Seasonal Forecasting
CA Perspectives

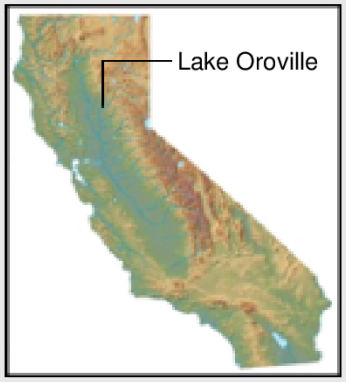
Michael Anderson

WSWC May 2015

All Models are Wrong Some Are Useful

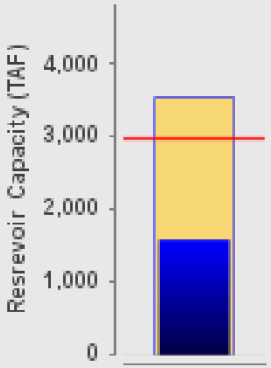
George E P Box

Reservoir Conditions - Lake Oroville



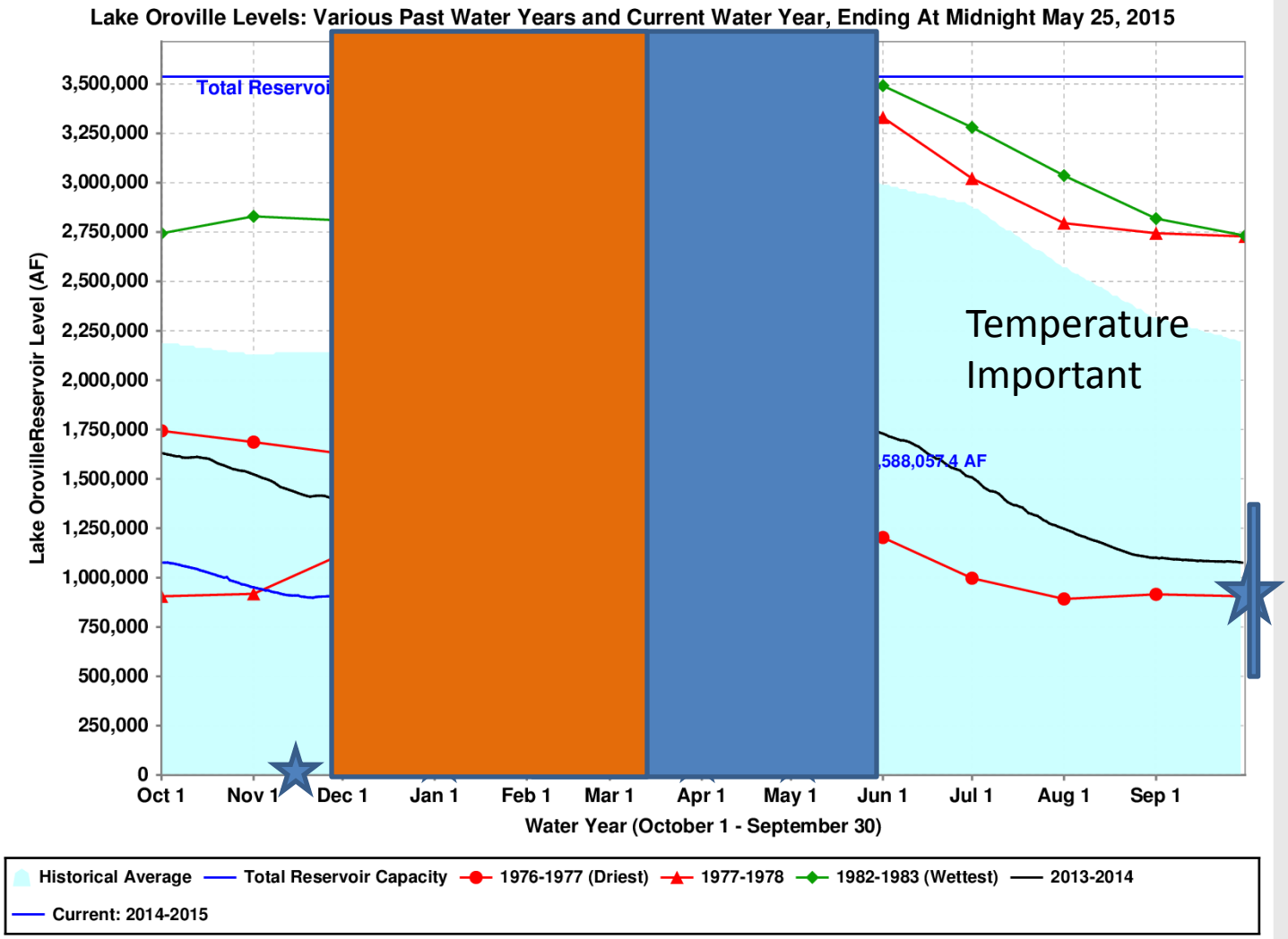
Lake Oroville Conditions

(as of Midnight - May 25, 2015)



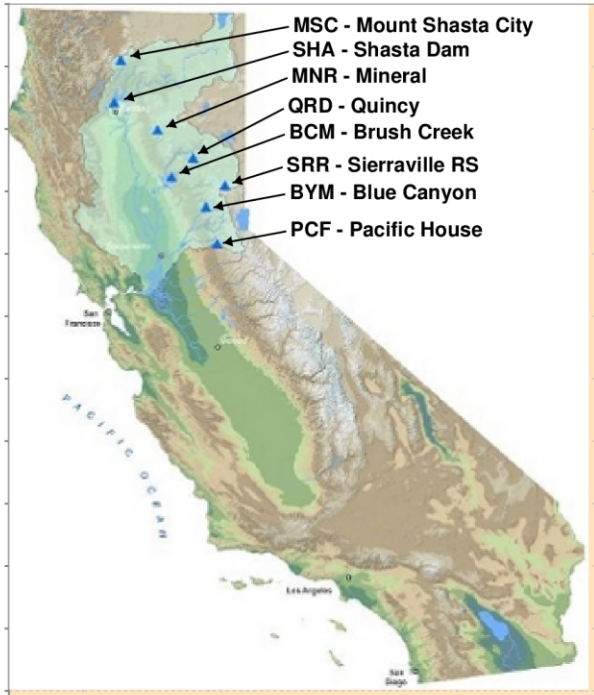
Current Level: 1,588,057.4 AF

45% (Total Capacity) | 54% (Historical Avg.)



