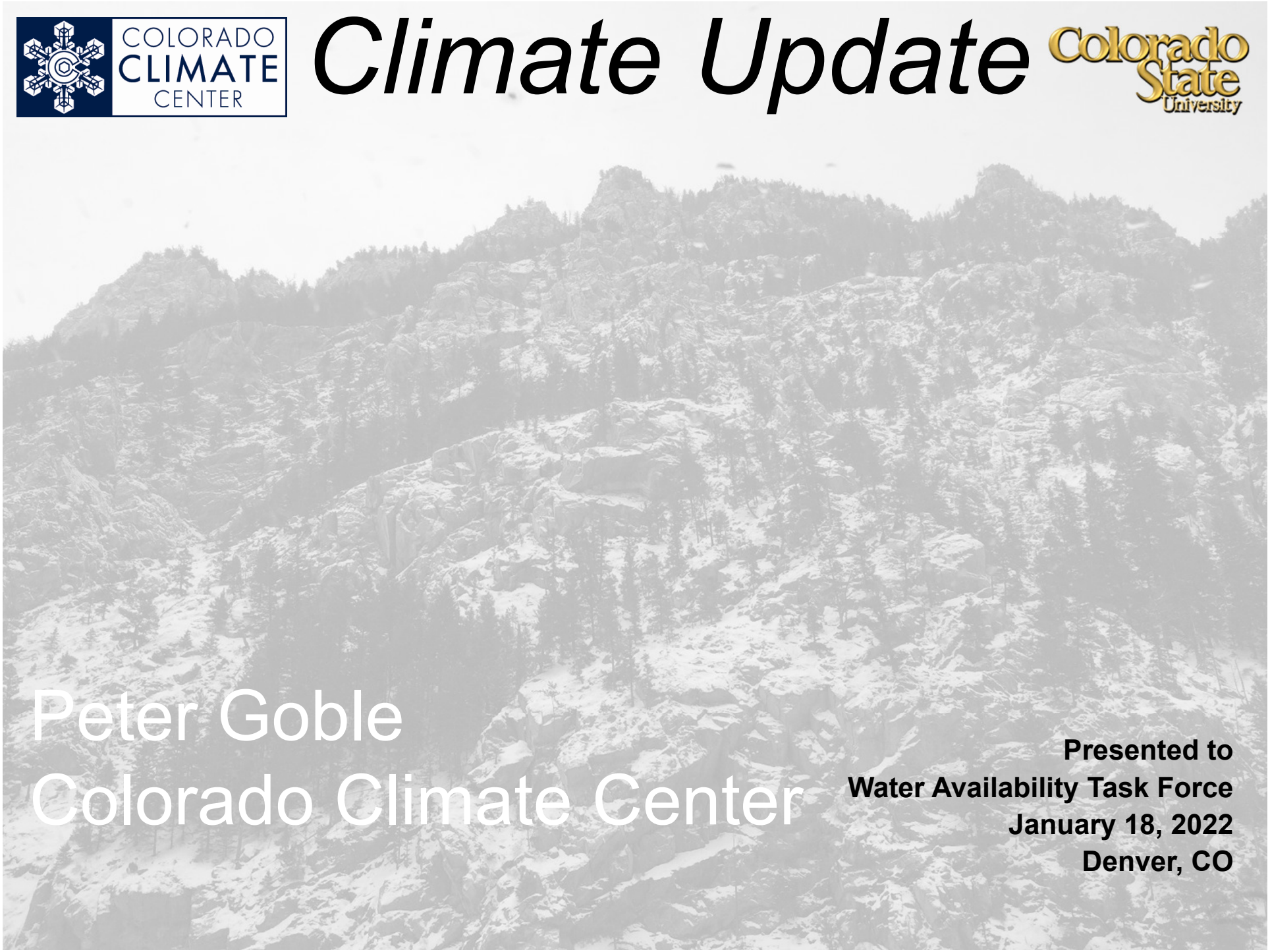
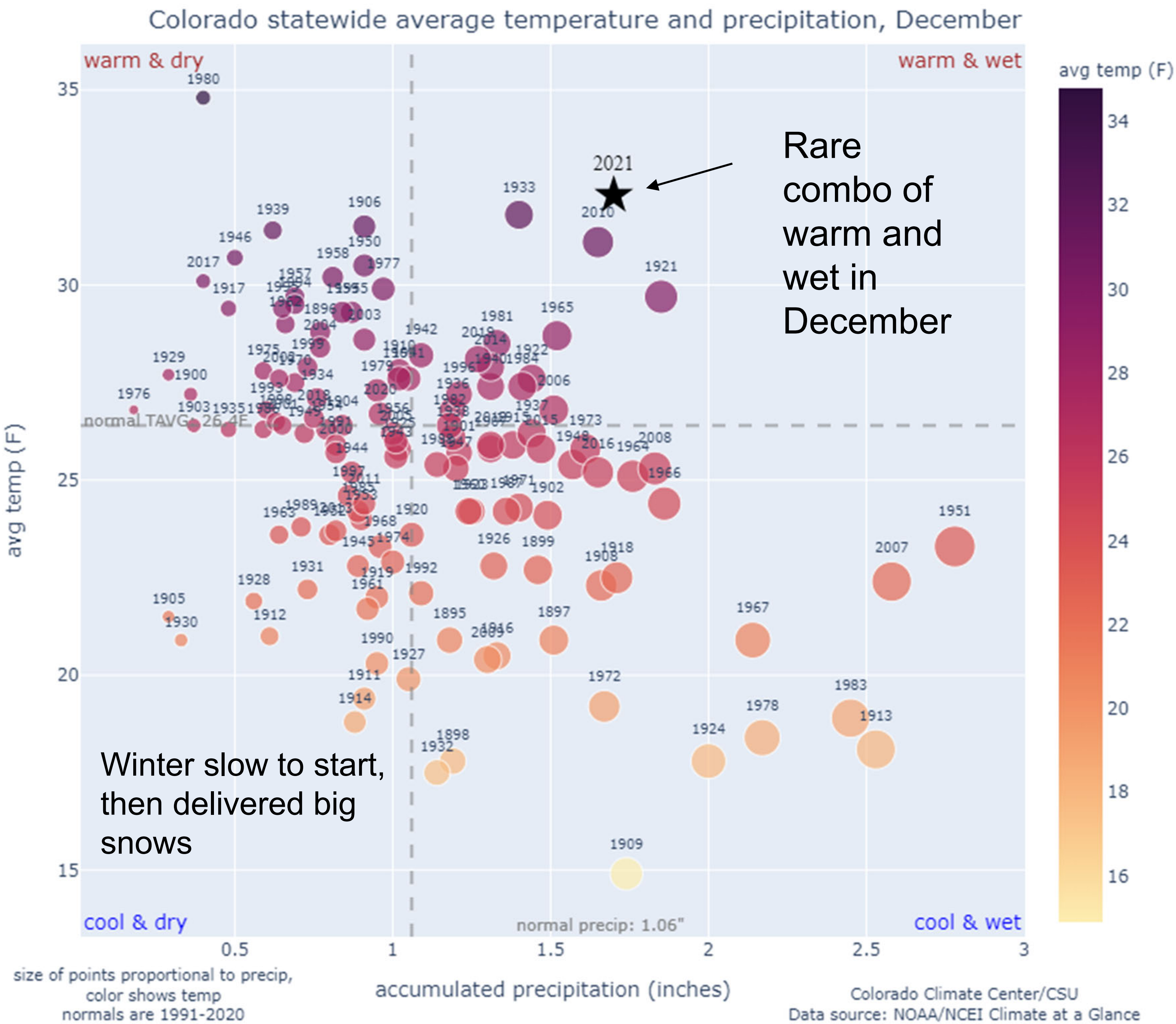
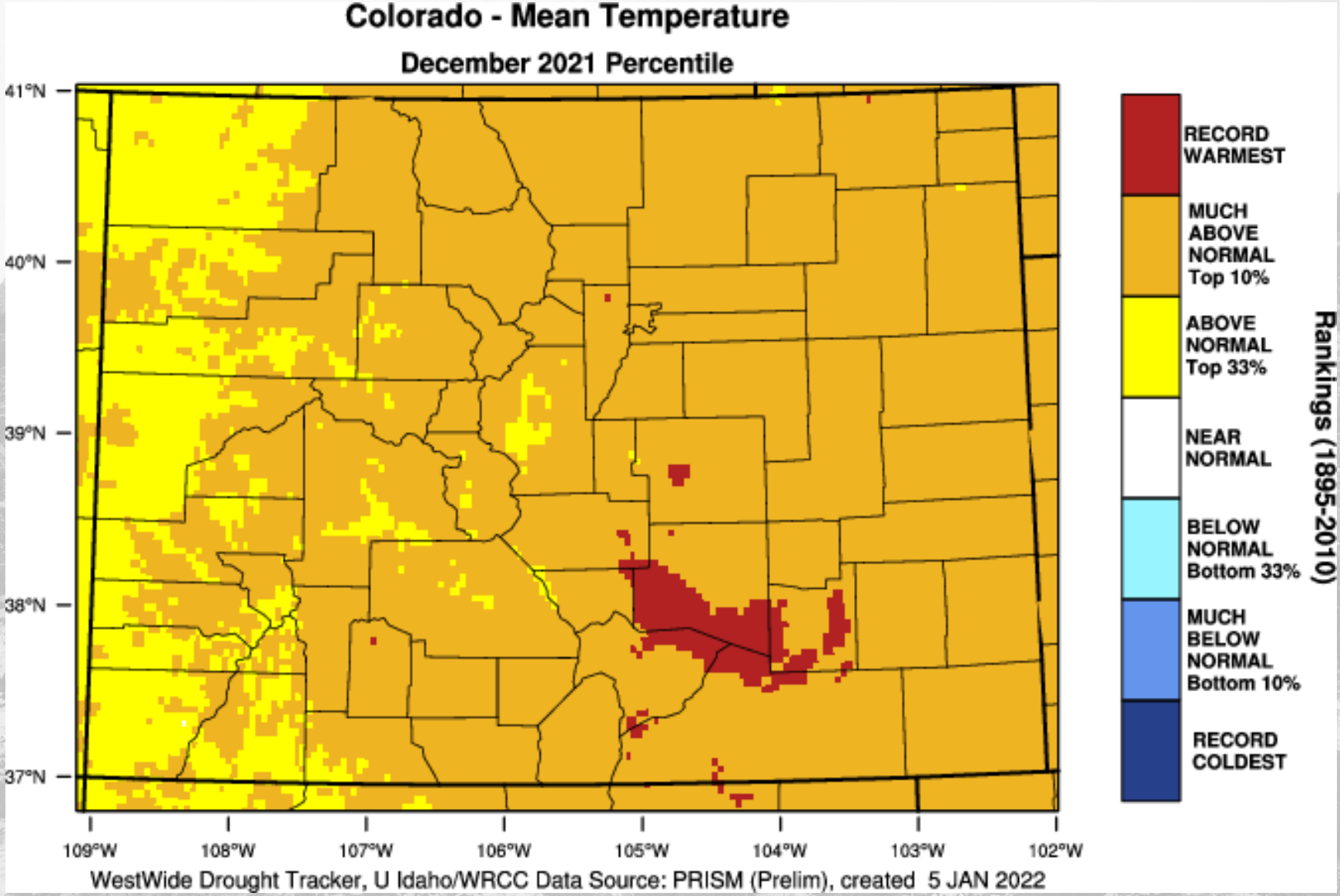


Climate Update

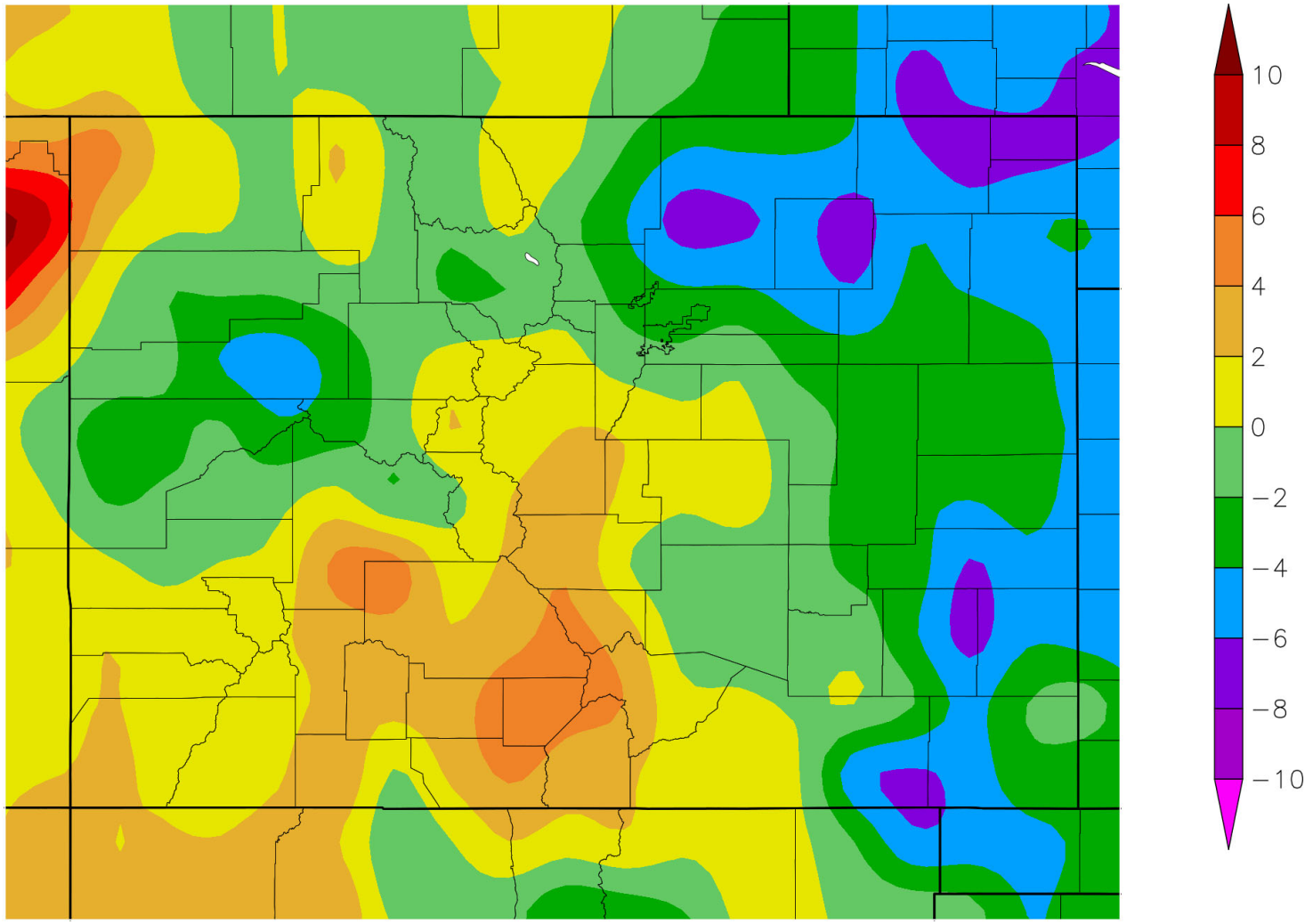
Peter Goble
Colorado Climate Center

Presented to
Water Availability Task Force
January 18, 2022
Denver, CO


Colorado statewide average temperature and precipitation, December
warm & dry
warm & wet
cool & dry
cool & wet
avg temp (F)
accumulated precipitation (inches)
normal TAVG: 26.4F
normal precip: 1.06"
35
30
25
20
15
0.5
1
1.5
2
2.5
3
34
32
30
28
26
24
22
20
18
16
2021
Rare combo of warm and wet in December
Winter slow to start, then delivered big snows
size of points proportional to precip,
color shows temp
normals are 1991-2020
Colorado Climate Center/CSU
Data source: NOAA/NCEI Climate at a Glance

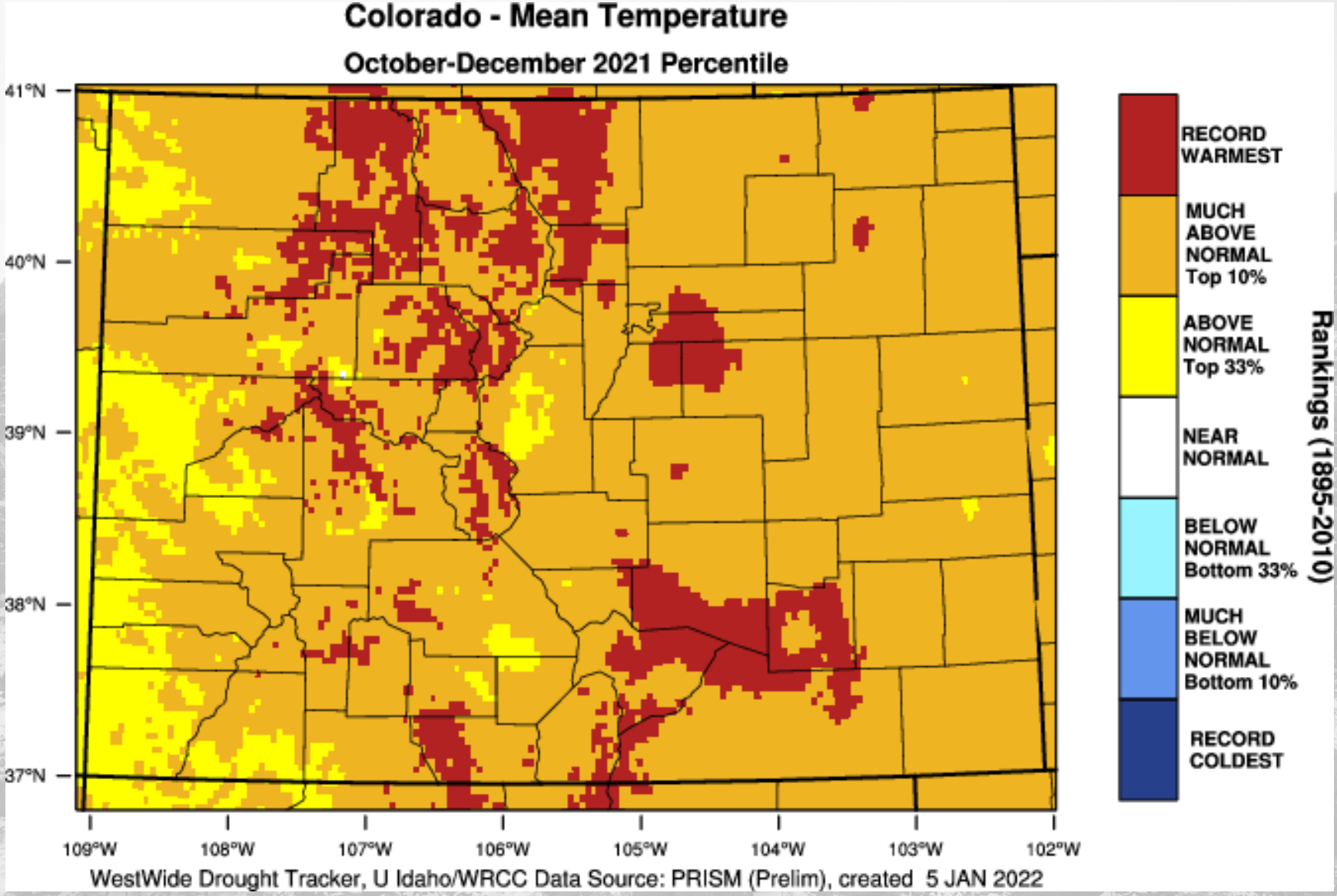

Colorado - Mean Temperature
December 2021 Percentile
41°N
40°N
39°N
38°N
37°N
109°W
108°W
107°W
106°W
105°W
104°W
103°W
102°W
RECORD WARMEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
BELOW NORMAL Bottom 33%
MUCH BELOW NORMAL Bottom 10%
RECORD COLDEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 5 JAN 2022

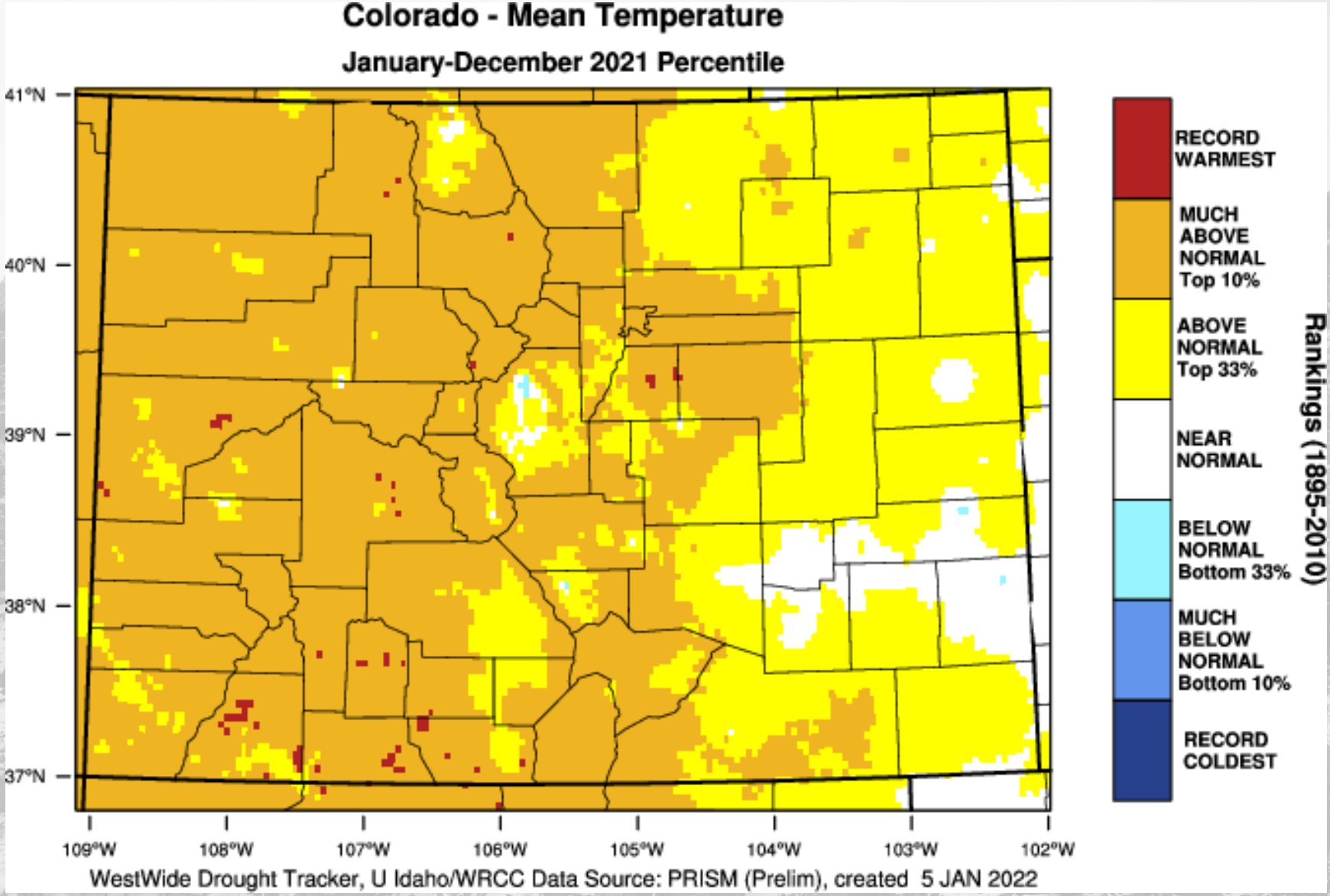
Departure from Normal Temperature (F)
1/1/2022 – 1/13/2022



Generated 1/14/2022 at HPRCC using provisional data.

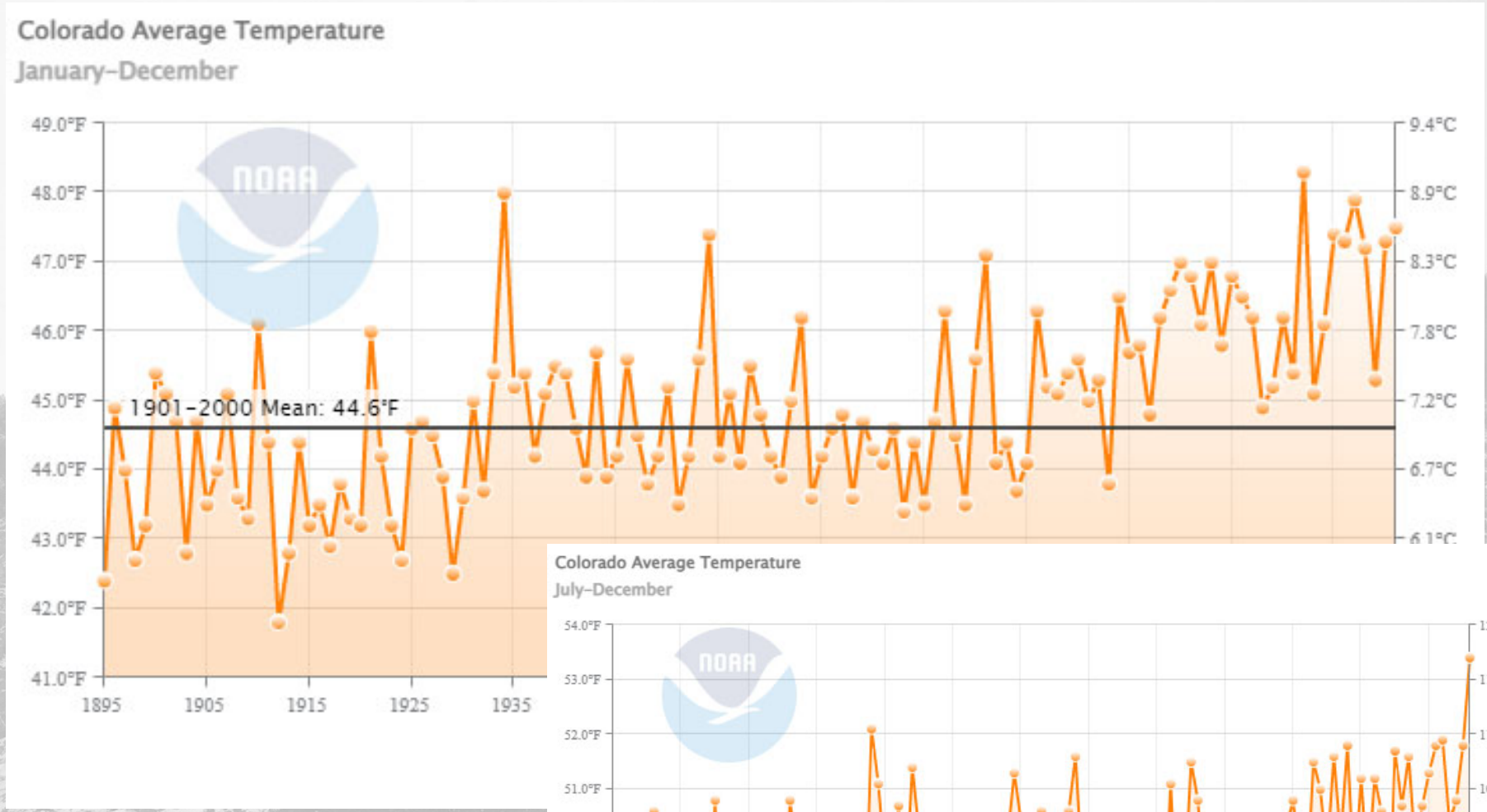
NOAA Regional Climate Centers

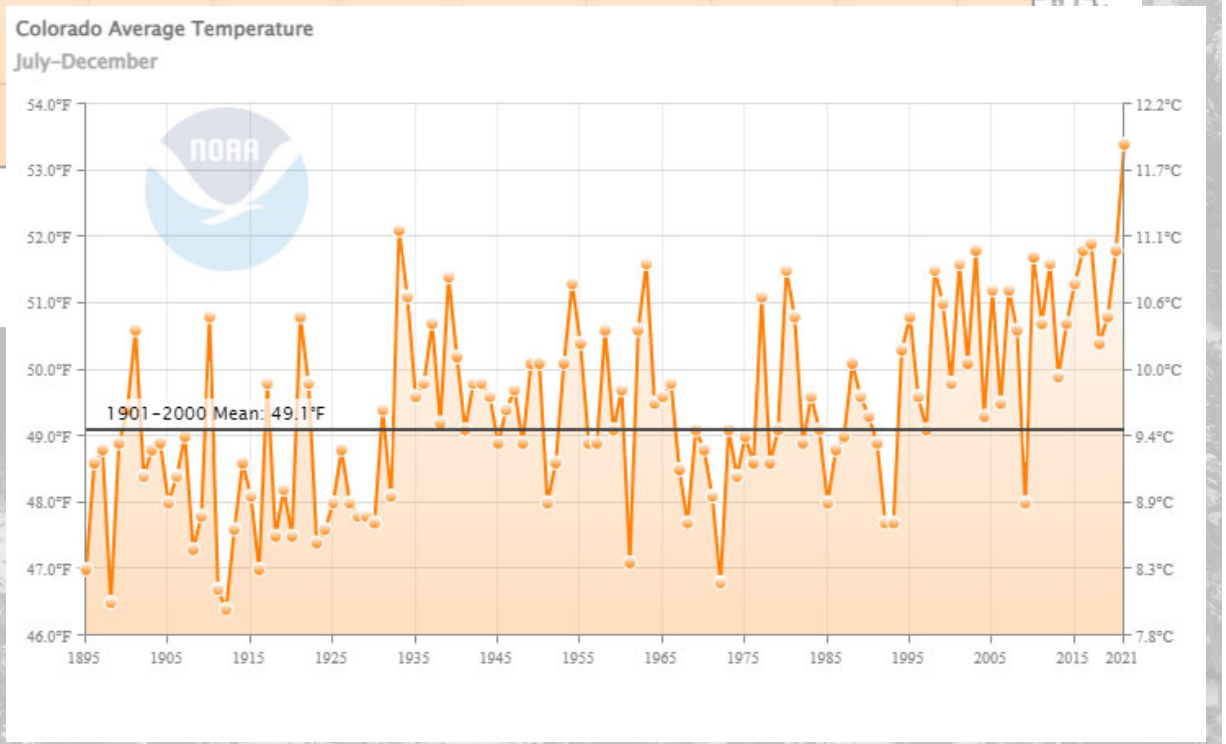

Colorado - Mean Temperature
October-December 2021 Percentile
41°N
40°N
39°N
38°N
37°N
109°W
108°W
107°W
106°W
105°W
104°W
103°W
102°W
RECORD WARMEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
BELOW NORMAL Bottom 33%
MUCH BELOW NORMAL Bottom 10%
RECORD COLDEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 5 JAN 2022



4th warmest year on record statewide

7 of our top ten years have occurred since 2012

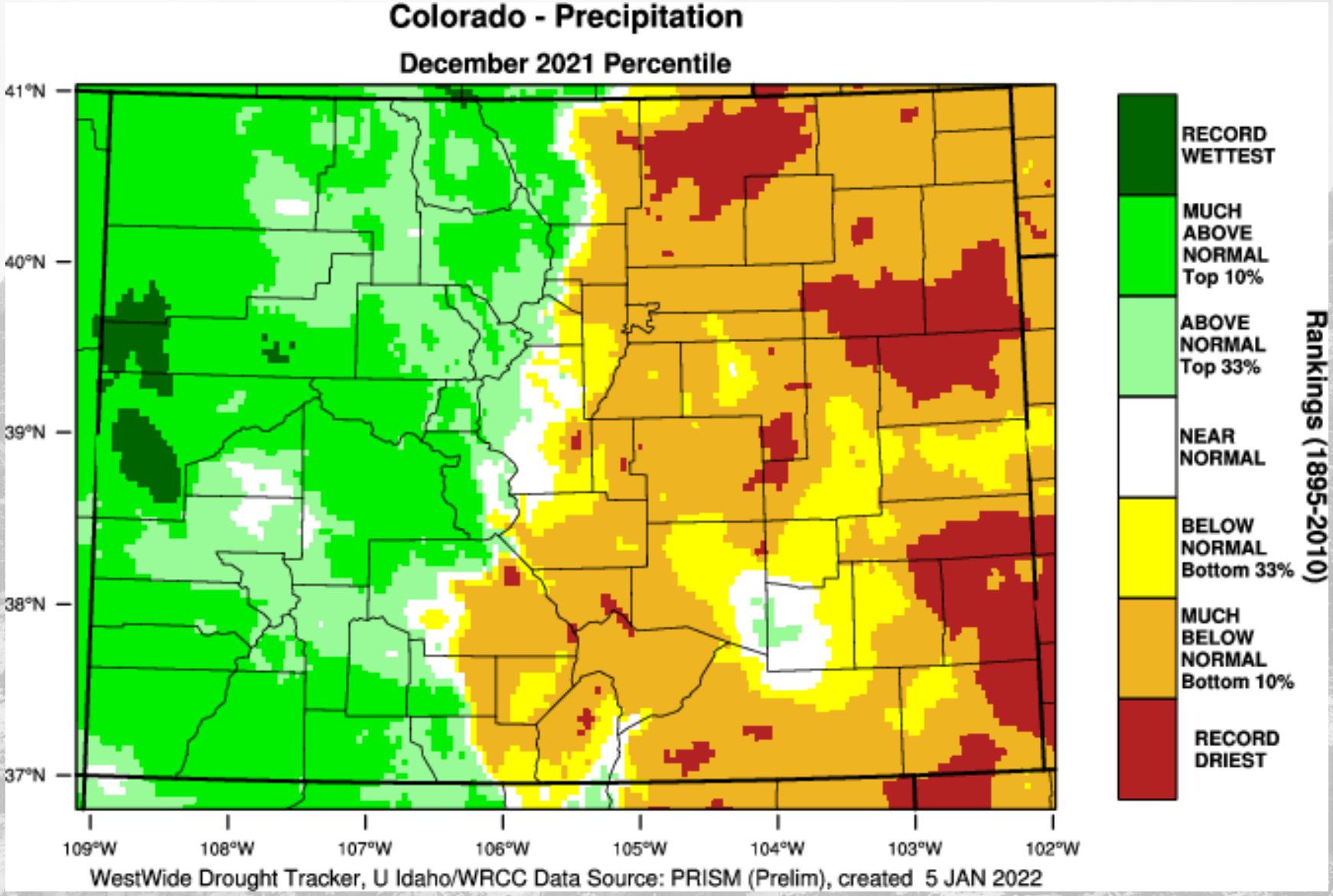




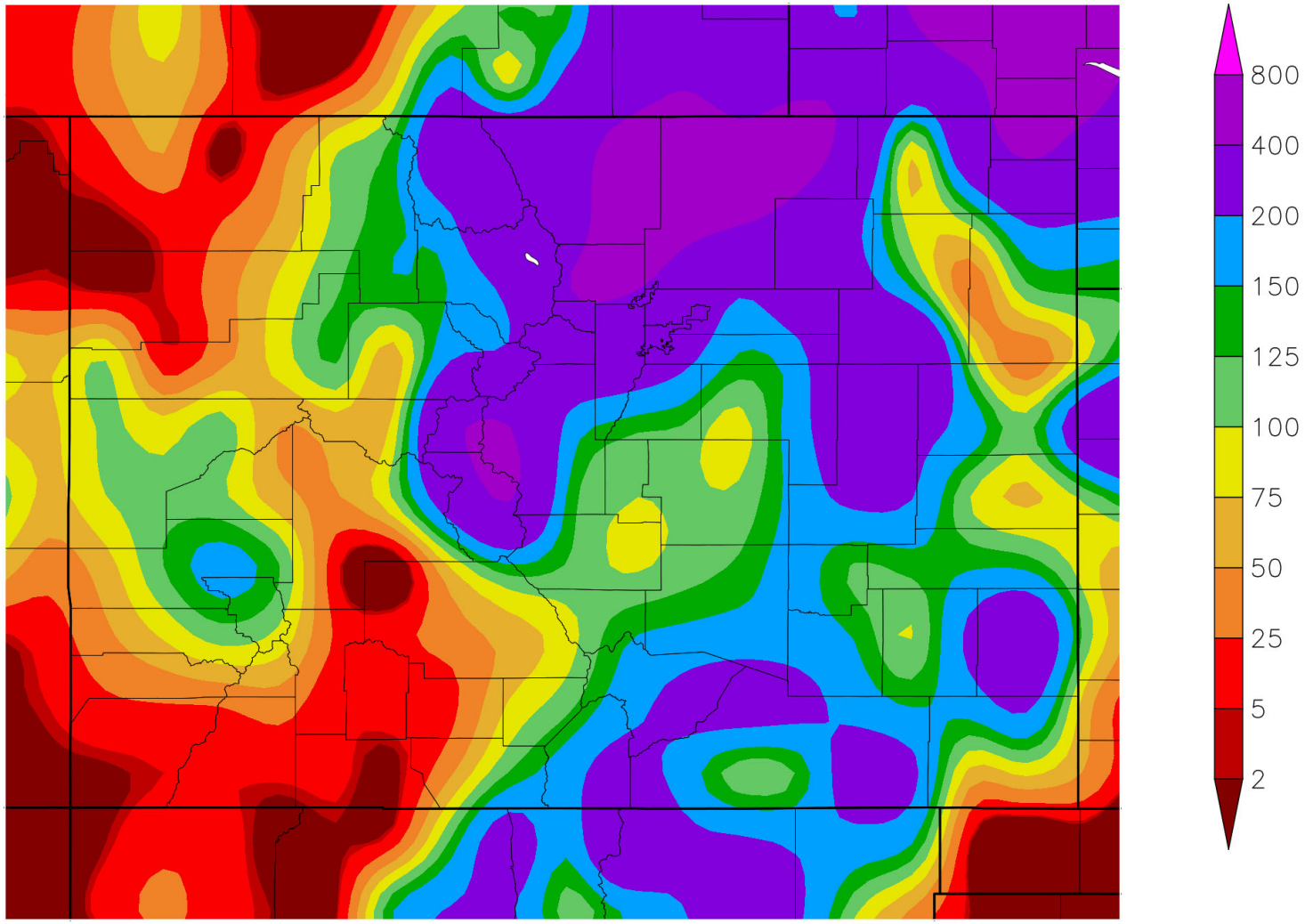
4th warmest calendar year

Warmest July-December

1.3 F warmer than 2nd place (1933)

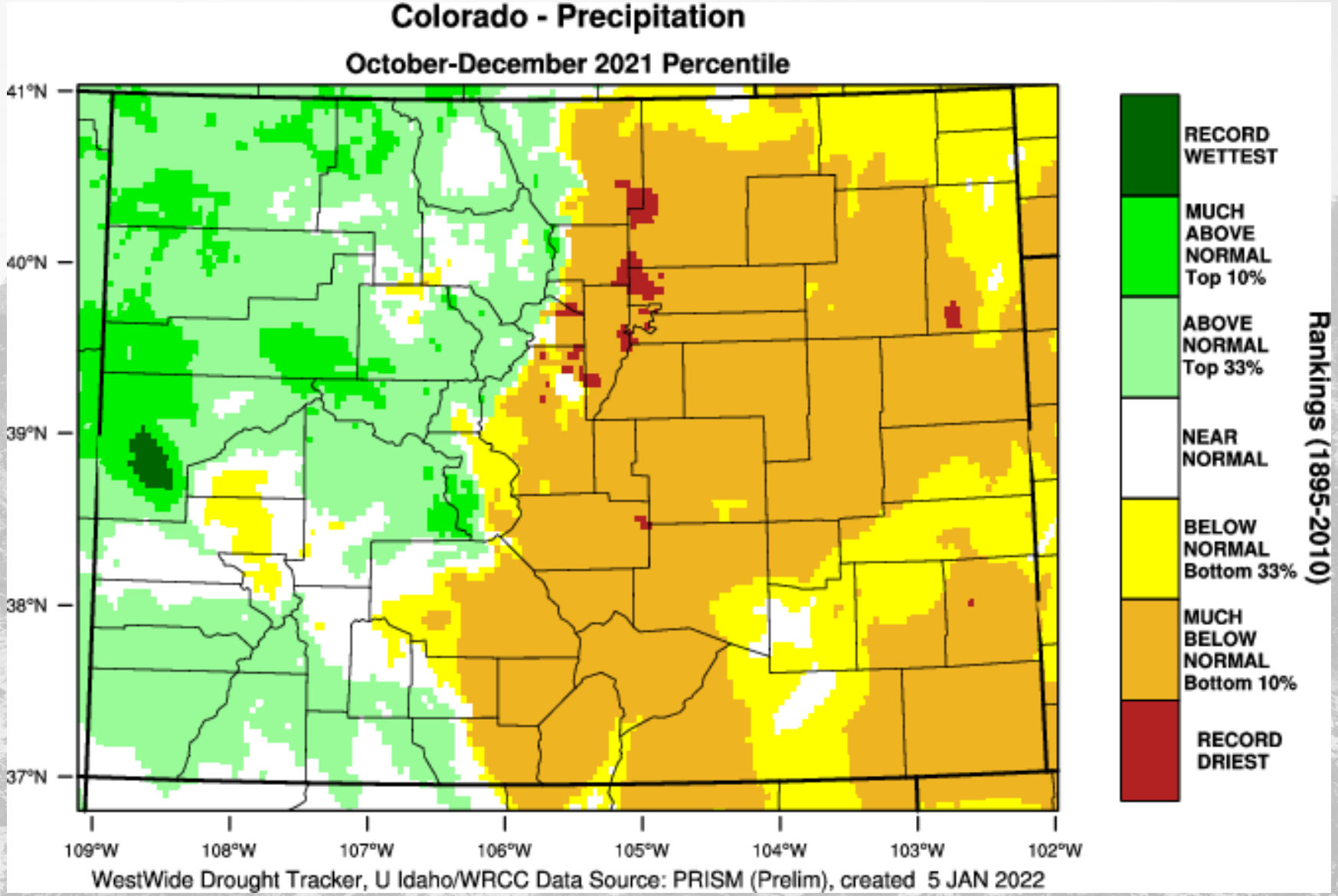

Colorado - Precipitation
December 2021 Percentile
41°N
40°N
39°N
38°N
37°N
109°W
108°W
107°W
106°W
105°W
104°W
103°W
102°W
RECORD WETTEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
BELOW NORMAL Bottom 33%
MUCH BELOW NORMAL Bottom 10%
RECORD DRIEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 5 JAN 2022

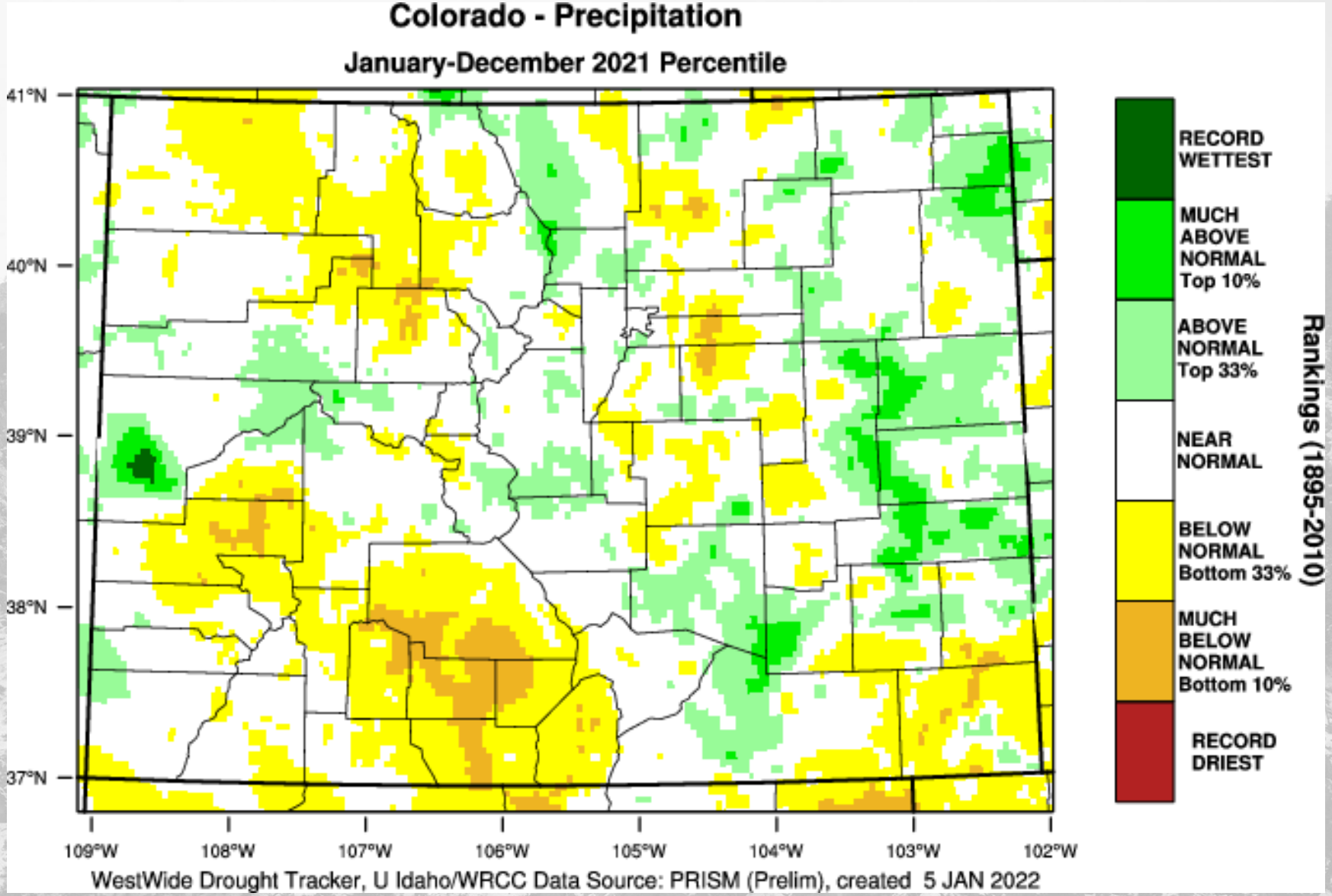
Percent of Normal Precipitation (%)
1/1/2022 – 1/13/2022



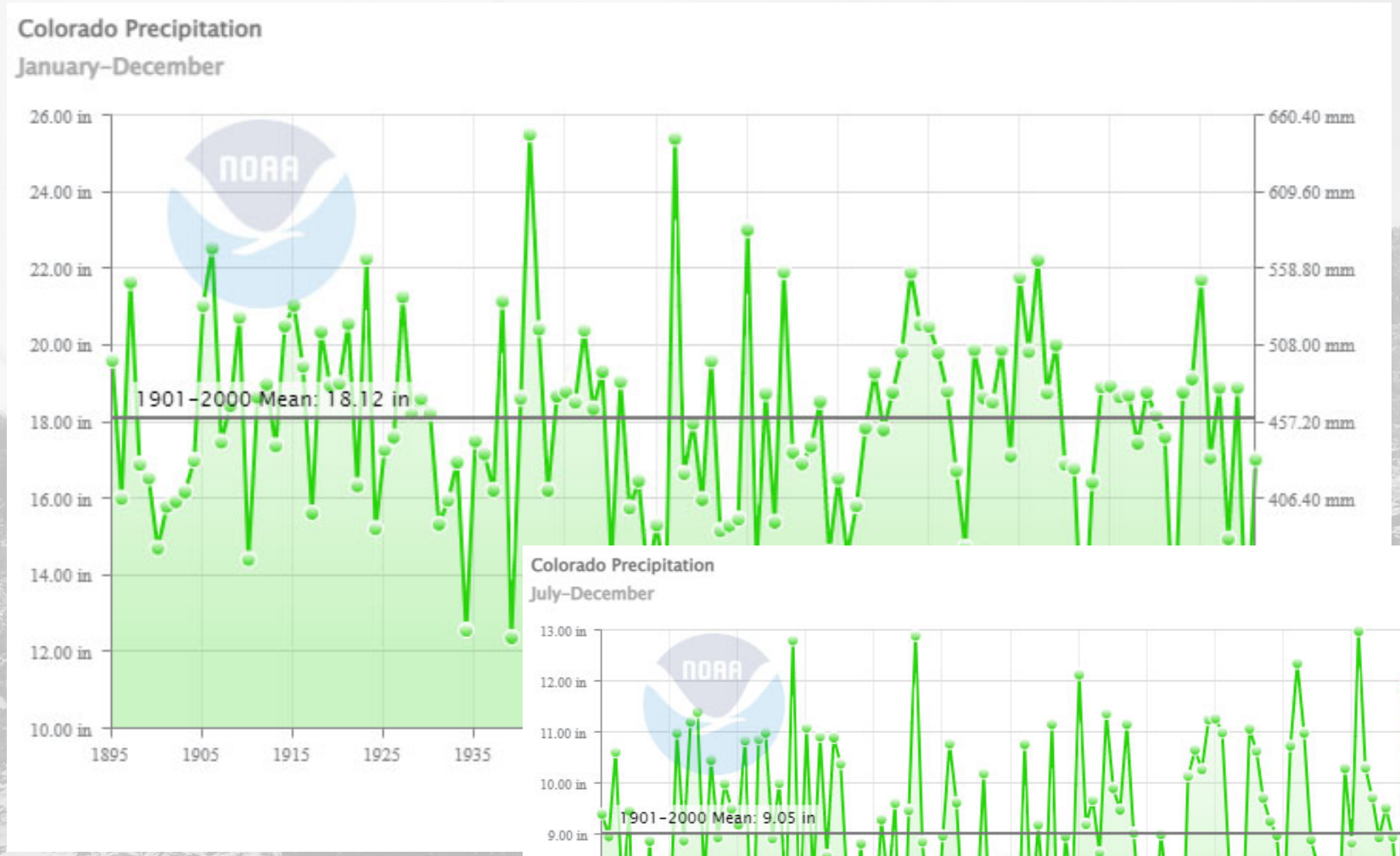
Generated 1/14/2022 at HPRCC using provisional data.

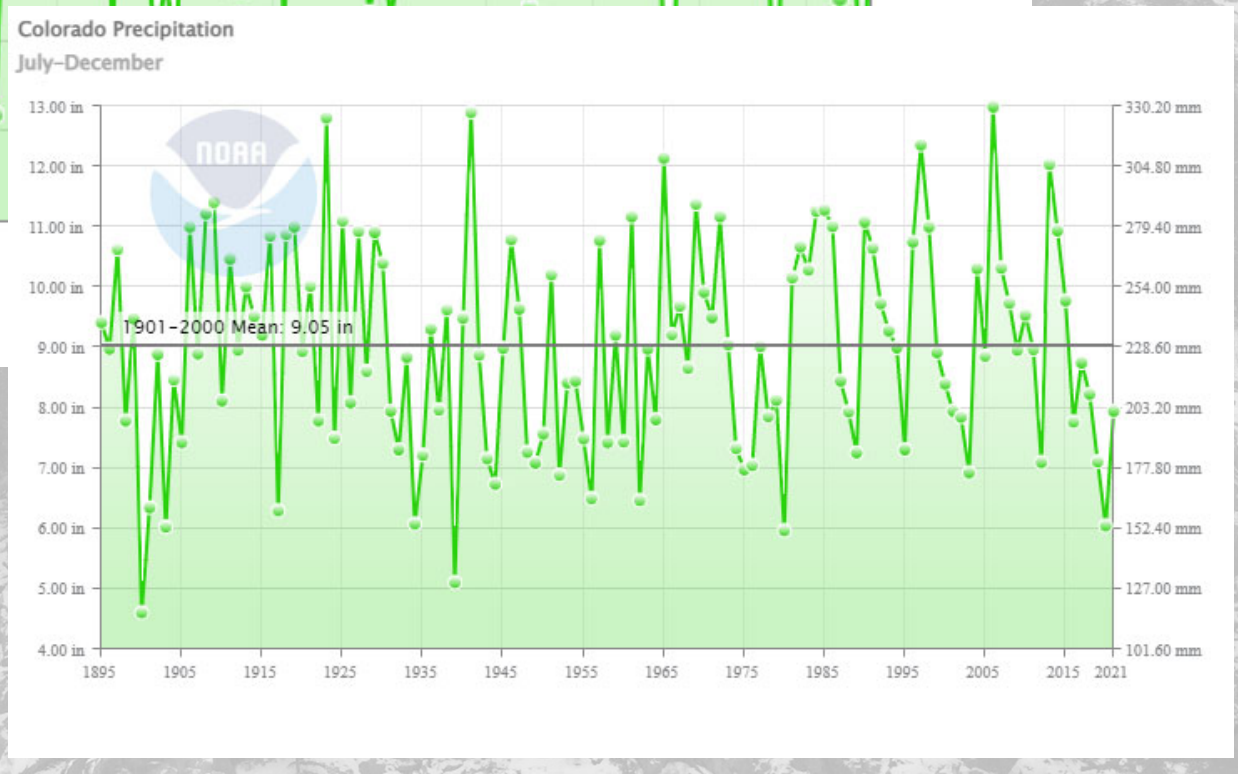
NOAA Regional Climate Centers


Colorado - Precipitation
October-December 2021 Percentile
41°N
40°N
39°N
38°N
37°N
109°W
108°W
107°W
106°W
105°W
104°W
103°W
102°W
RECORD WETTEST
MUCH ABOVE NORMAL Top 10%
ABOVE NORMAL Top 33%
NEAR NORMAL
BELOW NORMAL Bottom 33%
MUCH BELOW NORMAL Bottom 10%
RECORD DRIEST
Rankings (1895-2010)
WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 5 JAN 2022



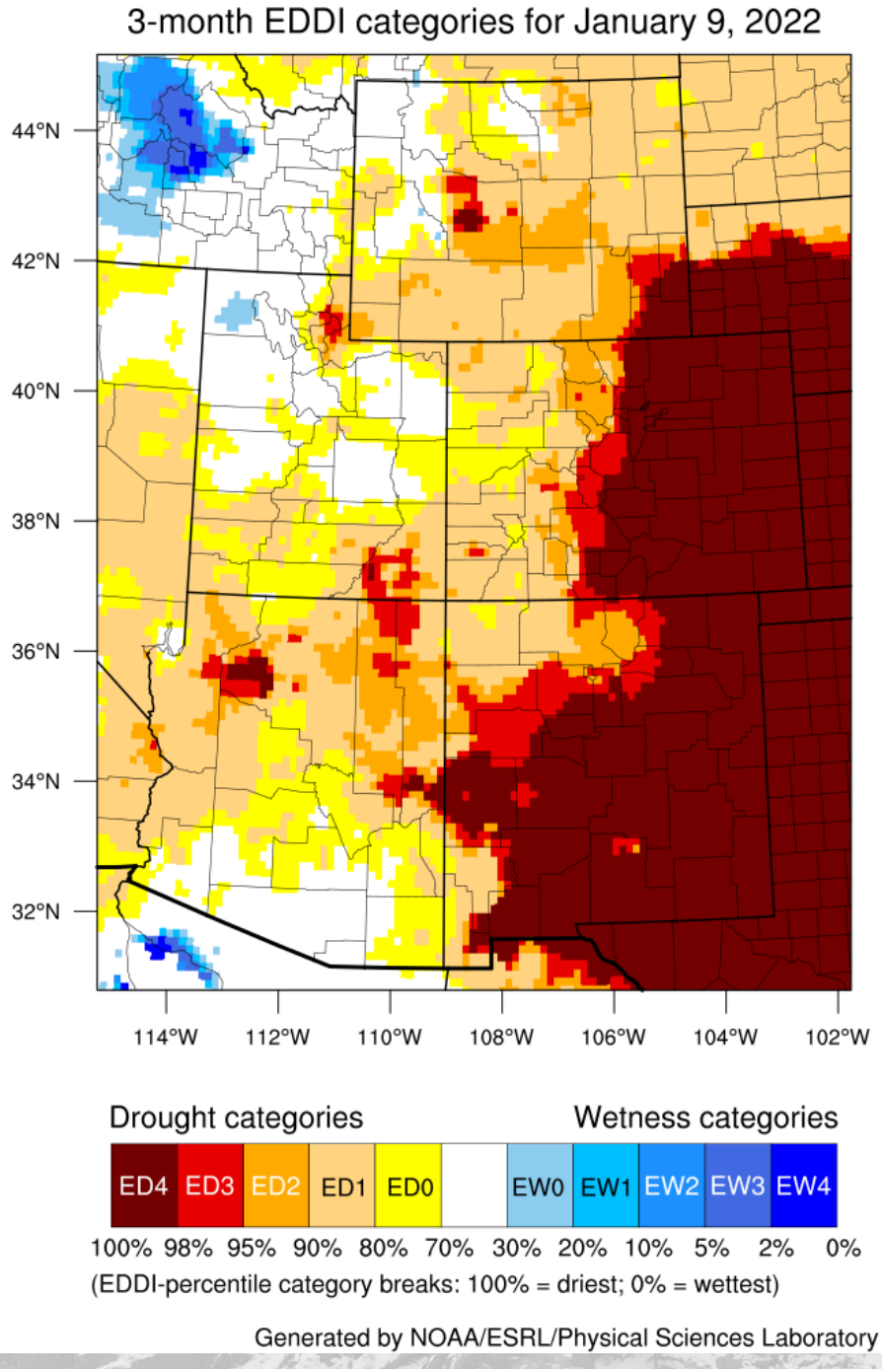
At then end of the day, a nice mix





47th driest year on record.

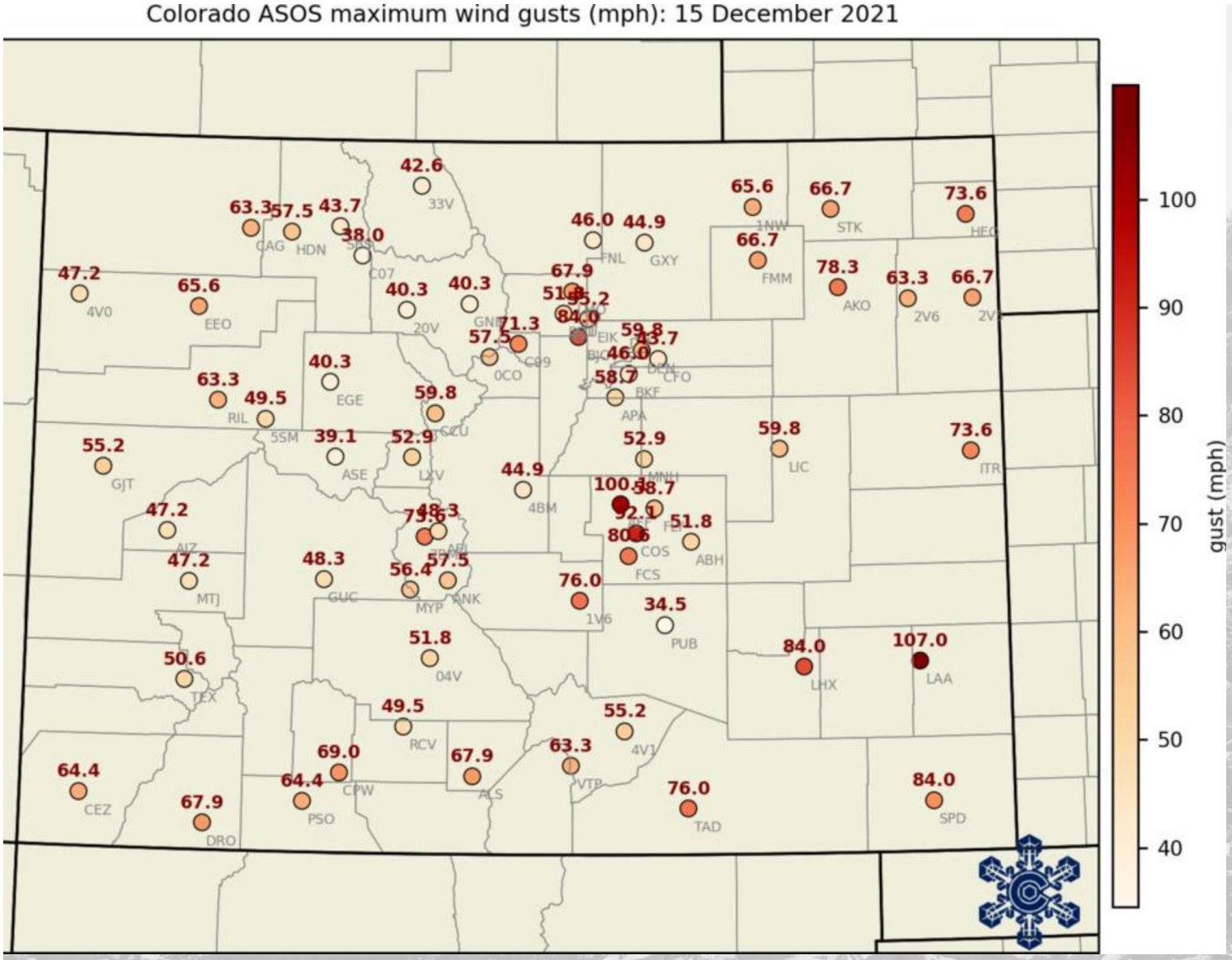
1.08” below normal



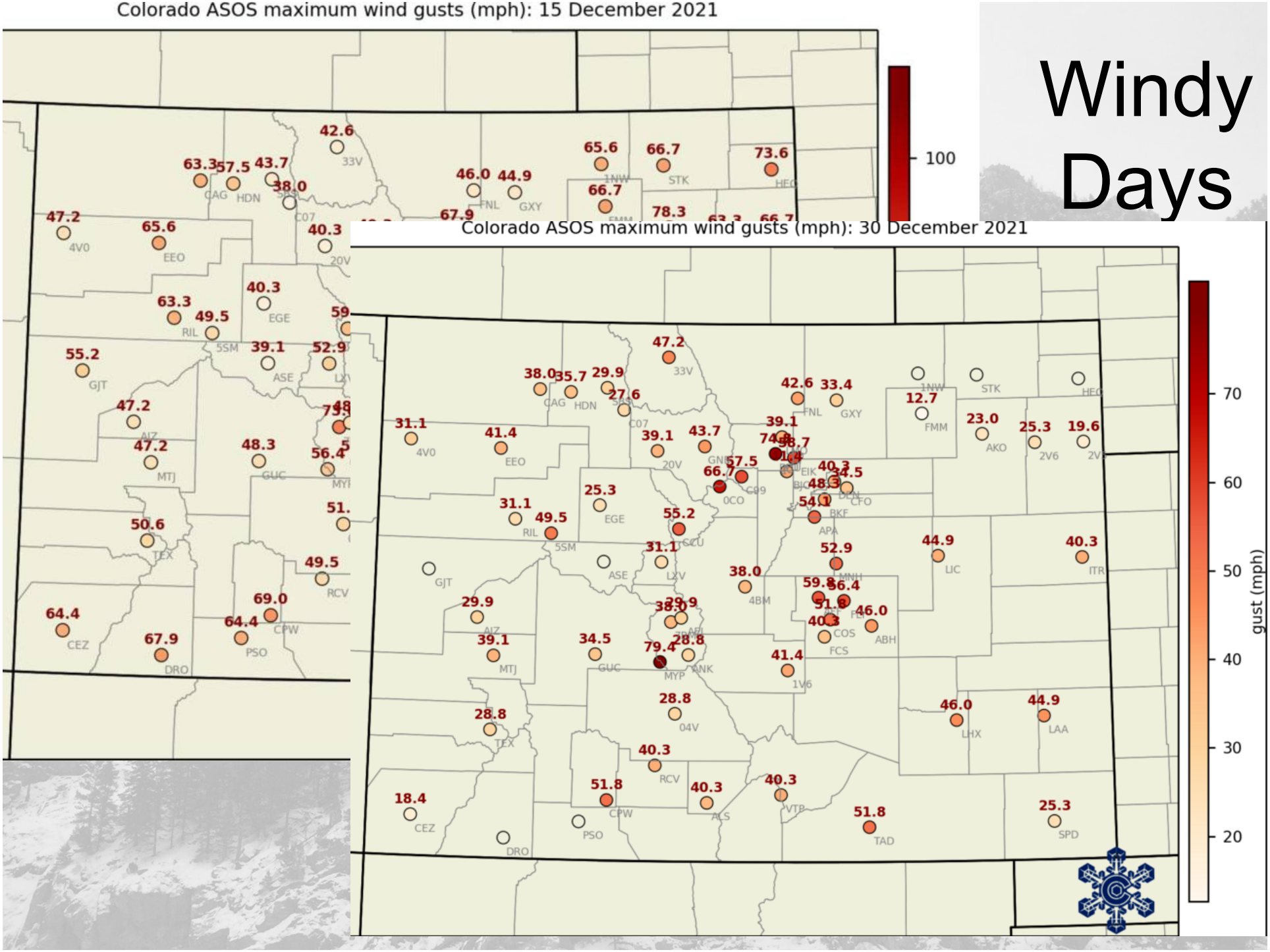
We don't usually talk much about evaporative demand in winter, but it was record high October-December

This, in combination with a wet spring, raised the probability of a winter wildfire

This needs to say on our radar. We've had some relief, but we could have a worse than normal brushfire season (SE CO especially)


Colorado ASOS maximum wind gusts (mph): 15 December 2021
gust (mph)
100
90
80
70
60
50
40
42.6
33V
63.3
57.5
43.7
CAG
HDN
38.0
65.6
1NW
66.7
STK
73.6
HEC
46.0
44.9
FNL
GXY
66.7
FMM
78.3
AKO
63.3
2V6
66.7
2V
47.2
4V0
65.6
EEO
40.3
40.3
20V
67.9
95.2
84.0
71.3
57.5
C99
0CO
59.8
43.7
46.0
CFO
58.7
BKF
APA
40.3
EGE
63.3
RIL
49.5
59.8
SCU
55.2
GJT
5SM
39.1
ASE
52.9
LXV
52.9
59.8
LIC
73.6
ITR
44.9
4BM
100.4
38.7
47.2
AIZ
79.6
51.8
ABH
80.6
COS
FCS
47.2
MTJ
48.3
GUC
56.4
57.5
MYP
ANK
76.0
1V6
34.5
PUB
51.8
04V
84.0
LHX
107.0
LAA
50.6
TEX
49.5
RCV
55.2
4V1
64.4
CEZ
69.0
CPW
64.4
PSO
67.9
ALS
63.3
VTP
67.9
DRO
76.0
TAD
84.0
SPD

Windy Days


Colorado ASOS maximum wind gusts (mph): 15 December 2021
100
Windy Days
Colorado ASOS maximum wind gusts (mph): 30 December 2021
gust (mph)
70
60
50
40
30
20

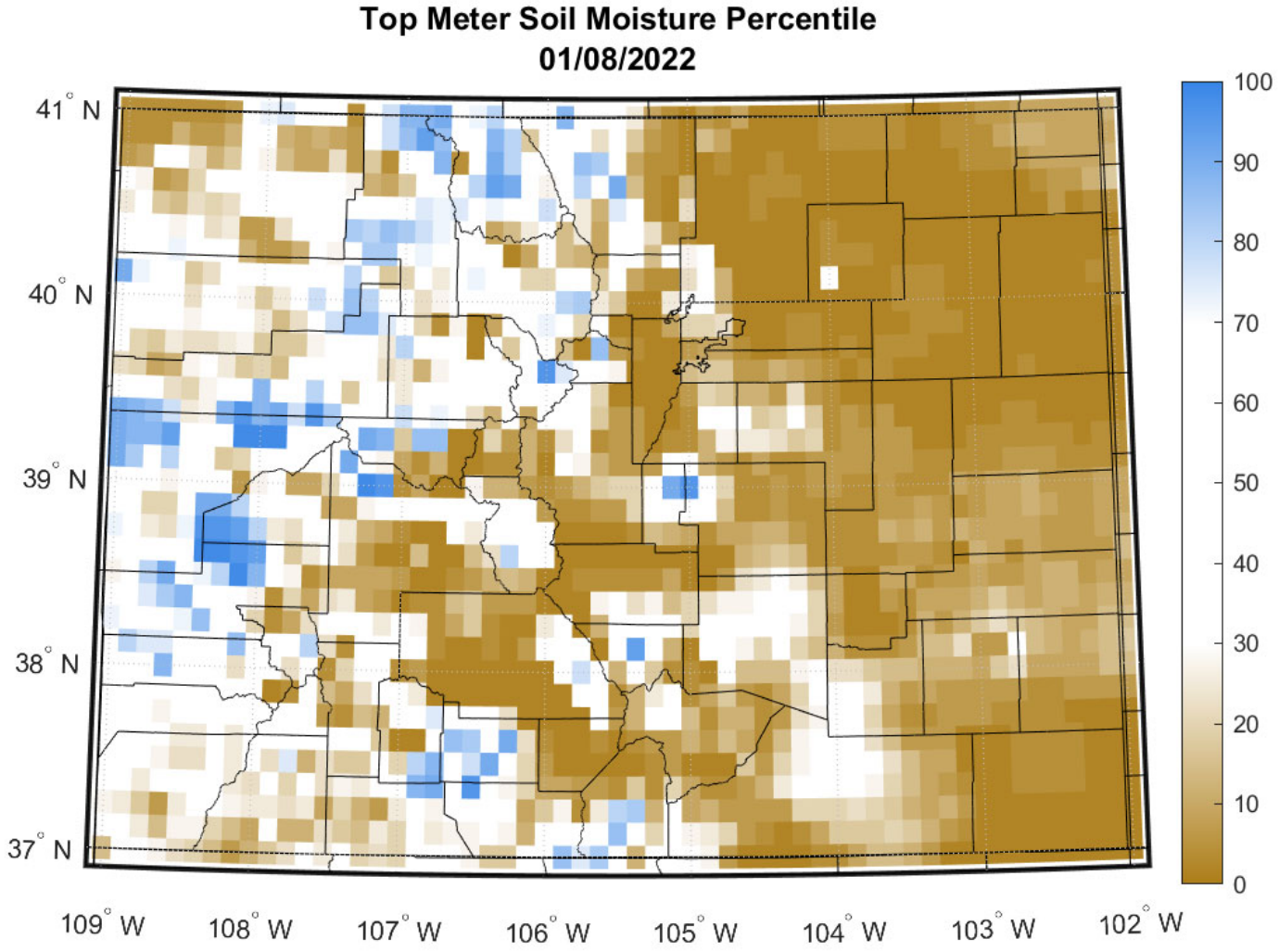
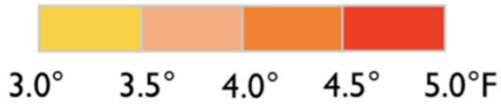
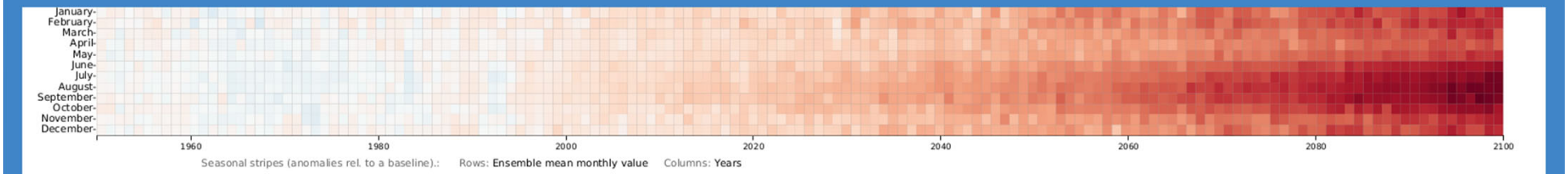

Top Meter Soil Moisture Percentile
01/08/2022
41° N
40° N
39° N
38° N
37° N
109° W
108° W
107° W
106° W
105° W
104° W
103° W
102° W
100
90
80
70
60
50
40
30
20
10
0

TABLE 5-1. Projected monthly temperature change for eight subregions under RCP 4.5 for 2035–2064

Subregion	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Northeastern Plains													
Denver Metro													
Arkansas Valley													
San Luis Valley													
Central Mountains													
Yampa Valley													
Grand Valley													
Western San Juans													





Mean temperature (T) - Change (deg C)
SSP3-7.0 (rel. to 1850-1900)
CMIP6 - Annual (30 models)-Western North America

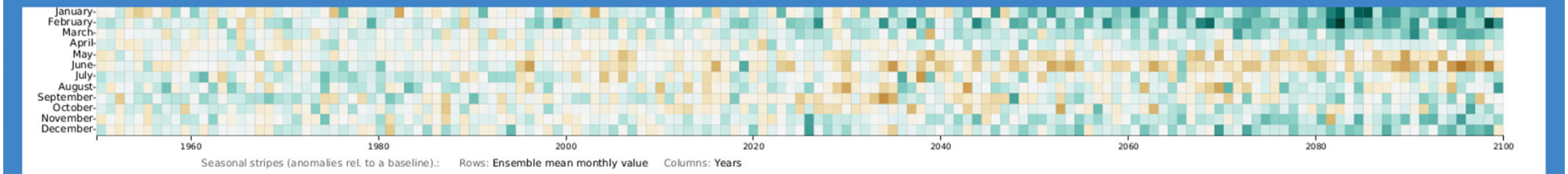
ipcc
INTERGOVERNMENTAL PANEL ON climate change
WMO UNEP

14-01-2022 17:10:35

TABLE 5-2. Projected monthly precipitation change for eight subregions under RCP 4.5 for 2035–2064

Subregion	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Northeastern Plains													
Denver Metro													
Arkansas Valley													
San Luis Valley													
Central Mountains													
Yampa Valley													
Grand Valley													
Western San Juans													

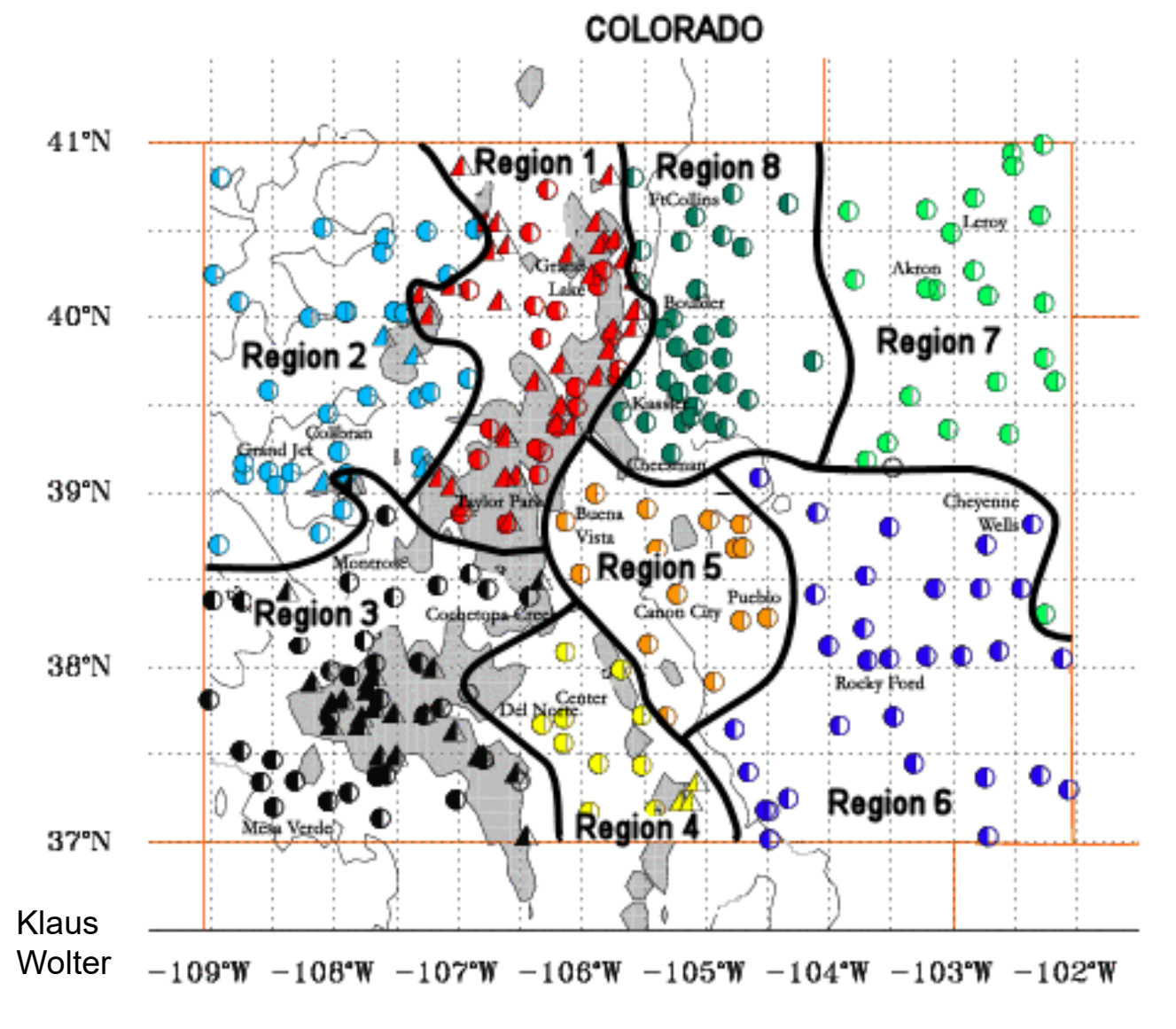
-10% -5% 0 +5% +10% +15% +20%



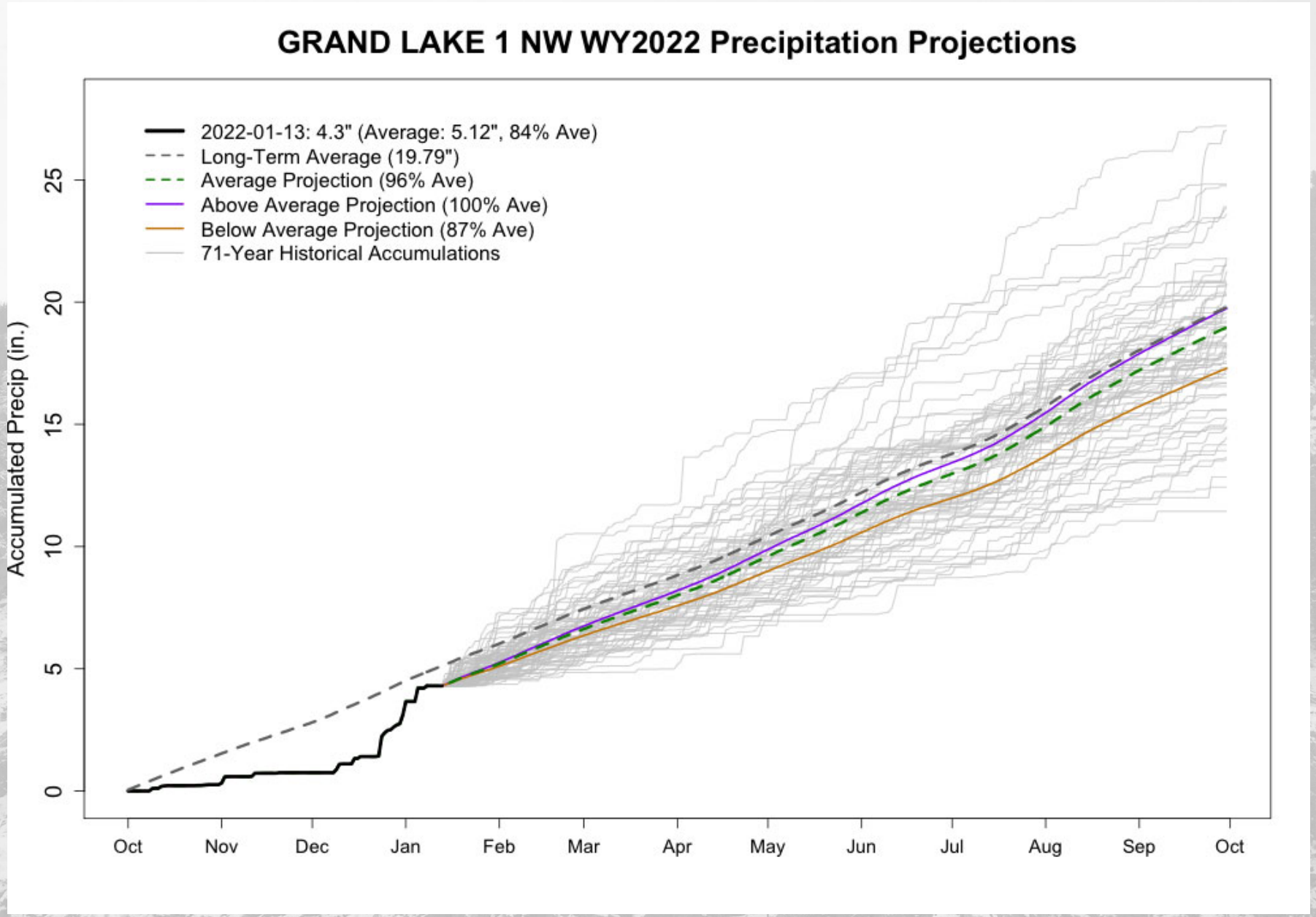
Total precipitation (PR) - Change (%)
SSP3-7.0 (rel. to 1850-1900)
CMIP6 - Annual (28 models)-Western North America

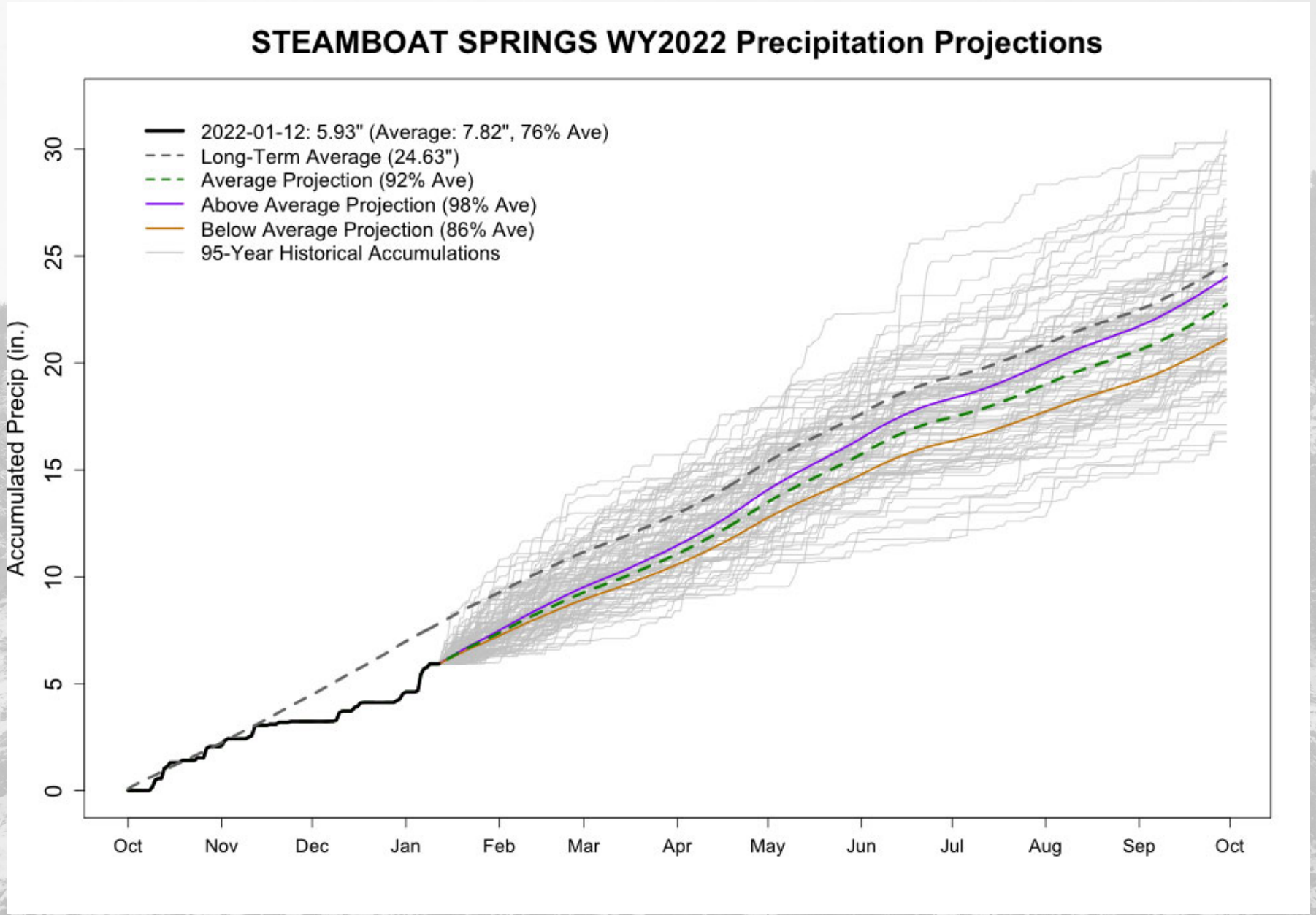
ipcc
INTERGOVERNMENTAL PANEL ON climate change

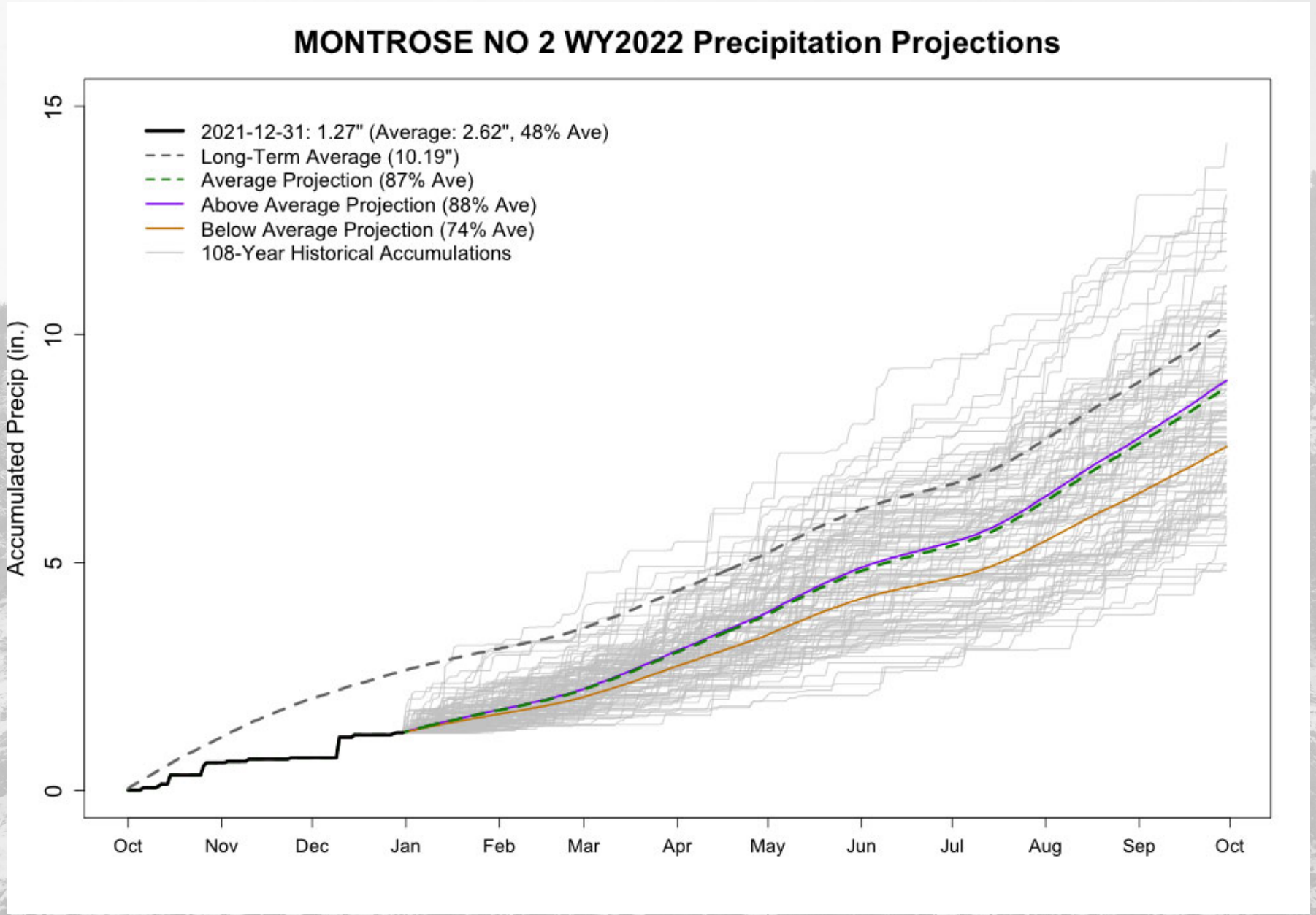
Climate divisions defined by Dr. Klaus Wolter of NOAA's Climate Diagnostic Center in Boulder, CO

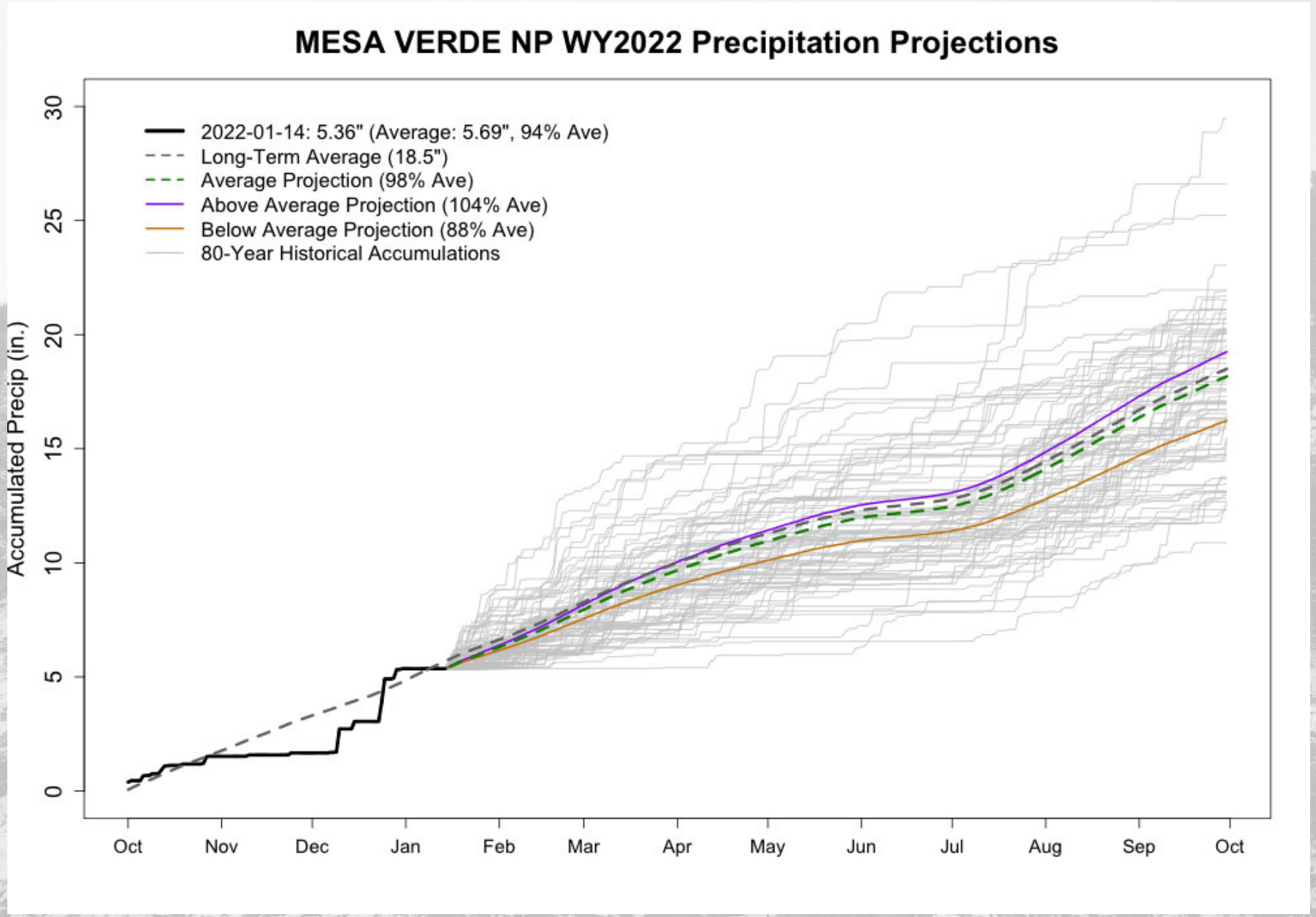


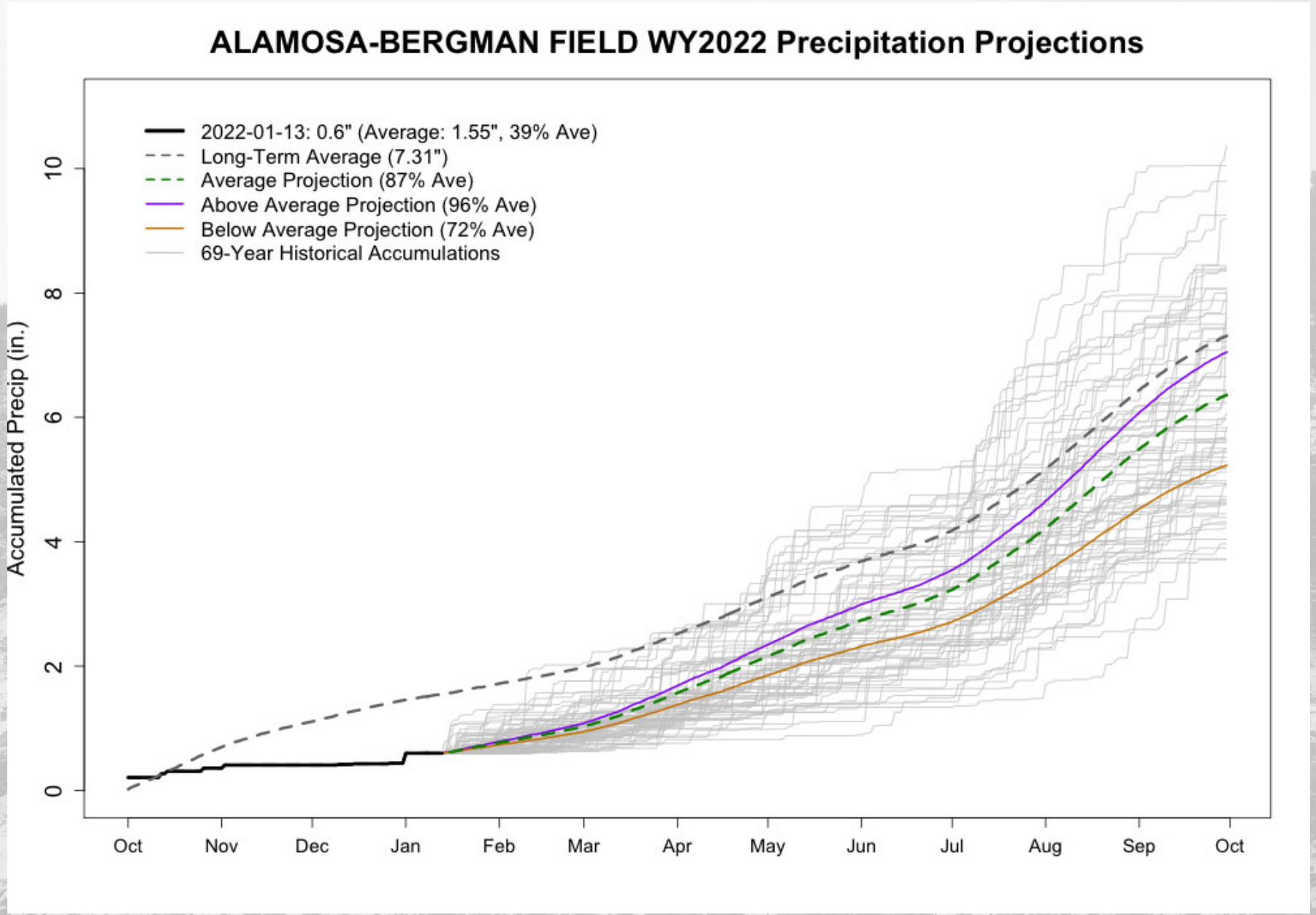
Klaus Wolter

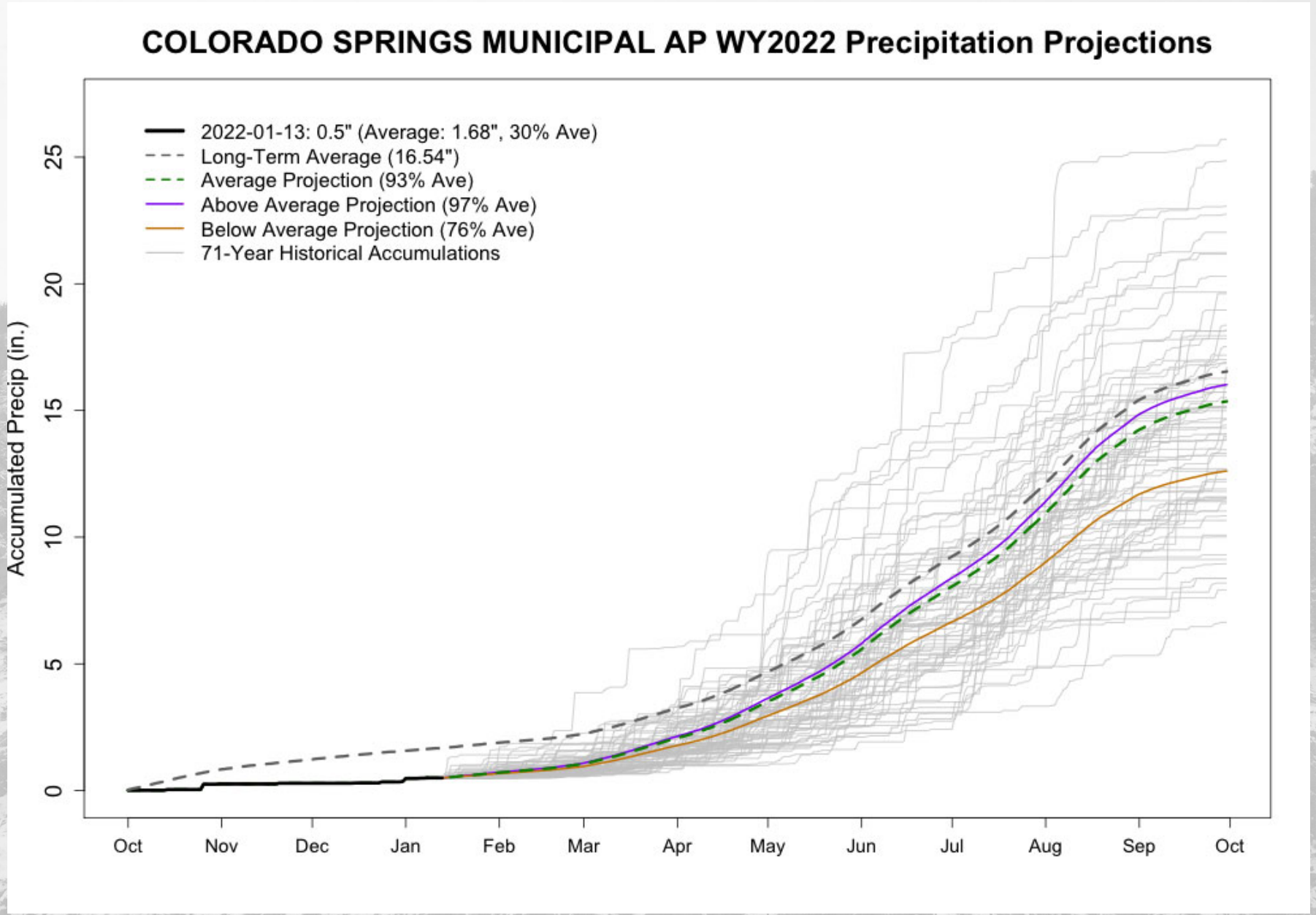

GRAND LAKE 1 NW WY2022 Precipitation Projections
2022-01-13: 4.3" (Average: 5.12", 84% Ave)
Long-Term Average (19.79")
Average Projection (96% Ave)
Above Average Projection (100% Ave)
Below Average Projection (87% Ave)
71-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

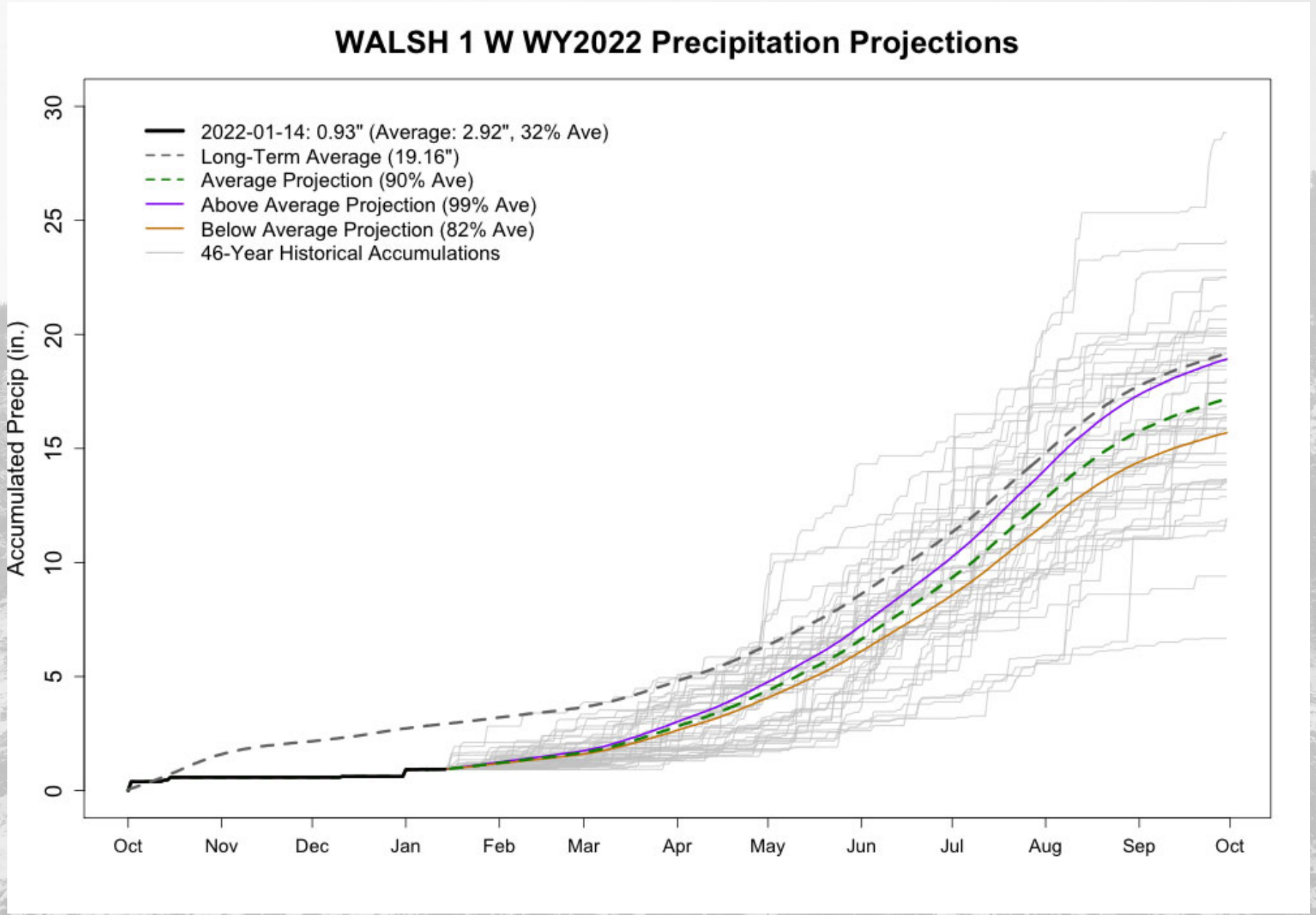

STEAMBOAT SPRINGS WY2022 Precipitation Projections
2022-01-12: 5.93" (Average: 7.82", 76% Ave)
Long-Term Average (24.63")
Average Projection (92% Ave)
Above Average Projection (98% Ave)
Below Average Projection (86% Ave)
95-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
30
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct


MONTROSE NO 2 WY2022 Precipitation Projections
2021-12-31: 1.27" (Average: 2.62", 48% Ave)
Long-Term Average (10.19")
Average Projection (87% Ave)
Above Average Projection (88% Ave)
Below Average Projection (74% Ave)
108-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

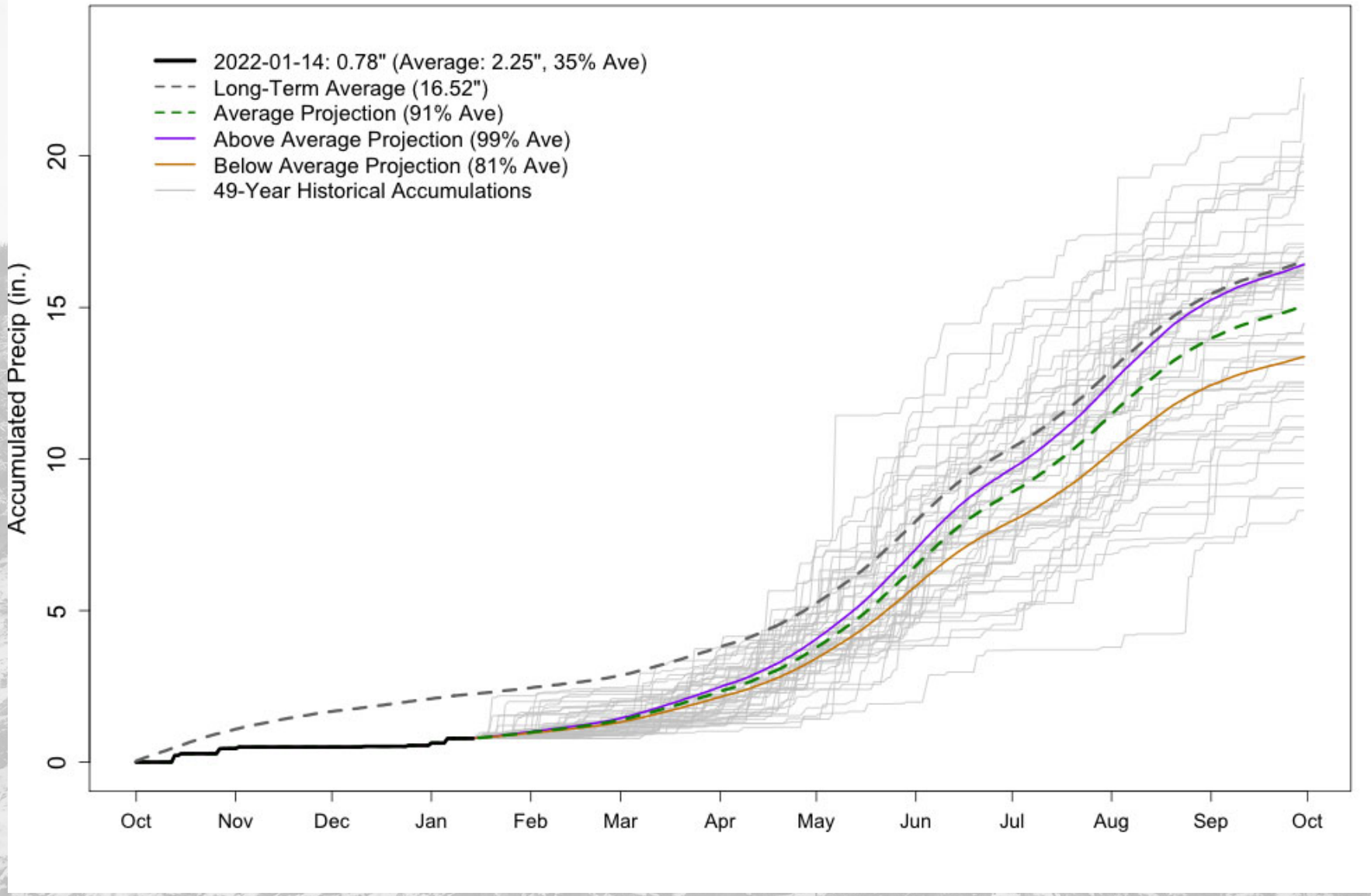

MESA VERDE NP WY2022 Precipitation Projections
2022-01-14: 5.36" (Average: 5.69", 94% Ave)
Long-Term Average (18.5")
Average Projection (98% Ave)
Above Average Projection (104% Ave)
Below Average Projection (88% Ave)
80-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
30
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

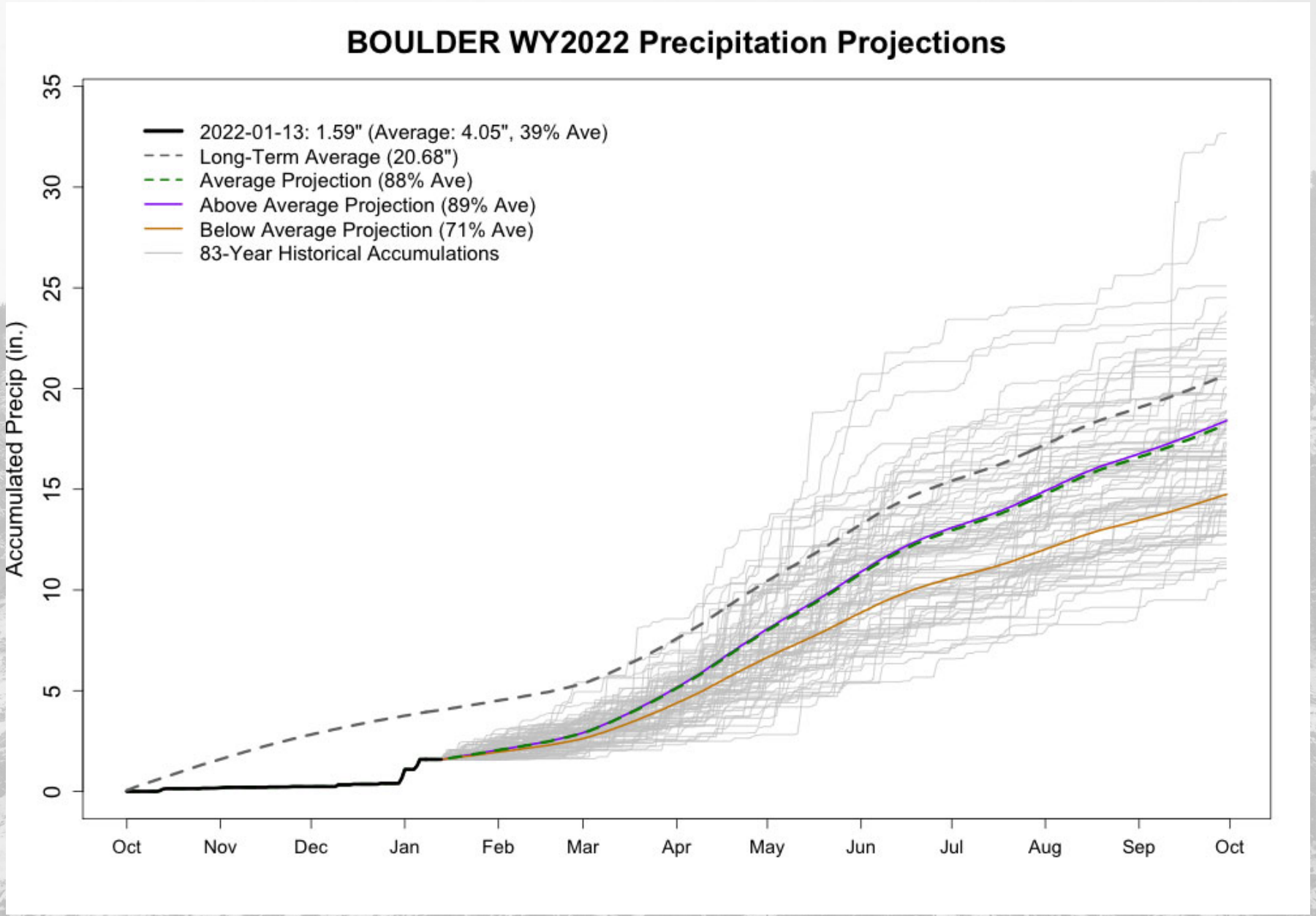

ALAMOSA-BERGMAN FIELD WY2022 Precipitation Projections
2022-01-13: 0.6" (Average: 1.55", 39% Ave)
Long-Term Average (7.31")
Average Projection (87% Ave)
Above Average Projection (96% Ave)
Below Average Projection (72% Ave)
69-Year Historical Accumulations
Accumulated Precip (in.)
0
2
4
6
8
10
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

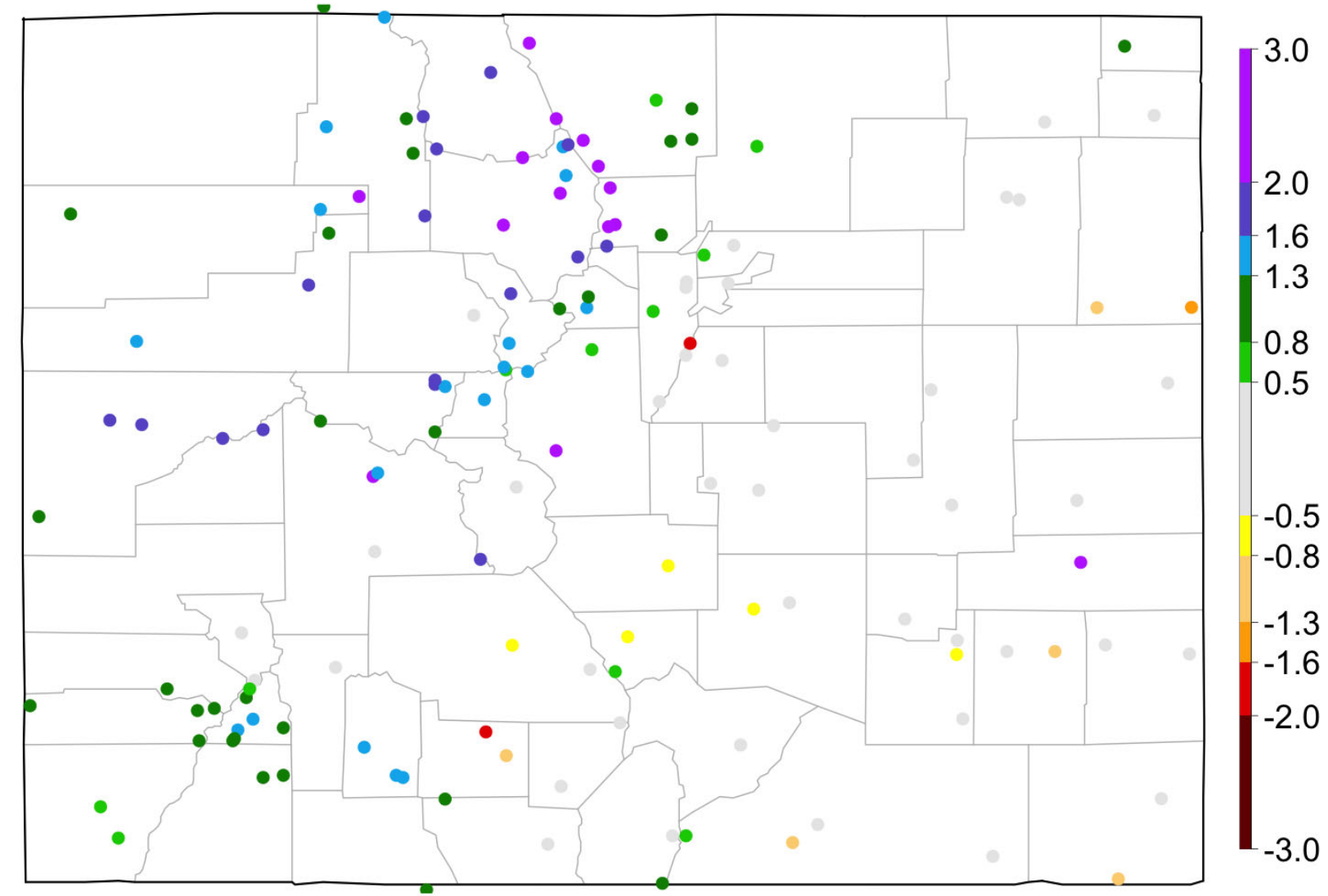

COLORADO SPRINGS MUNICIPAL AP WY2022 Precipitation Projections
2022-01-13: 0.5" (Average: 1.68", 30% Ave)
Long-Term Average (16.54")
Average Projection (93% Ave)
Above Average Projection (97% Ave)
Below Average Projection (76% Ave)
71-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

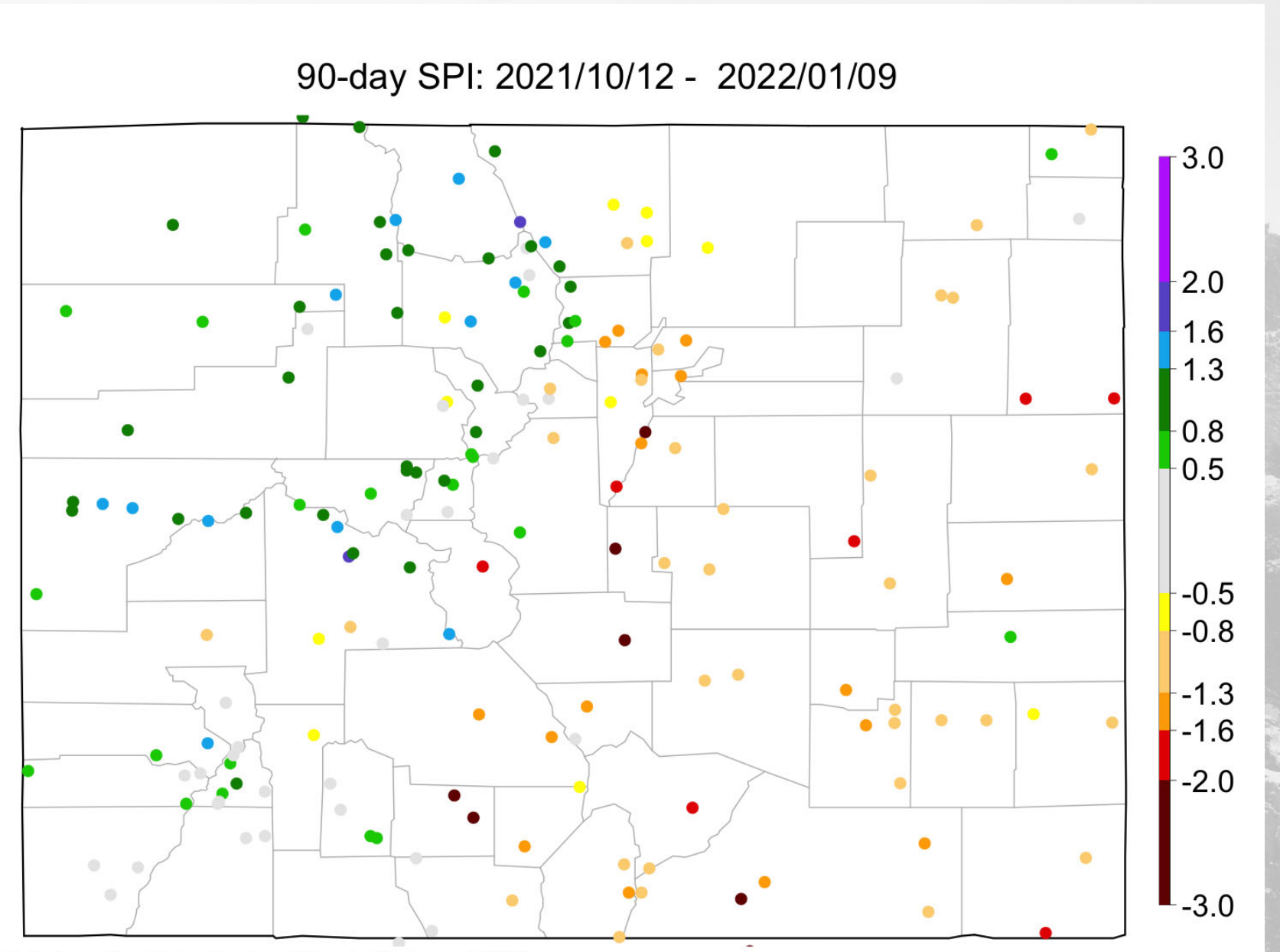

WALSH 1 W WY2022 Precipitation Projections
2022-01-14: 0.93" (Average: 2.92", 32% Ave)
Long-Term Average (19.16")
Average Projection (90% Ave)
Above Average Projection (99% Ave)
Below Average Projection (82% Ave)
46-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
30
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

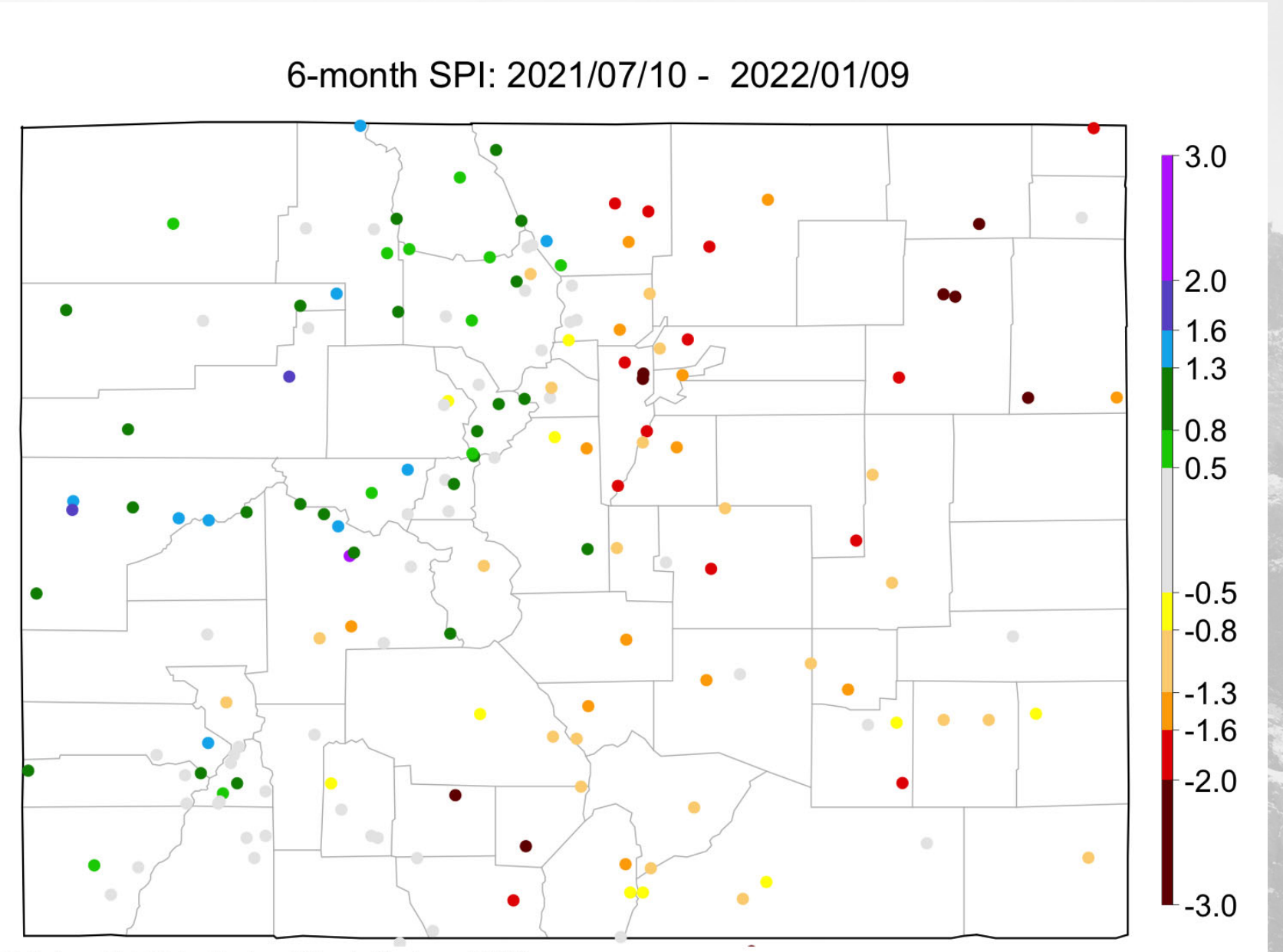
AKRON 4 E WY2022 Precipitation Projections

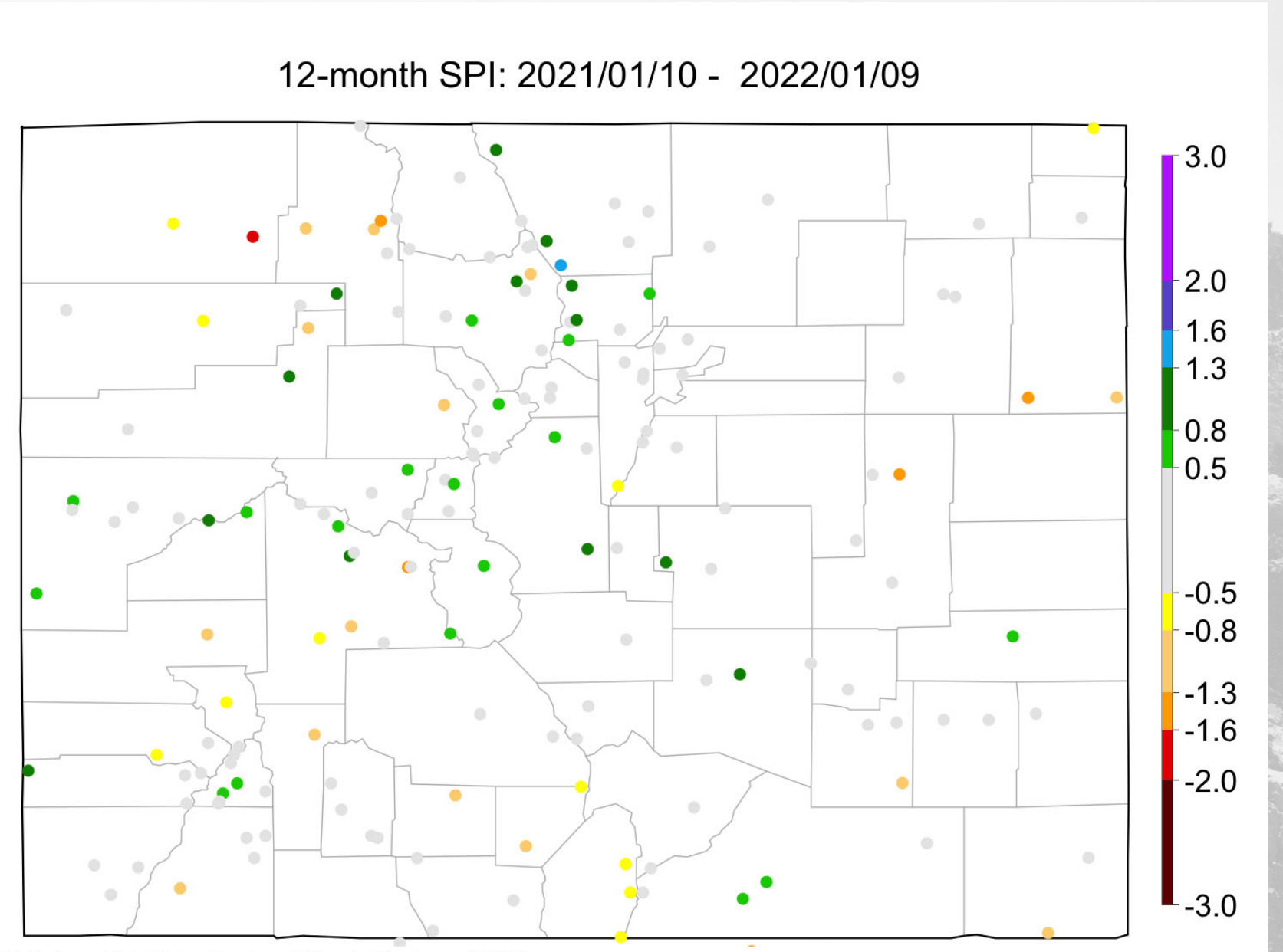



BOULDER WY2022 Precipitation Projections
2022-01-13: 1.59" (Average: 4.05", 39% Ave)
Long-Term Average (20.68")
Average Projection (88% Ave)
Above Average Projection (89% Ave)
Below Average Projection (71% Ave)
83-Year Historical Accumulations
Accumulated Precip (in.)
0
5
10
15
20
25
30
35
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct

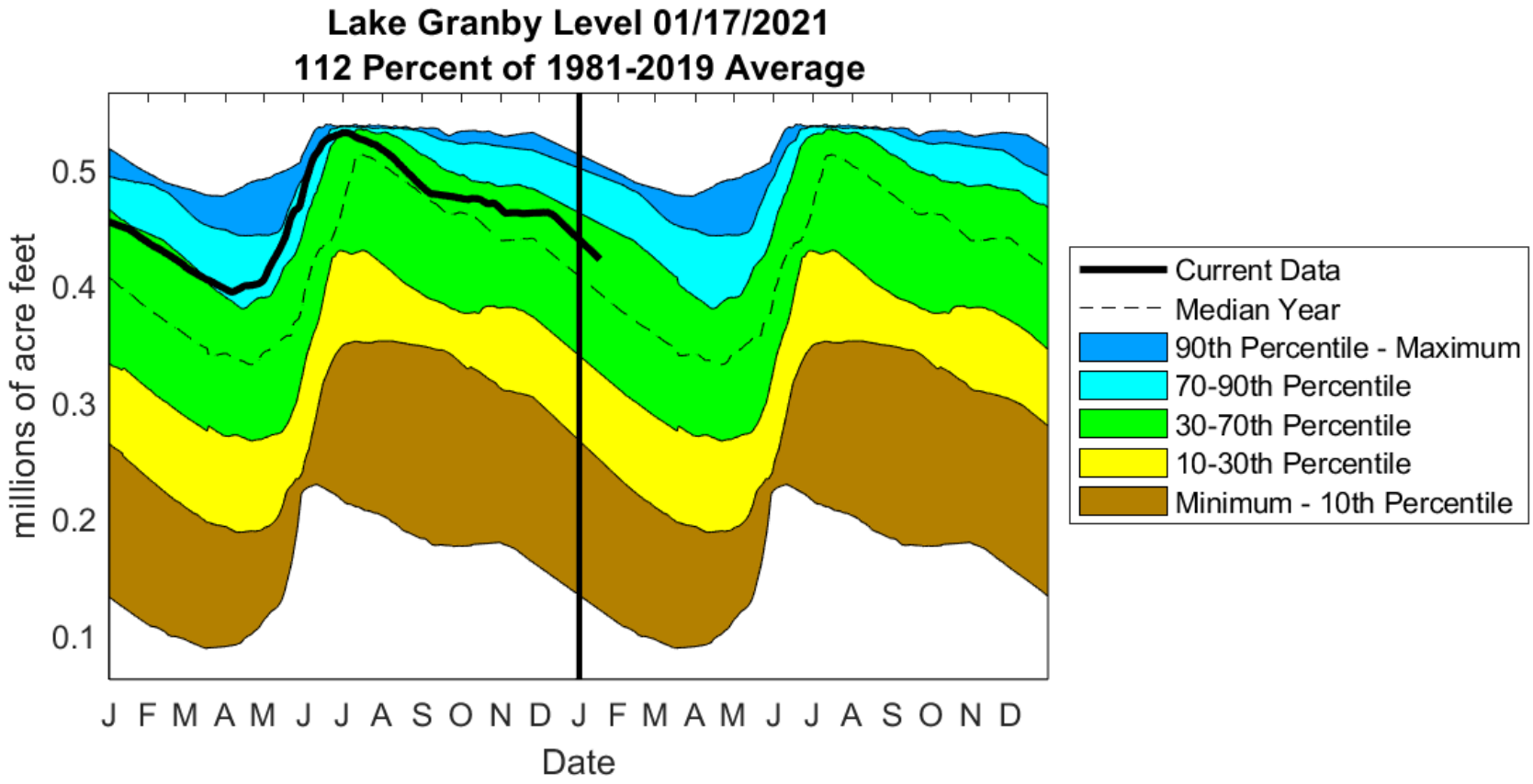

30-day SPI: 2021/12/11 - 2022/01/09
3.0
2.0
1.6
1.3
0.8
0.5
-0.5
-0.8
-1.3
-1.6
-2.0
-3.0
Data from High Plains Regional Climate Center and ACIS

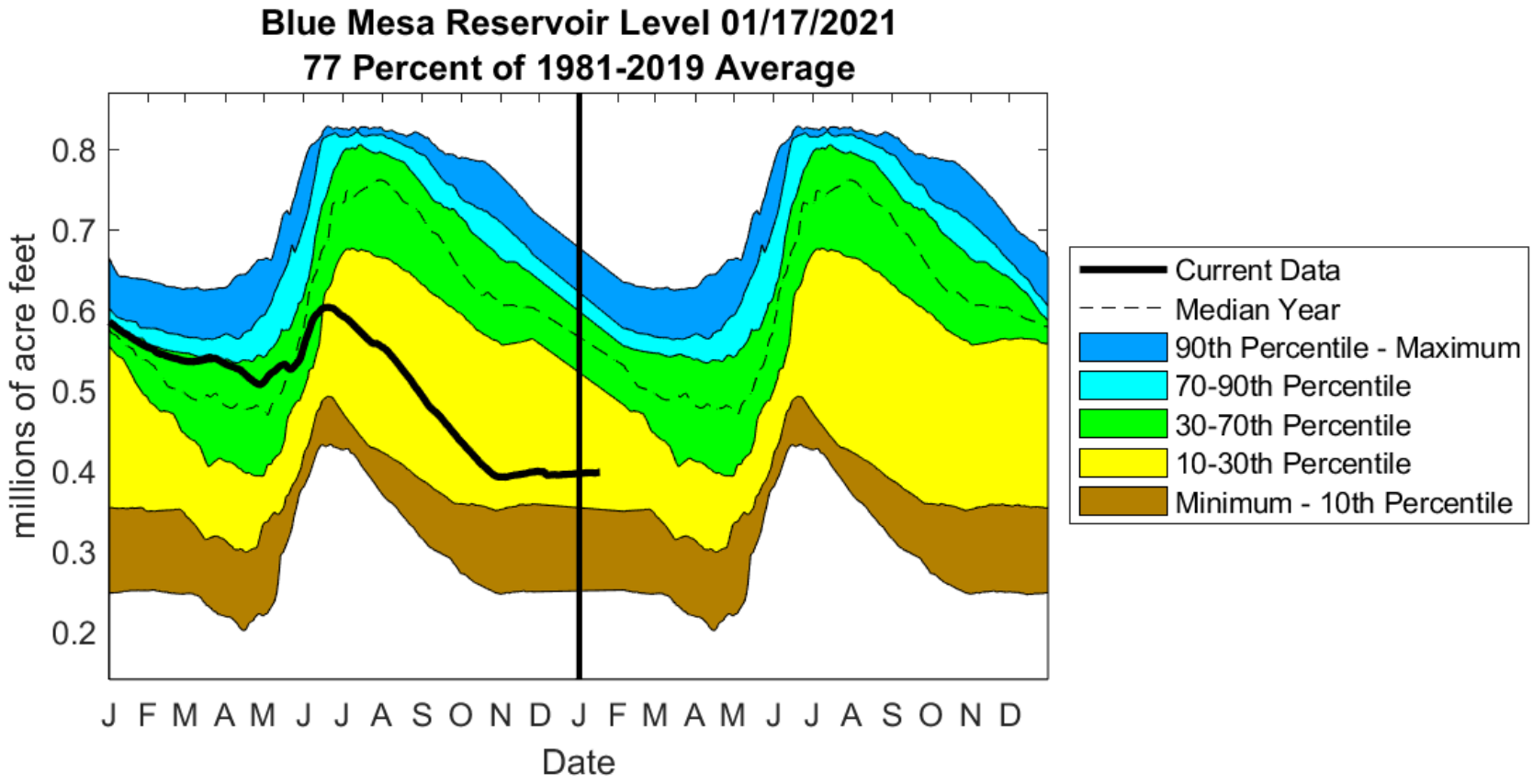

90-day SPI: 2021/10/12 - 2022/01/09
3.0
2.0
1.6
1.3
0.8
0.5
-0.5
-0.8
-1.3
-1.6
-2.0
-3.0
Data from High Plains Regional Climate Center and ACIS

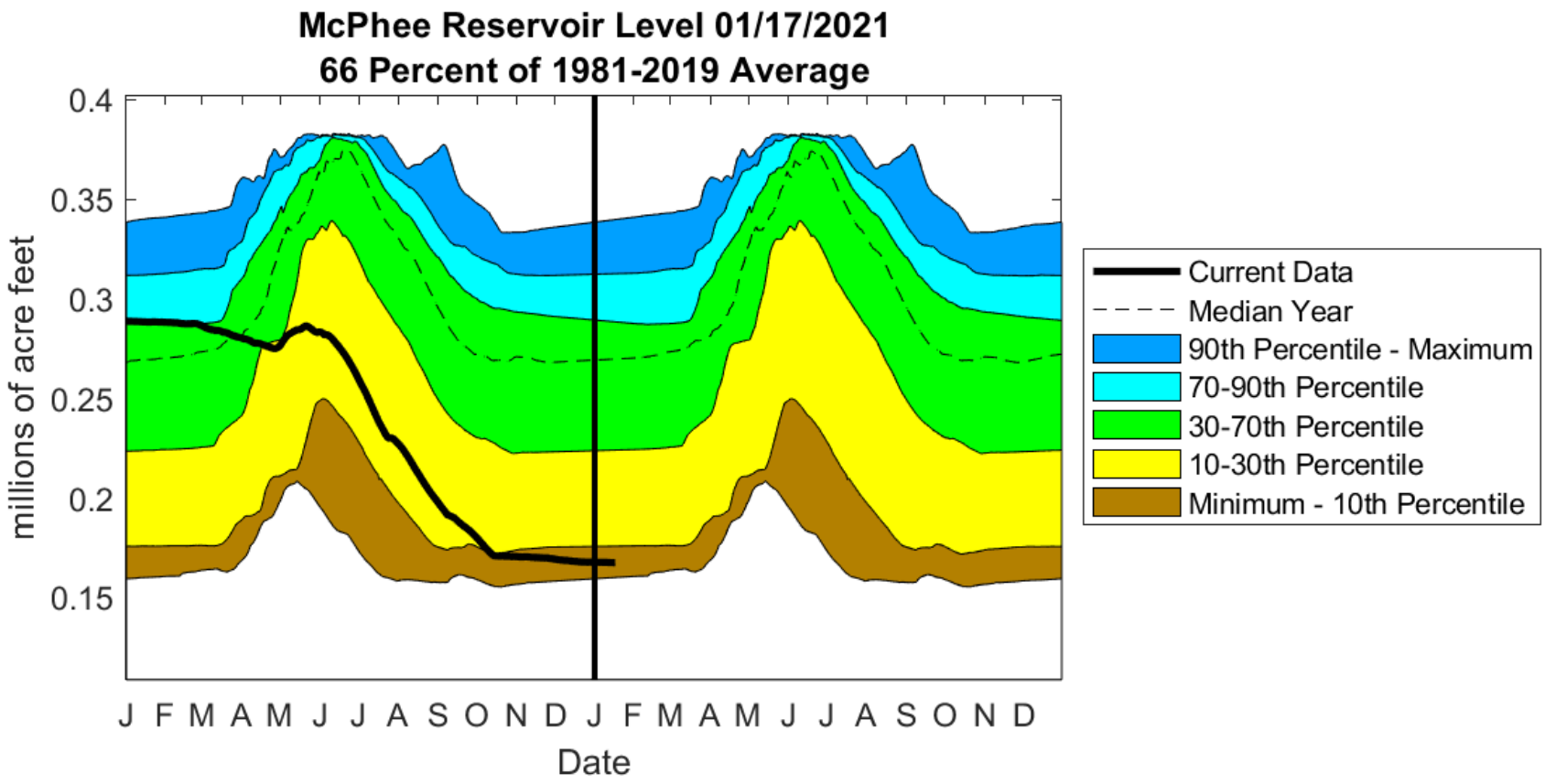

6-month SPI: 2021/07/10 - 2022/01/09
3.0
2.0
1.6
1.3
0.8
0.5
-0.5
-0.8
-1.3
-1.6
-2.0
-3.0
Data from High Plains Regional Climate Center and ACIS

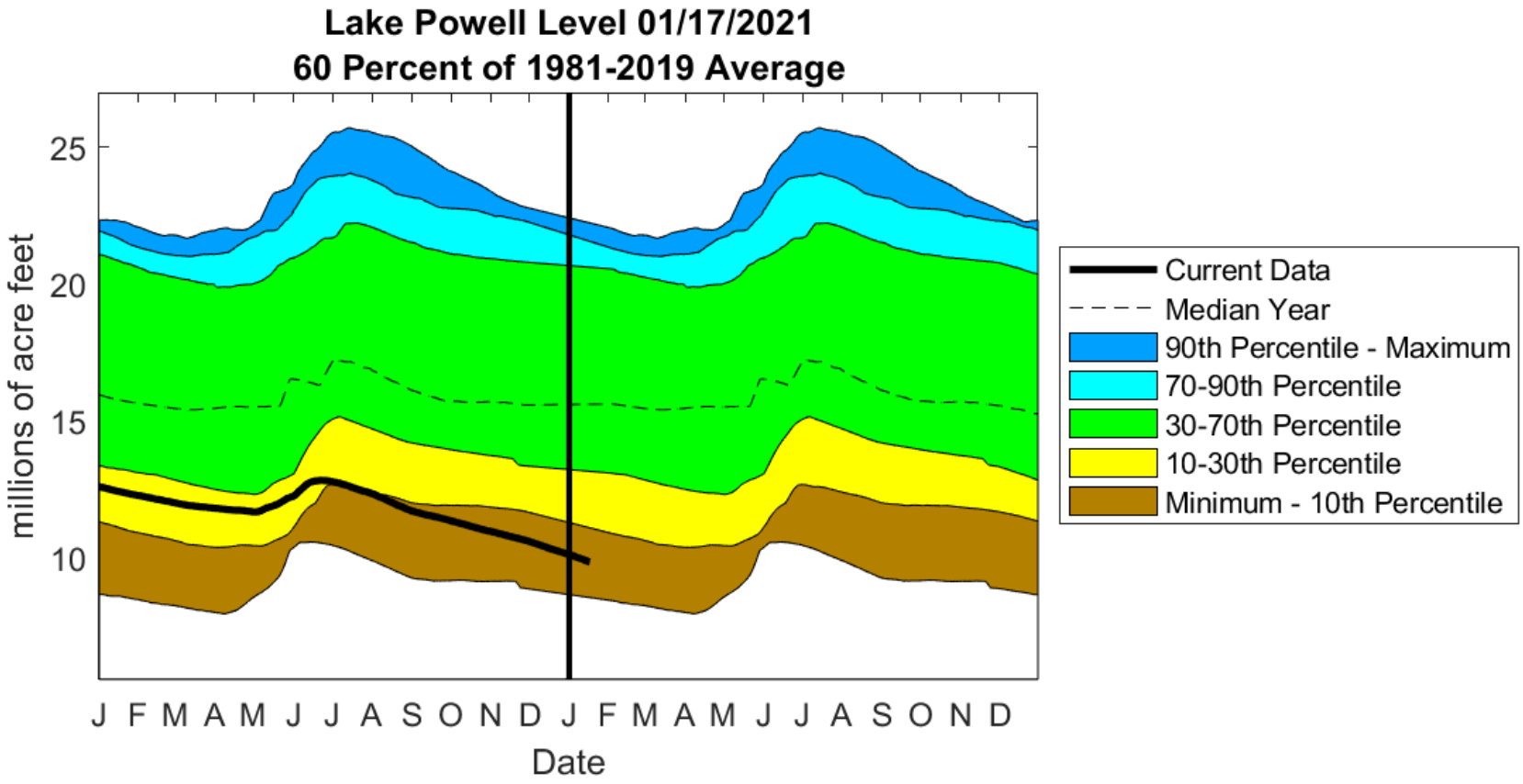

12-month SPI: 2021/01/10 - 2022/01/09
3.0
2.0
1.6
1.3
0.8
0.5
-0.5
-0.8
-1.3
-1.6
-2.0
-3.0
Data from High Plains Regional Climate Center and ACIS

Reservoir and Soils Update


Lake Granby Level 01/17/2021
112 Percent of 1981-2019 Average
millions of acre feet
0.5
0.4
0.3
0.2
0.1
J F M A M J J A S O N D J F M A M J J A S O N D
Date
Current Data
Median Year
90th Percentile - Maximum
70-90th Percentile
30-70th Percentile
10-30th Percentile
Minimum - 10th Percentile

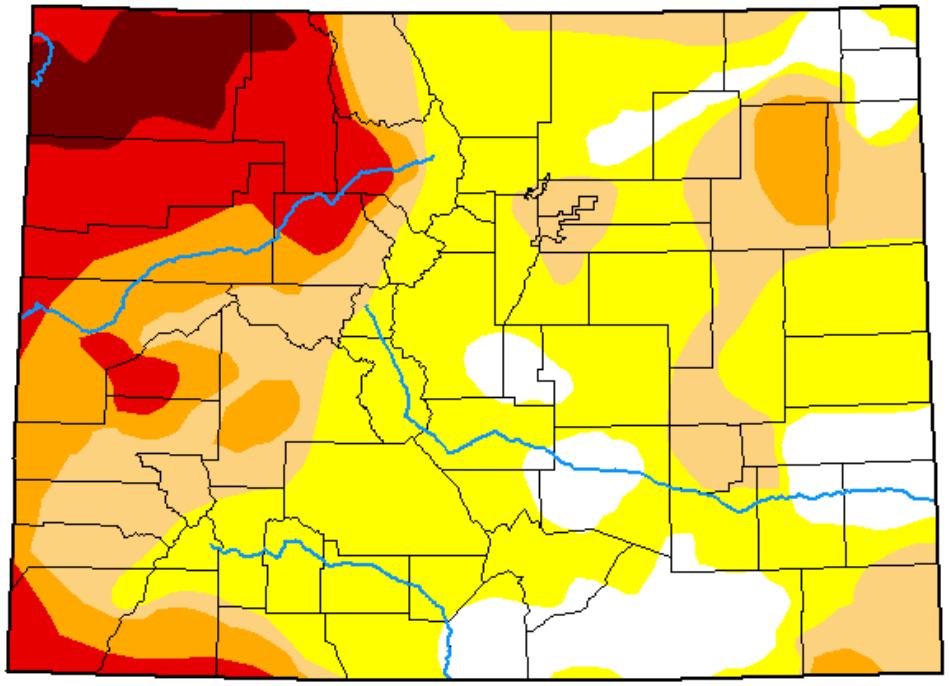

Blue Mesa Reservoir Level 01/17/2021
77 Percent of 1981-2019 Average
millions of acre feet
0.8
0.7
0.6
0.5
0.4
0.3
0.2
J F M A M J J A S O N D J F M A M J J A S O N D
Date
Current Data
Median Year
90th Percentile - Maximum
70-90th Percentile
30-70th Percentile
10-30th Percentile
Minimum - 10th Percentile


McPhee Reservoir Level 01/17/2021
66 Percent of 1981-2019 Average
millions of acre feet
0.4
0.35
0.3
0.25
0.2
0.15
J F M A M J J A S O N D J F M A M J J A S O N D
Date
Current Data
Median Year
90th Percentile - Maximum
70-90th Percentile
30-70th Percentile
10-30th Percentile
Minimum - 10th Percentile


Lake Powell Level 01/17/2021
60 Percent of 1981-2019 Average
millions of acre feet
25
20
15
10
J F M A M J J A S O N D J F M A M J J A S O N D
Date
Current Data
Median Year
90th Percentile - Maximum
70-90th Percentile
30-70th Percentile
10-30th Percentile
Minimum - 10th Percentile

U.S. Drought Monitor

Colorado



September 28, 2021

(Released Thursday, Sep. 30, 2021)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	12.72	87.28	46.42	26.30	15.05	3.91
Last Week *09-21-2021*	16.92	83.08	40.94	24.58	15.05	3.91
3 Months Ago *06-29-2021*	54.48	45.52	41.62	36.37	29.95	17.52
Start of Calendar Year *12-29-2020*	0.00	100.00	100.00	93.73	76.17	27.60
Start of Water Year *09-29-2020*	0.00	100.00	99.29	89.35	52.88	2.64
One Year Ago *09-29-2020*	0.00	100.00	99.29	89.35	52.88	2.64

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

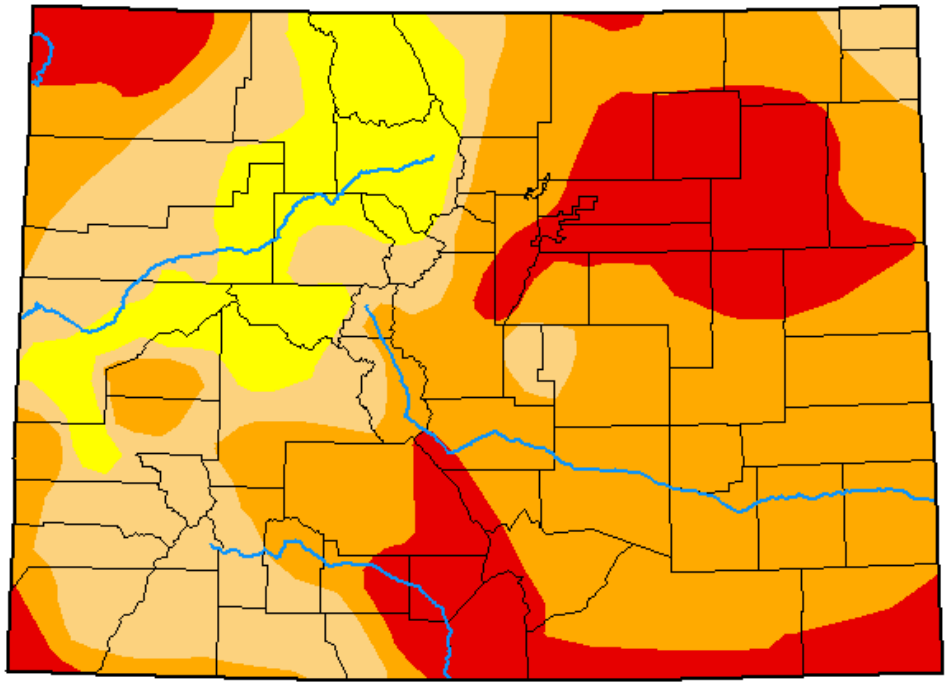
Author:

Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

U.S. Drought Monitor

Colorado



January 11, 2022

(Released Thursday, Jan. 13, 2022)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	88.32	65.93	20.59	0.00
Last Week *01-04-2022*	0.00	100.00	95.49	67.08	22.25	0.00
3 Months Ago *10-12-2021*	5.26	94.74	65.99	29.29	13.63	1.95
Start of Calendar Year *01-04-2022*	0.00	100.00	95.49	67.08	22.25	0.00
Start of Water Year *09-28-2021*	12.72	87.28	46.42	26.30	15.05	3.91
One Year Ago *01-12-2021*	0.00	100.00	100.00	91.03	73.63	27.59

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

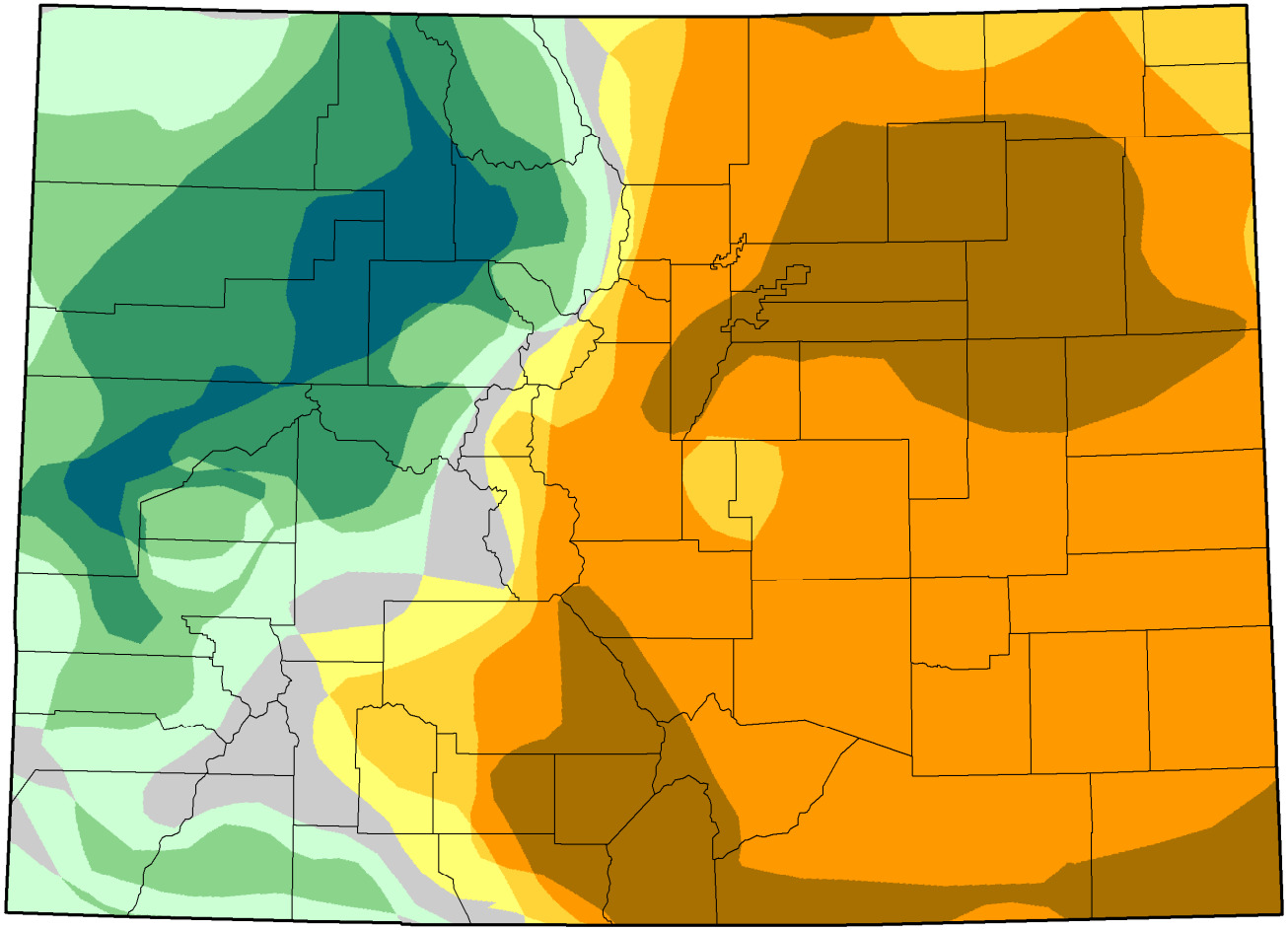
Author:

Richard Tinker
CPC/NOAA/NWS/NCEP

droughtmonitor.unl.edu

U.S. Drought Monitor Class Change - Colorado

24 Week

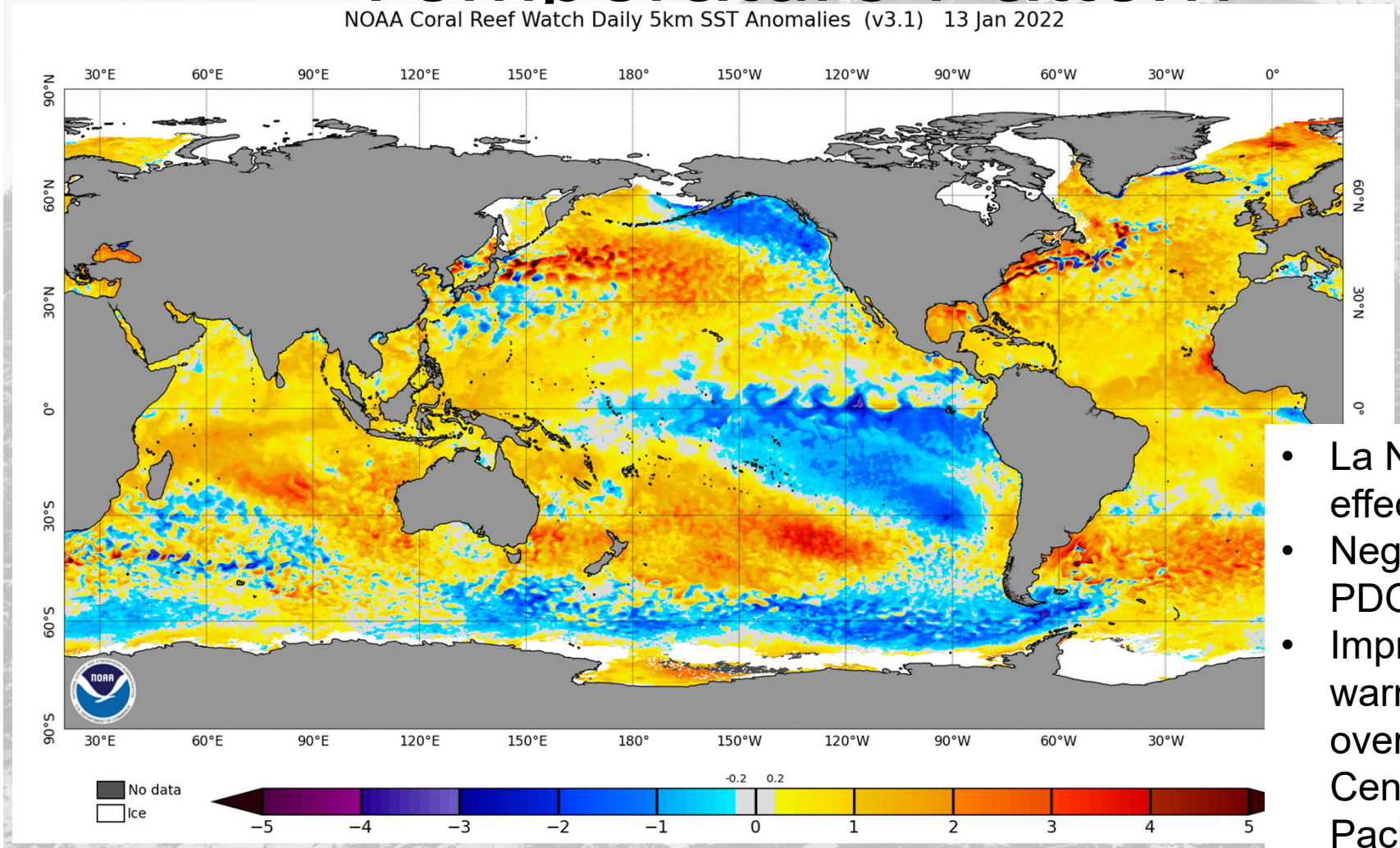


January 11, 2022
compared to
July 27, 2021

droughtmonitor.unl.edu

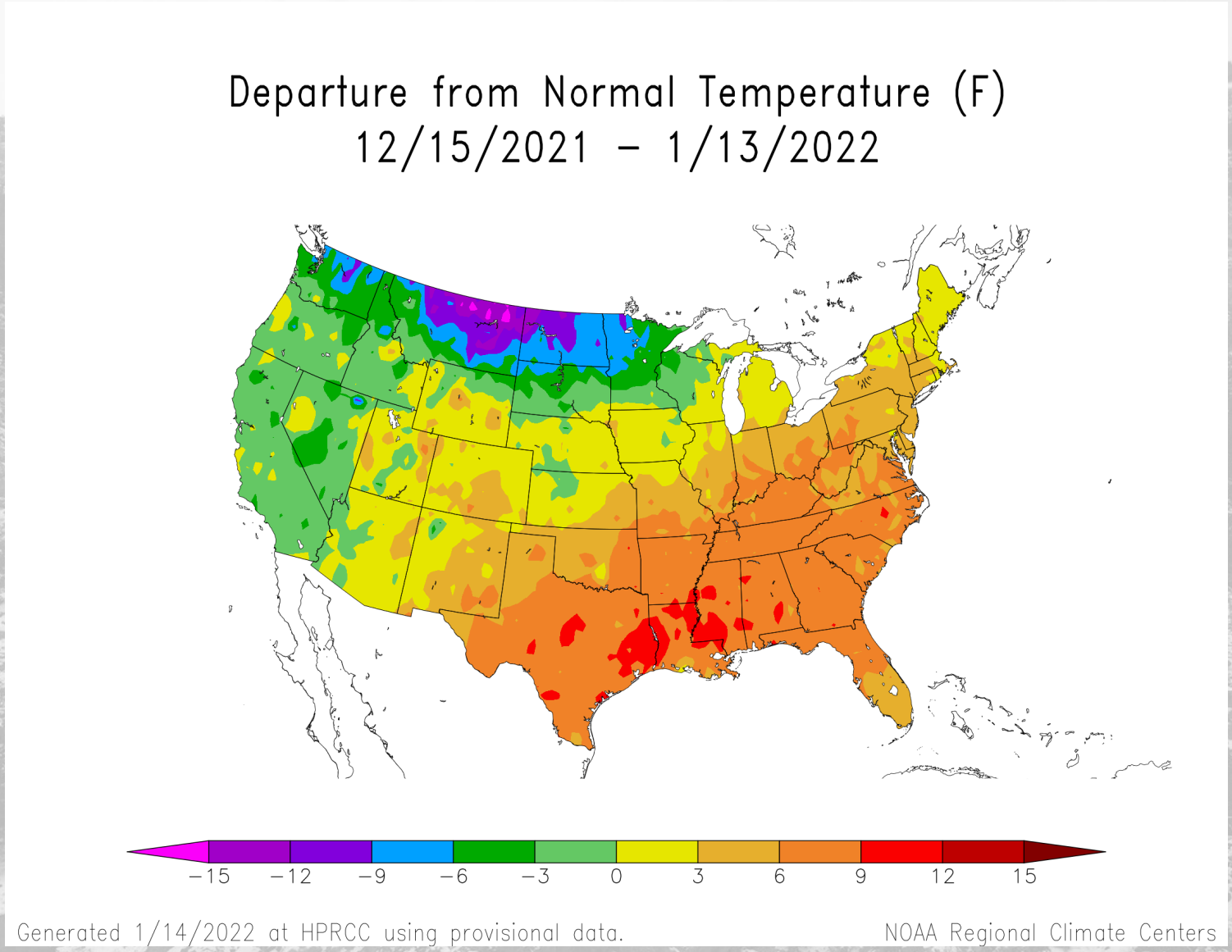
- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

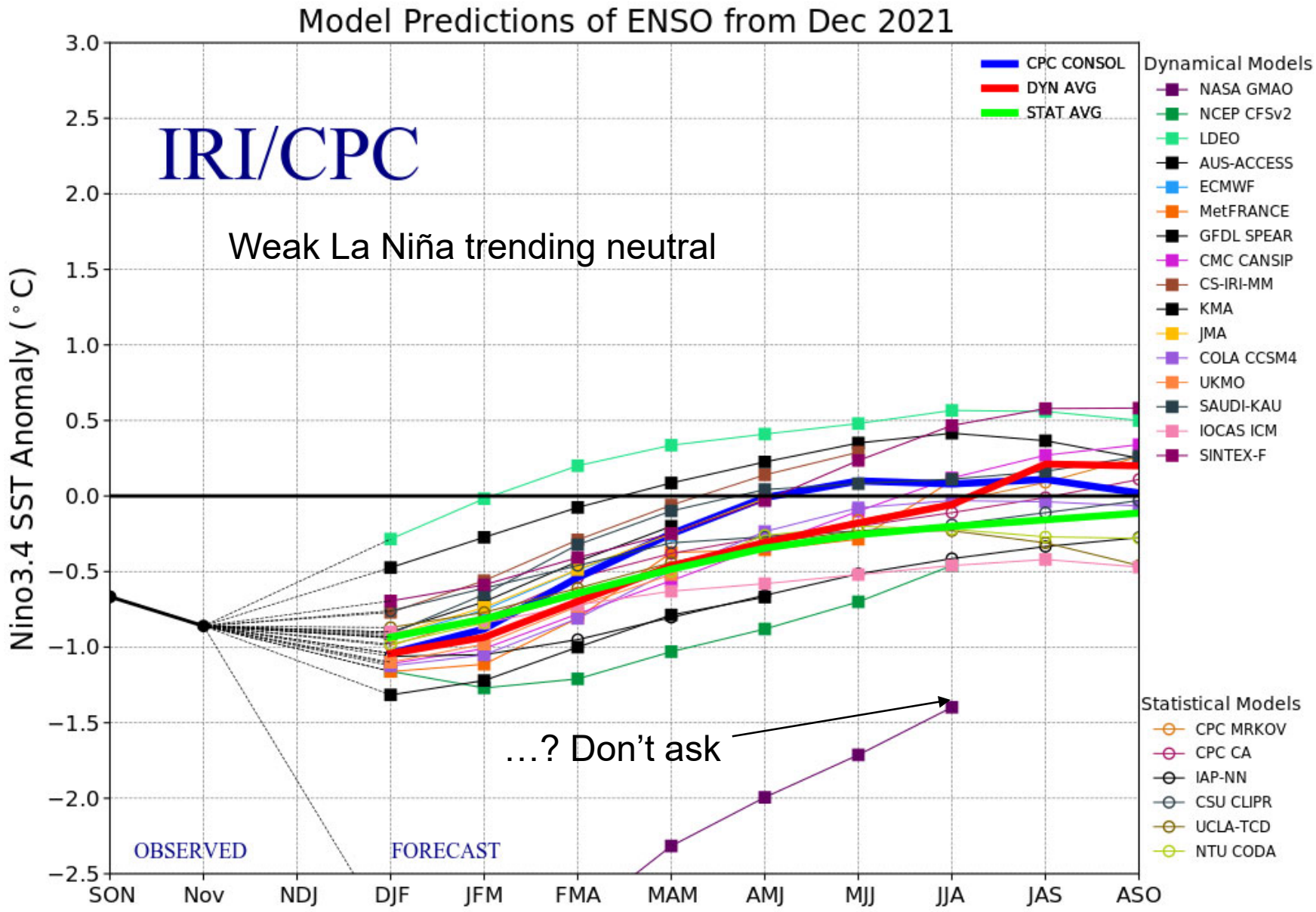
Current Sea Surface Temperature Pattern



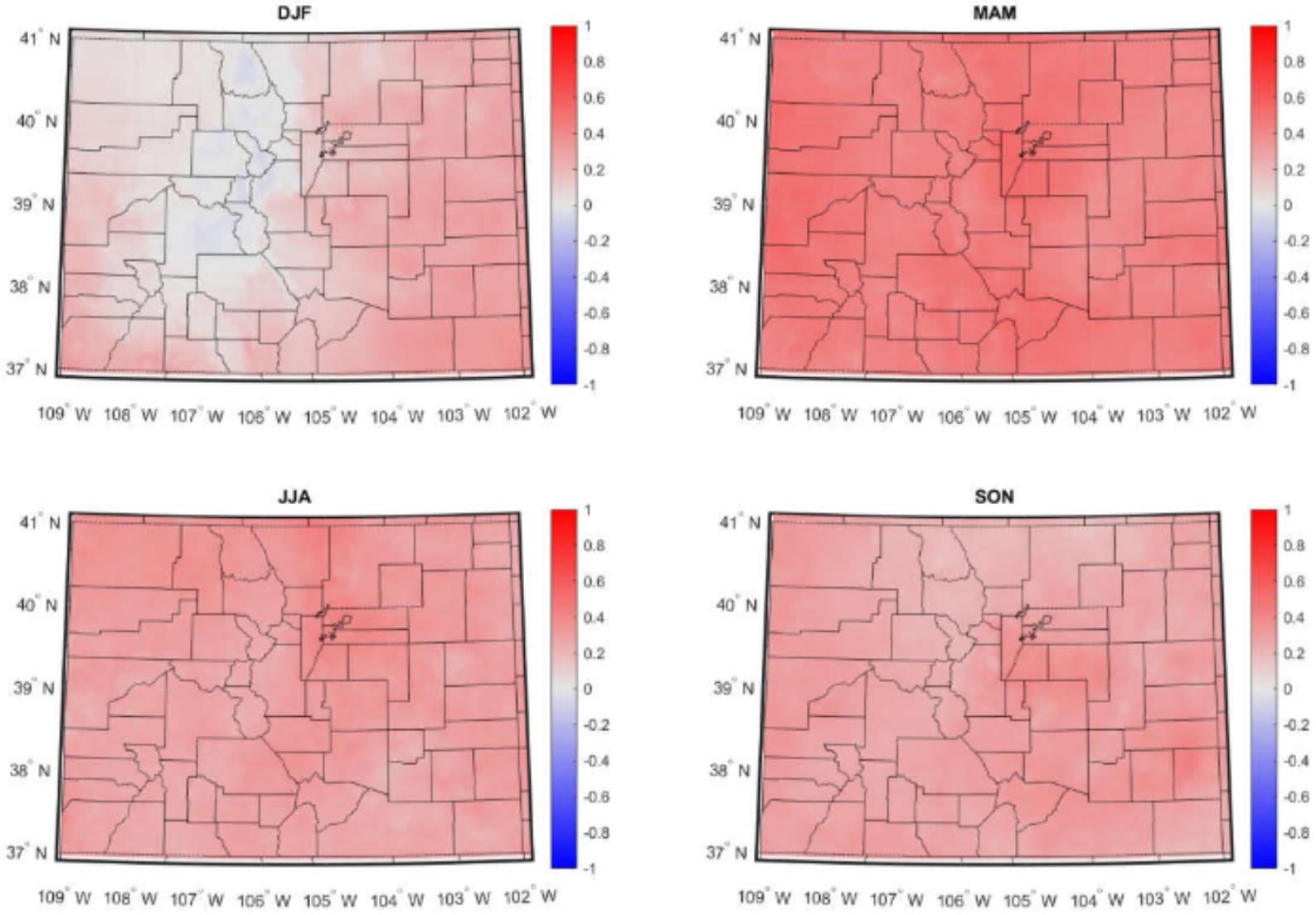
- La Niña in effect
- Negative PDO
- Impressive warm blob over the Central Pacific

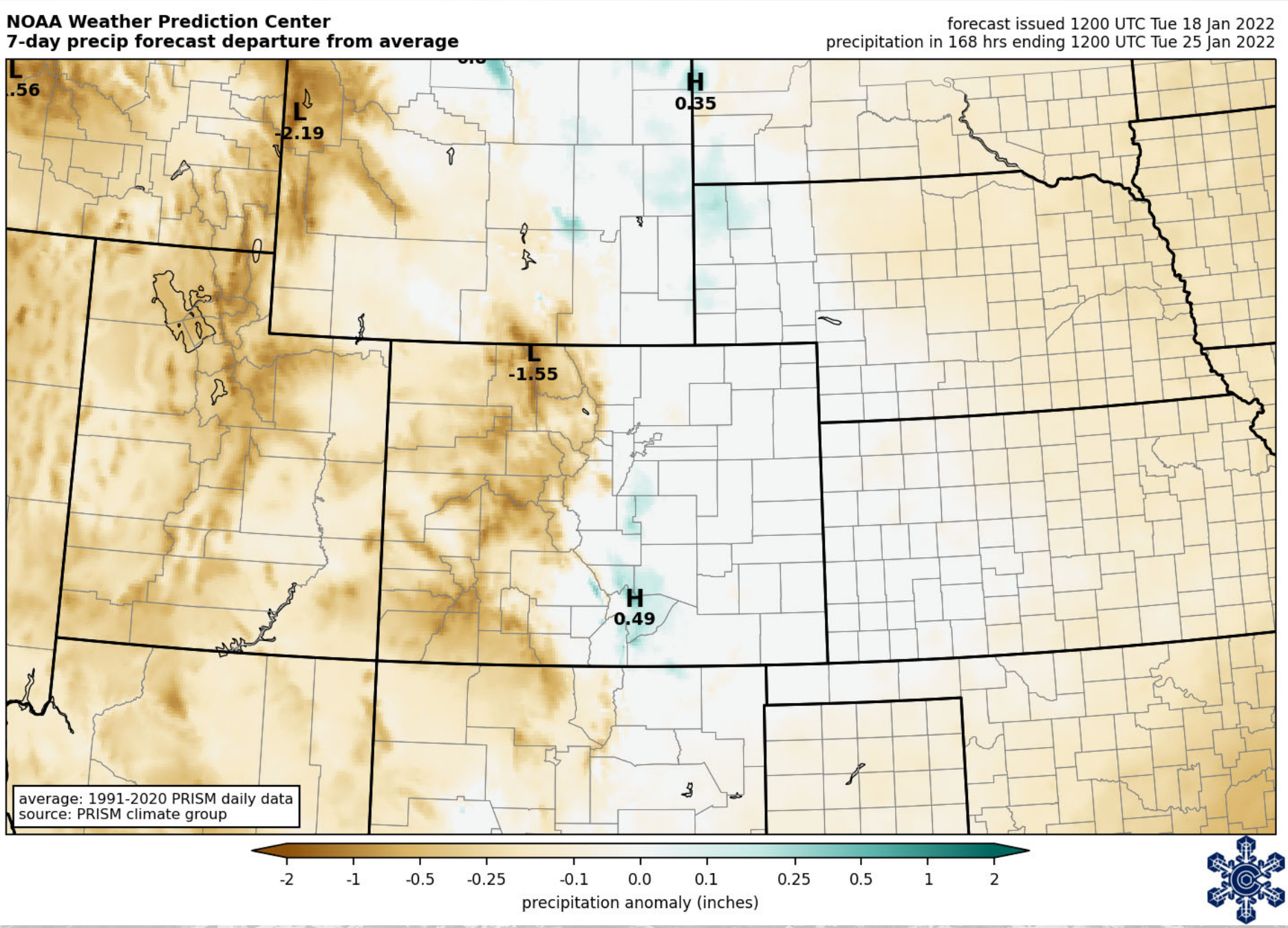
La Niña-like Temperature Pattern Last 30 Days
But winter took time to get going




Model Predictions of ENSO from Dec 2021
IRI/CPC
Weak La Niña trending neutral
…? Don't ask
Nino3.4 SST Anomaly (°C)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
−2.5
SON
Nov
NDJ
DJF
JFM
FMA
MAM
AMJ
MJJ
JJA
JAS
ASO
OBSERVED
FORECAST
CPC CONSOL
DYN AVG
STAT AVG
Dynamical Models
NASA GMAO
NCEP CFSv2
LDEO
AUS-ACCESS
ECMWF
MetFRANCE
GFDL SPEAR
CMC CANSIP
CS-IRI-MM
KMA
JMA
COLA CCSM4
UKMO
SAUDI-KAU
IOCAS ICM
SINTEX-F
Statistical Models
CPC MRKOV
CPC CA
IAP-NN
CSU CLIPR
UCLA-TCD
NTU CODA

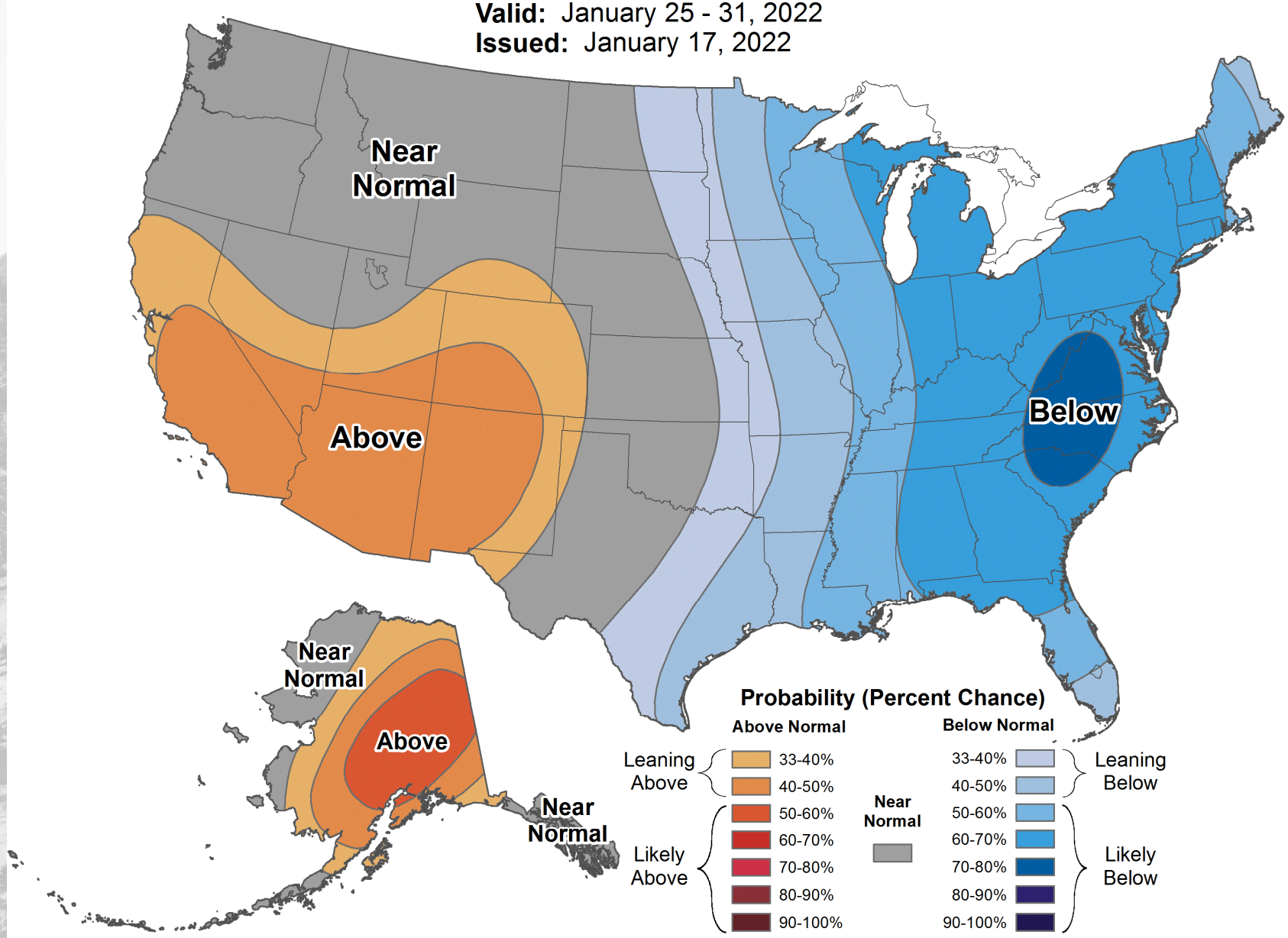
Correlation Between ENSO MEI and Seasonal Precipitation Accumulation (1981-2020)




NOAA Weather Prediction Center
7-day precip forecast departure from average
forecast issued 1200 UTC Tue 18 Jan 2022
precipitation in 168 hrs ending 1200 UTC Tue 25 Jan 2022
L
.56
L
-2.19
H
0.35
L
-1.55
H
0.49
average: 1991-2020 PRISM daily data
source: PRISM climate group
-2
-1
-0.5
-0.25
-0.1
0.0
0.1
0.25
0.5
1
2
precipitation anomaly (inches)

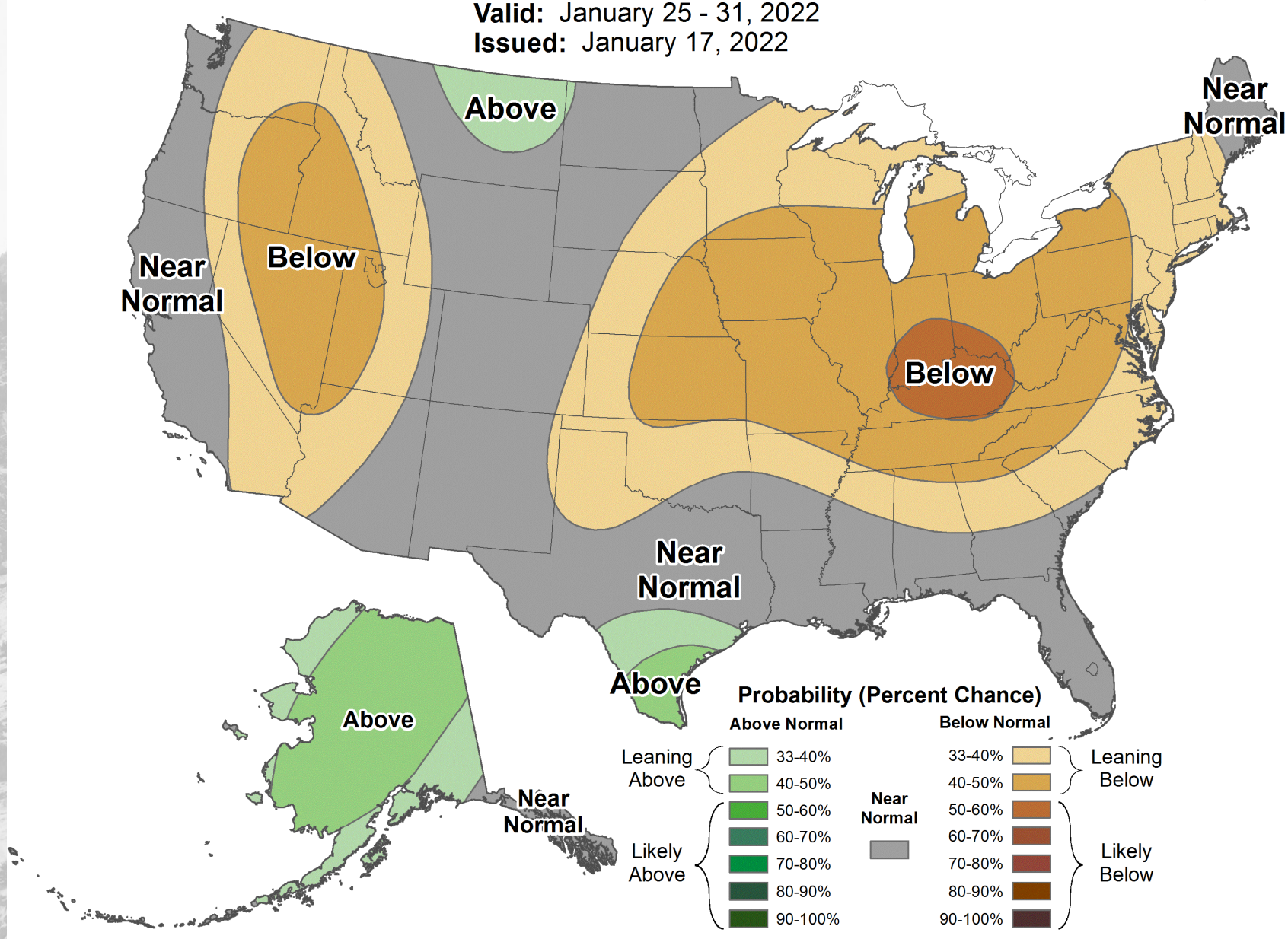
8-14 Day Temperature Outlook

Valid: January 25 - 31, 2022
Issued: January 17, 2022



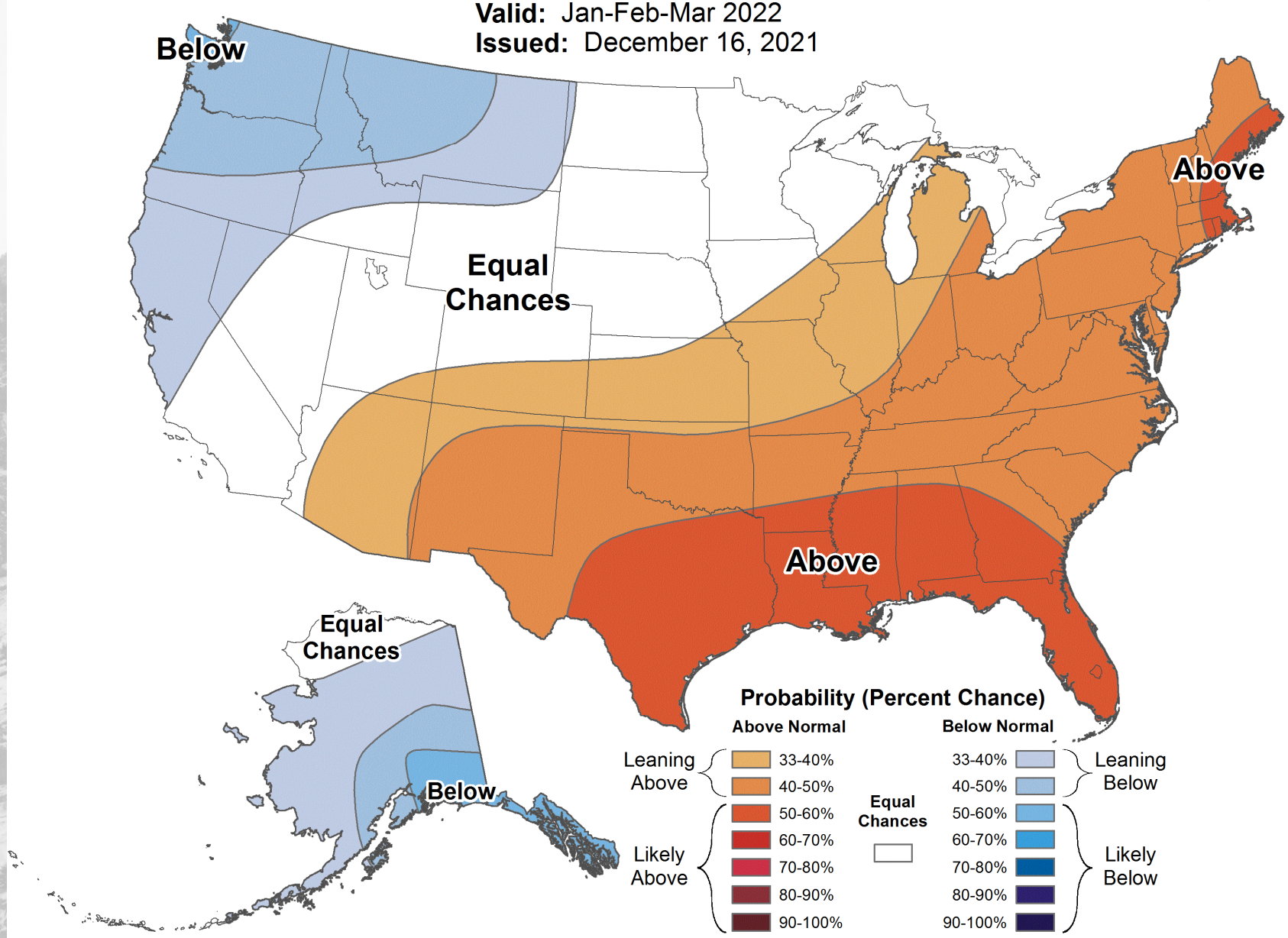
8-14 Day Precipitation Outlook

Valid: January 25 - 31, 2022
Issued: January 17, 2022



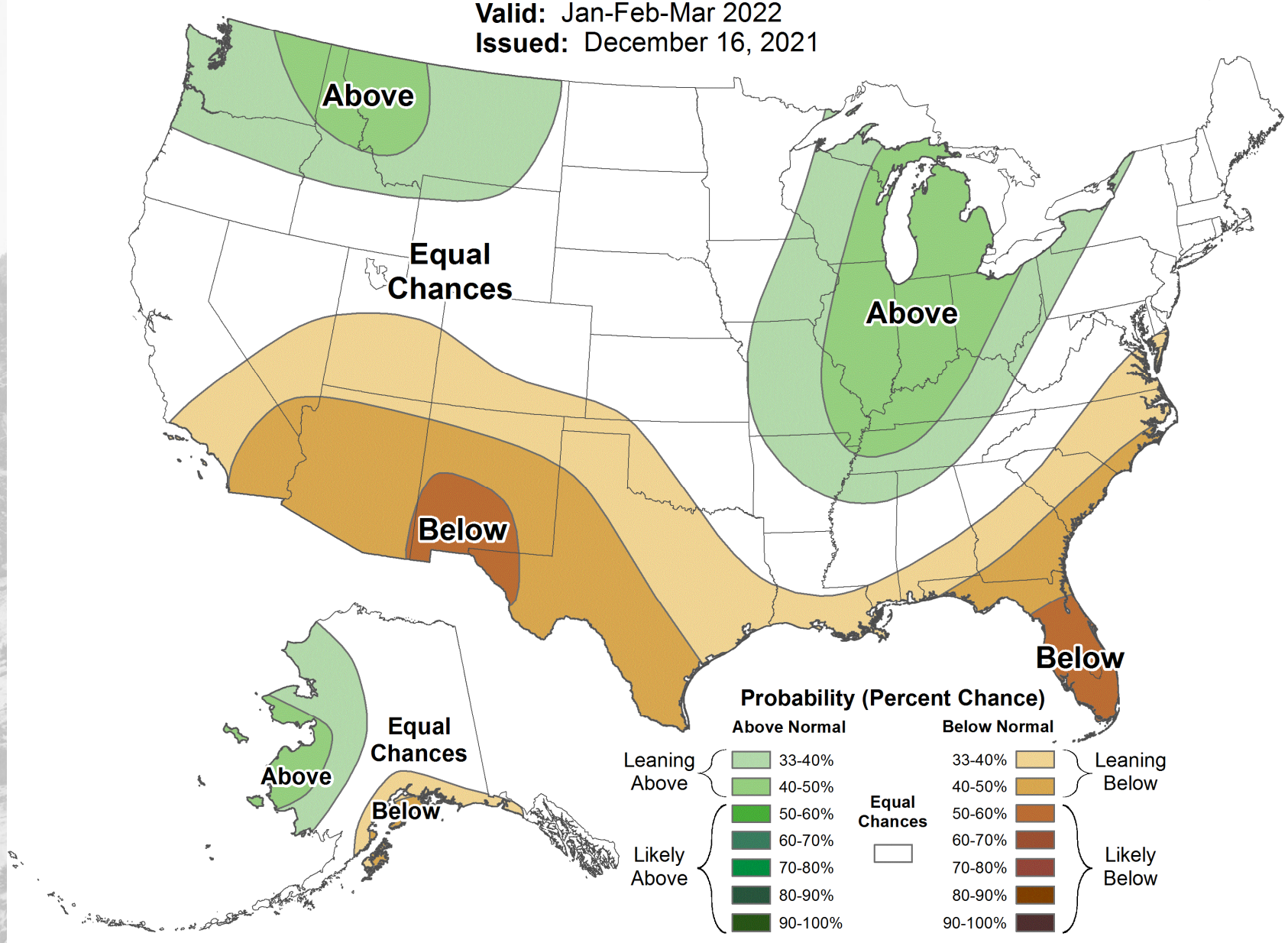
Seasonal Temperature Outlook

Valid: Jan-Feb-Mar 2022
Issued: December 16, 2021



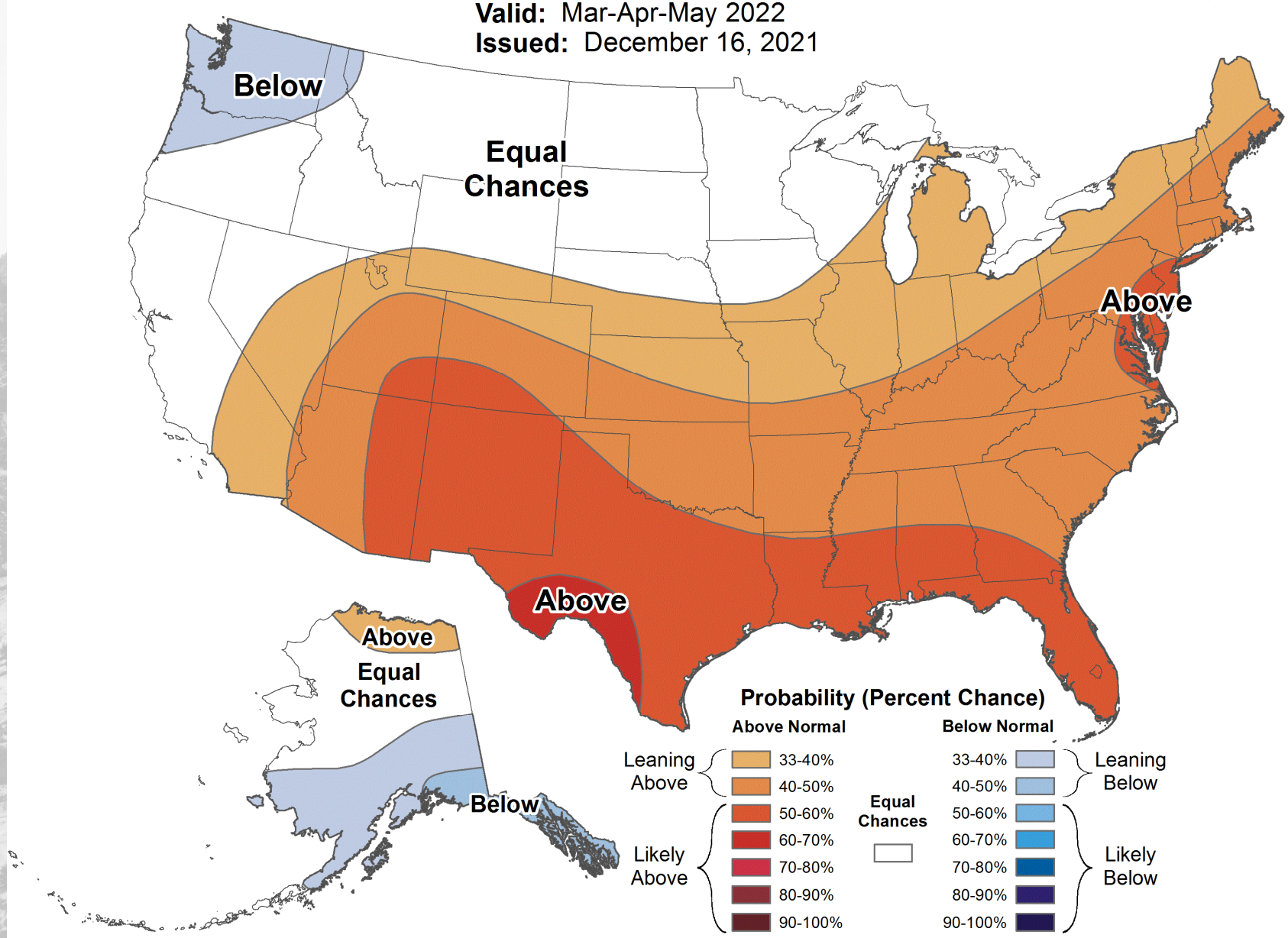
Seasonal Precipitation Outlook

Valid: Jan-Feb-Mar 2022
Issued: December 16, 2021



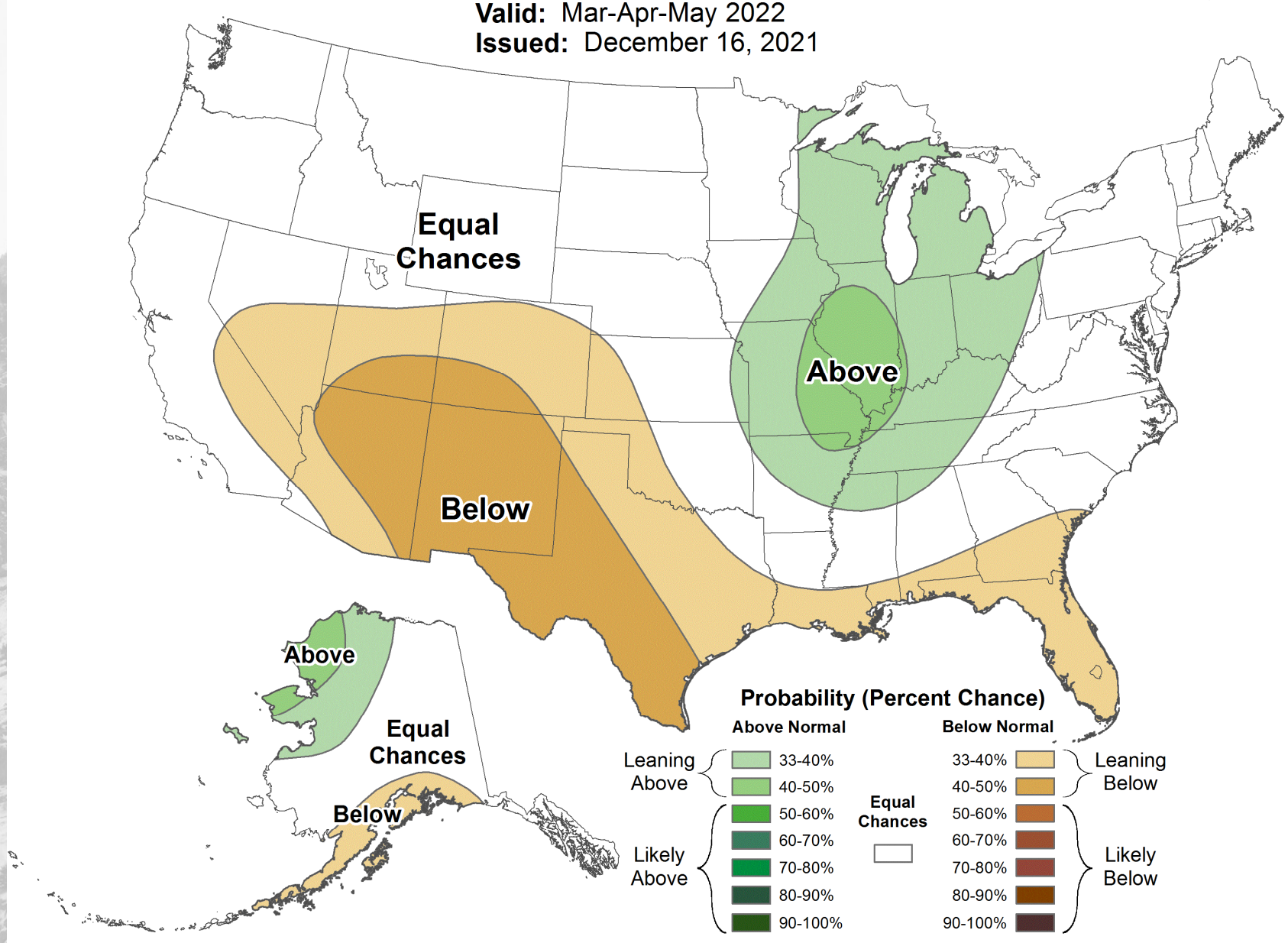
Seasonal Temperature Outlook

Valid: Mar-Apr-May 2022
Issued: December 16, 2021



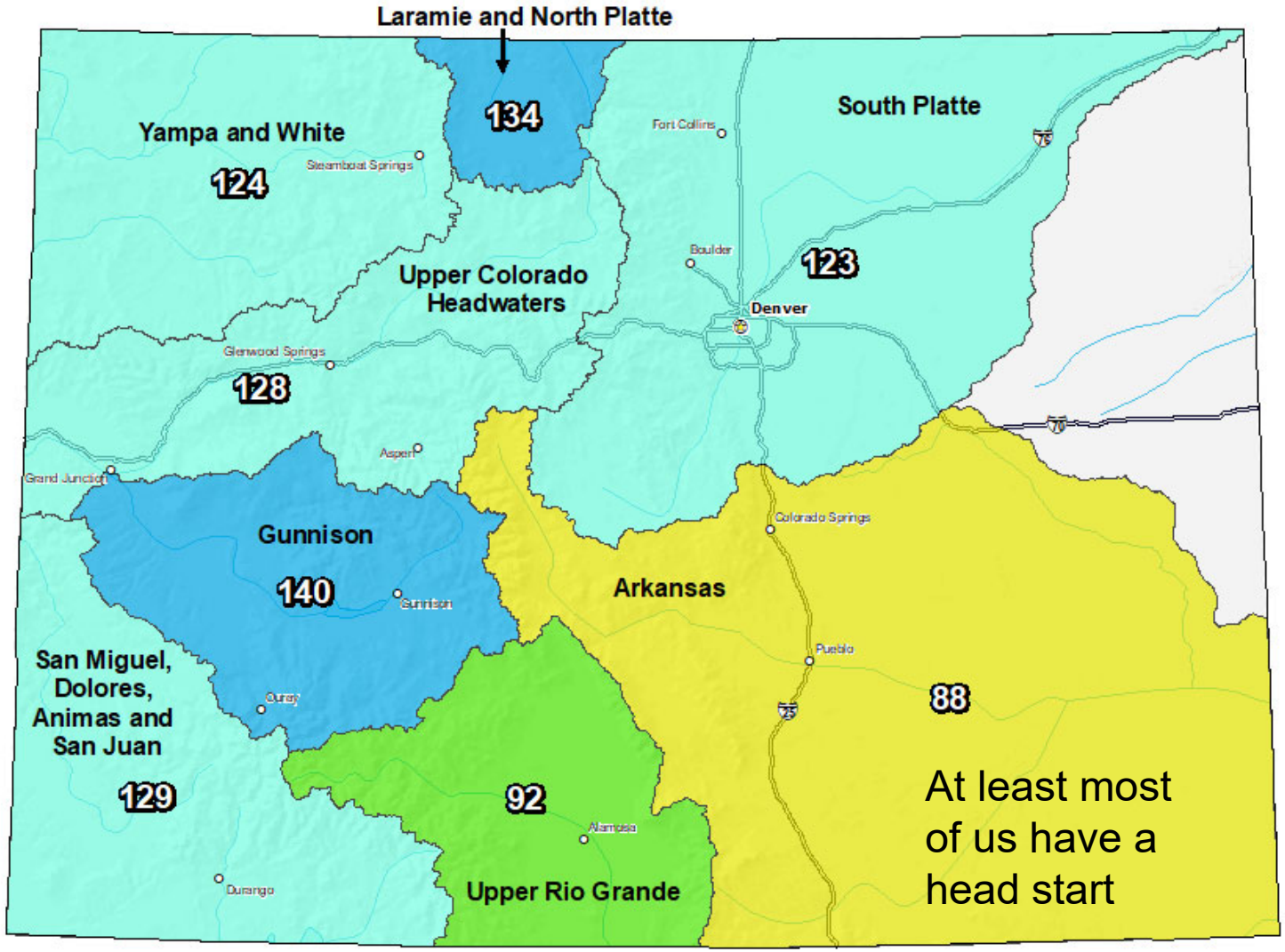
Seasonal Precipitation Outlook

Valid: Mar-Apr-May 2022
Issued: December 16, 2021



Colorado
SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Jan 14, 2022



Current Snow Water Equivalent (SWE) Basin-wide Percent of 1991-2020 Median

- unavailable *
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 109%
- 110 - 129%
- 130 - 149%
- >=150%

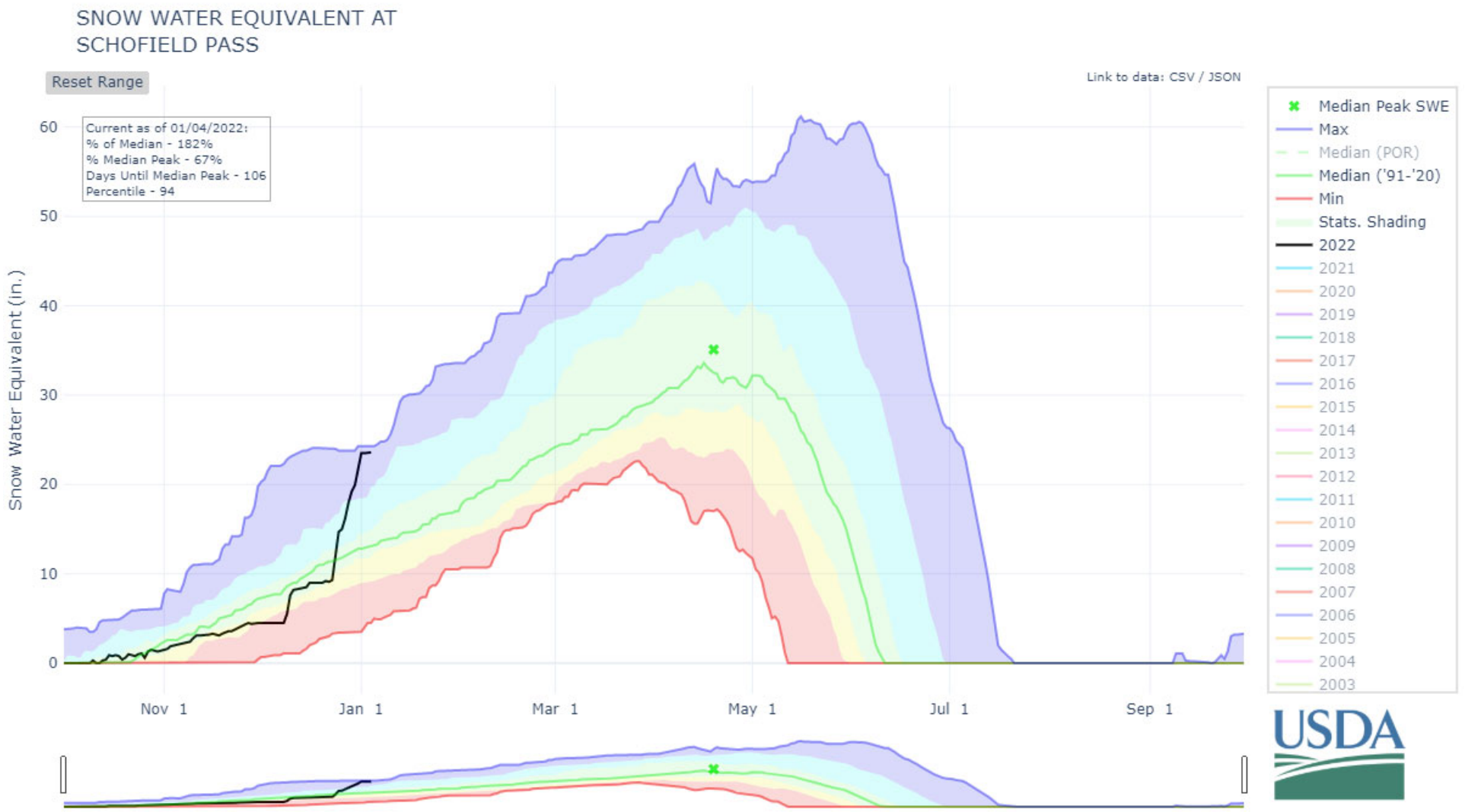
* *Data unavailable at time of posting or measurement is not representative at this time of year*

Provisional Data Subject to Revision

0 10 20 40 60 80 100 Miles

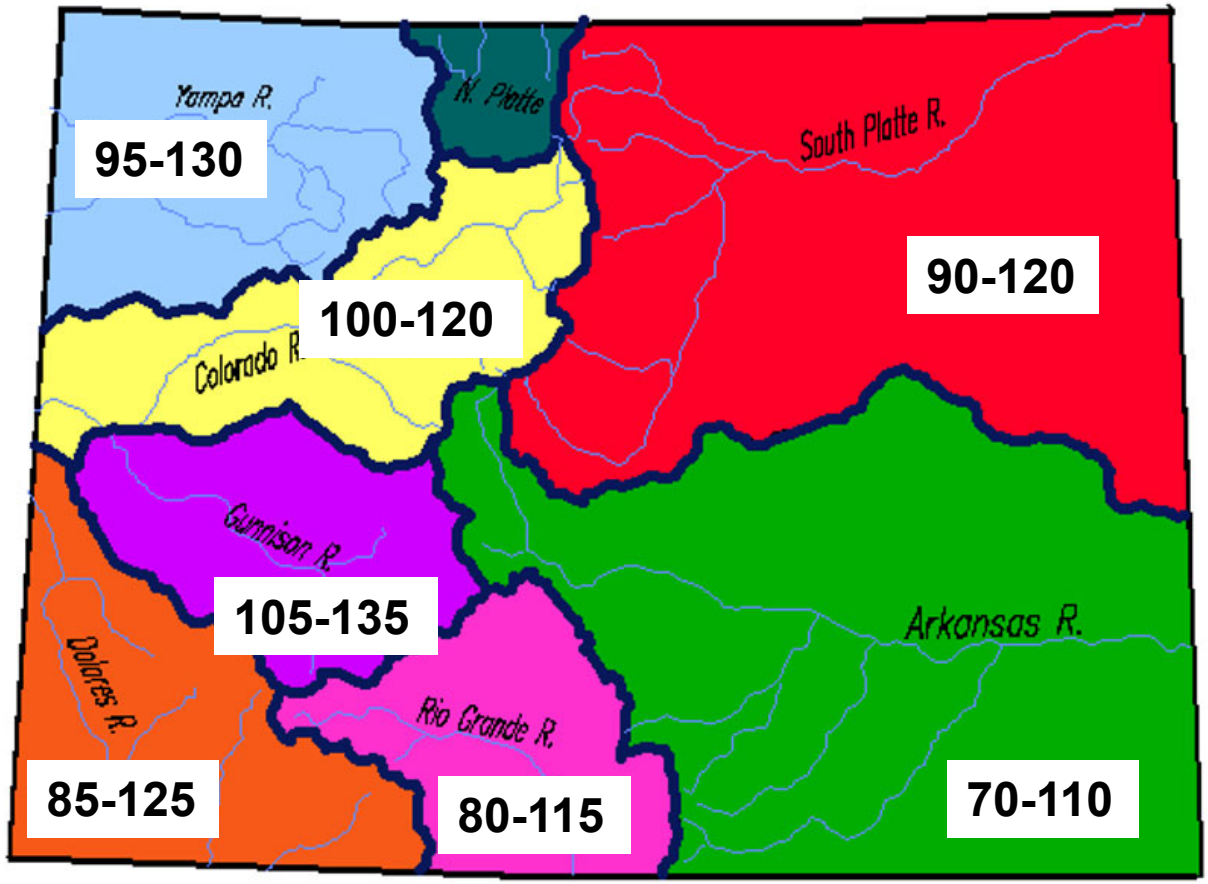
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
https://www.nrcs.usda.gov/wps/portal/wcc/home/



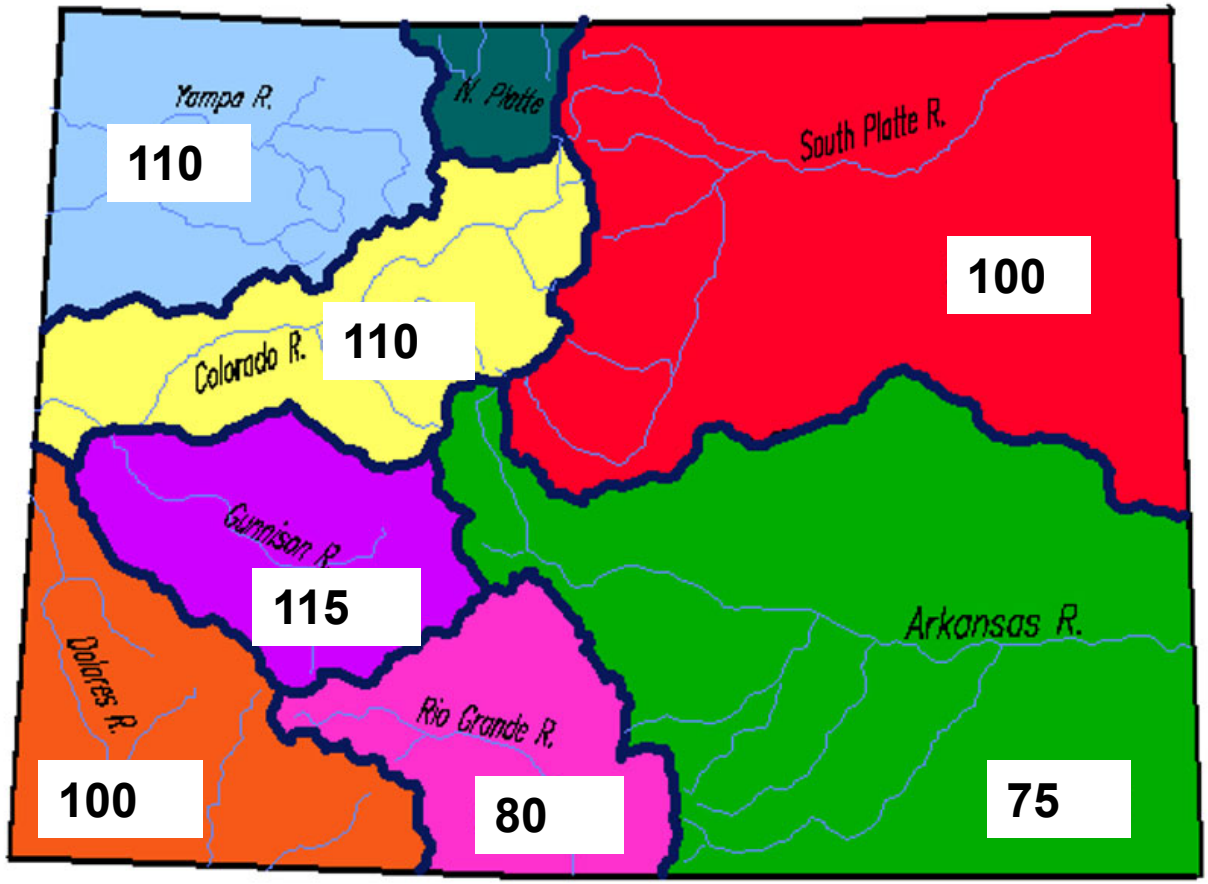
Wettest 10-day stretch on record at Schofield Pass!

Peak Snowpack Projection 20-80th Percentile Range



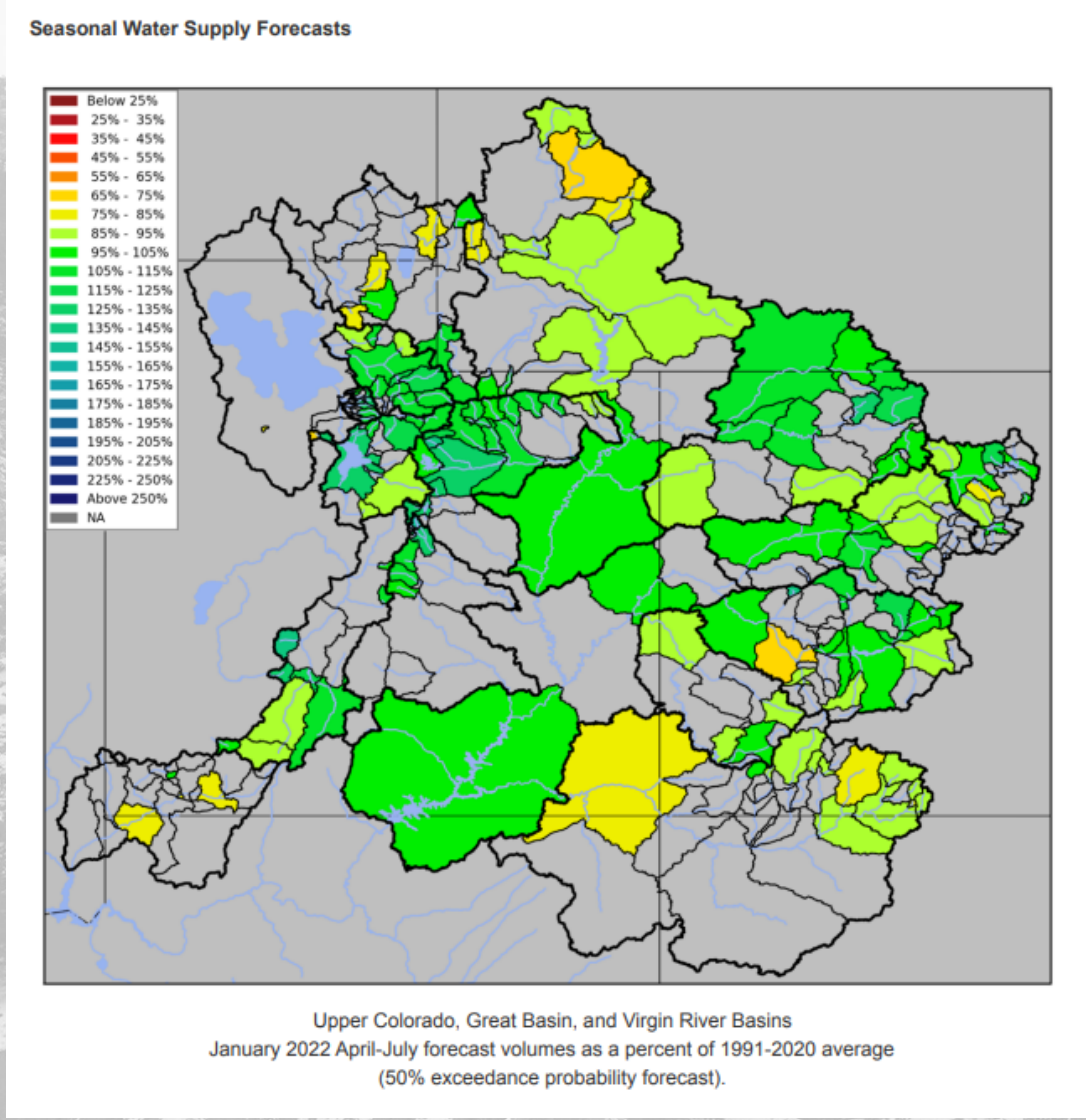
- Snowpack likely to peak well below normal
- This does not cover the true range of variability
- More variability in southern basins
- The seasonal forecast leads us to expect numbers closer to the low end of the range

Not Quite a Real Forecast (mostly fun)



- Snowpack likely to peak well below normal
- This does not cover the true range of variability
- More variability in southern basins
- The seasonal forecast leads us to expect numbers closer to the low end of the range

Colorado Basin River Forecast Center



CBRFC favors an average runoff! We haven't seen that in a while

Dry antecedent soils hamper runoff efficiency

Takeaways

- Drought remains an issue statewide, becoming more long-term/hydrological out west
- A wet spring followed by a warm/dry fall set the stage for off-season wildfire
- December was warm and wet out west/warm and dry east of the divide. We have seen some moisture since. Much needed heavy snow in western CO second half of December
- We remain in a La Niña pattern, which is expected to weaken over time. Seeing more typical La Niña behavior this year than last. The odds of a wet spring are lower than normal

Colorado Climate Center

Thanks, and let's keep in touch!

Peter Goble – peter.goble@colostate.edu
Russ Schumacher – russ.Schumacher@colostate.edu
Becky Bolinger – becky.bolinger@colostate.edu
Zach Schwalbe – zach.Schwalbe@colostate.edu

Viewing this, and previous WATF Briefings:
http://climate.colostate.edu/ccc_archive.html

COLORADO CLIMATE CENTER

Colorado State University
Knowledge to Go Places