The Drought:

To What Extent are the Headlines in Sync with the Science?
Which Parts of the State are More Affected than Susceptible Others?

- Overall scope of the problem
- Impact of precipitation falling as rain rather than snow
- Areas that are drier than others
- Potential relief for 2016 from possible El Nino warming pattern in the Pacific
- Expectations beyond 2016

Ron Abramovich
Water Supply Specialist
Snow Survey Boise, Idaho

USDA

NRCS Natural Resources Conservation Service

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Water Law in Idaho | Boise

Monday • September 21, 2015

To Understand Overall Scope of the Problem Need to Understand:

1. <u>WHERE</u> our precipitation comes from and <u>WHEN</u> it falls.

A. Annual & seasonal precipitation amounts

2. Teleconnection Indices – primary indices.

A. ENSO - El Nino/La Nina, Southern Oscillation Index
B. PDO – Pacific Decadal Oscillation Index
C. Other Indices – solar cycles, and mores
D. How the Indices set up each year determines the storm track
E. Good example is recent 2011 strong La Nina that brought abundant moisture to Upper Snake, which was strongest La Nina since 1974 that brought abundant moisture to the Salmon basin

3. Sea Surface Temperatures (SST) and influence of the warm waters in the NE Pacific Ocean on the weather pattern the past two seasons - western ridge allowing moisture to track east of the Continental Divide to Midwest/East Coast.

4. Need to understand the storm track that brings moisture to your Idaho basins.

A. Winter storm track winter 2013-14 and 2014-15
B. Weekly US Drought Monitor Map shows which areas in the state are more affected than others.
C. California drought pushing into Nevada, Owyhee basin and Central Idaho.
D. Flow trend graphs – showing dry streamflow trends in SW & Central Idaho.

Impact of Precipitation Falling as Rain Rather than Snow

1. Winter 2014-2015 is excellent illustration that had more of our winter precipitation falling as rain.
   - A. 2015 Snow Drought:
     - a. first signs of snow drought – moving ski races to snowier locations
     - b. 2015 precipitation & snow maps as percent of normal
     - c. SNOTEL precipitation & snow water analysis slides Abby Lute, USFS Rocky Mountain Research Station
   - B. 2015 Impacts on Streamflow:
     - a. early runoff in Owyhee River winter 2014-15
     - b. early runoff for Dworshak Reservoir Inflow with well below normal April – July volume

---

Which Parts of the State are More ~~Affected~~ Susceptible than Others?

1. Winter 2015 is excellent year to help answer this question

   A. Basin topography, topography, topography…..
   - a. Amount of high elevation in your basin, i.e., pretty & taller mountain peaks the better for collecting snowfall,
   - b. North facing slopes provide added bonus
   - c. Location based of storm tracks and 2nd chance for addition spring rains along Montana border (Spring 2011)

   B. Best way to visualize susceptible basins are Monthly Snow Graphs illustrating Chance of Snow to Recover by April 1

To What Extent are the Headlines in Sync with the Science?

1. Headlines from Newspapers and Academic Research Journals

A. Changes in Arctic & Antarctic Ice Coverage – records start 1978

B. and more…

Potential Relief for 2016 from Possible El Nino Warming Pattern in the Pacific - Expectations beyond 2016

1. How the current Sea Surface Temperatures are setting the stage for the coming winter
2. Early seasonal forecasts for the coming winter


MONTANA 650
COOL CREEK
84.79mi
073°
5680 Ft
5160 Ft
5640 Ft
5920 Ft
5600 Ft
5000 Ft
5400 Ft
4960 Ft
5280 Ft
4880 Ft
5480 Ft
5880 Ft
COOL CREEK
0.3mi
6000 Ft
5200 Ft
6040 Ft
5320 Ft
5840 Ft
Go

To Understand Overall Scope of the Problem Need to Understand:

1. <u>WHERE</u> does our precipitation comes from and <u>WHEN</u> does it falls.

A. Annual & seasonal precipitation amounts

2. Teleconnection Indices – primary climate indices.

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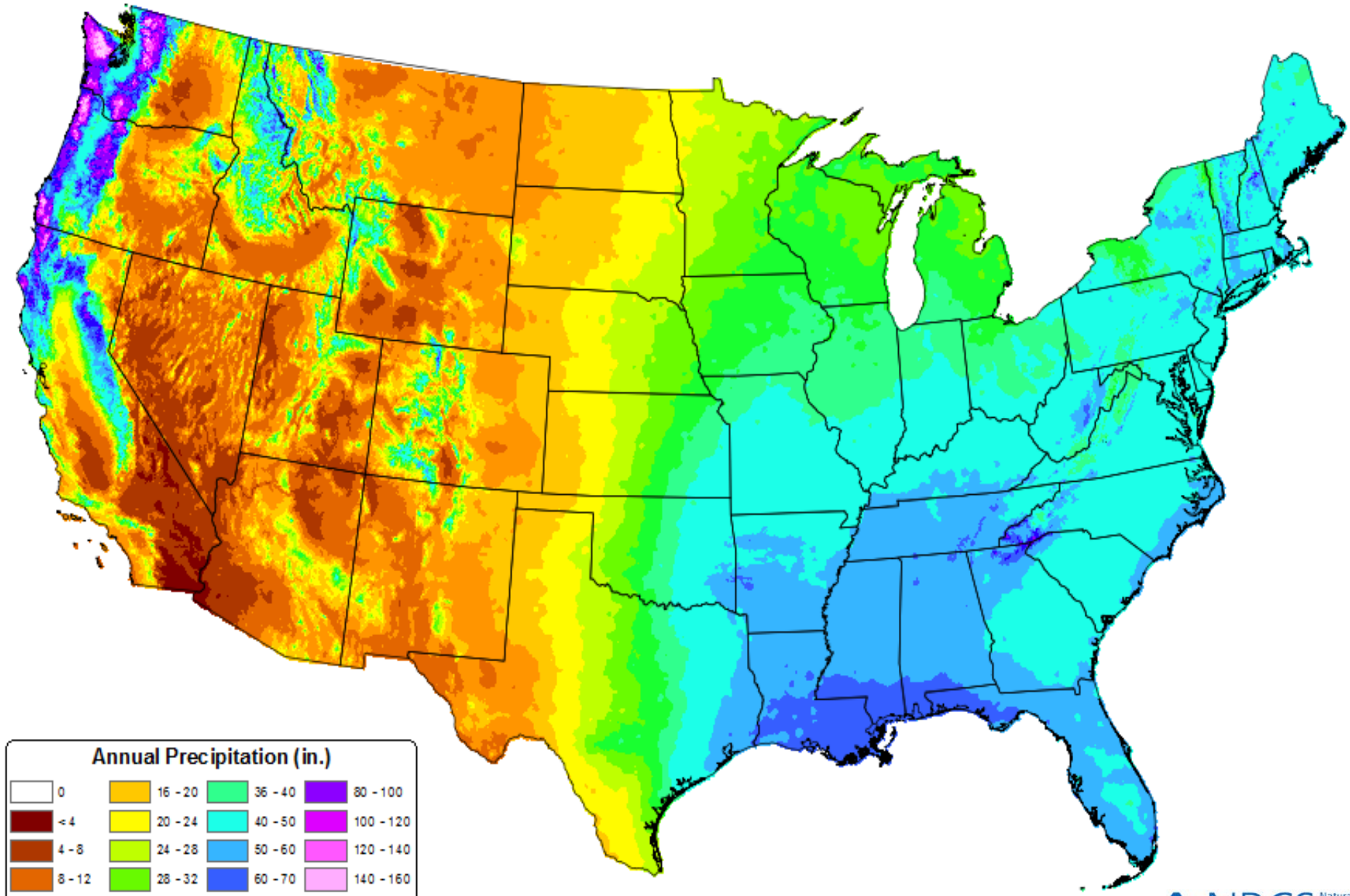
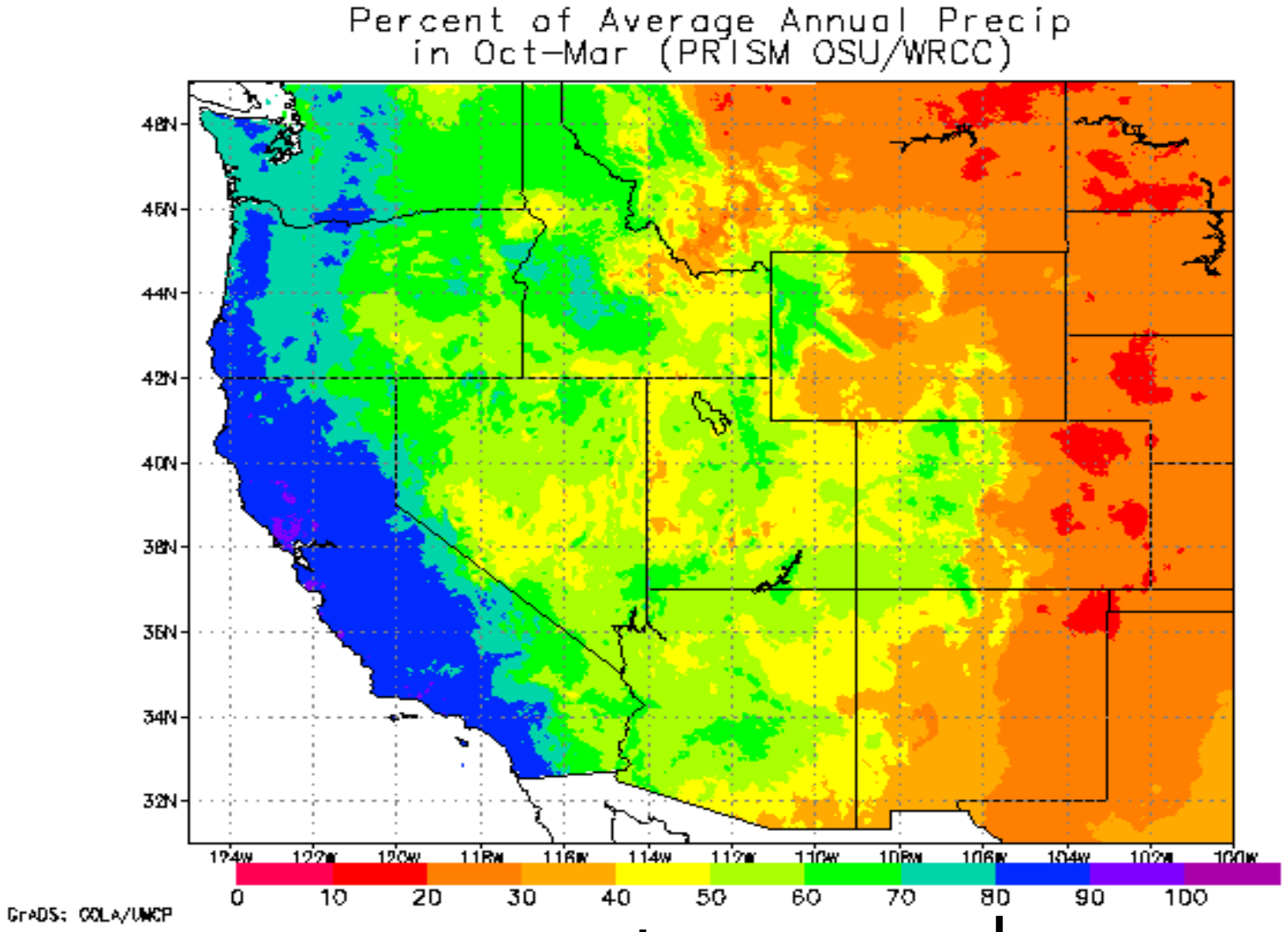
E. Good example is recent 2011 strong La Nina that brought abundant moisture to Upper Snake, which was strongest La Nina since 1974 that brought abundant moisture to the Salmon basin

30-yr Normal Precipitation: Annual

Period: 1981-2010



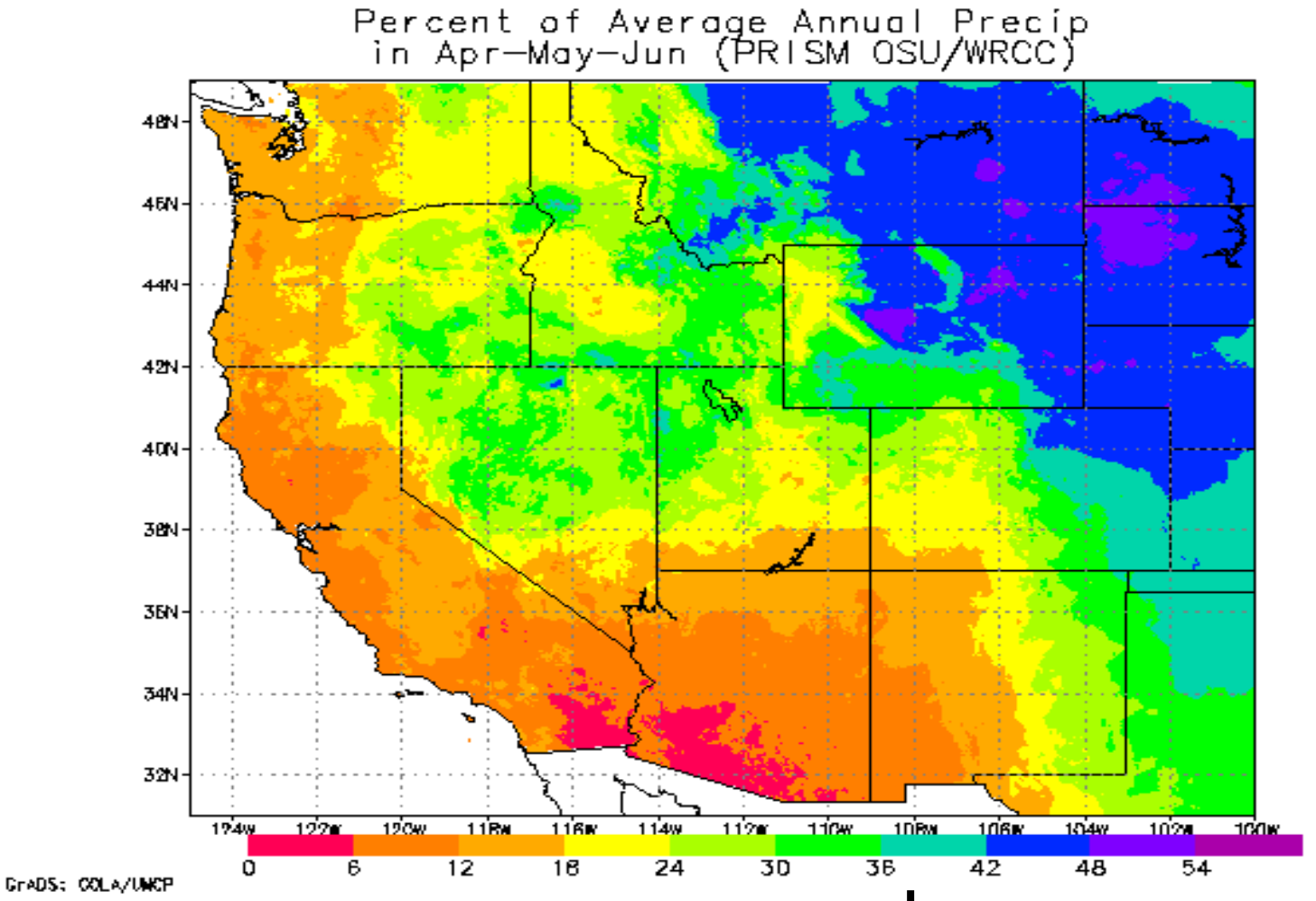
NRCS Natural Resources Conservation Service



40 - 80%

Oct - Mar

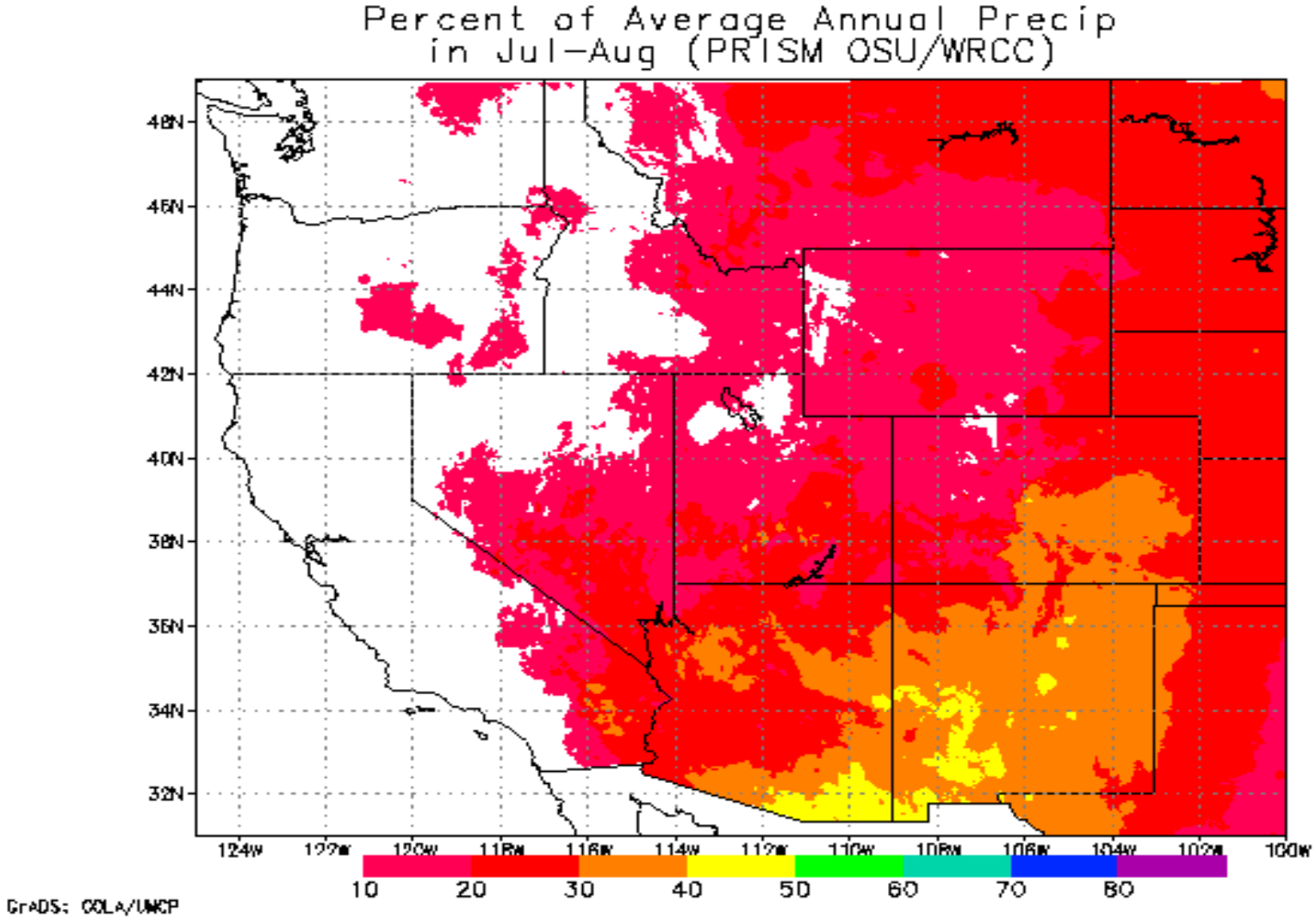
NRCS Natural Resources Conservation Service



15 - 40%

Apr - Jun

NRCS Natural Resources Conservation Service



0 – 20%

Jul - Aug

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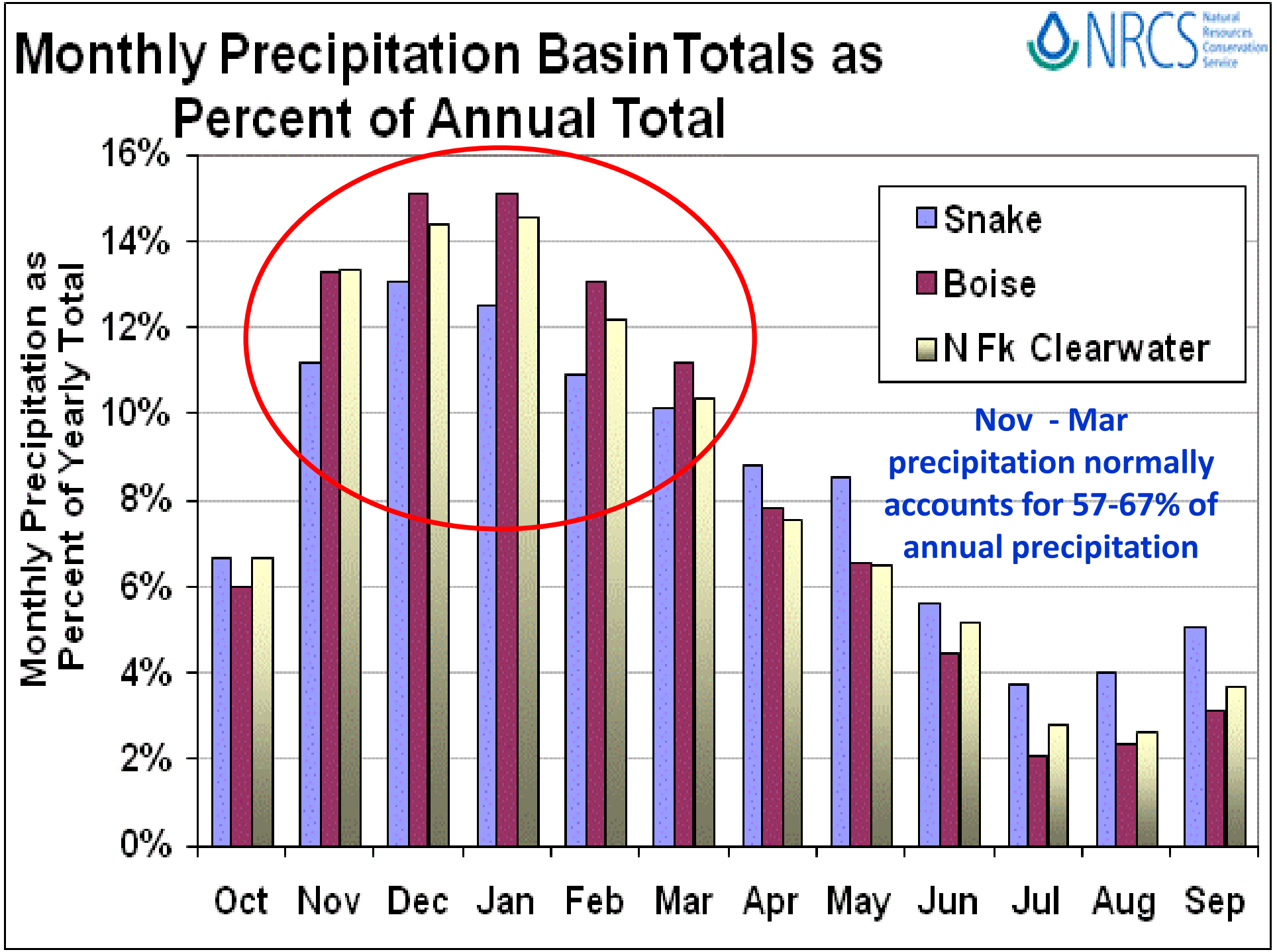
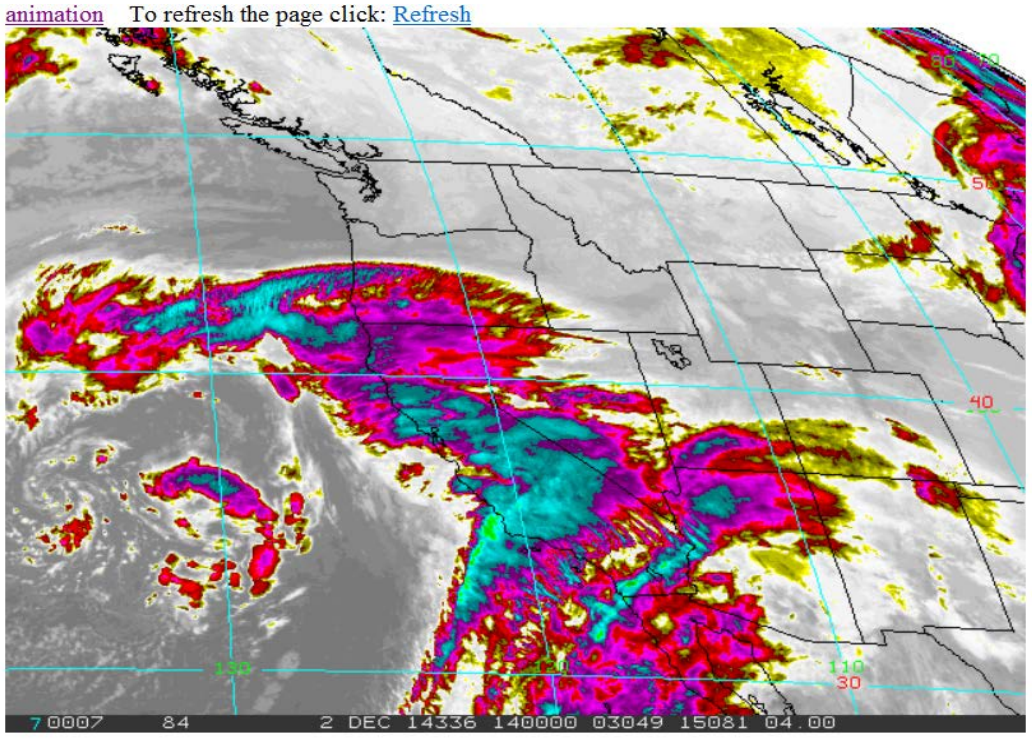
Monthly Precipitation BasinTotals as Percent of Annual Total

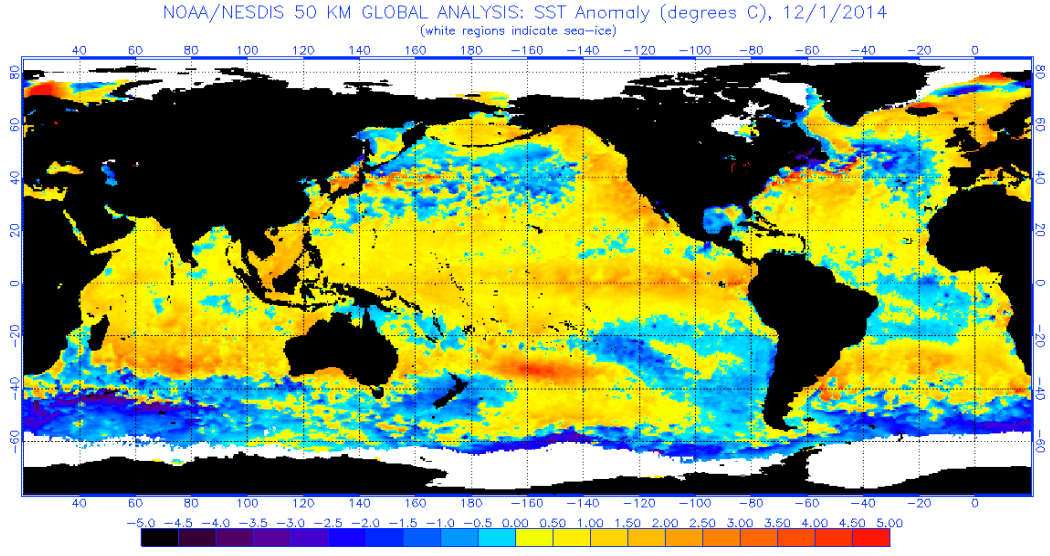


Satellite image Dec 2, 2014
El Nino Storm Track Pattern

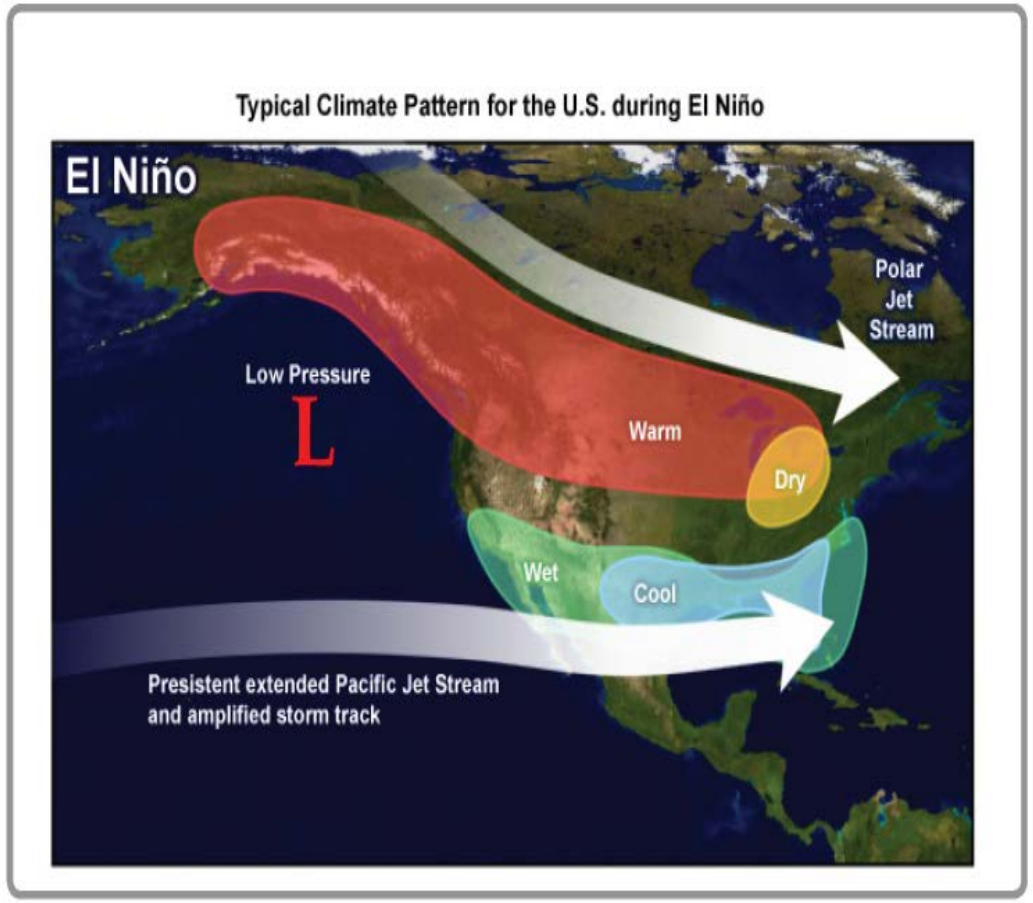


- ***Weather outlooks now encompass looking globally at climate conditions around the world to understanding how they impact our local weather & water supply.***

Teleconnections **climatic indexes**
Key is understanding their correlations AND influence on current weather, snowfall, streamflow, your business & more…



Typical El Niño Winter Pattern



Typical El Niño jet stream patterns across the U.S. include a stronger than usual storm track across the southern U.S., leaving the northern U.S. removed from the average storm track. Image courtesy of NOAA.

Teleconnections Primary Ones:

- **ENSO - El Nino/Neutral/La Nina - measure of Sea Surface Temperature (SST) 3 to 5 year cycle**
- **SOI - Southern Oscillation Index measure of barometric pressure difference in south Pacific**
- **PDO Pacific Decadal Oscillation *WAS* 20 to 30 year cycle**

La Nina and Pacific Decadal Oscillation (PDO) Cooling in the Pacific Ocean

Don J. Easterbrook, Dept. of Geology, Western Washington University, Bellingh

The announcement by NASA's Jet Propulsion Laboratory that the Pacific Decadal Os shifted to its cool phase (Fig. 1) is right on schedule as predicted by past climate and P (Easterbrook, 2001, 2006, 2007). It is *not* an oddity superimposed upon and masking t warming by the IPCC.

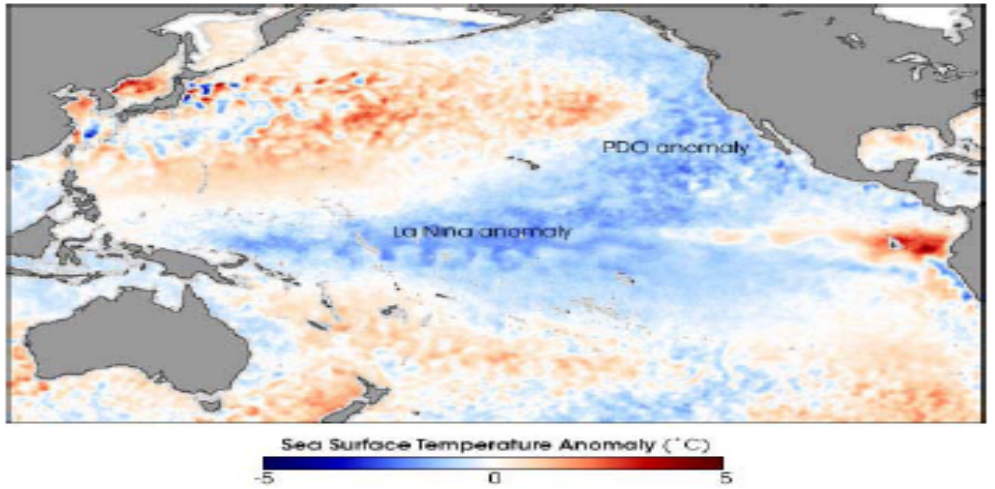
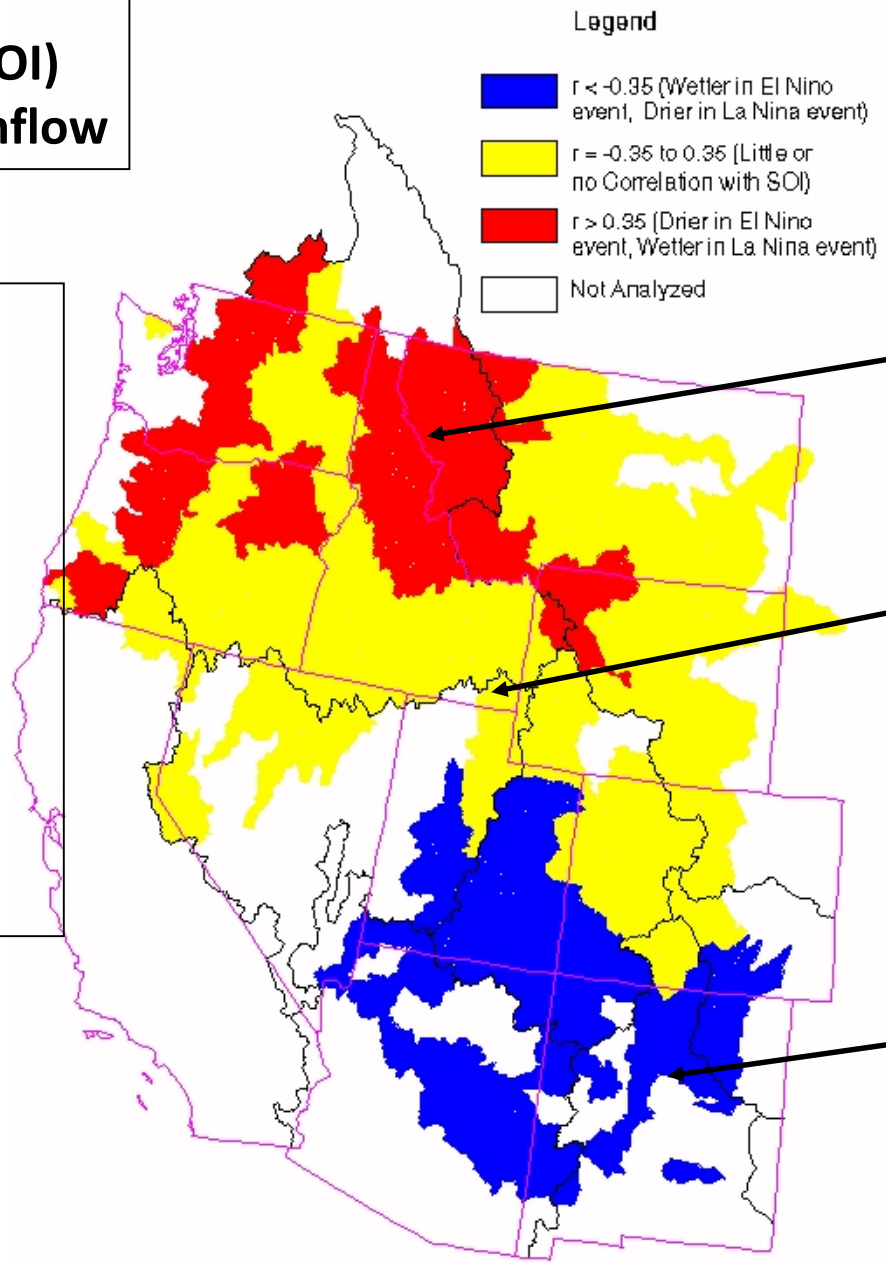


Figure 1. Cooling of the Pacific Ocean and setting up of the PDO. Sea surface ten

Correlation Map of the Southern Oscillation Index (SOI) with spring and summer streamflow

Winter 2015-2016

- ENSO Signal – Strong El Nino & SOI
- Pacific Decadal Oscillation (PDO) switched from cool to warm phase in Jan 2014



Dry El Nino

Wet La Nina

Little or No Correlation

Wet El Nino

Dry La Nina

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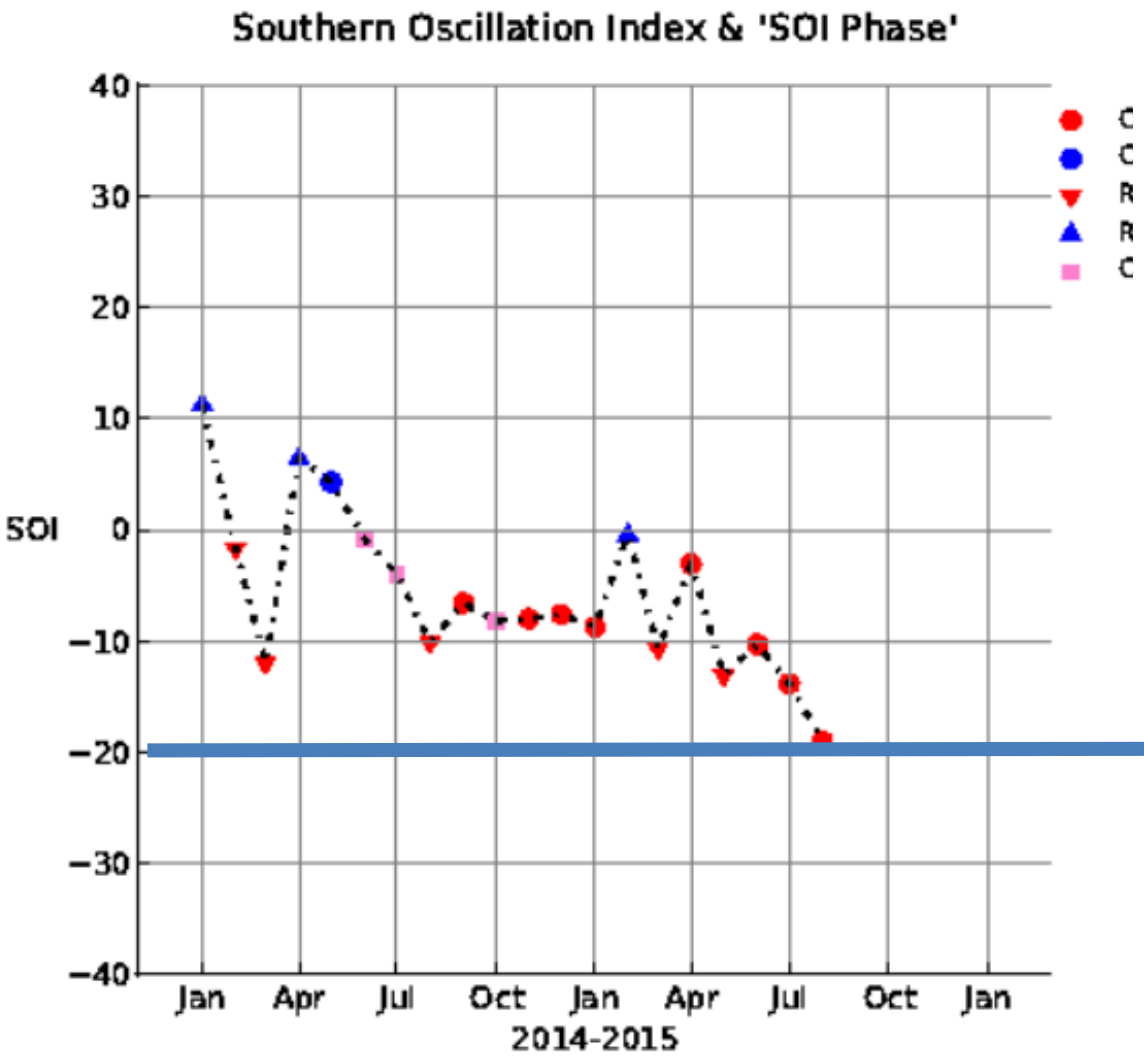
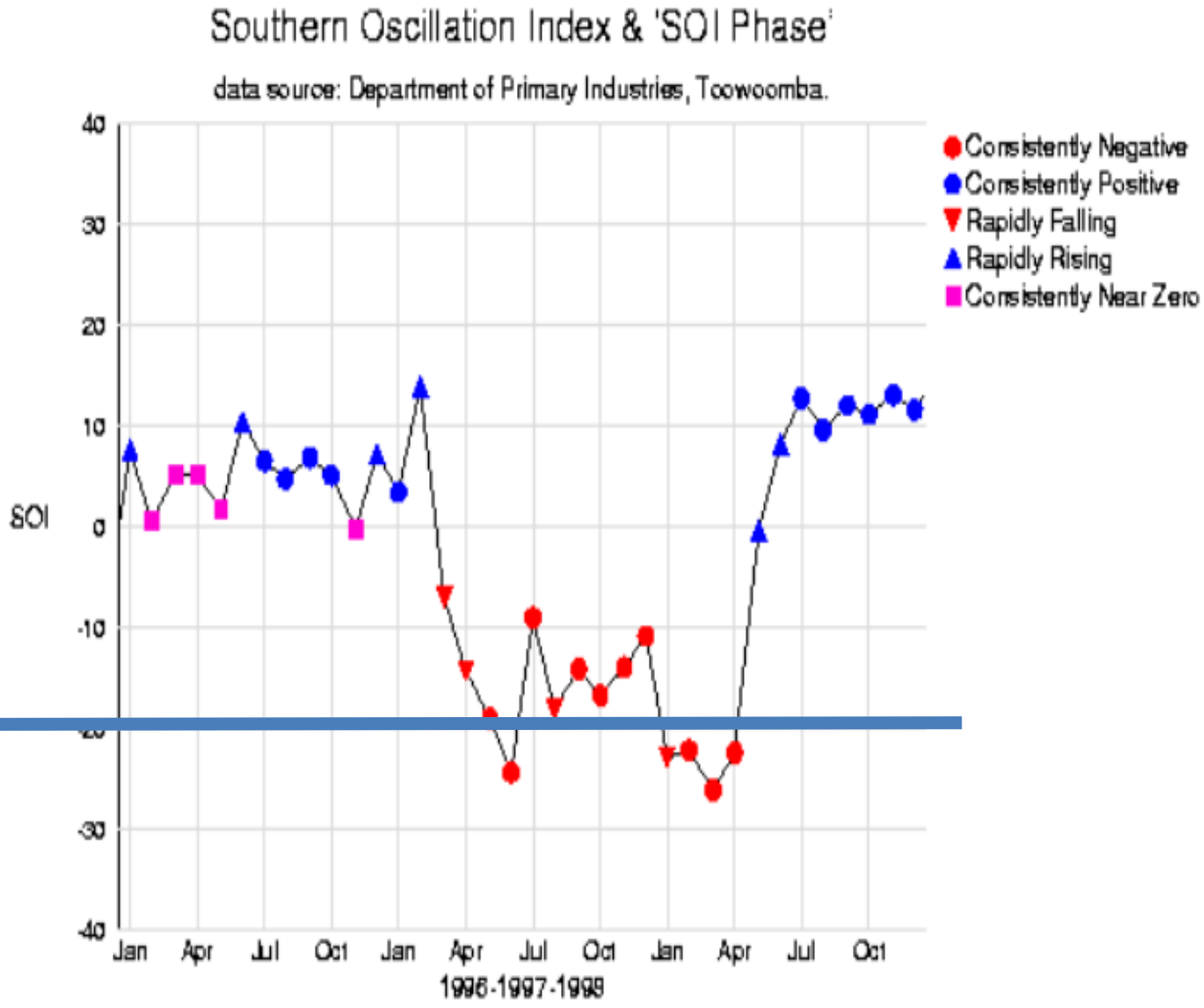
Most recent graph

Jan 2014 to Aug 2015



Monthly SOI values and SOI phases for 1997



La Nina and Pacific Decadal Oscillation (PDO)

Cooling in the Pacific Ocean

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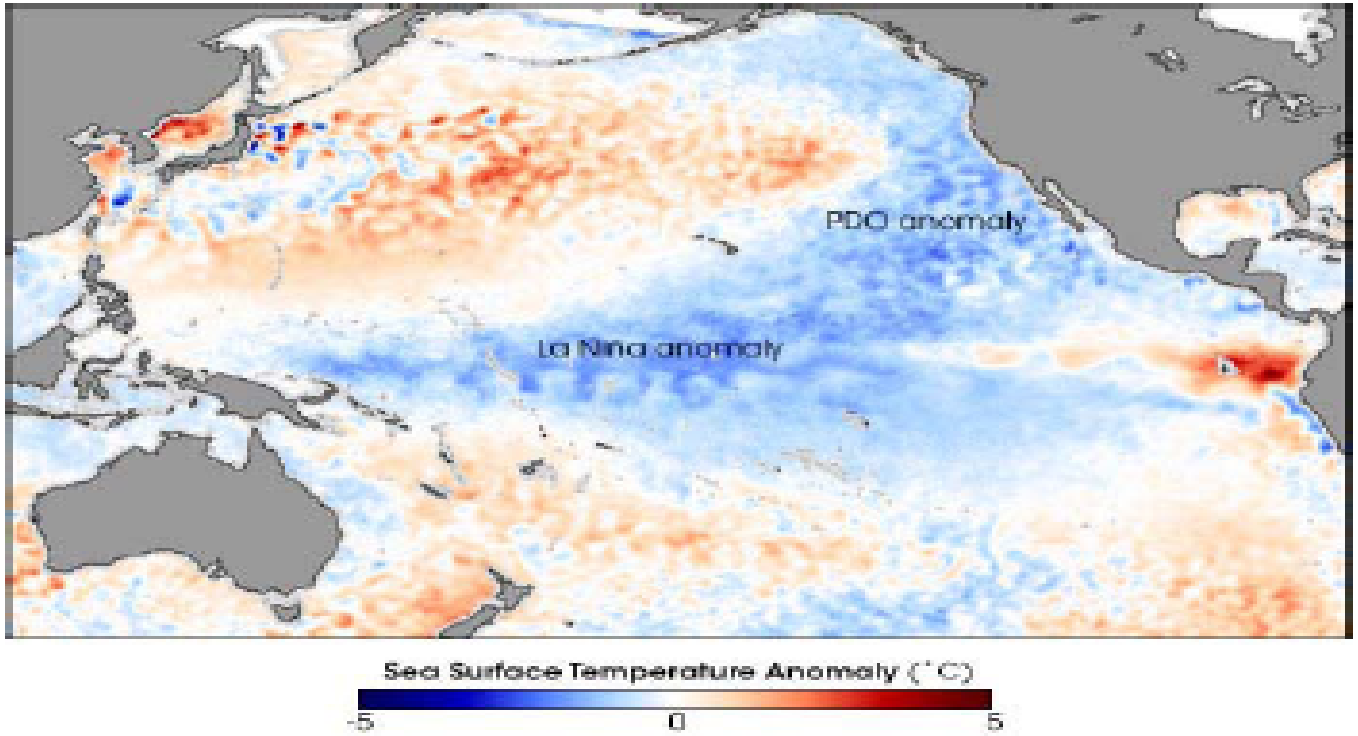
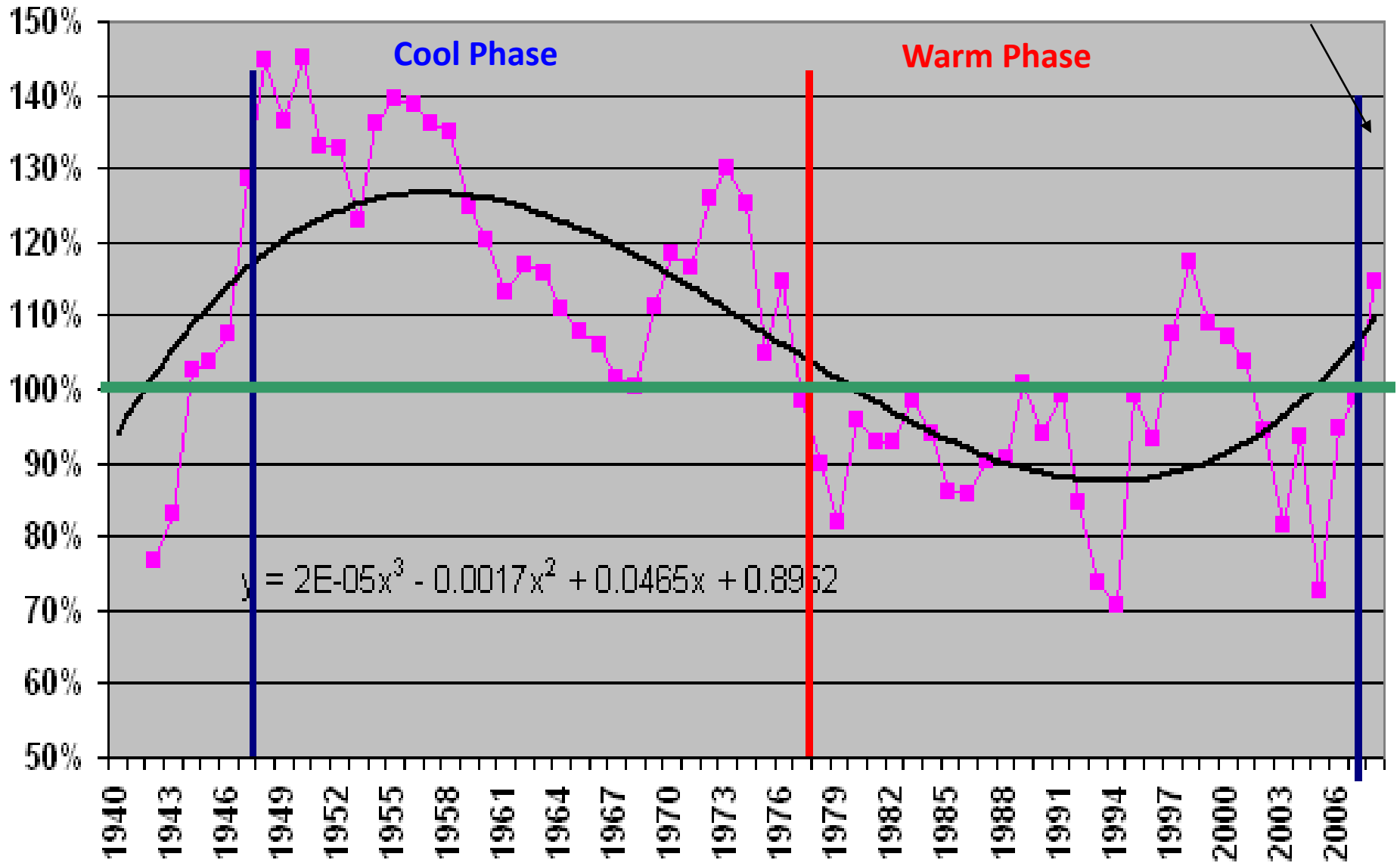
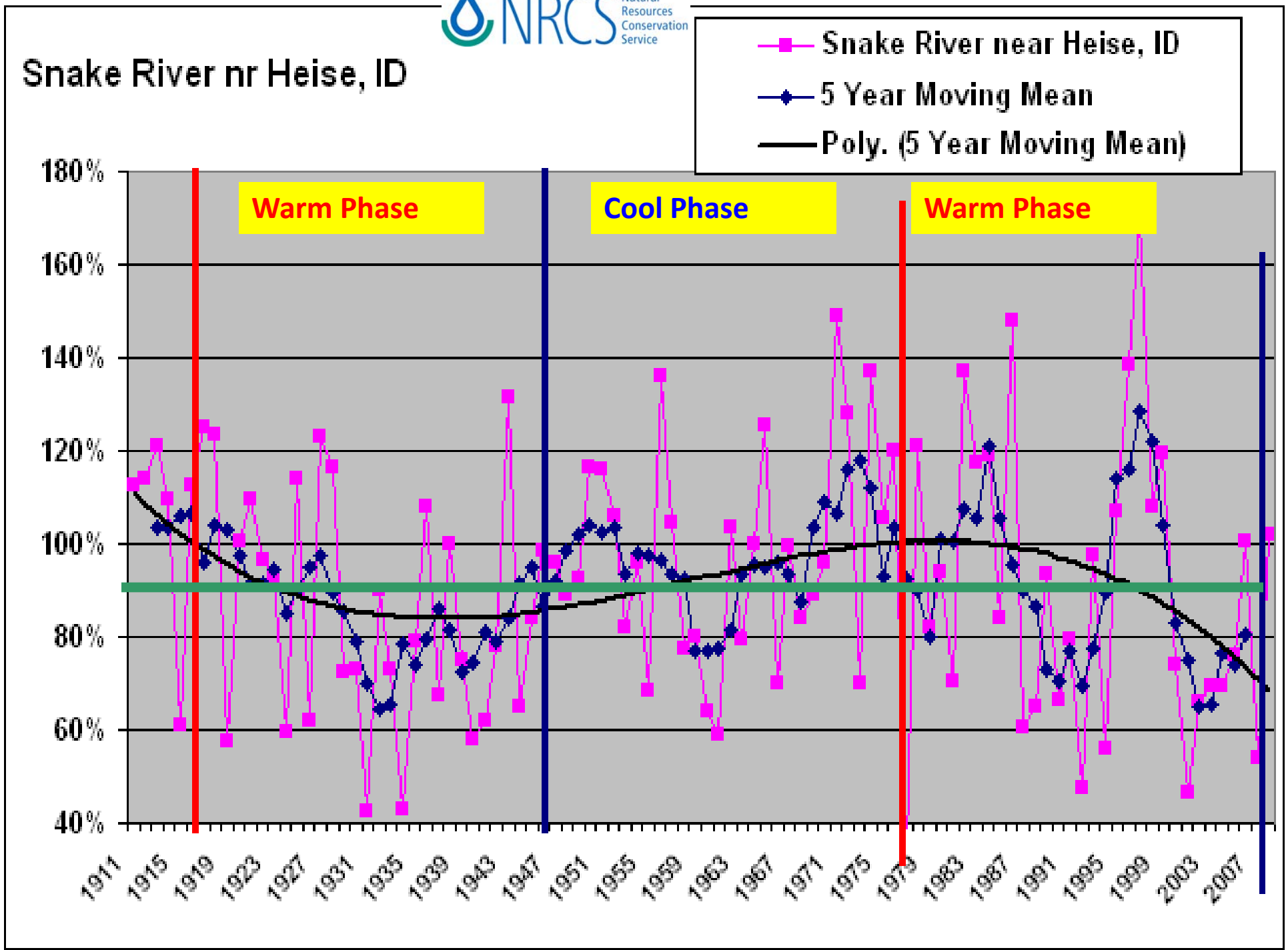


Figure 1. Cooling of the Pacific Ocean and setting up of the PDO. Sea surface temperature anomaly in the Pacific Ocean from April 14–21, 2008. The anomaly compares the recent temperatures measured by the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) on NASA's Aqua satellite with

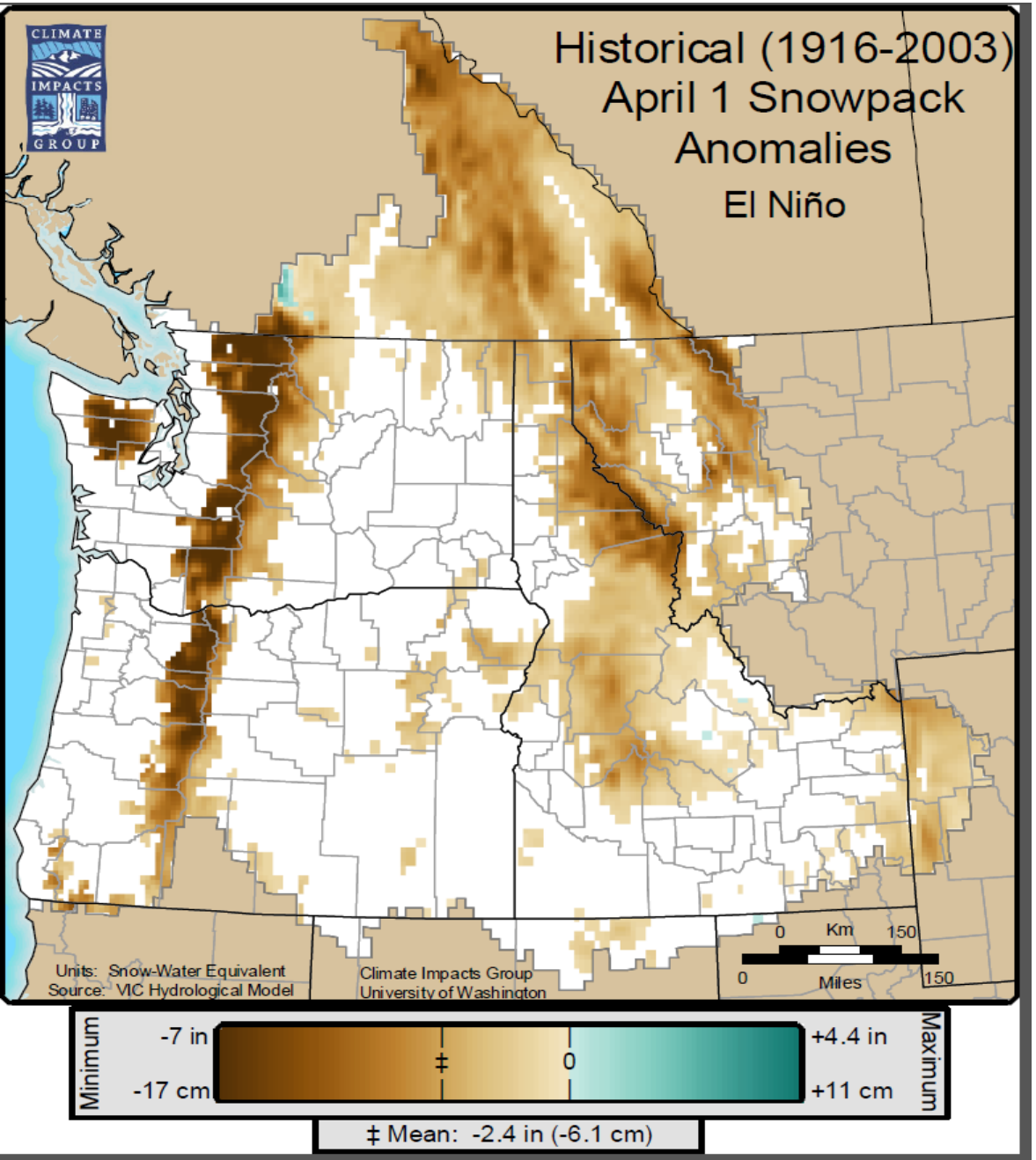
NRCS Natural Resources Conservation Service

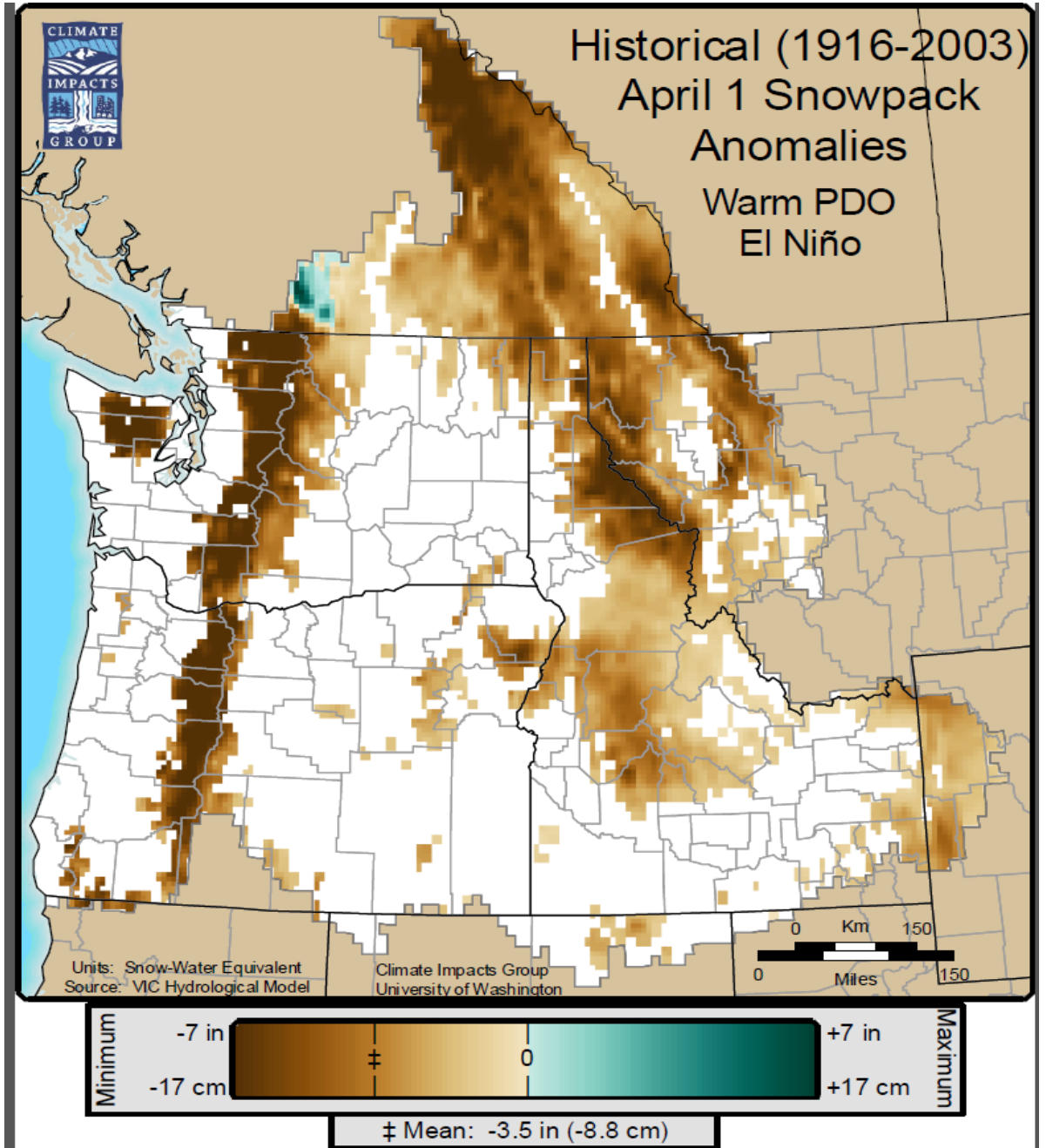
NF Coeur d'Alene River
5 Year Moving Average




NRCS
Natural Resources Conservation Service
Snake River nr Heise, ID
Snake River near Heise, ID
5 Year Moving Mean
Poly. (5 Year Moving Mean)
Warm Phase
Cool Phase
Warm Phase
180%
160%
140%
120%
100%
80%
60%
40%
1911
1915
1919
1923
1927
1931
1935
1939
1943
1947
1951
1955
1959
1963
1967
1971
1975
1979
1983
1987
1991
1995
1999
2003
2007

April 1 Snowpack Anomalies based on El Nino (left) and El Nino + warm PDO (right)





Teleconnections **– climatic indexes - key is understanding their correlations and influence on current weather (and snow, flow & more).**

Primary Ones:

PDO **Pacific Decadal Oscillation – larger cycle**

ENSO **El Nino Southern Oscillation – short cycle**

El Nino Neutral La Nina measure of Sea Surface Temperature SST

SOI **Southern Oscillation Index measure of barometric pressure difference between Darwin & Tahiti**

AMO **Atlantic Multidecadal Oscillation**

Key to 2014 winter – went negative in Jan for handful of months and returned to positive in May

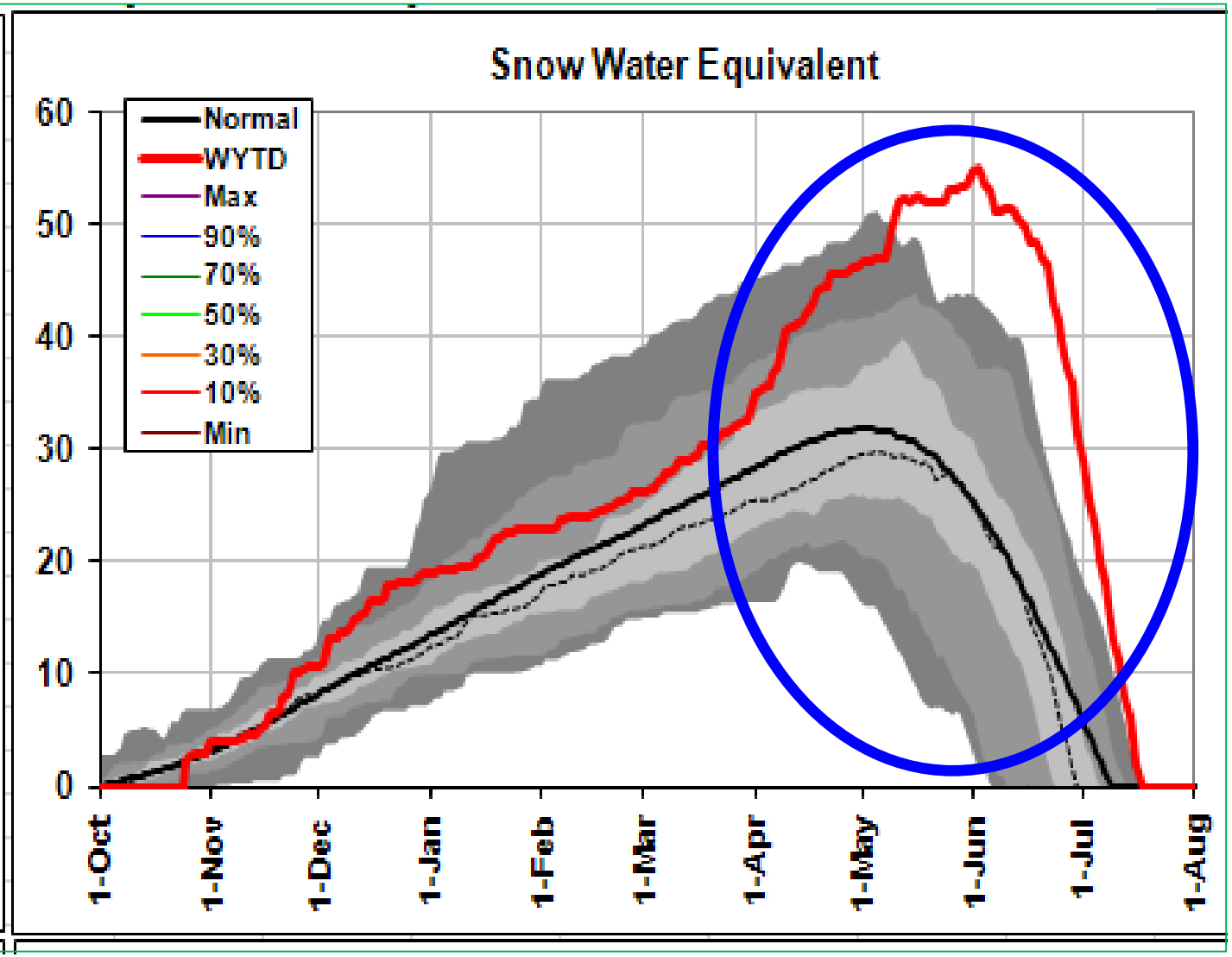
Additional Climate Indices: **NAO North Atlantic Oscillation**

AO Arctic Oscillation

Solar Cycles, Polar Vortex, and more…..

Other Possible Influences – Earthquake & Volcanic Activity

- How the Indices set up each year determines the storm track
- Good example is recent 2011 strong La Nina

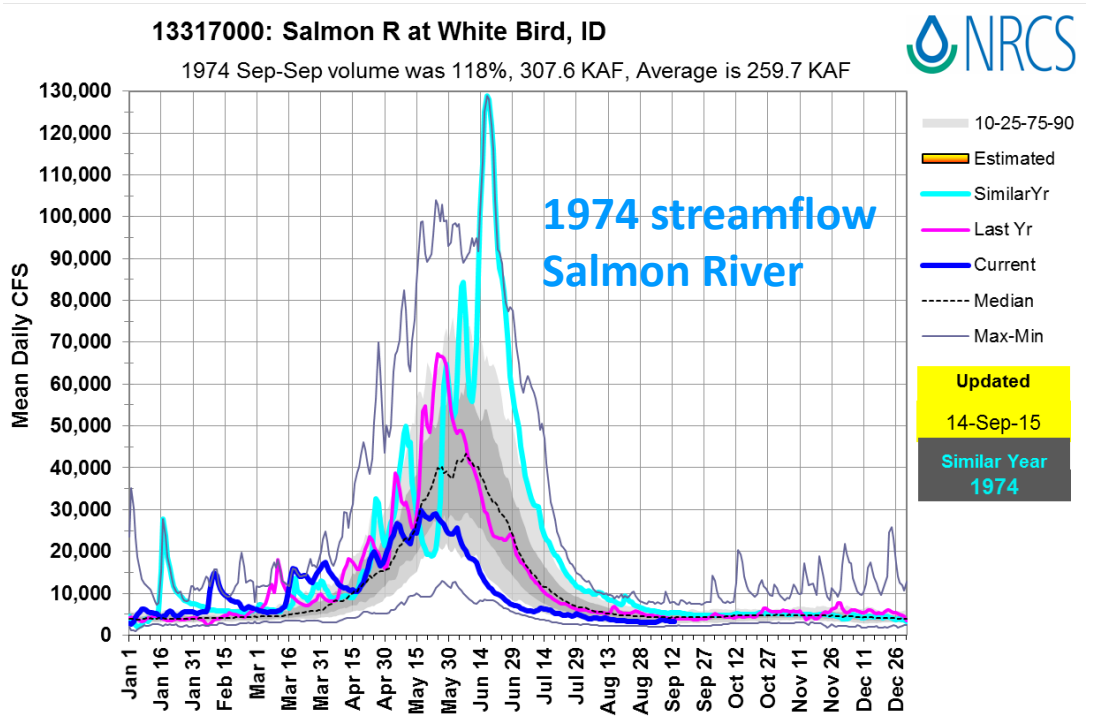


2011: Snow Water Equivalent at Two Ocean Plateau SNOTEL Site in Yellowstone NP, Elev. 9,240 feet

1974 was last strong La Nina and deposited an April 1 snowpack of 172% of median in Salmon River basin

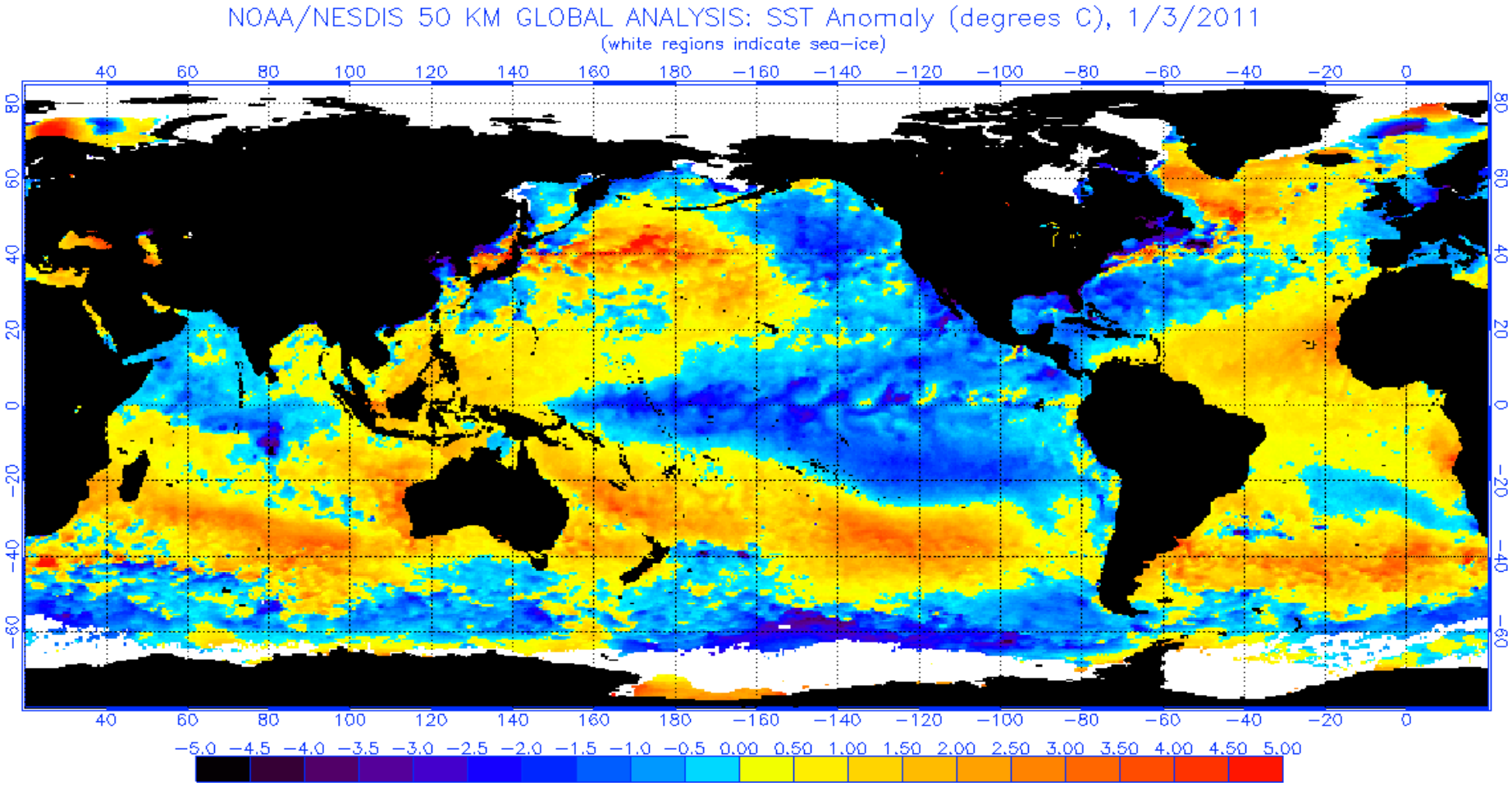
2011 Upper Snake received benefits of the strong La Nina with 152% median snowpack on May 1

Each event sets up different



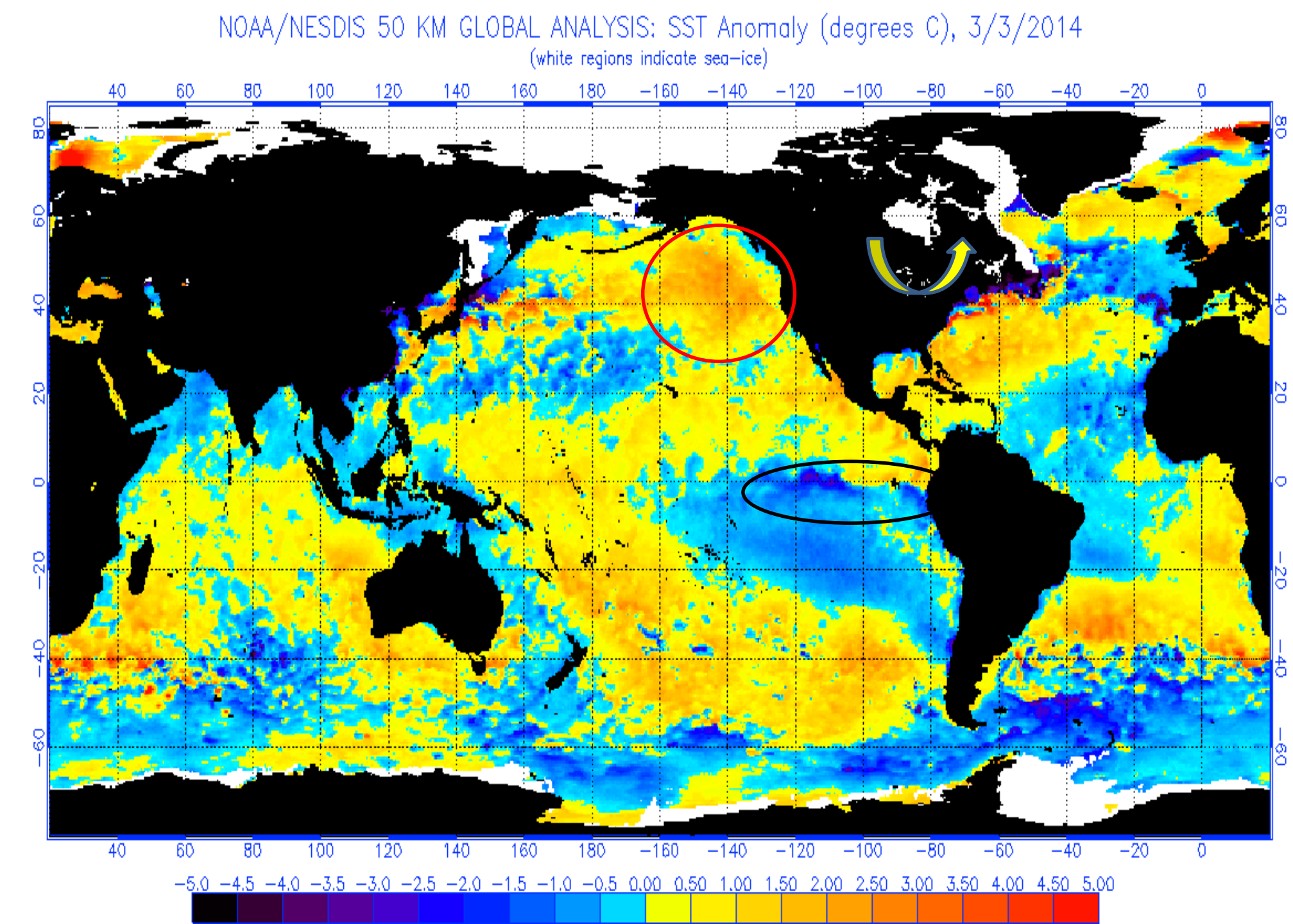
To Understand Overall Scope of the Problem Need to Understand

3. Sea Surface Temperatures (SST) and influence of the warm waters in the NE Pacific Ocean on the weather pattern the past two seasons - western ridge allowing moisture to track east of the Continental Divide to the Midwest/East Coast.



SST Jan 3, 2011

Winter 2010-11
Cool PDO
Strong La Nina

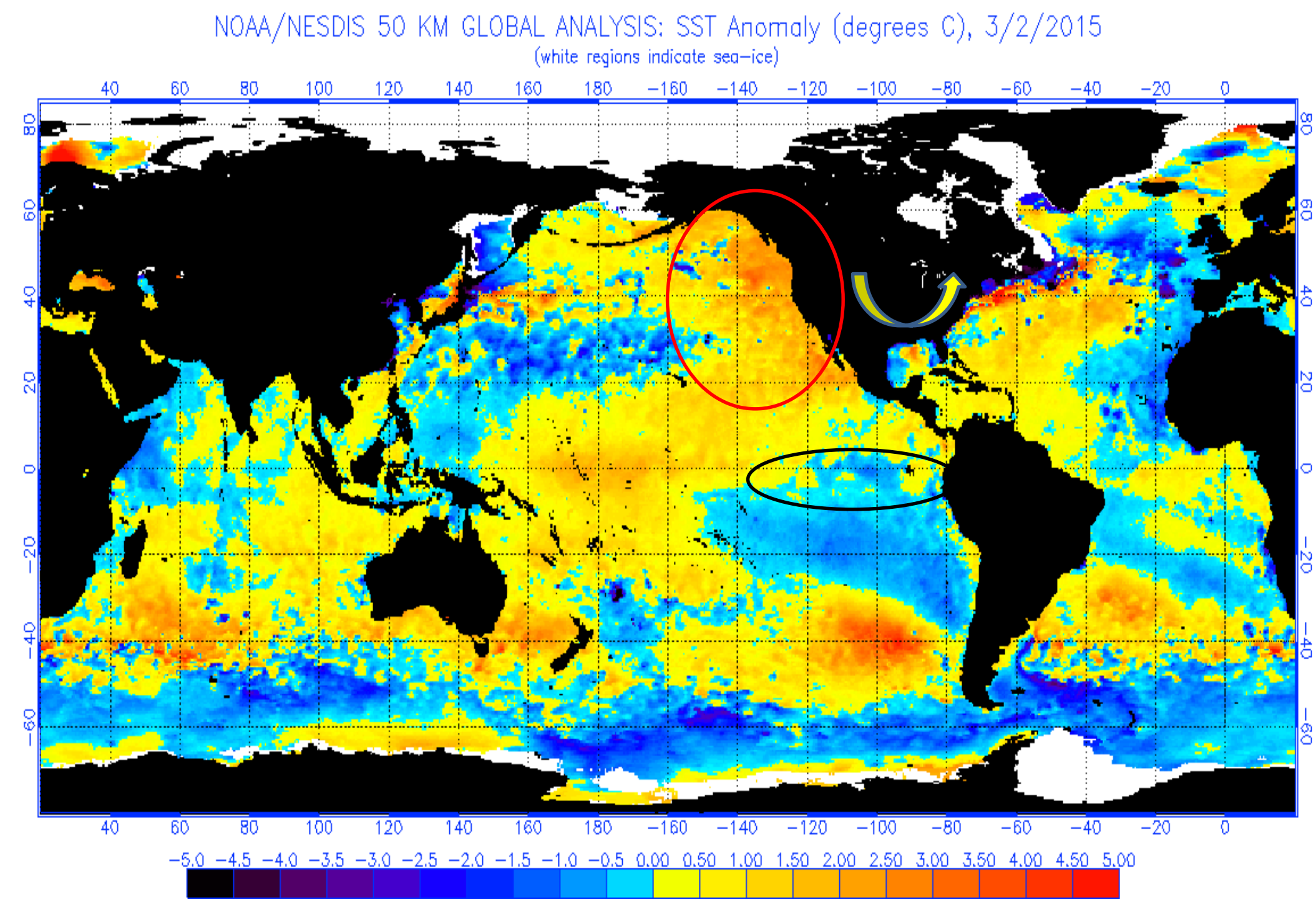


Winter 2013-14

Mar 3, 2014

Cool => Warm PDO
ENSO – Neutral

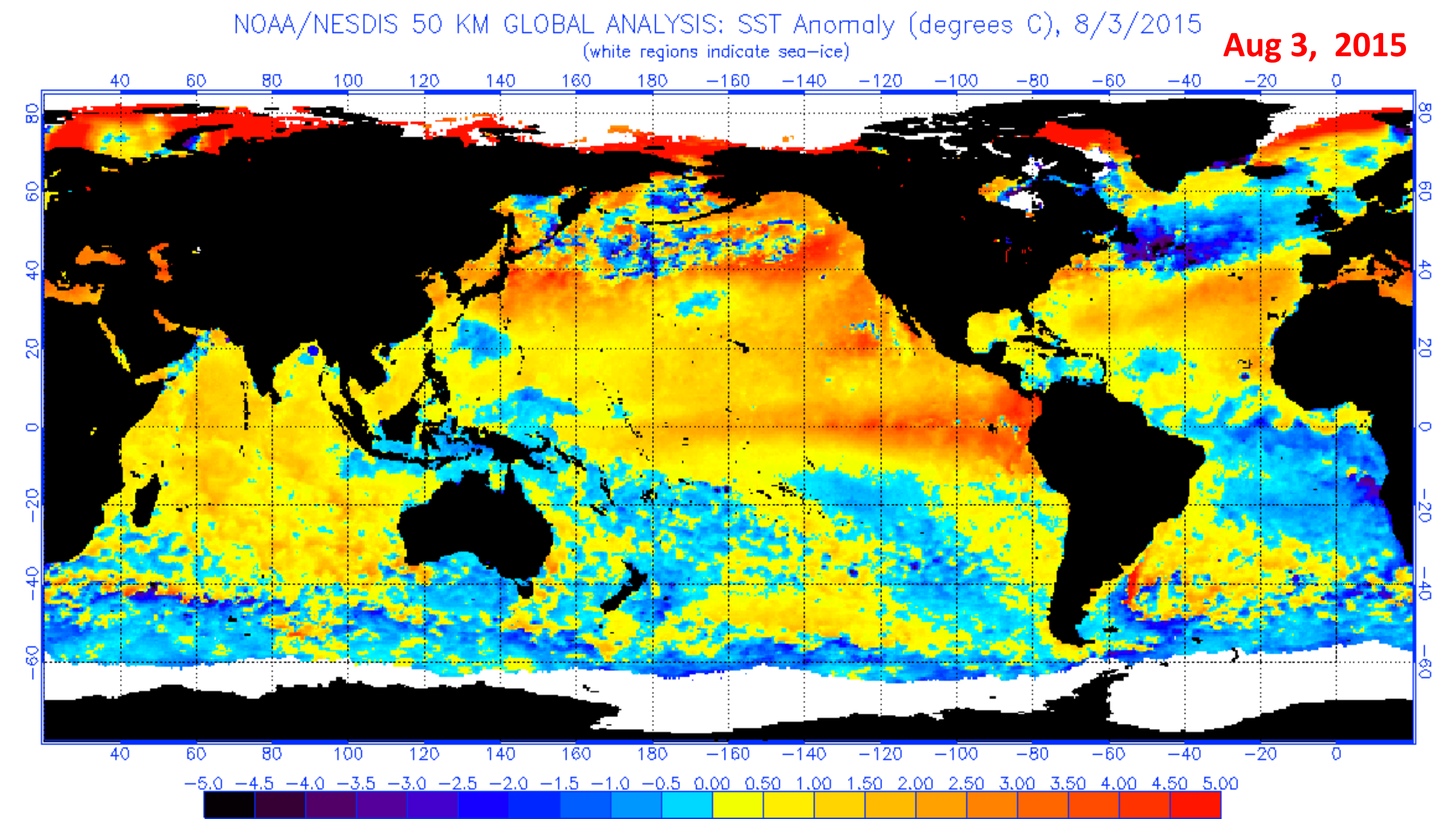
Grand Rapids MI got the snow

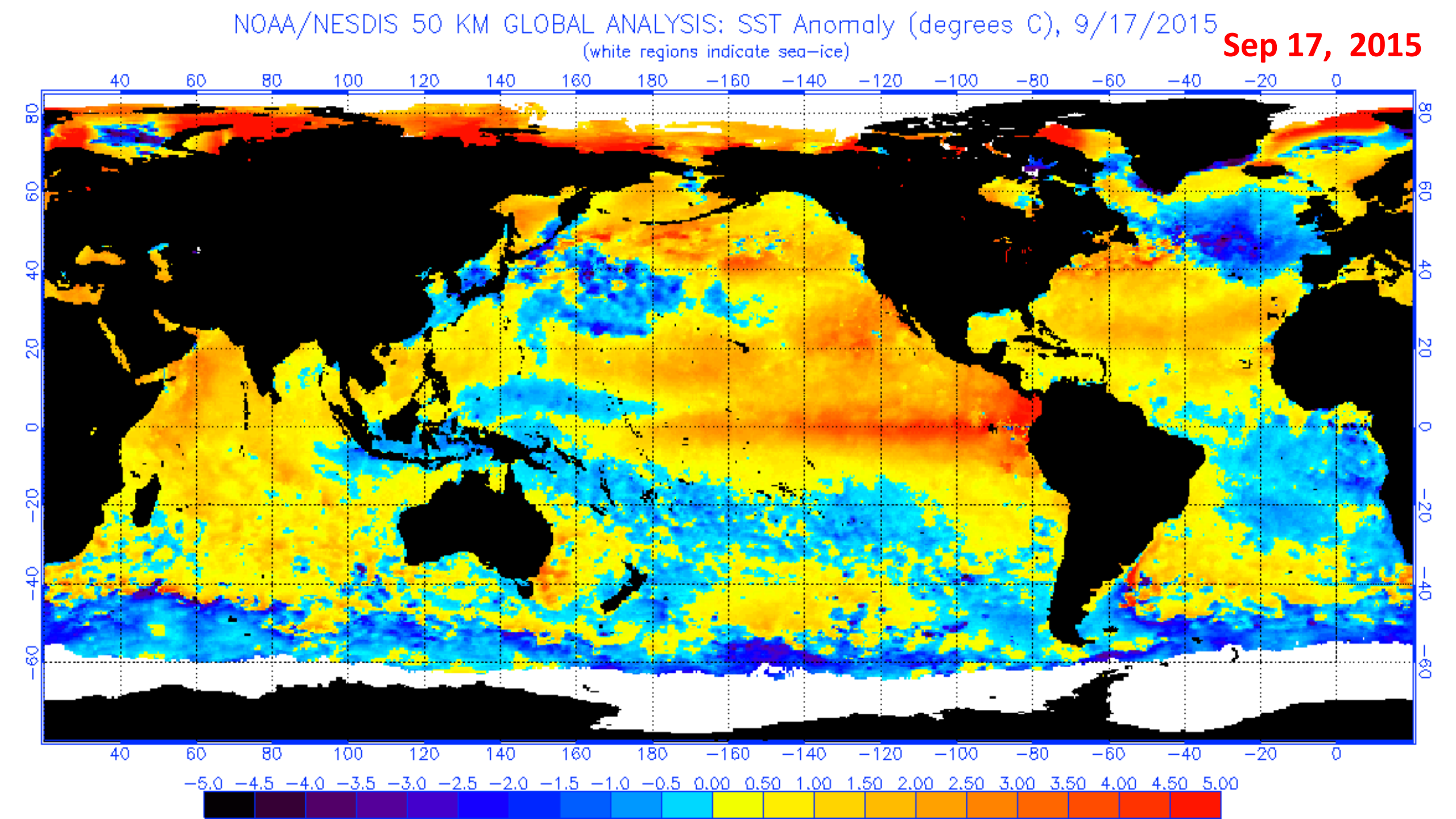


Winter 2014-15
March 2, 2015

Warm PDO
ENSO – Neutral to slight El Nino

Boston' s turn


NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 8/3/2015
(white regions indicate sea-ice)
Aug 3, 2015
40 60 80 100 120 140 160 180 −160 −140 −120 −100 −80 −60 −40 −20 0
80 60 40 20 0 −20 −40 −60
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00


NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 9/17/2015
(white regions indicate sea-ice)
Sep 17, 2015
40 60 80 100 120 140 160 180 −160 −140 −120 −100 −80 −60 −40 −20 0
80 60 40 20 0 −20 −40 −60
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00

To Understand Overall Scope of the Problem Need to Understand:

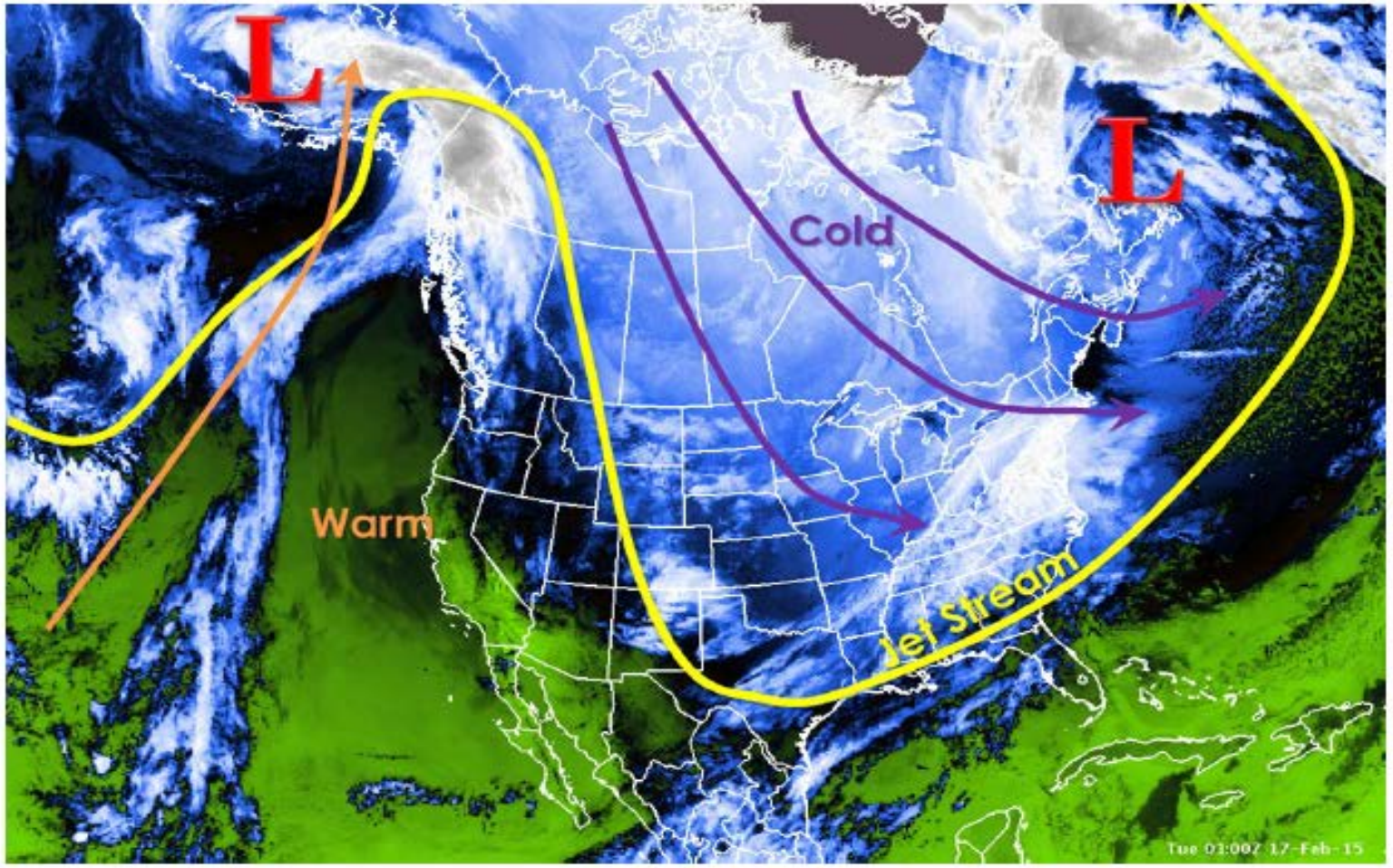
4. Need to understand the storm track that brings moisture to your Idaho basins.

A. Winter storm track winter 2013-14 and 2014-15

B. Weekly US Drought Monitor Map shows which areas the state are more affected than others.

C. California drought pushing into Nevada, Owyhee basin and Central Idaho.

D. Flow trend graphs – showing dry streamflow trends in SW & Central Idaho.



The ridge has kept our area unseasonably warm and relatively dry through early March. A few Pacific weather systems were able to punch through, but precipitation totals for January through the first part of March were less than 50% of normal across most of southwest Idaho and southeast Oregon, and less than 25% of normal in a few areas.

Example of weather pattern from NWS for 2015 but also for most of 2014

Science
AAAS

The Missing Mountain Water: Slower Westerlies Decrease Orographic Enhancement in the Pacific Northwest USA

C. H. Luce[1,*], J. T. Abatzoglou[2], Z. A. Holden[3]

± Author Affiliations

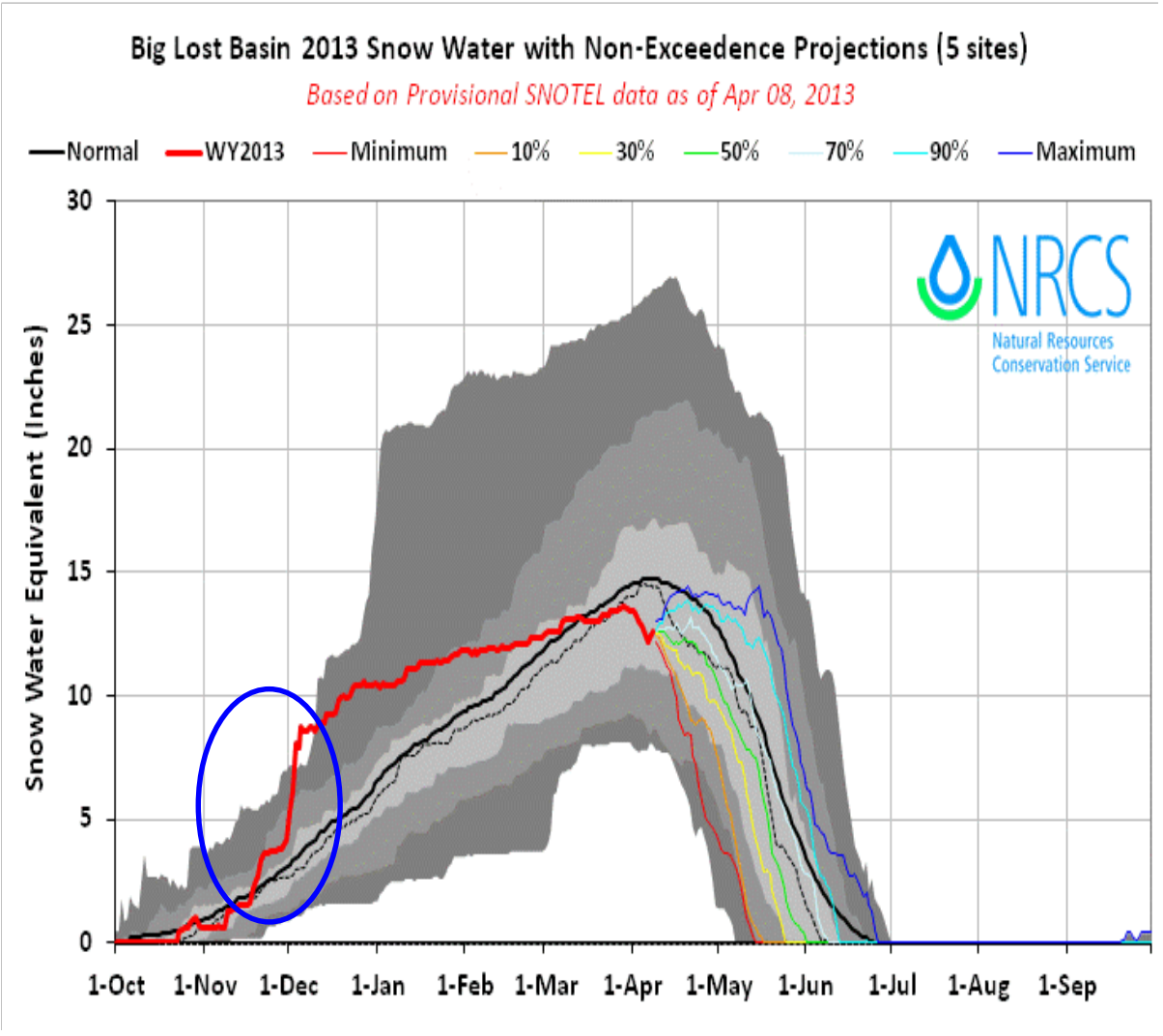
* Corresponding author. E-mail: cluce@fs.fed.us

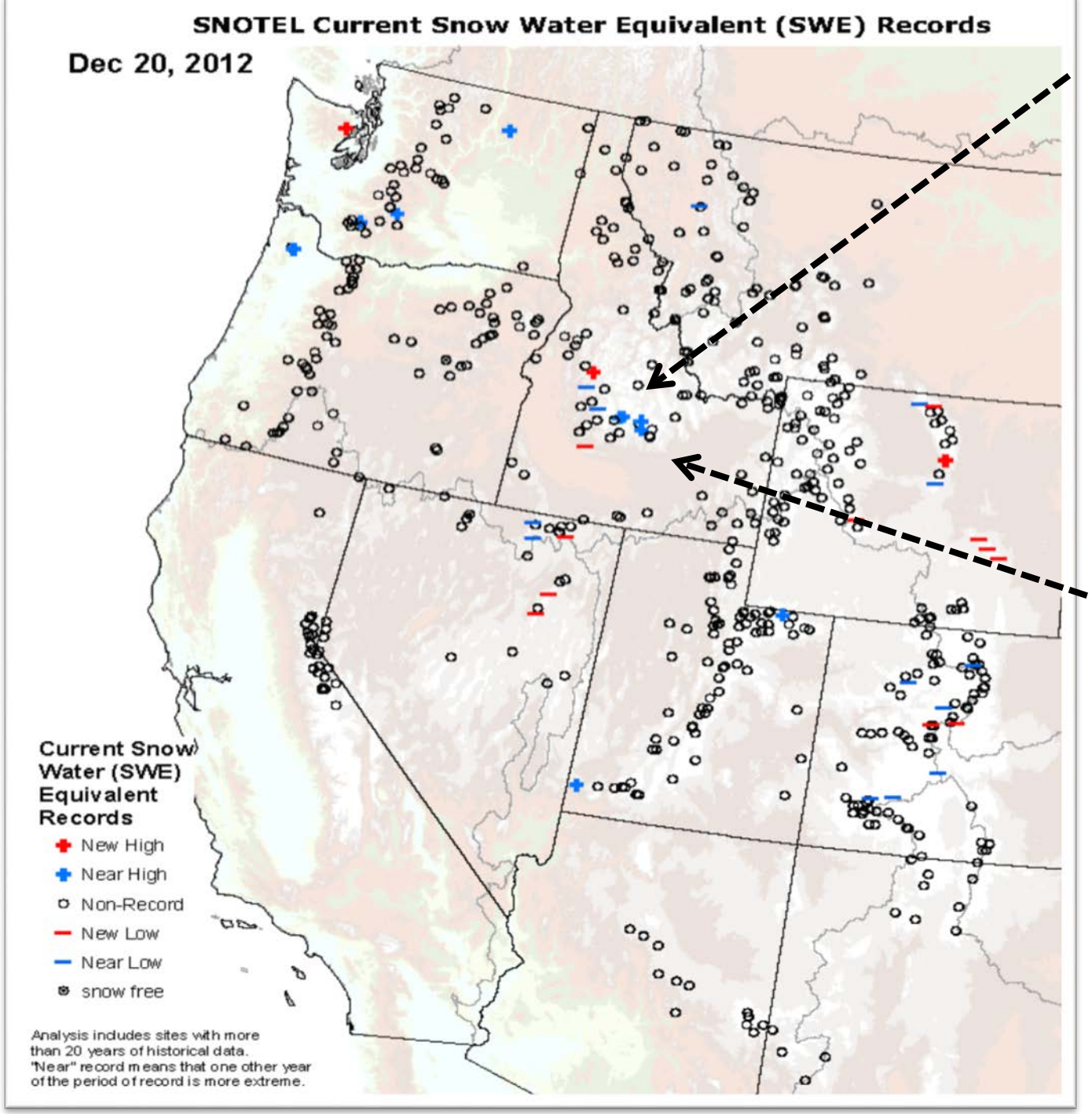
ABSTRACT | EDITOR'S SUMMARY

Trends in streamflow timing and volume in the Pacific Northwest United States have been attributed to increased temperatures, because trends in precipitation at lower-elevation stations were negligible. We demonstrate that observed streamflow declines are probably associated with declines in mountain precipitation, revealing previously unexplored differential trends. Lower-troposphere winter (November to March) westerlies are strongly correlated with high-elevation precipitation but weakly correlated with low-elevation precipitation. Decreases in lower-tropospheric winter westerlies across the region from 1950 to 2012 are hypothesized to have reduced orographic precipitation enhancement, yielding differential trends in precipitation across elevations and contributing to the decline in annual streamflow. Climate projections show weakened lower-troposphere zonal flow across the region under enhanced greenhouse forcing, highlighting an additional stressor that is relevant for climate change impacts on hydrology.

2013 WOOD and LOST RIVER BASINS

- Oct-Dec 2012 precipitation was 2nd wettest in the last 30 years at three SNOTEL sites
- Making it one of the best starts on record.
- January 1 snowpacks were 130-160%.





+ / – are Near Record High
Snow above 6,881 feet:

- **Deadwood Summit**
- **Lost-wood Divide**
- **Bear Canyon**
- **Stickney Mill**

+ / – are Near Record Low
Snow below 6101 feet:

- **Cozy Cove**
- **Graham GS**
- **Bogus Basin**

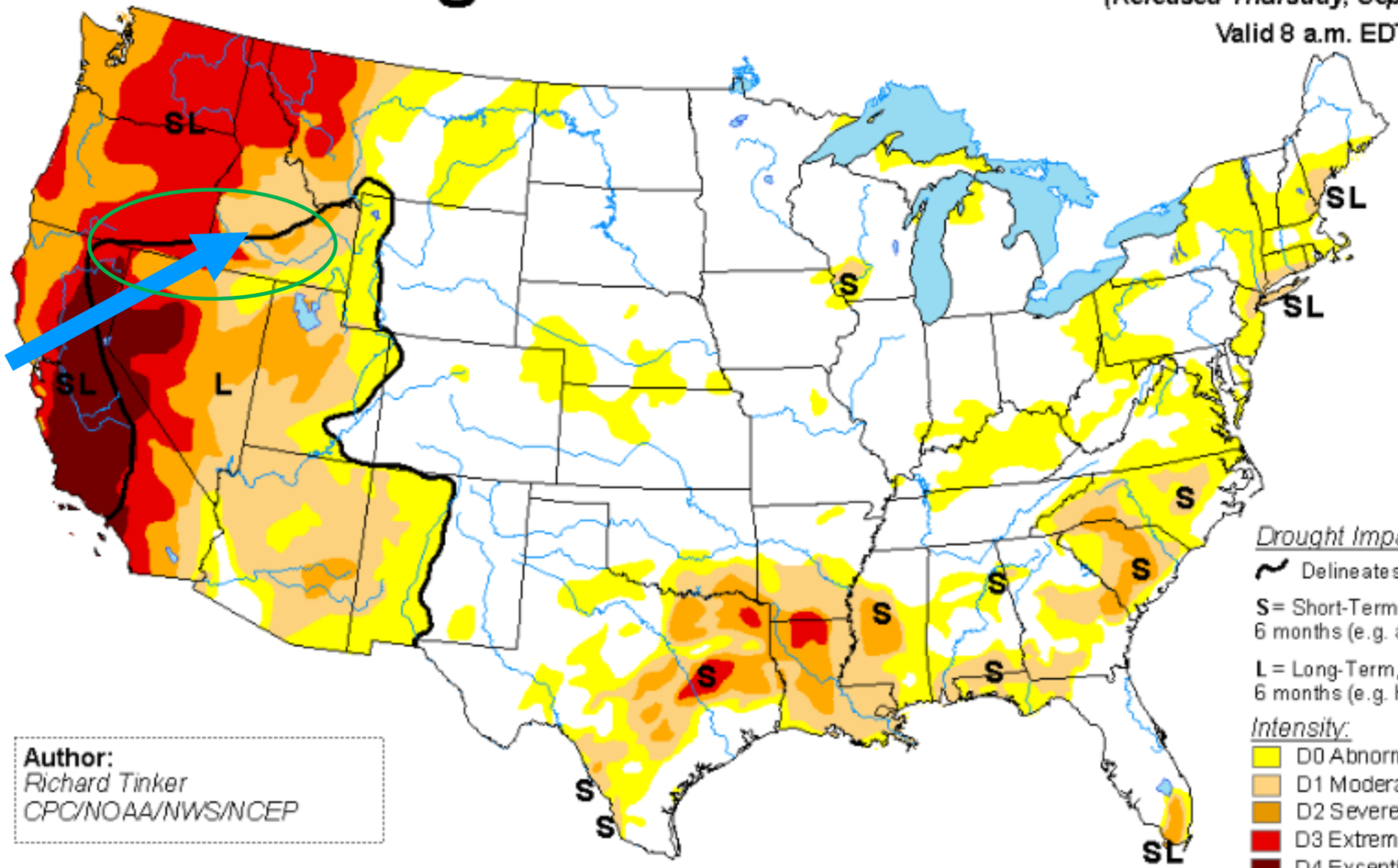
NRCS Natural Resources Conservation Service

U.S. Drought Monitor

September 8, 2015

(Released Thursday, Sep. 10, 2015)

Valid 8 a.m. EDT



Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

Drought Impact Types:

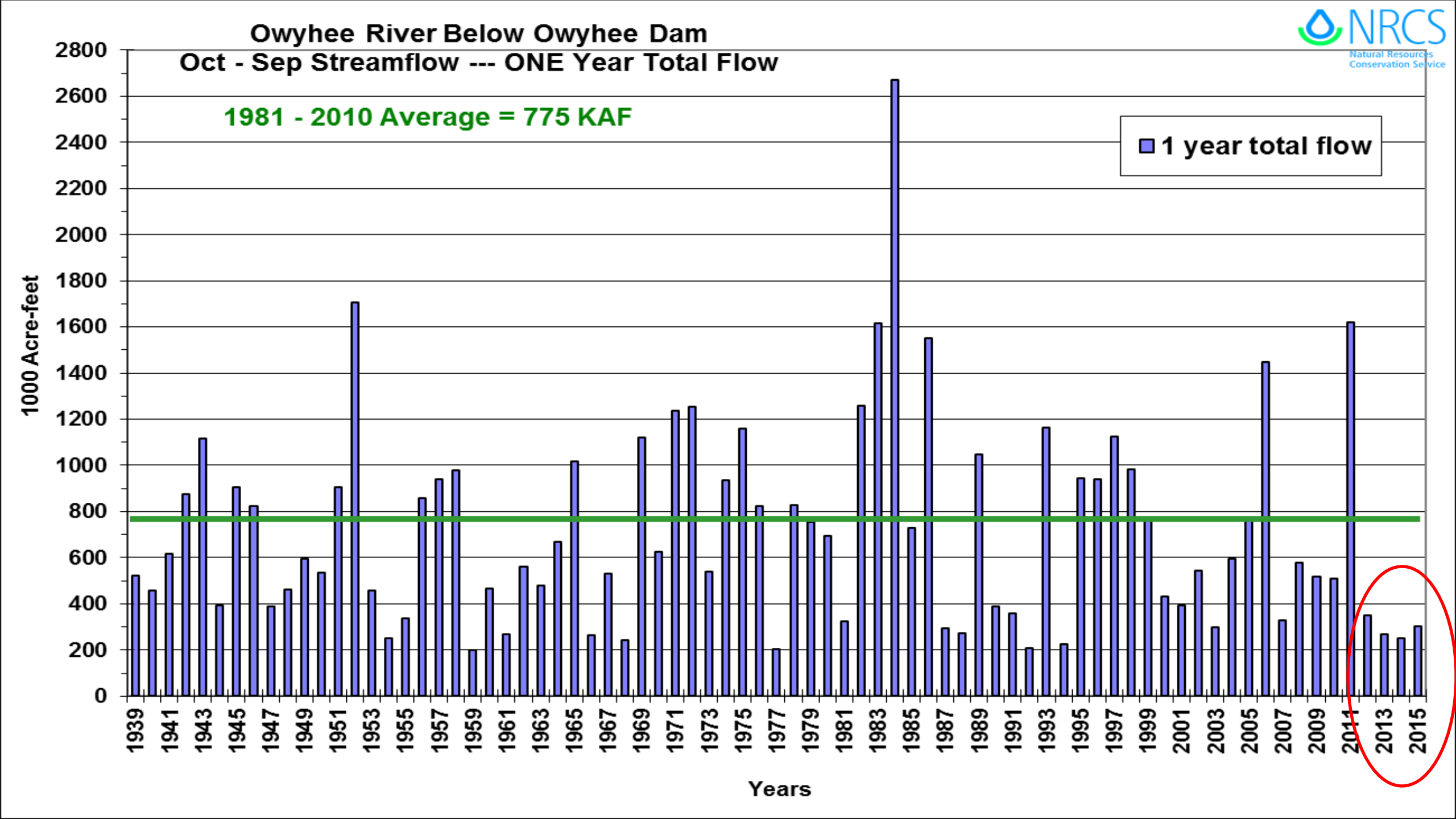
~ Delineates dominant impacts

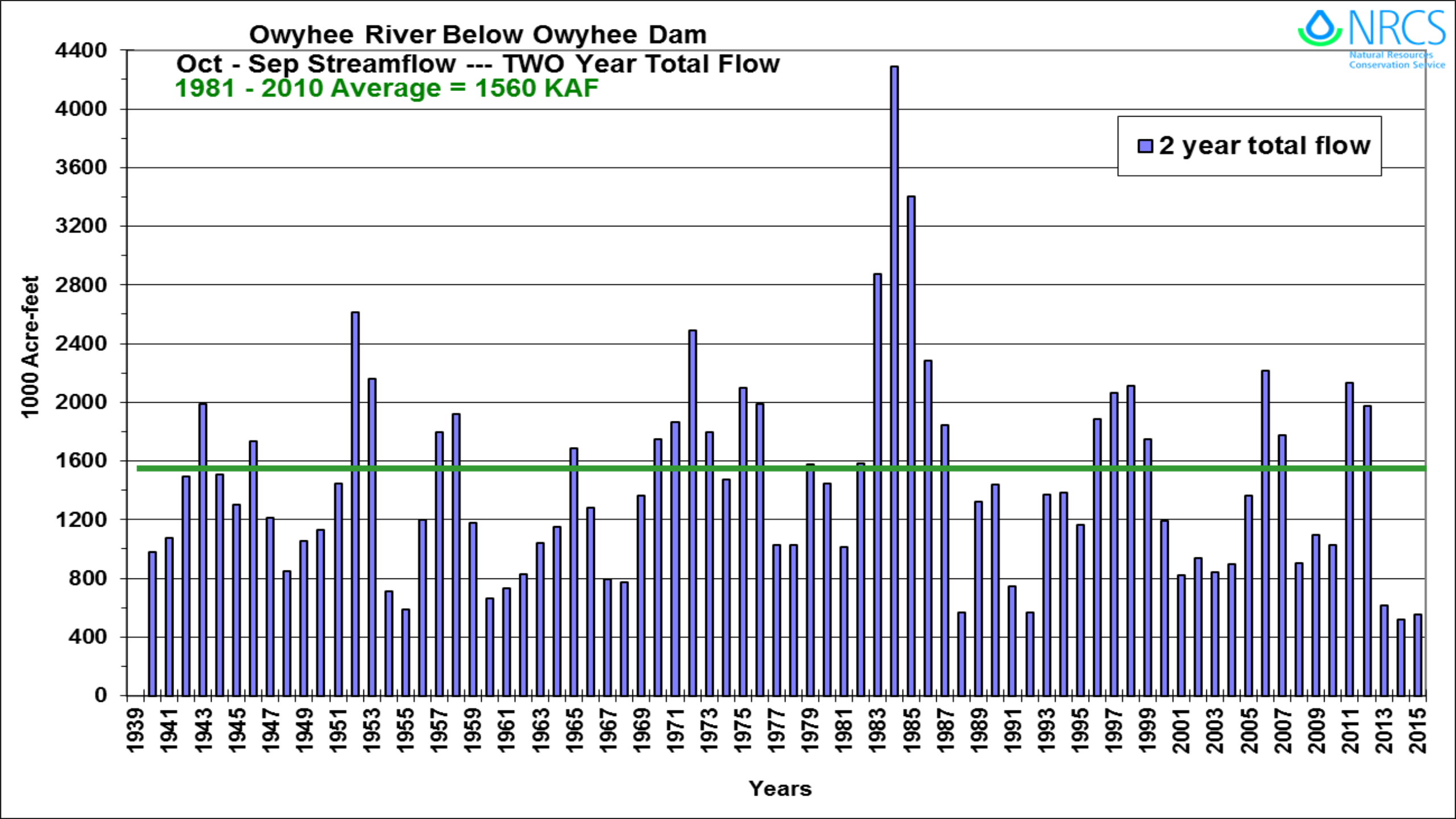
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- ONE Year Total Flow
1981 - 2010 Average = 775 KAF
1 year total flow
1000 Acre-feet
Years
NRCS
Natural Resources Conservation Service


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- TWO Year Total Flow
1981 - 2010 Average = 1560 KAF
NRCS
Natural Resources Conservation Service
2 year total flow
1000 Acre-feet
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
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2003
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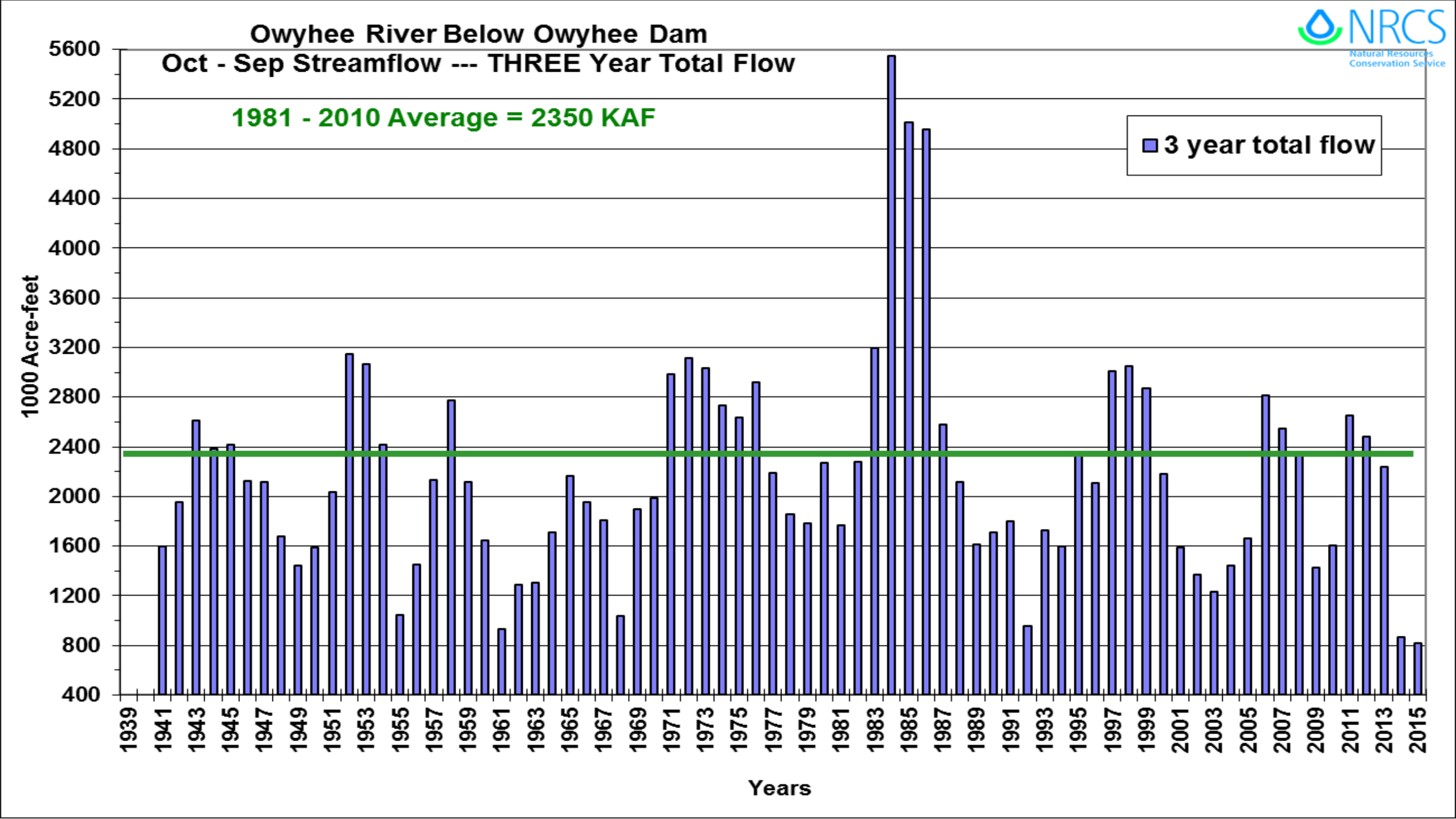
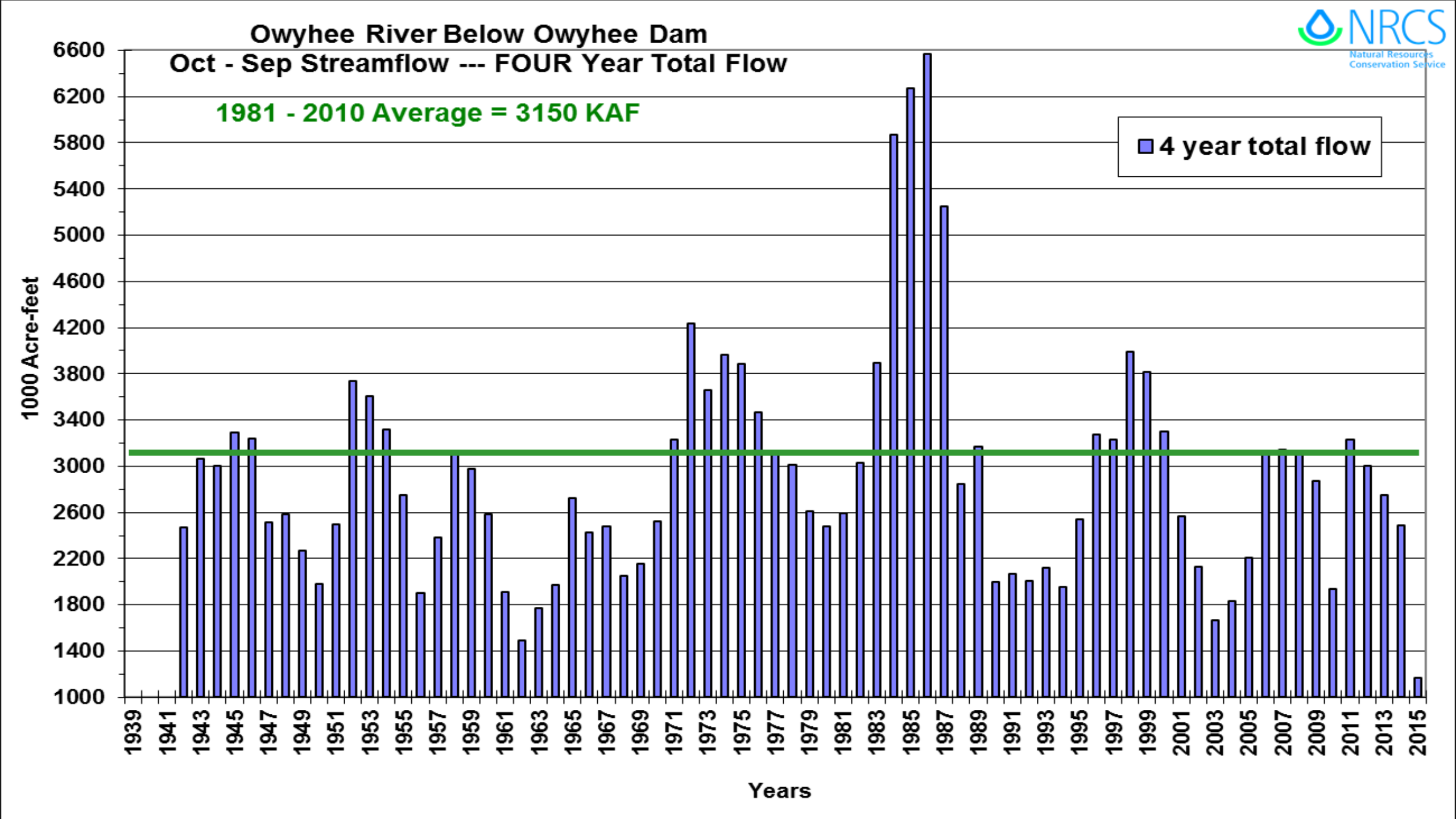
2007
2009
2011
2013
2015
Years


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- THREE Year Total Flow
1981 - 2010 Average = 2350 KAF
3 year total flow
1000 Acre-feet
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1600
1200
800
400
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Years
NRCS
Natural Resources Conservation Service


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- FOUR Year Total Flow
1981 - 2010 Average = 3150 KAF
4 year total flow
1000 Acre-feet
Years
6600
6200
5800
5400
5000
4600
4200
3800
3400
3000
2600
2200
1800
1400
1000
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
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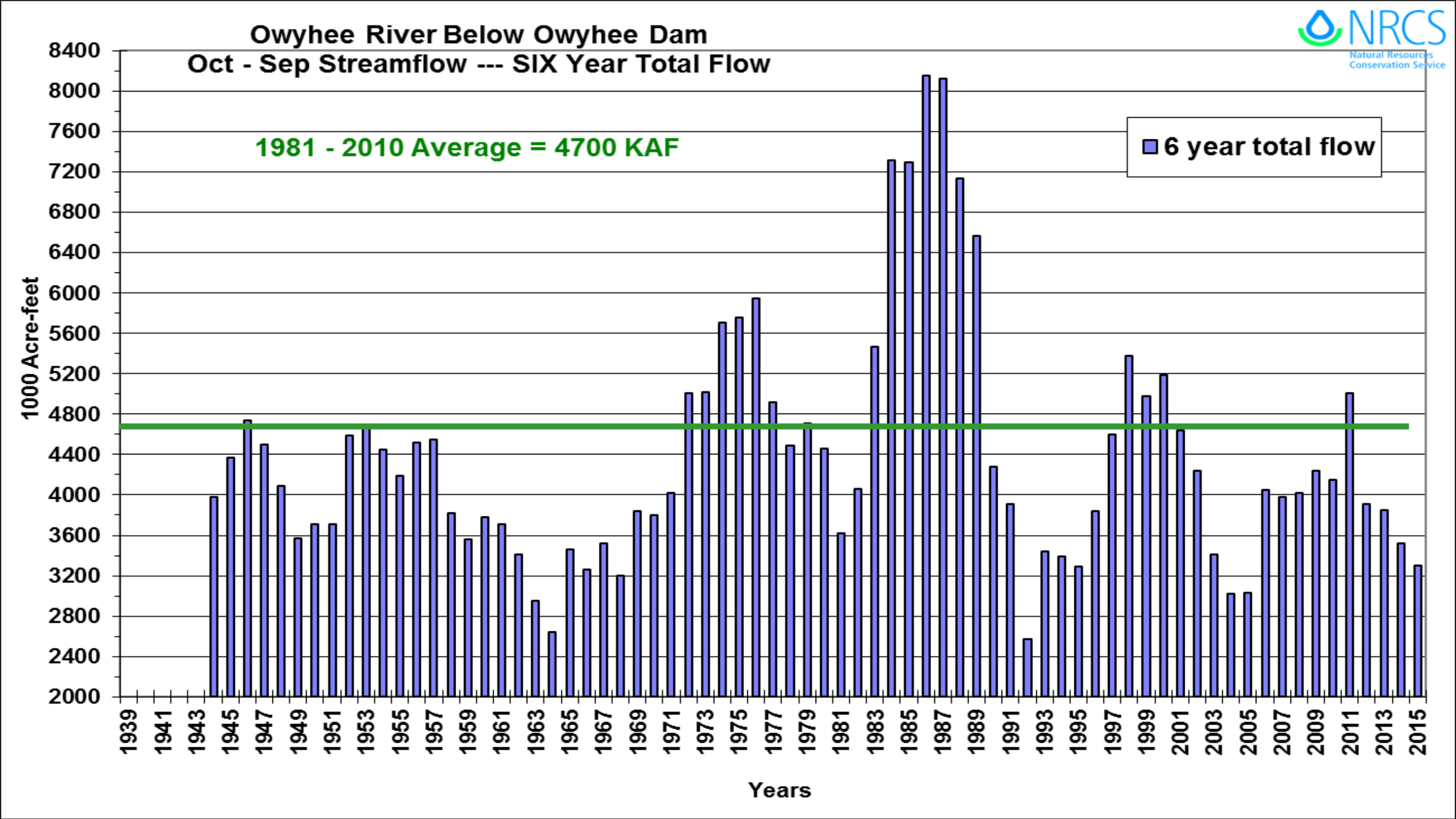
2007
2009
2011
2013
2015
NRCS
Natural Resources Conservation Service


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- SIX Year Total Flow
1981 - 2010 Average = 4700 KAF
6 year total flow
1000 Acre-feet
Years
8400
8000
7600
7200
6800
6400
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
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1995
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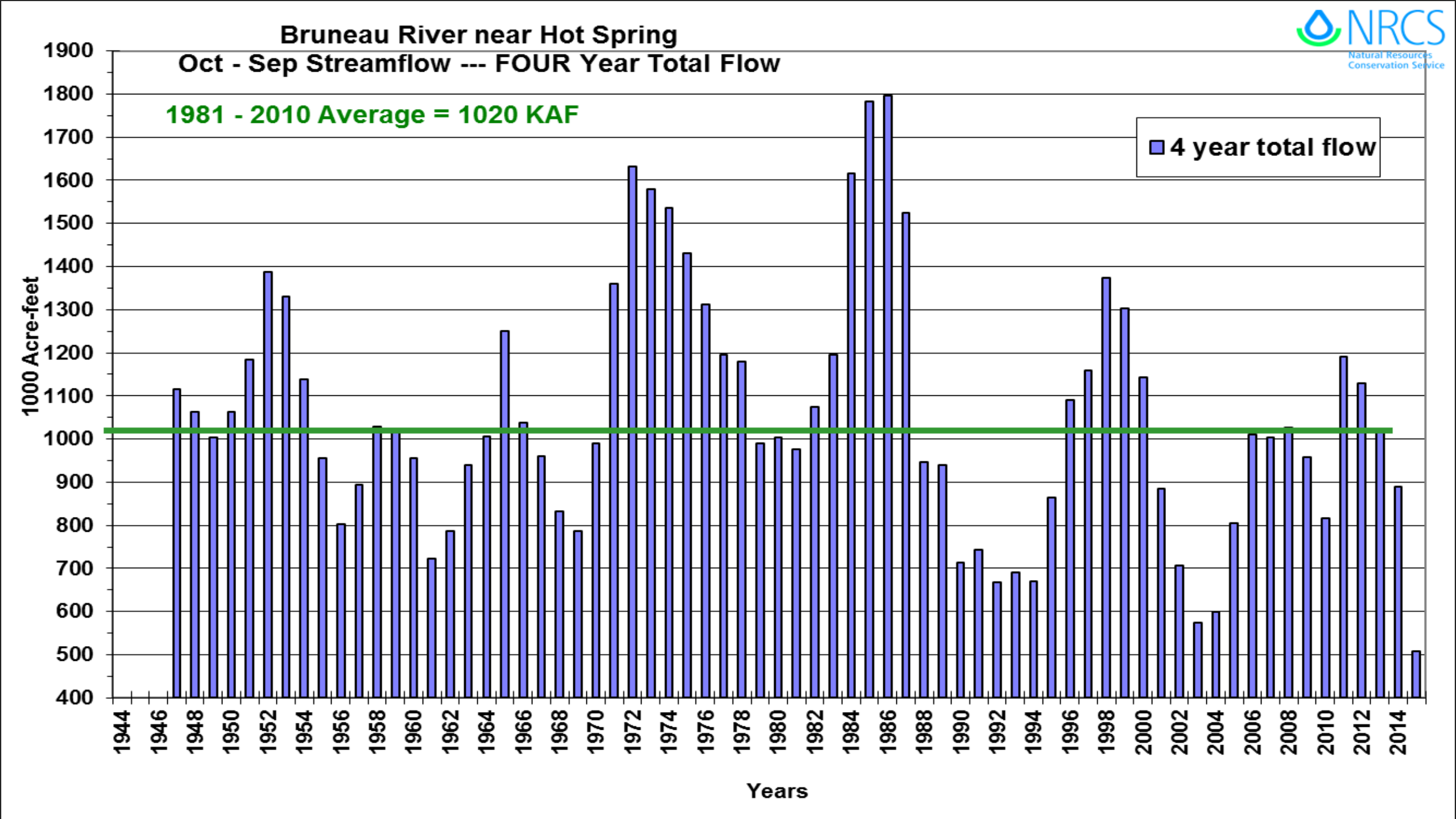
1999
2001
2003
2005
2007
2009
2011
2013
2015
NRCS
Natural Resources Conservation Service


Bruneau River near Hot Spring
Oct - Sep Streamflow --- FOUR Year Total Flow
1981 - 2010 Average = 1020 KAF
4 year total flow
1000 Acre-feet
Years
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
400
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
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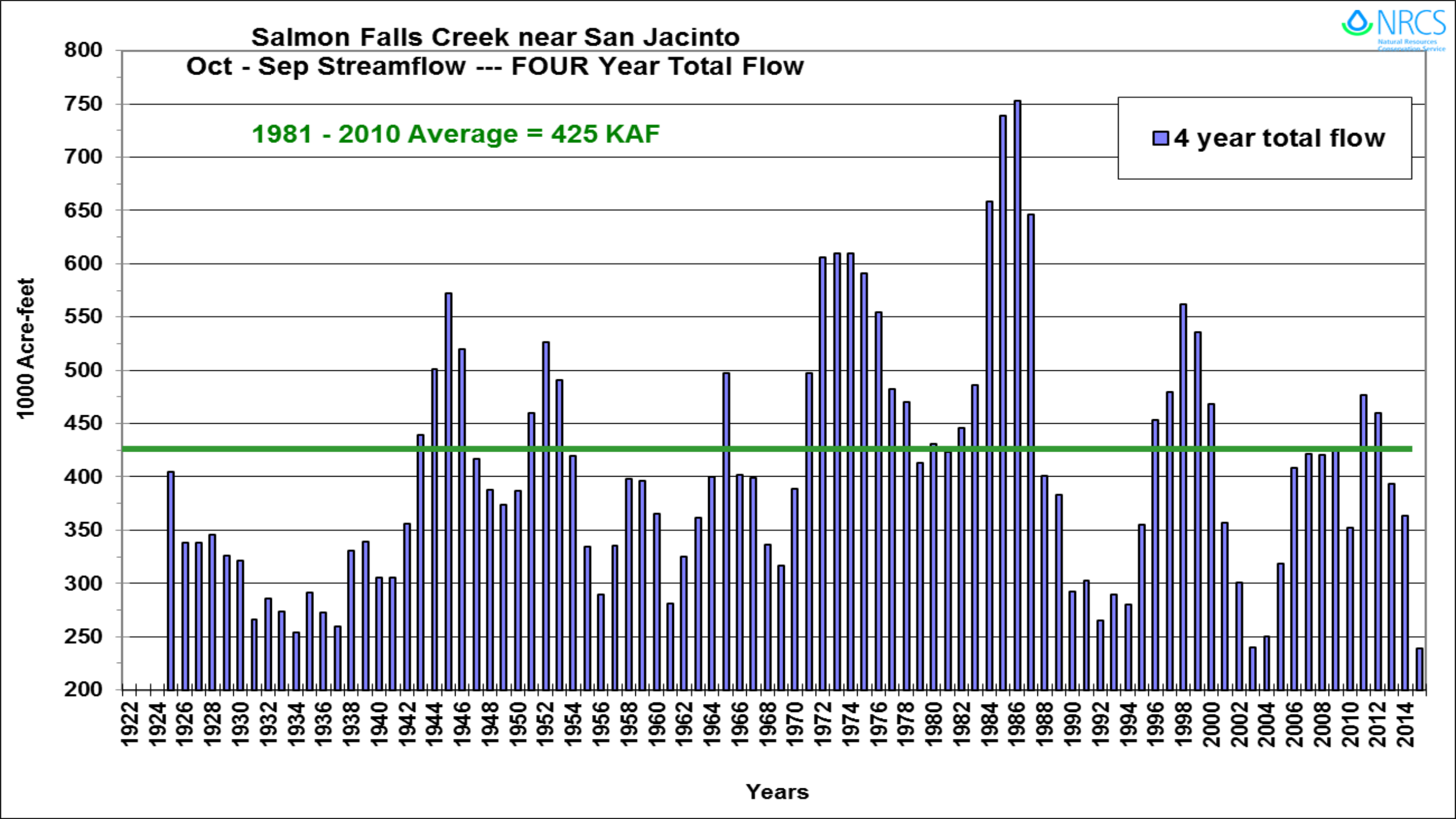
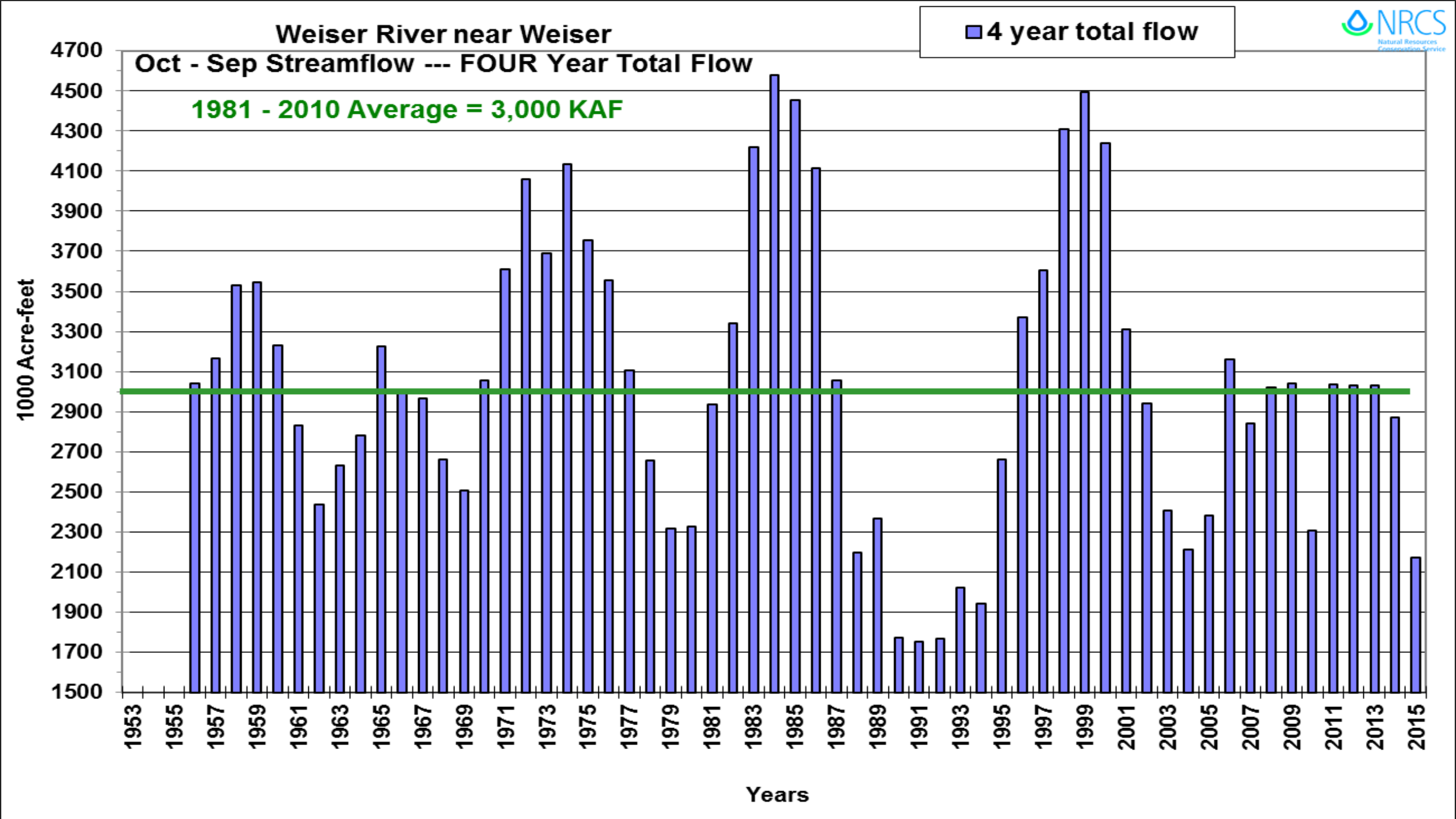
2002
2004
2006
2008
2010
2012
2014
NRCS
Natural Resources Conservation Service


Salmon Falls Creek near San Jacinto
Oct - Sep Streamflow --- FOUR Year Total Flow
1981 - 2010 Average = 425 KAF
4 year total flow
1000 Acre-feet
Years
800
750
700
650
600
550
500
450
400
350
300
250
200
1922
1924
1926
1928
1930
1932
1934
1936
1938
1940
1942
1944
1946
1948
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014


Weiser River near Weiser
Oct - Sep Streamflow --- FOUR Year Total Flow
1981 - 2010 Average = 3,000 KAF
4 year total flow
NRCS
Natural Resources Conservation Service
1000 Acre-feet
4700
4500
4300
4100
3900
3700
3500
3300
3100
2900
2700
2500
2300
2100
1900
1700
1500
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
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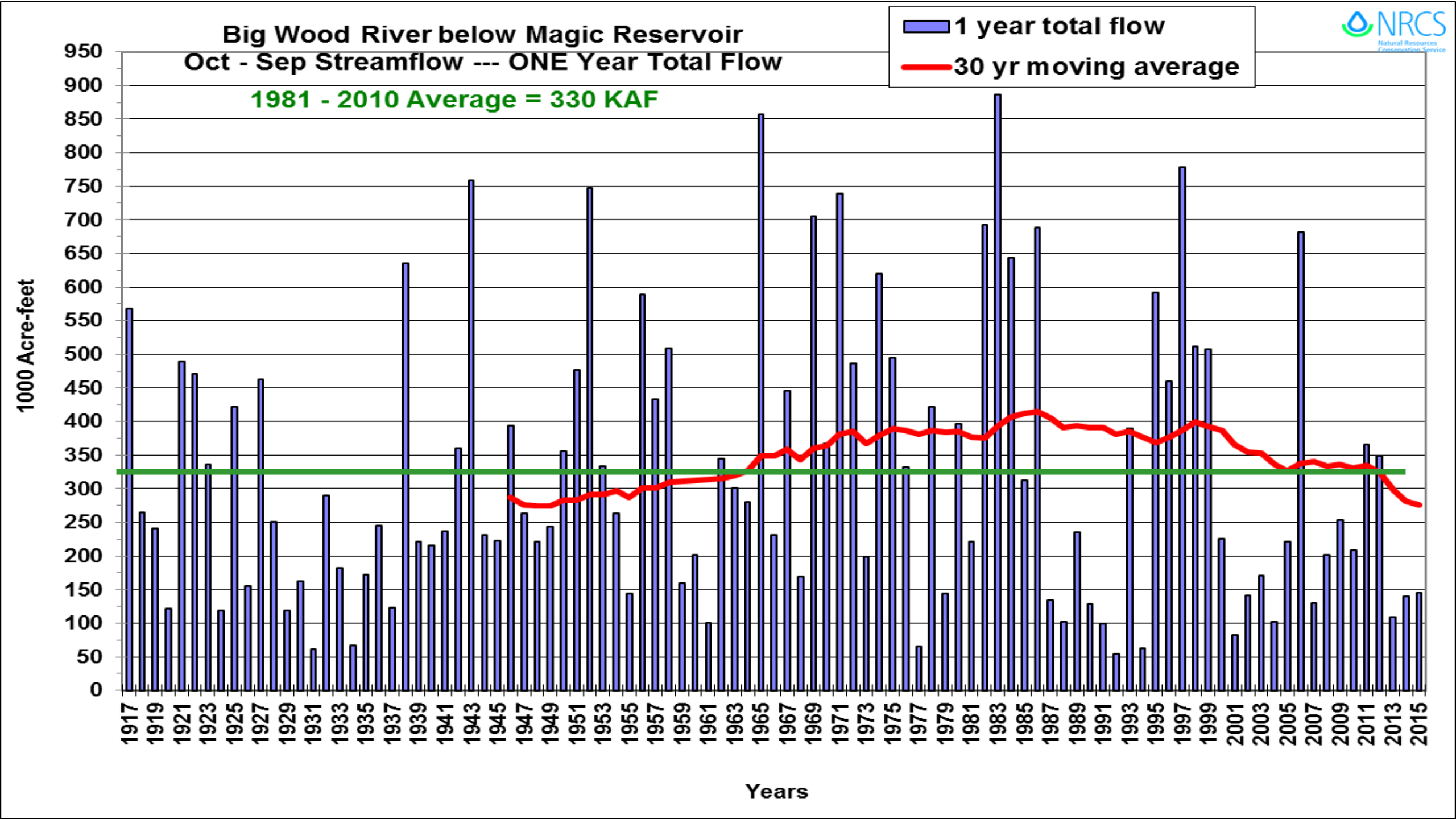
2003
2005
2007
2009
2011
2013
2015
Years


Big Wood River below Magic Reservoir
Oct - Sep Streamflow --- ONE Year Total Flow
1981 - 2010 Average = 330 KAF
1 year total flow
30 yr moving average
NRCS
Natural Resources Conservation Service
1000 Acre-feet
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
0
1917
1919
1921
1923
1925
1927
1929
1931
1933
1935
1937
1939
1941
1943
1945
1947
1949
1951
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1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
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1987
1989
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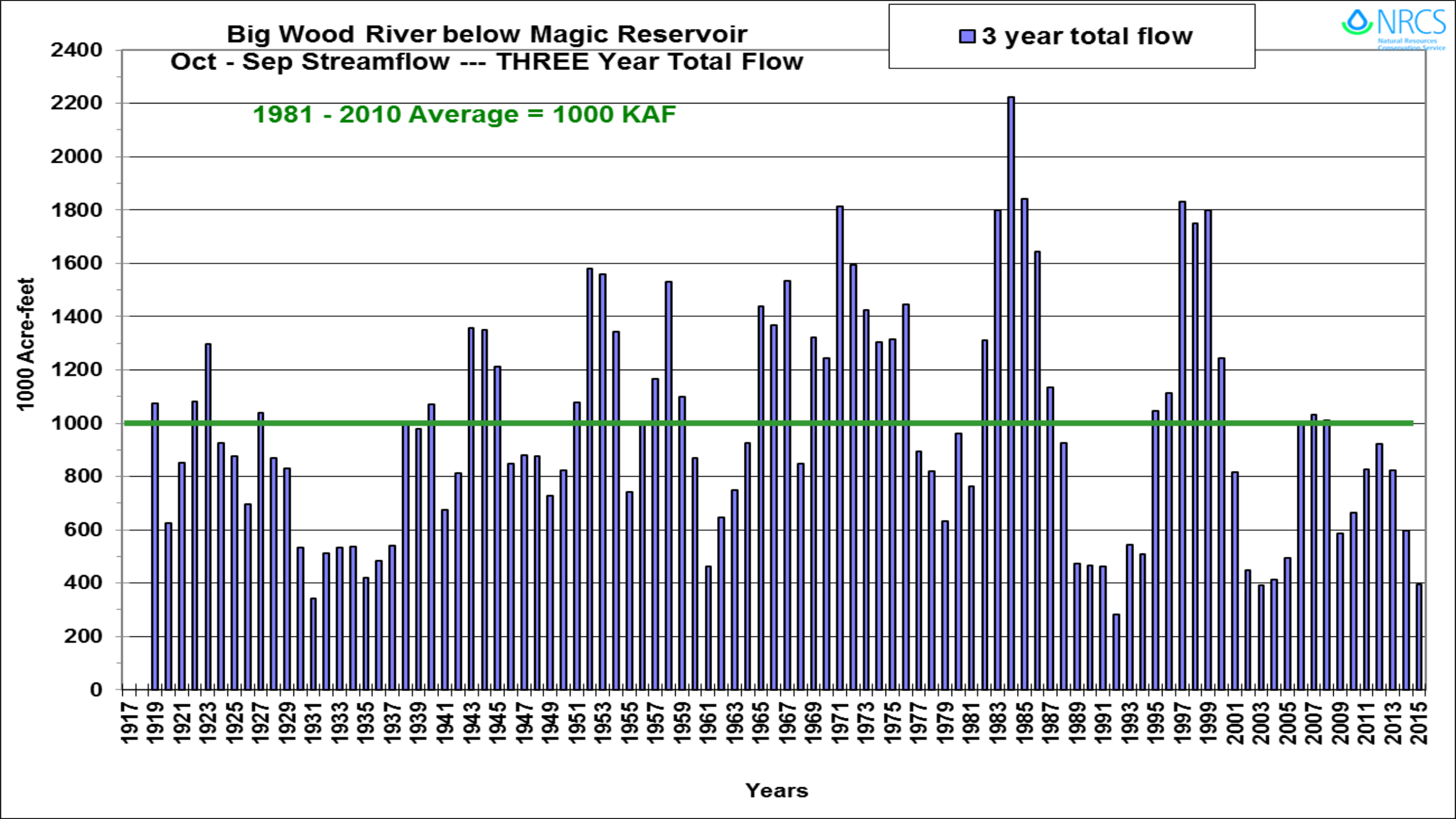
1999
2001
2003
2005
2007
2009
2011
2013
2015
Years


Big Wood River below Magic Reservoir
Oct - Sep Streamflow --- THREE Year Total Flow
1981 - 2010 Average = 1000 KAF
3 year total flow
NRCS
Natural Resources Conservation Service
1000 Acre-feet
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
1917
1919
1921
1923
1925
1927
1929
1931
1933
1935
1937
1939
1941
1943
1945
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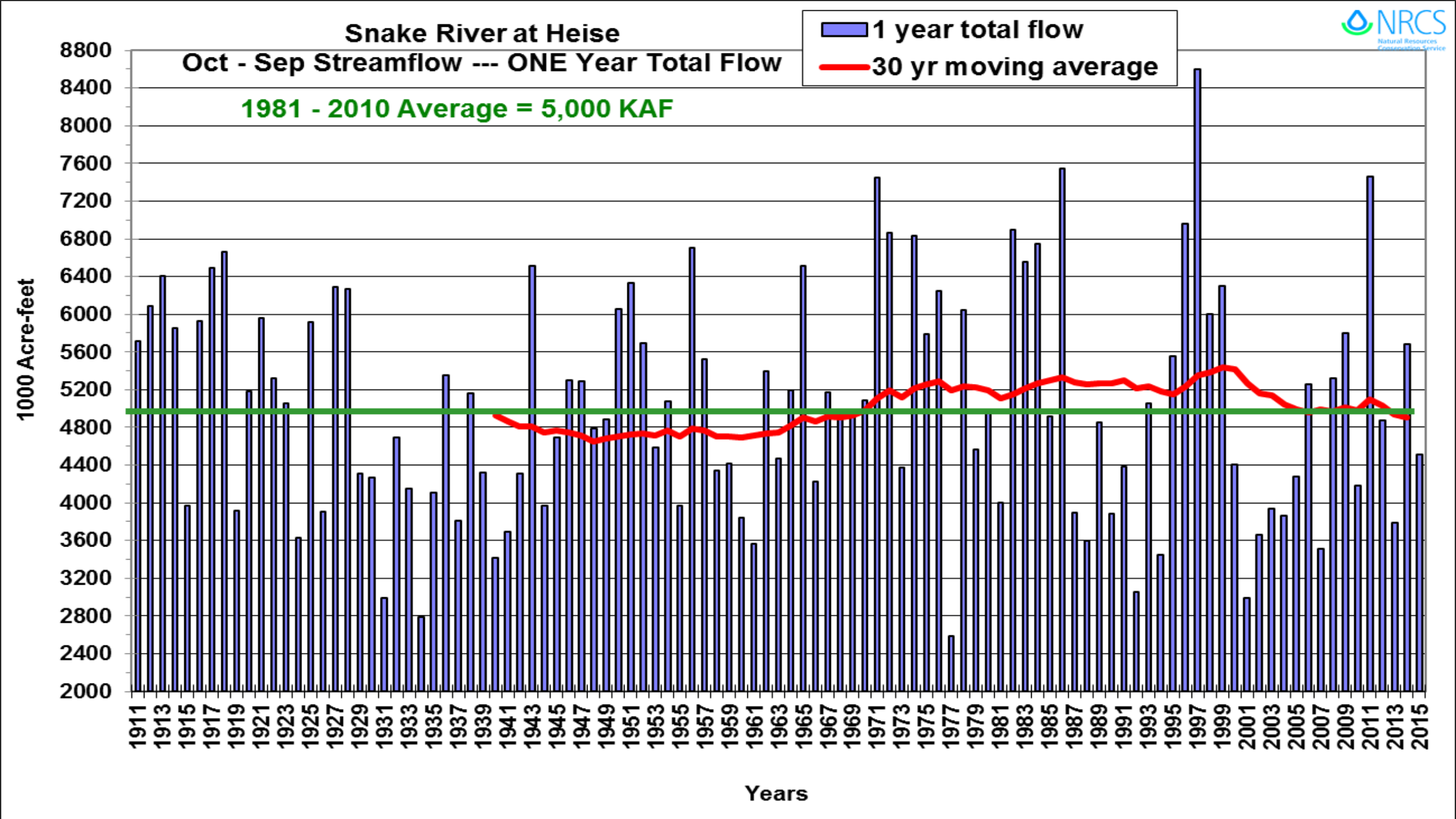
2011
2013
2015
Years


Snake River at Heise
Oct - Sep Streamflow --- ONE Year Total Flow
1981 - 2010 Average = 5,000 KAF
1 year total flow
30 yr moving average
NRCS
Natural Resources Conservation Service
1000 Acre-feet
8800
8400
8000
7600
7200
6800
6400
6000
5600
5200
4800
4400
4000
3600
3200
2800
2400
2000
1911 1913 1915 1917 1919 1921 1923 1925 1927 1929 1931 1933 1935 1937 1939 1941 1943 1945 1947 1949 1951 1953 1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005 2007 2009 2011 2013 2015
Years

Impact of Precipitation Falling as Rain Rather than Snow

1. **Winter 2014-2015 is excellent illustration that had more of our winter precipitation falling as rain.**

A. 2015 Snow Drought:

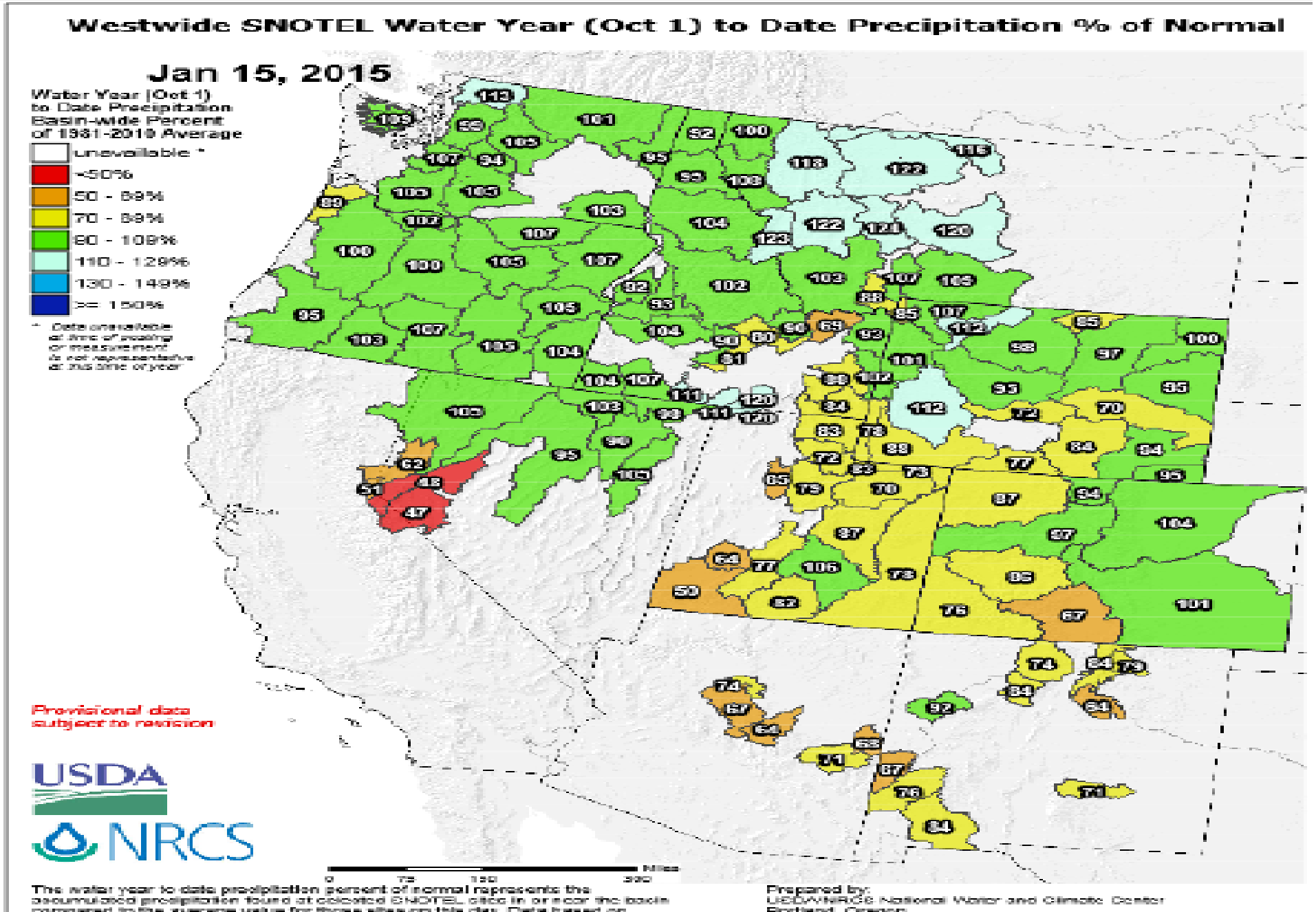
- **a. first signs of snow drought – moving ski races to snowier locations**
- **b. 2015 precipitation & snow maps as percent of normal**
- **c. SNOTEL precipitation & snow water analysis slides Abby Lute, USFS Rocky Mountain Research Station**

B. 2015 Impacts on Streamflow:

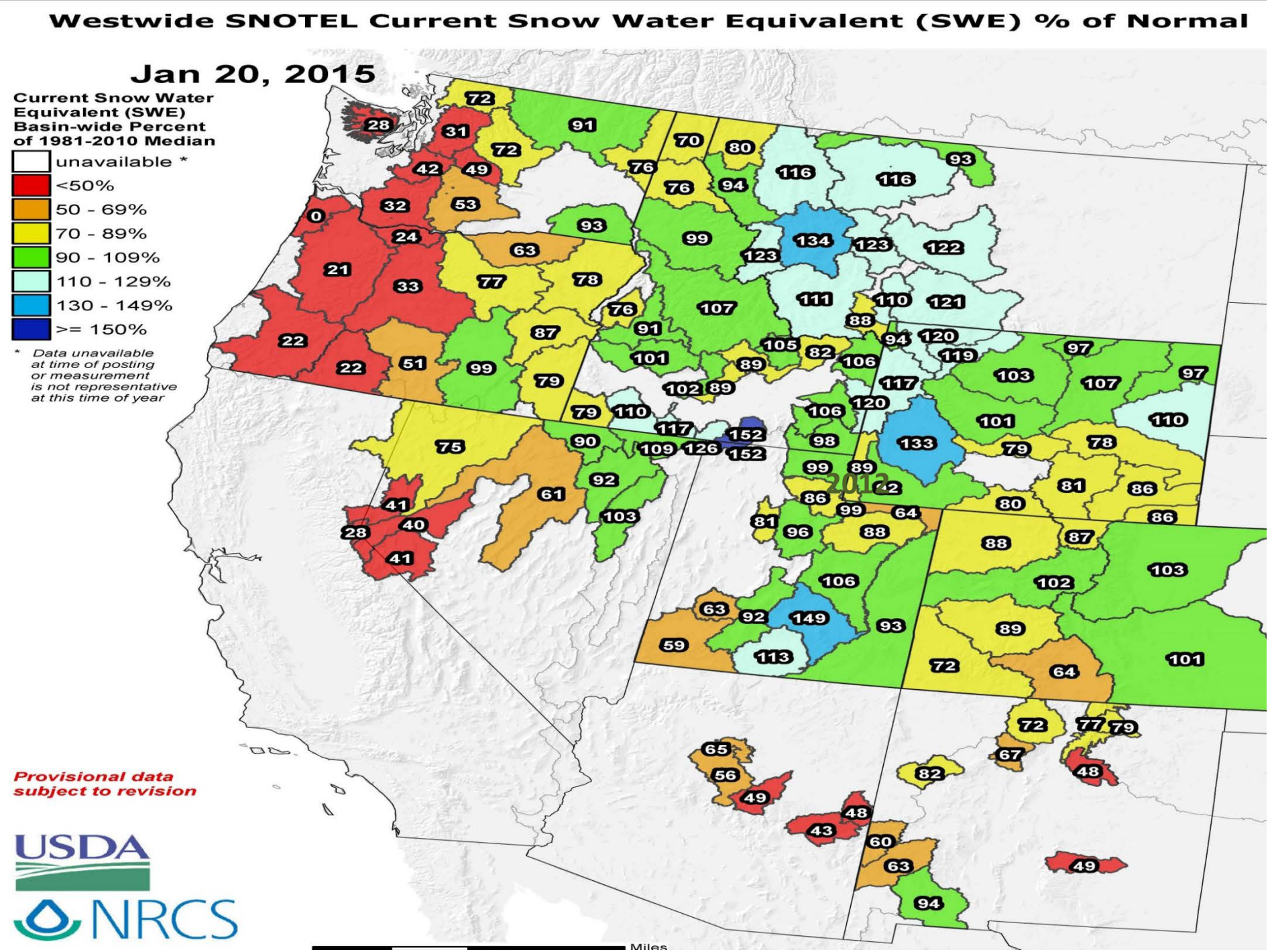
- **a. early runoff in Owyhee River winter 2014-15**
- **b. early runoff for Dworshak Reservoir Inflow with well below normal April – July volume**

- Nov 2014 Cold Spell that Suddenly Spilled into Idaho
- Went from 50s F to 10s F in a few days - MF Salmon River

Water Year to Date Precipitation Jan 15, 2015



Jan 15, 2015 normal or better water year to date precipitation in PNW



Cold temperatures brought best powder ski days in late Dec to mid-Jan from Bogus to Bridger Bowl

March 11, 2015 Lost-Wood Divide SNOTEL Site

Photo by Ray Gadd

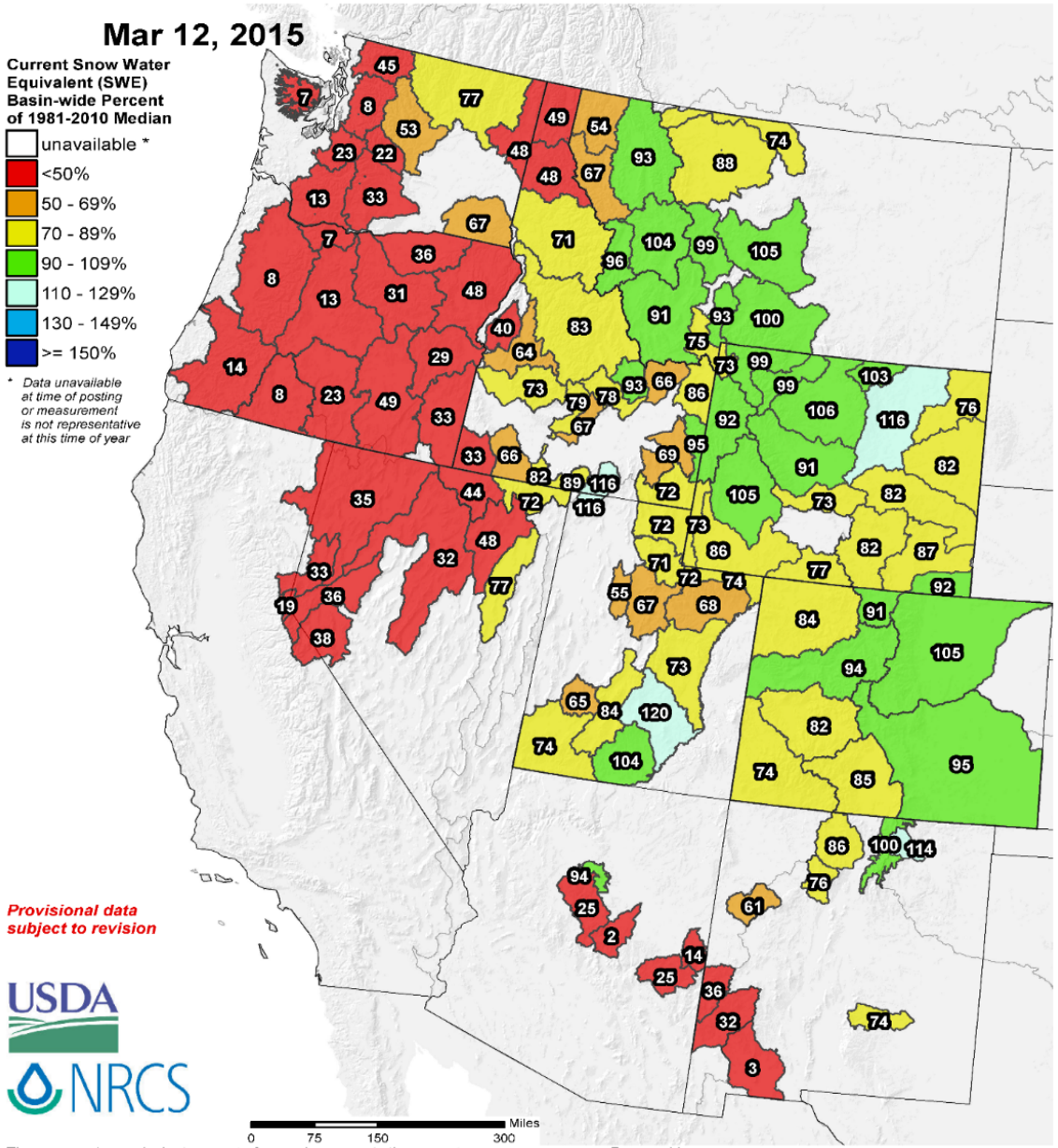
Impacts on Skiing

- Ski Races Moved
- Skier Days Down
- Season Pass Sale Down

Photo taken by Ray Gadd March 11, 2015 looking east over Ketchum in Big Wood River valley illustrating lack of snow on south facing slopes.

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

Mar 12, 2015

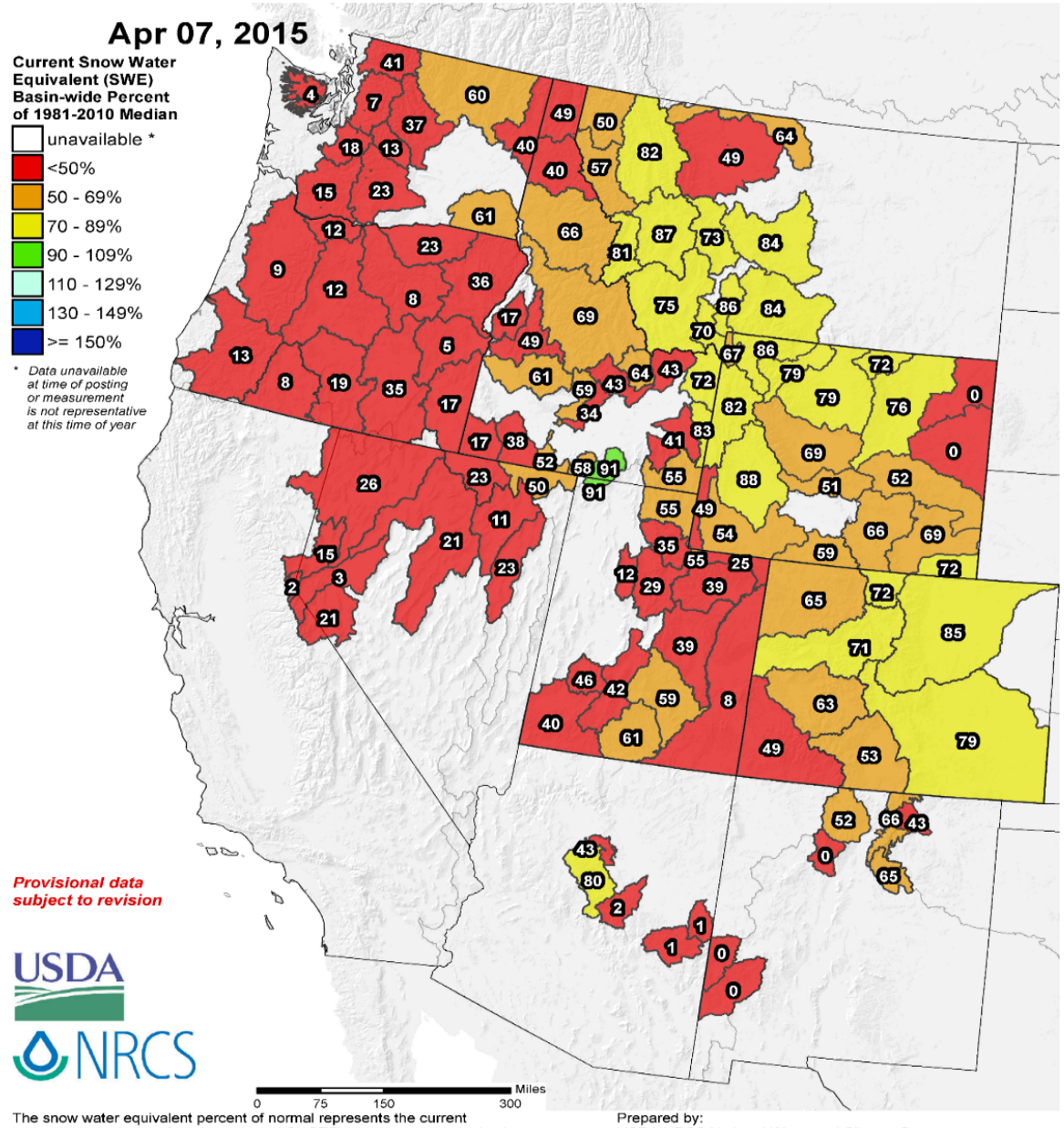


The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

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

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

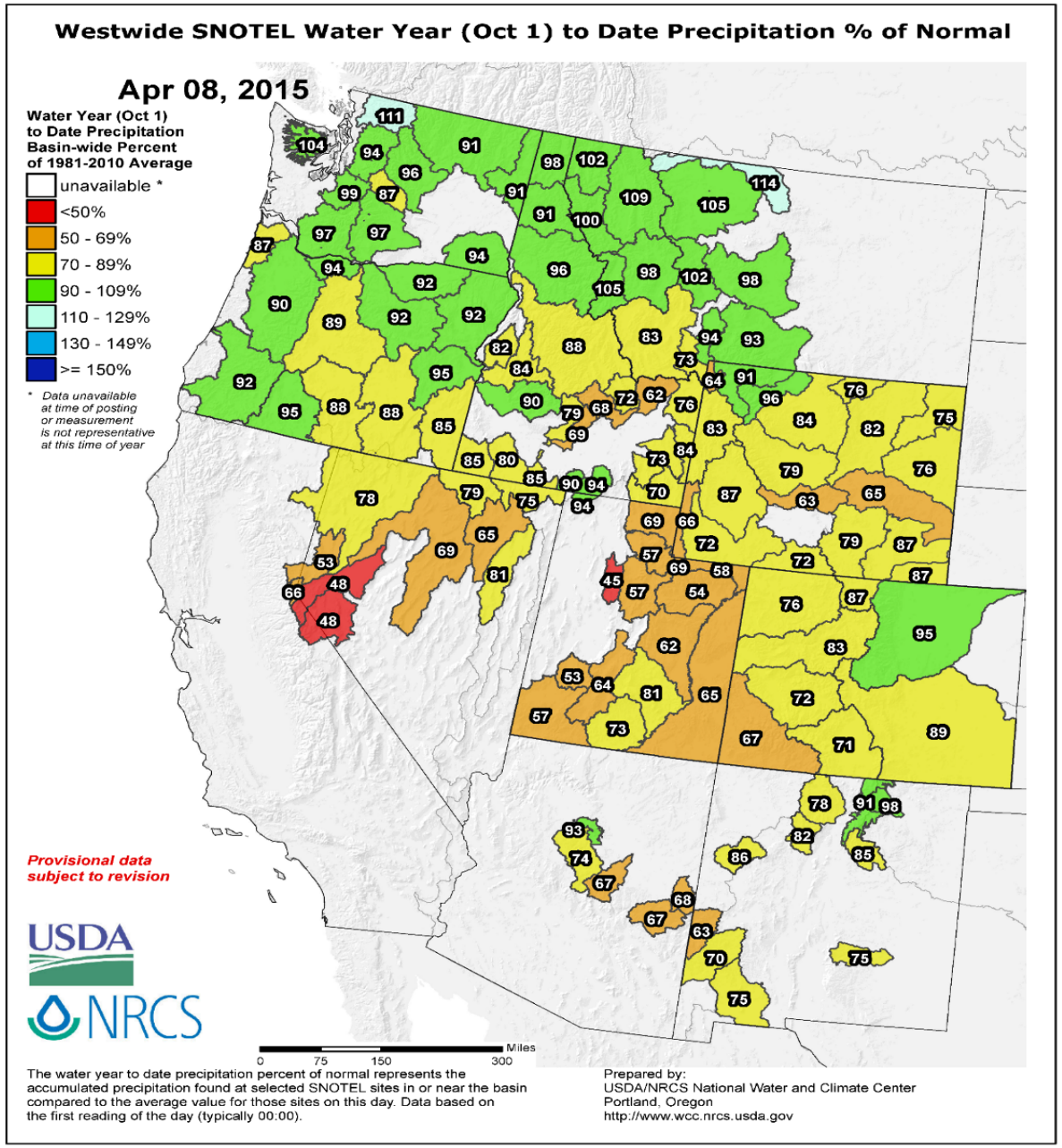
Apr 07, 2015

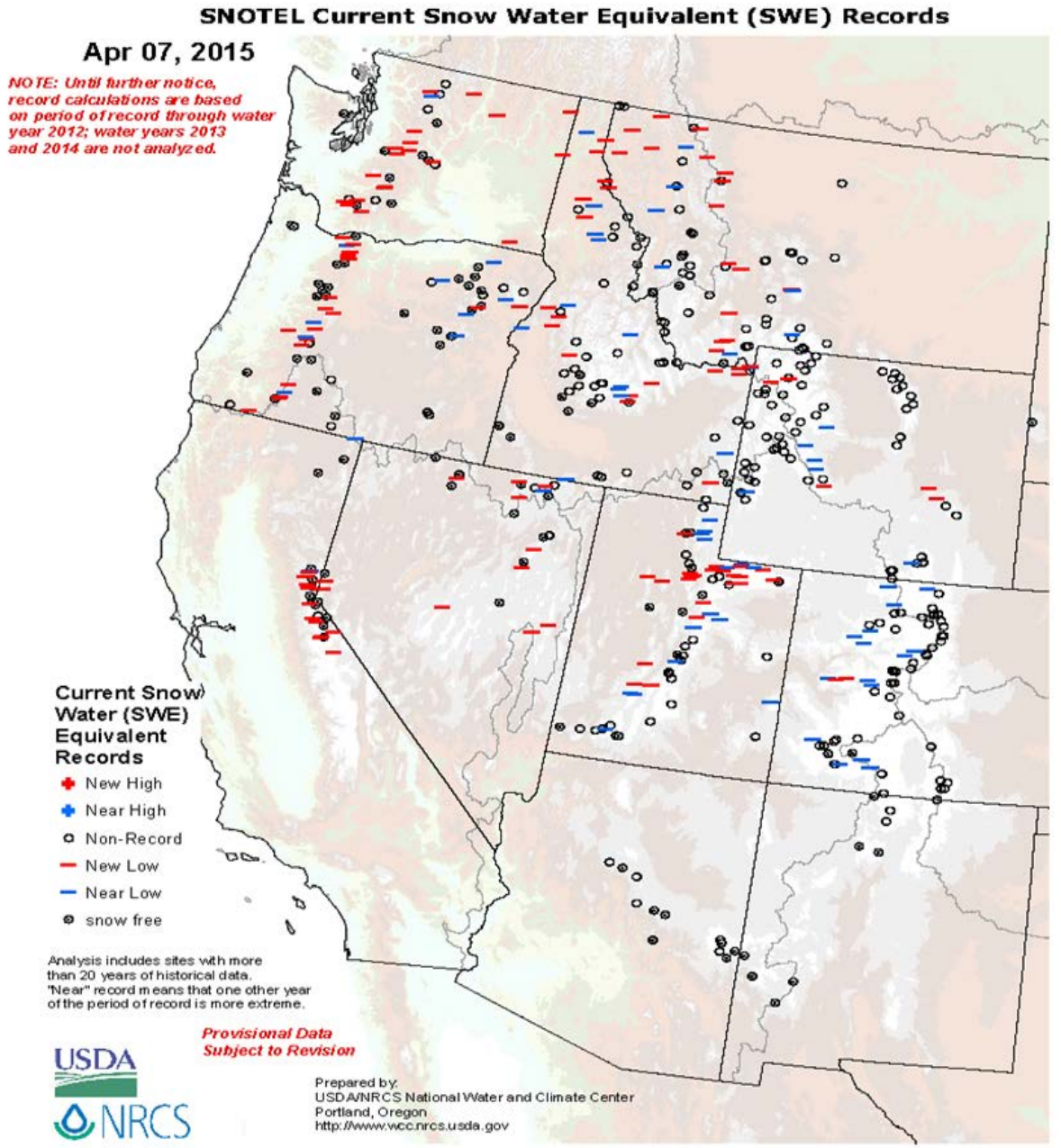


The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

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

Water Year to Date Precipitation April 7, 2015 Record Low Snow





Idaho --- Mean temperature departure & precipitation falling normal Nov 1 – Mar 31:

Graham Guard: 4.9 F

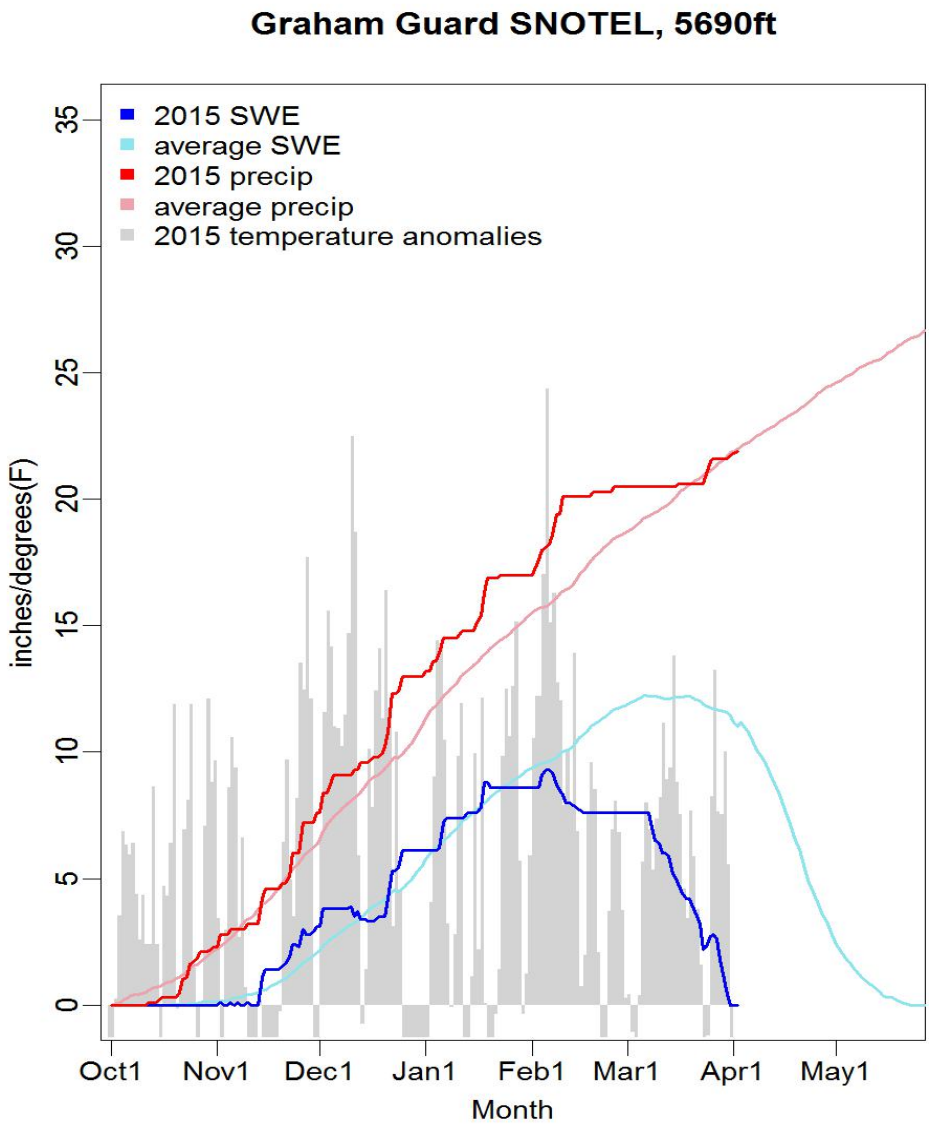
Normally 75% precip falls as snow

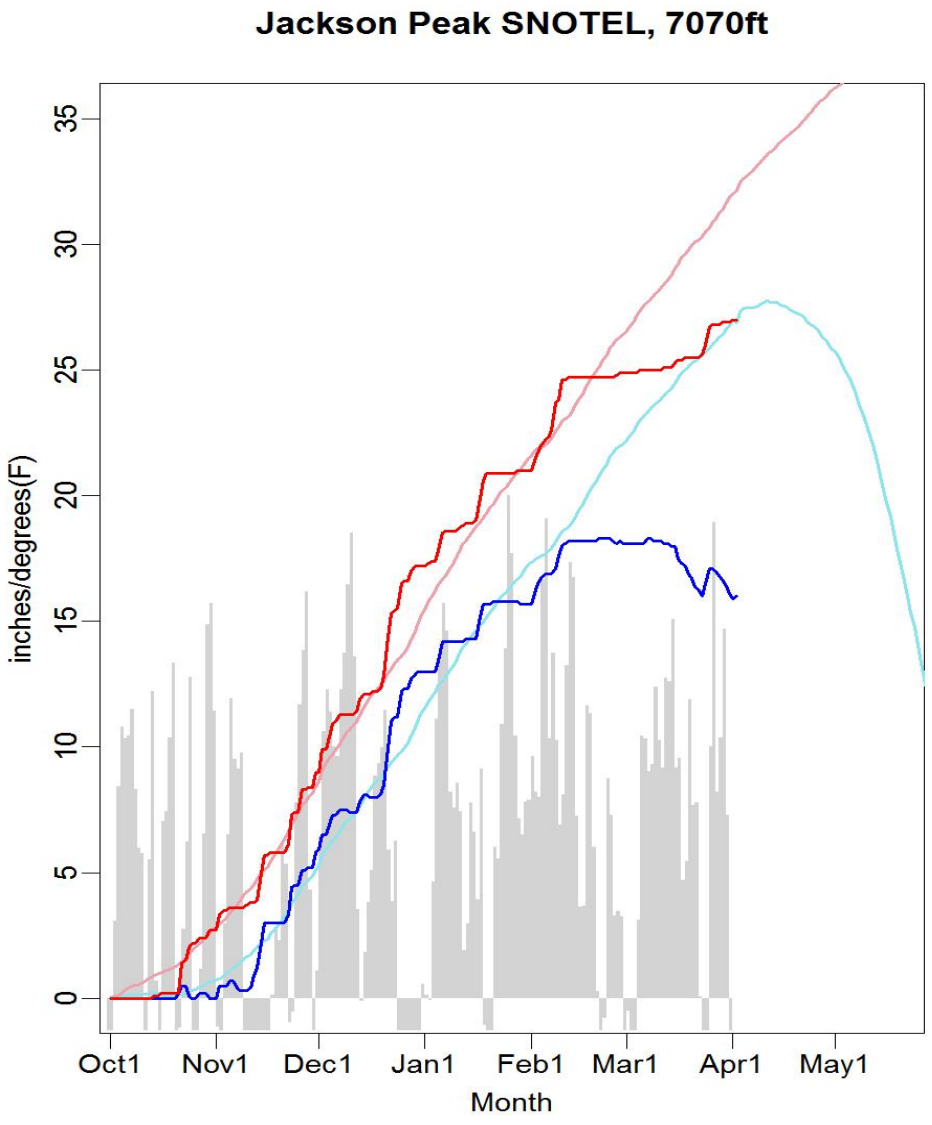
2015 60% fell as snow

Jackson Peak: 5.1 F

Normally 92% precip falls as snow

2015 84% fell as snow





Washington --- **Mean temperature departure & precipitation falling normal Nov 1 – Mar 31:**

Stampede Pass: 5.0 F

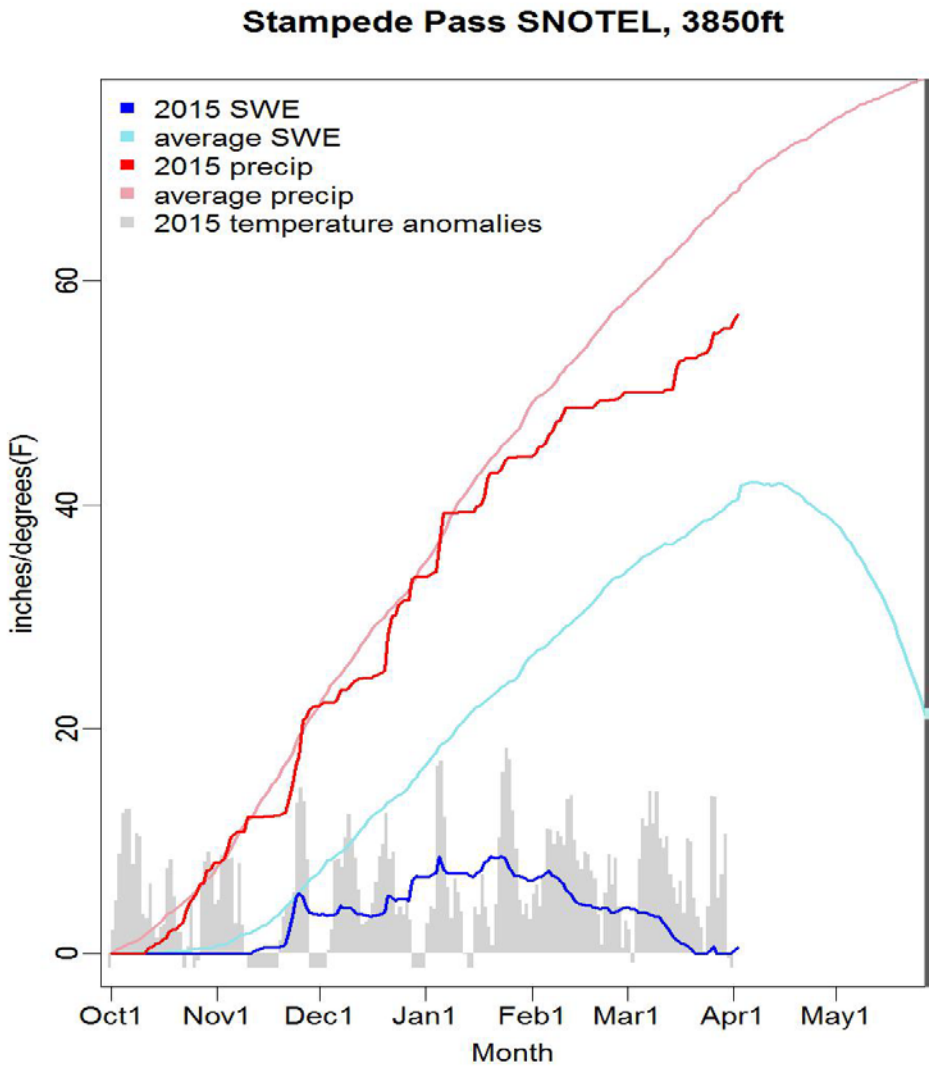
Normally 80% precip falls as snow

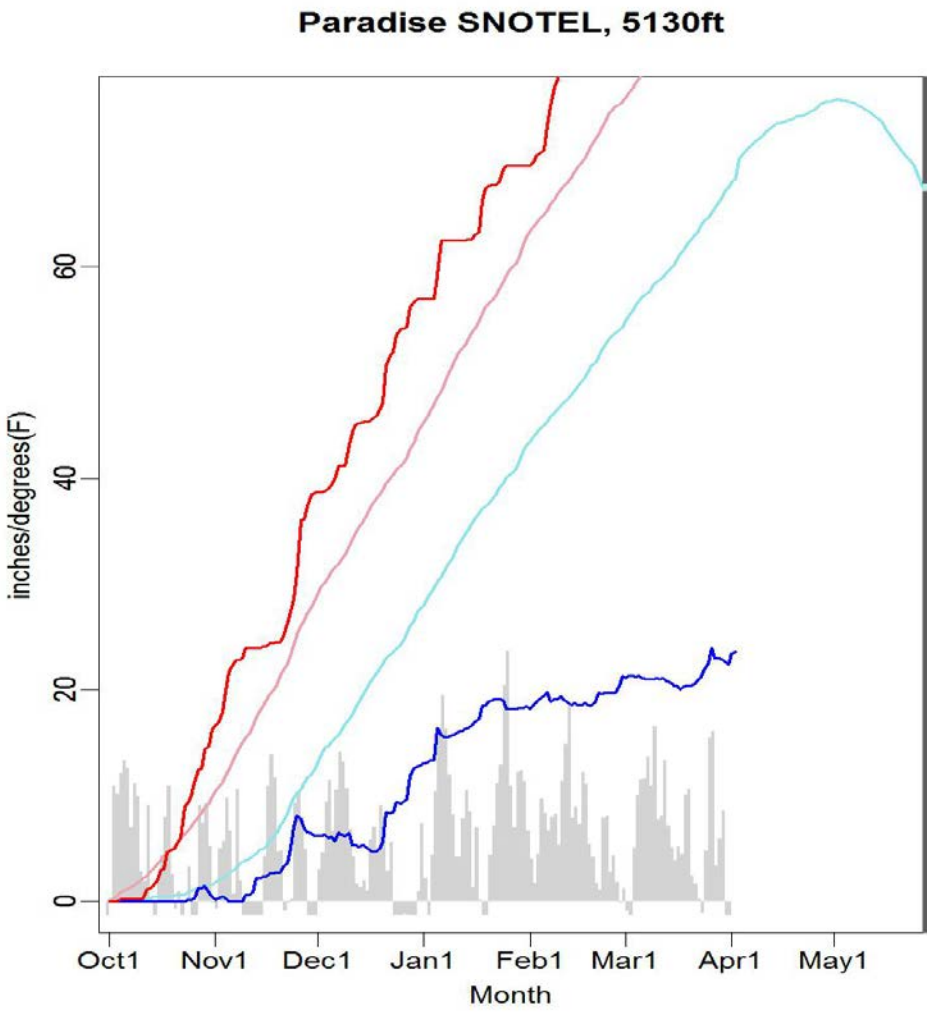
2015 34% fell as snow

Paradise: 5.3 F

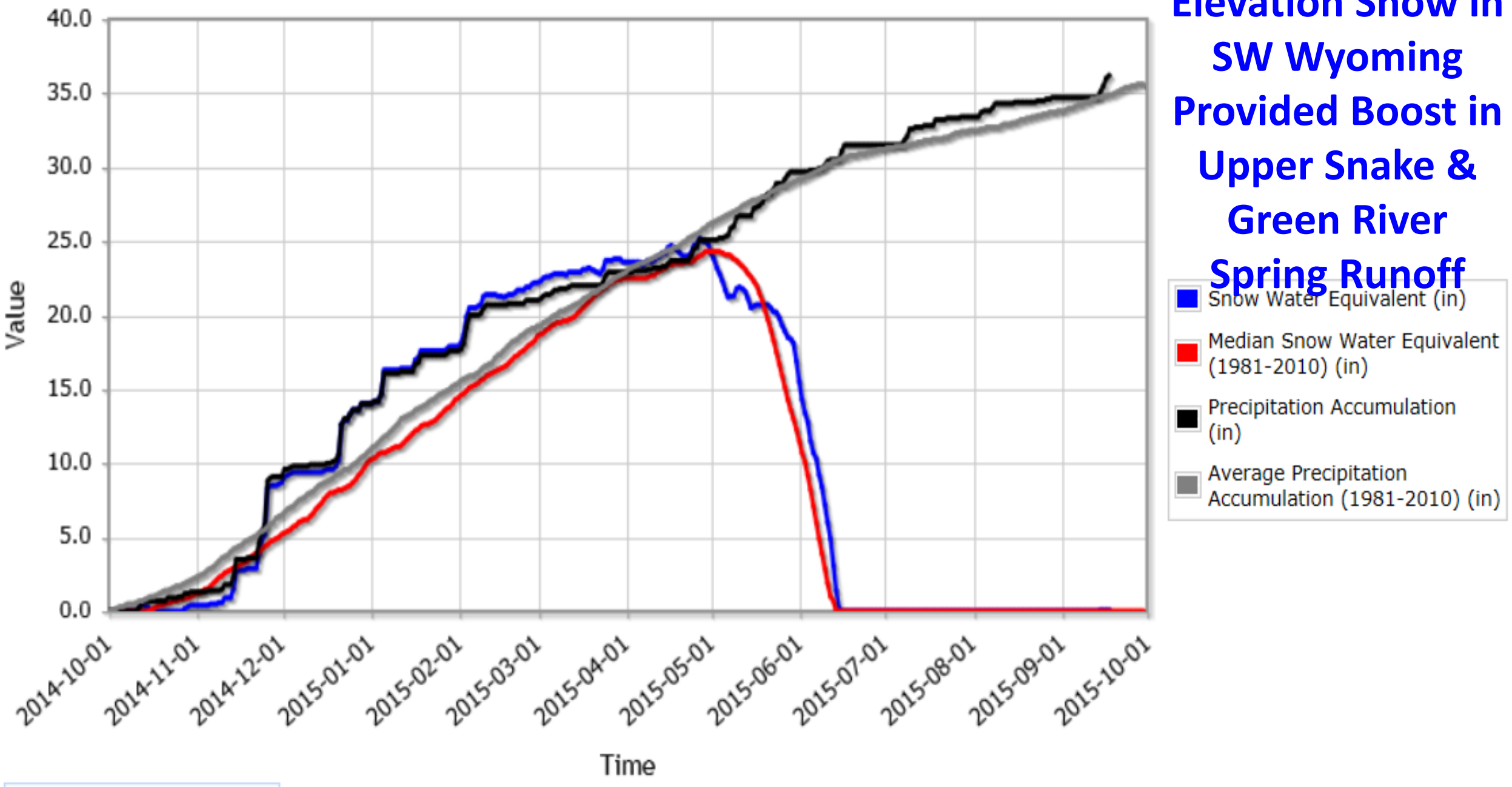
Normally 92% precip falls as snow

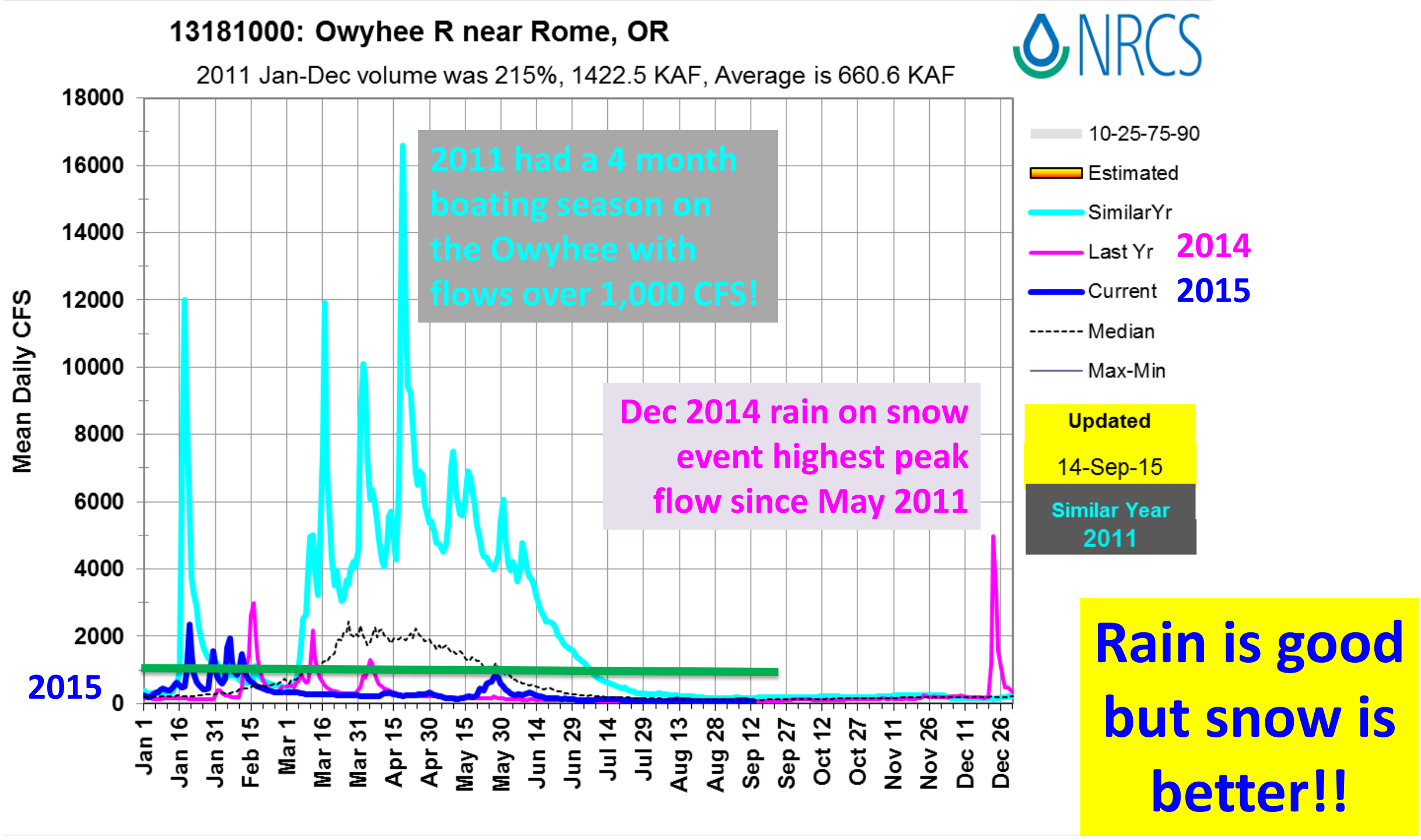
2015 46% fell as snow

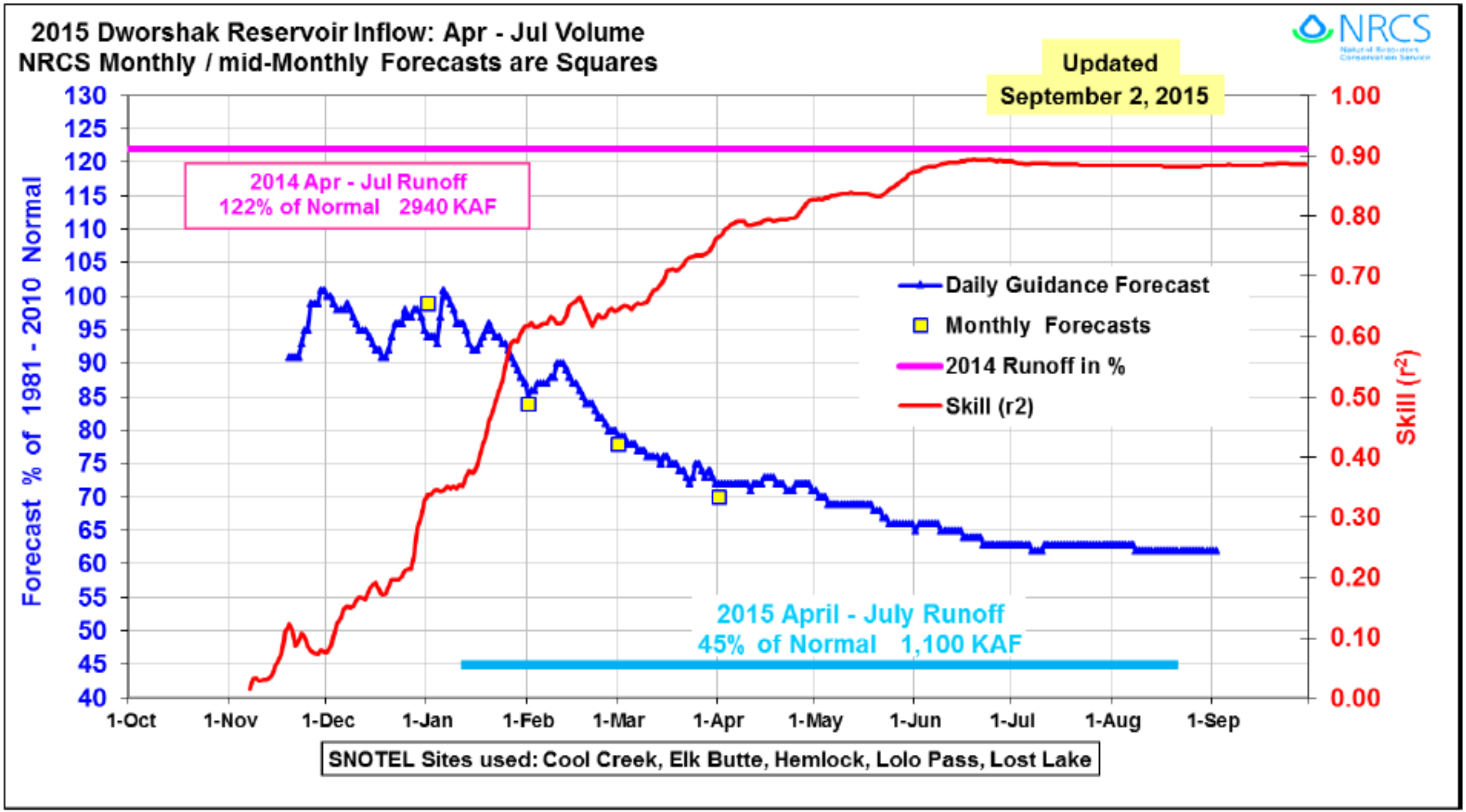


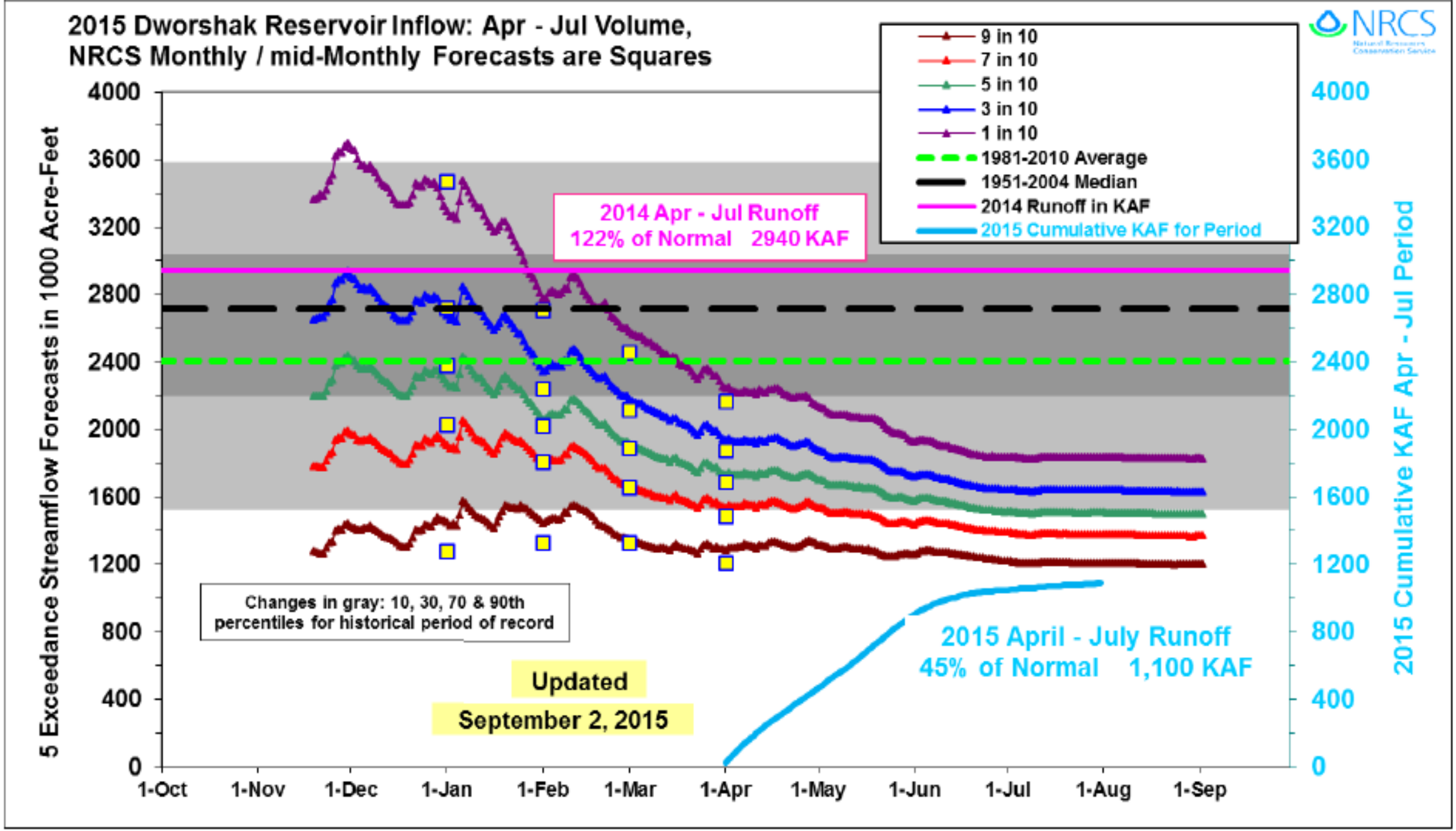


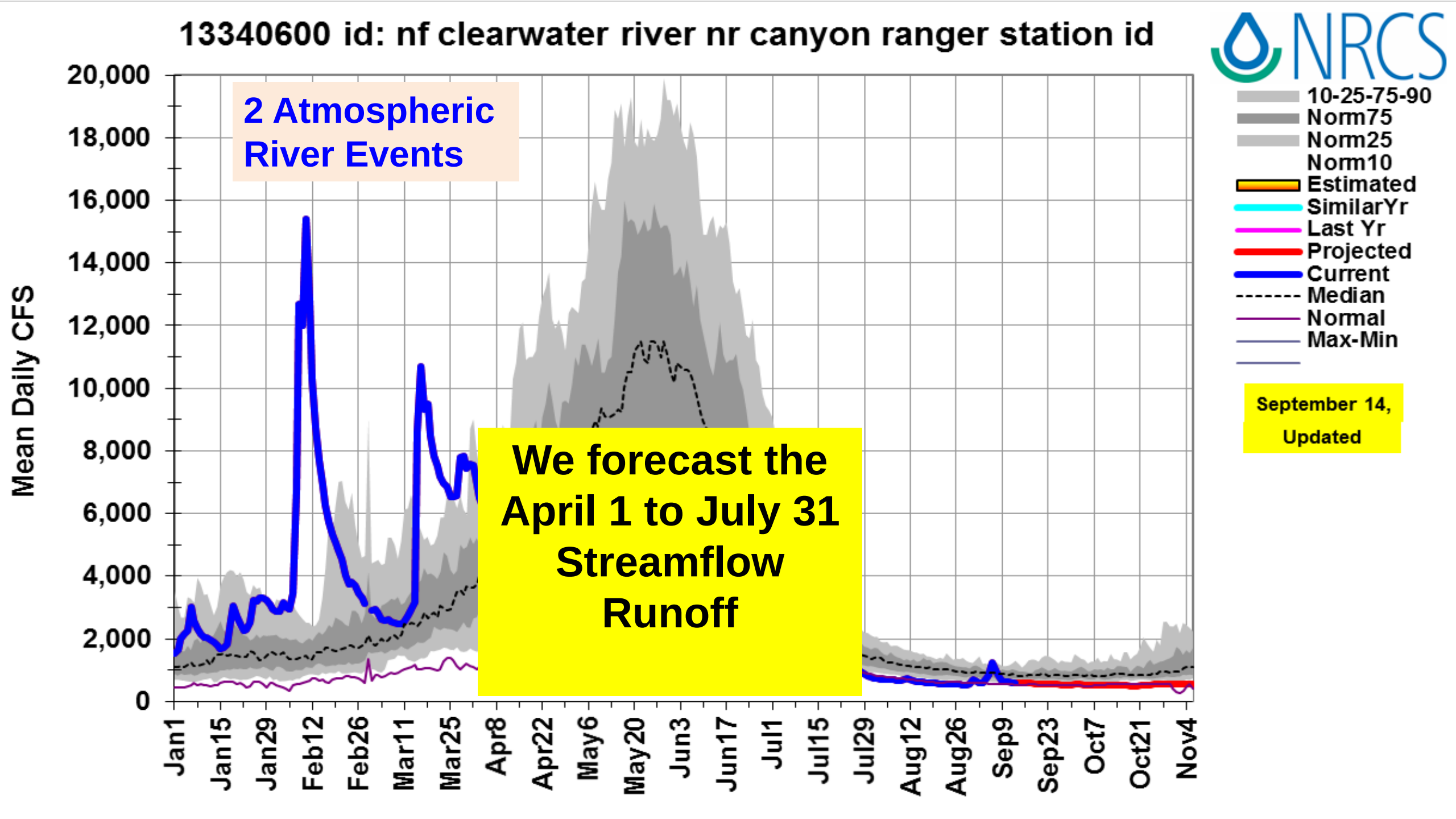
Normal High Elevation Snow in SW Wyoming Provided Boost in Upper Snake & Green River Spring Runoff

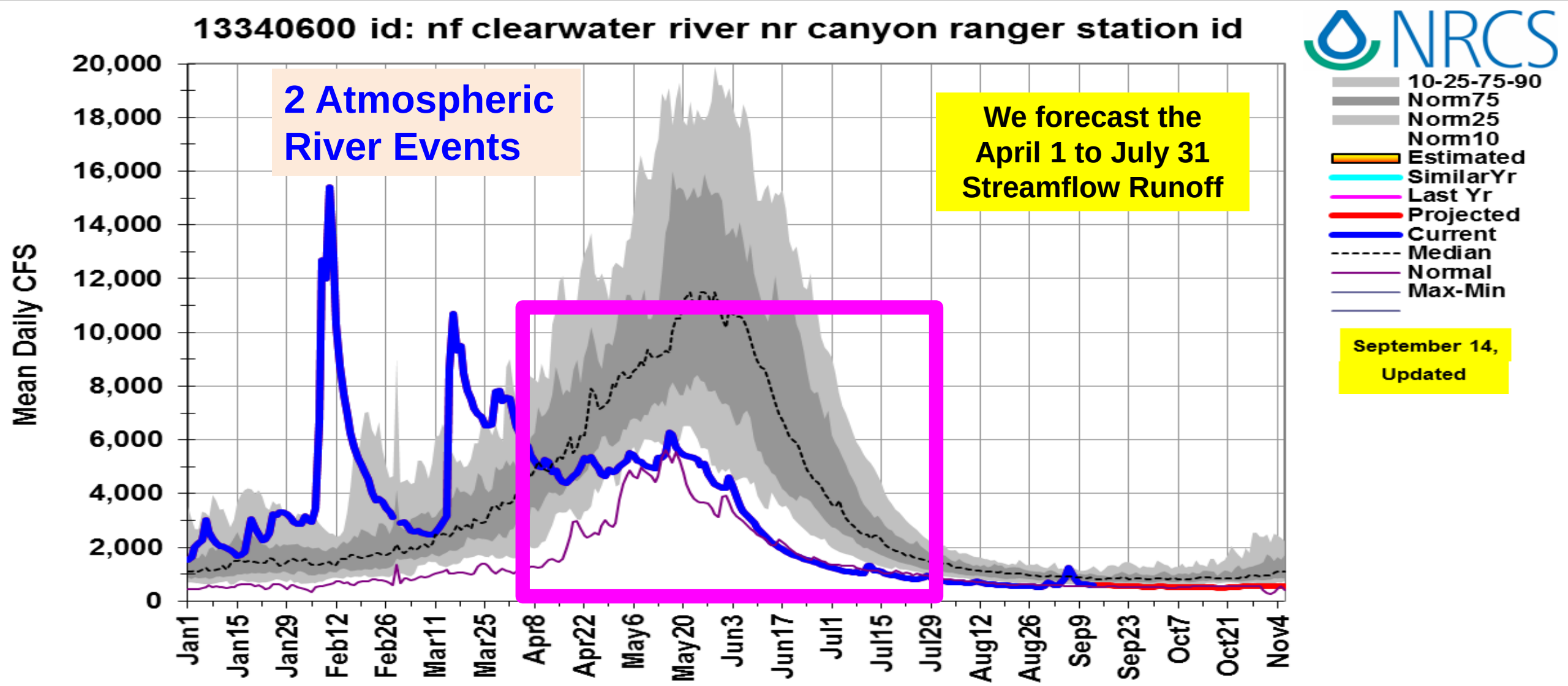



13181000: Owyhee R near Rome, OR
2011 Jan-Dec volume was 215%, 1422.5 KAF, Average is 660.6 KAF
NRCS
Mean Daily CFS
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
2015
Jan 1
Jan 16
Jan 31
Feb 15
Mar 1
Mar 16
Mar 31
Apr 15
Apr 30
May 15
May 30
Jun 14
Jun 29
Jul 14
Jul 29
Aug 13
Aug 28
Sep 12
Sep 27
Oct 12
Oct 27
Nov 11
Nov 26
Dec 11
Dec 26
2011 had a 4 month boating season on the Owyhee with flows over 1,000 CFS!
Dec 2014 rain on snow event highest peak flow since May 2011
10-25-75-90
Estimated
SimilarYr
Last Yr 2014
Current 2015
Median
Max-Min
Updated
14-Sep-15
Similar Year
2011
Rain is good but snow is better!!


2015 Dworshak Reservoir Inflow: Apr - Jul Volume
NRCS Monthly / mid-Monthly Forecasts are Squares
NRCS
Natural Resources Conservation Service
Updated
September 2, 2015
2014 Apr - Jul Runoff
122% of Normal 2940 KAF
Daily Guidance Forecast
Monthly Forecasts
2014 Runoff in %
Skill (r2)
2015 April - July Runoff
45% of Normal 1,100 KAF
Forecast % of 1981 - 2010 Normal
Skill (r^2)
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
SNOTEL Sites used: Cool Creek, Elk Butte, Hemlock, Lolo Pass, Lost Lake

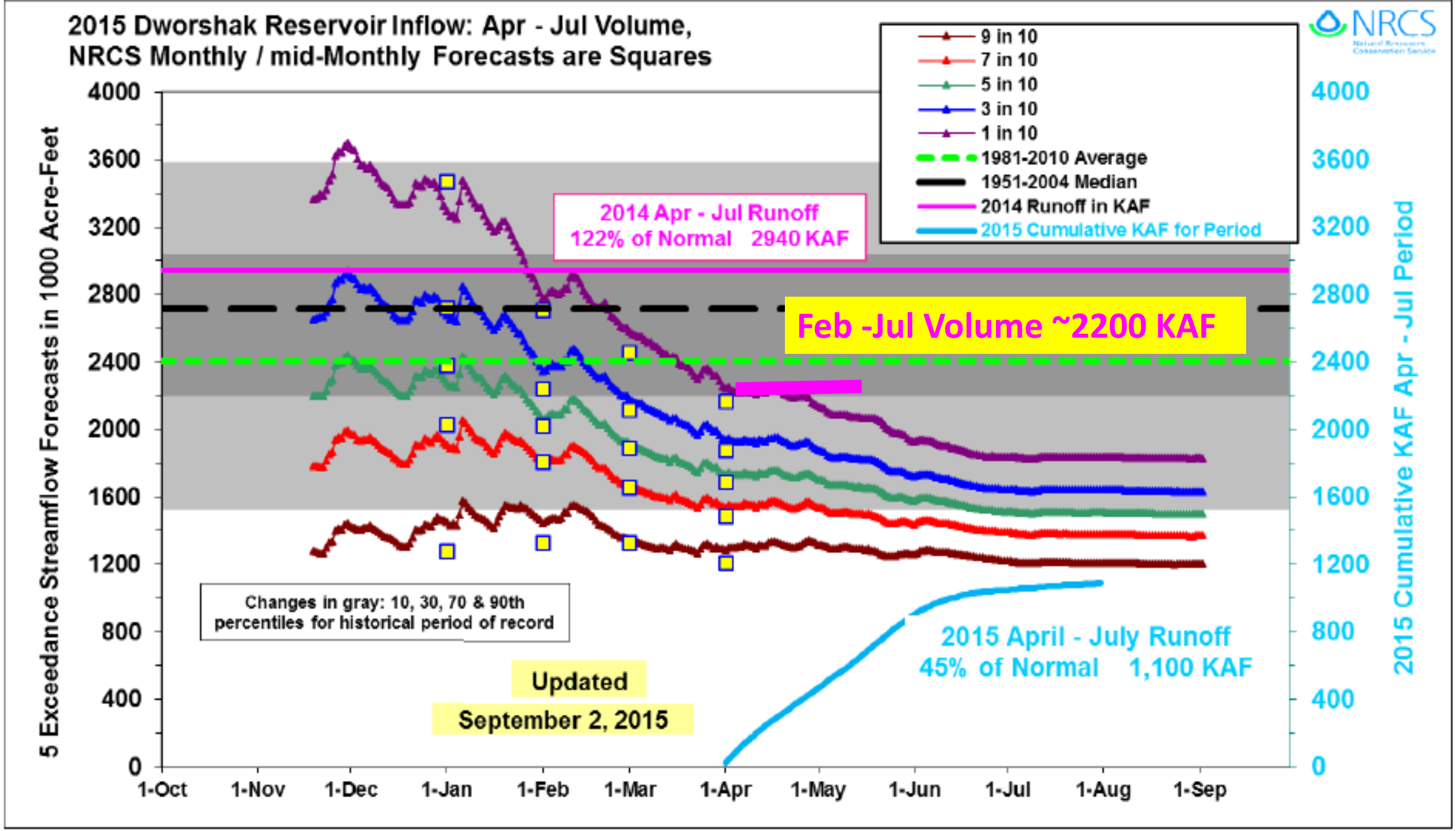

2015 Dworshak Reservoir Inflow: Apr - Jul Volume,
NRCS Monthly / mid-Monthly Forecasts are Squares
NRCS
9 in 10
7 in 10
5 in 10
3 in 10
1 in 10
1981-2010 Average
1951-2004 Median
2014 Runoff in KAF
2015 Cumulative KAF for Period
2014 Apr - Jul Runoff
122% of Normal 2940 KAF
5 Exceedance Streamflow Forecasts in 1000 Acre-Feet
2015 Cumulative KAF Apr - Jul Period
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Changes in gray: 10, 30, 70 & 90th
percentiles for historical period of record
Updated
September 2, 2015
2015 April - July Runoff
45% of Normal 1,100 KAF


13340600 id: nf clearwater river nr canyon ranger station id
NRCS
2 Atmospheric River Events
We forecast the April 1 to July 31 Streamflow Runoff
Mean Daily CFS
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan1
Jan15
Jan29
Feb12
Feb26
Mar11
Mar25
Apr8
Apr22
May6
May20
Jun3
Jun17
Jul1
Jul15
Jul29
Aug12
Aug26
Sep9
Sep23
Oct7
Oct21
Nov4
10-25-75-90
Norm75
Norm25
Norm10
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Normal
Max-Min
September 14,
Updated



Dworshak Inflow in Thousands of Acre-Feet for Water Year 2015

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
76	169	256	266	586	569	455	429	162	41	30	17


2015 Dworshak Reservoir Inflow: Apr - Jul Volume,
NRCS Monthly / mid-Monthly Forecasts are Squares
NRCS
9 in 10
7 in 10
5 in 10
3 in 10
1 in 10
1981-2010 Average
1951-2004 Median
2014 Runoff in KAF
2015 Cumulative KAF for Period
2014 Apr - Jul Runoff
122% of Normal 2940 KAF
Feb -Jul Volume ~2200 KAF
Changes in gray: 10, 30, 70 & 90th percentiles for historical period of record
Updated
September 2, 2015
2015 April - July Runoff
45% of Normal 1,100 KAF
5 Exceedance Streamflow Forecasts in 1000 Acre-Feet
2015 Cumulative KAF Apr - Jul Period
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep

Which Parts of the State are More Affected than Others?
Susceptible

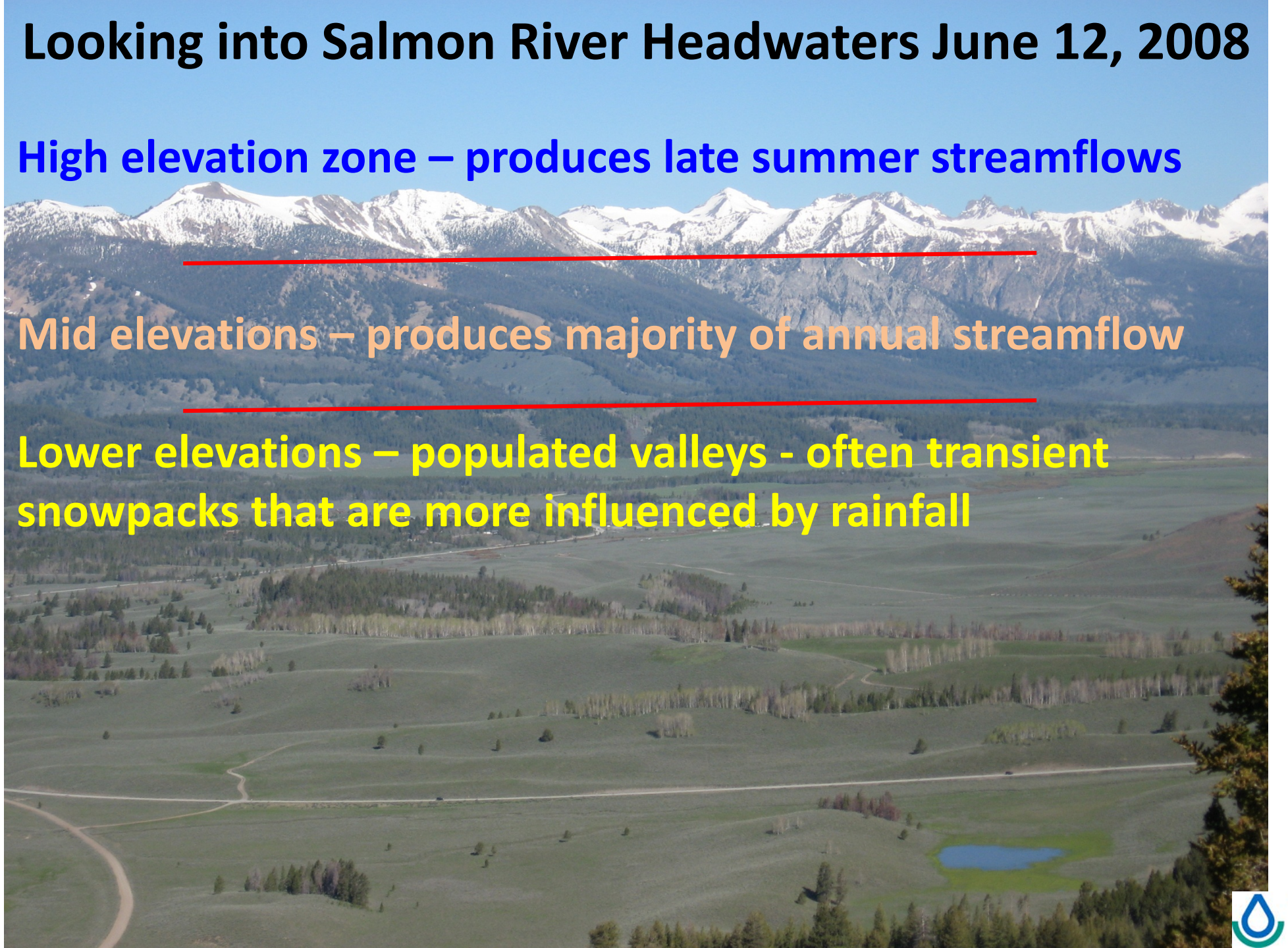
1. **Winter 2015 is excellent year to help answer this question**

A. Basin topography, topography, topography,…
   a. amount of high elevation in your basin, i.e., pretty mountain peaks,
   b. north facing slopes
   c. location, storm track, areas with greater chance for spring rains along southwest Montana border

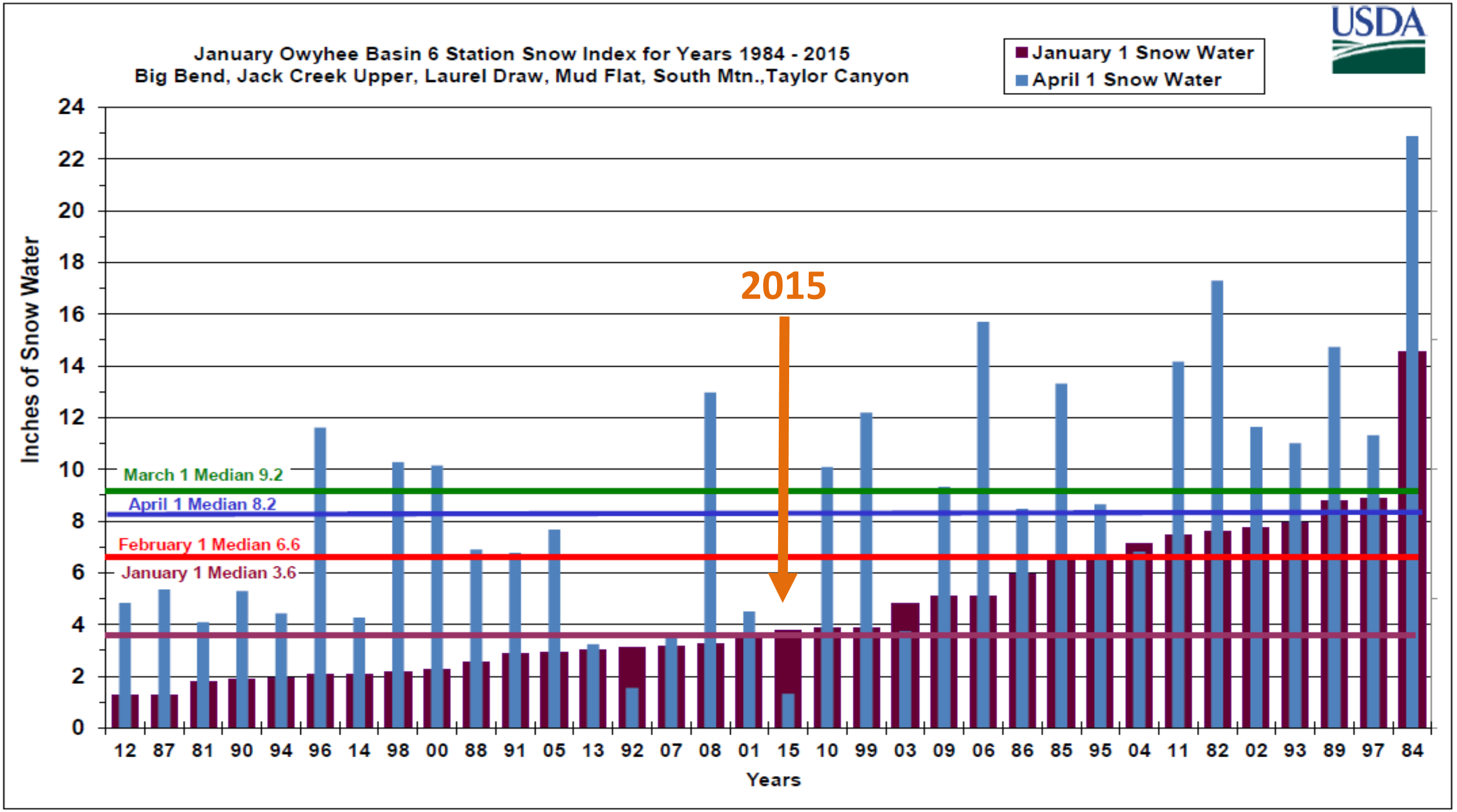
B. Best way to visualize susceptible basins are Monthly Snow Graphs illustrating Chance of Snow to Recover by April 1

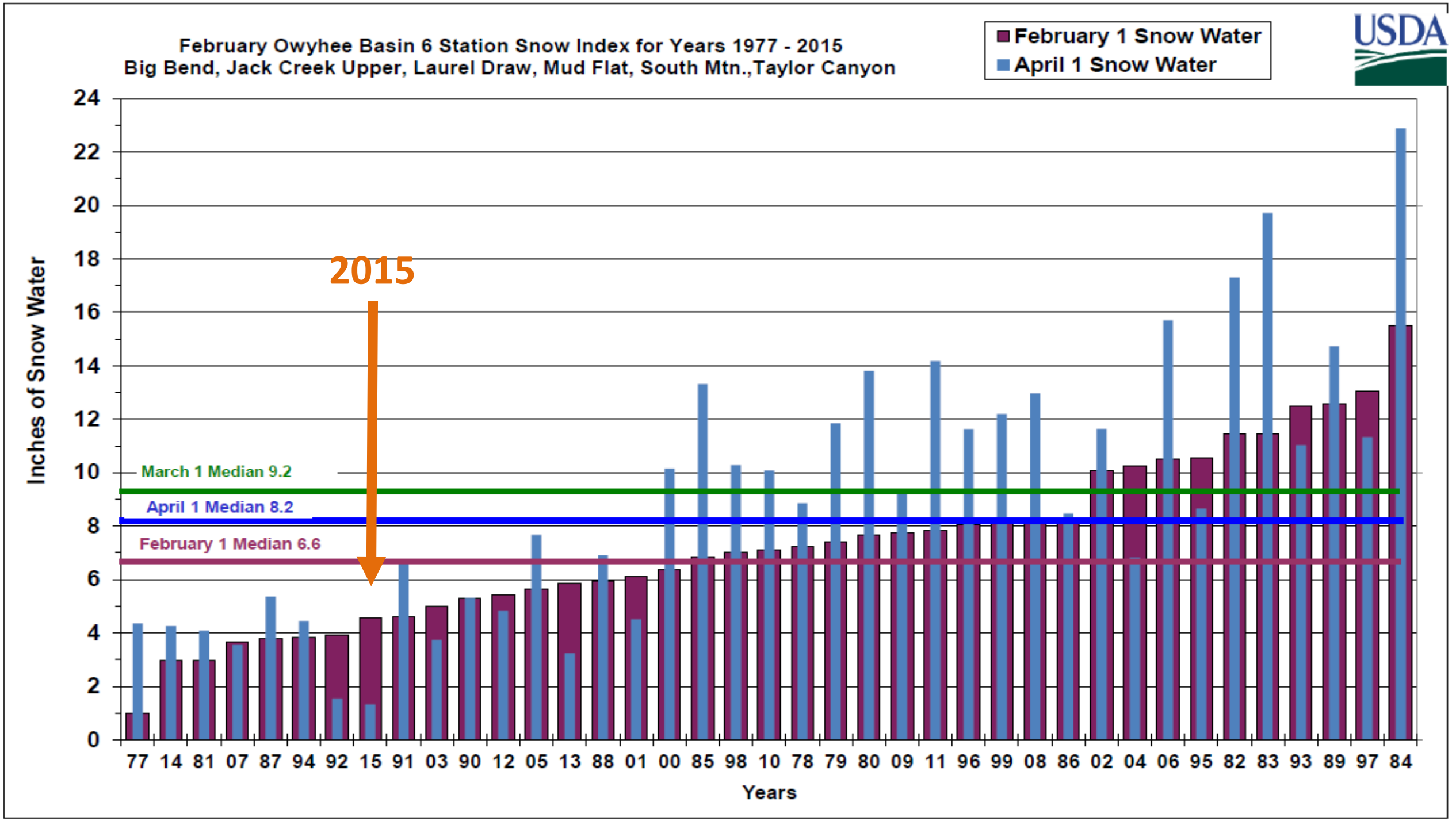
C. Increase in climate variability also increase need to understand your basin and what makes it flow

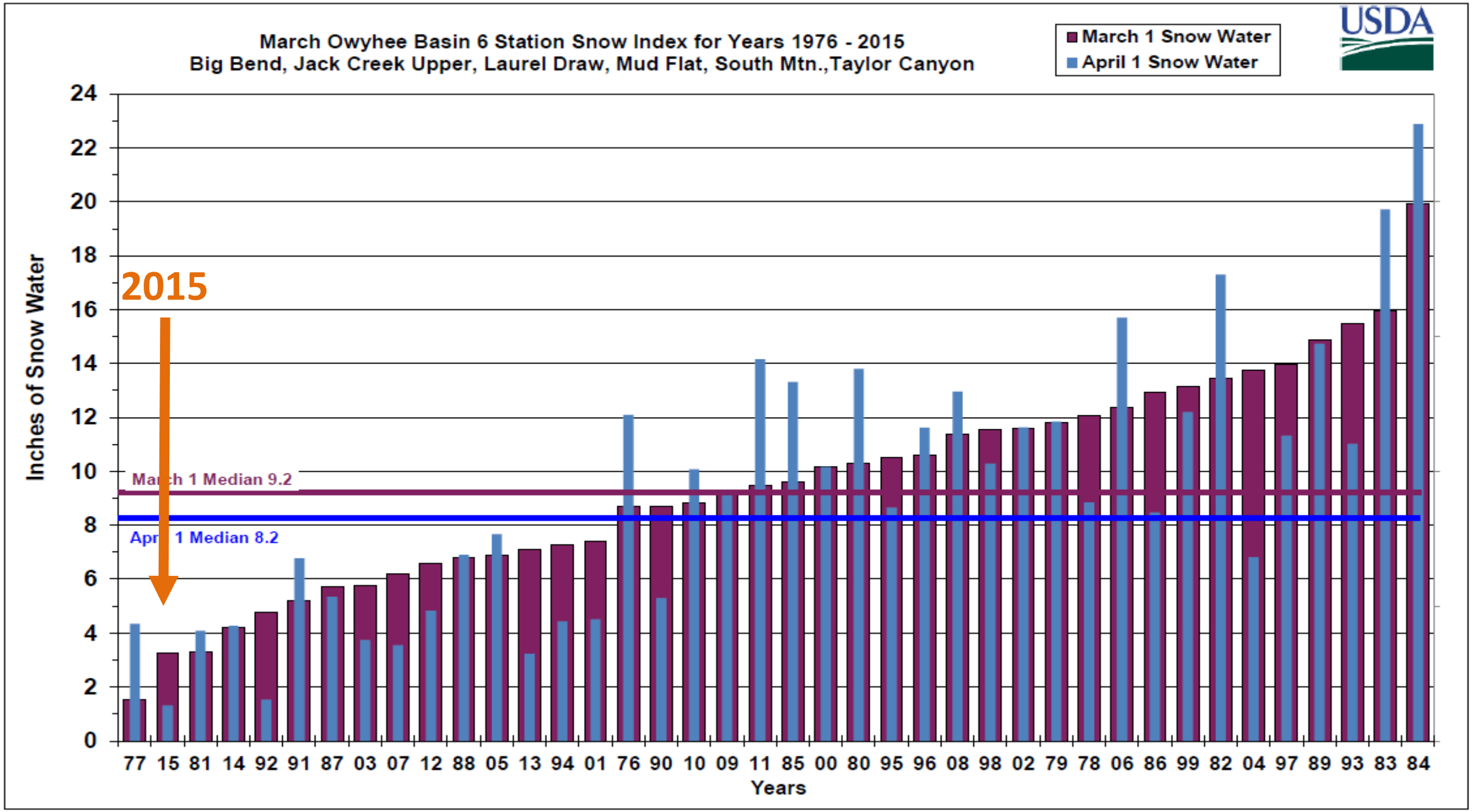
Looking into Salmon River Headwaters June 12, 2008

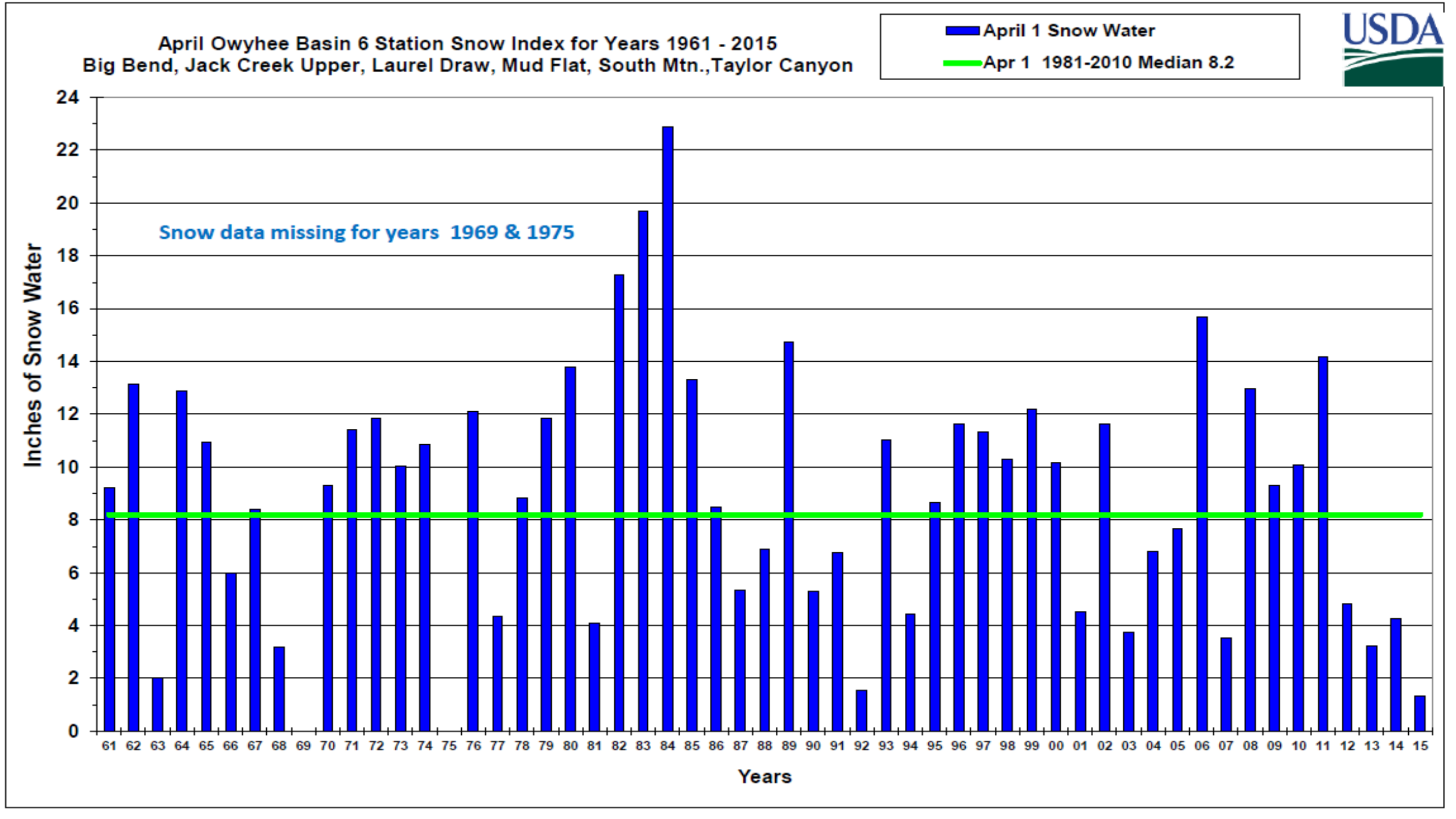


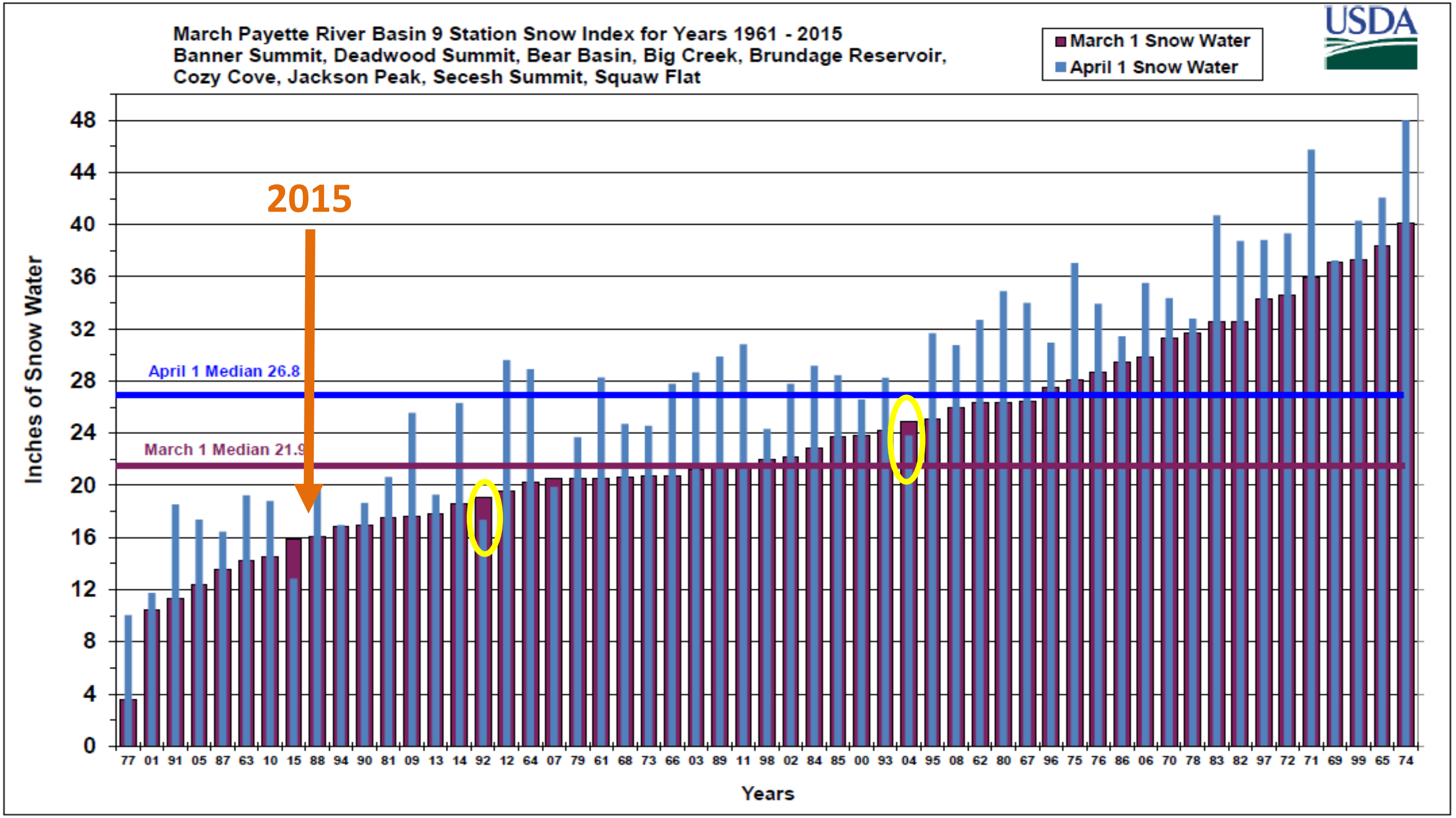
NRCS Natural Resources Conservation Service

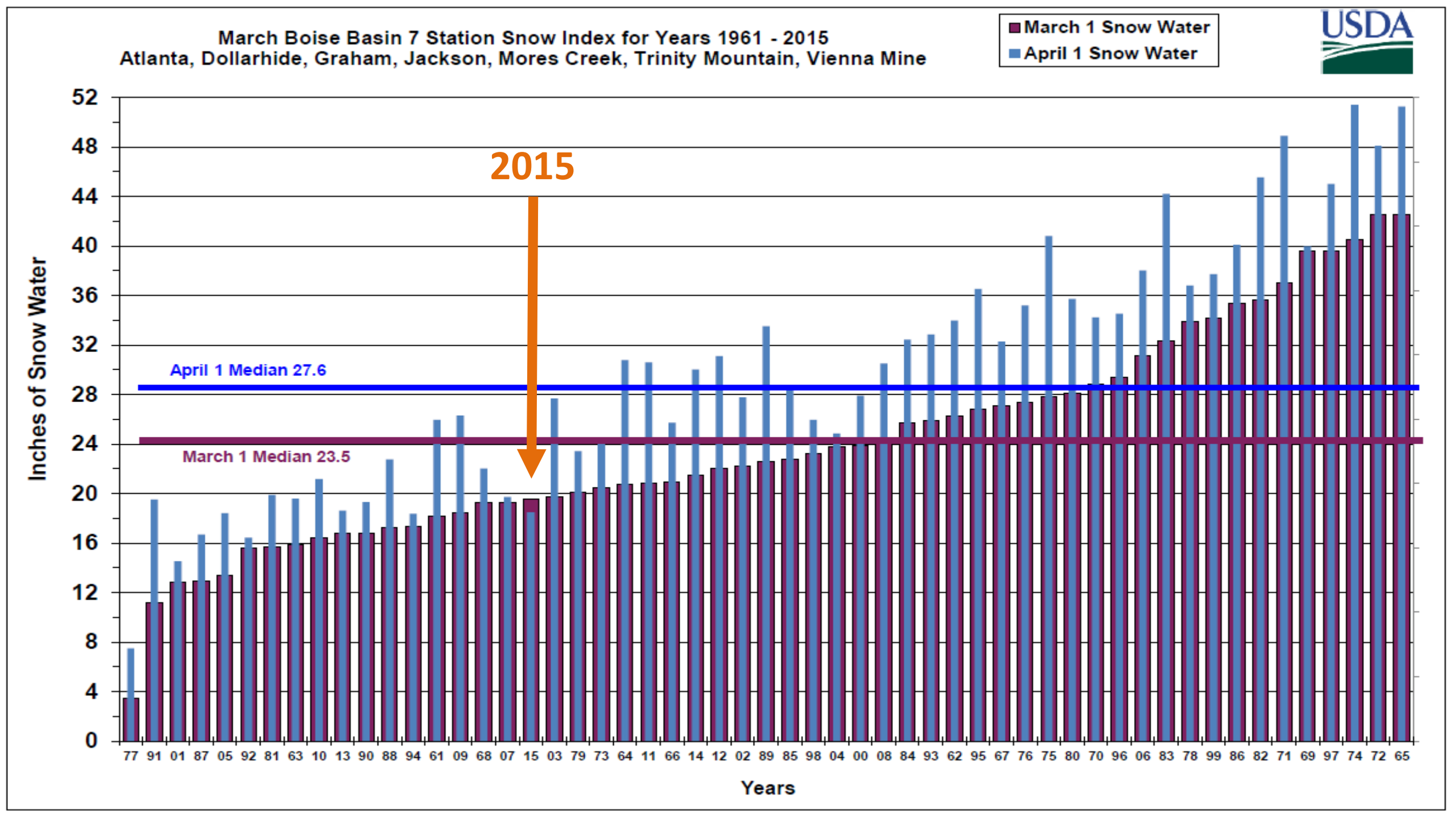

January Owyhee Basin 6 Station Snow Index for Years 1984 - 2015
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn.,Taylor Canyon
USDA
January 1 Snow Water
April 1 Snow Water
Inches of Snow Water
0
2
4
6
8
10
12
14
16
18
20
22
24
2015
March 1 Median 9.2
April 1 Median 8.2
February 1 Median 6.6
January 1 Median 3.6
12 87 81 90 94 96 14 98 00 88 91 05 13 92 07 08 01 15 10 99 03 09 06 86 85 95 04 11 82 02 93 89 97 84
Years

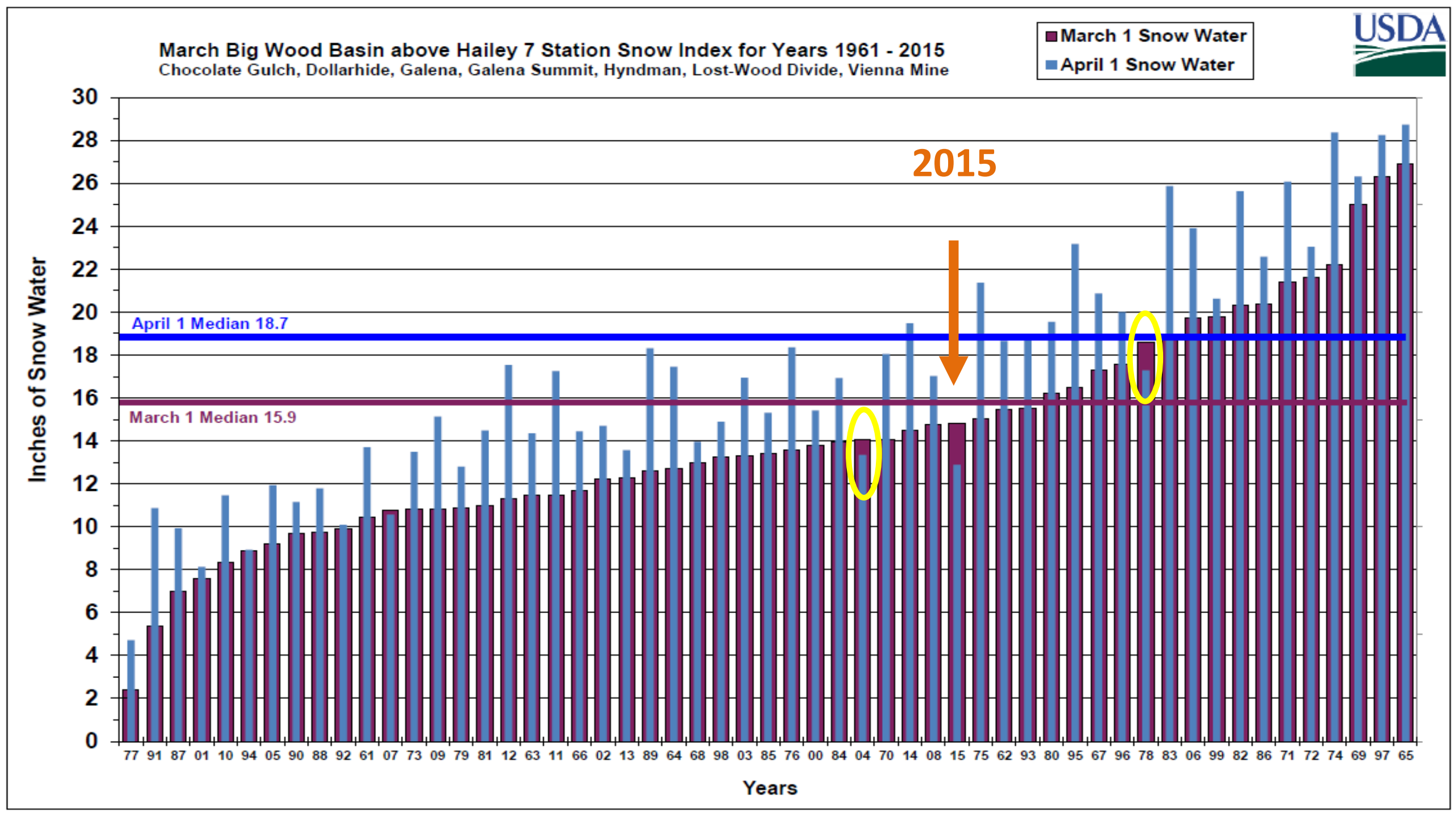

February Owyhee Basin 6 Station Snow Index for Years 1977 - 2015
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn.,Taylor Canyon
February 1 Snow Water
April 1 Snow Water
USDA
2015
March 1 Median 9.2
April 1 Median 8.2
February 1 Median 6.6
Inches of Snow Water
0
2
4
6
8
10
12
14
16
18
20
22
24
77 14 81 07 87 94 92 15 91 03 90 12 05 13 88 01 00 85 98 10 78 79 80 09 11 96 99 08 86 02 04 06 95 82 83 93 89 97 84
Years

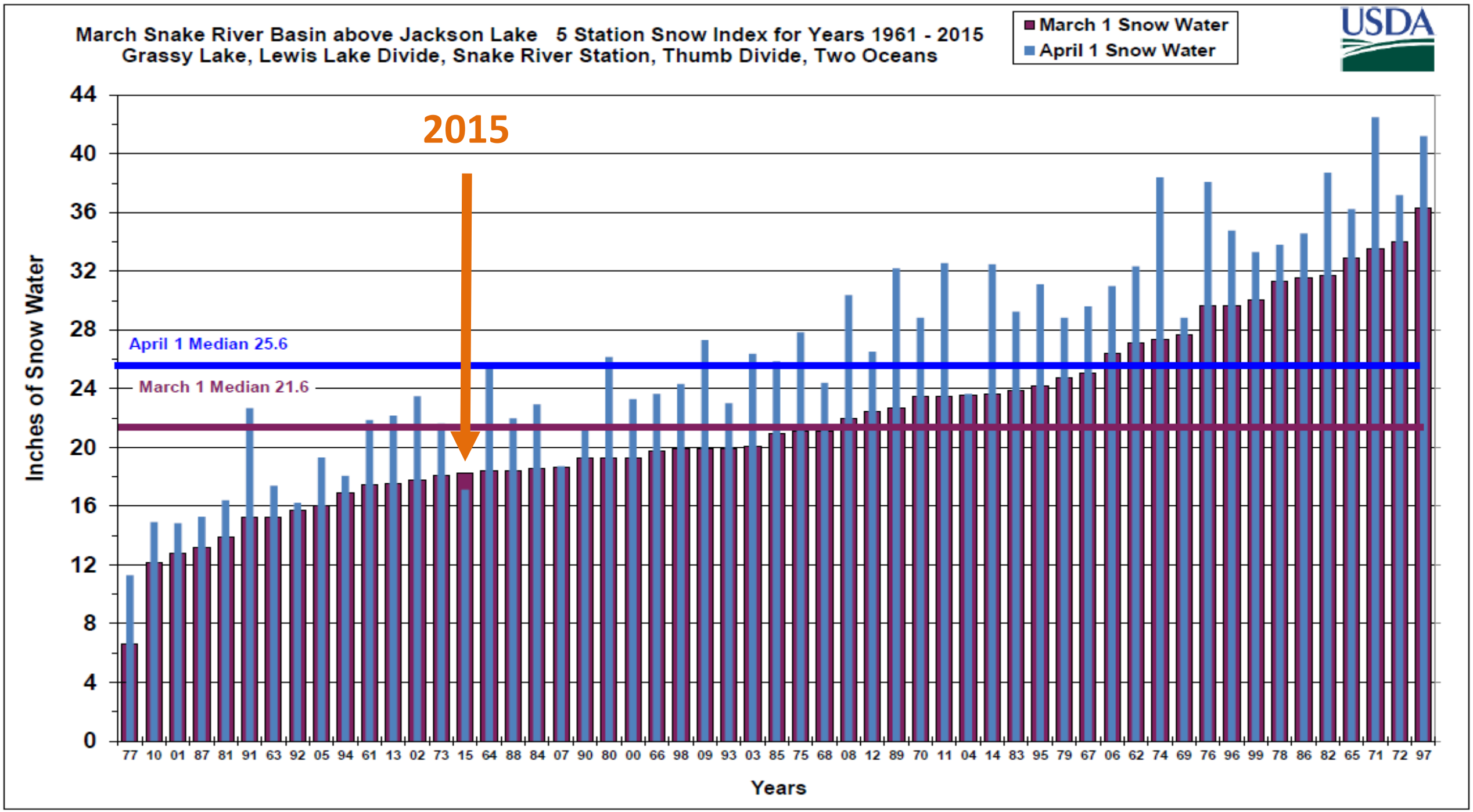

March Owyhee Basin 6 Station Snow Index for Years 1976 - 2015
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn.,Taylor Canyon
March 1 Snow Water
April 1 Snow Water
USDA
Inches of Snow Water
2015
March 1 Median 9.2
April 1 Median 8.2
0
2
4
6
8
10
12
14
16
18
20
22
24
77 15 81 14 92 91 87 03 07 12 88 05 13 94 01 76 90 10 09 11 85 00 80 95 96 08 98 02 79 78 06 86 99 82 04 97 89 93 83 84
Years

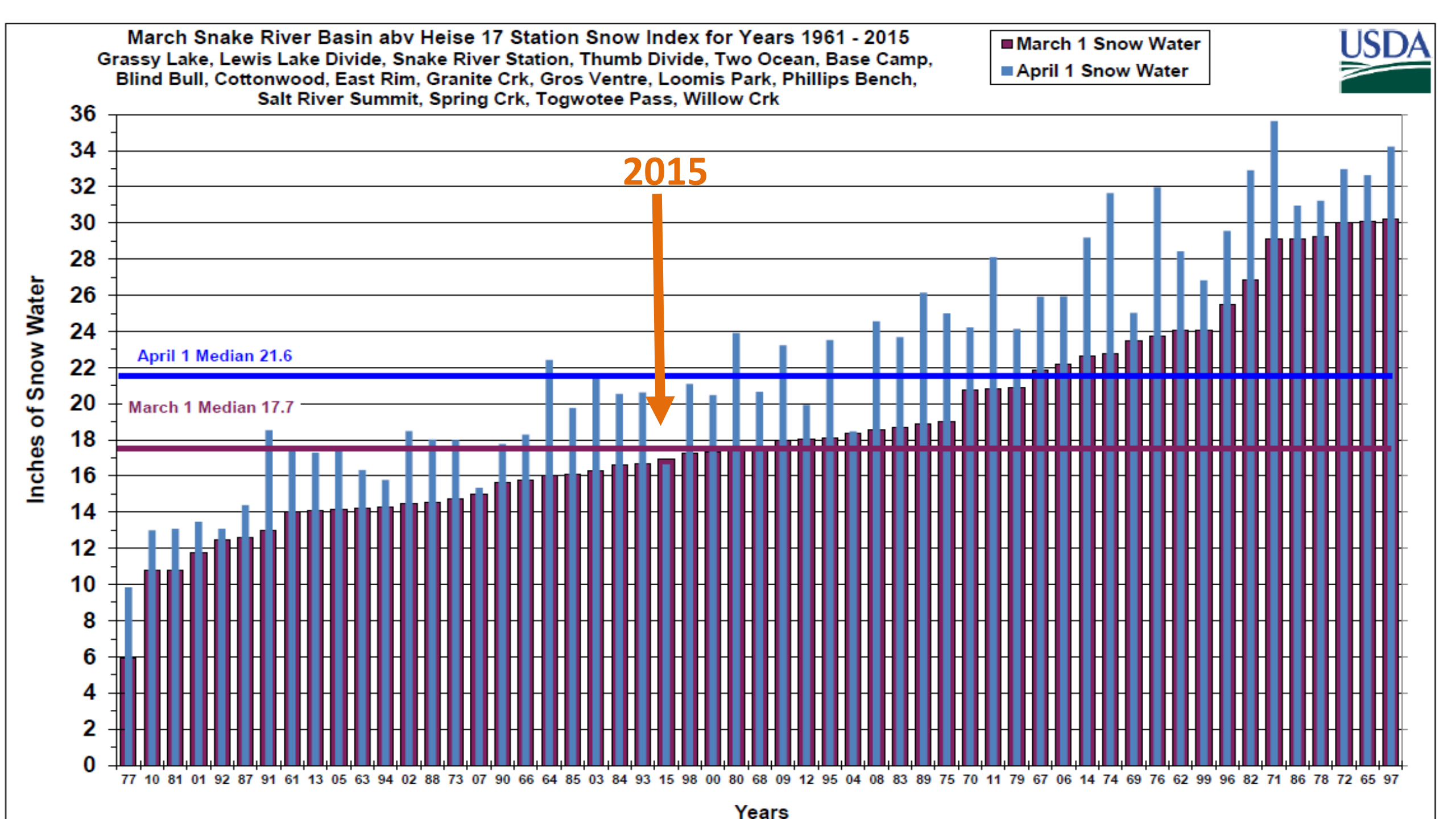

April Owyhee Basin 6 Station Snow Index for Years 1961 - 2015
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn.,Taylor Canyon
April 1 Snow Water
Apr 1 1981-2010 Median 8.2
USDA
Snow data missing for years 1969 & 1975
Inches of Snow Water
0
2
4
6
8
10
12
14
16
18
20
22
24
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15
Years

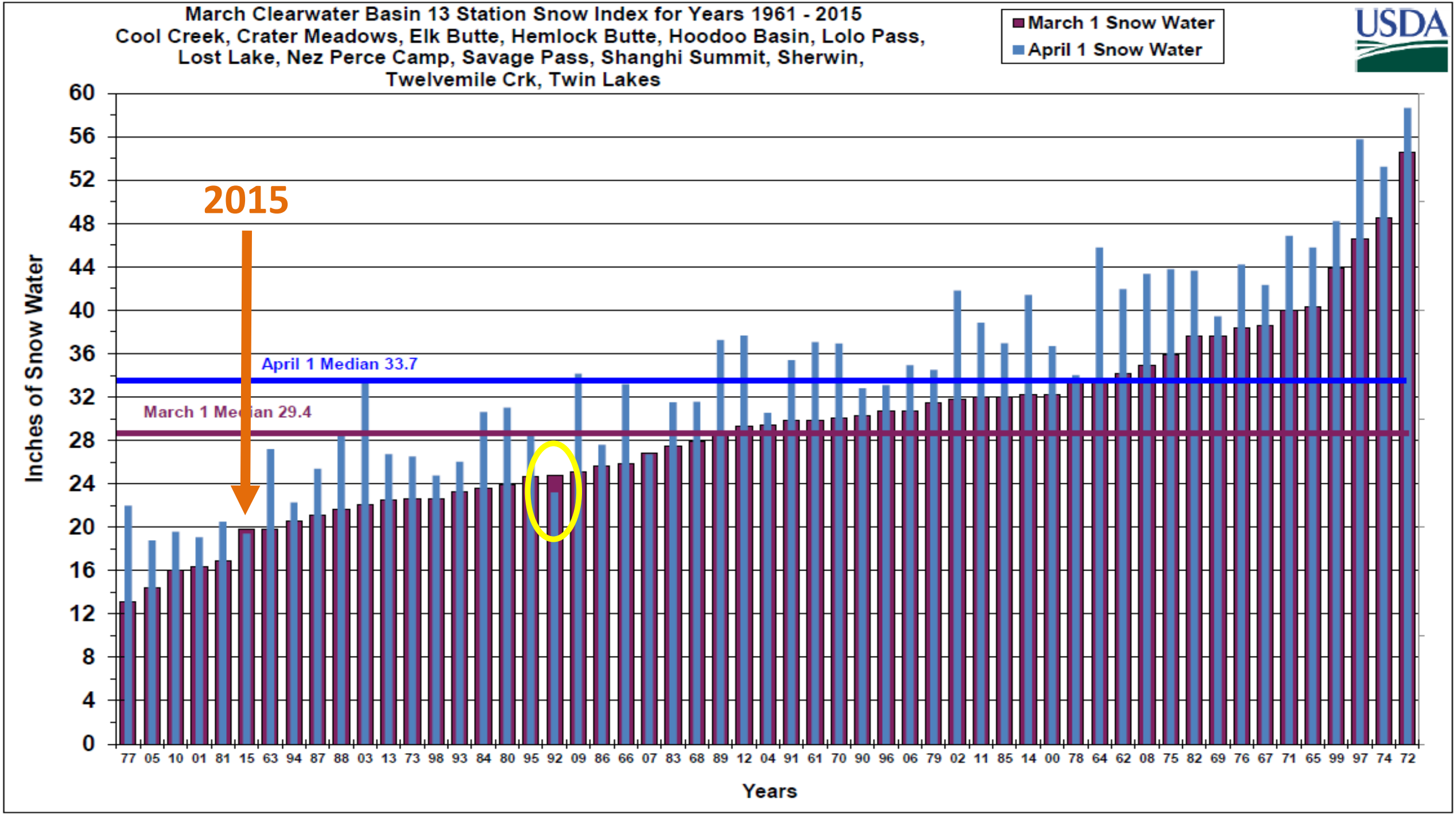

March Payette River Basin 9 Station Snow Index for Years 1961 - 2015
Banner Summit, Deadwood Summit, Bear Basin, Big Creek, Brundage Reservoir,
Cozy Cove, Jackson Peak, Secesh Summit, Squaw Flat
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 26.8
March 1 Median 21.9
Inches of Snow Water
0
4
8
12
16
20
24
28
32
36
40
44
48
77 01 91 05 87 63 10 15 88 94 90 81 09 13 14 92 12 64 07 79 61 68 73 66 03 89 11 98 02 84 85 00 93 04 95 08 62 80 67 96 75 76 86 06 70 78 83 82 97 72 71 69 99 65 74
Years


March Boise Basin 7 Station Snow Index for Years 1961 - 2015
Atlanta, Dollarhide, Graham, Jackson, Mores Creek, Trinity Mountain, Vienna Mine
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 27.6
March 1 Median 23.5
Inches of Snow Water
0
4
8
12
16
20
24
28
32
36
40
44
48
52
77 91 01 87 05 92 81 63 10 13 90 88 94 61 09 68 07 15 03 79 73 64 11 66 14 12 02 89 85 98 04 00 08 84 93 62 95 67 76 75 80 70 96 06 83 78 99 86 82 71 69 97 74 72 65
Years


March Big Wood Basin above Hailey 7 Station Snow Index for Years 1961 - 2015
Chocolate Gulch, Dollarhide, Galena, Galena Summit, Hyndman, Lost-Wood Divide, Vienna Mine
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 18.7
March 1 Median 15.9
Inches of Snow Water
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
77 91 87 01 10 94 05 90 88 92 61 07 73 09 79 81 12 63 11 66 02 13 89 64 68 98 03 85 76 00 84 04 70 14 08 15 75 62 93 80 95 67 96 78 83 06 99 82 86 71 72 74 69 97 65
Years


March Snake River Basin above Jackson Lake 5 Station Snow Index for Years 1961 - 2015
Grassy Lake, Lewis Lake Divide, Snake River Station, Thumb Divide, Two Oceans
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 25.6
March 1 Median 21.6
Inches of Snow Water
0
4
8
12
16
20
24
28
32
36
40
44
77 10 01 87 81 91 63 92 05 94 61 13 02 73 15 64 88 84 07 90 80 00 66 98 09 93 03 85 75 68 08 12 89 70 11 04 14 83 95 79 67 06 62 74 69 76 96 99 78 86 82 65 71 72 97
Years


March Snake River Basin abv Heise 17 Station Snow Index for Years 1961 - 2015
Grassy Lake, Lewis Lake Divide, Snake River Station, Thumb Divide, Two Ocean, Base Camp, Blind Bull, Cottonwood, East Rim, Granite Crk, Gros Ventre, Loomis Park, Phillips Bench, Salt River Summit, Spring Crk, Togwotee Pass, Willow Crk
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 21.6
March 1 Median 17.7
Inches of Snow Water
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
77 10 81 01 92 87 91 61 13 05 63 94 02 88 73 07 90 66 64 85 03 84 93 15 98 00 80 68 09 12 95 04 08 83 89 75 70 11 79 67 06 14 74 69 76 62 99 96 82 71 86 78 72 65 97
Years


March Clearwater Basin 13 Station Snow Index for Years 1961 - 2015
Cool Creek, Crater Meadows, Elk Butte, Hemlock Butte, Hoodoo Basin, Lolo Pass, Lost Lake, Nez Perce Camp, Savage Pass, Shanghi Summit, Sherwin, Twelvemile Crk, Twin Lakes
March 1 Snow Water
April 1 Snow Water
USDA
2015
April 1 Median 33.7
March 1 Median 29.4
Inches of Snow Water
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
77 05 10 01 81 15 63 94 87 88 03 13 73 98 93 84 80 95 92 09 86 66 07 83 68 89 12 04 91 61 70 90 96 06 79 02 11 85 14 00 78 64 62 08 75 82 69 76 67 71 65 99 97 74 72
Years

To What Extent are the Headlines in Sync with the Science?

1. Headlines from newspapers and academic research journals

2. More precipitation coming in fewer but bigger storms.

3. Nighttime temperatures are getting warmer

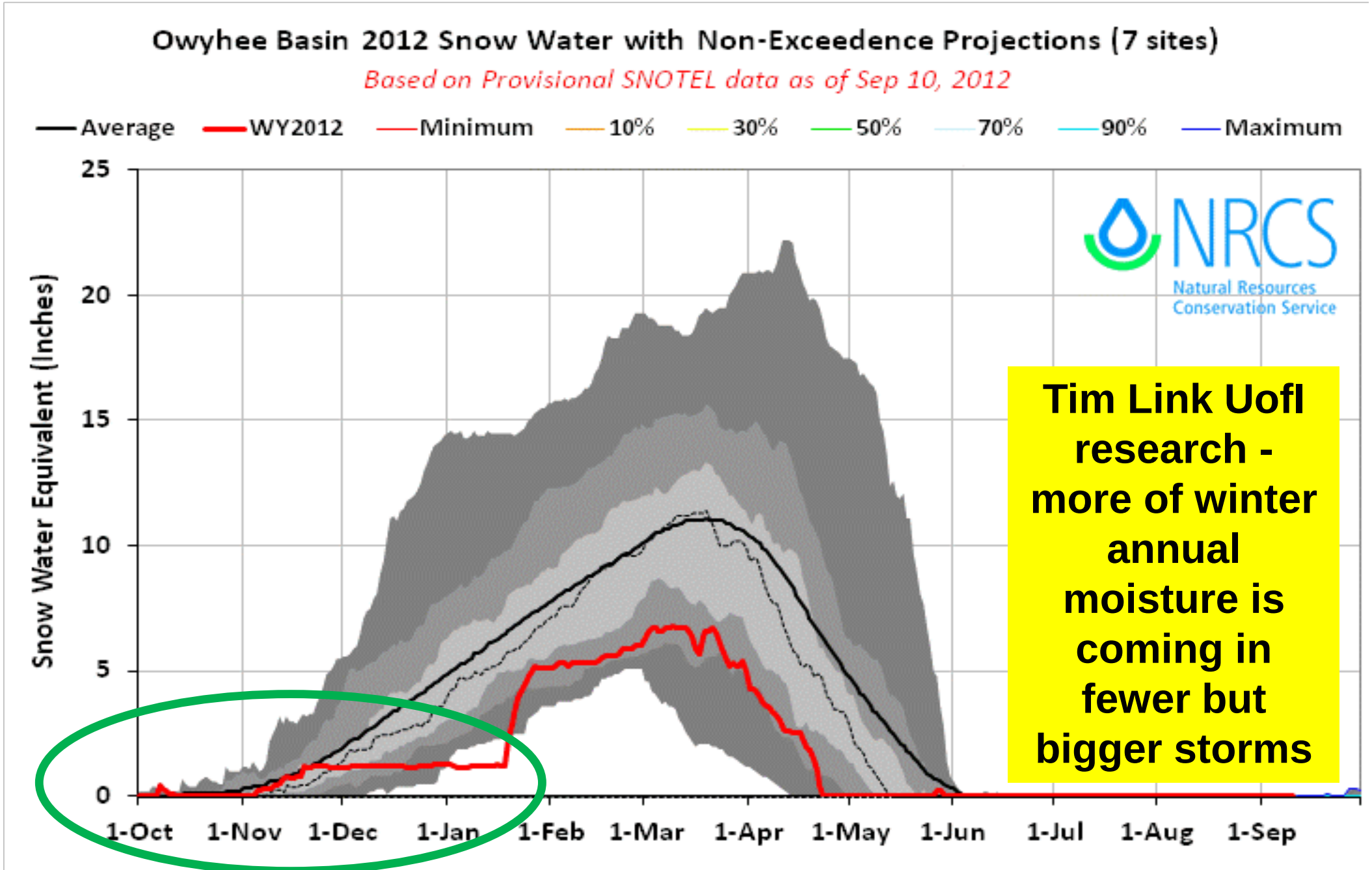
4. Artic & Antarctic Ice Cover – current and historic conditions since 1978

5. Sea volcanoes, ice cap melting warm temps
Sun spots solar cycle

Recent Research

Lewis River YNP, January, 2013

2012 Owyhee Basin 7 Station Snow Index at record low levels



HEADLINES:

- **Troy Magney Research Paper – Spatial and Seasonal Changes in Idaho's Max Daily Precipitation Events**

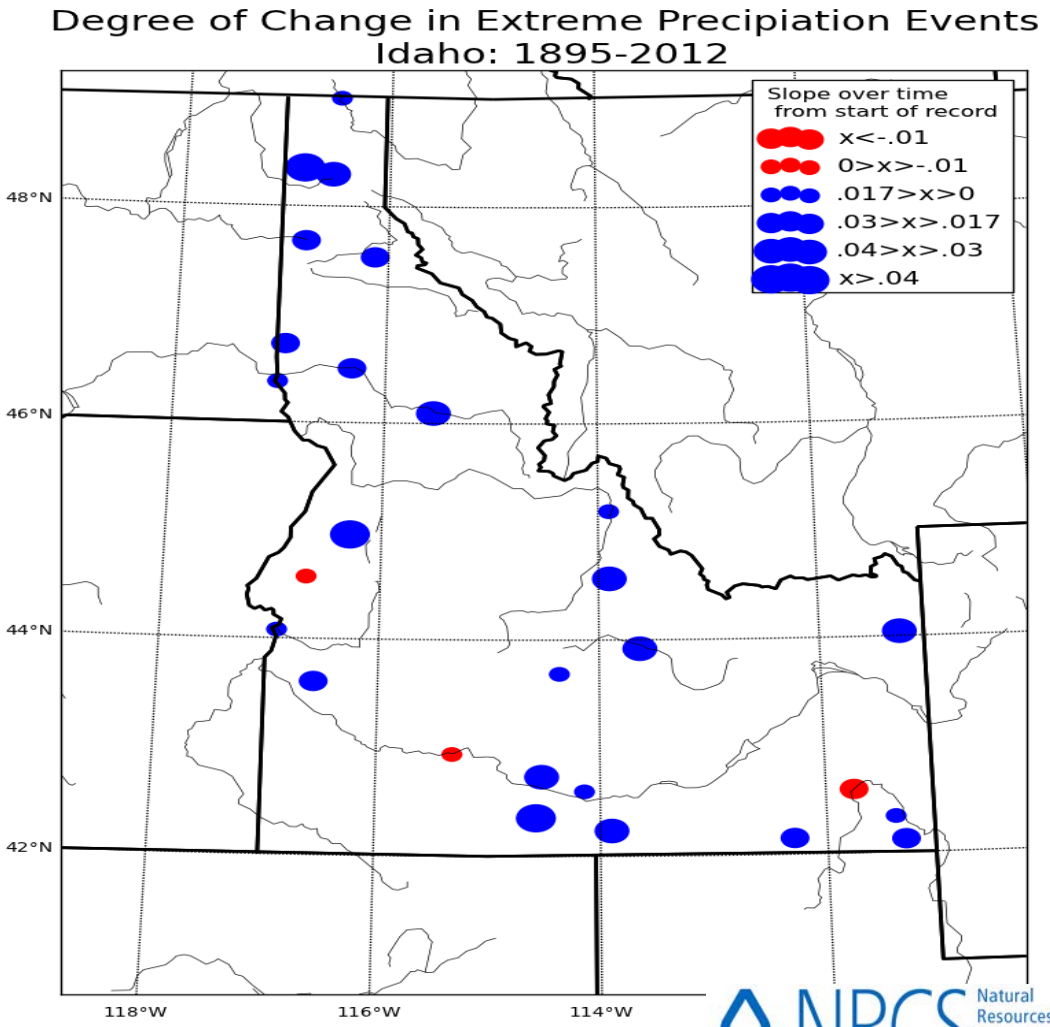
Spatial and Seasonal Changes in Idaho's Maximum Daily Precipitation Events

Troy Magney [1 2 4], John Abatzoglou [3], P. Zion Klos [4], Jan Eitel [1 2], Lee Vierling [1 2], Von Walden [3]

• Observed warming has led to an intensification of the largest precipitation events – primarily in spring/summer

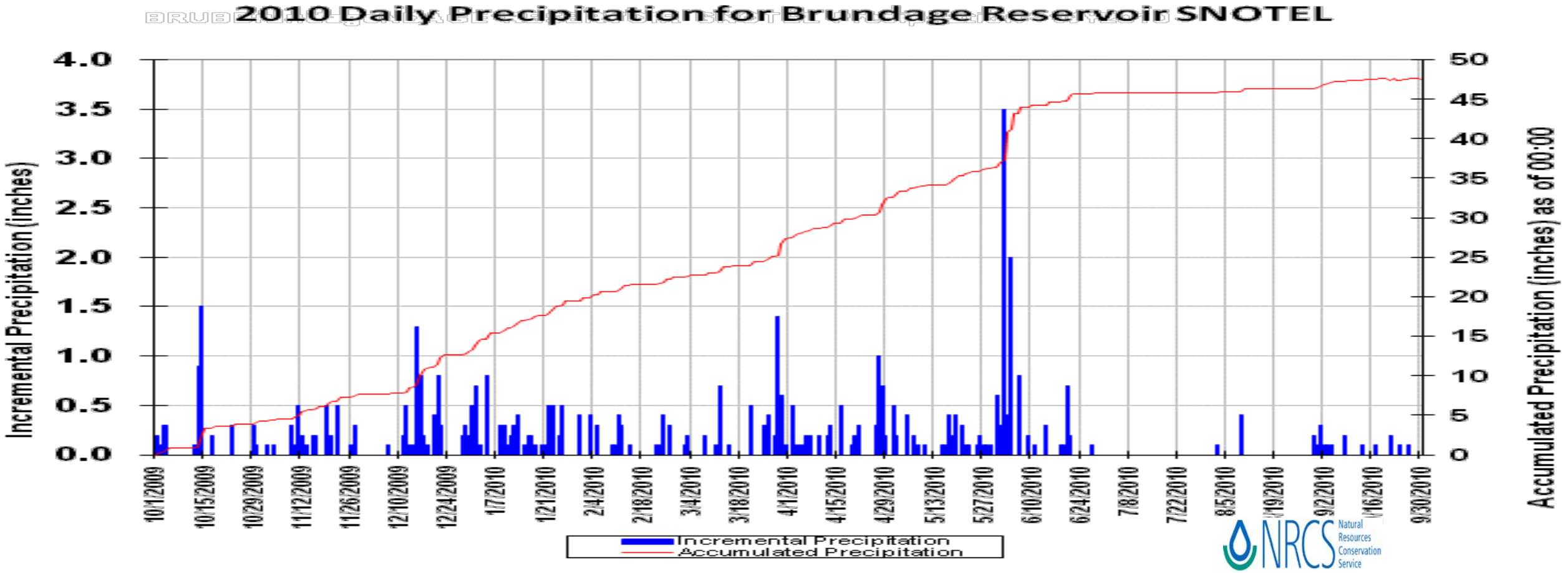
Impacts on: Ag, design, snowmelt…

Should use daily SNOTEL precipitation data in designs



Key is Knowing Snow Line Elevation in your Basin

- **Eastern Idaho: May 2010 ~ 1.5” in 24 hours with snow on the valley floor produced flood event**
- **TWICE in Payette Basin: 1997 & 2010: 3.0+” in 24 hours is Key Indicator for Brundage Reservoir SNOTEL near McCall led to major flooding with snow on the ground**



Climate Variability
Cuts from 2012 Idaho Water Supply Reports:

March 2012

Snowmelt started melting two weeks earlier than normal.

Record high March precipitation falls at 25 SNOTEL sites.

Rain increased snowmelt at mid-elevation stations across the state.

April 2012

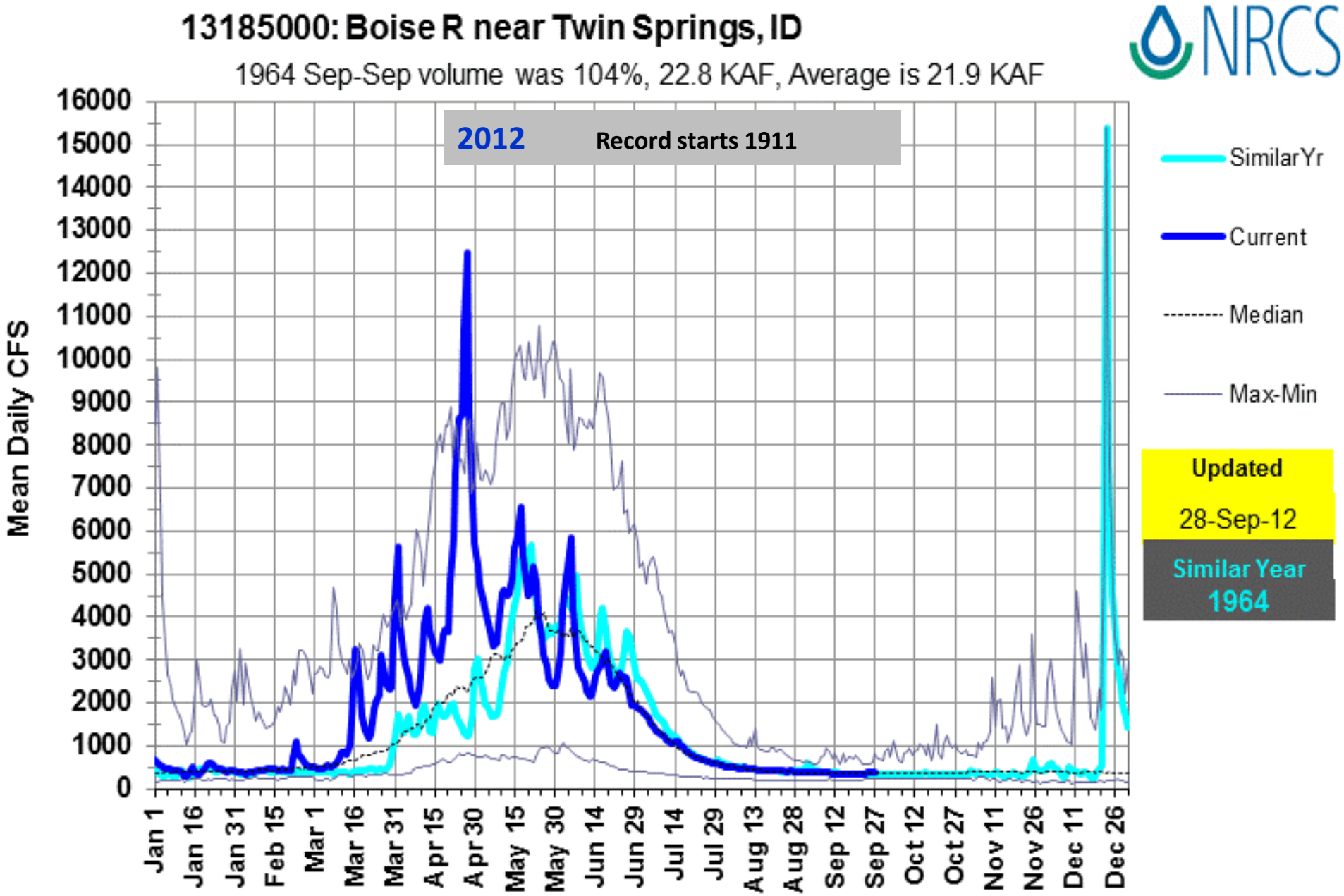
Record April temperatures reached 90 F in valleys and 70 F in the mountains… this heat wave was likely the hottest in April since 1875.

April 26

1-2 inches of rain increased streams to record high levels for this time of year.

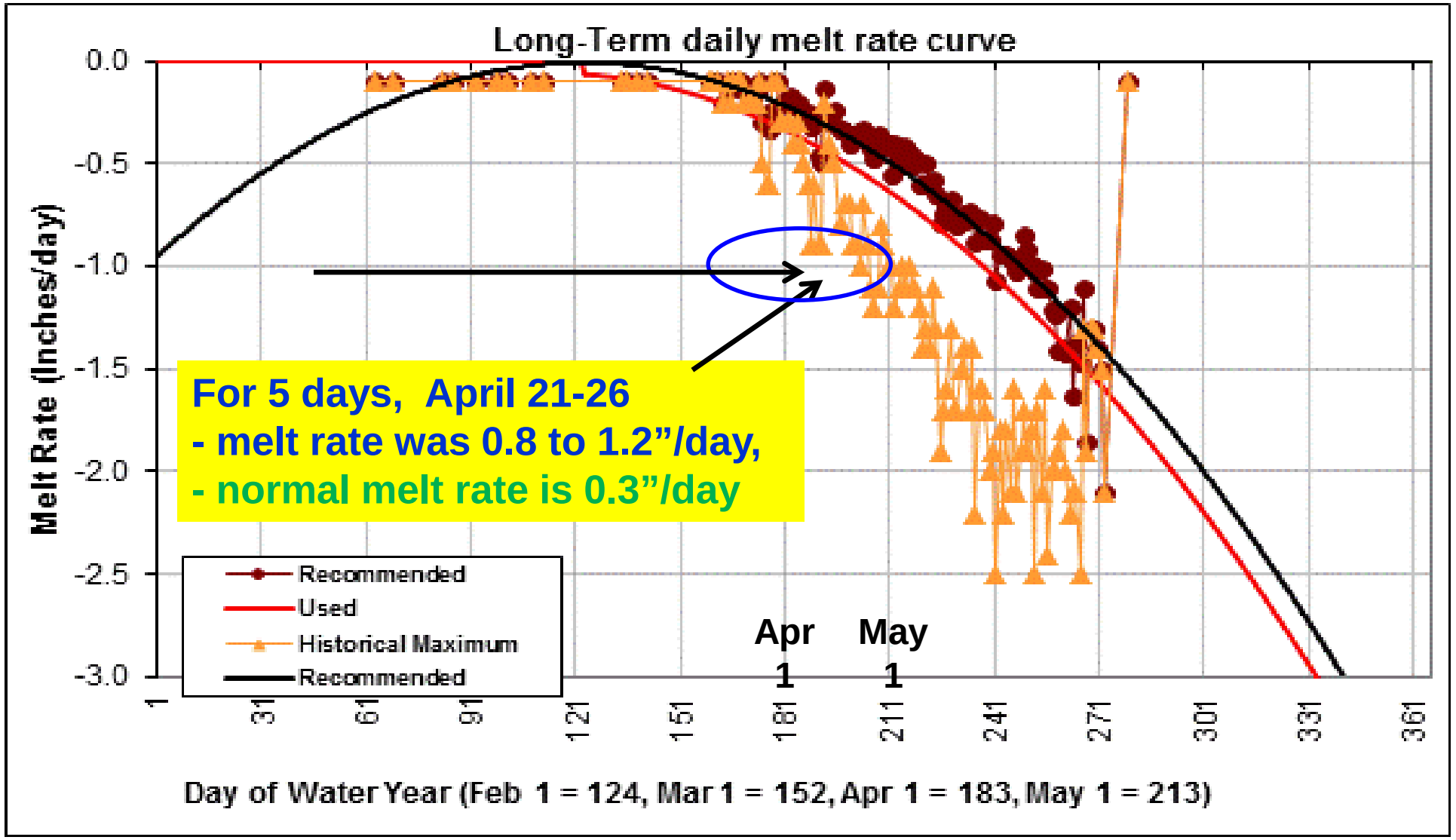
NRCS Natural Resources Conservation Service

2012

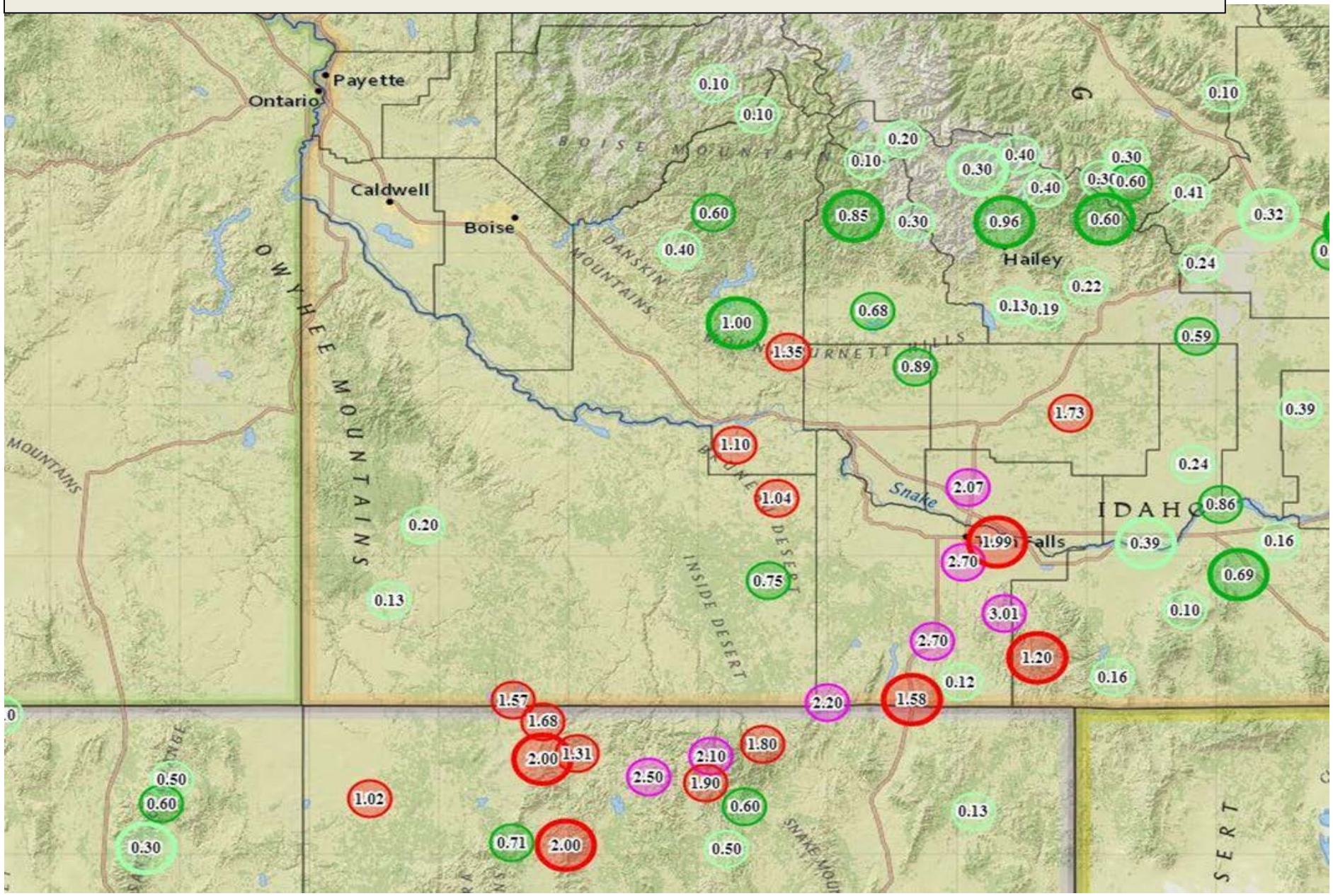

13185000: Boise R near Twin Springs, ID
1964 Sep-Sep volume was 104%, 22.8 KAF, Average is 21.9 KAF
2012
Record starts 1911
Mean Daily CFS
16000
15000
14000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Jan 1
Jan 16
Jan 31
Feb 15
Mar 1
Mar 16
Mar 31
Apr 15
Apr 30
May 15
May 30
Jun 14
Jun 29
Jul 14
Jul 29
Aug 13
Aug 28
Sep 12
Sep 27
Oct 12
Oct 27
Nov 11
Nov 26
Dec 11
Dec 26
SimilarYr
Current
Median
Max-Min
Updated
28-Sep-12
Similar Year
1964

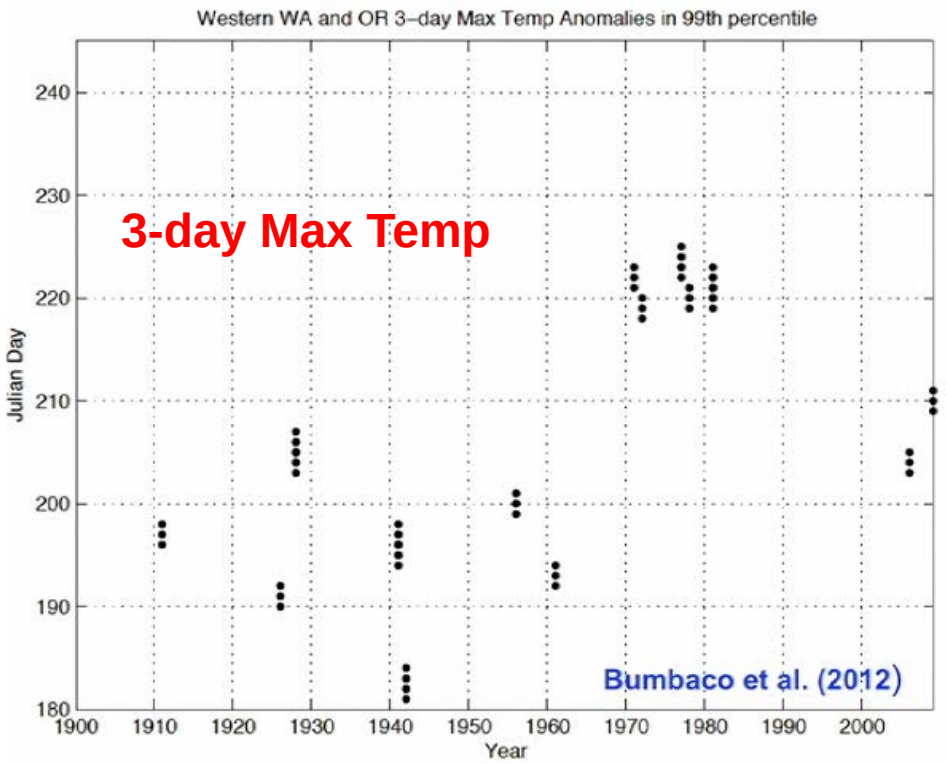
April 2013 Rain on Snow Event – snowmelt rates in Boise basin were at record high levels for this time of year melting at an 1" per day in the large snow covered areas up to ~8,500 feet.

Jackson Peak SNOTEL Boise Basin 7070 feet



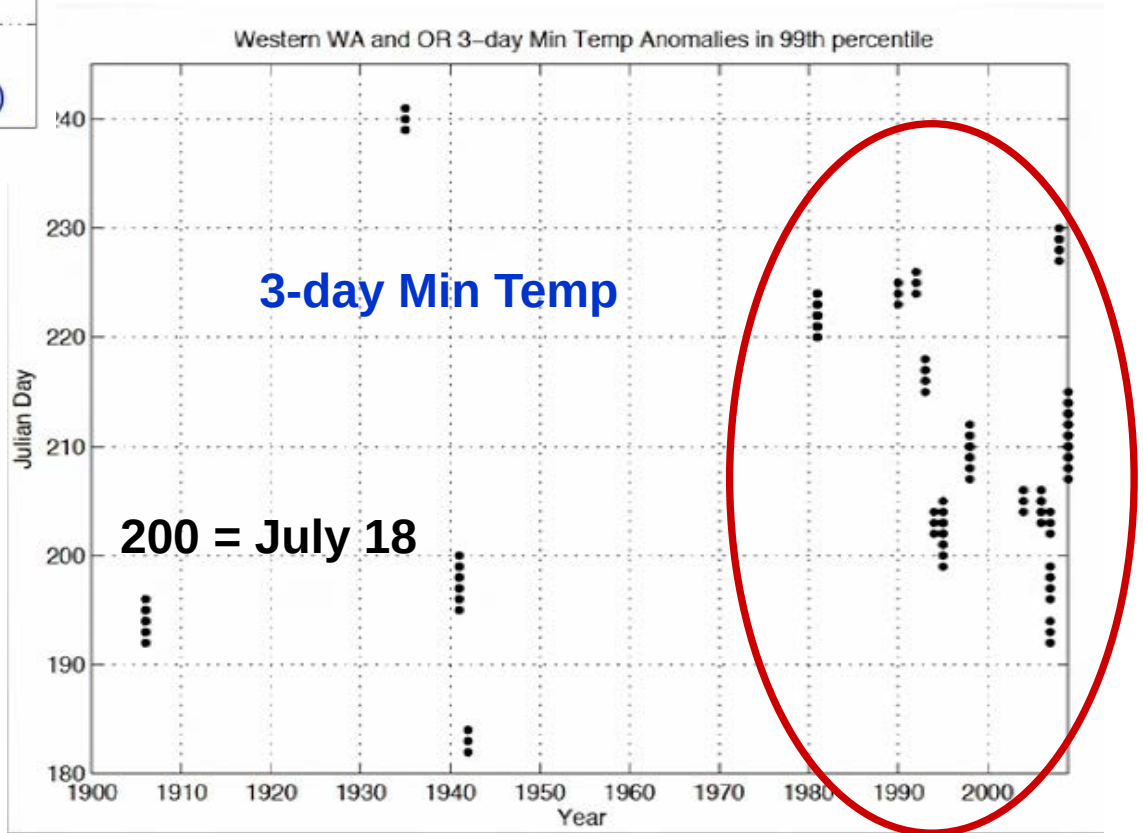
From Boise NWS: Southern Idaho August 5-6, 2014
24 Hour rainfall totals from 3 PM to 3 PM on





3rd Annual Pacific Northwest Climate Science Conference, 1-2 October 2012 Boise, Idaho

Climate Variability
Climate variability of the PNW
Nick Bond, UofW JISAO



Need to look at when event occurs:

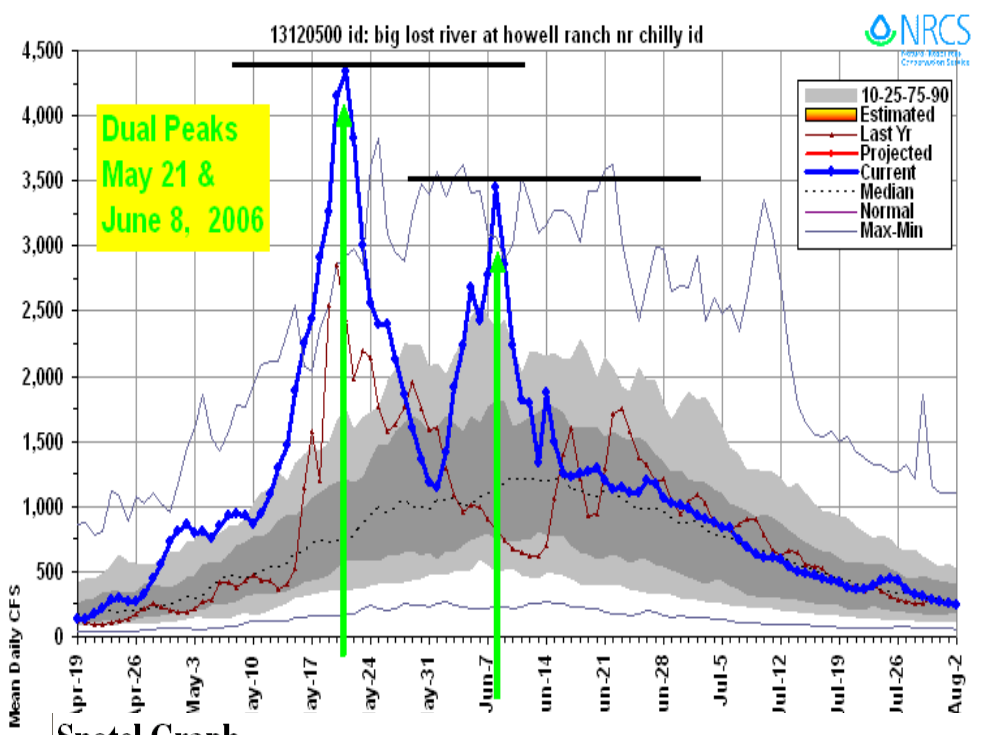
- **If outside snowmelt season - becomes a non-event**
- **If during snowmelt season - what are impacts?**

Nighttime Temperatures are getting Warmer

Need to Understand : Key Temperature Relationships

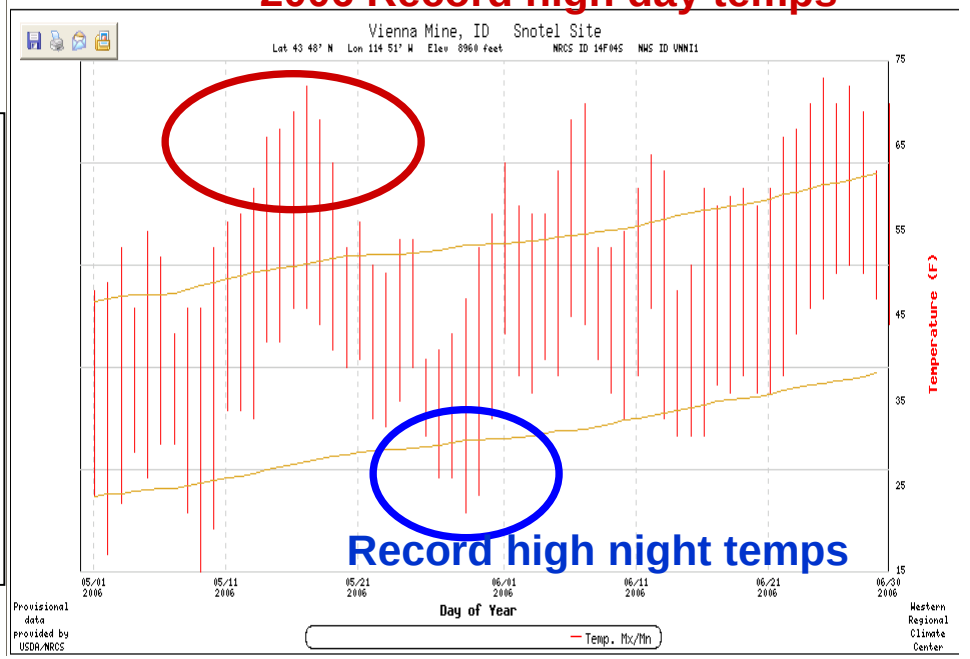
- **Signs to watch** - snow melting snow 24/7
- **2006 – Big Wood River**
  1st streamflow peak from record high daytime temps

  2nd peak from record high nighttime temps because of enough remaining snow



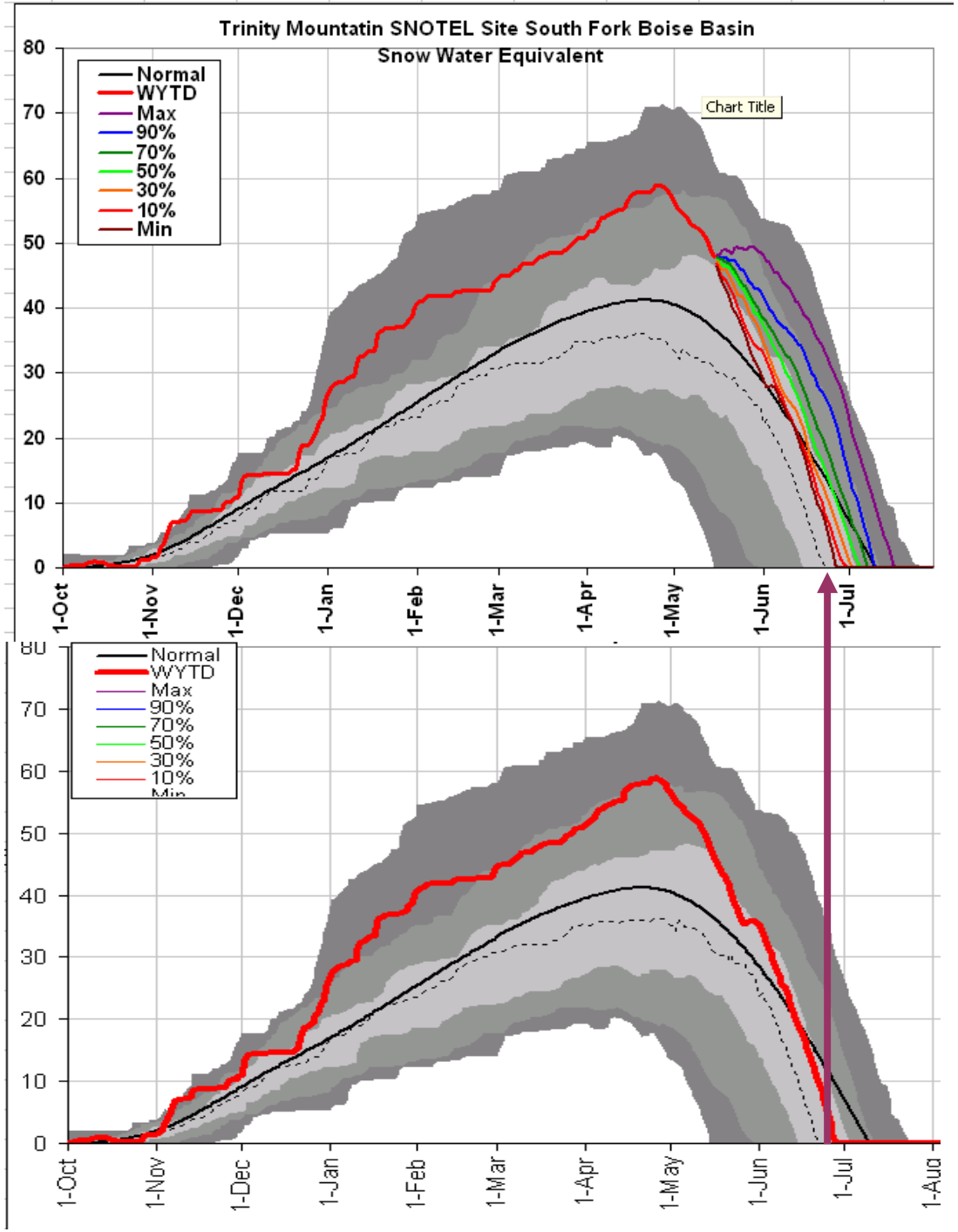
Snotel Graph

2006 Record high day temps



May 2006 record heat was predicted 7-10 days in advance BUT without snow cover, it is a non-event

NRCS Natural Resources Conservation Service



2006 Trinity Mountain snow melt illustrates influence of these record high temperatures and what happened in central Idaho in May & June 2006

Hot temps from mid-May on melted the snow at <10% chance of occurring. Based on average historic melt rates we would still have snow until mid-July.

NRCS Natural Resources Conservation Service

Setting the Stage for Winter 2013-2014

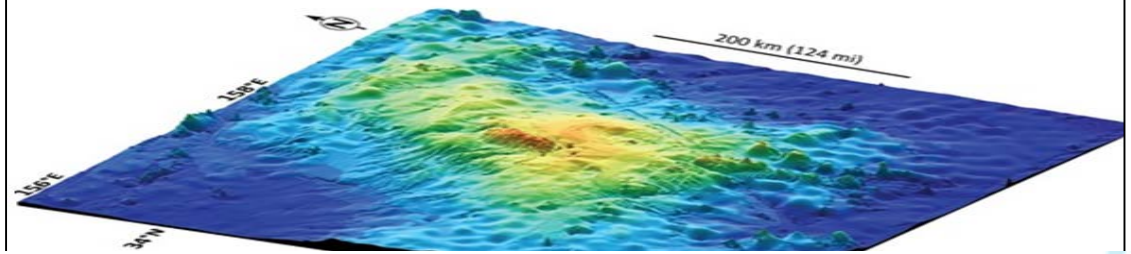
Natural Cycles – rate of change might be key to better understand…

SCIENCE -- SEPTEMBER 11, 2013 AT 9:36 AM ET

The largest volcano on earth discovered beneath the Pacific Ocean

BY: NEWS DESK

Like 140 Share



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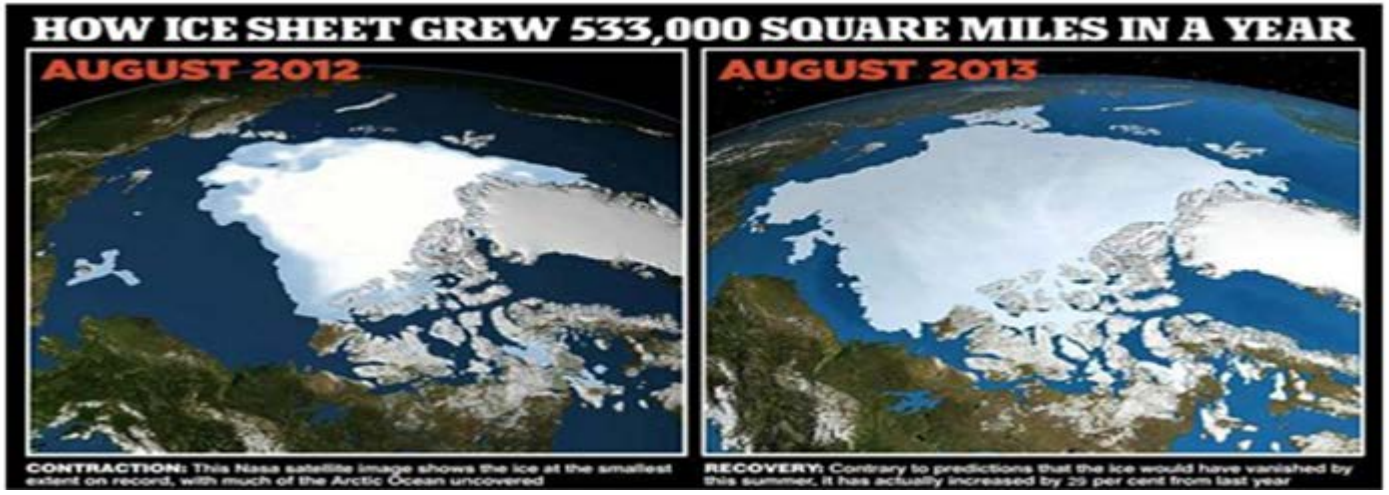
And now it's global COOLING! Return of Arctic ice cap as it grows by 29% in a year

- 533,000 more square miles of ocean covered with ice than in 2012
- BBC reported in 2007 global warming would leave Arctic ice-free in summer by 2013
- Publication of UN climate change report suggesting global warming caused by humans pushed back to later this month



Iceland's latest volcano eruption worsens

06/09 12:53 CET

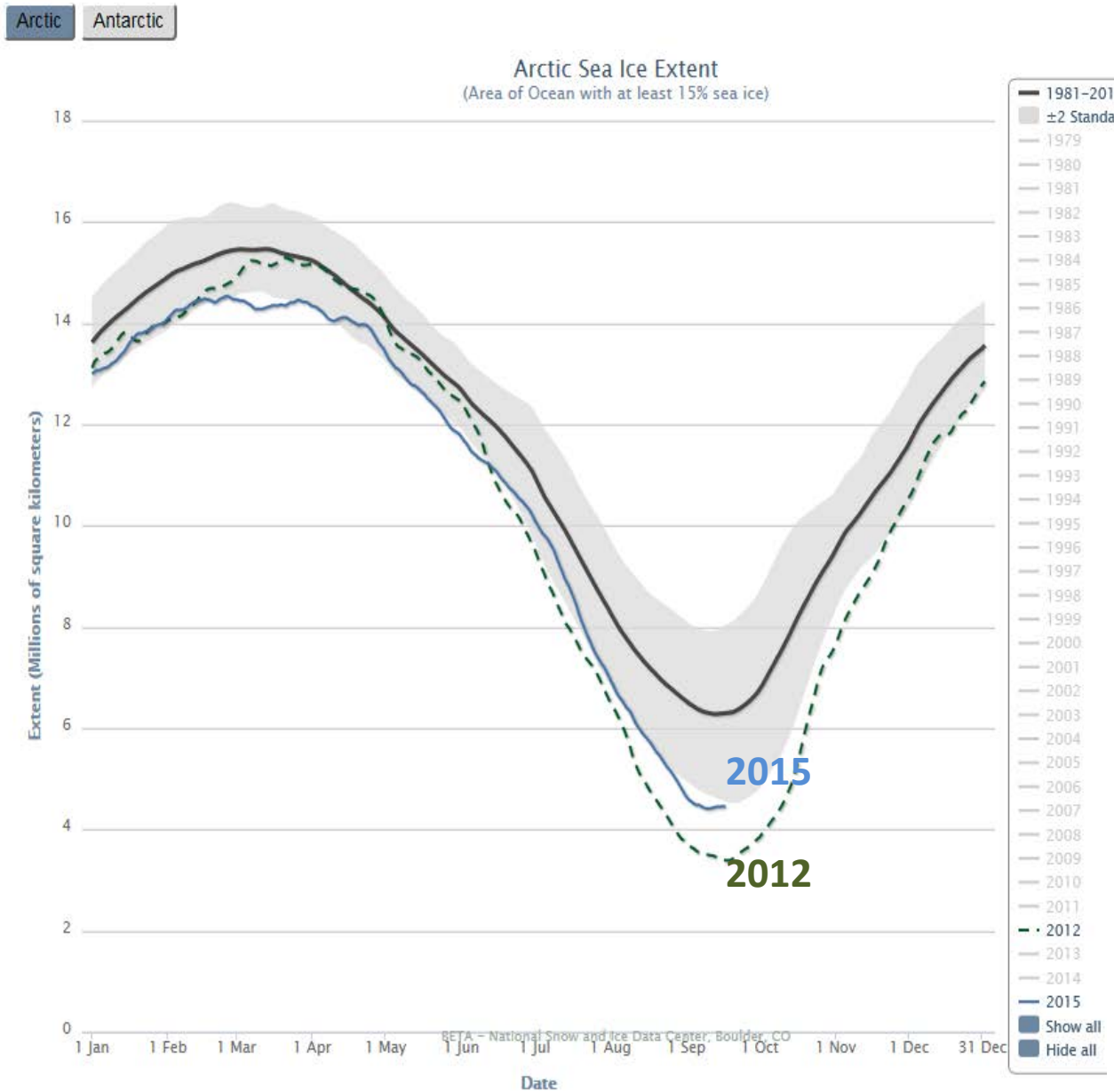
Sept 2014

New Volcanic Island near Japan Nov 2013

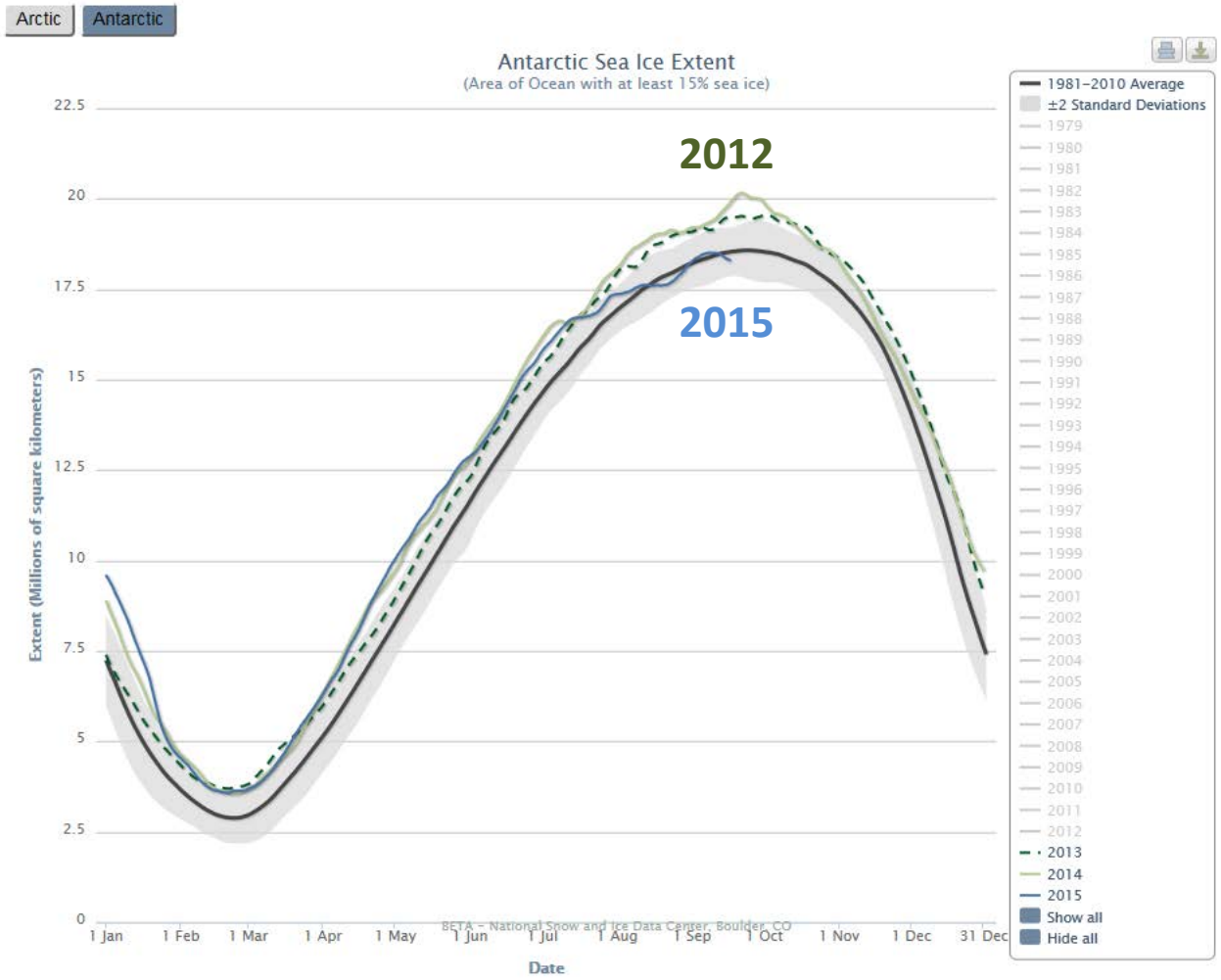
download large image (2 MB, JPEG, 3360x3360)
download GeoTIFF file (18 MB, TIFF)
download Google Earth file (KML)

In November 2013, a seafloor volcano in the western Pacific Ocean spewed enough material to rise above the water line. The new island, or "nijima" in Japanese, sprouted just 300 meters from Nishino-shima, another volcanic island that had last erupted and expanded in 1973-74. Four months later, the new and the old are now one island, and the volcanic eruption shows no sign of abating.

Charctic Interactive Sea Ice Graph



Charctic Interactive Sea Ice Graph



Environmental Research Letters

LETTER

Evidence for a wavier jet stream in response to rapid Arctic warming

Jennifer A Francis[1] and Stephen J Vavrus[2]

[1] Institute of Marine and Coastal Sciences, Rutgers University, New Brunswick, New Jersey, USA
[2] Center for Climatic Research, University of Wisconsin-Madison, Madison, Wisconsin, USA

E-mail: francis@imcs.rutgers.edu

OPEN ACCESS

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11 December 2014

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6 January 2015

Keywords: jet stream, Arctic amplification, extreme weather

Abstract

New metrics and evidence are presented that support a linkage between rapid Arctic warming, relative to Northern hemisphere mid-latitudes, and more frequent high-amplitude (wavy) jet-stream configurations that favor persistent weather patterns. We find robust relationships among seasonal and regional patterns of weaker poleward thickness gradients, weaker zonal upper-level winds, and a more meridional flow direction. These results suggest that as the Arctic continues to warm faster than elsewhere in response to rising greenhouse-gas concentrations, the frequency of extreme weather events caused by persistent jet-stream patterns will increase.

extreme weather events. Based on these results, we conclude that further strengthening and expansion of AA in all seasons, as a result of unabated increases in greenhouse gas emissions, will contribute to an increasingly wavy character in the upper-level winds, and consequently, an increase in extreme weather events that arise from prolonged atmospheric conditions.

ScienceDaily
Your source for the latest research news

Surprisingly high geothermal heating beneath West Antarctic Ice Sheet

First direct measurement of heat flow from deep within Earth to bottom of the West Antarctic ice sheet

July 10, 2015
Source: University of California - Santa Cruz

Summary:

The amount of heat flowing toward the base of the West Antarctic ice sheet from geothermal sources deep within the Earth is surprisingly high, according to a new study. The results provide important data for researchers trying to predict the fate of the ice sheet, which has experienced rapid melting over the past decade.

ScienceDaily
Your source for the latest research news

Seafloor volcano pulses may alter climate: Strikingly regular patterns, from weeks to eons

February 5, 2015

Source: The Earth Institute at Columbia University

Summary:

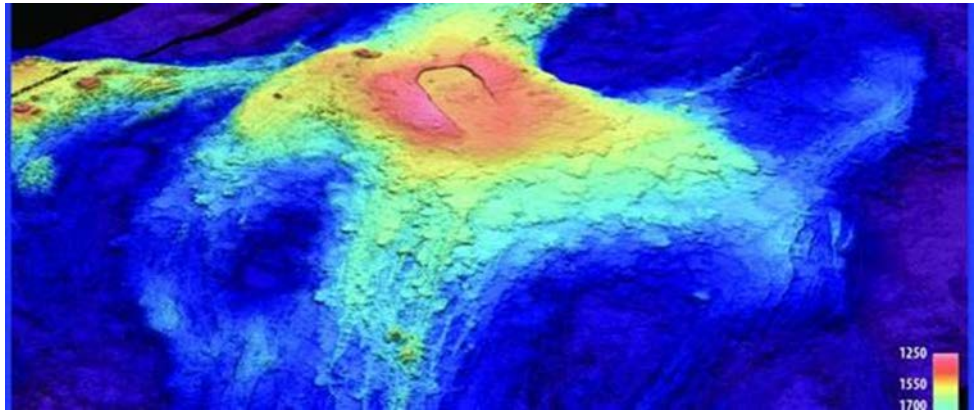
A new study shows that undersea volcanoes flare up on strikingly regular cycles, ranging from two weeks to 100,000 years -- and, that they erupt almost exclusively during the first six months of each year. The pulses -- apparently tied to short- and long-term changes in earth's orbit, and to sea levels -- may help trigger natural climate swings.

Science News

May 1 2015, 4:22 pm ET

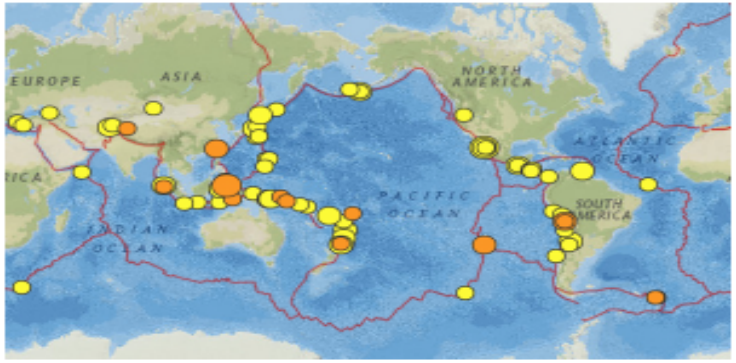
There She Blows? Underwater Volcano May Be Erupting Off Oregon

Axial Seamount, an undersea volcano located 300 miles (480 kilometers) off the coast of Oregon, appears to be erupting.



Mexico, Indonesia and Nevada: Earthquakes 10-16 September 2015

September 16, 2015 by Jennifer Young — Leave a Comment



The map shows earthquakes of at least M4.5 in the week of 10-16 September 2015. Image by USGS.

This week (10-16 September 2015), after a few weeks of up and down activity (mostly down), the planet's earthquake count seemed more or less back to what we might consider normal.

The United States Geological Survey's real time earthquake map, which records tremors of all magnitudes in the US and its territories and those of at least magnitude 4 (≥M4.0) elsewhere, included a total of 1575 tremors, of which 86 were ≥M4.5, 27 were ≥M5.0 and two ≥M6.0.

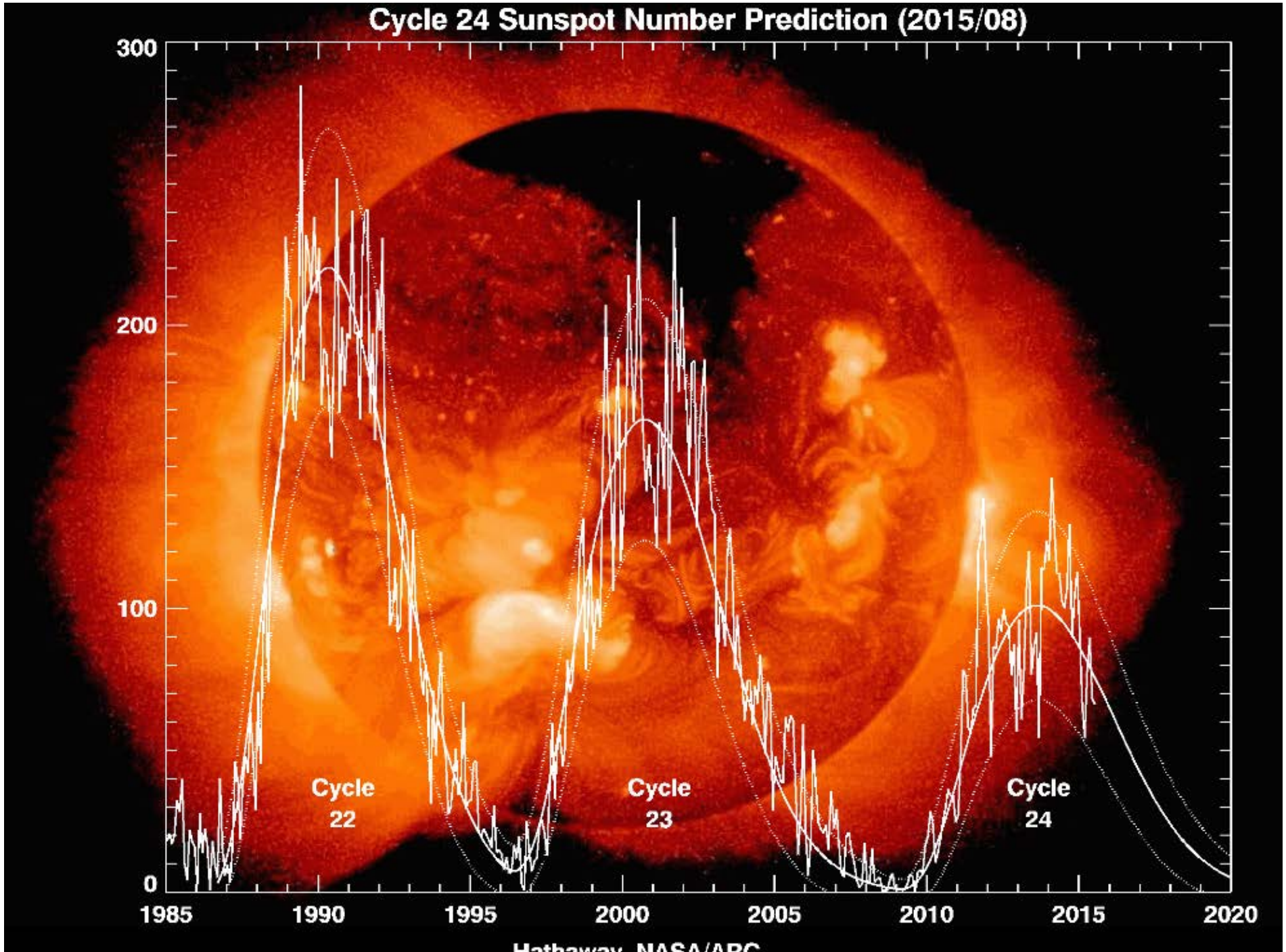
The distribution of the earthquakes also fits the expected pattern, with just over 80% of those recorded as ≥M4.5 showing up in and around (largely around) the Pacific Ocean.

Again as we might expect, these included the largest tremors, which occurred on either side of the ocean, in Mexico and Indonesia.

Chile earthquake: 8.3 magnitude quake strikes off coast
Sept 17, 2015

Earthquake
Volcanoes
Tsunami

Sept 14, 2015
Mount Aso, a volcano on Japan's main southern island of Kyushu, erupted,

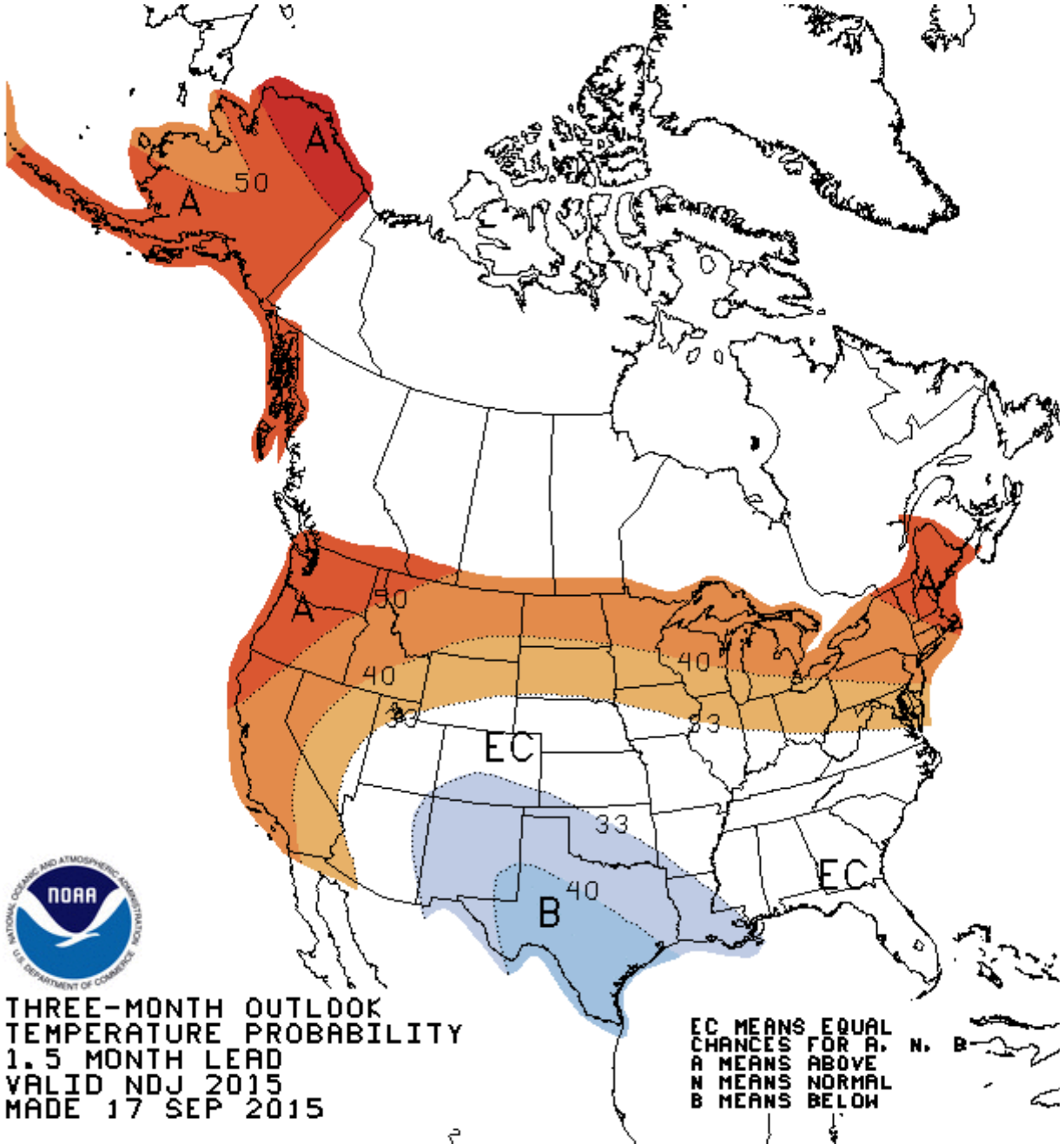

Cycle 24 Sunspot Number Prediction (2015/08)
300
200
100
0
1985
1990
1995
2000
2005
2010
2015
2020
Cycle
22
Cycle
23
Cycle
24
Hathaway, NASA/ARC

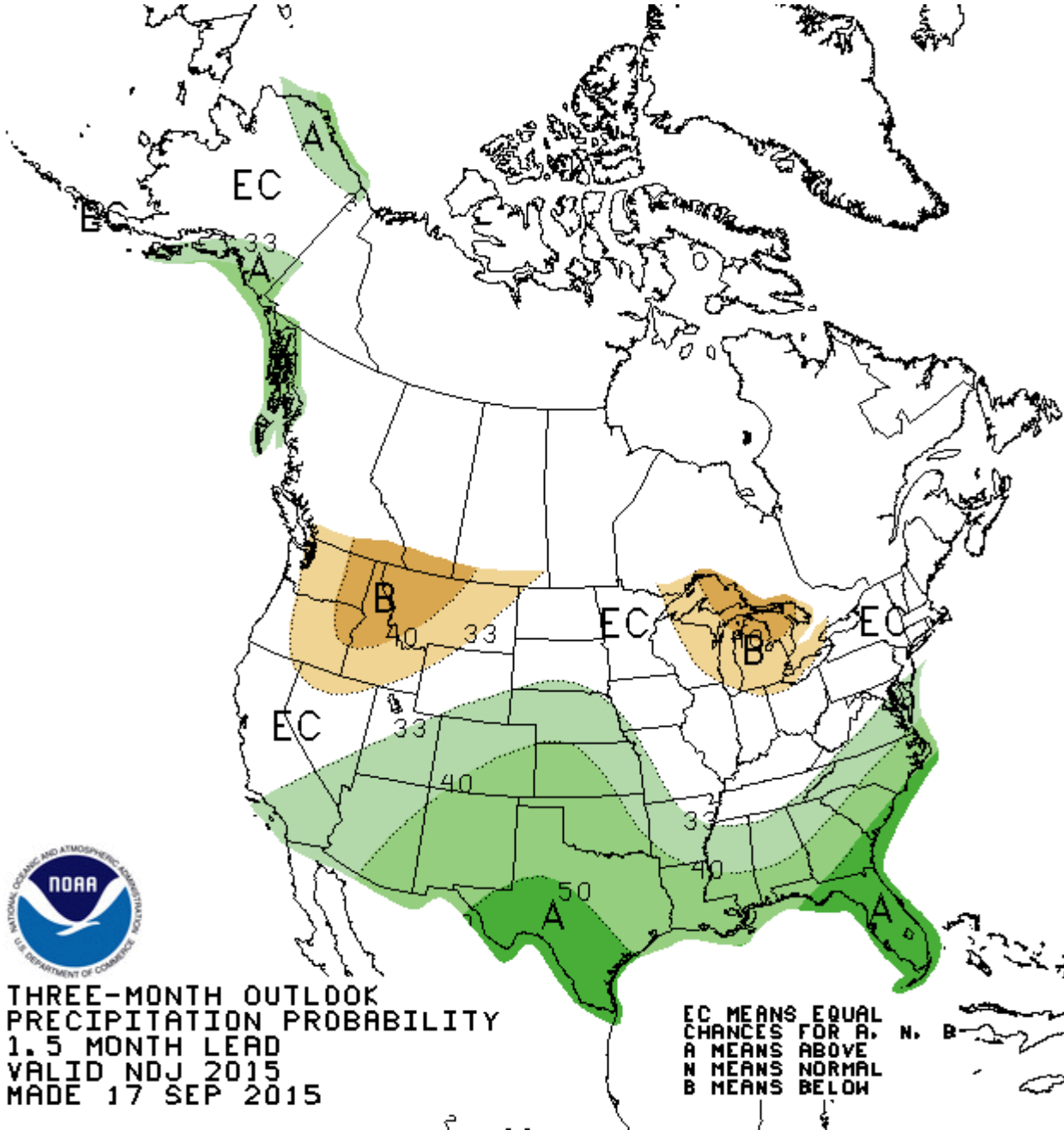
Potential Relief for 2016 from Possible El Nino Warming Pattern in the Pacific - Expectations beyond 2016

1. How the current Sea Surface Temperatures are setting the stage for the coming winter

2. Early seasonal forecasts for the coming winter

NOAA Nov, Dec Jan Temperature & Precipitation Forecast update Sept, 17, 2015

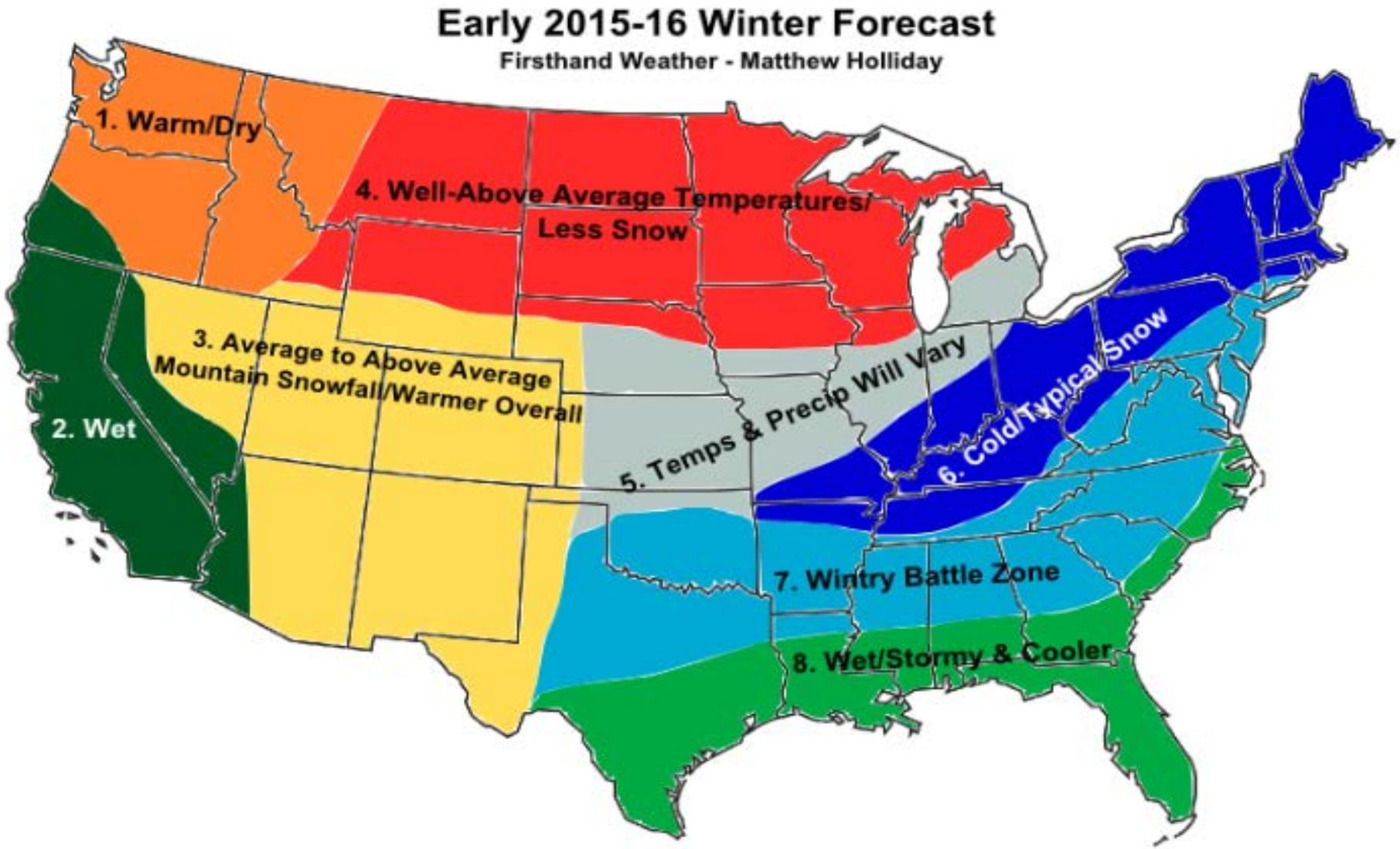




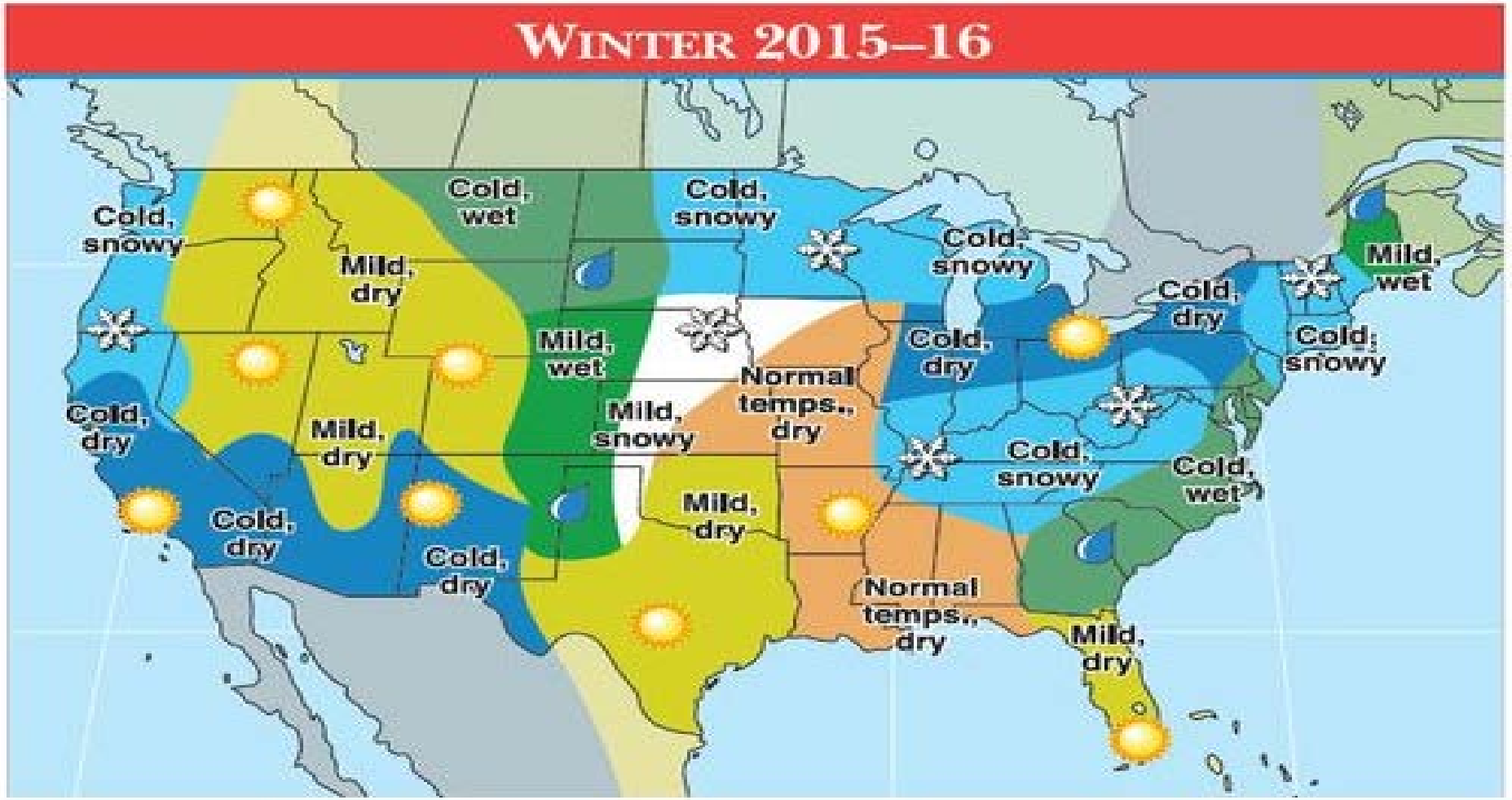
From FirstHand Weather Early 2015-16 Winter Forecast: A Regional Breakdown

Matthew Holliday | Firsthand Weather's Early 2015-16 Winter Forecast:

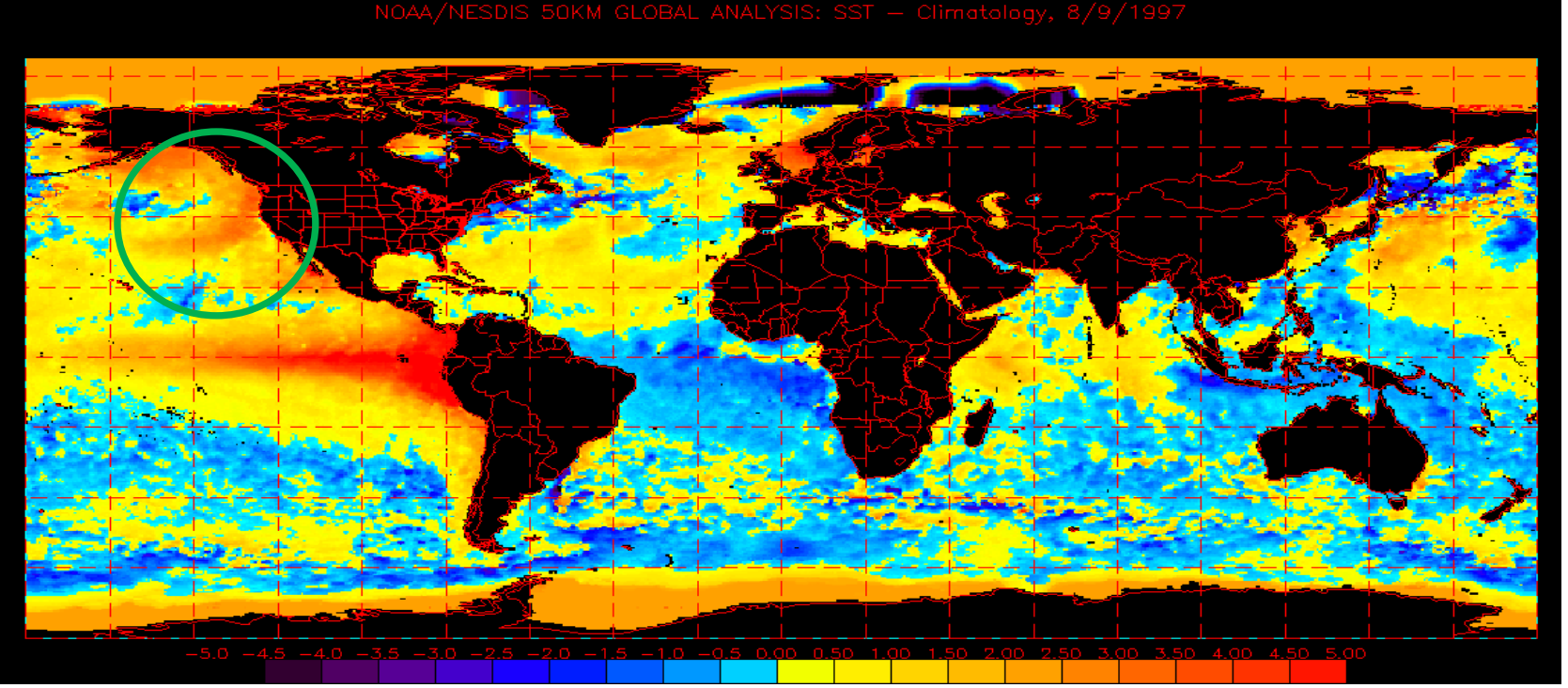
July 19, 2015 |



The Old Farmer's Almanac uses a "secret" formula for forecasting that includes sunspots, tides, planetary positions, climatology and meteorology, according to its website.

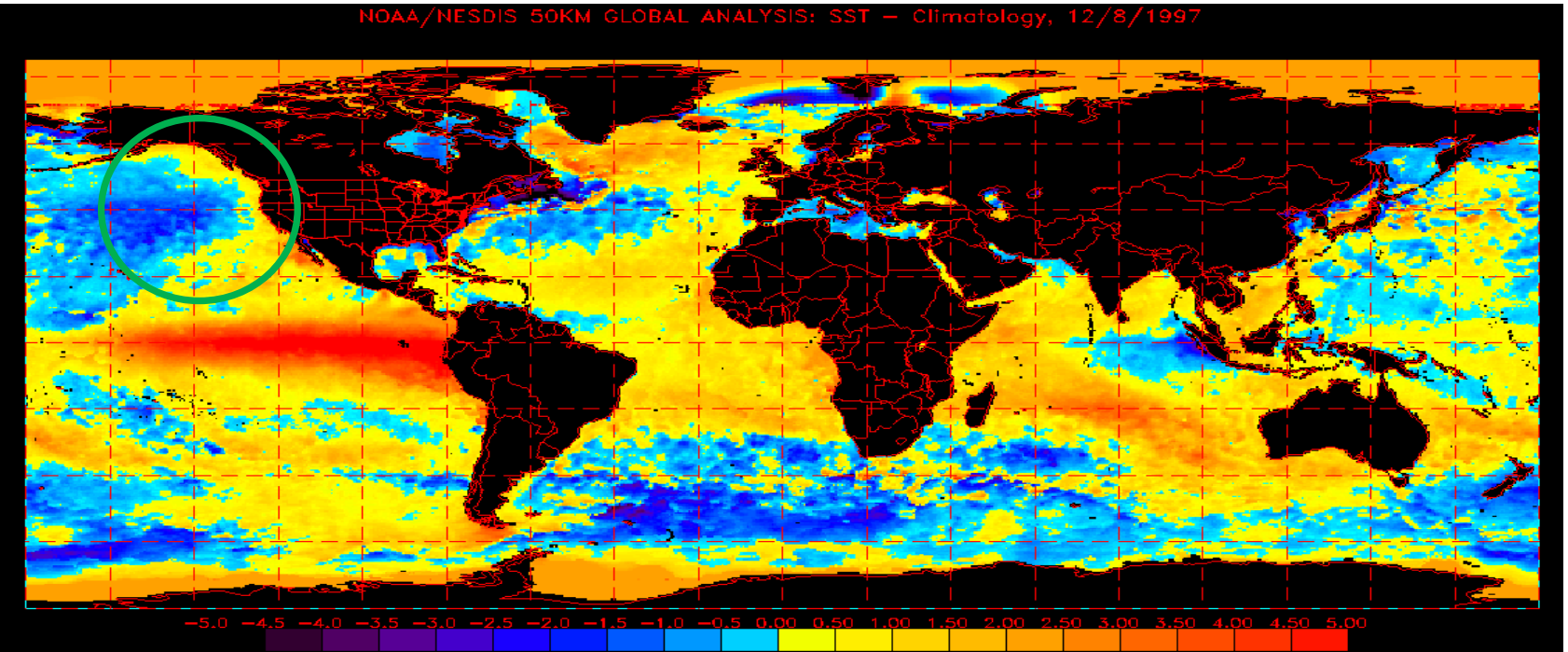


The Old Farmers Almanac's winter weather prediction for the USA. *(Photo: Old Farmers Almanac)*

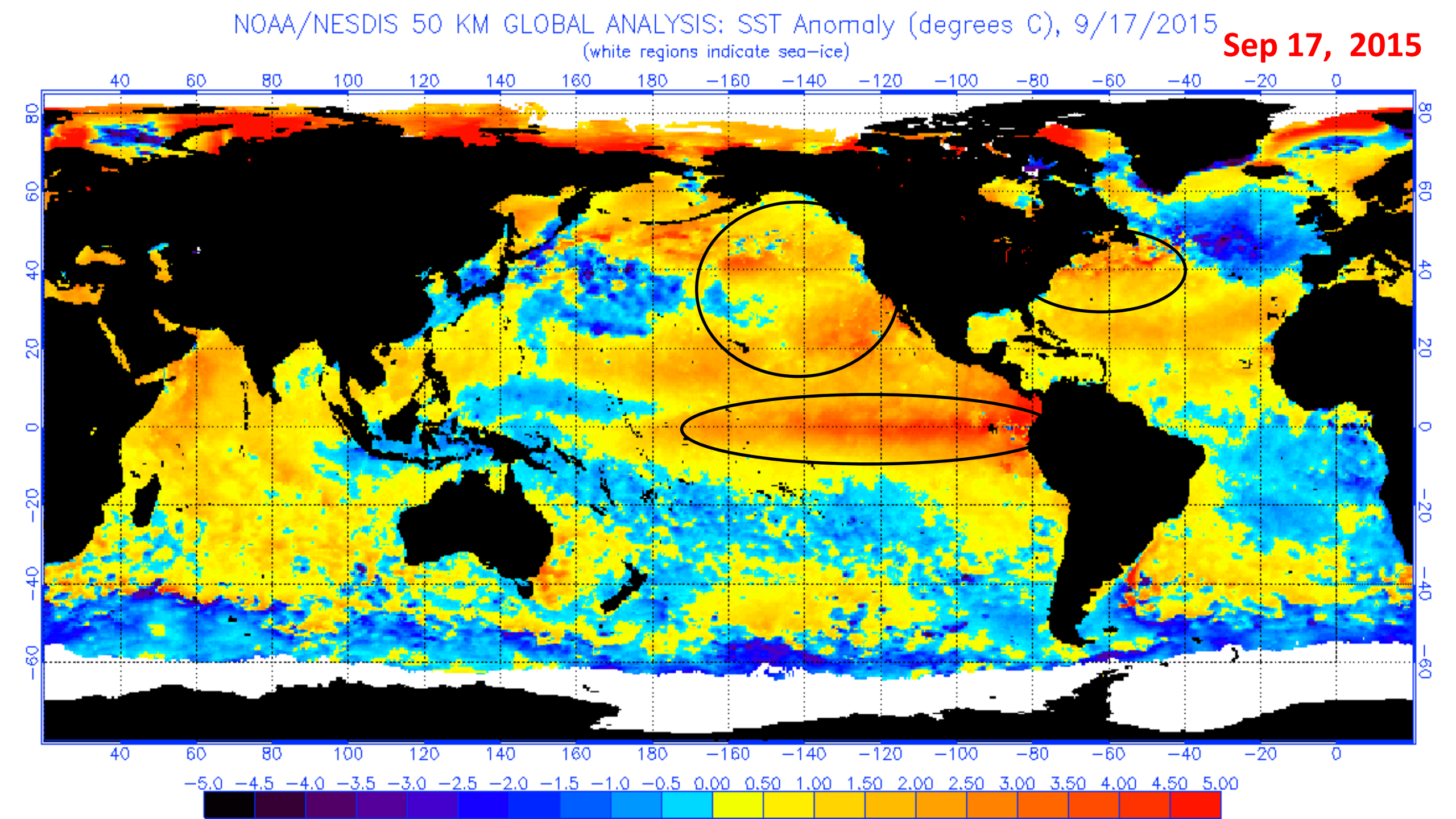


Sea Surface Temperature for Aug 8, 1997
A strong El Nino

SST Anomaly Notes: 9 DEC 97 ....
During the last six months, the anomalies in the South Atlantic have reversed sign from north to south: much of the southern Ocean is now running considerably below the normal during their spring season..



Sea Surface Temperature for Dec 8, 1997
A strong El Nino


NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 9/17/2015
(white regions indicate sea-ice)
Sep 17, 2015
40 60 80 100 120 140 160 180 −160 −140 −120 −100 −80 −60 −40 −20 0
80 60 40 20 0 −20 −40 −60
−5.0 −4.5 −4.0 −3.5 −3.0 −2.5 −2.0 −1.5 −1.0 −0.5 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00

From Klaus Wolter NOAA in Boulder, CO

El Niño conditions are guaranteed to persist into the upcoming boreal winter season, most likely at strong levels for much of that period.

Whether it will reach the elusive 'Super El Niño' level remains to be seen.

In addition, typical El Niño impacts will be **supported by positive PDO conditions that have endured since January 2014, reaching record levels from December 2014 through February 2015.**

Decoded Science - **Weather Around The World, 7/28: Heat, Local And Worldwide; El Niño; Monsoon; Tropics July 28, 2015 by Jon Plotkin**

If El Niño takes control of the weather pattern during fall and winter, we can expect a new alignment with a trough in the west and a ridge in the east.

The weather of the past two winters will be reversed, with warm in the east, and cool and rainy in the west.

Issued Sept 18, 2015 Andrew @ The Weather Centre

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EXPECT THE UNEXPECTED

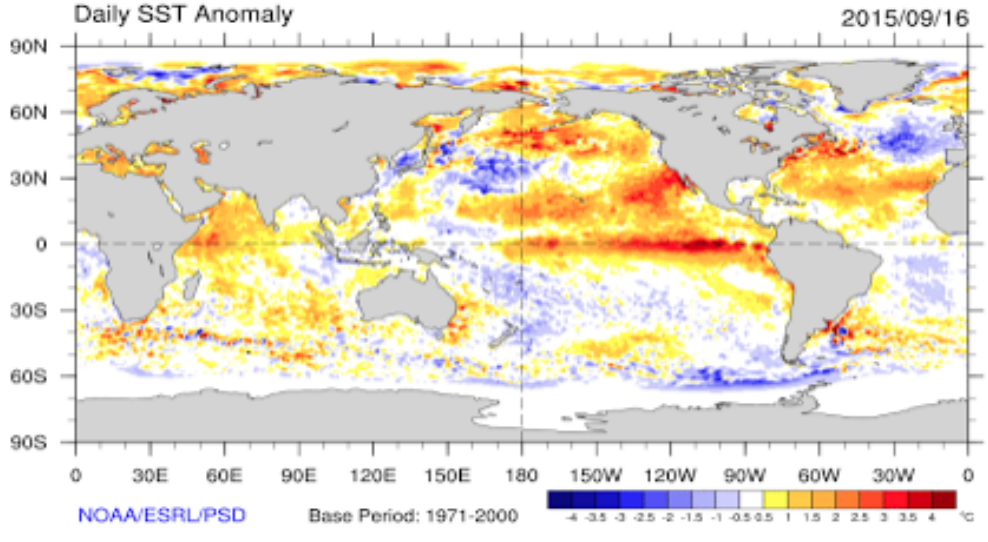
Home | Weather Models | Current Weather | Winter Weather Wall | Snow Day Formula | 2013-2014 Winter Forecast Directory

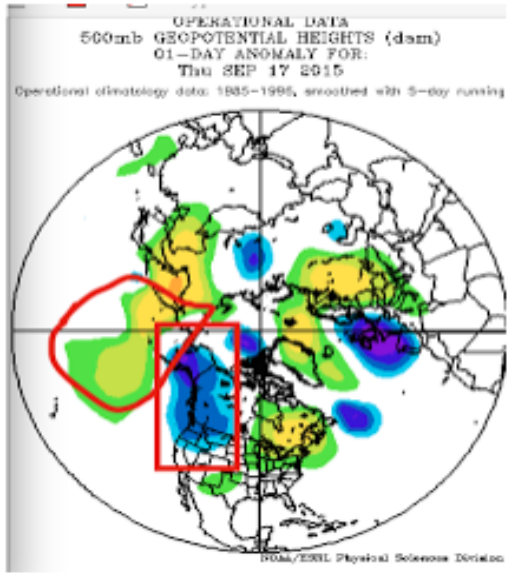
Friday, September 18, 2015

Special Post: 2015-2016 Winter Pattern Beginning to Form?

By Andrea at 11:50 AM

In today's special post, we're looking at how the upcoming winter pattern may be giving a sneak peak at what it will do this cold season.





ESRI

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To Summarize:

- The current weather pattern is forecasted to continue over at least the next two weeks.

- This pattern is following sea surface temperature anomalies over the Pacific, making it more likely to maintain.

- **This pattern resembles a modified Strong El Nino pattern, and could stick around for the winter months.**

Andrew - See more at:
http://theweathercentre.blogspot.com/#sthash.SoE5xzjO.dpuf

Streamflow April - September
as % of 1981-2010 Average

NRCS Natural Resources Conservation Service

12 Strong El Nino Years Sorted

Year	ENSO SE Strong El Nino	PDO Positive or Negative	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
1966	SE	neg	28	48	51	78	90
1947	SE	pos / neg	44	50	59	108	90
1941	SE	pos	83	53	69	73	45
1988	SE	pos	30	65	24	70	71
1978	SE	pos	110	112	140	133	99
1973	SE	pos / neg	61	114	51	79	45
1995	SE	pos	124	135	195	118	70
1998	SE	pos / neg	135	138	161	119	82
1983	SE	pos	221	157	282	132	91
1942	SE	pos	122	173	117	86	77
1952	SE	neg	247	178	263	116	123
2016	SE	Currently pos	?	?	?	?	?

It is going to be a very interesting winter…

Mores Creek SNOTEL Site March 1999

NRCS Snow School Lake Tahoe Jan 13, 2012