Idaho and Eastern Oregon Alfalfa & Clover Seed Growers Conference
2024 Winter Meeting Agenda
Tuesday January 9, 2024 Best Western – Caldwell, Idaho

2024 Water Year Outlook

This talk & more posted here https://snowweatherandflow.blog/

Ron Abramovich
Mostly Retired but still watching the weather….

Topics:

- Current ocean & atmosphere conditions
  Super El Nino – lets hope so
- 2024 analog years based on current conditions
- Fall / Winter streamflow & soil moisture
- Current snow conditions & chance for recover by Apr 1
- January 1 streamflow forecasts & amount needed for adequate supplies

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

Background Information:
Three Primary Atmospheric Teleconnections or Drivers

ENSO – El Nino / La Nina – measure of Pacific sea surface temperatures
=> Cool temps - La Nina conditions – past 3 winters
=> Warmer temps - Strong El Nino conditions – this winter 2022-23

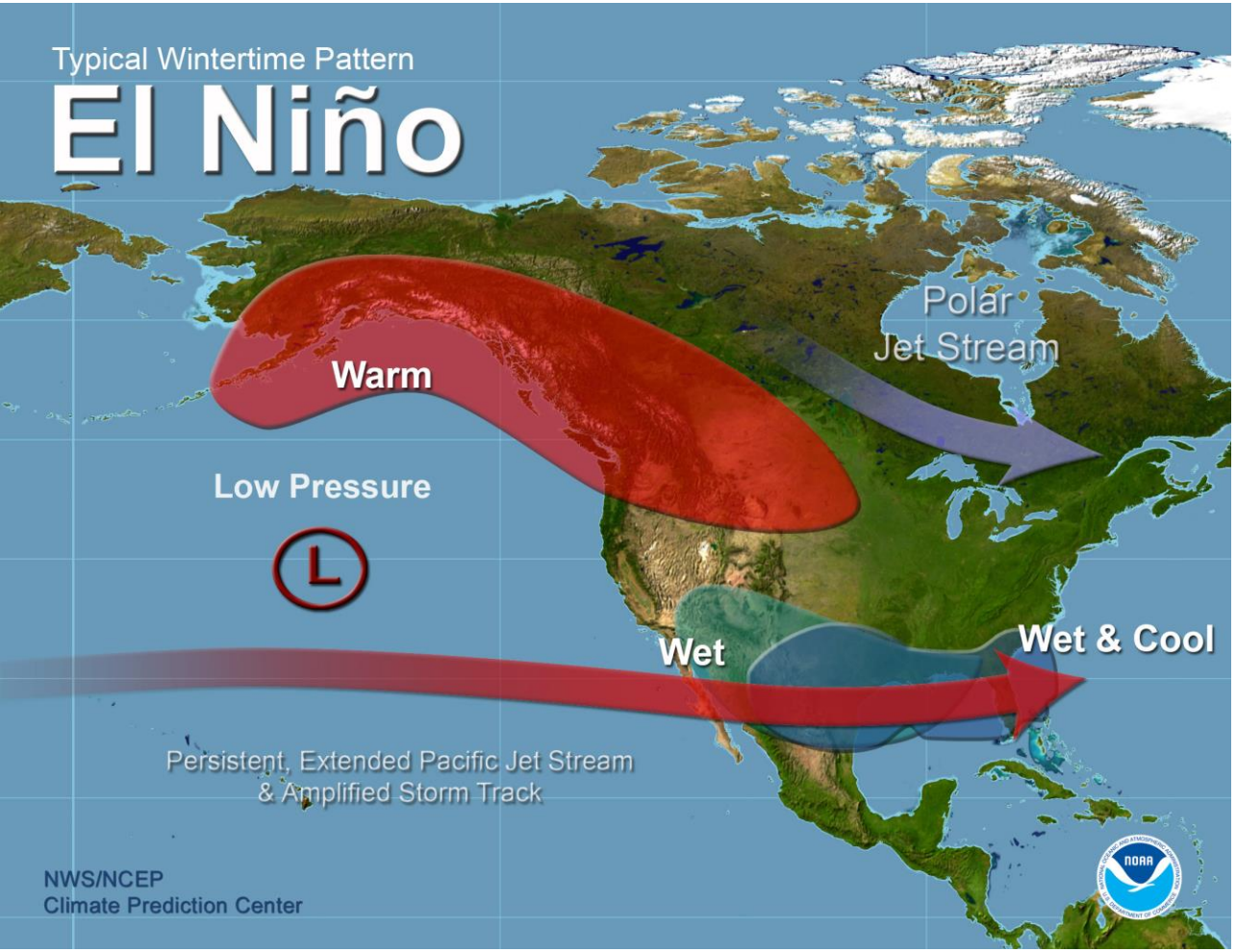
Southern Oscillation Index (SOI) - measure of the Pacific atmosphere
=> Positive - La Nina conditions – past 3 winters
=> Negative - El Nino conditions – this winter 2022-23

Pacific Decadal Oscillation (PDO) – measure of north Pacific sea surface temps
=> Cool Phase – cool the past few years

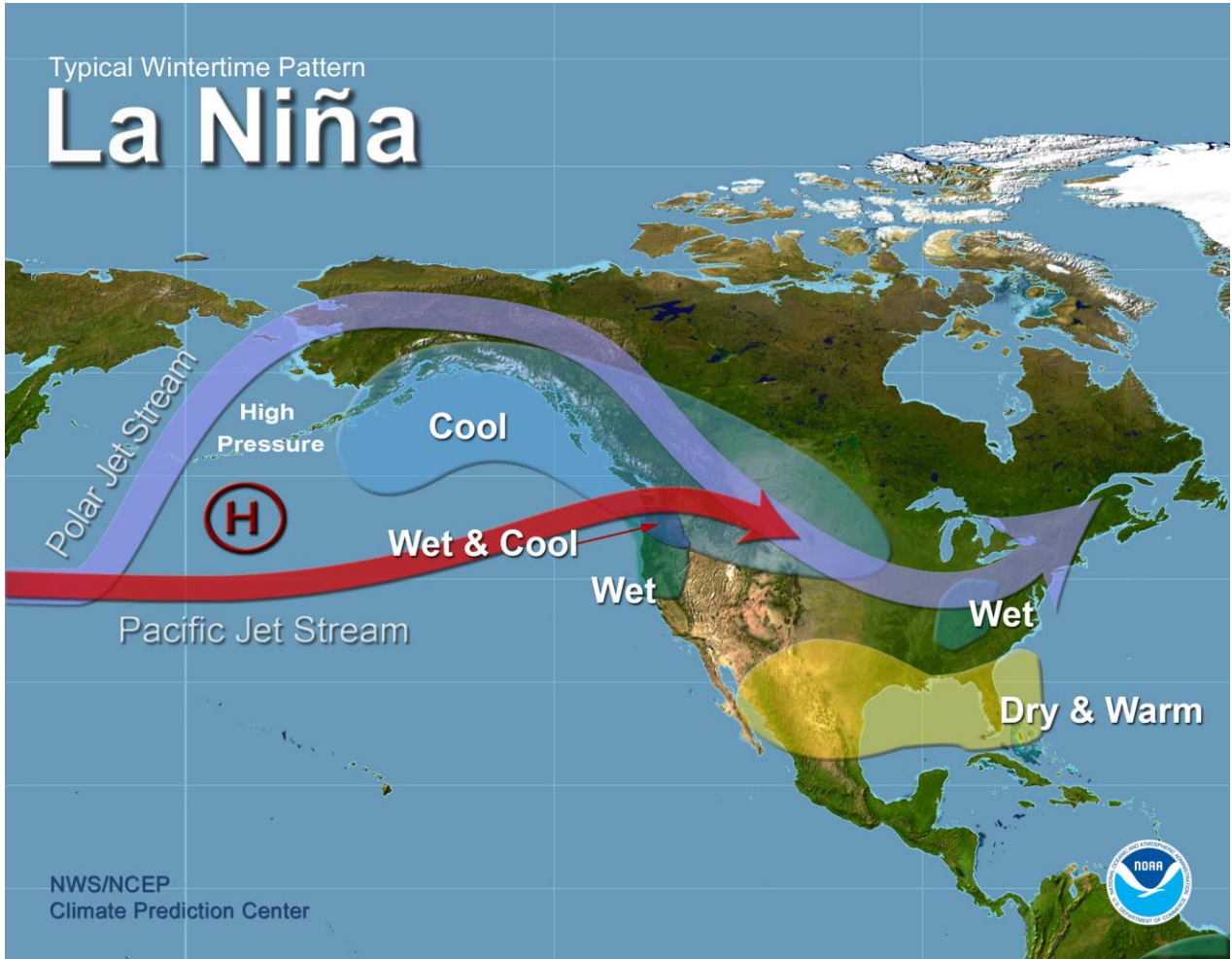
Many researchers, like Pete Parsons, look at these climate teleconnections that correlate with our wet season (winter) to better understand what the future may bring.

Quick Review

El Nino



La Nina



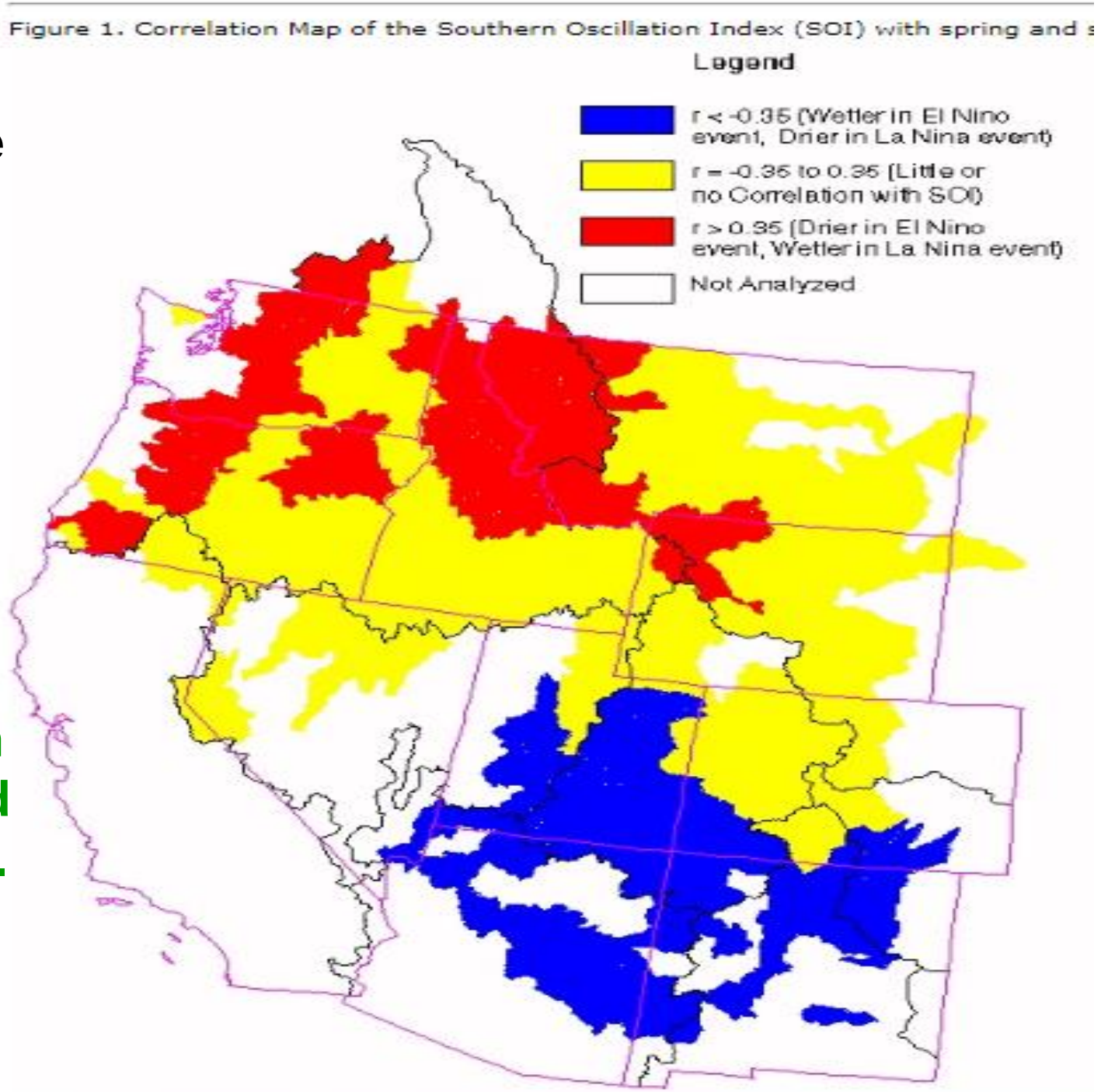
Southern Oscillation Index (SOI) measure of the Pacific Atmosphere

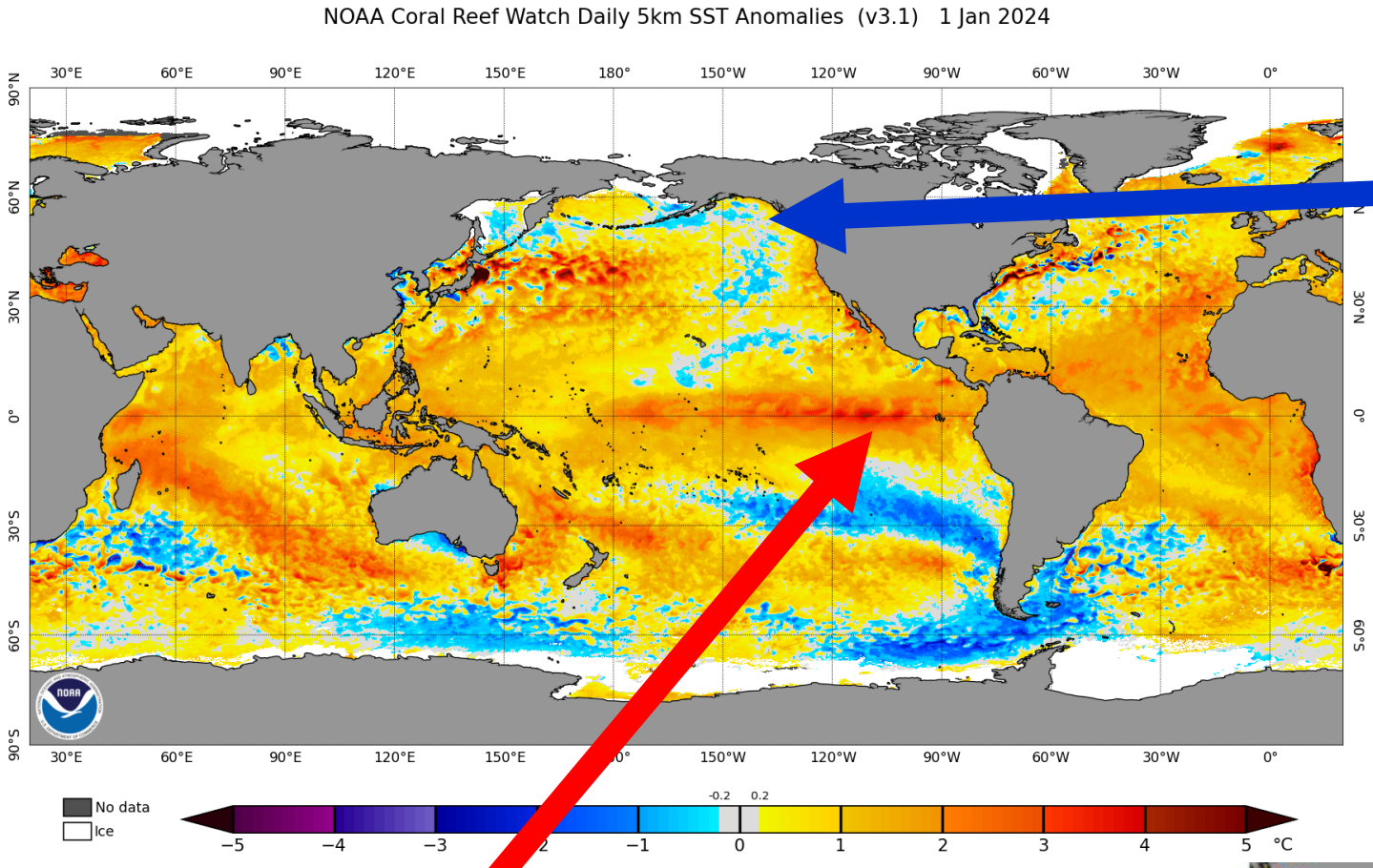
Correlation Map of SOI with Spring-Summer Streamflow

Red wetter in La Nina years.

Blue wetter in El Nino years.

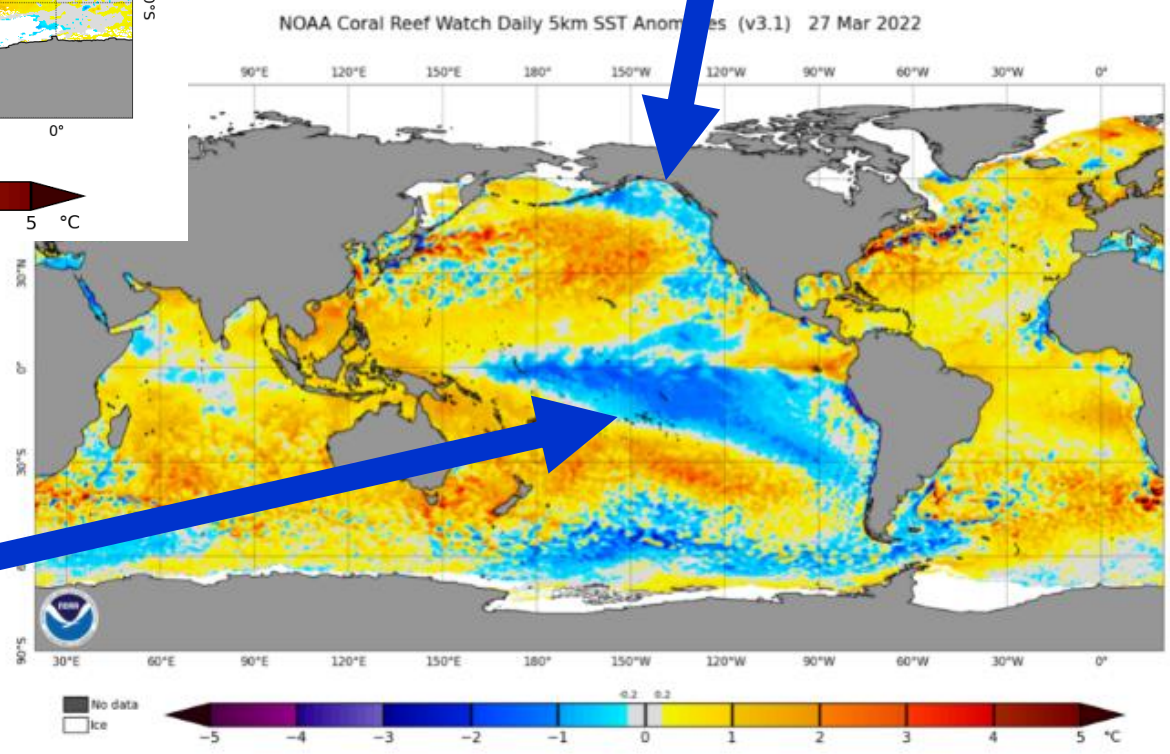
Key is – what happens July-Nov in Pacific correlates with snowfall and summer streamflow in Western US.





PDO Cool Phase
Winter 2024

Winters 2022 & 2023



El Nino conditions
Jan 1, 2024

La Nina conditions
Mar 27, 2022

From Oregon Department of Forestry
Meteorologist
Pete Parsons Dec 21, 2023

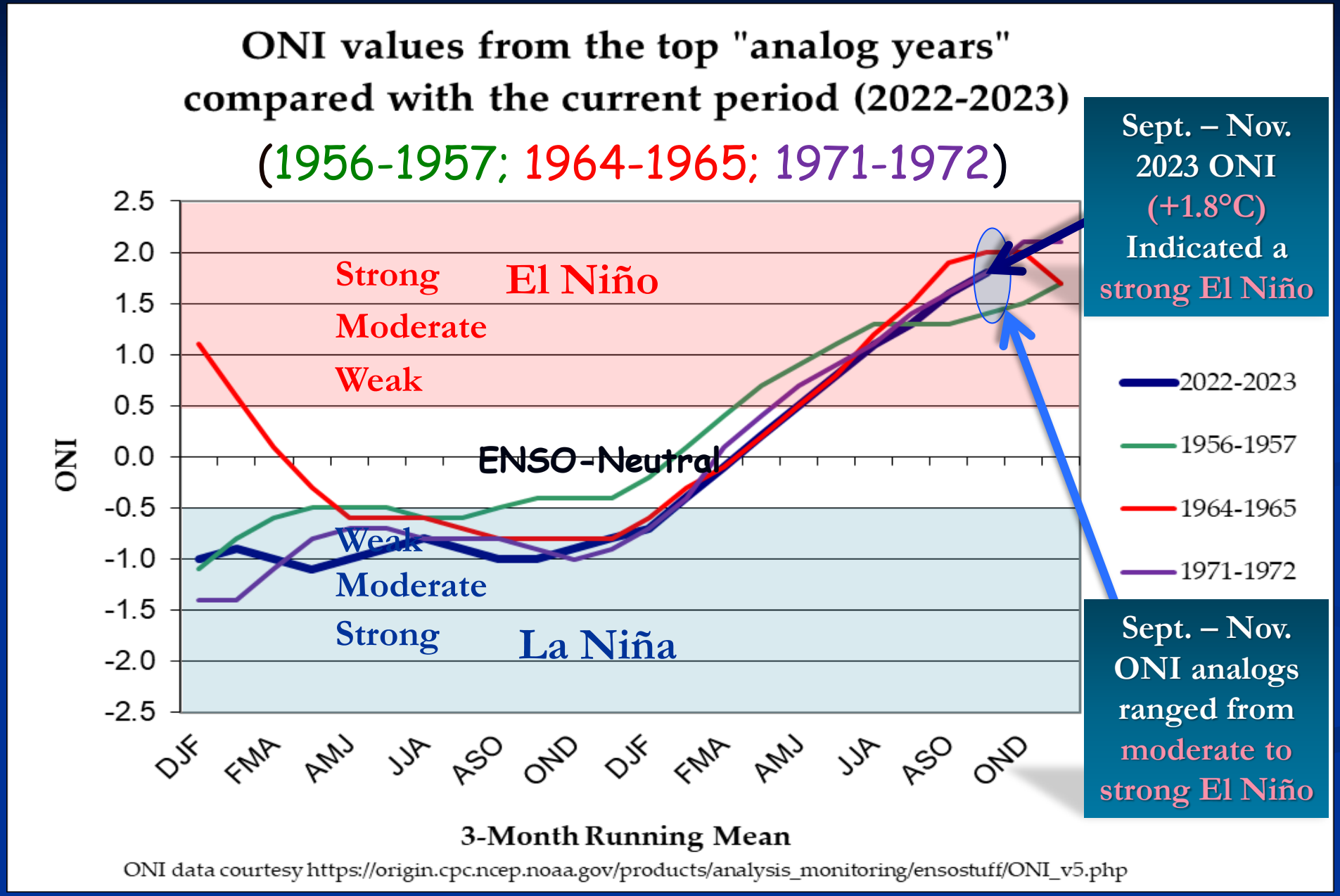
Jan Curtis retired USDA Climatologist provided input for Pete's analysis

Forecast Highlights

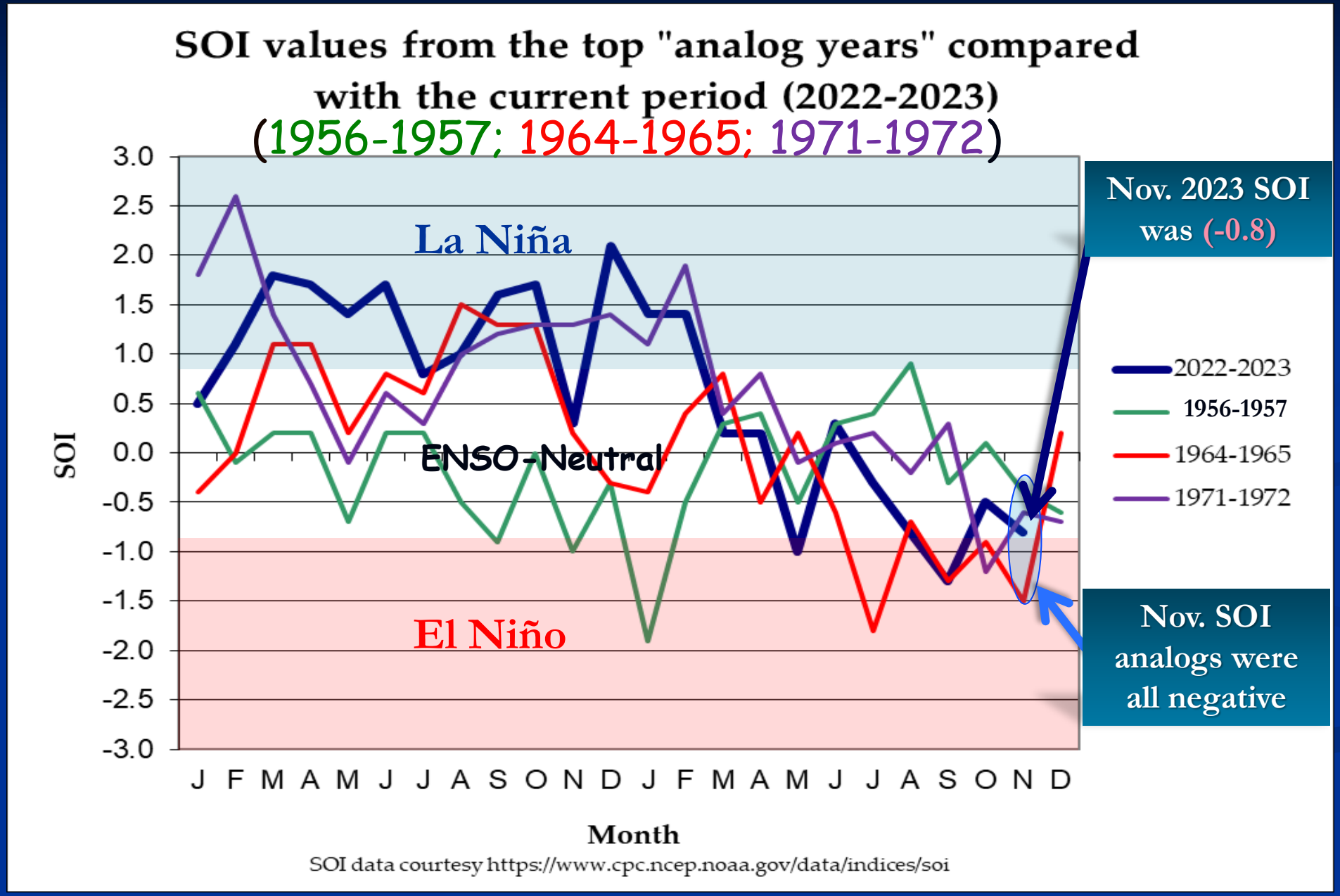
- Analog years are water years 1958, 1966 & 1973

- Bottom line: Expect a relatively mild winter...below-average rain & mountain snow north with near-average rain and mountain snow south

Oceanic Niño Index (ONI)

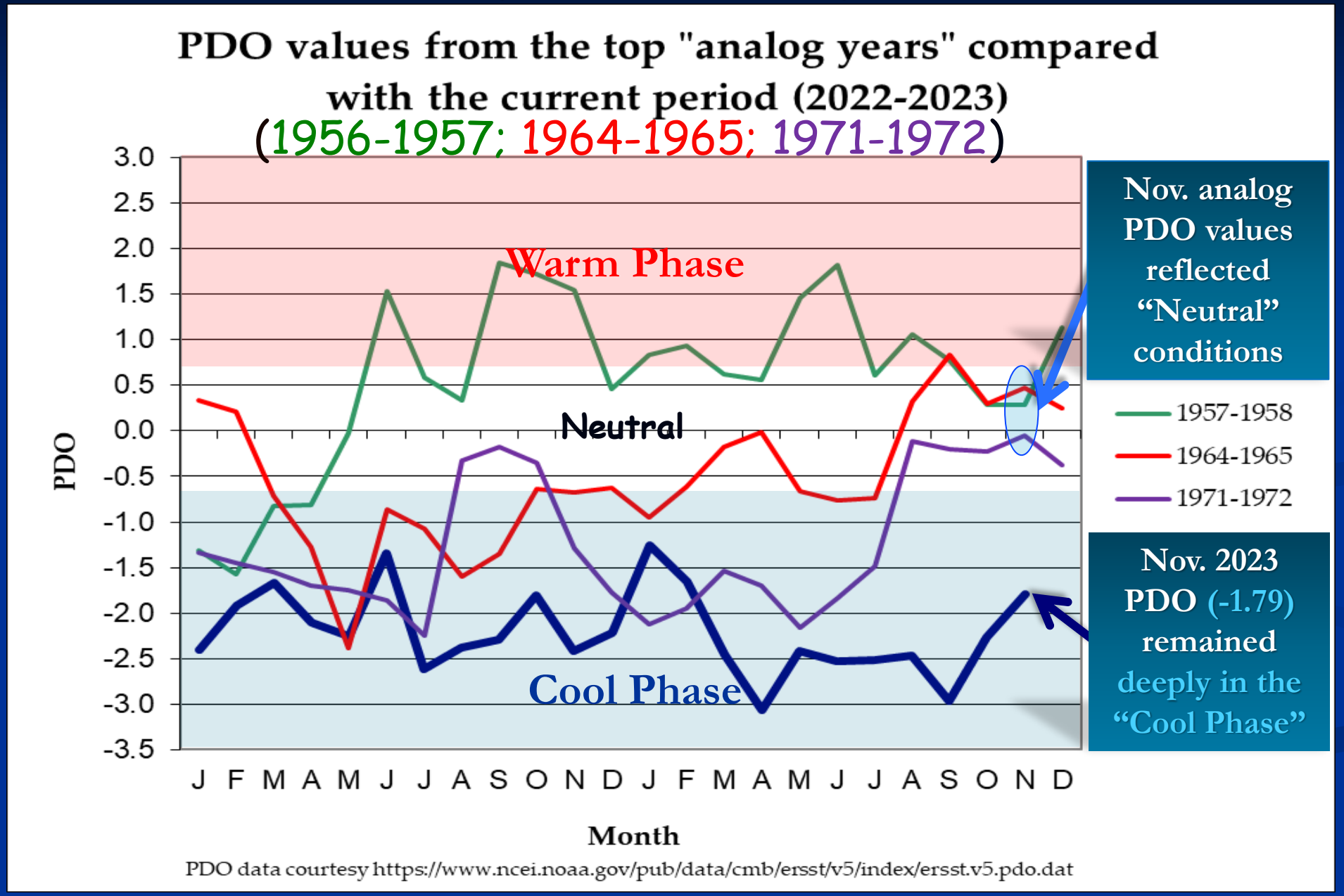


Southern Oscillation Index (SOI)



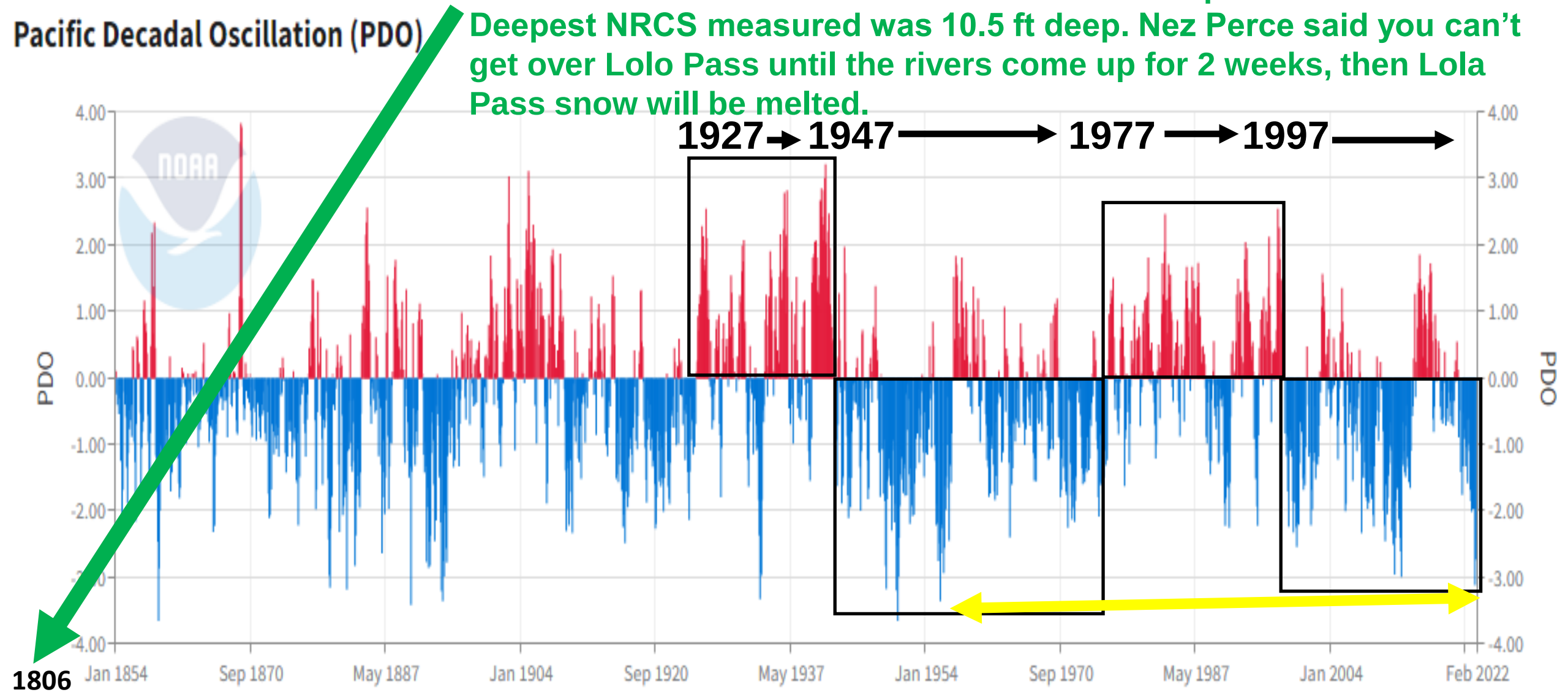
North Pacific Ocean

(Poleward of 20°N Latitude)



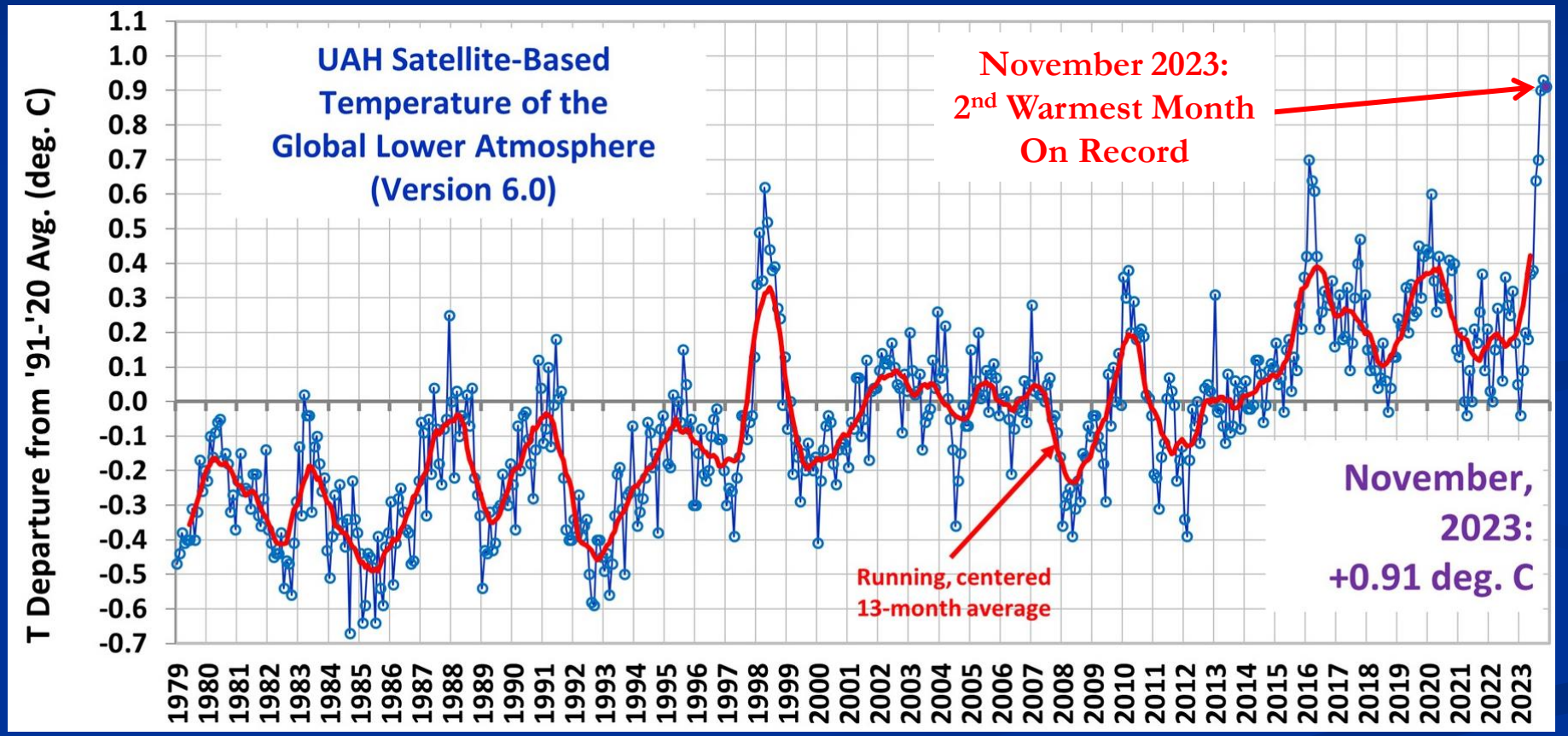
The Pacific Decadal Oscillation (PDO) is often described as a long-lived El Niño-like pattern of Pacific climate variability (Zhang et al. 1997).

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 Lola Pass snow will be melted.

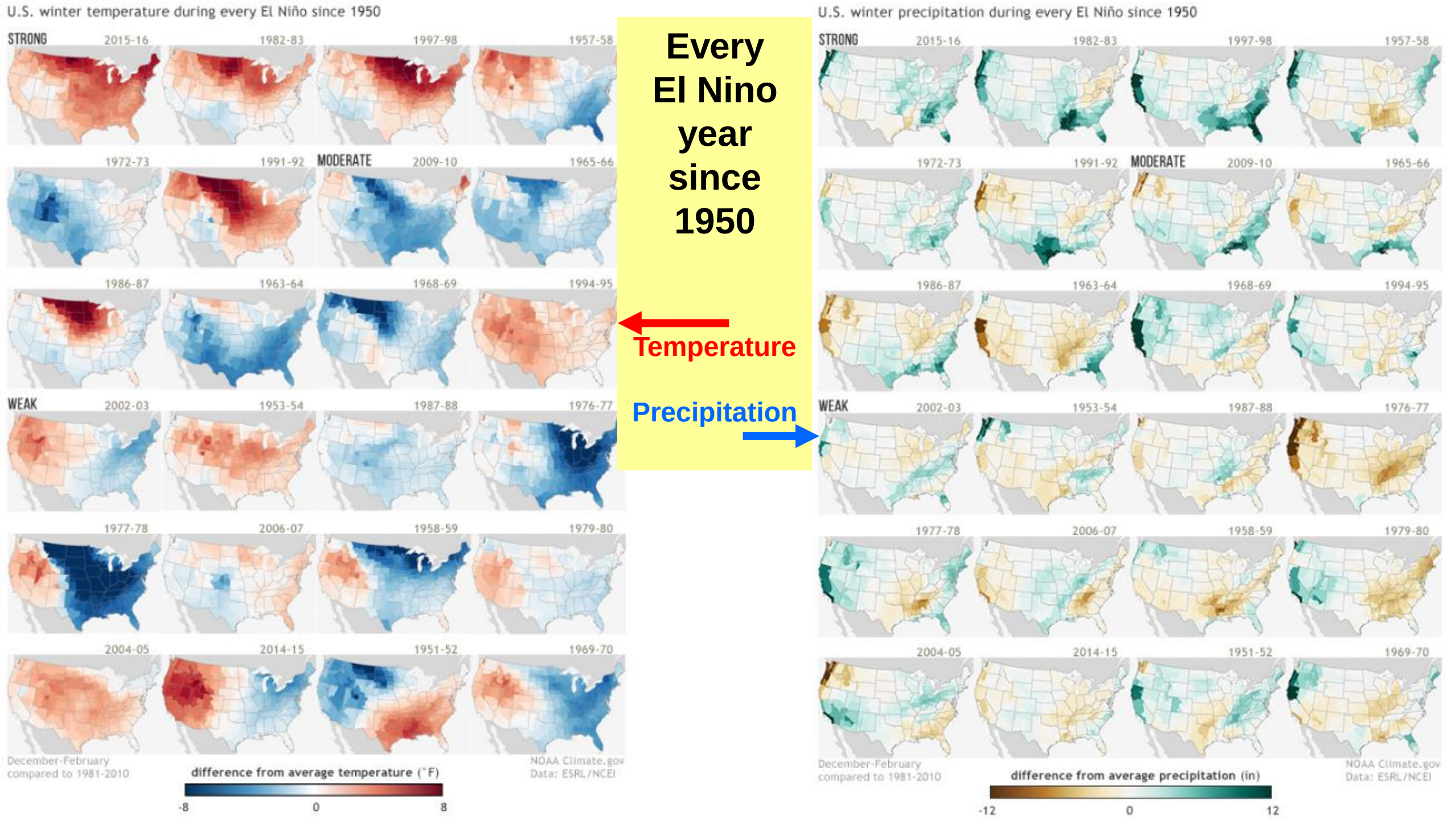


COLDEST IN 60 YRS!

Global Temperature Changes Increase Error in Analog Forecasts!



Courtesy: http://www.drroyspencer.com/latest-global-temperatures/


U.S. winter temperature during every El Niño since 1950
STRONG
2015-16
1982-83
1997-98
1957-58
1972-73
1991-92
MODERATE
2009-10
1965-66
1986-87
1963-64
1968-69
1994-95
WEAK
2002-03
1953-54
1987-88
1976-77
1977-78
2006-07
1958-59
1979-80
2004-05
2014-15
1951-52
1969-70
December-February
compared to 1981-2010
difference from average temperature (°F)
-8
0
8
NOAA Climate.gov
Data: ESRL/NCEI
Every El Nino year since 1950
Temperature
Precipitation
U.S. winter precipitation during every El Niño since 1950
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2015-16
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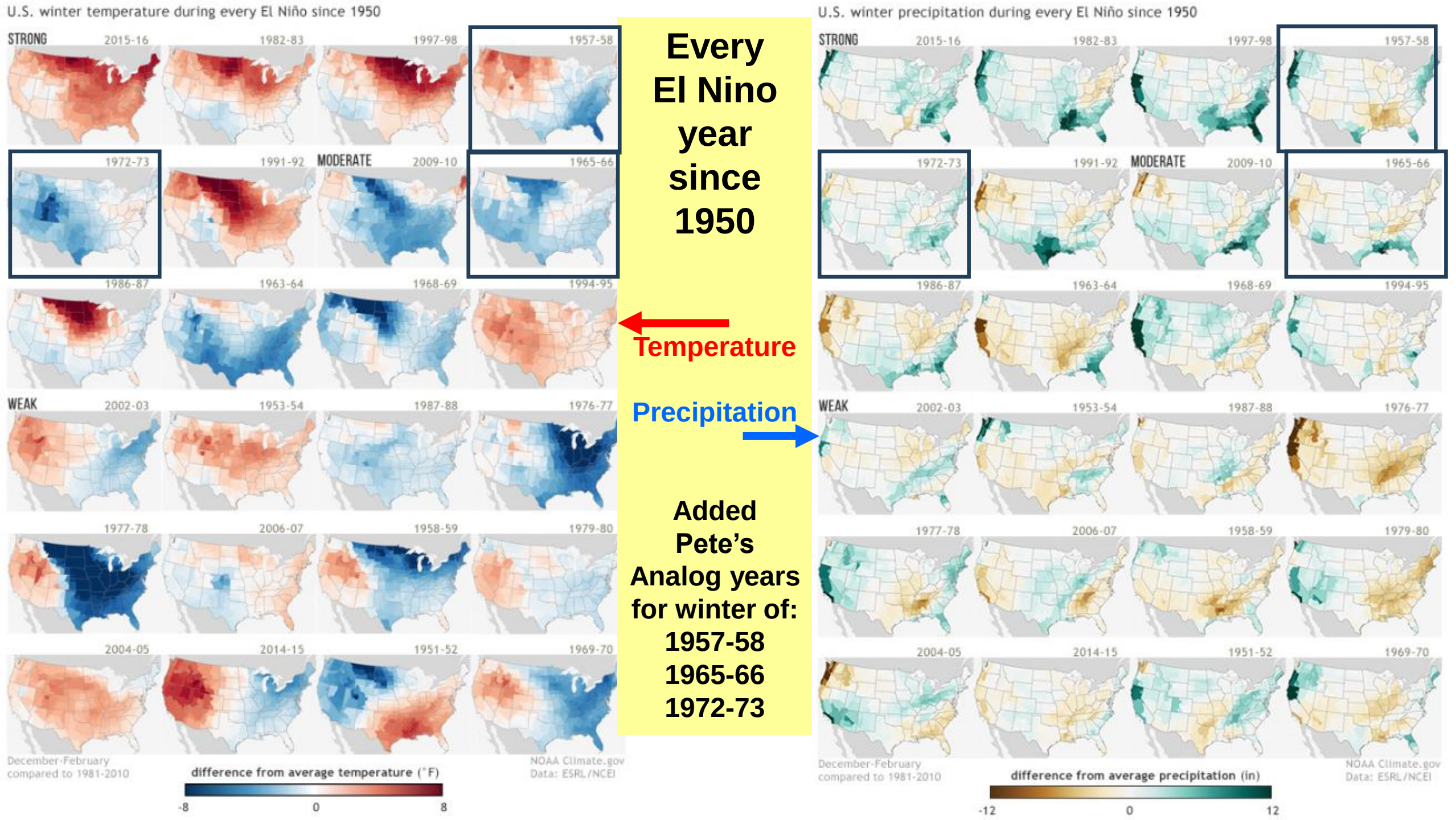
-12
0
12
NOAA Climate.gov
Data: ESRL/NCEI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Every El Nino year since 1950
Temperature
Precipitation
Added Pete's Analog years for winter of:
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1965-66
1972-73
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2015-16
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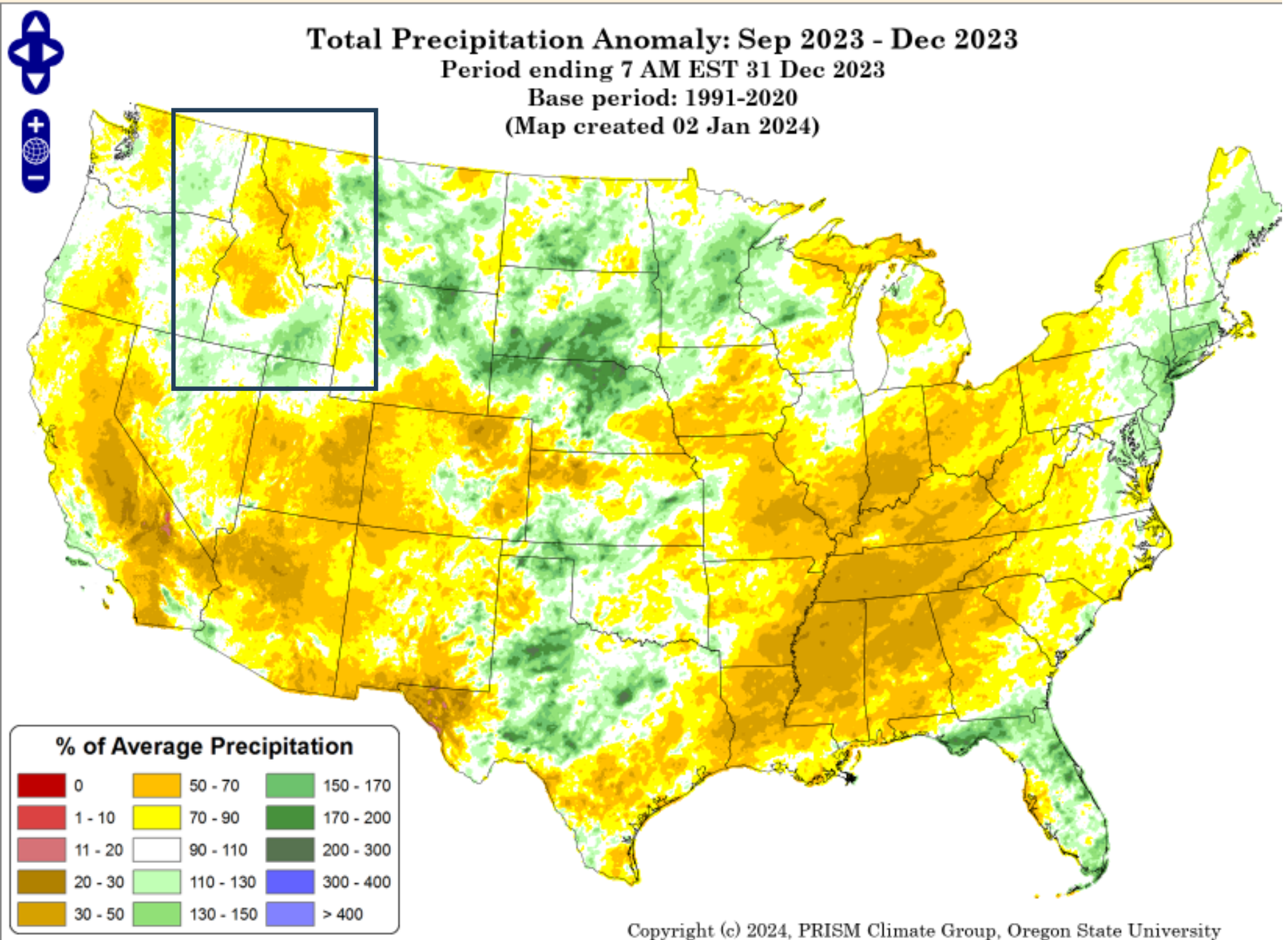
compared to 1981-2010
difference from average precipitation (in)
-12
0
12
NOAA Climate.gov
Data: ESRL/NCEI

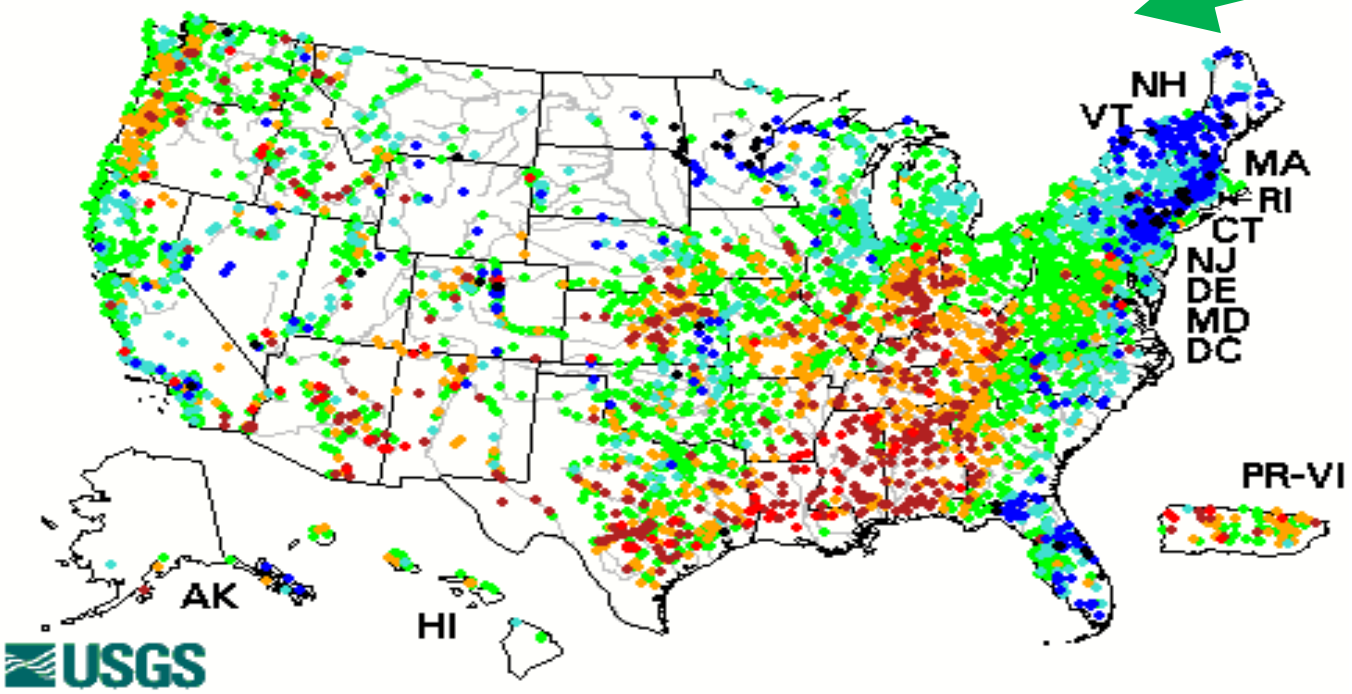


Precipitation Idaho Sep – Dec 2023

50 to 110% of normal

Daily Streamflow Conditions

Sunday, December 31, 2023 17:30ET



Explanation

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

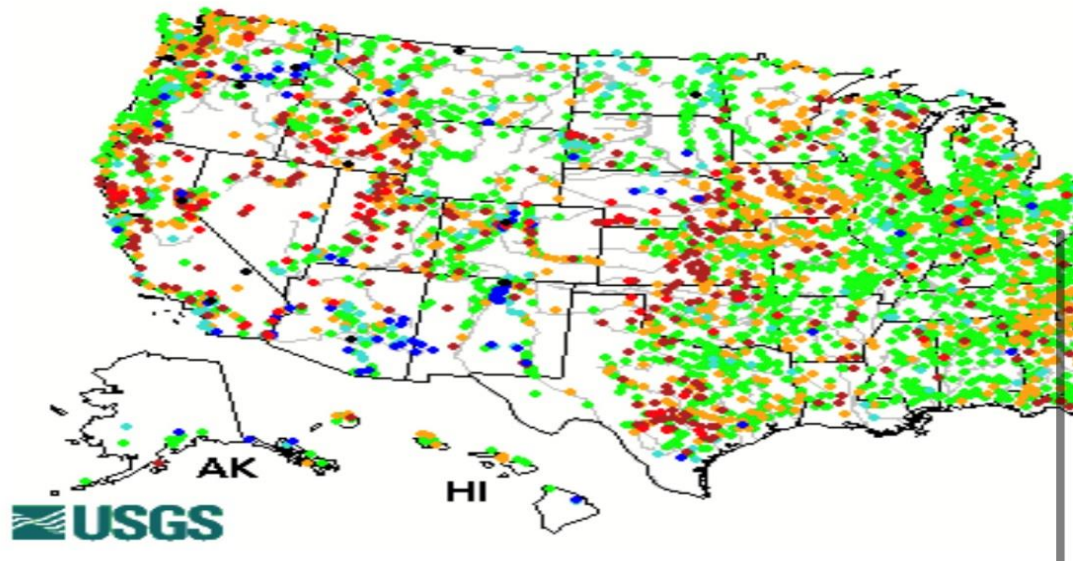
Dec 31, 2023 Fall Base Flows

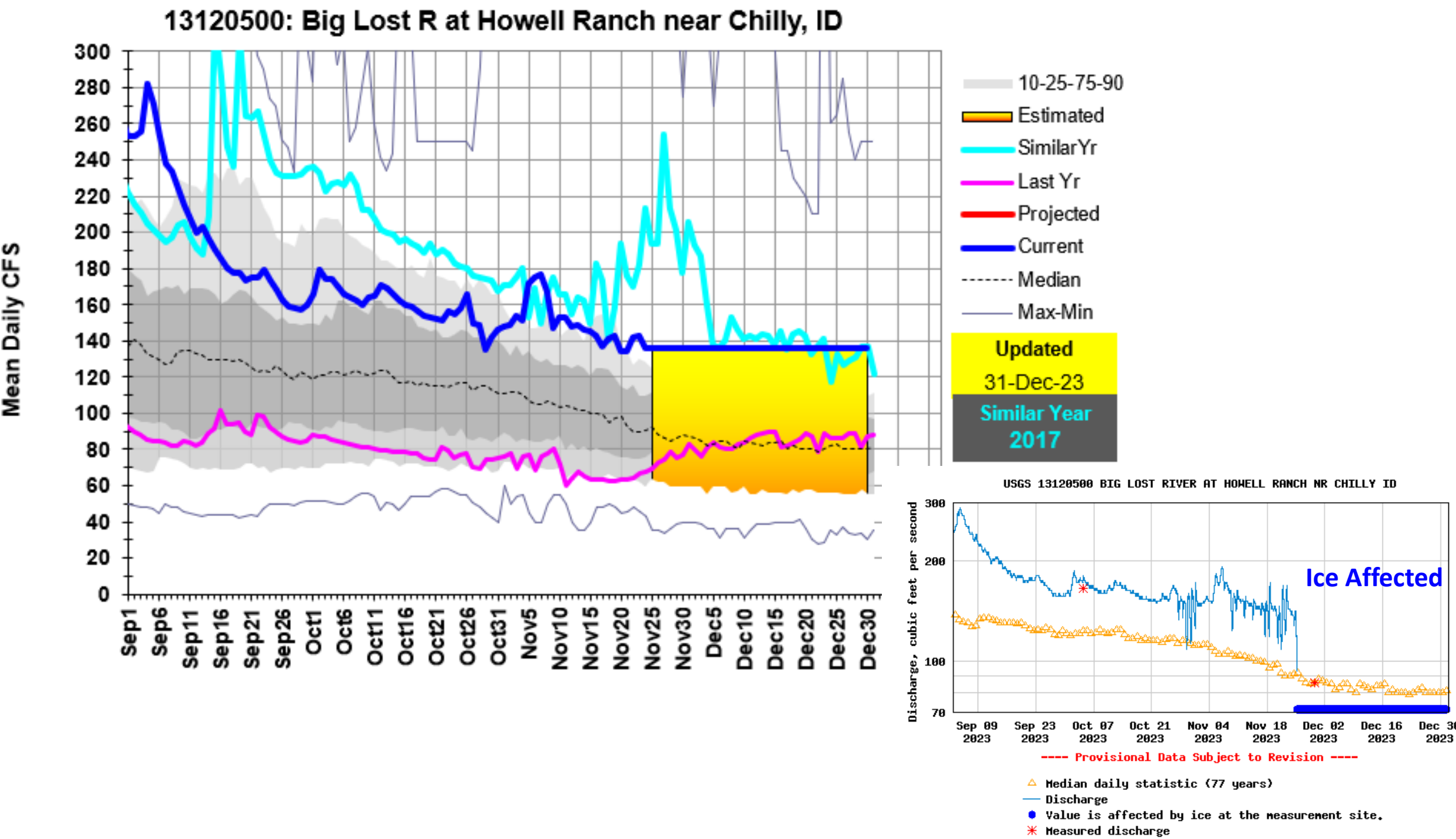
Fall 2023 flows near to above normal while in Fall 2022 were near record low because of cold temps and early snowfall.

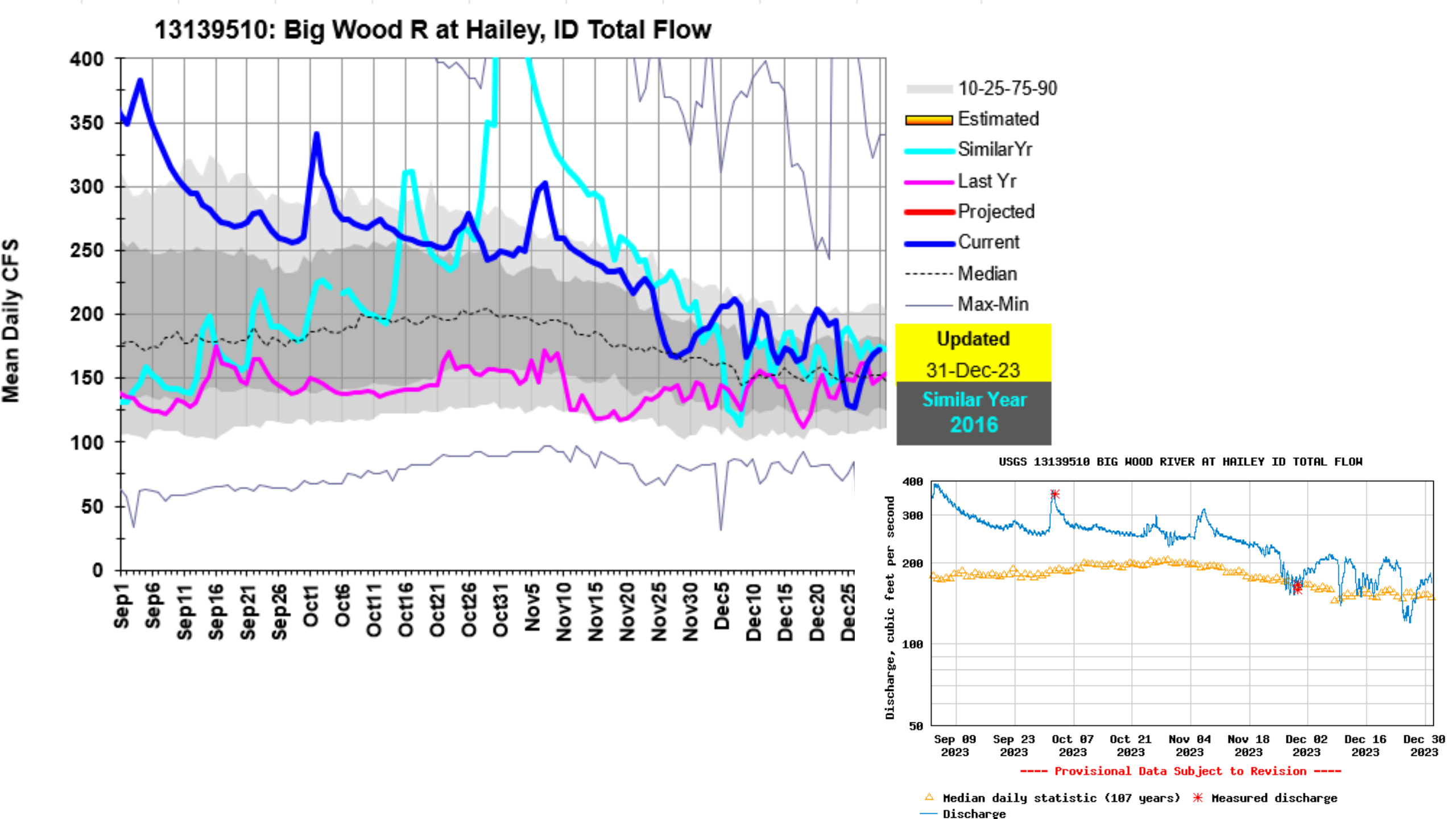
Nov 3, 2022 Fall Base Flows

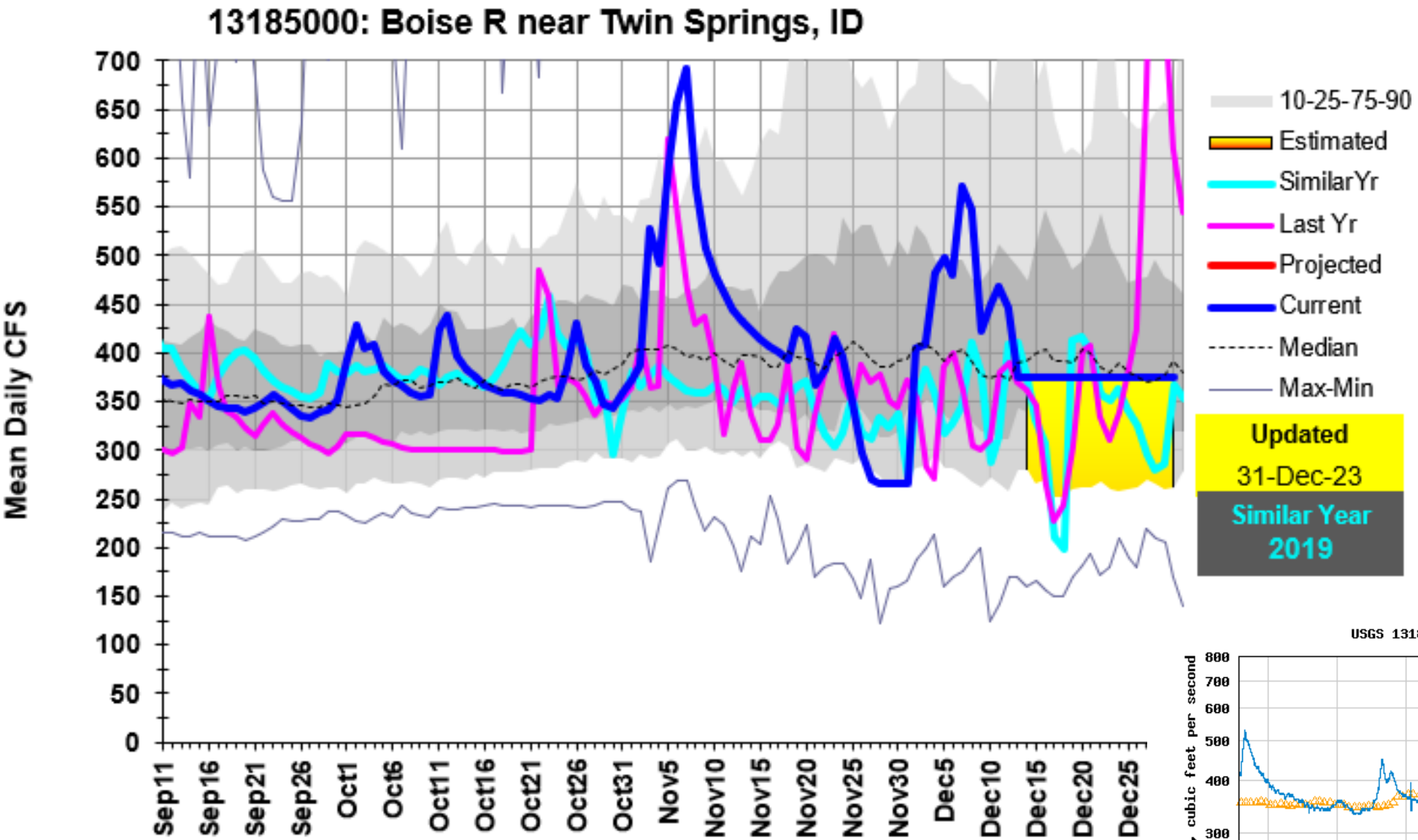
Daily Streamflow Conditions

Thursday, November 03, 2022 10:30ET

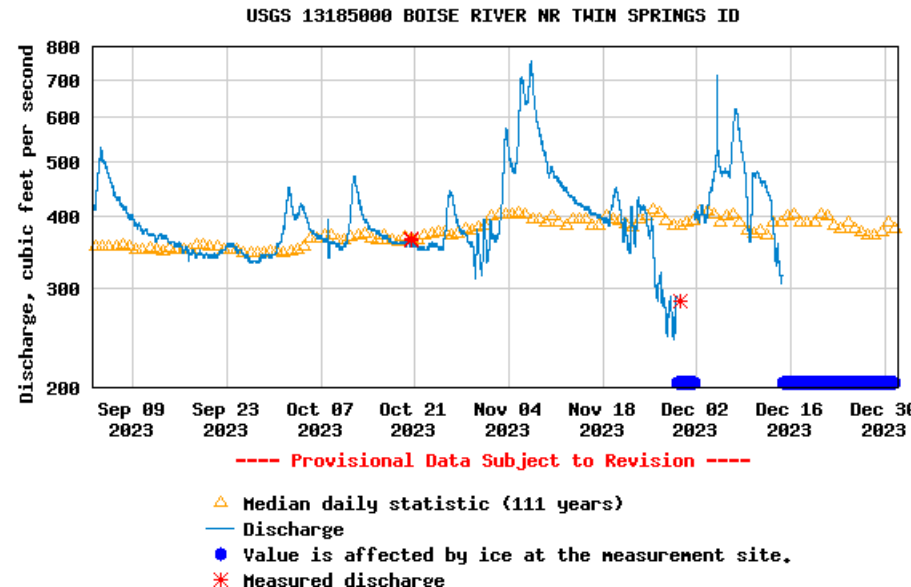



13120500: Big Lost R at Howell Ranch near Chilly, ID
Mean Daily CFS
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
Dec20
Dec25
Dec30
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
31-Dec-23
Similar Year
2017
USGS 13120500 BIG LOST RIVER AT HOWELL RANCH NR CHILLY ID
Discharge, cubic feet per second
300
200
100
70
Ice Affected
Sep 09
2023
Sep 23
2023
Oct 07
2023
Oct 21
2023
Nov 04
2023
Nov 18
2023
Dec 02
2023
Dec 16
2023
Dec 30
2023
---- Provisional Data Subject to Revision ----
Median daily statistic (77 years)
Discharge
Value is affected by ice at the measurement site.
Measured discharge


