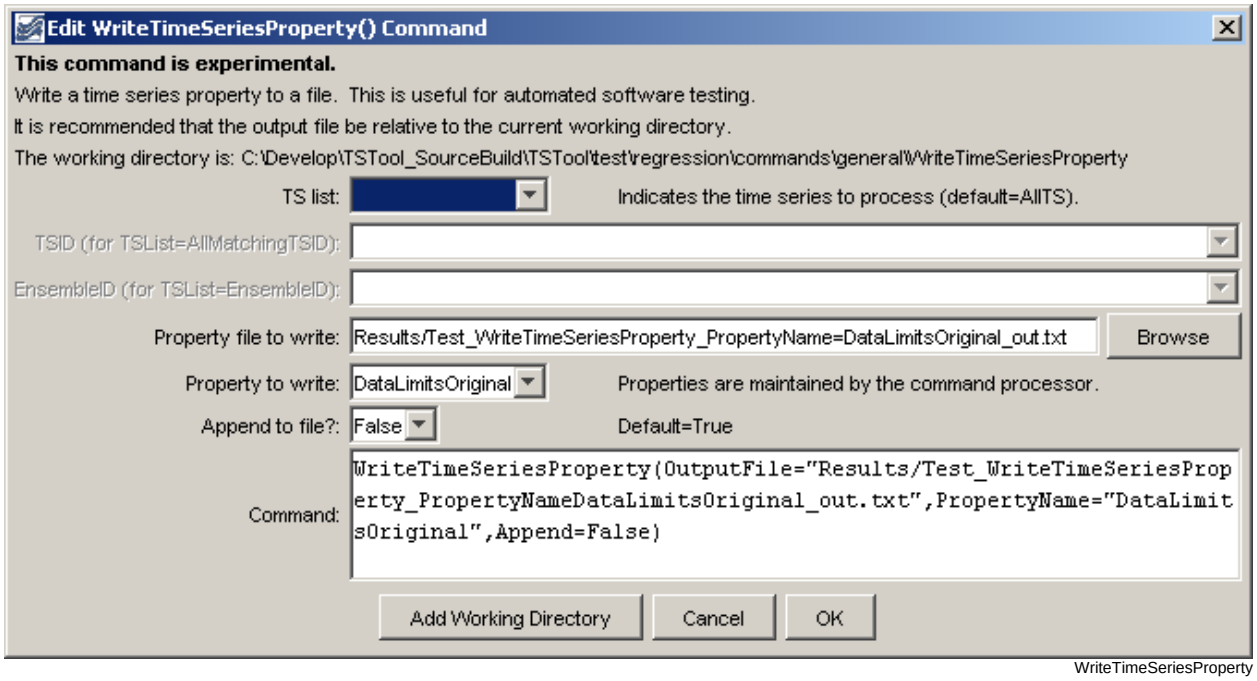
This command is under development and is used primarily for software testing. In particular one limitation is that the time series identifier is not included in output and therefore properties for multiple time series are not uniquely identified.

The `WriteTimeSeriesProperty()` command writes the value of a time series property to a file. This command should not be confused with the `WriteProperty()` command, which writes processor properties. This is useful for testing whether properties are being set. It could also be used to pass information from TSTool to another program. The format of the output is:

```
Property="Value"
```

Multi-line properties will be contained within the quotes. The number of properties is limited at this time, as needed for testing software, but may be increased in the future. The format of output may also change in the future.

The following dialog is used to edit this command and illustrates the syntax of the command.



WriteTimeSeriesProperty

WriteTimeSeriesProperty() Command Editor

The command syntax is as follows:

```
WriteTimeSeriesProperty(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be modified. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be modified. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be modified. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be modified, using the * wildcard character to match multiple time series.	Required when TSList=*TSID
EnsembleID	The ensemble to be modified, if processing an ensemble.	Required when TSList=EnsembleID.
OutputFile	The property file to write, as an absolute path or relative to the command file.	None – must be specified.
PropertyName	The property name to write.	None – must be specified.
Append	Indicates whether the property should be appended to the file (True) or overwrite the file (False).	True

A sample command file is as follows:

