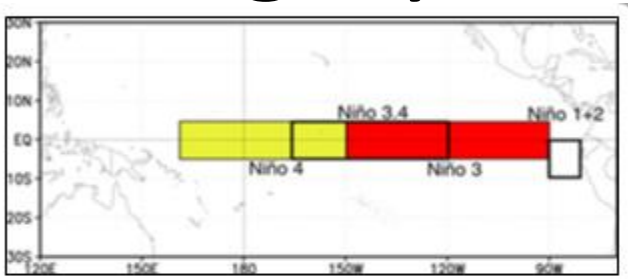
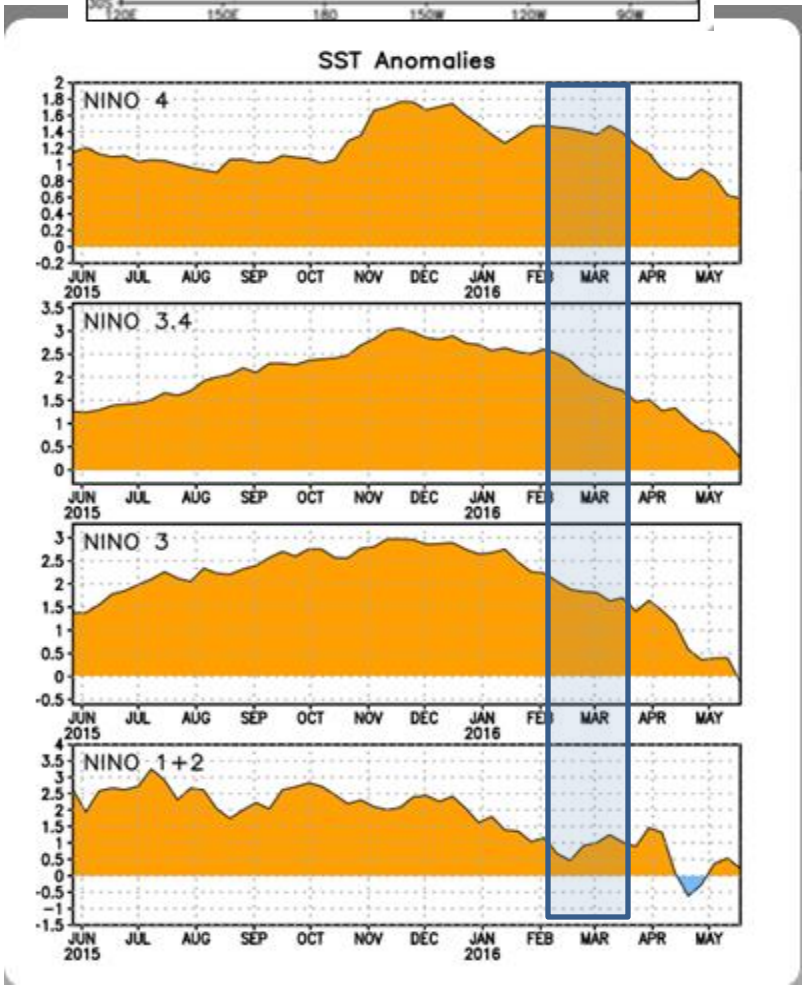
Water Year 2016 – Predictions and Observations for the West

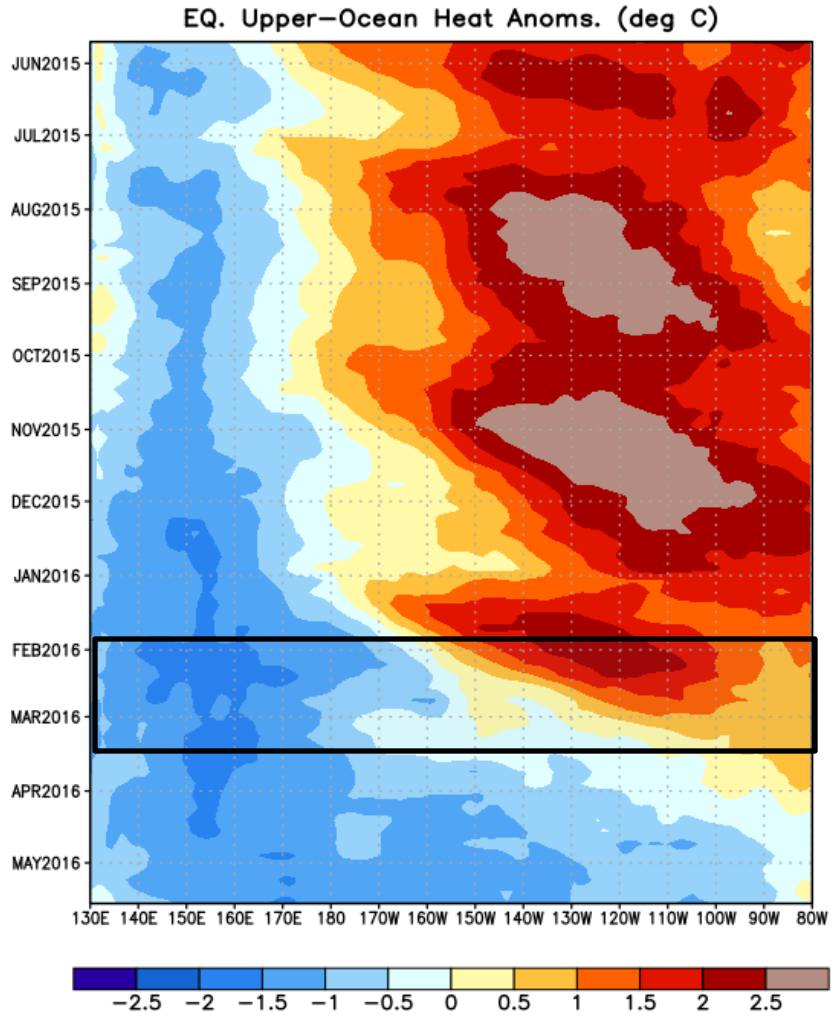
Talk Overview

- El Niño and Expectations and Outcomes
- Western Observations for Water Year 2016
- What Next?

The Mighty El Niño of 2015-2016





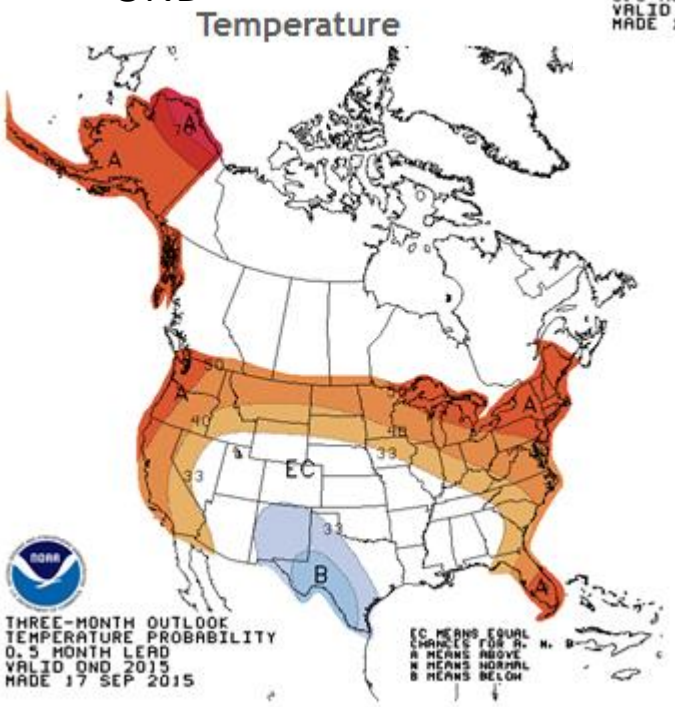


From CPC ENSO Diagnostic Discussion

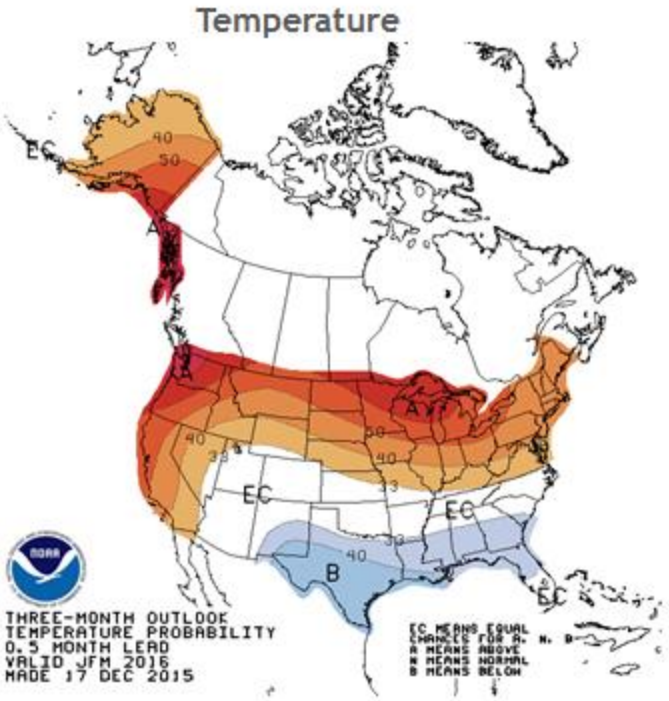
Great Expectations

- Jet Stream Zonal and Stronger
- Warm (coastal) and Wet South (westwide)
- Cooler than Average near Rio Grande Basin
- Warm and Dry North
- Higher Sea Levels with Coastal Damage in CA

OND


Temperature
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID OND 2015
MADE 17 SEP 2015
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

JFM


Temperature
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID JFM 2016
MADE 17 DEC 2015
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
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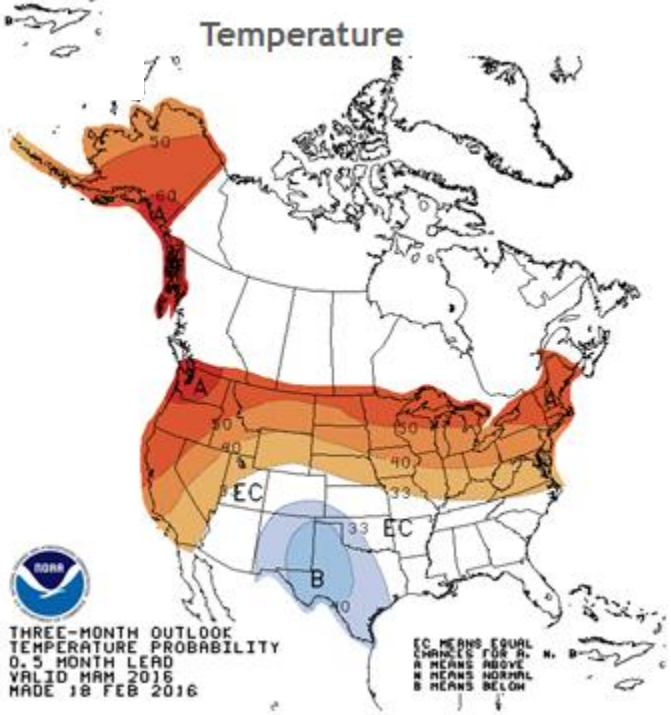
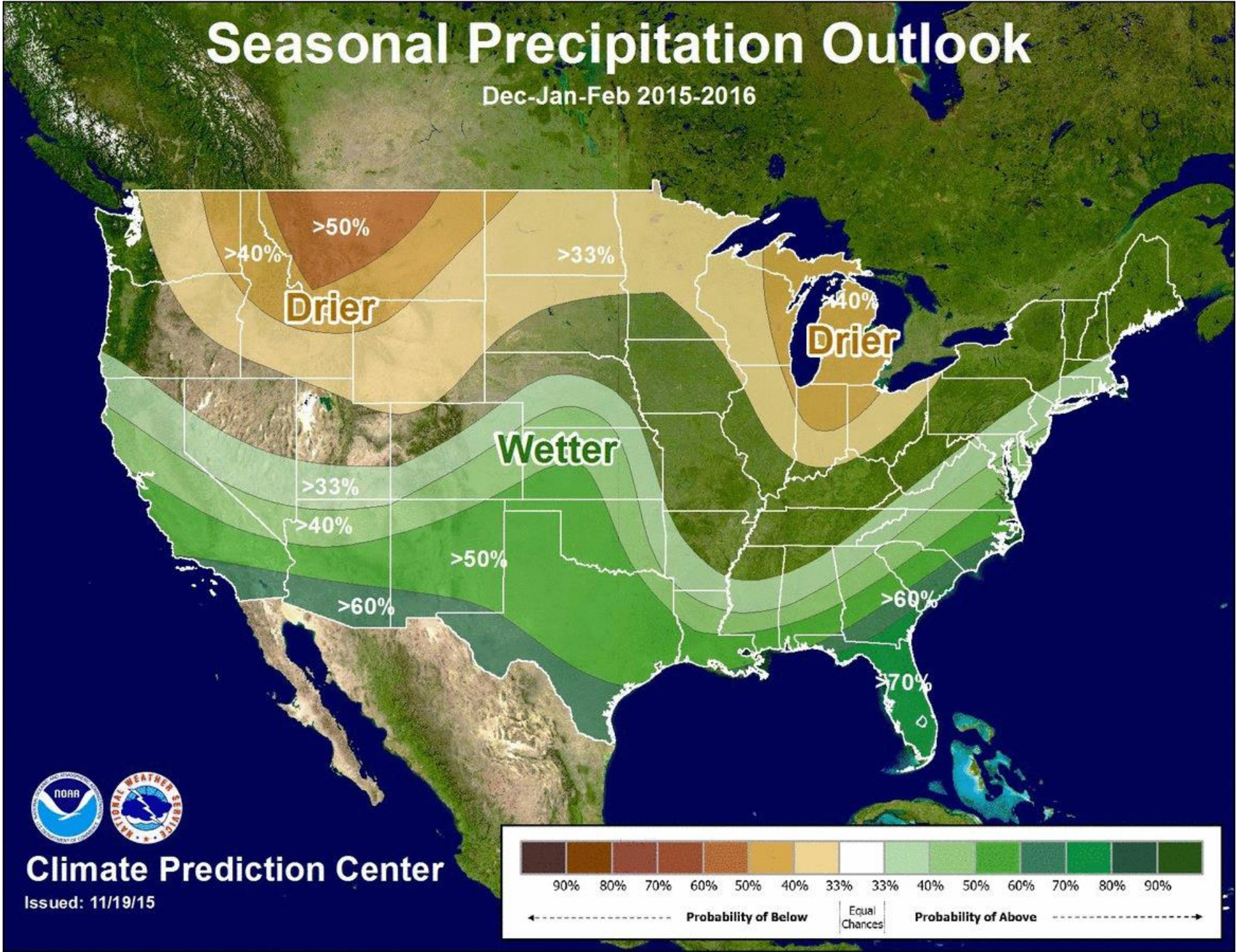
B MEANS BELOW

