ENSO: Recent Evolution, Current Status and Predictions

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

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ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.*

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

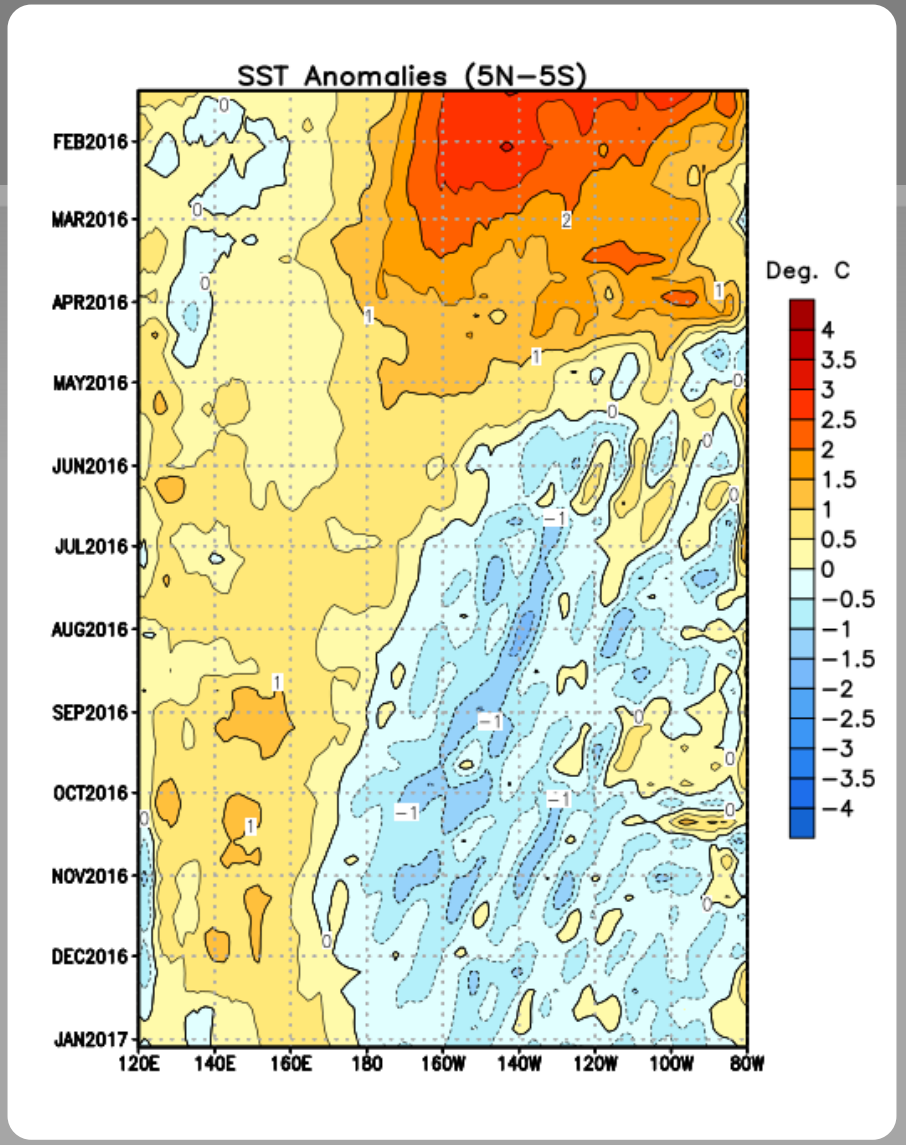
A transition to ENSO-neutral is favored during January-March 2017. *

*** 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 (ºC)

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

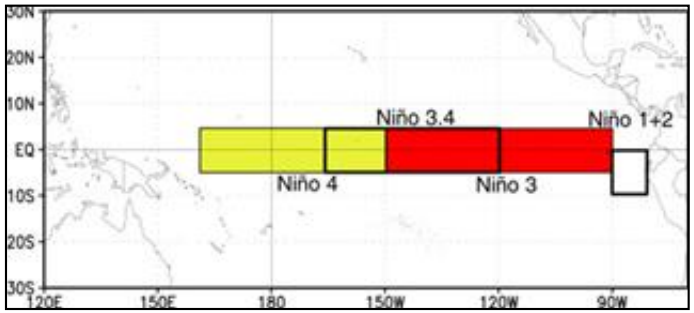
Since July 2016, negative SST anomalies have persisted in the central and eastern Pacific.

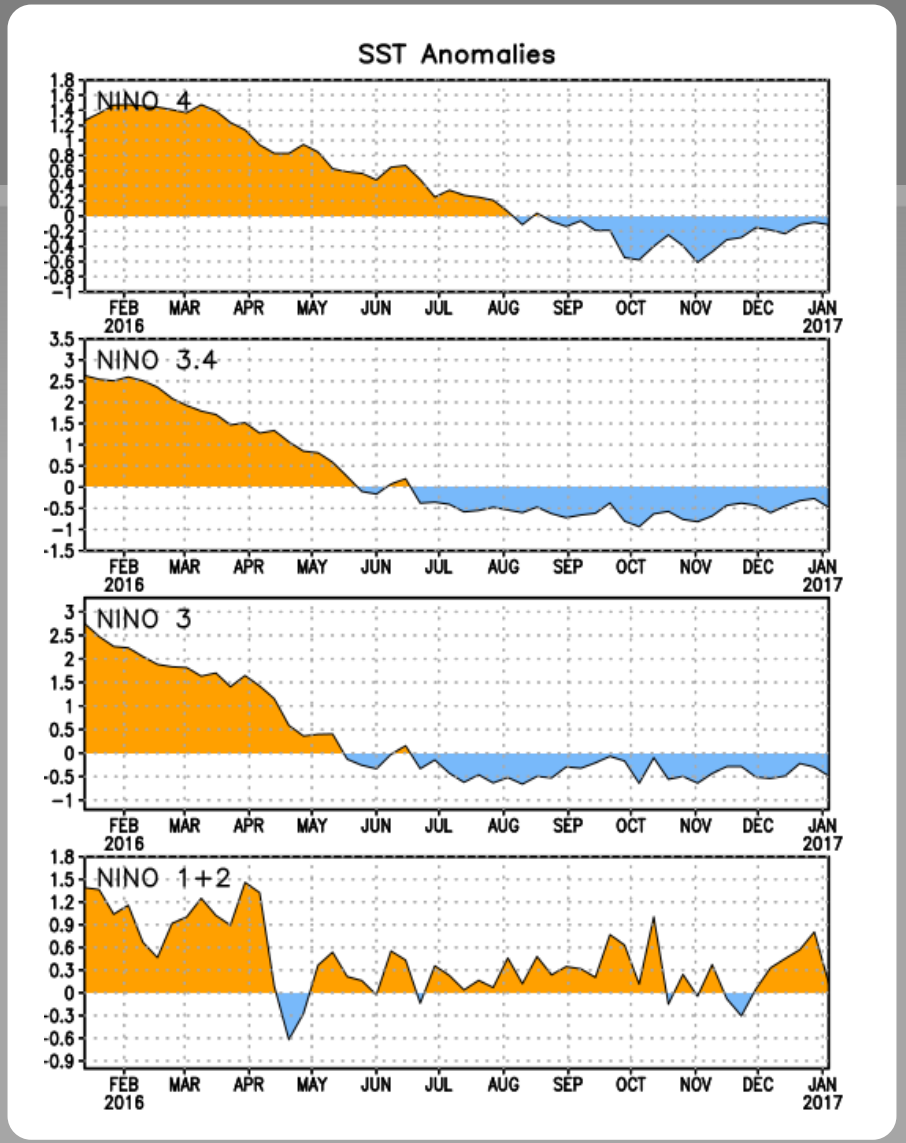


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

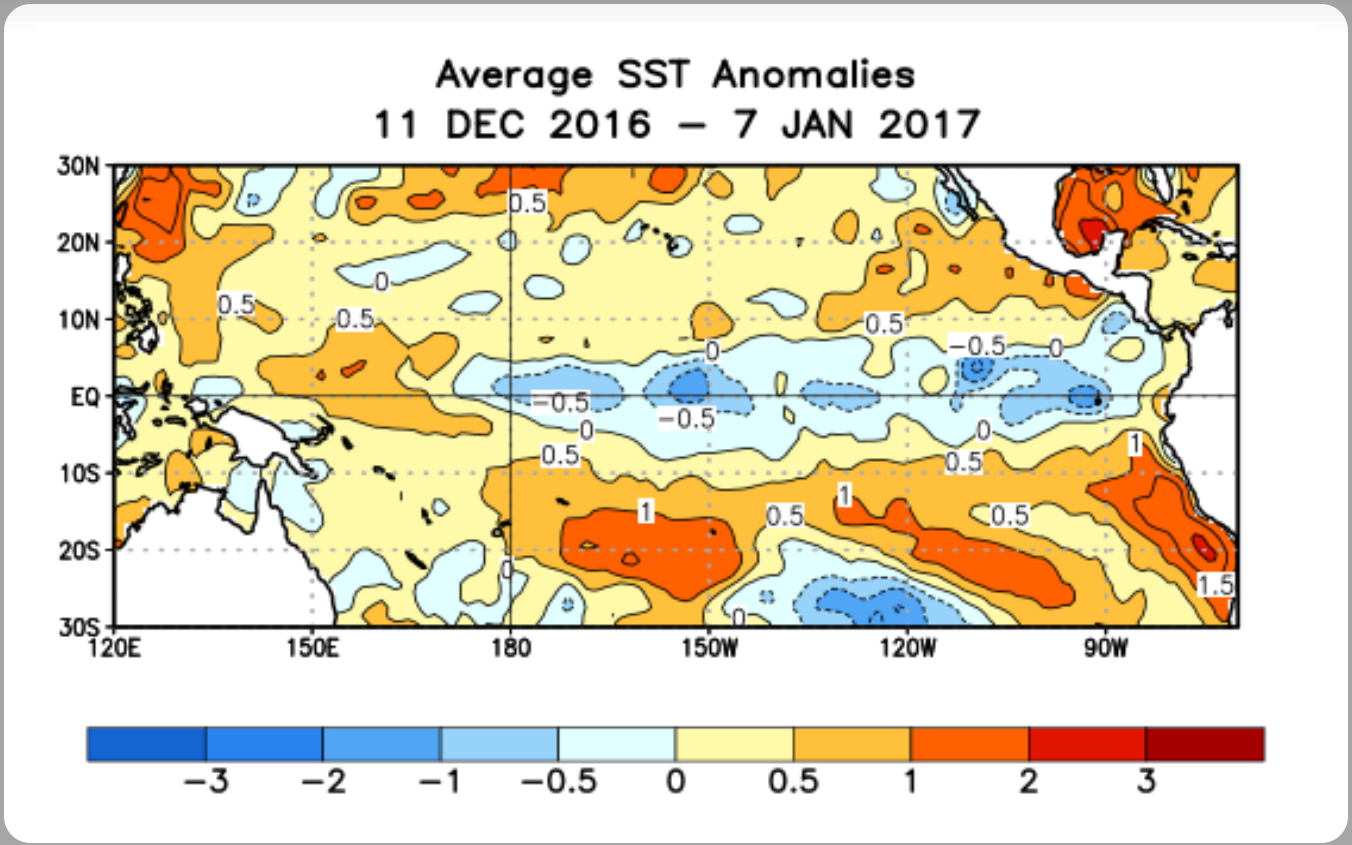
Niño 4	-0.1ºC
Niño 3.4	-0.5ºC
Niño 3	-0.5ºC
Niño 1+2	0.1ºC





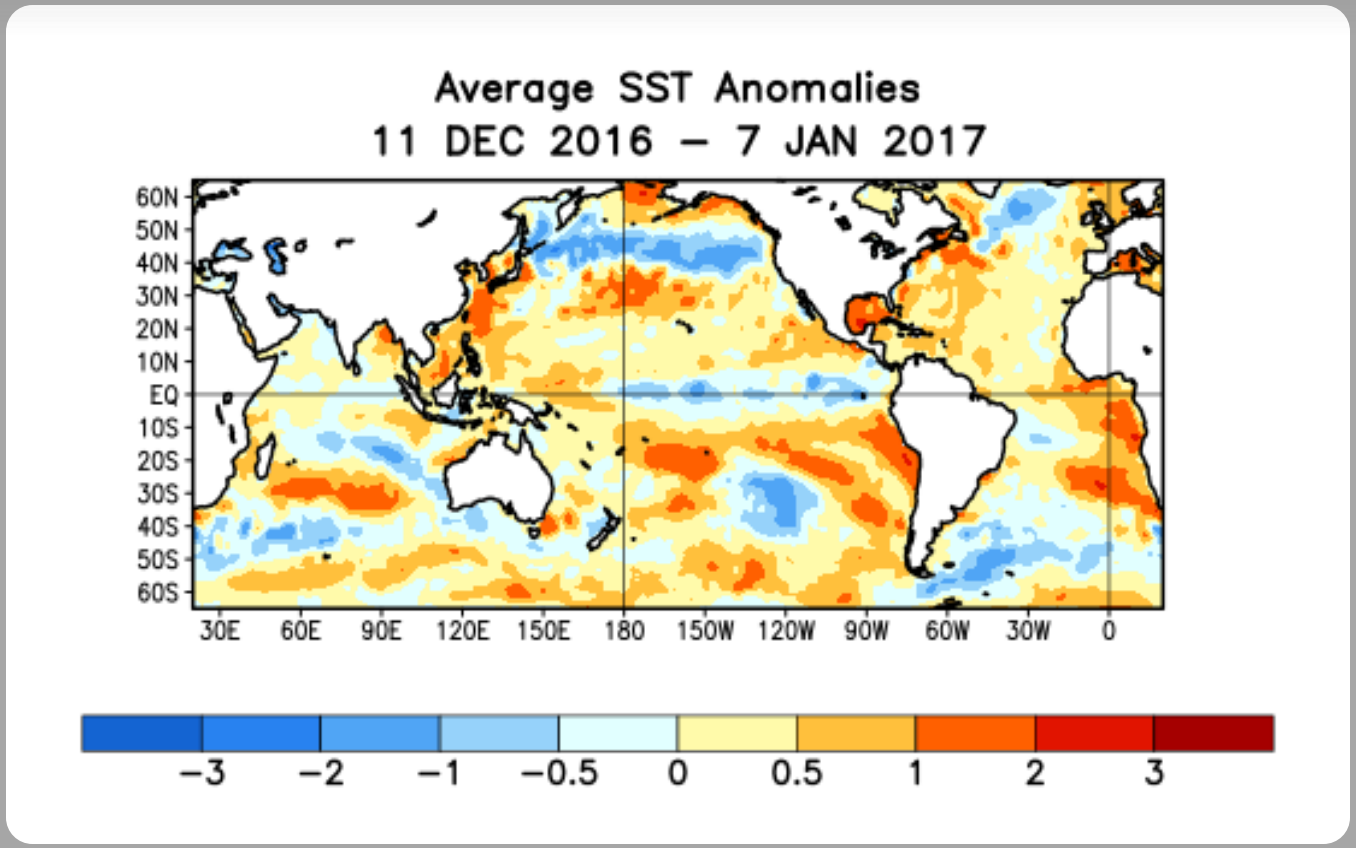
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were below average across much of the central and eastern Pacific Ocean.



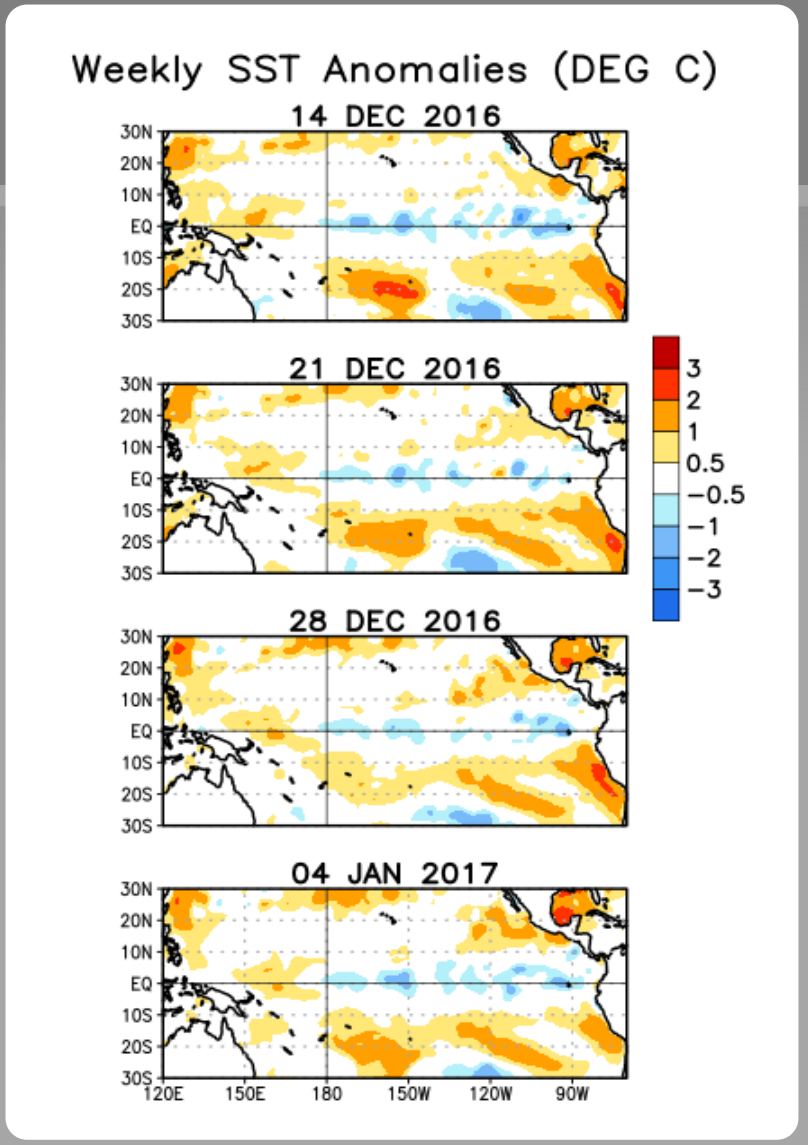
Global SST Departures (°C) During the Last Four Weeks

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



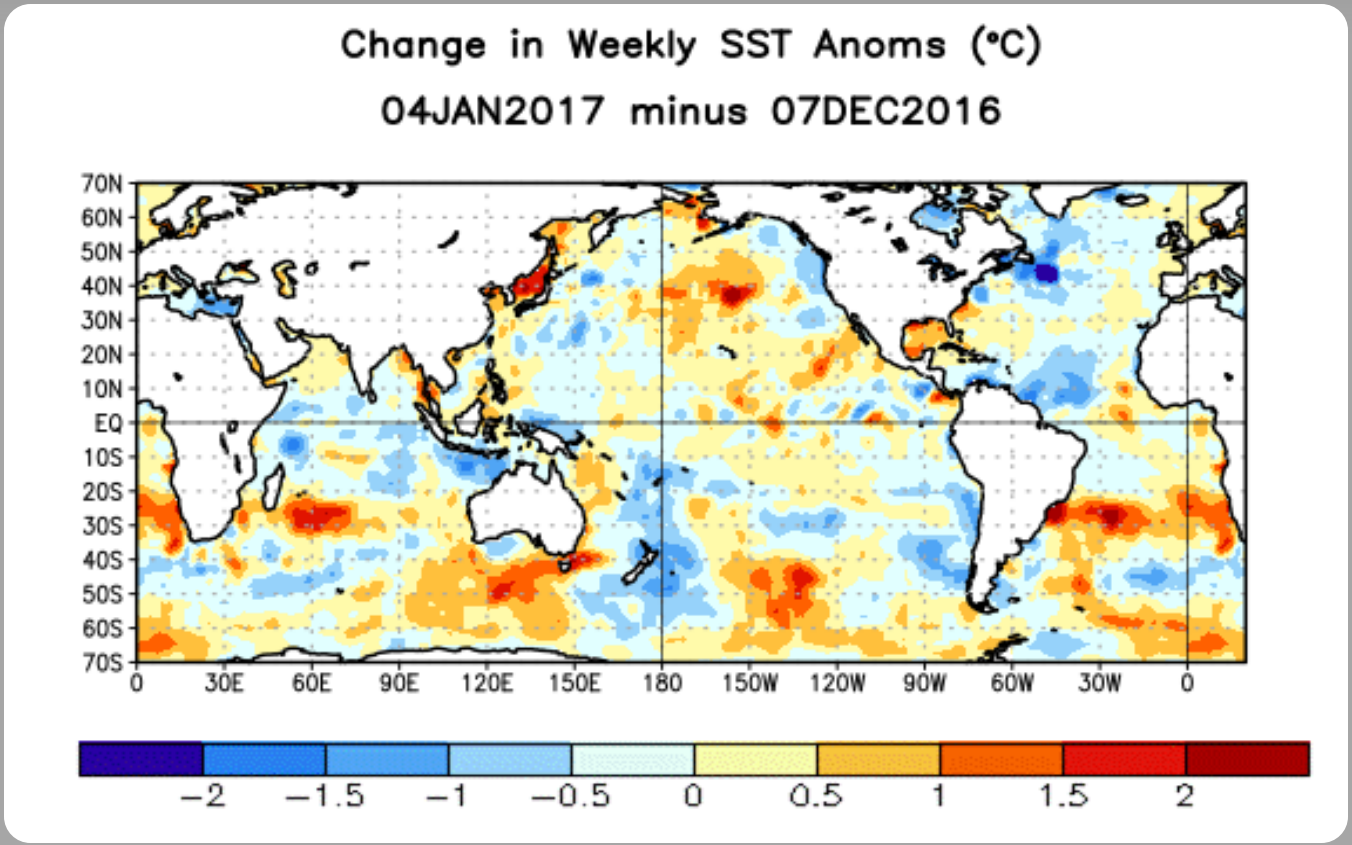
Weekly SST Departures during the Last Four Weeks

During the last four weeks, negative SST anomalies have mostly weakened across the central and eastern equatorial Pacific Ocean.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, changes in equatorial SST anomalies occurred across small areas of the central and eastern Pacific.



