

Colorado Climate Center

WATF Climate Update

Russ Schumacher, state climatologist

Water Availability Task Force

August 25, 2020



COLORADO
CLIMATE
CENTER



ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY

Water year 2020 to date:

temperature, precipitation, snow, evaporative demand

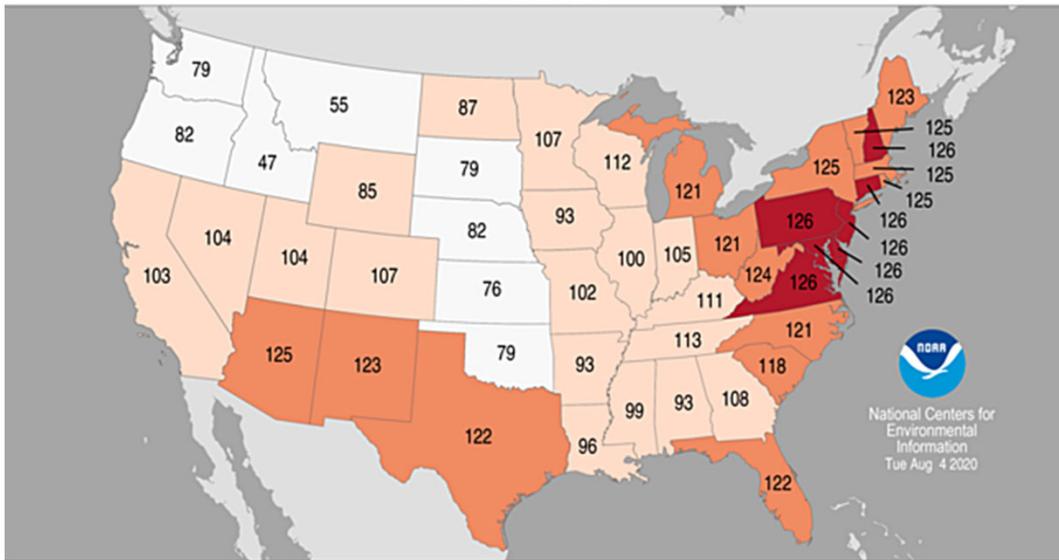


Williams Fork fire, August 15,
photo from Frisco by Vincent Davis on
twitter,
<https://twitter.com/Vincent15945195/status/1294768879059832835/photo/3>



Statewide Average Temperature Ranks

July 2020
Period: 1895–2020



Water year through July: 1.7°F above average
Ranked 108th out of 125 October-July periods

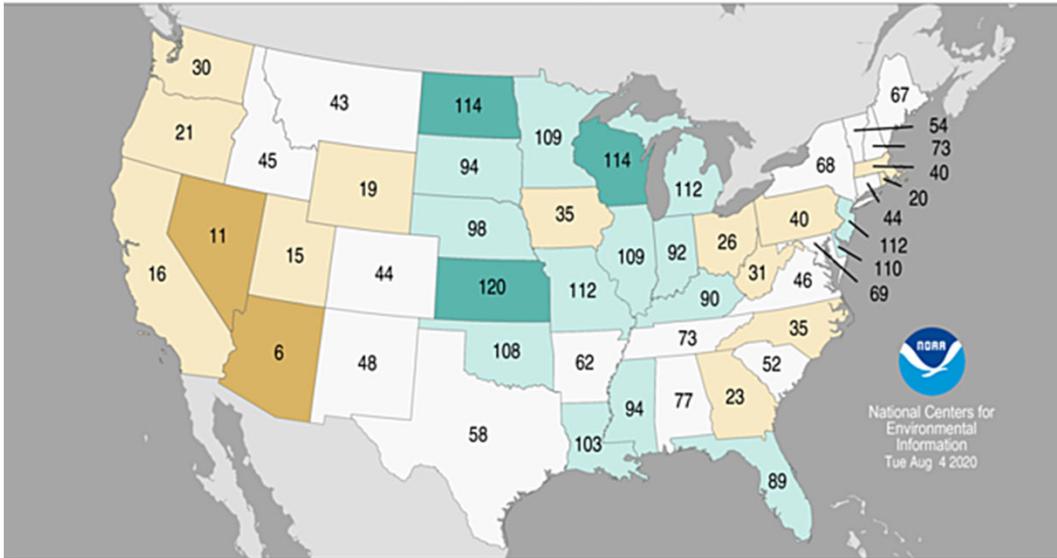
Calendar year through July: 2.6°F above average
Ranked 114th out of 125 Jan-July periods

Month	T Rank (of 125 years)	Above, below, or near avg?
Oct	4 th	much below
Nov	90 th	above
Dec	101 st	above
Jan	101 st	above
Feb	47 th	near avg
Mar	113 th	above
Apr	63 rd	near avg
May	118 th	much above
June	111 th	much above
July	107 th	above



Statewide Precipitation Ranks

July 2020
Period: 1895–2020



National Centers for
Environmental
Information
Tue Aug 4 2020

Water year through July: 3.32" below the 20th century avg
Ranked 8th driest out of 125 October-July periods
For comparison: 2017-18 was 5th driest October-July
Calendar year through July: 8th driest on record

Last 12 months: 3rd driest August-July (only 01-02 and 62-63 drier)

Month	P Rank (of 125 years)	Above, below, or near avg?
Oct	42 nd	below
Nov	68 th	near
Dec	83 rd	near
Jan	36 th	below
Feb	67 th	near
Mar	53 rd	near
Apr	6 th	much below
May	18 th	below
Jun	53 rd	near
Jul	44 th	near



Daily records

(Water year thus far:
Oct 1 – May 17)

Weather Record Broken	Record broken for a day	Record broken for a month
Highest max temperature	453	28
Highest min temperature	771	16
Lowest max temperature	837	110
Lowest min temperature	1020	123
Precipitation	558	18
Snowfall	274	11

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

Daily cold records outpacing warm records by about 1.6 to 1 so far this water year (around 5 to 1 for monthly records), primarily from the cold October

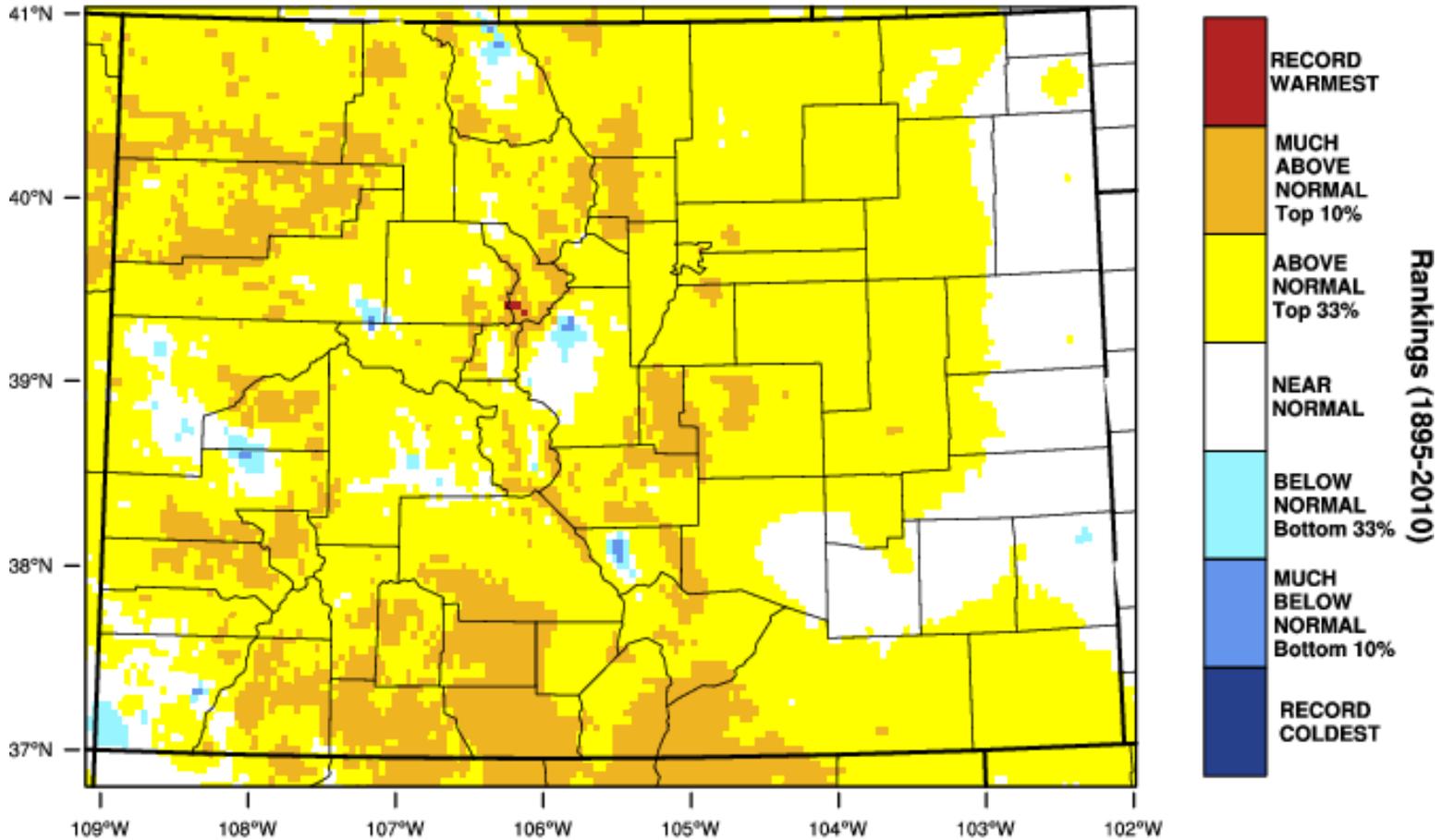


Some notable events

- Boulder set their all-time seasonal snowfall record: 152”
- Late-spring freeze on the west slope: Grand Junction reached a low of 19F on April 14; tied for the 2nd coldest temperature after April 10
- Alamosa set 13 daily high temperature records between April 26 and May 19 (though we’re a little suspicious of some of these numbers)



Colorado - Mean Temperature July 2020 Percentile



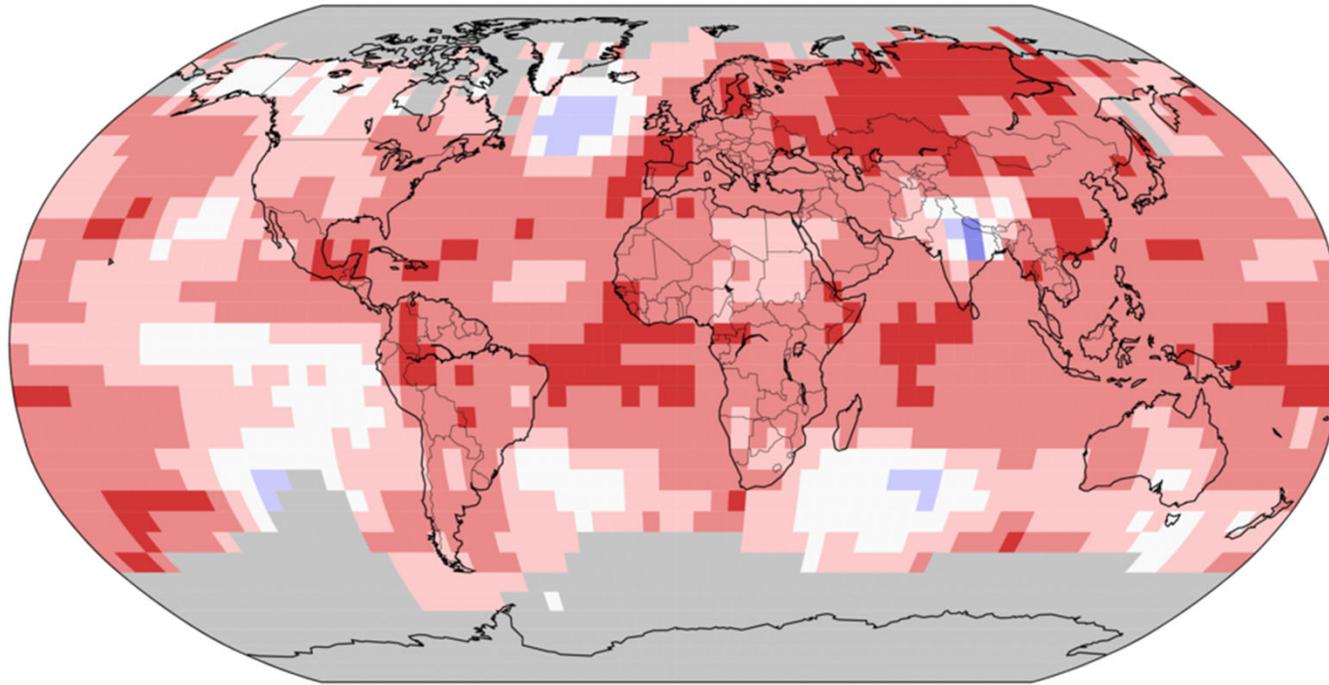
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020



Land & Ocean Temperature Percentiles Jan–Jul 2020

NOAA's National Centers for Environmental Information

Data Source: NOAA GlobalTemp v5.0.0–20200808



Globally, 2nd warmest year-to-date through July, trailing only 2016

“the year 2020 is very likely to rank among the five warmest years on record”



Record Coldest

Much Cooler than Average

Cooler than Average

Near Average

Warmer than Average

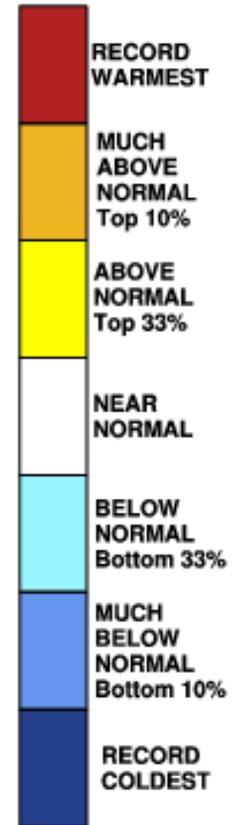
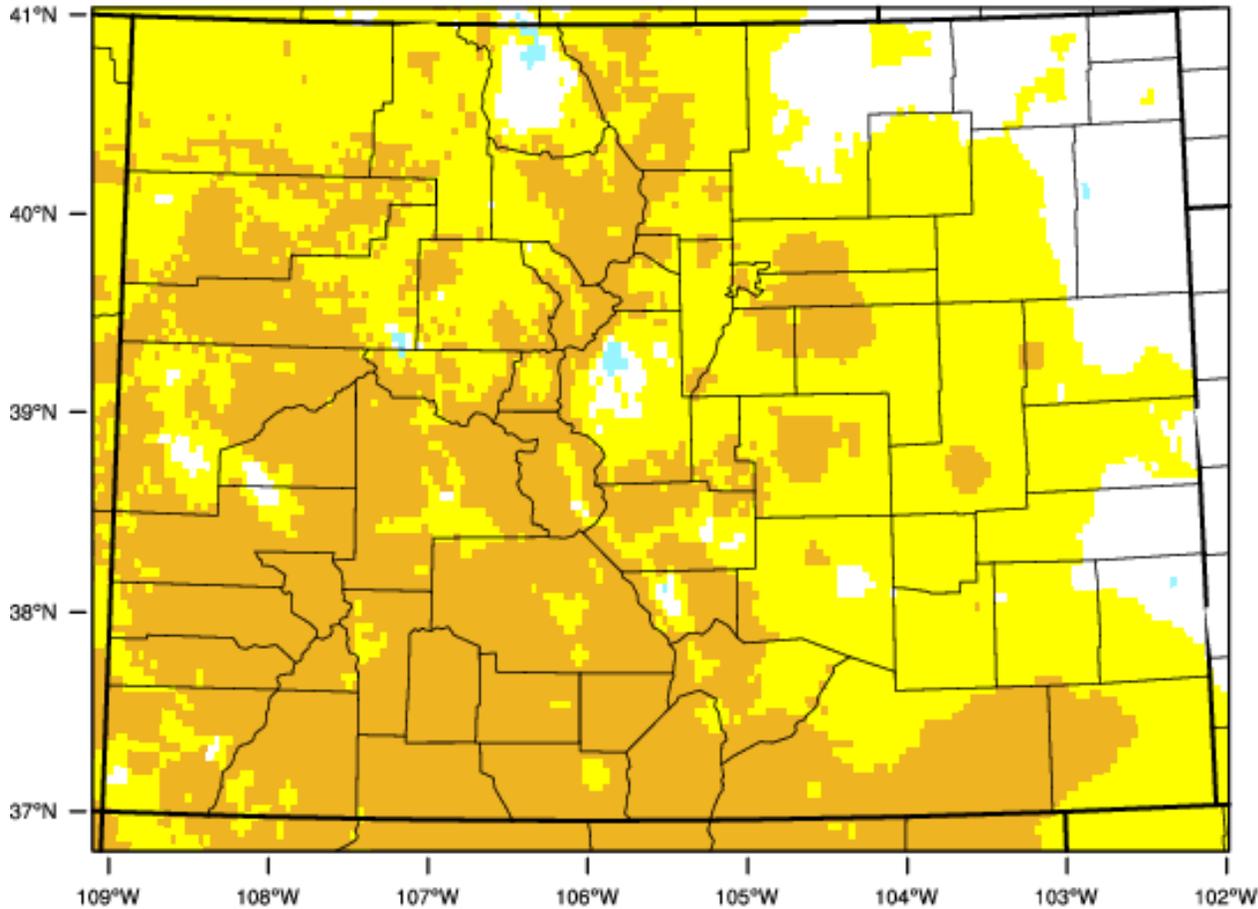
Much Warmer than Average

Record Warmest

GHCNM v4.0.1.20200807.qfe



Colorado - Mean Temperature April-July 2020 Percentile

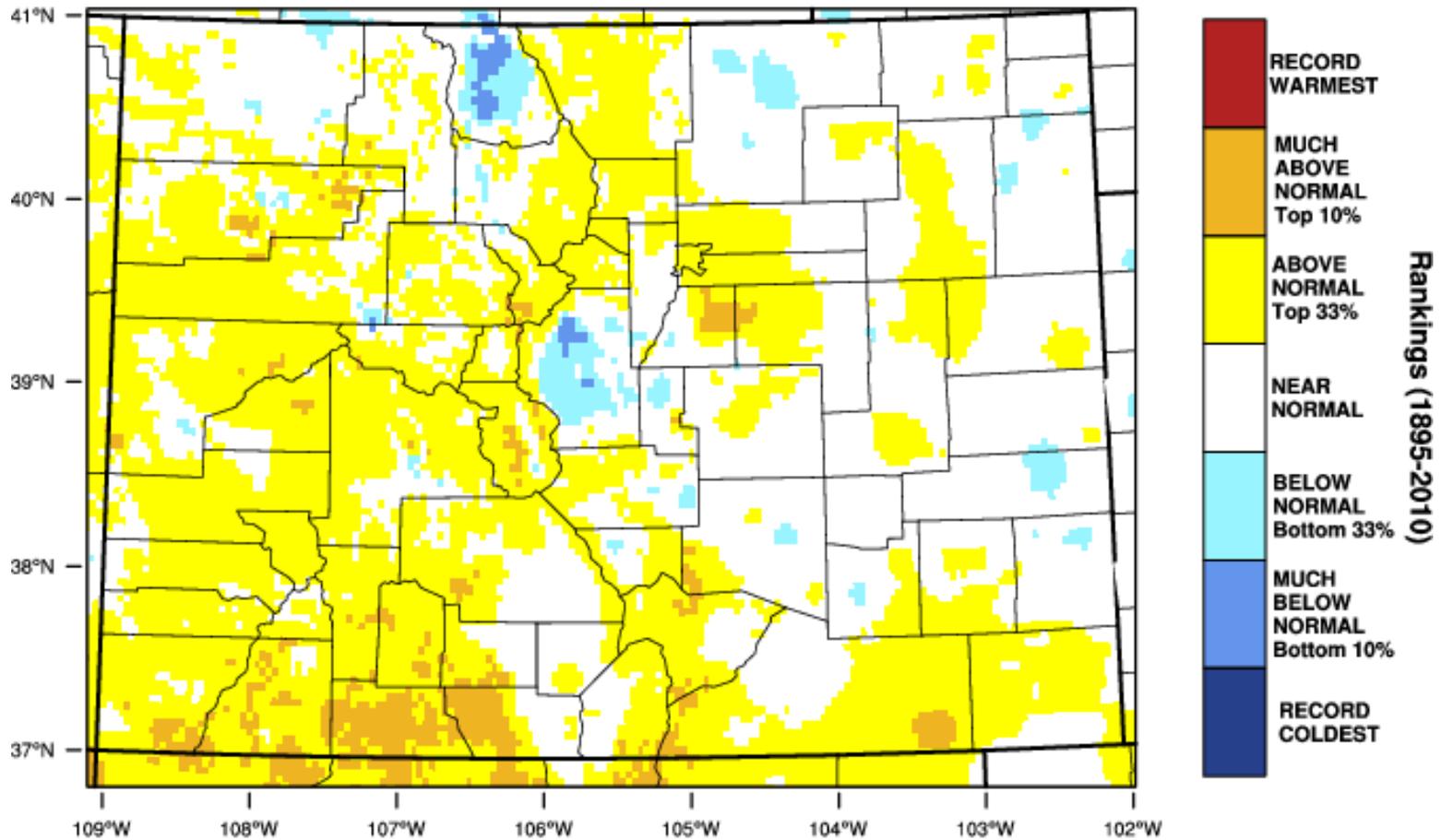


Rankings (1895-2010)

WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020



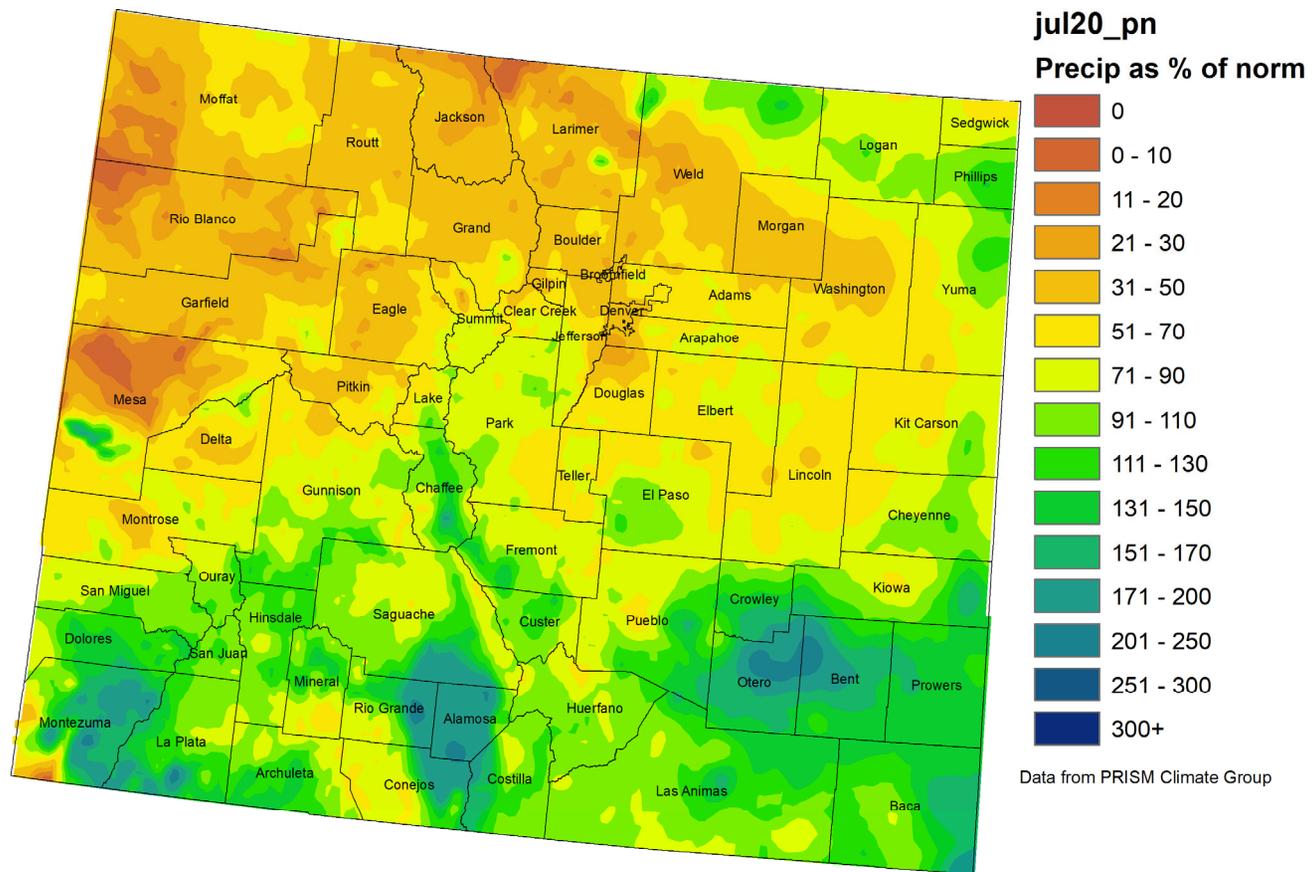
Colorado - Mean Temperature October-July 2020 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020

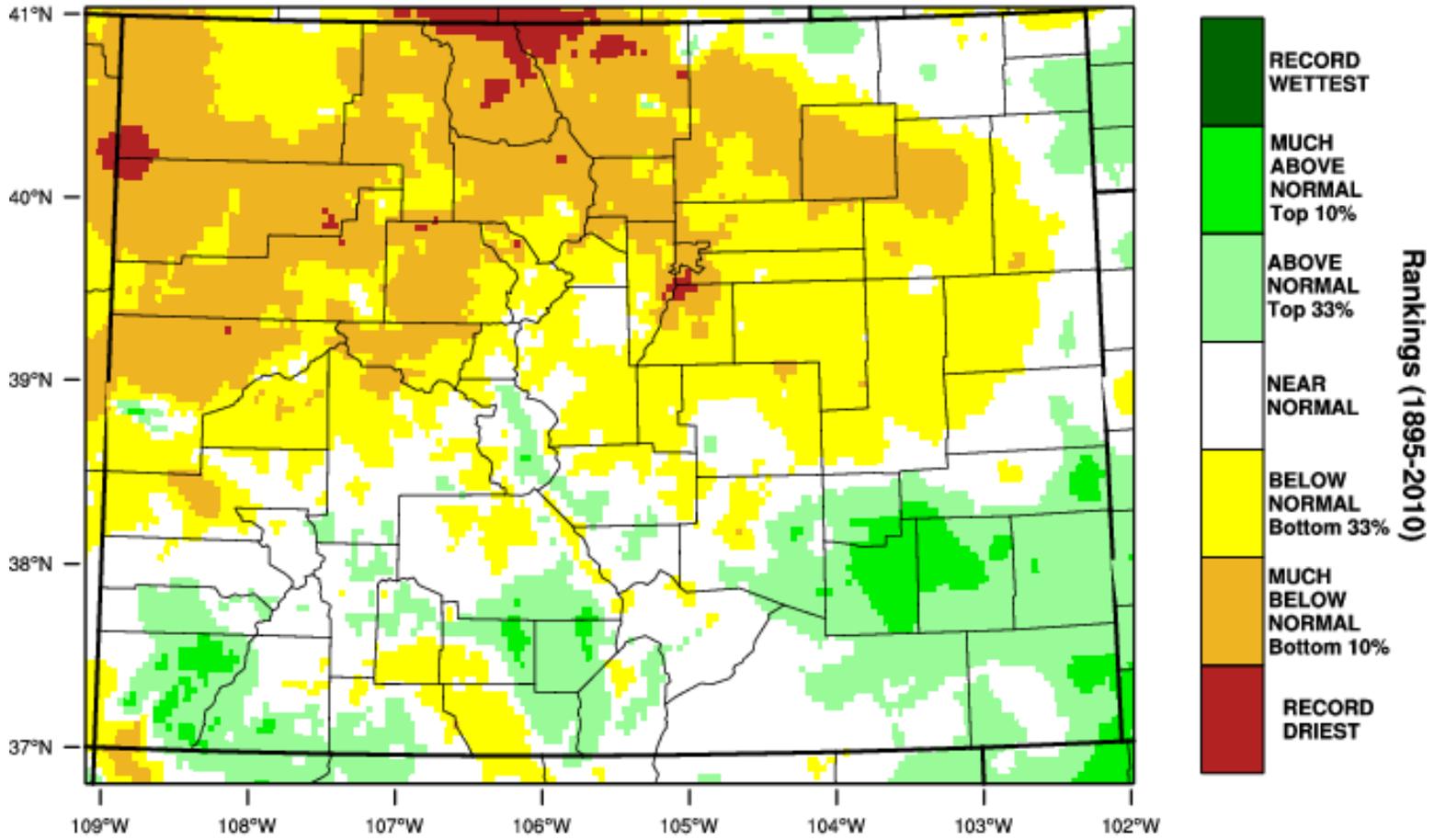


Colorado July 2020 Precipitation as a Percentage of Normal



Colorado - Precipitation

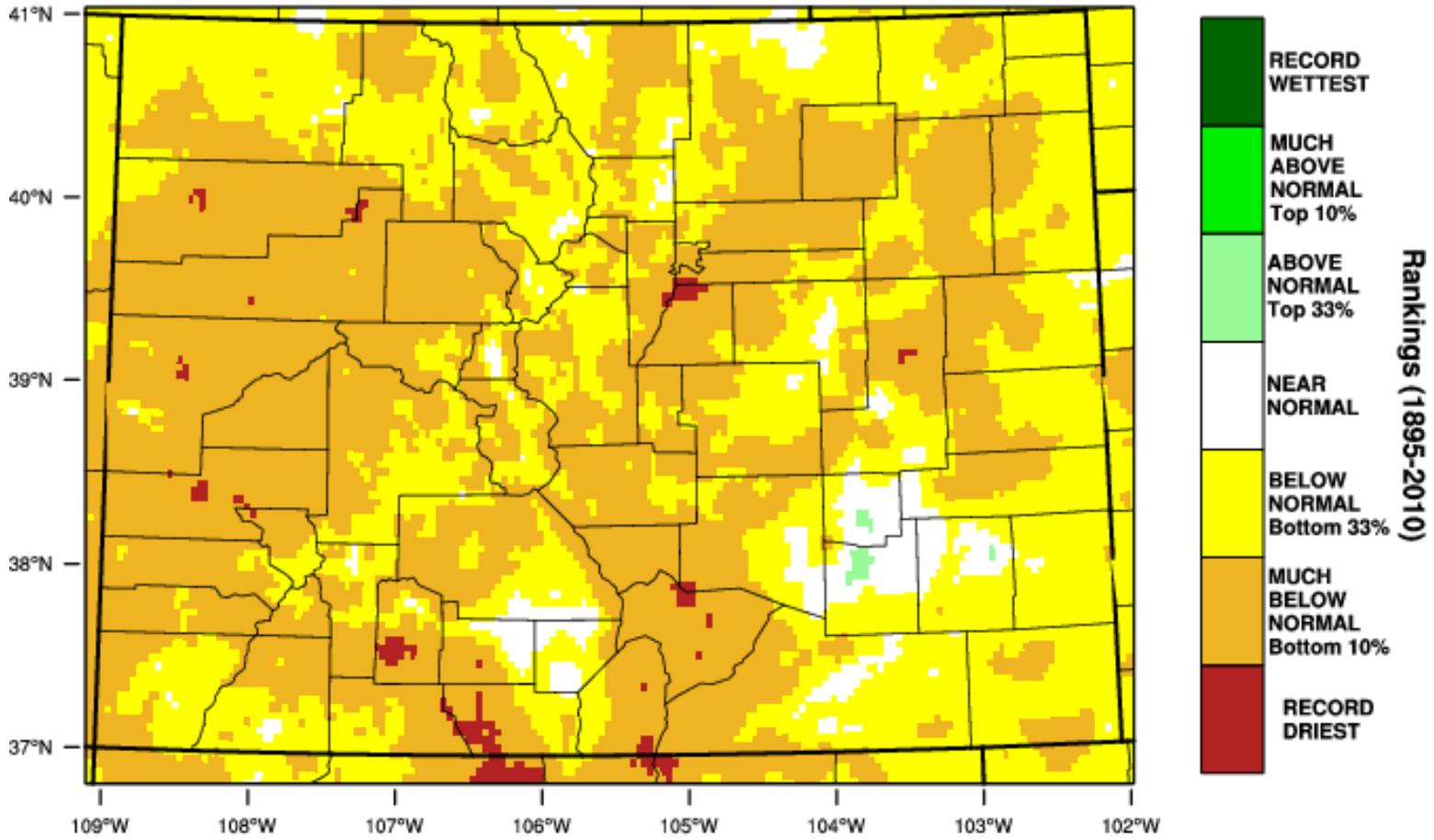
July 2020 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020



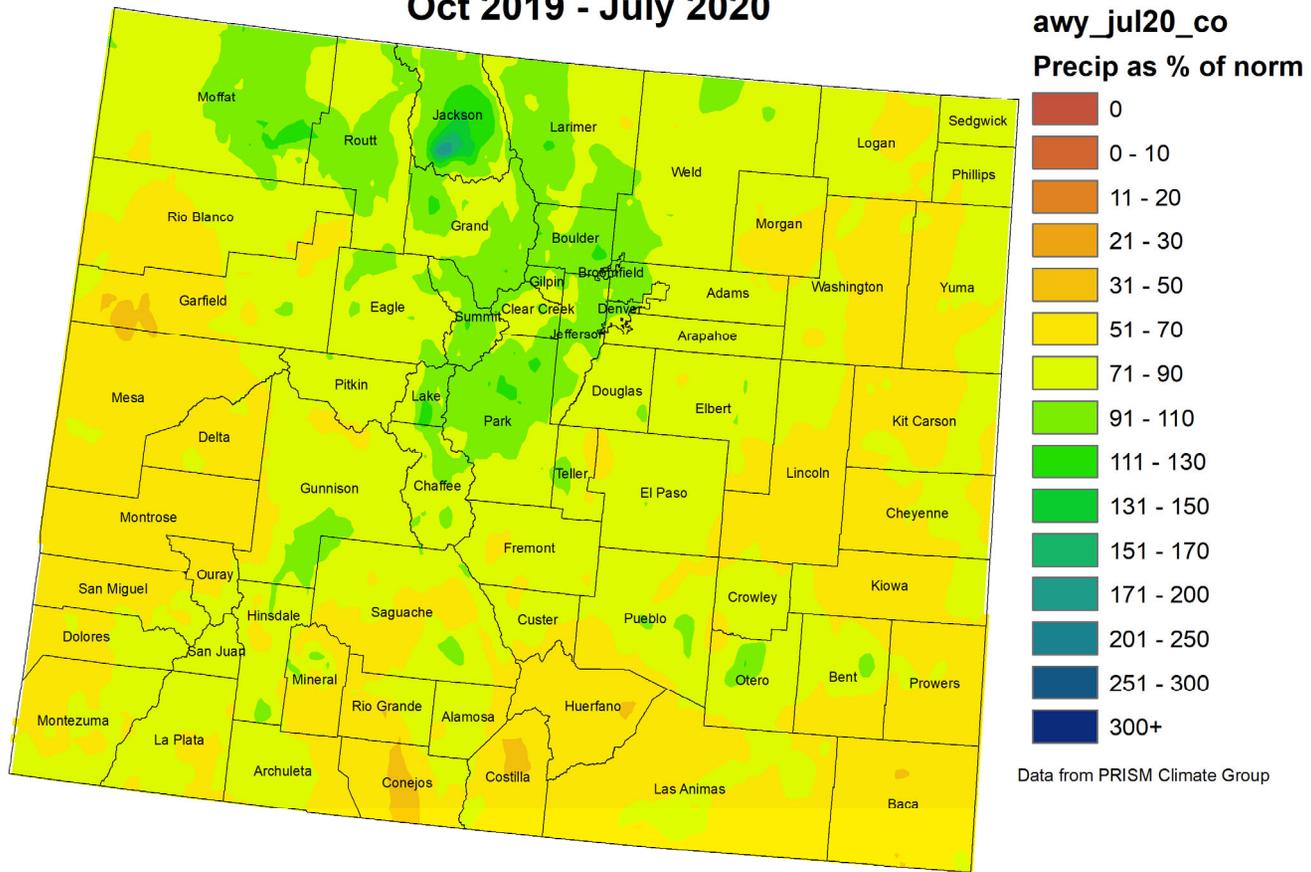
Colorado - Precipitation April-July 2020 Percentile



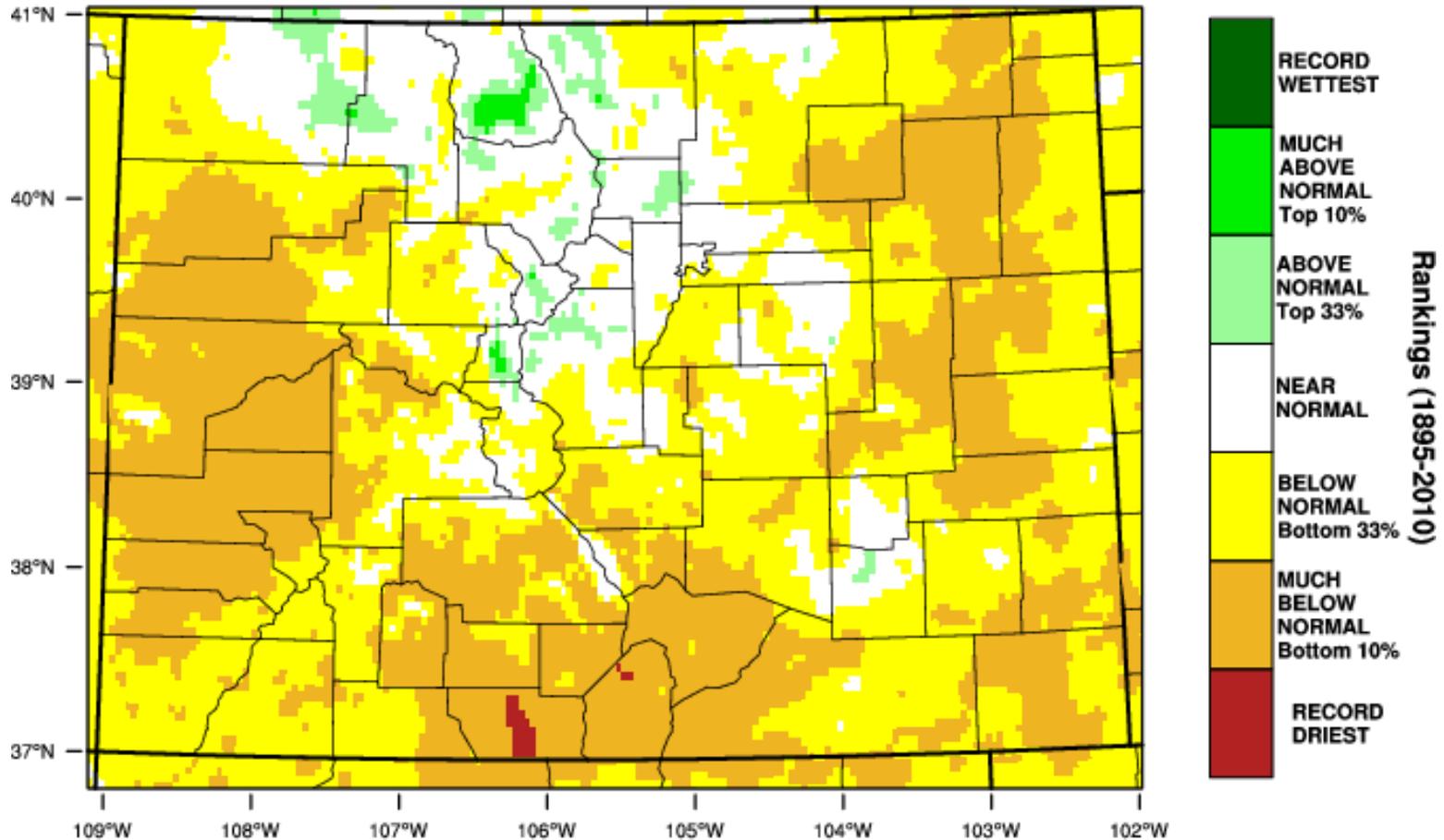
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020



Colorado Water Year 2020 Precipitation as a Percentage of Normal Oct 2019 - July 2020



Colorado - Precipitation October-July 2020 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 16 AUG 2020

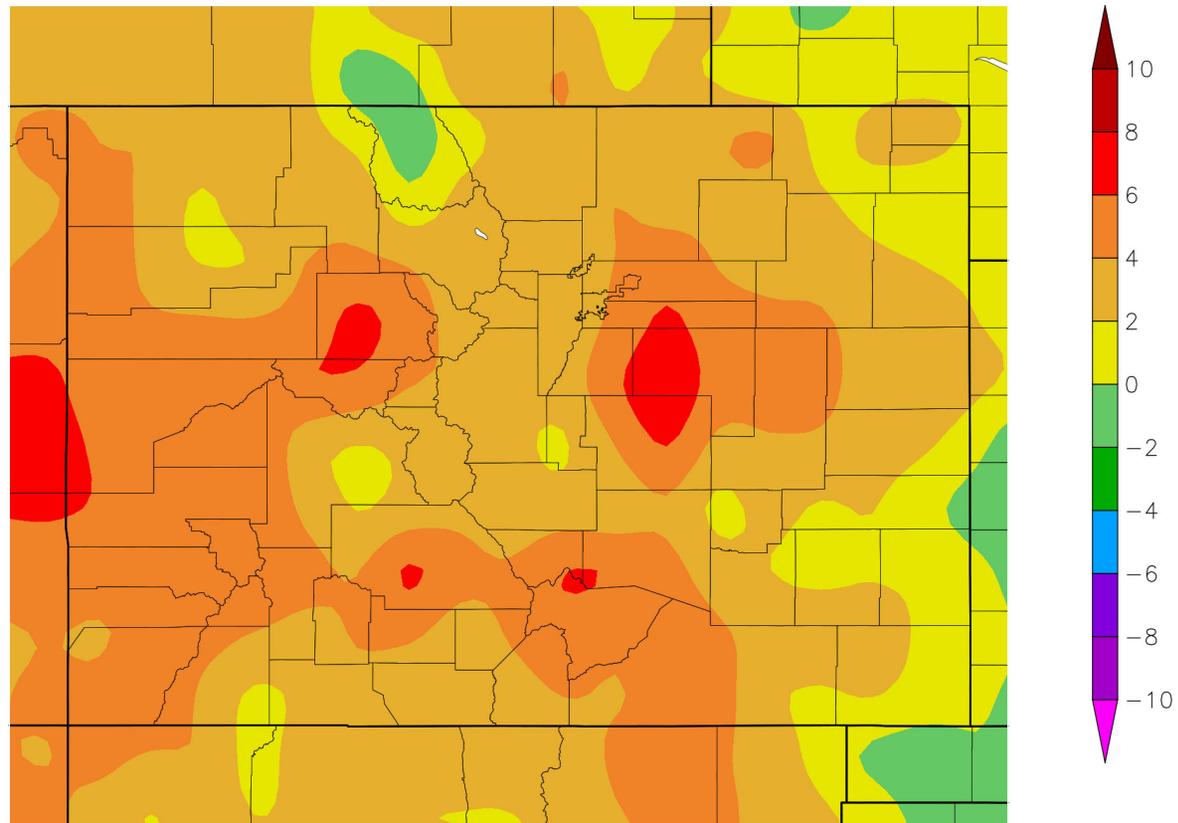


August thus far

August 2020 will go down as one of the most extreme summer months in recorded history for western Colorado



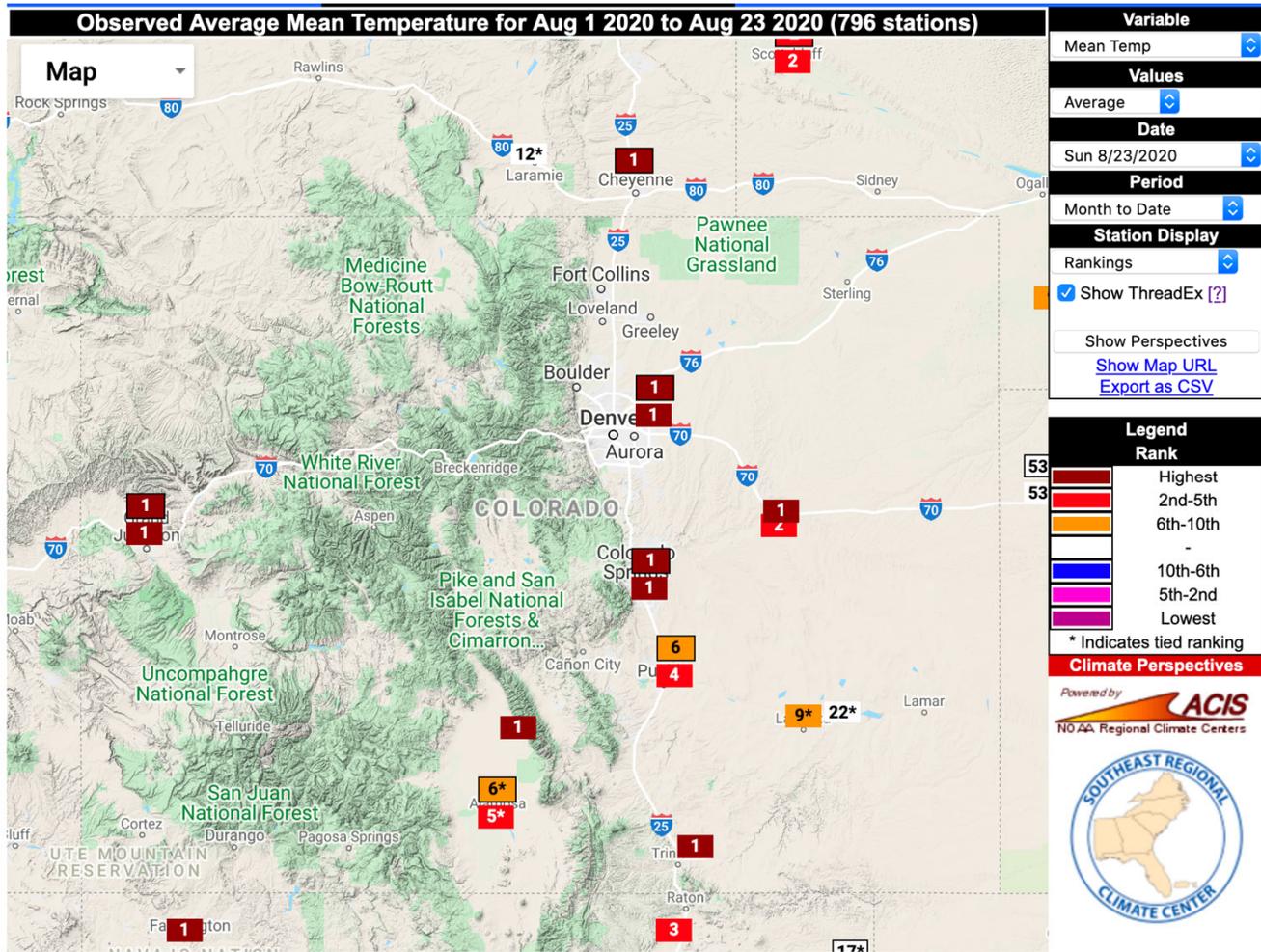
Departure from Normal Temperature (F) 8/1/2020 – 8/23/2020



Generated 8/24/2020 at HPRCC using provisional data.

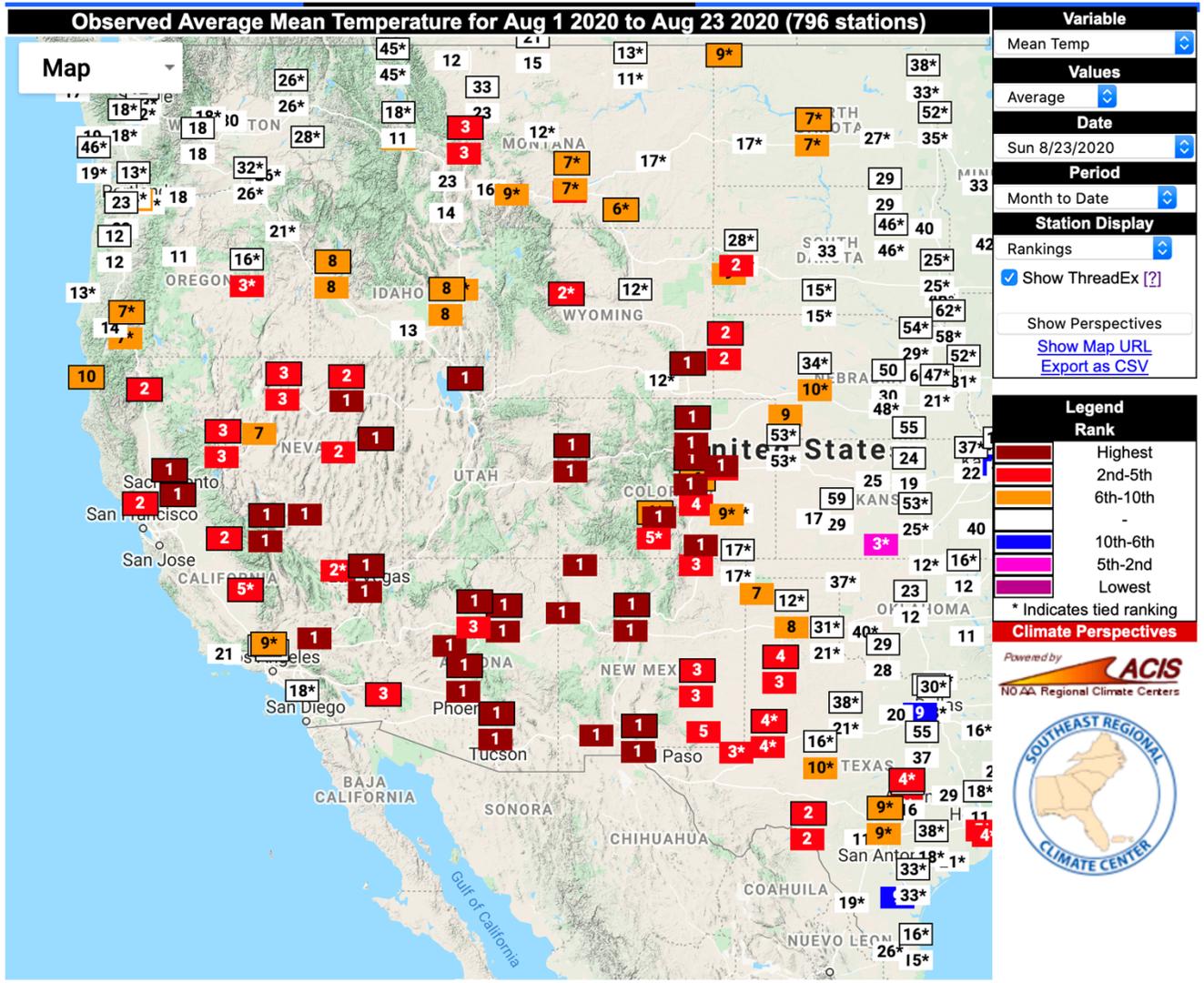
NOAA Regional Climate Centers





Temperature ranks at long-term stations for August thus far

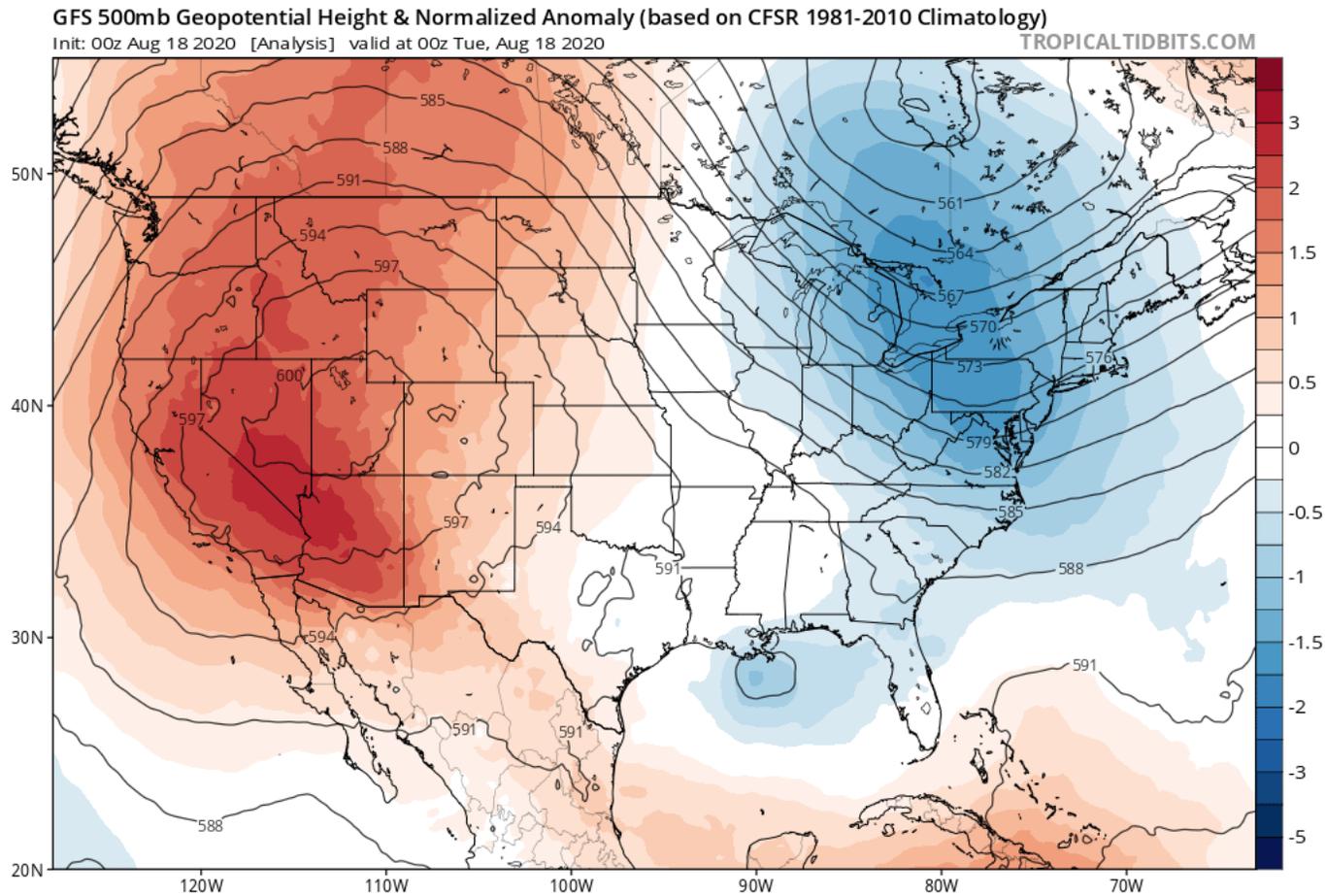




Temperature ranks at long-term stations for August thus far



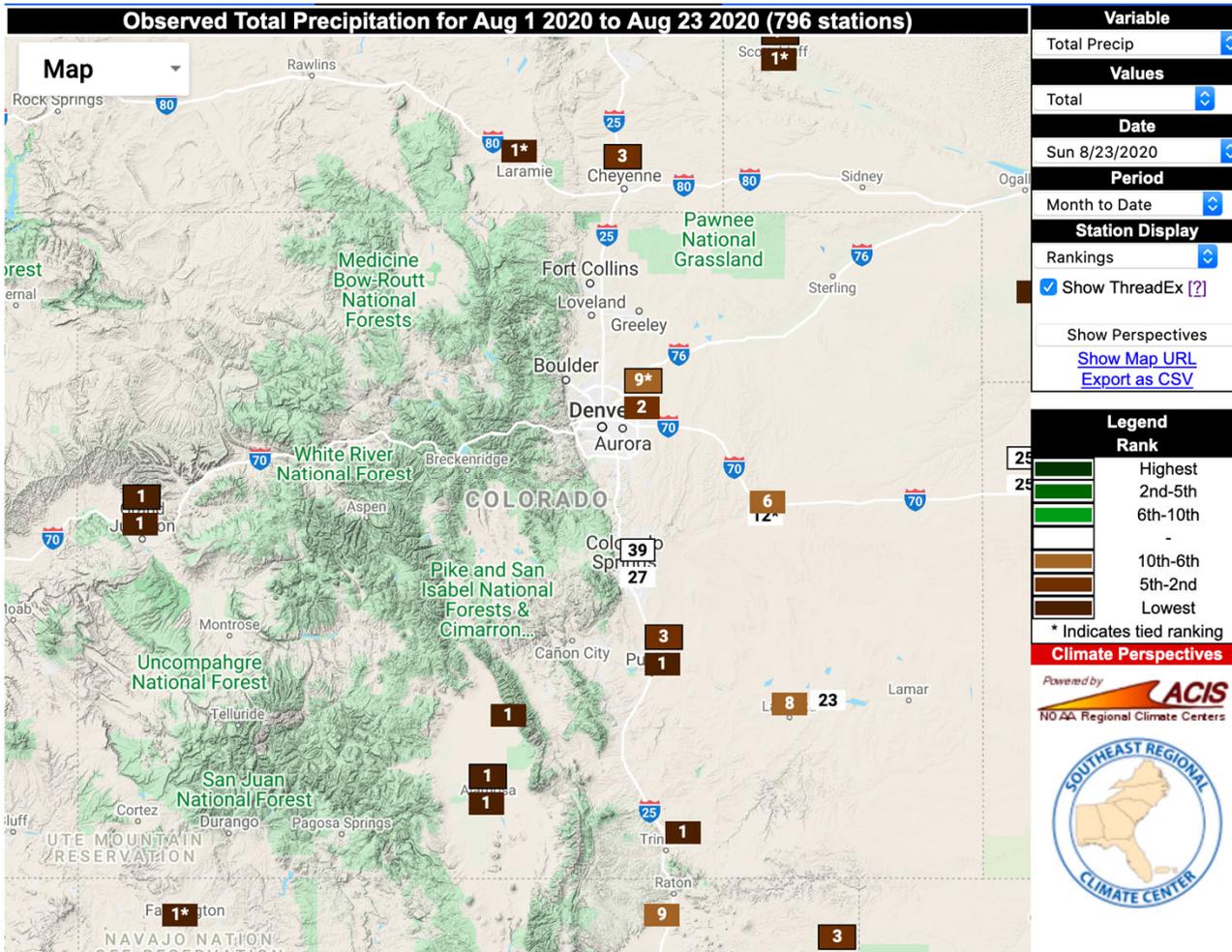
We've been stuck under an unmoving high-pressure ridge



Some temperature records

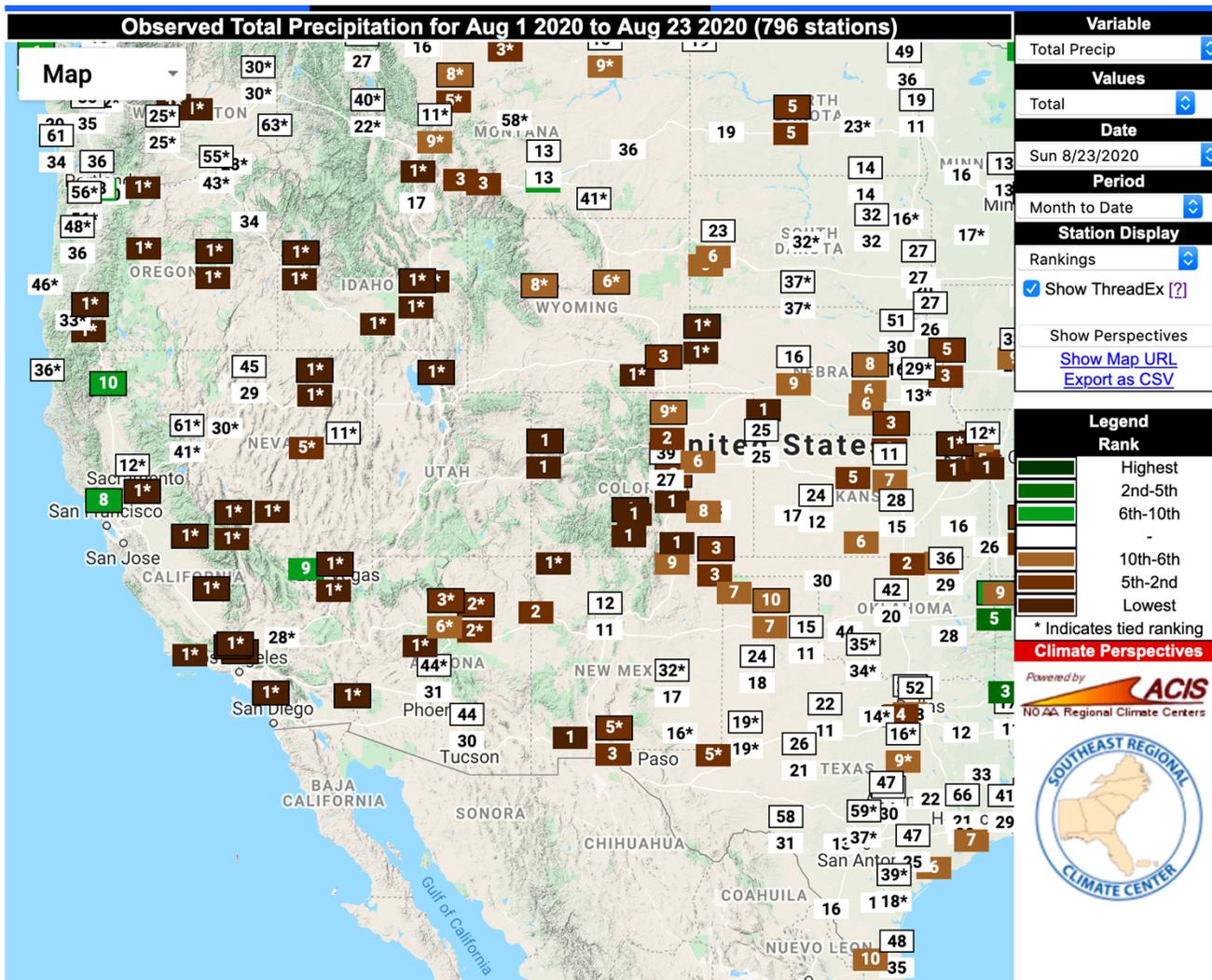
- Alamosa: highest August temperature on record (92F on August 19); set or tied daily high temperature records on 10 of the 23 days in August so far (there were some issues with the thermometer at Alamosa back in the spring, but those have been resolved; these are legit records)
- Grand Junction: tied August monthly record (103F on August 2 and 3); set or tied daily high temperature records on 6 days in August so far; 2nd most August 100-degree days; 6th most 100-degree days in a summer
- Denver: now 2nd most 90-degree days on record (behind only 2012)
- Fort Collins: now 4th most 90-degree days on record





Precipitation ranks at long-term stations for August thus far

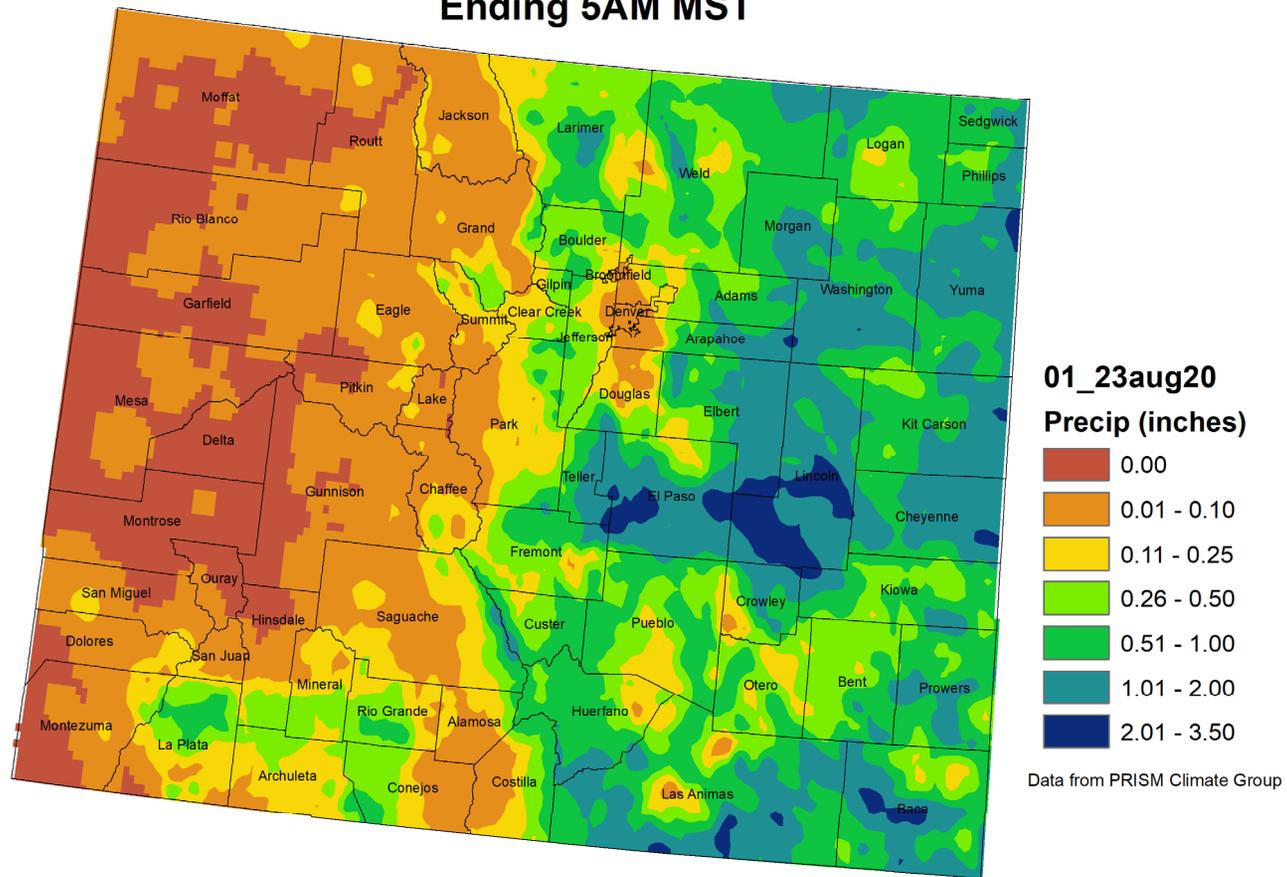




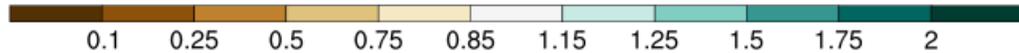
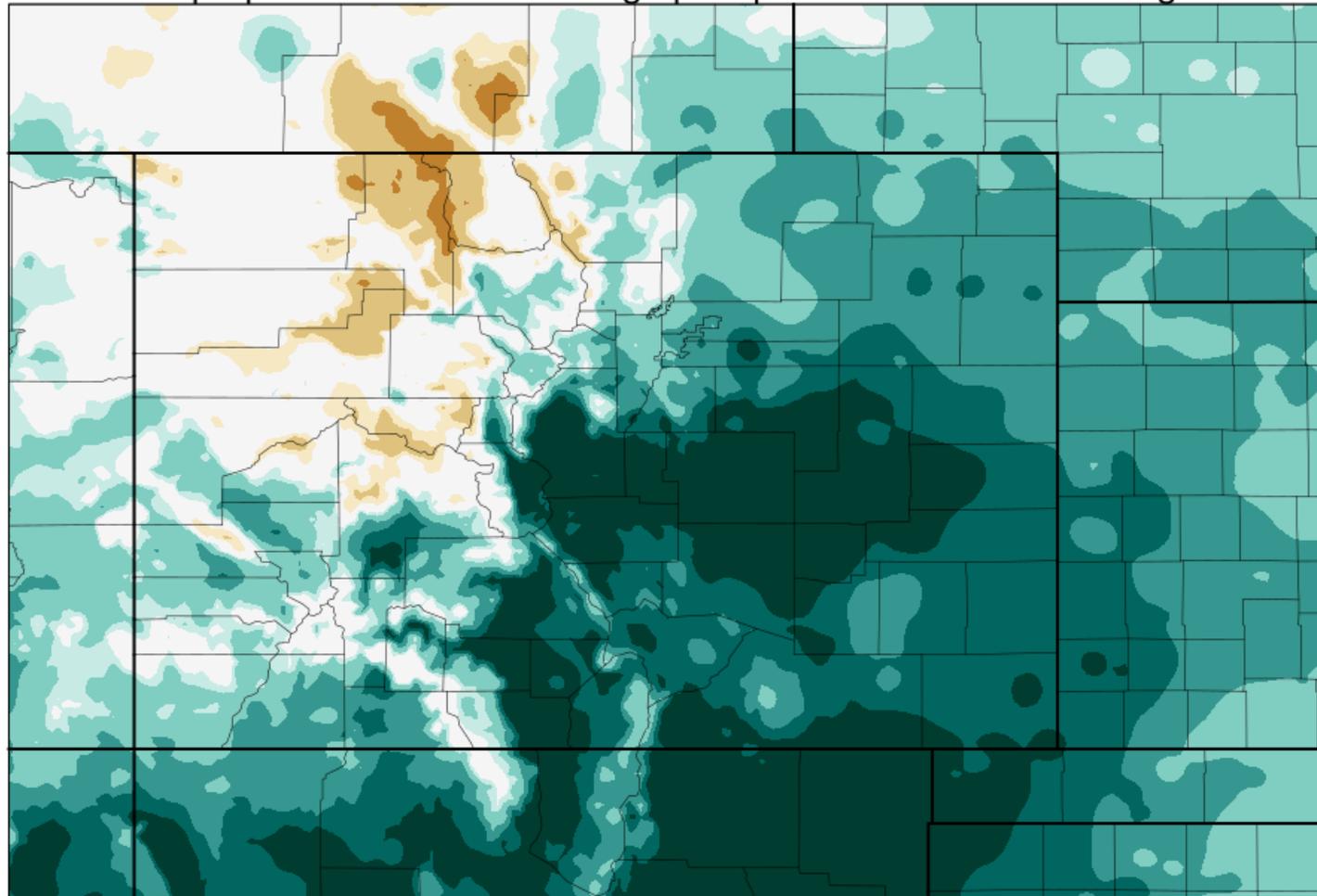
Precipitation ranks at long-term stations for August thus far



Colorado Month to Date Precipitation 1 - 23 August 2020 Ending 5AM MST



PRISM proportion of annual average precipitation in this month: August

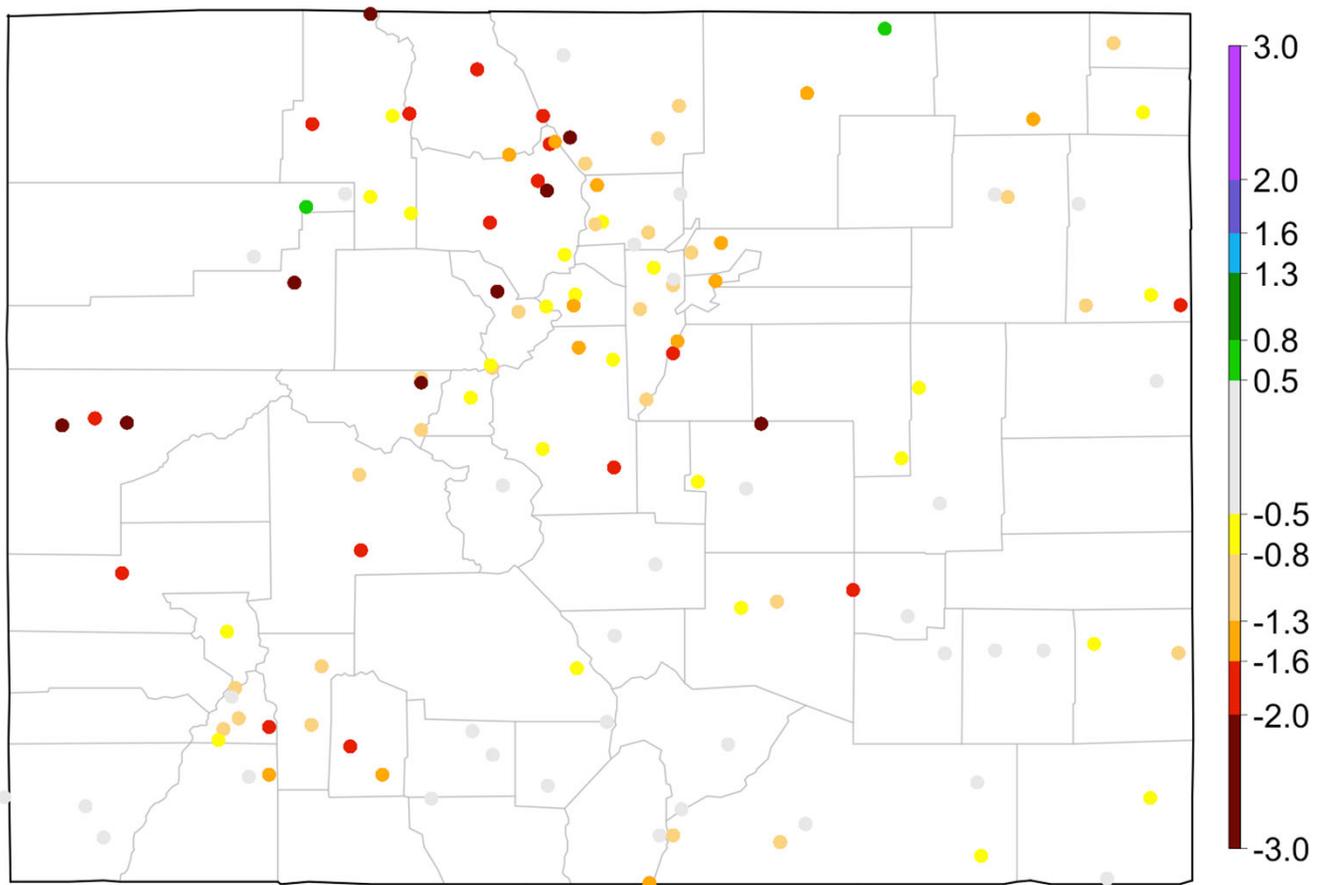


Proportion of precip relative to 1/12th

Russ Schumacher/Colorado Climate Center



30-day SPI: 2020/07/24 - 2020/08/22

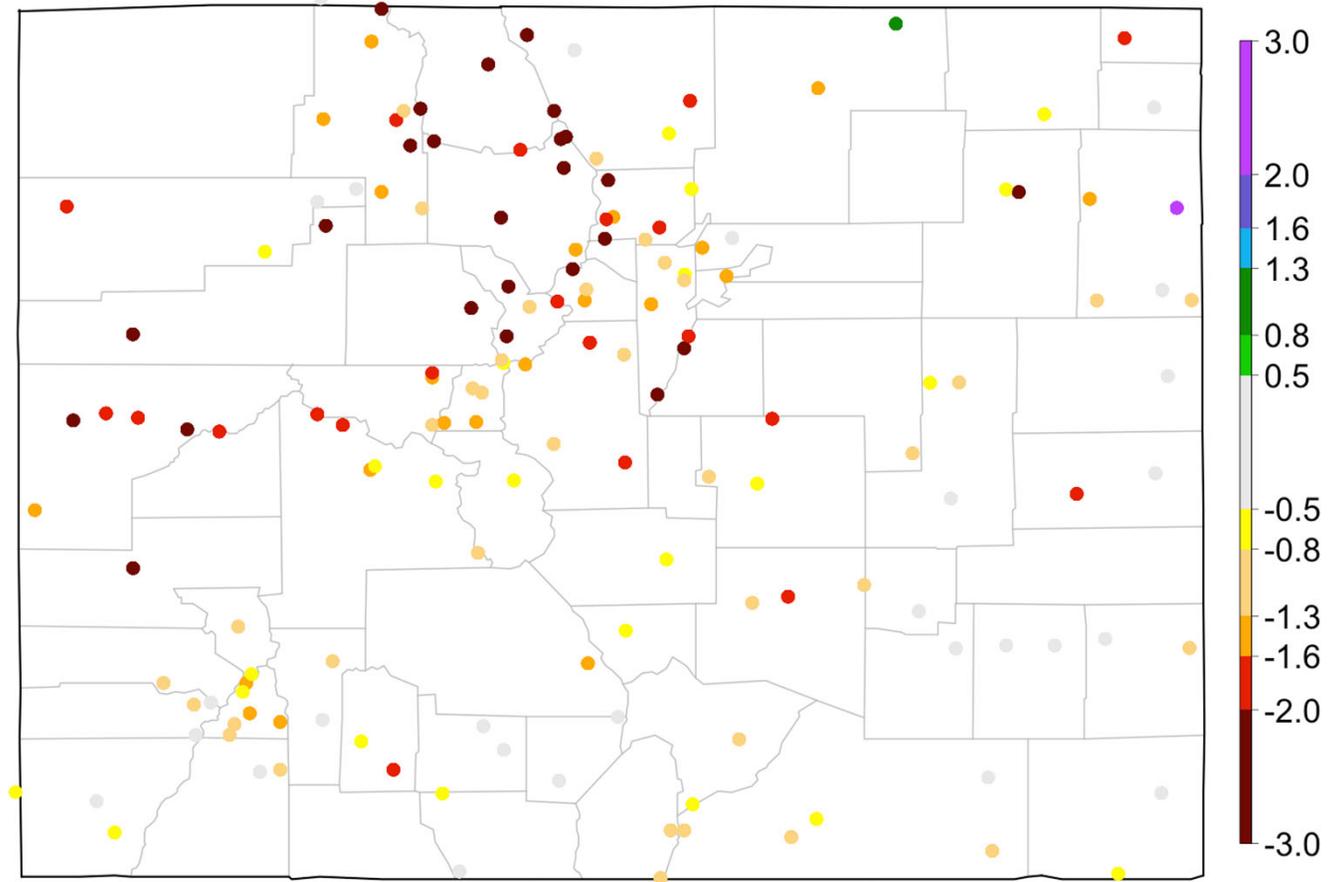


Data from High Plains Regional Climate Center and ACIS

[nl](#)



60-day SPI: 2020/06/24 - 2020/08/22

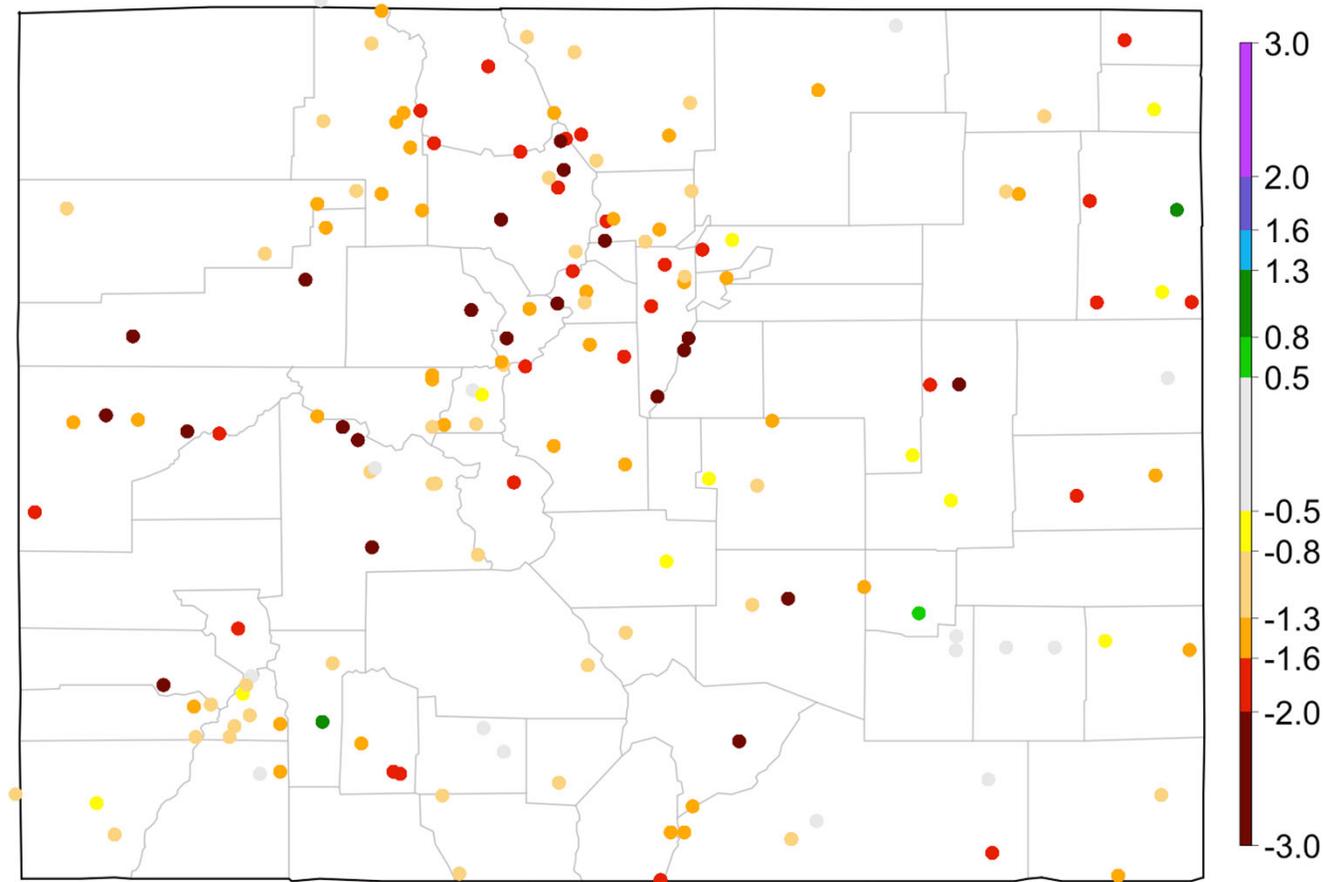


Data from High Plains Regional Climate Center and ACIS

[nl](#)



120-day SPI: 2020/04/25 - 2020/08/22

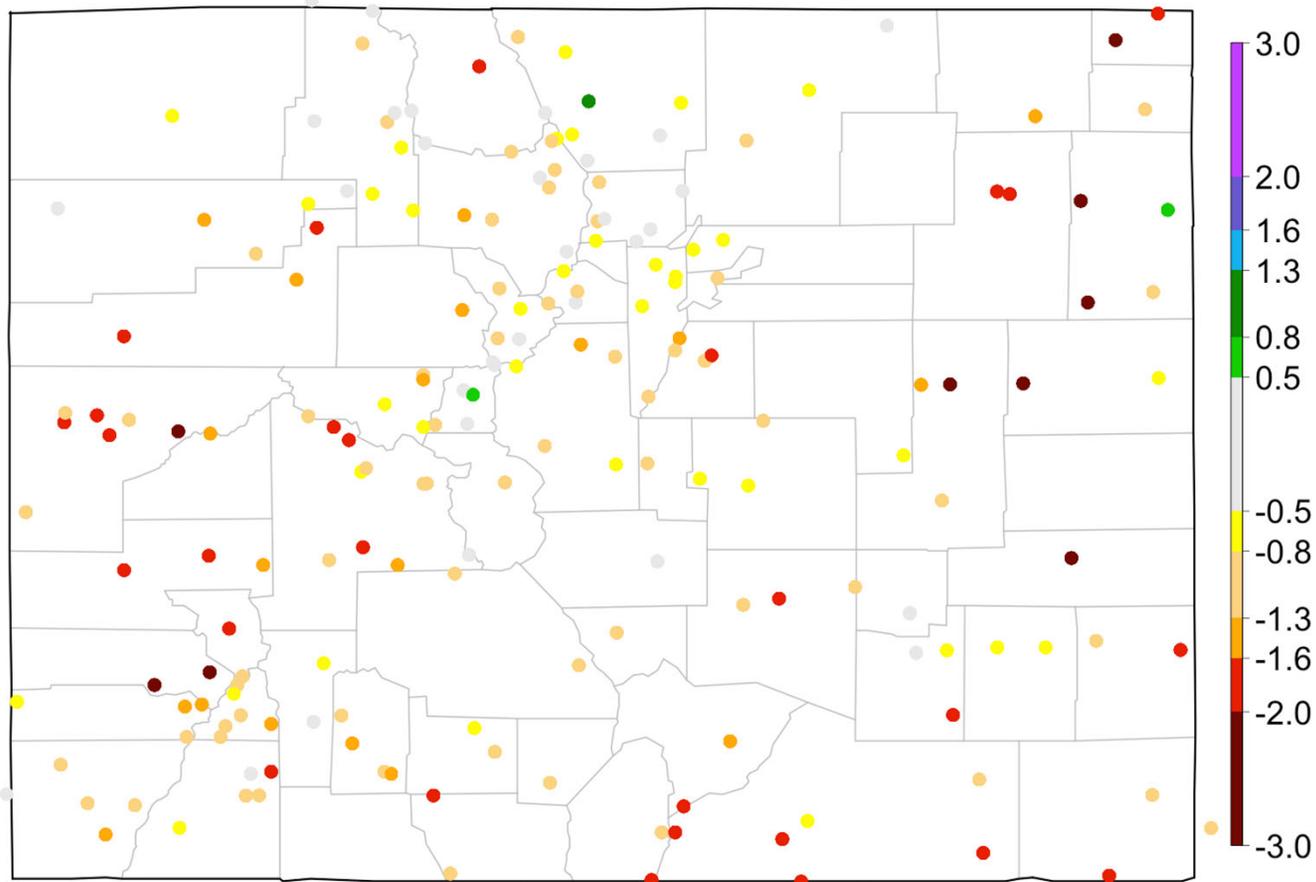


Data from High Plains Regional Climate Center and ACIS

[nl](#)



Water-year-to-date SPI: 2020/10/01 - 2020/08/22



Data from High Plains Regional Climate Center and ACIS

[nl](#)





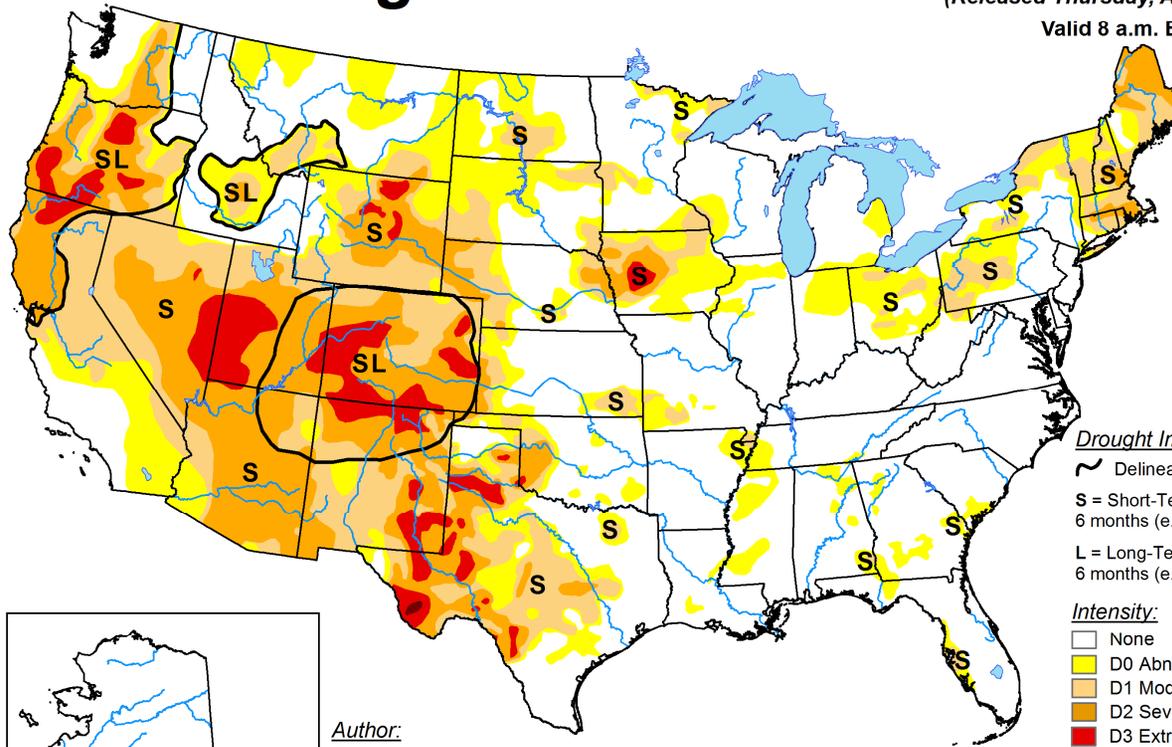
Cameron Peak smoke plume, August 14
Taken by me from Fort Collins City Park

Drought Conditions



U.S. Drought Monitor

August 18, 2020
 (Released Thursday, Aug. 20, 2020)
 Valid 8 a.m. EDT

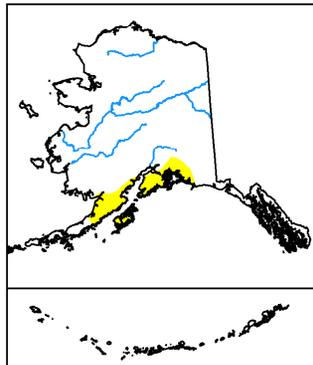


Drought Impact Types:

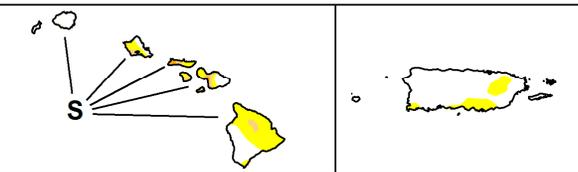
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

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



Author:
 David Simeral
 Western Regional Climate Center



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

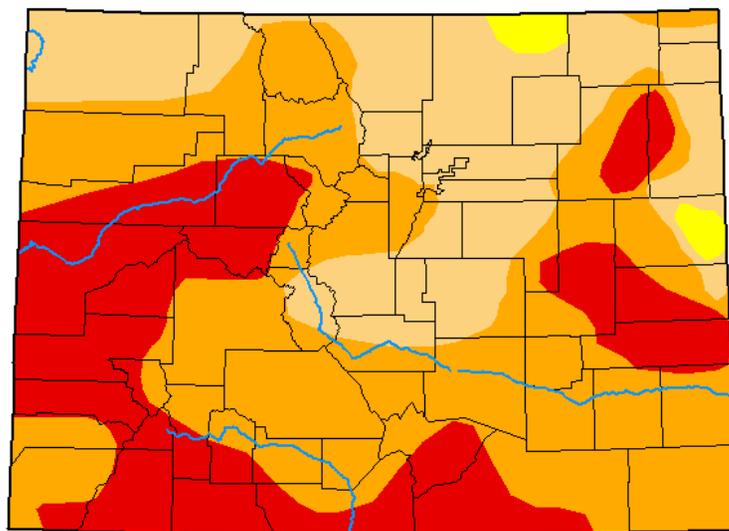


droughtmonitor.unl.edu



U.S. Drought Monitor Colorado

August 18, 2020
(Released Thursday, Aug. 20, 2020)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	98.76	72.69	27.31	0.00
Last Week <i>08-11-2020</i>	0.00	100.00	93.87	61.43	23.66	0.00
3 Months Ago <i>05-19-2020</i>	23.22	76.78	65.20	46.31	17.52	0.00
Start of Calendar Year <i>12-31-2019</i>	31.72	68.28	51.19	20.11	0.00	0.00
Start of Water Year <i>10-01-2019</i>	30.14	69.86	27.53	0.00	0.00	0.00
One Year Ago <i>08-20-2019</i>	93.35	6.65	0.00	0.00	0.00	0.00

Intensity:

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

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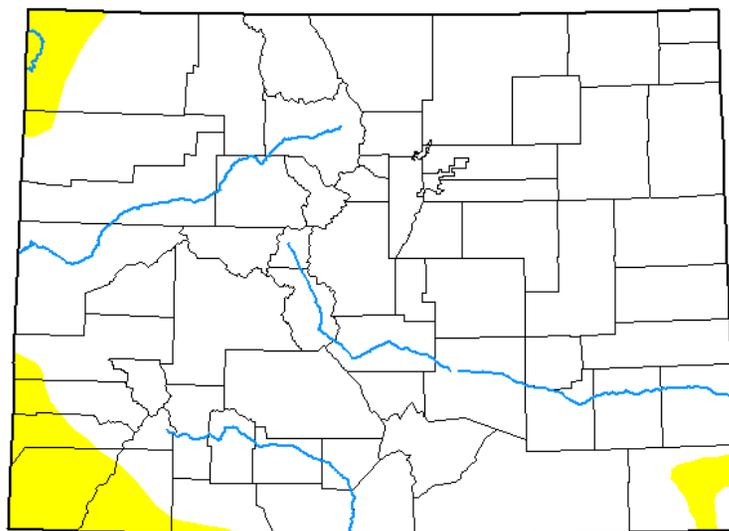
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U.S. Drought Monitor Colorado

August 20, 2019
(Released Thursday, Aug. 22, 2019)
Valid 8 a.m. EDT

One year ago



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	93.35	6.65	0.00	0.00	0.00	0.00
Last Week <i>08-13-2019</i>	93.35	6.65	0.00	0.00	0.00	0.00
3 Months Ago <i>05-21-2019</i>	99.99	0.01	0.00	0.00	0.00	0.00
Start of Calendar Year <i>01-01-2019</i>	17.94	82.06	66.26	54.91	27.11	11.22
Start of Water Year <i>09-25-2018</i>	14.19	85.81	72.30	64.41	48.47	16.21
One Year Ago <i>08-21-2018</i>	18.57	81.43	74.46	65.88	45.46	8.50

Intensity:

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

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Author:

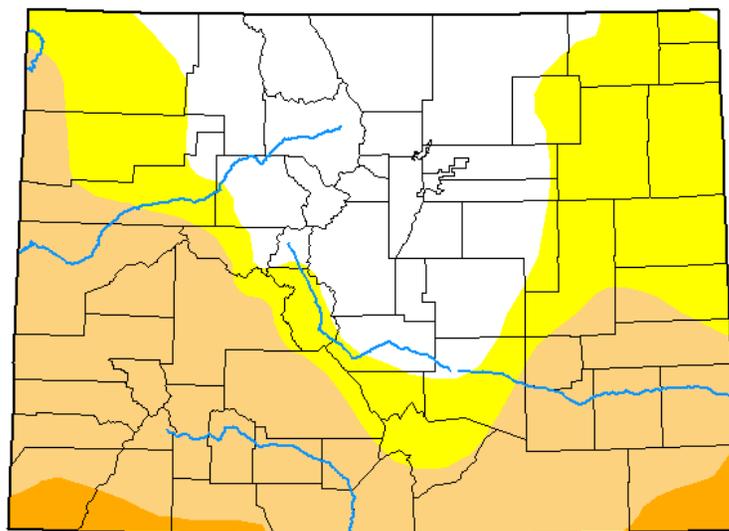
Jessica Blunden
NCEI/NOAA



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U.S. Drought Monitor Colorado



February 18, 2020
(Released Thursday, Feb. 20, 2020)
Valid 7 a.m. EST

Six months
ago

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	28.74	71.26	43.82	3.30	0.00	0.00
Last Week <i>02-11-2020</i>	27.72	72.28	43.82	3.30	0.00	0.00
3 Months Ago <i>11-19-2019</i>	25.19	74.81	59.95	32.23	0.00	0.00
Start of Calendar Year <i>12-31-2019</i>	31.72	68.28	51.19	20.11	0.00	0.00
Start of Water Year <i>10-01-2019</i>	30.14	69.86	27.53	0.00	0.00	0.00
One Year Ago <i>02-19-2019</i>	8.15	91.85	67.16	39.69	10.21	0.11

Intensity:

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

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Author:

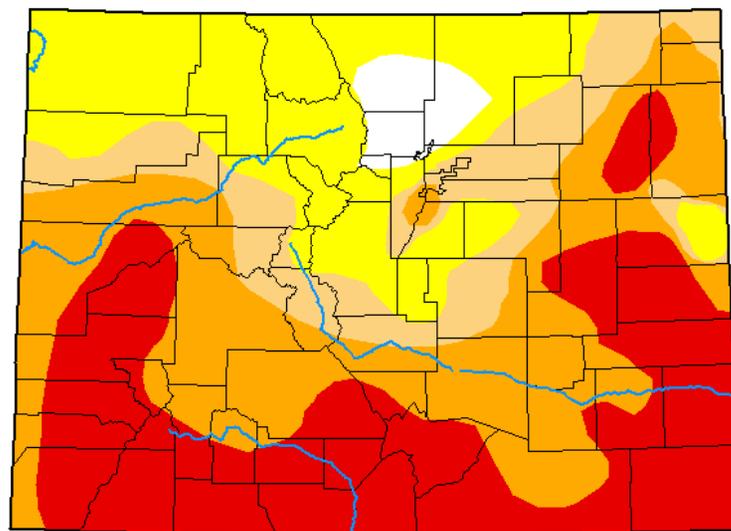
David Miskus
NOAA/NWS/NCEP/CPC



droughtmonitor.unl.edu



U.S. Drought Monitor Colorado



July 21, 2020
(Released Thursday, Jul. 23, 2020)
Valid 8 a.m. EDT

One month ago

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	2.95	97.05	73.99	60.34	31.77	0.00
Last Week <i>07-14-2020</i>	4.64	95.36	70.20	57.84	36.91	0.00
3 Months Ago <i>04-21-2020</i>	33.26	66.74	53.58	28.51	0.00	0.00
Start of Calendar Year <i>12-31-2019</i>	31.72	68.28	51.19	20.11	0.00	0.00
Start of Water Year <i>10-01-2019</i>	30.14	69.86	27.53	0.00	0.00	0.00
One Year Ago <i>07-23-2019</i>	96.93	3.07	0.00	0.00	0.00	0.00