MAM


Temperature
THREE-MONTH OUTLOOK
TEMPERATURE PROBABILITY
0.5 MONTH LEAD
VALID MAM 2016
MADE 18 FEB 2016
EC MEANS EQUAL CHANCES FOR A, N, B
A MEANS ABOVE
N MEANS NORMAL
B MEANS BELOW

Seasonal Precipitation Outlook

Dec-Jan-Feb 2015-2016



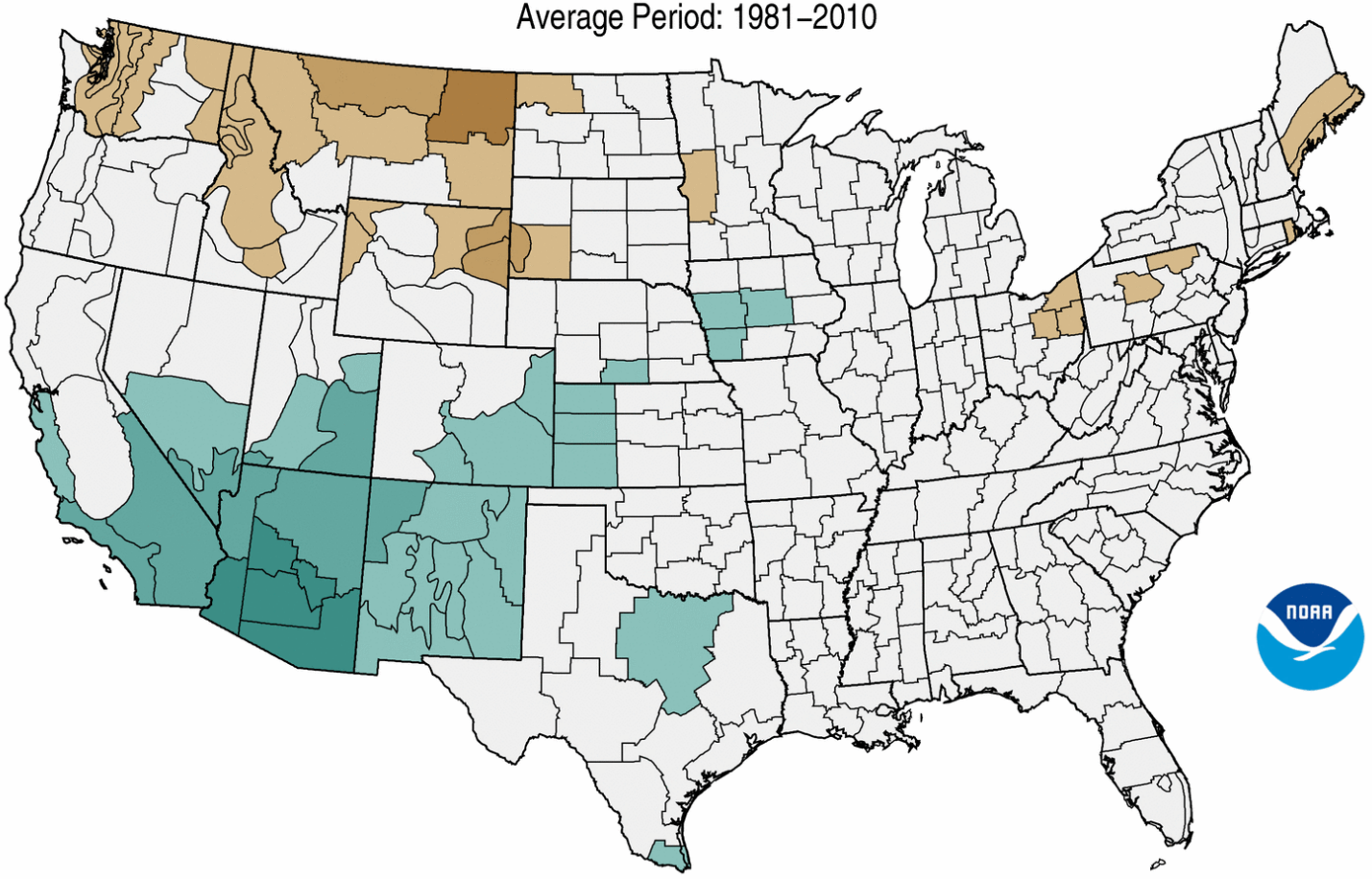
Climate Prediction Center

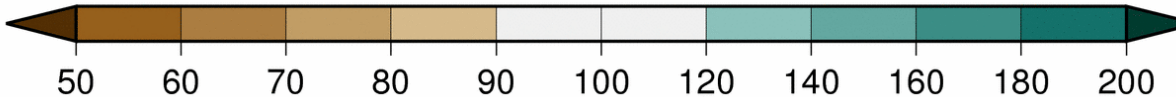
Issued: 11/19/15

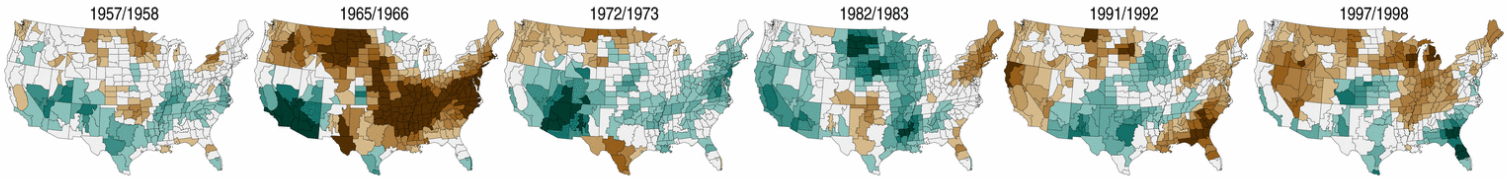
Strong El Niño Precipitation Percent of Average

Composite: October–December 1957, 1965, 1972, 1982, 1991, 1997

Average Period: 1981–2010







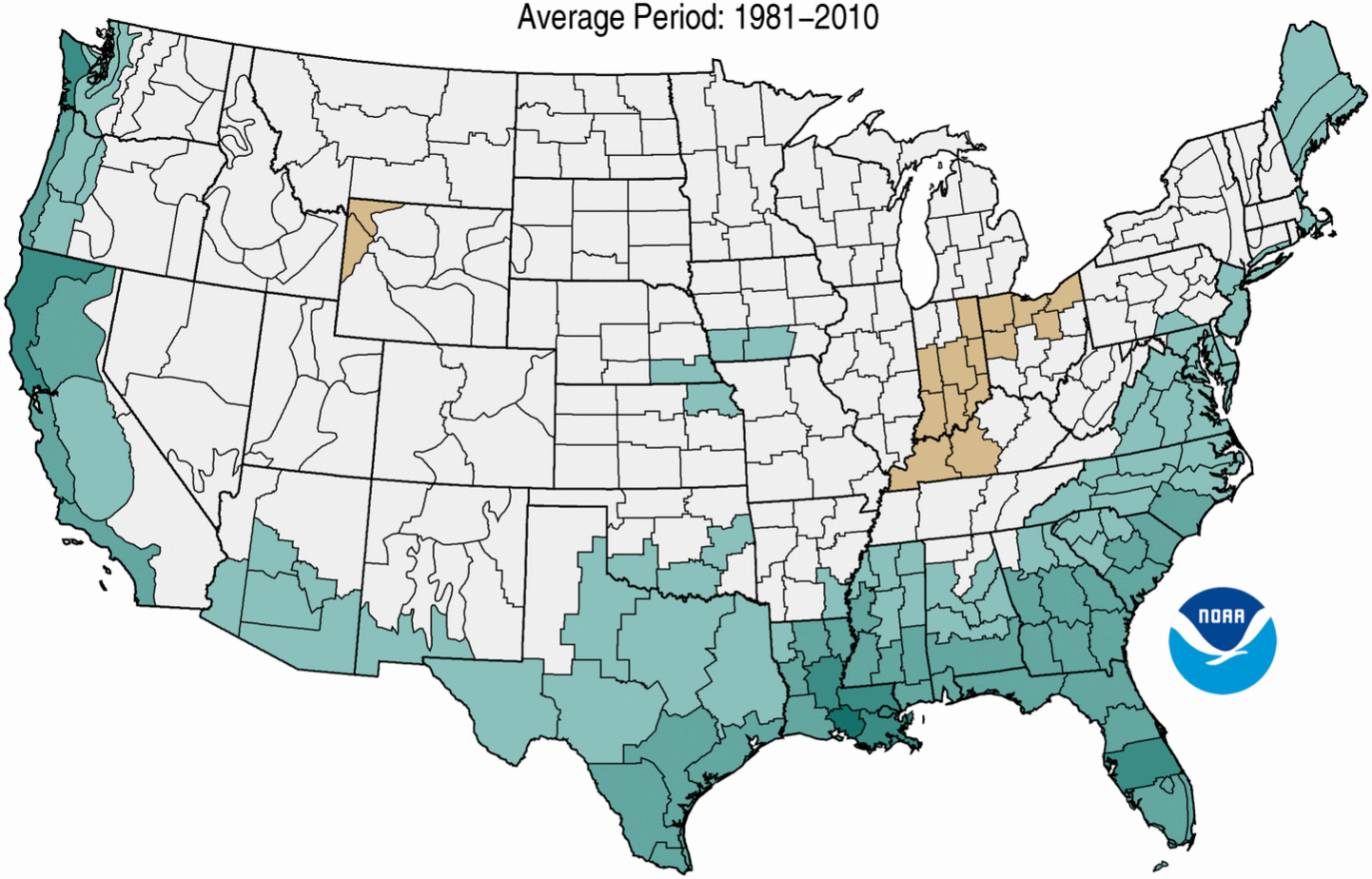
Data Source: 5km Divisional Dataset (nClimDiv)

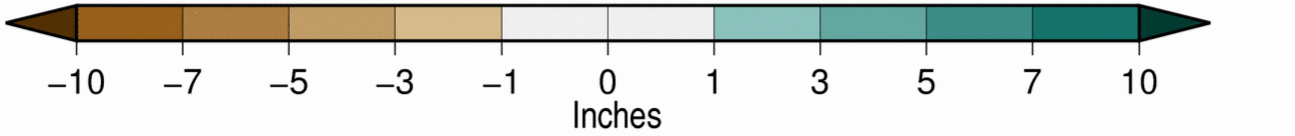
Created by: National Centers for Environmental Information

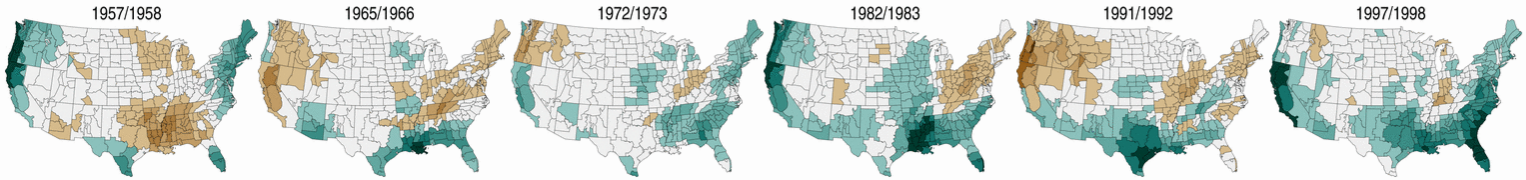
Strong El Niño Precipitation Departure from Average

Composite: December–February 1957/1958, 1965/1966, 1972/1973, 1982/1983, 1991/1992, 1997/1998

Average Period: 1981–2010



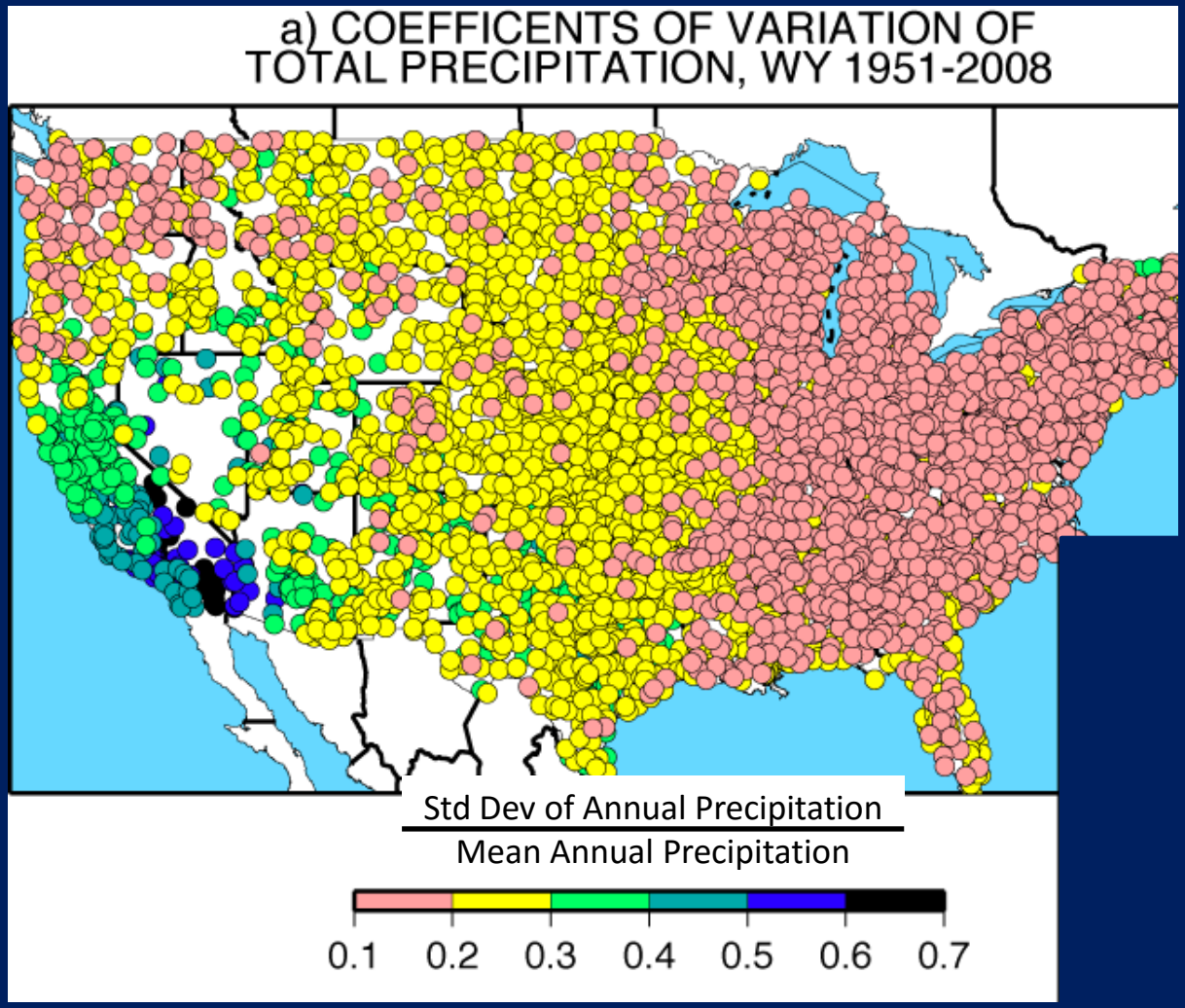




Data Source: 5km Divisional Dataset (nClimDiv)

Created by: National Centers for Environmental Information

California's precipitation is uniquely variable

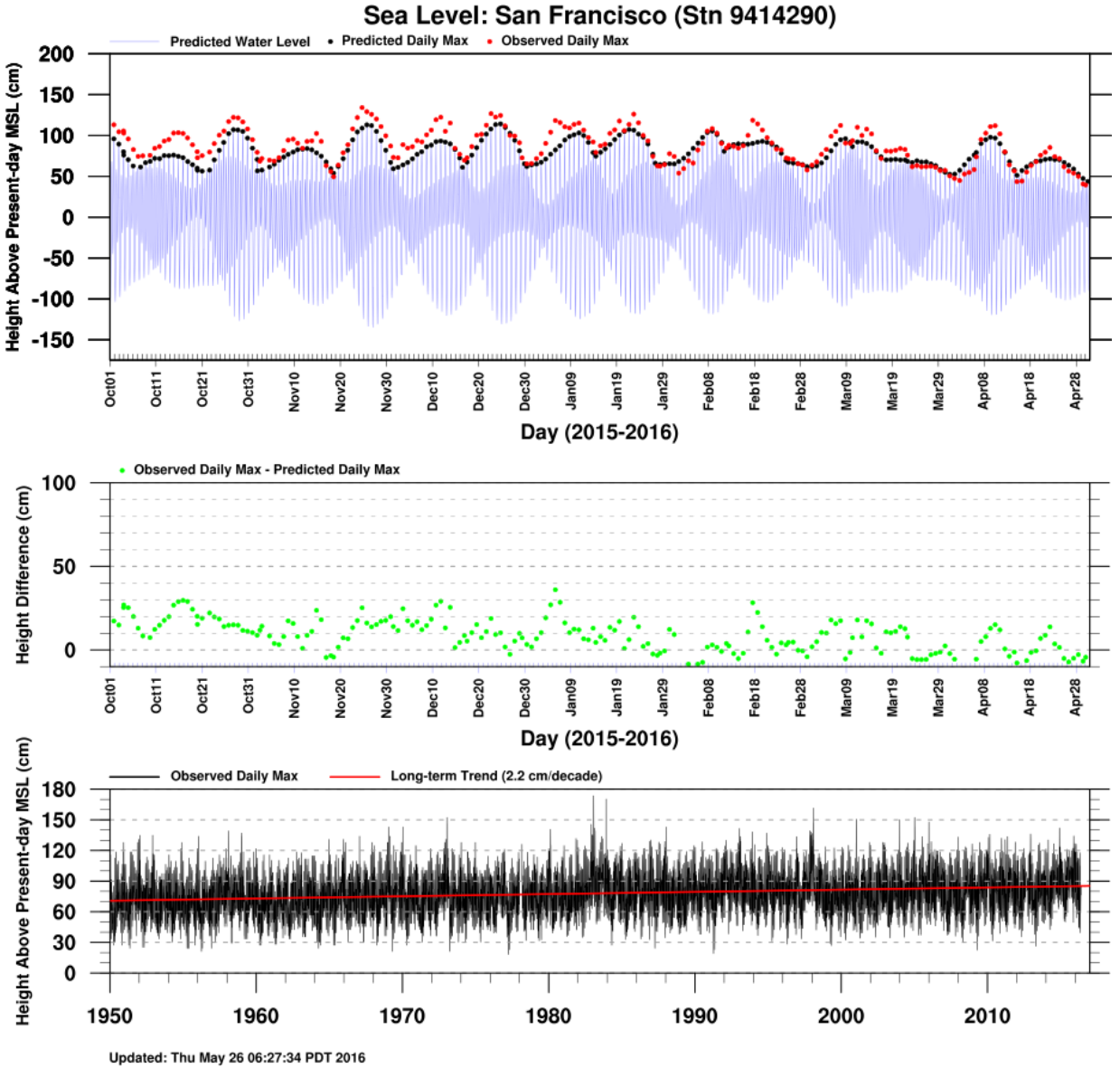


Higher values are higher variability

Source: Dettinger et al (2011)

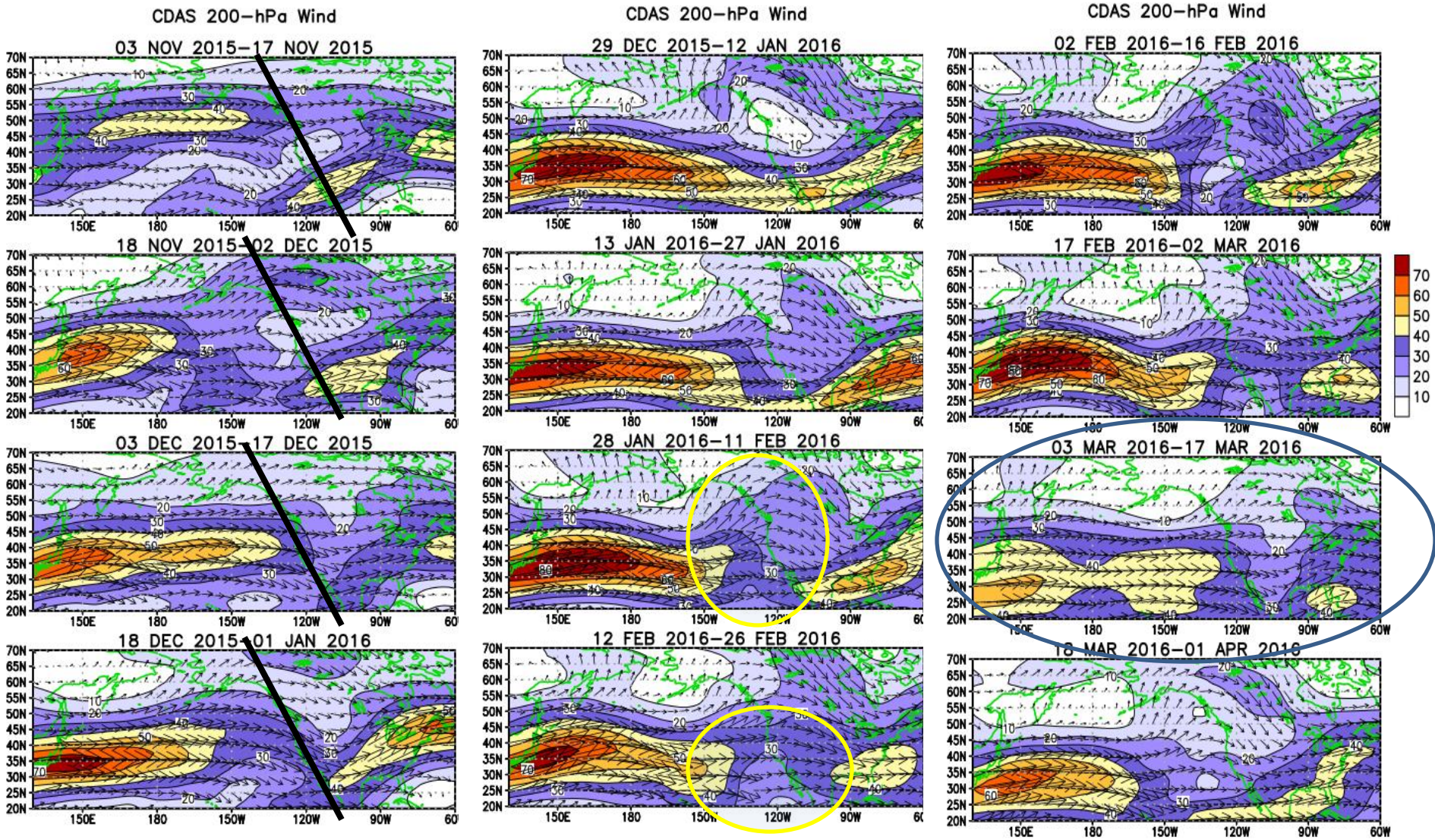
Outcomes for WY 2016

El Niño and Sea Level



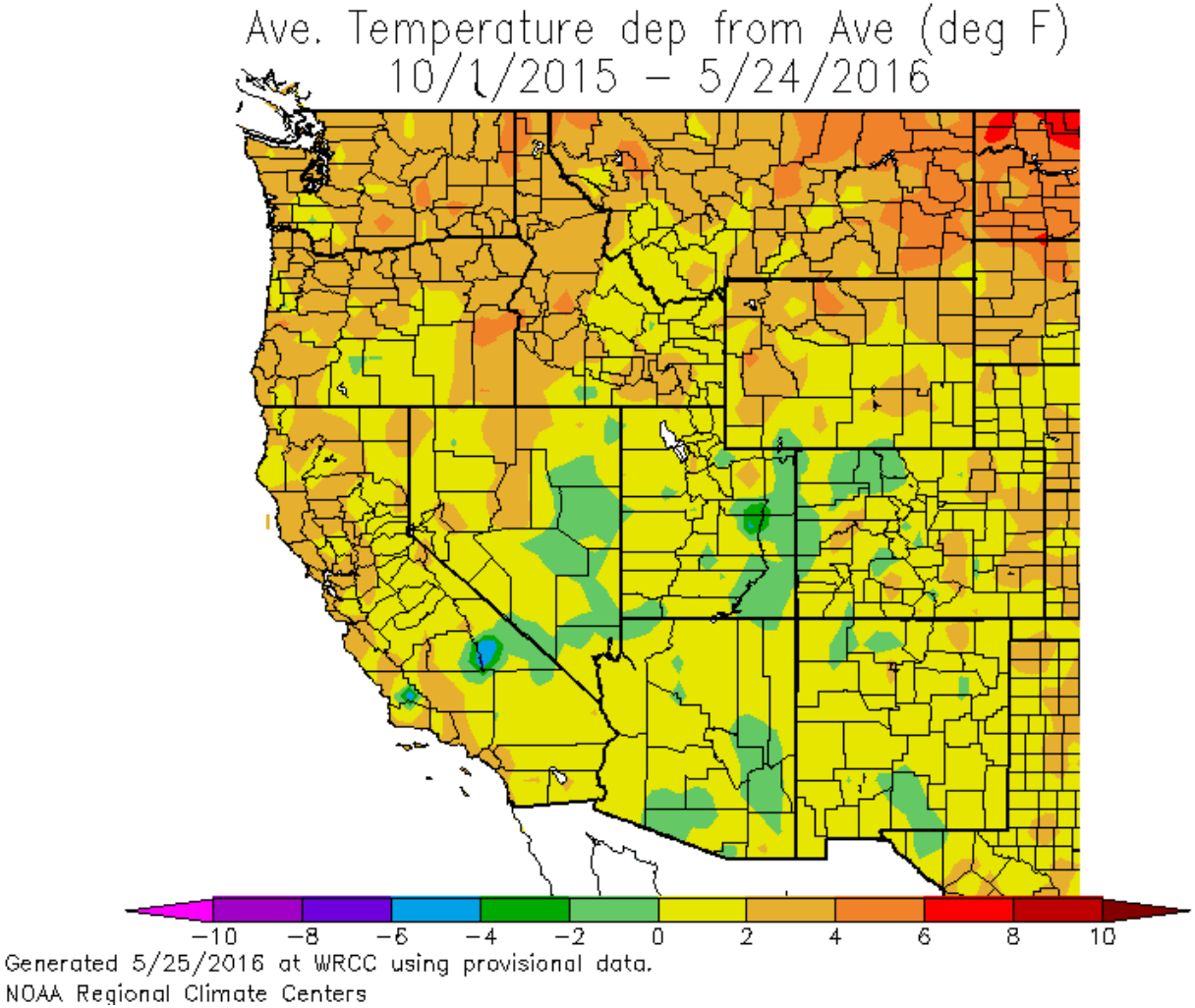
CNAP
California-Nevada Climate Applications Program
A NOAA RISA team

