

Colorado Climate Update – A look at WY2021 and October 2021

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Assistant State Climatologist

Water Availability Task Force

November 4, 2021



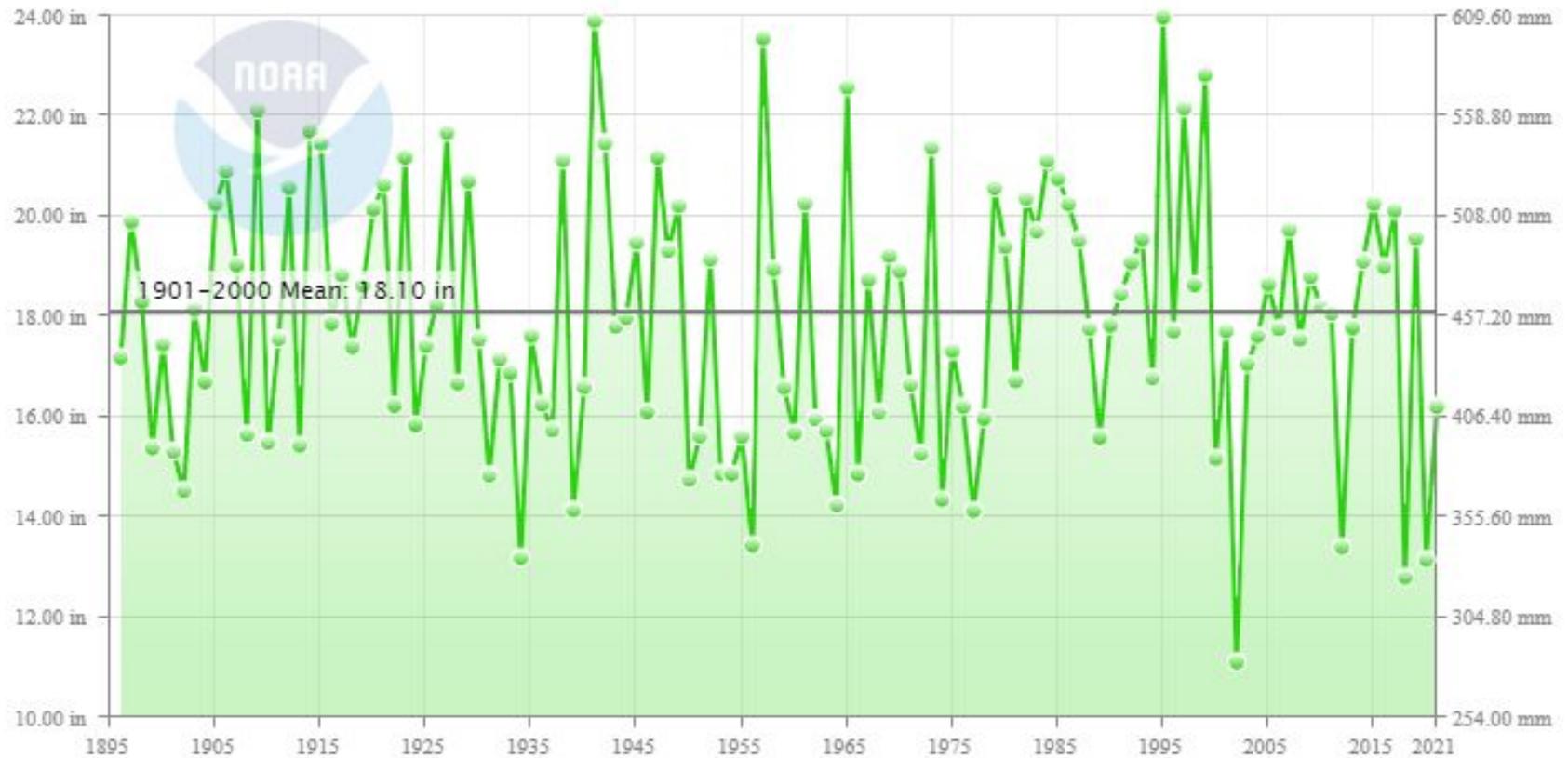
ATMOSPHERIC SCIENCE
COLORADO STATE UNIVERSITY

A look back at Water Year 2021



Colorado Precipitation

October–September



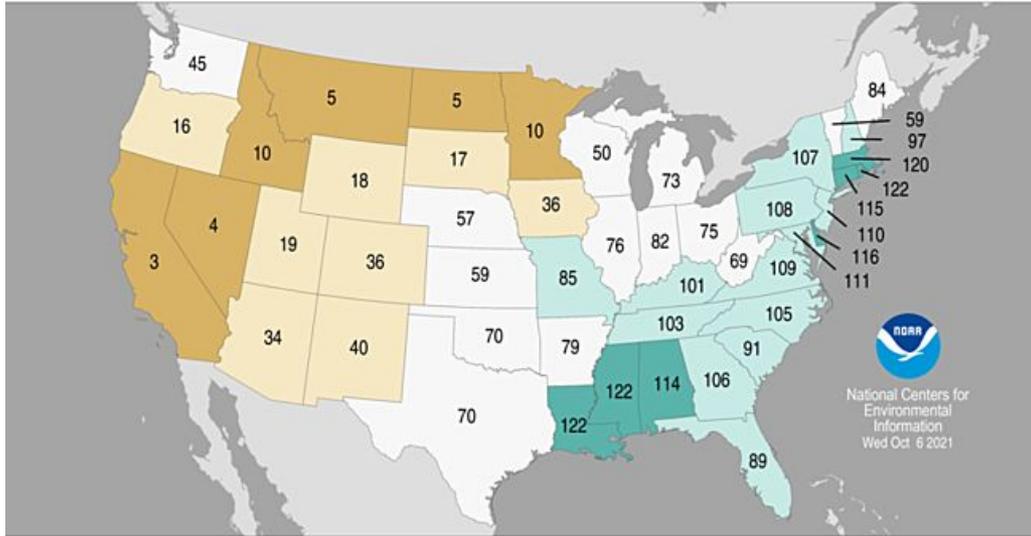
Water Year 2021 ranked as the 36th driest on record for Colorado. Precipitation 16.21", which is 1.89" below the long-term average.



Statewide Precipitation Ranks

October 2020 – September 2021

Period: 1895–2021



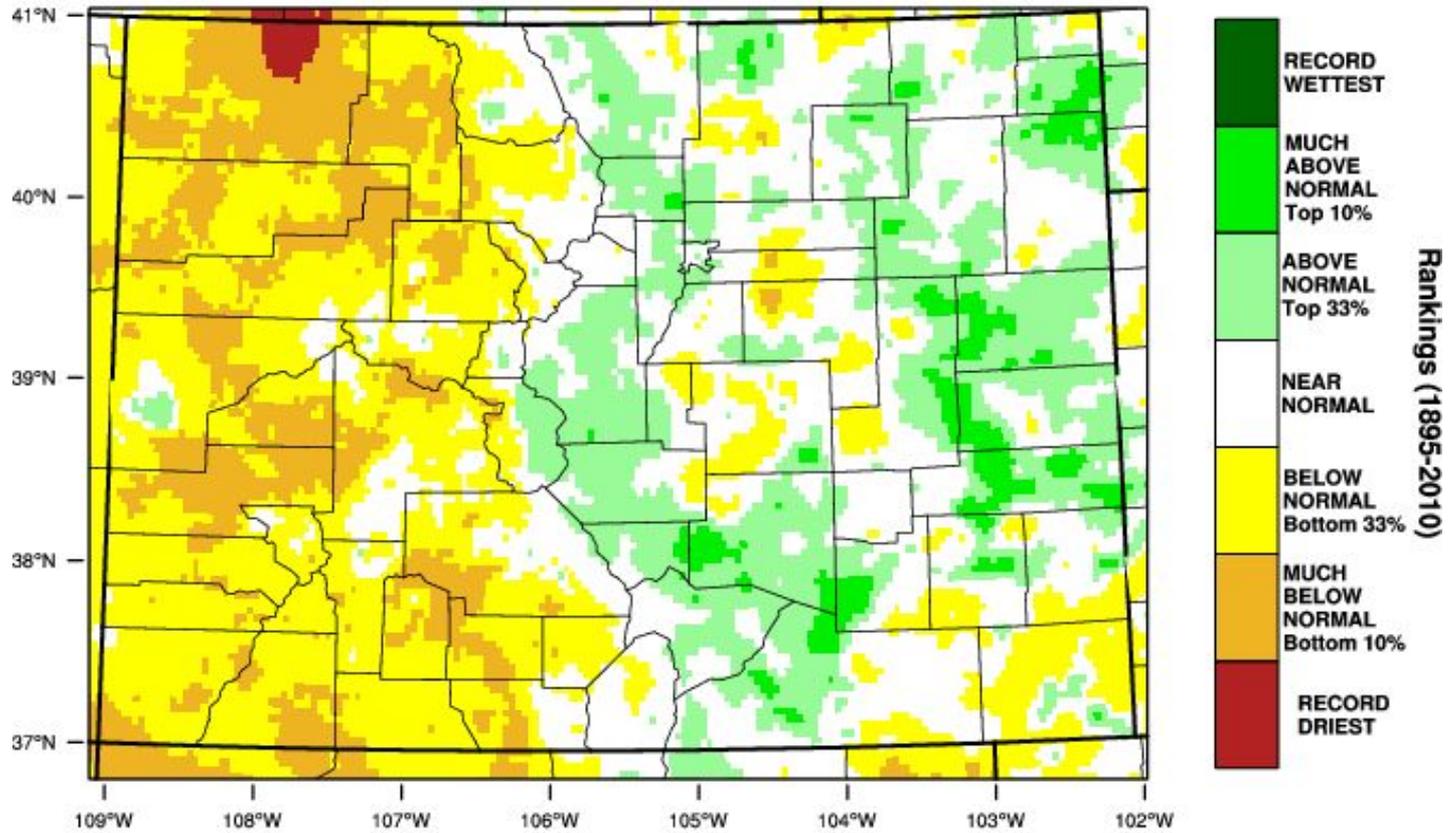
<https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

Month	P Rank (of 127 years)	Above, below, or near 20 th century avg?
Oct	16 th driest	below
Nov	44 th driest	near avg
Dec	59 th driest	near avg
Jan	38 th driest	below
Feb	71 st driest	near avg
Mar	20 th wettest	above
Apr	18 th driest	below
May	11 th wettest	much above
Jun	50 th driest	near avg
Jul	64 th driest	near avg
Aug	19 th driest	below
Sep	53 rd driest	near avg



Colorado - Precipitation

October-September 2021 Percentile

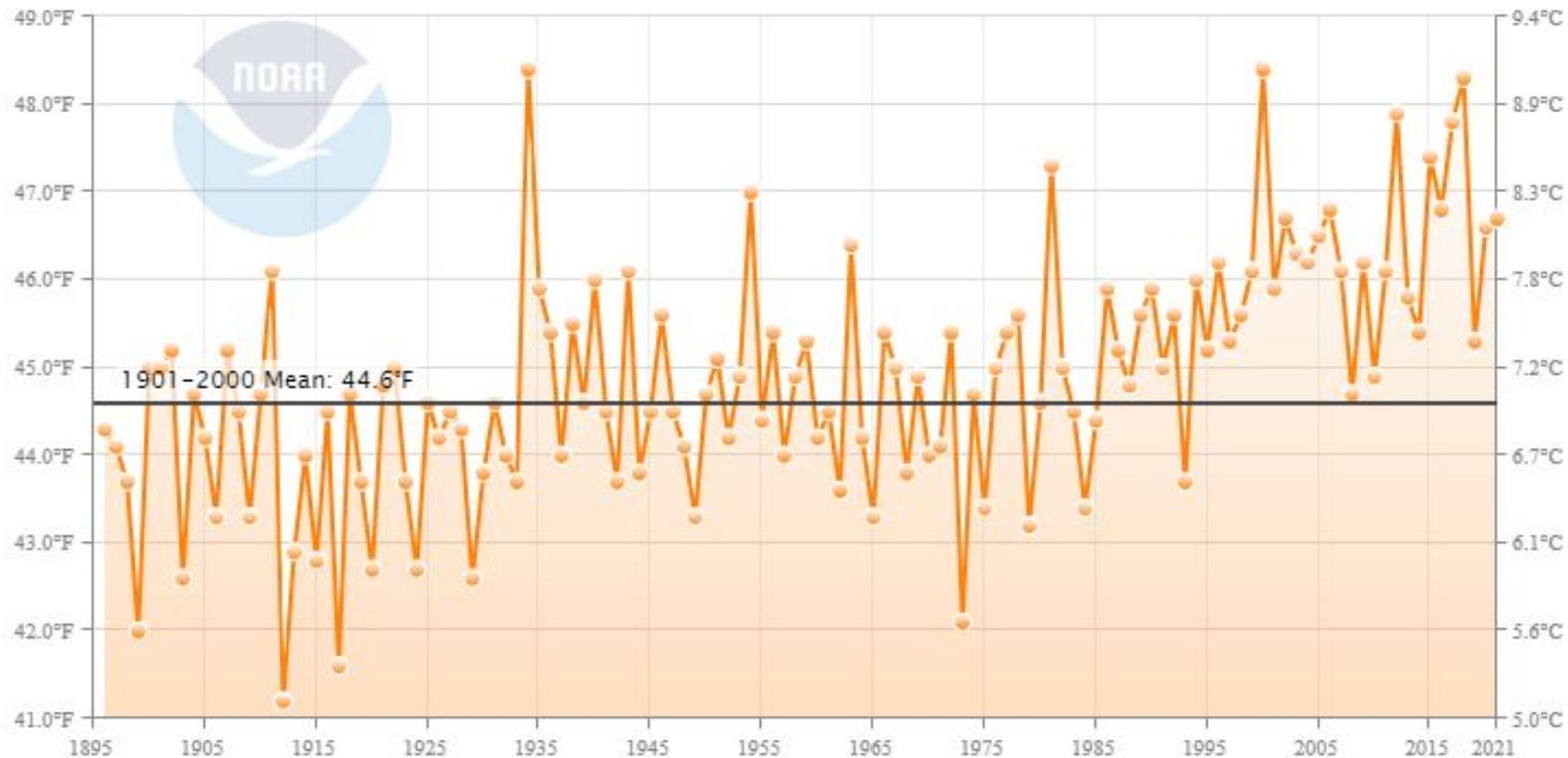


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 5 OCT 2021



Colorado Average Temperature

October–September

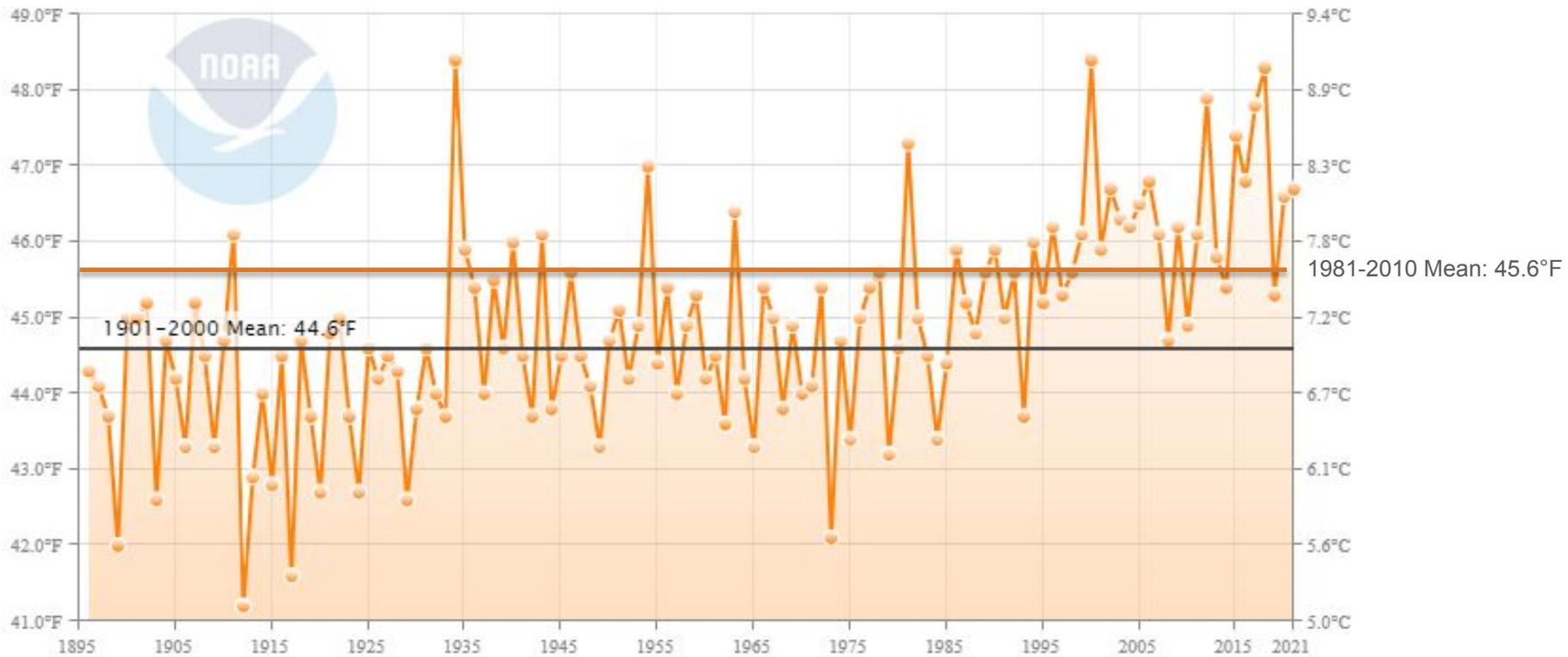


Water Year 2021 ranked as the 11th warmest on record for Colorado. Average temperature was 46.7°F, which is 2.1° above the long-term average.



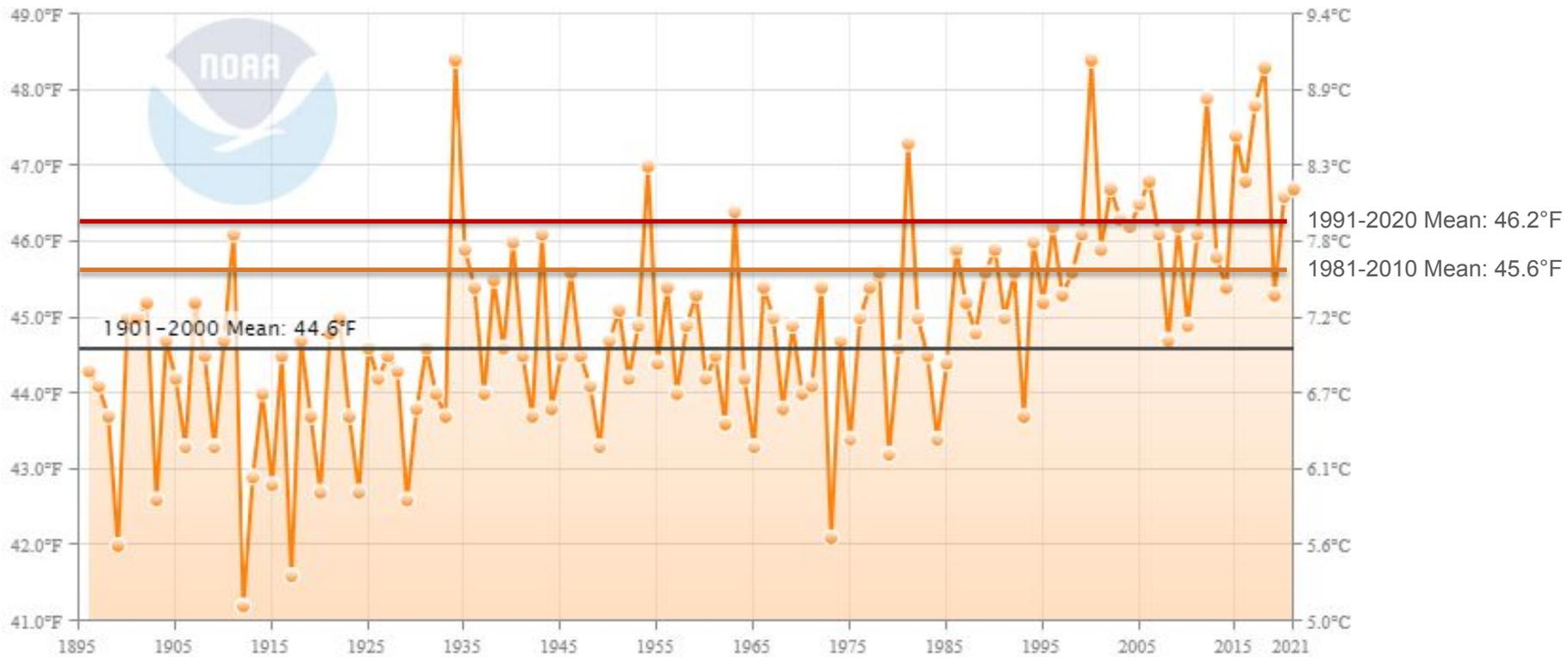
Colorado Average Temperature

October–September



Colorado Average Temperature

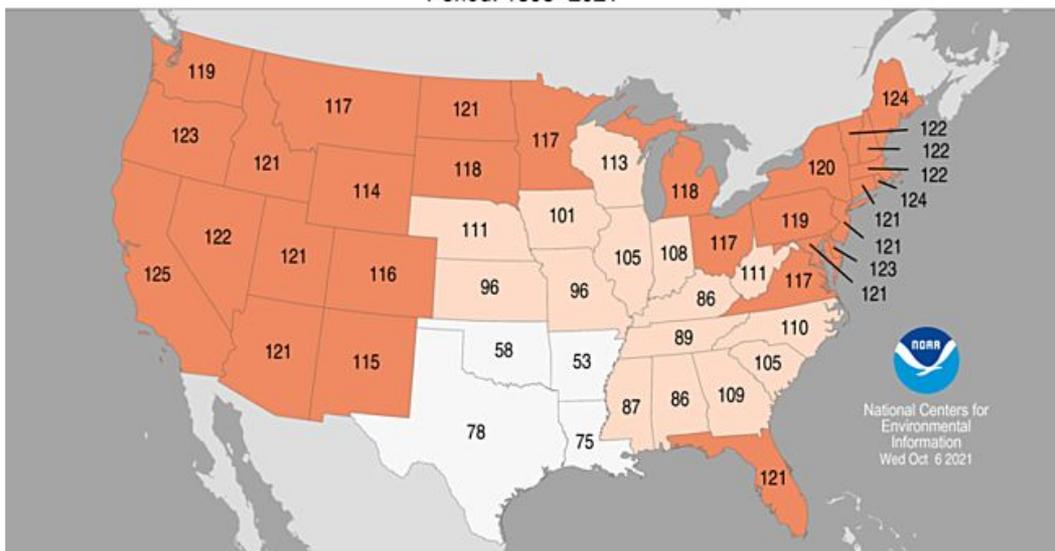
October–September



Statewide Average Temperature Ranks

October 2020 – September 2021

Period: 1895–2021

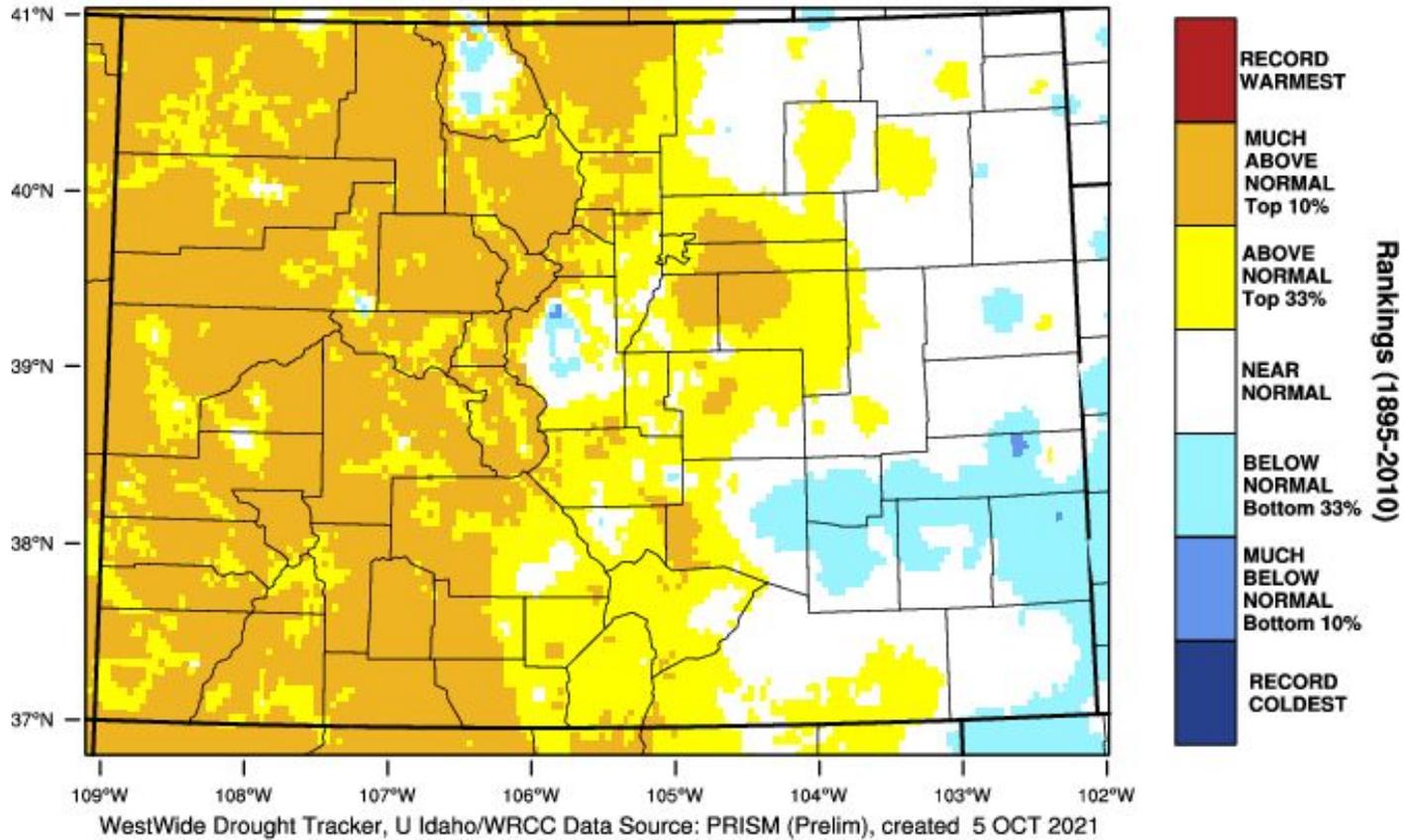


<https://www.ncdc.noaa.gov/temp-and-precip/us-maps/>

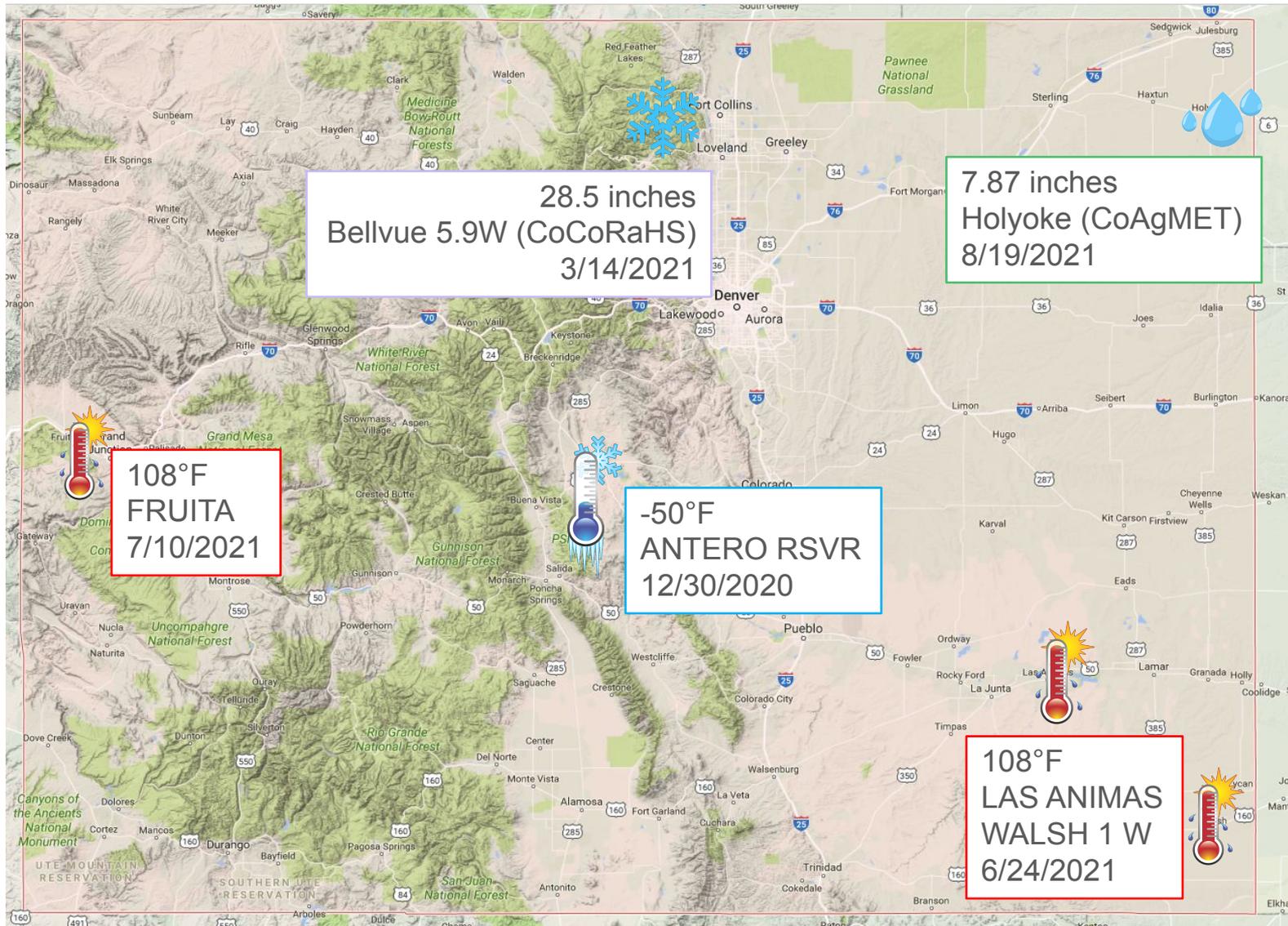
Month	T Rank (of 127 years)	Above, below, or near 20 th century avg?
Oct	52 nd warmest	near avg
Nov	7 th warmest	much above
Dec	46 th warmest	near avg
Jan	33 rd warmest	above
Feb	26 th coolest	below
Mar	46 th warmest	near avg
Apr	69 th warmest	near avg
May	50 th warmest	near avg
Jun	6 th warmest	much above
Jul	11 th warmest	much above
Aug	15 th warmest	above
Sep	3 rd warmest	much above



Colorado - Mean Temperature October-September 2021 Percentile



WY2021 extremes around the state

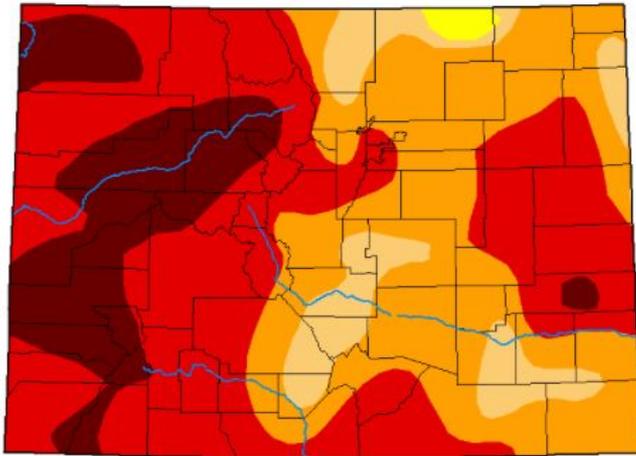


Daily records broken in Water Year 2021

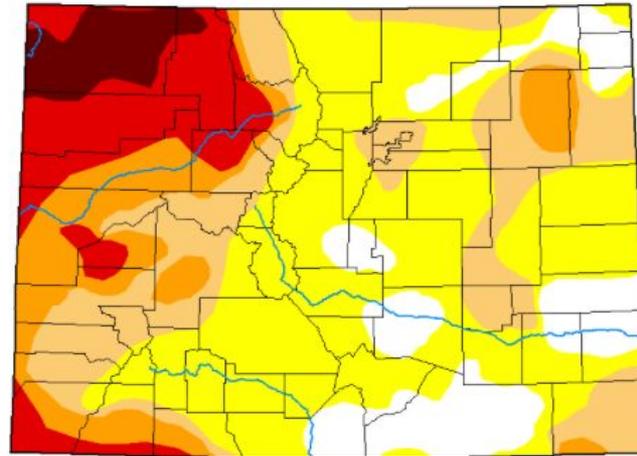
Month	High max T	High min T	Low max T	Low min T	Precipitation	Snowfall
October	437	365	233	374	35	42
November	352	388	31	13	64	9
December	216	70	33	22	60	27
January	35	69	20	14	72	31
February	34	64	241	175	101	64
March	63	85	24	20	140	64
April	293	158	106	131	38	39
May	86	139	83	29	127	26
June	679	450	131	15	85	0
July	110	320	16	12	133	0
August	63	149	4	85	9	0
September	447	249	30	2	55	0
TOTAL	2815	2506	952	892	919	302
	warm records: 5321		cold records: 1844			



Evolution of drought in WY2021



10/6/2020

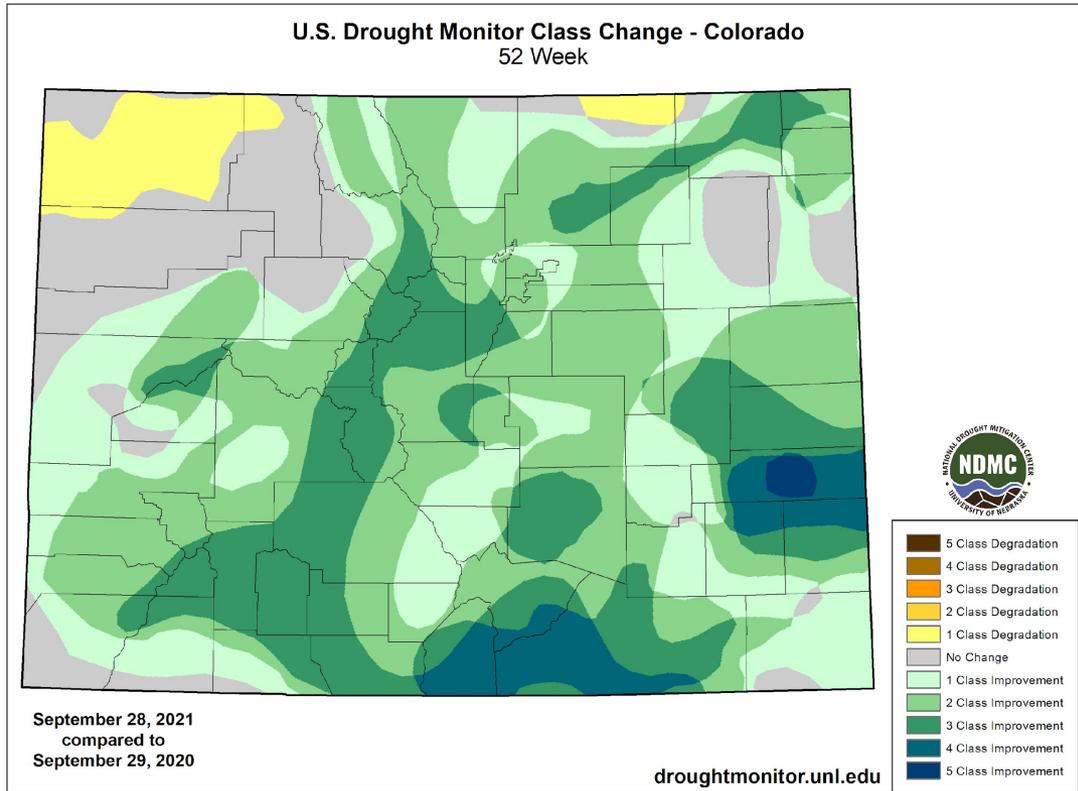


9/28/2021

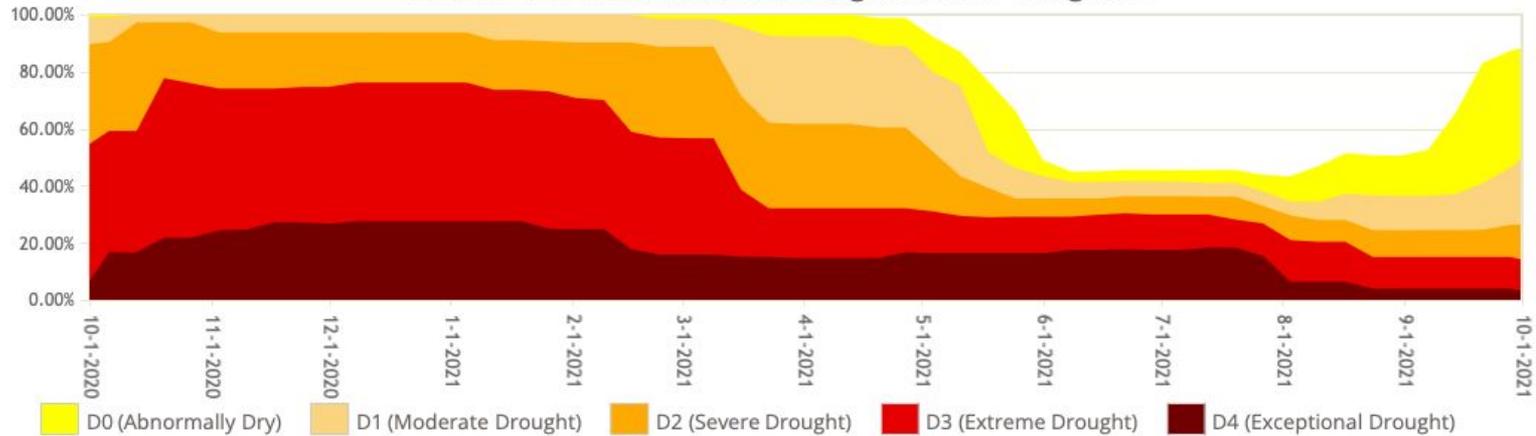
Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
2020-10-06	0.00	100.00	99.30	90.39	59.23	16.72
2021-09-28	12.72	87.28	46.42	26.30	15.05	3.91
Change	12.72	-12.72	-52.88	-64.09	-44.18	-12.81



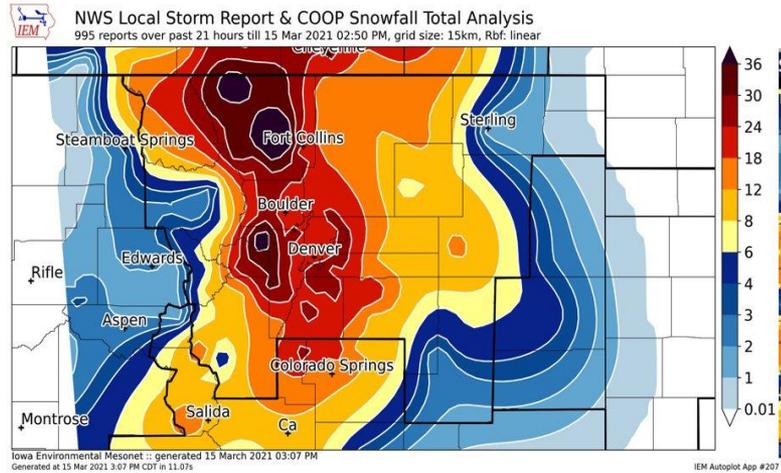
Evolution of drought in WY2021



Colorado Percent Area in U.S. Drought Monitor Categories



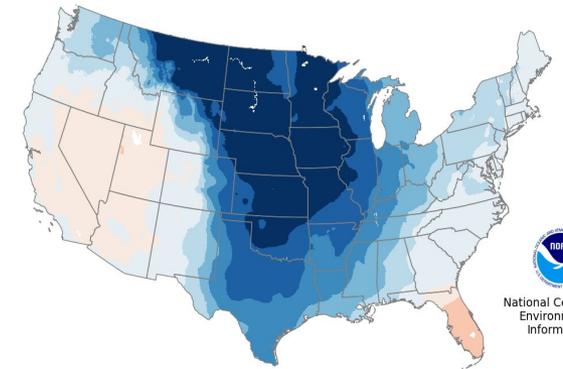
Significant events of WY2021



Pi Day Blizzard

Mean Temperature Departures from Average

February 7-21 2021
Average Period: 1981-2010



Created: Tue Mar 09 2021
Scaled data

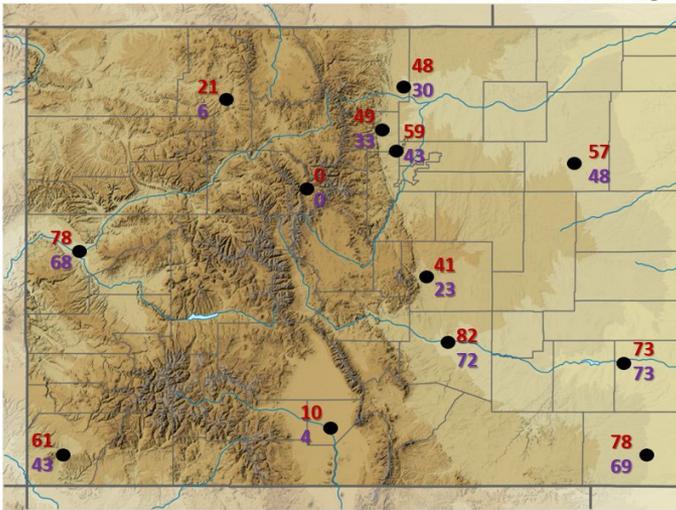
Degrees Fahrenheit

Data Source: 5km Gridded
(nClimGrid-Daily) Beta

February cold outbreak

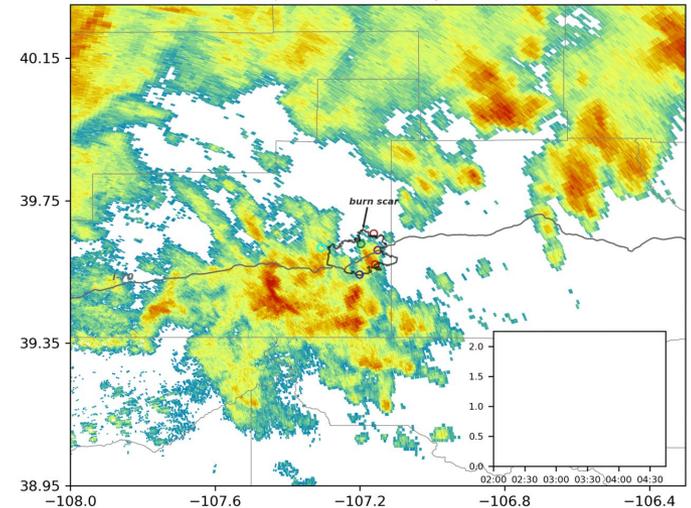
Number of 90 Degree Days in 2021

2021
1991-2020 average



City	N Days	1991-2020 Average	Rank	Records Begin
Fort Collins	48	30	3 rd	1893
Boulder	50	33	10 th	1893
Denver	61	43	4 th	1948
Colorado Springs	41	23	4 th	1948
Pueblo	87	72	4 th	1954
Akron	59	48	9 th	1937
Lamar	78	73	62 nd	1893
Walsh	84	69	5 th	1967
Dillon	0	0	---	1910
Alamosa	10	4	3 rd	1948
Steamboat Springs	21	6	4 th	1893
Grand Junction	78	68	9 th	1900
Cortez	61	43	3 rd	1911

KGJX 0.0 Deg. 2021-07-30T02:04:46.940000Z
Equivalent reflectivity factor



Check out the summary and extended
summary!

tinyurl.com/wy2021-climate



Water Year 2022

Temperature

Precipitation

Evaporative Demand

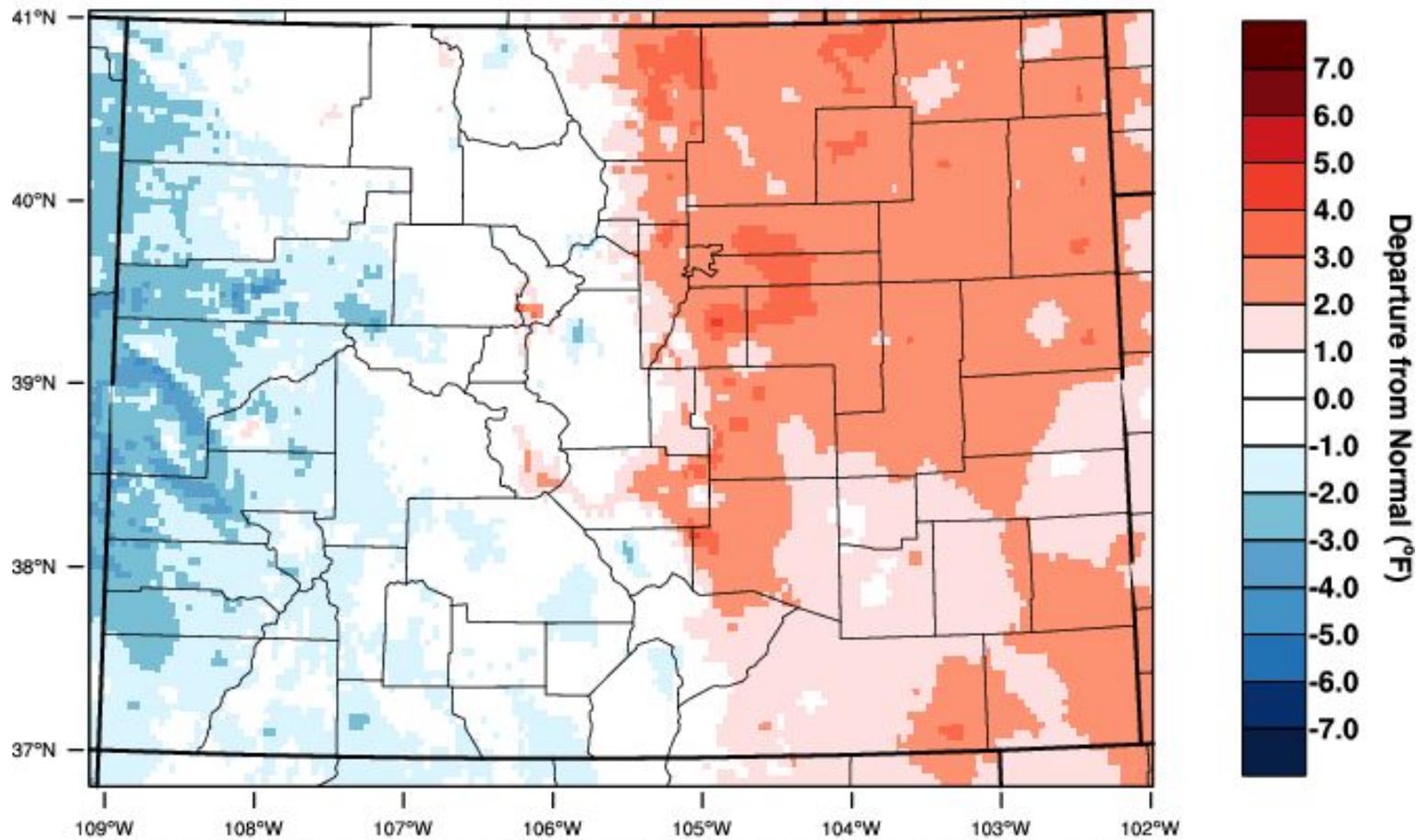
Soil Moisture

Vegetation



Colorado - Mean Temperature

October 2021 Departure from 1981-2010 Normal



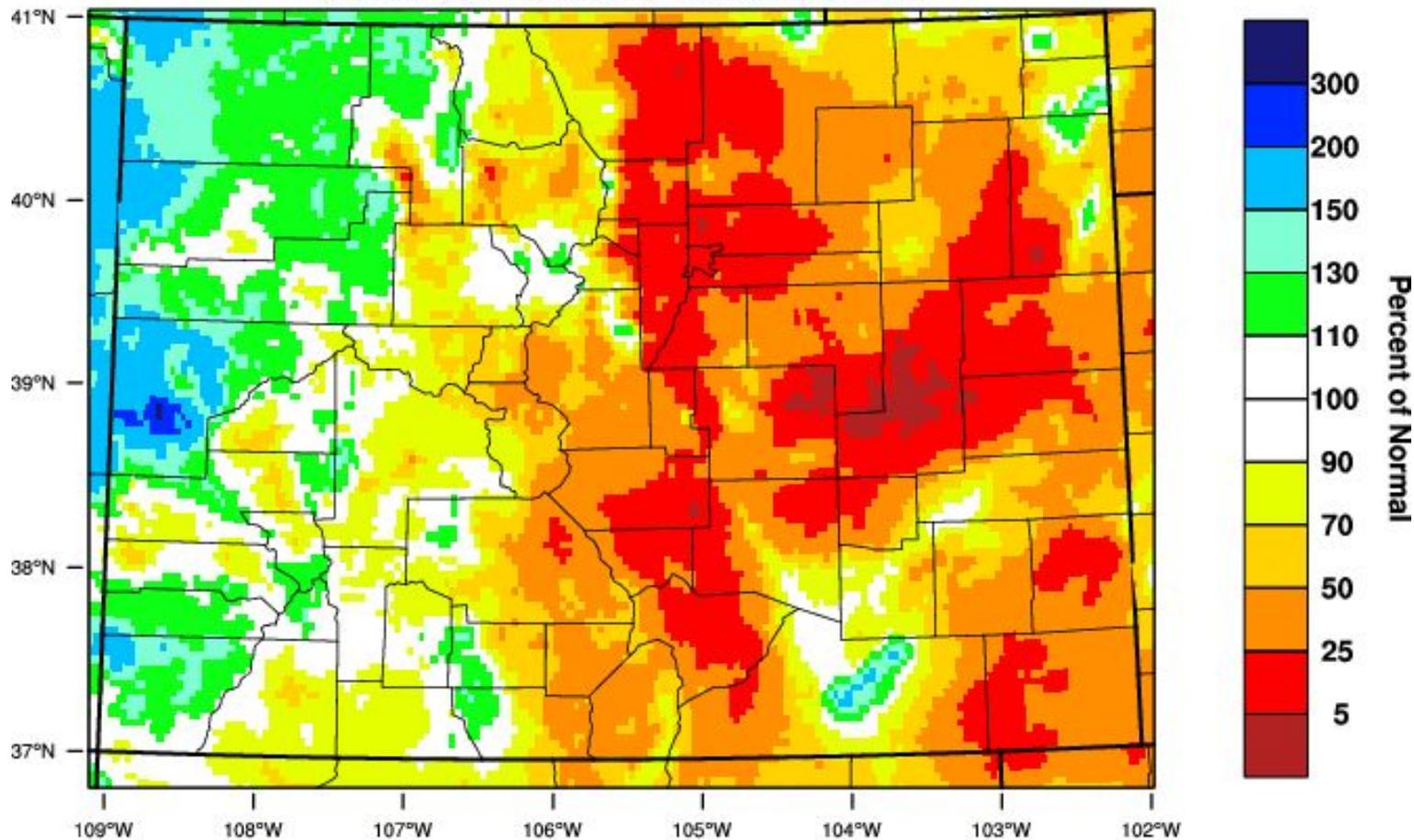
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 2 NOV 2021

<https://wrcc.dri.edu/wwdt/index.php?region=co>



Colorado - Precipitation

October 2021 Percent of 1981-2010 Normal

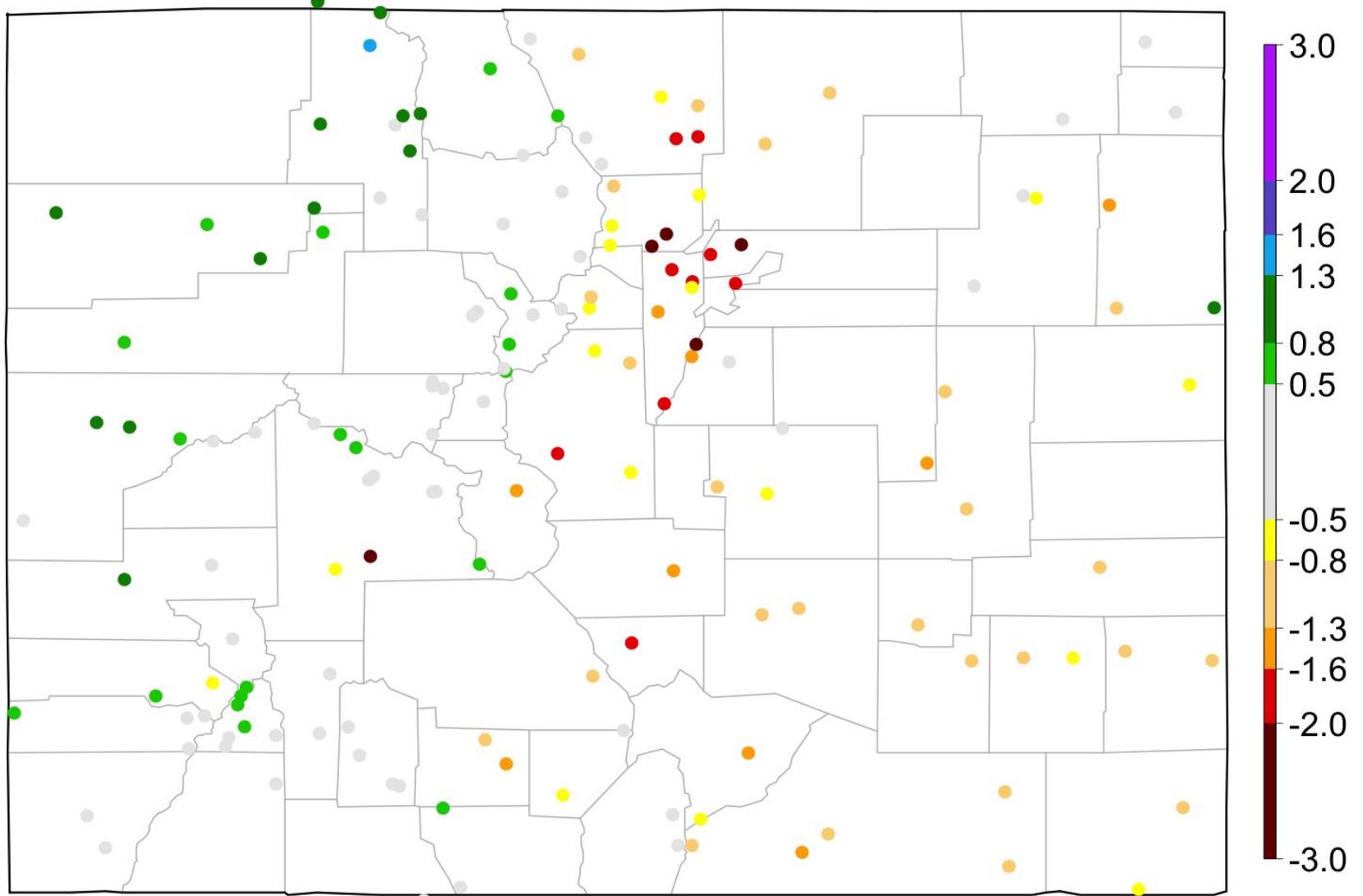


WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 2 NOV 2021

<https://wrcc.dri.edu/wwdt/index.php?region=co>



30-day SPI: 2021/10/03 - 2021/11/01

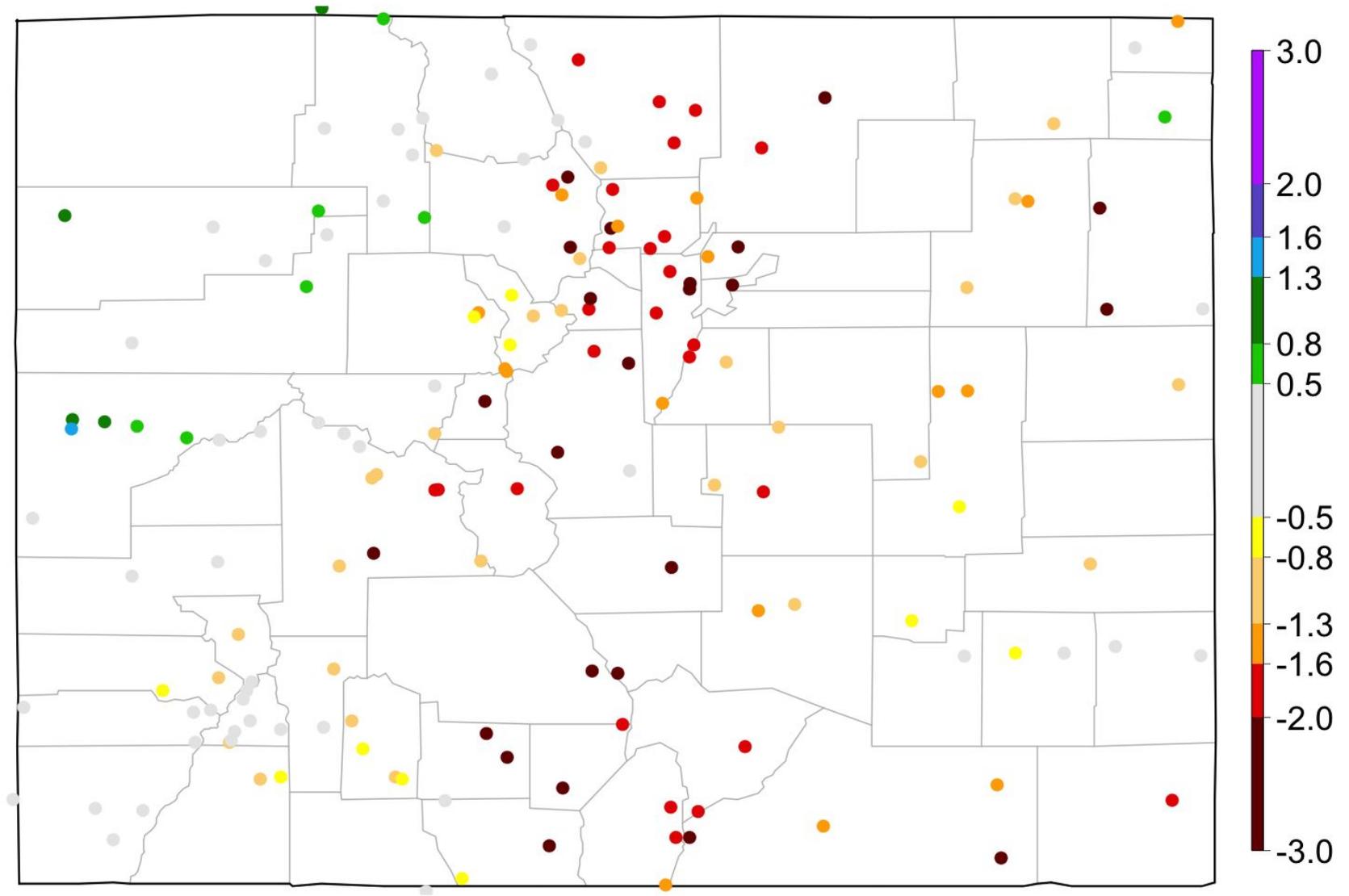


Data from High Plains Regional Climate Center and ACIS

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



90-day SPI: 2021/08/04 - 2021/11/01

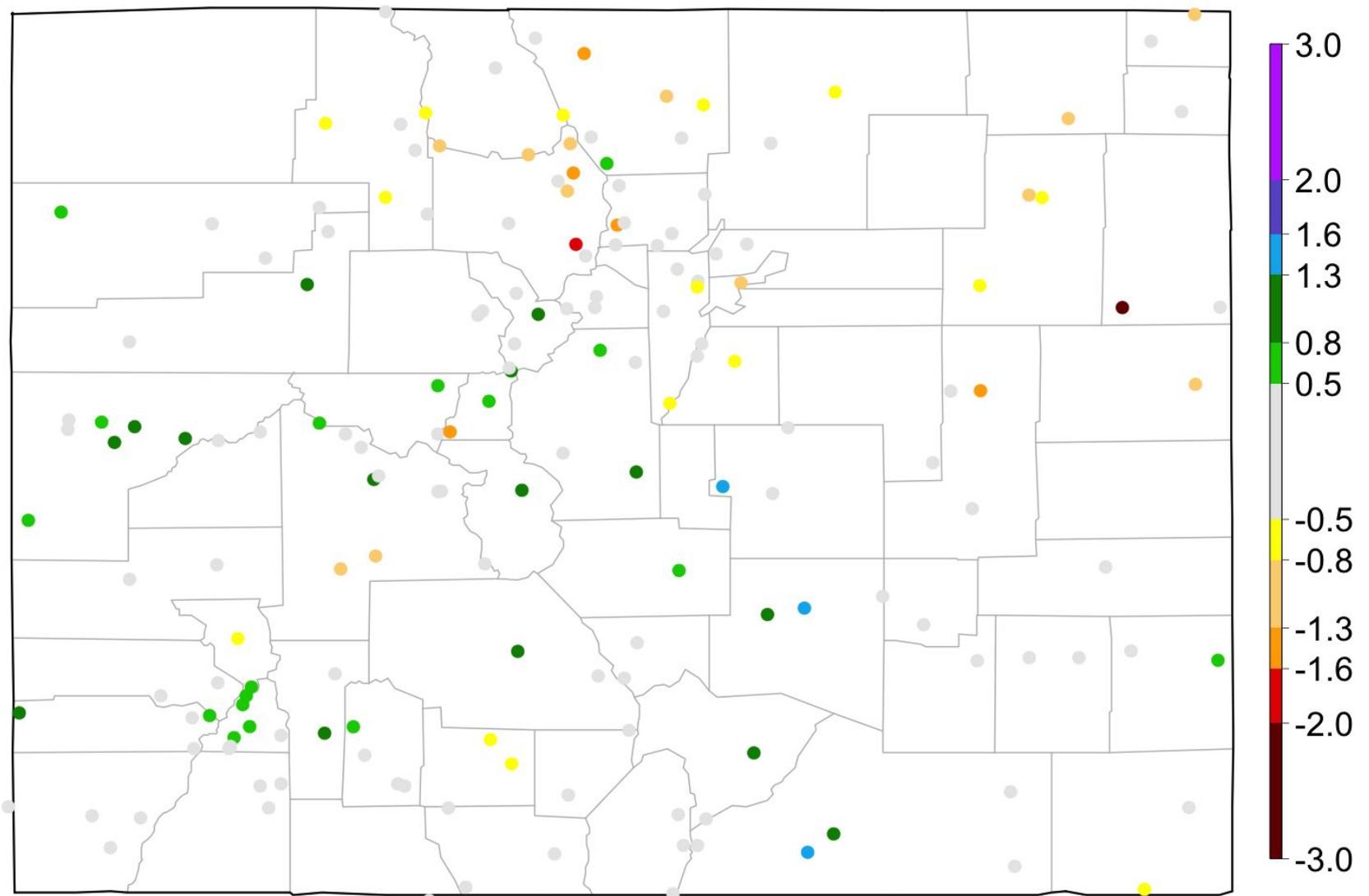


Data from High Plains Regional Climate Center and ACIS

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



6-month SPI: 2021/05/02 - 2021/11/01

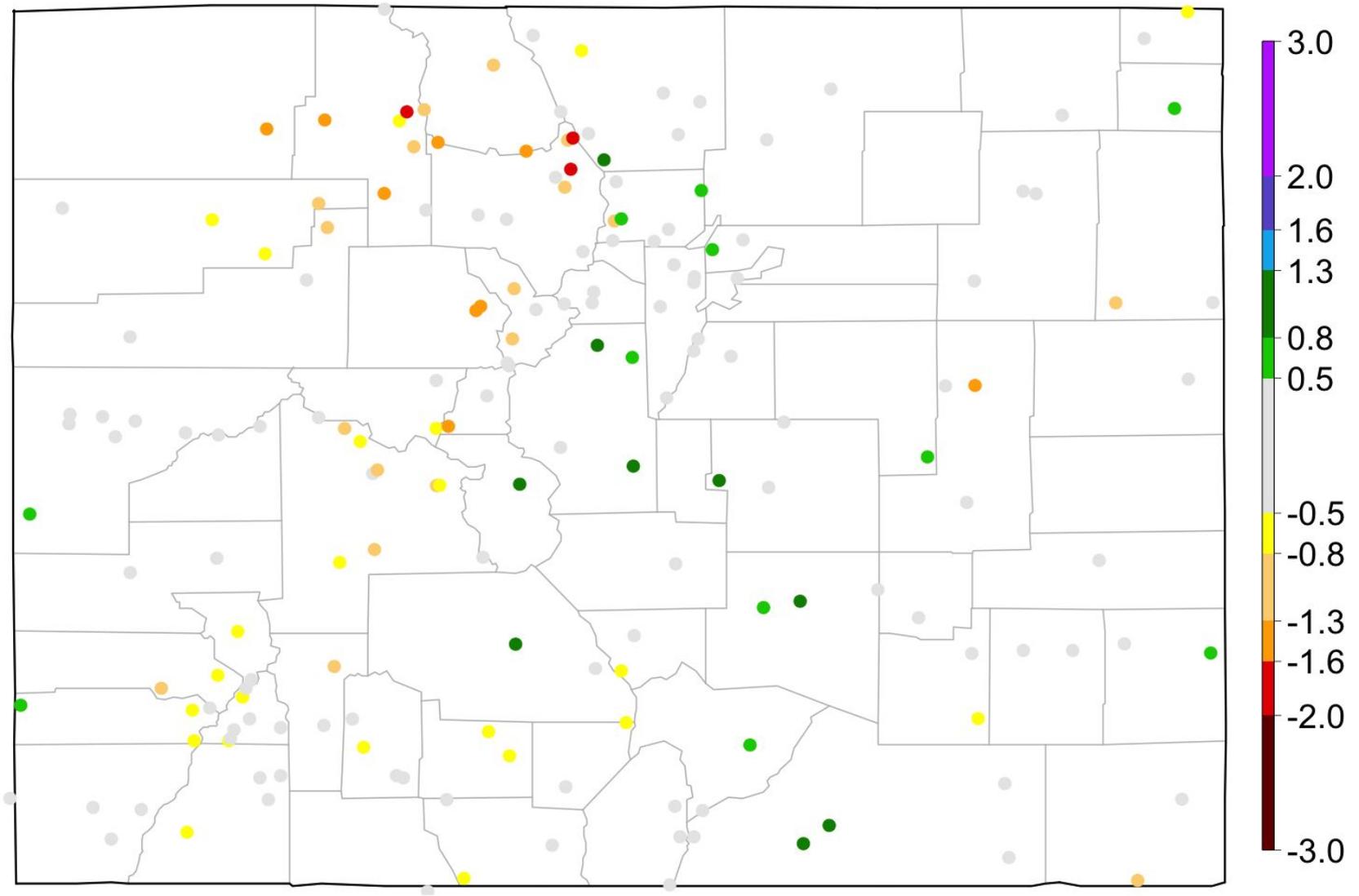


Data from High Plains Regional Climate Center and ACIS

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



Year-to-date SPI: 2021/01/01 - 2021/11/01

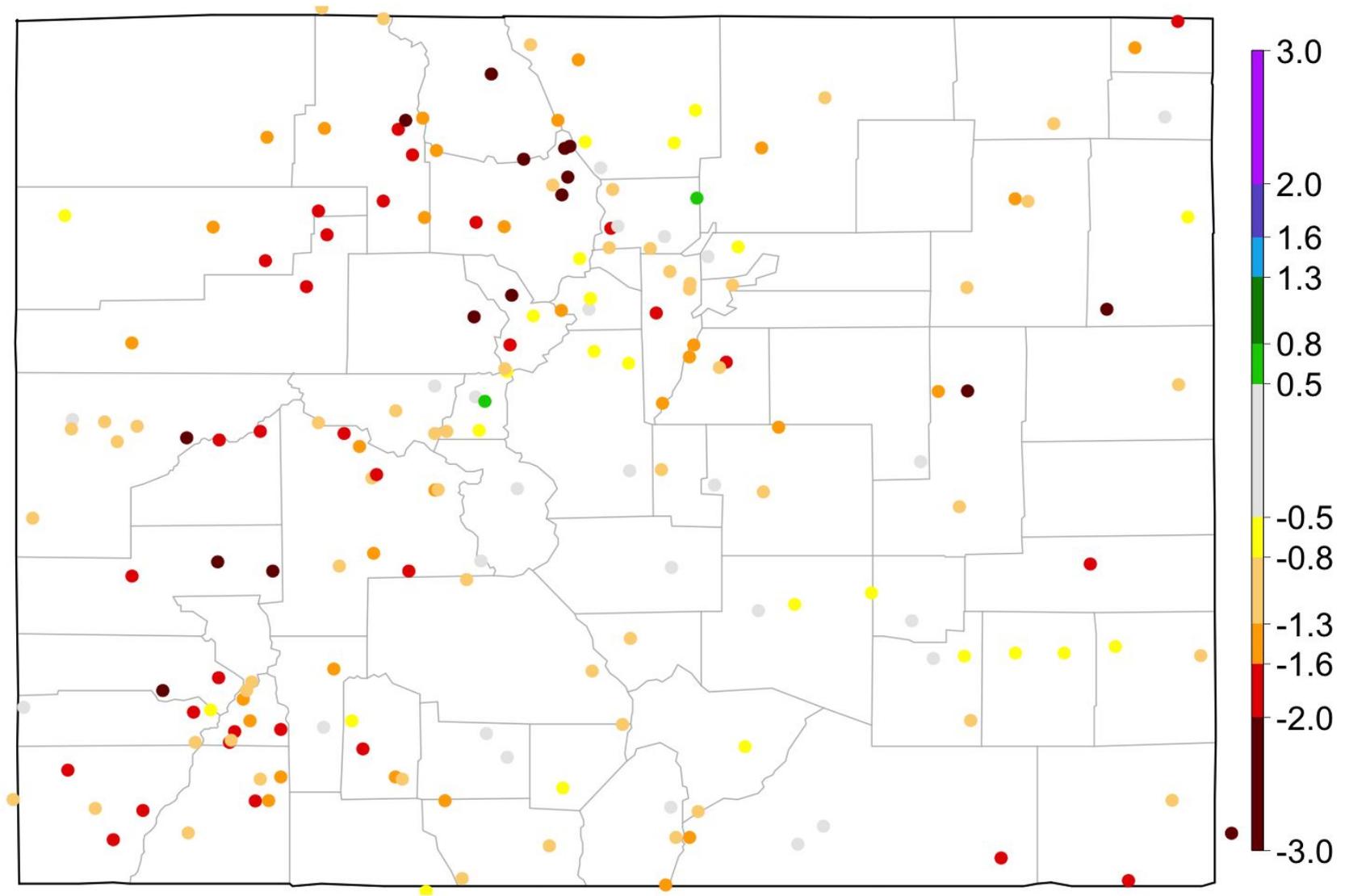


Data from High Plains Regional Climate Center and ACIS

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



24-month SPI: 2019/11/02 - 2021/11/01

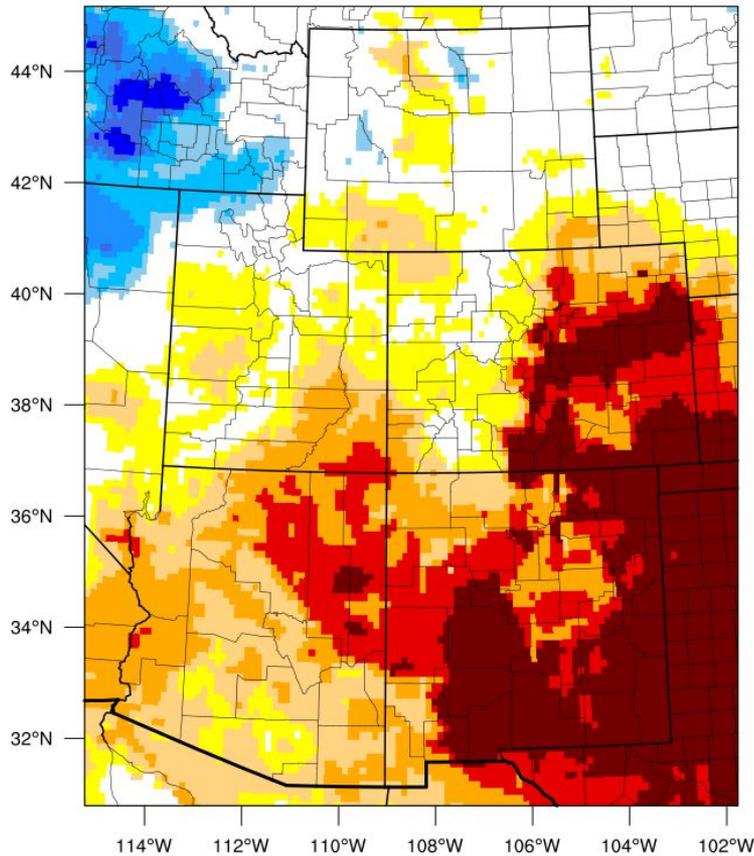


Data from High Plains Regional Climate Center and ACIS

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

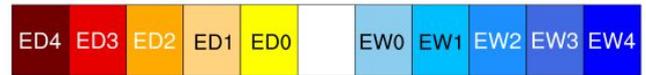


1-week EDDI categories for October 29, 2021



Drought categories

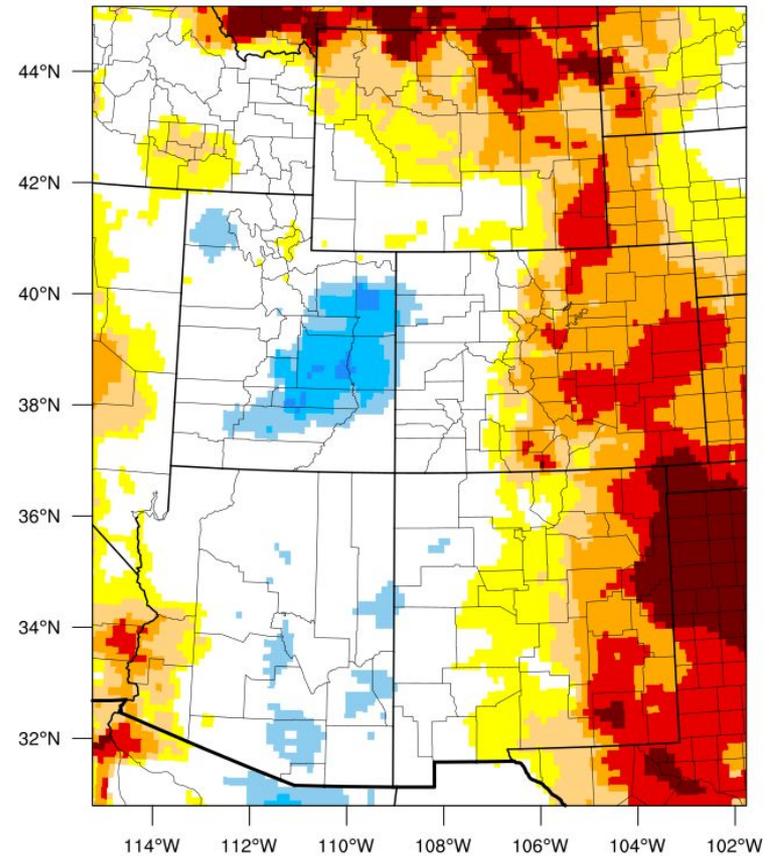
Wetness categories



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

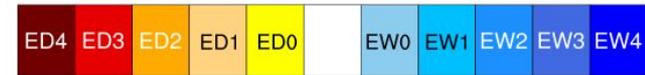
Generated by NOAA/ESRL/Physical Sciences Laboratory

2-month EDDI categories for October 29, 2021



Drought categories

Wetness categories



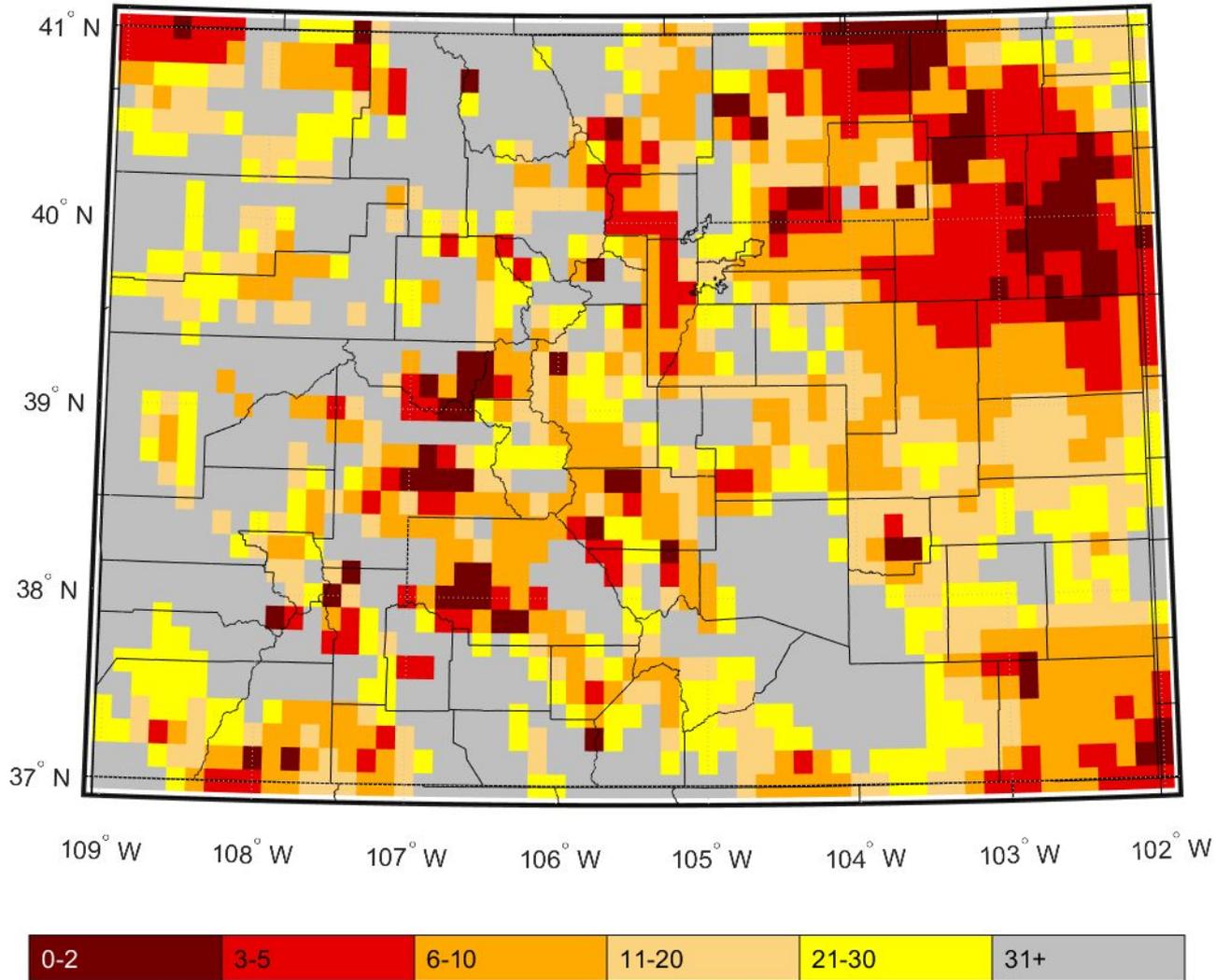
100% 98% 95% 90% 80% 70% 30% 20% 10% 5% 2% 0%
 (EDDI-percentile category breaks: 100% = driest; 0% = wettest)

Generated by NOAA/ESRL/Physical Sciences Laboratory

psl.noaa.gov/eddi



Top Meter Soil Moisture Percentile 10/26/2021



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



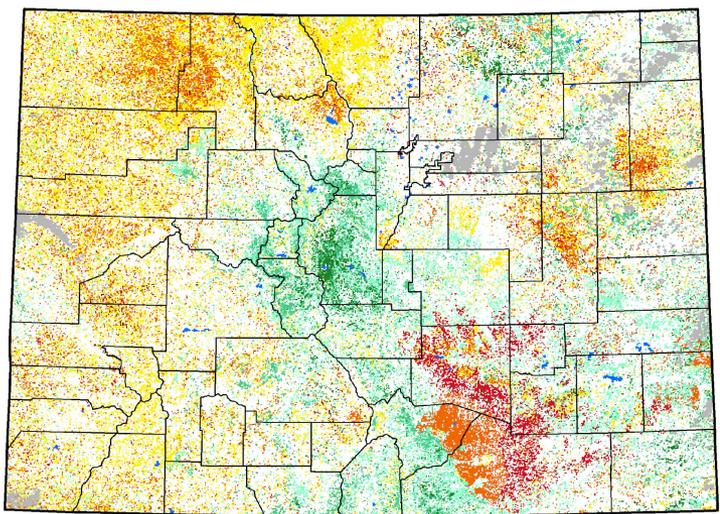
Vegetation Drought Response Index

Complete: Colorado

October 3, 2021

Vegetation Condition

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



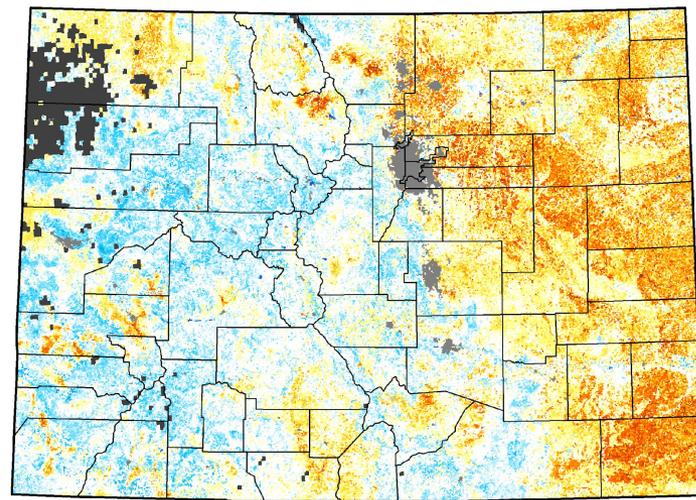
Quick Drought Response Index

Colorado

October 31, 2021
(Week 44)

Conditions Relative to
4-Week Historical Average

- Wetter
- Near Average
- Drier
- Out of Season
- Urban
- No Data
- Water



vegdiri.unl.edu
quickdri.unl.edu





Drought

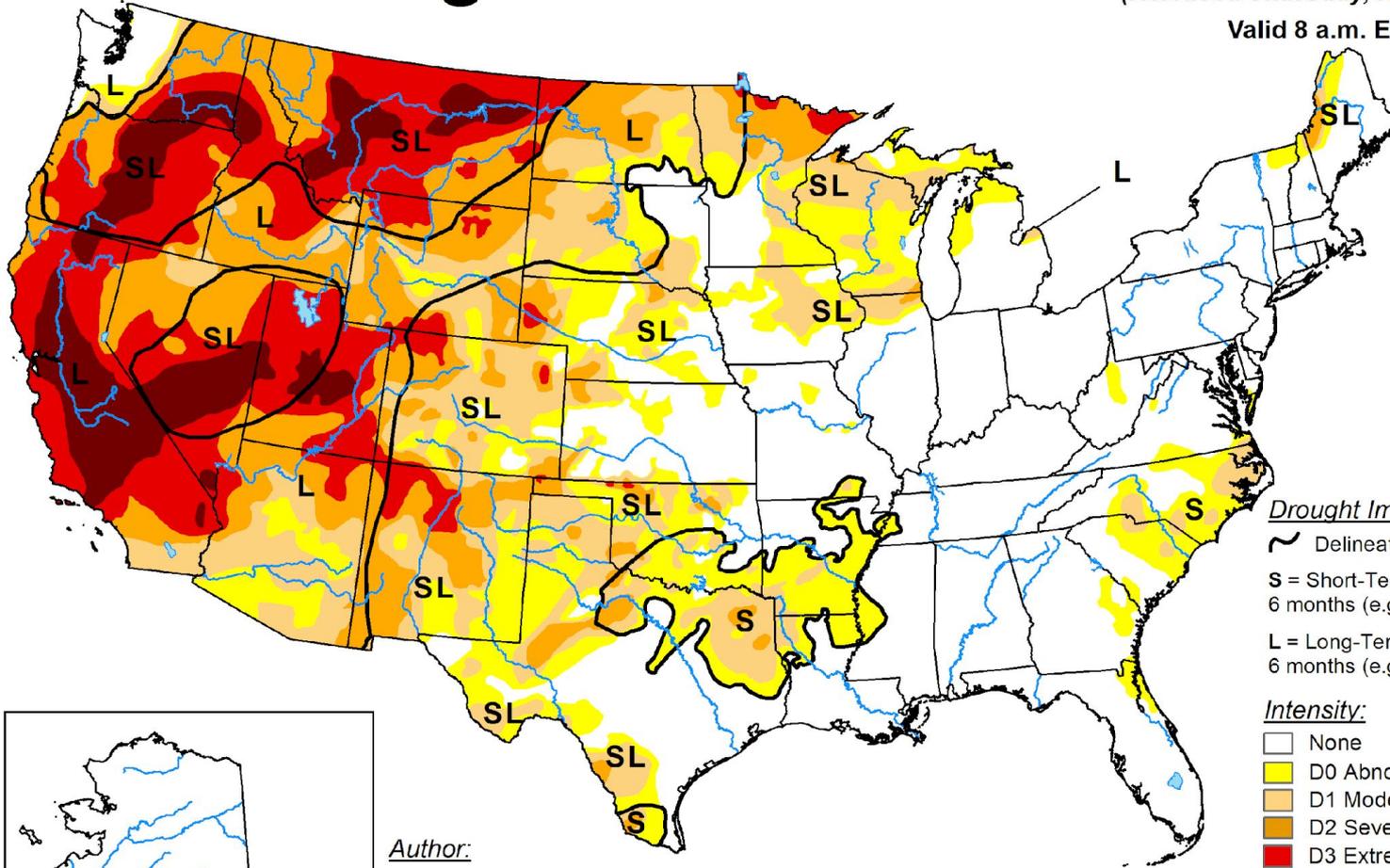
National Drought
Colorado Drought
Some Drought Facts



U.S. Drought Monitor

November 2, 2021
(Released Thursday, Nov. 4, 2021)

Valid 8 a.m. EDT

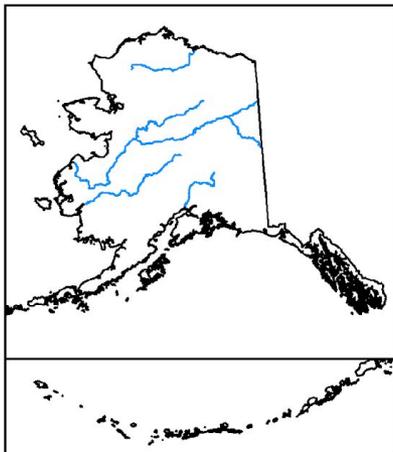


Drought Impact Types:

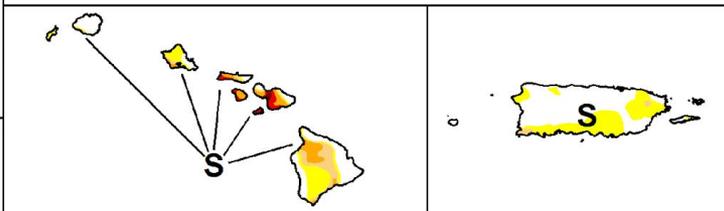
- ~ Delineates dominant impacts
- S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

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



Author:
Adam Hartman
NOAA/NWS/NCEP/CPC



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



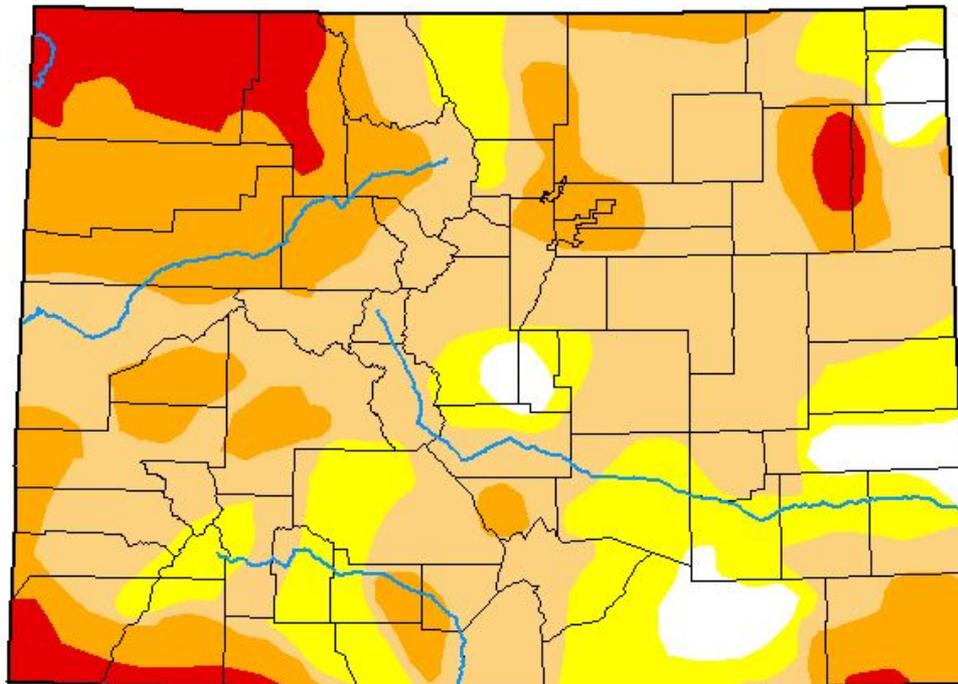
U.S. Drought Monitor

Colorado

November 2, 2021
 (Released Thursday, Nov. 4, 2021)
 Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4.44	95.56	76.77	30.46	6.93	0.00
Last Week <i>10-26-2021</i>	4.44	95.56	74.89	29.73	11.13	1.95
3 Months Ago <i>08-03-2021</i>	56.64	43.36	34.52	29.61	20.96	6.38
Start of Calendar Year <i>12-29-2020</i>	0.00	100.00	100.00	93.73	76.17	27.60
Start of Water Year <i>09-28-2021</i>	12.72	87.28	46.42	26.30	15.05	3.91
One Year Ago <i>11-03-2020</i>	0.00	100.00	100.00	93.71	74.08	24.39



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:

Adam Hartman
 NOAA/NWS/NCEP/CPC



droughtmonitor.unl.edu



The last time we had 0% D4
drought in Colorado was
August 18, 2020.

The duration of D4 drought lasted over a year for Moffat County!
How does that compare to other counties in the state?

Rank	FIPS	StartDate	EndDate	ConsecutiveWeeks	State	County
1	8011	7/5/12	8/7/14	108	CO	Bent County
2	8025	7/5/12	8/7/14	108	CO	Crowley County
3	8061	7/5/12	8/7/14	108	CO	Kiowa County
4	8089	7/5/12	8/7/14	108	CO	Otero County
5	8071	8/16/12	7/3/14	97	CO	Las Animas County
6	8073	7/5/12	9/12/13	62	CO	Lincoln County
7	8101	7/19/12	9/12/13	60	CO	Pueblo County
8	8081	10/8/20	10/28/21	56	CO	Moffat County
9	8099	7/19/12	8/15/13	56	CO	Prowers County
10	8009	8/9/12	8/15/13	53	CO	Baca County
11	8017	7/26/12	8/1/13	53	CO	Cheyenne County
12	8103	10/8/20	9/30/21	52	CO	Rio Blanco County
13	8107	10/8/20	9/30/21	52	CO	Routt County
14	8041	8/16/12	8/1/13	50	CO	El Paso County
15	8055	8/30/12	8/1/13	48	CO	Huerfano County
16	8029	10/1/20	8/19/21	47	CO	Delta County
17	8045	10/1/20	8/19/21	47	CO	Garfield County
18	8077	10/1/20	8/19/21	47	CO	Mesa County
19	8067	10/8/20	8/19/21	46	CO	La Plata County
20	8083	10/8/20	8/19/21	46	CO	Montezuma County





Outlook

Next 7 days

8-14 day Outlook

CPC Outlooks

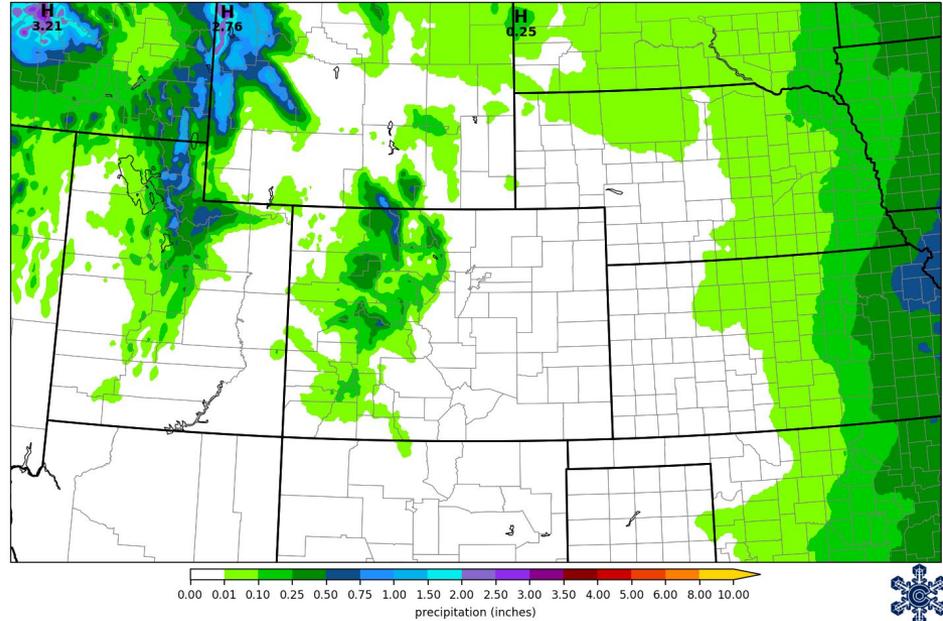
La Nina

Winter Snow?

NOAA 7-day precip forecast

NOAA Weather Prediction Center
7-day precipitation forecast

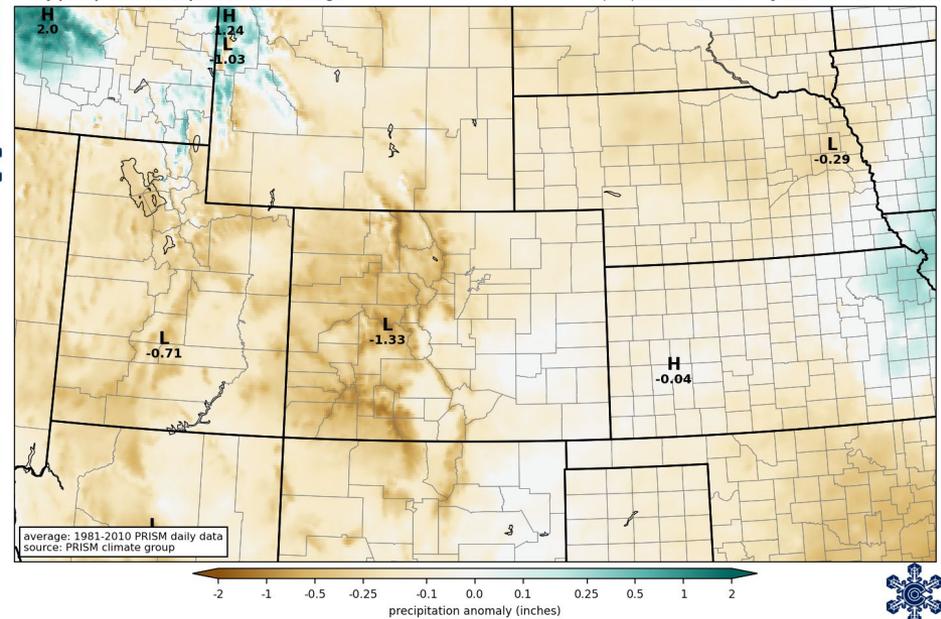
forecast issued 1200 UTC Thu 04 Nov 2021
precipitation in 168 hrs ending 1200 UTC Thu 11 Nov 2021



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

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

forecast issued 1200 UTC Thu 04 Nov 2021
precipitation in 168 hrs ending 1200 UTC Thu 11 Nov 2021



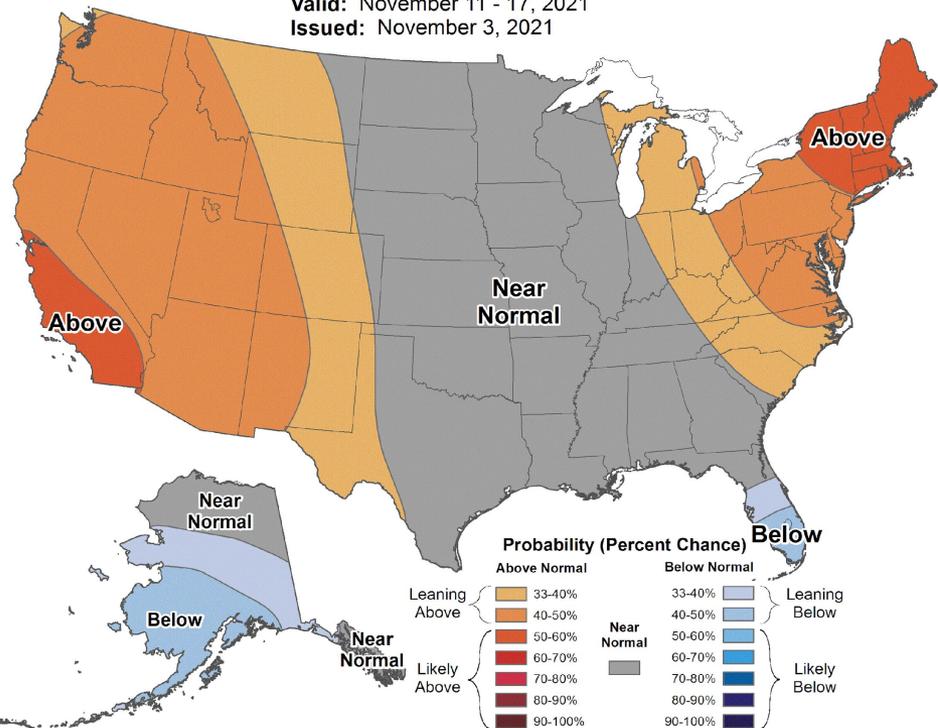
average: 1981-2010 PRISM daily data
source: PRISM climate group



8-14 day outlook

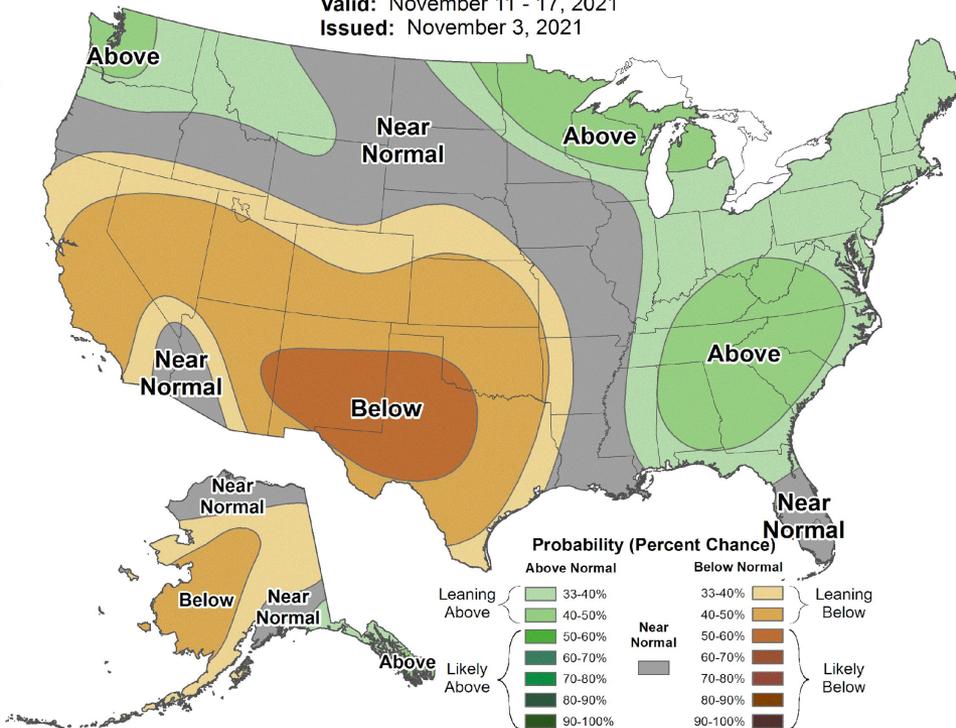
8-14 Day Temperature Outlook

Valid: November 11 - 17, 2021
Issued: November 3, 2021



8-14 Day Precipitation Outlook

Valid: November 11 - 17, 2021
Issued: November 3, 2021



Seasonal outlook

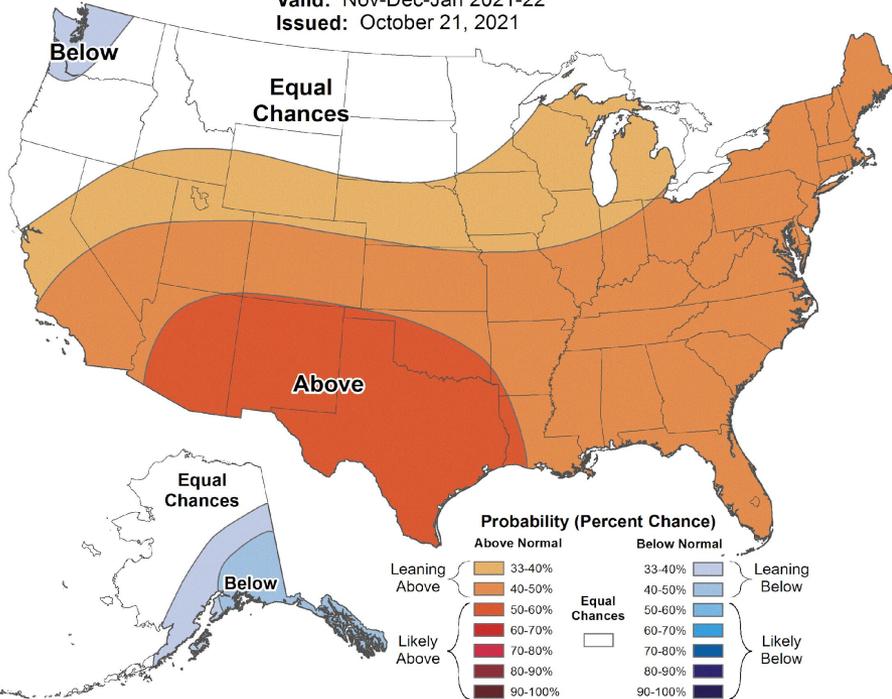
<https://www.cpc.ncep.noaa.gov>



Seasonal Temperature Outlook



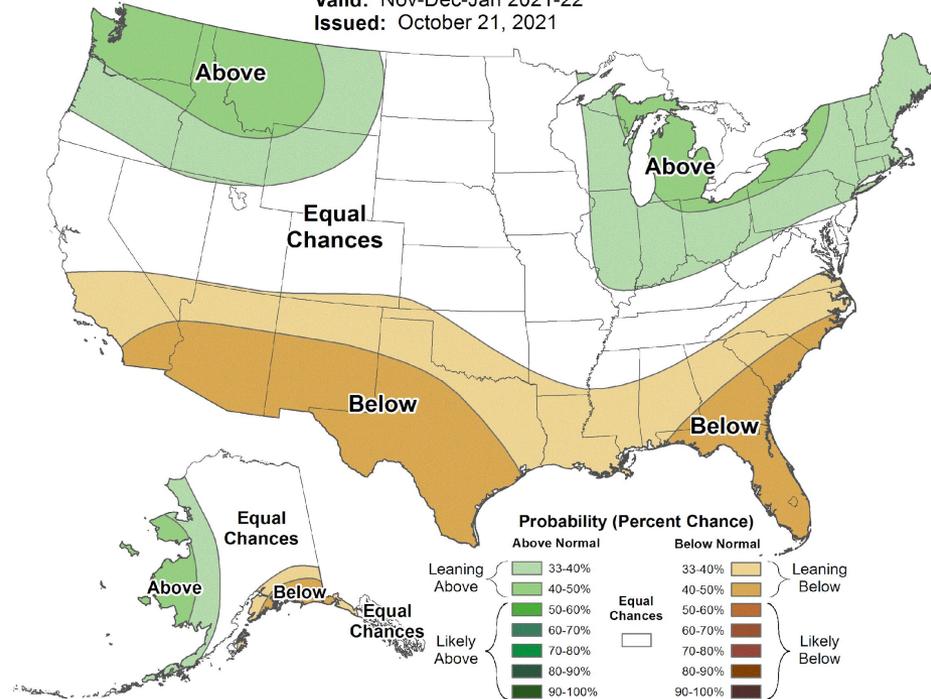
Valid: Nov-Dec-Jan 2021-22
 Issued: October 21, 2021



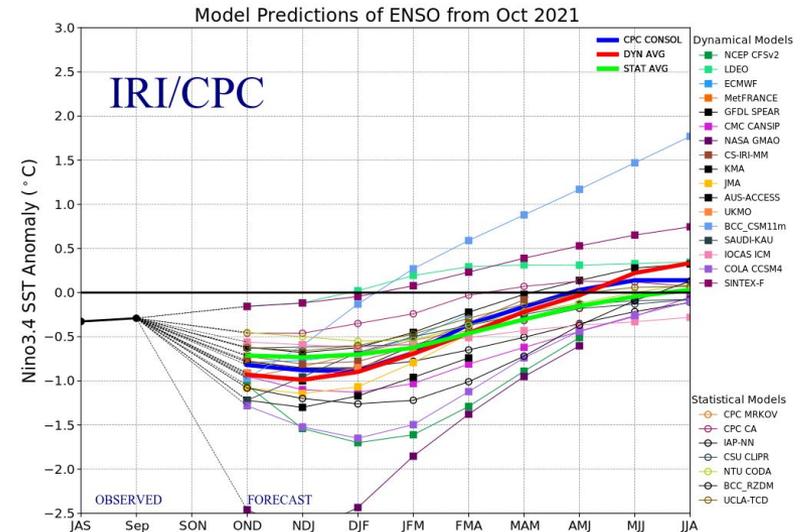
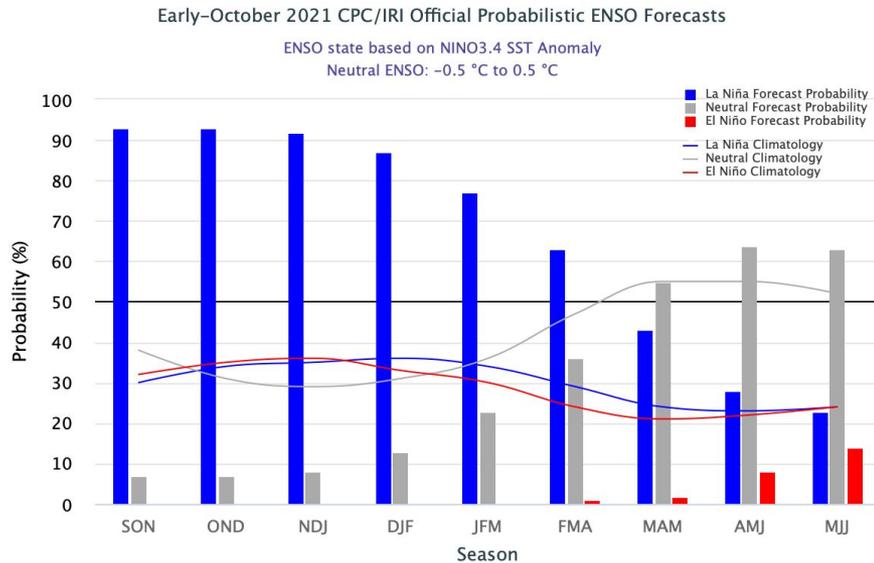
Seasonal Precipitation Outlook



Valid: Nov-Dec-Jan 2021-22
 Issued: October 21, 2021



What's the ENSO forecast?



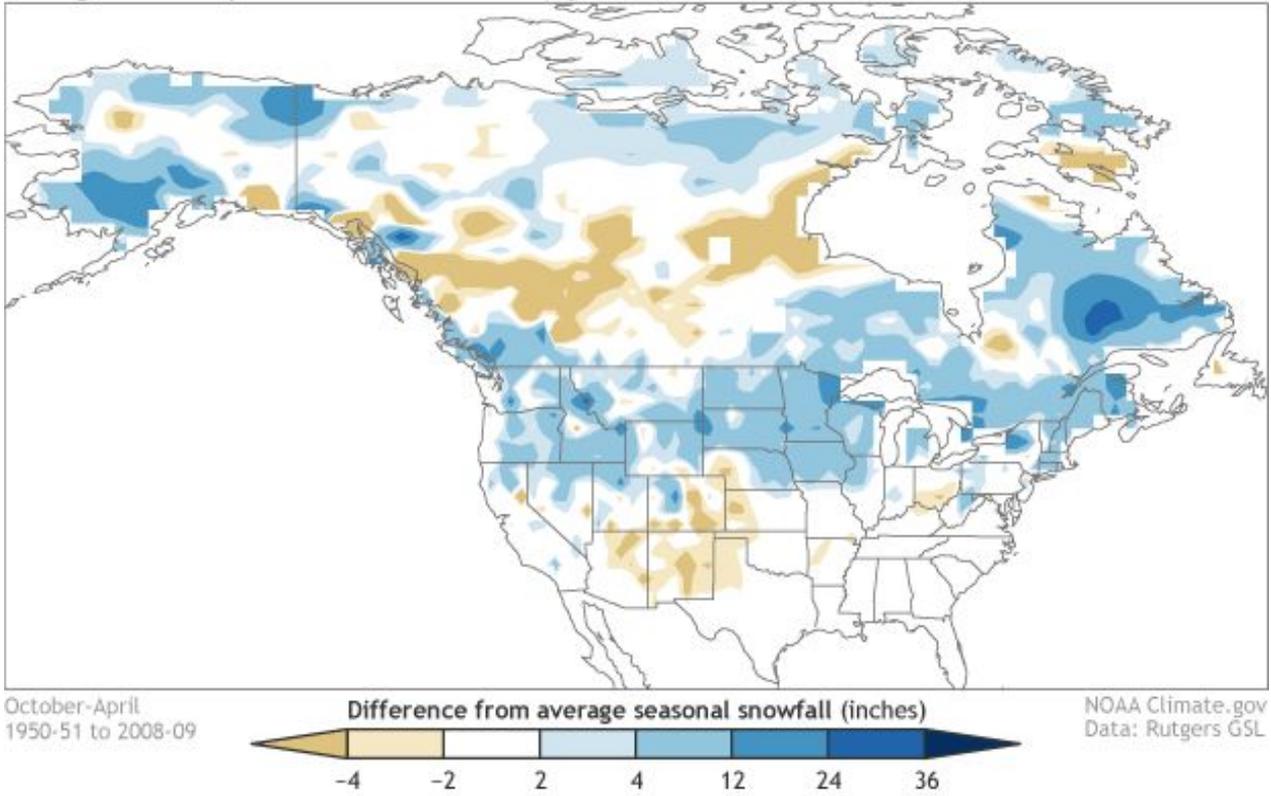
CPC/IRI October 19, 2021: In mid-October, SSTs in the central-eastern equatorial Pacific are $-0.8\text{ }^{\circ}\text{C}$ different from average. The evolution of key oceanic and atmospheric variables is consistent with La Niña conditions, and therefore, a **La Niña Advisory** has been issued for Oct 2021. A large majority of the models predict SSTs to cool further through boreal autumn and winter, and then **return to ENSO-neutral levels during spring**. Similar to the most-recent official CPC/IRI ENSO Outlook issued on October 14, this objective model-based ENSO outlook also anticipates **a La Niña event with high probability during Oct-Dec and persisting until Jan-Mar**, with a return to ENSO-neutral conditions with high probabilities for rest of the forecast period.

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



What does La Niña mean for winter?

Average snowfall patterns for weak La Niña years



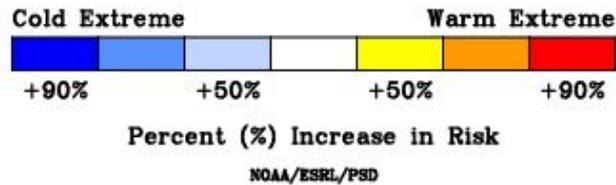
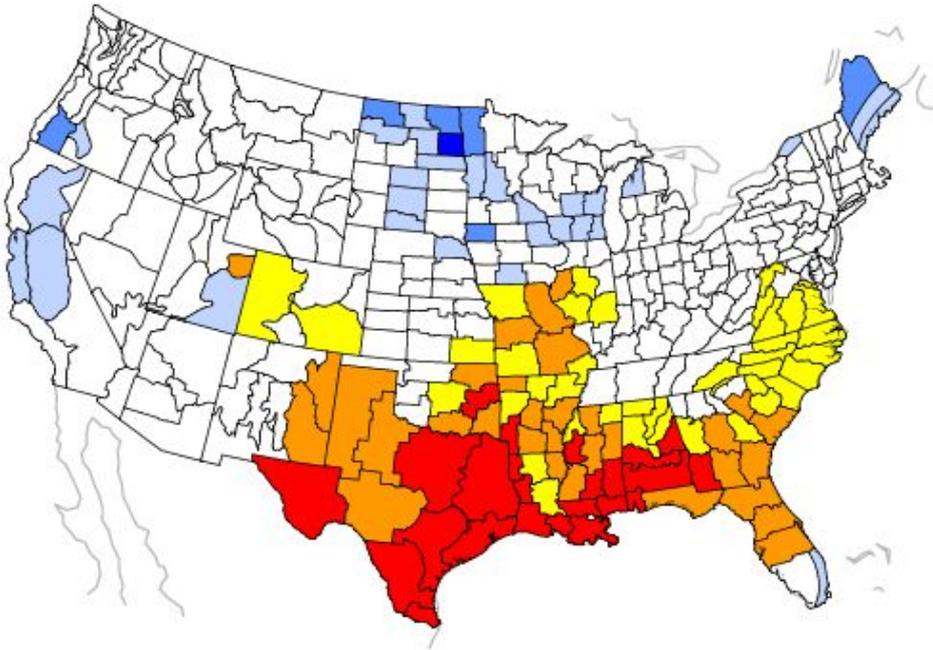
A wetter pattern in the northwest favors more snowfall over our northern mountains.

The drier southwest extends northward and favors less snowfall over the Four Corners and eastern plains.

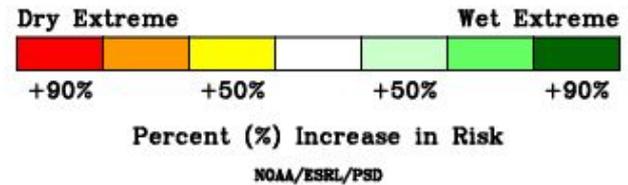
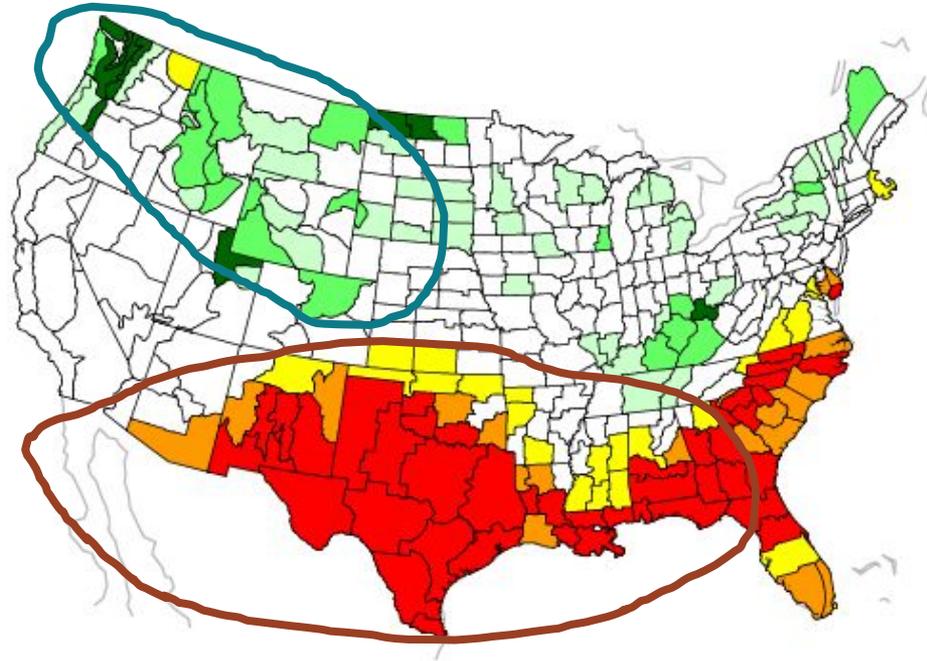
[What about snow during La Niña winters?](#) - ENSO Climate Blog, November 2017



DJF Temperature During La Nina
Increased Risk of Warm or Cold Extremes



DJF Precipitation During La Nina
Increased Risk of Wet or Dry Extremes



Risk of extremes during a La Niña, from <https://psl.noaa.gov/enso/climaterisks/>



Work on an experimental ski dashboard is underway!

short-term seasonal long-term



Ski Dashboard

Short-Term

Current Snow

Avalanche Info

Hazards and Warnings

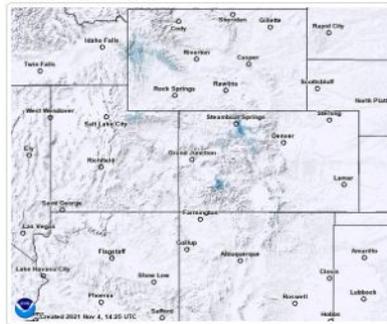
Drought

Outlook

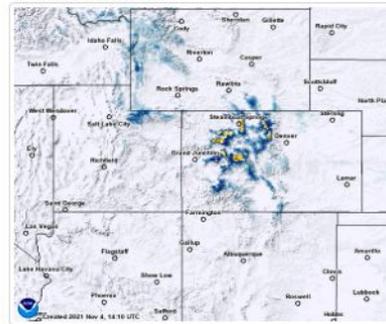
current snow

recent snowfall

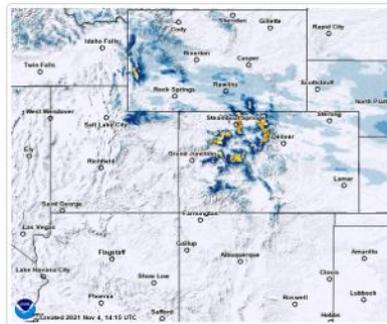
24hr Snowfall



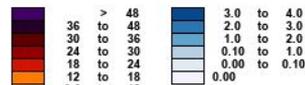
48hr Snowfall



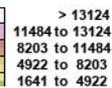
72hr Snowfall



Inches of depth



Elevation in feet



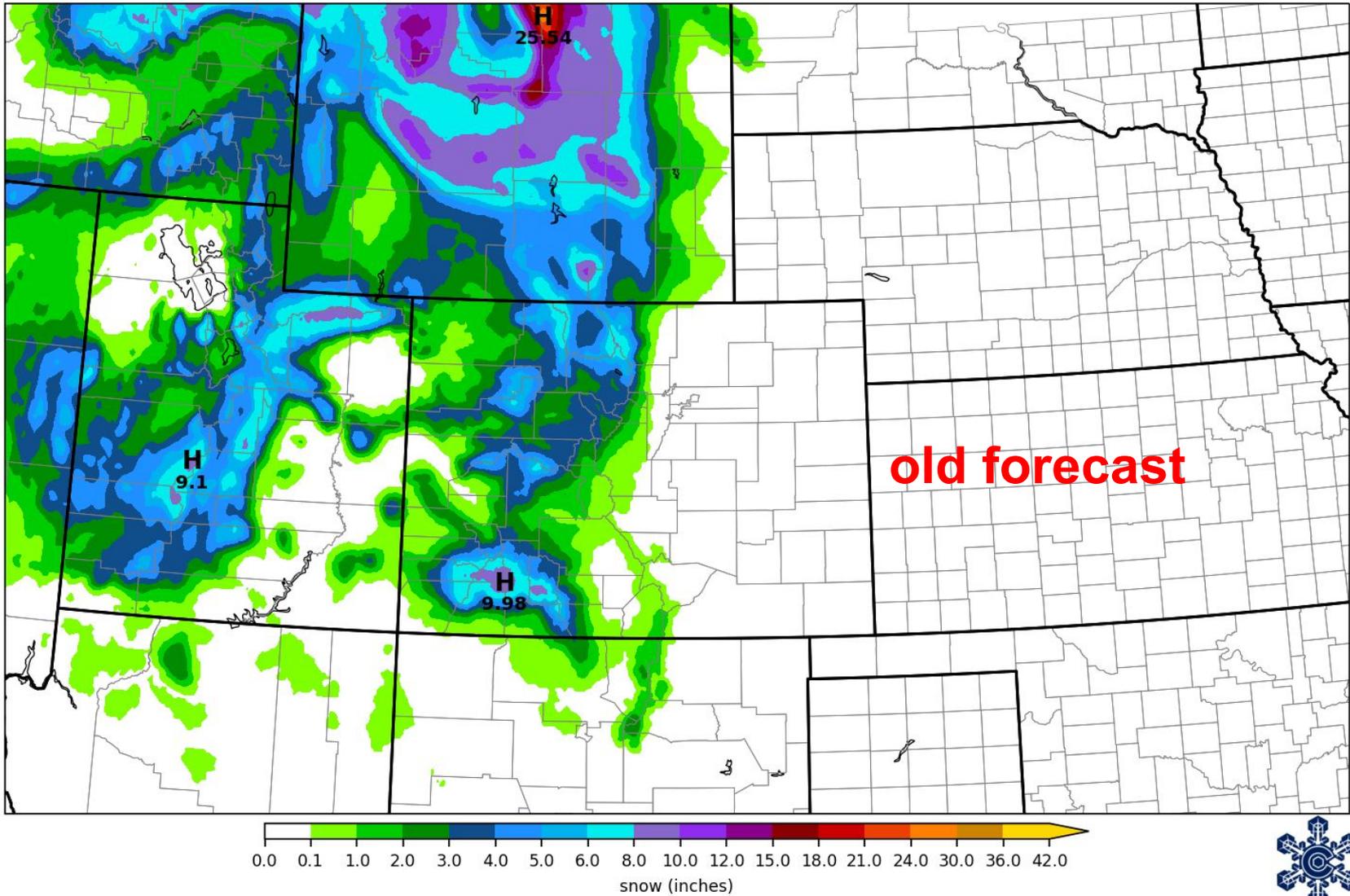
climate.colostate.edu/ski-dashboard



72-hour snowfall forecast – median forecast

NOAA Weather Prediction Center 72-hour 50th-percentile (median) accumulated snow forecast

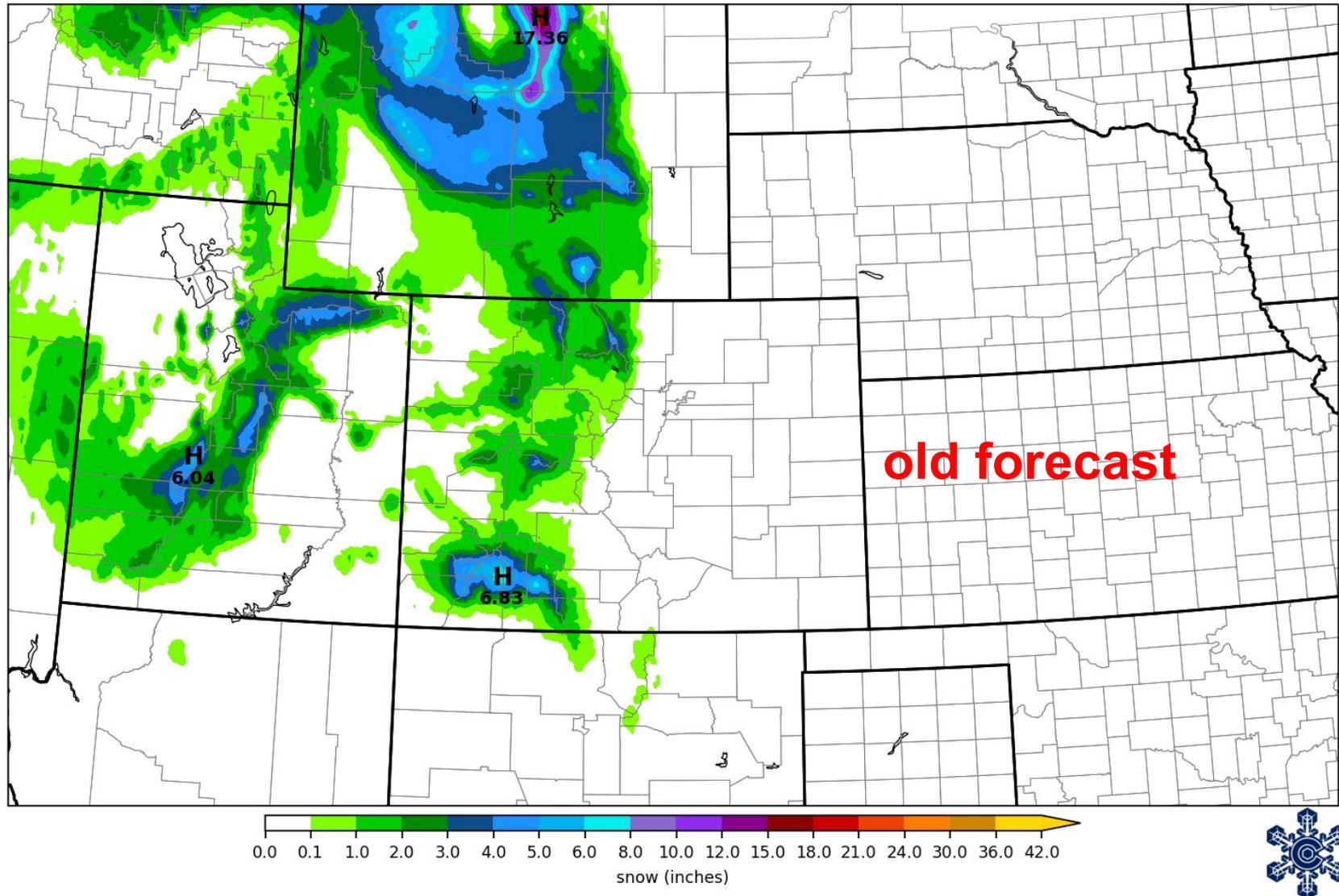
forecast issued 1200 UTC Sun 10 Oct 2021
snow in 72 hrs ending 1200 UTC Wed 13 Oct 2021



72-hour snowfall forecast – low end forecast

forecast issued 1200 UTC Sun 10 Oct 2021
snow in 72 hrs ending 1200 UTC Wed 13 Oct 2021

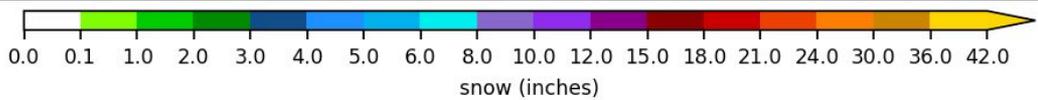
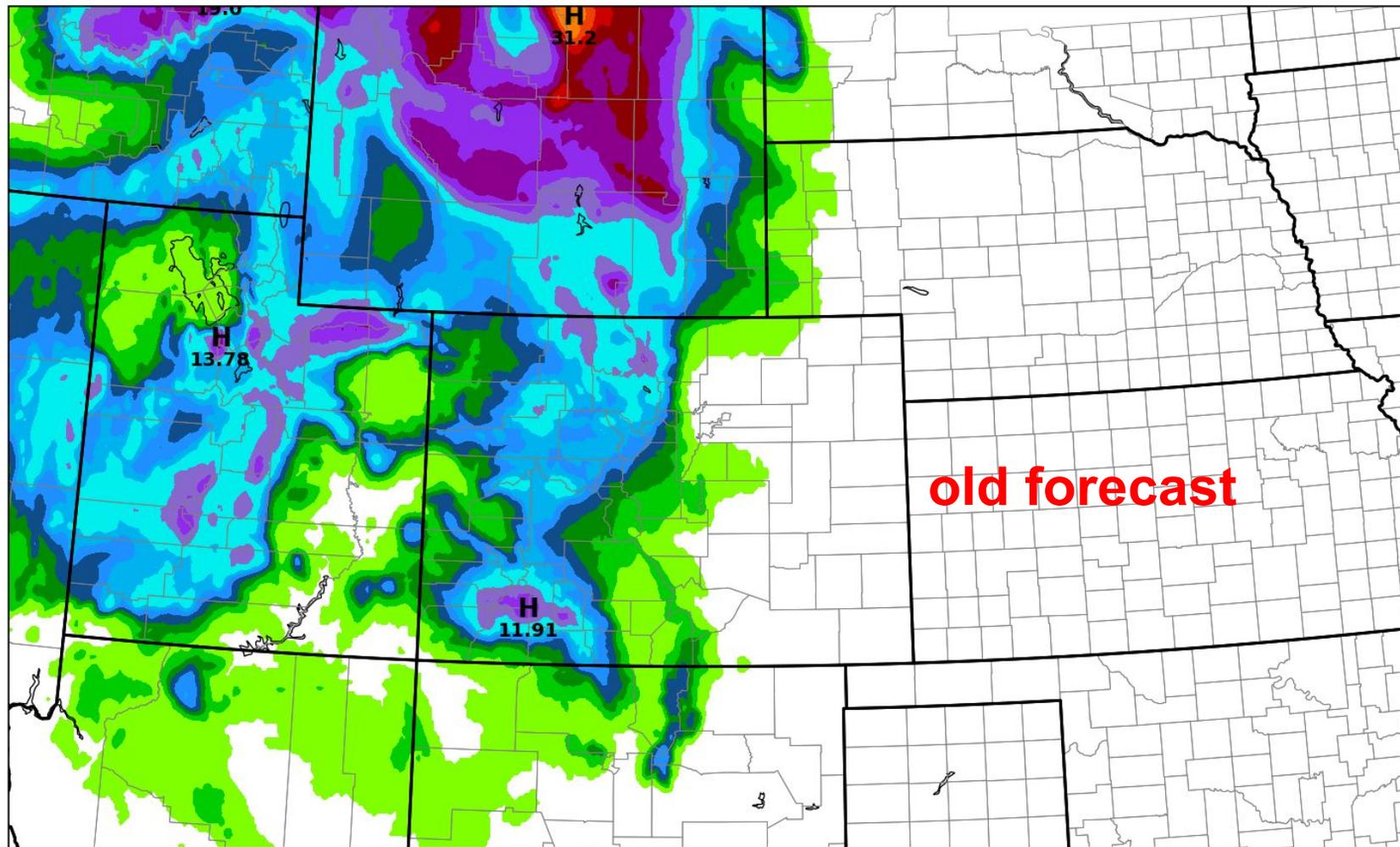
NOAA Weather Prediction Center 72-hour 10th-percentile (low-end) accumulated snow forecast



72-hour snowfall forecast – high end forecast

forecast issued 1200 UTC Sun 10 Oct 2021
snow in 72 hrs ending 1200 UTC Wed 13 Oct 2021

NOAA Weather Prediction Center 72-hour 90th-percentile (high-end) accumulated snow forecast



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To view this and other presentations:

https://climate.colostate.edu/ccc_archive.html

Thank you



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