

# Idaho's Water Supply Outlook and Forecast for 2016

Idaho Eastern - Oregon Seed Association

Wednesday Dec 2, 2015

**Ron Abramovich**  
**Water Supply Specialist**  
**Snow Survey Boise, Idaho**



# Streamflow April - September as % of 1981-2010 Average



12 Strong  
El Nino  
Years  
Sorted

Year	ENSO	PDO	Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	Snake River nr Heise	Spokane River nr Post Falls
1994	SE Strong El Nino	Positive or Negative	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
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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	?	?	?	?	?
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**Teleconnections – climatic indexes** - key is understanding their correlations and influence on current weather (and snow, flow & more).

**Primary Ones:**

**PDO**            **Pacific Decadal Oscillation – longer cycle: used to be 20-30 years**

**ENSO**            **El Nino Southern Oscillation – short cycle: 2, 3, 5 year 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**

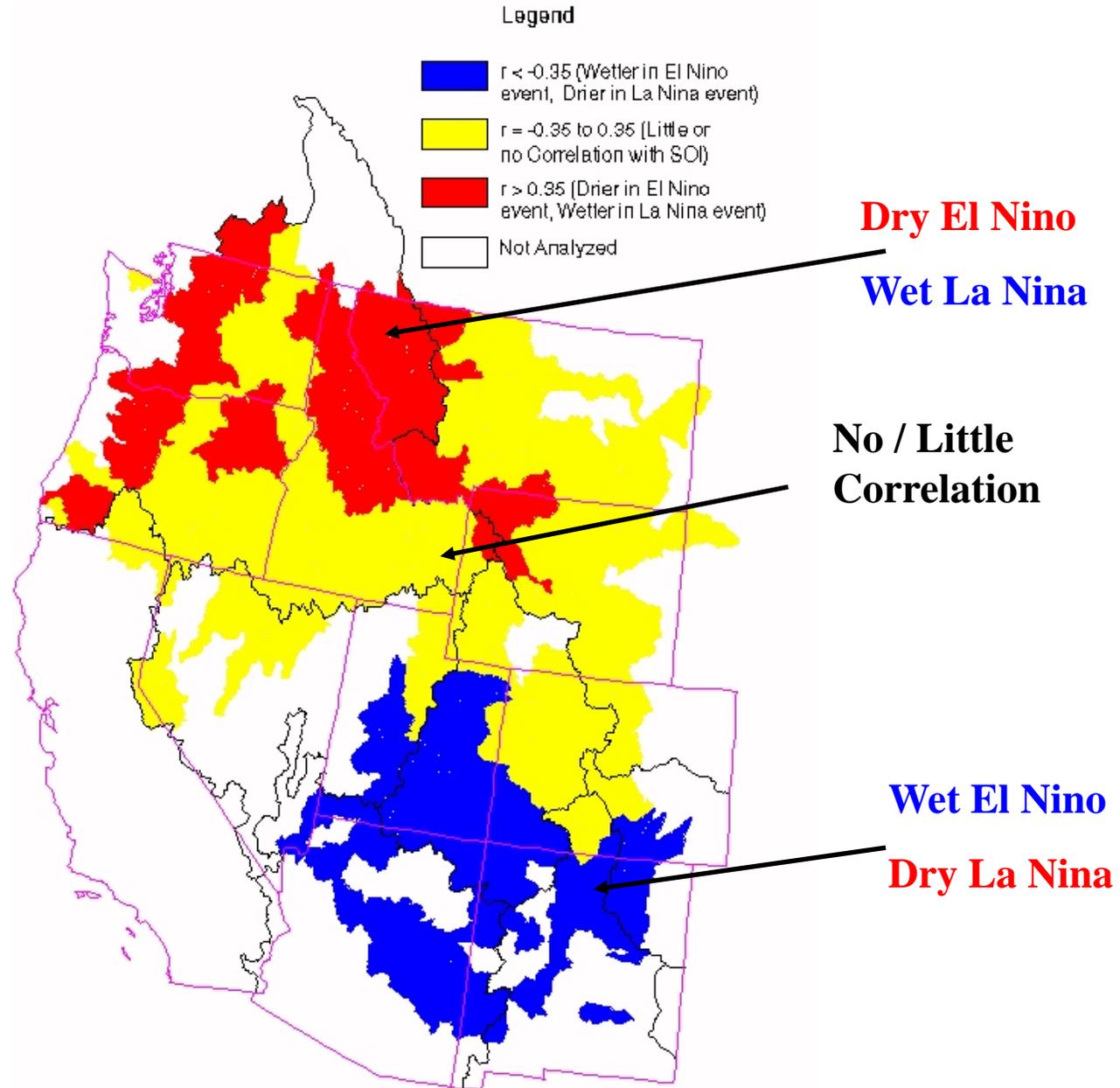
**20+ Other Climate Indices:**    **NAO**    **North Atlantic Oscillation**  
   **AO**    **Arctic Oscillation**  
   **Solar Cycles, Polar Vortex, Ice Caps and more.....**

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

Key is what happens during the July – Nov period

Winter 2014/2015:  
Slight El Nino & SOI

Winter 2015/2016:  
Strong El Nino is Here!



# La Nina and Pacific Decadal Oscillation (PDO)

## Cooling in the Pacific Ocean

Don J. Easterbrook, Dept. of Geology, Western Washington University, Bellingham, WA

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

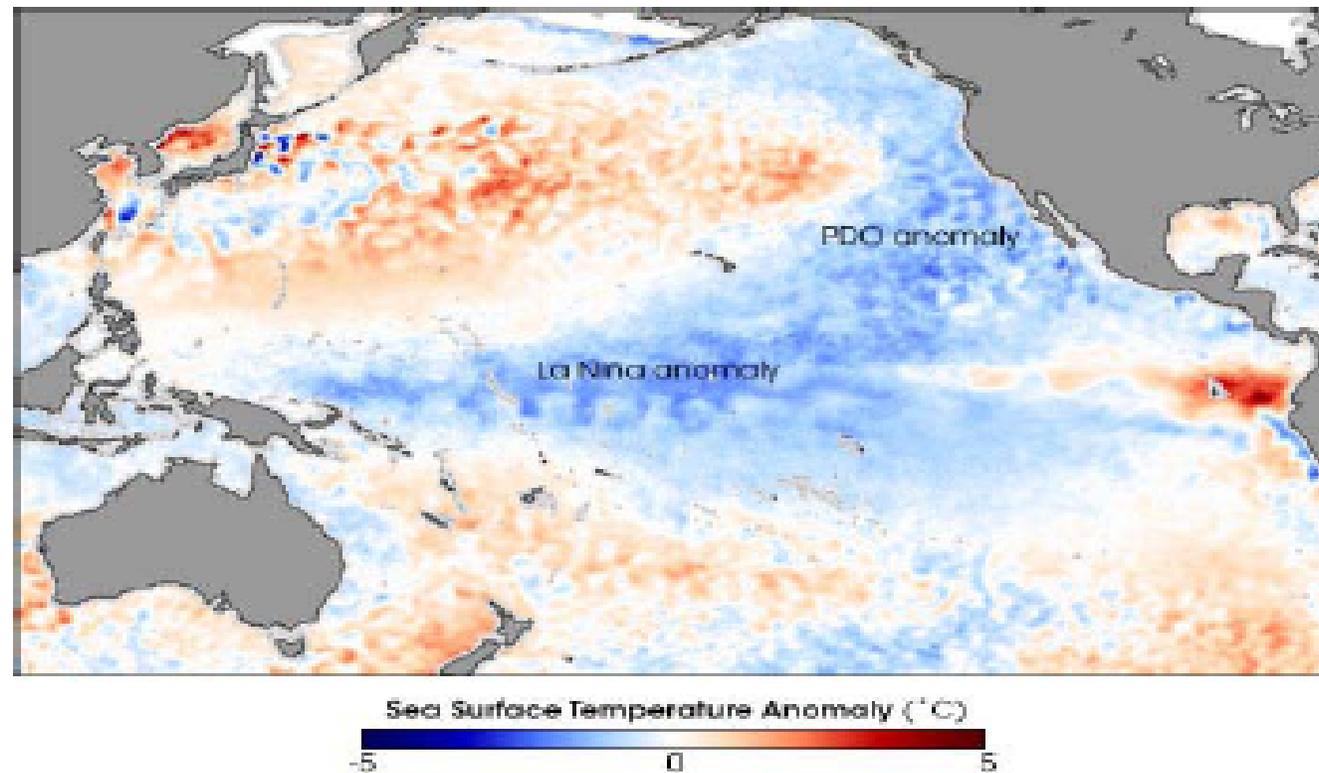
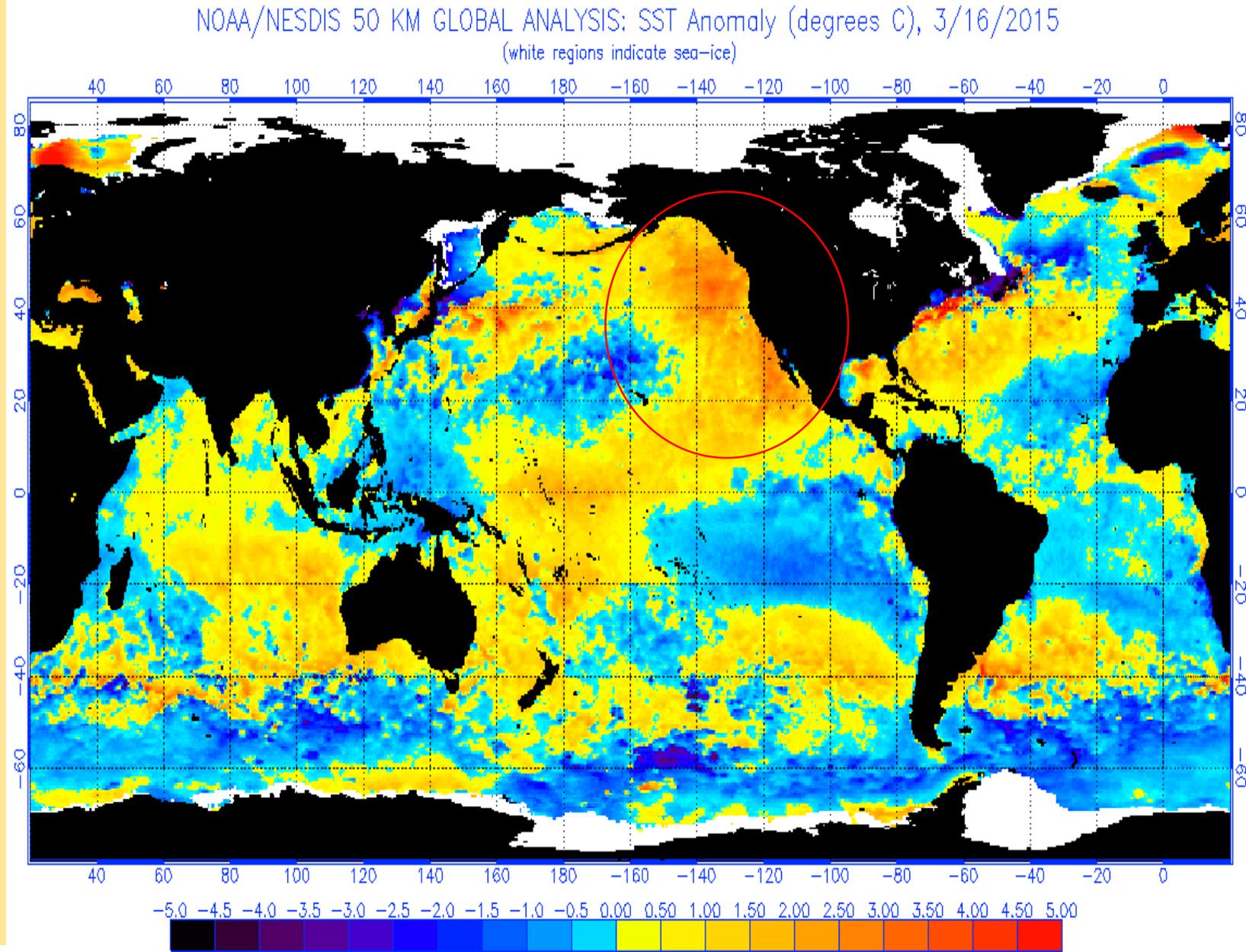


Figure 1. Cooling of the Pacific Ocean and setting up of the PDO. Sea surface temperature anomaly in the Pacific Ocean from April 14–21, 2008. The anomaly compares the recent temperatures measured by the Advanced Microwave Scanning Radiometer for EOS (AMSR-E) on NASA's Aqua satellite with

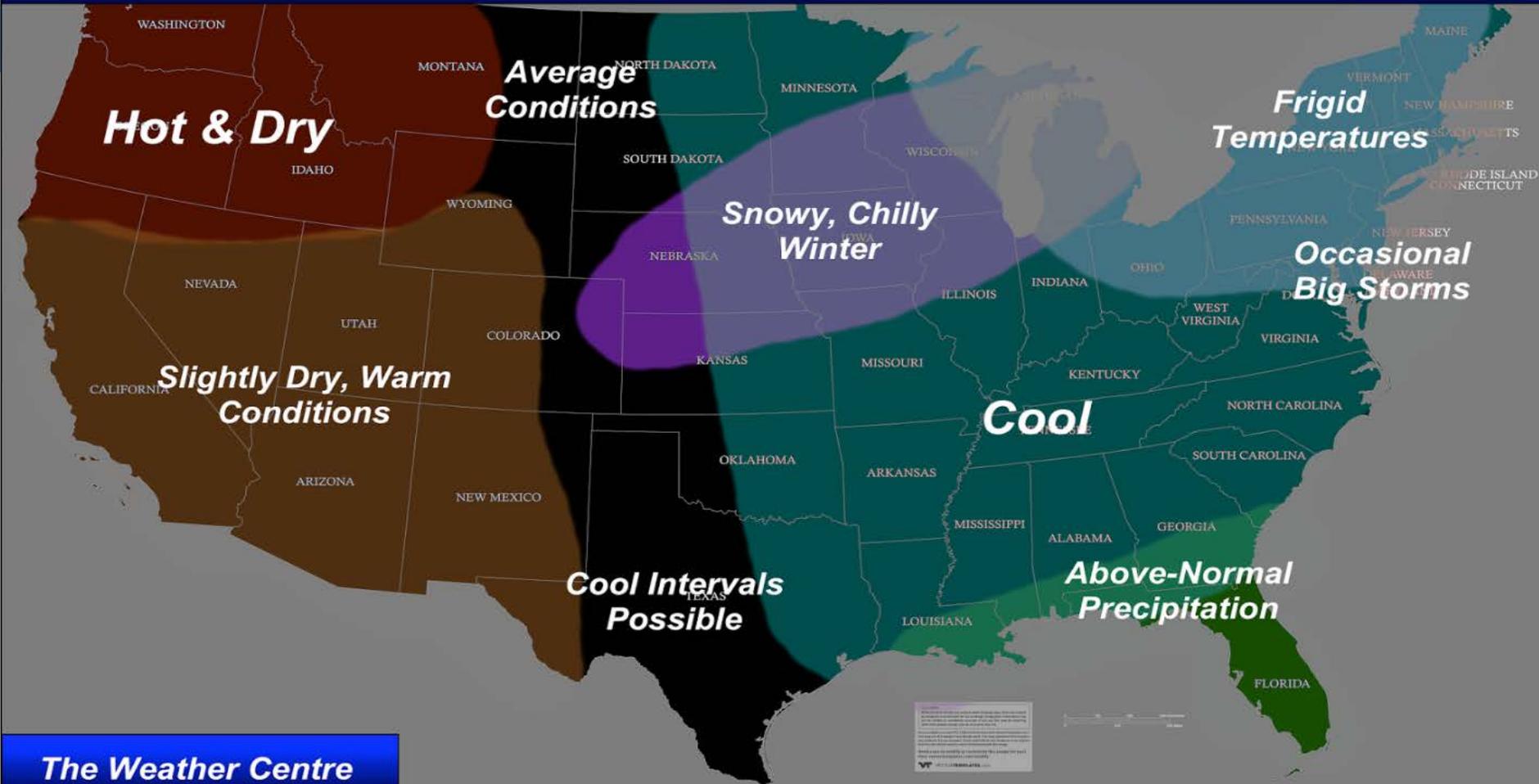
## Sea Surface Temperatures March 16, 2015

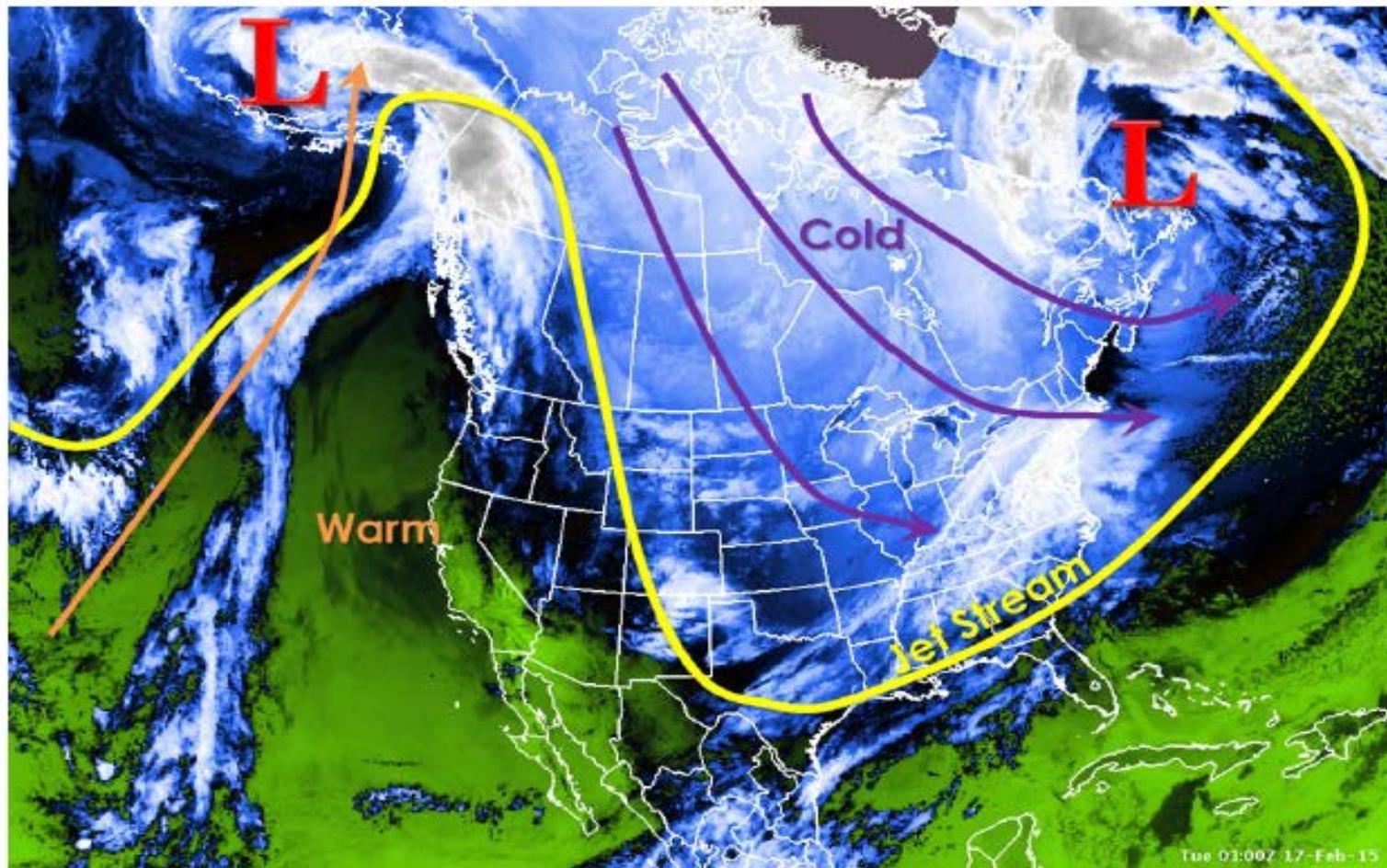
- **Warm waters off west coast: warmest in 60-70 years**
- **Flipped to positive PDO in January 2014**
- **Temperatures were ~6 F above normal, similar to Seattle's winter temperature**
- **NOAA / Clearing Up - mentioned warm waters have extended to depths of 60-100 meters – impacts of future salmon runs**





## Official 2014-2015 Winter Forecast





**From NWS:  
Example of  
winter weather  
pattern for  
2015 but also  
for most of  
2014**

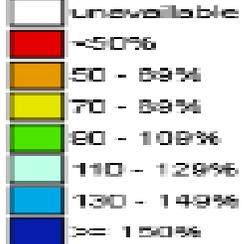
The ridge has kept our area unseasonably warm and relatively dry through early March. A few Pacific weather systems were able to punch through, but precipitation totals for January through the first part of March were less than 50% of normal across most of southwest Idaho and southeast Oregon, and less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

# SNOTEL Mountain Precipitation Water Year to Date: Jan 15, 2015

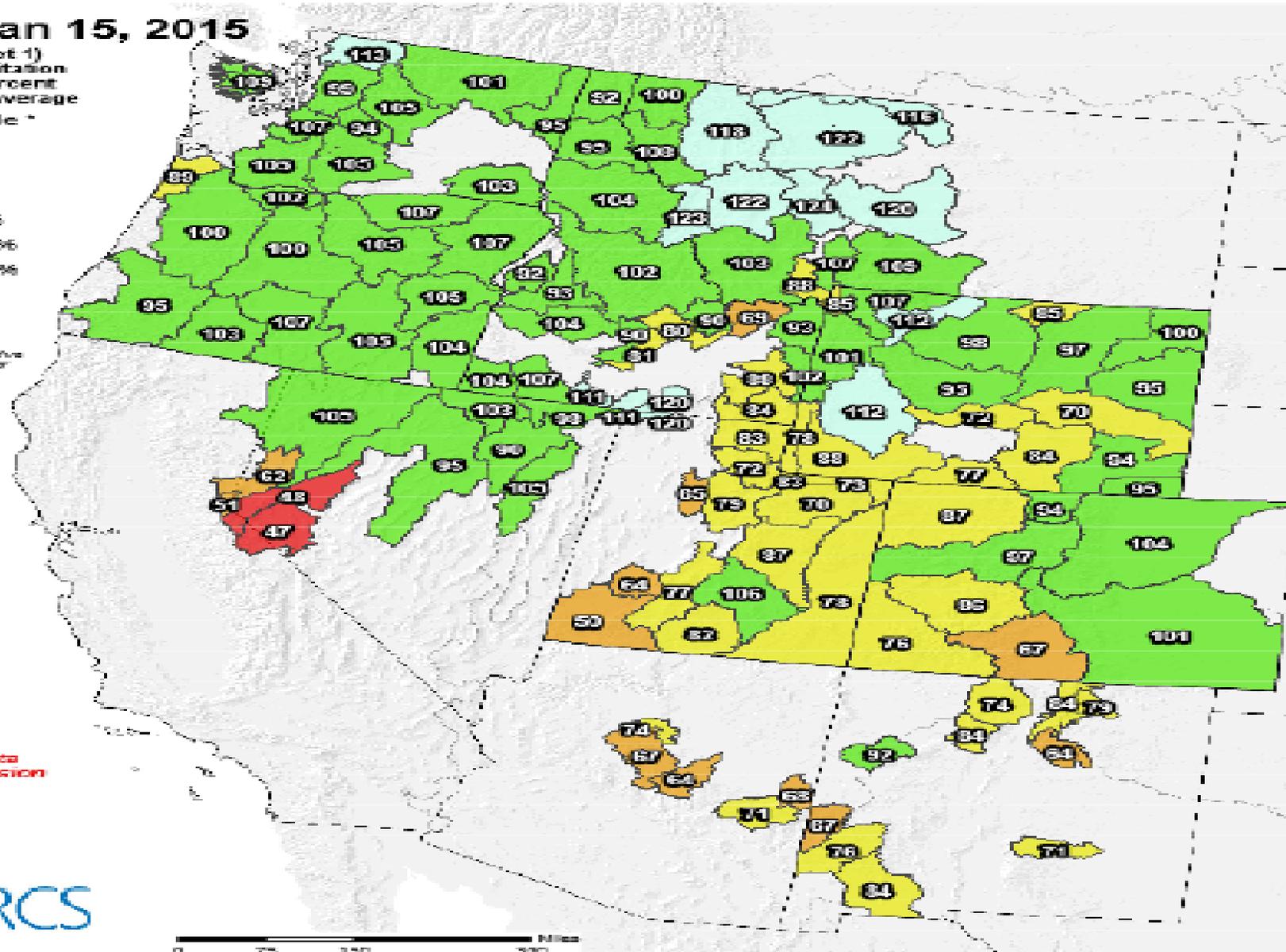
## Westwide SNOTEL Water Year (Oct 1) to Date Precipitation % of Normal

Jan 15, 2015

Water Year (Oct 1)  
to Date Precipitation  
Basin-wide Percent  
of 1981-2010 Average



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



Provisional data  
subject to revision



The water year to date precipitation percent of normal represents the accumulated precipitation found at selected SNOTEL sites in or near the basin compared to the average value for those sites in this data. Data based on

Prepared by:  
USDA/NRCS National Water and Climate Center  
Bozeman, Oregon

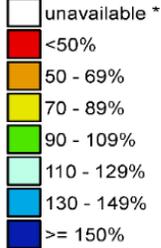
Normal or  
better across  
PNW

NOT a  
Precipitation  
Drought

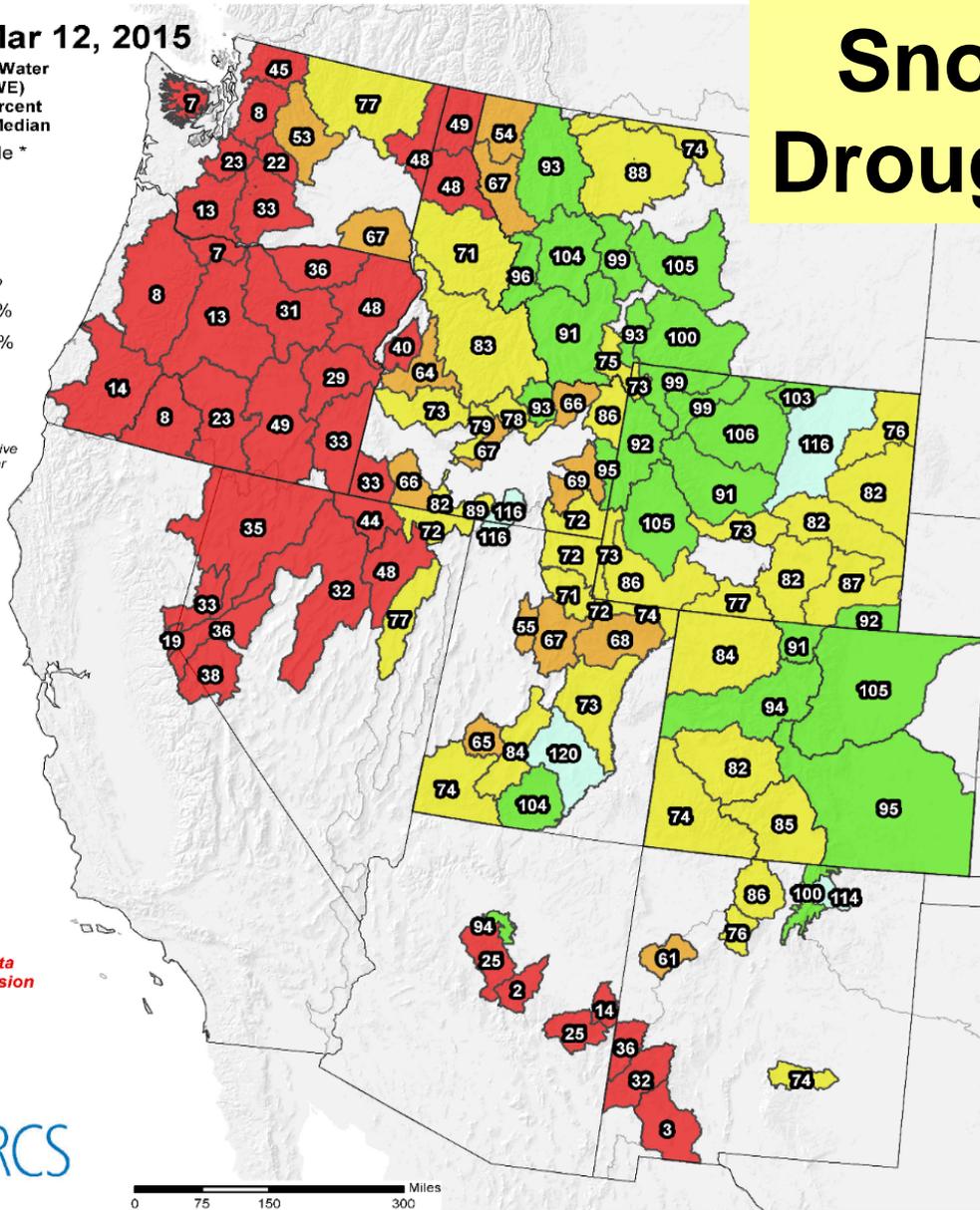
Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Mar 12, 2015

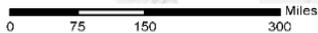
Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median



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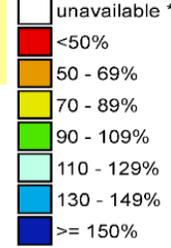
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

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

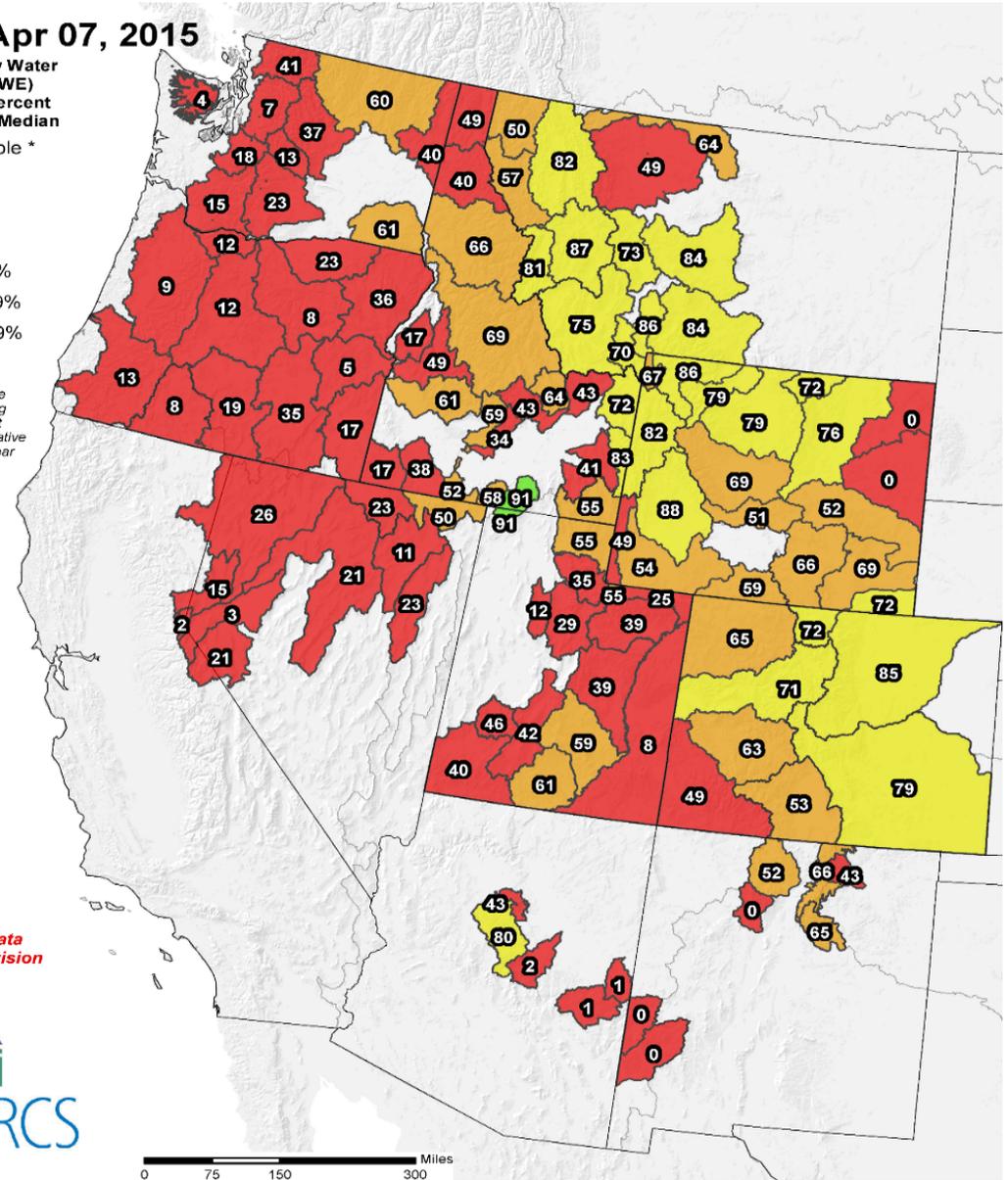
Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Apr 07, 2015

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median



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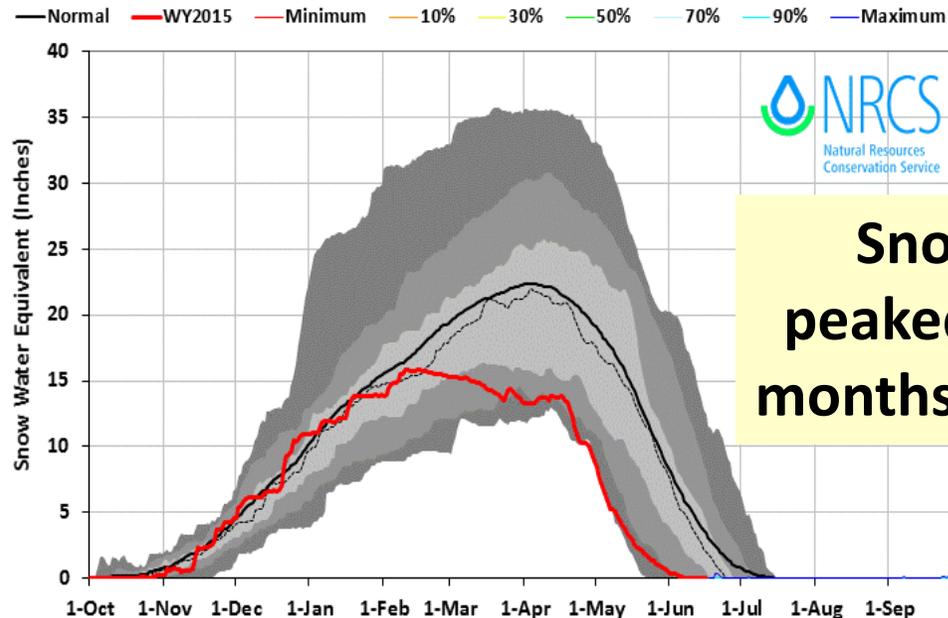
Prepared by:  
USDA/NRCS National Water and Climate Center  
Portland, Oregon  
<http://www.wcc.nrcs.usda.gov>

**Boise Basin 2015 Snow Water with Non-Exceedence Projections (10 sites)**

*Based on Provisional SNOTEL data as of Jun 16, 2015*

# Recap of Last Winter

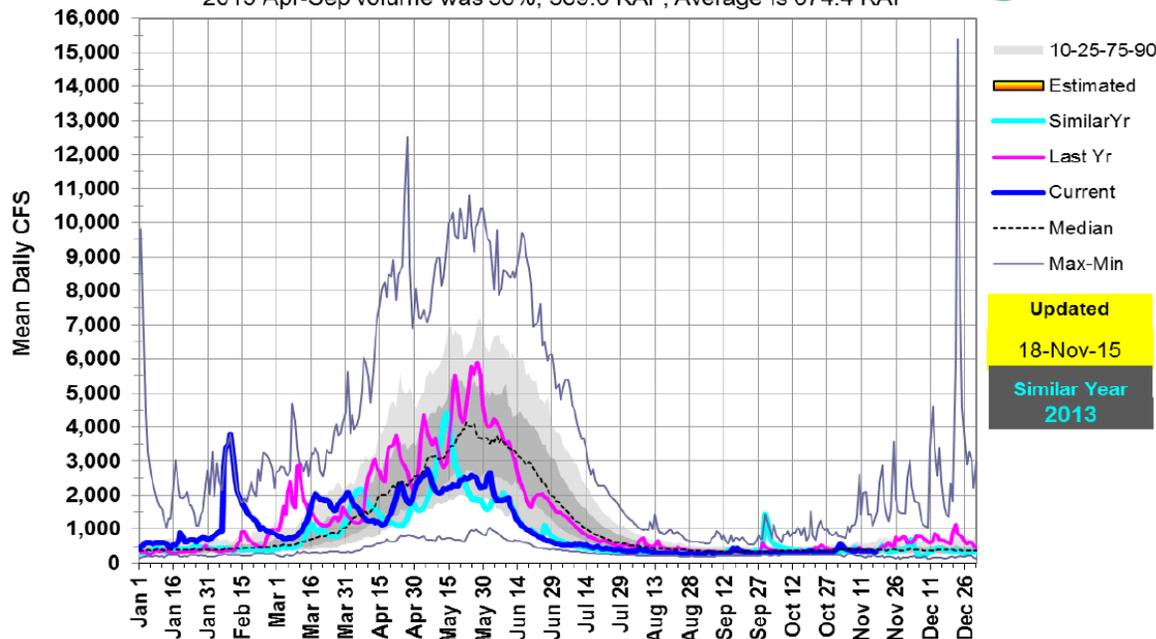
**Rain is good but snow is better**



**Snow peaked 1-2 months early**

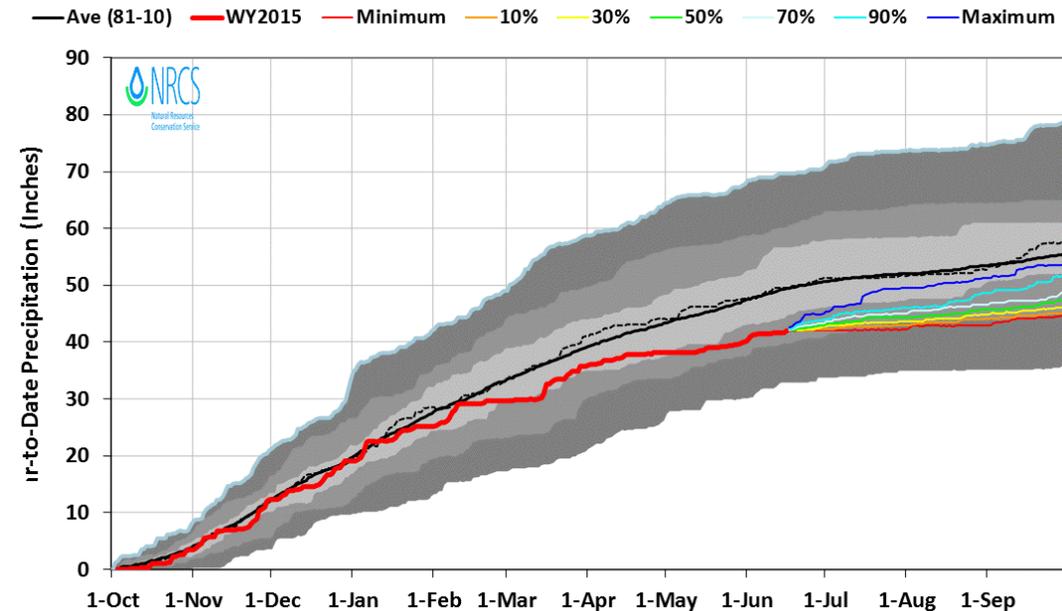
**13185000: Boise R near Twin Springs, ID**

2013 Apr-Sep volume was 58%, 389.6 KAF, Average is 674.4 KAF



**Spokane Basin 2015 Precipitation with Non-Exceedence Projections (9 sites)**

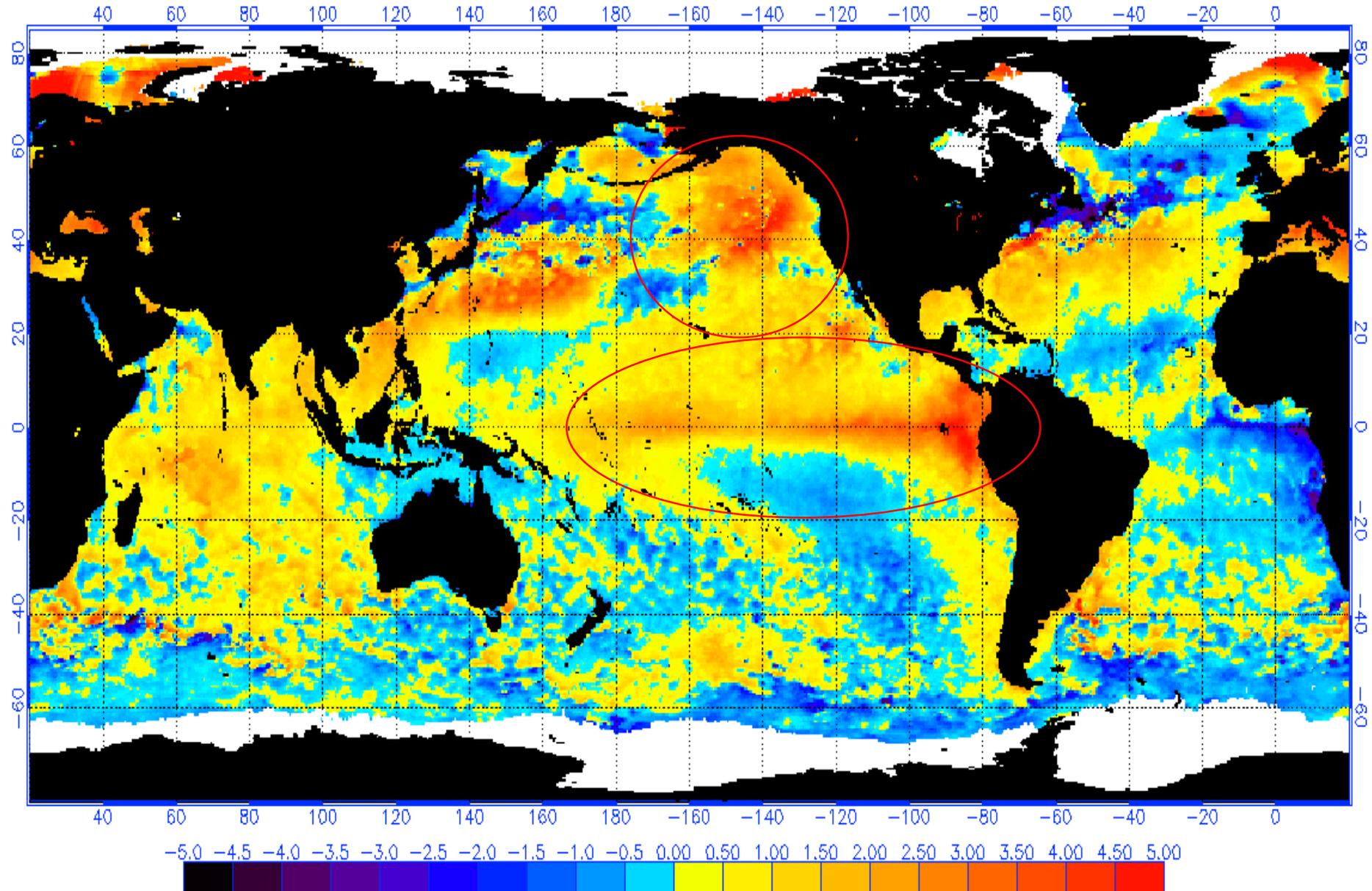
*Based on Provisional SNOTEL data as of Jun 16, 2015*



**Snowmelt peak flows were low and early, with an early return to base flows, especially northern Idaho & Owyhee basin**

# Sea Surface Temperatures June 15, 2015 – Strong El Nino Building

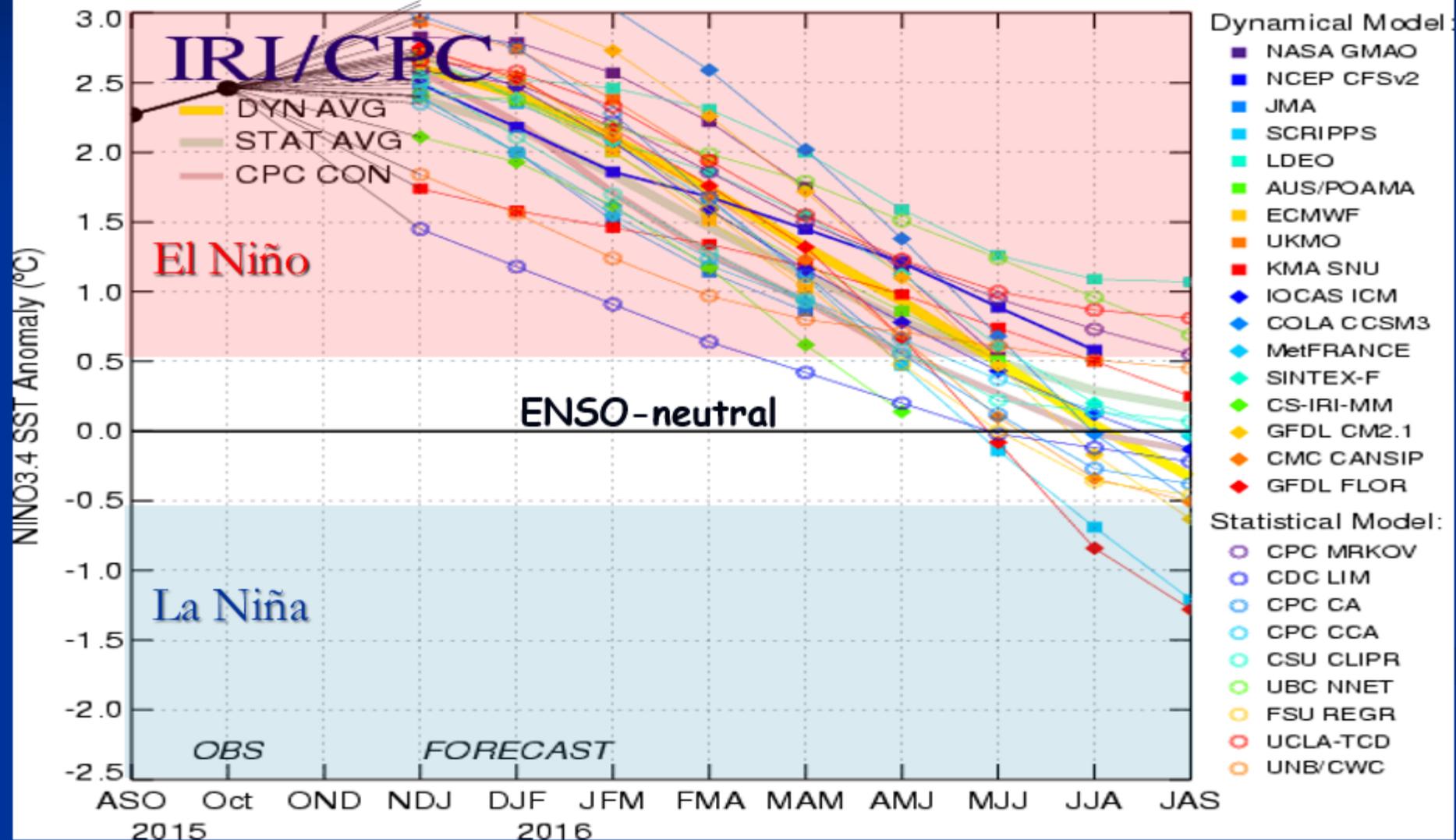
NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 6/15/2015  
(white regions indicate sea-ice)



# ENSO Predictive Models

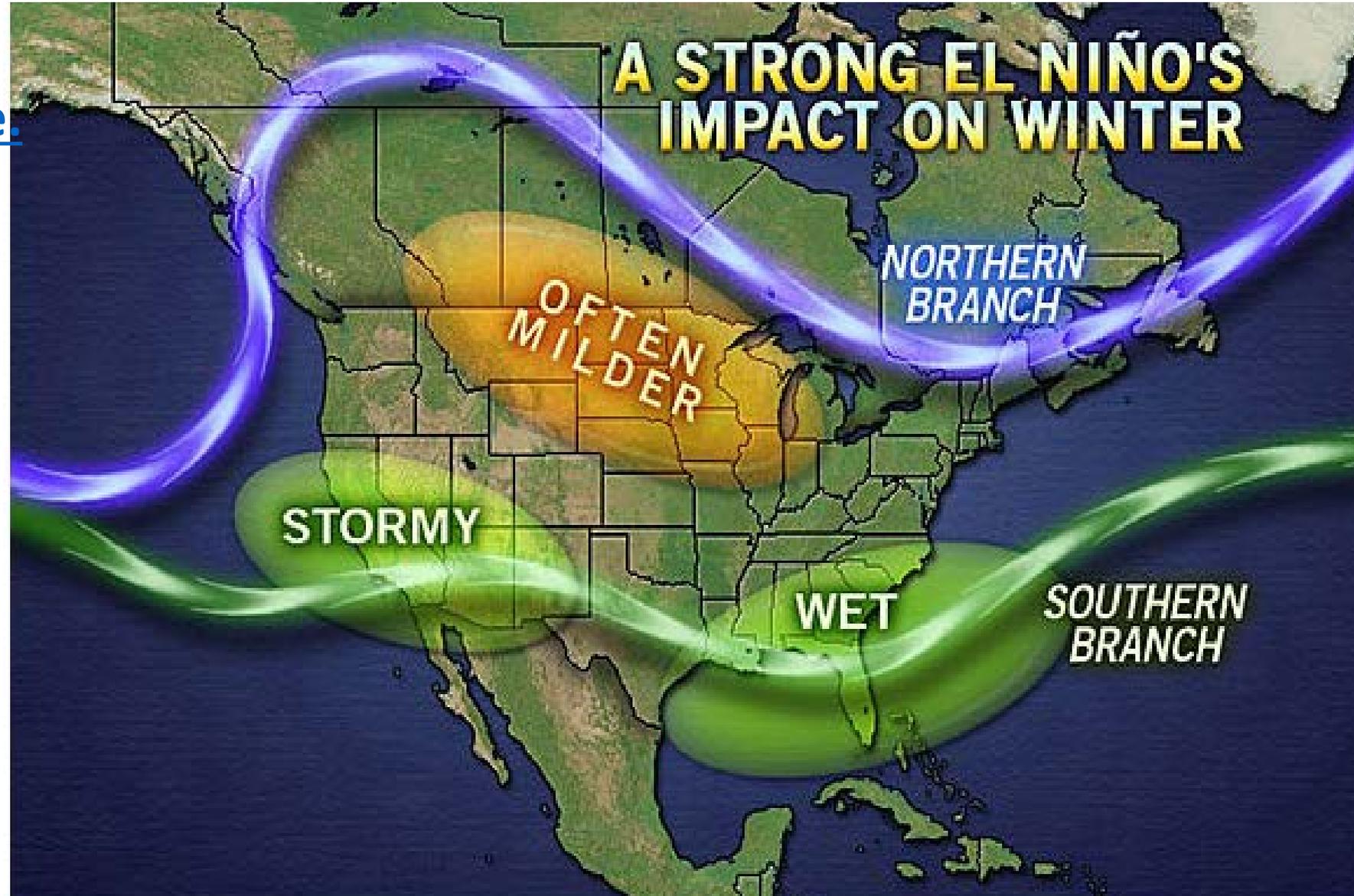
El Niño should peak this winter and weaken this spring...

Mid-Nov 2015 Plume of Model ENSO Predictions



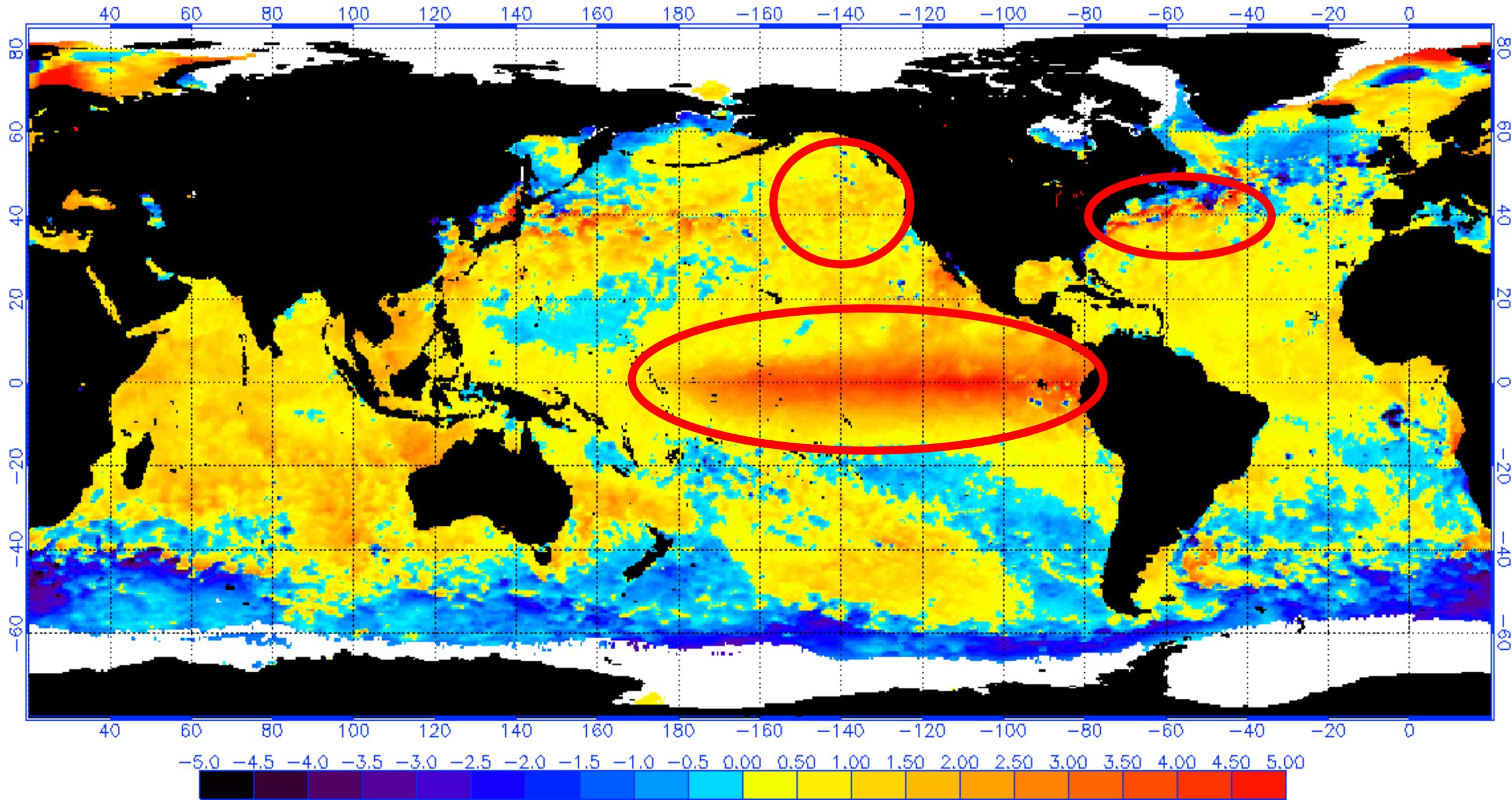
- This pattern resembles a modified Strong El Nino pattern, and could stick around for the winter months.

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

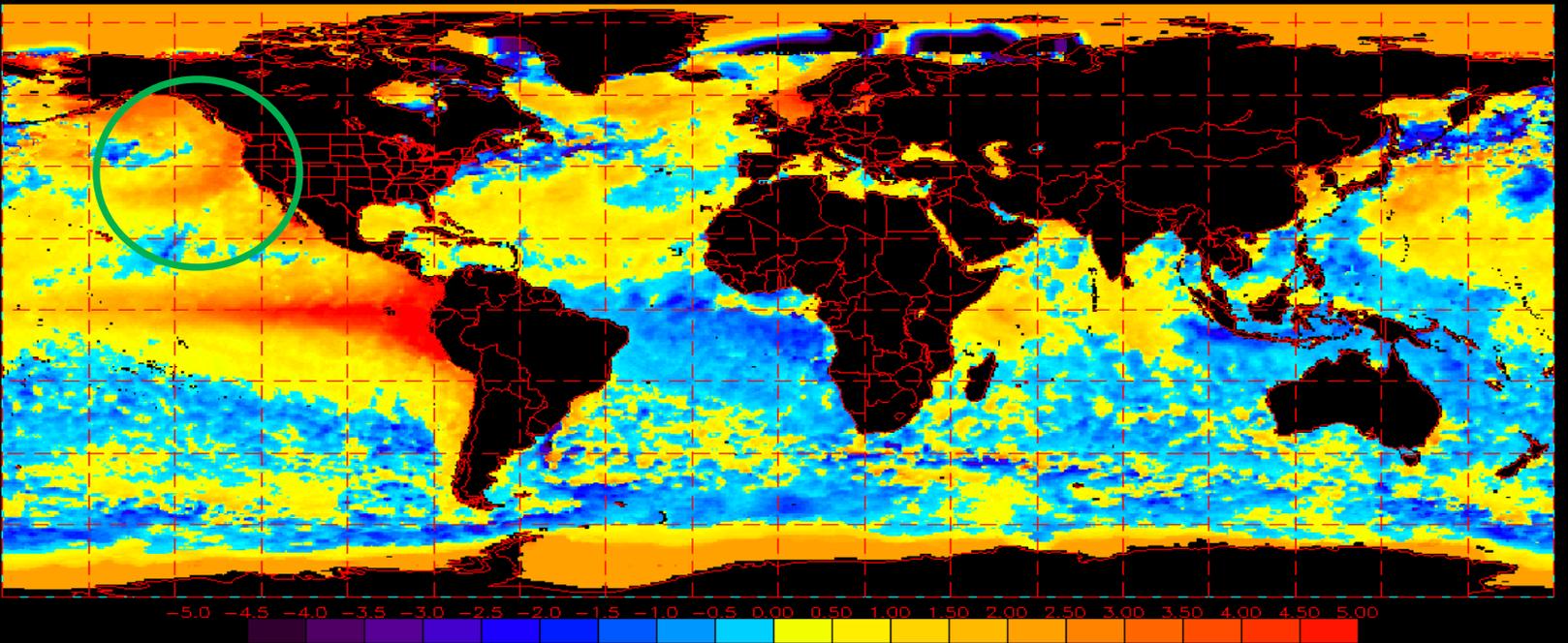


NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 11/30/2015  
(white regions indicate sea-ice)

**Nov 30 2015**

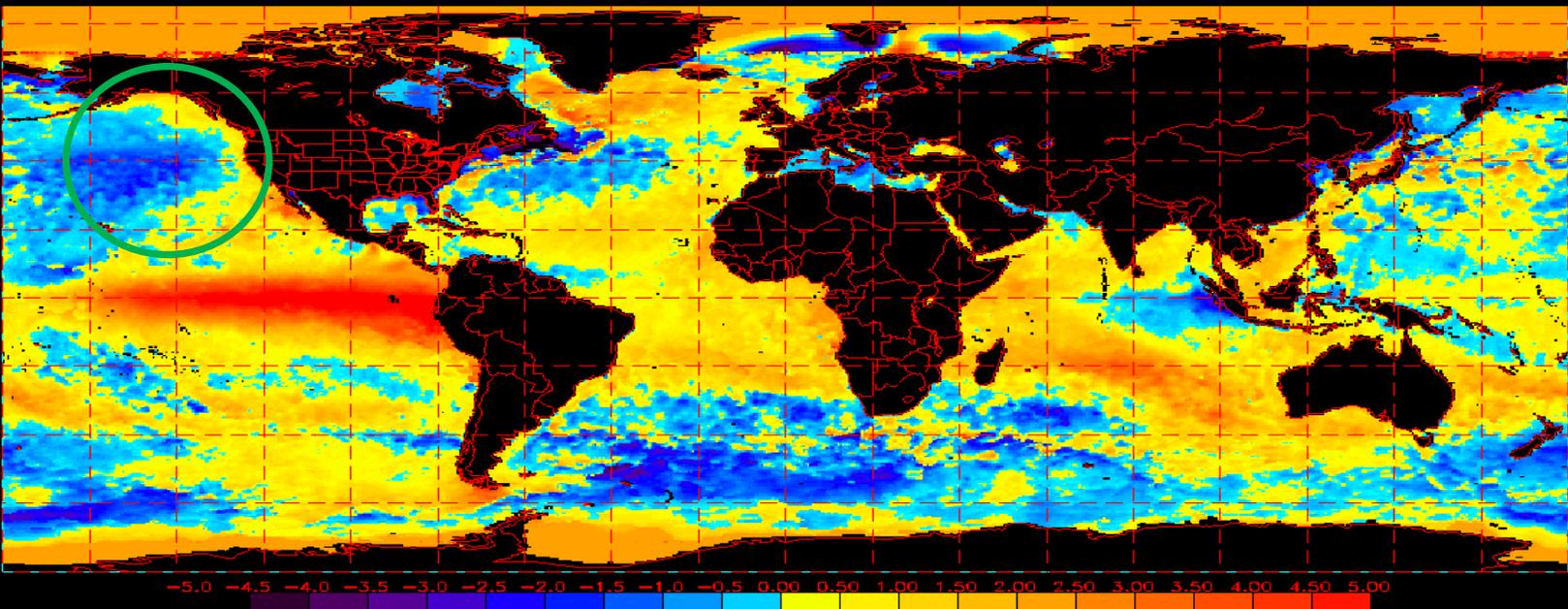


**Sea Surface Temperature for Aug 8, 1997**  
**A strong El Nino**



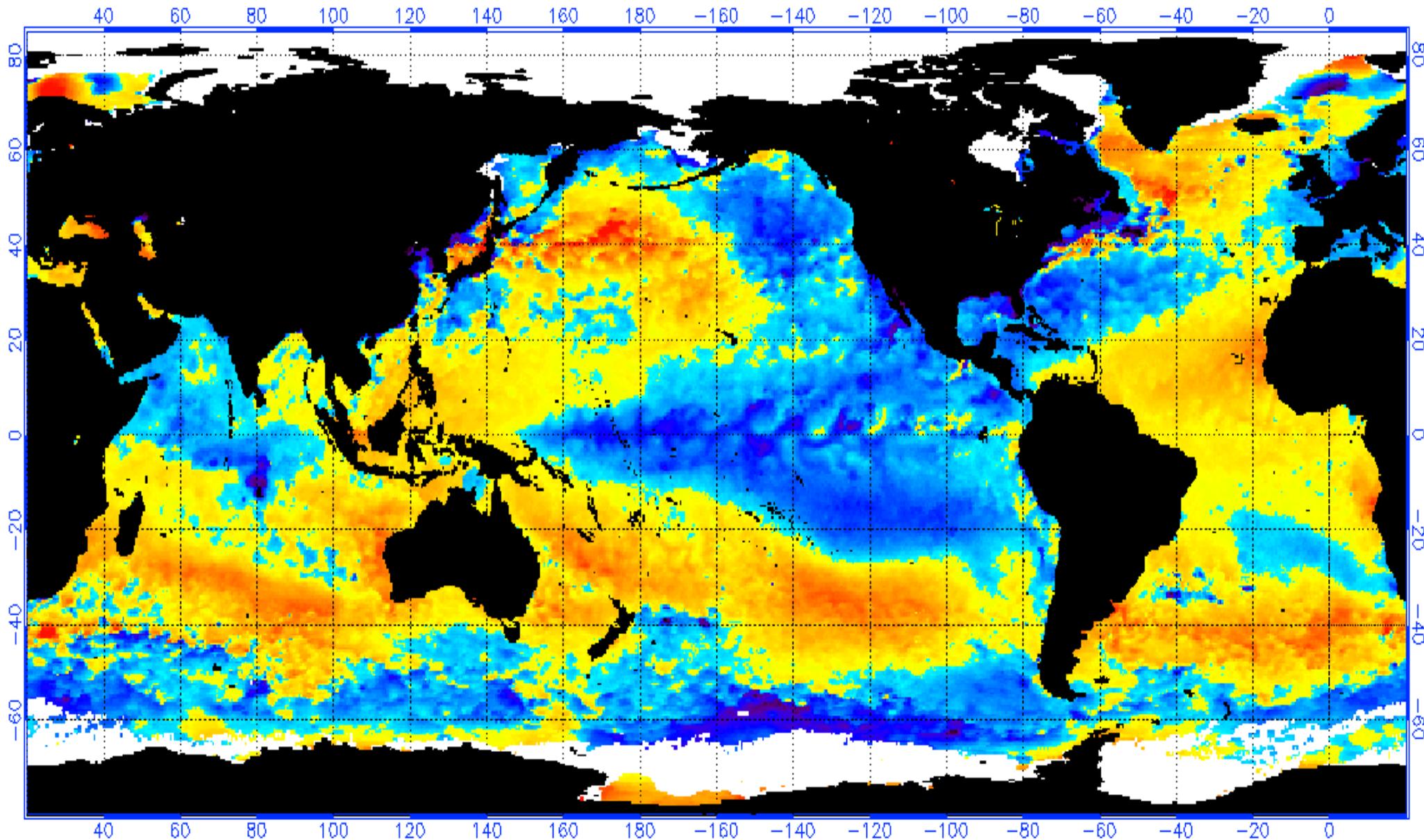
**SST Anomaly Notes:**  
**9 DEC 1997 ....**

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



NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 1/3/2011

(white regions indicate sea-ice)



**Jan 3, 2011**

**Winter  
2010-11**

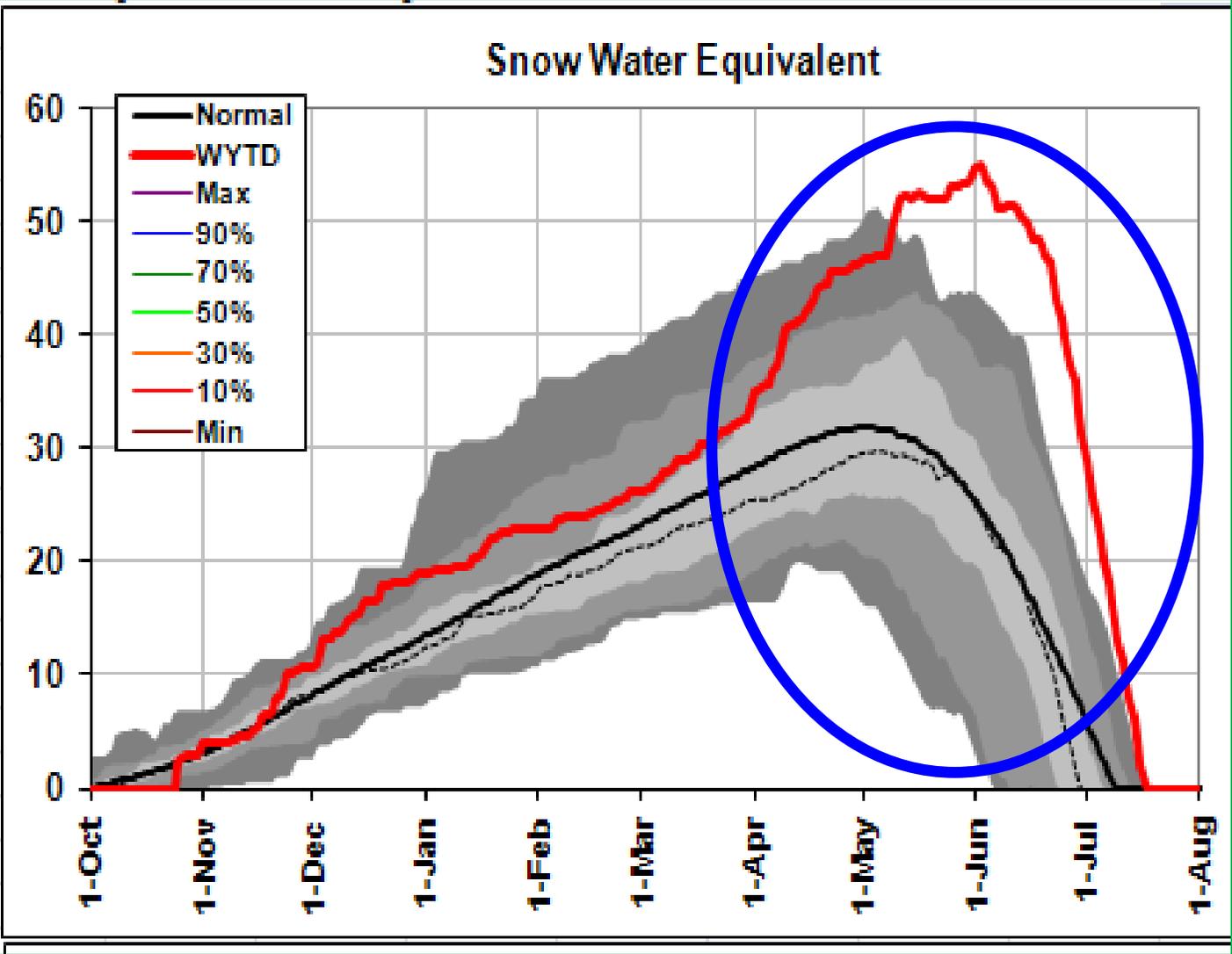
**Cool PDO  
Strong La  
Nina**

- How the Climate Indices set up each year determines the storm track
- Good example is 2011 strong La Nina, strongest La Nina since 1974

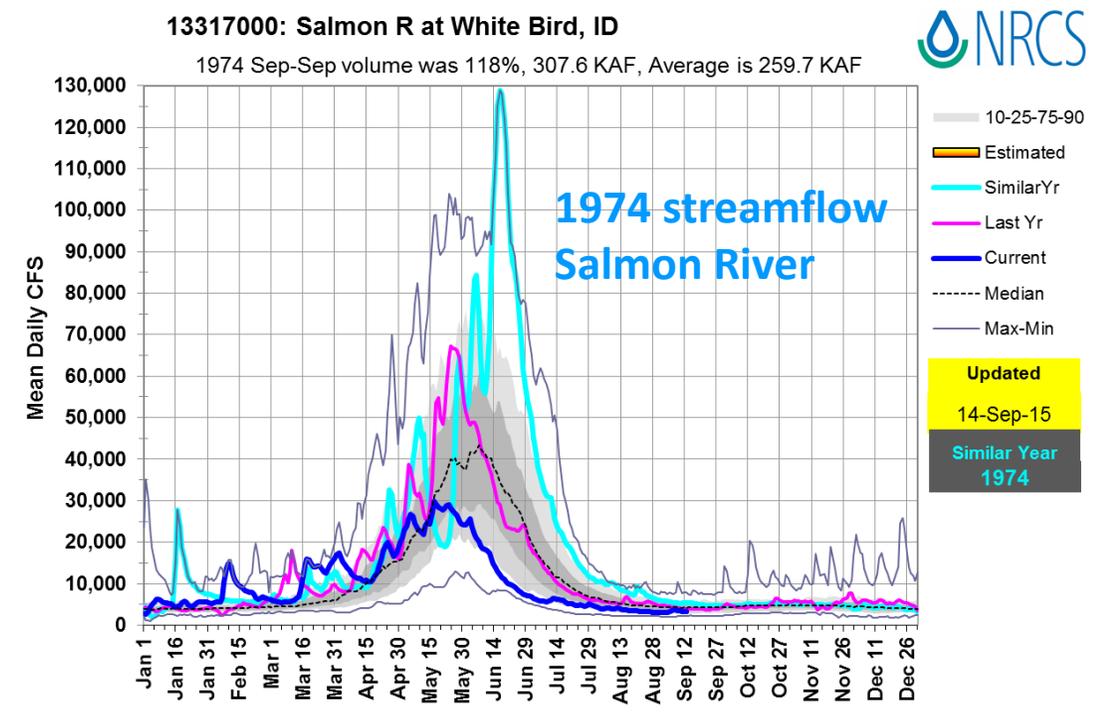
1974 was last strong La Nina and deposited an April 1 snowpack of 172% of median in Salmon River basin

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

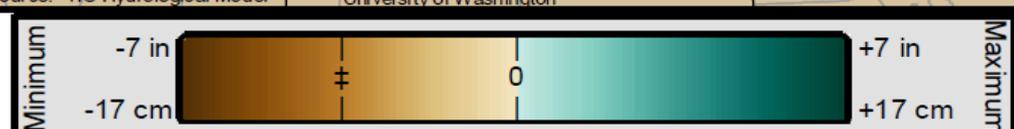
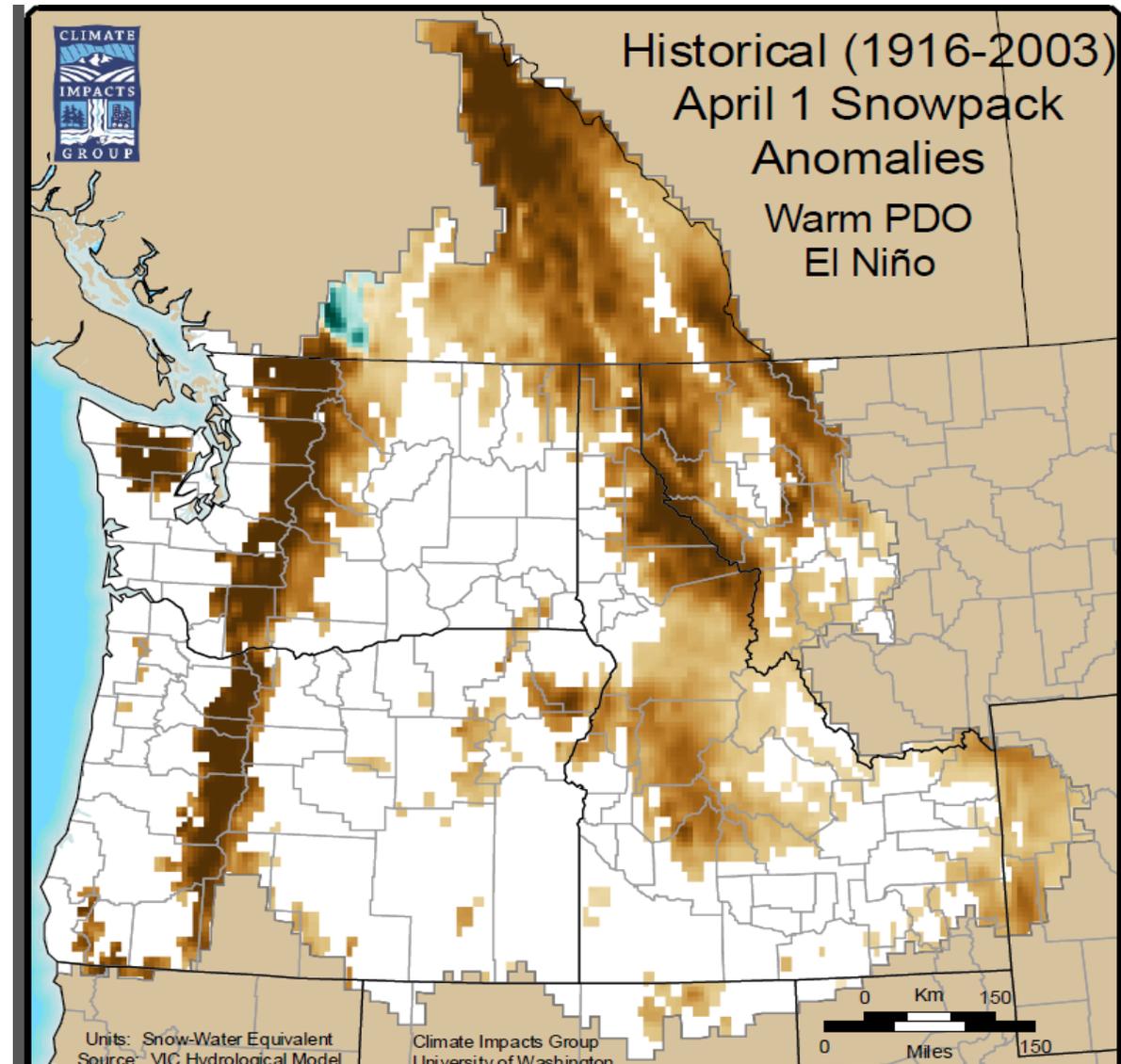
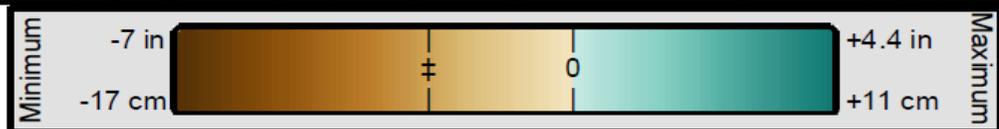
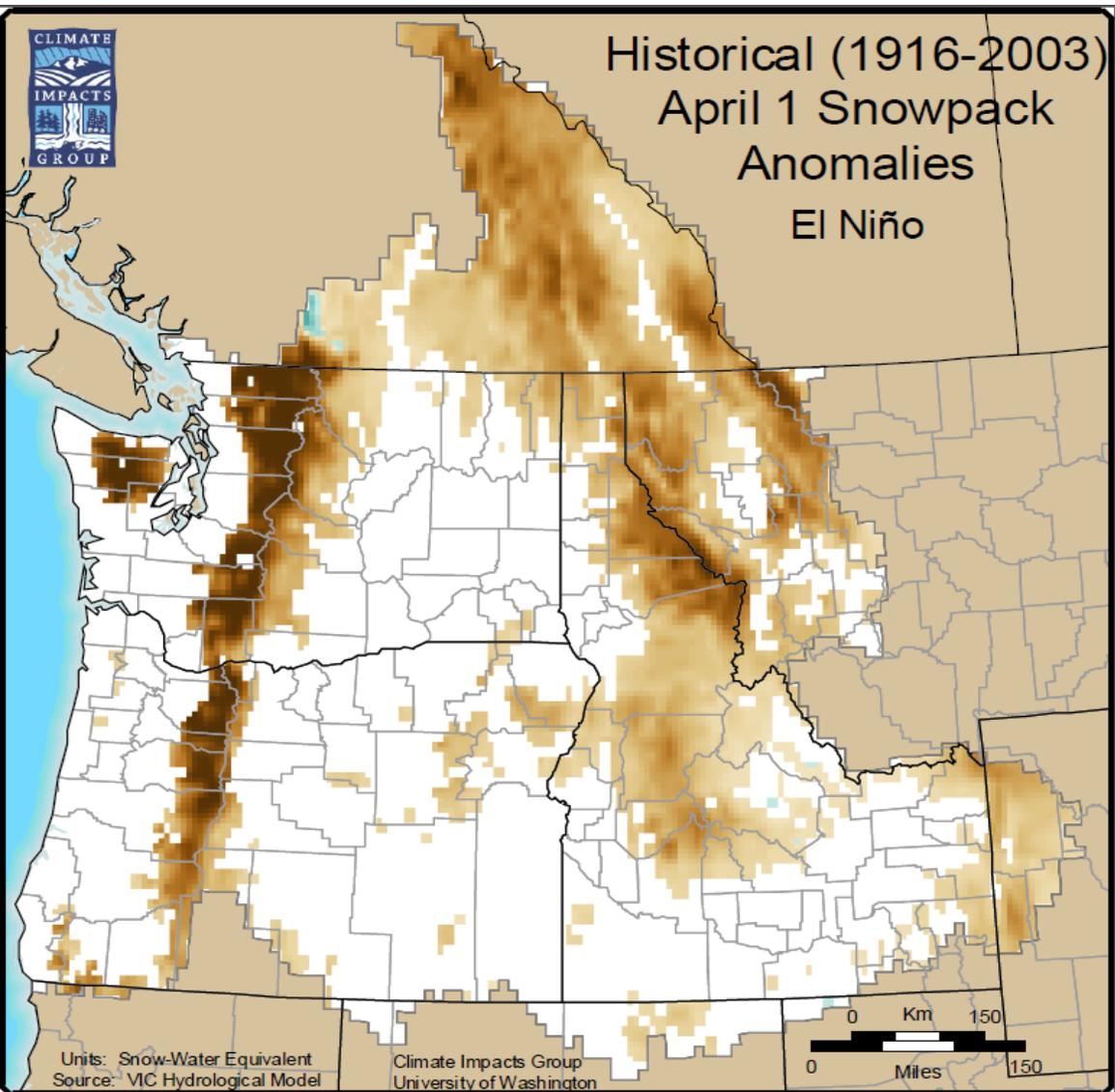
**Each event sets up different**



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



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



# Rule #1

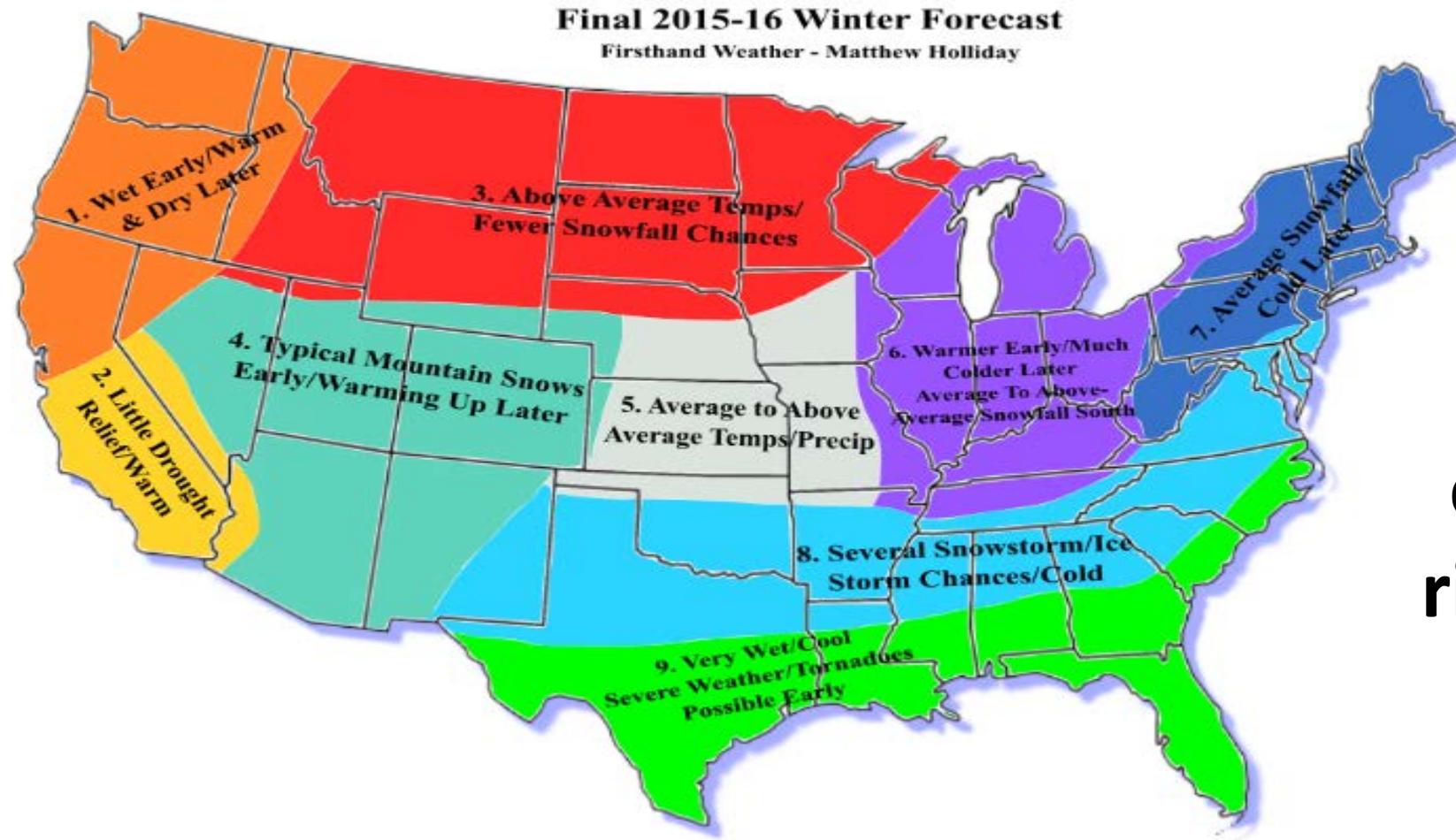
- **Don't believe the 1<sup>st</sup> forecast you hear**
- **Wait until you hear the Same or Similar forecast from two or more of your unrelated sources**



# 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.

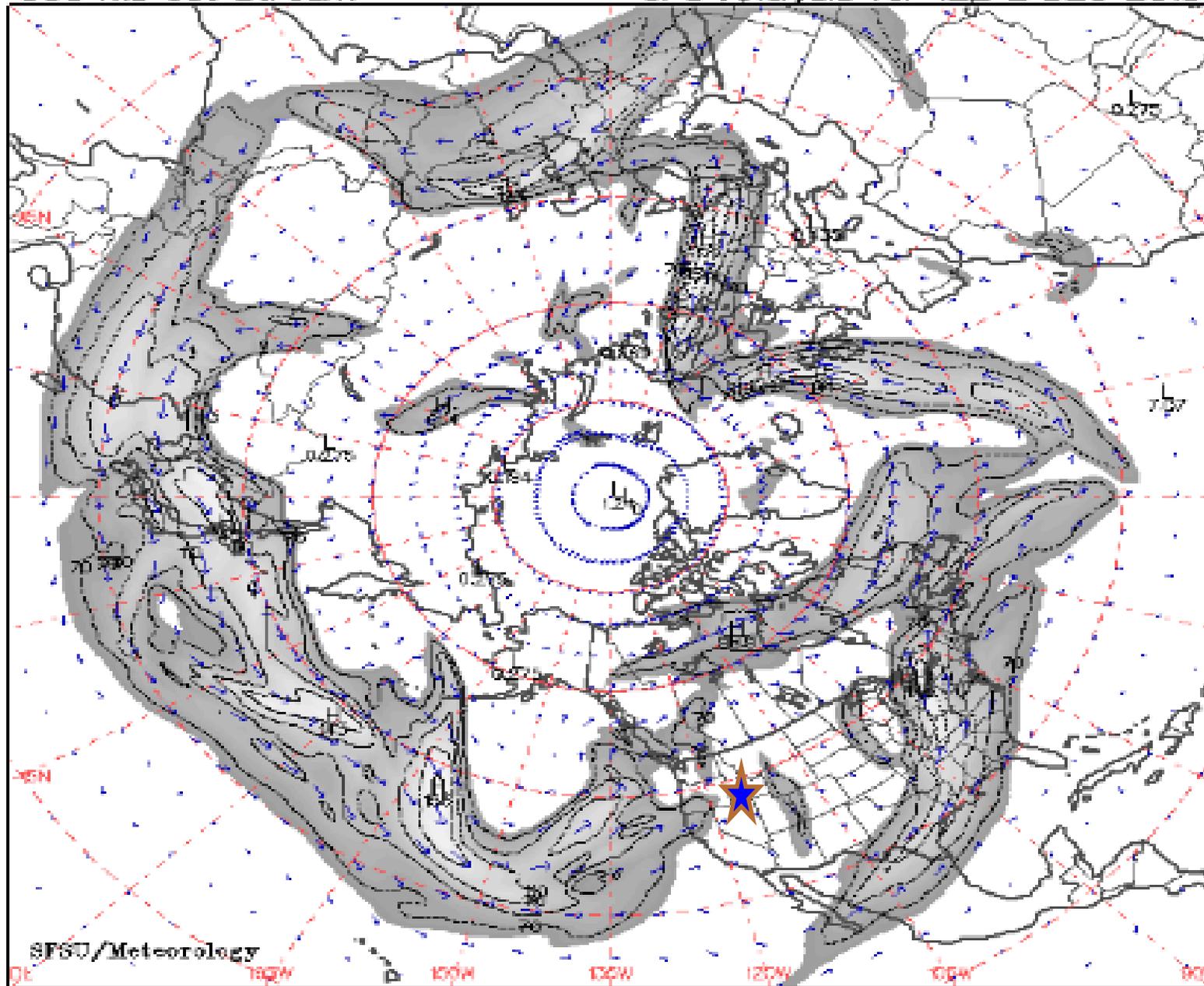
**Decoded Science - Weather Around The World, 7/28:  
Heat, Local And Worldwide; El Niño; Monsoon; Tropics  
July 28, 2015 by [Jon Plotkin](#)**

**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.**

300 mb Jet Stream

GFS Analysis for 12Z 2 DEC 2015

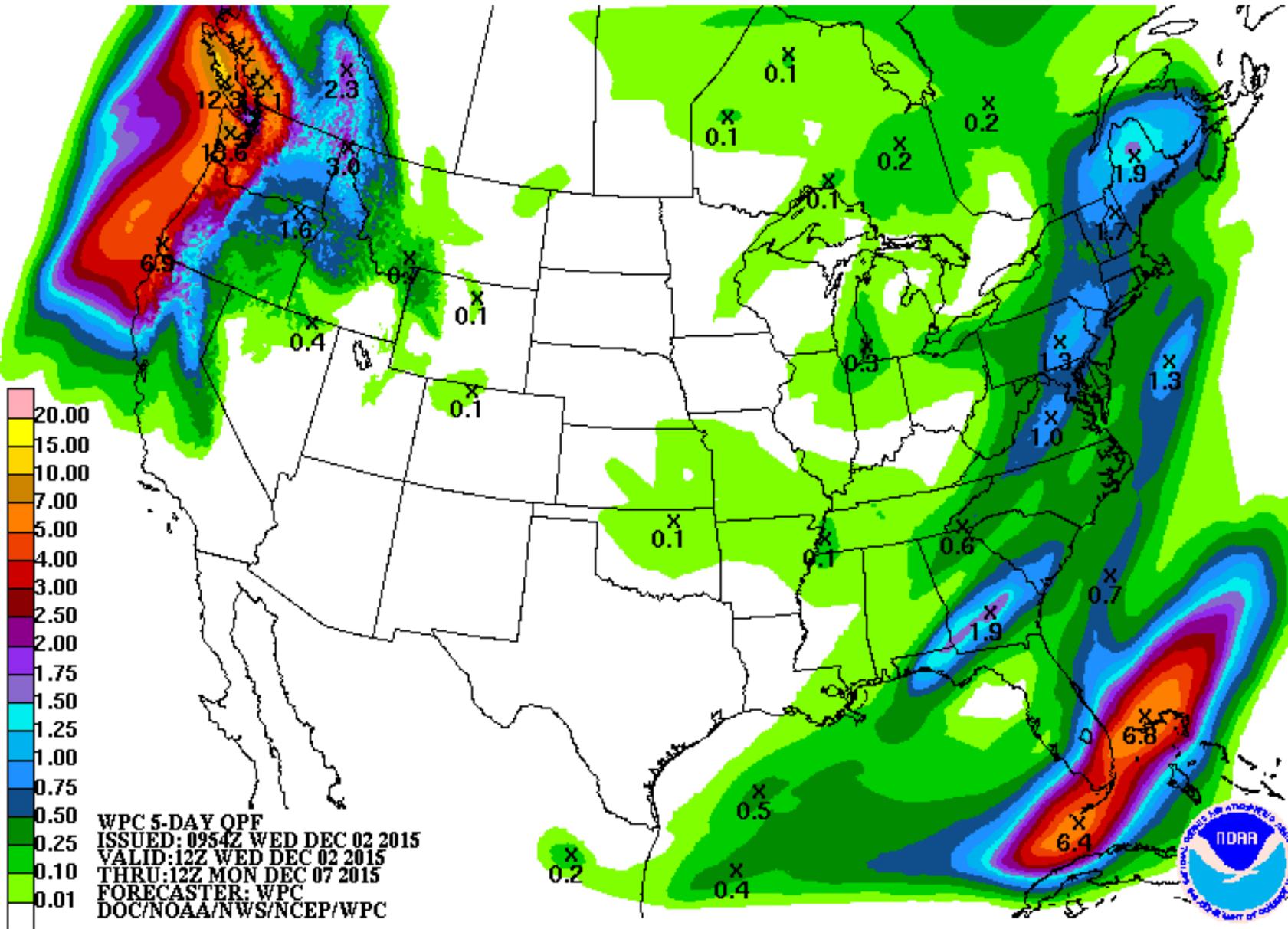


SFSU/Meteorology

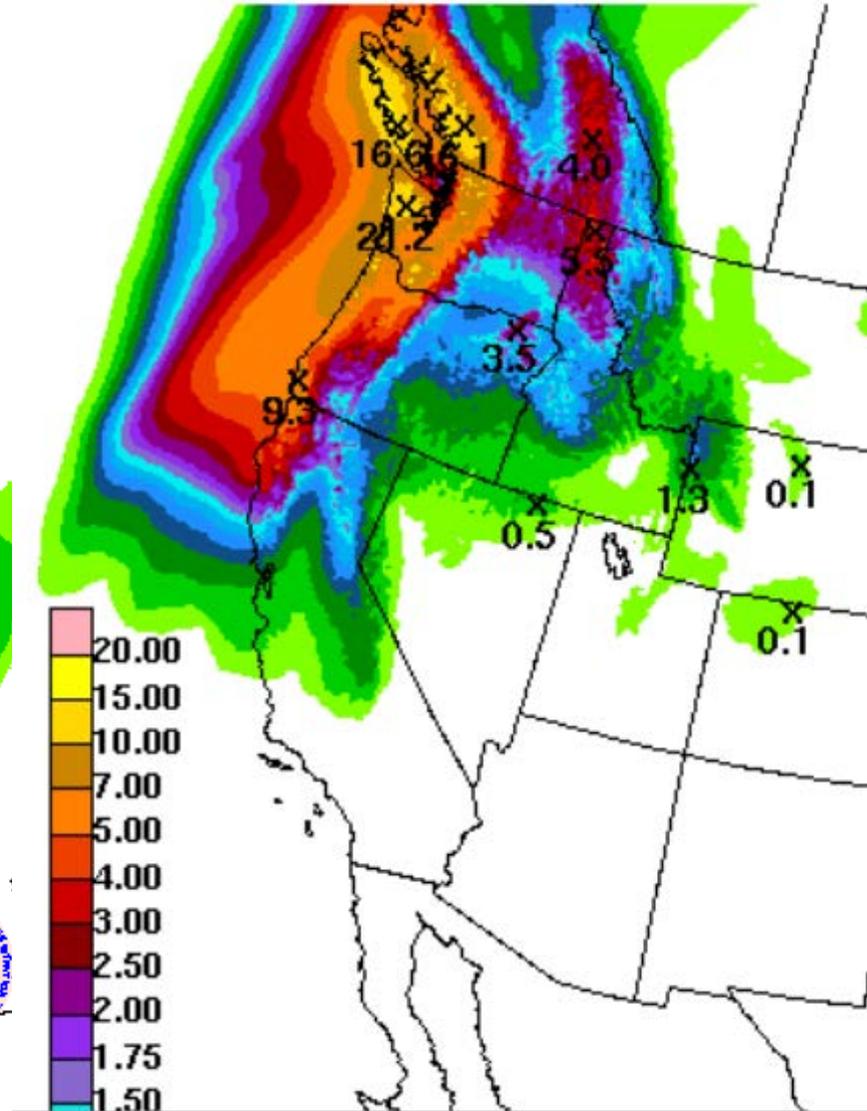


Wind Spd: knots 12Z 2 DEC 2015

# 5 Day Total Precipitation Forecast Dec 2 – 7



# 7 Day Total Precipitation Forecast Dec 2 – 9!



## Precipitation Forecasts

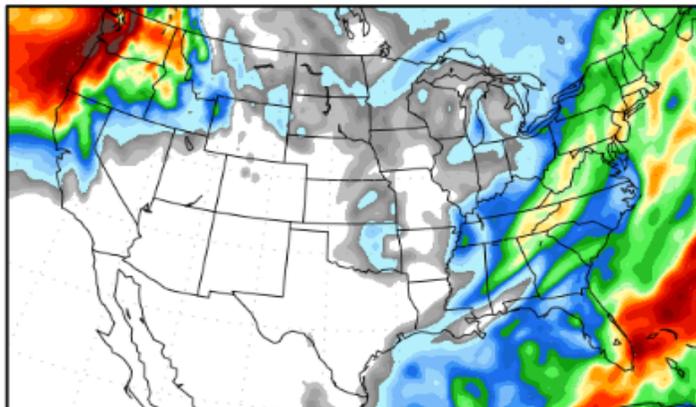
Precipitation (in)  
during the period:

Wed, 02 DEC 2015 at 00Z

-to-

Thu, 10 DEC 2015 at 00Z

**Total Precip  
Dec 2 – 10**

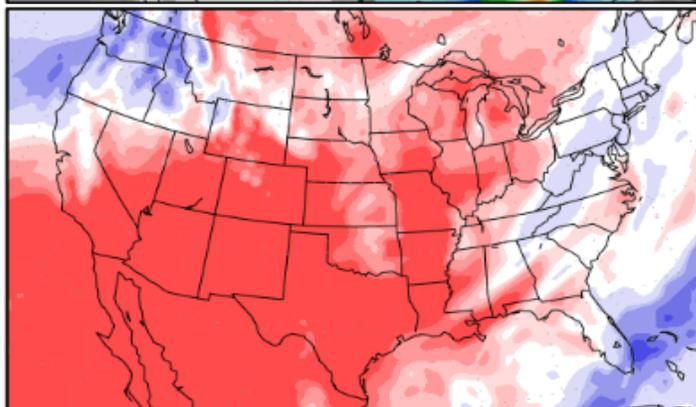
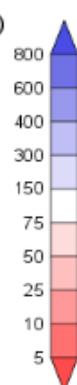


Thu, 10 DEC 2015 at 00Z

-to-

Fri, 18 DEC 2015 at 00Z

**Total Precip  
Dec 10 – 18**



Precipitation forecasts from the National Centers for Environmental Prediction.  
Normal rainfall derived from Xie-Arkin (CMAP) Monthly Climatology for 1979-2003.  
Forecast Initialization Time: 00Z02DEC2015

## Temperature Forecasts

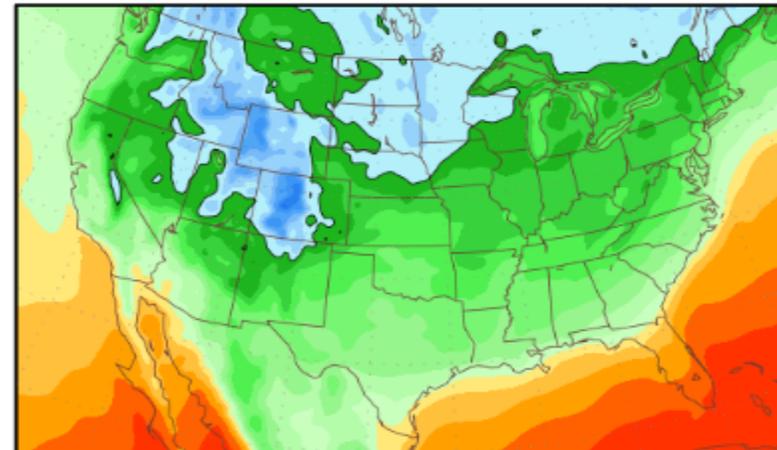
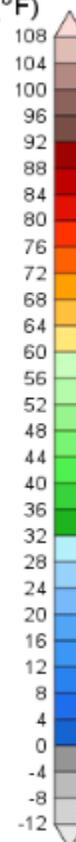
Mean Surface Temperature (°F)  
during the period:

Wed, 02 DEC 2015 at 00Z

-to-

Thu, 10 DEC 2015 at 00Z

**Mean Temps  
Dec 2 – 10**

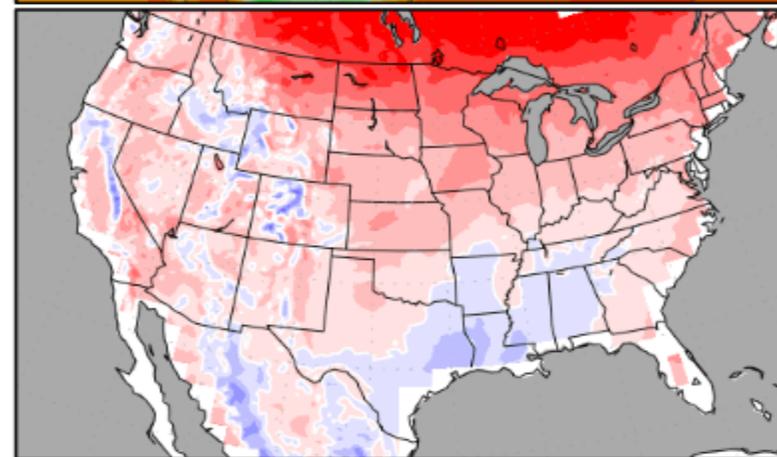
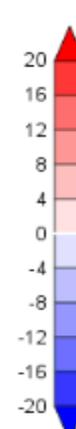


Thu, 10 DEC 2015 at 00Z

-to-

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**Mean Temps  
Dec 2 – 18**



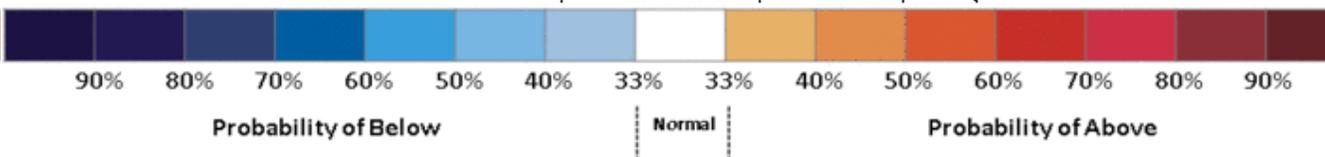
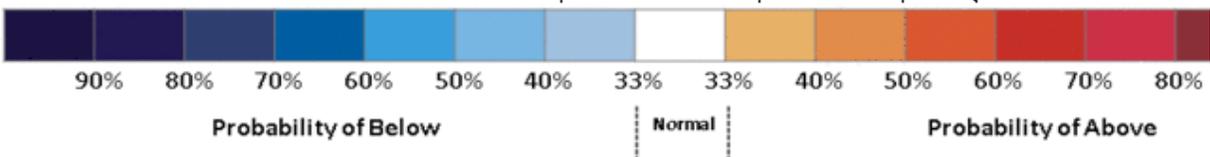
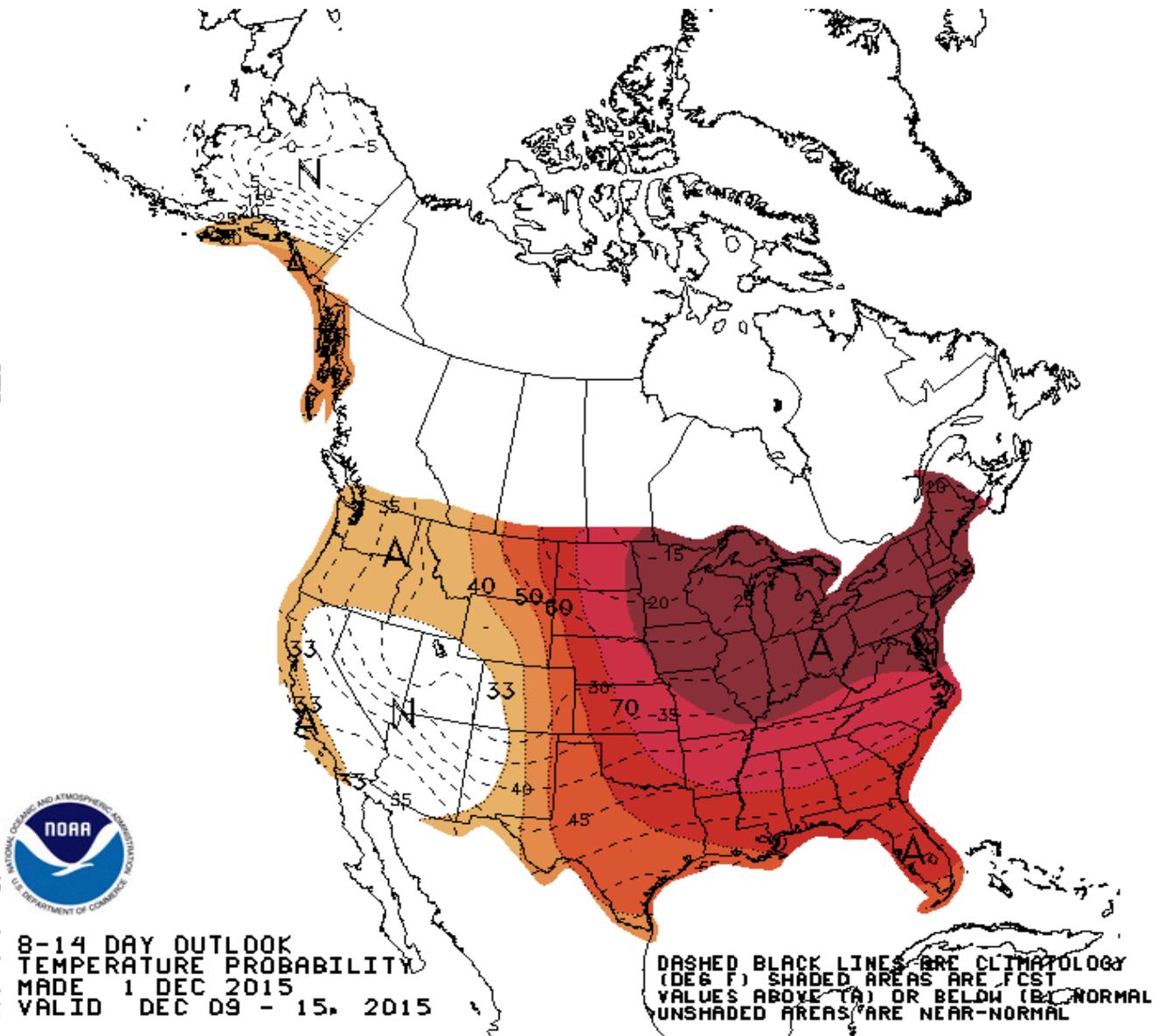
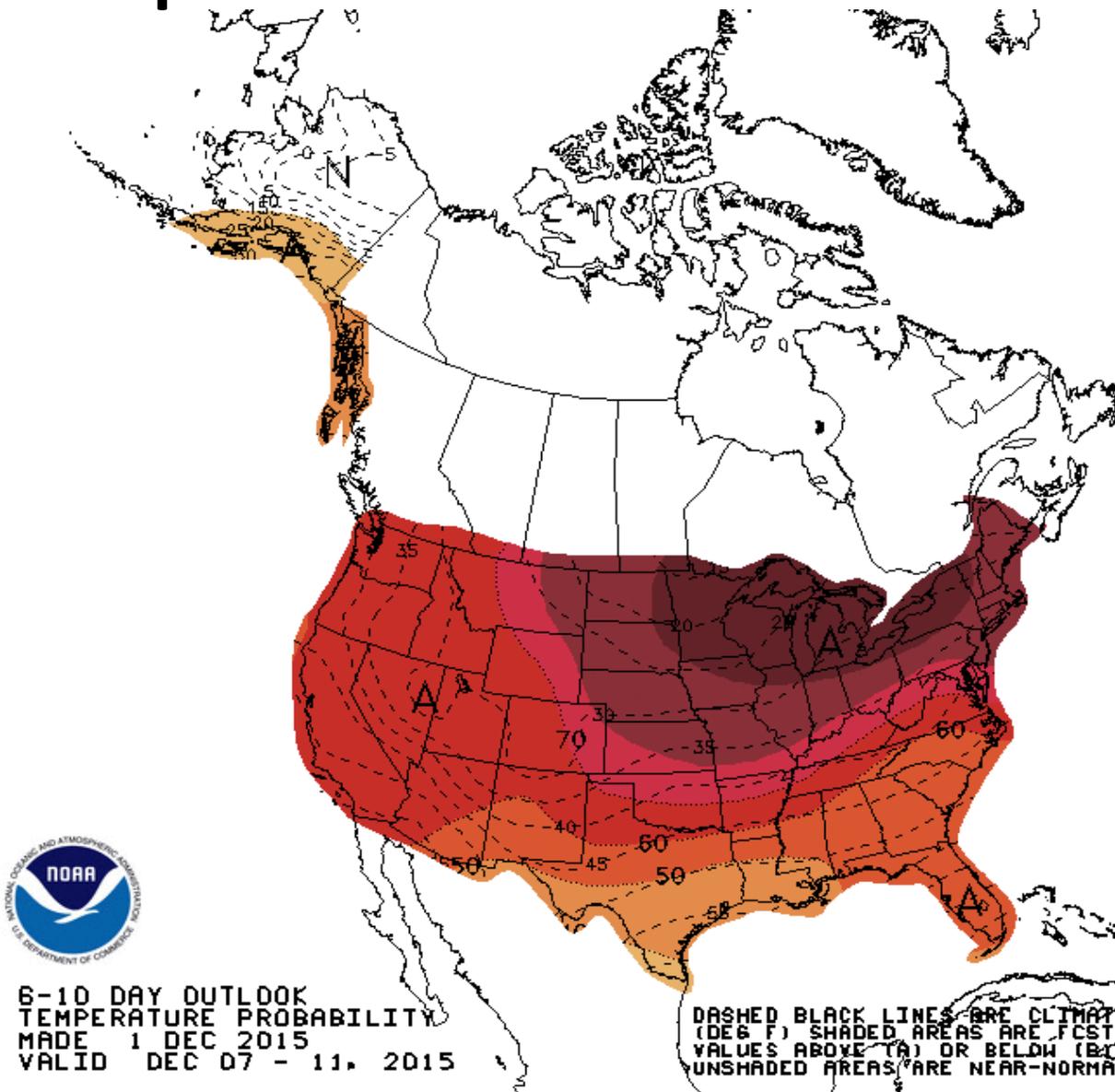
Temperature Anomaly  
during the first period:

Wed, 02 DEC 2015 at 00Z

-to-

Thu, 10 DEC 2015 at 00Z

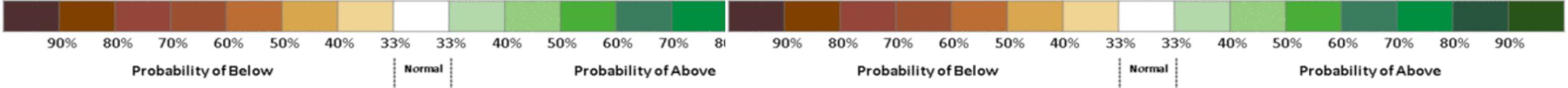
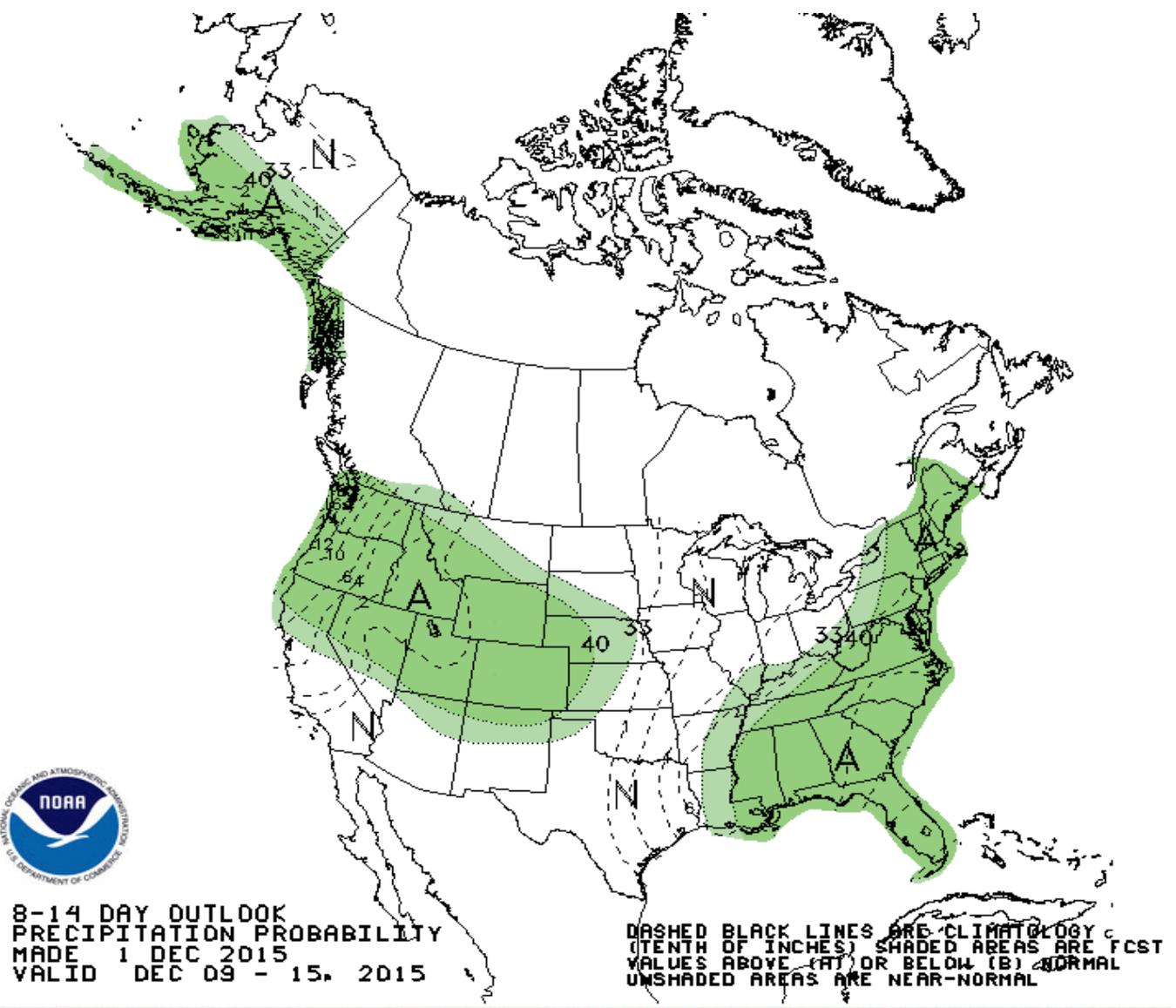
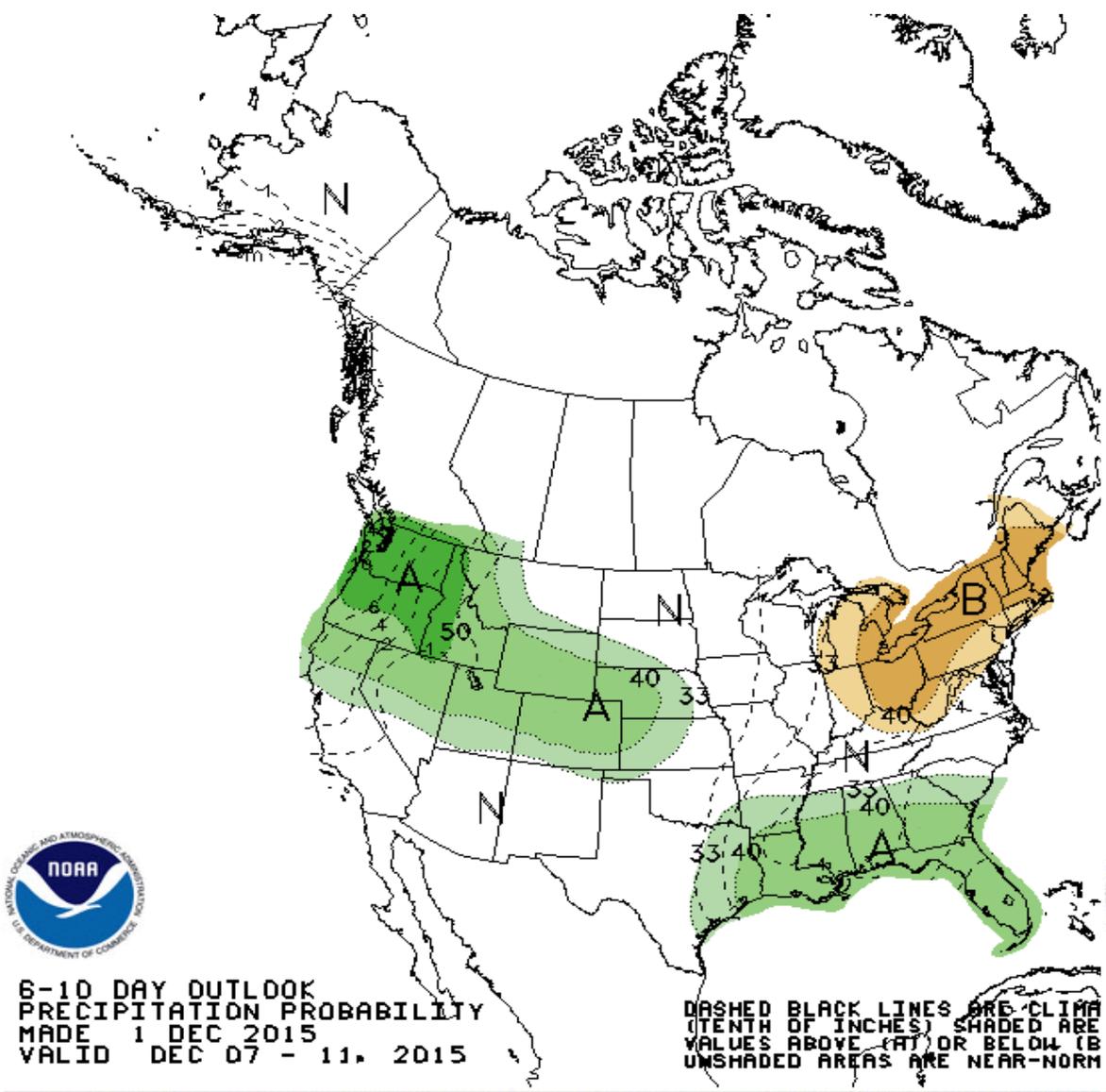
# Temperature Forecast for Dec 7 – 11 ..... and Dec 9- 15



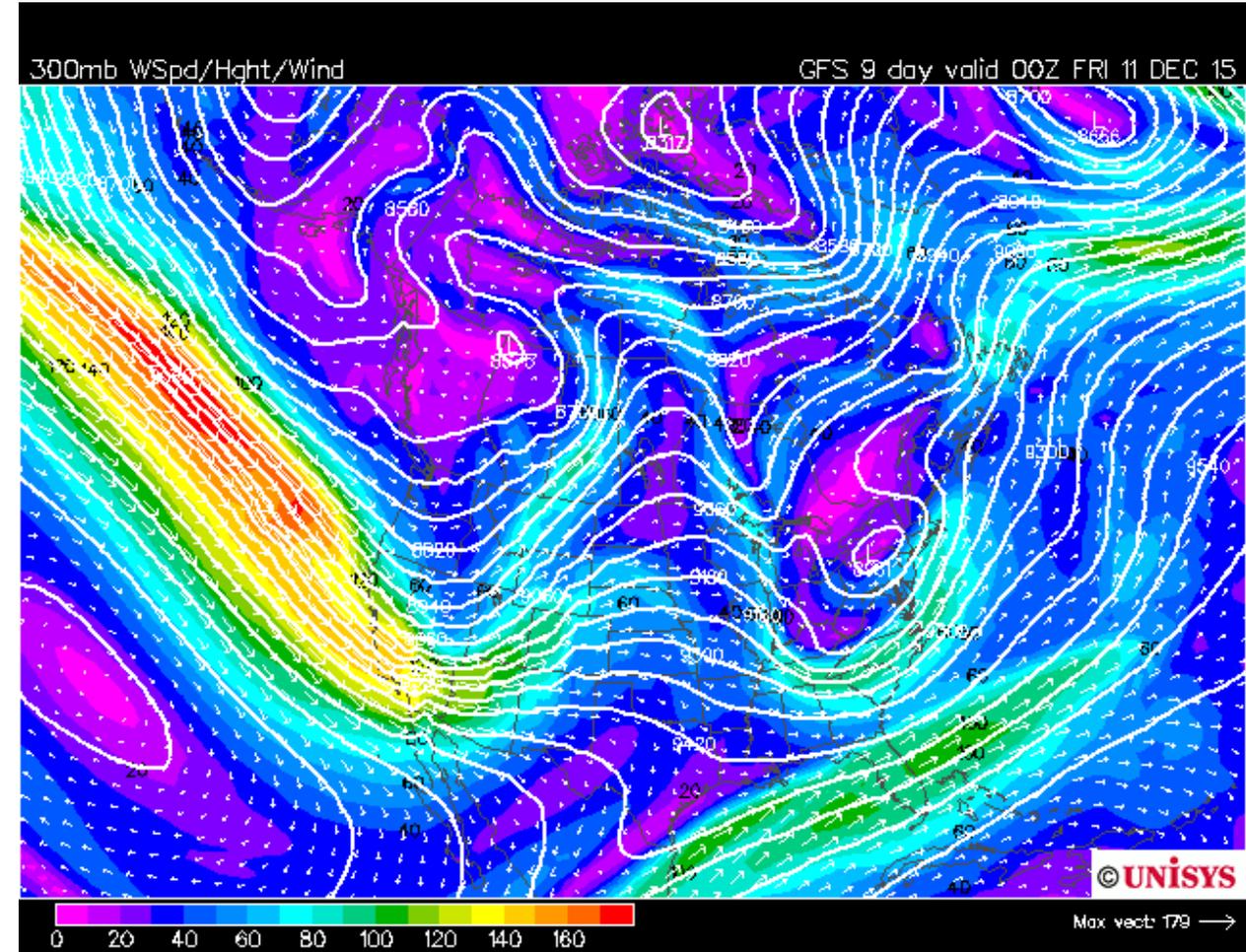
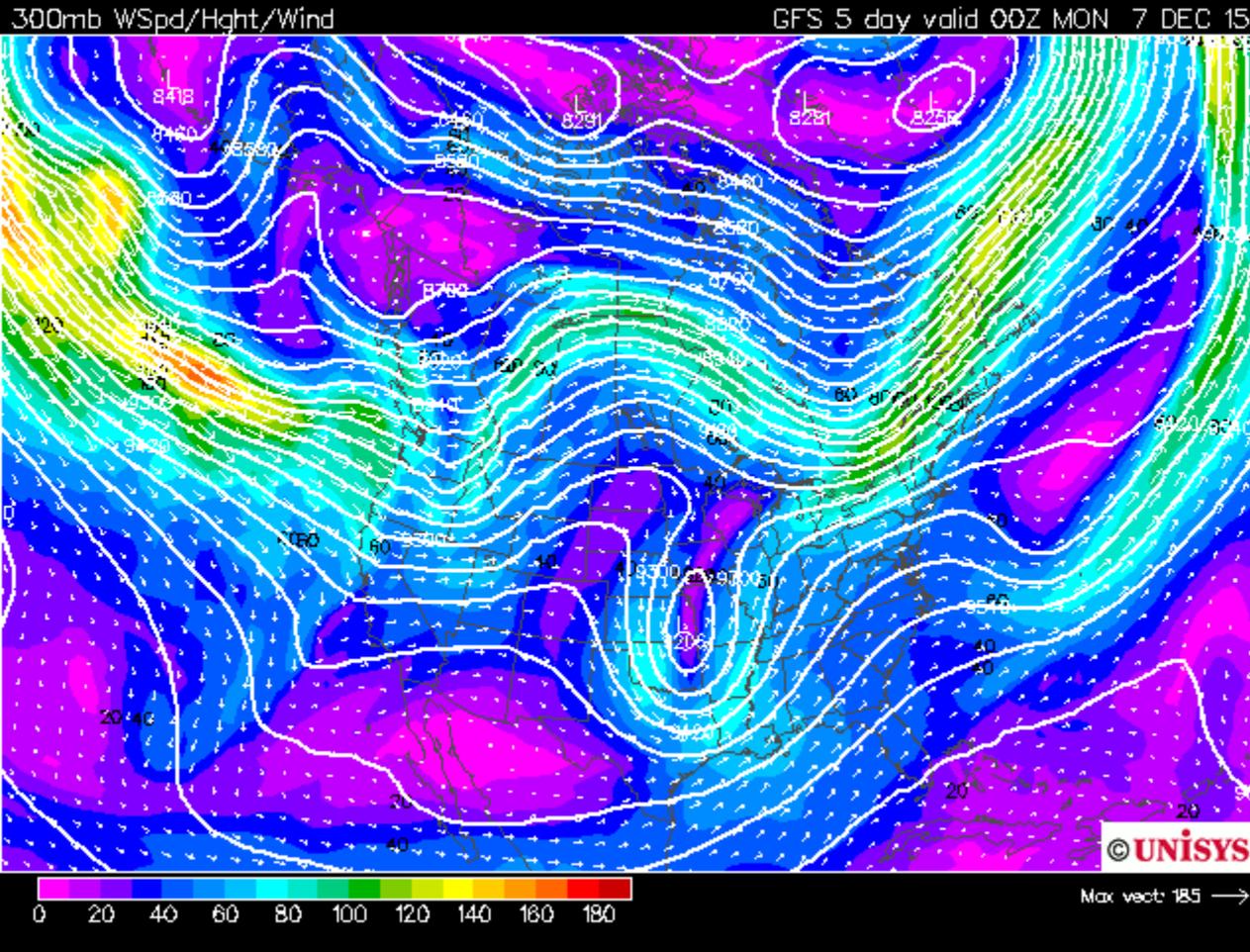
DASHED BLACK LINES ARE CLIMATOLOGY (DEG F) SHADED AREAS ARE FCST VALUES ABOVE (A) OR BELOW (B) UNSHADED AREAS ARE NEAR-NORMAL

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# Precipitation Forecast for Dec 7 – 11 ..... and Dec 9- 15

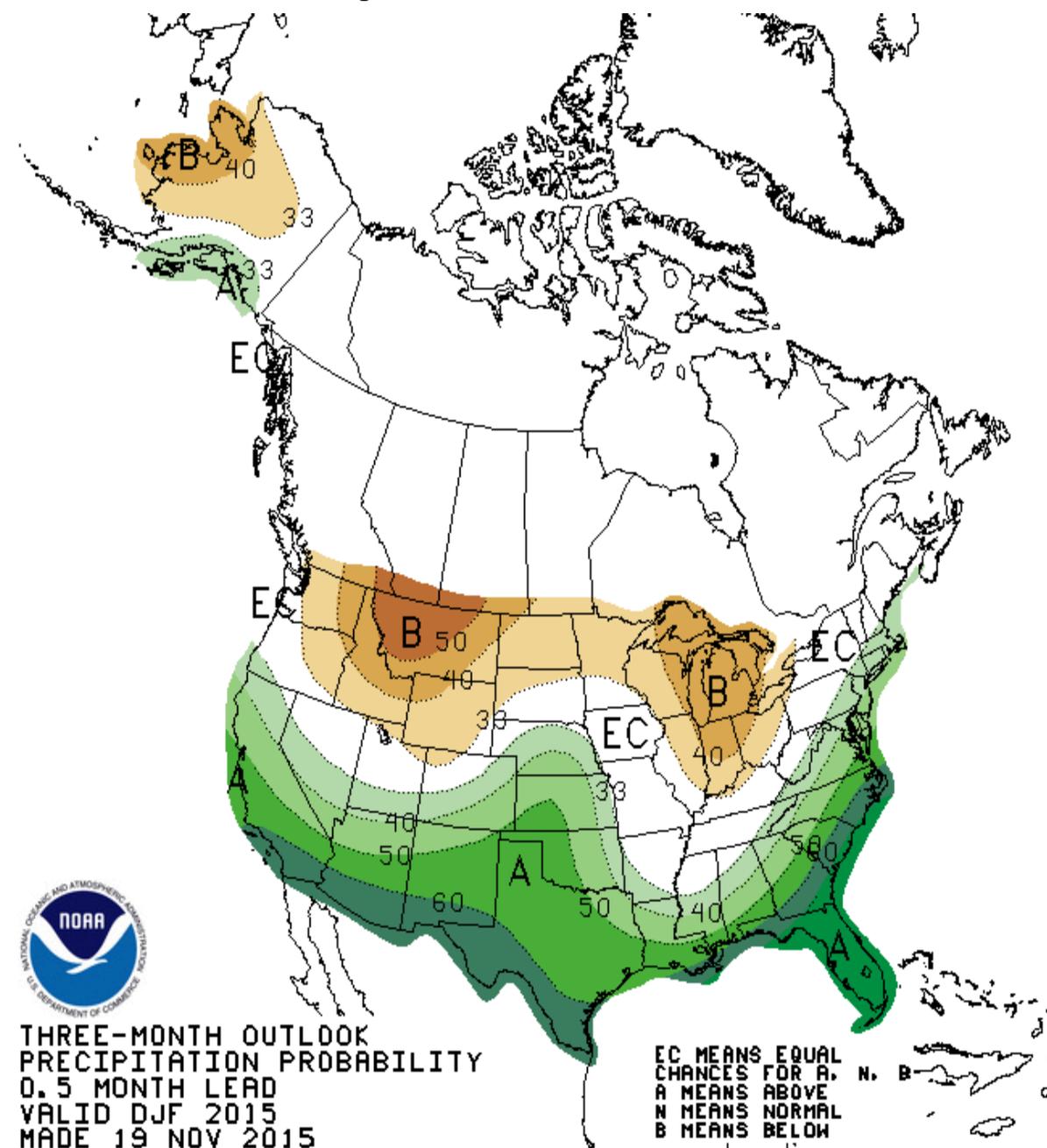
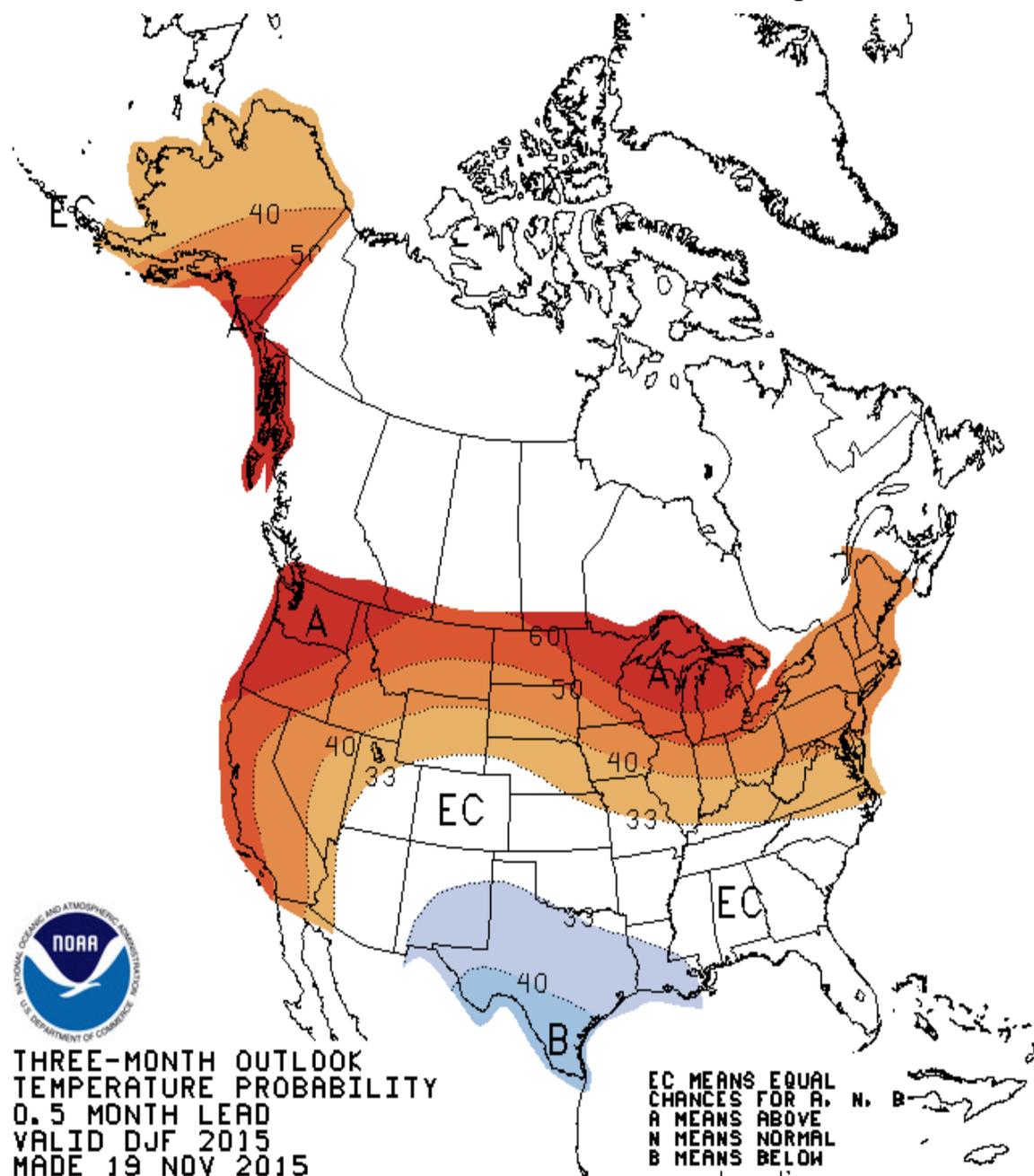


# 5 Day 300 mb image shows active jet stream along with 9 Days out ( Dec 11)



# Dec Jan Feb 3 Month Temperature

# & Precipitation Forecasts



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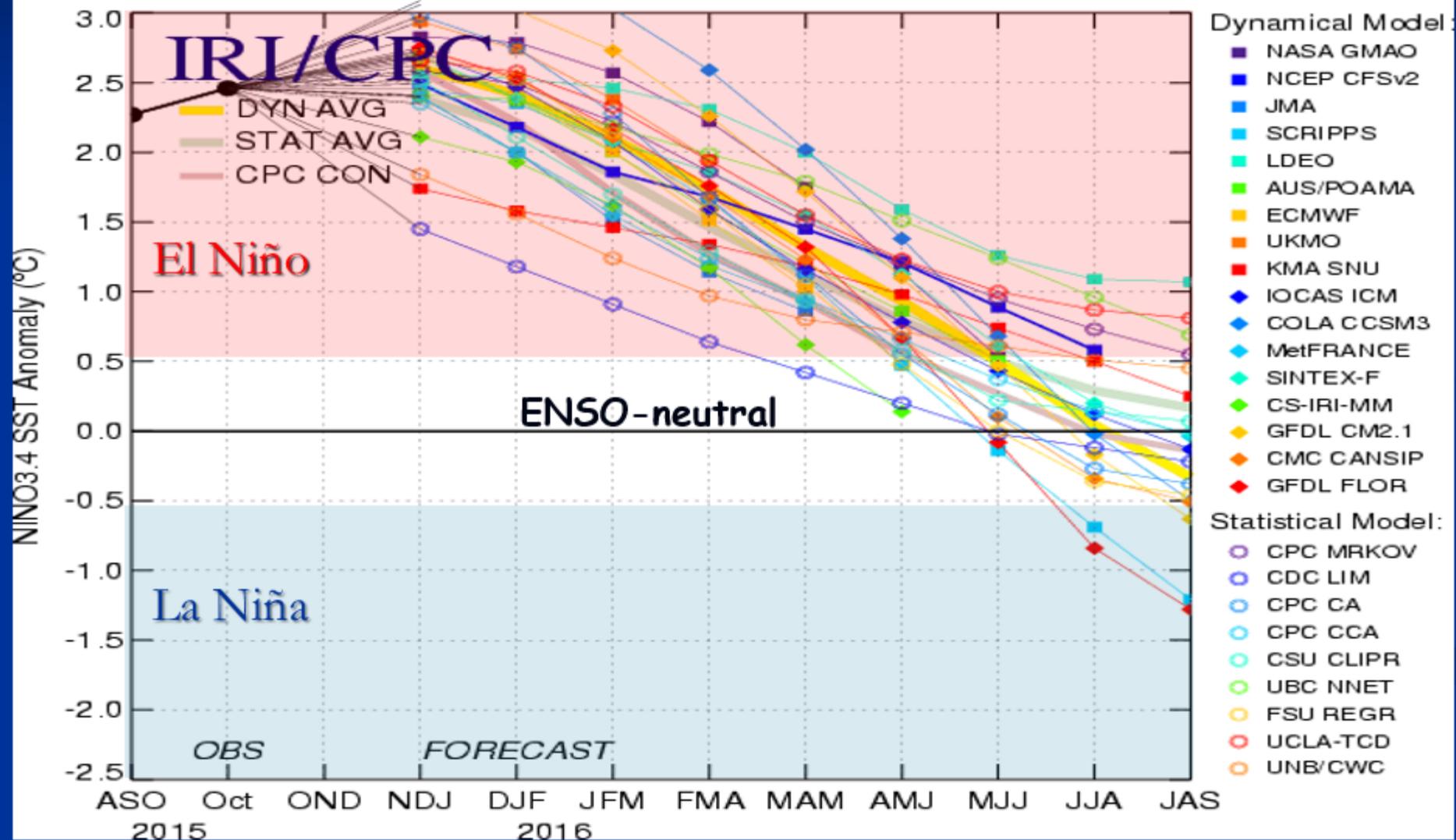
Year	ENSO	PDO	Owyhee River blw Dam	Salmon Falls Creek	Big Wood River blw Magic Dam	Snake River nr Heise	Spokane River nr Post Falls
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# ENSO Predictive Models

El Niño should peak this winter and weaken this spring...

Mid-Nov 2015 Plume of Model ENSO Predictions



## Decoded Science

### [El Niño Update: Third Strongest Pacific Ocean Warming In 65 Years](#)

November 13, 2015 by [Jon Plotkin](#)

- **When Will El Niño End?**
- **Most El Niños peak in December or January and decline into spring, often followed by a period of La Niña, and this is what CPC is forecasting.**
- **But with climate change playing serious tricks on our weather, Decoded Science will wait to see if this one ends in the usual way.**
- © Copyright 2015 Jon Plotkin, All rights Reserved. Written For: [Decoded Science](#) [November 13, 2015](#)

# Streamflow April - September as % of 1981-2010 Average



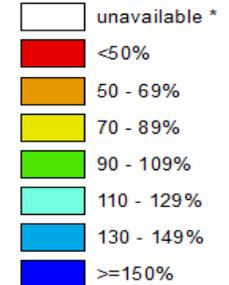
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1966	SE	neg	28	48	51	78	90
1947	SE	pos / neg	44	50	59	108	90
1941	SE	pos	83	53	69	73	45
1988	SE	pos	30	65	24	70	71
1978	SE	pos	110	112	140	133	99
1973	SE	pos / neg	61	114	51	79	45
1995	SE	pos	124	135	195	118	70
1998	SE	pos / neg	135	138	161	119	82
1999	SE	pos	221	157	282	132	91
1984	SE	pos	122	173	117	86	77
1952	SE	neg	247	178	263	116	123
2016	SE	Currently pos	?	?	?	?	?

## Idaho SNOTEL Current Snow Water Equivalent (SWE) % of Normal

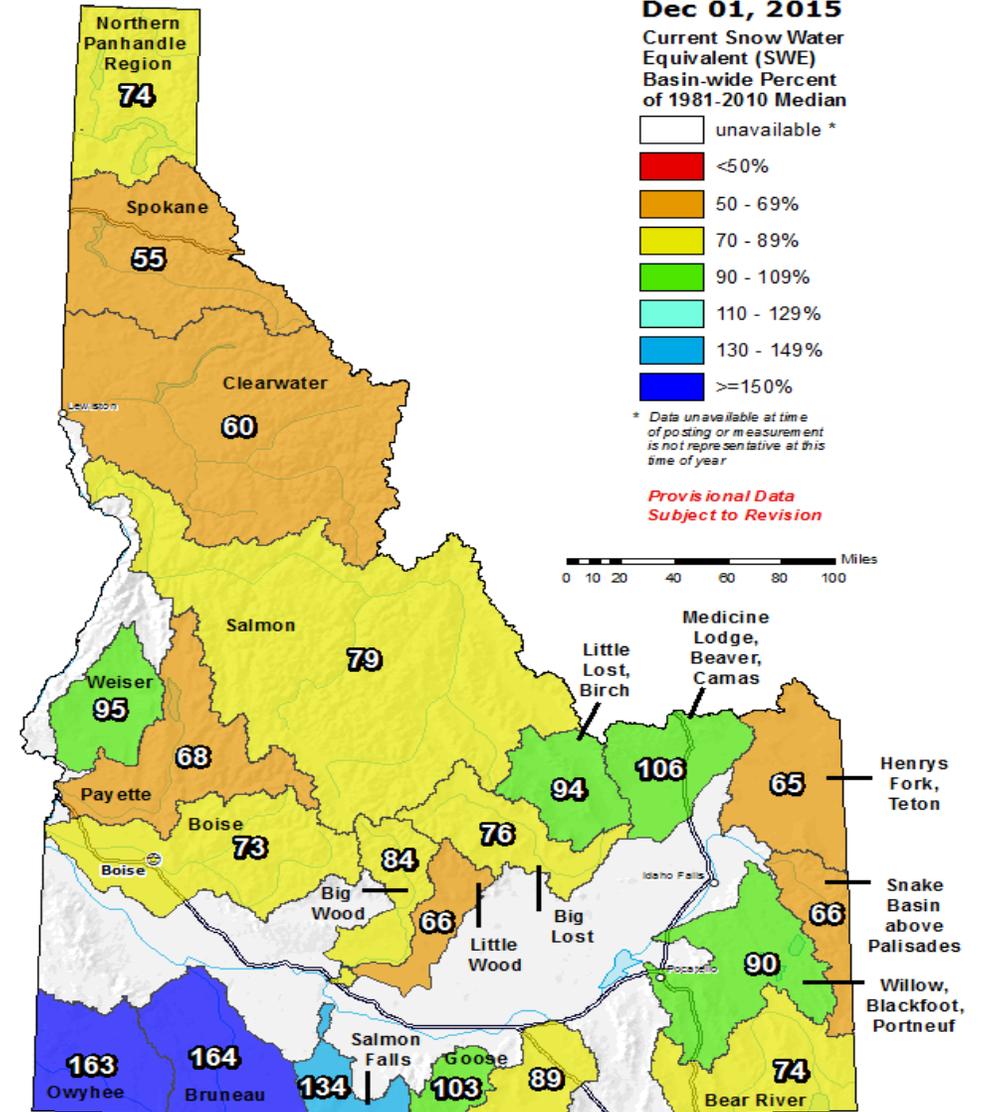
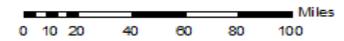
**Dec 01, 2015**

Current Snow Water Equivalent (SWE)  
Basin-wide Percent of 1981-2010 Median



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

*Provisional Data  
Subject to Revision*



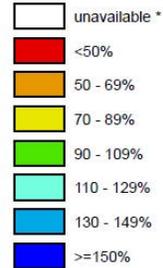
The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

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

## Oregon SNOTEL Current Snow Water Equivalent (SWE) % of Normal

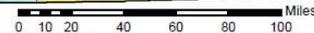
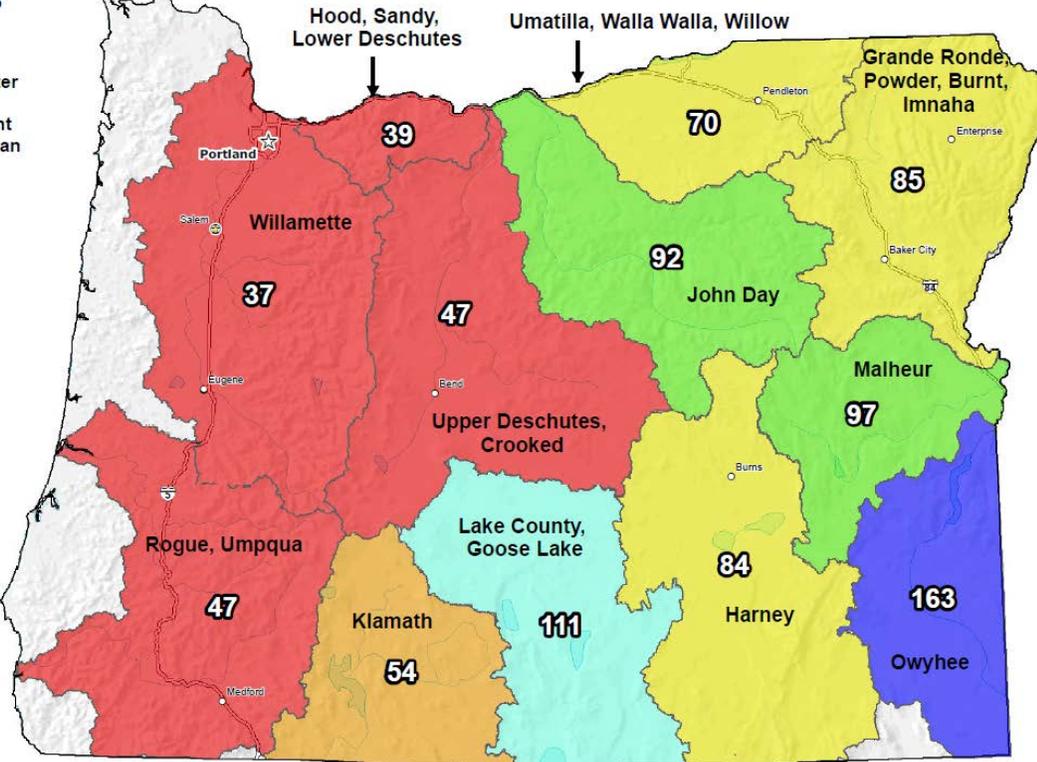
**Dec 01, 2015**

Current Snow Water Equivalent (SWE)  
Basin-wide Percent of 1981-2010 Median



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

*Provisional Data  
Subject to Revision*

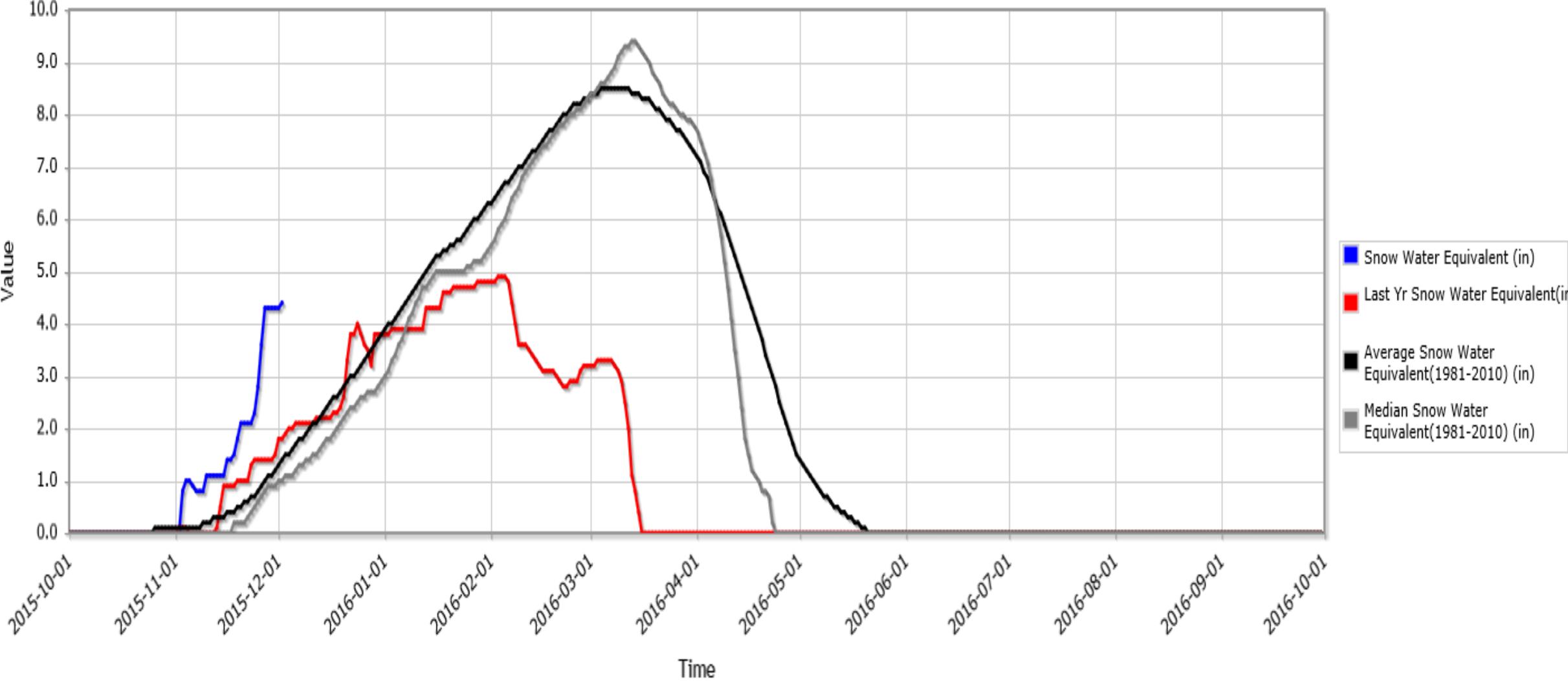


Prepared by:  
USDA/NRCS National Water and Climate Center  
Portland, Oregon  
<http://www.wcc.nrcs.usda.gov>



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).

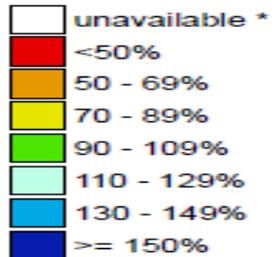
### Big Bend (336) Nevada SNOTEL Site - 6700 ft



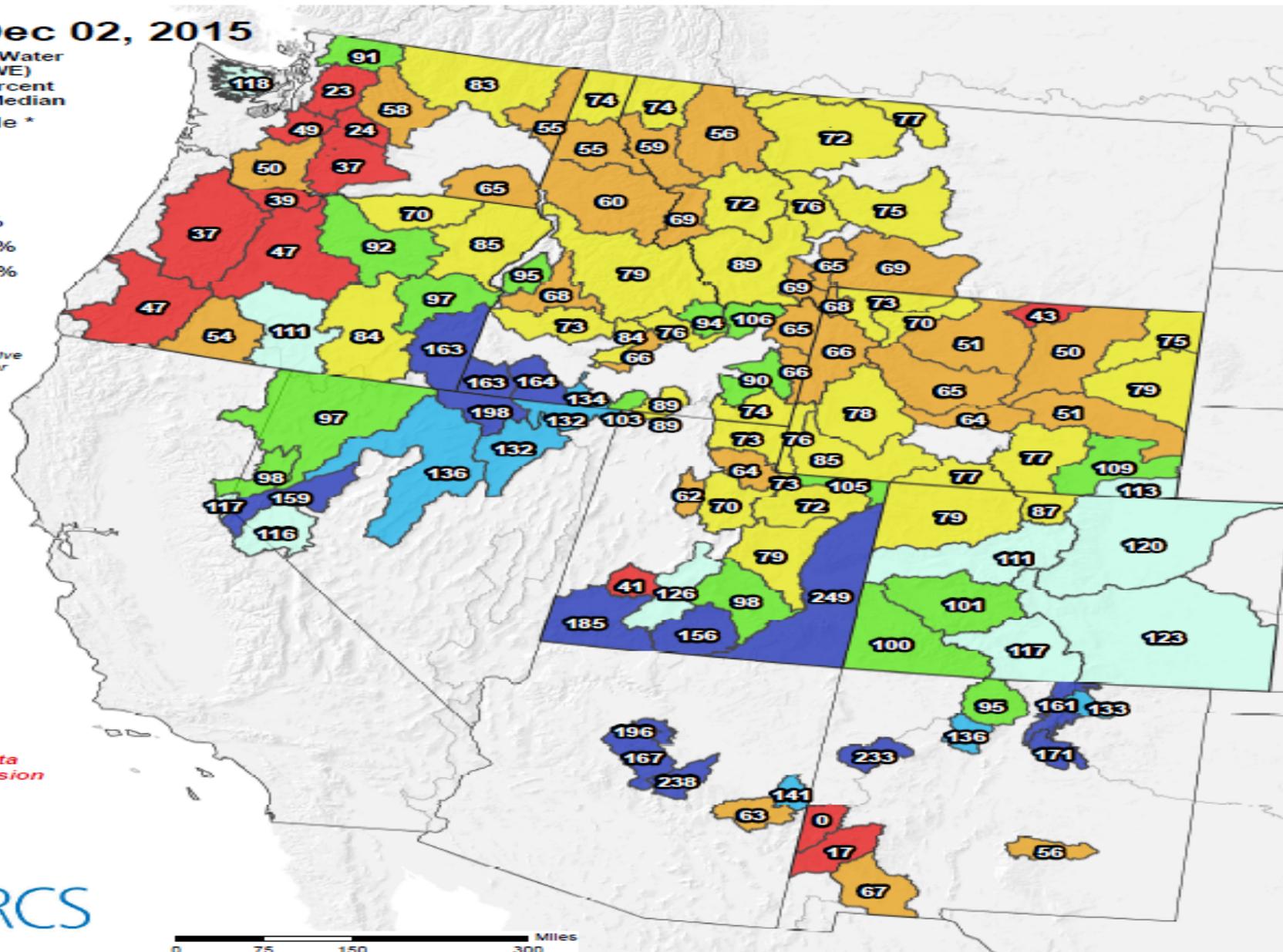
# Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Dec 02, 2015

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median



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



Provisional data subject to revision



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>

**It's going to be an interesting winter...**



**NRCS Snow  
School Lake Tahoe  
Jan 13, 2012**

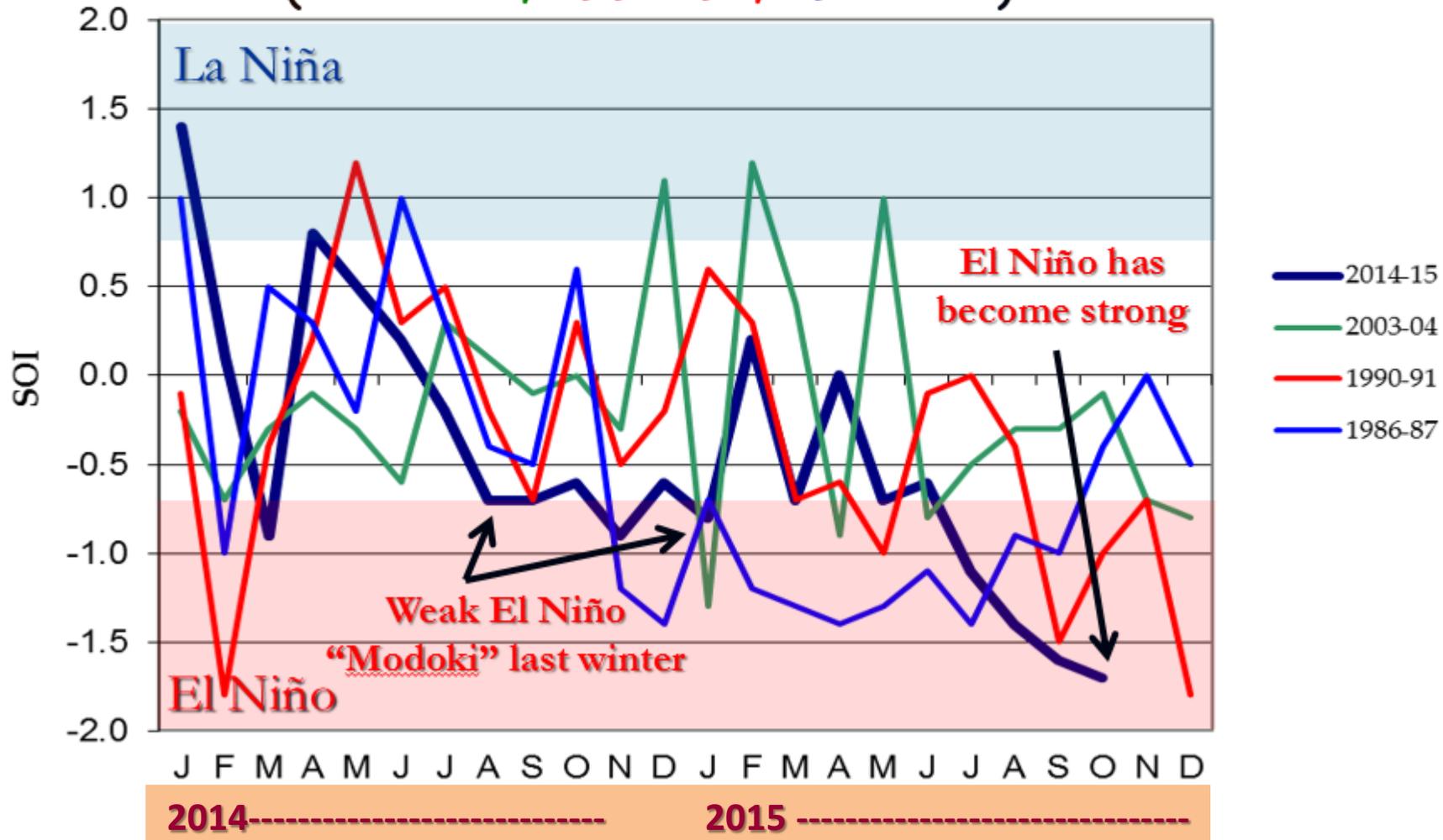


**Mores Creek SNOTEL Site March 1999**

Extra slides

# Tropical Pacific Ocean

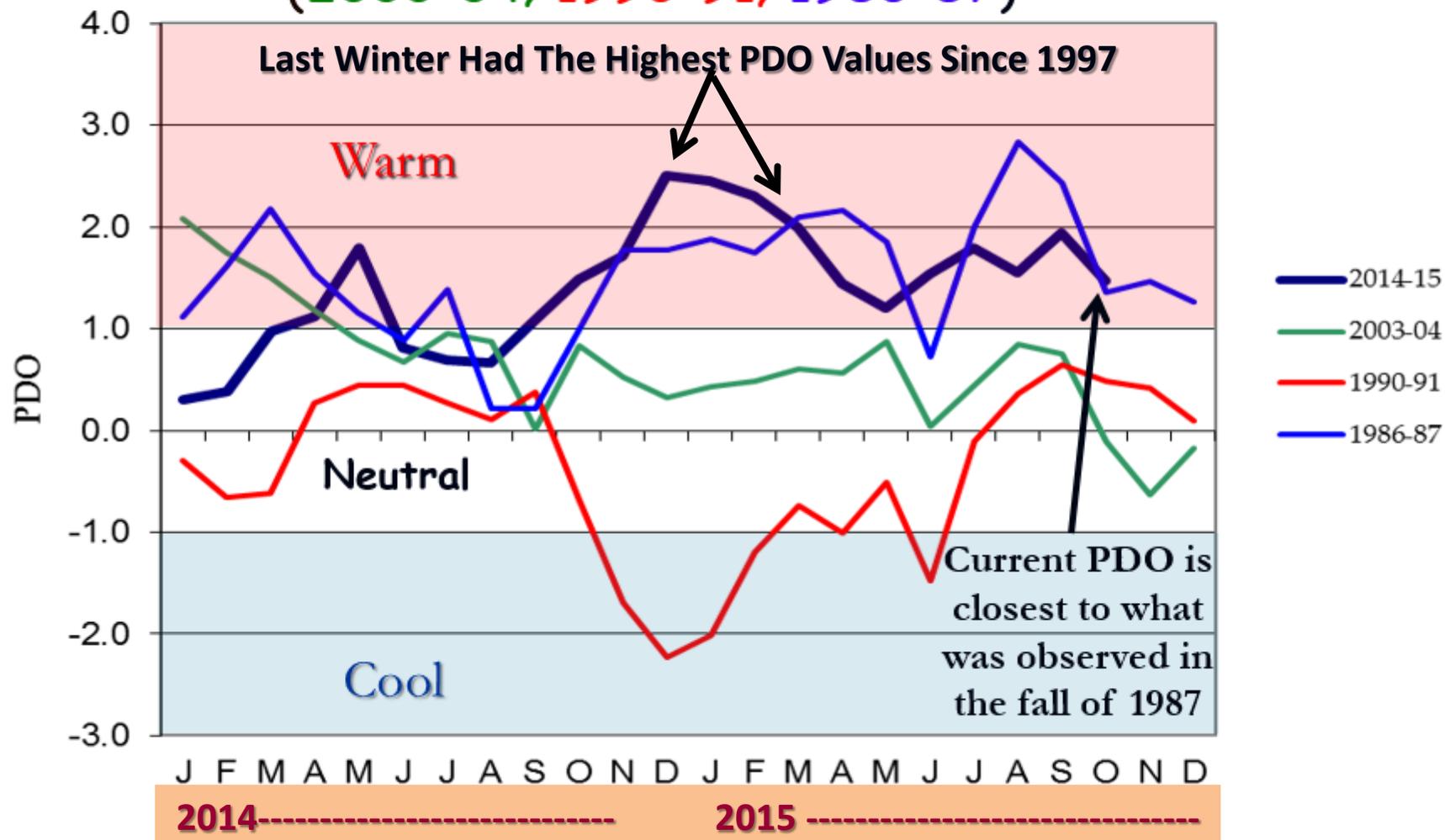
SOI\* values from the top "analog years"  
 compared with the current period (2014-15)  
 (2003-04; 1990-91; 1986-87)



\*SOI explanation via "Forecasting Methods..." at <http://www.oregon.gov/ODA/programs/NaturalResources/Pages/Weather.aspx>

# North Pacific Ocean

PDO\* values from the top "analog years" compared with the current period (2014-15) (2003-04; 1990-91; 1986-87)



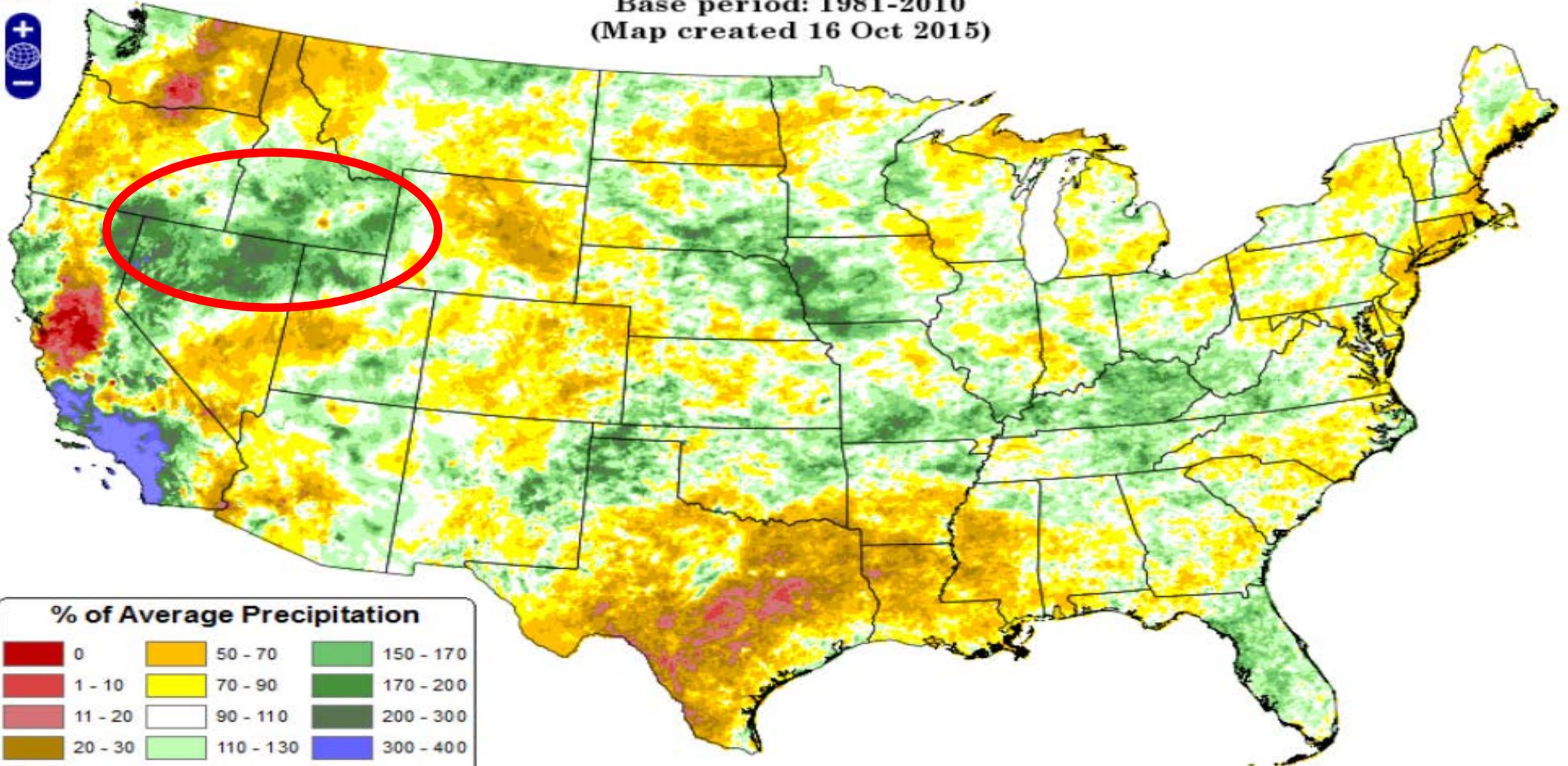
\*PDO explanation via "Forecasting Methods..." at <http://www.oregon.gov/ODA/programs/NaturalResources/Pages/Weather.aspx>

# Total Precipitation Anomaly: July 2015 - September 2015

Period ending 7 AM EST 30 Sep 2015

Base period: 1981-2010

(Map created 16 Oct 2015)



## % of Average Precipitation

0	50 - 70	150 - 170
1 - 10	70 - 90	170 - 200
11 - 20	90 - 110	200 - 300
20 - 30	110 - 130	300 - 400
30 - 50	130 - 150	> 400

## Recap 2014 / 2015 Winter



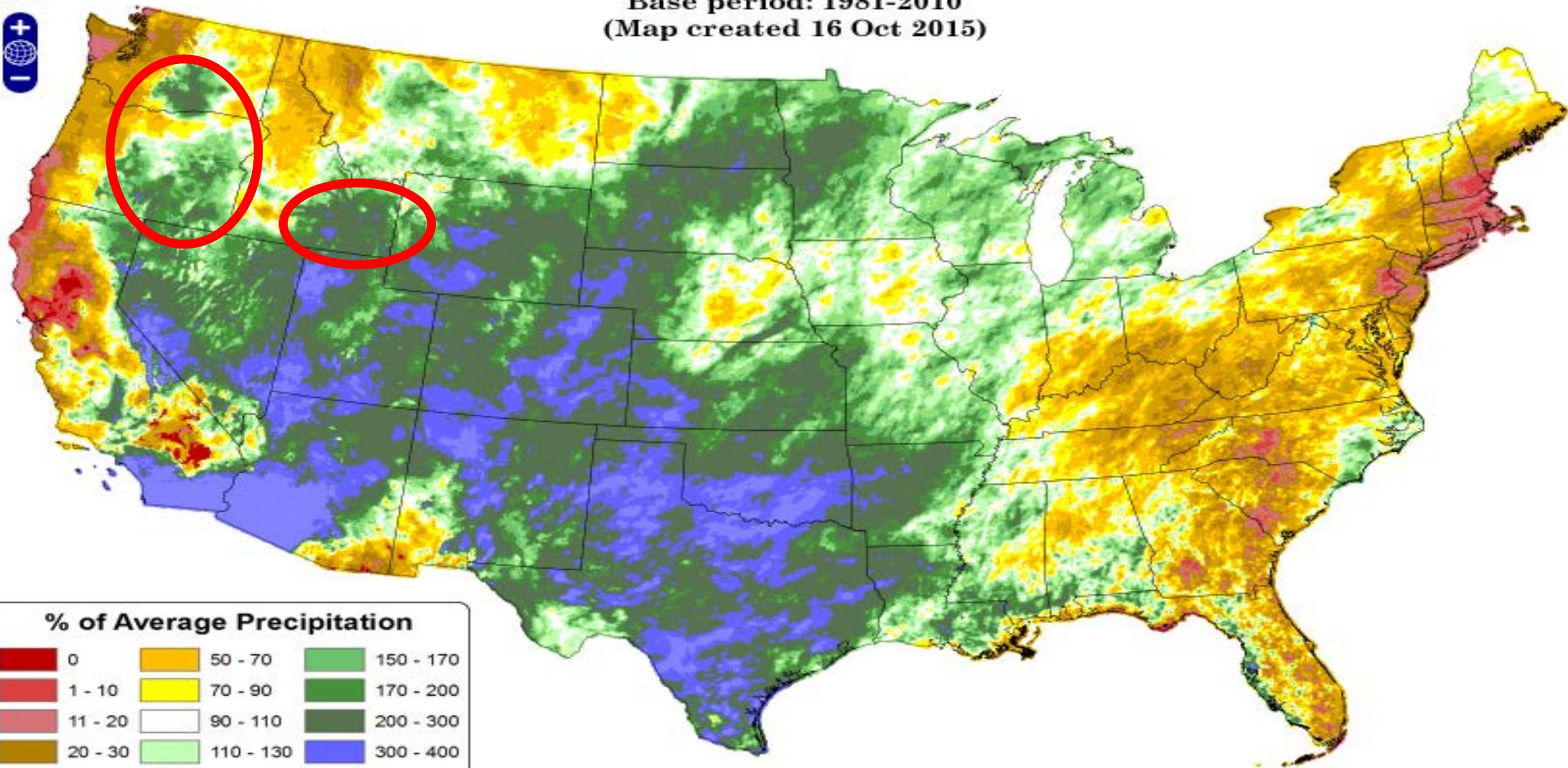
- MF Salmon River basically froze overnight

- Nov 2014 Arctic Cold Spell suddenly spilled into Idaho from Montana
- Went from 50s F to single digits in a few days



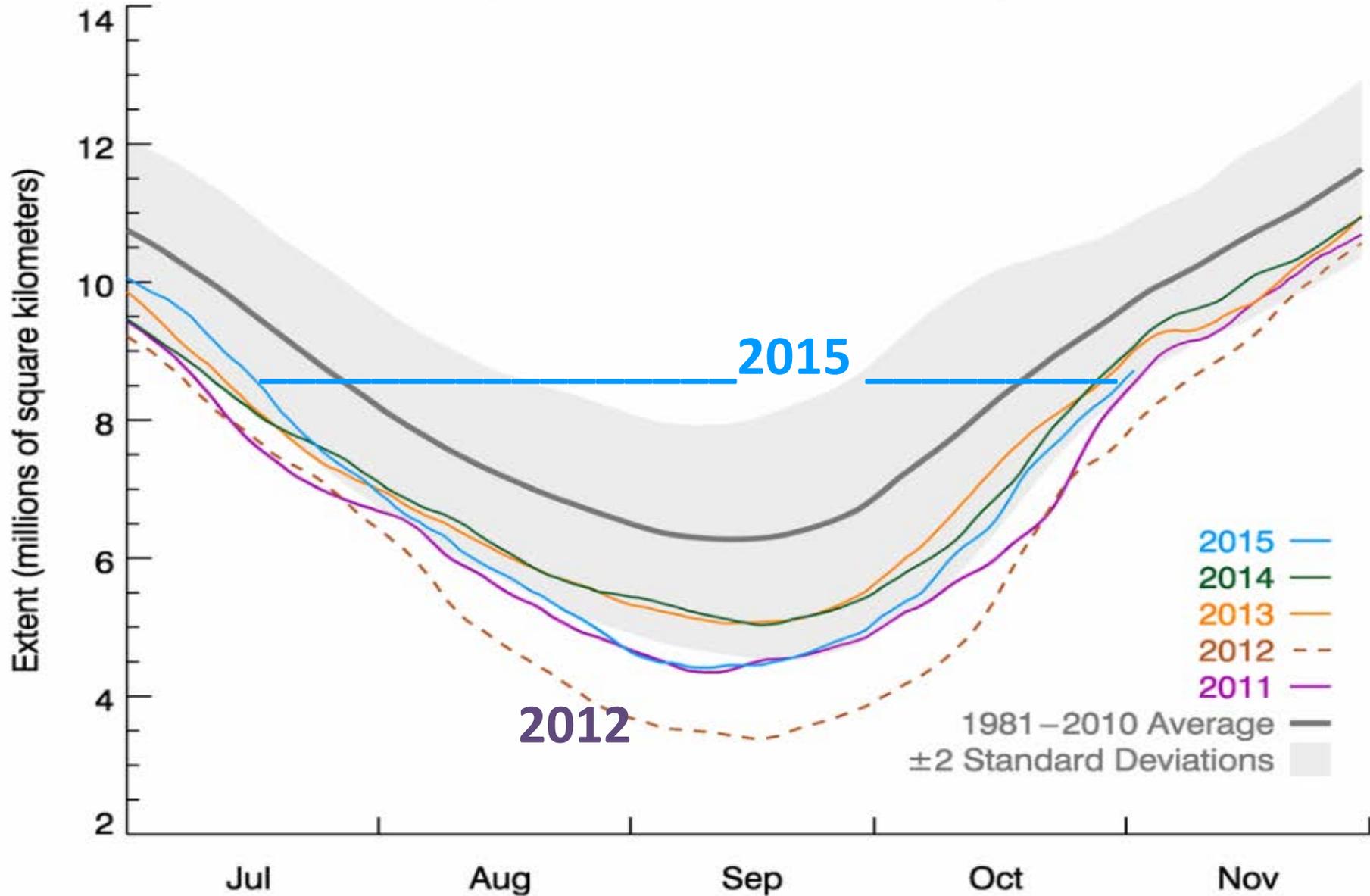


**Total Precipitation Anomaly: May 2015**  
Period ending 7 AM EST 31 May 2015  
Base period: 1981-2010  
(Map created 16 Oct 2015)



% of Average Precipitation		
0	50 - 70	150 - 170
1 - 10	70 - 90	170 - 200
11 - 20	90 - 110	200 - 300
20 - 30	110 - 130	300 - 400
30 - 50	130 - 150	> 400

# Arctic Sea Ice Extent (Area of ocean with at least 15% sea ice)

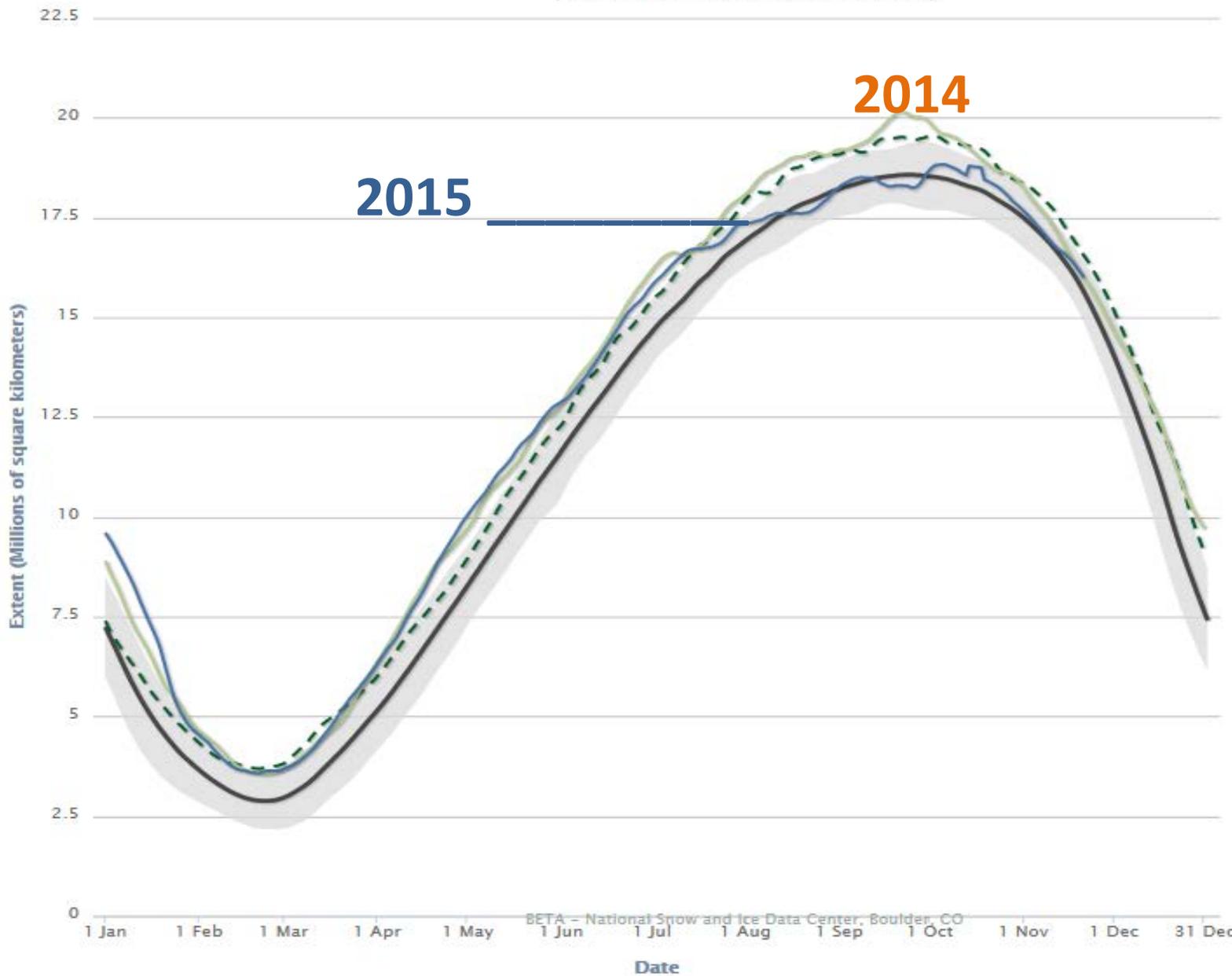


National Snow and Ice Data Center, Boulder CO

Arctic

Antarctic

### Antarctic Sea Ice Extent (Area of Ocean with at least 15% sea ice)



2014

2015

1981-2010 Average

±2 Standard Deviations

- 1979
- 1980
- 1981
- 1982
- 1983
- 1984
- 1985
- 1986
- 1987
- 1988
- 1989
- 1990
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- 2011
- 2012
- 2013
- 2014
- 2015

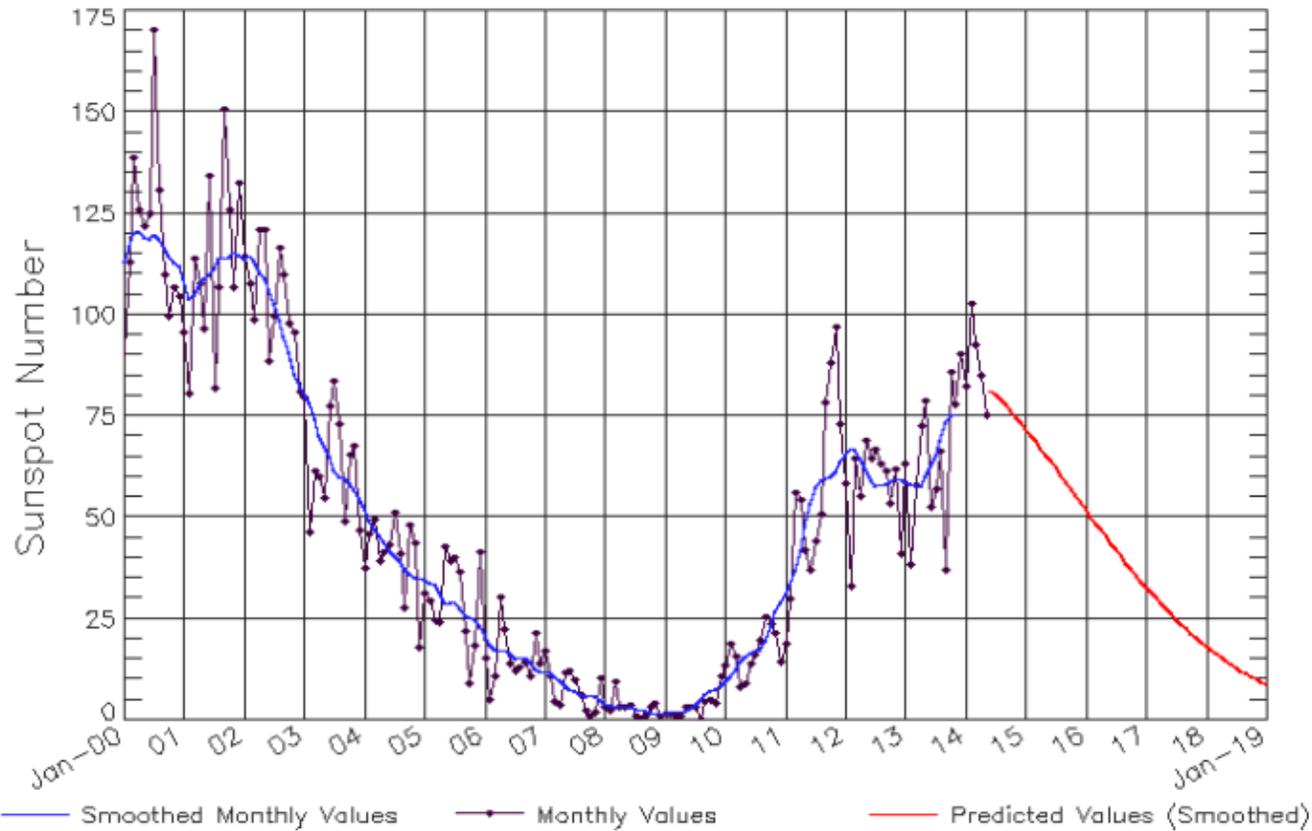
Show all

Hide all



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

ISES Solar Cycle Sunspot Number Progression  
Observed data through May 2014



Updated 2014 Jun 9

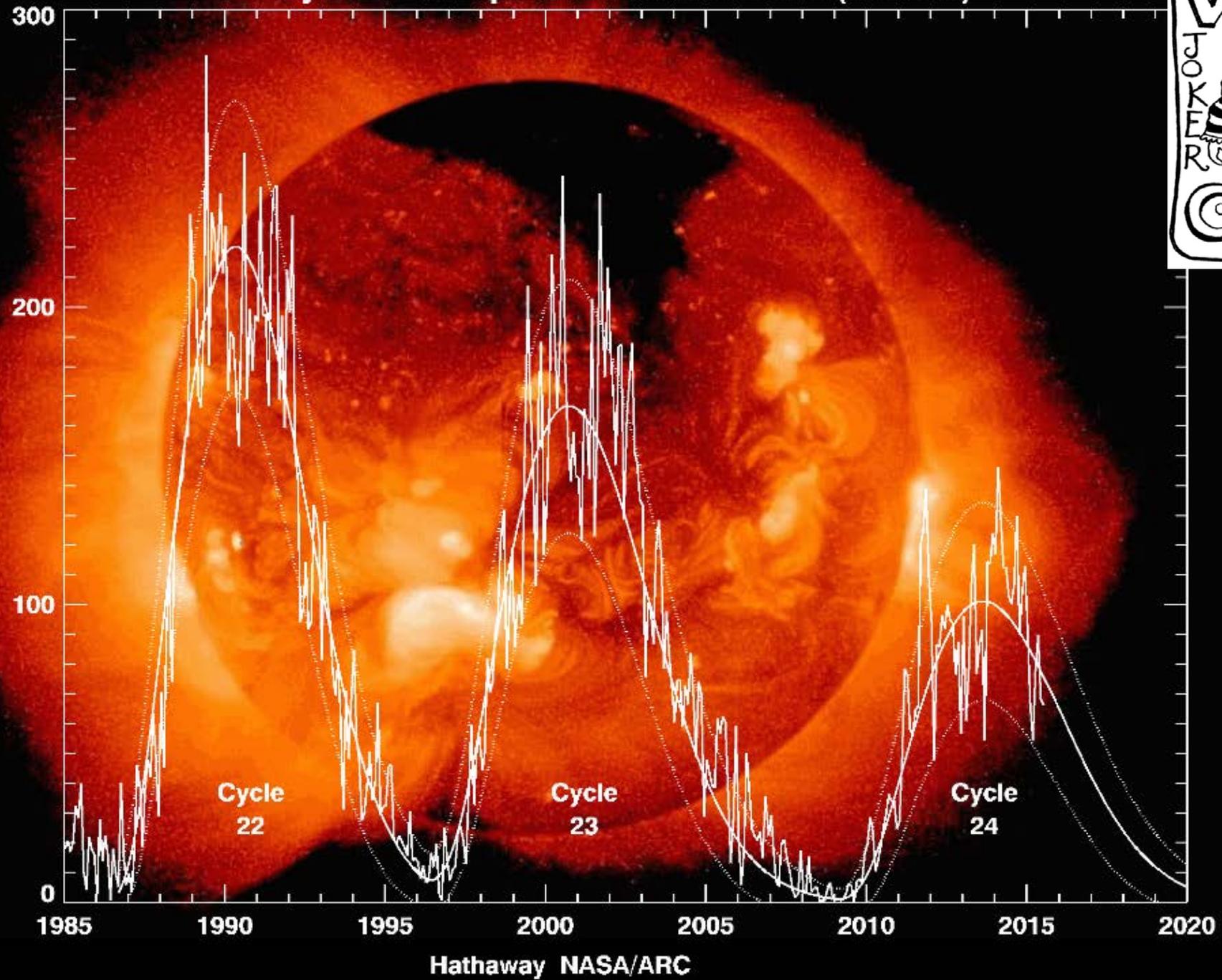
Years 2000 to 2018

NOAA/SWPC Boulder, CO USA

**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)



Hathaway NASA/ARC