El Nino and the Jet Stream

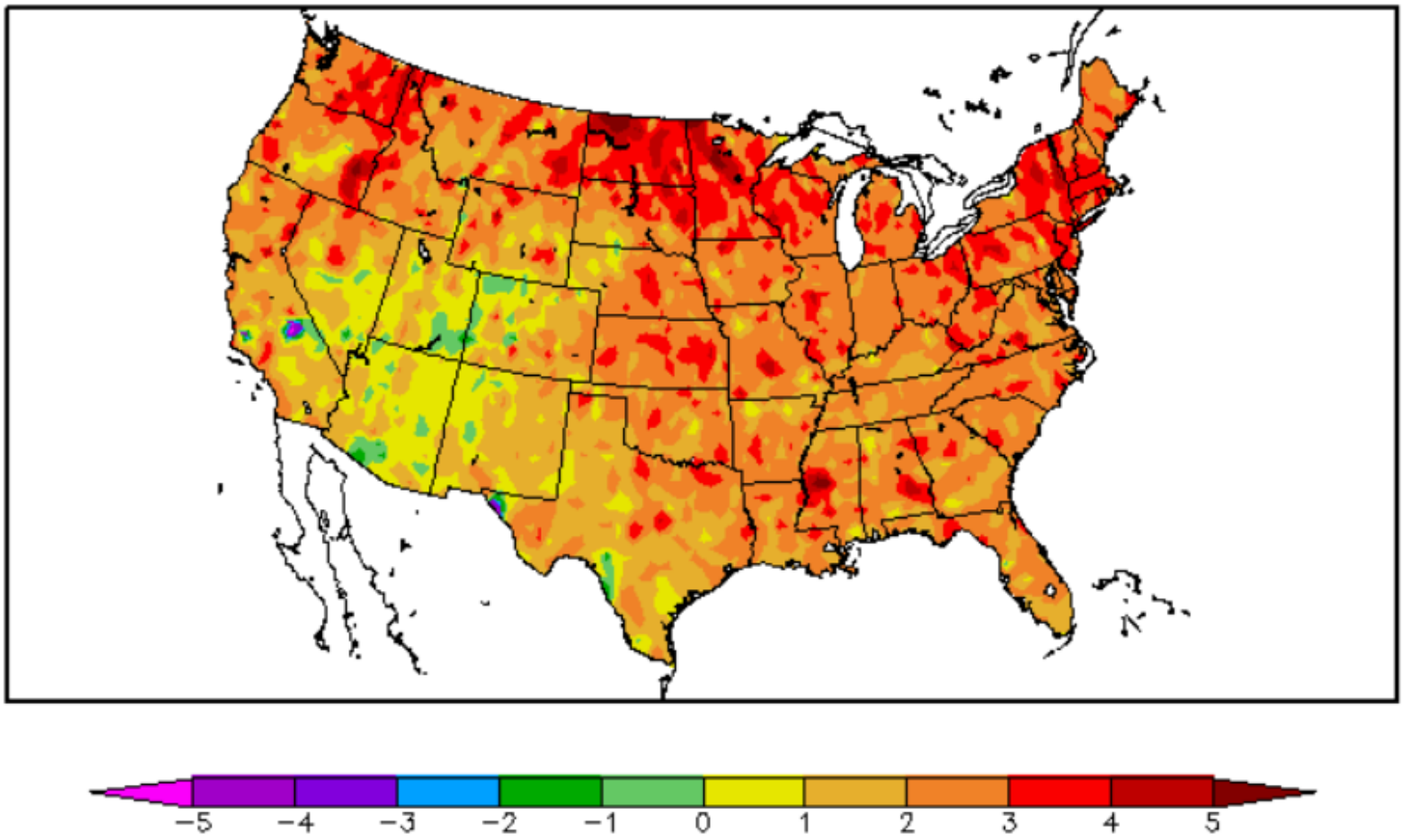


From CPC ENSO Diagnostic Discussion

Temperature Outcomes



Departure from Normal Temperature (F)
5/1/2015 – 4/30/2016



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

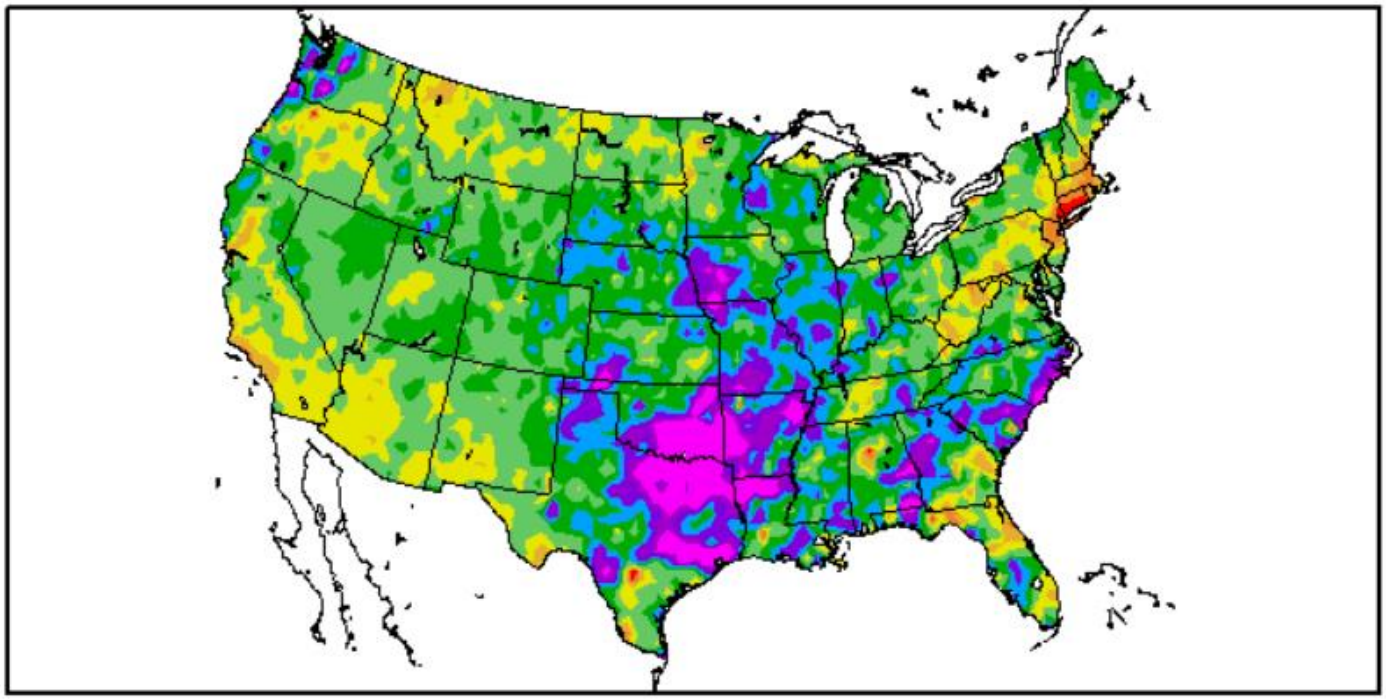
The Current Climate Summary Maps are produced daily using data from the Applied Climate Information System (ACIS). Stations used are from the National Weather Service Cooperative Observer Network (COOP), and the Automated Weather Data Network (AWDN). All near-real-time data are considered preliminary and should be used responsibly.

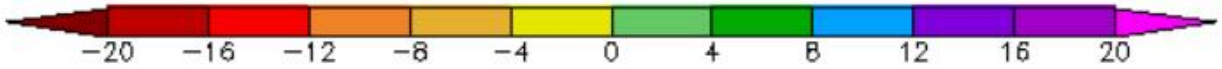
Regional Climate Centers

ACIS

Normal refers to the 1981-2010 Climate Normal for the selected product.

Departure from Normal Precipitation (in)
5/1/2015 – 4/30/2016





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

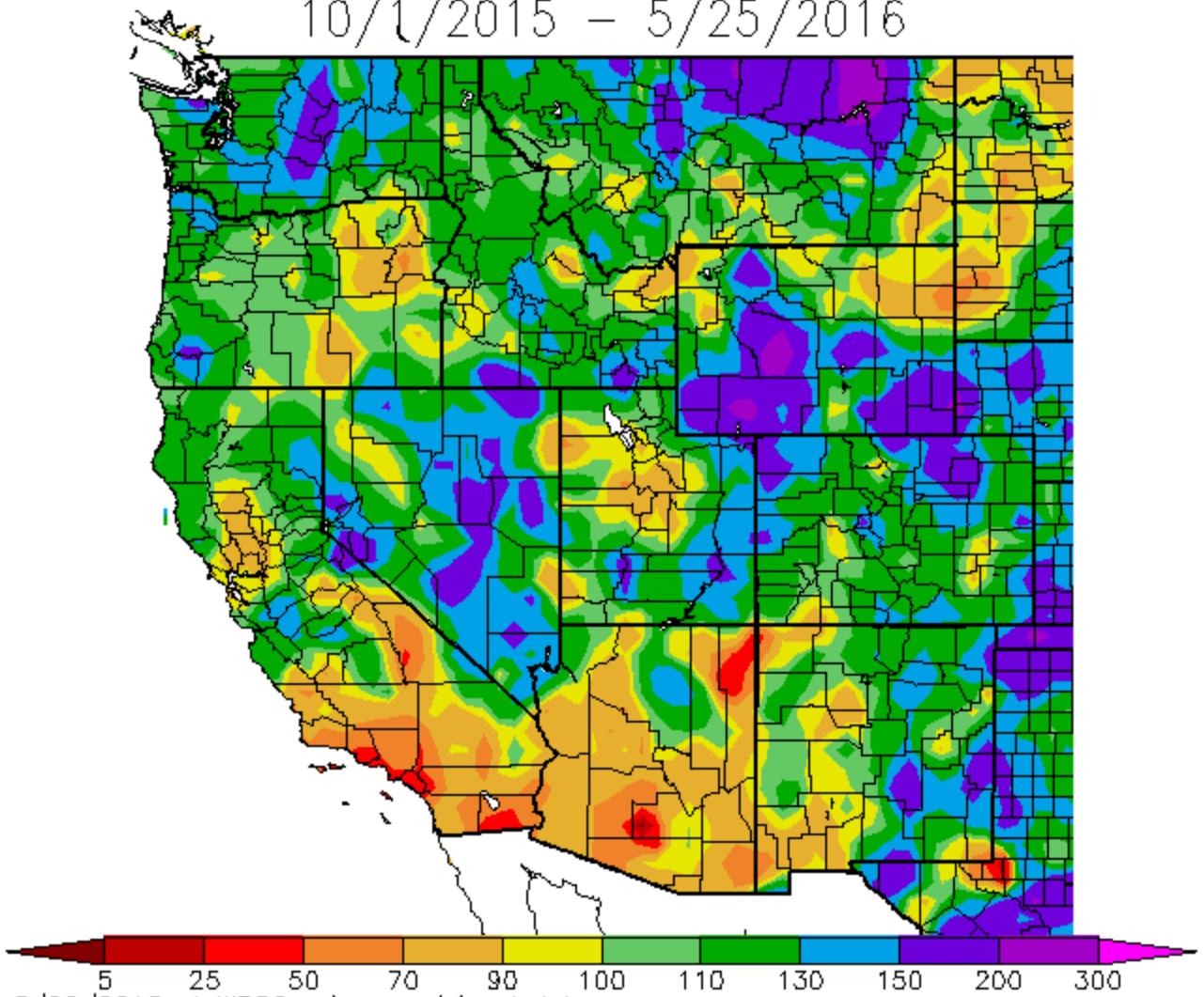
The Current Climate Summary Maps are produced daily using data from the Applied Climate Information System (ACIS). Stations used are from the National Weather Service Cooperative Observer Network (COOP), and the Automated Weather Data Network (AWDN). All near-real-time data are considered preliminary and should be used responsibly.

Regional Climate Centers

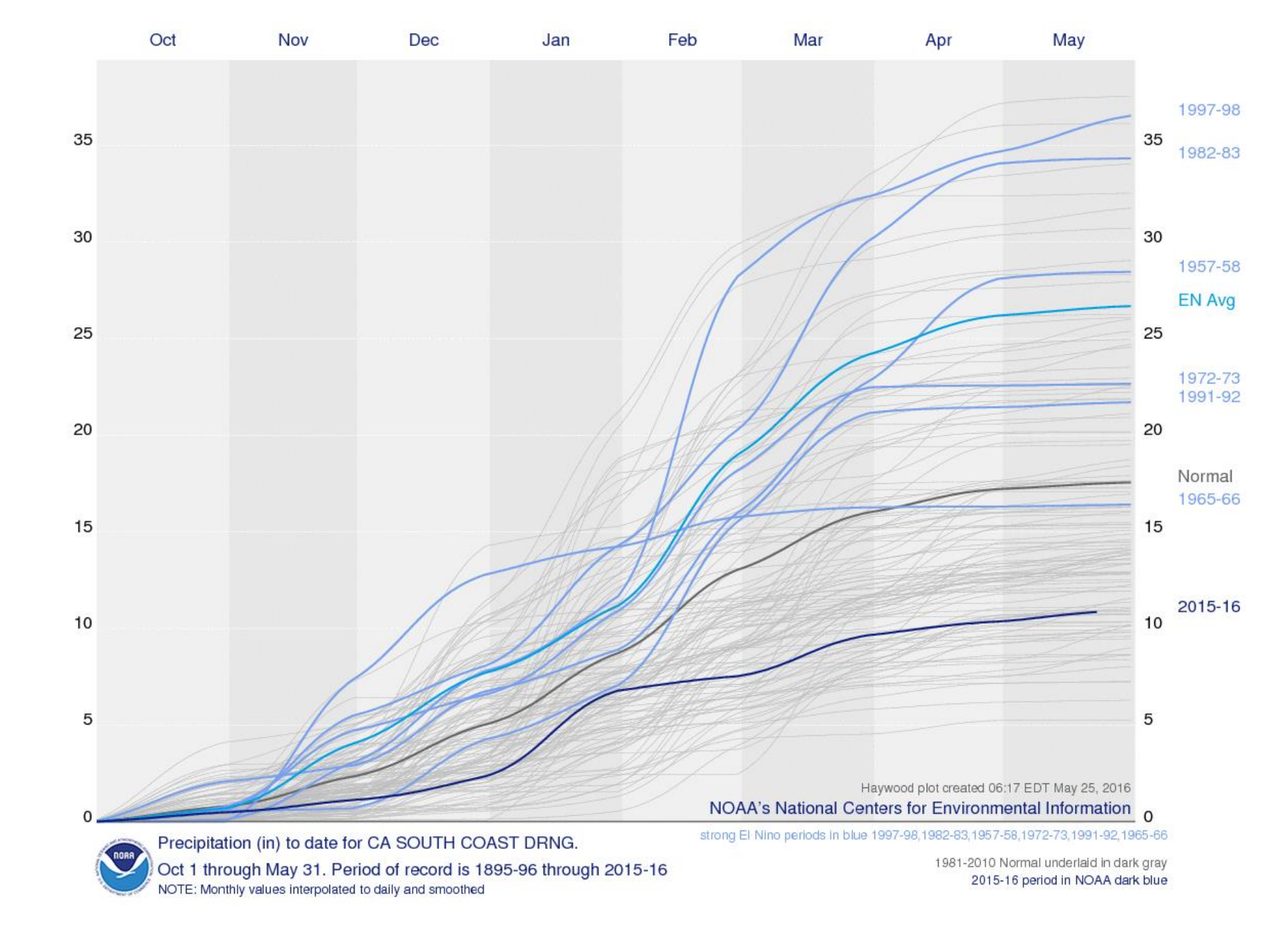
ACIS

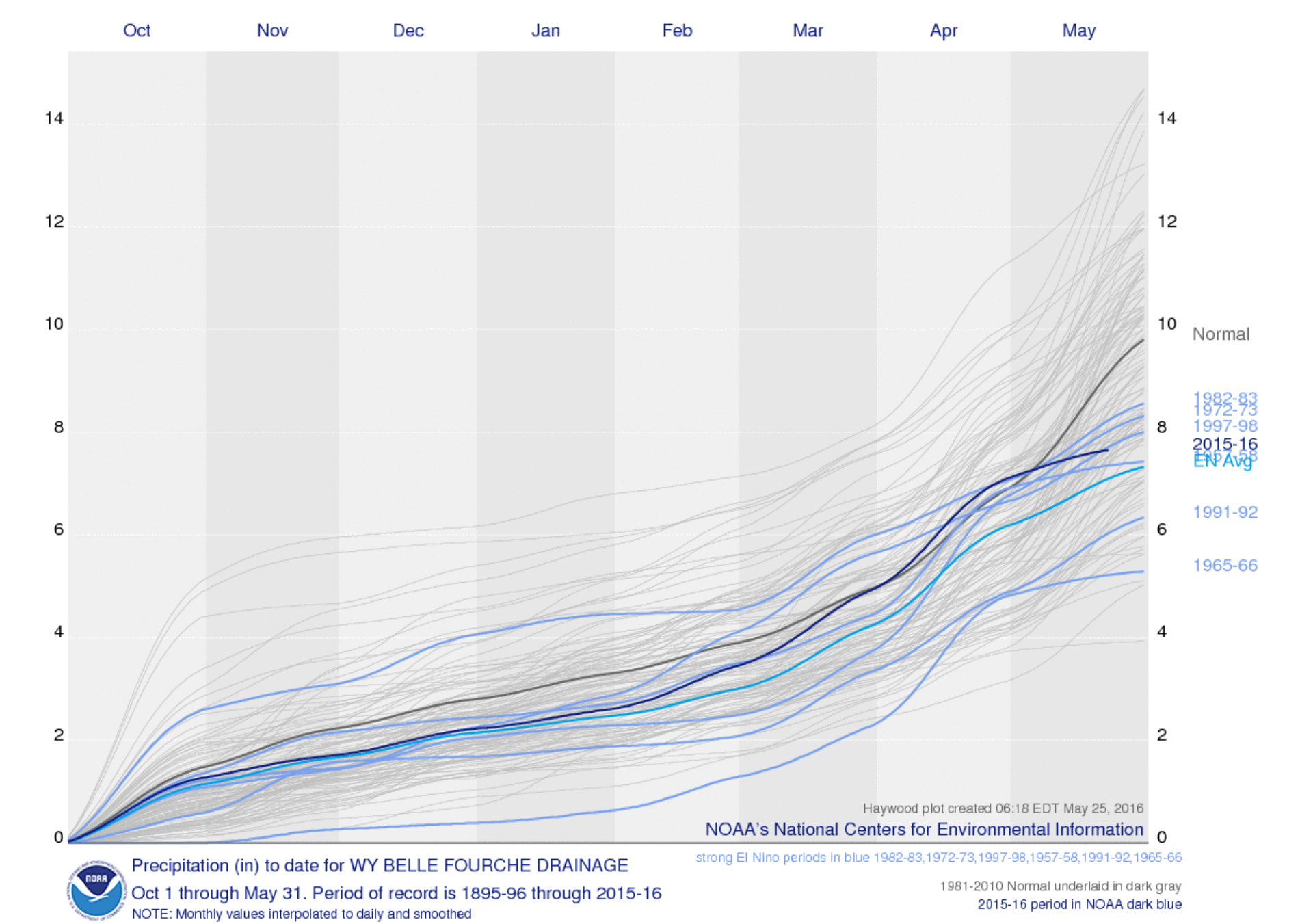
Normal refers to the 1981-2010 Climate Normal for the selected product.

Percent of Average Precipitation (%)
10/1/2015 – 5/25/2016



Generated 5/26/2016 at WRCC using provisional data.
NOAA Regional Climate Centers

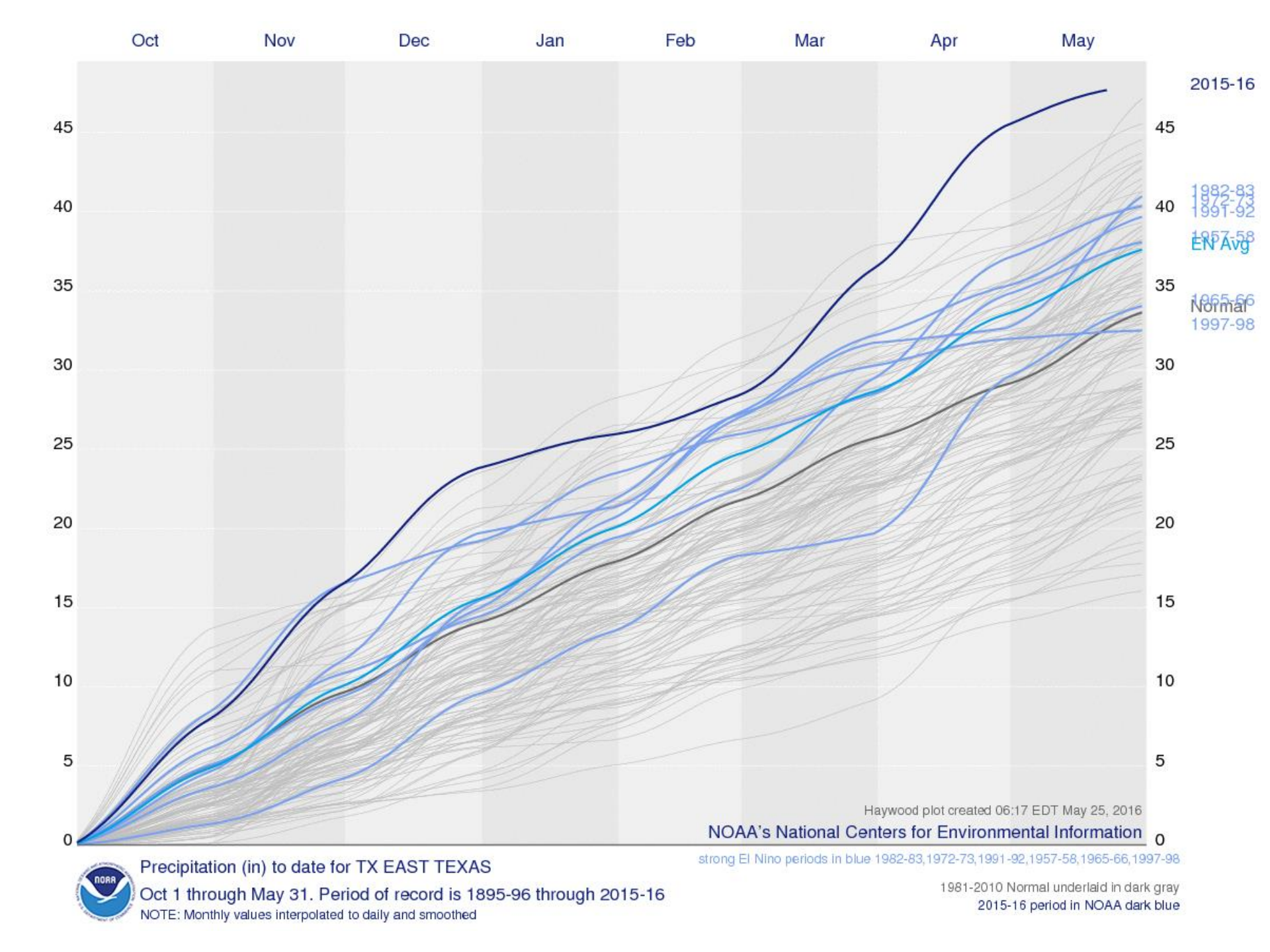

Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
0
5
10
15
20
25
30
35
1997-98
1982-83
1957-58
EN Avg
1972-73
1991-92
Normal
1965-66
2015-16
Haywood plot created 06:17 EDT May 25, 2016
NOAA's National Centers for Environmental Information
Precipitation (in) to date for CA SOUTH COAST DRNG.
Oct 1 through May 31. Period of record is 1895-96 through 2015-16
NOTE: Monthly values interpolated to daily and smoothed
strong El Nino periods in blue 1997-98,1982-83,1957-58,1972-73,1991-92,1965-66
1981-2010 Normal underlaid in dark gray
2015-16 period in NOAA dark blue



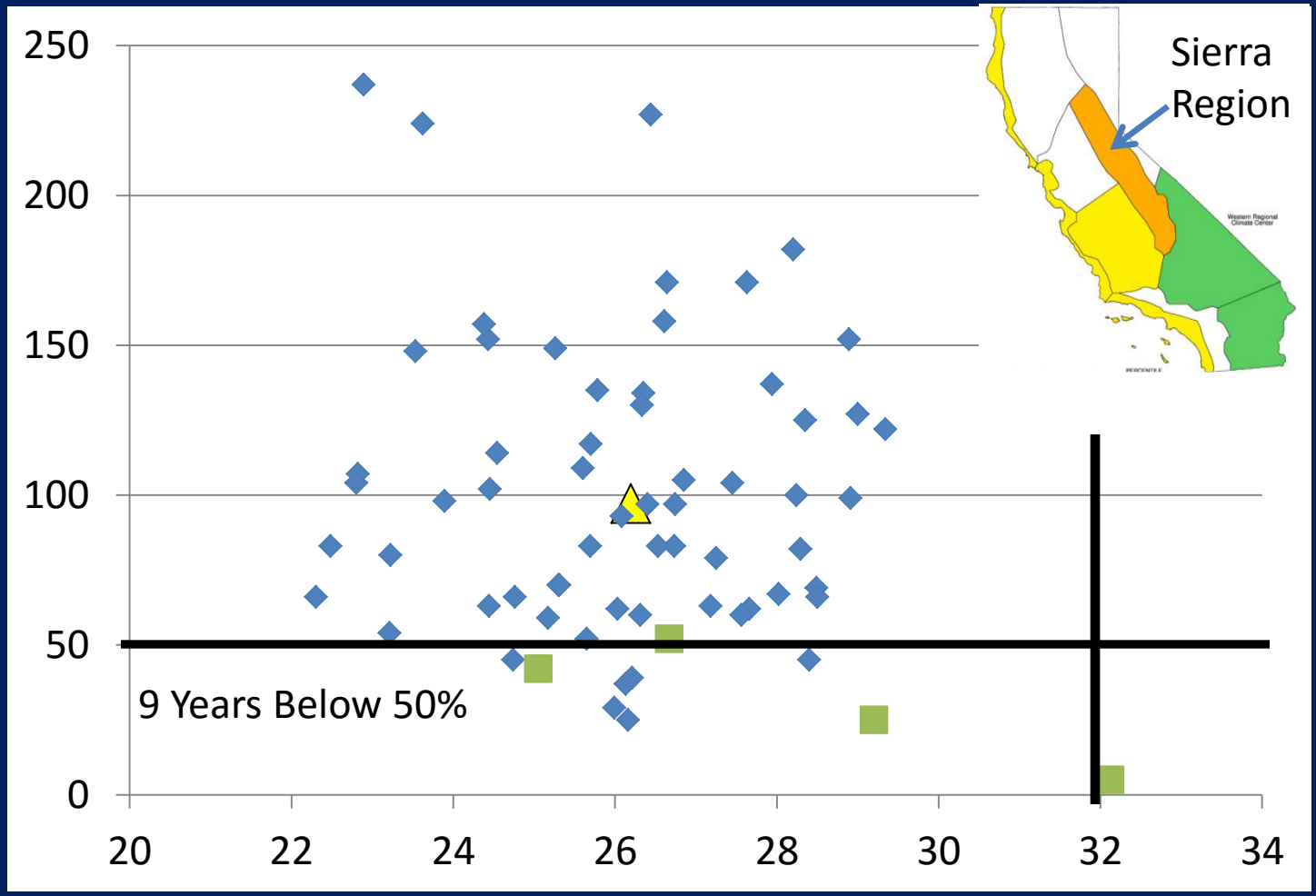
Precipitation (in) to date for WY BELLE FOURCHE DRAINAGE

Oct 1 through May 31. Period of record is 1895-96 through 2015-16

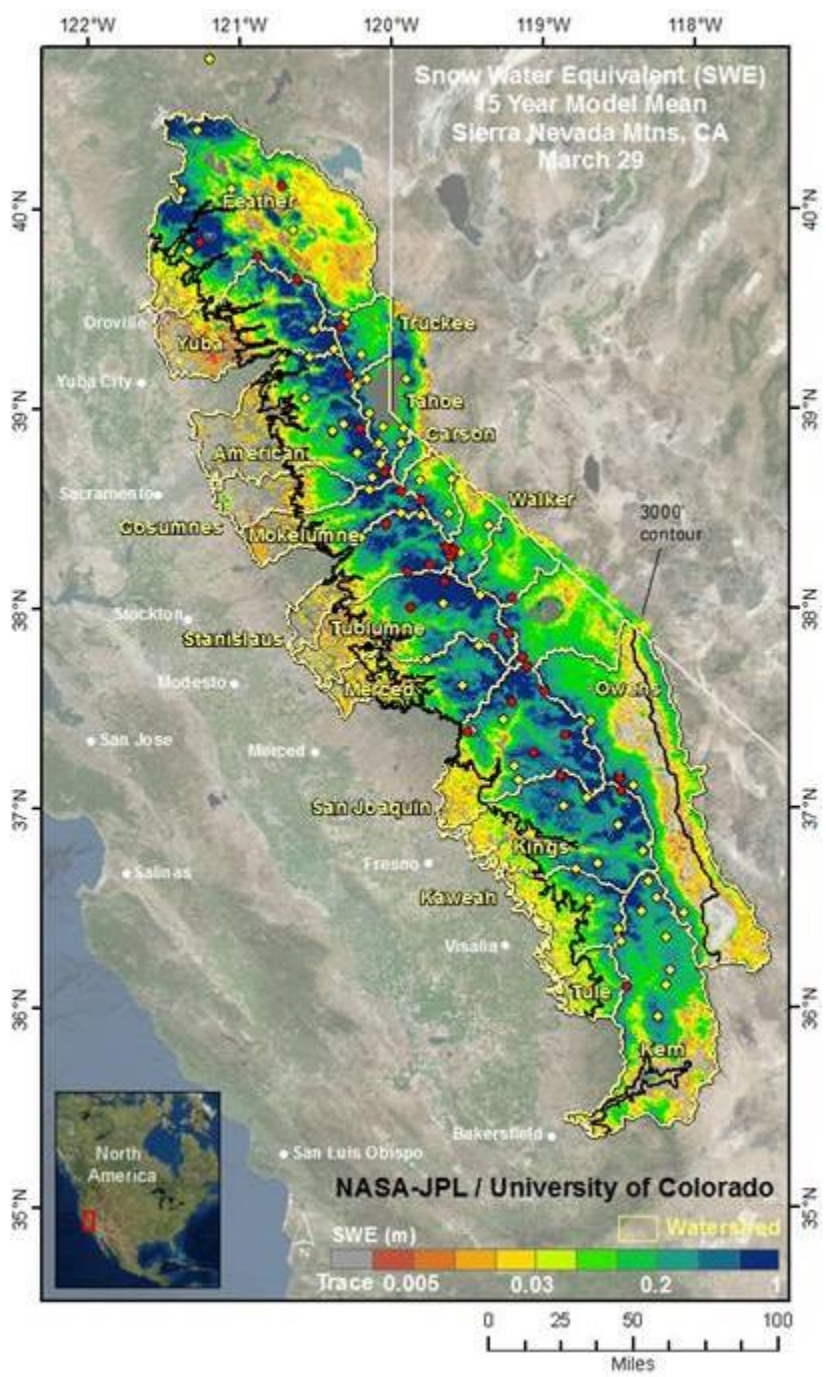
NOTE: Monthly values interpolated to daily and smoothed

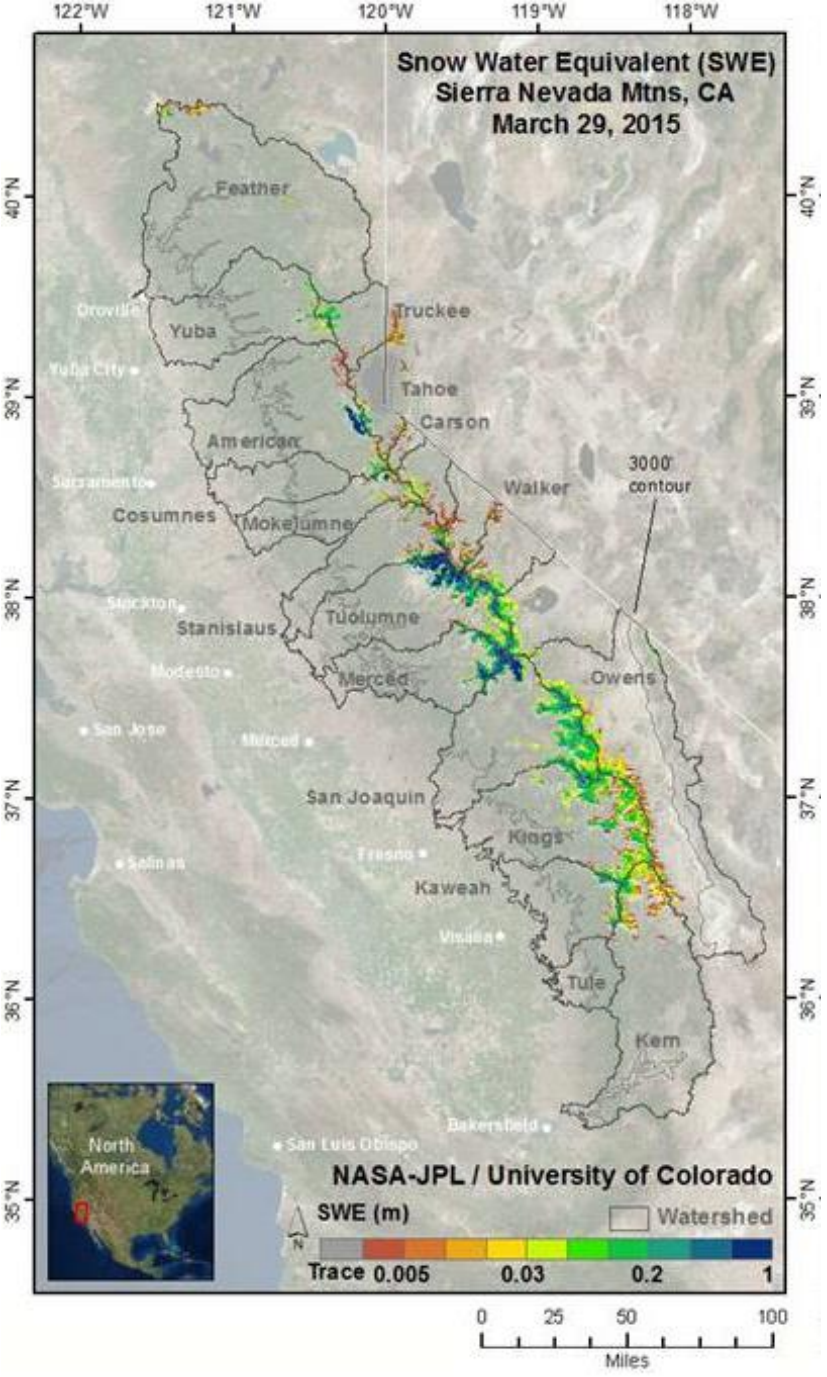

Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
45
40
35
30
25
20
15
10
5
0
2015-16
1982-83
1972-73
1991-92
1957-58
EN Avg
1965-66
Normal
1997-98
Haywood plot created 06:17 EDT May 25, 2016
NOAA's National Centers for Environmental Information
Precipitation (in) to date for TX EAST TEXAS
Oct 1 through May 31. Period of record is 1895-96 through 2015-16
NOTE: Monthly values interpolated to daily and smoothed
strong El Nino periods in blue 1982-83,1972-73,1991-92,1957-58,1965-66,1997-98
1981-2010 Normal underlaid in dark gray
2015-16 period in NOAA dark blue

Sierra Snowpack vs Winter Temperature 1950-2015



Temperature Data from California Climate Tracker, WRCC

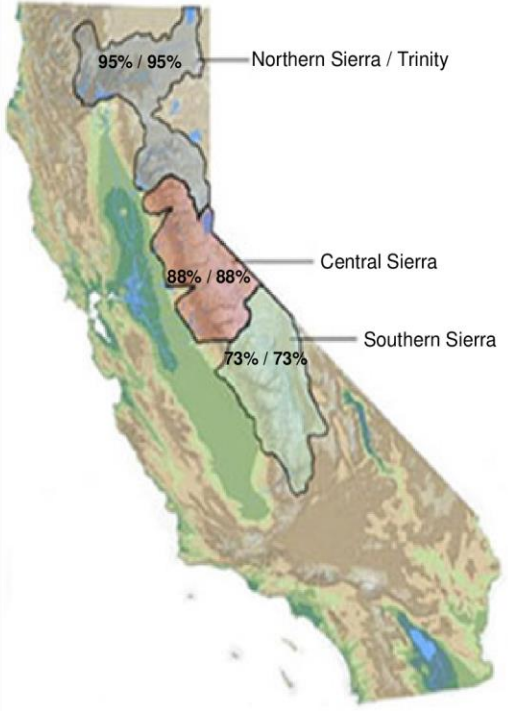

Snow Water Equivalent (SWE)
15 Year Model Mean
Sierra Nevada Mtns, CA
March 29
122°W
121°W
120°W
119°W
118°W
40°N
39°N
38°N
37°N
36°N
35°N
Feather
Oroville
Yuba
Yuba City
Truckee
Tahoe
Carson
American
Sacramento
Walker
Cosumnes
Mokelumne
3000' contour
Stockton
Stanislaus
Tuolumne
Modesto
Merced
Owens
San Jose
San Joaquin
Kings
Fresno
Salinas
Kaweah
Visalia
Tule
Kern
Bakersfield
San Luis Obispo
North America
NASA-JPL / University of Colorado
SWE (m)
Watershed
Trace 0.005 0.03 0.2 1
0 25 50 100
Miles


Snow Water Equivalent (SWE)
Sierra Nevada Mtns, CA
March 29, 2015
122°W
121°W
120°W
119°W
118°W
40°N
39°N
38°N
37°N
36°N
35°N
Feather
Oroville
Yuba
Yuba City
Truckee
Tahoe
Carson
American
Sacramento
Walker
Cosumnes
Mokelumne
3000' contour
Stockton
Stanislaus
Tuolumne
Modesto
Merced
Owens
San Jose
San Joaquin
Kings
Fresno
Salinas
Kaweah
Visalia
Tule
Kern
Bakersfield
San Luis Obispo
North America
NASA-JPL / University of Colorado
SWE (m)
Watershed
Trace 0.005 0.03 0.2 1
0 25 50 100
Miles

Statewide Summary of Snow Water Content

Current Regional Snowpack from Automated Snow Sensors

% of April 1 Average / % of Normal for This Date



NORTH	
Data as of April 1, 2016	
Number of Stations Reporting	28
Average snow water equivalent (Inches)	27.4
Percent of April 1 Average (%)	95
Percent of normal for this date (%)	95

CENTRAL	
Data as of April 1, 2016	
Number of Stations Reporting	39
Average snow water equivalent (Inches)	25.1
Percent of April 1 Average (%)	88
Percent of normal for this date (%)	88

SOUTH	
Data as of April 1, 2016	
Number of Stations Reporting	27
Average snow water equivalent (Inches)	19.4
Percent of April 1 Average (%)	73
Percent of normal for this date (%)	73

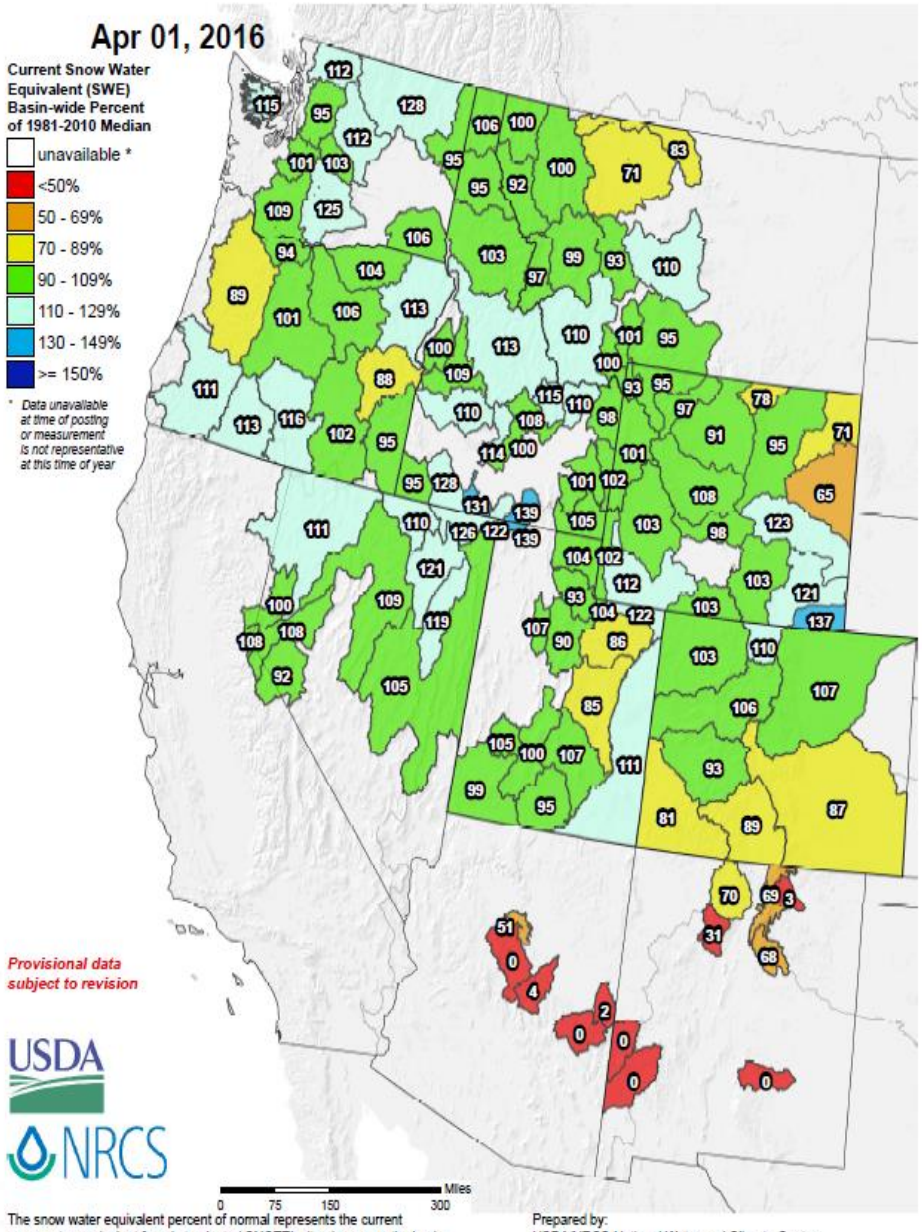
STATE	
Data as of April 1, 2016	
Number of Stations Reporting	94
Average snow water equivalent (Inches)	24.2
Percent of April 1 Average (%)	86
Percent of normal for this date (%)	86

Statewide Average: 86% / 86%

Data as of April 1, 2016

Updated 04/01/2016 08:45 AM

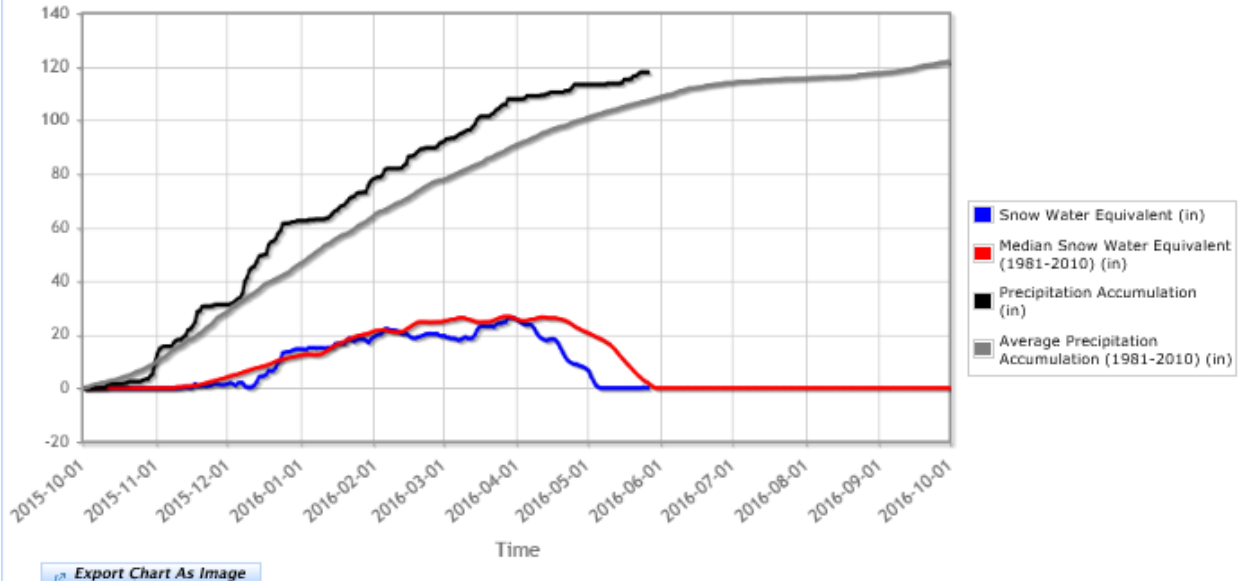
Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal



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).

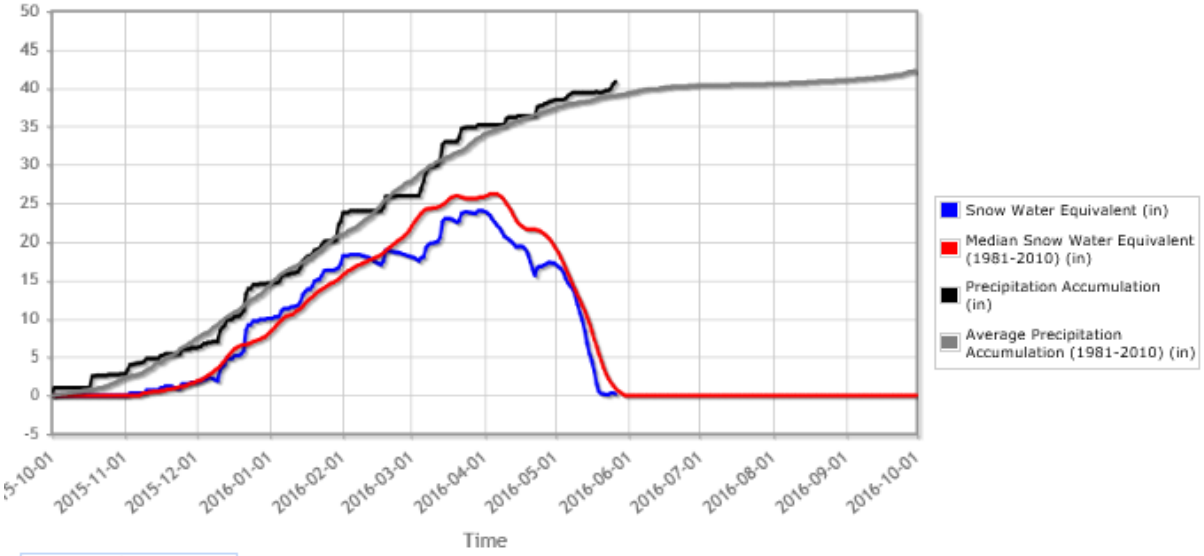
Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

Blazed Alder (351) Oregon SNOTEL Site - 3650 ft

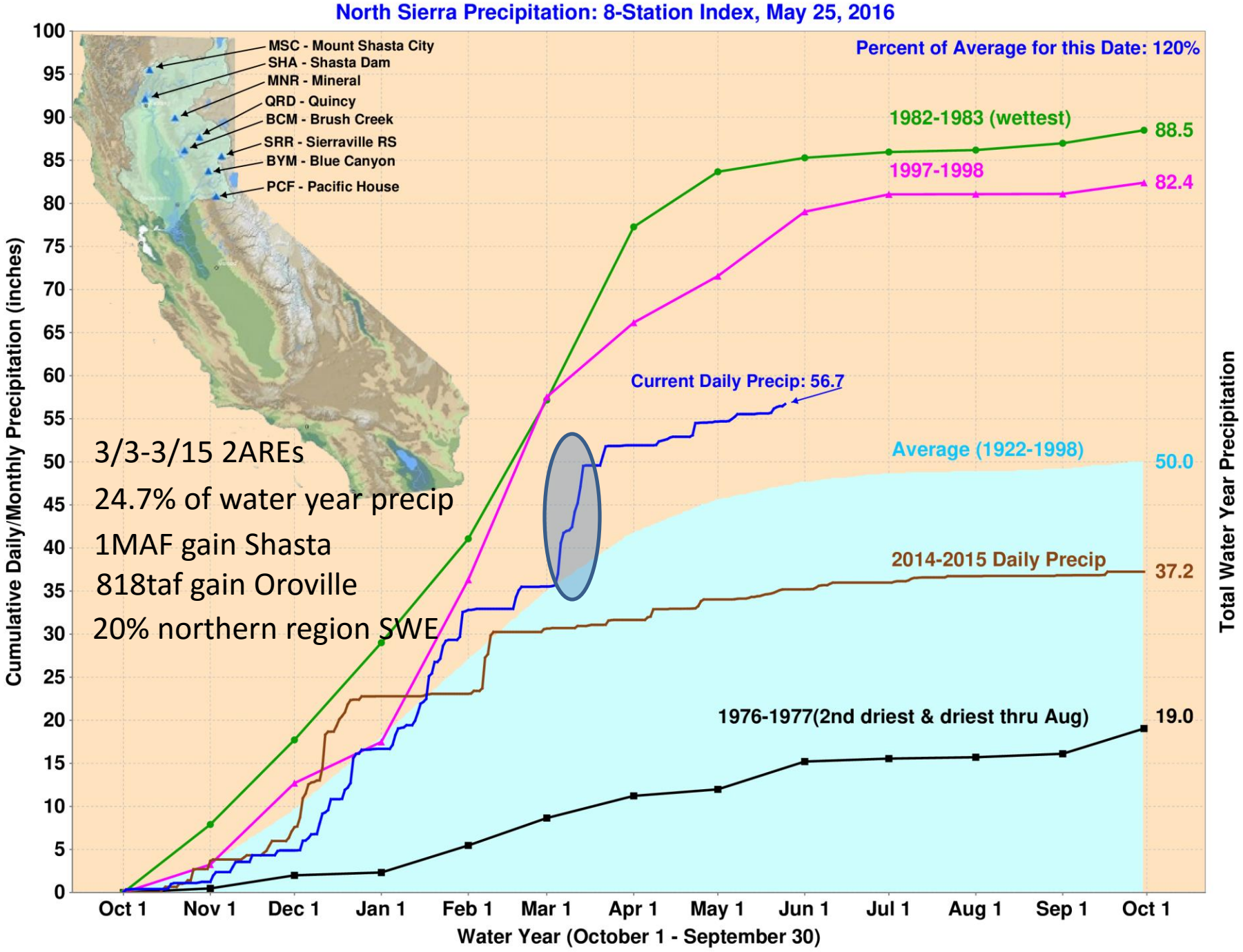


Export Chart As Image

Rubicon #2 (724) California SNOTEL Site - 7689 ft



Export Chart As Image

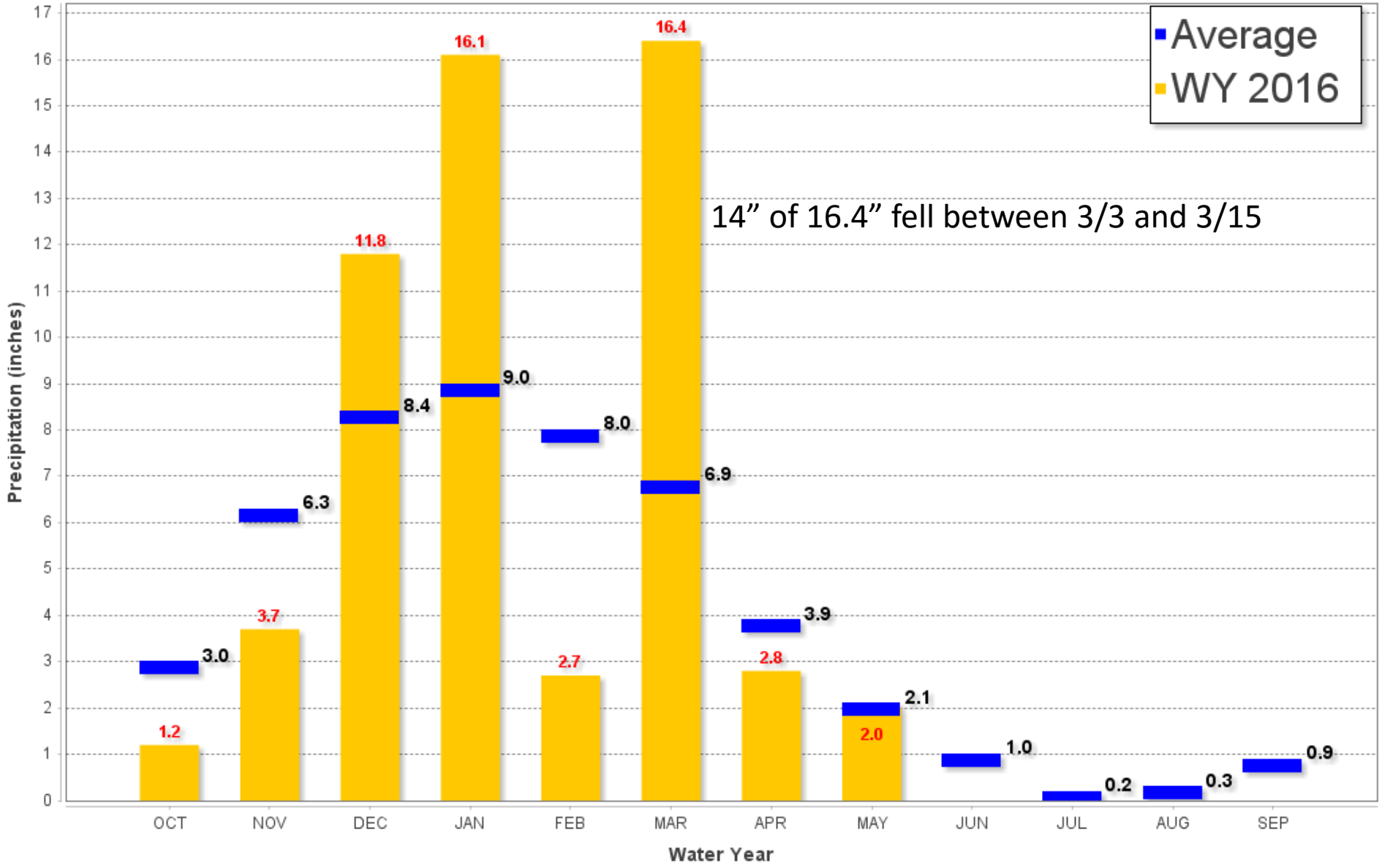

North Sierra Precipitation: 8-Station Index, May 25, 2016
MSC - Mount Shasta City
SHA - Shasta Dam
MNR - Mineral
QRD - Quincy
BCM - Brush Creek
SRR - Sierraville RS
BYM - Blue Canyon
PCF - Pacific House
Percent of Average for this Date: 120%
1982-1983 (wettest)
88.5
1997-1998
82.4
Current Daily Precip: 56.7
Average (1922-1998)
50.0
2014-2015 Daily Precip
37.2
1976-1977(2nd driest & driest thru Aug)
19.0
3/3-3/15 2AREs
24.7% of water year precip
1MAF gain Shasta
818taf gain Oroville
20% northern region SWE
Cumulative Daily/Monthly Precipitation (inches)
Total Water Year Precipitation
Water Year (October 1 - September 30)
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
May 1
Jun 1
Jul 1
Aug 1
Sep 1
Oct 1

Northern Sierra 8-Station

Precipitation Index for Water Year 2016 - Updated on May 25, 2016 08:45 AM

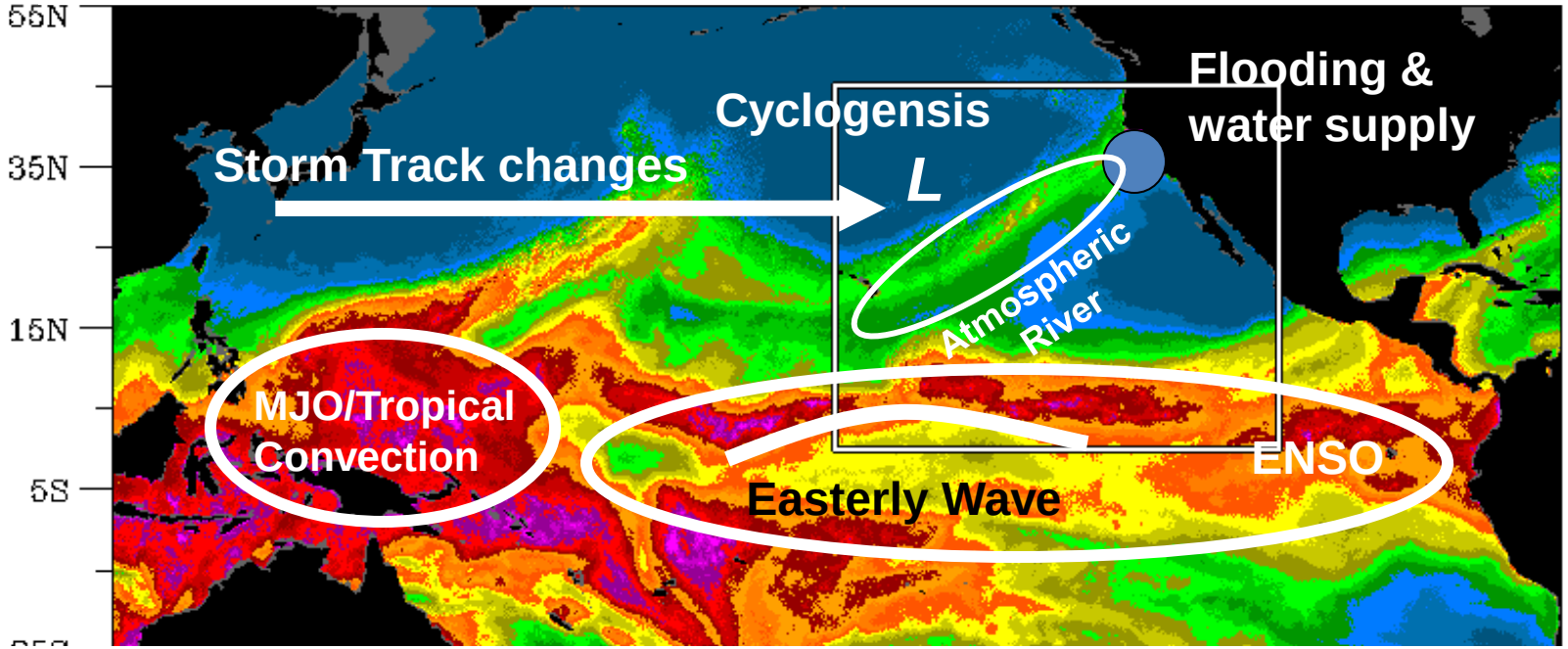
Note: Monthly totals may not add up to seasonal total because of rounding

Water Year Monthly totals are calculated based on Daily precipitation data from 12am to 12am PST



Key Phenomena Affecting California Water Supply/Flooding:

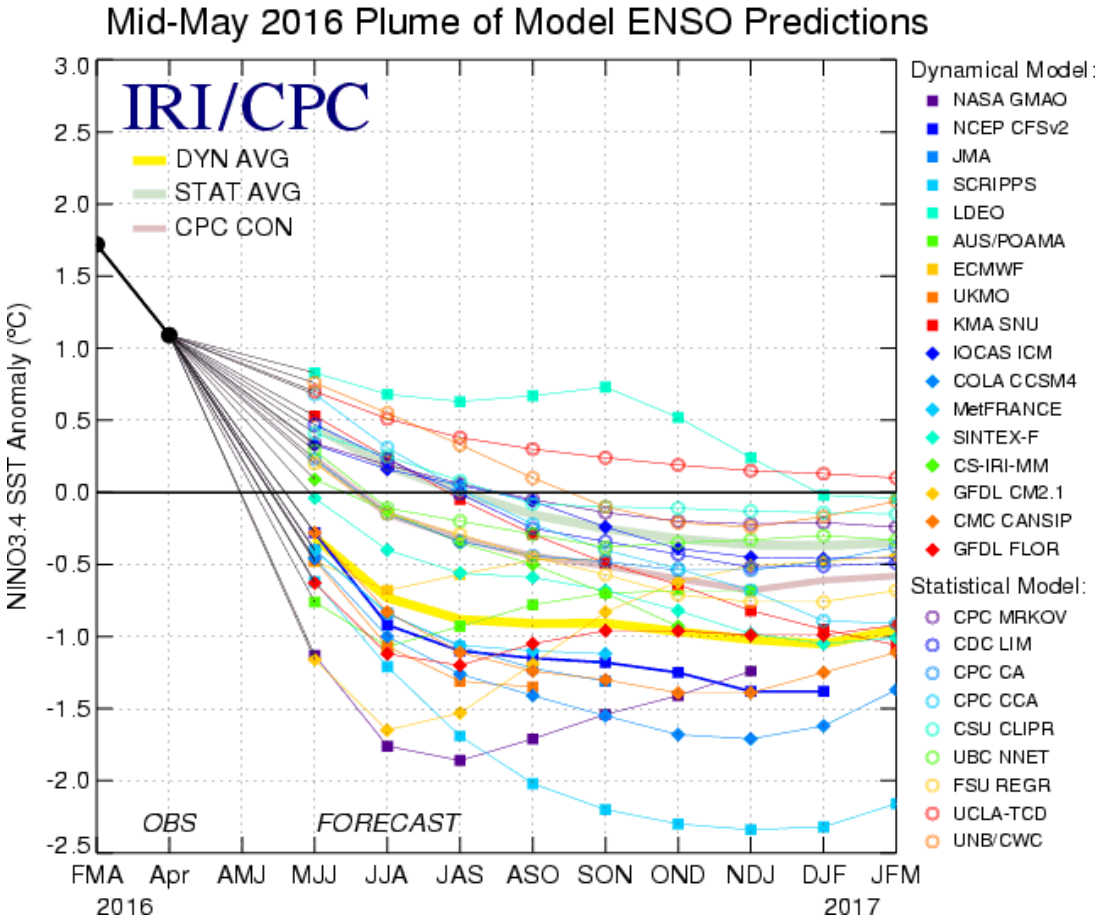
Polar Processes



The size, number, and strength of atmospheric river events (ARs) result from the alignment of key processes operating on different space and time scales

Slide adapted from M. Ralph, CW3E

What's Next? LaNiña!



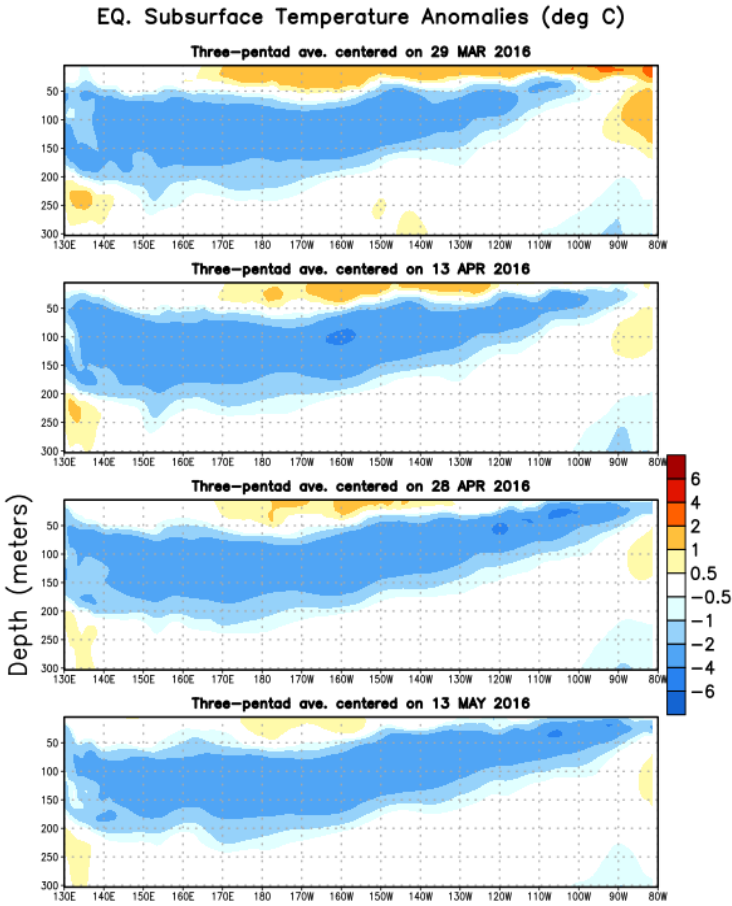
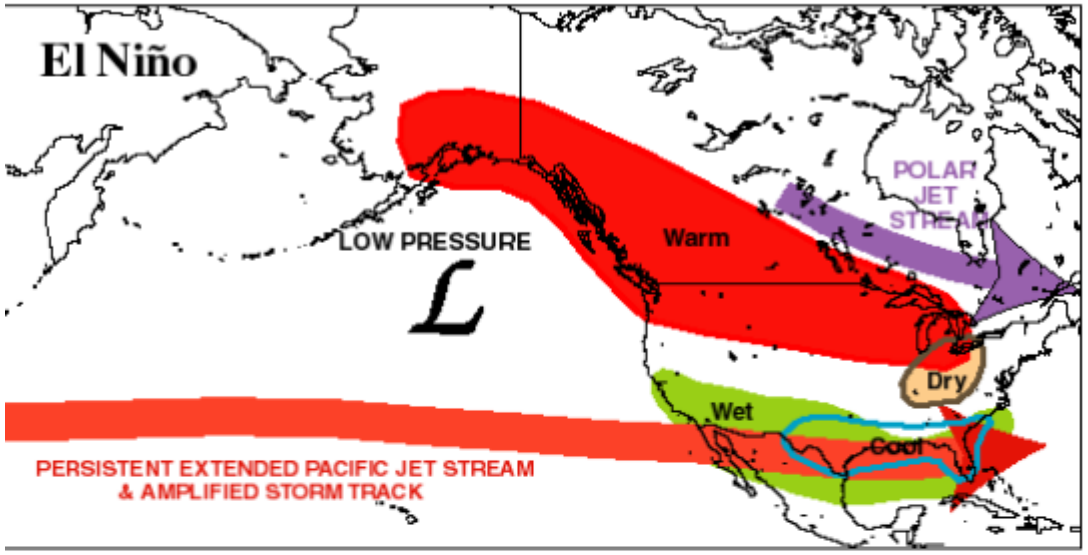
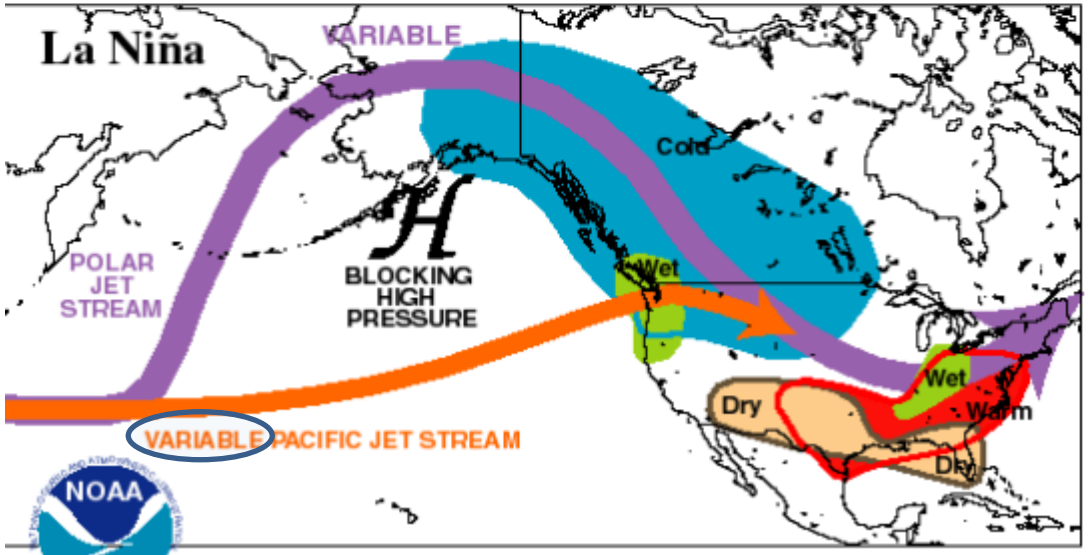


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 17 May 2016).

From CPC ENSO Diagnostic Discussion 5/25/2016

TYPICAL JANUARY-MARCH WEATHER ANOMALIES AND ATMOSPHERIC CIRCULATION DURING MODERATE TO STRONG EL NIÑO & LA NIÑA





Climate Prediction Center/NCEP/NWS

Summarizing Thoughts

- El Nino influenced the wintertime atmospheric circulation as expected for the most part (February/March anomaly)
- CA sea levels were higher but didn't coincide with a major storm event
- Precipitation and Temperature outcomes variable from expectations
- Snowpack not as large or long-lasting as hoped

Email: Michael.L.Anderson@water.ca.gov