Colorado Climate Center – *WATF Climate Update*

Peter Goble – Research Associate

Water Availability Task Force

September 25th, 2019

ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY

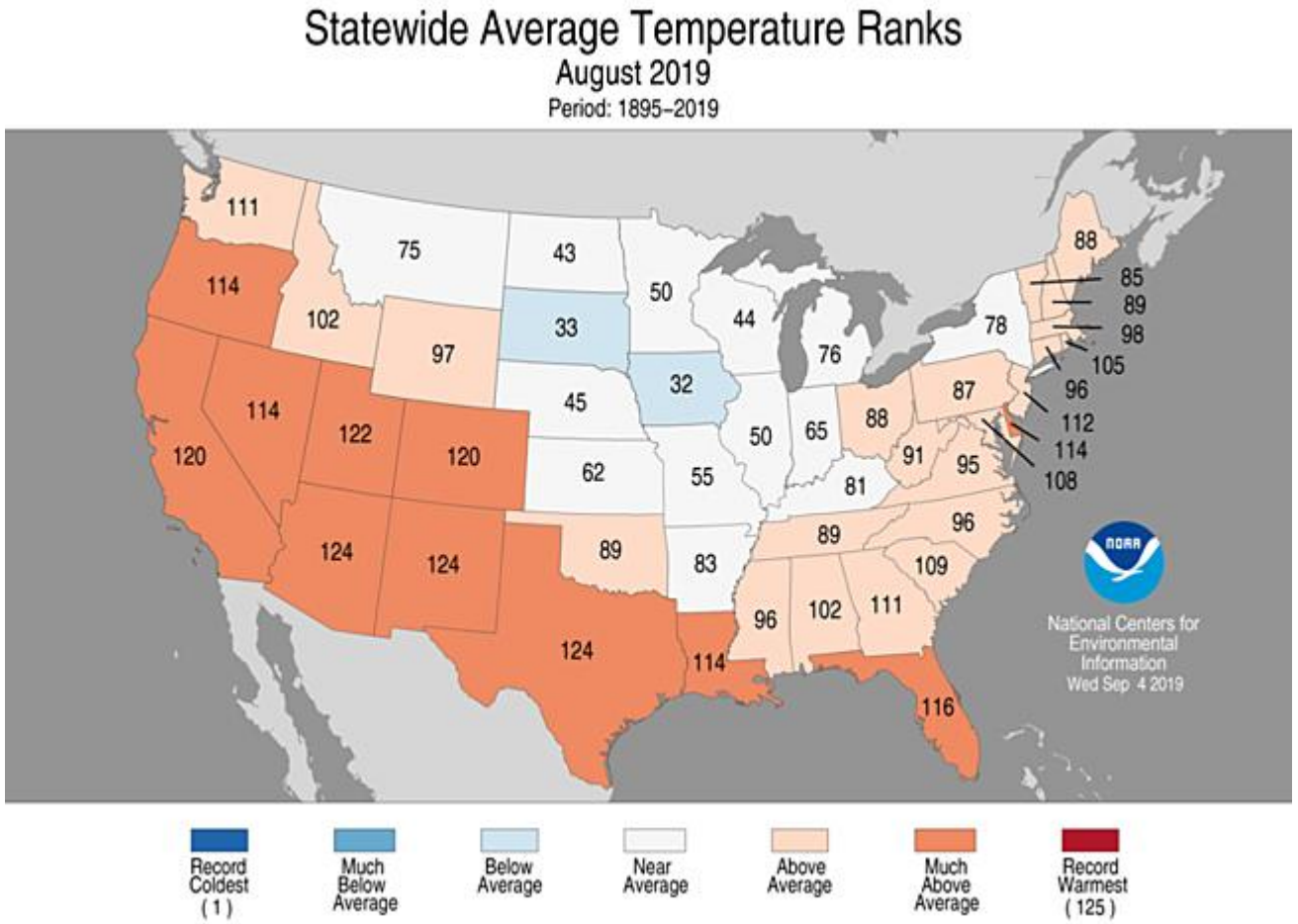
West Magnolia Trail. September 22nd, 2019

Photo Credit: Dr. Katie McCaffrey

COLORADO CLIMATE CENTER

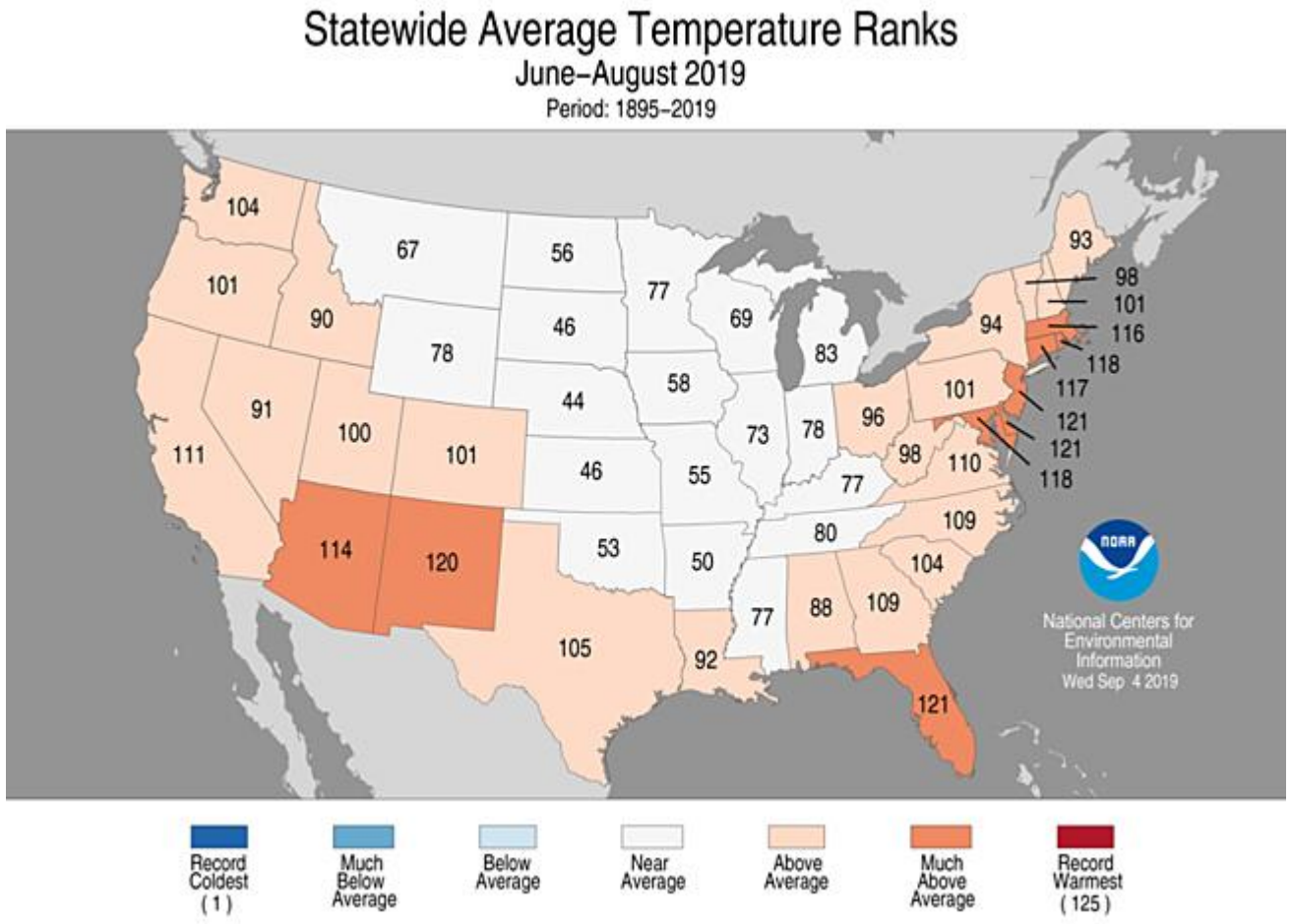
2019 Water Year To Date

temperature, precipitation, evaporative demand



Month	T Rank (of 125 years)	Above, below, or near avg?
Oct	35th	below
Nov	39th	below
Dec	80th	near
Jan	90th	above
Feb	28th	below
Mar	66th	near
Apr	108th	above
May	5th	much below
June	42nd	below
July	104th	above
August	120th	much above

Water year thus far: 0.1°F above the 20th century average
Coldest(?) since 2010



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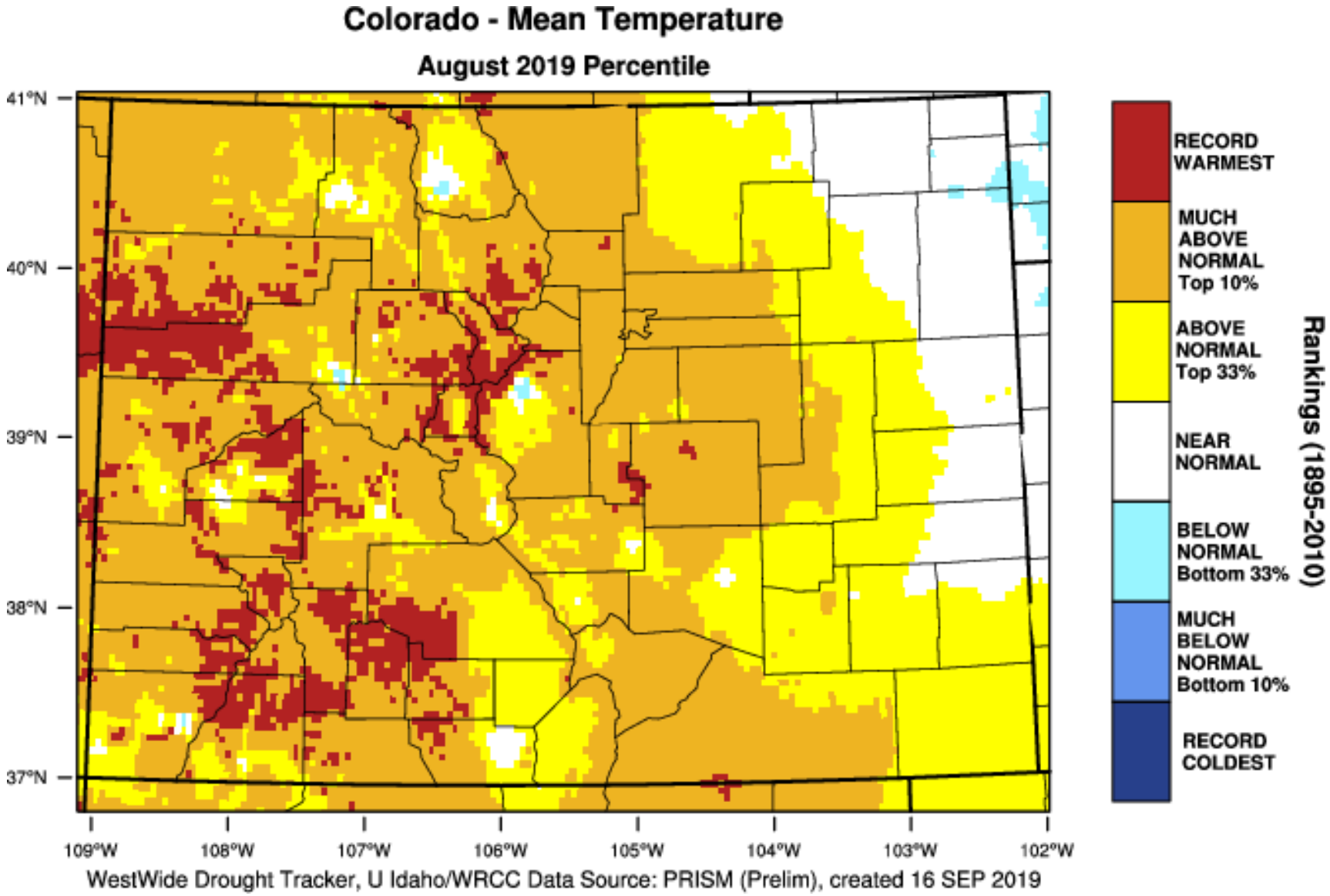
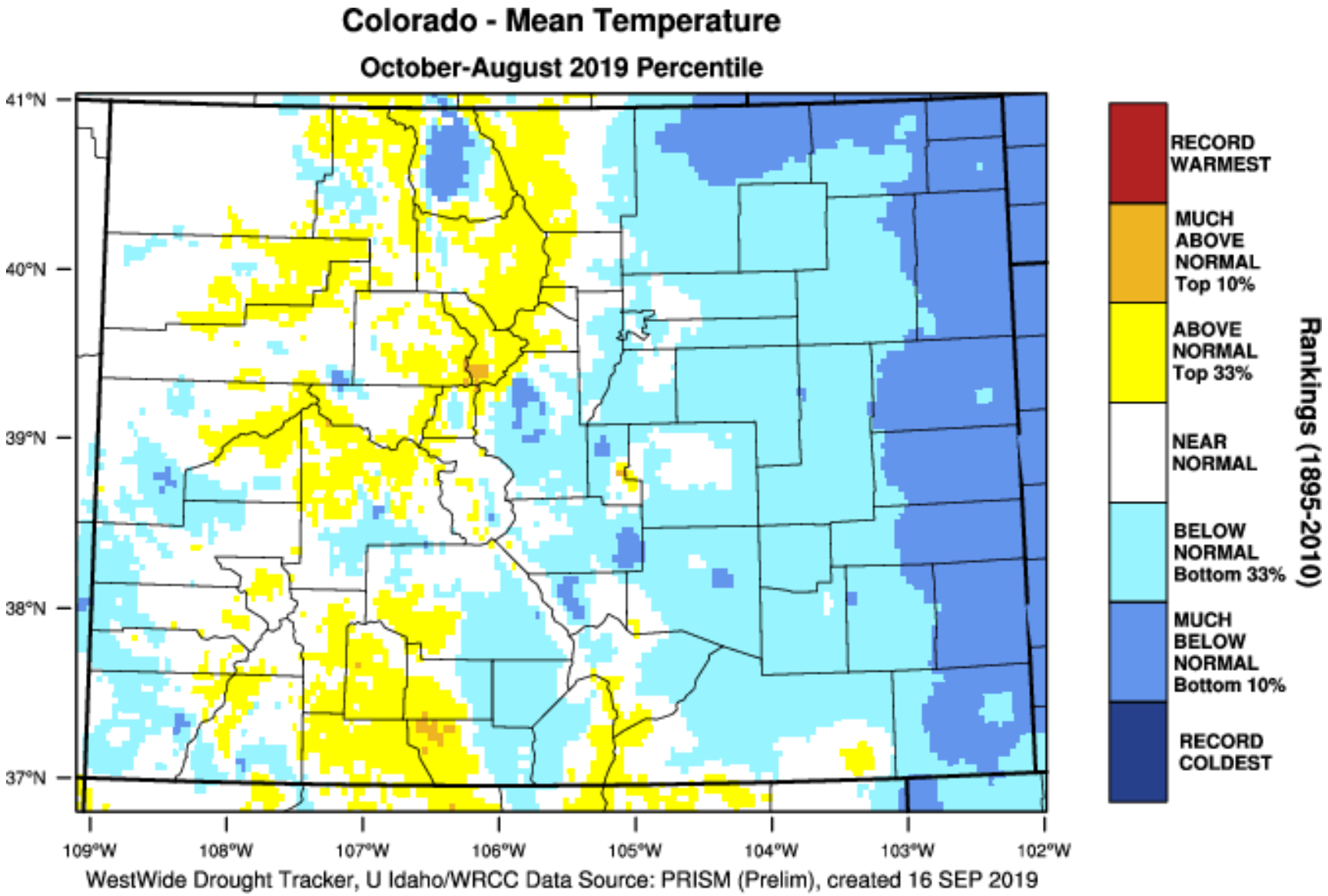

Colorado - Mean Temperature
August 2019 Percentile
41°N
40°N
39°N
38°N
37°N
109°W
108°W
107°W
106°W
105°W
104°W
103°W
102°W
RECORD WARMEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
BELOW NORMAL Bottom 33%
MUCH BELOW NORMAL Bottom 10%
RECORD COLDEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 SEP 2019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40°N
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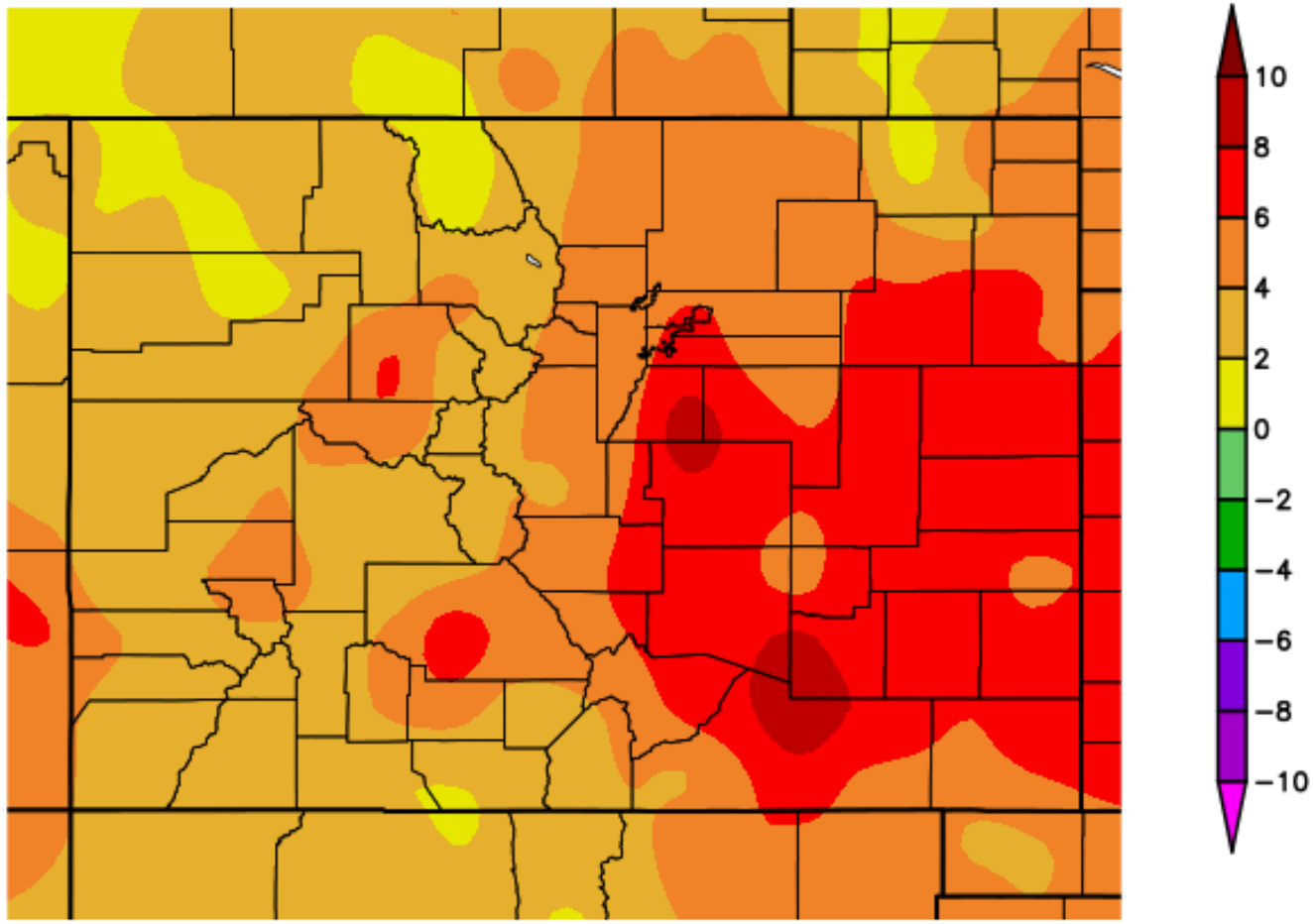
Departure from Normal Temperature (F)
9/1/2019 – 9/23/2019



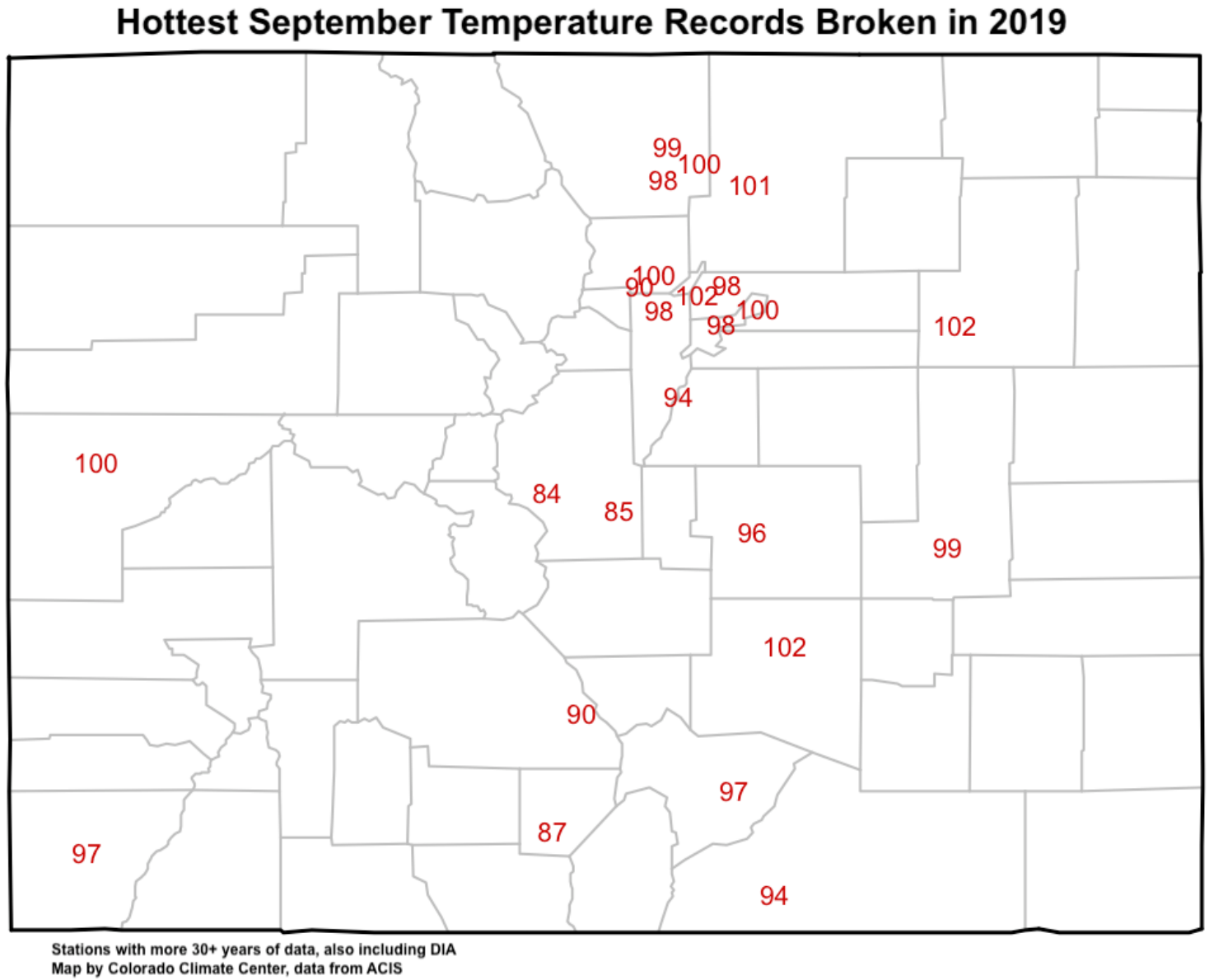
Generated 9/24/2019 at HPRCC using provisional data.

