ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
16 January 2017

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ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.*

Equatorial sea surface temperatures (SSTs) are near-to-below average in the central and eastern Pacific Ocean.

A transition to ENSO-neutral is expected to occur by February 2017, with ENSO-neutral then continuing through the first half of 2017. *

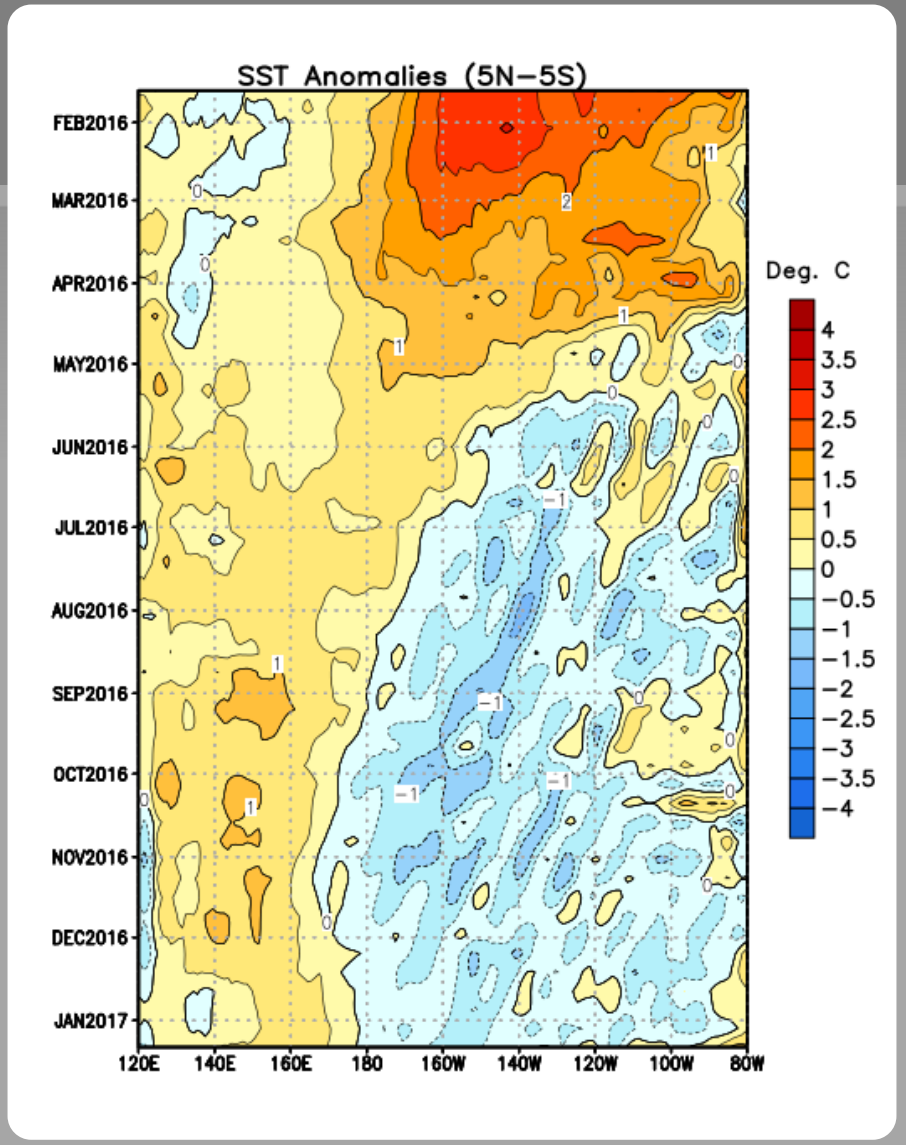
*** Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.**

Recent Evolution of Equatorial Pacific SST Departures (°C)

Since mid-April 2016, near-to-below average SSTs have expanded westward toward the Date Line.

Since July 2016, negative SST anomalies have persisted in the central and east-central Pacific Ocean.

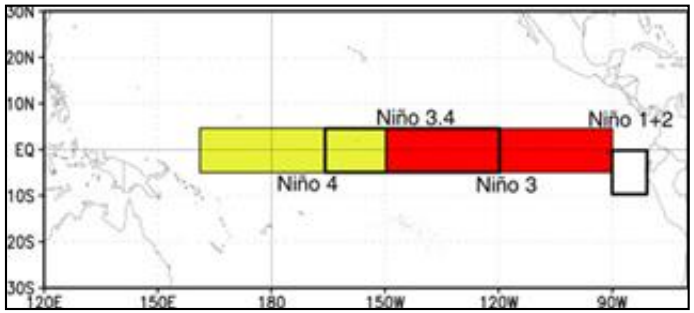
Recently, above-average SST have emerged in the far eastern Pacific.

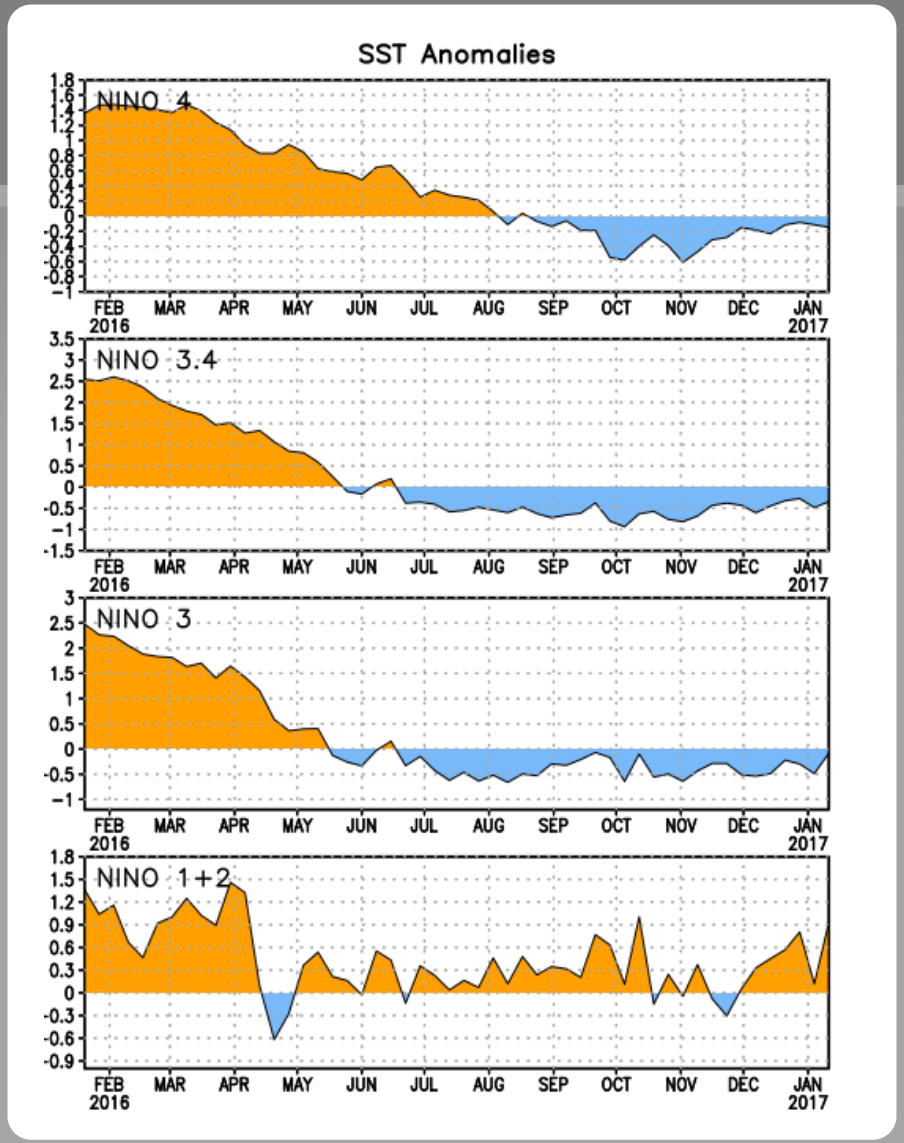


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

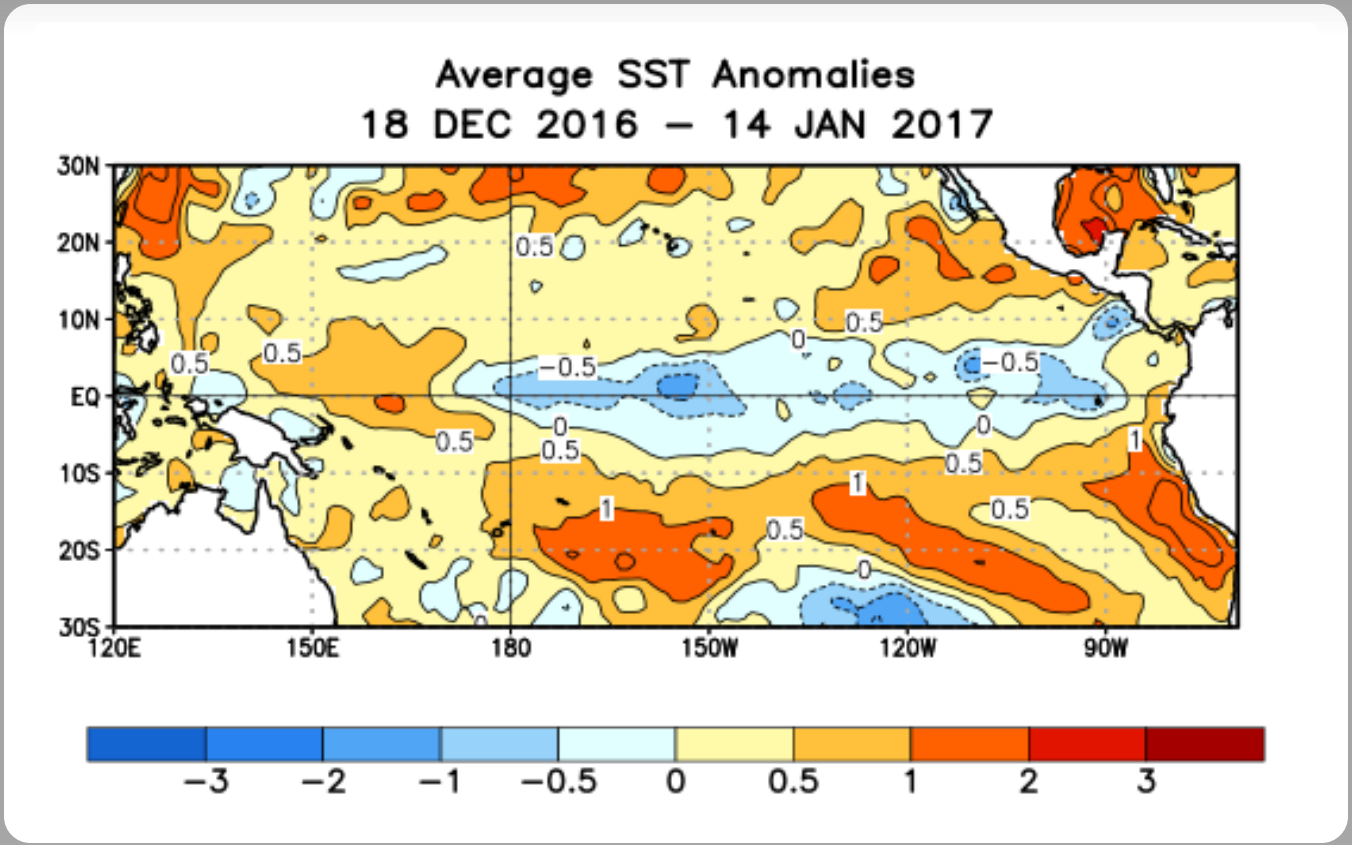
Niño 4	-0.1ºC
Niño 3.4	-0.3ºC
Niño 3	-0.1ºC
Niño 1+2	0.9ºC





