

Colorado Climate Update

Dr. Becky Bolinger
Assistant State Climatologist

Water Availability Task Force
November 28, 2023



ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY



Water Year 2023 Recap

Start of Water Year 2024

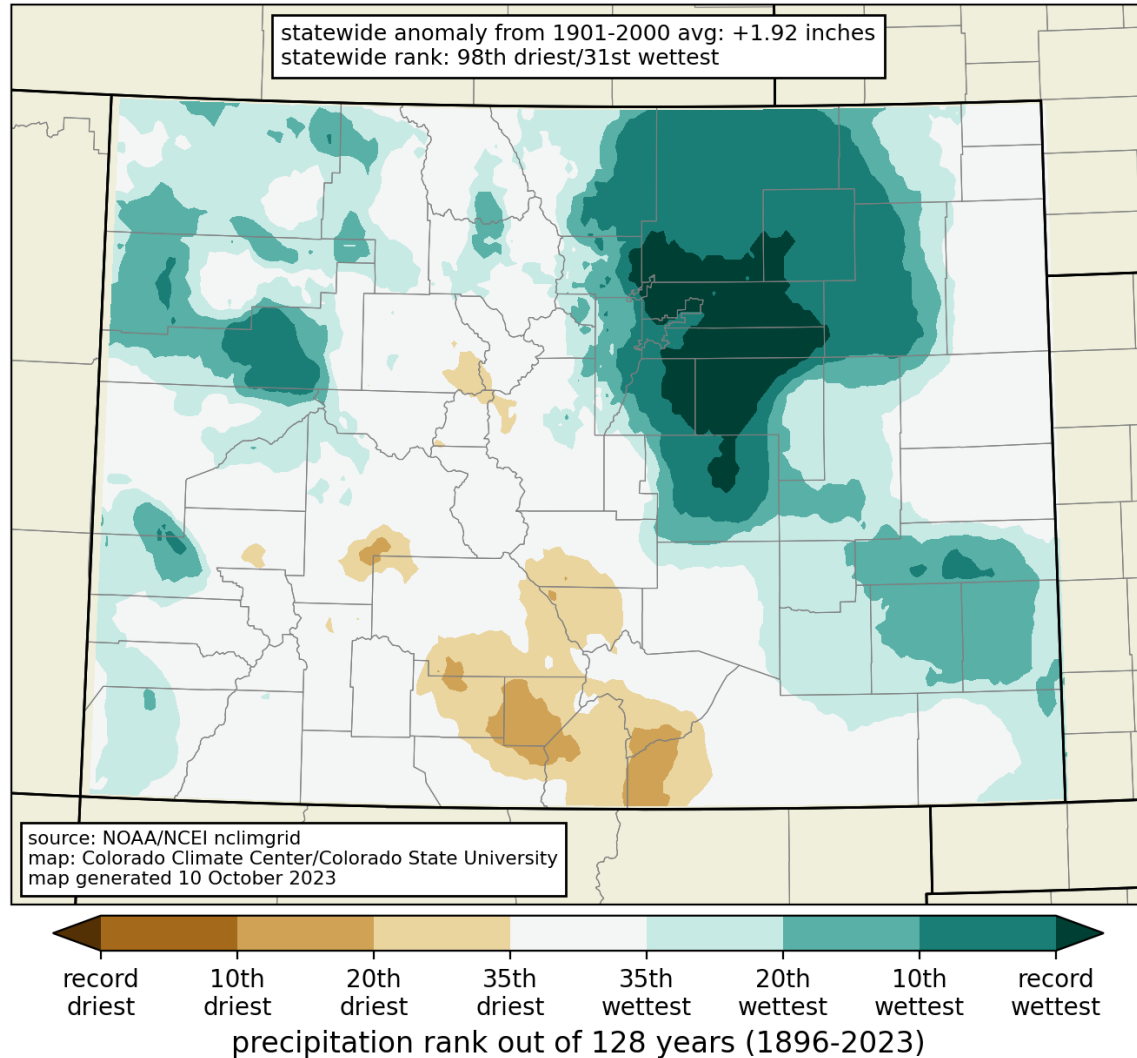


precipitation rank: 12 months ending September 2023 (Oct-Sep)

Water Year 2023 was wetter than average for many parts of the state. WY2023 was the 31st wettest water year in the 128-year record.

Record wet conditions were observed over parts of the Front Range Urban Corridor and eastern plains.

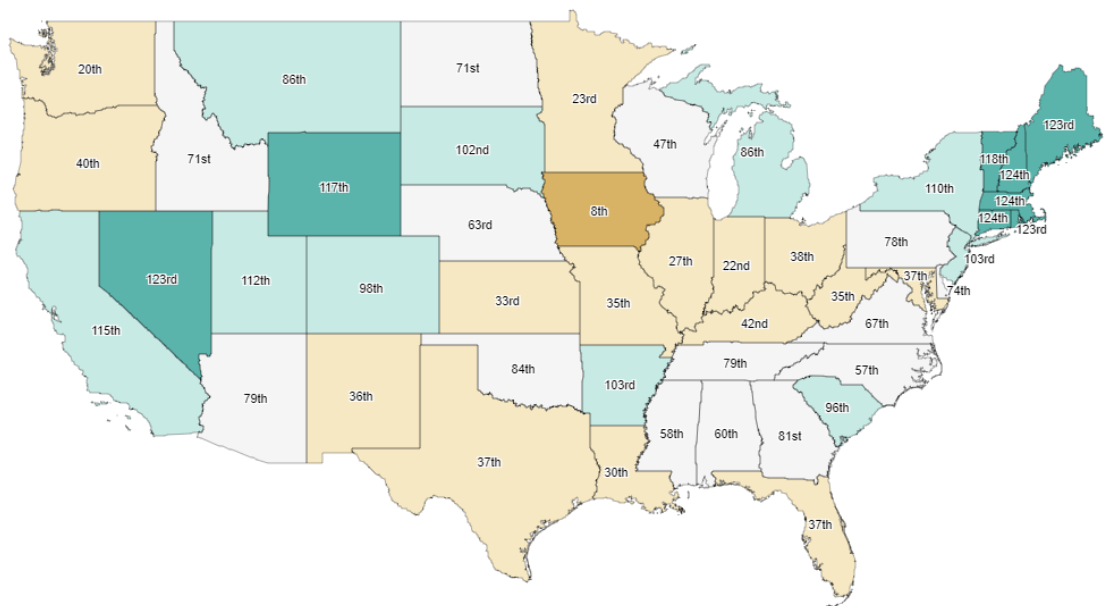
Dry conditions were observed over parts of the San Luis Valley and Sangre de Cristos.



https://climate.colostate.edu/co_cag/rank_maps.html



Statewide Precipitation Rank (128 years) October 2022 - September 2023



Driest $\downarrow \frac{1}{2}$ $\downarrow \frac{1}{4}$ Near Normal $\uparrow \frac{1}{4}$ $\uparrow \frac{1}{2}$ Wettest

Contiguous U.S. (Hover over a State)
 Precip: 30.23" Rank: 61st Wettest Anomaly: 0.29" Mean: 29.94"

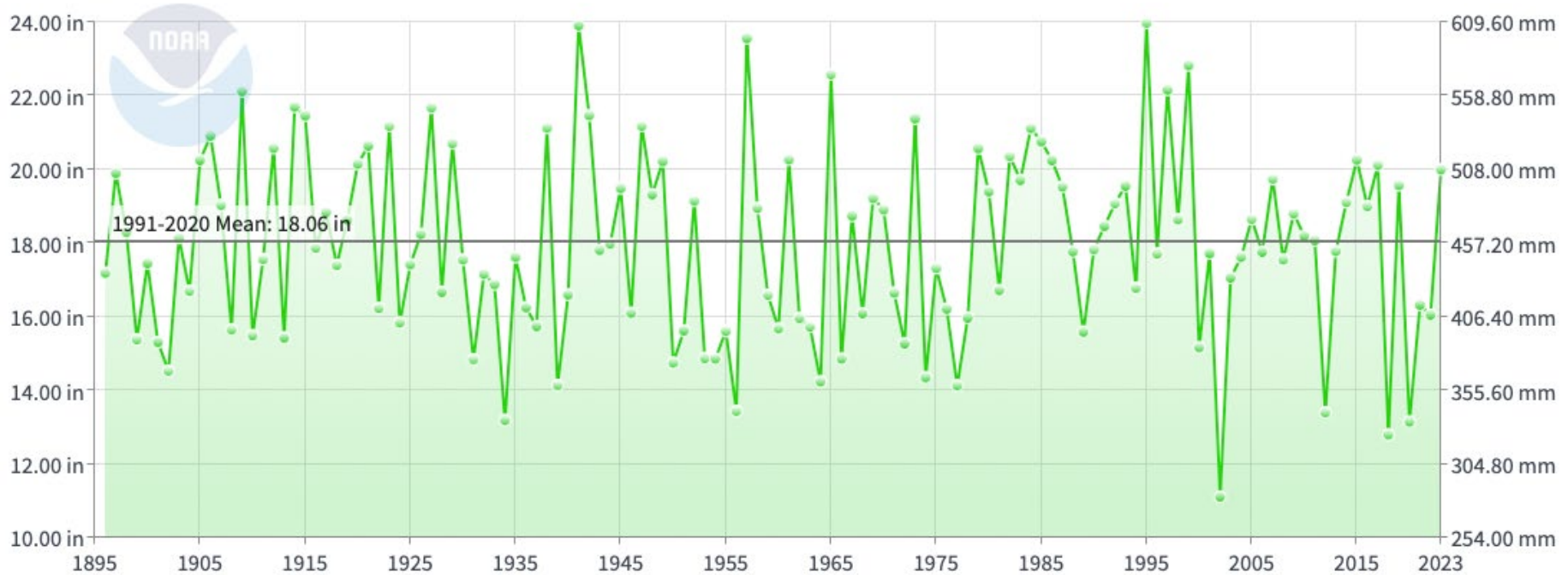
Month	P Rank (of 129 years)	Above, below, or near 20 th century avg?
Oct	62 nd driest	near avg
Nov	52 nd driest	near avg
Dec	20 th wettest	above
Jan	10 th wettest	much above
Feb	62 nd wettest	near avg
Mar	32 nd wettest	above
Apr	37 th driest	below
May	22 nd wettest	above
Jun	8 th wettest	much above
Jul	30 th driest	below
Aug	58 th wettest	near avg
Sep	52 nd driest	near avg

<https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

Water Year Precipitation over Time

Colorado Precipitation

October-September

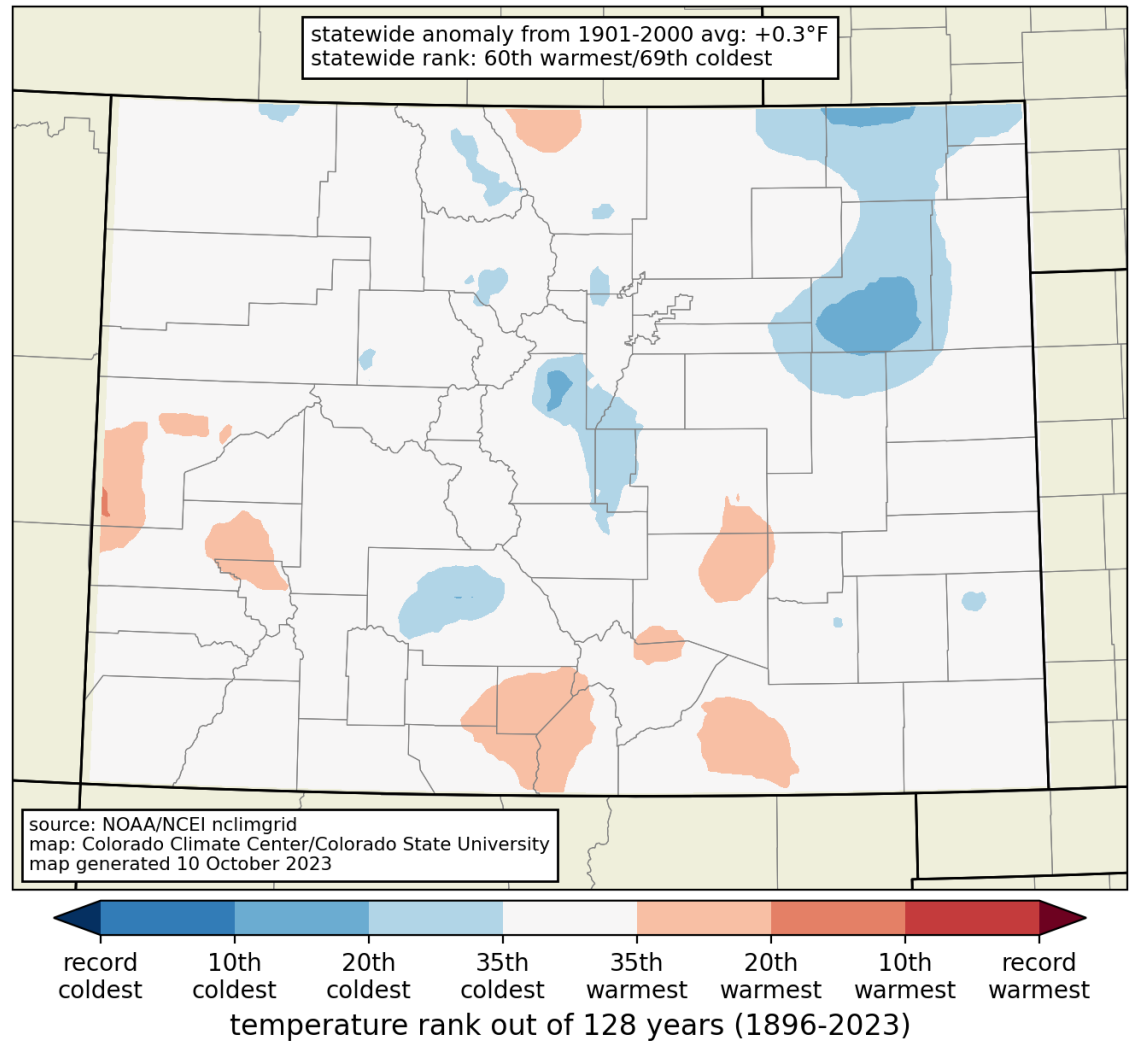


<https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance>



average temperature rank: 12 months ending September 2023 (Oct-Sep)

Water Year 2023 temperatures were near average for most of the state. Pockets of below average temperature were observed over northeast CO, with some warmer than average temperatures in southern and western CO.

