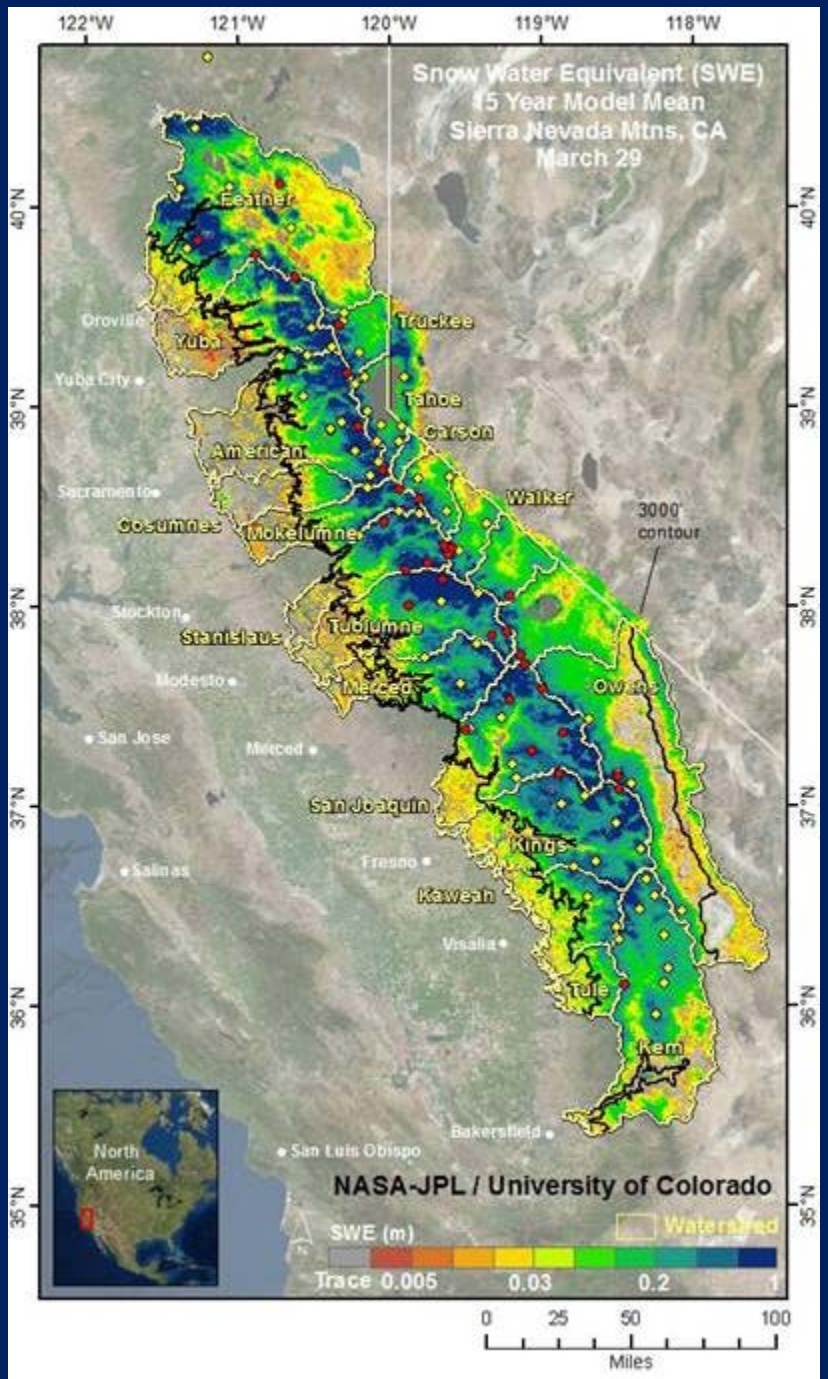
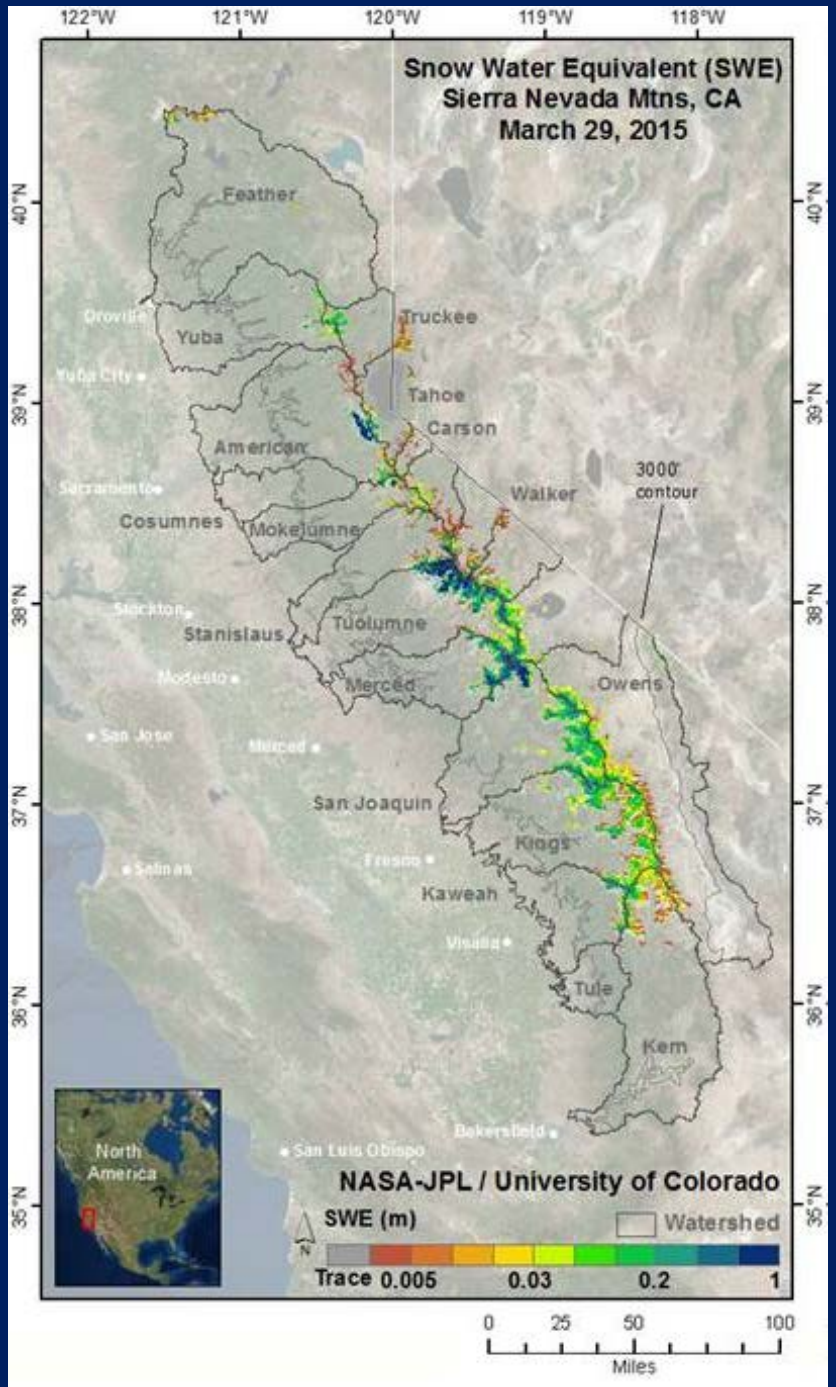
California Hydroclimate Outlook WY 2017

Talk Overview

- Antecedent Conditions
- WY 2016 in Review
- WY 2017 Outlook


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
Merced
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
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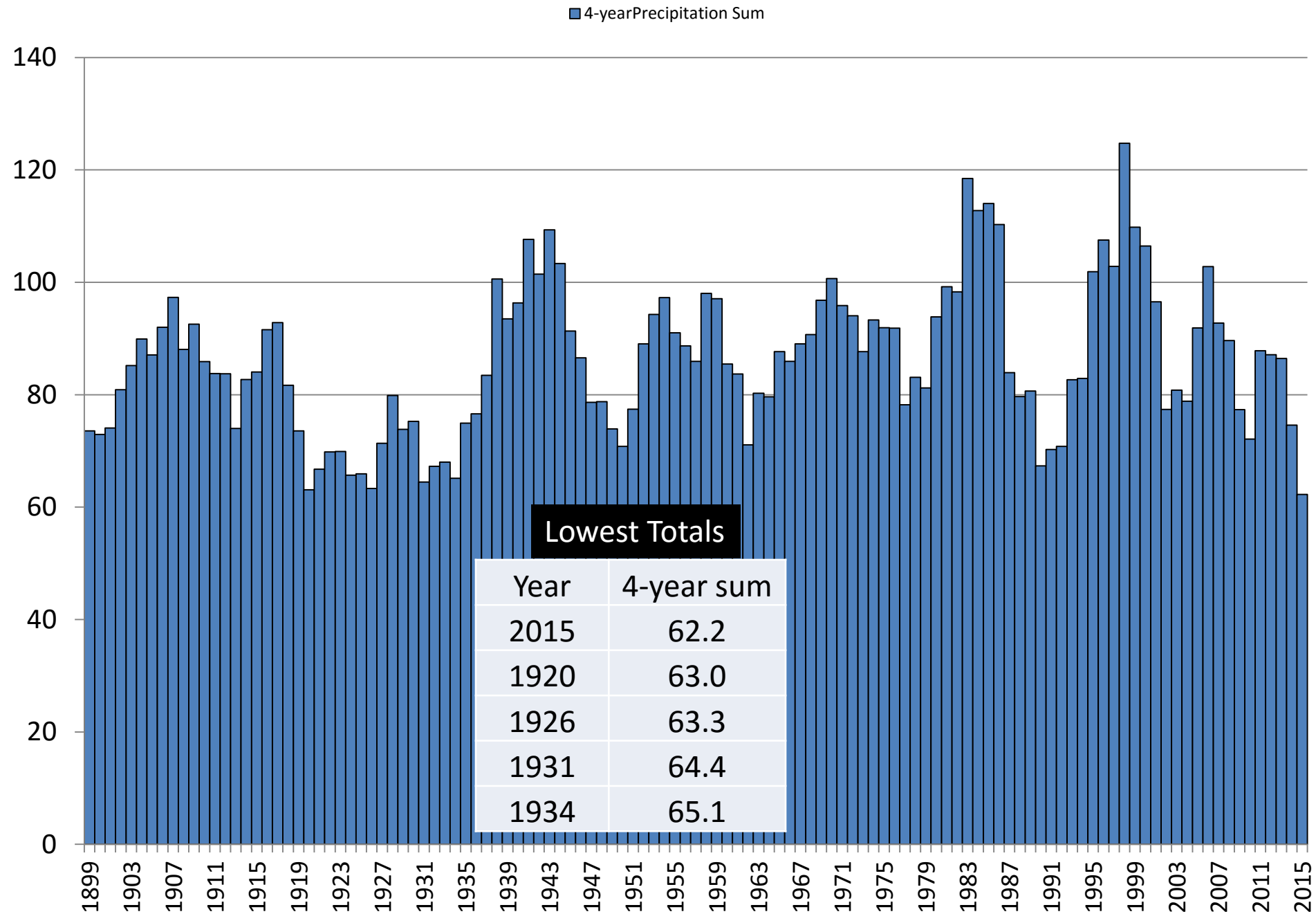
SWE (m)
Watershed
Trace
0.005
0.03
0.2
1
0
25
50
100
Miles

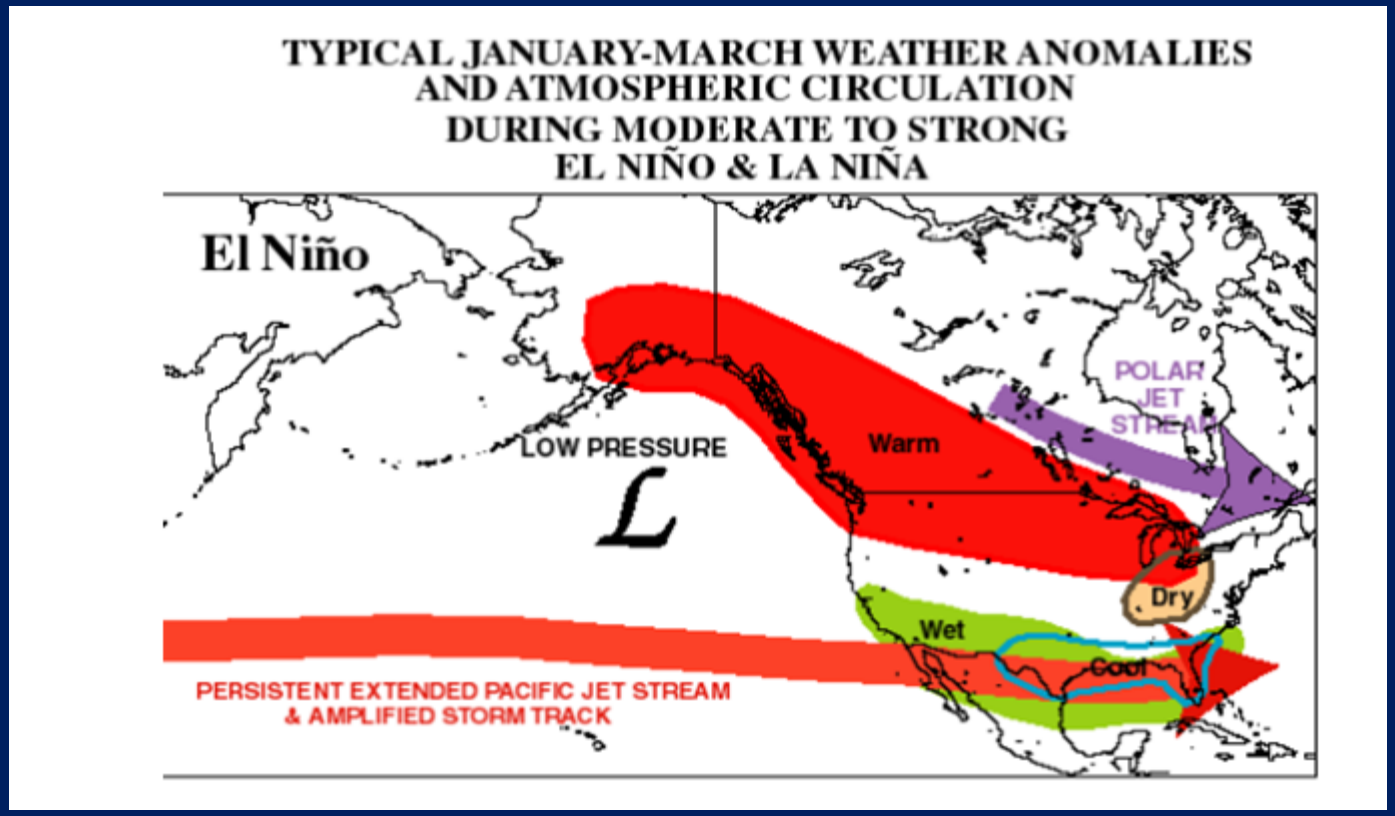
California Statewide 4-yearPrecipitation Sum