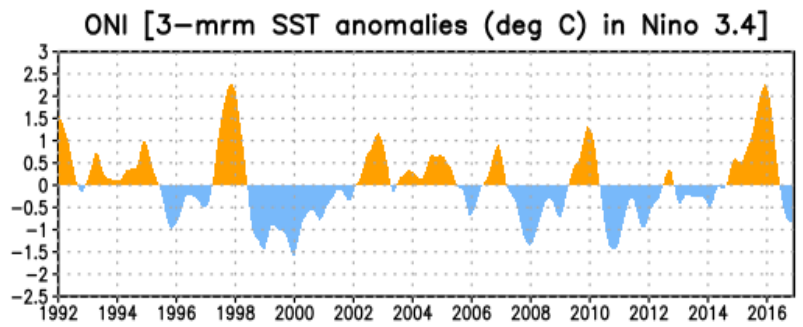
Upper-Ocean Conditions in the Equatorial Pacific

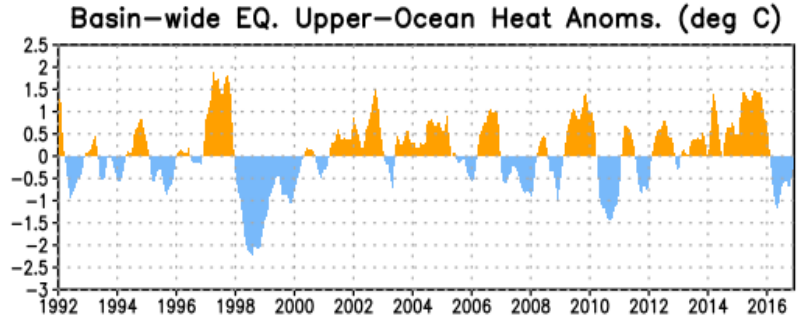
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

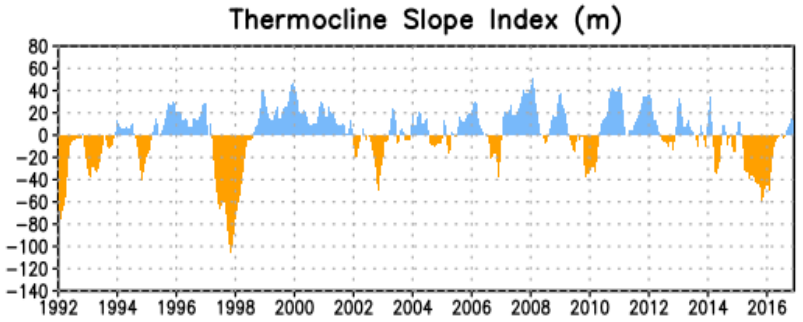
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (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).

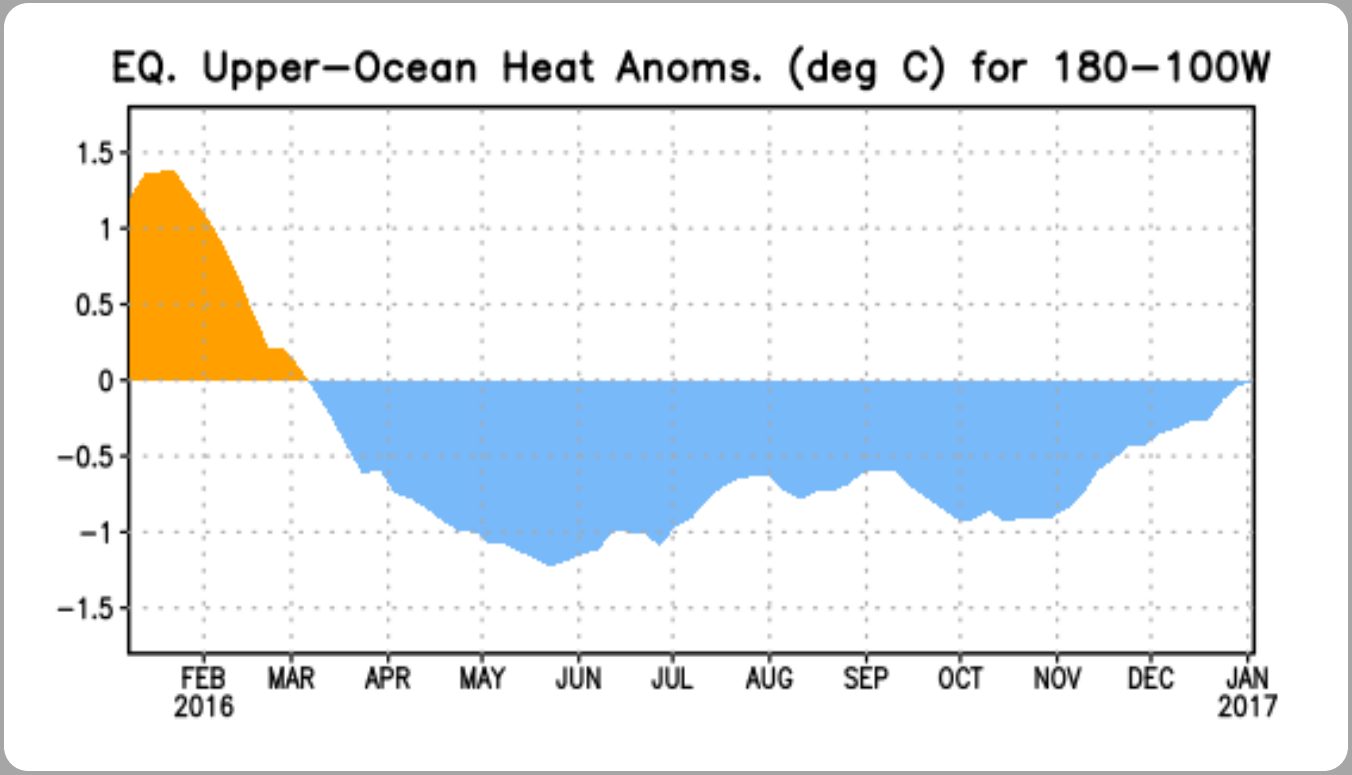






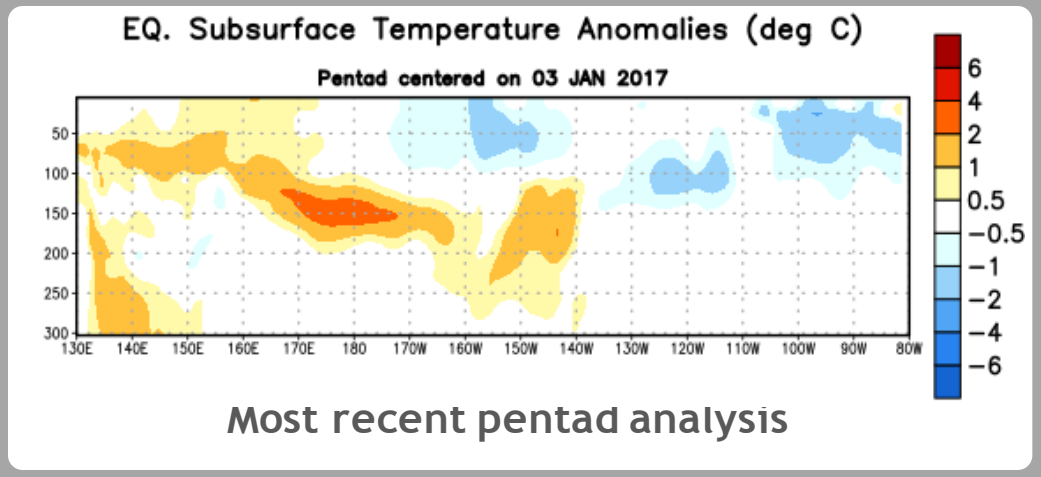
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies have been present since March. Since early November the negative anomalies have weakened and have recently returned to near zero.



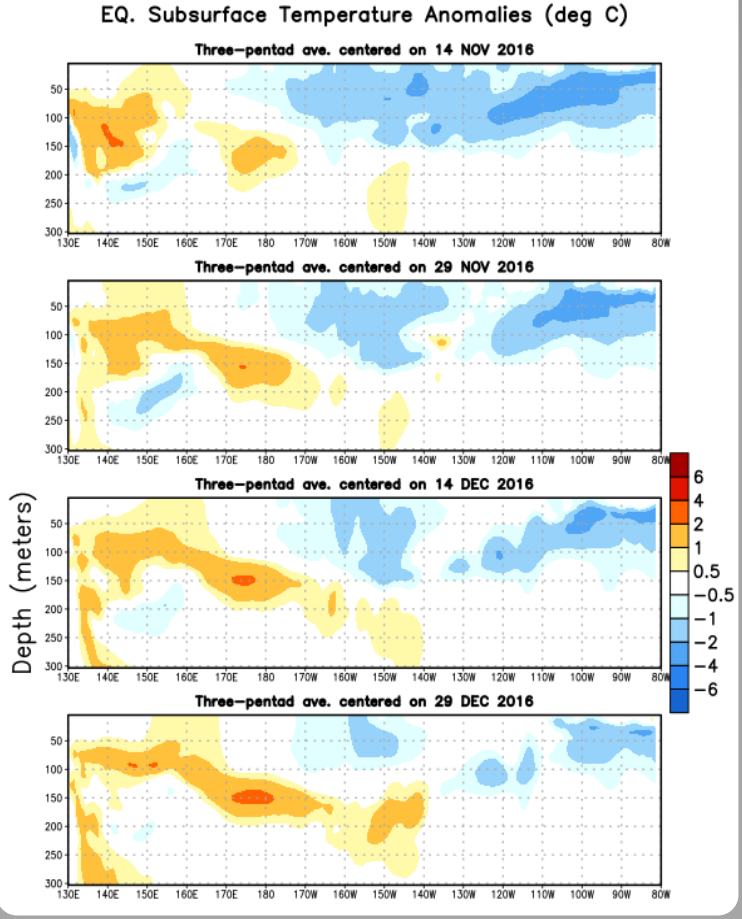
Sub-Surface Temperature Departures in the Equatorial Pacific

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.