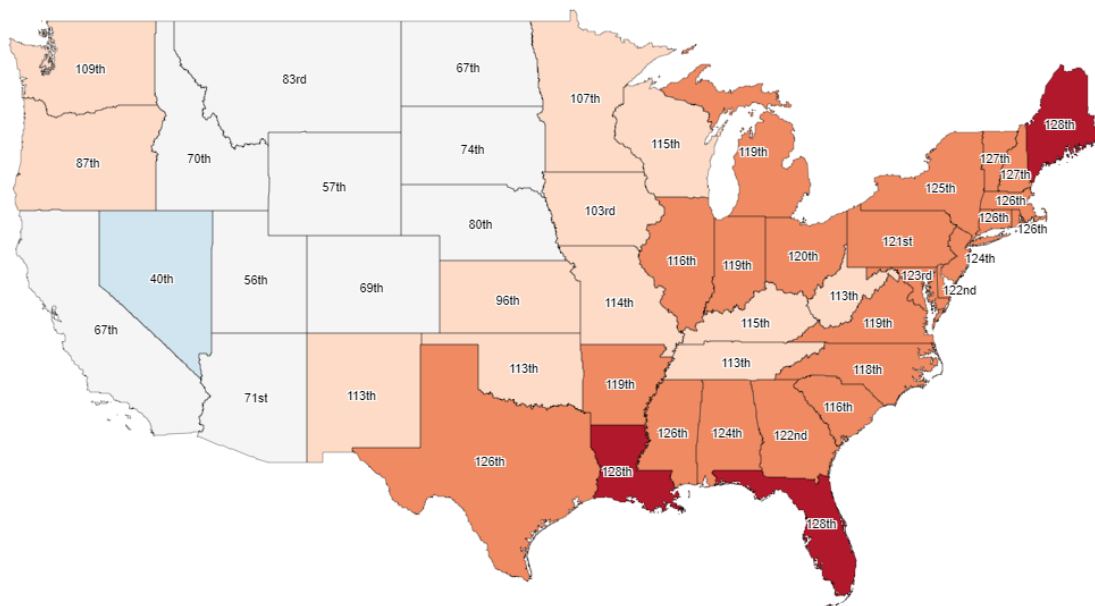


https://climate.colostate.edu/co_cag/rank_maps.html



Statewide Average Temperature Rank (128 years)

October 2022 - September 2023



Coldest $\downarrow \frac{1}{2}$ $\downarrow \frac{1}{4}$ Near Normal $\uparrow \frac{1}{4}$ $\uparrow \frac{1}{2}$ Warmest

Contiguous U.S. (Hover over a State)

Temp: 53.50°F Rank: 17th Warmest Anomaly: 1.47°F Mean: 52.03°F



Month	T Rank (of 129 years)	Above, below, or near 20 th century avg?
Oct	45 th warmest	near avg
Nov	29 th coolest	below
Dec	57 th coolest	near avg
Jan	55 th coolest	near avg
Feb	40 th coolest	below
Mar	22 nd coolest	below
Apr	41 st coolest	below
May	18 th warmest	above
Jun	30 th coolest	below
Jul	21 st warmest	above
Aug	10 th warmest	much above
Sep	14 th warmest	above

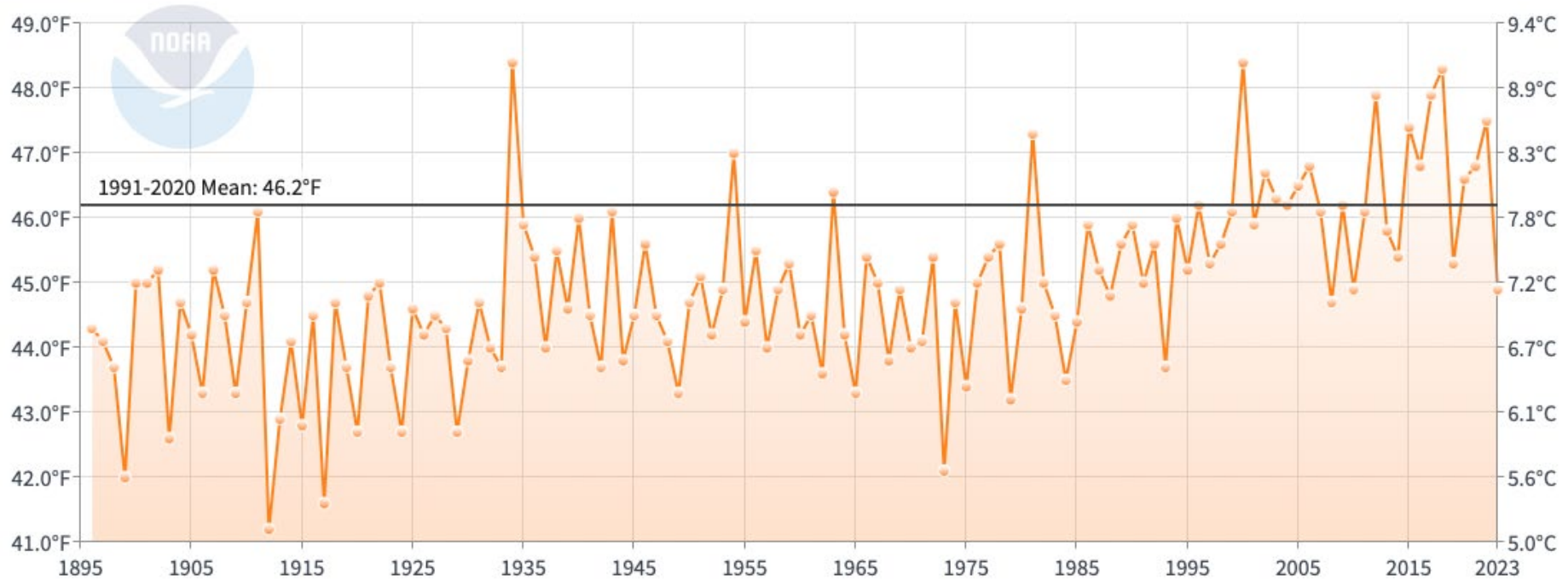
<https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>



Water Year Temperature over Time

Colorado Average Temperature

October-September



<https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance>



daily records broken

Month	High max T	High min T	Low max T	Low min T	Precipitation	Snowfall
October	4	37	87	8	68	8
November	5	58	106	91	67	35
December	36	178	100	41	86	23
January	9	147	130	39	162	68
February	16	19	153	134	47	47
March	0	37	245	264	170	19
April	109	105	6	8	49	22
May	6	42	7	0	103	3
June	1	24	88	10	117	0
July	184	279	37	6	58	3
August	108	338	31	17	126	0
September	28	53	29	1	68	0
TOTAL	506	1317	1019	619	1121	228
	warm records: 1,823		cold records: 1,638			

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



Read our Water Year 2023 Climate Summary!



https://climate.colostate.edu/reports/wy2023_climate_summary_long.pdf



Water Year 2024 Conditions

Temperature

Precipitation

Evaporative Demand

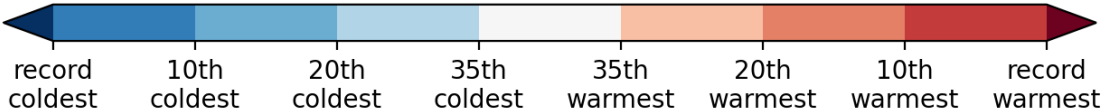
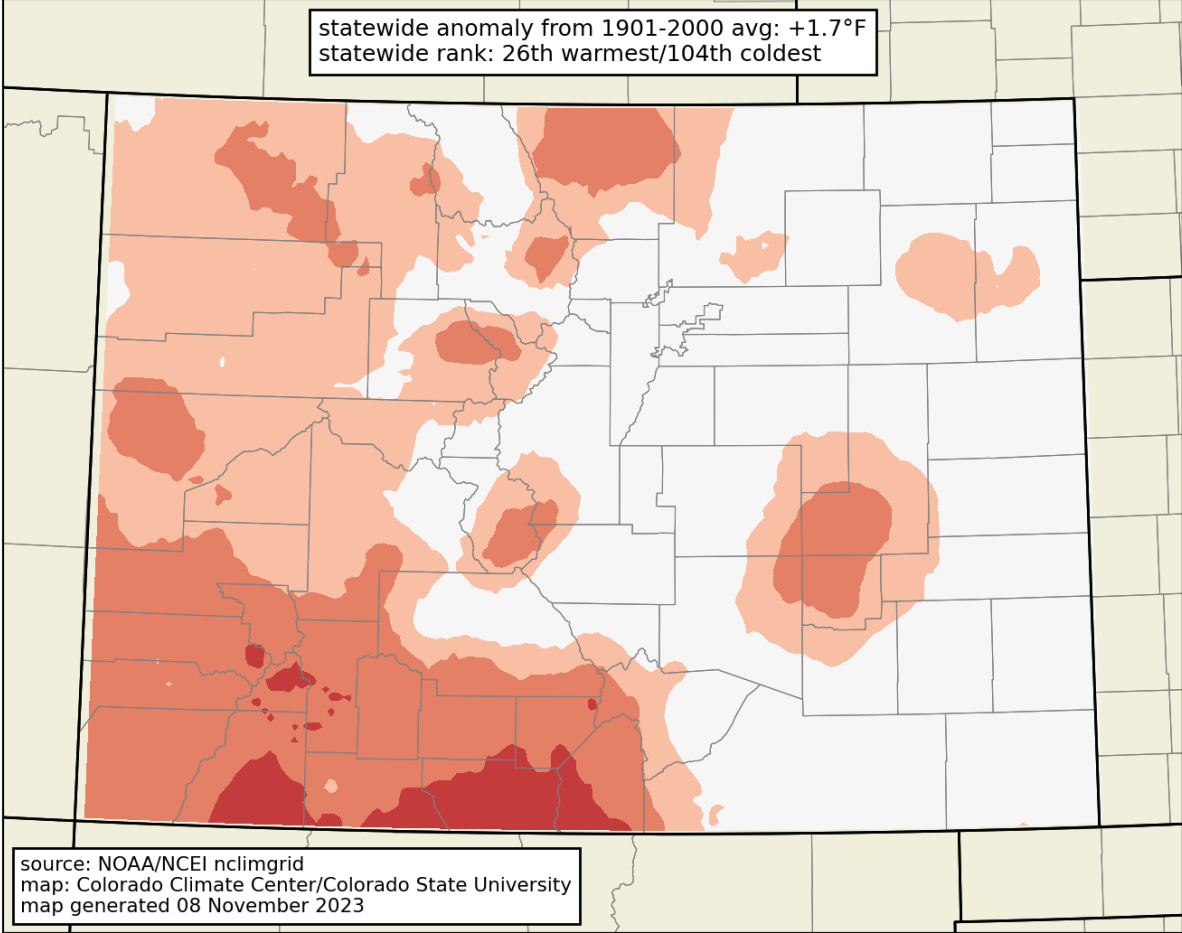
Soil Moisture