Intensity:

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

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Author:

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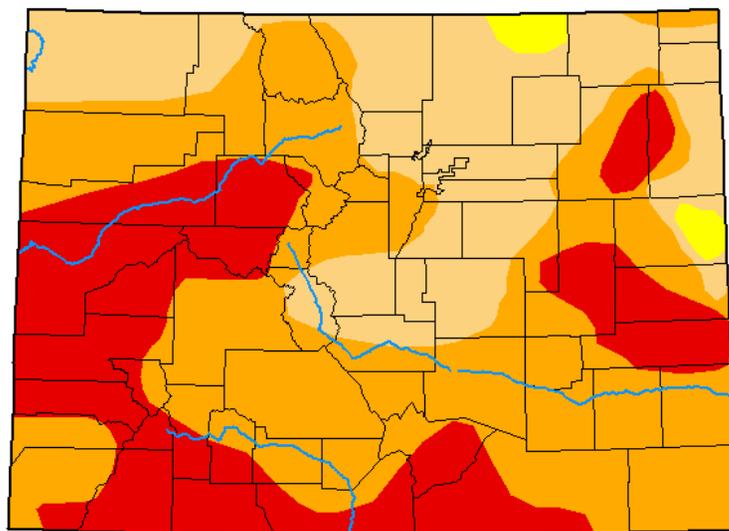


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U.S. Drought Monitor Colorado

August 18, 2020
(Released Thursday, Aug. 20, 2020)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	98.76	72.69	27.31	0.00
Last Week <i>08-11-2020</i>	0.00	100.00	93.87	61.43	23.66	0.00
3 Months Ago <i>05-19-2020</i>	23.22	76.78	65.20	46.31	17.52	0.00
Start of Calendar Year <i>12-31-2019</i>	31.72	68.28	51.19	20.11	0.00	0.00
Start of Water Year <i>10-01-2019</i>	30.14	69.86	27.53	0.00	0.00	0.00
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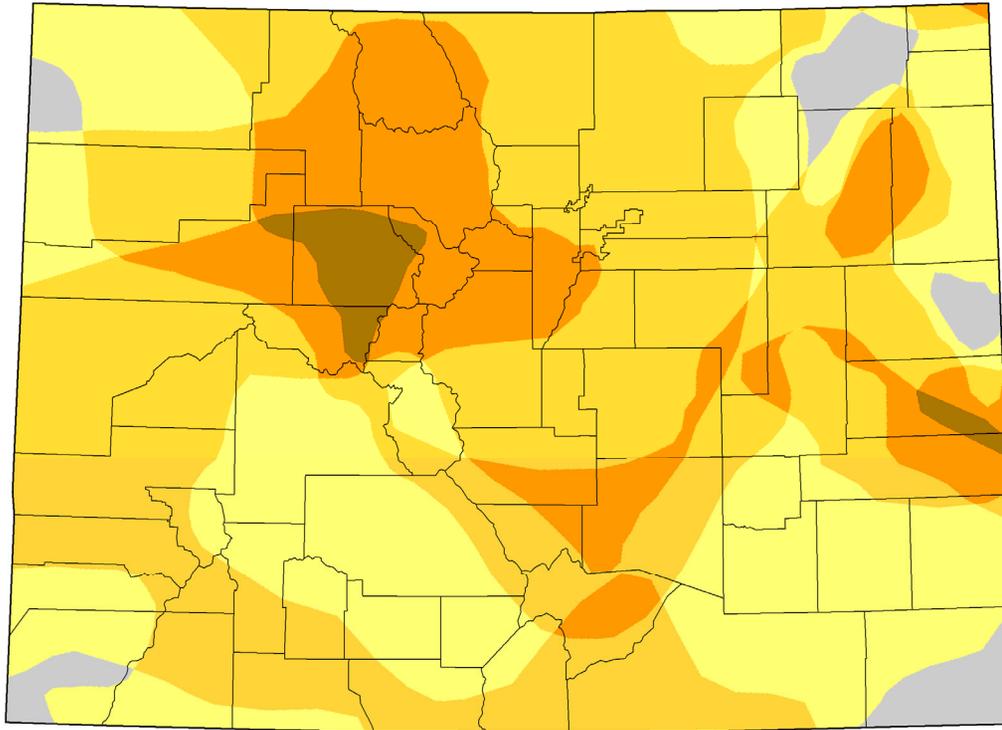
David Simeral
Western Regional Climate Center



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U.S. Drought Monitor Class Change - Colorado 6 Months



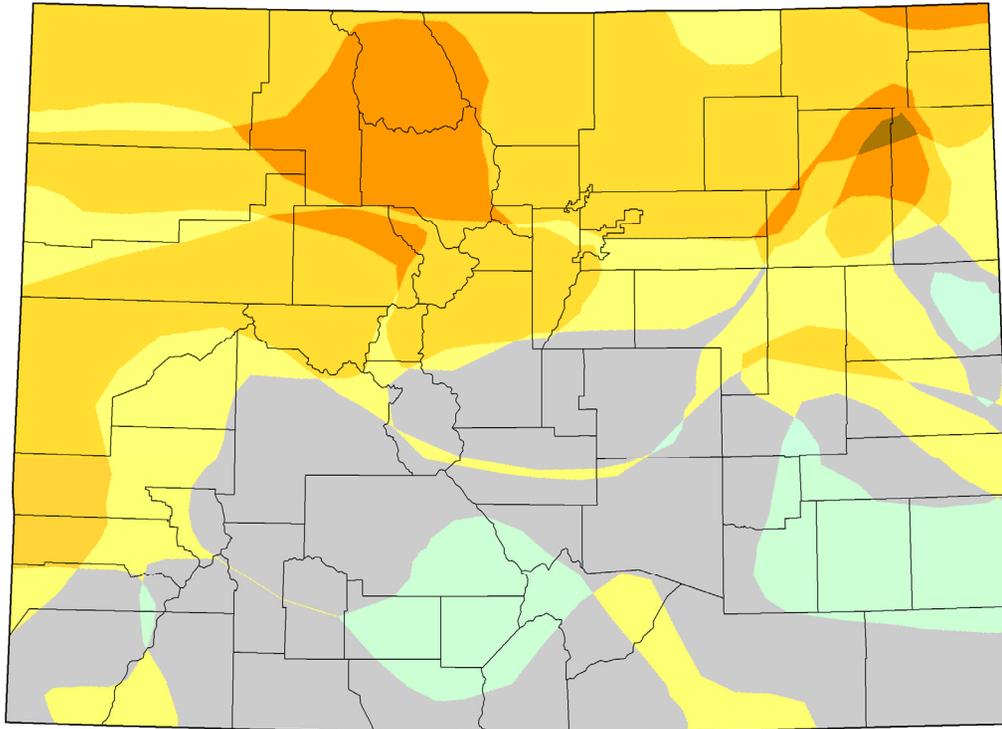
- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

August 18, 2020
compared to
March 3, 2020

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U.S. Drought Monitor Class Change - Colorado 3 Months



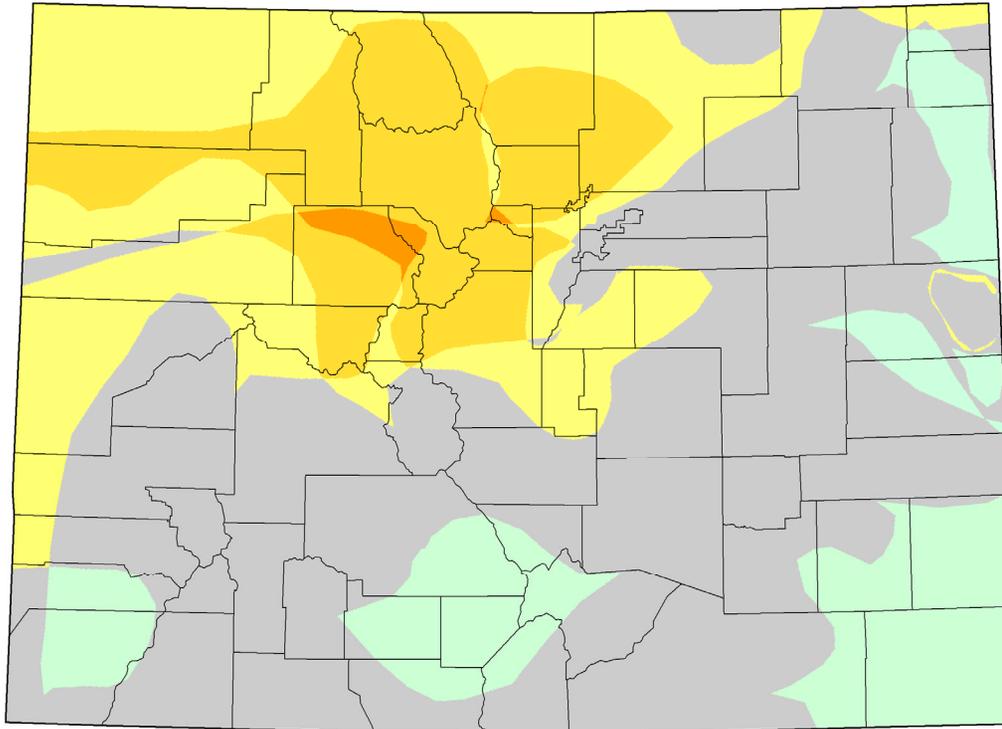
- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

August 18, 2020
compared to
May 26, 2020

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U.S. Drought Monitor Class Change - Colorado 1 Month



- 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

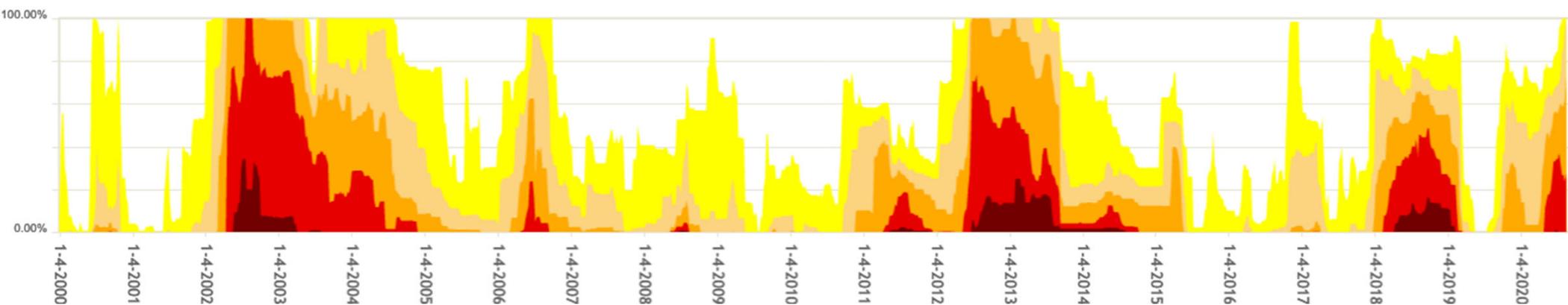
August 18, 2020
compared to
July 21, 2020

droughtmonitor.unl.edu

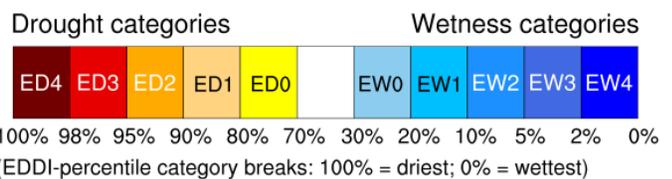
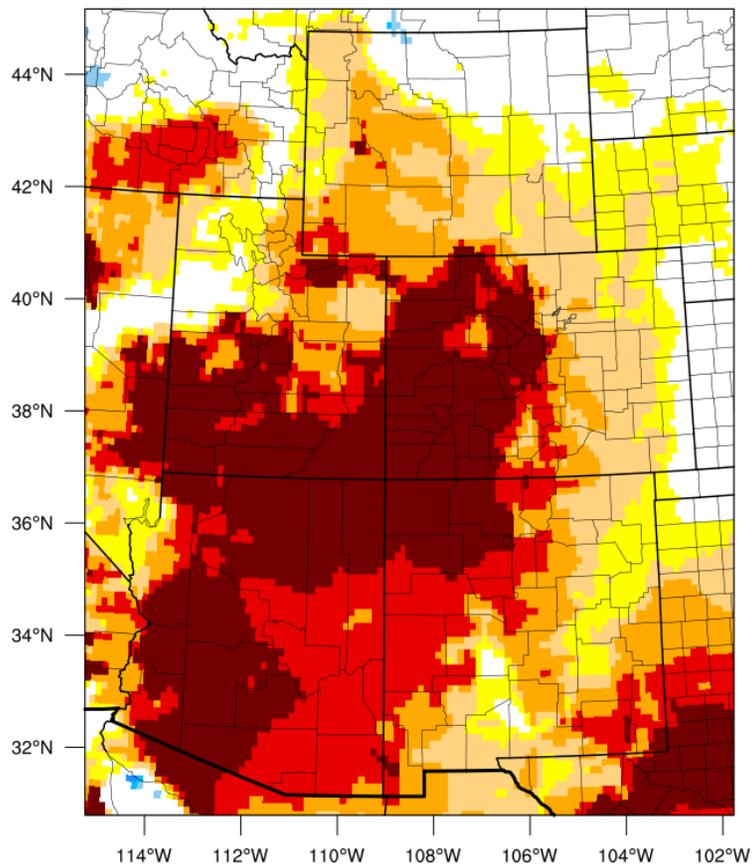


US Drought Monitor, percent of Colorado in drought

Colorado Percent Area



3-week EDDI categories for August 19, 2020



Generated by NOAA/ESRL/Physical Sciences Laboratory

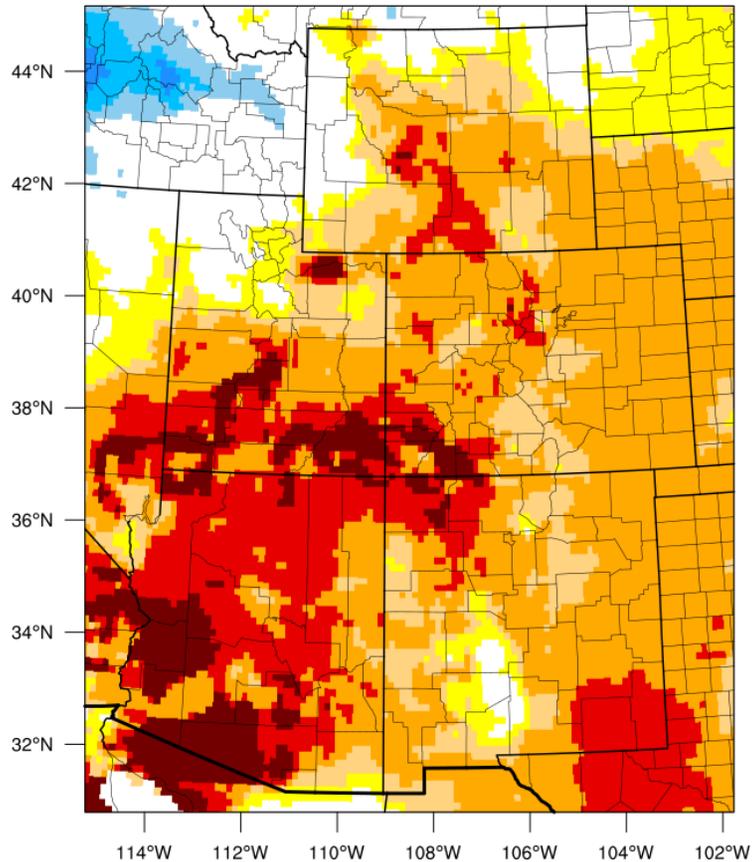
Evaporative Demand Drought Index

Record levels of evaporative demand across the west since the beginning of August

We expect more moisture, clouds, rain in August on the western slope, but not this year



3-month EDDI categories for August 18, 2020



Drought categories

Wetness categories



100% 98% 95% 90% 80% 70% 30% 20% 10% 5% 2% 0%
(EDDI-percentile category breaks: 100% = driest; 0% = wettest)

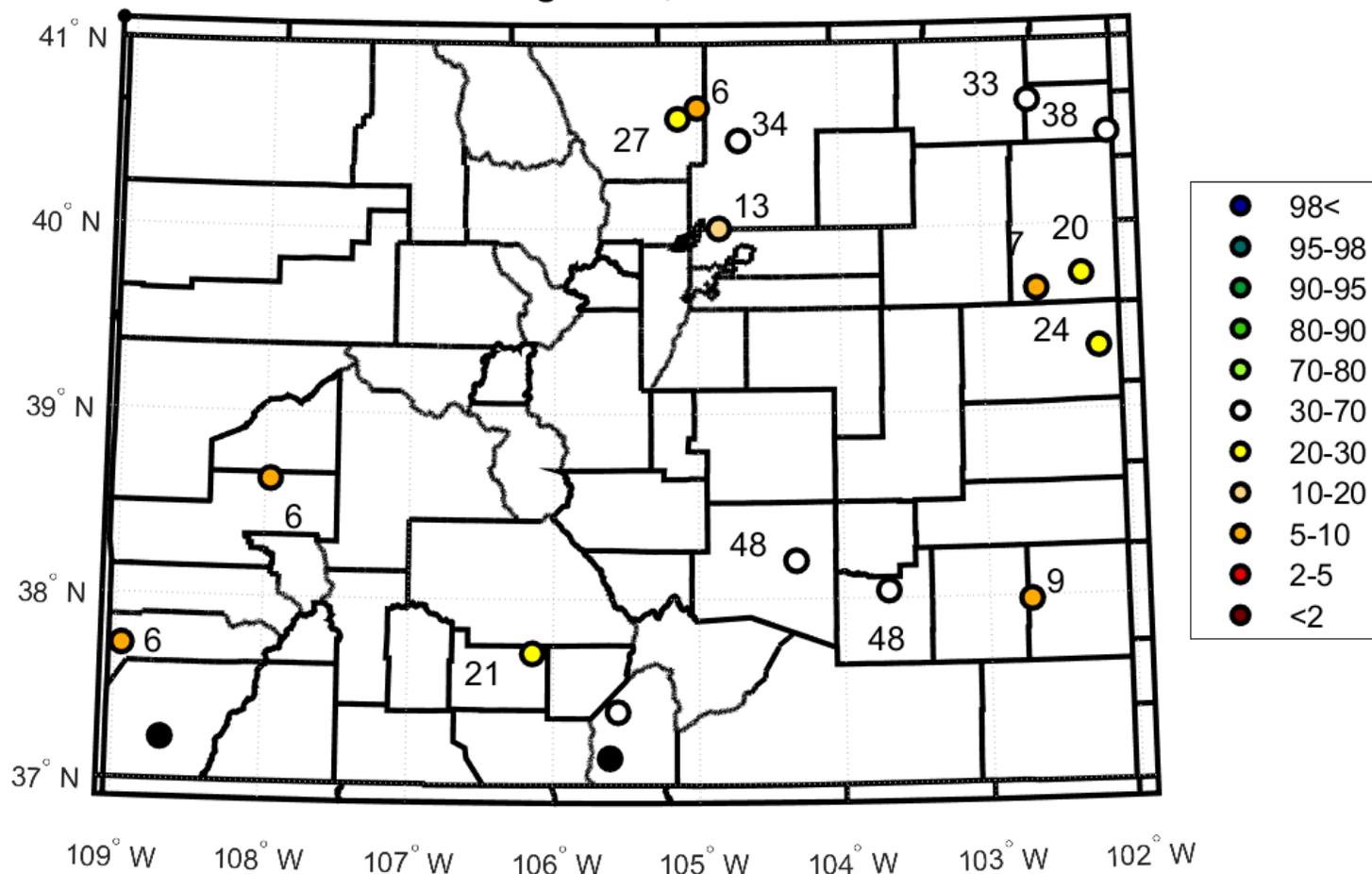
Generated by NOAA/ESRL/Physical Sciences Laboratory

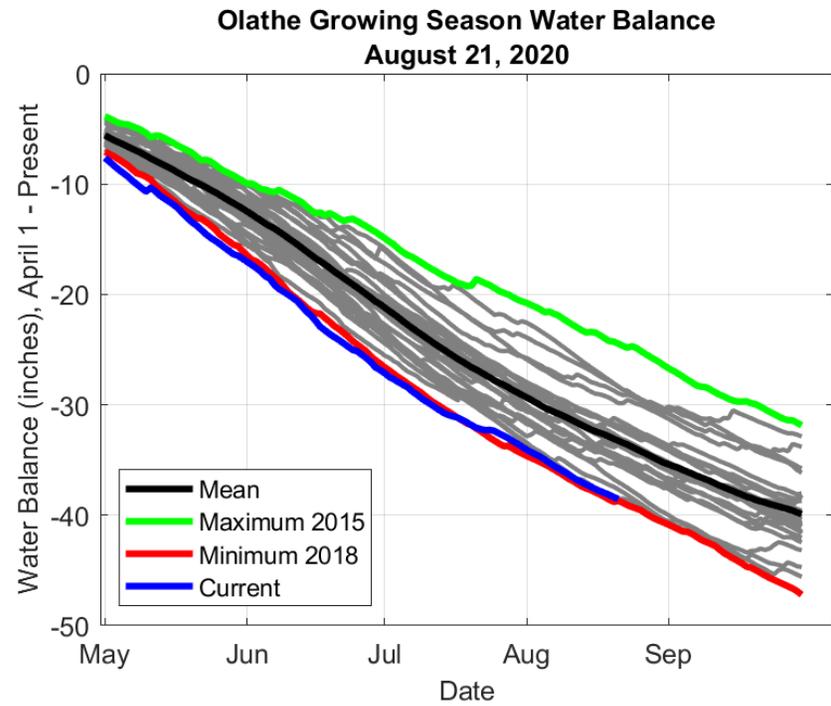
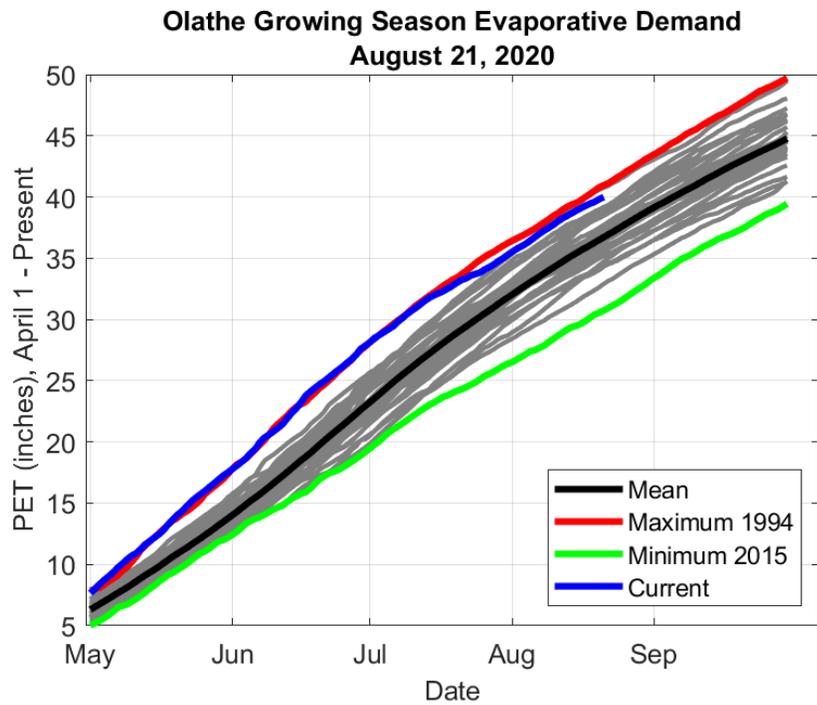
Evaporative Demand Drought Index

Evaporative demand has
been high statewide going
back to May



Growing Season Water Balance (P/PET) Percentiles August 21, 2020

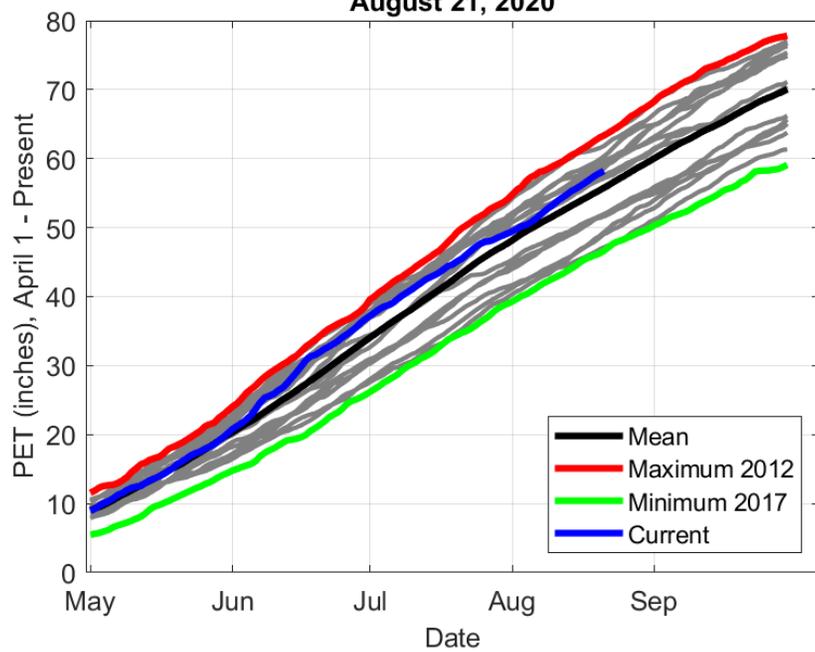




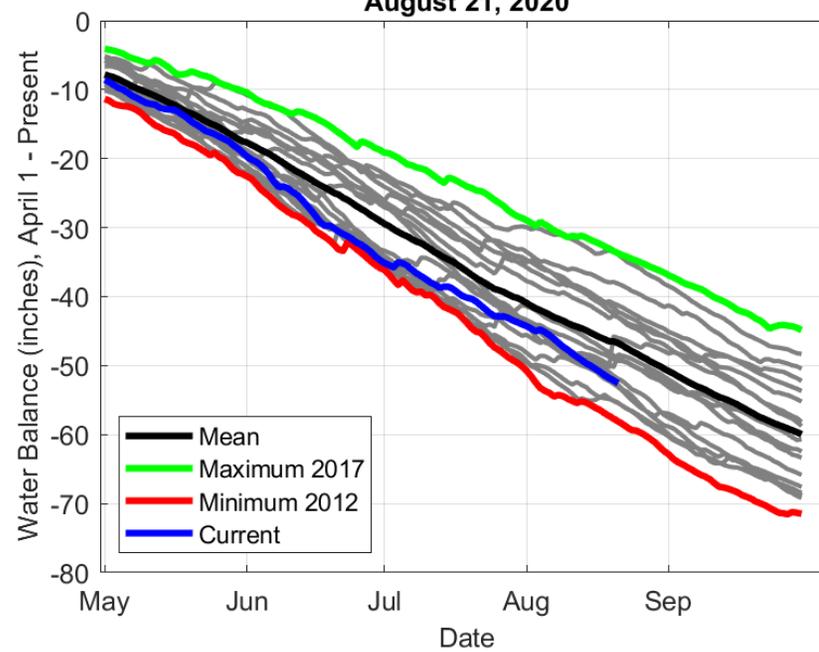
<http://climate.colostate.edu/~drought/et.php>



Lamar Growing Season Evaporative Demand
August 21, 2020



Lamar Growing Season Water Balance
August 21, 2020

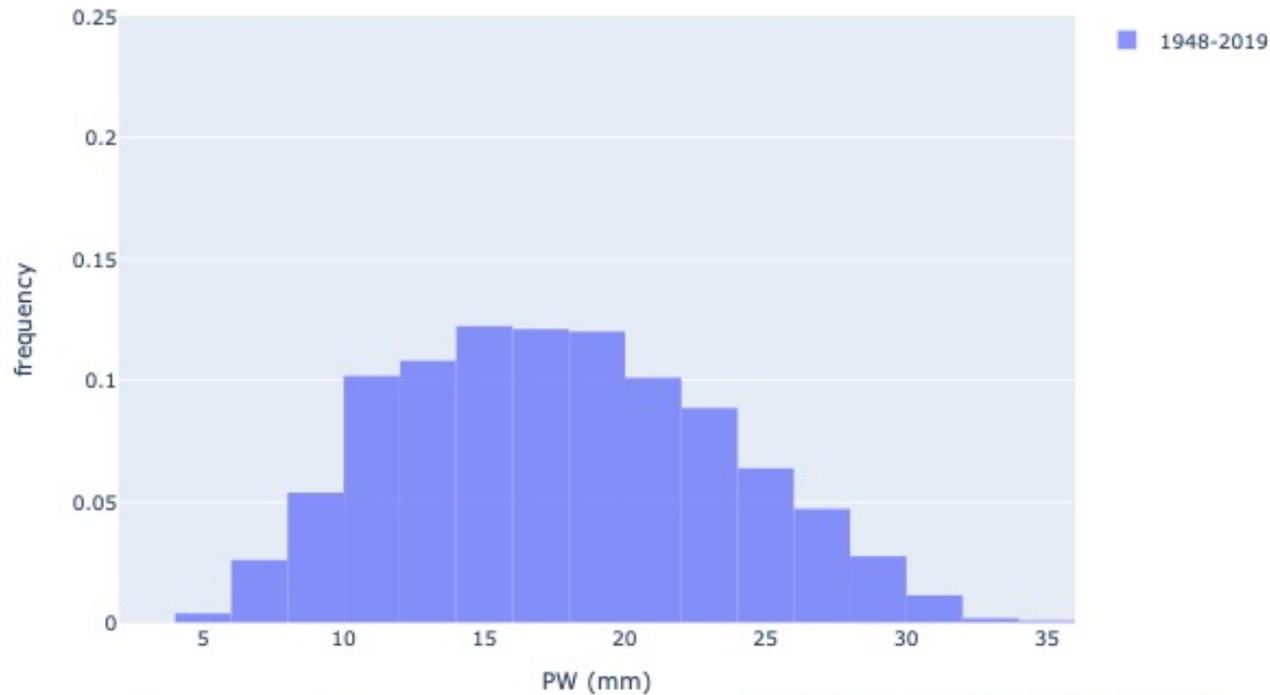


<http://climate.colostate.edu/~drought/et.php>



Precipitable water (how much moisture is in the atmosphere)

Grand Junction August precipitable water histogram

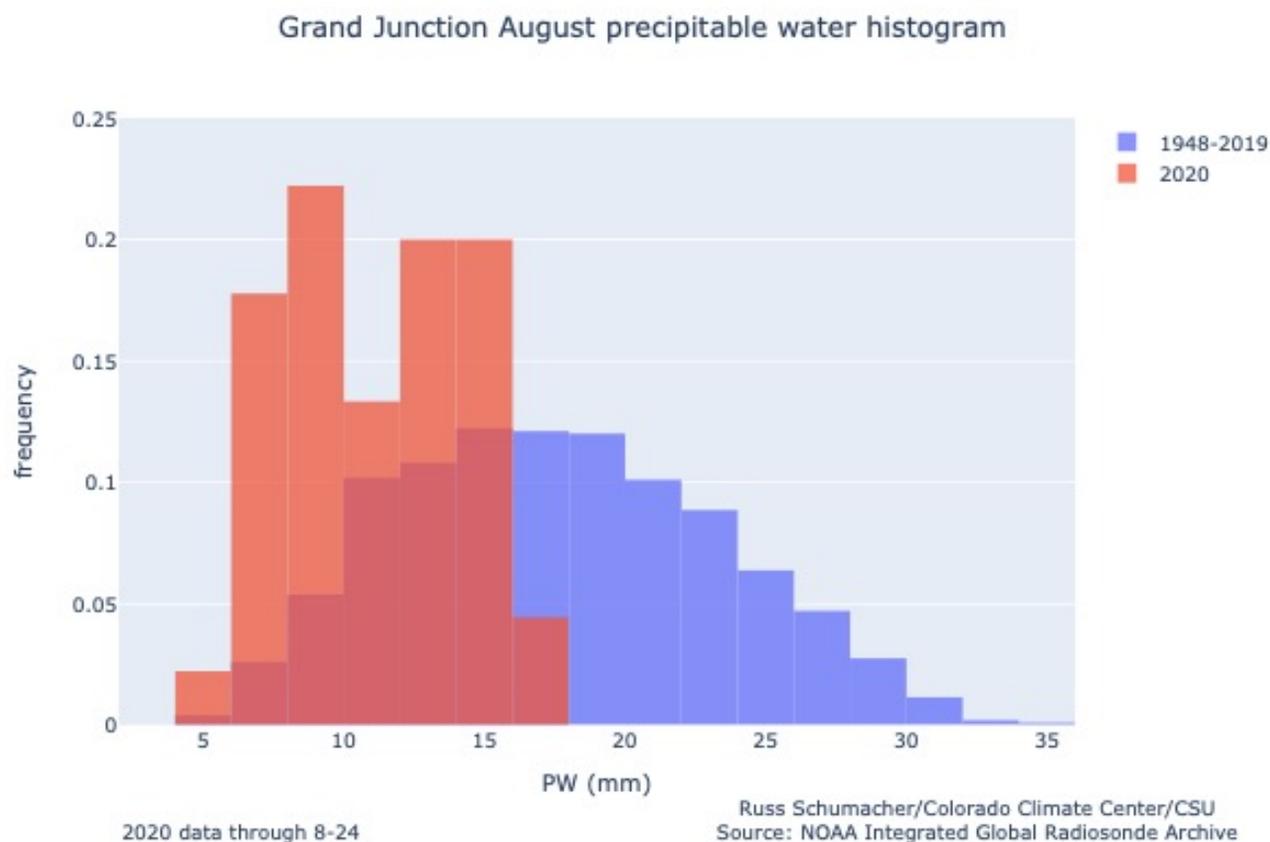


2020 data through 8-24

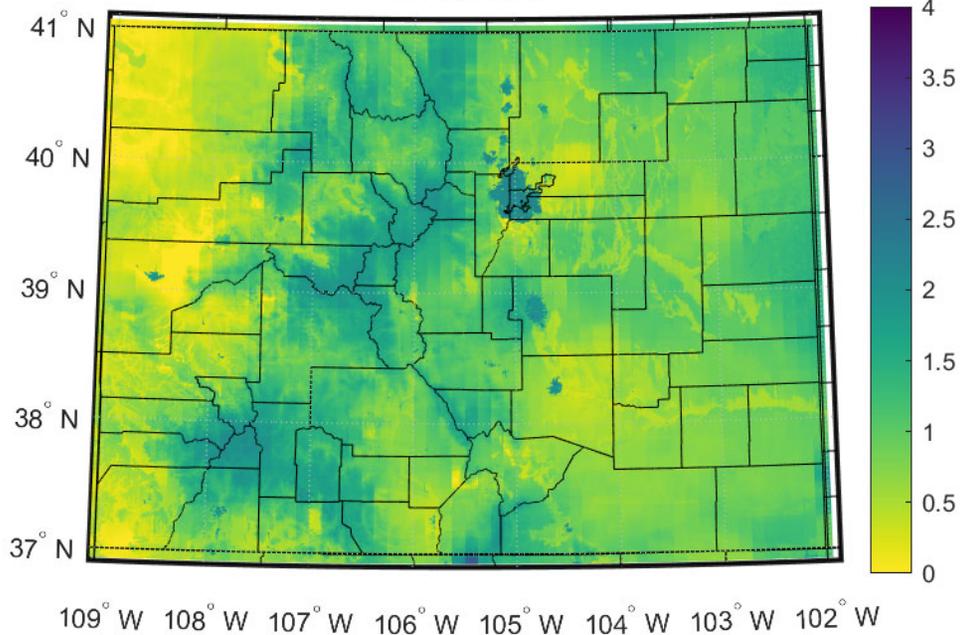
Russ Schumacher/Colorado Climate Center/CSU
Source: NOAA Integrated Global Radiosonde Archive



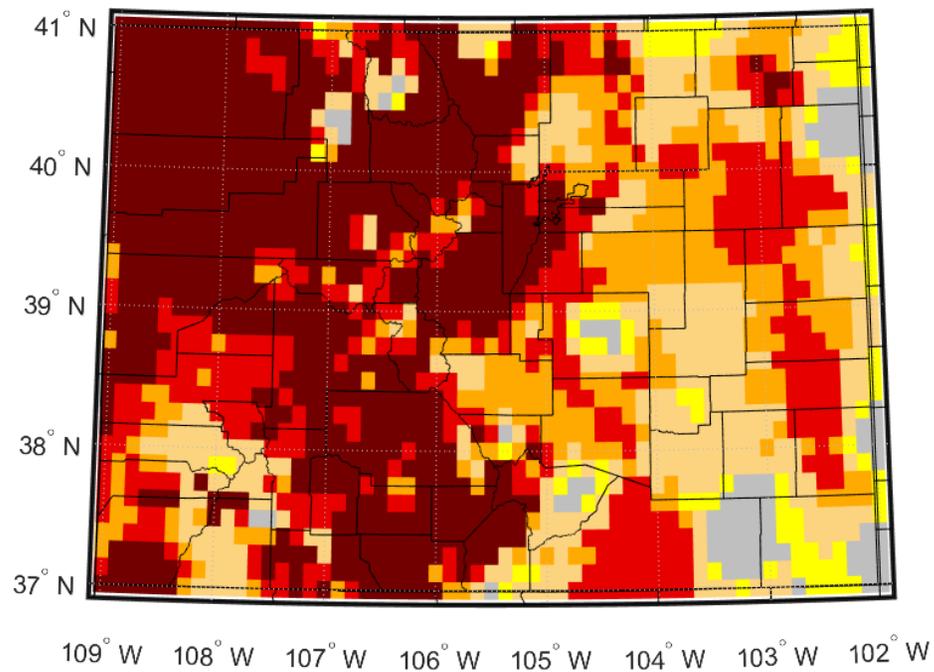
Precipitable water (how much moisture is in the atmosphere)



Top 10cm Available Plant Water (cm)
08/15/2020



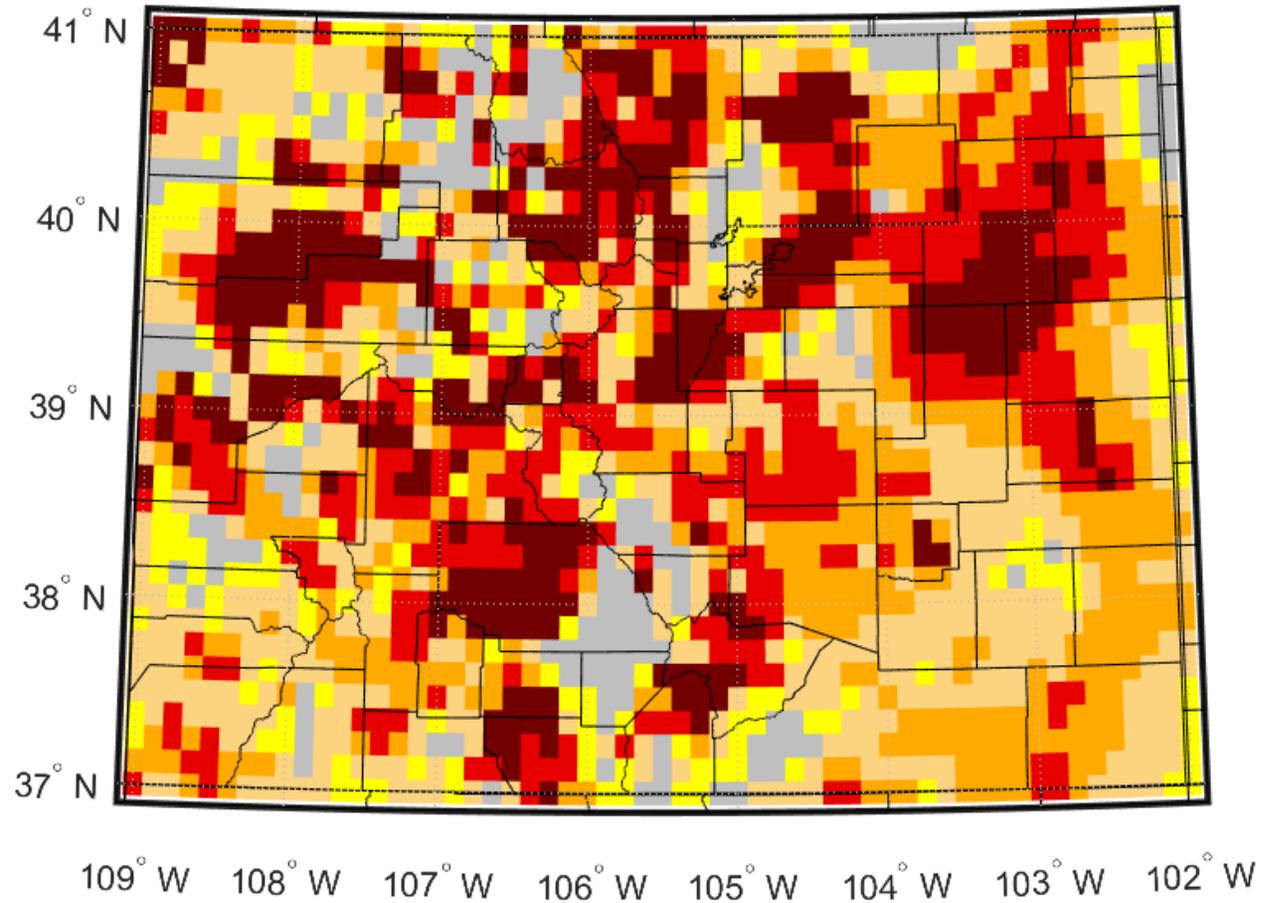
Top 10cm Soil Moisture Drought Category
08/19/2020



Top Meter Soil Moisture Drought Category 08/19/2020

Deep soil moisture continues to be bad across most of the state

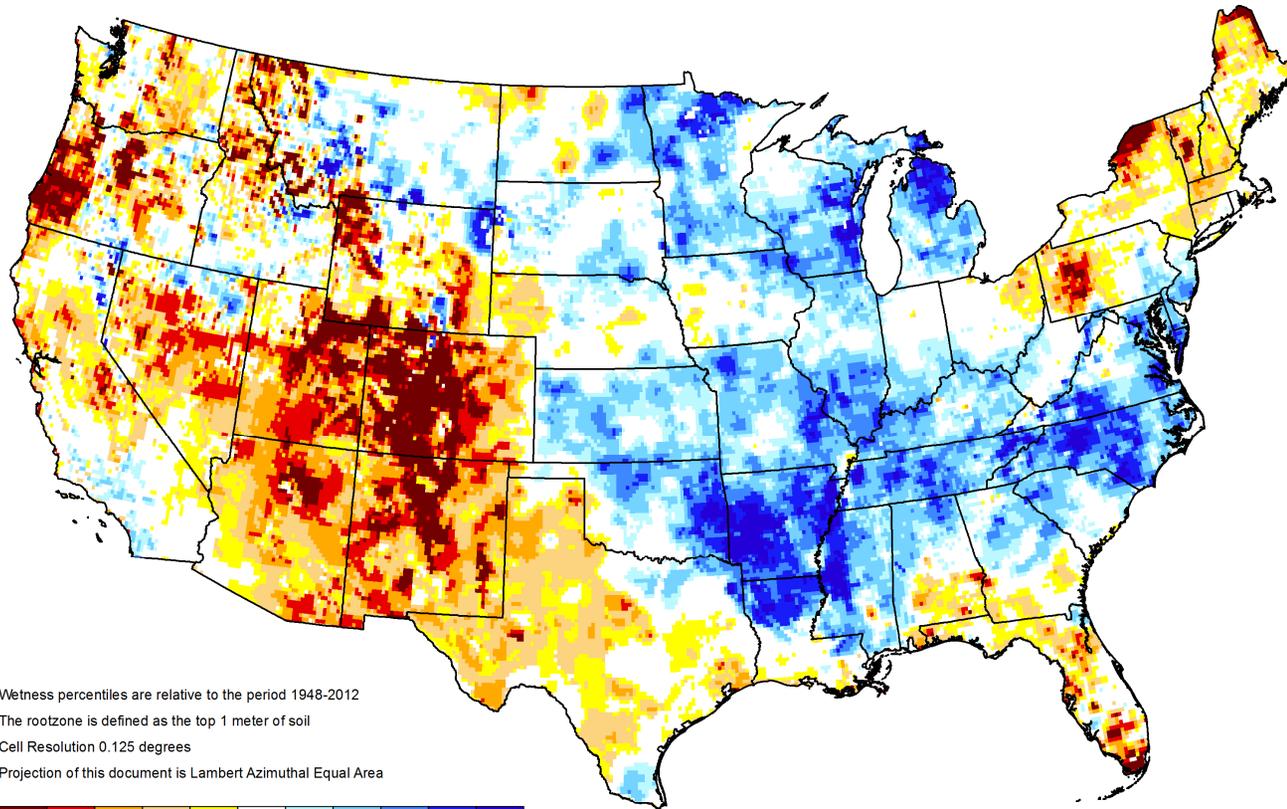
Dark red = drier than 2002,
2012, 2018



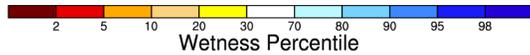


GRACE-Based Root Zone Soil Moisture Drought Indicator

August 17, 2020



Wetness percentiles are relative to the period 1948-2012
The rootzone is defined as the top 1 meter of soil
Cell Resolution 0.125 degrees
Projection of this document is Lambert Azimuthal Equal Area



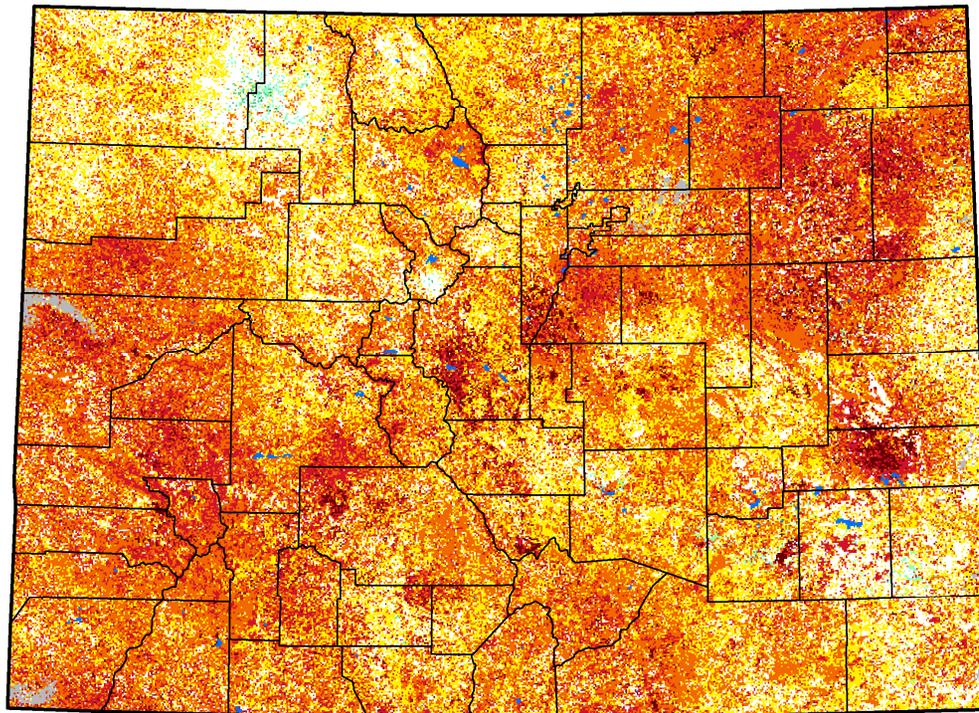
<https://nasagrace.unl.edu>



Vegetation Drought Response Index

Complete: Colorado

August 23, 2020

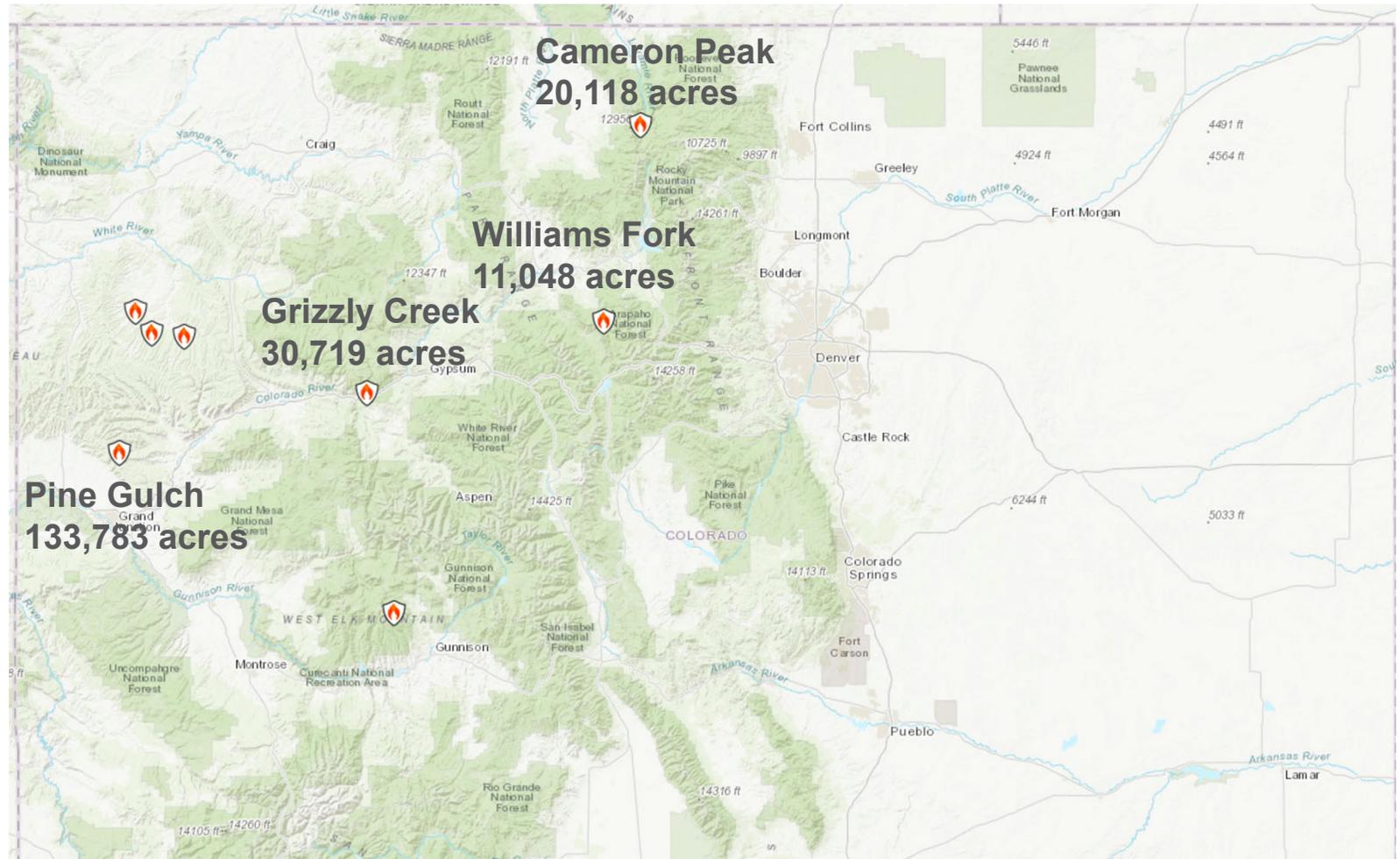


Vegetation Condition

- Extreme Drought
- Severe Drought
- Moderate Drought
- Pre-drought stress
- Near Normal
- Unusually Moist
- Very Moist
- Extreme Moist
- Out of Season
- Water



Four large fires

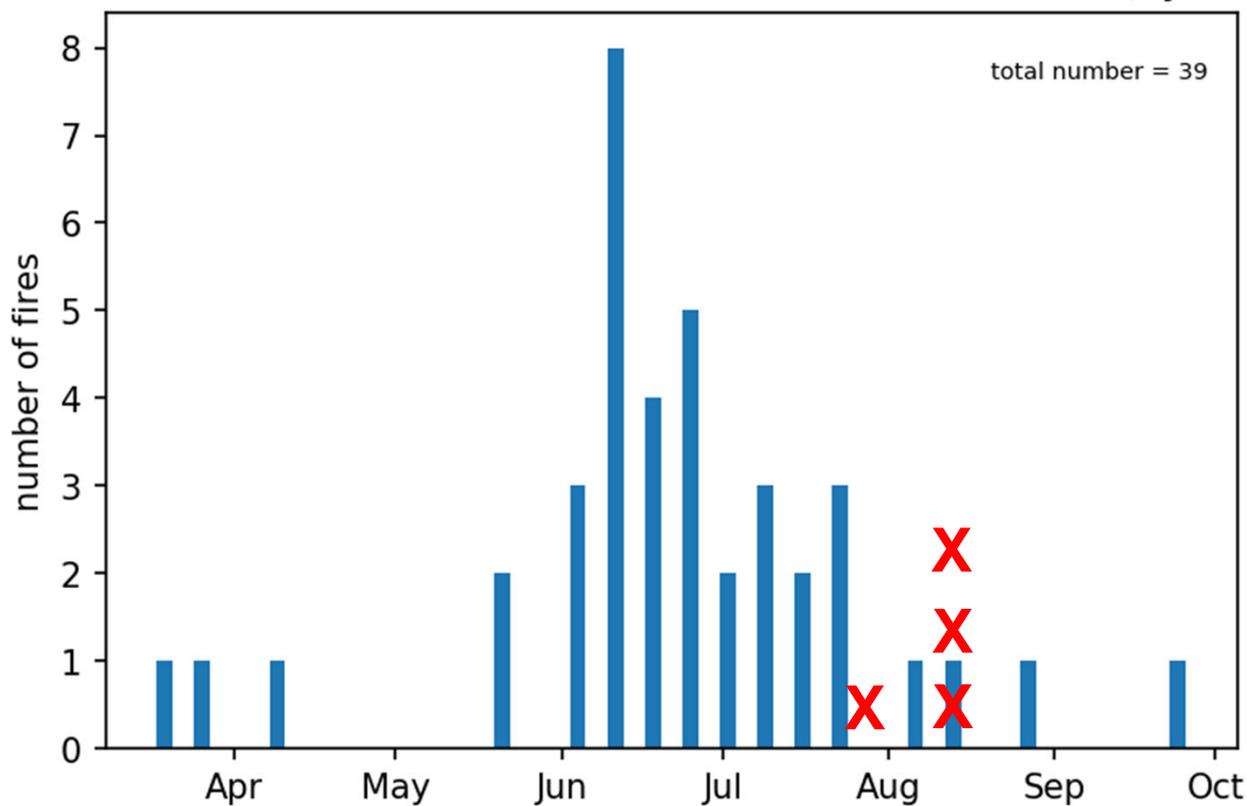


Numbers from inciweb on August 24



August is not our usual large-fire season

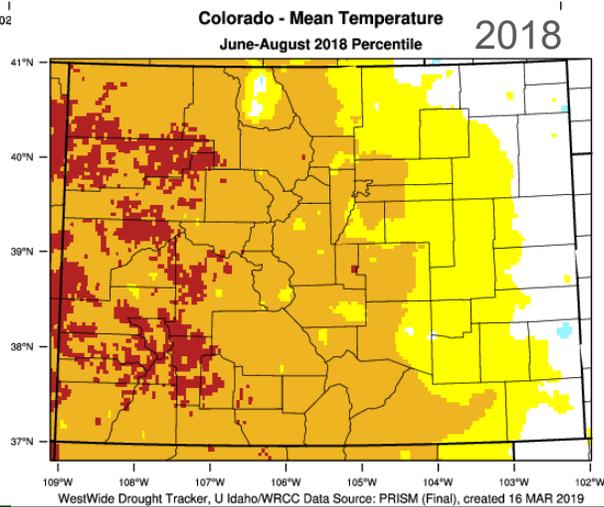
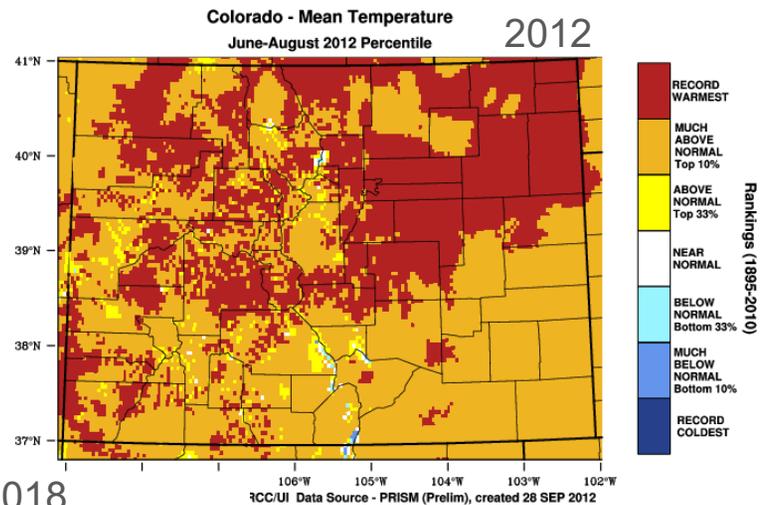
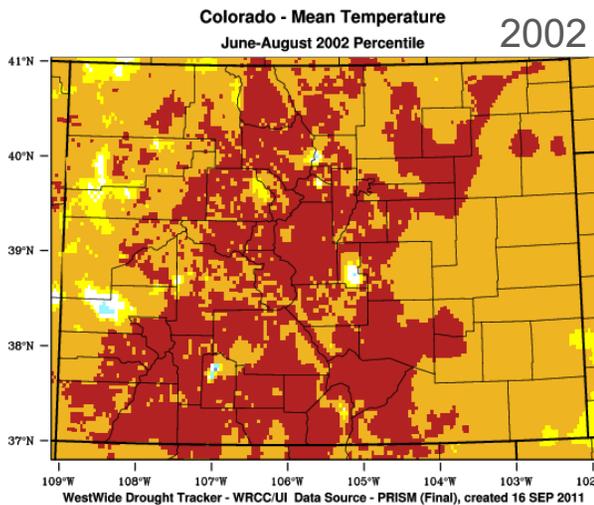
start date of Colorado 10,000+ acre fires, 1992-2015 (by week)



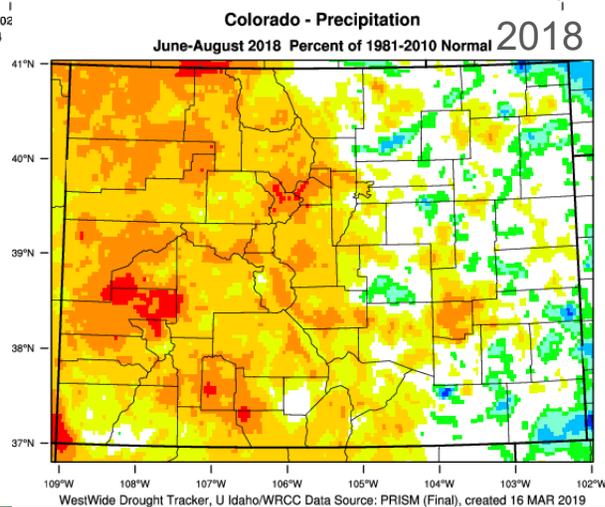
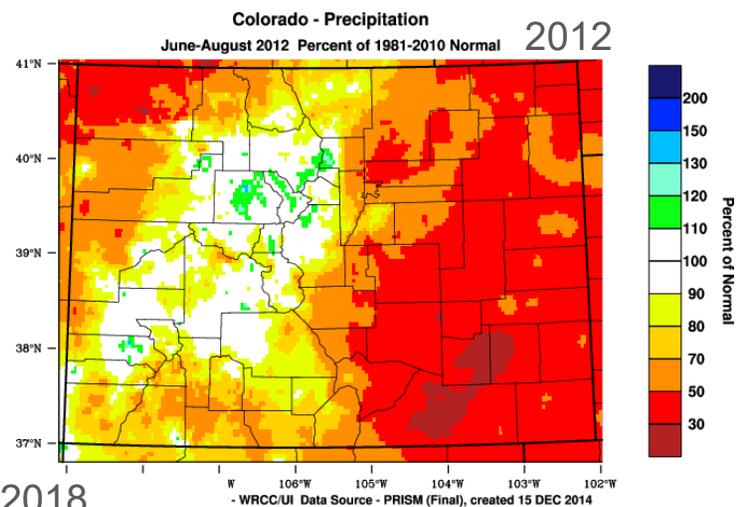
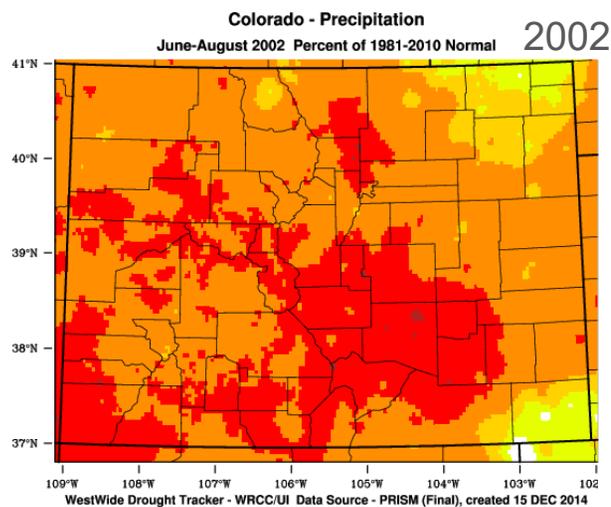
plot by Russ Schumacher/Colorado Climate Center
data source: USDA Fire Program Analysis fire-occurrence database



Comparison of recent droughts: summer temperature



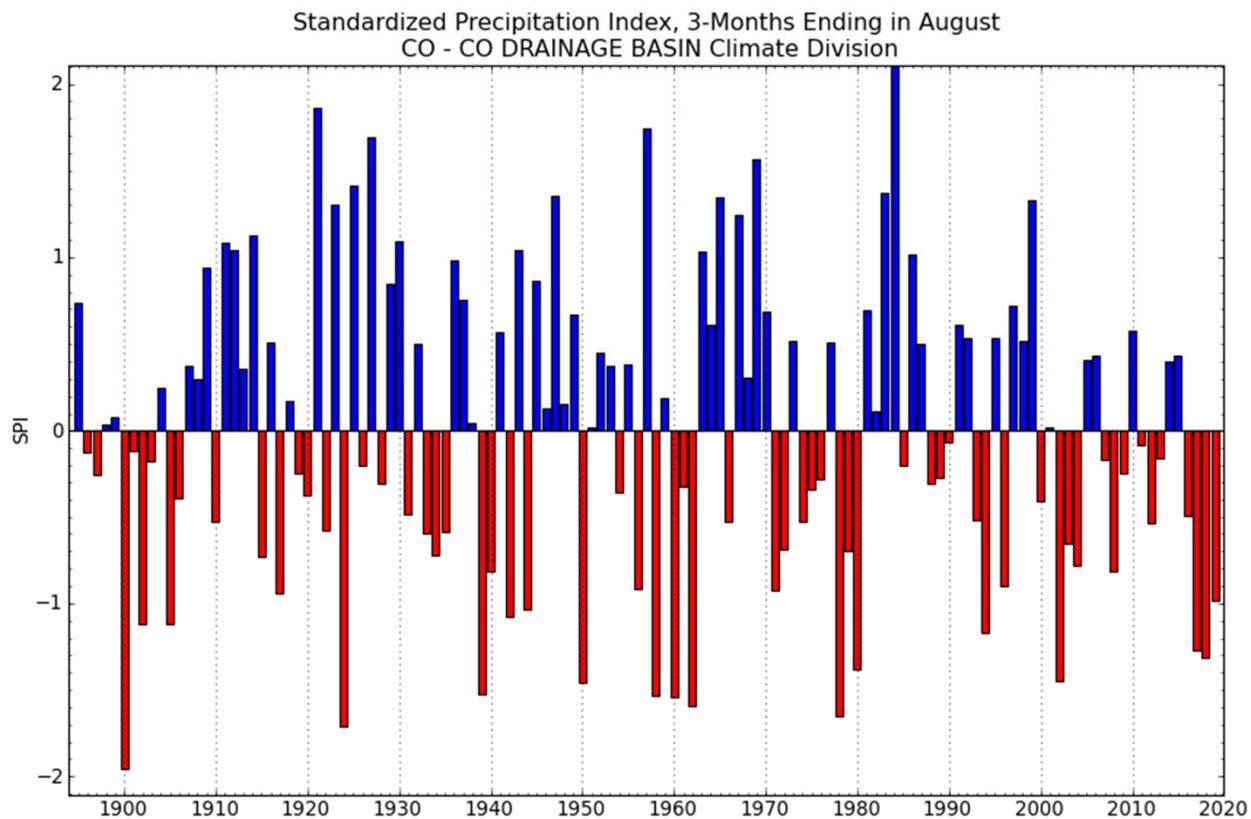
Comparison of recent droughts: summer precip



- 2018 was more of an extreme snow drought in winter 2017-18, then made worse by a hot dry summer
- 2002 spring through summer was exceptionally dry; summer was hot and dry
- 2012 was most extreme in spring, but continued into summer



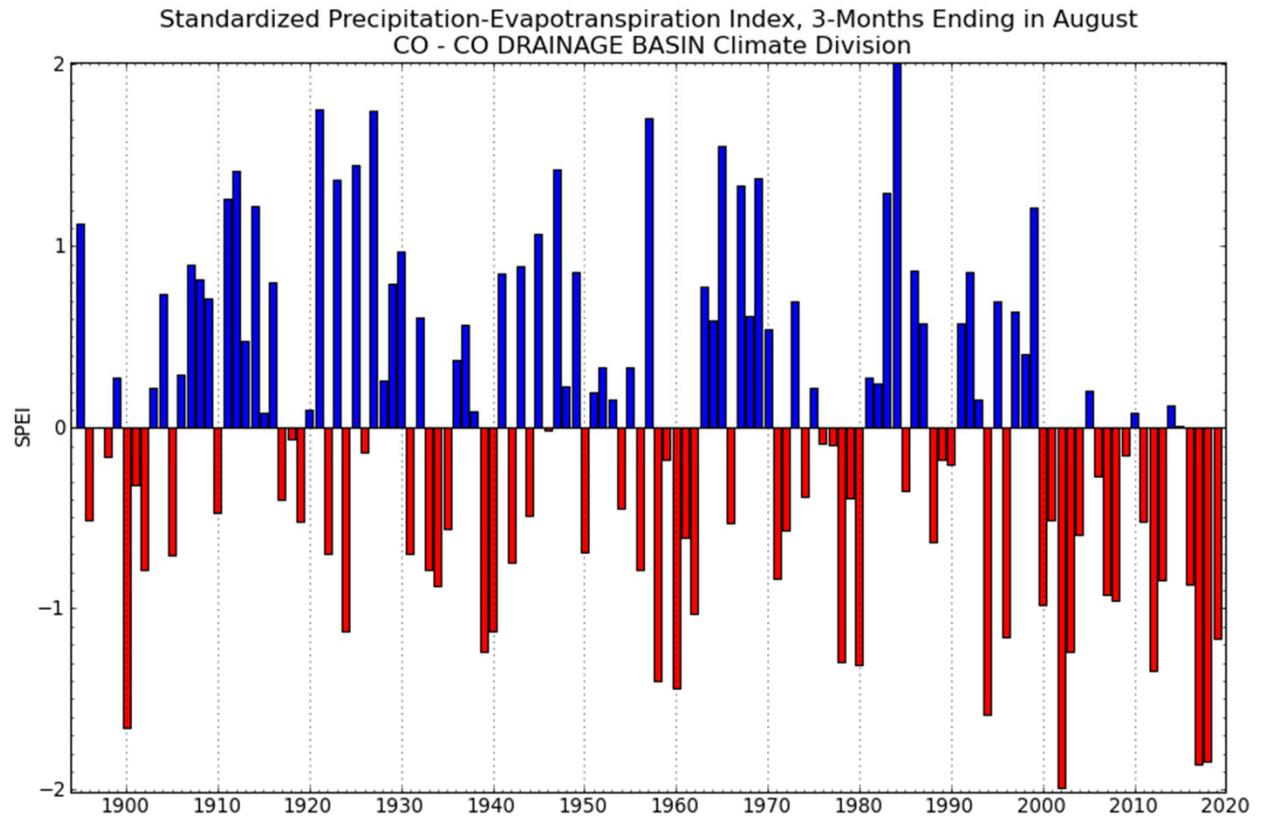
Standardized precipitation index: summer in western Colorado



Data Source: WRCC/UI, Created: 8-25-2020



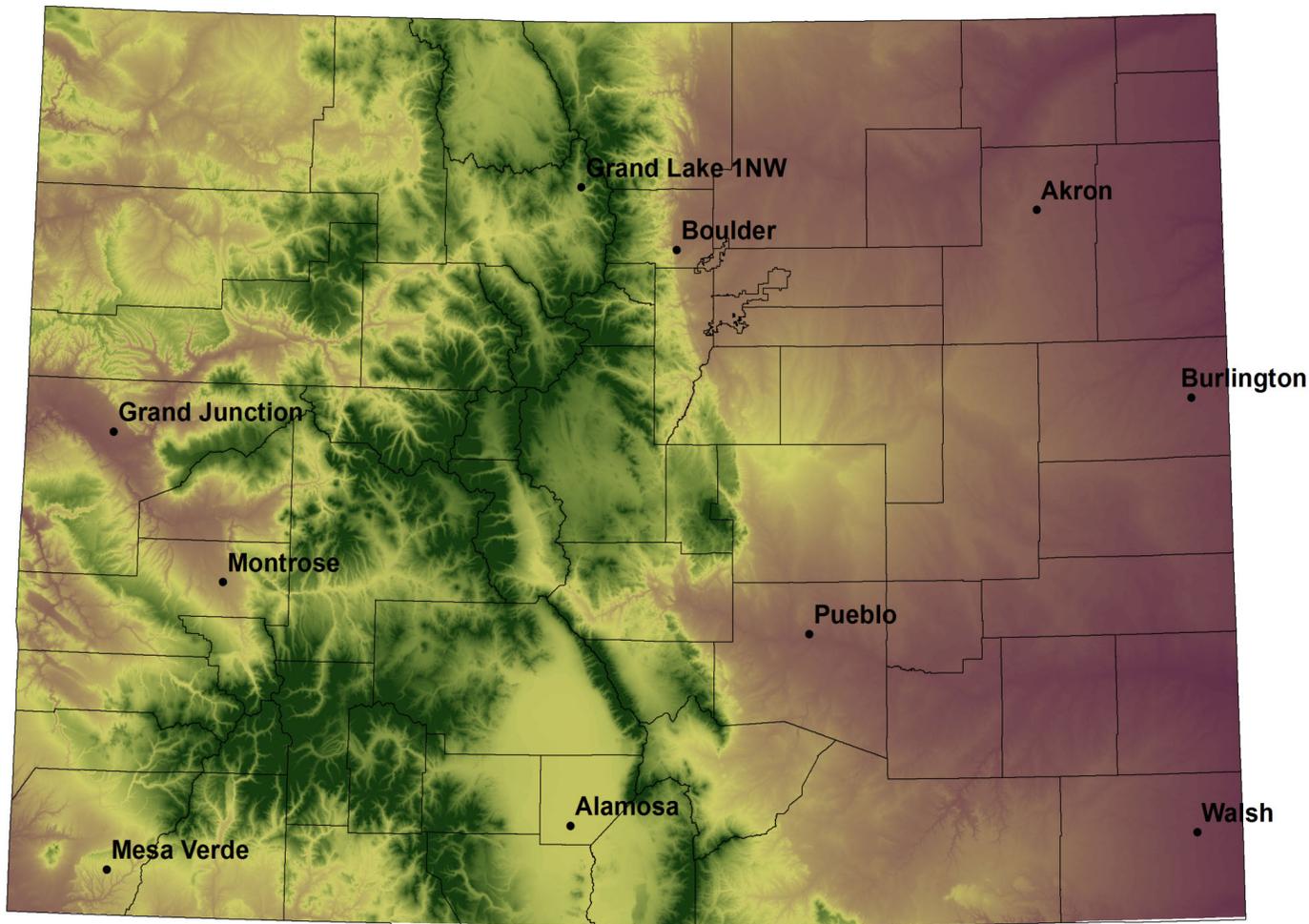
Standardized precipitation-evapotranspiration index: summer in western Colorado



Data Source: WRCC/UI, Created: 8-25-2020



NWS Cooperative Stations for WATF

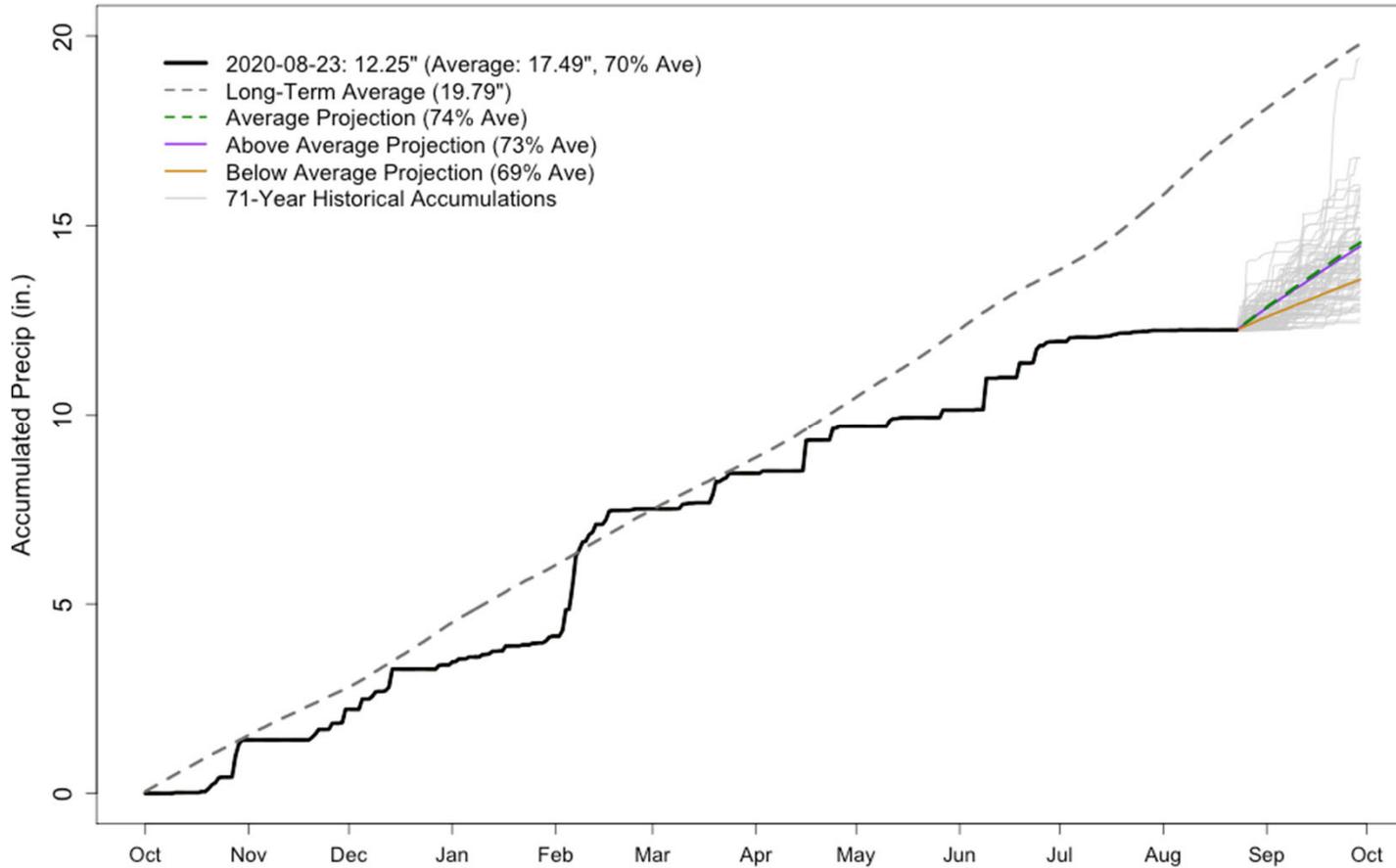


Water Year 2020 – Station Updates



Grand Lake

GRAND LAKE 1 NW WY2020 Precipitation Projections



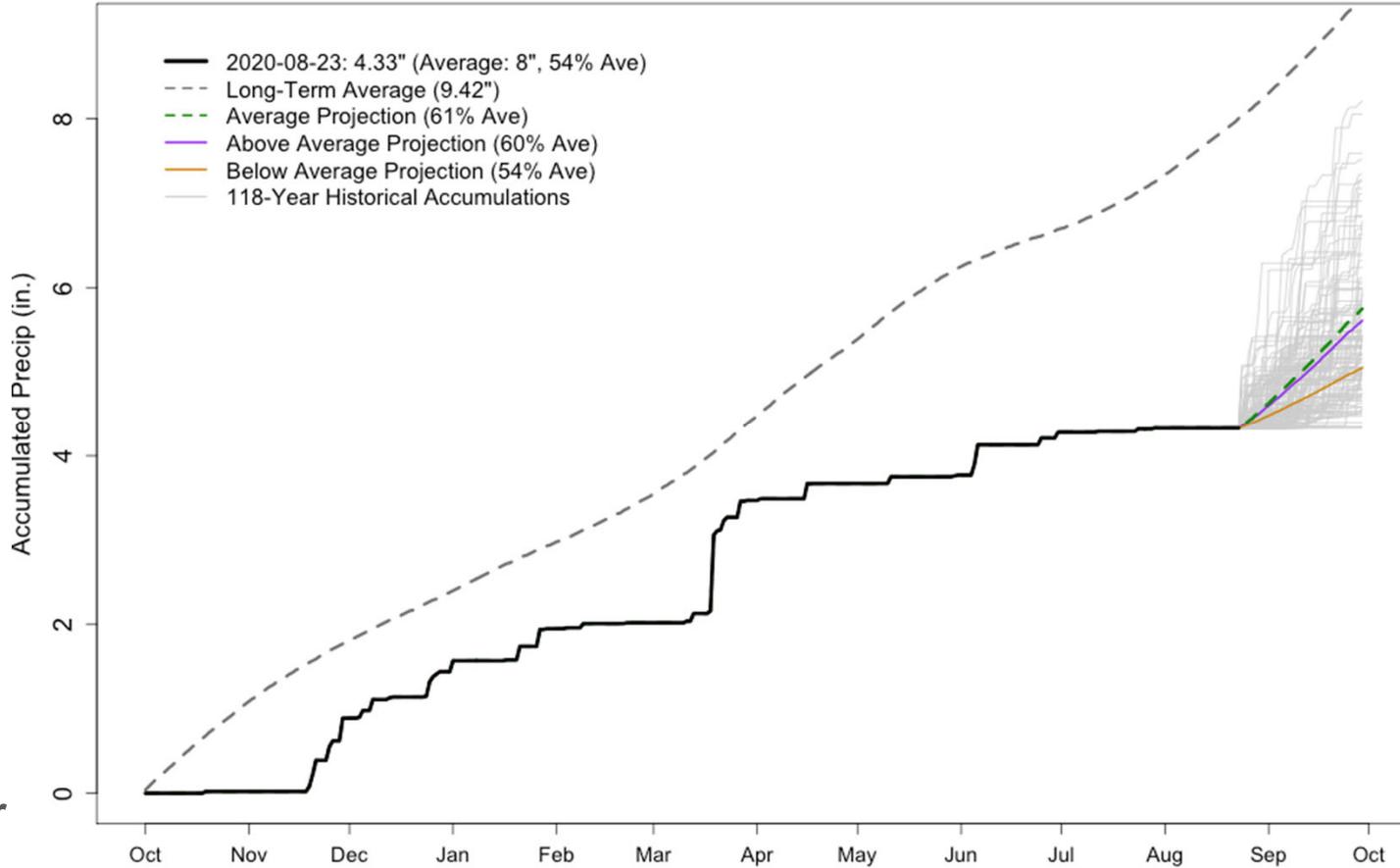
**Driest on record
since July 1**

**Normal: 3.74''
2020: 0.30''**



Grand Junction

GRAND JUNCTION WALKER FIELD WY2020 Precipitation Projections



Driest on record since April 1 and July 1

5th driest WY to date

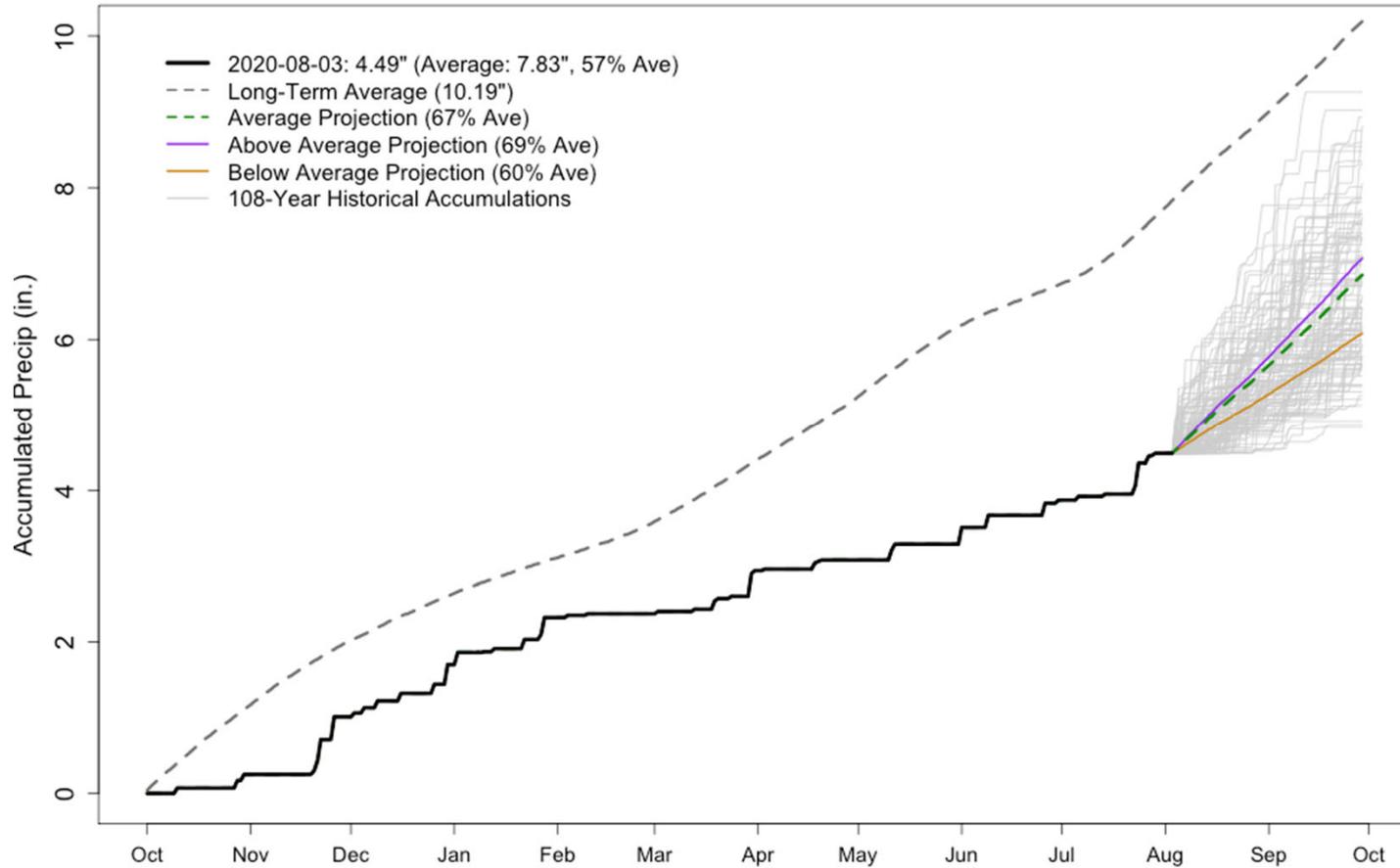
**Since April 1:
Normal: 3.58"
2020: 0.86"**

Zero precip so far in August



Montrose

MONTROSE NO 2 WY2020 Precipitation Projections



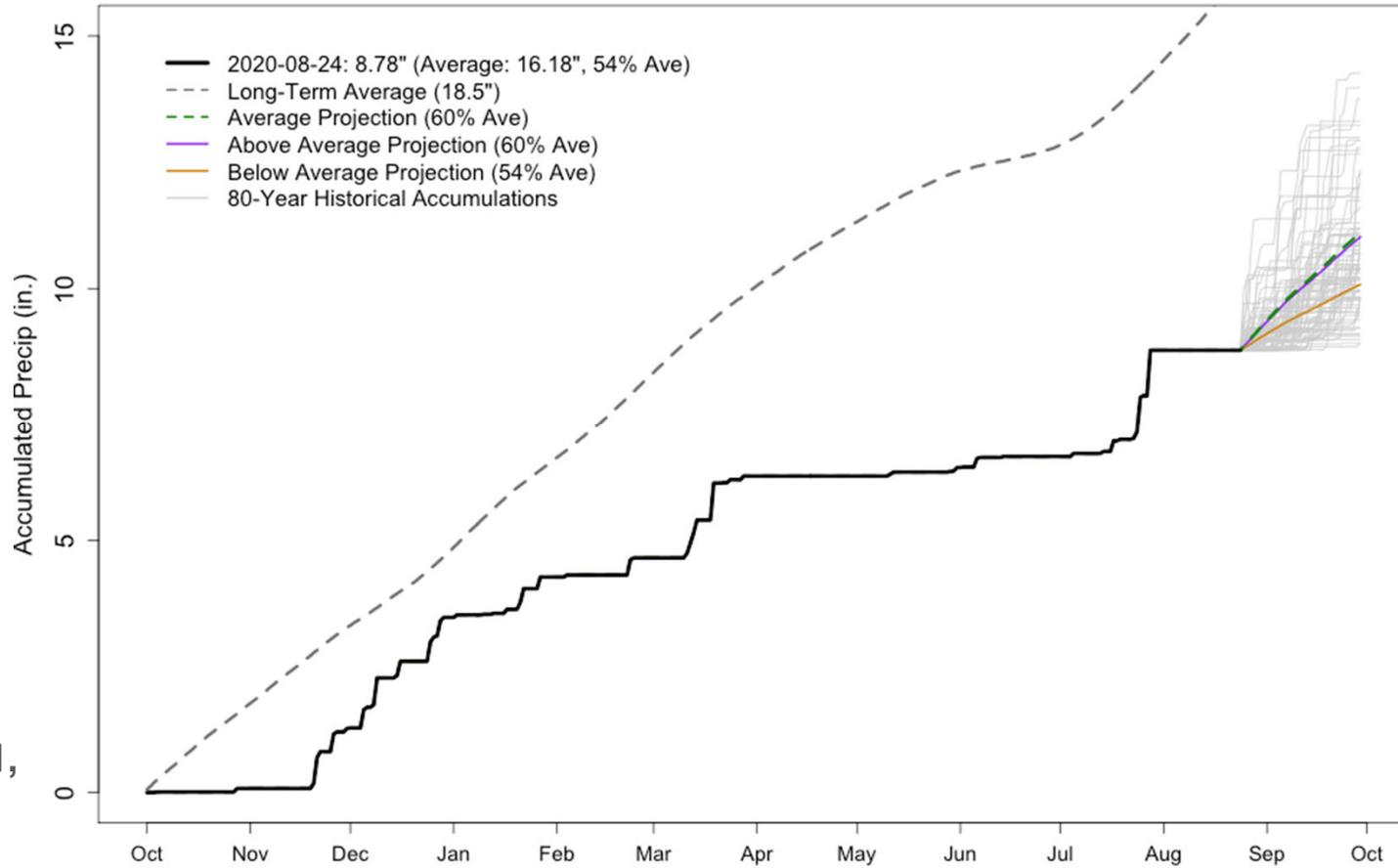
Note this only goes through August 3

Montrose airport has no precip in August



Mesa Verde NP

MESA VERDE NP WY2020 Precipitation Projections



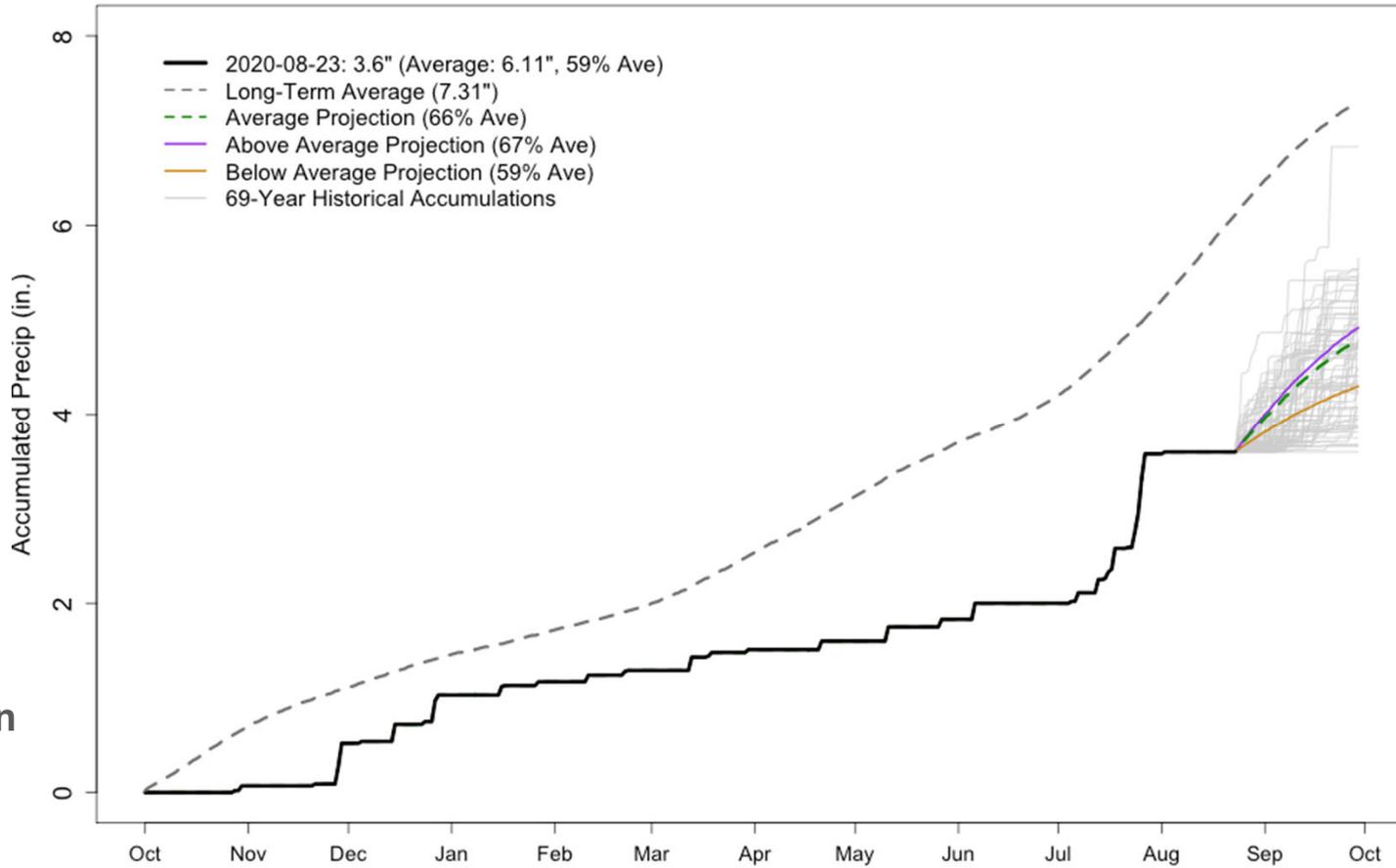
4th driest water year to date

Only 2002, 1951, 2018 drier



Alamosa

ALAMOSA-BERGMAN FIELD WY2020 Precipitation Projections



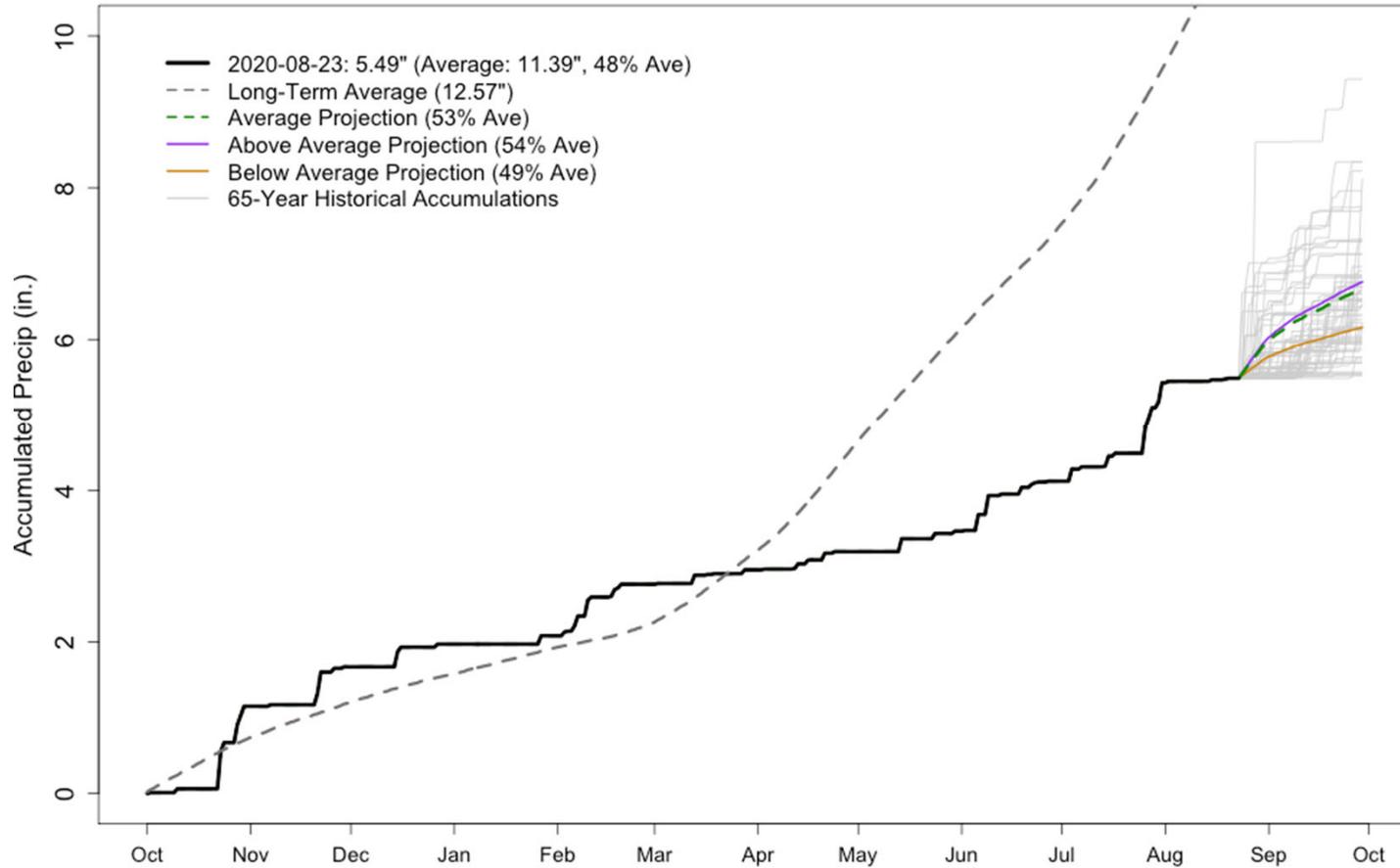
9th driest water year to date

Driest August on record thus far
Normal: 0.98"
2020: 0.01"



Pueblo

PUEBLO MEMORIAL AIRPORT WY2020 Precipitation Projections



4th driest water year to date

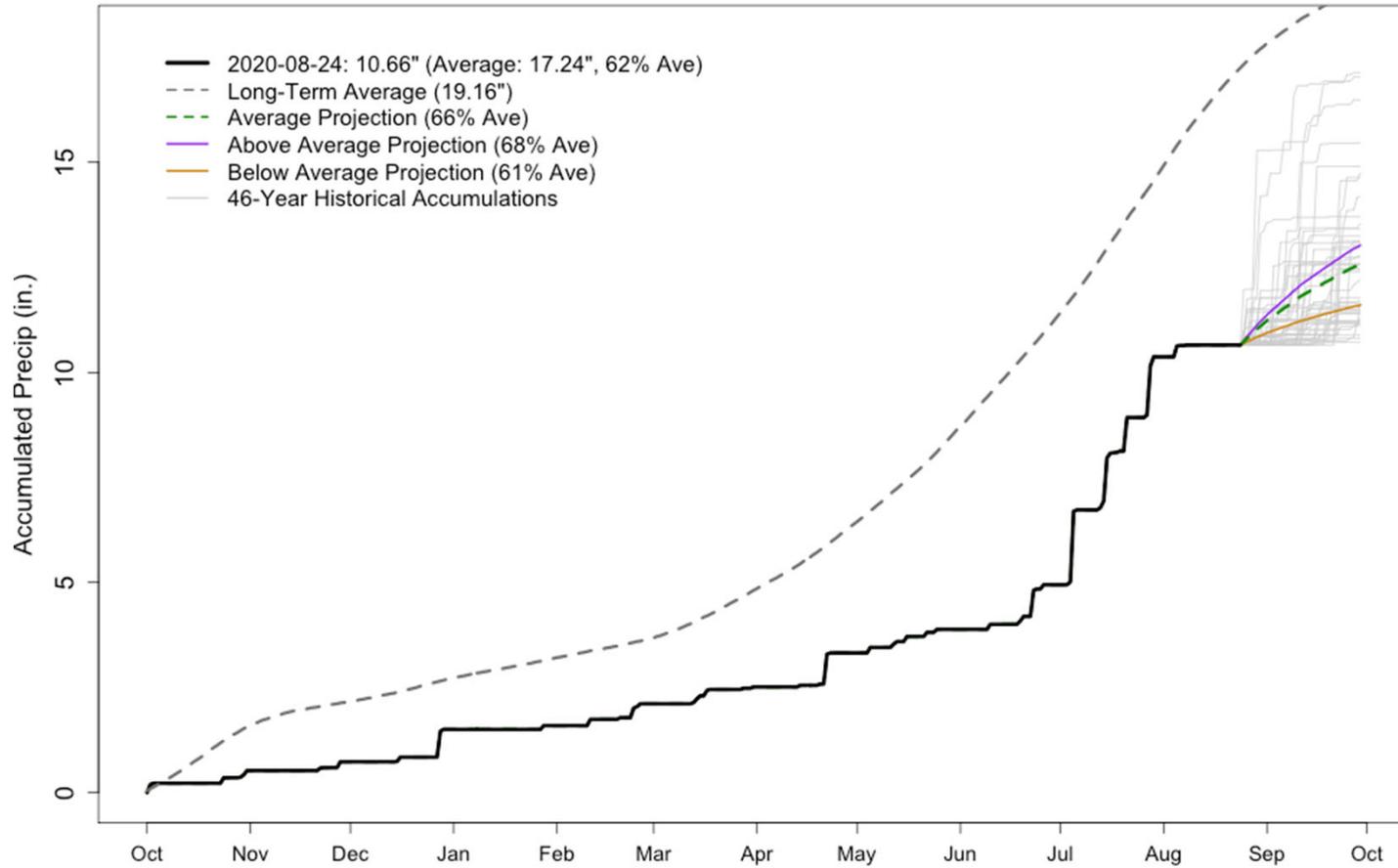
Only 2002, 1935, 1966 drier

2nd driest since April 1



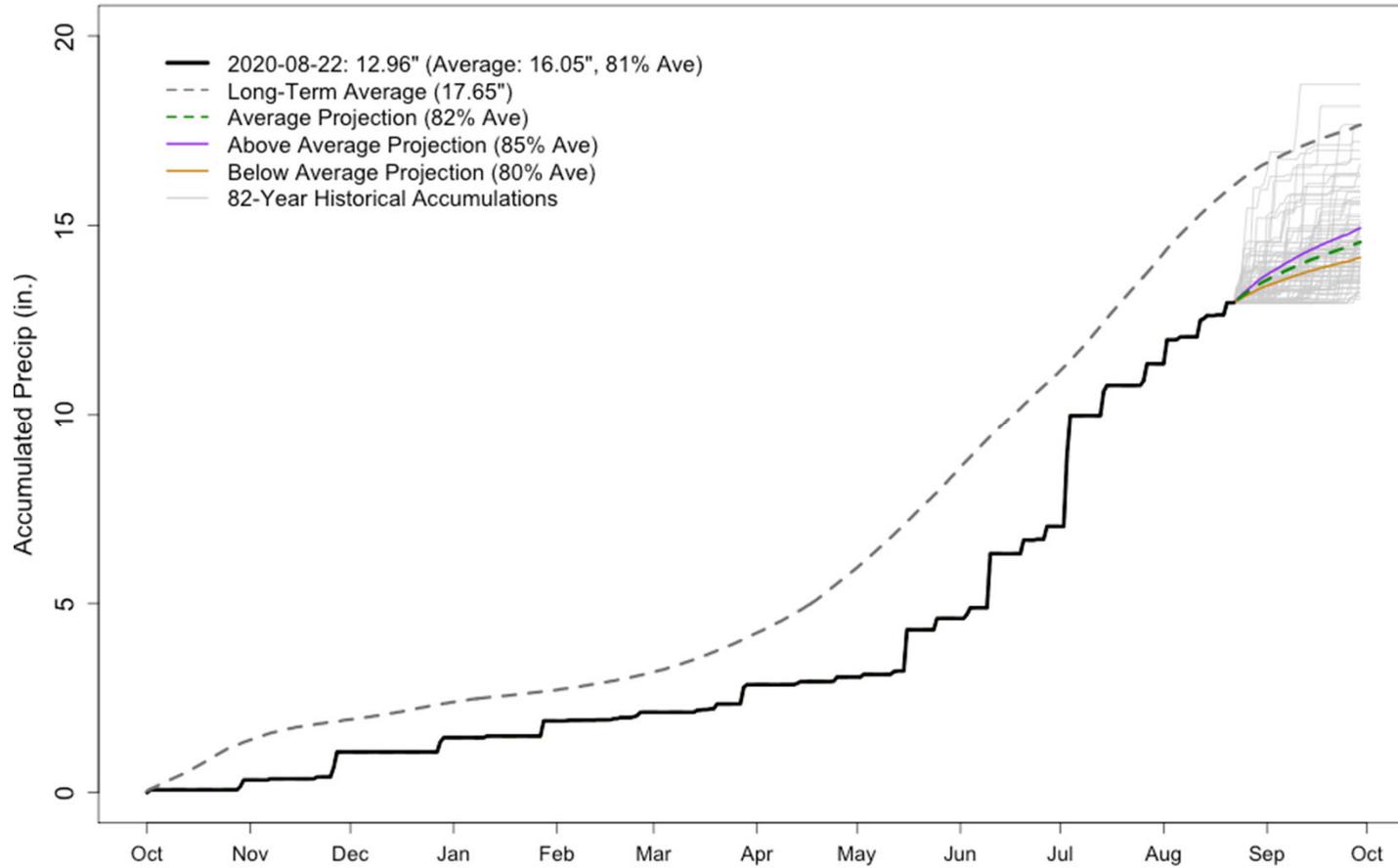
Walsh

WALSH 1 W WY2020 Precipitation Projections



Burlington

BURLINGTON WY2020 Precipitation Projections

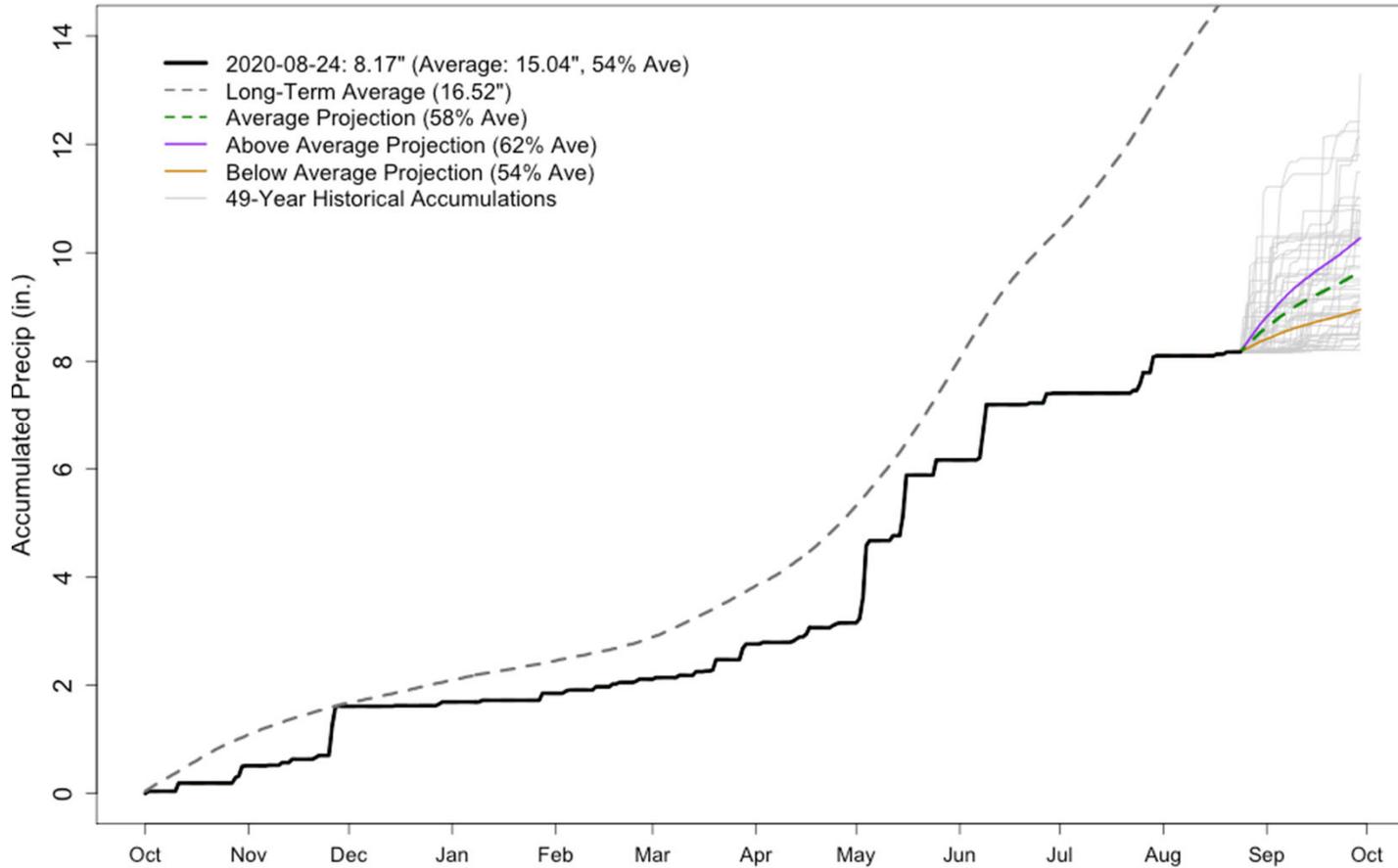


Above normal
since June 1!



Akron

AKRON 4 E WY2020 Precipitation Projections



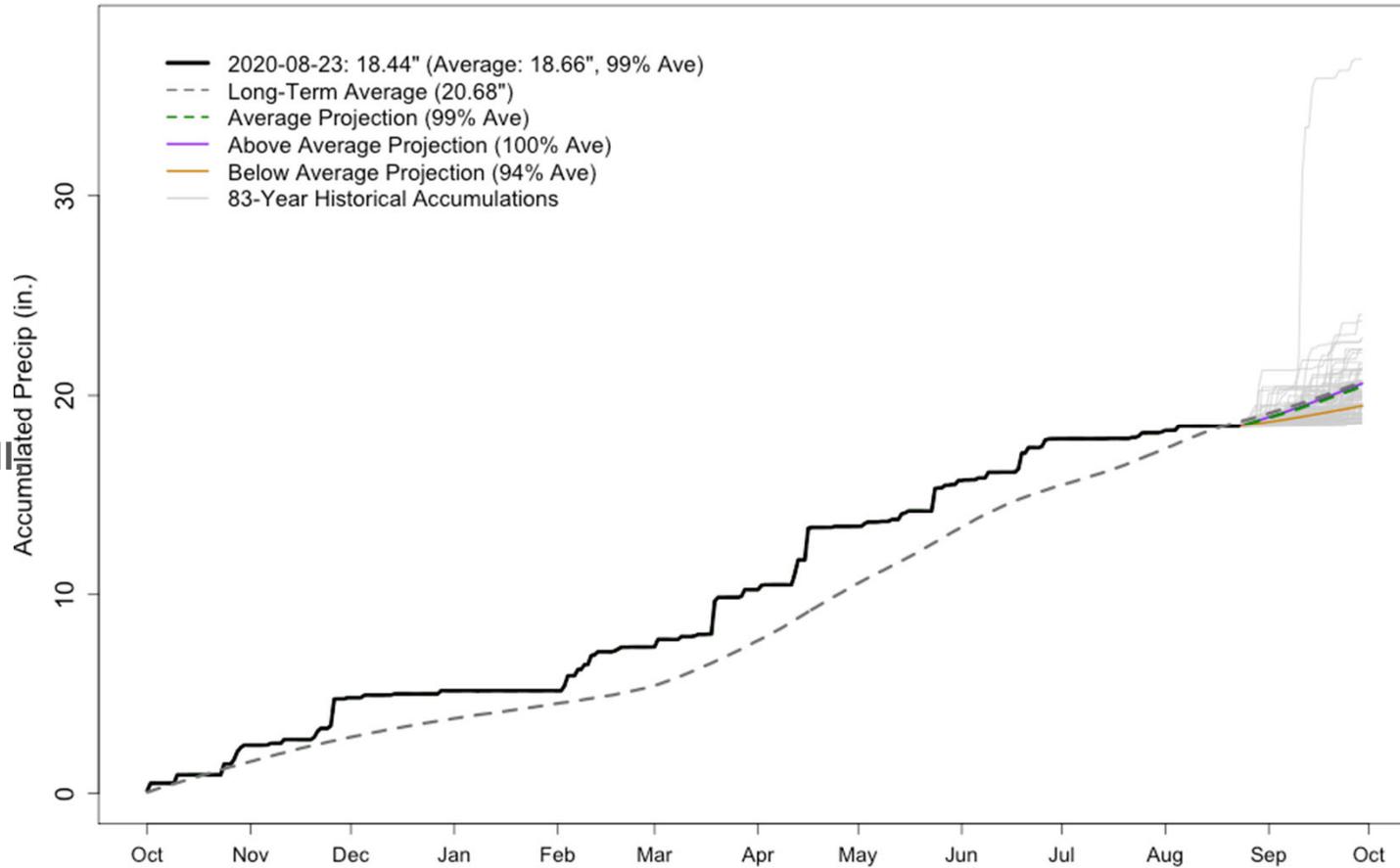
3rd driest WY to date, only 2002, 1911 drier

***may have under-reported some rain this month, so may not be quite this bad, but still bad**



Boulder

BOULDER WY2020 Precipitation Projections



Record snowfall yet now below-normal for precip over the water year

3rd driest on record since July 1





Outlook

Next 7 days

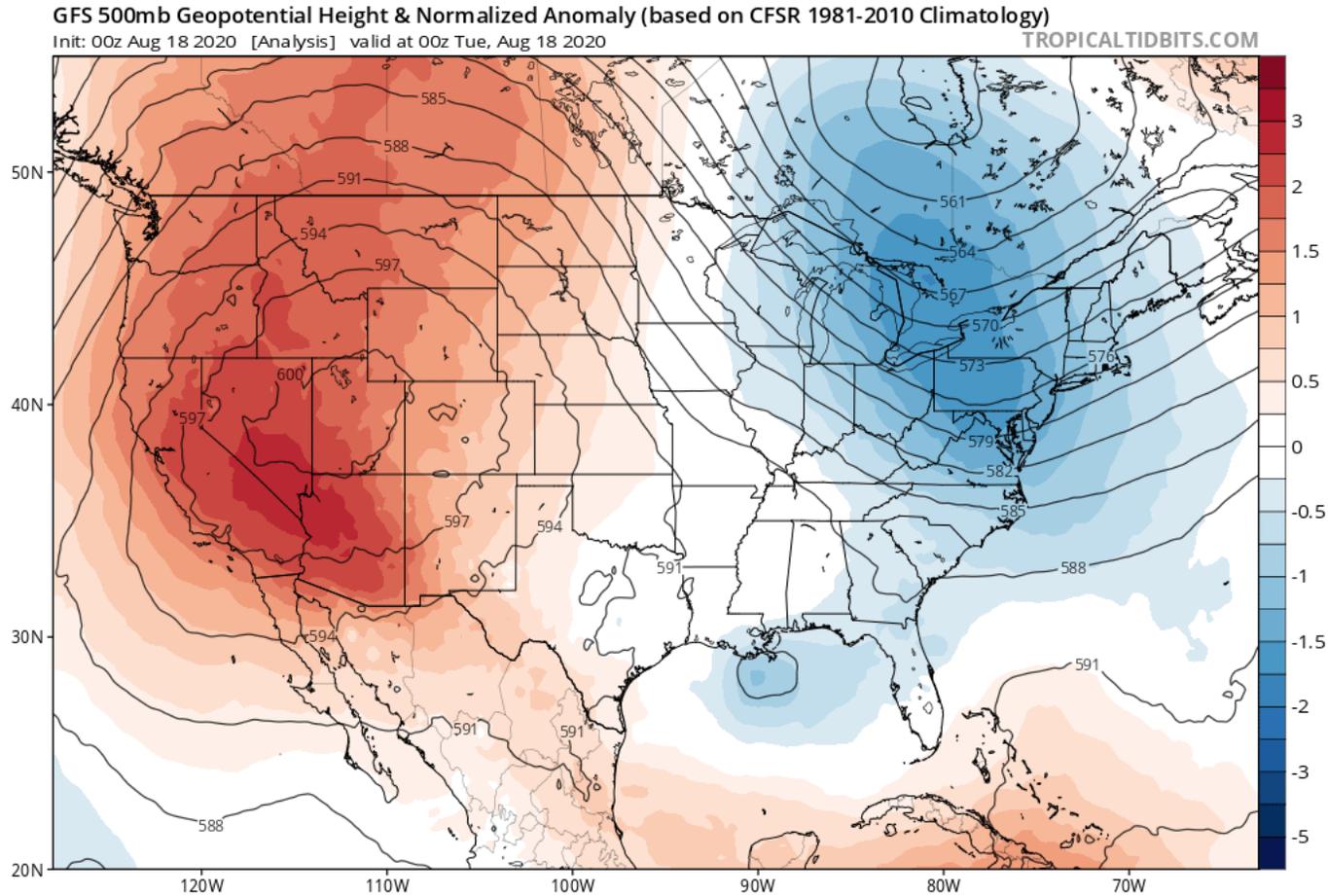
8-14 day Outlook

CPC Outlooks

What's happening with El Niño?



We've been stuck under an unmoving high pressure ridge

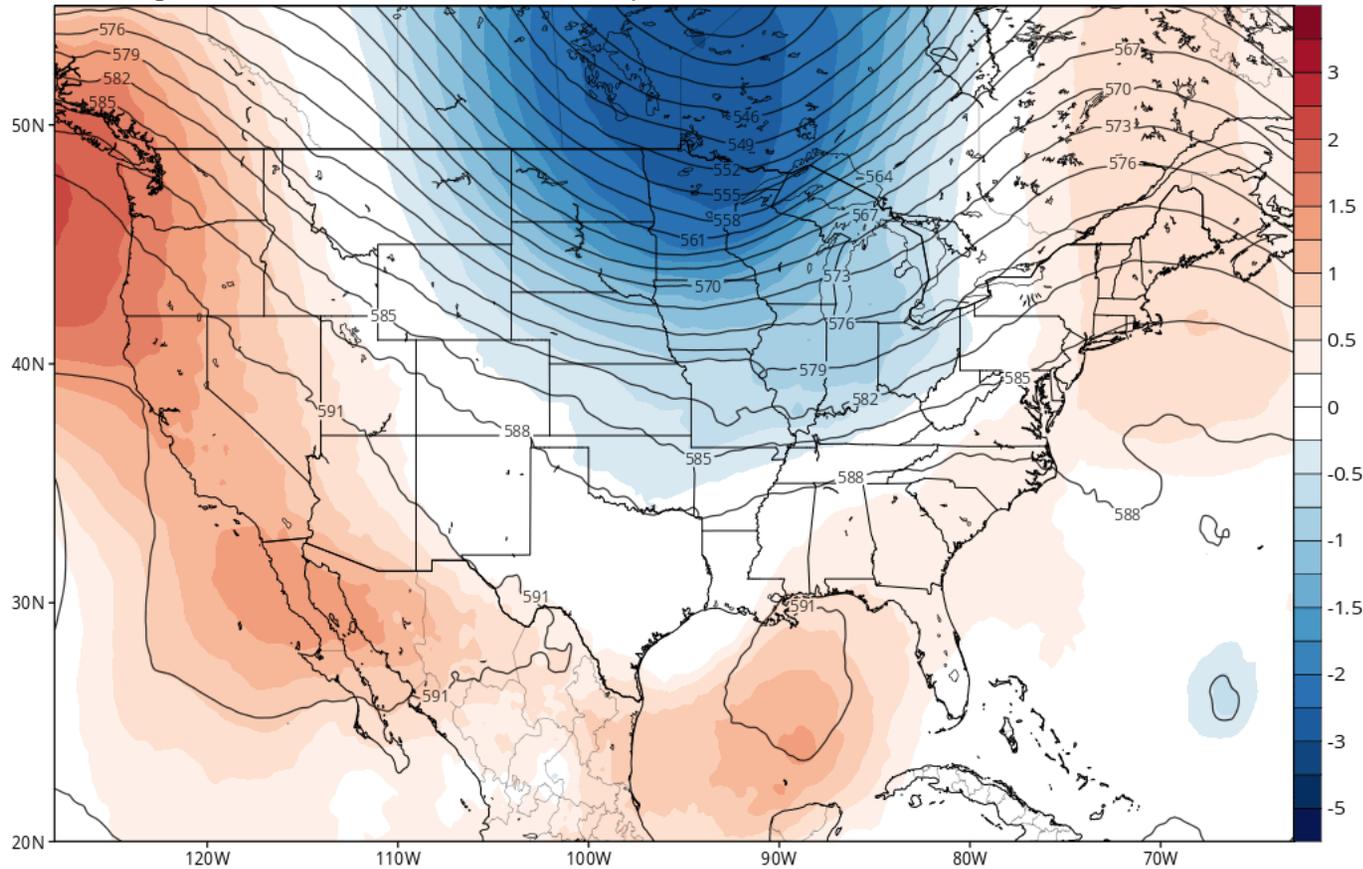


An actual pattern change around September 1!

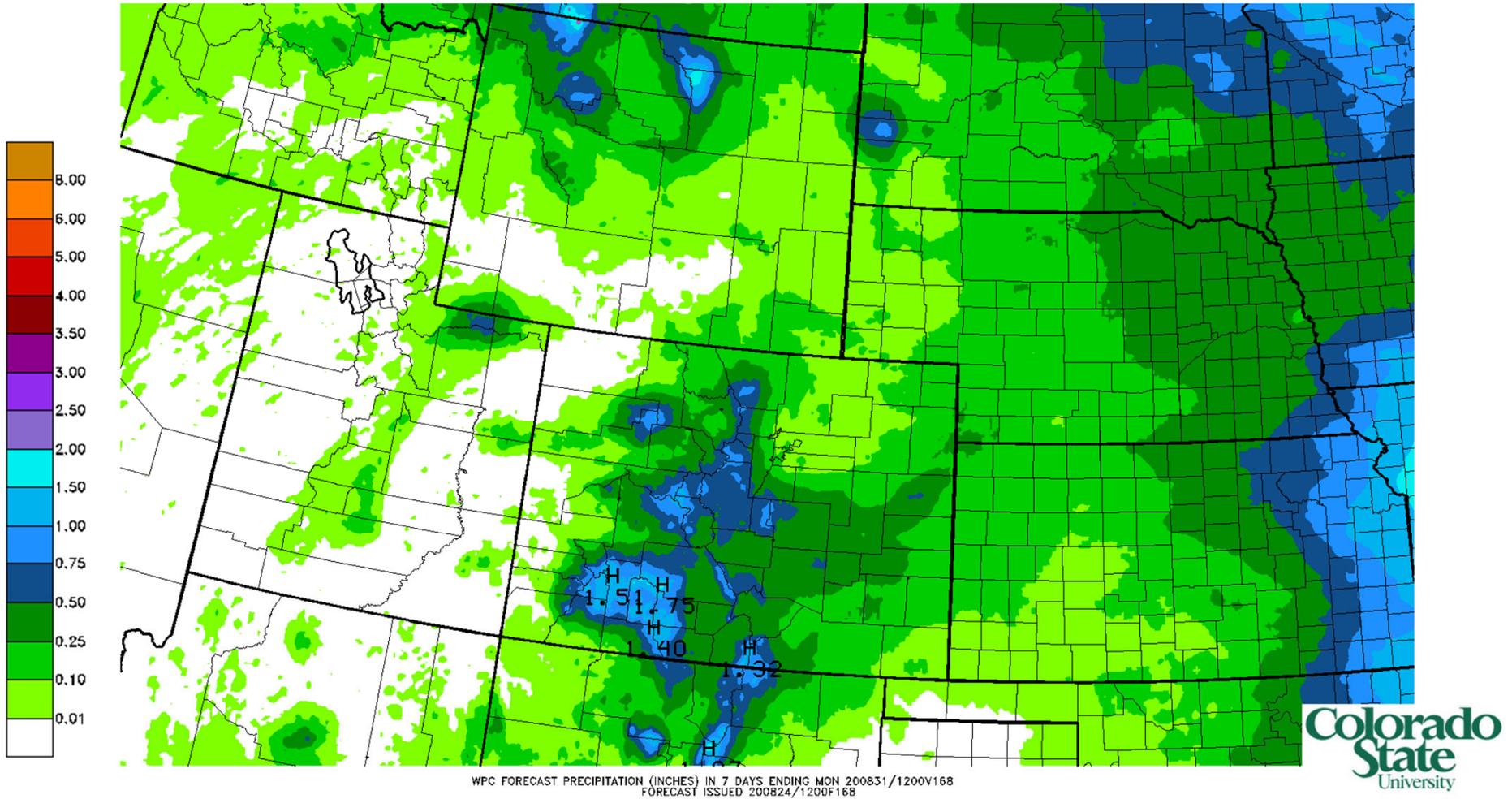
GFS 500mb Geopotential Height & Normalized Anomaly (based on CFSR 1981-2010 Climatology)

Init: 18z Aug 24 2020 Forecast Hour: [180] valid at 06z Tue, Sep 01 2020

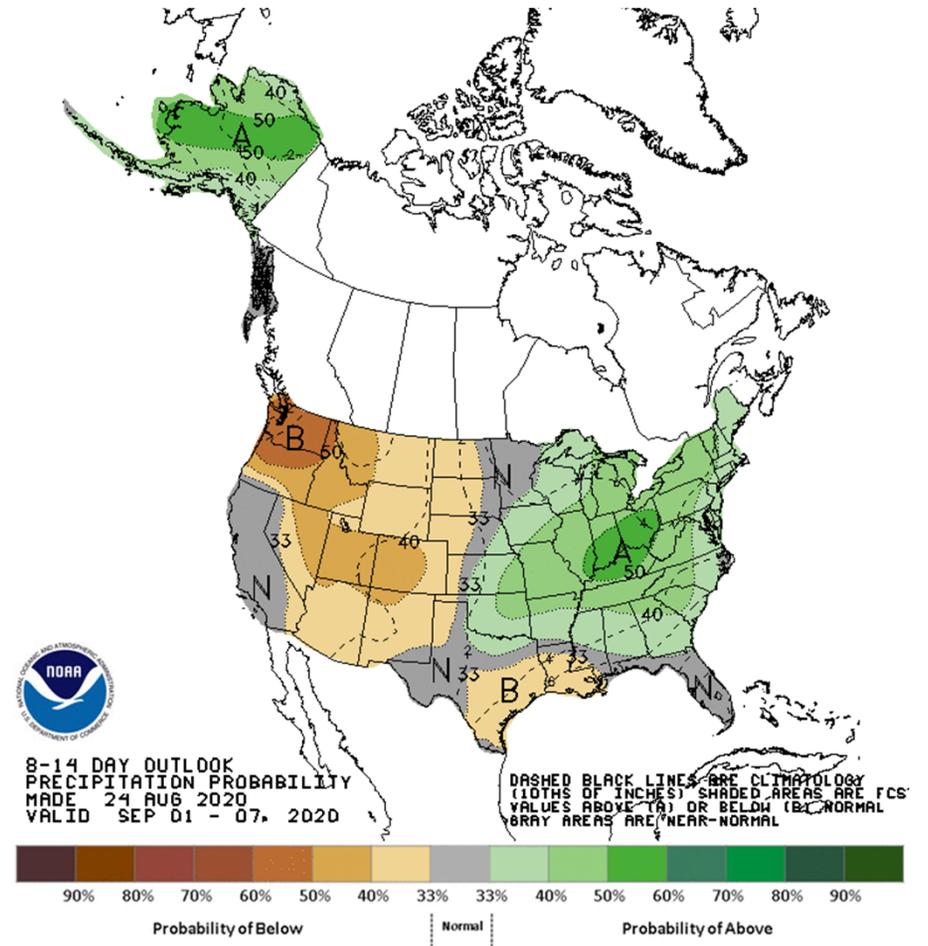
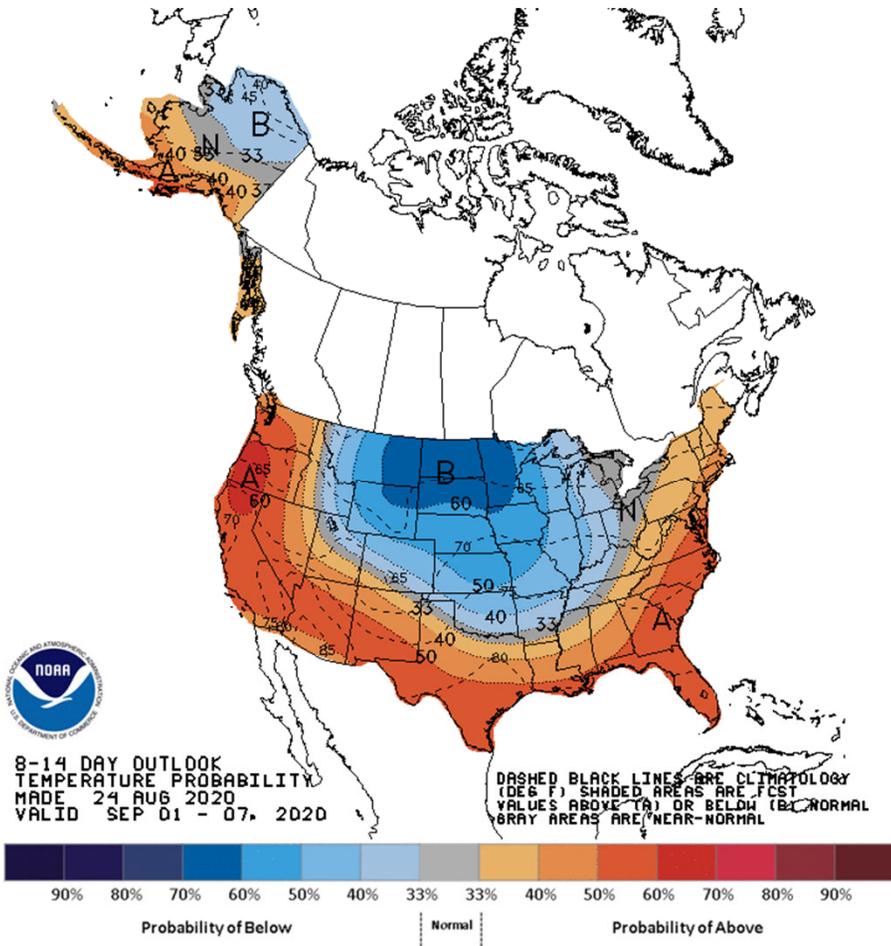
TROPICALTIDBITS.COM



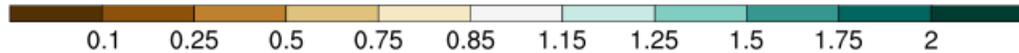
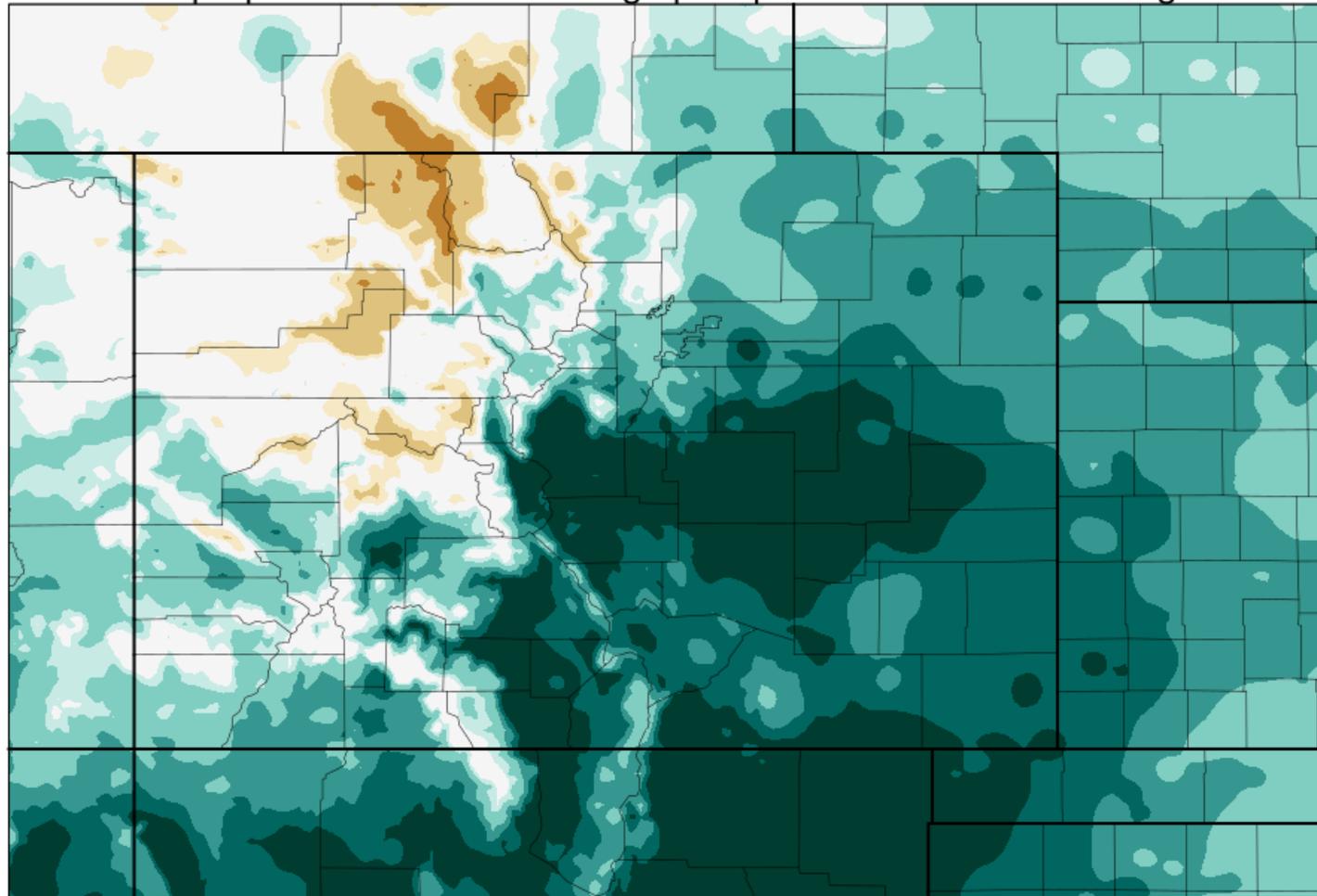
NOAA 7-day precip forecast



8-14 day outlook



PRISM proportion of annual average precipitation in this month: August

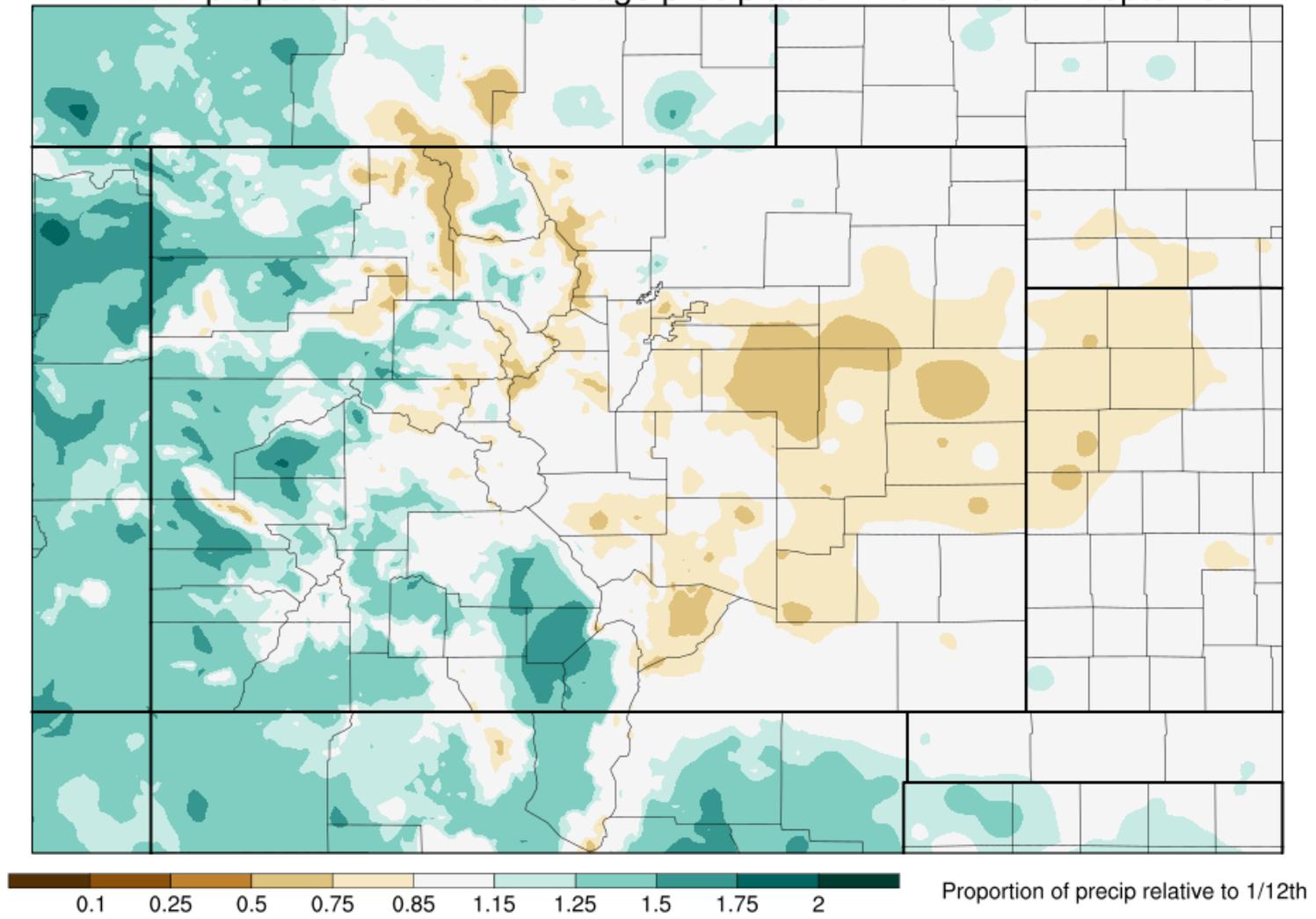


Proportion of precip relative to 1/12th

Russ Schumacher/Colorado Climate Center



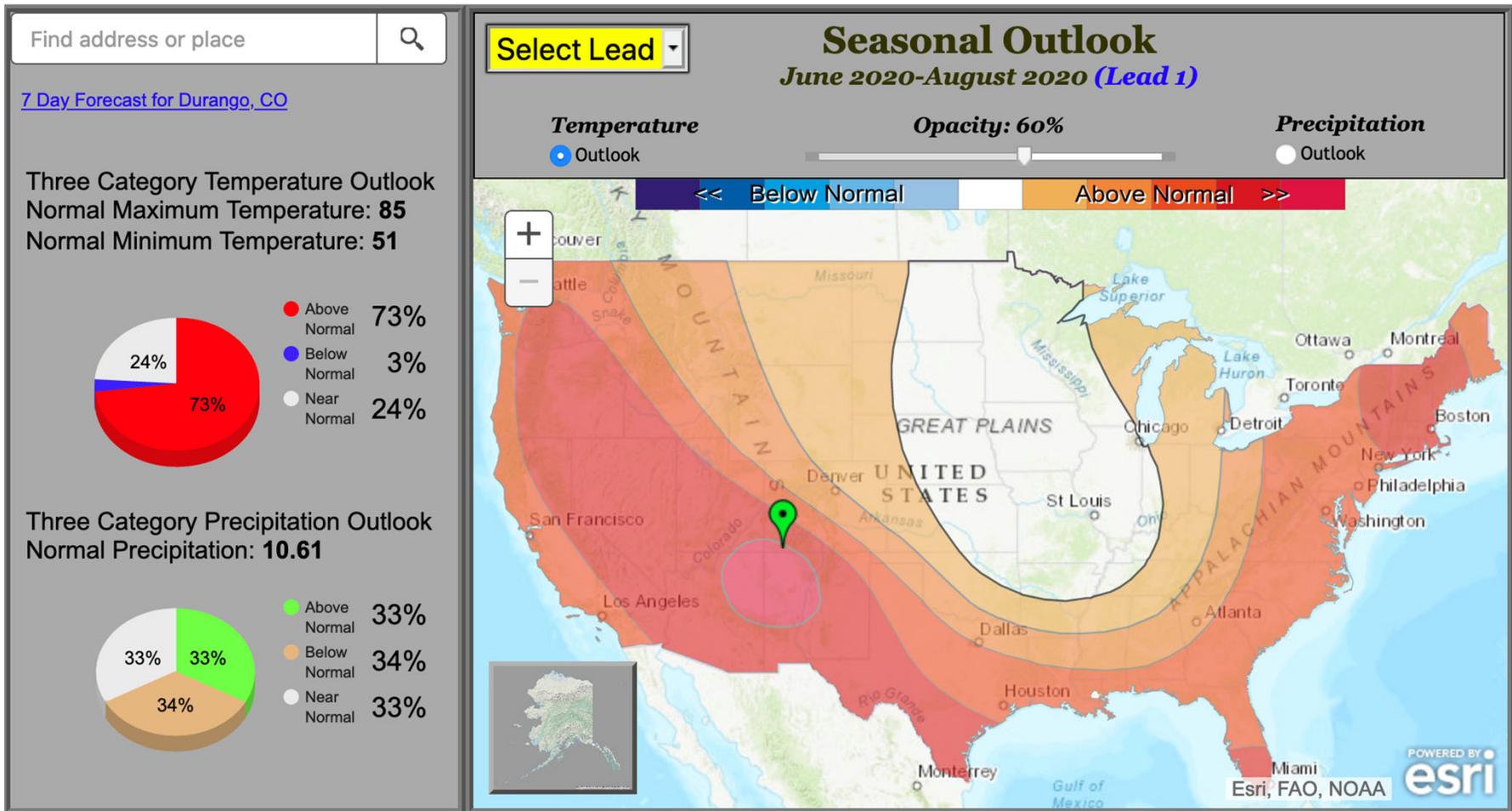
PRISM proportion of annual average precipitation in this month: September



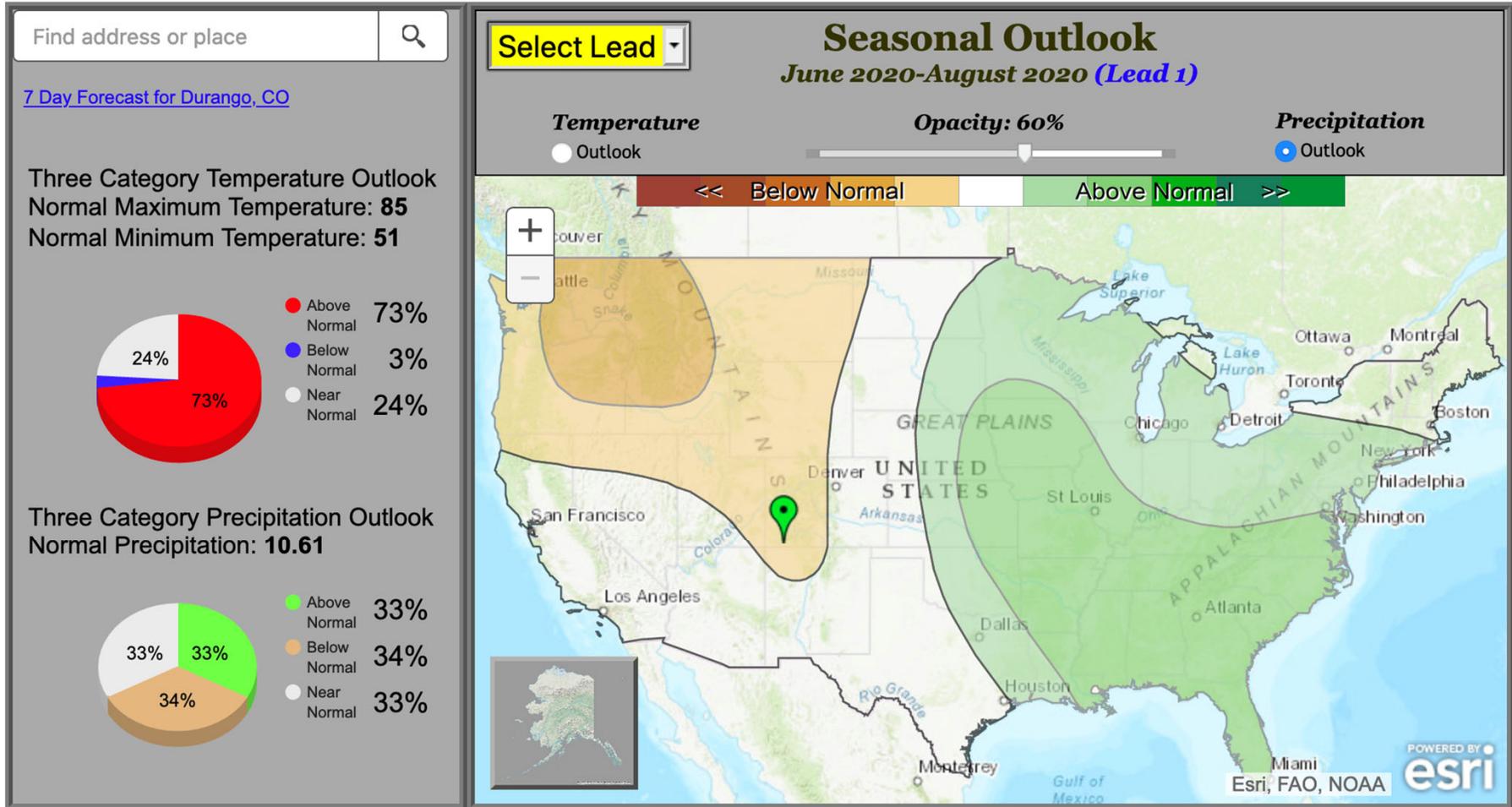
Russ Schumacher/Colorado Climate Center



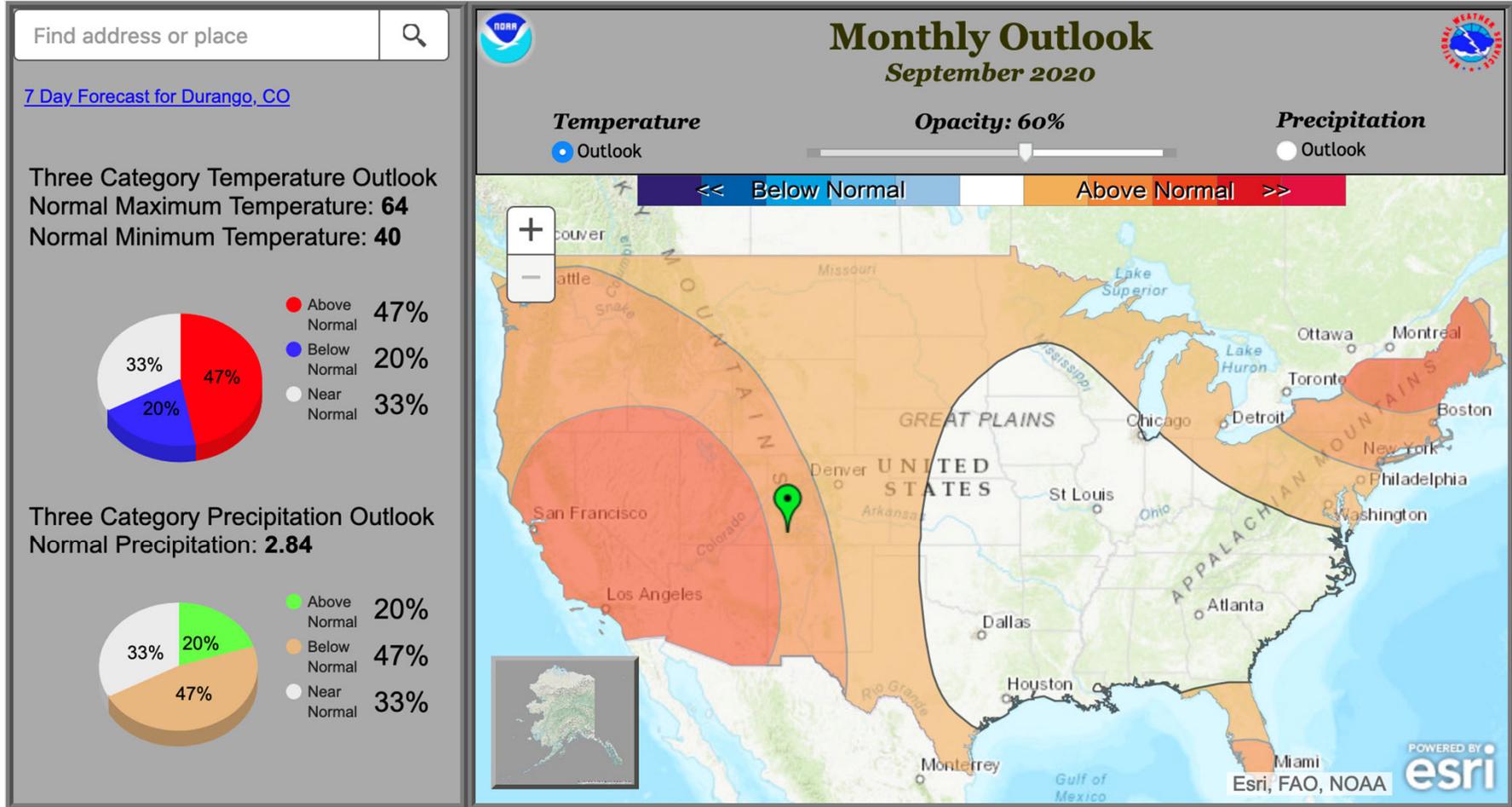
A look back at CPC outlooks for summer...



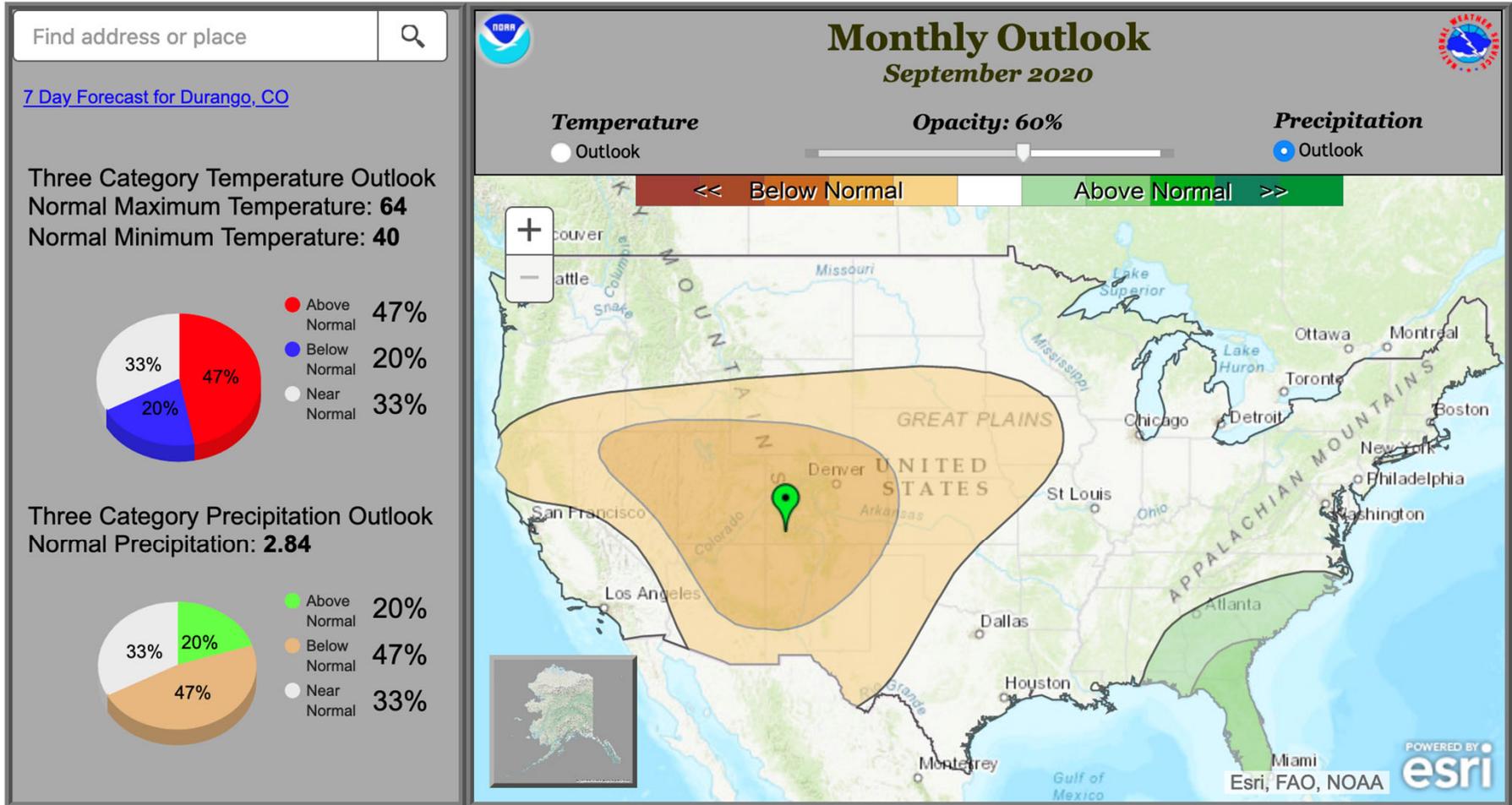
A look back at CPC outlooks for summer...



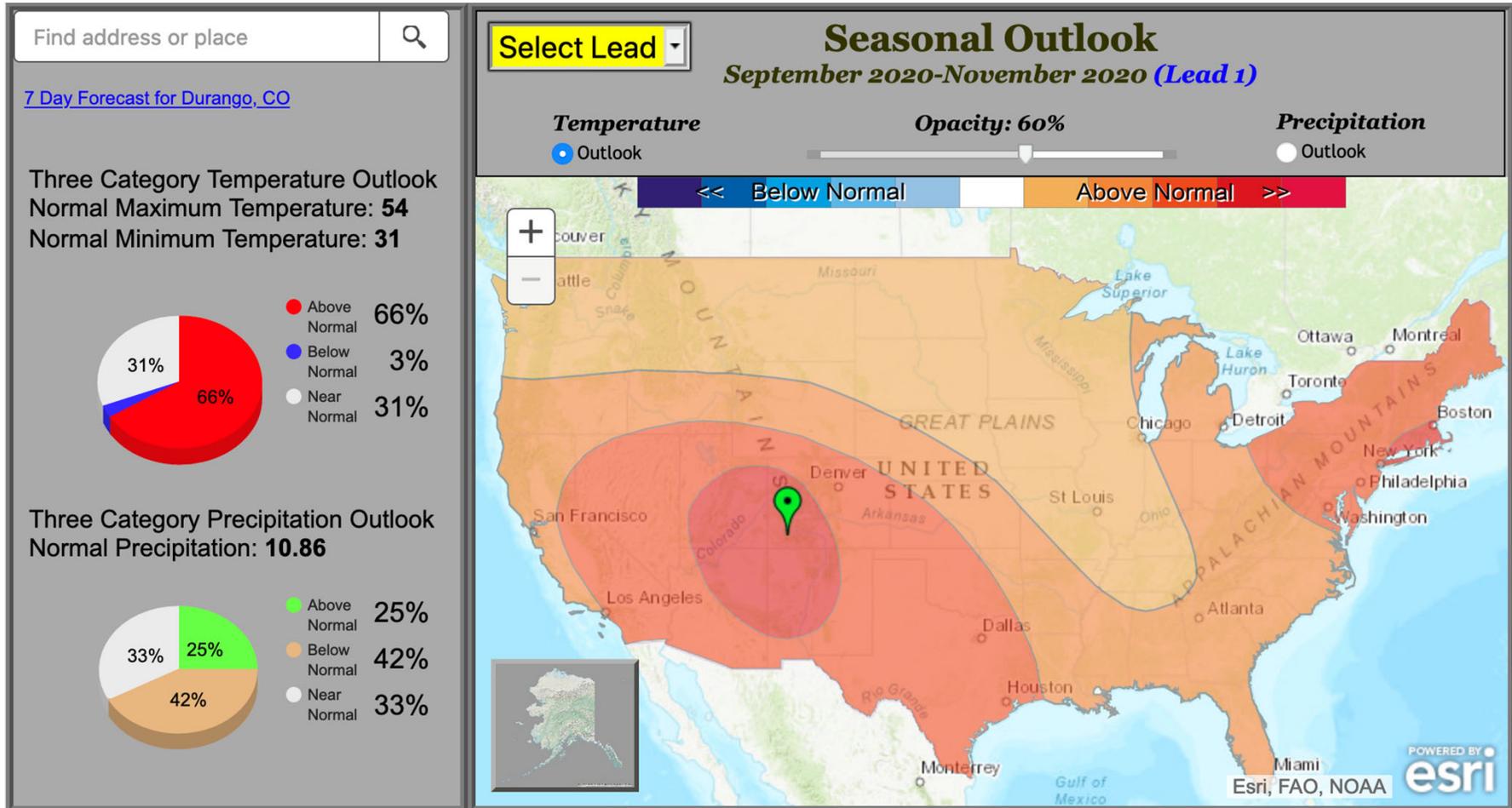
September outlook



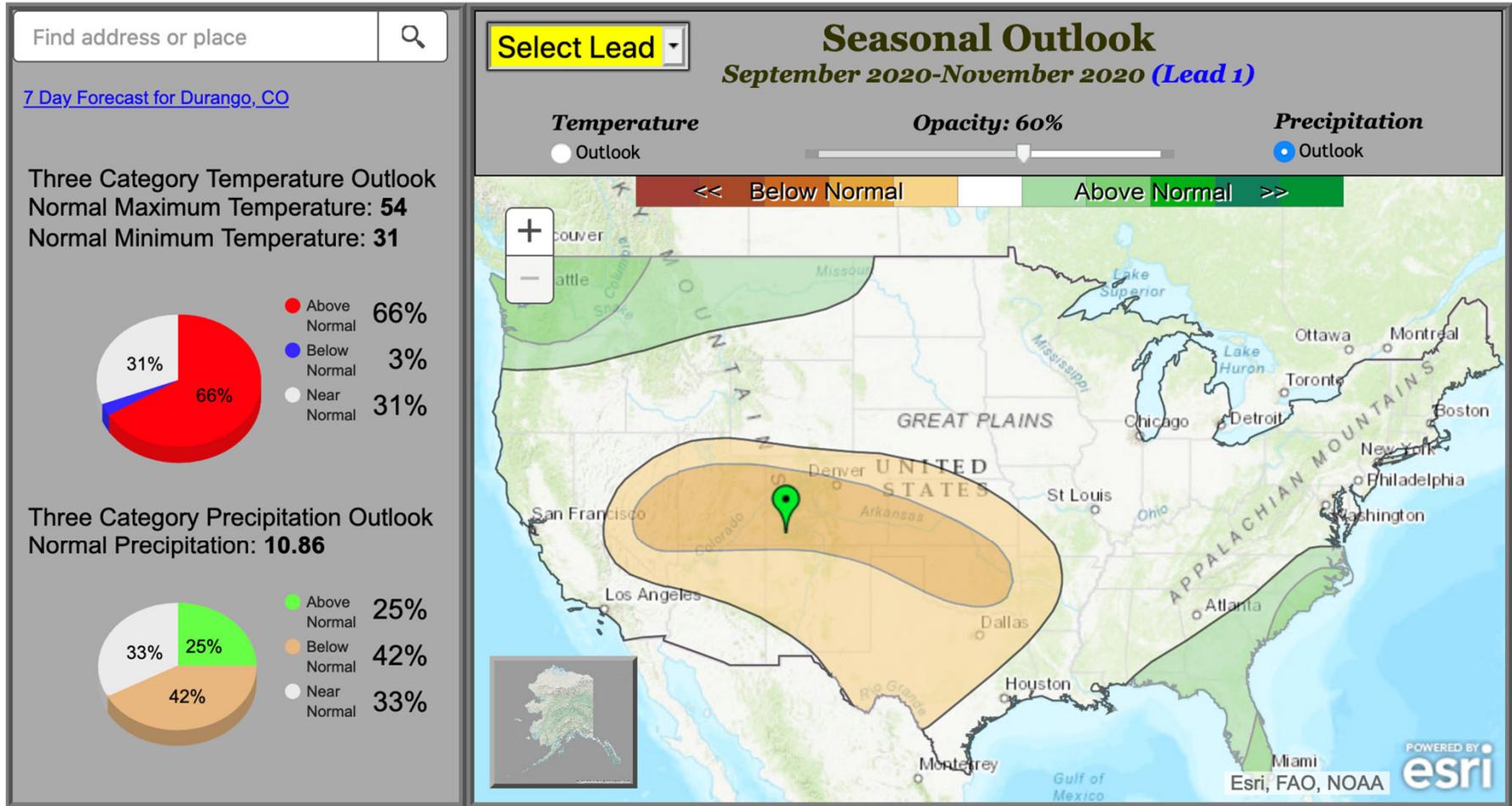
September outlook



September-October-November outlook



September-October-November outlook



La Niña in the works?

Early-August 2020 CPC/IRI Official Probabilistic ENSO Forecasts

ENSO state based on NINO3.4 SST Anomaly
Neutral ENSO: -0.5°C to 0.5°C

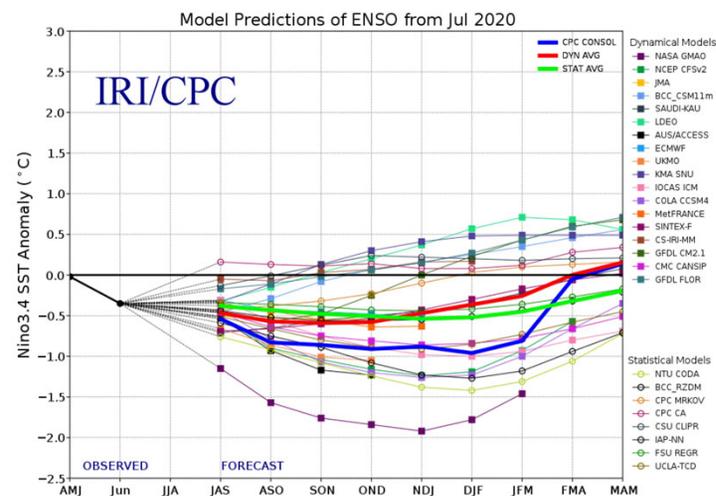
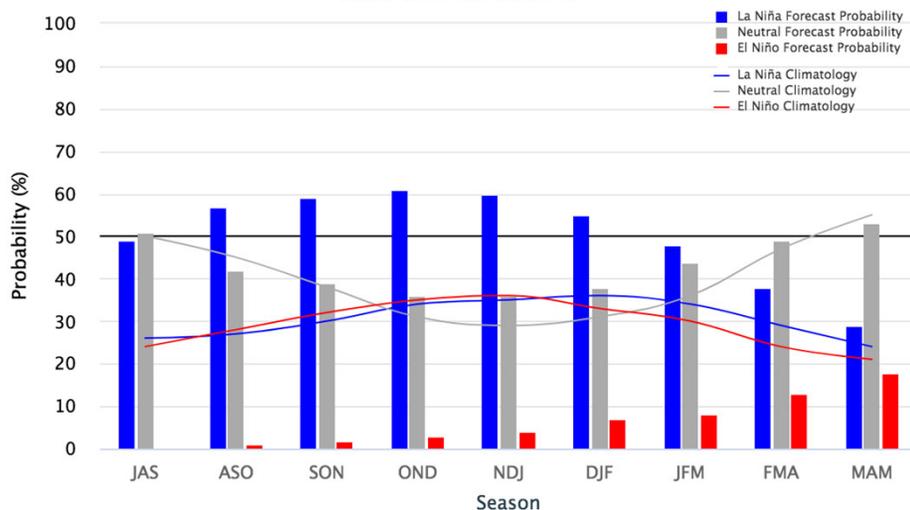


Figure 6. Forecasts of sea surface temperature (SST) anomalies for the Niño 3.4 region (5°N - 5°S , 120°W - 170°W). Figure updated 20 July 2020.

La Niña watch: 60% chance of La Niña development this fall, extending through winter

La Niña winters tend to be snowy north and less-snowy south, though the signal isn't that strong. CPC outlooks favor warmer-than-normal conditions through next spring, especially in southern Colorado



Summary points

- Since April, Colorado has been anomalously warm and dry, leading to development and expansion of drought across the state
- August has been exceptionally hot and dry, especially in western Colorado and across the west
- 99% of the state in drought; 73% in D2 (extreme drought) or worse
- Four large fires are burning at an unusual time in the summer
- Some minor relief in the near term, with better rain chances in the mountains later this week and a cold front around September 1
- Longer-term outlooks don't look promising, with warm conditions continuing, and the likely development of La Niña in the fall



russ.schumacher@colostate.edu

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

Thank you!

