2023 WINTER MEETING

IDAHO/OREGON ALFALFA & CLOVER SEED GROWERS ASSOCIATION

TUESDAY, JANUARY 10 – CALDWELL ELKS LODGE – CALDWELL, ID

January 5 &10, 2023

2023 Water Year Outlook

This talk will be posted and for more information see https://snowweatherandflow.blog/

Ron Abramovich
Mostly Retired….

Topics:

- 2022 analog years, how they performed and usefulness to understand last year's spring weather and runoff.
- 2023 analog years based on current ocean / atmosphere conditions.
- And a few global events, volcanoes and Siberian snow cover, that are influencing this winter.

Hopefully, as we progress into the second half of winter, this information will provide some insight for your crop and water management decisions.

Background Information:
Three Primary Atmospheric Teleconnections or Drivers

ENSO – El Nino / La Nina – measure of sea surface temperatures
=> Cool temps mean La Nina conditions

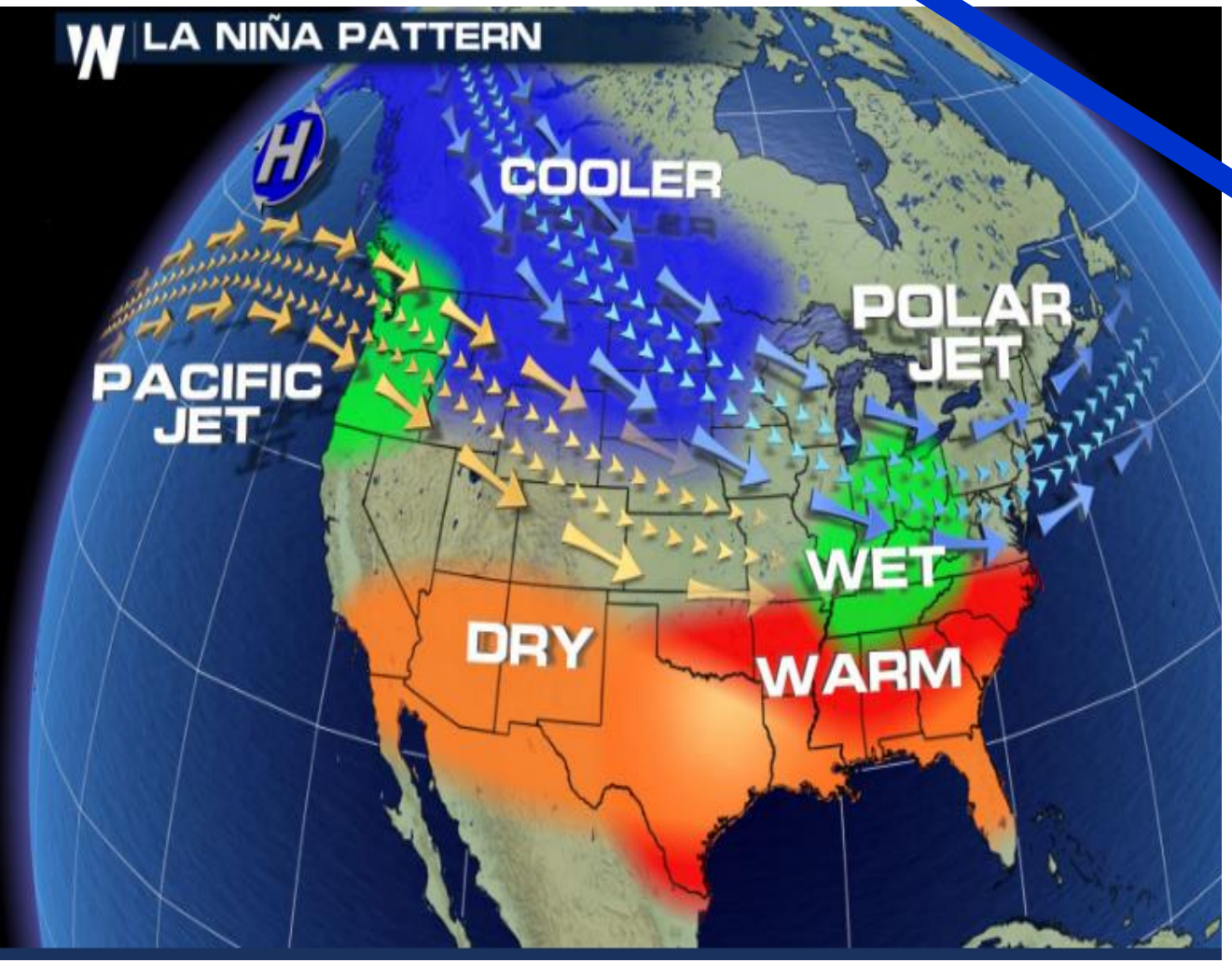
Southern Oscillation Index (SOI) - measure of the atmosphere
=> Cool temps mean La Nina conditions

Pacific Decadal Oscillation (PDO) – measure of north Pacific Ocean temps
=> Cool temps in north Pacific mean cool phase

Many researchers, like Pete Parsons, look at these climate teleconnections that correlate with snow, weather or flow to better understand what the future may bring.

Quick Review

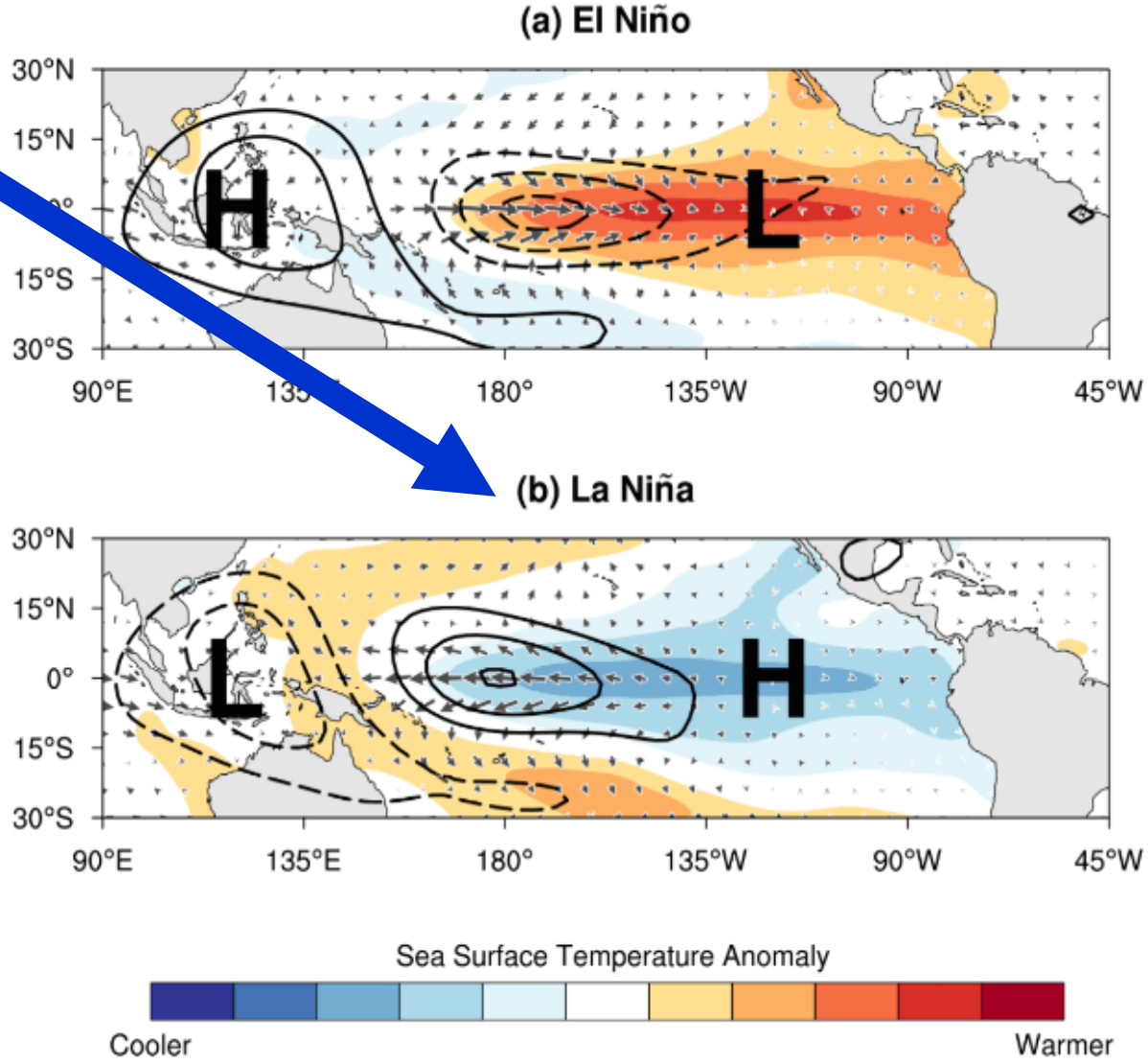
La Nina



El Nino / La Nina is a measure of sea surface temperatures along the equator.

Red – El Nino is warmer than normal

Blue - La Nina is colder than normal

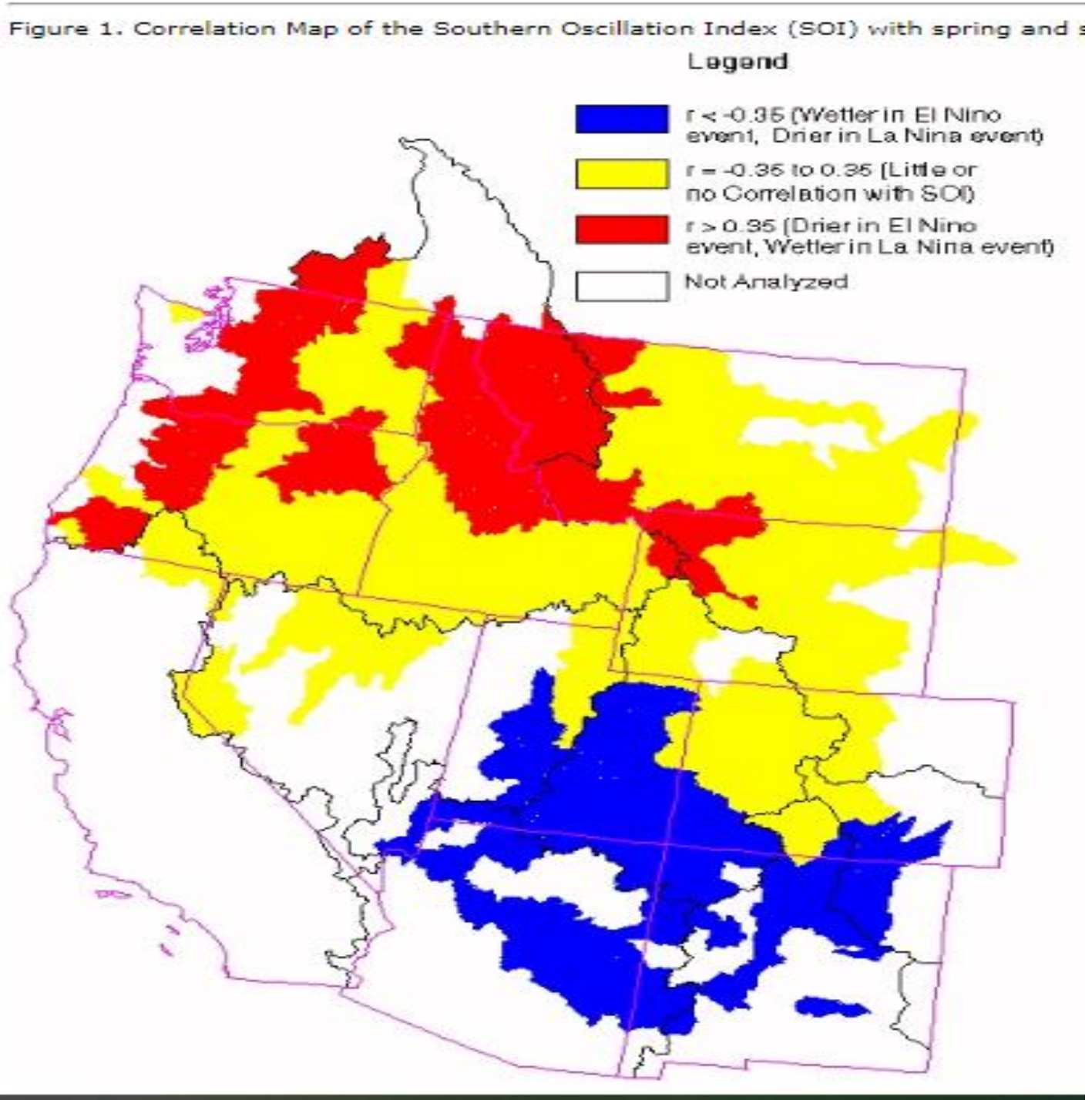


Southern Oscillation Index (SOI) measure of the Pacific Atmosphere

Correlation Map of with Spring-Summer Streamflow.

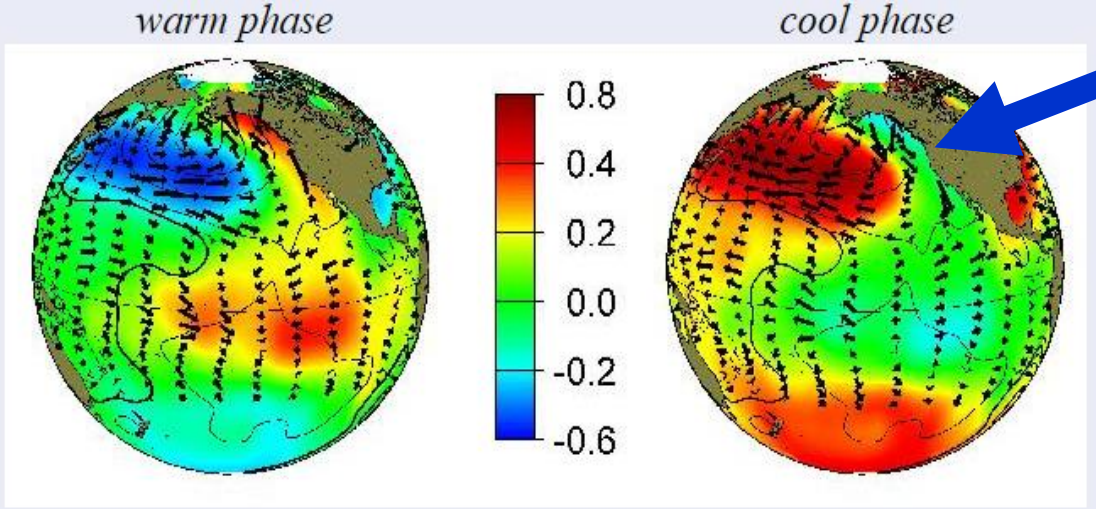
Red wetter in La Nina years.
Blue wetter in El Nino years.

Key is – what happens July-Nov in Pacific correlates with snowfall and summer streamflow in Western US.



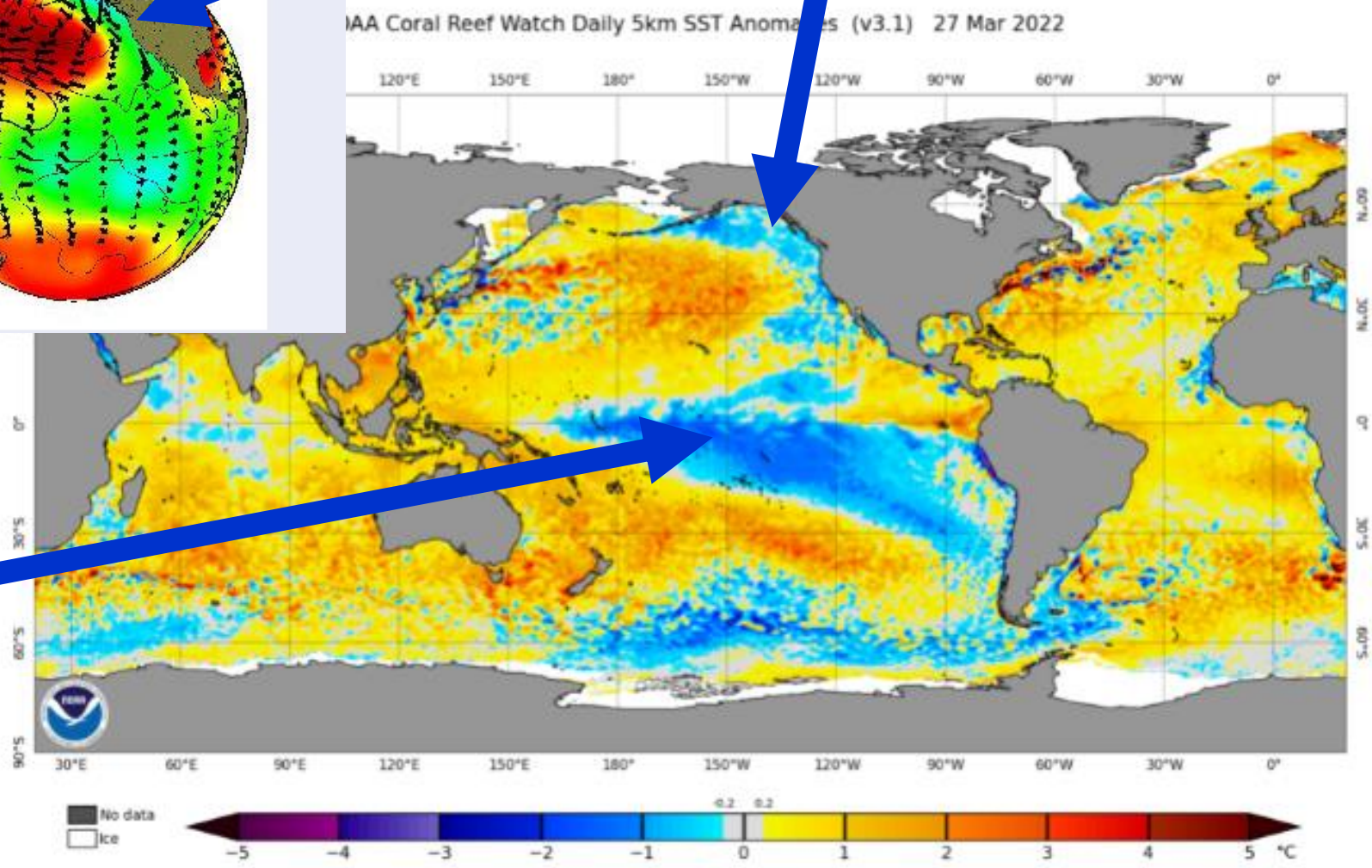
The Pacific Decadal Oscillation (PDO)

Typical wintertime Sea Surface Temperature (colors),
(contours) and surface windstress (arrows) anomaly patterns during warm and



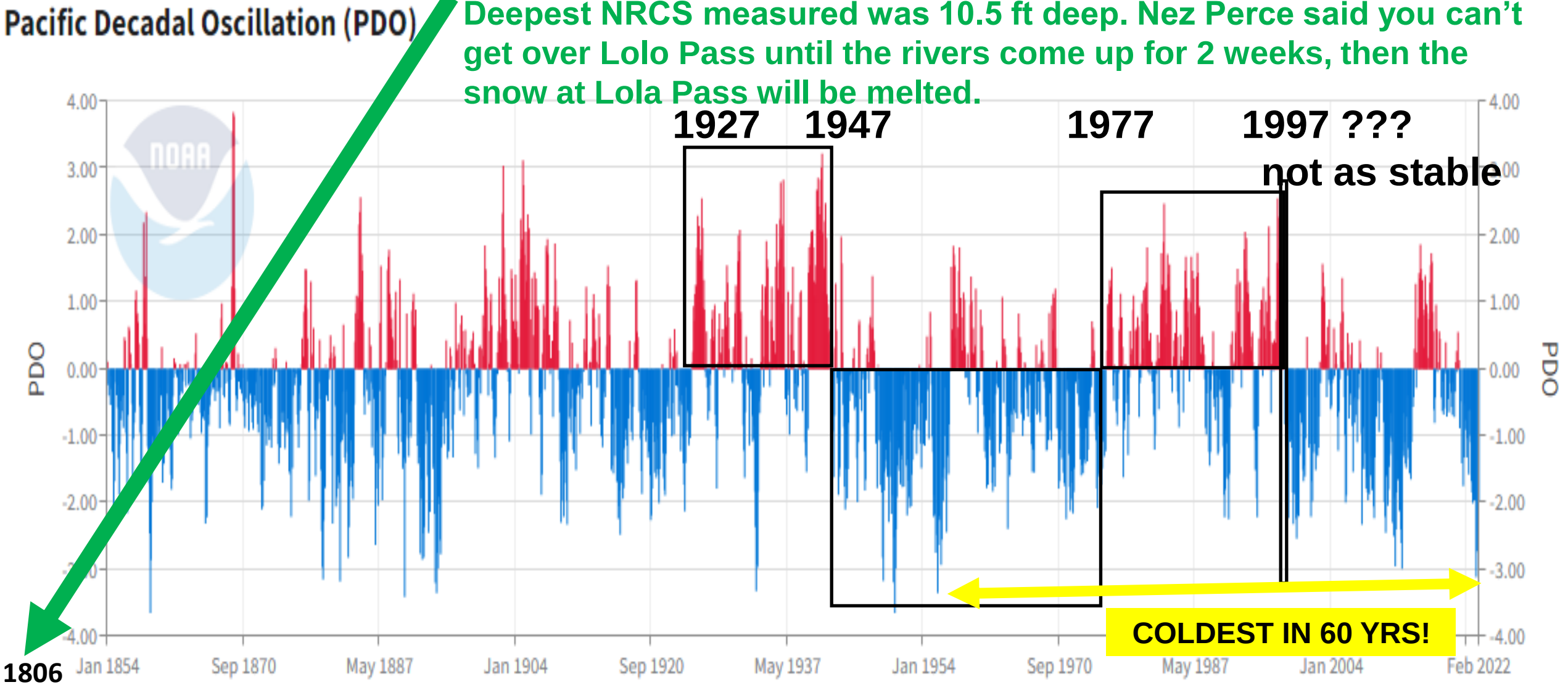
Winters 2022 & 2023 in Cool PDO phase Also Good for Salmon

La Nina sea surface temperatures



The Pacific Decadal Oscillation (PDO) is often described as a long-lived El Niño-like pattern of Pacific climate variability (Zhang et al. 1997).

Relationships have been around a long time….
June 1806 - Lewis & Clark found snow 18 ft deep on Lolo Pass. Deepest NRCS measured was 10.5 ft deep. Nez Perce said you can't get over Lolo Pass until the rivers come up for 2 weeks, then the snow at Lola Pass will be melted.



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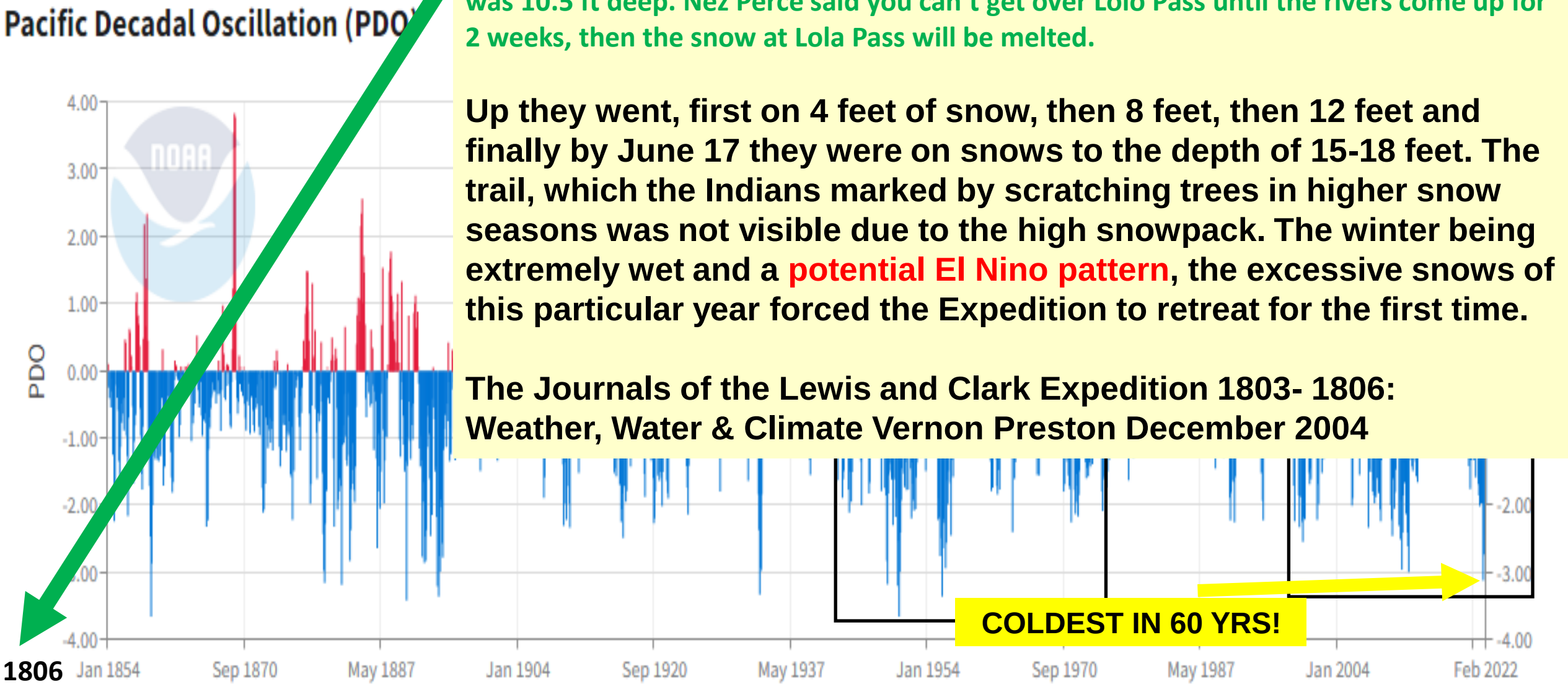
Up they went, first on 4 feet of snow, then 8 feet, then 12 feet and finally by June 17 they were on snows to the depth of 15-18 feet. The trail, which the Indians marked by scratching trees in higher snow seasons was not visible due to the high snowpack. The winter being extremely wet and a potential El Nino pattern, the excessive snows of this particular year forced the Expedition to retreat for the first time.

The Journals of the Lewis and Clark Expedition 1803- 1806: Weather, Water & Climate Vernon Preston December 2004



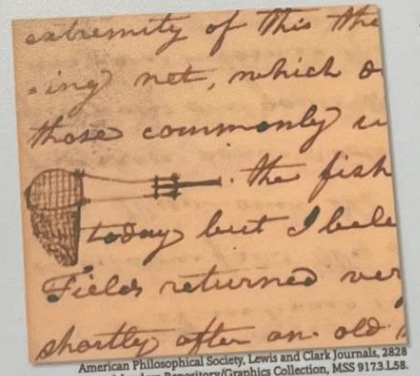
Snow Turns Them Back

In May 1806, Lewis and Clark returned to Idaho heading home. Deep snow prevented them from crossing the Bitterroot Mountains. They established Long Camp and stayed 26 days at present-day Kamiah.

On June 15, they attempted to cross Idaho's mountains, but steep, snow-covered slopes turned them back. They set out again on June 24 with the help of Nez Perce guides. This time they crossed successfully.

The Corps of Discovery left its mark on Idaho history. Idaho's landscape also left lasting impressions on expedition members.

© Michael Durham.



American Philosophical Society, Lewis and Clark Journals, 2828
Islandora Repository/Graphics Collection, MSS 917.3.L58.

Above: Weippe Prairie was in full camas bloom when the expedition returned in June 1806.

Left: While at Long Camp waiting for mountain snow to clear, Lewis and Clark recorded Nez Perce lifeways, including the fishing nets they used on the Clearwater River.

From display at Idaho Historical Museum.

From ODA/F Meteorologist
Pete Parsons Feb 18 2021

Jan Curtis retired USDA Climatologist provided input for Pete's analysis

Forecast Highlights

- This is the first La Niña since the 2017-18 winter. It follows on the heels of back-to-back weak El Niño winters (2018-19 & 2019-20).