Vegetation



October Temperatures

average temperature rank: October 2023



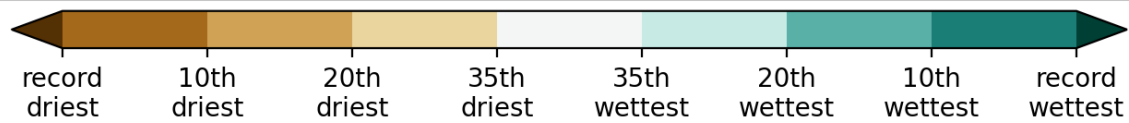
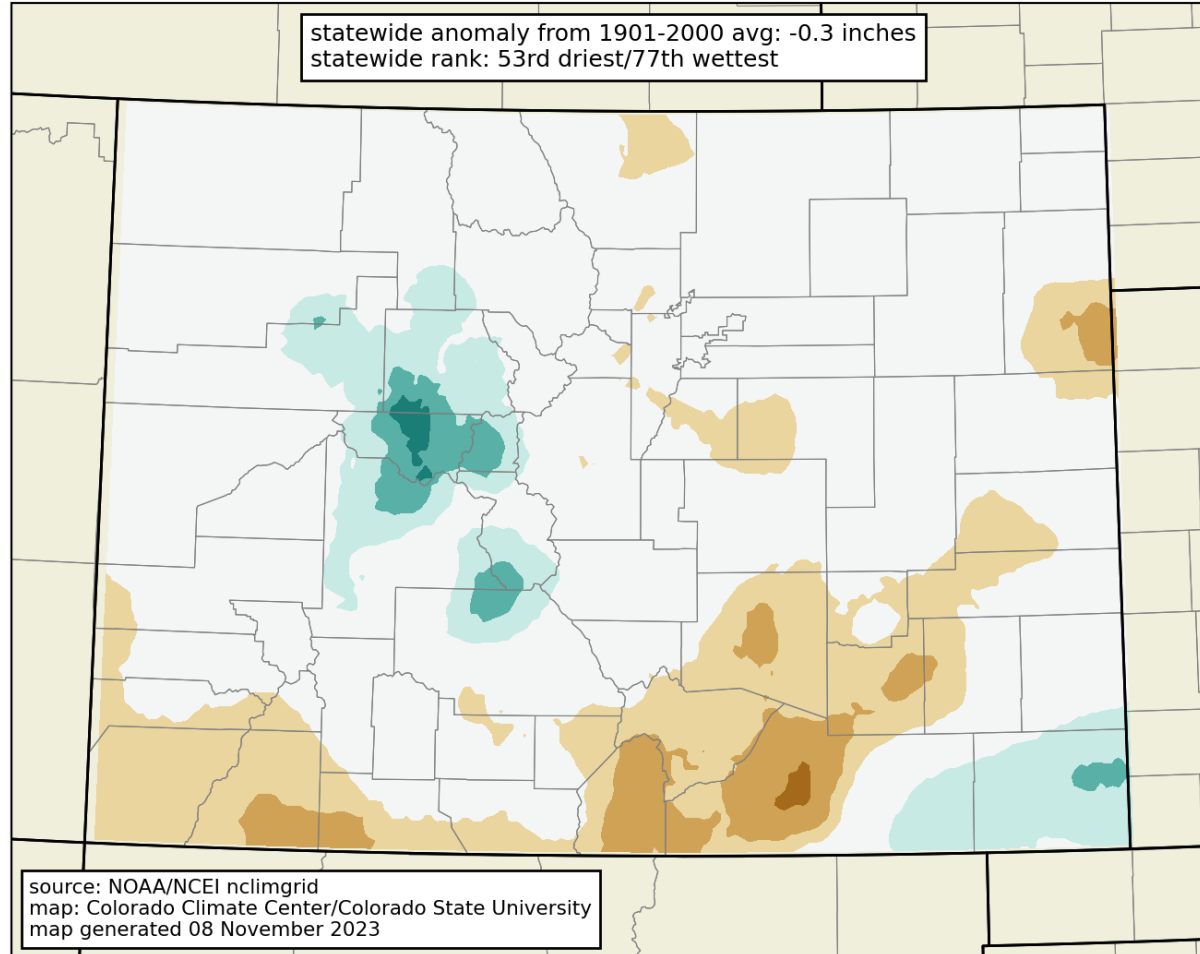
temperature rank out of 129 years (1895-2023)

https://climate.colostate.edu/co_cag/rank_maps.html



October Precipitation

precipitation rank: October 2023



precipitation rank out of 129 years (1895-2023)

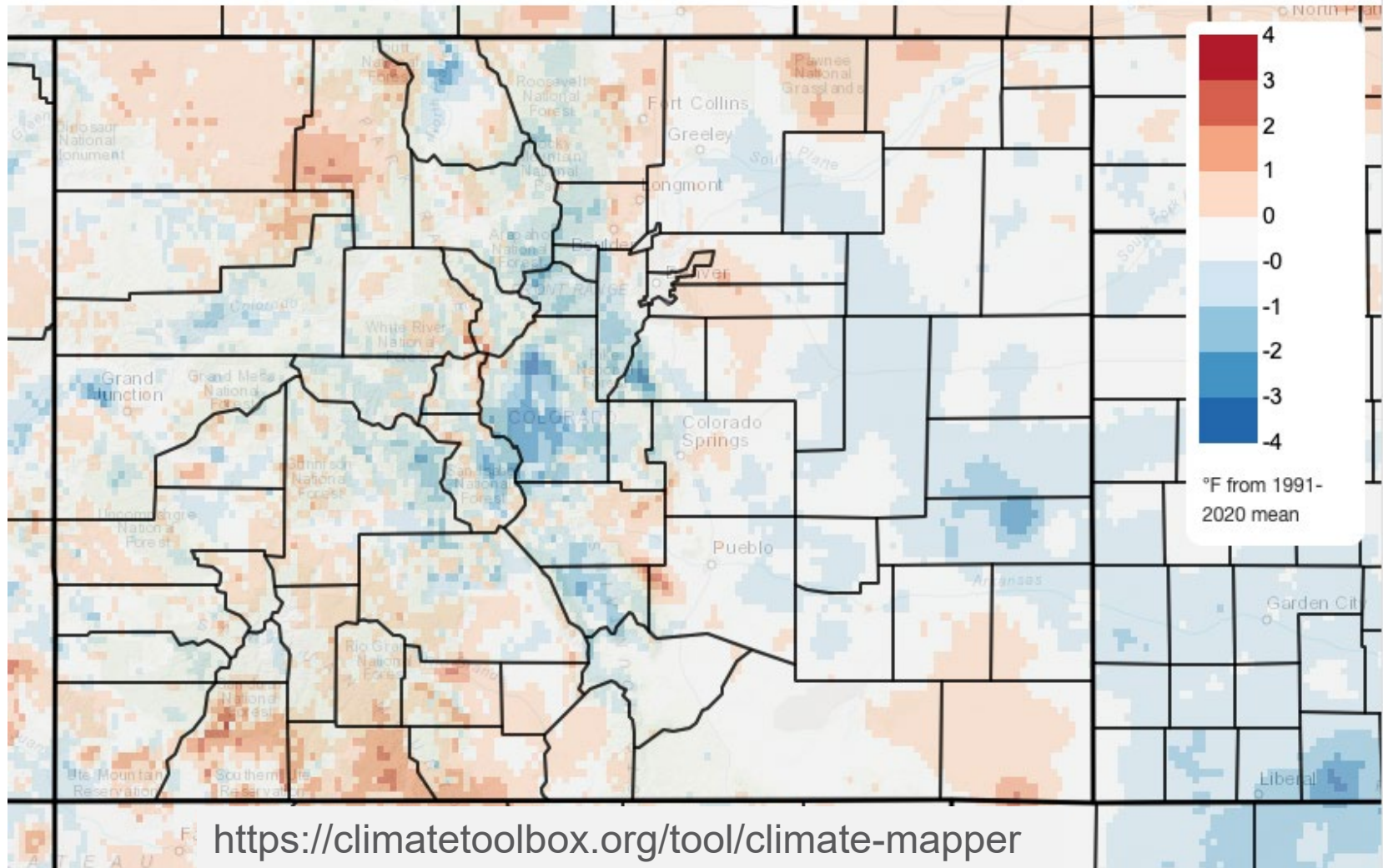
https://climate.colostate.edu/co_cag/rank_maps.html