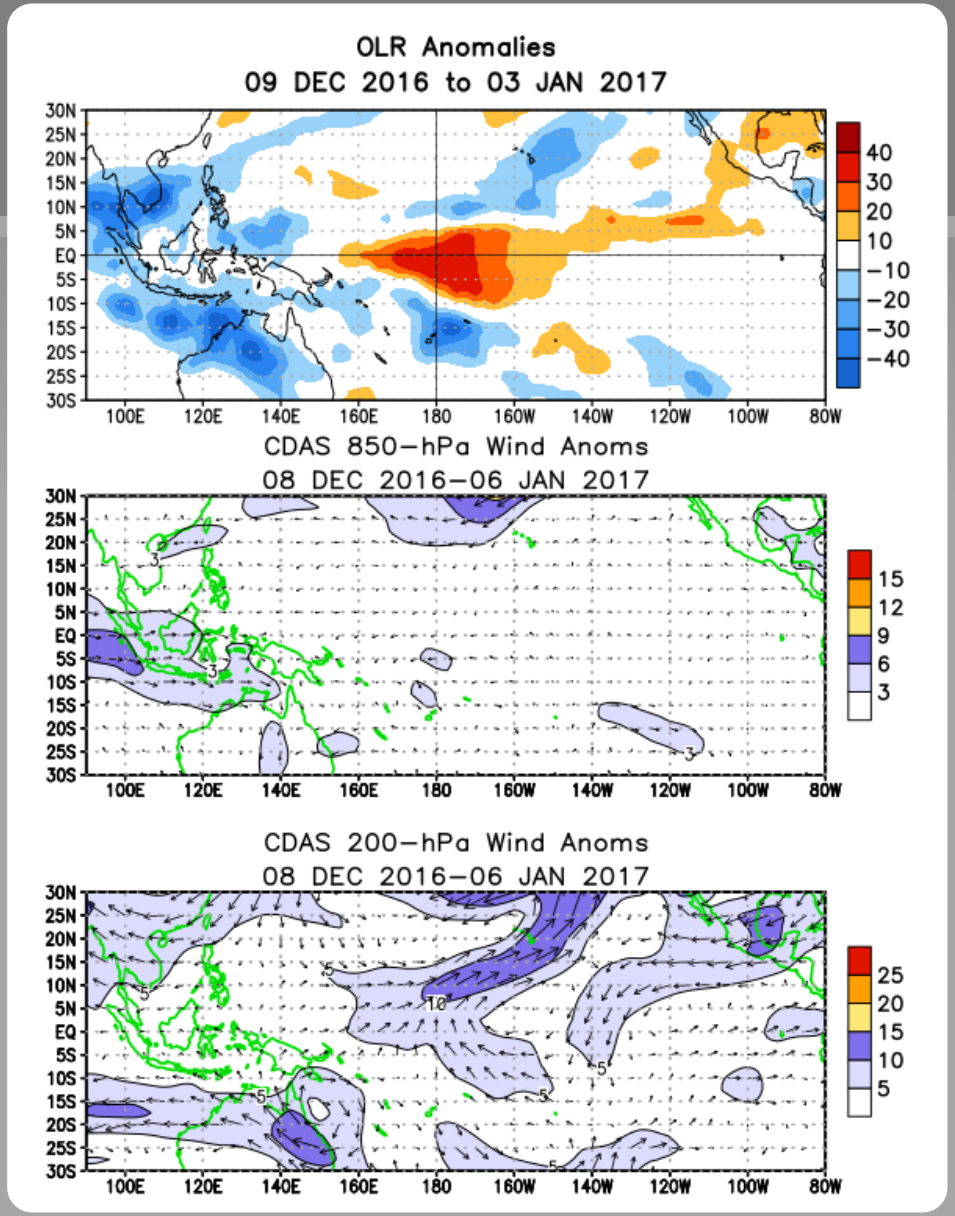


Tropical OLR and Wind Anomalies During the Last 30 Days

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

Low-level (850-hPa) winds were near average over most of the equatorial Pacific.

Upper-level (200-hPa) westerly wind anomalies were observed over the far eastern equatorial Pacific, along with cross-equatorial flow near the Date Line.



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.

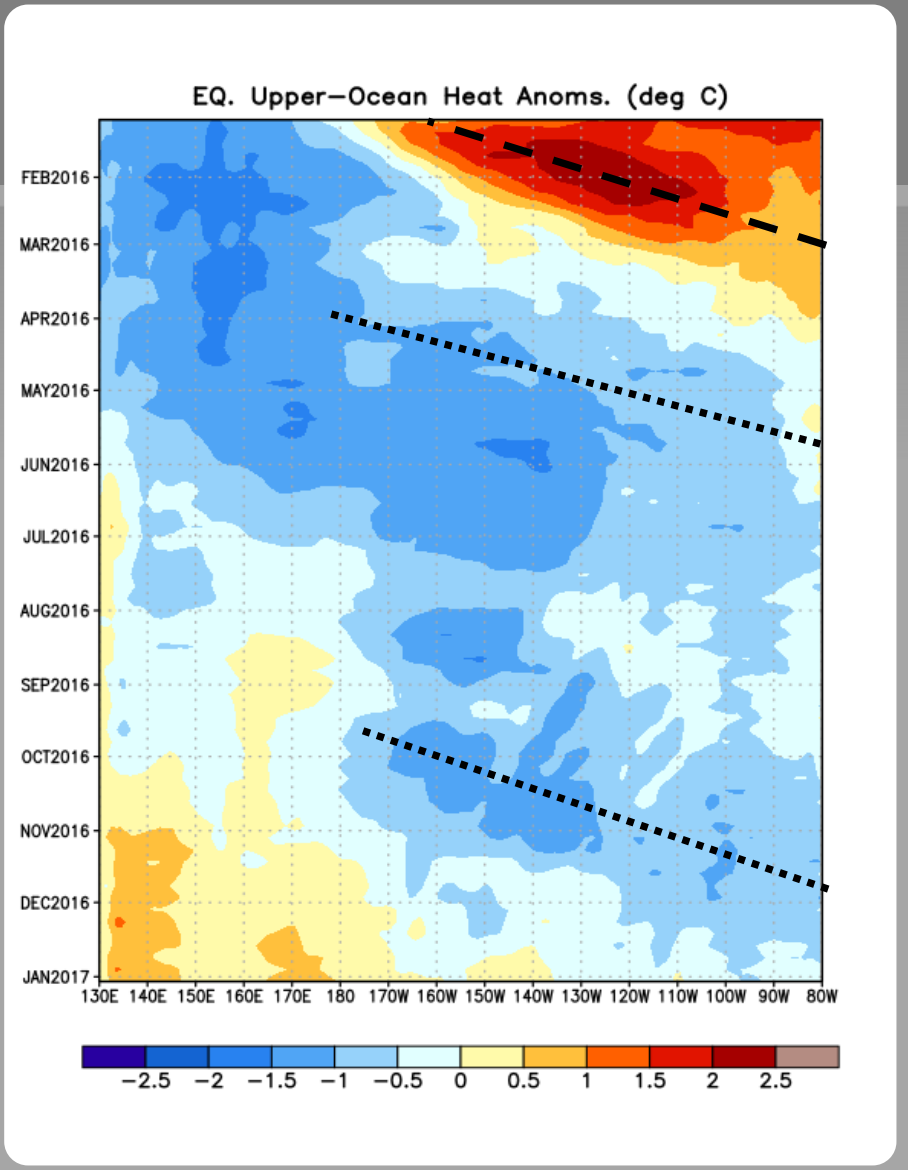
Weekly Heat Content Evolution in the Equatorial Pacific

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 November 2016, the subsurface temperature anomalies have gradually weakened.

Recently, positive subsurface temperature anomalies have expanded eastward to the east-central Pacific.



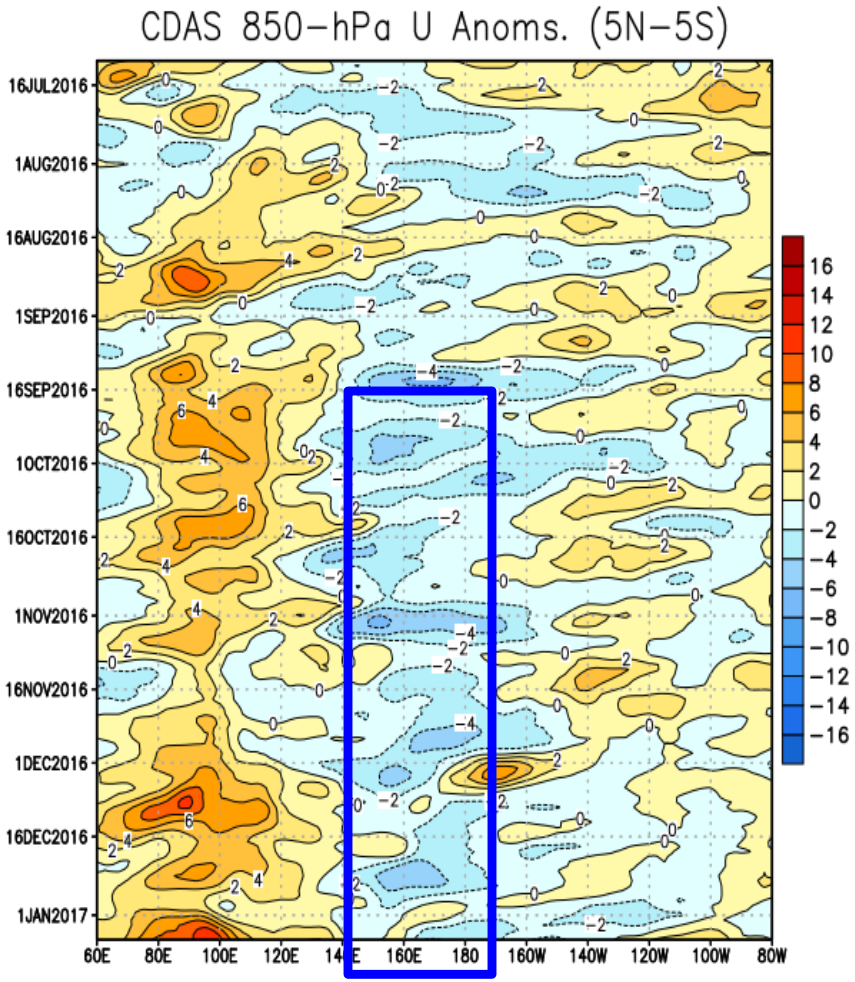
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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.

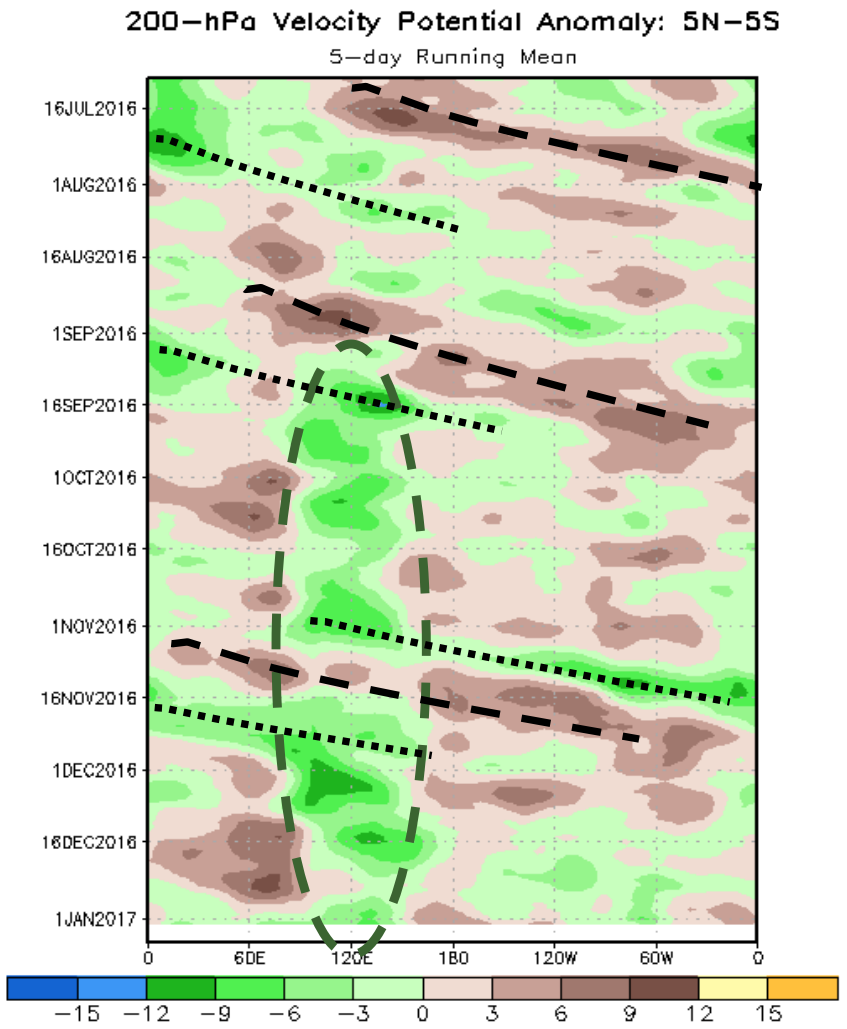


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

Eastward propagation of regions of upper-level divergence (green shading) and convergence (brown shading) are particularly evident from July through early August 2016, 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)

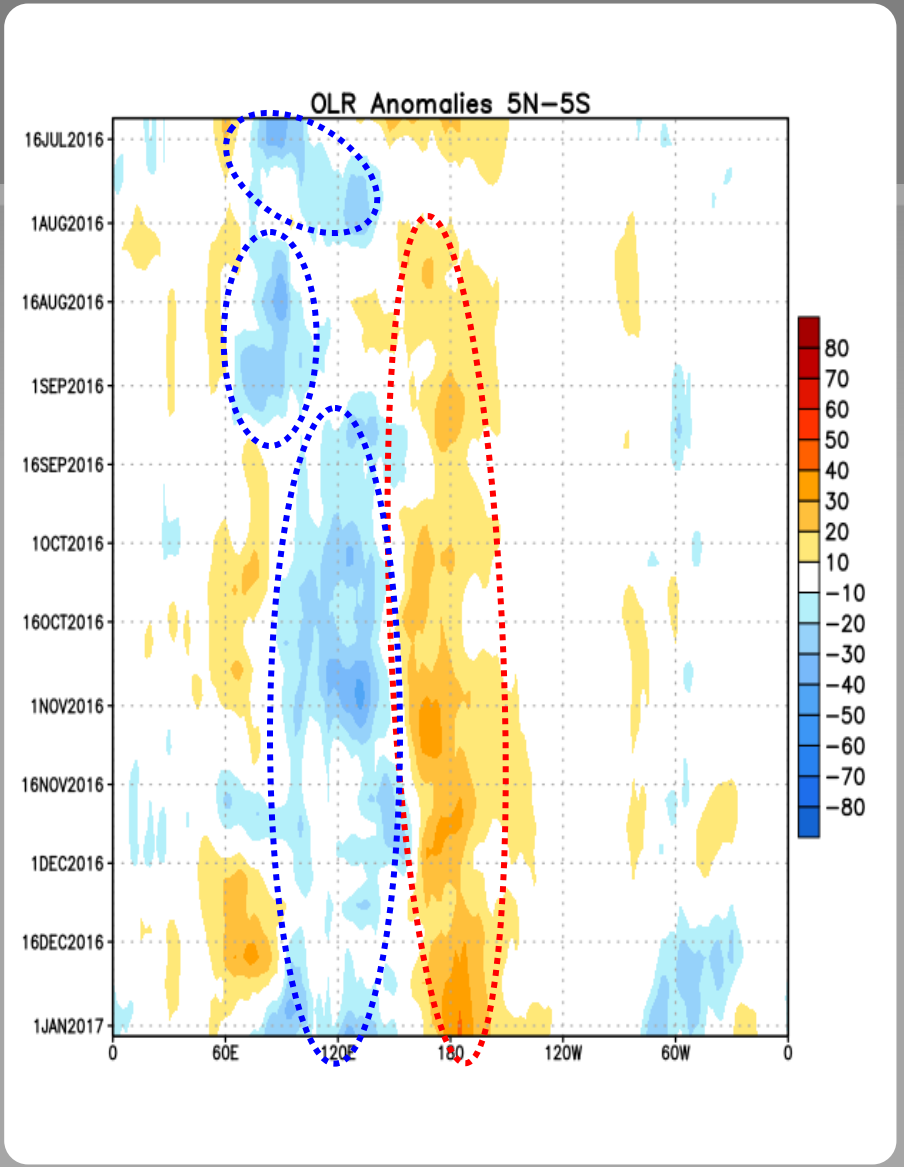
Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

During July 2016, eastward shifting OLR anomalies prevailed over the Indian Ocean and extended into the central Pacific Ocean.

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.

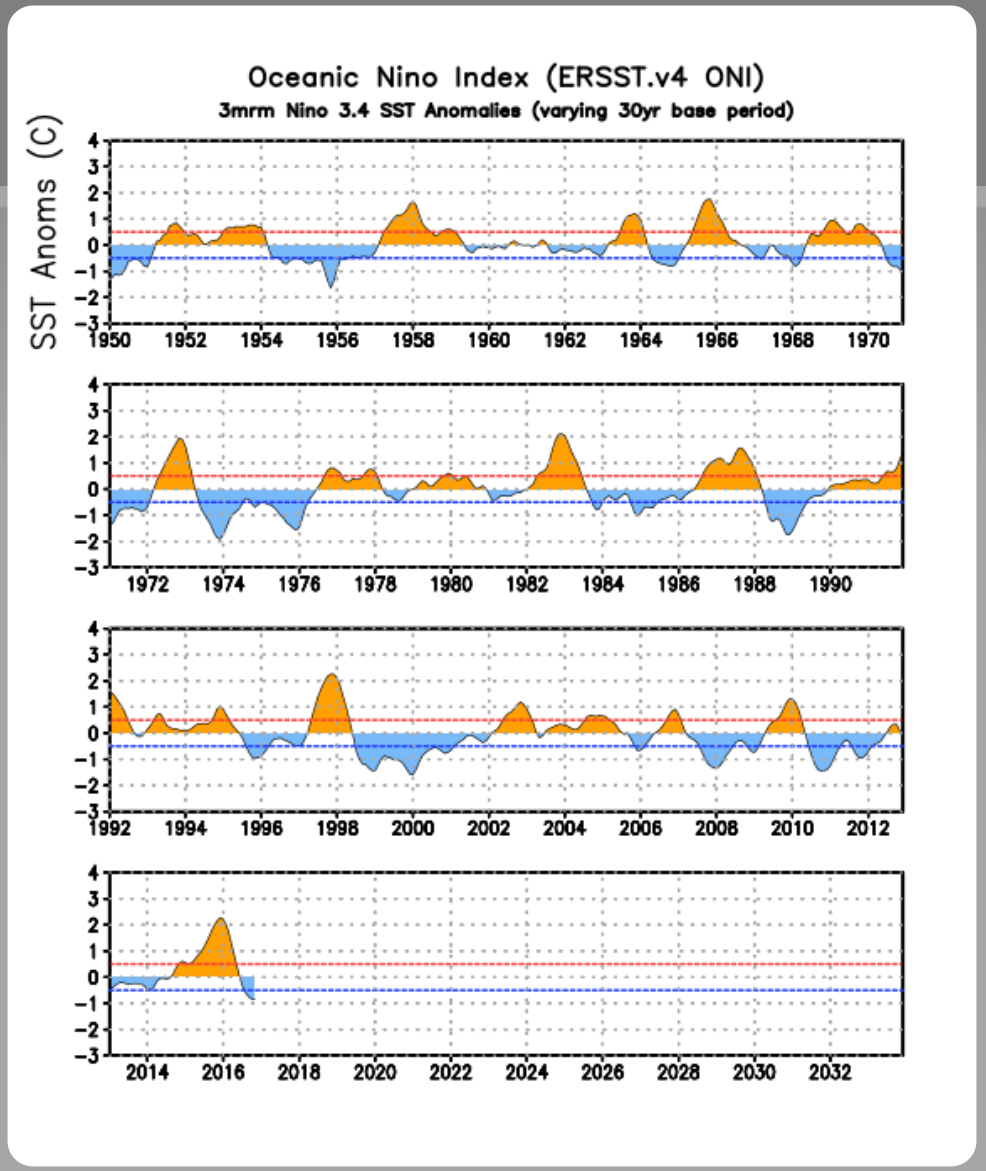
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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.