NOAA Regional Climate Centers

90-Degree Days

Location	2019 Total	2018
Fort Collins	36	37
Denver	46	53
Boulder	41	46
Colorado Springs	36	34
Pueblo	76	83
Akron	34	51
Lamar	73	77
Alamosa	0	5
Cortez	58	60
Grand Junction	73	90
Dillon	0	0

Labor Day Weekend Heat

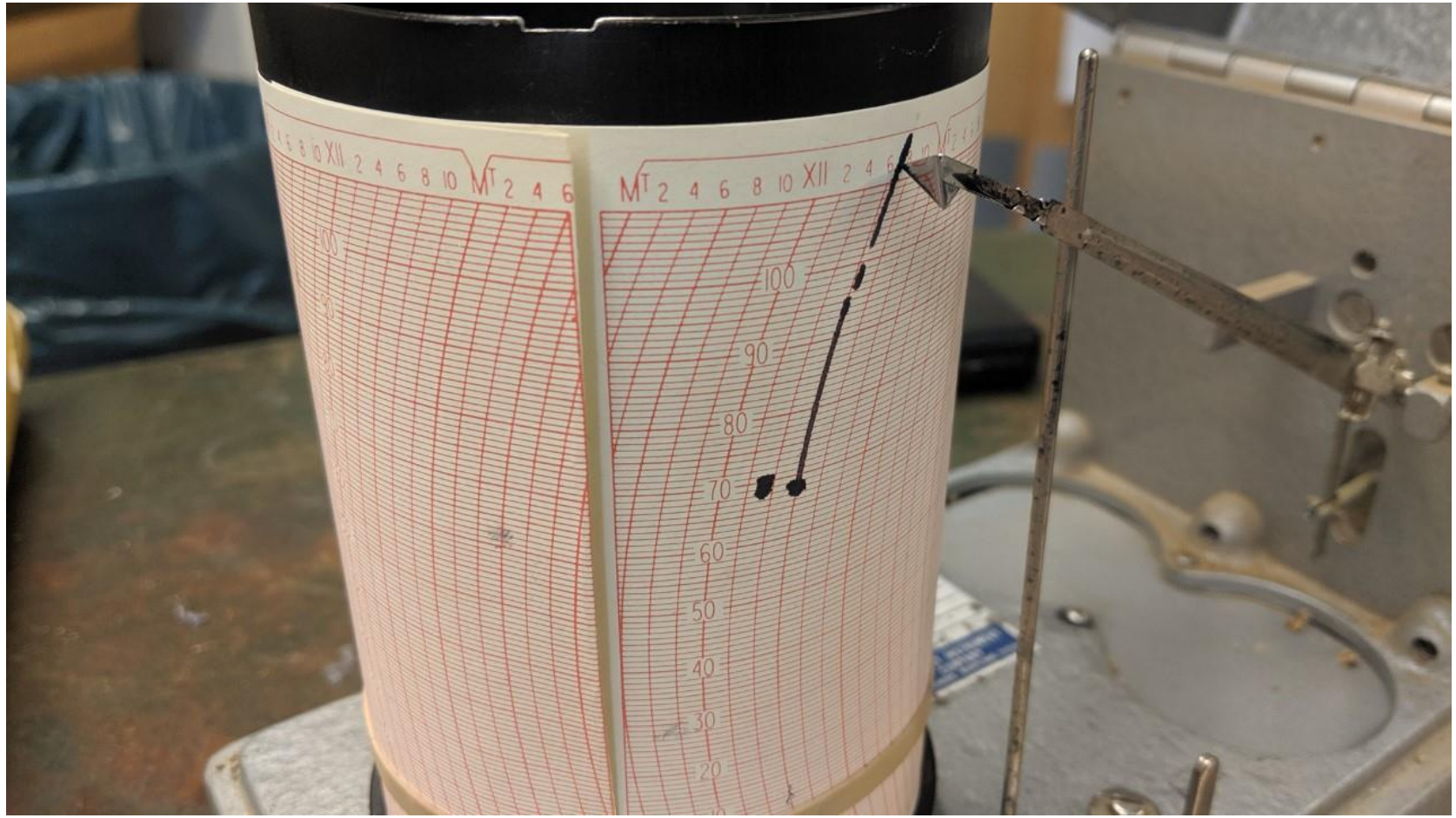


State Temperature Record Pending Approval from NCEI

A temperature of 115 F was recorded on July 20th, 2019 at the Cooperative Observer Network Site at John Martin Dam on

The thermograph responsible was tested at the Colorado State College of Engineering

No official announcement yet



Daily records

(Water year thus far: Oct 1 –Sep 21)

Weather Record Broken	Record broken for a day	Record broken for a month
Highest max temperature	510	62
Highest min temperature	1251	78
Lowest max temperature	1374	20
Lowest min temperature	720	6
Precipitation	1272	46
Snowfall	364	9

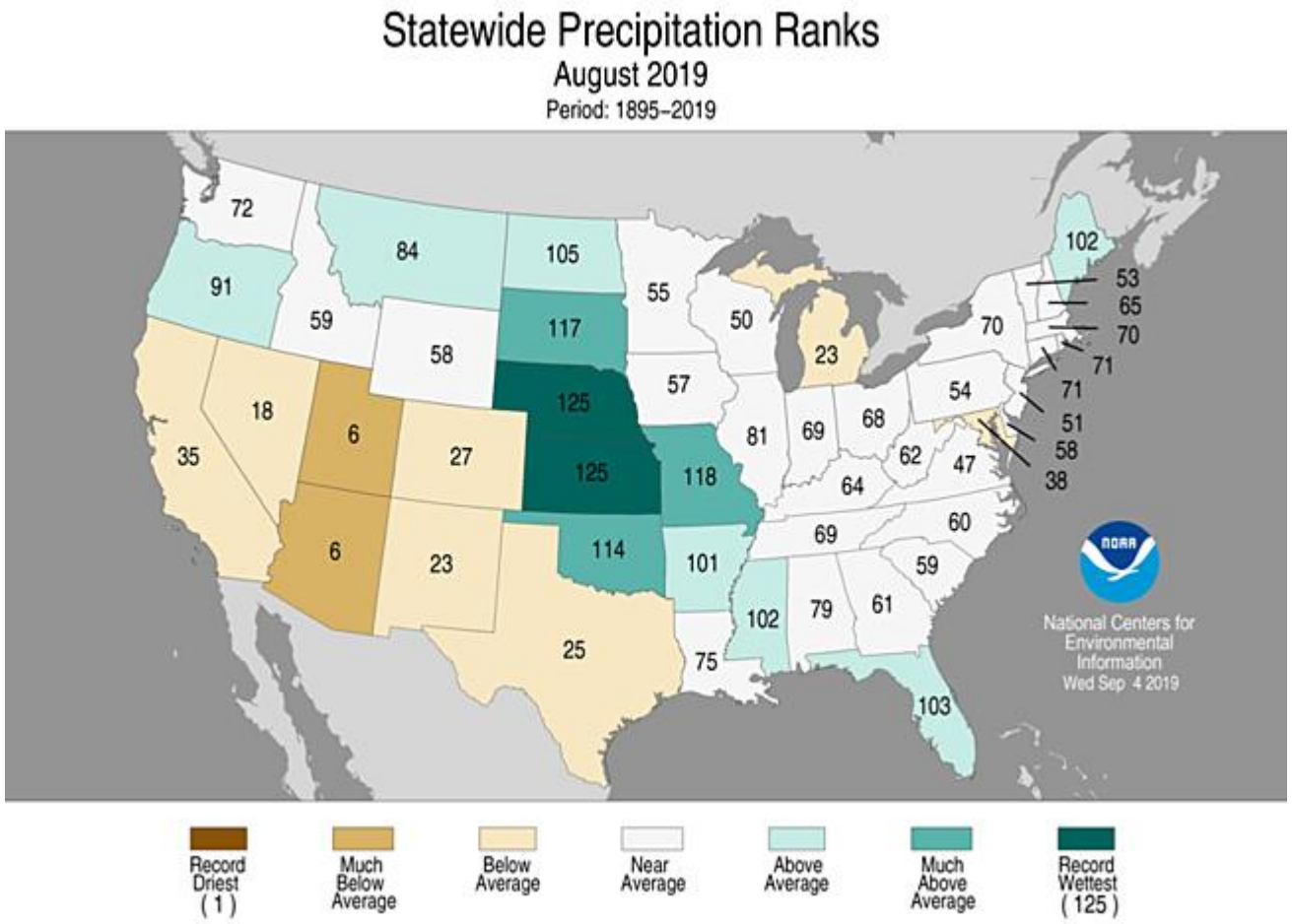
Source: https://www.ncdc.noaa.gov/cdo-web/datatools/records

Compare to last water year:

NUMBER OF DAILY AND MONTHLY STATION RECORDS BROKEN in CO

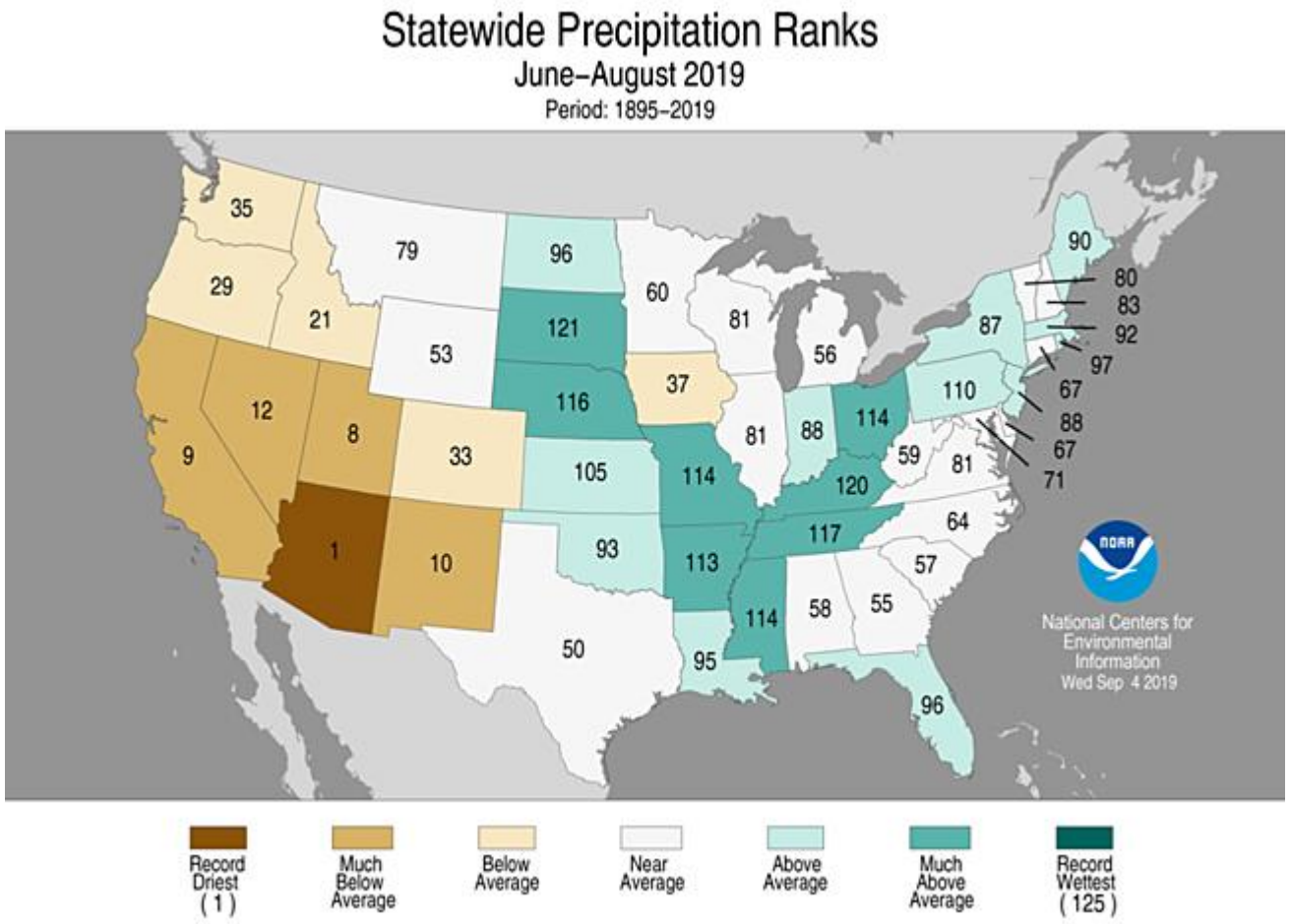
Weather Record Broken	Record broken for a day	Record broken for a month
Highest Max Temperature	1,696	22
Highest Min Temperature	2,971	100
Lowest Max Temperature	560	0
Lowest Min Temperature	292	0
Highest Precipitation	786	17
Highest Snowfall	196	2

From NOAA NCEI's Select U.S. Records: www.ncdc.noaa.gov/extremes/records



27th wettest October – August

Month	P Rank (of 125 years)	Above, below, or near avg?
Oct	112th	above
Nov	45th	near
Dec	31st	below
Jan	94th	above
Feb	109th	above
Mar	120th	much above
Apr	42nd	below
May	111th	above
June	82nd	near
July	29th	below
August	27th	below



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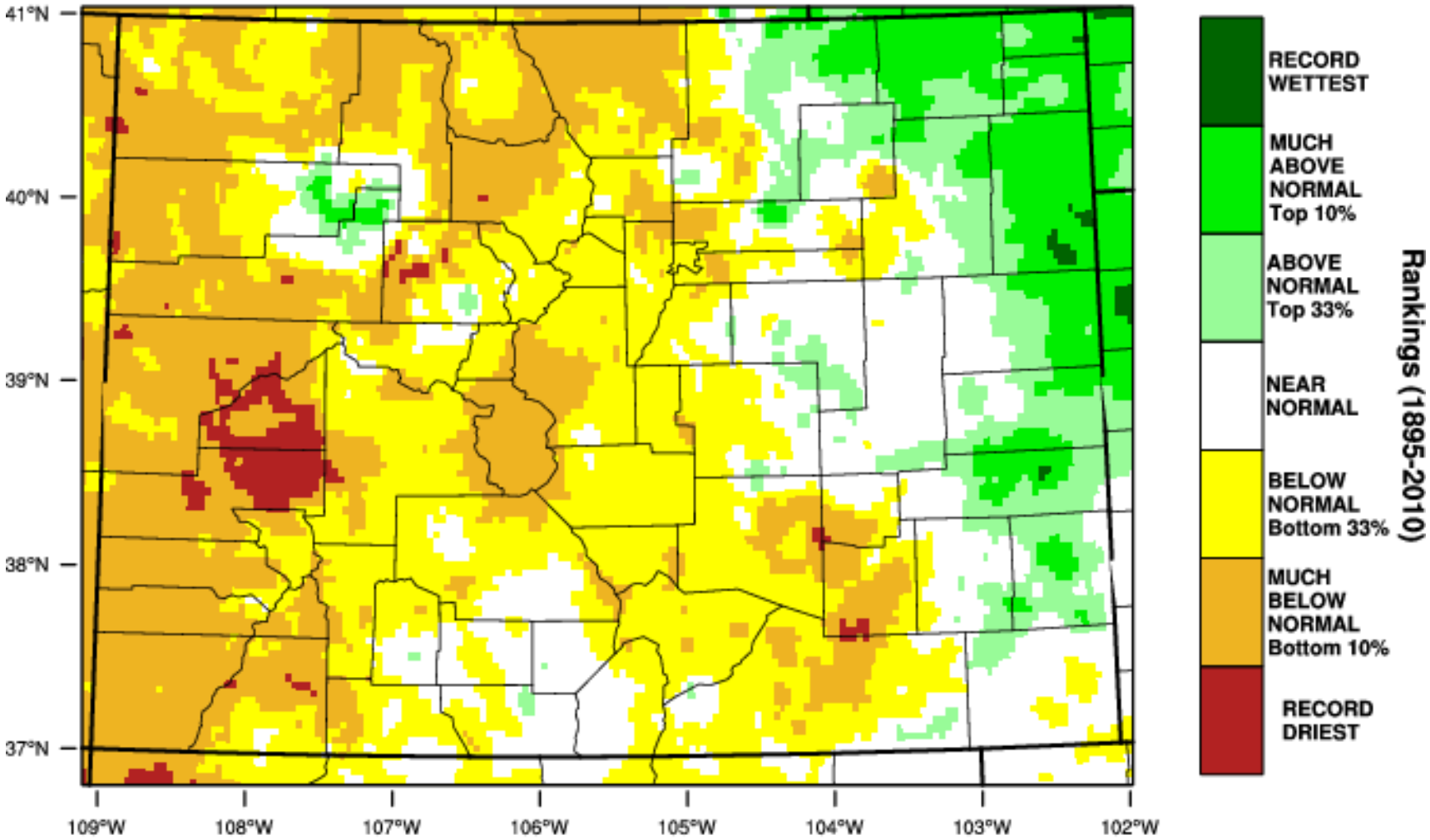
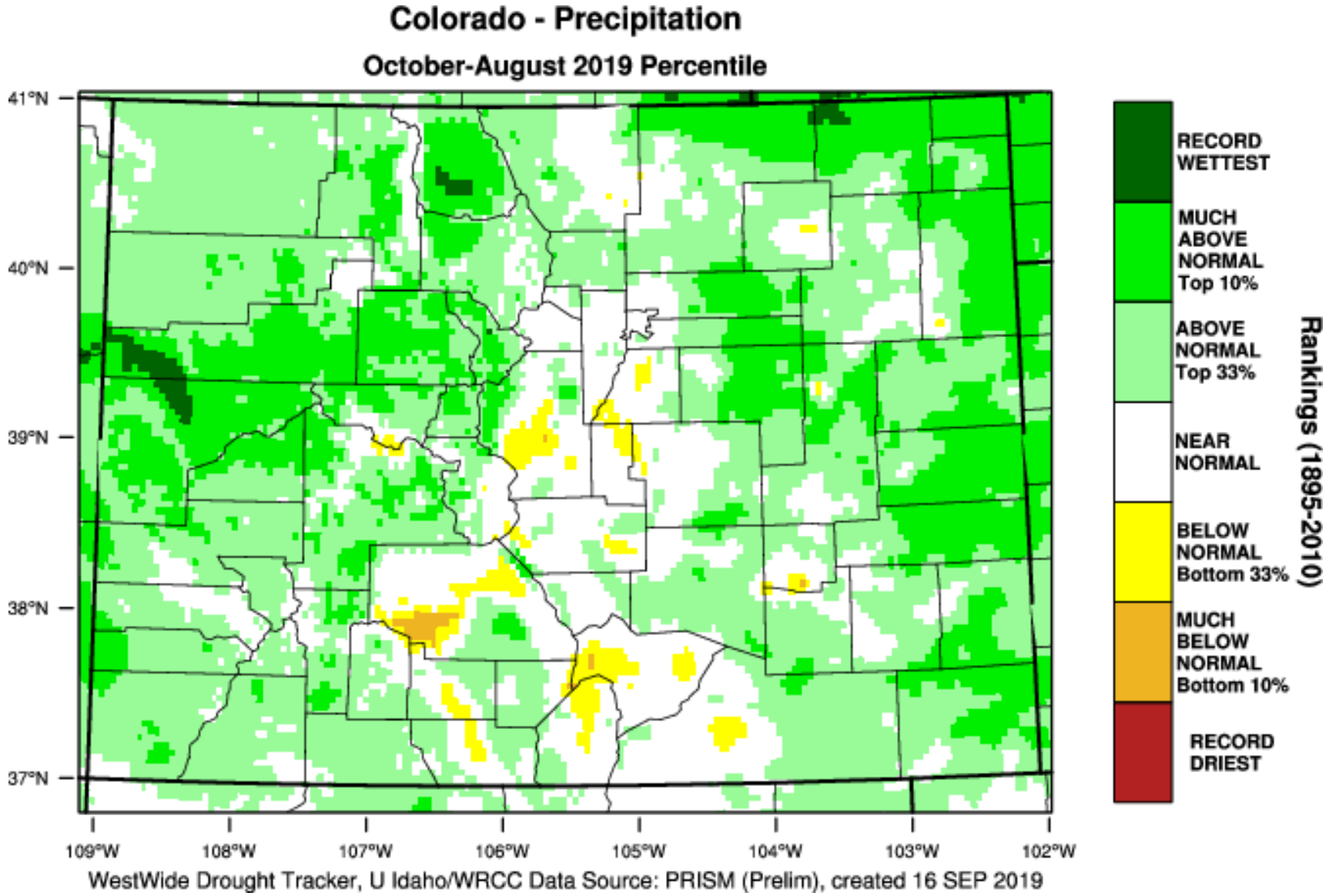
Colorado - Precipitation

August 2019 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 SEP 2019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104°W
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RECORD WETTEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
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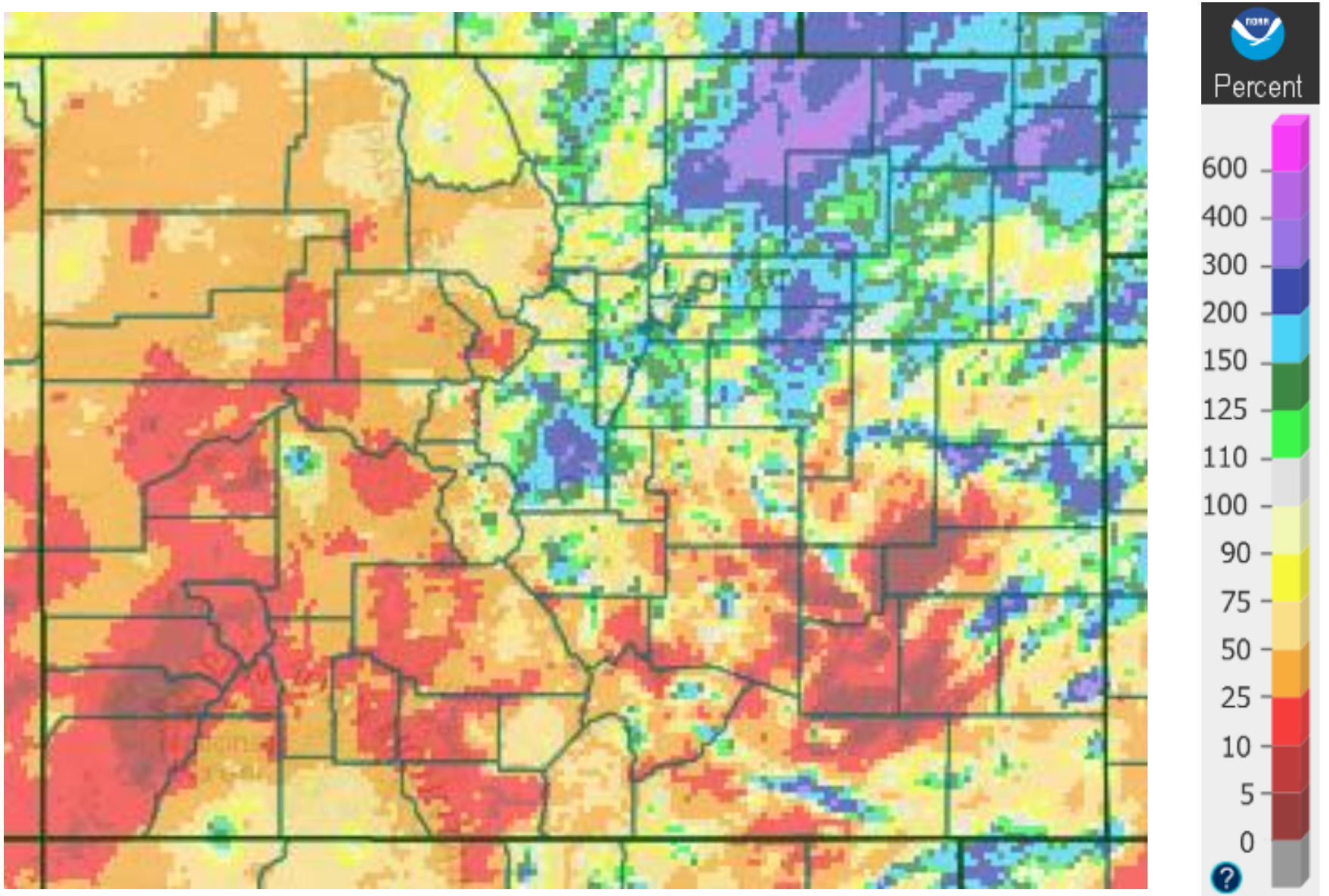
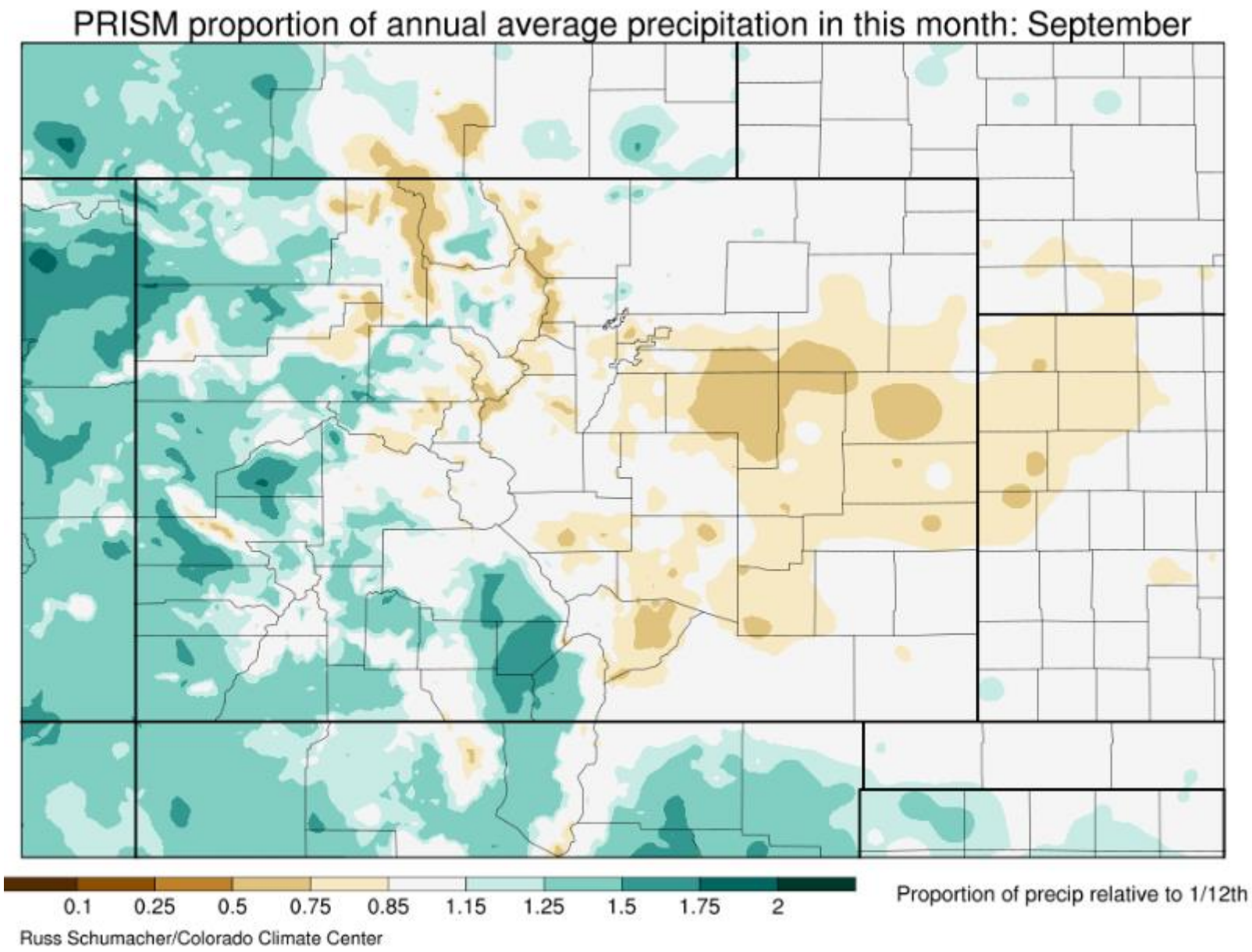
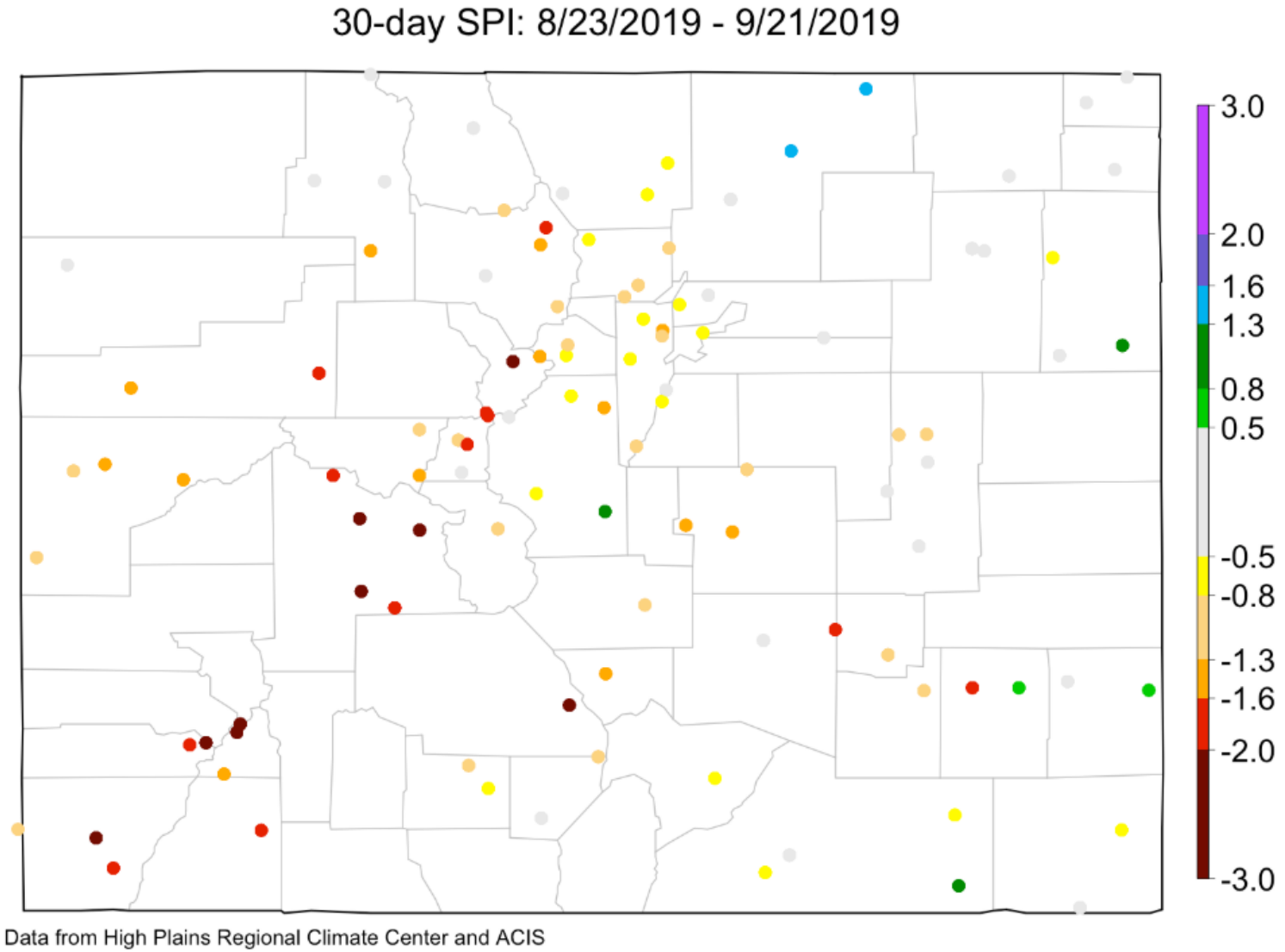
RECORD DRIEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 SEP 2019