Data Updated 05/26/2015 08:45 AM

Northern Sierra Precipitation: 8-Station Index, May 26, 2015



Percent of Average for this Date: 74%

1982-1983 (wettest) 88.5

2005-2006 Daily Precip. 80.1

Average (1922-1998) 50.0

2012-2013 Daily Precip. 44.3

Current Daily Precip:35.2

2013-2014 Daily Precip. 31.3

19.0

1976-1977 (2nd driest & driest thru Aug)

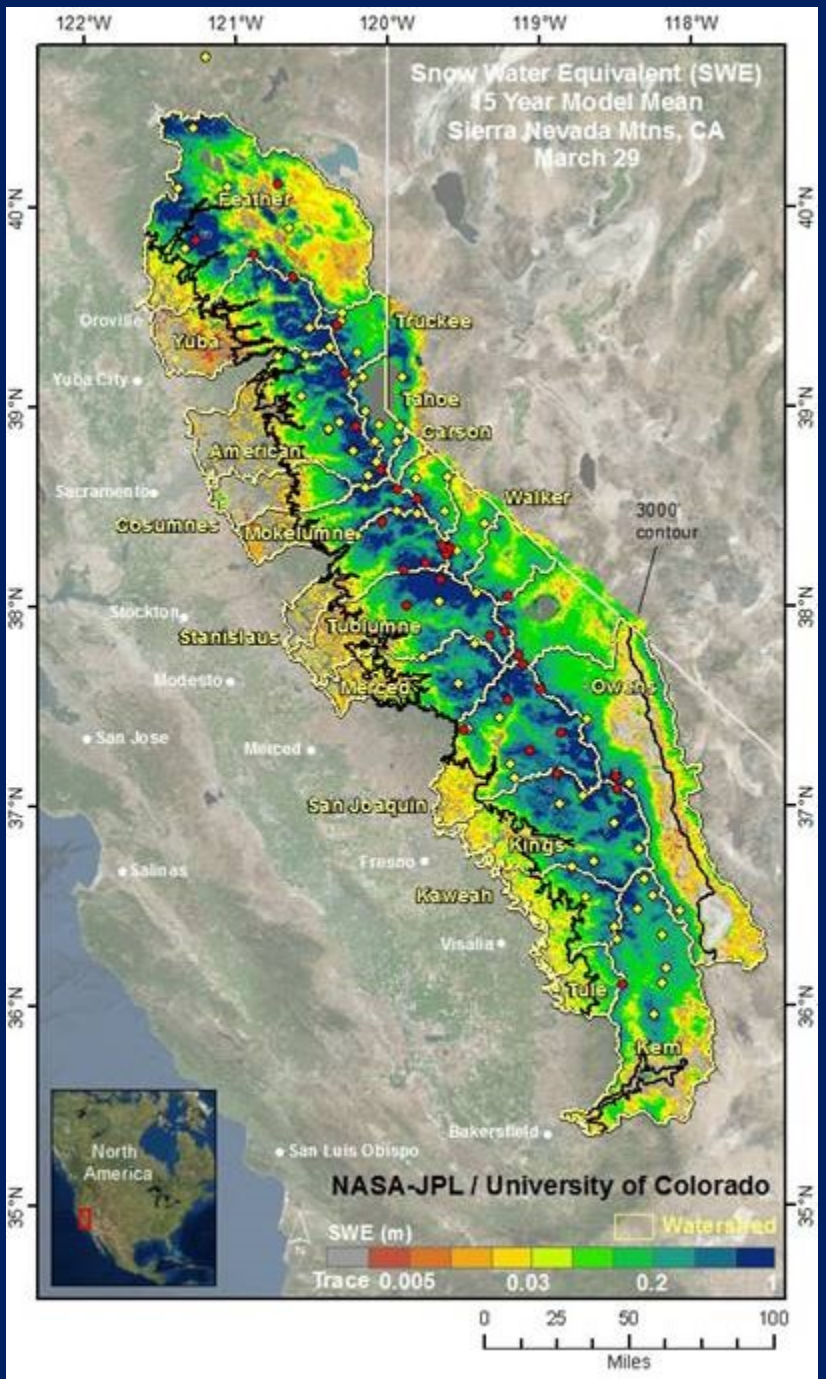
Cumulative Daily/Monthly Precipitation (inches)

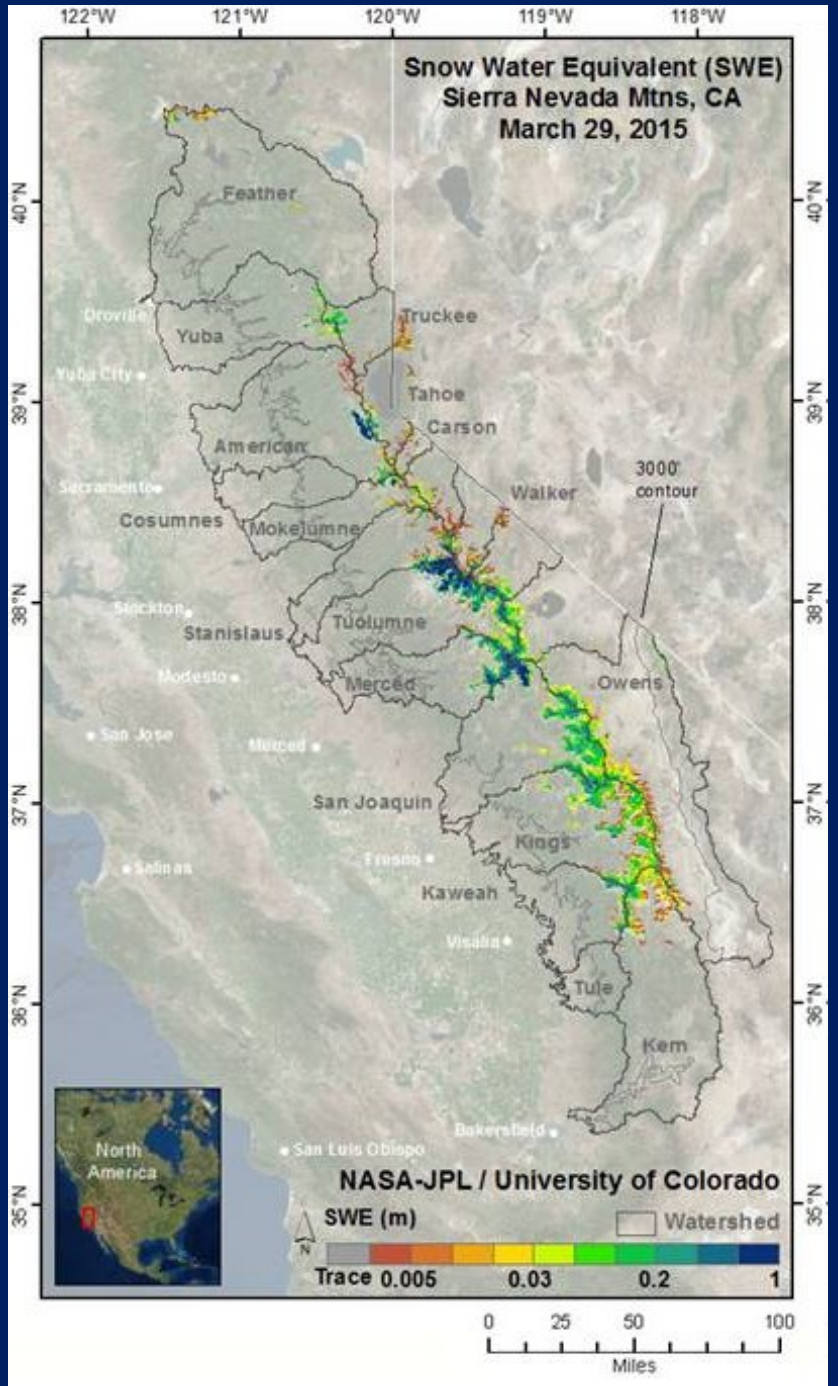
Total Water Year Precipitation

100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0

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

Water Year (October 1 - September 30)


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
3000' contour
Cosumnes
Mokelumne
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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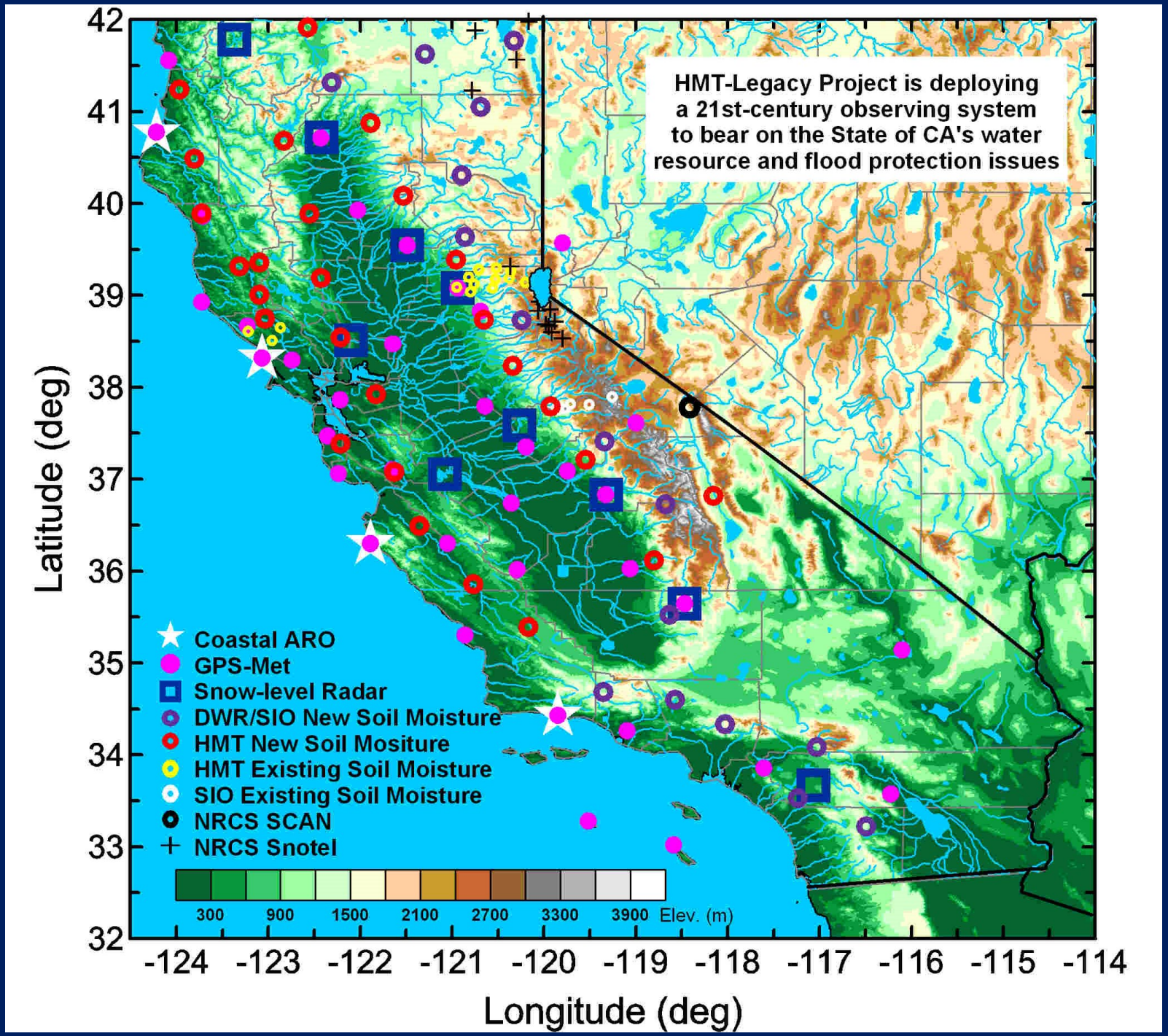
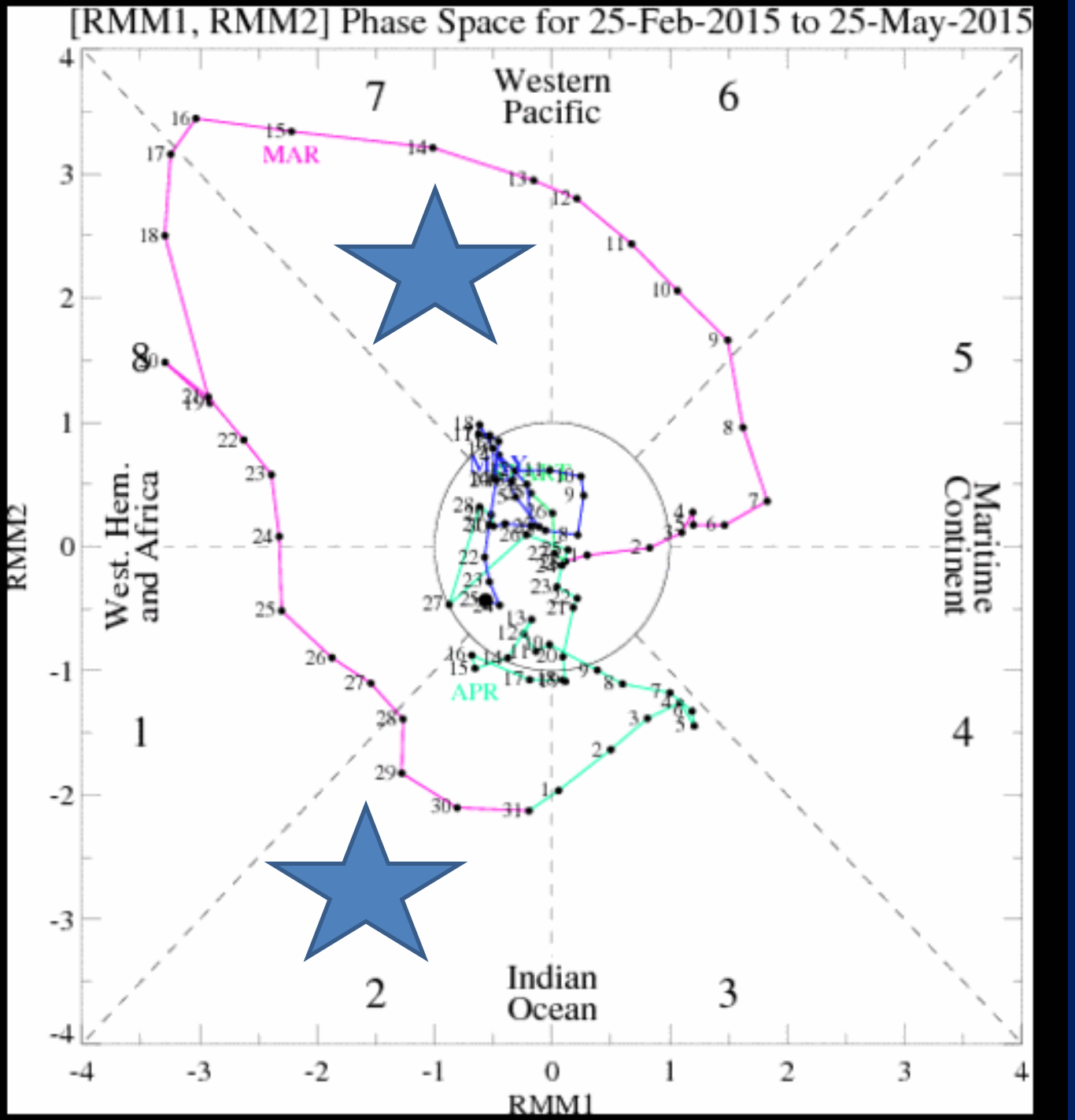
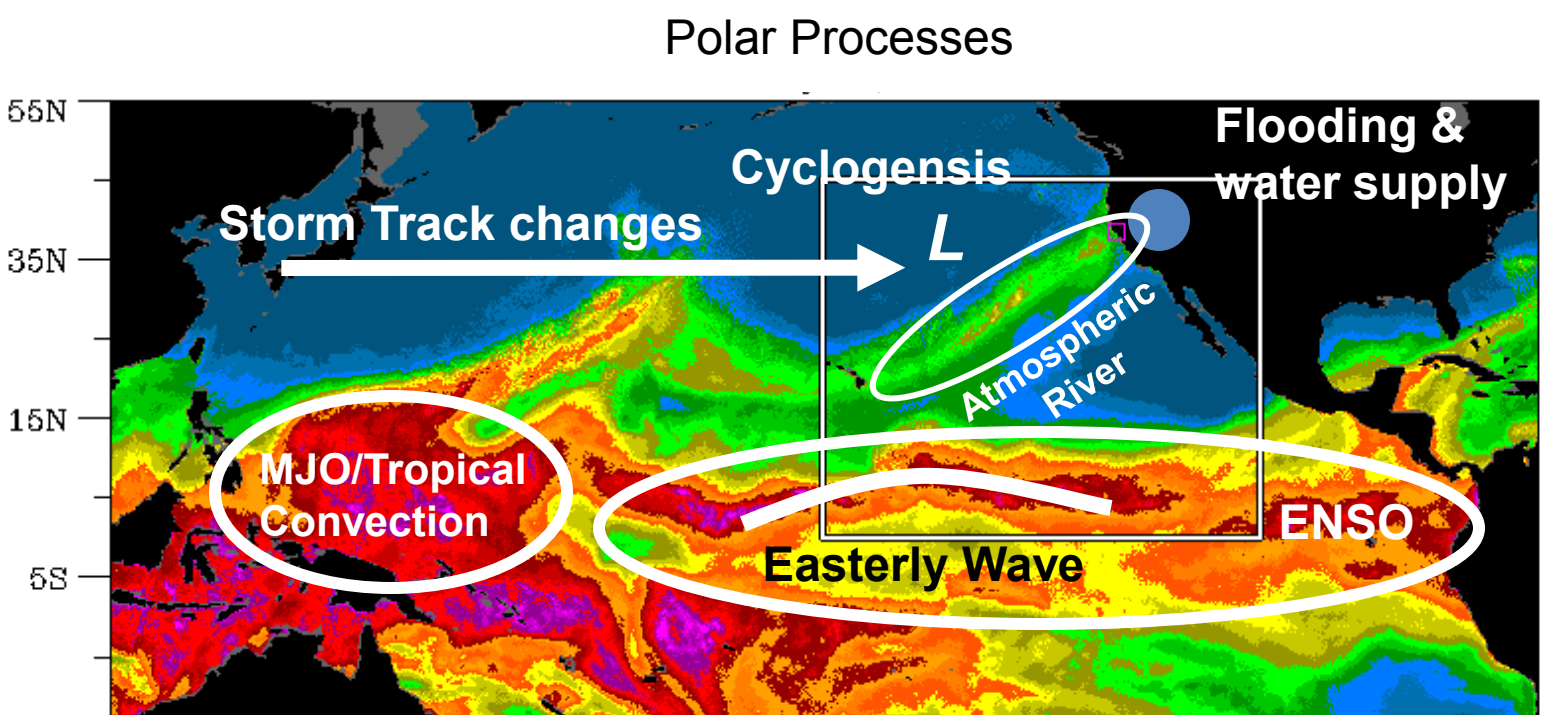

HMT-Legacy Project is deploying a 21st-century observing system to bear on the State of CA's water resource and flood protection issues
Coastal ARO
GPS-Met
Snow-level Radar
DWR/SIO New Soil Moisture
HMT New Soil Mositure
HMT Existing Soil Moisture
SIO Existing Soil Moisture
NRCS SCAN
NRCS Snotel
300
900
1500
2100
2700
3300
3900
Elev. (m)
Latitude (deg)
Longitude (deg)
42
41
40
39
38
37
36
35
34
33
32
-124
-123
-122
-121
-120
-119
-118
-117
-116
-115
-114



MJO

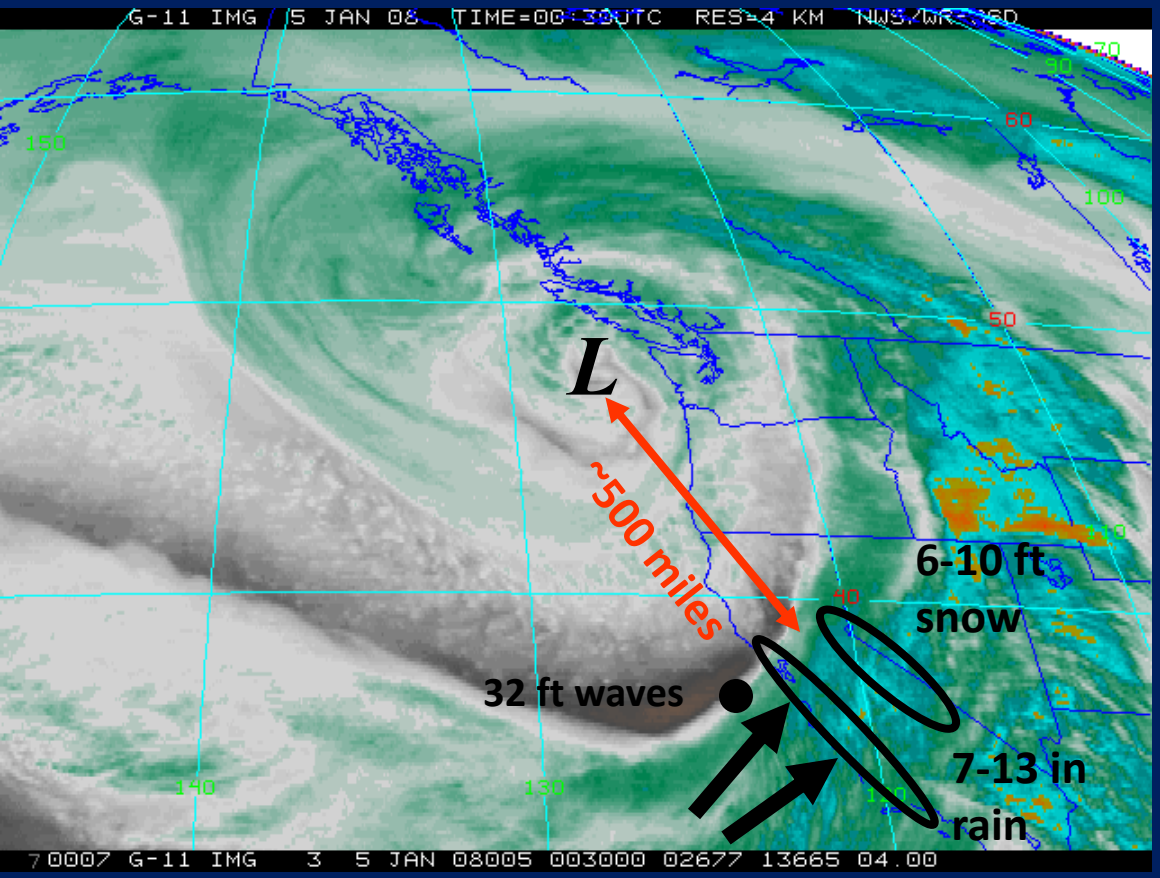
What month where and how strong?

Key Phenomena Affecting California Water Supply/Flooding:



Hydrologic Outcomes Depend on Multiple Processes at Multiple Space/Time Scales

The Storm of 4-5 Jan 2008



Atmospheric river

GOES IR image of major West Coast storm

- Time = 0030 UTC 5 January 2008
- Low pressure center is off WA coast

Note that major impacts were focused >500 miles south of the Low pressure center in this storm.

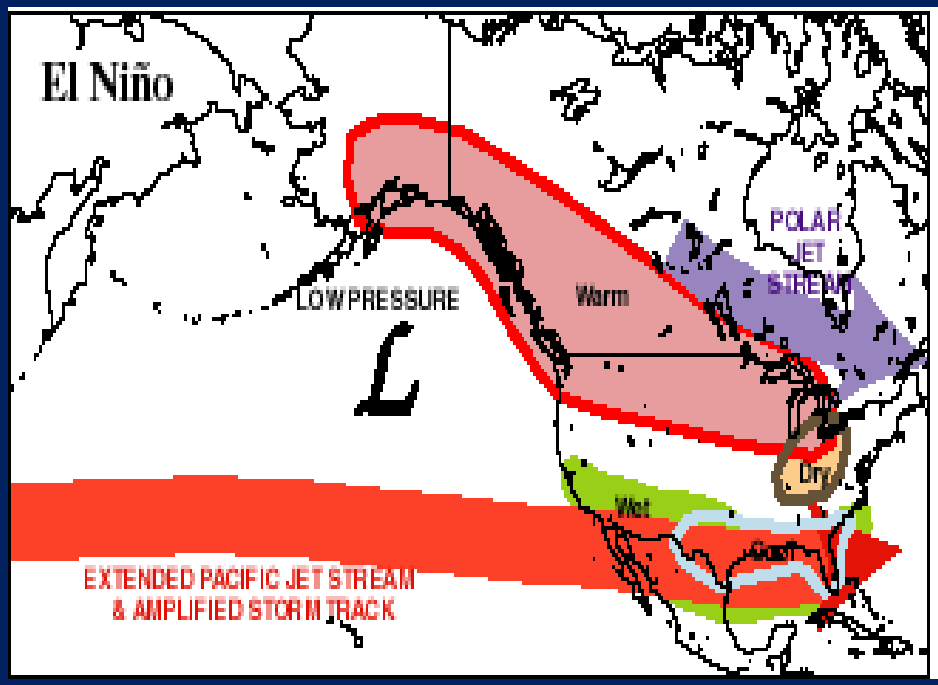
This differs significantly from hurricanes, but the impacts are enormous and spread over a large area

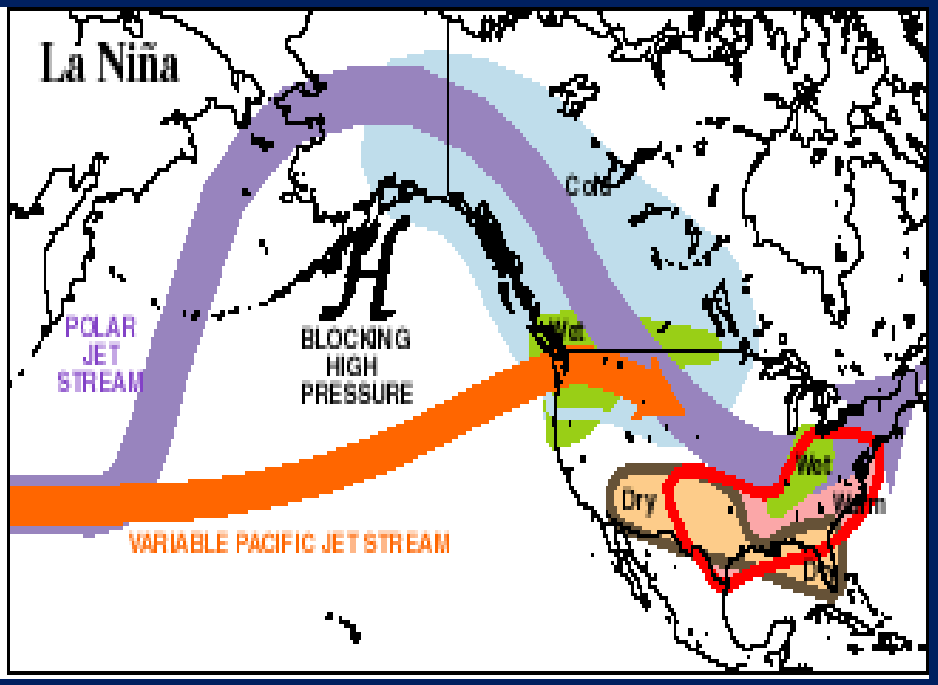
Many major impacts are associated with the landfall of the "atmospheric river" element of the storm, the precise characteristics of which are not operationally monitored offshore or onshore.