```
WriteTimeSeriesProperty(OutputFile="Results/Example_WriteTimeSeriesProperty.txt",
  PropertyName="DataLimitsOriginal")
```

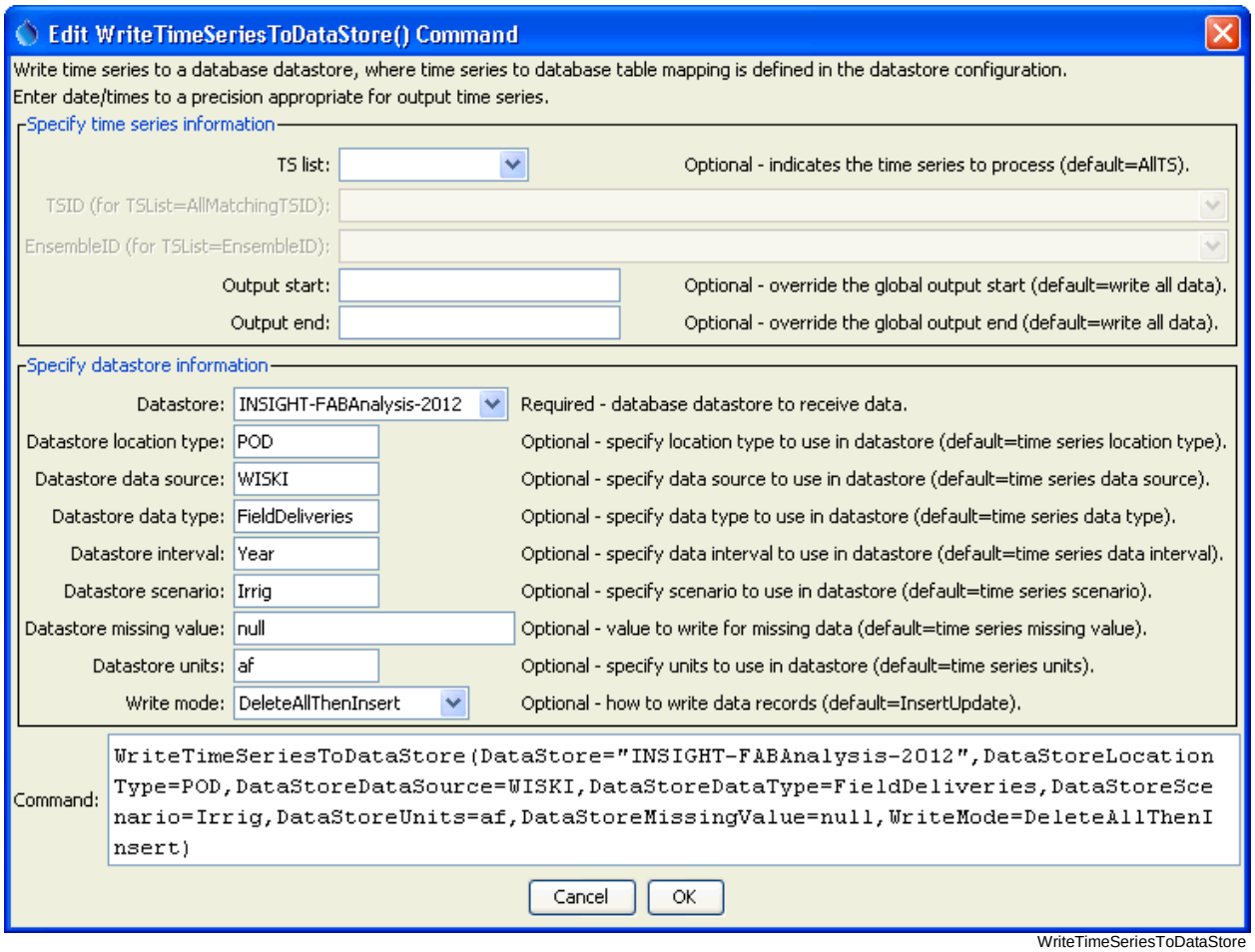
Command Reference: WriteTimeSeriesToDataStore()

Write time series to a database datastore

Version 10.21.00, 2013-06-28

The `WriteTimeSeriesToDataStore()` command writes time series to the specified database datastore. This command can only write to databases that have a supported design structure. Currently this command is only available for generic datastores (see the **Generic Database Datastore** appendix for information about supported database designs and datastore configuration properties). This command cannot be used with web service datastores and use with Excel datastores has not been tested. This command is useful in particular for bulk data loading such as for database initialization and when tight integration with TSTool is not required or has not been implemented.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteTimeSeriesToDataStore

WriteTimeSeriesToDataStore() Command Editor

The command syntax is as follows:

```
WriteTimeSeriesToDataStore(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command. • `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	`AllTS`
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`OutputStart`	The date/time for the start of the output.	Use the global output period.
`OutputEnd`	The date/time for the end of the output.	Use the global output period.
`DataStore`	The name of a database datastore to receive data.	None – must be specified.
`DataStore LocationType`	The location type to match in the datastore..	Location type from time series is used.
`DataStore DataSource`	The data source (provider) to match in the datastore.	Data source from time series is used.
`DataStore DataType`	The data type to match in the datastore.	Data type from time series is used.
`DataStore Interval`	The data interval to match in the datastore.	Data interval from time series is used.
`DataStore Scenario`	The scenario to match in the datastore.	Scenario from time series is used.
`DataStore MissingValue`	The value to write to the datastore to indicate a missing value in the time series. Specify `null` to write null to the database.	Missing value used for the time series will be used (e.g., `NaN`, `-999`).
`DataStoreUnits`	Units to use for time series in the database, currently not used. Time series data must match the time series as defined in the database.	
`WriteMode`	The method used to write time series data records, recognizing the databases use insert and	`InsertUpdate`

Parameter	Description	Default
	update SQL statements. Note that any insert/update actions only occur on exact matches of date/time, not on a period. For example, `DeleteInsert` only deletes records that match the specific date/time of a value in the time series. Specify `WriteMode` as: • `DeleteAllThenInsert` – delete all the data records for the time series and then insert the time series data records, useful for bulk loading • `DeletePeriodThenInsert` – delete the data records in the specified output period and then insert the time series data records, useful for bulk loading • `DeleteInsert` – delete the data first and then insert (all values will need to be matched to delete) • `Insert` – insert the data with no attempt to update if the insert fails • `InsertUpdate` – try inserting the data first and if that fails try to update • `Update` – update the data with no attempt to insert if the update fails • `UpdateInsert` – try updating the data first and if that fails try to insert	

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Command Reference: WriteTimeSeriesToJson()

Write time series to a JSON format file

Version 10.21.00, 2013-07-01

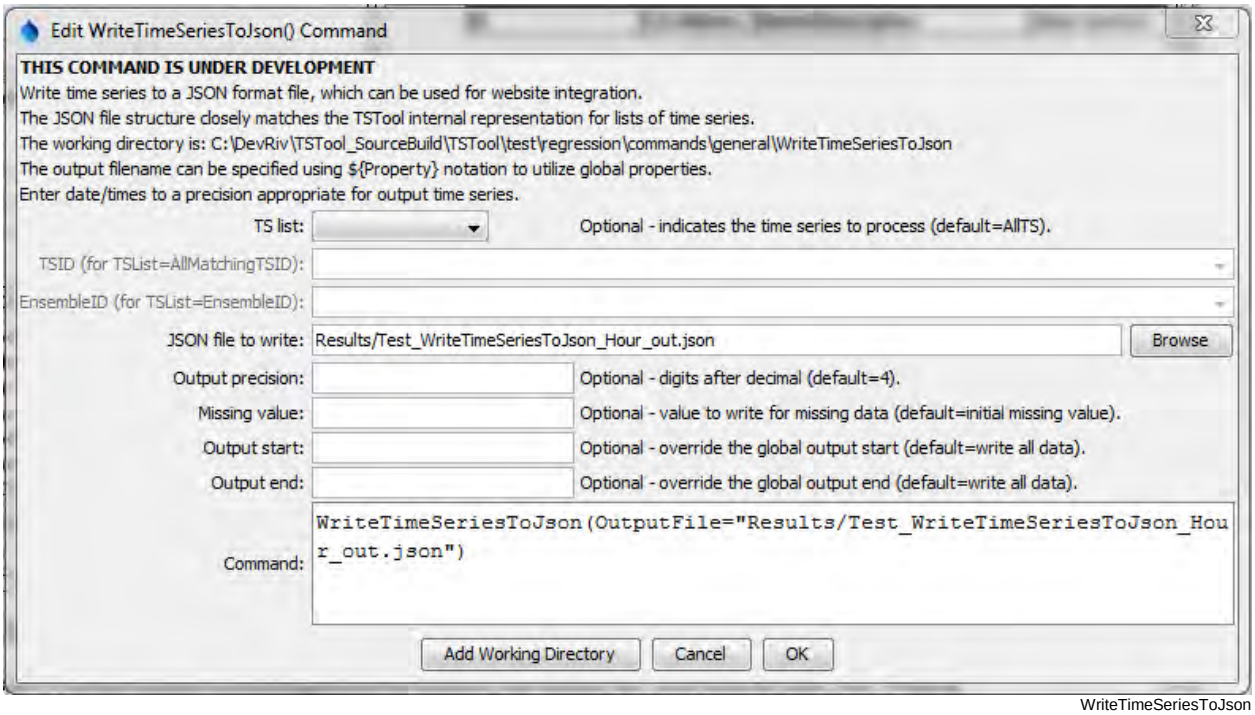
This command is under development. The JSON format will change as feedback is received and additional time series information is added to the output (e.g., comments, properties).

The `WriteTimeSeriesToJson()` command writes time series to a file using JSON (JavaScript Object Notation) format. The file can be included in a JavaScript script to instantiate data objects. The following example illustrates the format of the JSON file, with two hour-interval time series, one without data flags, and one with data flags. The JSON format closely matches time series data management conventions used by TSTool. In the future, support for writing time series data values in parallel (via `overlap=true` property for the list) may be implemented in order to save space in the file. JSON files can be viewed/edited by online tools such as http://jsoneditoronline.org.

```
{
 "timeSeriesList": {
  "numTimeSeries": 2,
  "overlap": false,
  "timeSeries": [
   {
    "timeSeriesMeta": {
     "tsid": "MyLoc1..MyDataType.Hour",
     "alias": "MyLoc1",
     "description": "Test data, pattern",
     "locationType": "",
     "locationId": "MyLoc1",
     "dataSource": "",
     "dataType": "MyDataType",
     "scenario": "",
     "missingVal": -999.0,
     "units": "CFS",
     "unitsOriginal": "CFS",
     "start": "1950-01-01 00",
     "end": "1950-01-03 12",
     "startOriginal": "1950-01-01 00",
     "endOriginal": "1950-01-03 12",
     "hasDataFlags": false
    },
    "timeSeriesData": [
     { "dt": "1950-01-01 00", "value": 5.0000 },
     { "dt": "1950-01-01 01", "value": 10.0000 },
     { "dt": "1950-01-01 02", "value": 12.0000 },
… omitted …
     { "dt": "1950-01-03 11", "value": 75.0000 },
     { "dt": "1950-01-03 12", "value": 5.0000 }
    ]
   },
   {
    "timeSeriesMeta": {
     "tsid": "MyLoc2..MyData.Hour",
     "alias": "MyLoc2",
     "description": "Test data, pattern",
     "locationType": "",
     "locationId": "MyLoc2",
     "dataSource": "",
     "dataType": "MyData",
     "scenario": "",
     "missingVal": -999.0,
```

```
      "units": "CFS",
      "unitsOriginal": "CFS",
      "start": "1950-01-01 00",
      "end": "1950-01-04 12",
      "startOriginal": "1950-01-01 00",
      "endOriginal": "1950-01-04 12",
      "hasDataFlags": true
     },
     "timeSeriesData": [
      { "dt": "1950-01-01 00", "value": 7.0000, "flag": "A" },
      { "dt": "1950-01-01 01", "value": 12.0000, "flag": "B" },
      { "dt": "1950-01-01 02", "value": 14.0000, "flag": "" },
…omitted…
      { "dt": "1950-01-04 11", "value": -999.0000, "flag": "D" },
      { "dt": "1950-01-04 12", "value": 77.0000, "flag": "E" }
     ]
    }
   ]
  }
}
```

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteTimeSeriesToJson

WriteTimeSeriesToJson() Command Editor

The command syntax is as follows:

```
WriteTimeSeriesToJson(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be processed, if processing an ensemble.	Required if TSList=EnsembleID.
OutputFile	The JSON output file. The path to the file can be absolute or relative to the working directory (command file location). Global properties can be used to specify the filename, using the ${Property} syntax.	None – must be specified.
Precision	The number of digits after the decimal for numerical output.	4 (in the future may default based on data type)
MissingValue	The value to write to the file to indicate a missing value in the time series, must be a number or NaN.	As initialized when reading the time series or creating a new time series, typically -999, NaN, or another value that is not expected in data.
OutputStart	The date/time for the start of the output.	Use the global output period.
OutputEnd	The date/time for the end of the output.	Use the global output period.

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Command Reference: WriteTimeSeriesToKml()

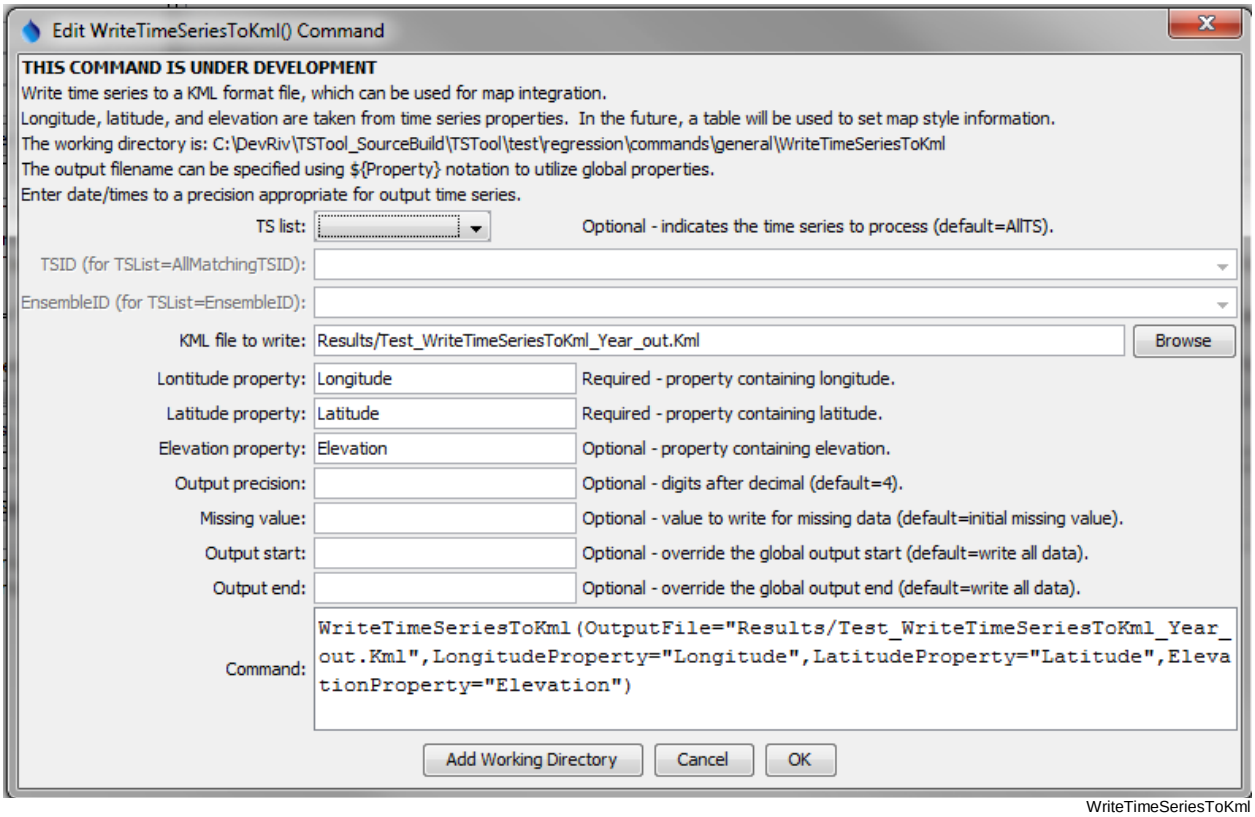
Write time series to a KML format file

Version 10.21.00, 2013-07-01

This command is under development. Additional capabilities will be implemented as resources allow and requirements are identified. The `WriteTimeSeriesToKml()` command writes time series to a file using KML (Keyhole Markup Language) format (see: https://developers.google.com/kml/documentation). The file can be used with Google Earth, Google Maps, and other spatial viewing tools. This command currently provides very basic capabilities to visualize the locations where time series data are collected, in particular for point data. In the future the command will be updated to have additional features, including:

- Providing the option to output the time series using the timestamp and timespan KML features.
- Providing the option to specify style information with a table, for example using the data type to indicate the symbol and icon.
- Providing additional time series properties for visualization.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteTimeSeriesToKml

WriteTimeSeriesToKml() Command Editor

The command syntax is as follows:

```
WriteTimeSeriesToKml(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
TSList	Indicates the list of time series to be processed, one of: • AllMatchingTSID – all time series that match the TSID (single TSID or TSID with wildcards) will be processed. • AllTS – all time series before the command. • EnsembleID – all time series in the ensemble will be processed. • FirstMatchingTSID – the first time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • LastMatchingTSID – the last time series that matches the TSID (single TSID or TSID with wildcards) will be processed. • SelectedTS – the time series are those selected with the SelectTimeSeries() command.	AllTS
TSID	The time series identifier or alias for the time series to be processed, using the * wildcard character to match multiple time series.	Required if TSList=*TSID.
EnsembleID	The ensemble to be processed, if processing an ensemble.	Required if TSList=EnsembleID.
OutputFile	The KML output file. The path to the file can be absolute or relative to the working directory (command file location). Global properties can be used to specify the filename, using the ${Property} syntax.	None – must be specified.
Longitude Property	The name of the time series property containing the longitude to use for the KML.	Required.
Latitude Property	The name of the time series property containing the latitude to use for the KML.	Required.
Elevation Property	The name of the time series property containing the elevation to use for the KML.	0
Precision	The number of digits after the decimal for numerical output. **Not currently enabled**.	4 (in the future may default based on data type)
Missing Value	The value to write to the file to indicate a missing value in the time series, must be a number or NaN. **Not currently enabled**.	As initialized when reading the time series or creating a new time series, typically -999, NaN, or another value that is not expected in data.
OutputStart	The date/time for the start of the output, used with KML timestamp. **Not currently enabled**.	Use the global output period.
OutputEnd	The date/time for the end of the output, used with KML timestamp. **Not currently enabled**.	Use the global output period.

Command Reference: WriteWaterML()

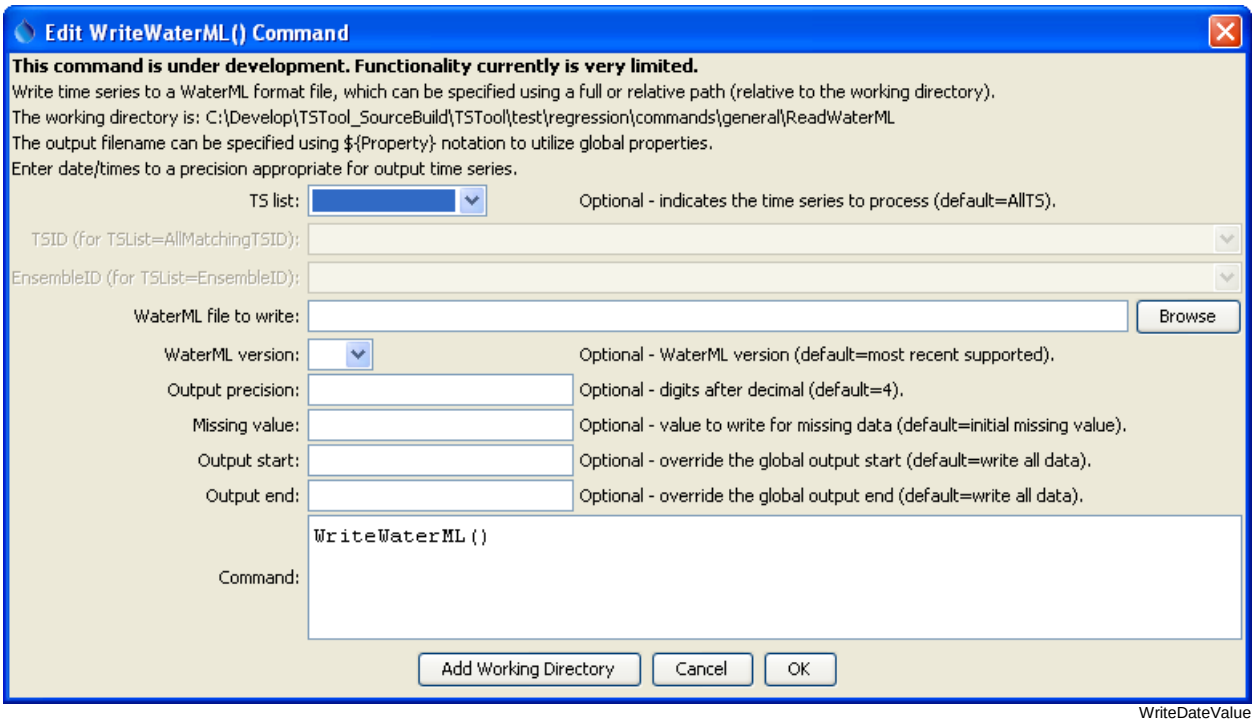
Write time series to a WaterML XML format file

Version 10.05.00, 2012-03-06

This command is under development. In particular, an evaluation is determining how best to map internal time series properties to the WaterML specification, including selecting reasonable defaults while allowing override of defaults.

The `WriteWaterML()` command writes time series to a WaterML XML format file. See the **WaterML Input Type Appendix** for more information about the file format.

The following dialog is used to edit the command and illustrates the syntax of the command.



WriteDateValue

WriteDateValue() Command Editor

The command syntax is as follows:

```
WriteWaterML(Parameter=Value,…)
```

Command Parameters

Parameter	Description	Default
`TSList`	Indicates the list of time series to be processed, one of: • `AllMatchingTSID` – all time series that match the `TSID` (single TSID or TSID with wildcards) will be processed. • `AllTS` – all time series before the command.	`AllTS`

	• `EnsembleID` – all time series in the ensemble will be processed. • `FirstMatchingTSID` – the first time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `LastMatchingTSID` – the last time series that matches the `TSID` (single TSID or TSID with wildcards) will be processed. • `SelectedTS` – the time series are those selected with the `SelectTimeSeries()` command.	
`TSID`	The time series identifier or alias for the time series to be processed, using the `*` wildcard character to match multiple time series.	Required if `TSList=*TSID`.
`EnsembleID`	The ensemble to be processed, if processing an ensemble.	Required if `TSList=EnsembleID`.
`OutputFile`	TheWaterML output file. The path to the file can be absolute or relative to the working directory (command file location). Global properties can be used to specify the filename, using the `${Property}` syntax.	None – must be specified.
`Version`	The WaterML version to write. Currenly only version 1.1 is supported.	1.1
`Precision`	The number of digits after the decimal for numerical output.	`4` (in the future may default based on data type)
`MissingValue`	The value to write to the file to indicate a missing value in the time series.	As initialized when reading the time series or creating a new time series, typically `-999`, `NaN`, or another value that is not expected in data.
`OutputStart`	The date/time for the start of the output.	Use the global output period.
`OutputEnd`	The date/time for the end of the output.	Use the global output period.

Documentation Binder Spine Labels

This page, when printed, can be used for a spine in a binder.

Colorado's Decision Support Systems (CDSS)

TSTool – Time Series Tool – Command Reference