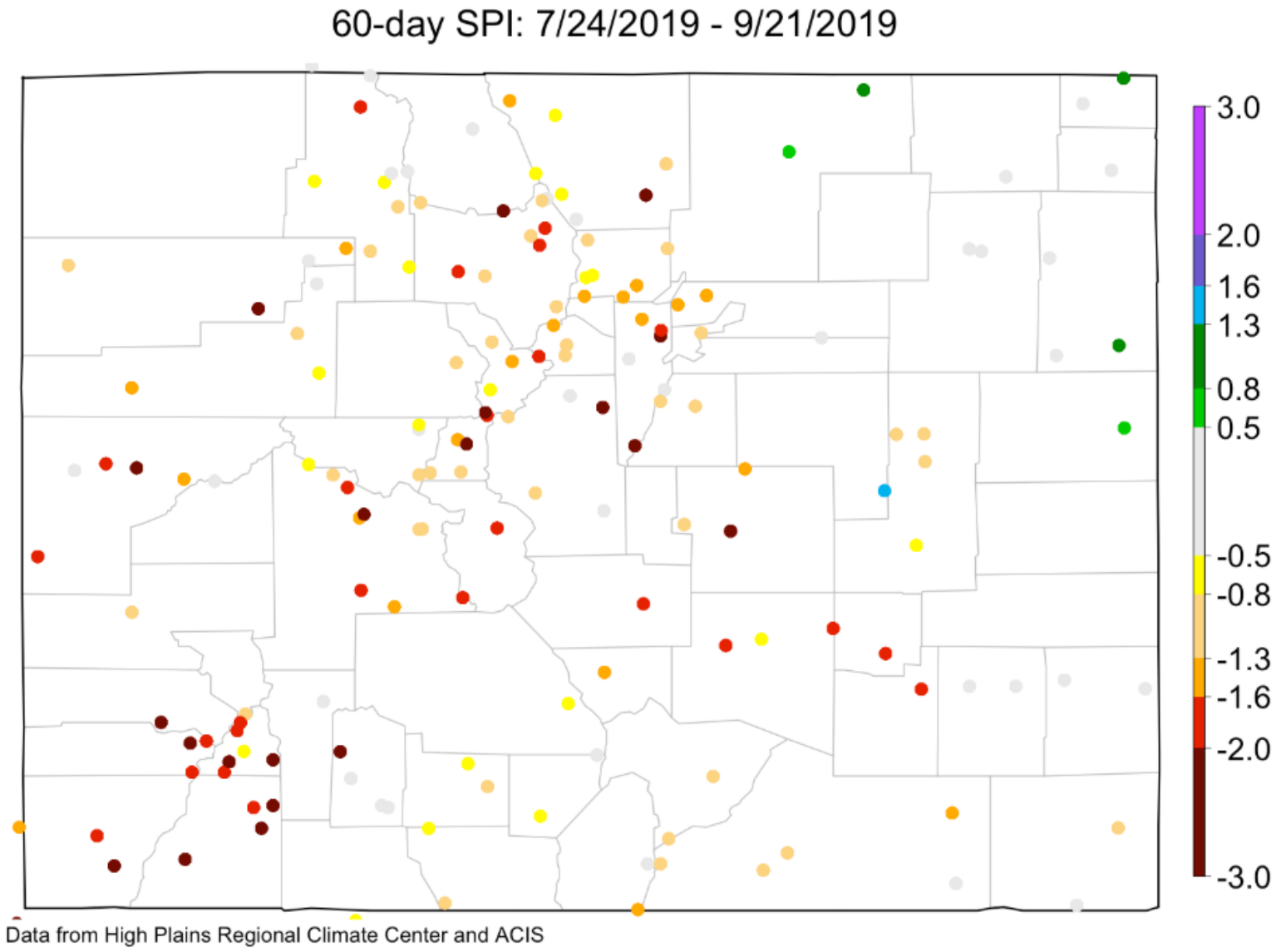


September month to date percent of normal precipitation


PRISM proportion of annual average precipitation in this month: September
0.1
0.25
0.5
0.75
0.85
1.15
1.25
1.5
1.75
2
Proportion of precip relative to 1/12th
Russ Schumacher/Colorado Climate Center



http://climate.colostate.edu/~drought/spi.html



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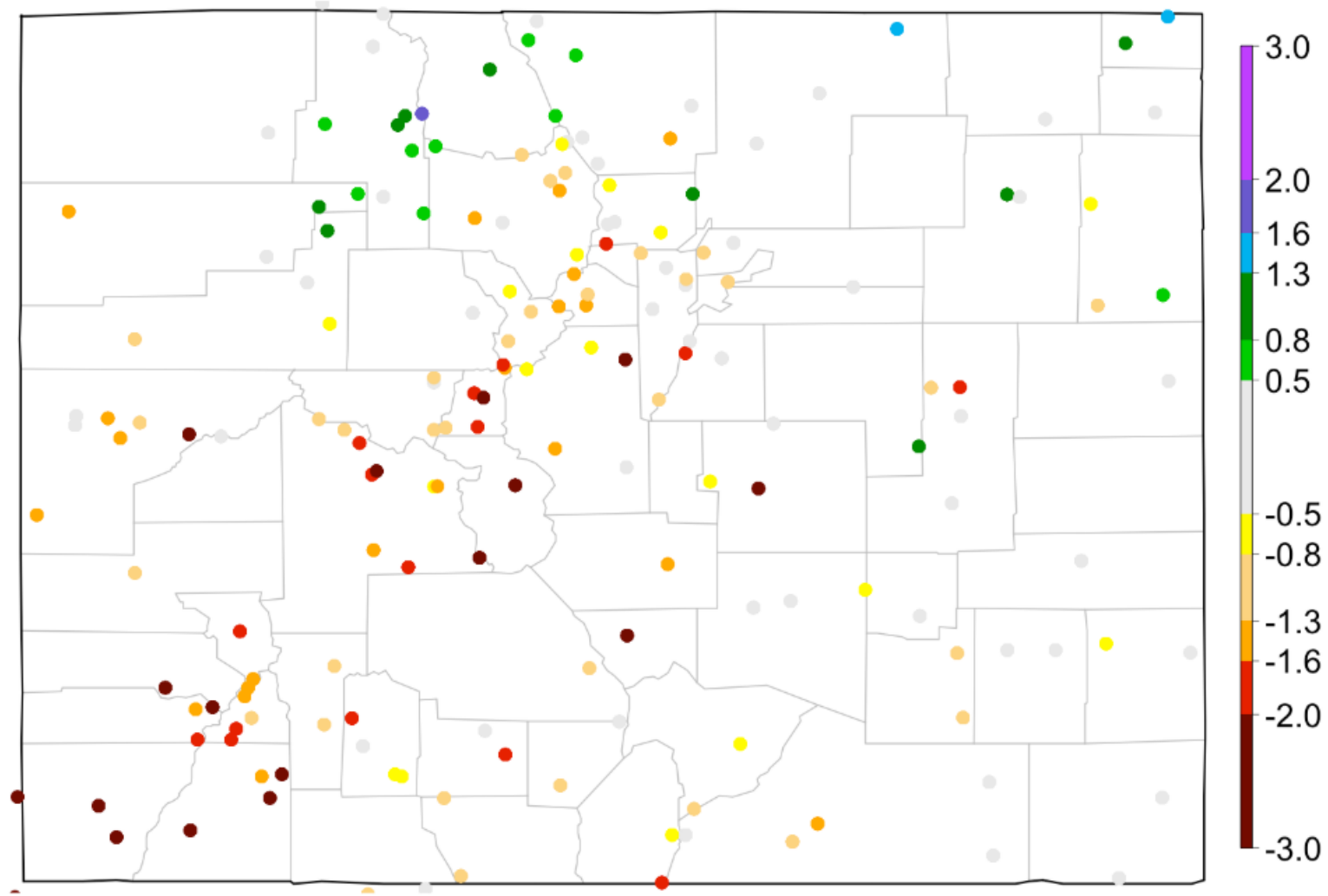
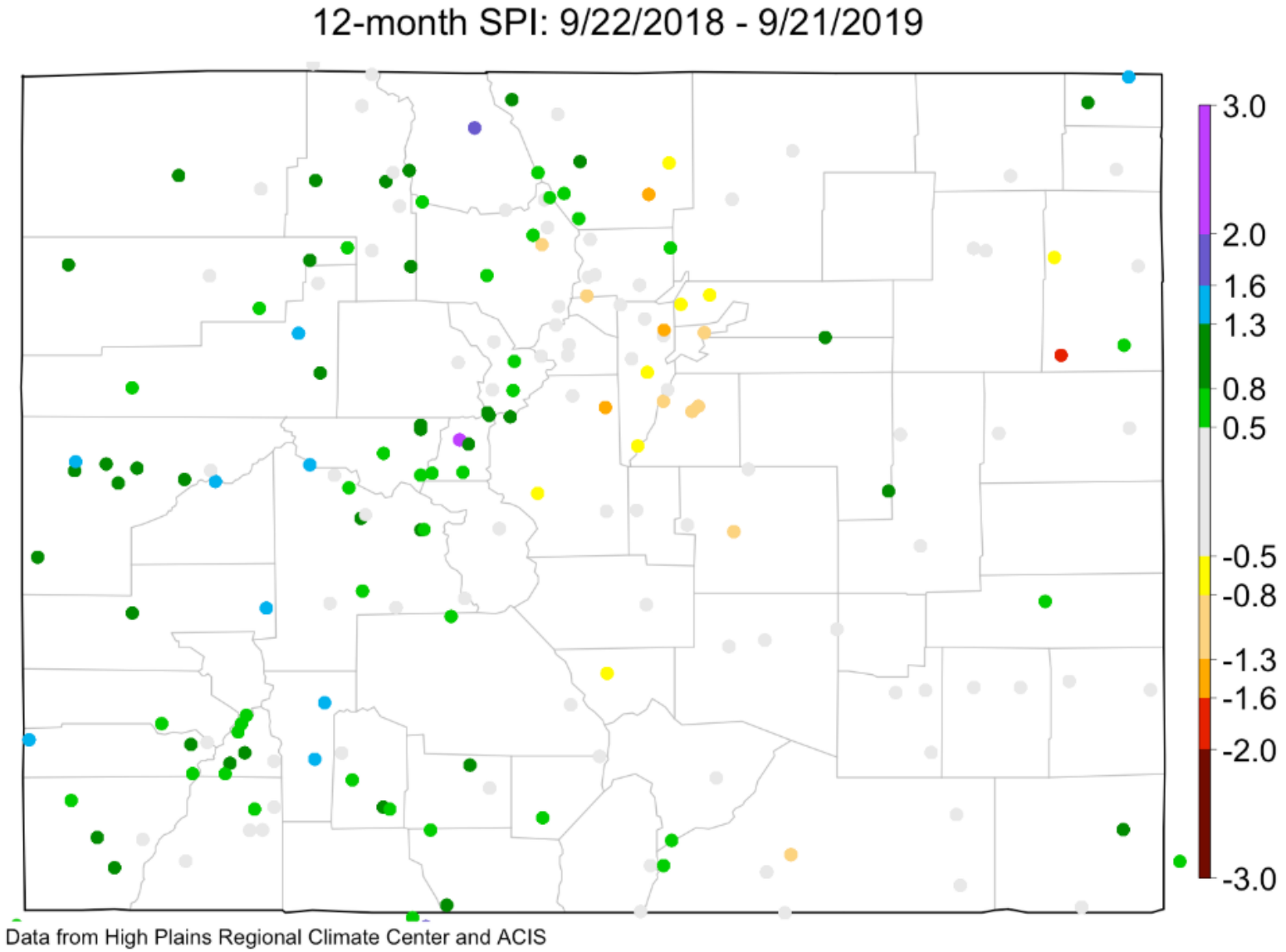
120-day SPI: 5/25/2019 - 9/21/2019



Data from High Plains Regional Climate Center and ACIS

http://climate.colostate.edu/~drought/spi.html



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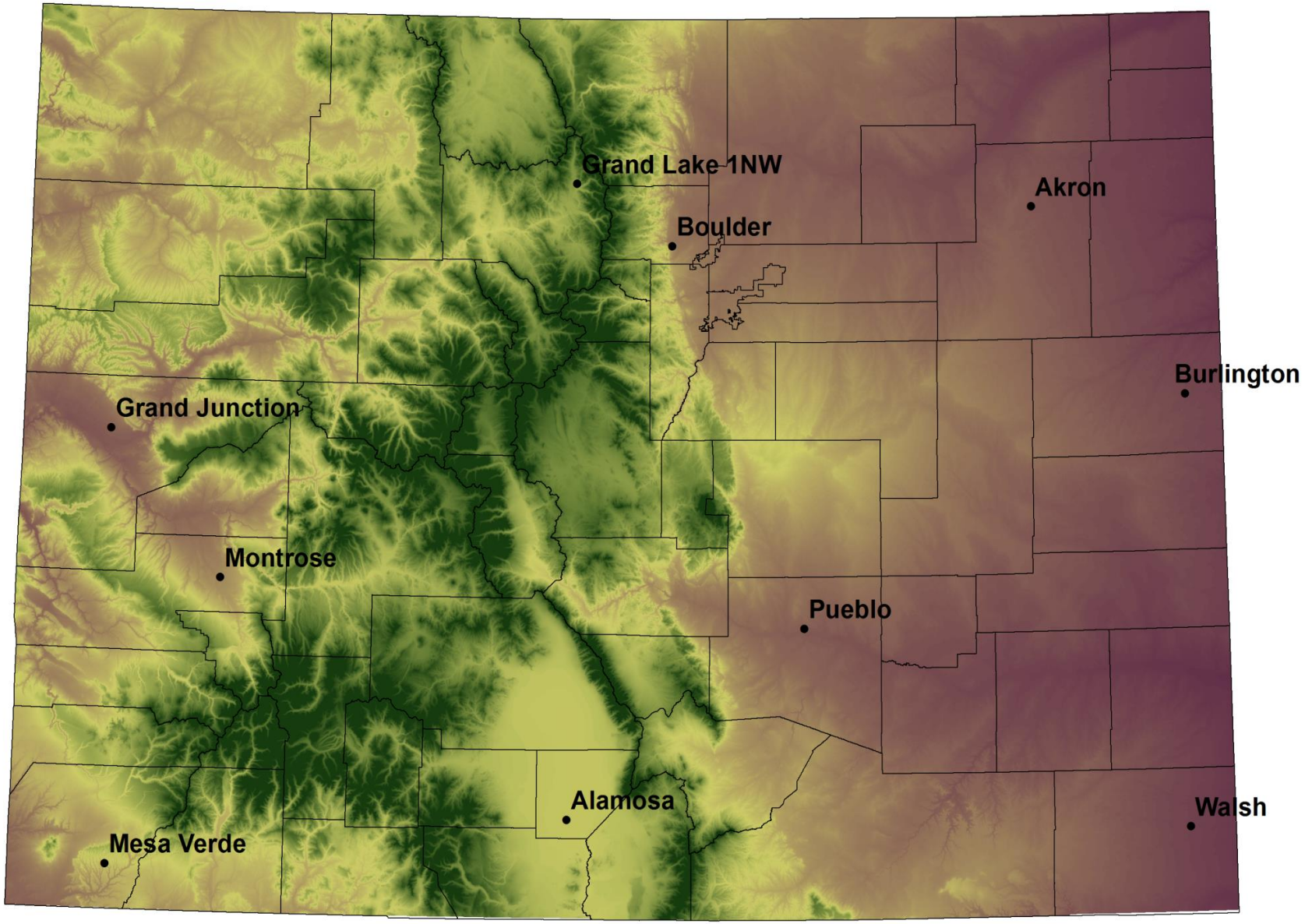
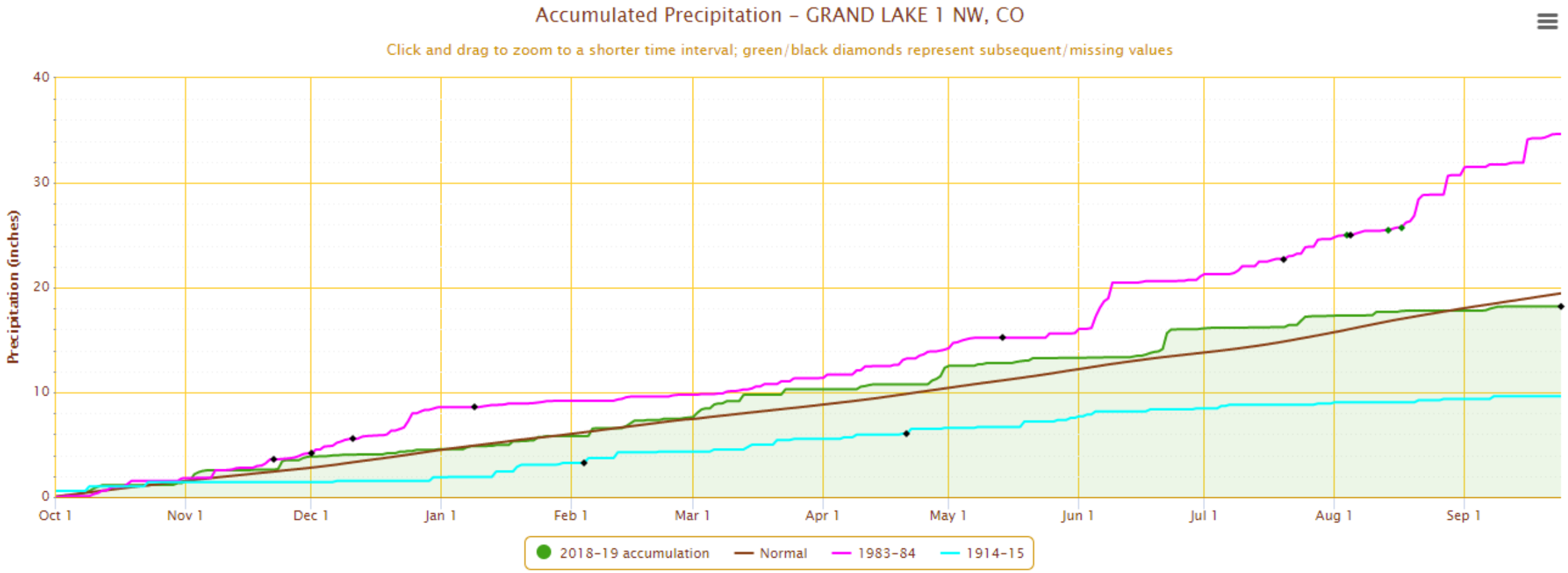
NWS Cooperative Stations for WATF

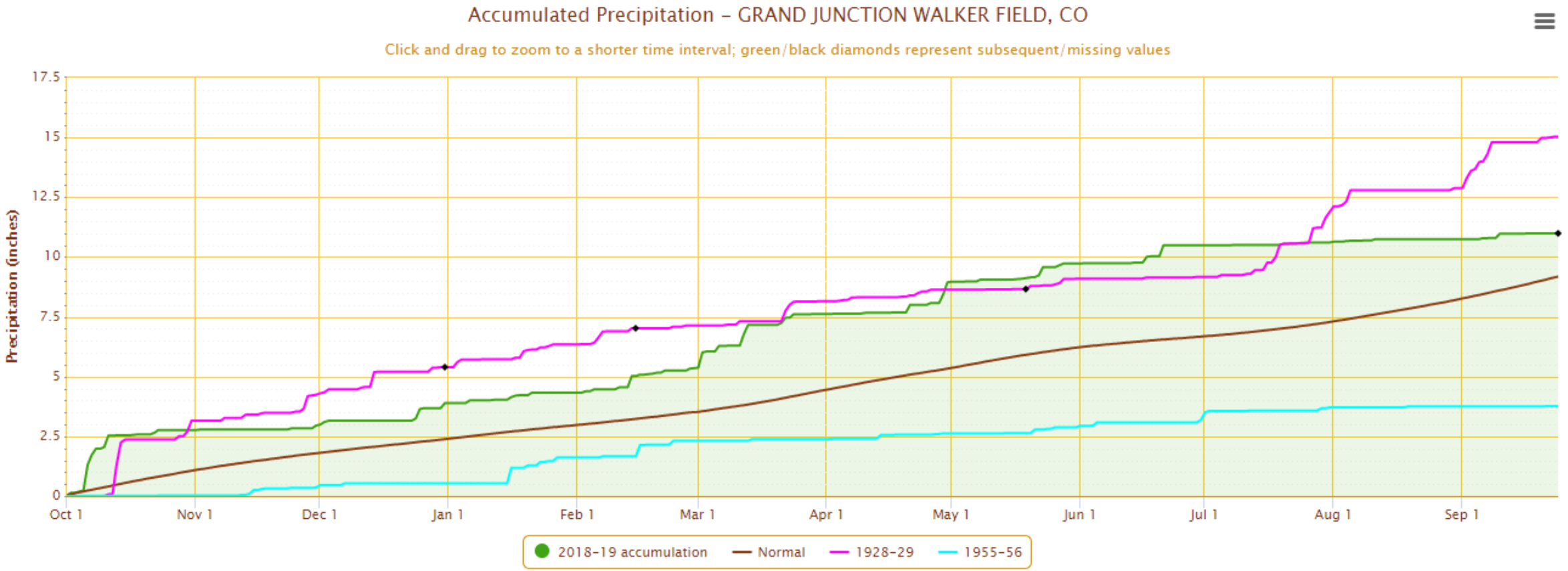


Water Year 2019 – Station Updates

Grand Lake


Accumulated Precipitation – GRAND LAKE 1 NW, CO
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
40
30
20
10
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
2018-19 accumulation
Normal
1983-84
1914-15

