

# ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:  
Climate Prediction Center / NCEP  
2 January 2018

# Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

U.S. Seasonal Precipitation and Temperature Outlooks

Summary

# Summary

## ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.\*

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

La Niña is likely (exceeding ~80%) through the Northern Hemisphere winter 2017-18, with a transition to ENSO-neutral most likely during the mid-to-late spring.\*

\* Note: These statements are updated once a month (2<sup>nd</sup> 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)

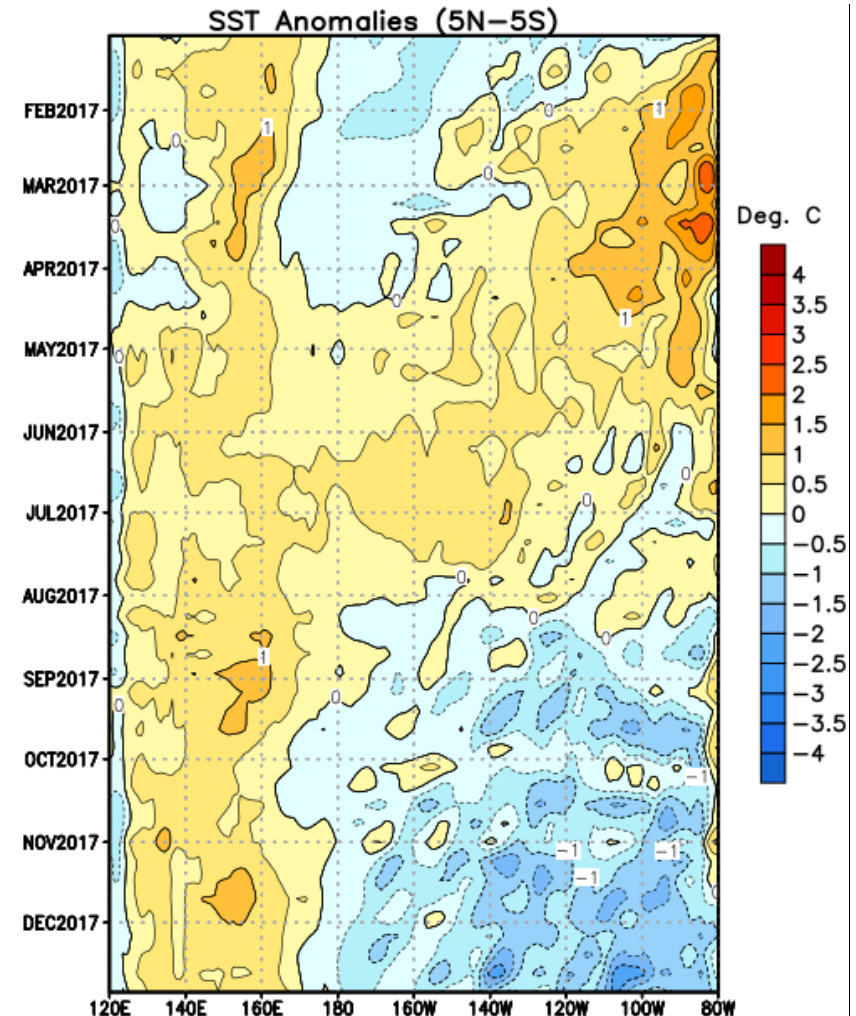
During January and February 2017, above-average SSTs expanded in the eastern Pacific Ocean.

From mid April to July 2017, near-to-above average SSTs spanned most of the equatorial Pacific.

During August 2017, above-average SSTs dissipated east of the date line.

Since September 2017, SSTs have been near-to-below average across the central and eastern Pacific Ocean.

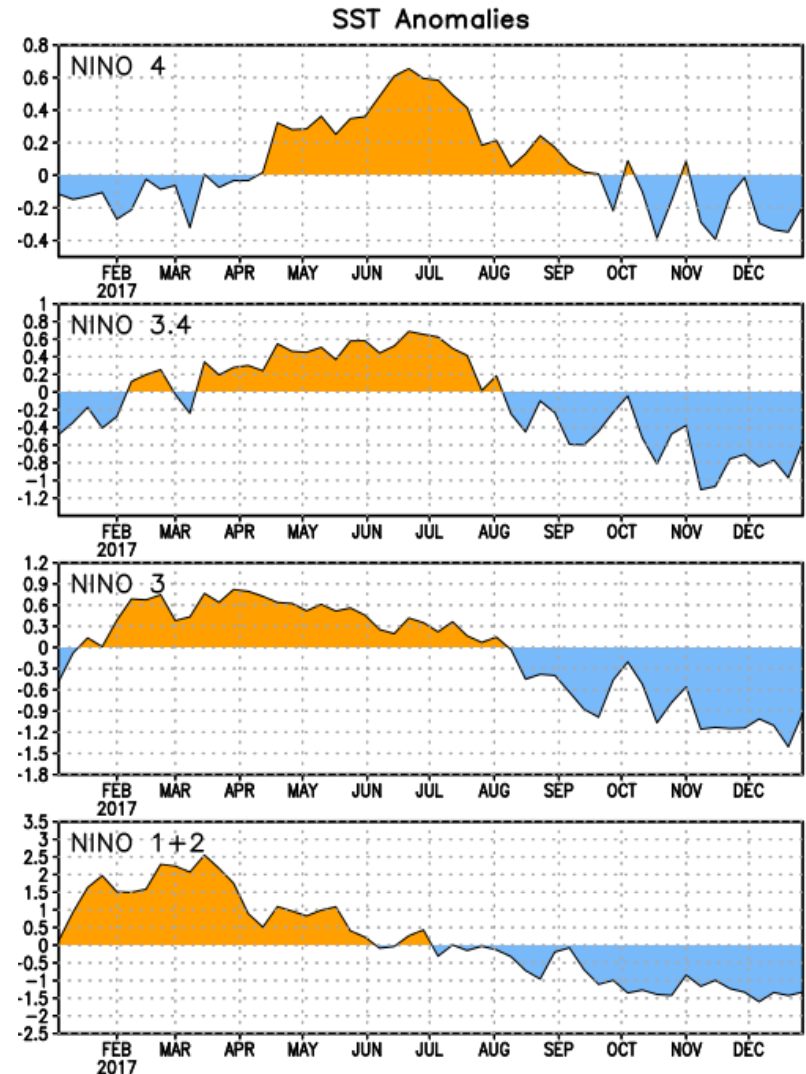
Negative SST anomalies have persisted in the central and eastern equatorial Pacific.



