ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
1 February 2016

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Summary

Recent Evolution and Current Conditions

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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.

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

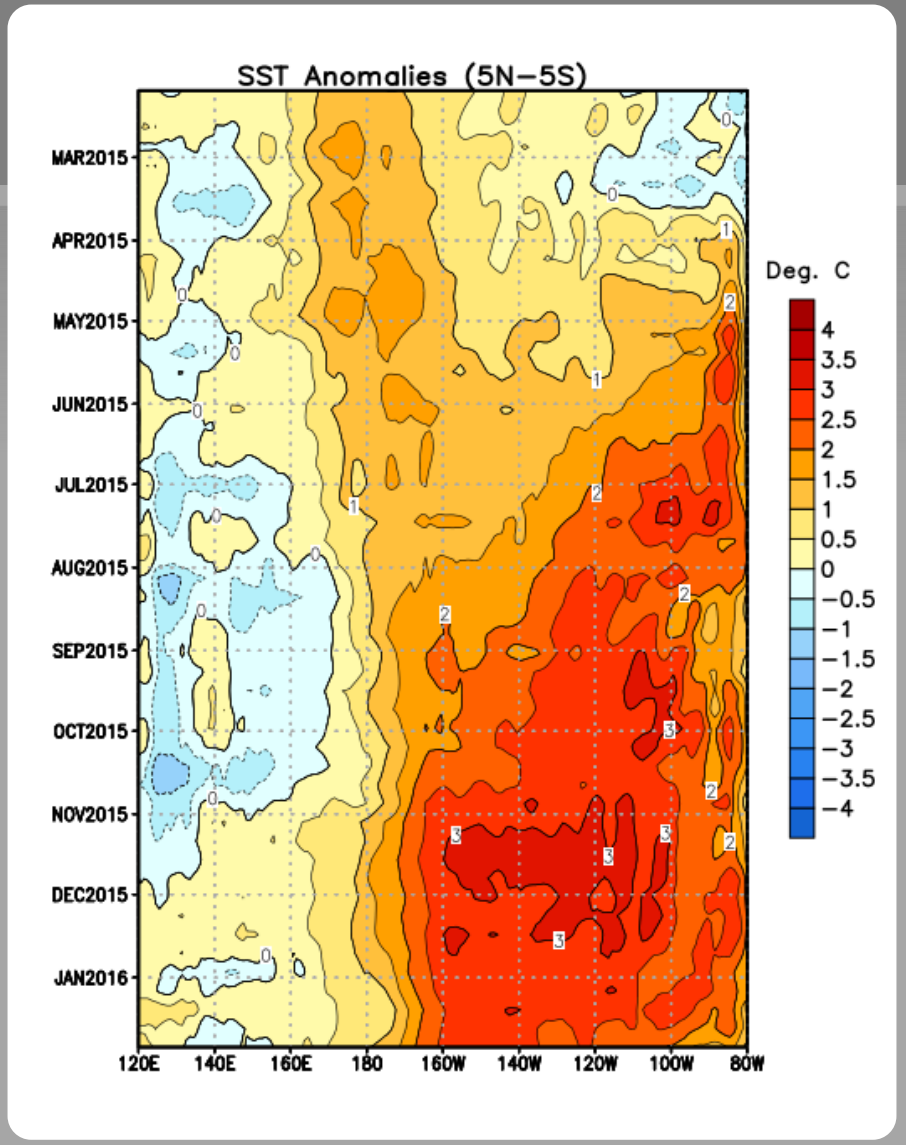
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (ºC)

During January through mid-March 2015, near-to-below average SSTs were observed in the eastern Pacific, and positive SST anomalies persisted across the western and central Pacific.

From June through September, the largest positive SST anomalies shifted westward.

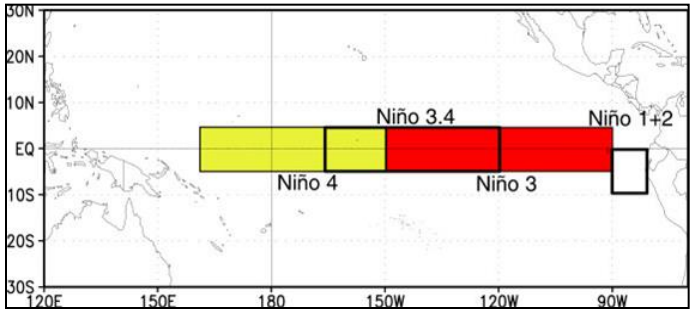
Generally, positive SST anomalies greater than 2°C remain between 170°W and 100°W.

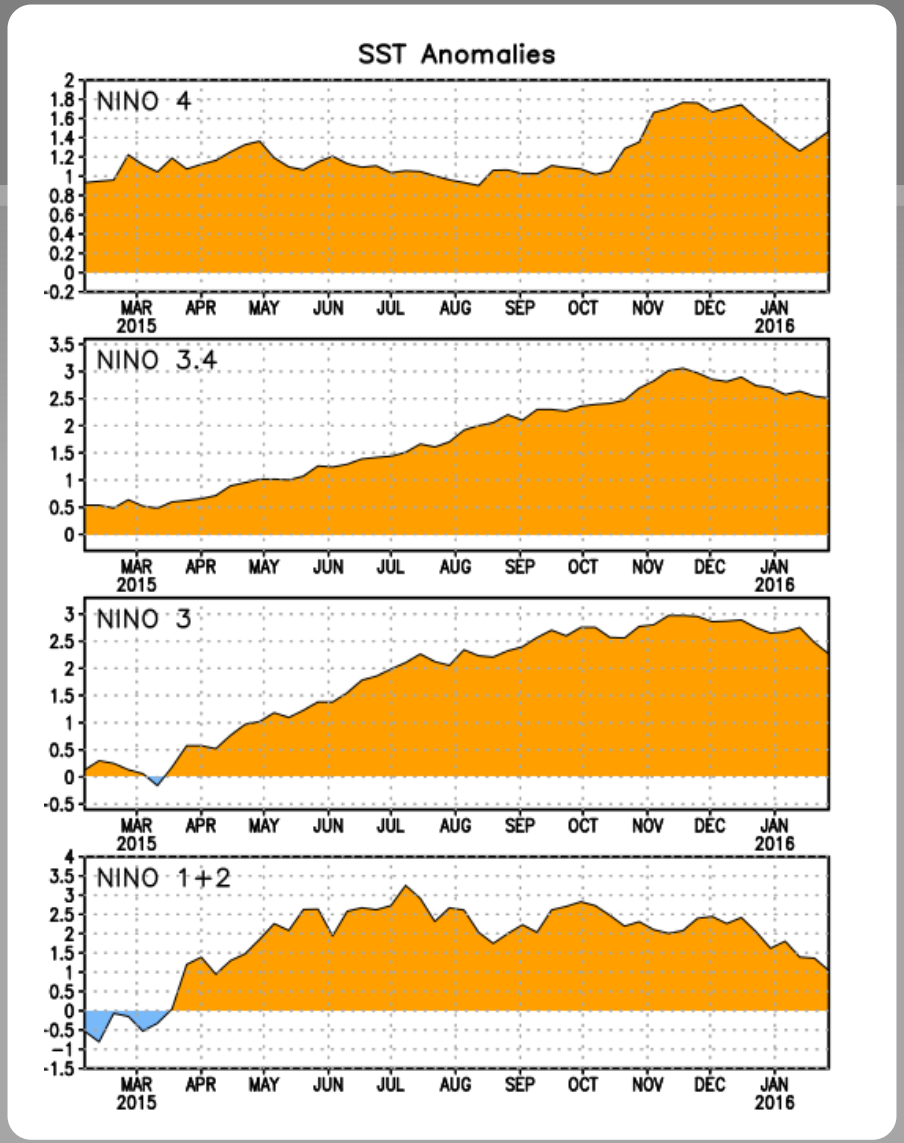


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

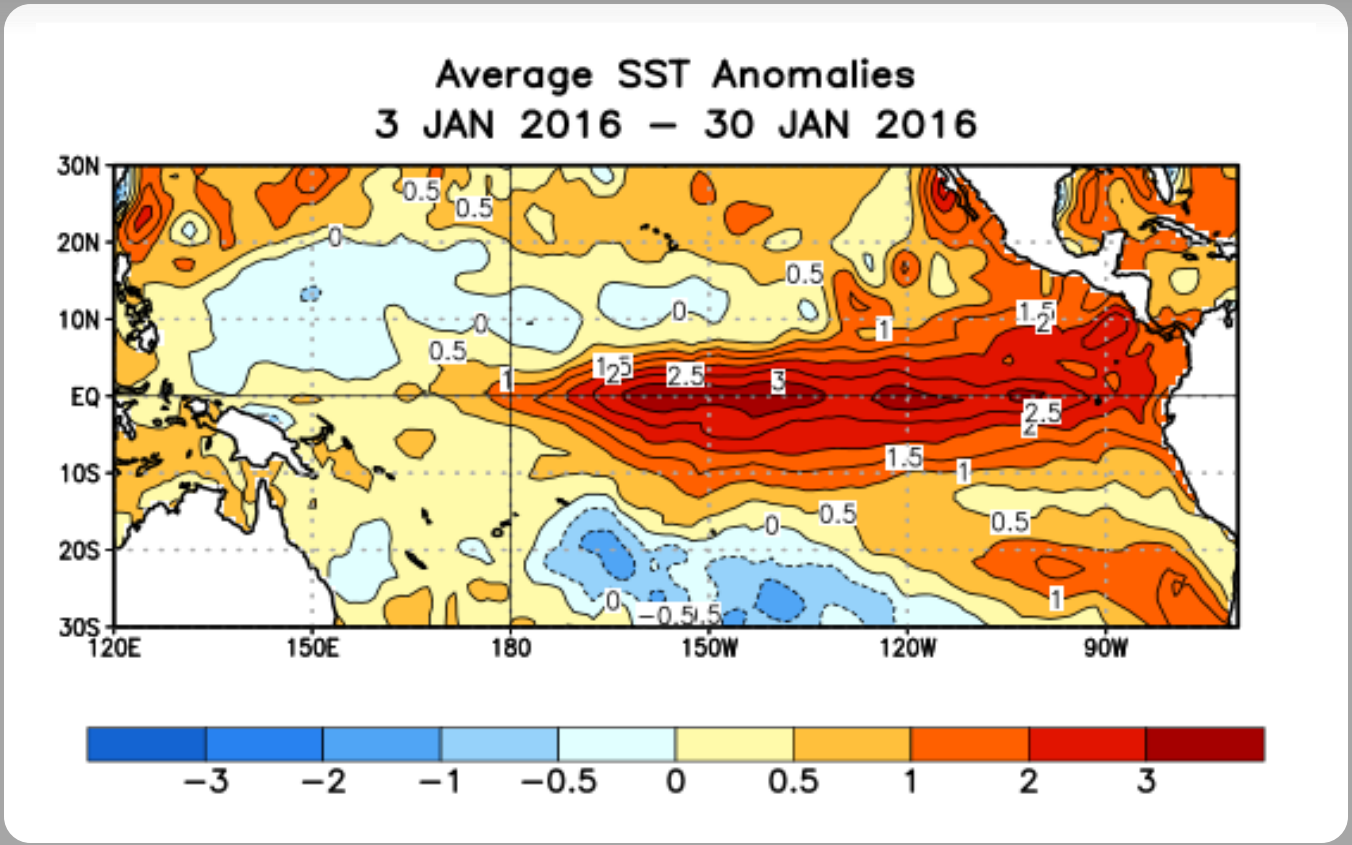
Niño 4	1.5ºC
Niño 3.4	2.5ºC
Niño 3	2.3ºC
Niño 1+2	1.0ºC





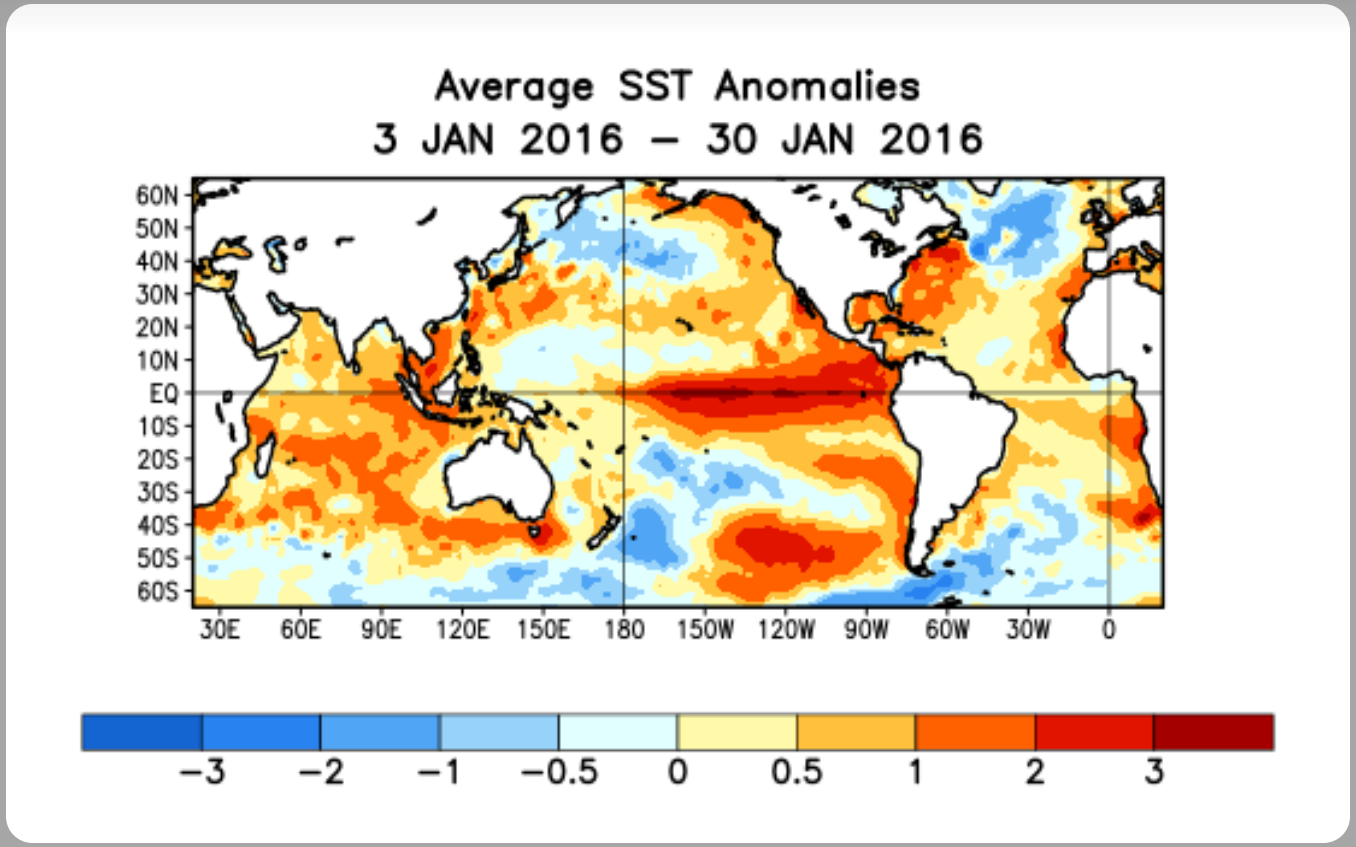
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, tropical SSTs were above average across most of the Pacific.



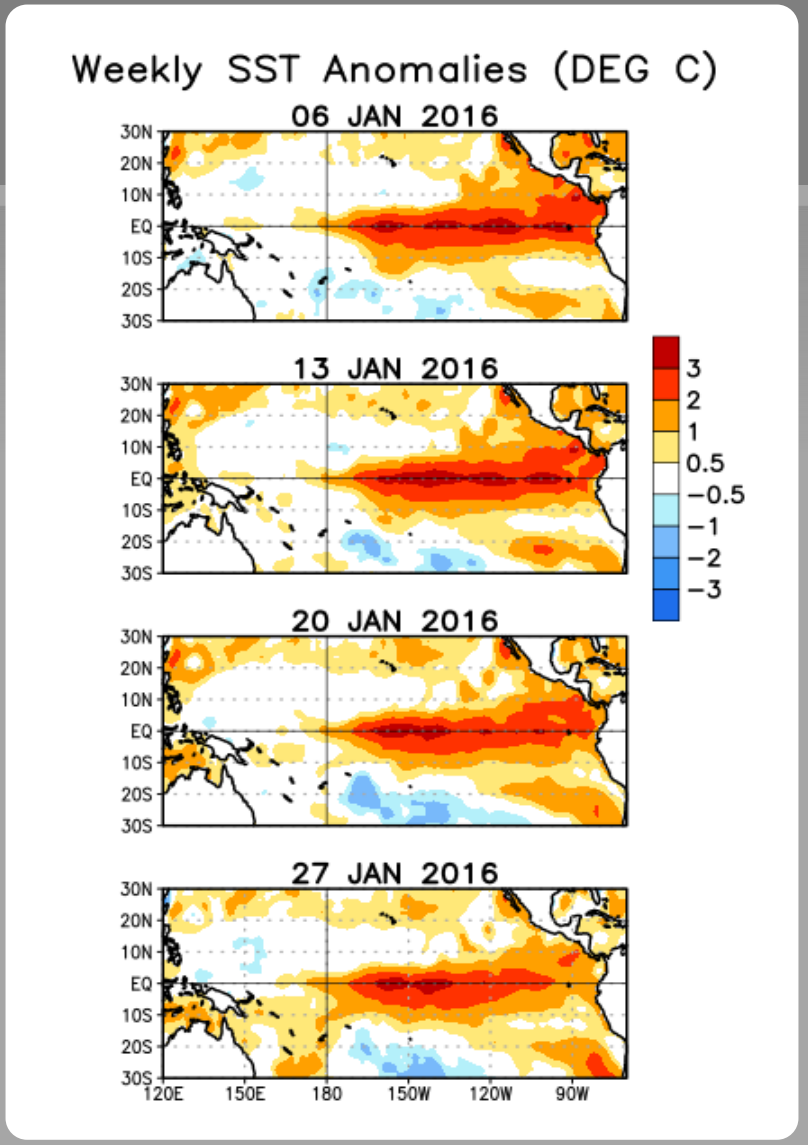
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, tropical SSTs were above average across the most of the Pacific and the Indian Ocean.



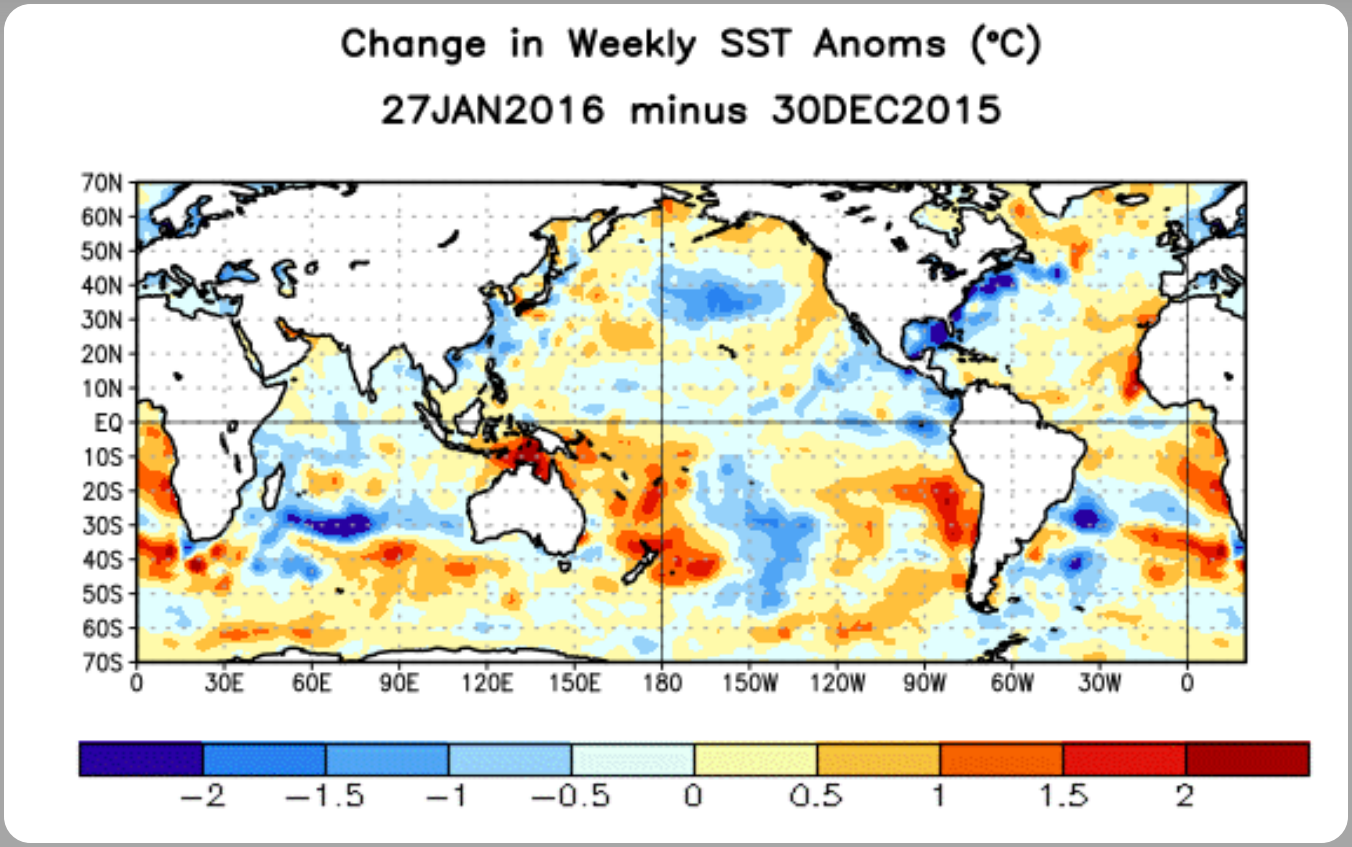
Weekly SST Departures during the Last Four Weeks

During the last four weeks, positive SST anomalies persisted across most of the equatorial Pacific, with diminishing strength near S. America.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, SST anomalies decreased in the eastern equatorial Pacific.



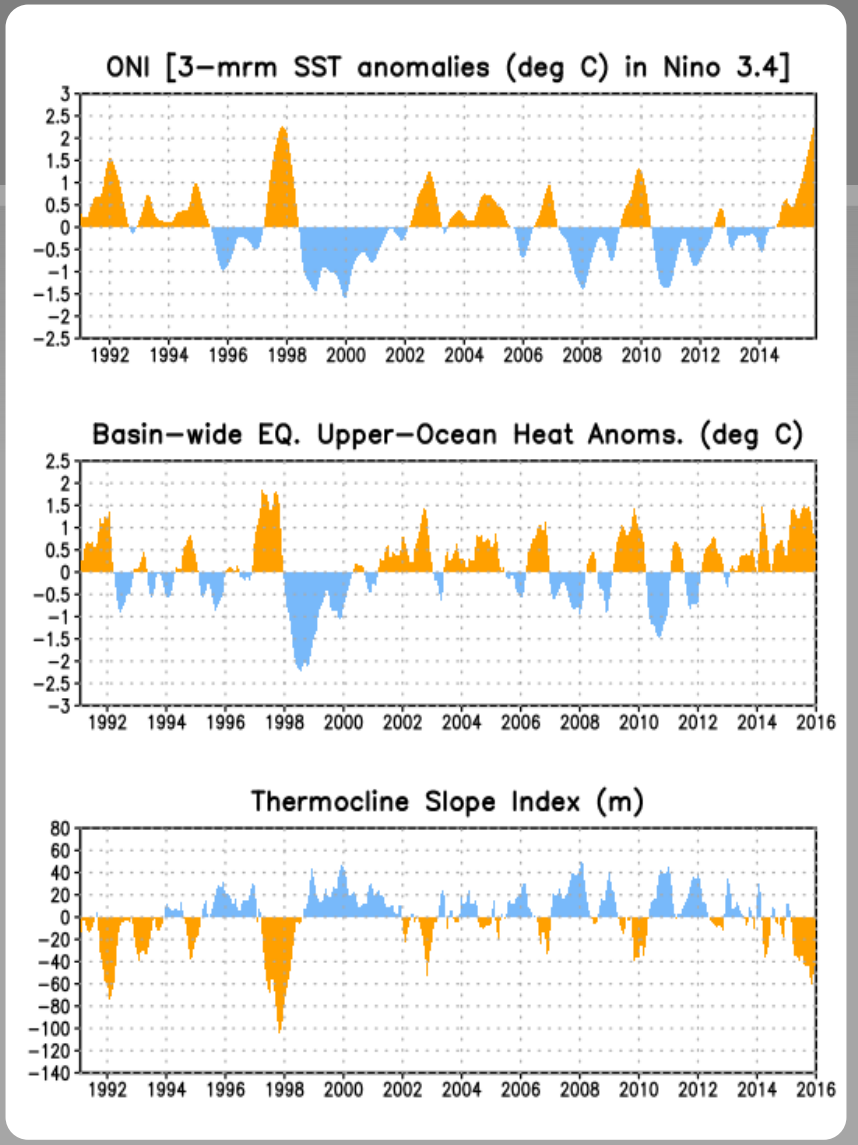
Upper-Ocean Conditions in the Equatorial Pacific

The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

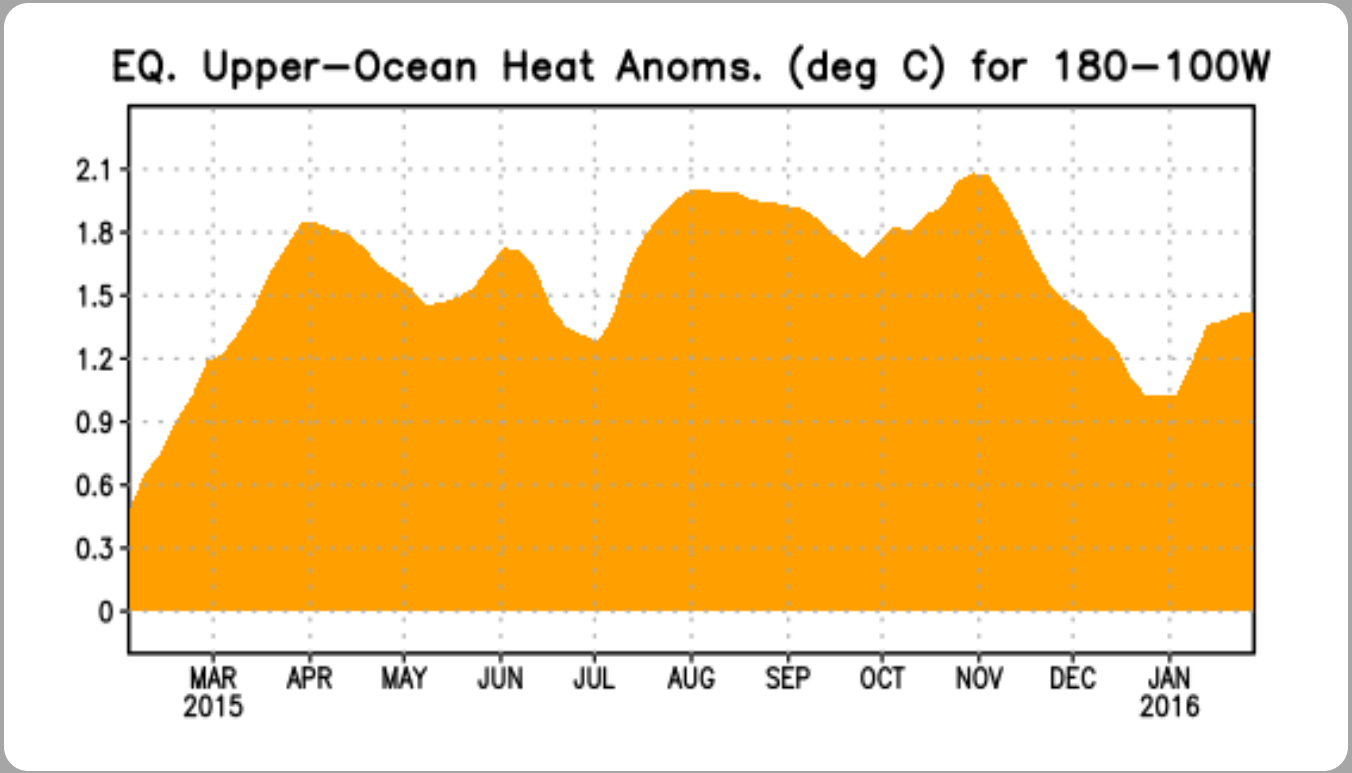
Recent values of the upper-ocean heat anomalies (positive) and thermocline slope index (negative) reflect El Niño.

The monthly thermocline slope index represents the difference in anomalous depth of the 20°C isotherm between the western Pacific (160°E-150°W) and the eastern Pacific (90°-140°W).



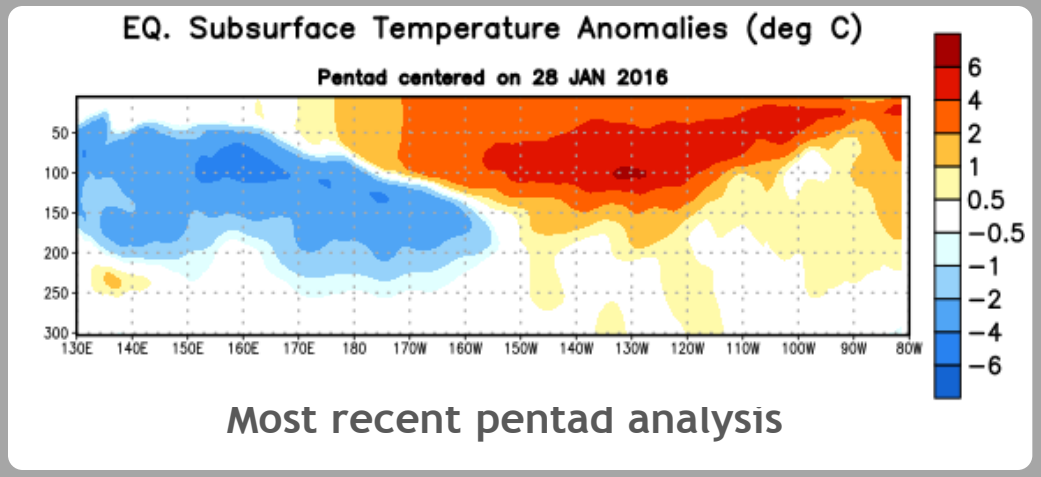
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

During January - March 2015, a significant sub-surface warming occurred across the eastern Pacific. During August through late September, positive anomalies decreased. Positive anomalies increased during October, decreased during November and December, and have recently increased again.



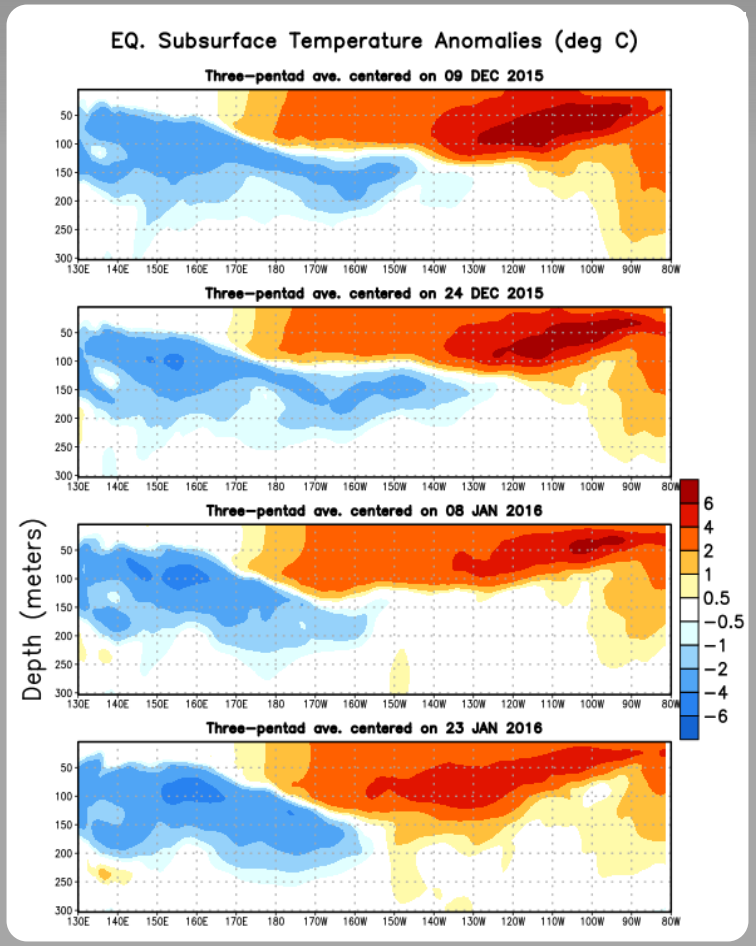
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive subsurface temperature anomalies were observed across the central and eastern equatorial Pacific.



Most recent pentad analysis

Negative anomalies in the western Pacific have retracted back to ~165°W and remain at depth.

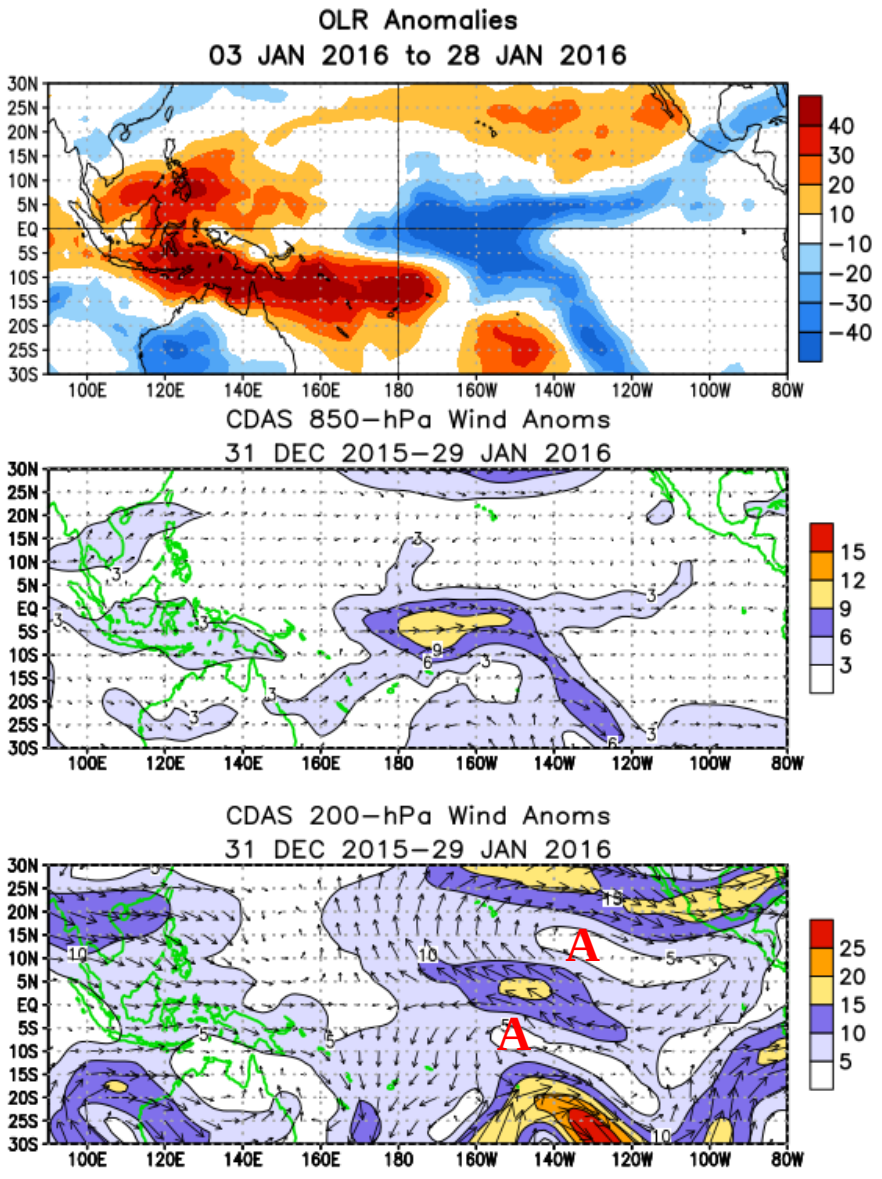


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident in the central and east-central Pacific. Positive OLR anomalies (suppressed convection and precipitation) were observed over Indonesia, Philippines, Papua New Guinea, and northern Australia.

Strong, anomalous low-level (850-hPa) westerly winds were evident near the Date Line.

Anomalous upper-level (200-hPa) easterlies were observed over most of the equatorial Pacific. Anomalous anti-cyclones straddled the equator.



Intraseasonal Variability

Intraseasonal variability in the atmosphere (wind and pressure), which is often related to the Madden-Julian Oscillation (MJO), can significantly impact surface and subsurface conditions across the Pacific Ocean.

Related to this activity:

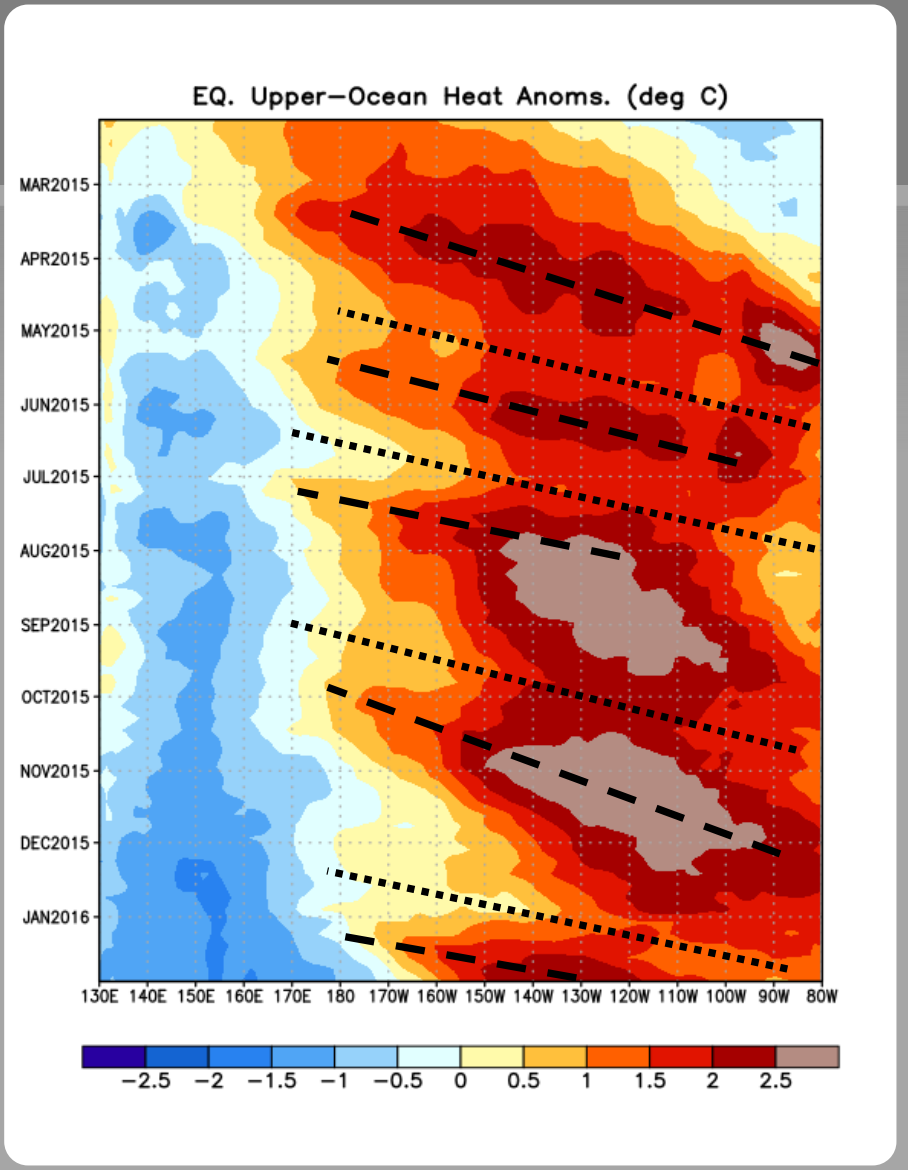
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

Downwelling phases of a Kelvin wave were observed in March-April, mid-May to late June, July-August, and October to November.

During August and September, positive subsurface temperature anomalies slowly shifted eastward.

Another downwelling phase of a Kelvin wave is evident more recently.

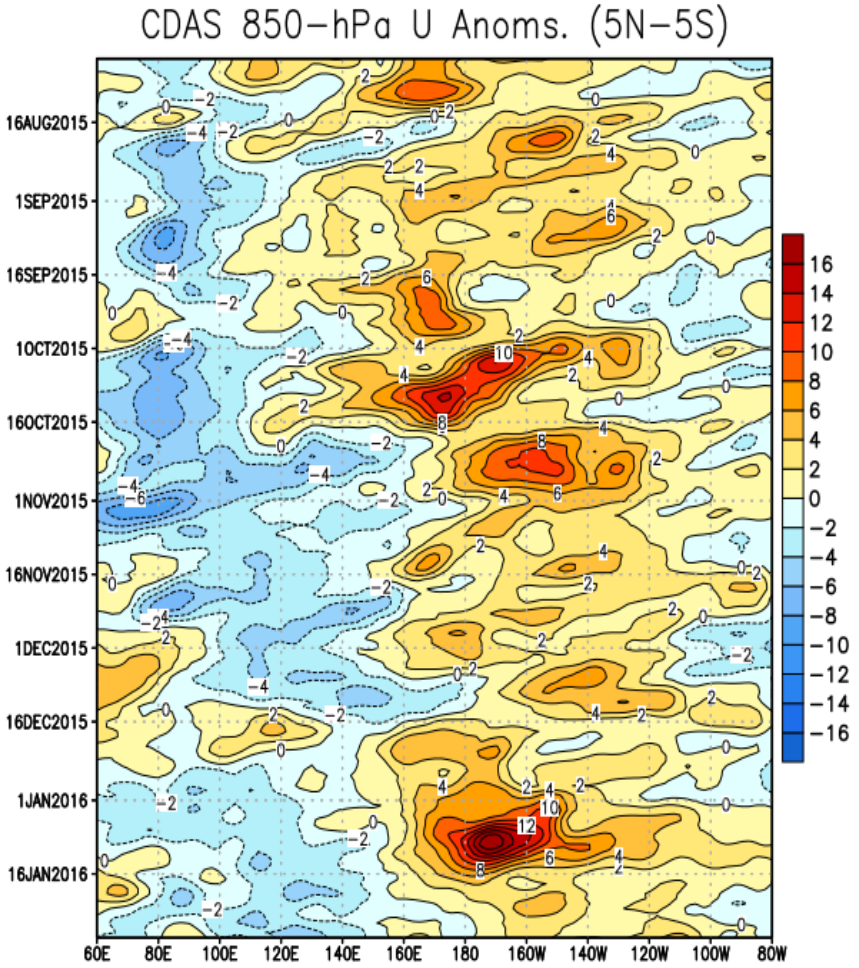


Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

During early August 2015, late September and early October 2015, and early January 2016 westerly wind bursts were observed between 140°E and 140°W.

Westerly wind anomalies continue to persist east of the Date Line.



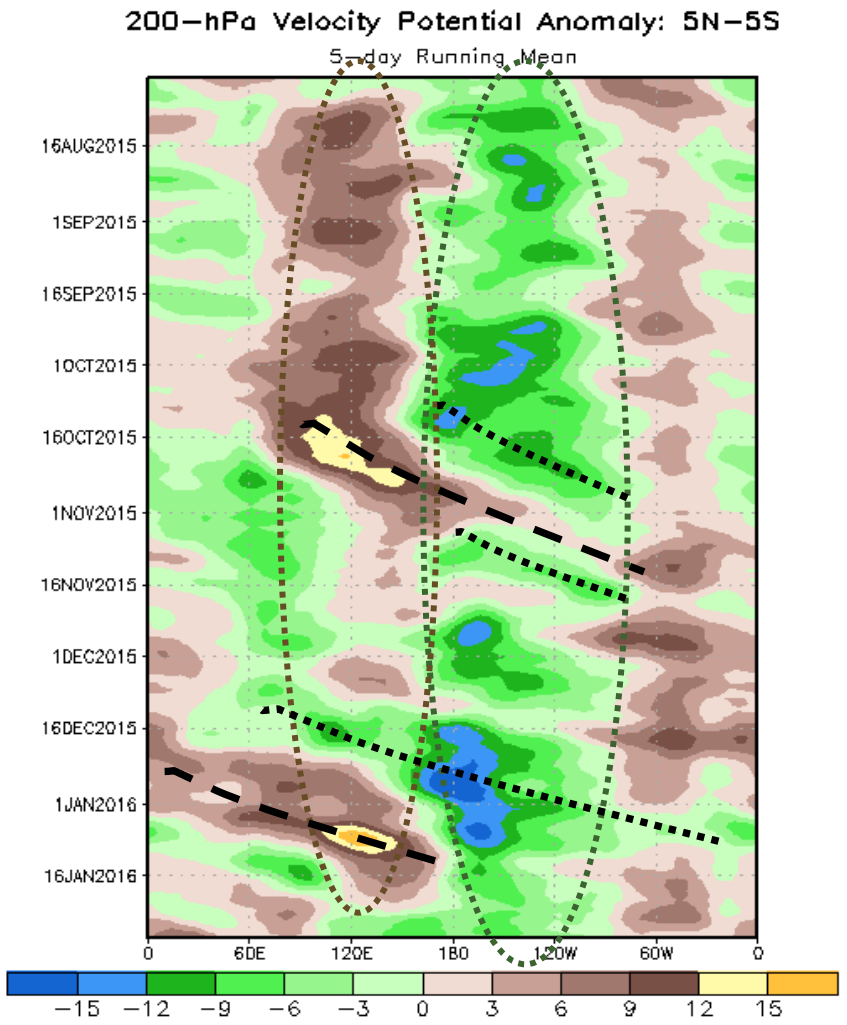
Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

Throughout the period, anomalous upper-level divergence (green shading) and convergence (brown shading) have generally persisted over the Central/Eastern Pacific and Indonesia, respectively.

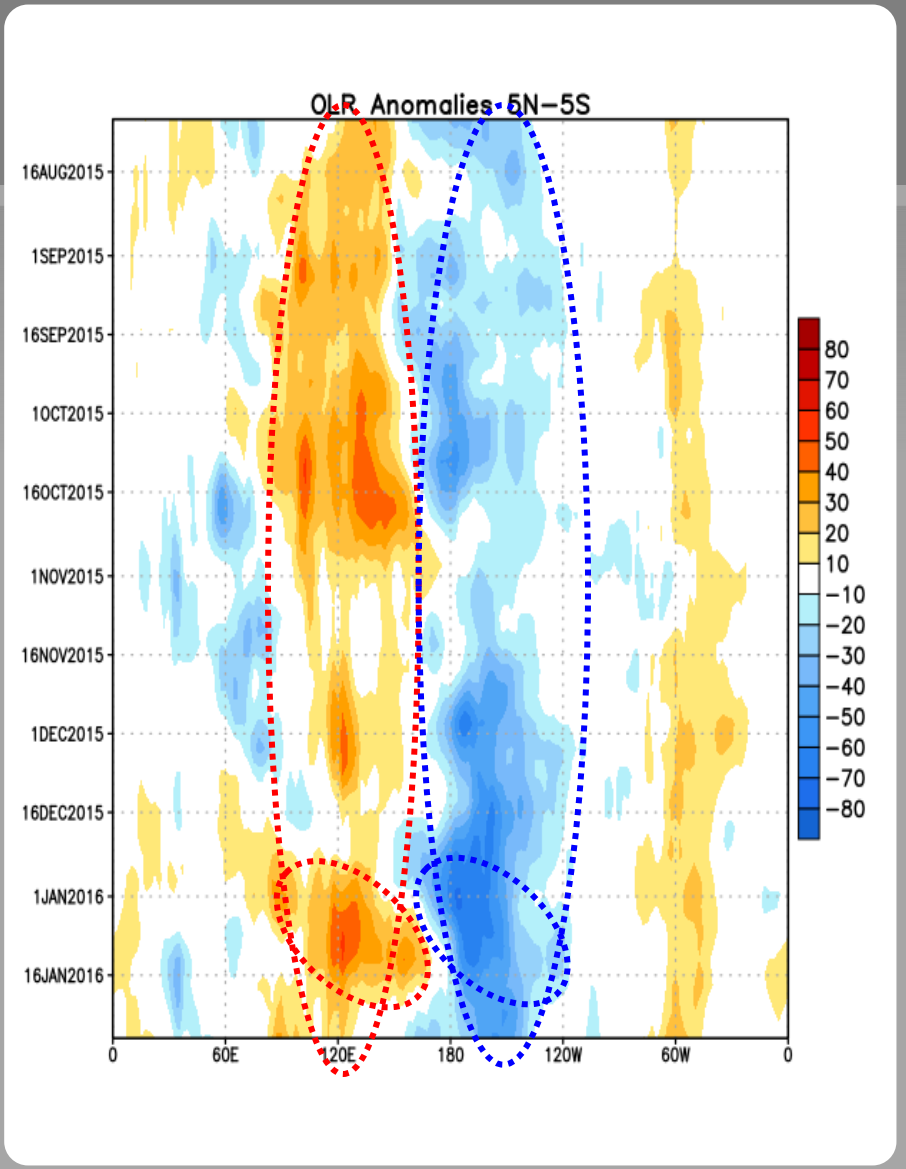
Sub-seasonal or Madden-Julian Oscillation (MJO) activity contributed to an eastward propagation of regions of upper-level divergence and convergence during late October-early November 2015 and more recently in December and January 2016.

Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)



Outgoing Longwave Radiation (OLR) Anomalies

Throughout the period negative anomalies have been observed over the central and/or eastern Pacific, and positive anomalies have persisted near Indonesia.



Drier-than-average Conditions (orange/red shading)
Wetter-than-average Conditions (blue shading)

Oceanic Niño Index (ONI)

The ONI is based on SST departures from average in the Niño 3.4 region, and is a principal measure for monitoring, assessing, and predicting ENSO.

Defined as the three-month running-mean SST departures in the Niño 3.4 region. Departures are based on a set of improved homogeneous historical SST analyses (Extended Reconstructed SST – ERSST.v4). The SST reconstruction methodology is described in Huang et al., 2015, J. Climate, vol. 28, 911-930.)

It is one index that helps to place current events into a historical perspective

NOAA Operational Definitions for El Niño and La Niña

El Niño: characterized by a positive ONI greater than or equal to +0.5°C.

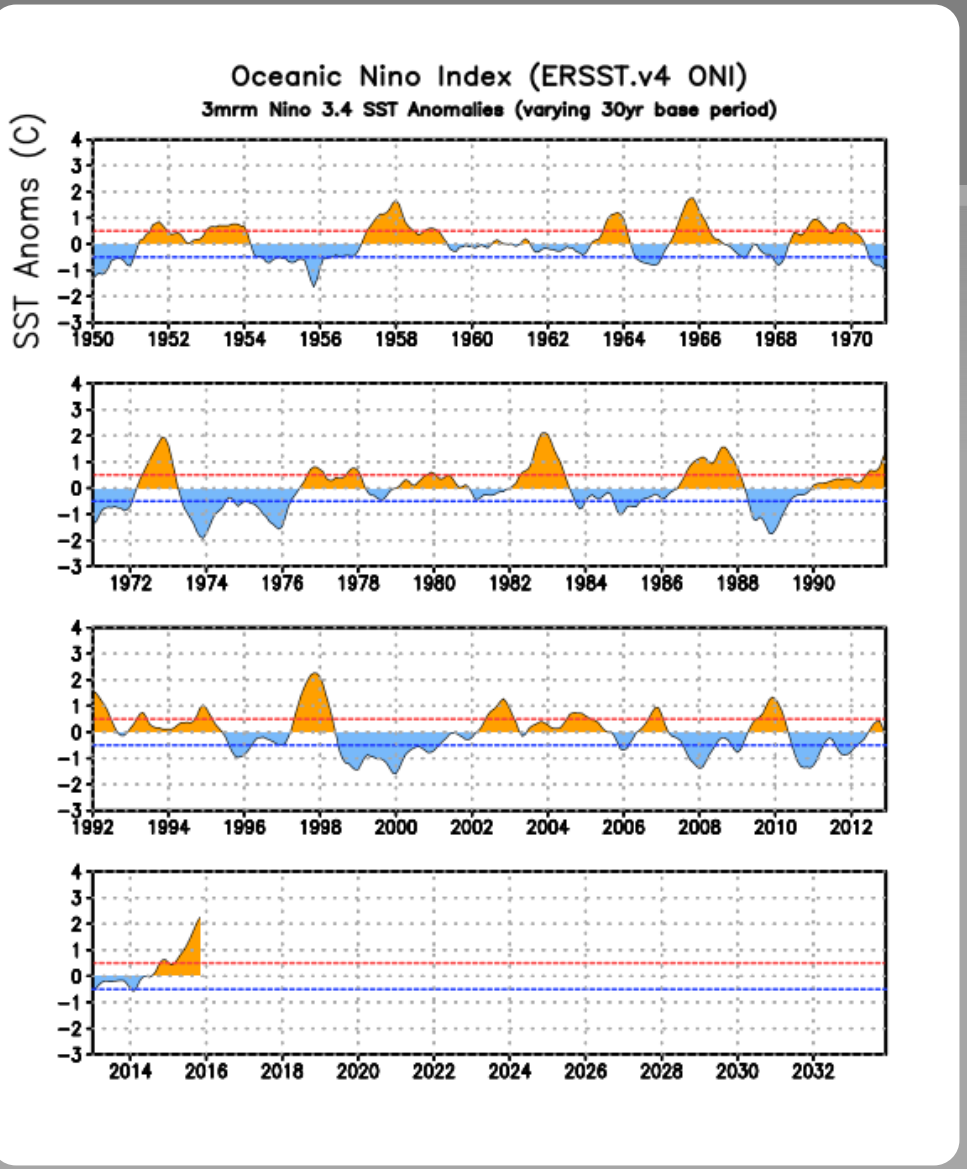
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed +/- 0.5°C along with consistent atmospheric features. These anomalies must also be forecasted to persist for 3 consecutive months.

ONI (°C): Evolution since 1950

The most recent ONI value (October- December 2015) is 2.3°C.



Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v4

Recent Pacific warm (red) and cold (blue) periods based on a threshold of +/- 0.5 °C for the Oceanic Nino Index (ONI) [3 month running mean of ERSST.v4 SST anomalies in the Nino 3.4 region (5N-5S, 120-170W)]. For historical purposes, periods of below and above normal SSTs are colored in blue and red when the threshold is met for a minimum of 5 consecutive over-lapping seasons.

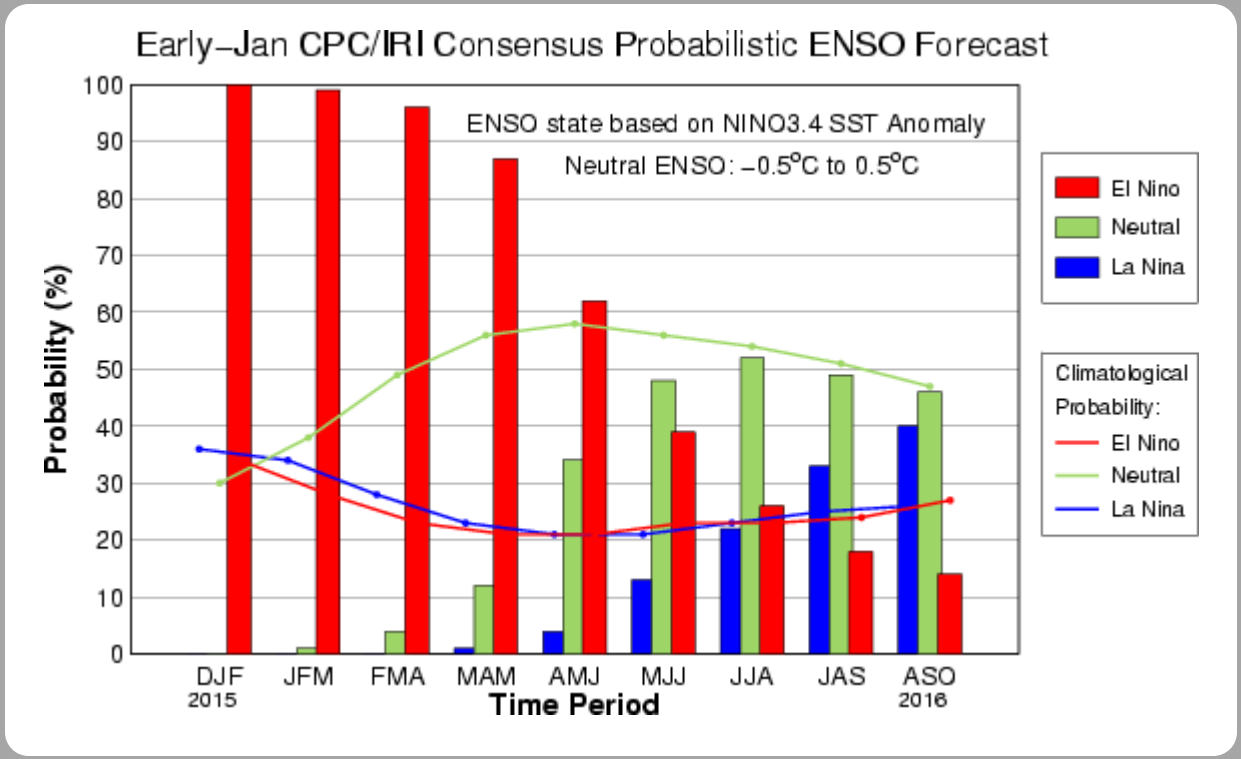
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2003	0.9	0.6	0.4	0.0	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	0.4
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.1	0.2	0.3	0.5	0.8	0.9	1.0
2007	0.7	0.3	0.0	-0.1	-0.2	-0.2	-0.3	-0.6	-0.8	-1.1	-1.2	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.3	-0.2	-0.2	-0.3	-0.5	-0.7
2009	-0.8	-0.7	-0.4	-0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.3
2010	1.3	1.1	0.8	0.5	0.0	-0.4	-0.8	-1.1	-1.3	-1.4	-1.3	-1.4
2011	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.3	-0.5	-0.7	-0.9	-0.9	-0.8
2012	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.2
2013	-0.4	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
2014	-0.5	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6
2015	0.5	0.4	0.5	0.7	0.9	1.0	1.2	1.5	1.8	2.0	2.3	

CPC/IRI Probabilistic ENSO Outlook

Updated: 14 January 2016

The chance of El Niño gradually decreases into the spring and ENSO-neutral is favored by May-June-July (MJJ) 2016. The chance of La Niña increases to 40% in August-September-October (ASO) 2016.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Positive Niño 3.4 SST anomalies are predicted to weaken into the Northern Hemisphere Spring 2016.

Most models suggest a transition to ENSO-neutral by May-June-July (MJJ) 2016.

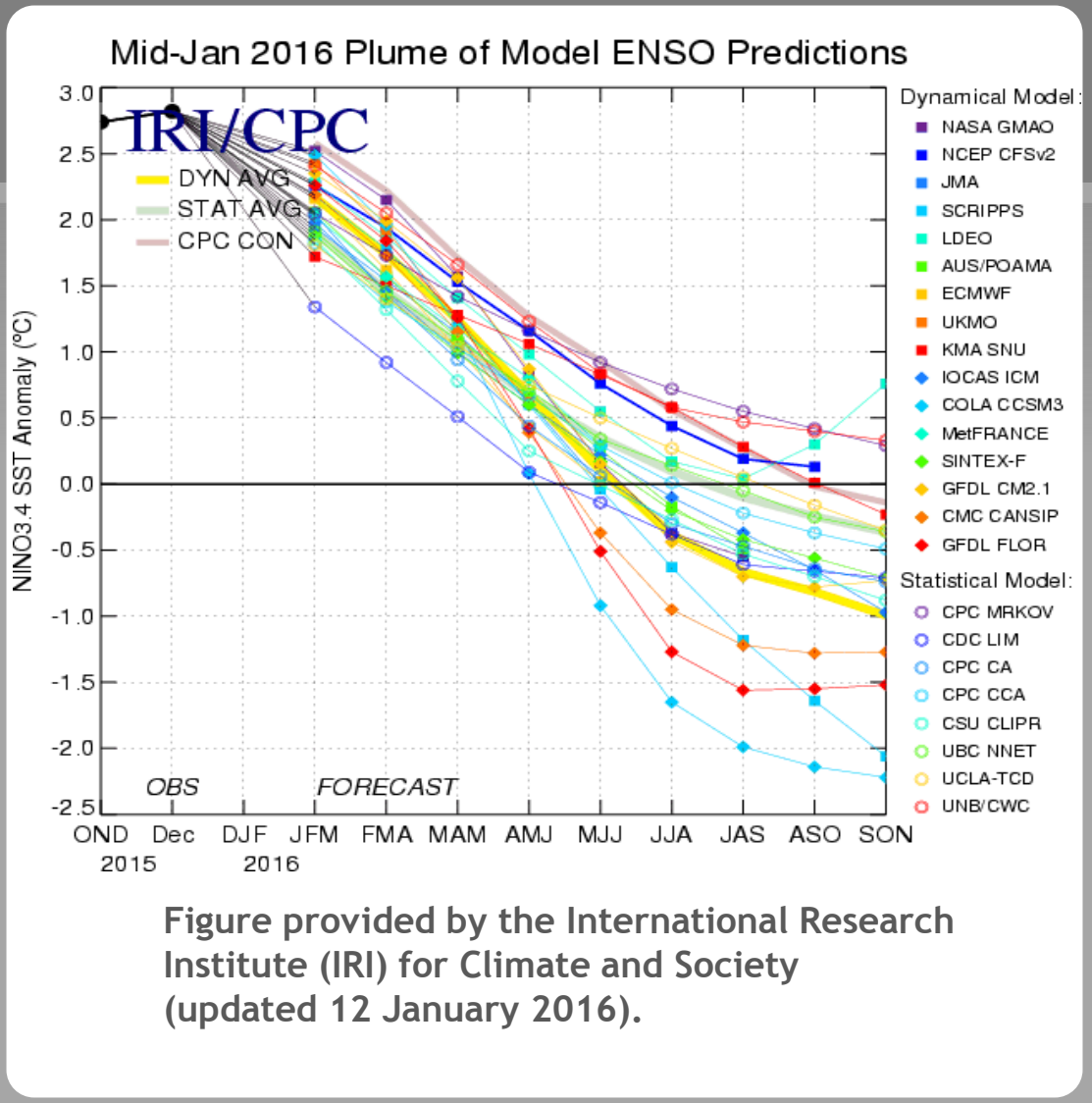
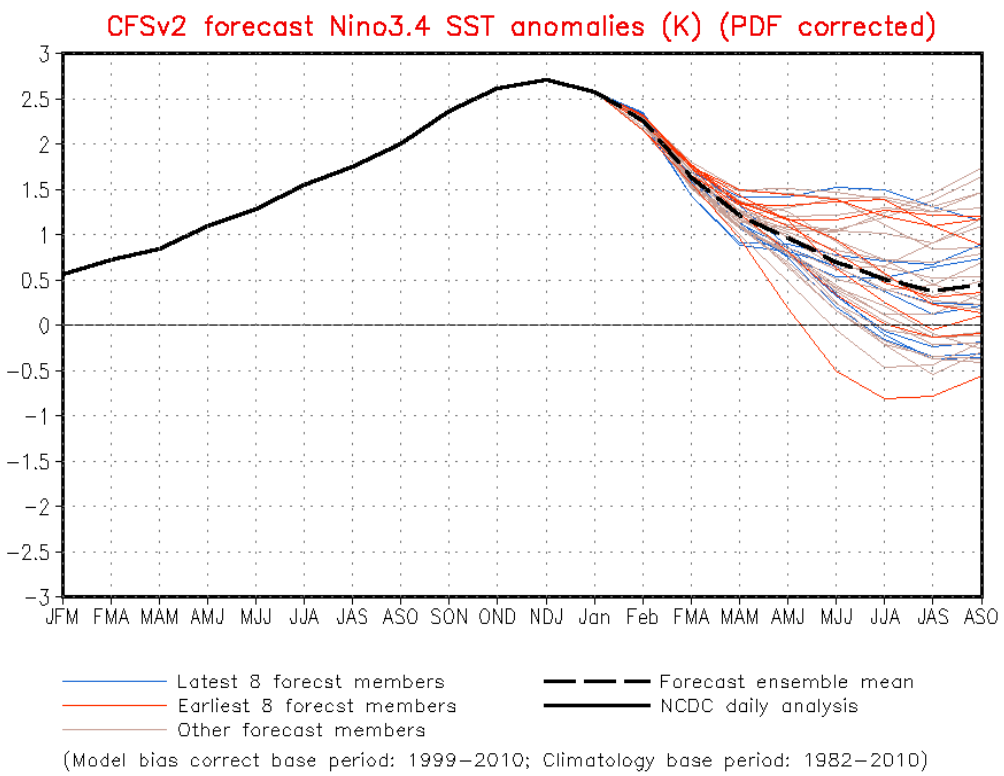


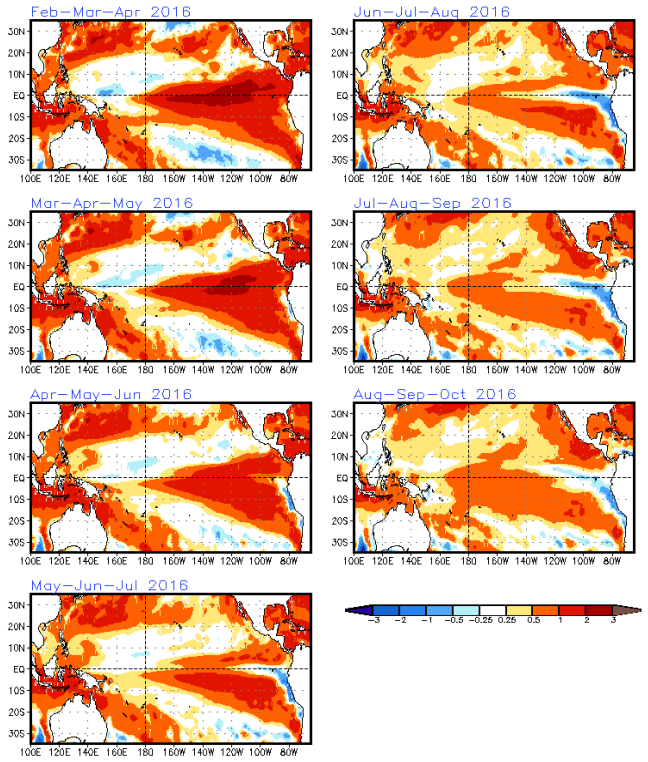
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 12 January 2016).

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

Issued: 1 February 2016

The CFS.v2 ensemble mean (black dashed line) predicts El Niño through JJA 2016.



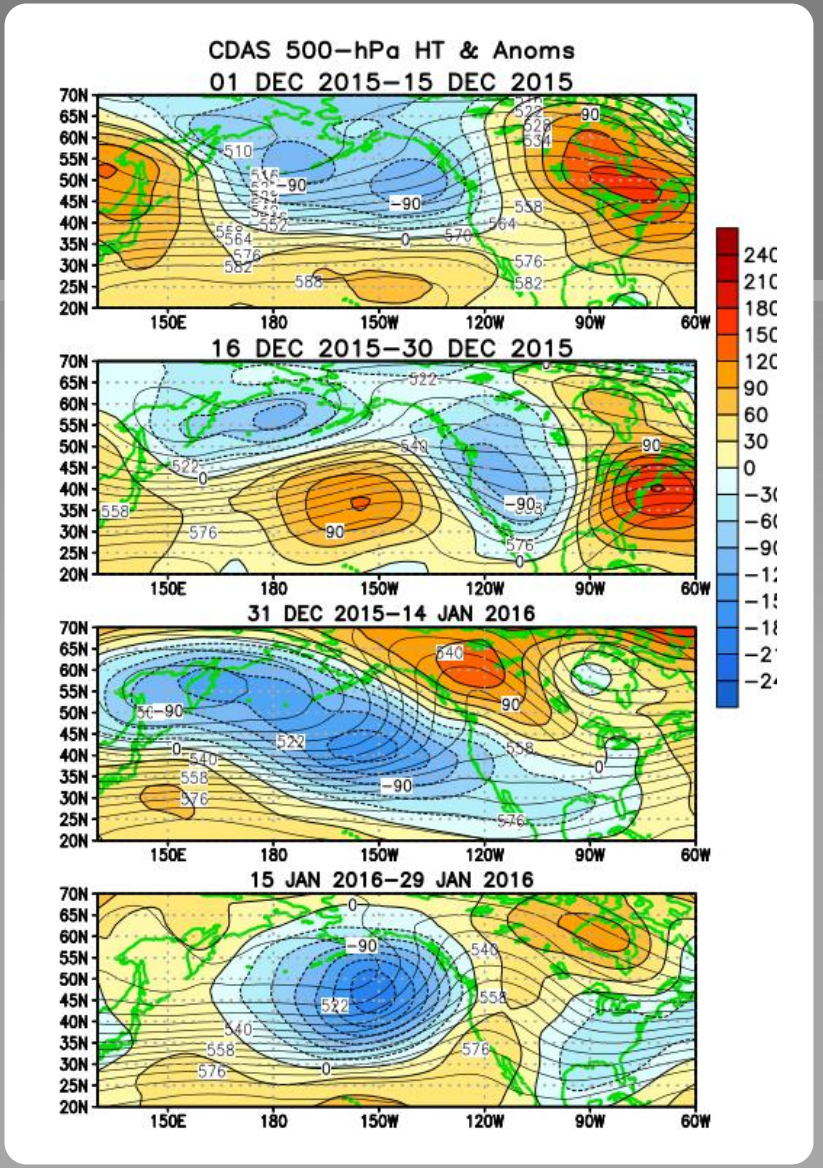


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During December, above-average heights/temperatures dominated over the East and near-to-below average heights/temperatures were observed over the West.

Since January, the Pacific jet stream has extended eastward and strengthened.

Over North America during the last half of January, an anomalous trough over the eastern U.S. contributed to below-average temperatures, while temperatures remained above-average across Alaska and most of Canada.



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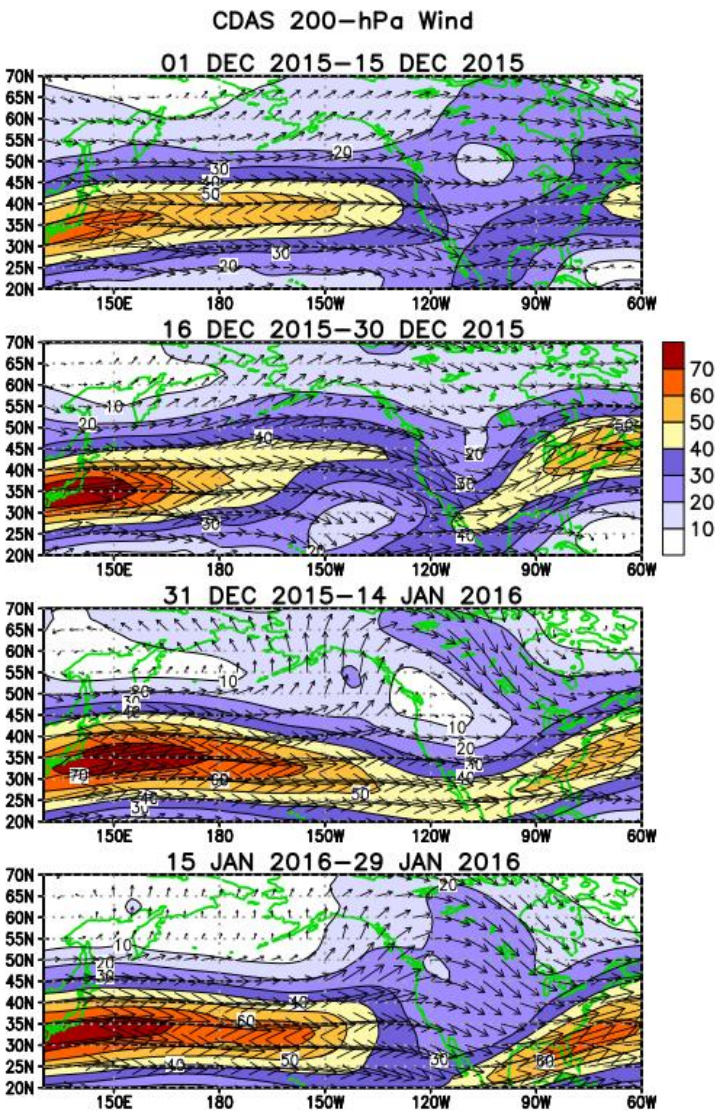

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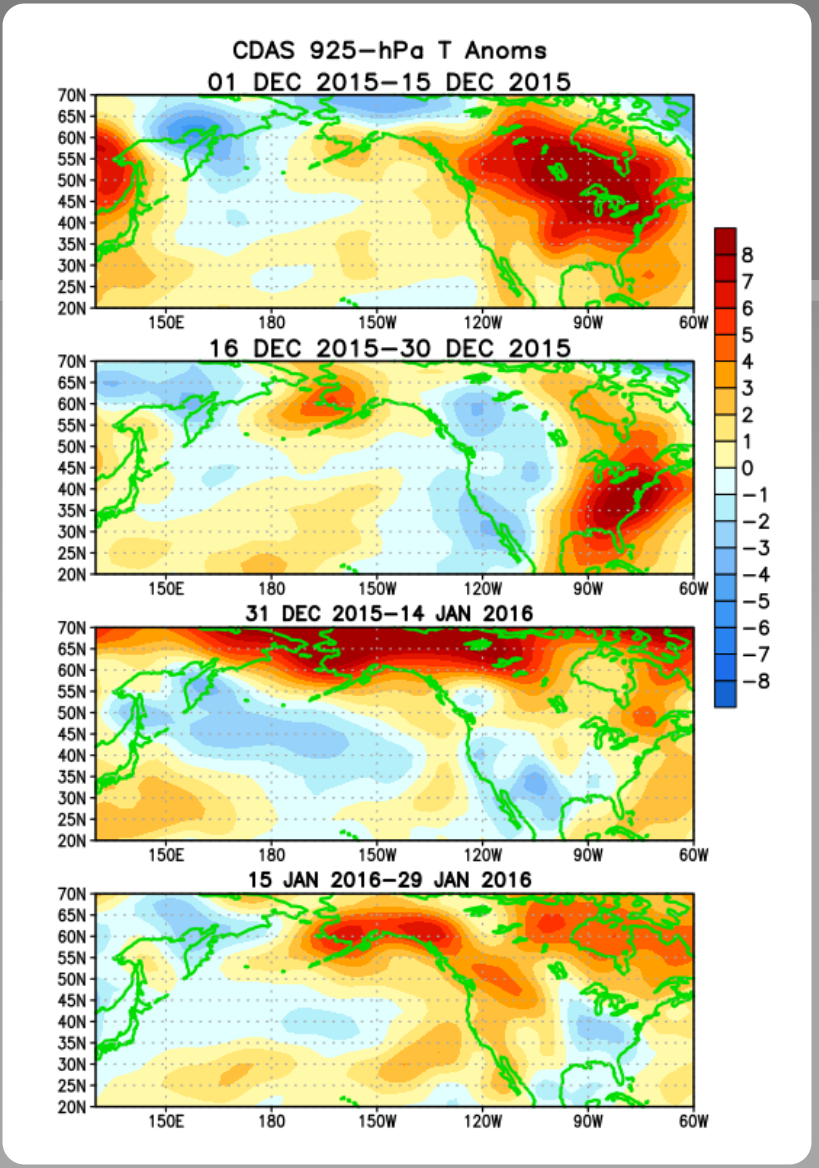
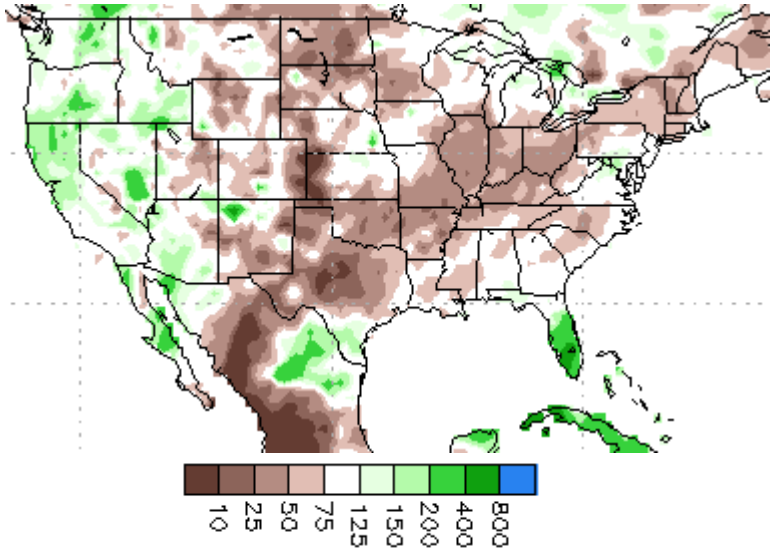


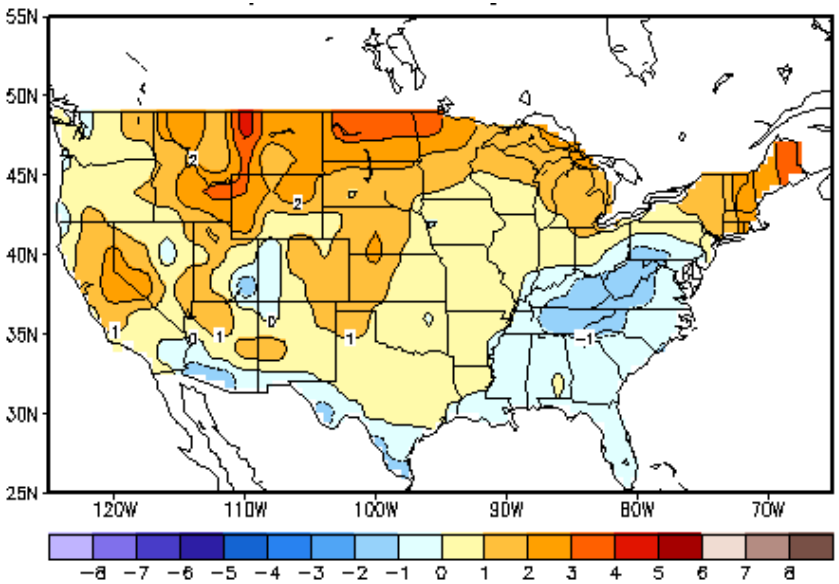
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 30 January 2016

Percent of Average Precipitation



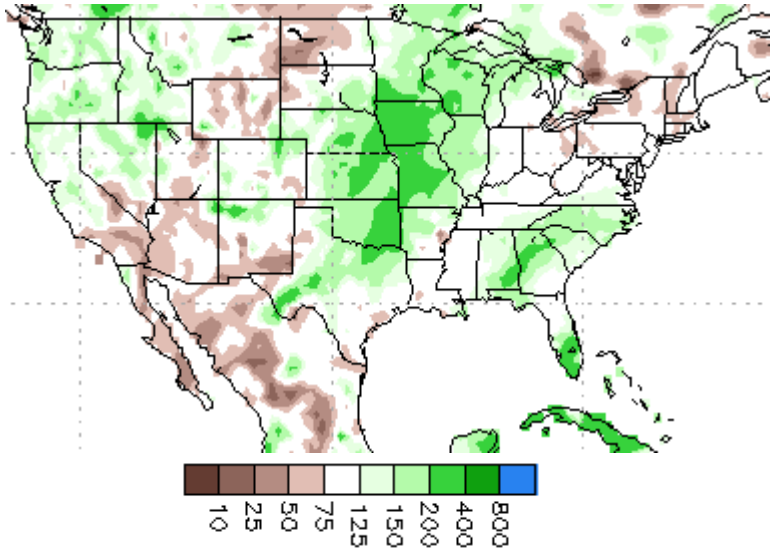
Temperature Departures (degree C)



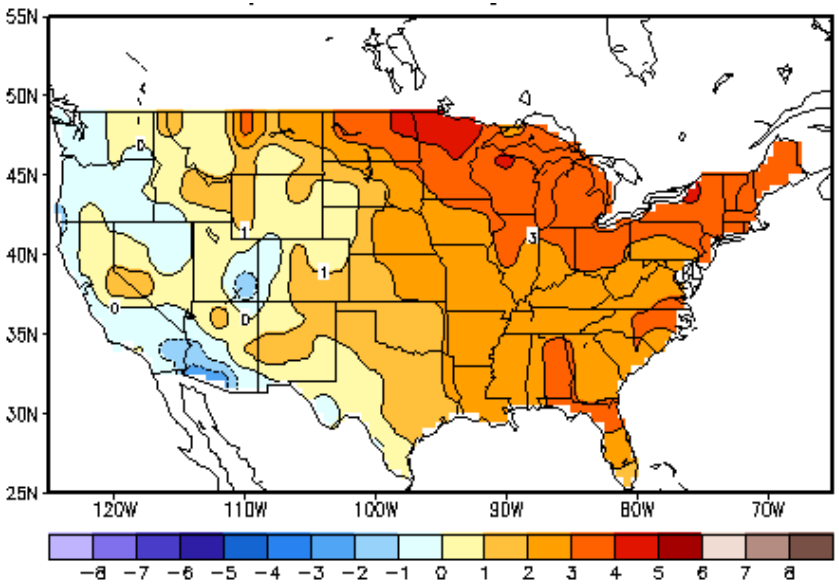
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 30 January 2016

Percent of Average Precipitation



Temperature Departures (degree C)

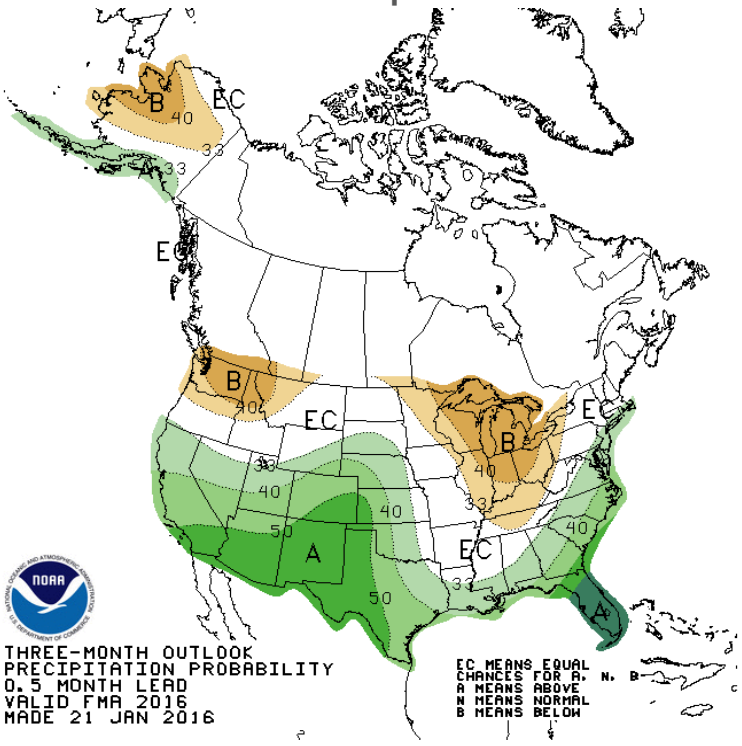


U. S. Seasonal Outlooks

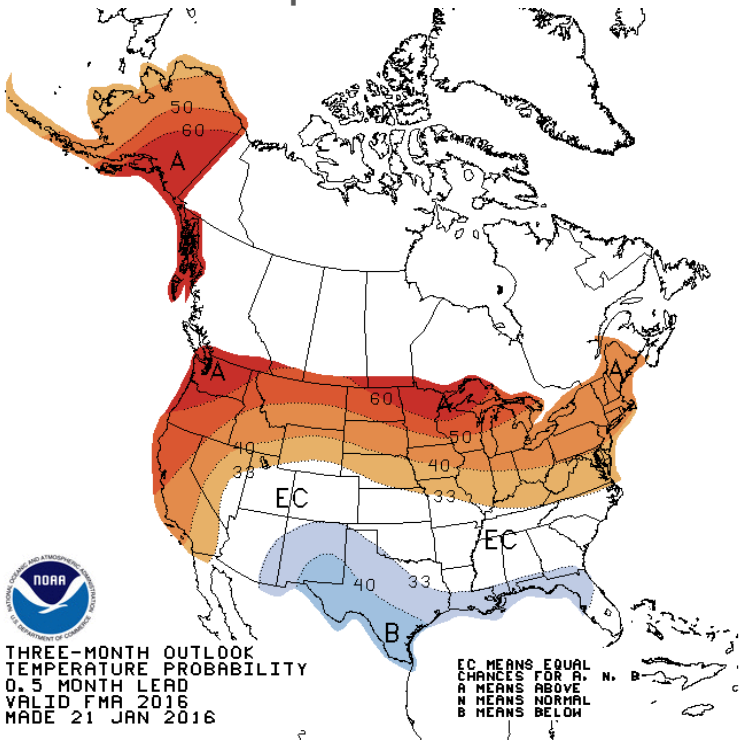
February - April 2016

The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.

Precipitation



Temperature



Summary

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

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