Marine Corps Camp Pendleton 10/1/2015

El Nino 2015 Update and Prospects

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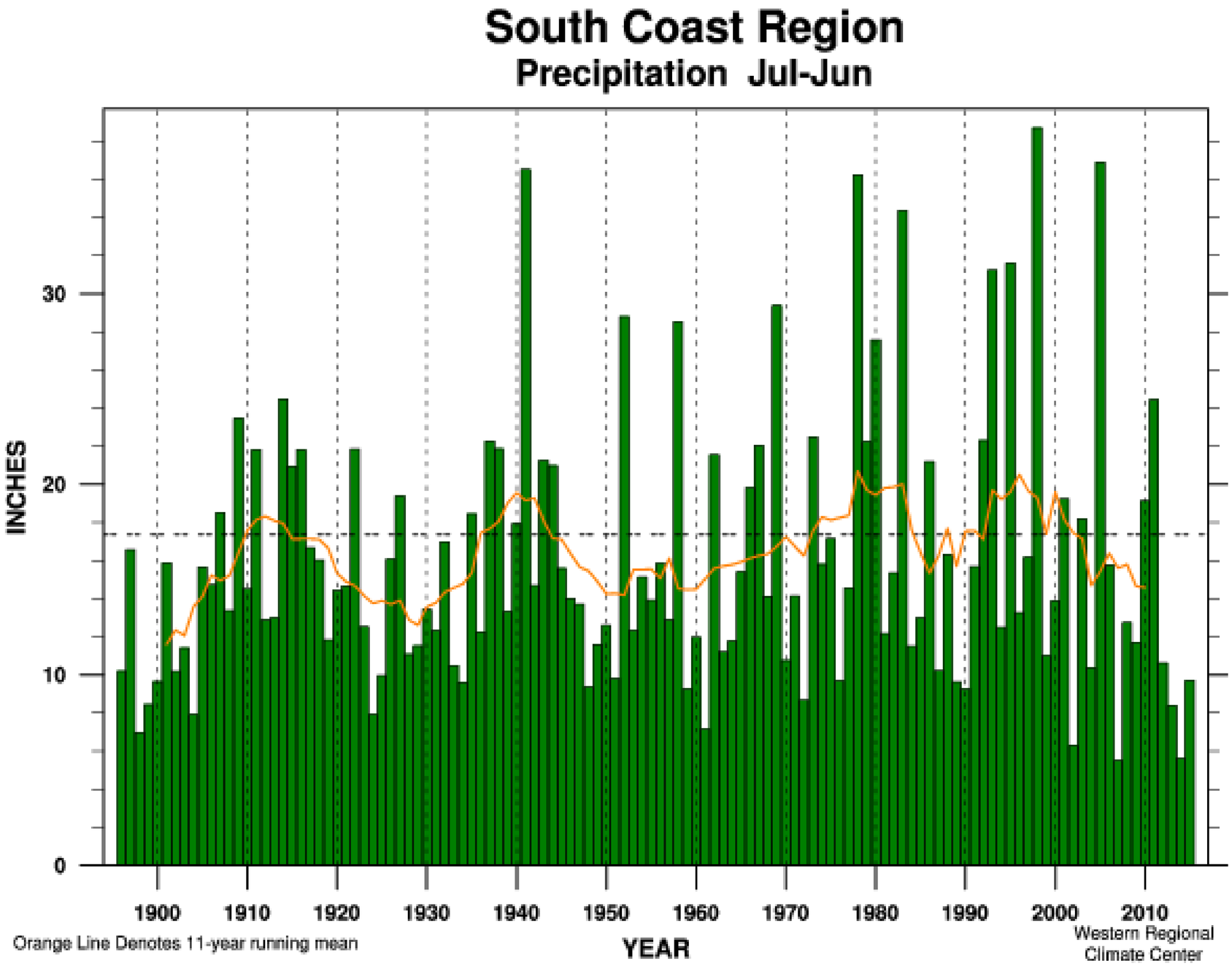
USGS Water Resources Discipline

Sponsors:

California Energy Commission

NOAA RISA program

California DWR, DOE, NSF

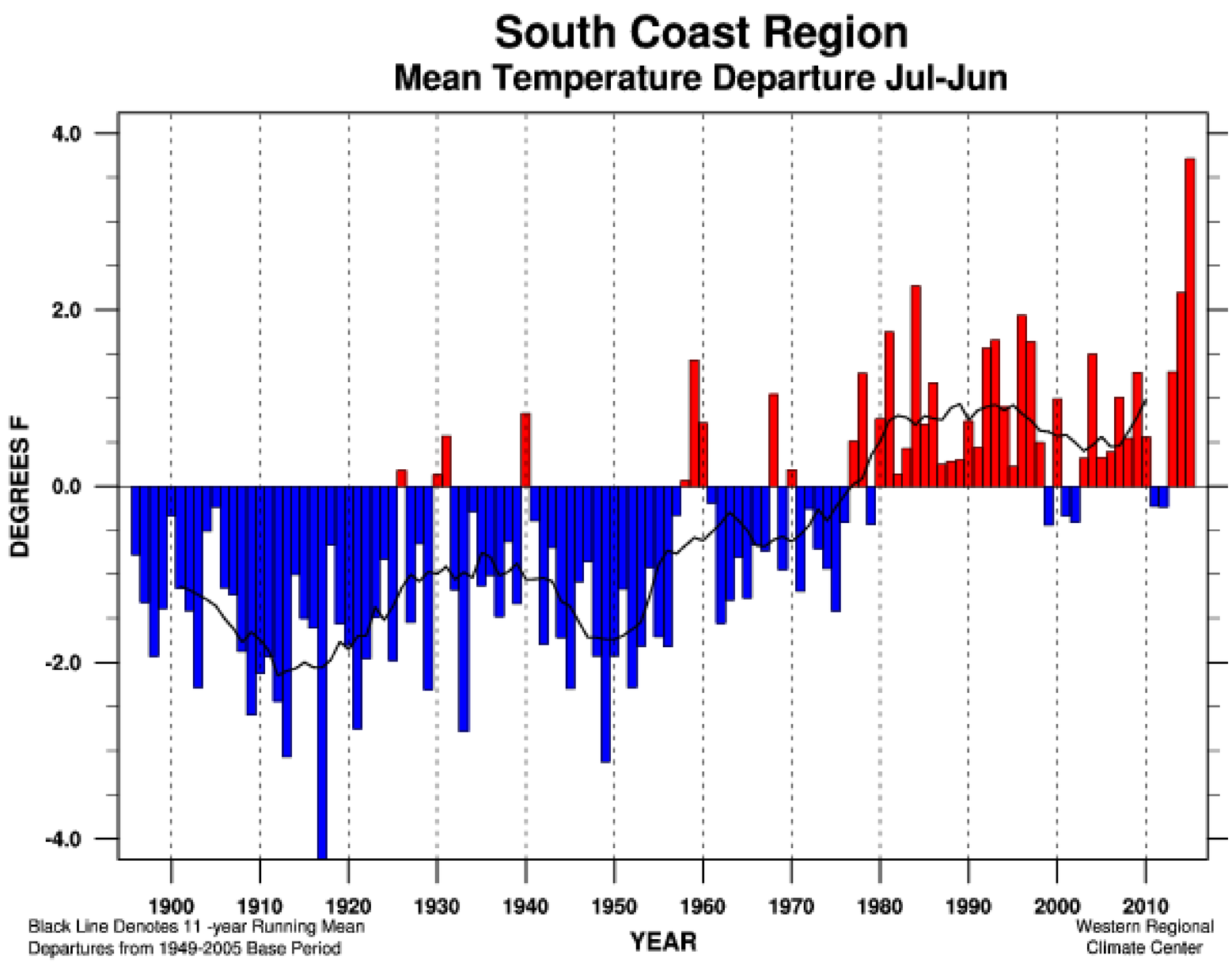


Linear Trend 1895-present	+ 2.18 ± 3.63 in.	(+ 12 ± 20%) per 100 yr		
Linear Trend 1949-present	- 0.98 ± 10.46 in.	(- 5 ± 60%) per 100 yr		
Linear Trend 1975-present	-18.49 ± 24.74 in.	(-106 ± 142%) per 100 yr		
Wettest Year	38.71 in. (222%)	in 1998	MEAN	17.38 in.
Driest Year	5.49 in. (31%)	in 2007	STDEV	8.11in.
Jul-Jun 2015	9.72 in. (55%)		RANK	18 of 120

Southern California Precipitation

exceptionally high variability

only two wet years 2007-2015



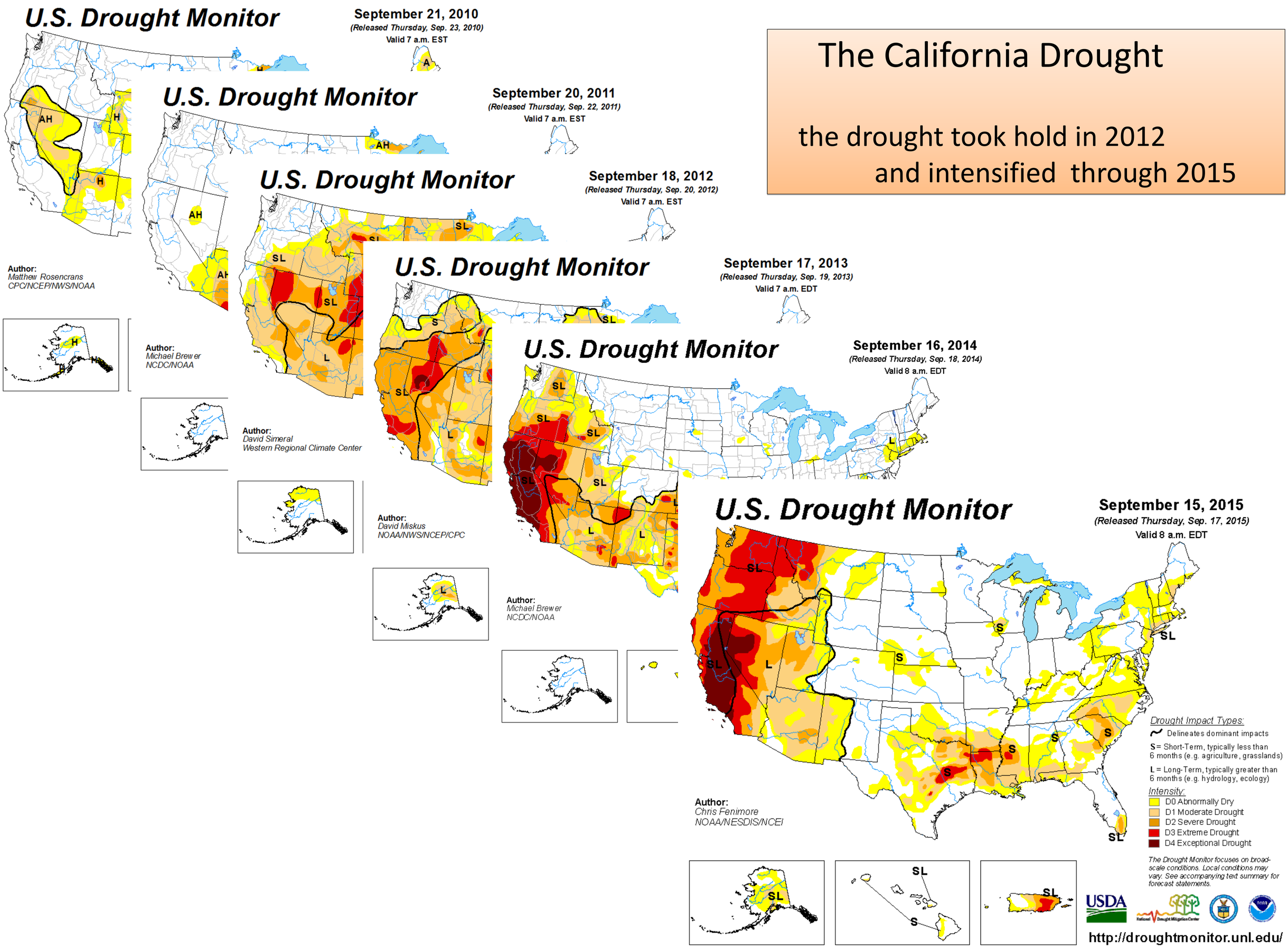
Linear Trend 1895-present	+ 2.62 ± 0.51°F/100yr		
Linear Trend 1949-present	+ 3.88 ± 1.21°F/100yr		
Linear Trend 1975-present	+ 1.28 ± 2.44°F/100yr		
Warmest Year	65.1°F (+ 3.7 °F) in 2015	MEAN	61.4 °F
Coldest Year	57.1°F (- 4.2 °F) in 1917	STDEV	1.10 °F
Jul-Jun 2015	65.1°F (+ 3.7 °F)	RANK	120 of 120

since 1977 average temp in SoCal has been warm

2014 and 2015 exceptionally warm!

The California Drought

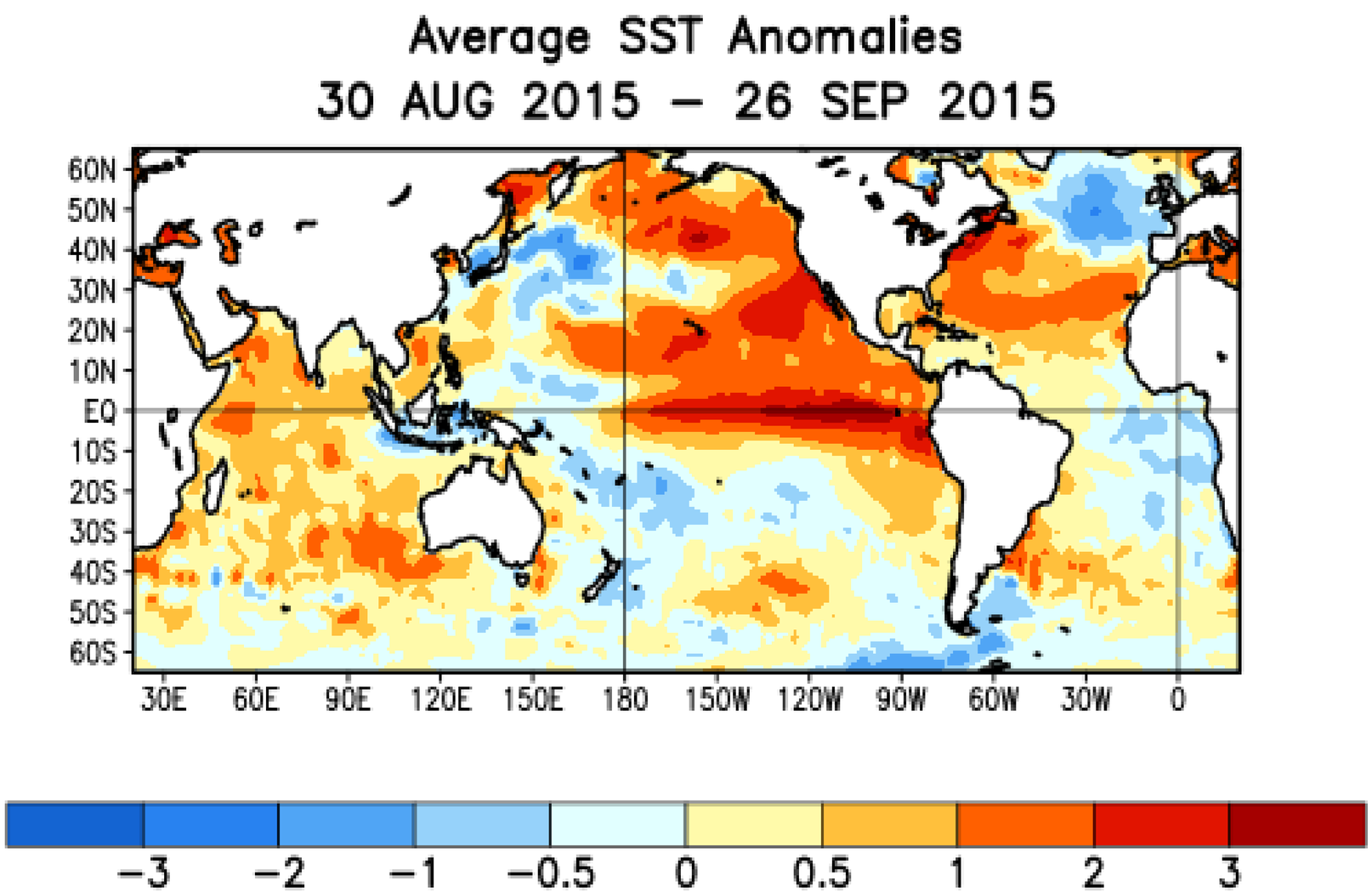
the drought took hold in 2012
and intensified through 2015



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

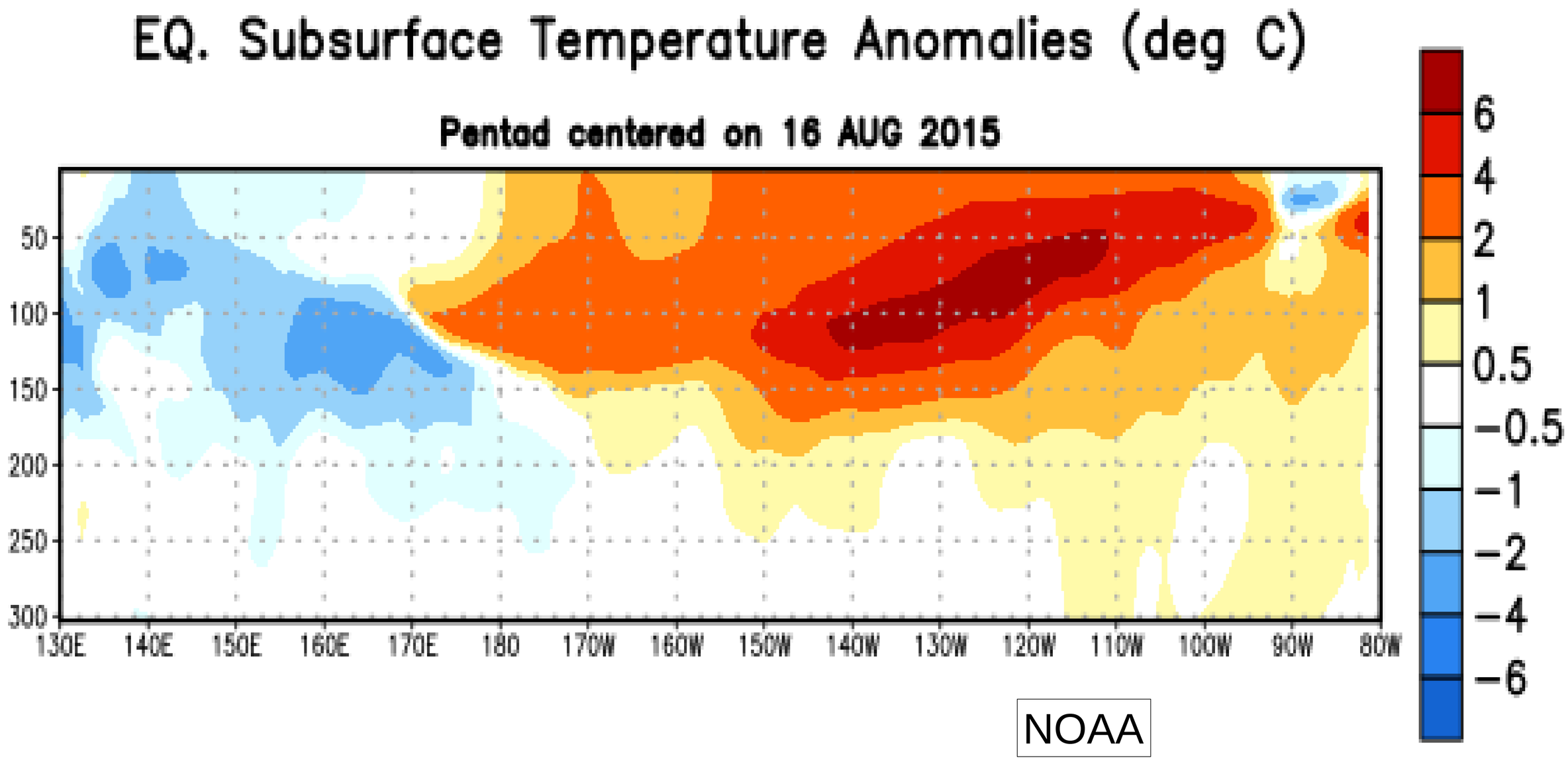
During the last four weeks, equatorial SSTs were above average across the central and eastern Pacific and most of the Indian Ocean. SSTs were below average in the eastern Atlantic Ocean and near Indonesia.

Very warm surface waters now in Eastern Pacific Ocean



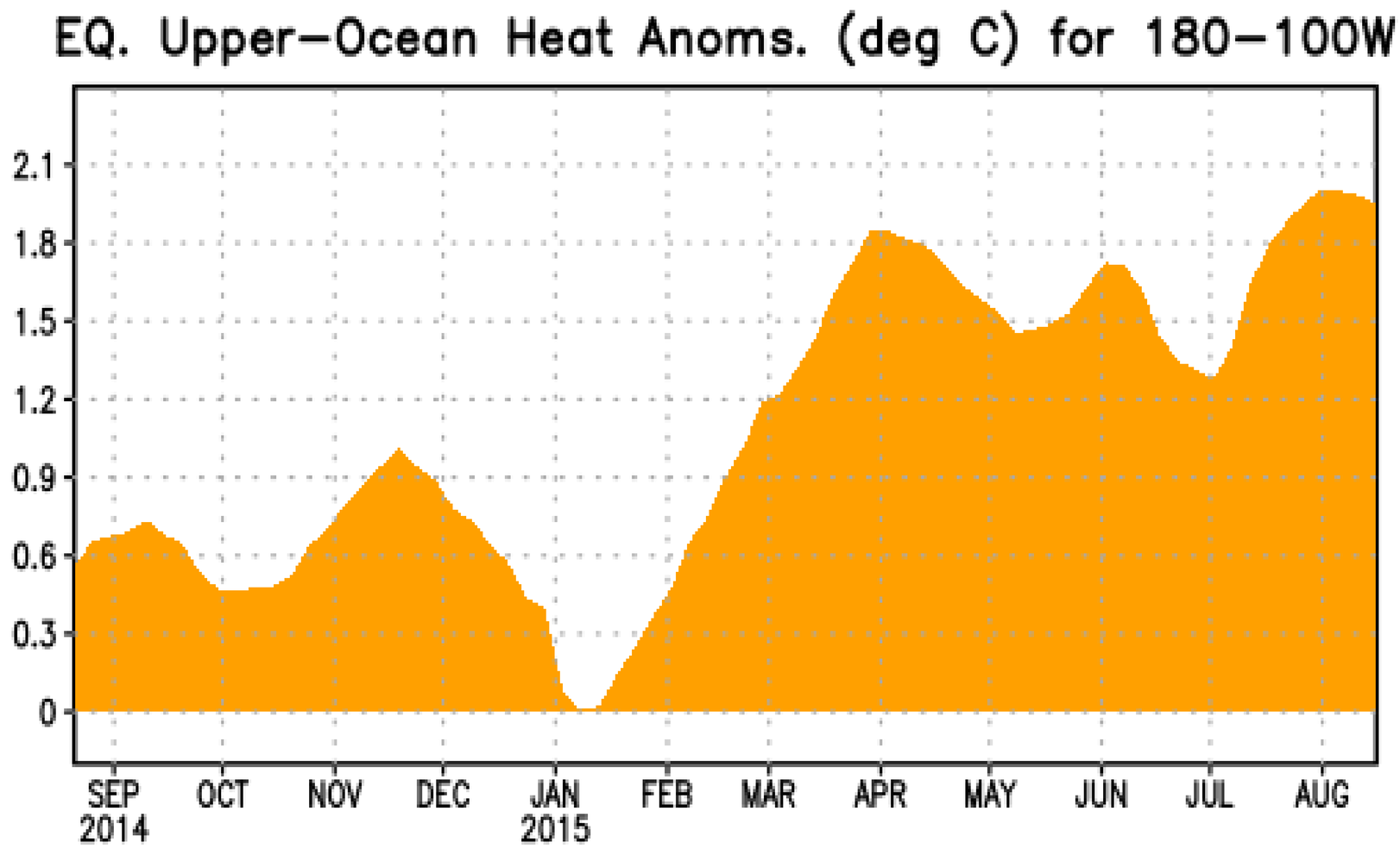
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive subsurface temperature anomalies were observed across most of the equatorial Pacific



Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

During January - March, a significant sub-surface warming occurred across the eastern Pacific. Since March, sub-surface temperature anomalies have remained large, but with some minor fluctuations in strength. Following a drop in June, the anomalies increased in July. Since early August, positive anomalies have persisted.

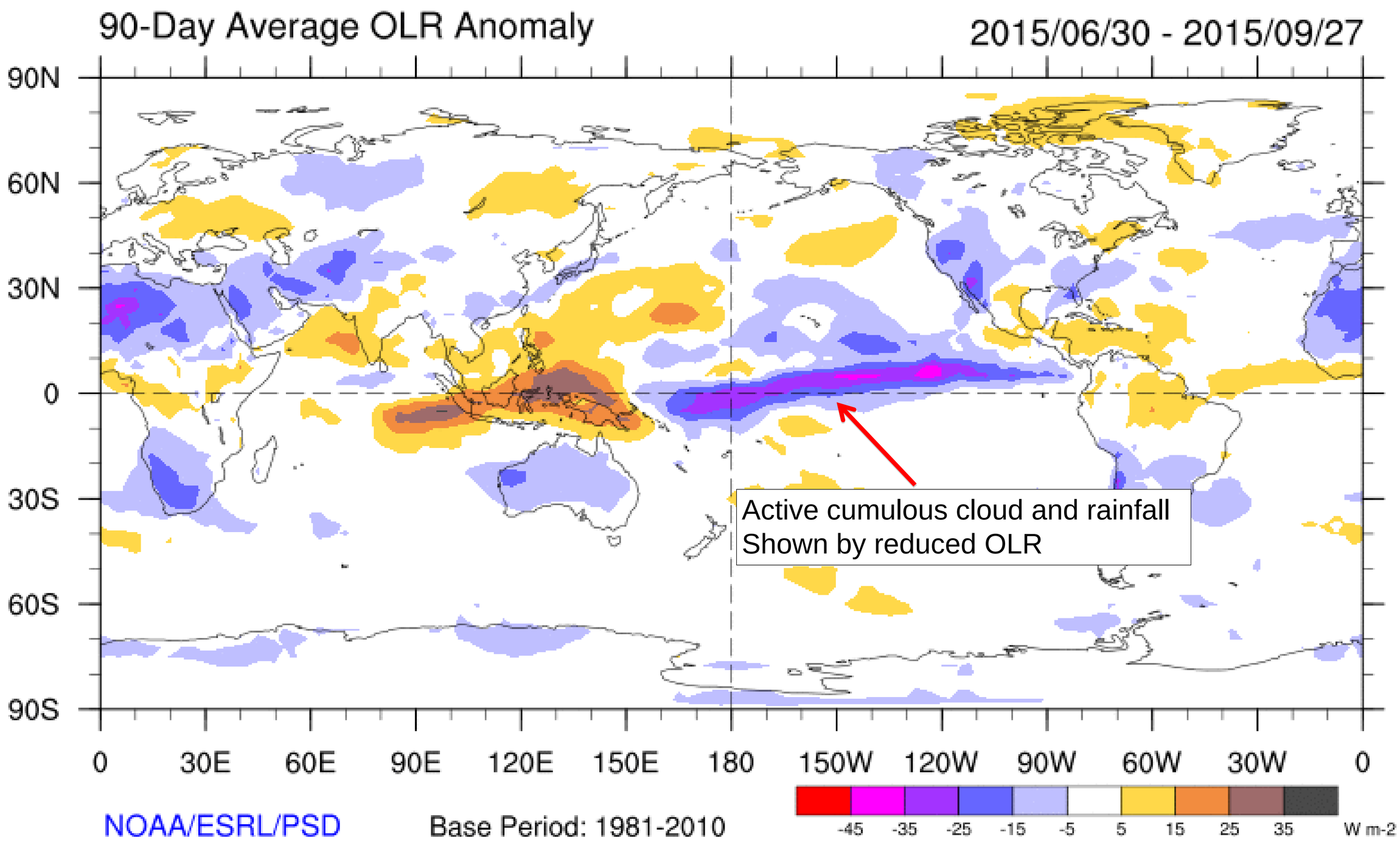


Tropical Pacific has warmed (El Nino) developed from spring to summer 2015

tropical atmosphere is responding to El Nino warming

clouds and rainfall (OLR) has shifted from west to east

in winter, this pattern strenthens winds and storminess across North Pacific



Summary

ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.*

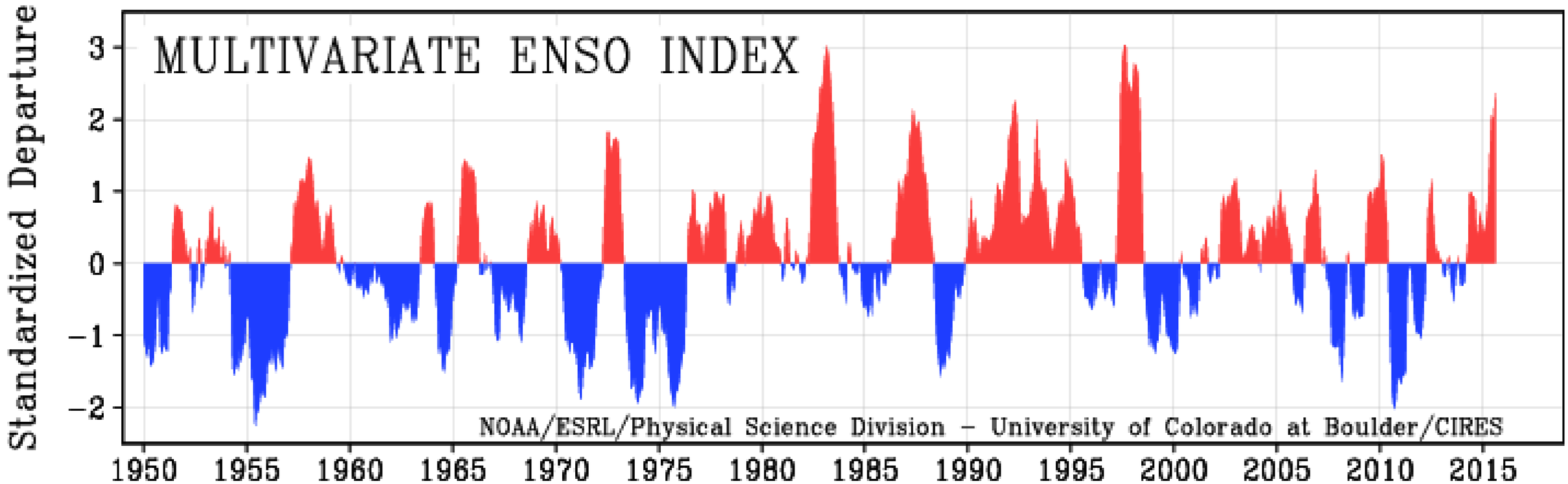
Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

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

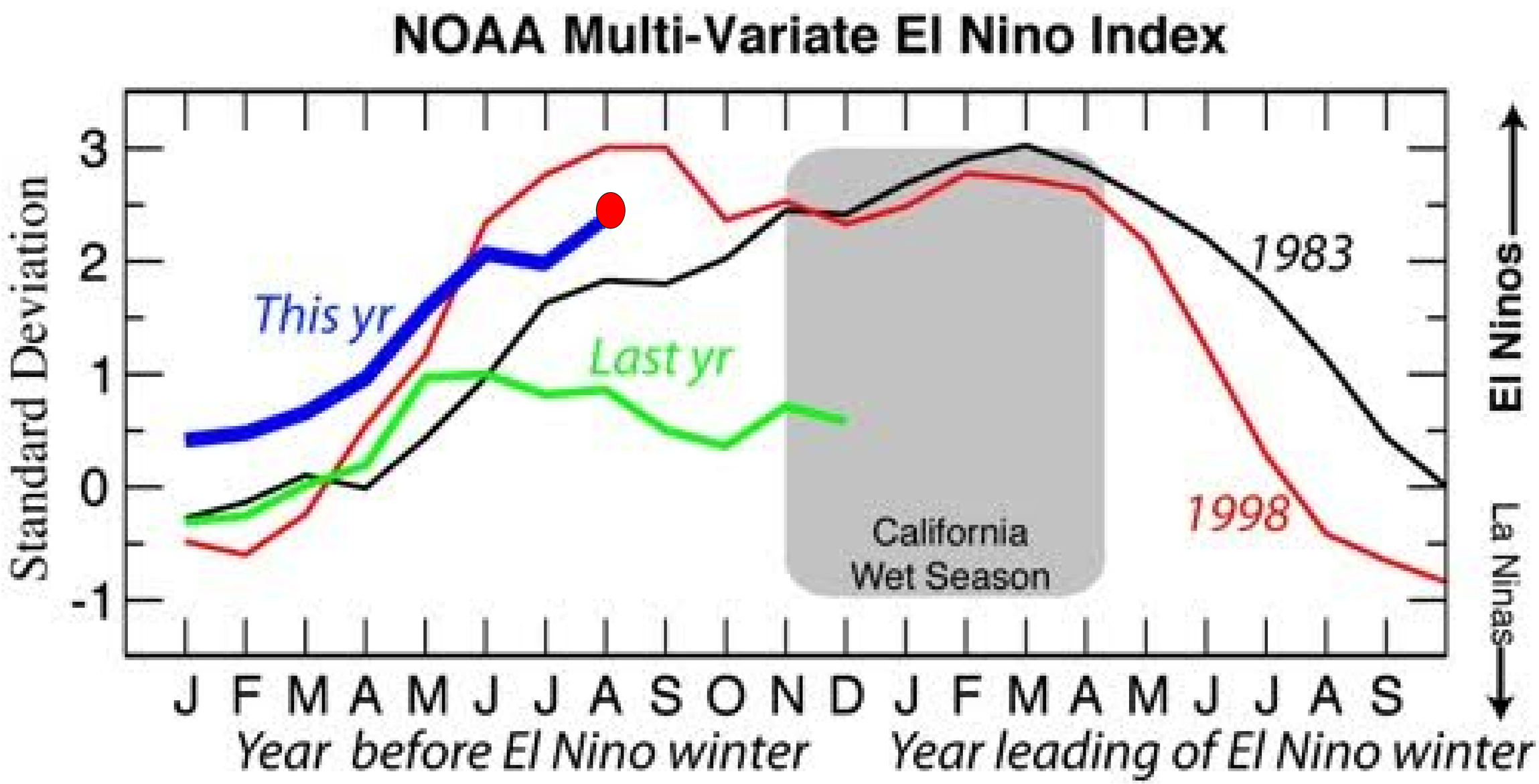
*** Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion .**

NOAA

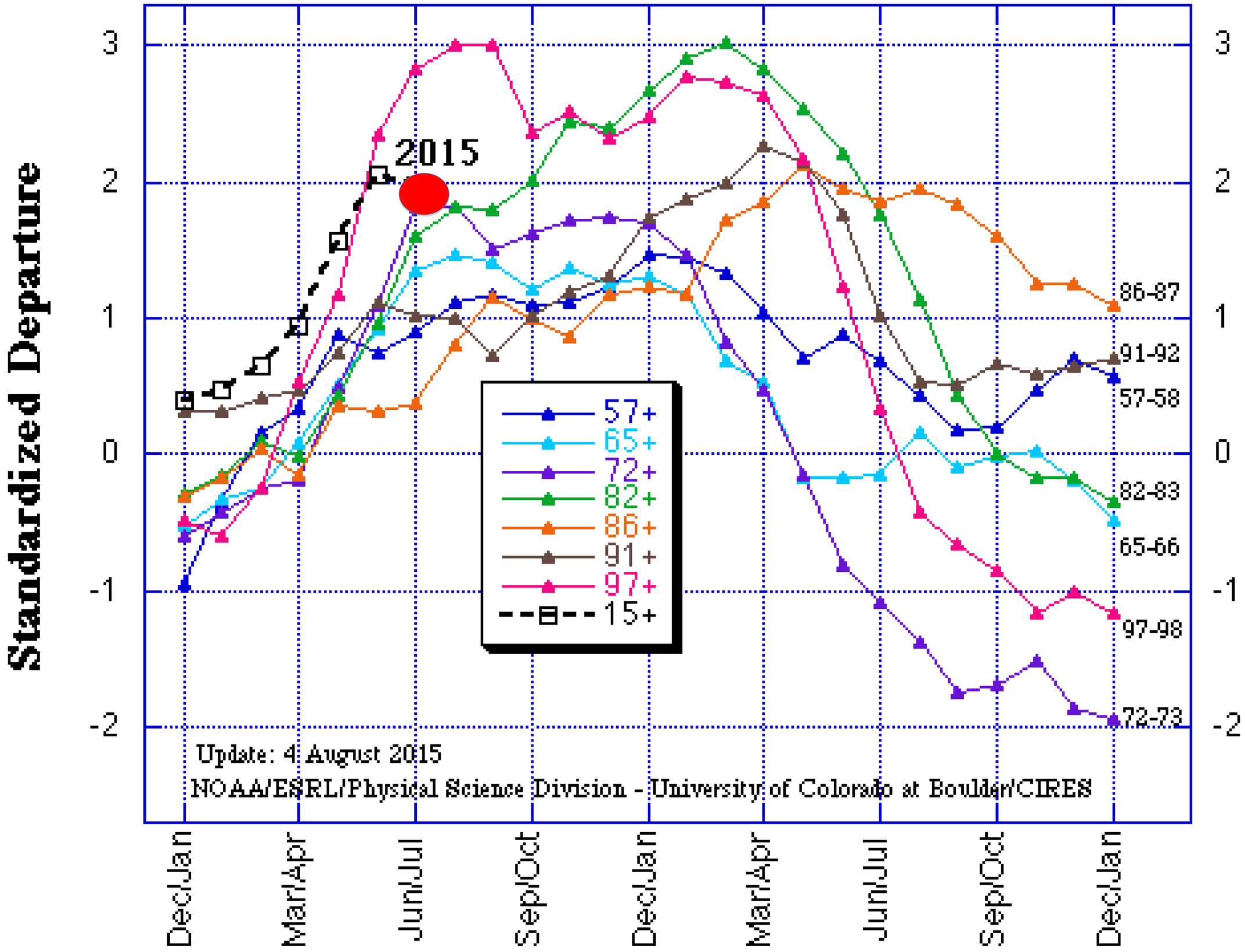
El Niño and La Niña Since 1950



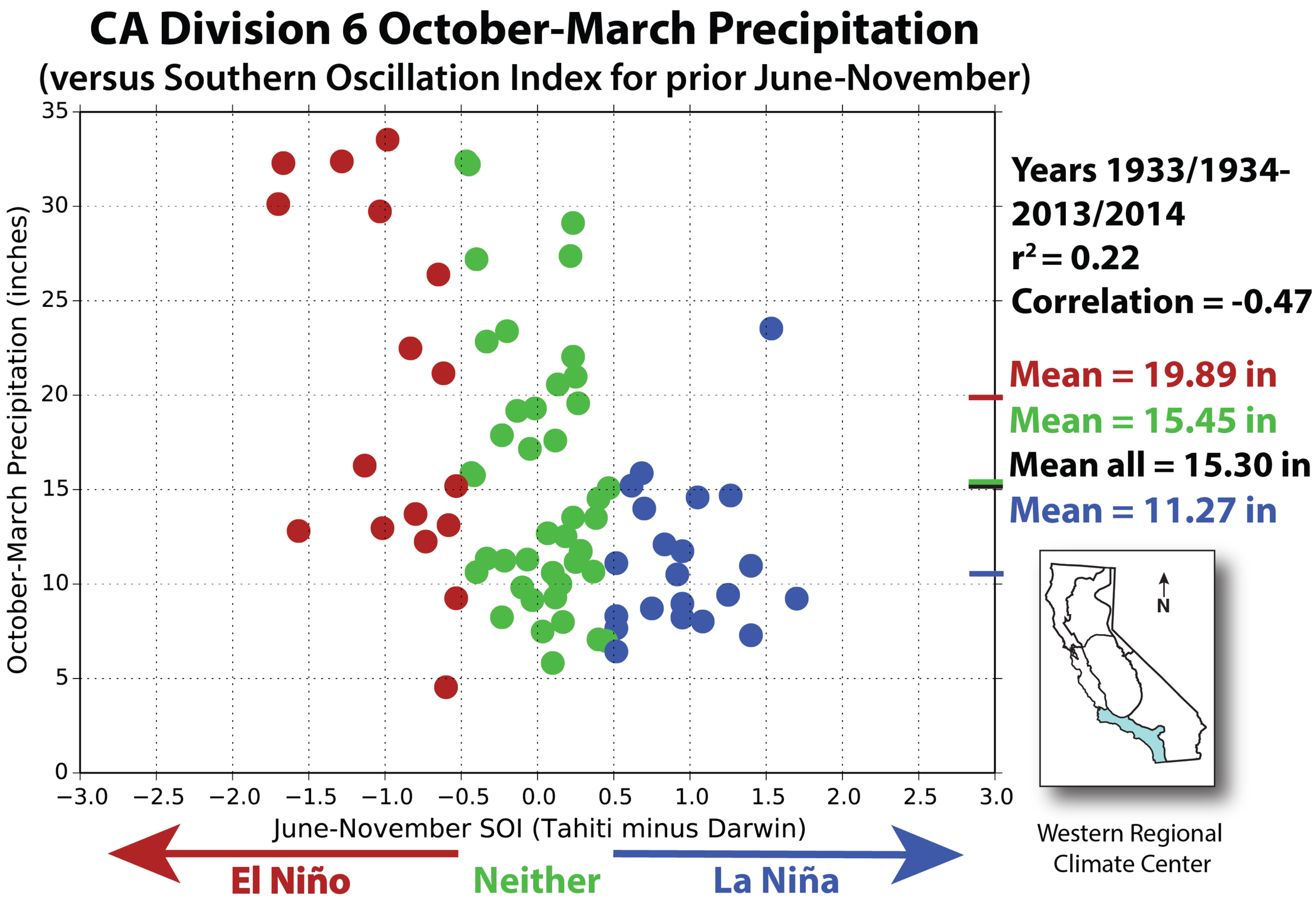
Tracking El Niño 2015



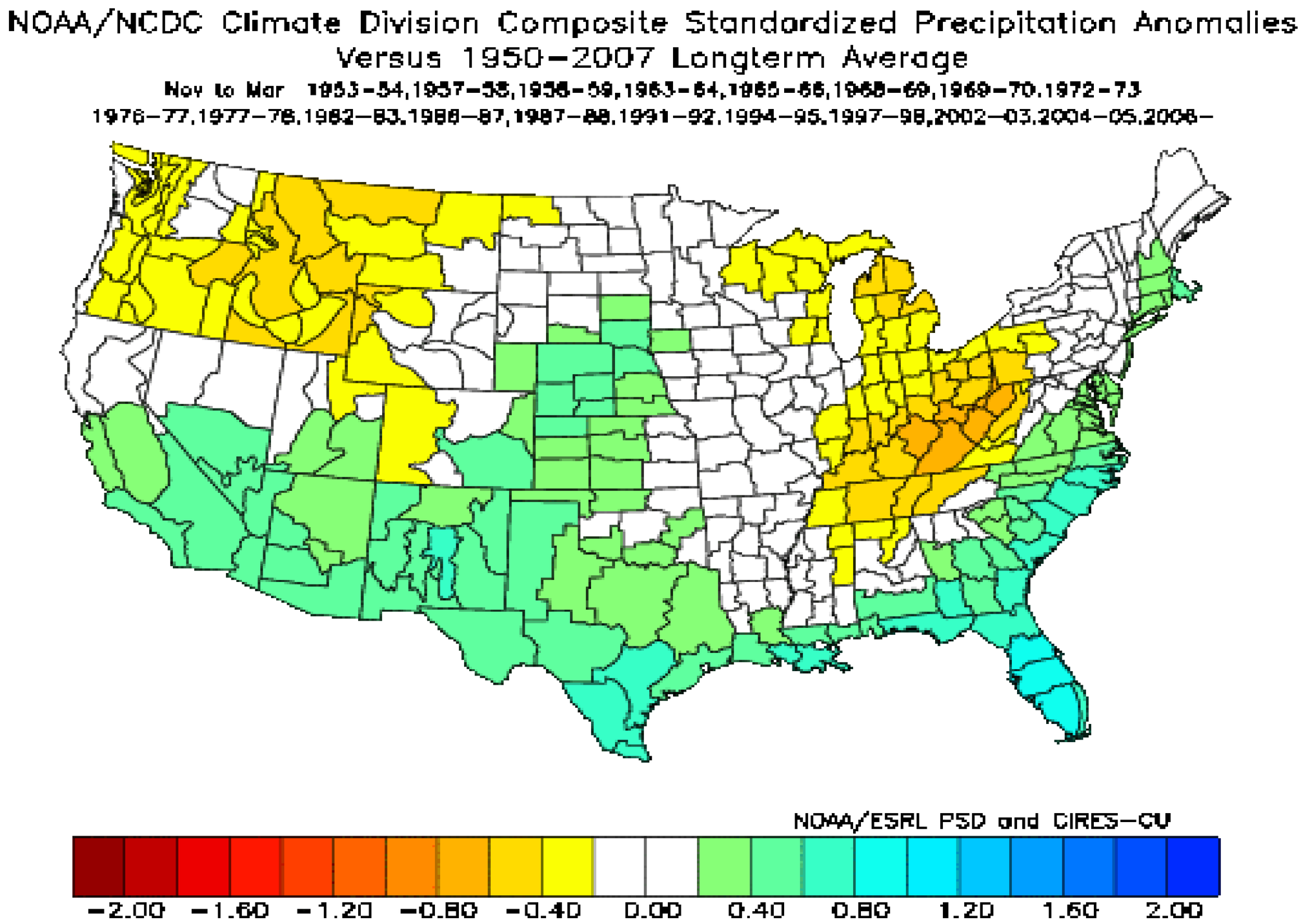
Multivariate ENSO Index (MEI) for the seven strongest El Niño events since 1950 vs. 2015



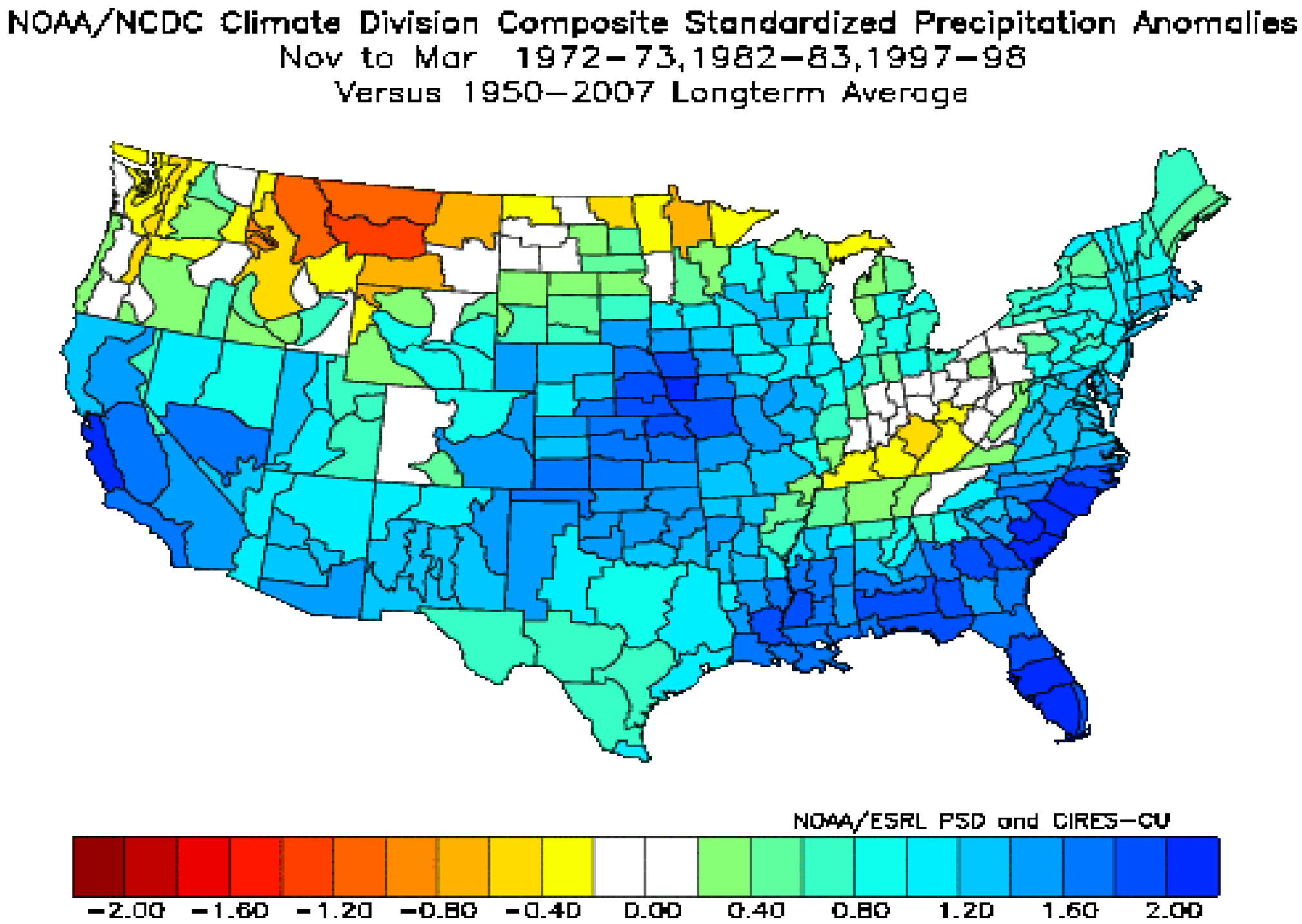
El Niño favors wet winters in Southern California, but not always large El Niño tilts odds more strongly toward heavy years



US Precipitation: ENSO > 0.5



US Precipitation: ENSO > 2.0



LARGE EL NINO YEARS Monthly San Diego precipitation in inches

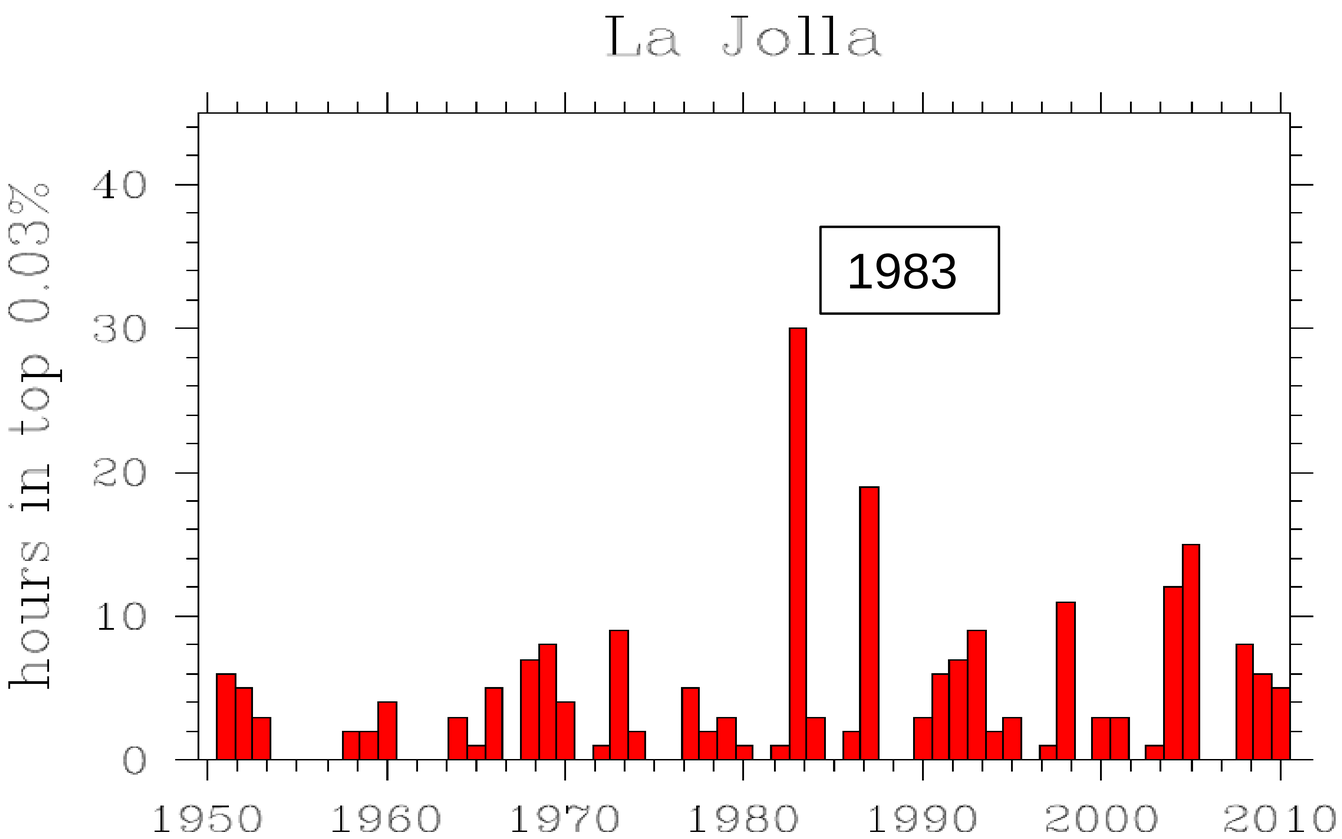
water year	oct	nov	dec	jan	feb	mar	apr	may
1957-58	1.76	0.59	1.38	0.62	3.15	3.99	1.65	0.40
1965-66	0.00	5.83	6.59	1.30	0.86	0.17	0.00	0.02
1972-73	0.58	3.16	1.61	1.68	1.64	2.26	0.05	0.00
1982-83	0.05	2.10	1.43	2.09	3.88	6.57	1.74	0.01
1986-87	1.39	1.16	0.95	1.68	1.54	1.04	0.78	0.03
1991-92	0.69	0.05	1.70	1.81	3.34	4.43	0.28	0.07
1997-98	0.02	1.17	1.35	2.68	7.65	2.21	1.11	0.64

LARGE EL NINO YEARSMonthly Sacramento precipitation in inches

water year	oct	nov	dec	jan	feb	mar	apr	may
1957-58	0.92	0.52	2.99	4.87	7.72	5.62	4.00	0.76
1965-66	0.11	2.93	2.44	1.91	1.56	0.14	0.47	0.25
1972-73	1.75	5.15	1.89	6.87	5.64	2.76	0.05	0.13
1982-83	2.61	5.74	3.25	4.93	5.57	6.75	4.21	0.25
1986-87	0.19	0.14	0.76	2.30	3.23	3.05	0.20	0.00
1991-92	1.25	0.19	1.60	1.39	5.47	2.05	0.92	0.00
1992-93	1.31	0.28	4.94	8.62	4.94	2.39	0.63	1.14
1997-98	0.82	4.57	2.91	6.40	9.95	2.47	1.06	2.98

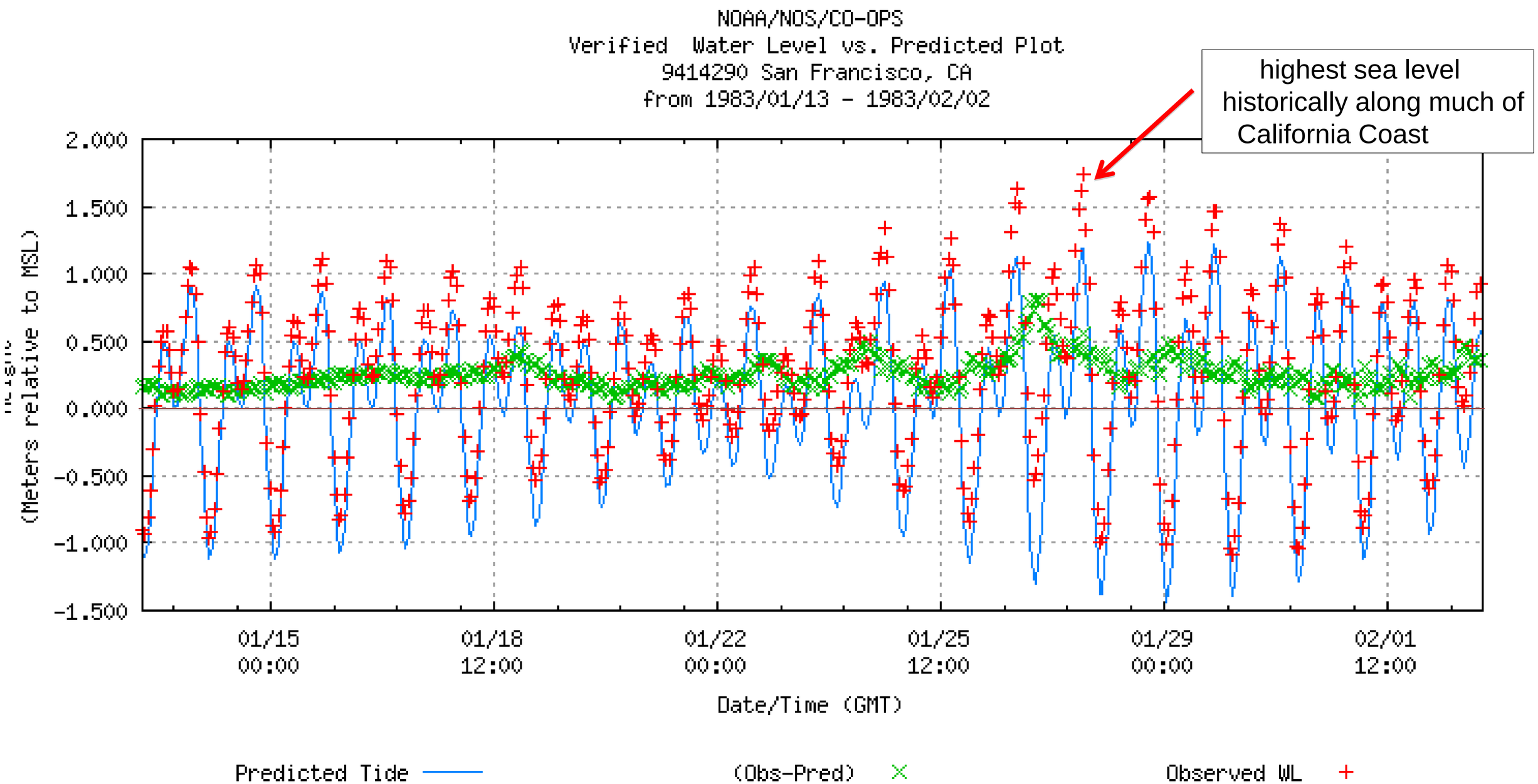
Extreme sea level occurrences La Jolla

observed at or above 99.99% historical hourly threshold 1.41m above mean



highest sea levels have mainly occurred in just a few years, esp large El Ninos (e.g., 1983)

Very high sea levels during the great January 26-28 1983 storm



during high sea levels, the sea is often *not* quiescent

January 1983 Monterey Bay, California

SUMMARY

Rather strong El Niño conditions have developed in the tropical Pacific. El Niño will likely remain in place through winter 2015-16.

If winter El Niño is strong, we could see above normal storminess in Southern California and maybe Northern California.

Historical El Niño's have resulted in a wide range of California precipitation during the water year. Strongest odds of wet winter in SoCal.

Historical El Niño's have produced large Pacific storms along with high waves and high sea levels along the Calfiornia coast. Periods with highest tides would produce strongest impacts if large storms were present.

Frank Gehrke,
California Cooperative Snow Surveys, DWR