# Niño Region SST Departures (°C) Recent Evolution

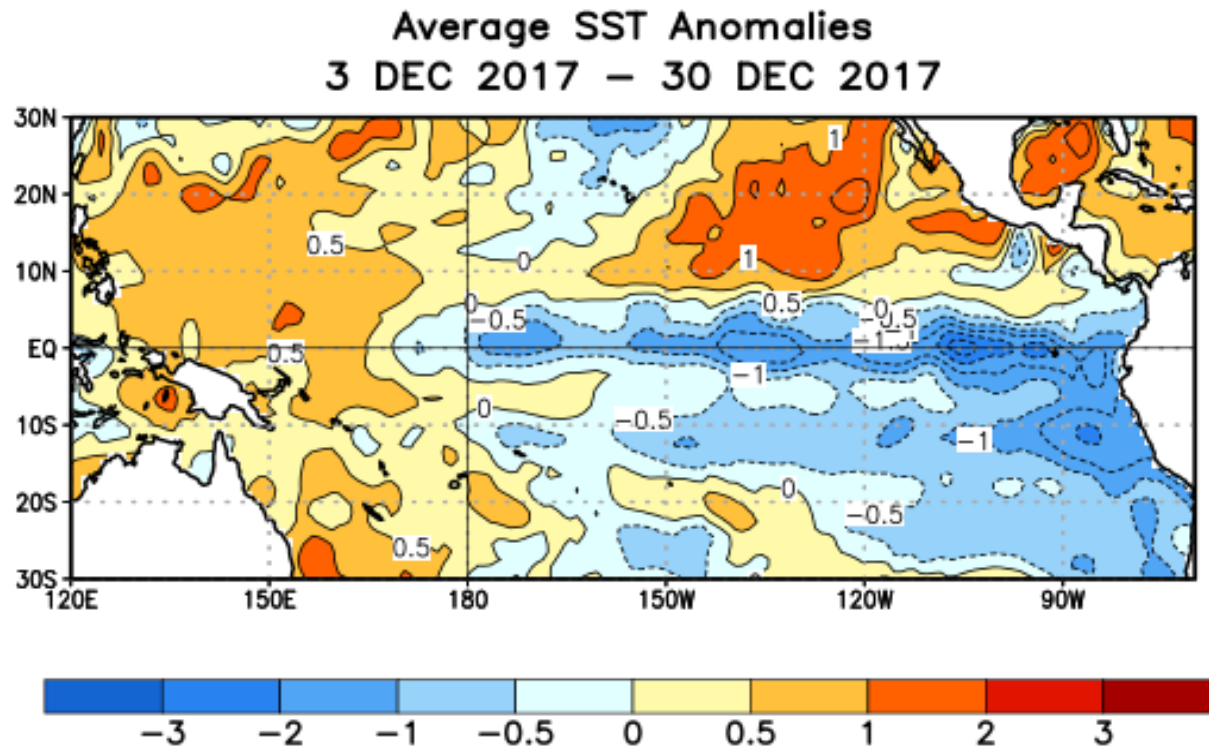
The latest weekly SST departures are:

Niño 4	-0.2°C
Niño 3.4	-0.6°C
Niño 3	-0.9°C
Niño 1+2	-1.3°C



# SST Departures ( $^{\circ}\text{C}$ ) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were below average across the central and eastern Pacific Ocean, and above average in the western Pacific.

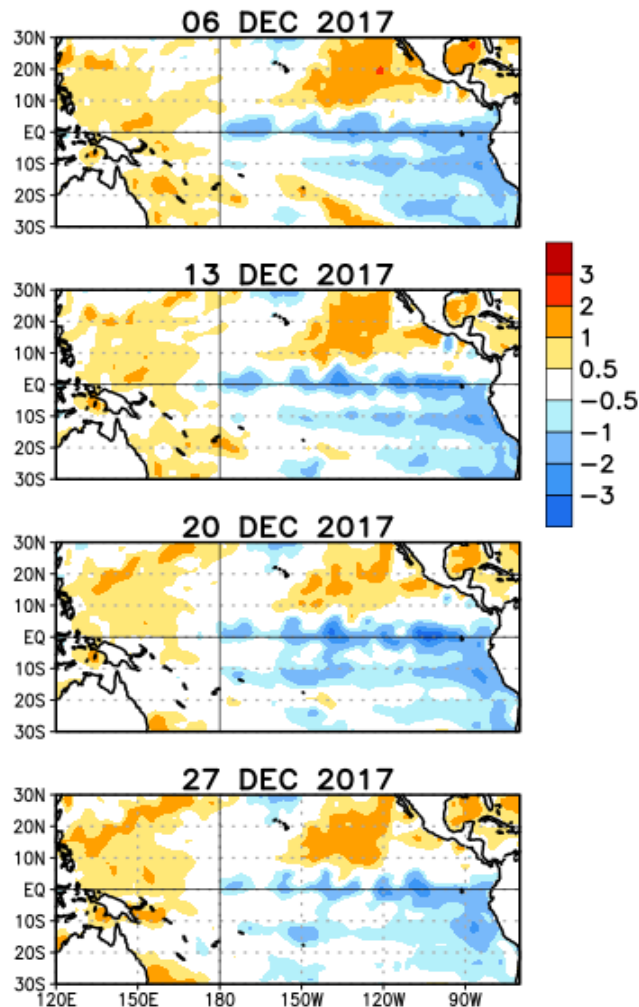




# Weekly SST Departures during the Last Four Weeks

During the last four weeks, below-average SSTs have persisted across the central and eastern Pacific Ocean.

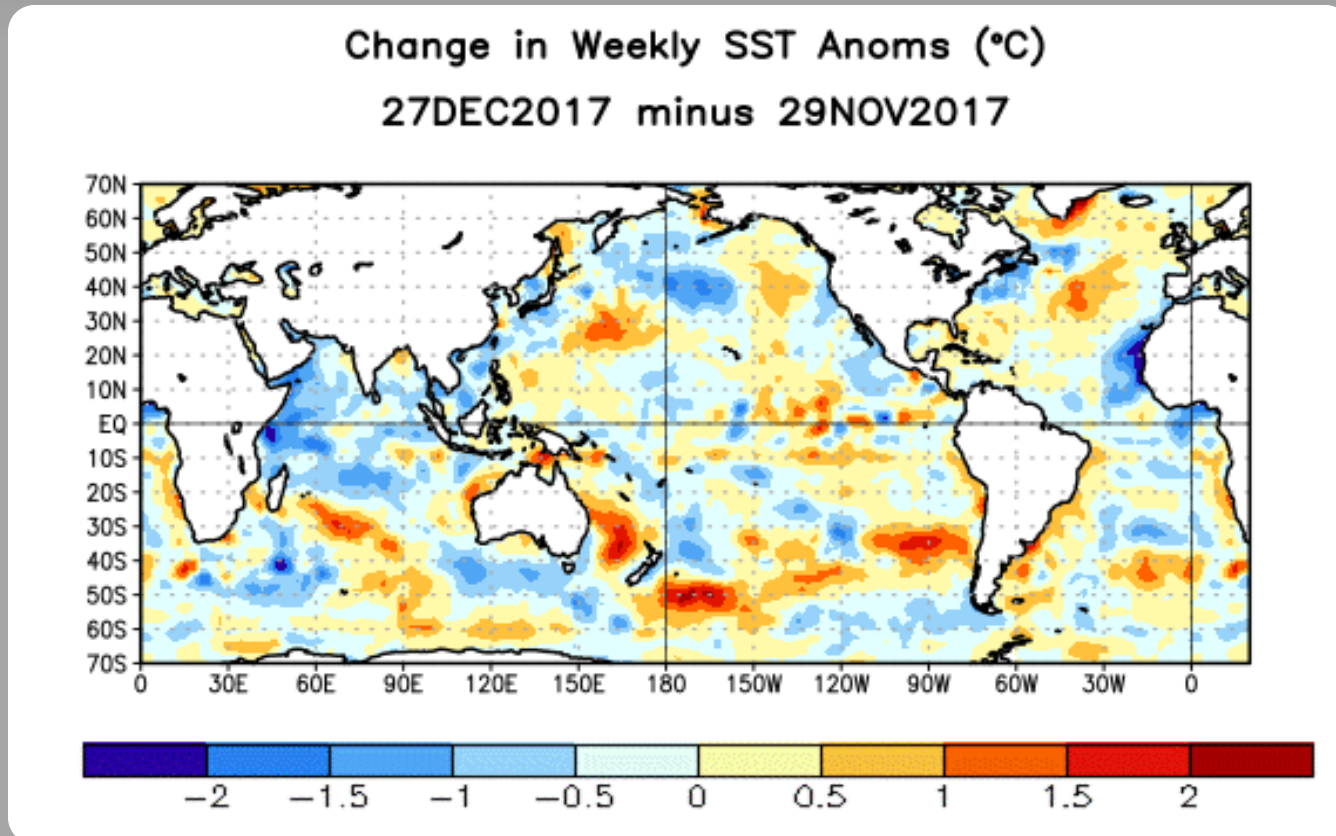
### Weekly SST Anomalies (DEG C)





# Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, localized changes (mostly positive) were observed in equatorial SST anomalies across the central and eastern Pacific.



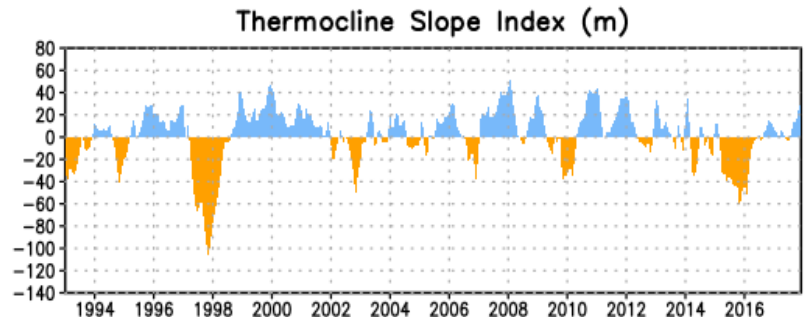
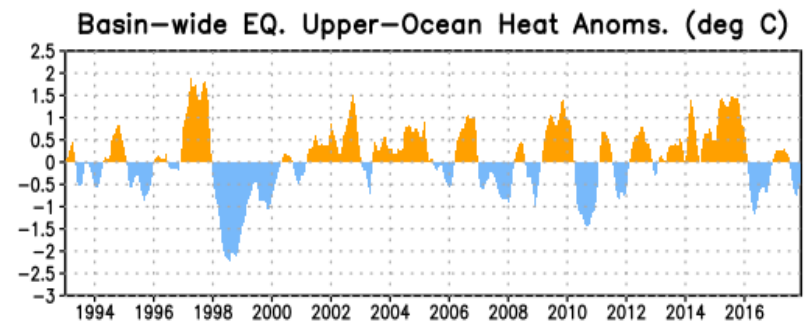
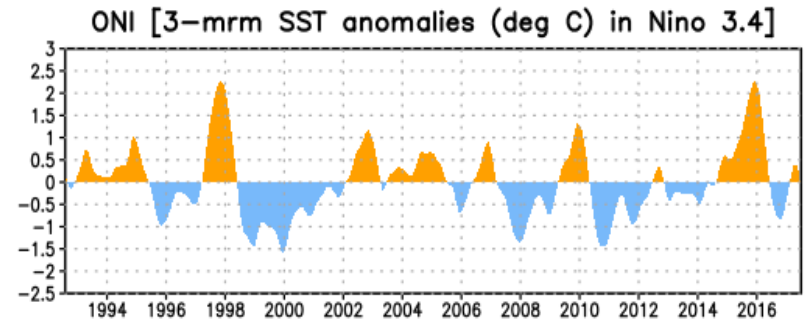
# Upper-Ocean Conditions in the Equatorial Pacific

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.

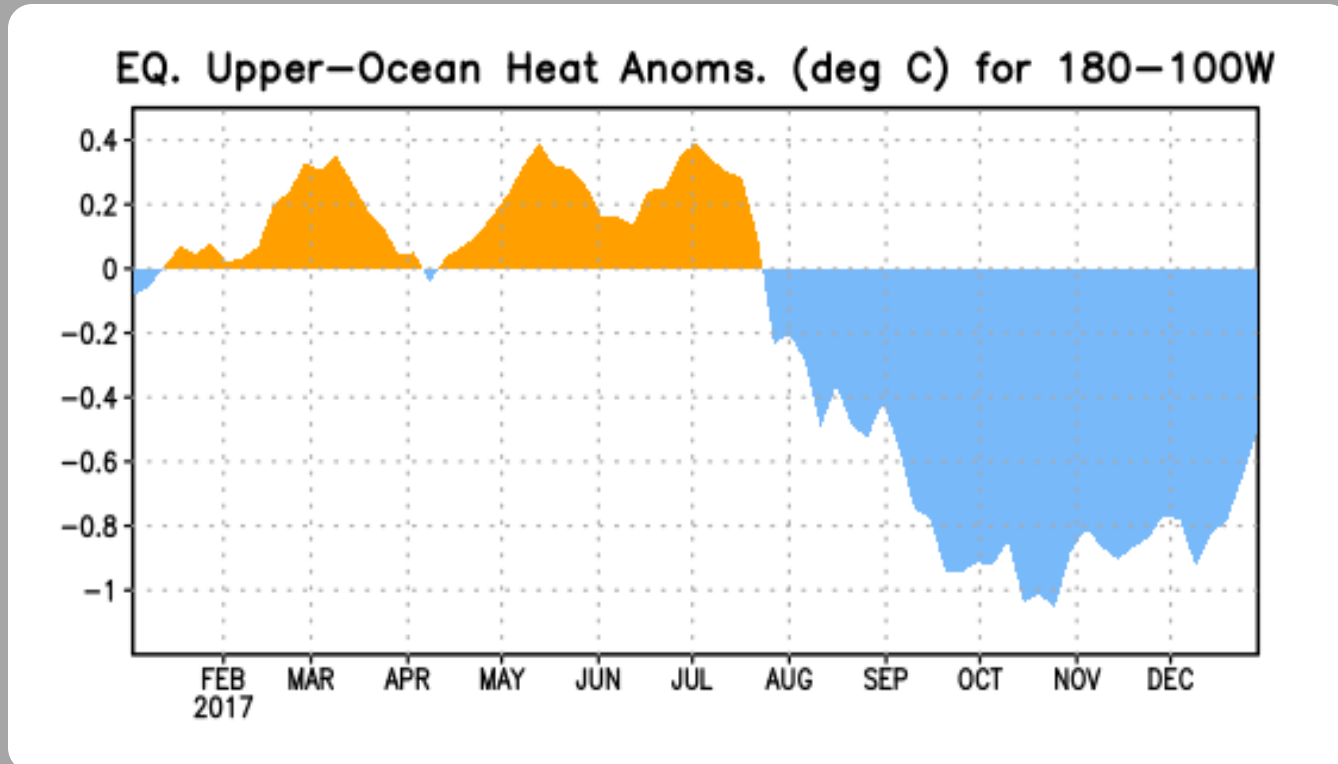
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (above average) reflect La Niña conditions.

*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).*



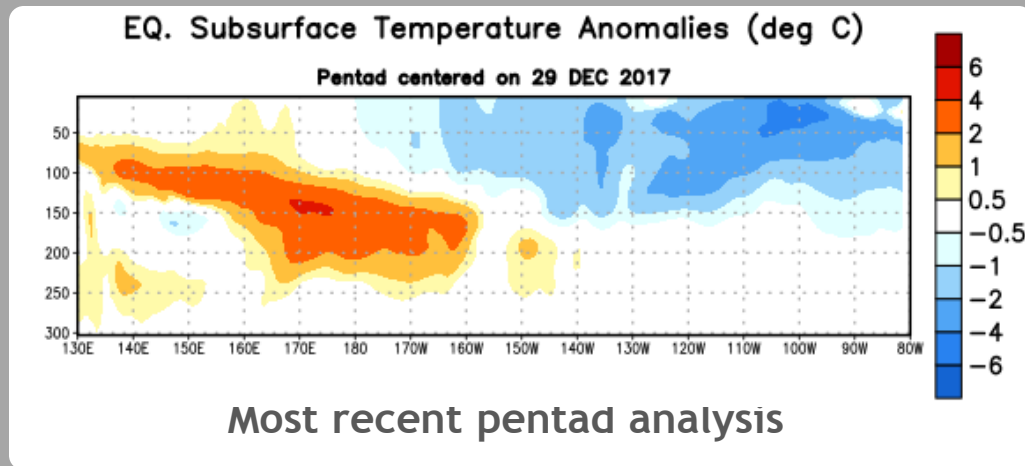
# Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies with large fluctuations in amplitude were present from mid-January through mid-July 2017. From mid-July to September 2017, anomalies decreased and became negative. Since mid-September, large negative anomalies have been present, with weakening observed during late December 2017.



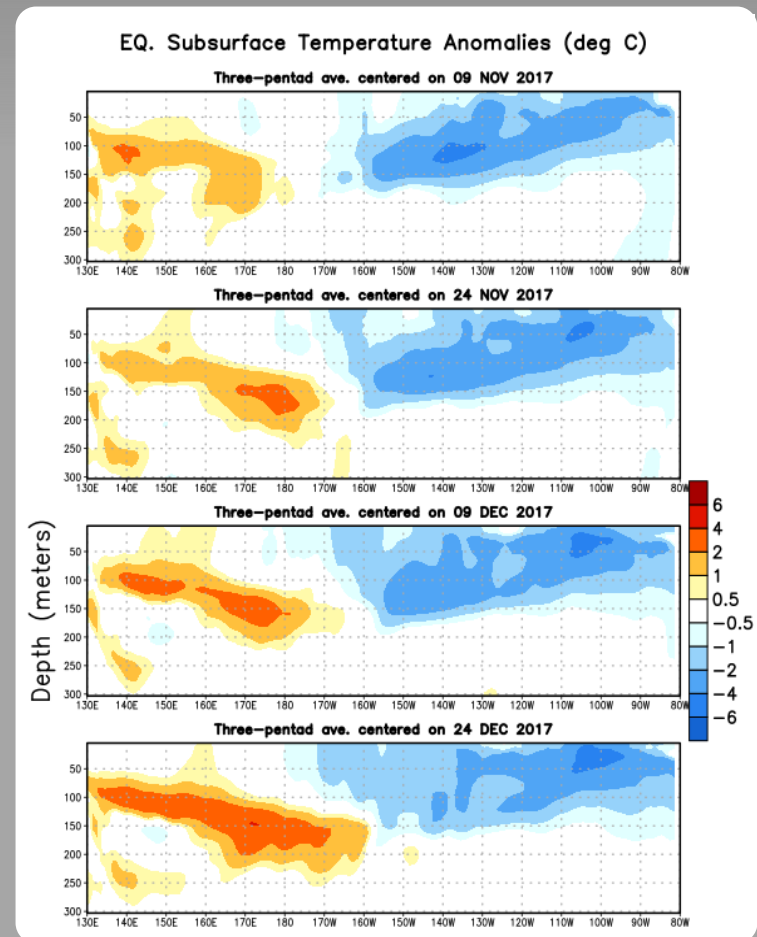
# Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, negative subsurface temperature anomalies have persisted across the central and eastern Pacific Ocean.



Positive anomalies have increased in the western Pacific Ocean, and have expanded eastward at depth to 150°W.

Recently, the strongest negative anomalies are between 160°W-80°W.

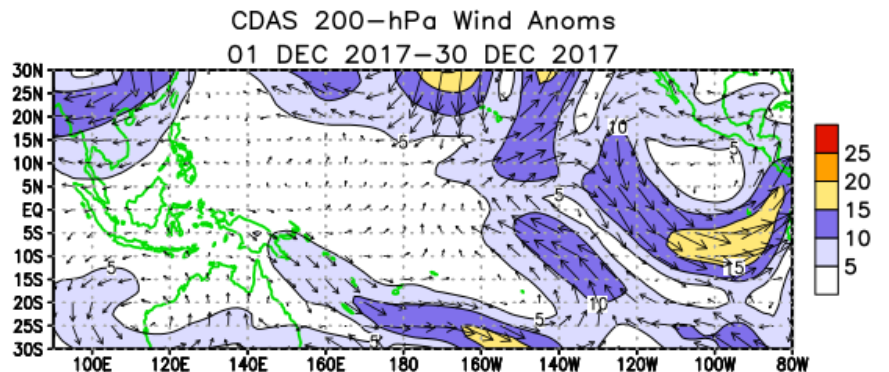
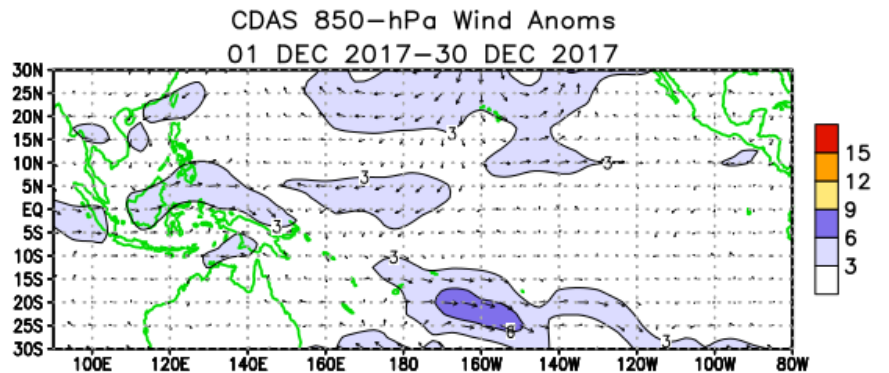
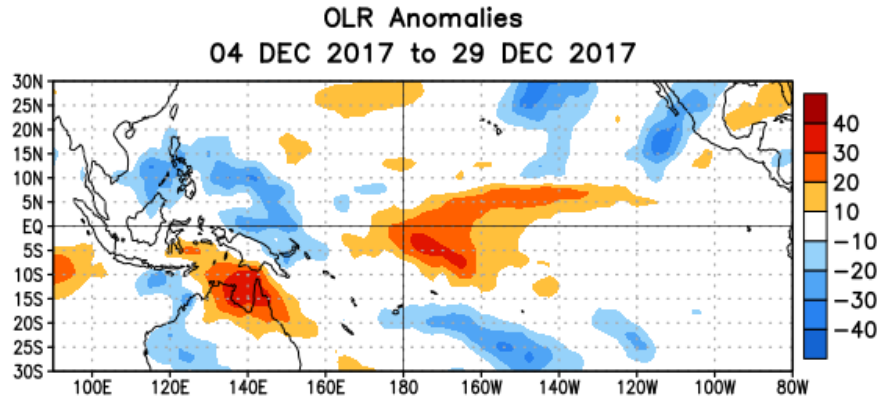


# Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident over parts of Indonesia, the Philippines, and the far western Pacific Ocean. Positive OLR anomalies (reduced convection and precipitation) were present over the central Pacific Ocean.

Low-level (850-hPa) winds were anomalous easterly over the central and western tropical Pacific Ocean.

Strong cross-equatorial flow was apparent in the anomalous upper-level (200-hPa) winds over the eastern tropical Pacific Ocean.