Grand Junction

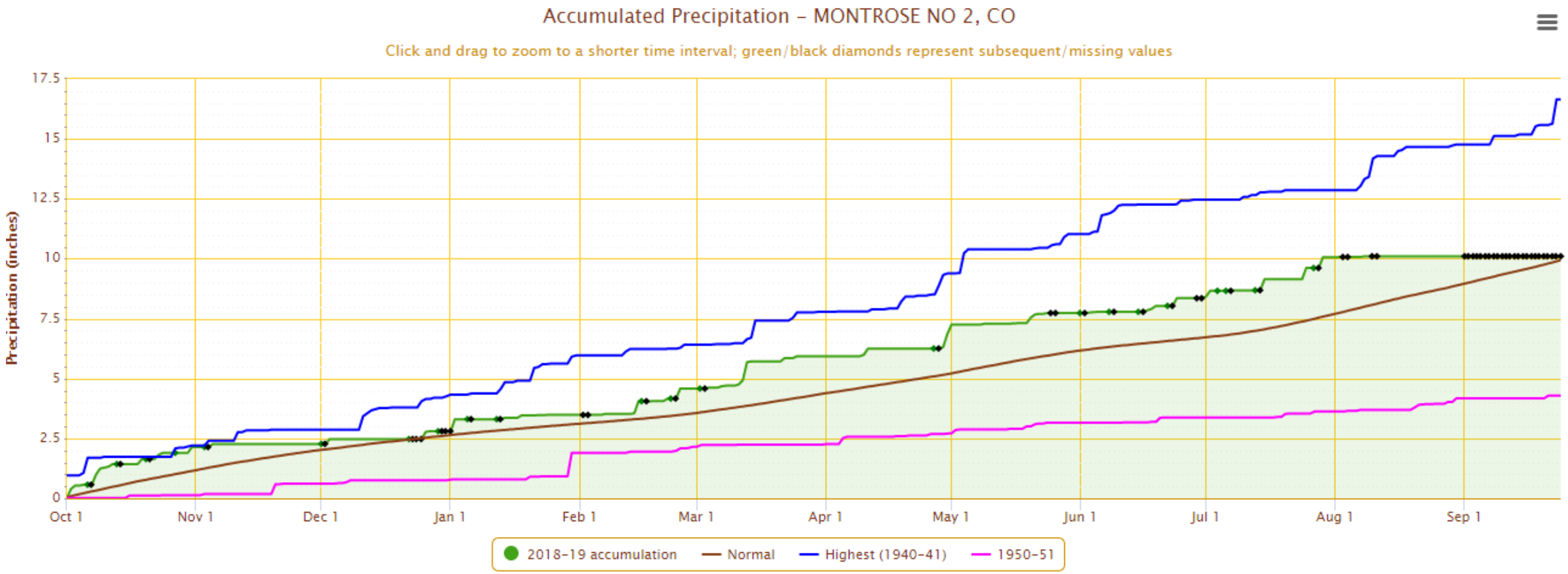


17th wettest on record through this point in the water year

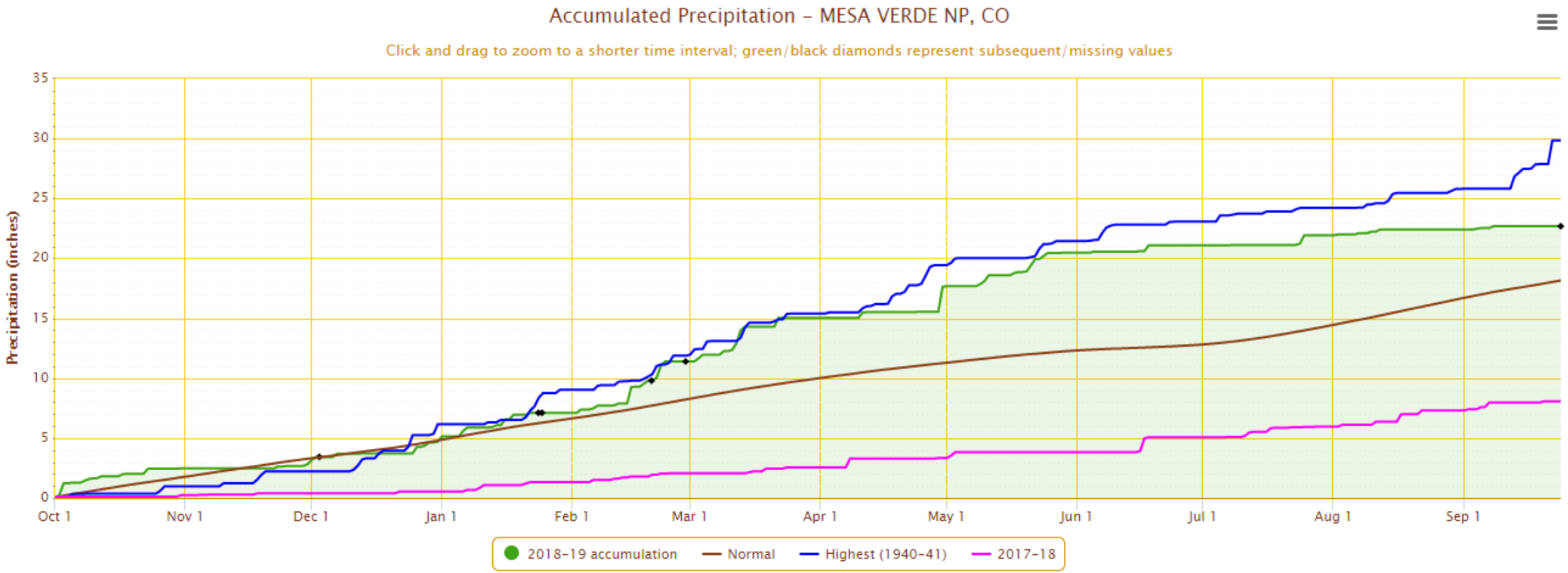
2.7” above average

Driest year on record since the start of July at 0.50”, over twice as dry as 2018

Montrose


Accumulated Precipitation – MONTROSE NO 2, CO
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
17.5
15
12.5
10
7.5
5
2.5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
2018-19 accumulation
Normal
Highest (1940-41)
1950-51

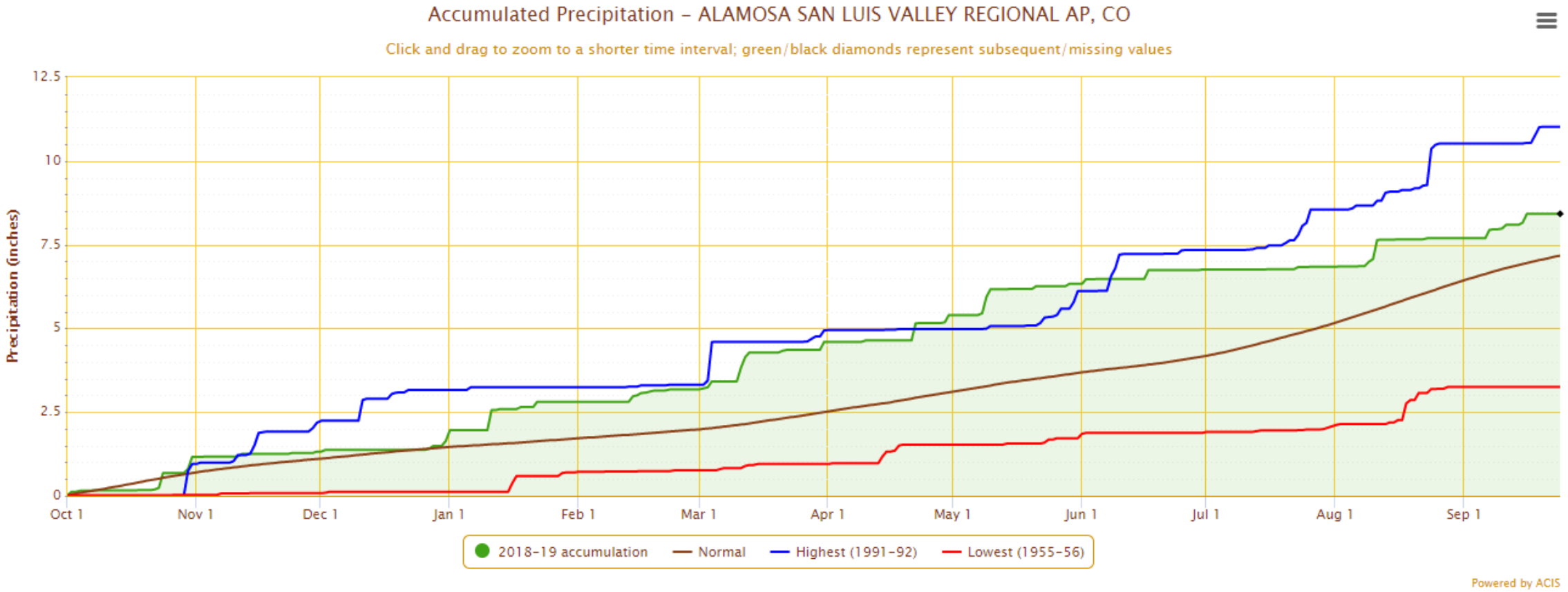
Mesa Verde NP



4th driest year since July 1st, drier than 2018

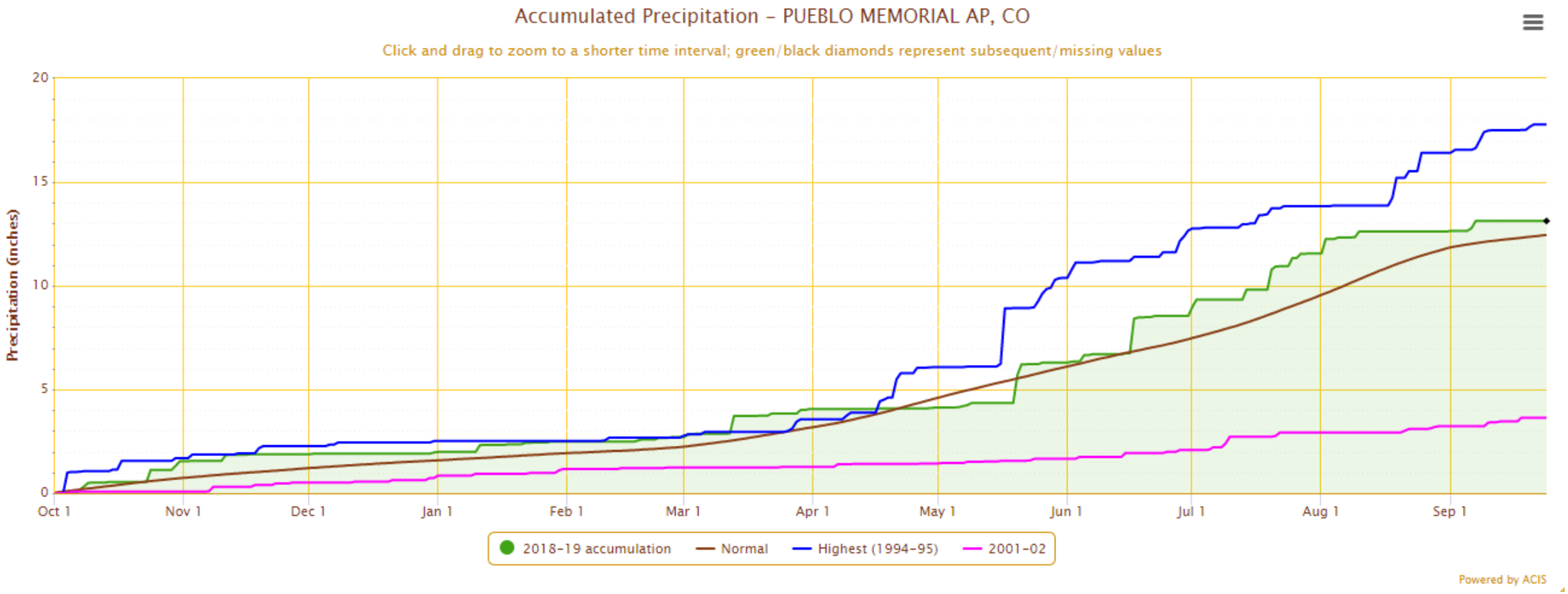
Still 4.53” above average

Alamosa

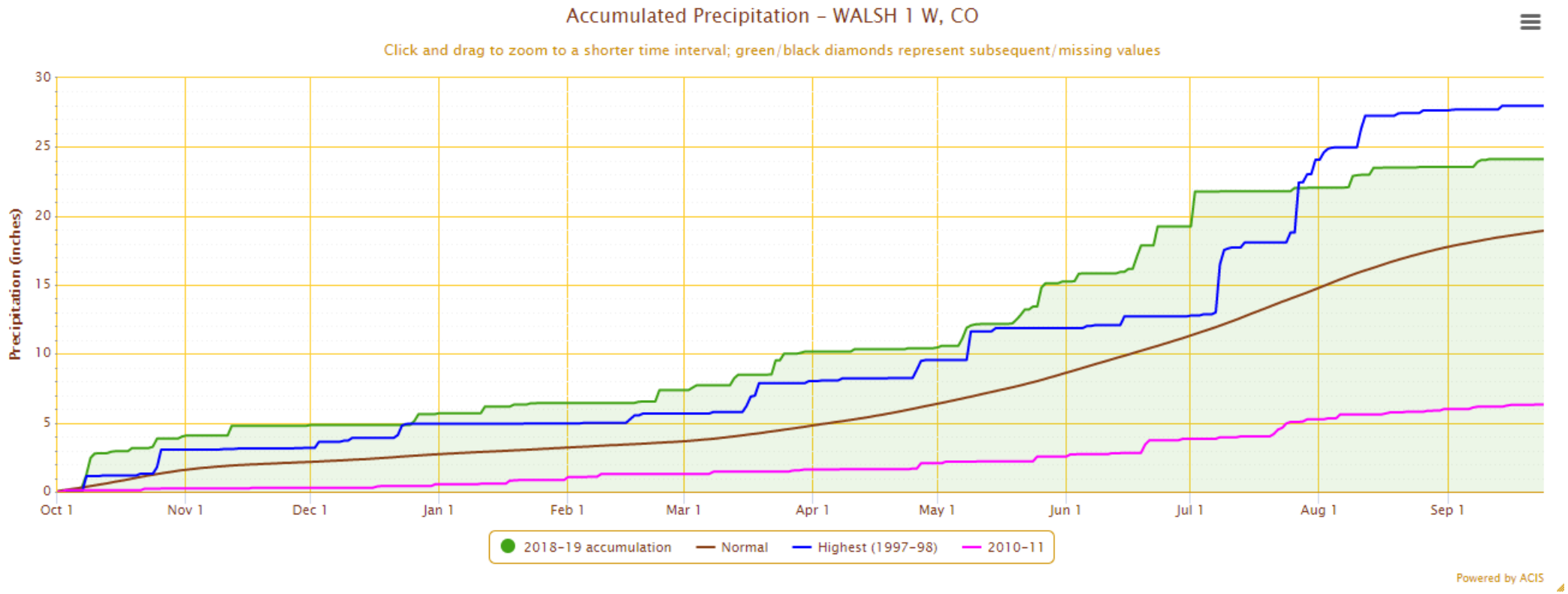


1.25” above average

Pueblo

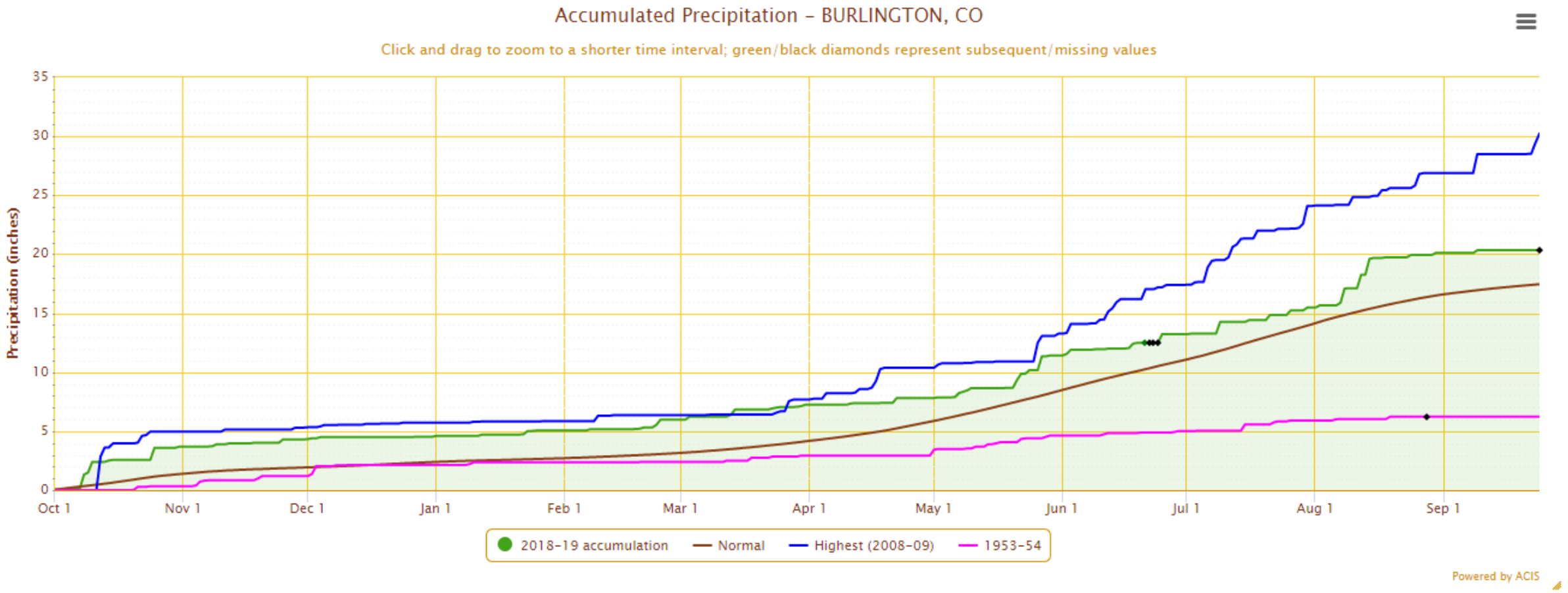

Accumulated Precipitation – PUEBLO MEMORIAL AP, CO
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
20
15
10
5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
2018-19 accumulation
Normal
Highest (1994-95)
2001-02
Powered by ACIS

Walsh

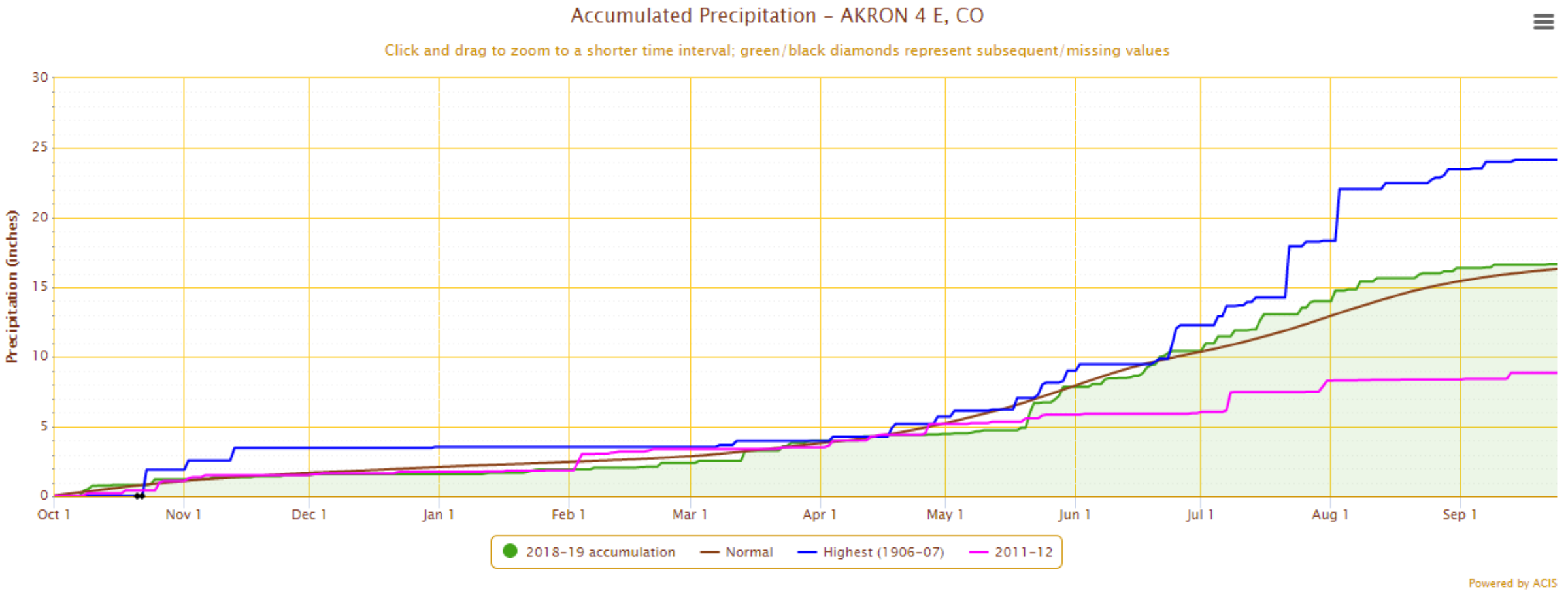


6th wettest on record through this point in the water year

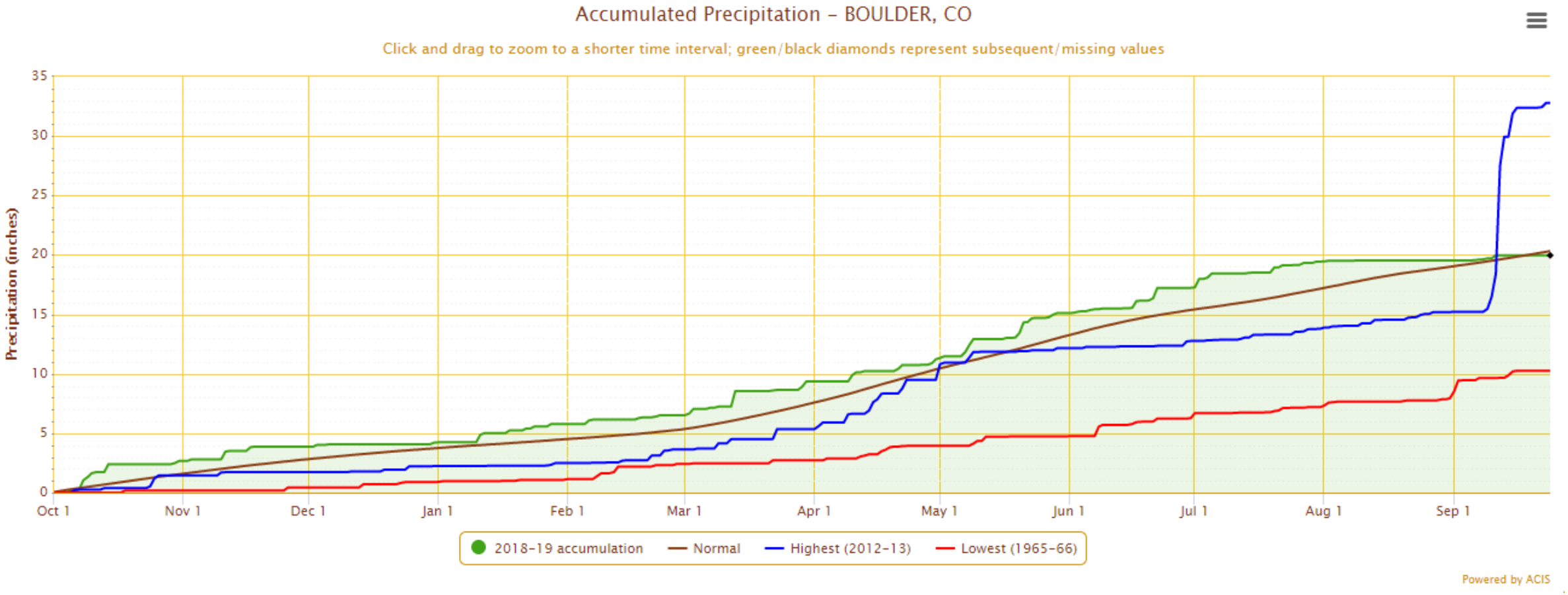
Burlington


Accumulated Precipitation – BURLINGTON, CO
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
35
30
25
20
15
10
5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
2018-19 accumulation
Normal
Highest (2008-09)
1953-54
Powered by ACIS

Akron

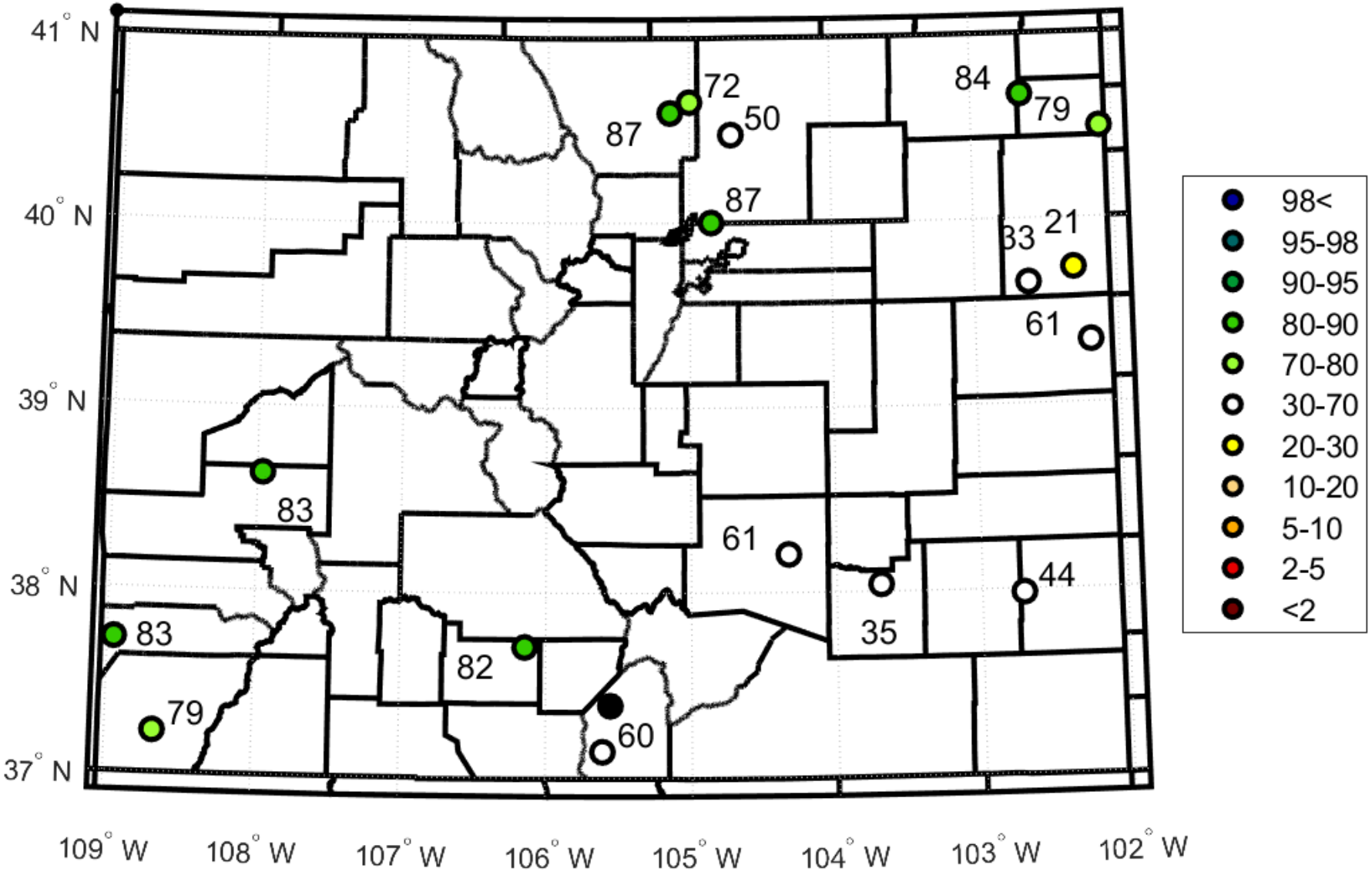

Accumulated Precipitation – AKRON 4 E, CO
Click and drag to zoom to a shorter time interval; green/black diamonds represent subsequent/missing values
Precipitation (inches)
30
25
20
15
10
5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
2018-19 accumulation
Normal
Highest (1906-07)
2011-12
Powered by ACIS

Boulder

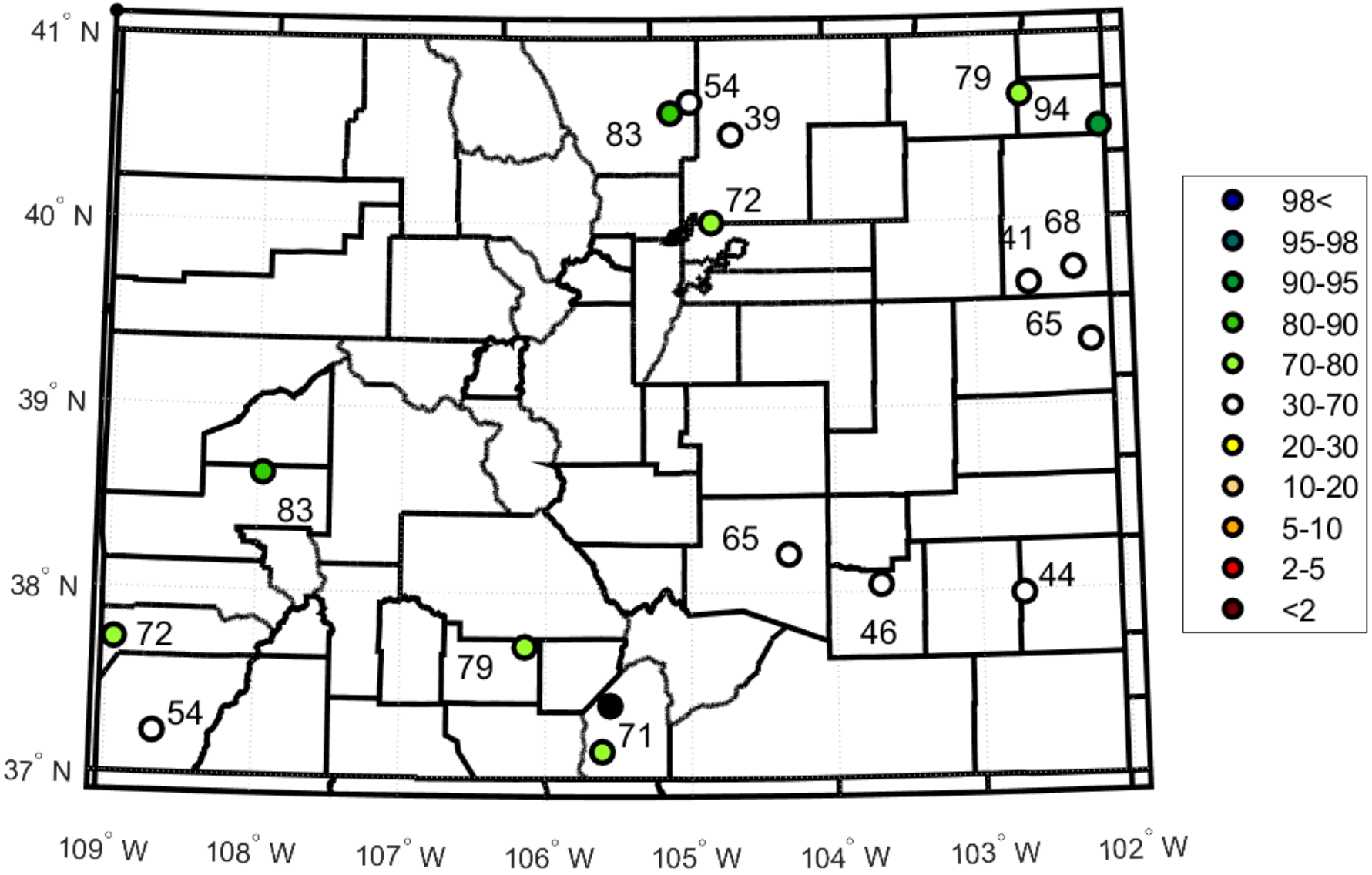


Fell below the water year average for the first time since October this week

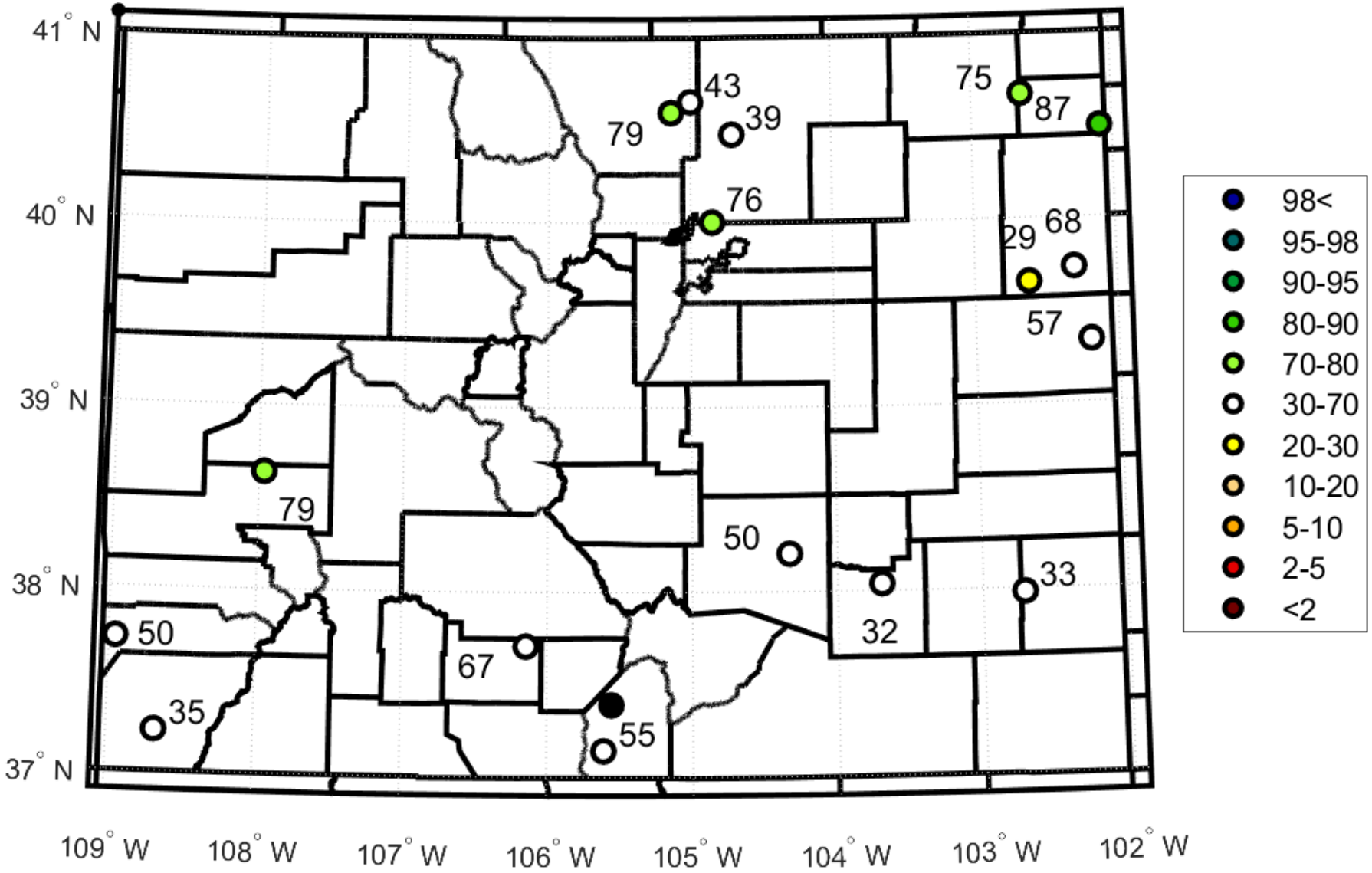
Growing Season Water Balance (P/PET) Percentiles
July 19, 2019

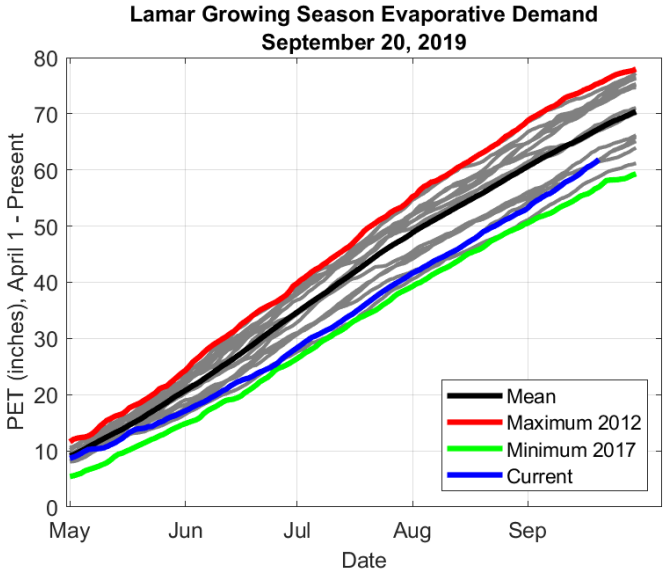


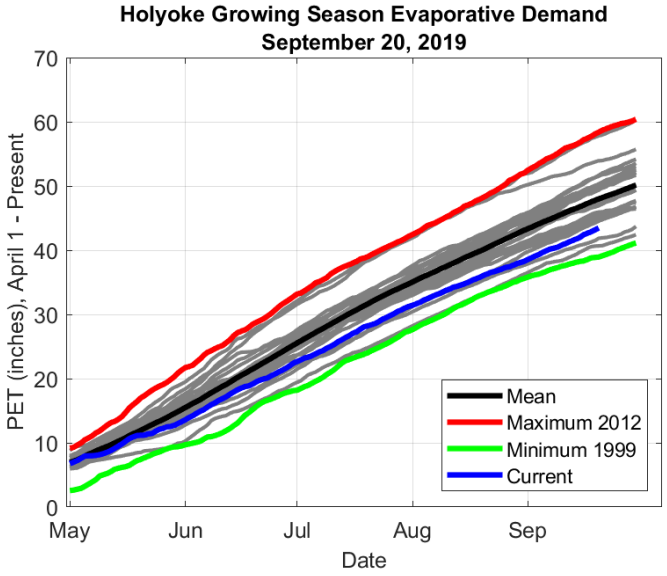
Growing Season Water Balance (P/PET) Percentiles
August 23, 2019

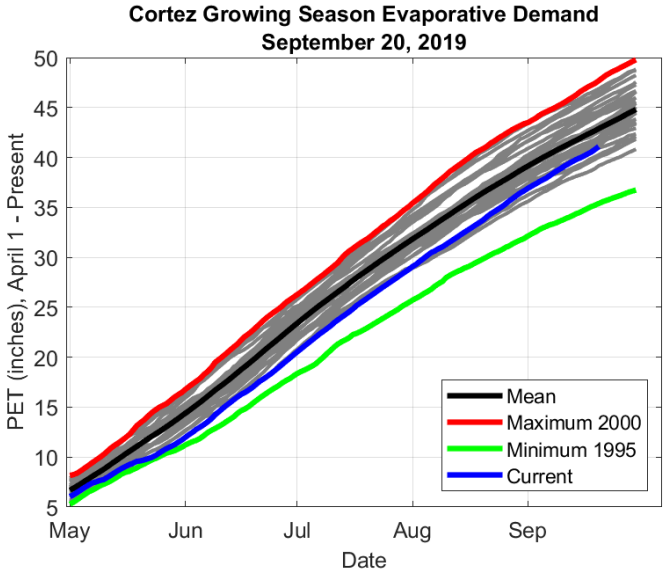


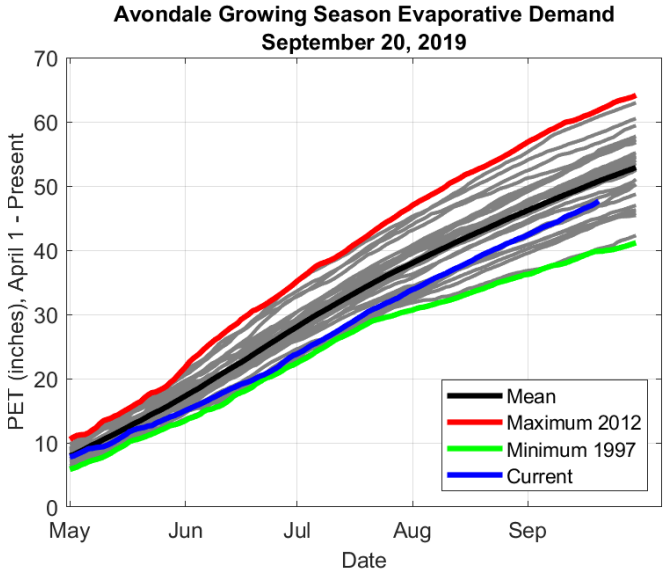
Growing Season Water Balance (P/PET) Percentiles
September 20, 2019

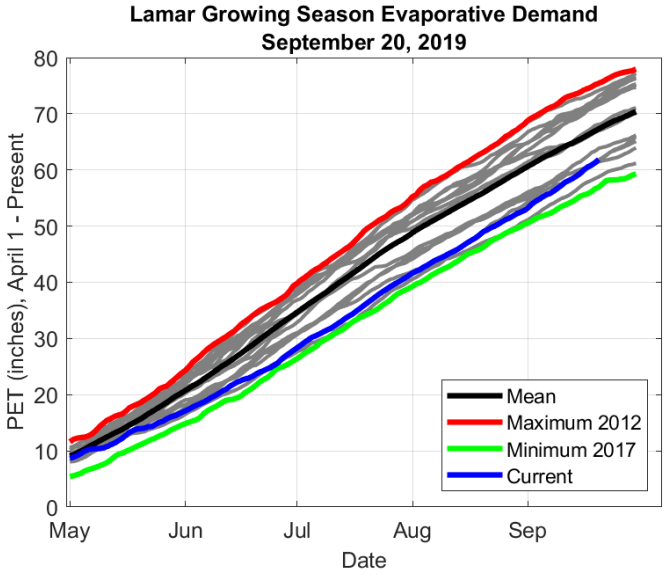



Lamar Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 2017
Current


Holyoke Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 1999
Current


Cortez Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2000
Minimum 1995
Current


Avondale Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 1997
Current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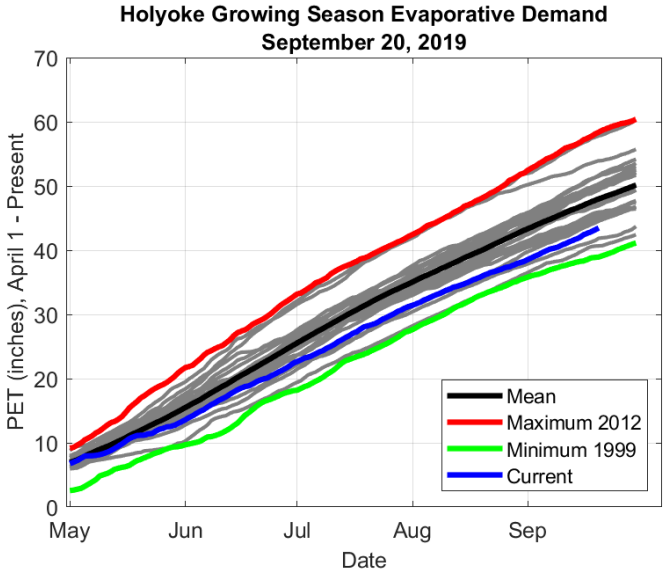
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 2017
Current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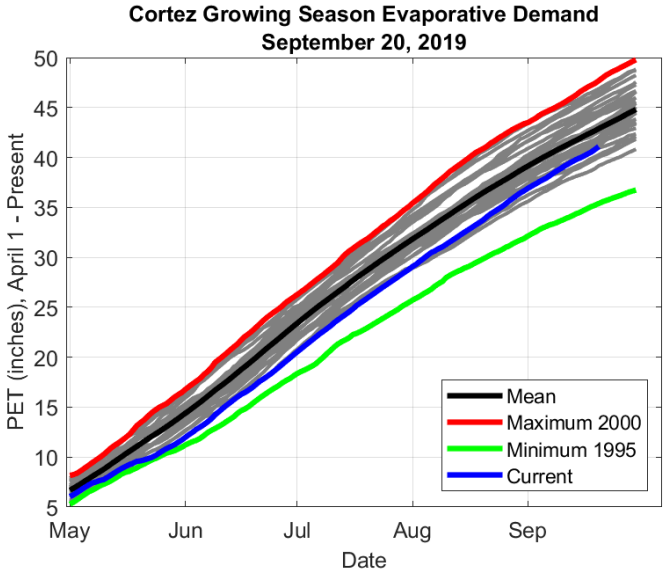
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 1999
Current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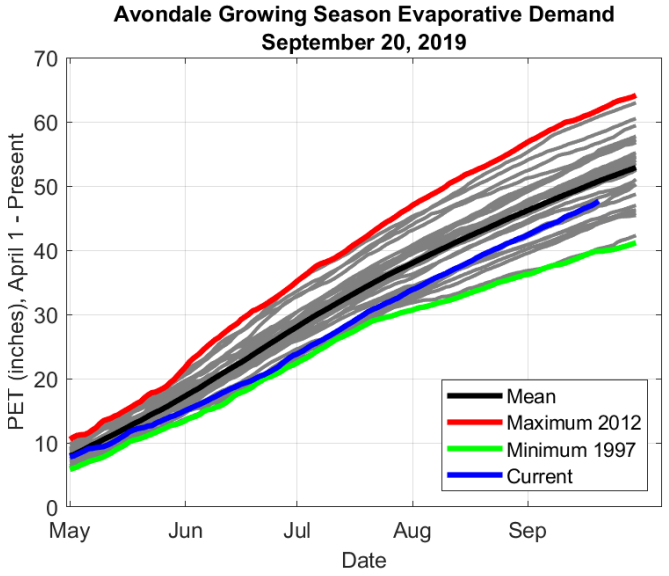
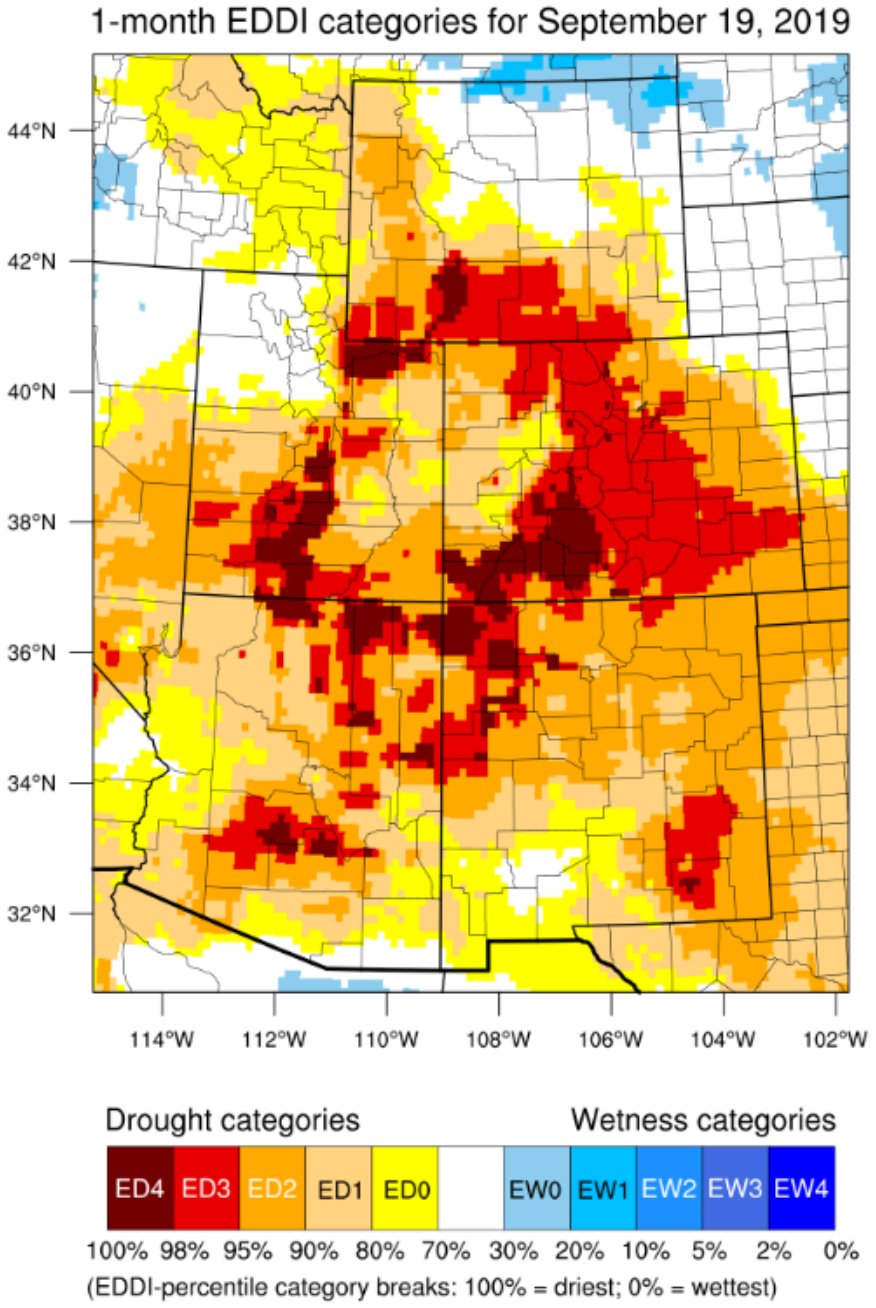
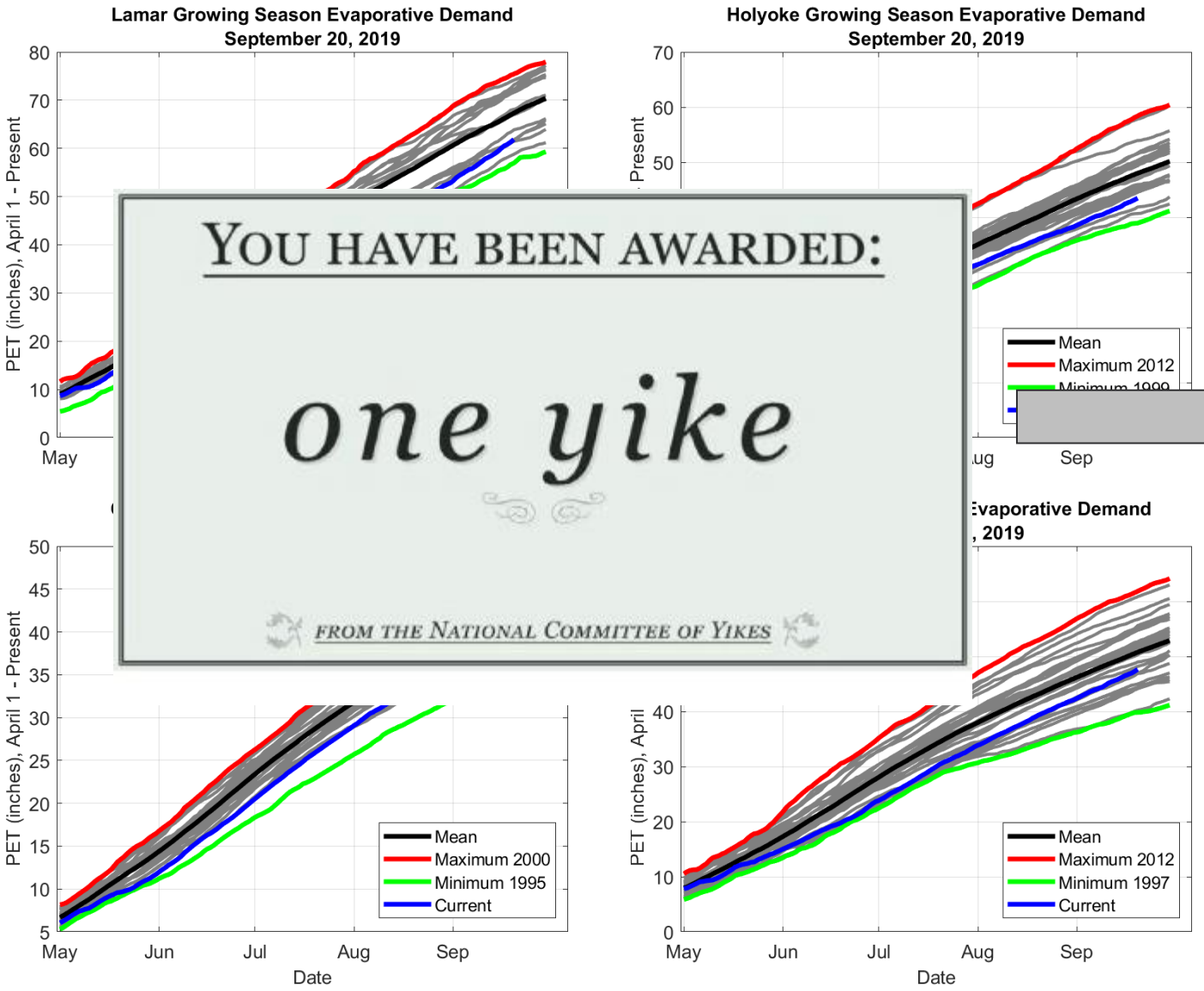
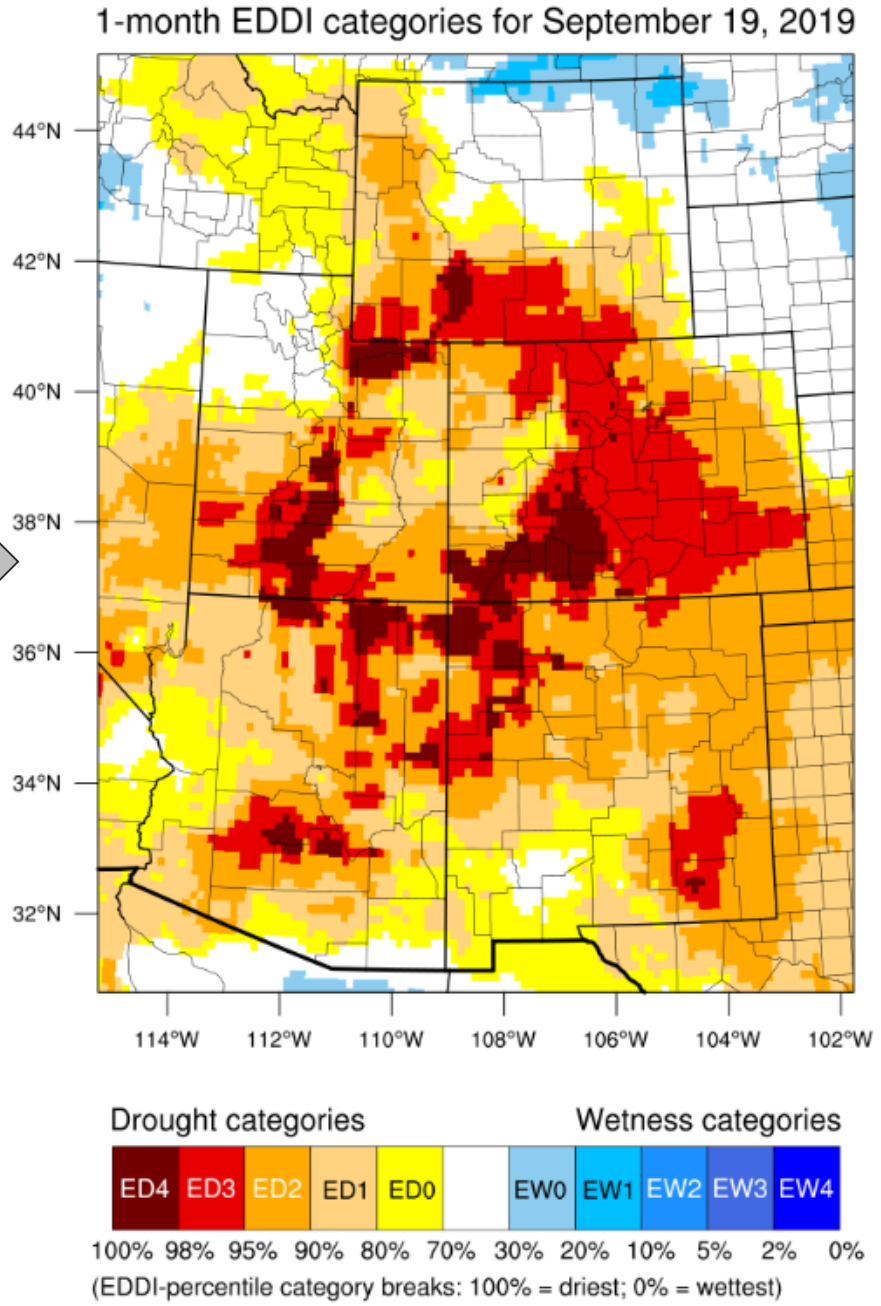
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2000
Minimum 1995
Current