November Temperatures

Mean Daily Temperature Anomaly, Last 30 Days

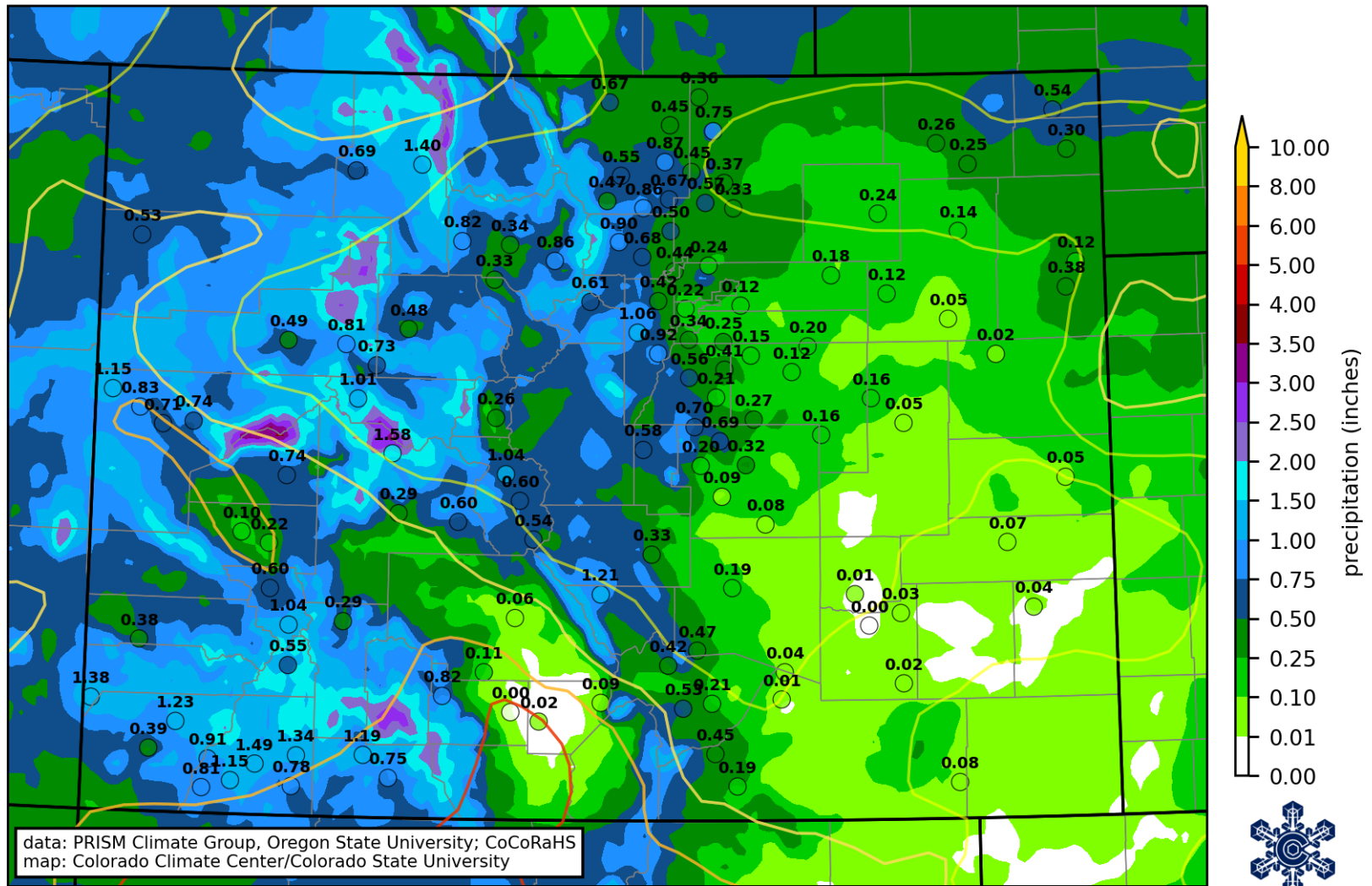
2023/10/28 - 2023/11/26



November Precipitation

PRISM and CoCoRaHS month-to-date precipitation, US Drought Monitor

through 5:00am MST Sun 26 November 2023



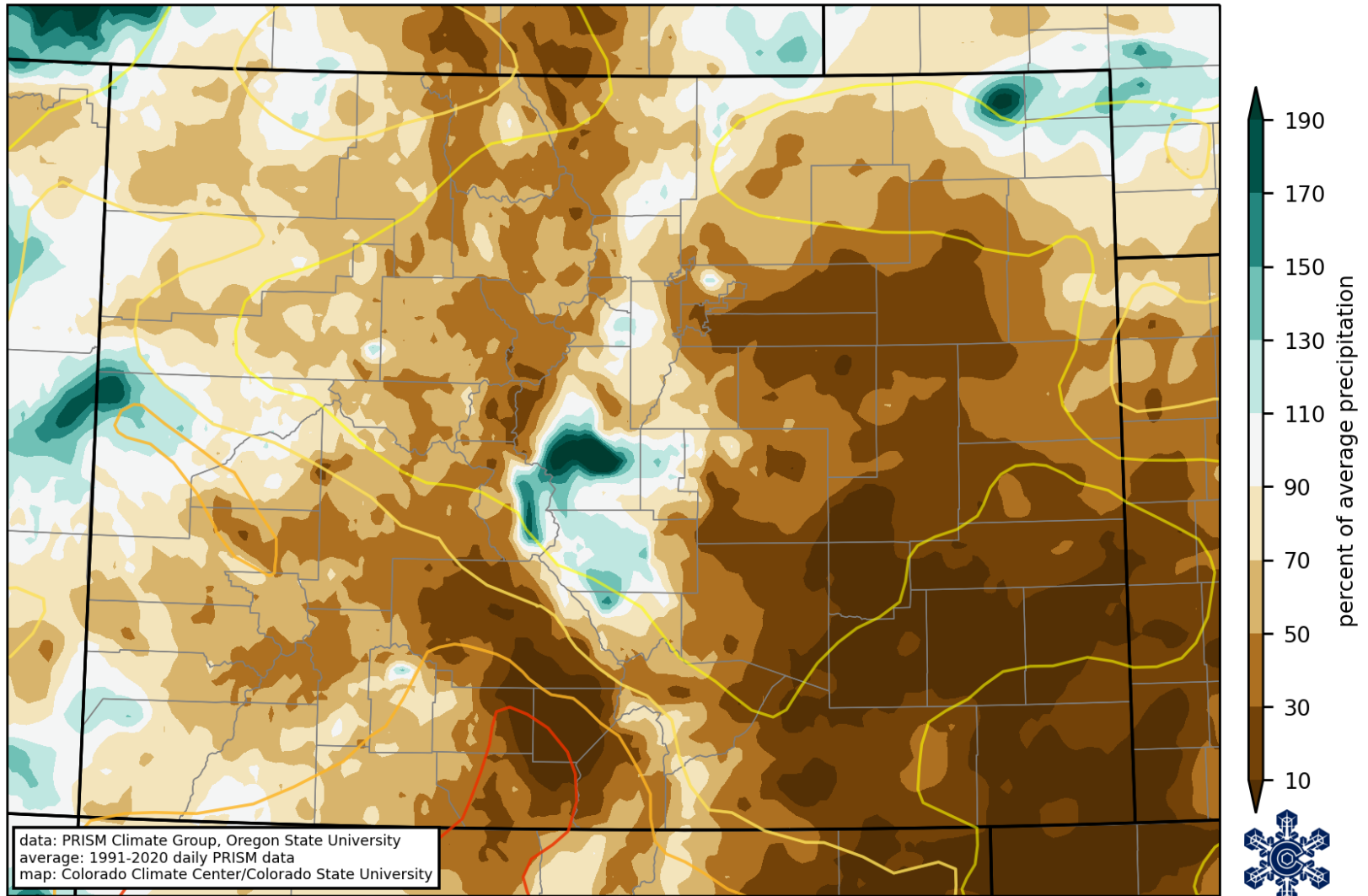
<https://climate.colostate.edu/drought/>



November Precipitation

PRISM month-to-date % of average precipitation, US Drought Monitor

through 5:00am MST Sun 26 November 2023

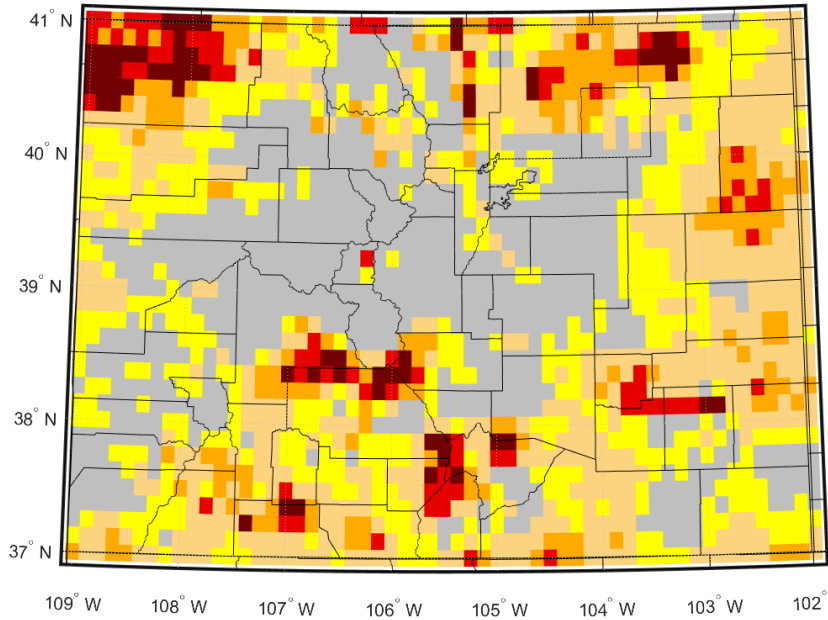


<https://climate.colostate.edu/drought/>

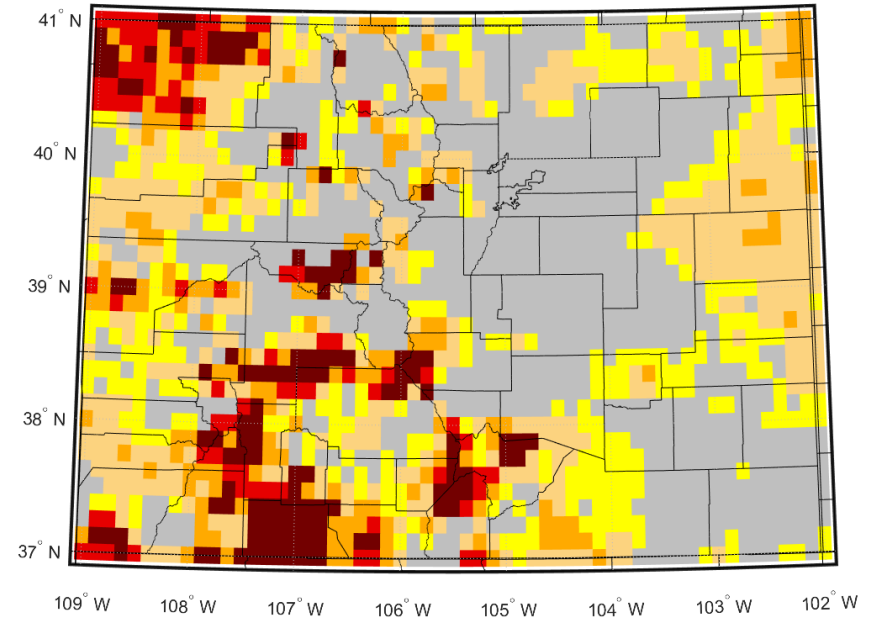


Soil Moisture

Top 10cm Soil Moisture Percentile
11/21/2023



Top Meter Soil Moisture Percentile
11/21/2023

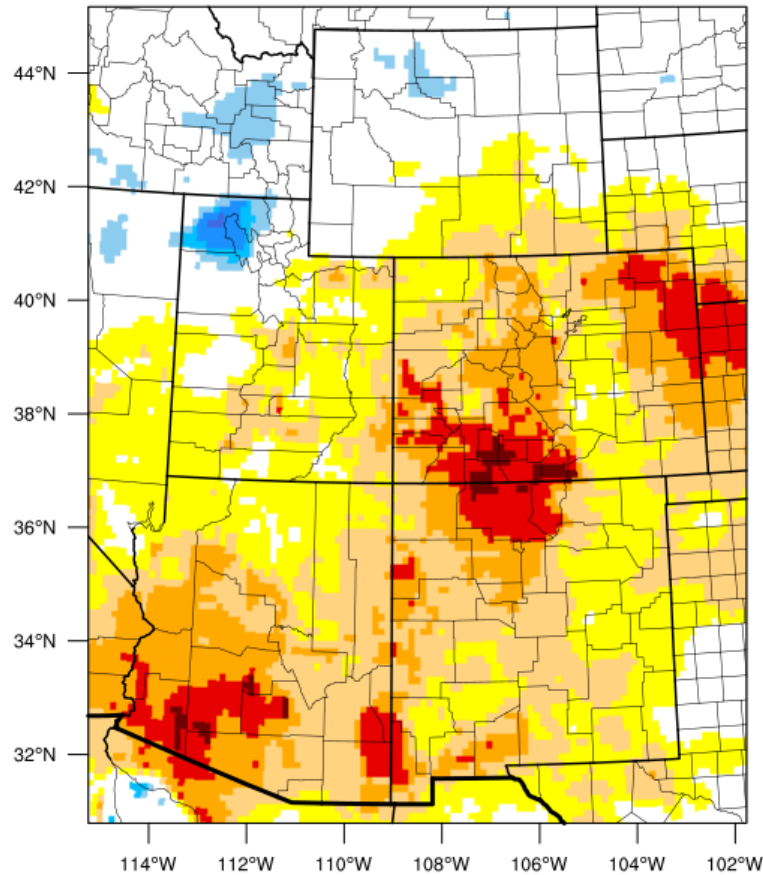


<https://climate.colostate.edu/drought/>



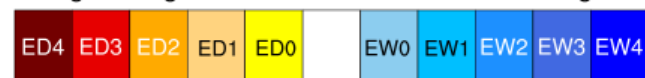
Evaporative Demand

2-month EDDI categories for November 22, 2023



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

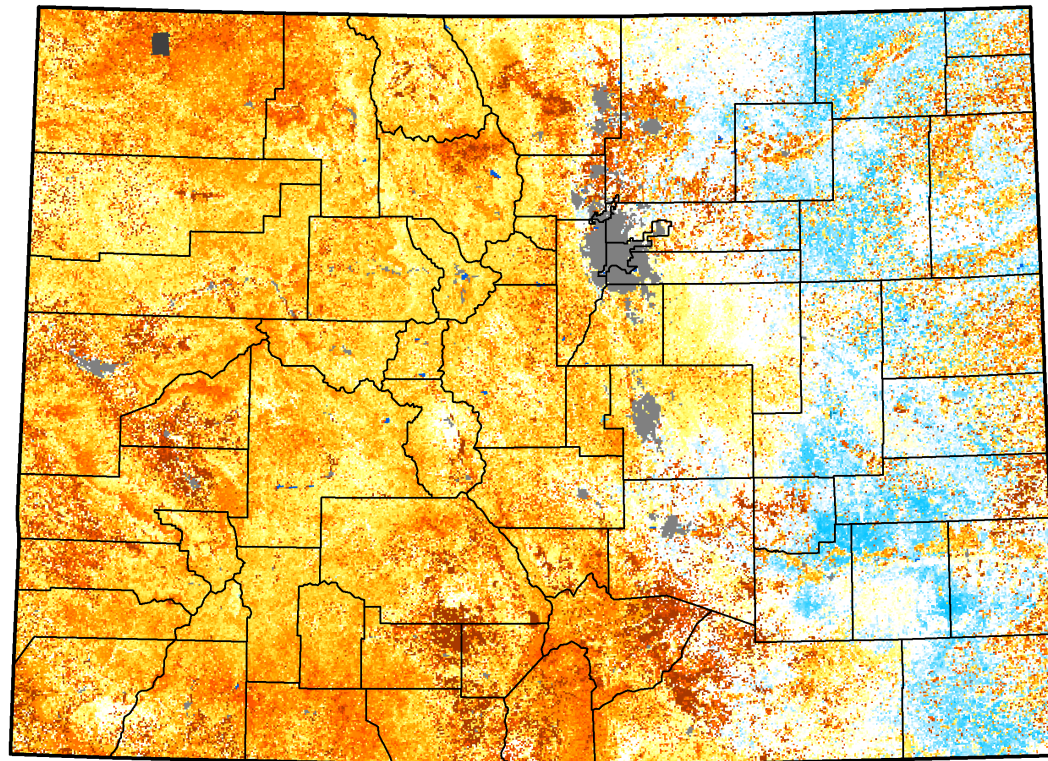
<https://psl.noaa.gov/eddi/>



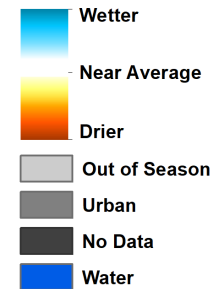
Vegetation - QuickDRI

Quick Drought Response Index Colorado

November 19, 2023
(Week 47)