- **Analog years are 1971, 1996, & 2008.**

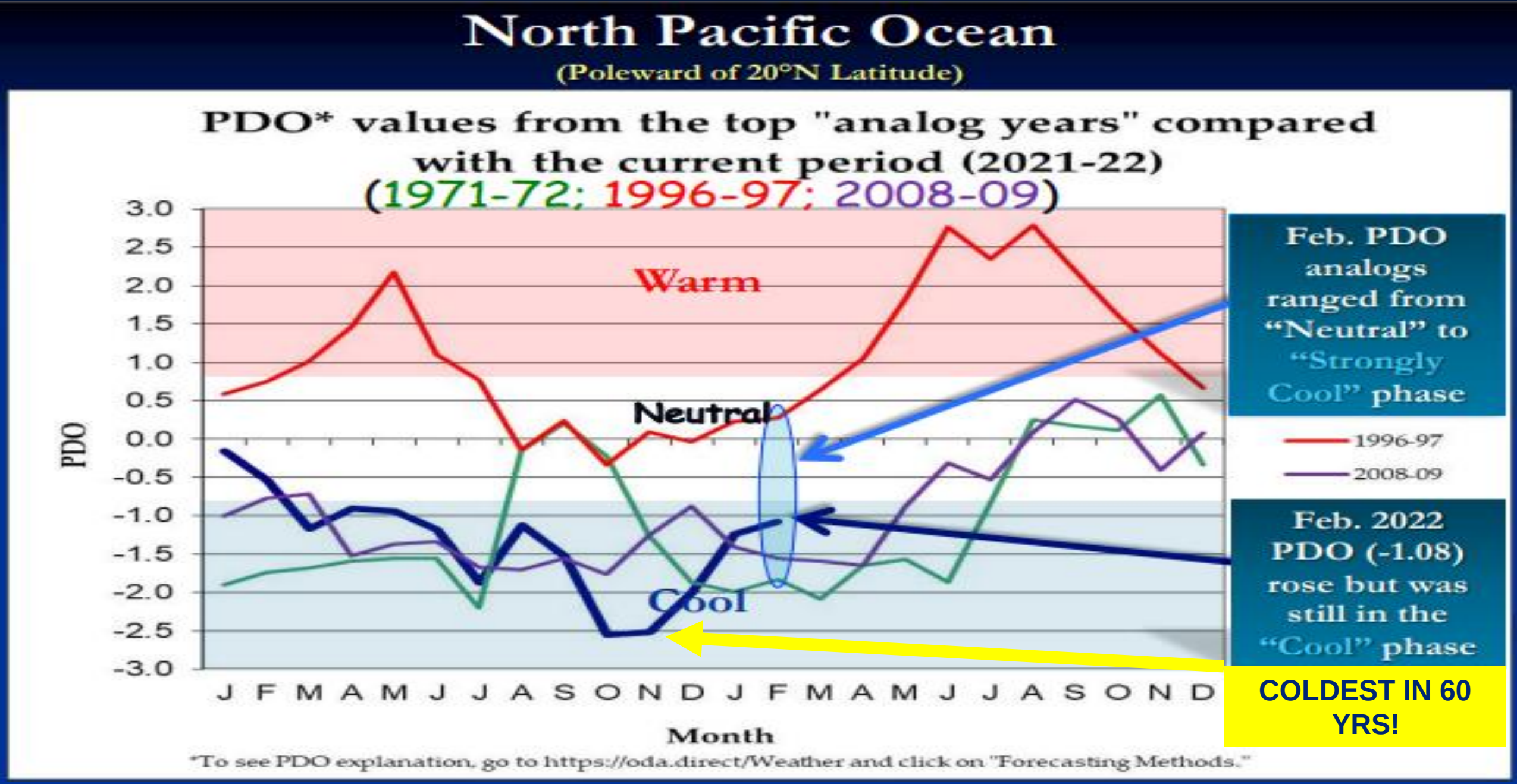
Seasonal Climate Forecast
April – June 2022
Issued: March 18, 2022

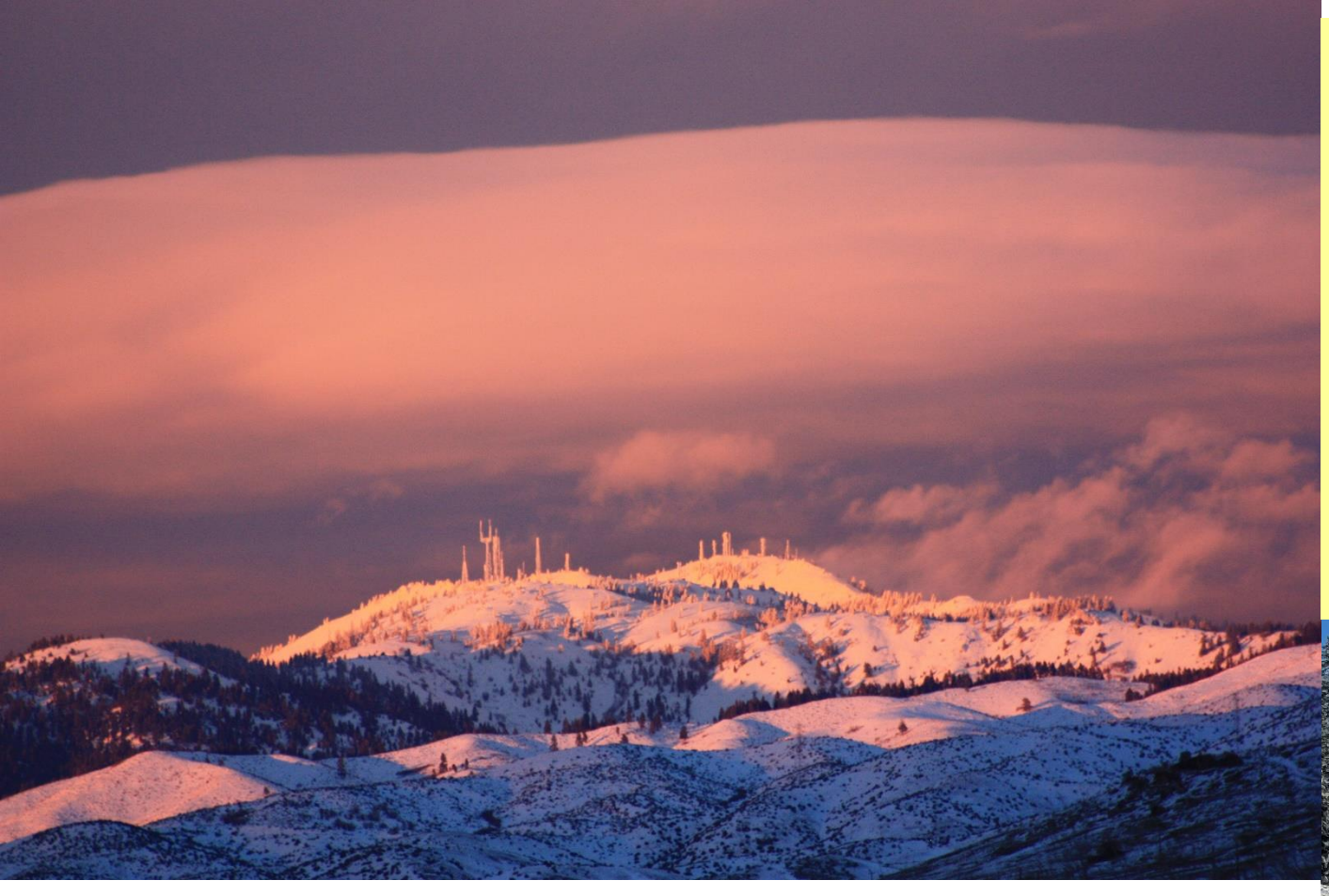
March 2022
back-to-back La Nina years

Forecast Highlights

- **The top 3 analog years (1972, 1997, & 2009)** were retained. They have had a remarkable run (since last summer).

Feb 2022 Pacific Decadal Oscillation – measure of North Pacific Temps



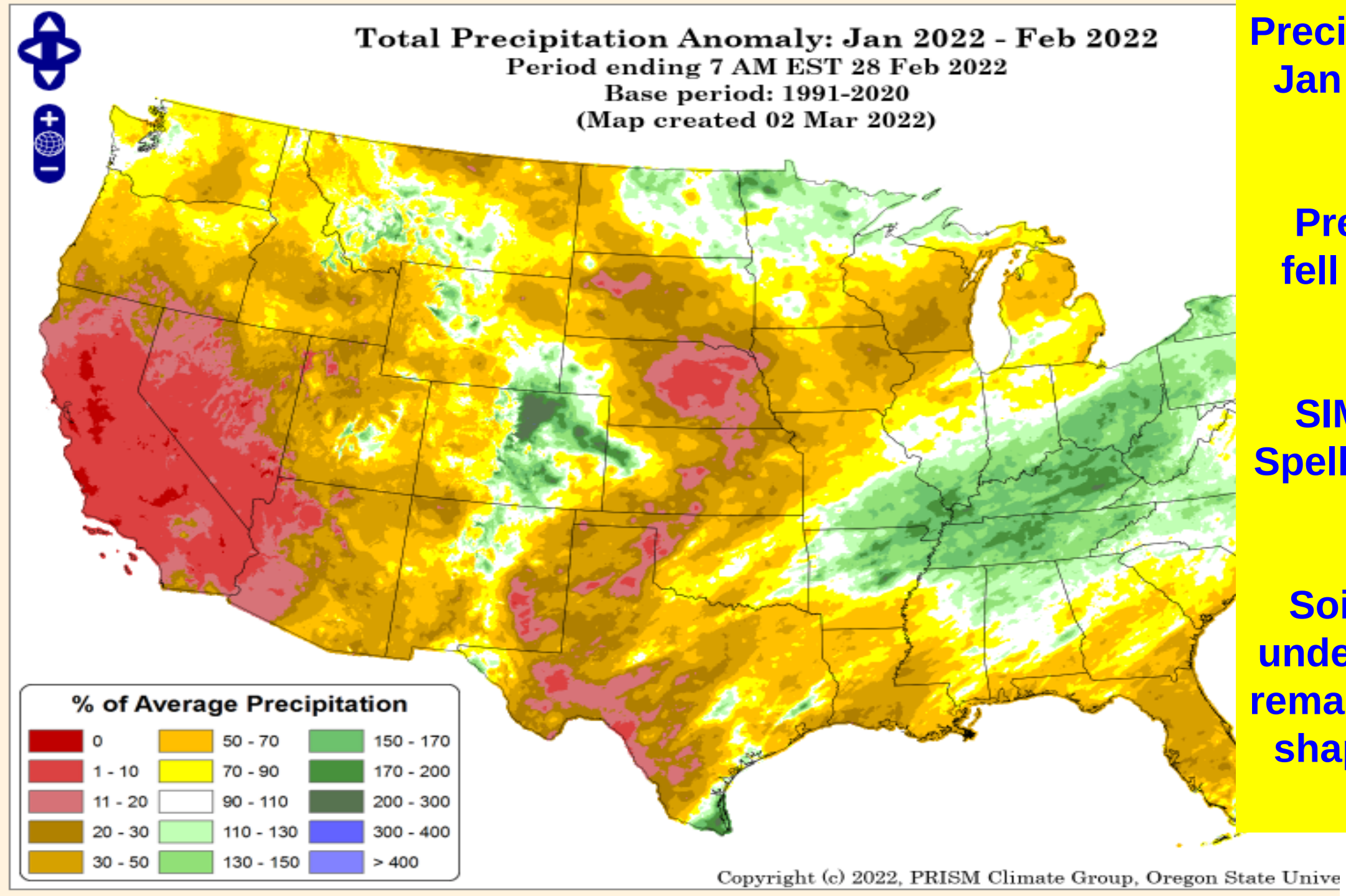


Let's talk about LAST winter and when storms stopped arriving.

Jan 6 2022 Sunset after the storms

←

Mores Creek Summit after Highway 21 reopened Jan 8, 2022.

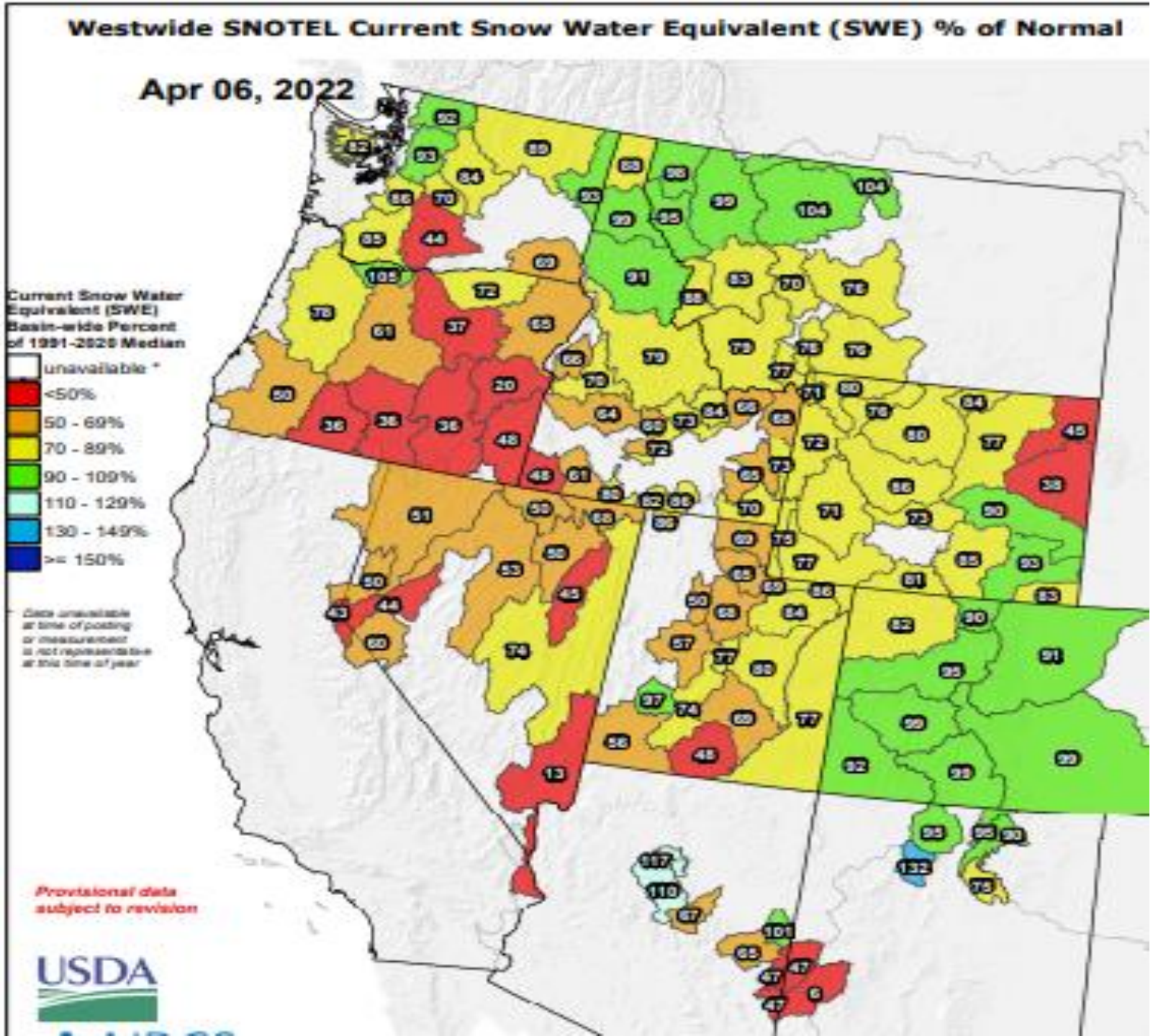


Precipitation Map Jan – Feb 2022

Little Precipitation fell after Jan 8

SIMILAR Dry Spell occurred in 2009

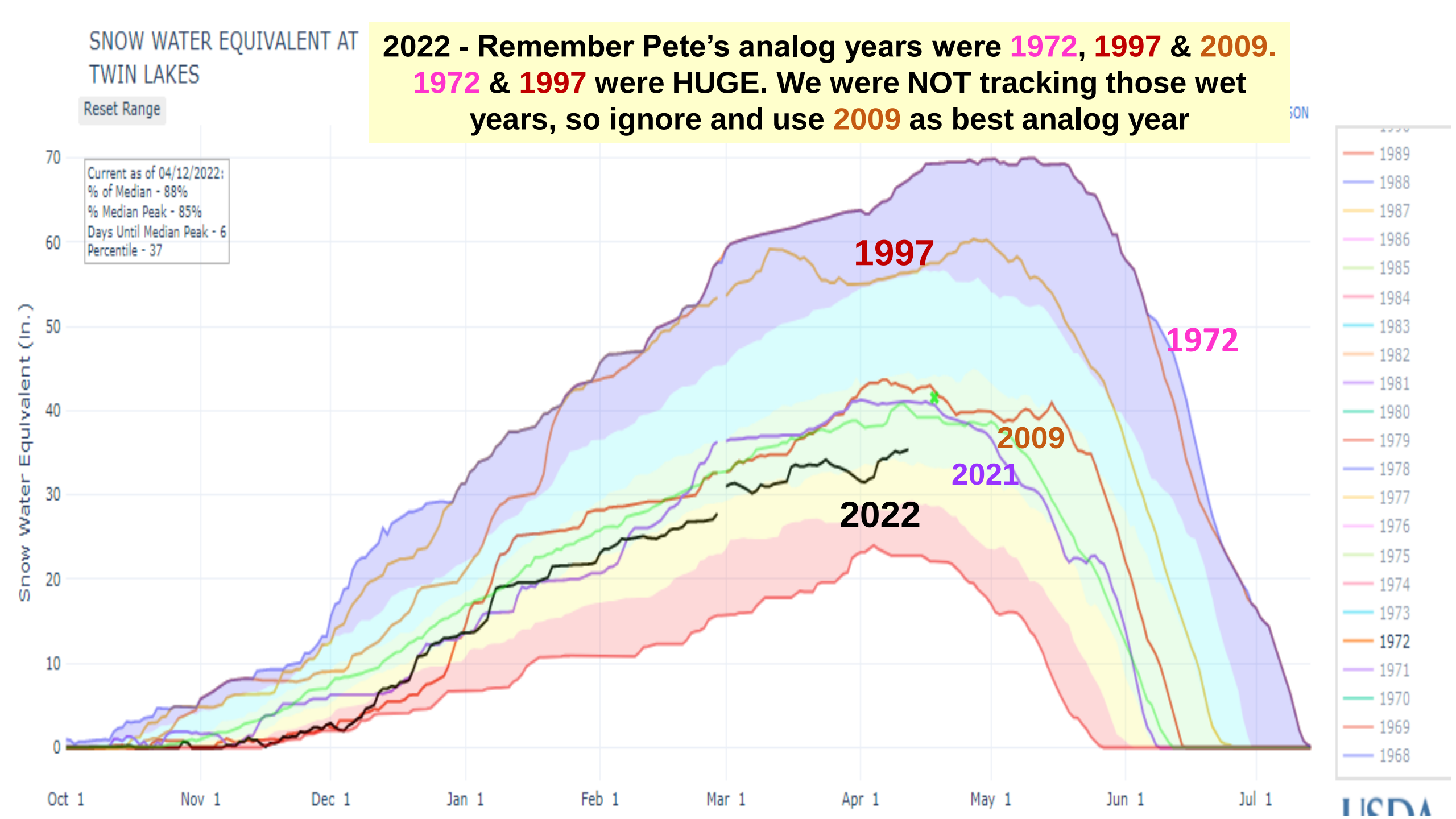
Soil moisture under snowpack remained in good shape from fall rains

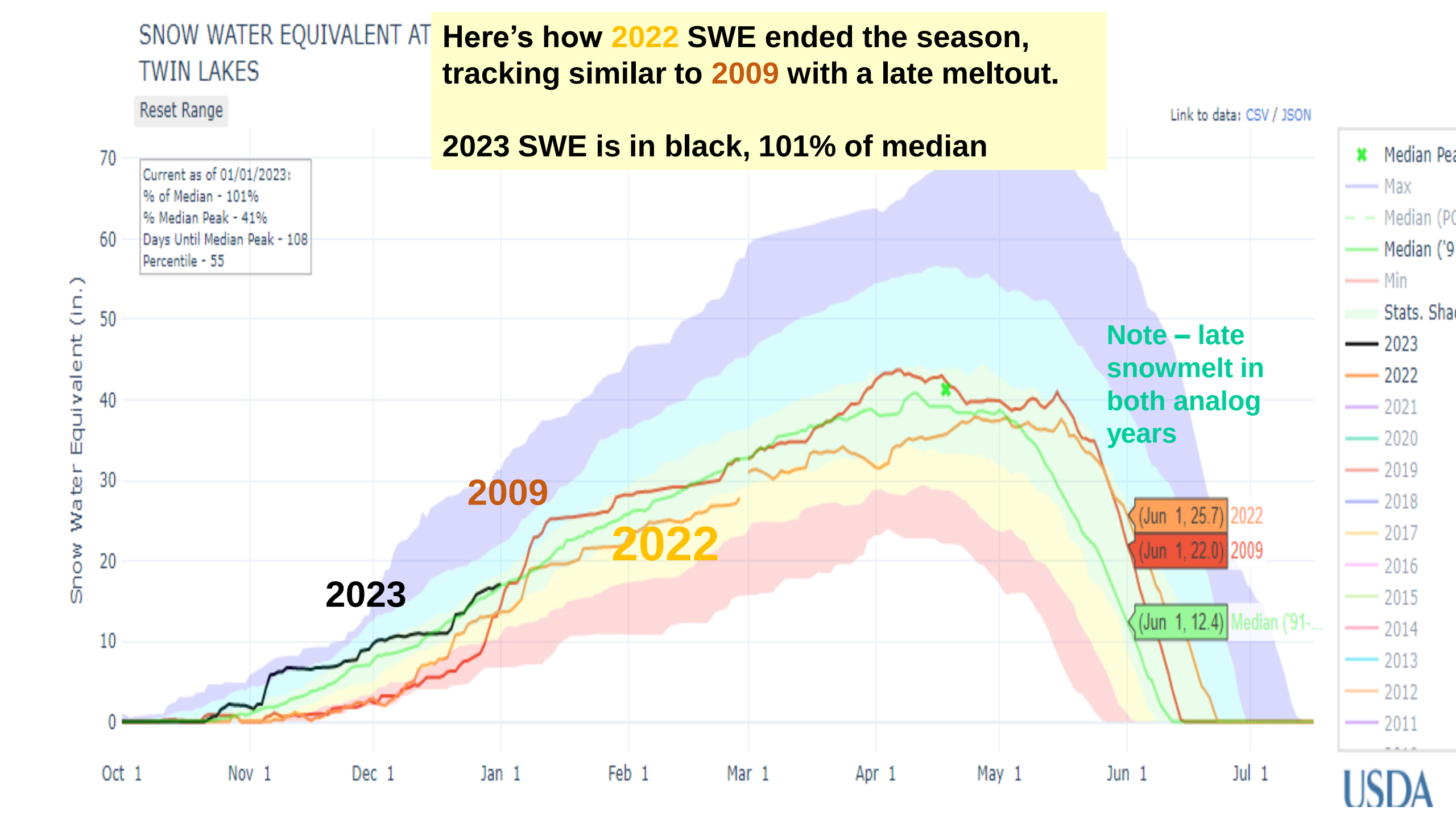


Westwide Snow map

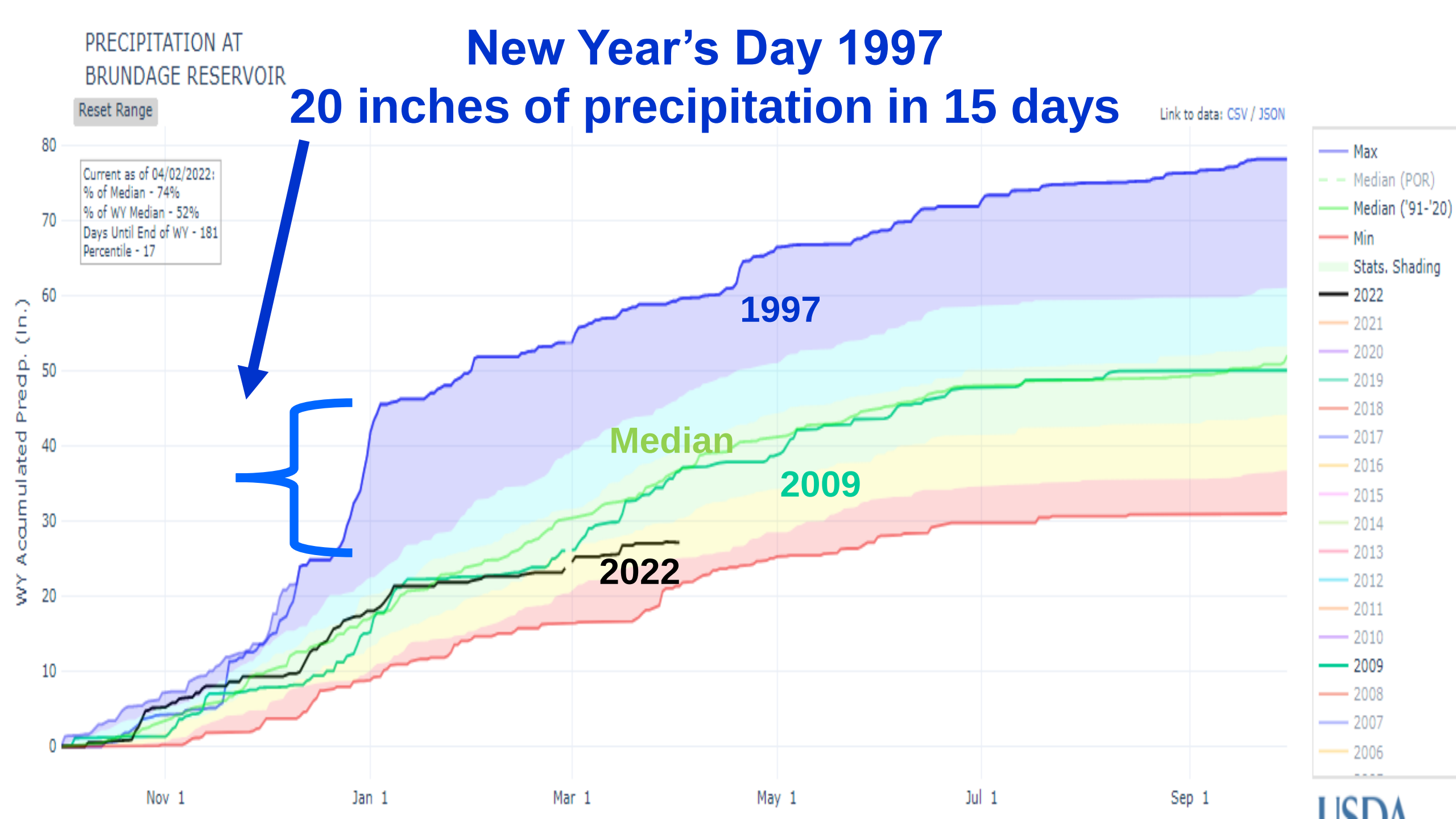
Apr 6, 2022

Percentages were higher in mid-March before the warm spell

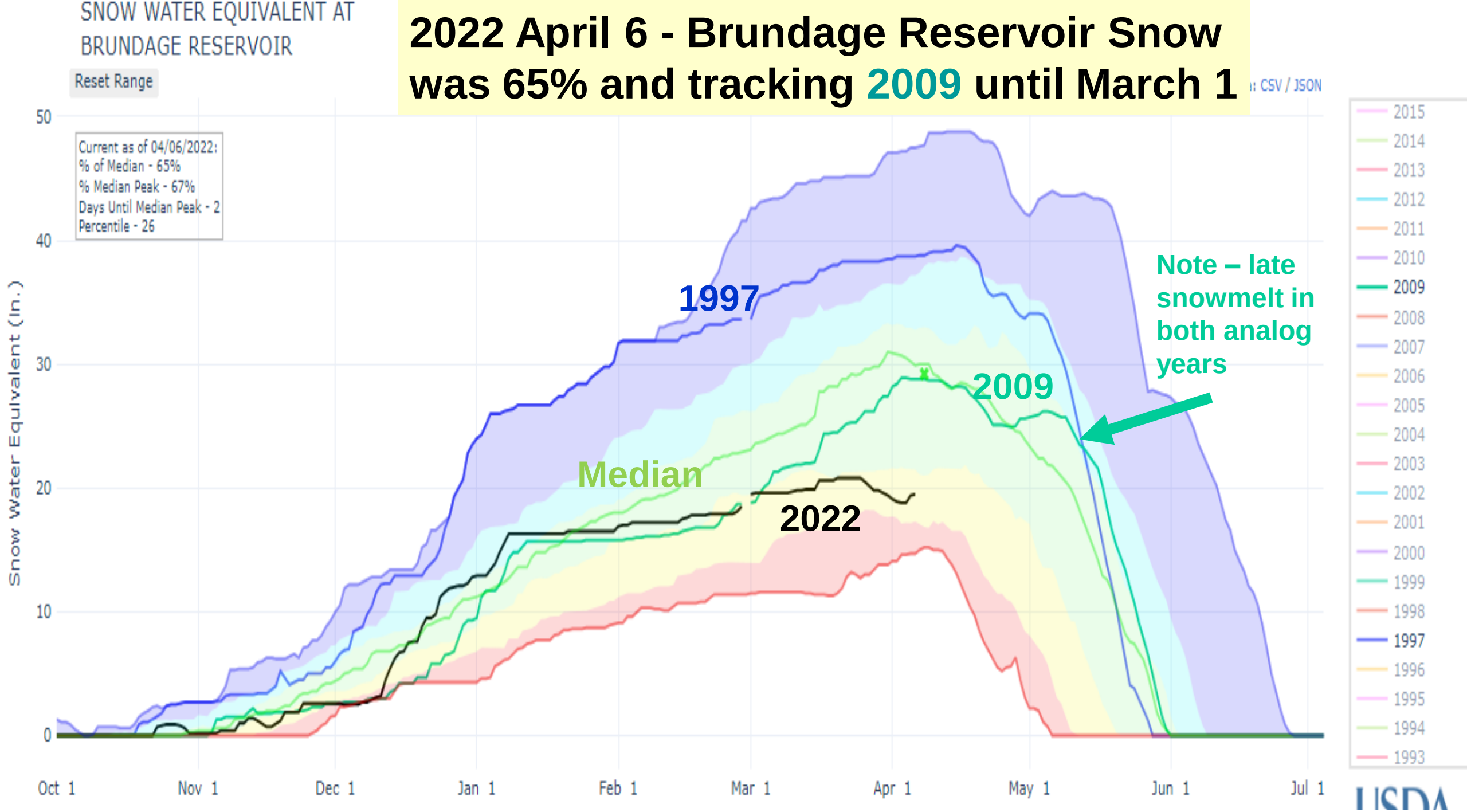

SNOW WATER EQUIVALENT AT TWIN LAKES
Reset Range
2022 - Remember Pete's analog years were 1972, 1997 & 2009. 1972 & 1997 were HUGE. We were NOT tracking those wet years, so ignore and use 2009 as best analog year
Current as of 04/12/2022:
% of Median - 88%
% Median Peak - 85%
Days Until Median Peak - 6
Percentile - 37
Snow Water Equivalent (In.)
70
60
50
40
30
20
10
0
1997
1972
2009
2021
2022
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
1989
1988
1987
1986
1985
1984
1983
1982
1981
1980
1979
1978
1977
1976
1975
1974
1973
1972
1971
1970
1969
1968

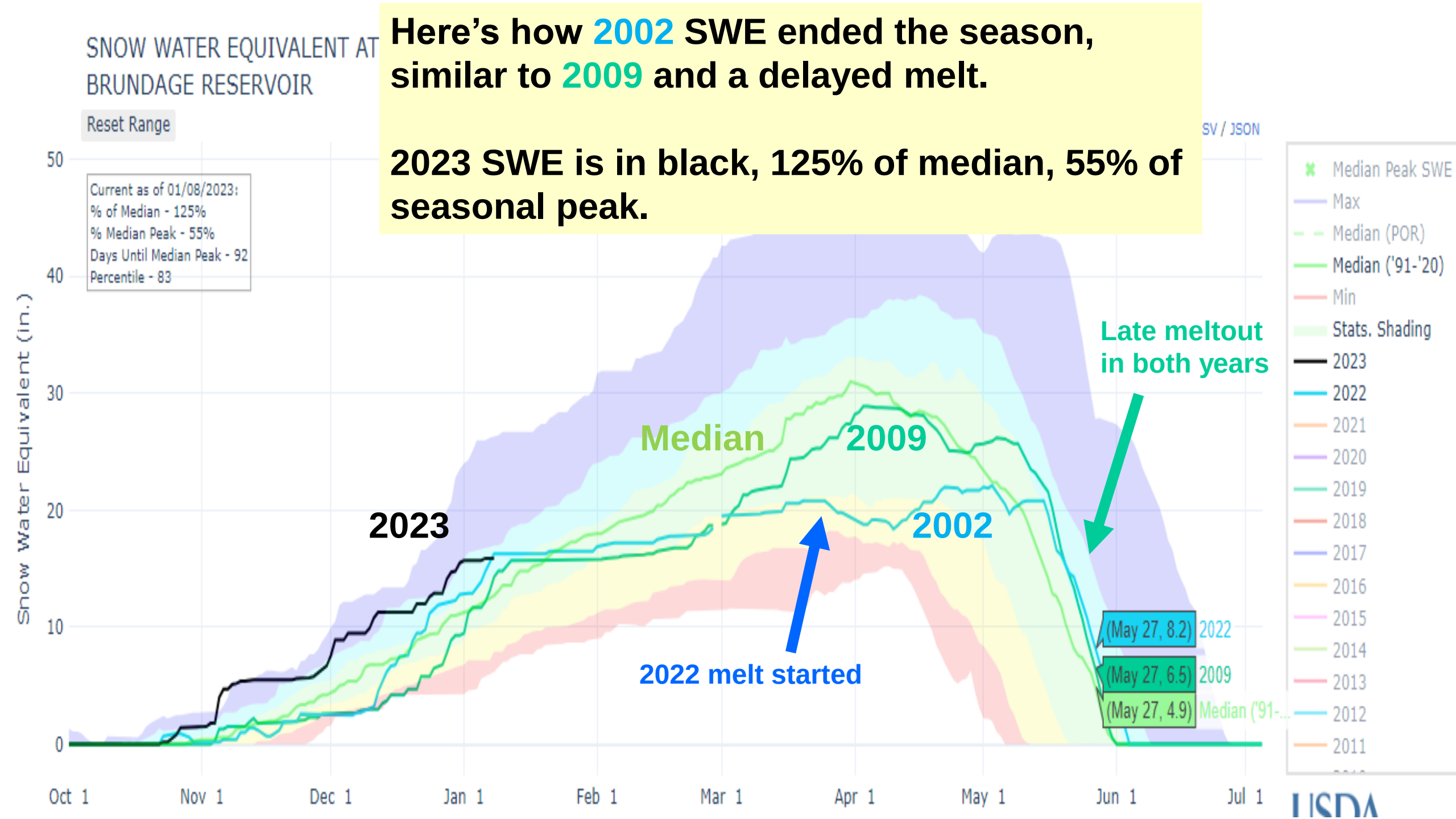

SNOW WATER EQUIVALENT AT TWIN LAKES
Here's how 2022 SWE ended the season, tracking similar to 2009 with a late meltout.
2023 SWE is in black, 101% of median
Reset Range
Link to data: CSV / JSON
Current as of 01/01/2023:
% of Median - 101%
% Median Peak - 41%
Days Until Median Peak - 108
Percentile - 55
Snow Water Equivalent (in.)
70
60
50
40
30
20
10
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
2009
2022
2023
Note – late snowmelt in both analog years
(Jun 1, 25.7) 2022
(Jun 1, 22.0) 2009
(Jun 1, 12.4) Median ('91-...
Median Pea
Max
Median (PC
Median ('9
Min
Stats. Shad
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
USDA

New Year's Day 1997
20 inches of precipitation in 15 days



2022 April 6 - Brundage Reservoir Snow was 65% and tracking 2009 until March 1




Here's how 2002 SWE ended the season, similar to 2009 and a delayed melt.
2023 SWE is in black, 125% of median, 55% of seasonal peak.
SNOW WATER EQUIVALENT AT BRUNDAGE RESERVOIR
Reset Range
SV / JSON
Current as of 01/08/2023:
% of Median - 125%
% Median Peak - 55%
Days Until Median Peak - 92
Percentile - 83
Snow Water Equivalent (in.)
50
40
30
20
10
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Median
2009
2002
2023
Late meltout in both years
2022 melt started
(May 27, 8.2) 2022
(May 27, 6.5) 2009
(May 27, 4.9) Median ('91-...
Median Peak SWE
Max
Median (POR)
Median ('91-'20)
Min
Stats. Shading
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
USDA

Climate crisis

Heatwaves at both of Earth's poles alarm climate scientists

Antarctic areas reach 40C above normal at same time as north pole regions hit 30C above usual levels

Fiona Harvey *Environment correspondent*

Sun 20 Mar 2022 10.48 EDT

Startling heatwaves at both of Earth's poles are causing alarm among climate scientists, who have warned the "unprecedented" events could signal faster and abrupt climate breakdown.

Challenges to predicting the weather
Mar 20, 2022

Severe World Weather

2h ·

The latest data shows that the North Atlantic Gulf Stream continues to weaken, as freshwater from the melting Greenland ice and Arctic sea ice is creating a growing imbalance in the Ocean Circulation.

Forecast from March 10, 2022 - by Cliff Mass Weather Blog

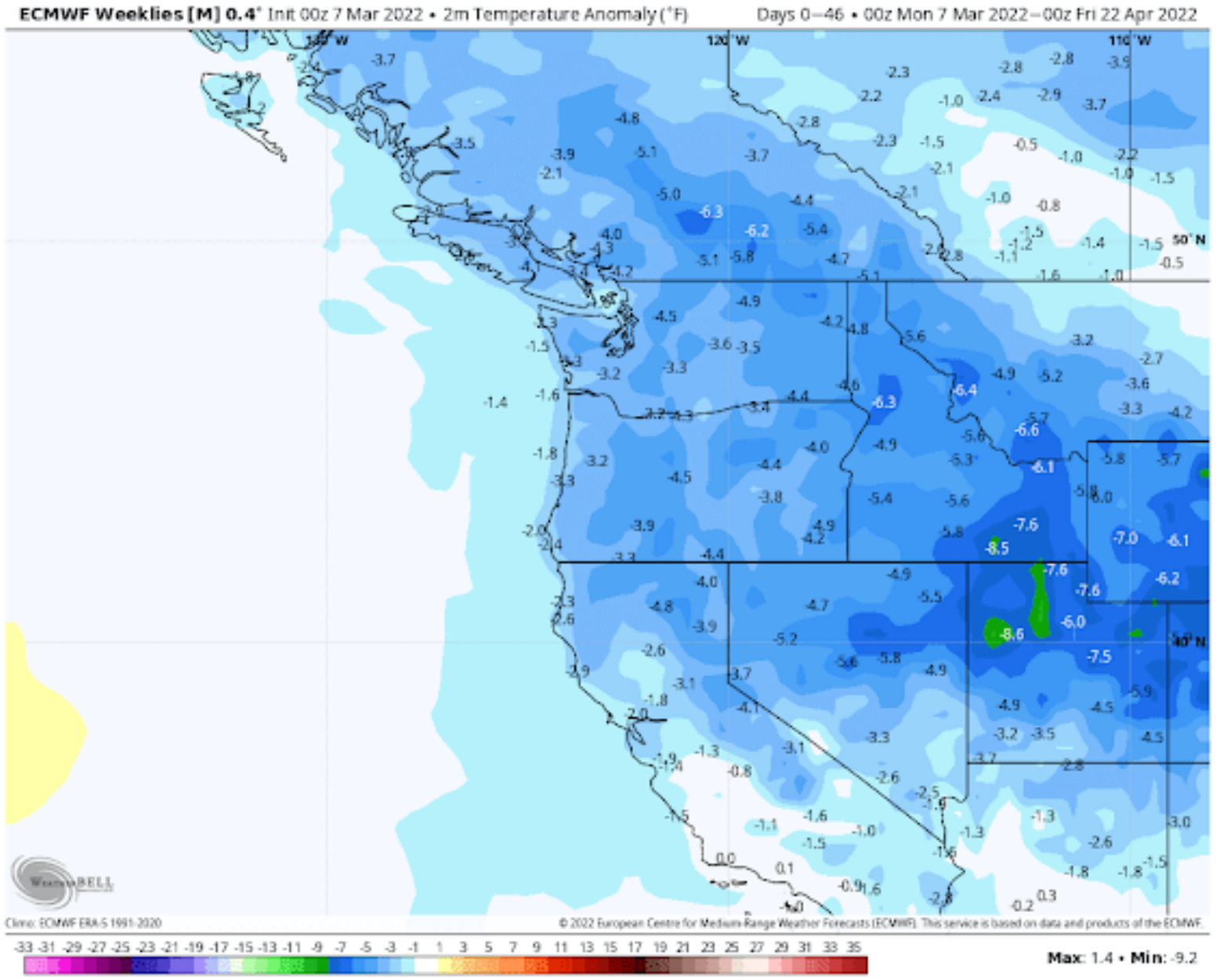
Nearly all forecast models are showing this for the next month or so. **A cool, wet spring.**

My favorite extended-period forecast model is run by the European Center and **shows its long-term (46-day) forecast below (through April 22).**

The temperature forecast difference from normal calls for colder temperatures than typical across the entire region. **(blue indicates cooler than normal temps)**

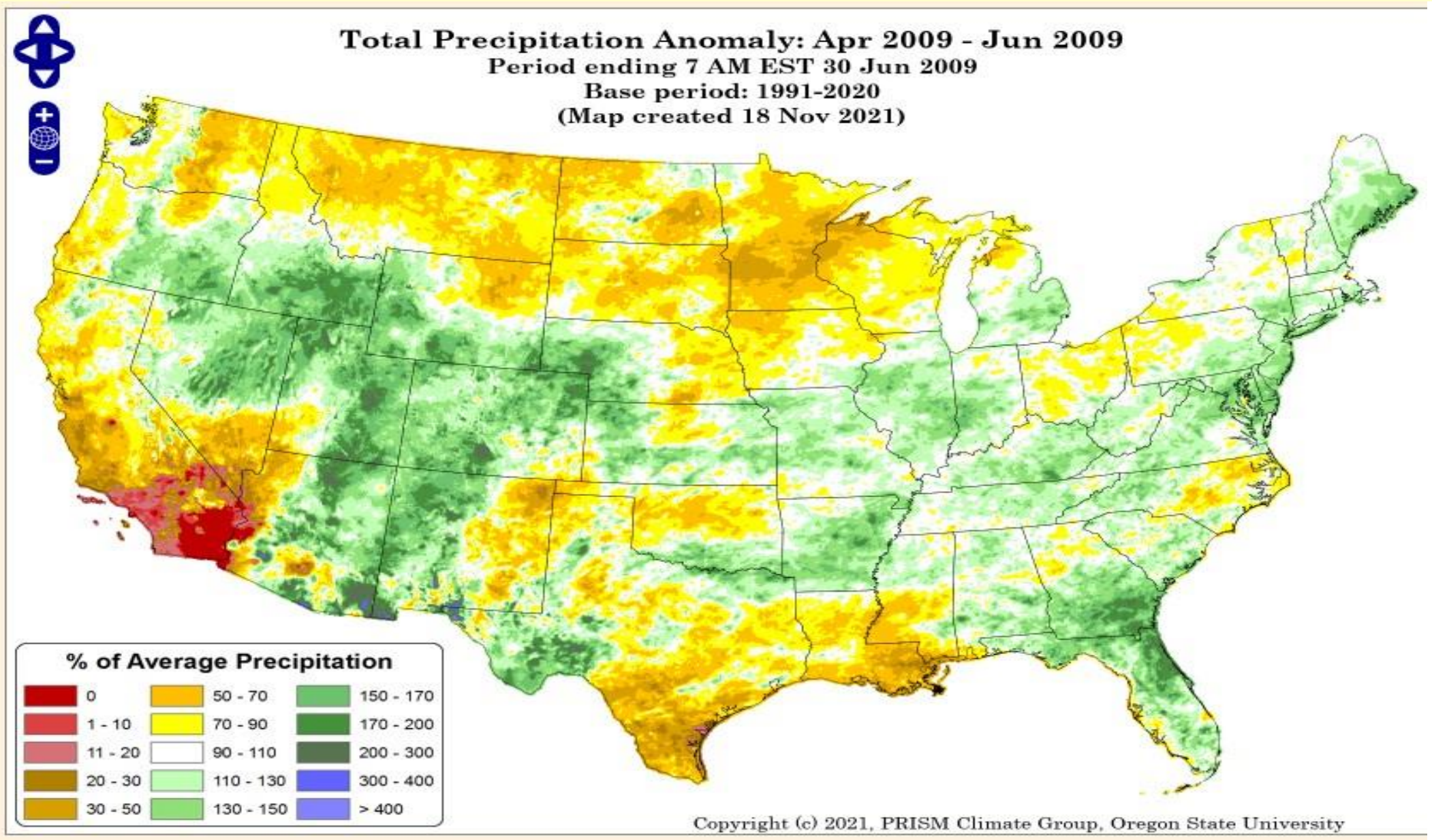
Precipitation for the same period?

Above normal precipitation in PNW.



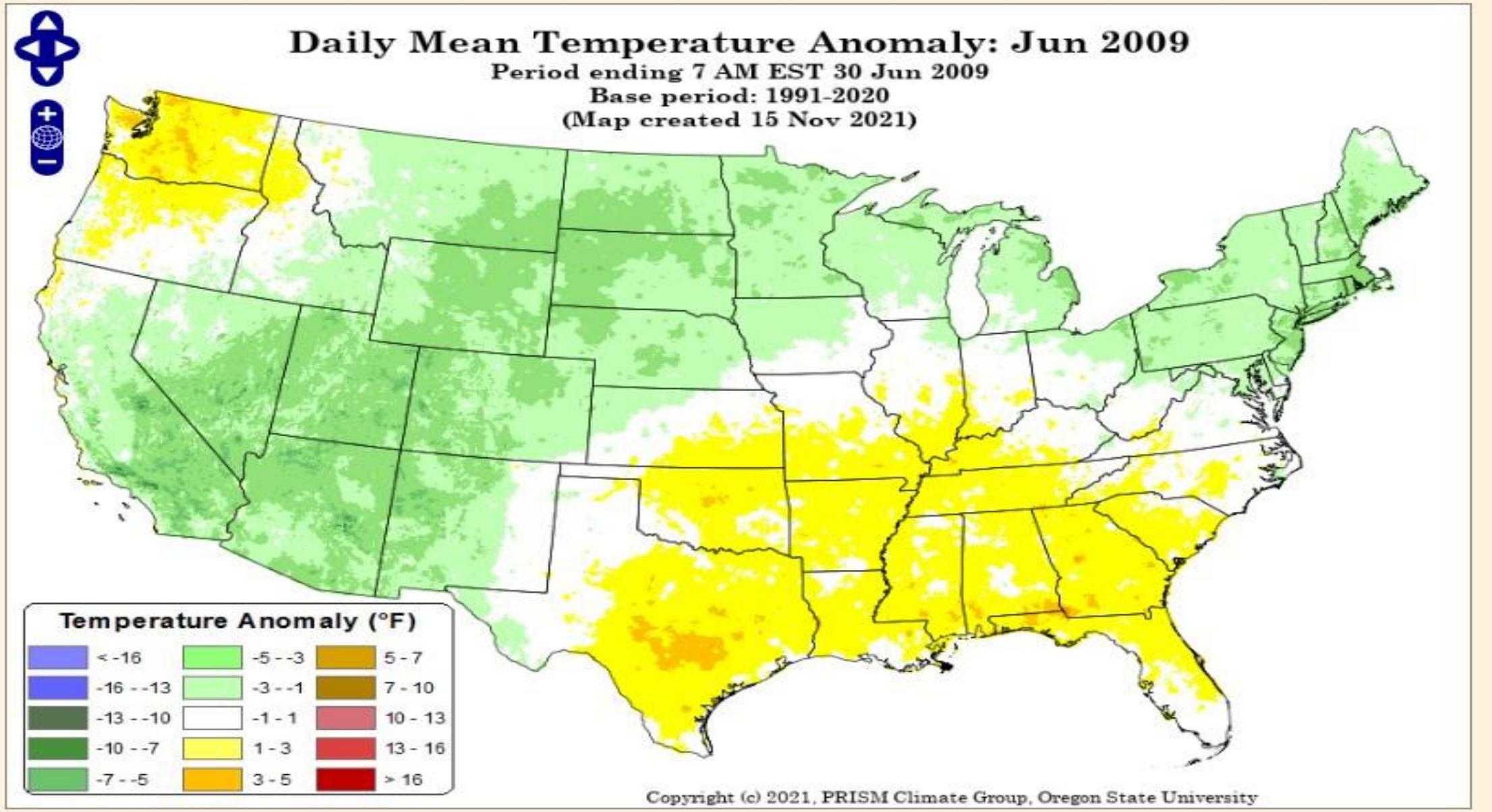
Memories of 2009: Apr-Jun Precipitation - Boise River flooding in June

This changed the water supply & water calls being made.

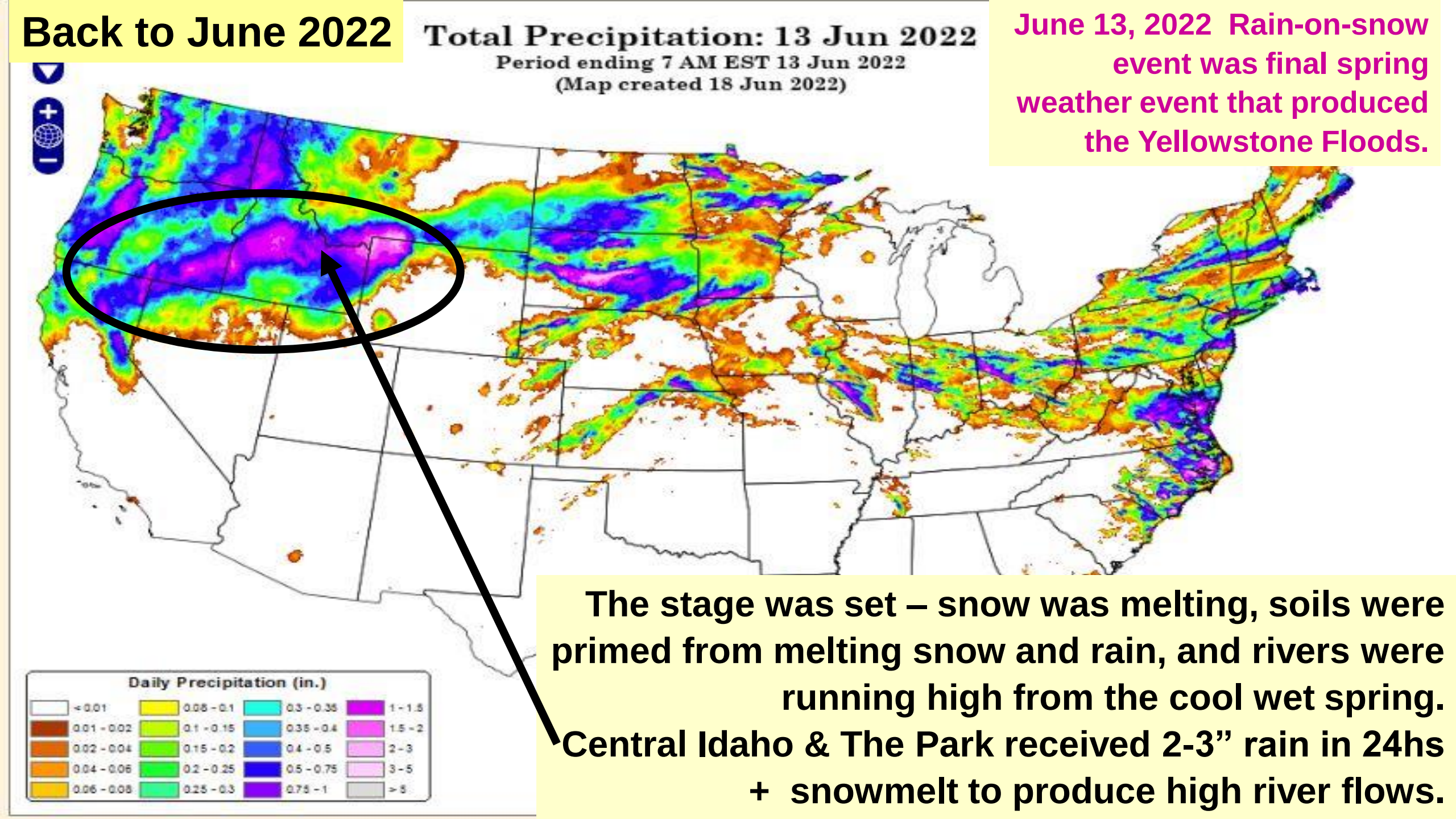


Plus below normal June 2009 Temperatures Cold is good !

Delayed snowmelt made the rivers pop and allowed reservoirs to fill !



Back to June 2022



June 13, 2022 Rain-on-snow event was final spring weather event that produced the Yellowstone Floods.

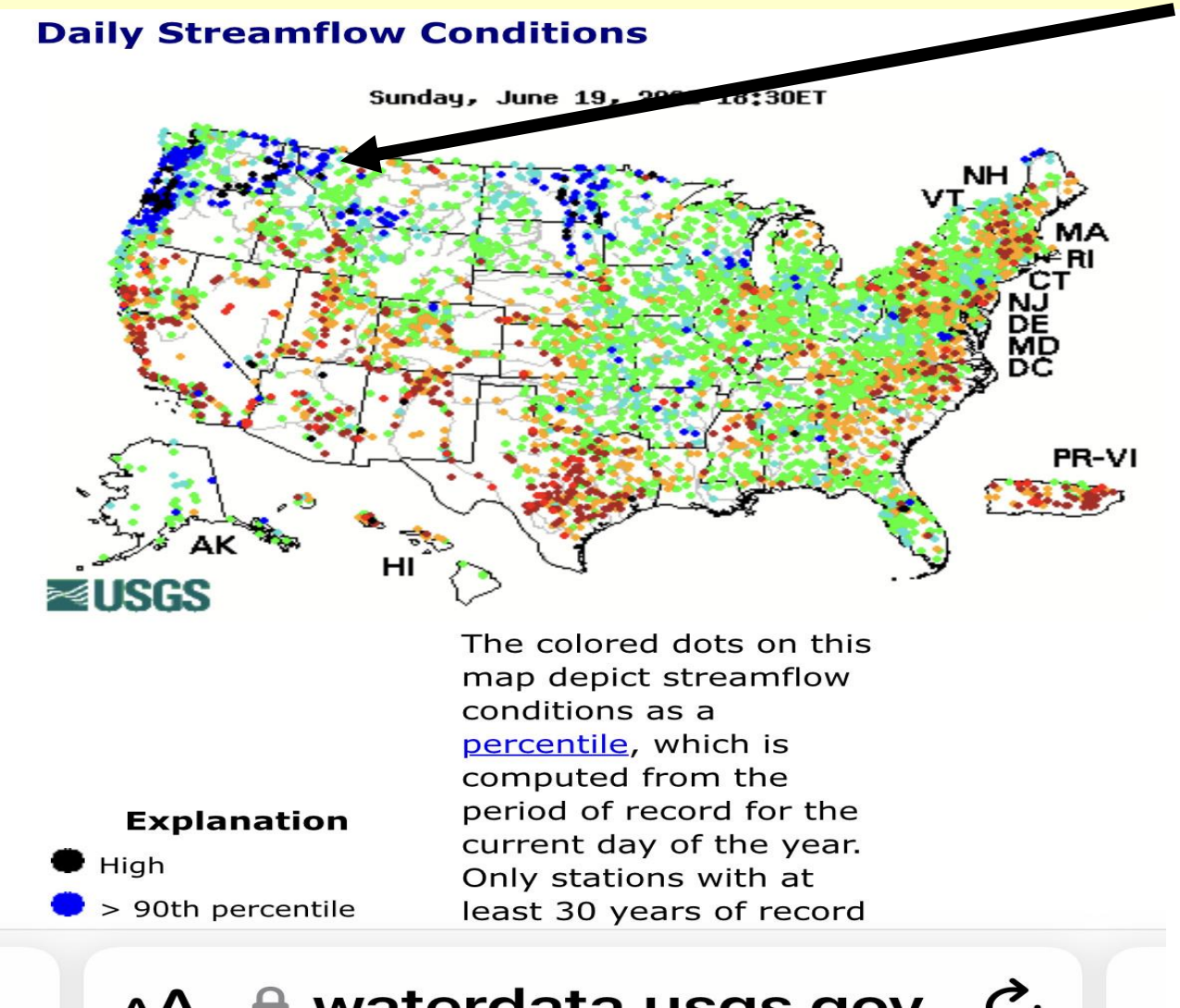
The stage was set – snow was melting, soils were primed from melting snow and rain, and rivers were running high from the cool wet spring.

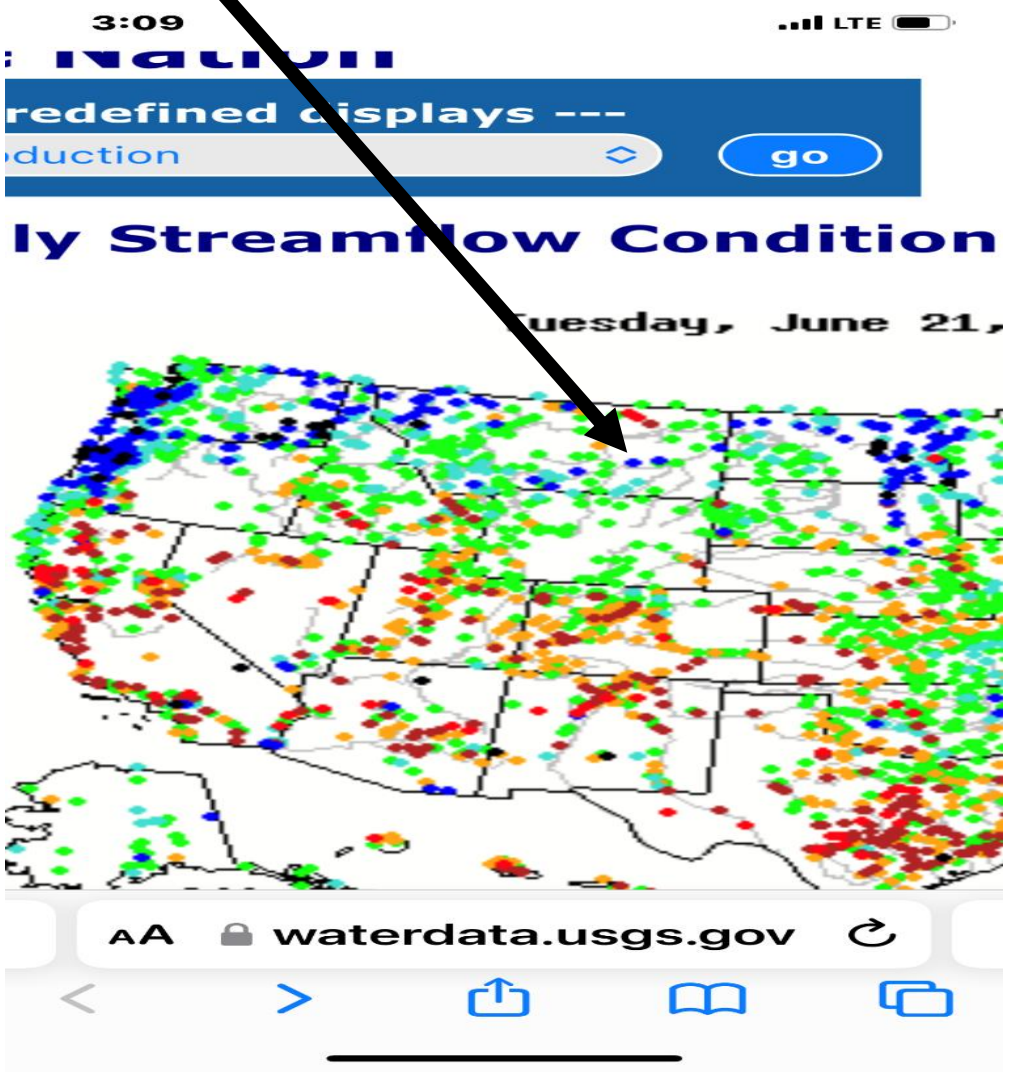
Central Idaho & The Park received 2-3” rain in 24hs + snowmelt to produce high river flows.

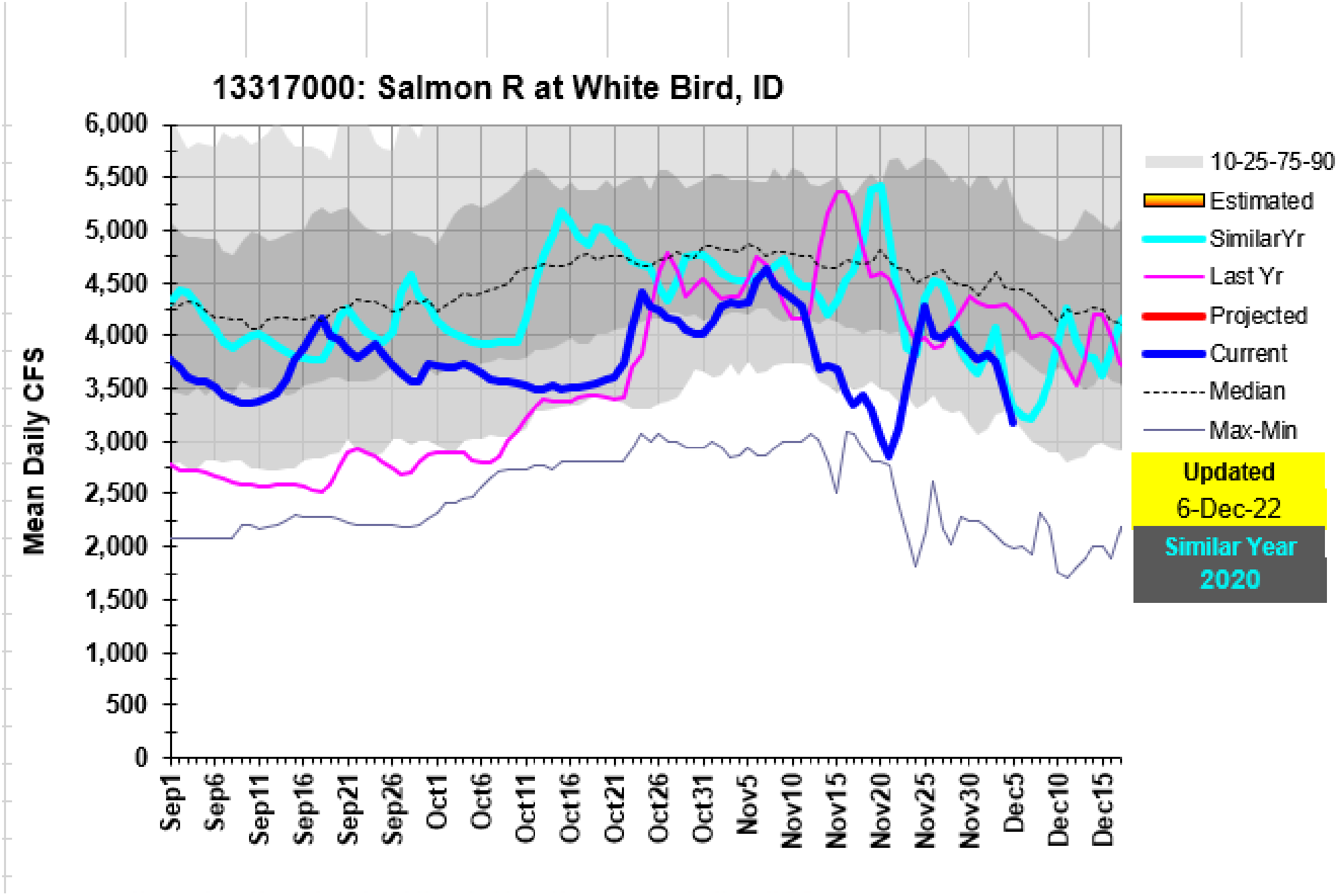
June 2022 Yellowstone Floods **One creek flows into and another, and another...**

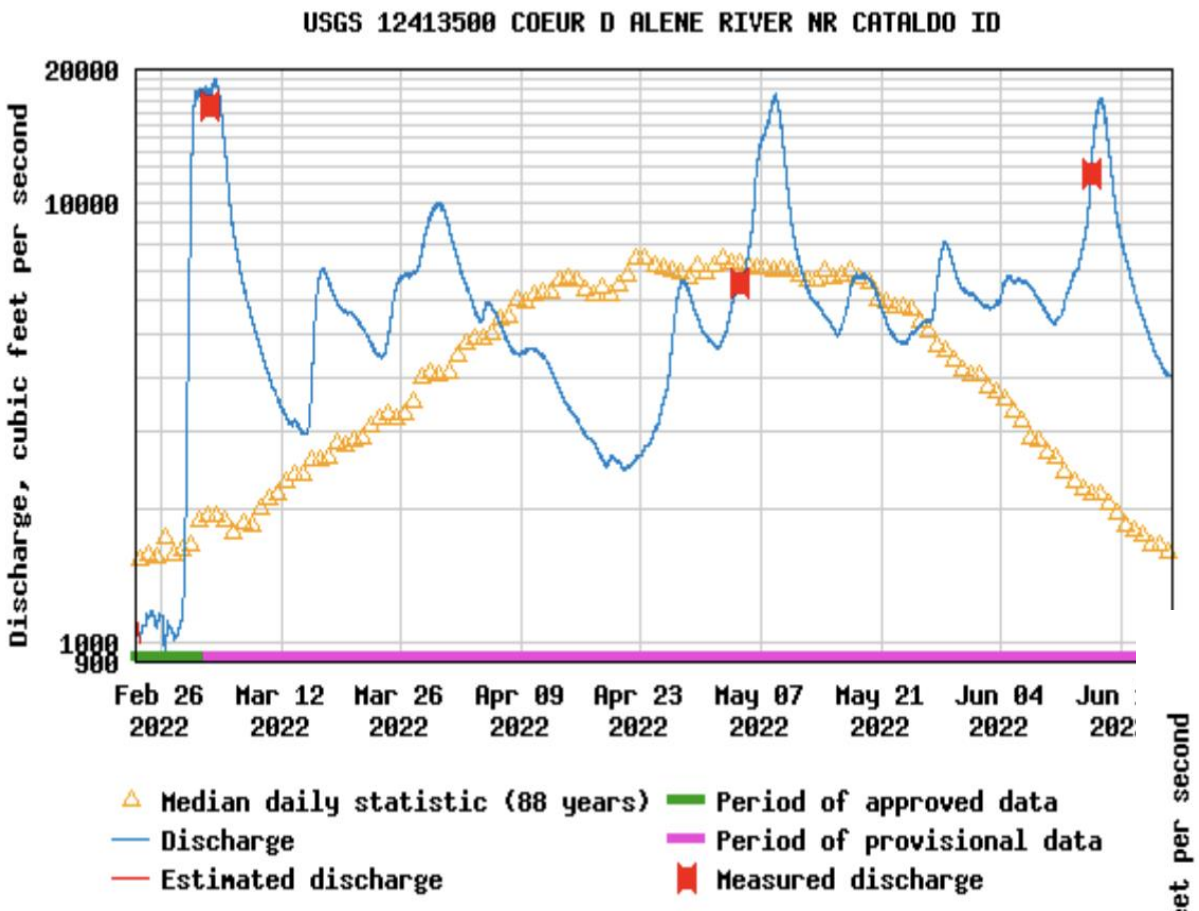
What Happens on the Continental Divide in Yellowstone National Park, DOES NOT stay there.

After the rain-on-snow runoff event, you could follow the runoff wave down both sides of Continental Divide to the Pacific and Atlantic oceans.



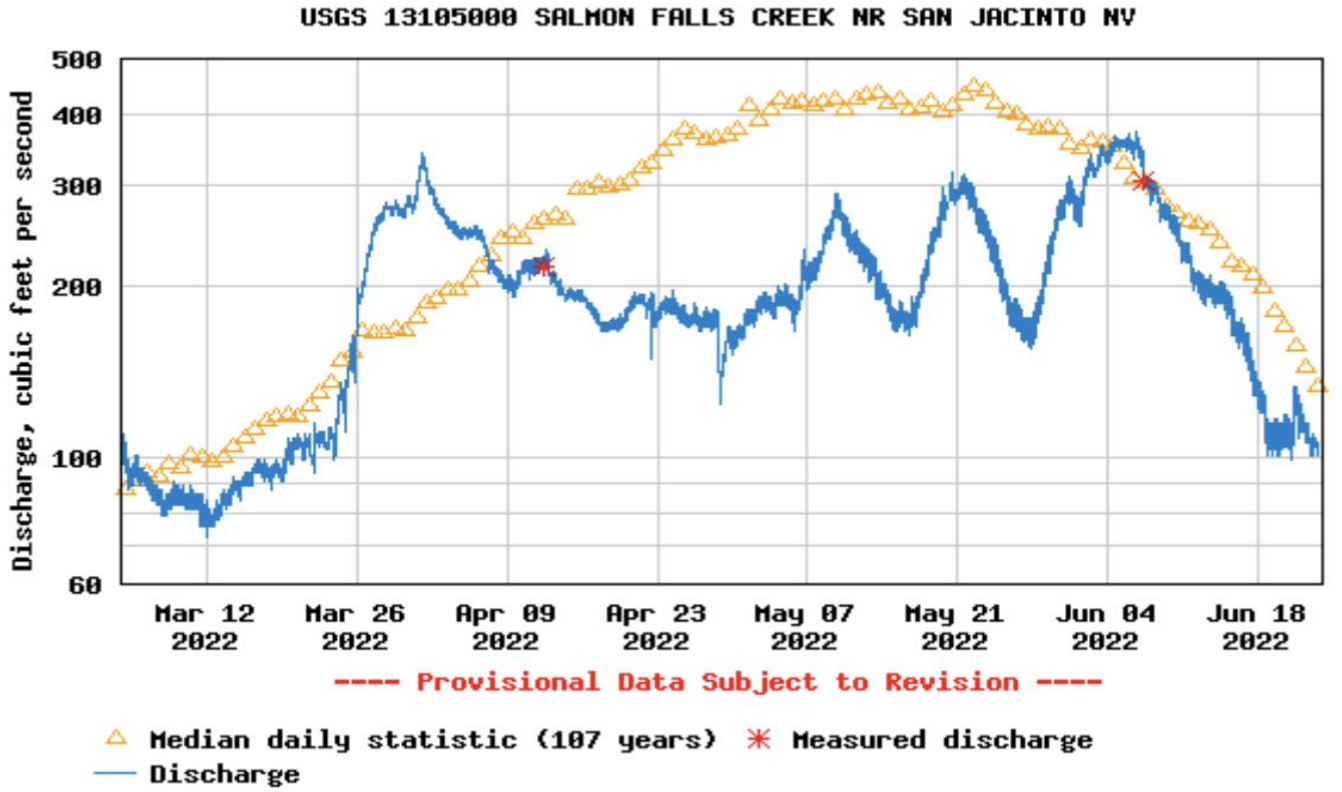



13317000: Salmon R at White Bird, ID
Mean Daily CFS
6,000
5,500
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
6-Dec-22
Similar Year
2020



From the Coeur d'Alene to Salmon Falls – each river had an earlier peak and late peak & near record high flows in the Clearwater !

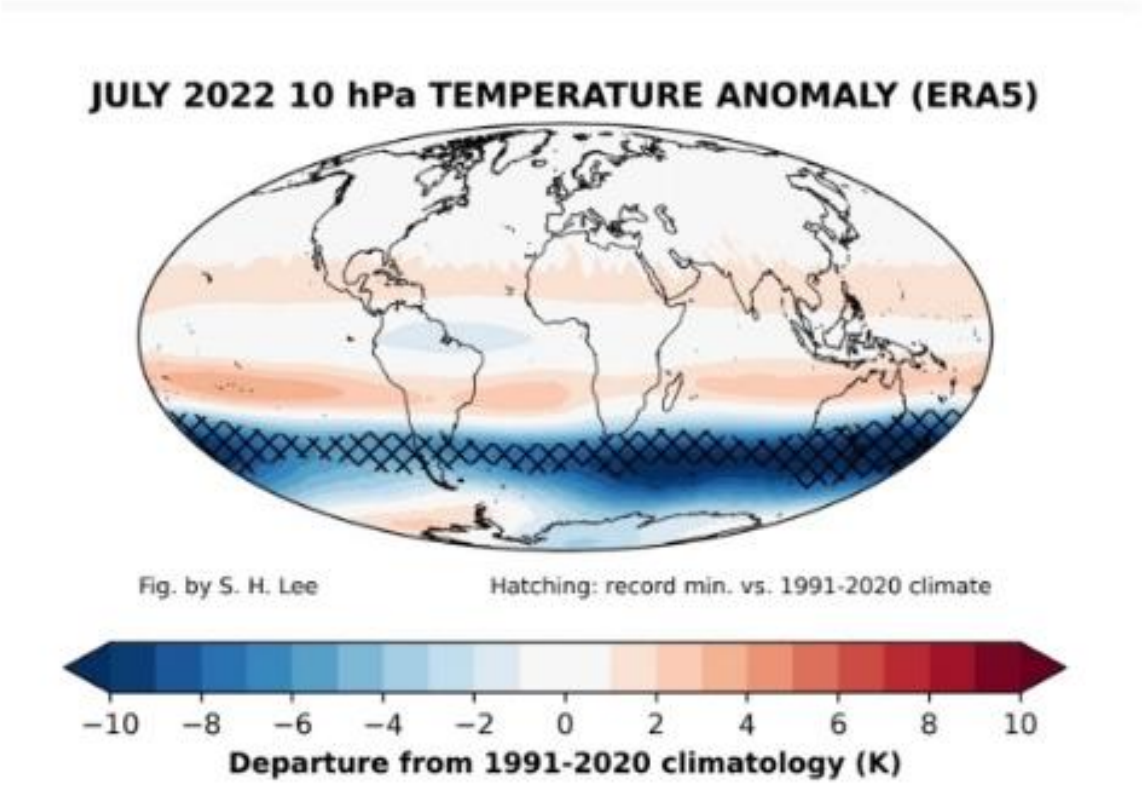
*** An interesting winter led to an interesting spring and a wild runoff season that was similar to 2009 !**



Now let's talk about events influencing this winter.

Jan 15, 2022 - Hunga Tonga Volcano exploded below & above the ocean putting a large amount of water vapor that is still circulating the southern hemisphere atmosphere.

Key is under the relationship between the southern & northern atmospheres and impacts on coming winter.



SEVERE WEATHER EUROPE

A significant cooling event continues in the Stratosphere due to the large Water Vapor cloud, but can it impact the upcoming Winter Season?

By Andrej Flis

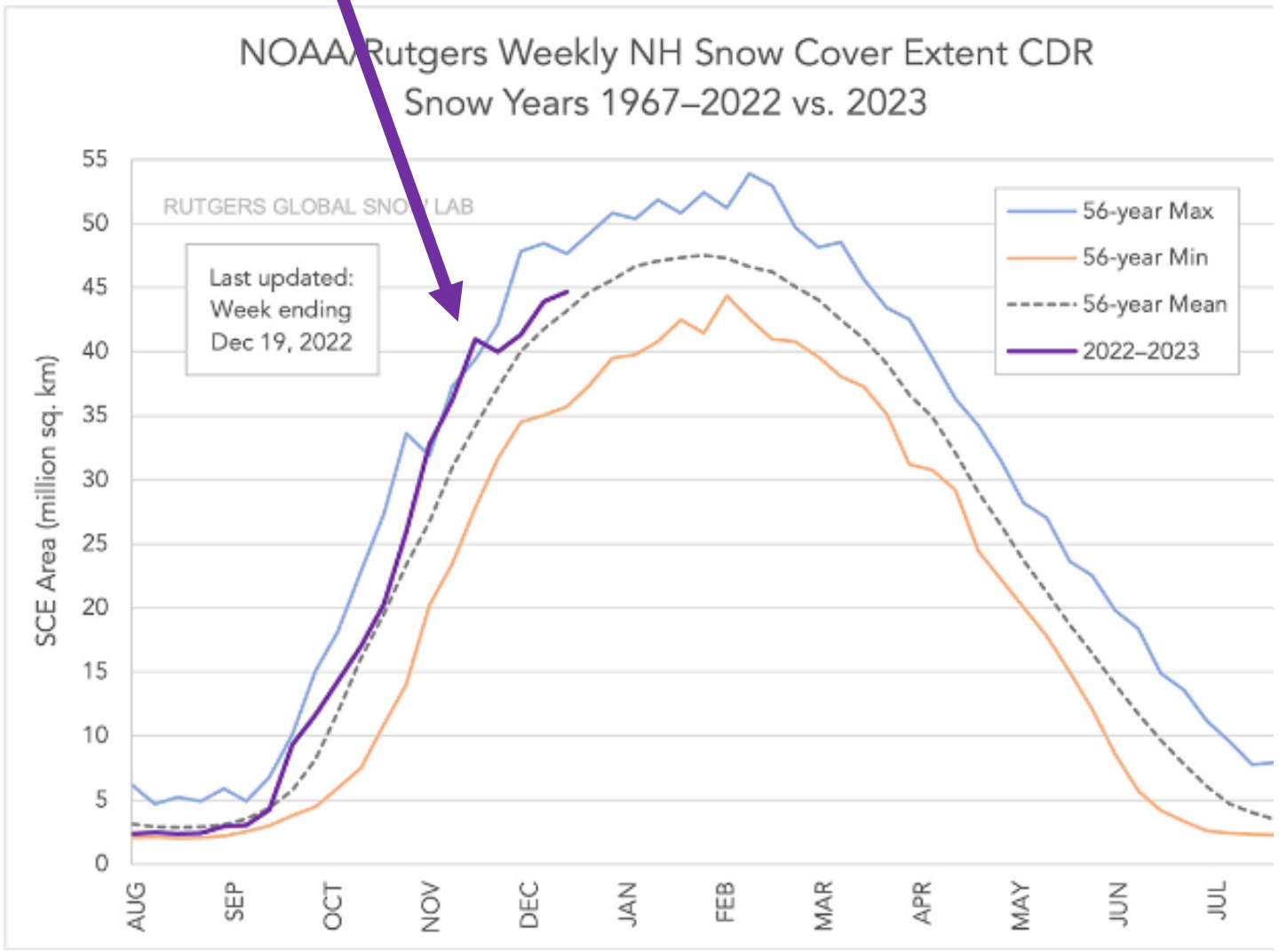
Published: 14/11/2022

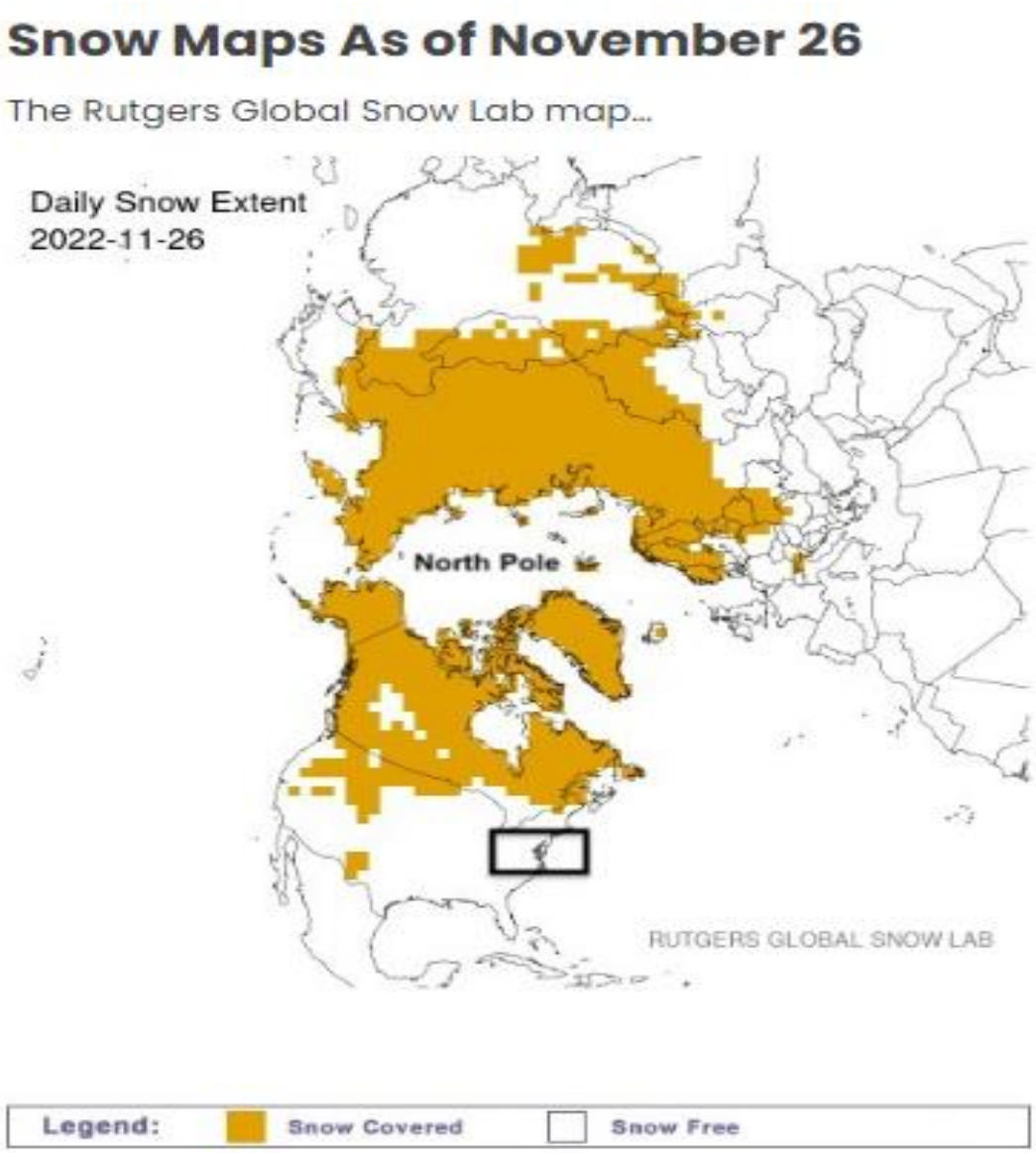
Global weather

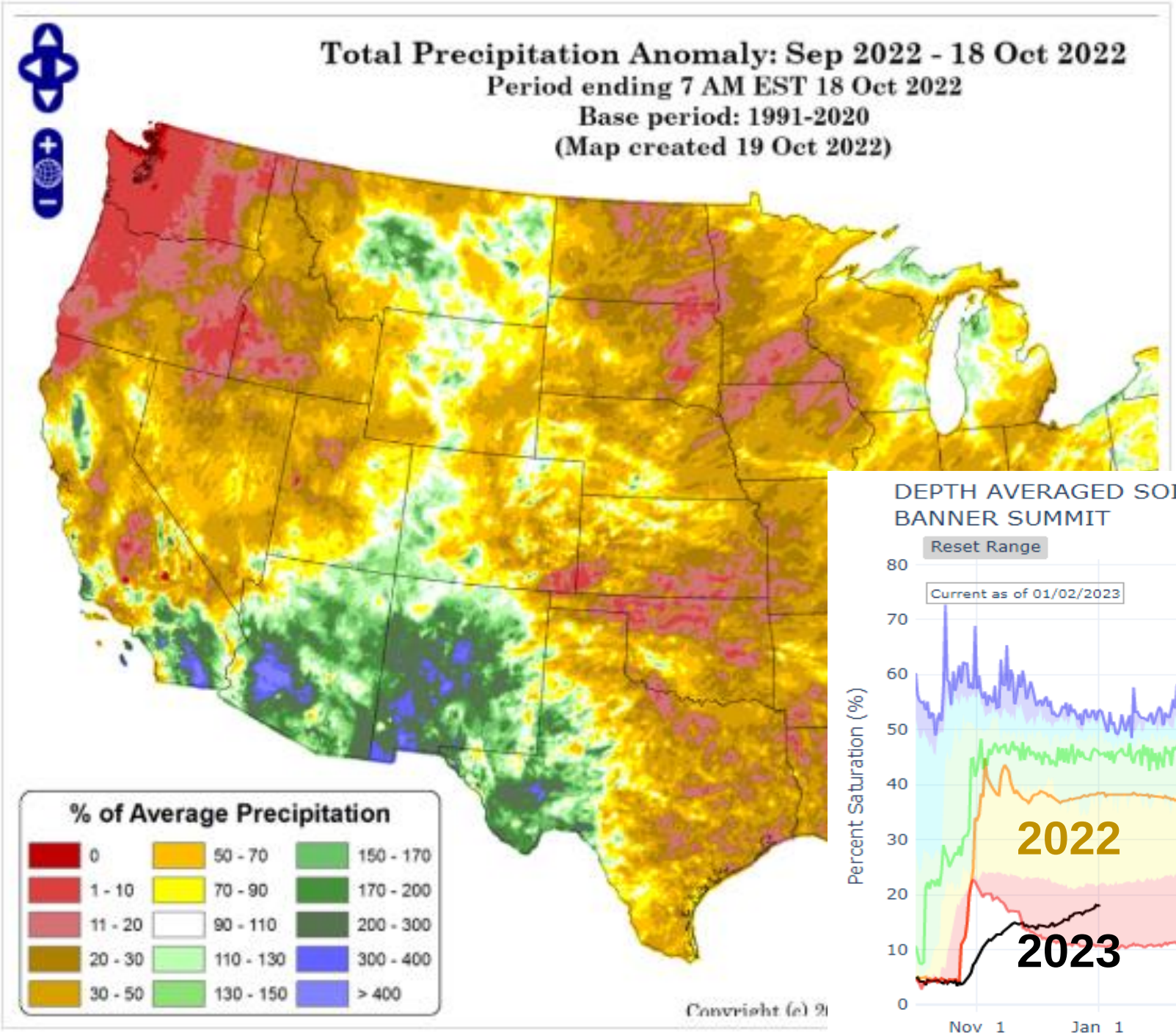
So the main takeaway is that a large water vapor "cloud" circles the globe in the stratosphere. As you will find out, it has a strong cooling effect and is likely to impact the global weather in some way over the coming months and years.

And now – a good Siberian snow cover in Oct/Nov influences the jet stream across the US/Can border from PNW to Great Lakes region and Europe.

- Record high snow cover in November since records start in 1967 and is now still above the long-term mean. Cold is good !

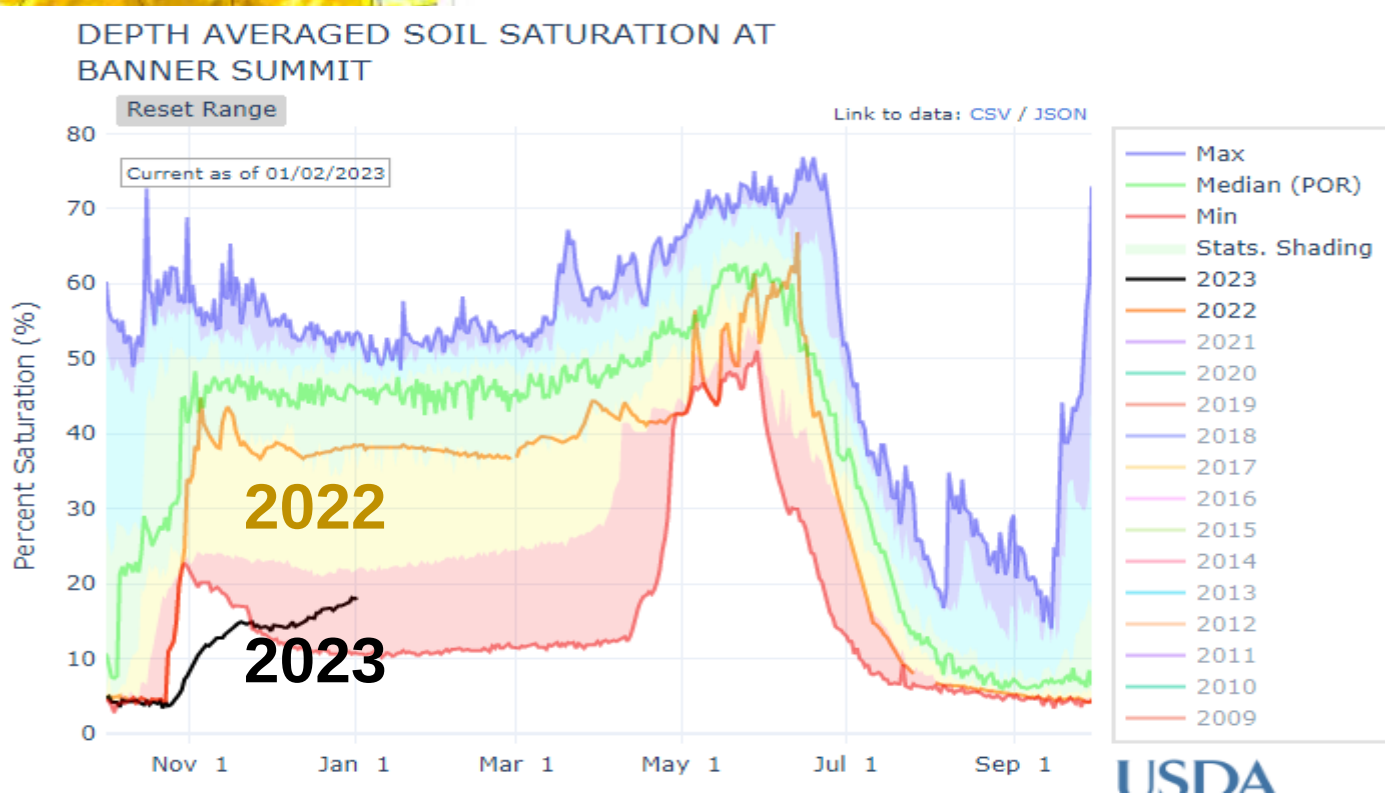






After the dry summer & long dry fall, dry mountainous soils remain.

Sep 1 to Oct 22 precipitation was 10 - 50% of average for most of state.

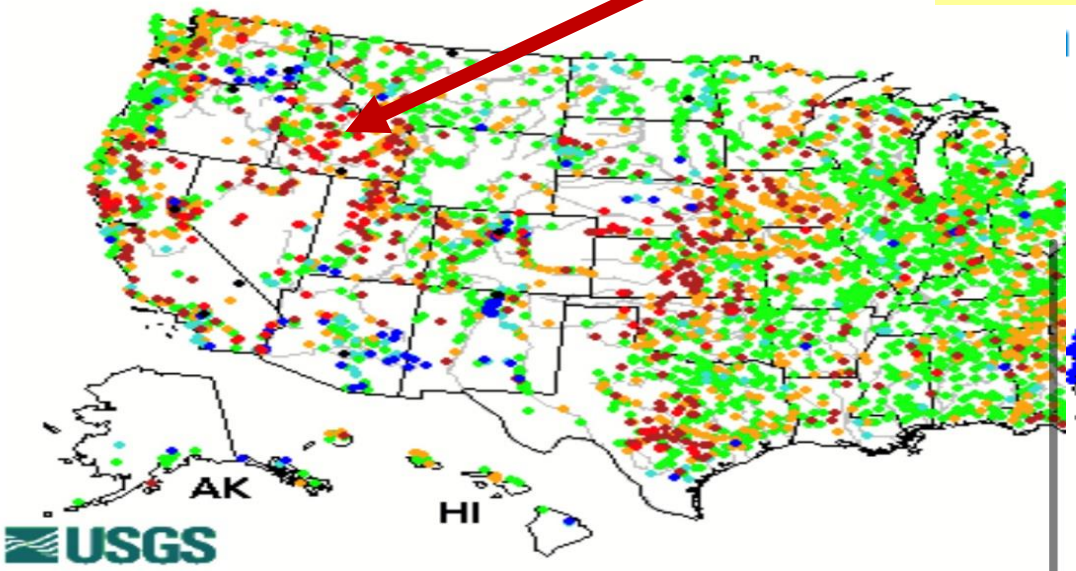


Nov 3 - many rivers near record low flows

Jan 8 - some rivers increased to near avg but did NOT pop to eliminate soil moisture deficit.

Daily Streamflow Conditions

Thursday, November 03, 2022



USGS

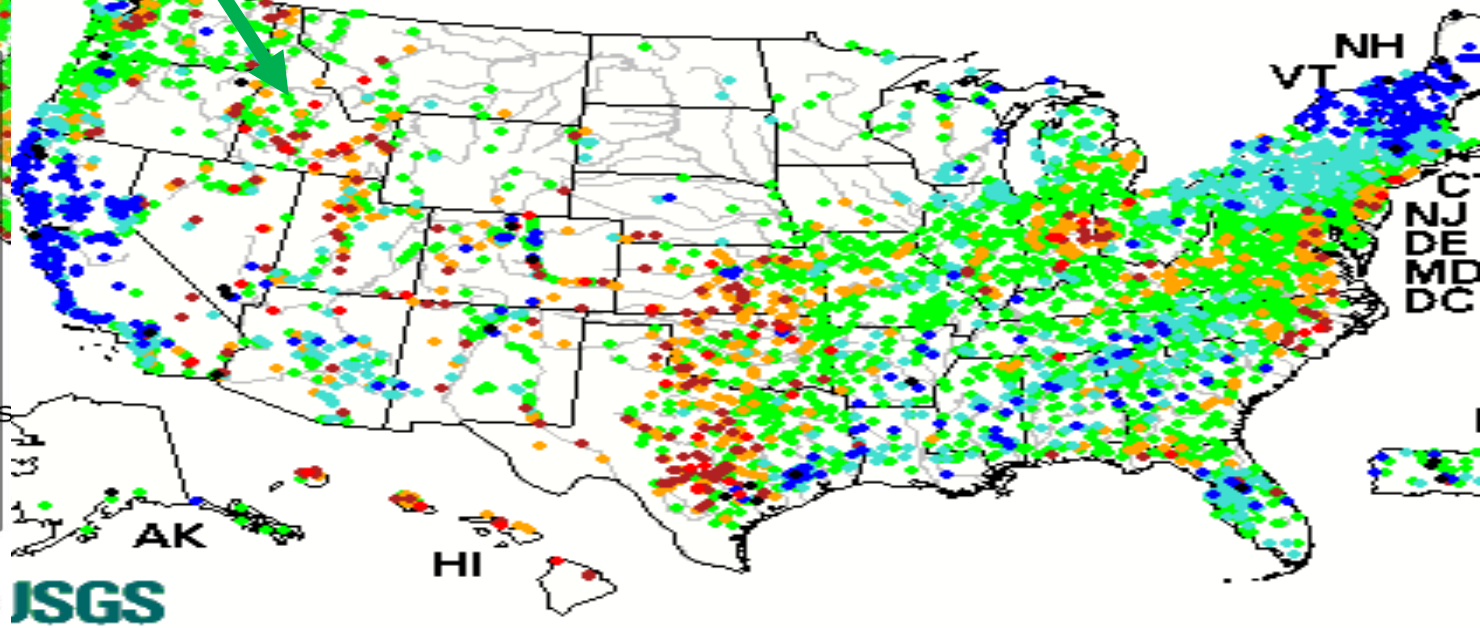
The colored dots on this map depict streamflow conditions as a percentile, which is computed from the period of record for the current day of the year. Only stations with at least 30 years of record are used.
The **gray circles** indicate other stations that were not ranked in percentiles either because they have fewer than 30 years of record or because they

Explanation

- High
- > 90th percentile
- 76th - 90th percentile
- 25th - 75th percentile
- 10th - 24th percentile
- < 10th percentile
- Low
- Not ranked

ily Streamflow Conditions

Sunday, January 08, 2023 22:30ET



JSGS

Explanation

igh
90th percentile
6th - 90th percentile
5th - 75th percentile
0th - 24th percentile
10th percentile

The colored dots on this map depic
conditions as a percentile, which is
the period of record for the current
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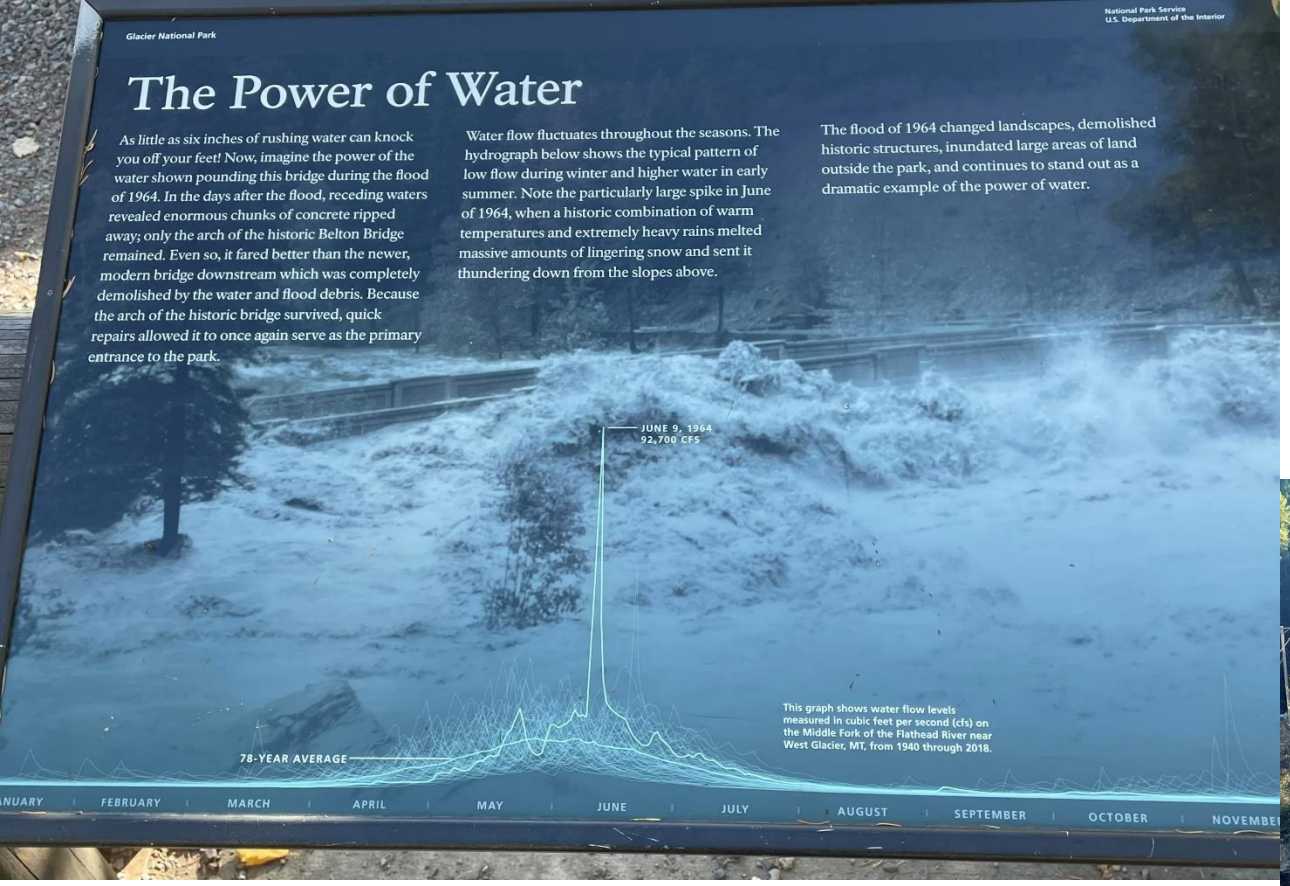
not ranked in percentiles either bec
fewer than 30 years of record or be



Similar rain on snow runoff event happened on MF Flathead River June 9, 1964, with a peak flow of 92,700 CFS.

Low water - September 2022 below

Released Dec 15, 2022 - Now back to Pete Parson and his 2023 analog years based on current ocean & atmosphere conditions

Seasonal Climate Forecast
January – March 2023

Issued: December 15, 2022

NOAA's Climate Prediction Center (CPC) predicts La Niña will weaken but continue into the winter.

That would make 3 consecutive winters with La Niña (last occurred from 1998-2001).

There has been no recorded occurrence of 4 consecutive La Niña winters.

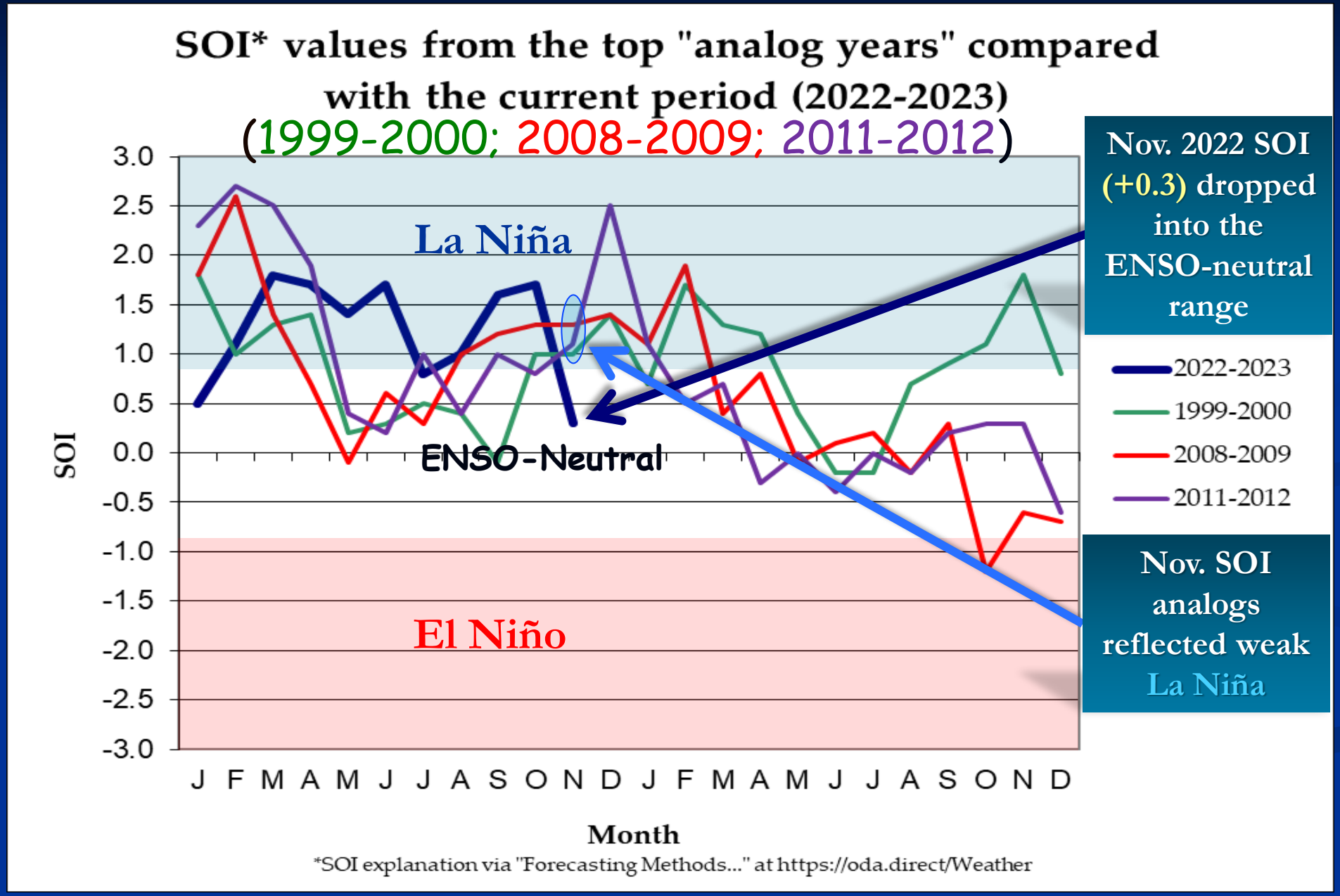
Contact: ODF Lead Meteorologist Pete Parsons
503-945-7448 or peter.gj.parsons@odf.oregon.gov

Oregon Department of Agriculture (ODA) - Oregon Department of Forestry (ODF)
Production support: Diana Walker; Andy Zimmerman; Julie Waters; Kristin Cody

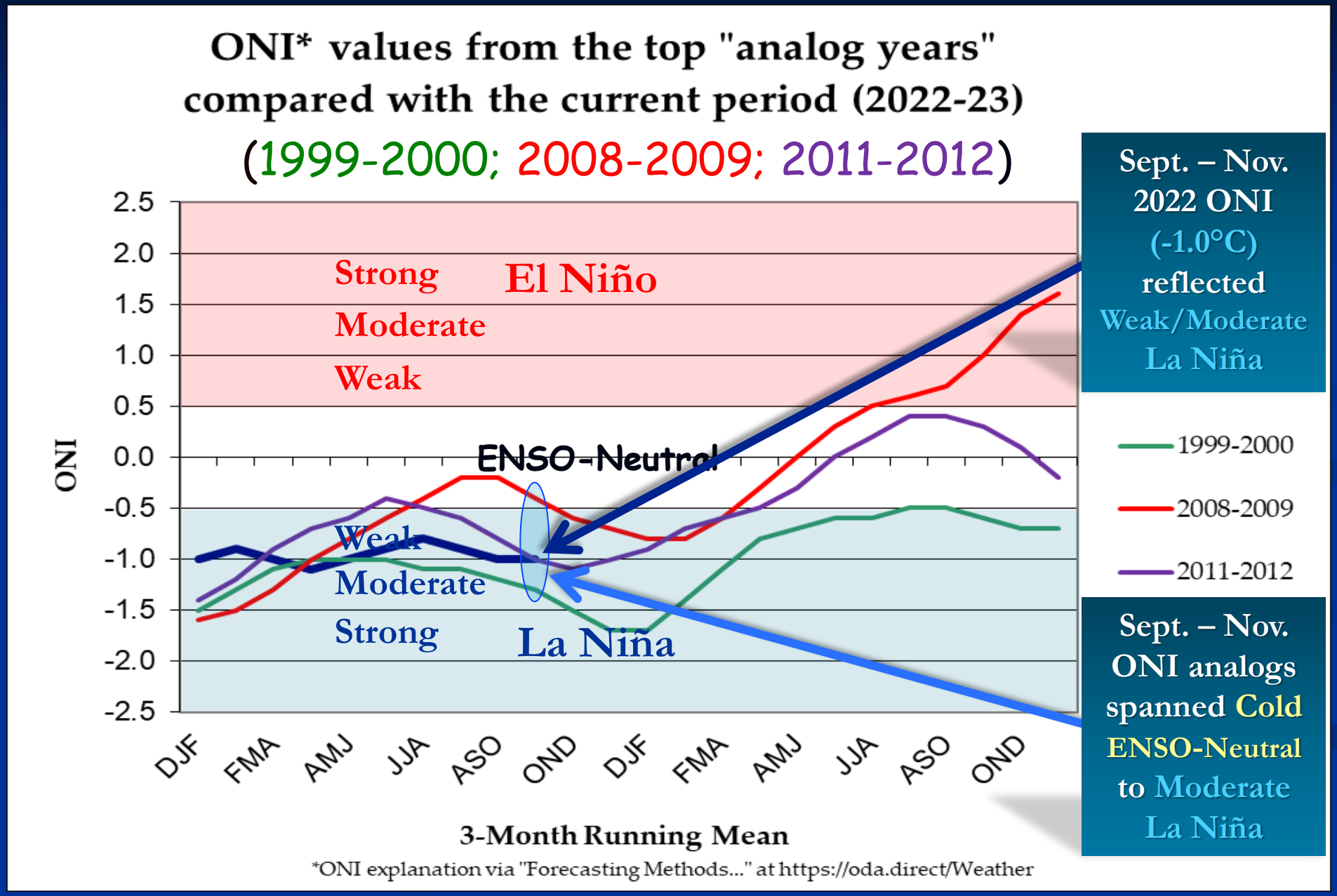
Forecast Highlights

- La Niña is expected to transition to ENSO-Neutral this winter, which promotes highly anomalous weather, but large “swings” can “balance” over a 3-month period.
- **Weather records from 2000, 2009, & 2012 were used to generate the forecast charts. 1957 & 1972 were also considered...** but to a lessor degree because of climate change...see next chart.
- **Monthly temperatures may have significant swings, but the 3-month period should be close to average** (cool west and warm east). January has heightened chances for an Arctic intrusion, which could be severe.
- **Precipitation should be near or slightly above average, with March having the best chances for above-average rain and mountain snow.**

Southern Oscillation Index (SOI)

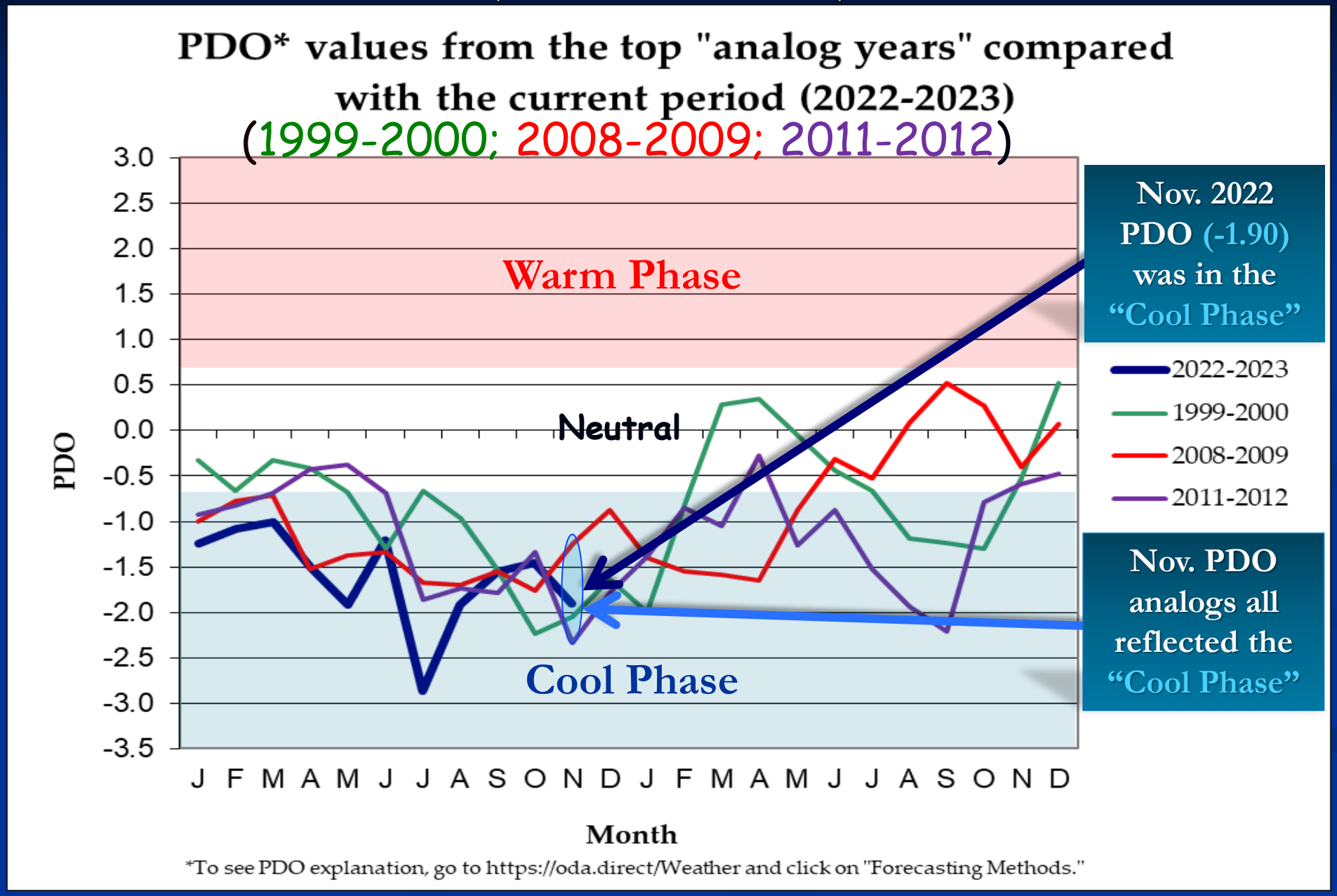


Oceanic Niño Index (ONI)



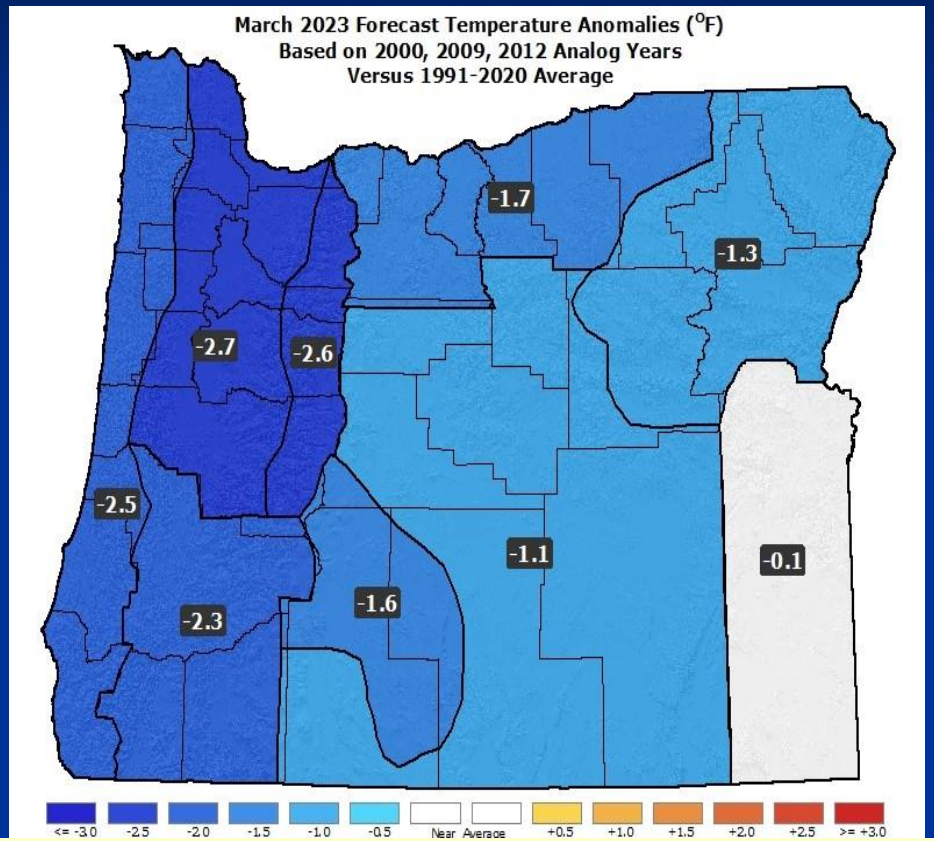
North Pacific Ocean

(Poleward of 20°N Latitude)

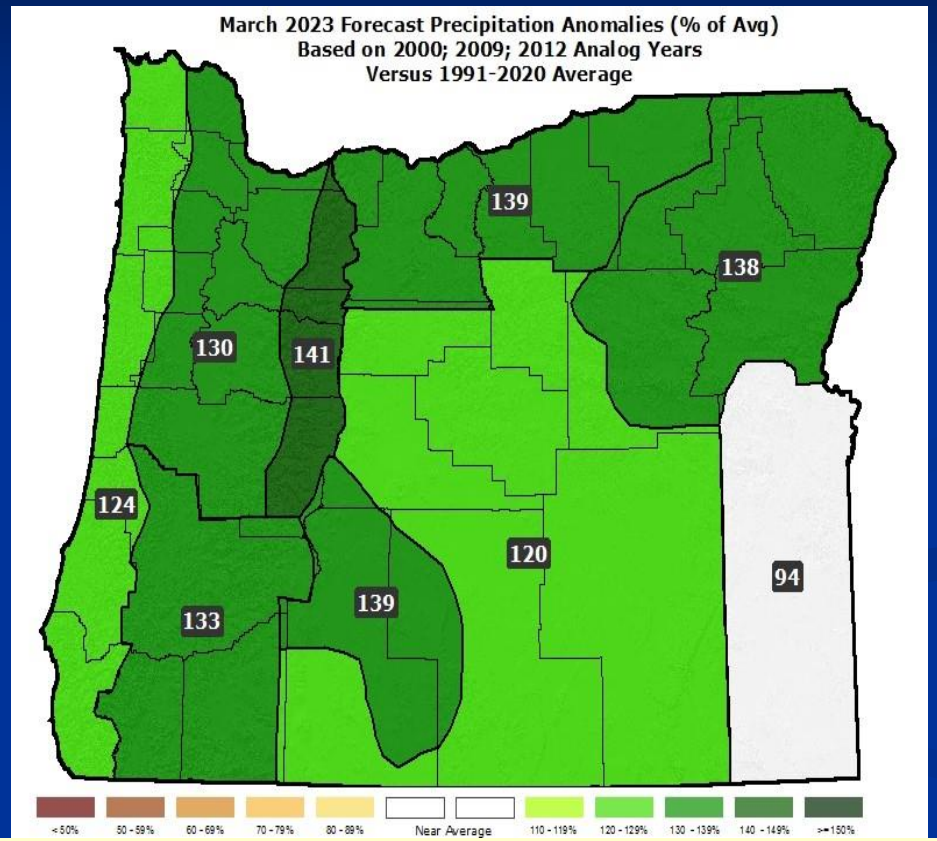


March 2023 Forecast

Temperatures

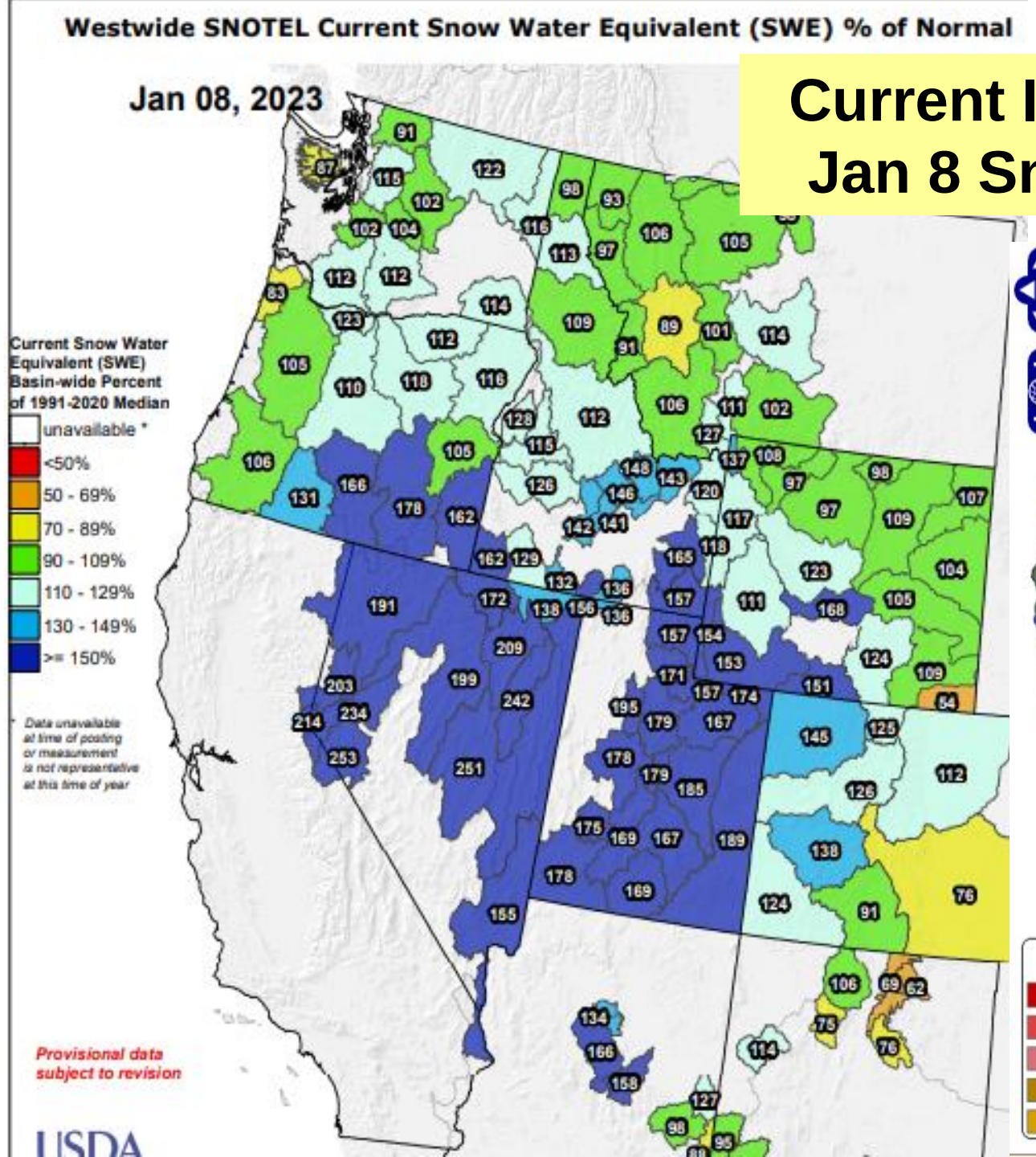


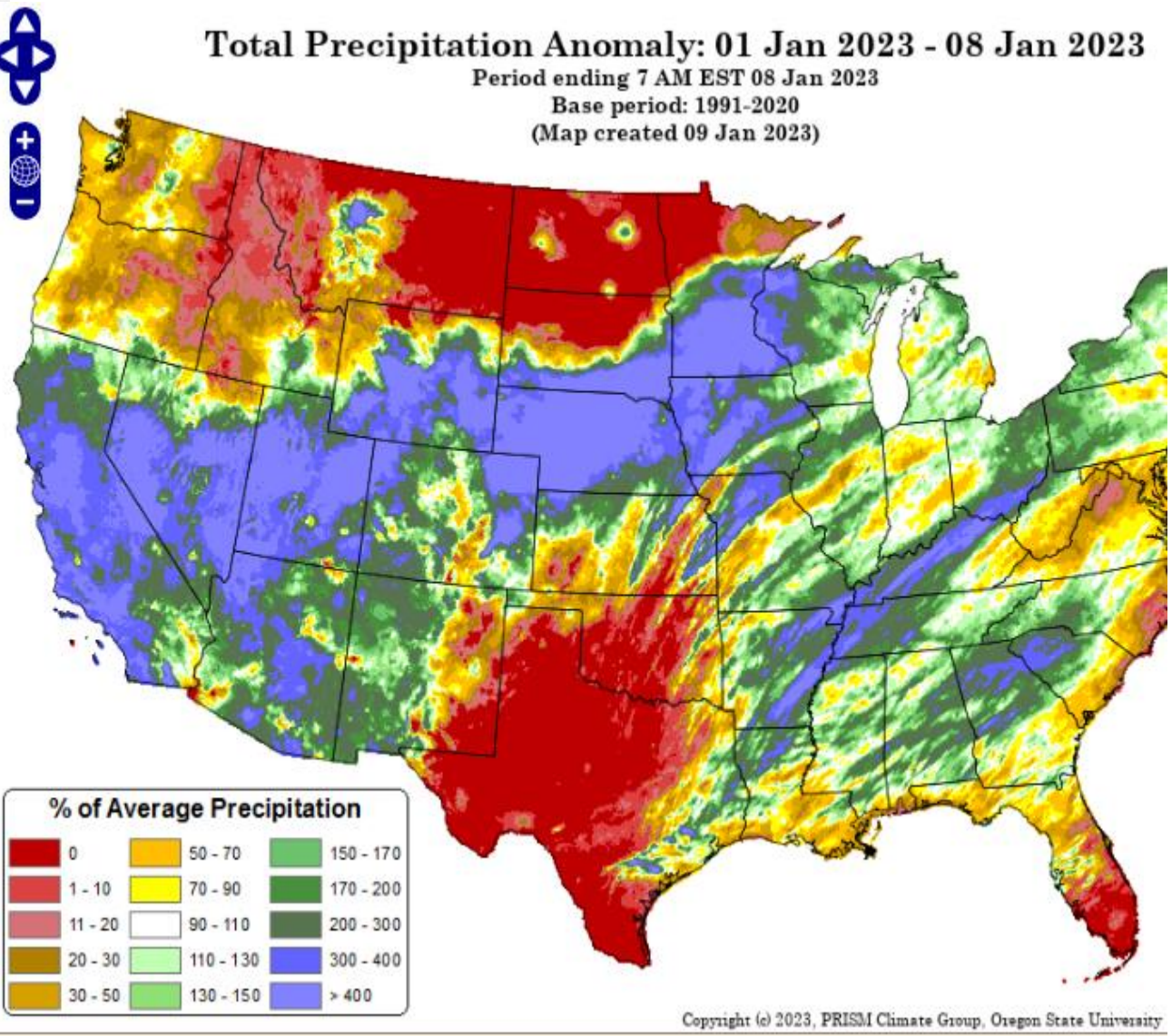
Precipitation

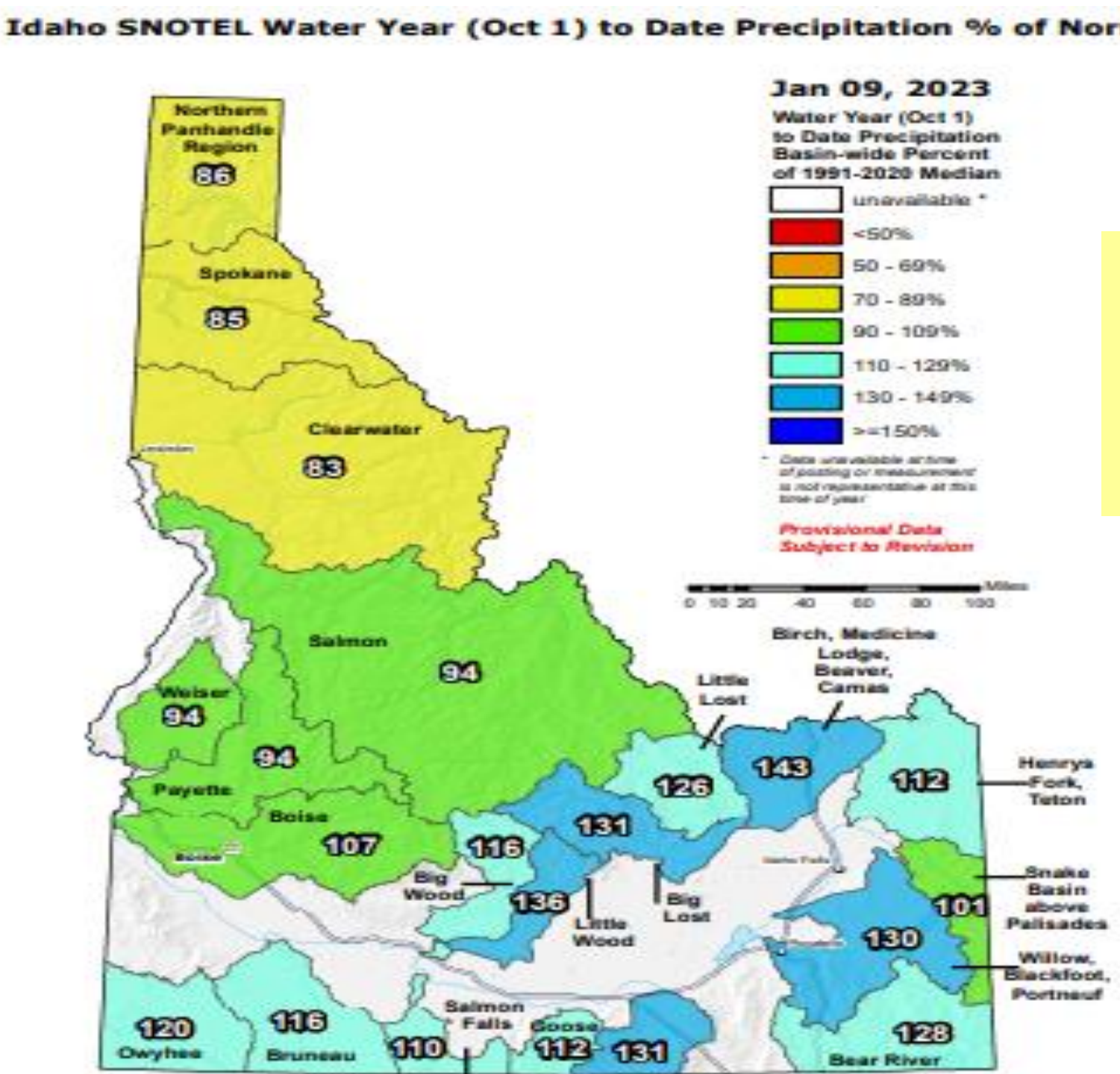


- **All 3 of the top analog years had generally below-average temperatures.**
- **The 2000 analog was a drier than average, but 2009 and 2012 were stormy with ample mountain snow and at least one episode of wet snow in the western valleys.**

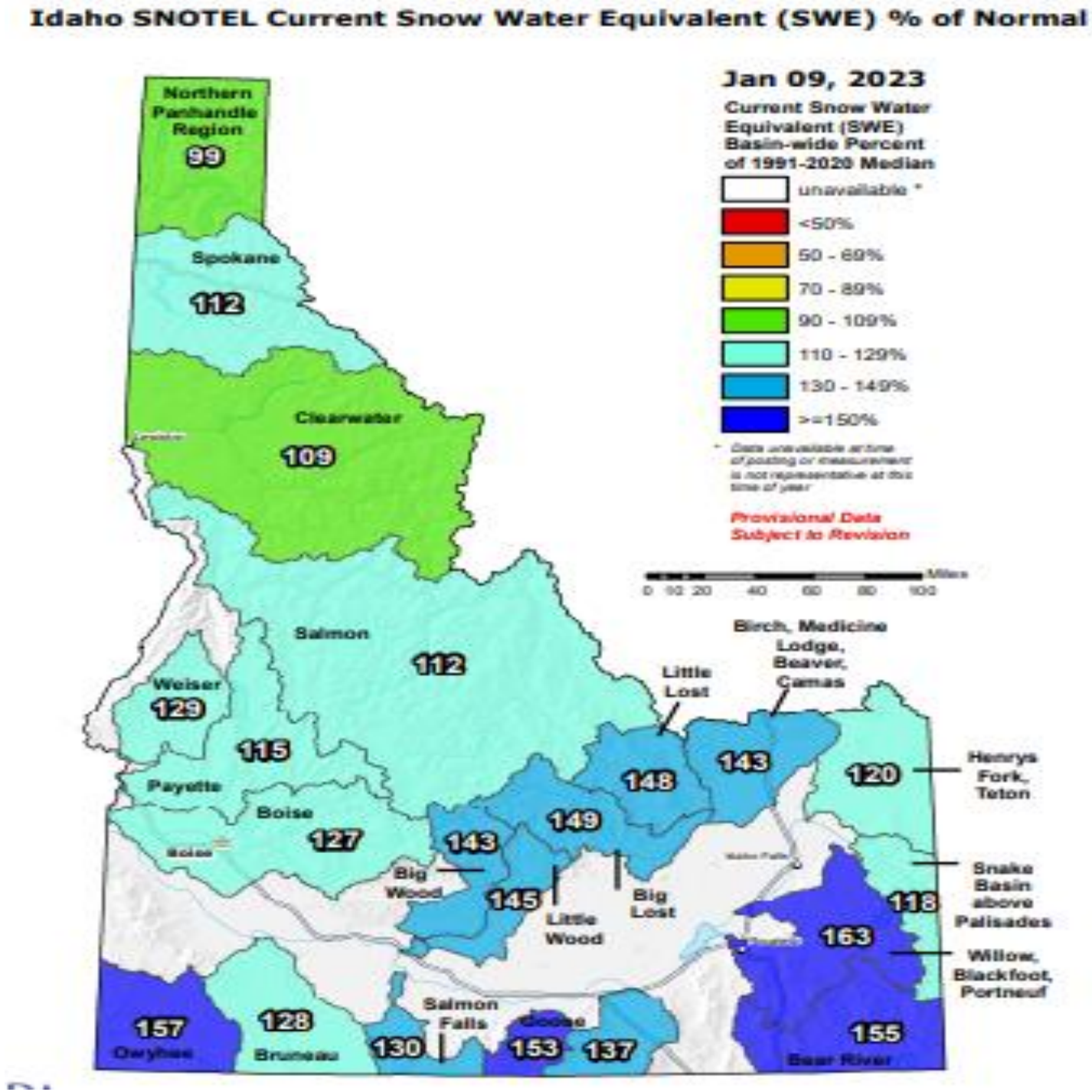
Current Information: % of Normal
Jan 8 Snow & Jan 1 to 8 Precipitation







Interesting Water Year to Date Precipitation Pattern ranging from 85 to 140%

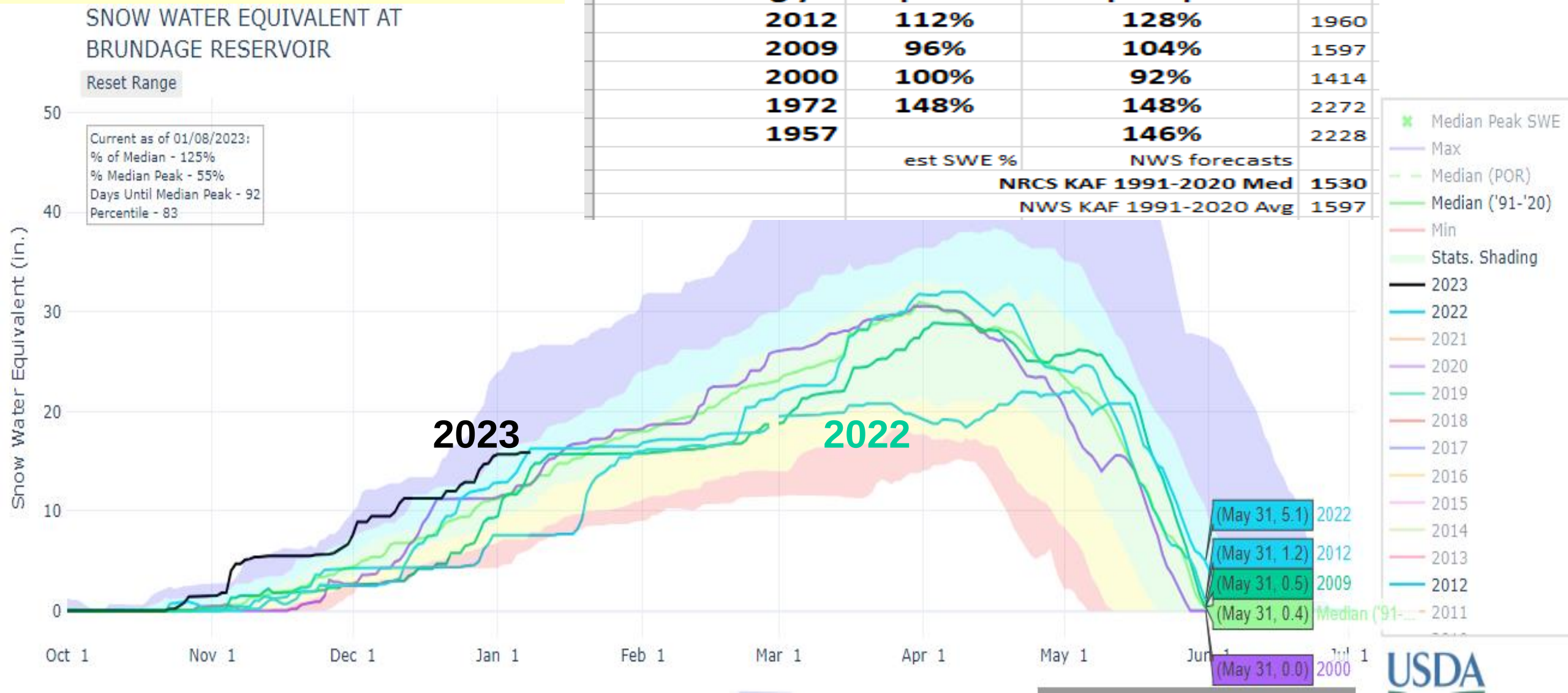


Jan 9, 2023, Snowpacks are looking good at 100-160% of Median

Key Point:
With the second half of winter still to come, current snowpacks are 45-70% of their seasonal peak that occurs late March to early April.

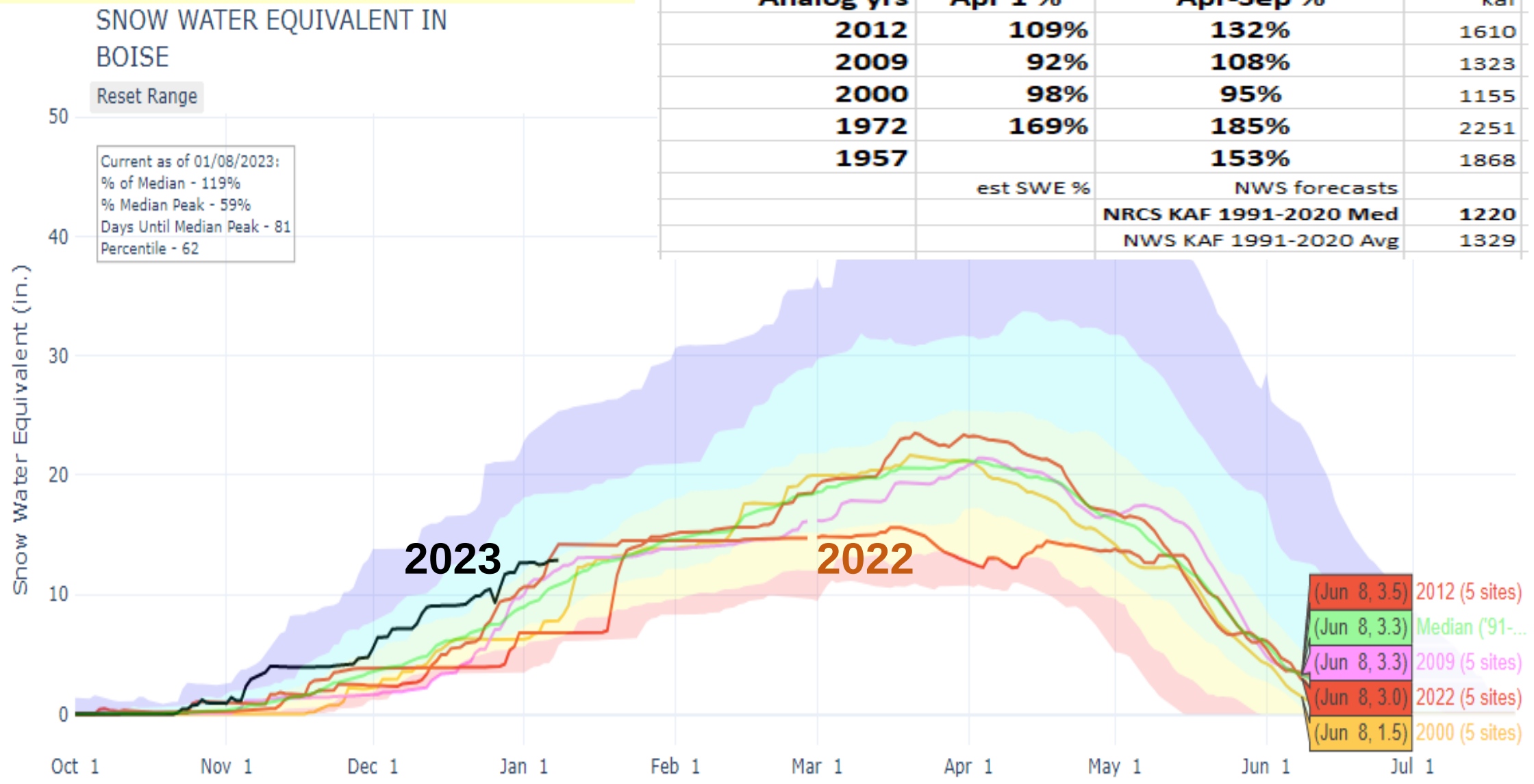
Jan 9 snow is 52% of seasonal peak, other yrs peaked at 96-148%. River fcst of 96% is ON LOW SIDE of analog yrs flow of 92-148%

	9-Jan-23	NWS Fcst Jan 2 2023	
Payette Horseshoe Bend	Snow % of Med / % of Peak 115 / 52	Streamflow Exceedance FCSTs 90% 50% 10% 59% 96% 131%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	112%	128%	1960
2009	96%	104%	1597
2000	100%	92%	1414
1972	148%	148%	2272
1957		146%	2228
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	1530
		NWS KAF 1991-2020 Avg	1597

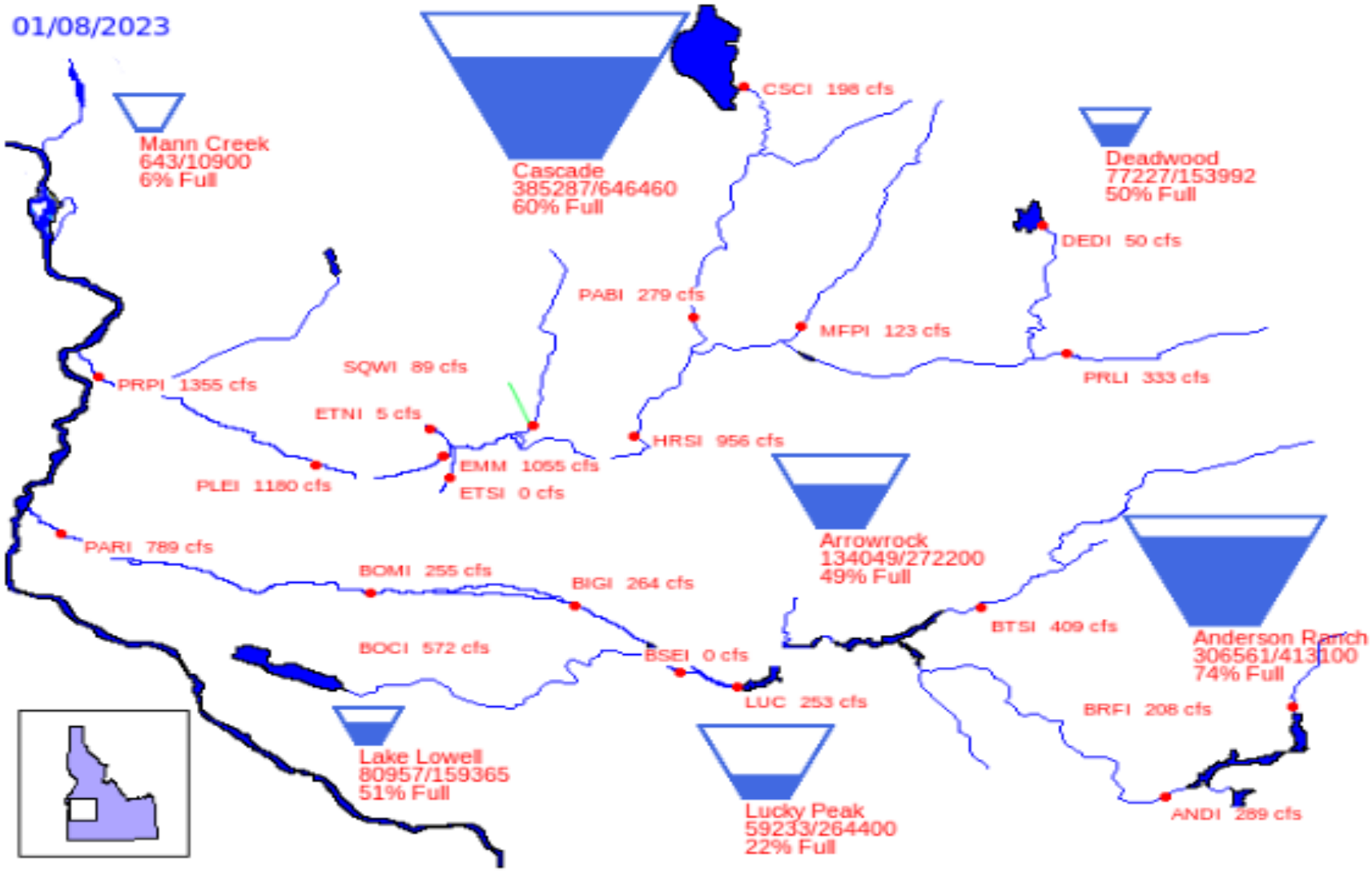


Jan 9 snow is 58% of seasonal peak, other yrs peaked at 92-169%. River fcst of 112% is IN RANGE of analog yrs flow of 95-185%

	9-Jan-23	NWS Fcst Jan 2 2023	
Boise near Boise	Snow % of Med / % of Peak 127 / 58	Streamflow Exceedance FCSTs 90% 50% 10% 69% 112% 156%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	109%	132%	1610
2009	92%	108%	1323
2000	98%	95%	1155
1972	169%	185%	2251
1957		153%	1868
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	1220
		NWS KAF 1991-2020 Avg	1329



Bureau of Reclamation, Pacific Northwest Region
Major Storage Reservoirs in the Boise & Payette River Basins

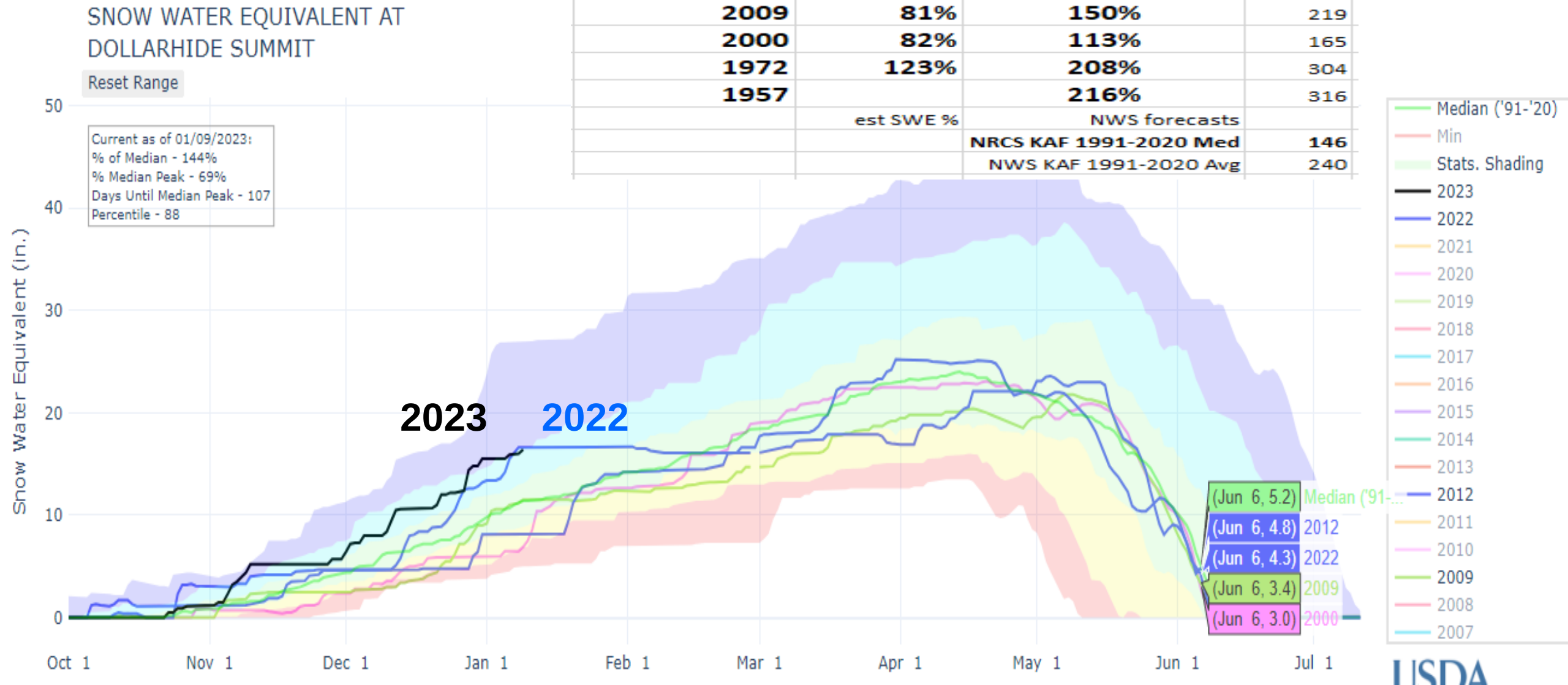


PROVISIONAL DATA - Subject to change

Boise & Payette Reservoir Systems are about 55% of capacity.

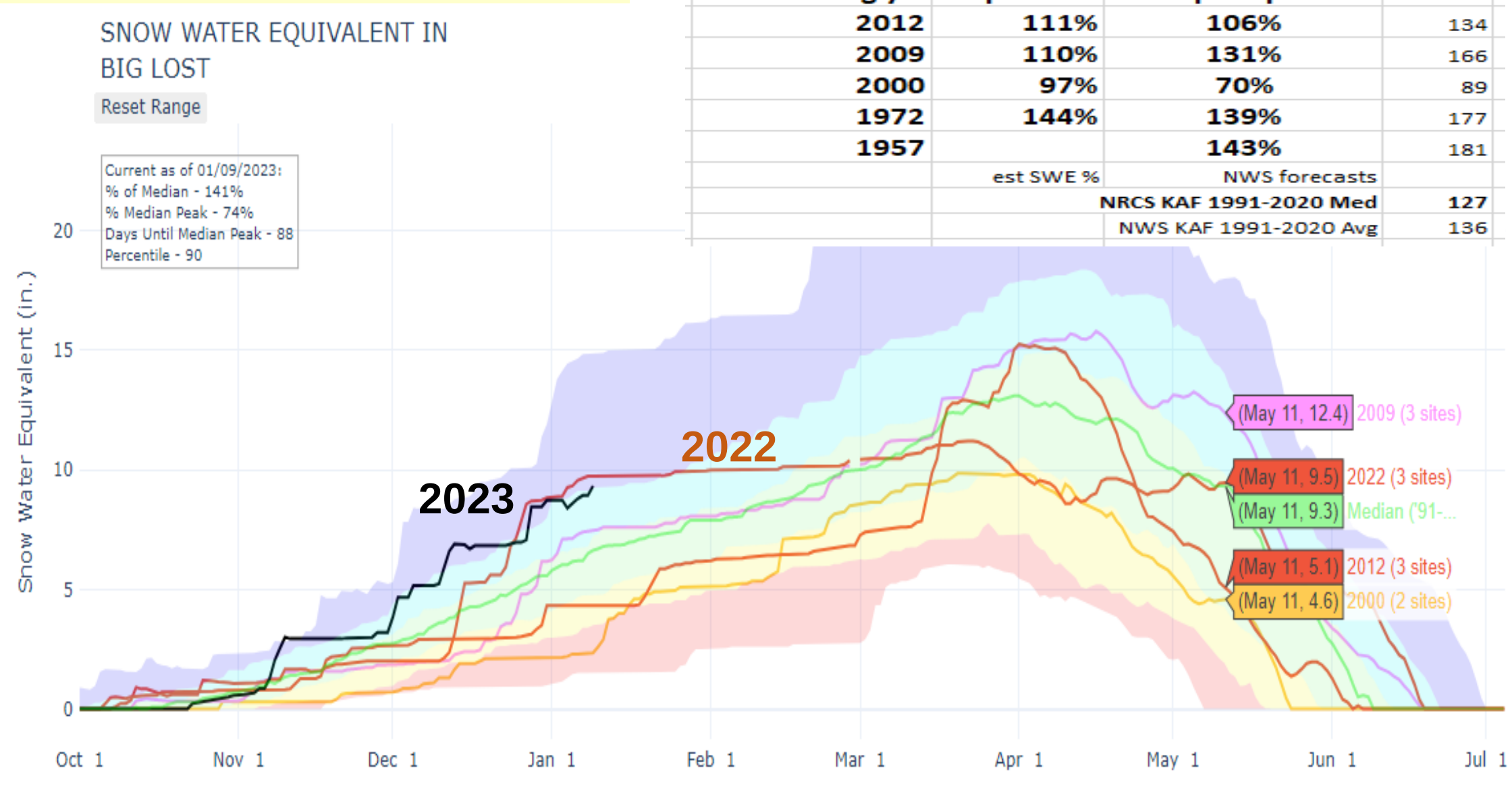
Jan 9 snow is 69% of seasonal peak, other yrs peaked at 81-123%. River fcst of 146% is IN RANGE of analog yrs flow of 113-216%

	9-Jan-23	NWS Fcst Jan 2 2023	
Big Wood blw Magic	Snow % of Med / % of Peak 143 / 69	Streamflow Exceedance FCSTs 90% 50% 10% 64% 146% 274%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	94%	163%	238
2009	81%	150%	219
2000	82%	113%	165
1972	123%	208%	304
1957		216%	316
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	146
		NWS KAF 1991-2020 Avg	240



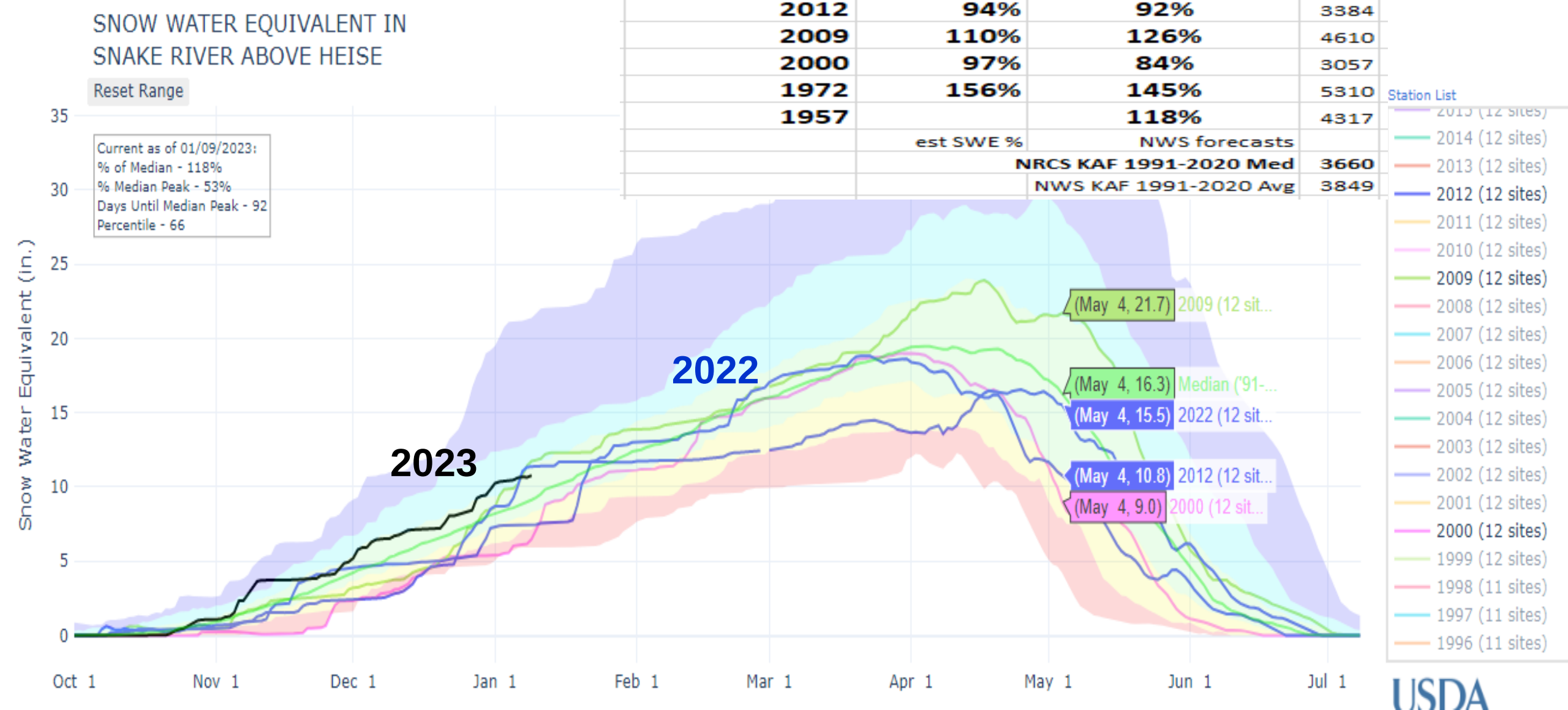
Jan 9 snow is 69% of seasonal peak, other yrs peaked at 97-144%. River fcst of 134% is ON HIGH SIDE of analog yrs flow of 70-143%

Big Lost blw Mackay	9-Jan-23 Snow % of Med / % of Peak 149 / 69	NWS Fcst Jan 2 2023 Streamflow Exceedance FCSTs 90% 50% 10% 74% 134% 216%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	111%	106%	134
2009	110%	131%	166
2000	97%	70%	89
1972	144%	139%	177
1957		143%	181
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	127
		NWS KAF 1991-2020 Avg	136

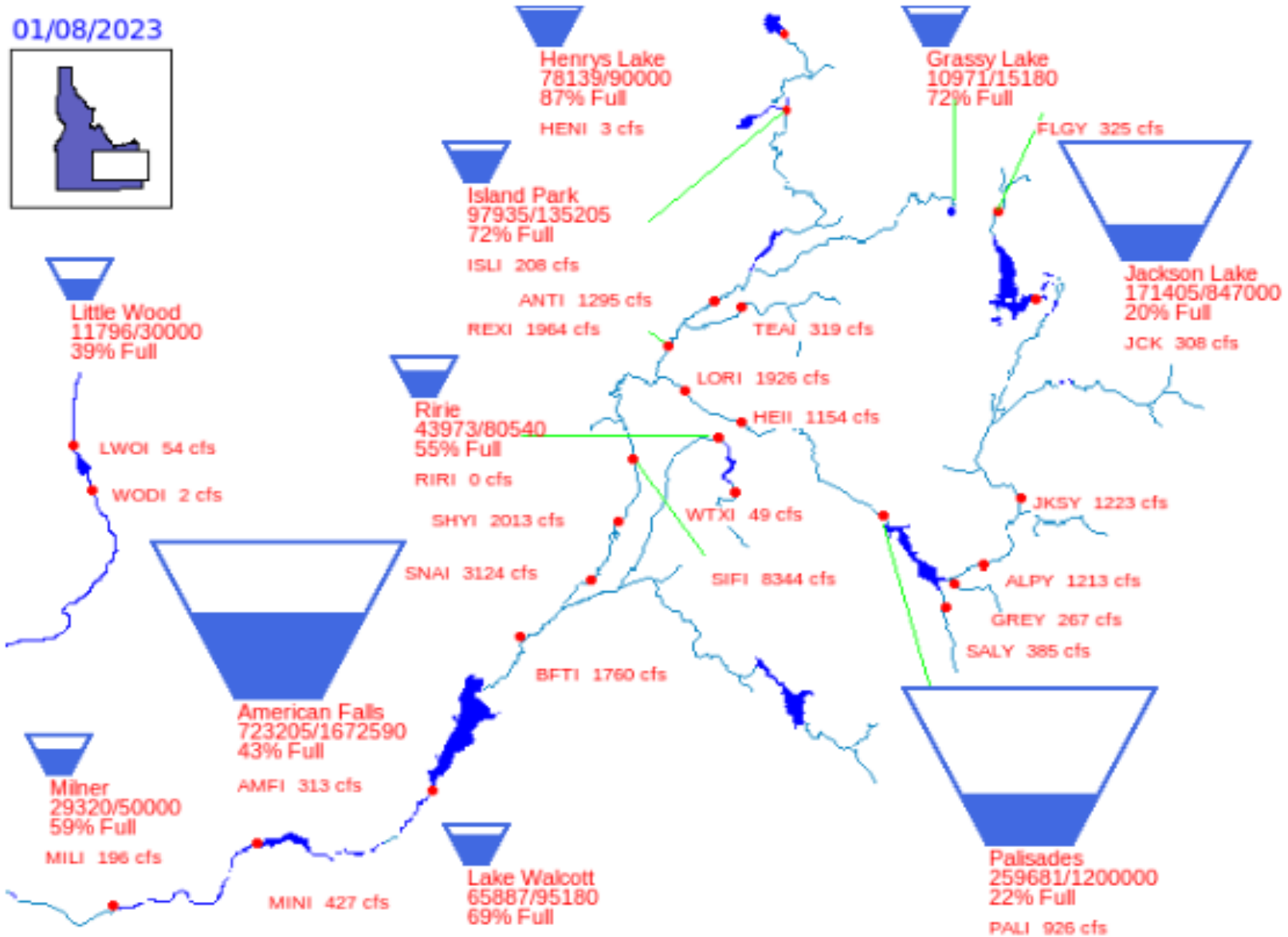


Jan 9 snow is 50% of seasonal peak, other yrs peaked at 94-156%. River fcst of 89% is ON LOW SIDE of analog yrs flow of 84-145%

	9-Jan-23	NWS Fcst Jan 2 2023	
Snake nr Heise	Snow % of Med / % of Peak 118 / 50	Streamflow Exceedance FCSTs 90% 50% 10% 65% 89% 122%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	94%	92%	3384
2009	110%	126%	4610
2000	97%	84%	3057
1972	156%	145%	5310
1957		118%	4317
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	3660
		NWS KAF 1991-2020 Avg	3849



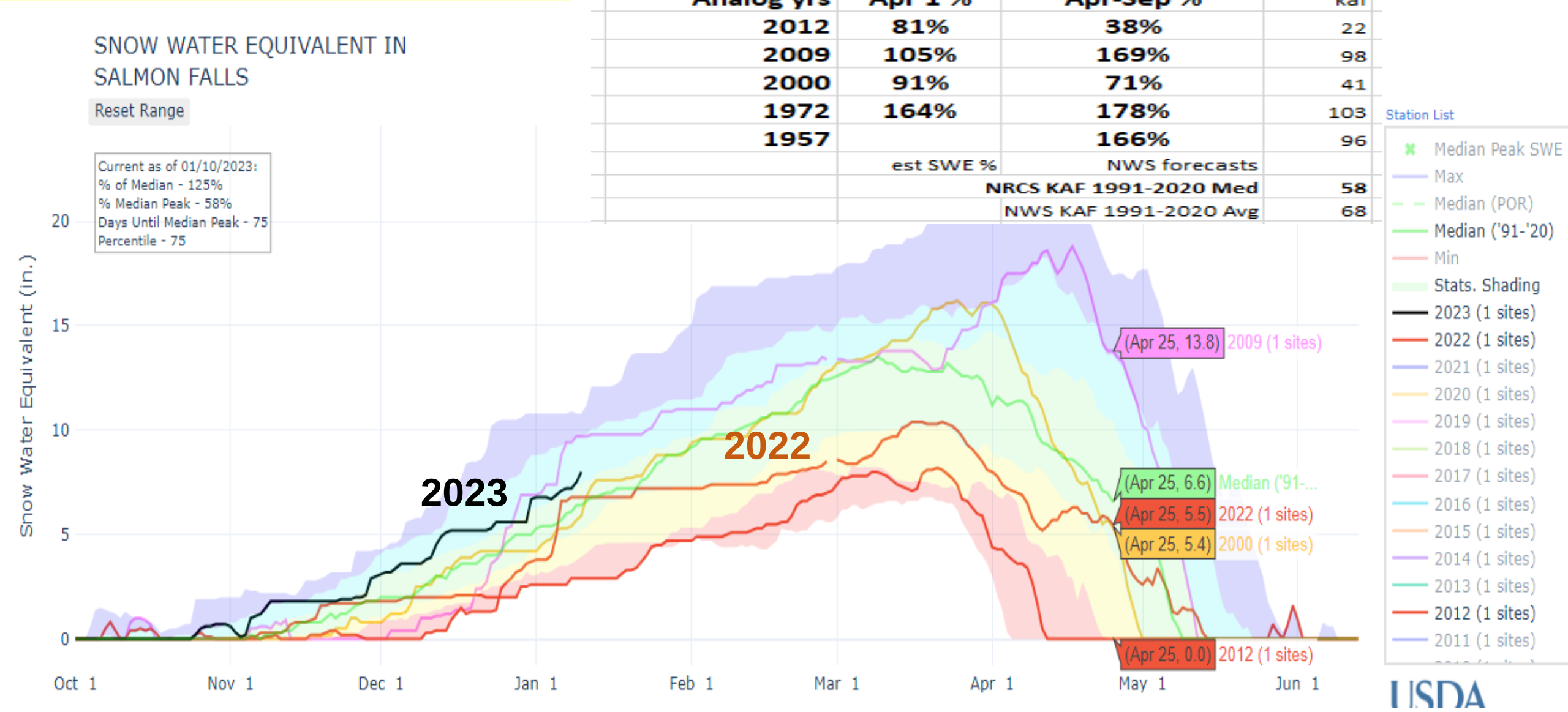
Bureau of Reclamation, Pacific Northwest Region
Major Storage Reservoirs in the Upper Snake River Basin



Upper Snake Reservoir System is 34% of capacity.

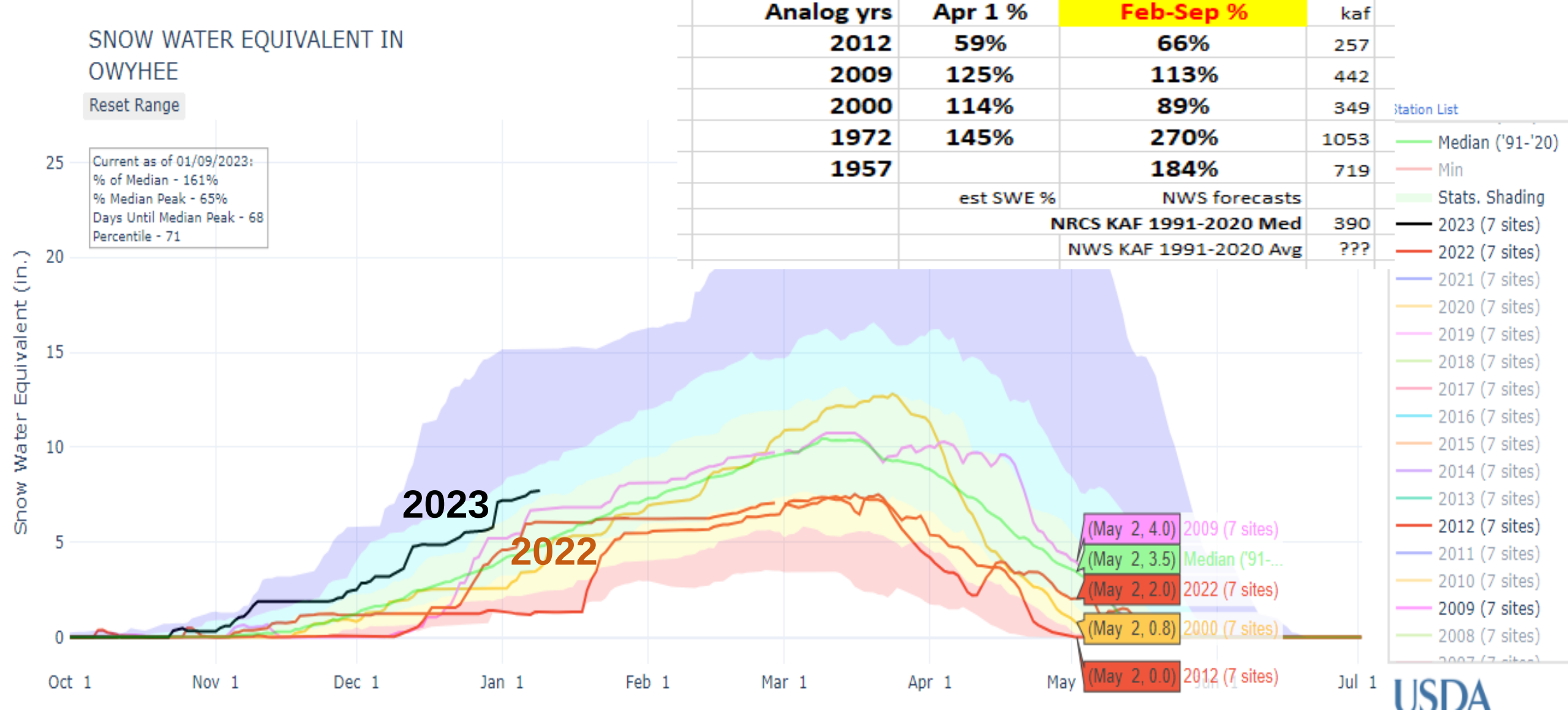
Jan 9 snow is 56% of seasonal peak, other yrs peaked at 81-164%. River fcst of 105% is IN RANGE of analog yrs flow of 38-178%

	9-Jan-23	NWS Fcst Jan 2 2023	
Salmon Falls nr San Jacinto	Snow % of Med / % of Peak 130 / 56	Streamflow Exceedance FCSTs 90% 50% 10% 62% 105% 179%	
Analog yrs	Apr 1 %	Apr-Sep %	kaf
2012	81%	38%	22
2009	105%	169%	98
2000	91%	71%	41
1972	164%	178%	103
1957		166%	96
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	58
		NWS KAF 1991-2020 Avg	68



Jan 9 snow is 64% of seasonal peak, other yrs peaked at 59-145%. Feb-Sep River fcst is NOT AVALIABLE while analog yrs flow was 66-270%

	9-Jan-23	NWS Fcst Jan 2 2023	
Owyhee blw Owy Dam	Snow % of Med / % of Peak 157 / 64	Streamflow Exceedance FCSTs 90% 50% 10% not available	
Analog yrs	Apr 1 %	Feb-Sep %	kaf
2012	59%	66%	257
2009	125%	113%	442
2000	114%	89%	349
1972	145%	270%	1053
1957		184%	719
	est SWE %	NWS forecasts	
		NRCS KAF 1991-2020 Med	390
		NWS KAF 1991-2020 Avg	???

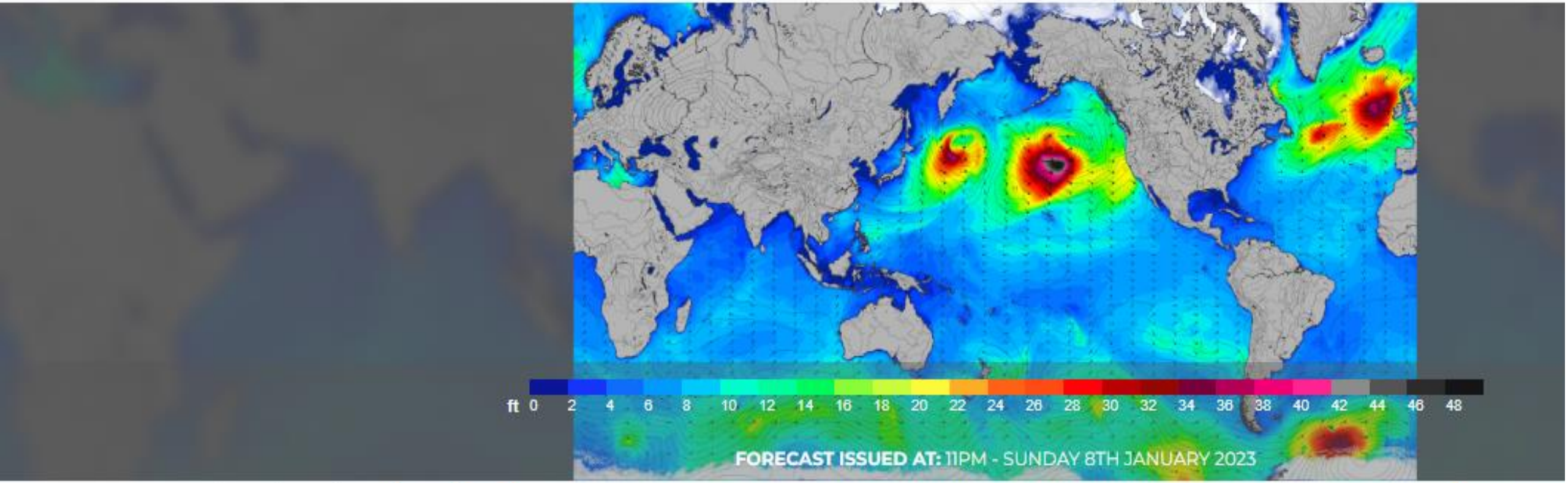


USDA

WORLD PACIFIC CHARTS

9 JAN 2023 - 15 JAN 2023 UTC +00:00

Wednesday's Atmospheric River with 50 ft swells.



WORLD PACIFIC

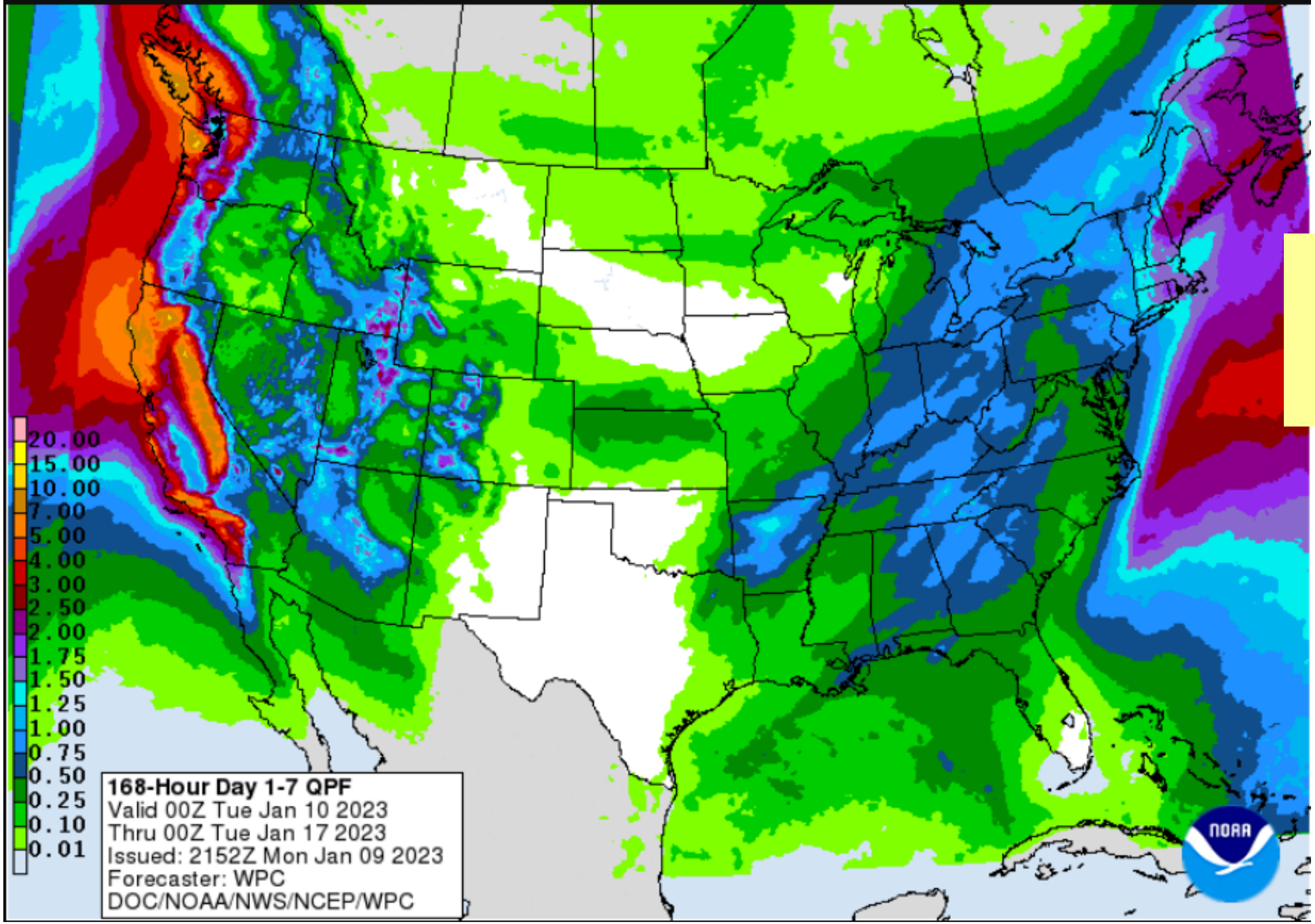
SWELL

6am Wed Jan 11th

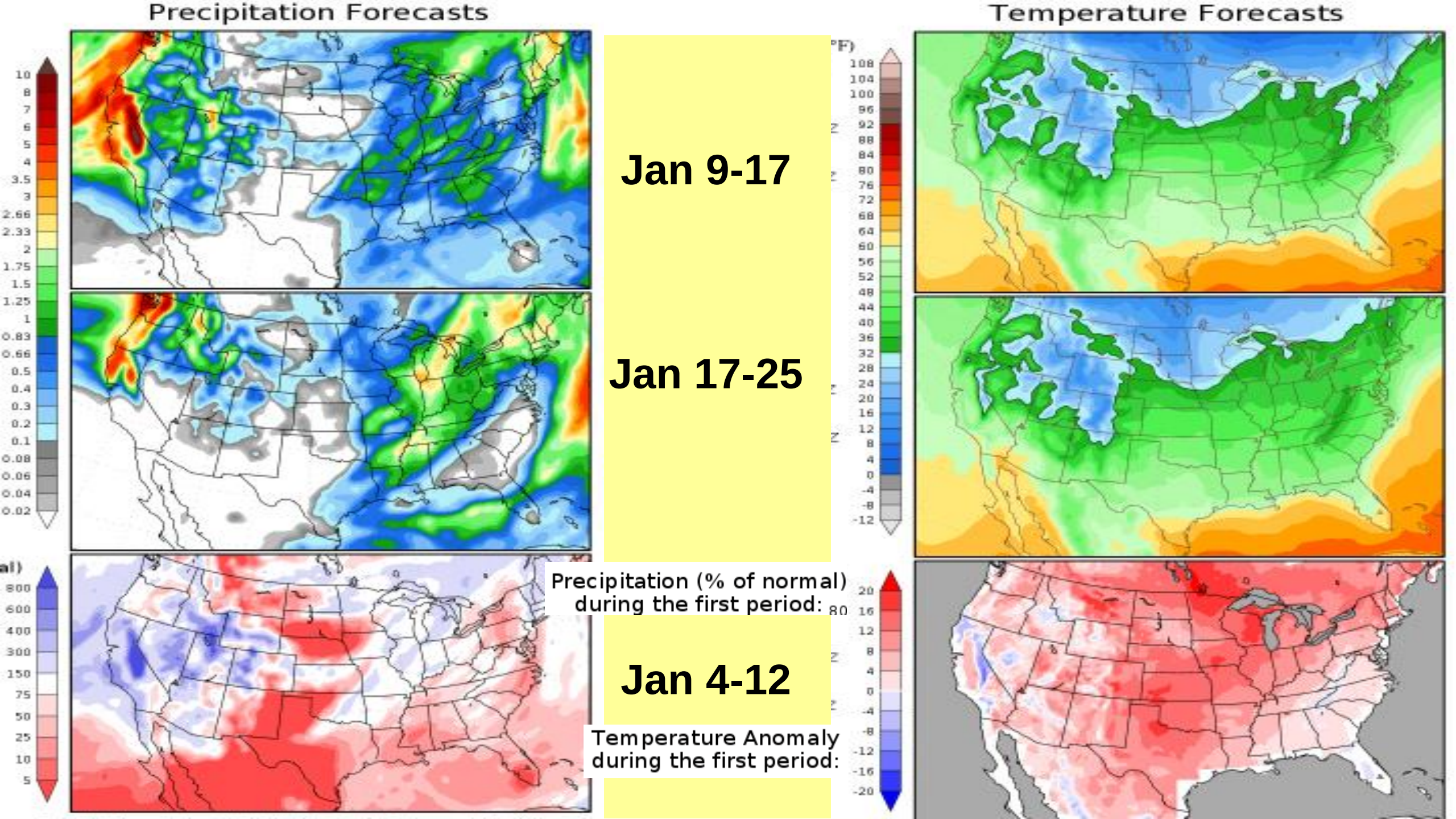
MON 9TH | TUE 10TH | WED 11TH | THU 12TH | FRI 13TH | SAT 14TH | SUN 15TH

PLAN YOUR NEXT SESSION WITH 16-

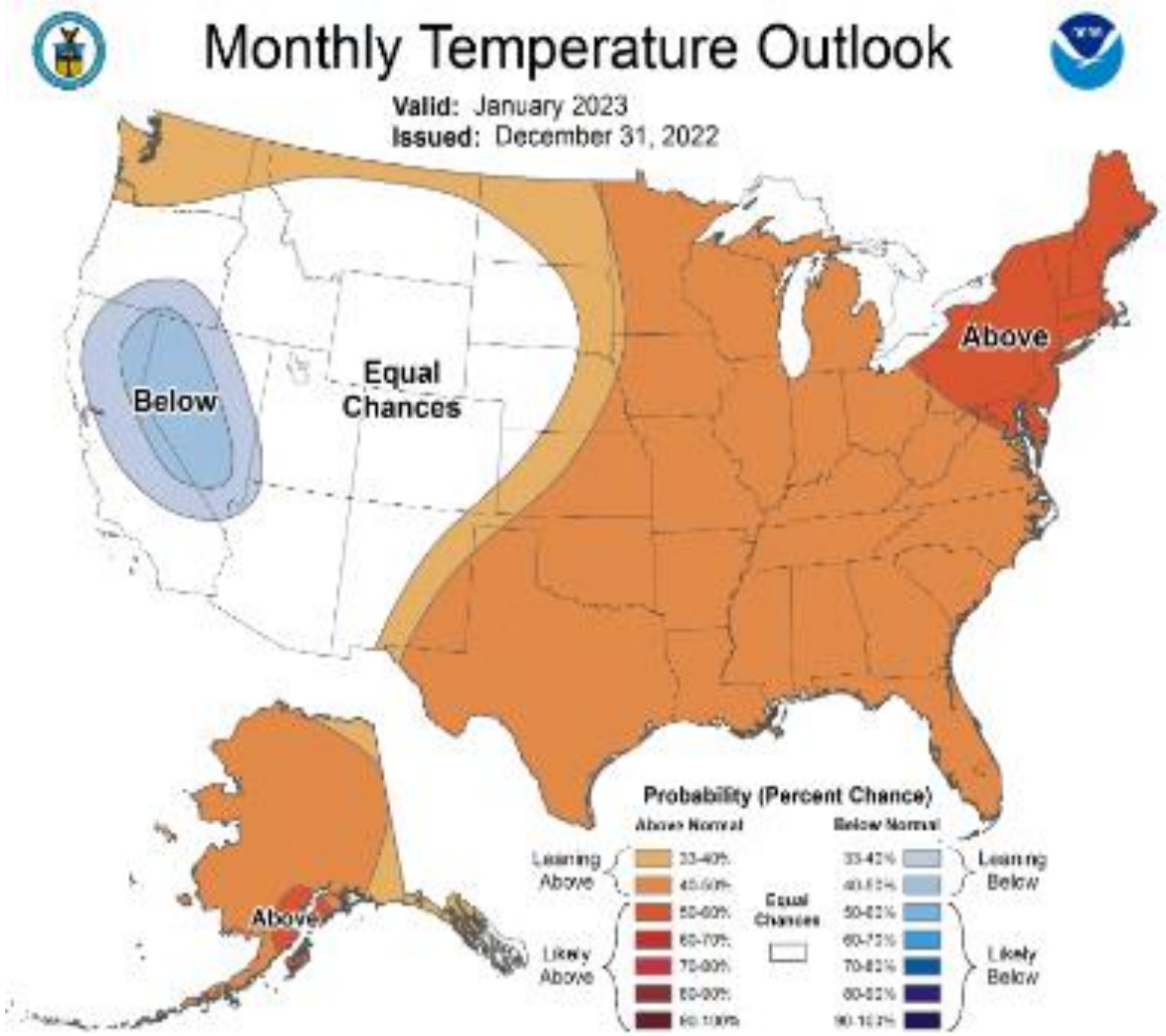
MON 16TH | TUE 17TH | WED 18TH | THU 19TH

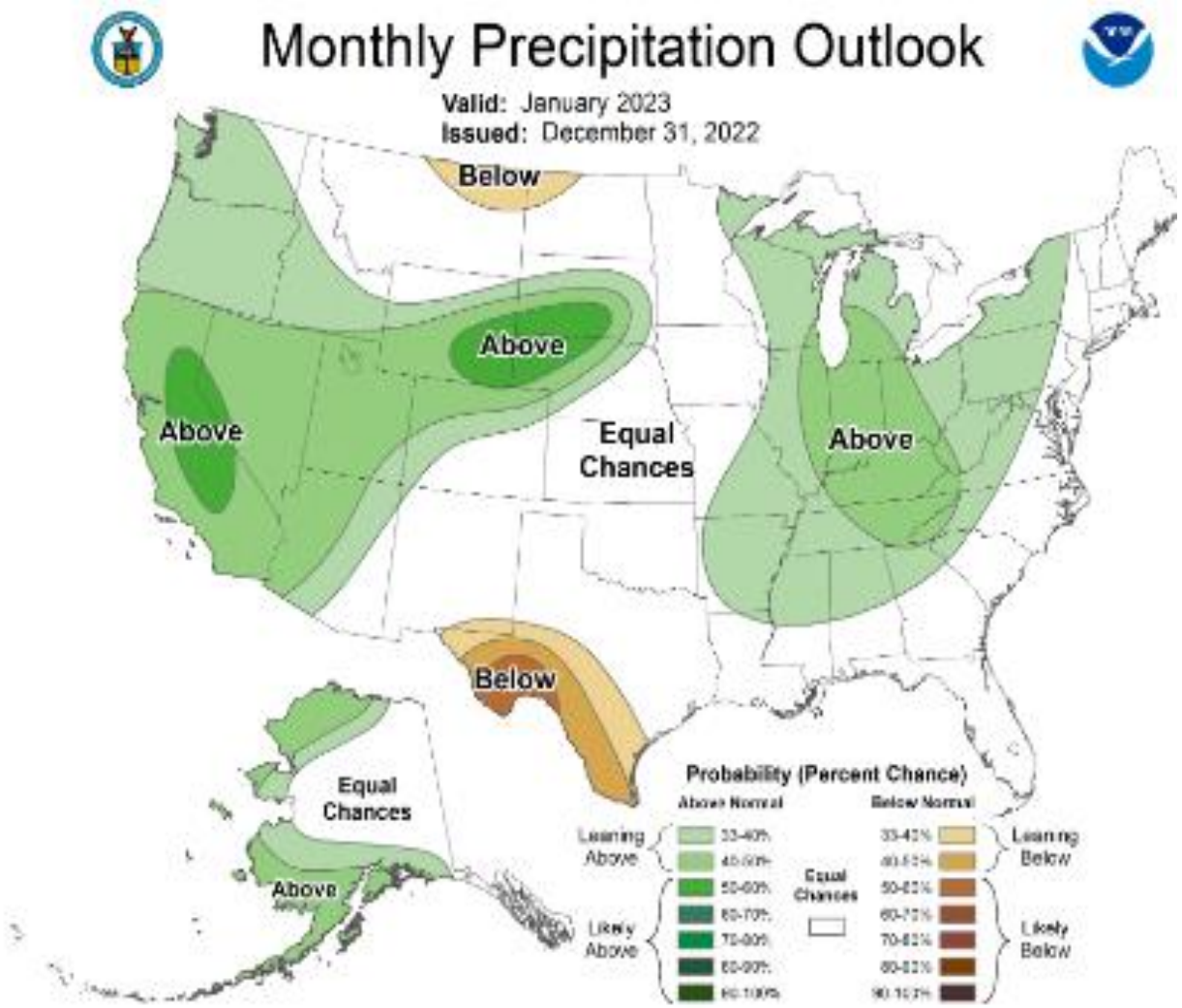


7 Day Total Precipitation Jan 10-17


Precipitation Forecasts
Temperature Forecasts
Jan 9-17
Jan 17-25
Jan 4-12
Precipitation (% of normal) during the first period:
Temperature Anomaly during the first period:

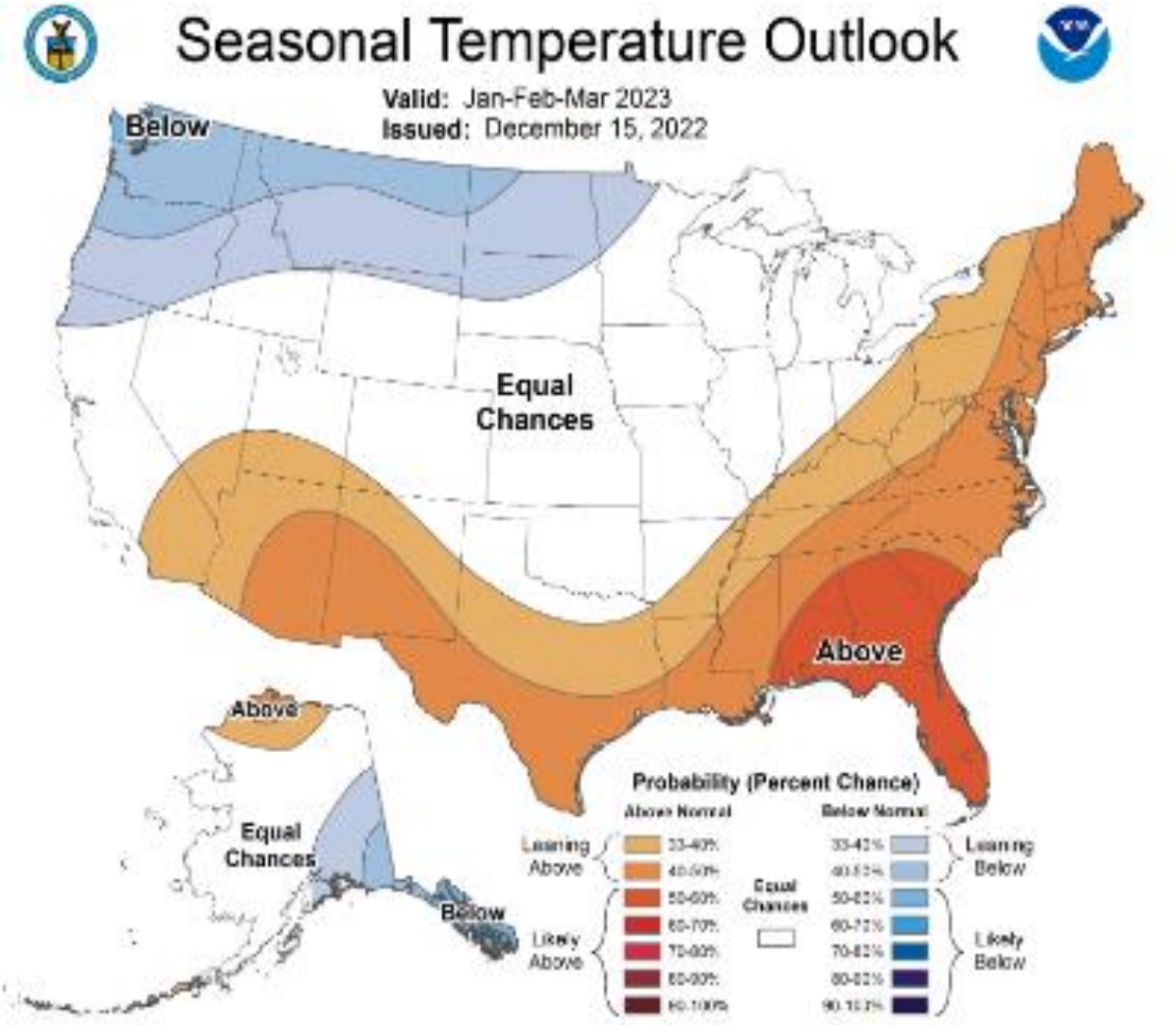
January Outlook from Dec 31
Temperature & Precipitation

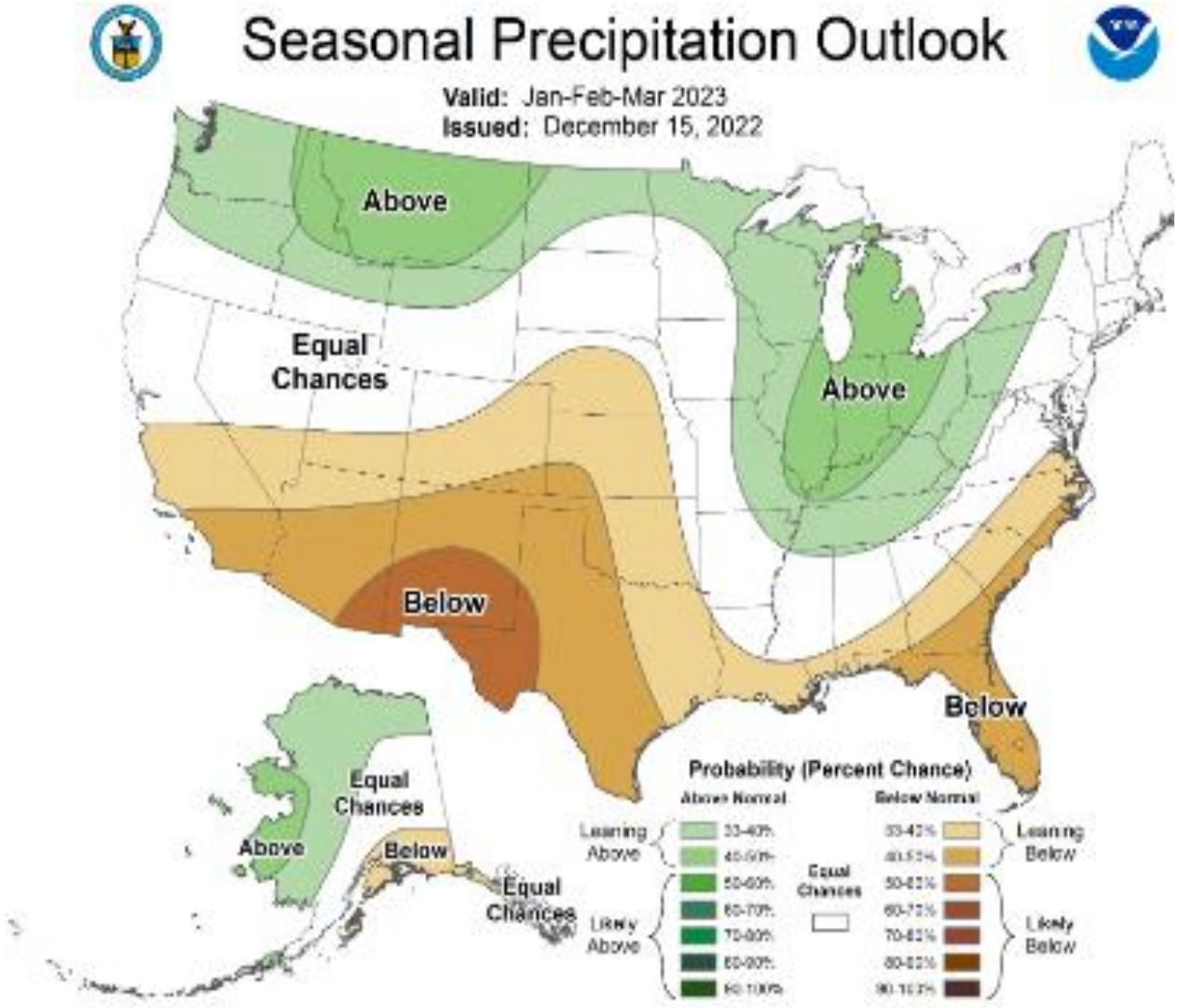




Seasonal Outlook for Jan-Feb-Mar from Dec 15

Temp **Precip**





Keep your eye on the horizon and let's hope the storms continue building snowpacks across Idaho in the 2nd half of winter !!!