Avondale Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
Date
May
Jun
Jul
Aug
Sep
Mean
Maximum 2012
Minimum 1997
Current


1-month EDDI categories for September 19, 2019
44°N
42°N
40°N
38°N
36°N
34°N
32°N
114°W
112°W
110°W
108°W
106°W
104°W
102°W
Drought categories
Wetness categories
ED4
ED3
ED2
ED1
ED0
EW0
EW1
EW2
EW3
EW4
100% 98% 95% 90% 80% 70% 30% 20% 10% 5% 2% 0%
(EDDI-percentile category breaks: 100% = driest; 0% = wettest)


Lamar Growing Season Evaporative Demand
September 20, 2019
PET (inches), April 1 - Present
May
Jun
Jul
Aug
Sep
Date
Mean
Maximum 2000
Minimum 1995
Current
Holyoke Growing Season Evaporative Demand
September 20, 2019
PET (inches), April
Mean
Maximum 2012
Minimum 1997
Current

YOU HAVE BEEN AWARDED:
one yike
FROM THE NATIONAL COMMITTEE OF YIKES


1-month EDDI categories for September 19, 2019
44°N
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Drought categories
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ED4
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(EDDI-percentile category breaks: 100% = driest; 0% = wettest)

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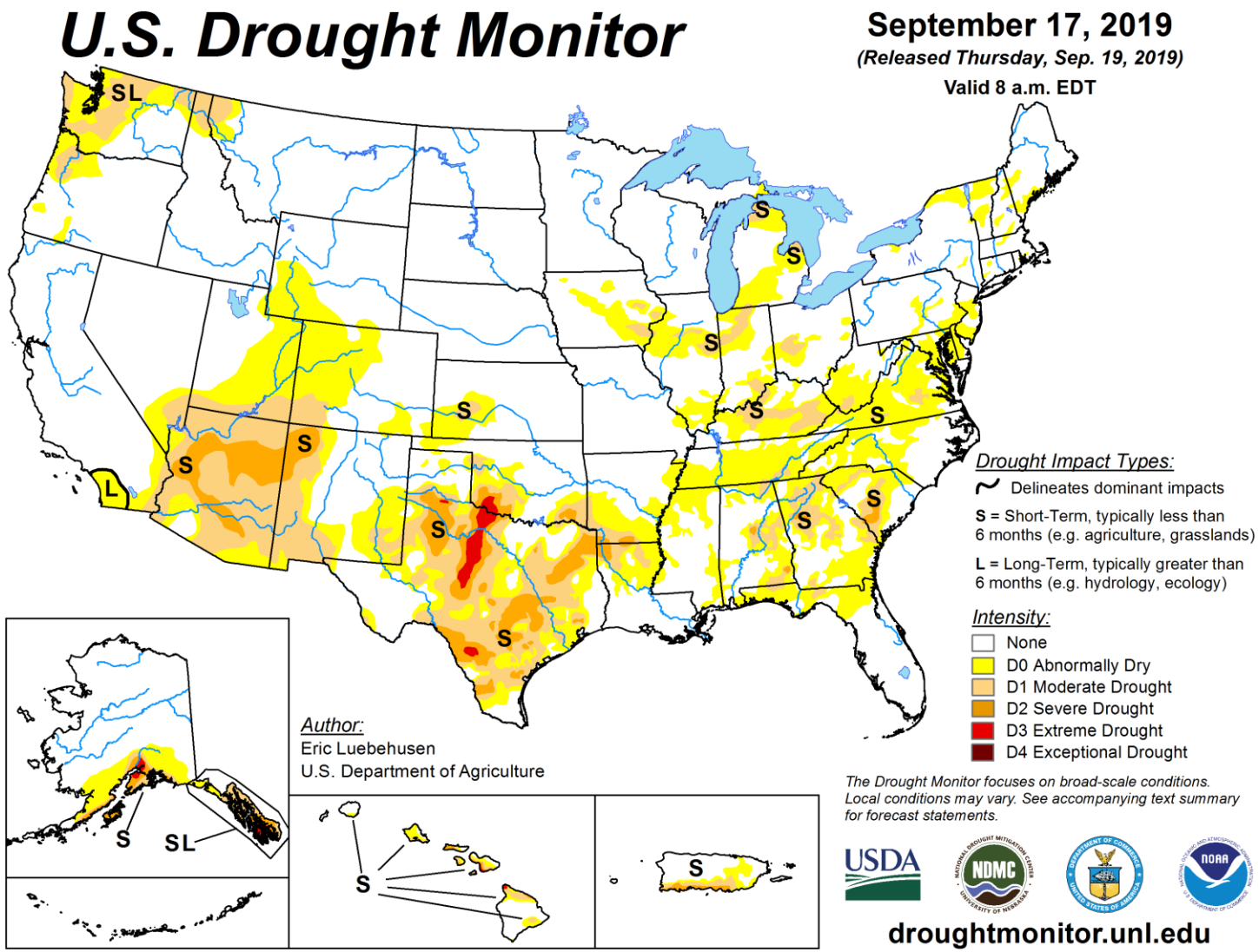
Drought

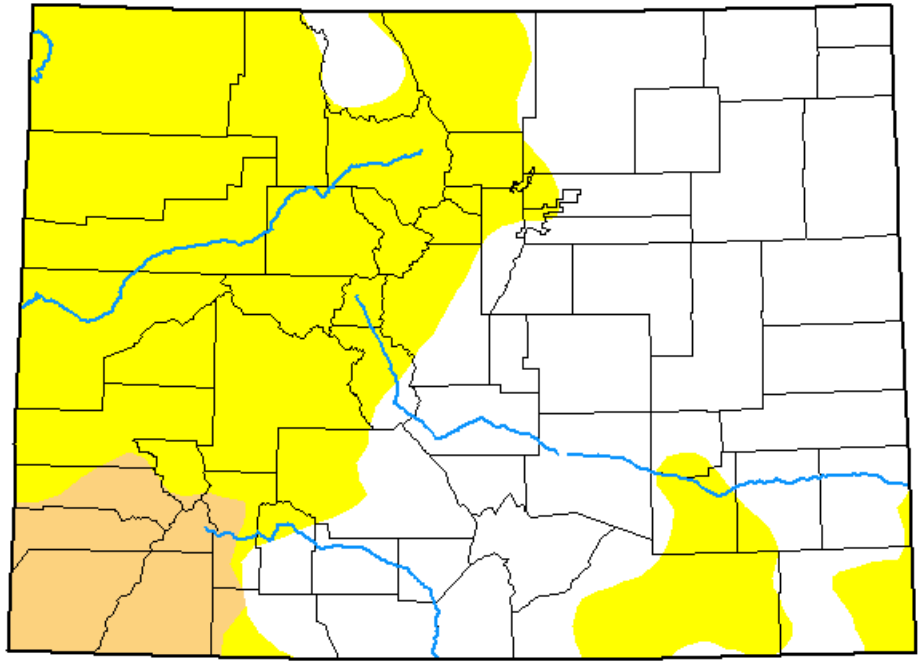
National Drought

Colorado Drought

Colorado Drought Facts


U.S. Drought Monitor
September 17, 2019
(Released Thursday, Sep. 19, 2019)
Valid 8 a.m. EDT
Drought Impact Types:
Delineates dominant impacts
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought
Author:
Eric Luebehusen
U.S. Department of Agriculture
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.
droughtmonitor.unl.edu

U.S. Drought Monitor
Colorado



September 17, 2019
(Released Thursday, Sep. 19, 2019)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	50.45	49.55	6.68	0.00	0.00	0.00
Last Week *09-10-2019*	50.45	49.55	6.68	0.00	0.00	0.00
3 Months Ago *06-18-2019*	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year *01-01-2019*	17.94	82.06	66.26	54.91	27.11	11.22
Start of Water Year *09-25-2018*	14.19	85.81	72.30	64.41	48.47	16.21
One Year Ago *09-18-2018*	16.89	83.11	71.59	63.93	44.29	12.62

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Eric Luebehusen
U.S. Department of Agriculture

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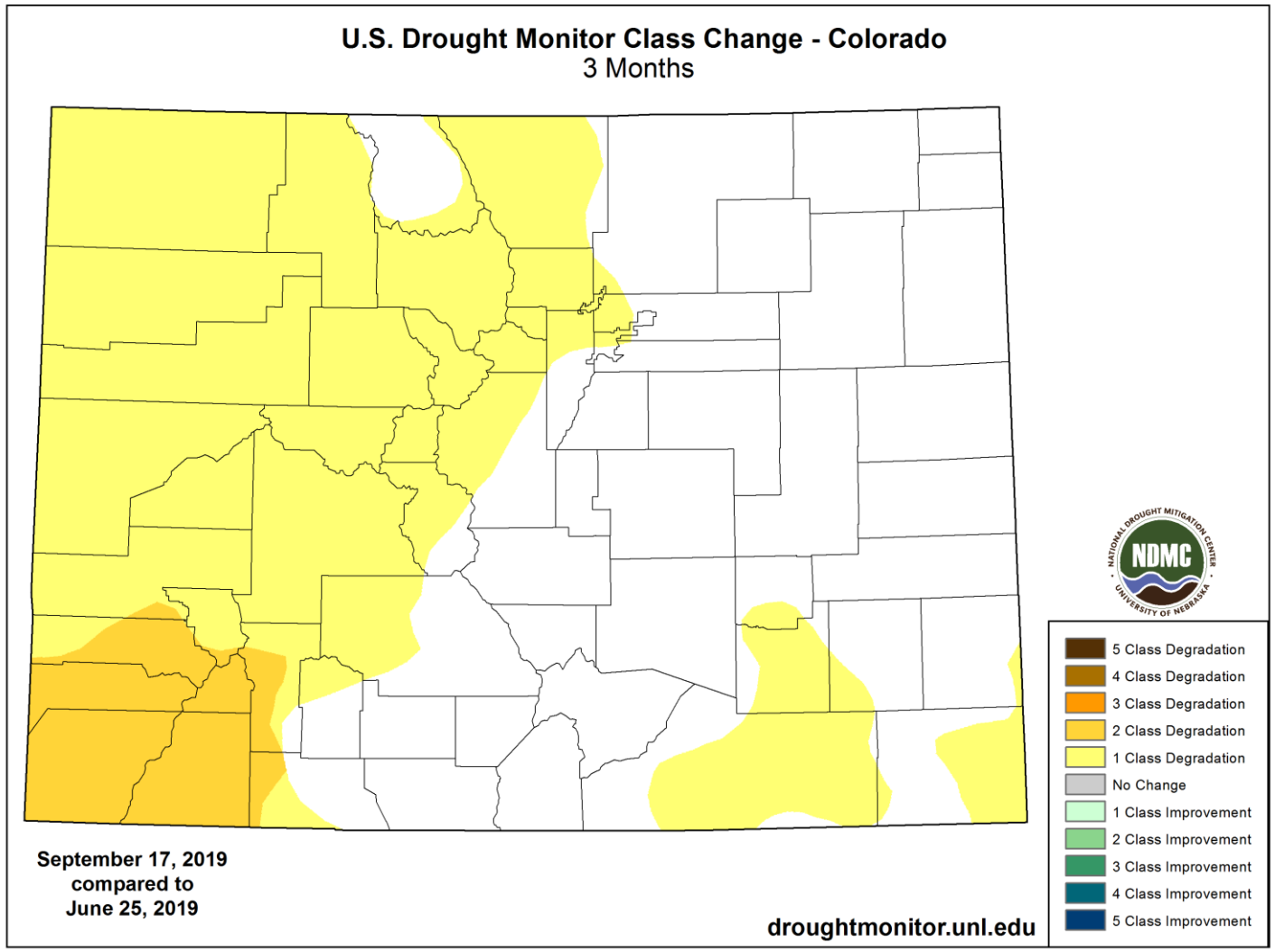
U.S. Drought Monitor Class Change - Colorado
3 Months
September 17, 2019
compared to
June 25, 2019
droughtmonitor.unl.edu
NDMC
NATIONAL DROUGHT MITIGATION CENTER
UNIVERSITY OF NEBRASKA
5 Class Degradation
4 Class Degradation
3 Class Degradation
2 Class Degradation
1 Class Degradation
No Change
1 Class Improvement
2 Class Improvement
3 Class Improvement
4 Class Improvement
5 Class Improvement

Colorado Drought Monitor Facts

- Prior to May of this year:
  - Since the beginning of the US Drought Monitor, our state had never been completely free of D0 – D4.
  - Our previous record smallest amount of D0 occurred in May 2001, when only 0.13% of our state showed D0.
- As of May 28, 2019:
  - We became the last state to finally report a week of no D0-D4.
  - We had 8 straight weeks of an empty map, but that streak ended on July 23

Week	None	D0-D4
2019-05-21	99.99	0.01
2019-05-28	100.00	0.00
2019-06-04	100.00	0.00
2019-06-11	100.00	0.00
2019-06-18	100.00	0.00
2019-06-25	100.00	0.00
2019-07-02	100.00	0.00
2019-07-09	100.00	0.00
2019-07-16	100.00	0.00
2019-07-23	96.93	3.07

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Outlook

Next 7 days

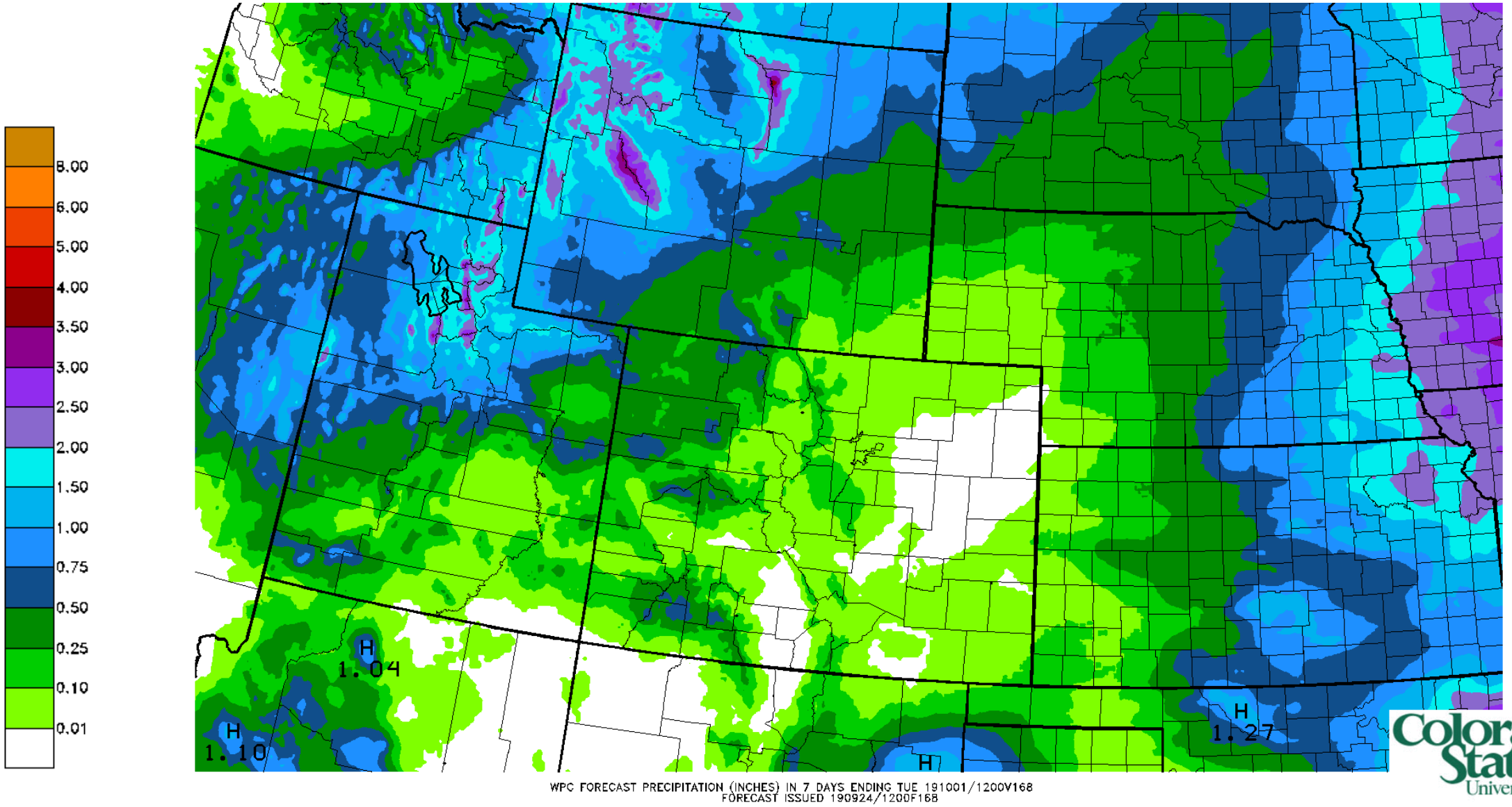
8-14 day Outlook

CPC Outlooks

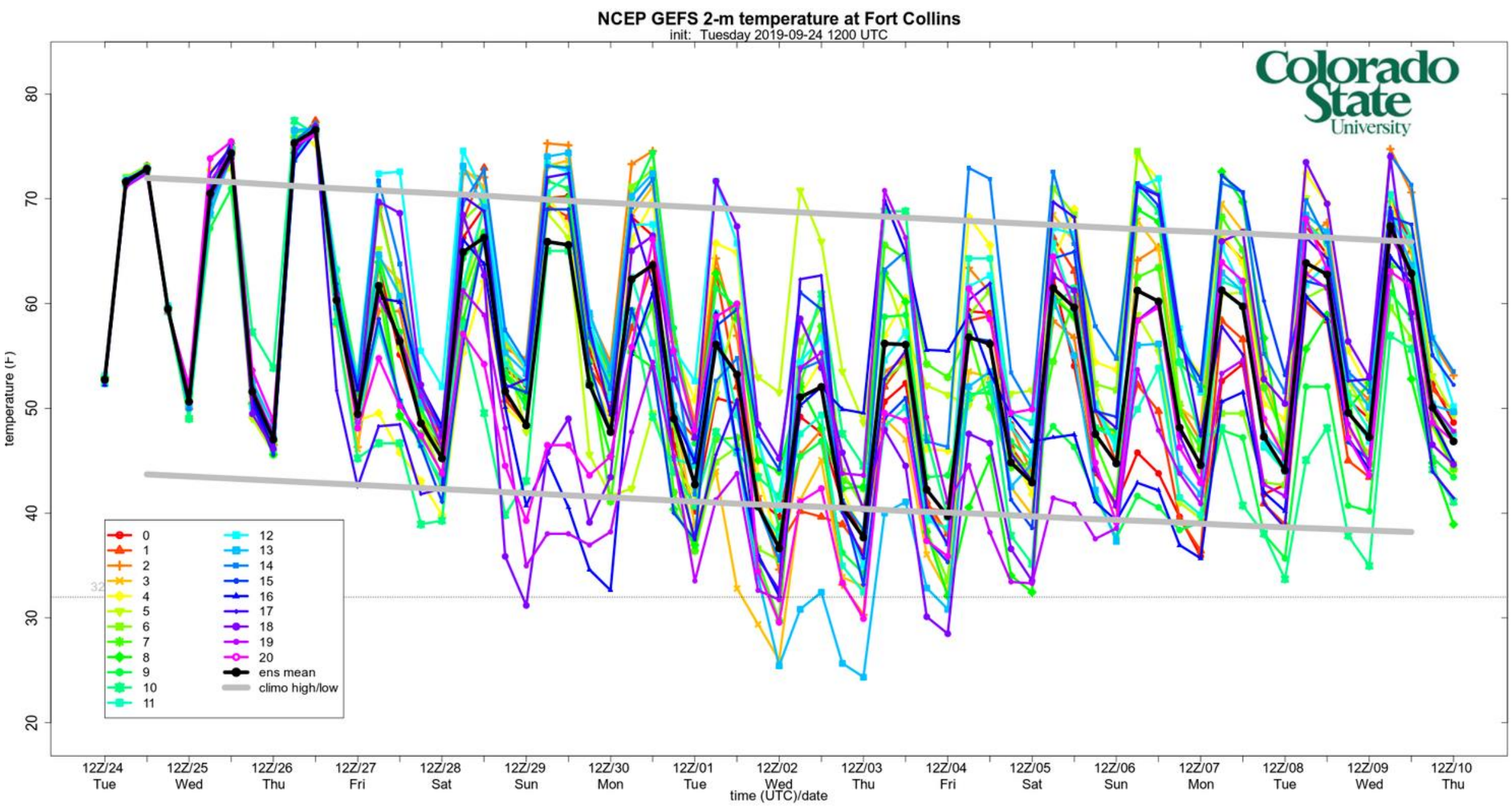
Precipitation Projections

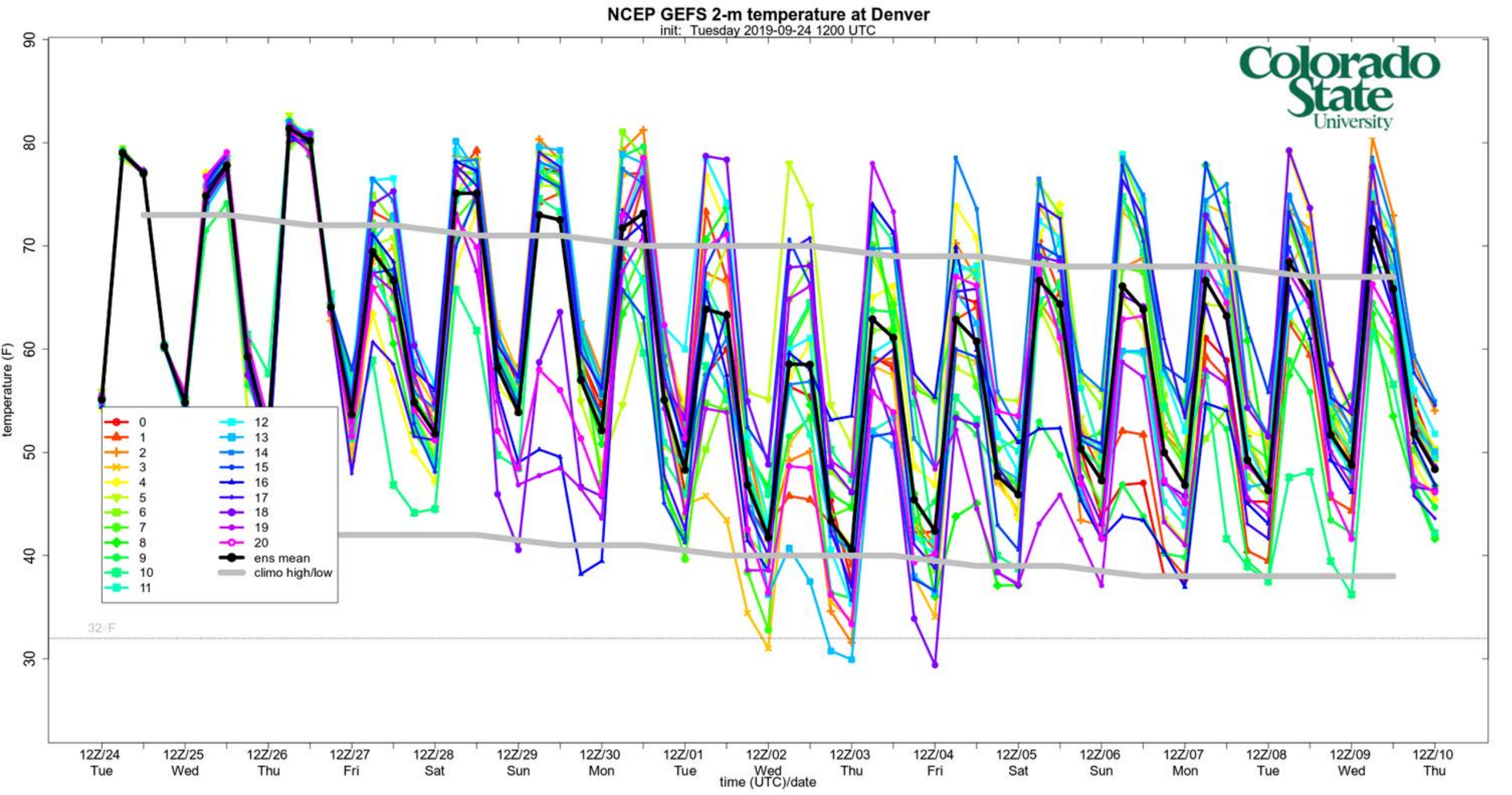
What is happening with El Niño?

NOAA 7-day precip forecast



Colorado State University


NCEP GEFS 2-m temperature at Fort Collins
init: Tuesday 2019-09-24 1200 UTC
Colorado State University
temperature (F)
80
70
60
50
40
32
30
20
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
ens mean
climo high/low
12Z/24 Tue
12Z/25 Wed
12Z/26 Thu
12Z/27 Fri
12Z/28 Sat
12Z/29 Sun
12Z/30 Mon
12Z/01 Tue
12Z/02 Wed
12Z/03 Thu
12Z/04 Fri
12Z/05 Sat
12Z/06 Sun
12Z/07 Mon
12Z/08 Tue
12Z/09 Wed
12Z/10 Thu
time (UTC)/date


NCEP GEFS 2-m temperature at Denver
init: Tuesday 2019-09-24 1200 UTC
Colorado State University
temperature (F)
90
80
70
60
50
40
30
32 F
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
ens mean
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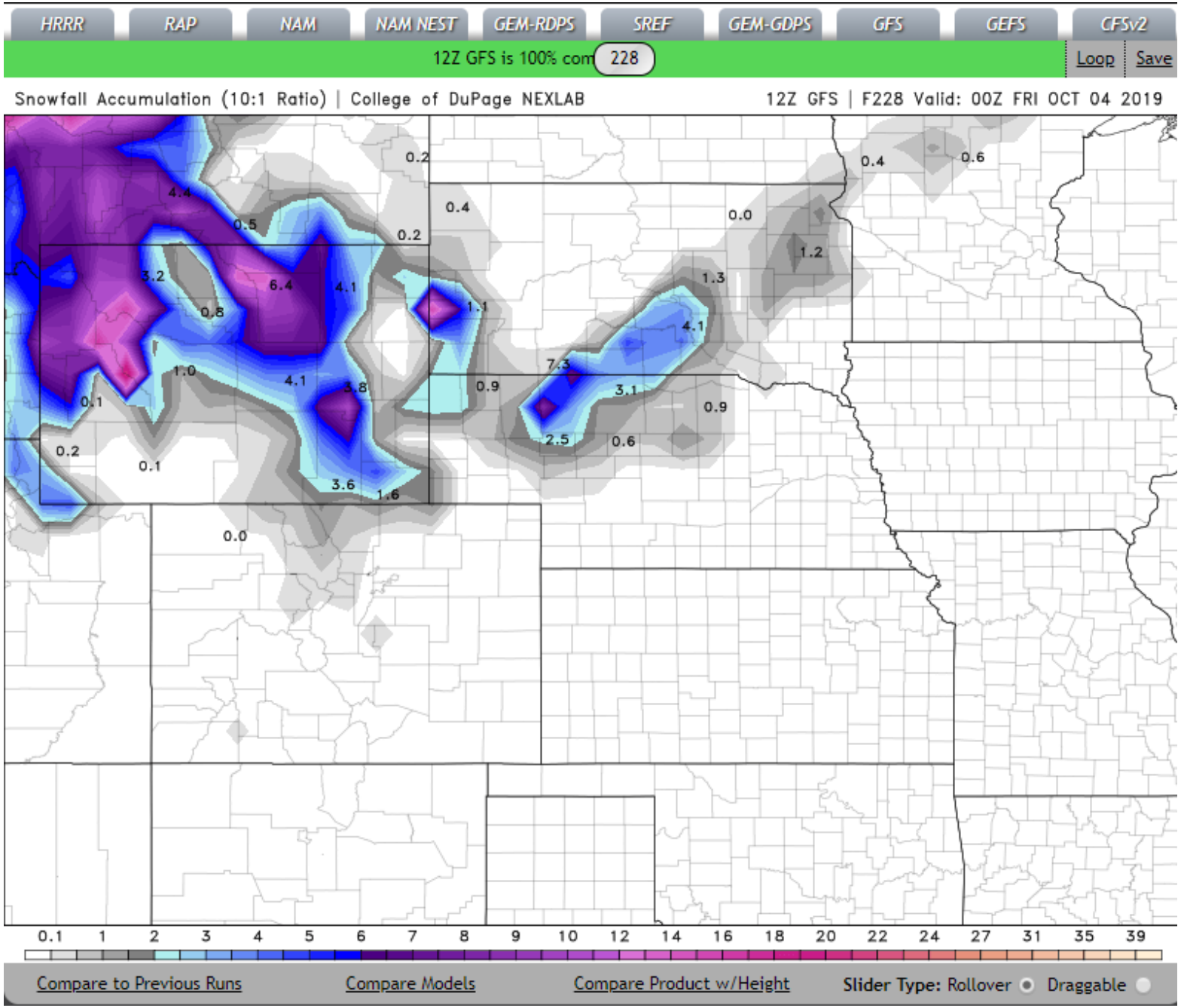
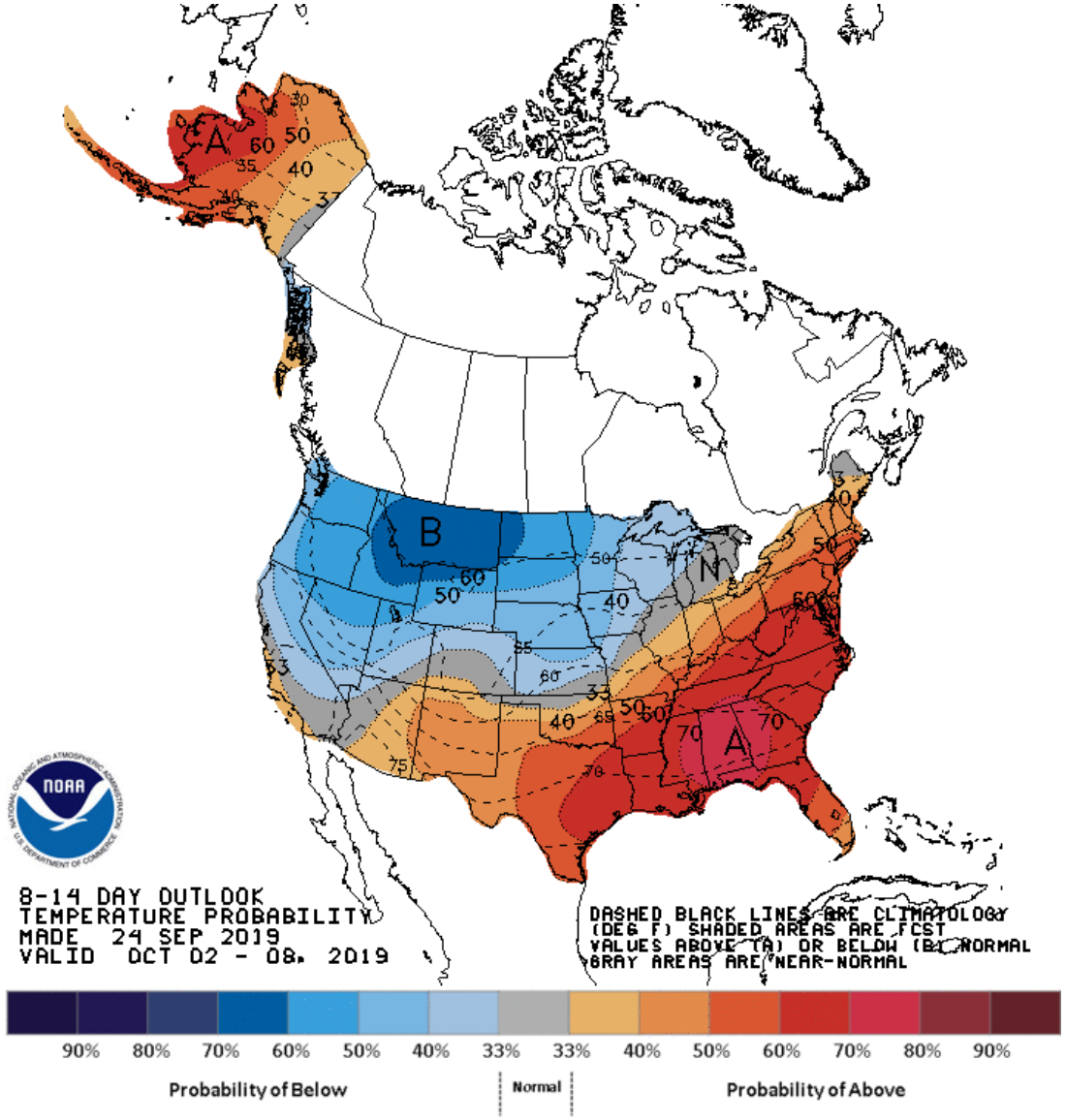
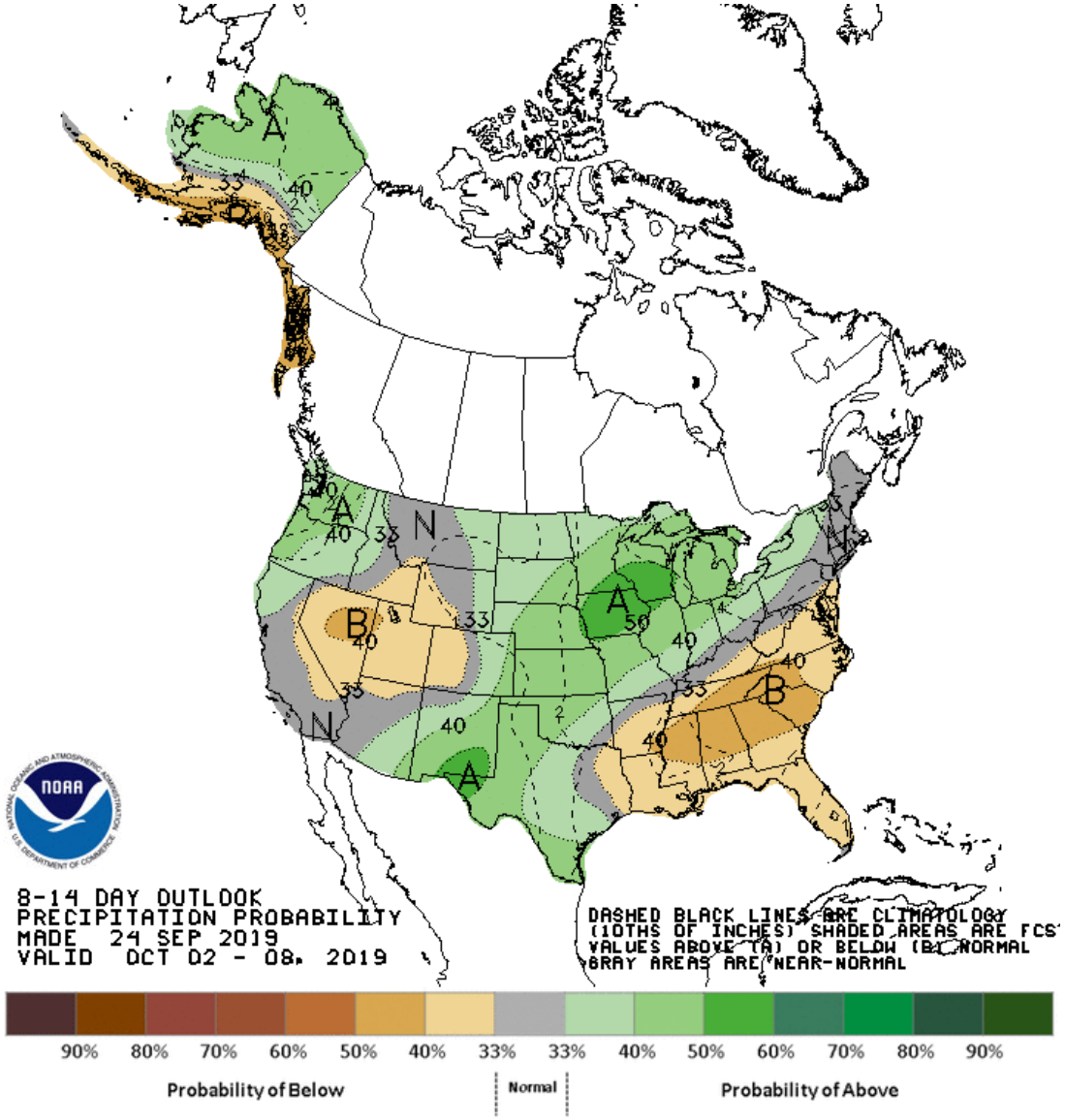
12Z/03 Thu
12Z/04 Fri
12Z/05 Sat
12Z/06 Sun
12Z/07 Mon
12Z/08 Tue
12Z/09 Wed
12Z/10 Thu
time (UTC)/date

Modeled Snowfall, yes you heard that right, snowfall, accumulation by next Friday Morning

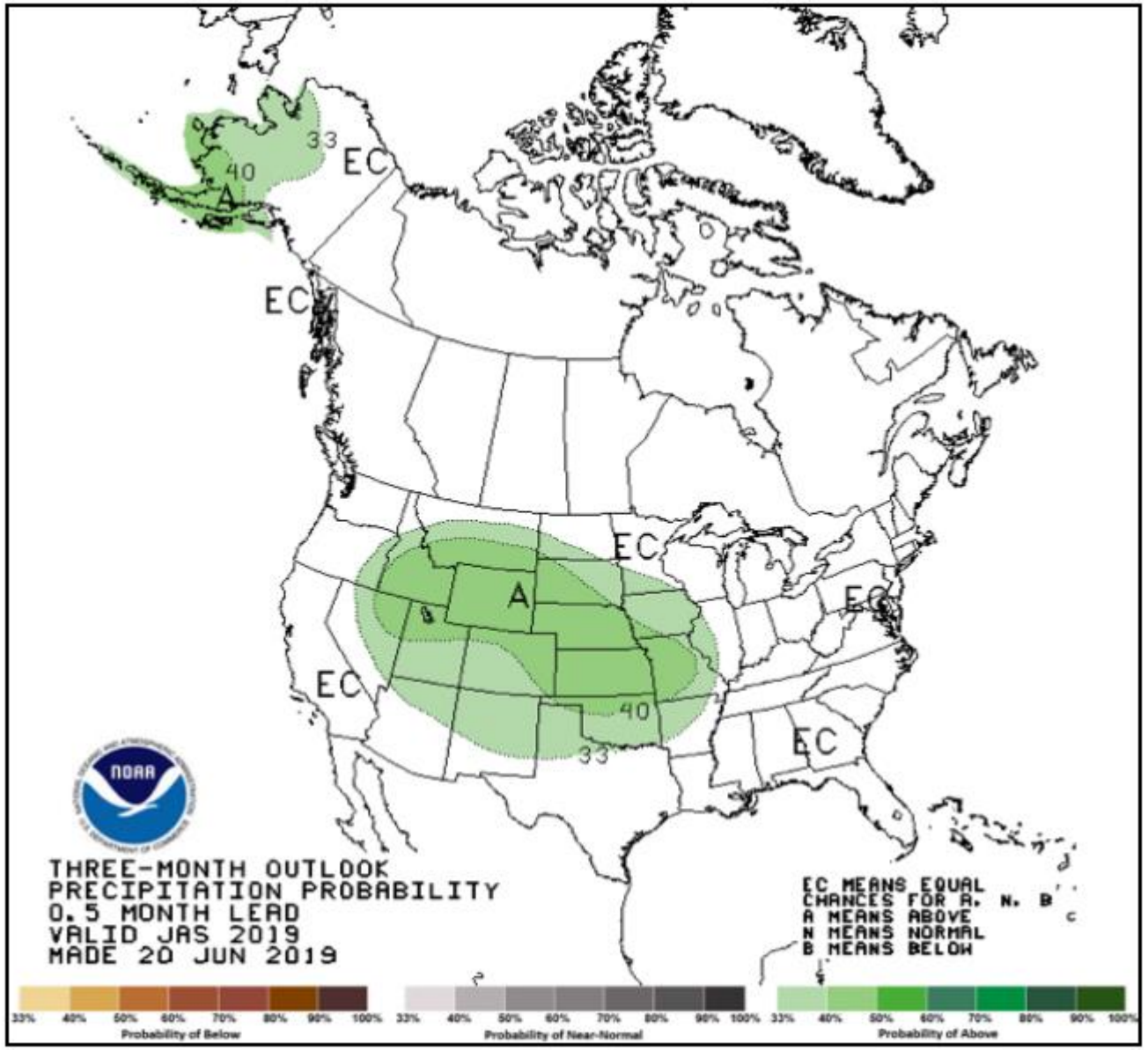


8-14 day outlook

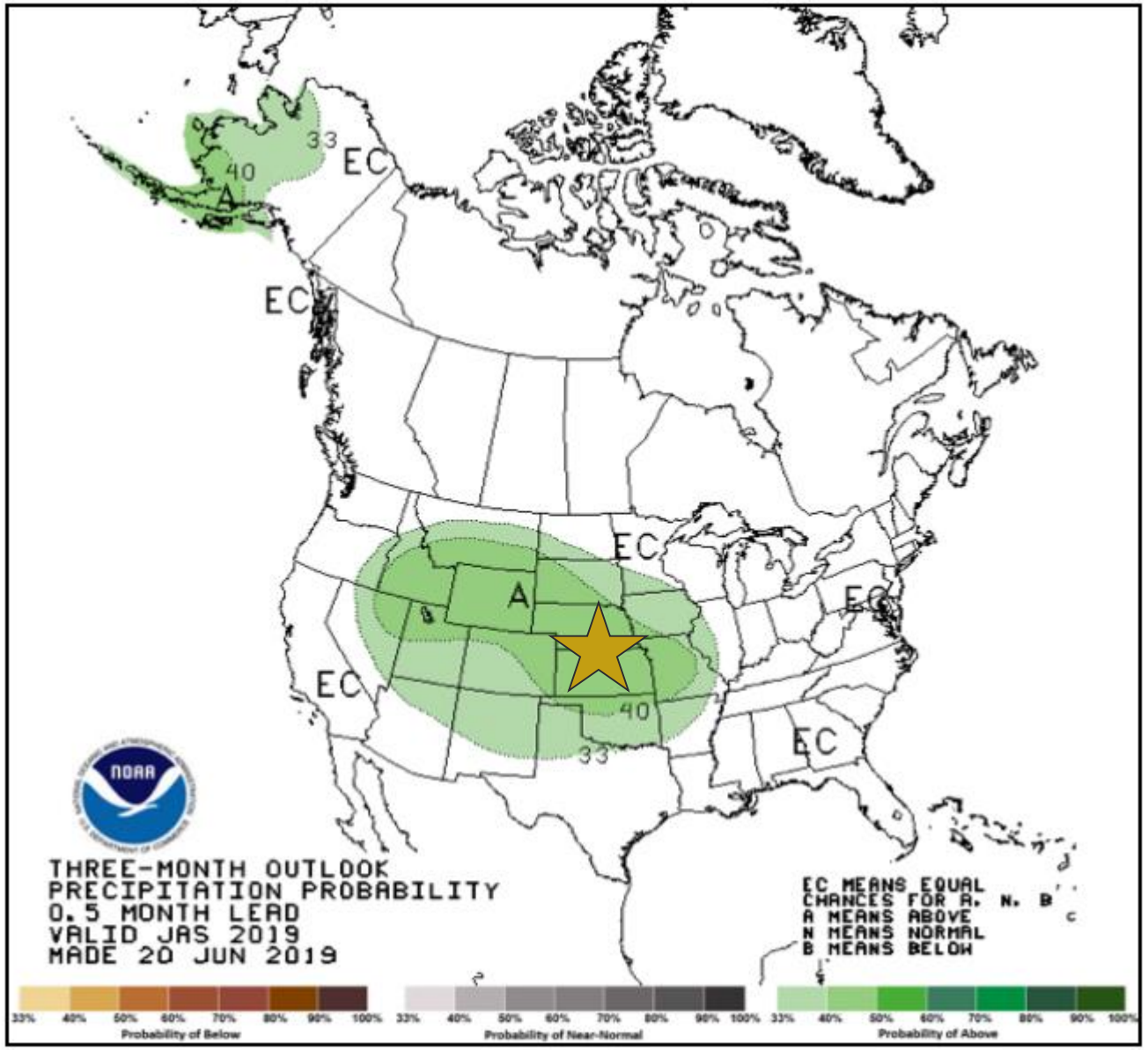




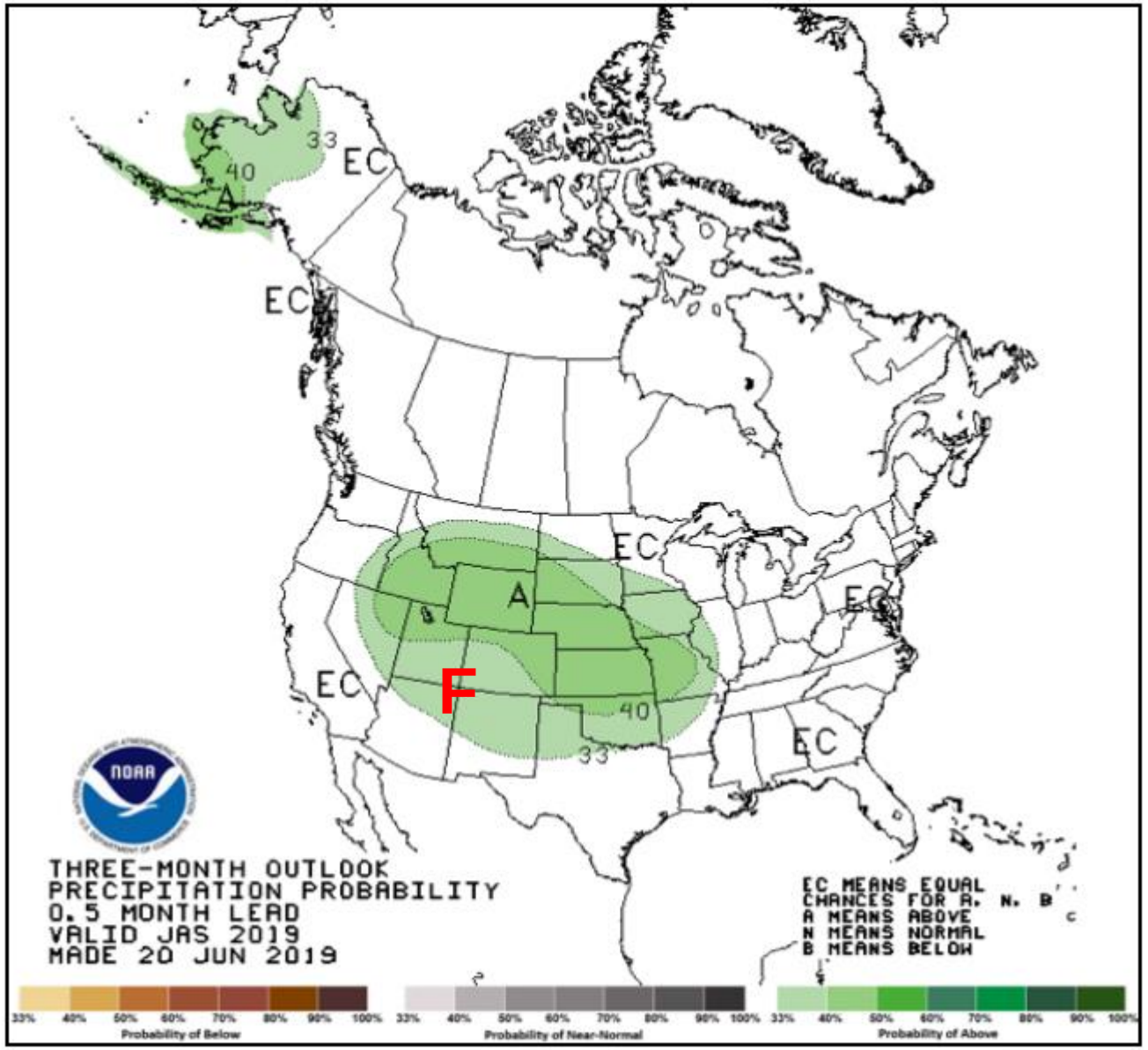
Looking back at the July-September Outlook...



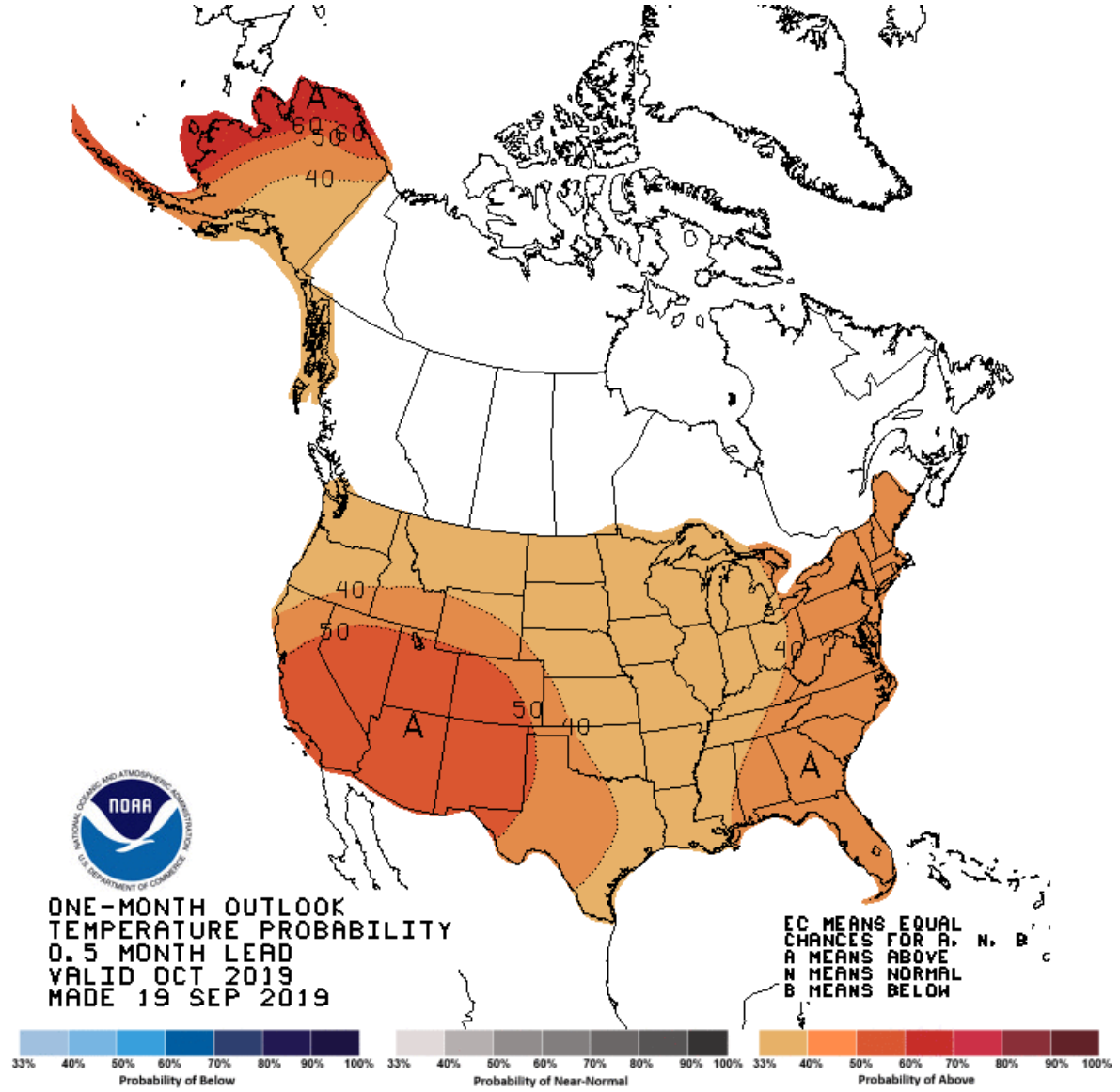
Looking back at the July-September Outlook...

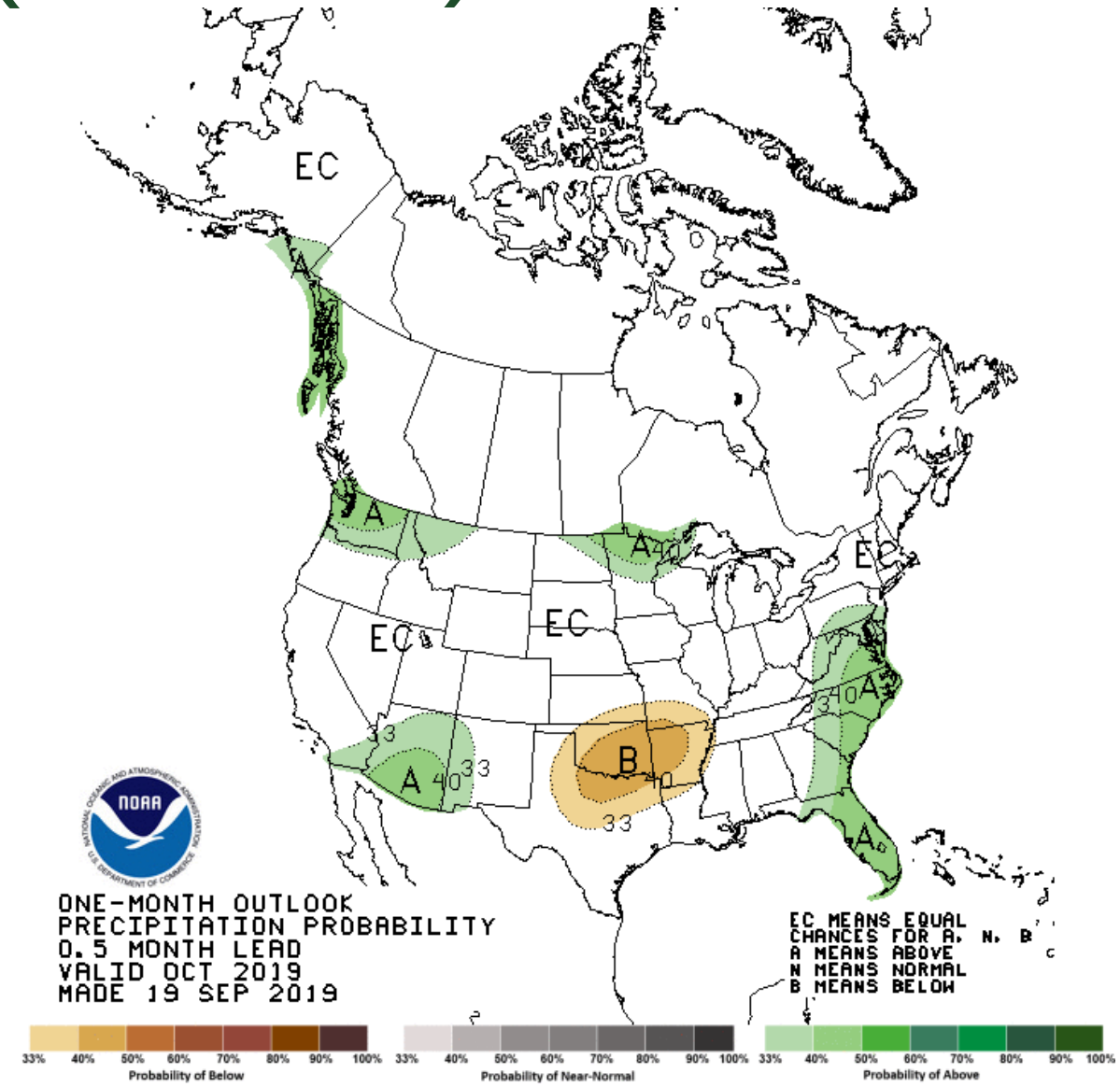


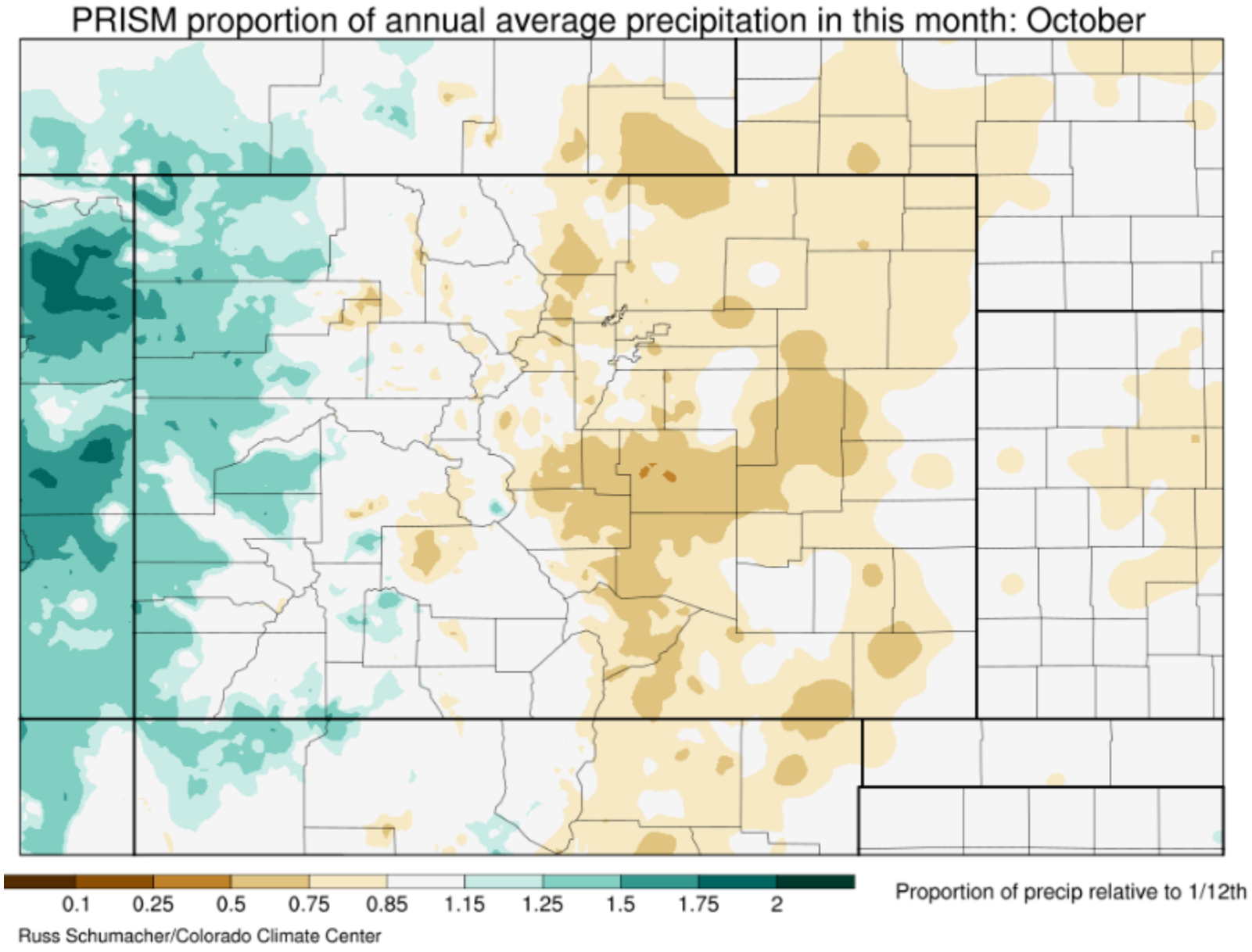
Looking back at the July-September Outlook...



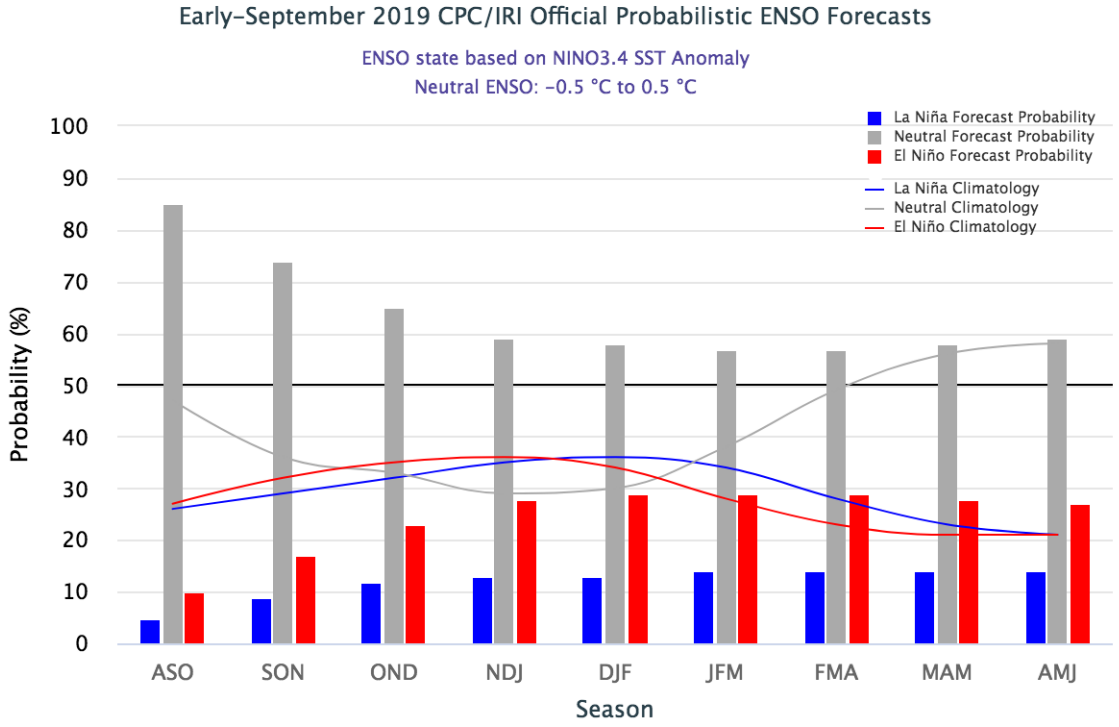
One month outlook (October)

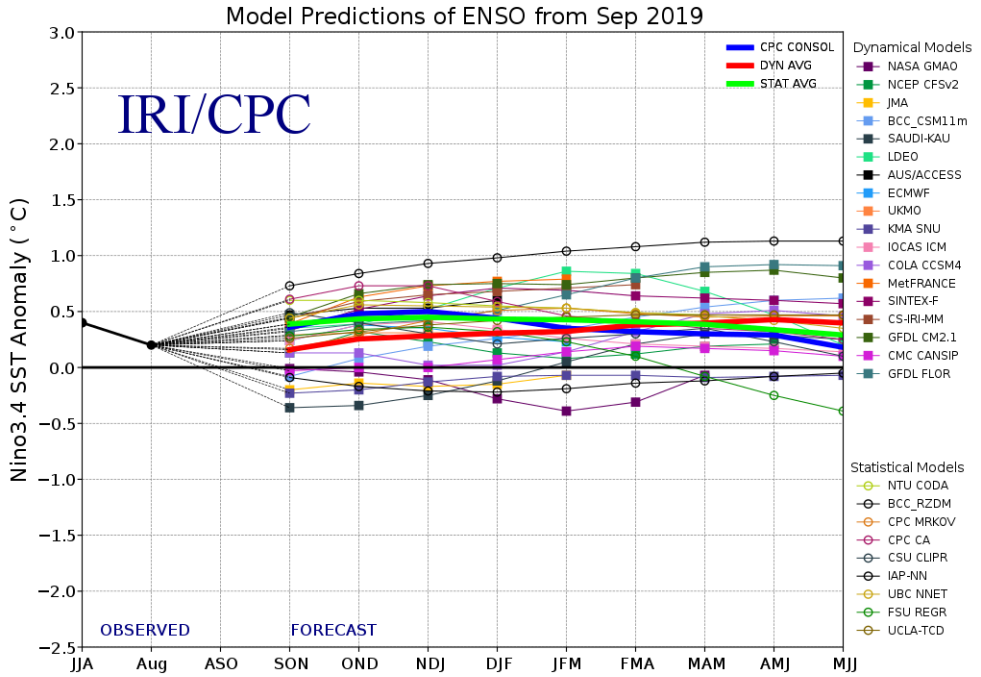





PRISM proportion of annual average precipitation in this month: October
0.1
0.25
0.5
0.75
0.85
1.15
1.25
1.5
1.75
2
Proportion of precip relative to 1/12th
Russ Schumacher/Colorado Climate Center

What's the El Niño forecast?



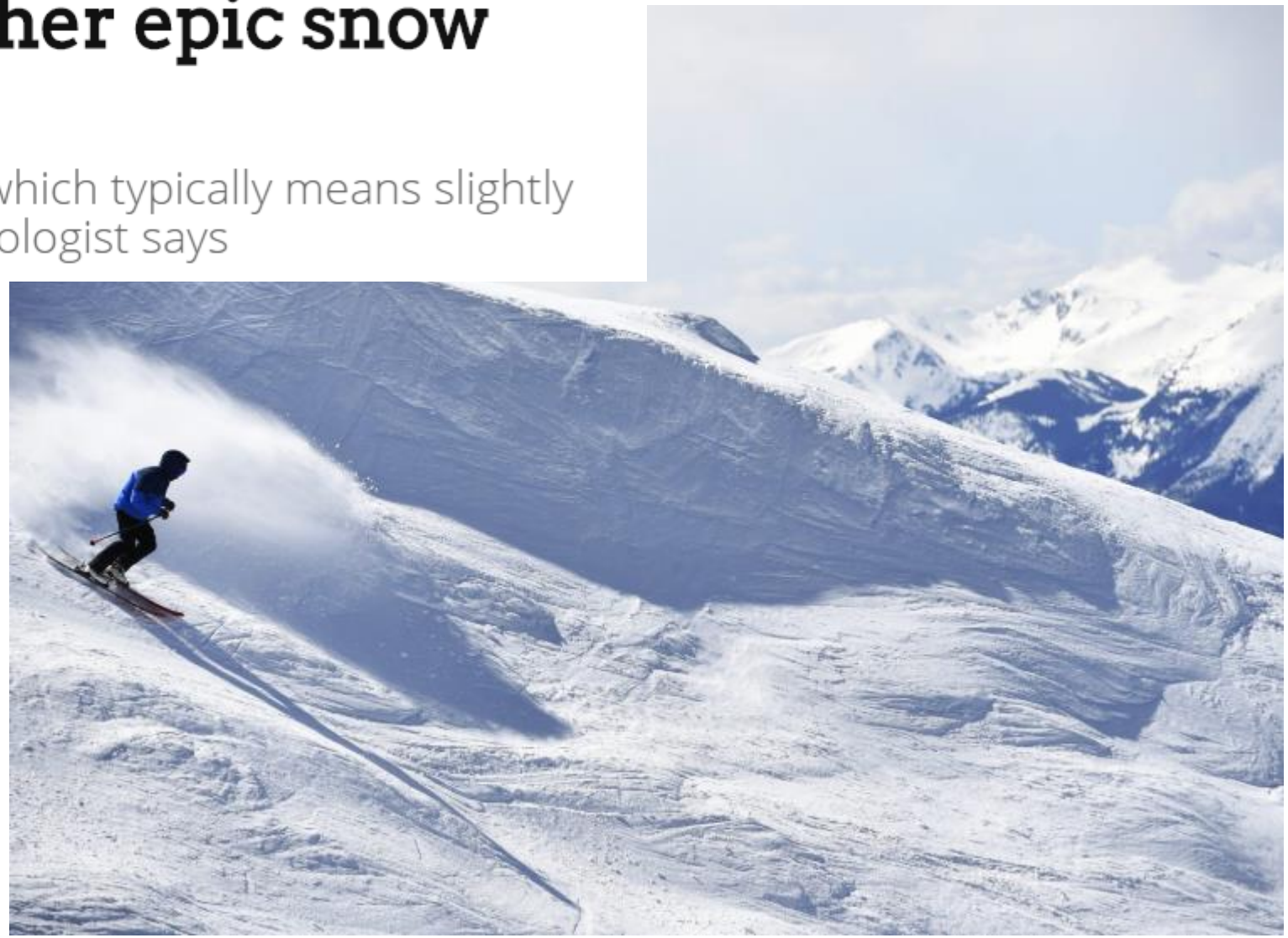


The El Niño is now over…back to neutral conditions

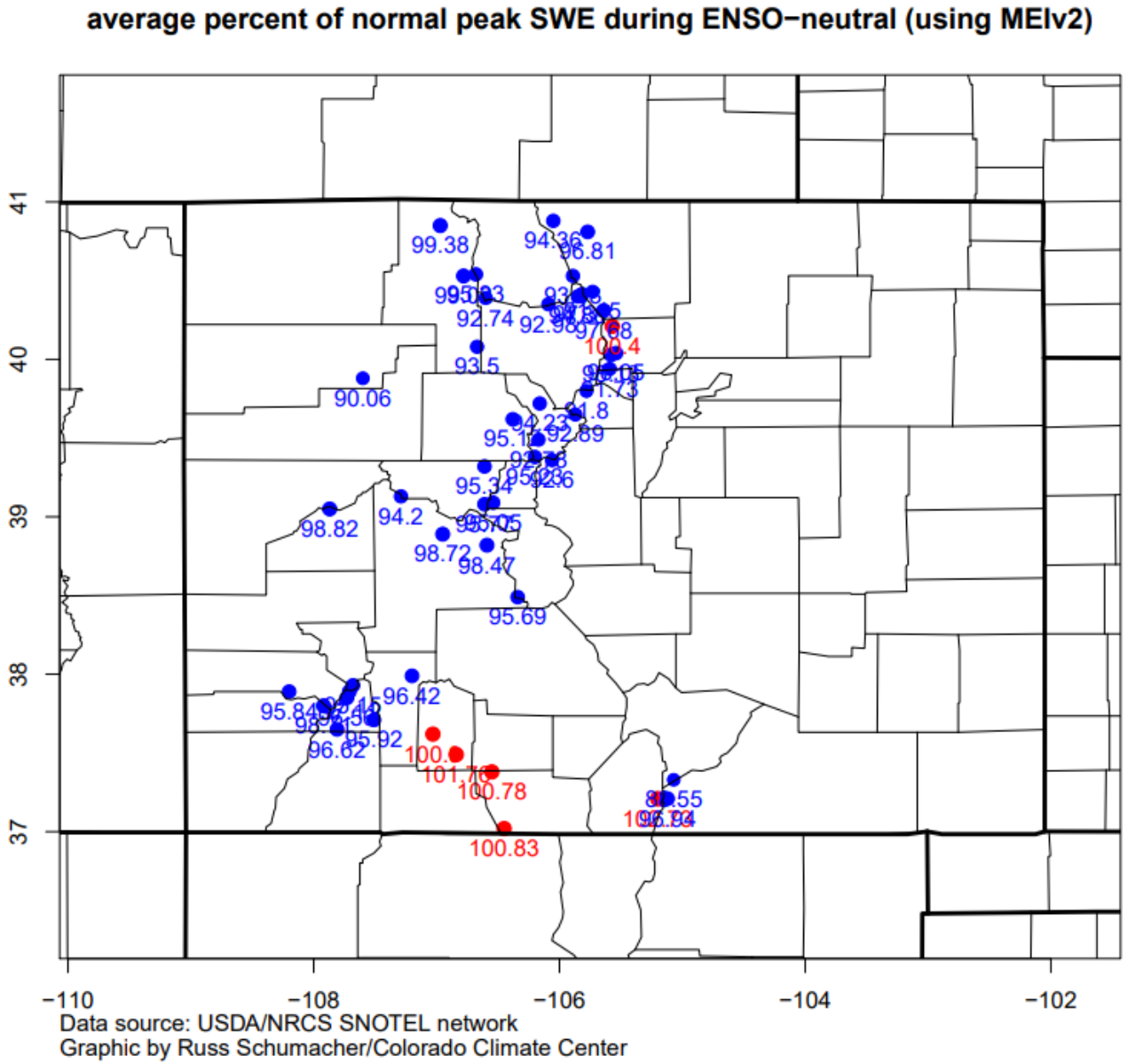
Neutral conditions more than 50% likely to continue through winter

Sorry, skiers, but we're probably not going to have another epic snow year

We're not in El Niño or La Niña, which typically means slightly below-normal snow, state climatologist says



1. Peak Snow Water Equivalent leans lower in neutral years than El Niño or La Niña years
2. More importantly, peak SWE is trending downward with time due to climate change
3. The combination of the two explains nowhere near all the variance in peak SWE. Could we have a terrific winter? Yes.



Summary points

- The monsoon has failed us
- July through September has been an historically hot, dry period for much of western CO. More seasonal on the eastern plains
- Drought has returned to Colorado, just D1
- A wet winter, and cool/wet spring saved our bacon! With recent hot and dry conditions, surface water supplies have regressed into the normal range (more from NRCS)
- El Niño has ended and neutral conditions likely to continue through winter
- ENSO-neutral winters tend to be a little less snowy in the mountains, but don’t lean too heavily on that forecast yet

To view this and other presentations:
http://climate.colostate.edu/ccc_archive.html

Let's keep in touch
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Russ Schumacher (State Climatologist) – russ.schumacher@colostate.edu
Becky Bolinger (Assistant State Climatologist) – becky.bolinger@colostate.edu

Thank you!

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ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY