



The 2015-16 El Niño

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Seattle, Washington, USA***

***Pacific Anomaly Workshop-2
University of Washington Tower
20 January 2016***

El Niño in the News



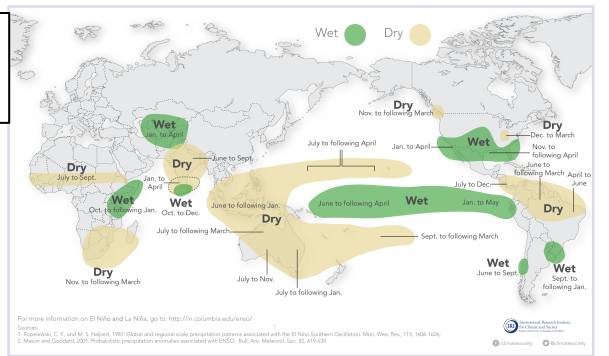
Torrential rain -- up to 20 inches in spots -- pummels much of Texas

By Greg Botelho, CNN
Updated 8:57 PM ET, Sat October 24, 2015 | Video Source: CNN

Indian summer monsoon rainfall 14% below normal

El Niño and Rainfall

El Niño conditions in the tropical Pacific are known to shift rainfall patterns in many different parts of the world. Although they vary somewhat from one El Niño to the next, the strongest shifts remain fairly consistent in the regions and seasons shown on the map below.



theguardian

Indonesia's fires labelled a 'crime against humanity' as 500,000 suffer

NBC NEWS

Hurricane Patricia: Strongest Storm Ever Measured to Hit Mexico

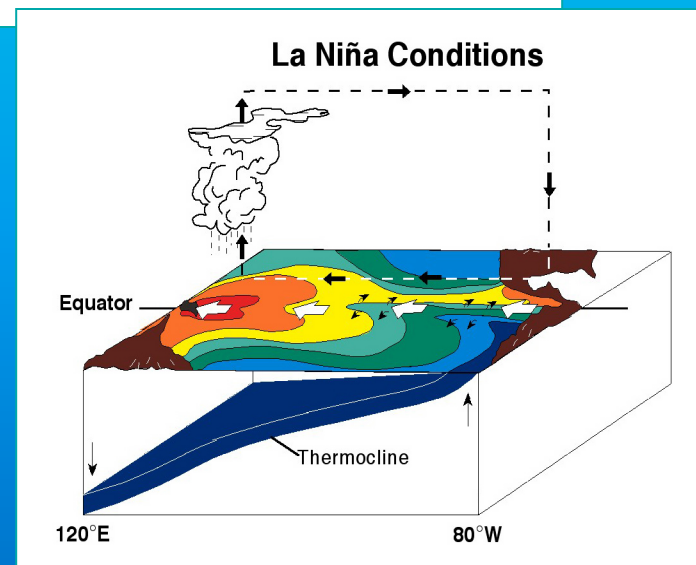
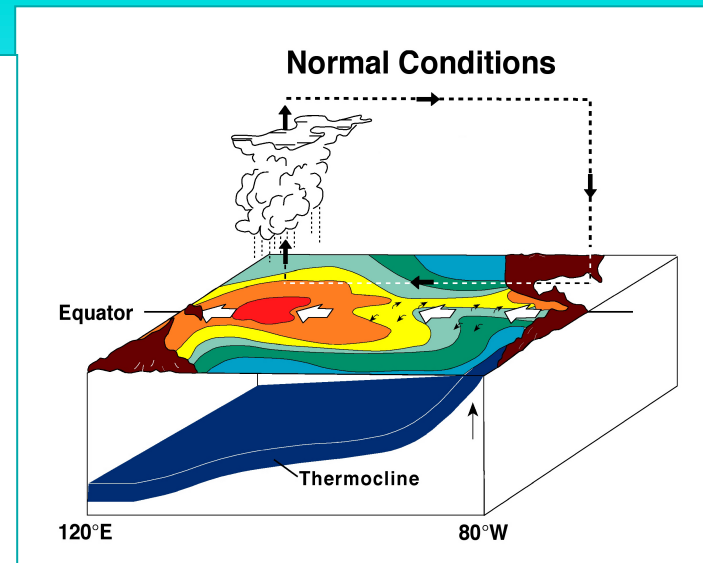
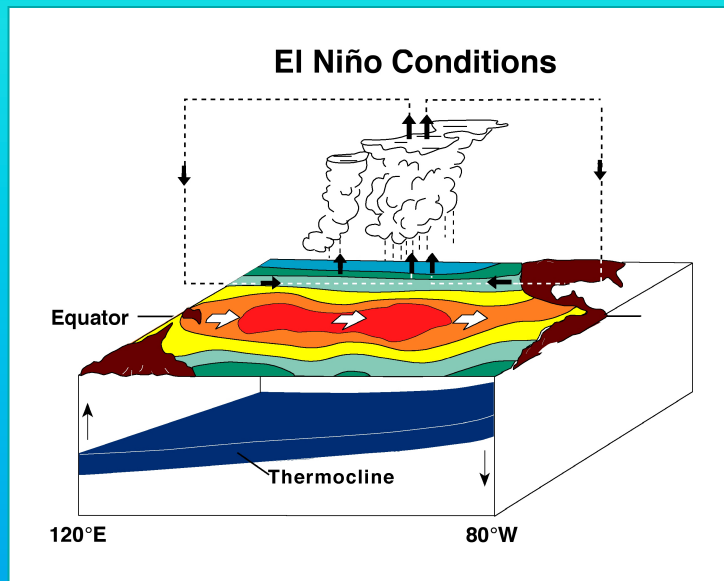
The 2015-16 El Niño



1. Development and current status
2. Comparison with previous events
3. Seasonal forecasts
4. Godzilla vs the Blob



El Niño and the Southern Oscillation (ENSO)

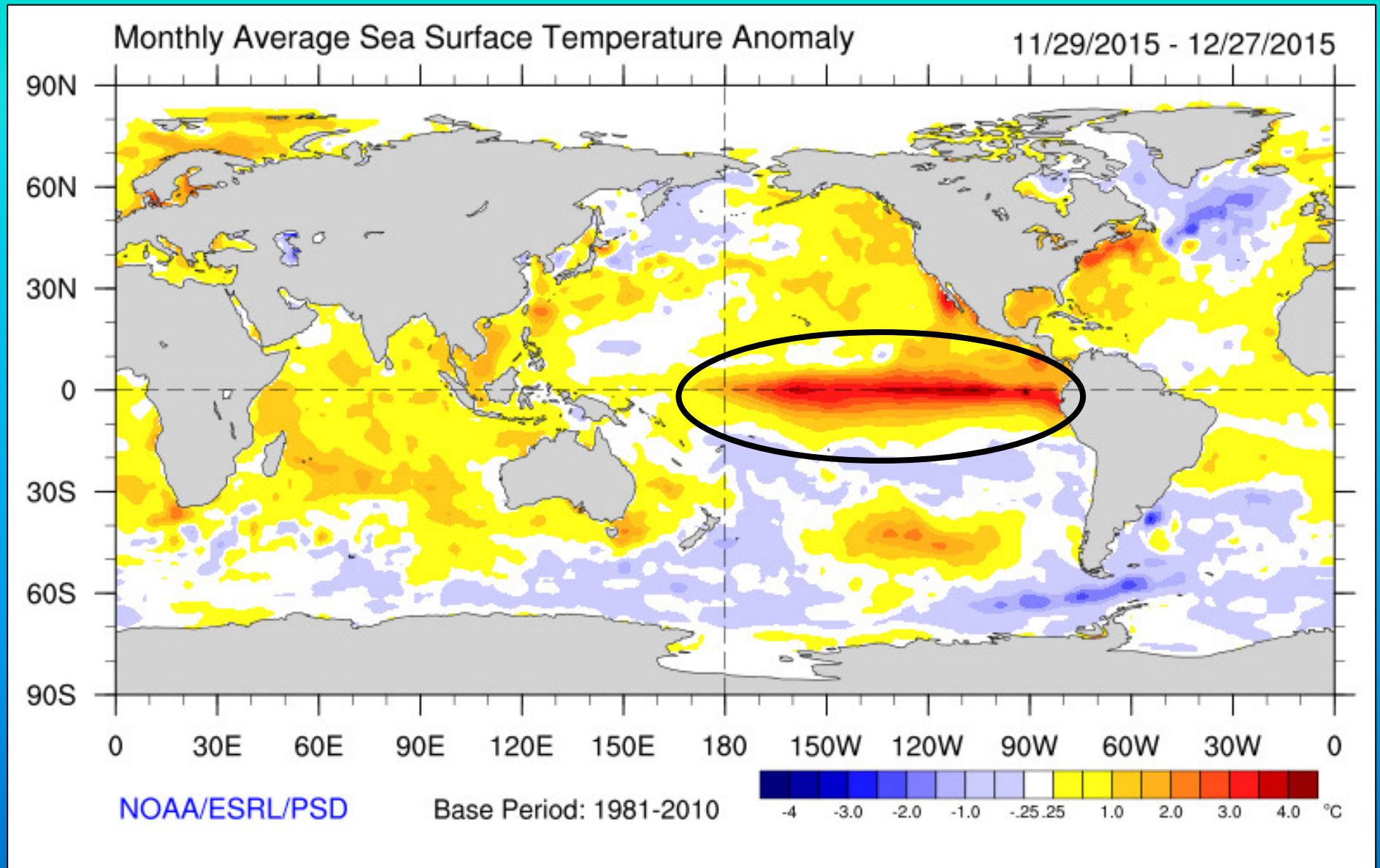


El Niño—Warm phase of ENSO

La Niña—Cold phase of ENSO

Global SST Anomaly

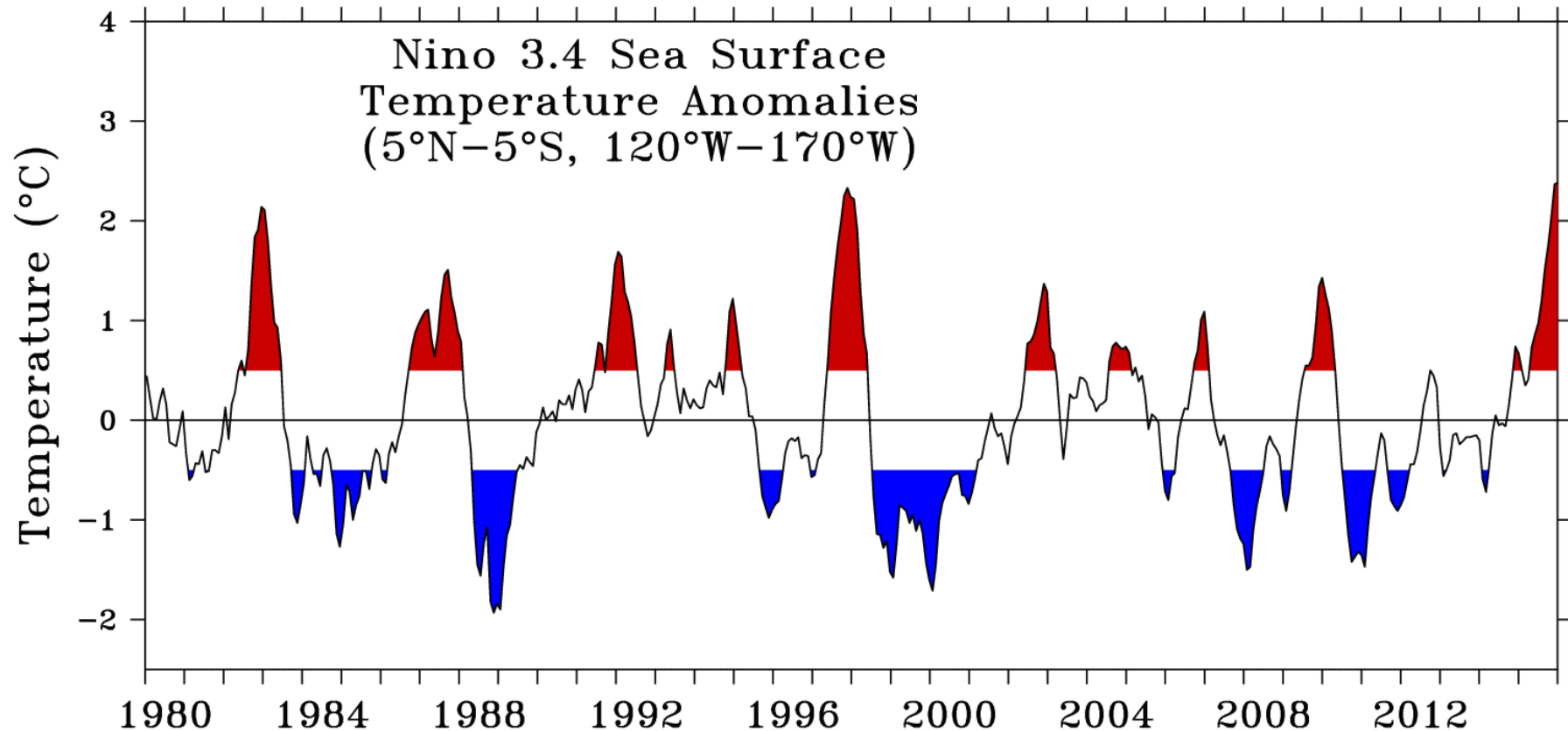
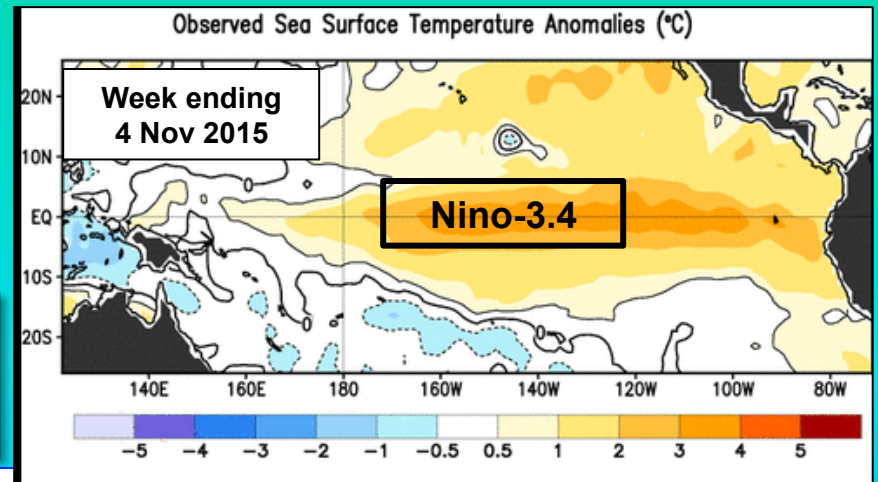
December 2015



An ENSO Index

El Niño=NINO3.4 $\geq 0.5^{\circ}\text{C}$ for 5 months

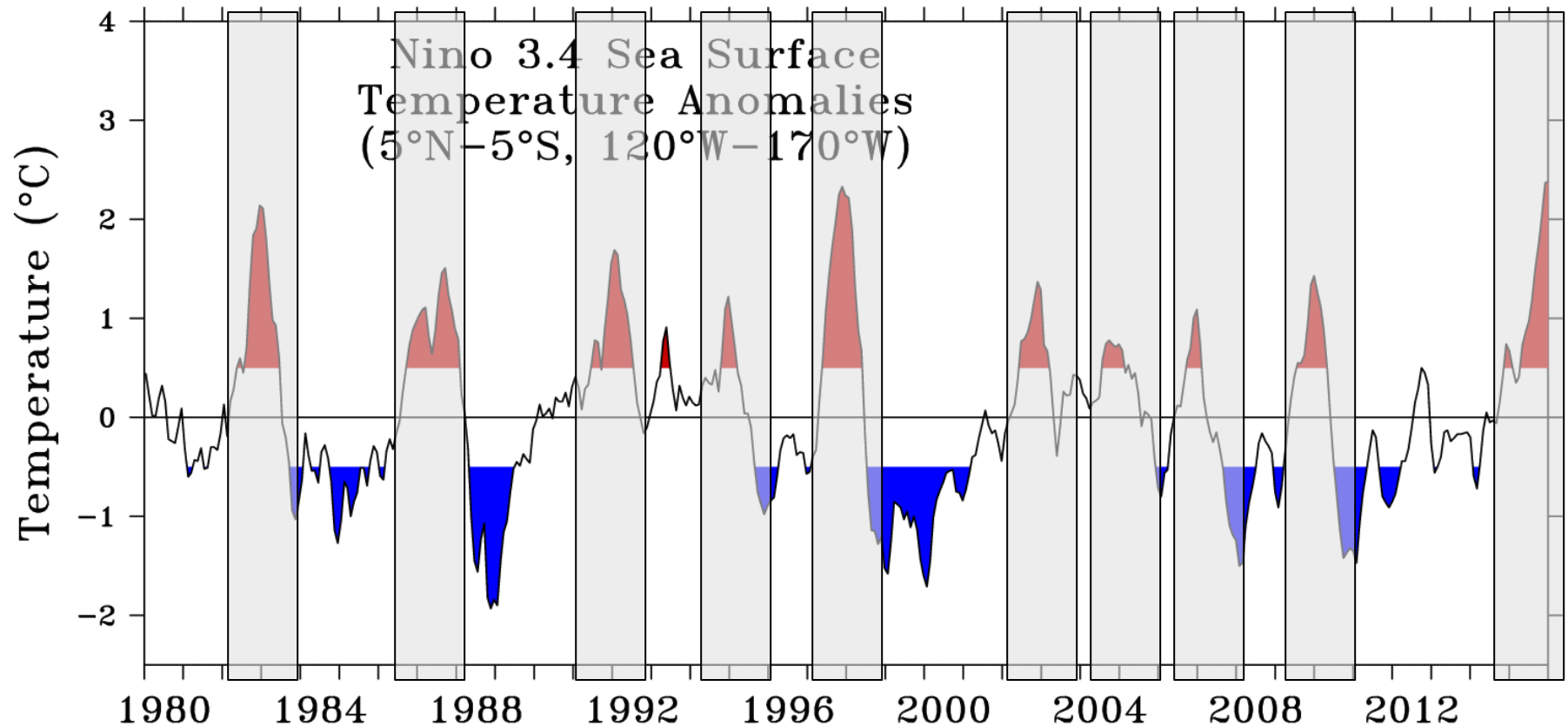
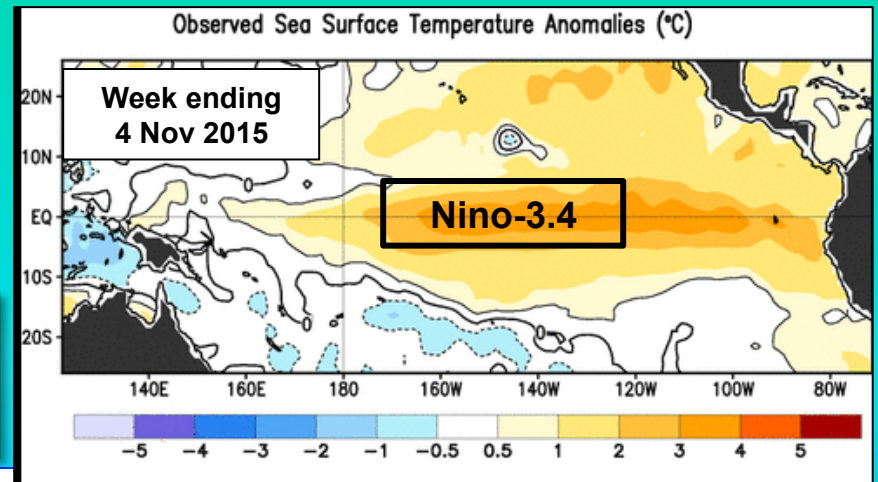
La Niña=NINO3.4 $\leq -0.5^{\circ}\text{C}$ for 5 months



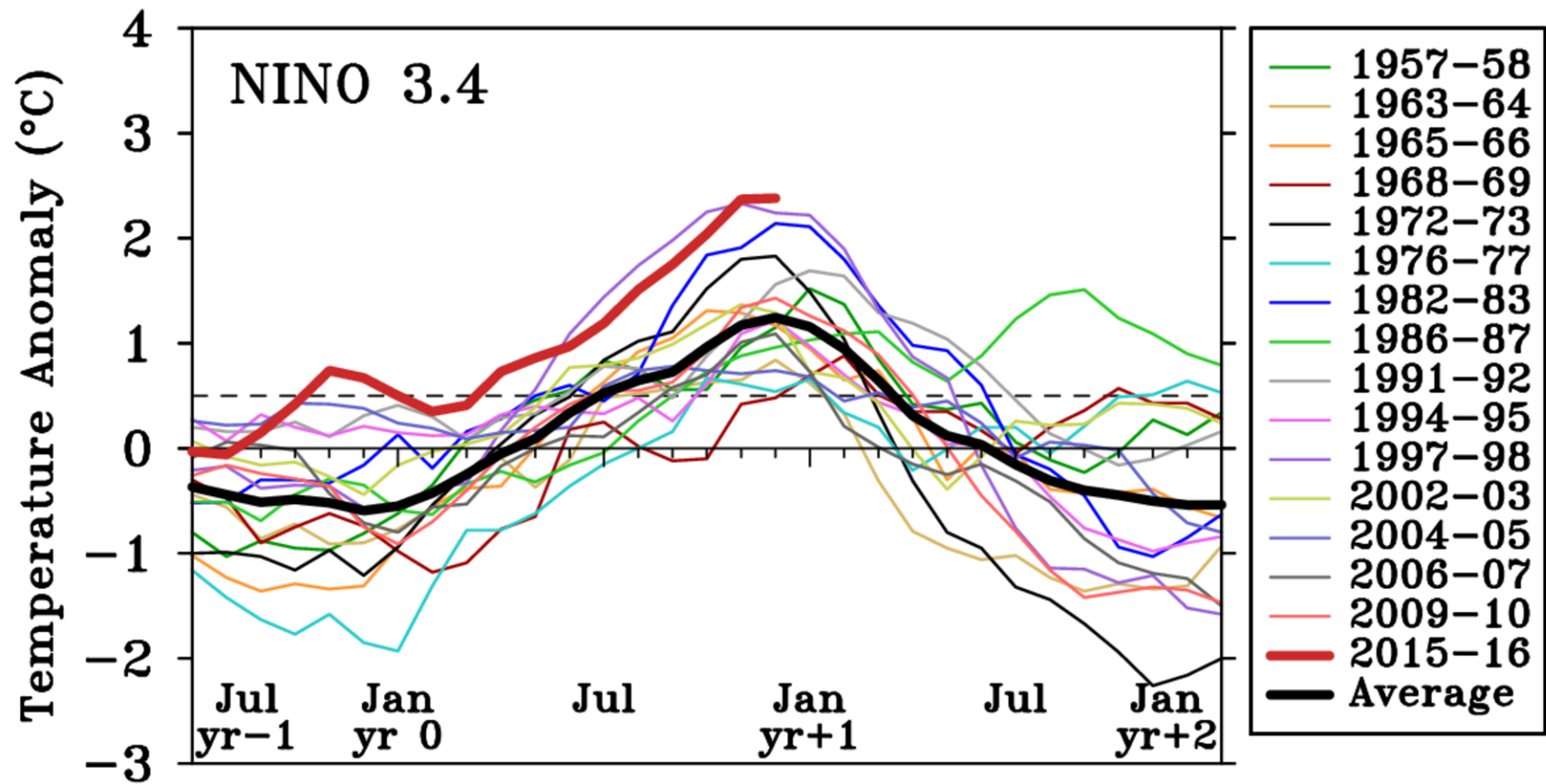
An ENSO Index

El Niño=NINO3.4 $\geq 0.5^{\circ}\text{C}$ for 5 months

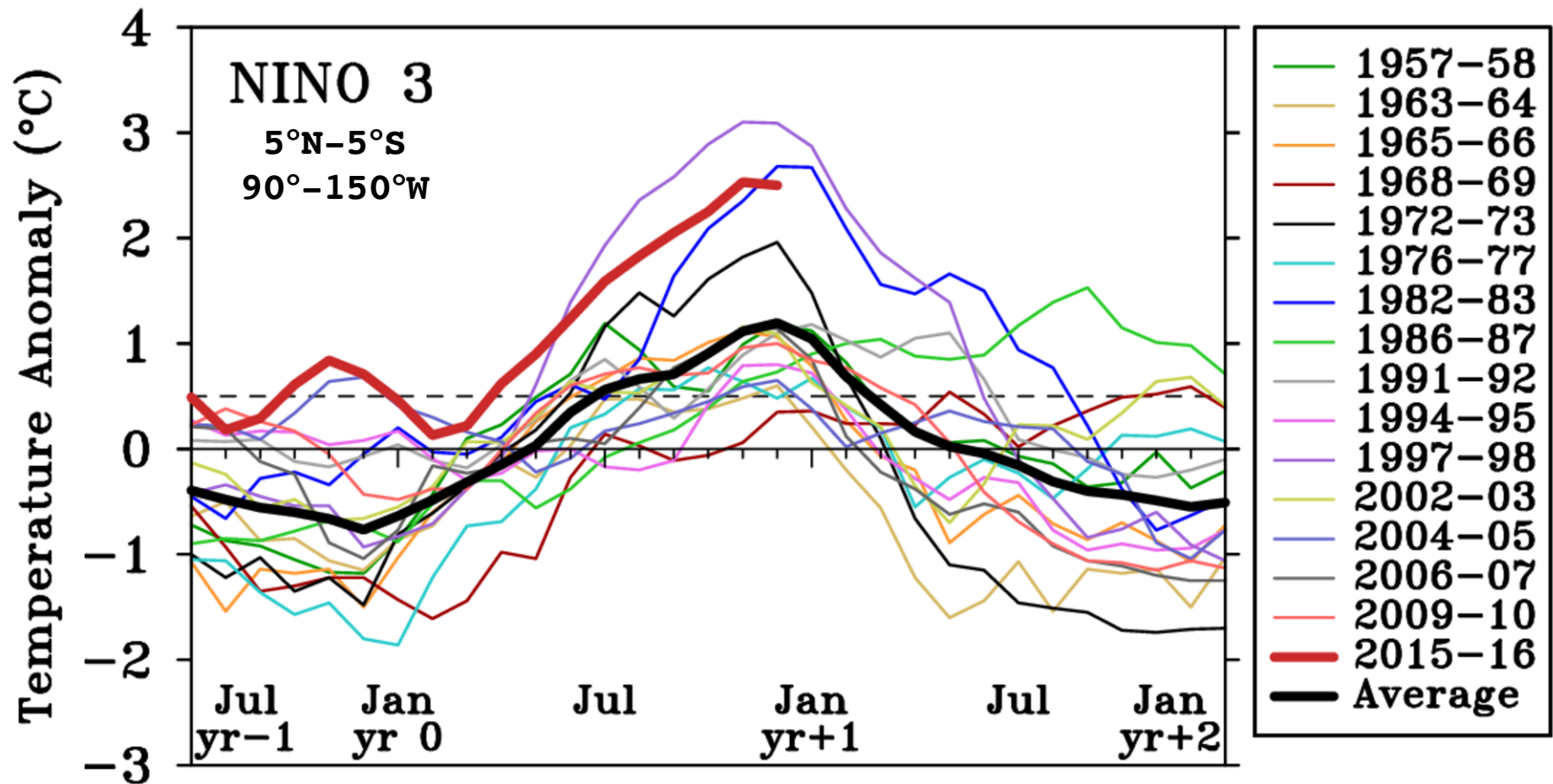
La Niña=NINO3.4 $\leq -0.5^{\circ}\text{C}$ for 5 months



2015-16 vs. Past El Niños

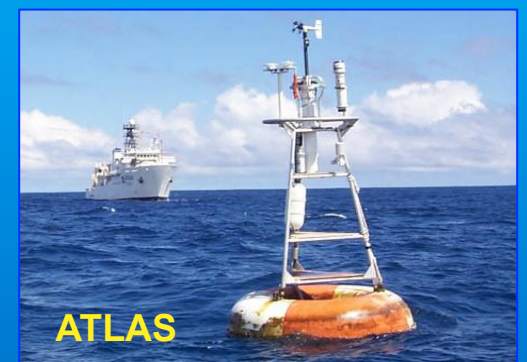
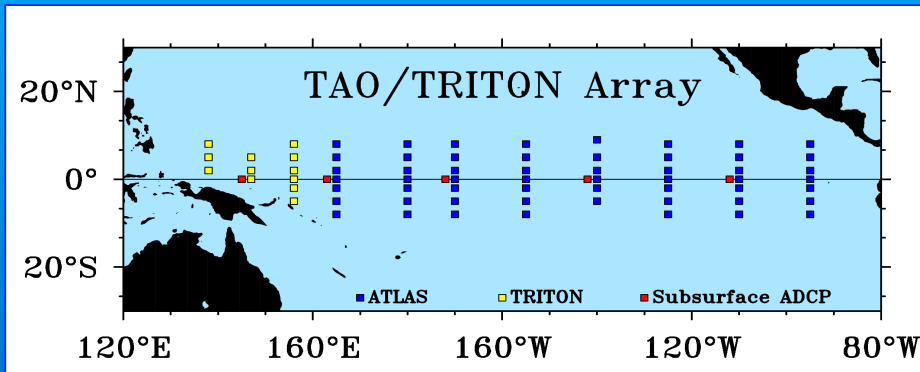
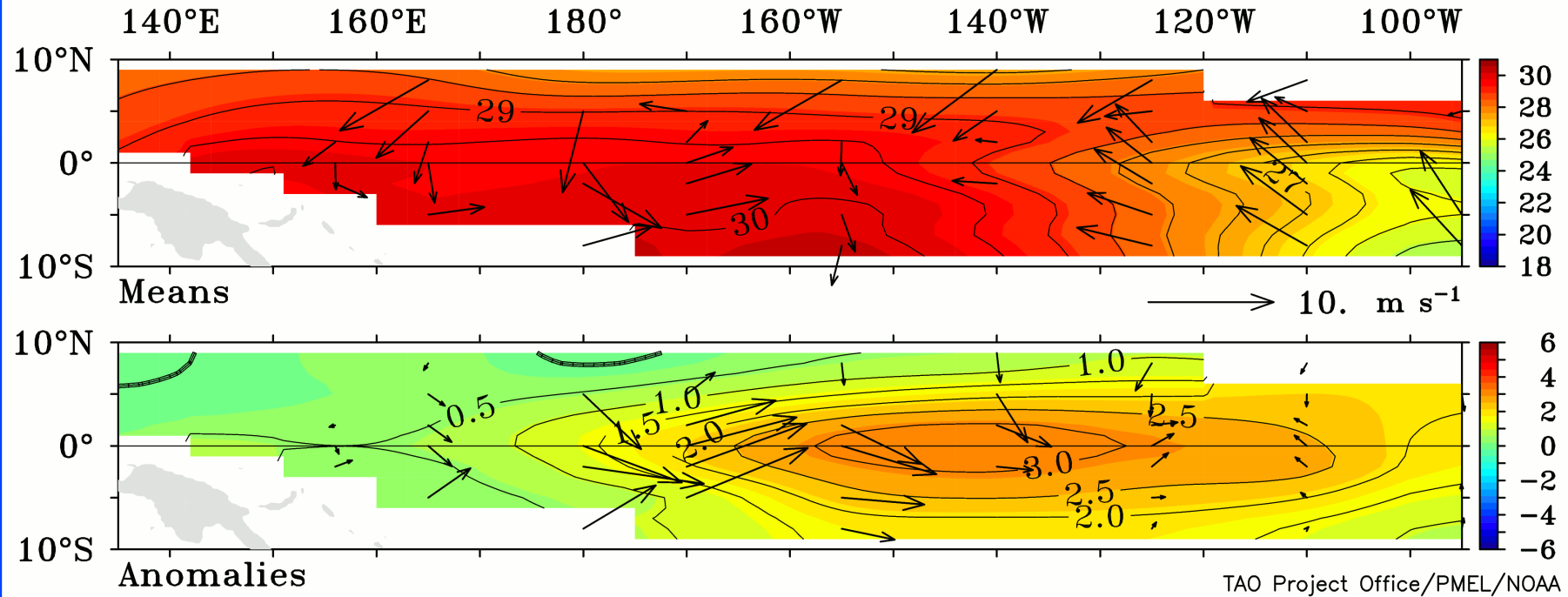


2015-16 vs. Past El Niños

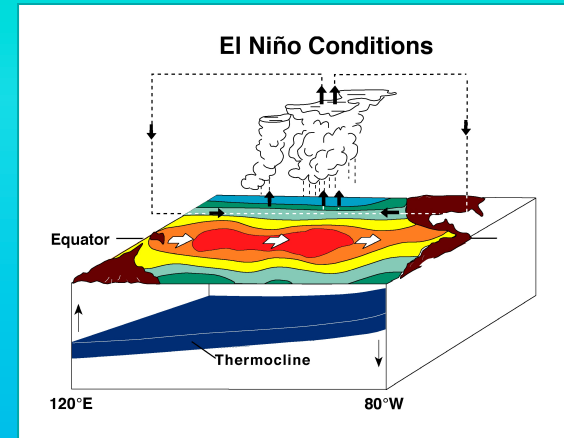
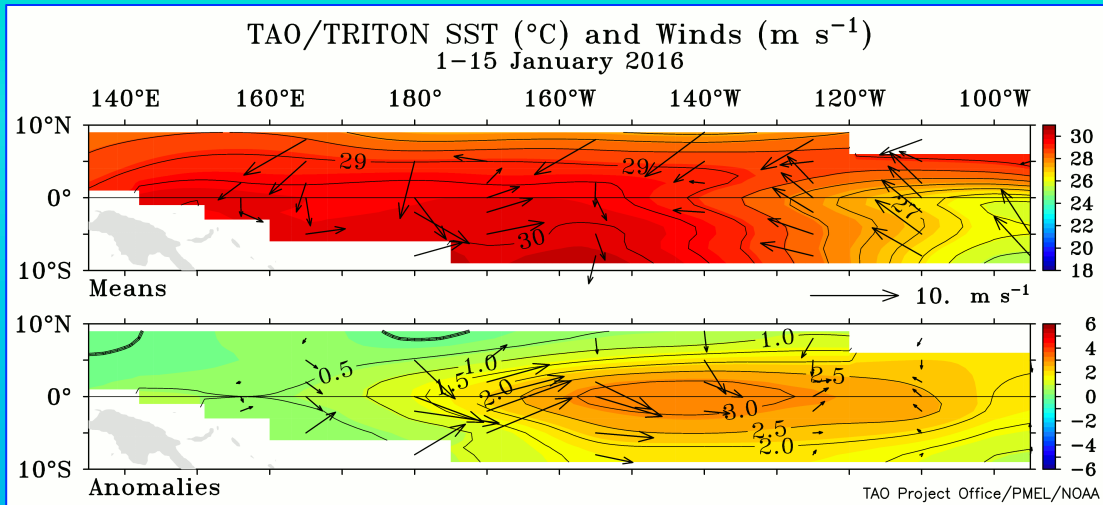


January 2016

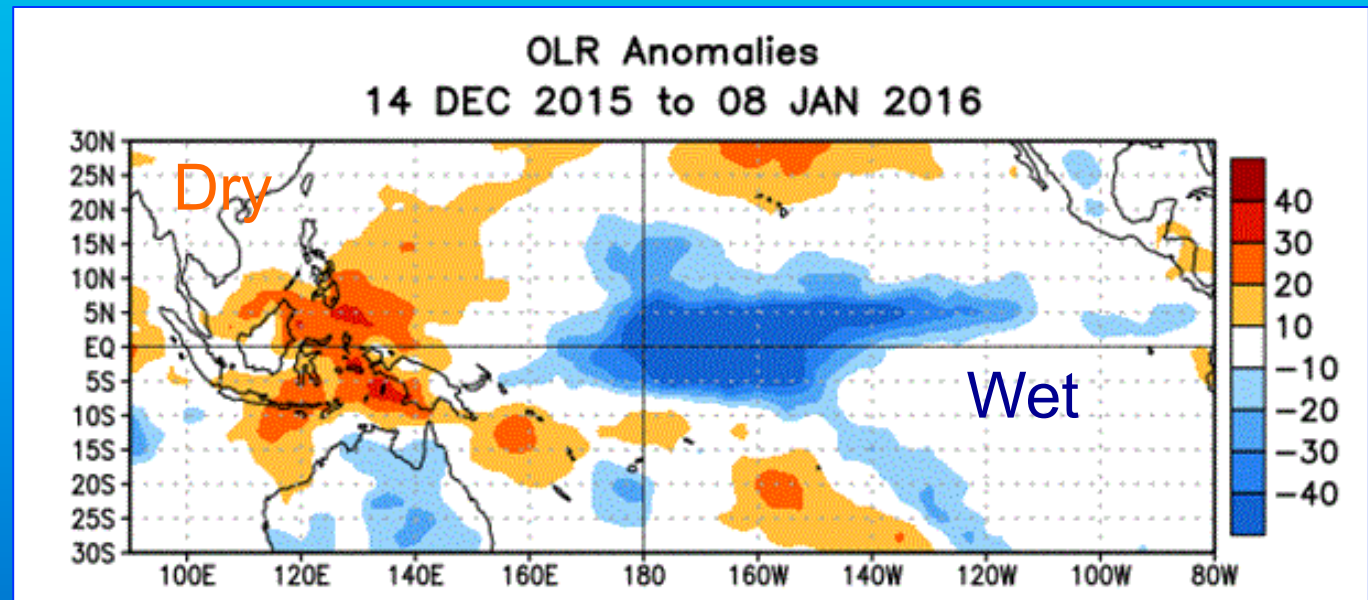
TAO/TRITON SST ($^{\circ}\text{C}$) and Winds (m s^{-1})
1-15 January 2016



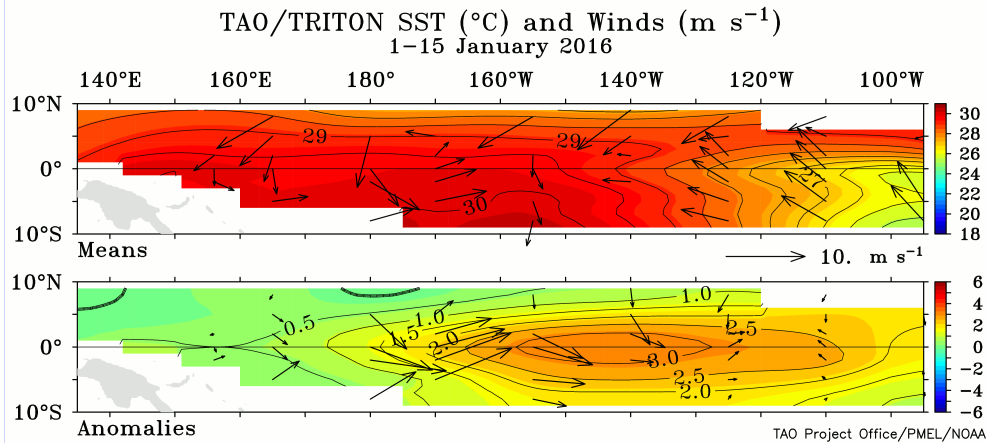
January 2016



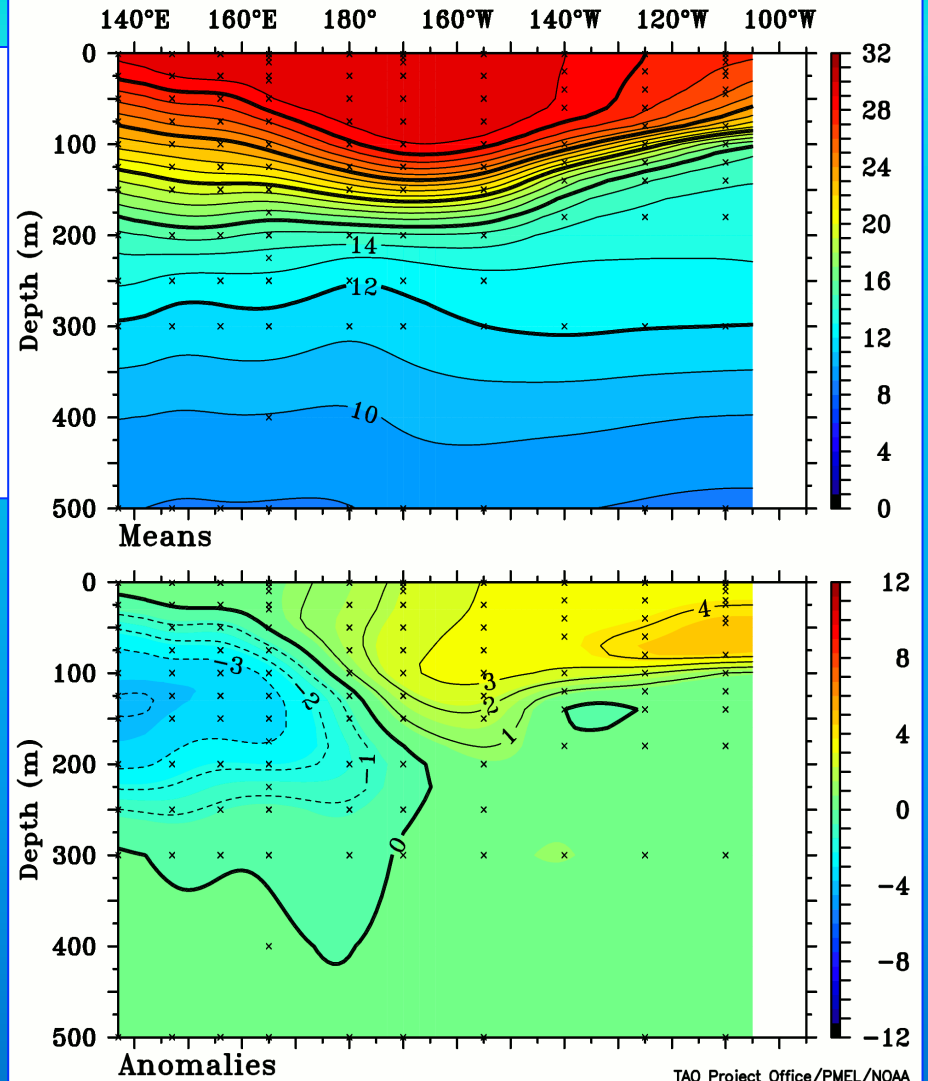
Outgoing
Longwave
Radiation: An
indicator of deep
convection and
heavy rainfall



January 2016

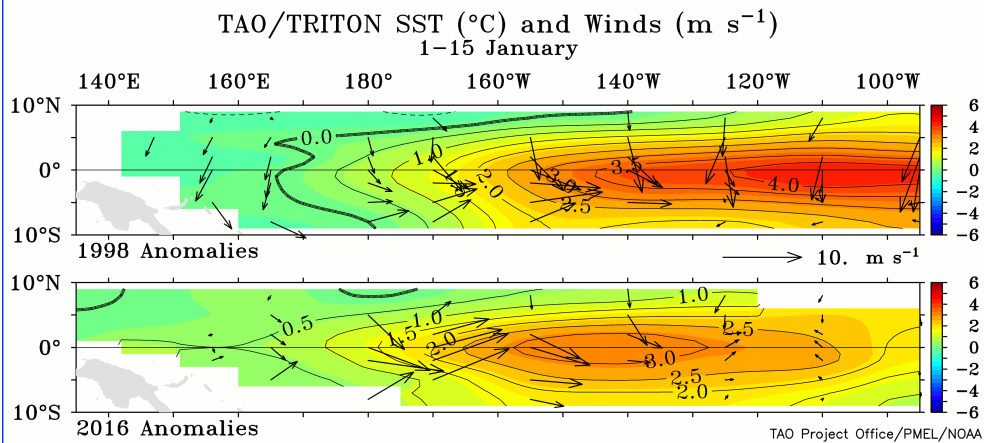


TAO/TRITON 2°N-2°S Average Temperature ($^{\circ}\text{C}$)
1-15 January 2016

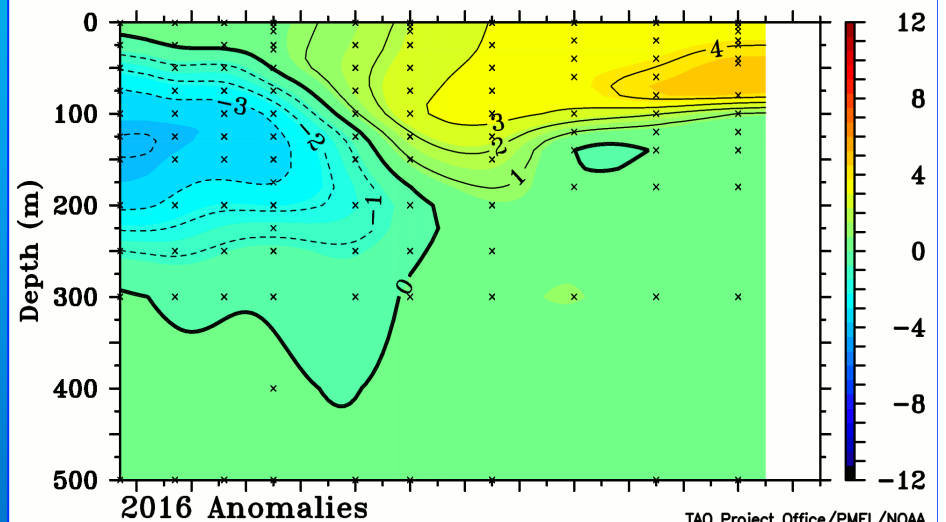
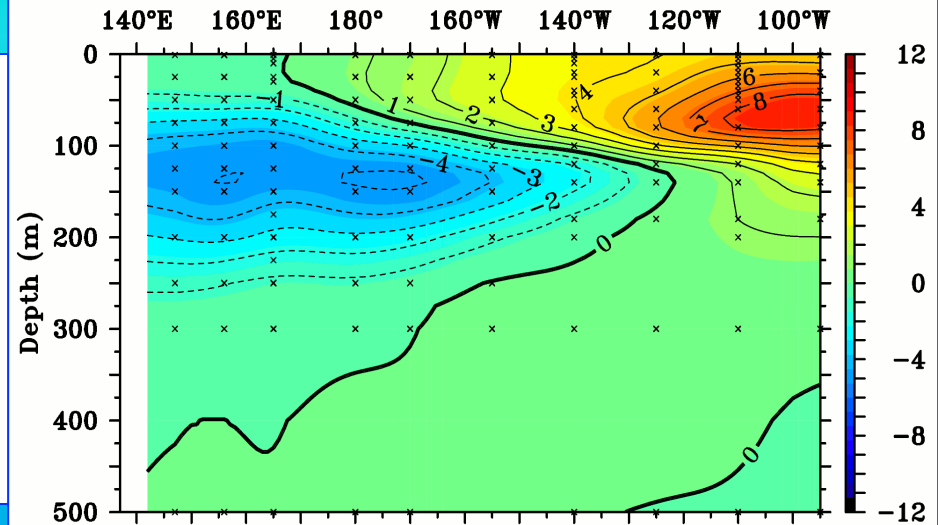


<http://www.pmel.noaa.gov/tao/>

January 1998 vs 2016



TAO/TRITON 2°N–2°S Average Temperature ($^{\circ}\text{C}$)
January 1–15



<http://www.pmel.noaa.gov/tao/>

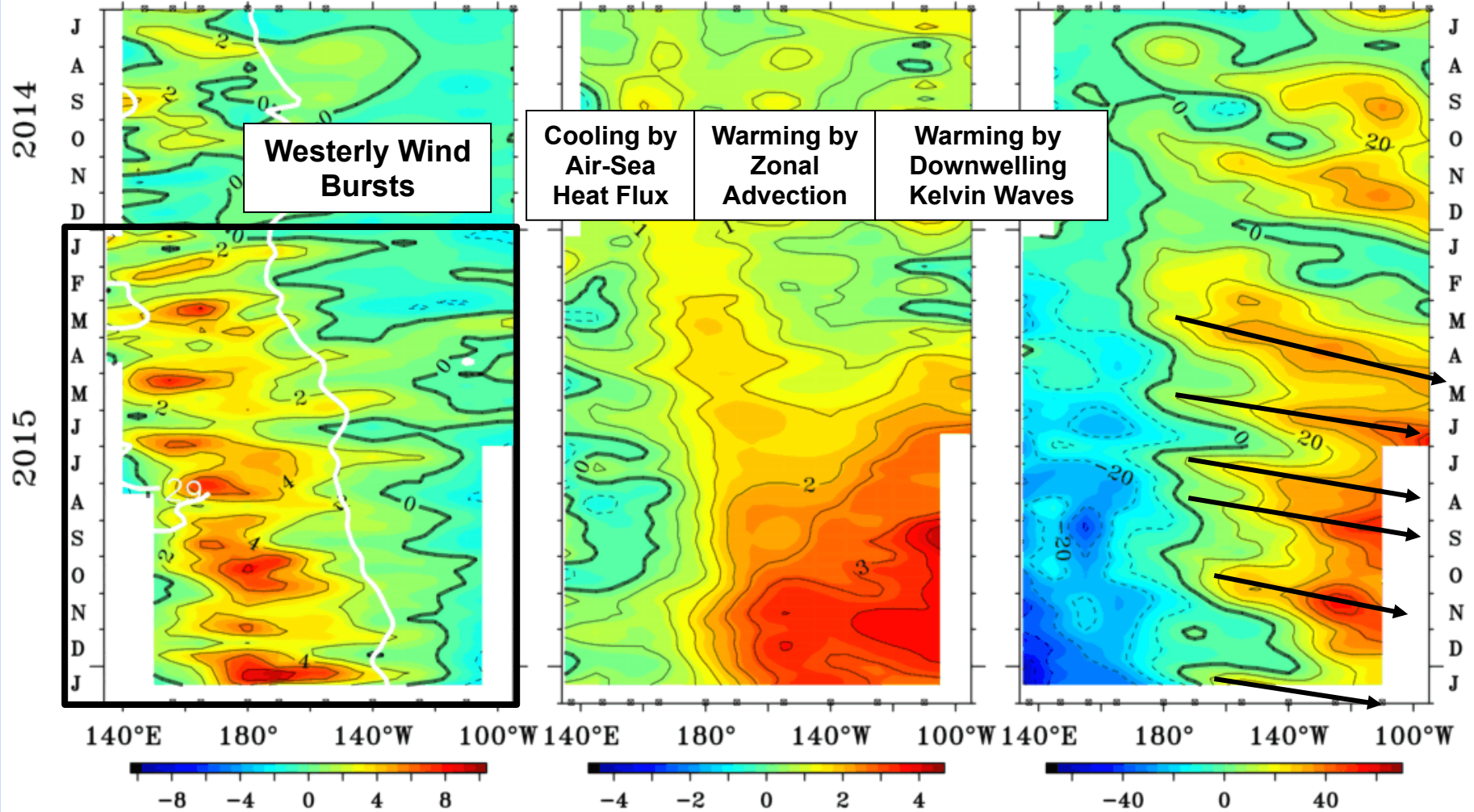
Evolution: July 2014-Jan 2016

Five Day TAO/TRITON Anomalies 2°S to 2°N Average

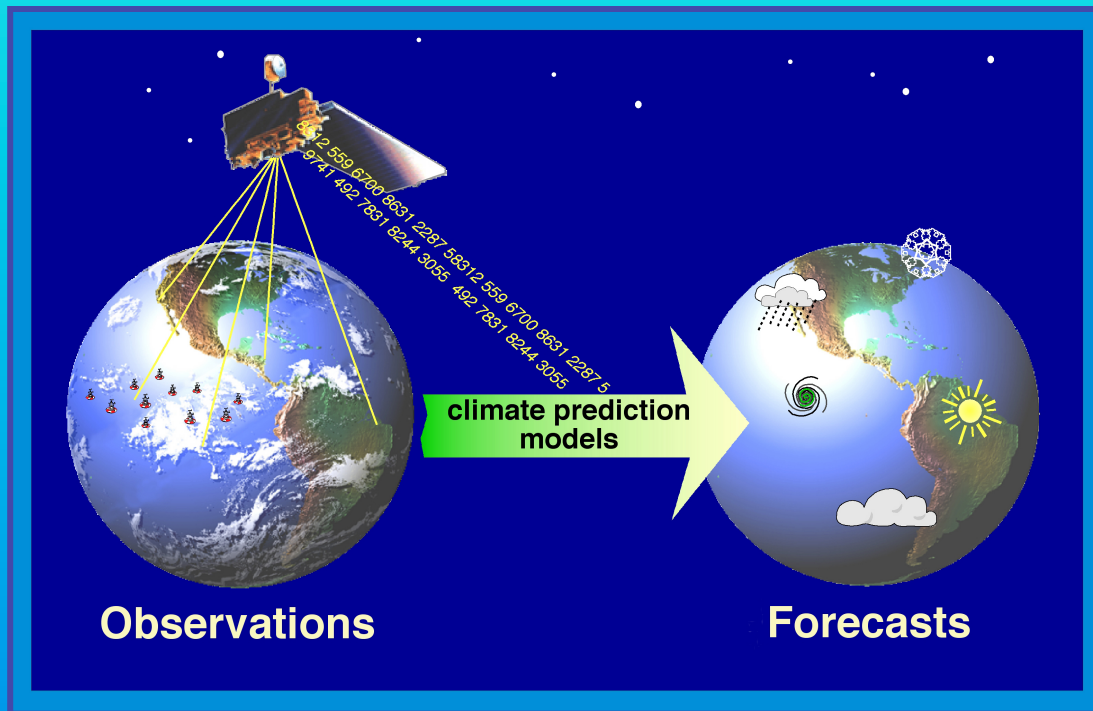
(a) Zonal Wind (m s^{-1})

(b) SST ($^{\circ}\text{C}$)

(c) 20°C Depth (m)



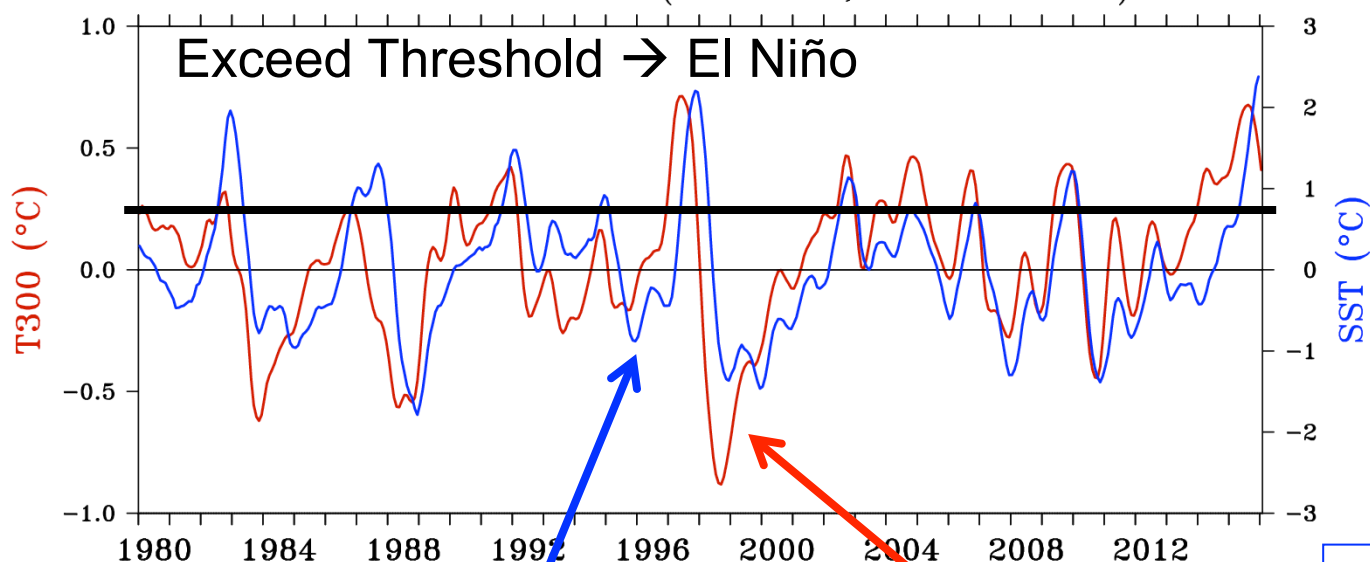
El Niño and La Niña are Predictable



- ***First successful El Niño prediction in 1986***
- ***~20 organizations around the world issue forecasts***
- ***Forecast models are reasonably accurate up to 6-9 months in advance***
- ***Predictability based variations in upper ocean heat content***

Upper Ocean Heat Content as a Predictor of El Niño (Recharge Oscillator Theory, Jin 1997)

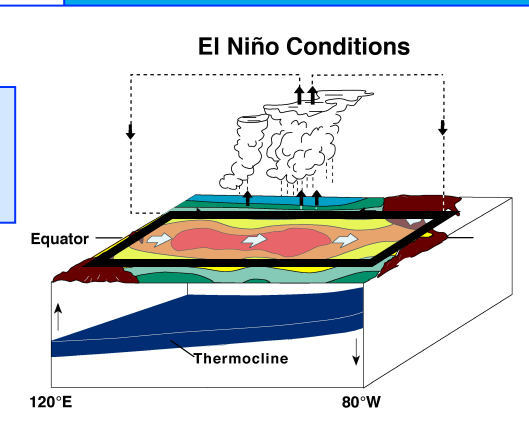
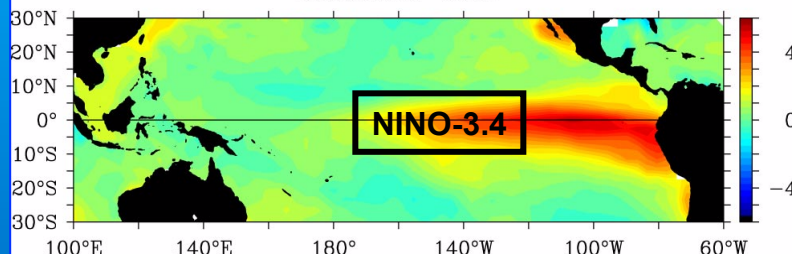
Depth Averaged Temperature Anomalies (0/300m)
and NINO 3.4 SST (5°N–5°S, 120°E–80°W)



- Build-up of excess heat content along equator is a necessary precondition for El Niño to occur.
- El Niño purges excess heat to higher latitudes, which terminates event.
- The time between El Niños is determined by the time to recharge.

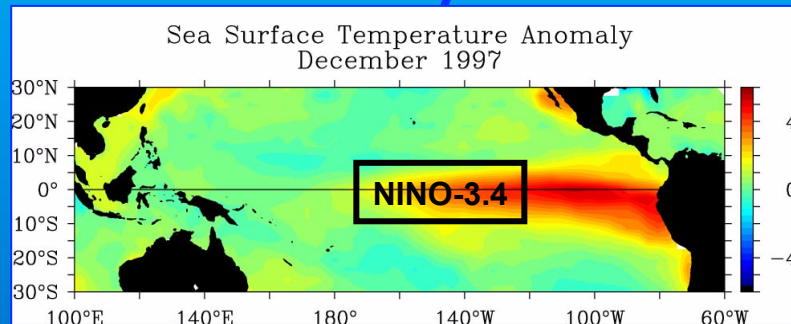
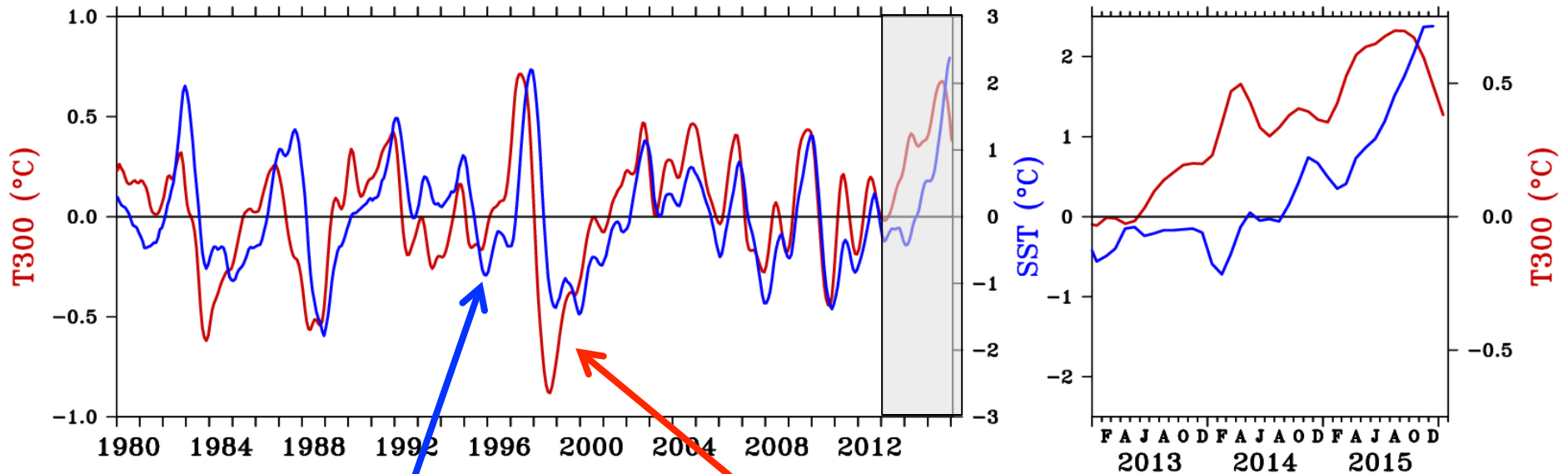
Heat content (proportional to average temperature anomaly in upper 300 m)

Sea Surface Temperature Anomaly
December 1997

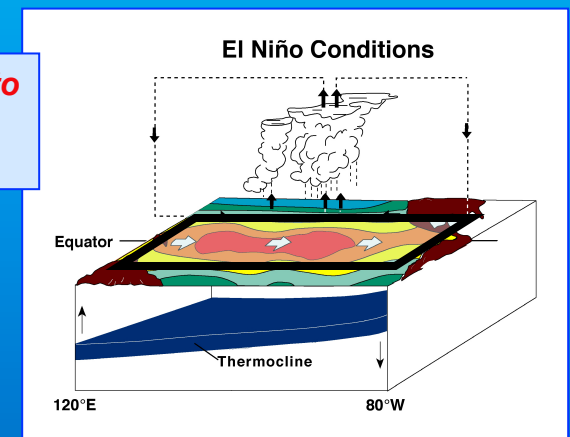


Upper Ocean Heat Content as a Predictor of El Niño (Recharge Oscillator Theory, Jin 1997)

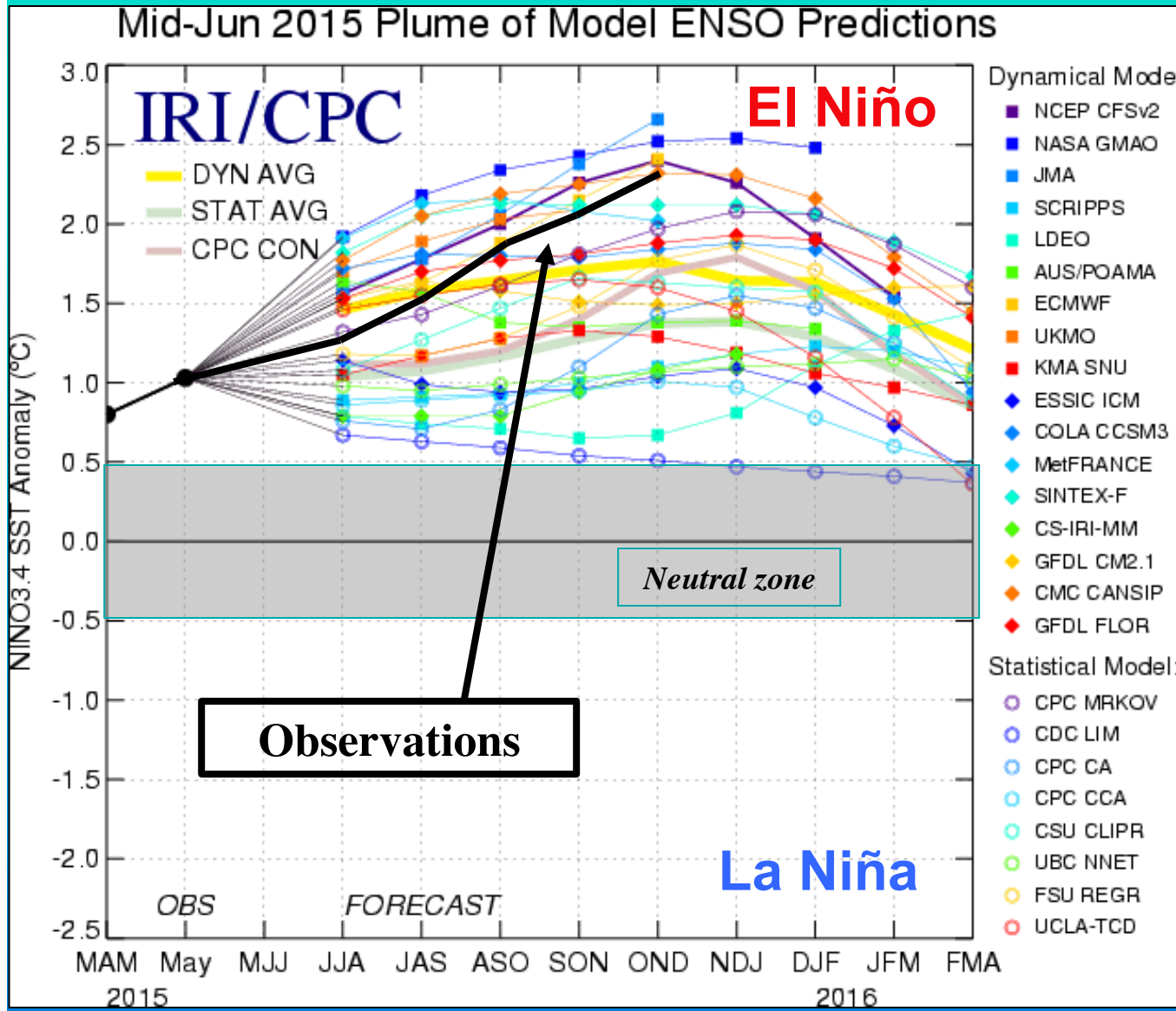
Depth Averaged Temperature Anomalies (0/300m)
and NINO 3.4 SST (5°N–5°S, 120°E–80°W)



Heat content (proportional to
average temperature
anomaly in upper 300 m)



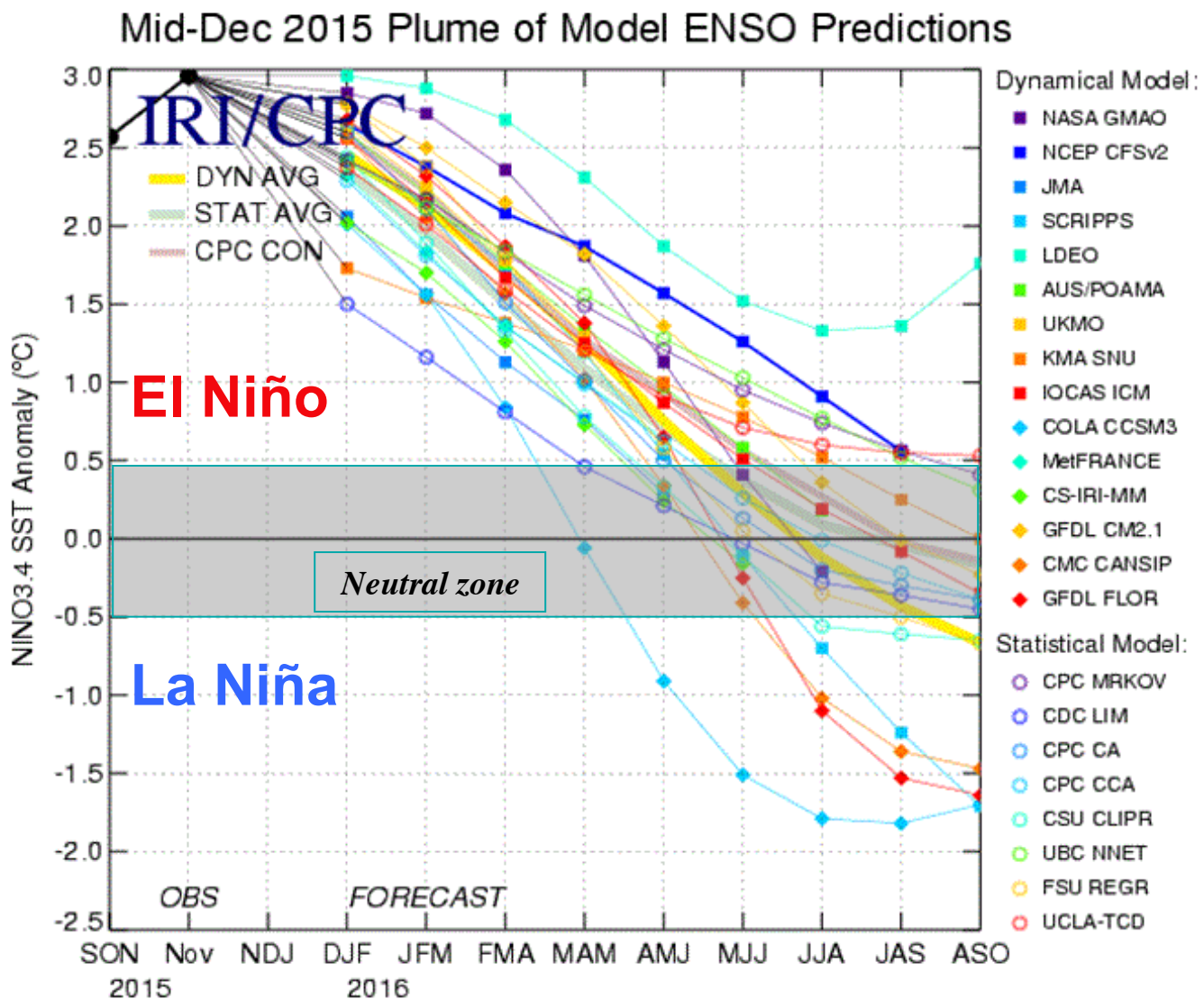
Niño-3.4 Predictions: May 2015 Initial Conditions



“There is a greater than 90% chance that El Niño will continue through Northern Hemisphere fall 2015...the consensus of forecasters slightly favors a strong event.”

NOAA/NCEP
11 June 2015

Niño-3.4 Predictions: December 2015 Initial Conditions

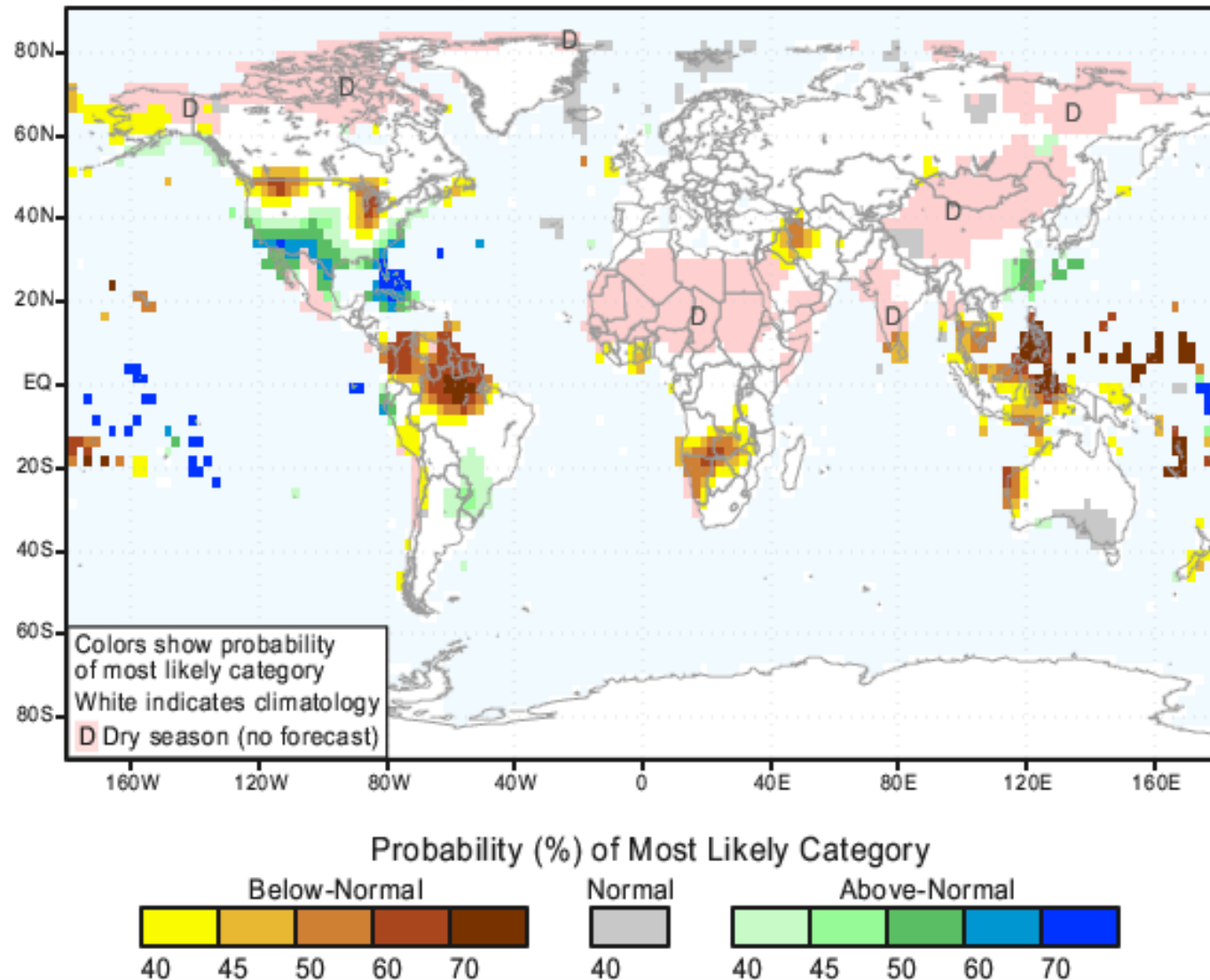


“A strong El Niño is expected to gradually weaken through spring 2016, and to transition to ENSO-neutral during late spring or early summer.”

NOAA/NCEP
14 January 2016

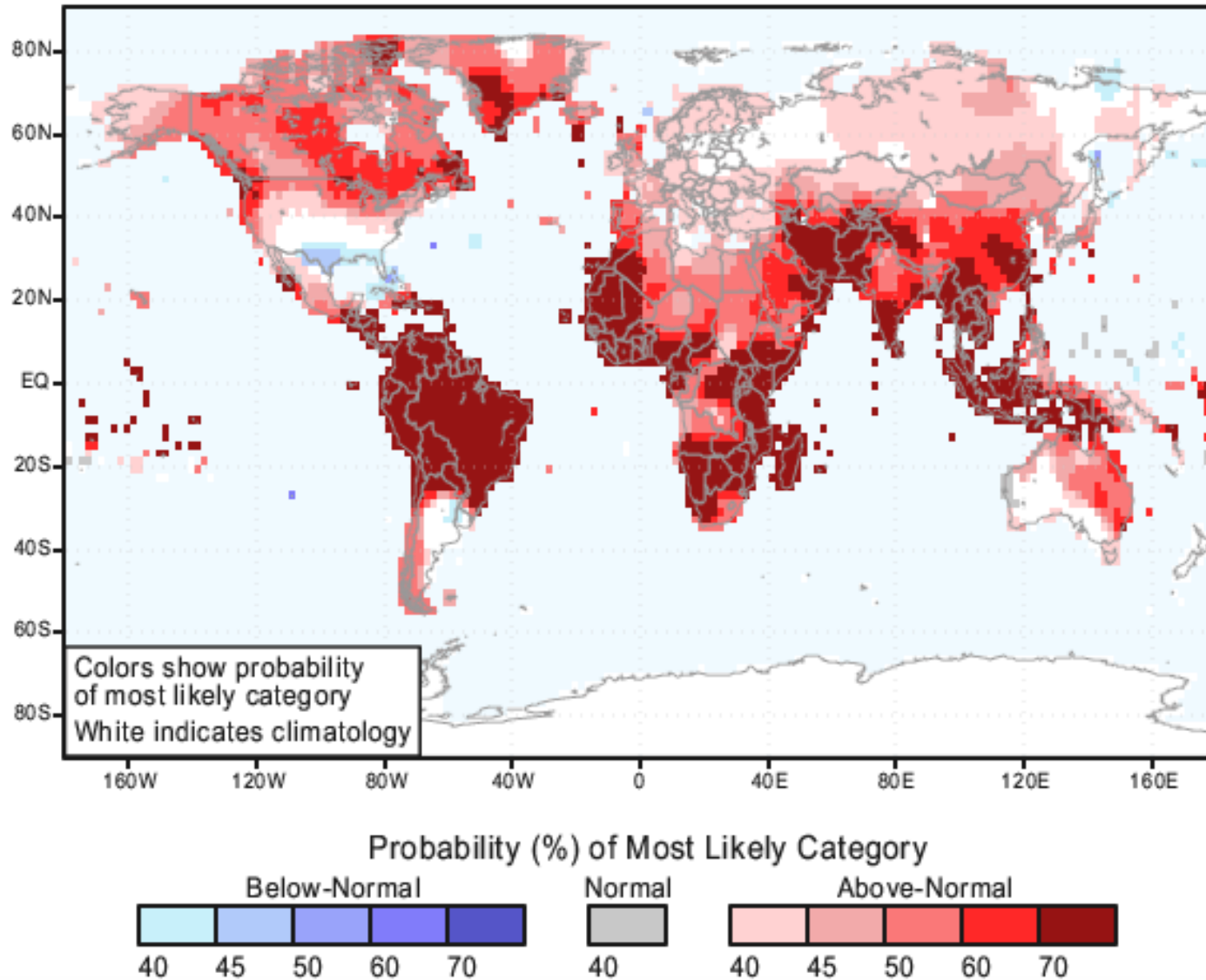
Precipitation Forecast for JFM 2016

IRI Multi-Model Probability Forecast for Precipitation
for January-February-March 2016, Issued December 2015

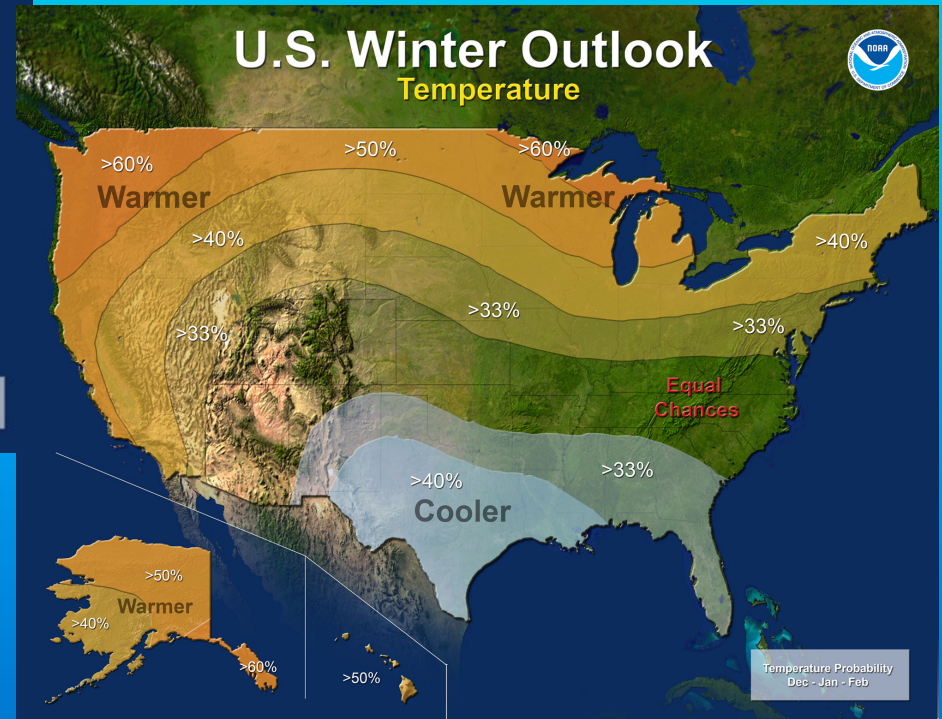
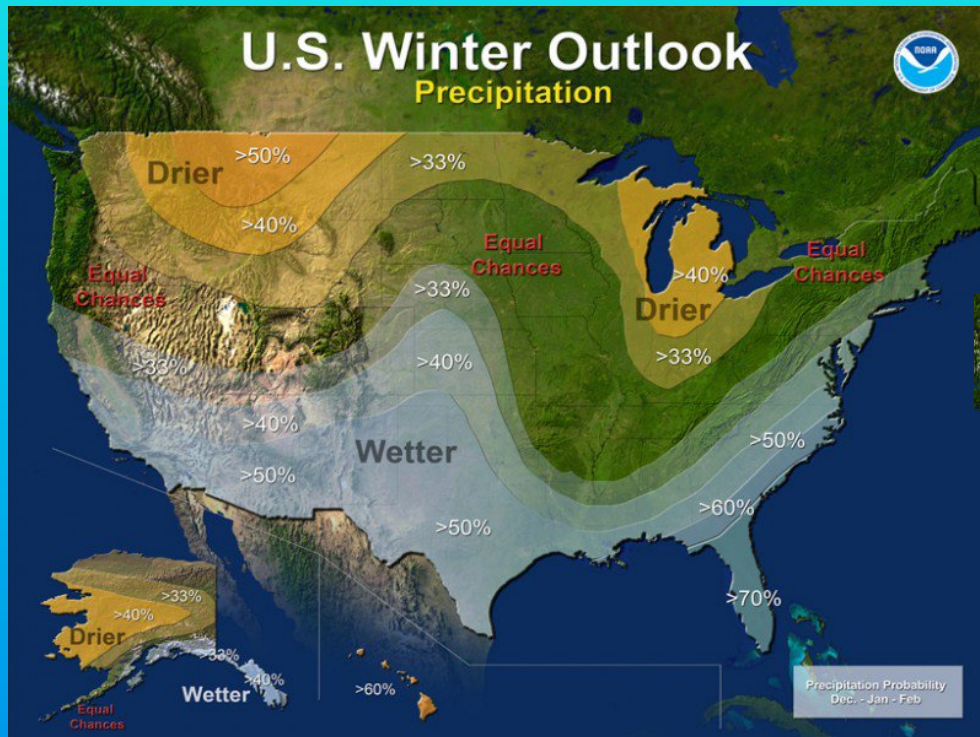


Temperature Forecast for JFM 2016

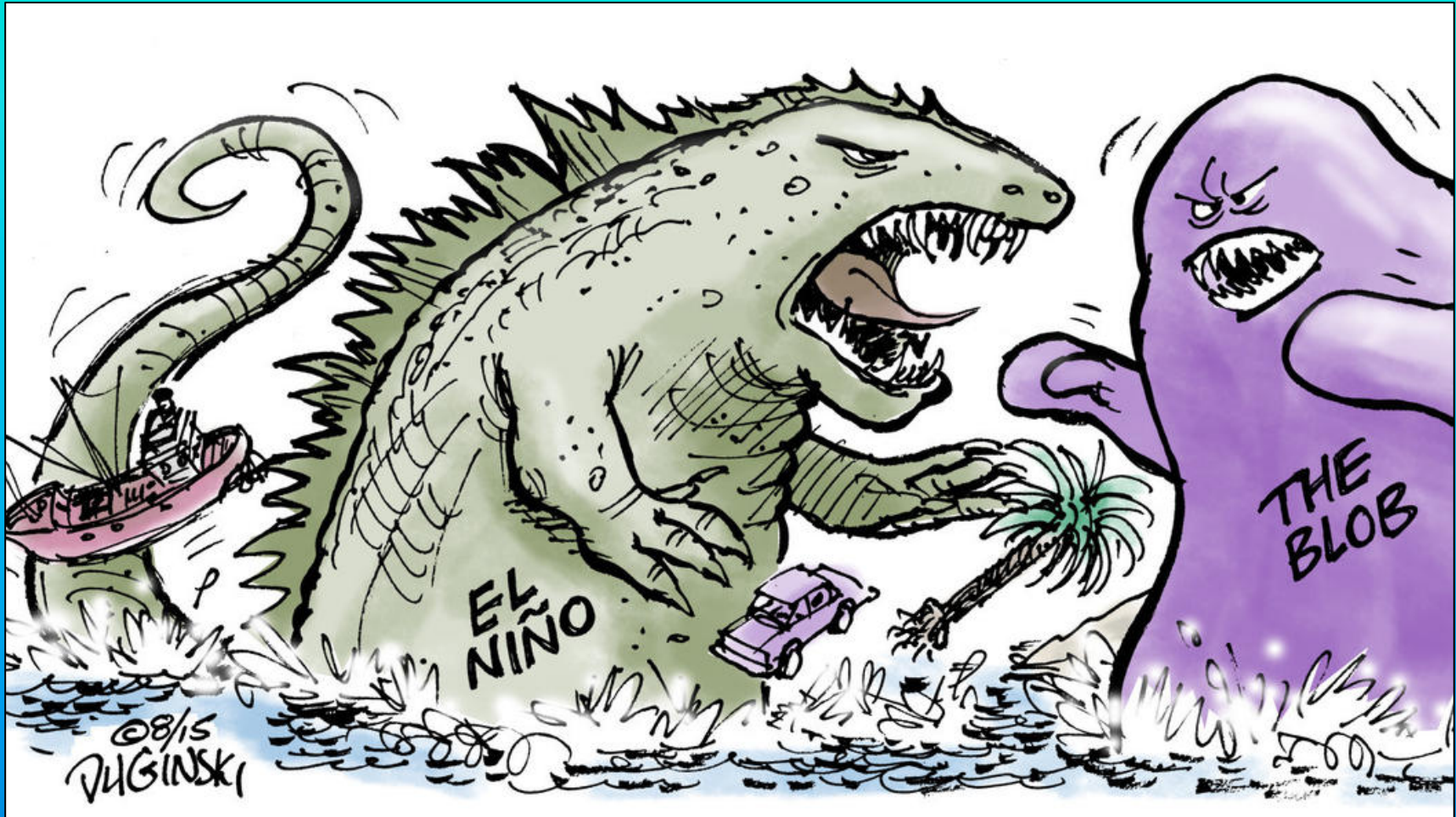
IRI Multi-Model Probability Forecast for Temperature
for January-February-March 2016, Issued December 2015



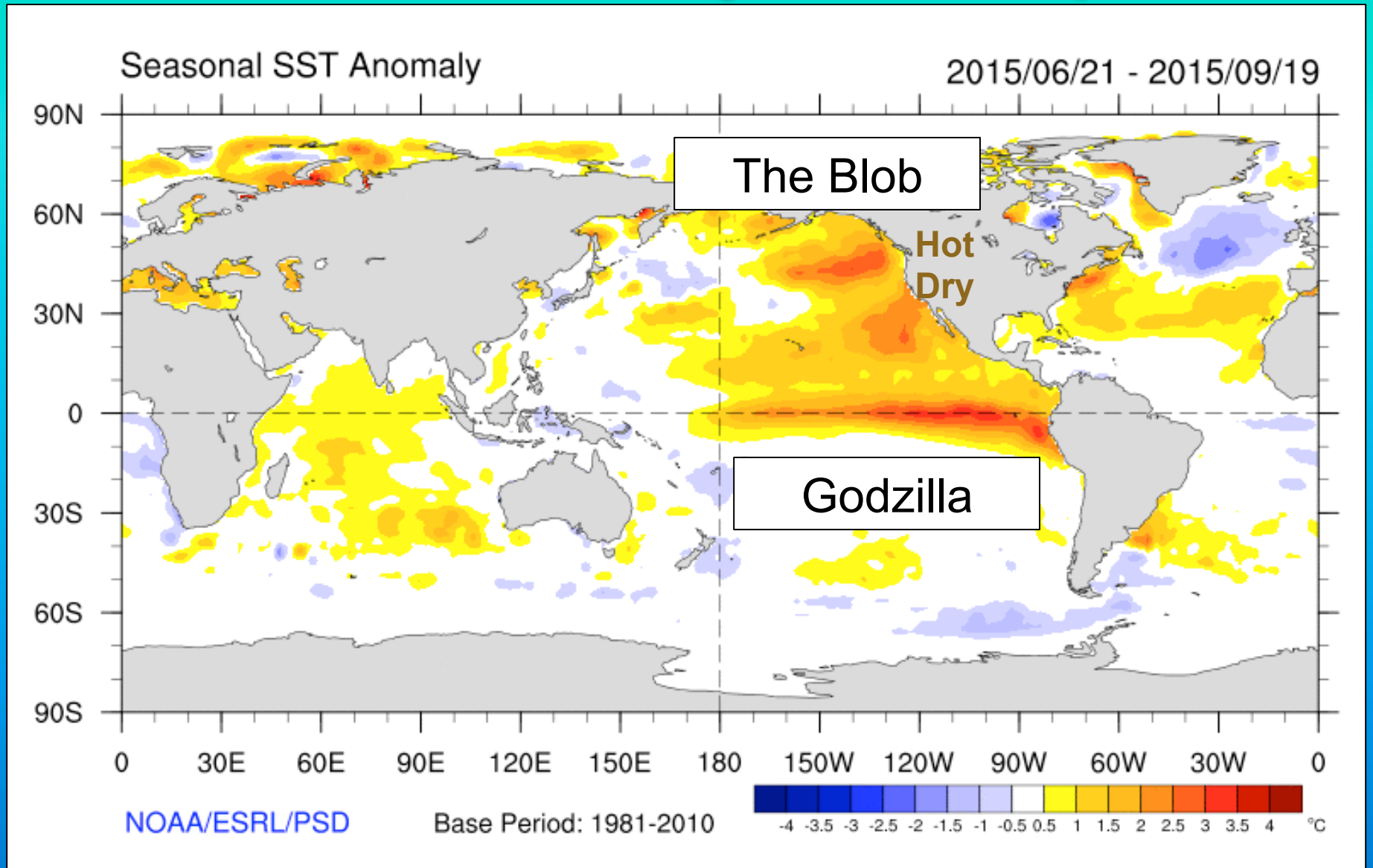
Winter Forecast United States



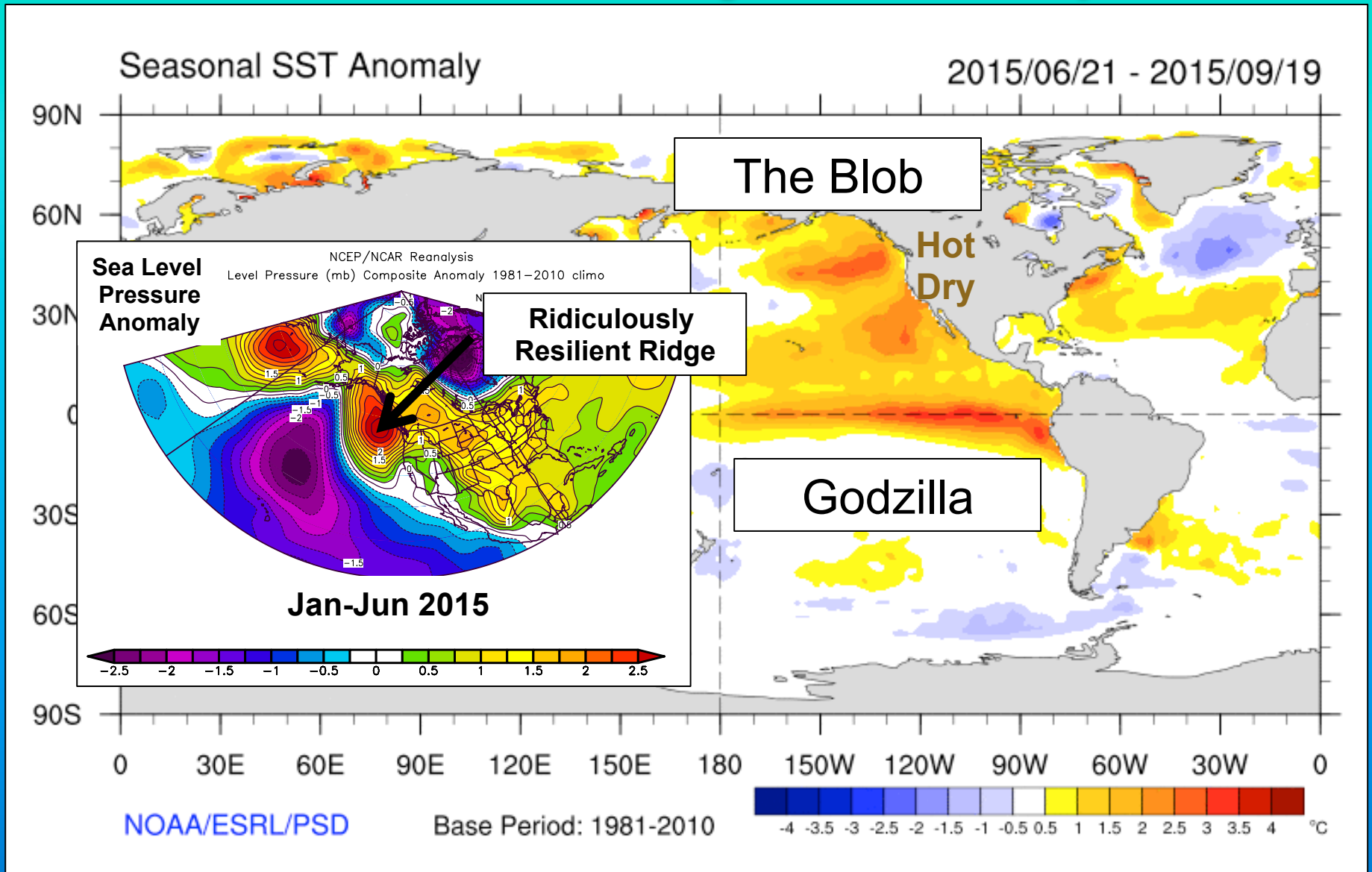
Godzilla vs The Blob



Global SST Anomaly, June-Sept 2015

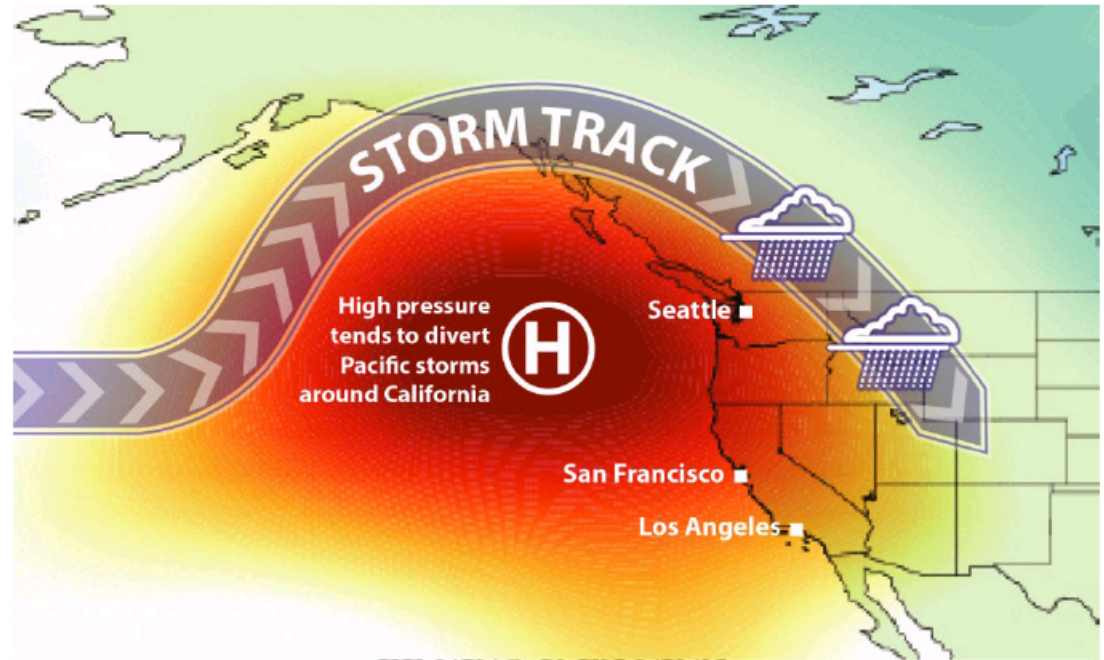


Global SST Anomaly, June-Sept 2015

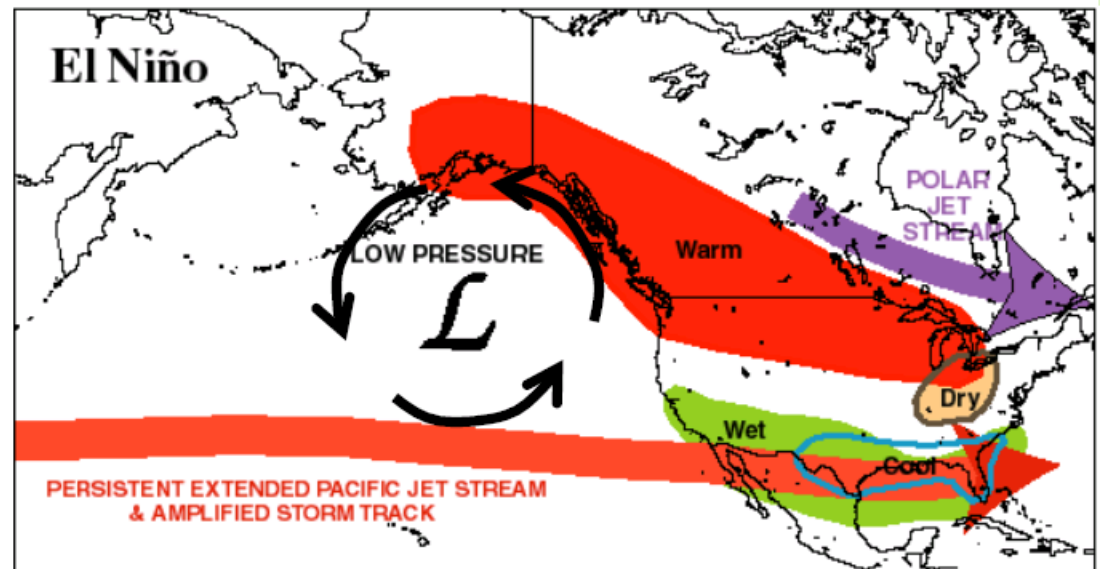


Atmospheric Forcing

The *Ridiculously Resilient Ridge*: the proximate cause for California's extended drought and the "Blob" of exceptionally warm ocean temperatures in the NE Pacific (2013-15)

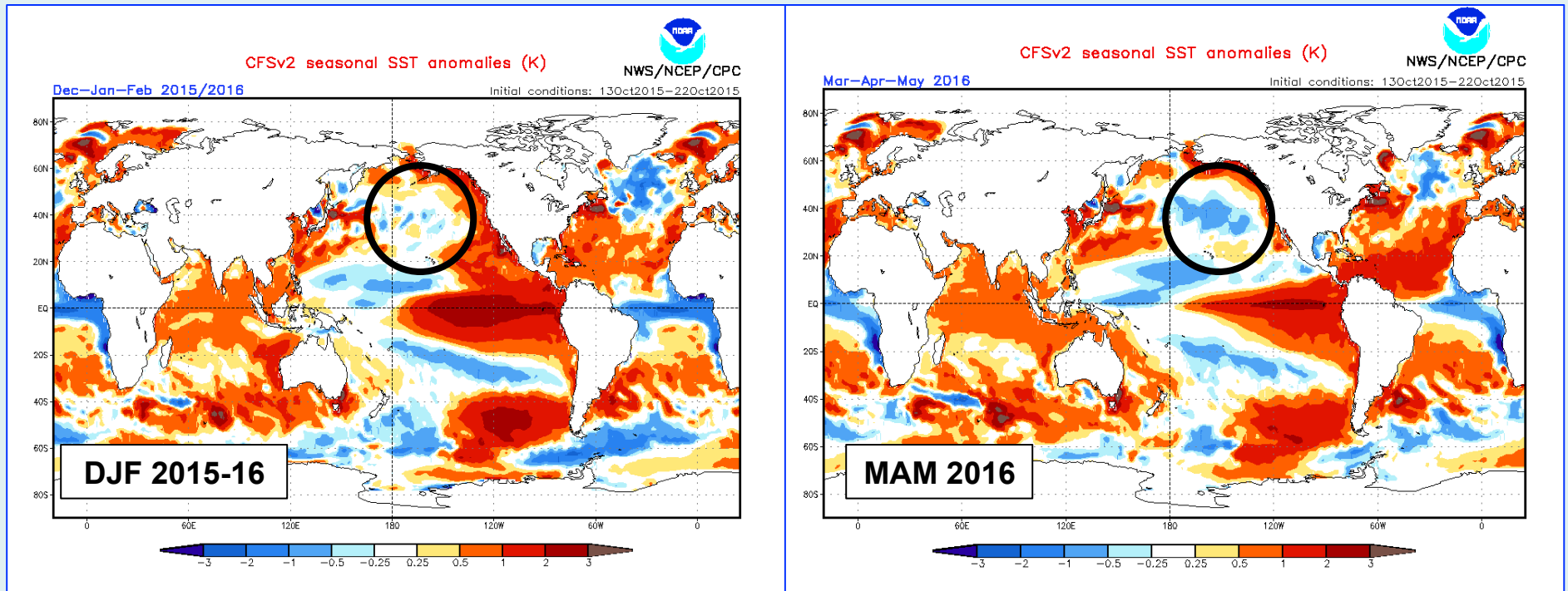


The typical El Niño winter pattern, featuring persistent and intense low pressure over the Gulf of Alaska and a very active jet stream and storm track just north of Hawaii extending over the southern US and northern Mexico.



NOAA SST Forecasts

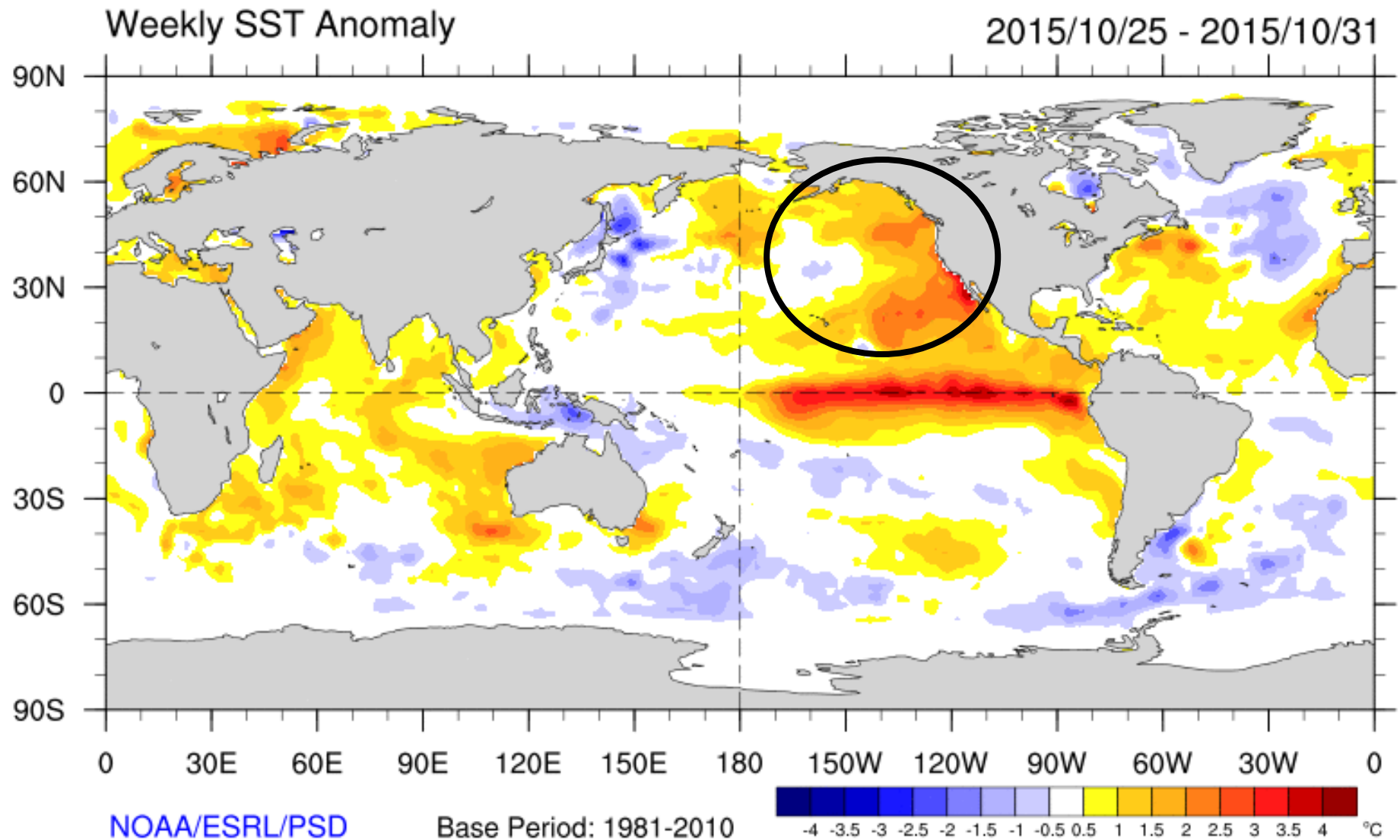
13-22 Oct 2015 Initial Conditions



Coupled ocean-atmosphere model forecasts for global SSTs in late 2015-early 2016 highlight expectations for the strong El Niño to continue and for El Niño teleconnections to wipe out the Blob

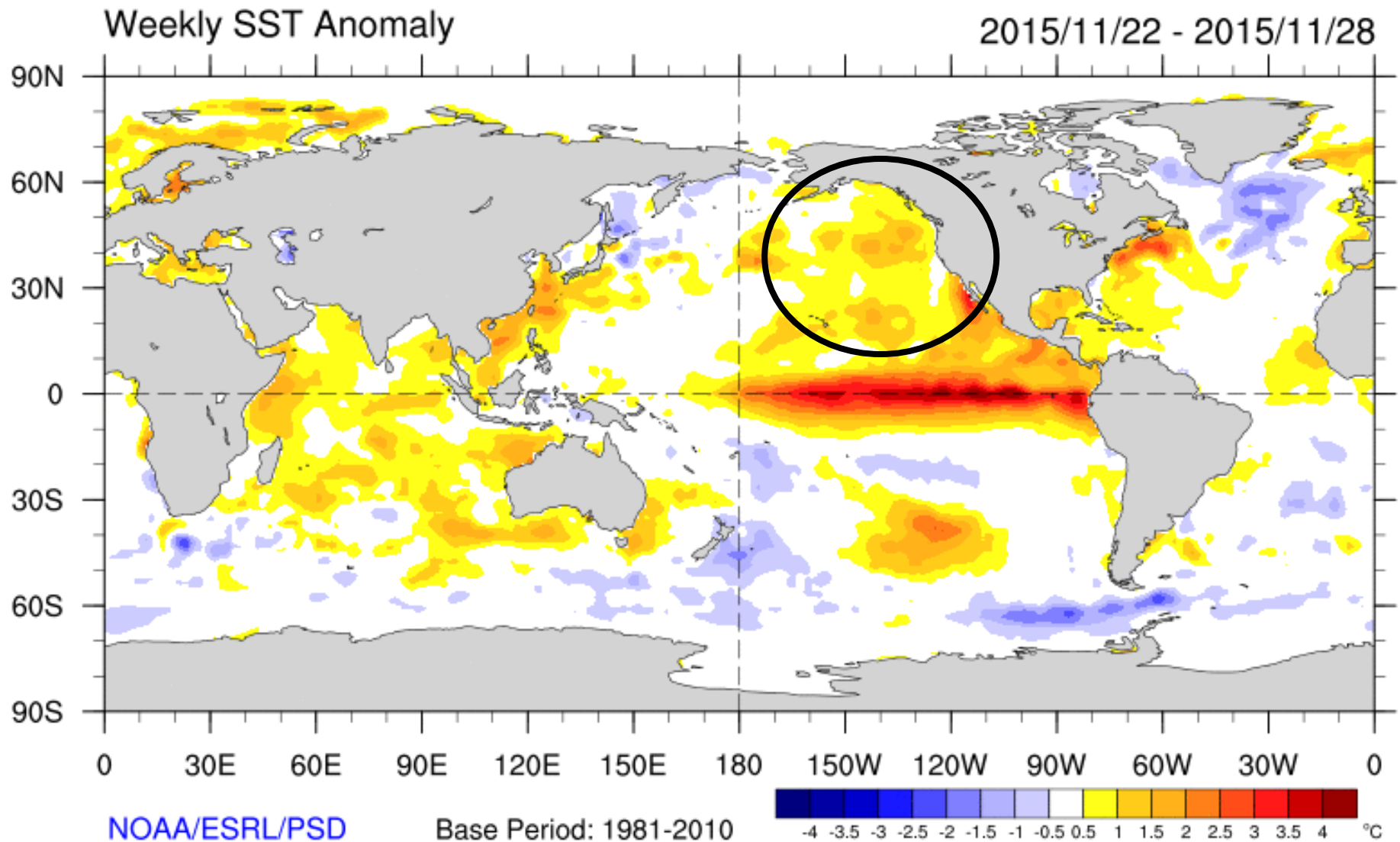
Global SST Anomaly

Oct 2015 to Jan 2016



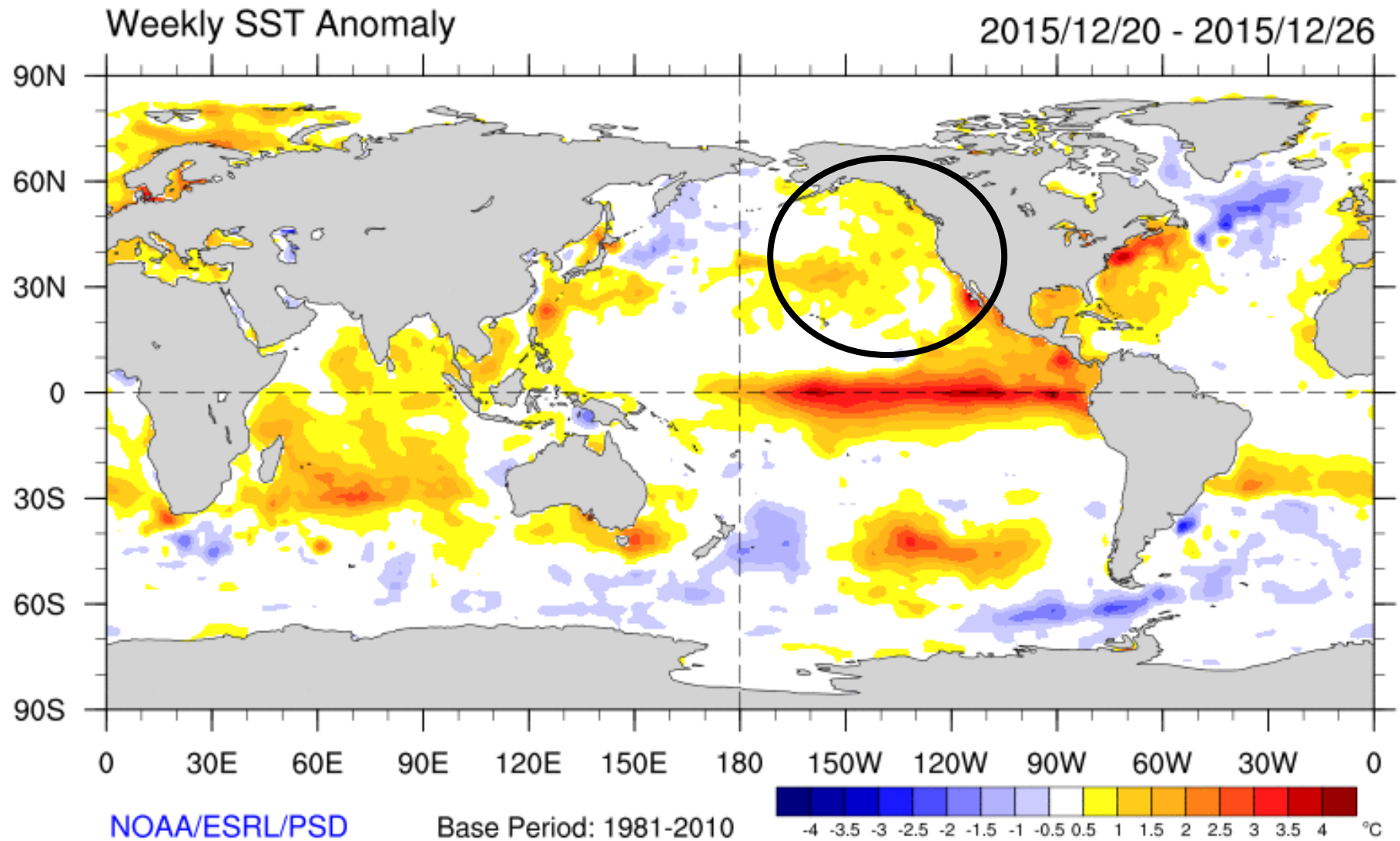
Global SST Anomaly

Oct 2015 to Jan 2016



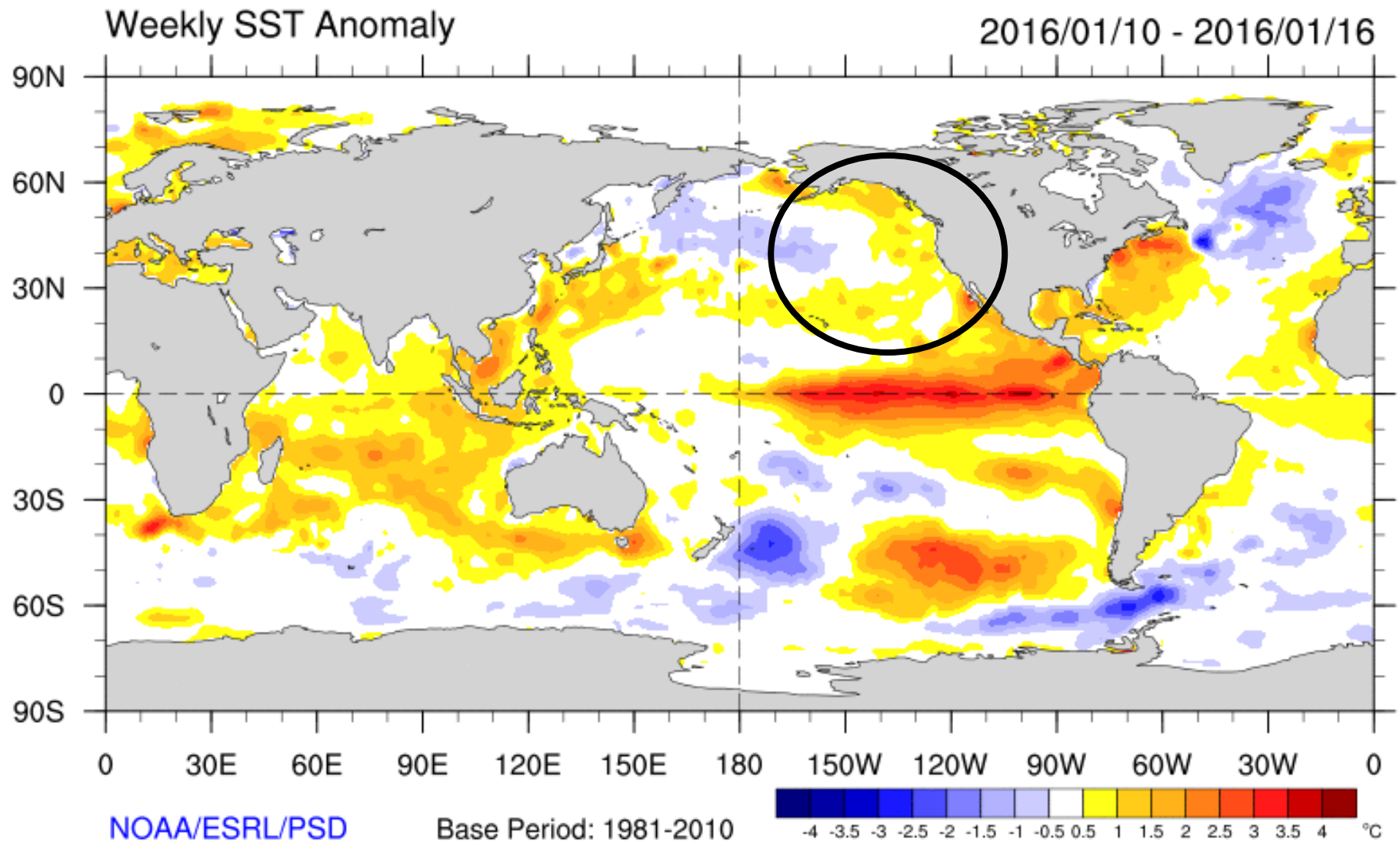
Global SST Anomaly

Oct 2015 to Jan 2016



Global SST Anomaly

Oct 2015 to Jan 2016



Summary

The 2015-16
El Niño will
rank among the
strongest on
record

It has already
had major
climatic impacts
around the world
and more are
coming

It appears to be
overwhelming
The Blob

It will probably
fade away by the
end of spring
and possibly
transition to La
Niña.