Conditions Relative to
4-Week Historical Average



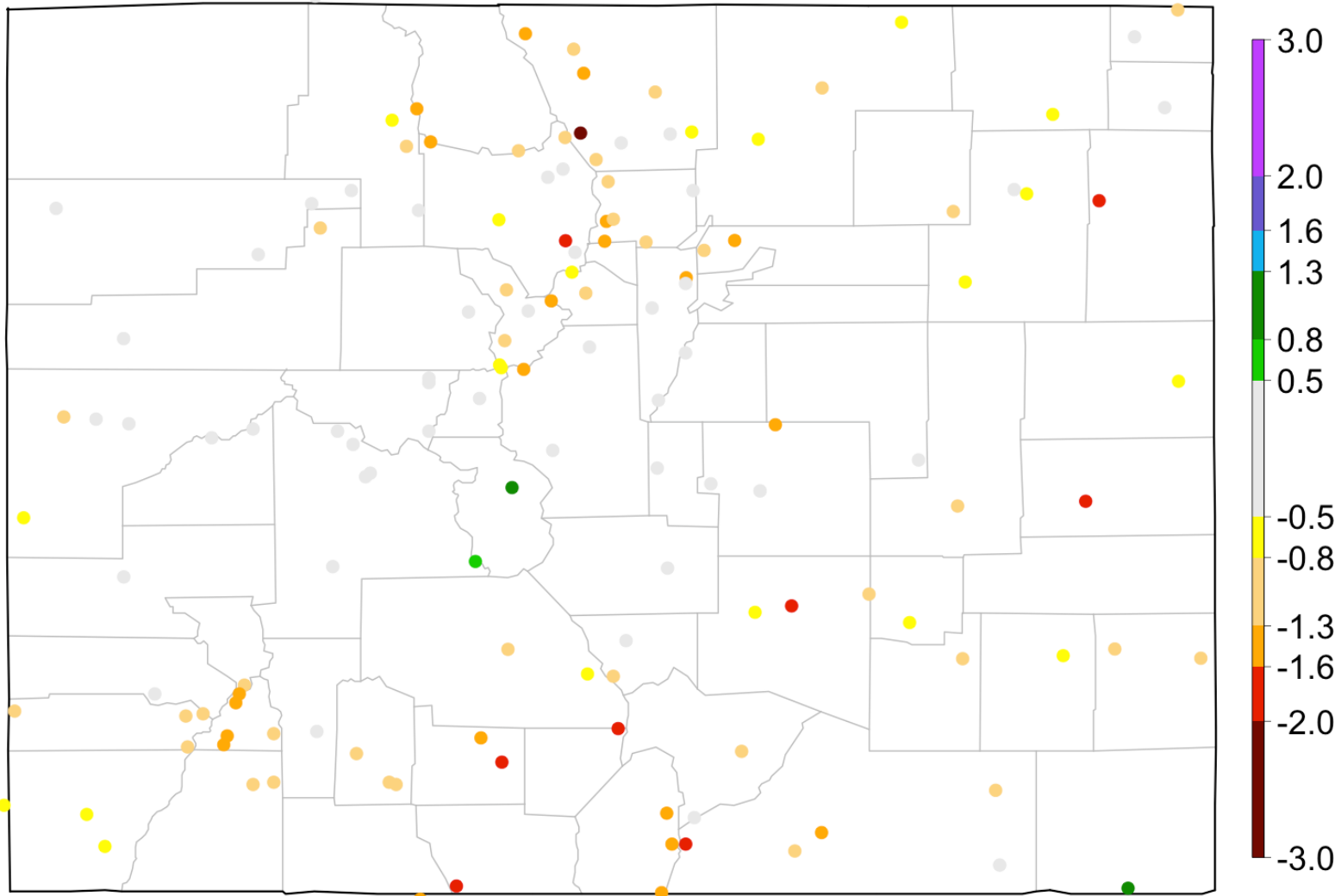
CALMIT
University of Nebraska - Lincoln
Center for Advanced Land Management Information Technologies



