



Climate Update



Peter Goble
Colorado Climate Center

**Presented to
Water Conditions Monitoring
Committee
January 23, 2024
Denver, CO**

Agenda

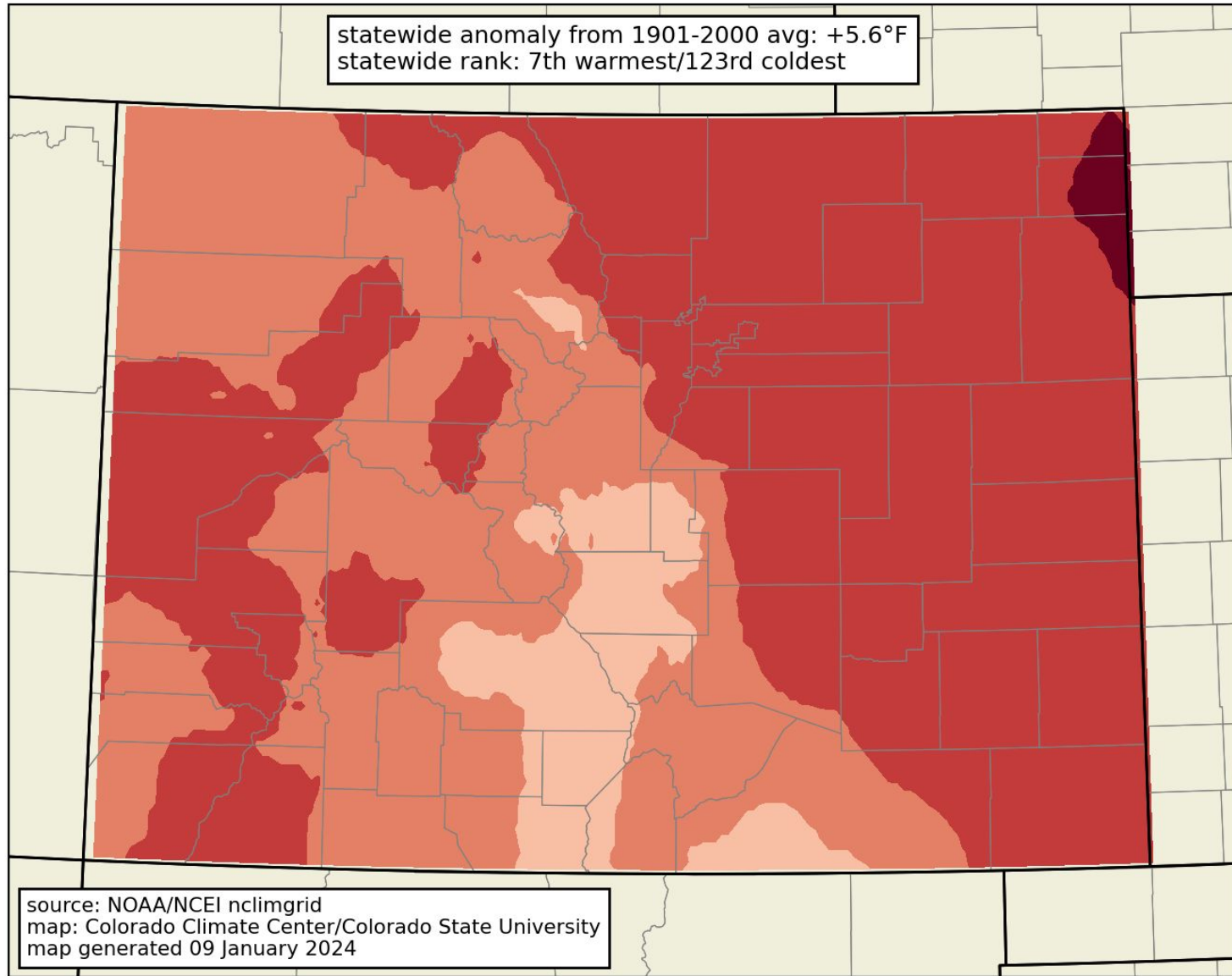
- Current seasonal climate conditions update
- Drought update
- Seasonal Forecast info (when are we going to get spring moisture?)
- Climate Change in Colorado Synthesis

Colorado statewide average temperature and precipitation, October - December

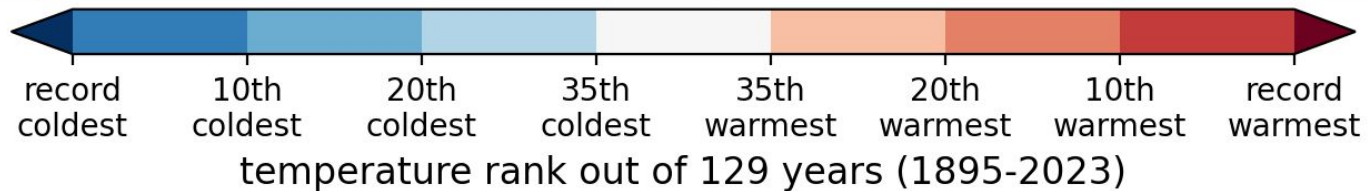


average temperature rank: December 2023

statewide anomaly from 1901-2000 avg: +5.6°F
statewide rank: 7th warmest/123rd coldest

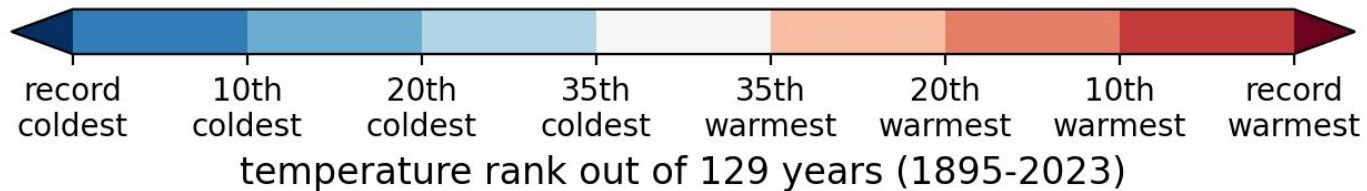
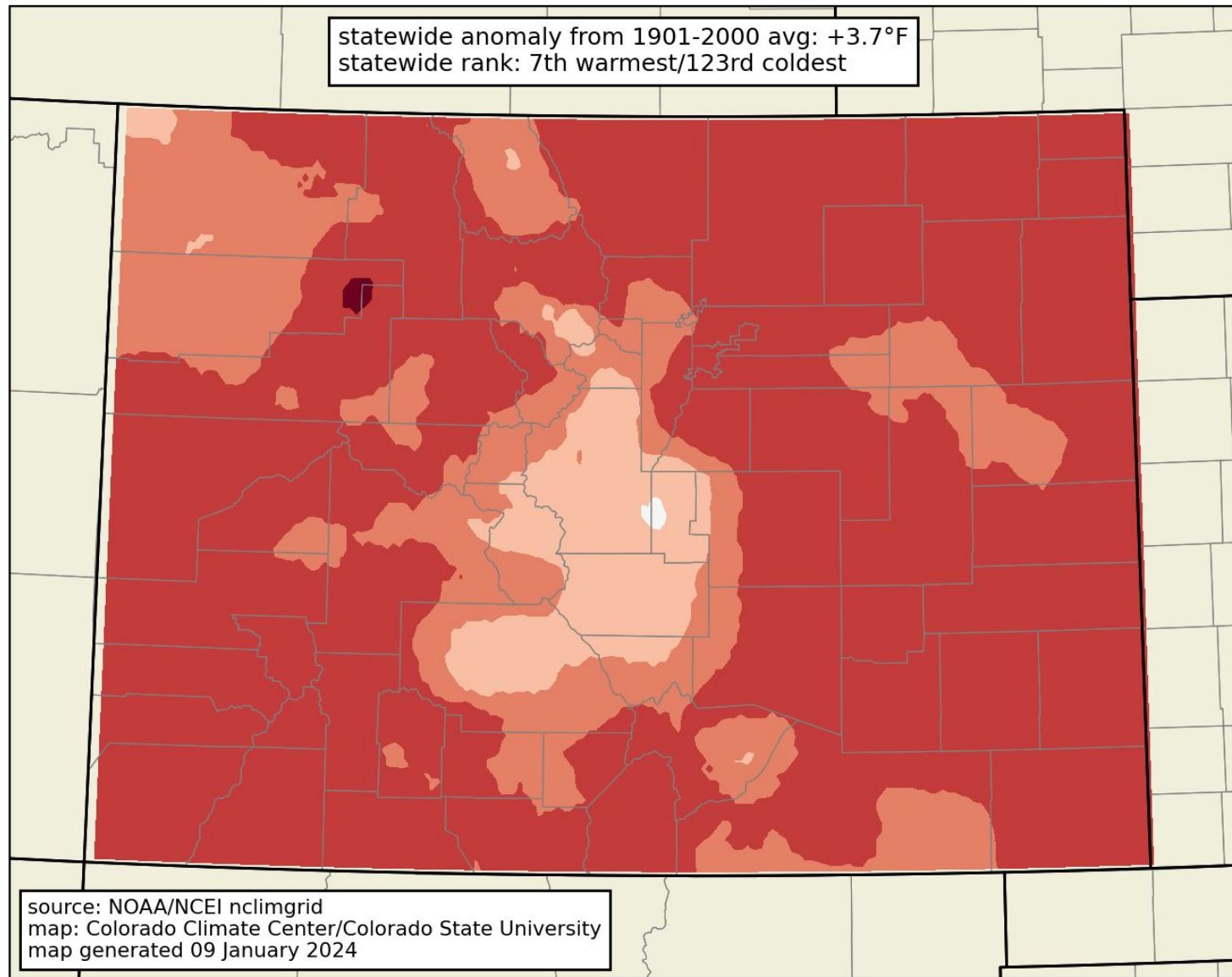


source: NOAA/NCEI nclimgrid
map: Colorado Climate Center/Colorado State University
map generated 09 January 2024



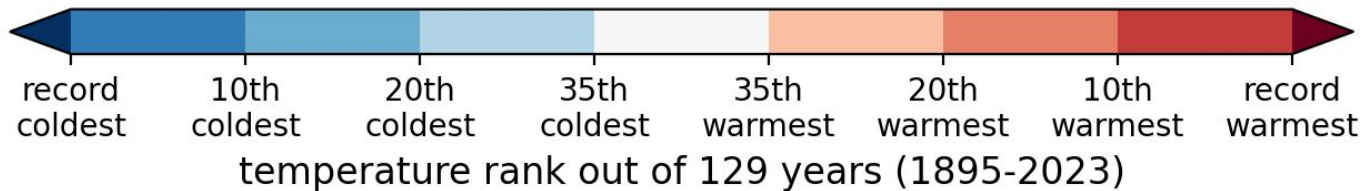
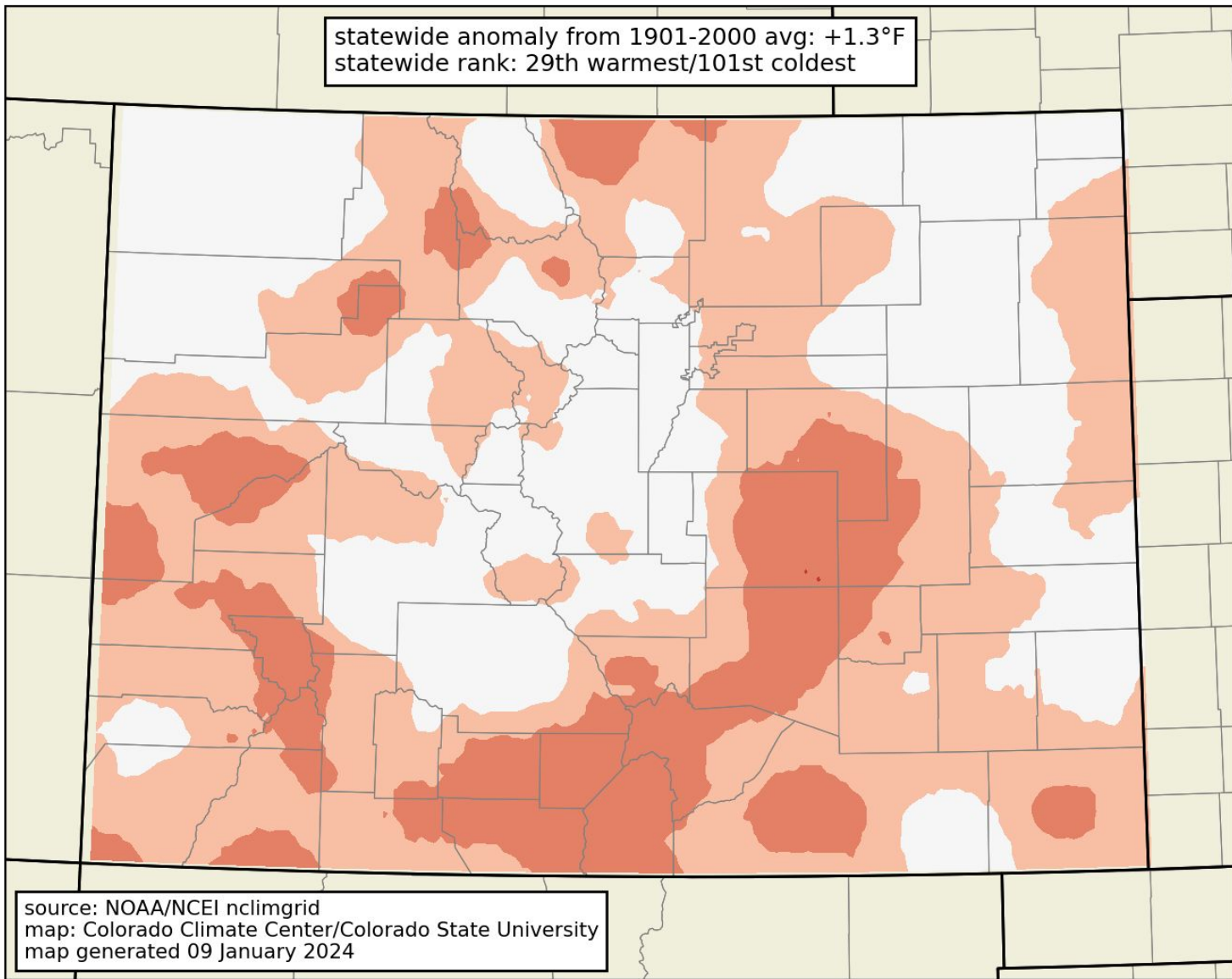
4.4 °F above
1991-2020
normal

average temperature rank: 3 months ending December 2023 (Oct-Dec)



2.6 °F above
1991-2020
normal

average temperature rank: 12 months ending December 2023 (Jan-Dec)

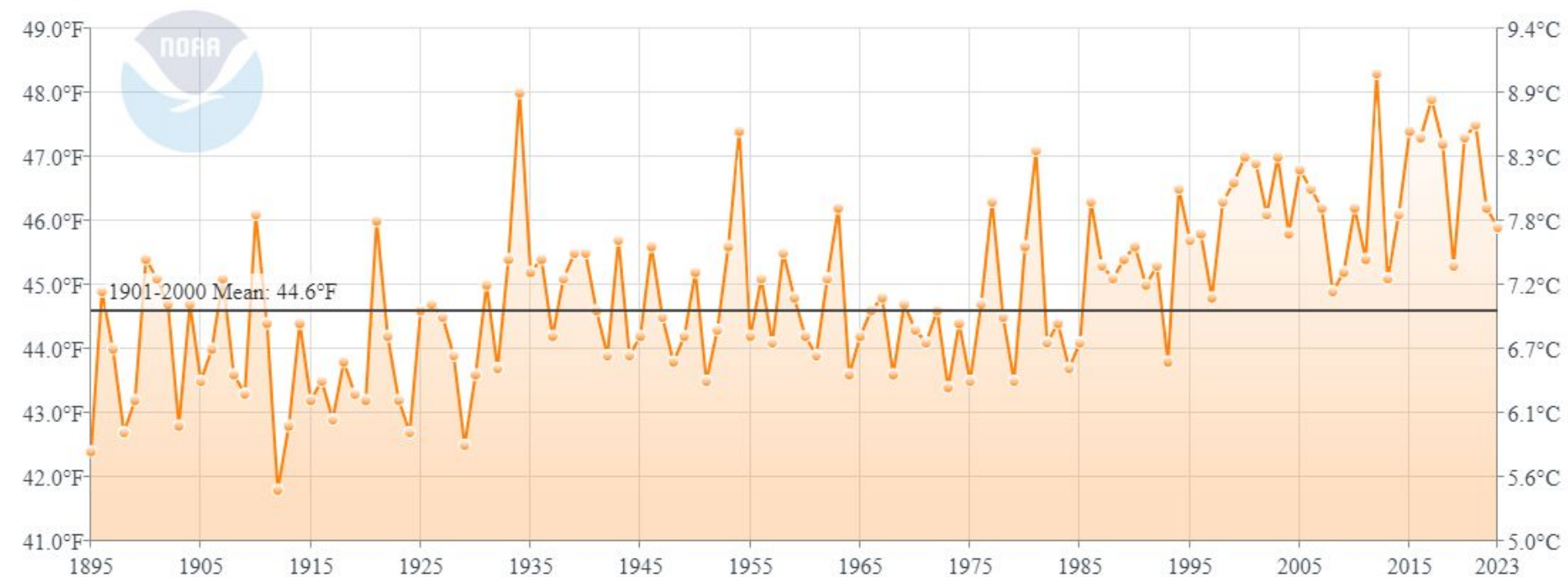


0.3 °F below
1991-2020
normal

Colorado Average Temperature

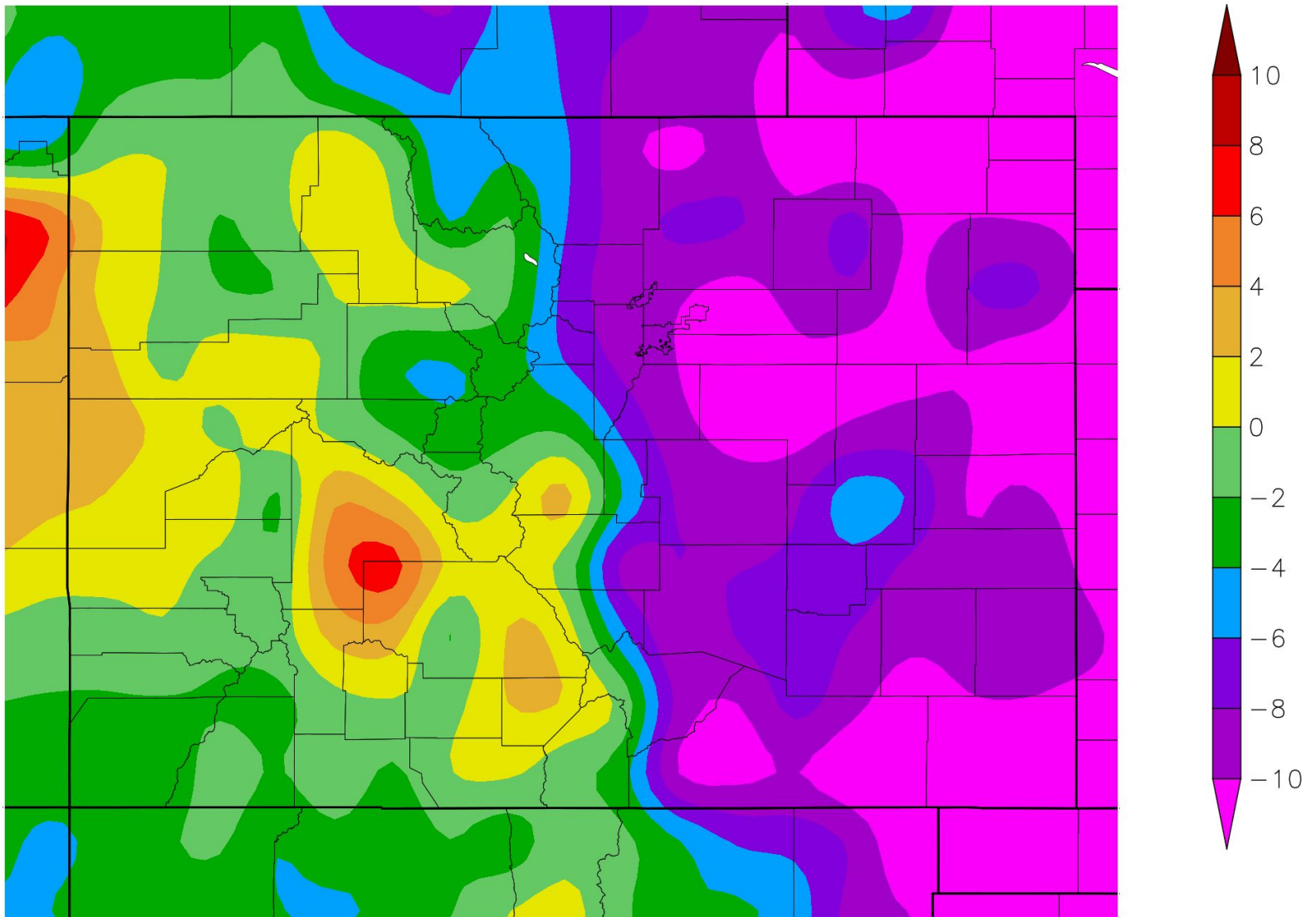
January-December

2023: 45.9 °F



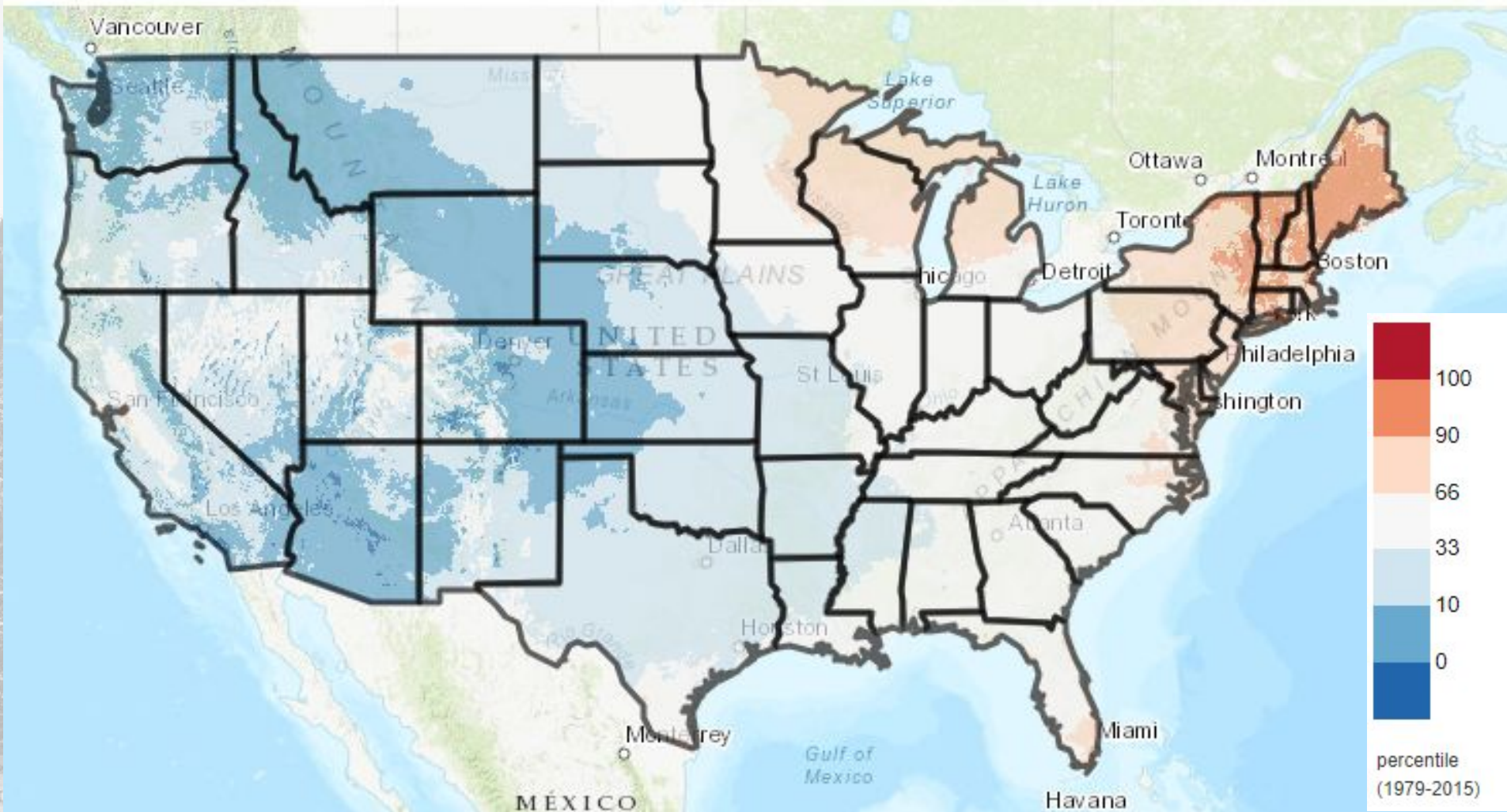
Departure from Normal Temperature (F)

1/1/2024 – 1/21/2024



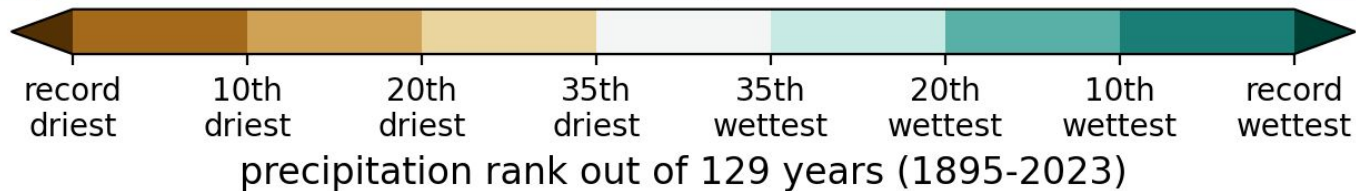
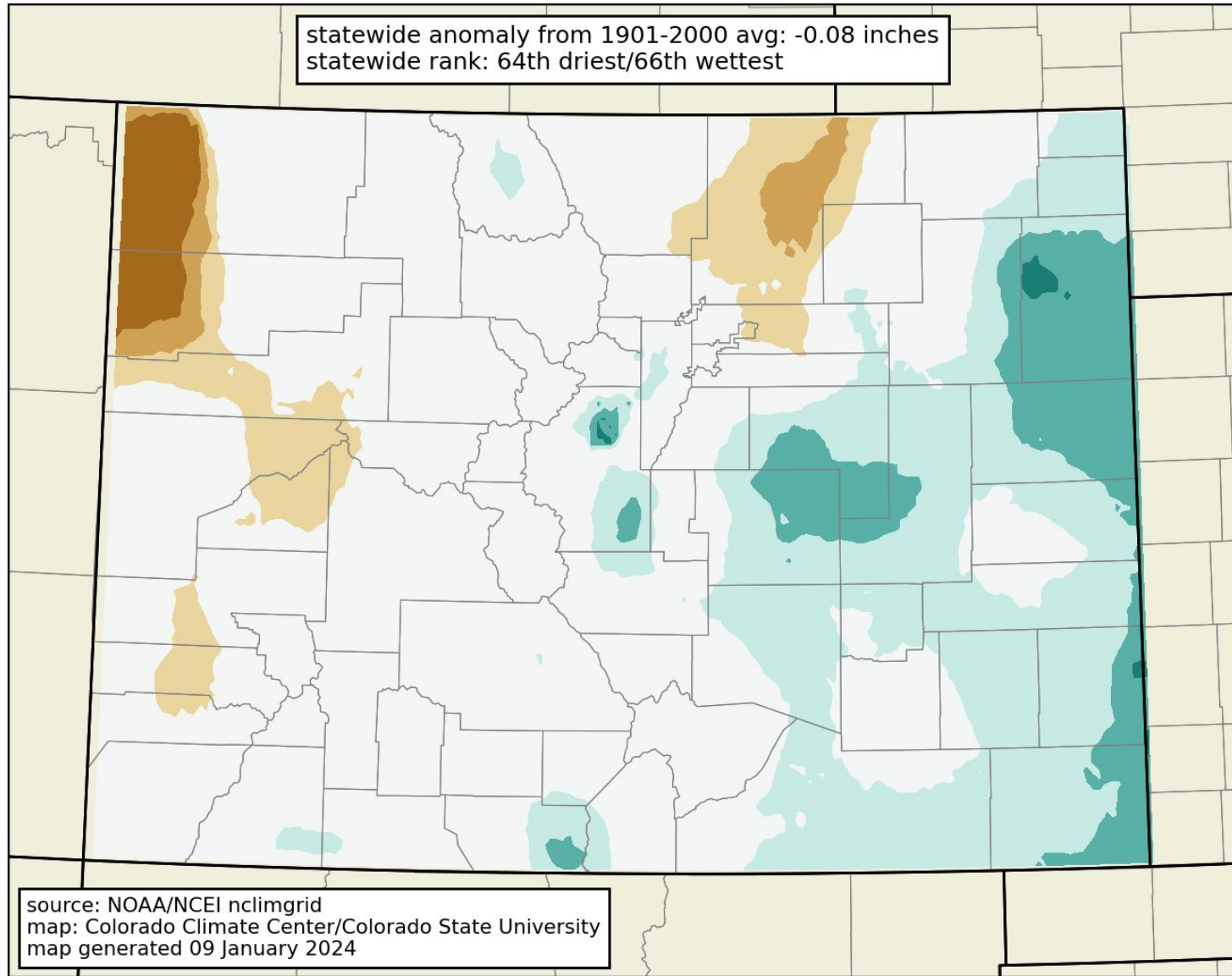
Mean Daily Temperature Percentile, Since Jan 1st

2024/01/01 - 2024/01/15



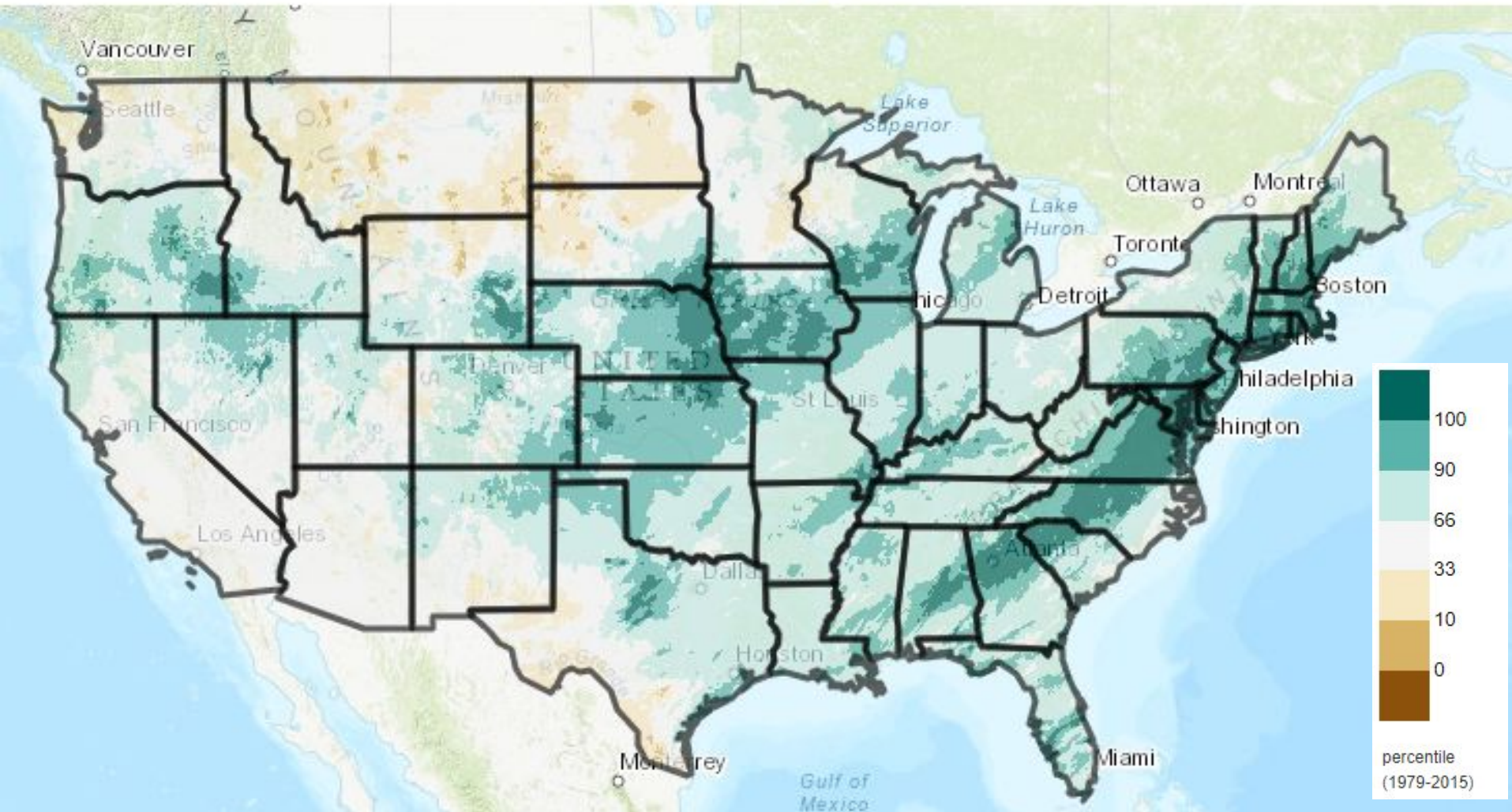
precipitation rank: December 2023

statewide anomaly from 1901-2000 avg: -0.08 inches
statewide rank: 64th driest/66th wettest



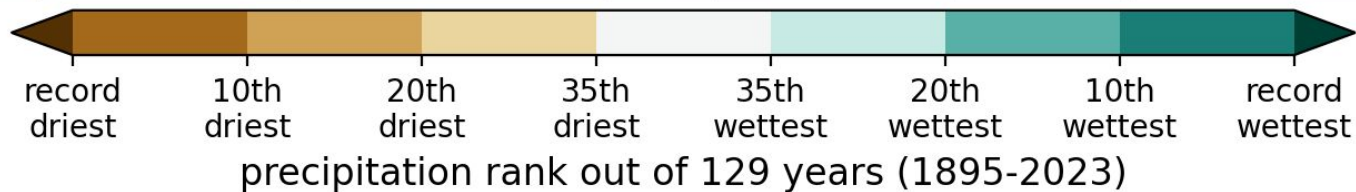
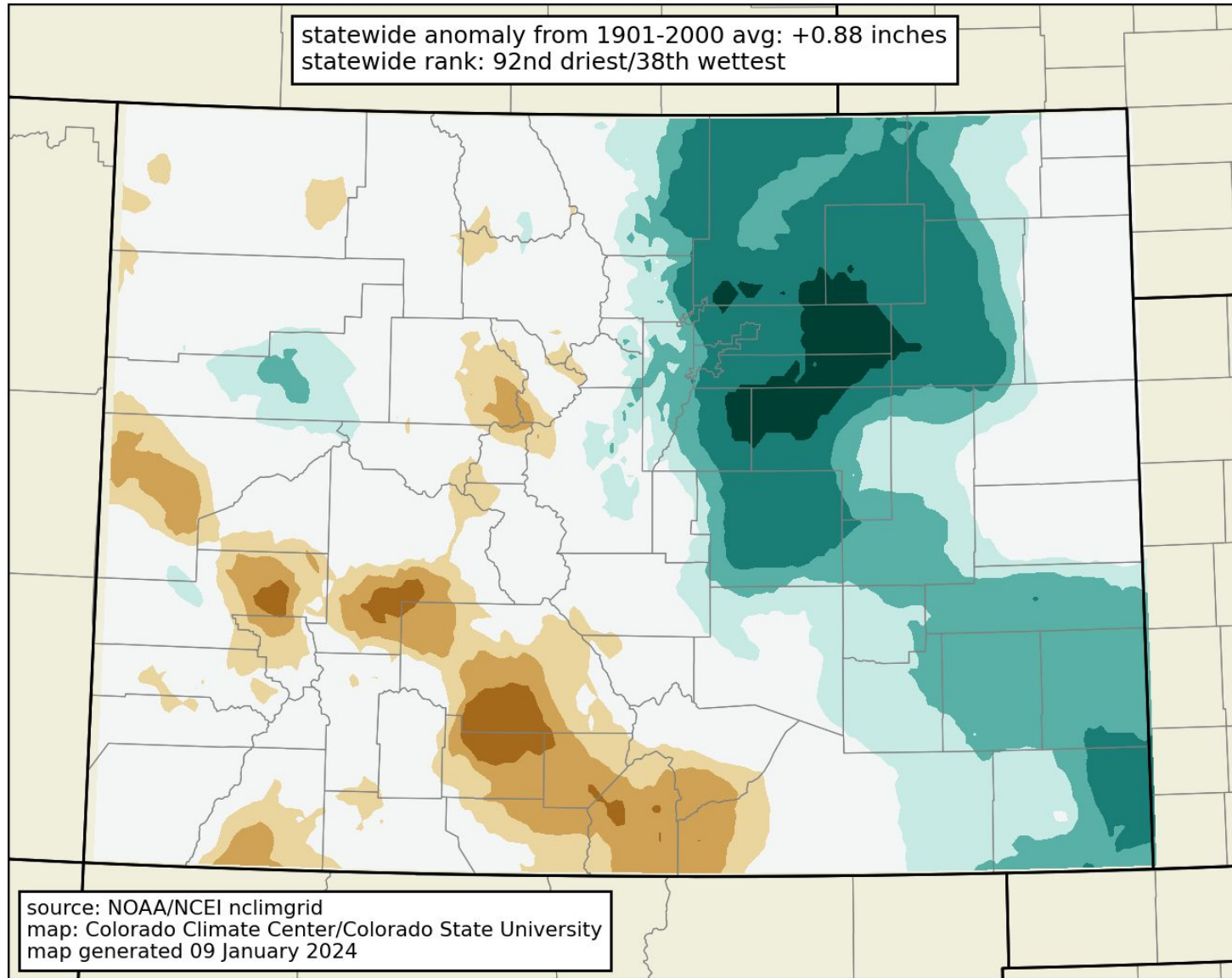
Total Precipitation Percentile, Since Jan 1st

2024/01/01 - 2024/01/15



precipitation rank: 12 months ending December 2023 (Jan-Dec)

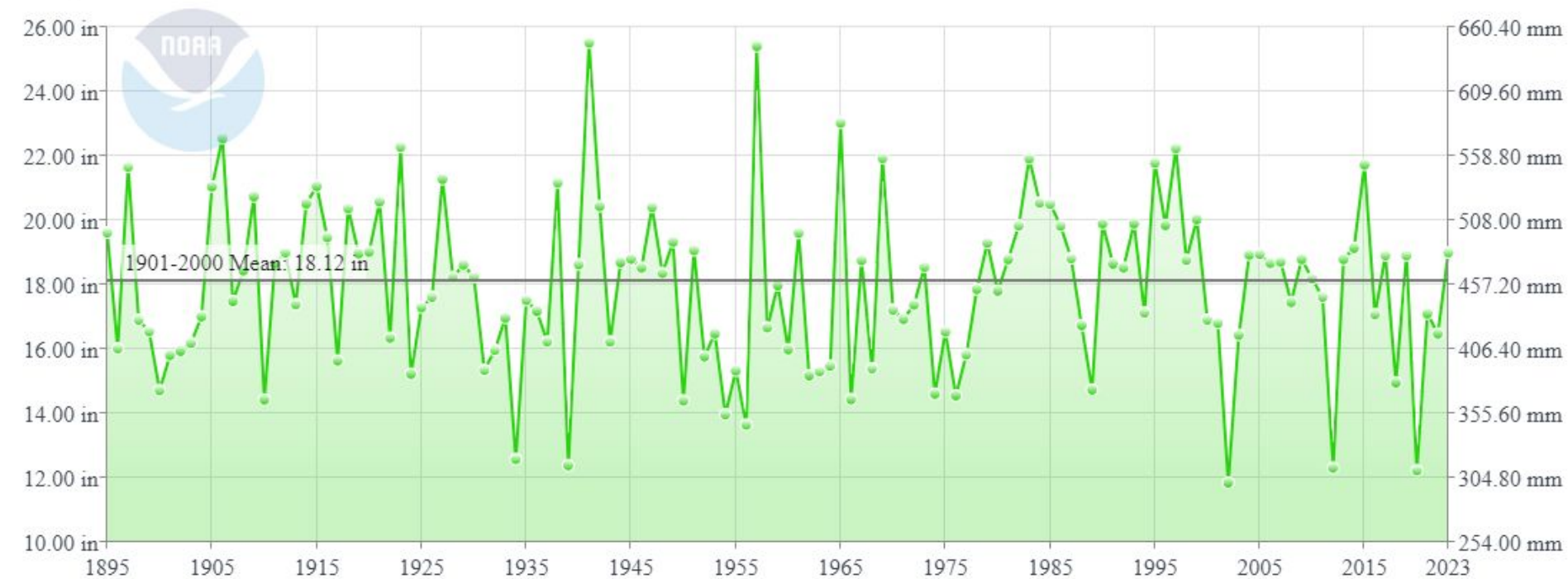
statewide anomaly from 1901-2000 avg: +0.88 inches
statewide rank: 92nd driest/38th wettest



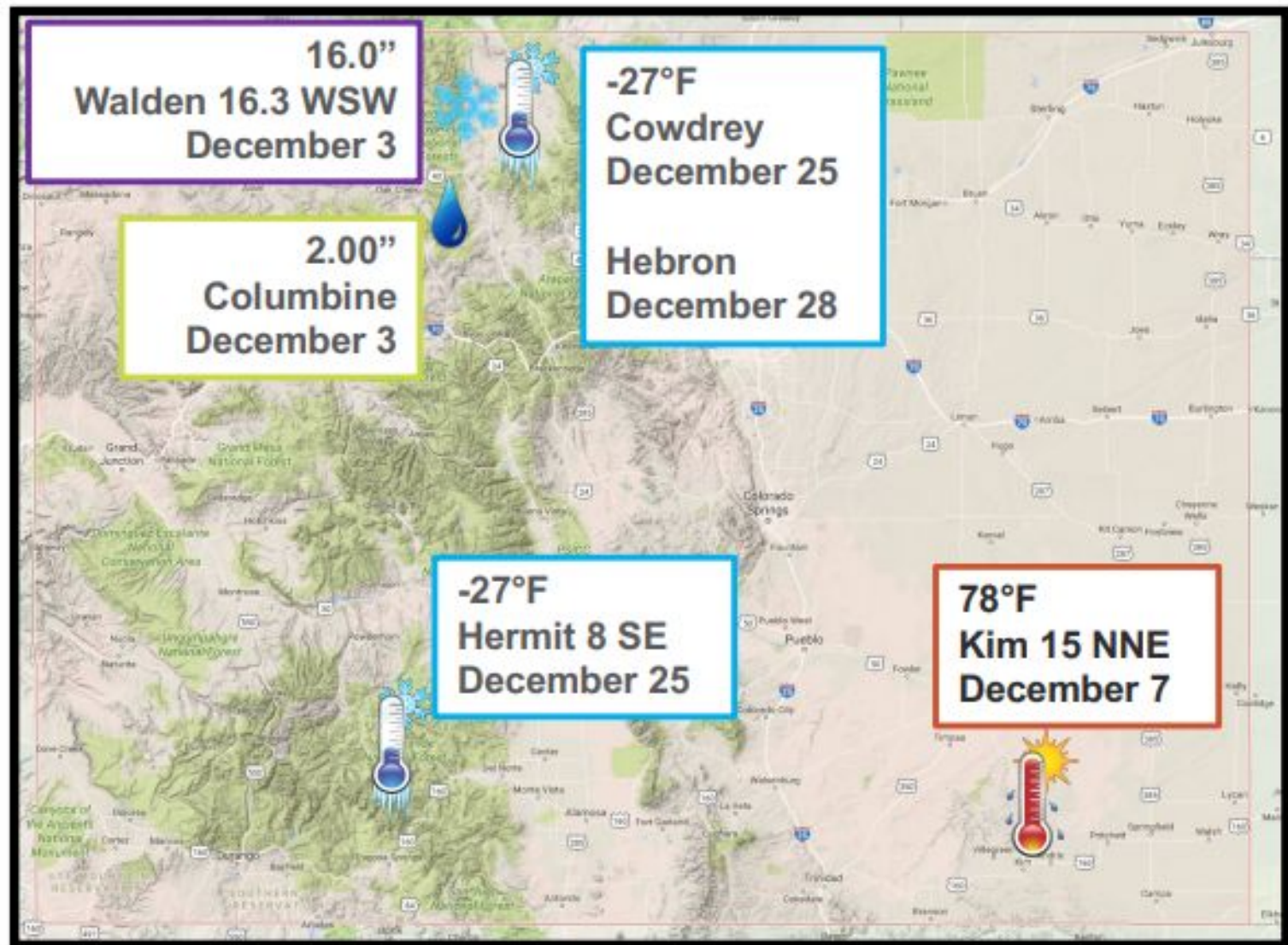
Colorado Precipitation

January-December

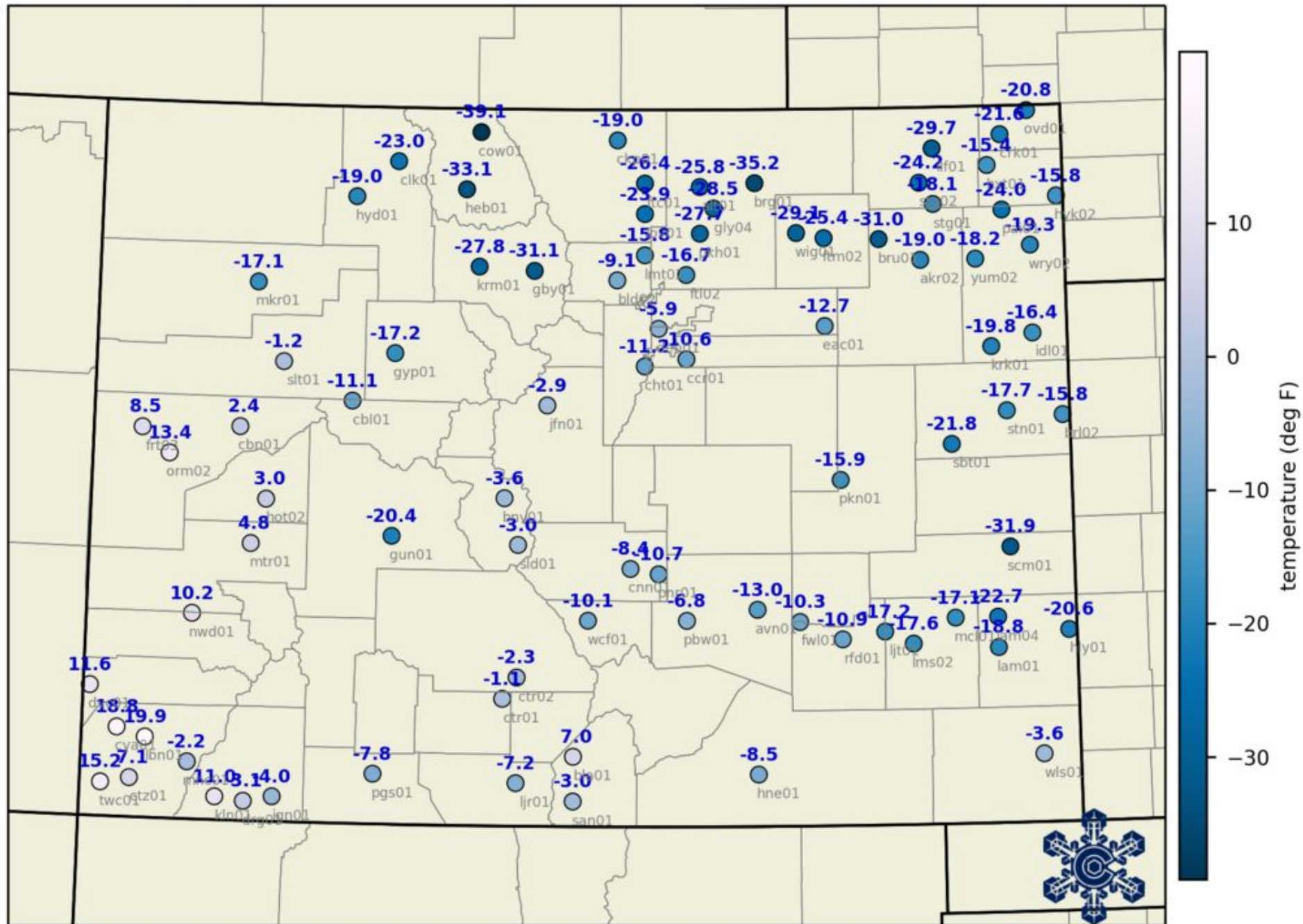
2023: 19.00"



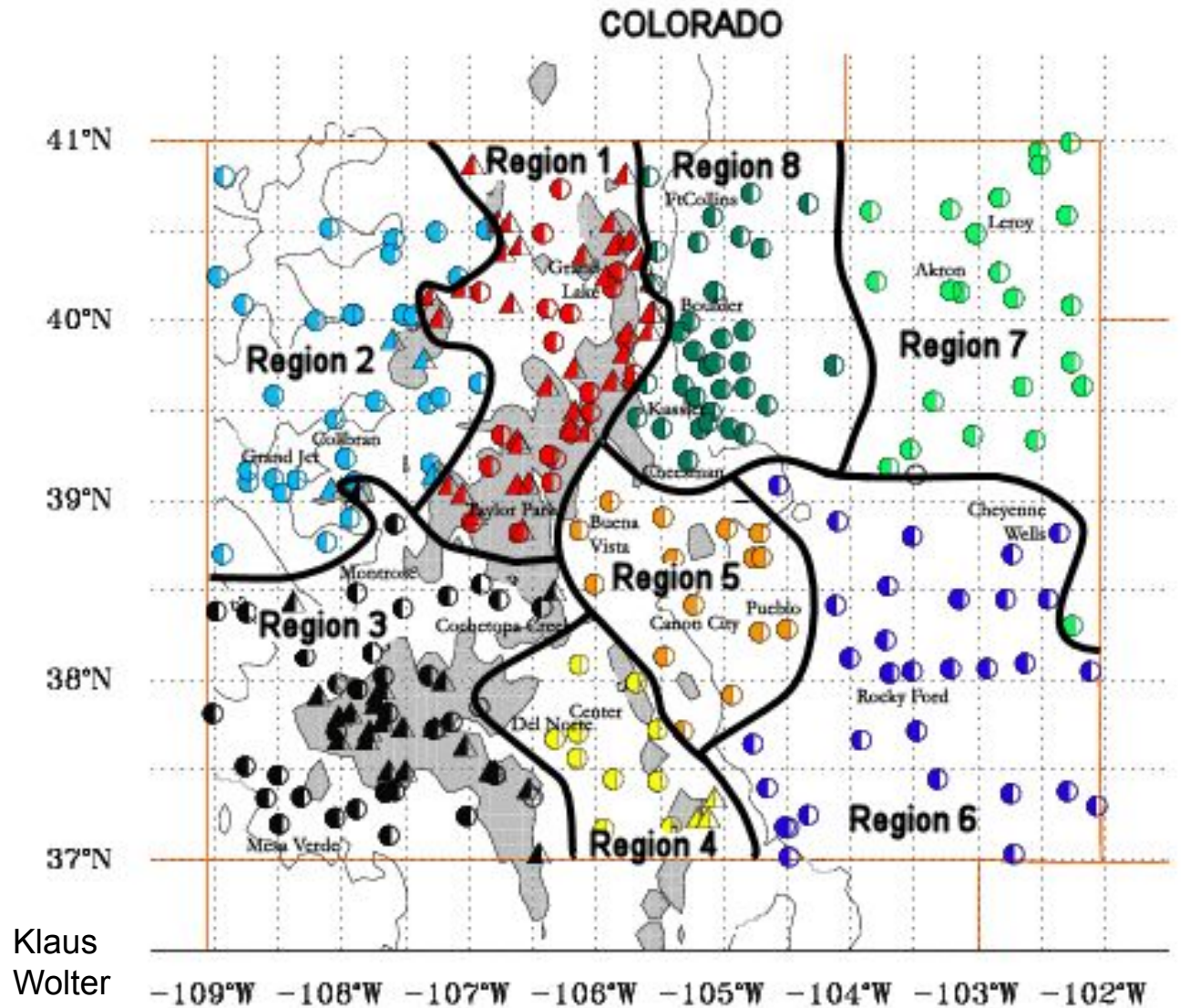
state extremes



CoAgMET/Northern Water daily minimum temperature (F): 16 Jan 2024

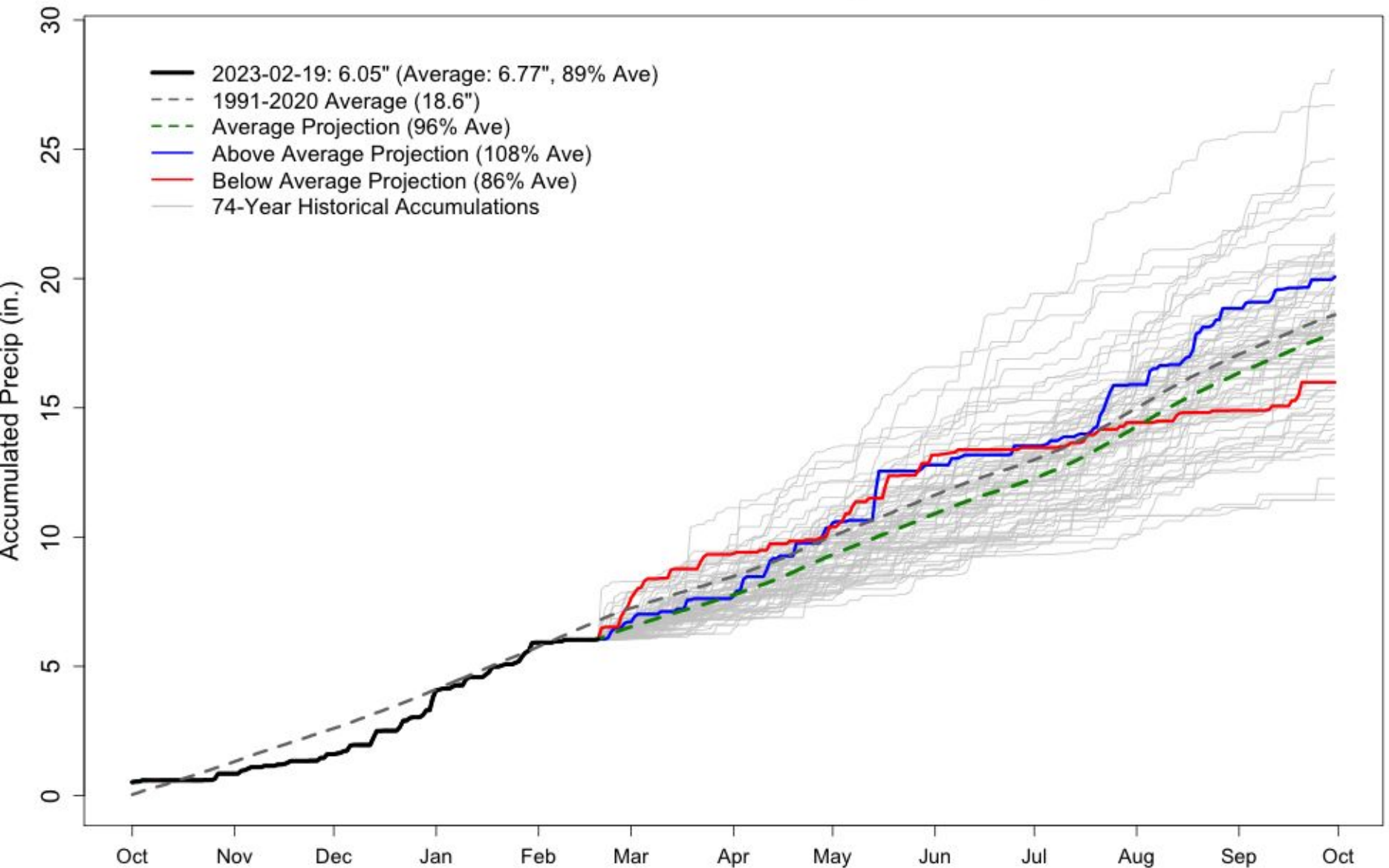


Climate divisions defined by Dr. Klaus Wolter of NOAA's Climate Diagnostic Center in Boulder, CO

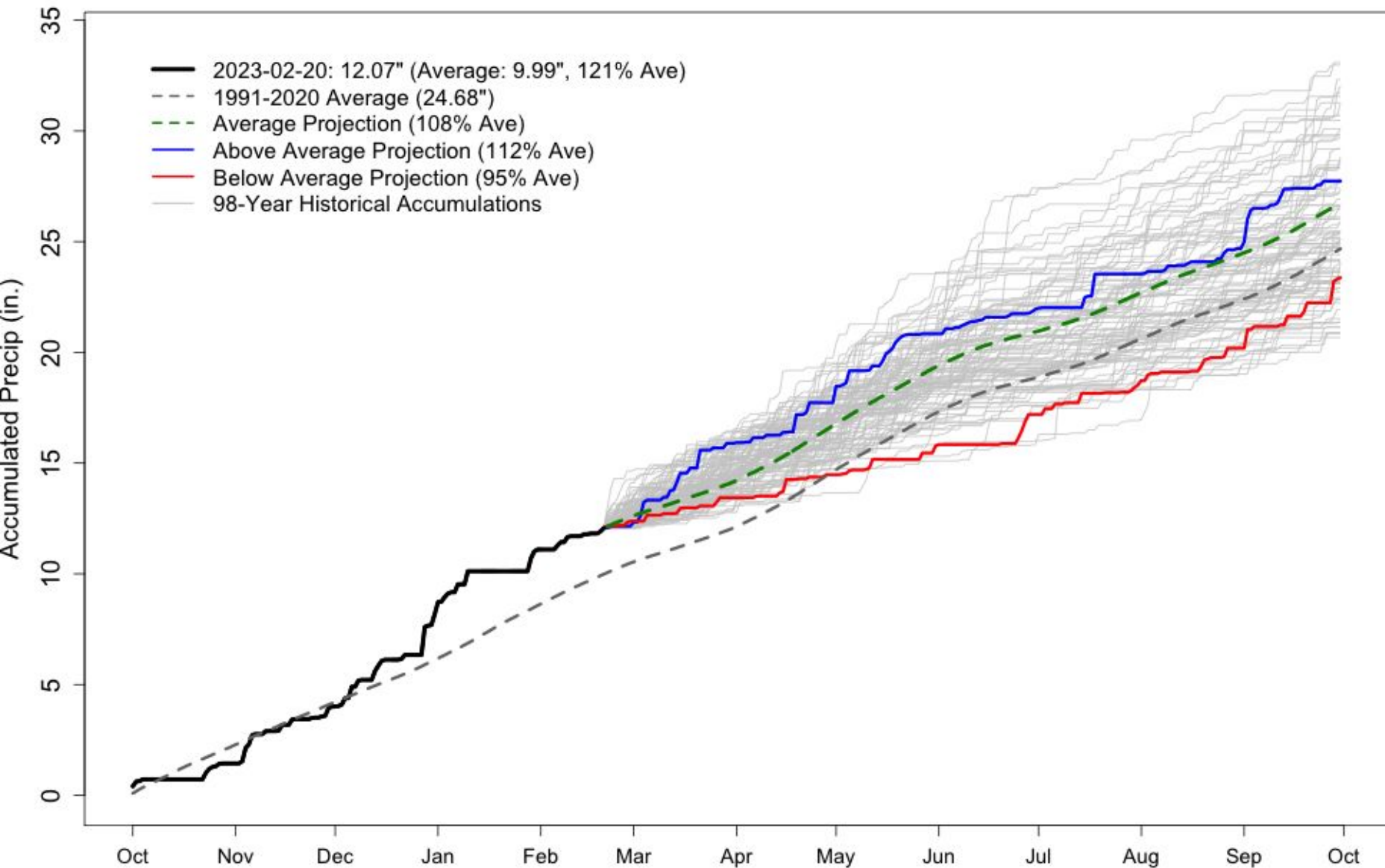


Klaus
Wolter

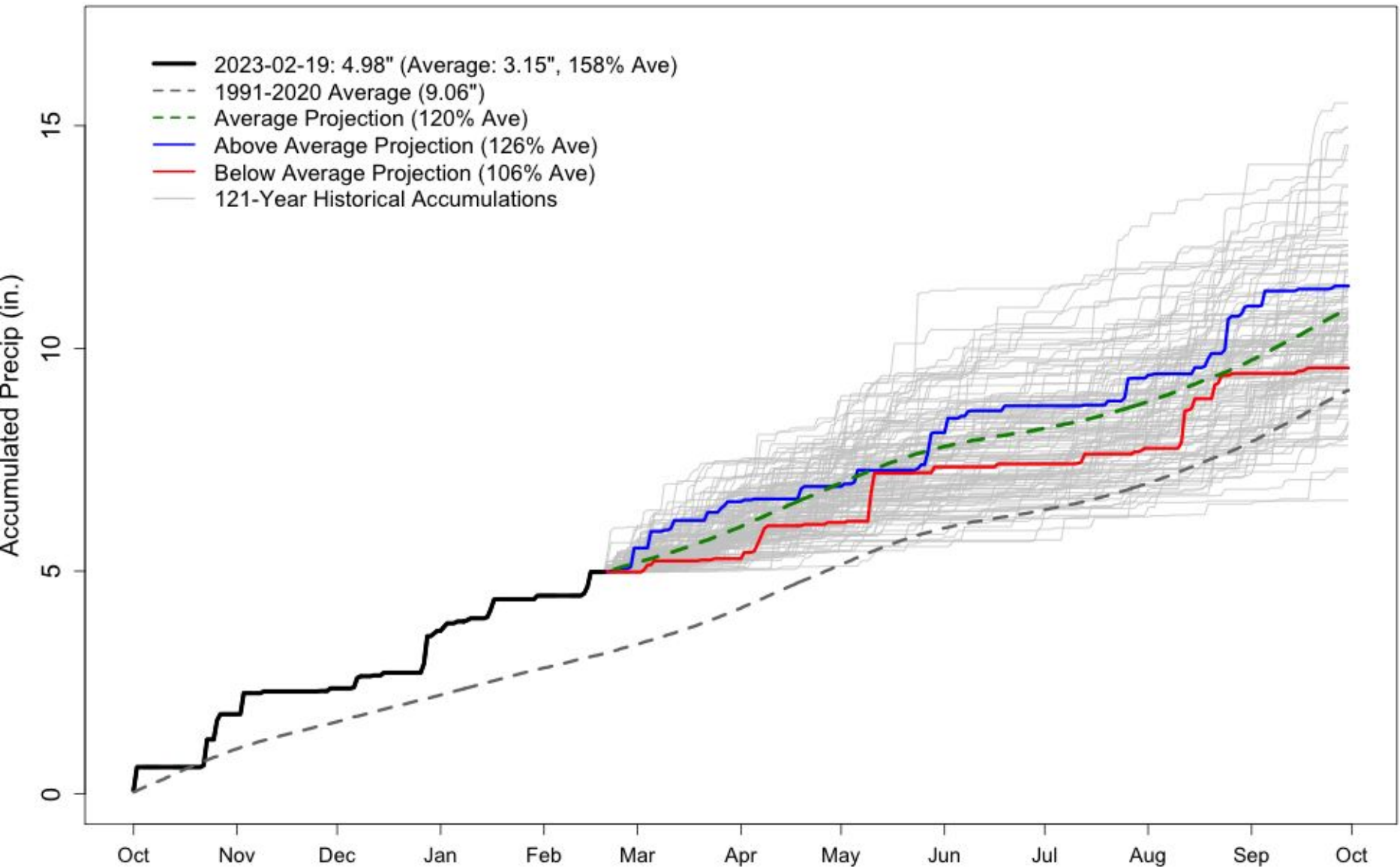
GRAND LAKE 1 NW WY2023 Precipitation Projections



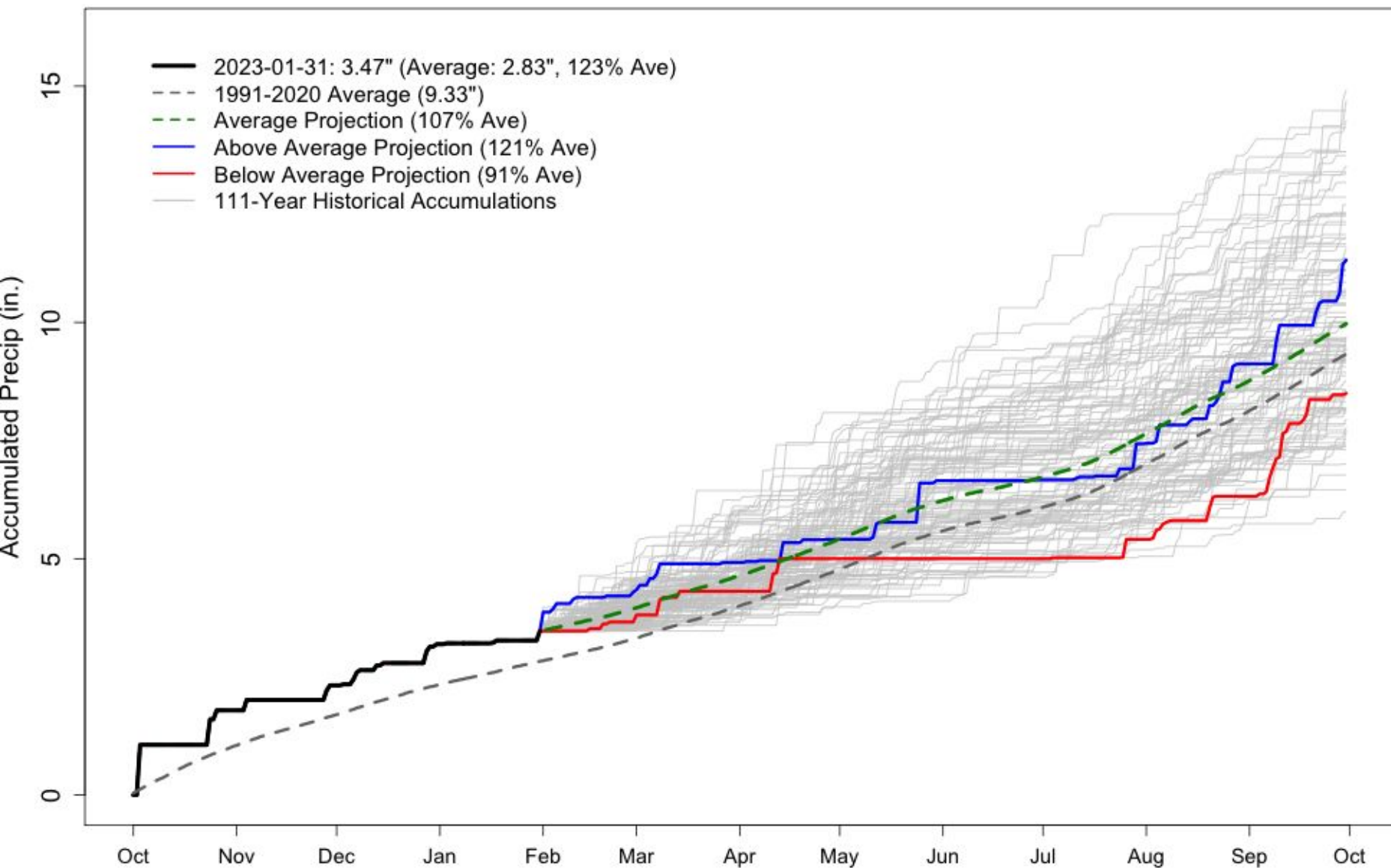
STEAMBOAT SPRINGS WY2023 Precipitation Projections



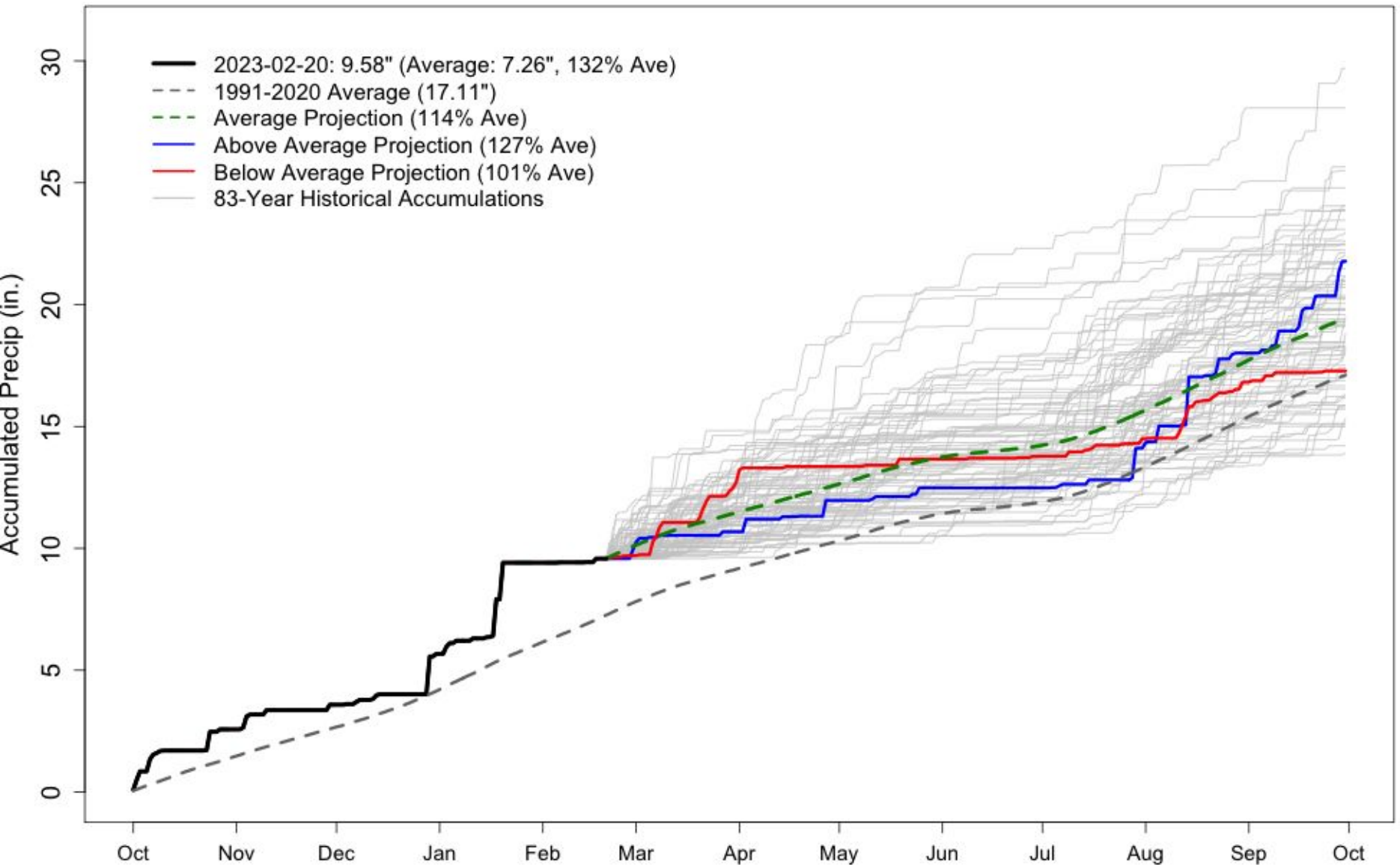
GRAND JUNCTION WALKER FIELD WY2023 Precipitation Projections



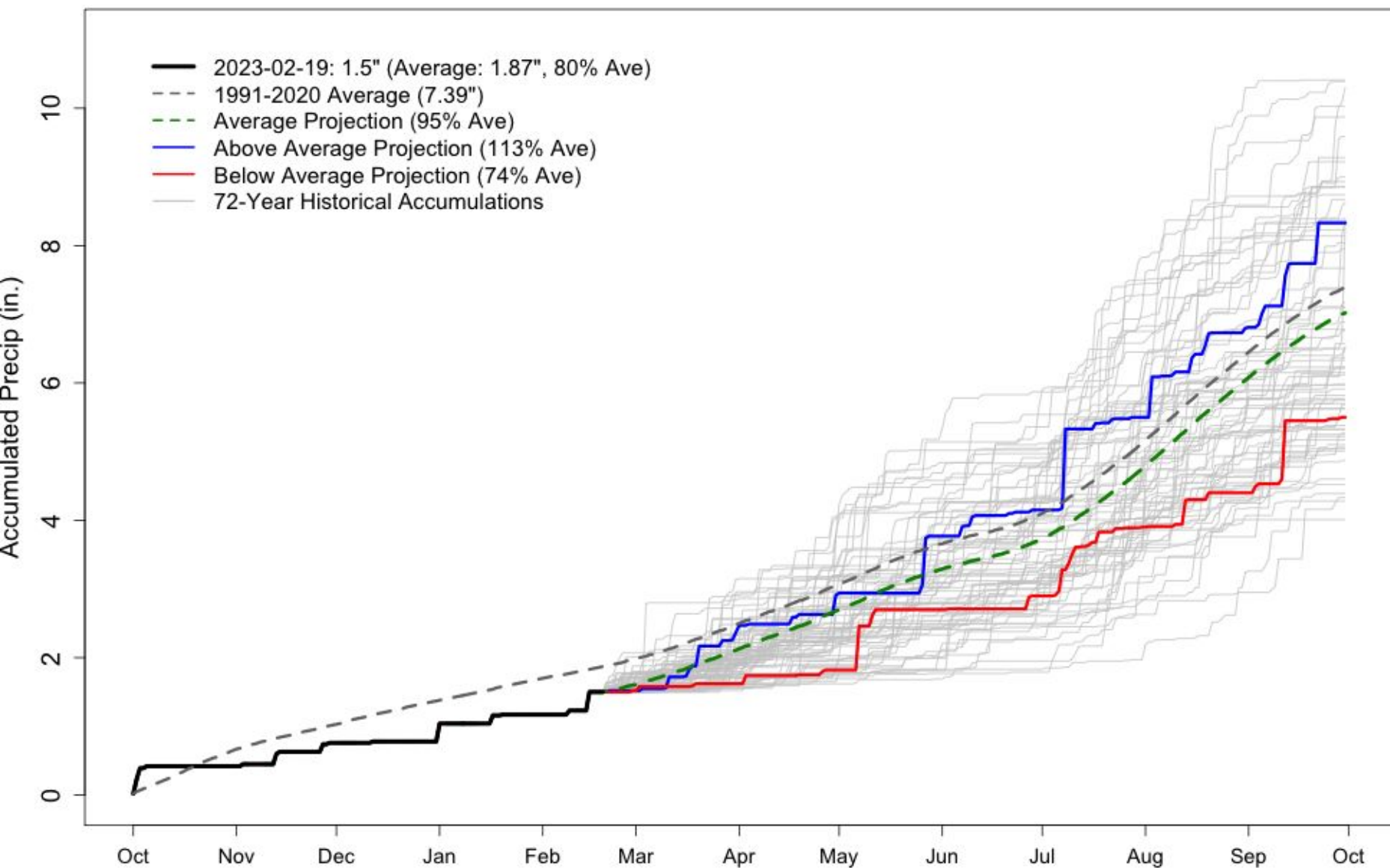
MONTROSE NO 2 WY2023 Precipitation Projections



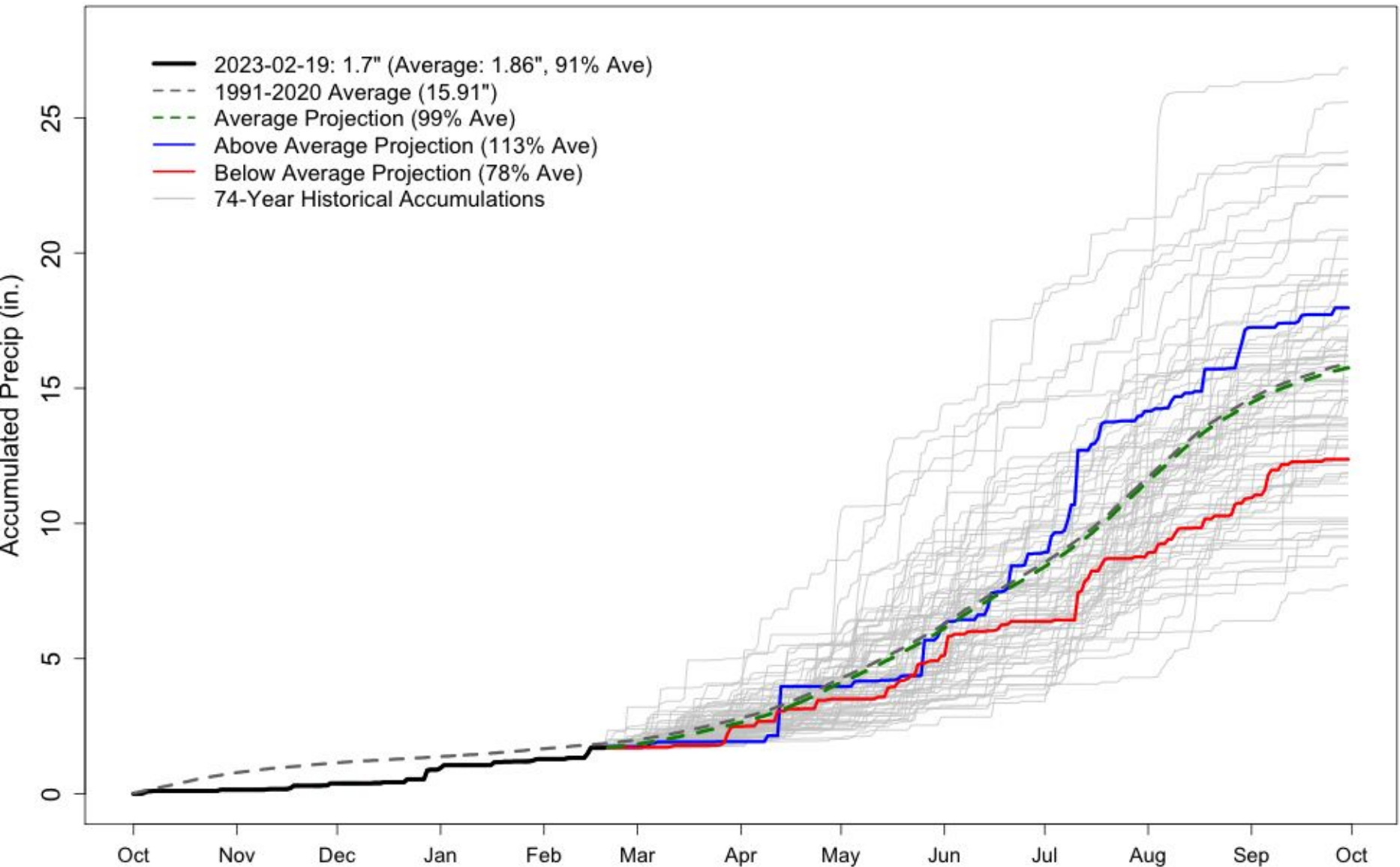
MESA VERDE NP WY2023 Precipitation Projections



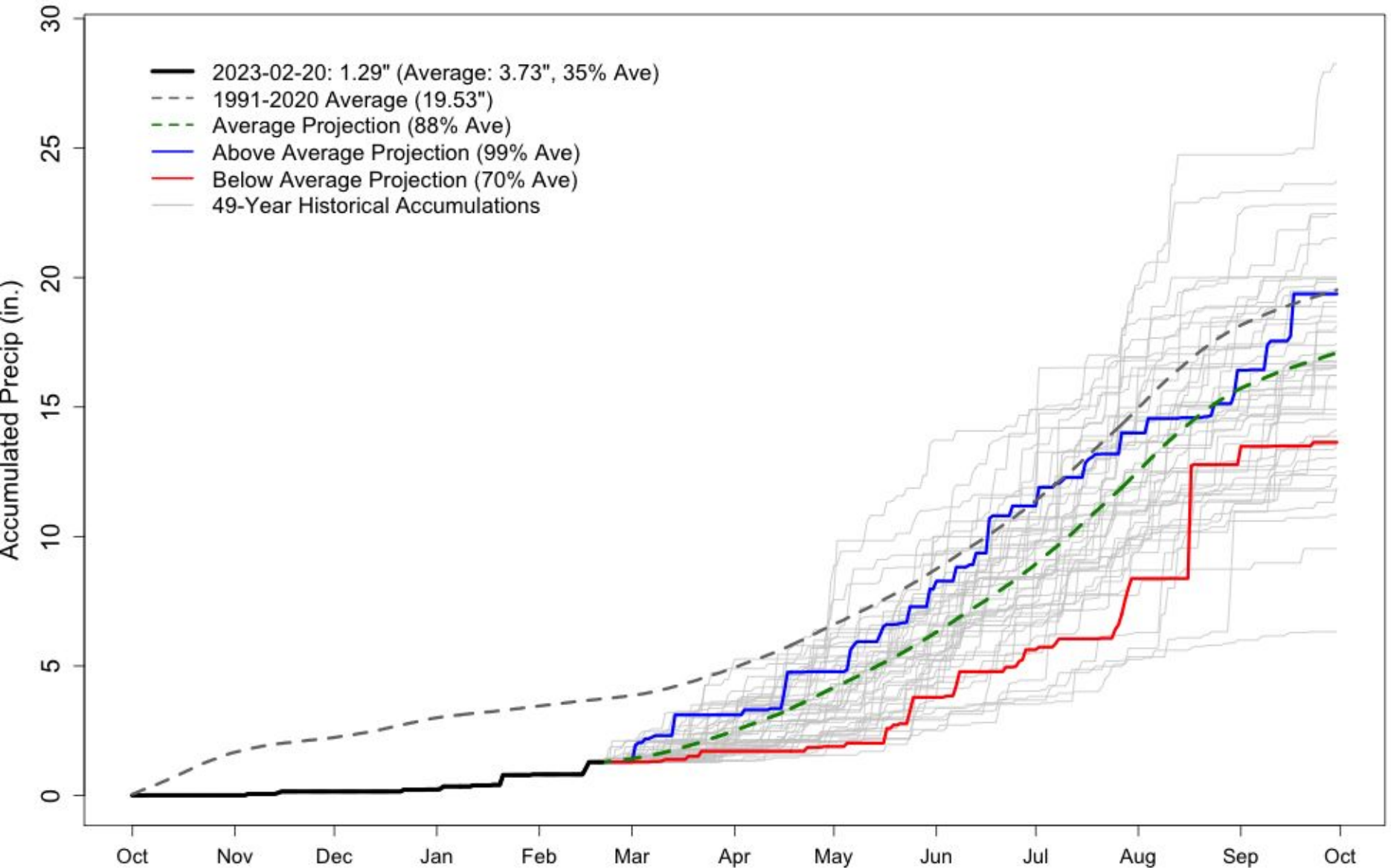
ALAMOSA-BERGMAN FIELD WY2023 Precipitation Projections



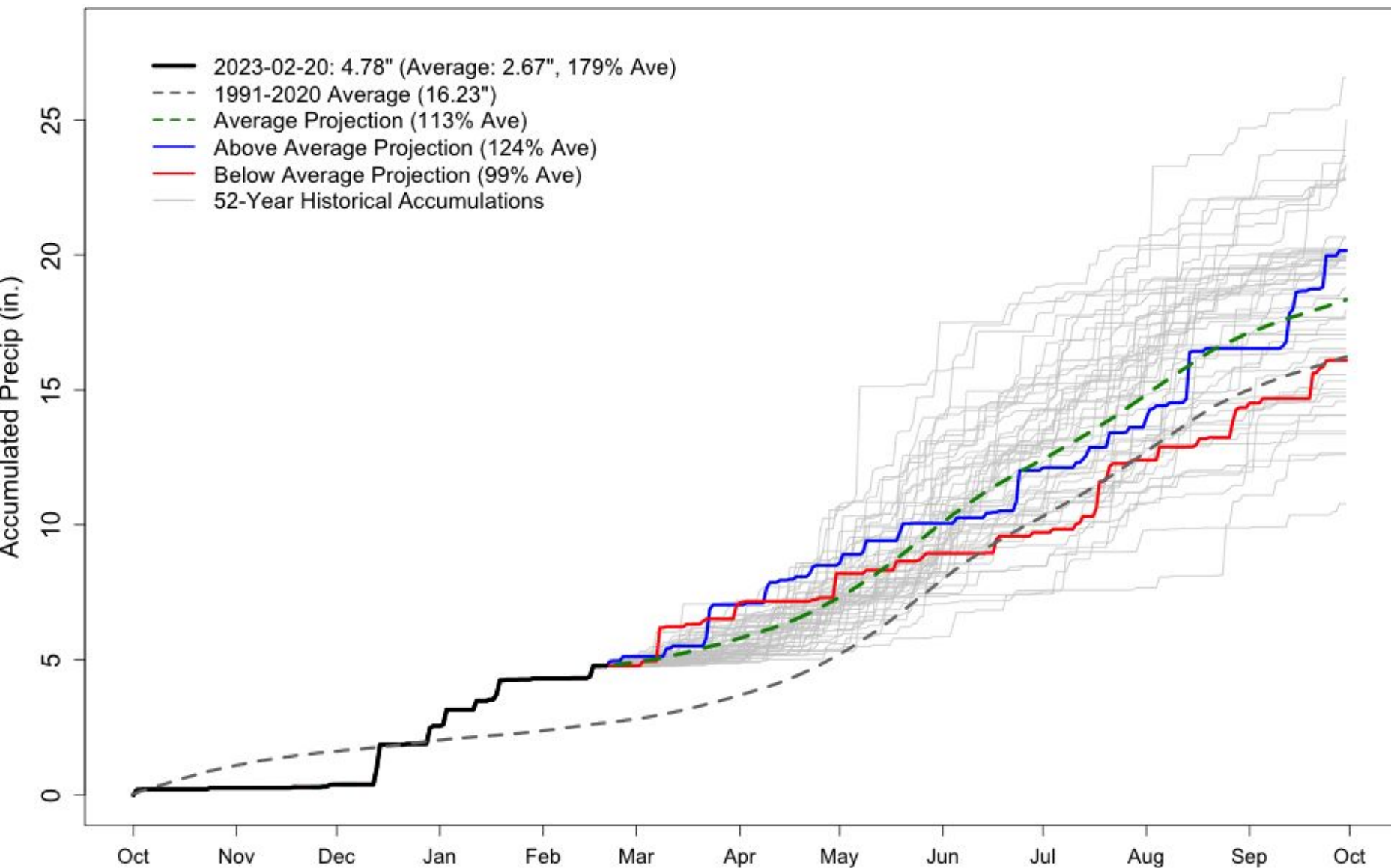
COLORADO SPRINGS MUNICIPAL AP WY2023 Precipitation Projections



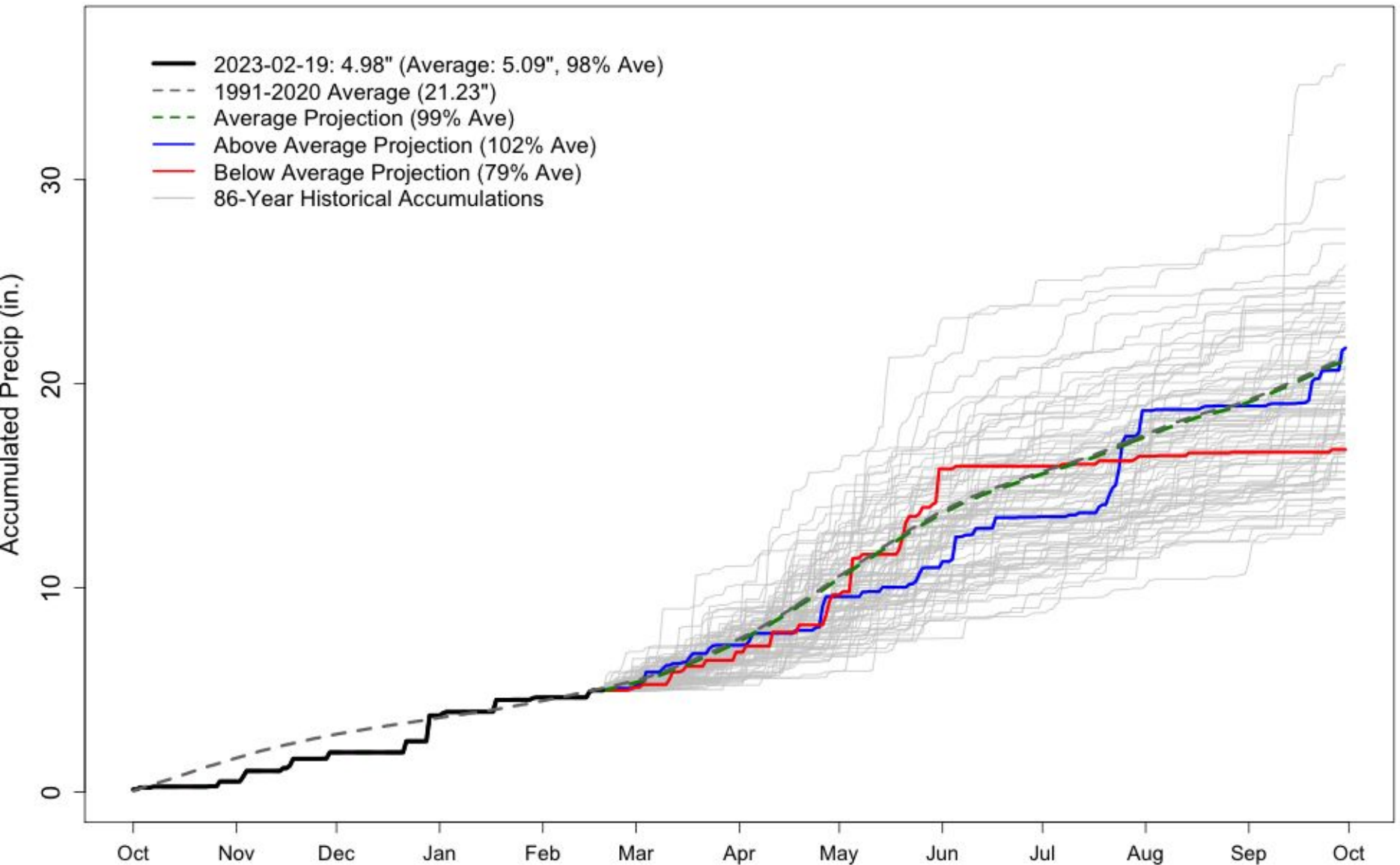
WALSH 1 W WY2023 Precipitation Projections



AKRON 4 E WY2023 Precipitation Projections



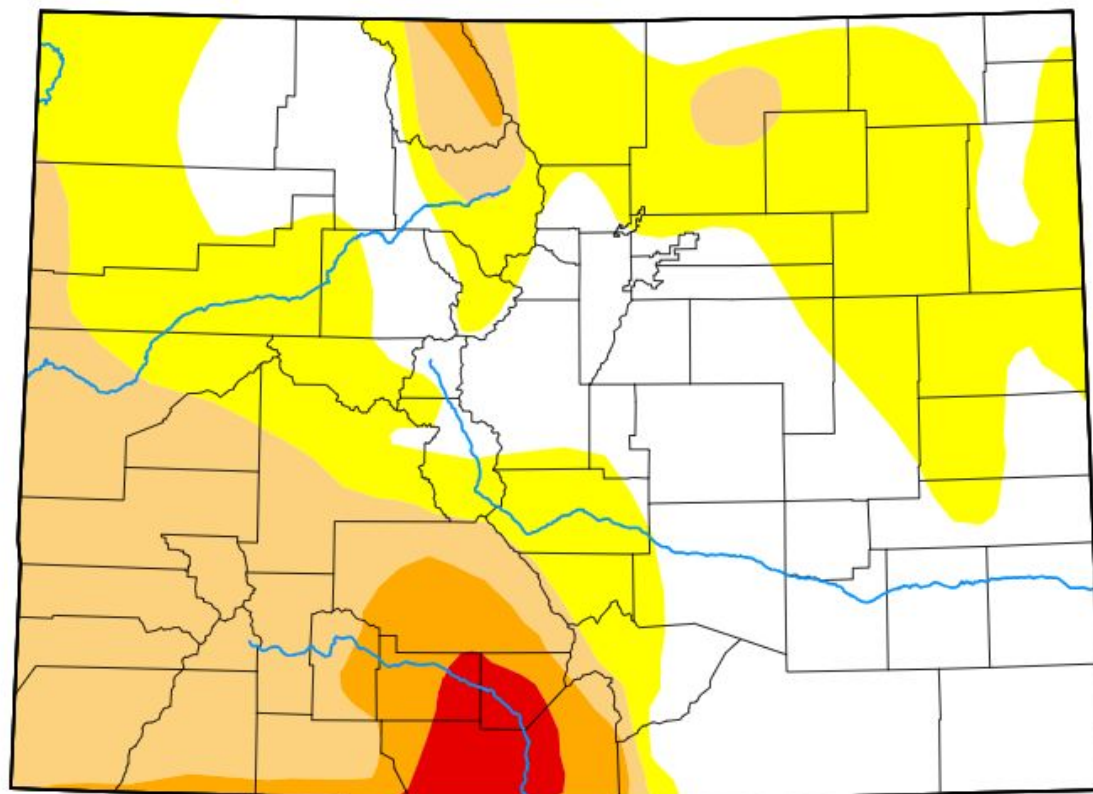
BOULDER WY2023 Precipitation Projections



Drought Update

- Long-term wet conditions from 2023's snowpack and wet spring, but drier conditions recently
- Snowpack much below normal at the beginning of January, but closer to normal now

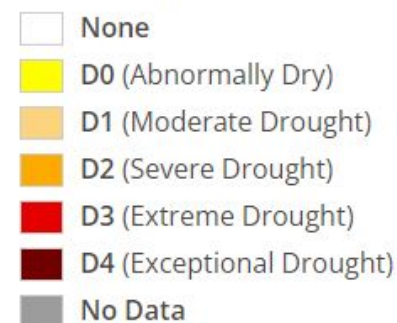
Colorado



Map released: Thurs. January 18, 2024

Data valid: January 16, 2024 at 7 a.m. EST

Intensity



Authors

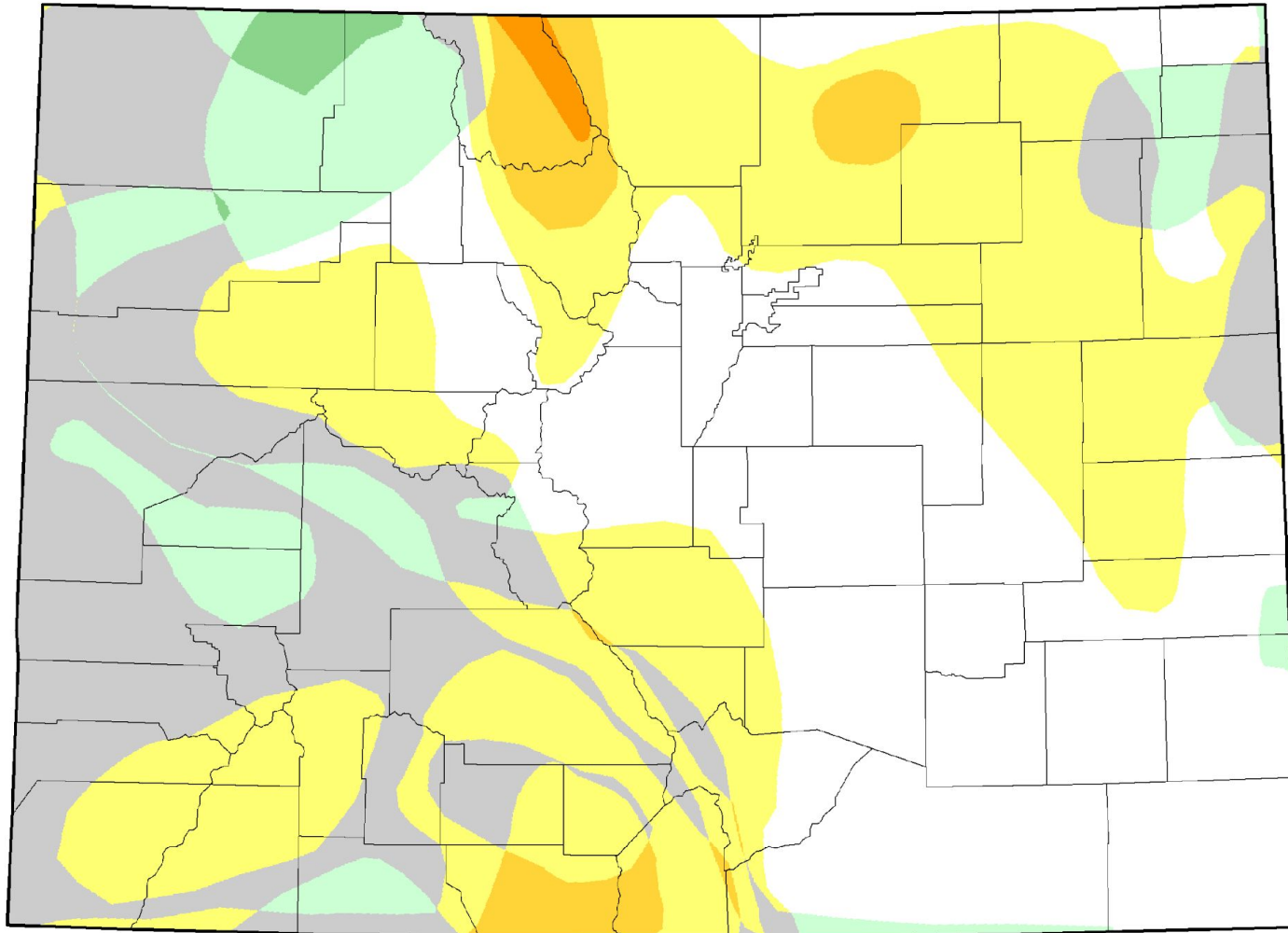
United States and Puerto Rico Author(s):

[Adam Hartman](#), NOAA/NWS/NCEP/CPC

Pacific Islands and Virgin Islands Author(s):

[Anthony Artusa](#), NOAA/NWS/NCEP/CPC

U.S. Drought Monitor Class Change - Colorado 12 Week

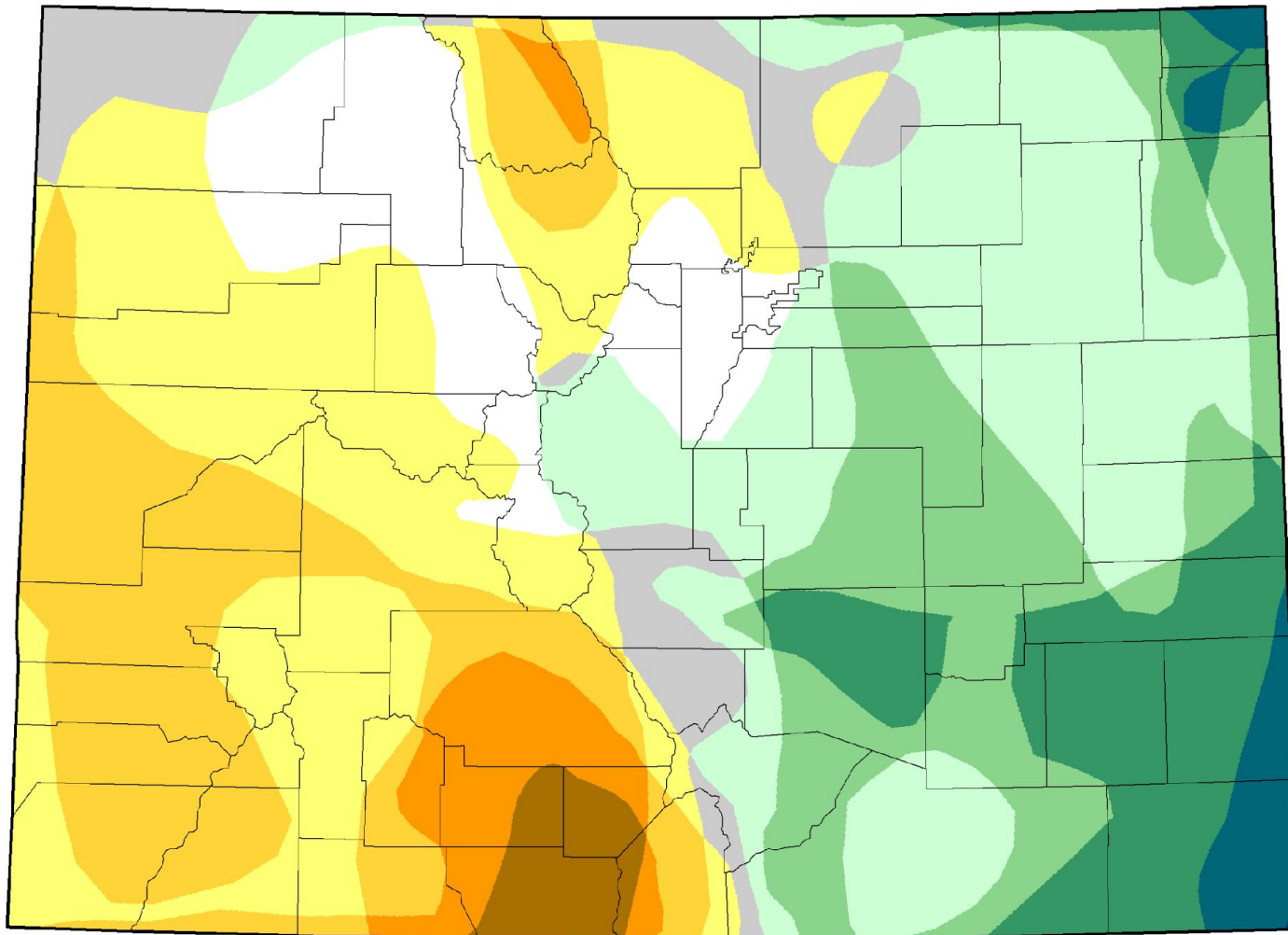


January 16, 2024
compared to
October 24, 2023

droughtmonitor.unl.edu

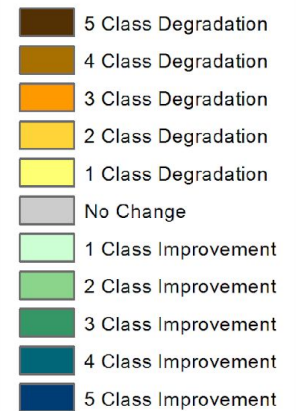


U.S. Drought Monitor Class Change - Colorado 52 Week

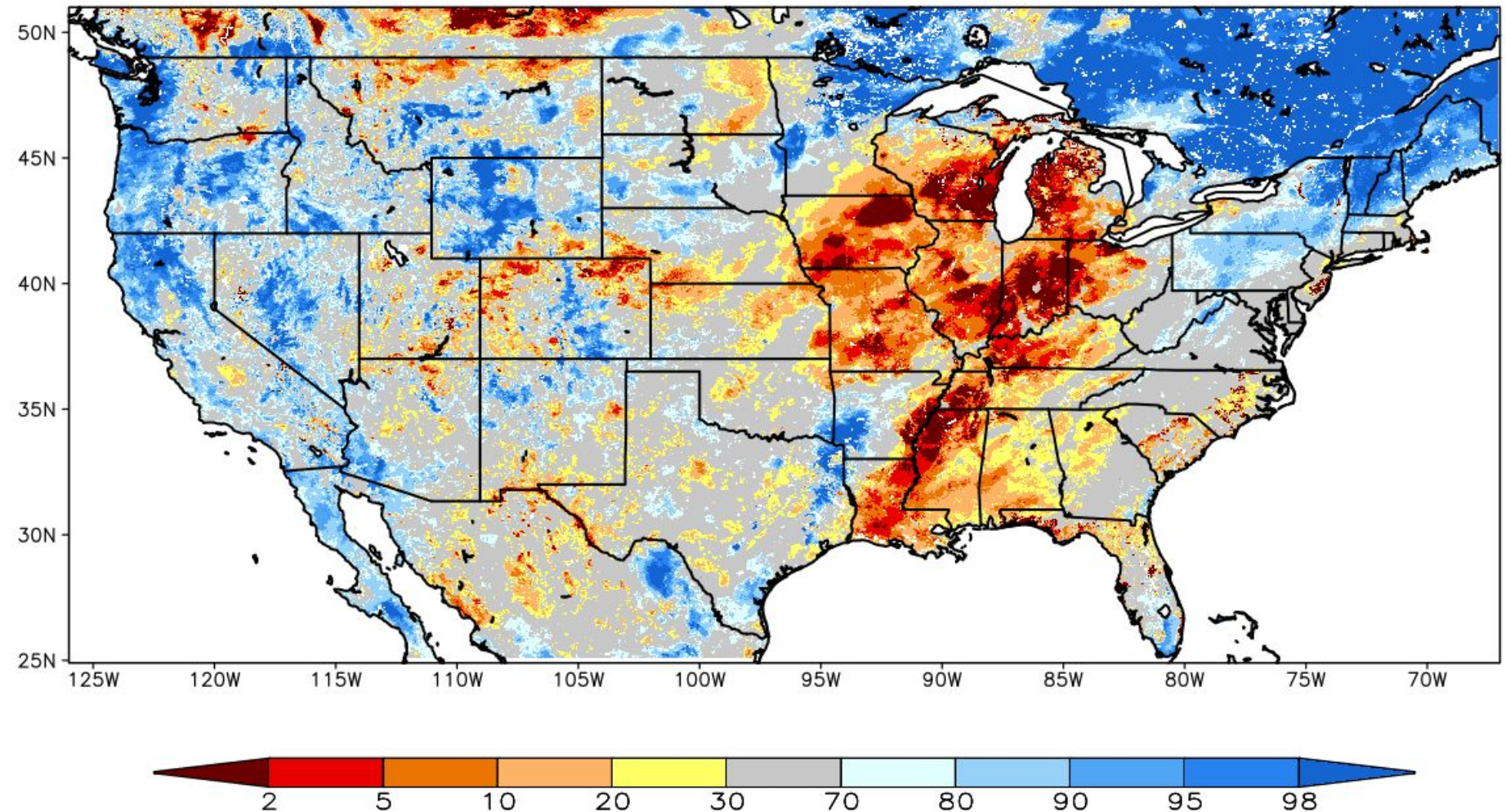


January 16, 2024
compared to
January 17, 2023

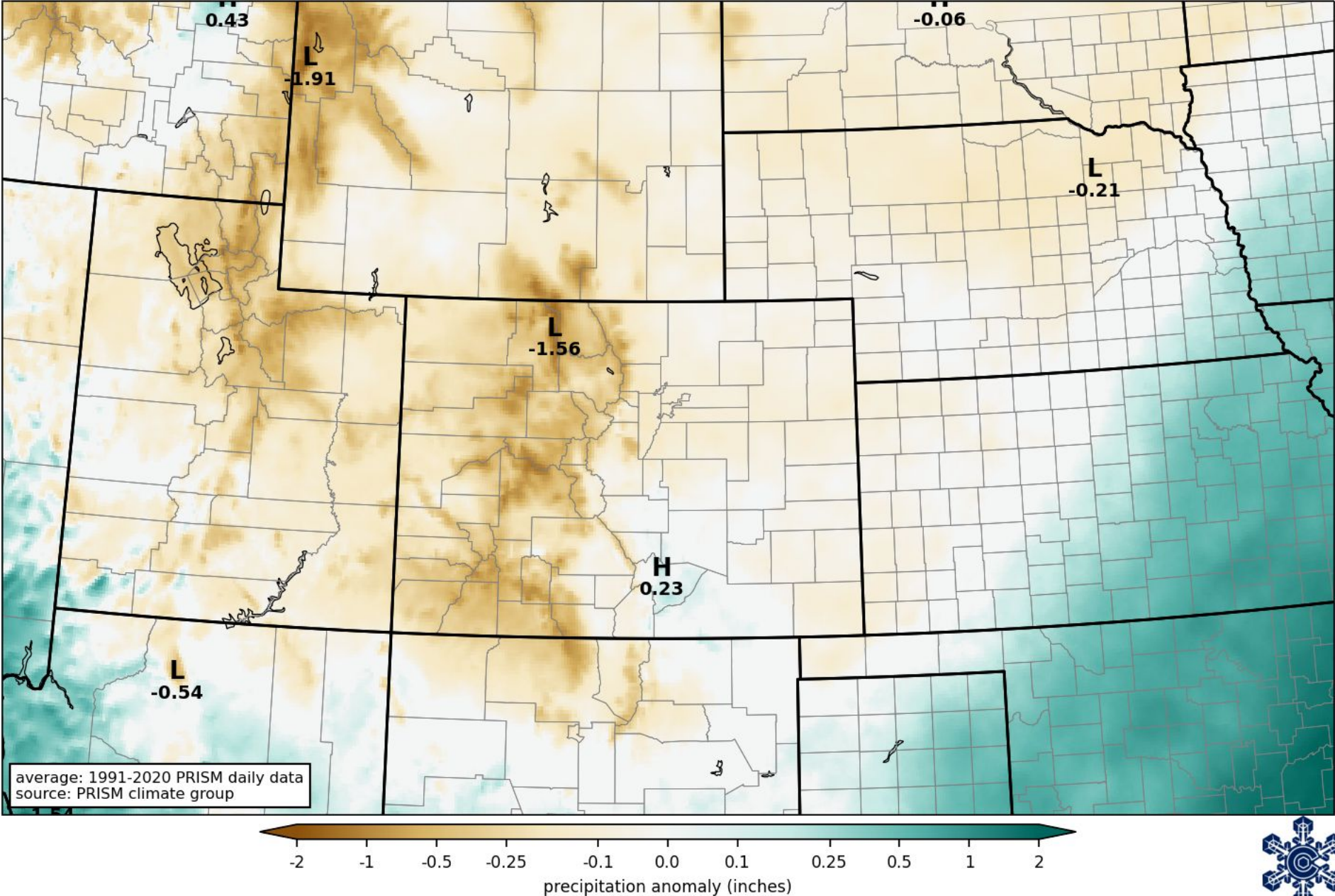
droughtmonitor.unl.edu



SPoRT-LIS 0-100 cm Soil Moisture percentile valid 23 Jan 2024



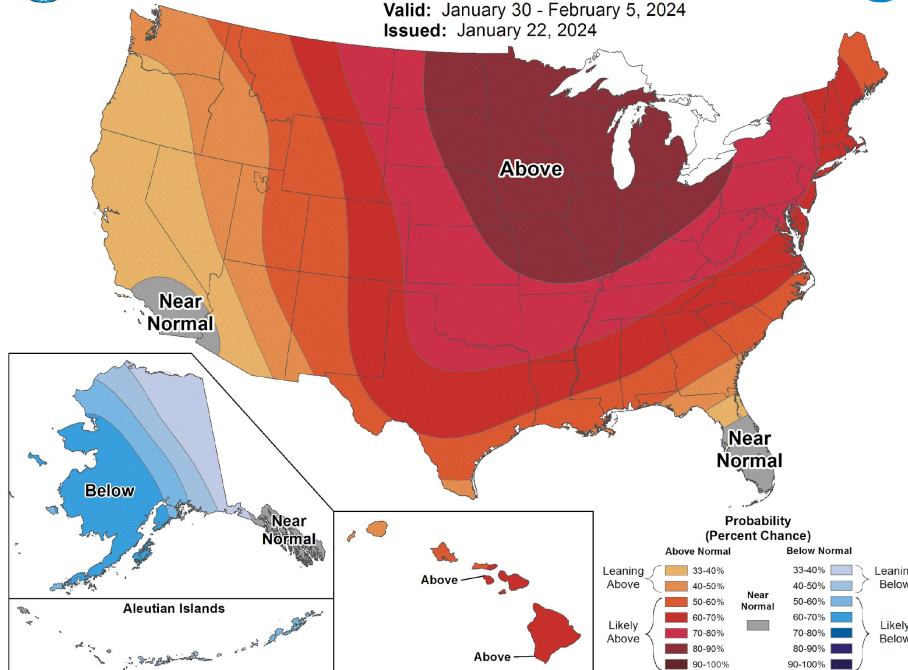
NOTE





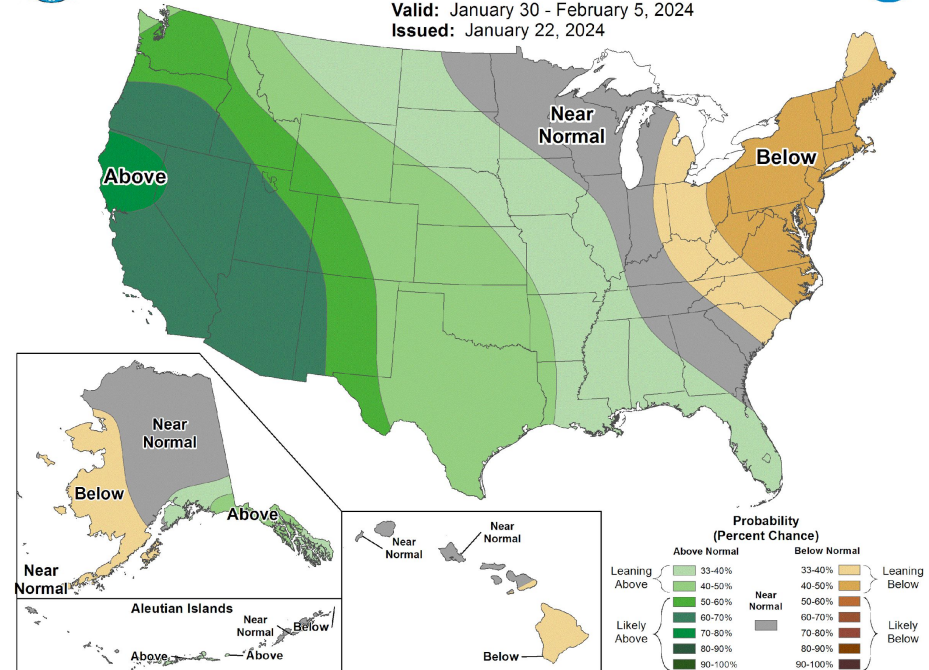
8-14 Day Temperature Outlook

Valid: January 30 - February 5, 2024
Issued: January 22, 2024



8-14 Day Precipitation Outlook

Valid: January 30 - February 5, 2024
Issued: January 22, 2024



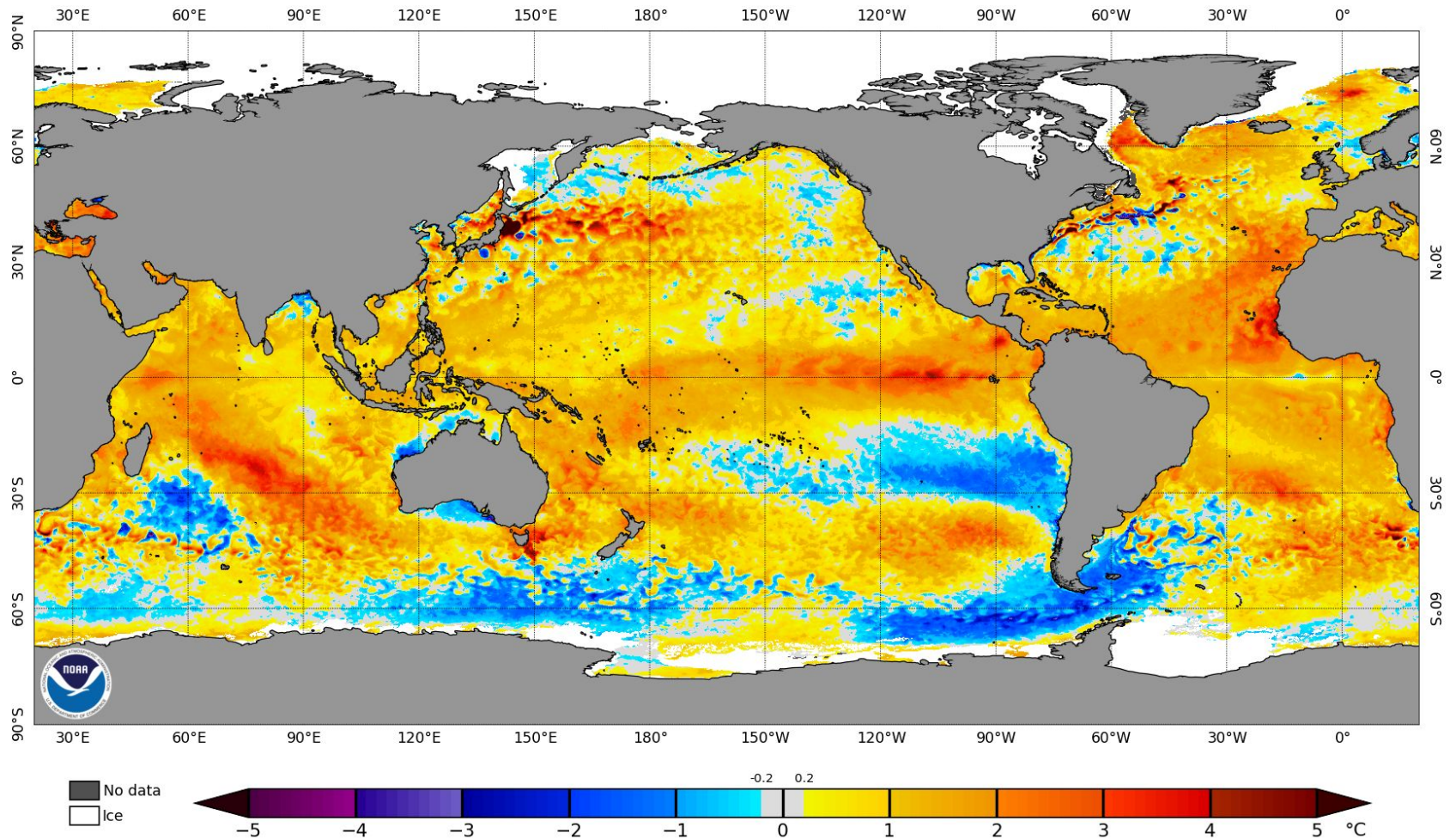
Milder air across CONUS

Potential large change in moisture 1st week of February

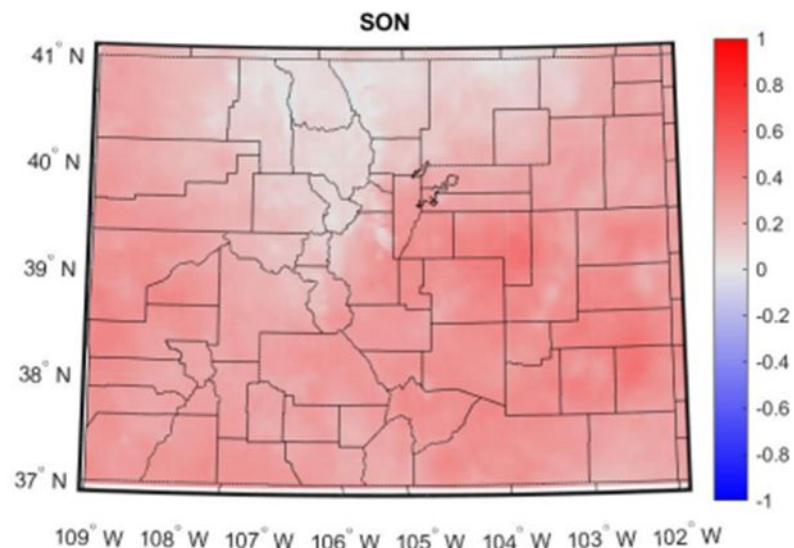
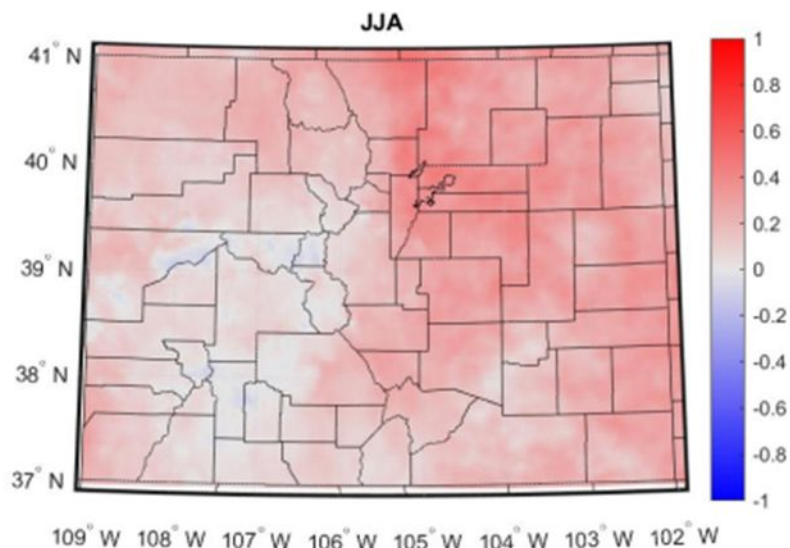
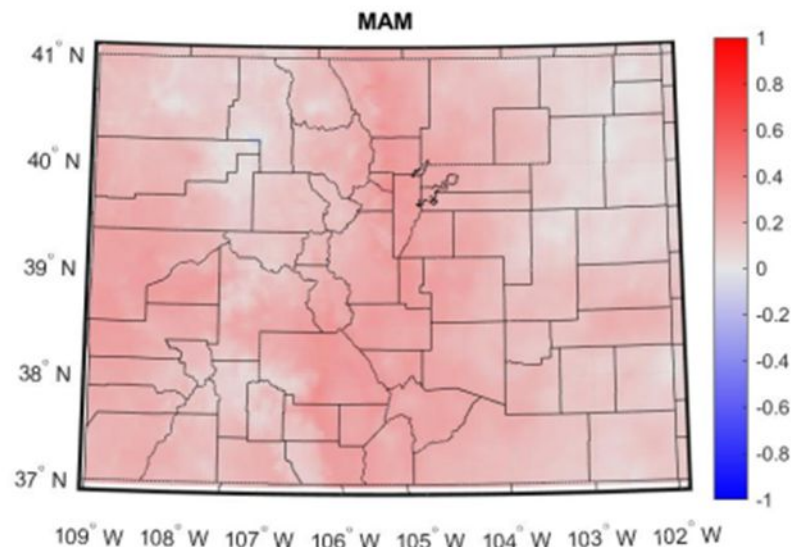
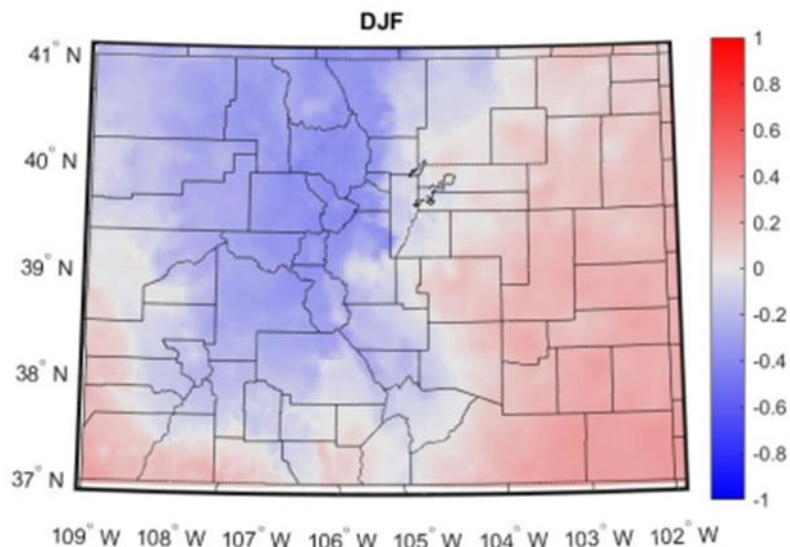
Greater certainty further west

Current Sea Surface Temperature Pattern

NOAA Coral Reef Watch Daily 5km SST Anomalies (v3.1) 16 Jan 2024



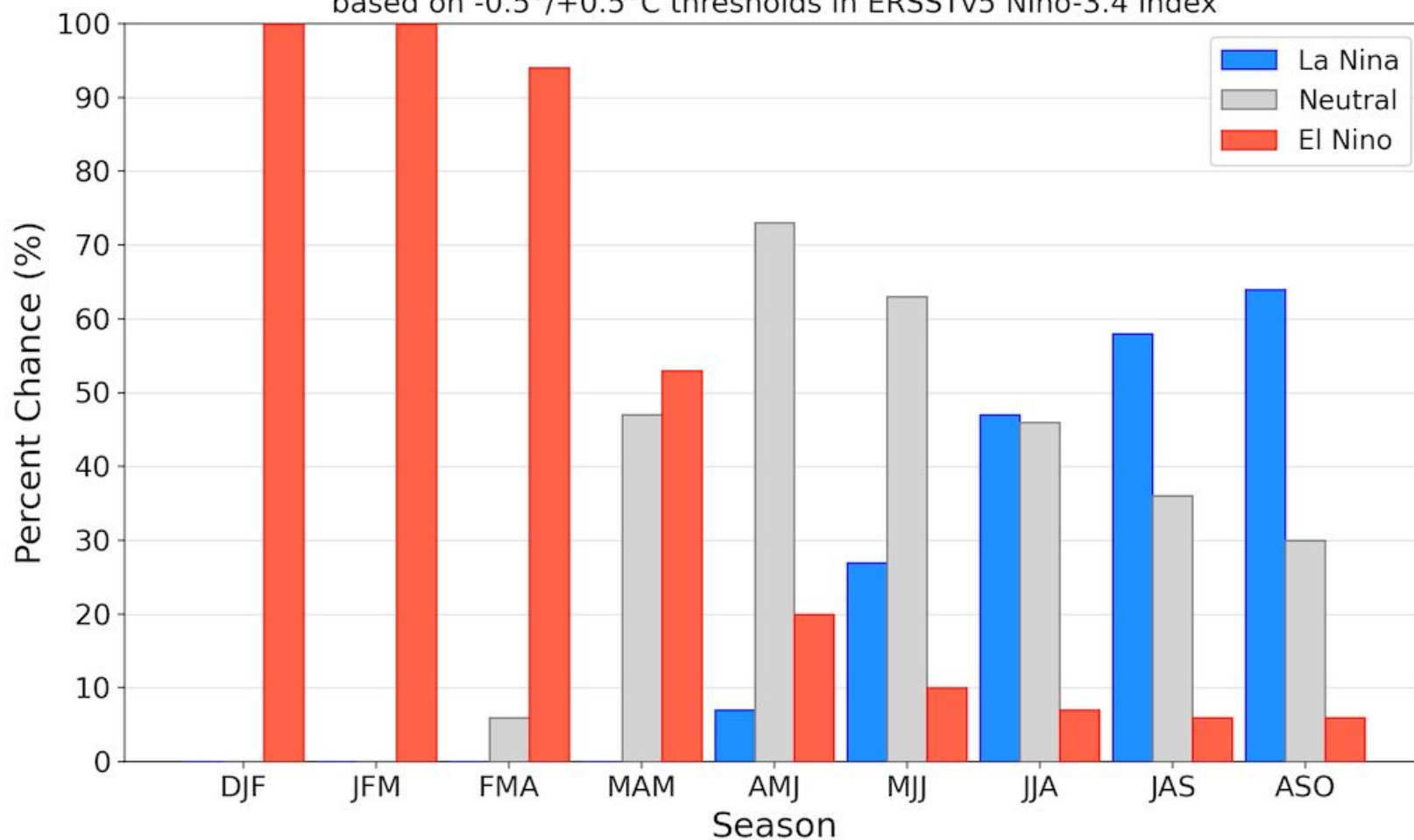
Correlation Between ENSO ONI and Seasonal Precipitation in Colorado (1951-2020)



Blue = La Niña wetter Red = El Niño wetter

Official NOAA CPC ENSO Probabilities (issued Jan. 2024)

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

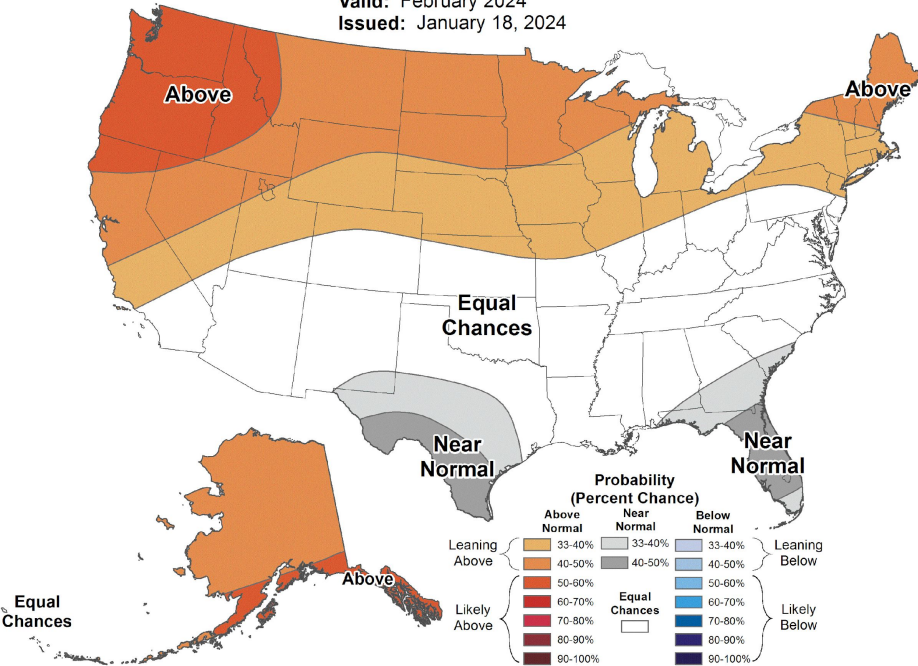


February Outlook



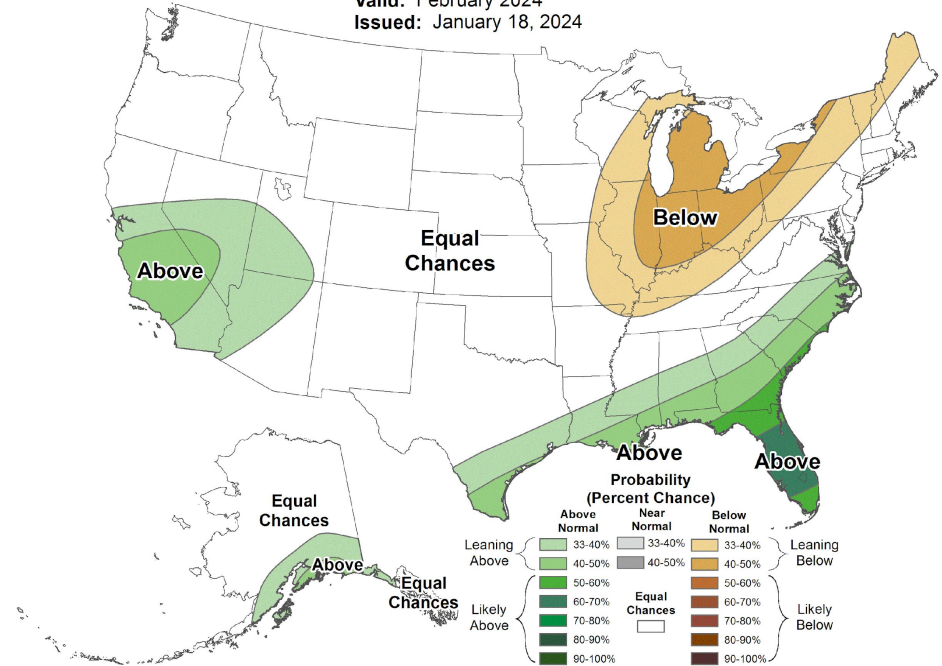
Monthly Temperature Outlook

Valid: February 2024
Issued: January 18, 2024



Monthly Precipitation Outlook

Valid: February 2024
Issued: January 18, 2024



CPC favoring persistence of current El Niño-like pattern in February

The last five Februaries have been cooler than normal

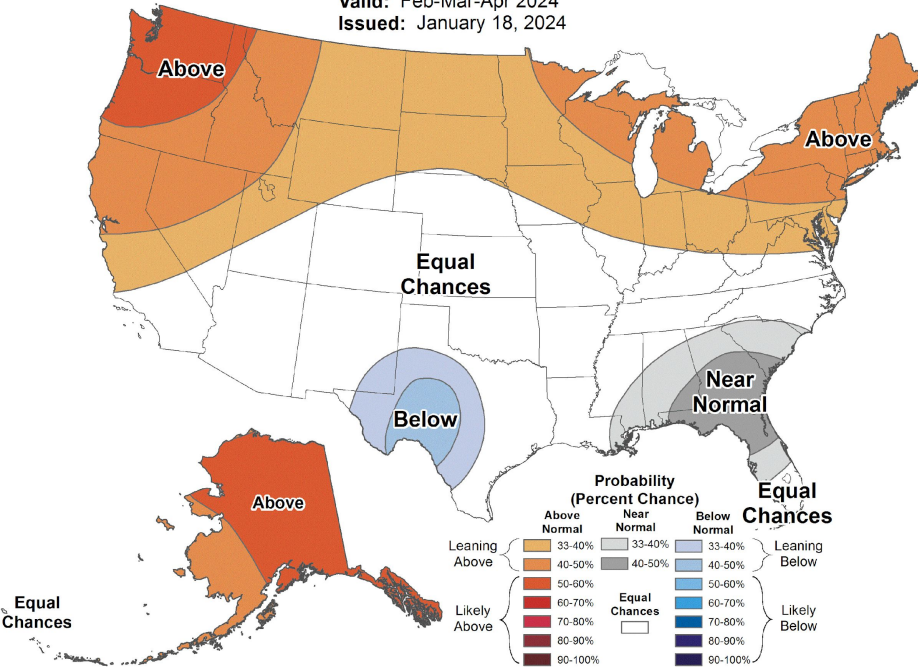
February-April Outlook



Seasonal Temperature Outlook



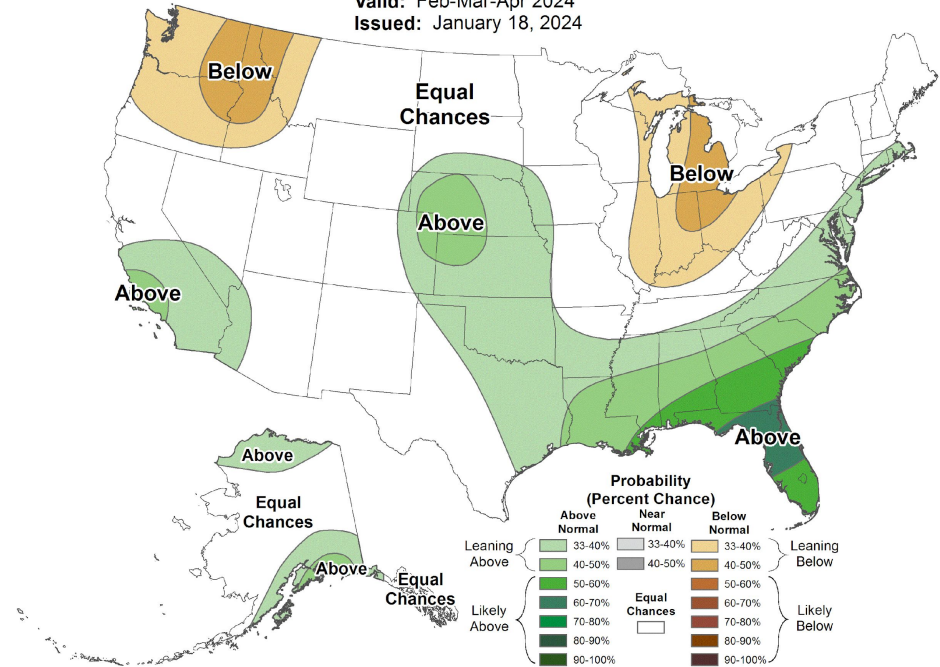
Valid: Feb-Mar-Apr 2024
Issued: January 18, 2024



Seasonal Precipitation Outlook



Valid: Feb-Mar-Apr 2024
Issued: January 18, 2024



CPC forecasting mostly equal chances for Colorado for FMA, with some elevated above normal precipitation probability in eastern Colorado

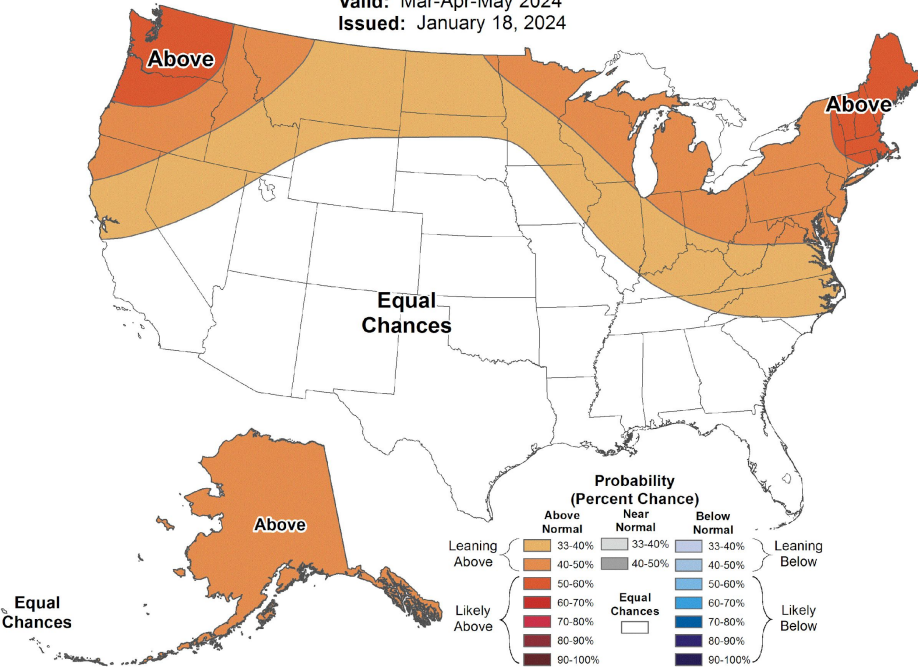
Summer out look leans heavily towards warmer than normal conditions and moderately towards drier than normal conditions

March-May Outlook



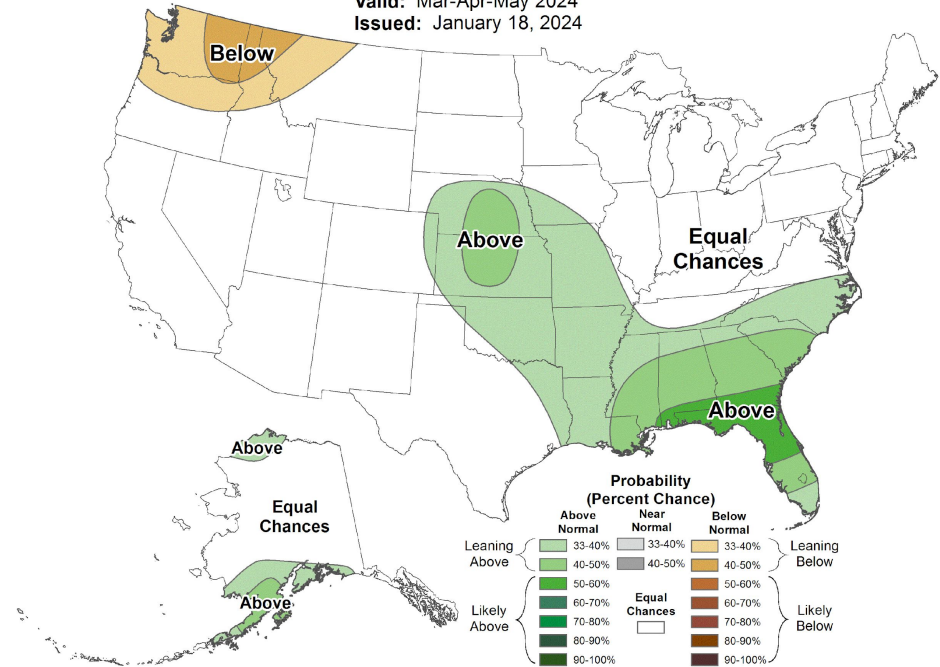
Seasonal Temperature Outlook

Valid: Mar-Apr-May 2024
Issued: January 18, 2024



Seasonal Precipitation Outlook

Valid: Mar-Apr-May 2024
Issued: January 18, 2024



CPC forecasting mostly equal chances for Colorado for FMA, with some elevated above normal precipitation probability in eastern Colorado

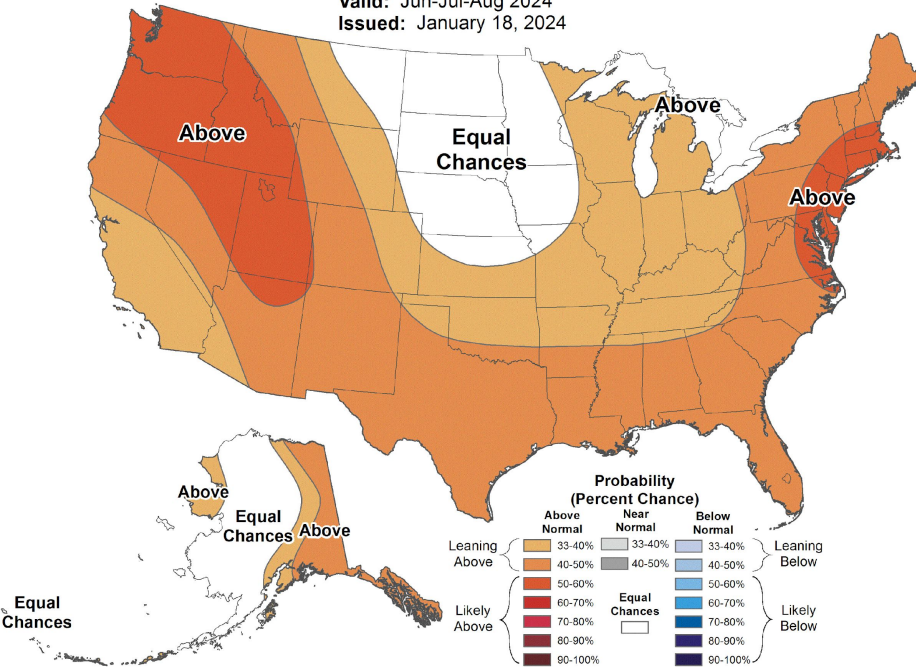
Summer out look leans heavily towards warmer than normal conditions and moderately towards drier than normal conditions

Early Summer Outlook



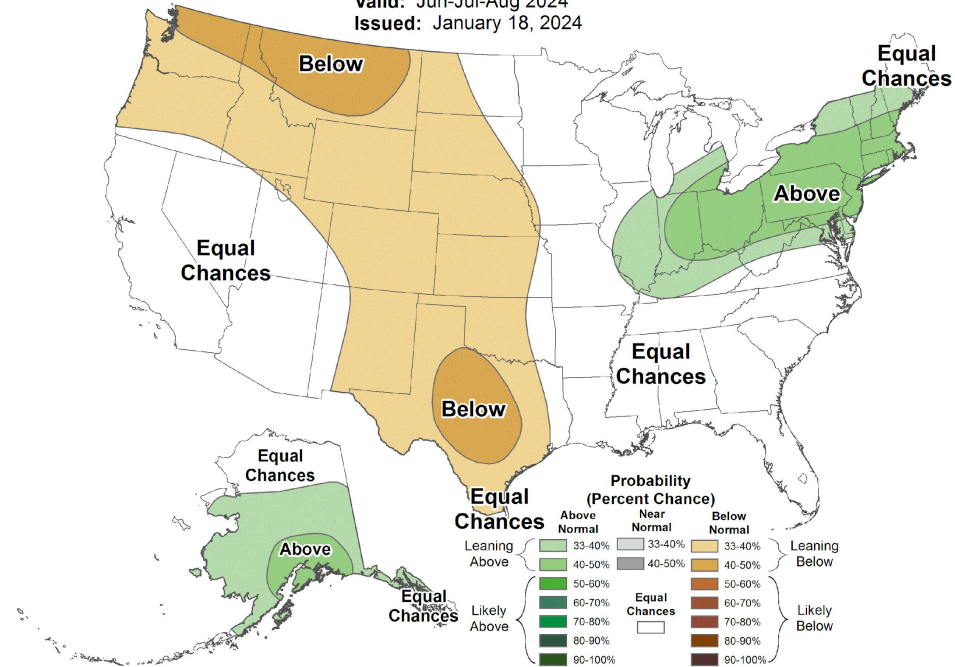
Seasonal Temperature Outlook

Valid: Jun-Jul-Aug 2024
Issued: January 18, 2024



Seasonal Precipitation Outlook

Valid: Jun-Jul-Aug 2024
Issued: January 18, 2024



CPC forecasting mostly equal chances for Colorado for FMA, with some elevated above normal precipitation probability in eastern Colorado

Summer out look leans heavily towards warmer than normal conditions and moderately towards drier than normal conditions

Takeaways

- 2023 was cooler and wetter than recent climate normals and long-term averages, but the warm end to the calendar year brought the end-of-year statistics close to average statewide
- January is off to a much cooler start than normal with lower than normal, but improving precipitation conditions over the last few months
- Current drought depiction in Colorado is primarily based on deficits developing since July
- El Niño conditions persist over the Pacific Ocean. This tends to be associated with wetter than normal springtime conditions in Colorado, leaving some optimism that early-season snow drought will improve
- Higher confidence in a warm summer with a slightly elevated probability of a dry summer. Spring rain will be important

Climate Change in Colorado Synthesis Report

- We partnered with Jeff Lukas to update the 2014 Climate Change in Colorado synthesis report for water managers
- This report is a bit broader with more info on future weather hazard risk
- Use QR code for more info!

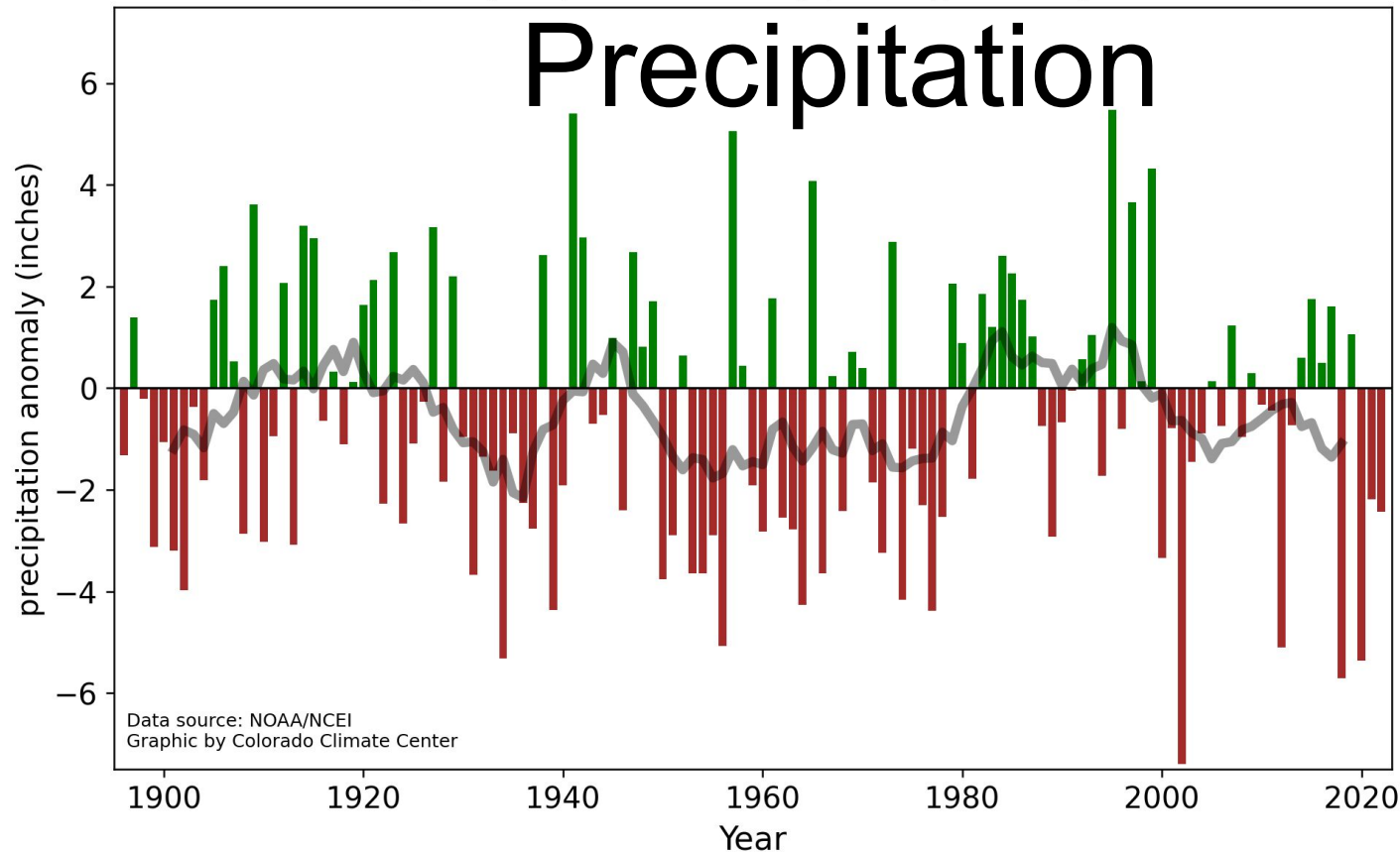


Temperature

- Statewide annual average temperatures warmed by 2.3°F from 1980 to 2022
- By 2050 (the 2035-2064 period average), Colorado statewide annual temperatures are projected to warm by +2.5°F to +5.5°F compared to a 1971-2000 baseline, and +1.0°F to +4.0°F compared to today, under a medium-low emissions scenario (RCP4.5)
- By 2070 (the 2055-2084 period average), Colorado statewide annual temperatures are projected to warm by +3.0°F to +6.5°F compared to the late 20th century, and +1.5°F to +5.0°F compared to today, under RCP4.5
- Summer and fall are projected to warm slightly more than winter and spring

Climate variable/event	Recent trend	Projected future change	Confidence in change
Average Temperature	Warmer	Warmer	Very High ●
Annual Precipitation	Lower	Uncertain	Low ☹️

Colorado statewide water year precipitation anomaly (inches), with respect to 1971-2000 average

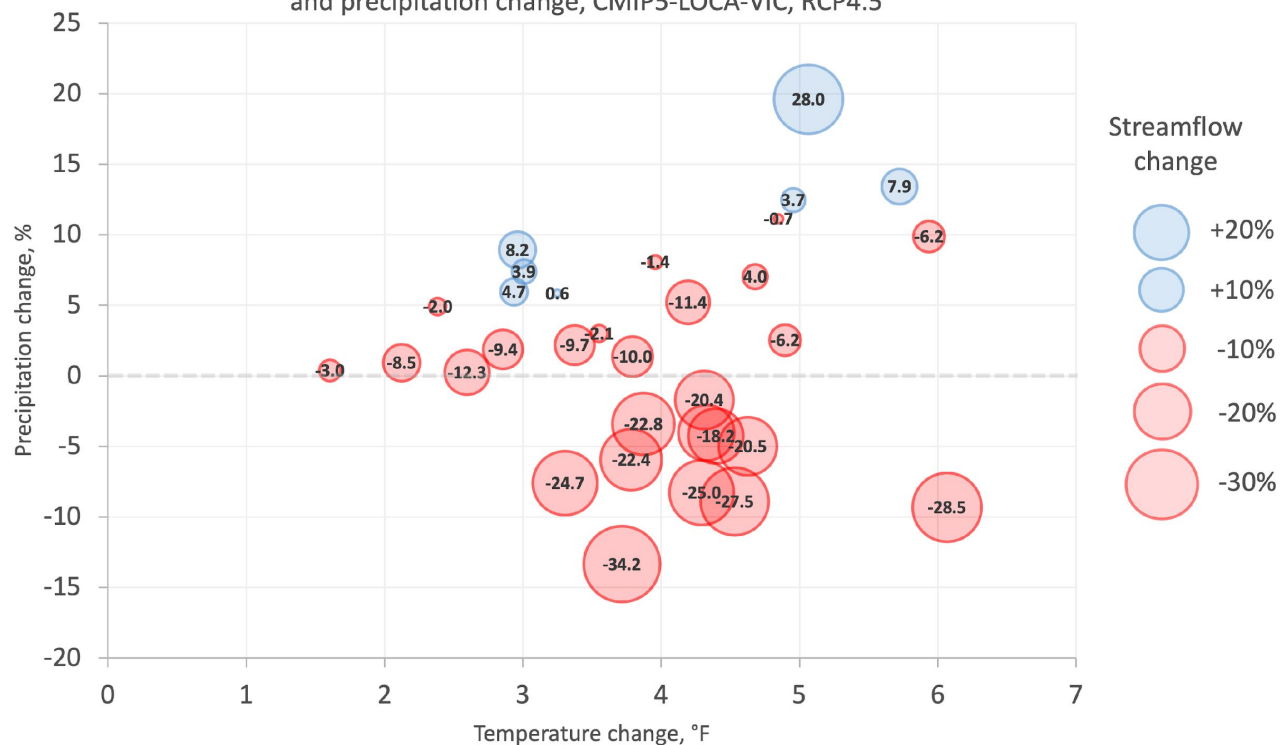


- Colorado has observed persistent dry conditions in the 21st century. According to water year precipitation accumulations, October 1 – September 30, four of the five driest years have occurred since 2000
- The direction of future change in annual statewide precipitation for Colorado is much less clear than for temperature. The climate model projections for 2050 range from -7% to +7% compared to the late 20th century average, under a medium-low (RCP4.5) emissions scenario.
- Most climate models project an increase in winter (Dec-Feb) statewide precipitation; the model consensus is weaker for the other seasons. The models do suggest enhanced potential for large decreases (-10% to -25%) in summer precipitation.

Snowpack and Streamflow

- Mid-century snowpack is projected to be 5-30% lower than 1971-2000 annual averages
- A bet on a warmer future is likely a bet on a drier future
- Every 1 °F warming would require ~a 2% increase in precipitation to maintain current runoff levels

Colorado R. near Dotsero, Projected change in annual streamflow, 1971-2000 to 2050 (2035-2064) as a function of temperature change and precipitation change, CMIP5-LOCA-VIC, RCP4.5



Climate variable/event	Recent trend	Projected future change	Confidence in change
Spring Snowpack	Lower	Lower	Medium 🟡
Runoff timing	Earlier	Earlier	High 🟢
Annual Streamflow	Lower	Lower	Medium 🟡
Summer soil moisture	Lower	Lower	High 🟢
Evaporative demand	Higher	Higher	Very High 🟢

Weather Hazards

Plenty of misinformation circulates about cold waves like the one we just experienced. Cold waves are neither compelling evidence for nor against climate change

Not all climate models predict fewer/less intense cold waves

Climate variable/event	Recent trend	Projected future change	Confidence in change
Heat waves	More frequent/intense	More frequent/intense	Very High 🟢
Cold waves	Fewer	Fewer	Medium 🟡
Droughts	More frequent/intense	More frequent/intense	High 🟢
Wildfires	More and larger	More and larger	High 🟢
Extreme precipitation	More intense	More frequent/intense	Medium 🟡
Flooding	Mixed	Higher	Medium 🟡
Windstorms	Uncertain	Uncertain	Low 🟡
Severe thunderstorms	Uncertain	More frequent	Low 🟡
Hail	Uncertain	More large hail	Low 🟡
Tornadoes	Uncertain	Uncertain	Low 🟡
Winter storms	Uncertain	Larger storms	Low 🟡
Dust on snow events	Greater dust levels	Greater dust levels	Medium 🟡

Colorado Climate Center

Thanks, and let's keep in touch!

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Becky Bolinger – becky.bolinger@colostate.edu

Viewing this, and previous WATF Briefings:

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