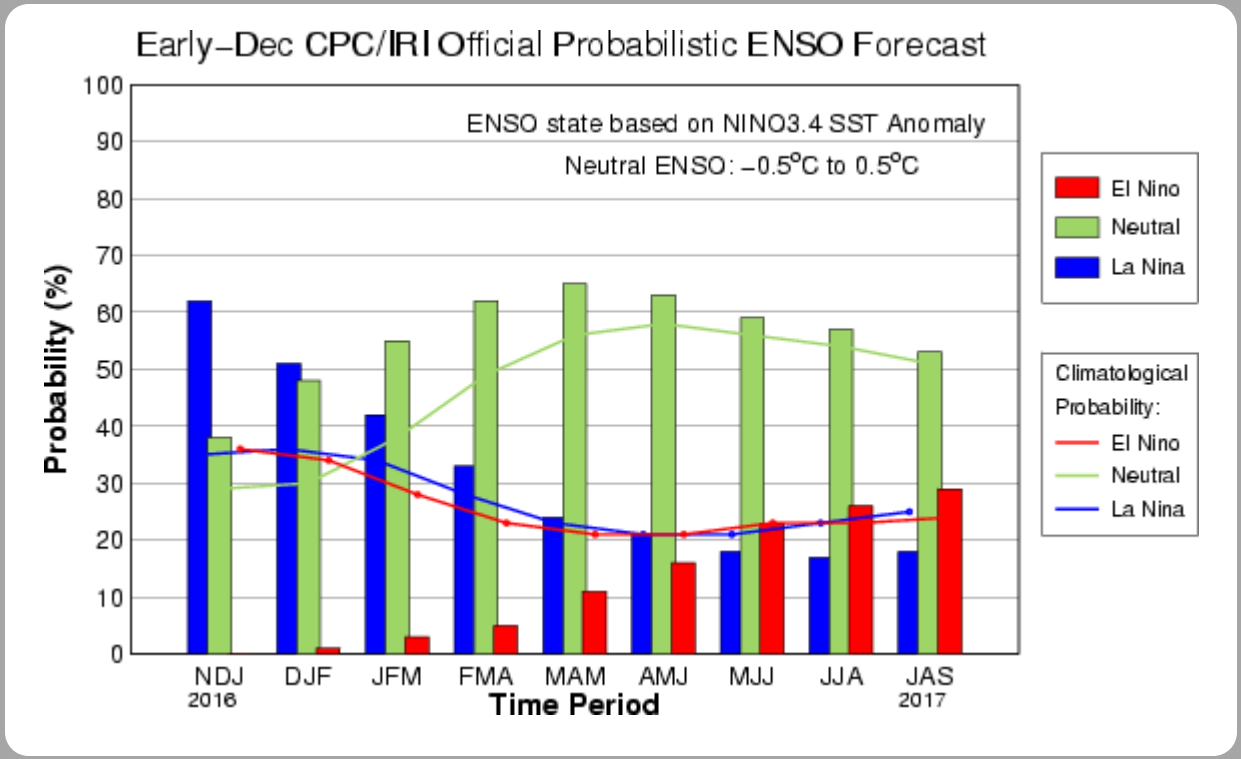
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

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: 8 December 2016

La Niña is slightly favored to persist (~50% chance) during the winter 2016-17. A transition to ENSO-neutral is favored during January-March 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.

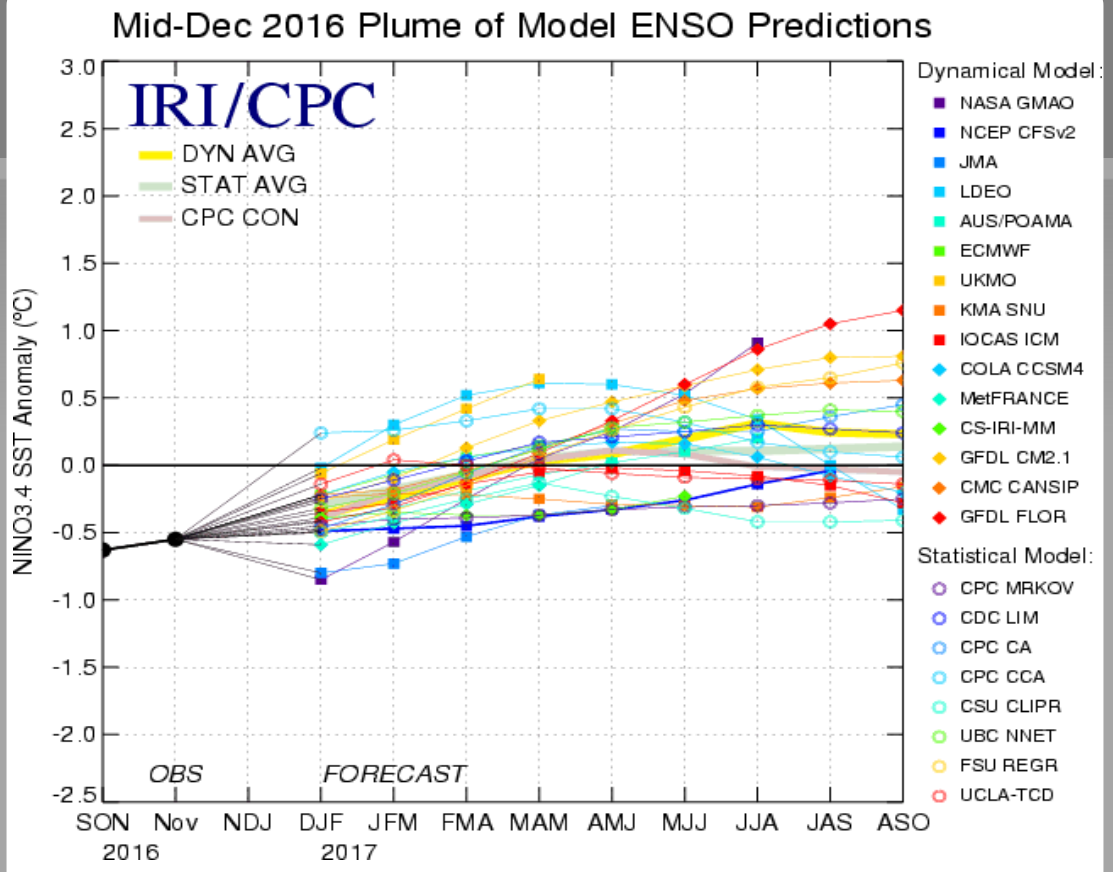
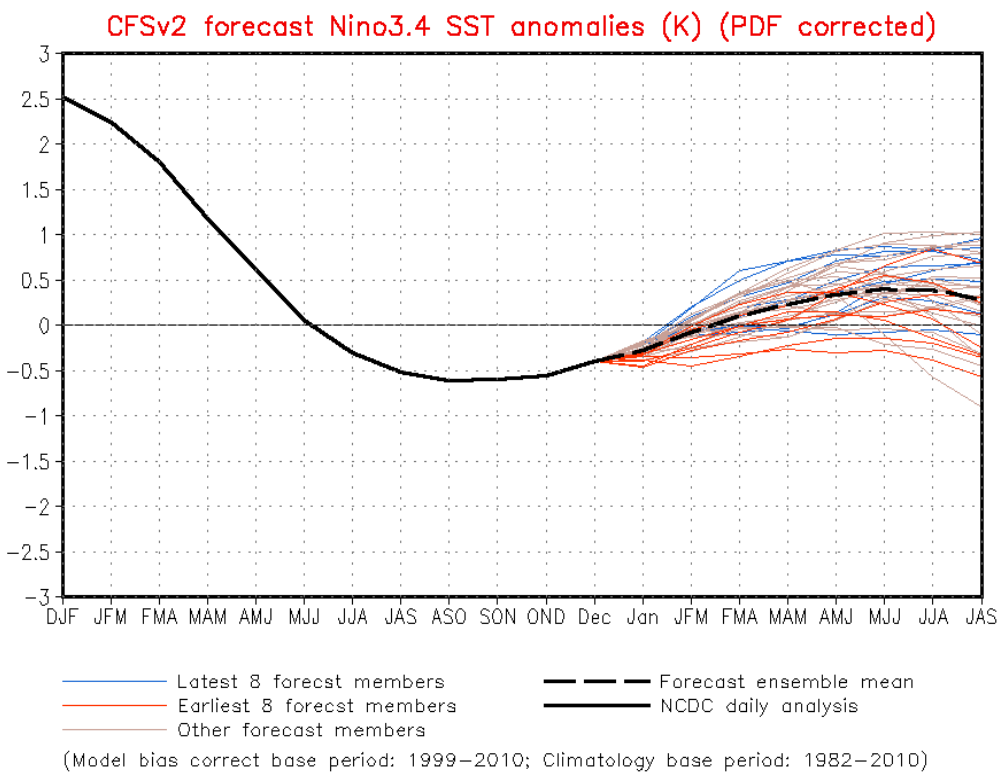


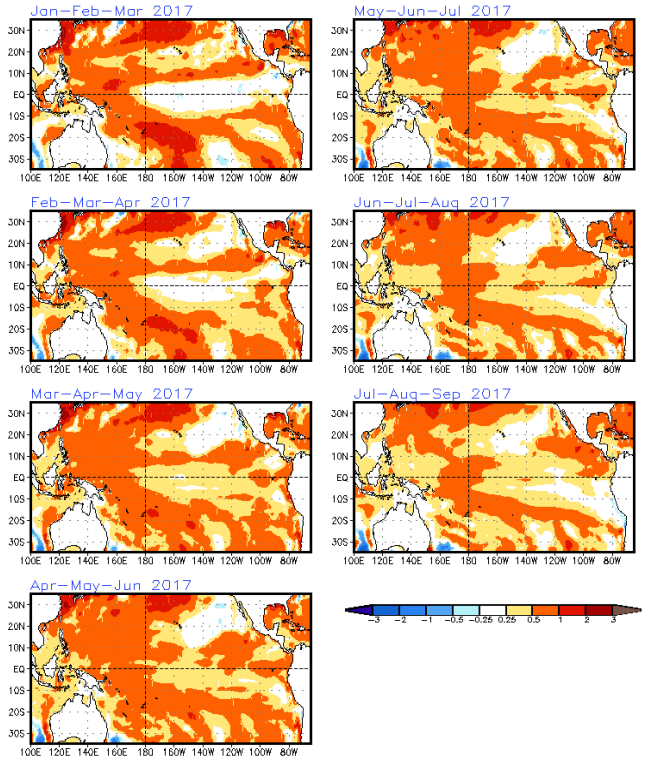
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 December 2016).

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

Issued: 30 December 2016

The CFS.v2 ensemble mean (black dashed line) favors ENSO-neutral conditions through mid-2017.

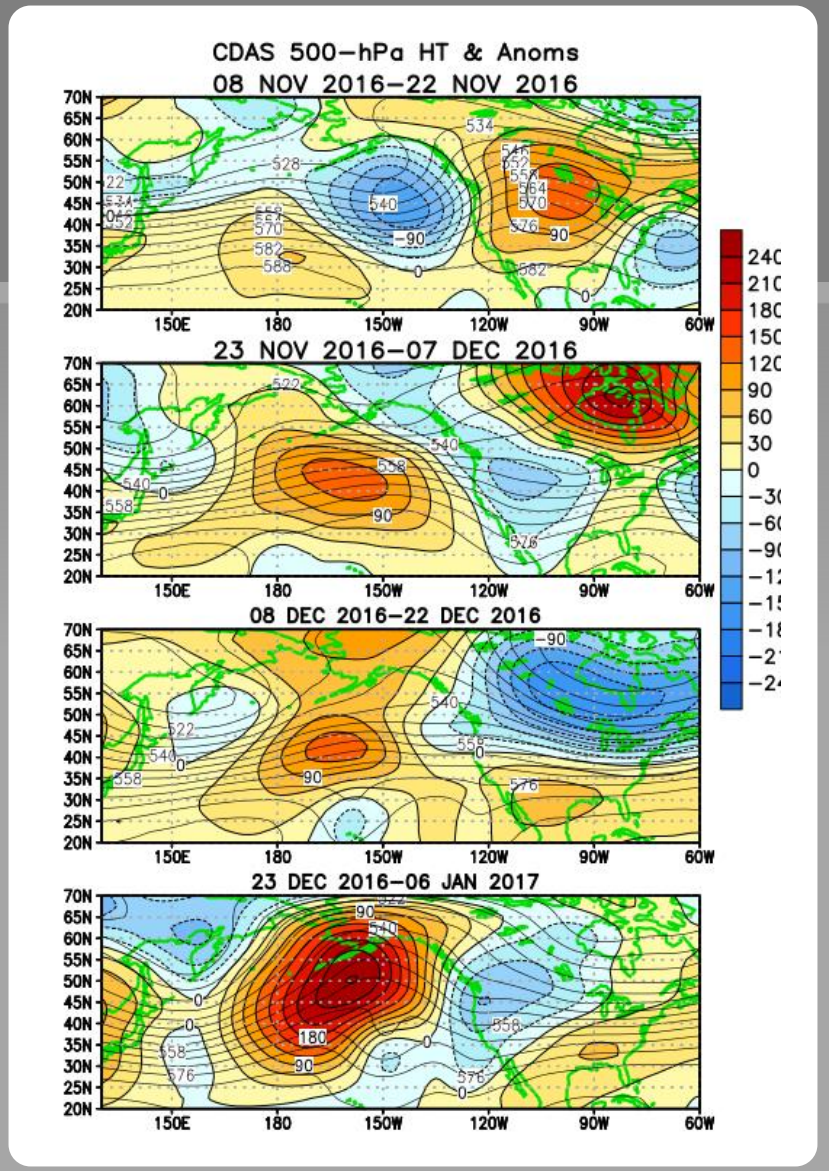




Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During mid November, above-average heights and temperatures prevailed over much of North America, and below-average heights were present over the Gulf of Alaska.

By December, above-average heights were observed over the Gulf of Alaska, with below-average (above-average) heights and negative (positive) temperature anomalies spanning the north-northwestern (south-southeastern) tier of the United States.



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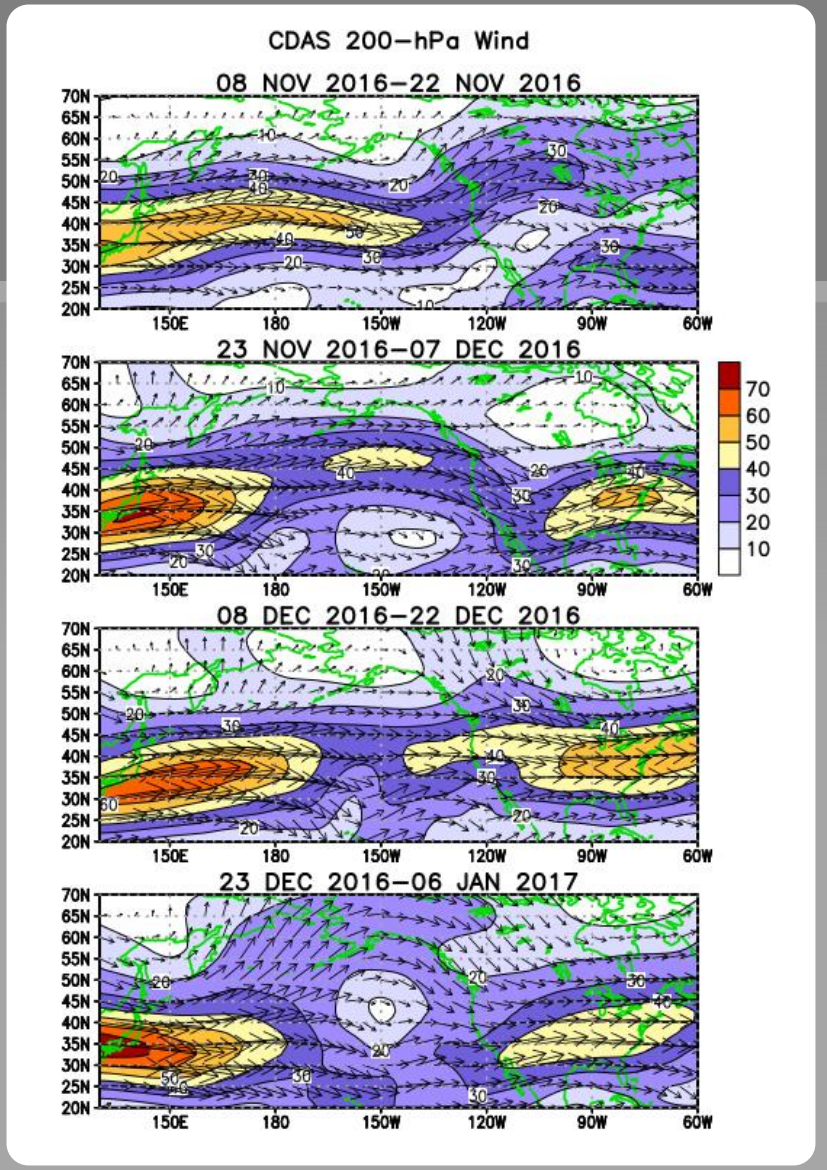

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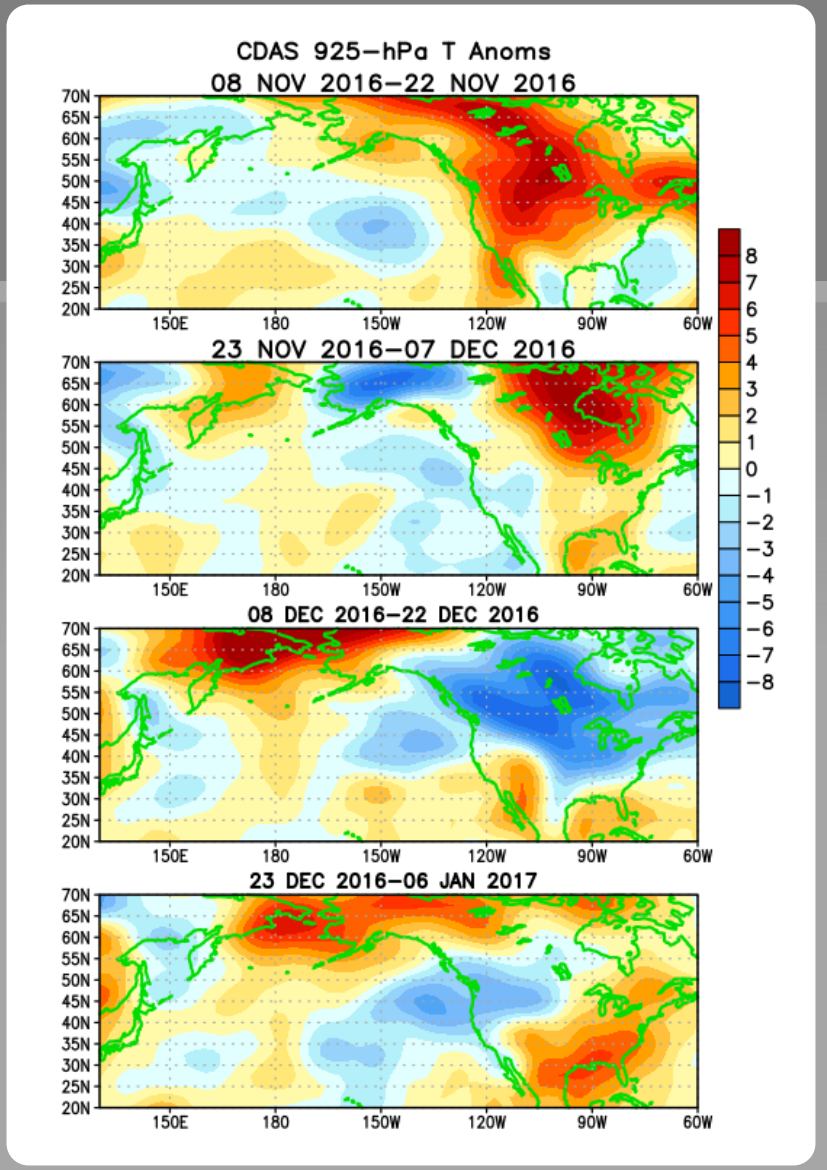
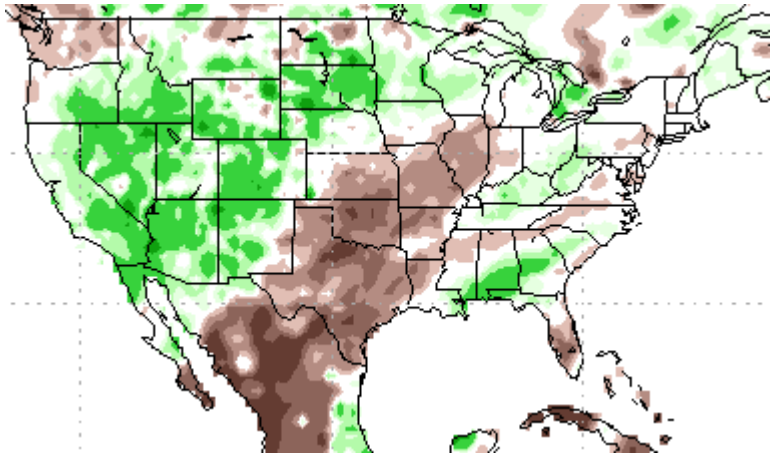


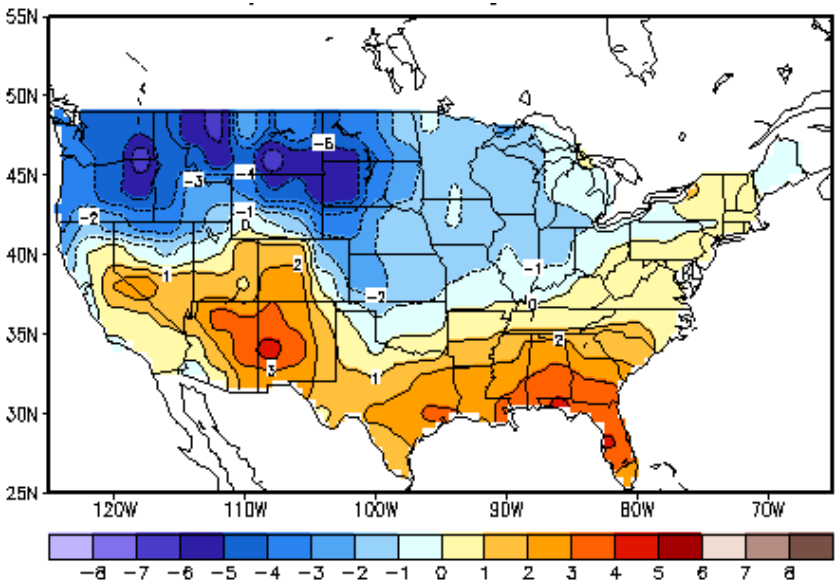
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 7 December 2017

Percent of Average Precipitation



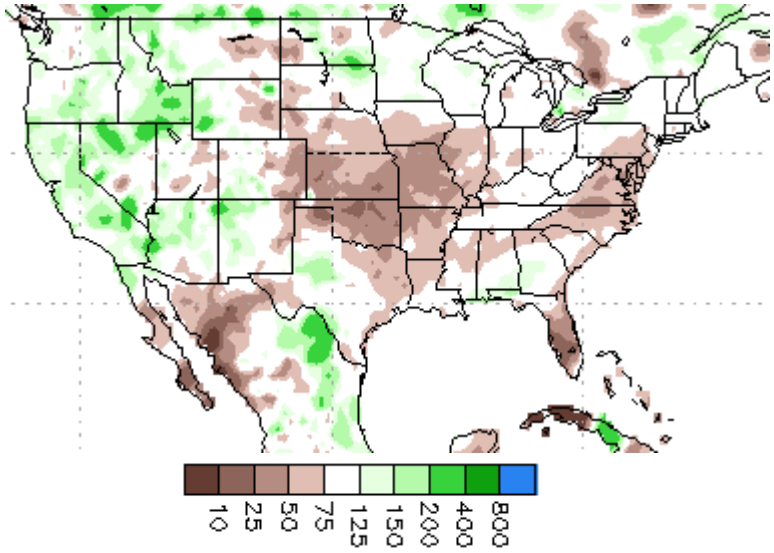
Temperature Departures (degree C)



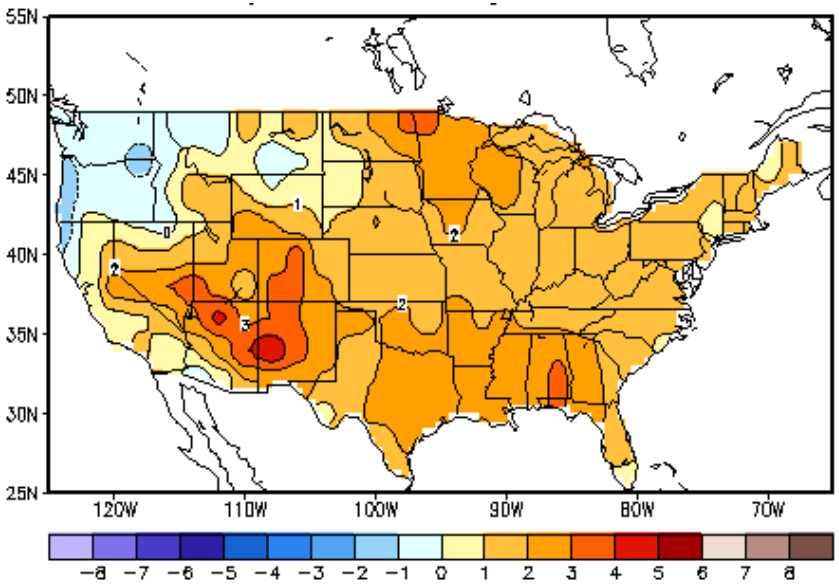
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 7 December 2017

Percent of Average Precipitation



Temperature Departures (degree C)

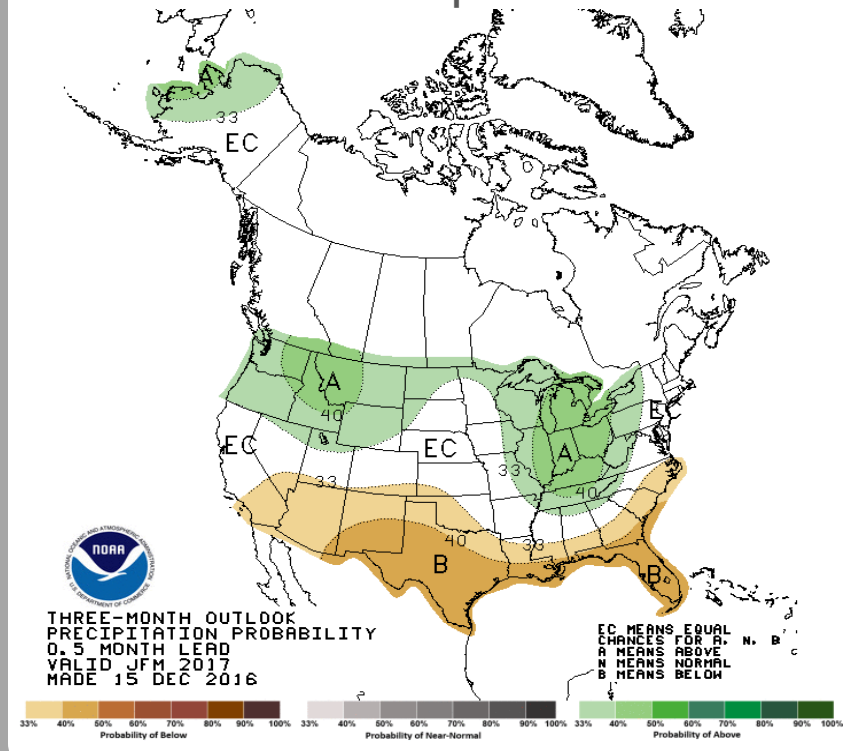


U. S. Seasonal Outlooks

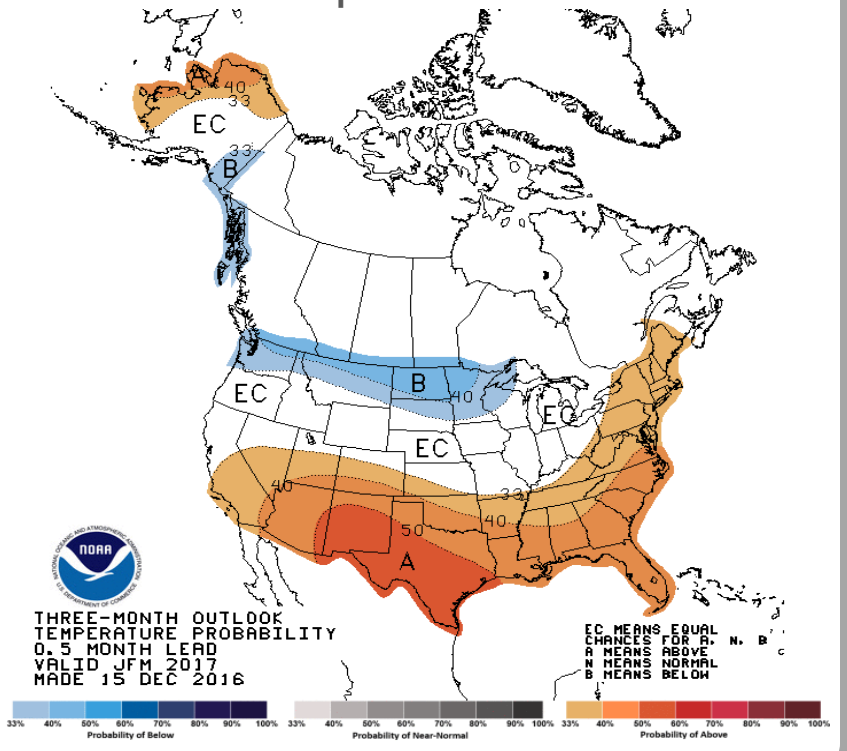
January - March 2017

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

Precipitation



Temperature



Summary

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