<https://quickdri.unl.edu>



60-day SPI: 2023/09/28 - 2023/11/26

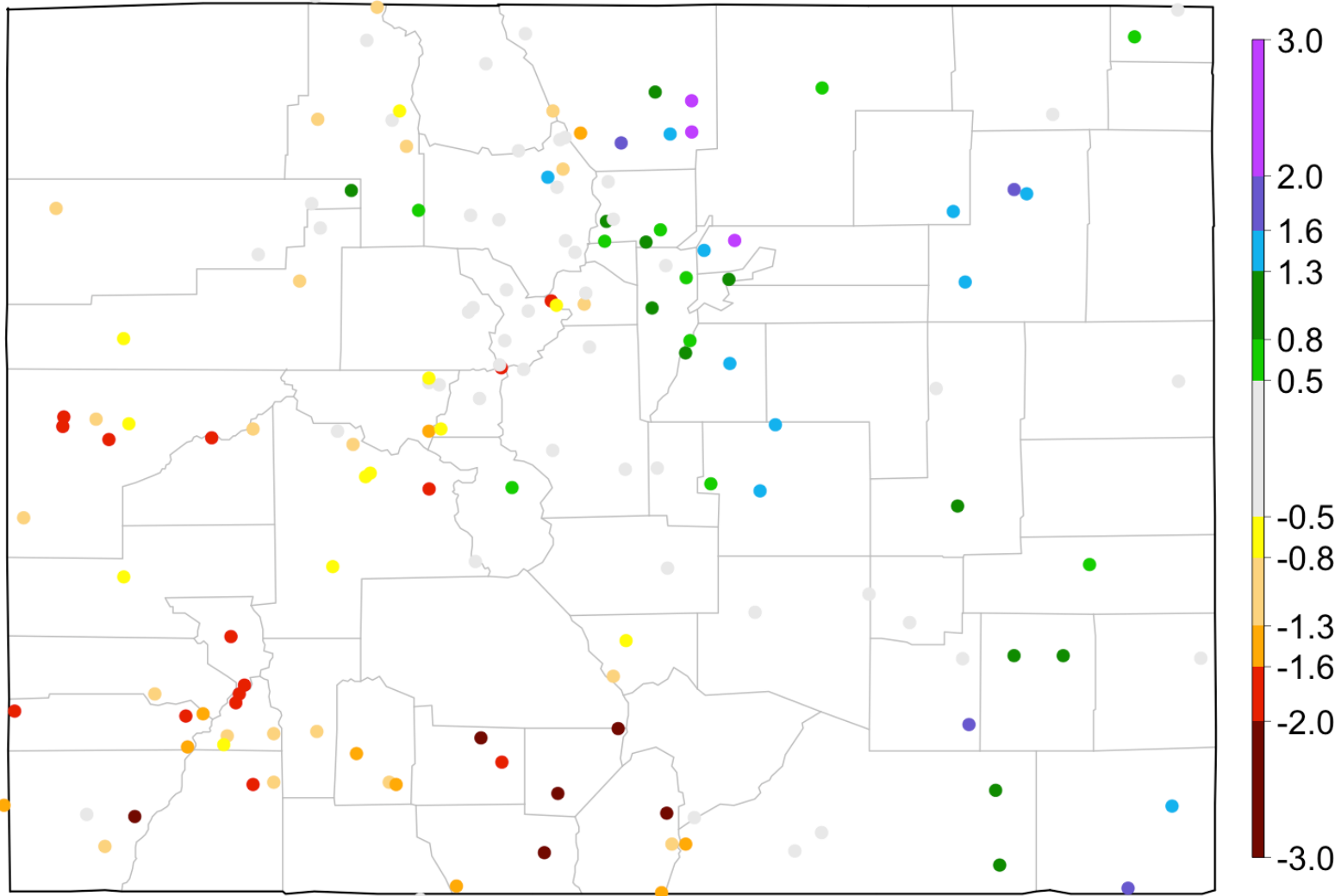


Data from High Plains Regional Climate Center and ACIS

<https://climate.colostate.edu/drought/>



6-month SPI: 2023/05/27 - 2023/11/26

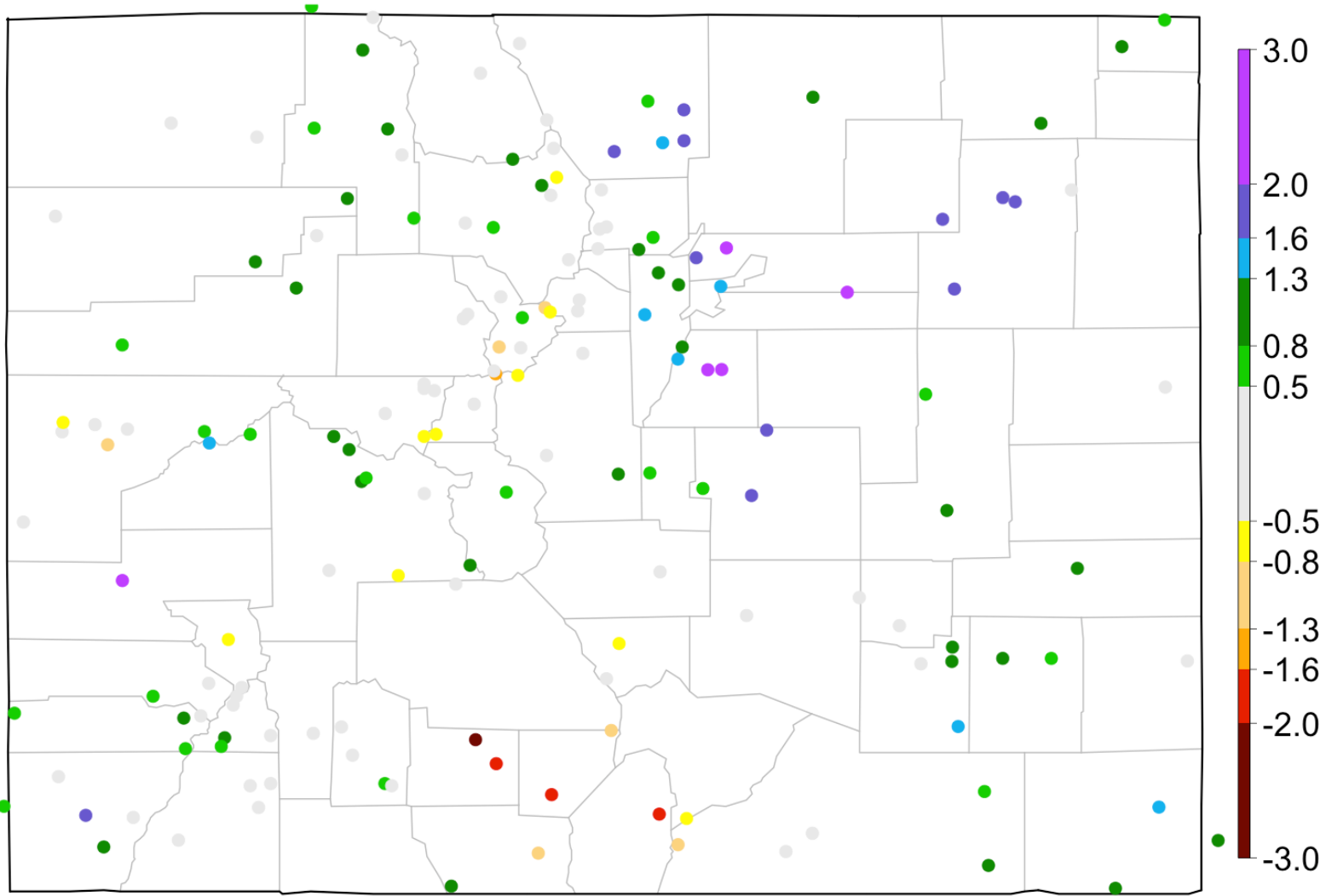


Data from High Plains Regional Climate Center and ACIS

<https://climate.colostate.edu/drought/>



12-month SPI: 2022/11/27 - 2023/11/26



Data from High Plains Regional Climate Center and ACIS

<https://climate.colostate.edu/drought/>





Drought

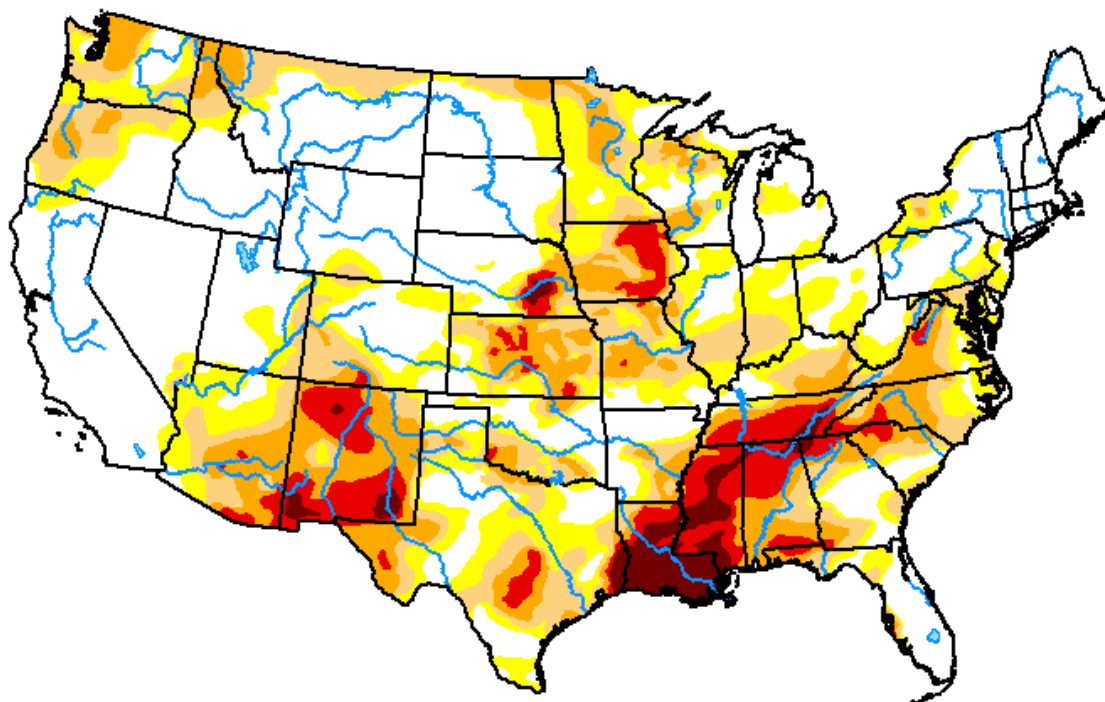
National Drought
Colorado Drought









U.S. Drought Monitor

Contiguous U.S. (CONUS)

November 21, 2023
(Released Wednesday, Nov. 22, 2023)
Valid 7 a.m. EST



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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Brad Rippey
U.S. Department of Agriculture



droughtmonitor.unl.edu

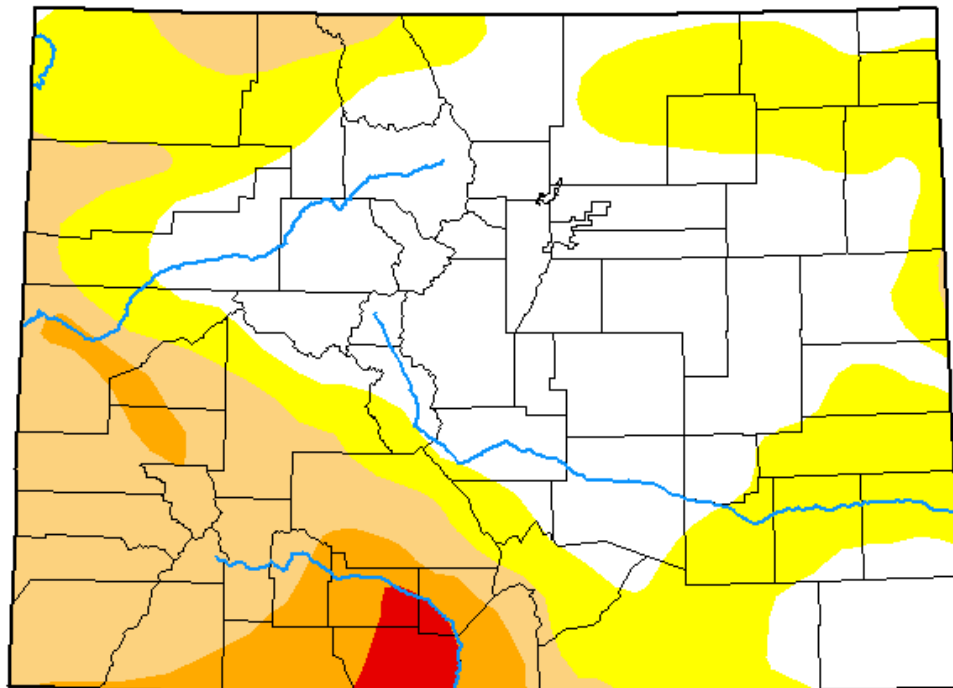


U.S. Drought Monitor Colorado

November 21, 2023
(Released Wednesday, Nov. 22, 2023)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	43.02	56.98	26.90	6.88	1.31	0.00
Last Week <i>11-14-2023</i>	47.66	52.34	26.90	6.87	1.31	0.00
3 Months Ago <i>08-22-2023</i>	69.61	30.39	15.67	1.52	0.00	0.00
Start of Calendar Year <i>01-03-2023</i>	39.97	60.03	33.83	12.28	1.91	0.01
Start of Water Year <i>09-26-2023</i>	65.71	34.29	17.43	2.77	0.00	0.00
One Year Ago <i>11-22-2022</i>	16.27	83.73	49.35	25.20	4.34	0.57



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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Brad Rippey
U.S. Department of Agriculture

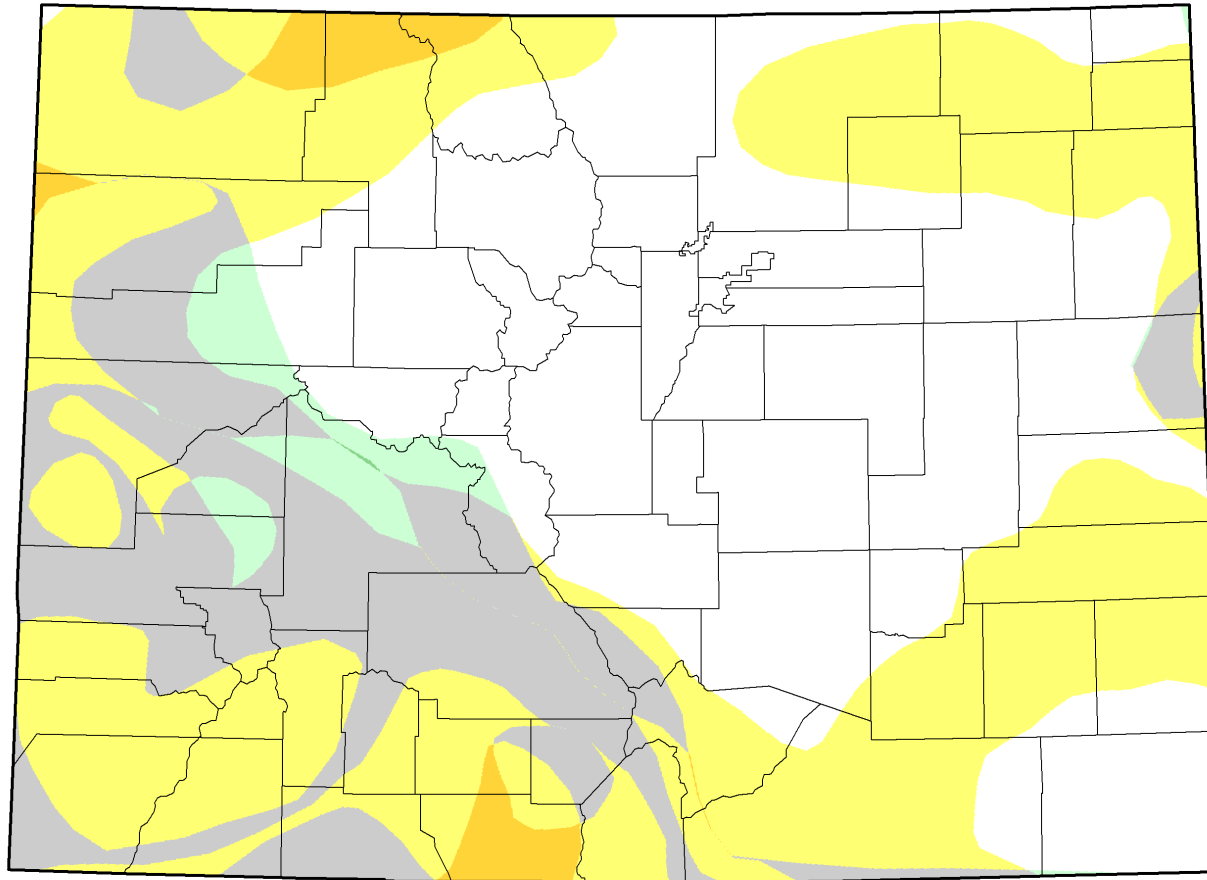


droughtmonitor.unl.edu



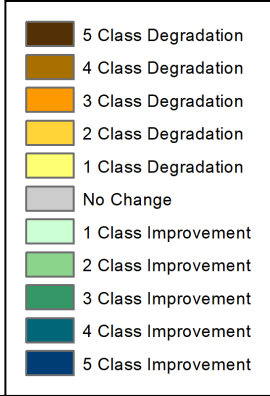
U.S. Drought Monitor Class Change - Colorado

Start of Water Year



November 21, 2023
compared to
September 26, 2023

droughtmonitor.unl.edu





Outlook

Next 7 days

8-14 day Outlook

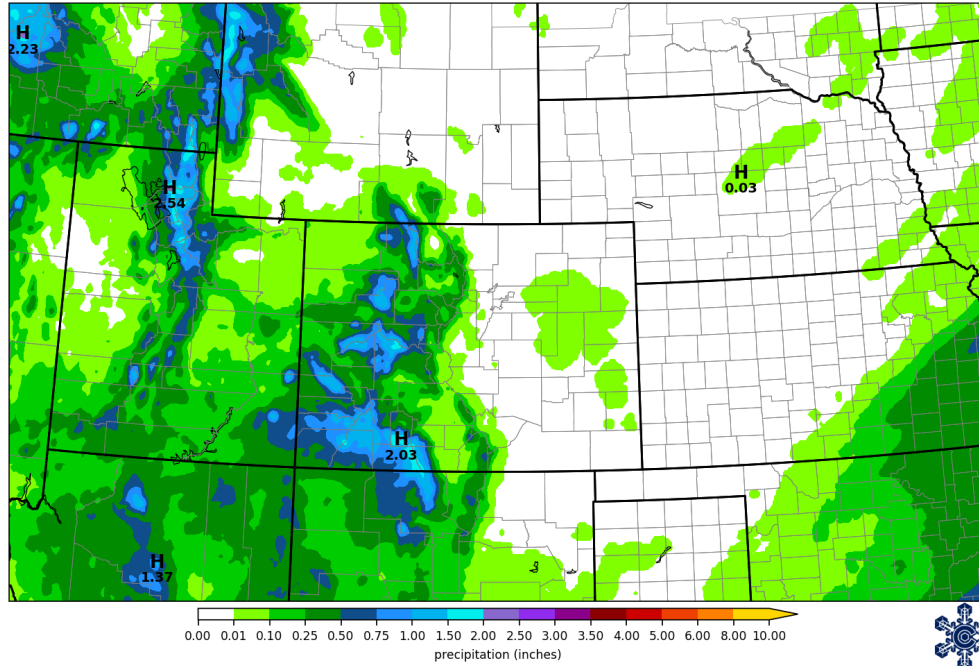
CPC Outlooks

El Niño

NOAA 7-day precip forecast

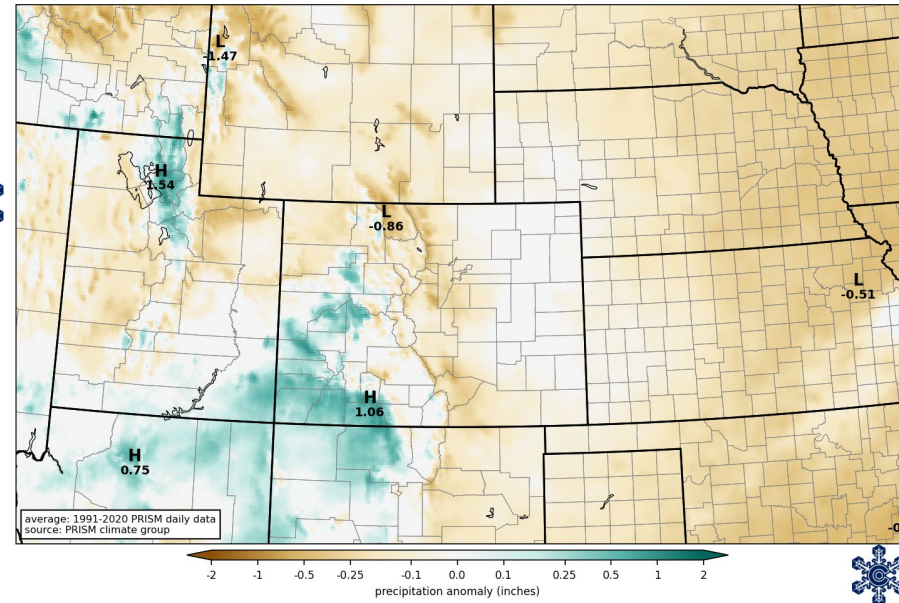
NOAA Weather Prediction Center
7-day precipitation forecast

forecast issued 1200 UTC Mon 27 Nov 2023
precipitation in 168 hrs ending 1200 UTC Mon 04 Dec 2023



NOAA Weather Prediction Center
7-day precip forecast departure from average

forecast issued 1200 UTC Mon 27 Nov 2023
precipitation in 168 hrs ending 1200 UTC Mon 04 Dec 2023



<http://schumacher.atmos.colostate.edu/weather/>



8-14 day outlook



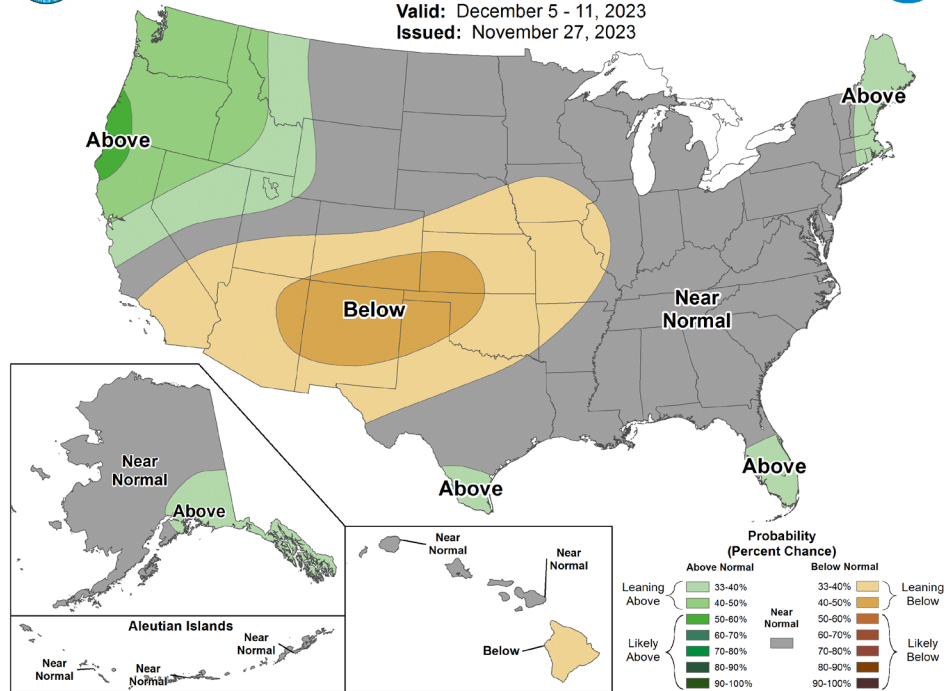
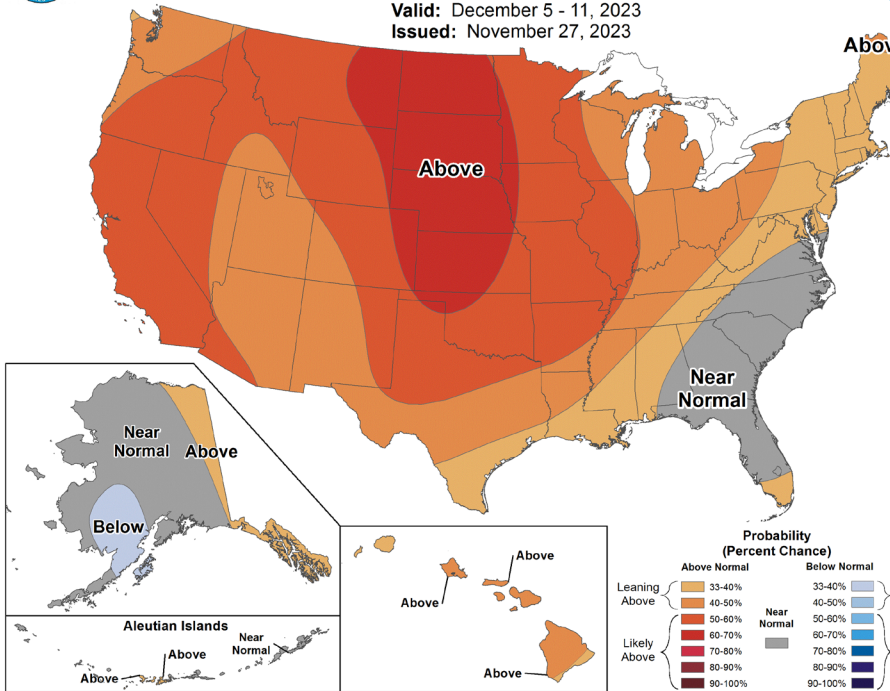
8-14 Day Temperature Outlook

Valid: December 5 - 11, 2023
 Issued: November 27, 2023



8-14 Day Precipitation Outlook

Valid: December 5 - 11, 2023
 Issued: November 27, 2023



Temperatures likely to be above average at the beginning of December with a slight chance of below average precipitation, especially in southern CO.

<https://www.cpc.ncep.noaa.gov>



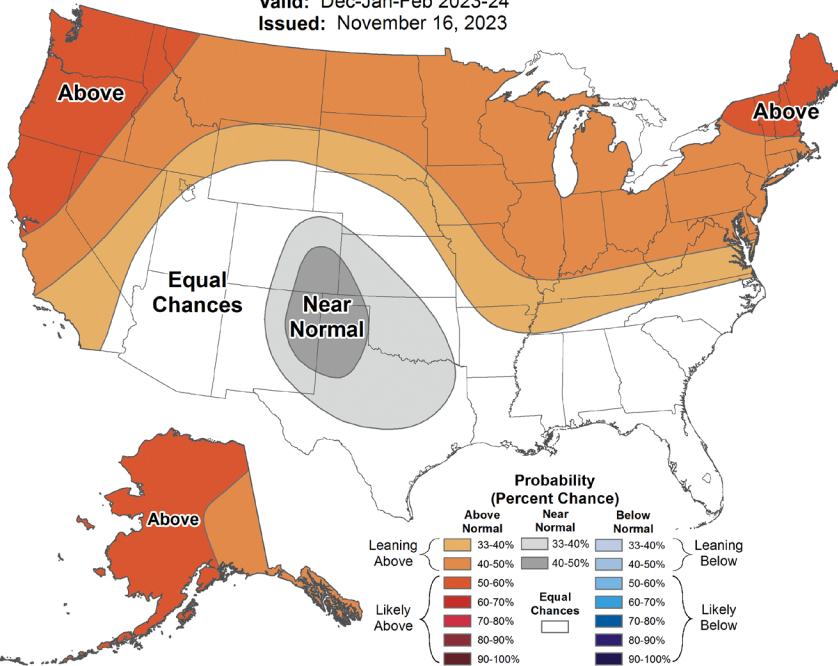
Seasonal outlook



Seasonal Temperature Outlook



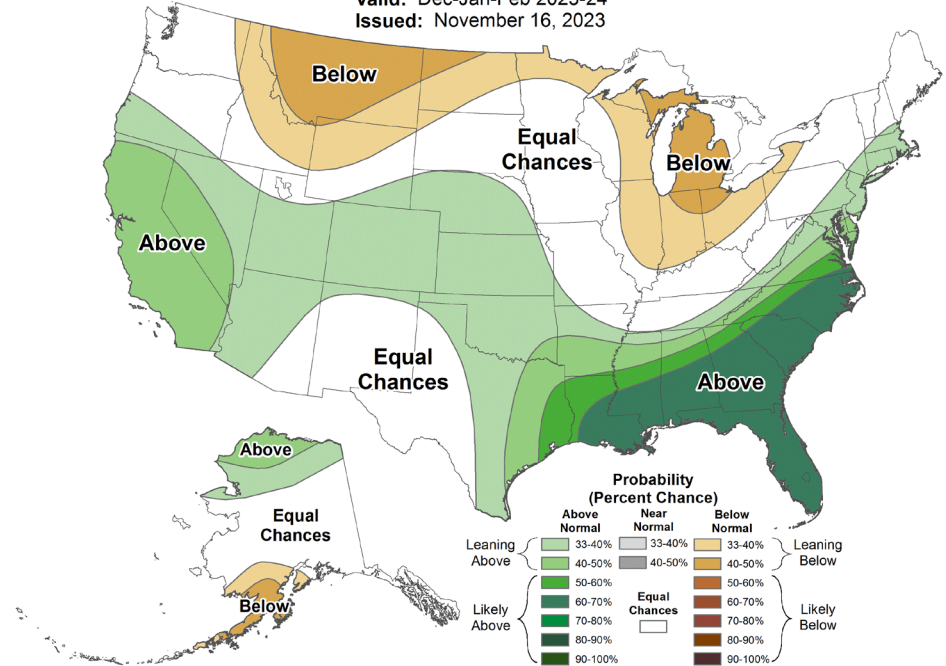
Valid: Dec-Jan-Feb 2023-24
 Issued: November 16, 2023



Seasonal Precipitation Outlook



Valid: Dec-Jan-Feb 2023-24
 Issued: November 16, 2023



Winter temperatures are expected to be seasonal, especially over the plains. There is a slight leaning for above average precipitation during the winter.

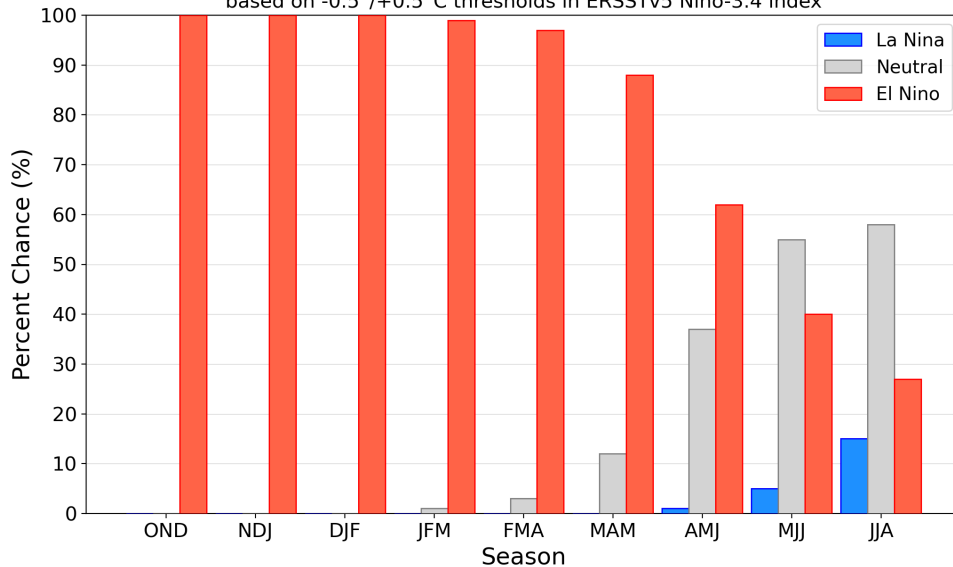
<https://www.cpc.ncep.noaa.gov>



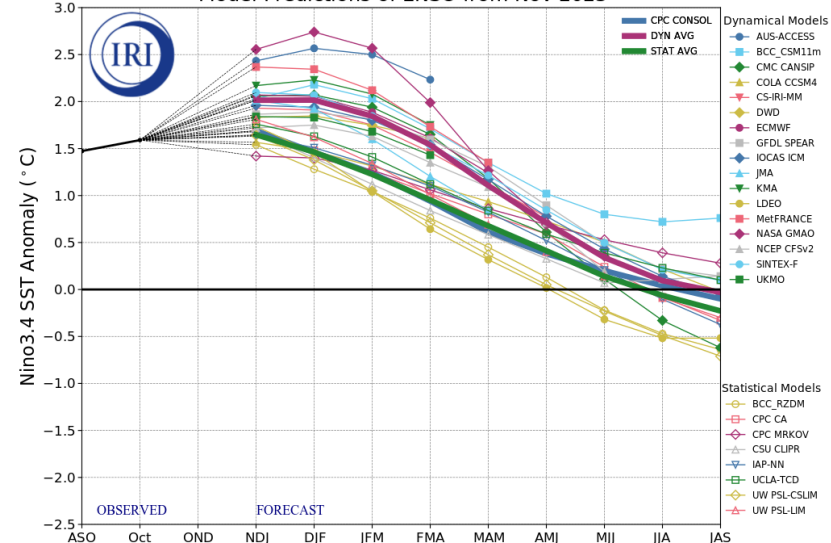
What's the ENSO forecast?

Official NOAA CPC ENSO Probabilities (issued Nov. 2023)

based on $-0.5^{\circ}/+0.5^{\circ}\text{C}$ thresholds in ERSSTv5 Niño-3.4 index



Model Predictions of ENSO from Nov 2023



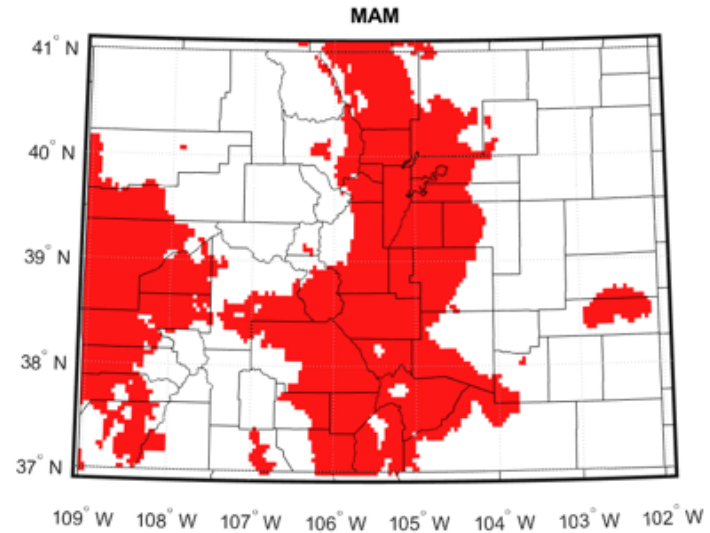
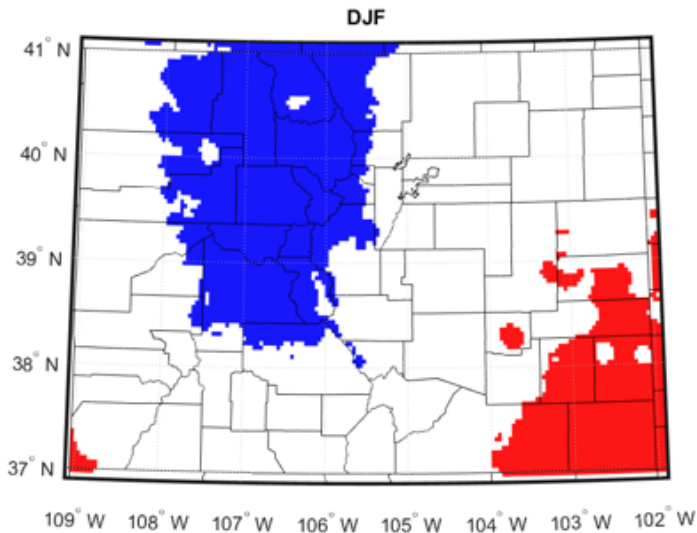
CPC/IRI November 20, 2023: As of mid-Nov 2023, El Niño conditions in the central-eastern equatorial Pacific remain strong with key oceanic and atmospheric variables consistent with an ongoing El Niño event. A CPC El Niño advisory remains in place for November 2023. Almost all the models in the IRI ENSO prediction plume forecast a continuation of the El Niño event during the boreal winter and early boreal spring of 2024, which rapidly weakens thereafter. ENSO-neutral conditions become the most likely category in May-Jul, of 2024, and remain so during rest of the forecast period.

<https://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/>



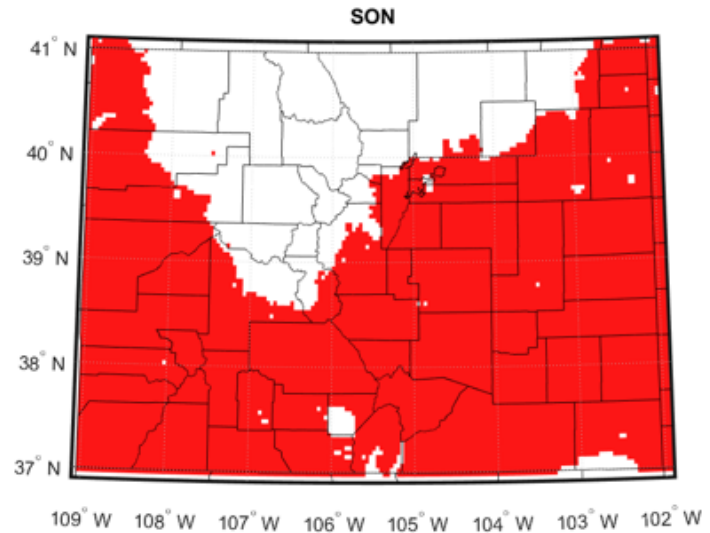
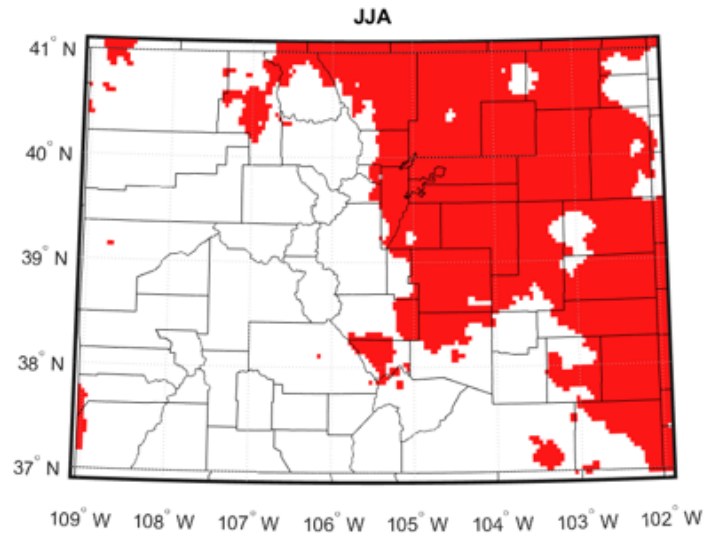
What does El Niño mean for
the upcoming cold season?

General Relationship Between Colorado Precipitation and El Niño Southern Oscillation (1951-2020)



Red: El Niño tends wetter

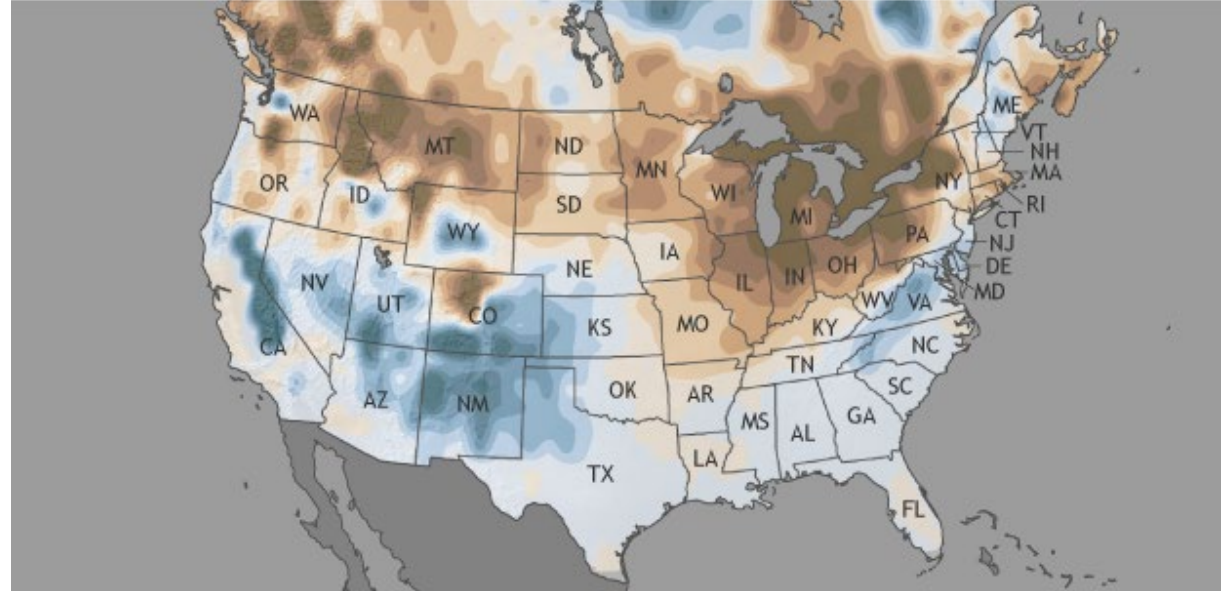
Blue: La Niña tends wetter



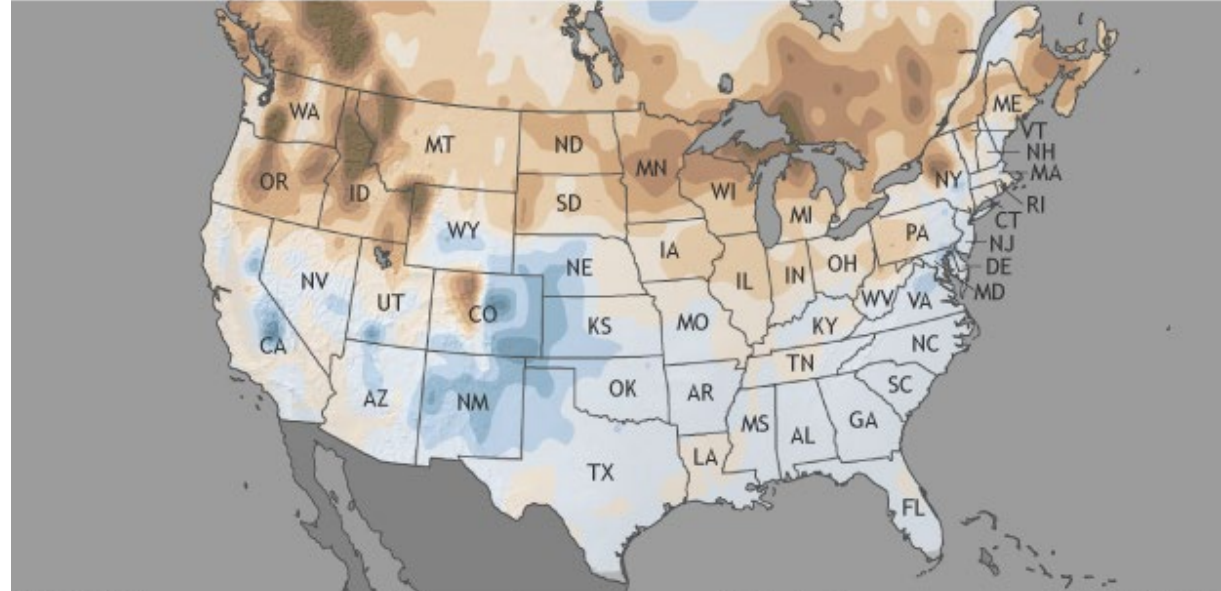
Snow during El Niño winters (1950-2009)
10 strongest events

Snow and El Niño

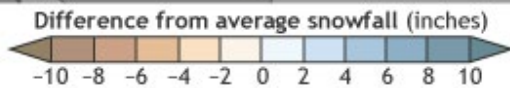
<https://climate.gov>



All events



October-April
compared to 1950-2009



NOAA Climate.gov
Data: Rutgers/CPC



Key Takeaways

- ❑ Current Conditions
 - ❑ We finished Water Year 2023 cooler and wetter
 - ❑ Water Year 2024 has started out warmer and drier
 - ❑ Drought conditions have expanded
 - ❑ Given current conditions, more drought expansion is expected
- ❑ What can we expect with El Nino?
 - ❑ With the favoring to the southern mountains, drought recovery is possible
 - ❑ Drought expansion could be in the cards for the northern mountains
 - ❑ Of course that relationship is never perfect!
 - ❑ As always, expect some cold snaps and snowy conditions.



Becky.Bolinger@colostate.edu

 @ClimateBecky

climate.colostate.edu

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

Thank you



ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY