Think Snow!!

Nov. 12, 2015: Water Year 2016 Outlook, Agency Updates and New Research Discussion

We will be hosting a 2016 Idaho water supply outlook and technical discussion. The morning session will provide an update on current climate conditions, weather outlooks, and updates by different agencies. The afternoon session will include discussions on new snow research, monitoring and water use. There will be an opportunity to interact with decision makers and providers of information to provide your input.

This meeting is co-hosted by the Natural Resources Conservation Service, Idaho Department of Water Resources, Idaho Power, US Army Corps of Engineers and PNW Climate Impacts Research Consortium.

Date: November 12, 2015
Time: 9:00 to 4:15
Location: 'The Auditorium' located in the Washington Group Plaza at 720 Park Blvd. Boise.

This meeting is free and open to the public. You just need to register on line and check if you'll be joining us for lunch or not. Lunch is provided by Climate Impacts Research Consortium (CIRC).
For questions, please contact organizers:

Ron Abramovich	Ron.Abramovich@id.usda.gov
Kathie Dello	kdello@coas.oregonstate.edu
Brandon Hobbs	Brandon.W.Hobbs@usace.army.mil
David Hoekema	David.Hoekema@idwr.idaho.gov
Mel Kunkel	MKunkel@idahopower.com

Water Year 2016 Outlook, Agency Updates and New Research Discussion as of Nov 6, 2015

Date: **Thursday, November 12, 2015**
Time: **9:00 to 4:15**
Location: **The Auditorium located in the Washington Group Plaza at 720 Park Blvd. Boise**

8:30	Check in		
9:00	Welcome:	Morning Moderator	Ron Abramovich
	Natural Resources Conservation Service	State Conservationist	Curtis Elke
	Idaho Department of Water Resources		Confirmed
9:15	Idaho Department of Water Resources 2015 Water Year Summary, Agency Update, US Drought Monitor		David Hoekema
9:30	Natural Resources Conservation Service Water Supply Outlook, Agency Update		Ron Abramovich
9:45	University of Idaho Current climate conditions - what it means for the PNW and climate variability		John Abatzoglou
10:30	Break		
10:45	NOAA Northwest River Forecast Center	2016 Water Supply Outlook	Kevin Berghoff
11:15	Idaho Power - Fall Chinook Operations and mid-season counts		Kresta Davis-Butts
11:30	Idaho Power - Cloud Seeding Update		Mel Kunkel
11:45	Colorado State University CoCoRaHS in Idaho and request to recruit more citizen volunteers		Nolan Doesken
12:00	Lunch provided (free if registered on line and checked yes)	Afternoon Moderator Mel Kunkel	

12:00 Lunch provided (free if registered on line and checked yes) Afternoon Moderator Mel Kunkel

12:45 NASA Jet Propulsion Laboratory Tom Painter
Airborne Snow Observatory (ASO)

1:45 Agricultural Research Service Scott Havens
Real time snowmelt modeling in support of reservoir operations in the Boise River Basin

2:05 Break
2:20 University of Idaho John Abatzoglou
Google Earth Drought - Visualization of Observational &
Remote Sensing Dataset for Drought and Ecological Monitoring

2:50 Boise State University Mark Robertson / HP Marshall
Fluidless Snow Water Sensor Research

3:15 PNW Climate Impacts Research Consortium Kathie Dello
Feedback on Climate Impacts Research Consortium (CIRC) Research

3:30 Group Discussion / Feedback by PNW CIRC Kathie Dello and John Stevenson
Q&A Discussion about today's topic and what it means? How will users use the information? Will you use the information? What would be more useful? We've learned people enjoy this feedback discussion and learn a lot from each other, but we had to put it last on the agenda.

4:15 Adjourned
4:30 Continue discussion at the RAM Restaurant

Think Snow!!

NRCS - Jan Curtis, Applied Climatologist retired after 41 yrs with several agencies.

Jan always had a wealth of info to share about current weather & future outlook that might affect snowfall, snow accumulation, snowmelt rates, peak flows, and fall weather patterns hinting at first frost.

- **Persistence -**

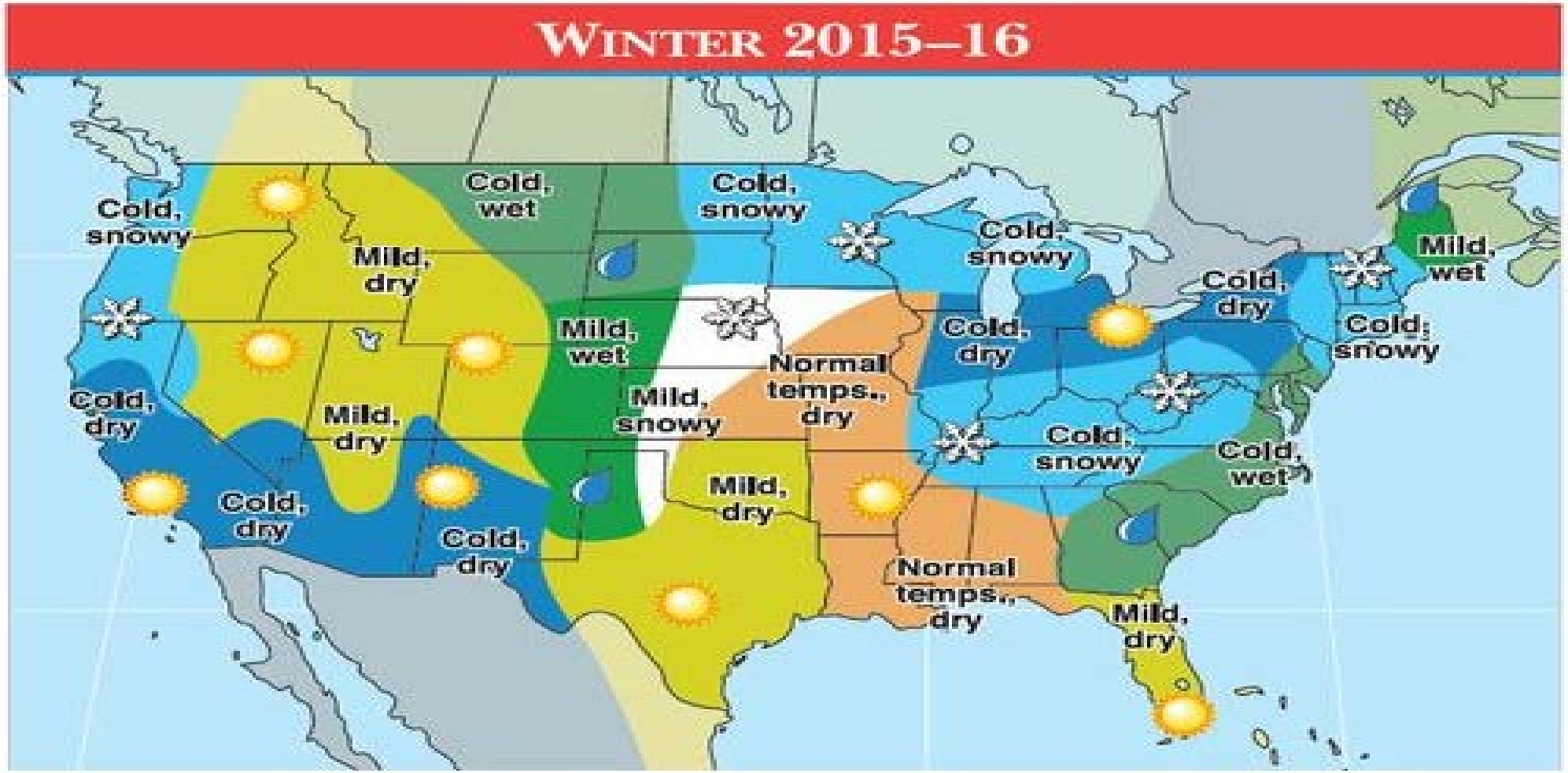
  is best forecast and wins when what you see is what you will continue to have until a different weather pattern sets in.

Rule #1

- **Don’t believe the 1st forecast you hear**

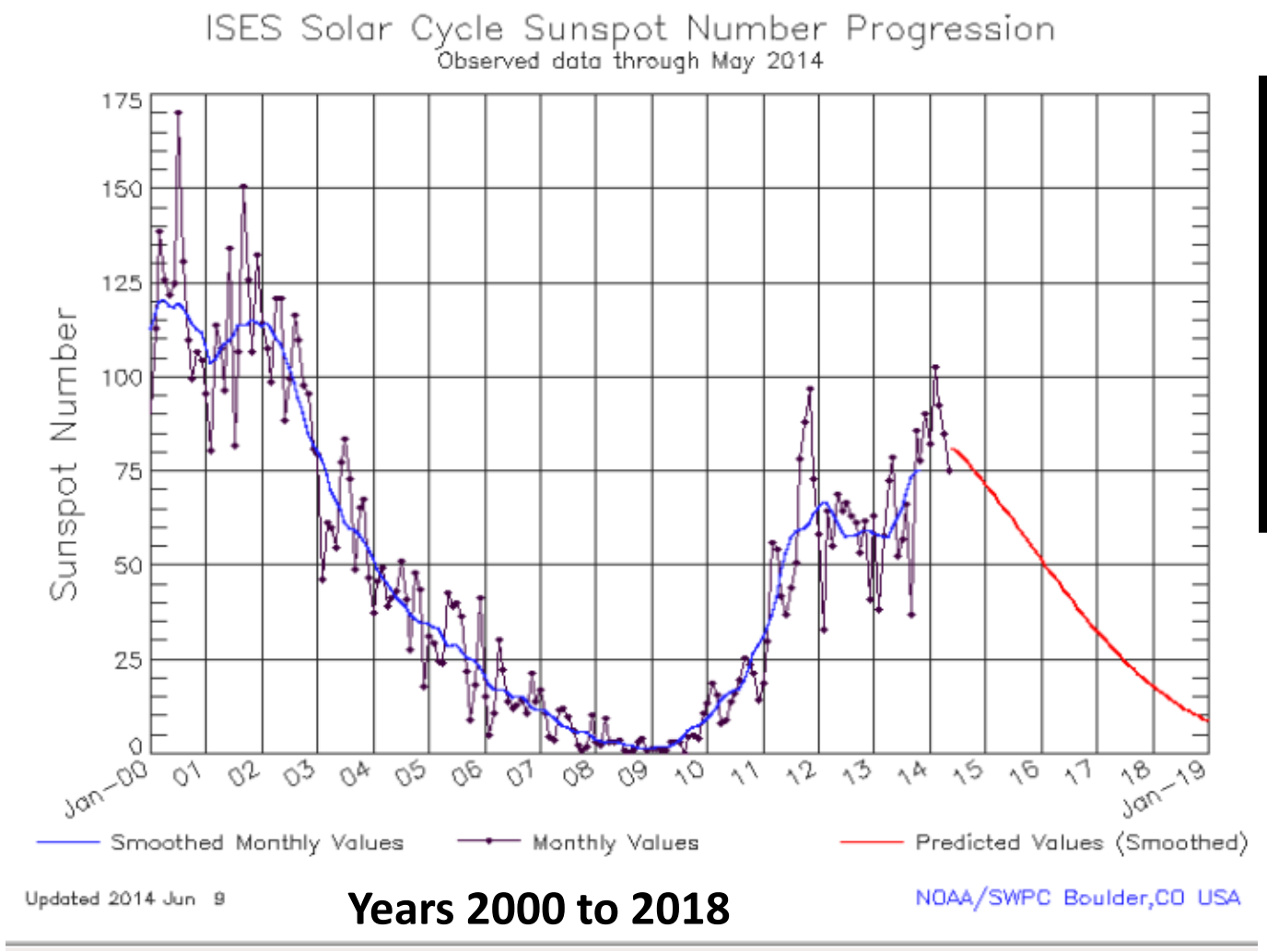
- **Wait until you hear the Same or Similar forecast from two or more of your unrelated sources**

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



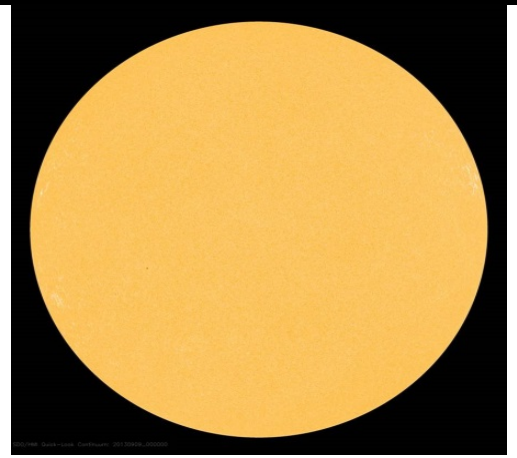
The Old Farmers Almanac's winter weather prediction for the USA. *(Photo: Old Farmers Almanac)*

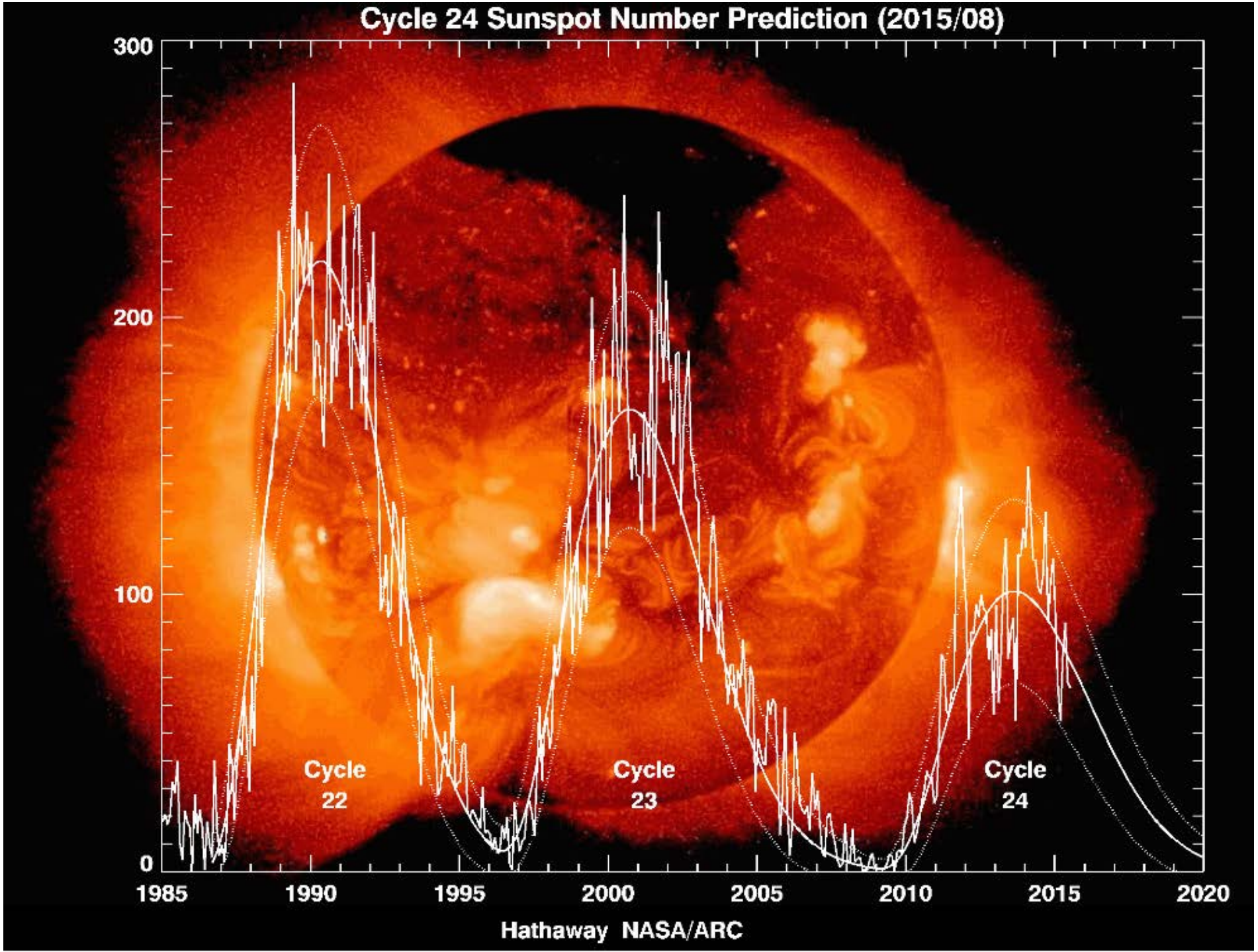
The abnormally low sunspot numbers will likely have some sort of effect on the Earth … <u>take home message is that we are more prone to a chilly winter with sunspots projected to drop than a warm one</u>. **Andrew 6-14-14 The Weather Centre**



Years 2000 to 2018

Sept 9, 2013 - the sun, which should be at SOLAR MAX, is sporting a measly 24 sunspot number (150 is more typical):

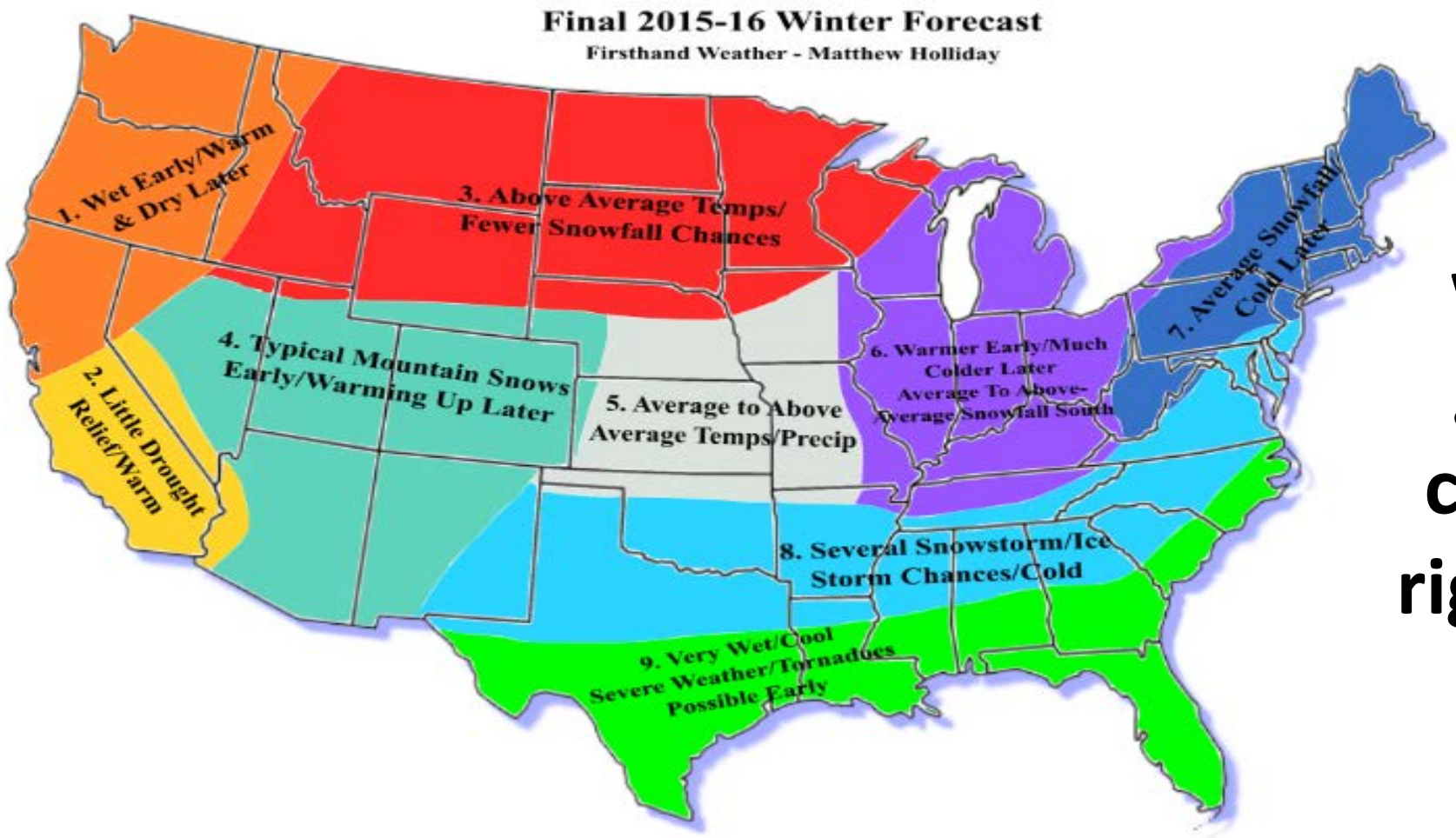



Cycle 24 Sunspot Number Prediction (2015/08)
300
200
100
0
1985
1990
1995
2000
2005
2010
2015
2020
Cycle 22
Cycle 23
Cycle 24
Hathaway NASA/ARC

Firsthand Weather's Final 2015-16 Winter Forecast

Matthew Holliday | November 8, 2015

Firsthand Weather's Final 2015-16 Winter Forecast:



… this upcoming winter forecast is going to be more challenging to "get right" than the prior two winter forecasts.

From Klaus Wolter NOAA in Boulder, CO

U.S. Department of Commerce | National Oceanic & Atmospheric Administration | NOAA Research

Earth System Research Laboratory
Physical Sciences Division

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.**

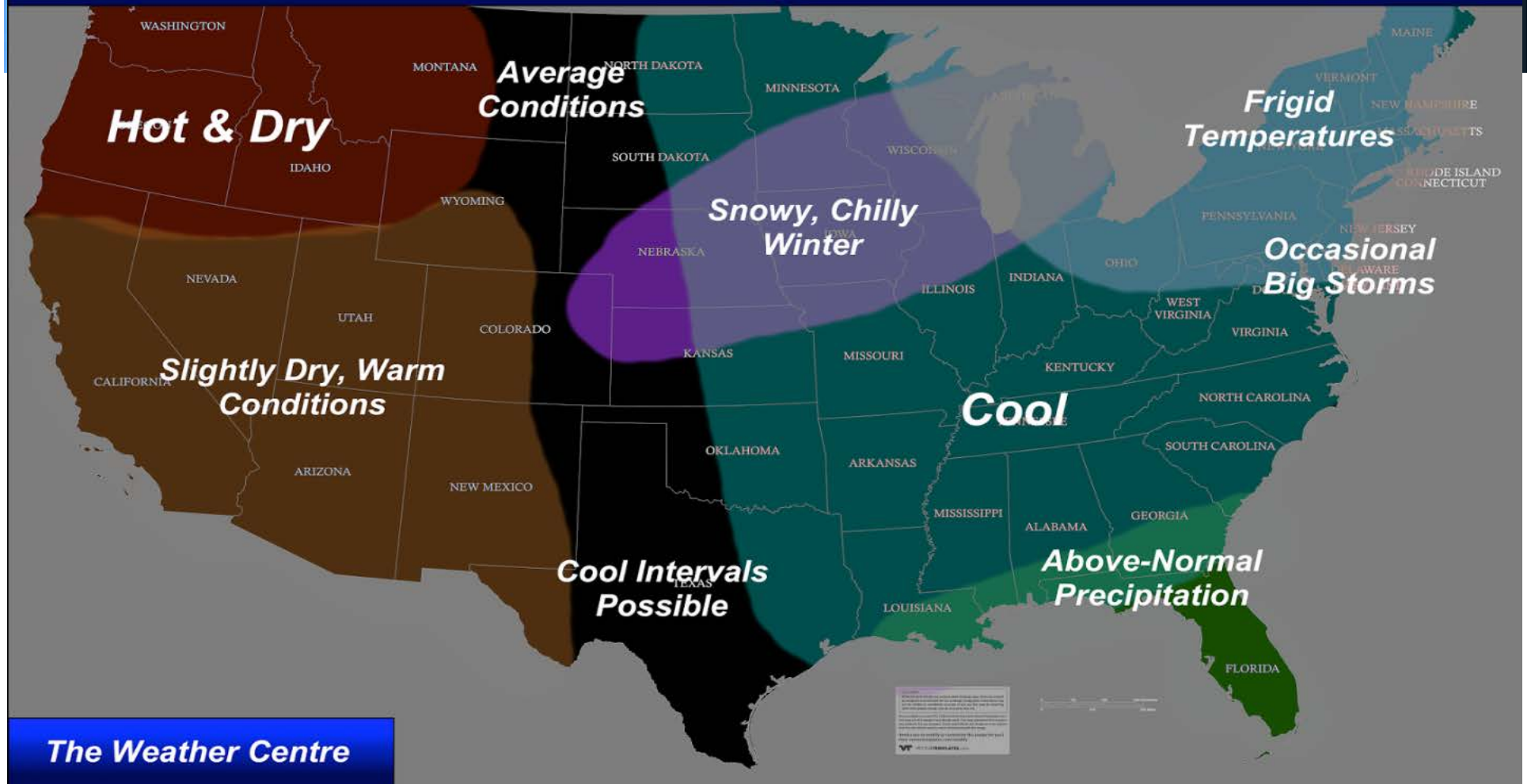
Decoded Science - **Weather Around The World, 7/28: Heat, Local And Worldwide; El Niño; Monsoon; Tropics July 28, 2015 by Jon Plotkin**

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.

From OCT 2105

Official 2014-2015 Winter Forecast



Streamflow April - September as % of 1981-2010 Average

12 Strong El Nino Years Sorted

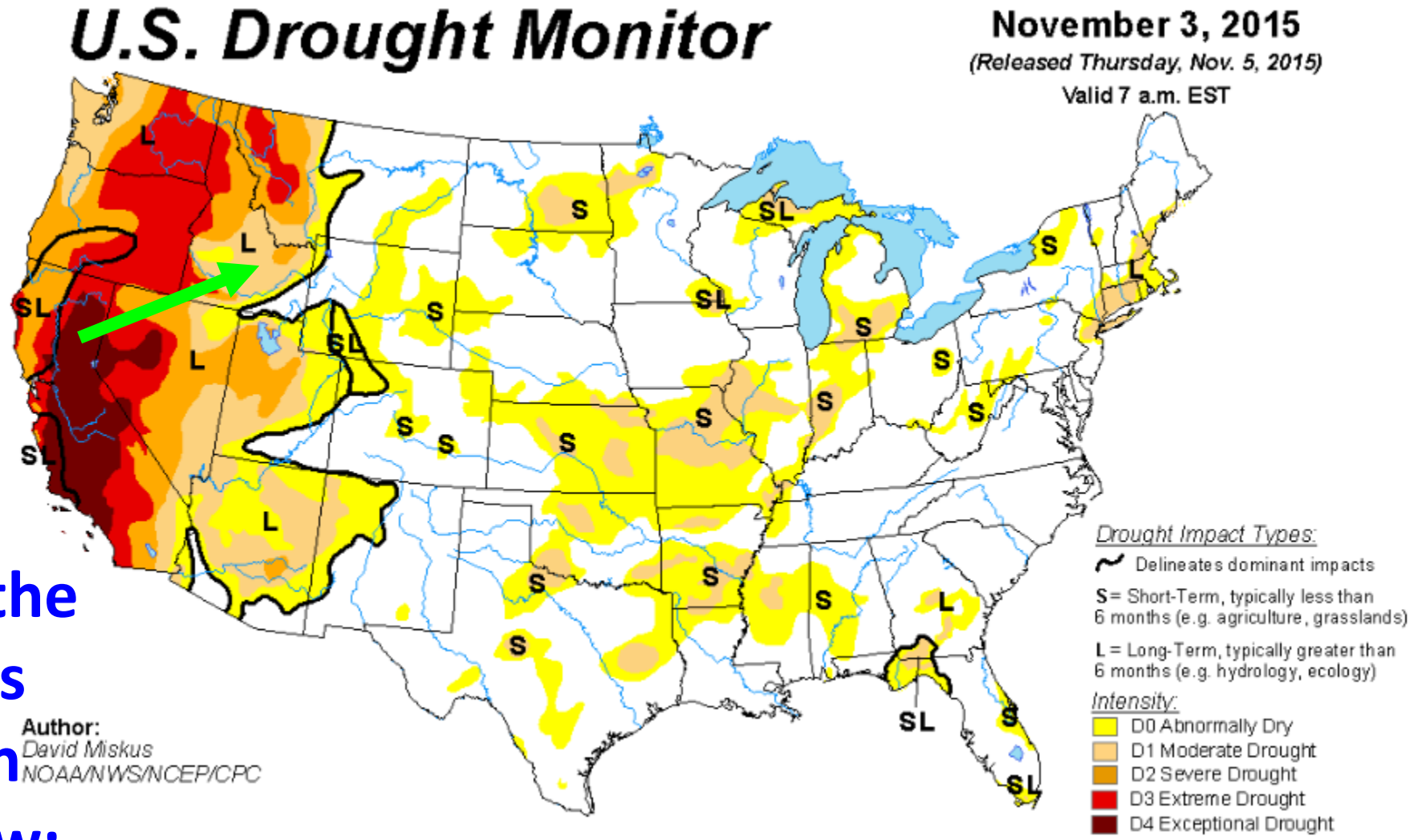
Year	ENSO SE Strong El Nino	PDO Positive or Negative	Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	Snake River nr Heise	Spokane River nr Post Falls
1994	SE	pos	23	36	12	61	51
1966	SE	neg	28	48	51	78	90
1947	SE	pos / neg	44	50	59	108	90
1941	SE	pos	83	53	69	73	45
1988	SE	pos	30	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’s going to be an interesting winter…

Mores Creek SNOTEL Site March 1999

NRCS Snow
School Lake Tahoe
Jan 13, 2012

With increase in climate variability:

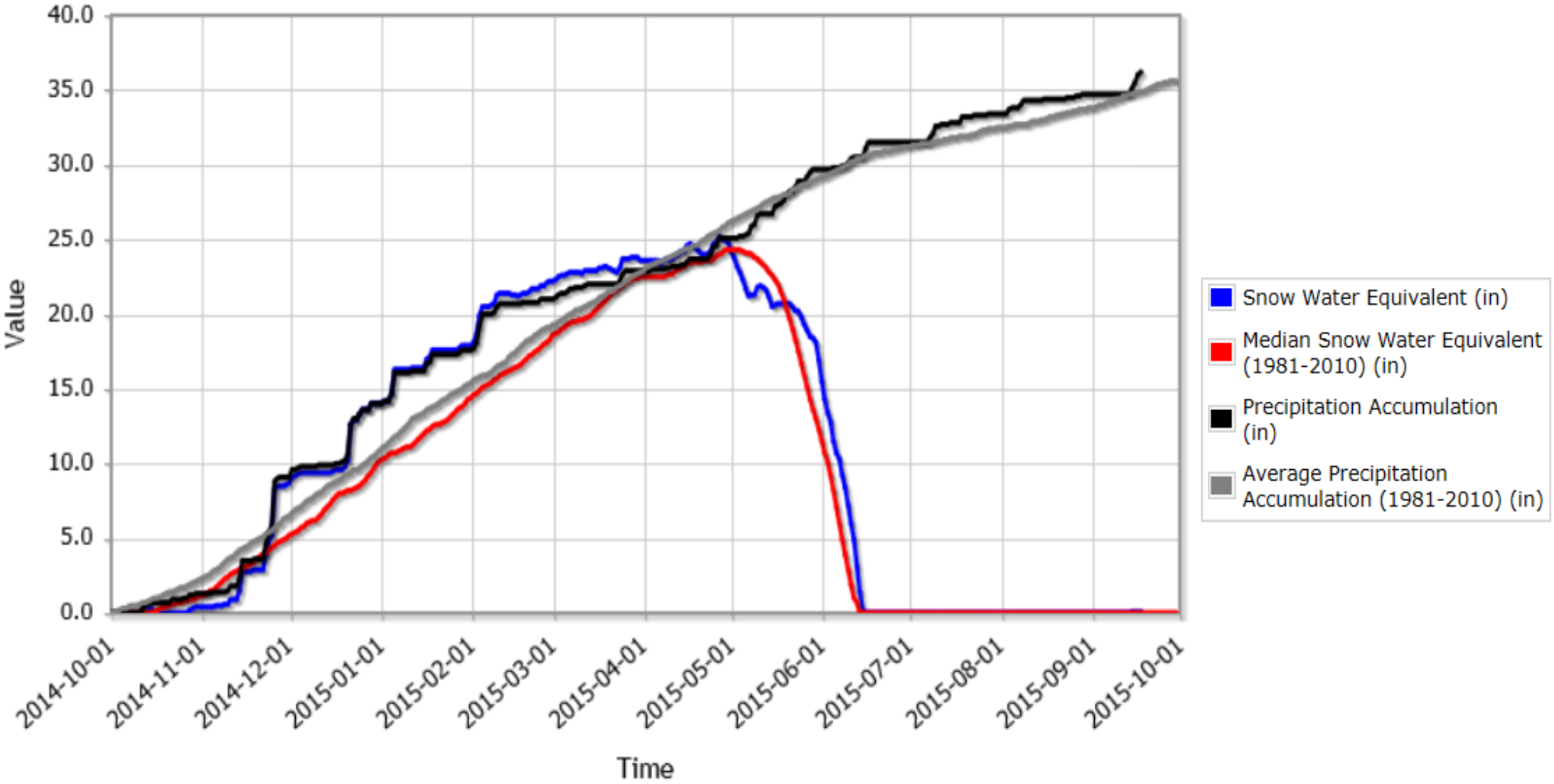


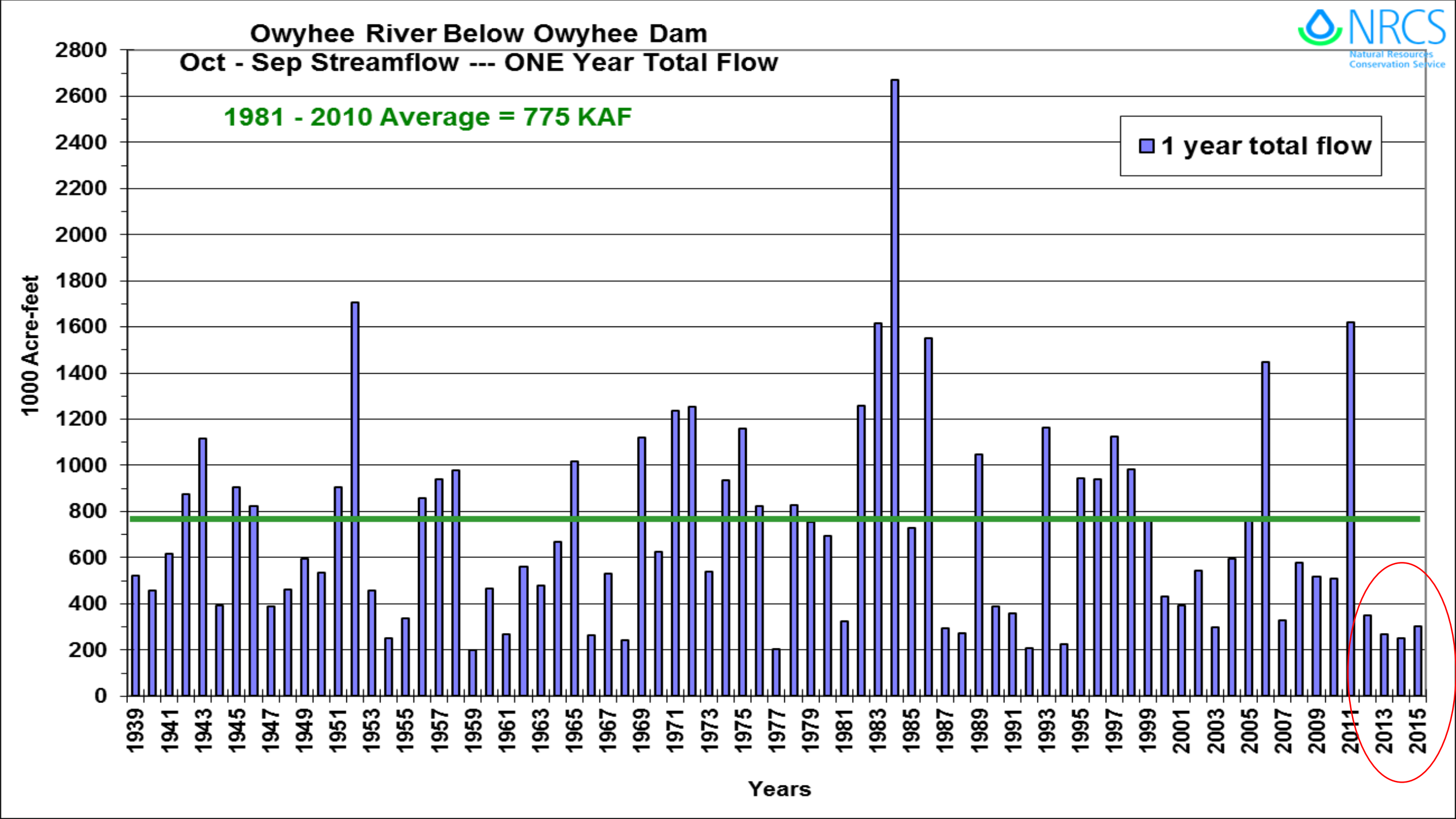
Key is understanding the storm track that brings moisture to your basin and what makes it flow:

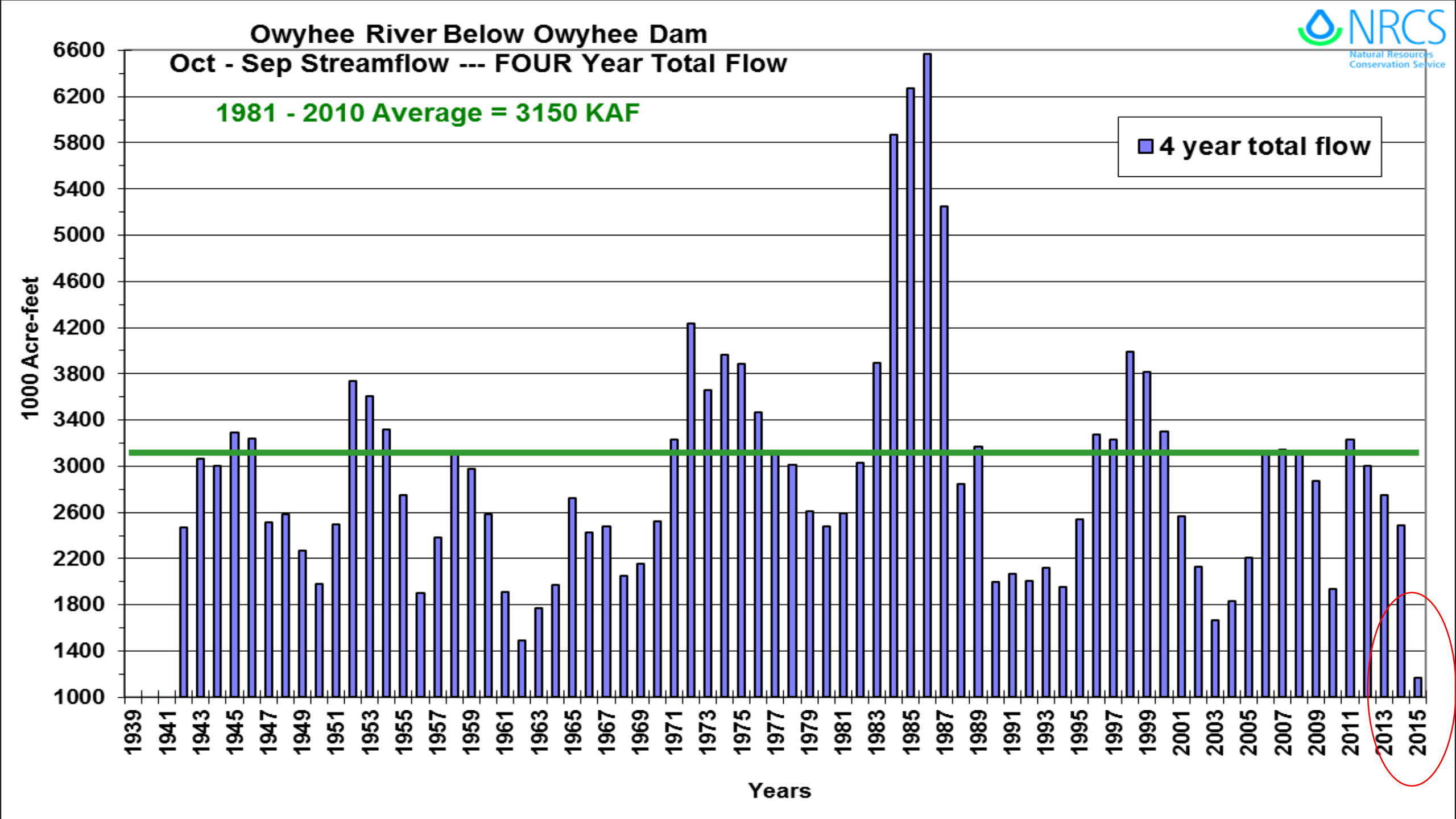
- Snow cover area
- Snowmelt relationships
- spring rain intensities.

Near Normal High Elevation Snow in southwest Wyoming boosted spring runoff in Upper Snake & Green River

Spring Creek Divide (779) Wyoming SNOTEL Site - 9000 ft




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 --- FOUR Year Total Flow
1981 - 2010 Average = 3150 KAF
4 year total flow
1000 Acre-feet
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
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
Years
NRCS
Natural Resources Conservation Service

BOISE STATE UNIVERSITY

From Snow to Flow

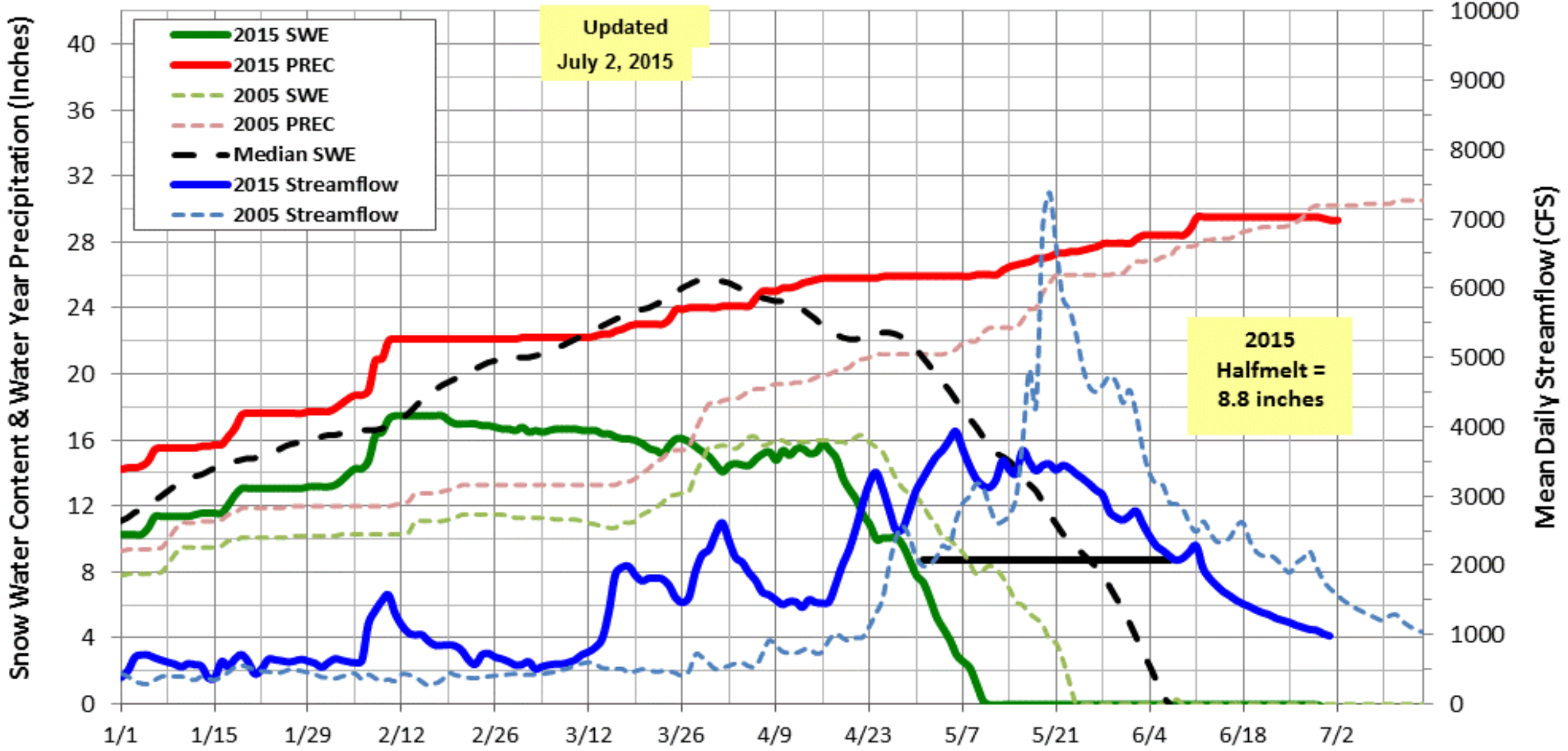
1. **Estimating the timing of peak streamflow using SNOTEL ablation curves**

   (Kara Ferguson & Dr. Jim McNamara)

2. **Estimating critical flow magnitudes using SNOTEL data**

   (Becca Garst & Dr. Jim McNamara)

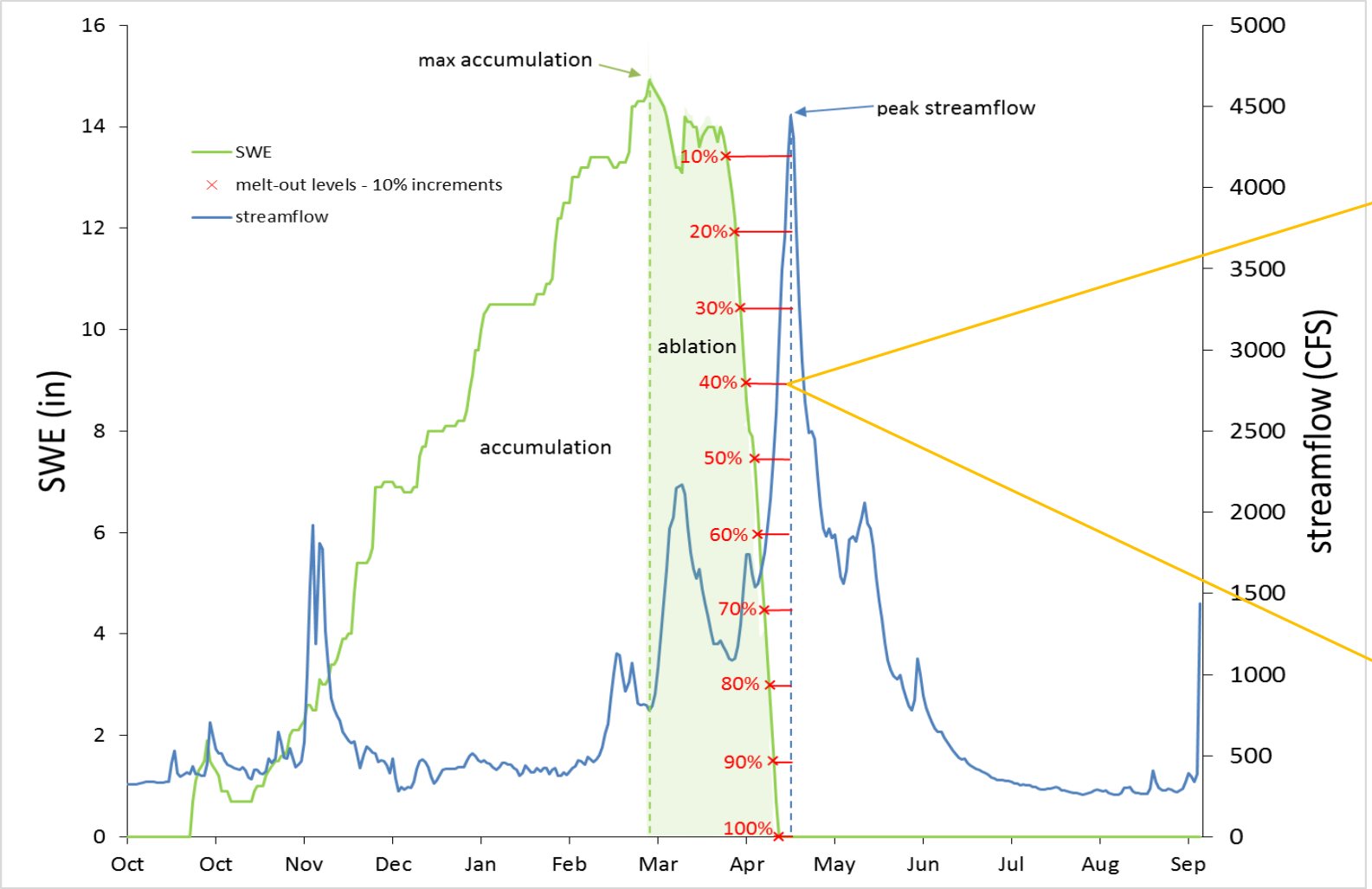
2015 & 2005 Banner Summit SNOTEL and MF Salmon River at MF Lodge

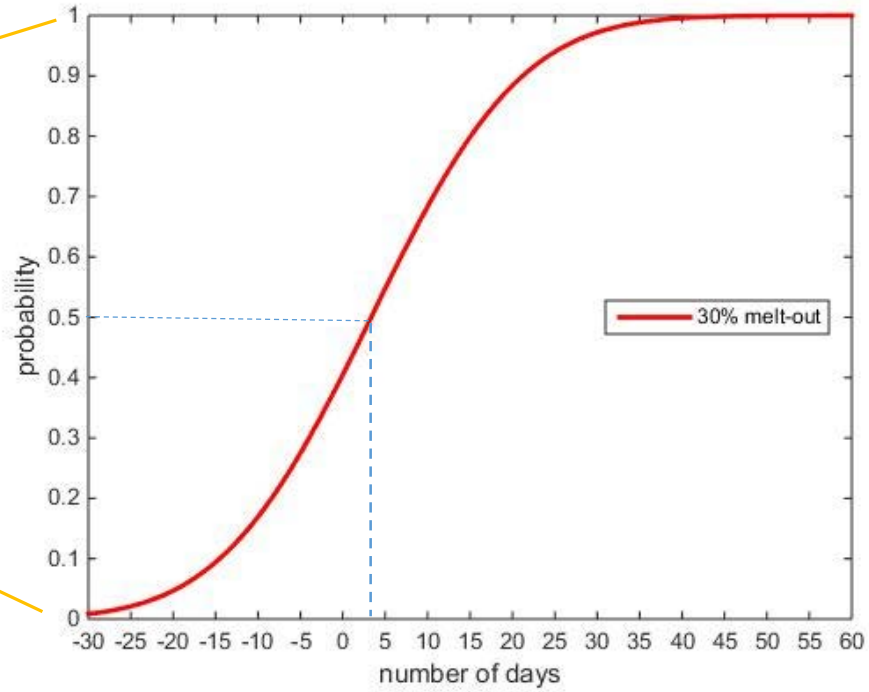


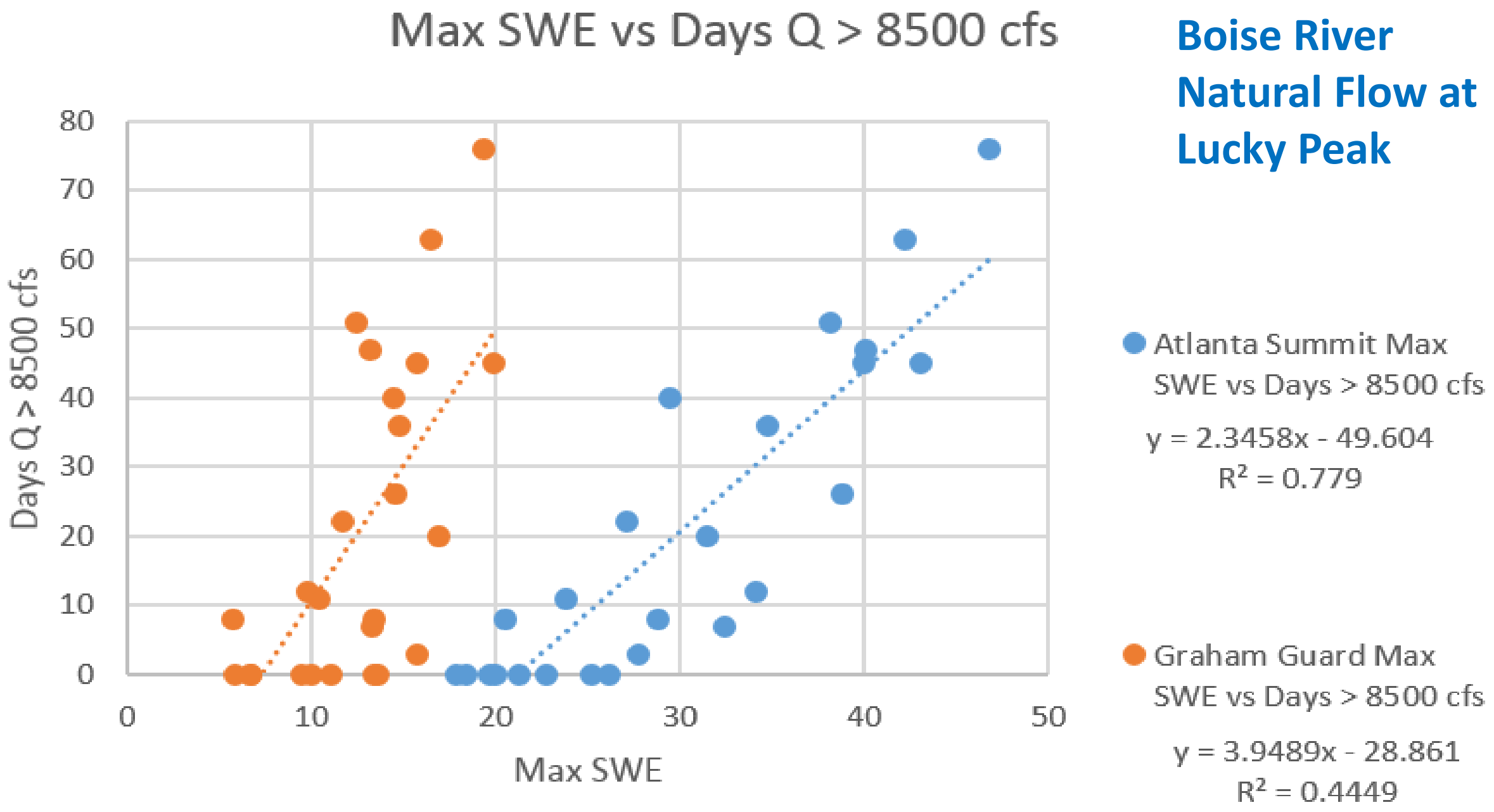
On average MF Salmon River experiences a snowmelt streamflow peak, or increase in flow, when Banner Summit SNOTEL is half-melted.

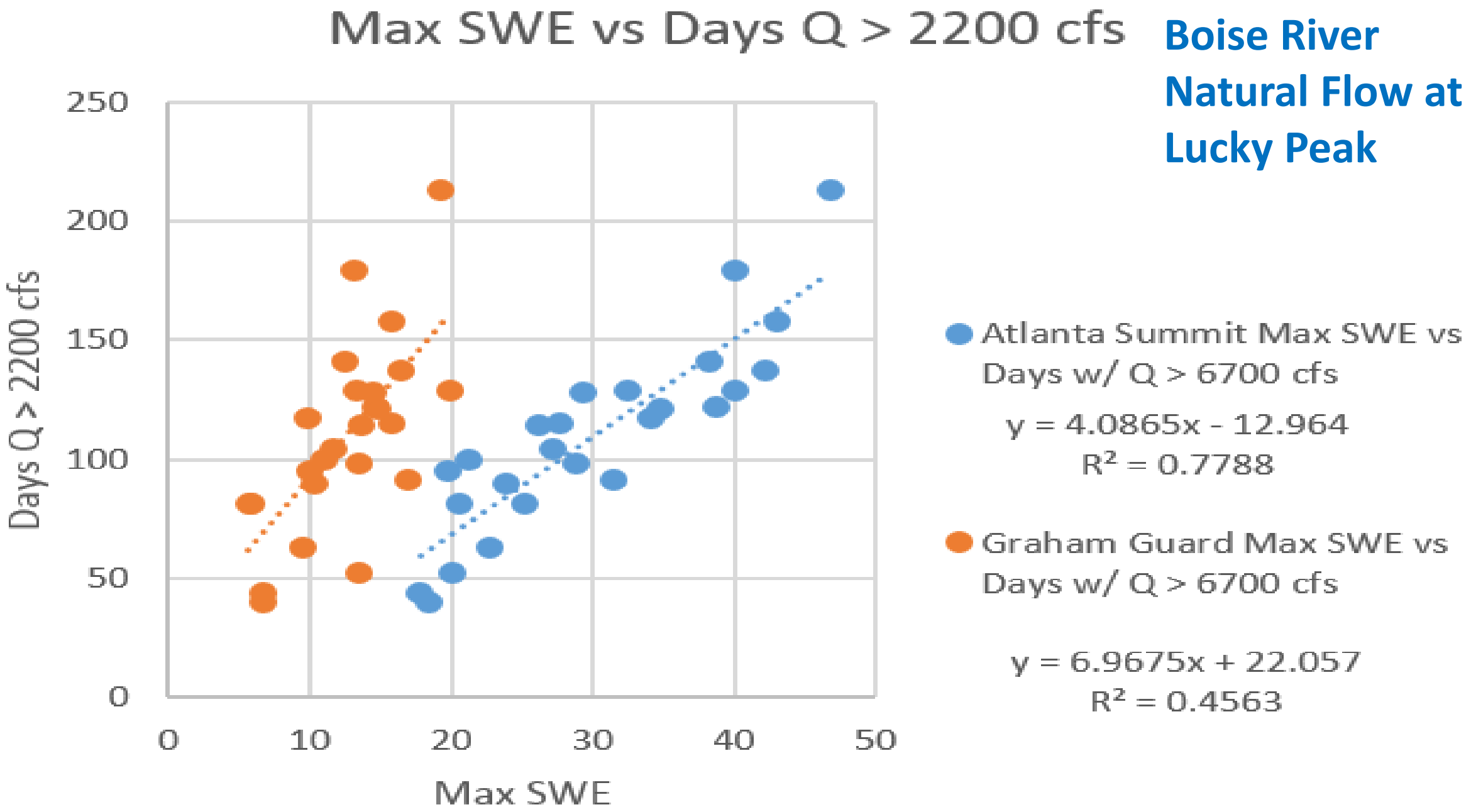
From Snow to Flow highlights:

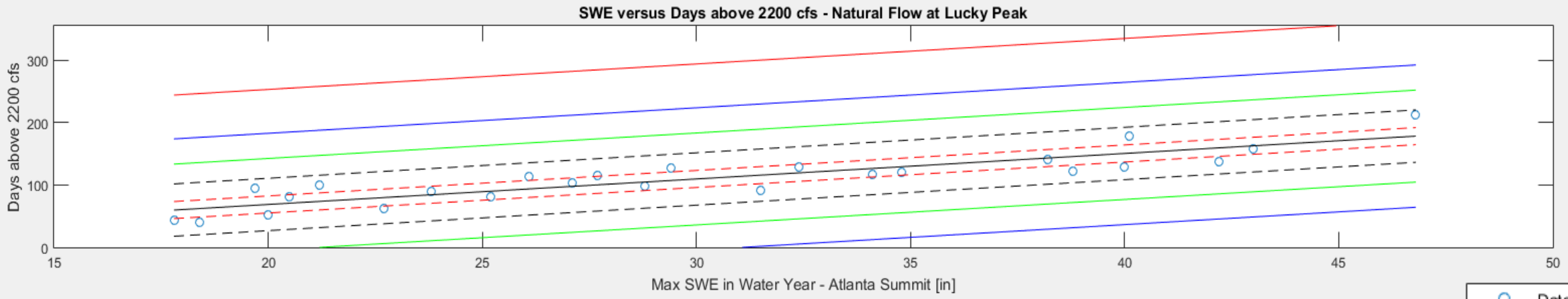
- **Statistical evaluation of historical data**
  - ➢ **Estimates the probability of peak streamflow occurring within a certain number of days once a SNOTEL site reaches a specific melt-out level**
  - ➢ **Update current snowmelt-peak streamflow relationships for 13 basins throughout Idaho**

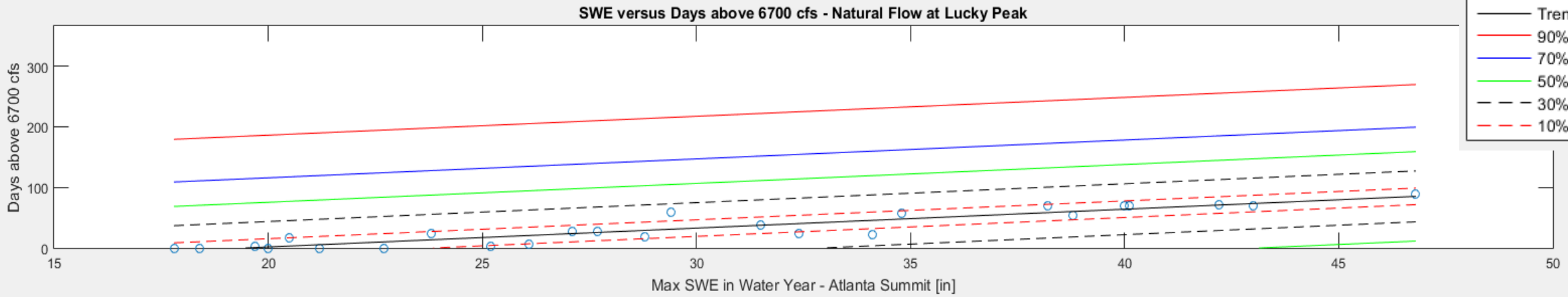


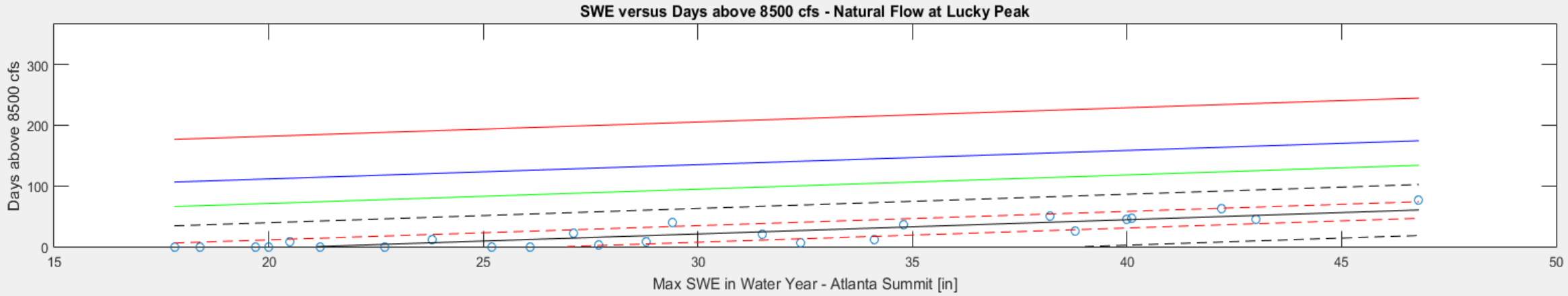


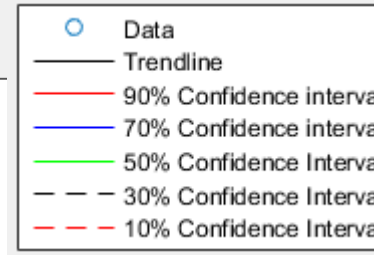

Max SWE vs Days Q > 8500 cfs
Boise River Natural Flow at Lucky Peak
Days Q > 8500 cfs
Max SWE
0
10
20
30
40
50
60
70
80
0
10
20
30
40
50
Atlanta Summit Max SWE vs Days > 8500 cfs
y = 2.3458x - 49.604
R² = 0.779
Graham Guard Max SWE vs Days > 8500 cfs
y = 3.9489x - 28.861
R² = 0.4449


Max SWE vs Days Q > 2200 cfs
Boise River Natural Flow at Lucky Peak
Days Q > 2200 cfs
250
200
150
100
50
0
0
10
20
30
40
50
Max SWE
Atlanta Summit Max SWE vs Days w/ Q > 6700 cfs
y = 4.0865x - 12.964
R² = 0.7788
Graham Guard Max SWE vs Days w/ Q > 6700 cfs
y = 6.9675x + 22.057
R² = 0.4563


SWE versus Days above 2200 cfs - Natural Flow at Lucky Peak
Days above 2200 cfs
Max SWE in Water Year - Atlanta Summit [in]


SWE versus Days above 6700 cfs - Natural Flow at Lucky Peak
Days above 6700 cfs
Max SWE in Water Year - Atlanta Summit [in]


SWE versus Days above 8500 cfs - Natural Flow at Lucky Peak
Days above 8500 cfs
Max SWE in Water Year - Atlanta Summit [in]


Data
Trendline
90% Confidence interva
70% Confidence interva
50% Confidence Interva
30% Confidence Interva
10% Confidence Interva

IDAHO SURFACE WATER SUPPLY INDEX (SWSI) February 1, 2014

The Surface Water Supply Index (SWSI) is a predictive indicator of surface water availability within a watershed for the spring and summer water use season. The index is calculated by combining pre-runoff reservoir storage (carryover) with forecasts of spring and summer streamflow. SWSI values are scaled from +4.0 (abundant supply) to -4.0 (extremely dry), with a value of zero indicating a median water supply as compared to historical occurrences. The SWSI analysis period is from 1981 to present.

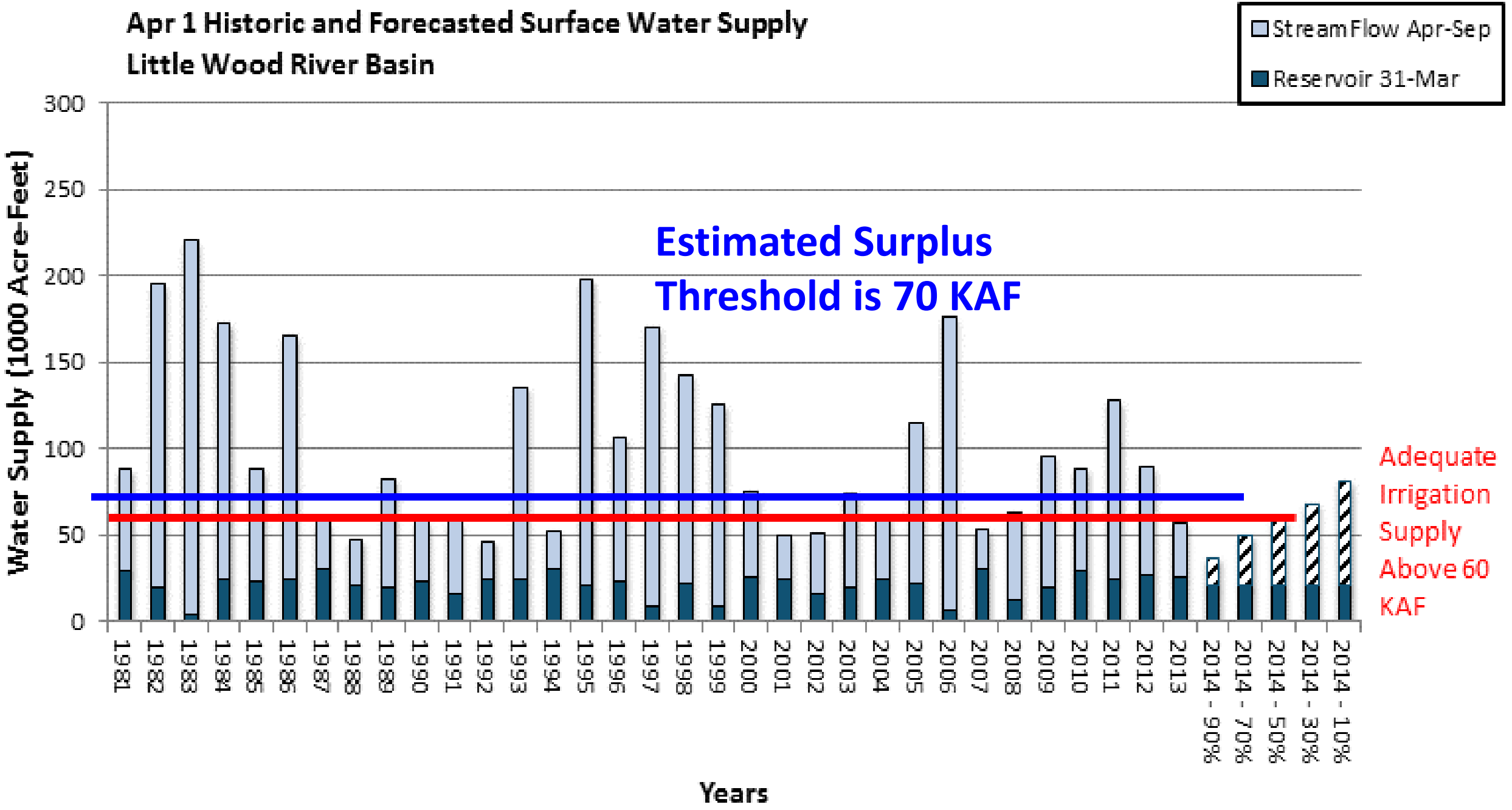
SWSI values provide a more comprehensive outlook of water availability by combining streamflow forecasts and reservoir storage where appropriate. The SWSI index allows comparison of water availability between basins for drought or flood severity analysis. Threshold SWSI values have been determined for some basins to indicate the potential for agricultural irrigation water shortages.

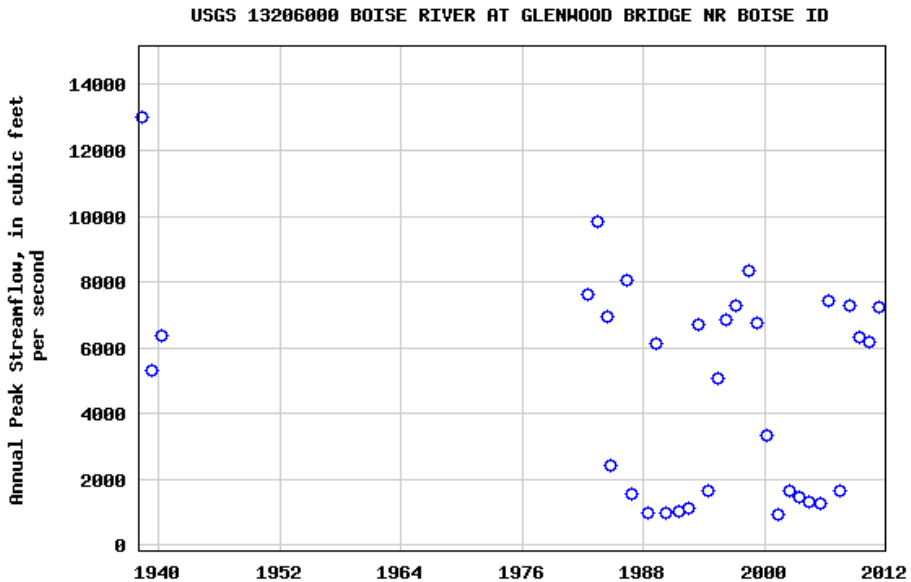
BASIN or REGION	*SWSI Value*	*Most Recent Year With Similar SWSI Value*	*Agricultural Water Supply Shortage May Occur When SWSI is Less Than*
Northern Panhandle	-2.6	2004/2005	NA
Spokane	-2.1	2007	NA
Clearwater	-0.9	2004	NA
Salmon	-2.1	2005	NA
Weiser	-2.6	2013	NA
Payette	-2.8	1991/2007	NA
Boise	**-3.3**	**1991/2001**	**-1.5**
Big Wood	**-3.7**	**1992/2013**	**0.5**
Little Wood	**-3.3**	**2001/2002**	**-1.5**
Big Lost	**-2.3**	**2003**	**0.5**
Little Lost	**-2.1**	**2007**	**1.2**
Teton	-1.6	2002/2013	-3.9
Henrys Fork	-1.3	2007	-3.4
Snake (Heise)	**-1.8**	**2007/2013**	**-1.5**
Oakley	**-2.5**	**2002/2004**	**0.2**
Salmon Falls	**-3.8**	**1992/2001**	**-1.0**
Bruneau	**-3.3**	**2001/2012**	**NA**
Owyhee	**-3.8**	**1992/2003**	**-3.4**
Bear River	-0.3	1989/2001	-2.7

SWSI SCALE, PERCENT CHANCE OF EXCEEDANCE, AND INTERPRETATION

```
 -4      -3      -2      -1       0       1       2       3       4
  |-------|-------|-------|-------|-------|-------|-------|-------|
 99%      87%      75%      63%      50%      37%      25%     13%      1%
-----------------------------------------------------------------------
|Much    | Below      |        Near Normal        |  Above    |  Much  |
|Below   | Normal     |        Water Supply       |  Normal   |  Above |
```

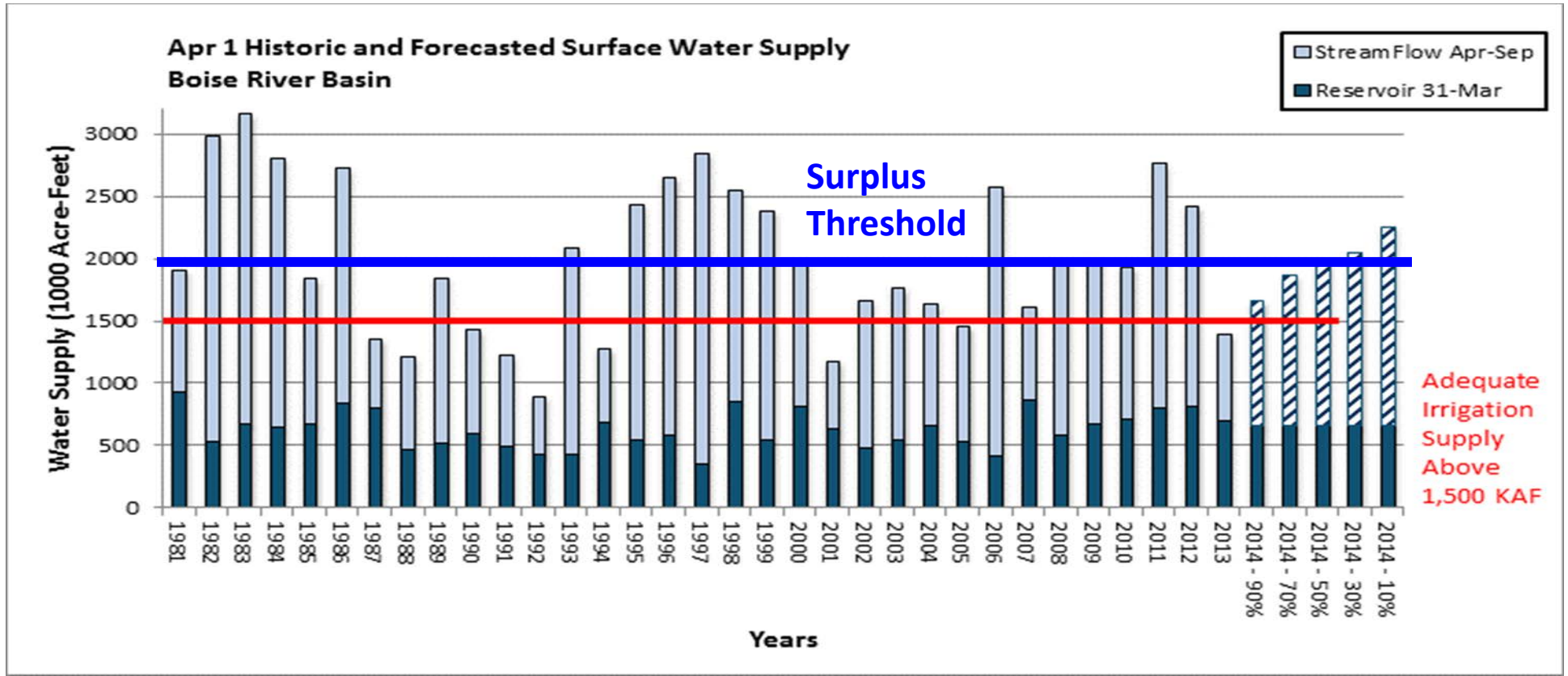
- **Surface Water Supply Index requests to include Surplus Thresholds expand and include more headwater basins**


Apr 1 Historic and Forecasted Surface Water Supply
Little Wood River Basin
Stream Flow Apr-Sep
Reservoir 31-Mar
Water Supply (1000 Acre-Feet)
300
250
200
150
100
50
0
Estimated Surplus
Threshold is 70 KAF
Adequate Irrigation Supply Above 60 KAF
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014 - 90%
2014 - 70%
2014 - 50%
2014 - 30%
2014 - 10%
Years



Boise R @ Glenwood flow > 6700 cfs
13 years since 1982

Only 1995 was a false positive when peak flow was 5086 cfs @ Glenwood



Boise River at Boise SWSI

Adequate Water Supply Greater than 1,500 KAF or -1.8 to -2.1 SWSI

		Period	Data Type	Years	# of Years	
13202000	Boise River near Boise	Apr-Sep	strm	1971-2011	31	Units KAF
13201500	Lucky Peak Reservior	31-Mar	resv	1971-2011	31	Units KAF
13194000	Arrowrock Reservior	31-Mar	resv	1971-2011	31	Units KAF
13190000	Anderson Ranch Reservior	31-Mar	resv	1971-2011	31	Units KAF

ENSO Classification

SE Strong El Nino - EN Mild El Nino - N Neutral - LN Mild La Nina - SL Strong La Nina

2010 & 2011 Provisional Data

Historic Rank	Year	ENSO	Streamflow Apr-Sep	Sum of Reservoirs 31-Mar	Streamflow + Reservoir Sum	Non-Exceedance Probability	SWSI
1	1983	SE	2494.7	655.5	3150.2	0.969	3.9
2	1982	N	2460.4	515.9	2976.3	0.938	3.6
3	1997	N	2490.7	346.5	2837.2	0.906	3.4
4	1984	N	2161.1	630.0	2791.1	0.875	3.1
5	**2011**	SL	1962.0	785.1	2747.1	0.844	2.9
	2012 10% Chance Exceedance Forecast	**LN**	**1920.0**	**801.2**	**2721.2**	**0.828**	**2.7**
6	1986	N	1881.7	831.3	2713.0	0.813	2.6
7	1996	N	2065.6	574.1	2639.7	0.781	2.3
8	2006	N	2162.4	412.9	2575.3	0.750	2.1
9	1998	SE	1700.6	837.0	2537.6	0.719	1.8
	2012 30% Chance Exceedance Forecast	**LN**	**1710.0**	**801.2**	**2511.2**	**0.709**	**1.7**
	2012 50% Chance Exceedance Forecast	**LN**	**1620.0**	**801.2**	**2421.2**	**0.700**	**1.7**
10	1995 ★	SE	1883.6	535.8	2419.4	0.688	1.6
11	1999	SL	1838.0	537.5	2375.5	0.656	1.3
	2012 70% Chance Exceedance Forecast	**LN**	**1530.0**	**801.2**	**2331.2**	**0.647**	**1.2**
	2012 90% Chance Exceedance Forecast	**LN**	**1320.0**	**801.2**	**2121.2**	**0.638**	**1.1**
12	1993	EN	1656.1	421.7	2077.8	0.625	1.0
13	**2008**	N	1381.8	577.9	1959.7	0.594	0.8
14	2000	N	1154.5	801.5	1956.0	0.563	0.5
15	**2009**	N	1323.0	600.8	1923.8	0.531	0.3
16	**2010**	EN	1224.0	697.0	1921.0	0.500	0.0
17	1981	N	980.3	918.8	1899.1	0.469	-0.3
18	2003	EN	1314.6	538.4	1853.0	0.438	-0.5
19	1989	SL	1324.2	507.5	1831.7	0.406	-0.8
20	1985	N	1166.0	664.0	1830.0	0.375	-1.0
21	2002	N	1178.6	471.8	1650.4	0.344	-1.3
22	2004	N	973.6	647.1	1620.7	0.313	-1.6
23	2007	EN	738.8	816.8	1555.6	0.281	-1.8
24	2005	EN	931.2	517.2	1448.5	0.250	-2.1
25	1990	N	840.7	579.3	1420.0	0.219	-2.3
26	1987	N	561.8	784.6	1346.4	0.188	-2.6
27	1994	SE	588.4	677.9	1266.3	0.156	-2.9
28	1991	N	733.1	477.5	1210.6	0.125	-3.1
29	1988	SE	745.6	451.3	1196.9	0.094	-3.4
30	2001	LN	544.8	619.5	1164.3	0.063	-3.6
31	1992	EN	470.8	412.3	883.1	0.031	-3.9

Flow > 6700 CFS

Flow < 6700 CFS

USDA

Think Snow!!