Western Regional Climate Center

Desert Research Institute

Sierra Weather and Climate Update 2015-16

Kelly Redmond

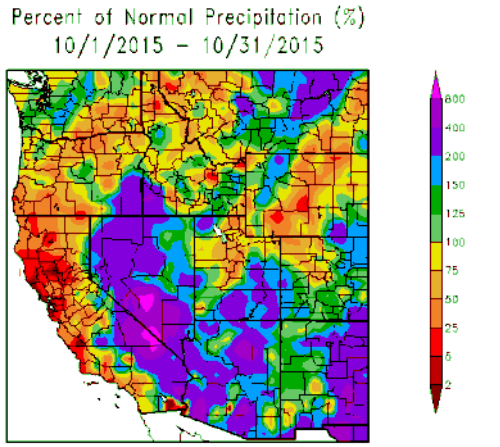
Western Regional Climate Center

Desert Research Institute

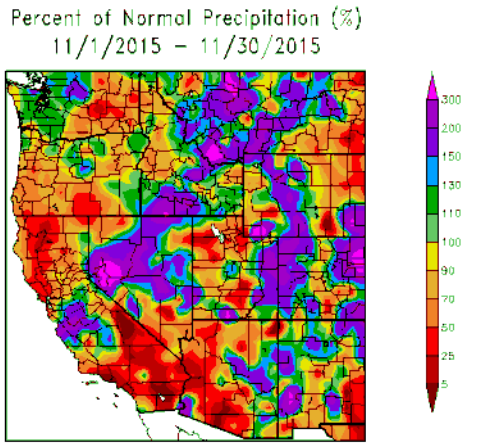
Reno Nevada

Yosemite Hydroclimate Workshop
Yosemite Valley, 2016 October 5-6

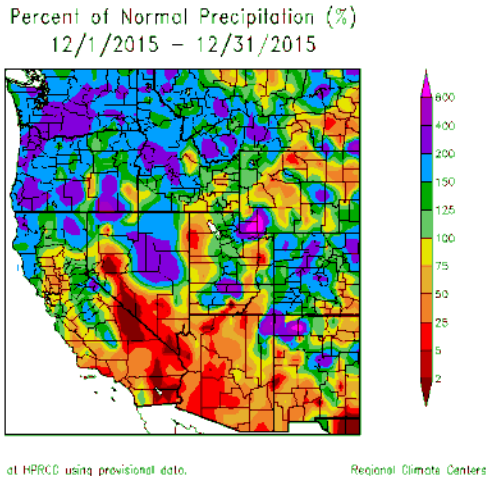
Percent of Average Precipitation



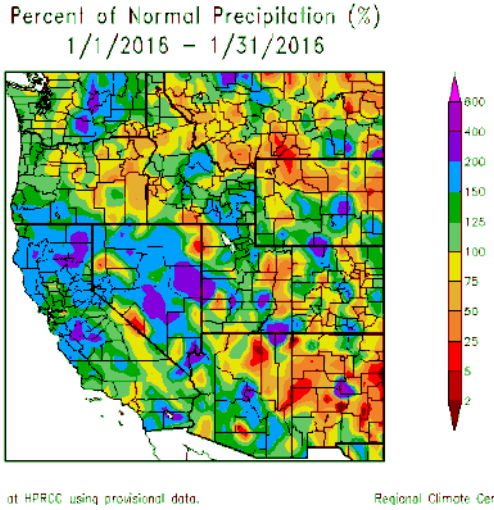
Oct 2015



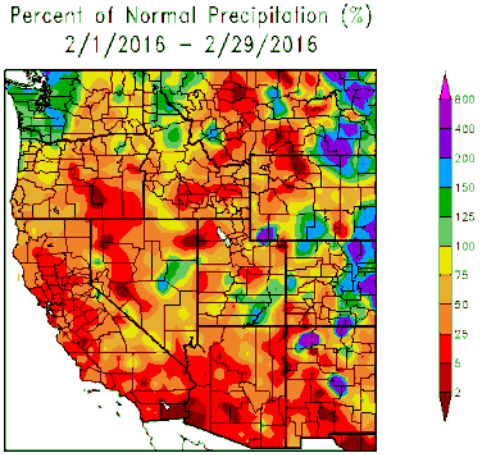
Nov 2015



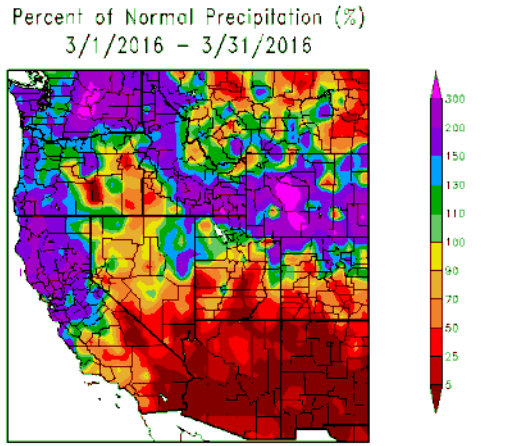
Dec 2015



Jan 2016

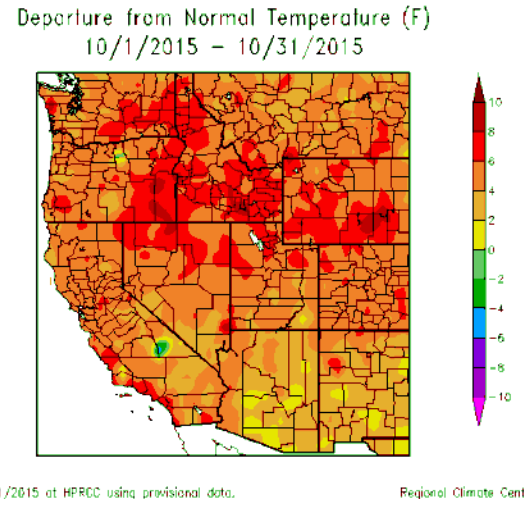


Feb 2016



Mar 2016

Mean Temperature Departure from Normal



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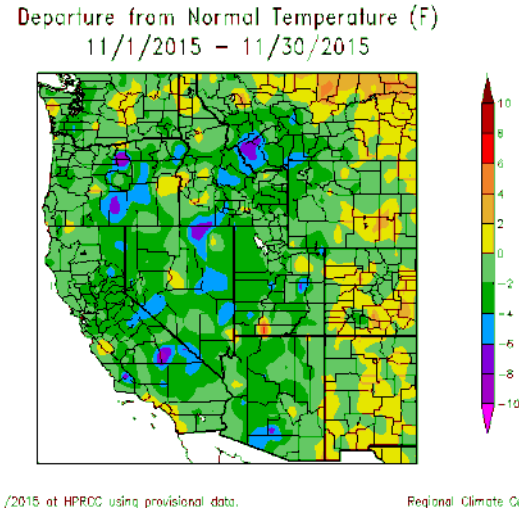

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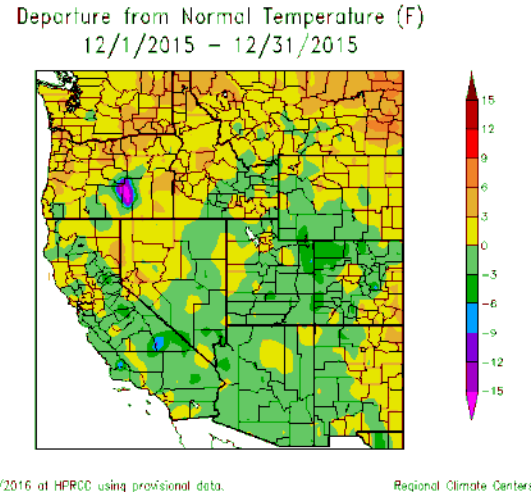

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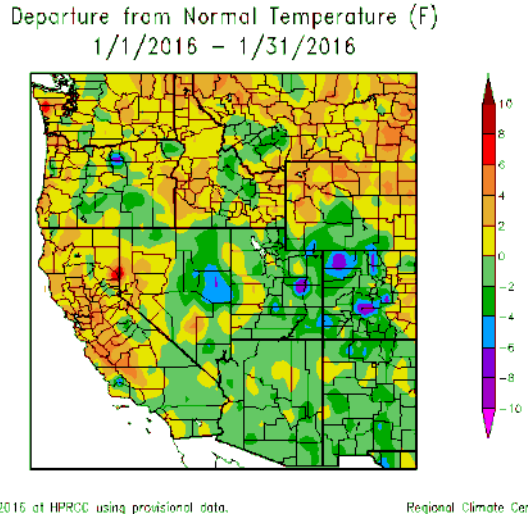

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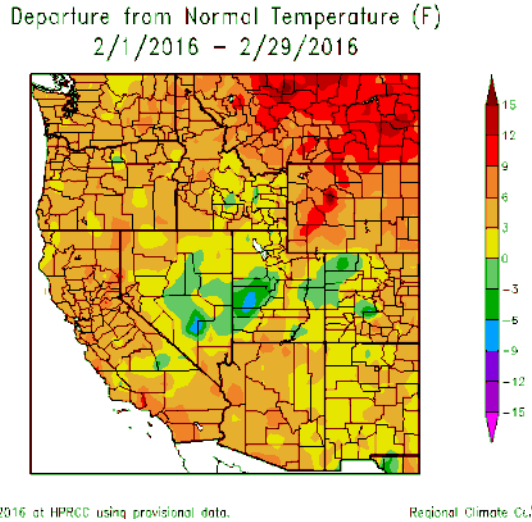

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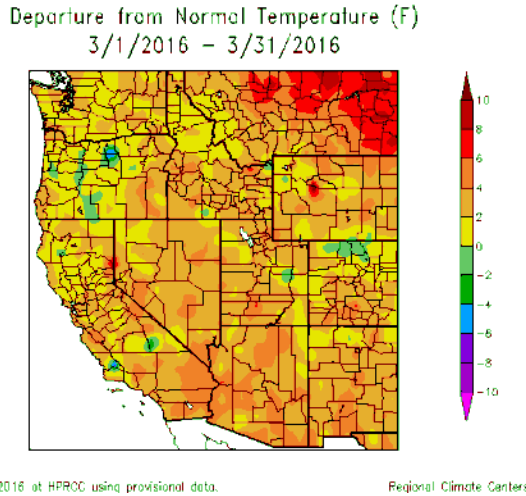
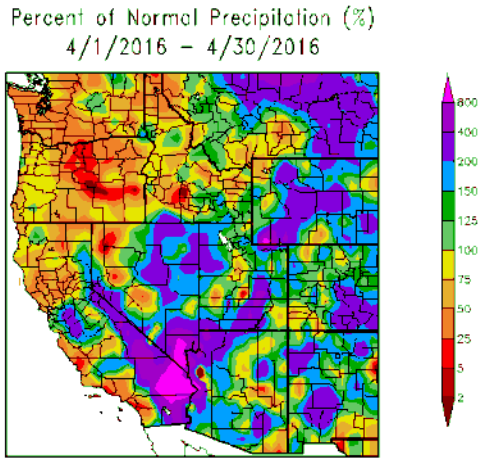
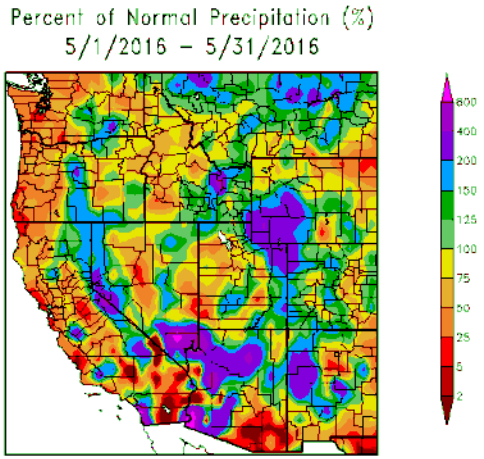


Mar 2016

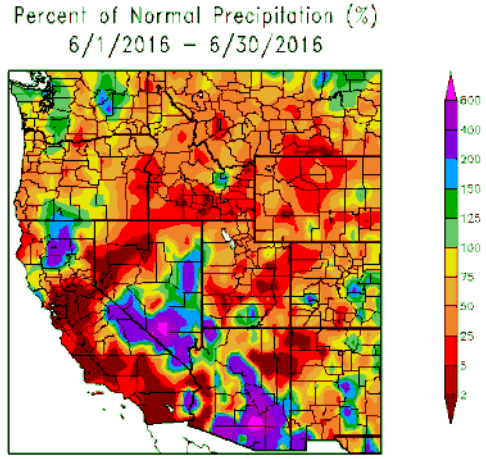
Percent of Average Precipitation



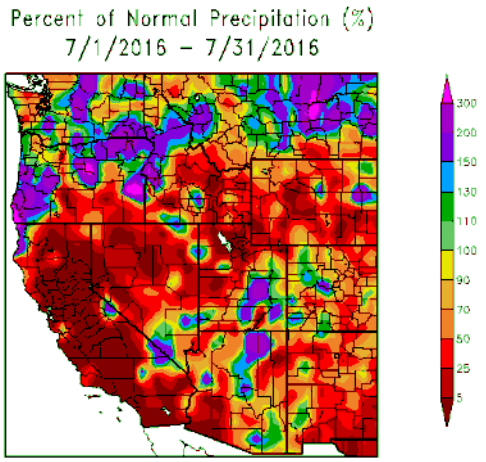
Apr 2016



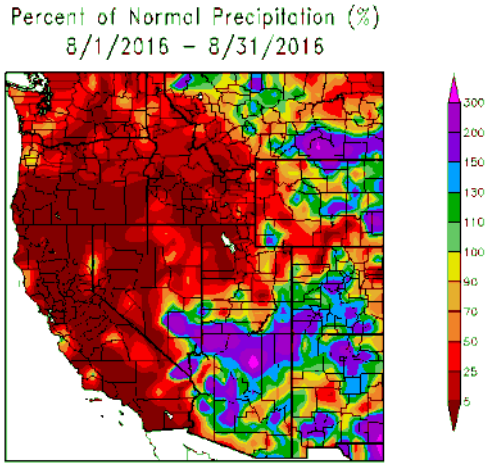
May 2016



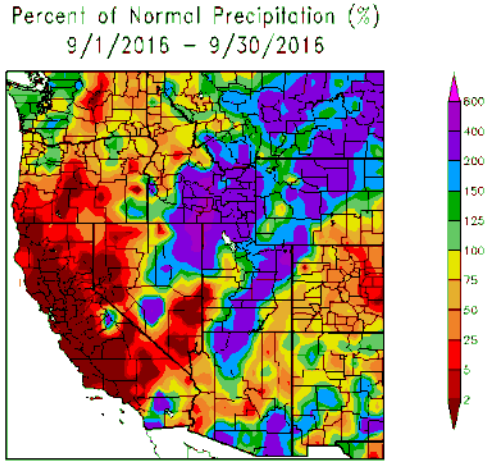
Jun 2016



Jul 2016

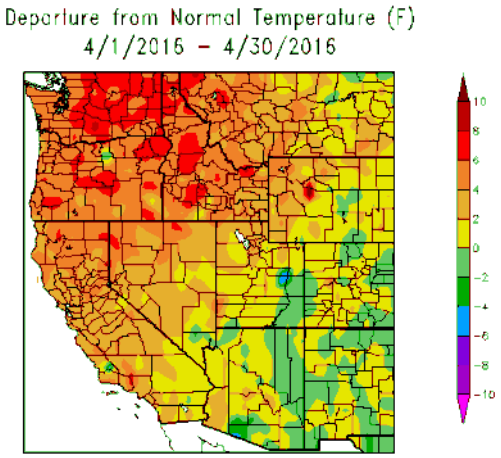


Aug 2016

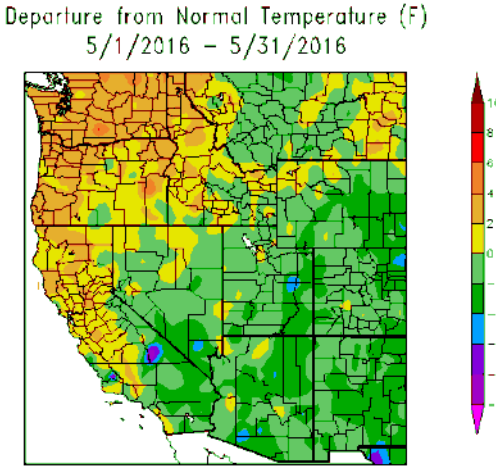


Sep 2016

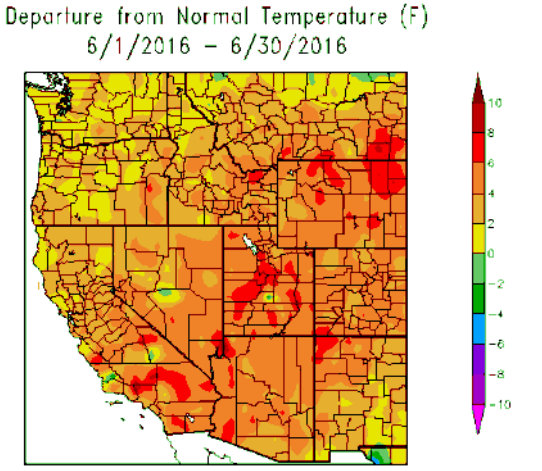
Mean Temperature Departure from Normal



Apr 2016



May 2016



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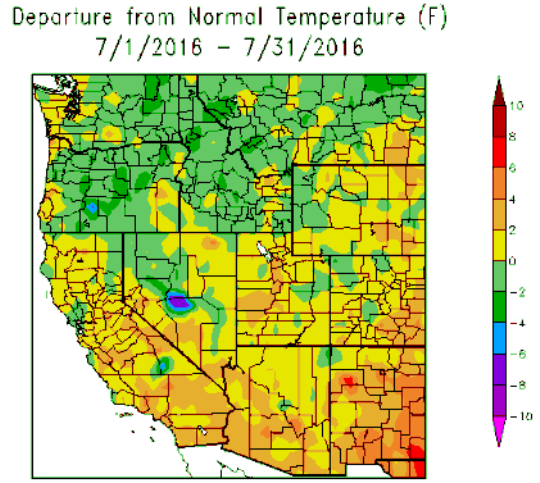

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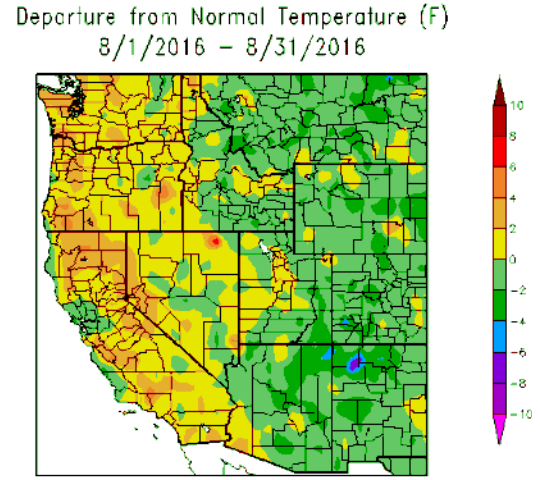
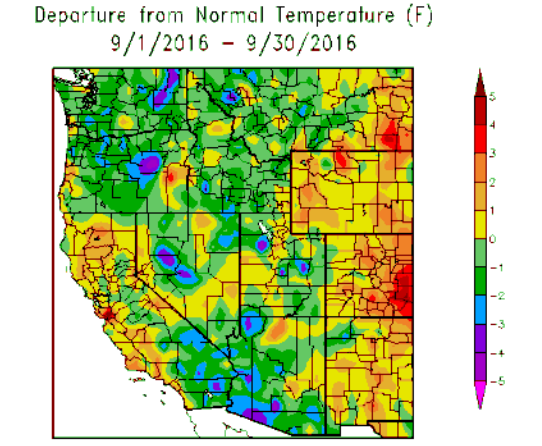


Aug 2016



Sep 2016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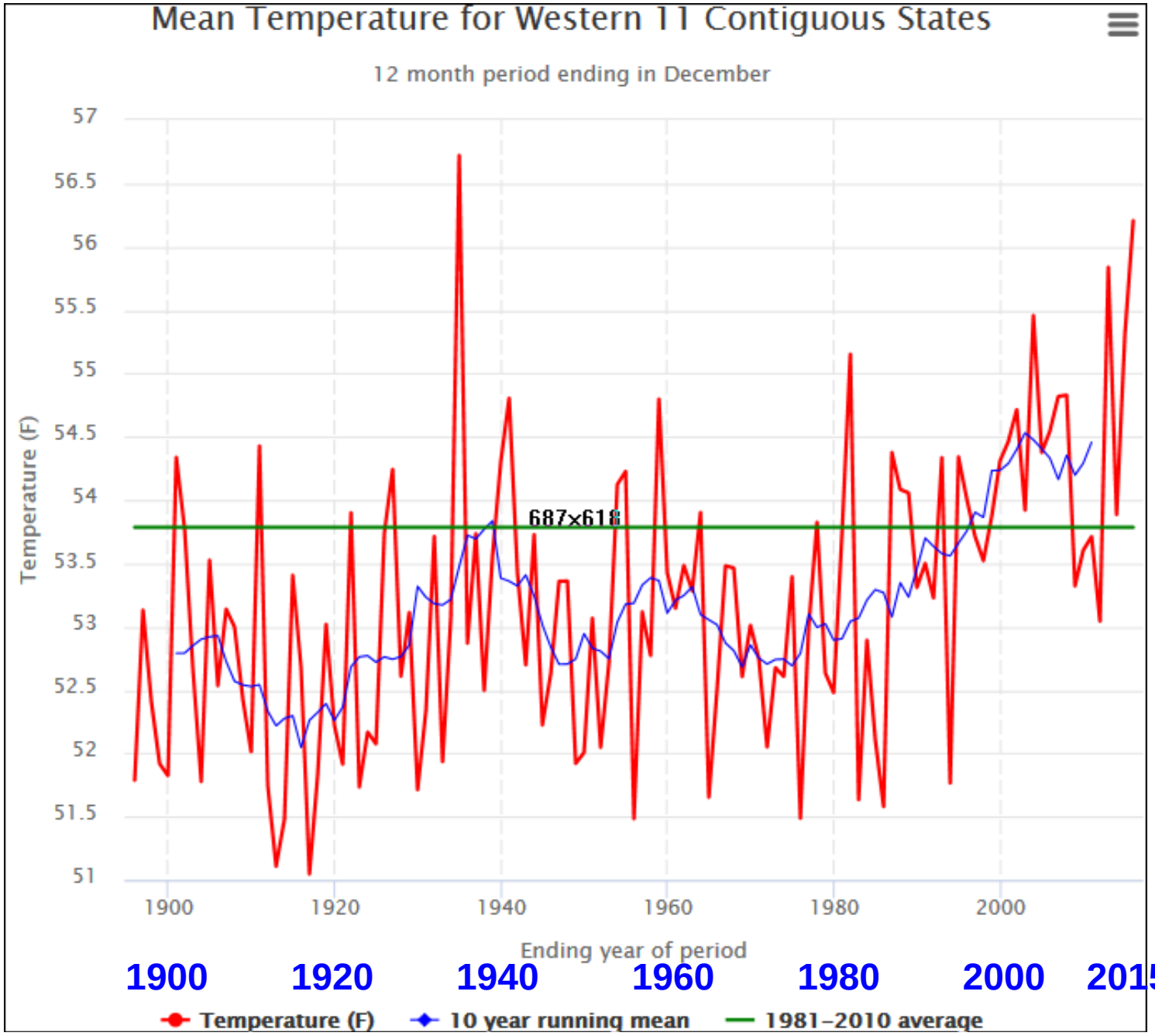
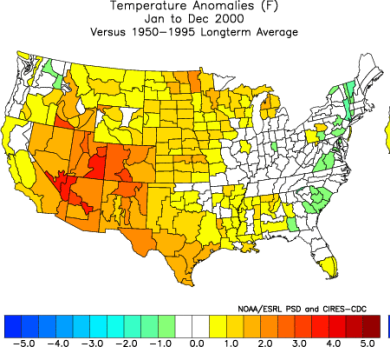

Mean Temperature for Western 11 Contiguous States
12 month period ending in December
Temperature (F)
57
56.5
56
55.5
55
54.5
54
53.5
53
52.5
52
51.5
51
687x618
1900
1920
1940
1960
1980
2000
Ending year of period
1900
1920
1940
1960
1980
2000
2015
Temperature (F)
10 year running mean
1981-2010 average



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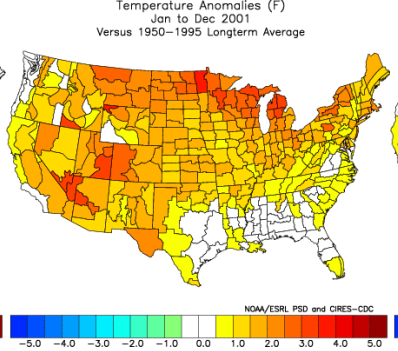

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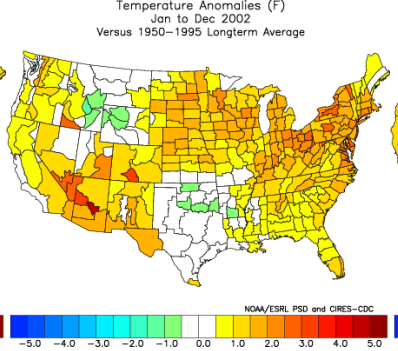

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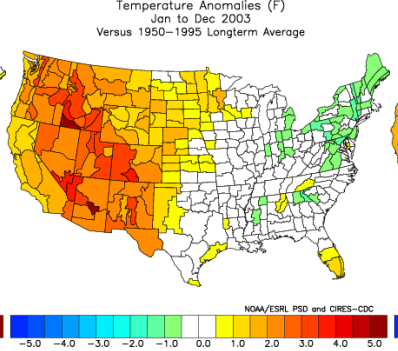

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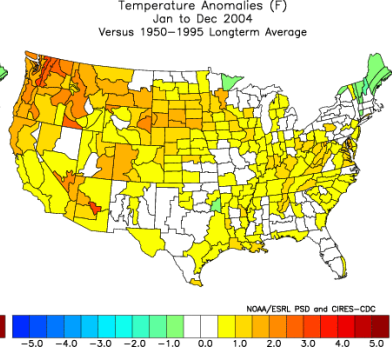

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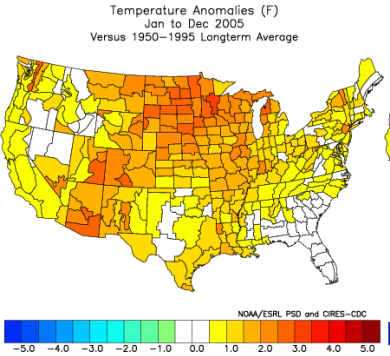

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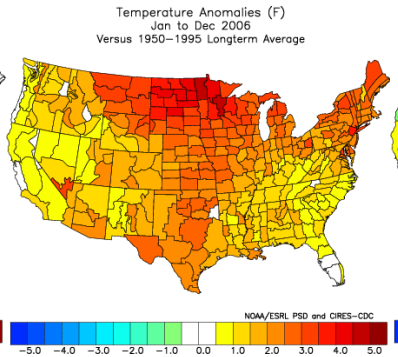

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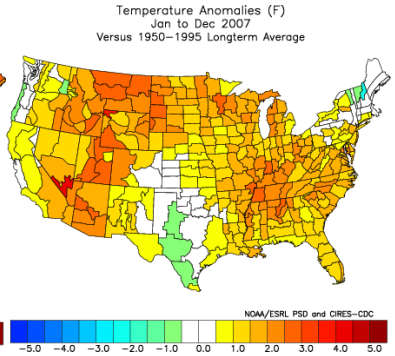

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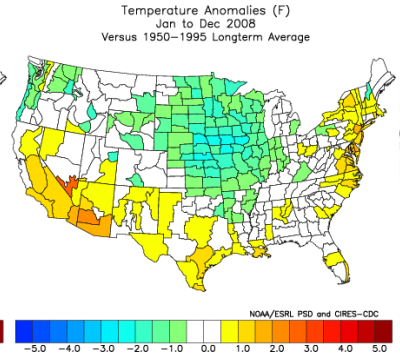

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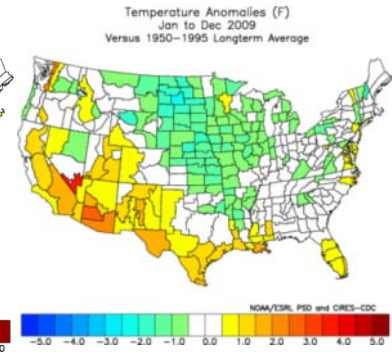
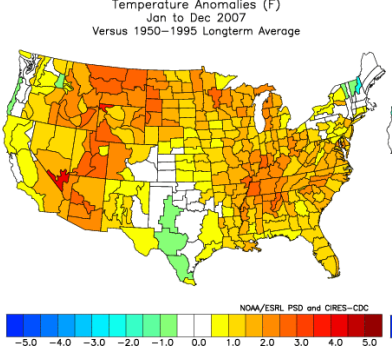


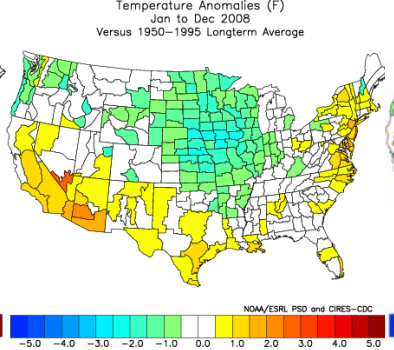
2009

United States Annual Temperature Departure from 1950-1995 Mean

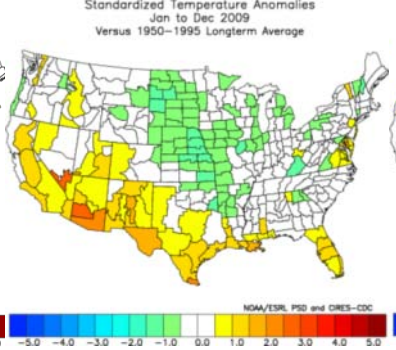
NOAA Divisional Data, Western Regional Climate Center, Plotted by ESRL PSD



2007



2008



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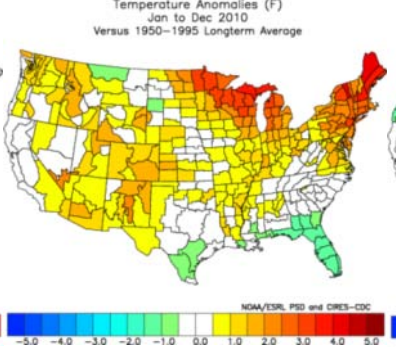
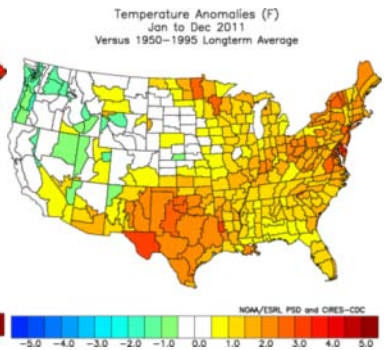
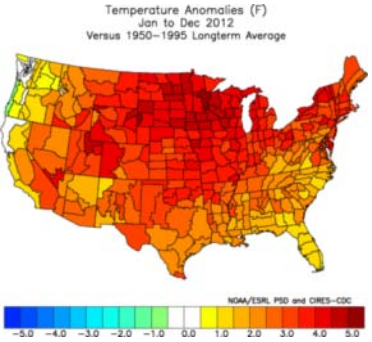


2010



2011



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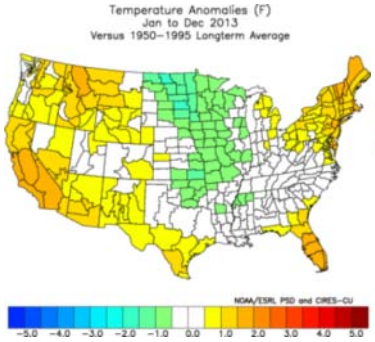

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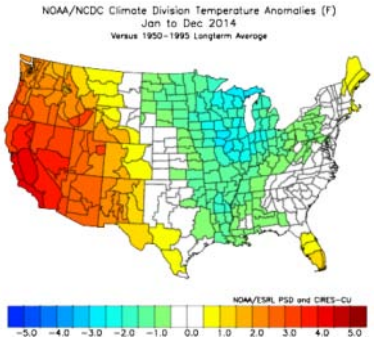
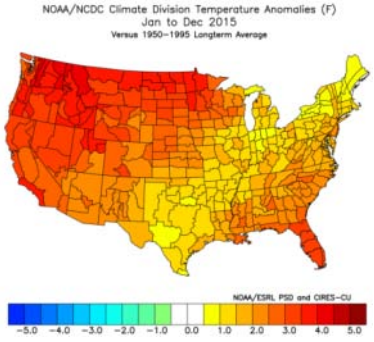
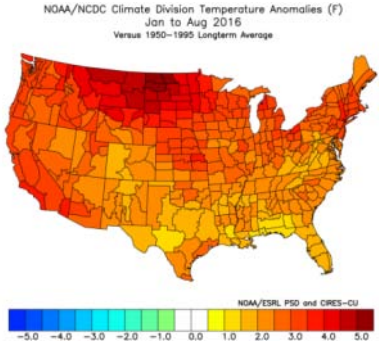


2014



2015



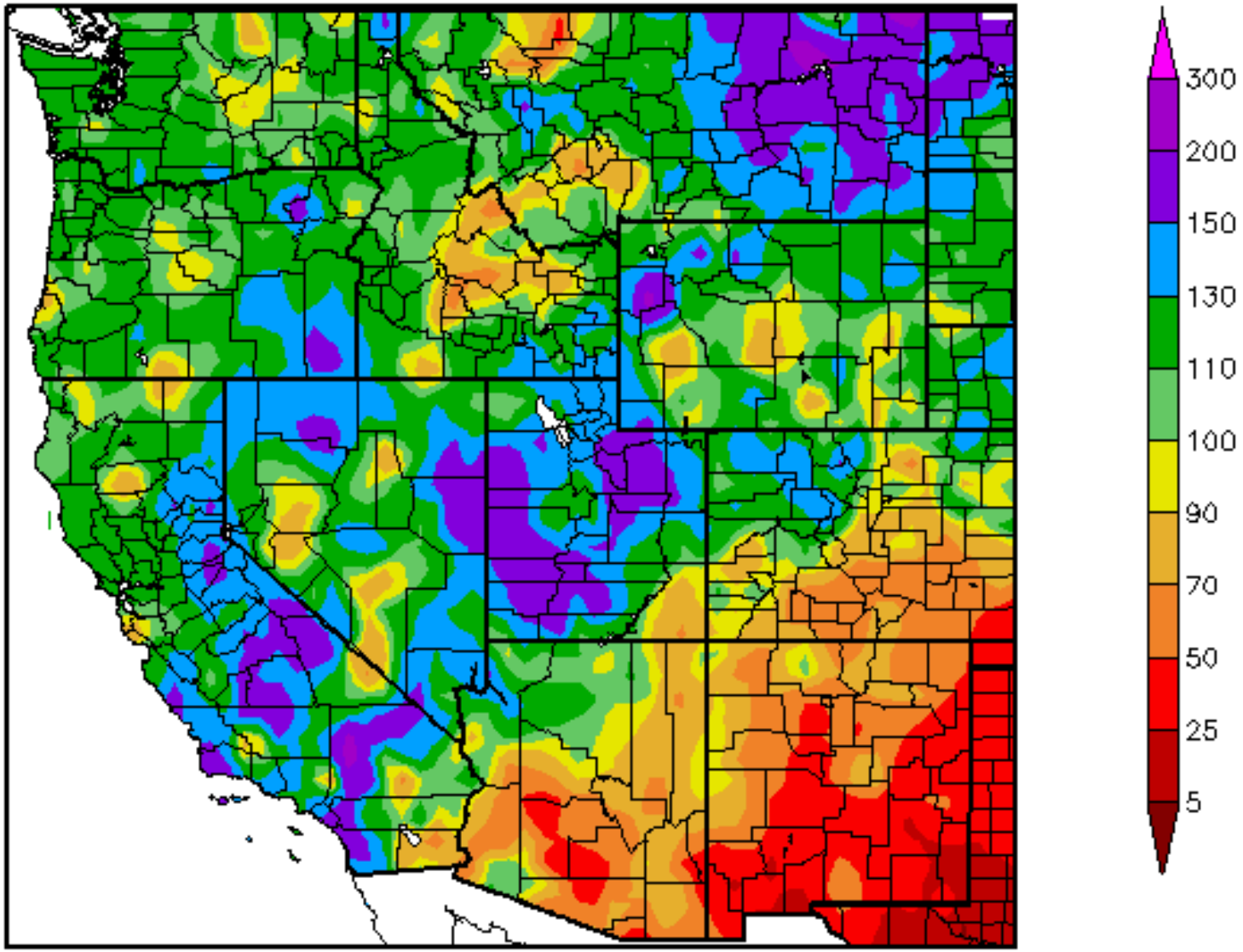
2016 Jan-Aug

United States Annual Temperature Departure from 1950-1995 Mean

NOAA Divisional Data, Western Regional Climate Center, Plotted by ESRL PSD

Water Year
2010-11
01 Oct 2010
Thru
30 Sep 2011

Percent of Normal Precipitation (%)
10/1/2010 – 9/30/2011

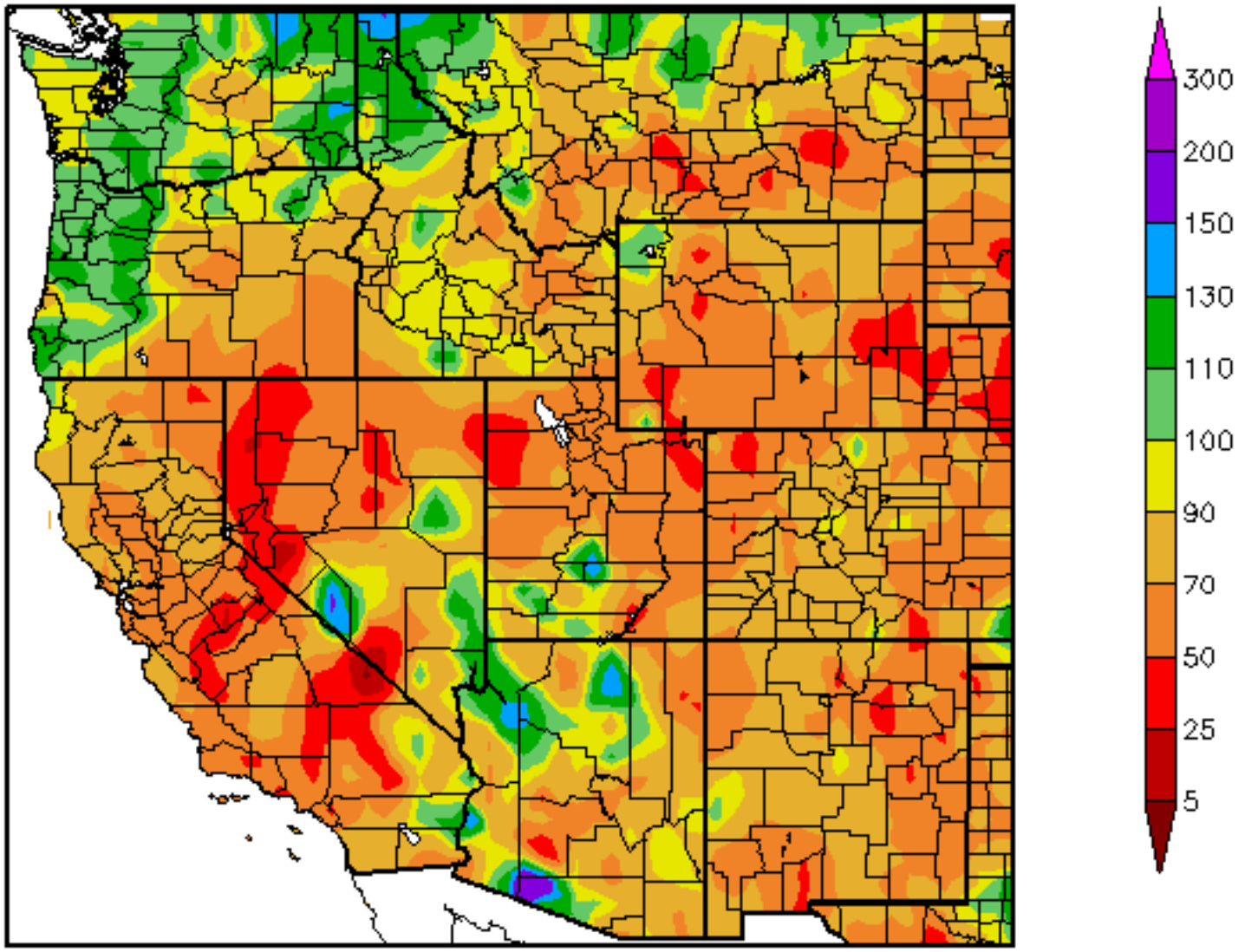


Generated 6/15/2012 at HPRCC using provisional data.

Regional Climate Centers

Water Year
2011-12
01 Oct 2011
Thru
30 Sep 2012

Percent of Normal Precipitation (%)
10/1/2011 – 9/30/2012

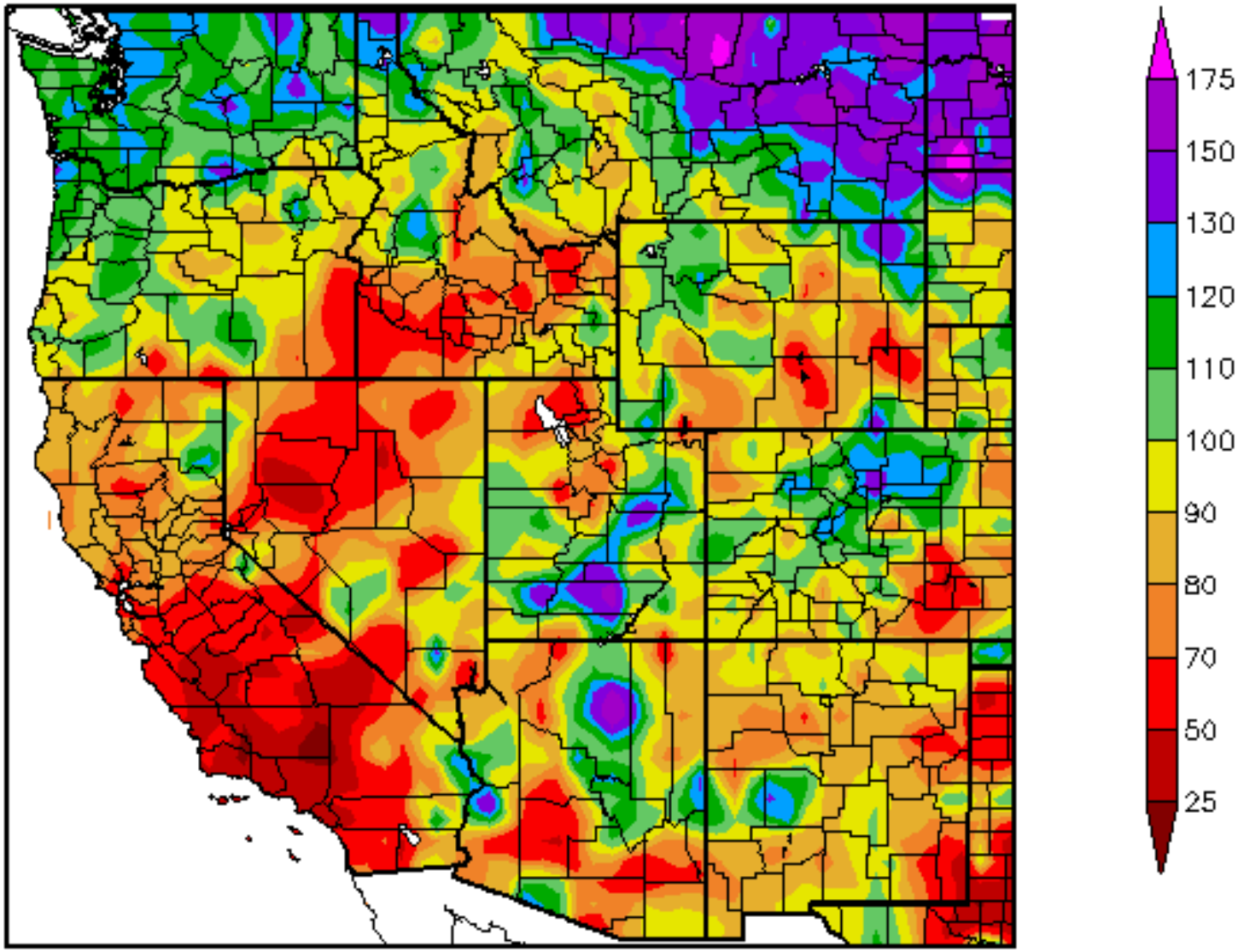


Generated 10/11/2012 at HPRCC using provisional data.

Regional Climate Centers

Water Year
2012-13
01 Oct 2012
Thru
30 Sep 2013

Percent of Normal Precipitation (%)
10/1/2012 – 9/30/2013

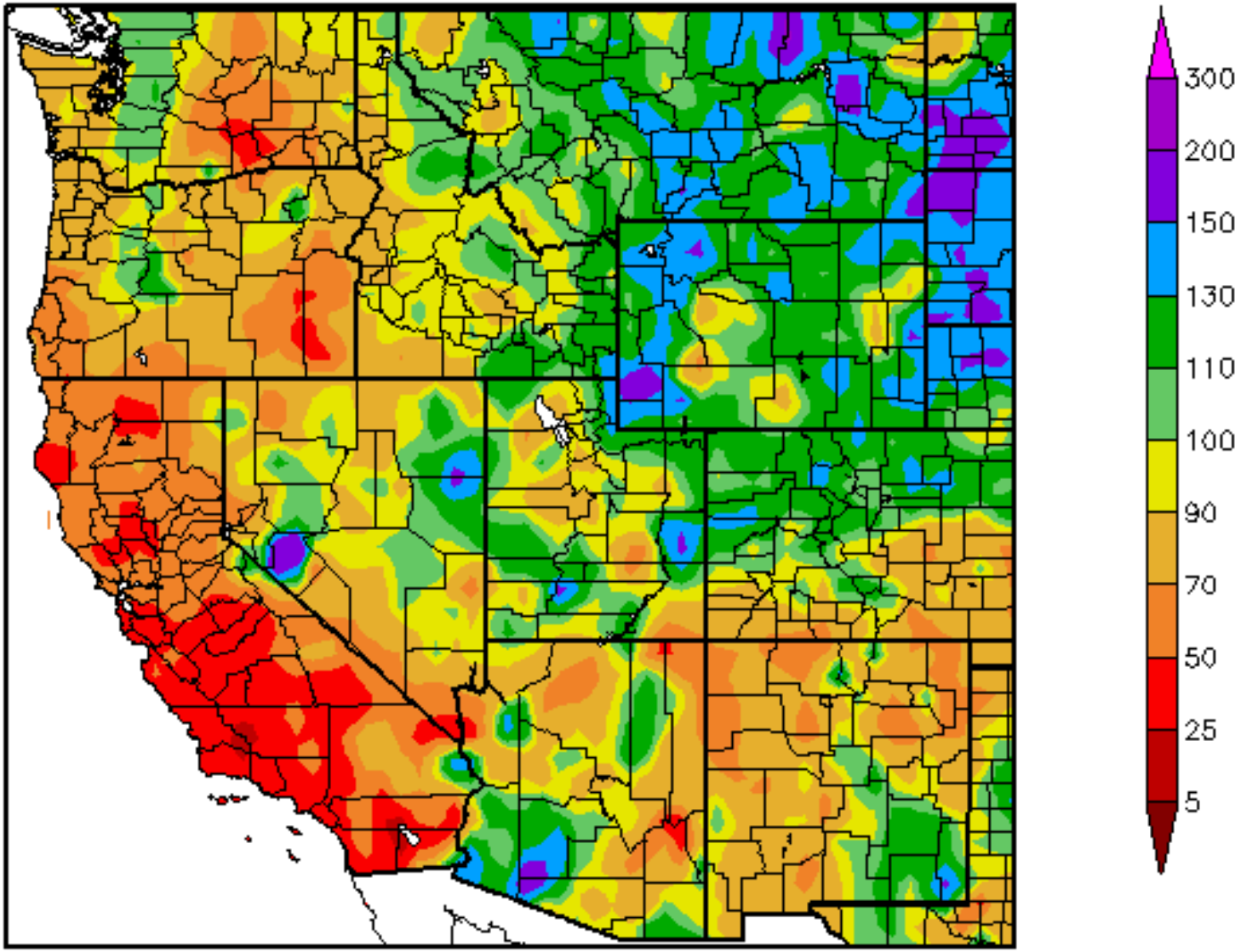


Generated 10/11/2013 at HPRCC using provisional data.

Regional Climate Centers

Water Year
2013-14
01 Oct 2013
Thru
30 Sep 2014

Percent of Normal Precipitation (%)
10/1/2013 – 9/30/2014

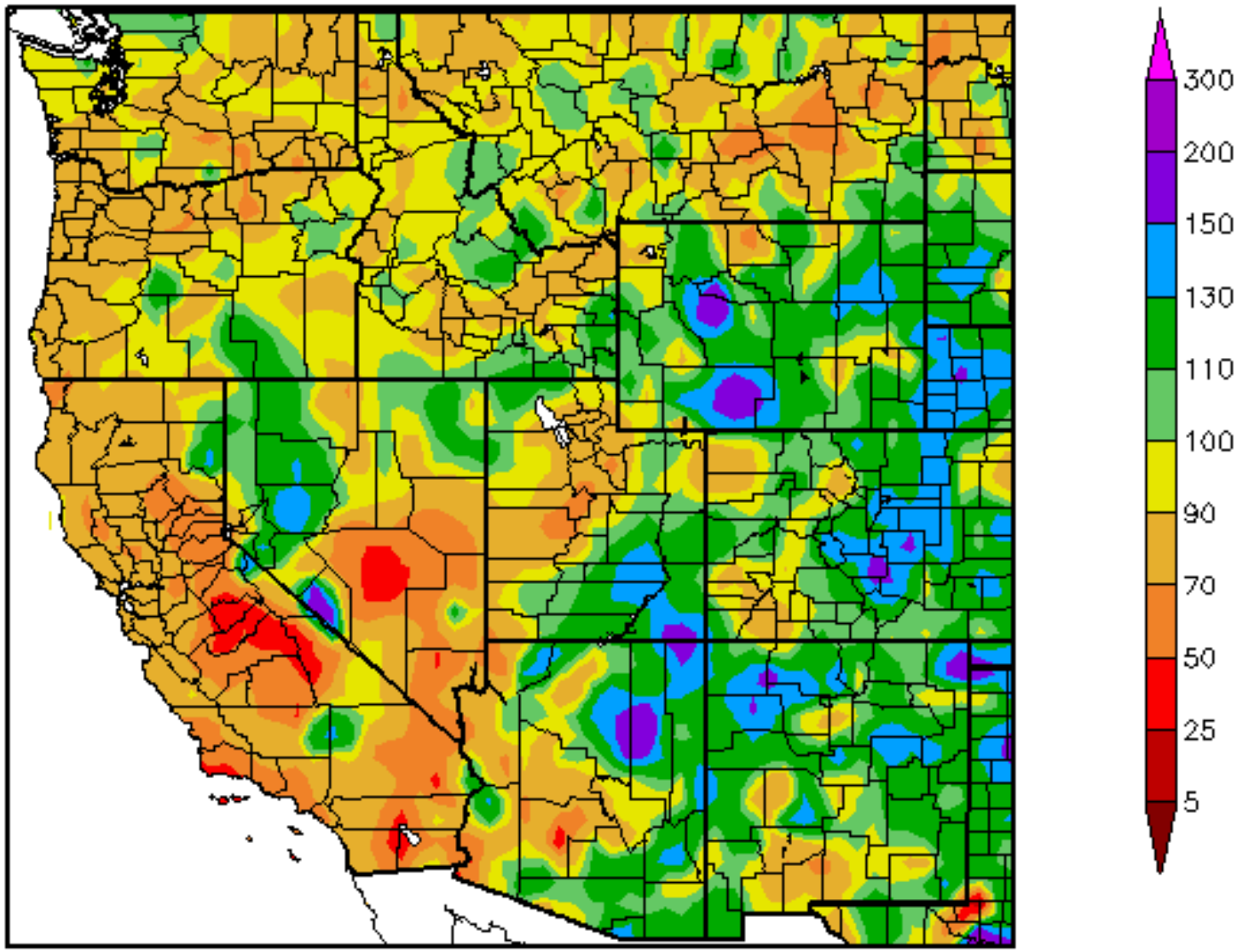


Generated 10/11/2014 at HPRCC using provisional data.

Regional Climate Centers

Water Year
2014-15 to date
01 Oct 2014
Thru
30 Sep 2015

Percent of Normal Precipitation (%)
10/1/2014 – 9/30/2015

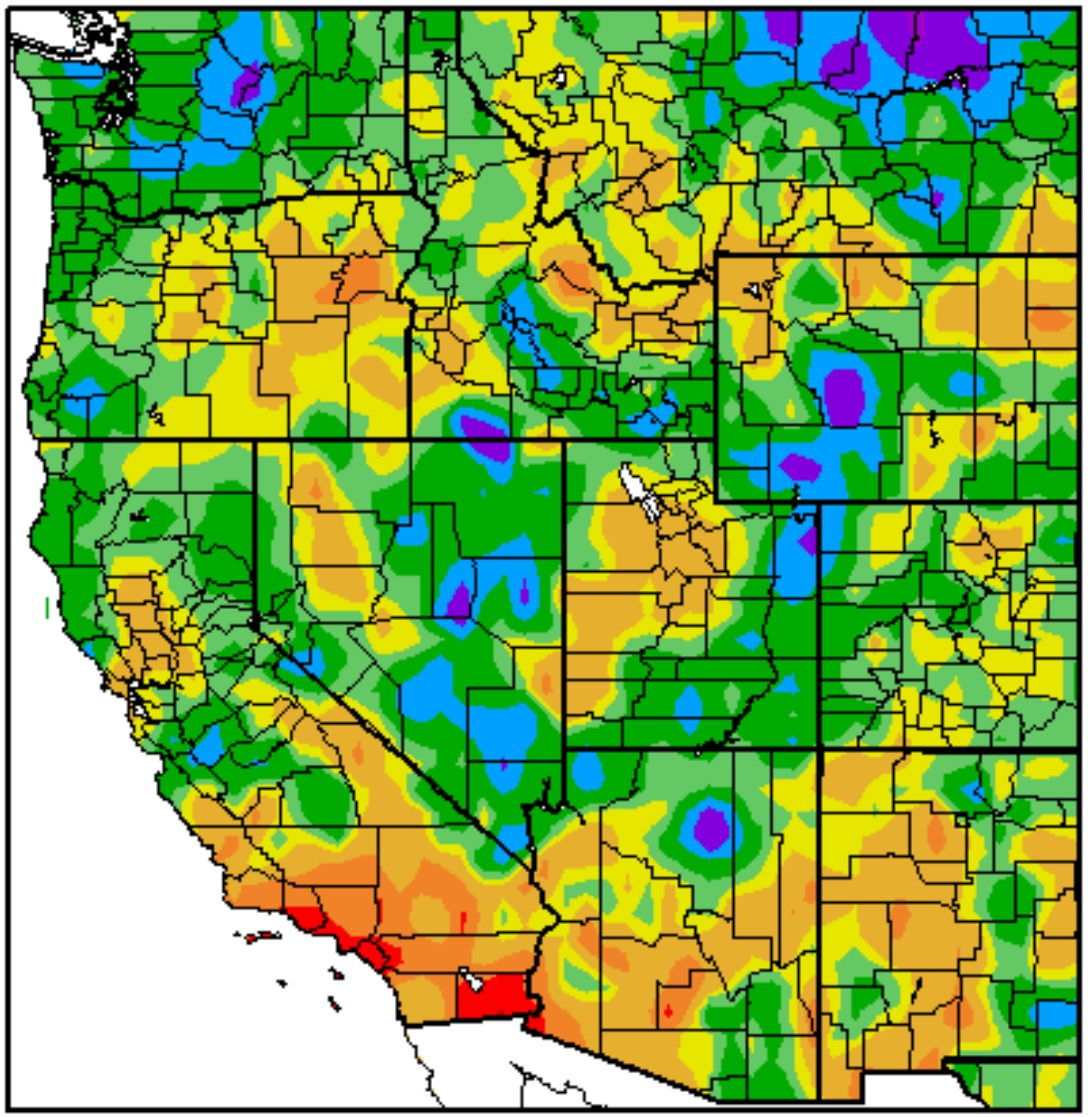


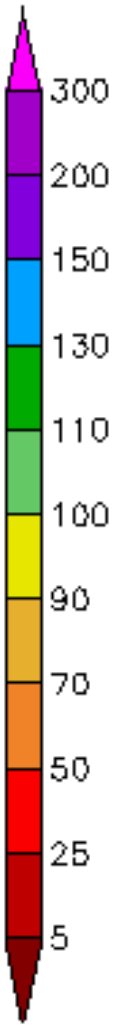
Generated 10/2/2015 at HPRCC using provisional data.

Regional Climate Centers

Water Year
2014-15
01 Oct 2015
Thru
30 Sep 2016

Percent of Normal Precipitation (%)
10/1/2015 – 9/30/2016

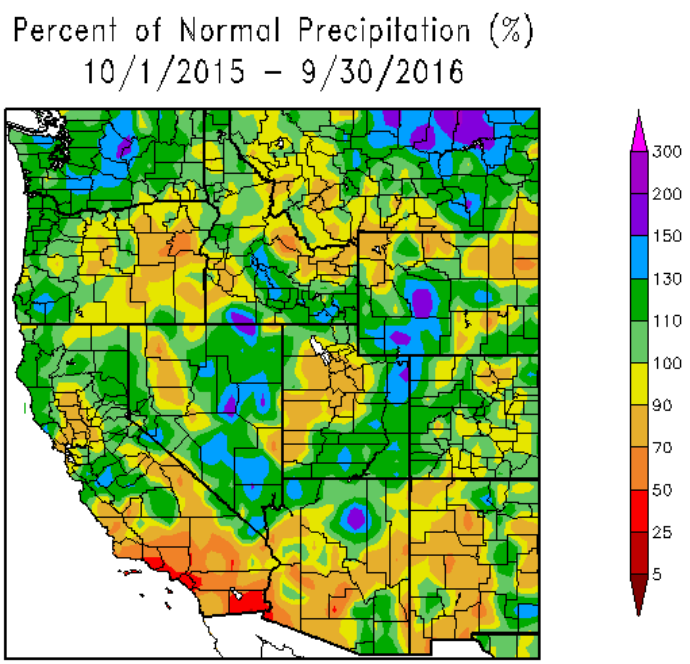




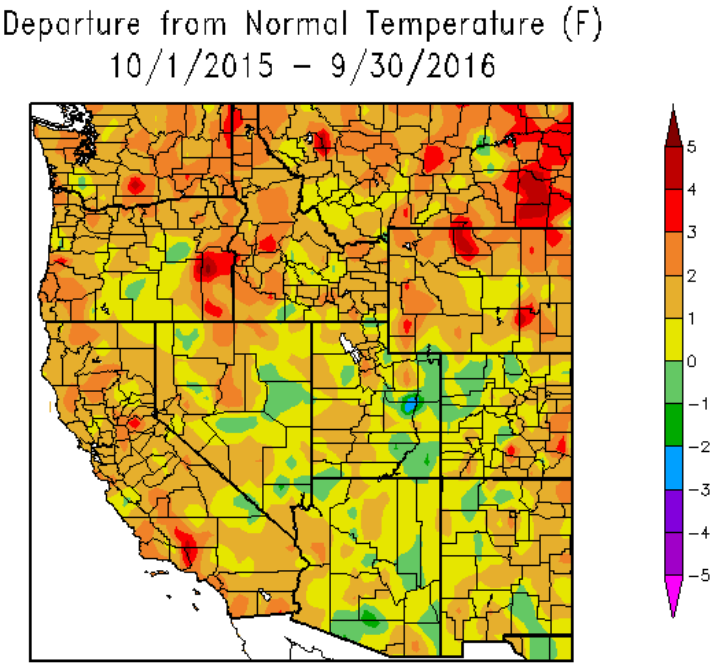
Generated 10/2/2016 at HPRCC using provisional data.

Regional Climate Centers

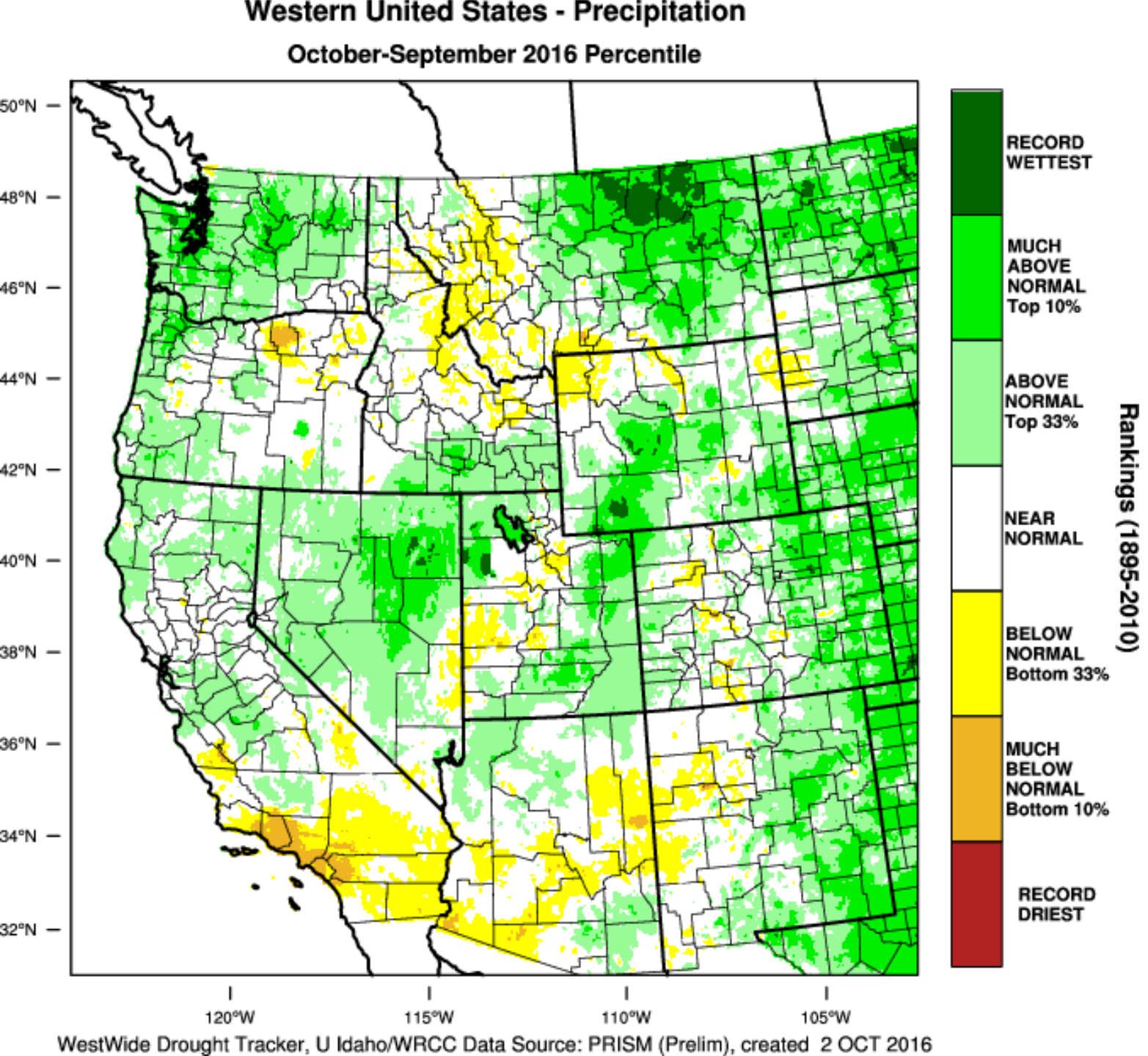
Water Year 2015-2016



Precipitation Percent



Temperature Departure (F)

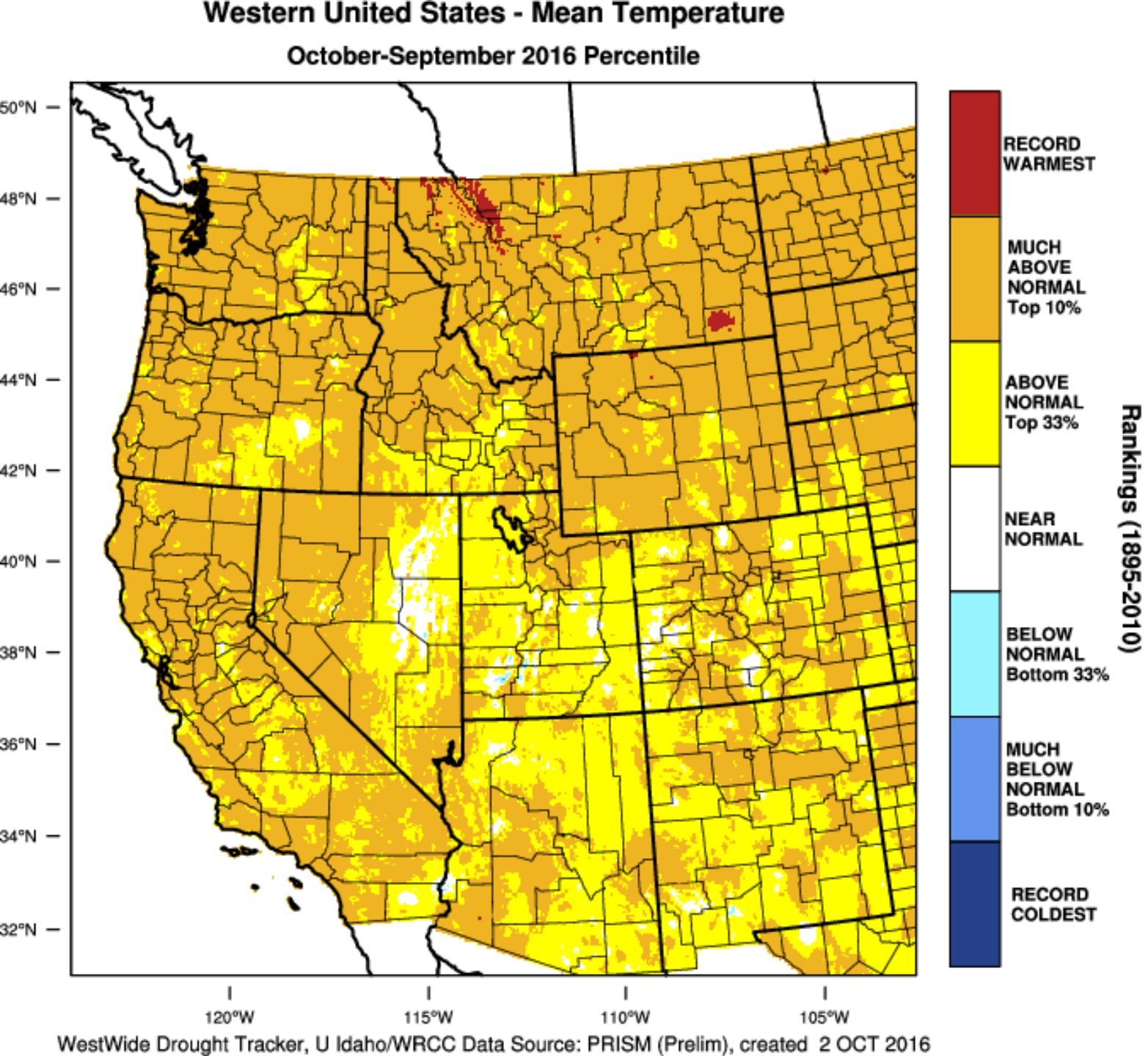


Water Year Precipitation Rank

Oct 2015 Thru Sep 2016

Reference Period 1896 Thru 2015

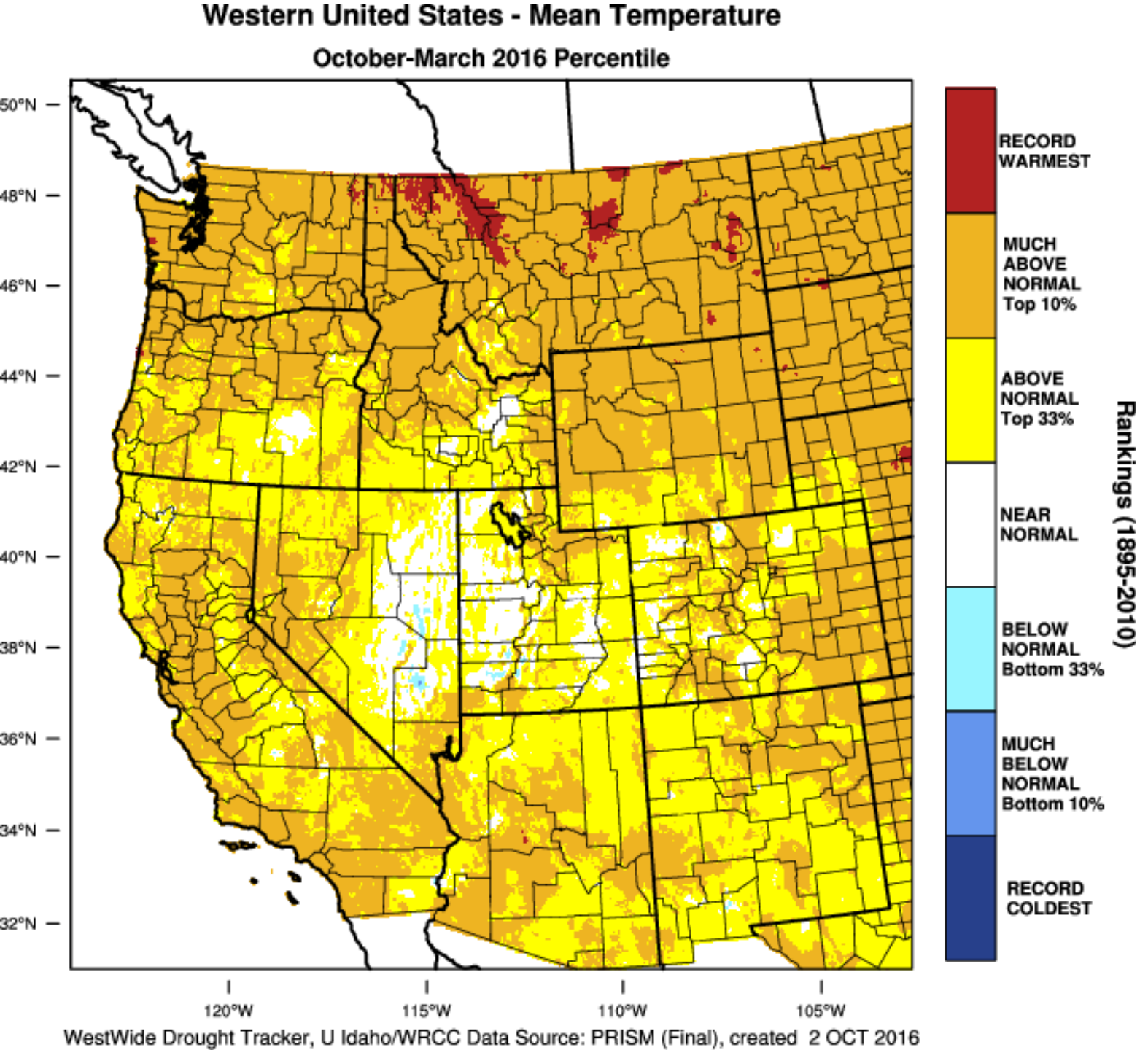
West-Wide Drought Tracker



Oct-Sep Precipitation Rank

Oct 2015 Thru Sep 2016

Reference Period 1895 - 2015



Western US Temperature Percentiles

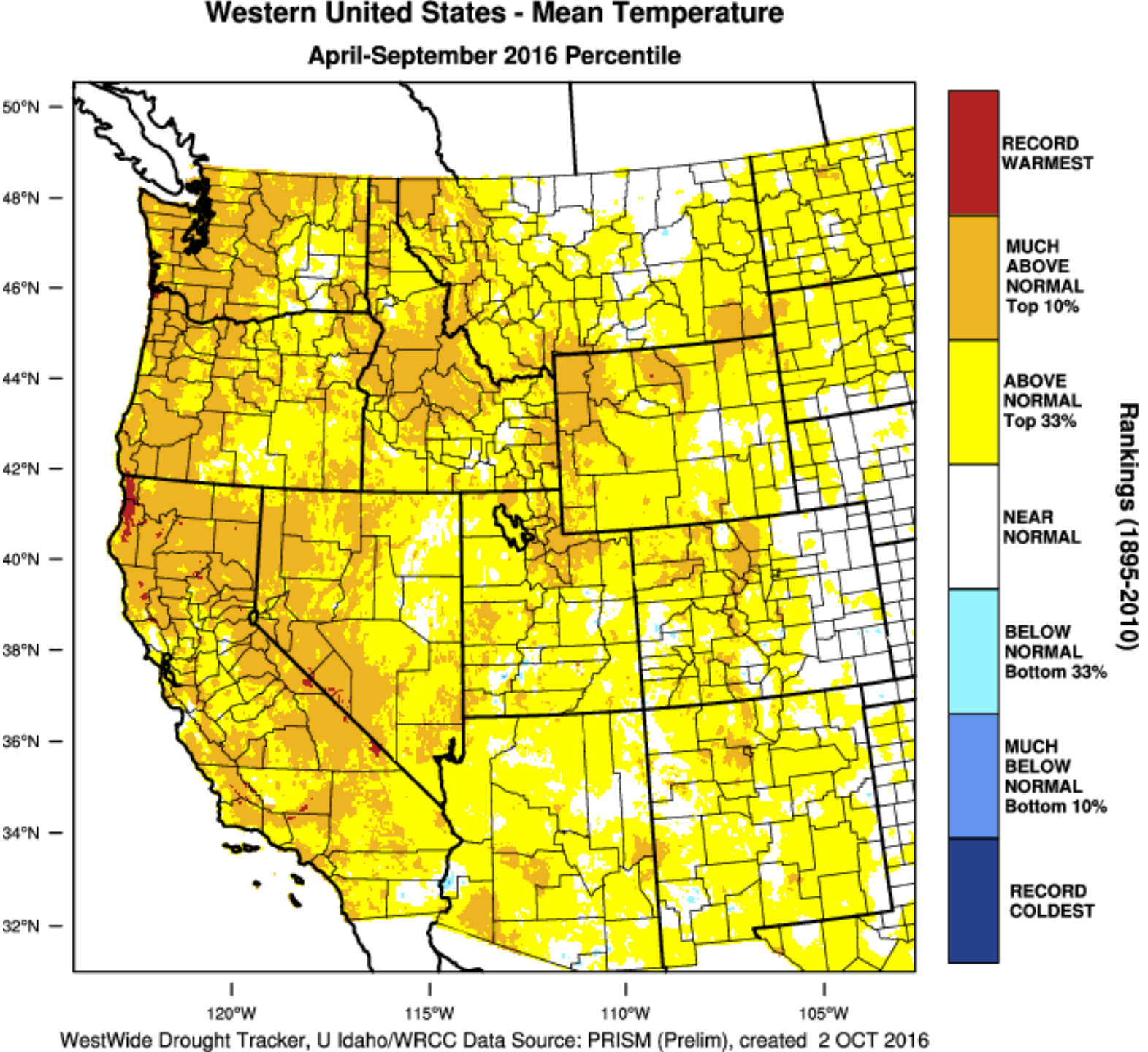
Oct 2015 thru Mar 2016

Reference Period 121 Years 1895-2016

WestWide Drought Tracker

Updated Monthly

WRCC



Western US Temperature Percentiles

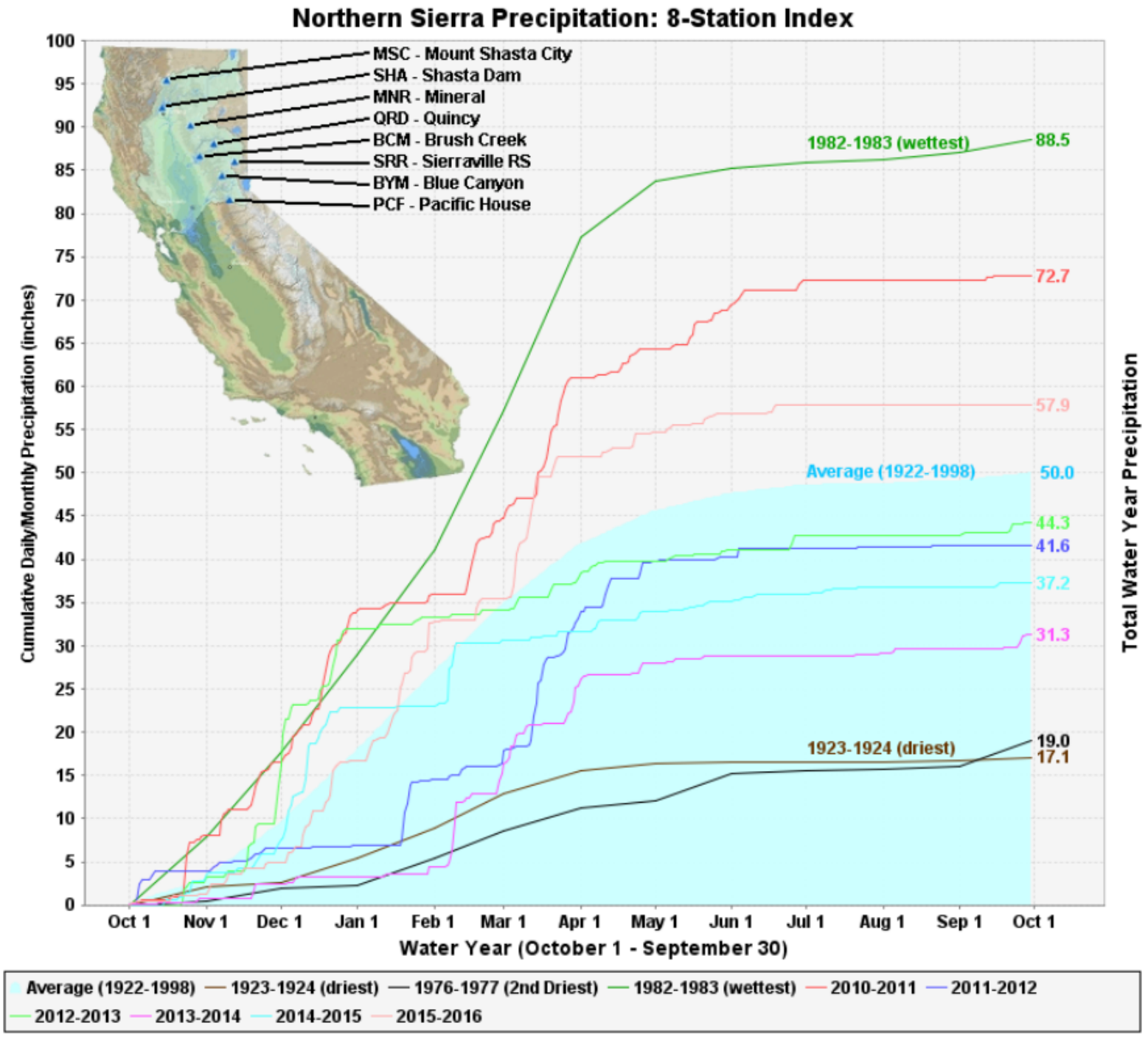
Apr 2015 thru Sep 2016

Reference Period 121 Years 1895-2015

WestWide Drought Tracker

Updated Monthly

WRCC



8-Station Index Precipitation

Wettest (1982-83)

2010-11

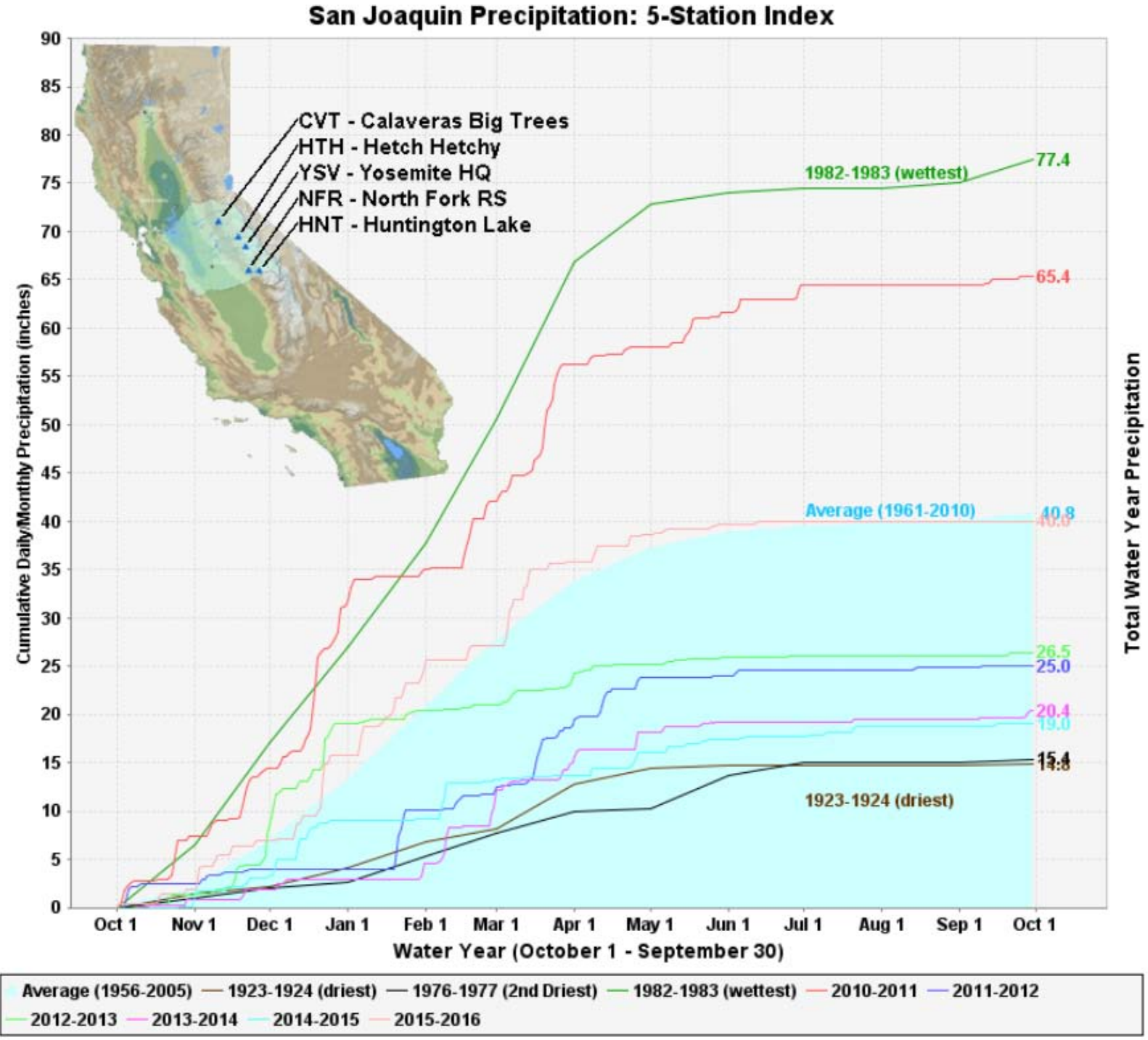
2015-16

2012-13
2011-12
2014-15

2013-14

Two driest years, (1976-77, 1923-24)

CA - DWR



5-Station Index Precipitation

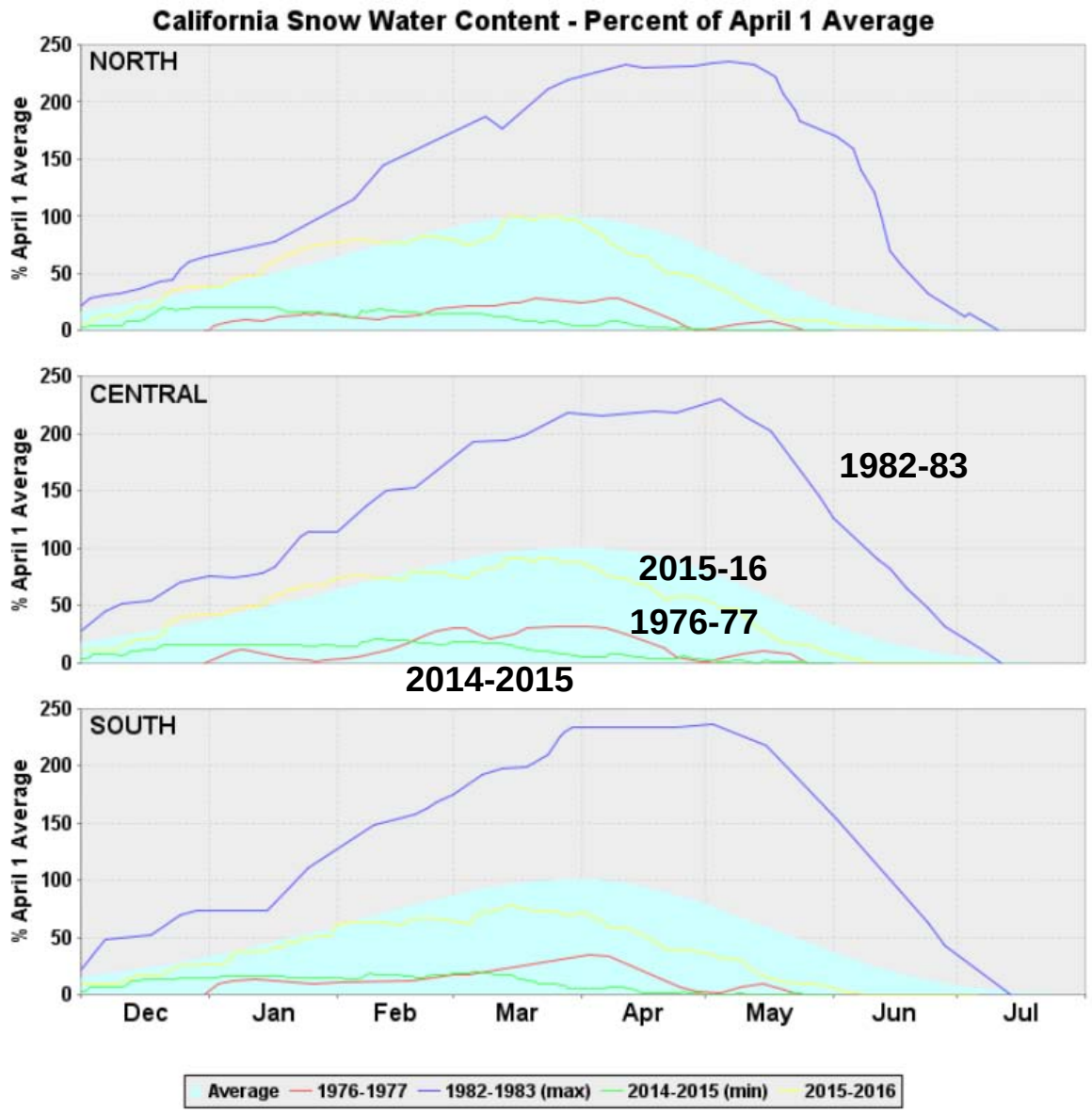
Wettest (1982-83)

2010-11

2015-16

2012-13
2011-12
2013-14
2014-15
Two driest years, 1976-77, 1923-24)

CA - DWR



Northern Sierra

Central Sierra

Southern Sierra

Winter Season Snow Water Content

1982-83 wettest

Average

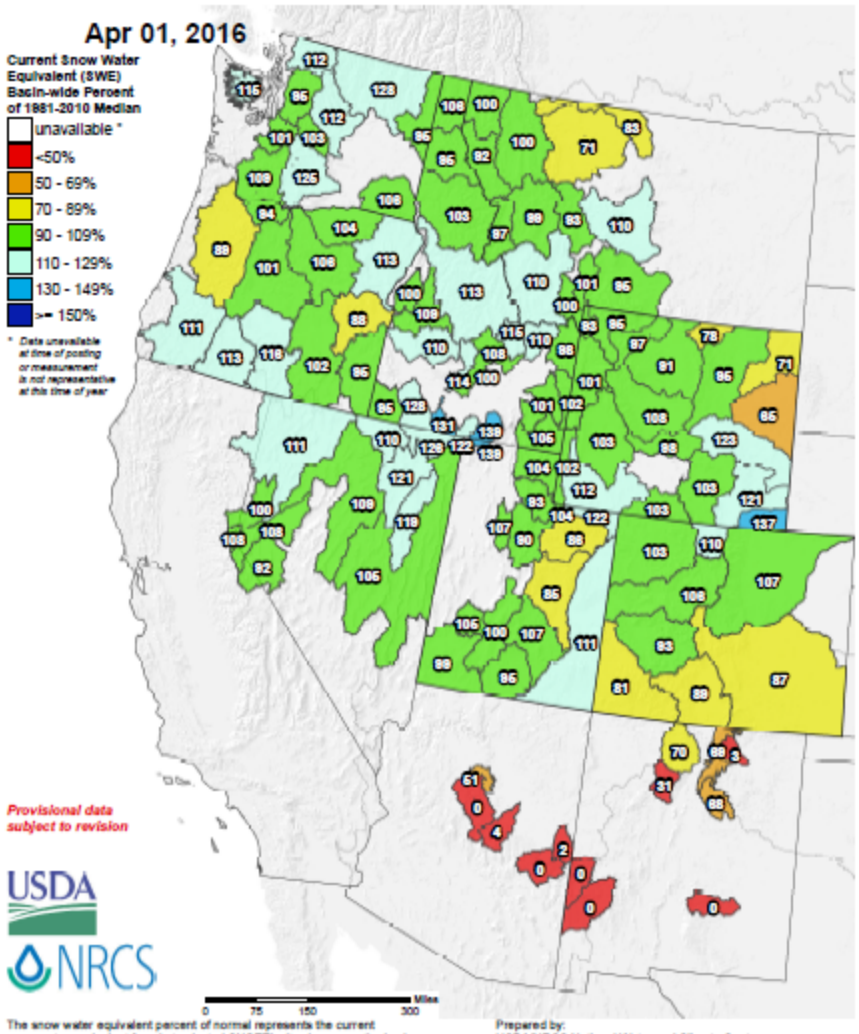
2013-14

2014-15

1976-77 driest

Thru 06 Jul 2016
Cal DWR

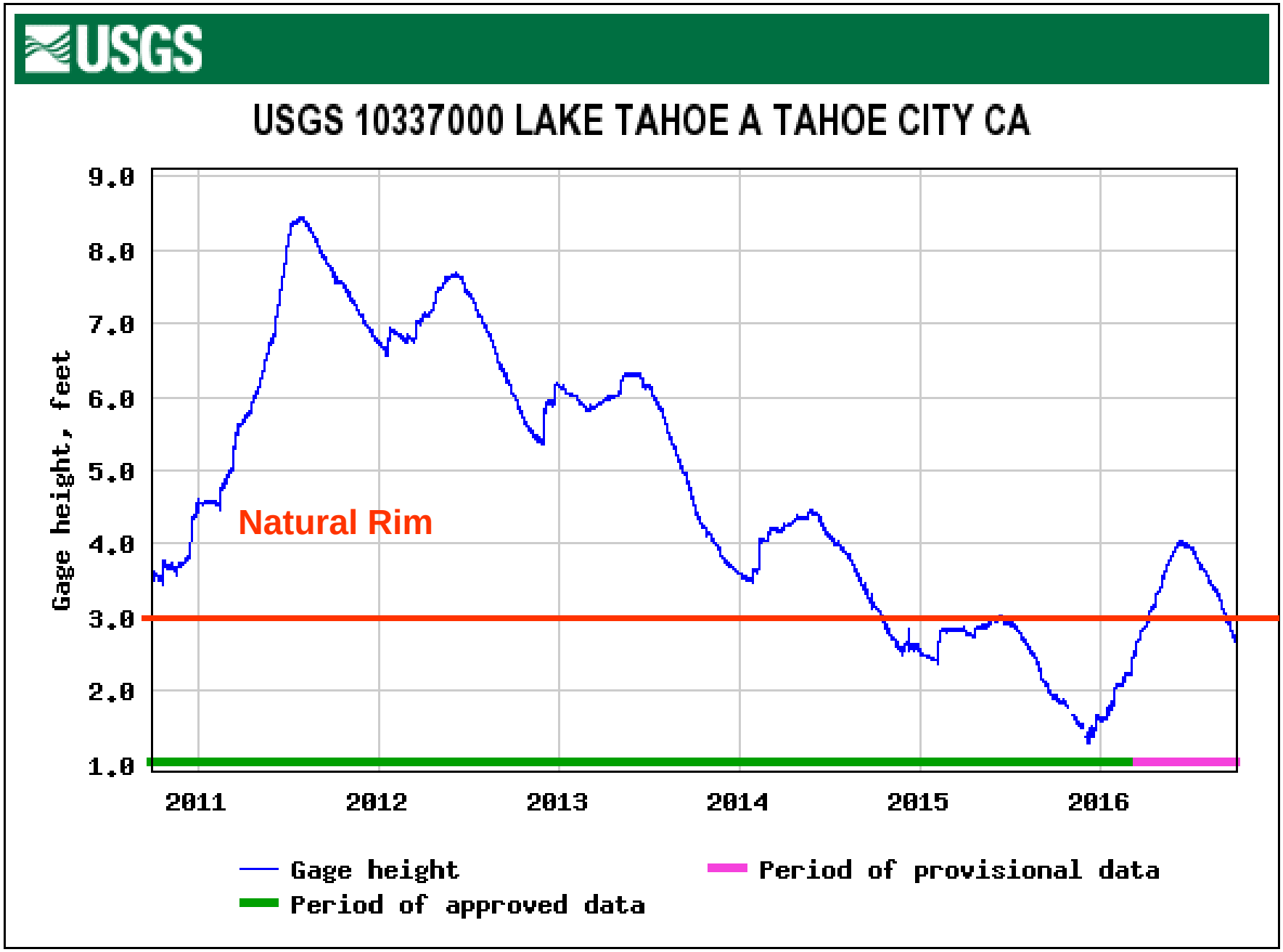
Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal



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

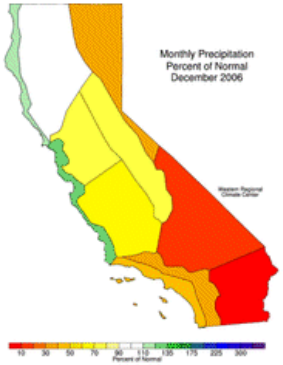
Elevation of Lake Tahoe at Tahoe City 2010 Oct 01 - 2015 Oct 03



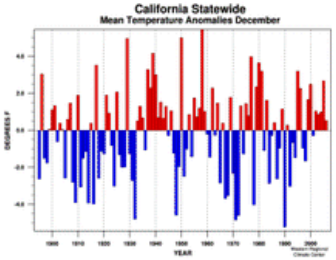
California Climate Tracker

Select from the Menu to the Right

Latest Graphics



Time Series



Latest Graphics

Select Region

Select Element

Select Data Type

Select Time Period

Select

Time Series

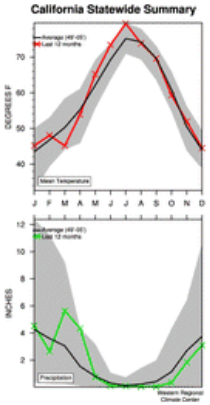
Select Region

Select Element

Select Time Period

Select

Last 12 Months



Summary of the Past 12 Months

Select Region GO

- Climate region data: 1895 to present
- Averages taken from: 1949-2005

Time Series

Select Region

Select Element

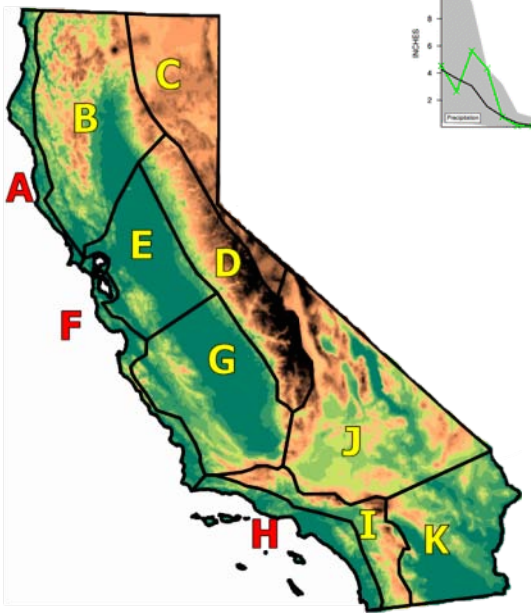
Select Element
Maximum Temperature
Minimum Temperature
Mean Temperature
Precipitation
Temperature Summary

Select Time Period
March
April
May
June
July
August
September
October
November
December
Winter (DJF)
Spring (MAM)
Summer (JJA)
Autumn (SON)
Calendar Year (Jan-Dec)
Water Year (Oct-Sep)
Water Year (Jul-Jun)
January to Present
October To Present
July To Present

Time Series

Sierra

Select Region
Statewide
Sierra
Northeast
North Central
Sacramento-Delta
San Joaquin Valley
North Coast
Central Coast
South Coast
South Interior
Mohave
Sonoran



[Climate Regions](#) [More Info](#)
[Plot Data](#) [Retrieve Data](#)

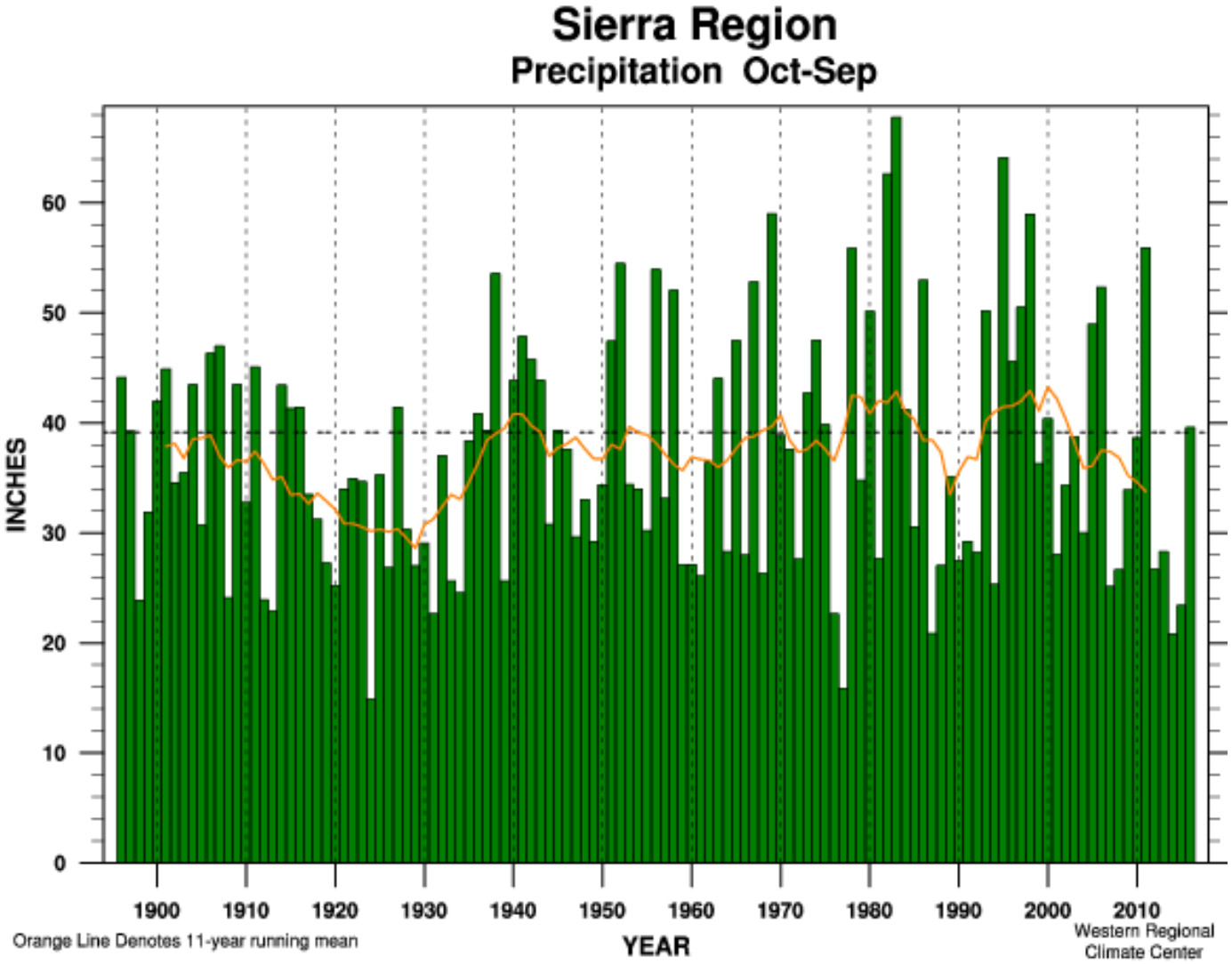
[Back to the California Climate Tracker Non-Frames Version](#)

Western Regional Climate Center

DRI Desert Research Institute

Powered by ACIS NOAA Regional Climate Centers

Several types of summaries And presentations available.



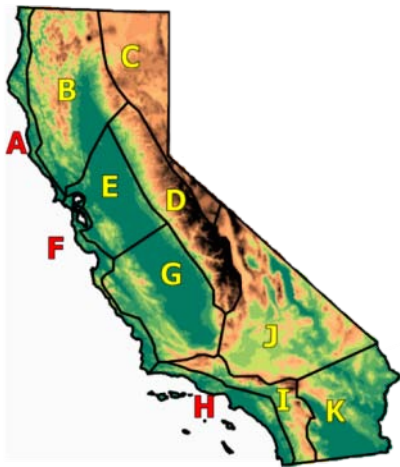
Linear Trend 1895-present	+ 2.72 ± 5.55 in.	(+ 6 ± 14%) per 100 yr	
Linear Trend 1949-present	- 5.30 ± 15.56 in.	(- 13 ± 39%) per 100 yr	
Linear Trend 1975-present	-14.46 ± 36.22 in.	(- 36 ± 92%) per 100 yr	
Wettest Year	67.79 in. (173%)	in 1983	MEAN 39.15 in.
Driest Year	14.89 in. (38%)	in 1924	STDEV 12.33 in.
Oct-Sep 2016	39.59 in. (101%)		RANK 77 of 121

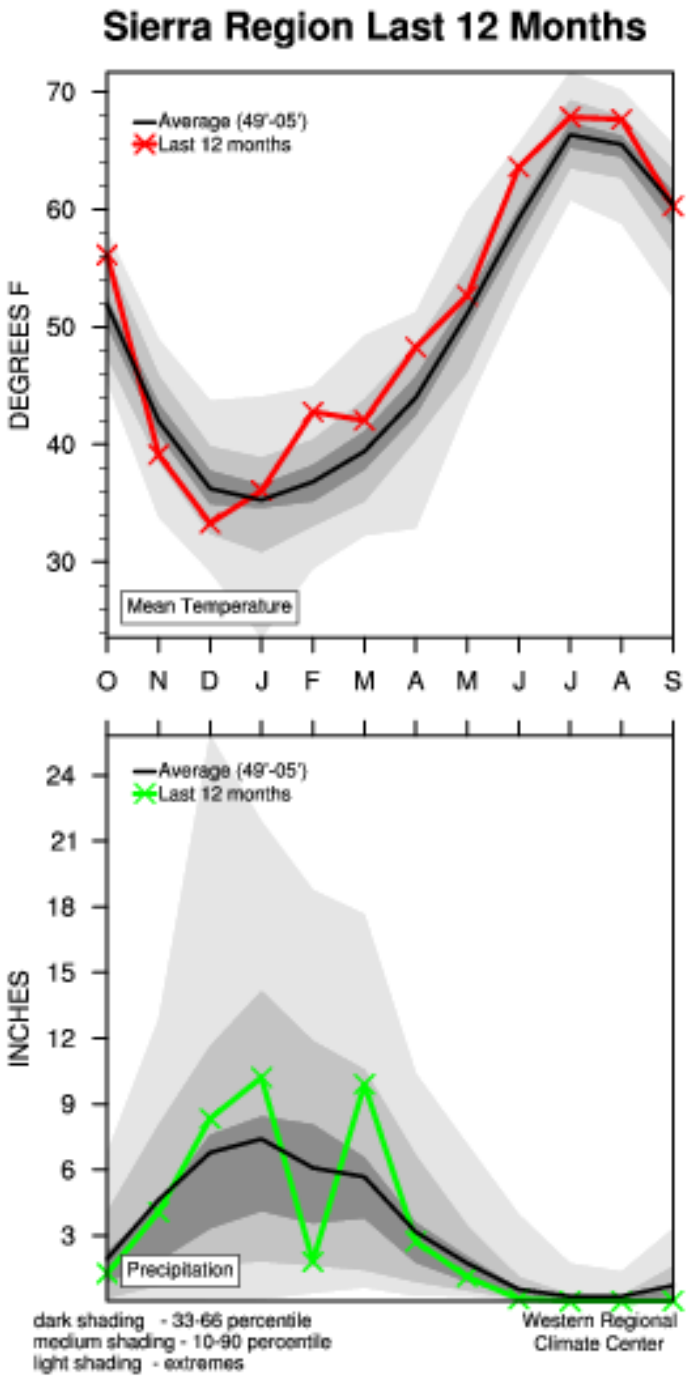
Sierra Nevada Precipitation

Water Year Oct-Sep

1895-96 thru 2015-16

California Climate Tracker





Sierra Nevada

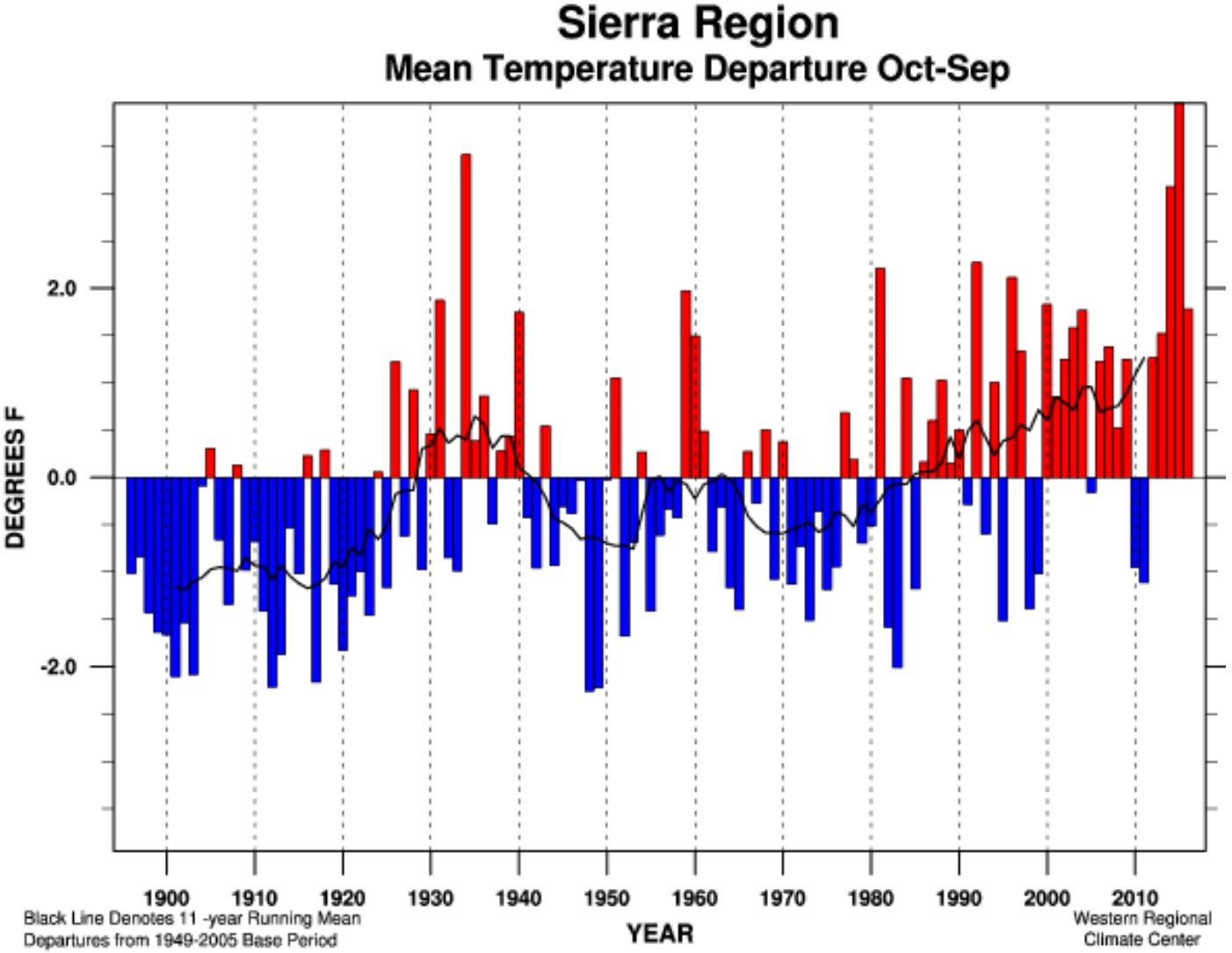
Temperature
&
Precipitation

Summary

Snow Season

Oct 2015
thru
Sep 2016

California
Climate Tracker

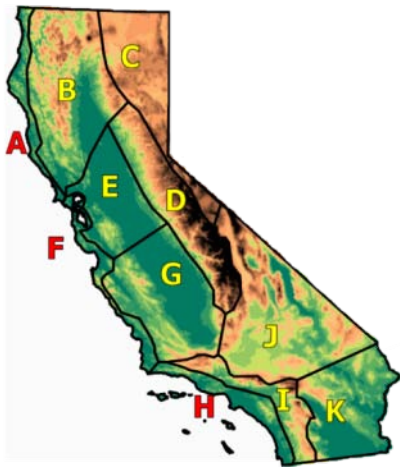


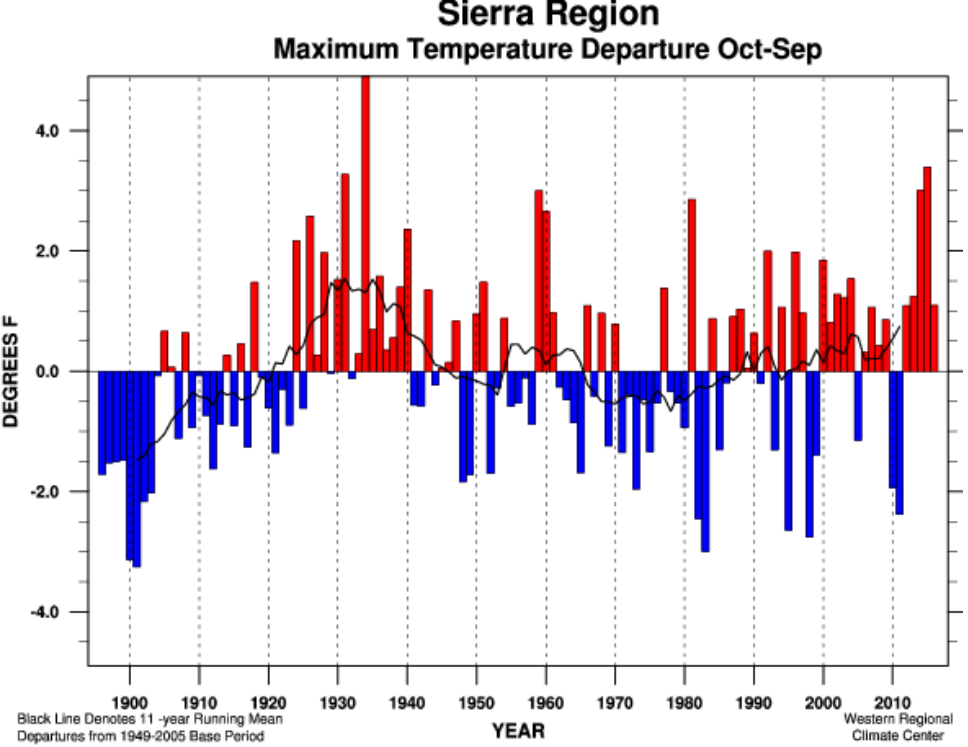
Linear Trend 1895-present	+ 1.67 ± 0.59 °F/100yr	
Linear Trend 1949-present	+ 2.84 ± 1.46 °F/100yr	
Linear Trend 1975-present	+ 4.92 ± 3.31 °F/100yr	
Warmest Year	53.0 °F (+ 4.0 °F) in 2015	MEAN 49.0 °F
Coldest Year	46.8 °F (- 2.3 °F) in 1948	STDEV 1.15 °F
Oct-Sep 2016	50.8 °F (+ 1.8 °F)	RANK 112 of 121

Water Year Oct-Sep Temperature Departure

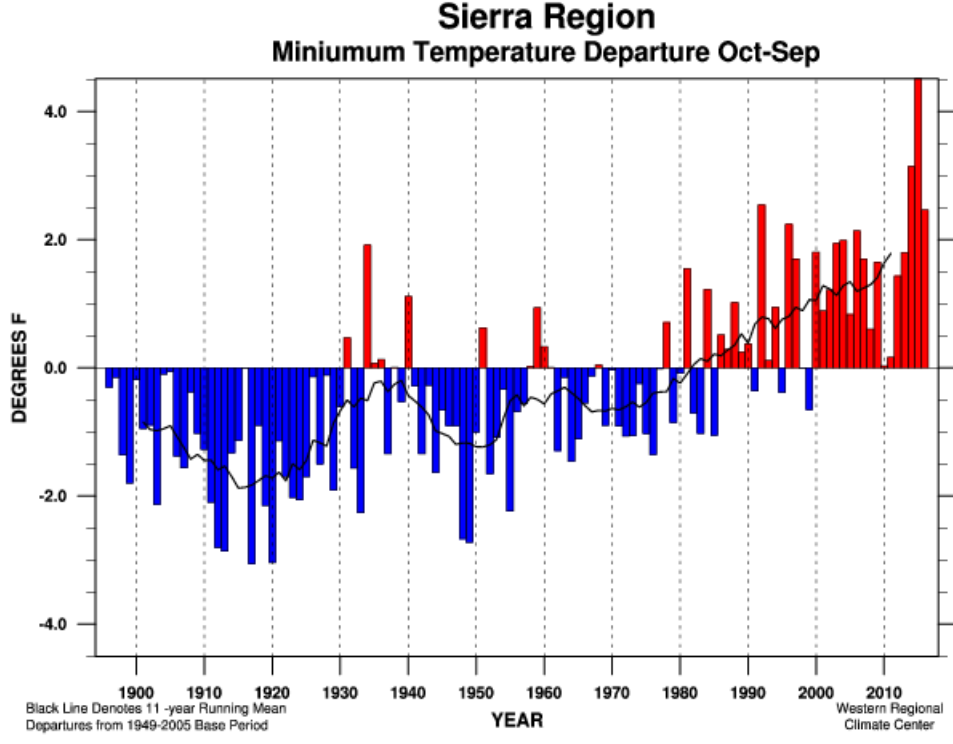
Sierra Nevada

1895-96 thru 2015-16





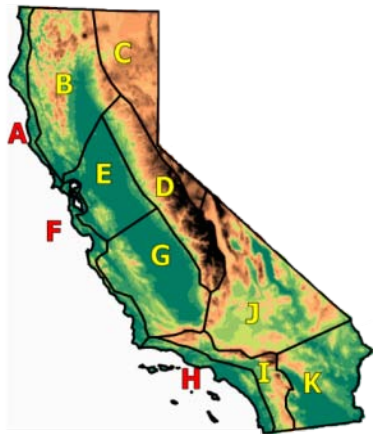
Linear Trend 1895-present	+ 0.81 ± 0.76 °F/100yr		
Linear Trend 1949-present	+ 1.11 ± 1.87 °F/100yr		
Linear Trend 1975-present	+ 3.40 ± 4.21 °F/100yr		
Warmest Year	66.4 °F (+ 4.9 °F) in 1934	MEAN	61.5 °F
Coldest Year	58.2 °F (- 3.3 °F) in 1901	STDEV	1.41°F
Oct-Sep 2016	62.6 °F (+ 1.1°F)	RANK	96 of 121



Linear Trend 1895-present	+ 2.53 ± 0.54 °F/100yr		
Linear Trend 1949-present	+ 4.57 ± 1.18 °F/100yr		
Linear Trend 1975-present	+ 6.44 ± 2.67 °F/100yr		
Warmest Year	41.1°F (+ 4.5 °F) in 2015	MEAN	36.6 °F
Coldest Year	33.5 °F (- 3.1°F) in 1917	STDEV	1.12 °F
Oct-Sep 2016	39.0 °F (+ 2.5 °F)	RANK	118 of 121

Tmax

Tmin

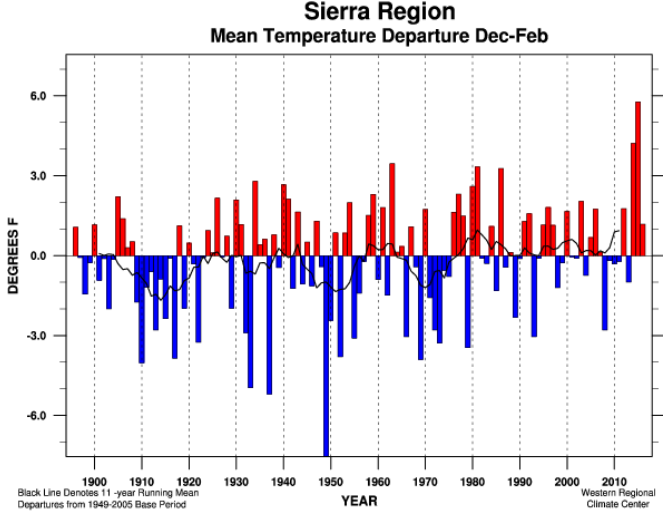


Water Year Oct-Sep Temperature Departure
Sierra Nevada

1895/96 thru 2015/16

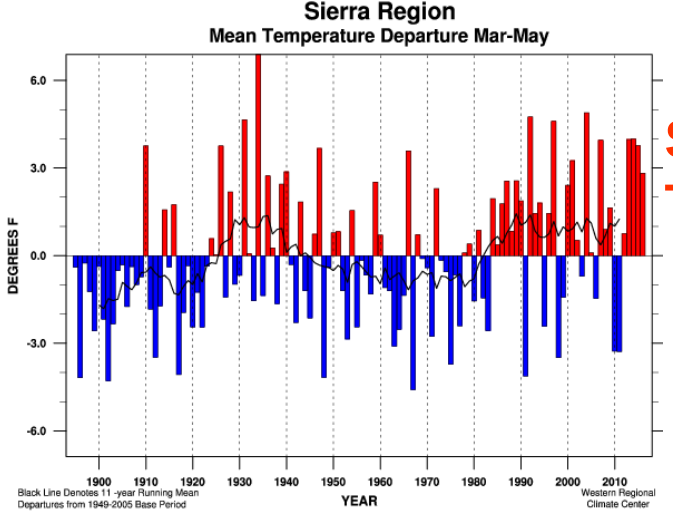
Sierra Nevada thru Sep 2016

Winter Temp



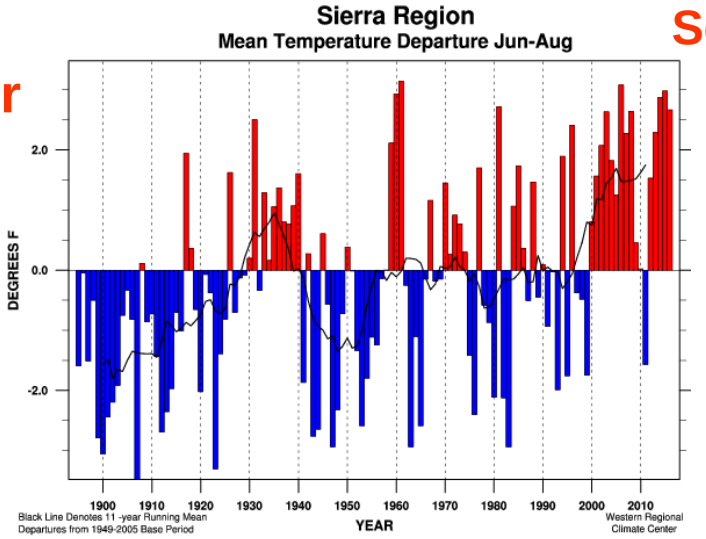
Linear Trend 1895-present	+ 1.17 ± 1.04 °F/100yr		
Linear Trend 1949-present	+ 2.40 ± 2.49 °F/100yr		
Linear Trend 1975-present	+ 1.16 ± 5.06 °F/100yr		
Warmest Year	42.0 °F (+ 5.8 °F) in 2015	MEAN	36.2 °F
Coldest Year	28.6 °F (- 7.5 °F) in 1949	STDEV	1.90 °F
Dec-Feb 2016	37.4 °F (+ 1.2 °F)	RANK	91 of 121

Spring Temp



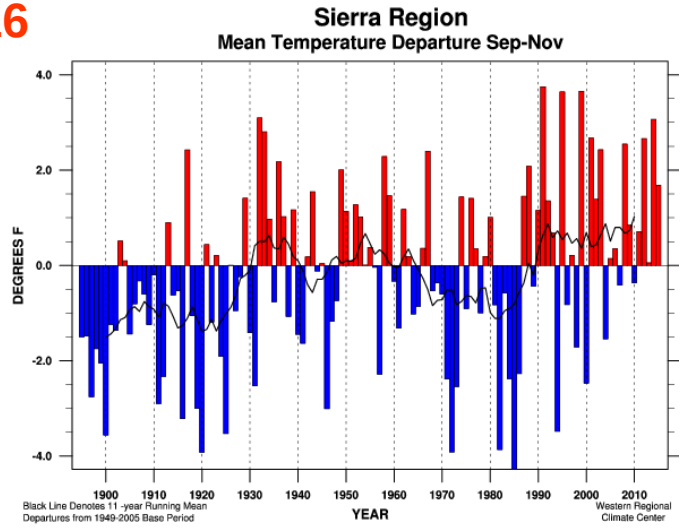
Linear Trend 1895-present	+ 1.81 ± 1.16 °F/100yr		
Linear Trend 1949-present	+ 4.00 ± 2.77 °F/100yr		
Linear Trend 1975-present	+ 6.53 ± 6.27 °F/100yr		
Warmest Year	51.7 °F (+ 6.9 °F) in 1934	MEAN	44.8 °F
Coldest Year	40.3 °F (- 4.6 °F) in 1967	STDEV	2.24 °F
Mar-May 2016	47.7 °F (+ 2.8 °F)	RANK	107 of 122

Summer Temp

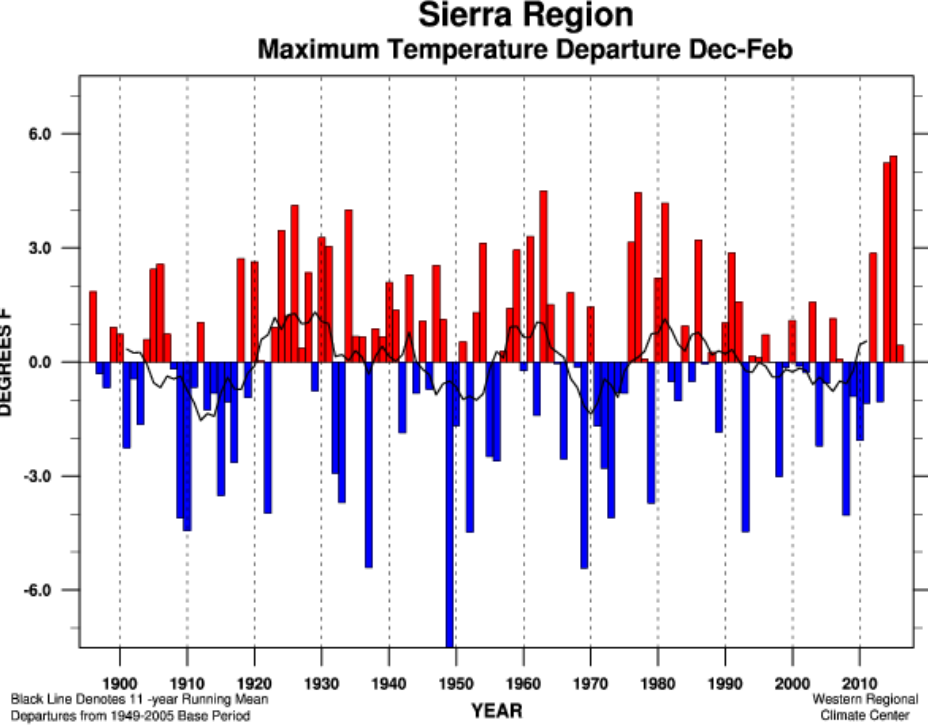


Linear Trend 1895-present	+ 2.09 ± 0.77 °F/100yr		
Linear Trend 1949-present	+ 3.42 ± 1.96 °F/100yr		
Linear Trend 1975-present	+ 7.58 ± 3.91 °F/100yr		
Warmest Year	66.8 °F (+ 3.1 °F) in 1961	MEAN	63.7 °F
Coldest Year	60.2 °F (- 3.5 °F) in 1907	STDEV	1.64 °F
Jun-Aug 2016	66.4 °F (+ 2.7 °F)	RANK	116 of 122

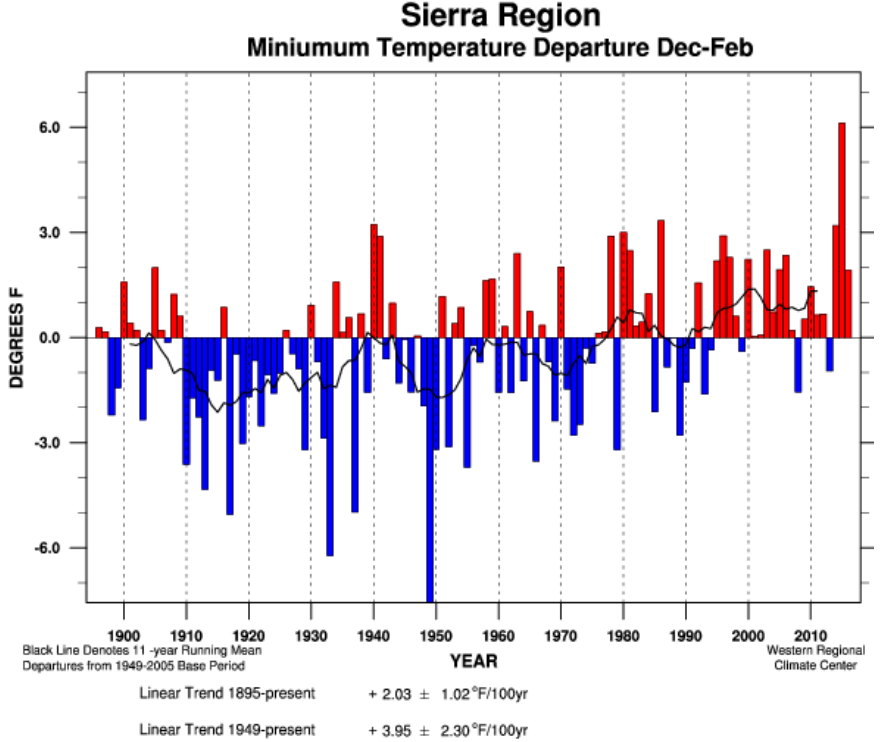
Fall Temp



Linear Trend 1895-present	+ 1.64 ± 0.88 °F/100yr		
Linear Trend 1949-present	+ 1.40 ± 2.33 °F/100yr		
Linear Trend 1975-present	+ 5.46 ± 5.17 °F/100yr		
Warmest Year	55.2 °F (+ 3.8 °F) in 1991	MEAN	51.4 °F
Coldest Year	47.1 °F (- 4.3 °F) in 1985	STDEV	1.88 °F
Sep-Nov 2015	53.1 °F (+ 1.7 °F)	RANK	105 of 121

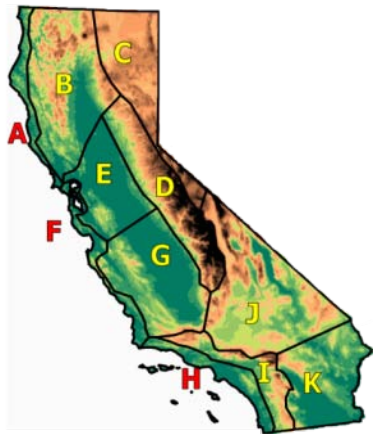


Linear Trend 1895-present		+ 0.30 ± 1.26 °F/100yr	
Linear Trend 1949-present		+ 0.86 ± 3.06 °F/100yr	
Linear Trend 1975-present		- 1.37 ± 6.27 °F/100yr	
Warmest Year		51.8 °F (+ 5.4 °F) in 2015	MEAN 46.4 °F
Coldest Year		38.9 °F (- 7.5 °F) in 1949	STDEV 2.29 °F
Dec-Feb	2016	46.8 °F (+ 0.4 °F)	RANK 67 of 121



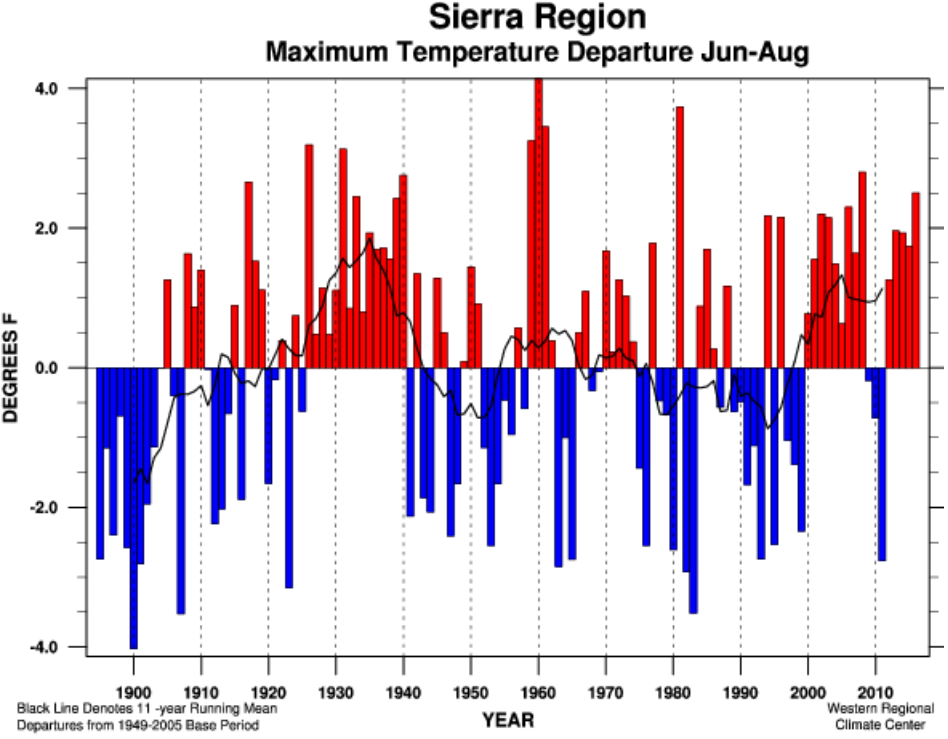
Linear Trend 1895-present		+ 2.03 ± 1.02 °F/100yr	
Linear Trend 1949-present		+ 3.95 ± 2.30 °F/100yr	
Linear Trend 1975-present		+ 3.70 ± 4.87 °F/100yr	
Warmest Year		32.1 °F (+ 6.1 °F) in 2015	MEAN 26.0 °F
Coldest Year		18.4 °F (- 7.6 °F) in 1949	STDEV 1.88 °F
Dec-Feb	2016	27.9 °F (+ 1.9 °F)	RANK 103 of 121

Tmax **Tmin**

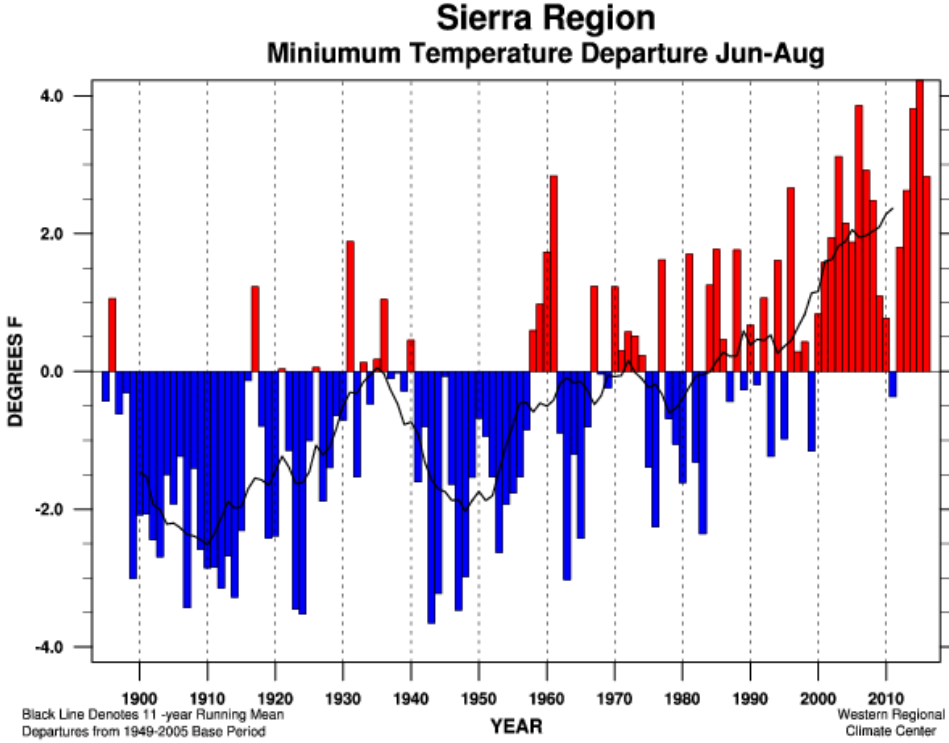


Water Year Dec-Jan-Feb Temperature Departure
Sierra Nevada

1895/96 thru 2015/16



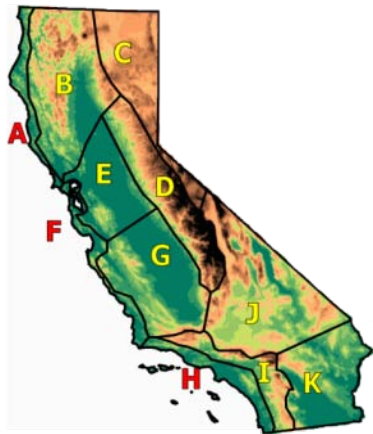
Linear Trend 1895-present		+ 0.96 ± 0.94 °F/100yr	
Linear Trend 1949-present		+ 1.42 ± 2.27 °F/100yr	
Linear Trend 1975-present		+ 6.01 ± 4.63 °F/100yr	
Warmest Year		82.6 °F (+ 4.1 °F) in 1960	MEAN 78.4 °F
Coldest Year		74.4 °F (- 4.0 °F) in 1900	STDEV 1.85 °F
Jun-Aug	2016	80.9 °F (+ 2.5 °F)	RANK 113 of 122



Linear Trend 1895-present		+ 3.22 ± 0.74 °F/100yr	
Linear Trend 1949-present		+ 5.42 ± 1.71 °F/100yr	
Linear Trend 1975-present		+ 9.15 ± 3.37 °F/100yr	
Warmest Year		53.2 °F (+ 4.2 °F) in 2015	MEAN 49.0 °F
Coldest Year		45.3 °F (- 3.7 °F) in 1943	STDEV 1.59 °F
Jun-Aug	2016	51.8 °F (+ 2.8 °F)	RANK 116 of 122

Tmax

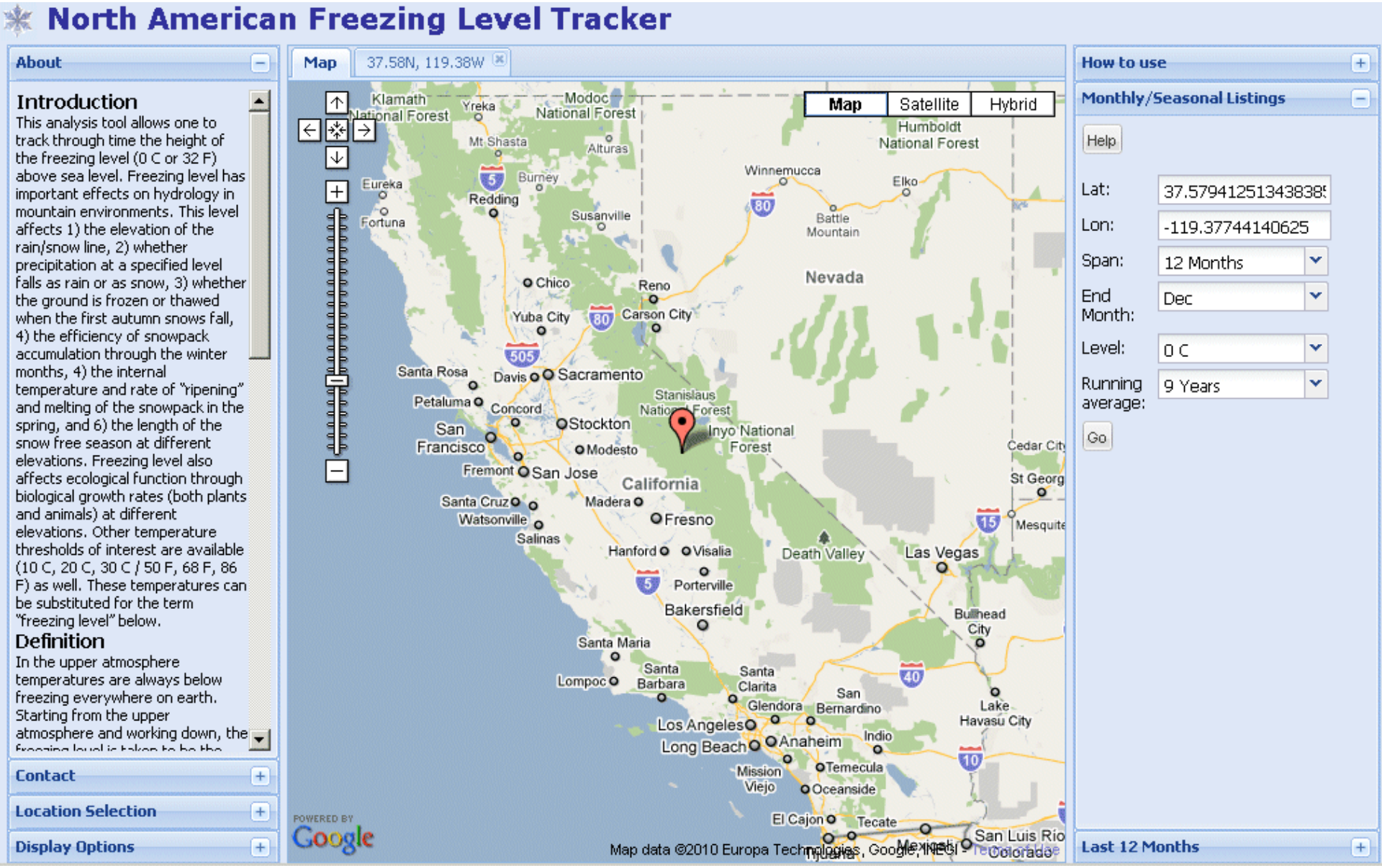
Tmin



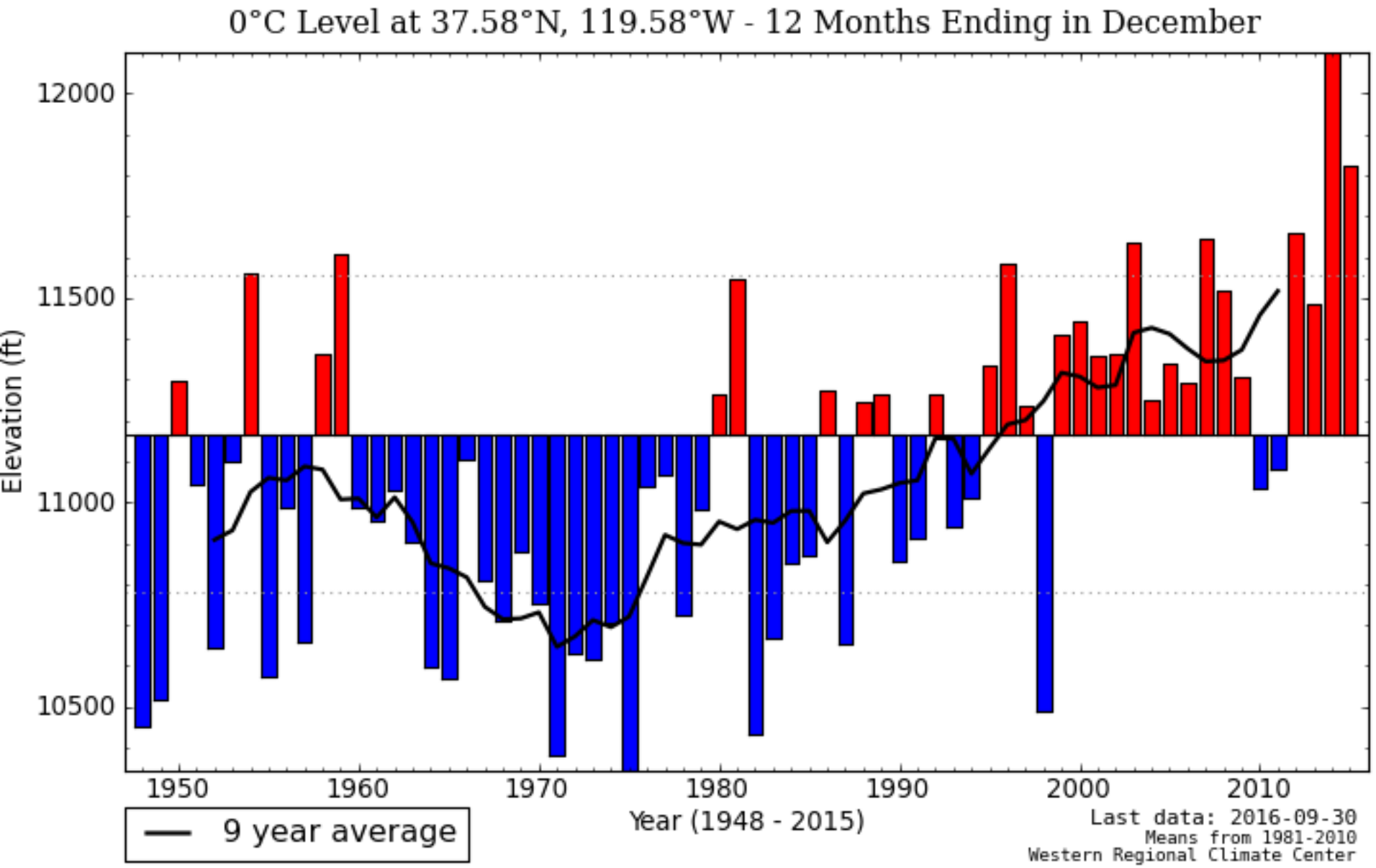
Water Year Jun-Jul-Aug Temperature Departure
Sierra Nevada

1895 thru 2016

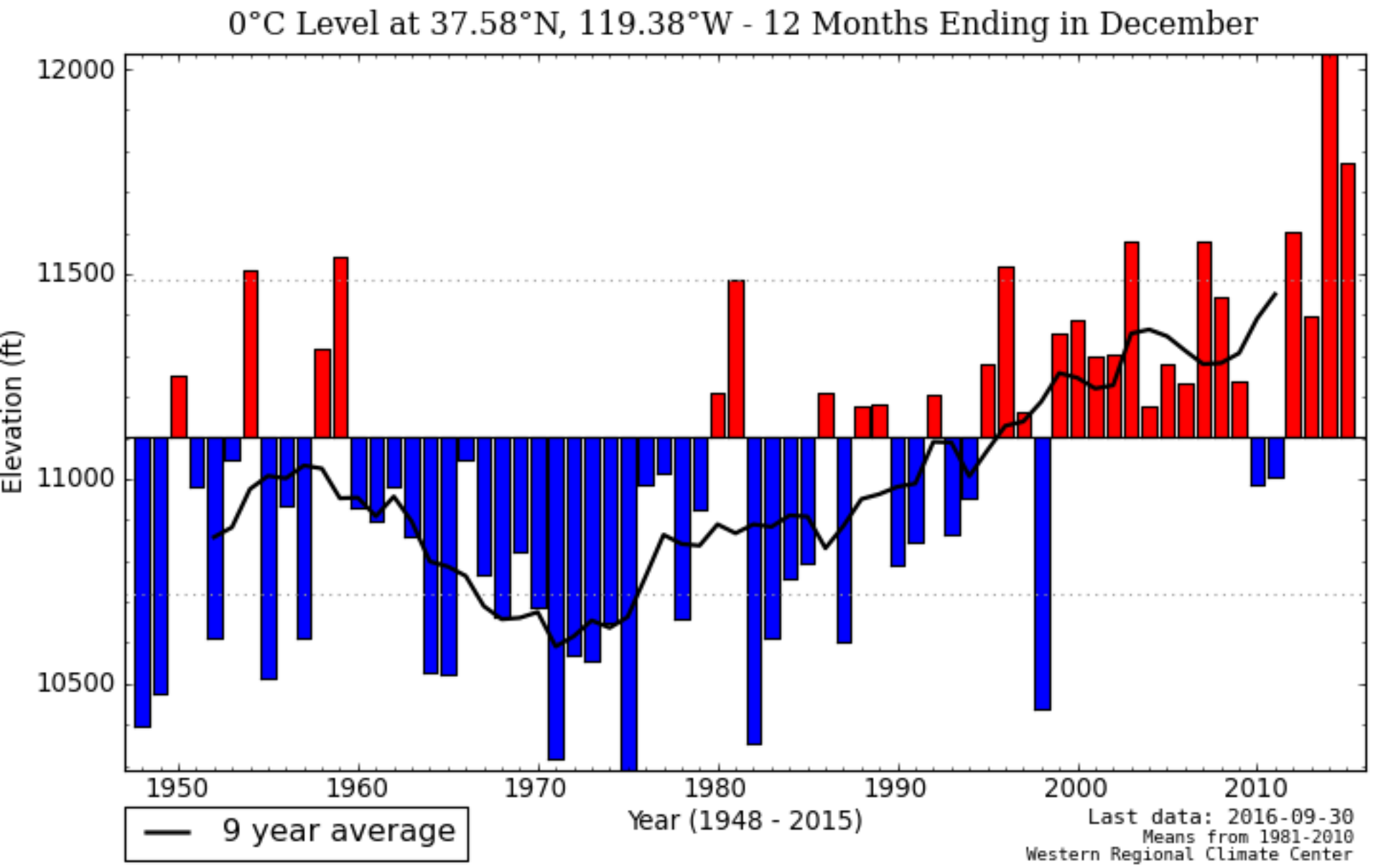
Select: YOSE-SEKI area, 12 months ending in Dec, Temperature 0 C, 9-year running mean.



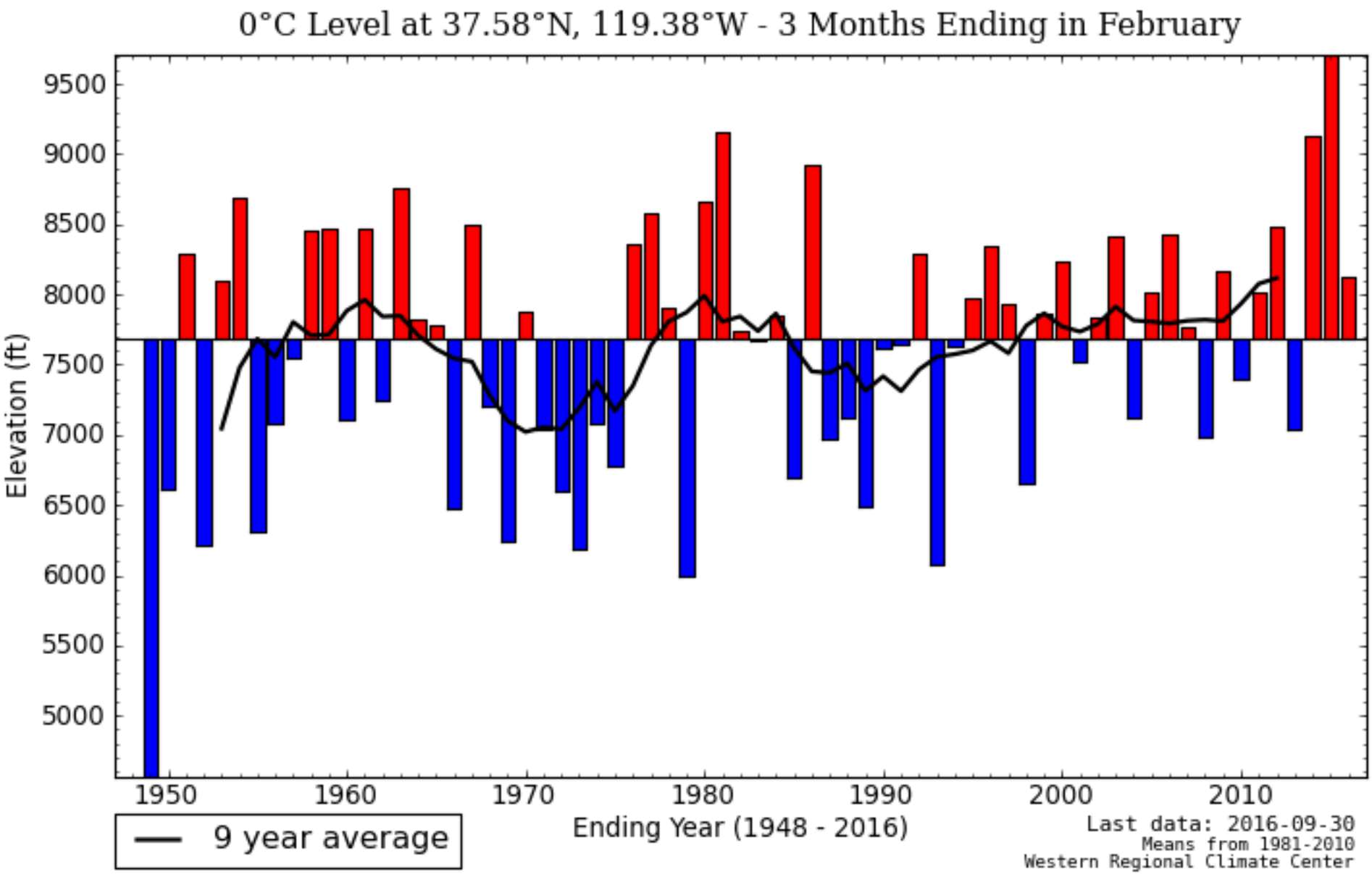
Elevation of Freezing Level over YOSE-SEKI. Annual. 1948 through 2015.



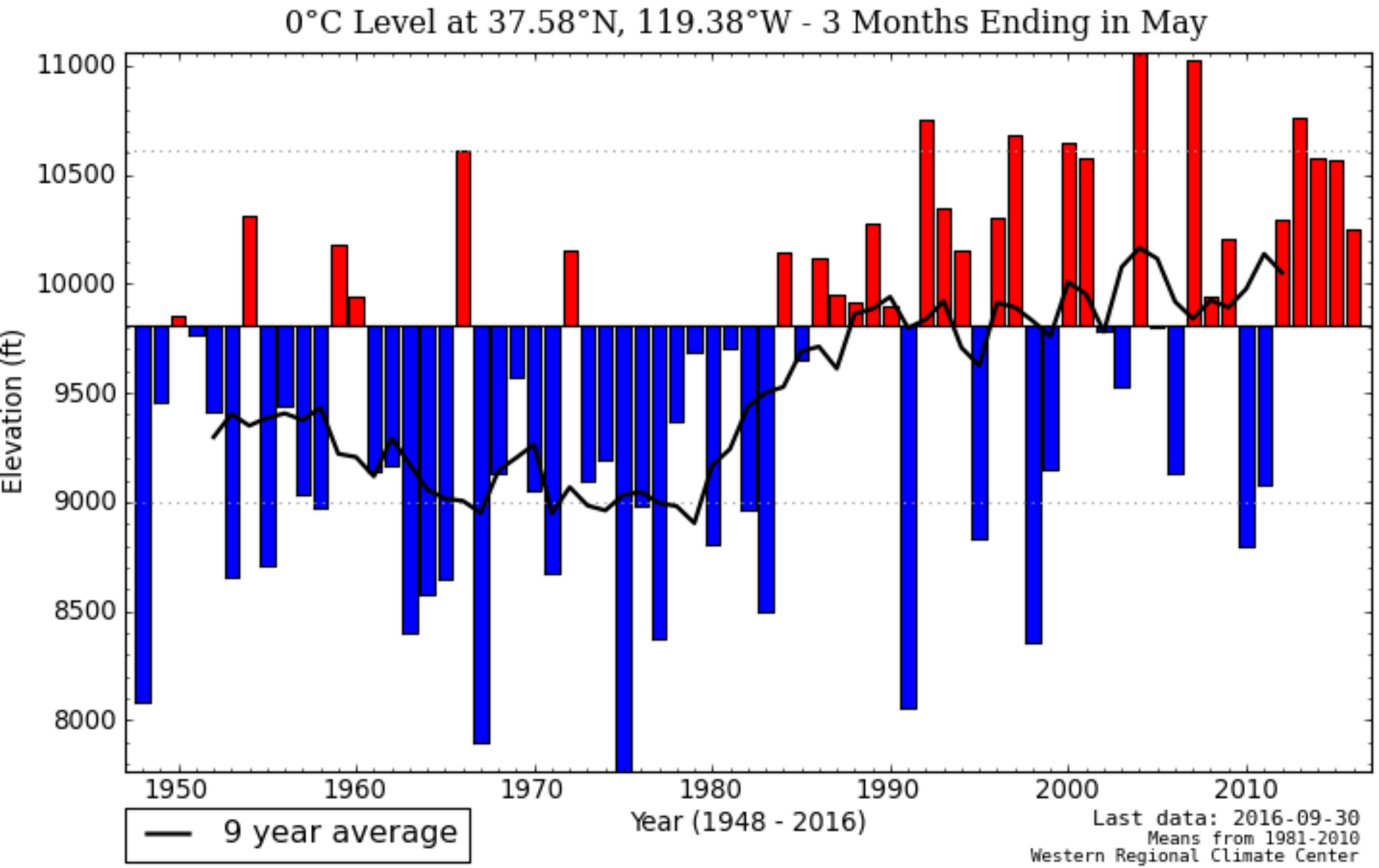
Elevation of Freezing Level over YOSE-SEKI. Annual. 1948 through 2014.



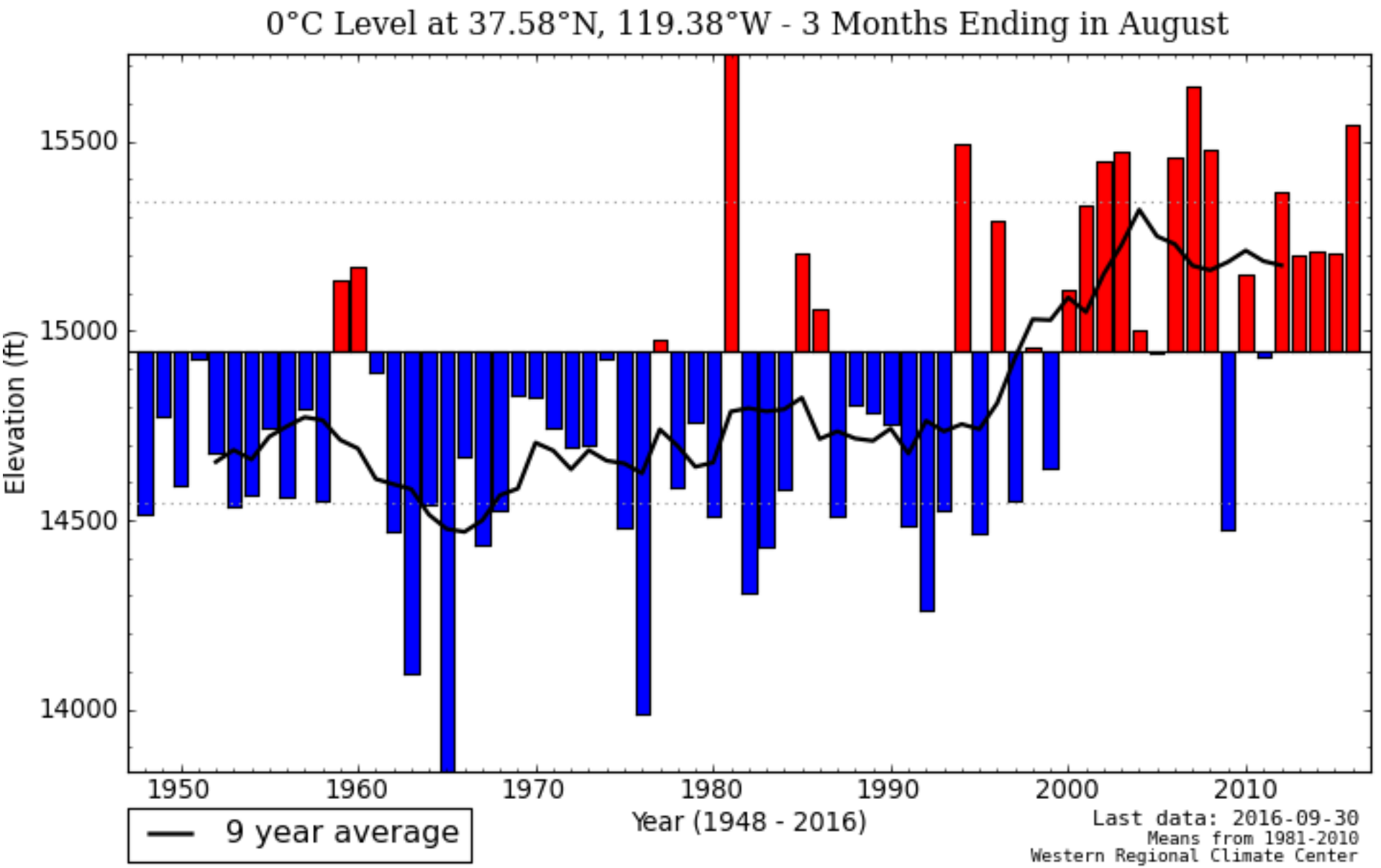
Elevation of Freezing Level over YOSE-SEKI. Winter. 1948-49 thru 2015-16.



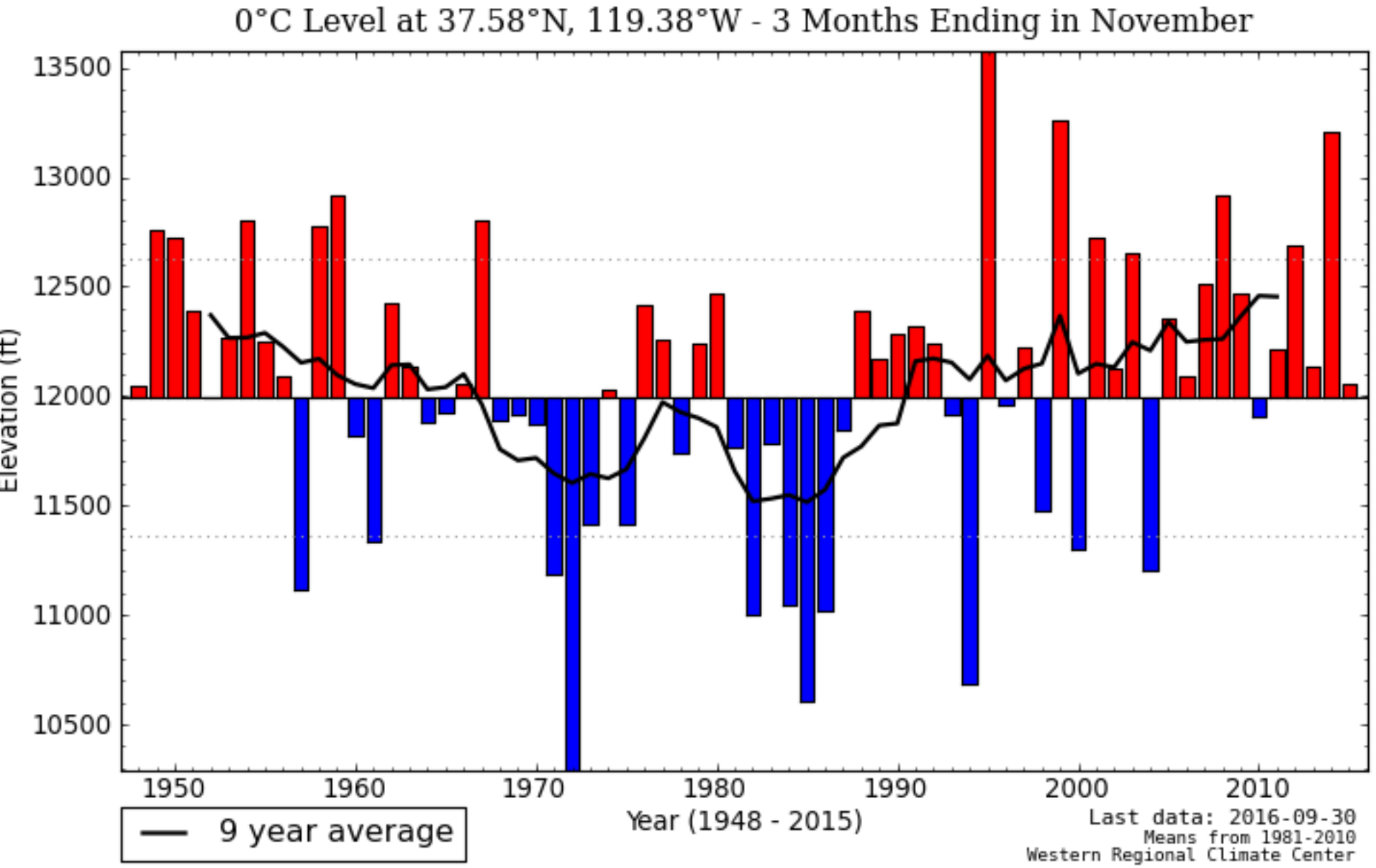
Elevation of Freezing Level over YOSE-SEKI. Spring. 1948 thru 2016.



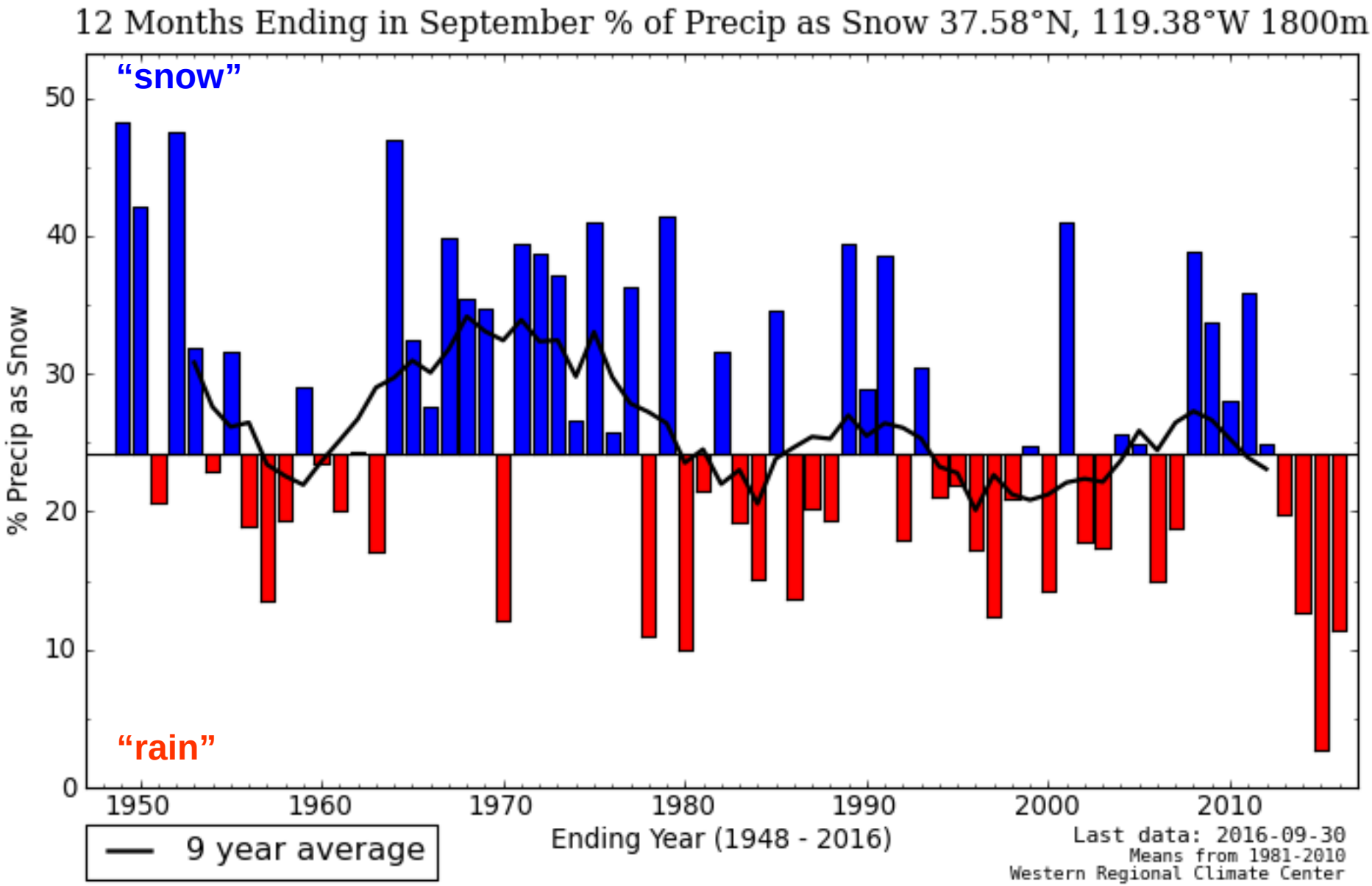
Elevation of Freezing Level over YOSE-SEKI. Summer. 1948 thru 2016.



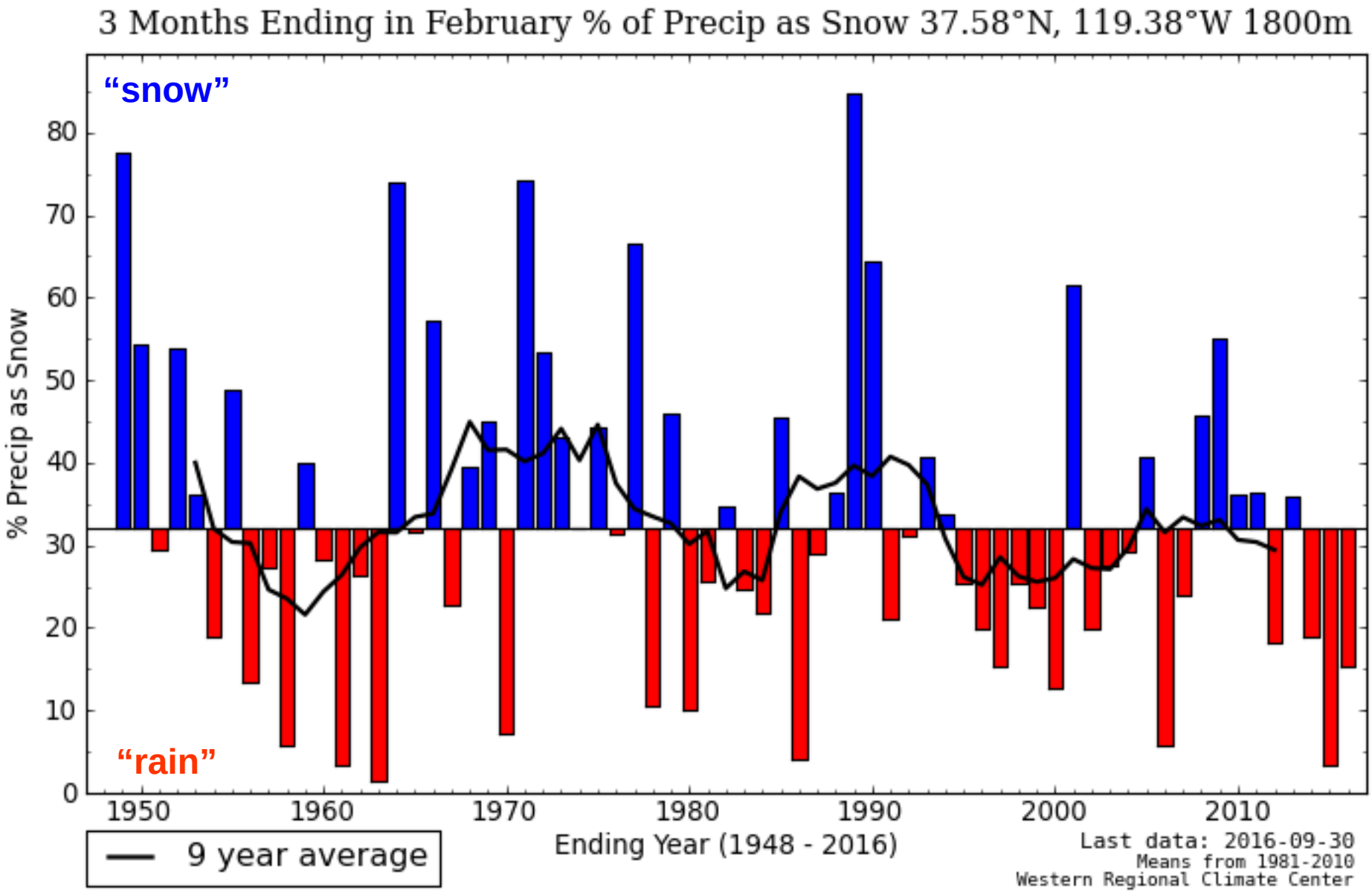
Elevation of Freezing Level over YOSE-SEKI. Autumn. 1948 thru 2015 Sep 30.



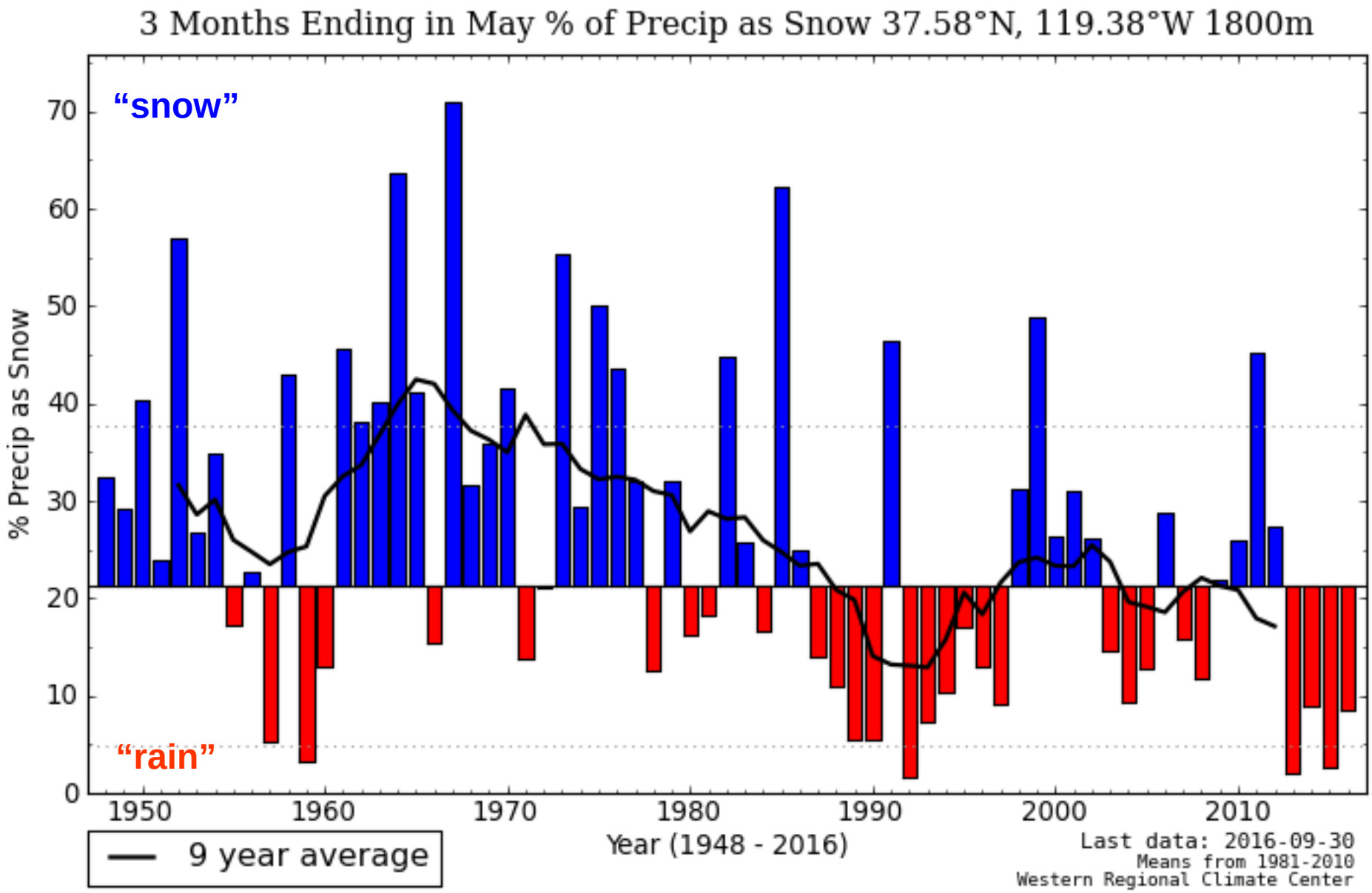
Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft. Yosemite - Sequoia - Kings Canyon area. Water Years 1948/49 - 2014/15.



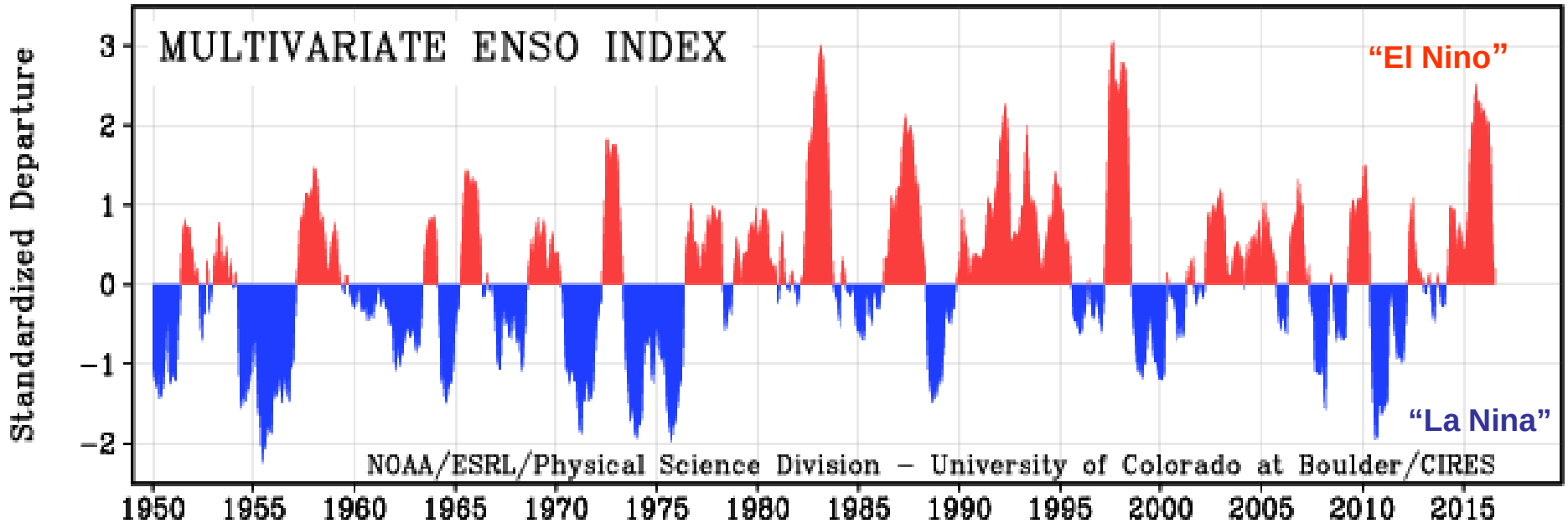
Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft. Yosemite - Sequoia - Kings Canyon area. Winter (DJF) 1948/49 - 2014/15.



Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft.
Yosemite - Sequoia - Kings Canyon area. Spring (MAM) 1948 - 2015.

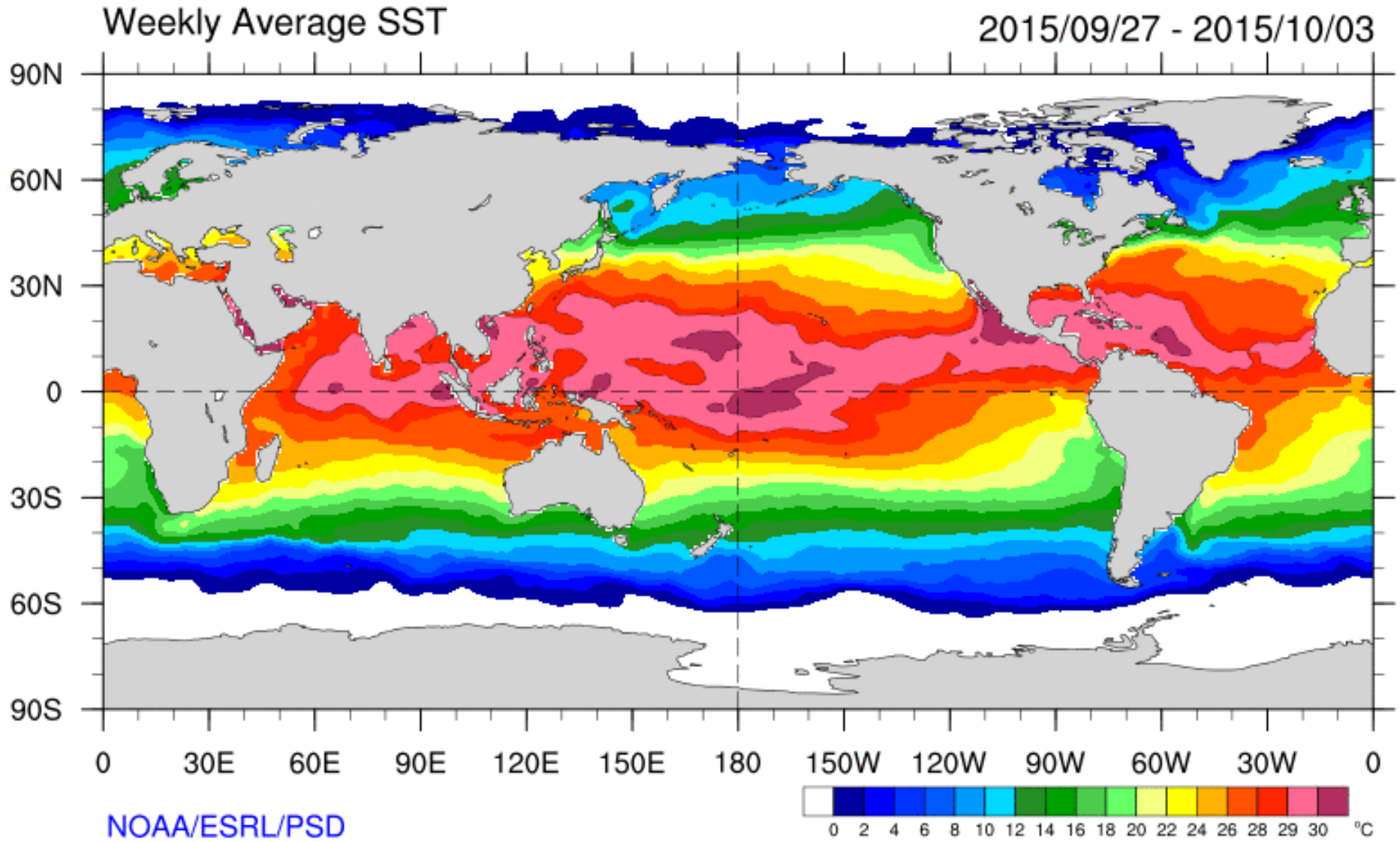


Through September 2016

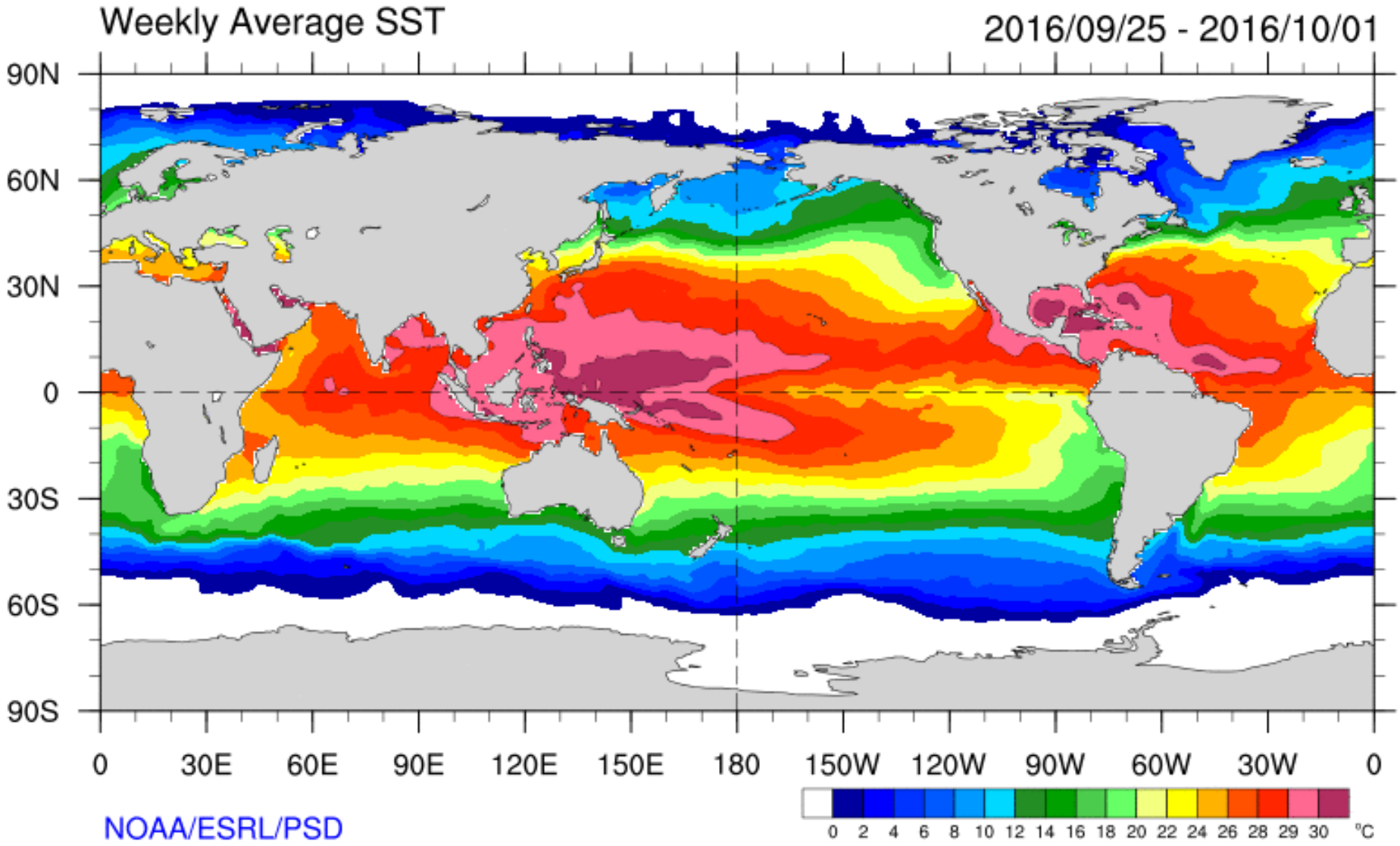


NOAA ESRL ("CDC"), Wolter and Timlin

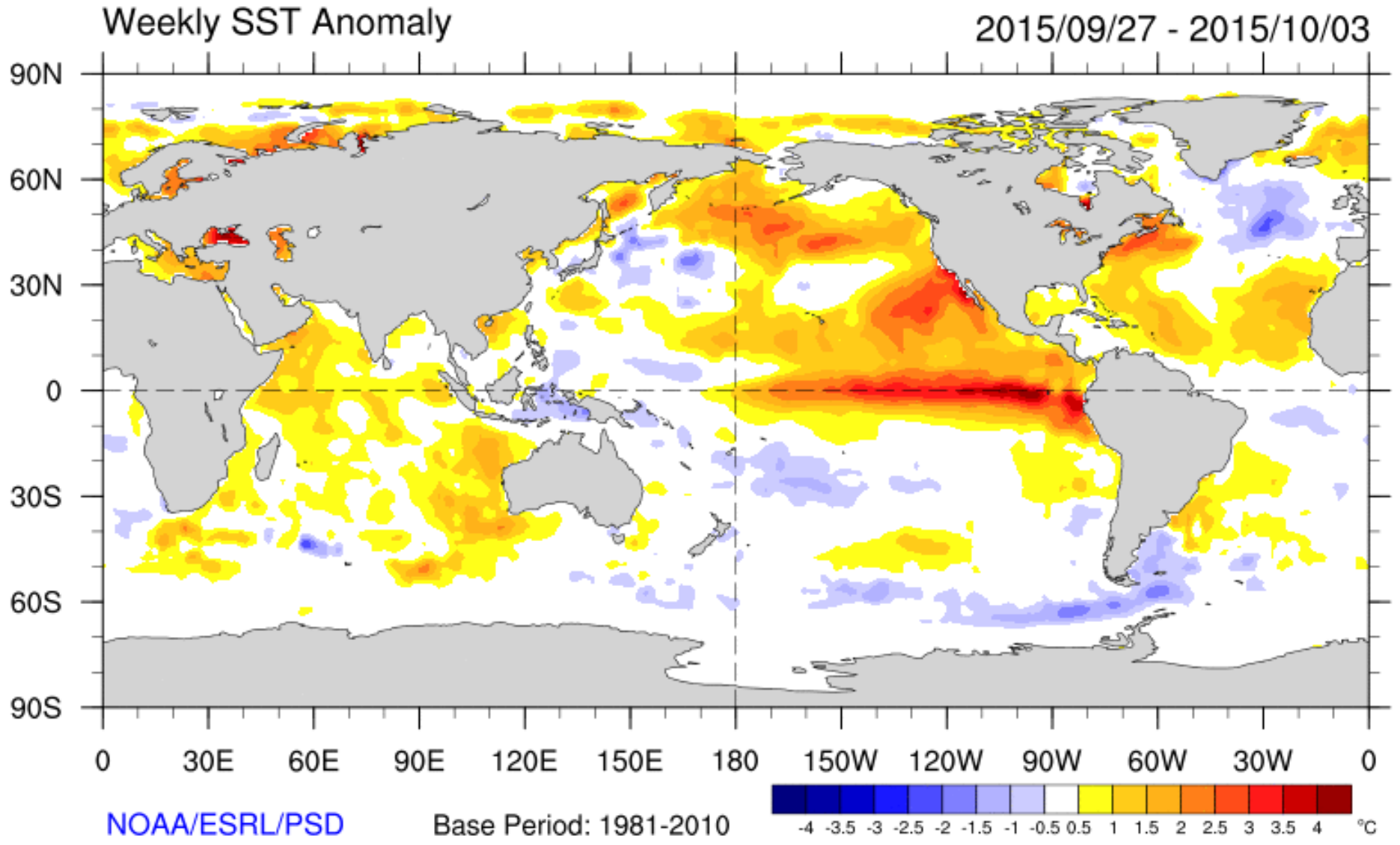
Ocean Surface Temperature (C) 2015 Sep 27 - Oct 03



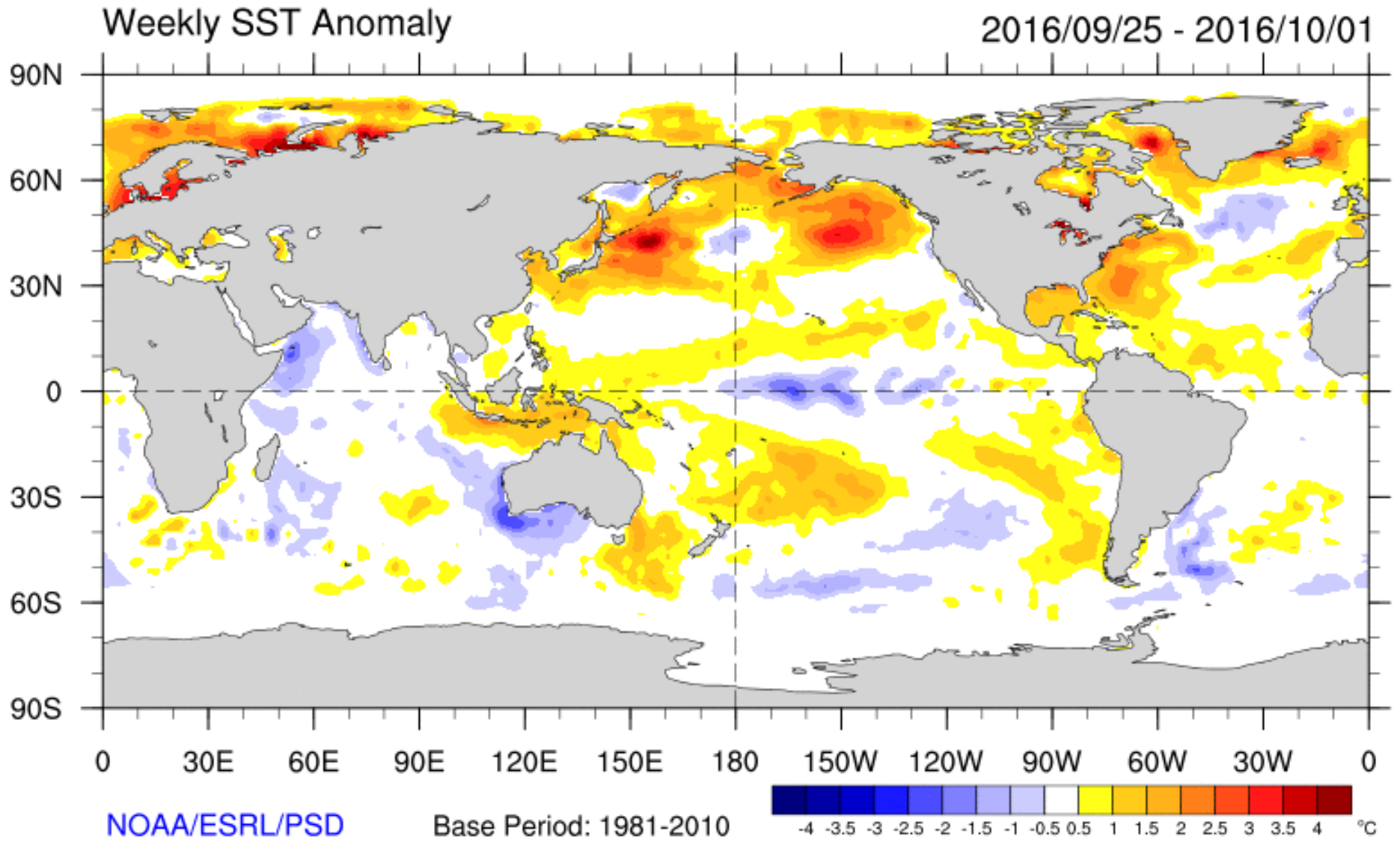
Ocean Surface Temperature (C) 2016 Sep 25 - Oct 01



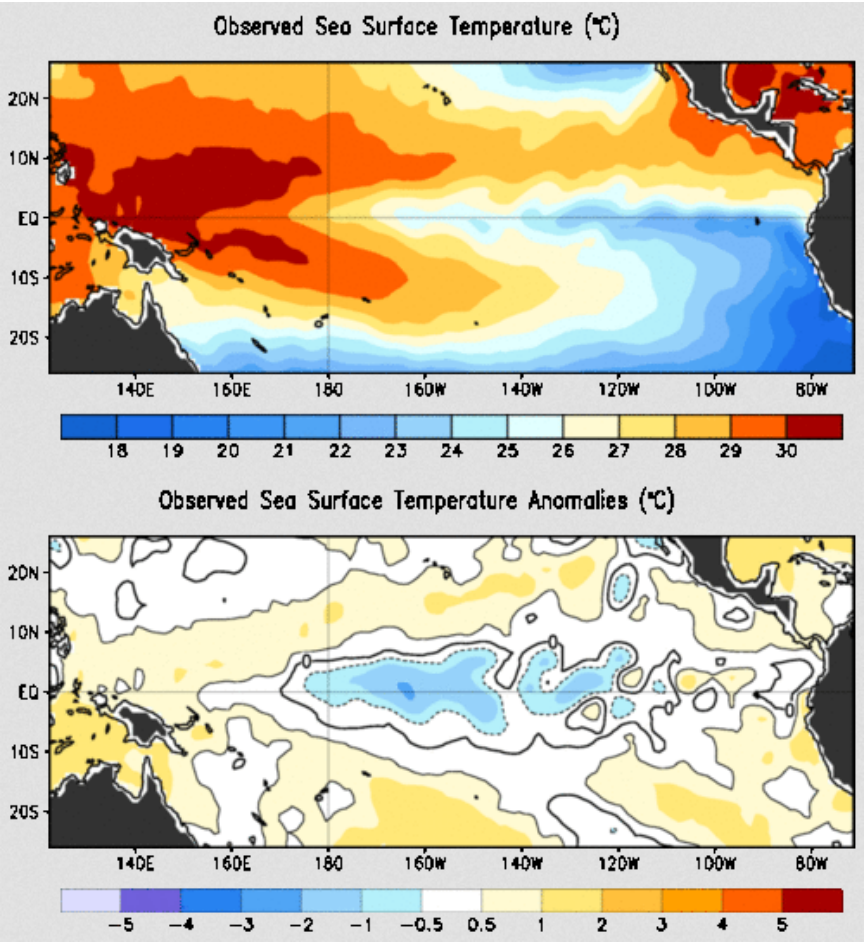
Ocean Departures from Average Temperature (C) 2015 Sep 27 - Oct 03

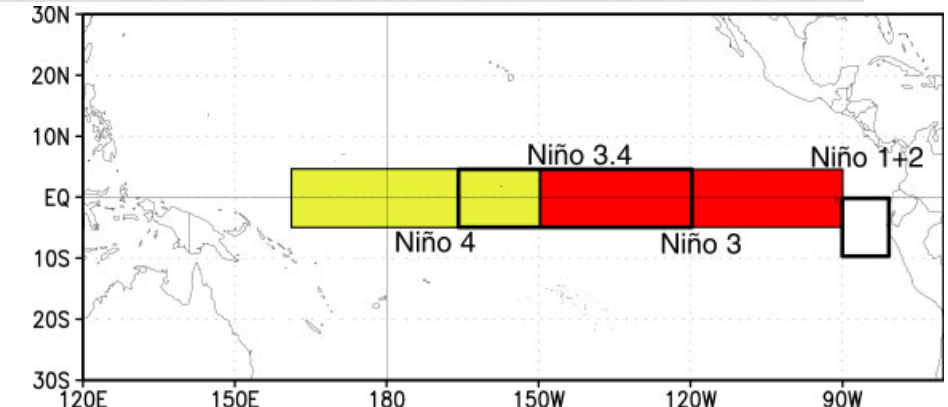


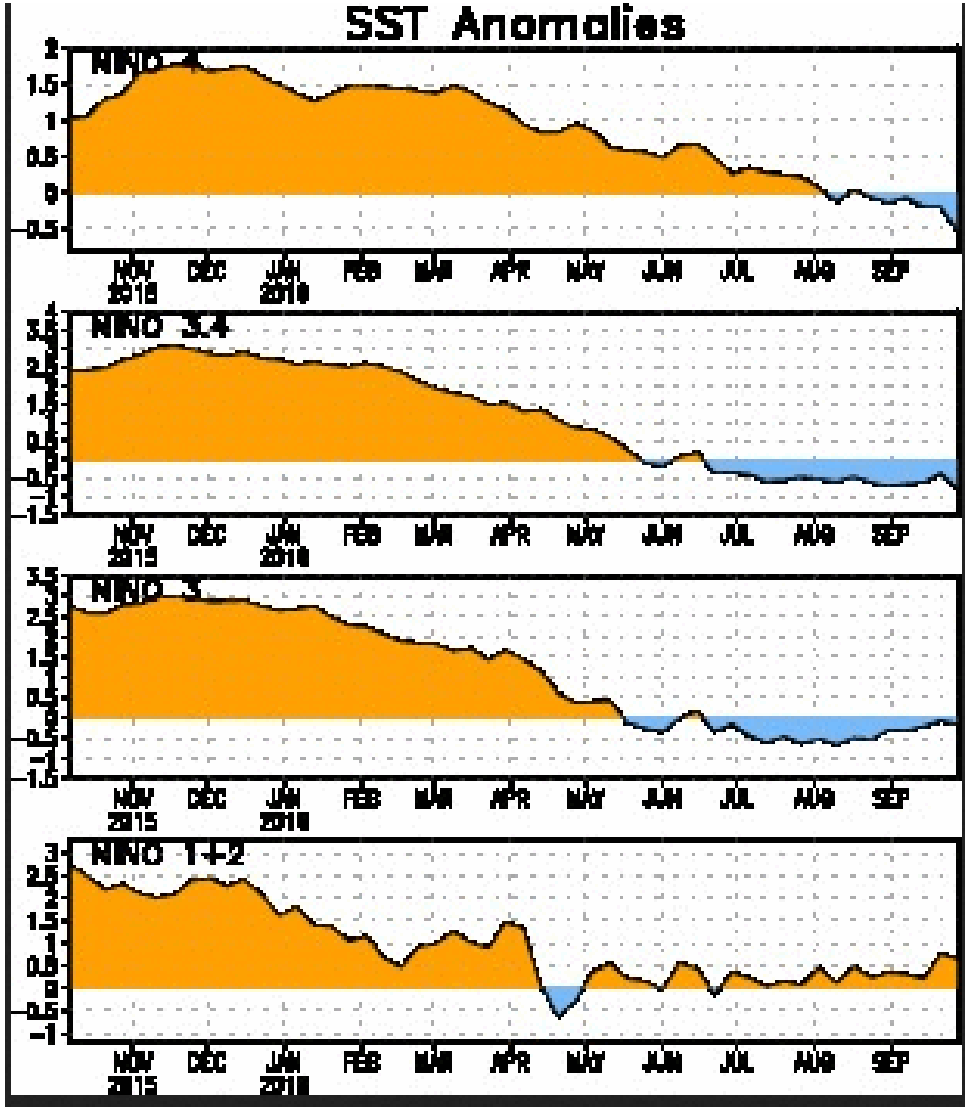
Ocean Departures from Average Temperature (C) 2016 Sep 25 - Oct 01



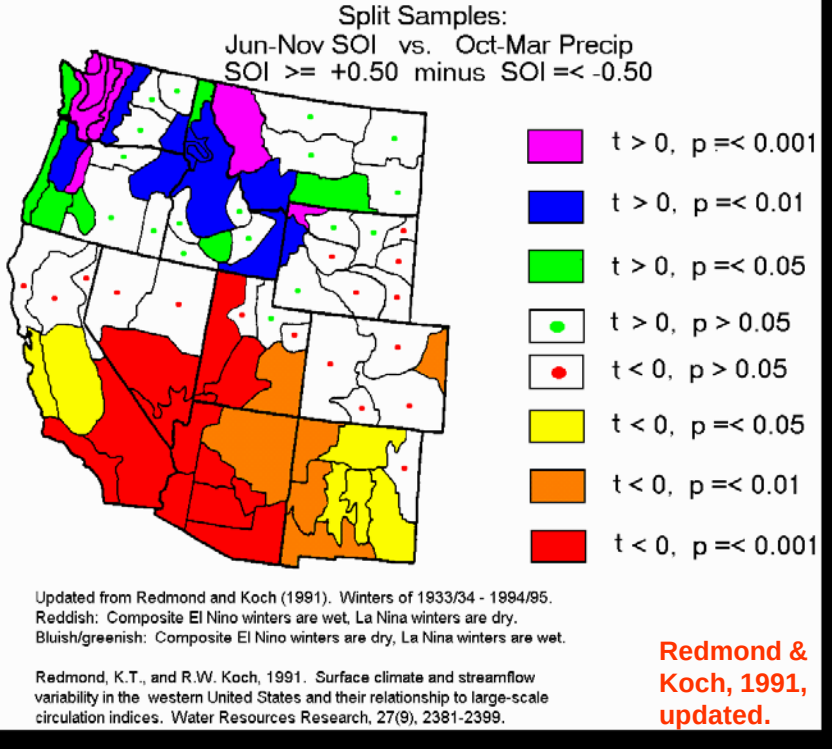
Recent Evolution of Equatorial Pacific SST Departures

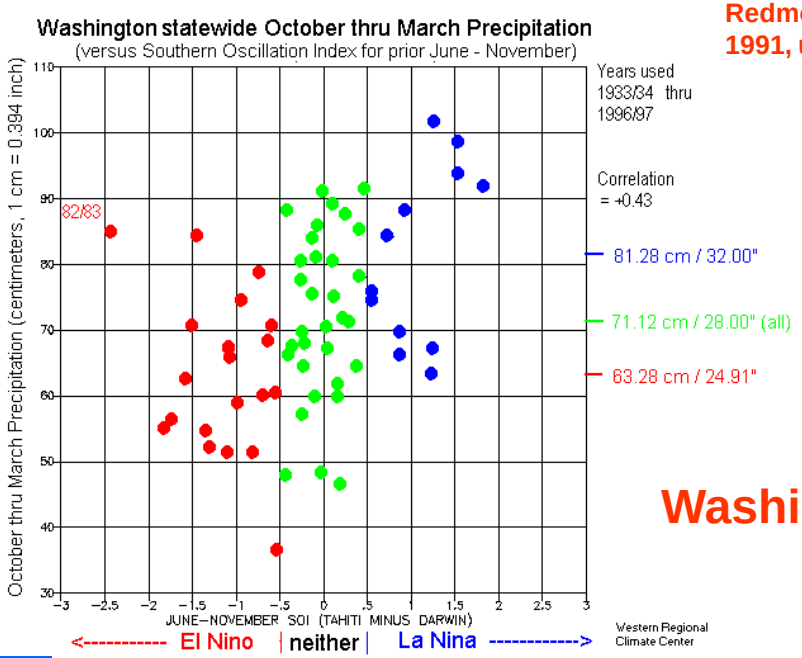






Updated through 2016 Sep 25 - Oct 01

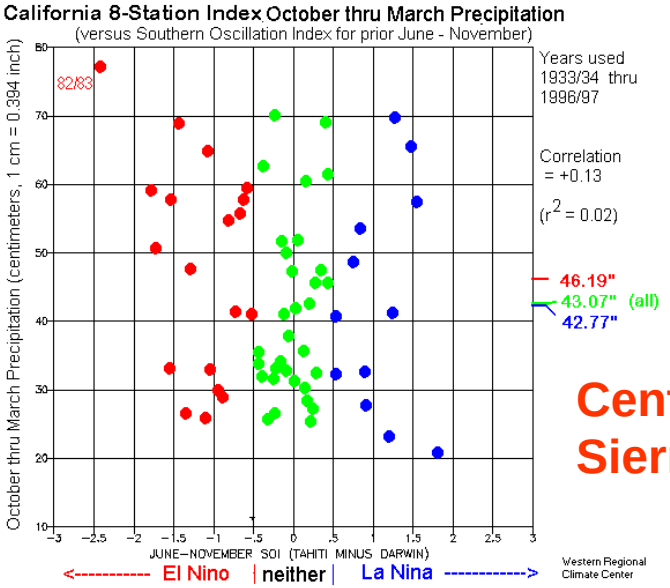




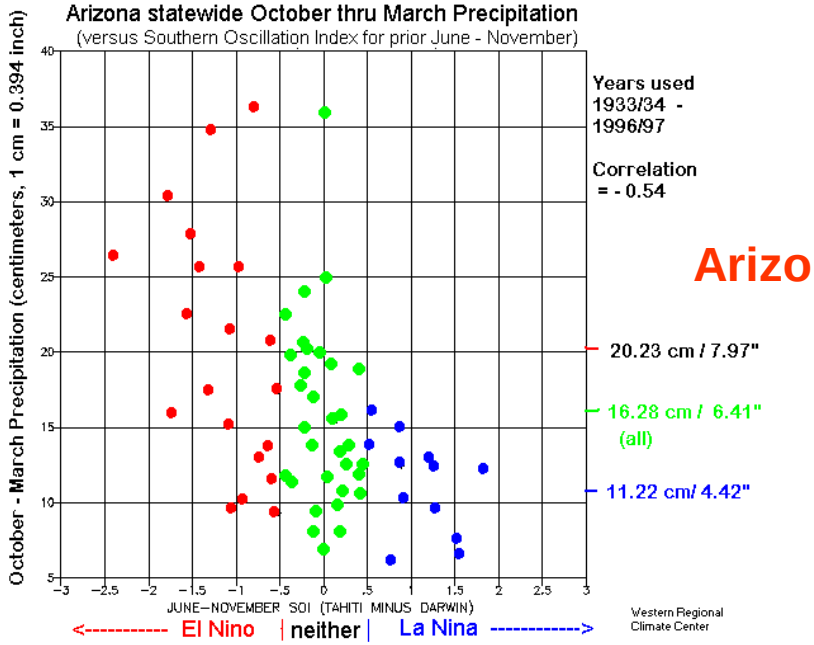
Redmond & Koch, 1991, updated.

Washington

ENSO



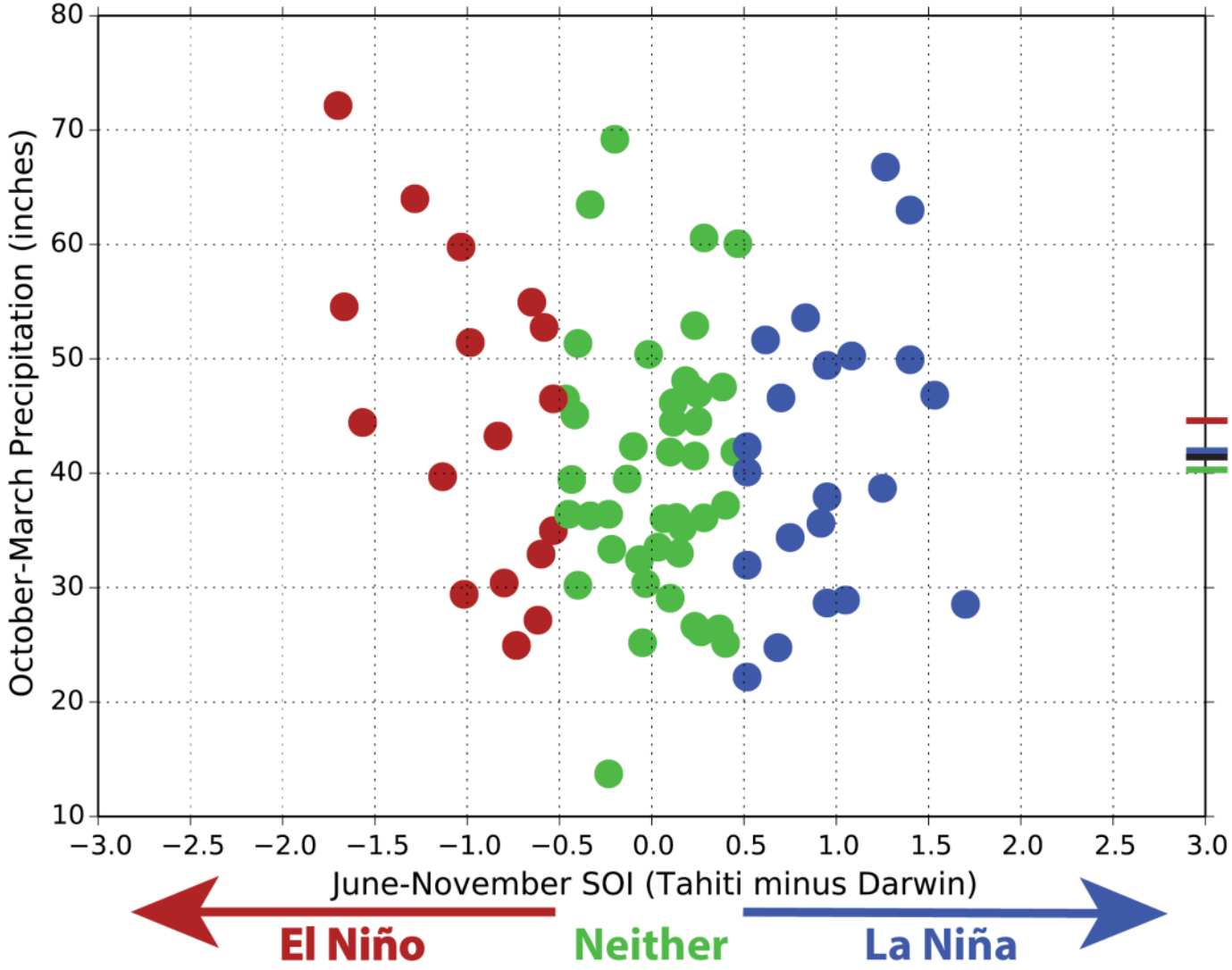
Central Sierra



Arizona

CA Division 1 October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



Years 1933/1934-2013/2014

$r^2 = 0.01$

Correlation = -0.11

Mean = 44.9 in

Mean = 41.53 in

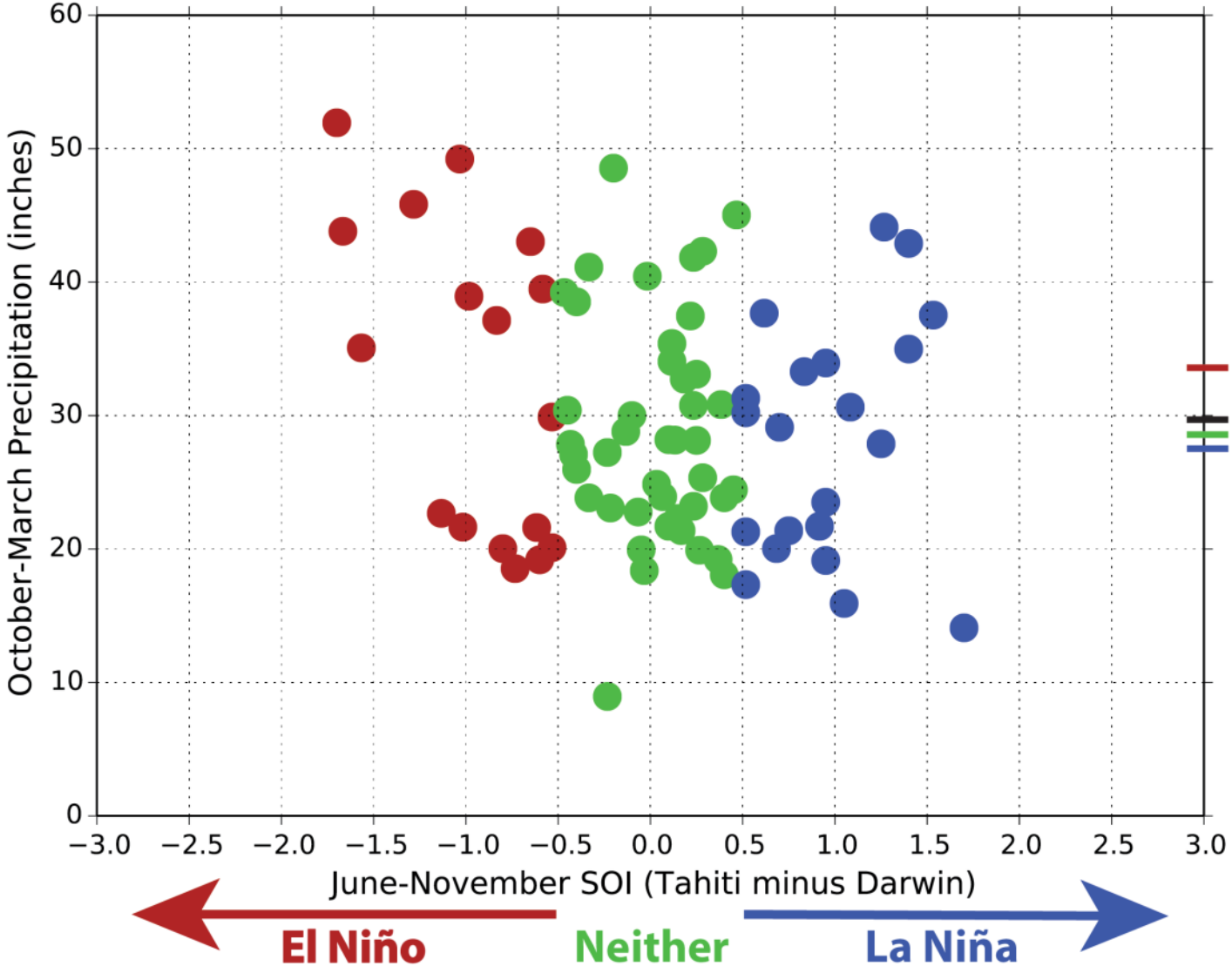
Mean all = 41.51 in

Mean = 40.15 in

Western Regional Climate Center

CA Division 2 October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



Years 1933/1934-2013/2014

$r^2 = 0.05$

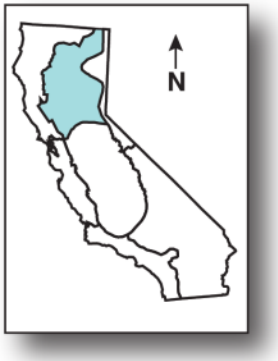
Correlation = -0.22

Mean = 32.83 in

Mean all = 29.44 in

Mean = 28.8 in

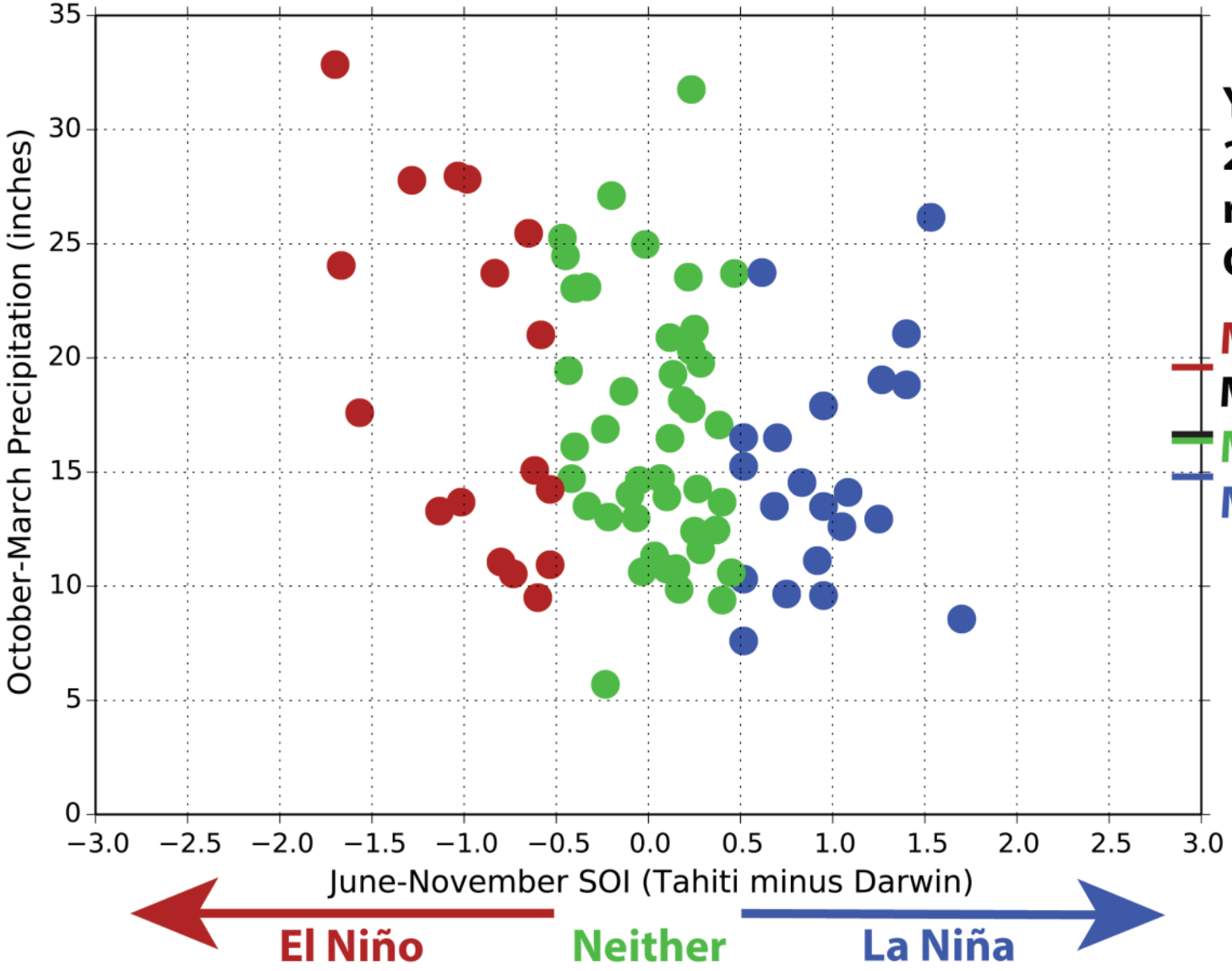
Mean = 28.0 in



Western Regional Climate Center

CA Division 5 October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



Years 1933/1934-2013/2014

$r^2 = 0.09$

Correlation = -0.3

Mean = 19.21 in

Mean all = 16.83 in

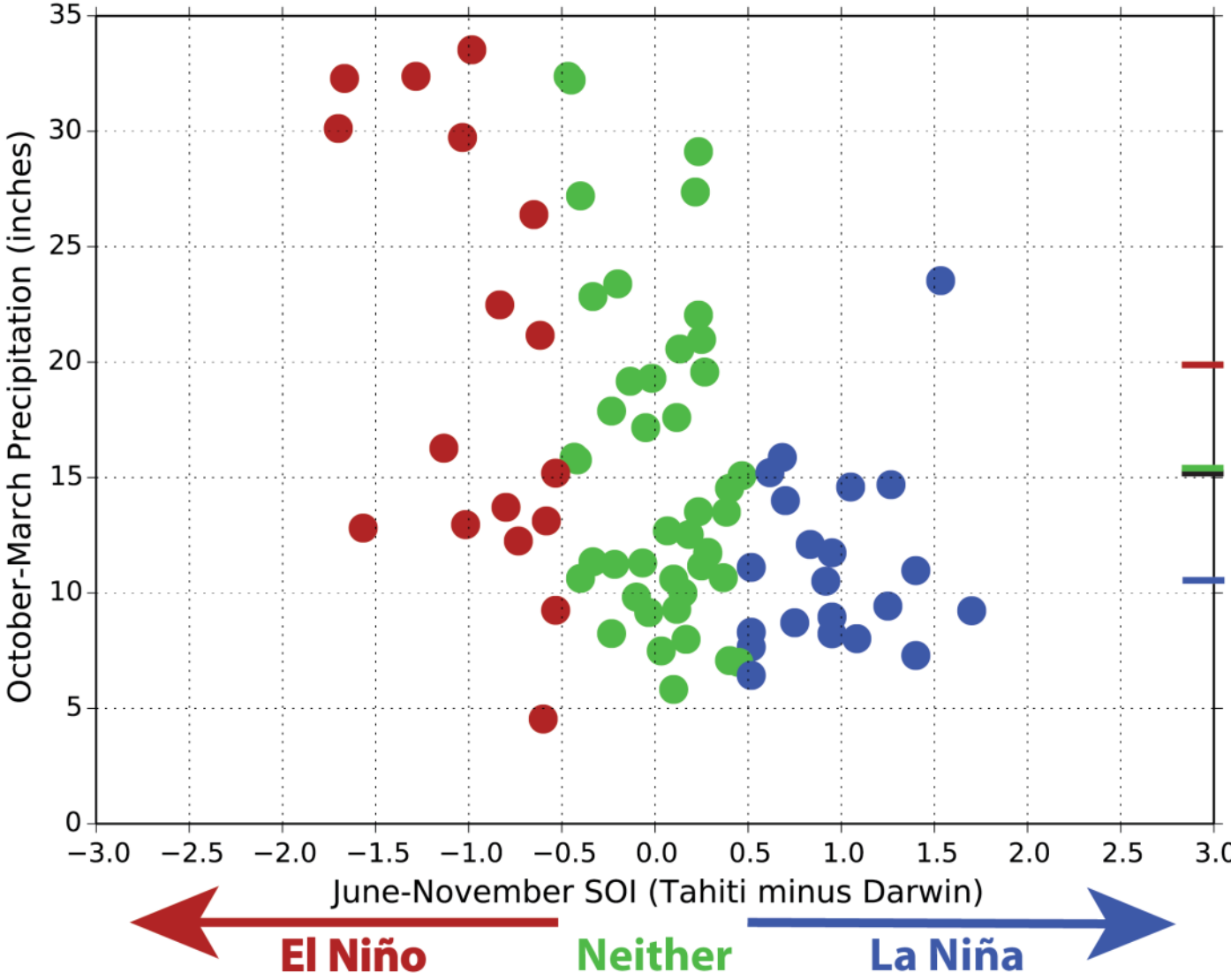
Mean = 16.83 in

Mean = 14.91 in

Western Regional Climate Center

CA Division 6 October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



Years 1933/1934-2013/2014

$r^2 = 0.22$

Correlation = -0.47

Mean = 19.89 in

Mean = 15.45 in

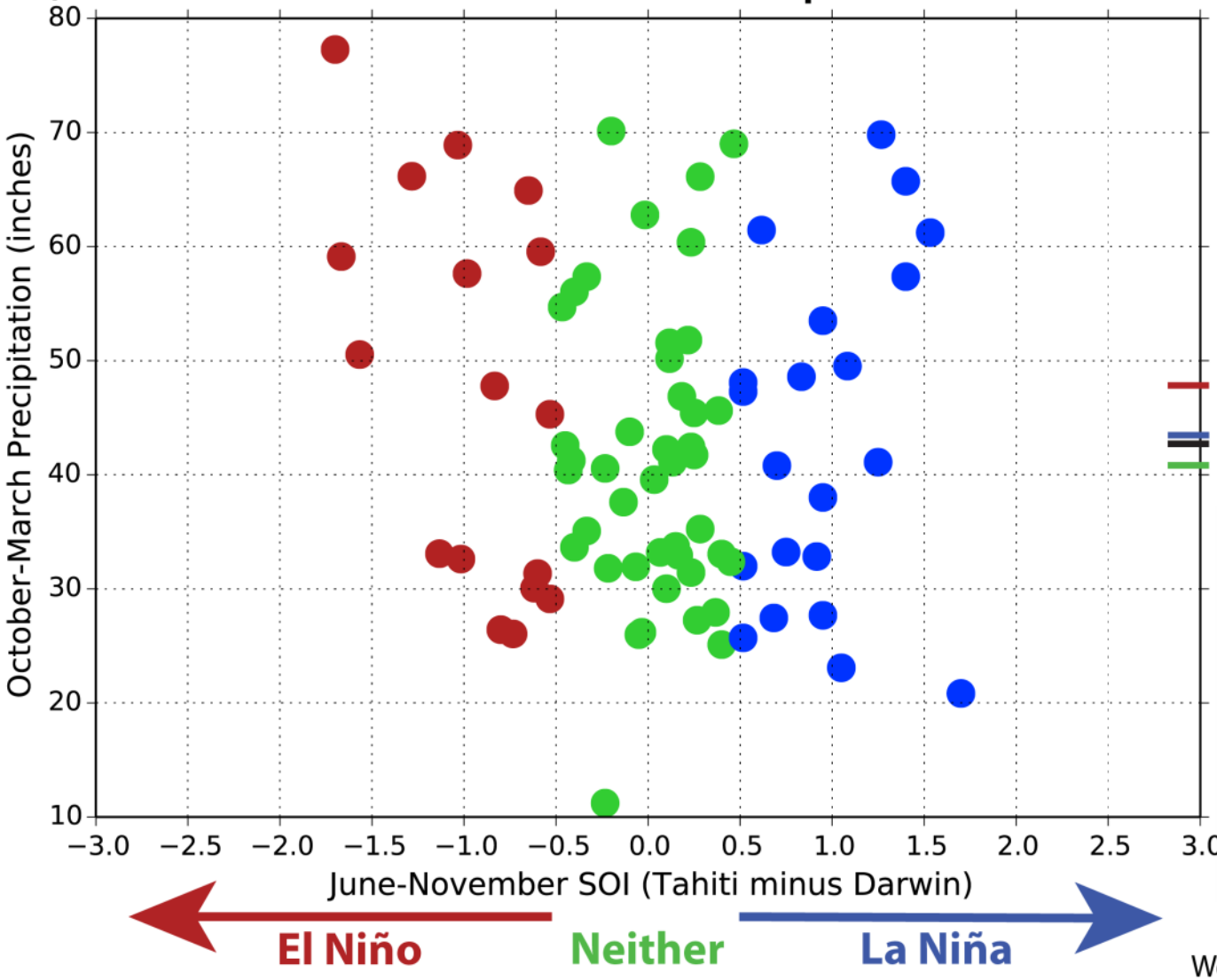
Mean all = 15.30 in

Mean = 11.27 in

Western Regional Climate Center

CA 8-Station Index October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



Years 1933/1934-2013/2014

$r^2 = 0.02$

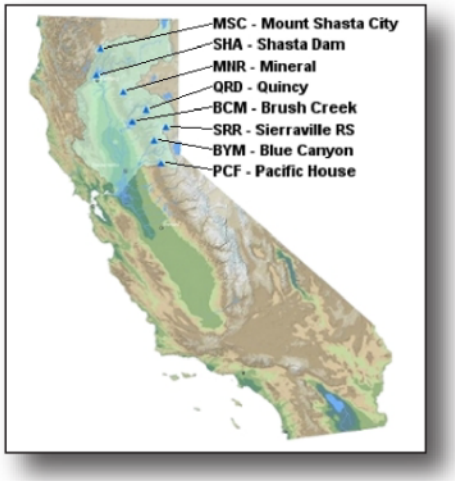
Correlation = -0.13

Mean = 47.4 in

Mean = 43.11 in

Mean all = 43.09 in

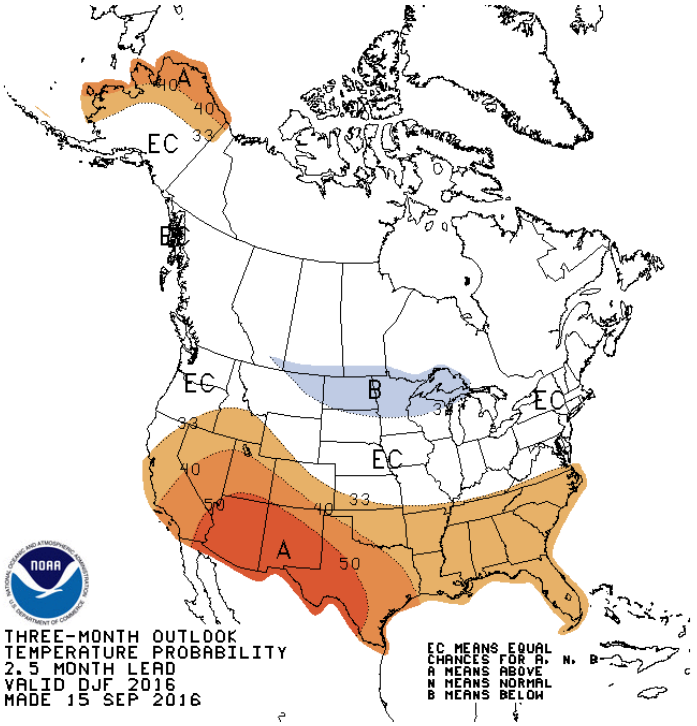
Mean = 41.38 in



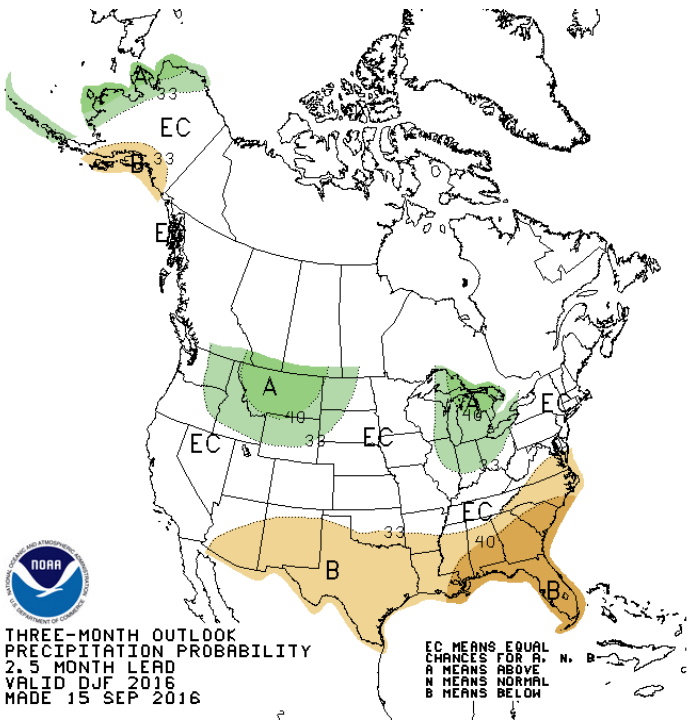
Data Source: CA DWR
Western Regional Climate Center

Temperature & Precipitation
2015-2016 Official Outlooks
Three Month Winter

Dec-Jan-Feb Temperature



Dec-Jan-Feb Precipitation

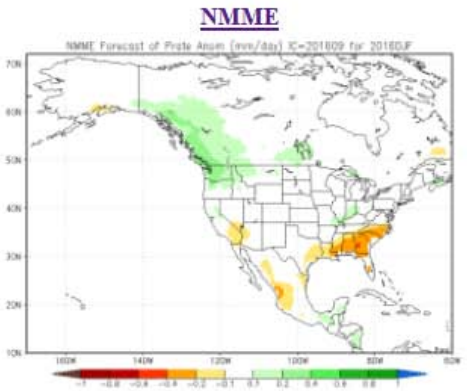


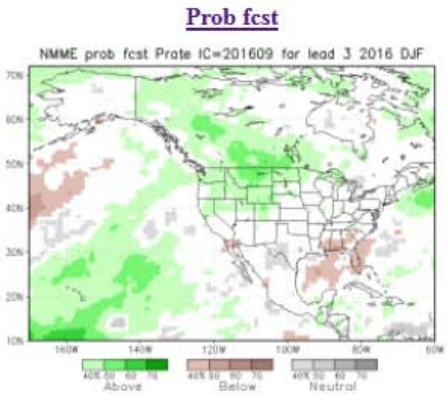
Orange / Red - Higher likelihood of warmer / drier than usual

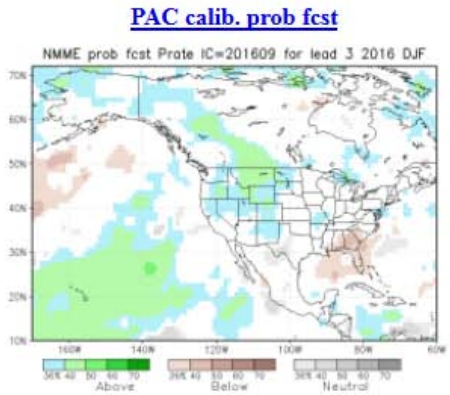
Green / Blue - Higher likelihood of cooler / wetter than usual

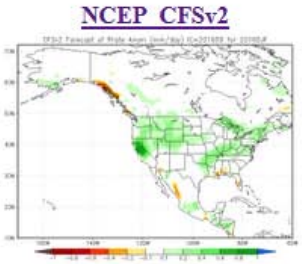
NOAA Climate Prediction Center

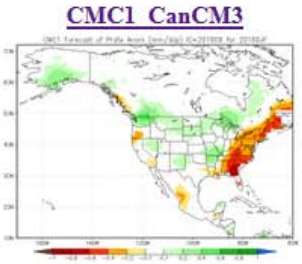
Seven experiments in near-term climate forecasting Dec-Feb 2015-6. Precipitation.
NMME (National Multi-Model Ensemble).
IMME (International Multi-Model Ensemble).

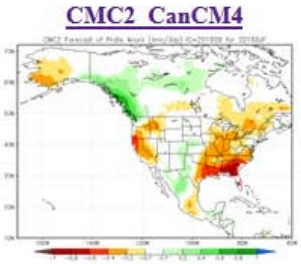


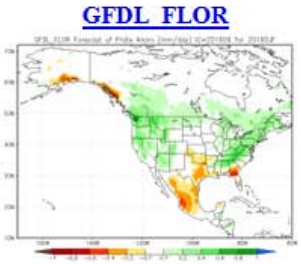


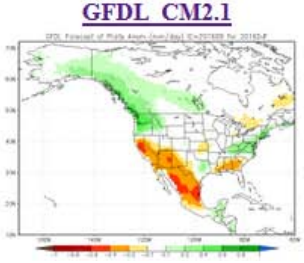


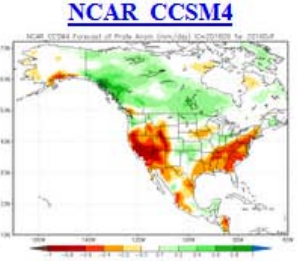


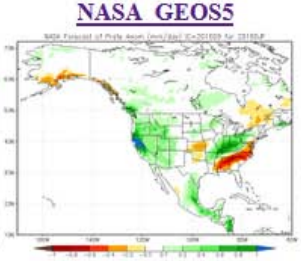


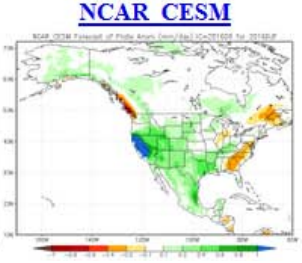


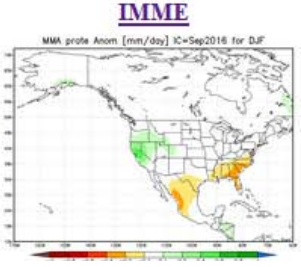












Dynamical Models

CFSv2: US Climate Forecasting System version 2
CMC1: Canadian Meteorological Center version 1
CMC2: Canadian Meteorological Center version 2
GFDL: US Geophysical Fluid Dynamics Laboratory
NCAR: US National Center for Atmospheric Research
NASA: US National Aeronautics and Space Administration
NMME: National Multi-Model Ensemble
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2016 September

Seven experiments in near-term climate forecasting Dec-Feb 2015. Temperature.

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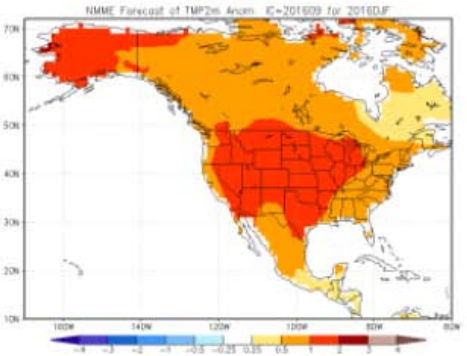
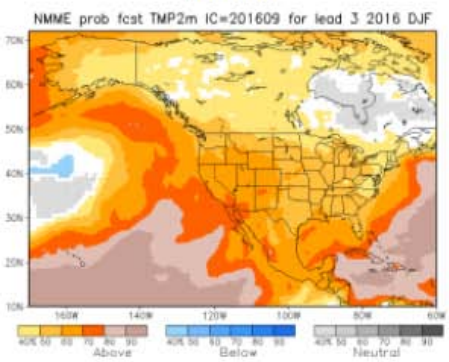
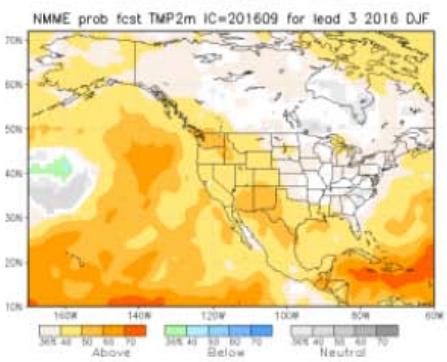
NMME



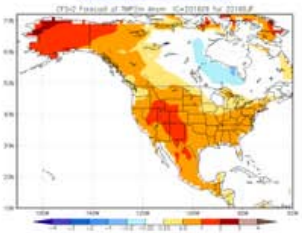
Prob fcst



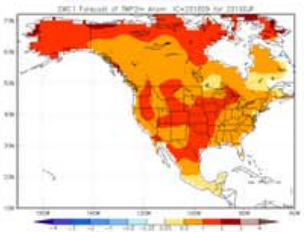
PAC calib. prob fcst



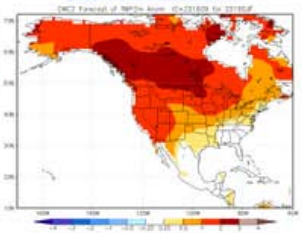
NCEP CFSv2



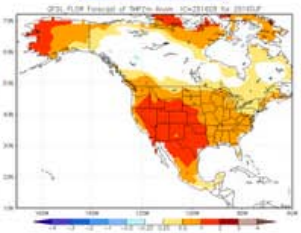
CMC1 CanCM3



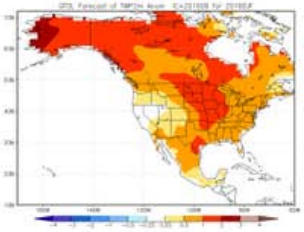
CMC2 CanCM4



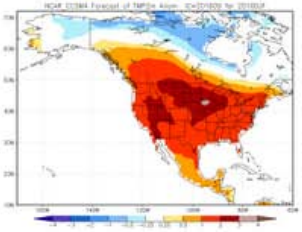
GFDL FLOR



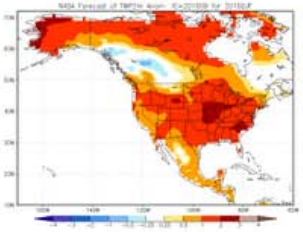
GFDL CM2.1



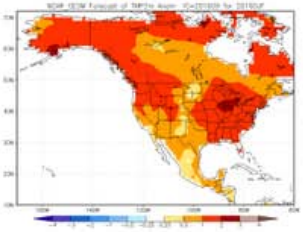
NCAR CCSM4



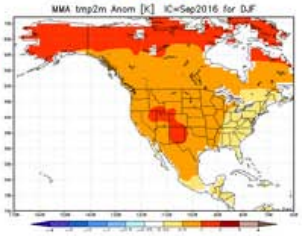
NASA GEOS5



NCAR CESM



IMME



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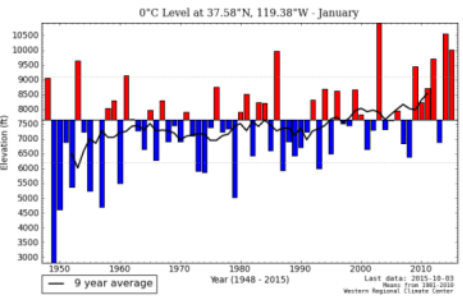
NMME: National Multi-Model Ensemble

IMME: International Multi-Model Ensemble

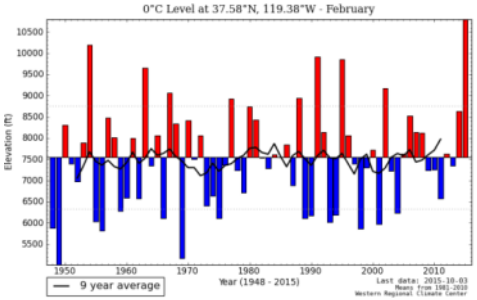
2016 September


YOUNG
Thank
You !
20101008

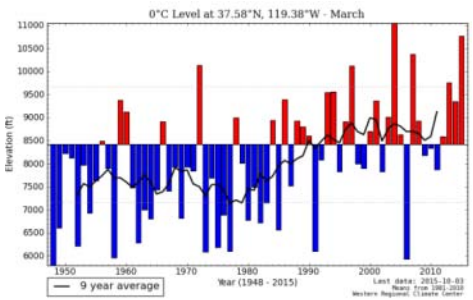
Elevation of Freezing Level over YOSE-SEKI. Monthly. Jan 1948 thru 3 Oct 2015.



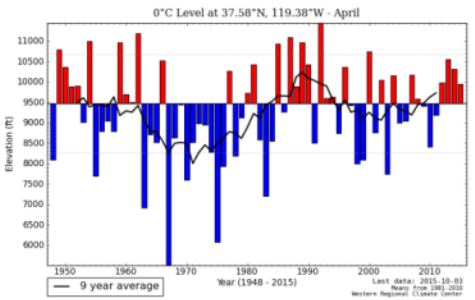
January



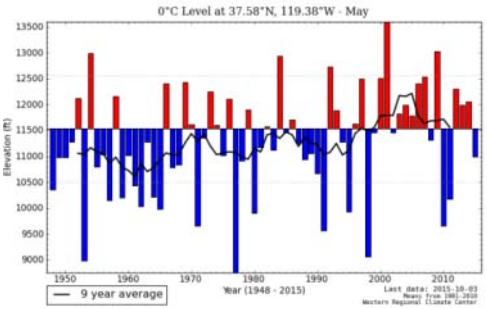
February



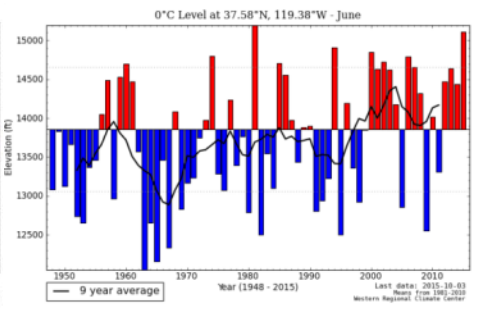
March



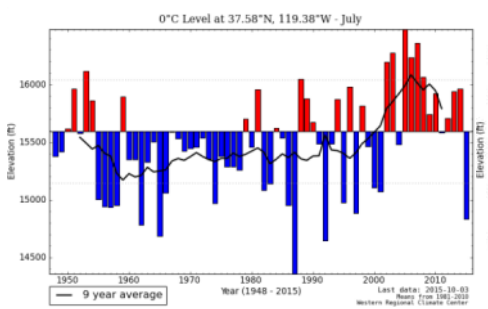
April



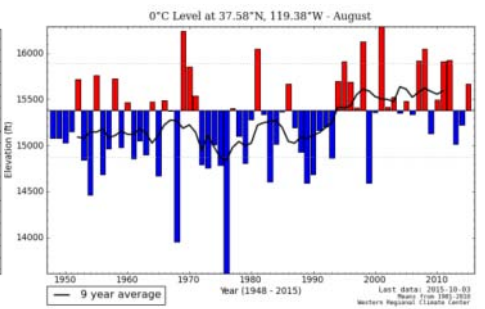
May



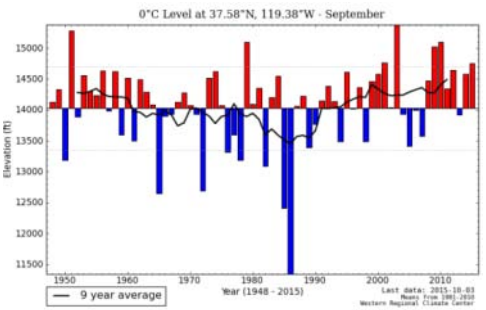
June



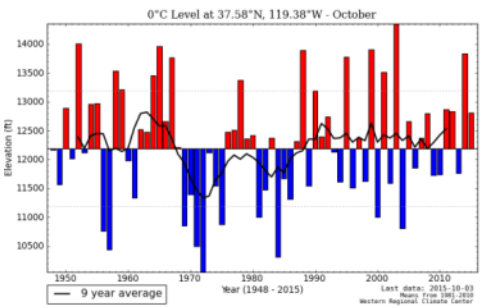
July



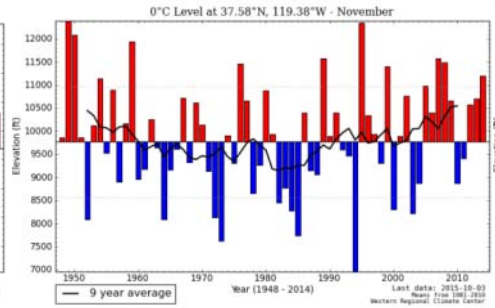
August



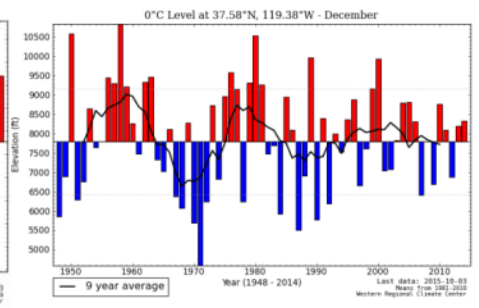
September



October (3rd)



November



December