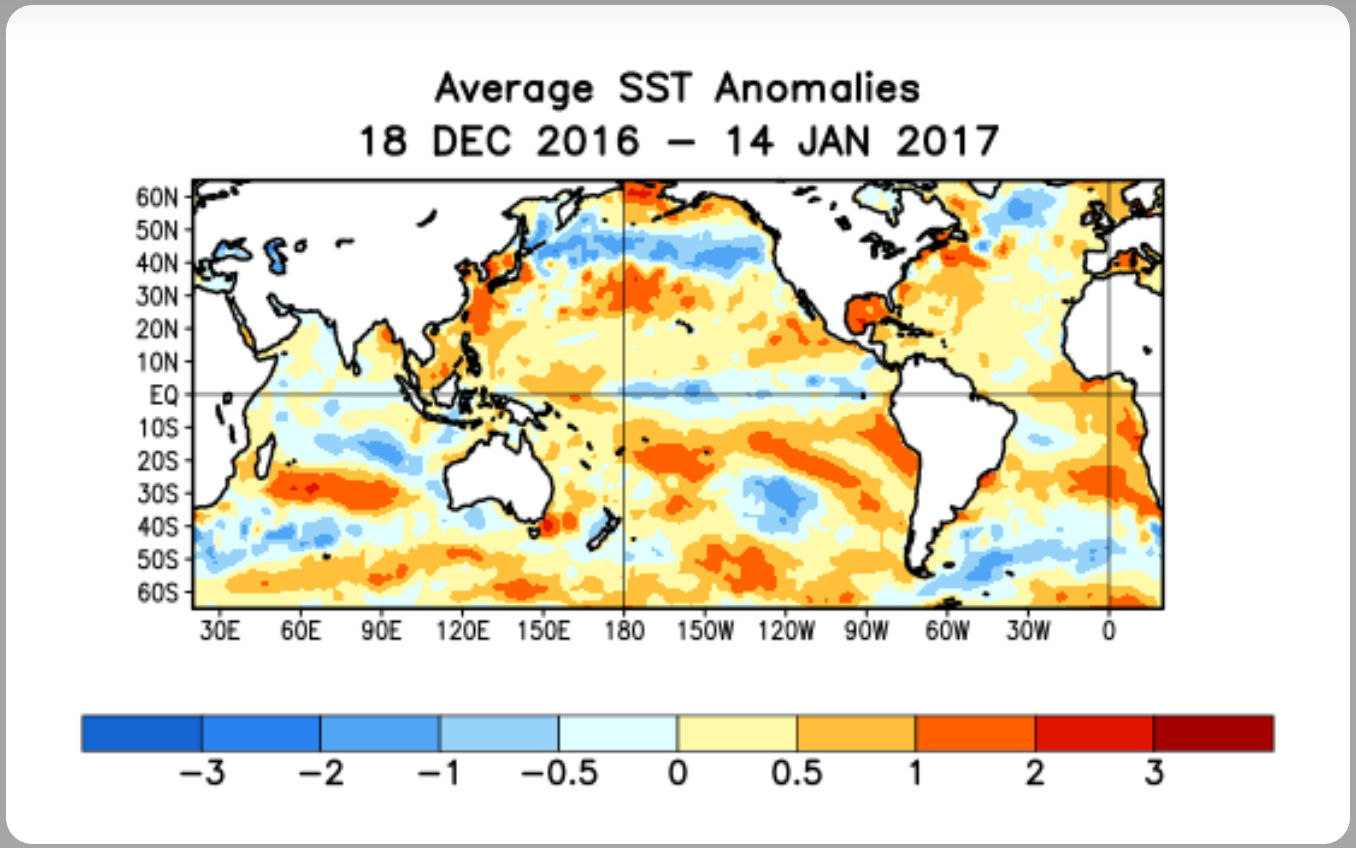
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were near-to-below average across much of the central and east-central Pacific Ocean.



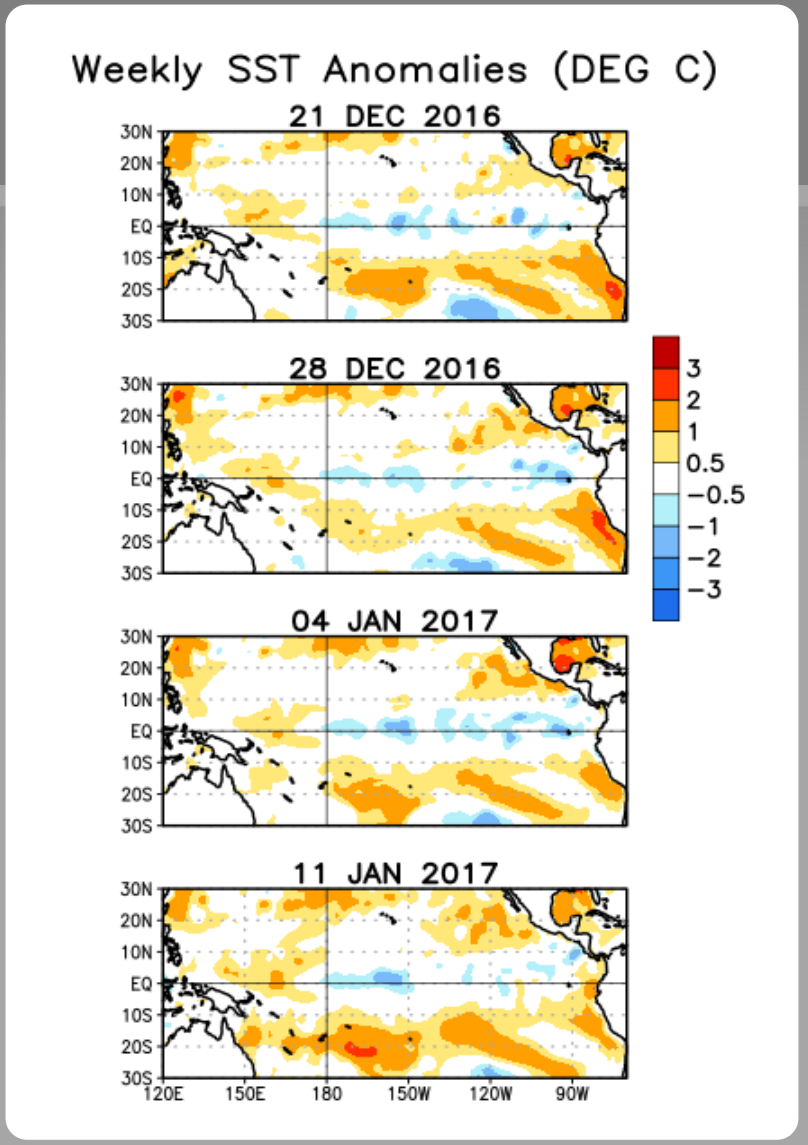
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average in the western Pacific and in the eastern Atlantic. Equatorial SSTs were near-to-below average across much of the central and east-central Pacific Ocean.



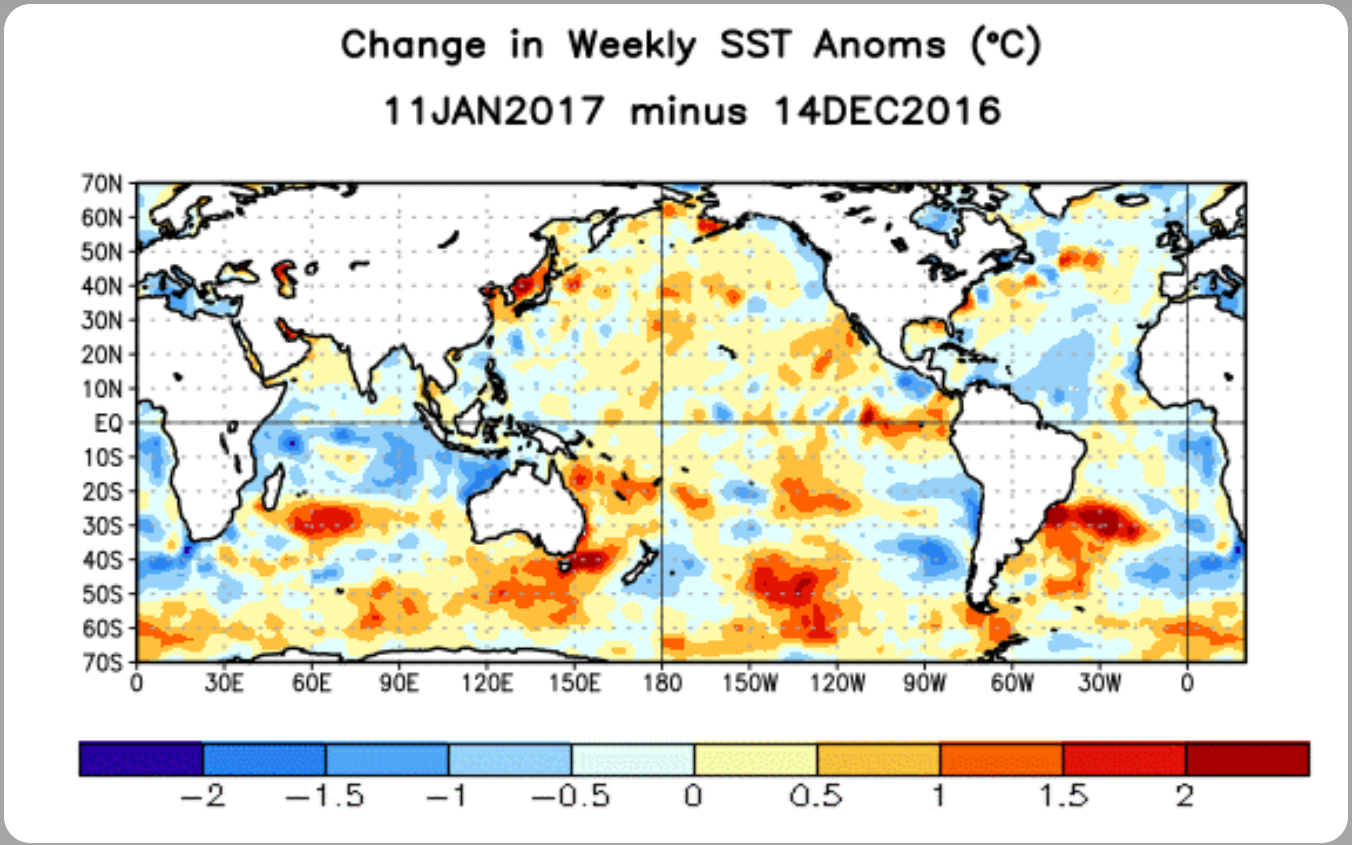
Weekly SST Departures during the Last Four Weeks

During the last four weeks, negative SST anomalies have mostly weakened across the central and eastern equatorial Pacific Ocean. Recently, above-average SSTs have emerged near the coast of South America.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, changes in equatorial SST anomalies were positive over most of the Pacific Ocean.



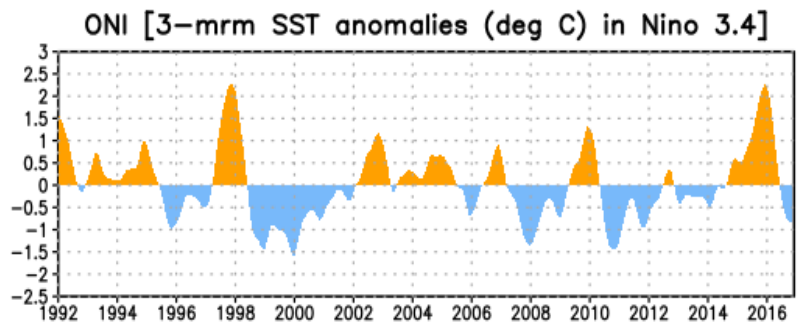
Upper-Ocean Conditions in the Equatorial Pacific

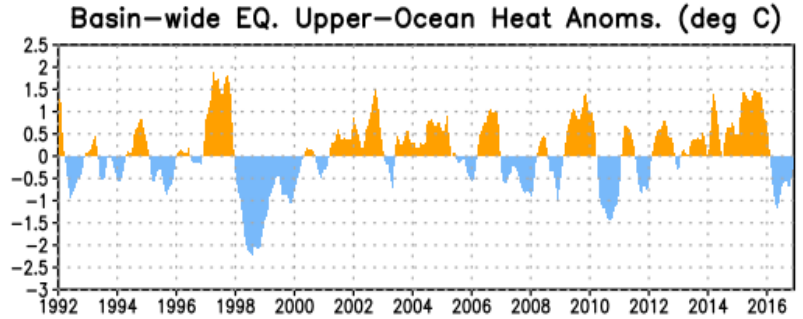
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

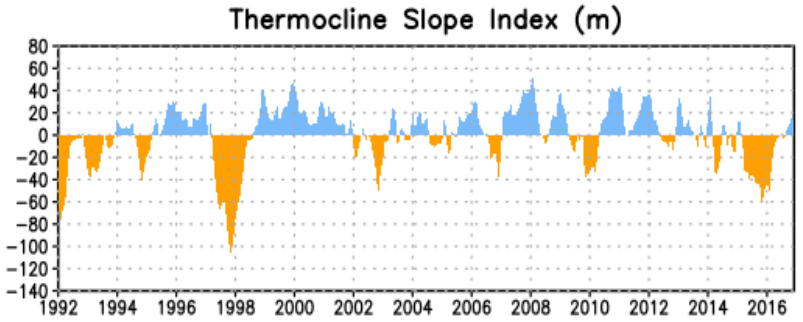
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (negative) and thermocline slope index (slightly positive) reflect weak La Niña conditions.

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).

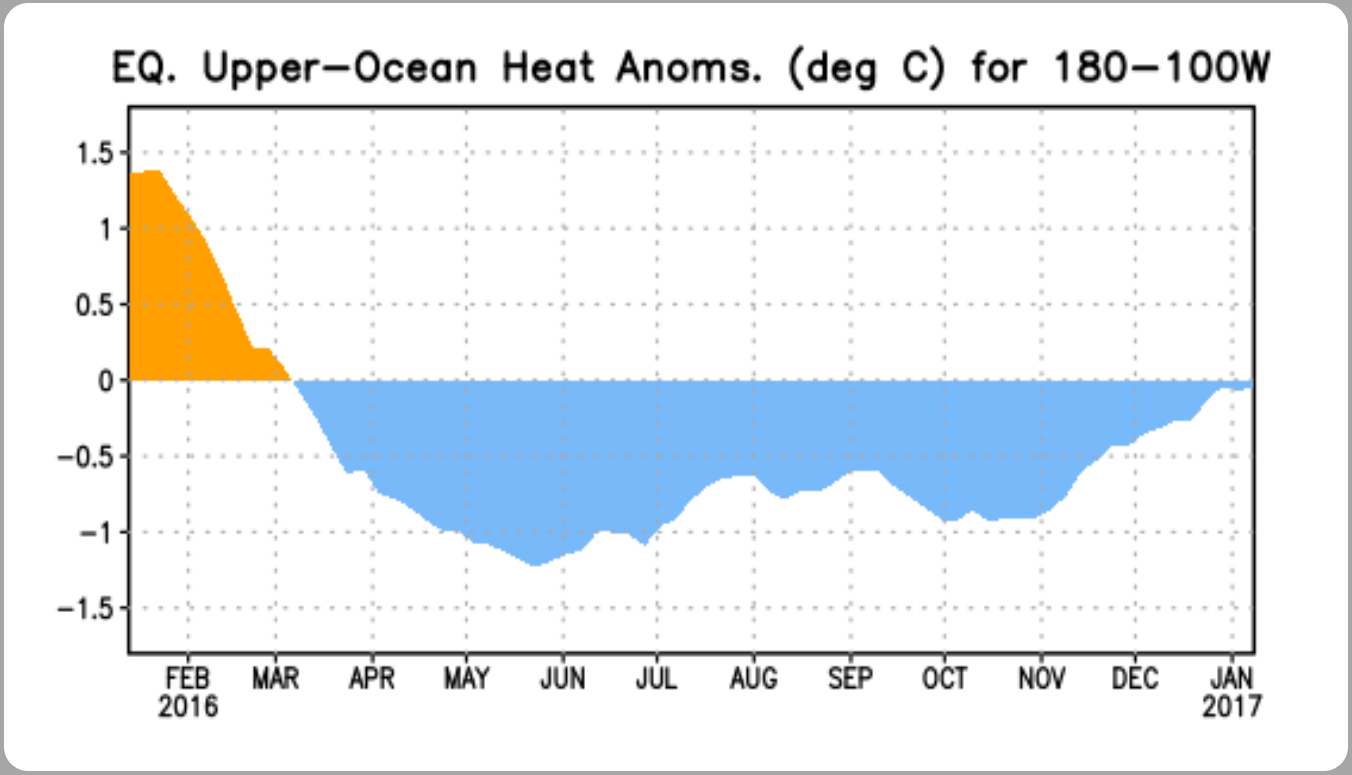






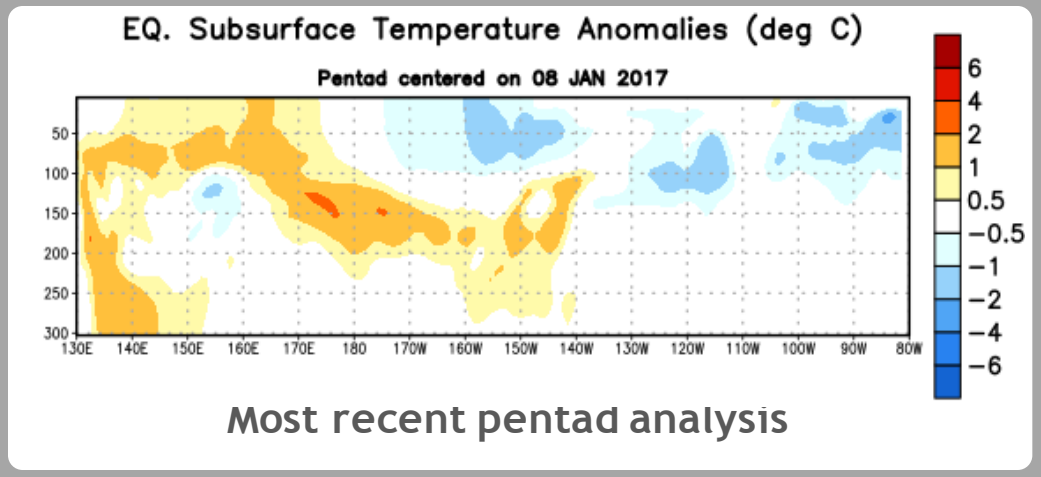
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies have been present since March 2016. Since early November 2016 the negative anomalies have weakened and returned to near zero around the start of the new year.



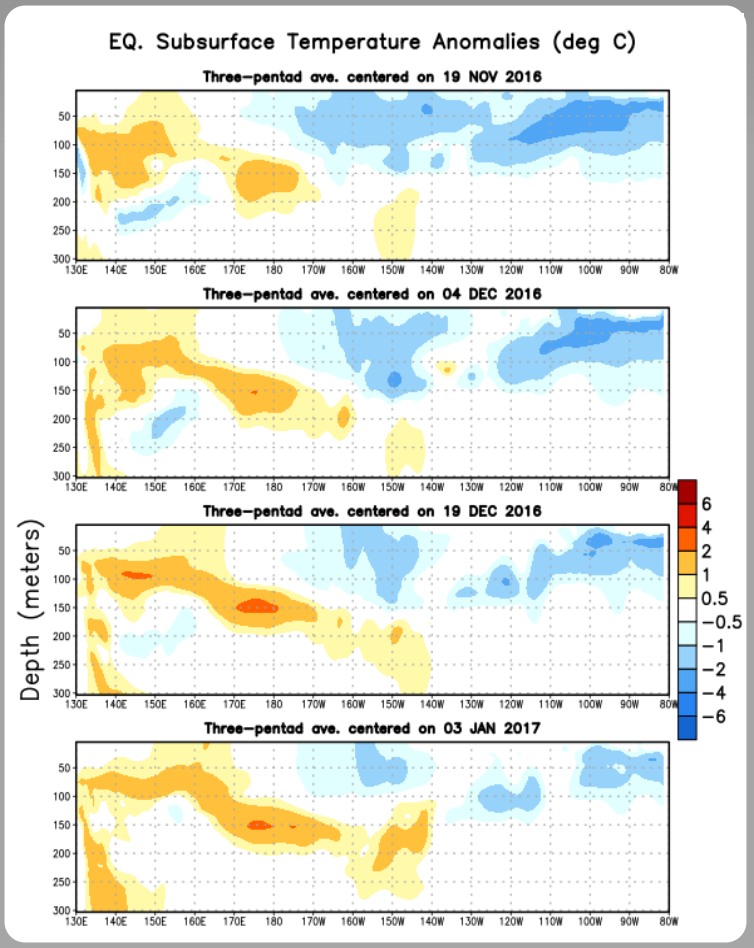
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, negative subsurface temperature anomalies have extended to the surface in portions of the central and eastern Pacific Ocean.



Most recent pentad analysis

Negative subsurface temperature anomalies weakened across most of the equatorial Pacific Ocean, while positive subsurface anomalies increased in the western and central Pacific Ocean.

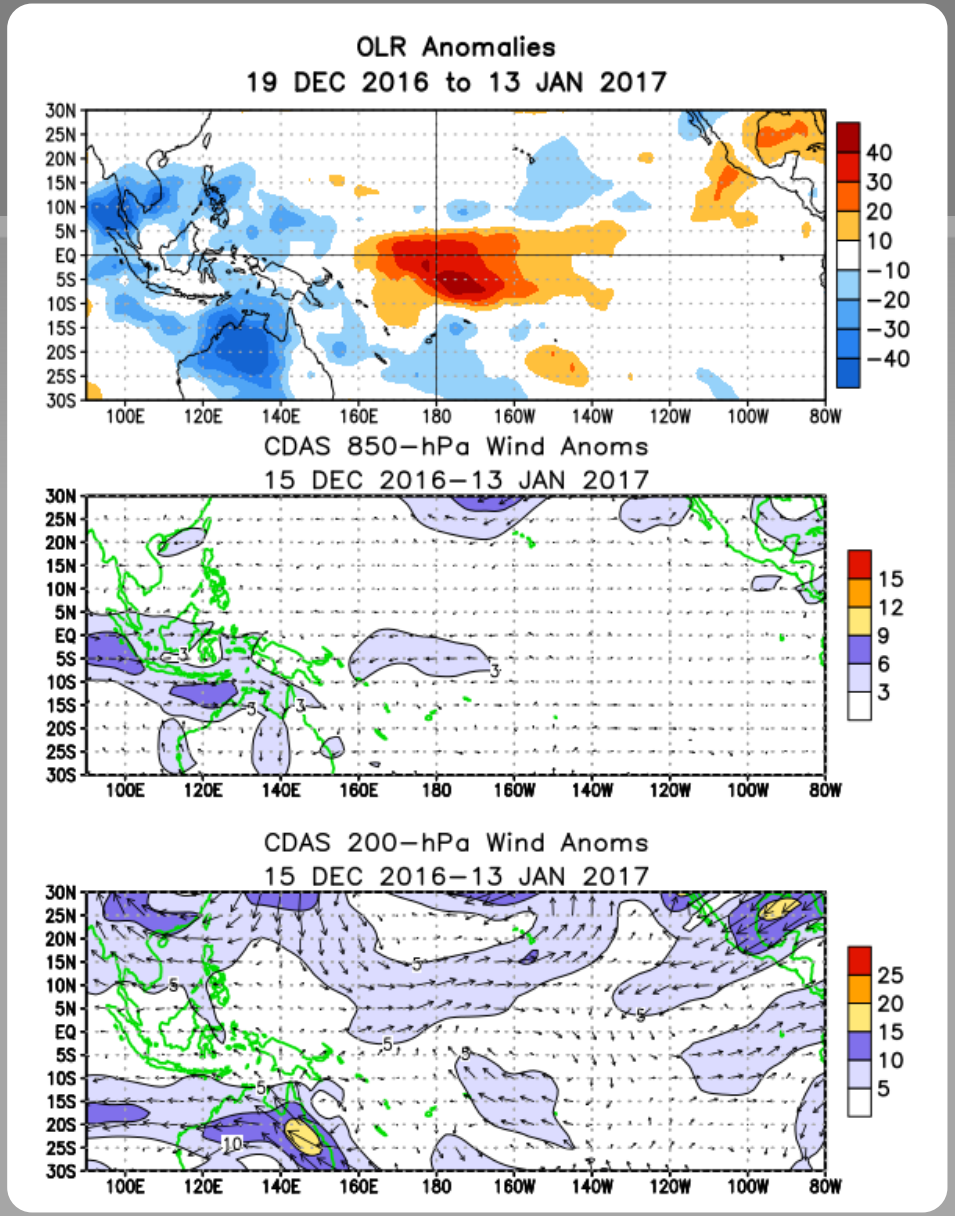


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident over Indonesia, Southeast Asia, the Philippines, and northern Australia. Positive OLR anomalies (suppressed convection and precipitation) were observed around the International Date Line.

Low-level (850-hPa) easterly wind anomalies were observed over the western equatorial Pacific.

Upper-level (200-hPa) westerly wind anomalies were observed over the western and eastern equatorial Pacific.



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:

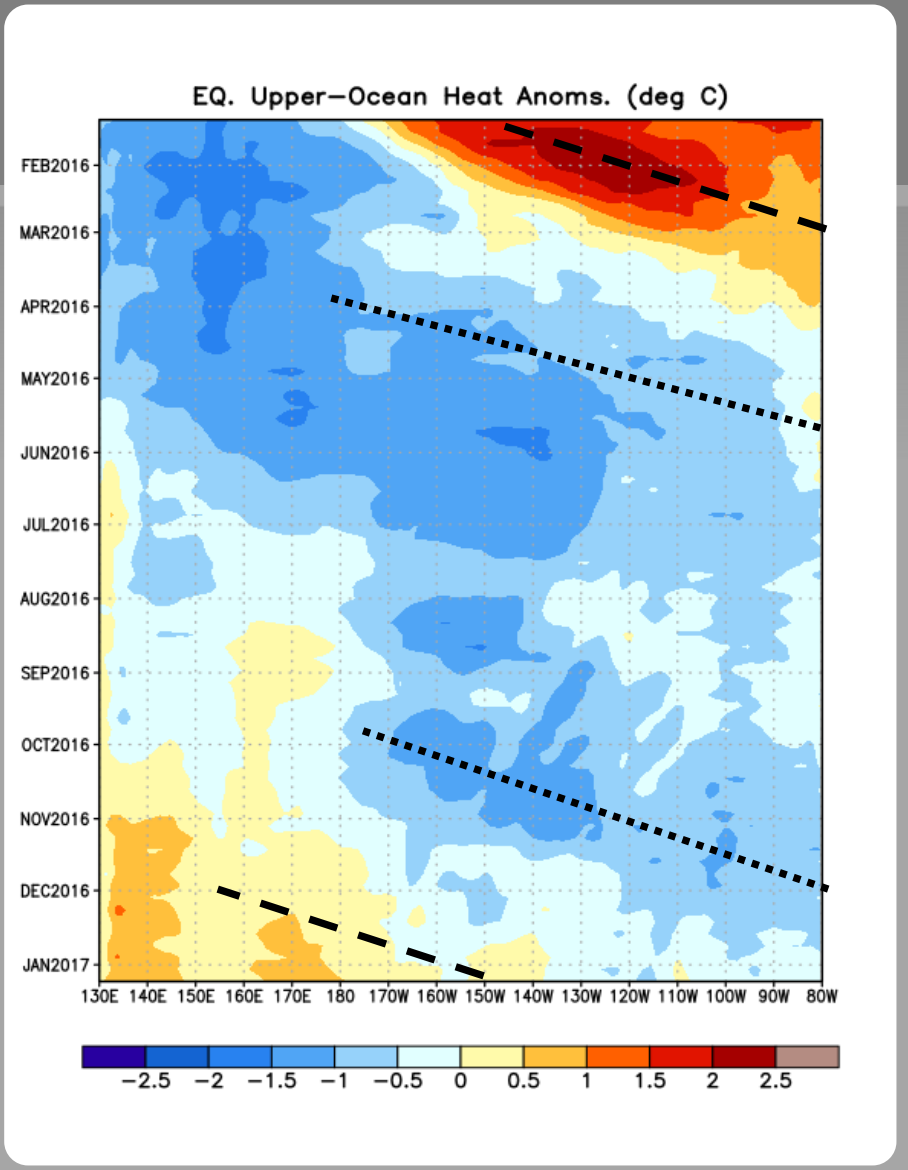
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

The downwelling phase of an equatorial oceanic Kelvin wave was observed during January-February 2016.

With the passage of an upwelling equatorial oceanic Kelvin wave in March 2016, below-average subsurface temperatures extended across much of the equatorial Pacific.

Since December 2016, positive subsurface temperature anomalies have expanded eastward.



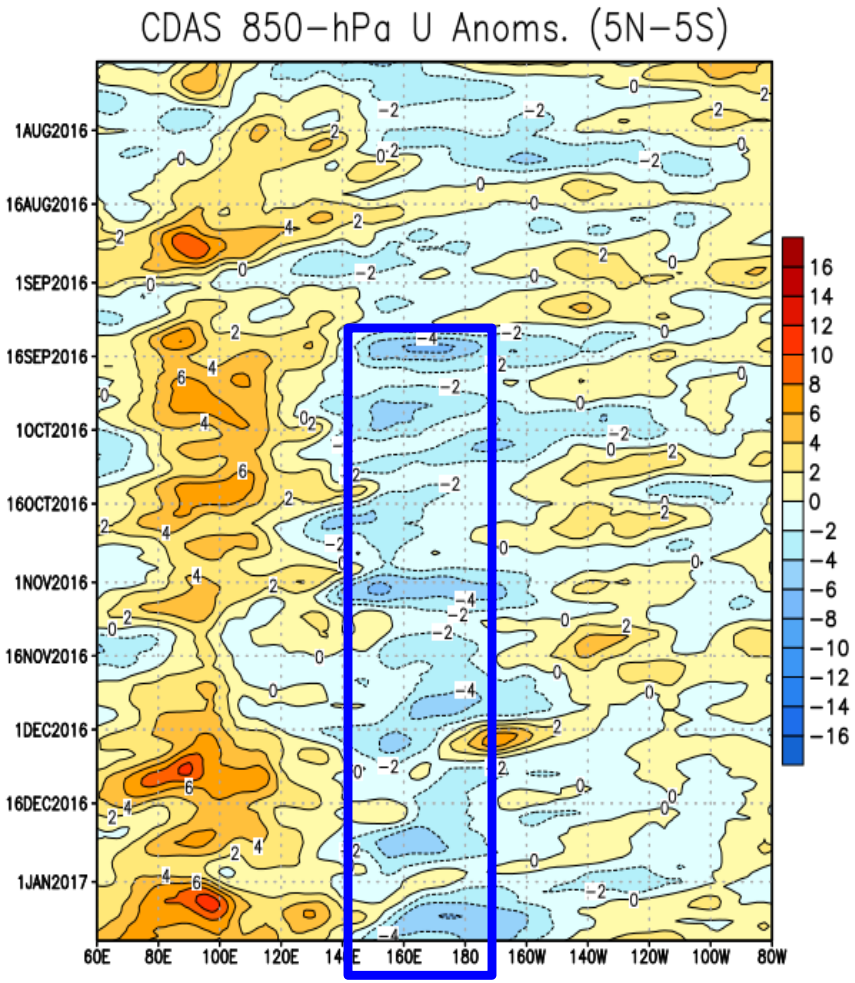
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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

Since July, the low-level wind anomalies have been variable over the eastern equatorial Pacific.

Since mid-August, low-level westerly wind anomalies have persisted over the eastern Indian and western Pacific Oceans.

Since September, low-level easterly wind anomalies have persisted over the central and western equatorial Pacific.

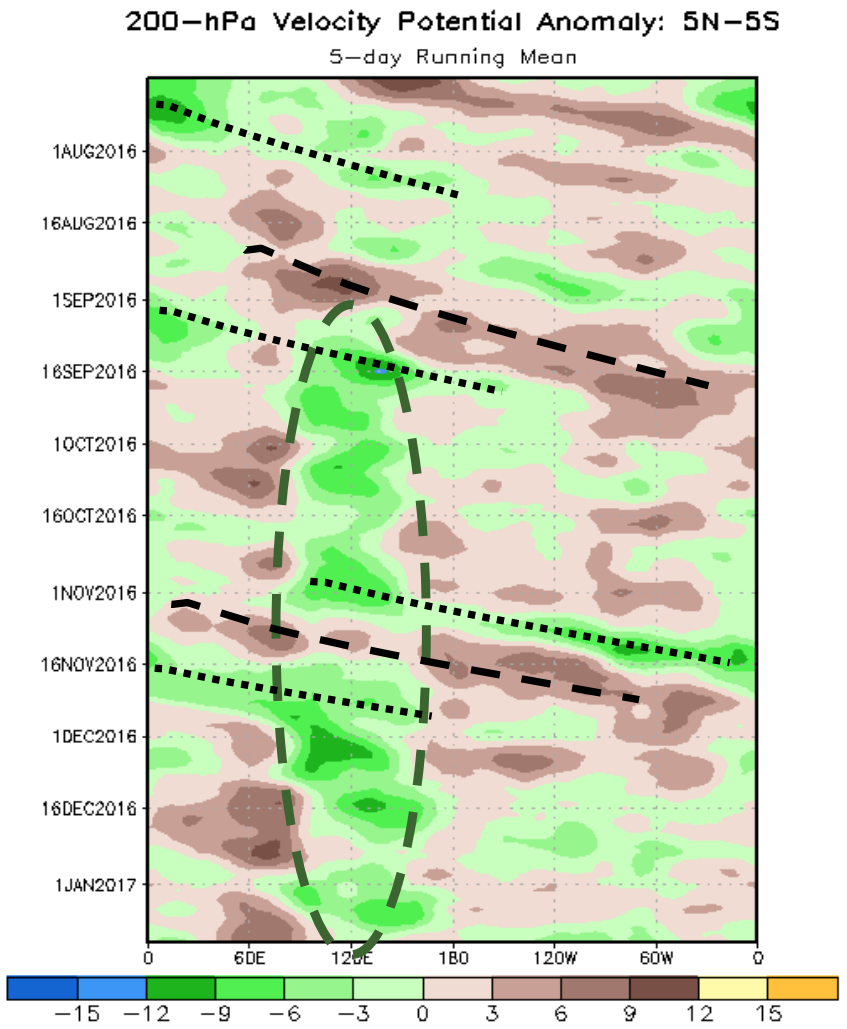


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

Eastward propagation of regions of upper-level divergence (green shading) and convergence (brown shading) are particularly evident during September 2016 and during November 2016.

Since early September, anomalous upper-level divergence has generally persisted near Indonesia.



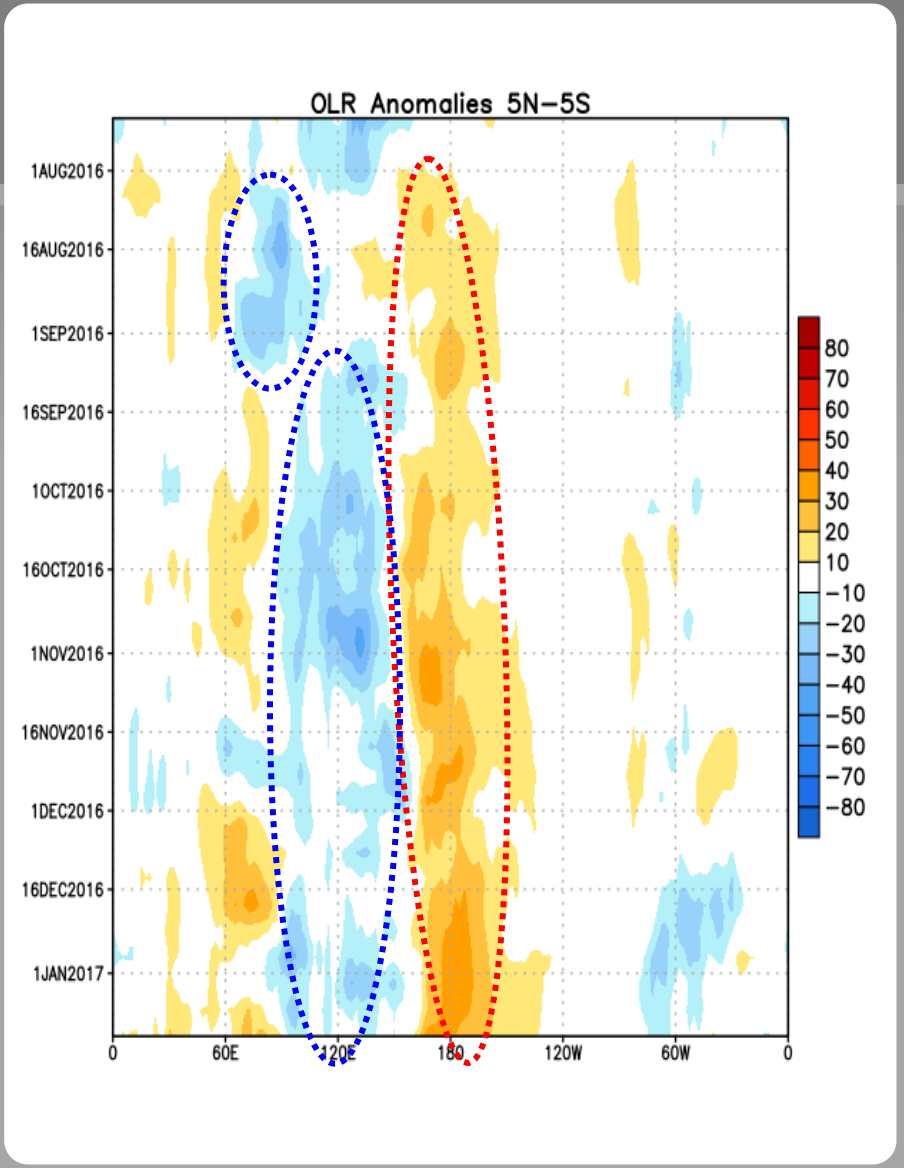
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

Since early August 2016, positive OLR anomalies have persisted near the International Date Line.

Since early September 2016, negative OLR anomalies have generally persisted near the Maritime Continent/far western Pacific Ocean.



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.

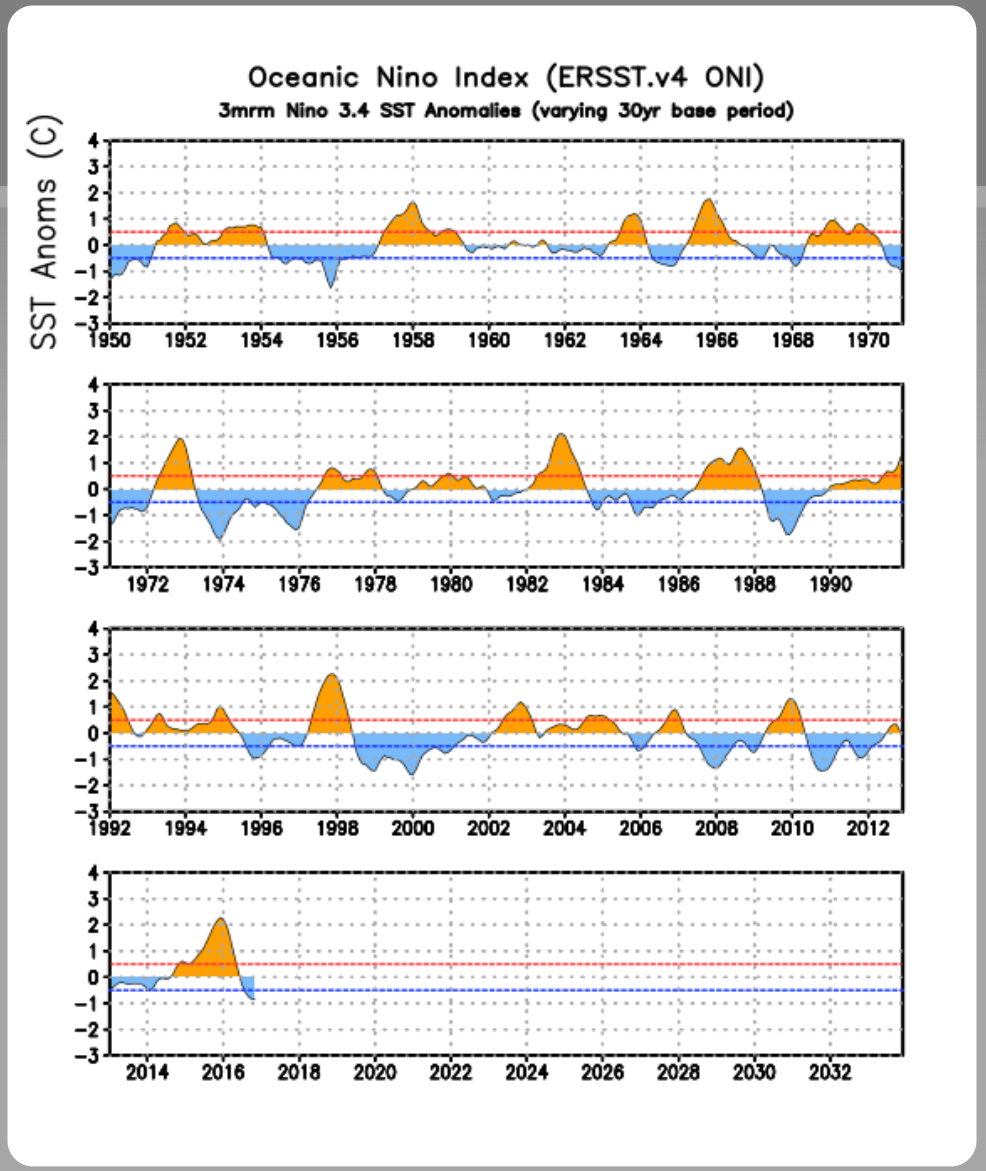
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 2016) is -0.8°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.

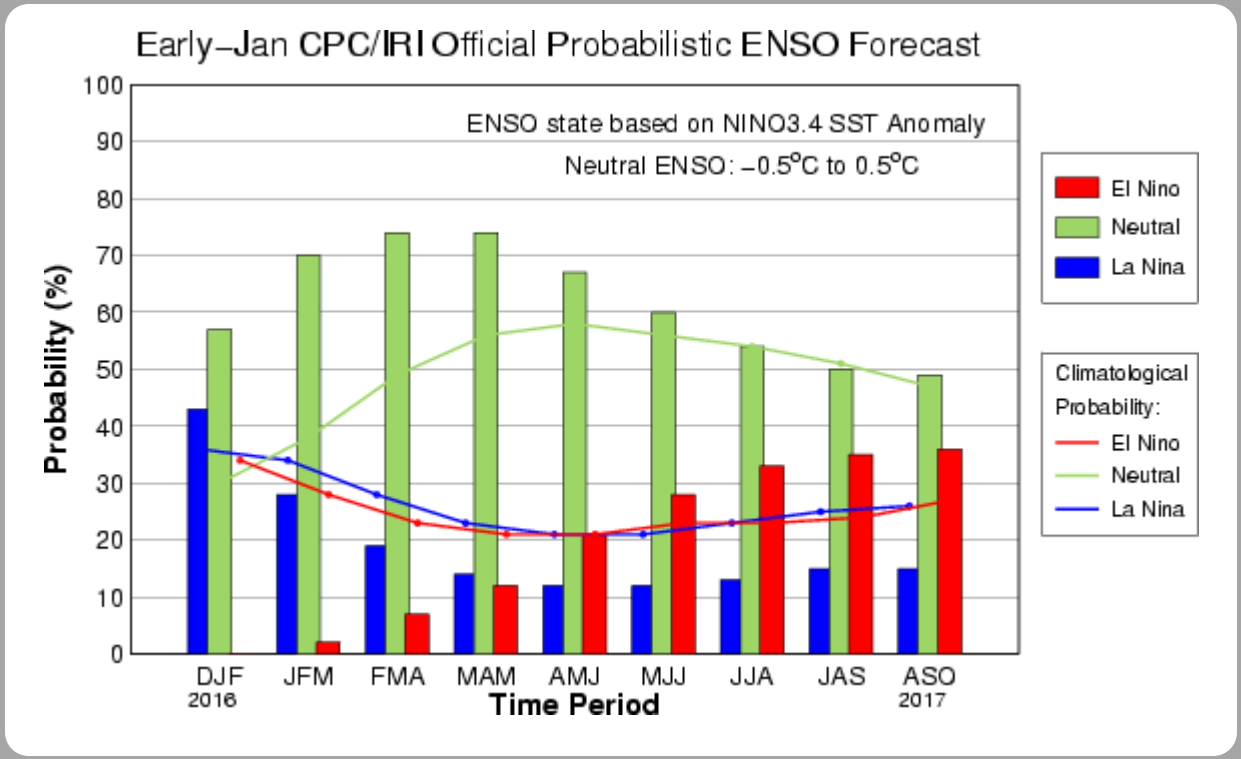
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2004	0.3	0.3	0.2	0.1	0.2	0.3	0.5	0.6	0.7	0.7	0.6	0.7
2005	0.7	0.6	0.5	0.5	0.3	0.2	0.0	-0.1	0.0	-0.2	-0.5	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.4	0.1	-0.1	-0.2	-0.3	-0.4	-0.6	-0.9	-1.1	-1.3	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.7	-0.6	-0.4	-0.1	0.2	0.4	0.5	0.5	0.6	0.9	1.1	1.3
2010	1.3	1.2	0.9	0.5	0.0	-0.4	-0.9	-1.2	-1.4	-1.5	-1.4	-1.4
2011	-1.3	-1.0	-0.7	-0.5	-0.4	-0.3	-0.3	-0.6	-0.8	-0.9	-1.0	-0.9
2012	-0.7	-0.5	-0.4	-0.4	-0.3	-0.1	0.1	0.3	0.3	0.3	0.1	-0.2
2013	-0.4	-0.4	-0.3	-0.2	-0.2	-0.2	-0.3	-0.3	-0.2	-0.3	-0.3	-0.3
2014	-0.5	-0.5	-0.4	-0.2	-0.1	0.0	-0.1	0.0	0.1	0.4	0.5	0.6
2015	0.6	0.5	0.6	0.7	0.8	1.0	1.2	1.4	1.7	2.0	2.2	2.3
2016	2.2	2.0	1.6	1.1	0.6	0.1	-0.3	-0.6	-0.8	-0.8	-0.8	

CPC/IRI Probabilistic ENSO Outlook

Updated: 12 January 2017

ENSO-neutral is favored through mid-2017, with smaller chances of El Niño (~35%) and La Niña (~15%) by August-September-October (ASO) 2017.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The multi-model averages indicate a transition to ENSO-neutral during the Northern Hemisphere winter 2016-17.

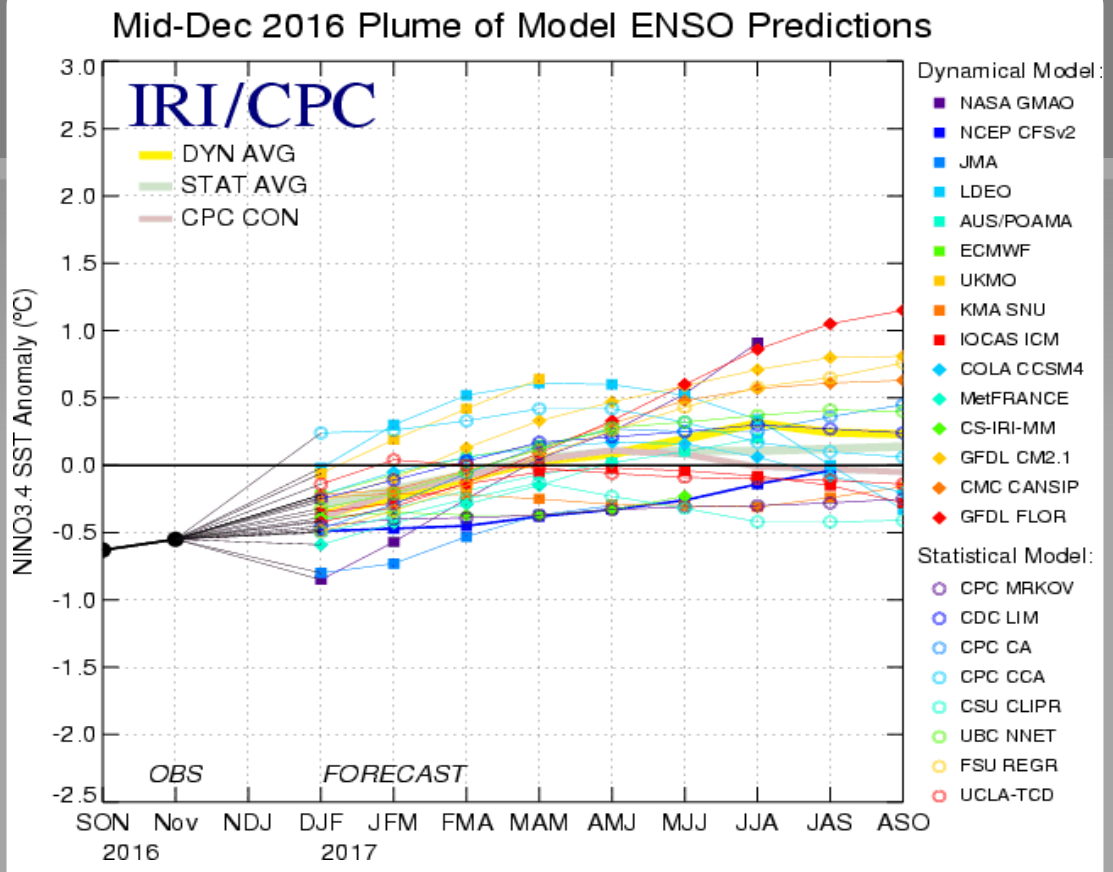
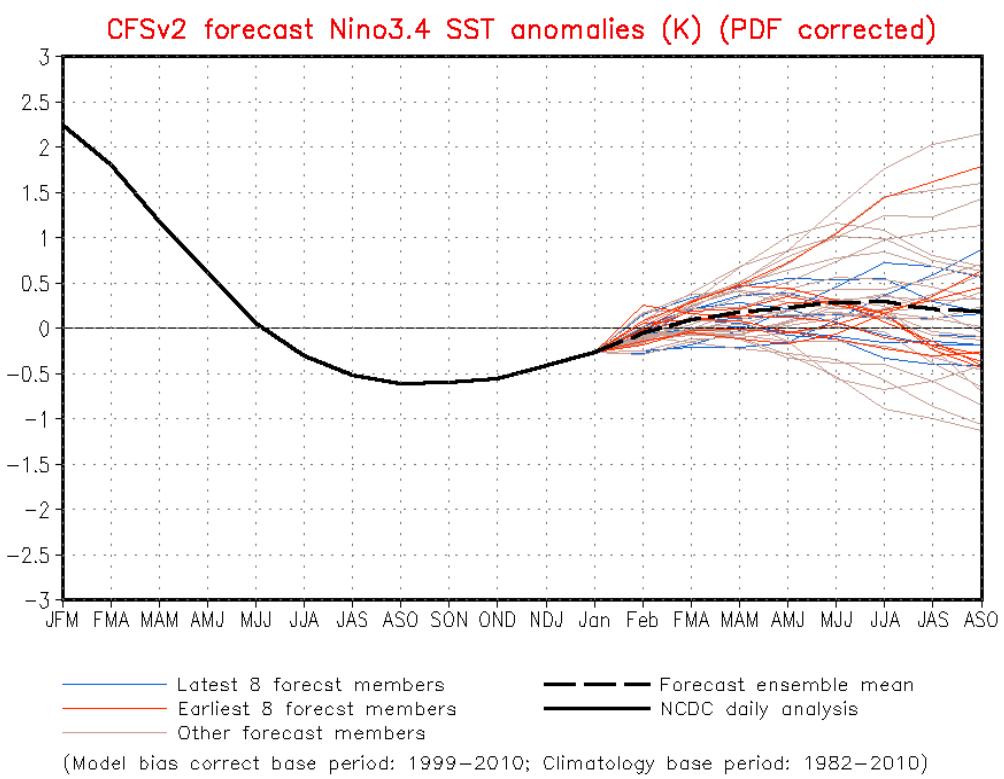


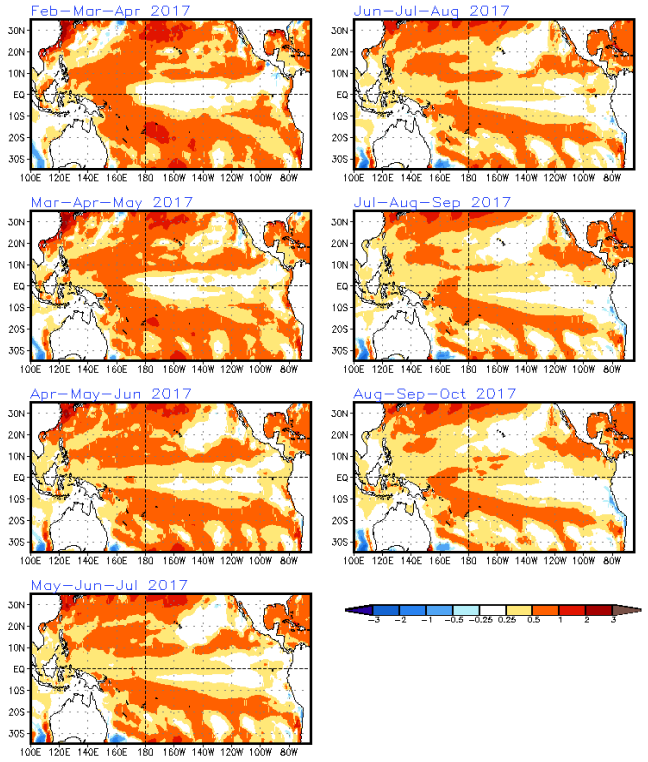
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 December 2016).

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

Issued: 16 January 2017

The CFS.v2 ensemble mean (black dashed line) favors ENSO-neutral conditions through mid-2017. The thin ensemble members indicate large spread.

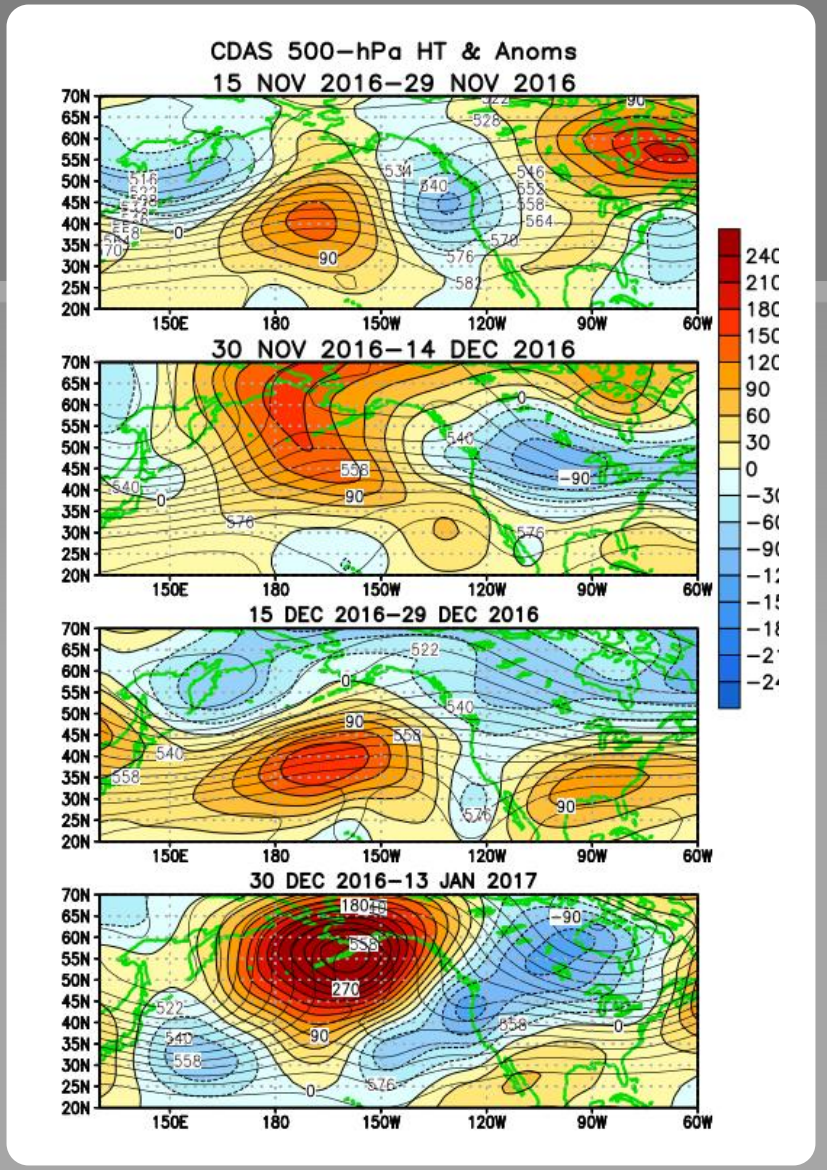




Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From late November 2016 through mid-January 2017, a westward retracted Asian-North Pacific jet stream and above-average heights dominated over the Gulf of Alaska.

Downstream of the anomalous ridge, below-average heights (and temperatures) prevailed over much of Canada and the northern United States, while above-average heights (and temperatures) have persisted across the southern tier of the U.S.



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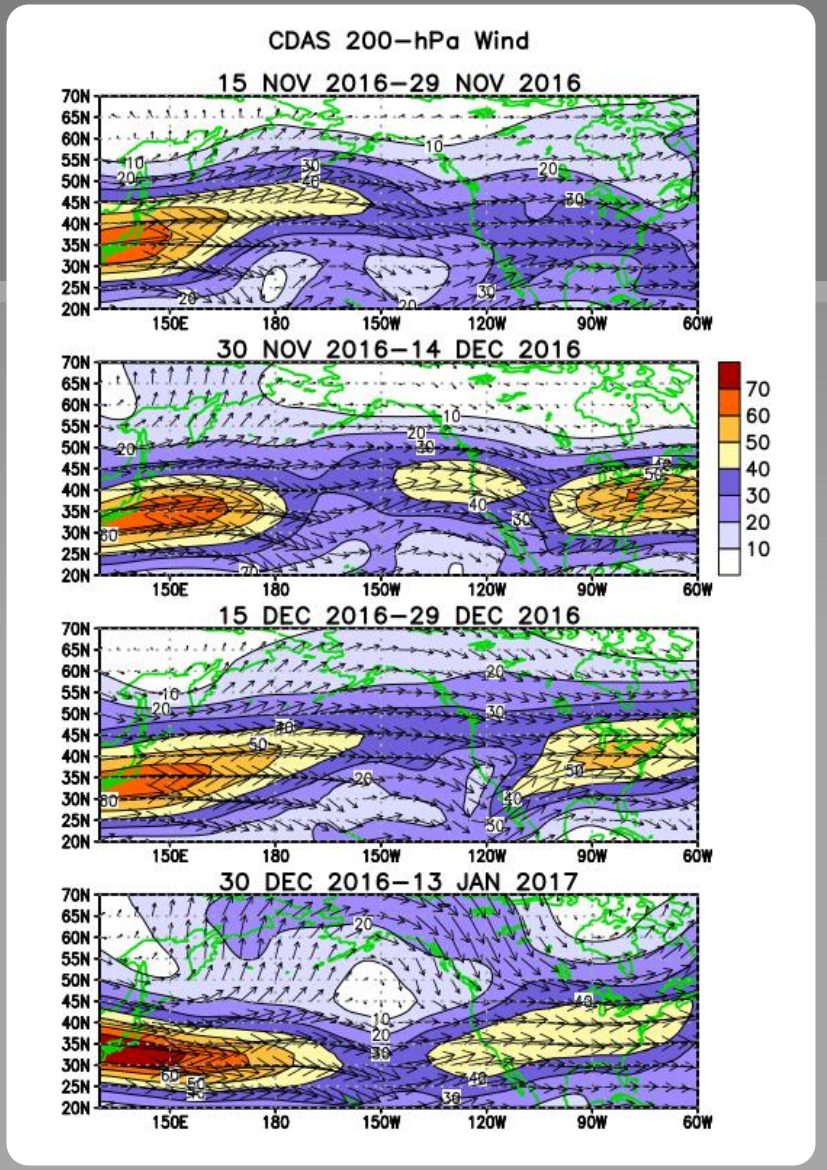

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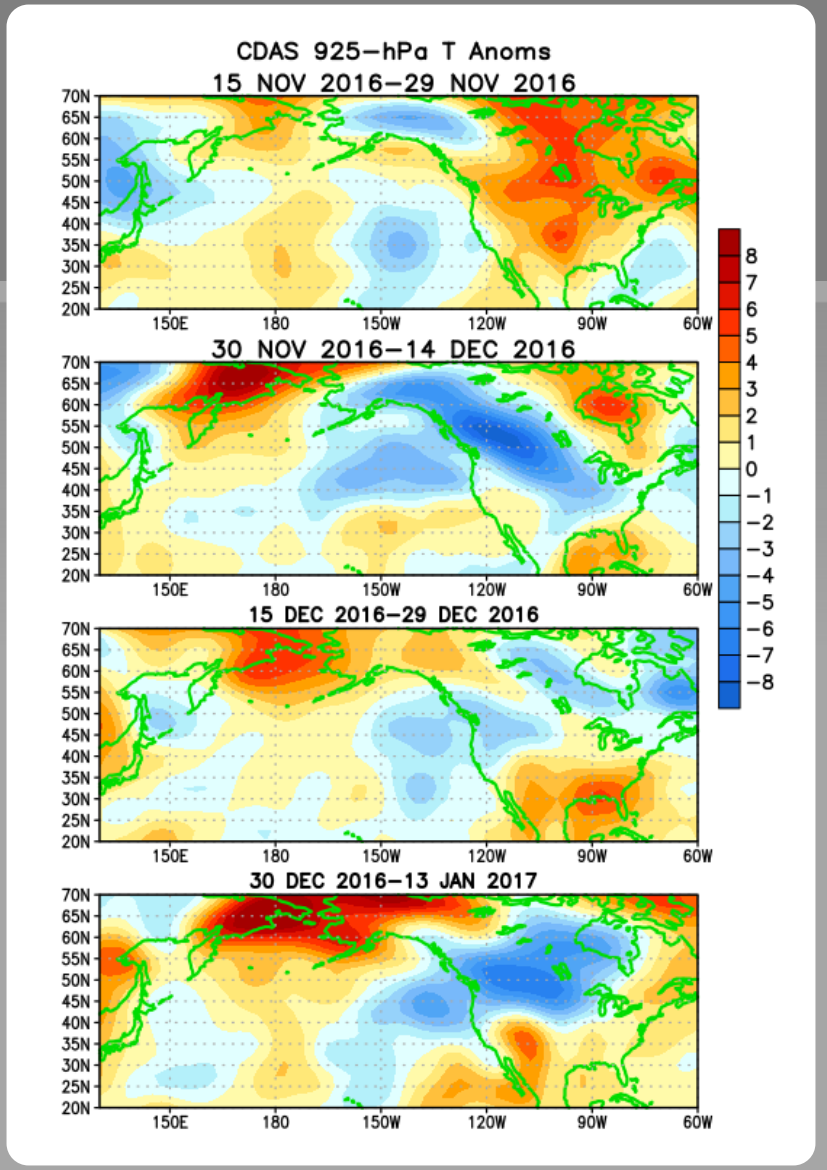
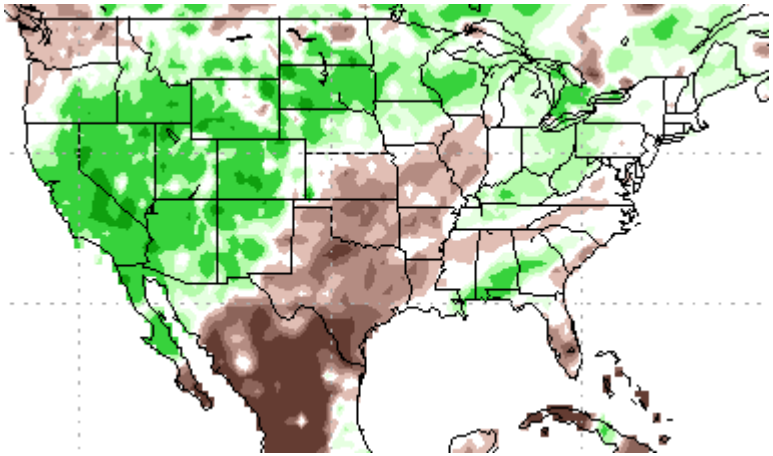


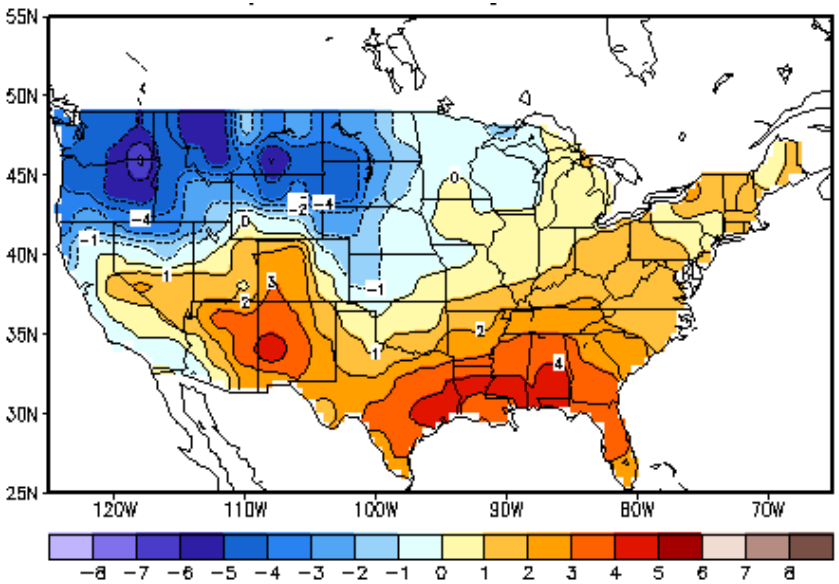
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 14 January 2017

Percent of Average Precipitation



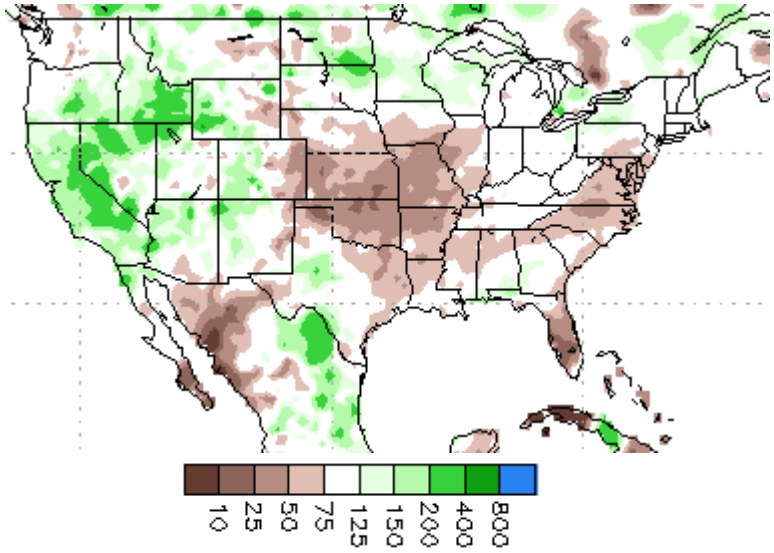
Temperature Departures (degree C)



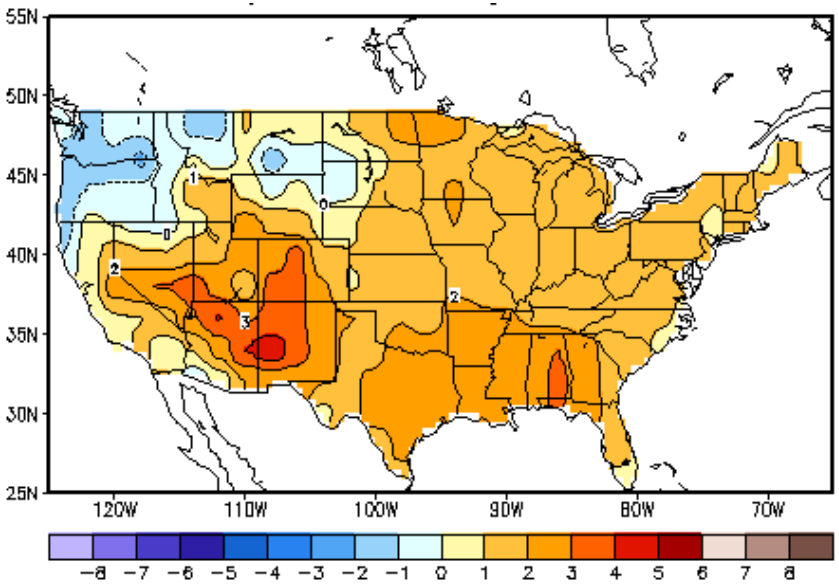
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 14 January 2017

Percent of Average Precipitation



Temperature Departures (degree C)

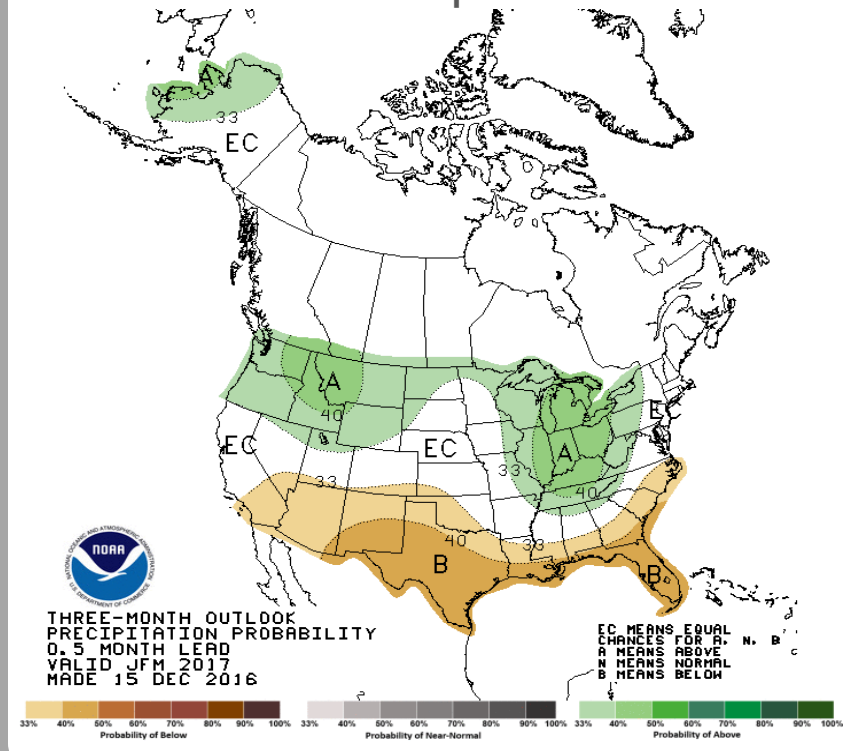


U. S. Seasonal Outlooks

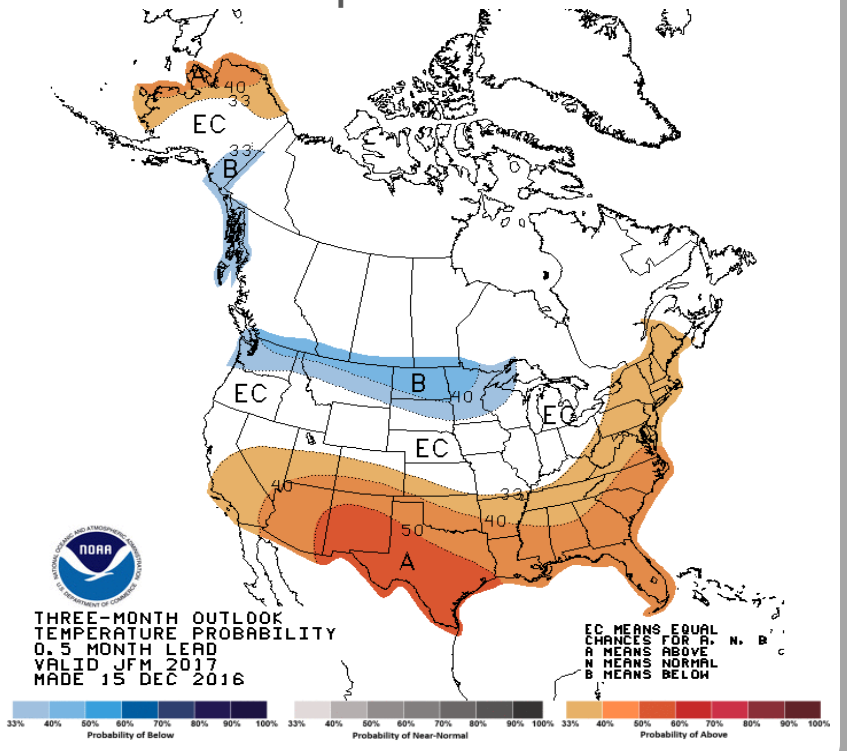
January - March 2017

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

Precipitation



Temperature



Summary

ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.*

Equatorial sea surface temperatures (SSTs) are near-to-below average in the central and eastern Pacific Ocean.

A transition to ENSO-neutral is expected to occur by February 2017, with ENSO-neutral then continuing through the first half of 2017. *

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