# 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:

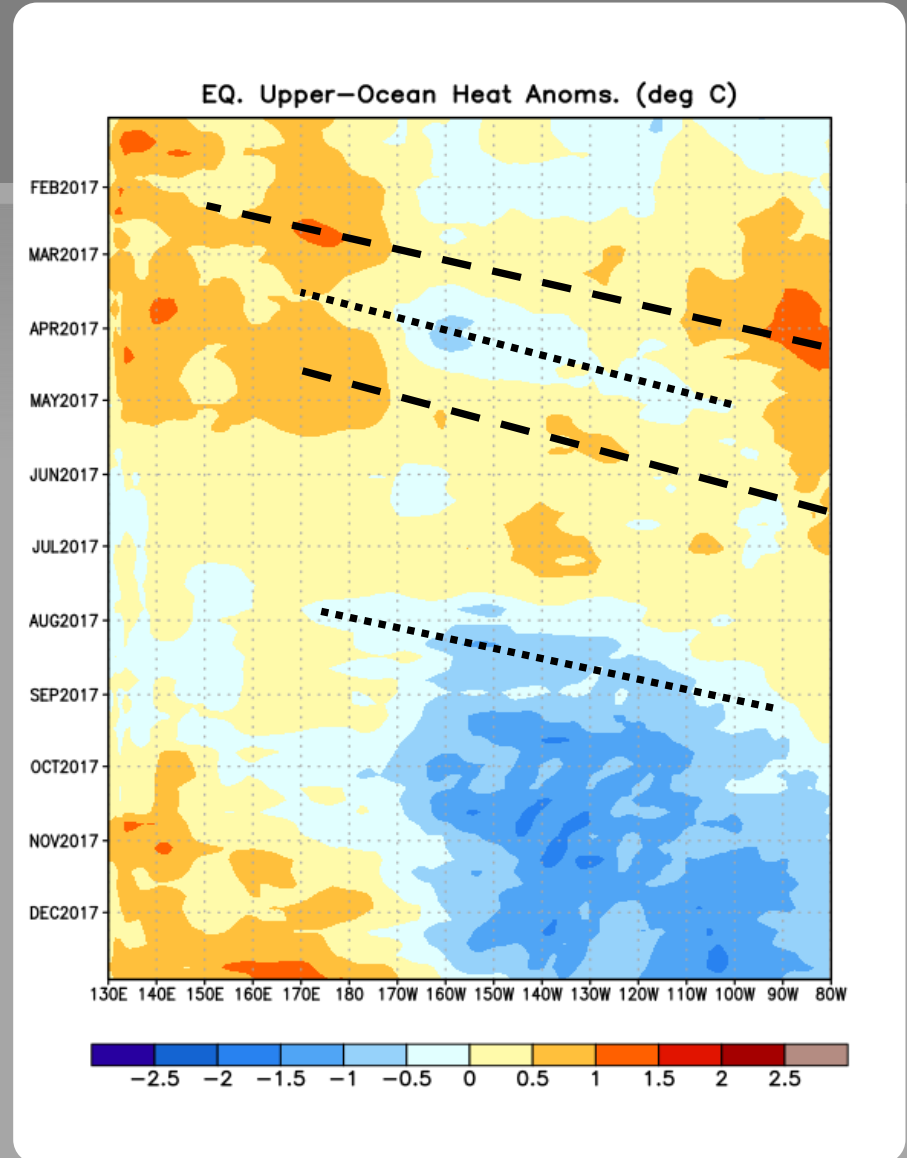
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

# Weekly Heat Content Evolution in the Equatorial Pacific

From February 2017 through May 2017, positive subsurface temperature anomalies persisted in the western and eastern Pacific Ocean, with oceanic Kelvin waves resulting in temperature variability in the central Pacific.

During August 2017, an upwelling Kelvin wave resulted in below-average sub-surface temperatures across the east-central and eastern equatorial Pacific. Since September 2017, negative sub-surface anomalies have persisted in those regions.

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 ( $\text{m s}^{-1}$ )

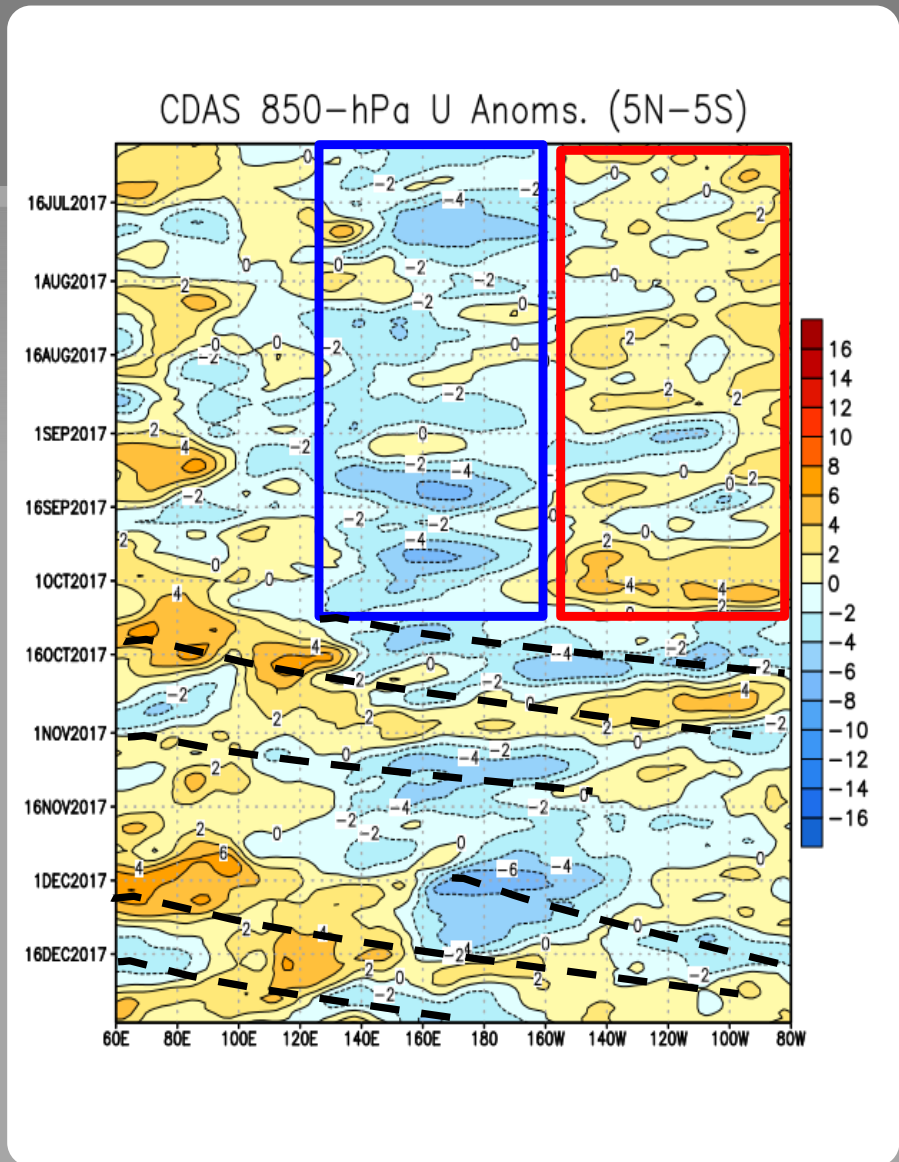
Low-level easterly wind anomalies generally persisted over the central and western equatorial Pacific from May-October 2017.

From January-October 2017, westerly wind anomalies were generally observed over the eastern Pacific Ocean.

From mid-October to early November 2017 and from early December 2017 to the present, the Madden Julian Oscillation (MJO) disrupted the pattern, contributing to the eastward propagation of low-level wind anomalies.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)





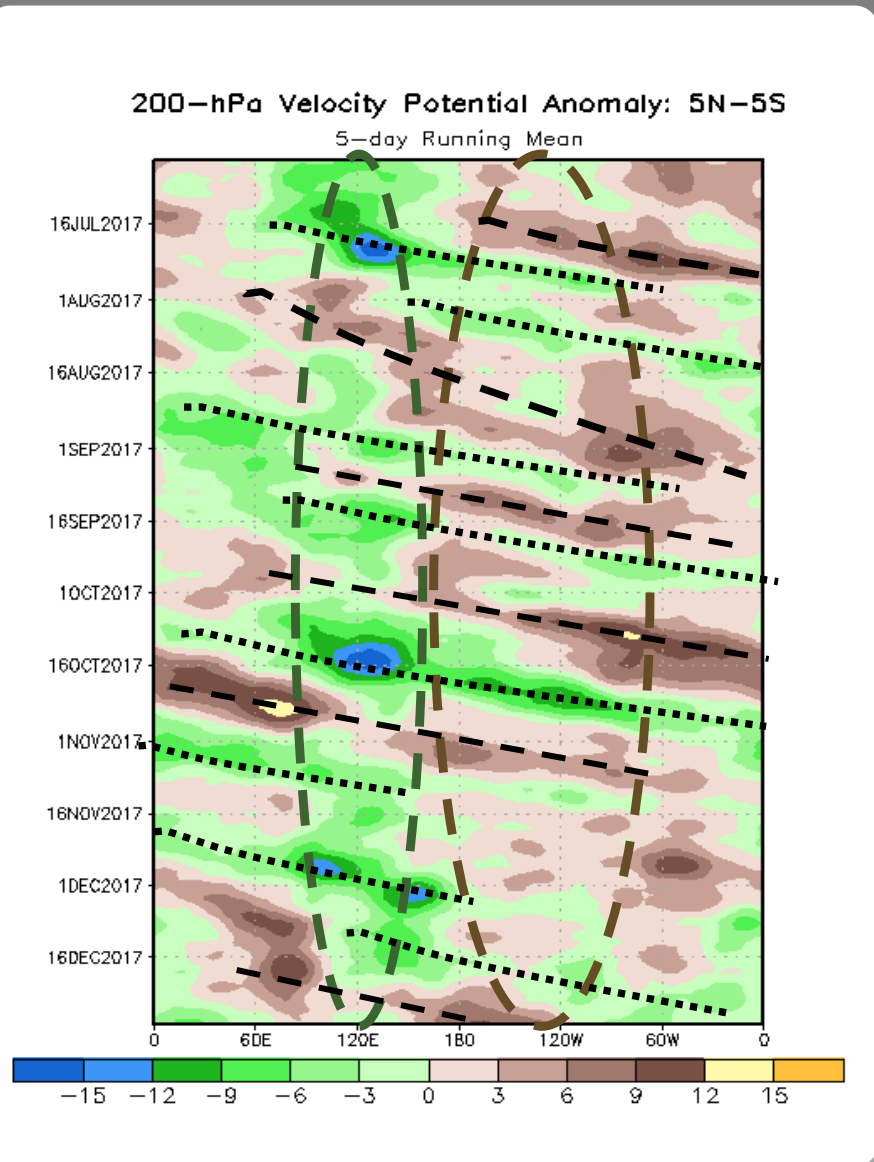
# Upper-level (200-hPa) Velocity Potential Anomalies

Since at least April 2017, anomalous upper-level divergence (green shading) generally persisted near Indonesia, while anomalous convergence (brown shading) persisted near the Date Line.

Eastward propagation of regions of upper-level divergence (green shading) and convergence (brown shading) has been evident from mid-July 2017 to the present.