Wanted vs Need

- Life beyond P and T maps
- 500 mb anomalies
- 700 mb anomalies
- Water vapor analyses
- Geopotential Gradients and Tendencies

Forecast the Drivers Instead of the Outcomes


El Niño
LOW PRESSURE
L
Warm
POLAR
JET
STREAM
Dry
Wet
Cold
EXTENDED PACIFIC JET STREAM
& AMPLIFIED STORM TRACK


La Niña
POLAR
JET
STREAM
H
BLOCKING
HIGH
PRESSURE
Cold
Warm
Dry
Wet
Warm
Dry
VARIABLE PACIFIC JET STREAM

IRI/CPC Pacific Niño 3.4 SST Model Outlook

Almost all of the models indicate Niño 3.4 SST anomalies will remain greater than or equal to +0.5C through the end of 2015.

However, there is a large amount of spread in the potential strength of El Niño.

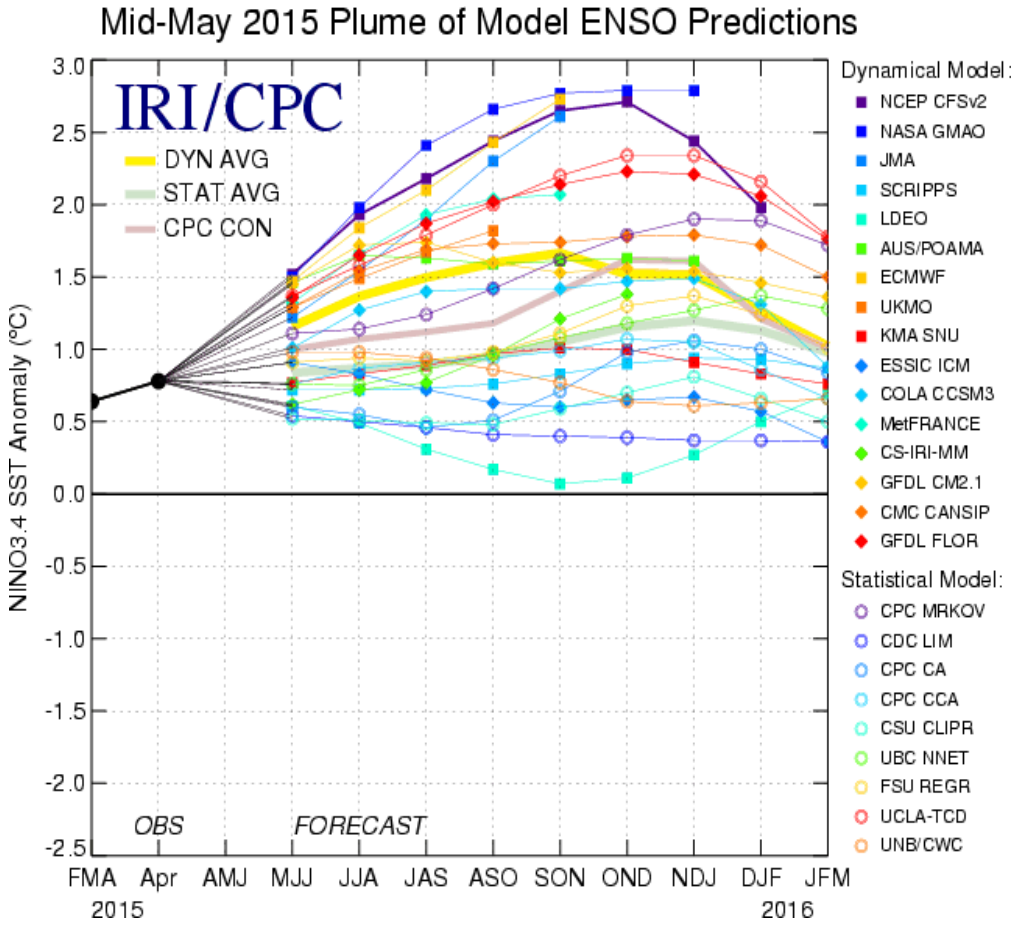
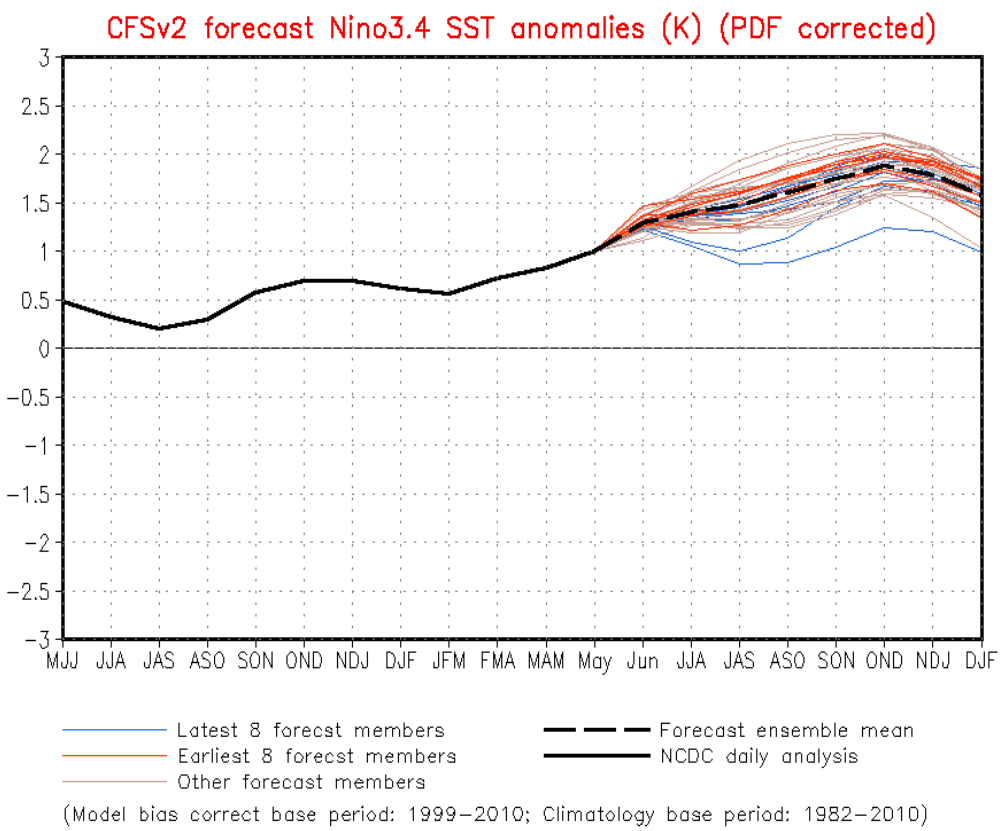


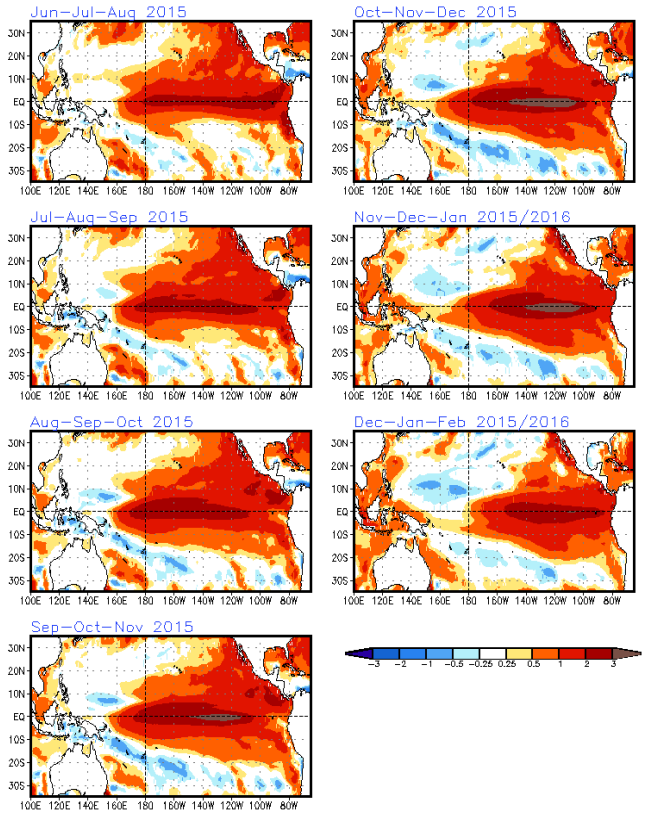
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 May 2015).

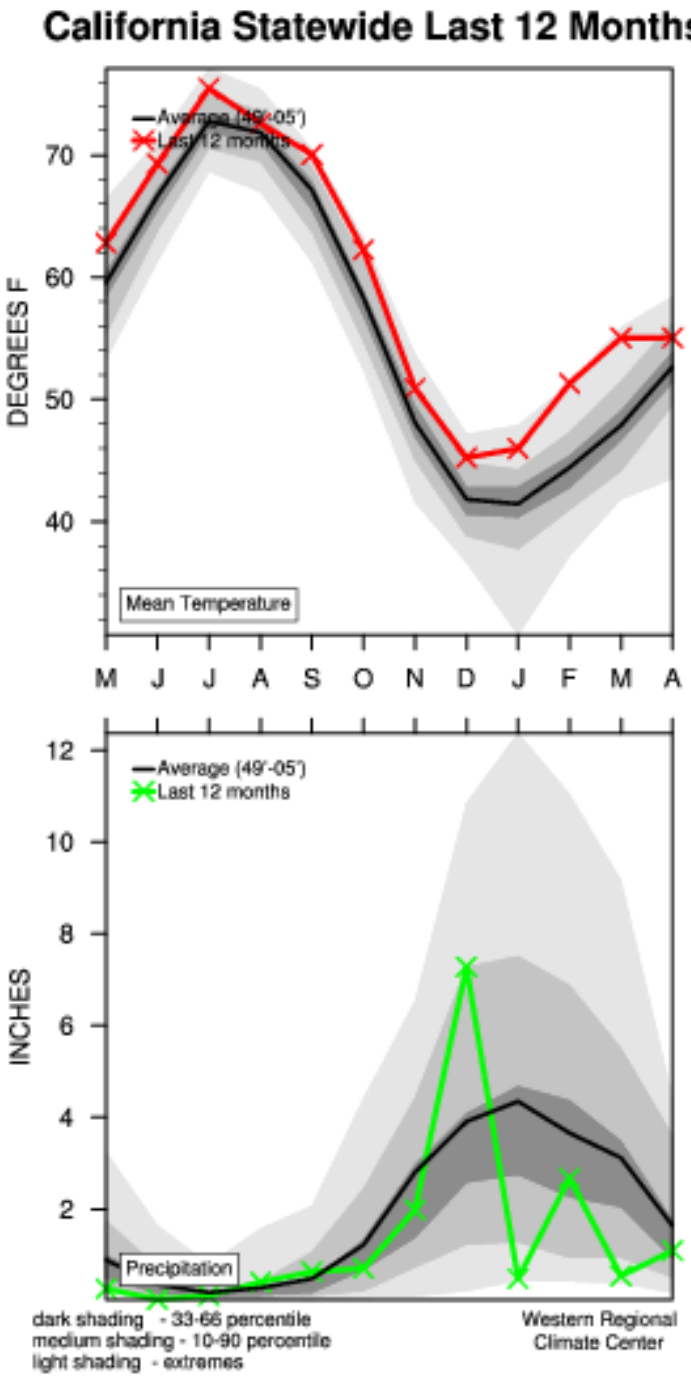
SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 26 May 2015

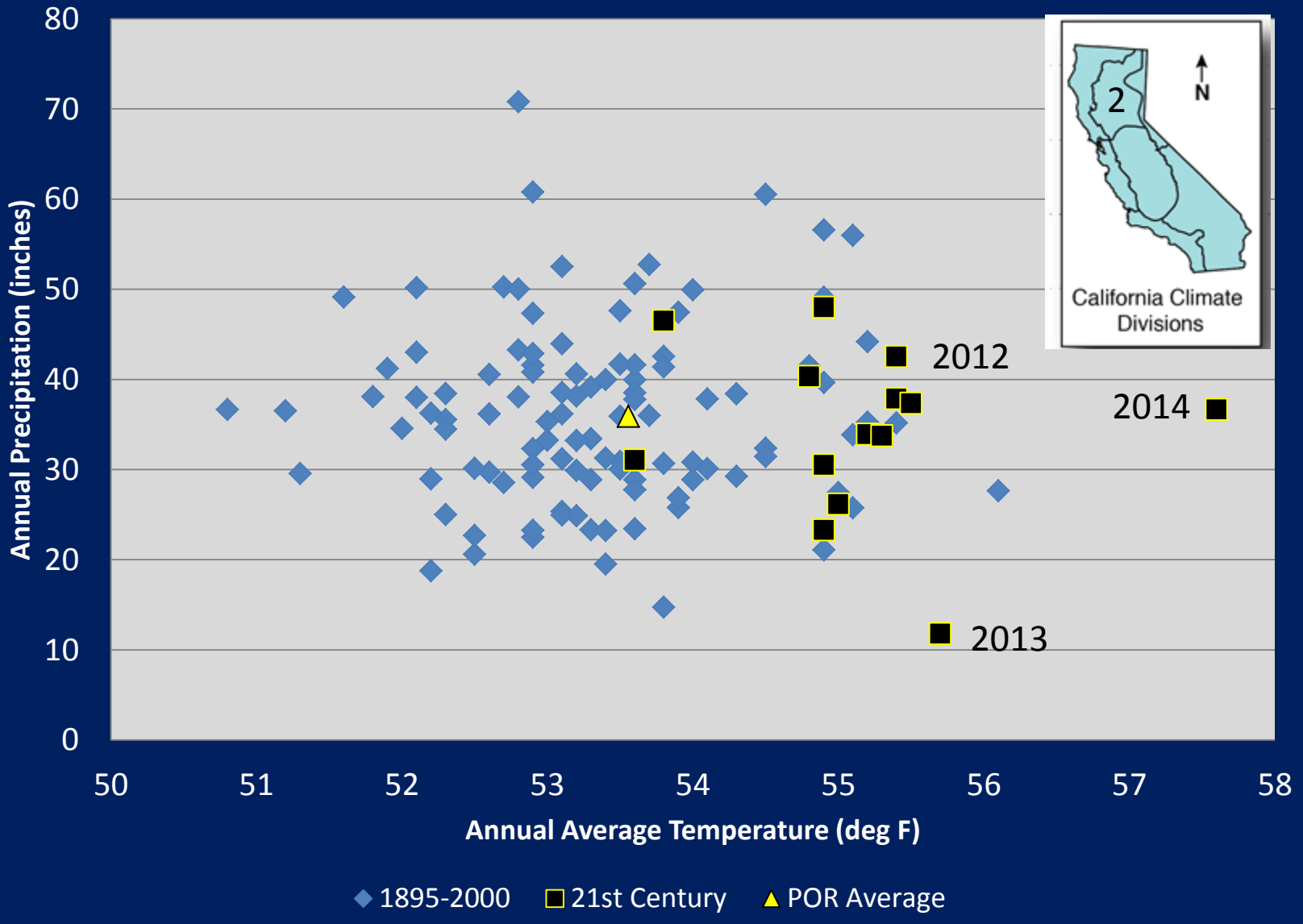
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through DJF 2015-16.





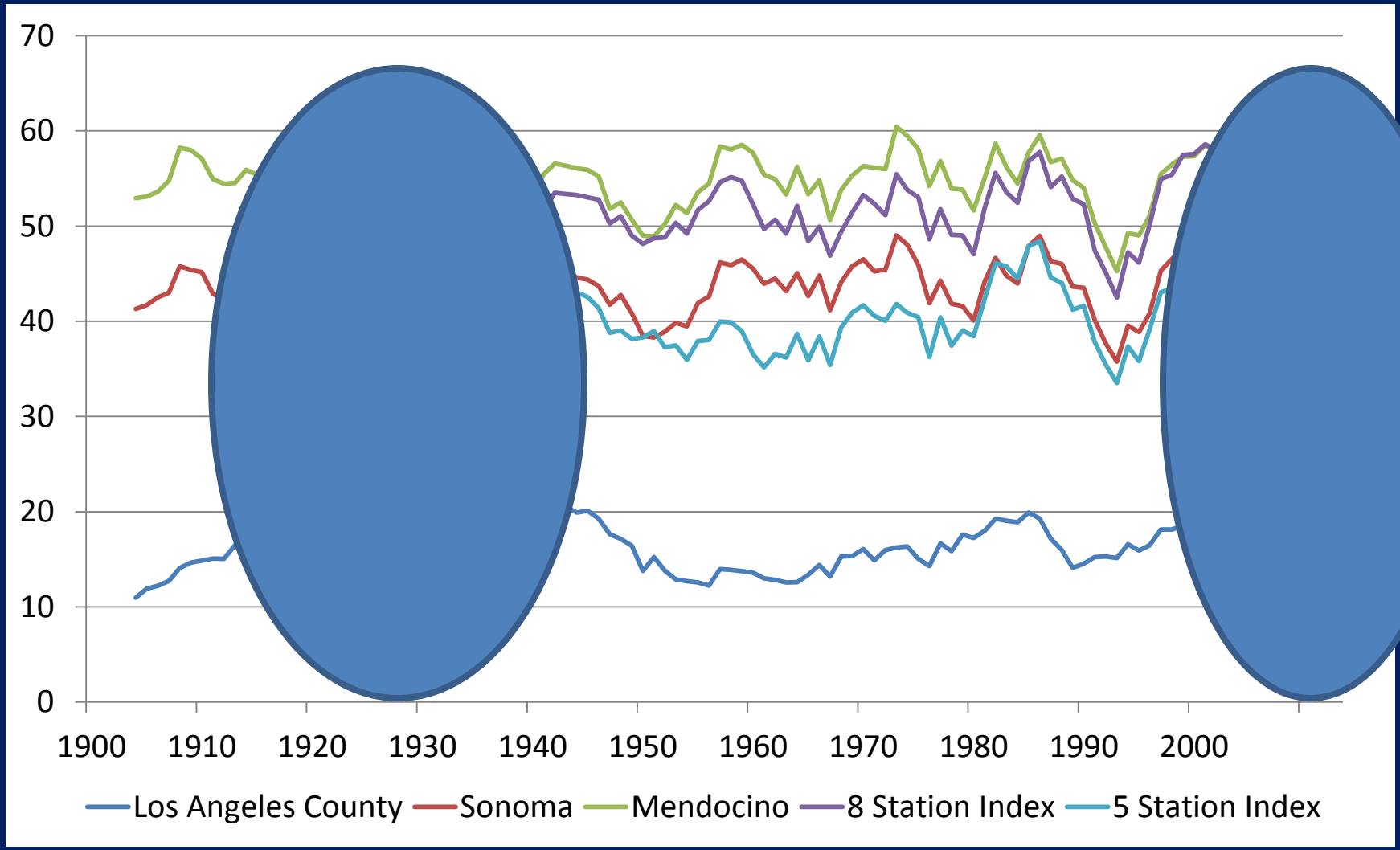

California Statewide Last 12 Months
Average (49'-05')
Last 12 months
DEGREES F
70
60
50
40
Mean Temperature
M J J A S O N D J F M A
12
10
8
6
4
2
INCHES
Average (49'-05')
Last 12 months
Precipitation
dark shading - 33-66 percentile
medium shading - 10-90 percentile
light shading - extremes
Western Regional
Climate Center

It's Getting Warmer – Sacramento River



Source: NOAA Climate Division 2 Calendar Year Data

Decadal Scale Variability



Concluding Thoughts

- There is more information available than the official products which have been found wanting
- Opportunities exist for hybrid dynamical/statistical forecast efforts that work with atmospheric circulation drivers and relate those to the hydrologic outcomes
- Federal/State/Other partnerships can be useful to create end-to-end products


Questions?
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