13139510: Big Wood R at Hailey, ID Total Flow
Mean Daily CFS
400
350
300
250
200
150
100
50
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
Dec20
Dec25
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
31-Dec-23
Similar Year
2016
USGS 13139510 BIG WOOD RIVER AT HAILEY ID TOTAL FLOW
Discharge, cubic feet per second
400
300
200
100
50
Sep 09 2023
Sep 23 2023
Oct 07 2023
Oct 21 2023
Nov 04 2023
Nov 18 2023
Dec 02 2023
Dec 16 2023
Dec 30 2023
---- Provisional Data Subject to Revision ----
Median daily statistic (107 years)
Measured discharge
Discharge

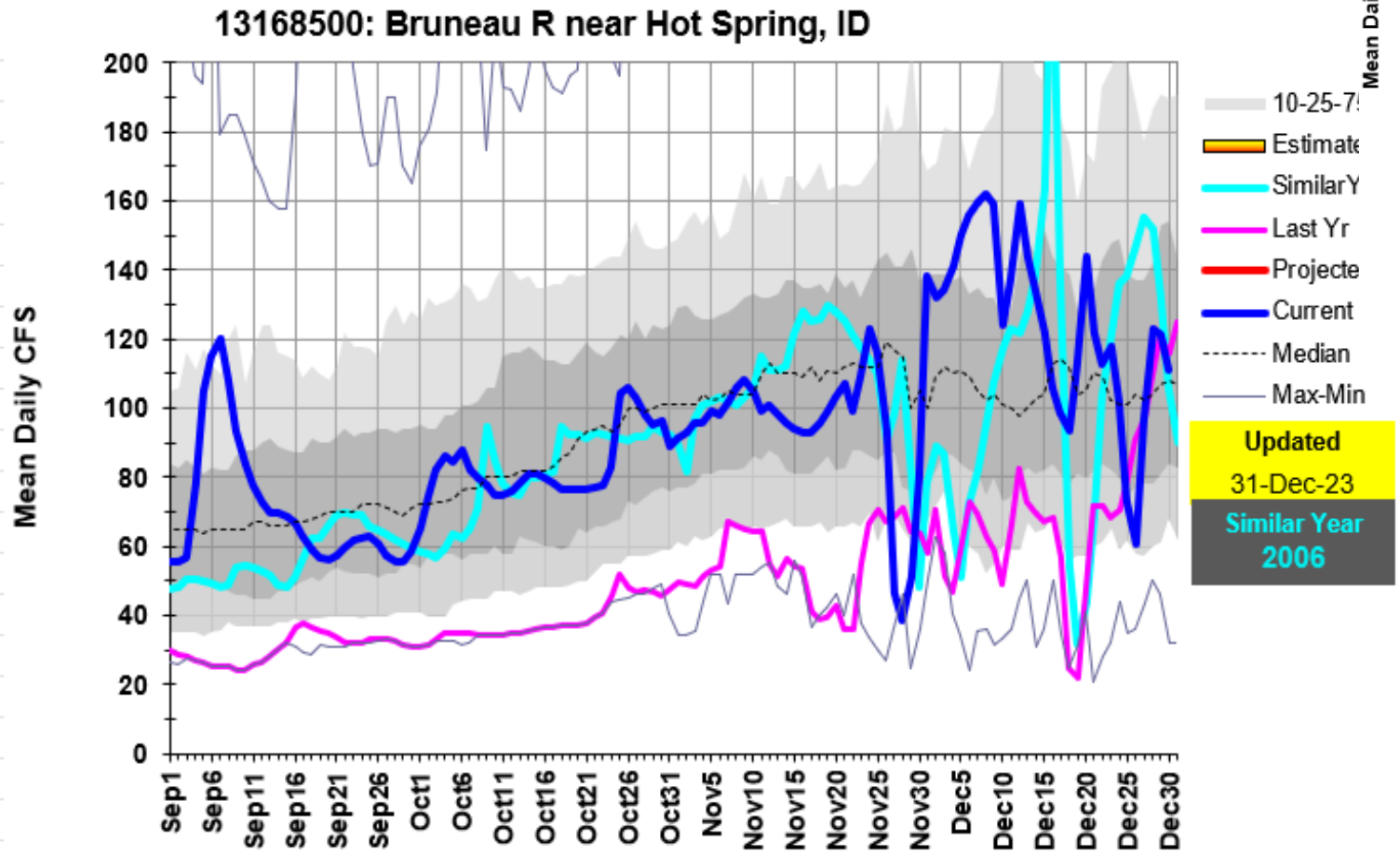


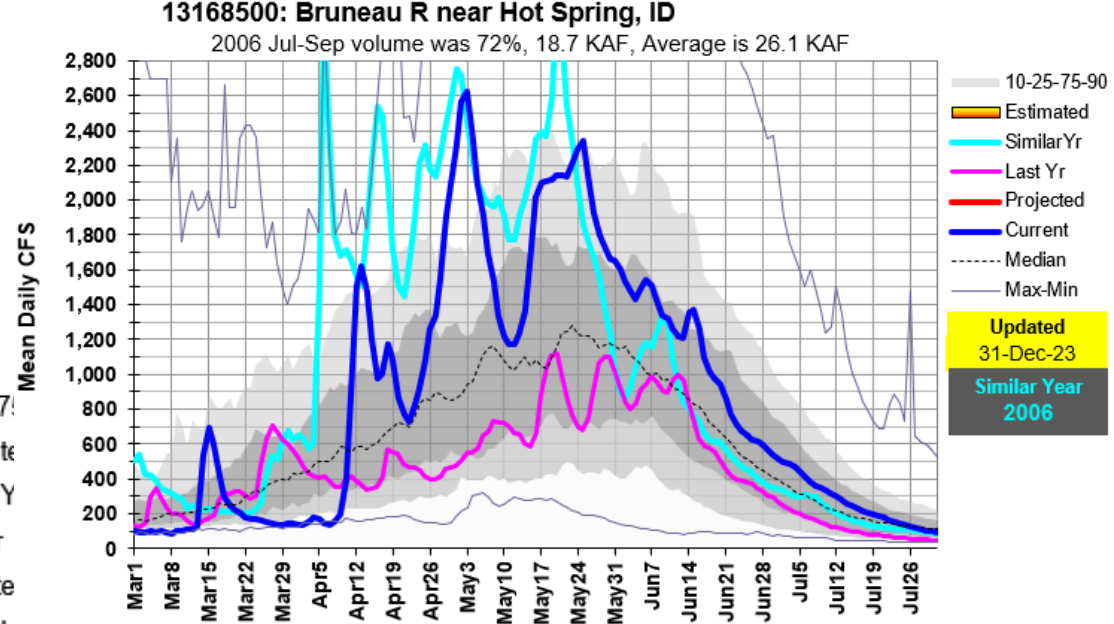
Ice Affected

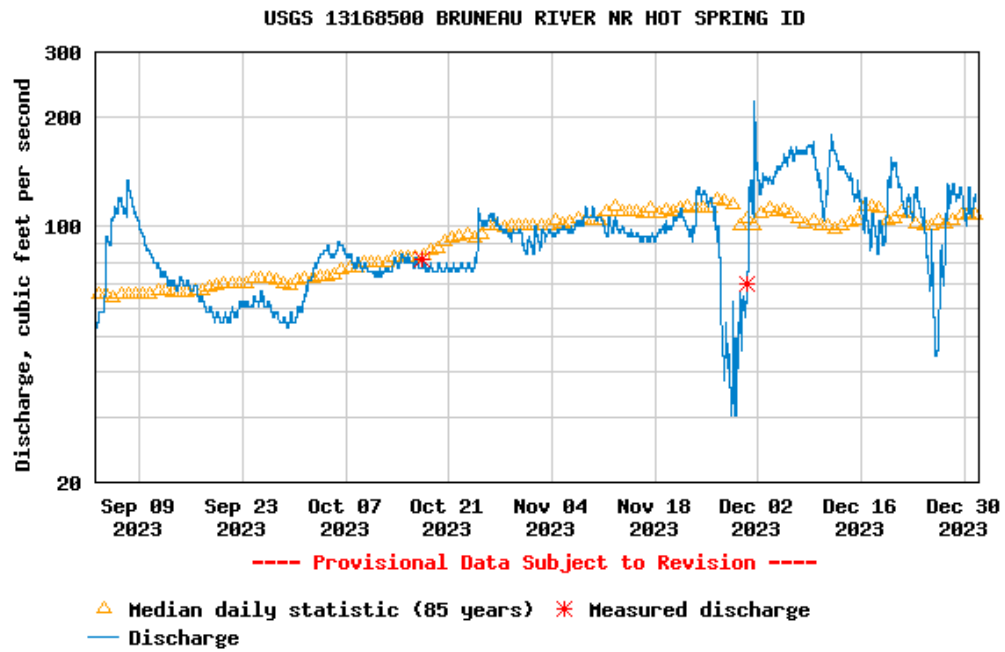


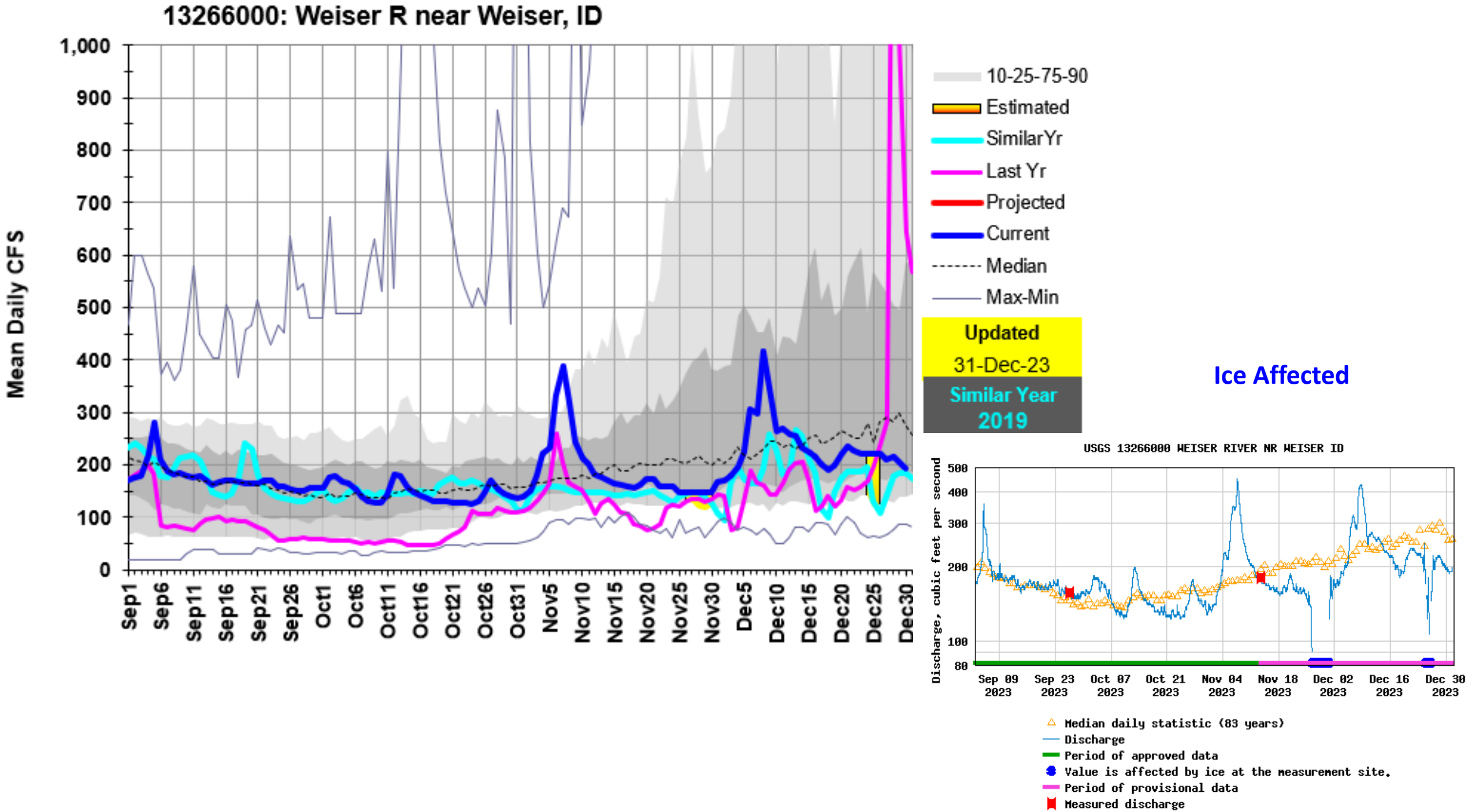
Similar Years selected by similar spring/summer peak/volume and recession flow along with the early winter level/pattern with ice present or not.

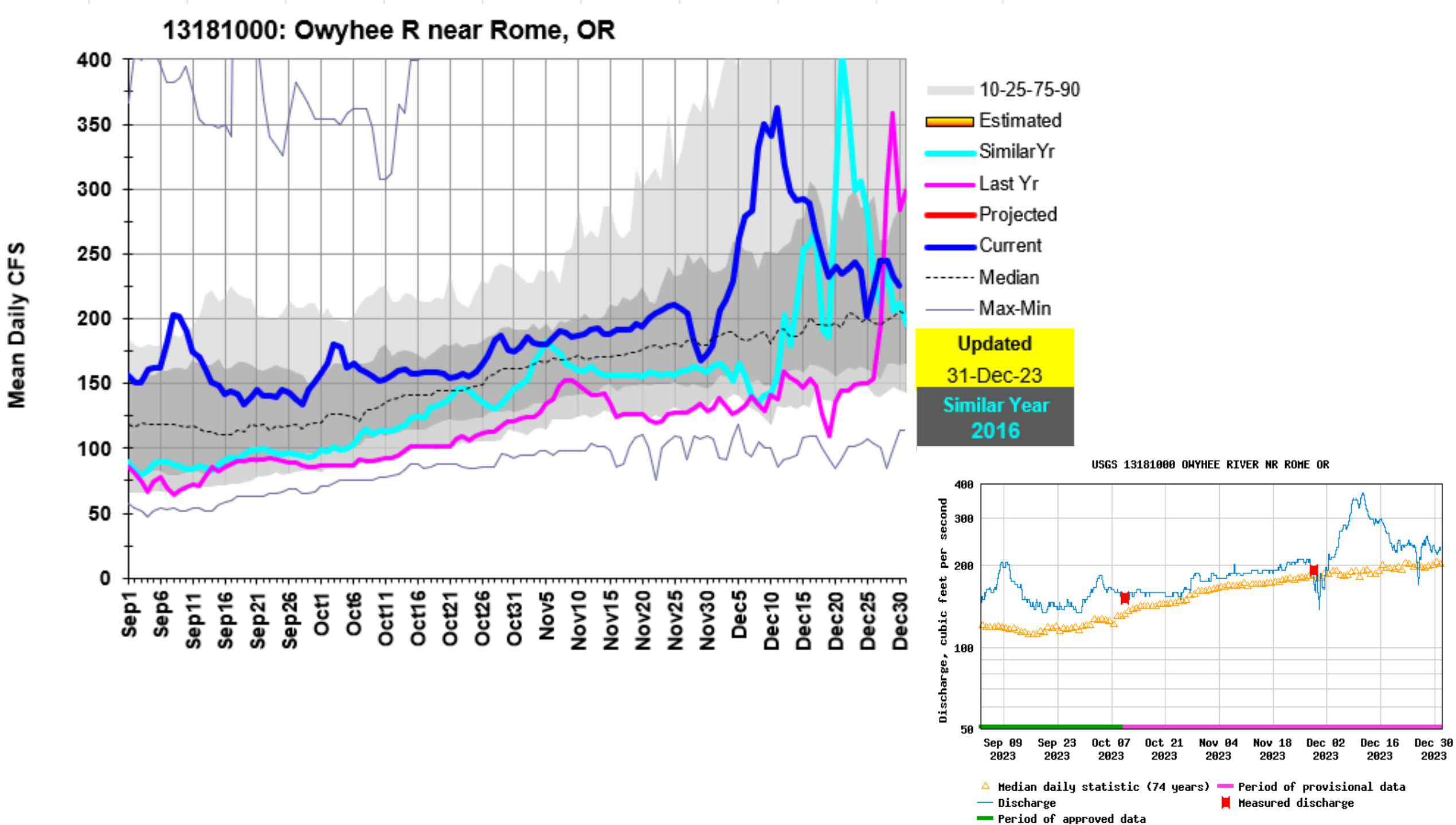
Oct & Nov & Dec 2023 were warm/record warm.

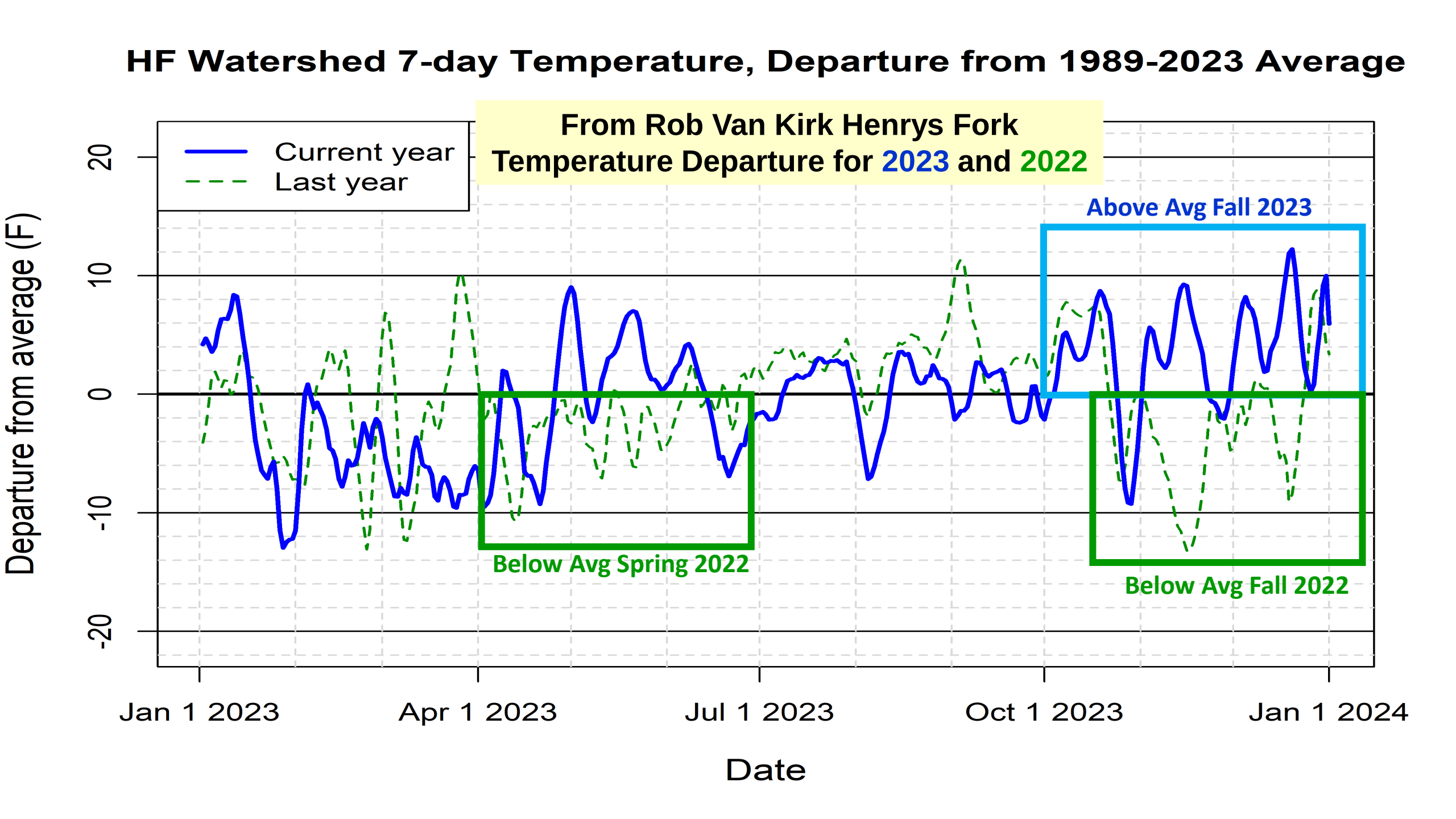







13266000: Weiser R near Weiser, ID
Mean Daily CFS
1,000
900
800
700
600
500
400
300
200
100
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
Dec20
Dec25
Dec30
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
31-Dec-23
Similar Year
2019
Ice Affected
USGS 13266000 WEISER RIVER NR WEISER ID
Discharge, cubic feet per second
500
400
300
200
100
80
Sep 09 2023
Sep 23 2023
Oct 07 2023
Oct 21 2023
Nov 04 2023
Nov 18 2023
Dec 02 2023
Dec 16 2023
Dec 30 2023
Median daily statistic (83 years)
Discharge
Period of approved data
Value is affected by ice at the measurement site.
Period of provisional data
Measured discharge


13181000: Owyhee R near Rome, OR
Mean Daily CFS
400
350
300
250
200
150
100
50
0
Sep1
Sep6
Sep11
Sep16
Sep21
Sep26
Oct1
Oct6
Oct11
Oct16
Oct21
Oct26
Oct31
Nov5
Nov10
Nov15
Nov20
Nov25
Nov30
Dec5
Dec10
Dec15
Dec20
Dec25
Dec30
10-25-75-90
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Max-Min
Updated
31-Dec-23
Similar Year
2016
USGS 13181000 OWYHEE RIVER NR ROME OR
Discharge, cubic feet per second
400
300
200
100
50
Sep 09
2023
Sep 23
2023
Oct 07
2023
Oct 21
2023
Nov 04
2023
Nov 18
2023
Dec 02
2023
Dec 16
2023
Dec 30
2023
Median daily statistic (74 years)
Discharge
Period of approved data
Period of provisional data
Measured discharge


HF Watershed 7-day Temperature, Departure from 1989-2023 Average
From Rob Van Kirk Henrys Fork
Temperature Departure for 2023 and 2022
Current year
Last year
Above Avg Fall 2023
Below Avg Spring 2022
Below Avg Fall 2022
Departure from average (F)
20
10
0
-10
-20
Jan 1 2023
Apr 1 2023
Jul 1 2023
Oct 1 2023
Jan 1 2024
Date

Soil Moisture

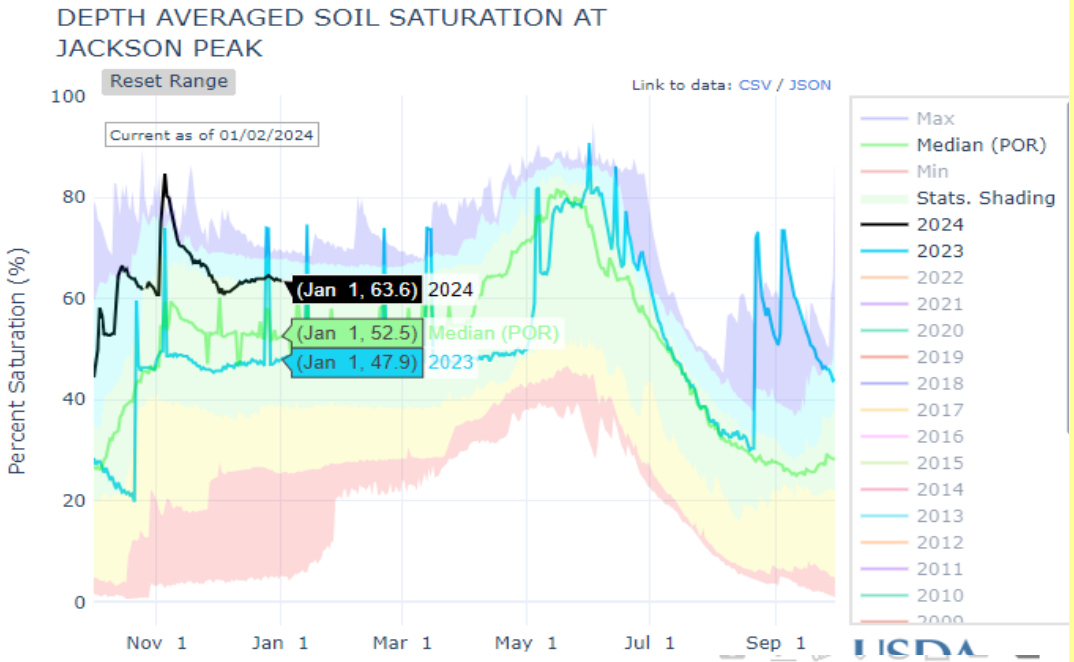
Boise

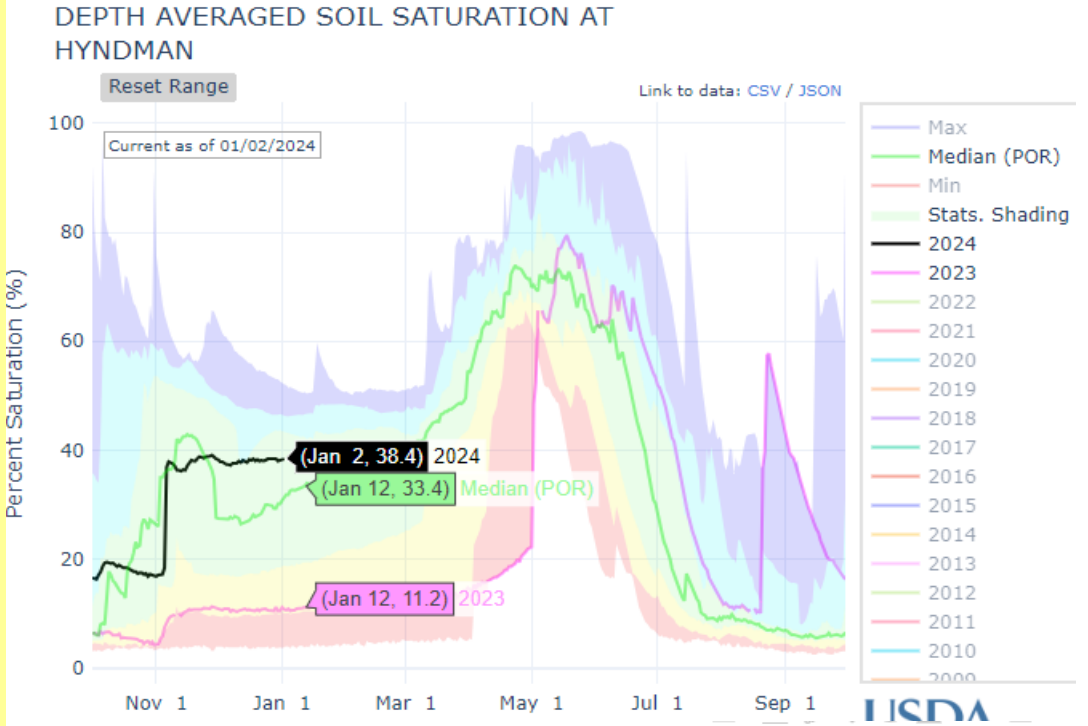
Big Wood

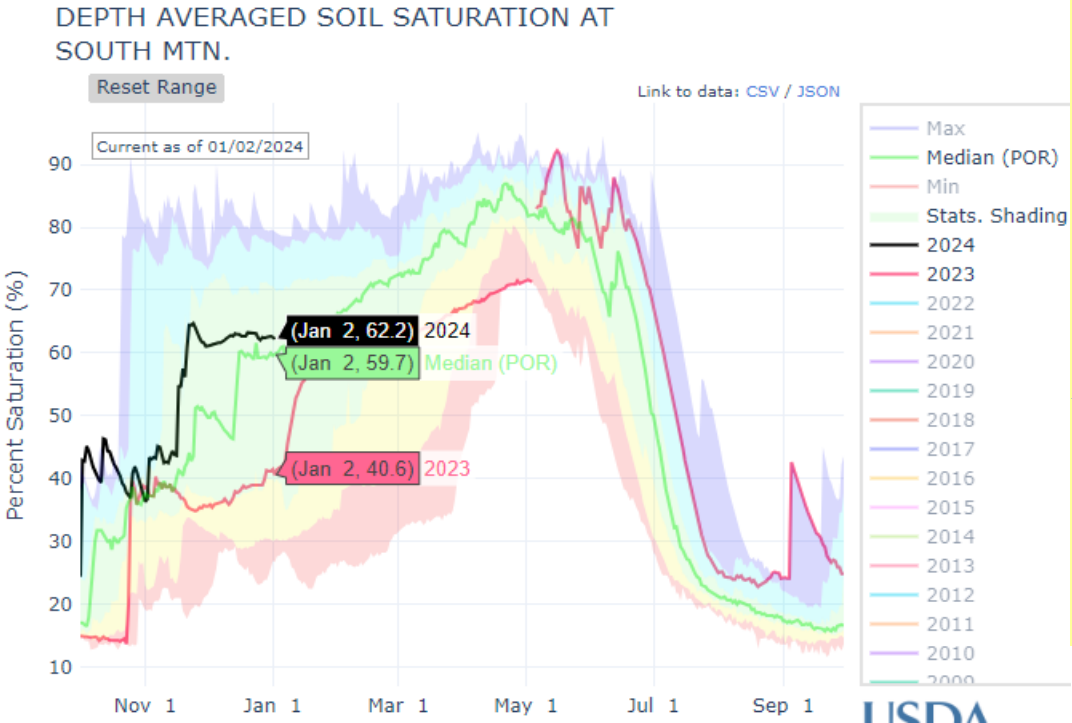
Shows soil moisture is above normal and a little better than Dec 2023

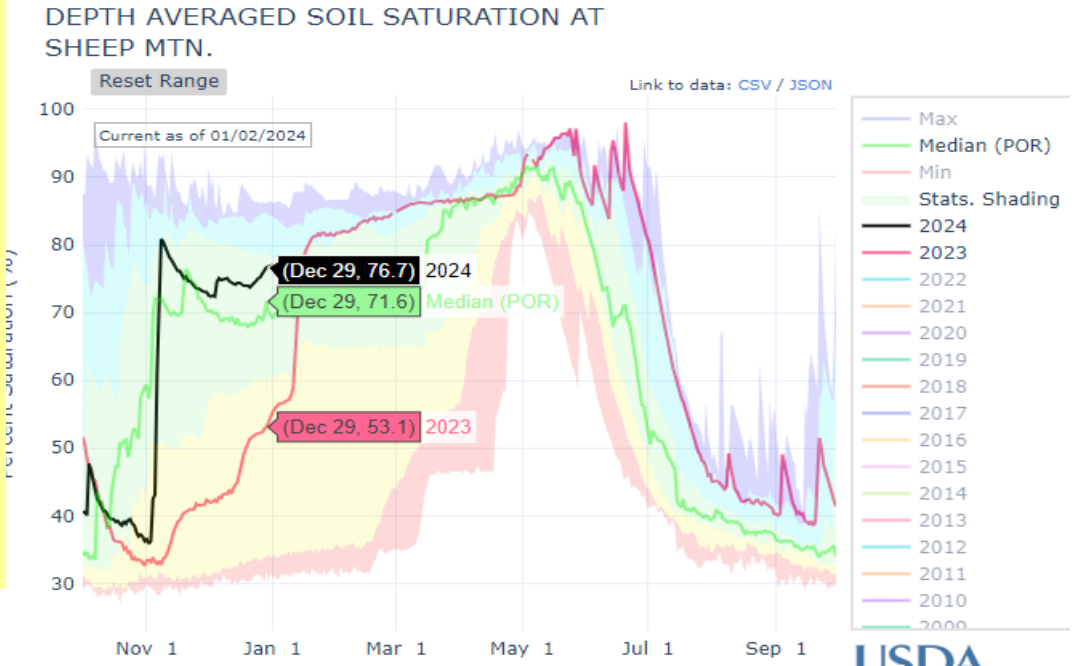
Owyhee

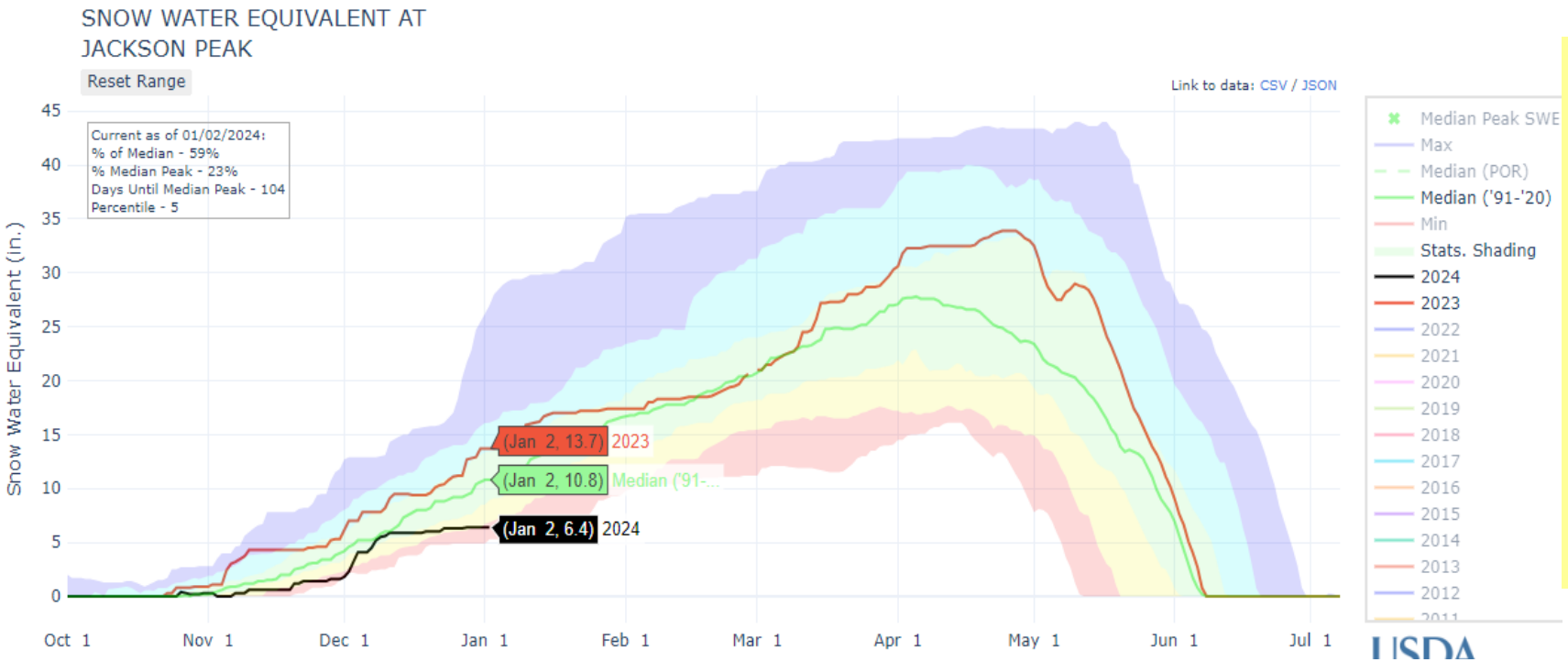
Eastern Idaho





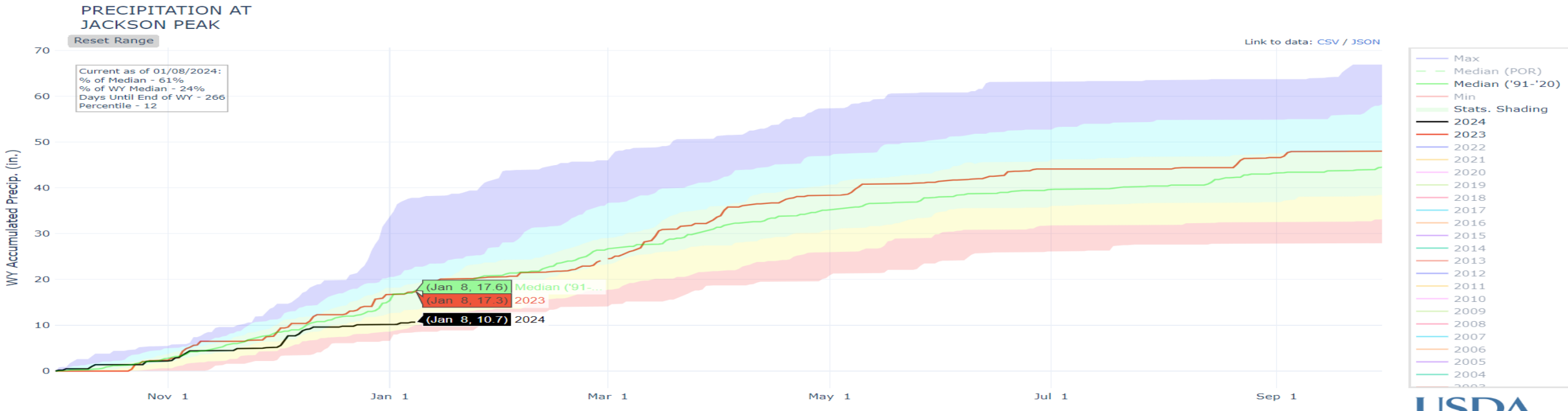


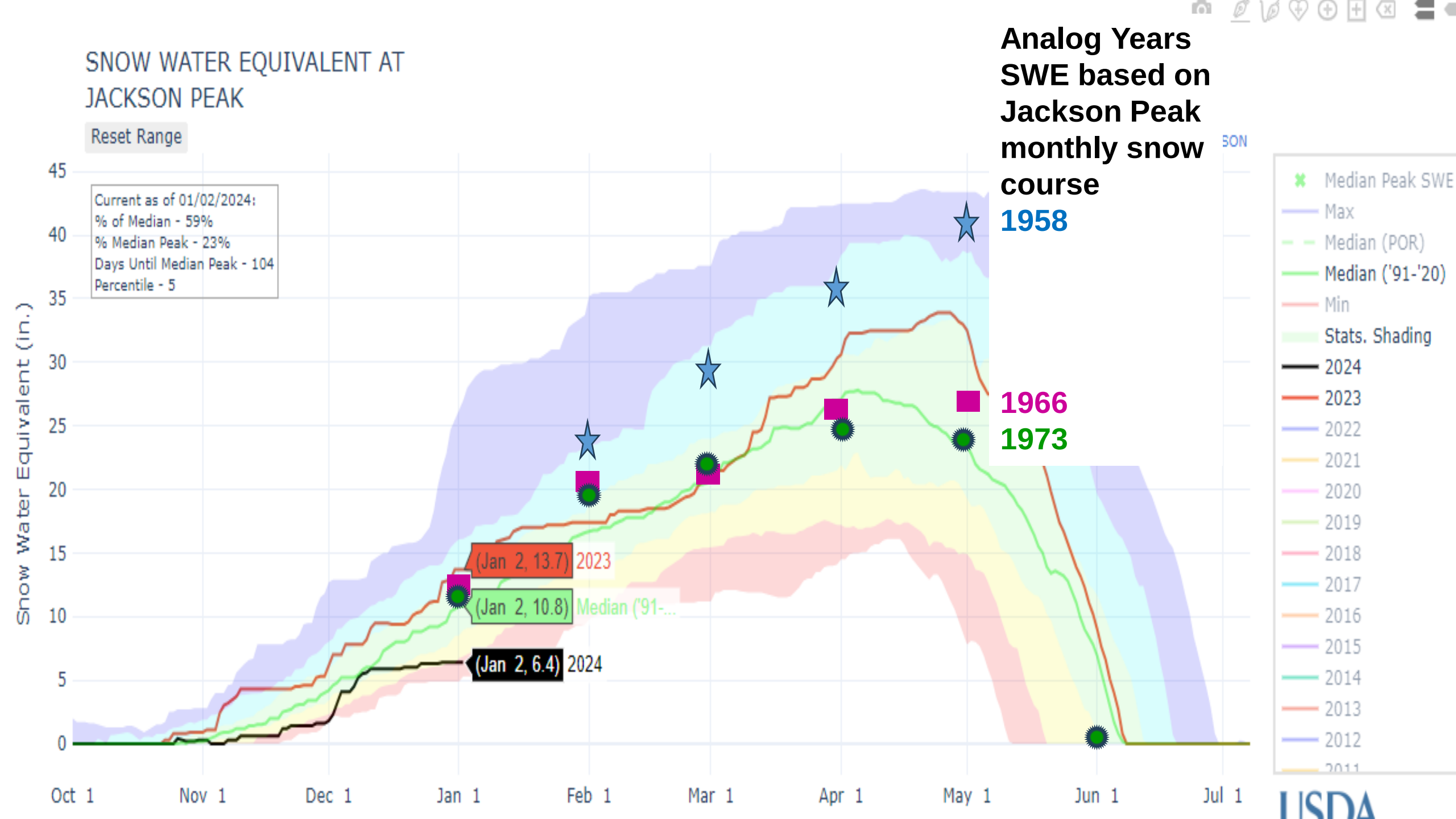




Boise Basin
Jackson Peak Snow Water
&
Precipitation

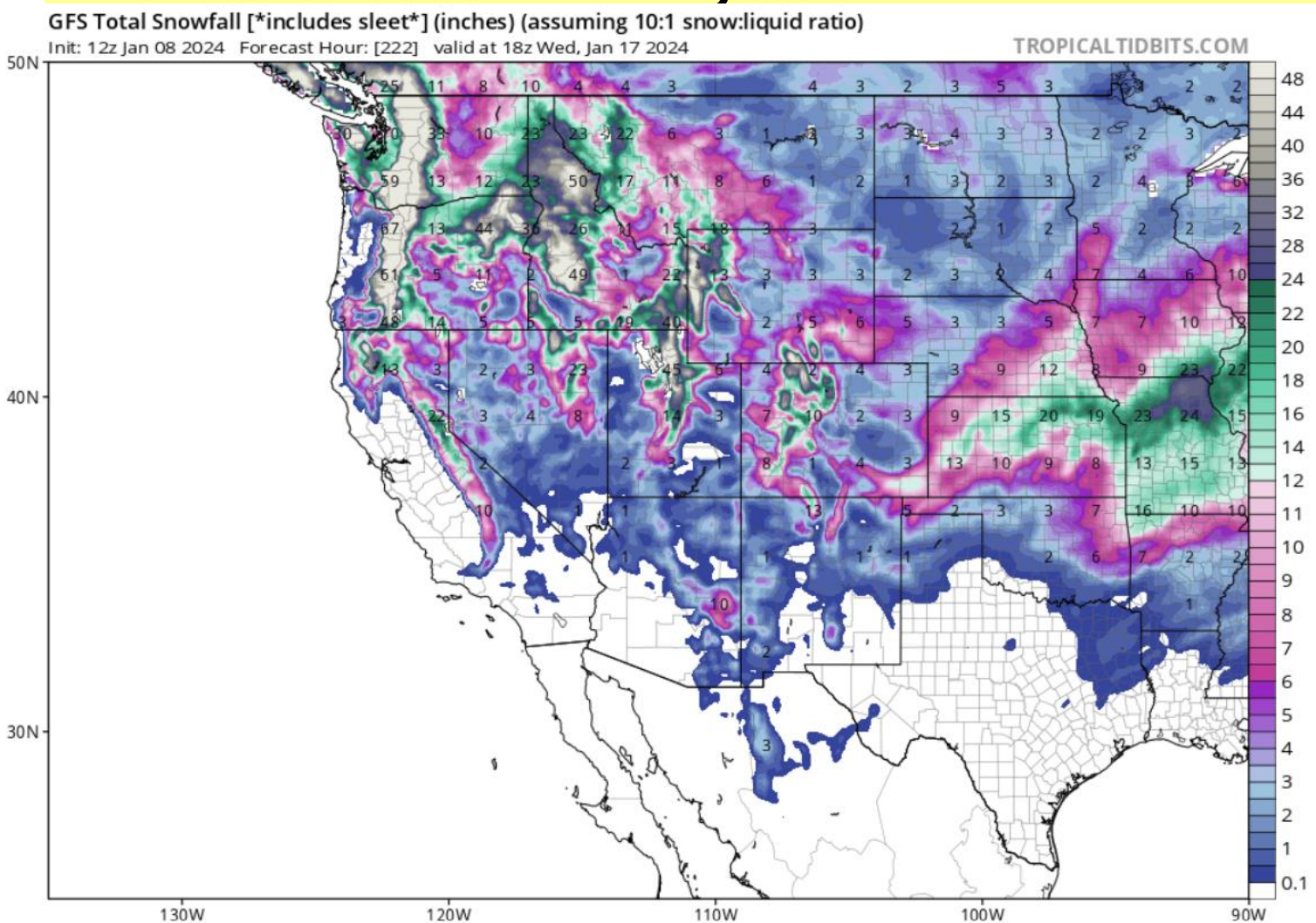
Both are well below last year. Early Nov rains increased soil moisture. Last year moisture fell as snow to start accumulation season.




SNOW WATER EQUIVALENT AT JACKSON PEAK
Reset Range
Current as of 01/02/2024:
% of Median - 59%
% Median Peak - 23%
Days Until Median Peak - 104
Percentile - 5
Snow Water Equivalent (in.)
45
40
35
30
25
20
15
10
5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
(Jan 2, 13.7) 2023
(Jan 2, 10.8) Median ('91-...
(Jan 2, 6.4) 2024
Median Peak SWE
Max
Median (POR)
Median ('91-'20)
Min
Stats. Shading
2024
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
Analog Years
SWE based on
Jackson Peak
monthly snow
course
1958
1966
1973
USDA

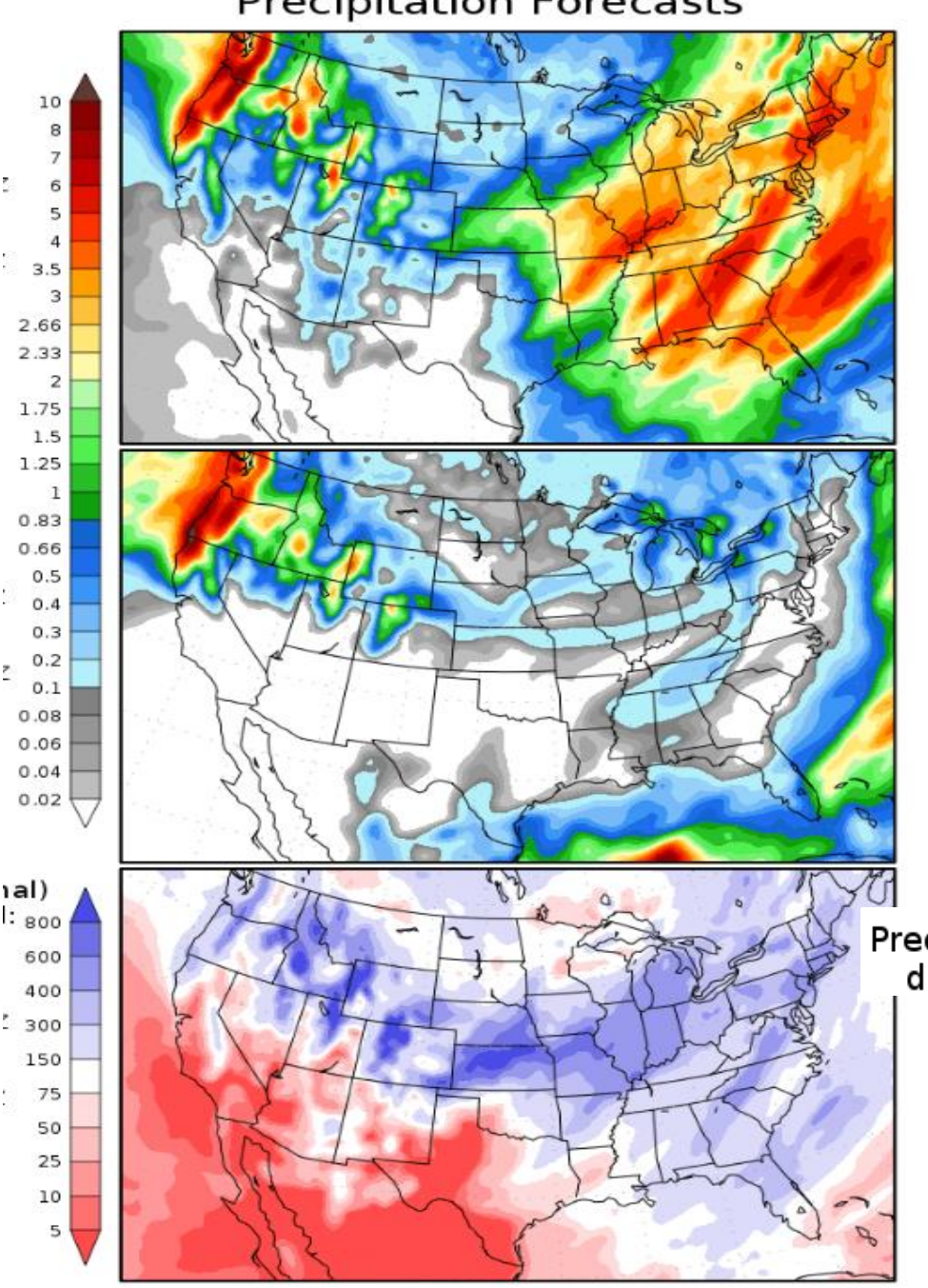
Let's talk about the weather…

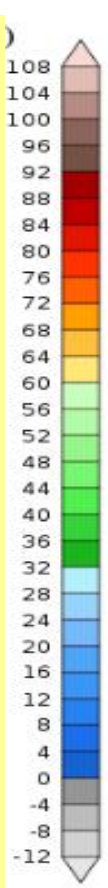
GFS Total Snowfall from Jan 8
For Jan 8 thru 17
All / Many forecasts are showing the cool / wet western weather thru Jan 19, some even into early Feb.

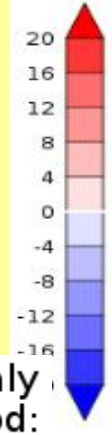


Precipitation Forecasts

Temperature Forecasts







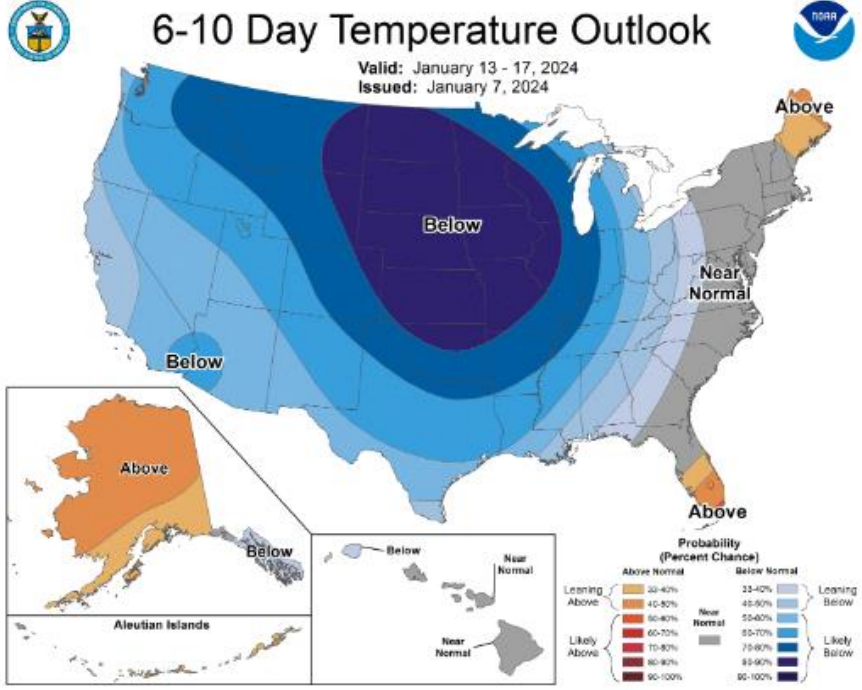
Jan 8-16

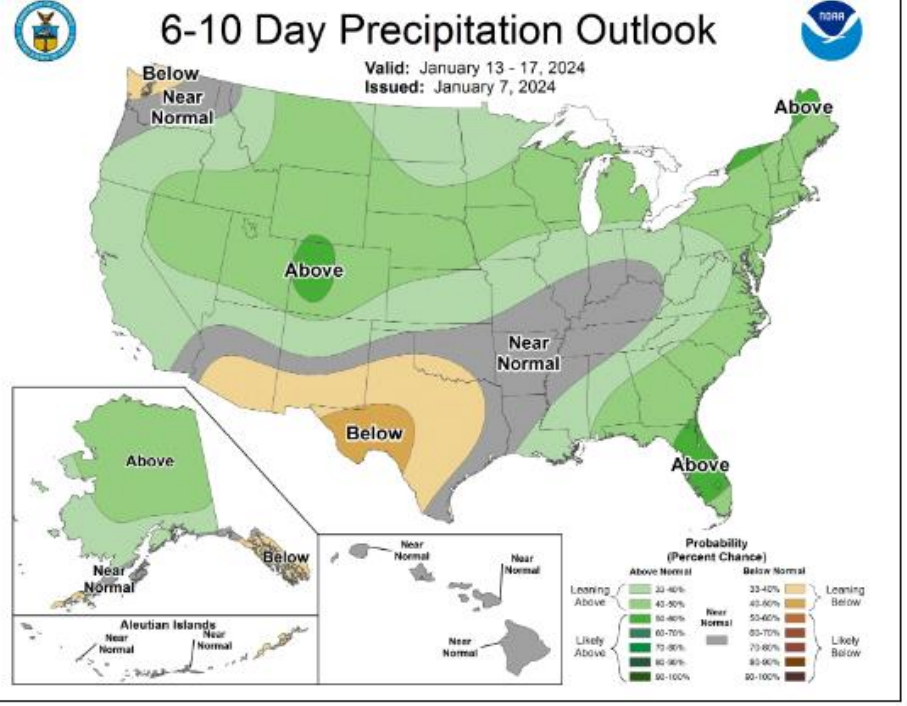
Jan 16-24

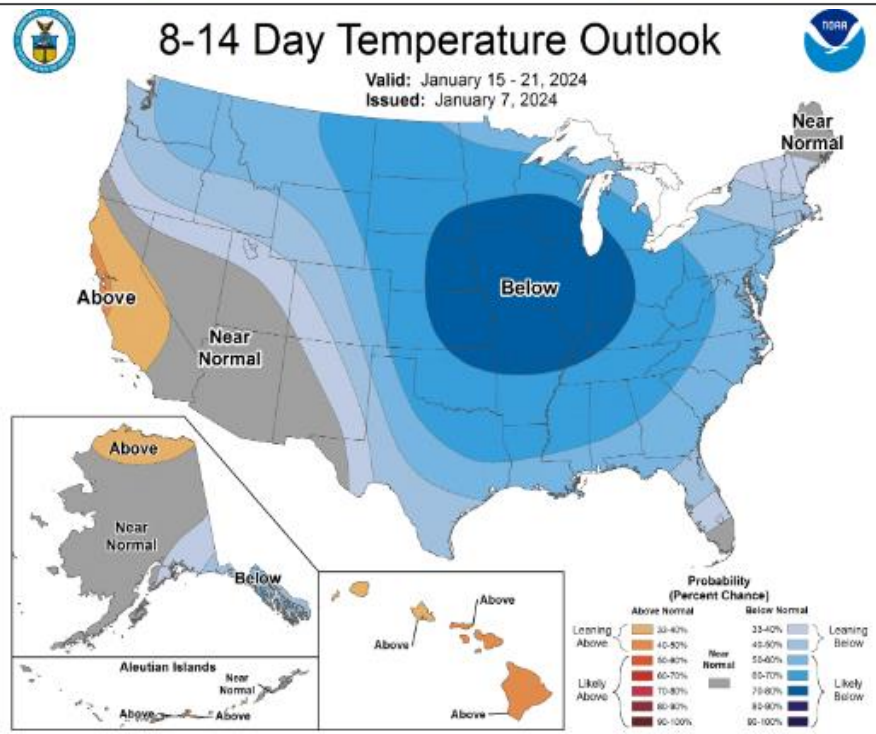
Precipitation (% of normal) during the first period: 80

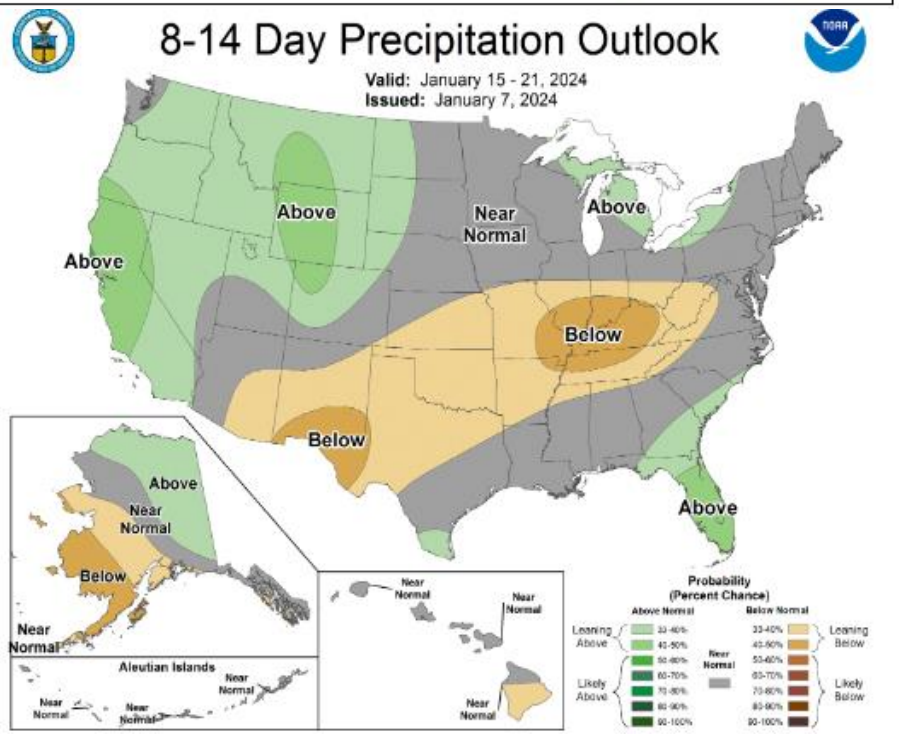
Jan 8-16

Temperature Anomaly during the first period:









Jan 13-17

Temperature & Precipitation Outlook

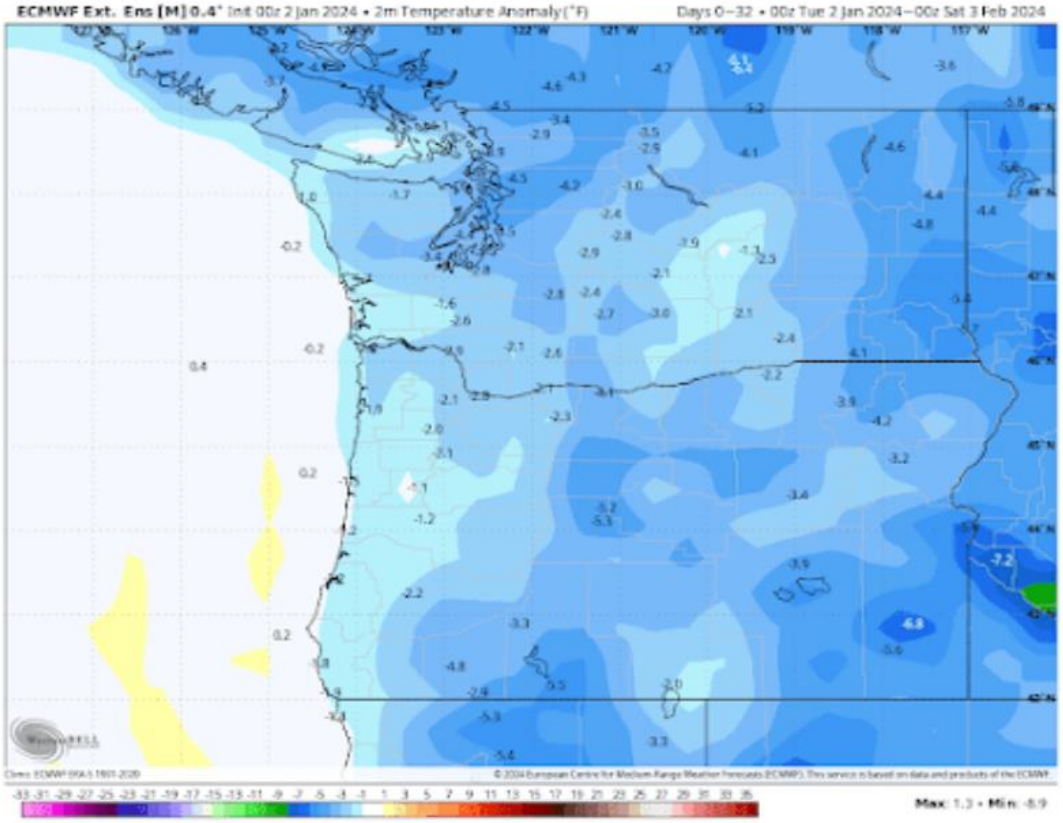
Jan 15-21

And now the real shocker. The latest European Center 30-day forecast is for **much colder than normal conditions** for our region! (see below). We will get a lot of snow and will stick around.

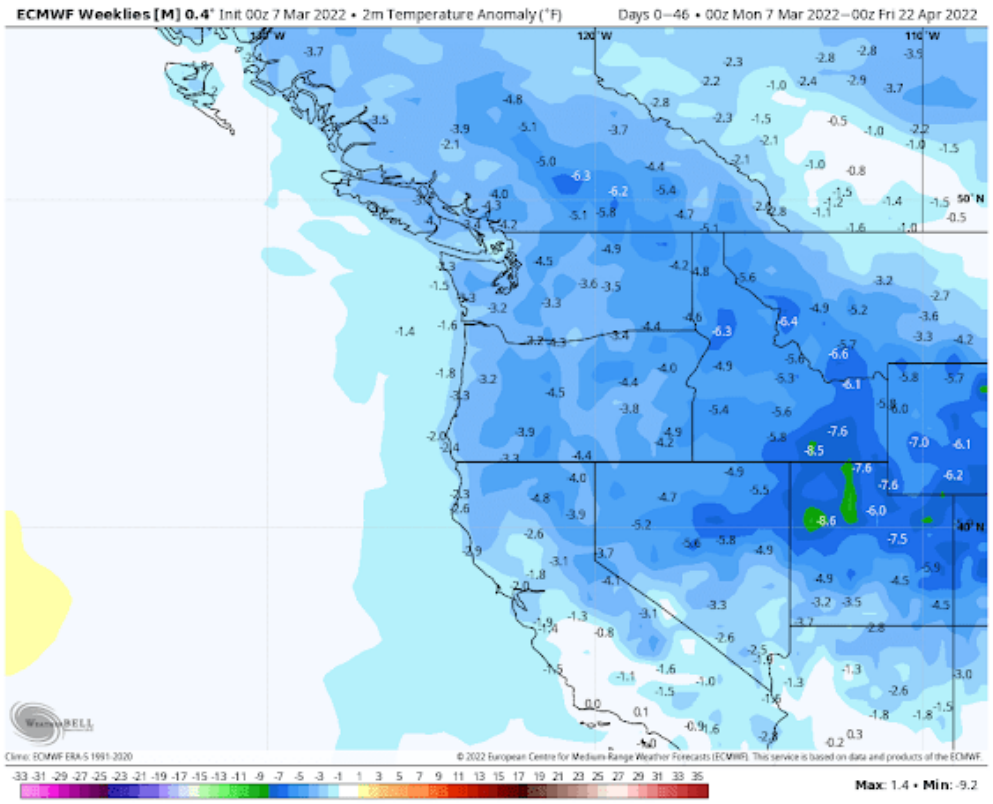
From: Cliff Mass Weather Blog

Get your skis ready!

Temp Forecast made Jan 2
for Jan 2 – Feb 3, 2024

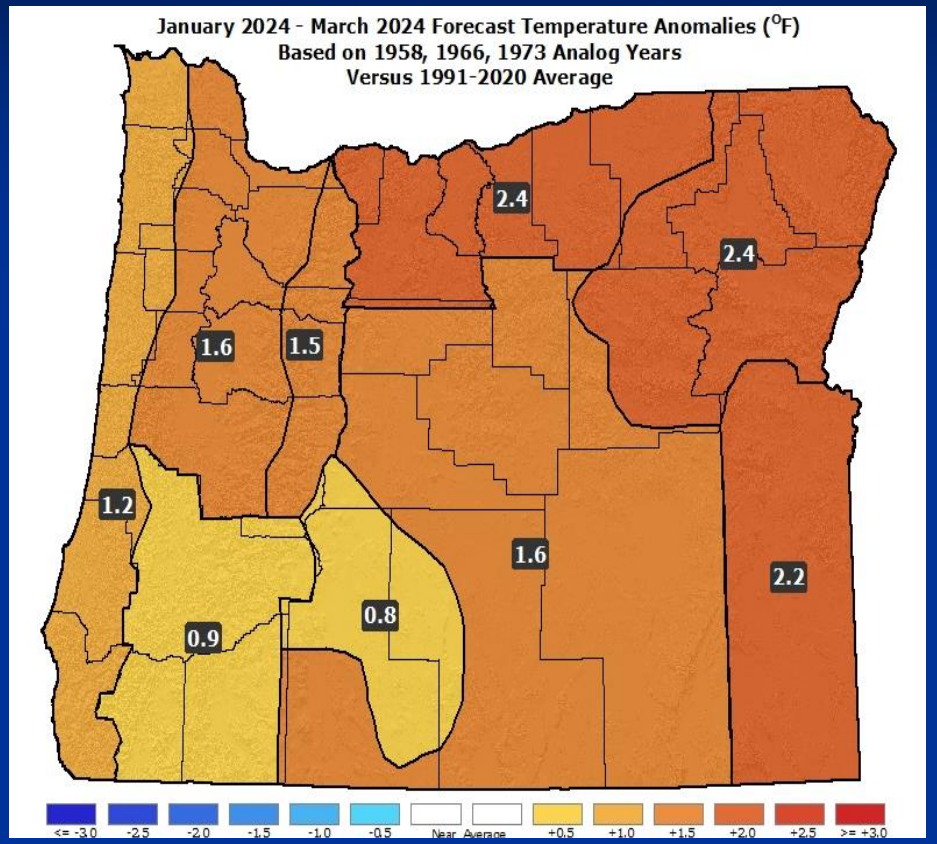


Temp Forecast made Mar 7
for Mar 7 - Apr 22, 2022

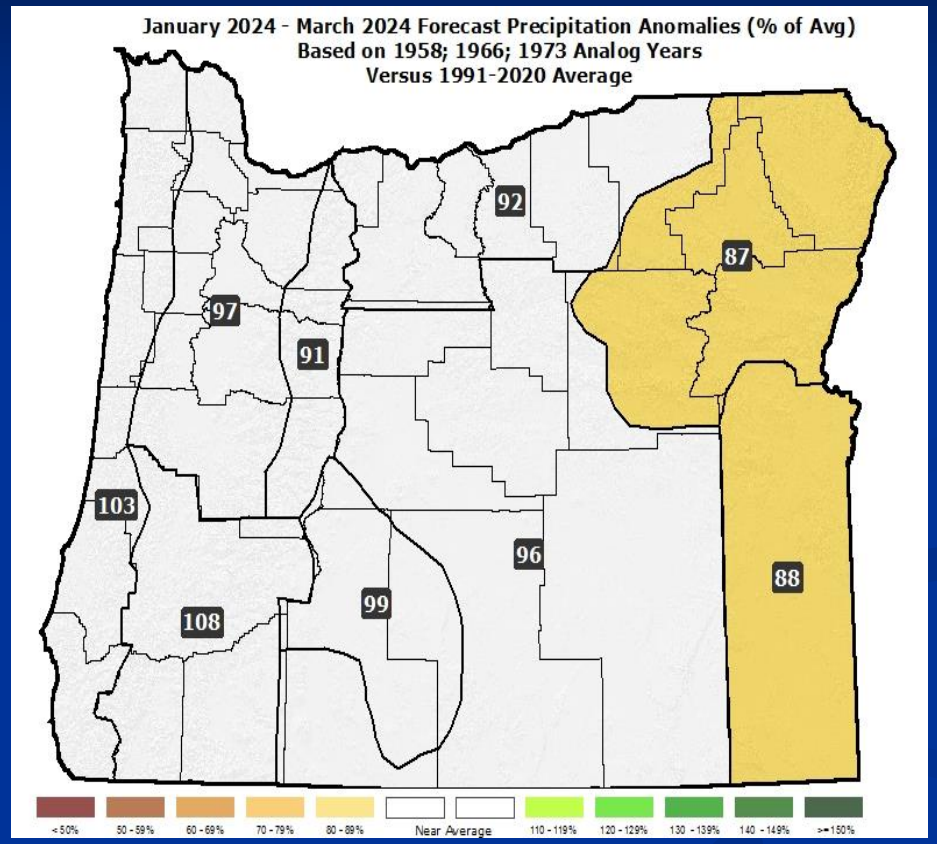


January – March 2024 Forecast

Temperatures



Precipitation

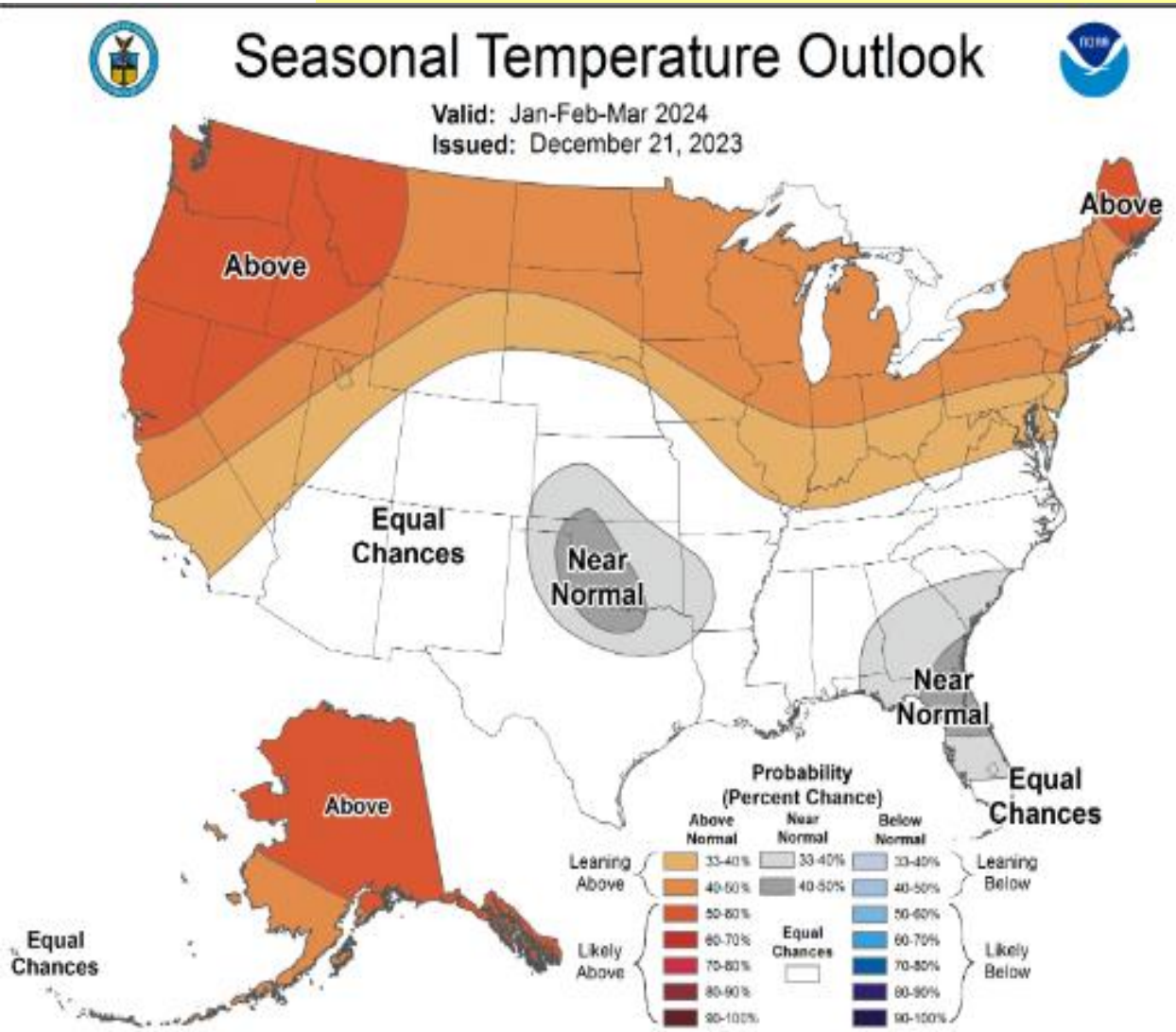


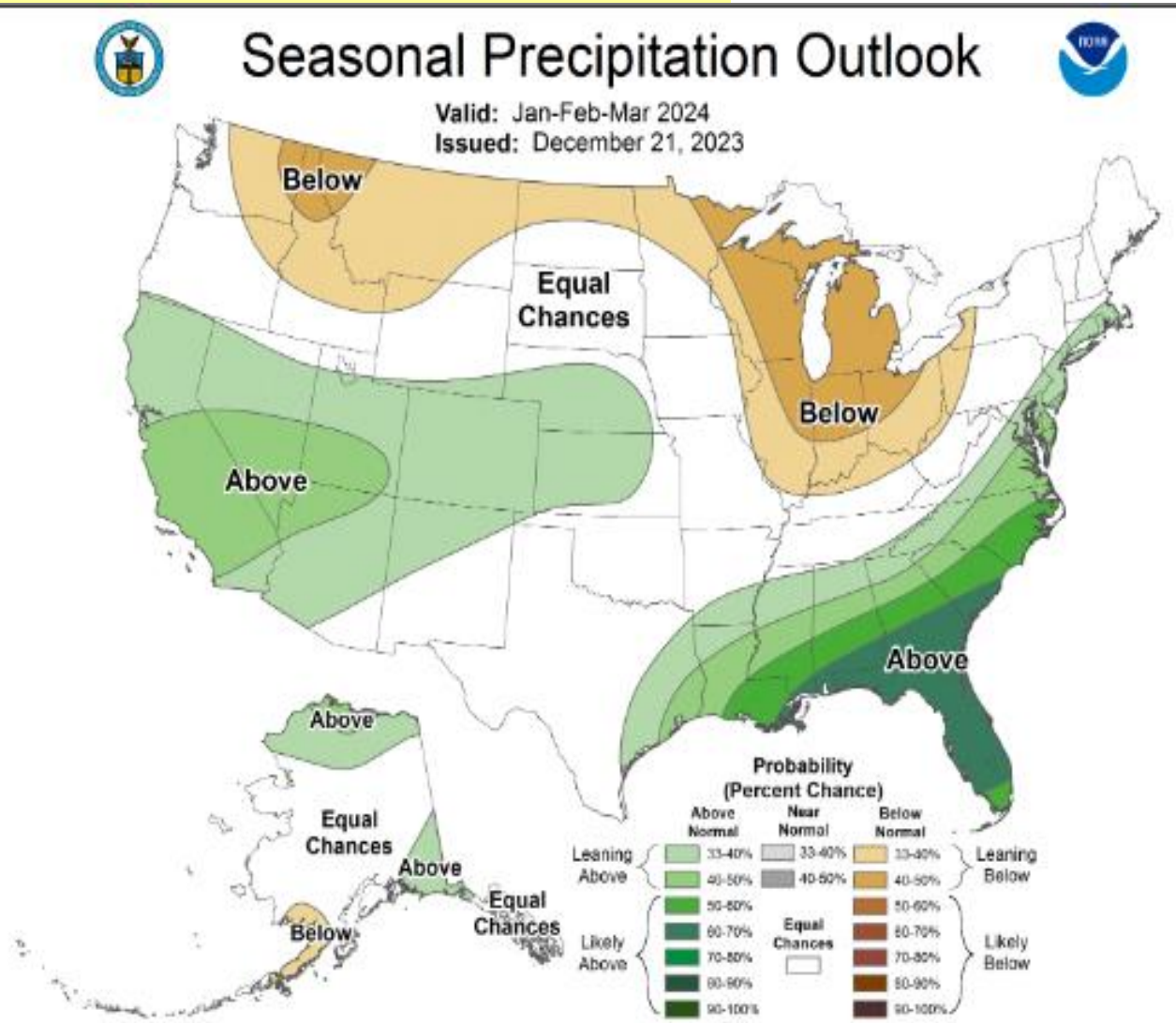
- Above-average temperatures, especially in January and February.
- An abundance of days with precipitation but expect overall rain and mountain snow totals to be near-to-below normal. SW Oregon has the best chances for above normal precipitation.

Seasonal Outlook Feb-Mar-Apr from Dec 21, 2023

Temperature Precipitation

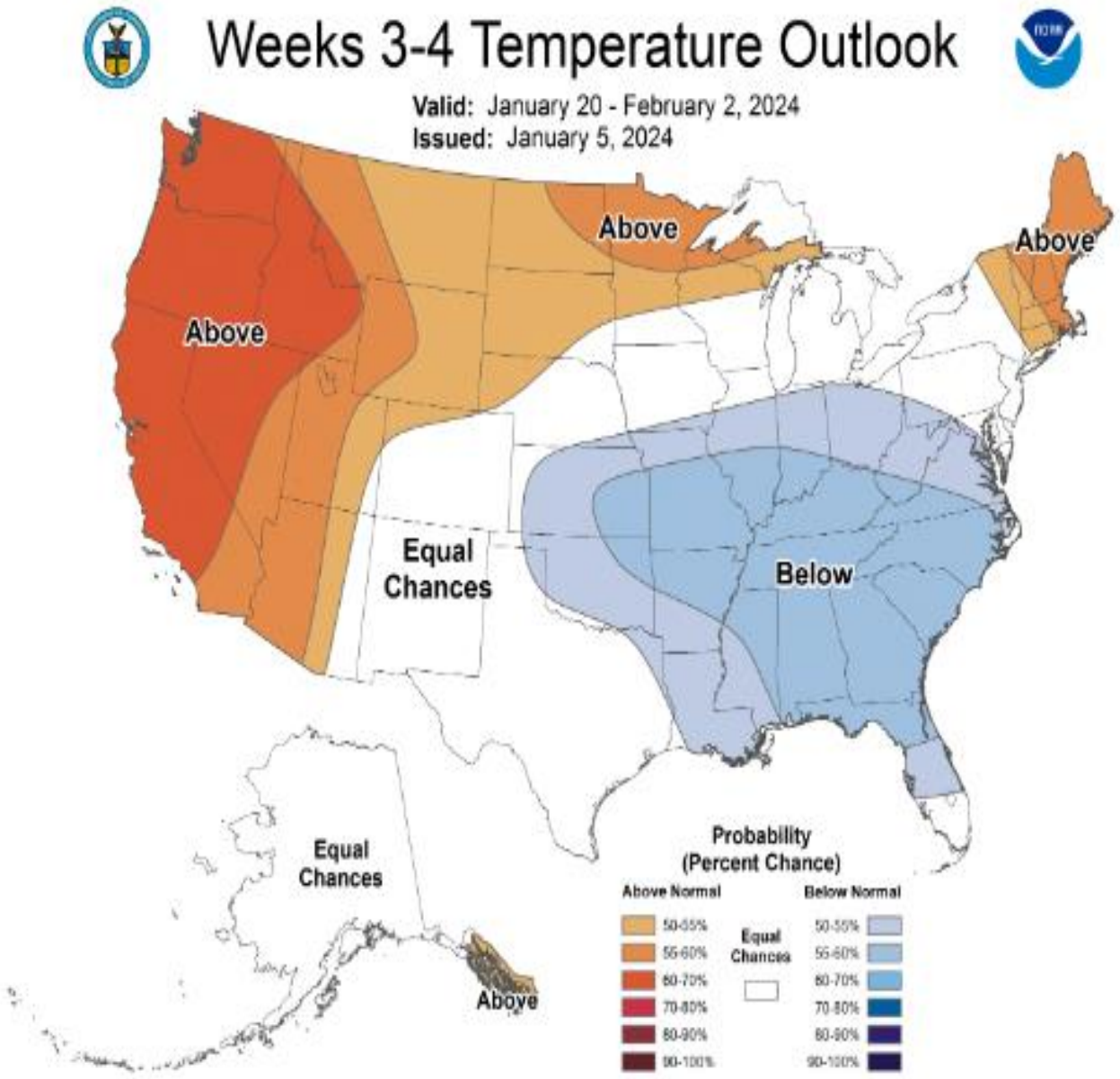
Typical El Nino pattern - let's look at these again after January to see if pattern changed or not.

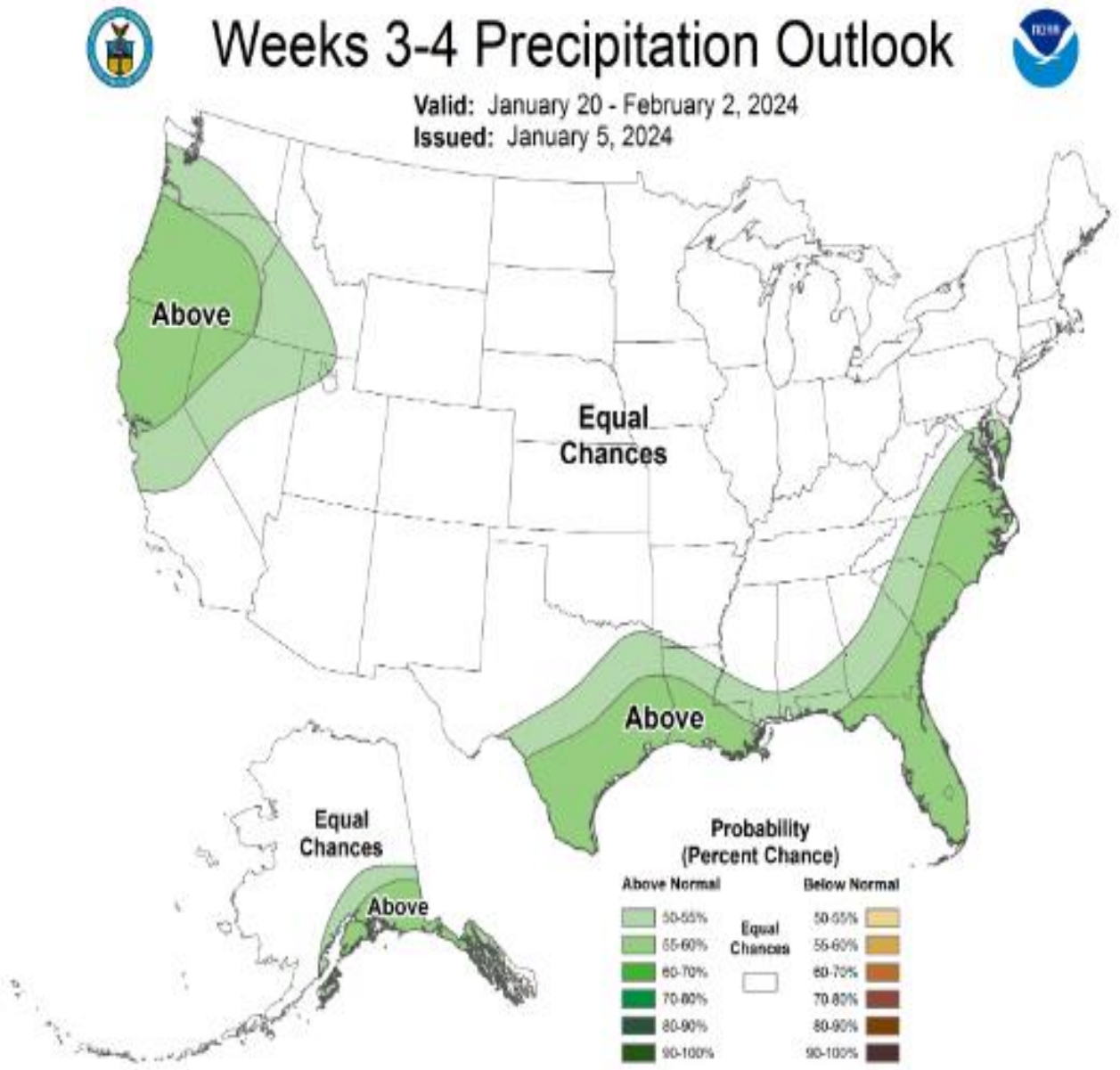




Weeks 3 - 4 Outlook for Jan 20 – Feb 2

Temperature **Precipitation**





Payette Lake

Dec 29, 2023
Not Frozen

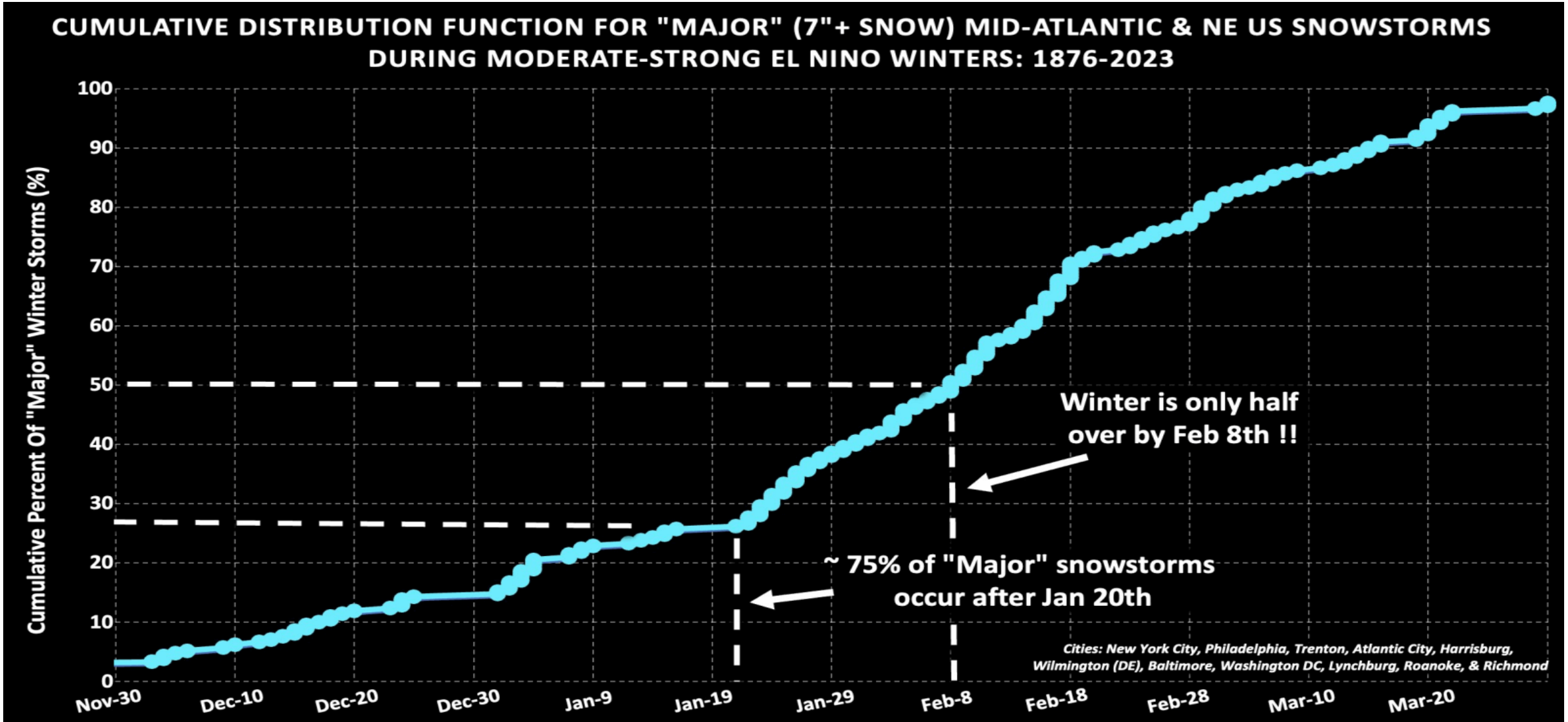
Who remembers the Nov 12, 2014 Cold Spell that Suddenly Spilled into Idaho from western Montana ? Went from 50s F to 10s F in a few days.

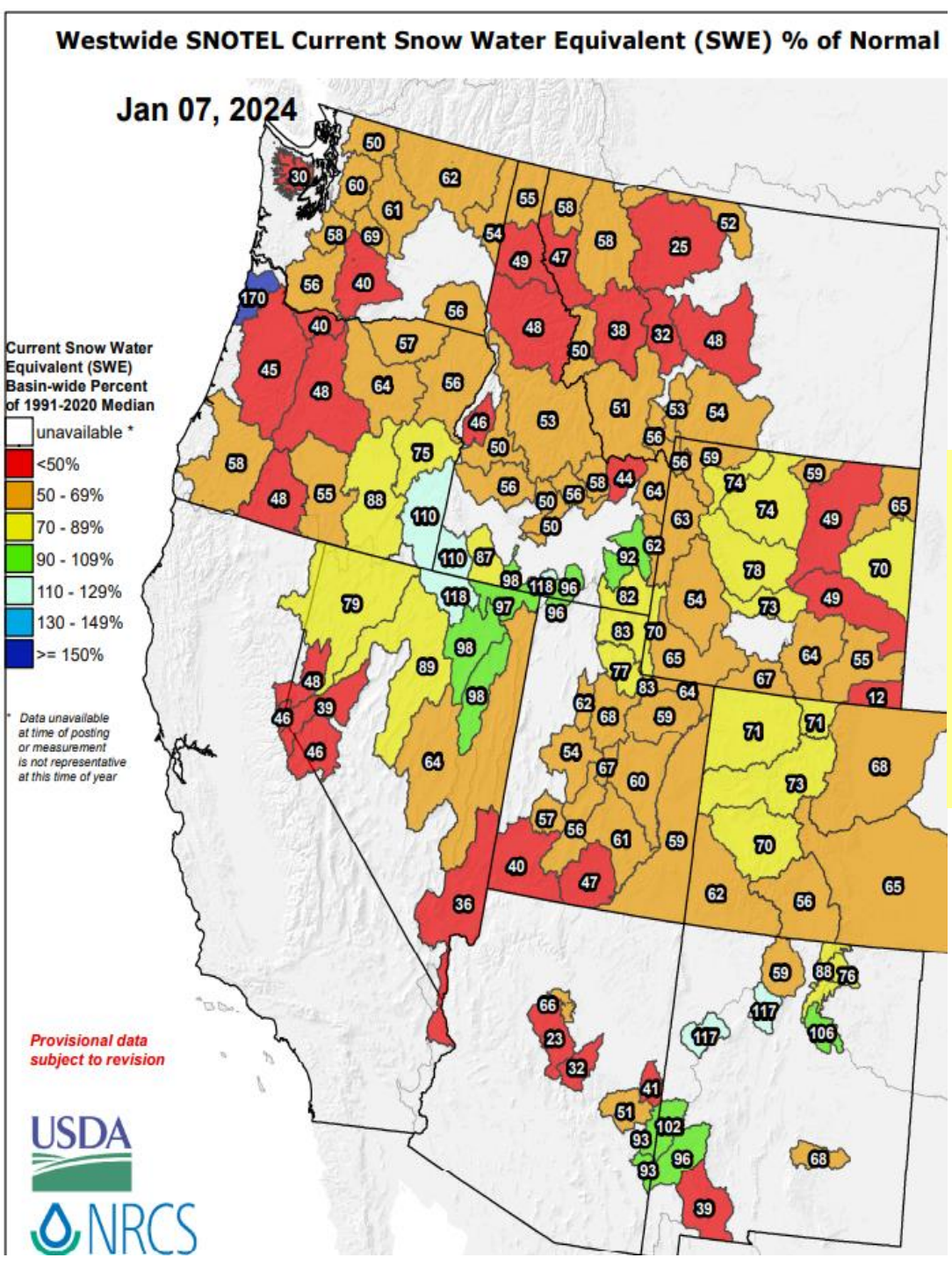
The MF Salmon River froze overnight.

We'll see how fast the rivers & lakes freeze with Artic Cold approaching.

Moisture – Soils, rivers, snow will be help in place.

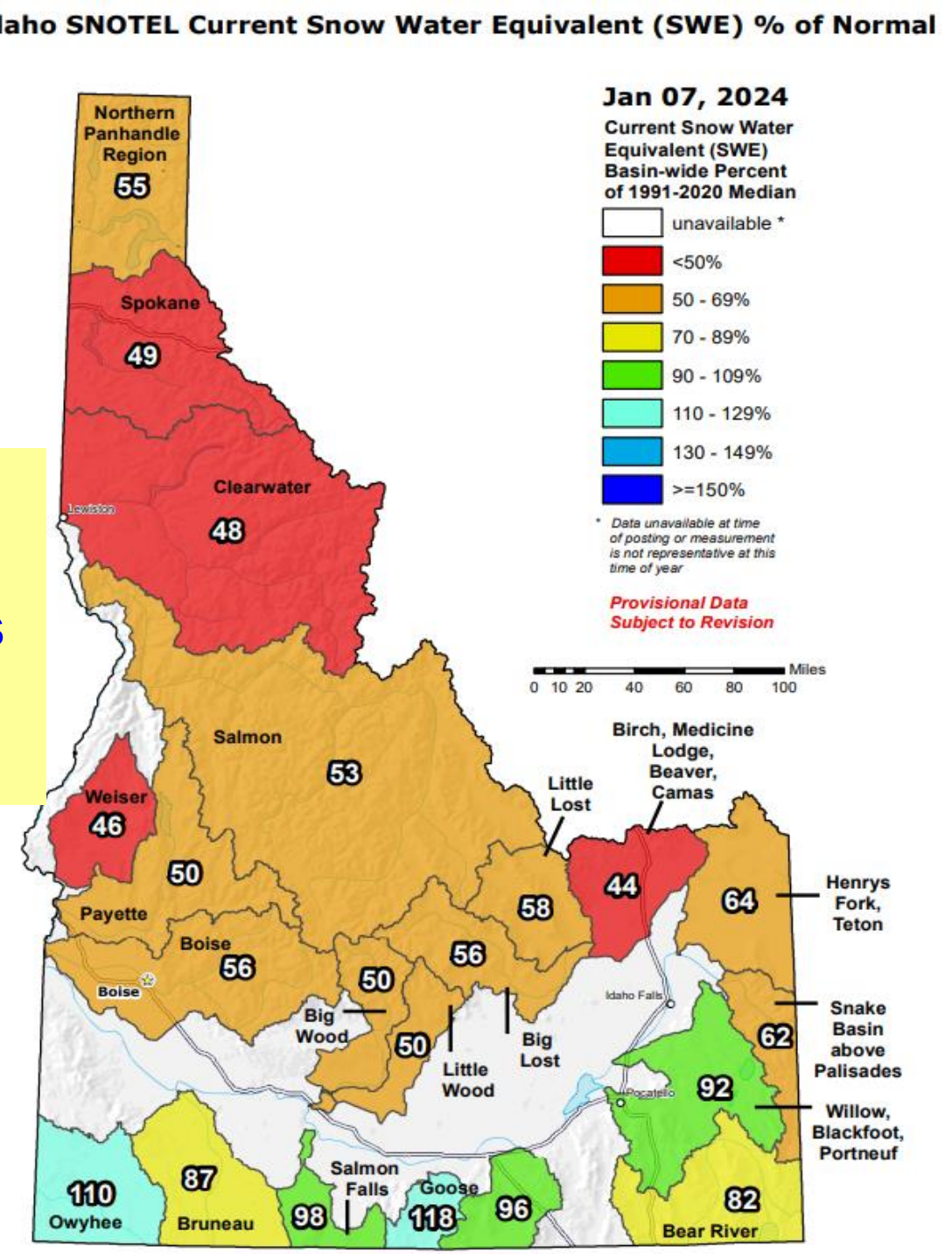
Graph of Major Storms +7” of Snow for Mid-Atlantic & NE Snowstorms during Moderate-Strong El Nino Winter for past 150 years. Produced by meteorologist Eric Webb.
It show 75% Major Storms occur after Jan 19 and Feb 8 – winter is only half over.
Need similar distribution for West or number of Atmospheric Rivers hitting West coast each year.





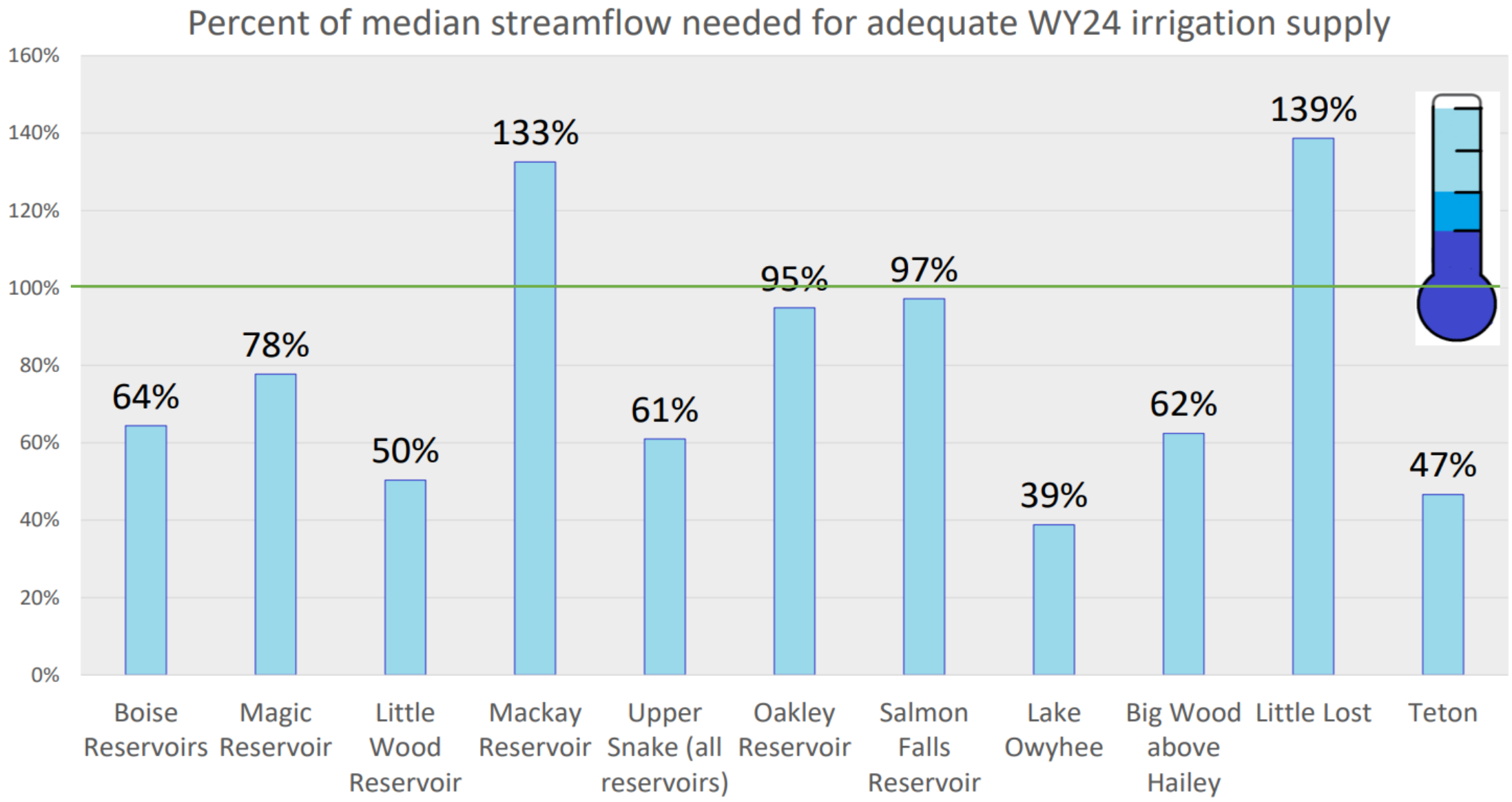
Westwide & Idaho Snow Maps

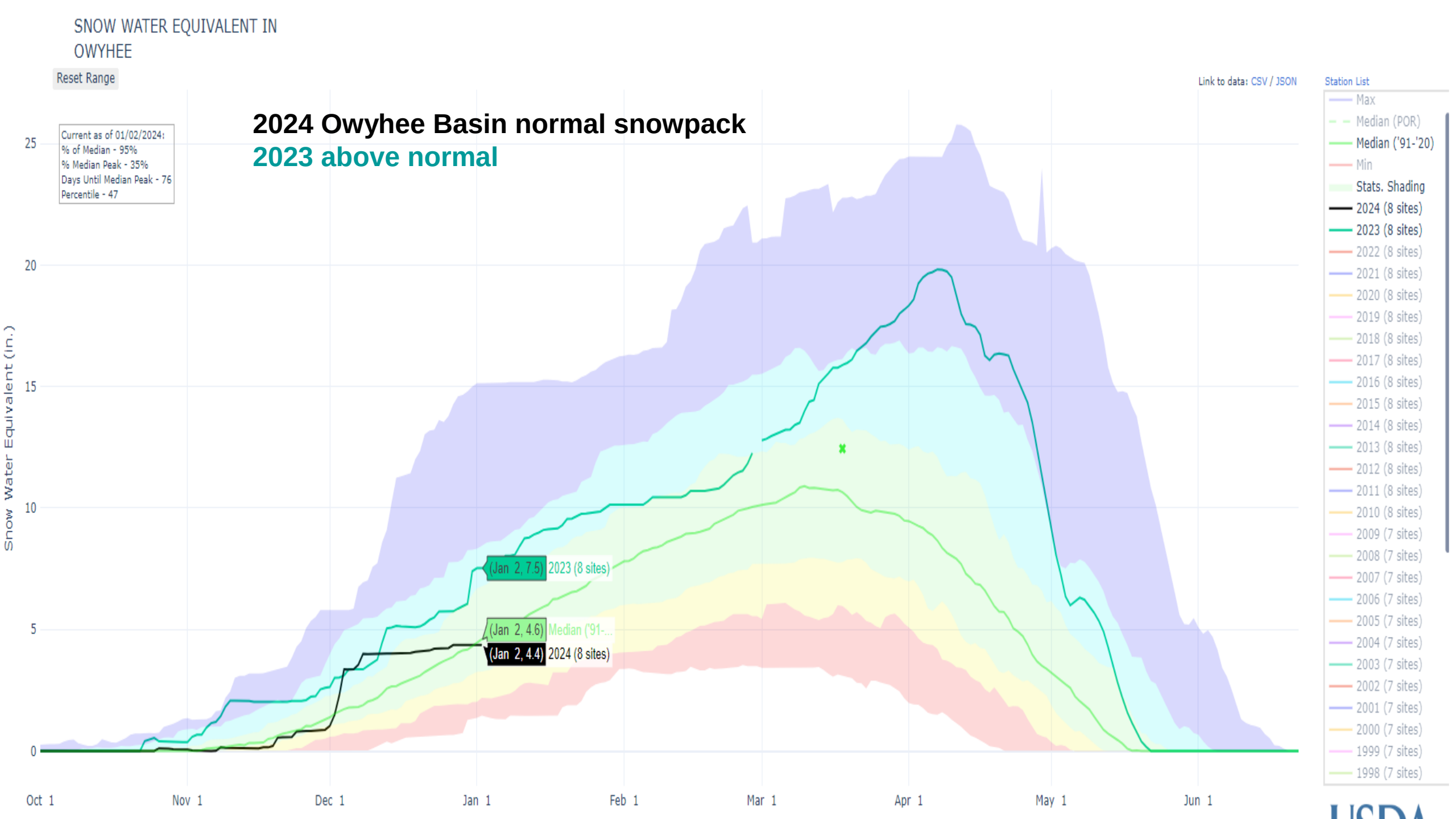
Jan 7, 2024

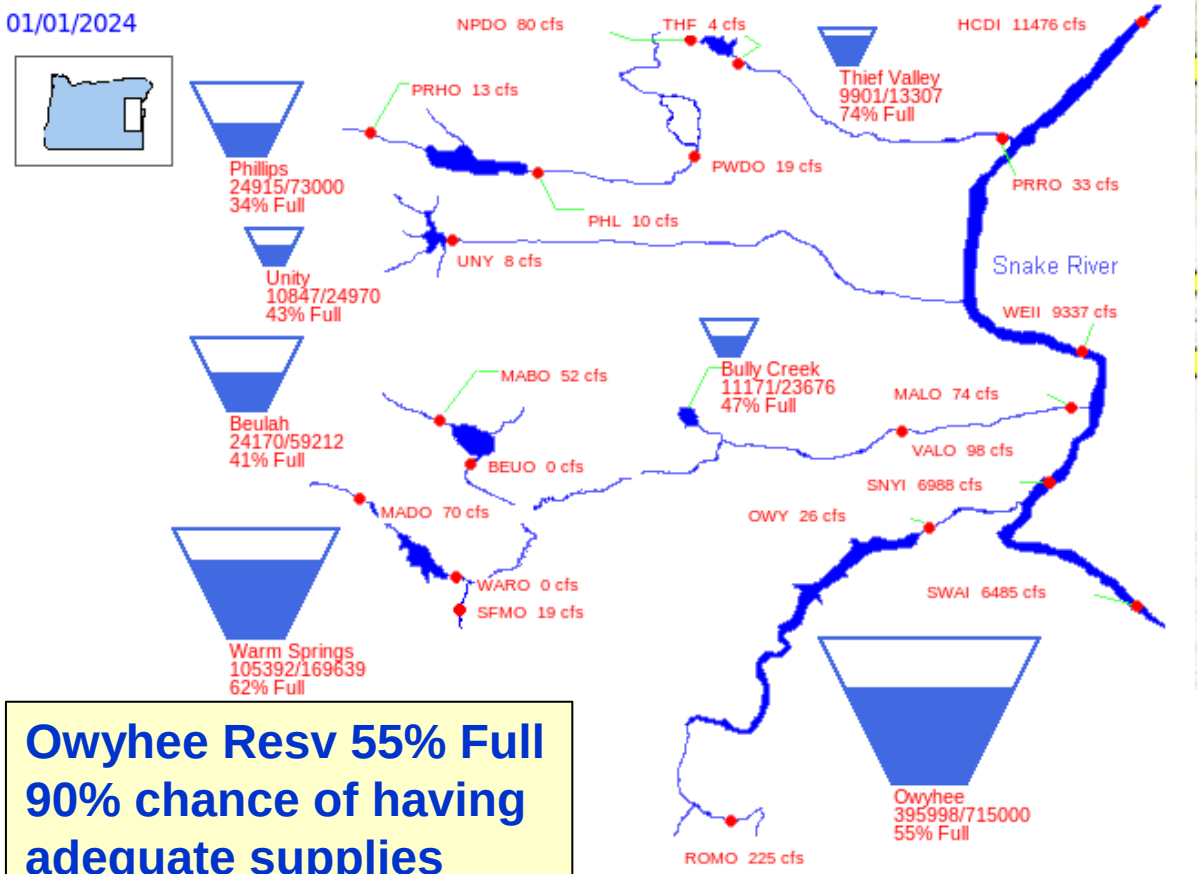


Presented by NRCS at IDWR Fall Water Supply Outlook Meeting Nov 2023

Keep in mind values are in % of MEDIAN and NWS forecasts are in % of AVG




SNOW WATER EQUIVALENT IN
OWYHEE
Reset Range
Link to data: CSV / JSON
Station List
2024 Owyhee Basin normal snowpack
2023 above normal
Current as of 01/02/2024:
% of Median - 95%
% Median Peak - 35%
Days Until Median Peak - 76
Percentile - 47
Snow Water Equivalent (in.)
25
20
15
10
5
0
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
(Jan 2, 7.5) 2023 (8 sites)
(Jan 2, 4.6) Median ('91-...
(Jan 2, 4.4) 2024 (8 sites)
Max
Median (POR)
Median ('91-'20)
Min
Stats. Shading
2024 (8 sites)
2023 (8 sites)
2022 (8 sites)
2021 (8 sites)
2020 (8 sites)
2019 (8 sites)
2018 (8 sites)
2017 (8 sites)
2016 (8 sites)
2015 (8 sites)
2014 (8 sites)
2013 (8 sites)
2012 (8 sites)
2011 (8 sites)
2010 (8 sites)
2009 (7 sites)
2008 (7 sites)
2007 (7 sites)
2006 (7 sites)
2005 (7 sites)
2004 (7 sites)
2003 (7 sites)
2002 (7 sites)
2001 (7 sites)
2000 (7 sites)
1999 (7 sites)
1998 (7 sites)



Owyhee Resv 55% Full
90% chance of having adequate supplies

OWYO3 OWYHEE - OWYHEE DAM

Based on 75 years of historical record (1949-2023):

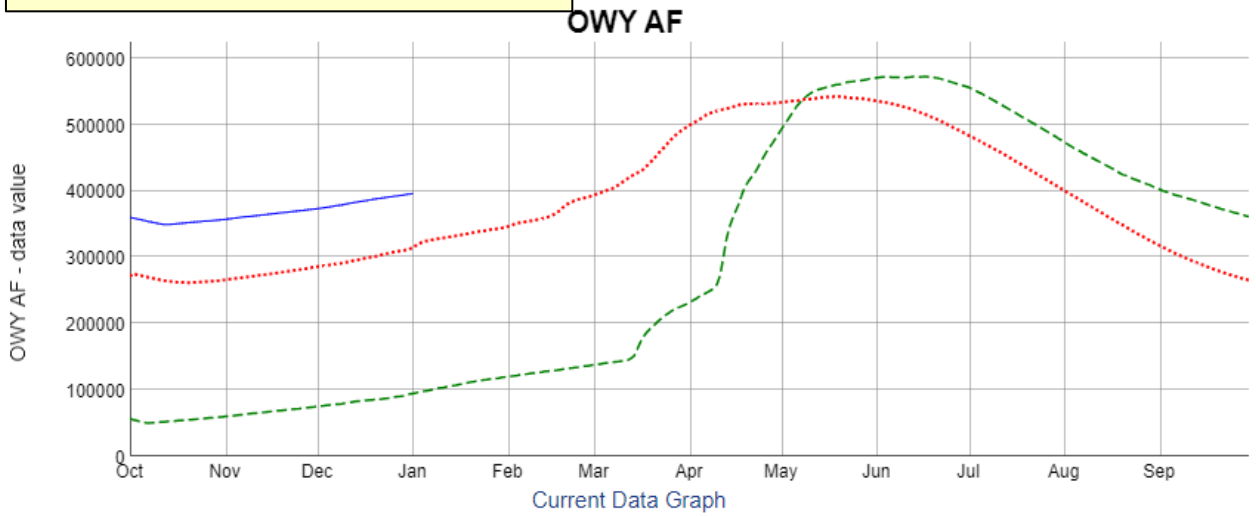
- The median (50%) forecast is ranked 47th wettest and 30th driest
- The forecast is placed in the 39th percentile of the record (exceedance probability is 61%)

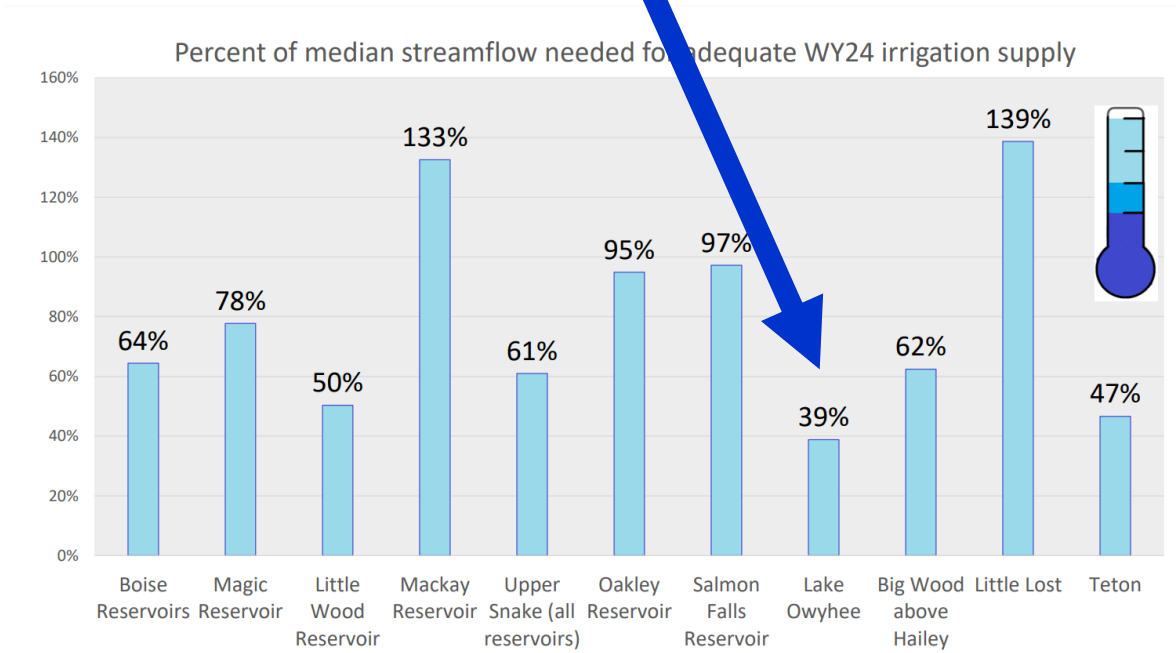
APR-SEP WY2024 Ensemble Traces: **2024-01-03** Issued: **2024-01-03** (Volumes in KAF)

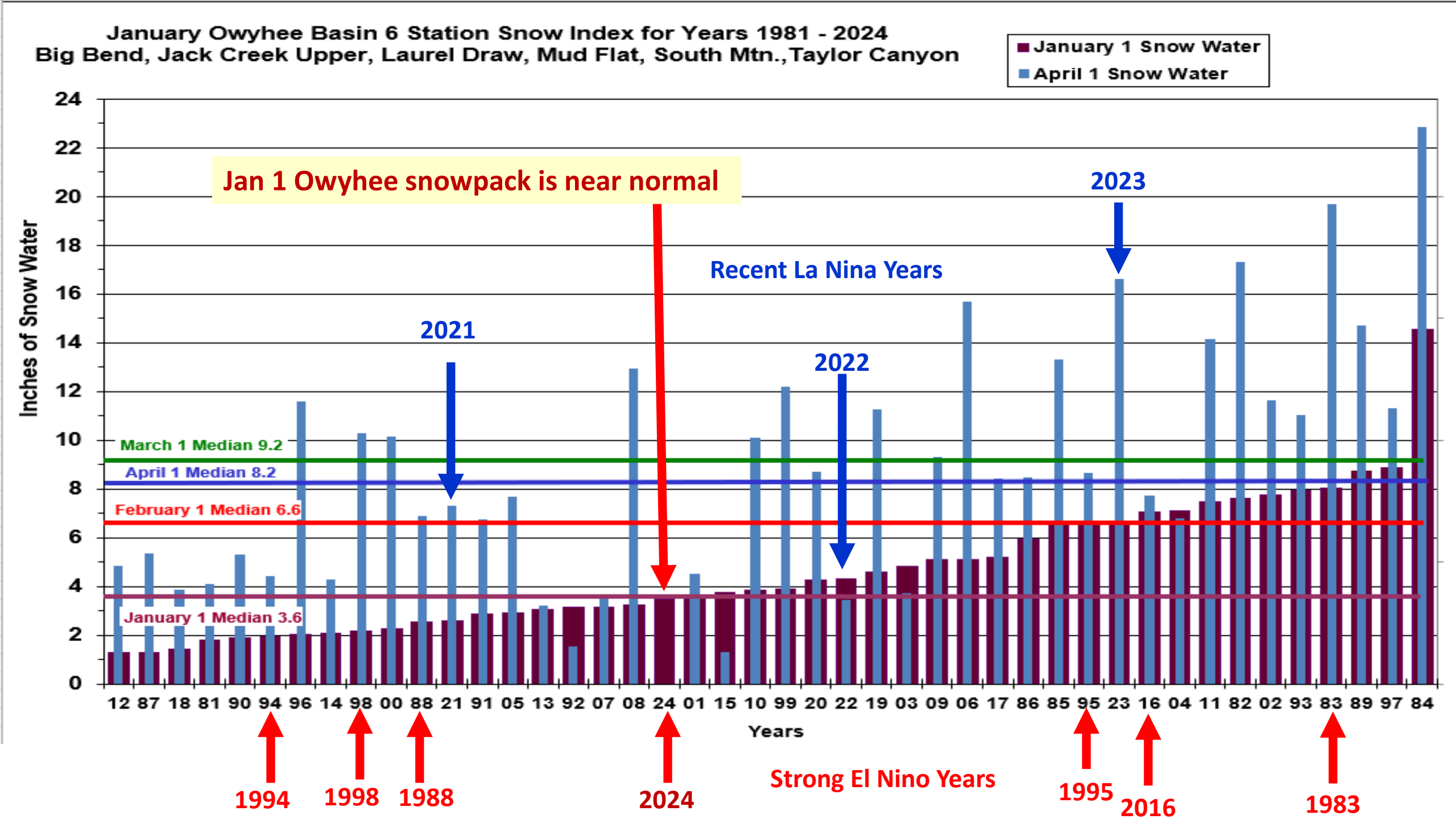
Exceedance	Natural Forecast (ESP10)		Experimental (HEFS)		Reference (ESP0)	
50%	268 KAF	79% AVG	274	81%	239	71%
90%	139 KAF	41% AVG	147	44%	123	36%
10%	570 KAF	169% AVG	618	183%	528	156%

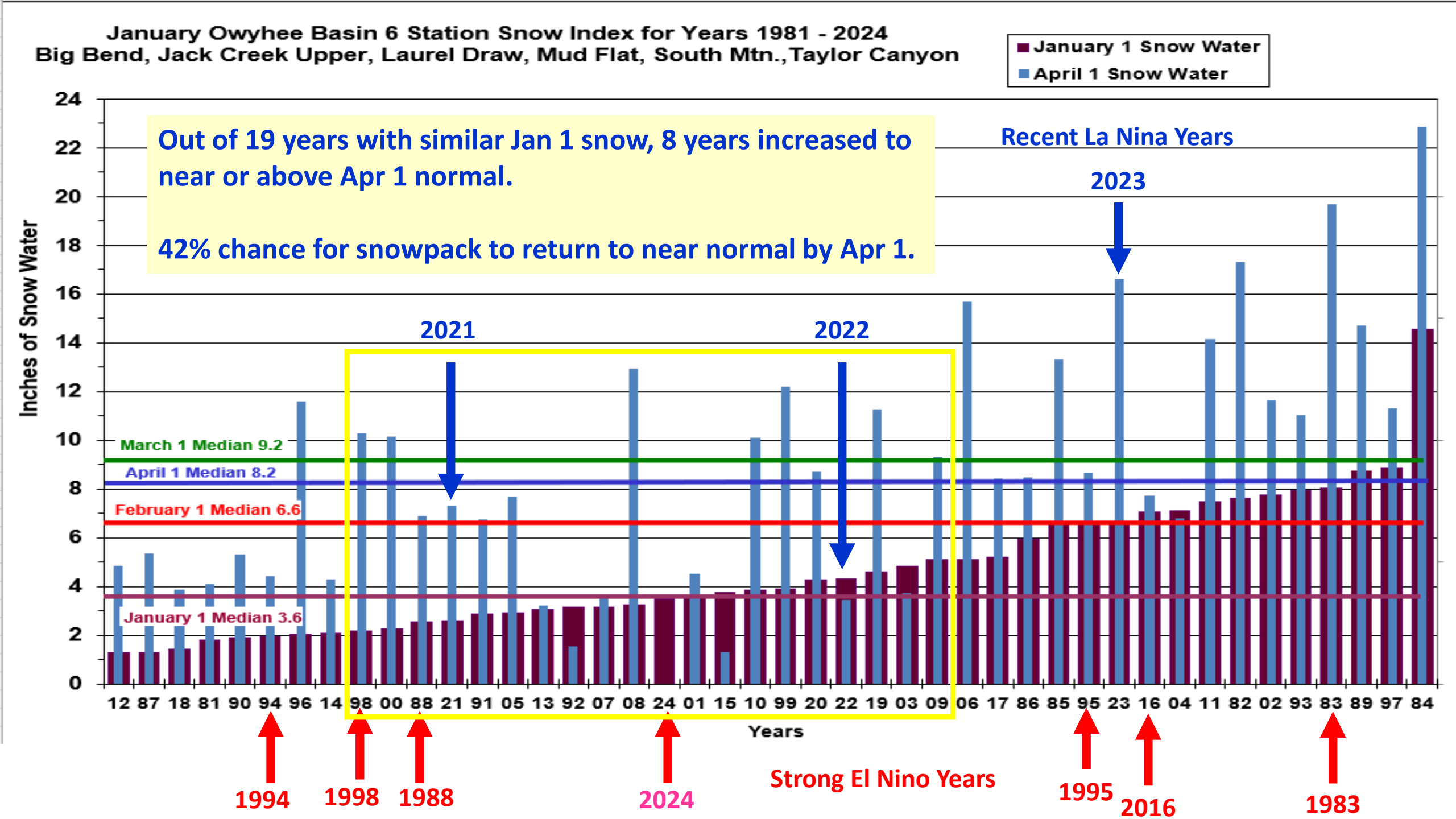
Observed Natural Runoff

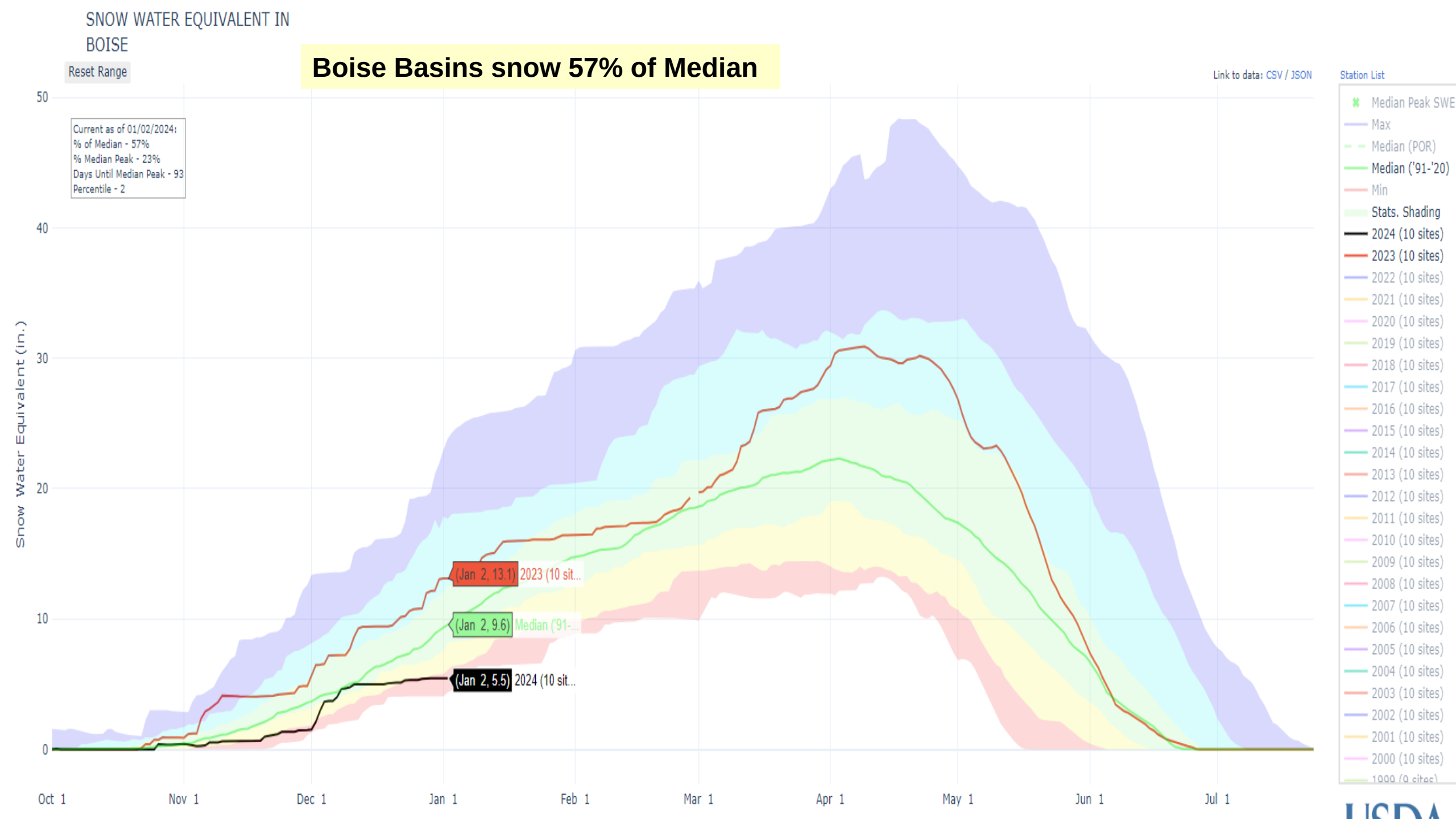
October thru 2024-01-03	55.01 KAF	81% AVG

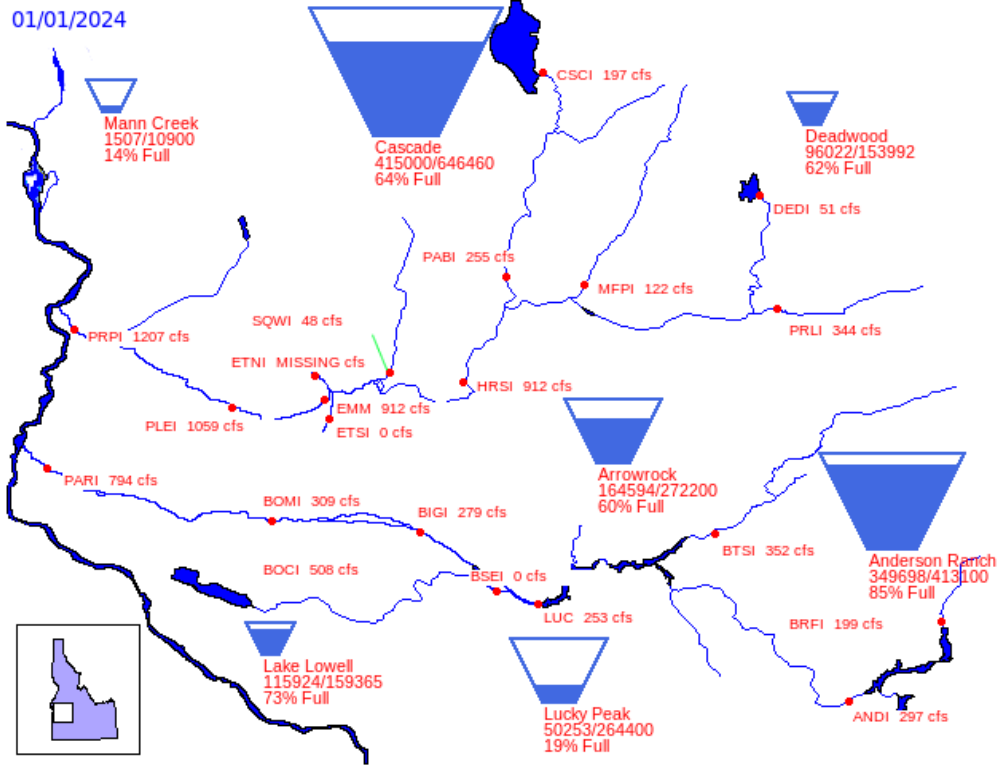





January Owyhee Basin 6 Station Snow Index for Years 1981 - 2024
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn., Taylor Canyon
January 1 Snow Water
April 1 Snow Water
Inches of Snow Water
Jan 1 Owyhee snowpack is near normal
Recent La Nina Years
2023
2022
2021
March 1 Median 9.2
April 1 Median 8.2
February 1 Median 6.6
January 1 Median 3.6
Years
12 87 18 81 90 94 96 14 98 00 88 21 91 05 13 92 07 08 24 01 15 10 99 20 22 19 03 09 06 17 86 85 95 23 16 04 11 82 02 93 83 89 97 84
Strong El Nino Years
1994
1998
1988
2024
1995
2016
1983


January Owyhee Basin 6 Station Snow Index for Years 1981 - 2024
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn., Taylor Canyon
January 1 Snow Water
April 1 Snow Water
Out of 19 years with similar Jan 1 snow, 8 years increased to near or above Apr 1 normal.
42% chance for snowpack to return to near normal by Apr 1.
Recent La Nina Years
2023
2021
2022
Inches of Snow Water
March 1 Median 9.2
April 1 Median 8.2
February 1 Median 6.6
January 1 Median 3.6
0 2 4 6 8 10 12 14 16 18 20 22 24
12 87 18 81 90 94 96 14 98 00 88 21 91 05 13 92 07 08 24 01 15 10 99 20 22 19 03 09 06 17 86 85 95 23 16 04 11 82 02 93 83 89 97 84
Years
1994
1998
1988
2024
Strong El Nino Years
1995
2016
1983


SNOW WATER EQUIVALENT IN BOISE
Reset Range
Boise Basins snow 57% of Median
Link to data: CSV / JSON
Station List
Current as of 01/02/2024:
% of Median - 57%
% Median Peak - 23%
Days Until Median Peak - 93
Percentile - 2
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
(Jan 2, 13.1) 2023 (10 sit...
(Jan 2, 9.6) Median ('91-...
(Jan 2, 5.5) 2024 (10 sit...
Median Peak SWE
Max
Median (POR)
Median ('91-'20)
Min
Stats. Shading
2024 (10 sites)
2023 (10 sites)
2022 (10 sites)
2021 (10 sites)
2020 (10 sites)
2019 (10 sites)
2018 (10 sites)
2017 (10 sites)
2016 (10 sites)
2015 (10 sites)
2014 (10 sites)
2013 (10 sites)
2012 (10 sites)
2011 (10 sites)
2010 (10 sites)
2009 (10 sites)
2008 (10 sites)
2007 (10 sites)
2006 (10 sites)
2005 (10 sites)
2004 (10 sites)
2003 (10 sites)
2002 (10 sites)
2001 (10 sites)
2000 (10 sites)

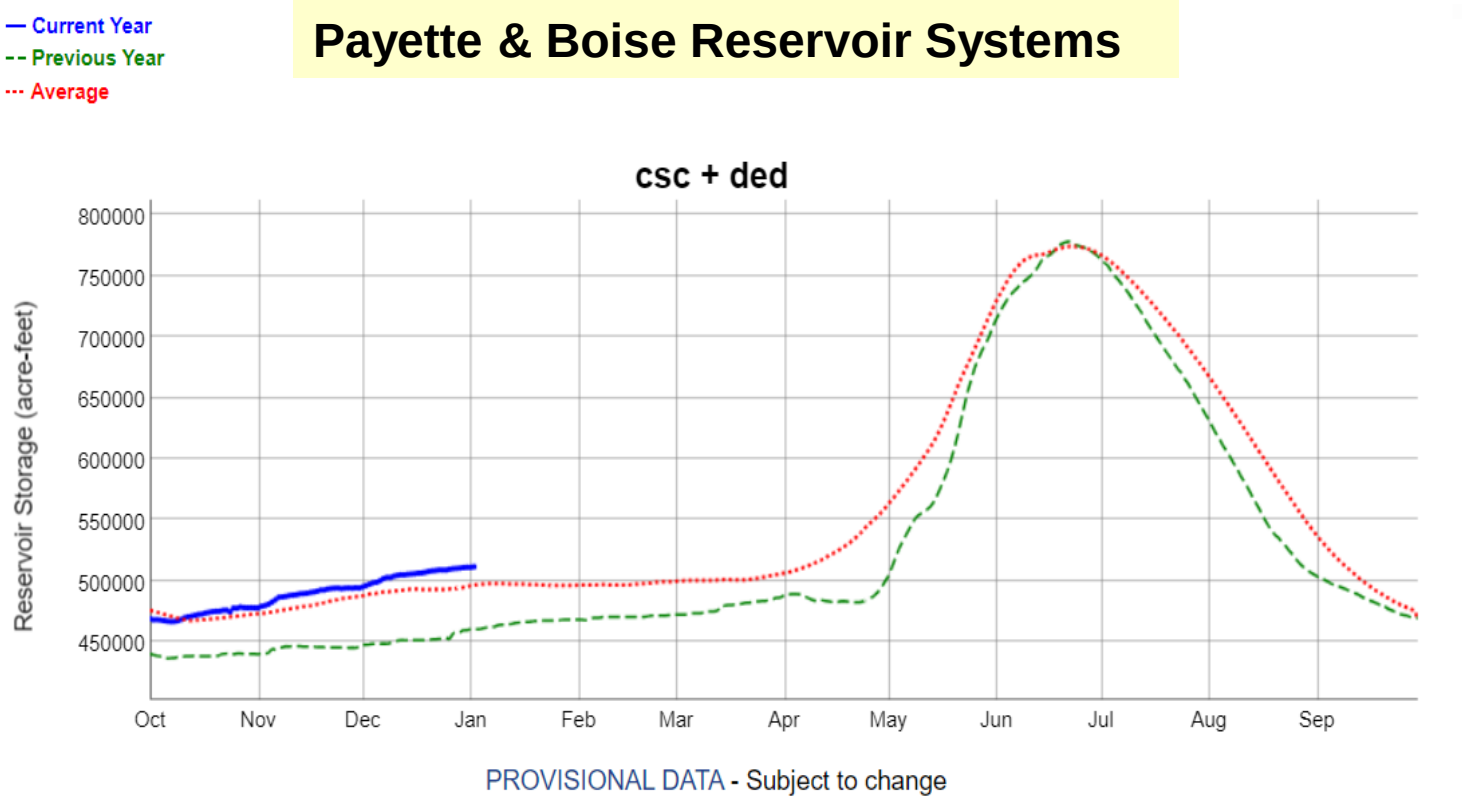


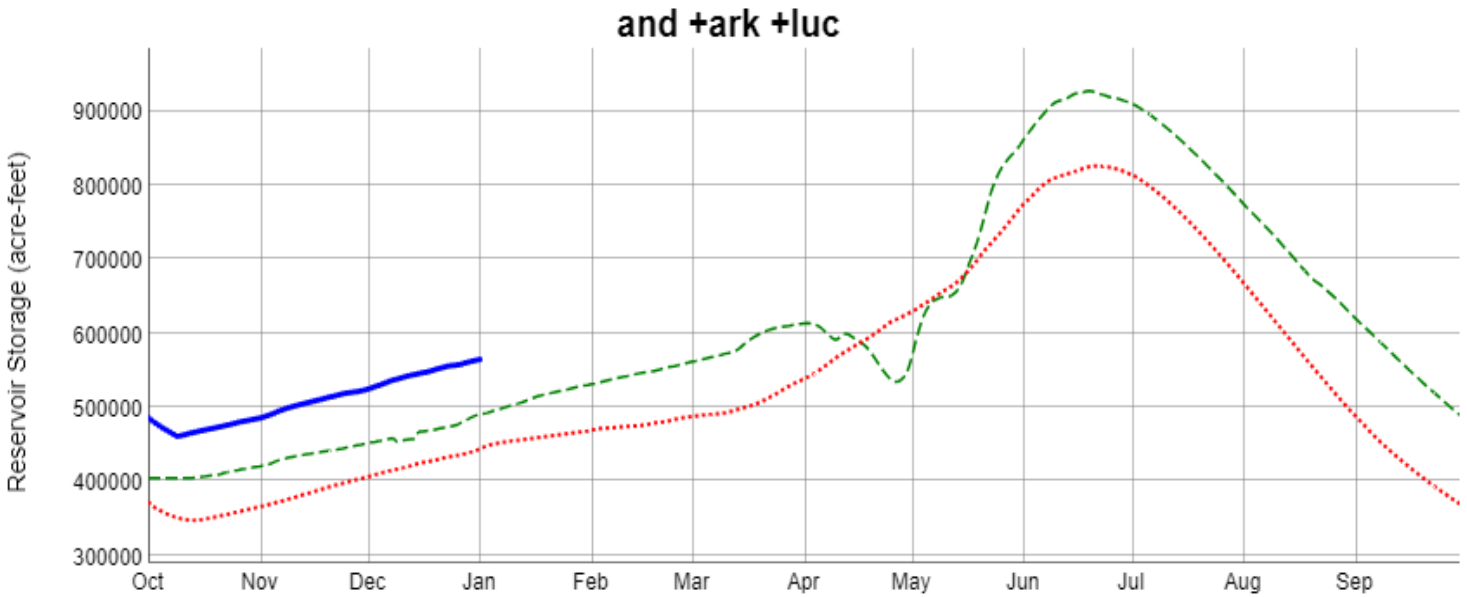
Jan 1, 2024

Payette System 64% Capacity

Boise System 59% Capacity

Payette & Boise Reservoir Systems





From Mike Meyers Jan 5
Avg Boise R runoff is 1566 KAF
Forecast is around 1150 KAF 73% of Avg

Jan 1 NWS forecast is 79% of AVG
Exceedance Range of 42 - 117% of AVG.

From NRCS:
Amount needed for adequate irrigation supply is 64% of MEDIAN.

Current forecasts are around 75% and going to increase with current weather…

Can the snowpack recover ??

LUCI1 ◆ BOISE - LUCKY PEAK DAM

Based on 75 years of historical record (1949-2023):

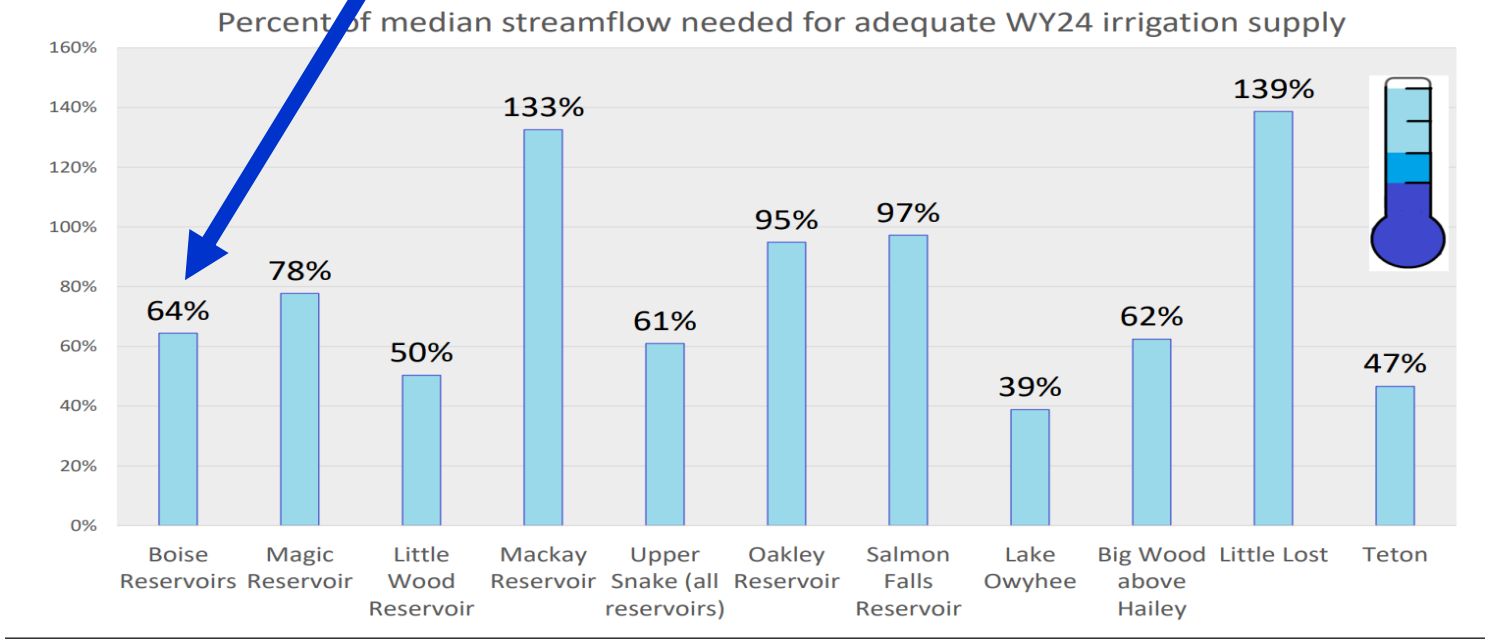
- The median (50%) forecast is ranked 54th wettest and 23rd driest
- The forecast is placed in the 30th percentile of the record (exceedance probability is 70%)

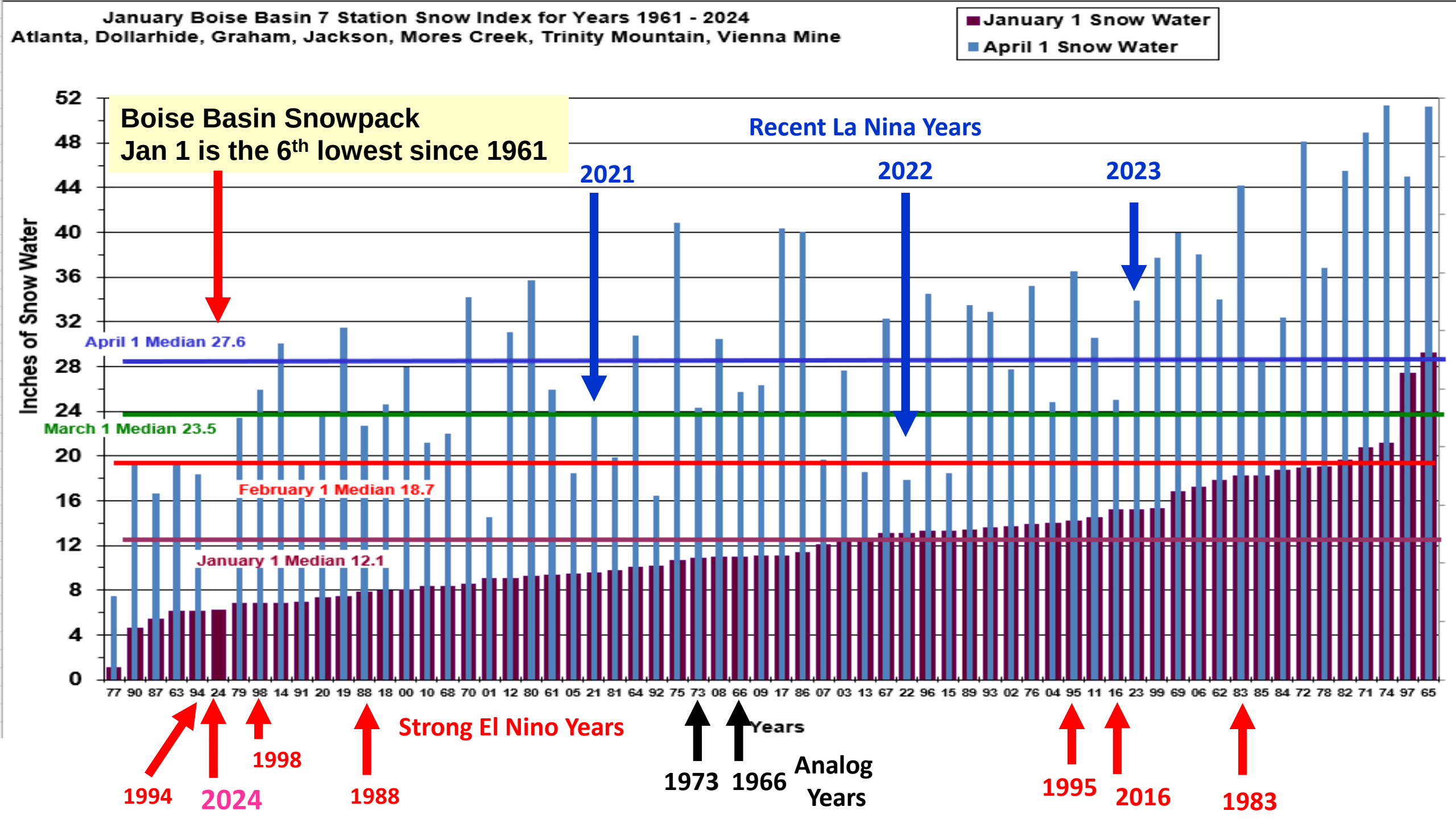
APR-SEP WY2024 Ensemble Traces: **2024-01-03** Issued: **2024-01-03** (Volumes in KAF)

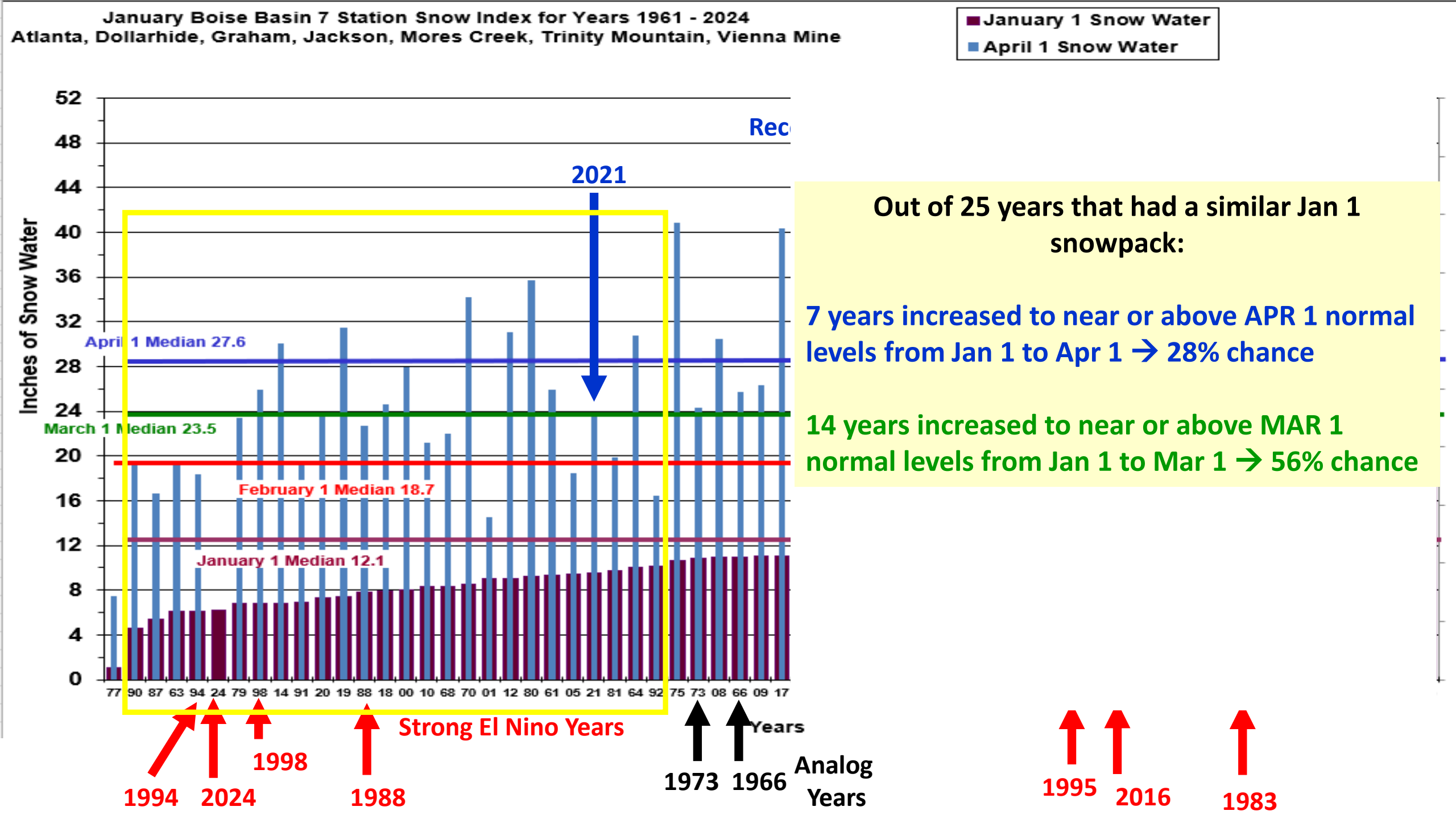
Exceedance	Natural Forecast (ESP10)		Experimental (HEFS)		Reference (ESP0)	
50%	1049 KAF	79% AVG	1112	84%	1044	79%
90%	563 KAF	42% AVG	579	44%	518	39%
10%	1553 KAF	117% AVG	1734	131%	1649	124%

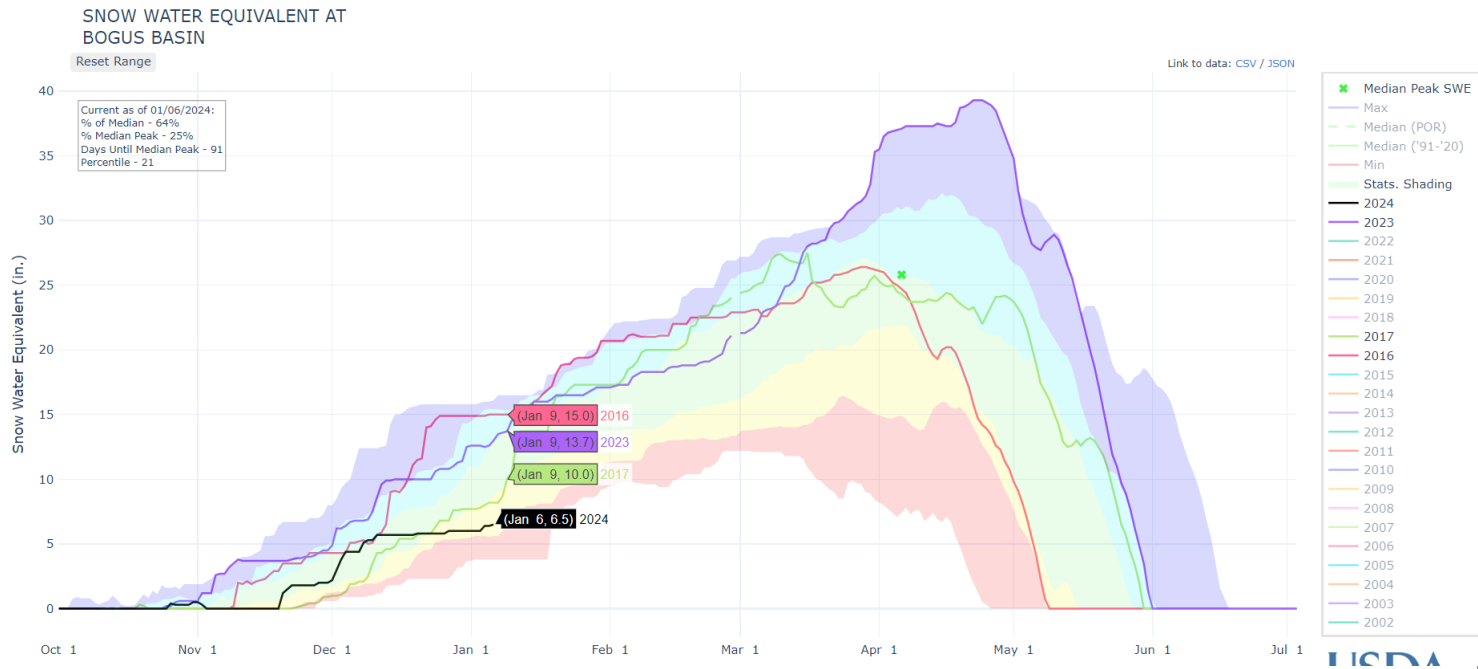
Observed Natural Runoff

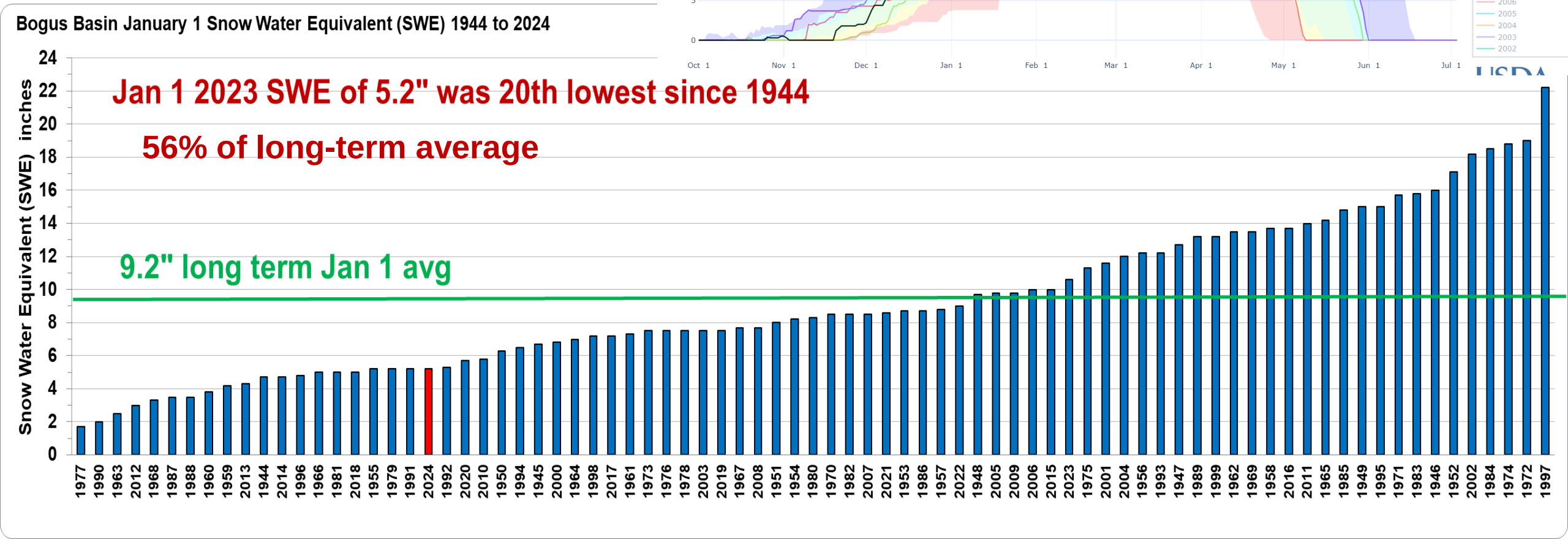
October thru 2024-01-03	164.97 KAF	92% AVG

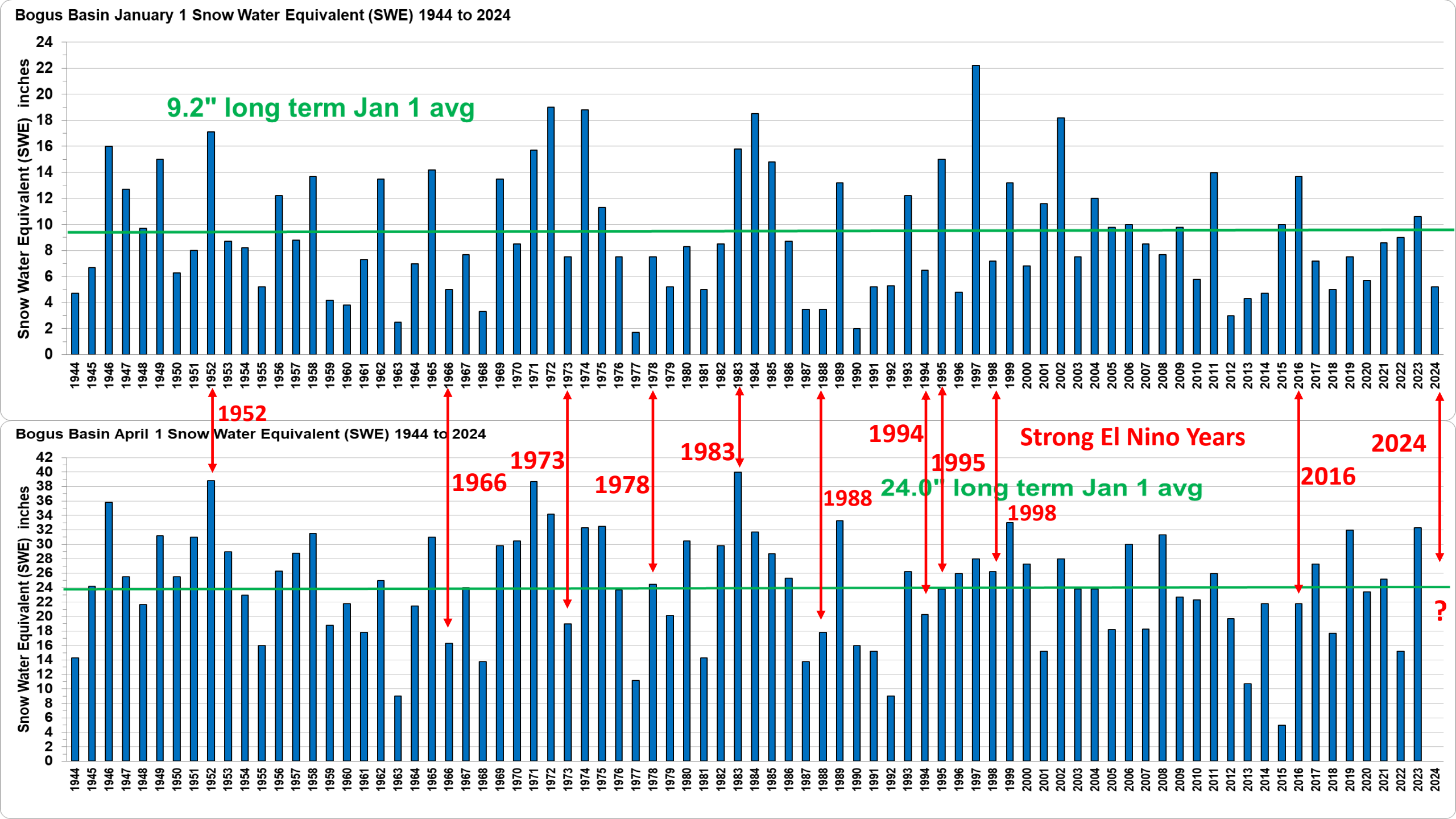


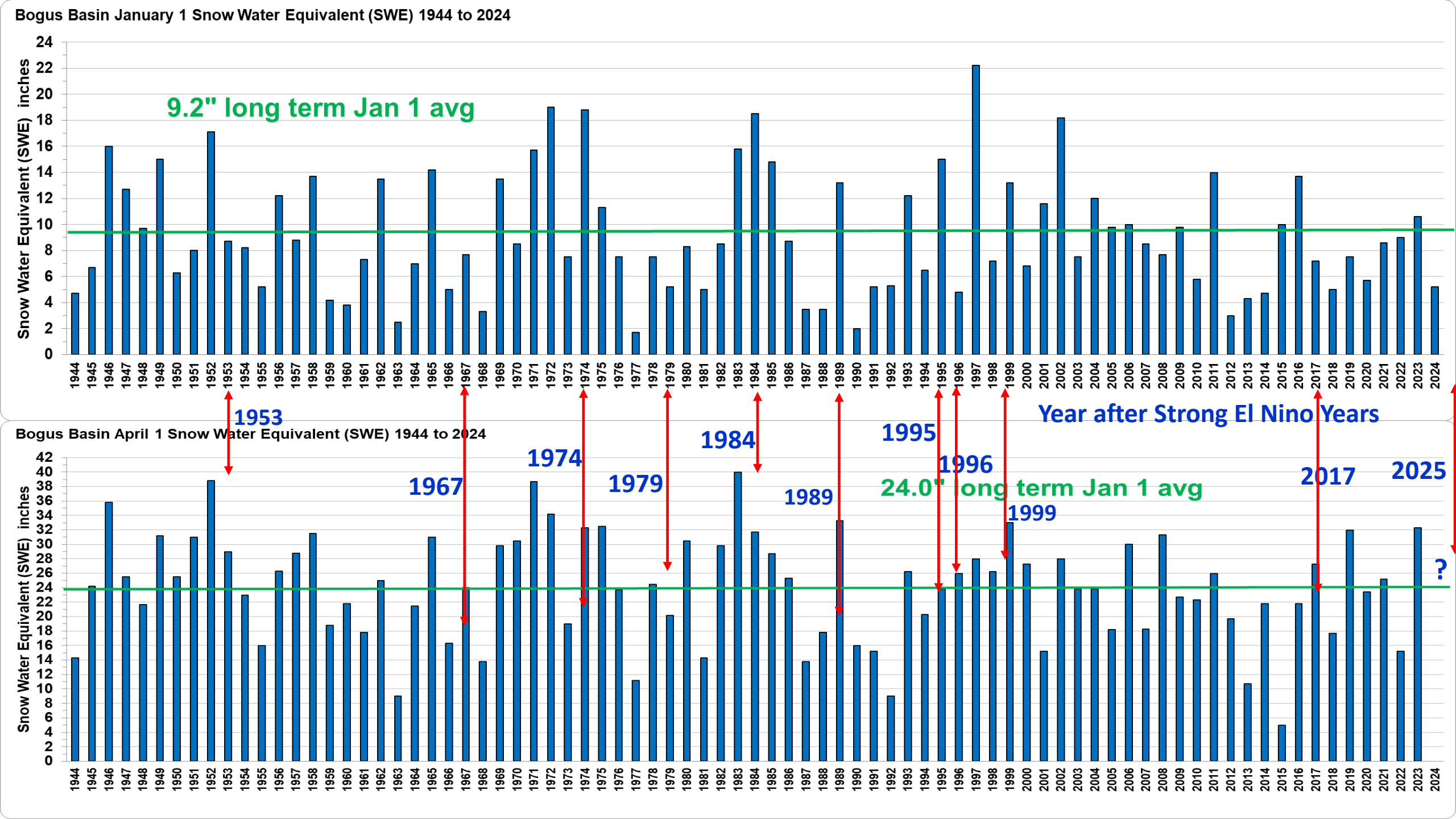

January Boise Basin 7 Station Snow Index for Years 1961 - 2024
Atlanta, Dollarhide, Graham, Jackson, Mores Creek, Trinity Mountain, Vienna Mine
January 1 Snow Water
April 1 Snow Water
Boise Basin Snowpack
Jan 1 is the 6th lowest since 1961
Recent La Nina Years
2021
2022
2023
Inches of Snow Water
April 1 Median 27.6
March 1 Median 23.5
February 1 Median 18.7
January 1 Median 12.1
Years
Strong El Nino Years
1994
2024
1998
1988
1973
1966
Analog Years
1995
2016
1983


January Boise Basin 7 Station Snow Index for Years 1961 - 2024
Atlanta, Dollarhide, Graham, Jackson, Mores Creek, Trinity Mountain, Vienna Mine
January 1 Snow Water
April 1 Snow Water
Inches of Snow Water
52
48
44
40
36
32
28
24
20
16
12
8
4
0
Rec
2021
April 1 Median 27.6
March 1 Median 23.5
February 1 Median 18.7
January 1 Median 12.1
77 90 87 63 94 24 79 98 14 91 20 19 88 18 00 10 68 70 01 12 80 61 05 21 81 64 92 75 73 08 66 09 17
Years
Strong El Nino Years
1994
2024
1998
1988
1973
1966
Analog Years
1995
2016
1983
Out of 25 years that had a similar Jan 1 snowpack:
7 years increased to near or above APR 1 normal levels from Jan 1 to Apr 1 → 28% chance
14 years increased to near or above MAR 1 normal levels from Jan 1 to Mar 1 → 56% chance


SNOW WATER EQUIVALENT AT
BOGUS BASIN
Reset Range
Link to data: CSV / JSON
Current as of 01/06/2024:
% of Median - 64%
% Median Peak - 25%
Days Until Median Peak - 91
Percentile - 21
Snow Water Equivalent (in.)
(Jan 9, 15.0) 2016
(Jan 9, 13.7) 2023
(Jan 9, 10.0) 2017
(Jan 6, 6.5) 2024
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Median Peak SWE
Max
Median (POR)
Median ('91-'20)
Min
Stats. Shading
2024
2023
2022
2021
2020
2019
2018
2017
2016
2015
2014
2013
2012
2011
2010
2009
2008
2007
2006
2005
2004
2003
2002


Bogus Basin January 1 Snow Water Equivalent (SWE) 1944 to 2024
Jan 1 2023 SWE of 5.2" was 20th lowest since 1944
56% of long-term average
9.2" long term Jan 1 avg
Snow Water Equivalent (SWE) inches
1977 1990 1963 2012 1968 1987 1988 1960 1959 2013 1944 2014 1996 1966 1981 2018 1955 1979 1991 2024 1992 2020 2010 1950 1994 1945 2000 1964 1998 2017 1961 1973 1976 1978 2003 2019 1967 2008 1951 1954 1980 1970 1982 2007 2021 1953 1986 1957 2022 1948 2005 2009 2006 2015 2023 1975 2001 2004 1956 1993 1947 1989 1999 1962 1969 1958 2016 2011 1965 1985 1949 1995 1971 1983 1946 1952 2002 1984 1974 1972 1997


Bogus Basin January 1 Snow Water Equivalent (SWE) 1944 to 2024
Snow Water Equivalent (SWE) inches
9.2" long term Jan 1 avg
Bogus Basin April 1 Snow Water Equivalent (SWE) 1944 to 2024
Snow Water Equivalent (SWE) inches
1952
1966
1973
1978
1983
1988
1994
1995
1998
2016
2024
Strong El Nino Years
24.0" long term Jan 1 avg
?


Bogus Basin January 1 Snow Water Equivalent (SWE) 1944 to 2024
Snow Water Equivalent (SWE) inches
9.2" long term Jan 1 avg
Bogus Basin April 1 Snow Water Equivalent (SWE) 1944 to 2024
Snow Water Equivalent (SWE) inches
1953
1967
1974
1979
1984
1989
1995
1996
1999
2017
2025
Year after Strong El Nino Years
24.0" long term Jan 1 avg
?

Magic Reservoir
Jan 1 NWS forecast is 77% of AVG
Exceedance Range of 40 - 123% of AVG

NRCS amount needed for adequate irrigation supply is 78% of MEDIAN.

Forecast is for 77% AVG
Need 78% MEDIAN

Need more snow…

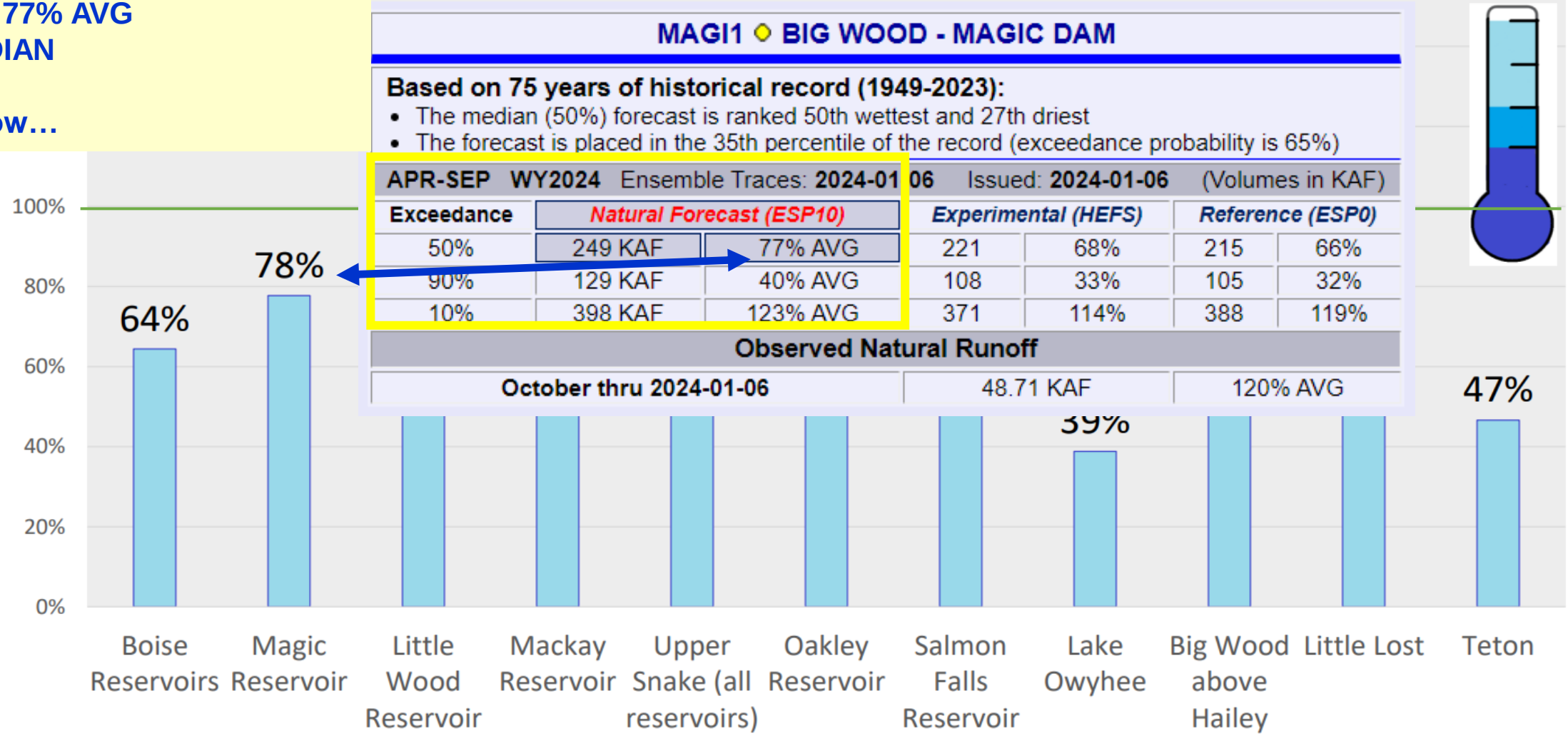
Presented by NRCS at the IDWR Fall Water Supply Outlook Meeting Nov 2023
Keep in mind values are in % of MEDIAN

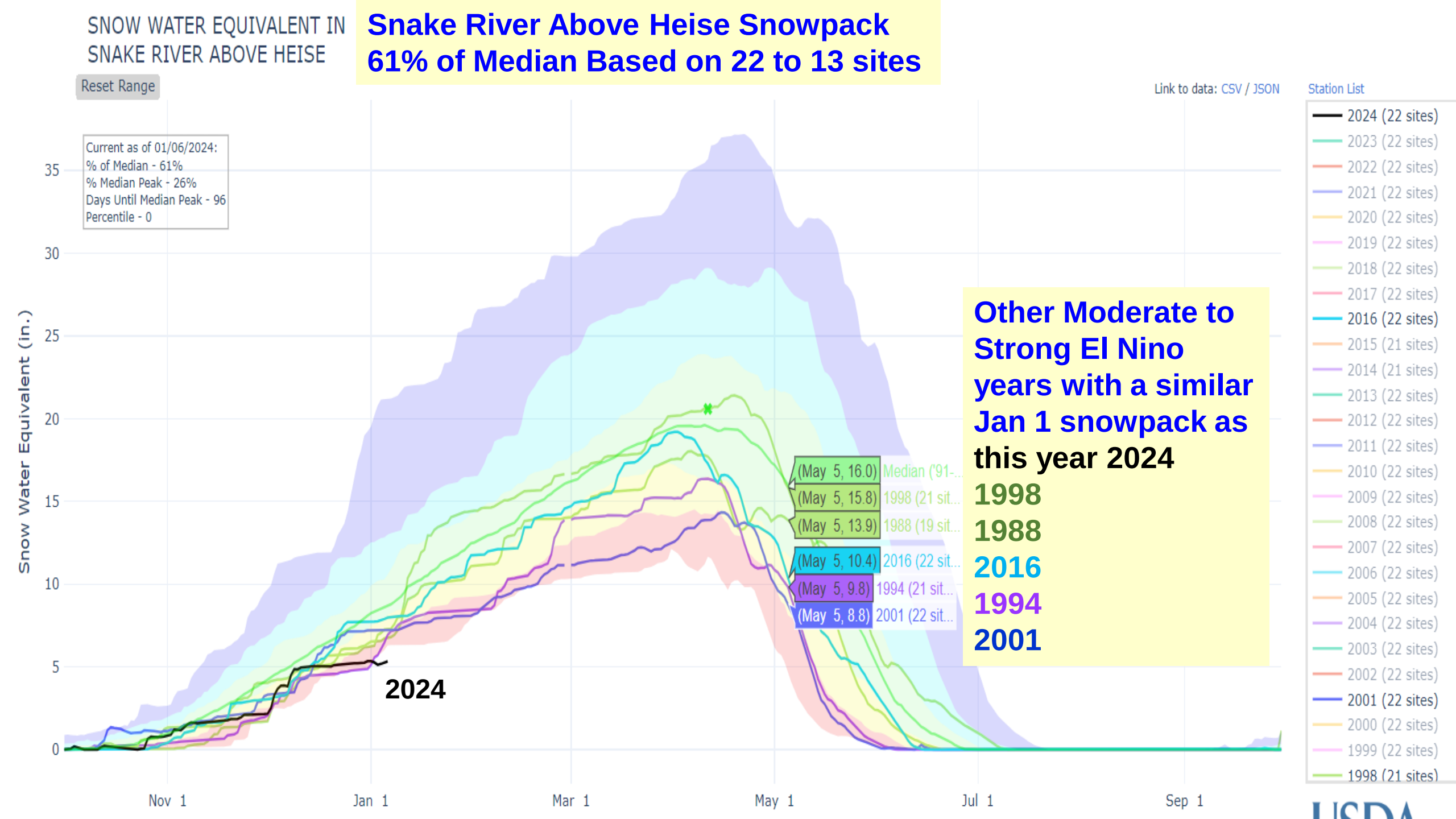
median streamflow needed for adequate WY24 irrigation supply

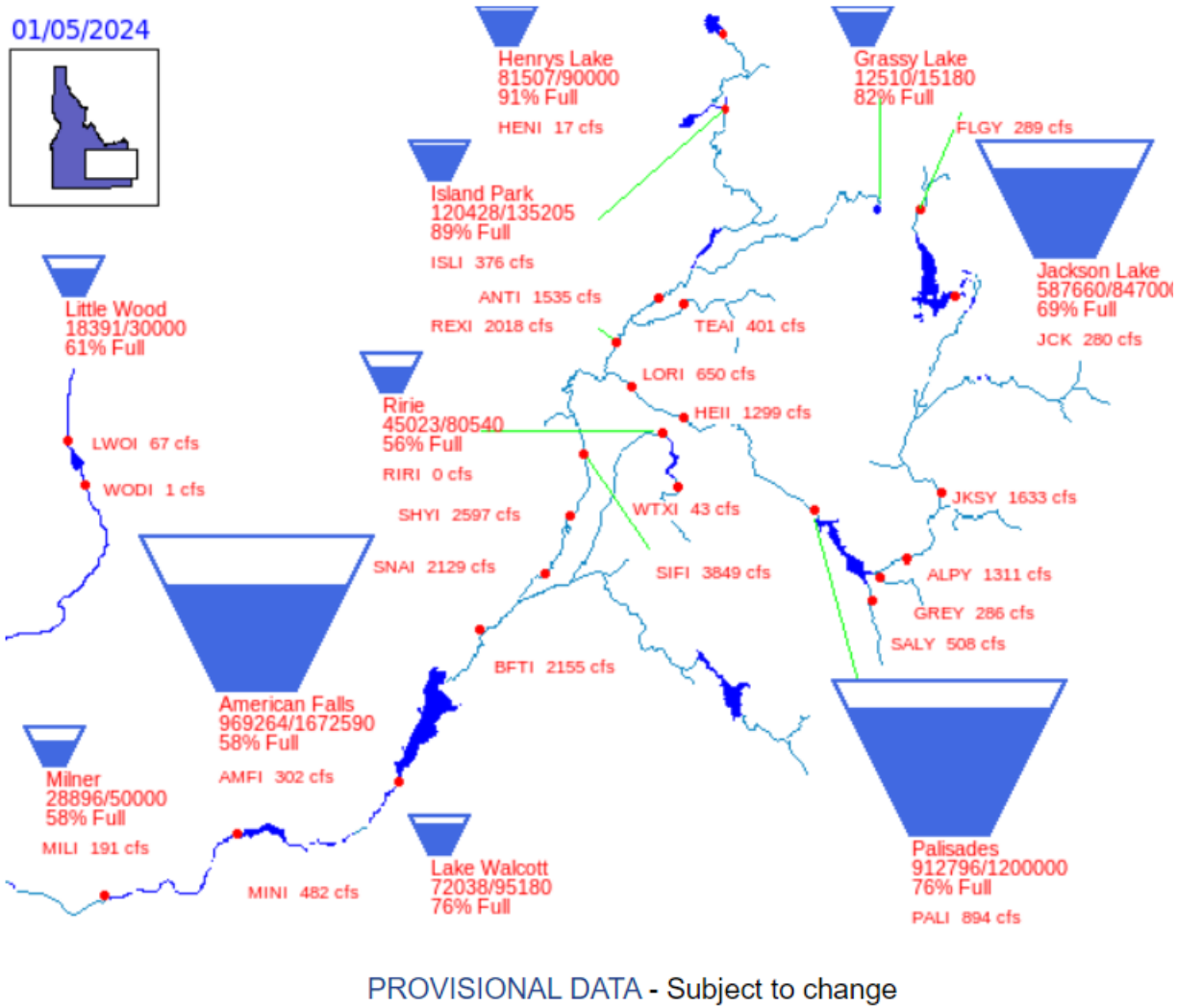
MAGI1 ○ BIG WOOD - MAGIC DAM

Based on 75 years of historical record (1949-2023):
- The median (50%) forecast is ranked 50th wettest and 27th driest
- The forecast is placed in the 35th percentile of the record (exceedance probability is 65%)

APR-SEP WY2024 Ensemble Traces: 2024-01 06			Issued: 2024-01-06	(Volumes in KAF)		
Exceedance	Natural Forecast (ESP10)		Experimental (HEFS)		Reference (ESP0)	
50%	249 KAF	77% AVG	221	68%	215	66%
90%	129 KAF	40% AVG	108	33%	105	32%
10%	398 KAF	123% AVG	371	114%	388	119%
Observed Natural Runoff						
October thru 2024-01-06	48.71 KAF	120% AVG				




SNOW WATER EQUIVALENT IN
SNAKE RIVER ABOVE HEISE
Snake River Above Heise Snowpack
61% of Median Based on 22 to 13 sites
Reset Range
Link to data: CSV / JSON
Station List
Current as of 01/06/2024:
% of Median - 61%
% Median Peak - 26%
Days Until Median Peak - 96
Percentile - 0
Snow Water Equivalent (in.)
0
5
10
15
20
25
30
35
Nov 1
Jan 1
Mar 1
May 1
Jul 1
Sep 1
(May 5, 16.0) Median ('91-...
(May 5, 15.8) 1998 (21 sit...
(May 5, 13.9) 1988 (19 sit...
(May 5, 10.4) 2016 (22 sit...
(May 5, 9.8) 1994 (21 sit...
(May 5, 8.8) 2001 (22 sit...
2024
Other Moderate to Strong El Nino years with a similar Jan 1 snowpack as this year 2024
1998
1988
2016
1994
2001
2024 (22 sites)
2023 (22 sites)
2022 (22 sites)
2021 (22 sites)
2020 (22 sites)
2019 (22 sites)
2018 (22 sites)
2017 (22 sites)
2016 (22 sites)
2015 (21 sites)
2014 (21 sites)
2013 (22 sites)
2012 (22 sites)
2011 (22 sites)
2010 (22 sites)
2009 (22 sites)
2008 (22 sites)
2007 (22 sites)
2006 (22 sites)
2005 (22 sites)
2004 (22 sites)
2003 (22 sites)
2002 (22 sites)
2001 (22 sites)
2000 (22 sites)
1999 (22 sites)
1998 (21 sites)



PROVISIONAL DATA - Subject to change

Jan 5, 2024
Upper Snake River Reservoir System is at 67% Capacity

HEII1 ○ SNAKE - NEAR HEISE

Based on 75 years of historical record (1949-2023):

- The median (50%) forecast is ranked 52nd wettest and 25th driest
- The forecast is placed in the 32nd percentile of the record (exceedance probability is 68%)

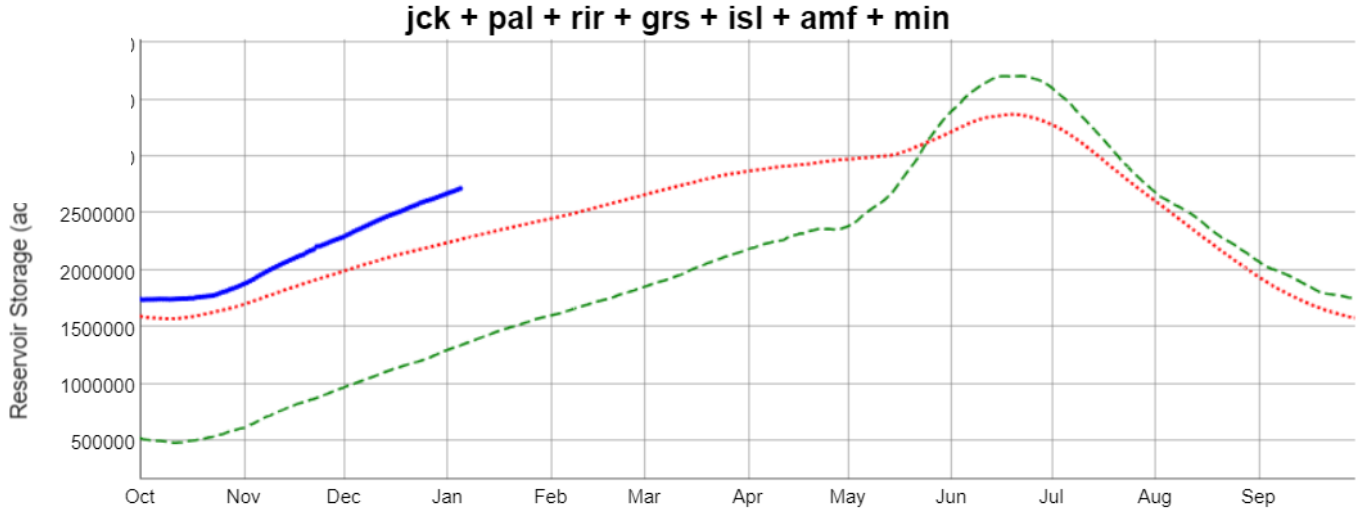
APR-SEP WY2024 Ensemble Traces: **2024-01-06** Issued: **2024-01-06** (Volumes in KAF)

Exceedance	*Natural Forecast (ESP10)*		*Experimental (HEFS)*		*Reference (ESP0)*	
50%	3237 KAF	84% AVG	3112	81%	3047	79%
90%	2379 KAF	62% AVG	2133	55%	1989	51%
10%	4356 KAF	113% AVG	4370	113%	4245	110%

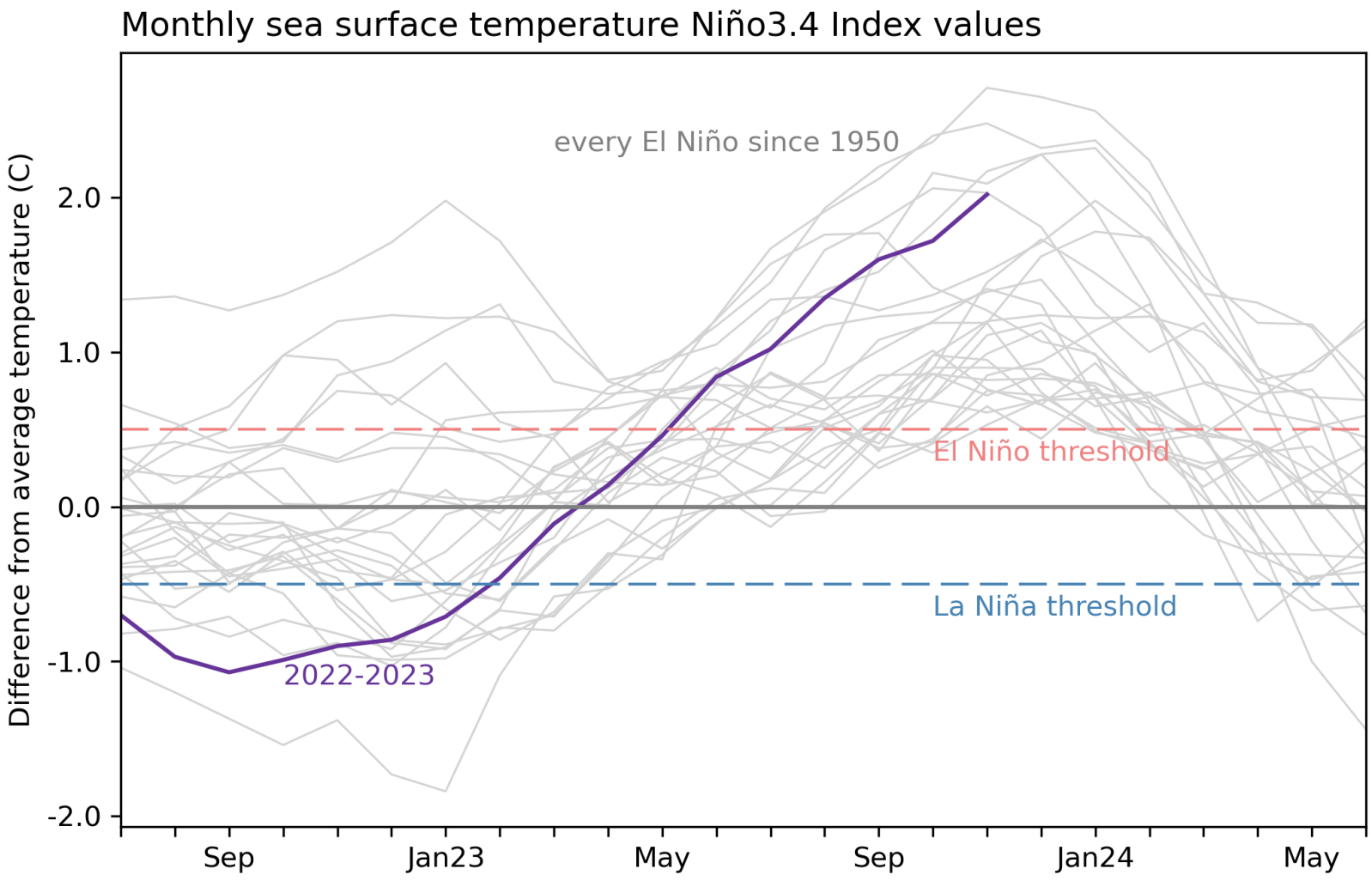
Observed Natural Runoff

October thru 2024-01-06	618.68 KAF	100% AVG

Jan 6 NWS forecast is 84% of AVG with Exceedance Range of 62 - 123%



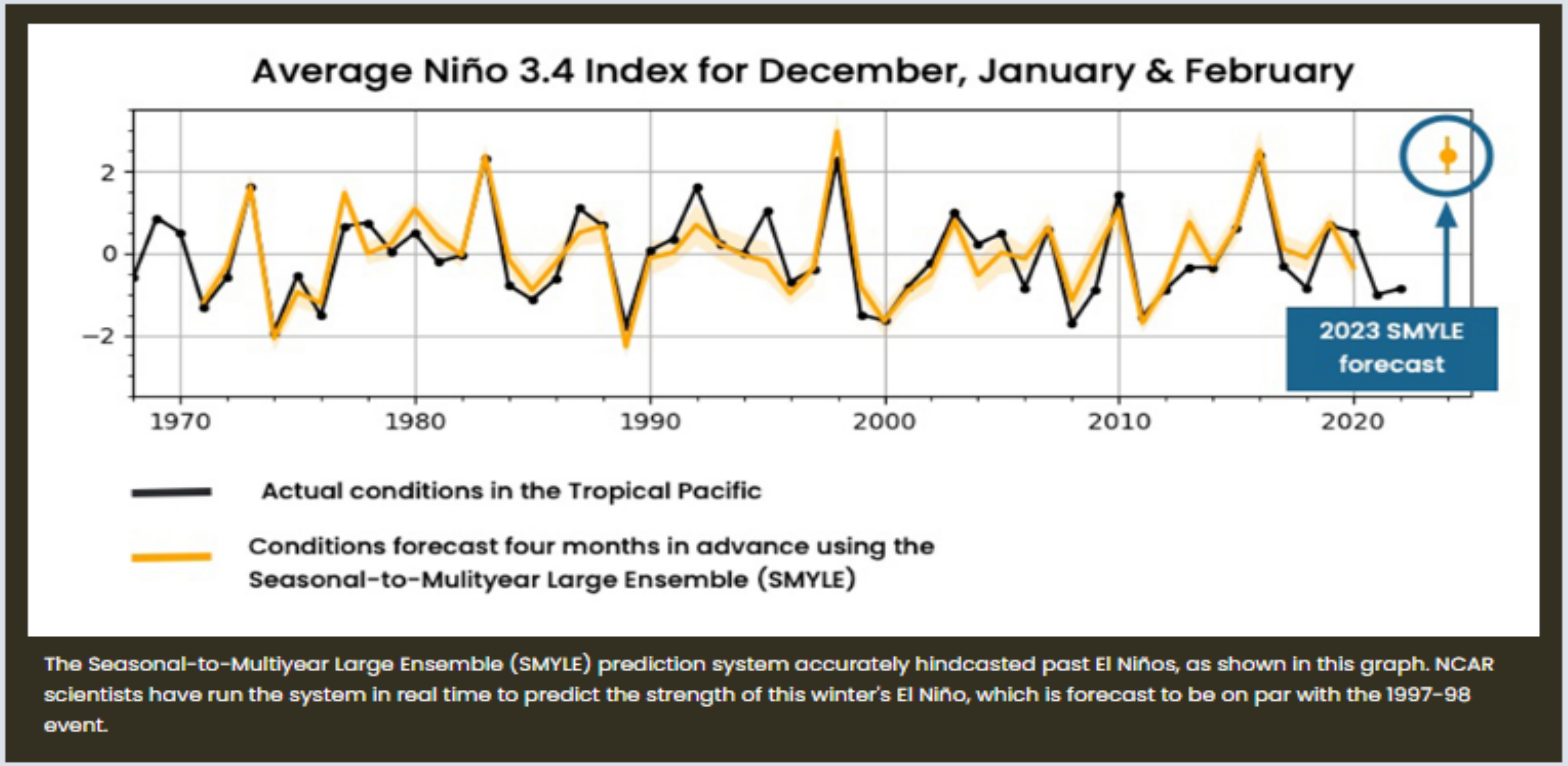
Looking for that Strong El Nino…



NCAR EXPERIMENTAL PREDICTION SYSTEM CALLS FOR A SUPER EL NIÑO THIS WINTER

New system forecasts an event similar to the 1997-98 El Niño

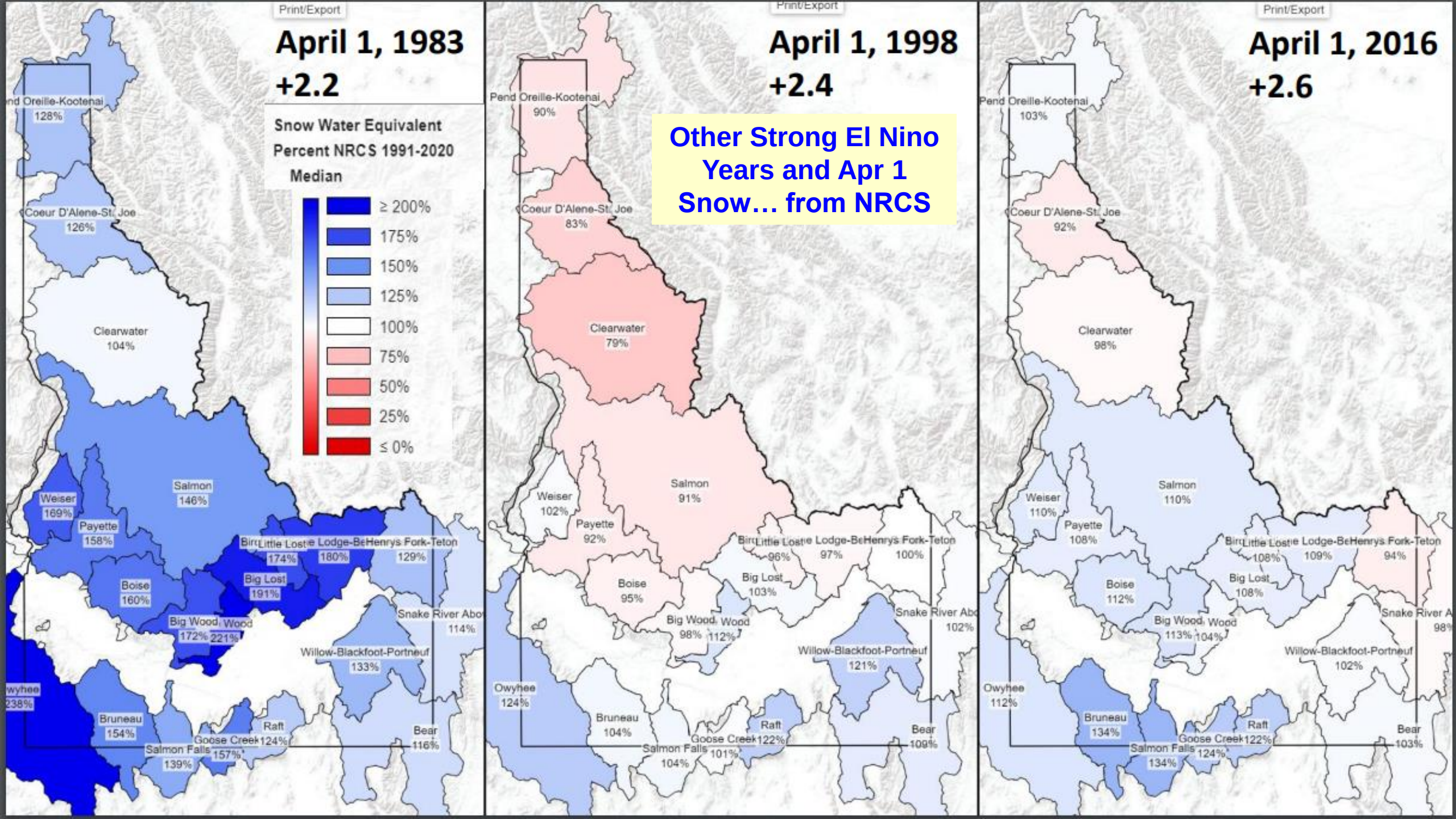
SEP 26, 2023 - BY LAURA SNIDER



The Seasonal-to-Multiyear Large Ensemble (SMYLE) prediction system accurately hindcasted past El Niños, as shown in this graph. NCAR scientists have run the system in real time to predict the strength of this winter's El Niño, which is forecast to be on par with the 1997-98 event.

Current El Niño conditions are likely to develop into one of the strongest events on record — comparable to the major El Niño of 1997-98 — according to an experimental prediction system developed for research purposes by the National Science Foundation's National Center for Atmospheric Research (NCAR).

"Our forecast system has shown that it can do a remarkably good job of accurately hindcasting past El Niño events when we've tested it using historical data, which gives us high confidence in this forecast," said NCAR scientist Stephen Yeager, who helped lead the modeling effort.


Print/Export
April 1, 1983
+2.2
Snow Water Equivalent
Percent NRCS 1991-2020
Median
≥ 200%
175%
150%
125%
100%
75%
50%
25%
≤ 0%
Pend Oreille-Kootenai
128%
Coeur D'Alene-St. Joe
126%
Clearwater
104%
Salmon
146%
Weiser
169%
Payette
158%
Little Lost
174%
Lodge-Be
180%
Henrys Fork-Teton
129%
Big Lost
191%
Boise
160%
Big Wood
172%
Wood
221%
Snake River Abo
114%
Willow-Blackfoot-Portneuf
133%
Owyhee
238%
Bruneau
154%
Goose Creek
157%
Raft
124%
Salmon Falls
139%
Bear
116%
Print/Export
April 1, 1998
+2.4
Other Strong El Nino Years and Apr 1 Snow… from NRCS
Pend Oreille-Kootenai
90%
Coeur D'Alene-St. Joe
83%
Clearwater
79%
Salmon
91%
Weiser
102%
Payette
92%
Little Lost
96%
Lodge-Be
97%
Henrys Fork-Teton
100%
Boise
95%
Big Lost
103%
Big Wood
98%
Wood
112%
Snake River Abo
102%
Willow-Blackfoot-Portneuf
121%
Owyhee
124%
Bruneau
104%
Goose Creek
101%
Raft
122%
Salmon Falls
104%
Bear
109%
Print/Export
April 1, 2016
+2.6
Pend Oreille-Kootenai
103%
Coeur D'Alene-St. Joe
92%
Clearwater
98%
Salmon
110%
Weiser
110%
Payette
108%
Little Lost
108%
Lodge-Be
109%
Henrys Fork-Teton
94%
Boise
112%
Big Lost
108%
Big Wood
113%
Wood
104%
Snake River A
98%
Willow-Blackfoot-Portneuf
102%
Owyhee
112%
Bruneau
134%
Goose Creek
124%
Raft
122%
Salmon Falls
134%
Bear
103%

Analysis of Streamflow in Strong El Nino Years (SE) like 2016

	ENSO	PDO	Streamflow as % of 1981-2010 Average				
			Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
Year	SE Strong El Nino	pos or neg	Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	Snake River nr Heise	Spokane River nr Post Falls
1994	SE	pos	23	36	12	61	51
1988	SE	pos	30	65	24	70	71
1941	SE	pos	83	53	69	73	45
1966	SE	neg	28	39	51	78	90
1973	SE	pos / neg	61	114	51	79	45
1942	SE	pos	122	173	117	86	77
1947	SE	pos / neg	44	50	59	108	90
1952	SE	neg	246	178	263	116	123
1995	SE	pos	124	135	195	118	70
1998	SE	pos	135	138	161	119	82
1983	SE	pos	221	157	282	132	91
1978	SE	pos	110	112	140	133	99
2016	SE	pos	82	122	70	80	66

sorted

	<60
	60-90
	90-110
	~111-130
	>130

Analysis of Streamflow for a year like 2017 that follows a Strong El Nino Year like 2016

sorted

				Streamflow as % of 1981-2010 Average					
	ENSO		ENSO	Feb-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep	Apr-Sep
Year	SE Strong El Nino	Year Following a Strong El Nino		Owyhee River blw Dam	Salmon Falls Creek	Boise River nr Boise	Big Wood River blw Magic Dam	Snake River nr Heise	Spokane River nr Post Falls
1978	SE	1979	N	97	116	63	34	90	105
1941	SE	1942	SE	122	173	91	117	86	77
1988	SE	1989	SL	145	100	97	75	102	116
1966	SE	1967	N	69	88	105	151	109	113
1947	SE	1948	LN	58	86	105	66	97	176
1952	SE	1953	N	56	76	124	92	92	108
1998	SE	1999	SL	100	108	135	158	131	129
1994	SE	1995	SE	124	135	138	195	118	70
1995	SE	1996	N	124	115	152	132	148	116
1983	SE	1984	N	363	369	158	206	133	112
1973	SE	1974	SL	120	111	181	184	147	193
1942	SE	1943	N	137	150	209	259	144	150
2016	SE	2017	LN	155	161	180	266	163	112

12 years

Color coded streamflow as % of average

<60
60-90
90-110
~111-130
>130

1998/1999 Mt Baker set word snowfall with 95 feet of snowfall

Remember winter of 2016 / 2017
45 Atmospheric Rivers made landfall on West Coast
The atmospheric river activity was unprecedented in the 70-year record

*

<u>Take Home Point</u> – Oceans & Atmosphere are very active following Strong El Nino Years and have a lot of energy to get rid of… and that's what happened

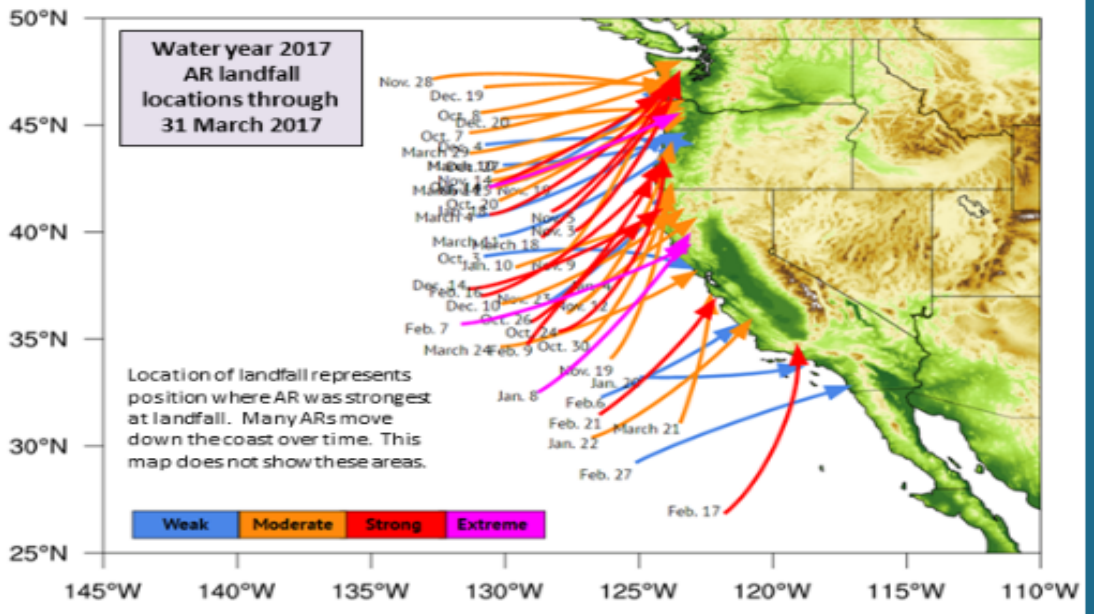
Distribution of Landfalling Atmospheric Rivers on the U.S. West Coast
(From 1 Oct 2016 to 31 March 2017)

AR Strength	AR Count*
Weak	11
Moderate	20
Strong	12
Extreme	3

Ralph/CW3E AR Strength Scale
- Weak: IVT=250–500 kg m^{-1} s^{-1}
- Moderate: IVT=500–750 kg m^{-1} s^{-1}
- Strong: IVT=750–1000 kg m^{-1} s^{-1}
- Extreme: IVT>1000 kg m^{-1} s^{-1}

*Radiosondes at Bodega Bay, CA indicated the 10–11 Jan AR was strong (noted as moderate based on GFS analysis data) and 7–8 Feb AR was extreme (noted as strong)

- 45 Atmospheric Rivers have made landfall on the West Coast thus far during the 2017 water year (1 Oct. – 31 March 2017)
- This is much greater than normal
- 1/3 of the landfalling ARs have been "strong" or "extreme"



Center for Western Weather and Water Extremes
SCRIPPS INSTITUTION OF OCEANOGRAPHY AT UC SAN DIEGO

By F.M. Ralph, B. Kawzenuk, C. Hecht, J. Kalansky

Experimental

Keep your eye on the sky & watching those forecasts!
Let's hope the 2nd half of Winter starts today!

The Powder Buoy
9m ·

The last buoypop for the 17th was a few days long, hopefully that parlays into a multi-day storm, there's another pop forming right now and it looks like there's potential for pops for the next week, on the experimental buoypop predicting crystal ball which would keep snow rolling on and off from the 17th to the 25/26 or so. We'll see, either way, better than high pressure!

https://airflare.com/