Lowest Totals

Year	4-year sum
2015	62.2
1920	63.0
1926	63.3
1931	64.4
1934	65.1

Expectations of a Strong El Niño

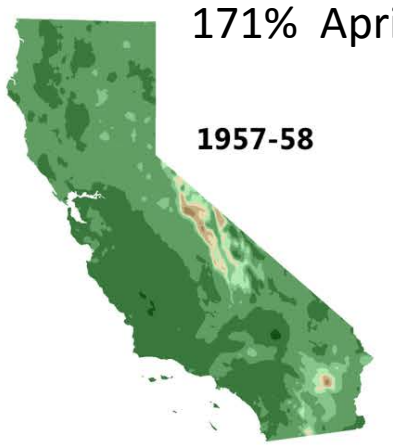


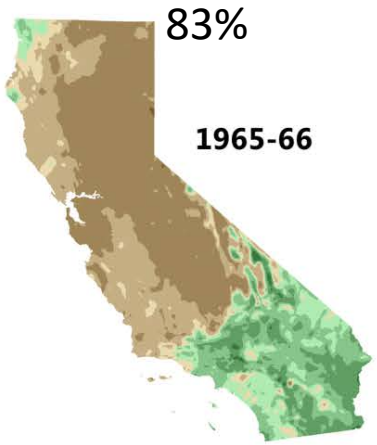
Graphic from NOAA Climate Prediction Center

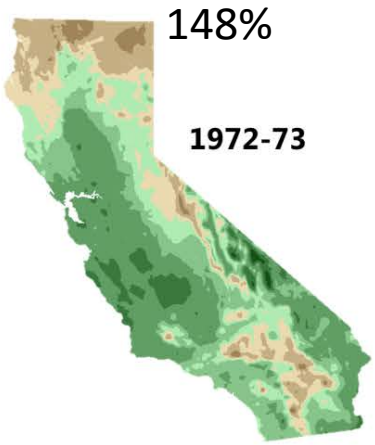
Expectations:

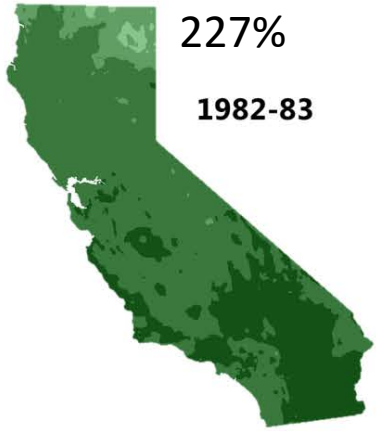
- High Sea Levels with Coastal Storm Damage
- Heavy rains and flooding in Southern California maybe extending into northern CA
- Warmer than Average Temperatures
- Improvement or Elimination of Drought in California

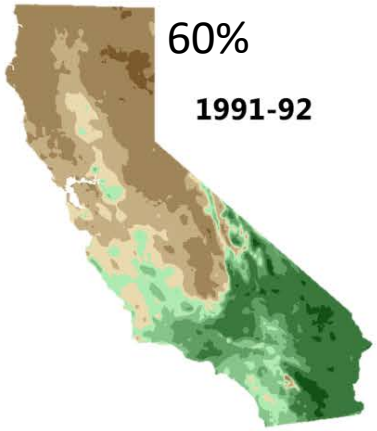
Historical Strong El Niño Outcomes For California

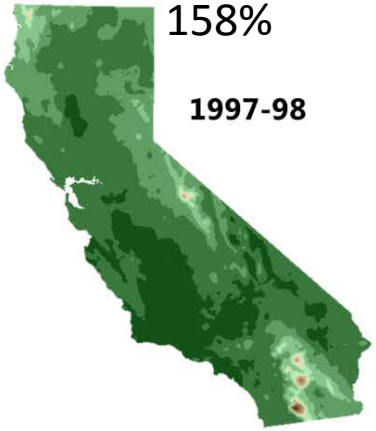


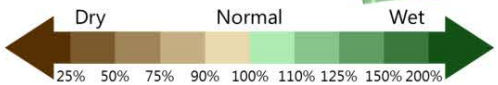






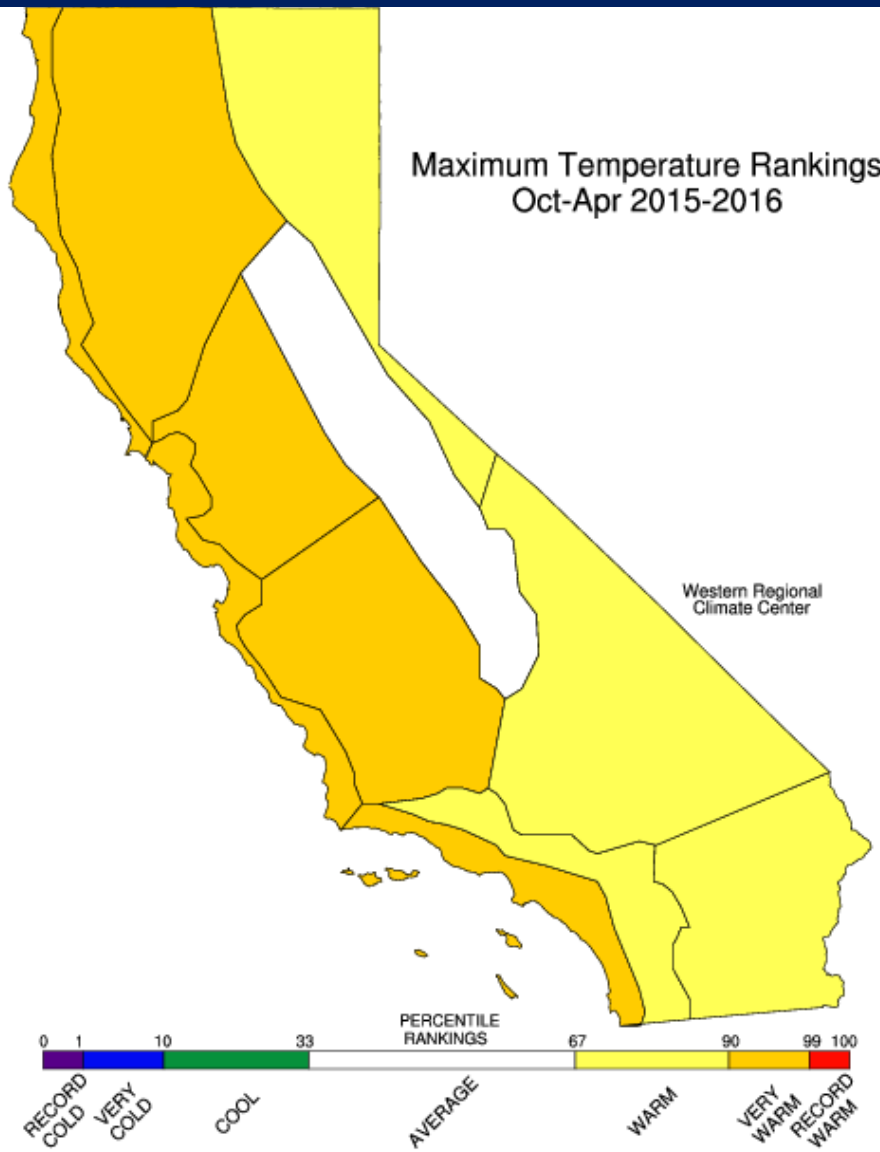


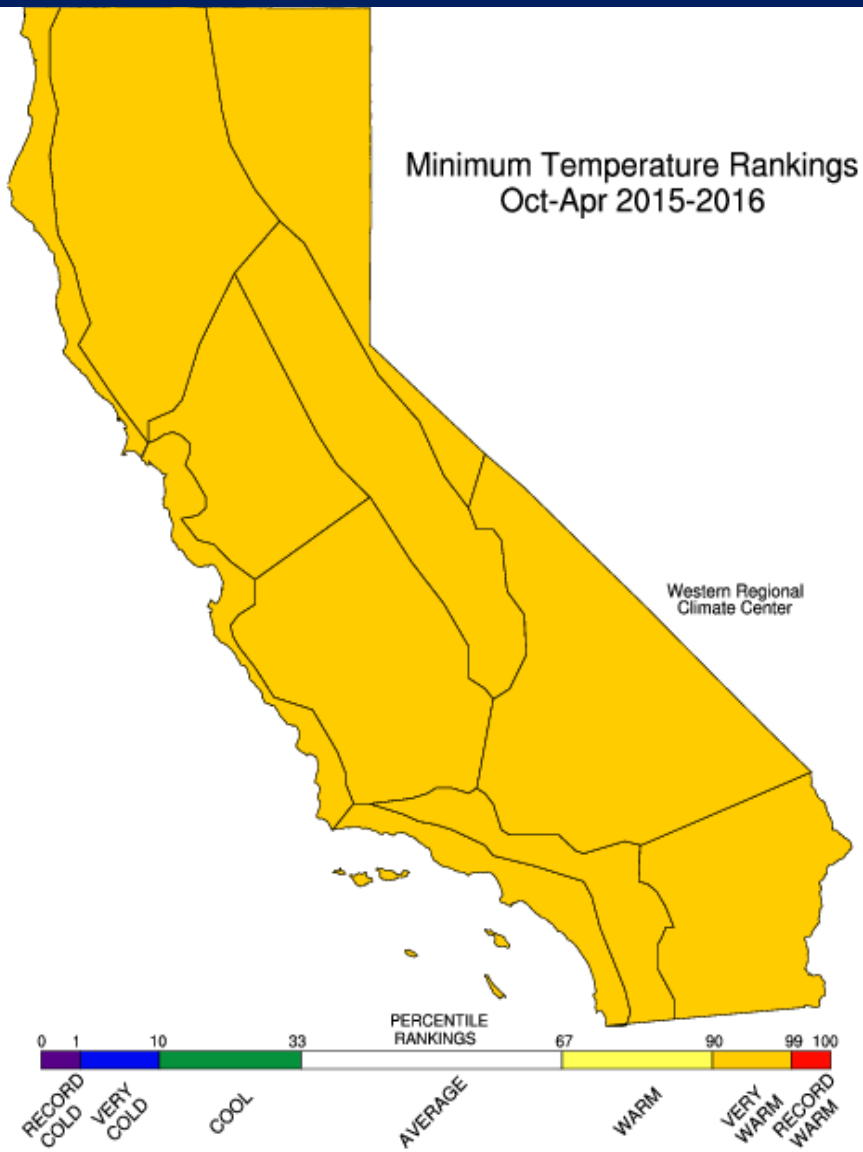




PRISM, Oregon State University

From NWS Sacramento


Maximum Temperature Rankings
Oct-Apr 2015-2016
Western Regional
Climate Center
PERCENTILE
RANKINGS
0
1
10
33
67
90
99
100
RECORD
COLD
VERY
COLD
COOL
AVERAGE
WARM
VERY
WARM
RECORD
WARM


Minimum Temperature Rankings
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PERCENTILE
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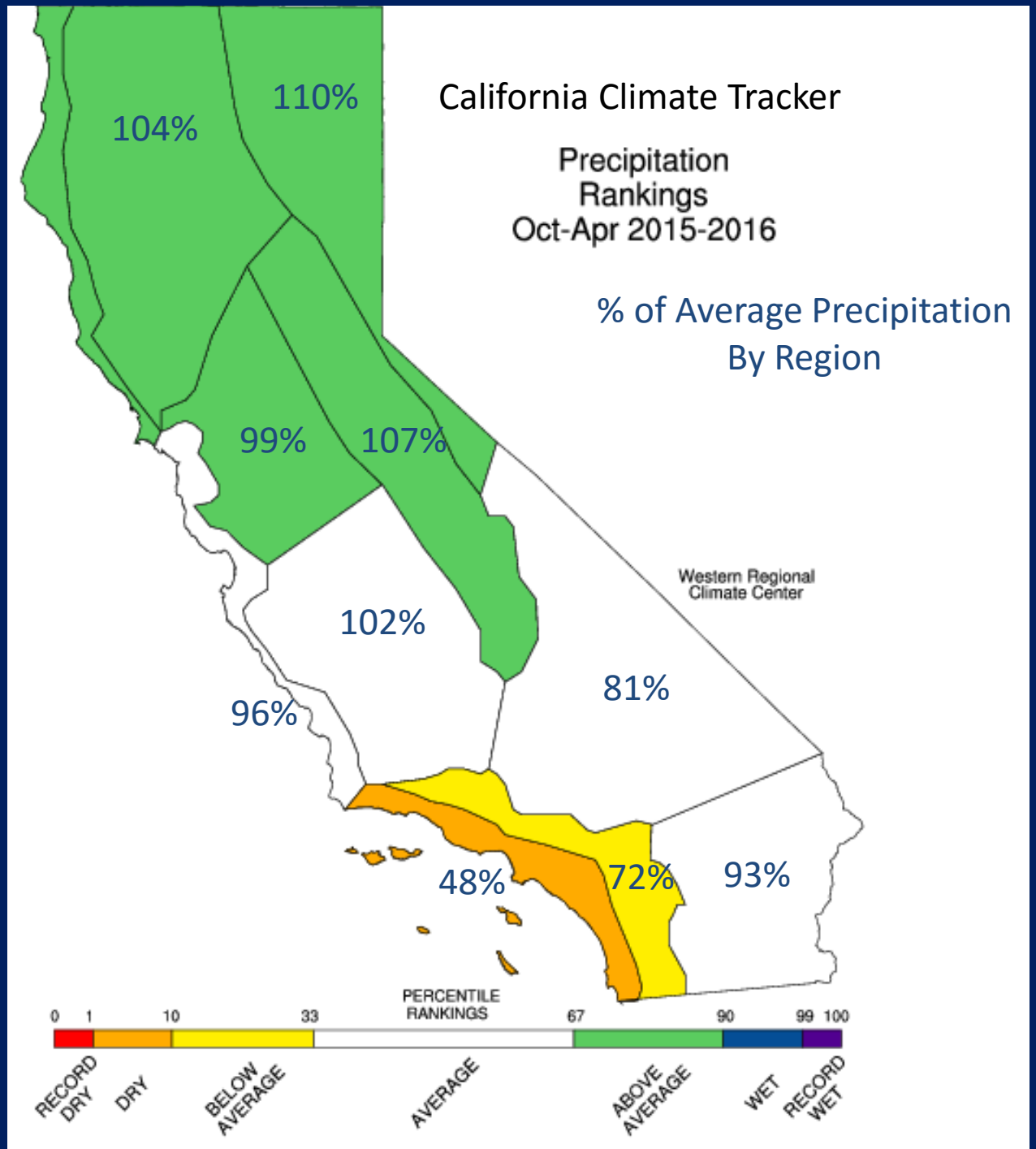
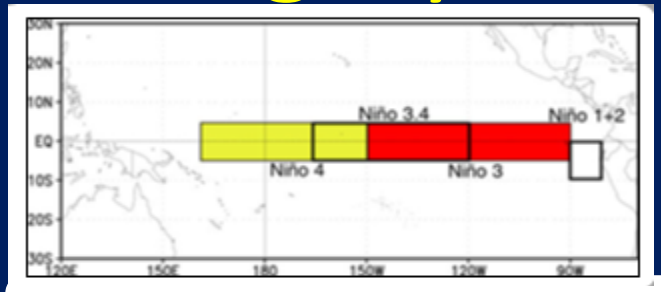
0
1
10
33
67
90
99
100
RECORD
COLD
VERY
COLD
COOL
AVERAGE
WARM
VERY
WARM
RECORD
WARM

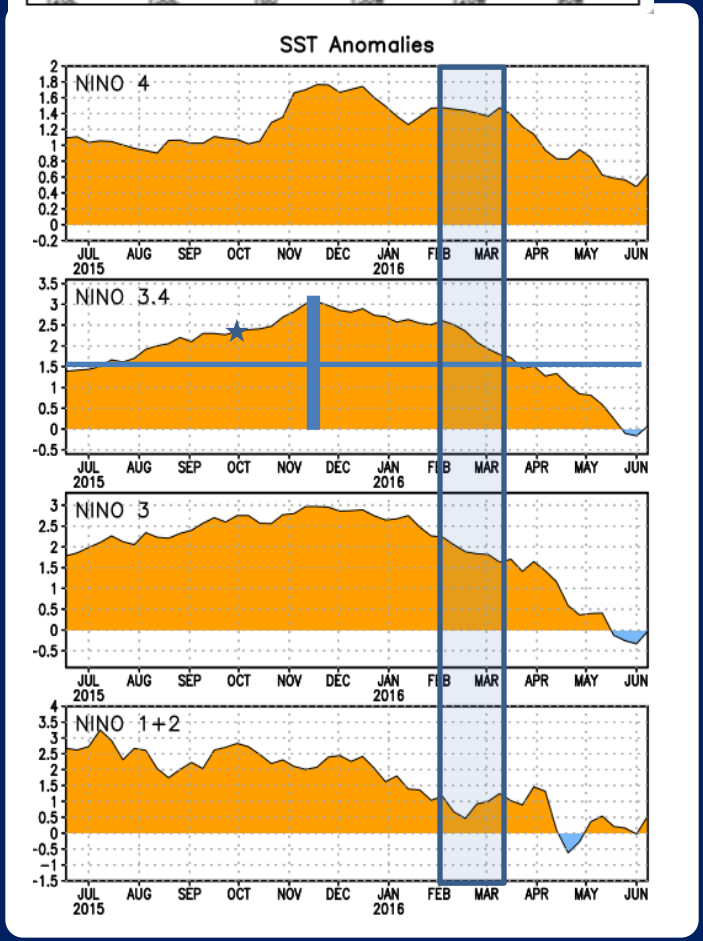
119%

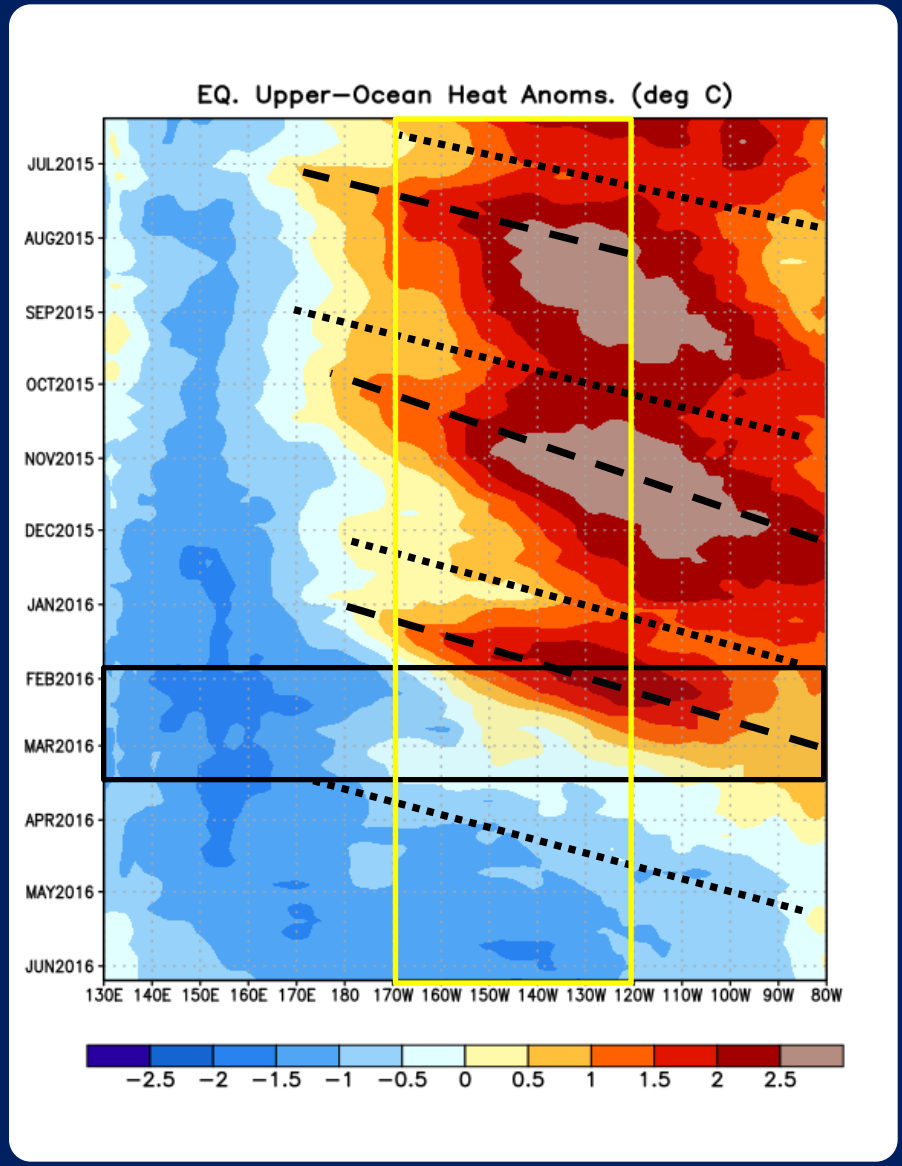
Statewide: 100%



The Mighty El Niño of 2015-2016

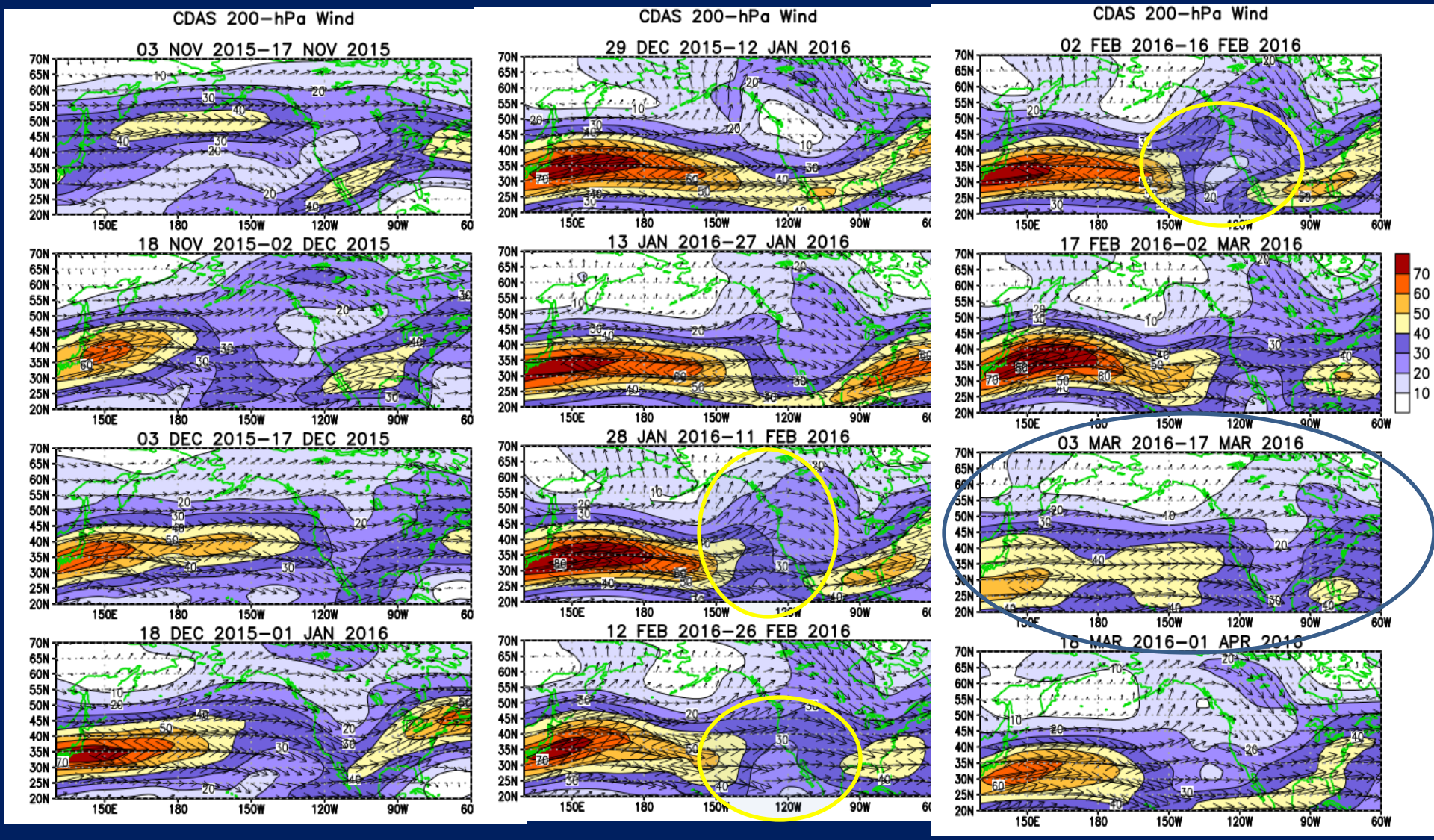




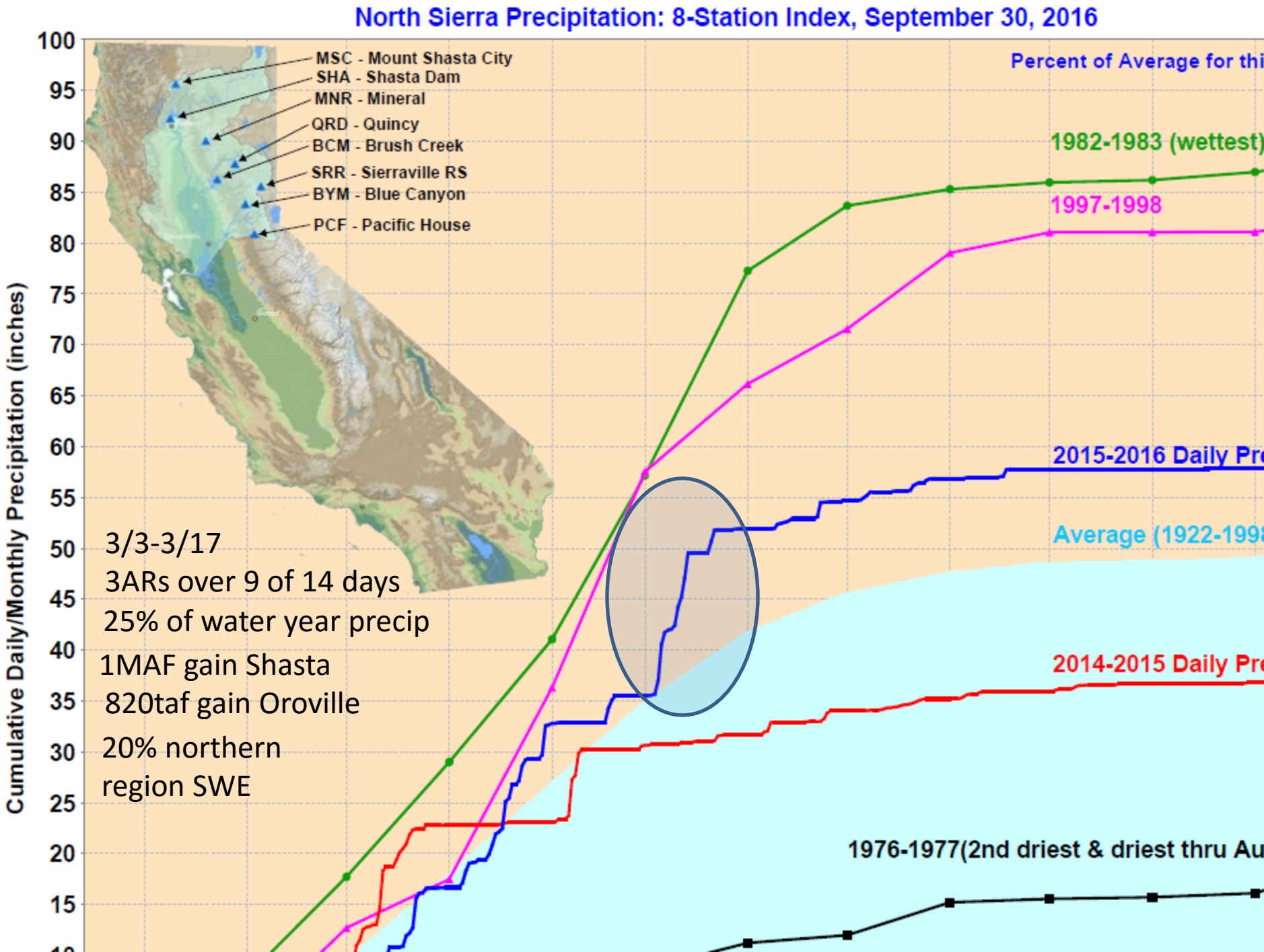


From CPC ENSO Diagnostic Discussion

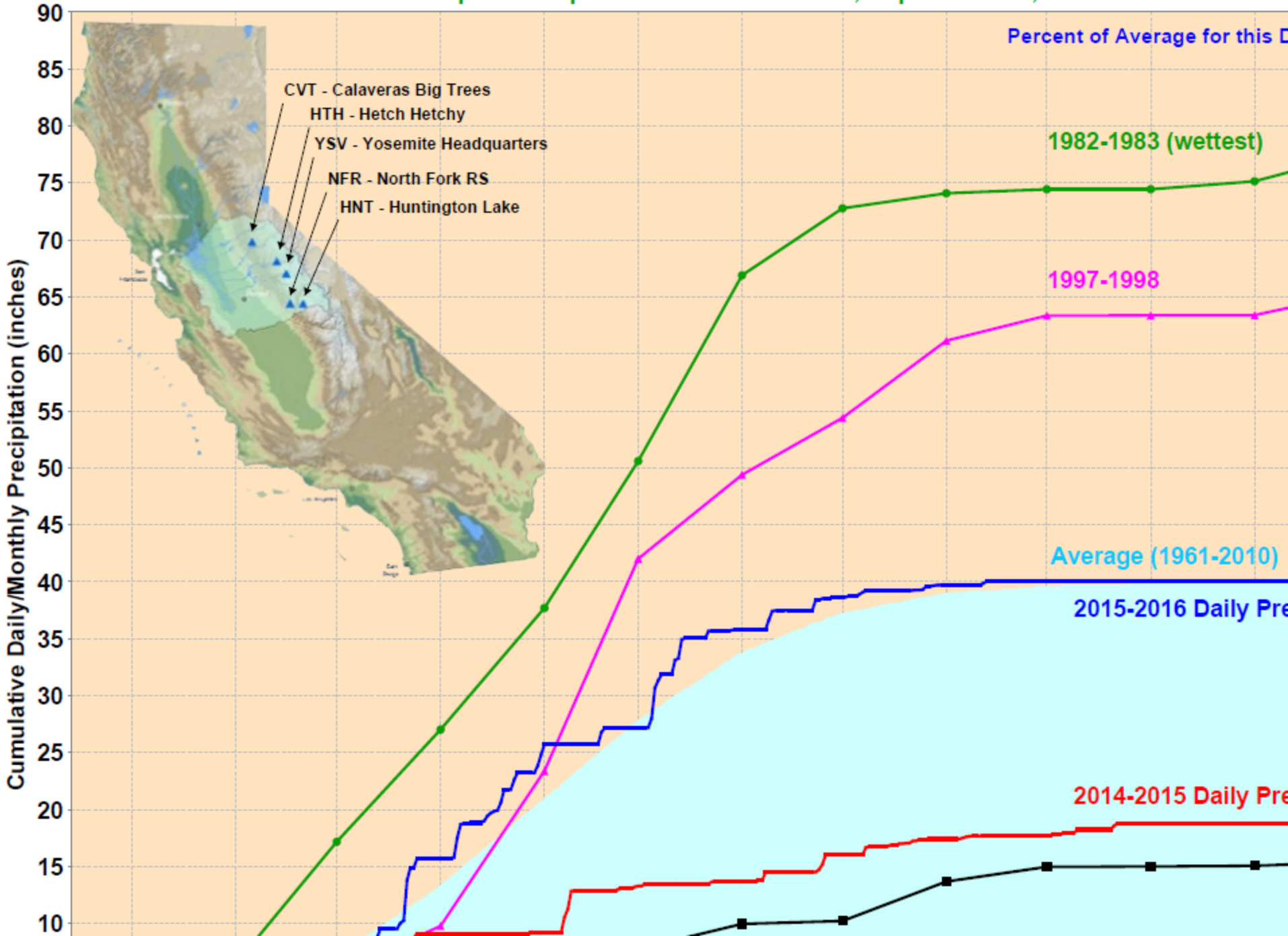
El Niño and the Jet Stream



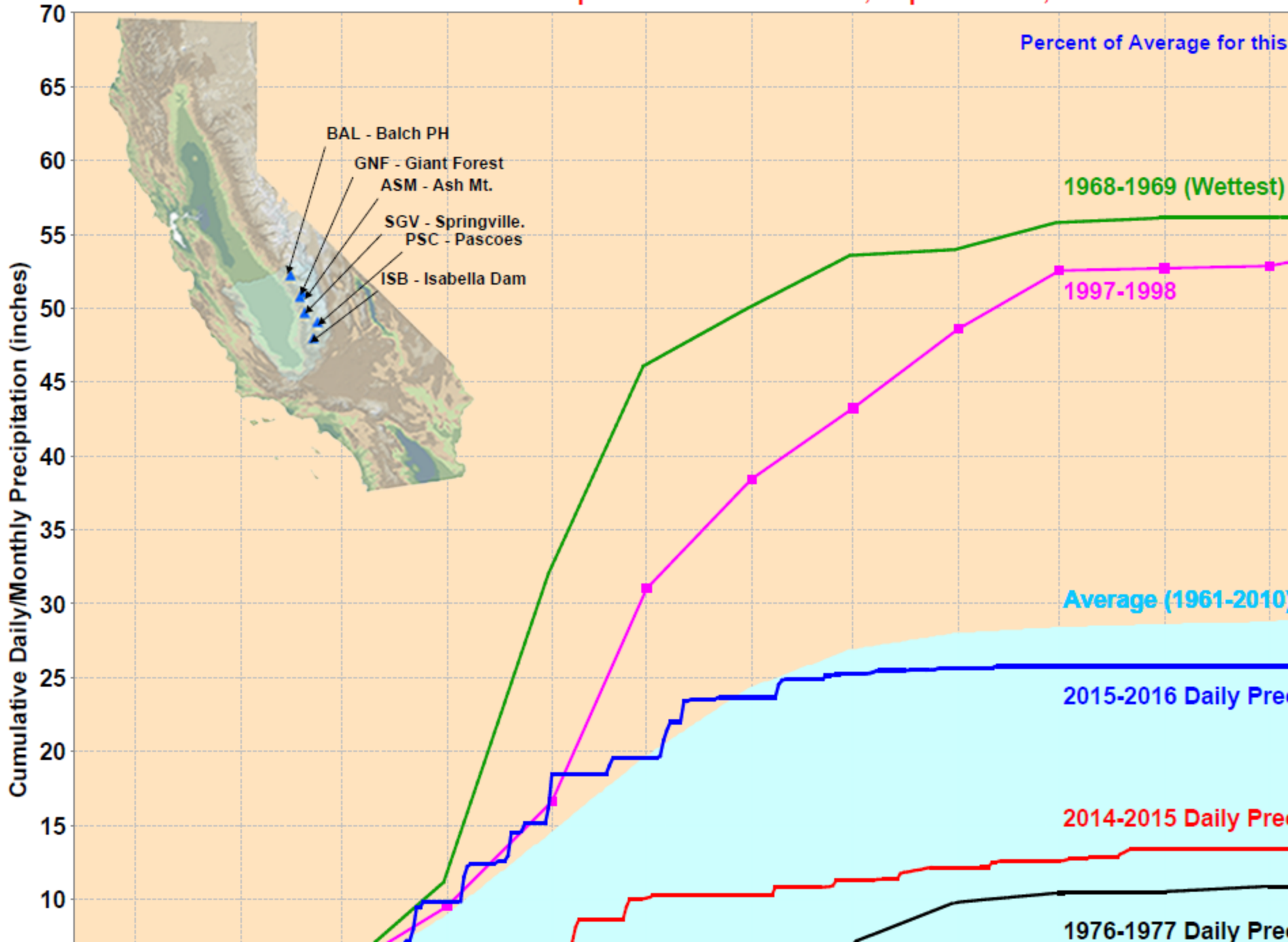
From CPC ENSO Diagnostic Discussion


North Sierra Precipitation: 8-Station Index, September 30, 2016
Cumulative Daily/Monthly Precipitation (inches)
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
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 thi
1982-1983 (wettest)
1997-1998
2015-2016 Daily Pre
Average (1922-1998
2014-2015 Daily Pre
1976-1977(2nd driest & driest thru Au
3/3-3/17
3ARs over 9 of 14 days
25% of water year precip
1MAF gain Shasta
820taf gain Oroville
20% northern
region SWE

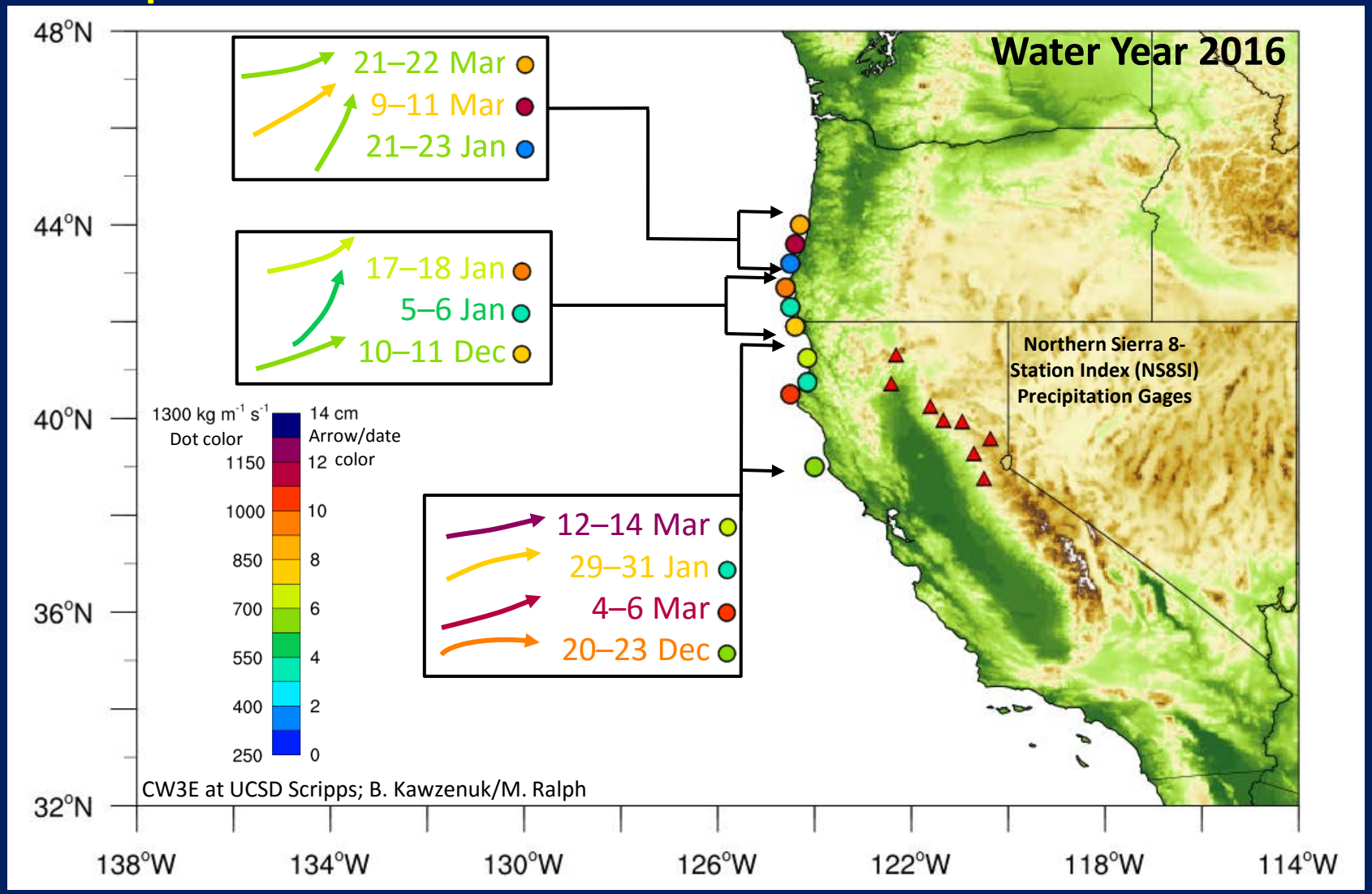
San Joaquin Precipitation: 5-Station Index, September 30, 2016

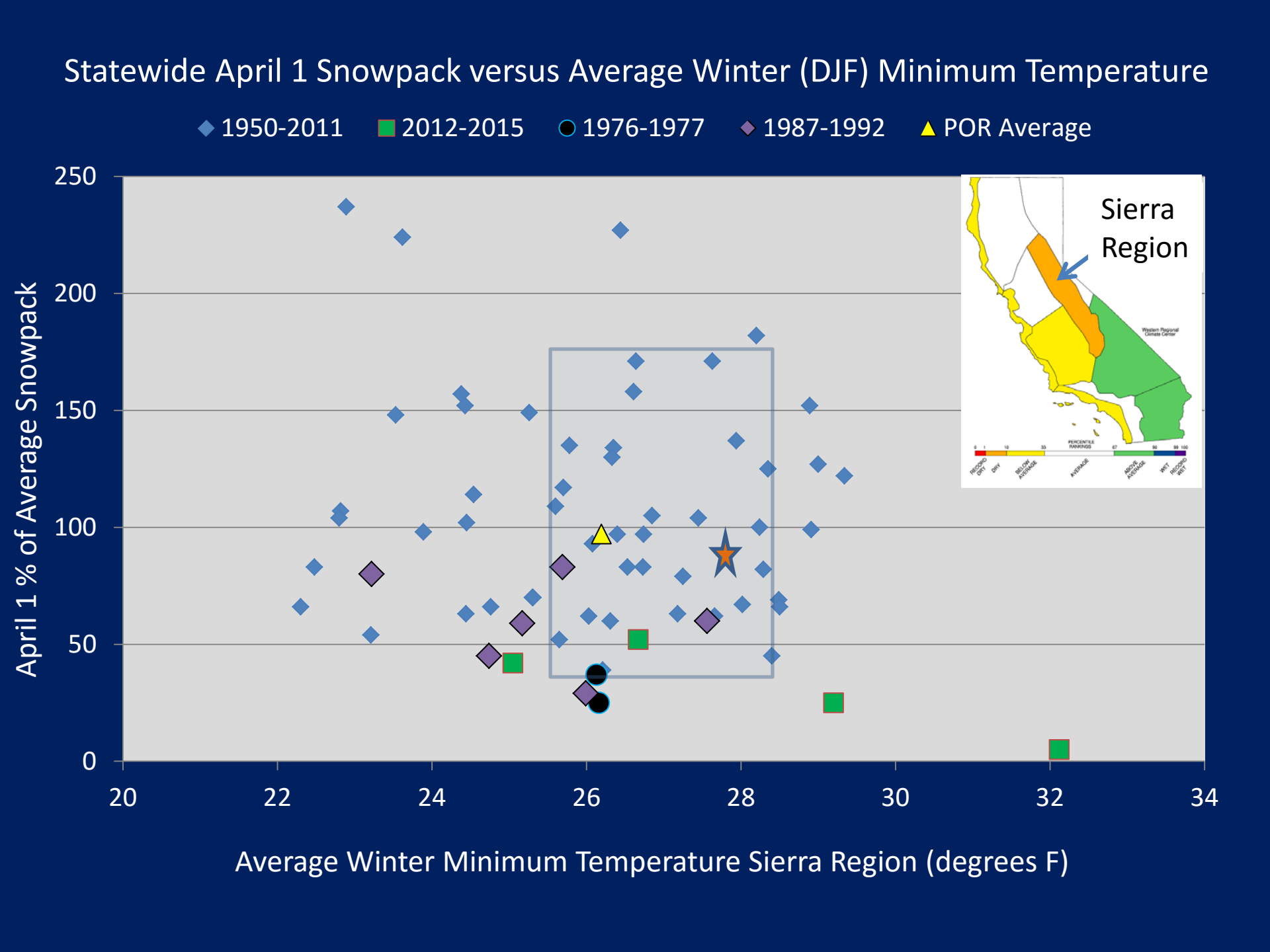


Tulare Basin Precipitation: 6-Station Index, September 30, 2016



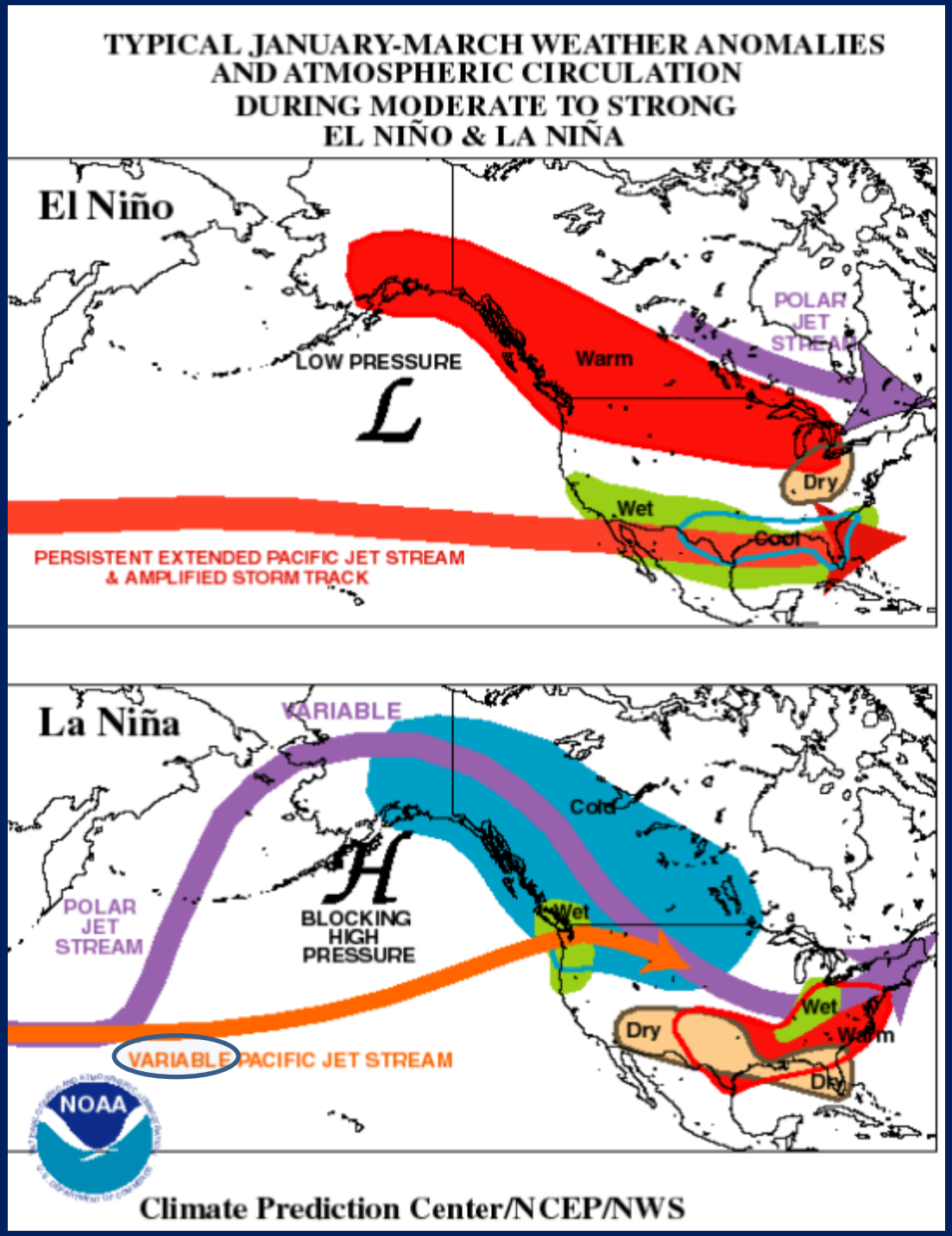
Top 10 ARs for the 8-station index WY 2016




Statewide April 1 Snowpack versus Average Winter (DJF) Minimum Temperature
1950-2011
2012-2015
1976-1977
1987-1992
POR Average
April 1 % of Average Snowpack
250
200
150
100
50
0
20
22
24
26
28
30
32
34
Average Winter Minimum Temperature Sierra Region (degrees F)
Sierra Region

What's Next?

La Niña?



La Nina and the
8-Station Index
Max: 78.5"
Min: 28.3"
Average: 51.1"
10 of 19 years
above average

La Nina and the
5-Station Index
Max: 65.4"
Min: 23.6"
Average: 38"
8 of 19 years
above average

IRI/CPC Pacific Niño 3.4 SST Model Outlook

Most multi-model averages indicate borderline ENSO-neutral/ La Niña conditions during the Northern Hemisphere fall and winter 2016-17.

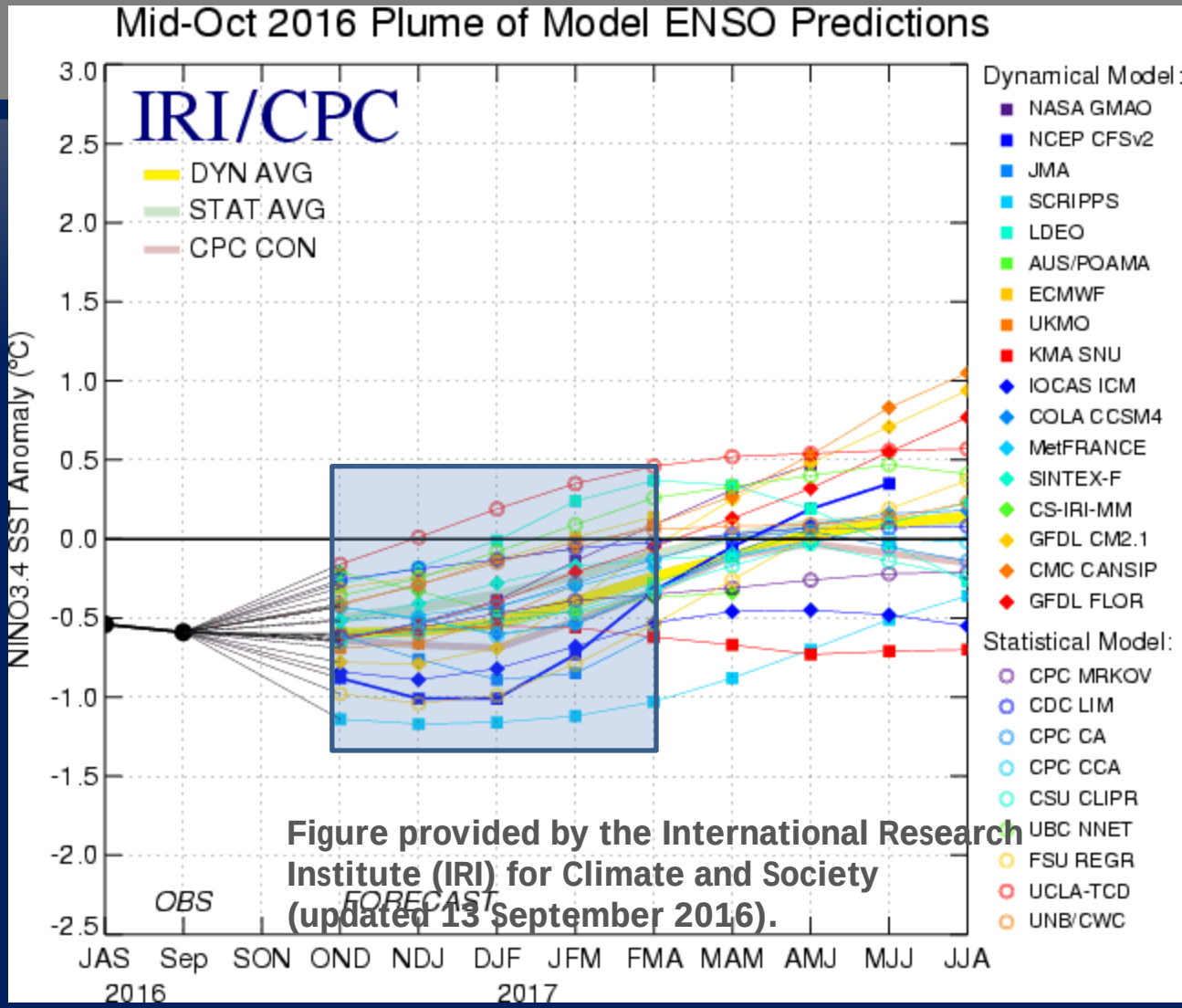
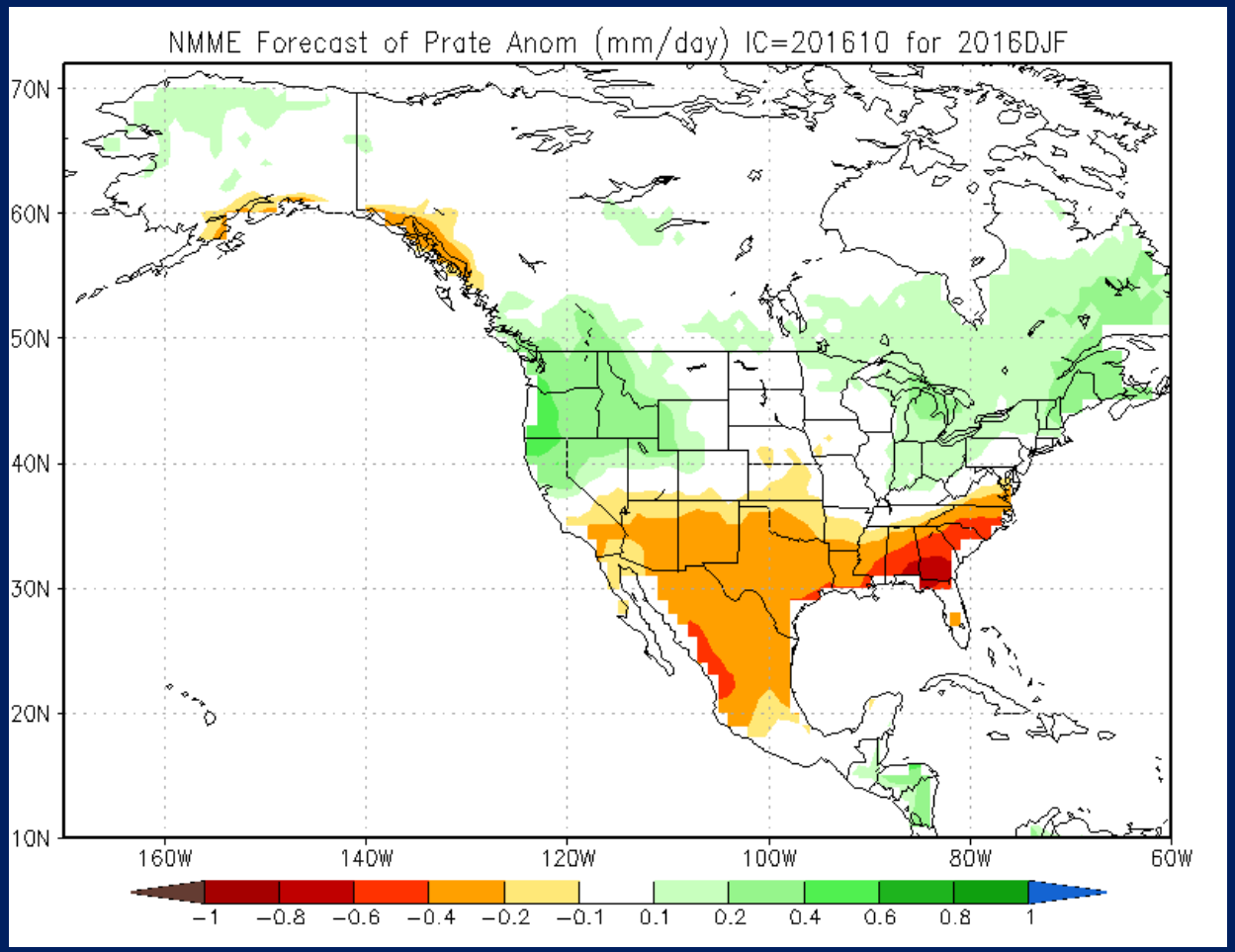


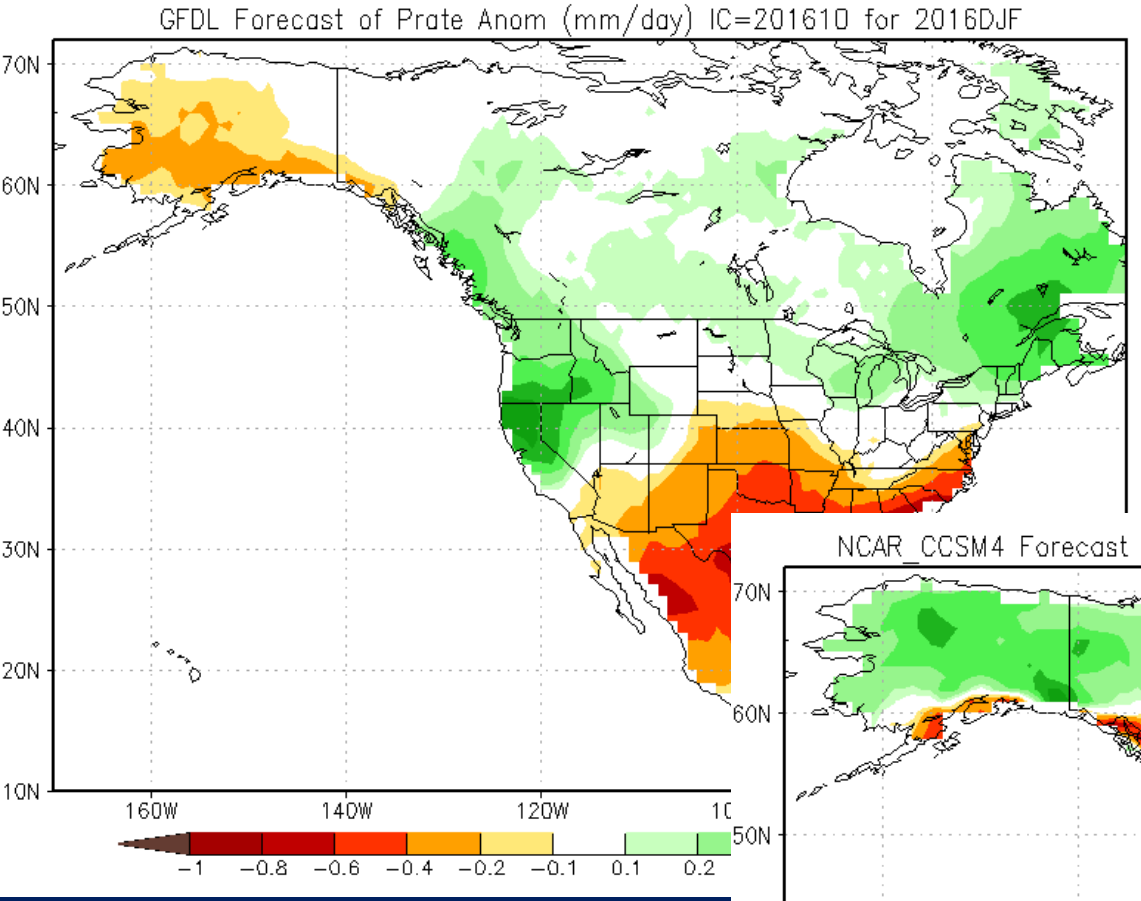
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 September 2016).

From CPC ENSO Diagnostic Discussion 10/17/16

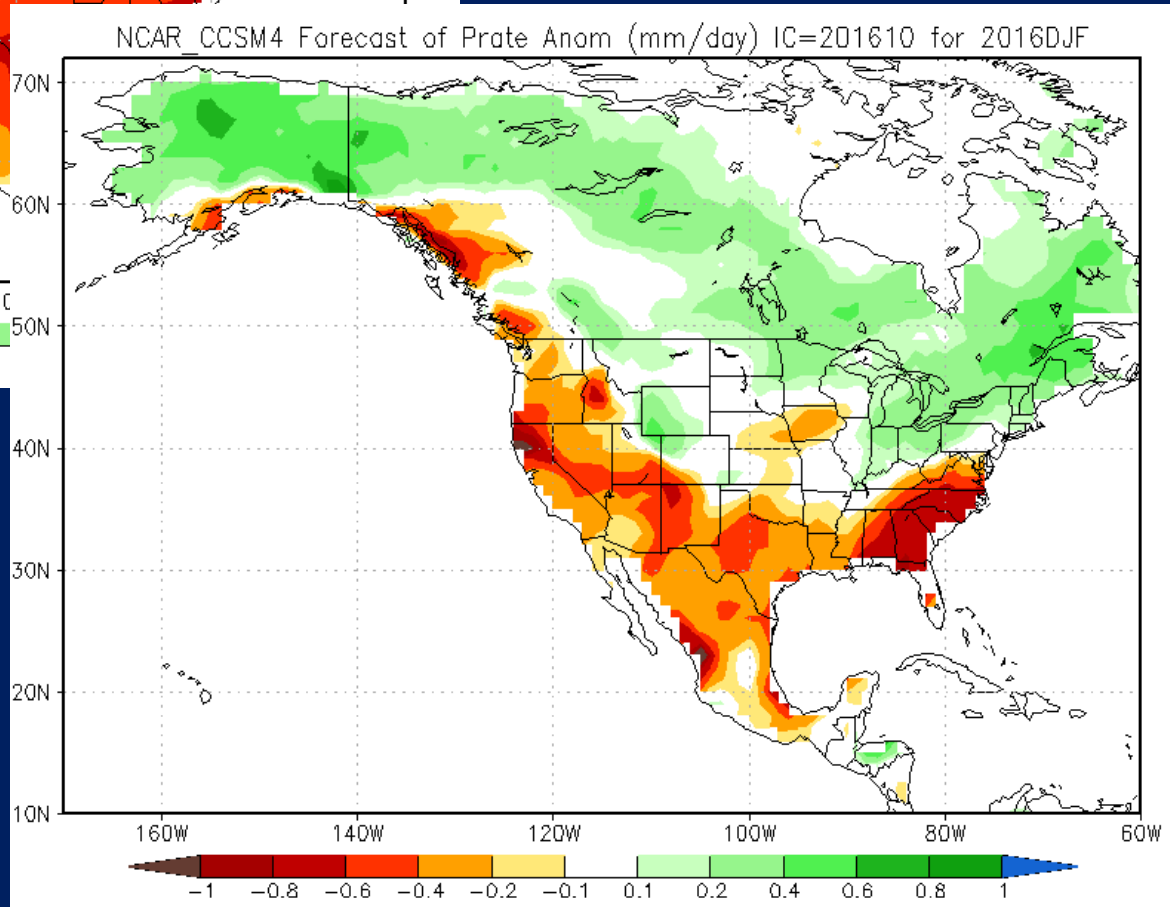
North American Multimodel Ensemble



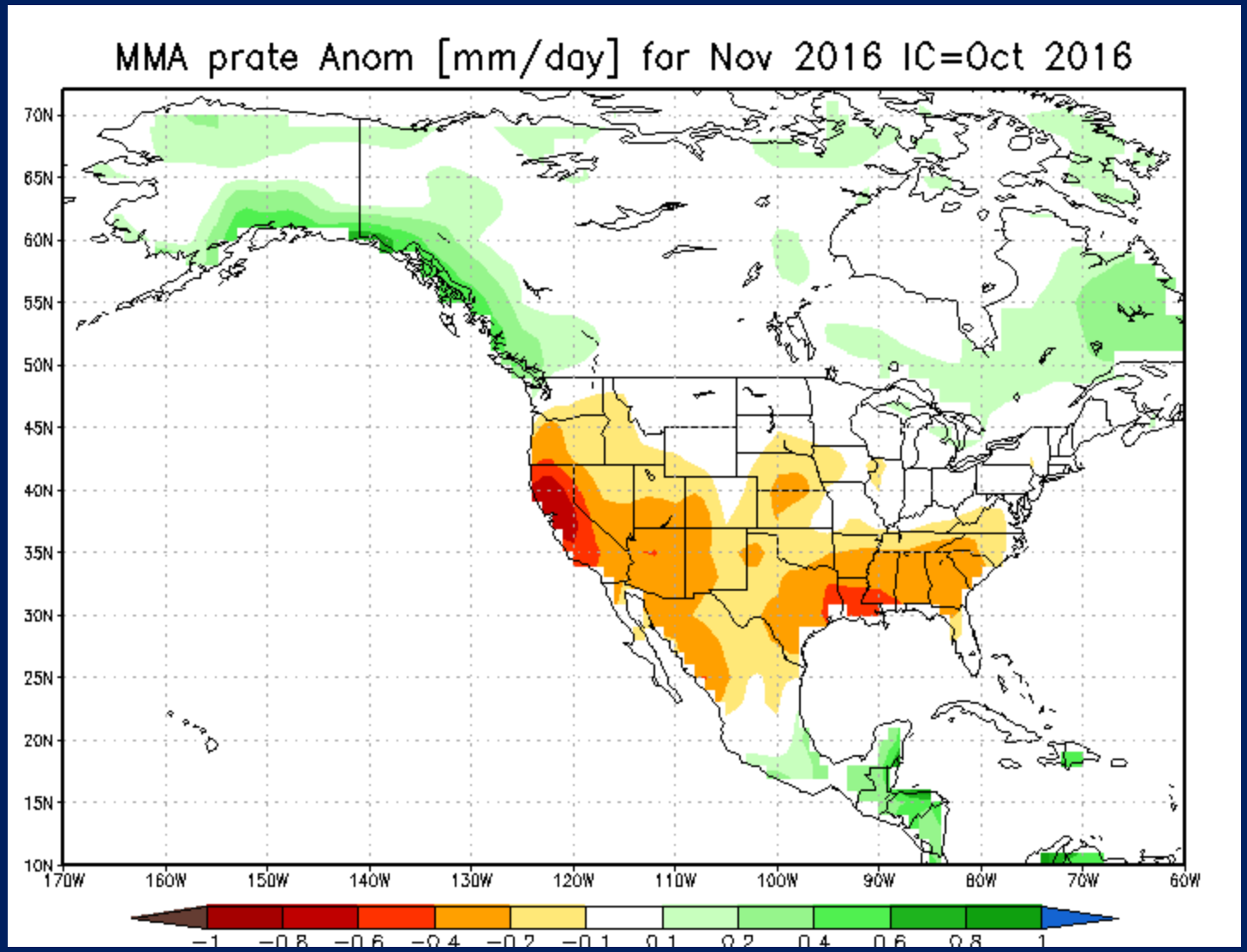
GFDL Model Positive

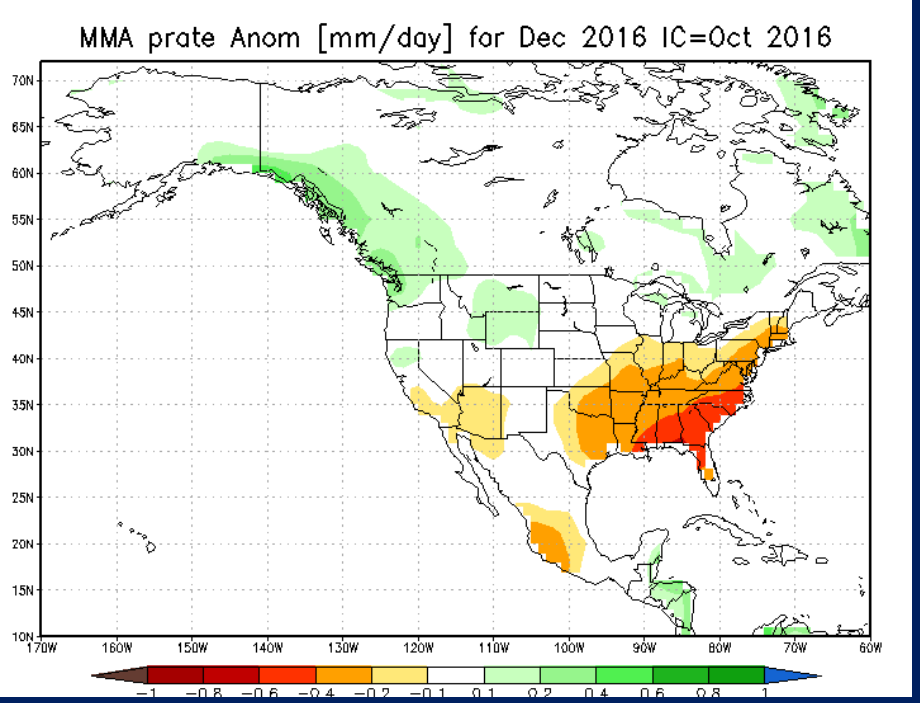


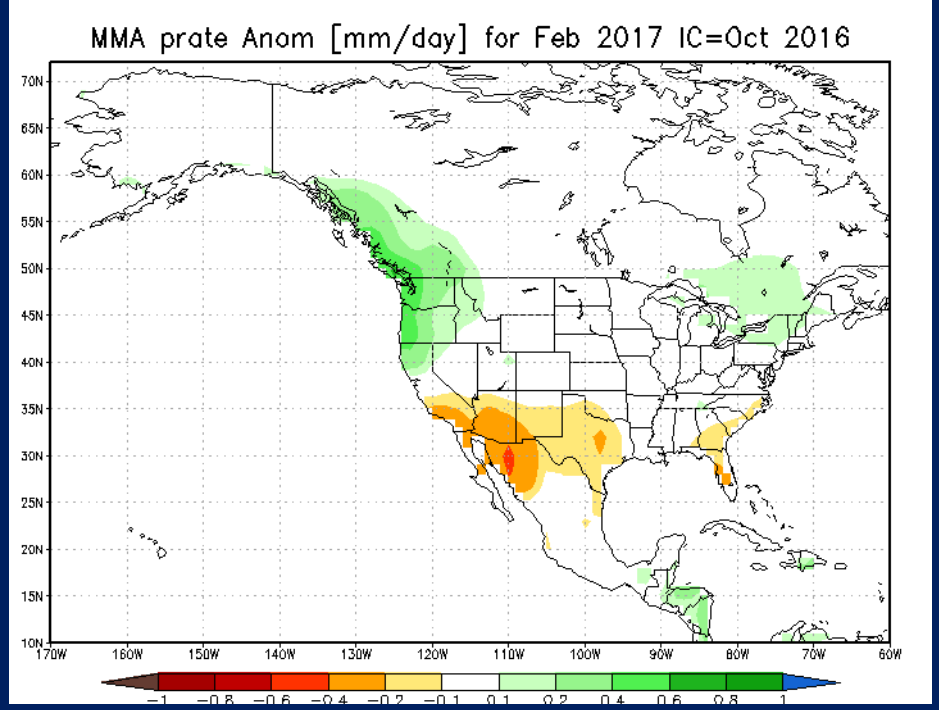
NCAR Model Negative

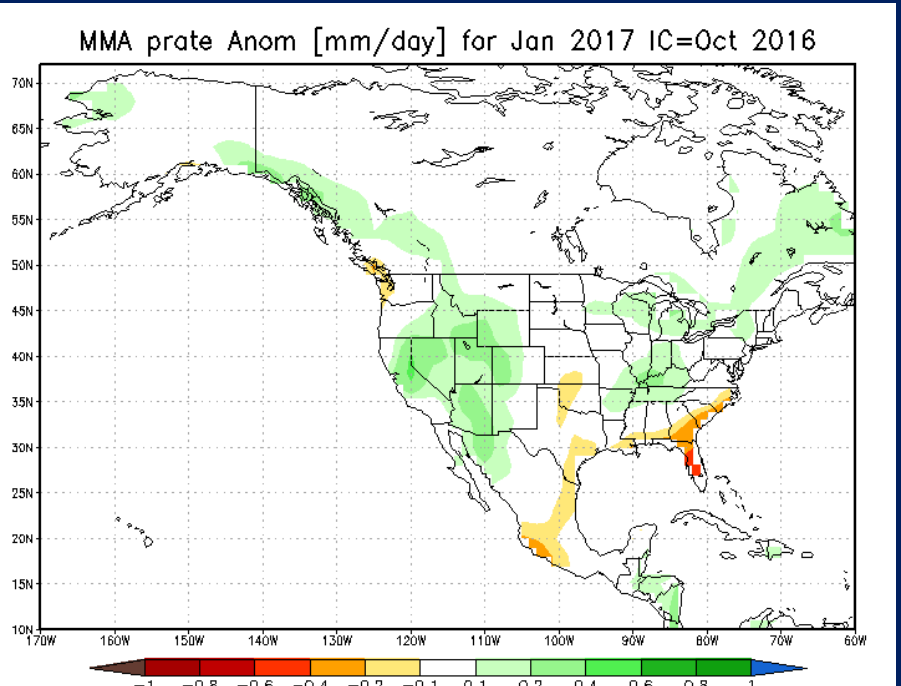


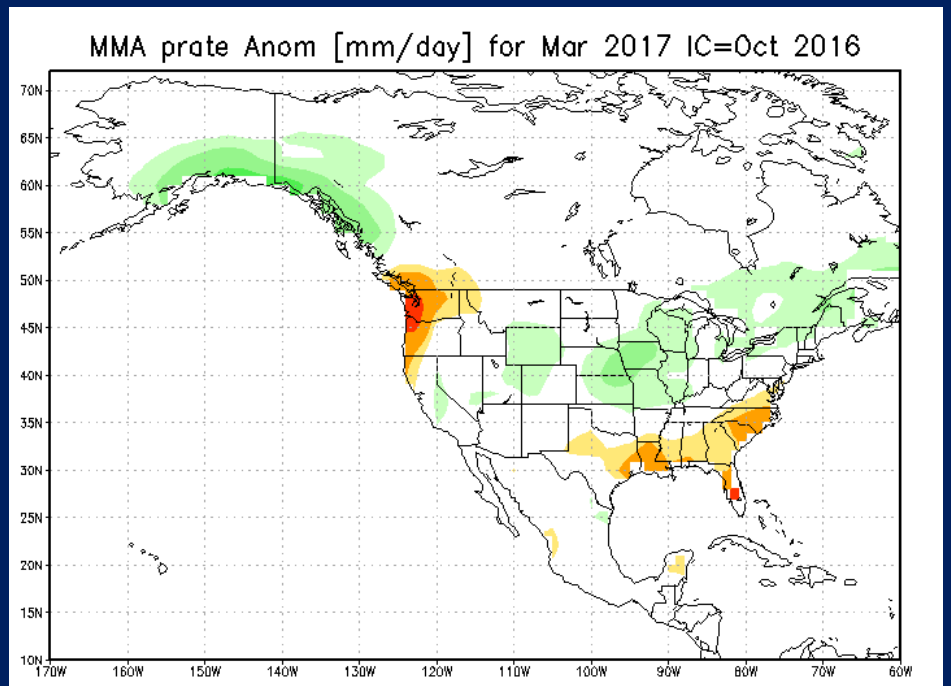
International Multimodel Ensemble




MMA prate Anom [mm/day] for Dec 2016 IC=Oct 2016
70N 65N 60N 55N 50N 45N 40N 35N 30N 25N 20N 15N 10N
170W 160W 150W 140W 130W 120W 110W 100W 90W 80W 70W 60W
−1 −0.8 −0.6 −0.4 −0.2 −0.1 0.1 0.2 0.4 0.6 0.8 1

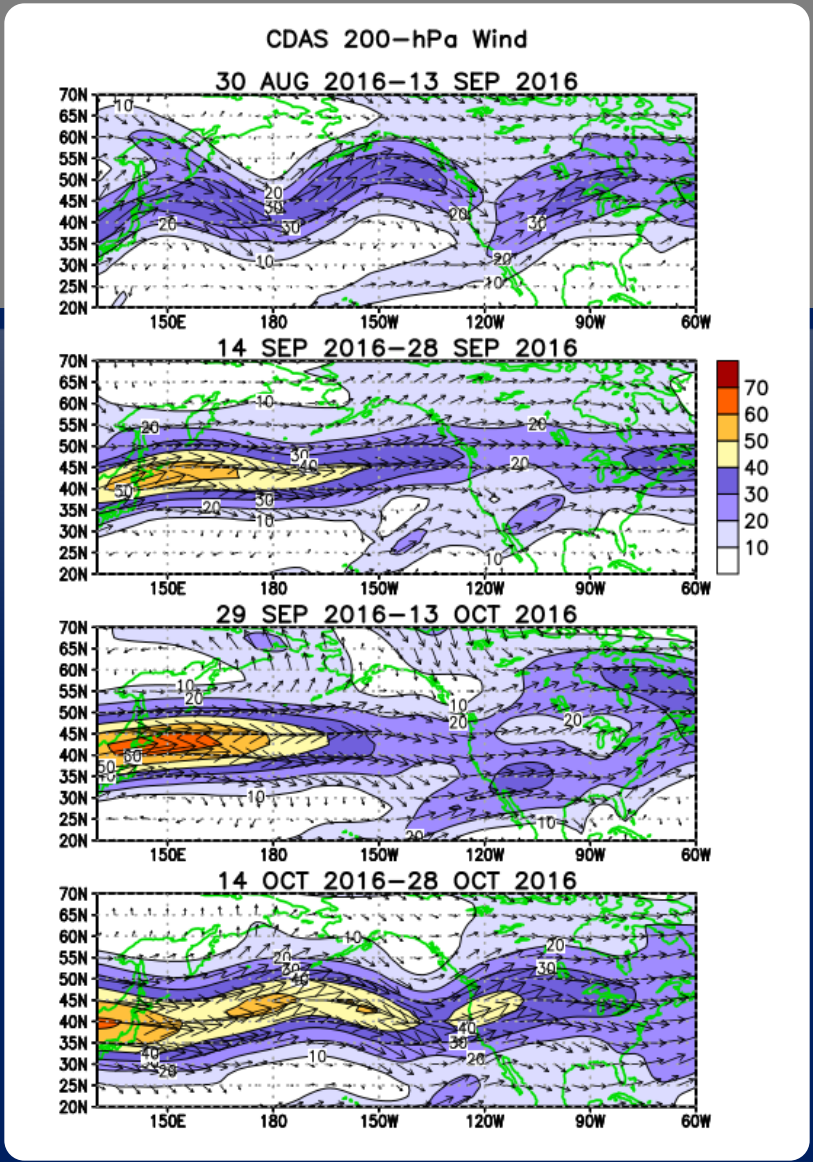

MMA prate Anom [mm/day] for Feb 2017 IC=Oct 2016
70N 65N 60N 55N 50N 45N 40N 35N 30N 25N 20N 15N 10N
170W 160W 150W 140W 130W 120W 110W 100W 90W 80W 70W 60W
−1 −0.8 −0.6 −0.4 −0.2 −0.1 0.1 0.2 0.4 0.6 0.8 1


MMA prate Anom [mm/day] for Jan 2017 IC=Oct 2016
70N 65N 60N 55N 50N 45N 40N 35N 30N 25N 20N 15N 10N
170W 160W 150W 140W 130W 120W 110W 100W 90W 80W 70W 60W
−1 −0.8 −0.6 −0.4 −0.2 −0.1 0.1 0.2 0.4 0.6 0.8 1


MMA prate Anom [mm/day] for Mar 2017 IC=Oct 2016
70N 65N 60N 55N 50N 45N 40N 35N 30N 25N 20N 15N 10N
170W 160W 150W 140W 130W 120W 110W 100W 90W 80W 70W 60W

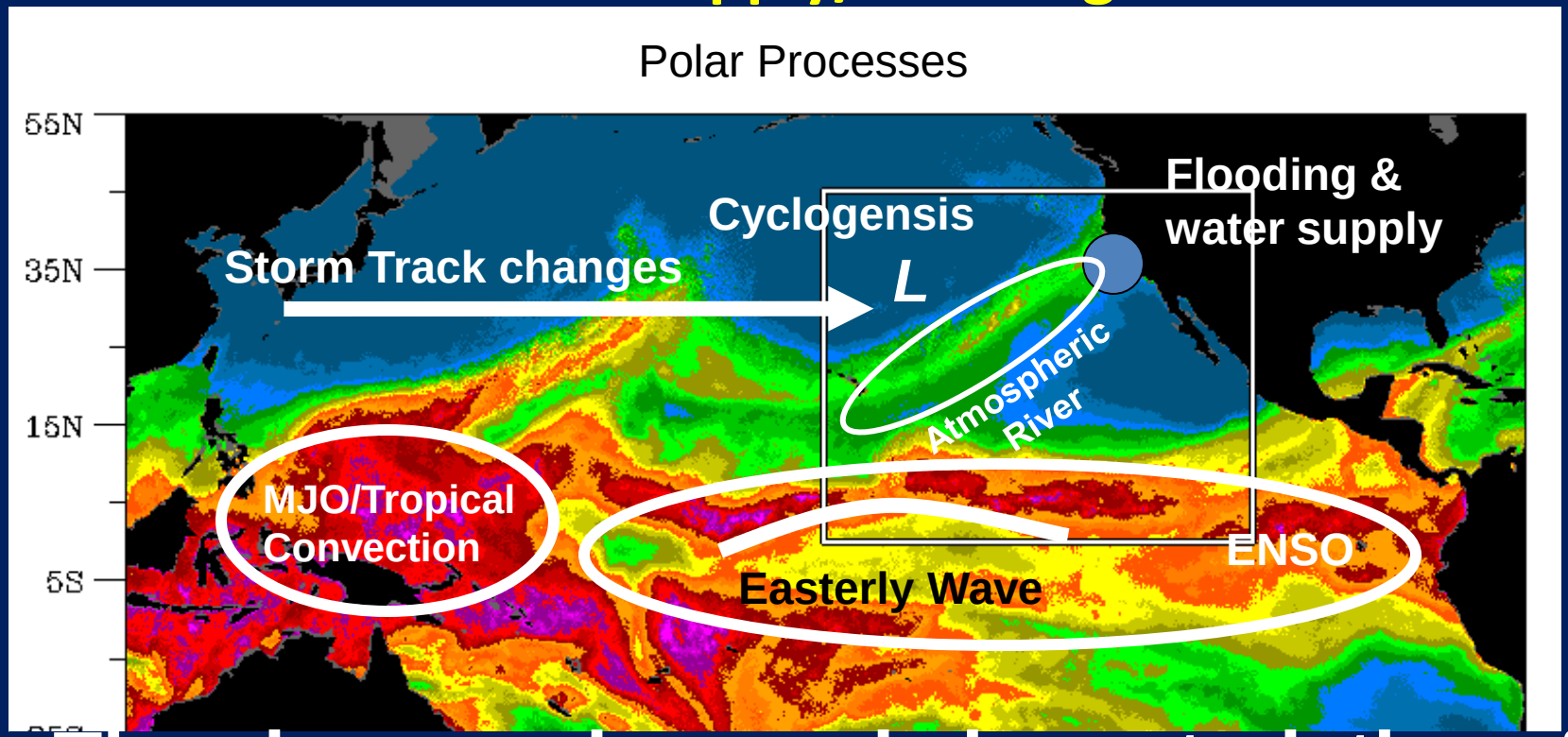
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since mid August, above-average heights and temperatures have prevailed over eastern N. America. Over the western contiguous U.S., an anomalous trough and below-average temperatures have generally persisted.

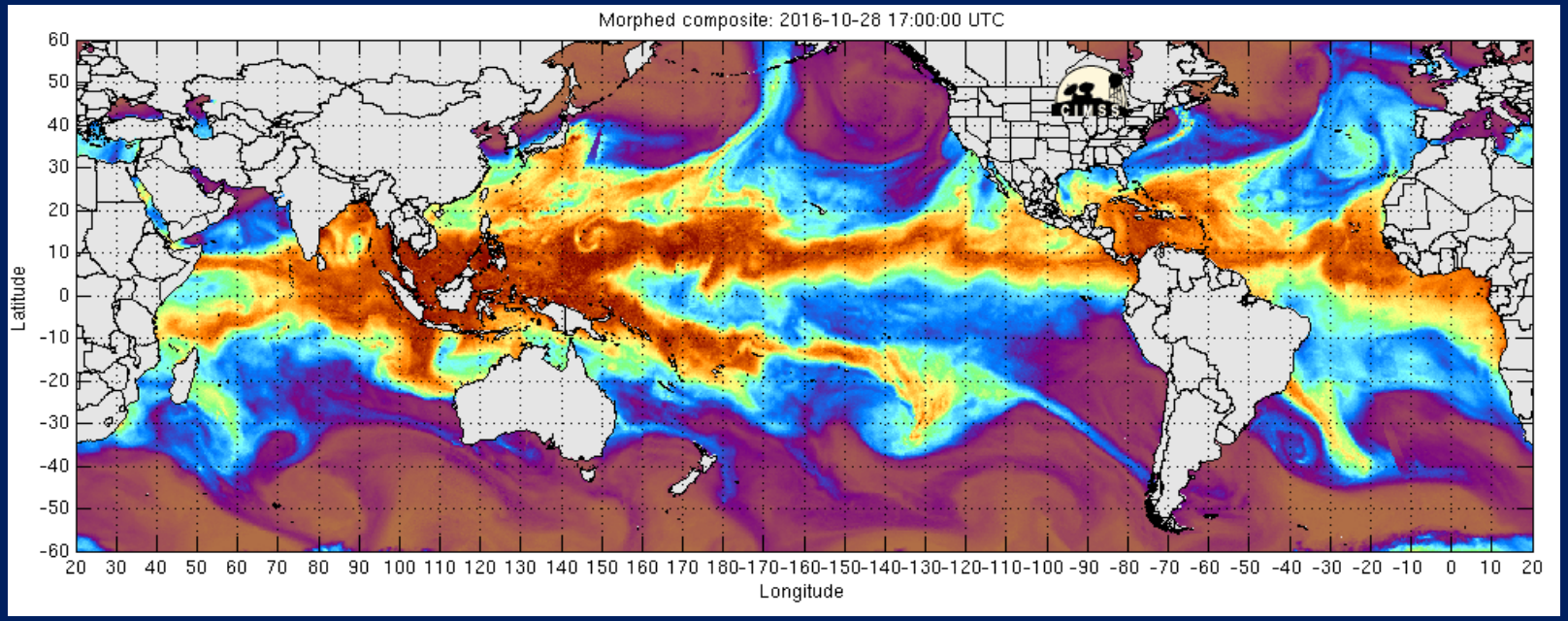


From CPC ENSO Diagnostic Discussion 10/31/16

Key Phenomena Affecting California Water Supply/Flooding:



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



Some Links for AR information:

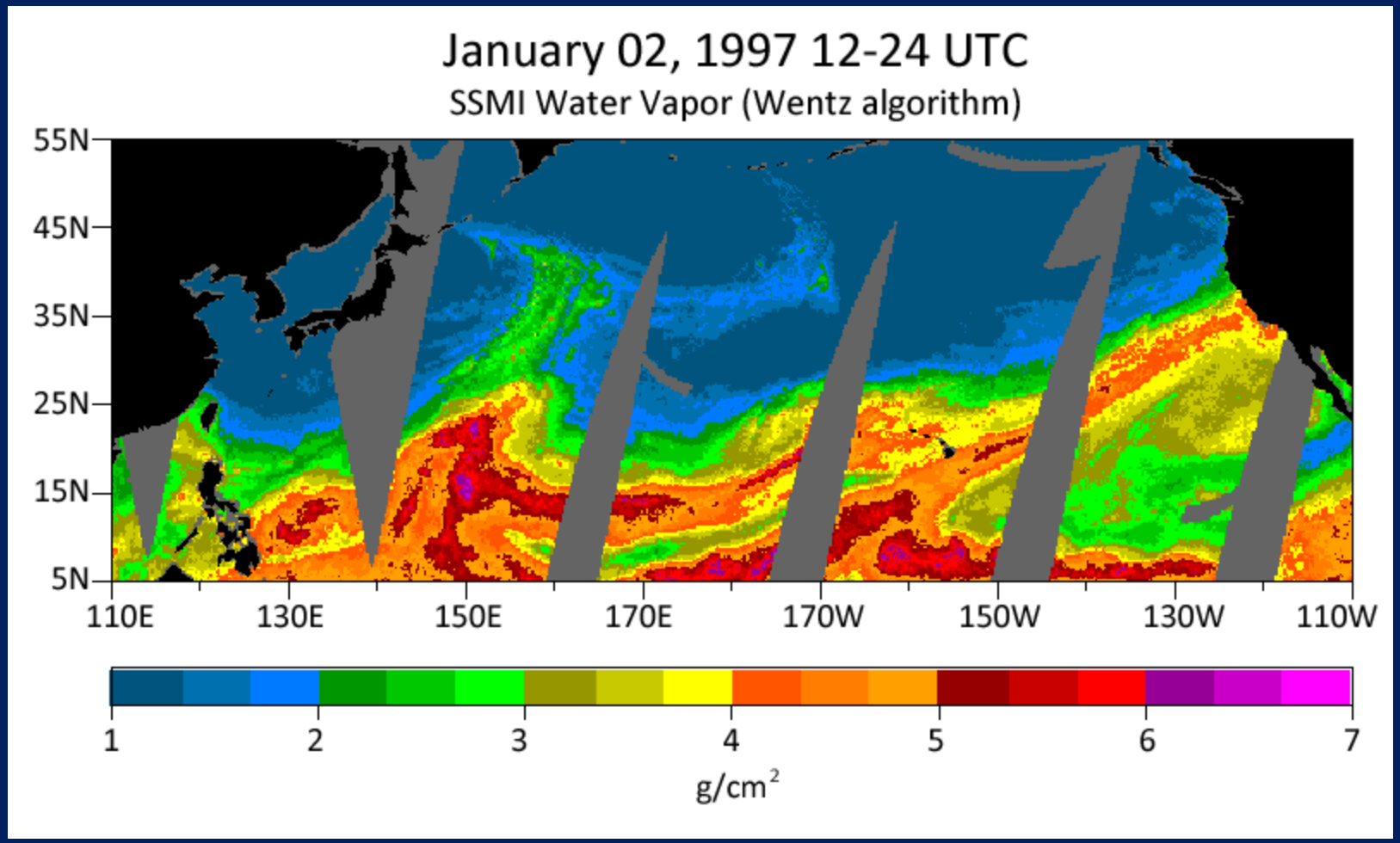
CW3E - http://woodland.ucsd.edu/

NOAA HMT Page: http://noaa.hmt.noaa.gov

CPC Teleconnections page:

http://www.cpc.ncep.noaa.gov/data/teledoc/telecontents.shtml

It’s been 20 years since…



The Big 4 Central Valley Floods

Event	ONI Value with Center Month During Event
December 1955	-1.4 (NDJ)
December 1964	-0.8 (NDJ)
February 1986	-0.4 (JFM)
New Year 1997 (Dec 1996/Jan 1997)	-0.5 (DJF)

2006 -0.7 (NDJ)

Current ONI Weekly Value -0.8

Final Thoughts

- ENSO by itself is not a good predictor of winter outcomes in CA
- Flood events are driven by AR activity which can be modulated by a number of climate system processes operating at different space/time scales
- Californians should be prepared for flooding in any given winter – Are you flood ready?

Questions?

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