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

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

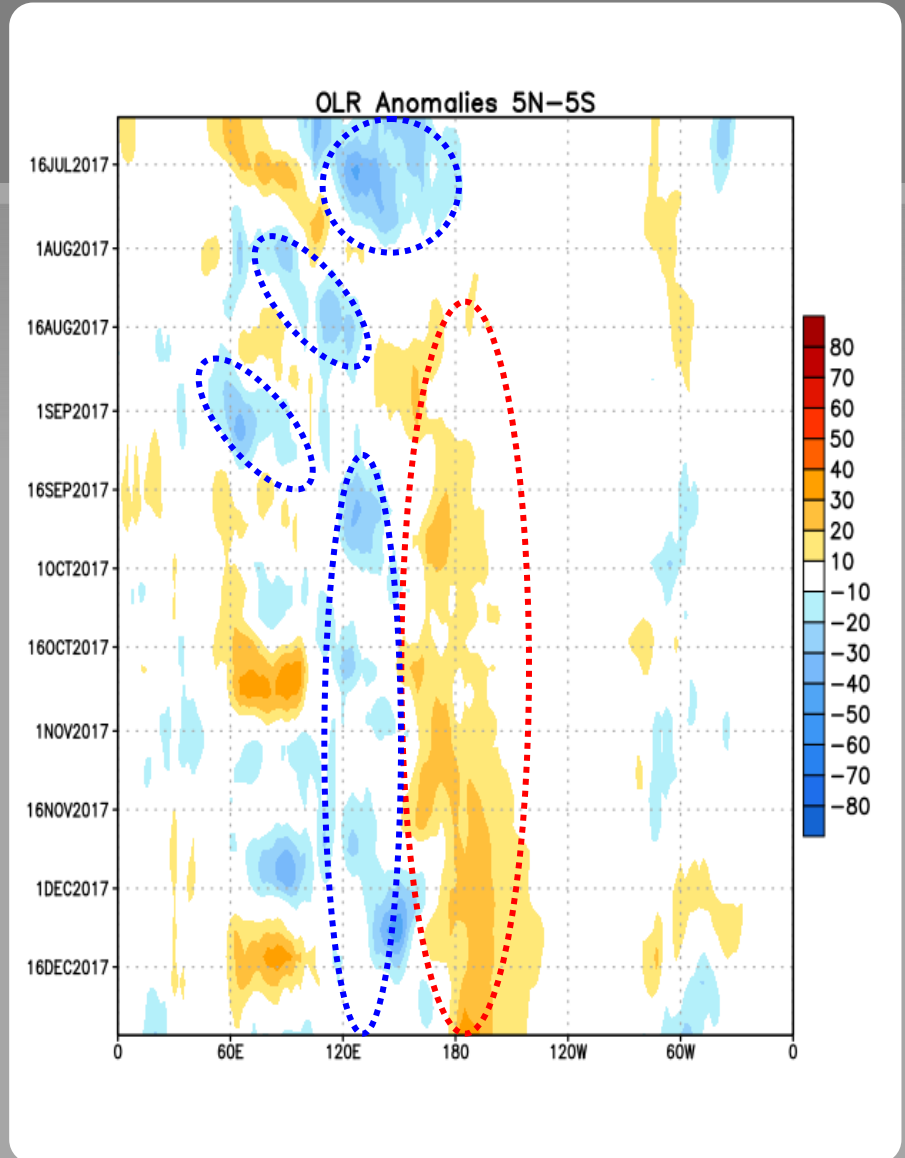


# Outgoing Longwave Radiation (OLR) Anomalies

From mid-May to late July 2017, OLR anomalies were negative near Indonesia.

Since mid-August 2017, positive OLR anomalies have persisted over the central Pacific Ocean. Negative OLR anomalies have been more intermittent near the Maritime Continent.

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.v5). The SST reconstruction methodology is described in Huang et al., 2017, J. Climate, vol. 30, 8179-8205.)

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  $+0.5^{\circ}\text{C}$ .

La Niña: characterized by a negative ONI less than or equal to  $-0.5^{\circ}\text{C}$ .

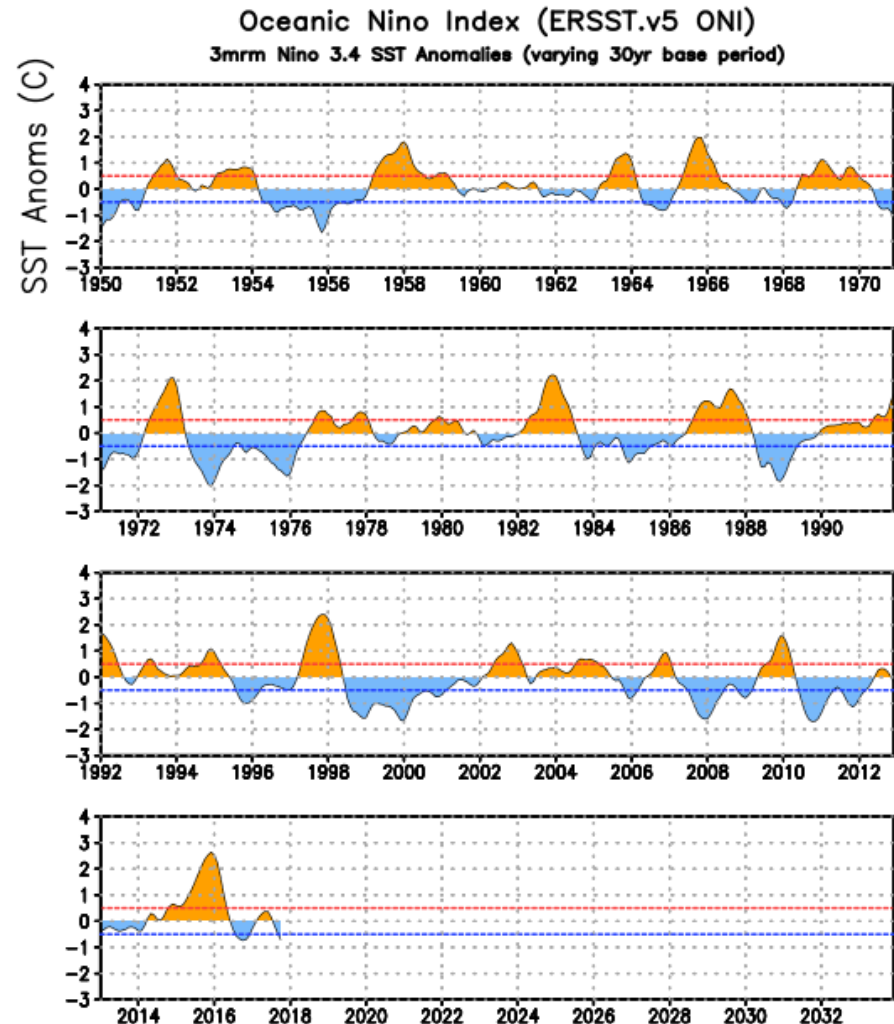
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed  $\pm 0.5^{\circ}\text{C}$  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 (September - November 2017) is  $-0.7^{\circ}\text{C}$ .

El Niño ↑  
Neutral  
La Niña ