



Western Regional
Climate Center



Sierra Weather and Climate Update 2015-16



Kelly Redmond



**Western Regional Climate Center
Desert Research Institute
Reno Nevada**

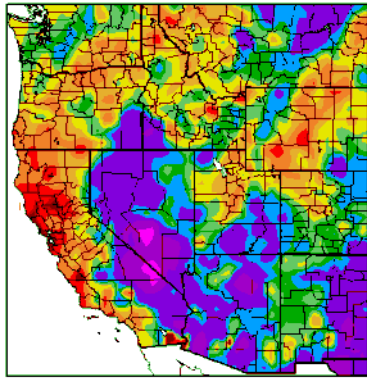


**Yosemite Hydroclimate Workshop
Yosemite Valley, 2016 October 5-6**



Percent of Average Precipitation

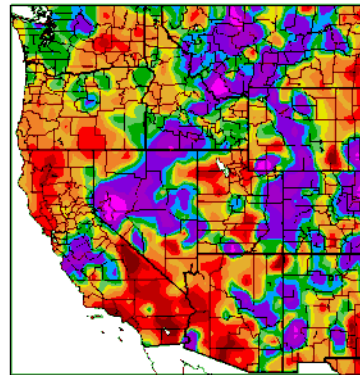
Percent of Normal Precipitation (%)
10/1/2015 – 10/31/2015



Generated 11/11/2015 at HPRCC using provisional data.

Regional Climate Centers

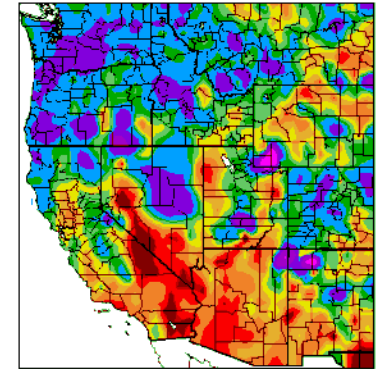
Percent of Normal Precipitation (%)
11/1/2015 – 11/30/2015



Generated 12/11/2015 at HPRCC using provisional data.

Regional Climate Centers

Percent of Normal Precipitation (%)
12/1/2015 – 12/31/2015



Generated 1/11/2016 at HPRCC using provisional data.

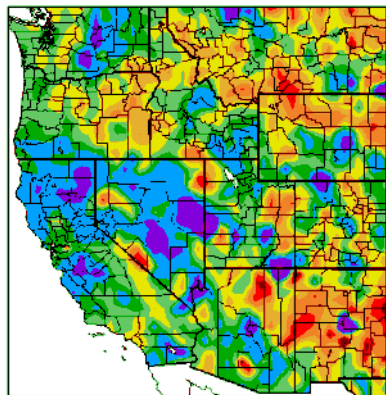
Regional Climate Centers

Oct 2015

Nov 2015

Dec 2015

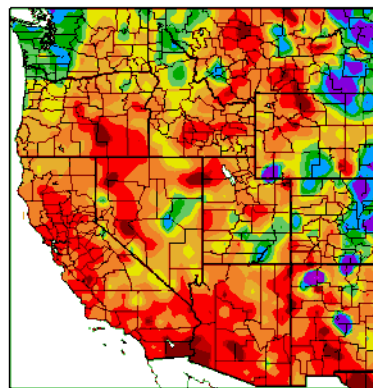
Percent of Normal Precipitation (%)
1/1/2016 – 1/31/2016



Generated 2/11/2016 at HPRCC using provisional data.

Regional Climate Centers

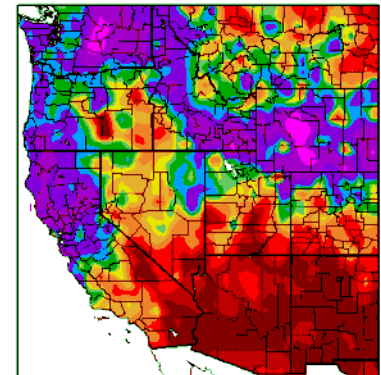
Percent of Normal Precipitation (%)
2/1/2016 – 2/29/2016



Generated 3/11/2016 at HPRCC using provisional data.

Regional Climate Centers

Percent of Normal Precipitation (%)
3/1/2016 – 3/31/2016



Generated 4/11/2016 at HPRCC using provisional data.

Regional Climate Centers

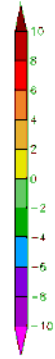
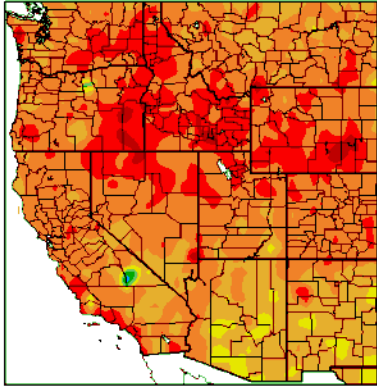
Jan 2016

Feb 2016

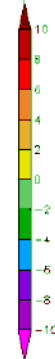
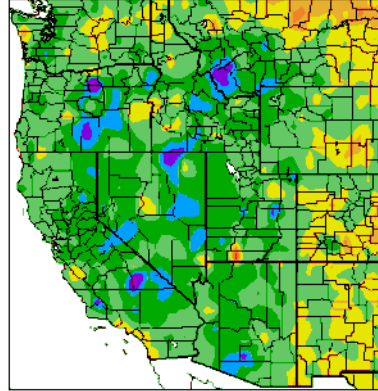
Mar 2016

Mean Temperature Departure from Normal

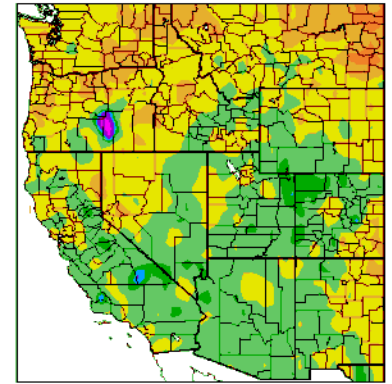
Departure from Normal Temperature (F)
10/1/2015 – 10/31/2015



Departure from Normal Temperature (F)
11/1/2015 – 11/30/2015



Departure from Normal Temperature (F)
12/1/2015 – 12/31/2015



Generated 11/11/2015 at HPRCC using provisional data.

Regional Climate Centers

Generated 12/11/2015 at HPRCC using provisional data.

Regional Climate C

Generated 1/11/2016 at HPRCC using provisional data.

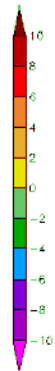
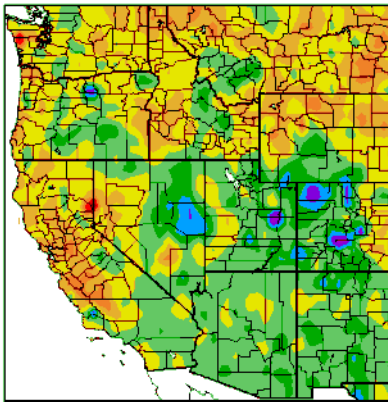
Regional Climate Centers

Oct 2015

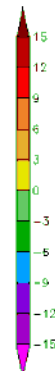
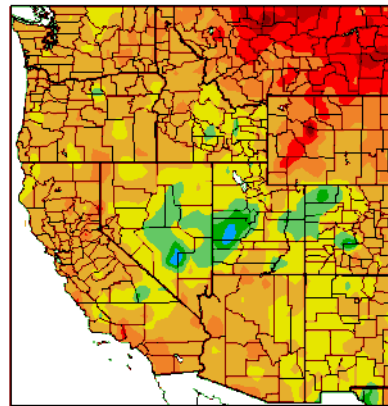
Nov 2015

Dec 2015

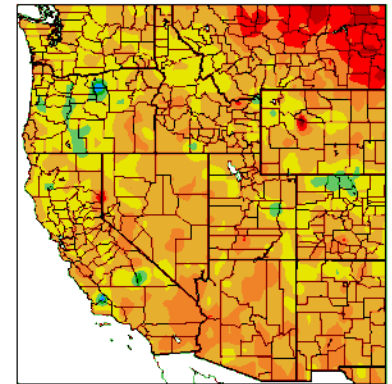
Departure from Normal Temperature (F)
1/1/2016 – 1/31/2016



Departure from Normal Temperature (F)
2/1/2016 – 2/29/2016



Departure from Normal Temperature (F)
3/1/2016 – 3/31/2016



Generated 2/11/2016 at HPRCC using provisional data.

Regional Climate Cen

Generated 3/11/2016 at HPRCC using provisional data.

Regional Climate C

Generated 4/11/2016 at HPRCC using provisional data.

Regional Climate Centers

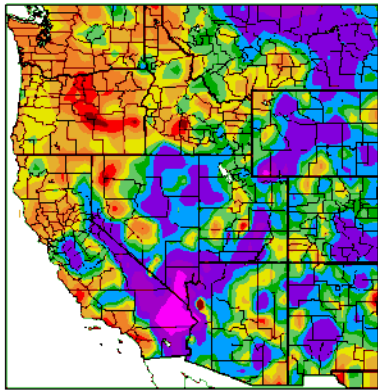
Jan 2016

Feb 2016

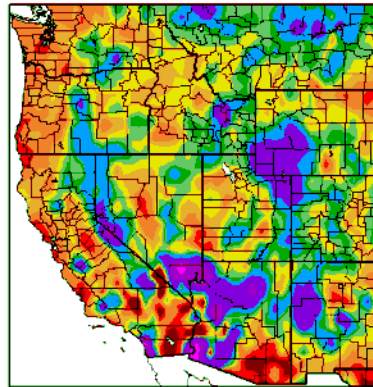
Mar 2016

Percent of Average Precipitation

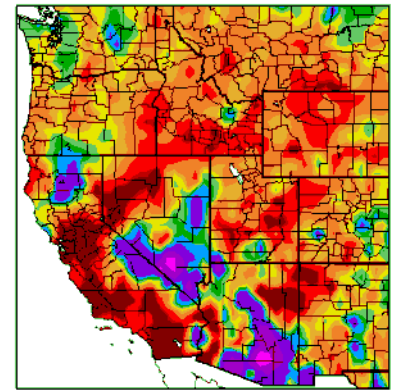
Percent of Normal Precipitation (%)
4/1/2016 - 4/30/2016



Percent of Normal Precipitation (%)
5/1/2016 - 5/31/2016



Percent of Normal Precipitation (%)
6/1/2016 - 6/30/2016



Generated 5/11/2016 at HPRCC using provisional data.

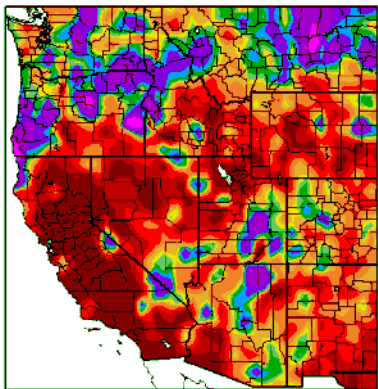
Regional Climate Centers Generated 5/11/2016 at HPRCC using provisional data.

Regional Climate Cen. Generated 7/11/2016 at HPRCC using provisional data.

Regional Climate Centers

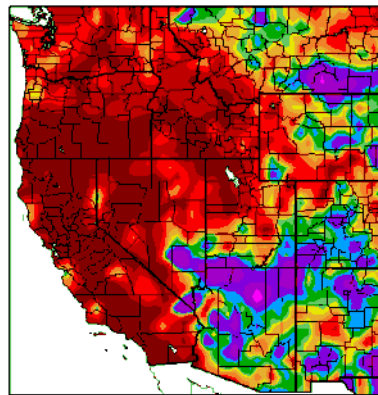
Apr 2016

Percent of Normal Precipitation (%)
7/1/2016 - 7/31/2016



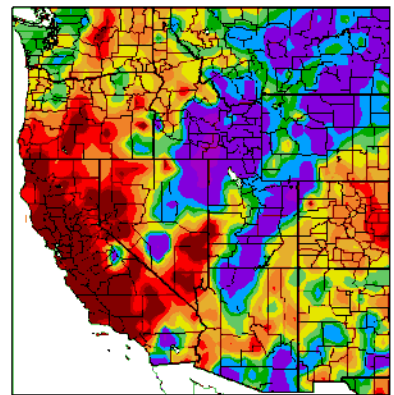
May 2016

Percent of Normal Precipitation (%)
8/1/2016 - 8/31/2016



Jun 2016

Percent of Normal Precipitation (%)
9/1/2016 - 9/30/2016



Generated 8/11/2016 at HPRCC using provisional data.

Regional Climate Cente Generated 8/11/2016 at HPRCC using provisional data.

Regional Climate Cent Generated 10/2/2016 at HPRCC using provisional data.

Regional Climate Centers

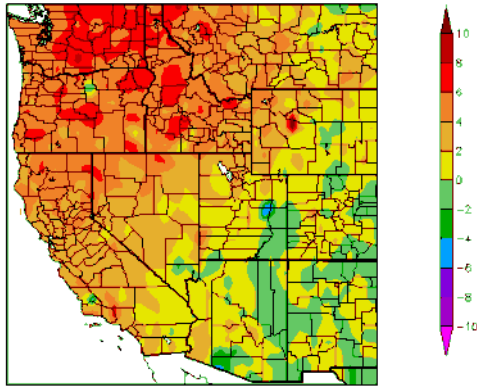
Jul 2016

Aug 2016

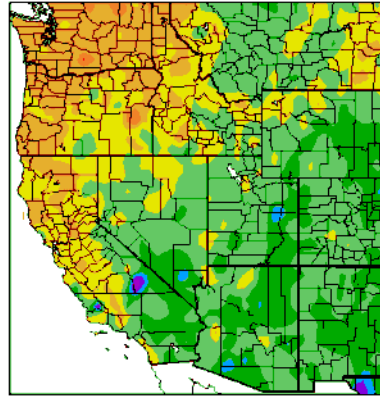
Sep 2016

Mean Temperature Departure from Normal

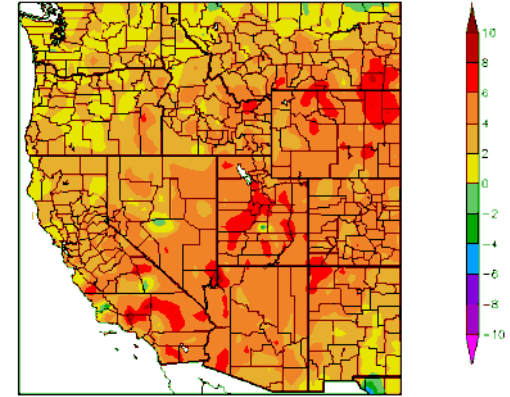
Departure from Normal Temperature (F)
4/1/2016 - 4/30/2016



Departure from Normal Temperature (F)
5/1/2016 - 5/31/2016



Departure from Normal Temperature (F)
6/1/2016 - 6/30/2016

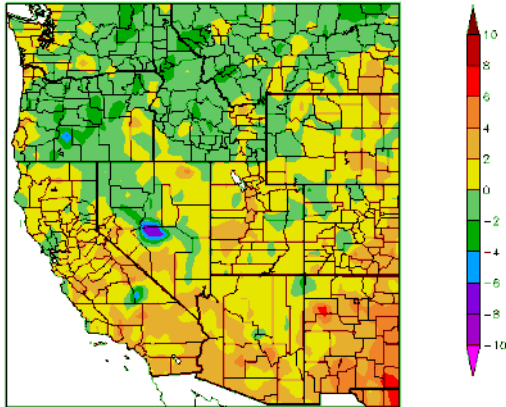


Apr 2016

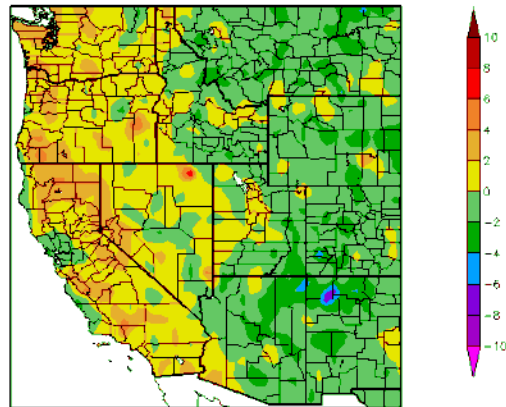
May 2016

Jun 2016

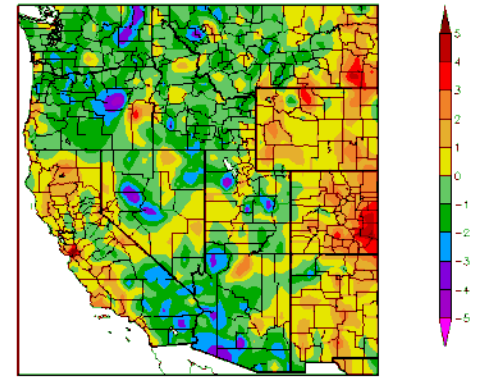
Departure from Normal Temperature (F)
7/1/2016 - 7/31/2016



Departure from Normal Temperature (F)
8/1/2016 - 8/31/2016



Departure from Normal Temperature (F)
9/1/2016 - 9/30/2016



Jul 2016

Aug 2016

Sep 2016

Generated 5/11/2016 at HPRCC using provisional data.

Regional Climate Centers Generated 6/11/2016 at HPRCC using provisional data.

Regional Climate Centers Generated 7/11/2016 at HPRCC using provisional data.

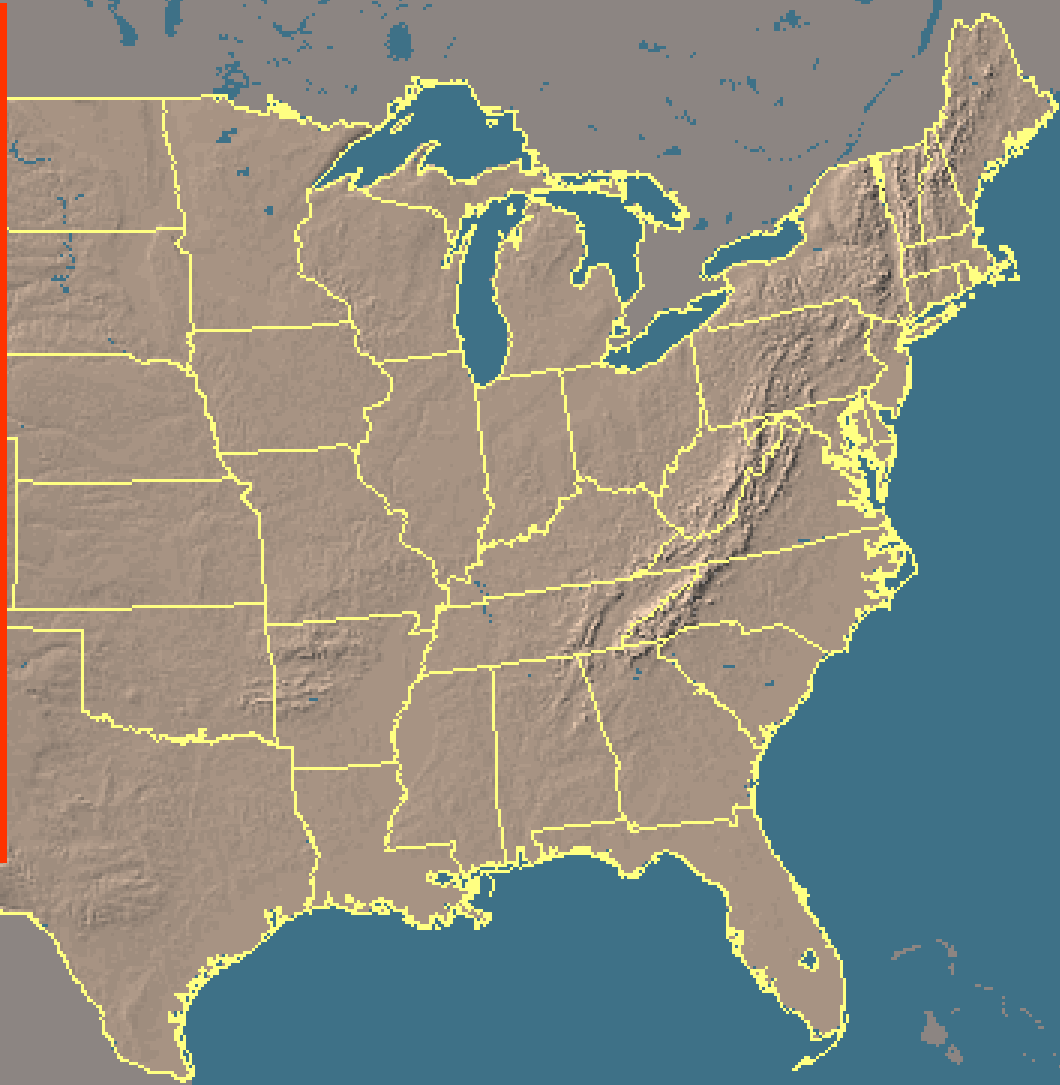
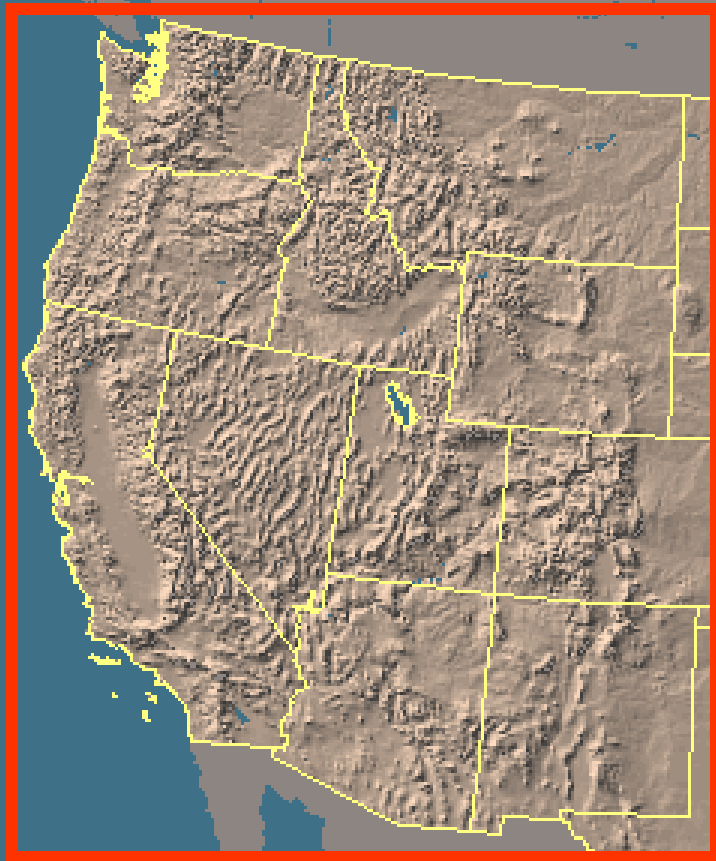
Regional Climate Centers

Generated 8/11/2016 at HPRCC using provisional data.

Regional Climate Centers Generated 9/11/2016 at HPRCC using provisional data.

Regional Climate Centers Generated 10/2/2016 at HPRCC using provisional data.

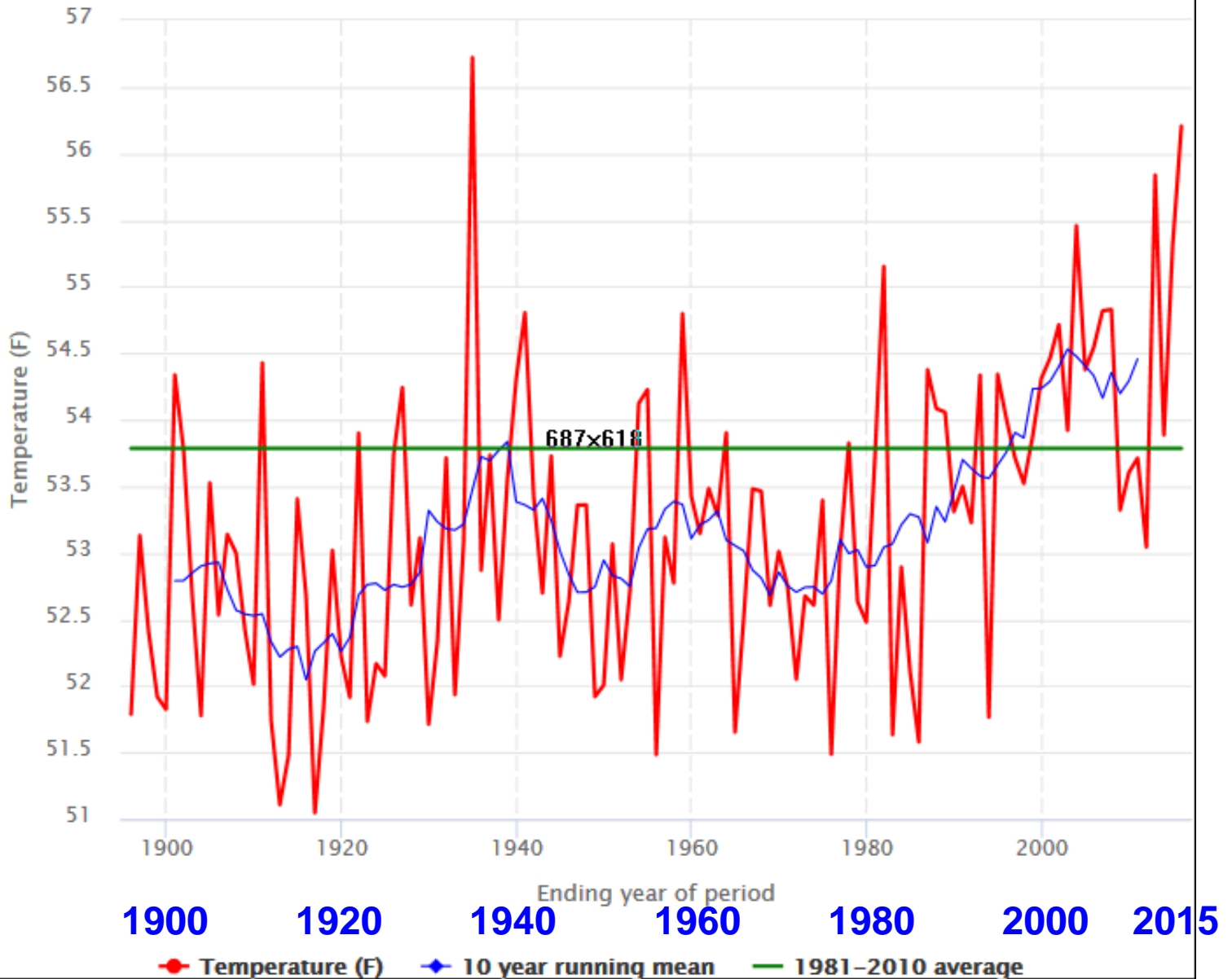
Regional Climate Centers

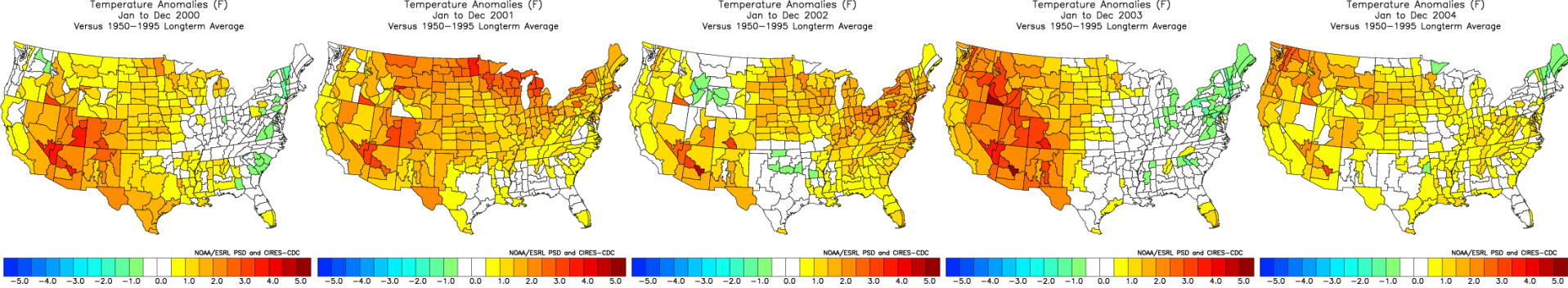


Mean Temperature for Western 11 Contiguous States



12 month period ending in December





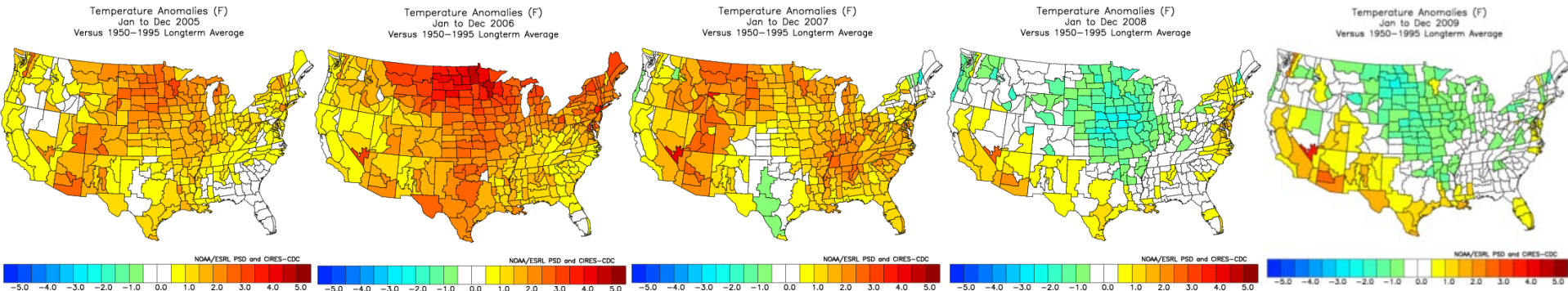
2000

2001

2002

2003

2004



2005

2006

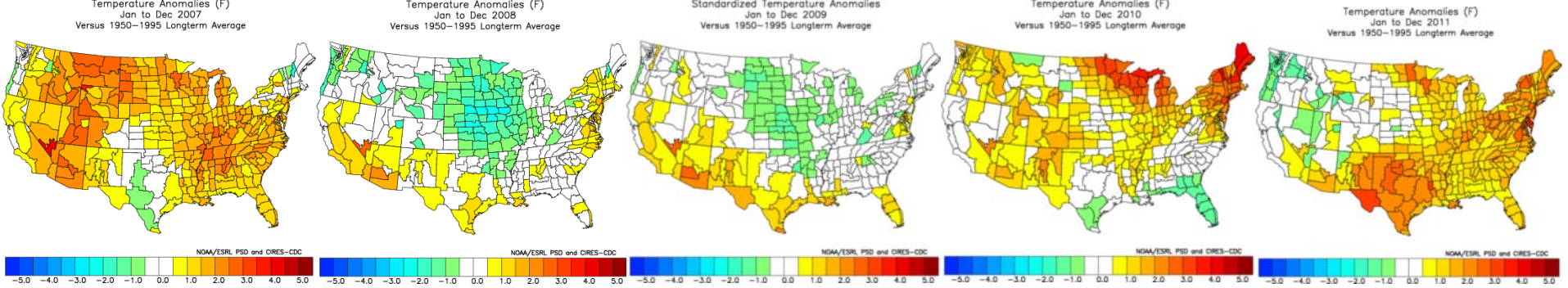
2007

2008

2009

United States Annual Temperature Departure from 1950-1995 Mean

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



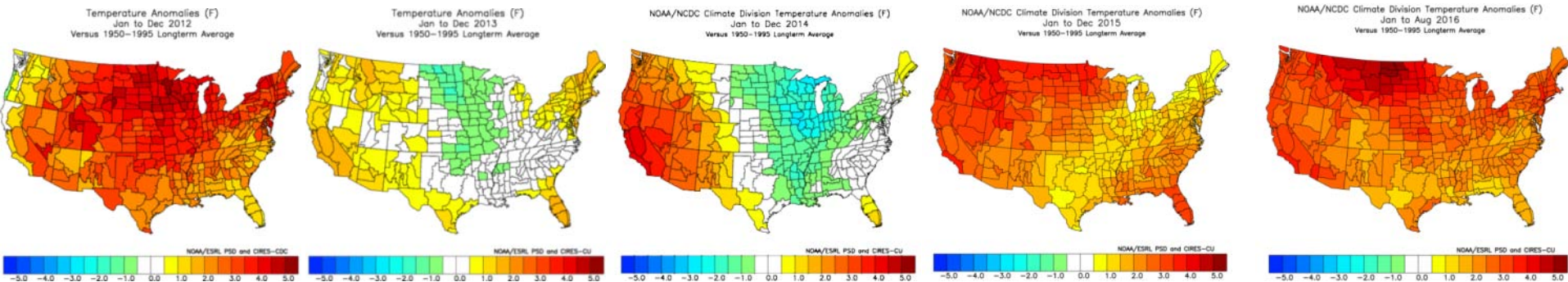
2007

2008

2009

2010

2011



2012

2013

2014

2015

2016 Jan-Aug

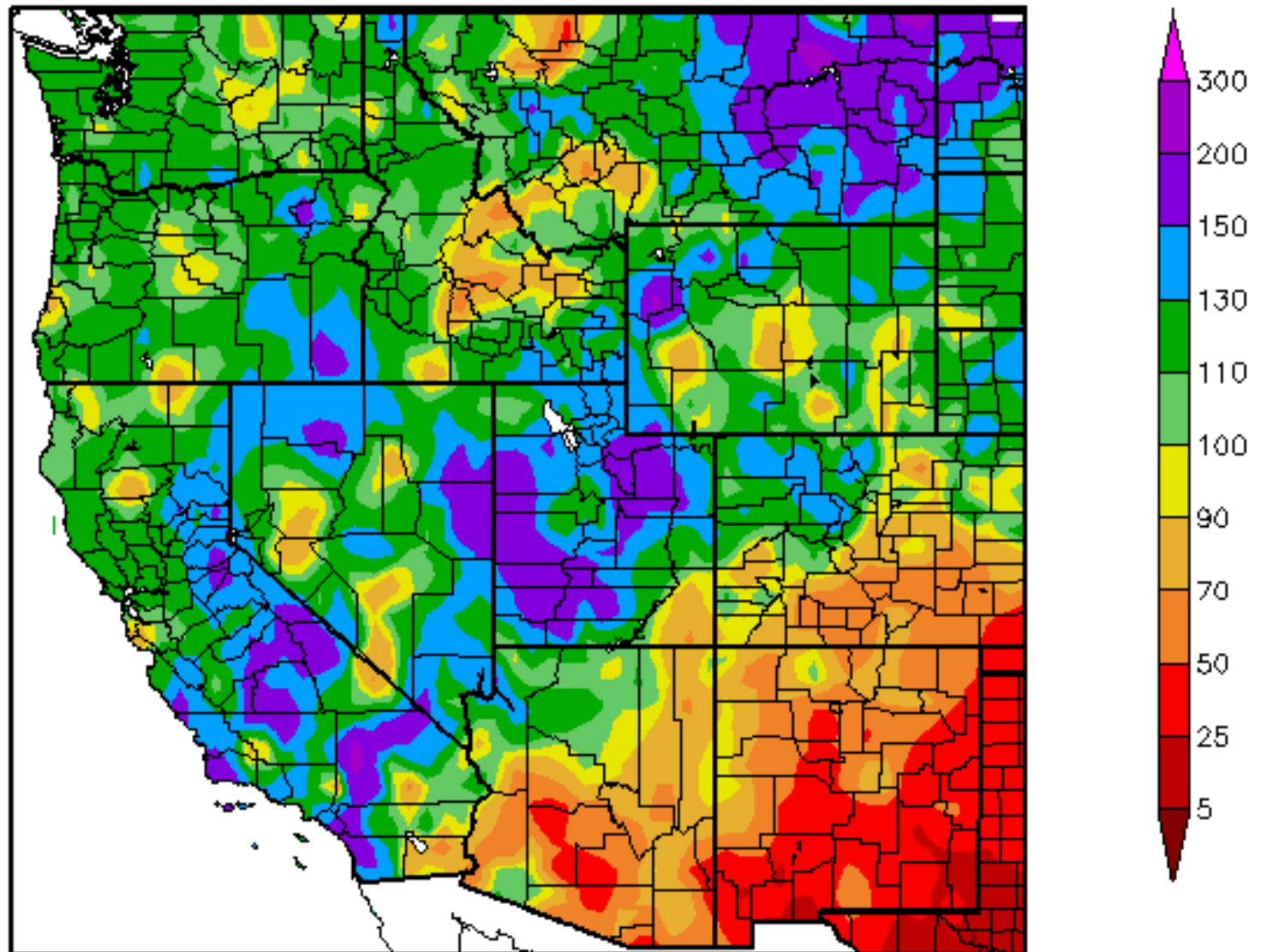
United States Annual Temperature Departure from 1950-1995 Mean

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 (%)

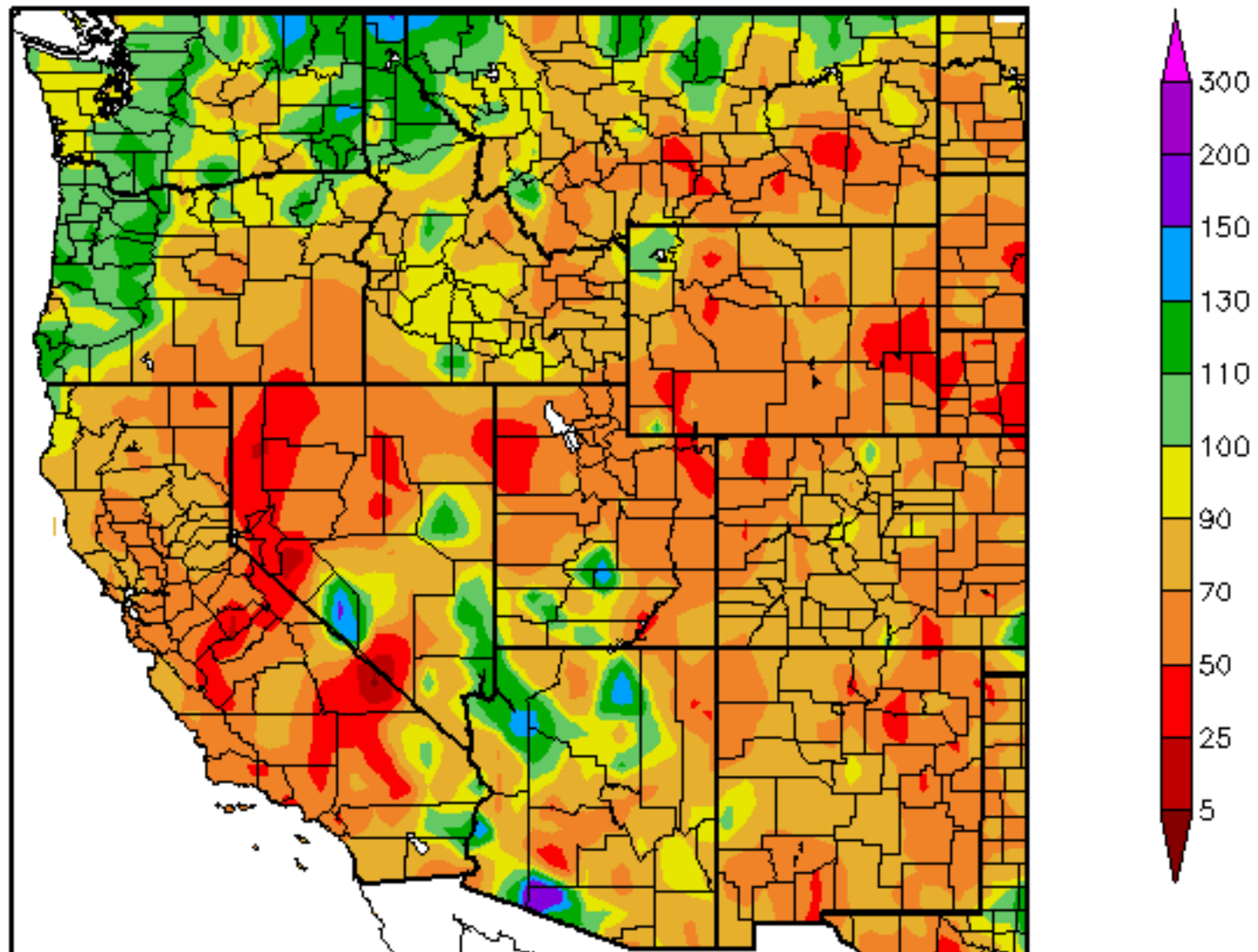
10/1/2010 - 9/30/2011



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

Percent of Normal Precipitation (%)

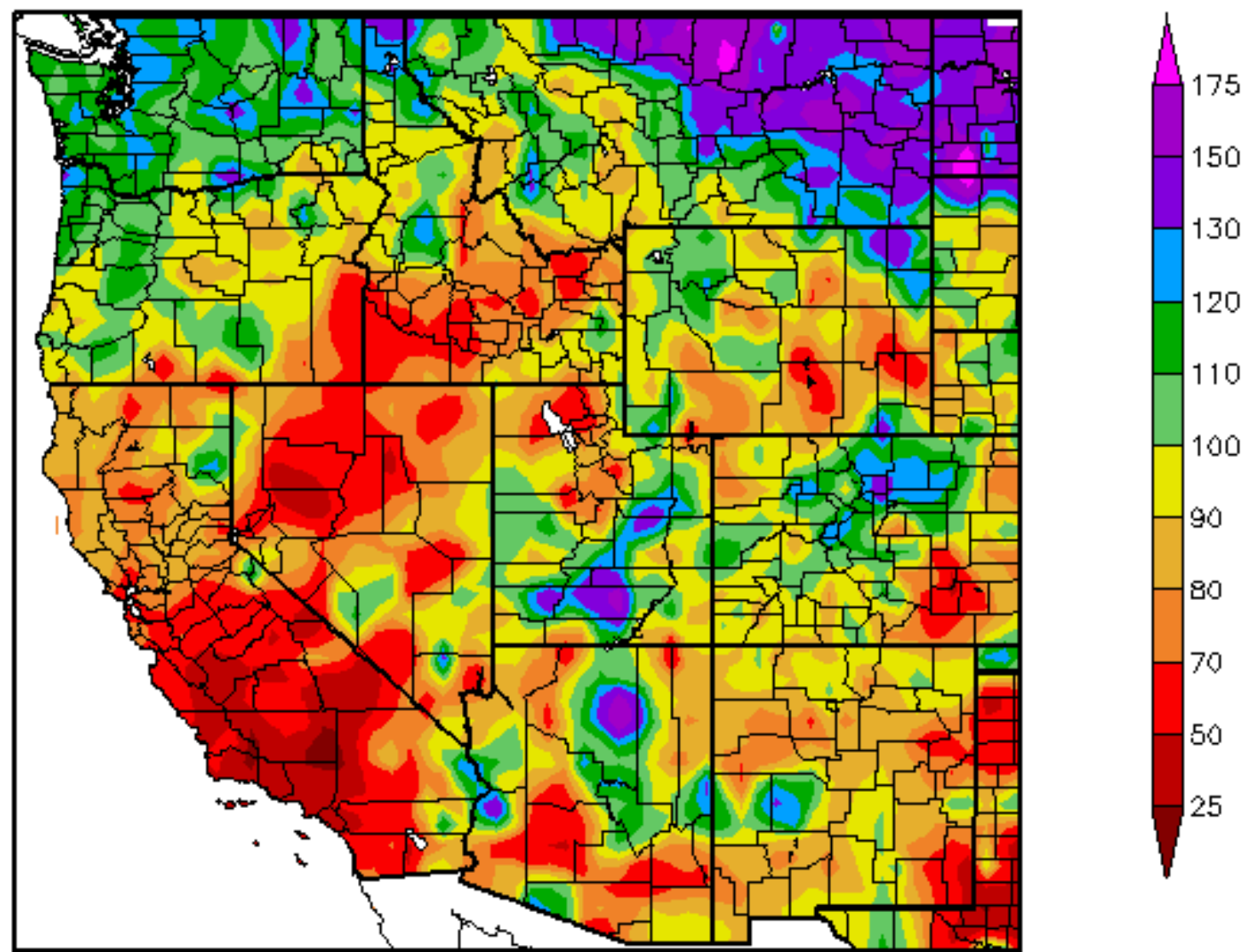
10/1/2011 - 9/30/2012



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

Percent of Normal Precipitation (%)

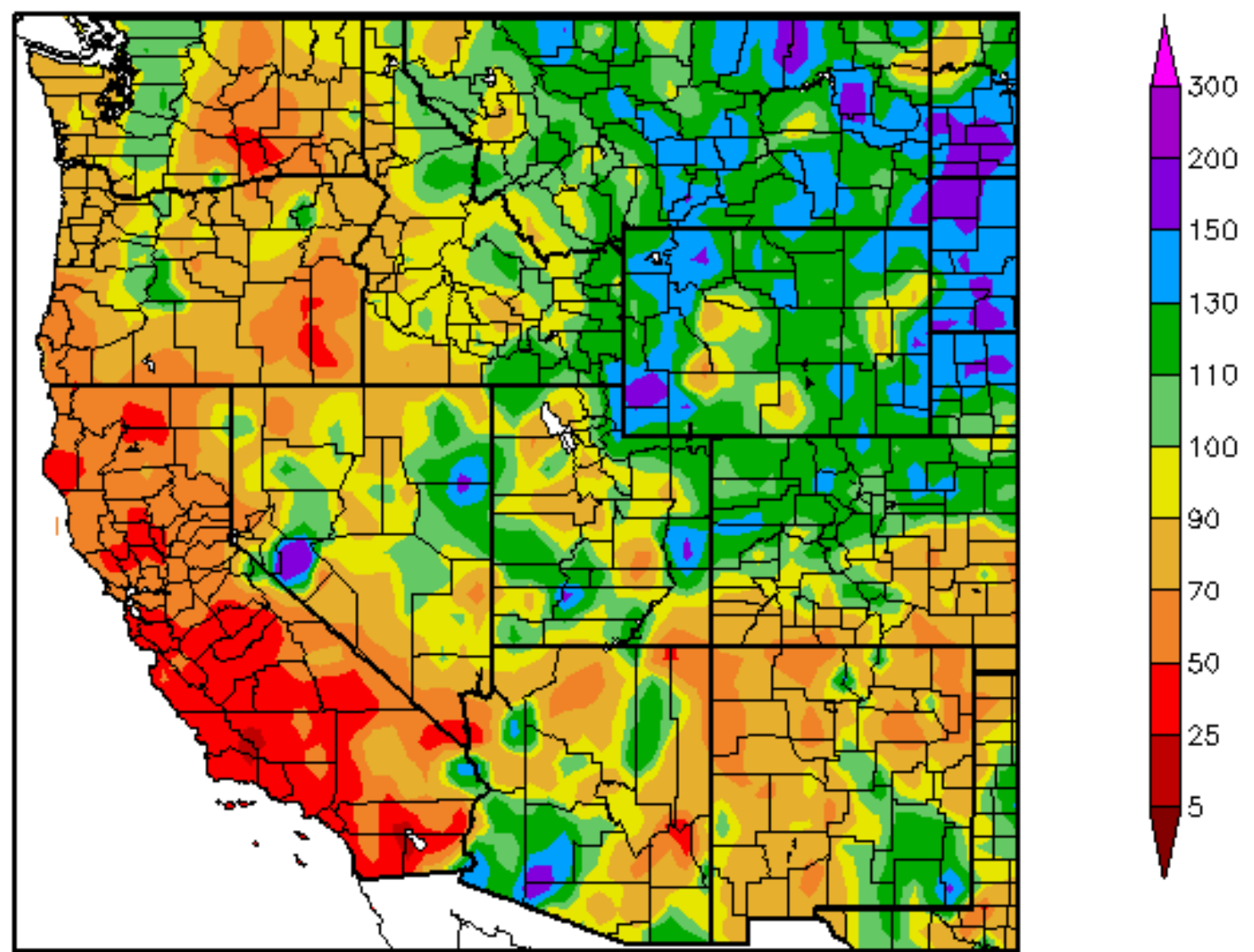
10/1/2012 - 9/30/2013



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

Percent of Normal Precipitation (%)

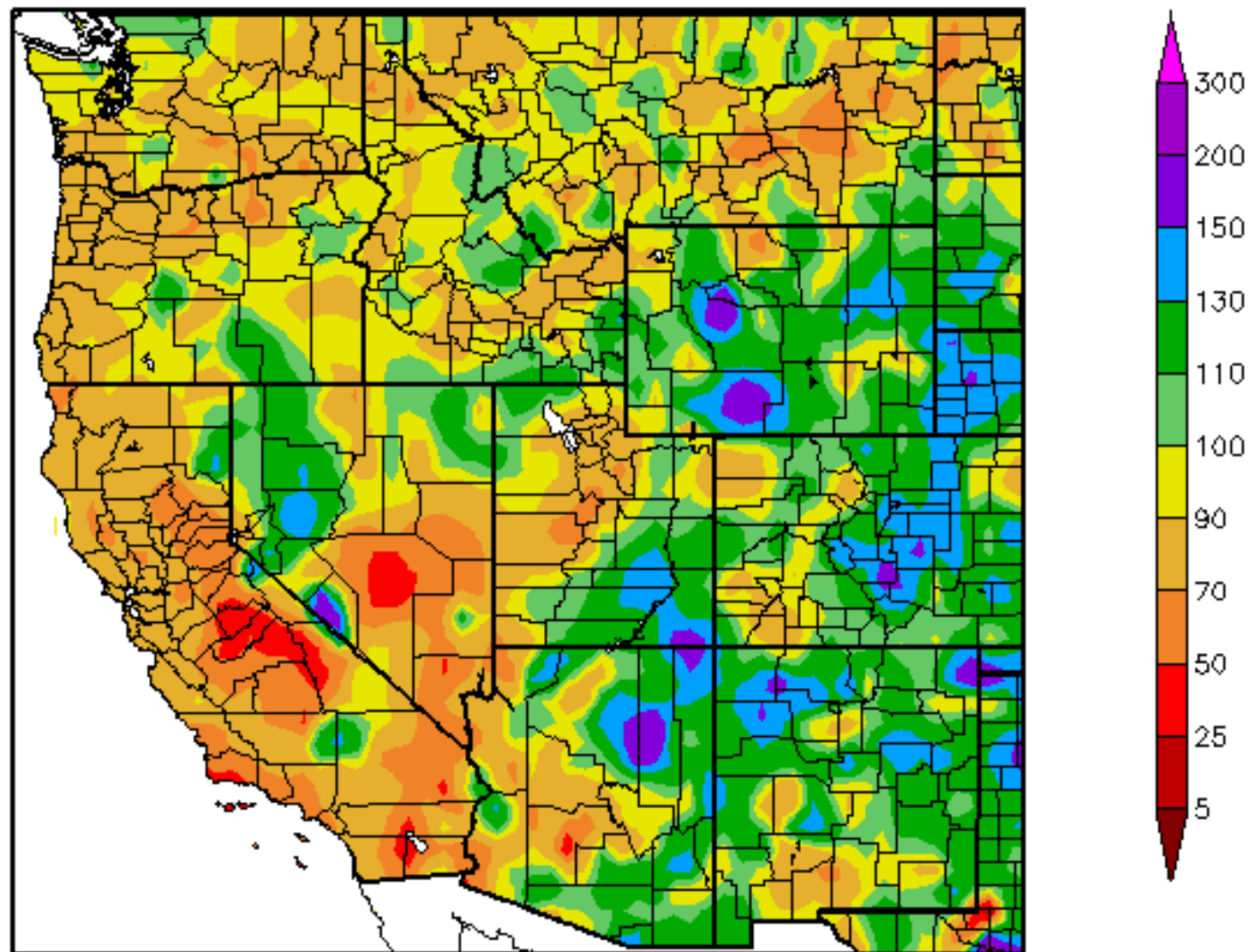
10/1/2013 - 9/30/2014



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

Percent of Normal Precipitation (%)

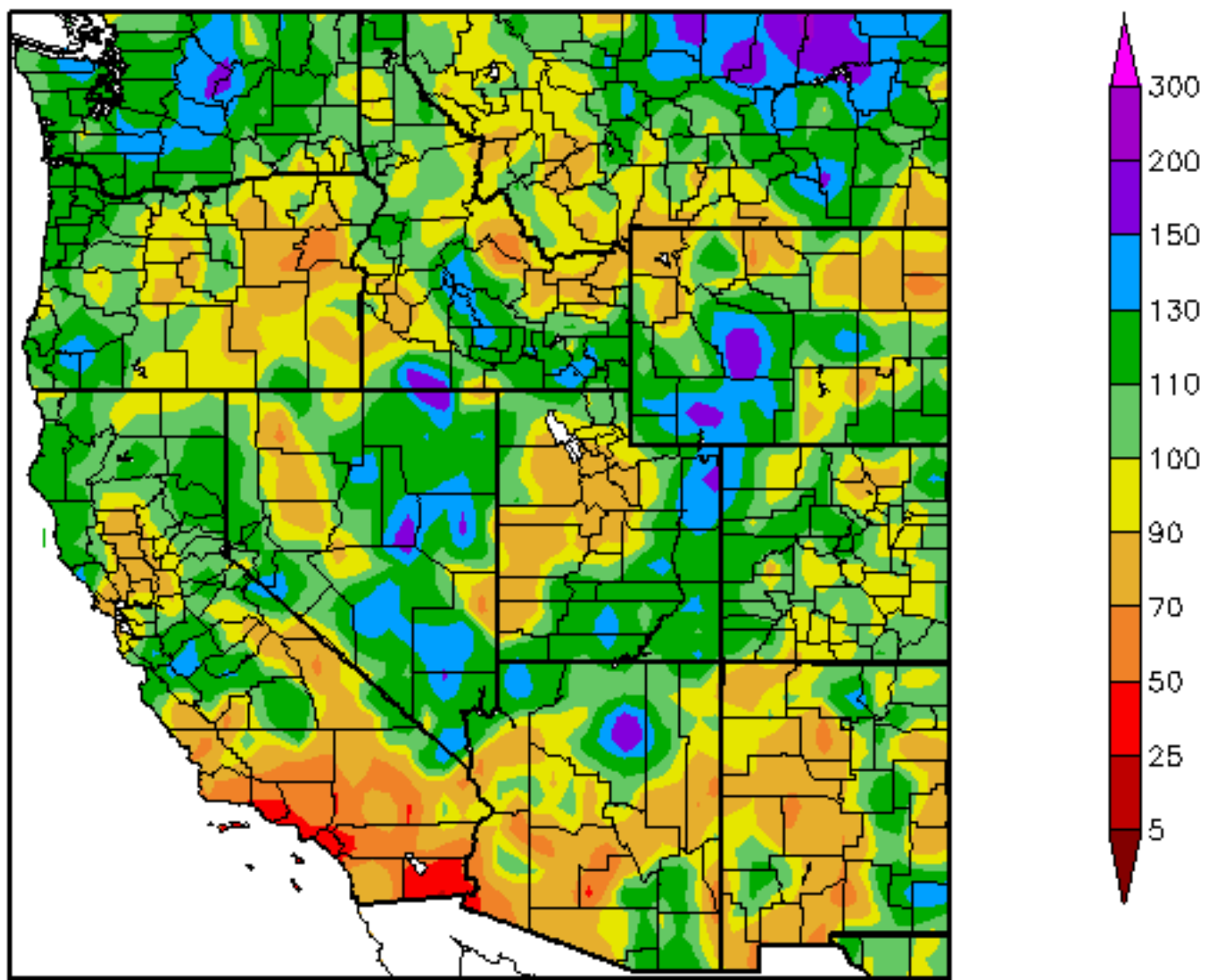
10/1/2014 - 9/30/2015



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

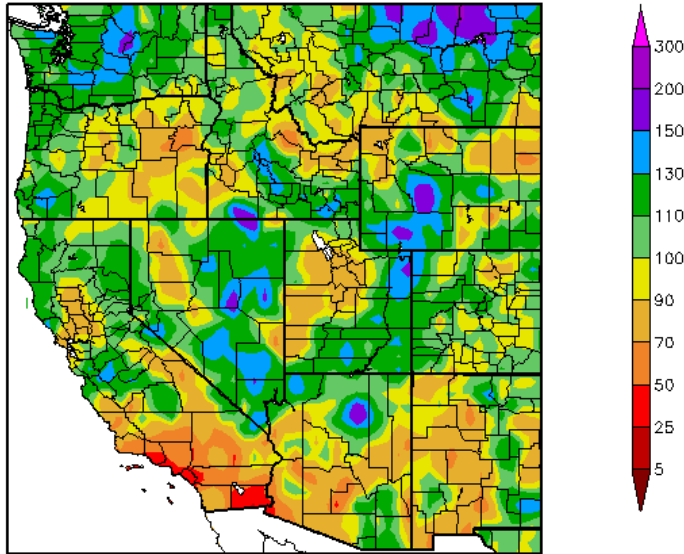
Percent of Normal Precipitation (%)

10/1/2015 – 9/30/2016



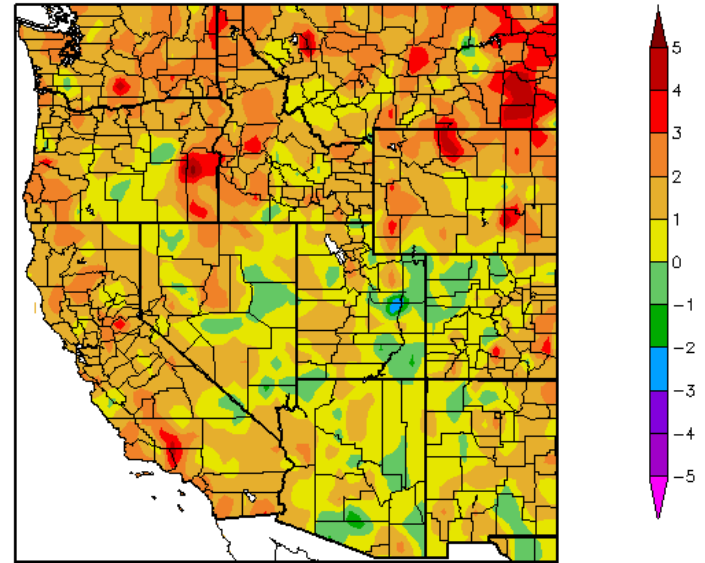
Water Year 2015-2016

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



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

Departure from Normal Temperature (F)
10/1/2015 – 9/30/2016



Regional Climate Cent Generated 10/2/2016 at HPRCC using provisional data.

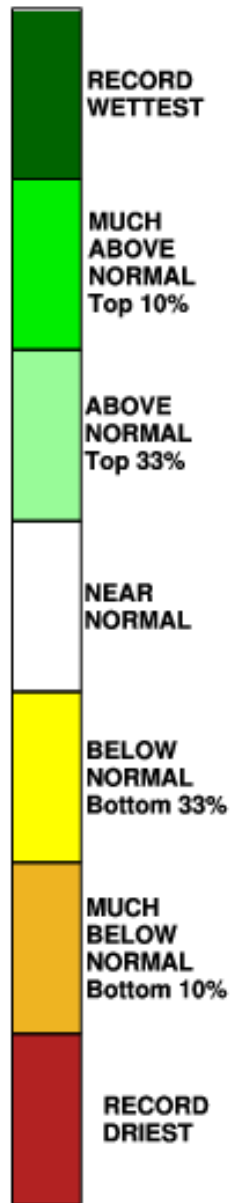
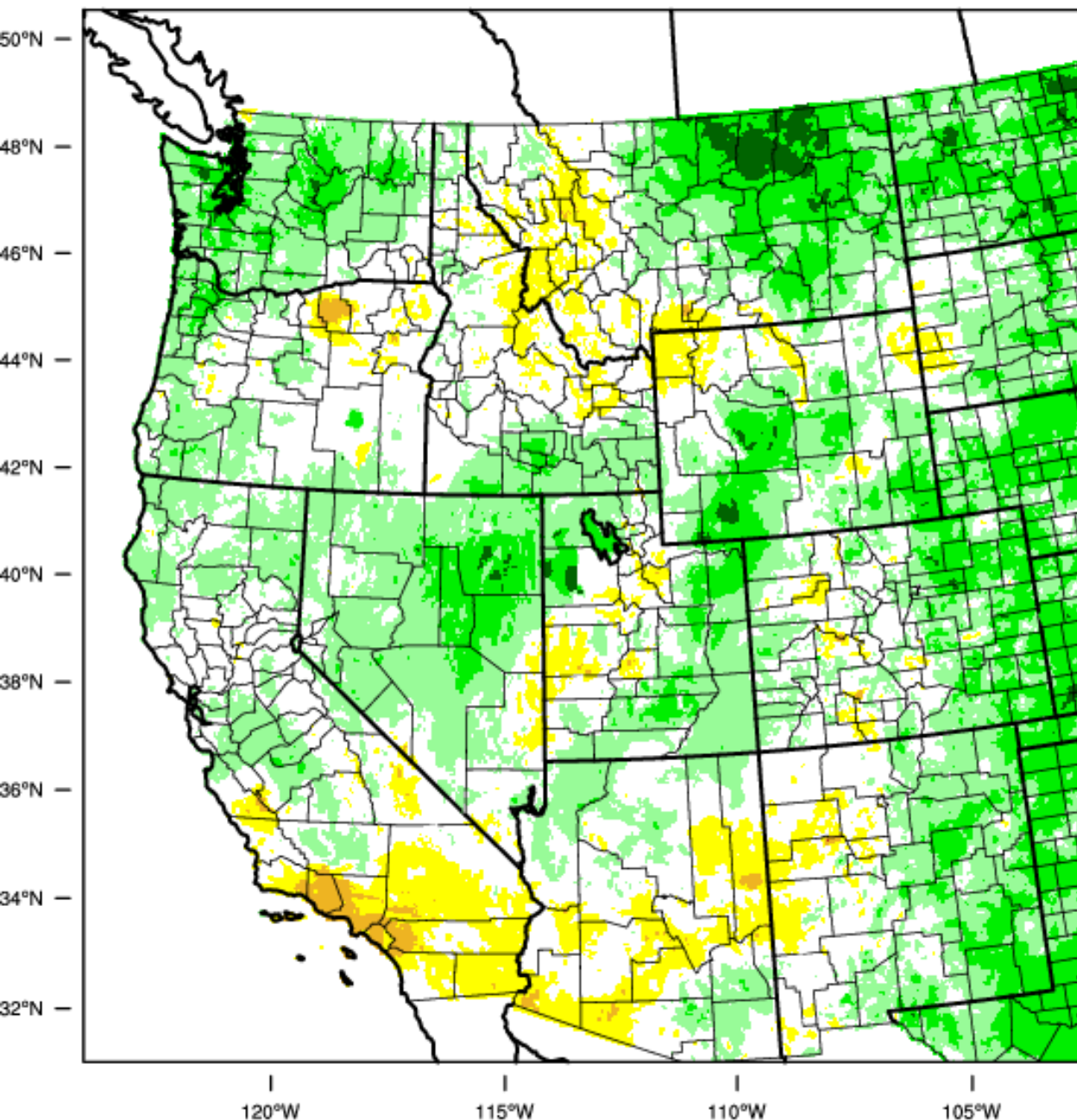
Regional Climate Centers

Precipitation Percent

Temperature Departure (F)

Western United States - Precipitation

October-September 2016 Percentile



Rankings (1895-2010)

**Water Year
Precipitation
Rank**

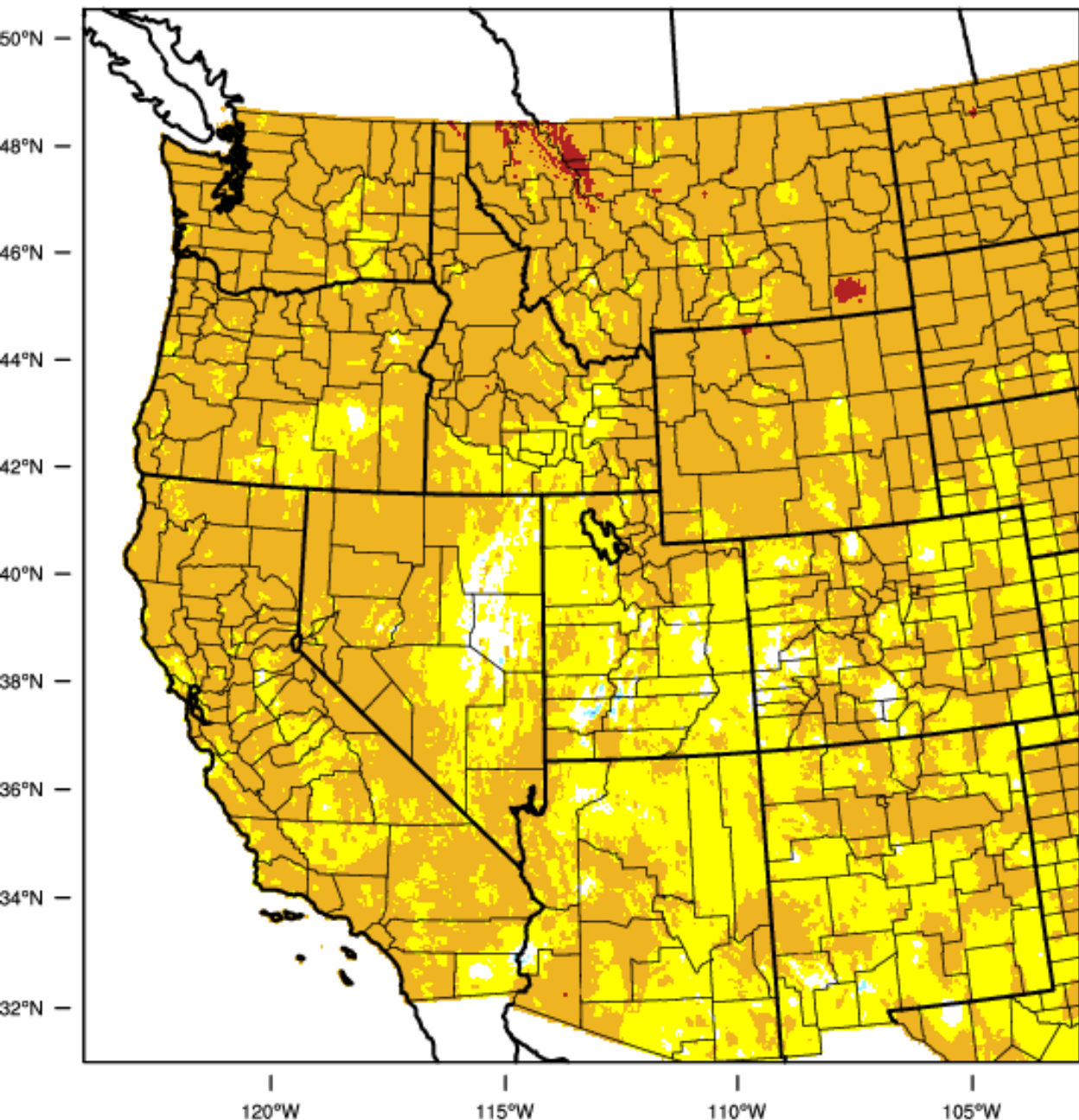
**Oct 2015
Thru
Sep 2016**

**Reference
Period
1896
Thru
2015**

**West-Wide
Drought
Tracker**

Western United States - Mean Temperature

October-September 2016 Percentile



**Oct-Sep
Precipitation
Rank**

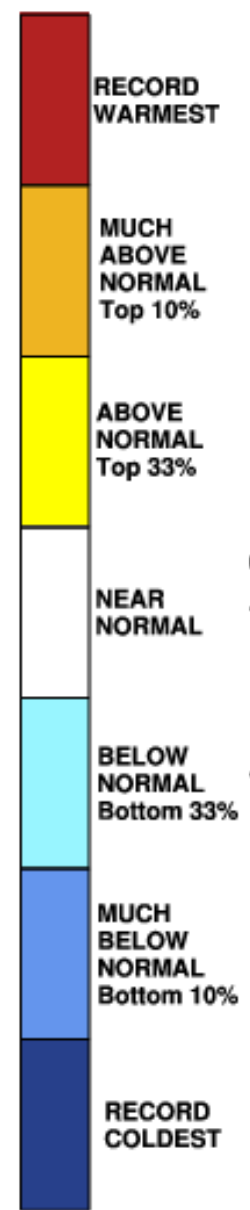
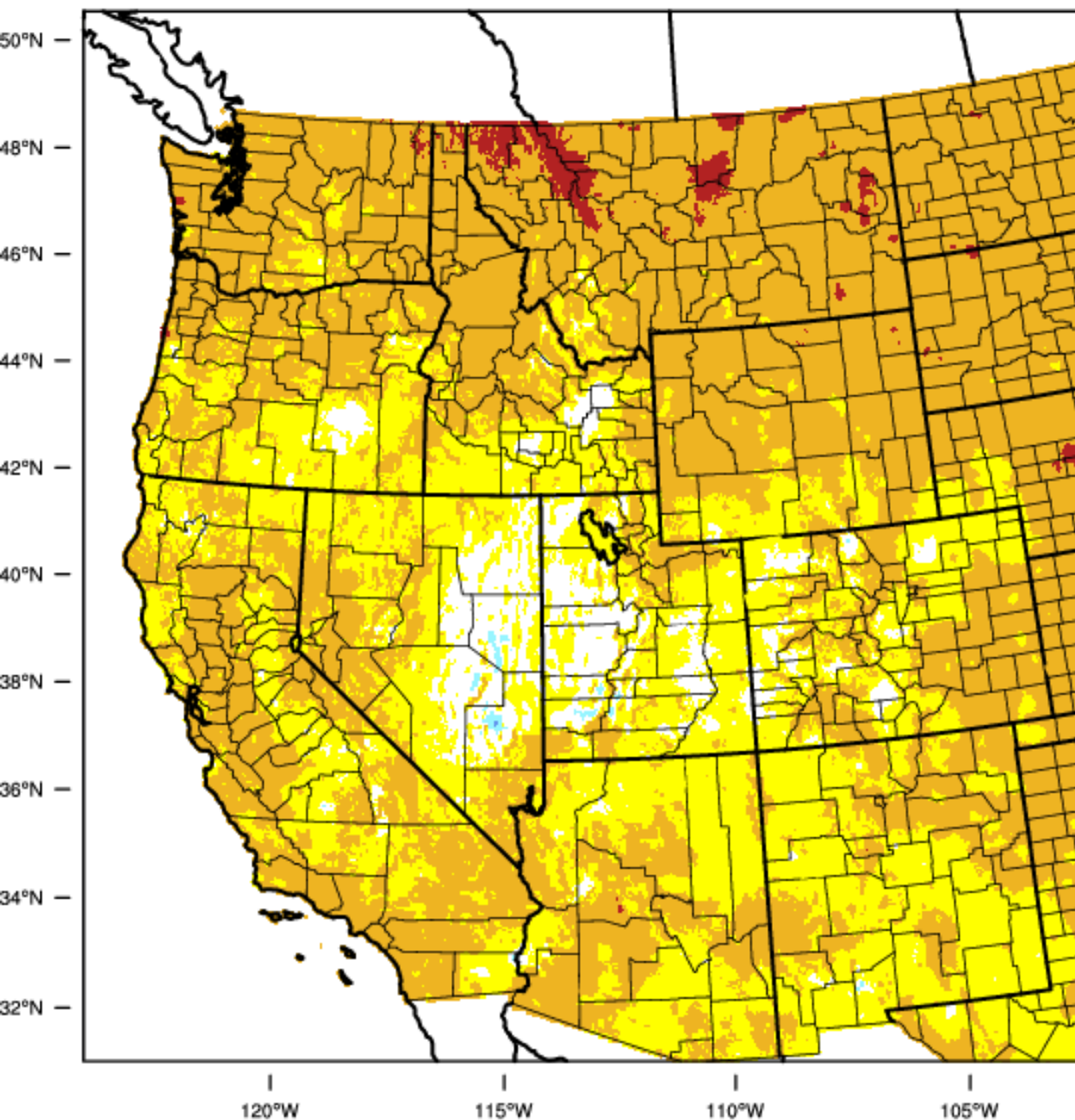
**Oct 2015
Thru
Sep 2016**

**Reference
Period
1895 - 2015**

Rankings (1895-2010)

Western United States - Mean Temperature

October-March 2016 Percentile



Rankings (1895-2010)

Western US
Temperature
Percentiles

Oct 2015
thru
Mar 2016

Reference
Period
121 Years
1895-2016

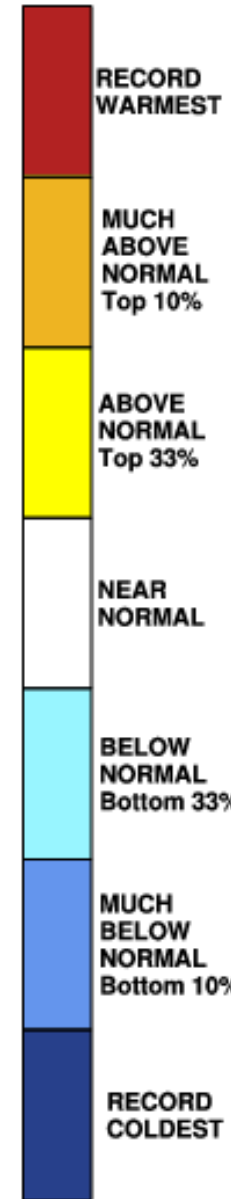
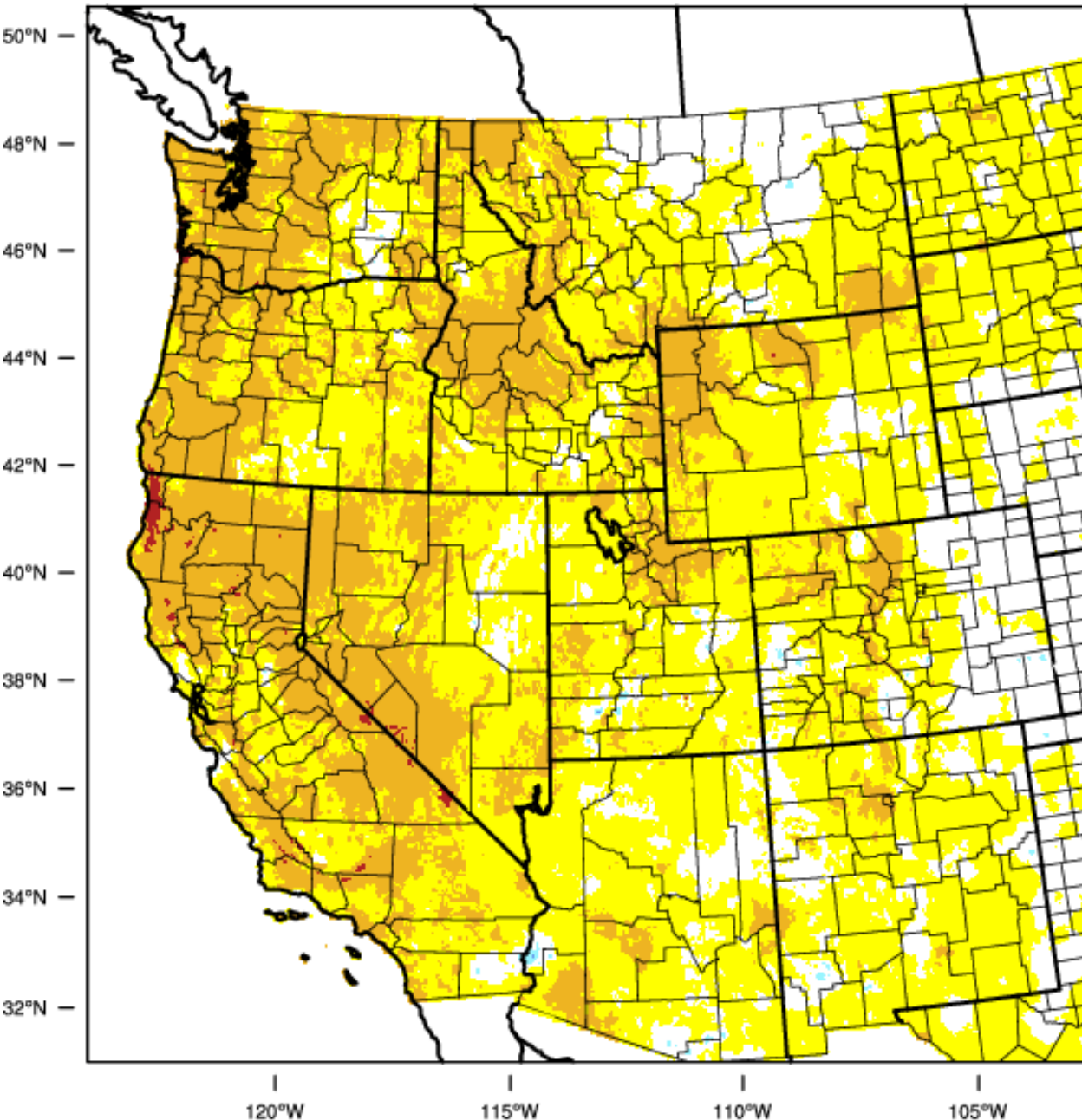
WestWide
Drought
Tracker

Updated
Monthly

WRCC

Western United States - Mean Temperature

April-September 2016 Percentile



Rankings (1895-2010)

**Western US
Temperature
Percentiles**

**Apr 2015
thru
Sep 2016**

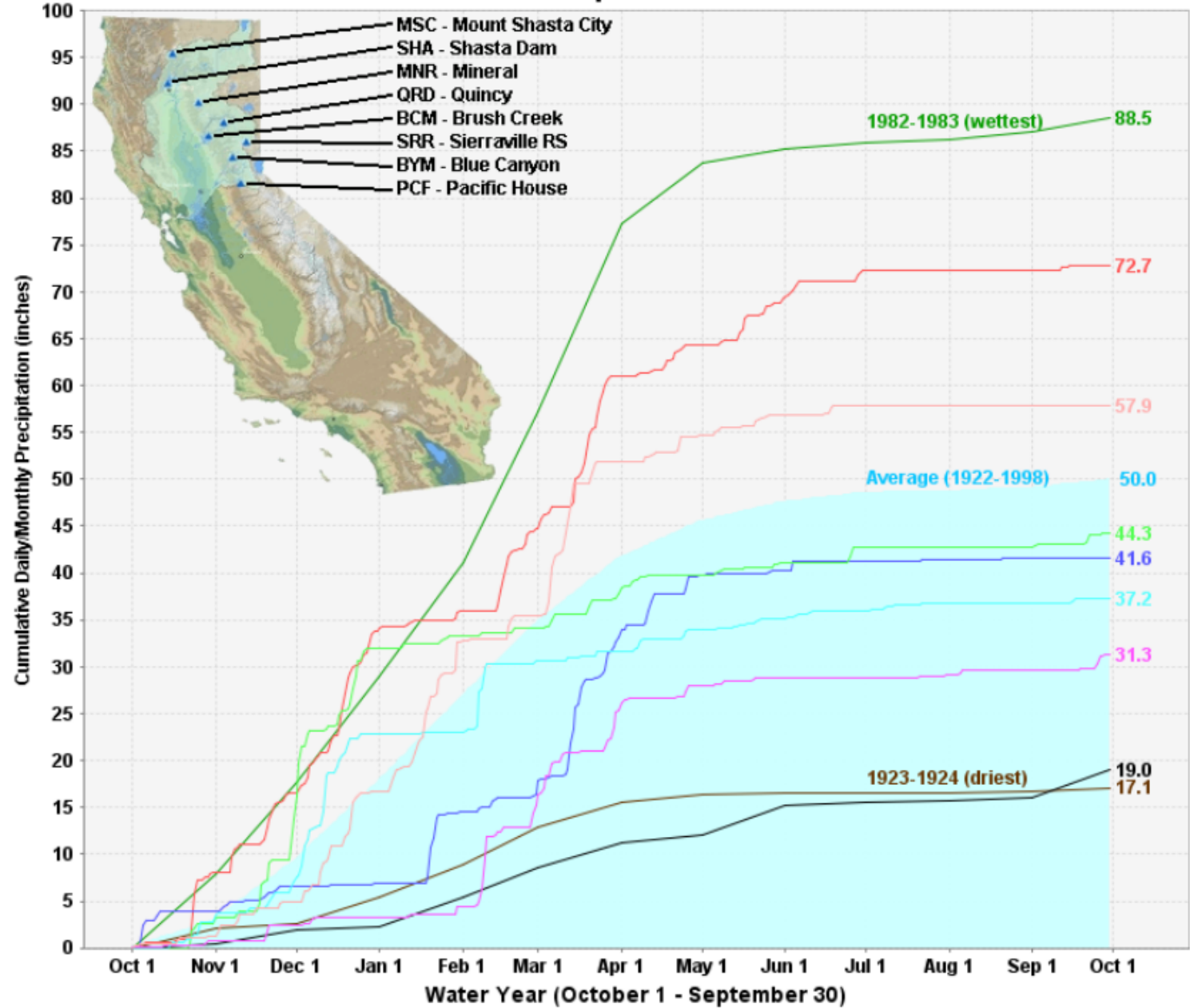
**Reference
Period
121 Years
1895-2015**

**WestWide
Drought
Tracker**

**Updated
Monthly**

WRCC

Northern Sierra Precipitation: 8-Station Index



San Joaquin Precipitation: 5-Station Index

5-Station Index Precipitation

Wettest (1982-83)

2010-11

2015-16

2012-13

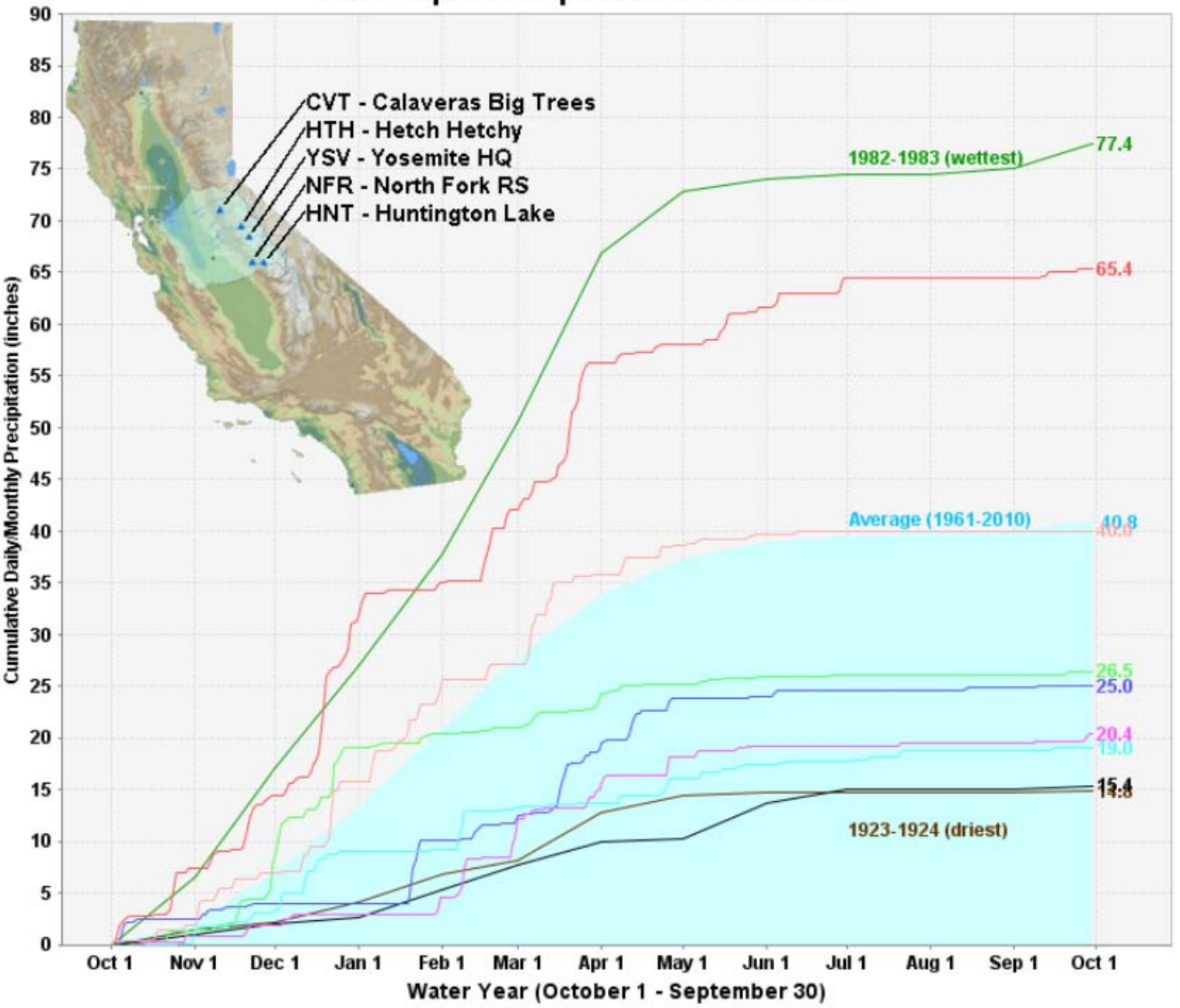
2011-12

2013-14

2014-15

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

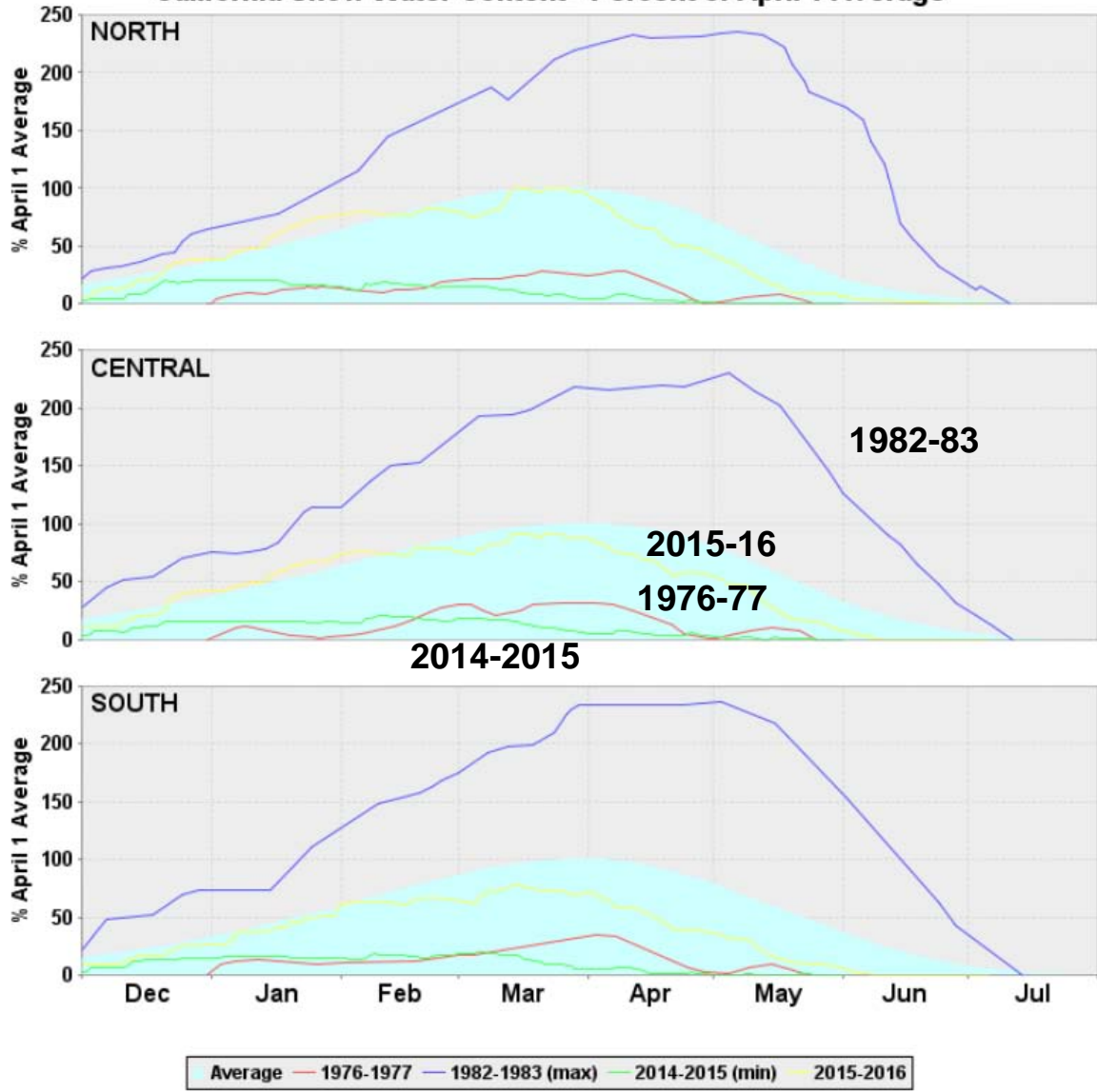
CA - DWR



Total Water Year Precipitation



California Snow Water Content - Percent of April 1 Average



**Northern
Sierra**

**Winter Season
Snow Water
Content**

1982-83 wettest

Average

2013-14

2014-15

**Central
Sierra**

1976-77 driest

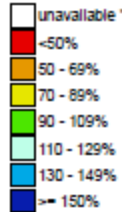
**Southern
Sierra**

**Thru 06 Jul 2016
Cal DWR**

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

Apr 01, 2016

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



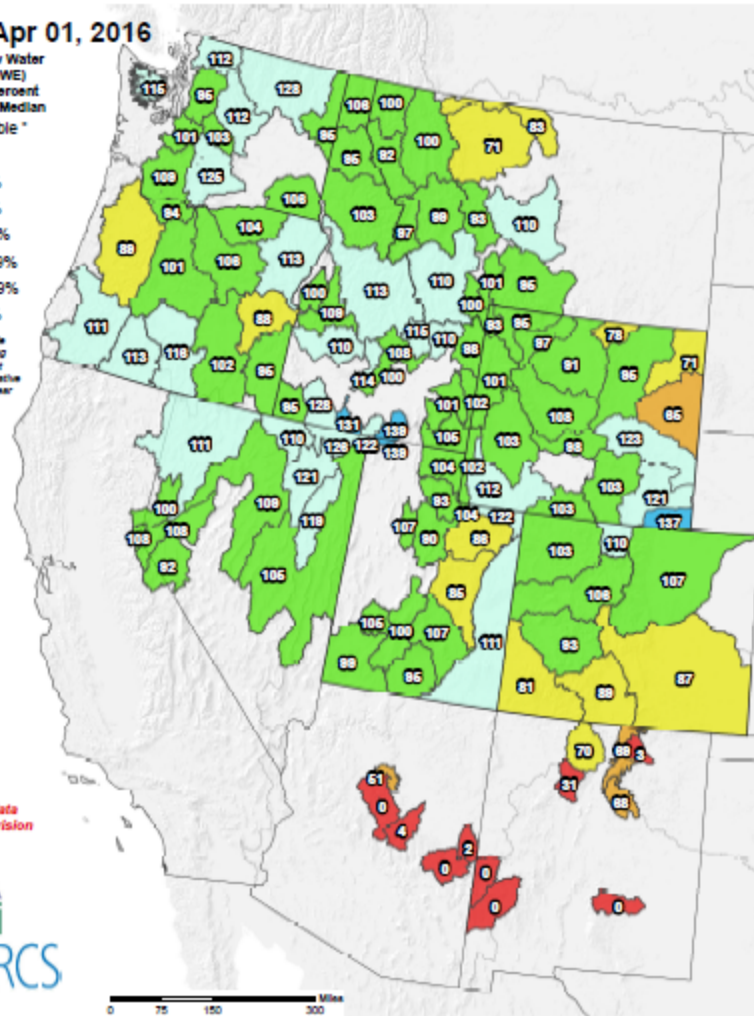
* Data unavailable at time of posting or measurement is not representative at this time of year

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).

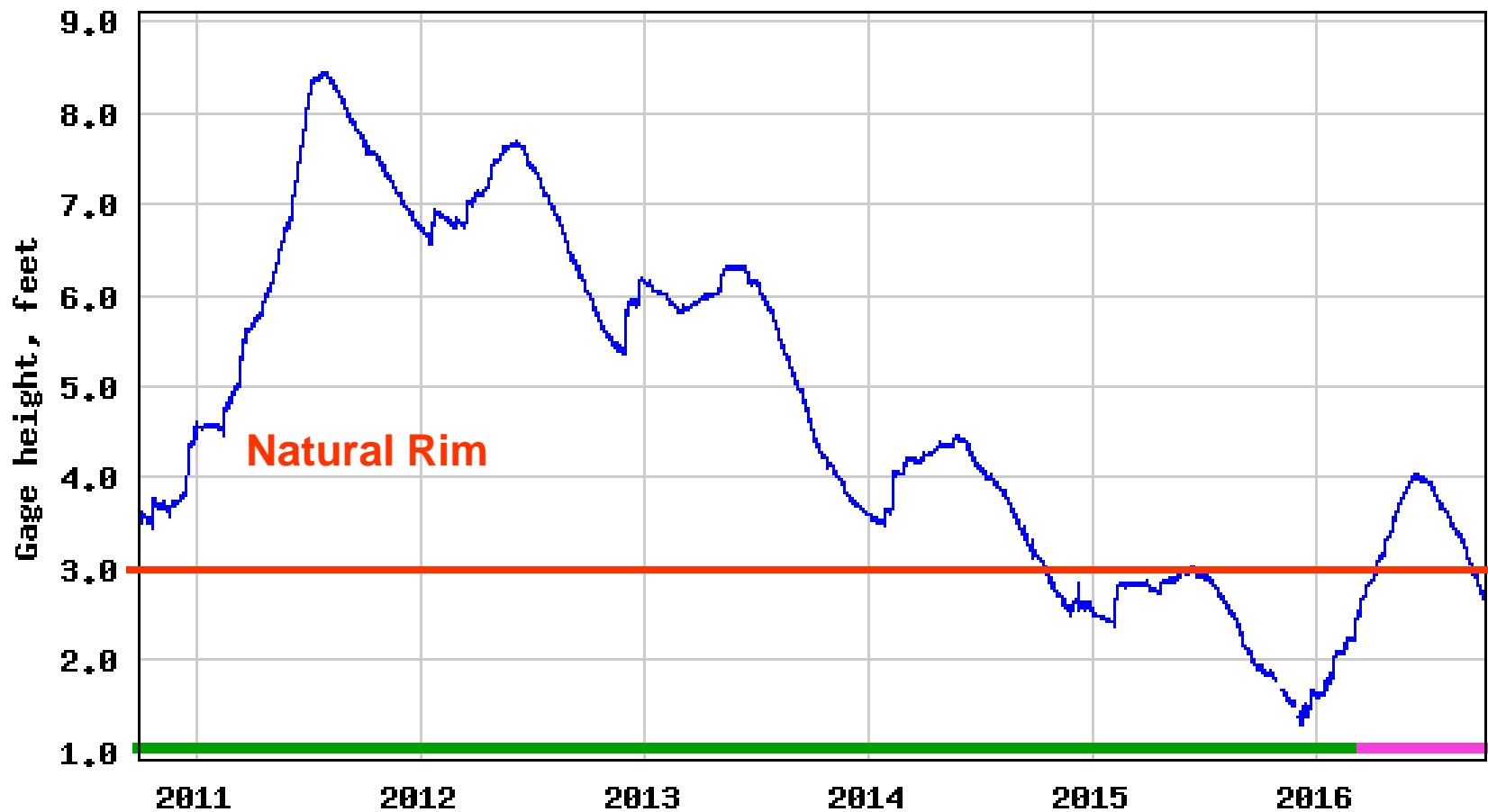
Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
<http://www.wcc.nrcs.usda.gov>



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



USGS 10337000 LAKE TAHOE A TAHOE CITY CA



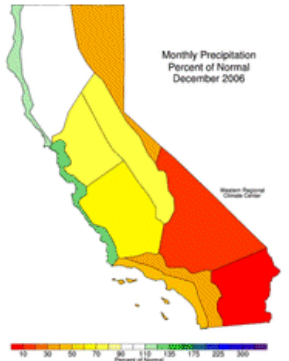
— Gage height

— Period of approved data

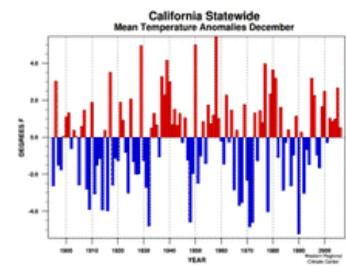
— Period of provisional data

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

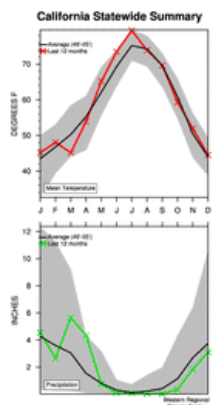
Select Region

Select Element

Select Time Period

Select

Last 12 Months



Summary of the Past 12 Months

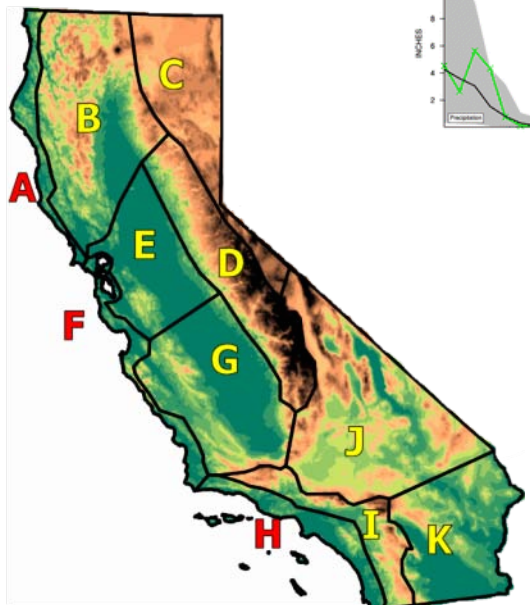
Select Region GO

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

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



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



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

Time Series

Select Region

Select Element

Select Element

Maximum Temperature

Minimum Temperature

Mean Temperature

Precipitation

Temperature Summary

Time Series

Select Region

Select Element

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)

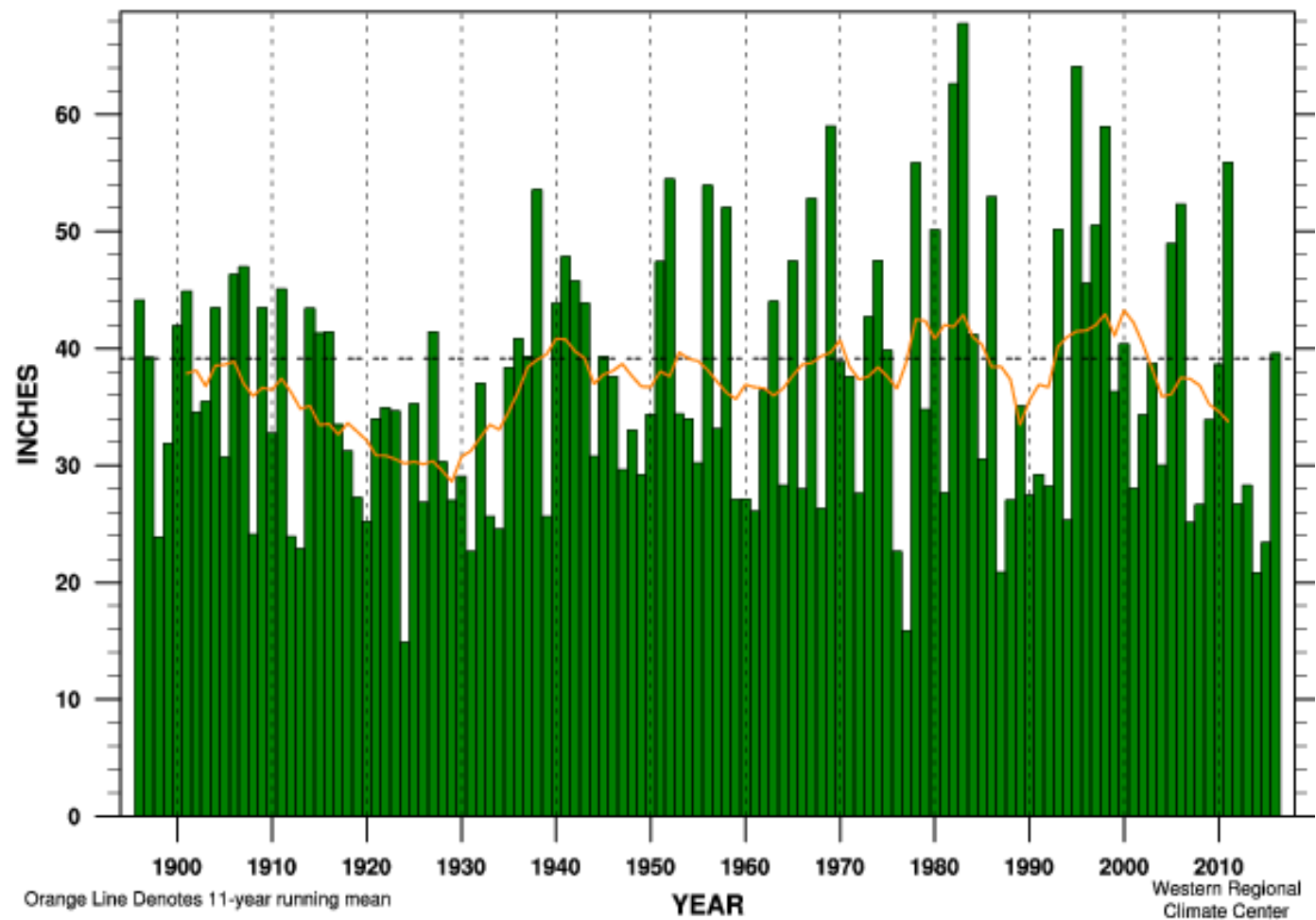
January to Present

October To Present

July To Present

Several types of summaries
And presentations available.

Sierra Region Precipitation Oct-Sep



**Sierra Nevada
Precipitation**

**Water Year
Oct-Sep**

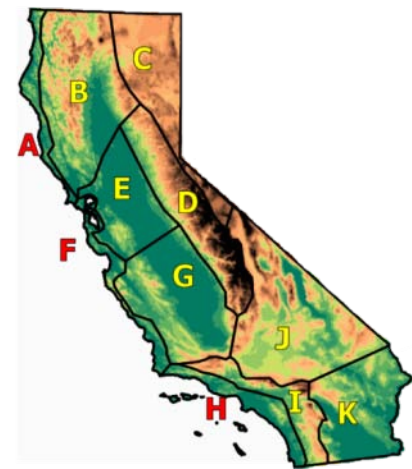
**1895-96
thru
2015-16**

**California
Climate Tracker**

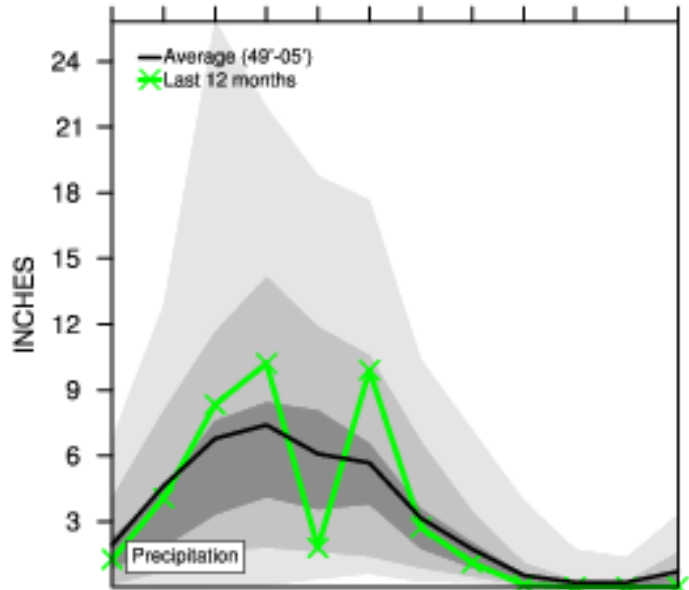
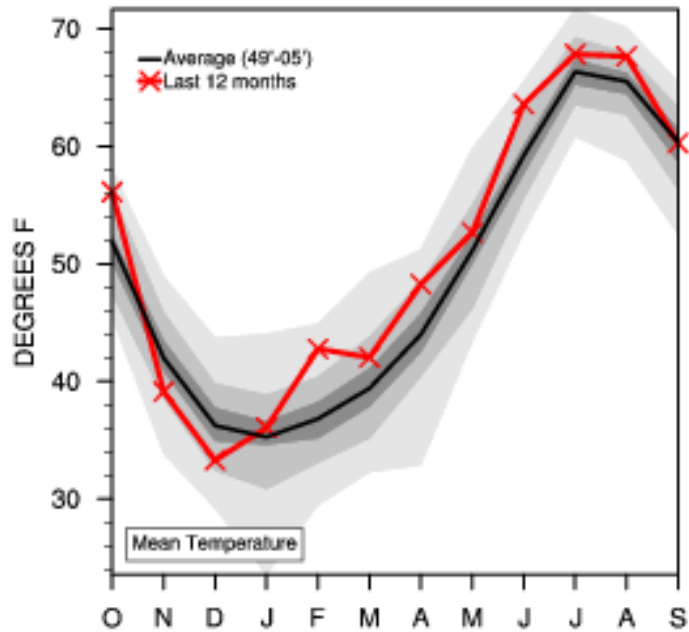
Orange Line Denotes 11-year running mean

Western Regional
Climate Center

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 Region Last 12 Months



dark shading - 33-66 percentile
medium shading - 10-90 percentile
light shading - extremes
Western Regional Climate Center

Sierra Nevada

Temperature
&
Precipitation

Summary

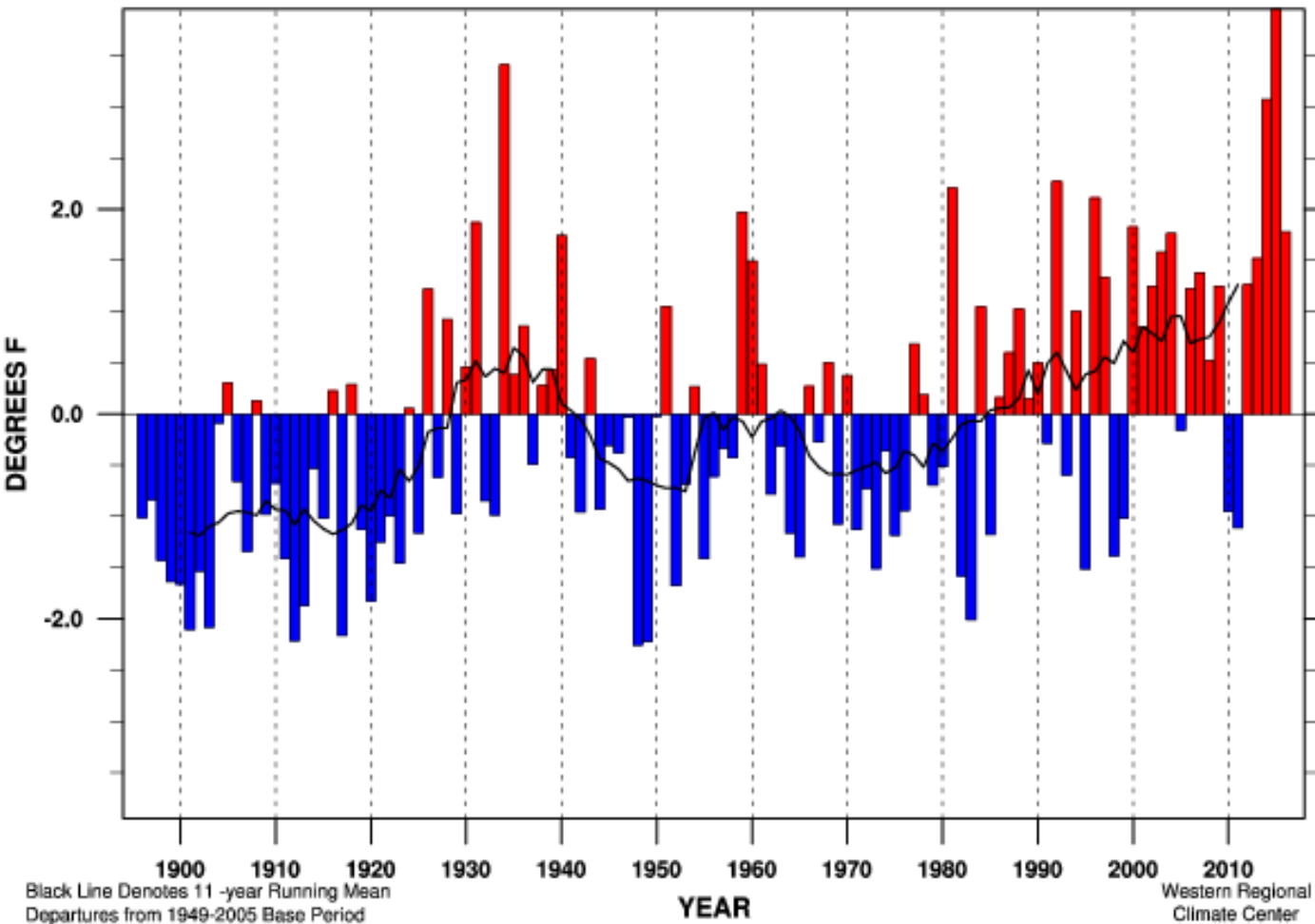
Snow Season

Oct 2015
thru
Sep 2016

California
Climate Tracker

Sierra Region

Mean Temperature Departure Oct-Sep

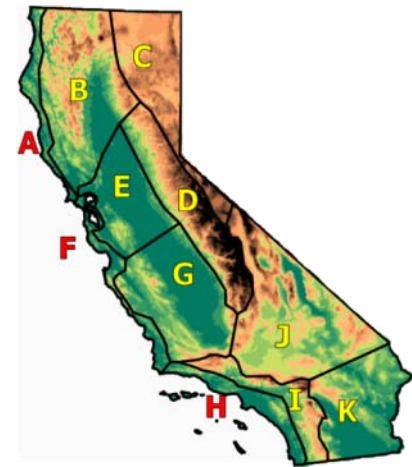


**Water Year
Oct-Sep
Temperature
Departure**

**Sierra
Nevada**

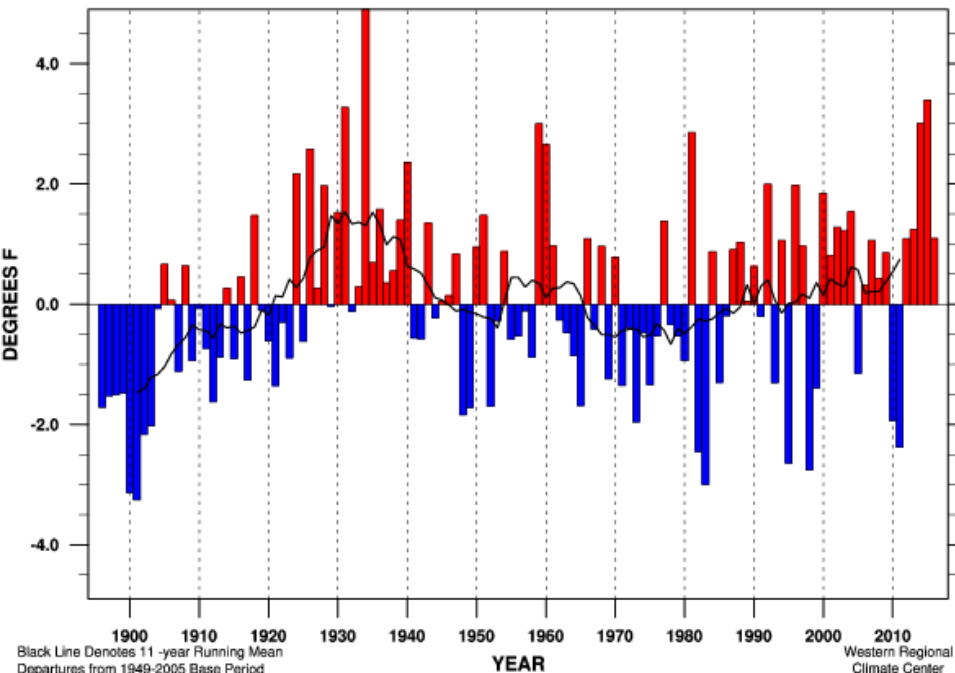
**1895-96
thru
2015-16**

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



Sierra Region

Maximum Temperature Departure Oct-Sep

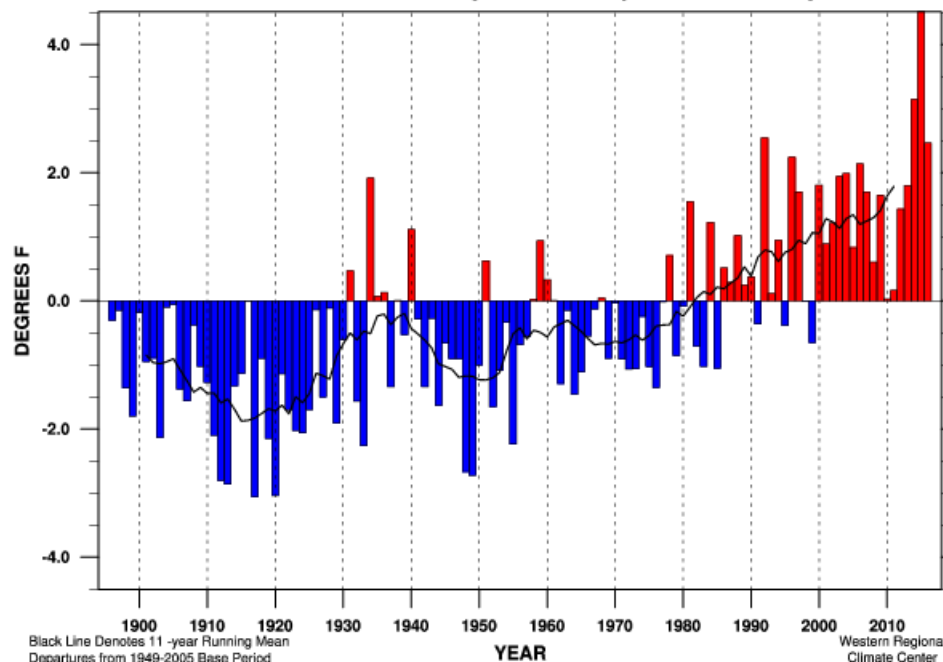


Linear Trend 1895-present	+ 0.81 ± 0.76 °F/100yr		
Linear Trend 1949-present	+ 1.11 ± 1.87 °F/100yr		
Linear Trend 1975-present	+ 3.40 ± 4.21 °F/100yr		
Warmest Year	66.4 °F (+ 4.9 °F) in 1934	MEAN	61.5 °F
Coldest Year	58.2 °F (- 3.3 °F) in 1901	STDEV	1.41 °F
Oct-Sep	2016	62.6 °F (+ 1.1 °F)	RANK 96 of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

Tmax

Sierra Region

Minimum Temperature Departure Oct-Sep

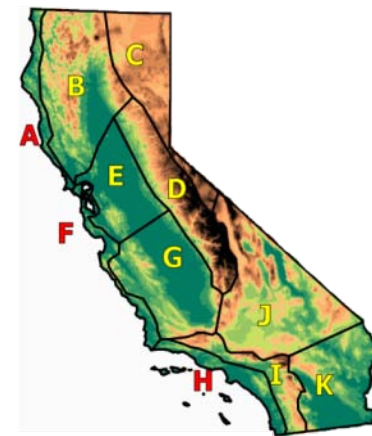


Linear Trend 1895-present	+ 2.53 ± 0.54 °F/100yr		
Linear Trend 1949-present	+ 4.57 ± 1.18 °F/100yr		
Linear Trend 1975-present	+ 6.44 ± 2.67 °F/100yr		
Warmest Year	41.1 °F (+ 4.5 °F) in 2015	MEAN	36.6 °F
Coldest Year	33.5 °F (- 3.1 °F) in 1917	STDEV	1.12 °F
Oct-Sep	2016	39.0 °F (+ 2.5 °F)	RANK 118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

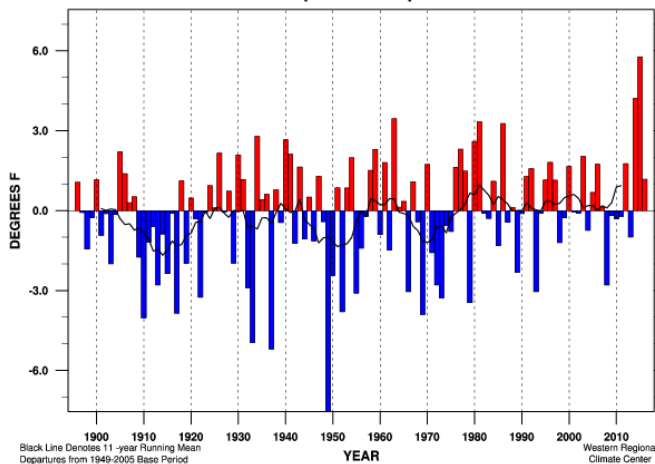
Tmin

Water Year Oct-Sep Temperature Departure Sierra Nevada

1895/96 thru 2015/16



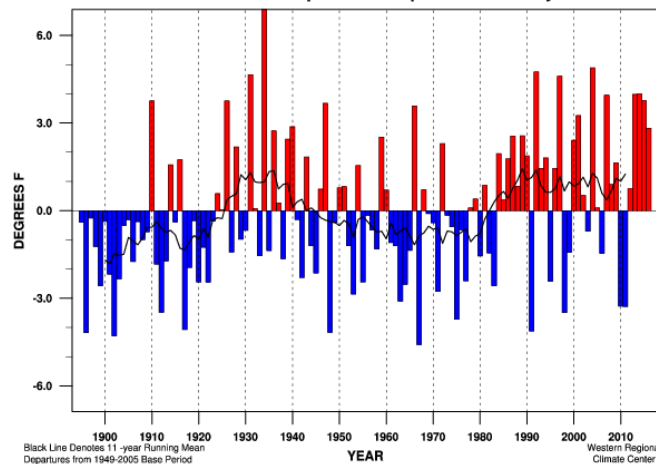
Sierra Region Mean Temperature Departure Dec-Feb



Black Line Denotes 11-year Running Mean
Departures from 1949-2005 Base Period

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

Sierra Region Mean Temperature Departure Mar-May

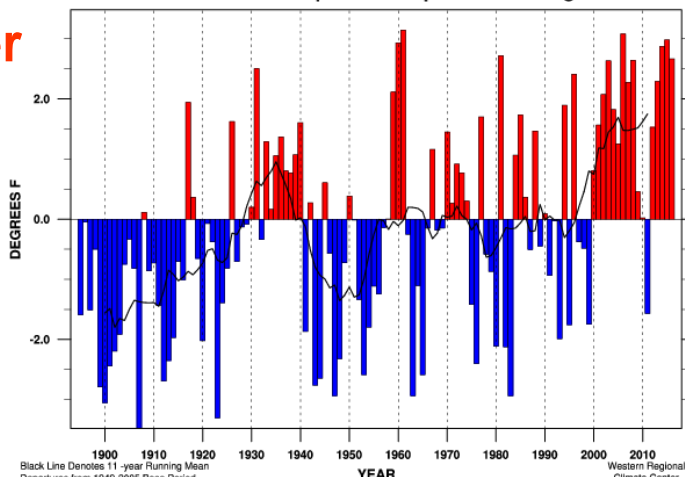


Black Line Denotes 11-year Running Mean
Departures from 1949-2005 Base Period

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

**Sierra Nevada
thru
Sep 2016**

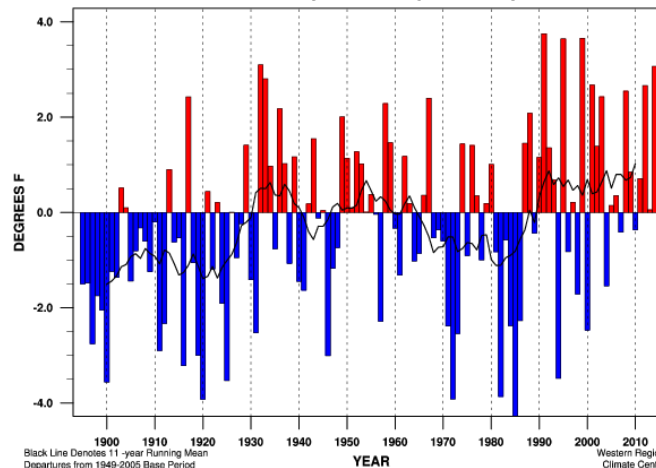
Sierra Region Mean Temperature Departure Jun-Aug



Black Line Denotes 11-year Running Mean
Departures from 1949-2005 Base Period

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

Sierra Region Mean Temperature Departure Sep-Nov



Black Line Denotes 11-year Running Mean
Departures from 1949-2005 Base Period

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

**Winter
Temp**

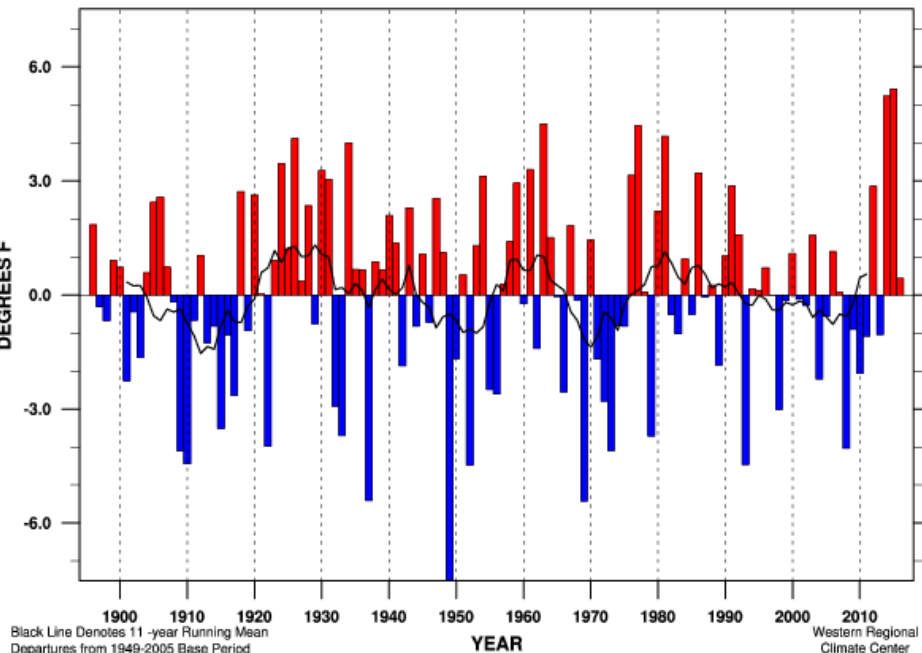
**Spring
Temp**

**Summer
Temp**

**Fall
Temp**

Sierra Region

Maximum Temperature Departure Dec-Feb



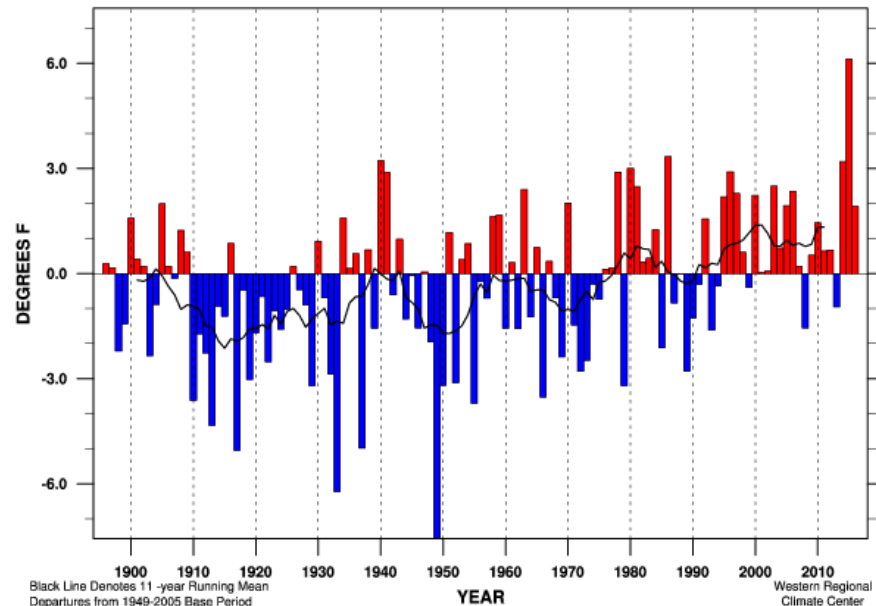
Black Line Denotes 11 -year Running Mean
 Departures from 1949-2005 Base Period
 Western Regional Climate Center

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

Tmax

Sierra Region

Miniumum Temperature Departure Dec-Feb



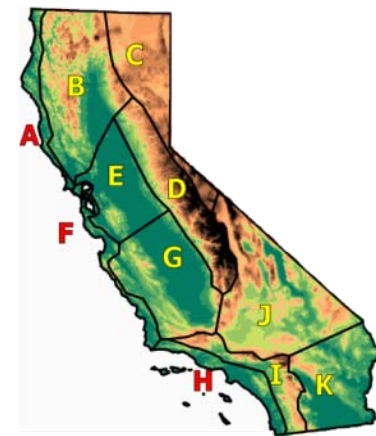
Black Line Denotes 11 -year Running Mean
 Departures from 1949-2005 Base Period
 Western Regional Climate Center

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

Tmin

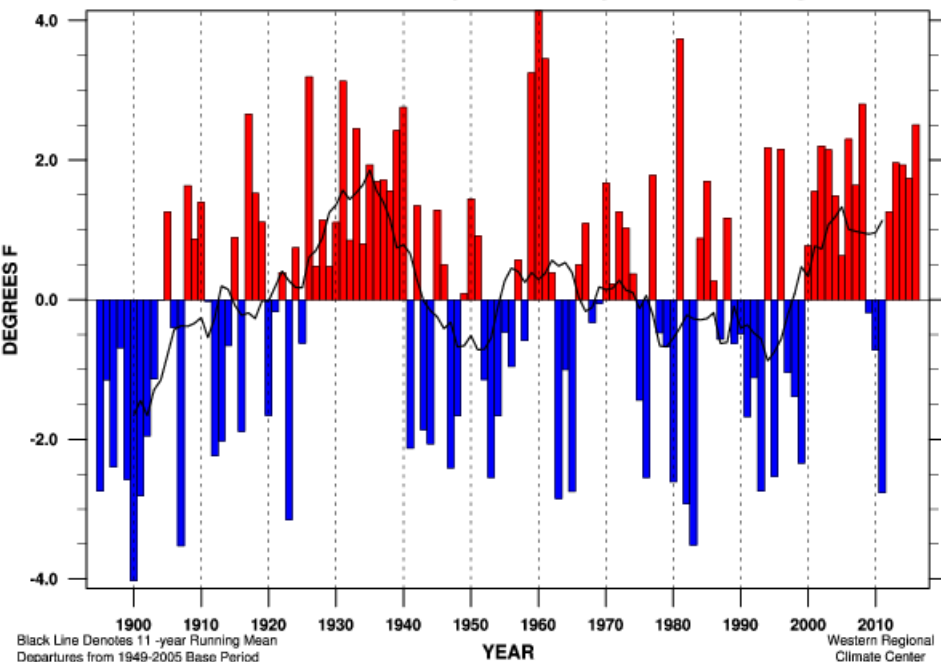
Water Year Dec-Jan-Feb Temperature Departure Sierra Nevada

1895/96 thru 2015/16



Sierra Region

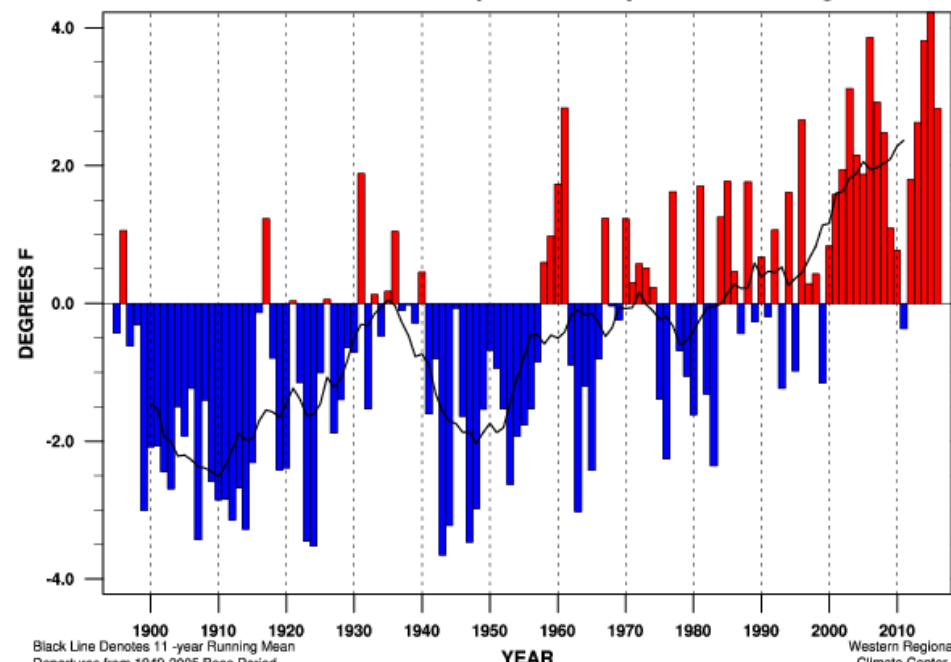
Maximum Temperature Departure Jun-Aug



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

Sierra Region

Minimum Temperature Departure Jun-Aug



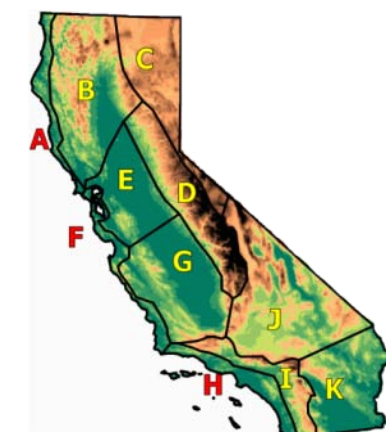
Linear Trend 1895-present	+ 3.22 ± 0.74 °F/100yr		
Linear Trend 1949-present	+ 5.42 ± 1.71 °F/100yr		
Linear Trend 1975-present	+ 9.15 ± 3.37 °F/100yr		
Warmest Year	53.2 °F (+ 4.2°F) in 2015	MEAN	49.0 °F
Coldest Year	45.3 °F (- 3.7°F) in 1943	STDEV	1.59 °F
Jun-Aug	2016	51.8 °F (+ 2.8°F)	RANK 116 of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

North American Freezing Level Tracker

About

Introduction

This analysis tool allows one to track through time the height of the freezing level (0 C or 32 F) above sea level. Freezing level has important effects on hydrology in mountain environments. This level affects 1) the elevation of the rain/snow line, 2) whether precipitation at a specified level falls as rain or as snow, 3) whether the ground is frozen or thawed when the first autumn snows fall, 4) the efficiency of snowpack accumulation through the winter months, 4) the internal temperature and rate of "ripening" and melting of the snowpack in the spring, and 6) the length of the snow free season at different elevations. Freezing level also affects ecological function through biological growth rates (both plants and animals) at different elevations. Other temperature thresholds of interest are available (10 C, 20 C, 30 C / 50 F, 68 F, 86 F) as well. These temperatures can be substituted for the term "freezing level" below.

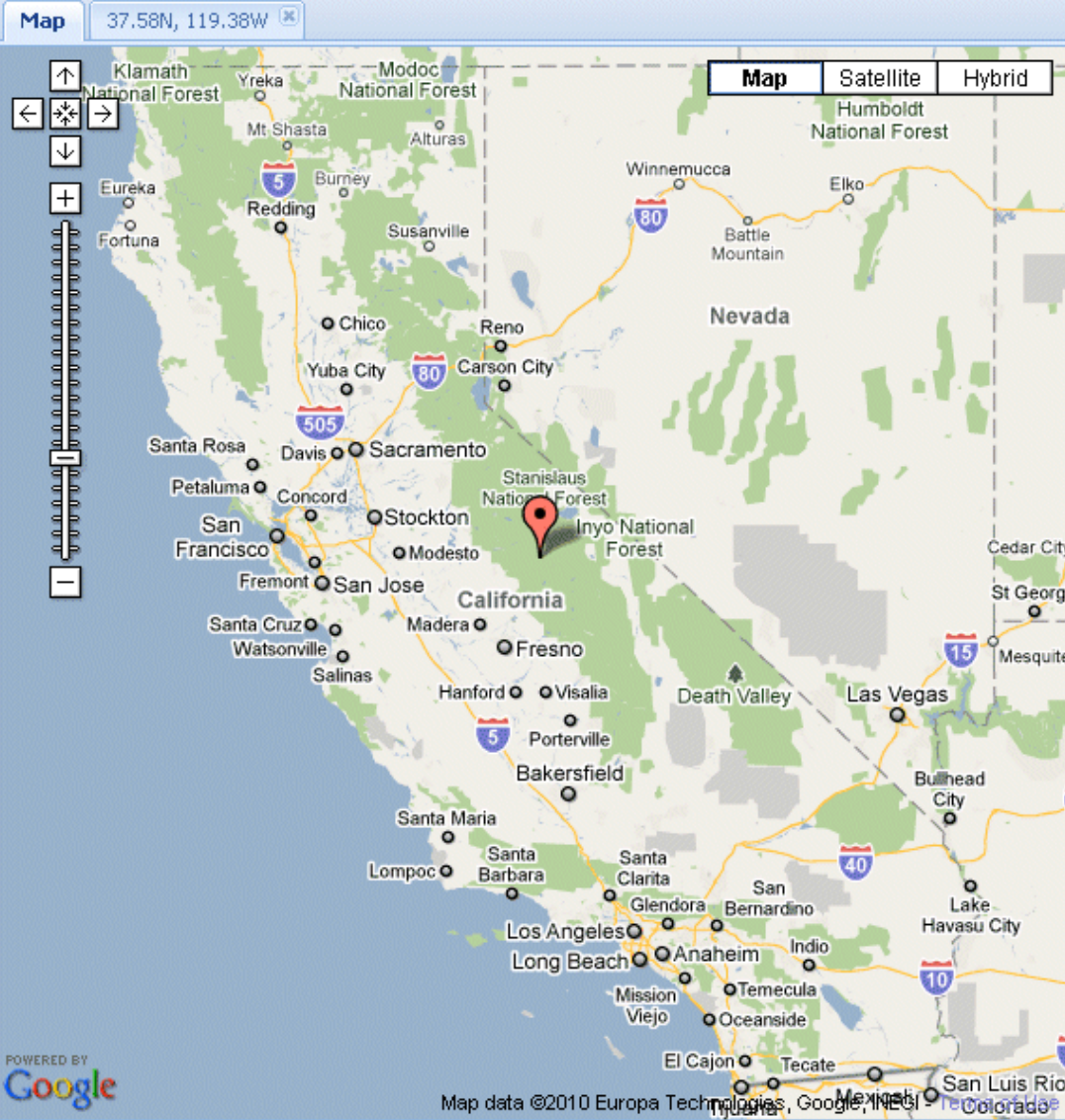
Definition

In the upper atmosphere temperatures are always below freezing everywhere on earth. Starting from the upper atmosphere and working down, the freezing level is taken to be the

Contact

Location Selection

Display Options



How to use

Monthly/Seasonal Listings

Help

Lat:

Lon:

Span:

End Month:

Level:

Running average:

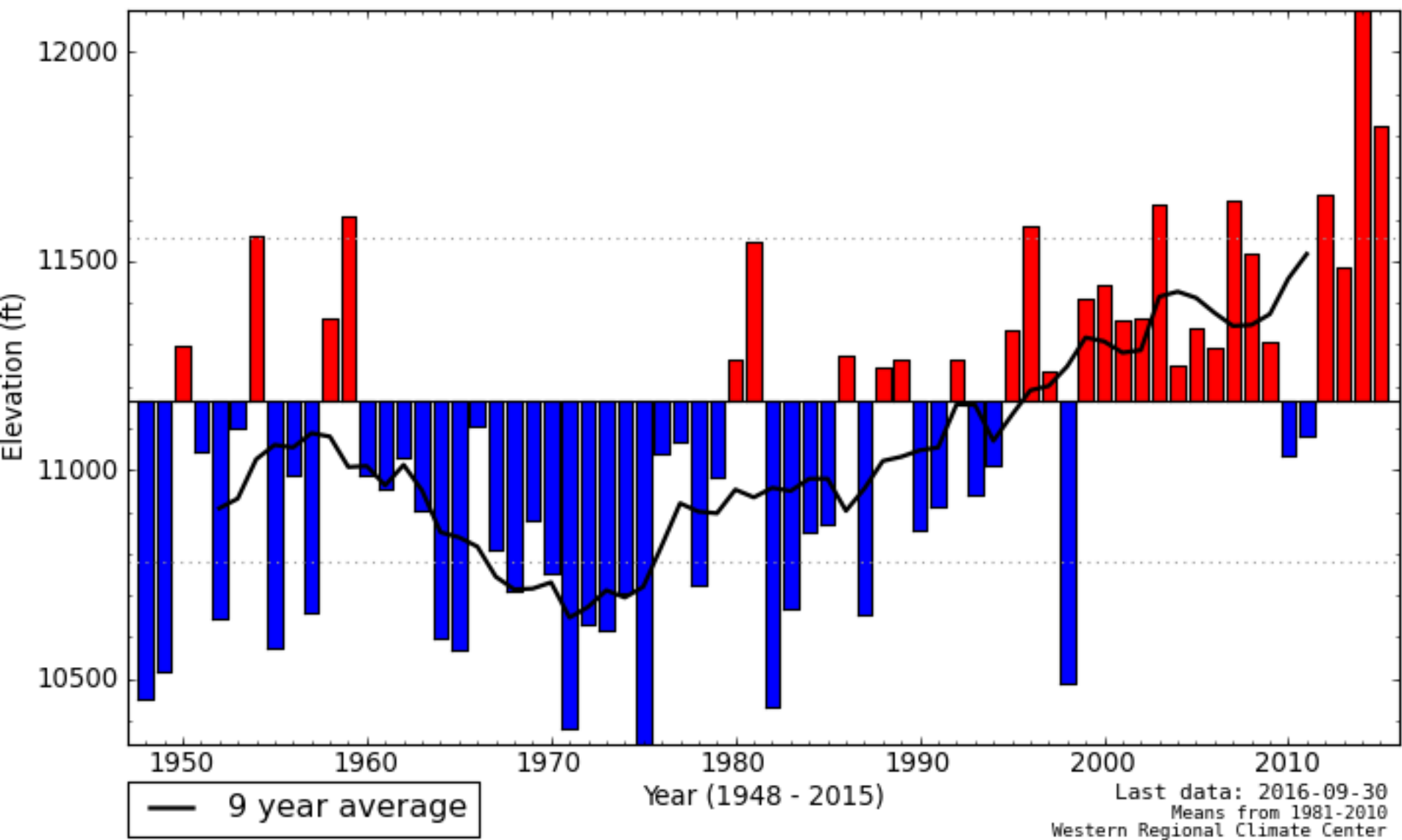
Go

Last 12 Months



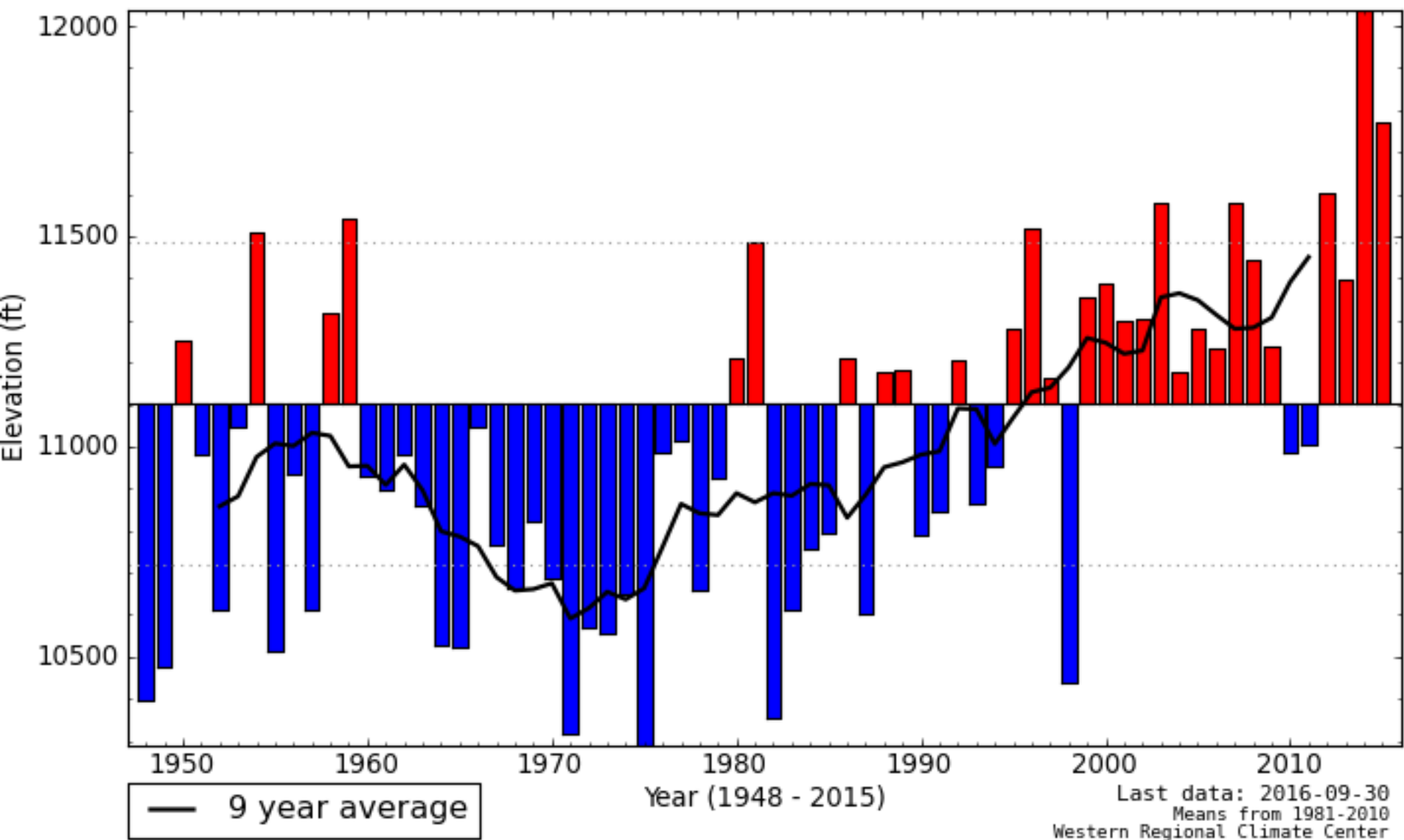
Elevation of Freezing Level over YOSE-SEKI. Annual. 1948 through 2015.

0°C Level at 37.58°N, 119.58°W - 12 Months Ending in December



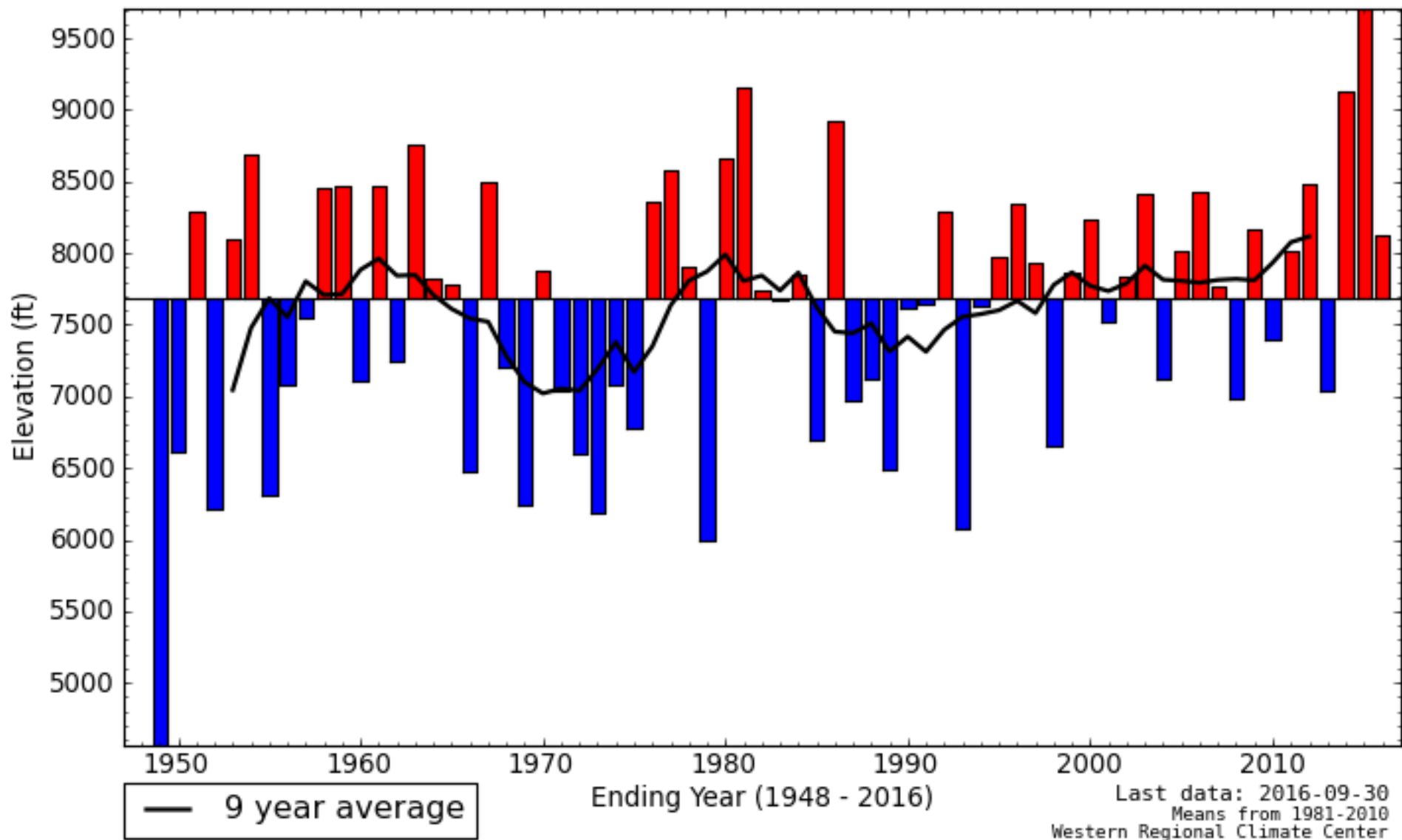
Elevation of Freezing Level over YOSE-SEKI. Annual. 1948 through 2014.

0°C Level at 37.58°N, 119.38°W - 12 Months Ending in December



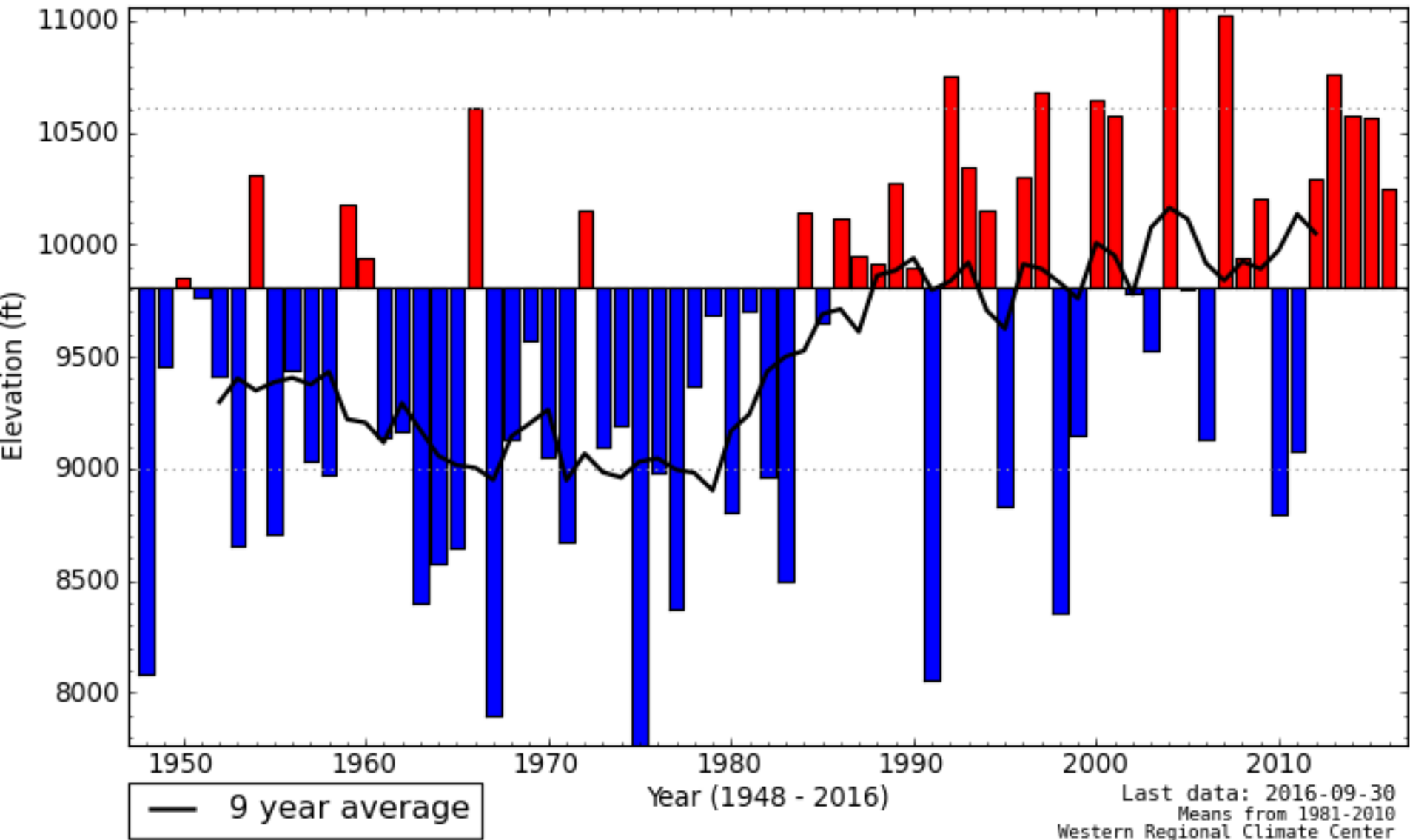
Elevation of Freezing Level over YOSE-SEKI. Winter. 1948-49 thru 2015-16.

0°C Level at 37.58°N, 119.38°W - 3 Months Ending in February



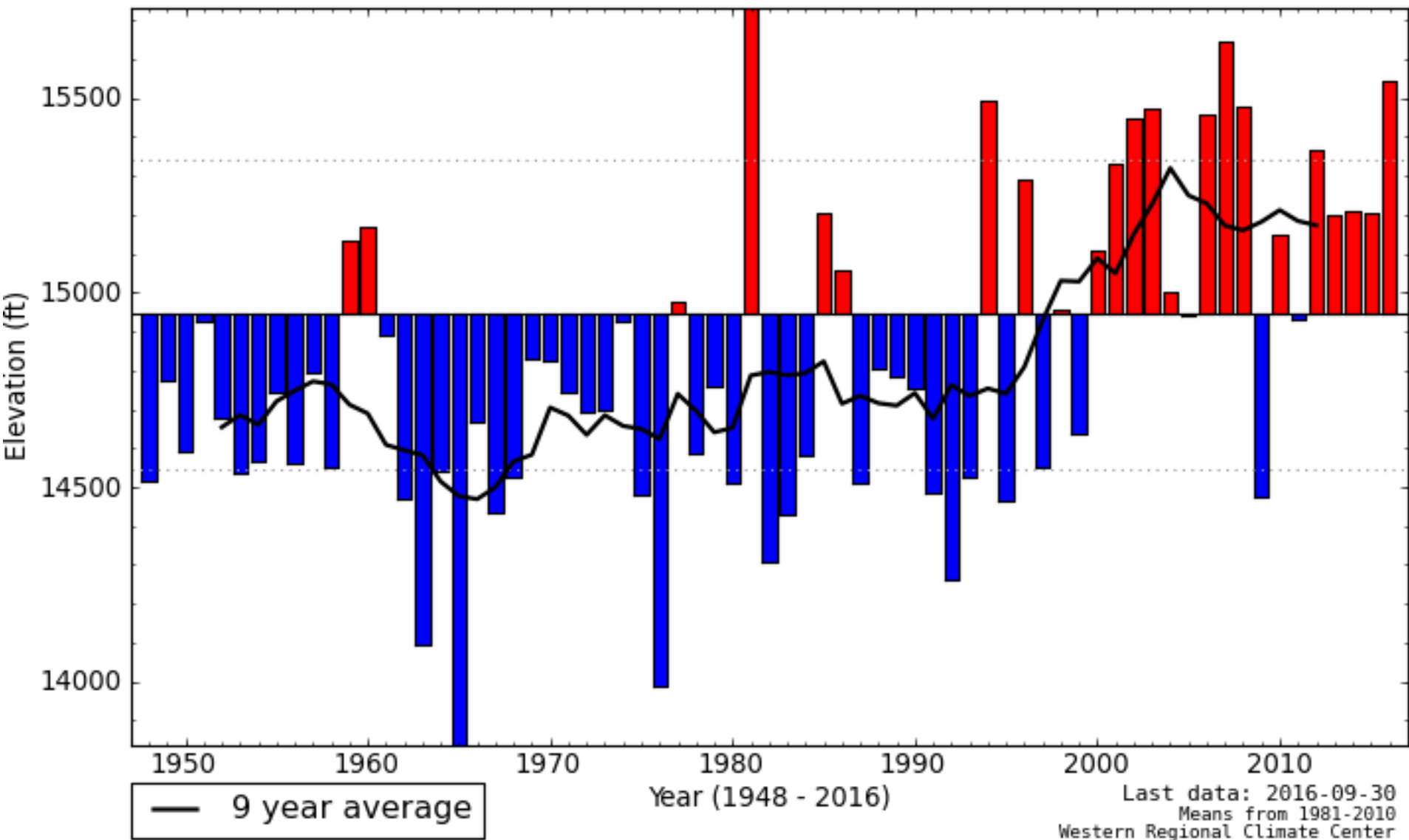
Elevation of Freezing Level over YOSE-SEKI. Spring. 1948 thru 2016.

0°C Level at 37.58°N, 119.38°W - 3 Months Ending in May



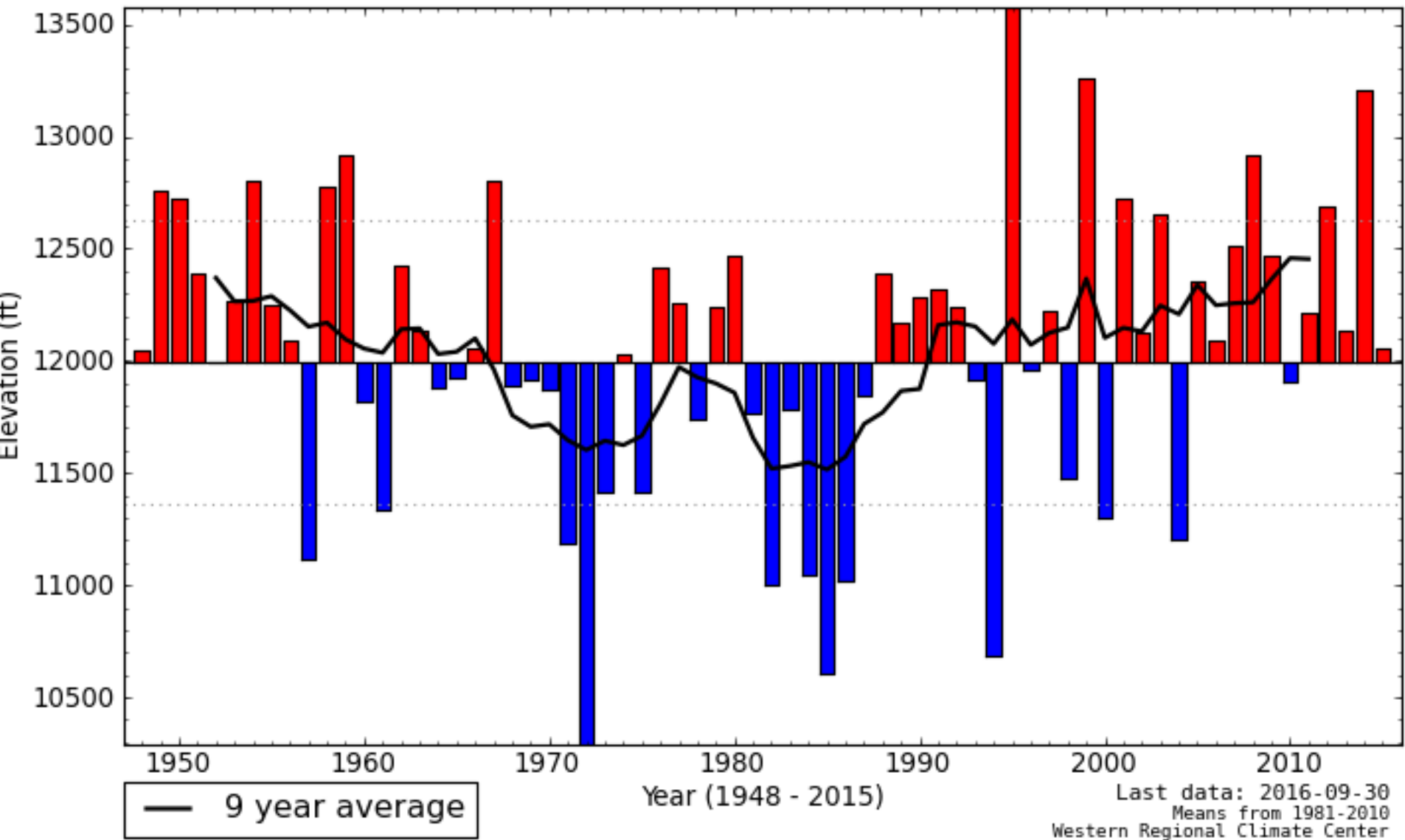
Elevation of Freezing Level over YOSE-SEKI. Summer. 1948 thru 2016.

0°C Level at 37.58°N, 119.38°W - 3 Months Ending in August



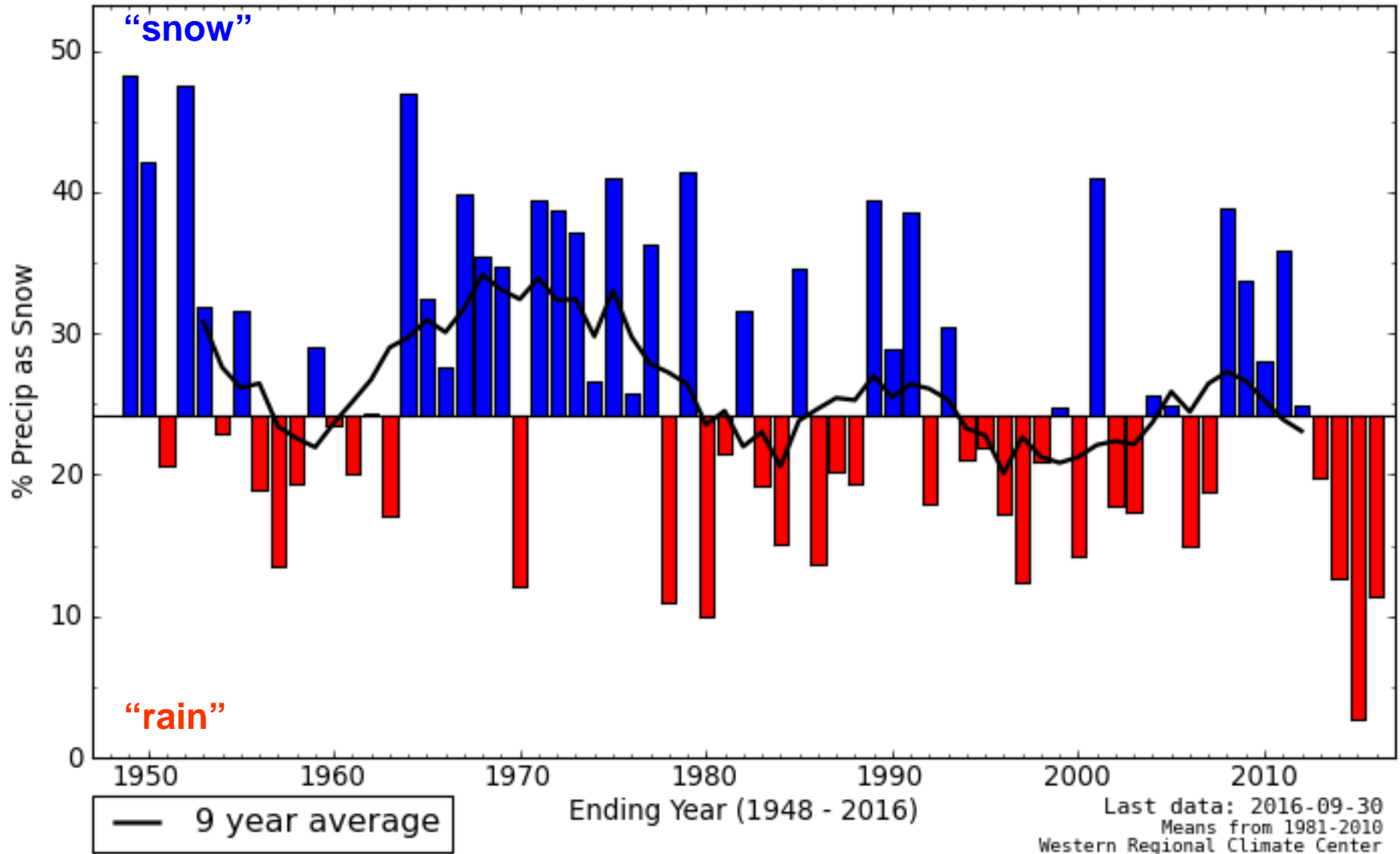
Elevation of Freezing Level over YOSE-SEKI. Autumn. 1948 thru 2015 Sep 30.

0°C Level at 37.58°N, 119.38°W - 3 Months Ending in November



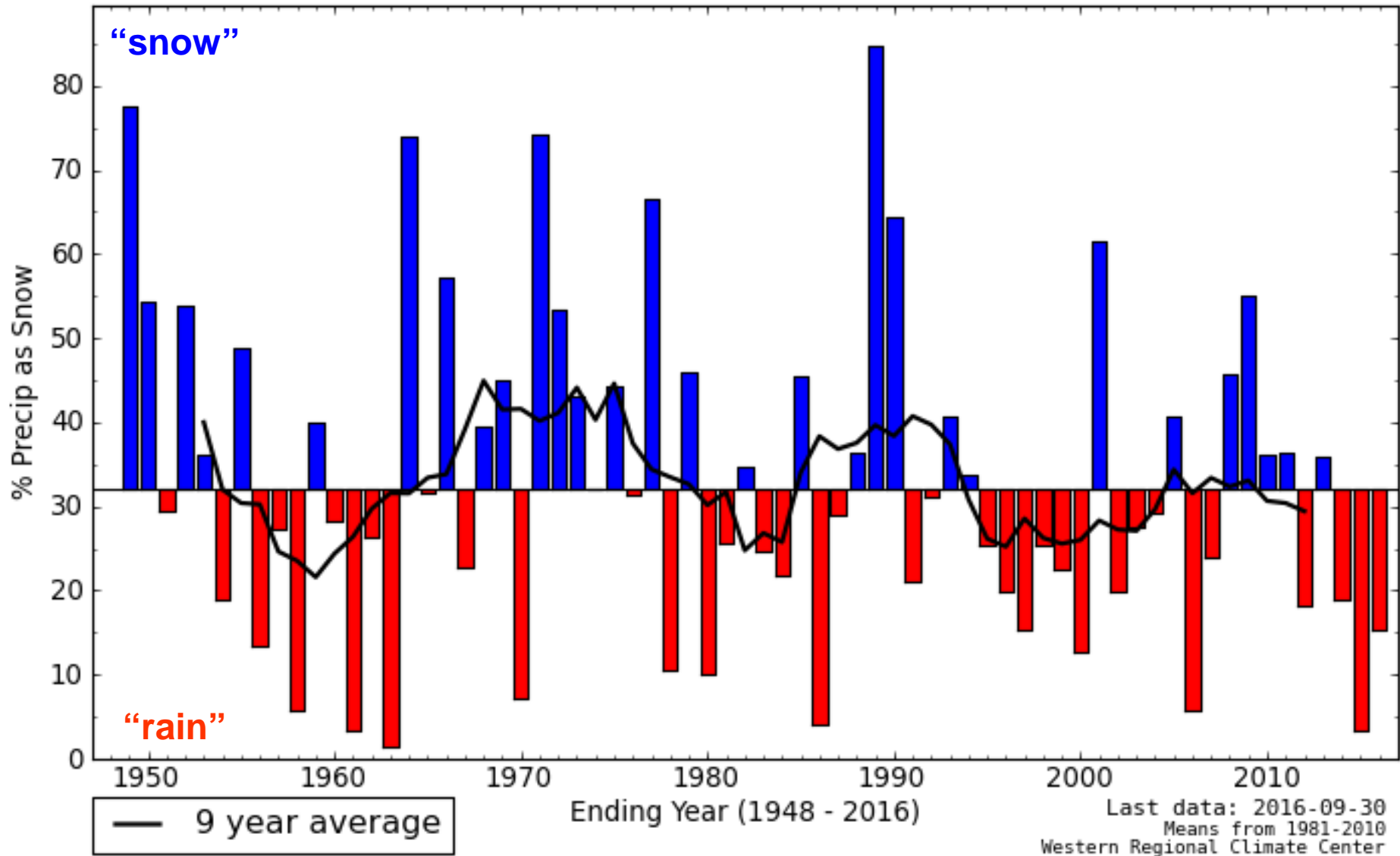
Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft.
Yosemite - Sequoia - Kings Canyon area. Water Years 1948/49 - 2014/15.

12 Months Ending in September % of Precip as Snow 37.58°N, 119.38°W 1800m



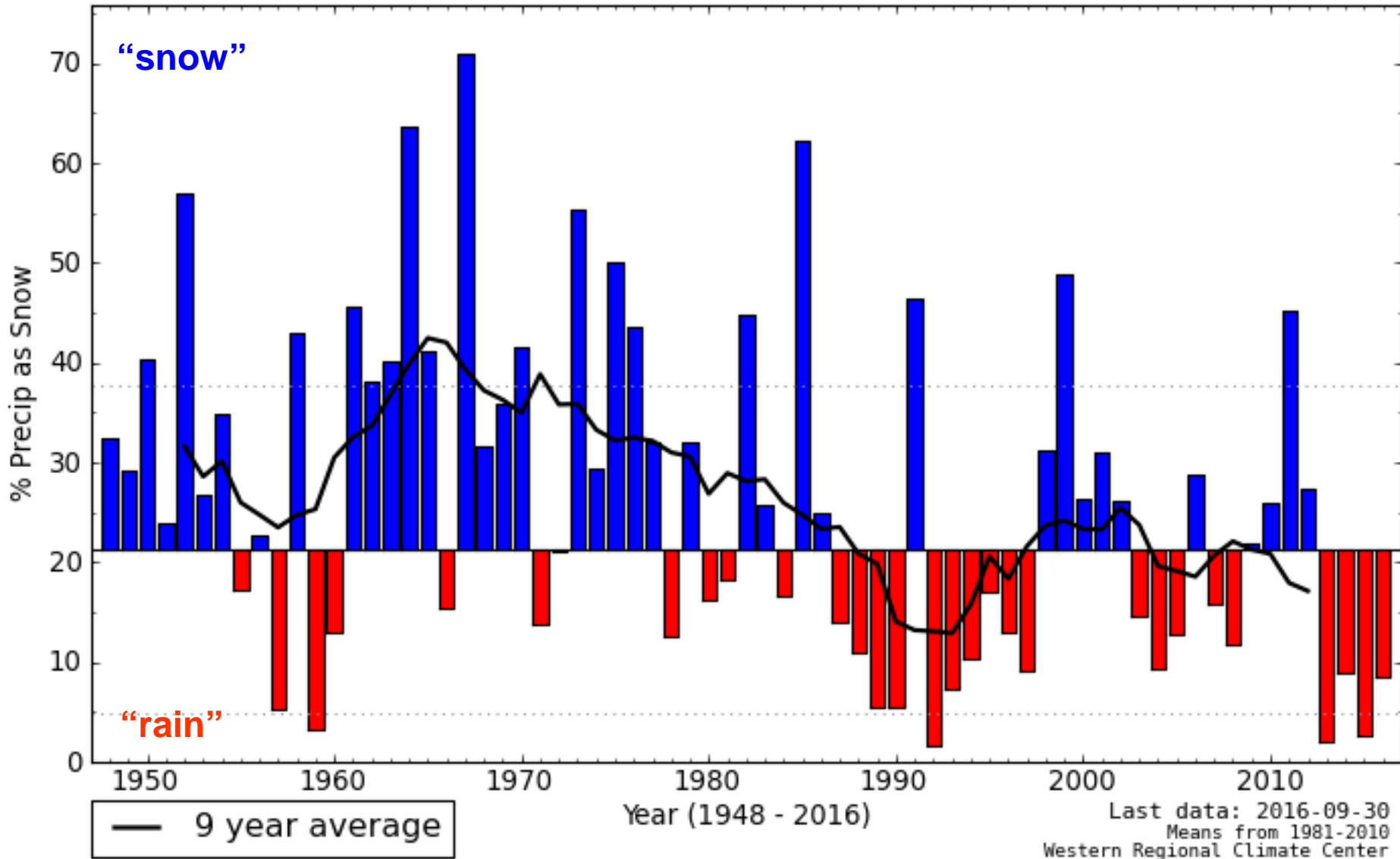
**Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft.
Yosemite - Sequoia - Kings Canyon area. Winter (DJF) 1948/49 - 2014/15.**

3 Months Ending in February % of Precip as Snow 37.58°N, 119.38°W 1800m

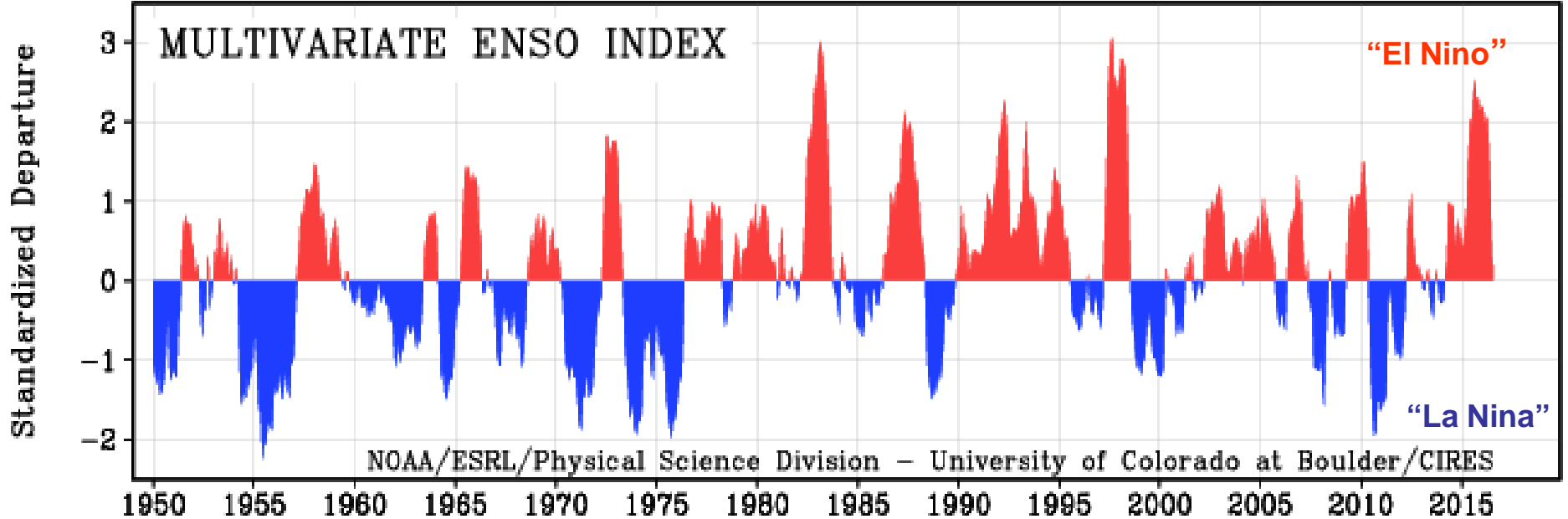


Percent of Reanalysis precipitation with below-freezing temperature at 1800 m / 5900 ft. Yosemite - Sequoia - Kings Canyon area. Spring (MAM) 1948 - 2015.

3 Months Ending in May % of Precip as Snow 37.58°N, 119.38°W 1800m



Through September 2016

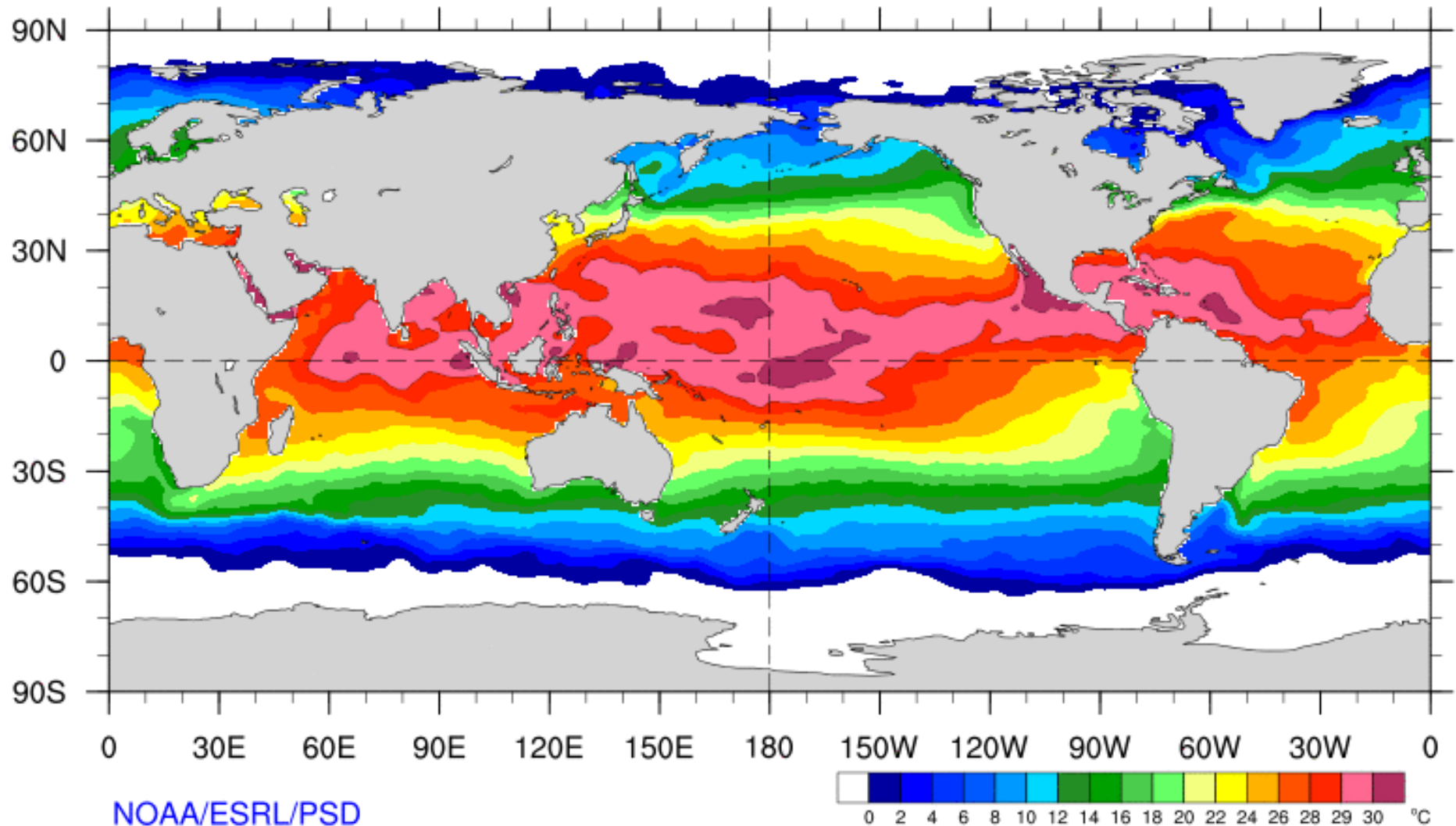


NOAA ESRL ("CDC"), Wolter and Timlin

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

Weekly Average SST

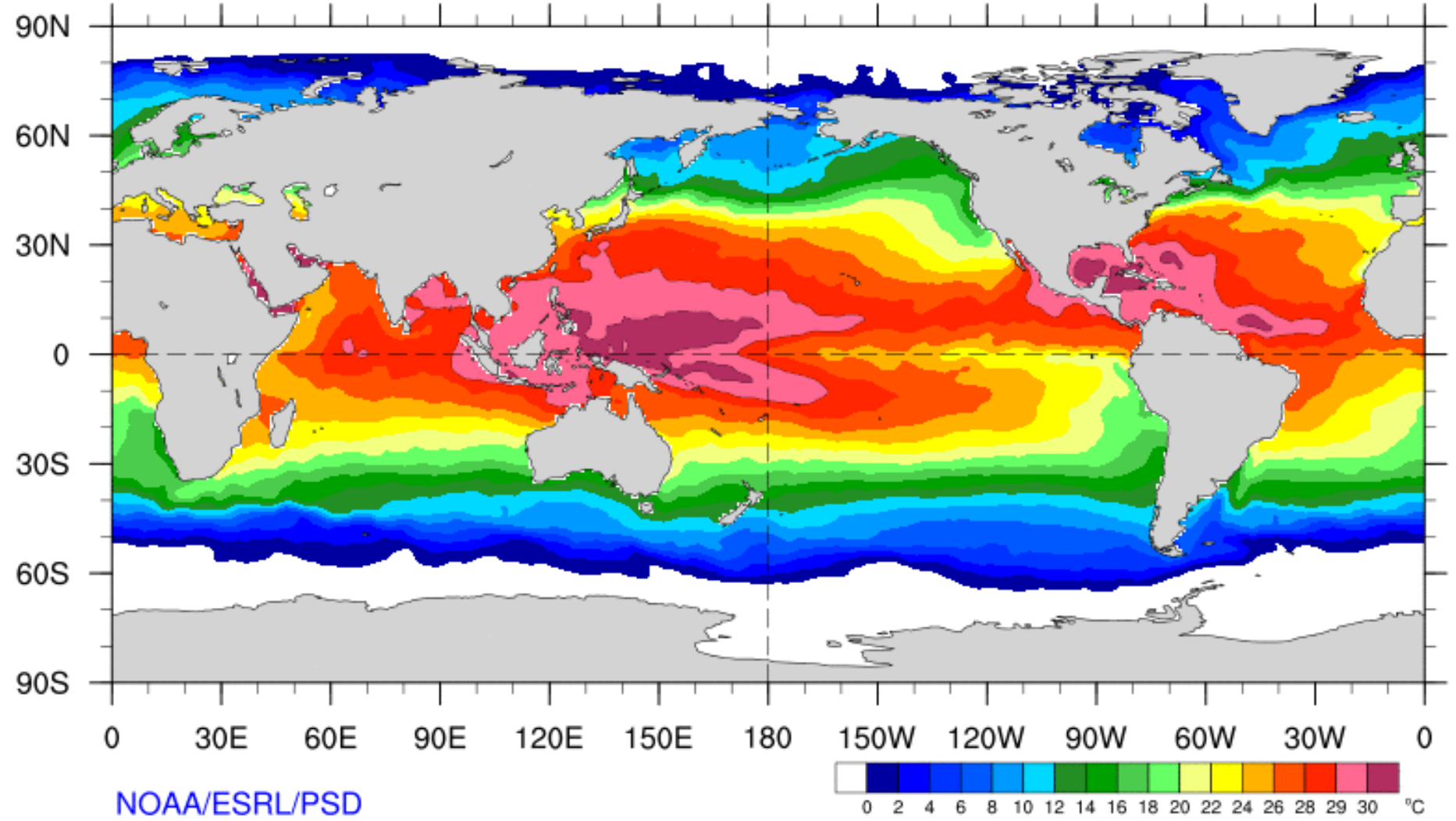
2015/09/27 - 2015/10/03



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

Weekly Average SST

2016/09/25 - 2016/10/01

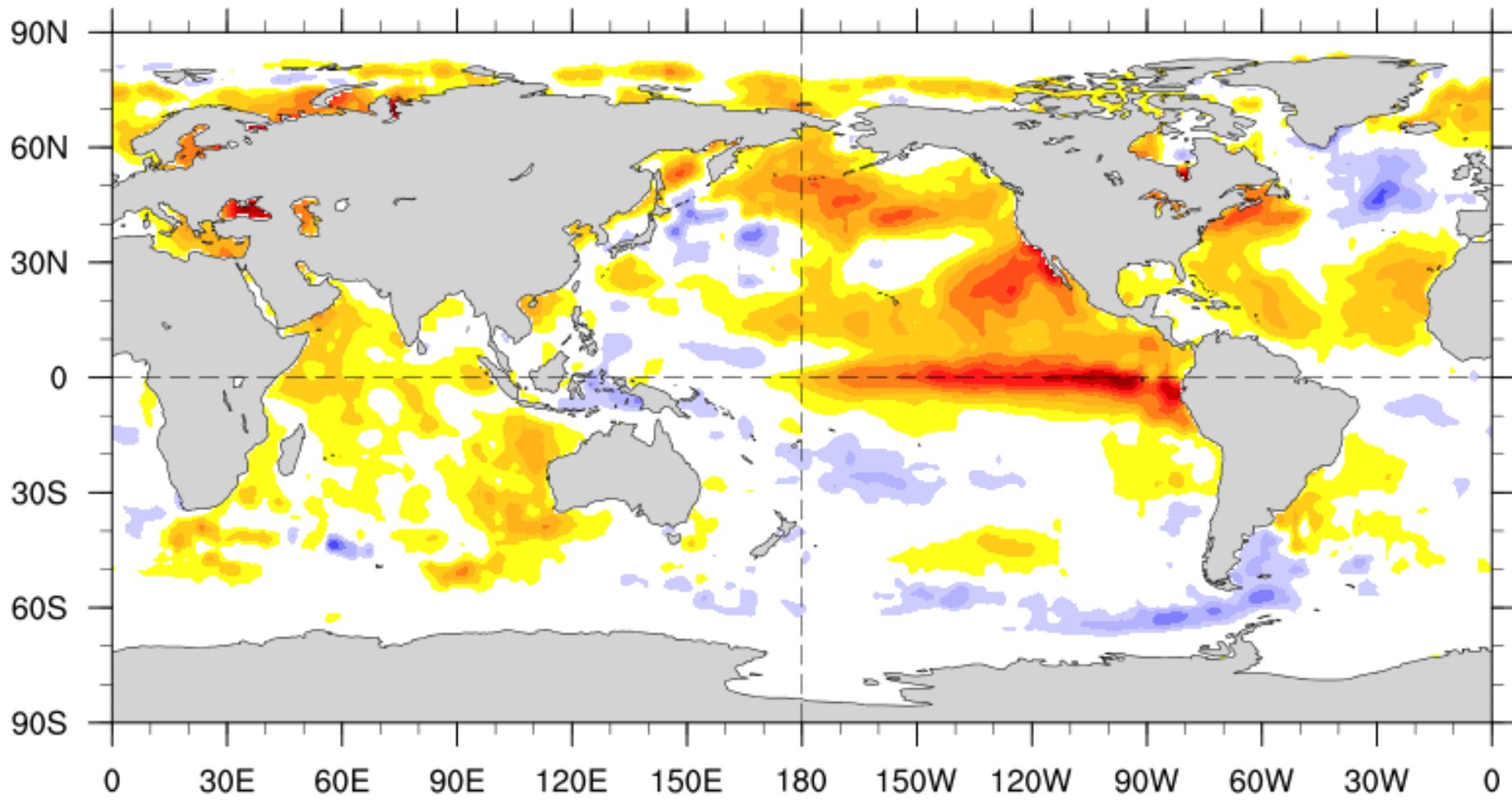


NOAA/ESRL/PSD

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

Weekly SST Anomaly

2015/09/27 - 2015/10/03



NOAA/ESRL/PSD

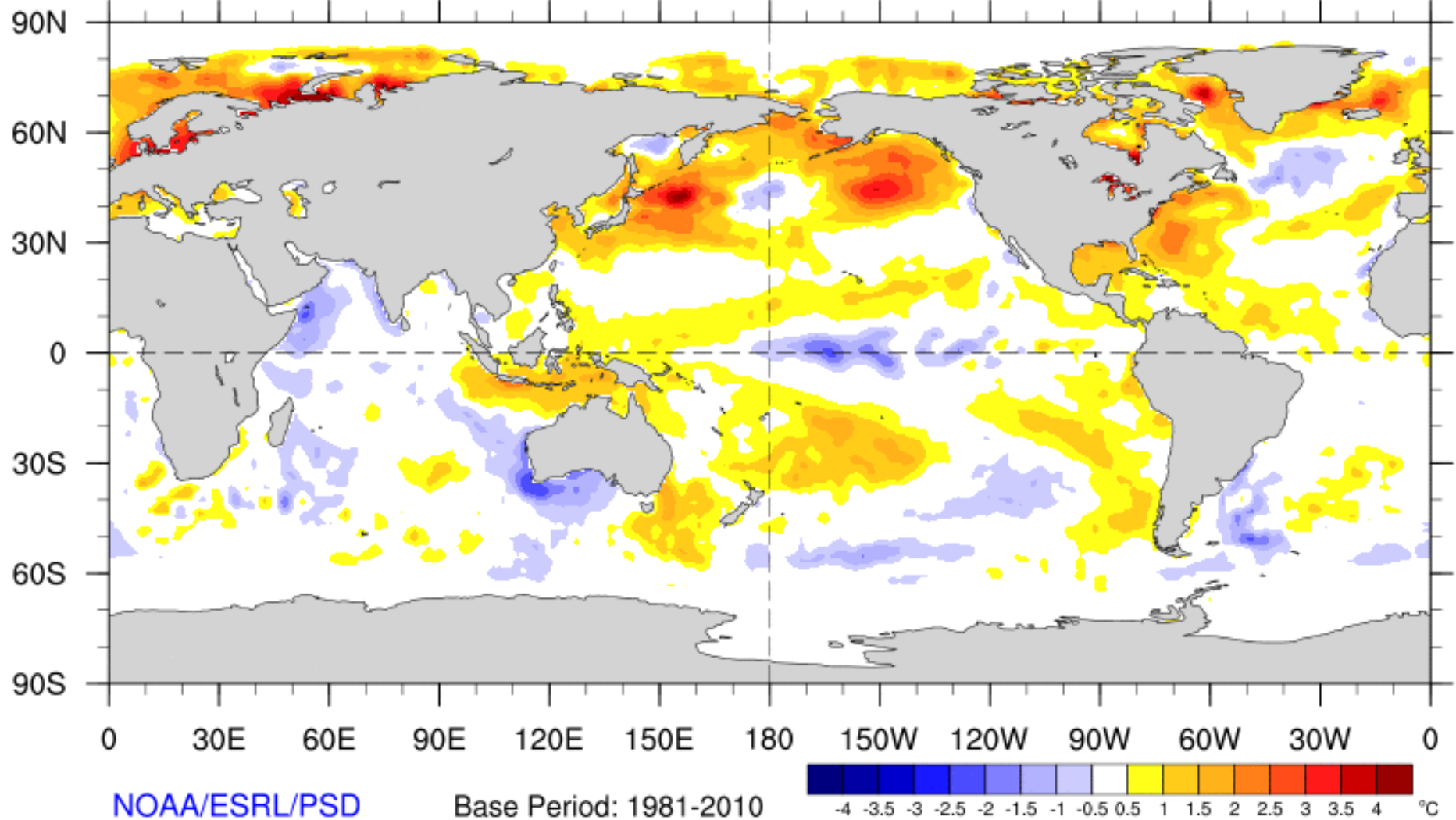
Base Period: 1981-2010



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

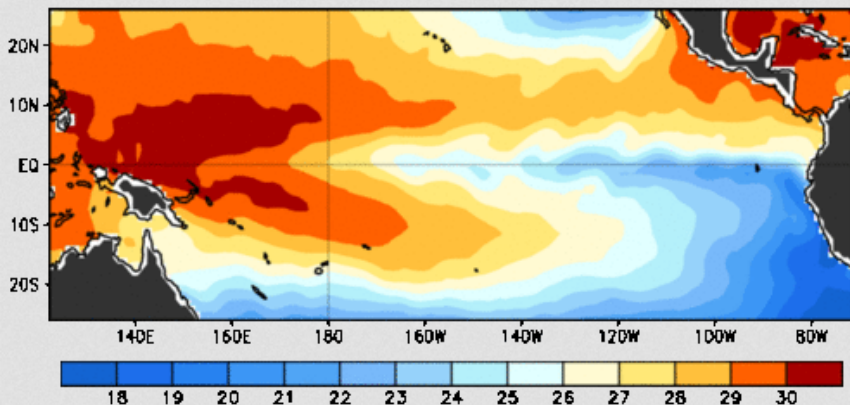
Weekly SST Anomaly

2016/09/25 - 2016/10/01

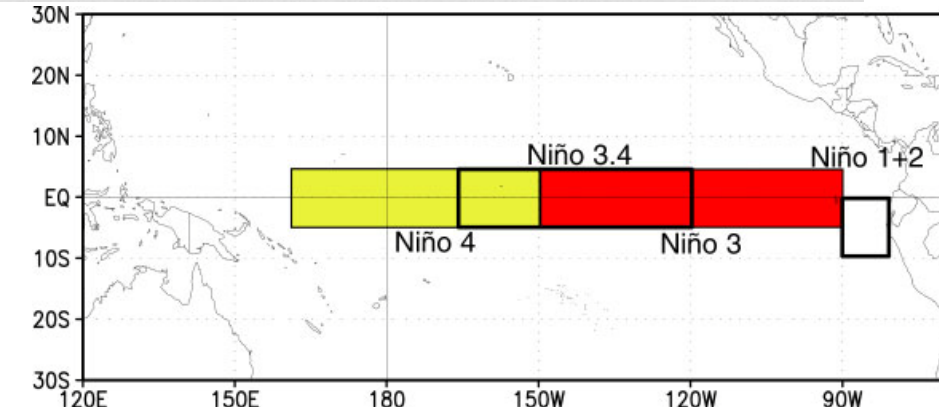
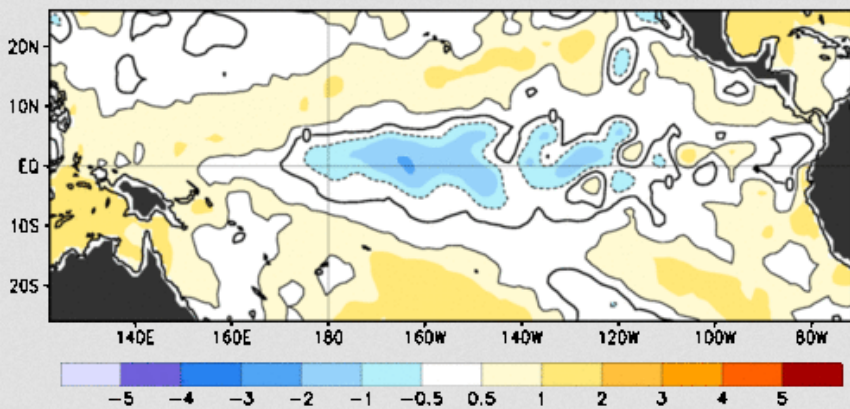


Recent Evolution of Equatorial Pacific SST Departures

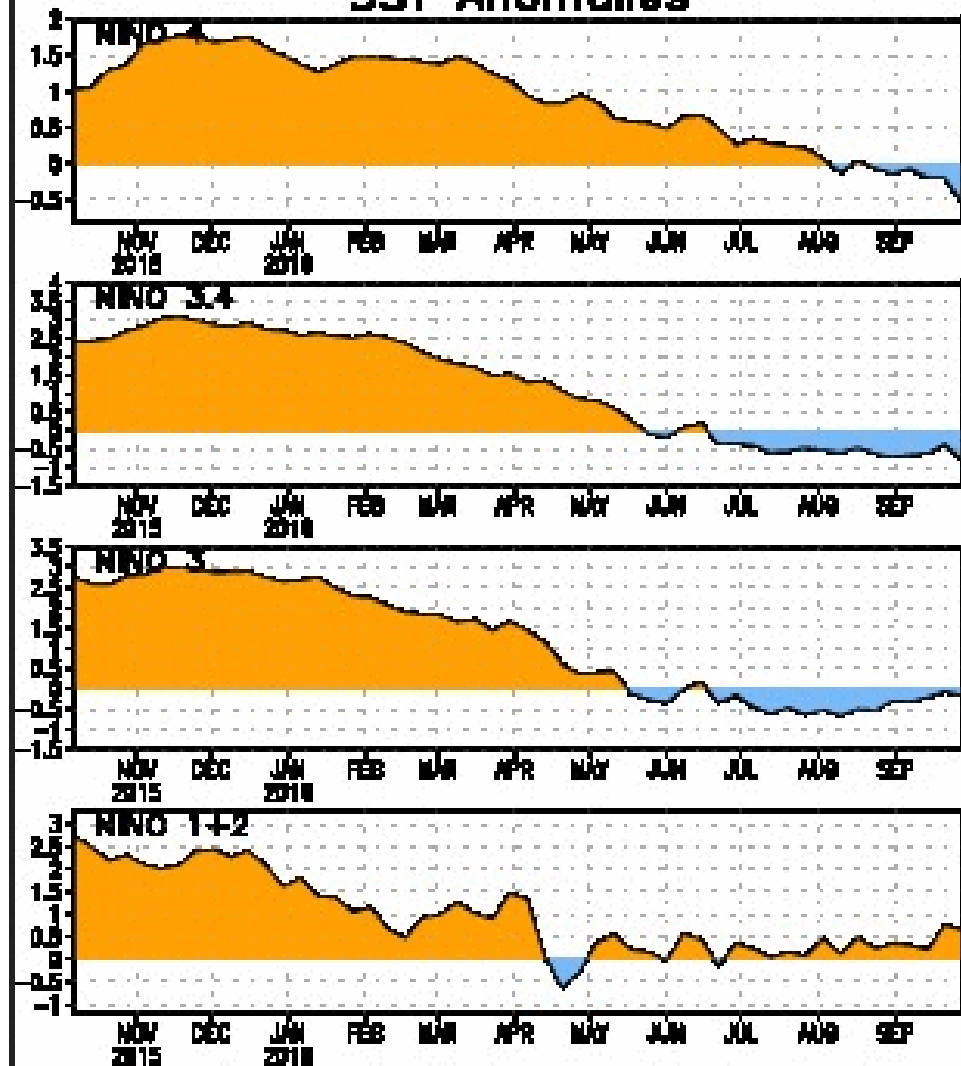
Observed Sea Surface Temperature (°C)



Observed Sea Surface Temperature Anomalies (°C)



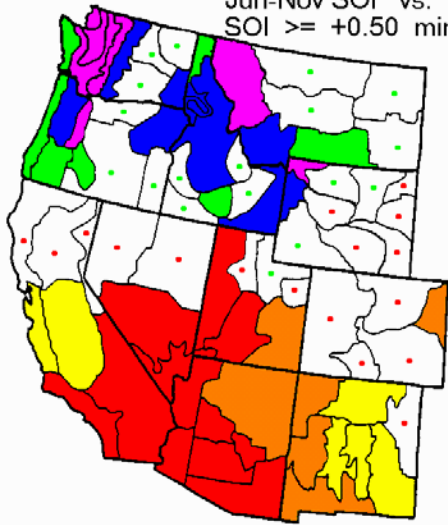
SST Anomalies



Updated through 2016 Sep 25 - Oct 01

Split Samples:

Jun-Nov SOI vs. Oct-Mar Precip
 SOI $\geq +0.50$ minus SOI ≤ -0.50



- $t > 0, p \leq 0.001$
- $t > 0, p \leq 0.01$
- $t > 0, p \leq 0.05$
- $t > 0, p > 0.05$
- $t < 0, p > 0.05$
- $t < 0, p \leq 0.05$
- $t < 0, p \leq 0.01$
- $t < 0, p \leq 0.001$

Updated from Redmond and Koch (1991). Winters of 1933/34 - 1994/95.
 Reddish: Composite El Nino winters are wet, La Nina winters are dry.
 Bluish/greenish: Composite El Nino winters are dry, La Nina winters are wet.

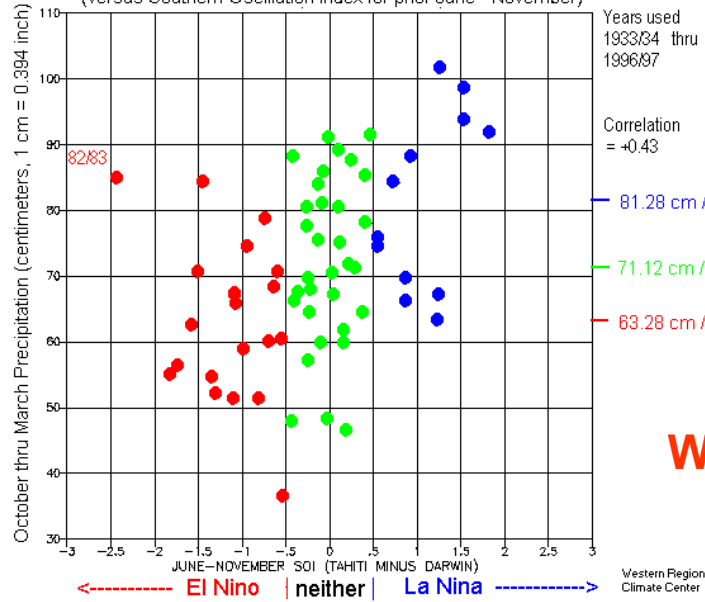
Redmond, K.T., and R.W. Koch, 1991. Surface climate and streamflow variability in the western United States and their relationship to large-scale circulation indices. Water Resources Research, 27(9), 2381-2399.

Redmond & Koch, 1991, updated.

ENSO

Redmond & Koch, 1991, updated.

Washington statewide October thru March Precipitation
 (versus Southern Oscillation Index for prior June - November)



Years used
 1933/34 thru
 1996/97

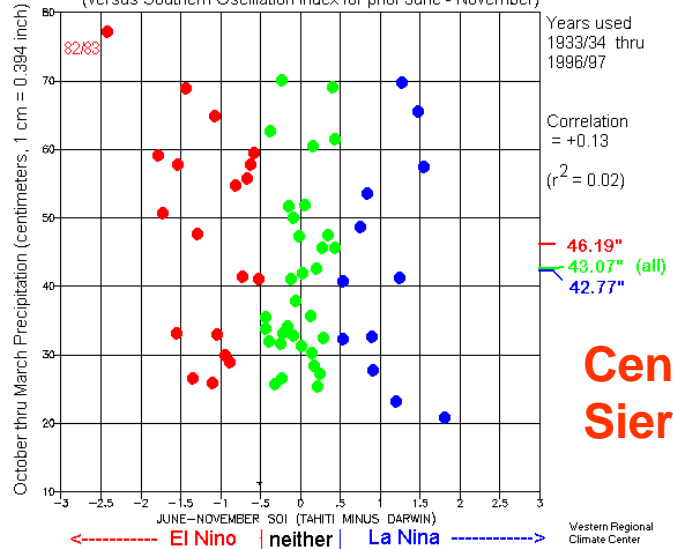
Correlation
 = +0.43

- 81.28 cm / 32.00"
- 71.12 cm / 28.00" (all)
- 63.28 cm / 24.91"

Washington

Western Regional
 Climate Center

California 8-Station Index October thru March Precipitation
 (versus Southern Oscillation Index for prior June - November)



Years used
 1933/34 thru
 1996/97

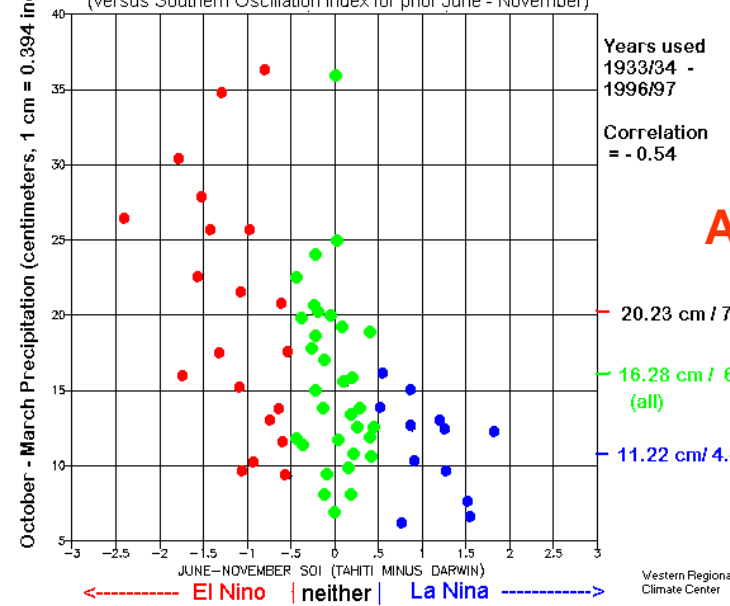
Correlation
 = +0.13
 ($r^2 = 0.02$)

- 46.19"
- 43.07" (all)
- 42.77"

**Central
 Sierra**

Western Regional
 Climate Center

Arizona statewide October thru March Precipitation
 (versus Southern Oscillation Index for prior June - November)



Years used
 1933/34 -
 1996/97

Correlation
 = -0.54

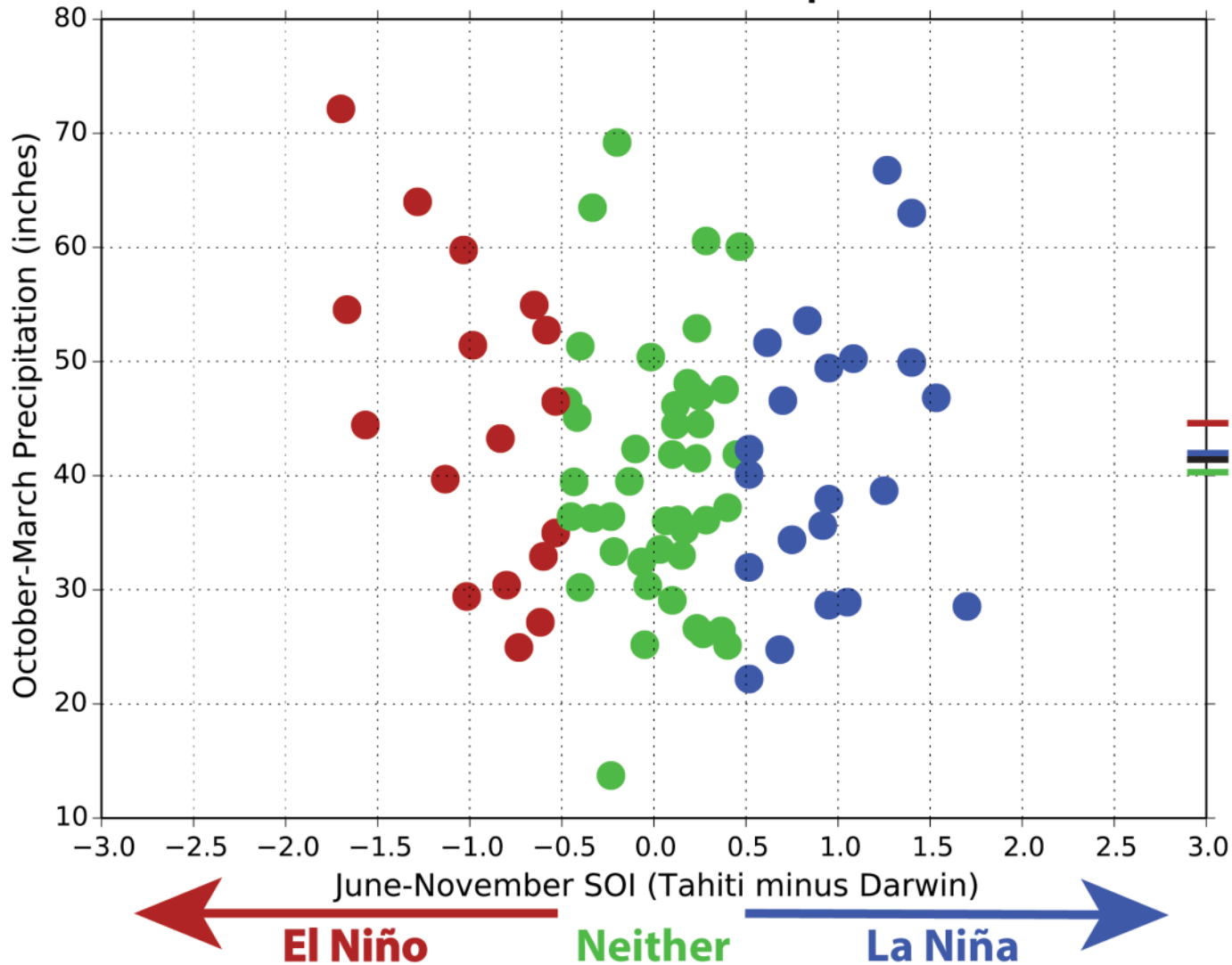
- 20.23 cm / 7.97"
- 16.28 cm / 6.41" (all)
- 11.22 cm / 4.42"

Arizona

Western Regional
 Climate Center

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

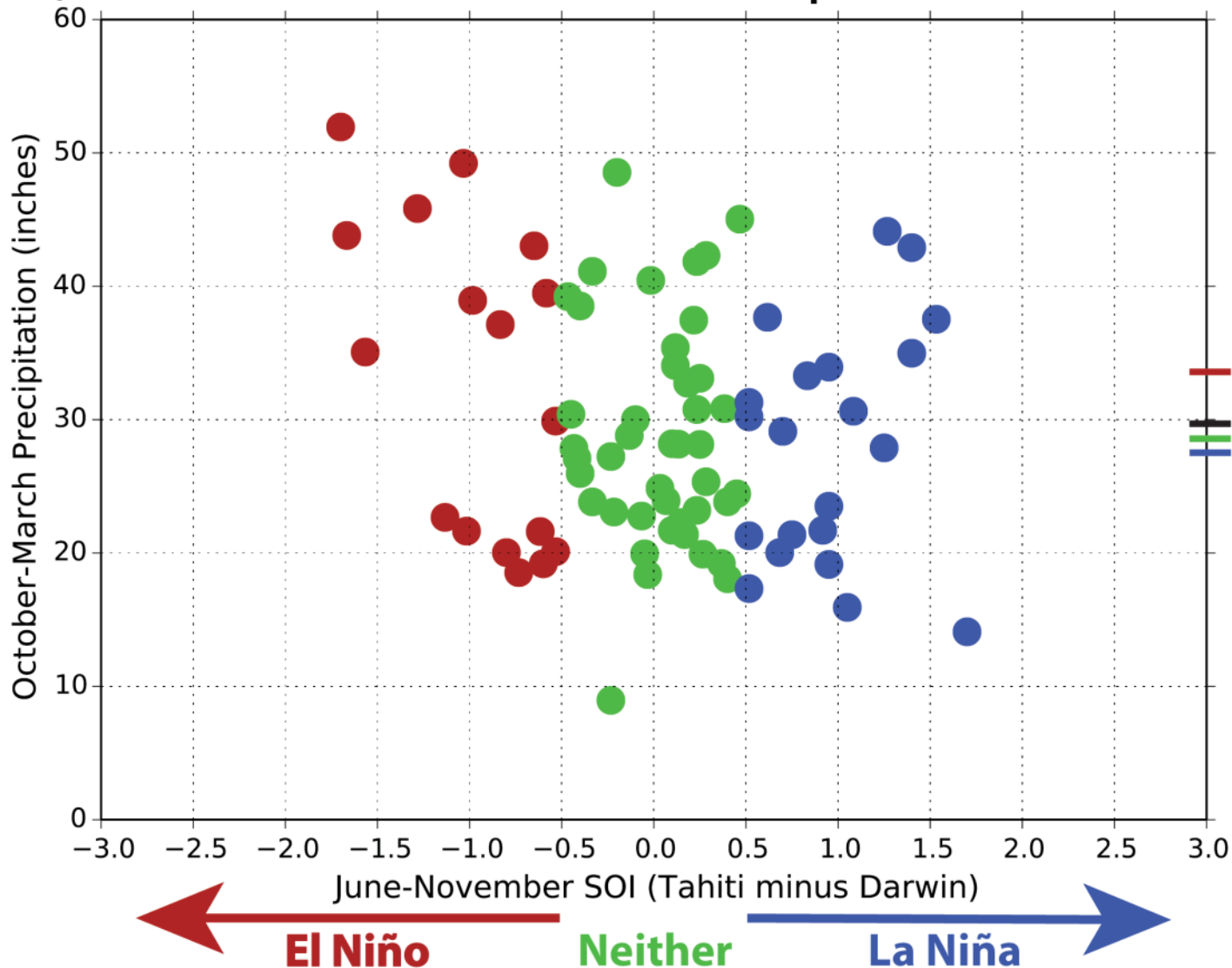
Mean = 44.9 in
Mean = 41.53 in
Mean all = 41.51 in
Mean = 40.15 in



Western Regional
Climate Center

CA Division 2 October-March Precipitation

(versus Southern Oscillation Index for prior June-November)



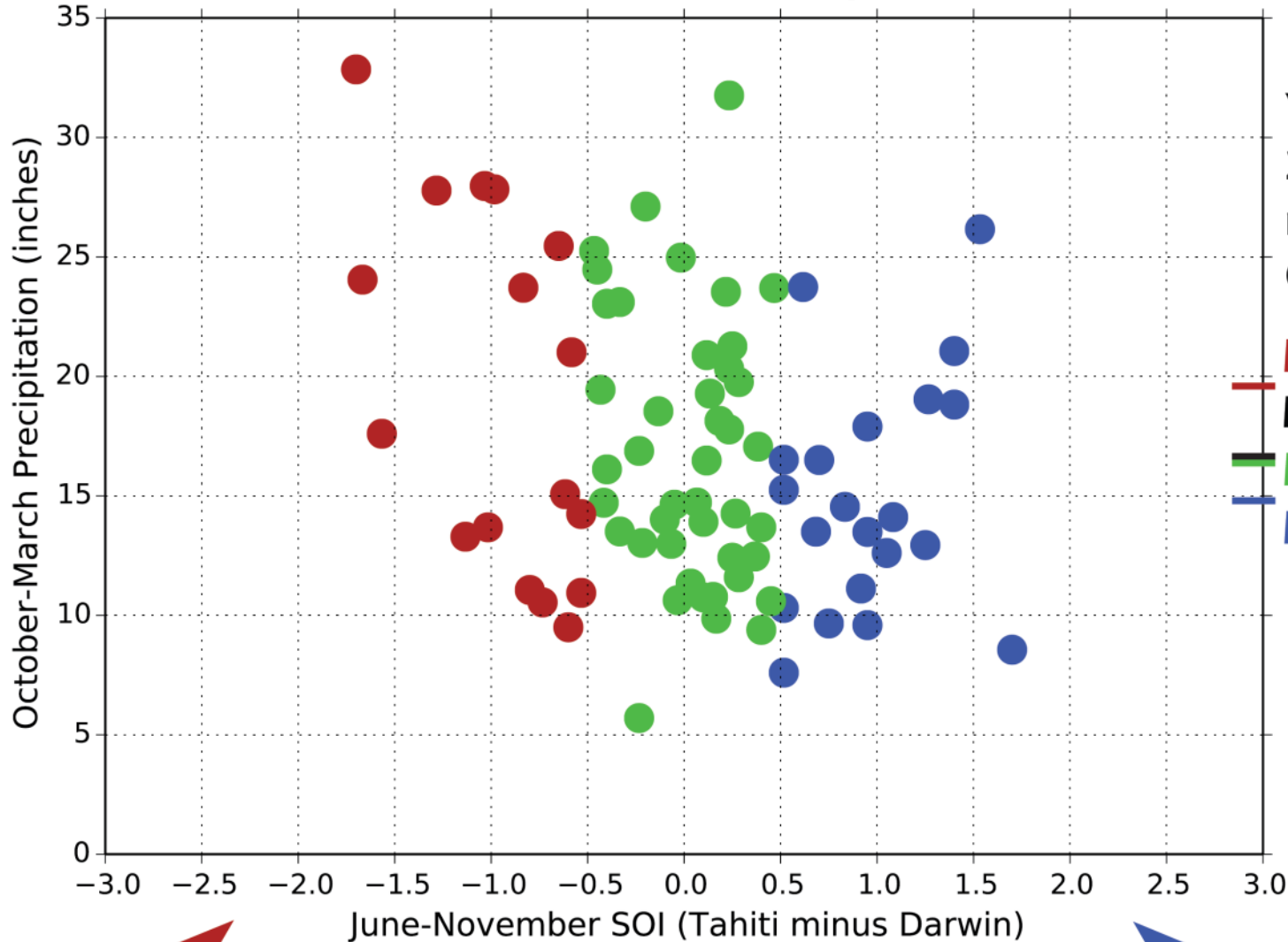
Years 1933/1934-2013/2014
 $r^2 = 0.05$
Correlation = -0.22
Mean = 32.83 in
Mean all = 29.44 in
Mean = 28.8 in
Mean = 28.0 in



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

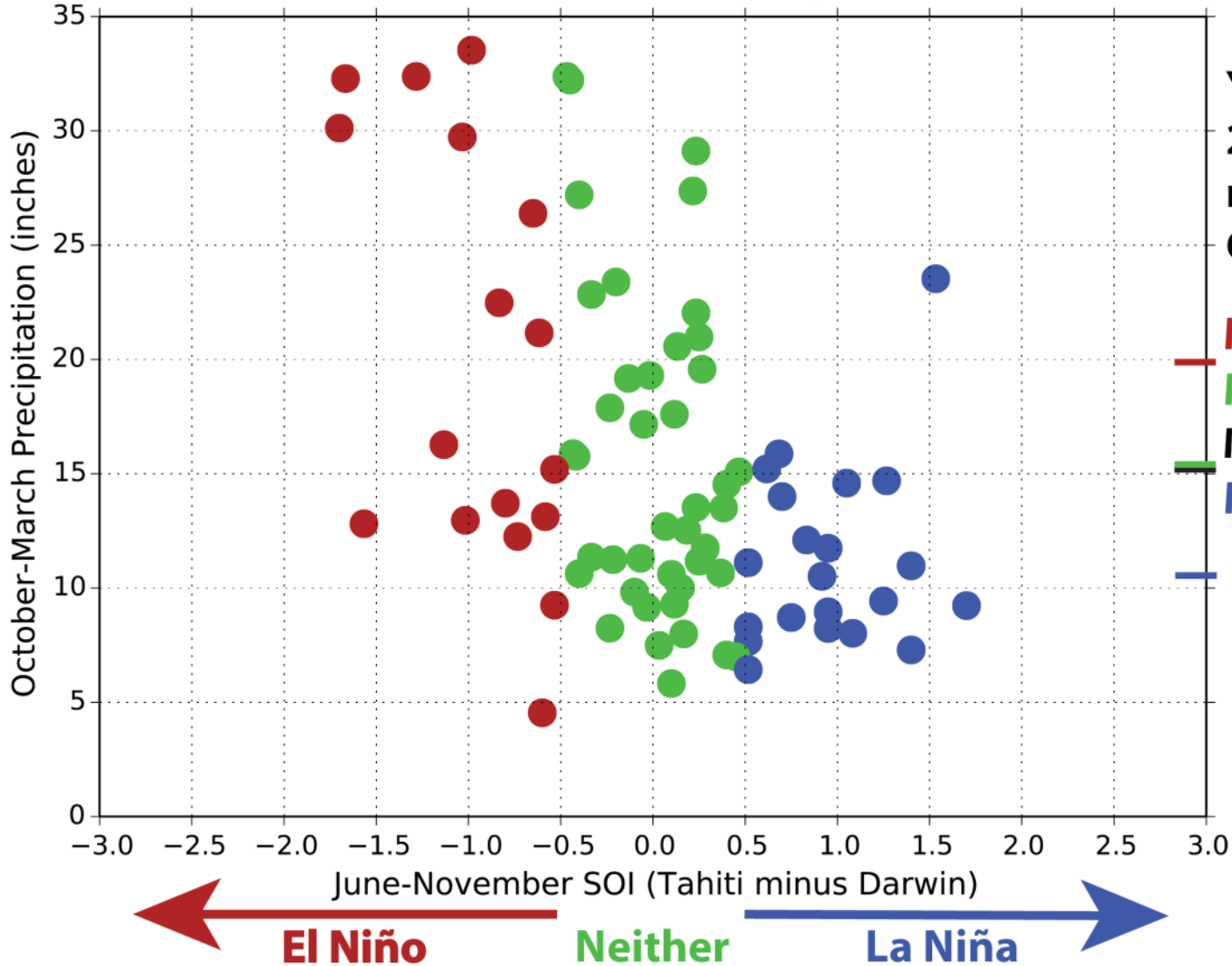
El Niño

Neither

La Niña

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

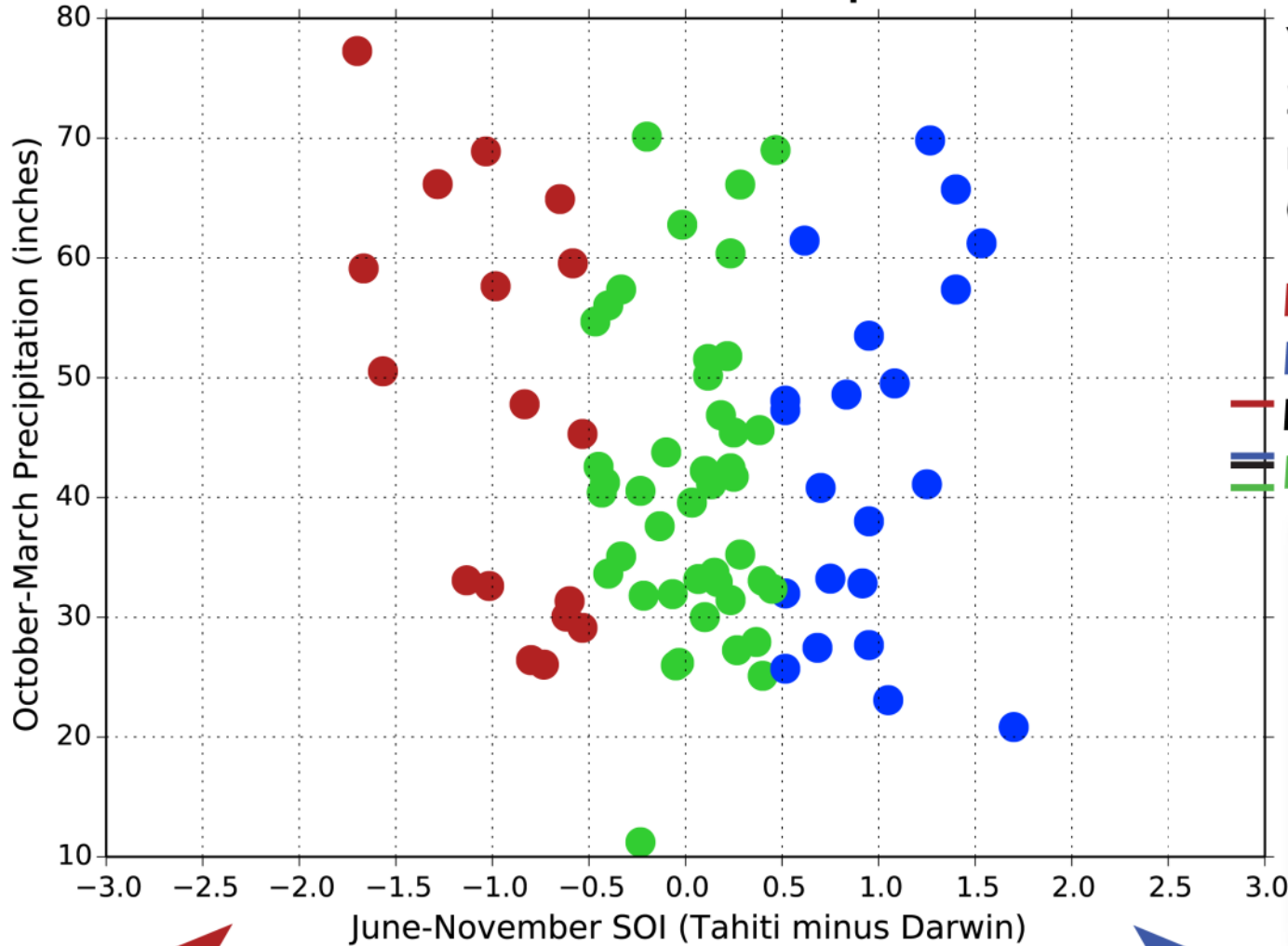
Mean = 19.89 in
Mean = 15.45 in
Mean all = 15.30 in
Mean = 11.27 in



Western Regional
Climate Center

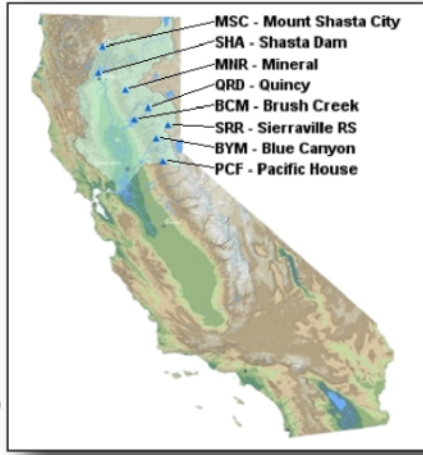
CA 8-Station Index October-March Precipitation

(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

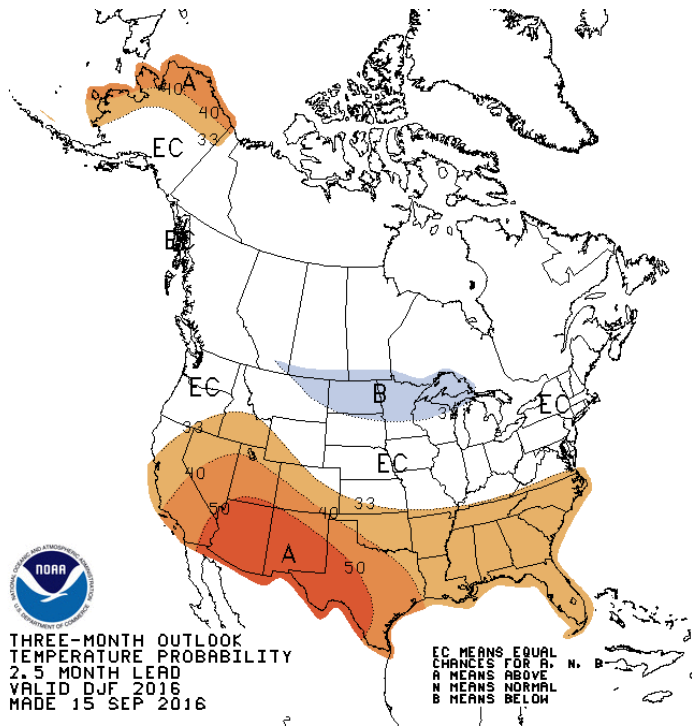


El Niño Neither La Niña

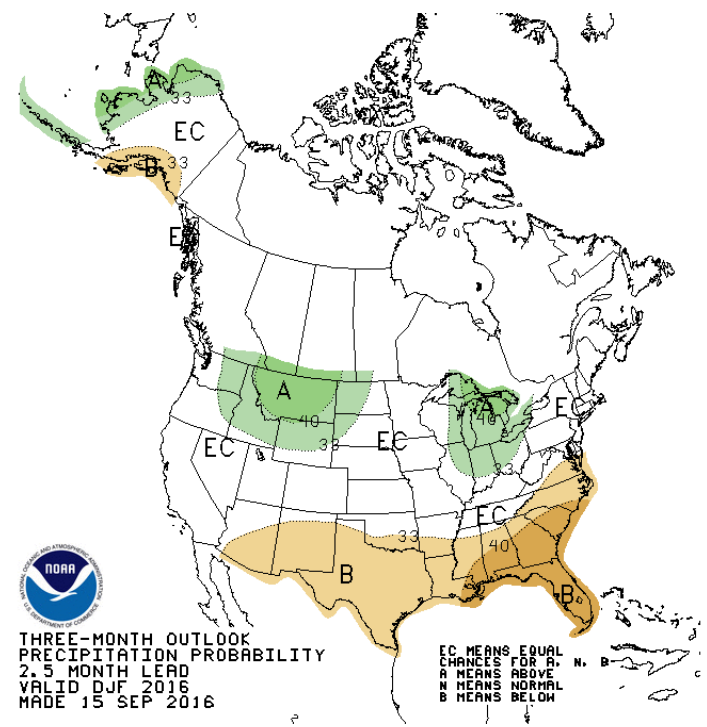
Data Source: CA DWR
Western Regional Climate Center

Temperature & Precipitation 2015-2016 Official Outlooks Three Month Winter

Dec-Jan-Feb Temperature



Dec-Jan-Feb Precipitation

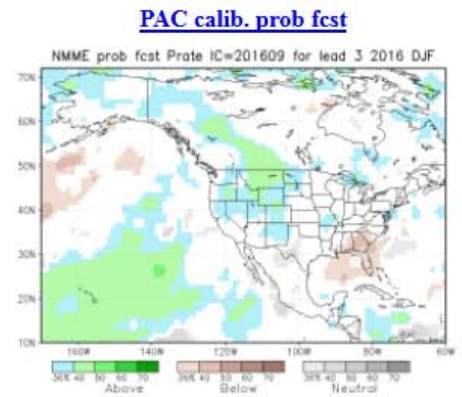
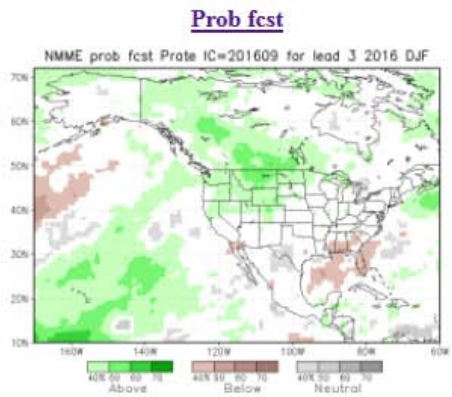
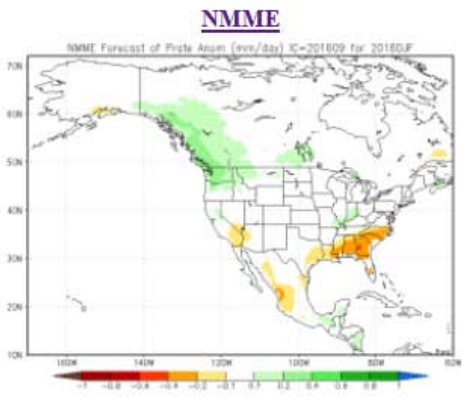


Orange / Red - Higher likelihood of warmer / drier than usual
Green / Blue - Higher likelihood of cooler / wetter than usual

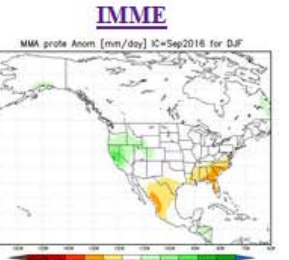
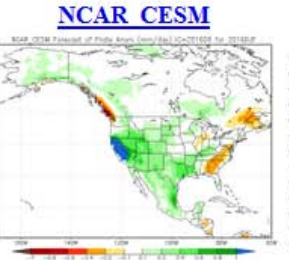
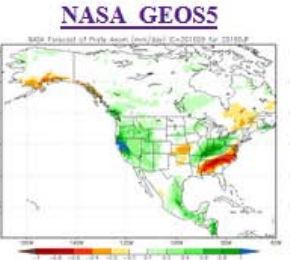
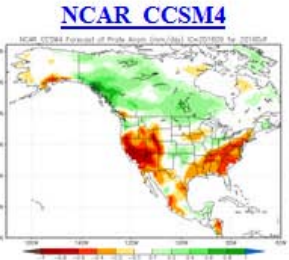
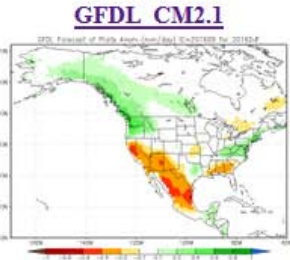
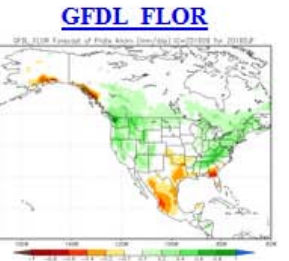
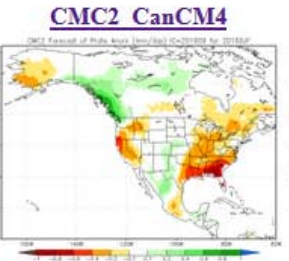
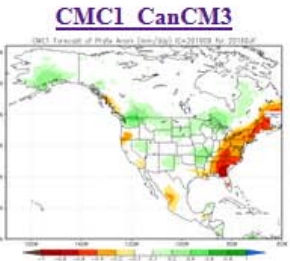
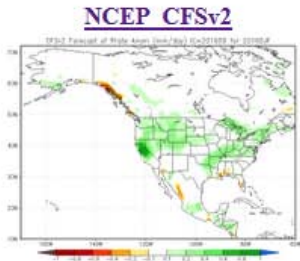
Seven experiments in near-term climate forecasting Dec-Feb 2015-6. Precipitation.

NMME (National Multi-Model Ensemble).
IMME (International Multi-Model Ensemble).

Dynamical Models



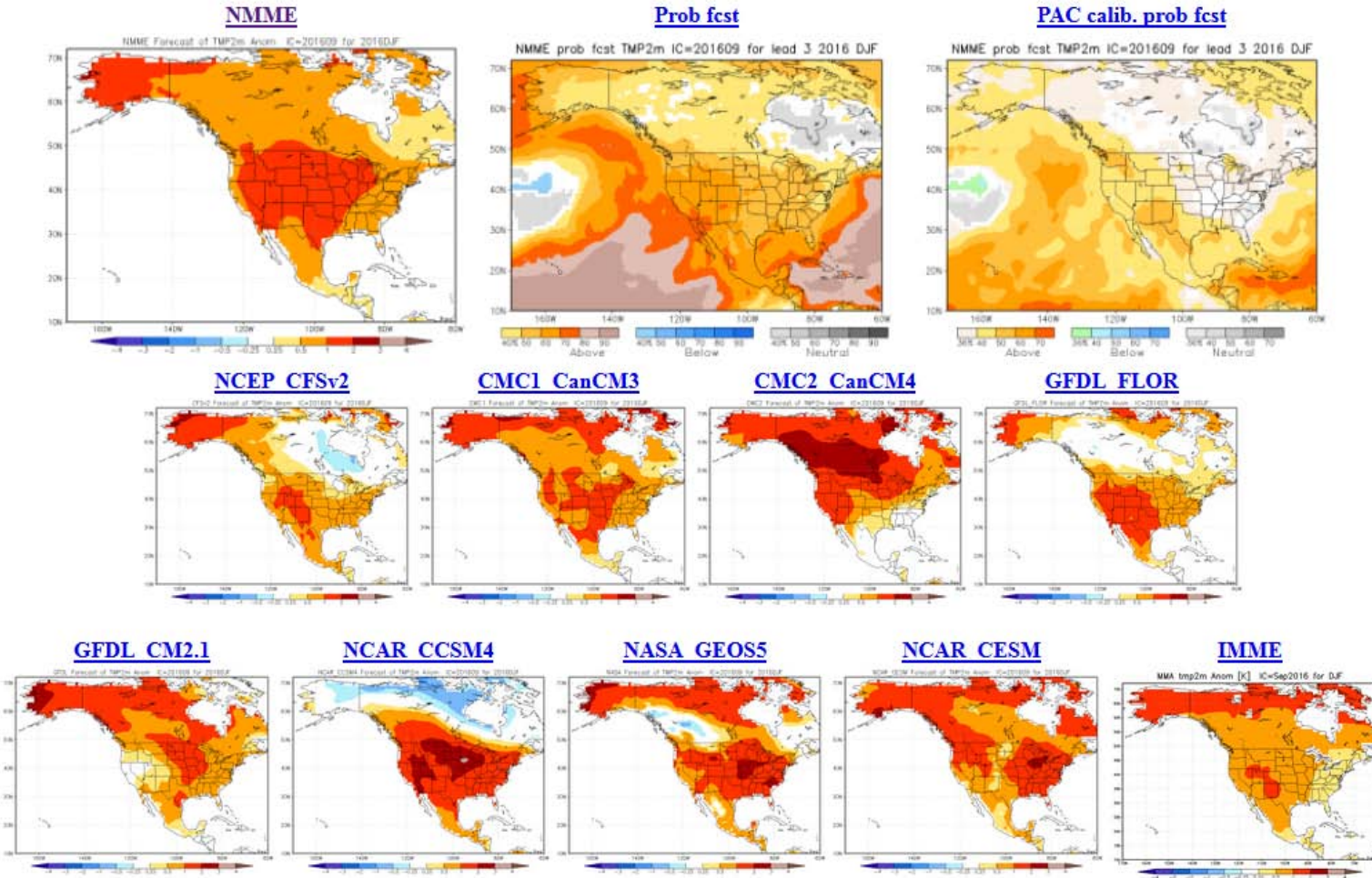
- CFSv2:** US Climate Forecasting System version 2
- CMC1:** Canadian Meteorological Center version 1
- CMC2:** Canadian Meteorological Center version 2
- GFDL:** US Geophysical Fluid Dynamics Laboratory
- NCAR:** US National Center for Atmospheric Research
- NASA:** US National Aeronautics and Space Administration
- NMME:** National Multi-Model Ensemble
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Seven experiments in near-term climate forecasting Dec-Feb 2015. Temperature.

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Dynamical Models



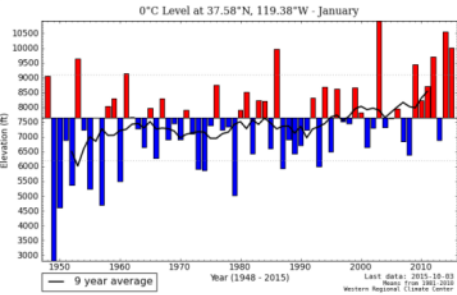
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**Thank
You !**

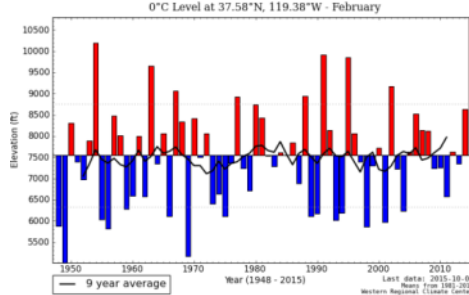
20101008



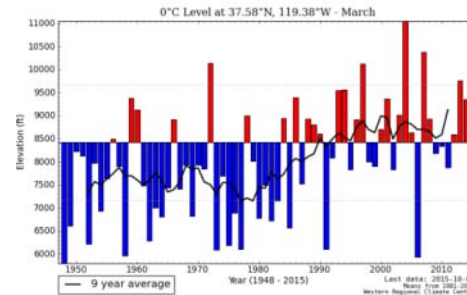
Elevation of Freezing Level over YOSE-SEKI. Monthly. Jan 1948 thru 3 Oct 2015.



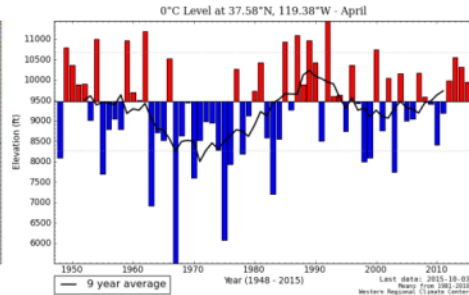
January



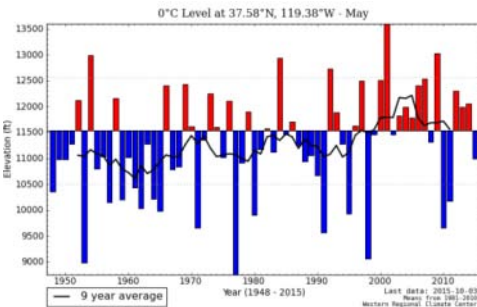
February



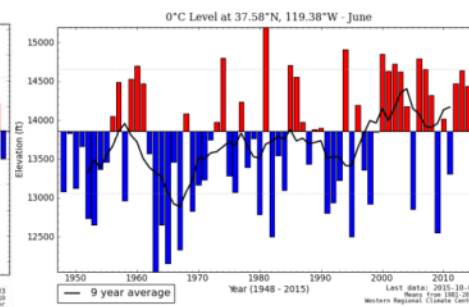
March



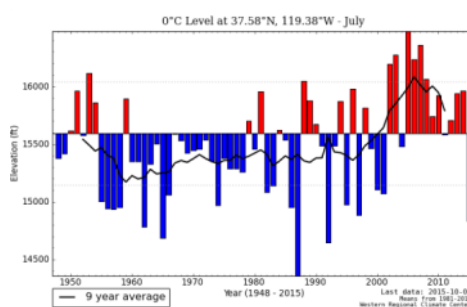
April



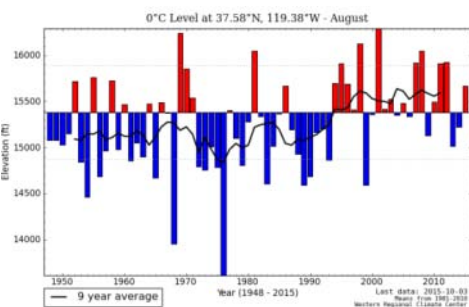
May



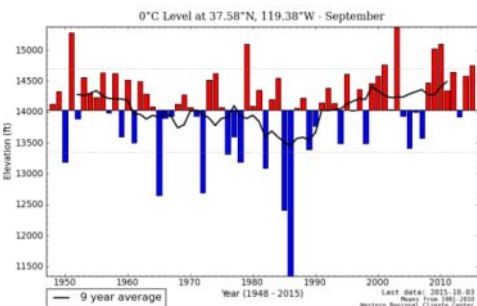
June



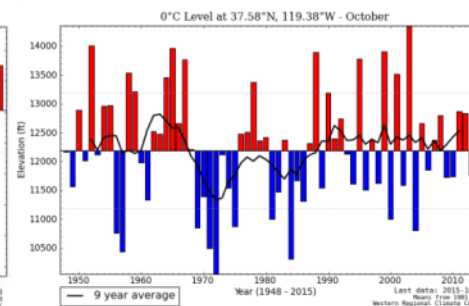
July



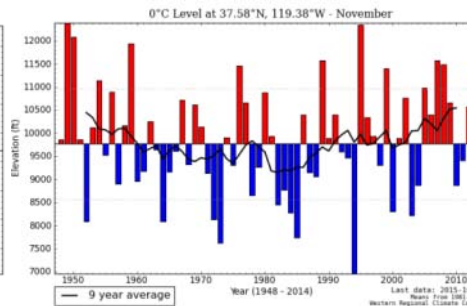
August



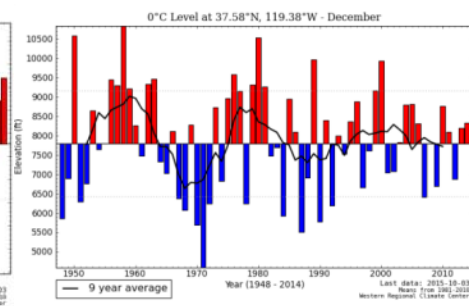
September



October (3rd)



November



December