Western US Climate and El Nino Update

Public Webinar

October 19, 2015

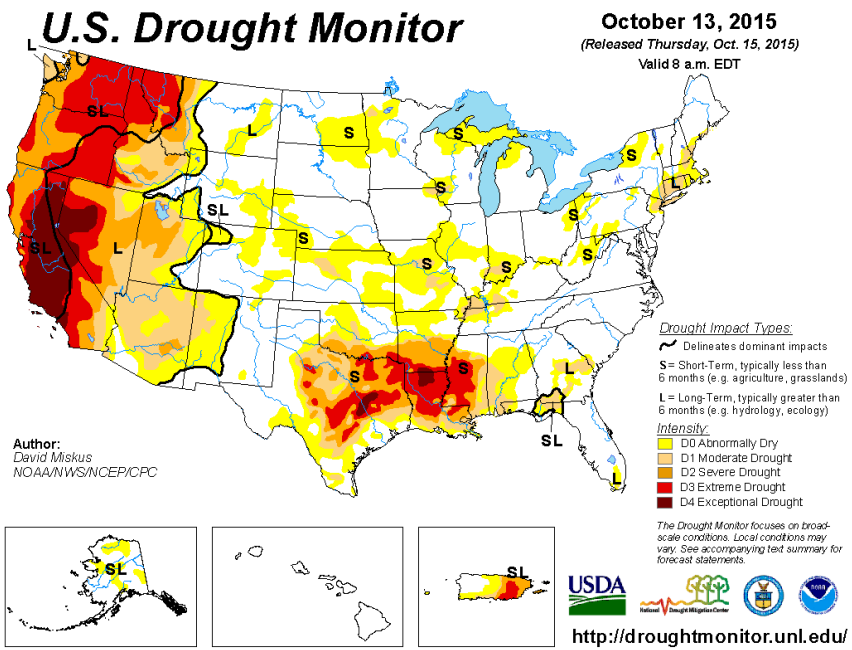
10am PT, 11am MT

Outline

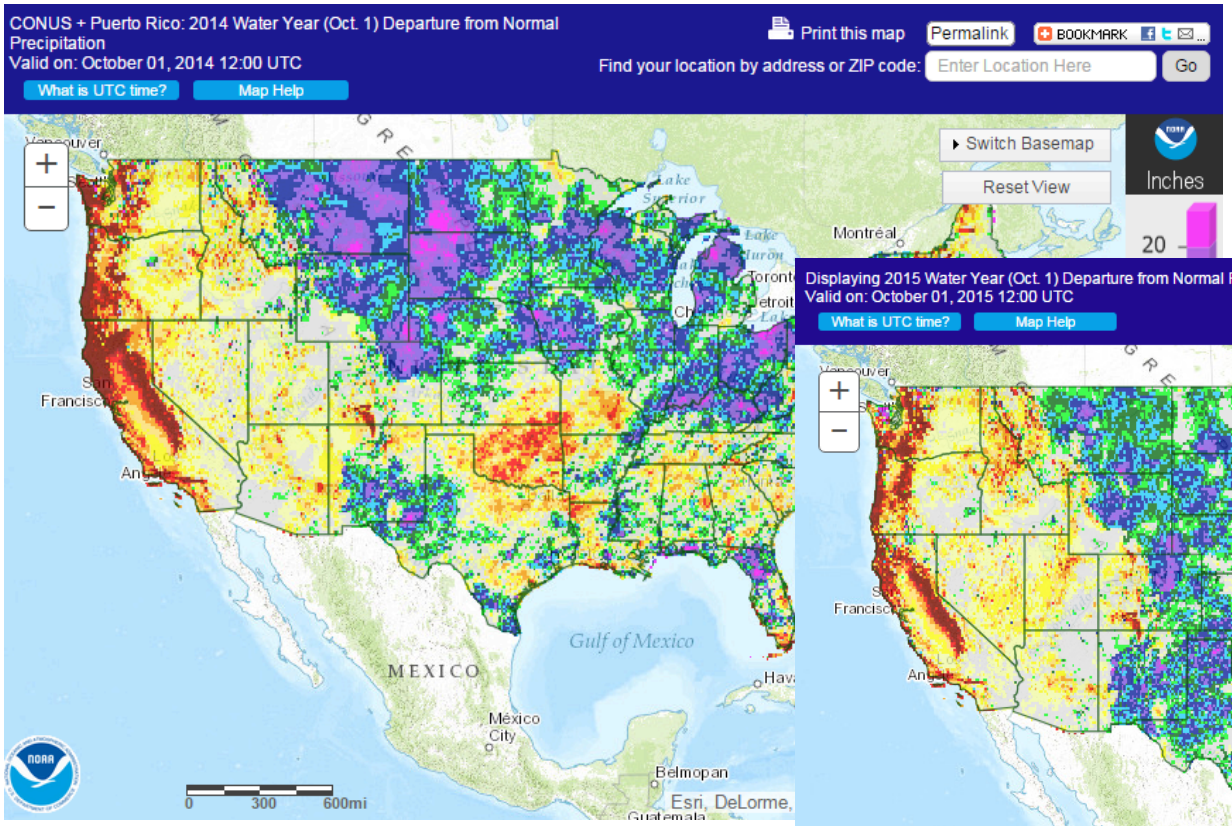
- Western drought status (Kevin Werner)
- El Nino status (Mike Halpert)
- Typical impacts of previous El Nino events
  - National Weather Service (Andrea Bair)
  - Western Regional Climate Center and the California Nevada Application Program (Nina Oakley)
  - Climate Assessment for the Southwest (Ben McMahan)
- Seasonal Outlook (Mike Halpert)
- Question and Answer

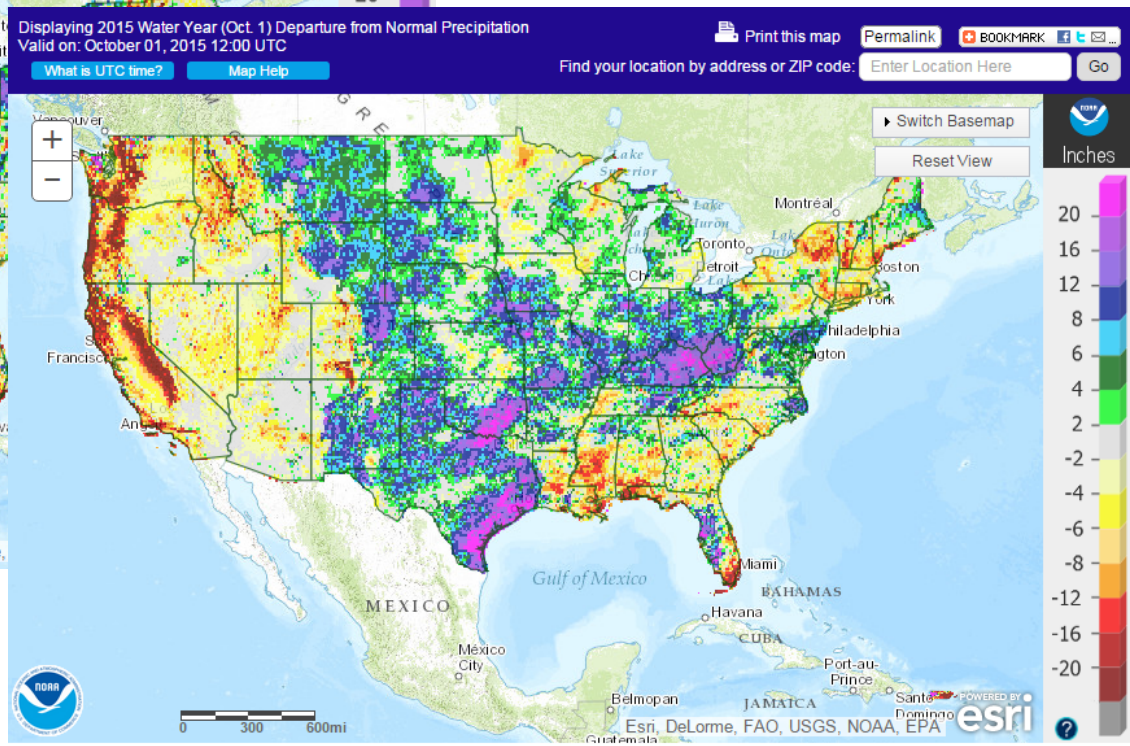
Western Drought Status

- Ongoing four year drought in California
- More recent ongoing drought across much of the west
- Drought characterized by:
  - Precipitation
  - Snow
  - Streamflow
  - Reservoirs
  - Soil Moisture and Groundwater



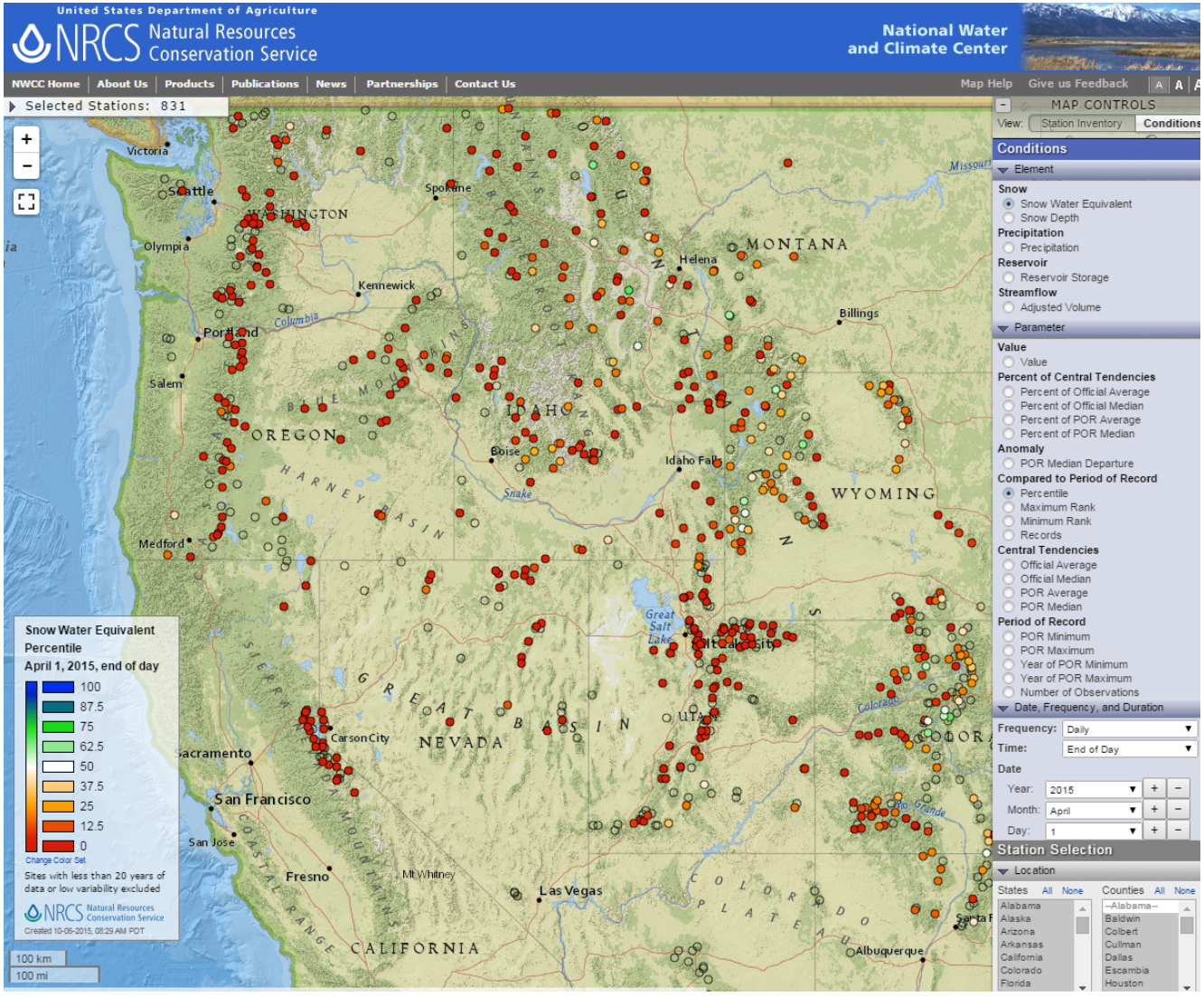
Precipitation





Water.weather.gov/precip

Snow



Credit: NRCS

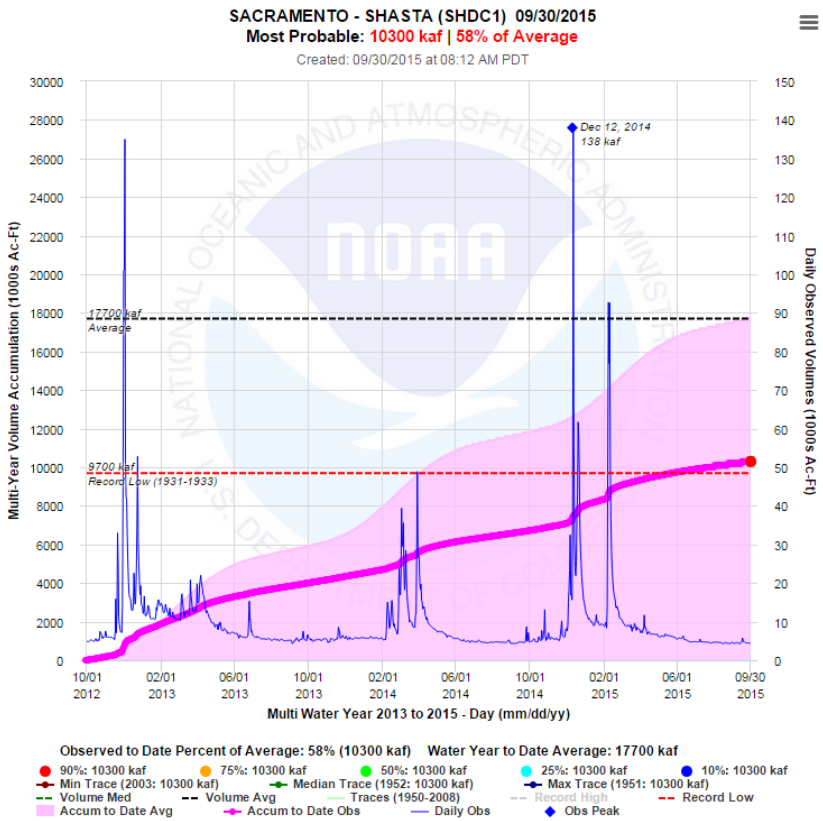
Streamflow

SACRAMENTO RIVER - SHASTA LAKE (SHDC1)

Latitude: 40.72° N Longitude: 122.42° W Elevation: 1070 Feet
Location: Shasta County in California River Group: Upper Sacramento

Issuance Time: Sep 30 2015 at 8:15 AM PDT

3-Water Year Accum. Volume Plot Ending 2016 CSV Ensemble File Download: Forecast Group | SHDC1

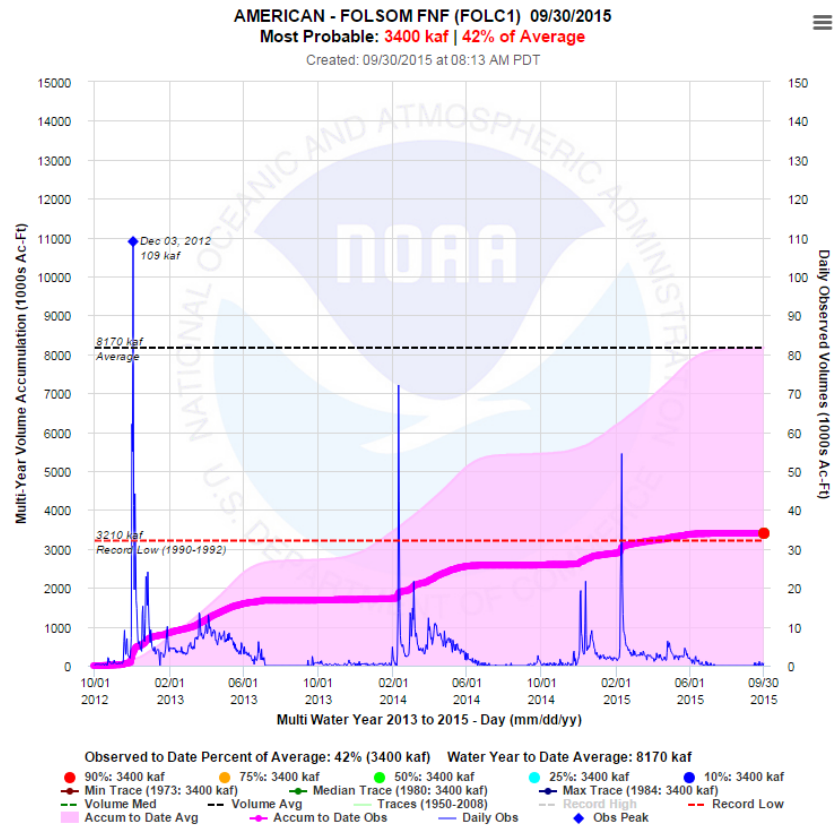


AMERICAN RIVER - FOLSOM LAKE (FOLC1)

Latitude: 38.71° N Longitude: 121.16° W Elevation: 350 Feet
Location: Sacramento County in California River Group: Lower Sacramento

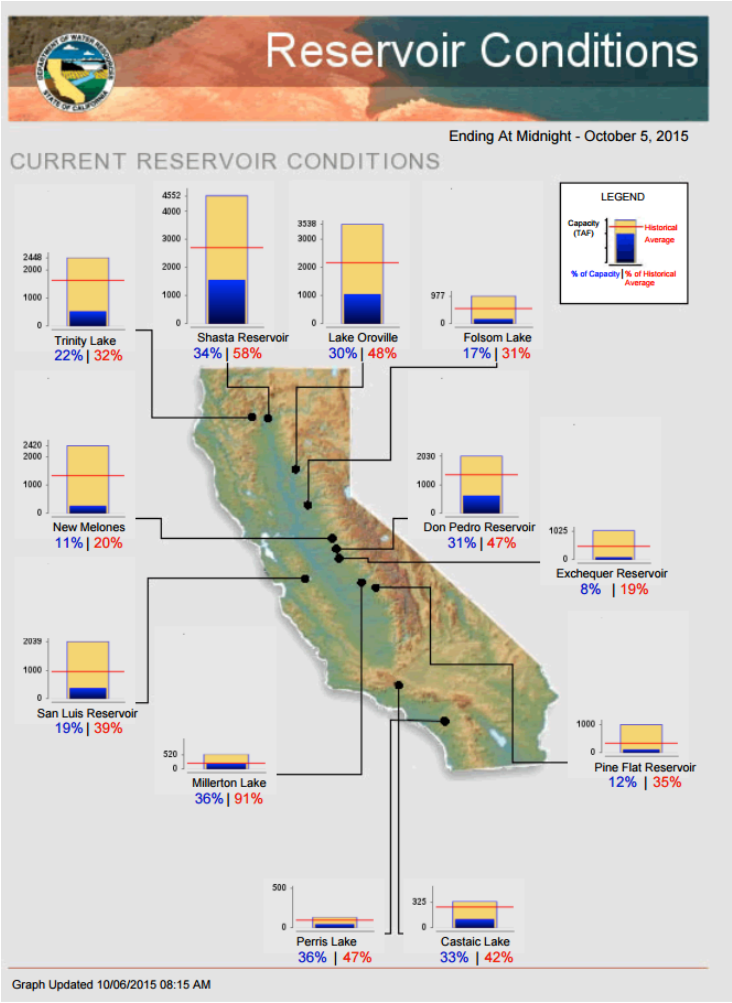
Issuance Time: Sep 30 2015 at 8:15 AM PDT

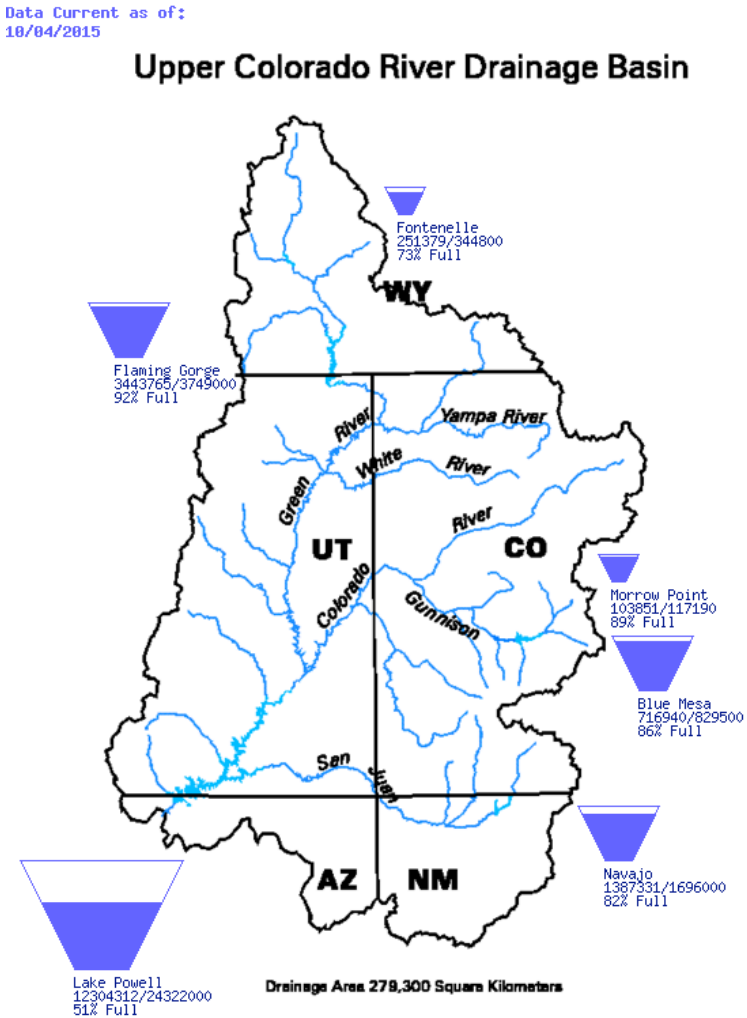
3-Water Year Accum. Volume Plot Ending 2016 CSV Ensemble File Download: Forecast Group | FOLC1



Credit: NOAA/NWS

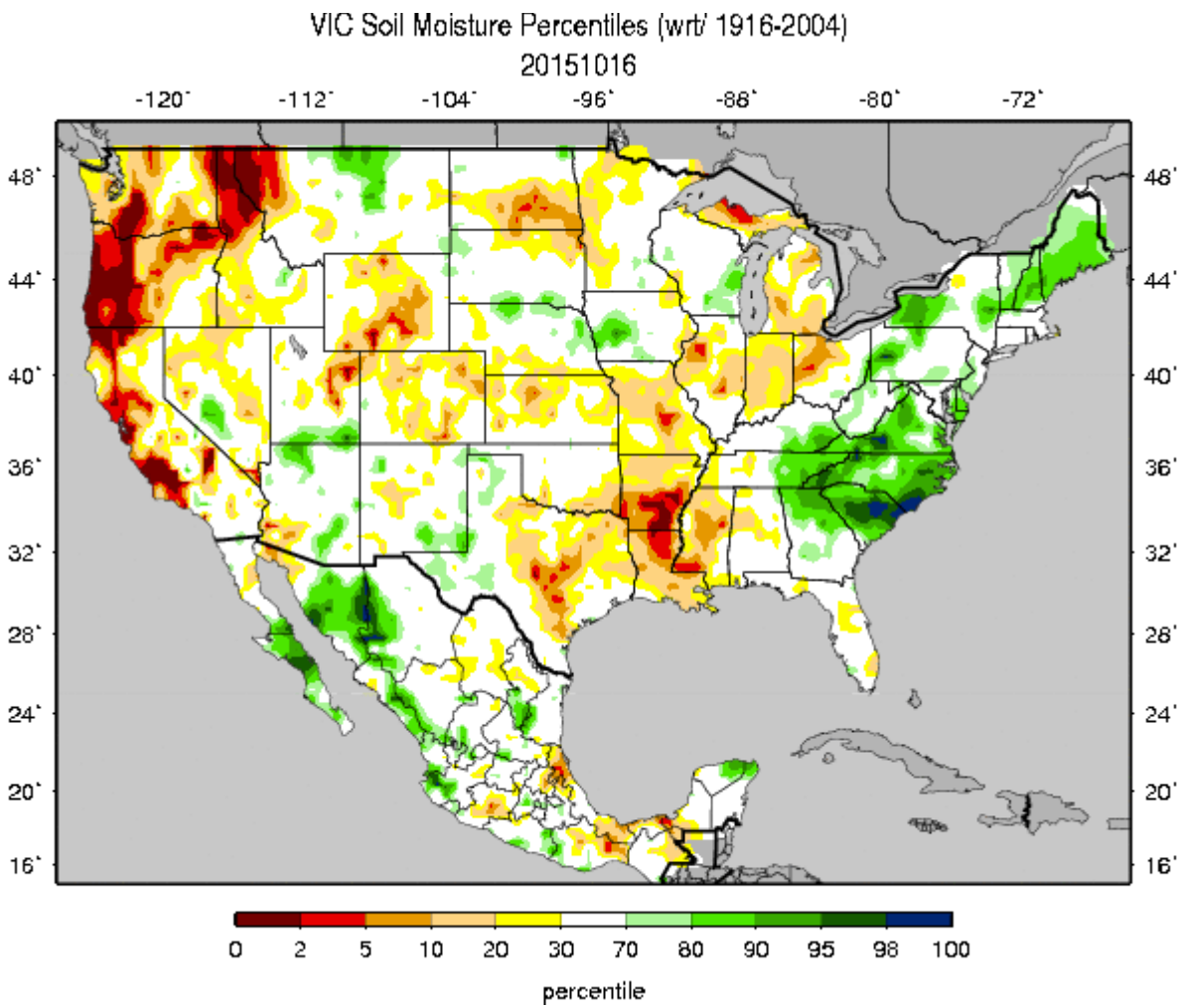
Reservoirs





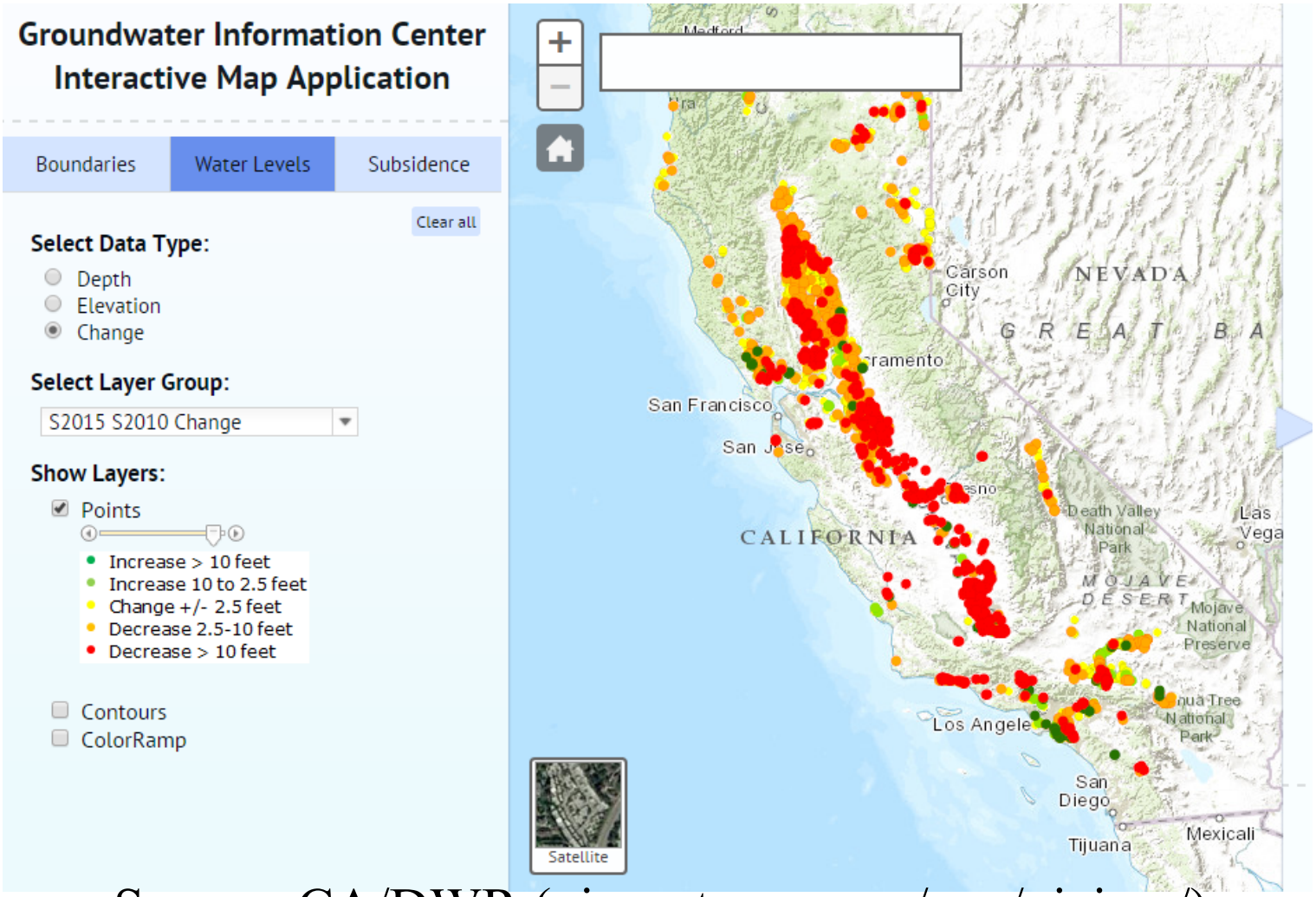
Credit: CA/DWR and USBR

Soil Moisture and Groundwater



Credit: U Washington

Soil Moisture and Groundwater



Source: CA/DWR (gis.water.ca.gov/app/gicima/)

El Nino and Outlook for Winter 2015-6

Mike Halpert
Climate Prediction Center / NCEP/ NOAA
19 October 2015

ENSO Summary

ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.*

Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

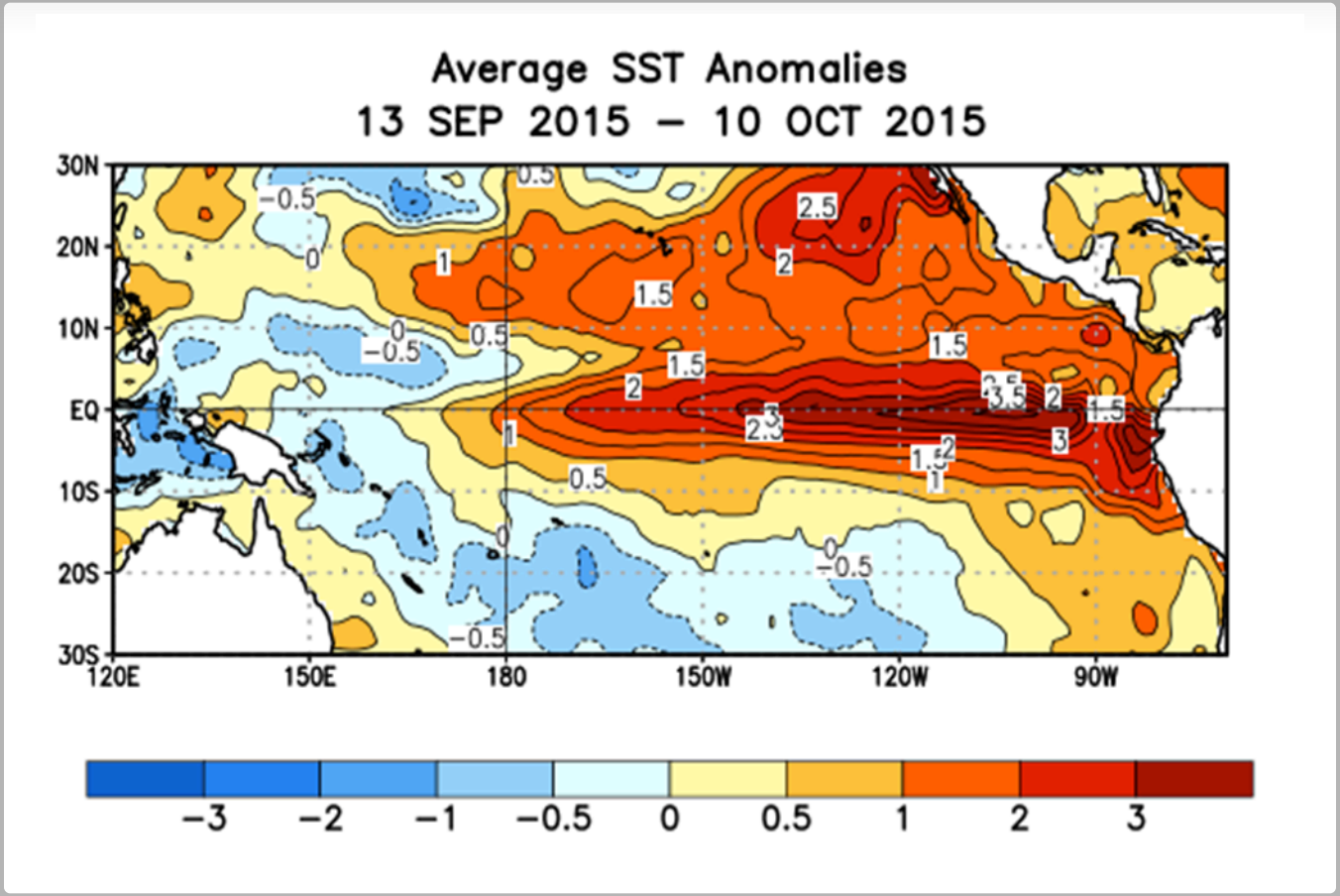
There is an approximately 95% chance that El Niño will continue through Northern Hemisphere winter 2015-16, gradually weakening through spring 2016.

ENSO Diagnostics Discussion http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/ensodisc.html

ENSO Blog http://www.climate.gov/news-features/department/enso-blog

Global SST Departures (°C) During the Last Four Weeks

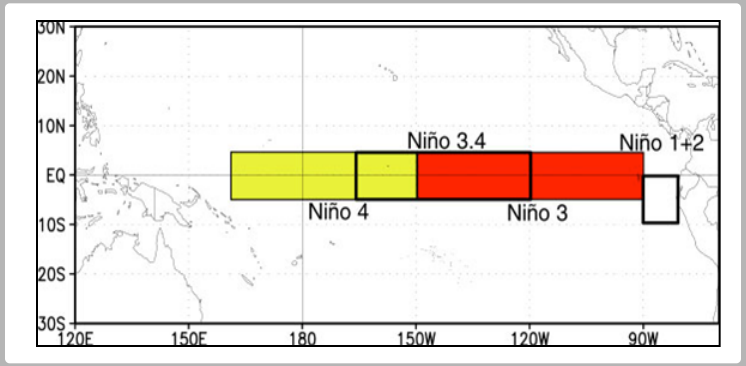
During the last four weeks, equatorial SSTs were above average across the central and eastern Pacific and the Indian Ocean.

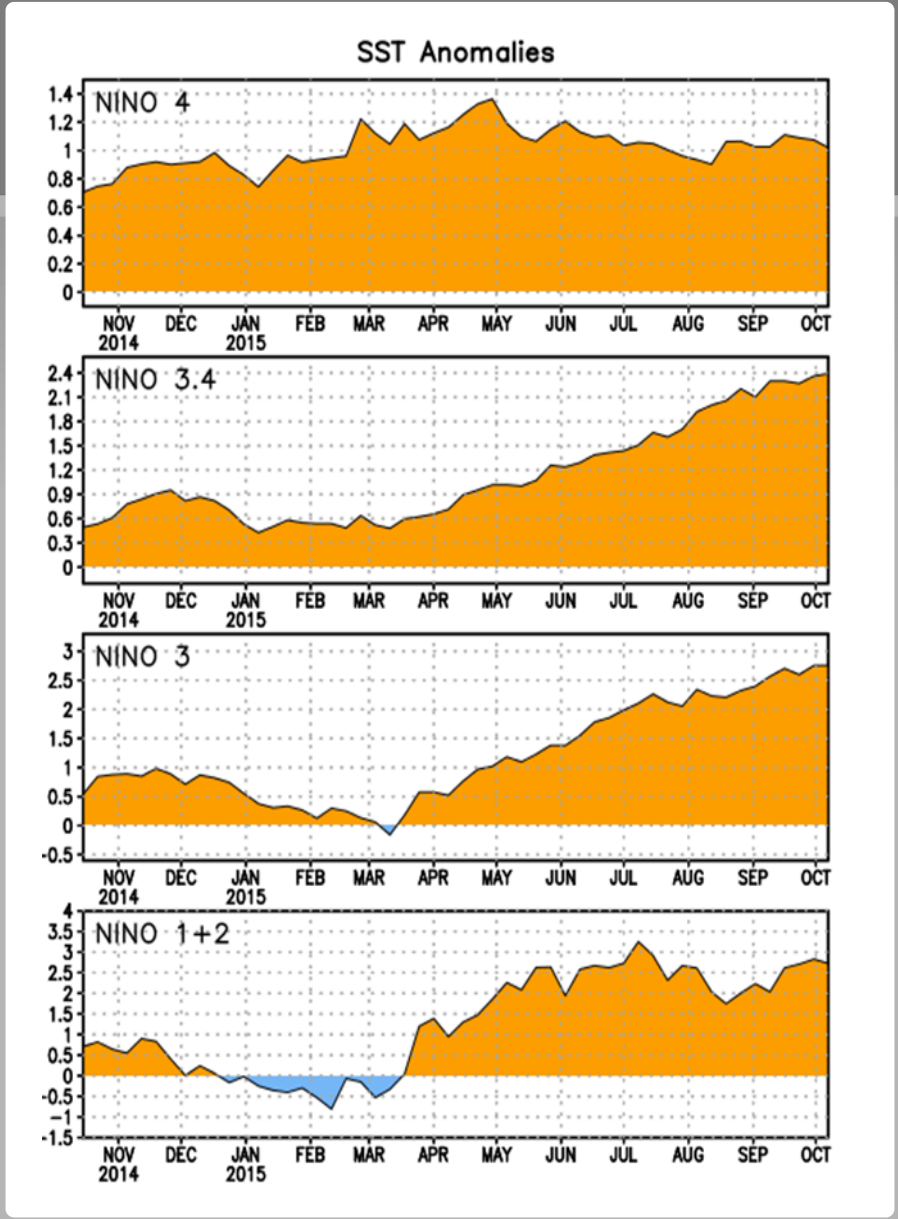


Niño Region SST Departures (ºC) Recent Evolution

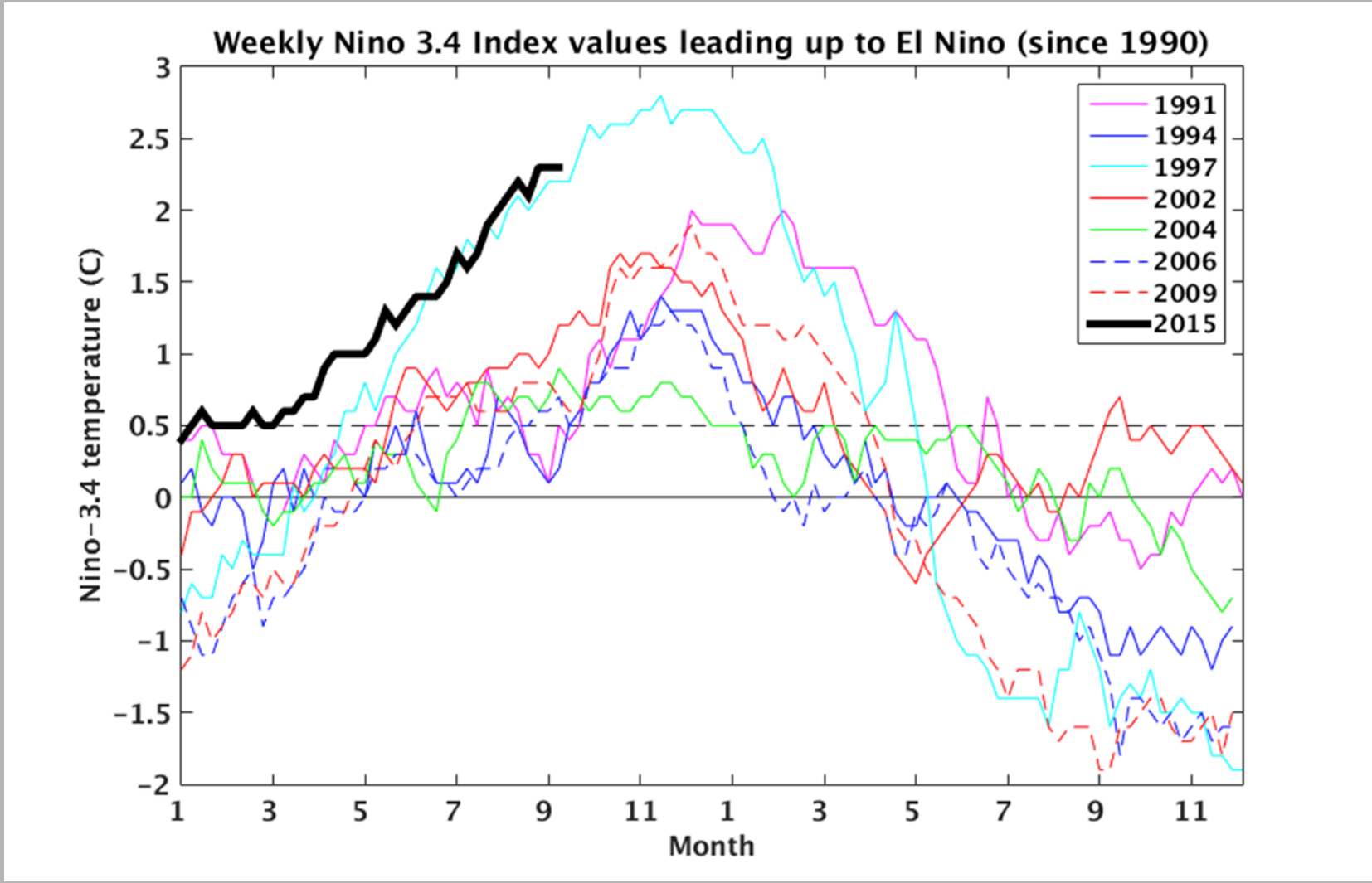
The latest weekly SST departures are:

Niño 4	1.0ºC
Niño 3.4	2.4ºC
Niño 3	2.8ºC
Niño 1+2	2.7ºC



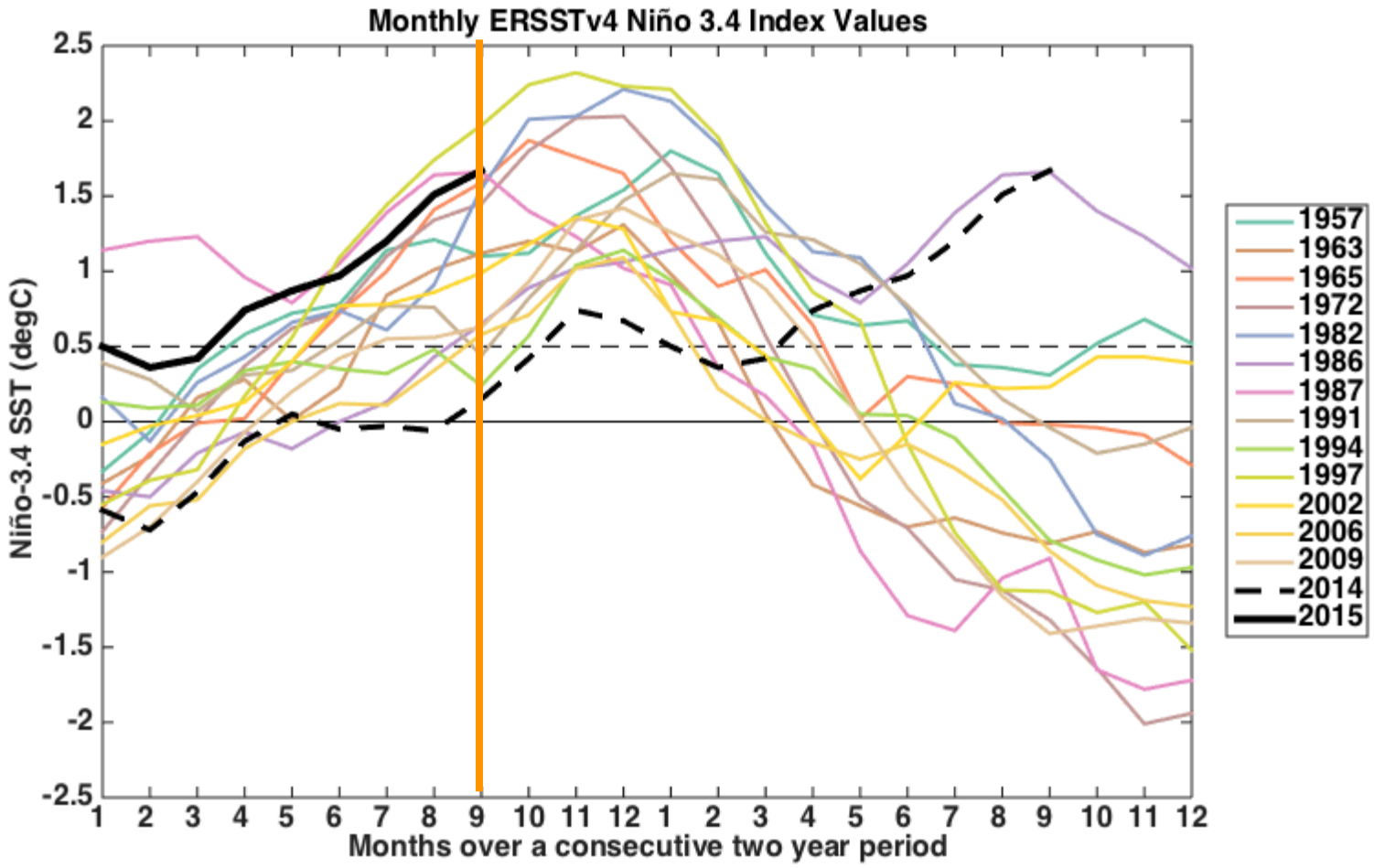


Weekly Niño 3.4 index values during El Niño events (since 1990)



Weekly OISSTv2 data going back to 1990

Monthly Niño 3.4 index values during El Niño events (since 1950)

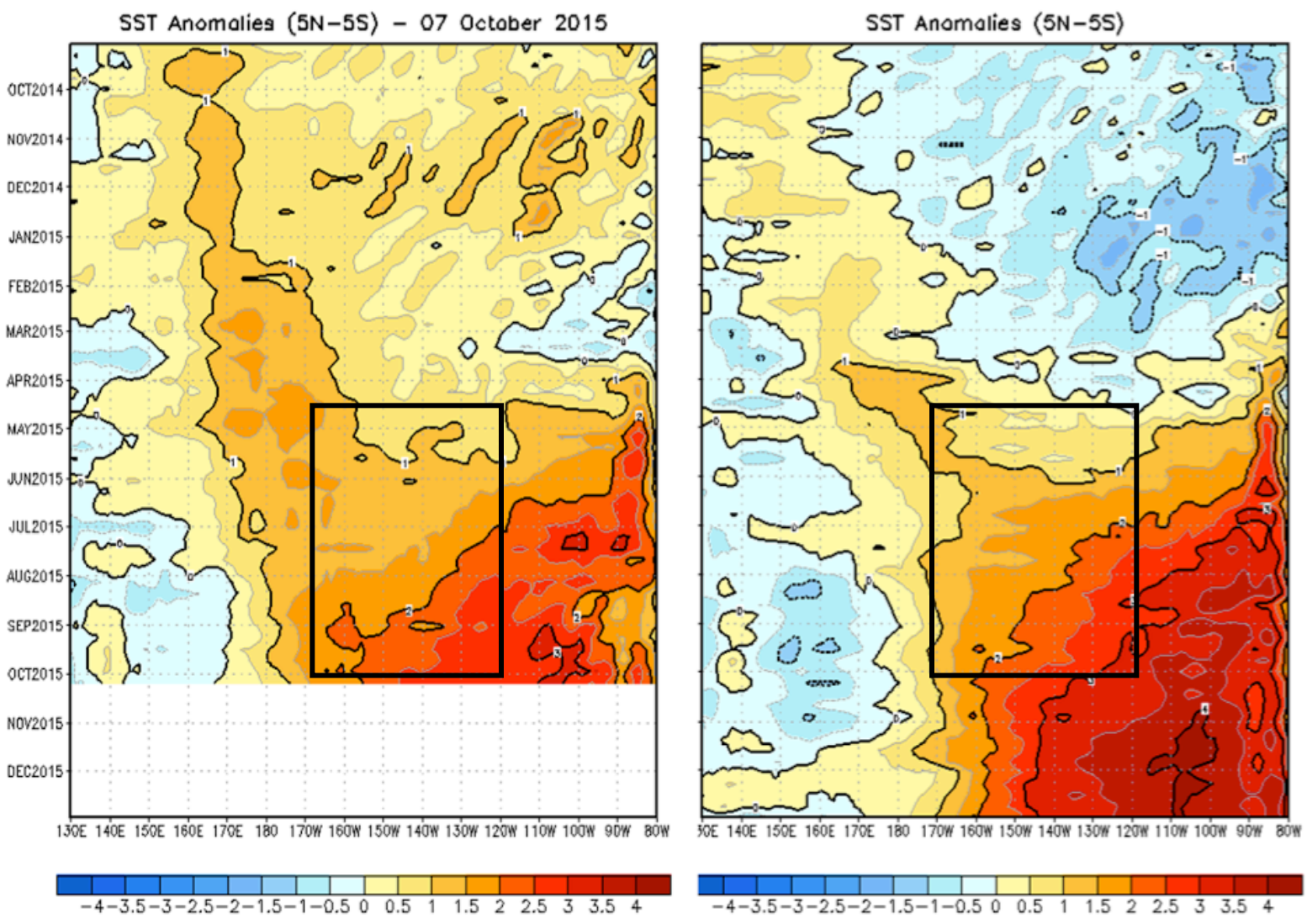


Monthly ERSST data going back to 1950

Sea Surface Temperature Anomalies (°C)

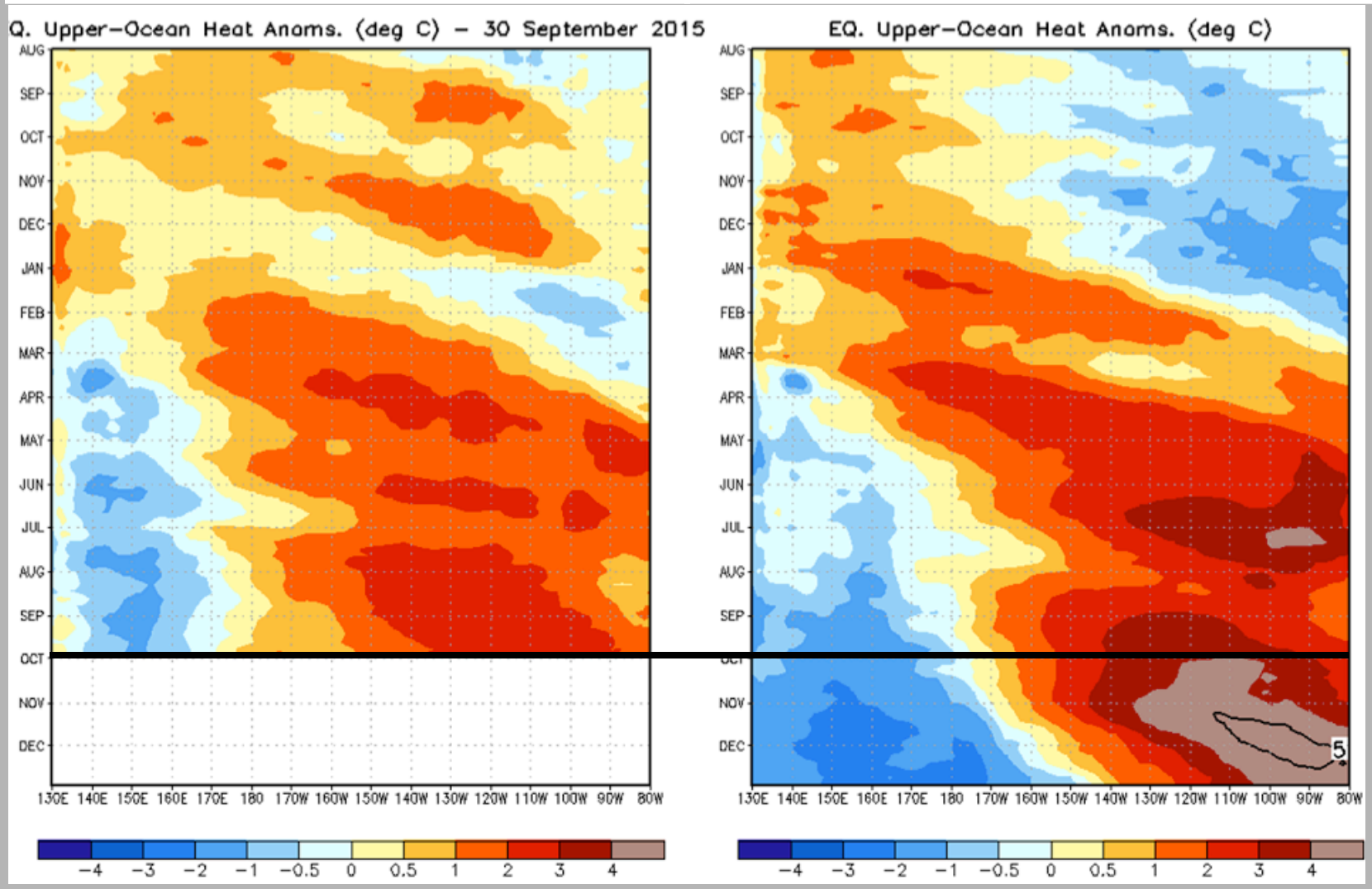
Oct 2014 – Dec 2015

Oct 1996 – Dec 1997

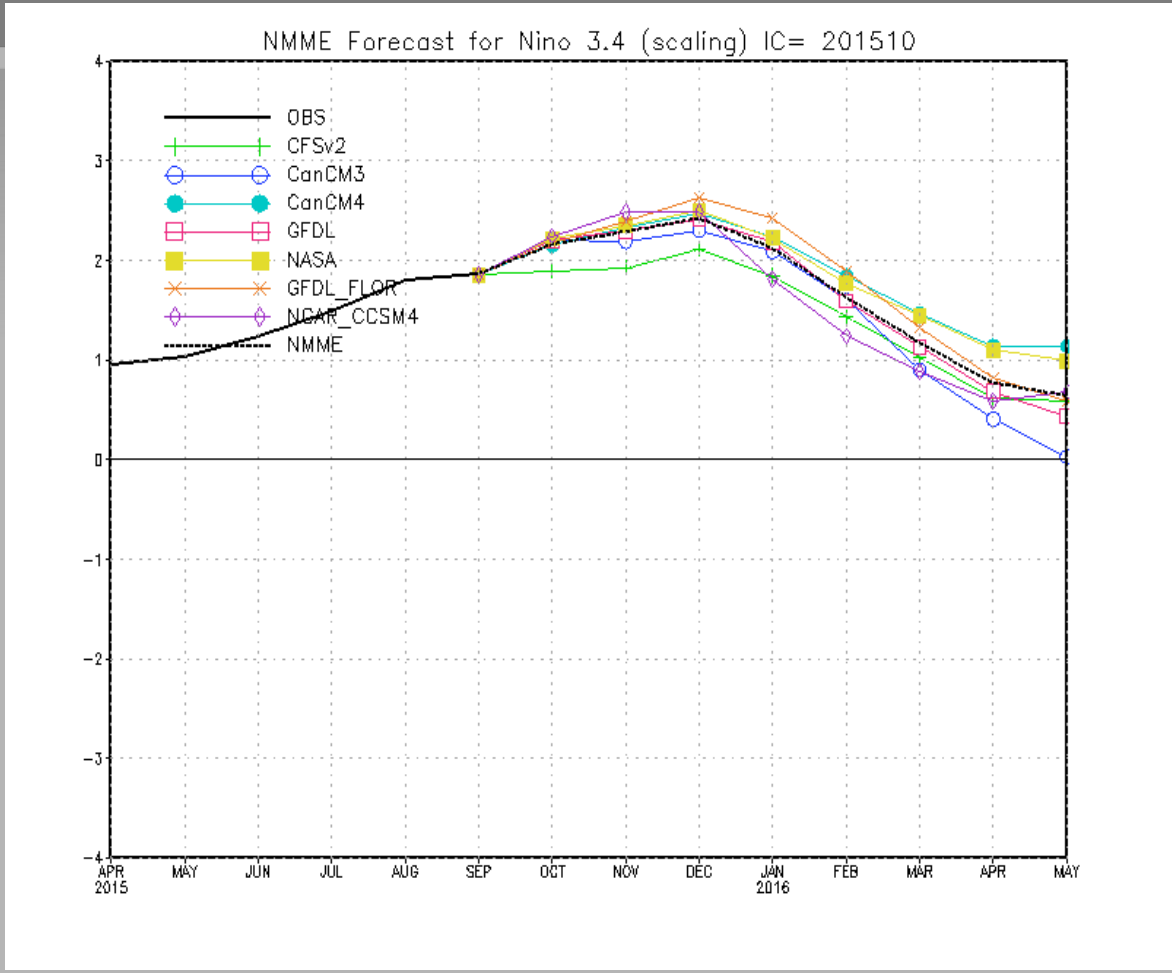


Sub-surface Anomalies (°C)

Aug 2014 – Dec 2015 Aug 1996 – Dec 1997



North American Multi-Model Ensemble (NMME) Niño 3.4 SST Model Outlook

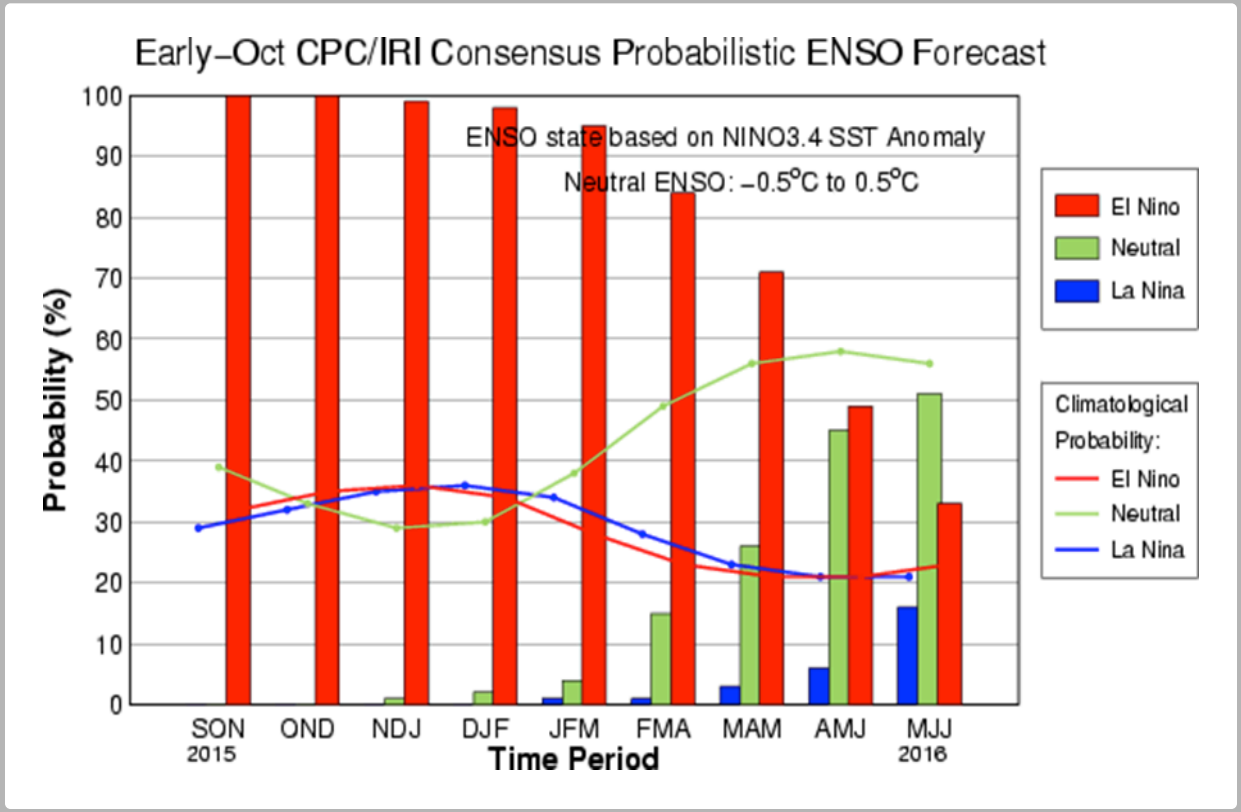


At this time, CPC/IRI forecasters favor "strong" (ONI > 1.5°C) peak amplitude during the late fall and early winter.

CPC/IRI Probabilistic ENSO Outlook

Updated: 8 October 2015

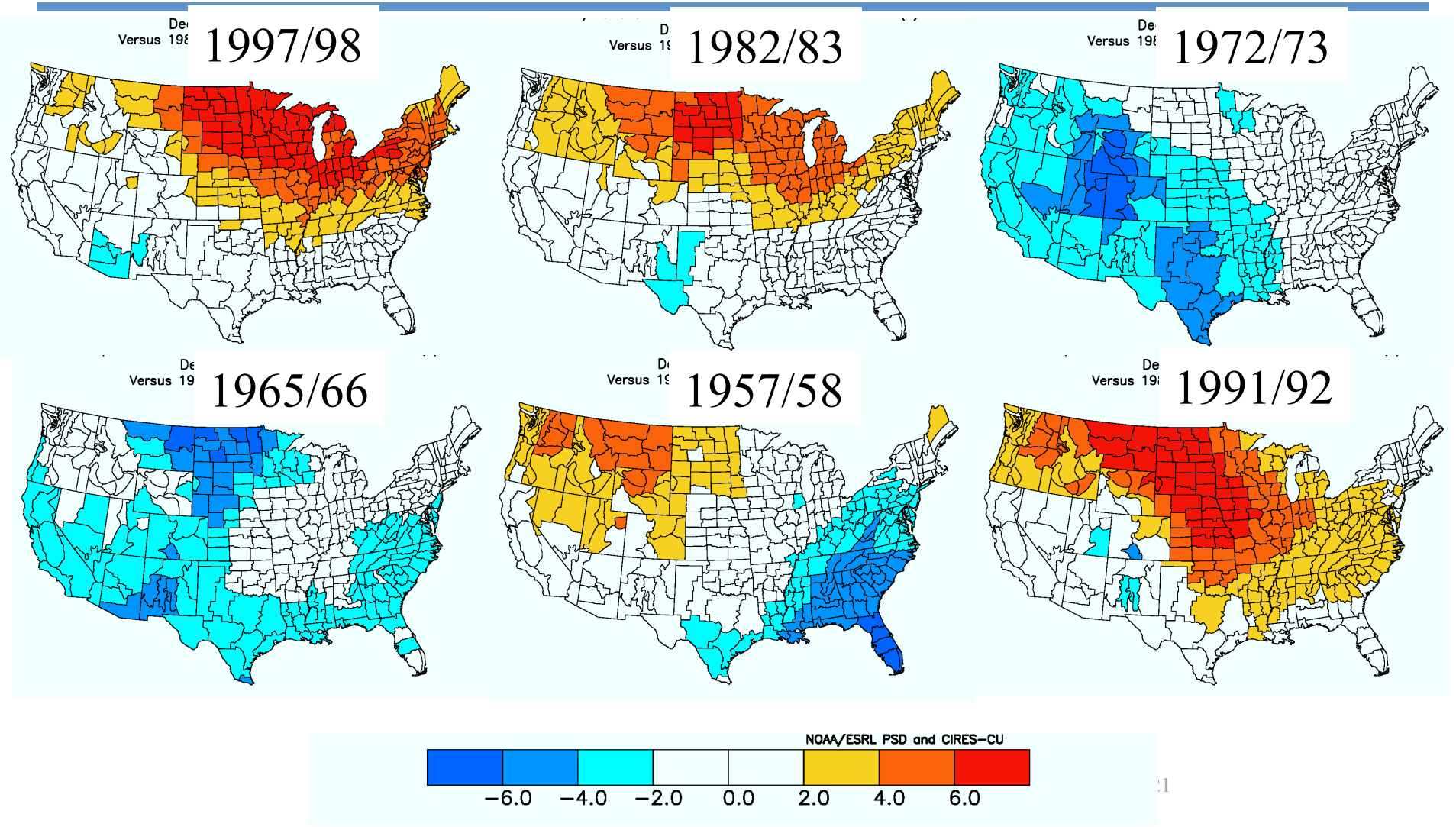
The chance of El Niño is approximately 95% through Northern Hemisphere winter and is just under 50% by late spring (AMJ) 2016.



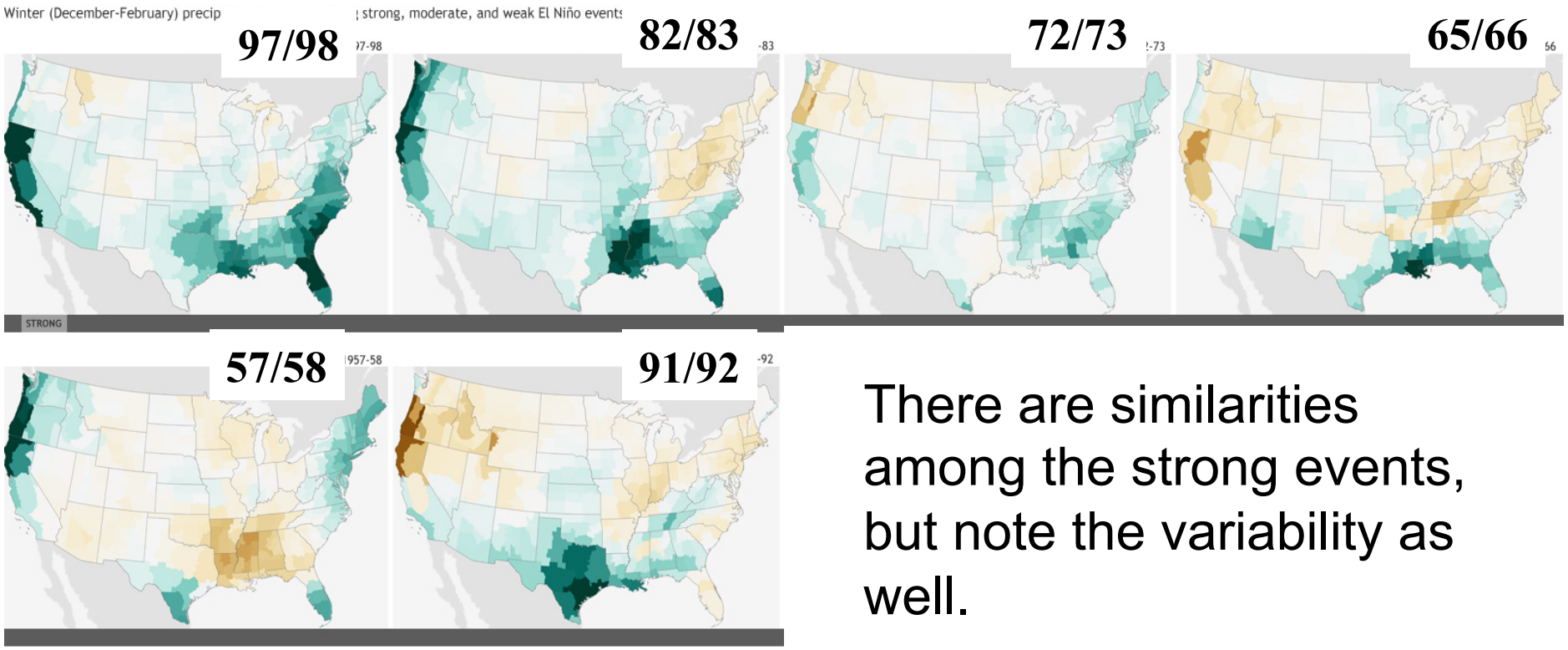
Typical El Nino Impacts

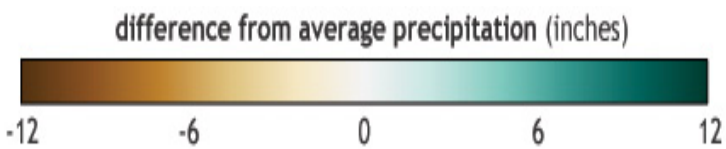
- Perspectives on typical impacts of previous El Nino events from the following (5-8 minutes each):
  - National Weather Service (Andrea Bair)
  - Western Regional Climate Center and the California Nevada Application Program (Nina Oakley)
  - Climate Assessment for the Southwest (Ben McMahan)
  - Western Region Climate Services (Kevin Werner)

Winter Temperature Departures
6 Strongest El Niños



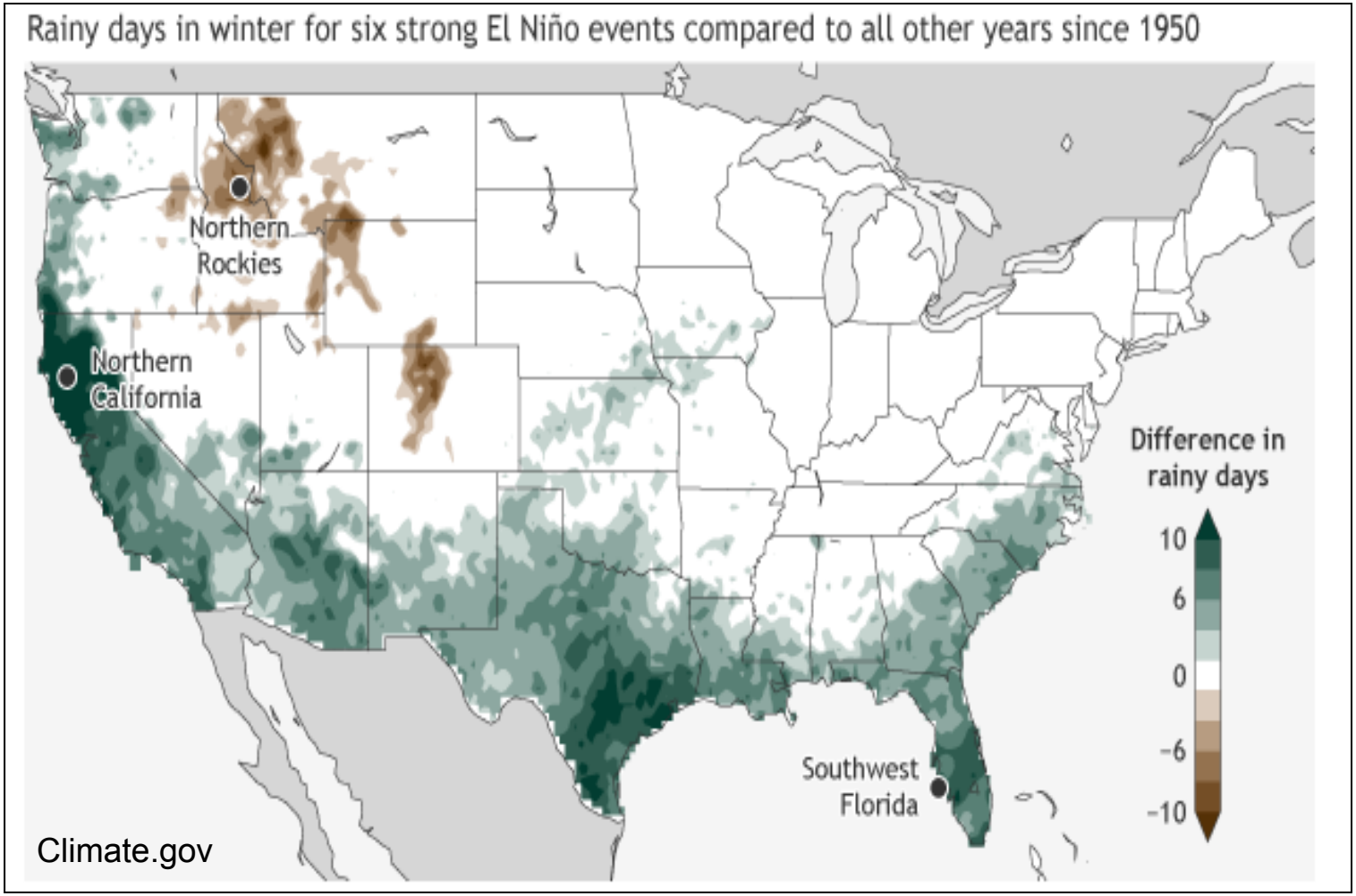
Winter (Dec-Jan-Feb) Precipitation during Past Strong El Niño Events





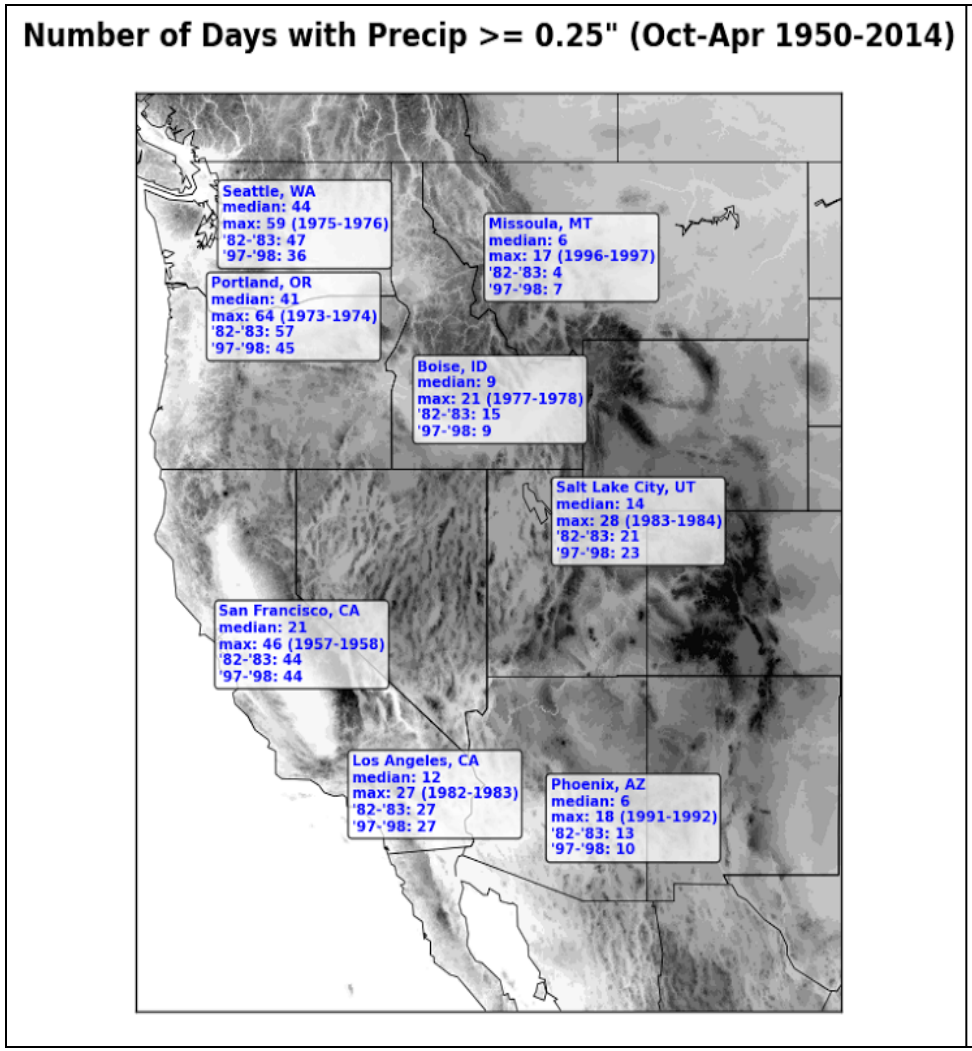
There are similarities among the strong events, but note the variability as well.

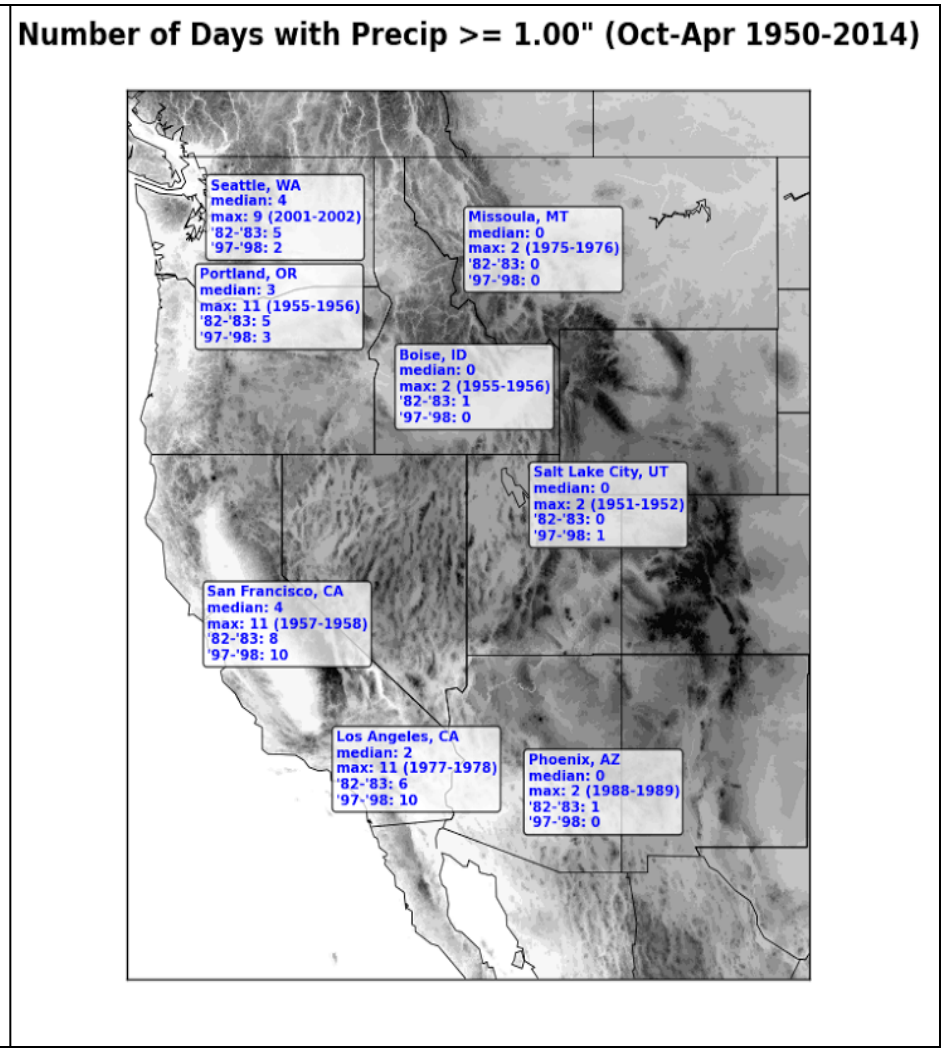
Historical Impacts of six Strong El Niños



Number of precipitation days (> 0.10”)

The Two Strongest El Niños





Jonathan Rutz – National Weather Service

CA Statewide winter precipitation During previous 6 strong El Niños

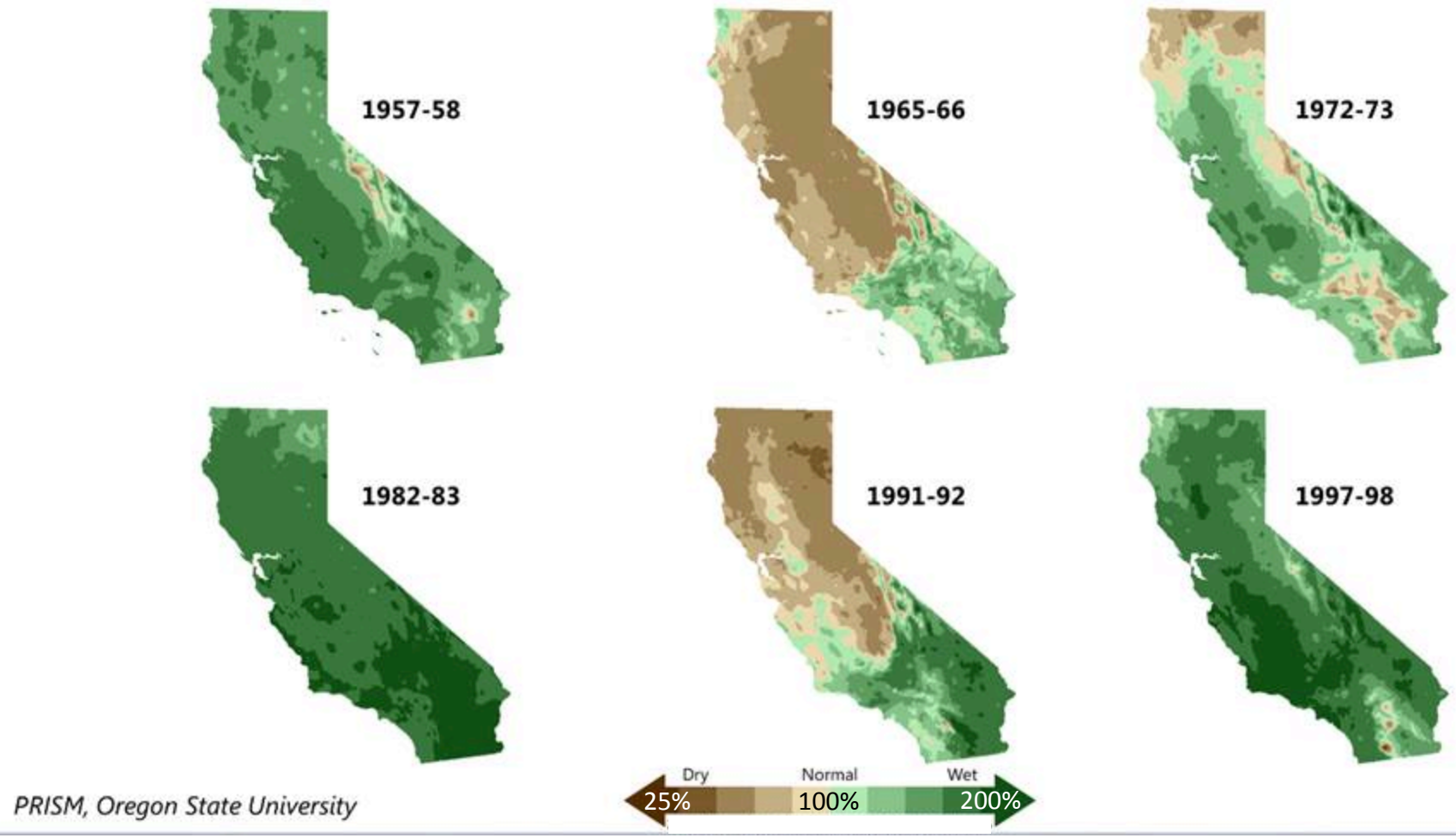
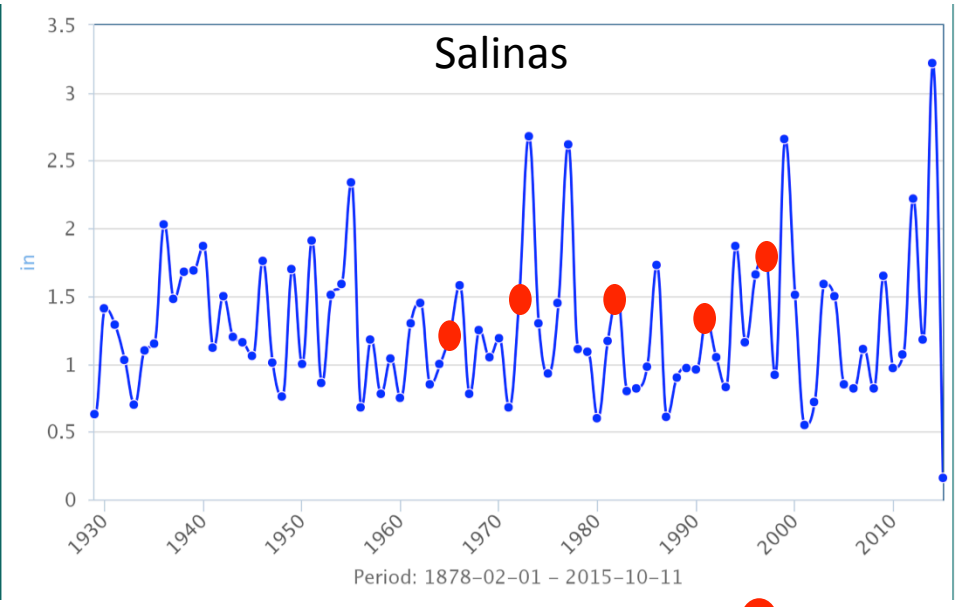
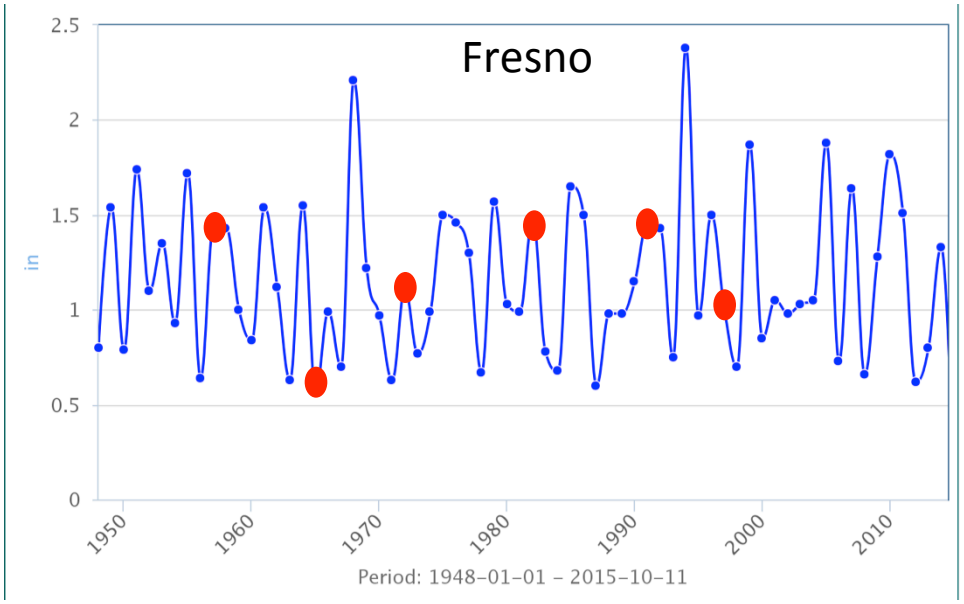


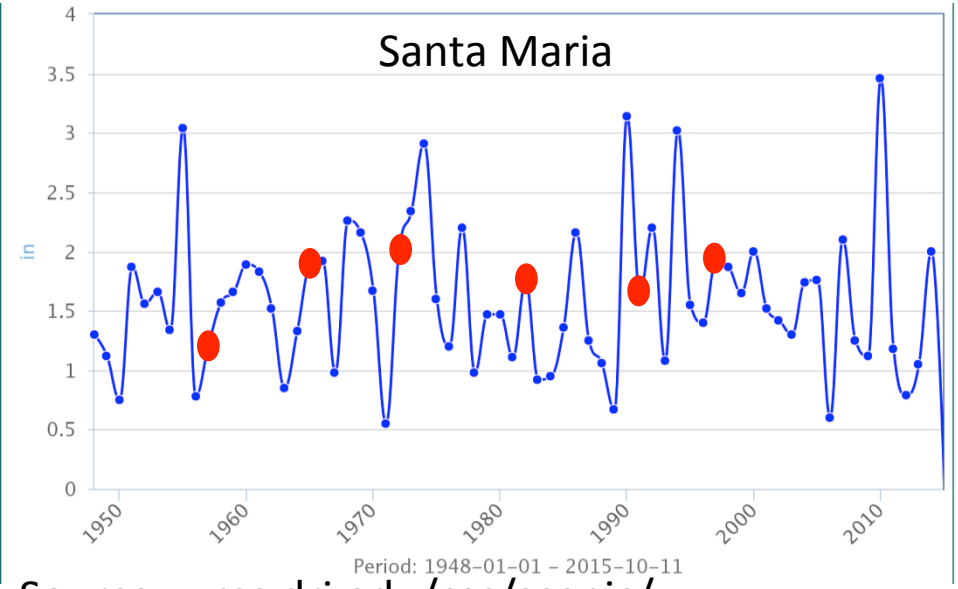
Image courtesy NWS Sacramento

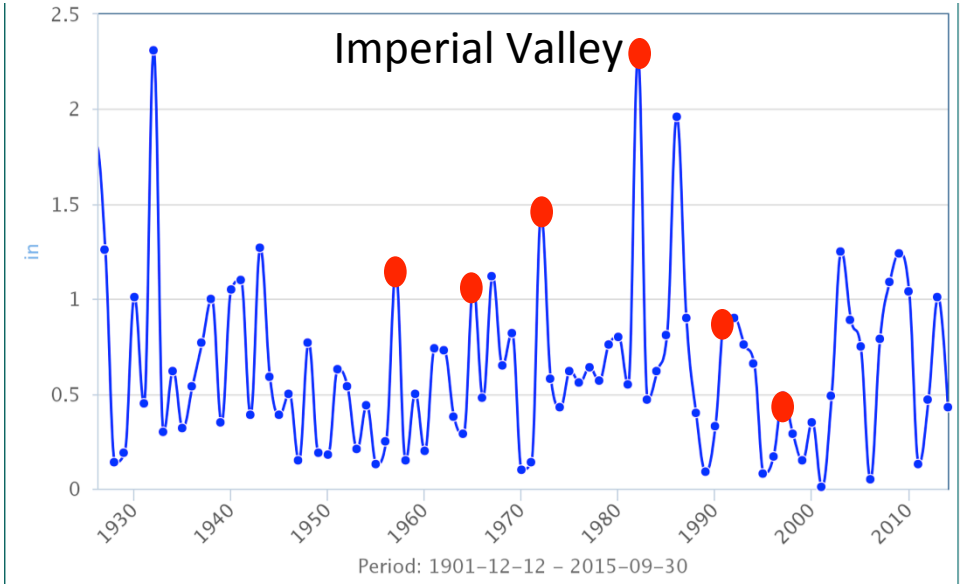
1-day Oct-Mar rainfall extremes by year





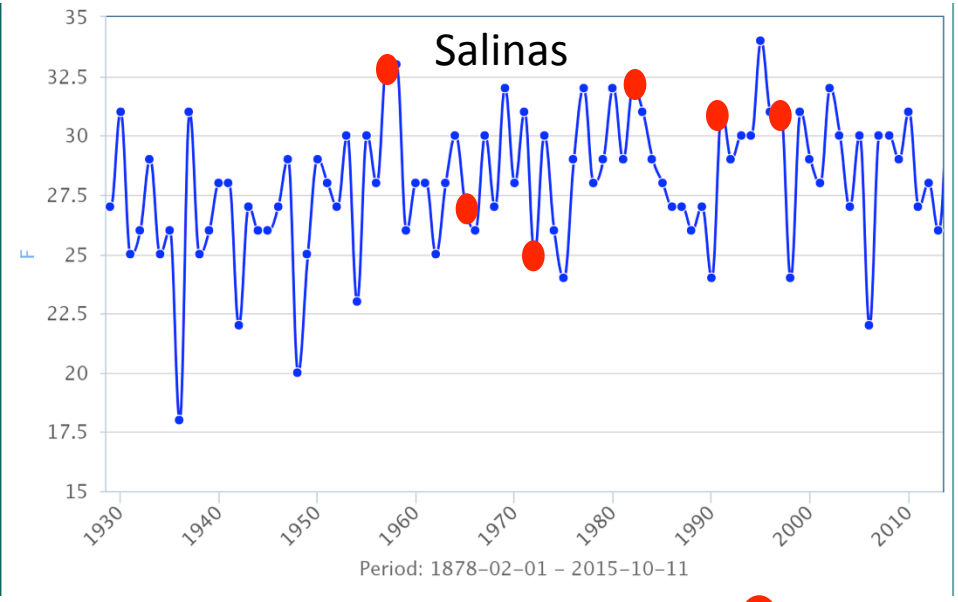
= Strong El Niño Winter

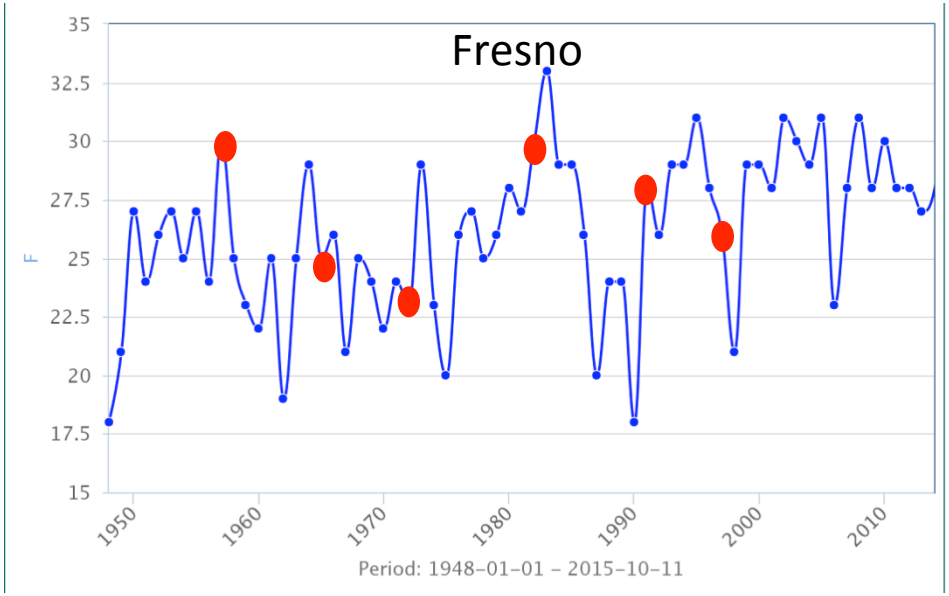




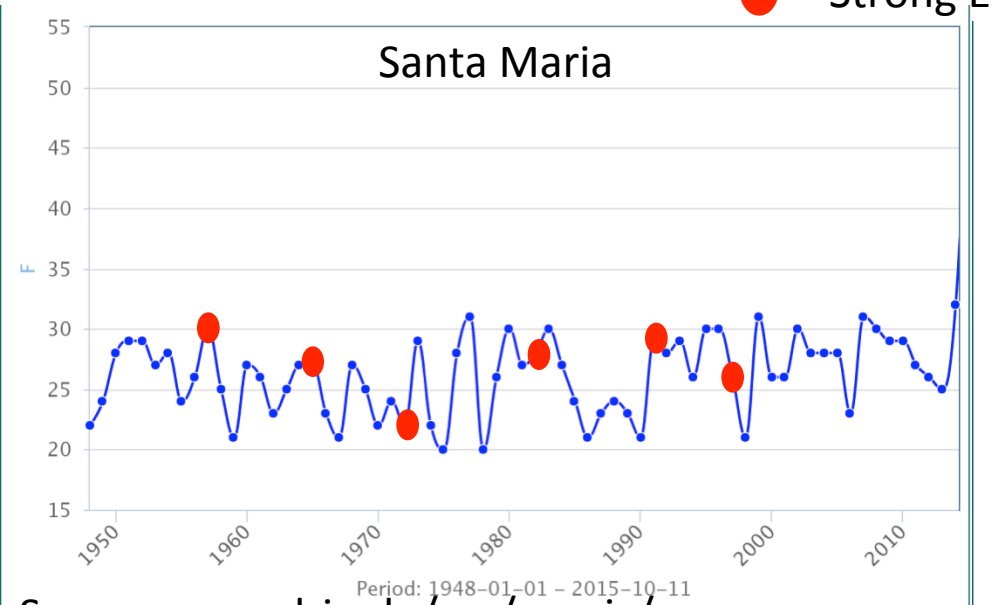
Source: wrcc.dri.edu/csc/scenic/

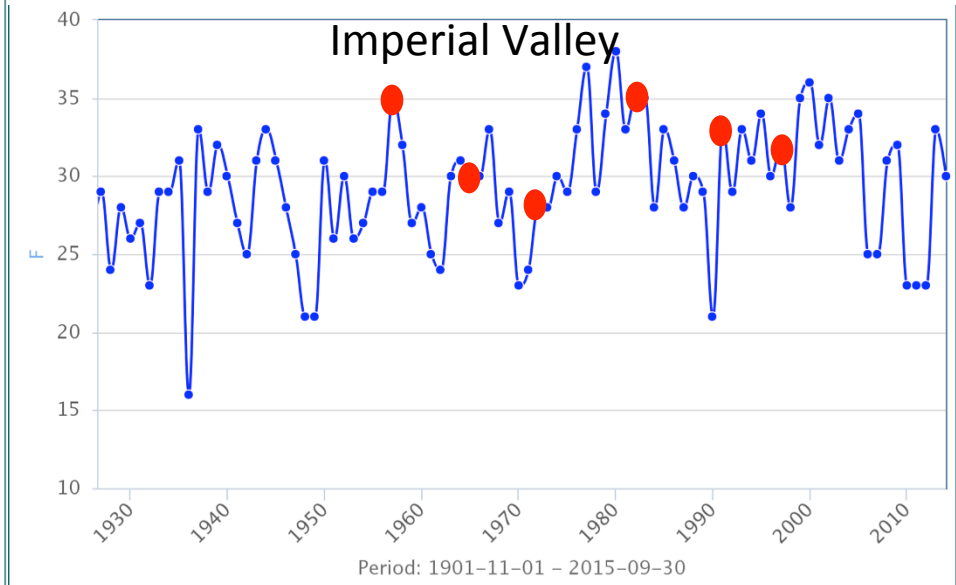
1-day Oct-Mar min. temperature extremes





= Strong El Niño Winter

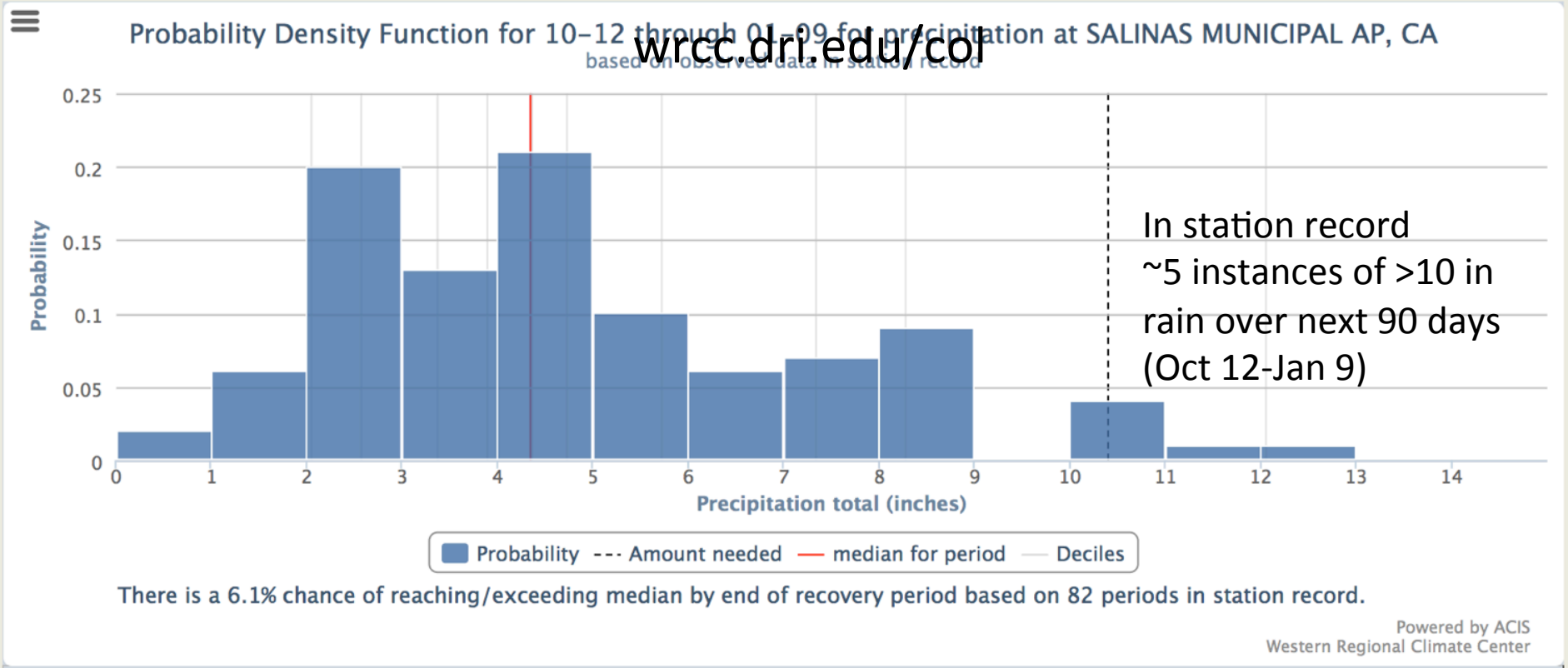




Source: wrcc.dri.edu/csc/scenic/

CA Climate Outcome Likelihood Tool

wrcc.dri.edu/col



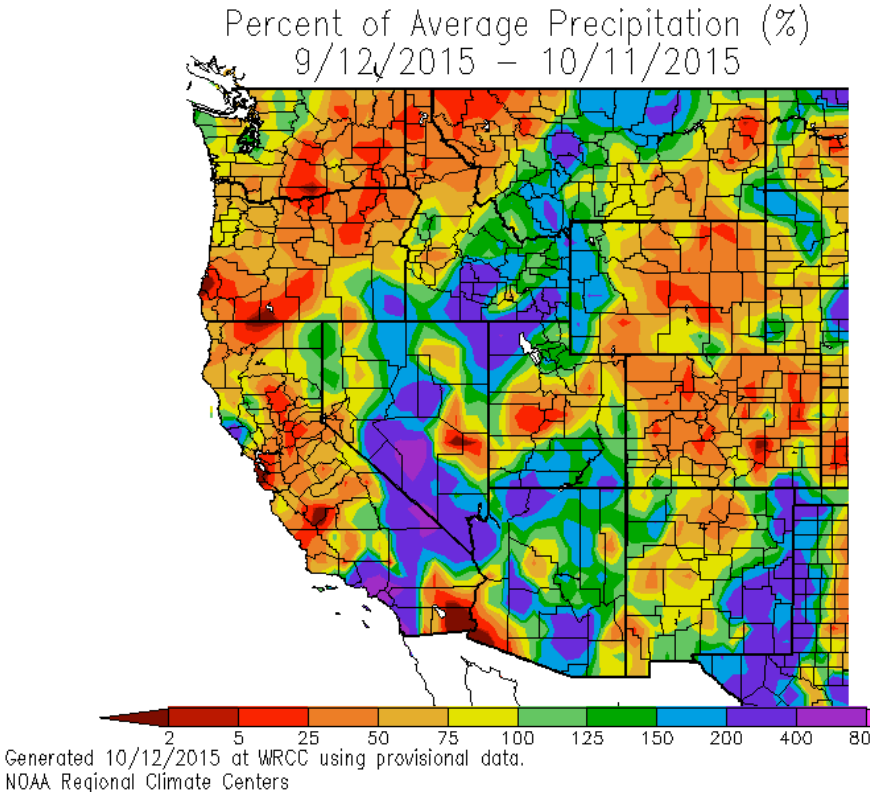
Analysis for: SALINAS MUNICIPAL AP, CA ? How to interpret graph	
Precipitation accumulated from 2015-01-01 to 2015-10-11: 2.12 in. (0 missing days)	There is a deficit of 6.05 in. from median for this period. Median for this period is 8.17 inches based on 78 periods in station record.
Amount needed to reach/exceed median by 2016-01-09: 10.41 in.	Likelihood of recovery between 2015-10-12 and 2016-01-09: **6.1%**
82 of 137 records used based on station record 1878-02-01 to 2015-10-11	

Climate Anomaly Maps

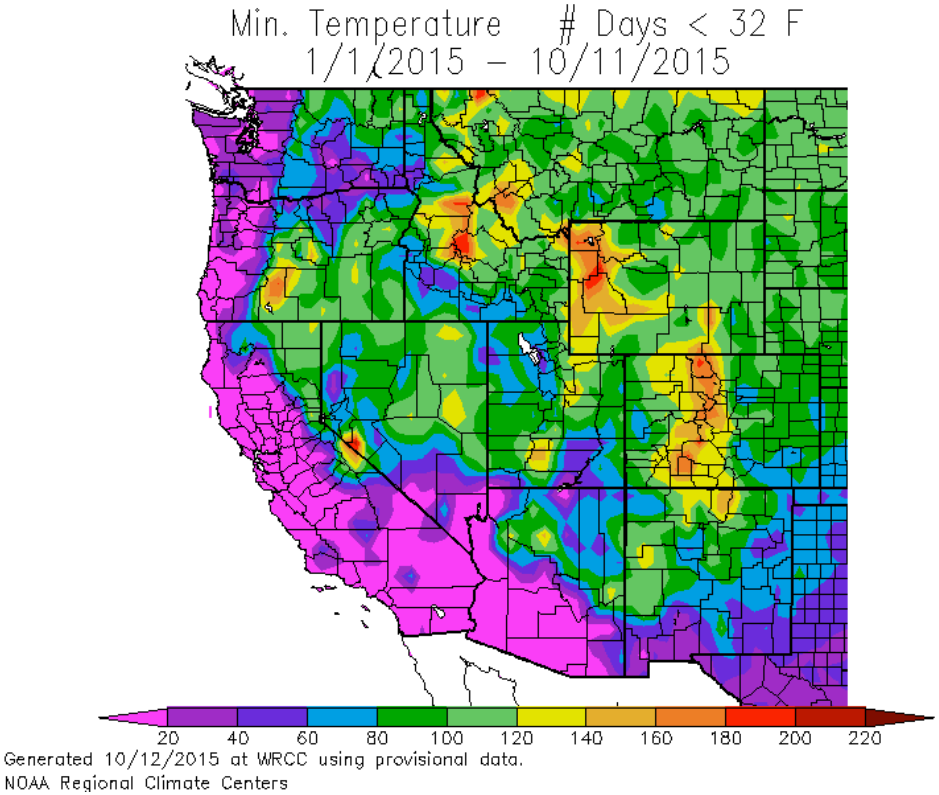
www.wrcc.dri.edu/anom/

Archives: hprcc.unl.edu/maps.php?map=ACISClimateMaps

Last 30 days: % avg precip



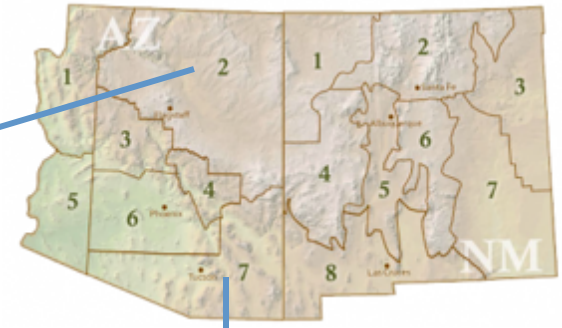
Since Jan 1: # days below freezing

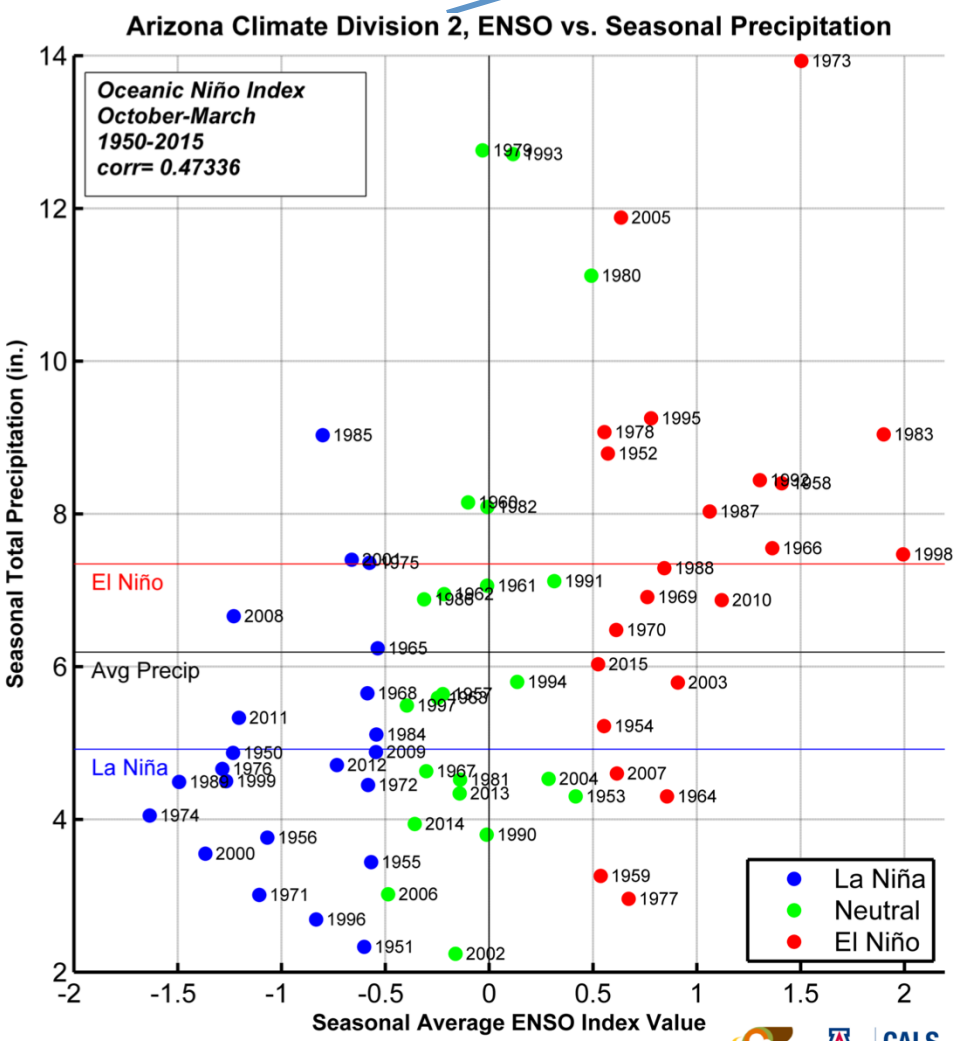


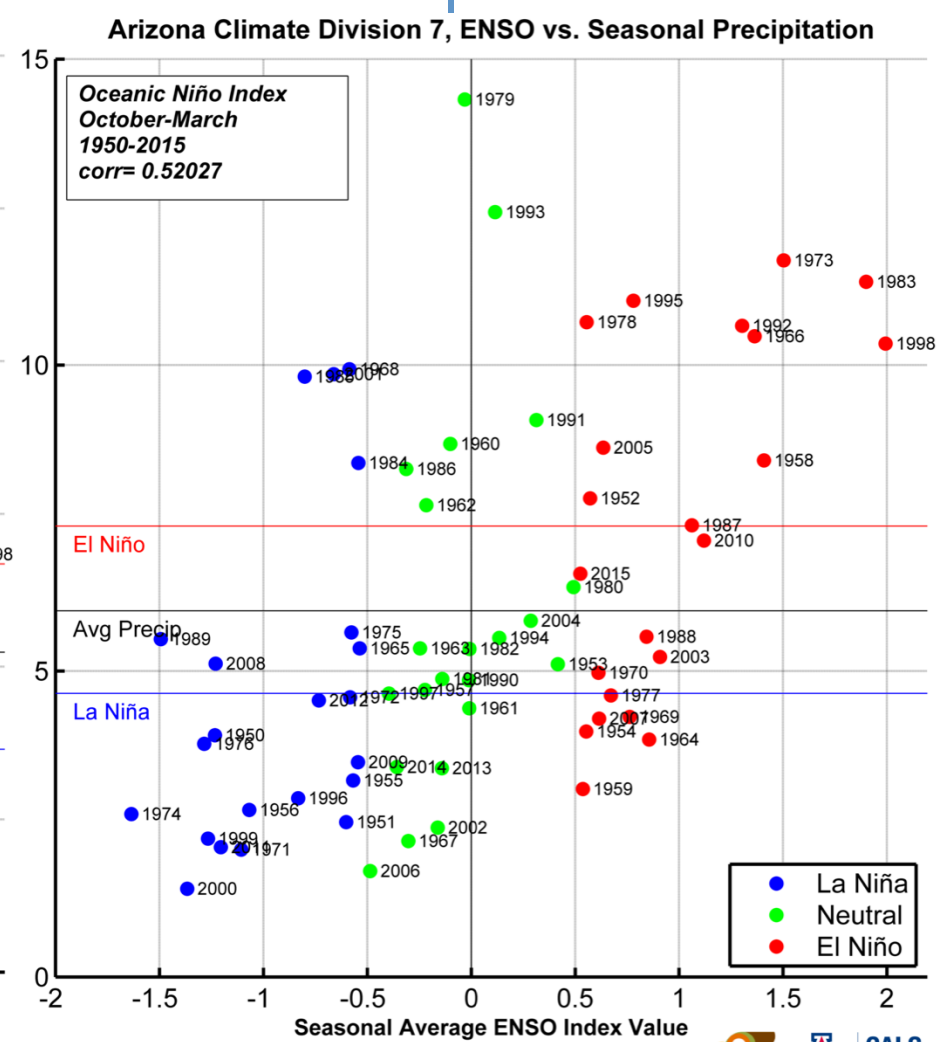
Many precipitation, temperature analyses available at multiple timescales

Southwest Impacts (CLIMAS)

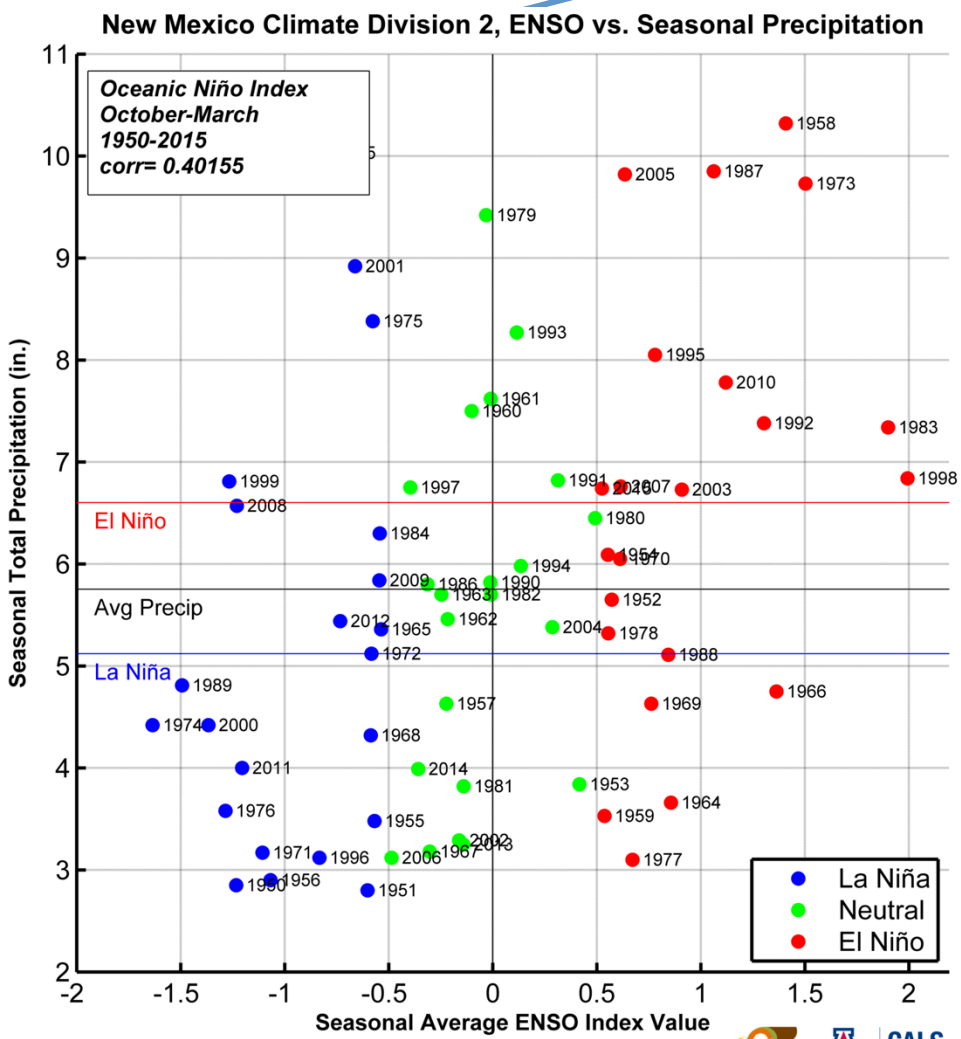
AZ: ENSO Index Seasonal Average vs. Cool Season Precipitation (Oct-Mar)



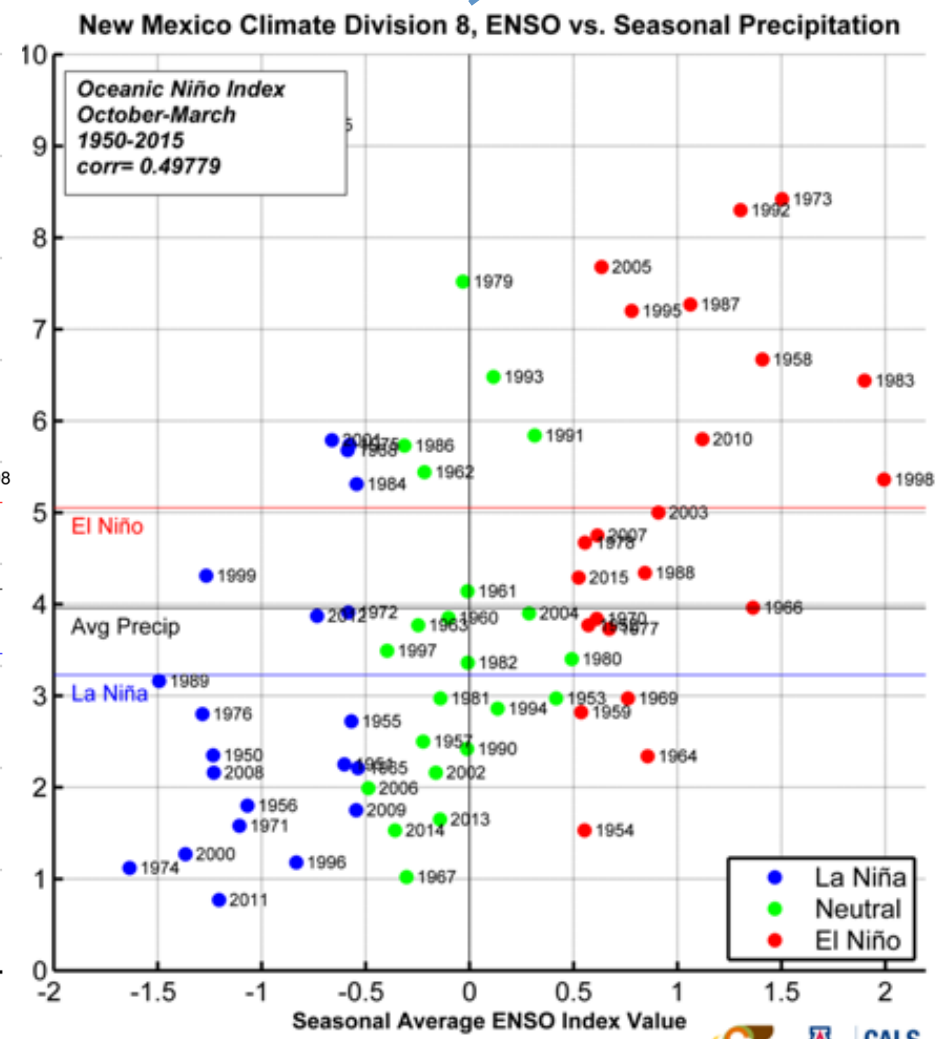




NM: ENSO Index Seasonal Average vs. Cool Season Precipitation (Oct-Mar)

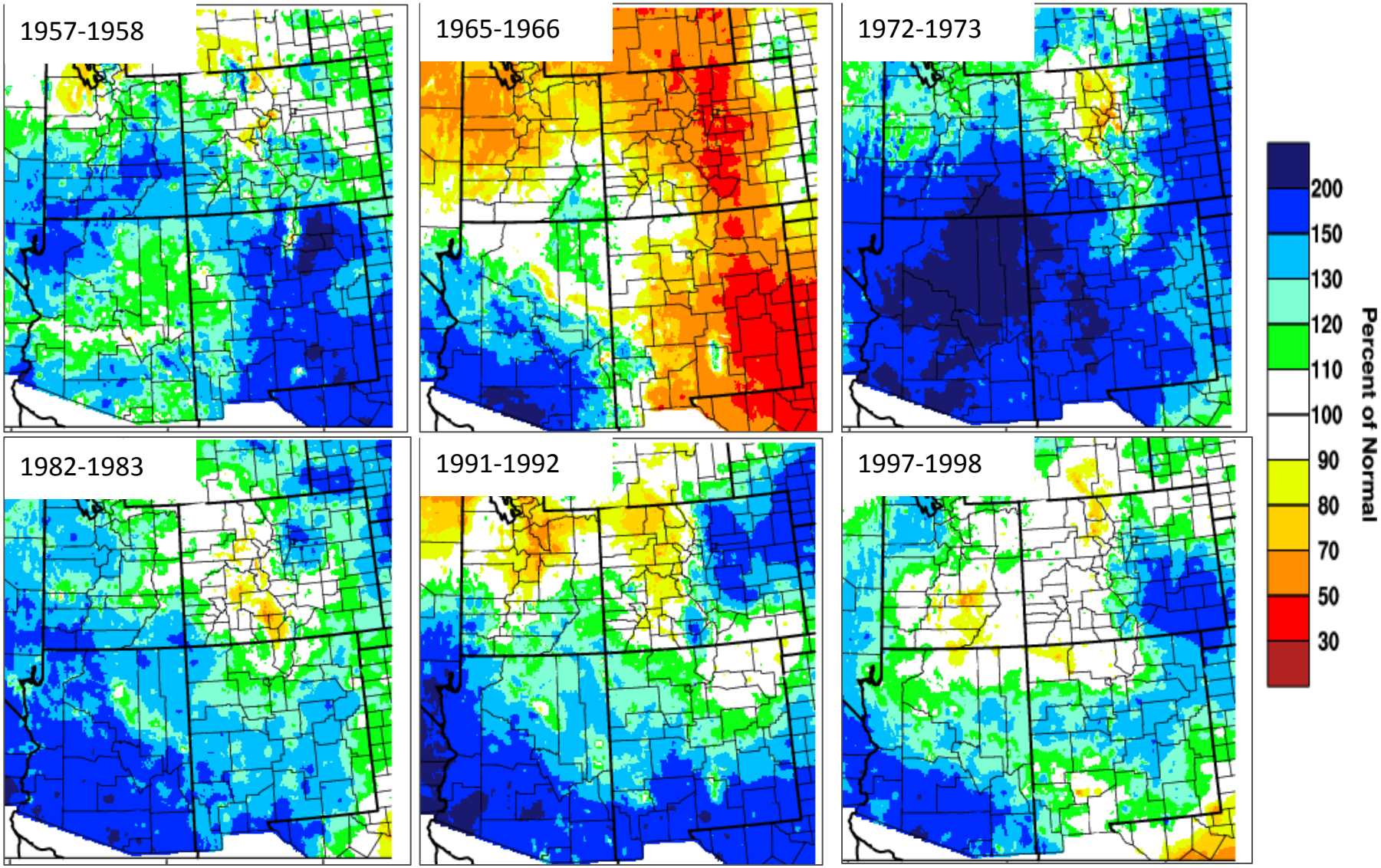


Data from NOAA-NCDC and NOAA ESRL, Date created: 30-Sep-2015
University of Arizona - http://cals.arizona.edu/climate/



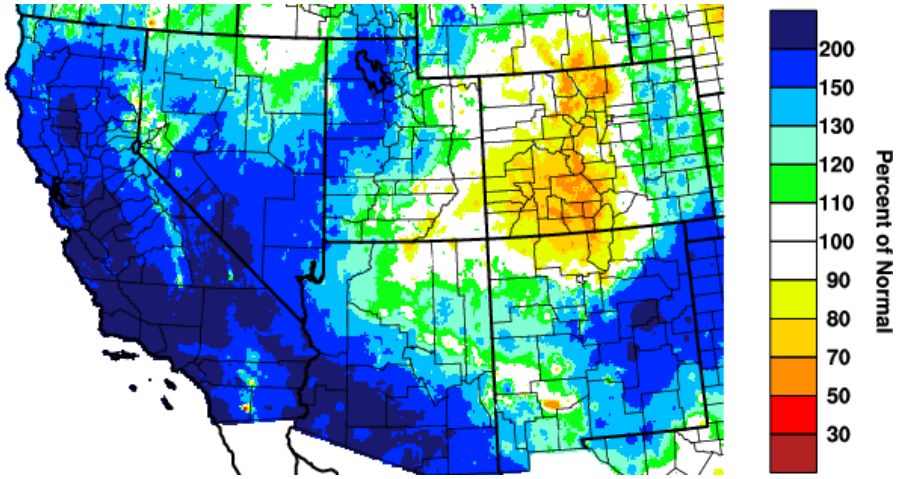
Data from NOAA-NCDC and NOAA ESRL, Date created: 30-Sep-2015
University of Arizona - http://cals.arizona.edu/climate/

Cool Season (Oct-Mar) Percent of Normal Precipitation
6 strongest El Niño Events on Record

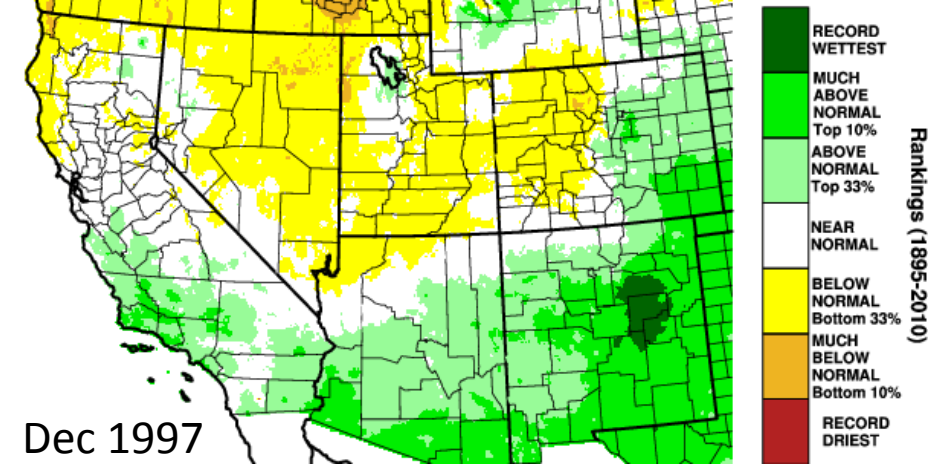


WestWide Drought Tracker: http://www.wrcc.dri.edu/wwdt/

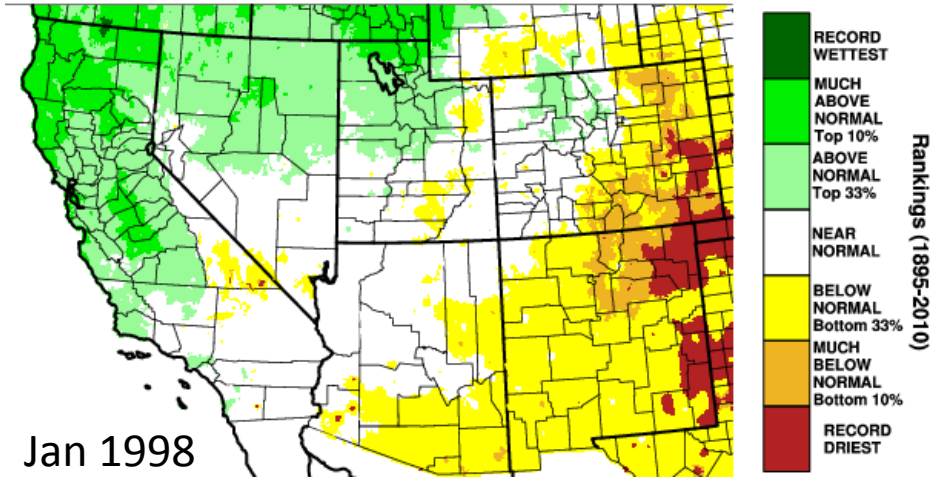
1997-98 – Seasonal Totals vs. Monthly/Spatial Variability (DJF) Precip in 1997-1998



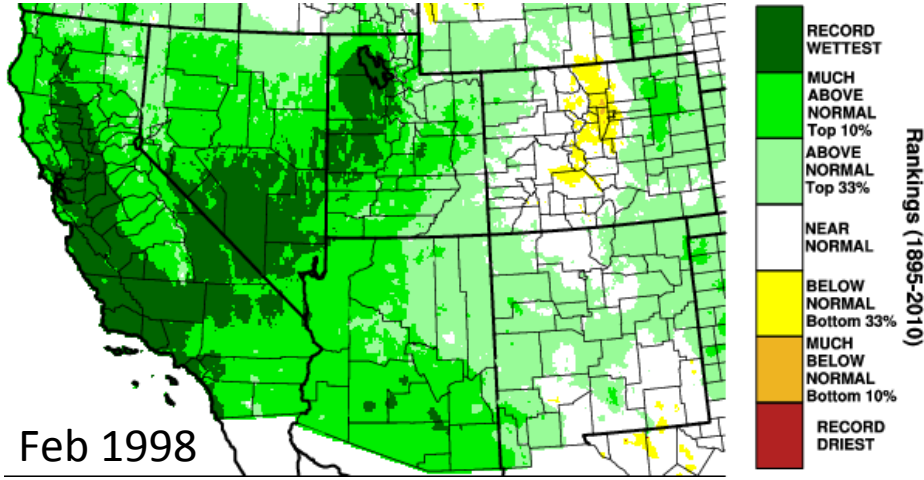
Percent of Normal - Dec 97 – Feb 98



Dec 1997



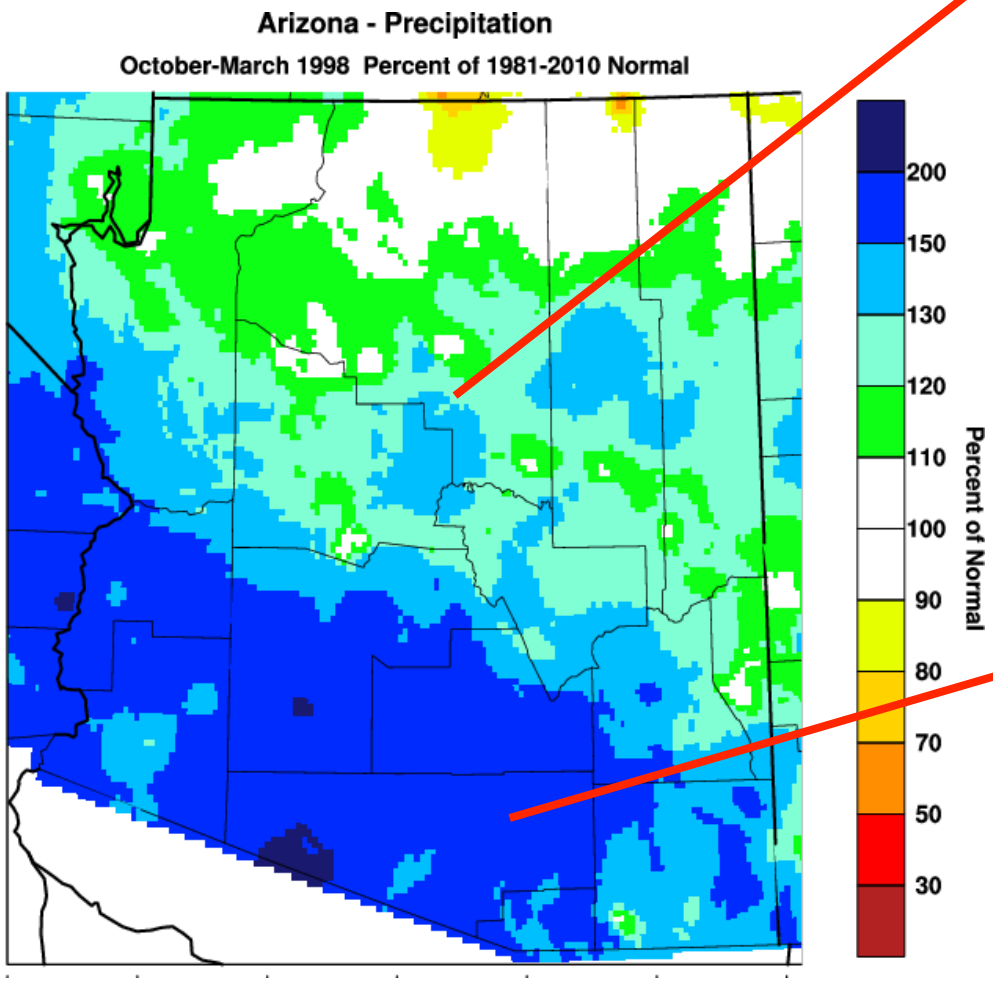
Jan 1998

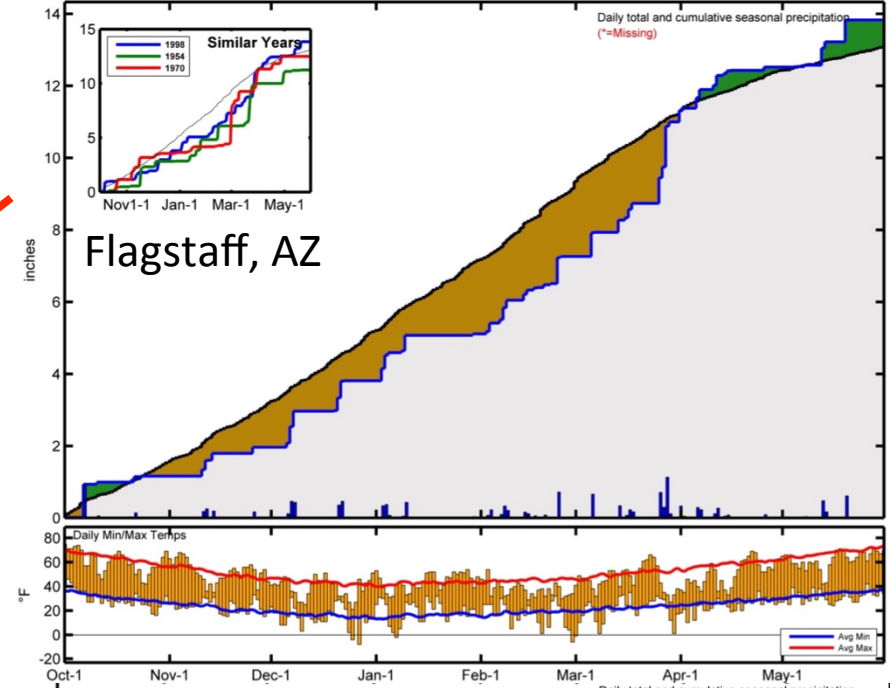


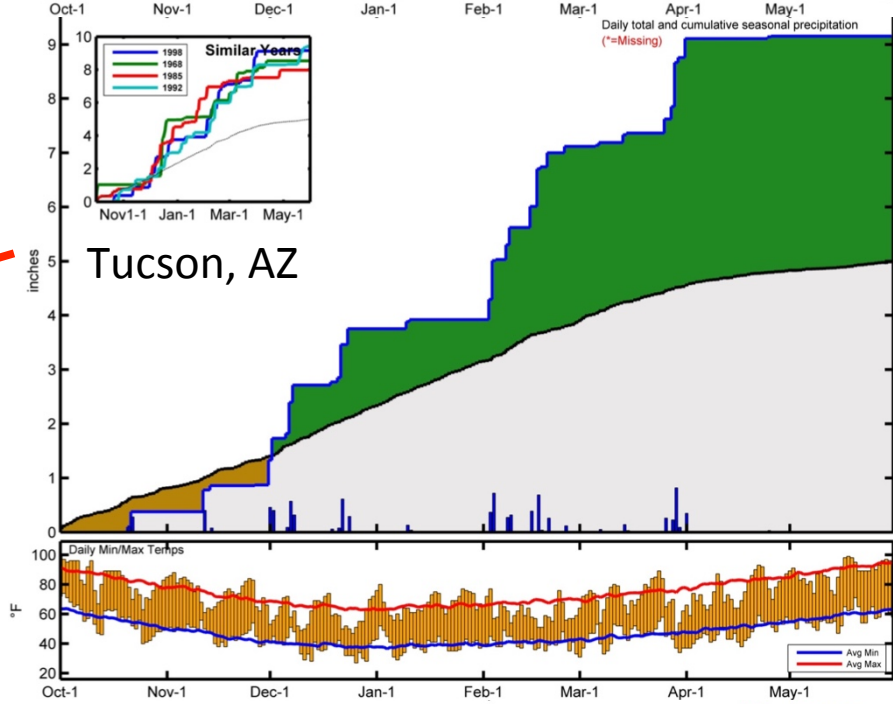
Feb 1998

WestWide Drought Tracker: http://www.wrcc.dri.edu/wwdt/

1997-98 – Seasonal Precip Arizona



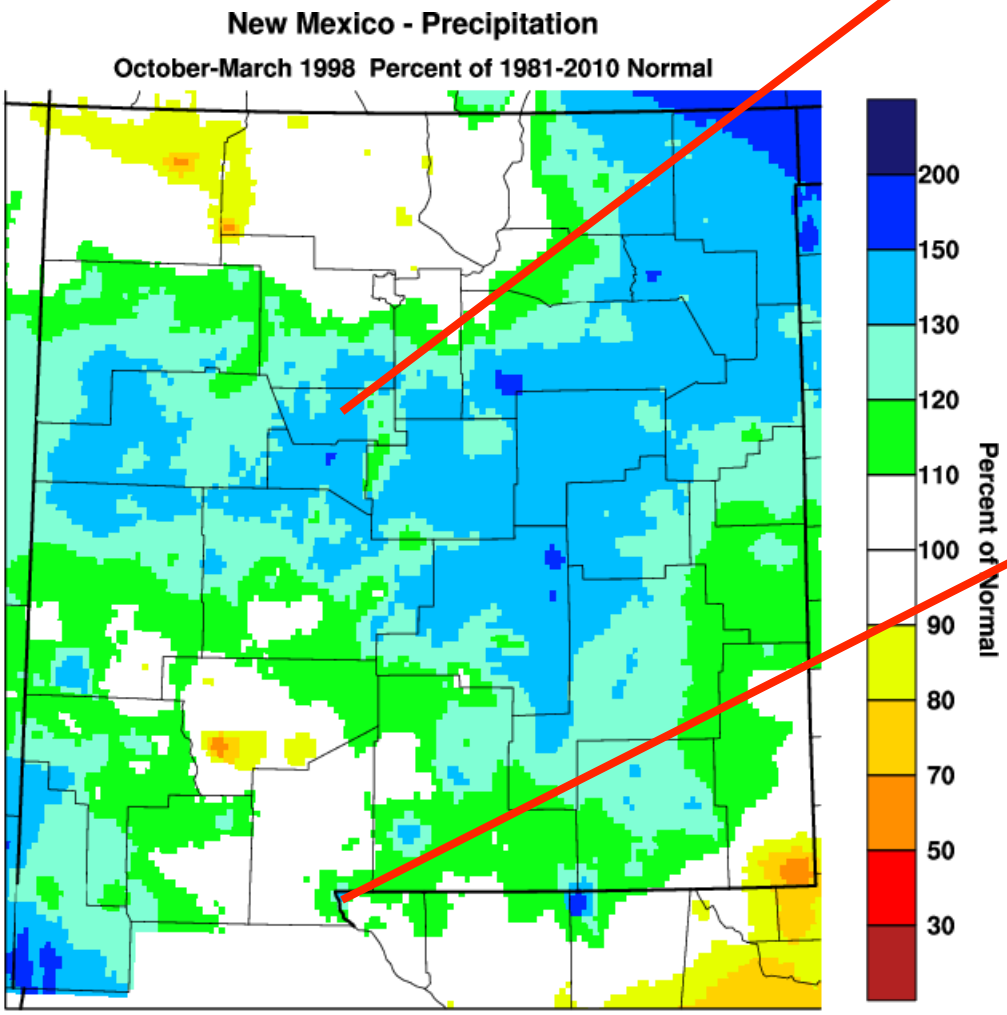


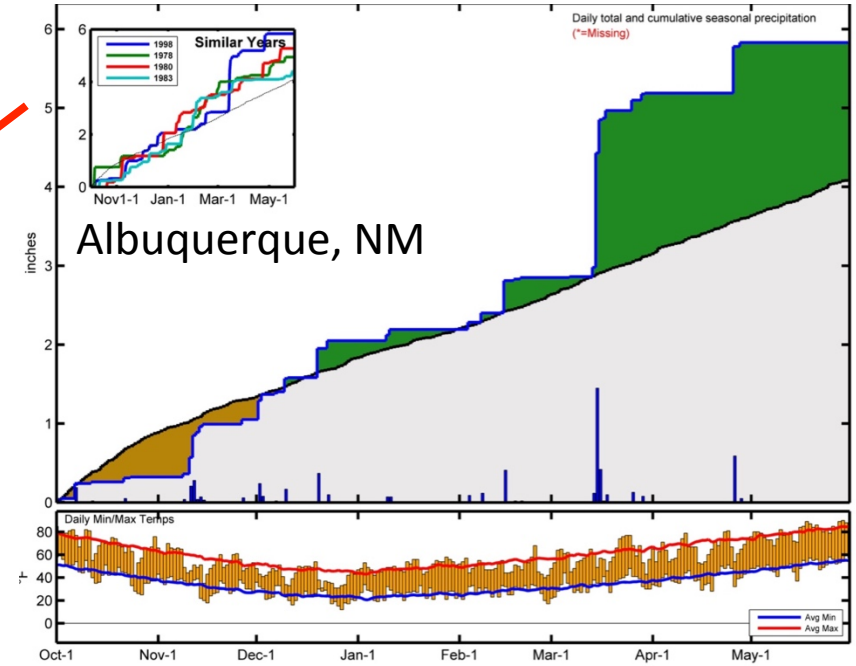


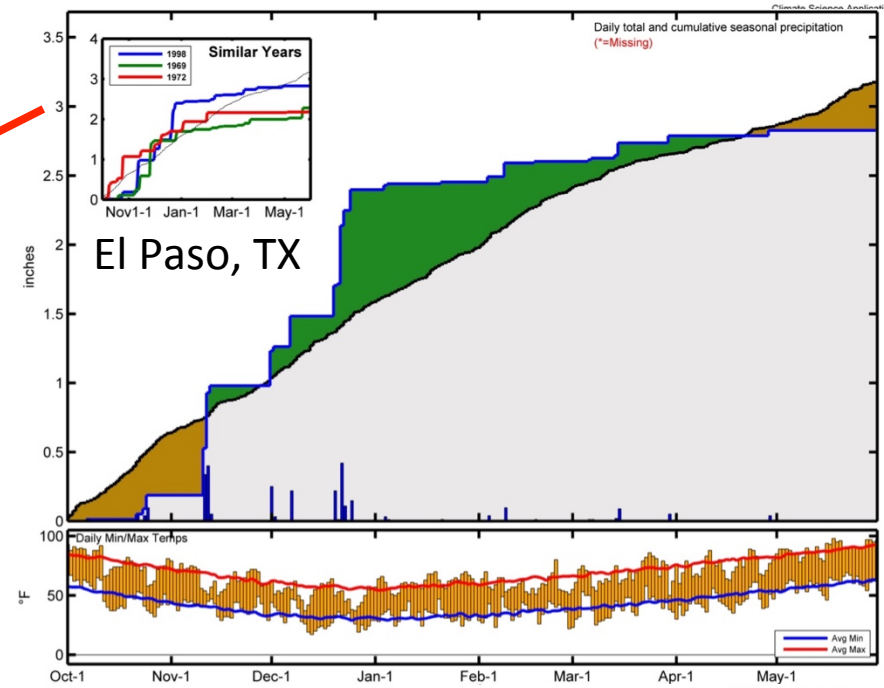
Climate Science Applications Program
University of Arizona Cooperative Extension
http://cals.arizona.edu/climate
Date created: 13-Aug-2015

WestWide Drought Tracker: http://www.wrcc.dri.edu/wwdt/
Climate Science Applications Program: http://cals.arizona.edu/climate/

1997-98 – Seasonal Precip New Mexico







WestWide Drought Tracker: http://www.wrcc.dri.edu/wwdt/
Climate Science Applications Program: http://cals.arizona.edu/climate/

Regional Impacts Summary – 9/21 to 10/19

Anomalous Conditions:

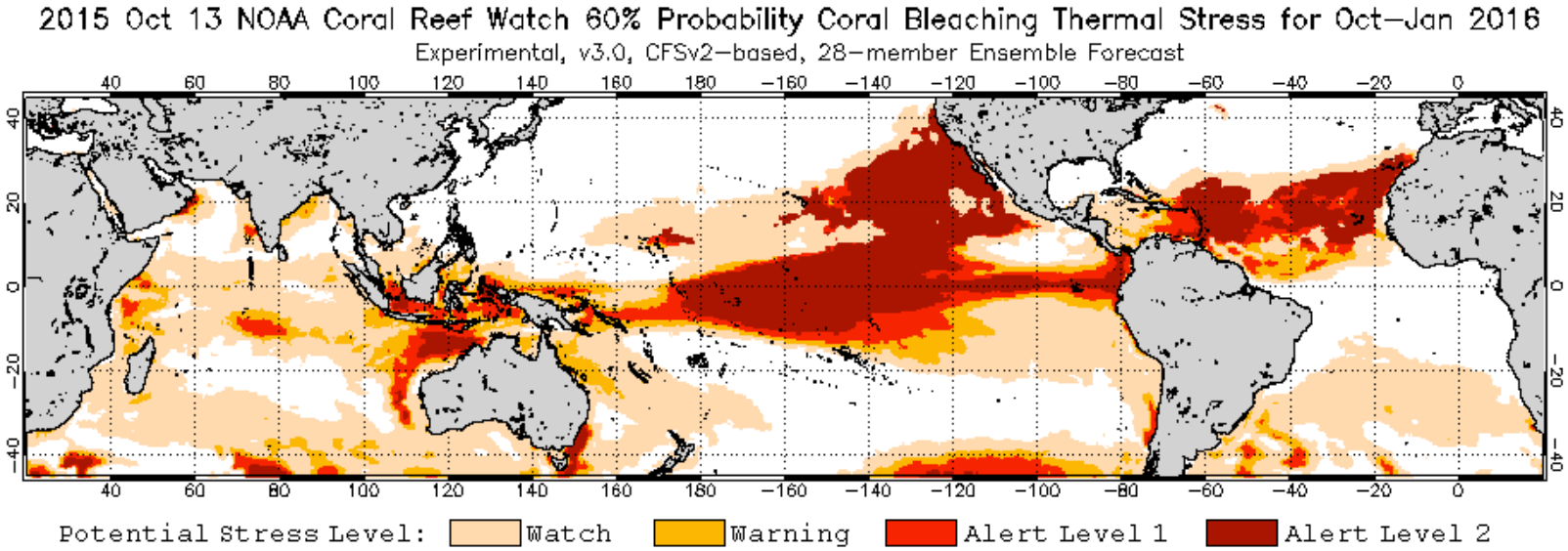
1. Warm water & “The Blob”
2. El Niño
3. Drought

Impacts:

1. Marine ecosystem
    - Species shifts & distribution
    - “Unusual Mortality Event”
    - Coral bleaching
2. Wildfire, forestry
3. Water supply/reservoir management
4. Policy

COLUMBIA RIVER — Salmon fishermen in the Columbia River's Buoy 10 fishery this week encountered Humpback whales. They have been sighted within the Columbia River in recent days.
Daily Astorian

Unusual Mortality Event – Sea Lions in Rehab.
Credit: Pacific Marine Mammal Center



NOAA Coral Reef Watch's most recent Four-Month Coral Bleaching Thermal Stress Outlook
http://coralreefwatch.noaa.gov/satellite/analyses_guidance/enso_bleaching_97-99_ag_20140507.php

Seasonal Impacts

- Fall, increased eastern Pacific tropical storm activity
- Winter, Localized flooding possible, but also possibility of below average precip on a month-to-month basis – variability across the season
- Spring, whether we transition out of El Niño conditions or not, wildfire risk following growth of fine fuels, particularly if the region dries out.

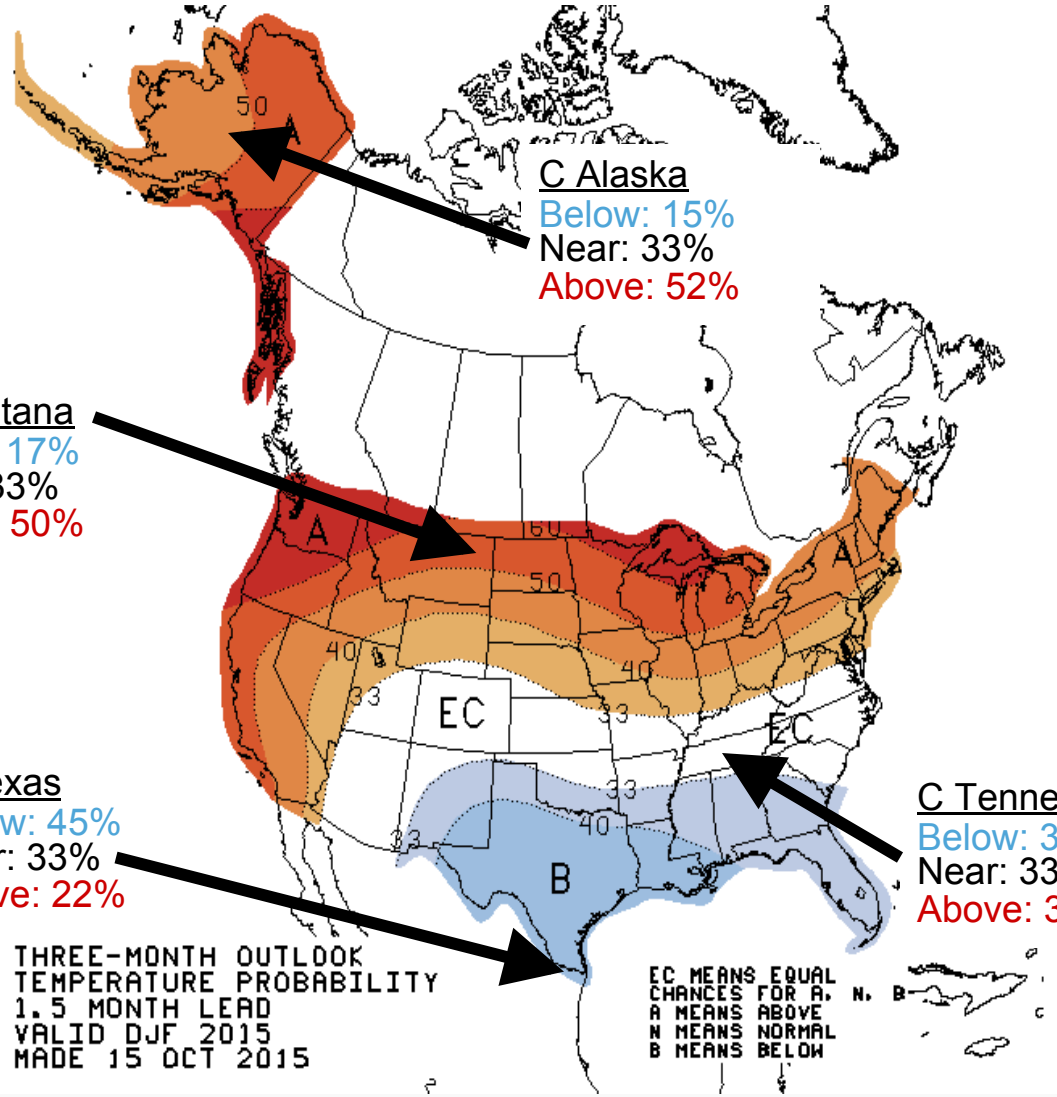
Historical Take-Aways

- Every El Niño is different – history can only tell you so much!
- Dry periods of 2 weeks+ are possible
- The strongest El Niño years tend to:
  - Make CA wet, but more so in the south than the north, and in the late winter than early winter
  - Have more wet days, and the wet days tend to be "wetter" than average wet days
  - Have higher snow levels, but you can get more snow above this level
  - Have significant wave/marine issues at times
  - Be warmer in the Pacific NW with potential for near-to below-normal temperatures far south

Seasonal Outlook

- Mike Halpert (5-10 min)

December 2015 – February 2016 Temperature Outlook



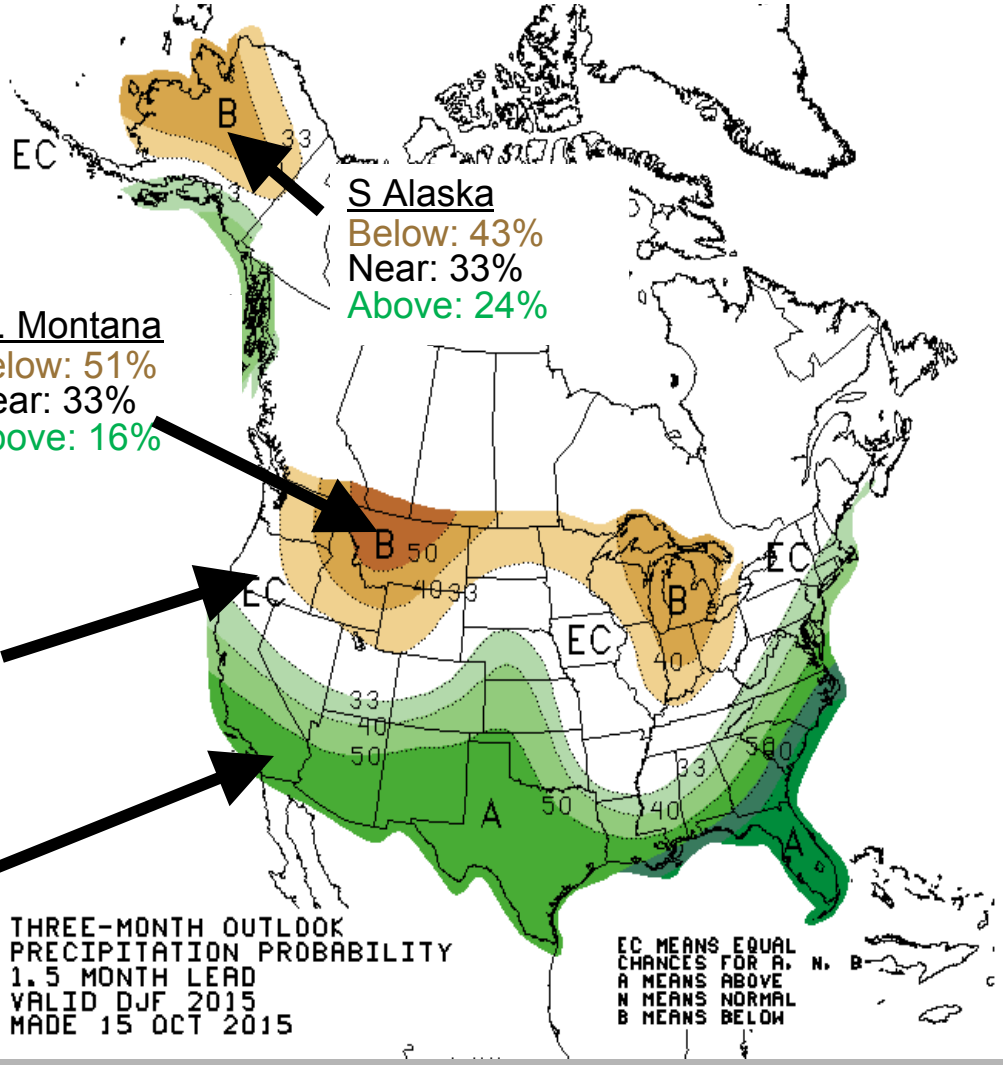
C Alaska
Below: 15%
Near: 33%
Above: 52%

E. Montana
Below: 17%
Near: 33%
Above: 50%

S Texas
Below: 45%
Near: 33%
Above: 22%

C Tennessee
Below: 33%
Near: 33%
Above: 33%

December 2015 – February 2016 Precipitation Outlook



ENSO Box and Whiskers Analysis

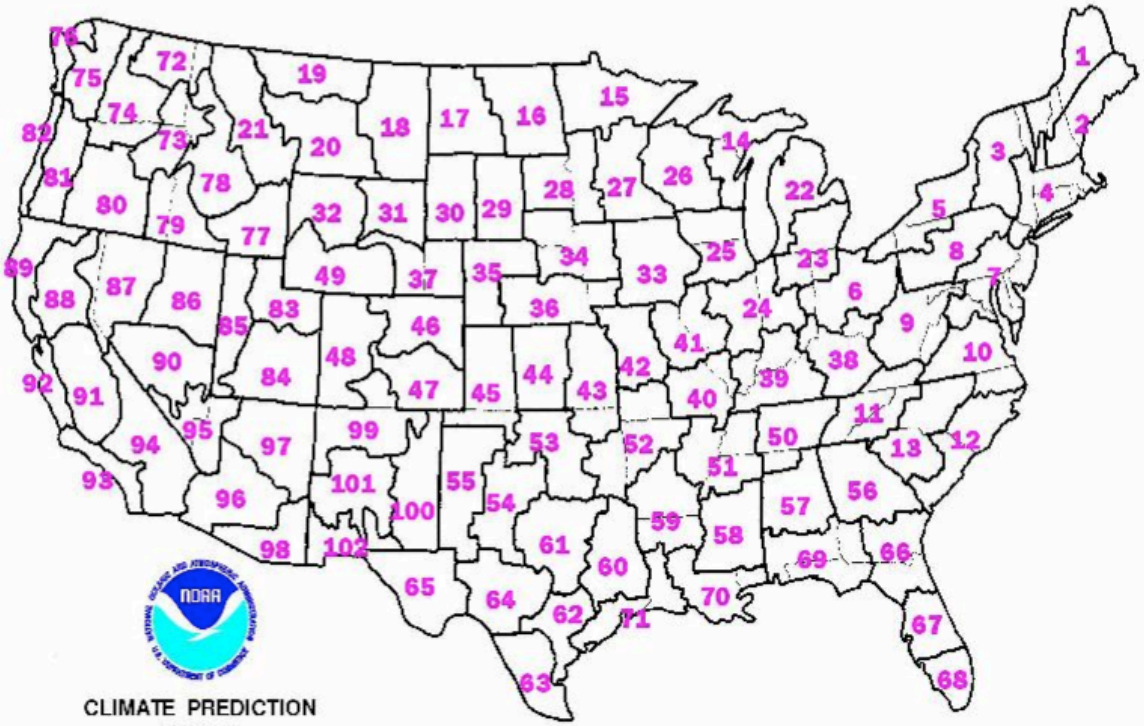
3-month Temperature and Precipitation Distribution

By making selections below, you can obtain historical distributions of 3-month temperature and precipitation associated with 3 different ENSO categories - El Nino, La Nina, and Neutral events for a climate division.

Click here for information about the ENSO distribution analysis

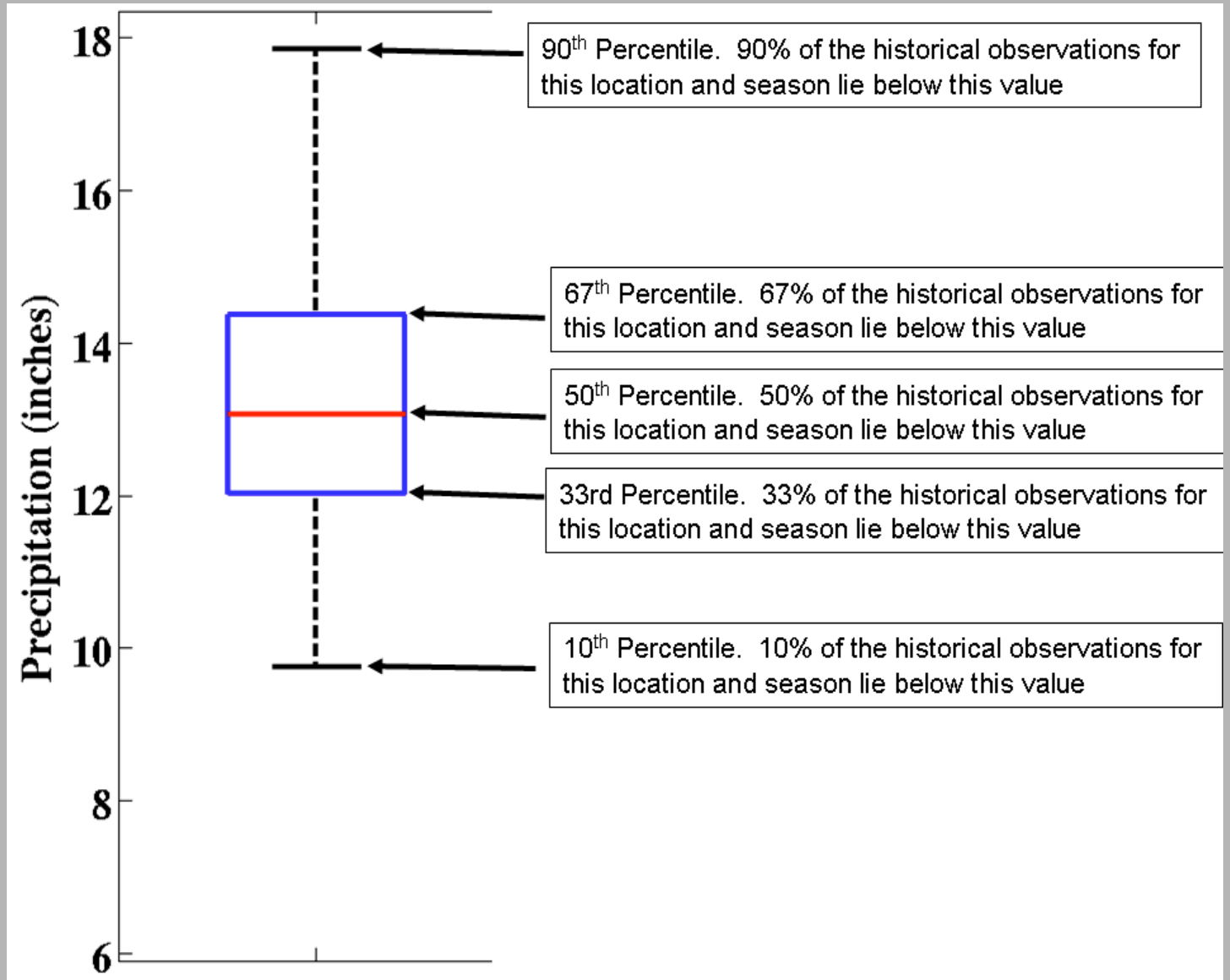
Select a date and type of image. Then click on a climate division on the map to display the box and whiskers distribution plot which will open on a new page.

JFM ◉ Temperature ○ Precipitation



http://www.cpc.ncep.noaa.gov/products/precip/CWlink/ENSO/box_whiskers/index.php

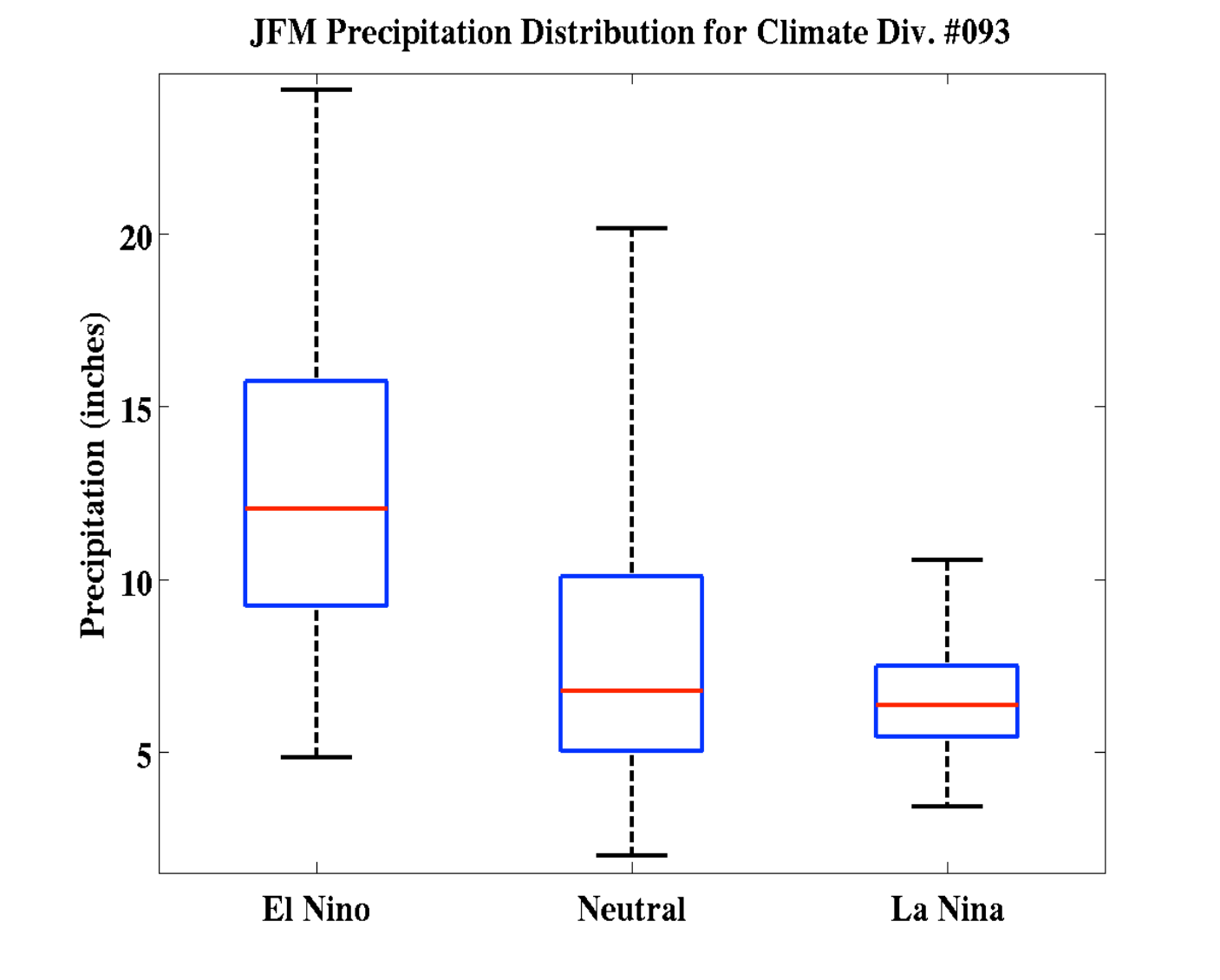
ENSO Box & Whisker Analysis



ENSO Box & Whisker Analysis

Southern California Coast

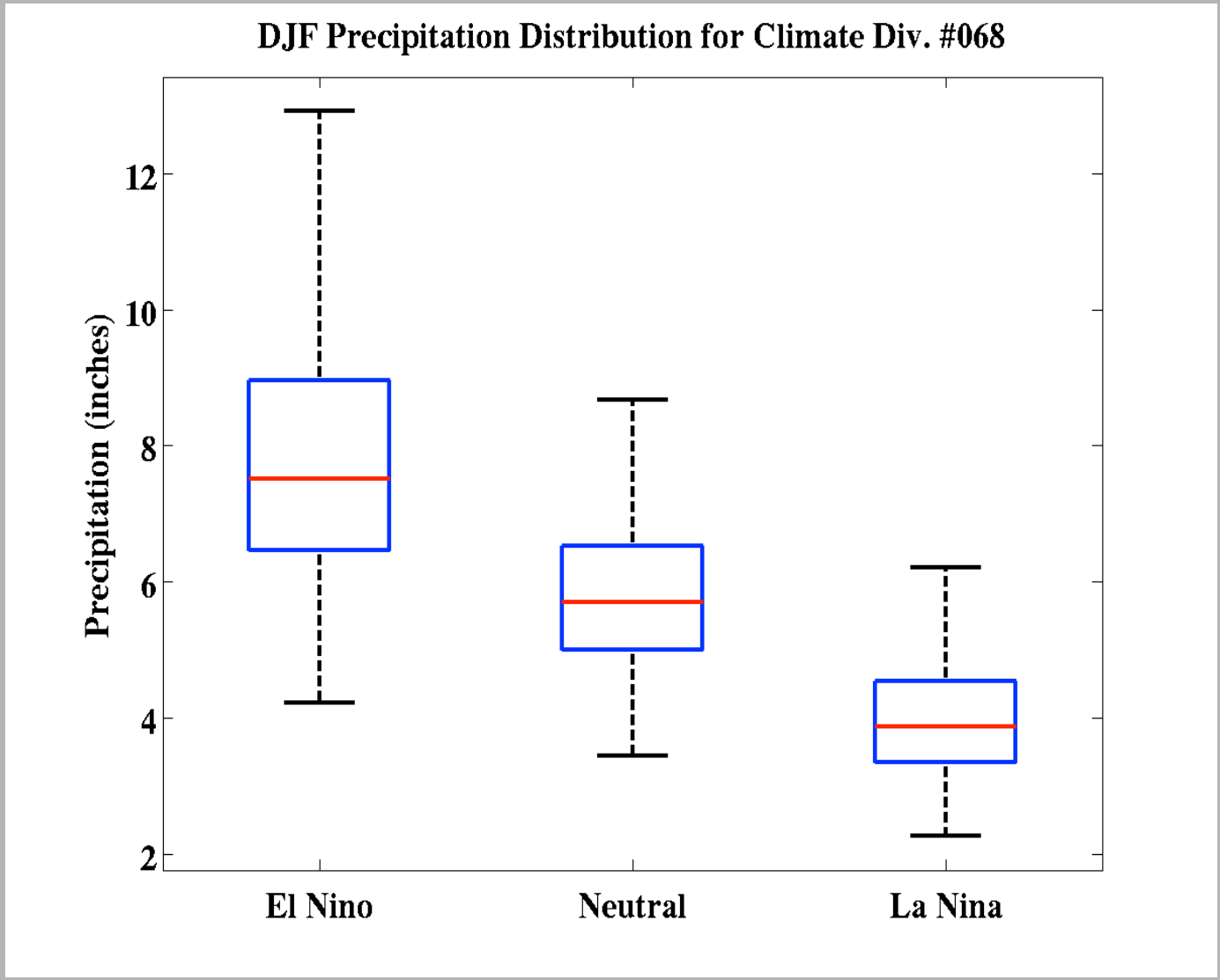
Jan – Mar Prec.



ENSO Box & Whisker Analysis

Southern Florida

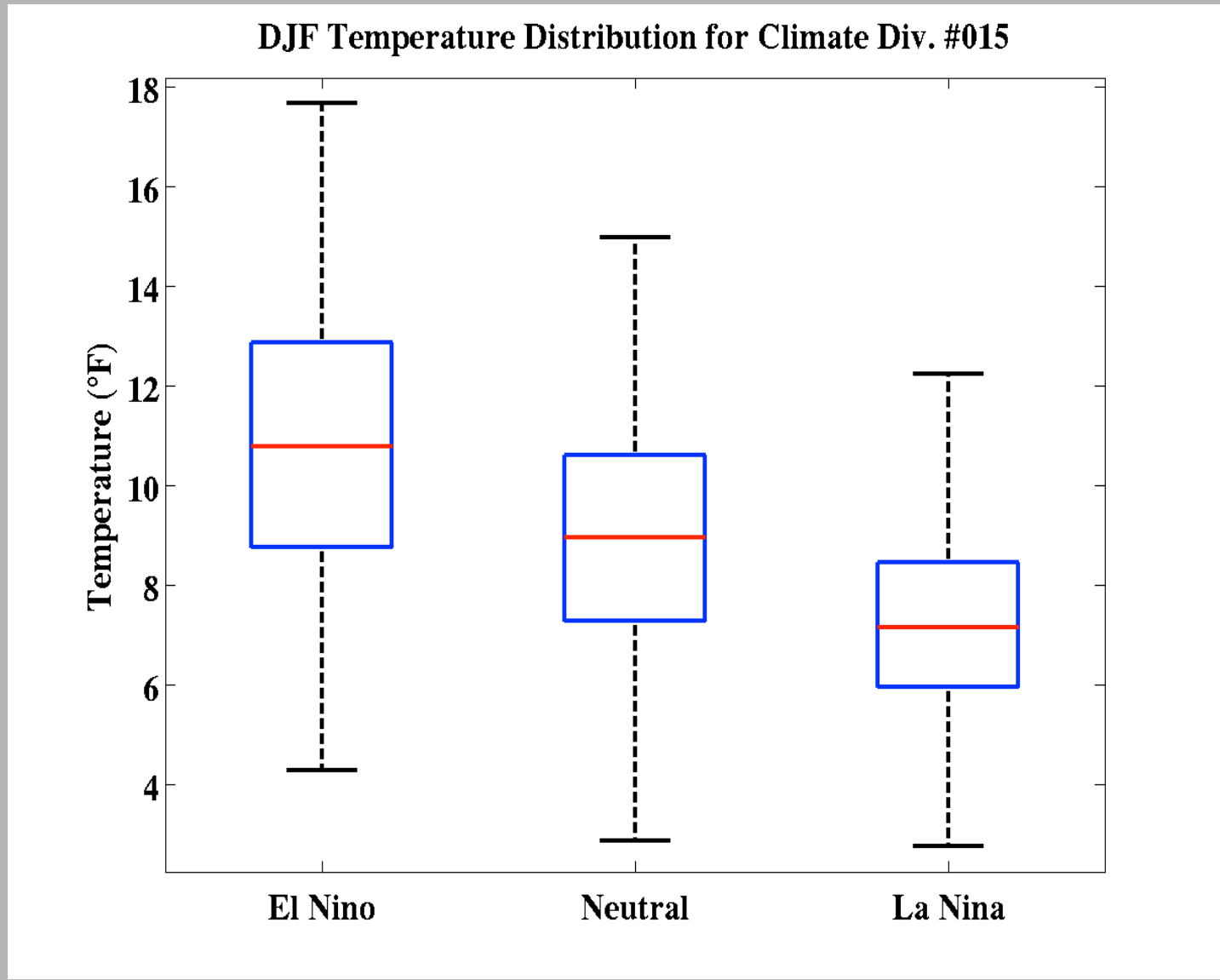
Dec – Feb Prec.



ENSO Box & Whisker Analysis

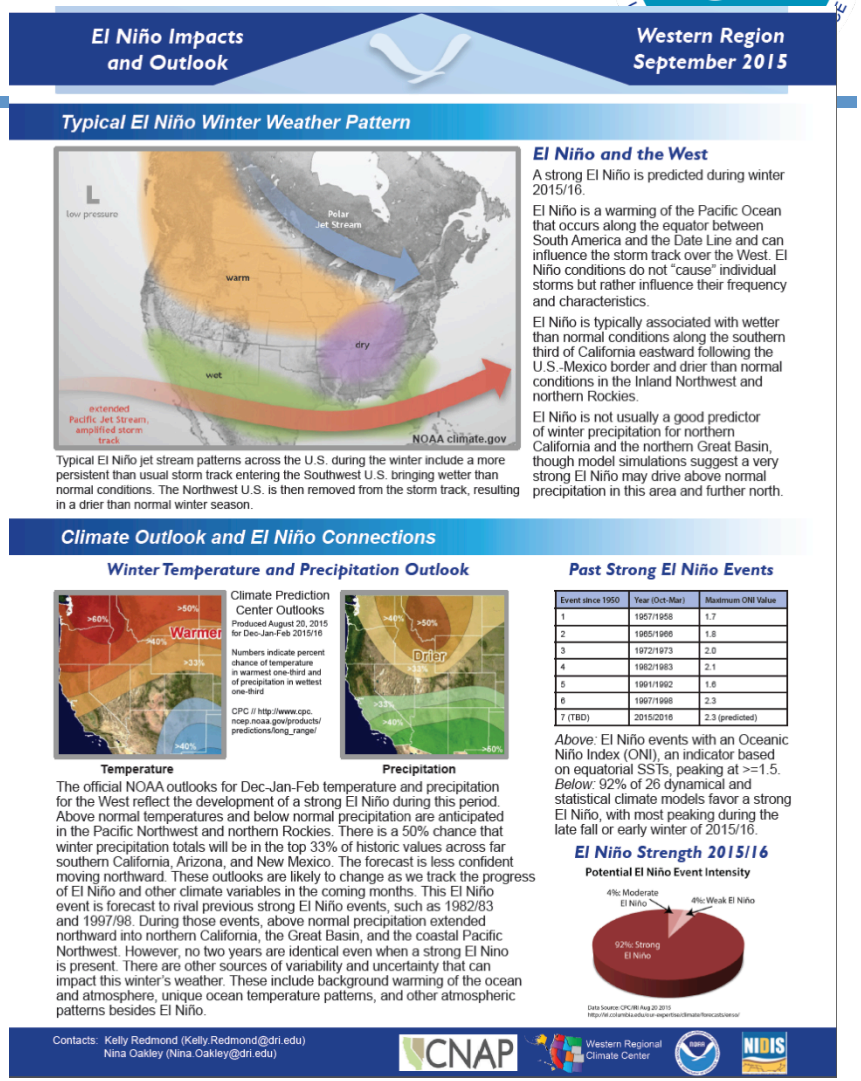
Northern Minnesota

Dec – Feb Temp.



Resources

- Climate Prediction Center (cpc.noaa.gov)
- National Weather Service (weather.gov)
- Western Region Climate Center (wrcc.dri.edu)
- ….



El Niño Impacts and Outlook

Western Region September 2015

Typical El Niño Winter Weather Pattern

Typical El Niño jet stream patterns across the U.S. during the winter include a more persistent than usual storm track entering the Southwest U.S. bringing wetter than normal conditions. The Northwest U.S. is then removed from the storm track, resulting in a drier than normal winter season.

El Niño and the West

A strong El Niño is predicted during winter 2015/16.

El Niño is a warming of the Pacific Ocean that occurs along the equator between South America and the Date Line and can influence the storm track over the West. El Niño conditions do not "cause" individual storms but rather influence their frequency and characteristics.

El Niño is typically associated with wetter than normal conditions along the southern third of California eastward following the U.S.-Mexico border and drier than normal conditions in the Inland Northwest and northern Rockies.

El Niño is not usually a good predictor of winter precipitation for northern California and the northern Great Basin, though model simulations suggest a very strong El Niño may drive above normal precipitation in this area and further north.

Climate Outlook and El Niño Connections

Winter Temperature and Precipitation Outlook

Temperature

Climate Prediction Center Outlooks

Produced August 20, 2015 for Dec-Jan-Feb 2015/16

Numbers indicate percent chance of temperature in warmest one-third and of precipitation in wettest one-third

CPC // http://www.cpc.ncep.noaa.gov/products/predictions/long_range/

Precipitation

The official NOAA outlooks for Dec-Jan-Feb temperature and precipitation for the West reflect the development of a strong El Niño during this period. Above normal temperatures and below normal precipitation are anticipated in the Pacific Northwest and northern Rockies. There is a 50% chance that winter precipitation totals will be in the top 33% of historic values across far southern California, Arizona, and New Mexico. The forecast is less confident moving northward. These outlooks are likely to change as we track the progress of El Niño and other climate variables in the coming months. This El Niño event is forecast to rival previous strong El Niño events, such as 1982/83 and 1997/98. During those events, above normal precipitation extended northward into northern California, the Great Basin, and the coastal Pacific Northwest. However, no two years are identical even when a strong El Nino is present. There are other sources of variability and uncertainty that can impact this winter's weather. These include background warming of the ocean and atmosphere, unique ocean temperature patterns, and other atmospheric patterns besides El Niño.

Past Strong El Niño Events

Event since 1950	Year (Oct-Mar)	Maximum ONI Value
1	1957/1958	1.7
2	1965/1966	1.8
3	1972/1973	2.0
4	1982/1983	2.1
5	1991/1992	1.6
6	1997/1998	2.3
7 (TBD)	2015/2016	2.3 (predicted)

Above: El Niño events with an Oceanic Niño Index (ONI), an indicator based on equatorial SSTs, peaking at >=1.5. *Below:* 92% of 26 dynamical and statistical climate models favor a strong El Niño, with most peaking during the late fall or early winter of 2015/16.

El Niño Strength 2015/16

Potential El Niño Event Intensity

Data Source: CPC/IRI Aug 20 2015
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/

Contacts: Kelly Redmond (Kelly.Redmond@dri.edu)
Nina Oakley (Nina.Oakley@dri.edu)

CNAP · Western Regional Climate Center · NIDIS

Source: NOAA/CPC

Questions?

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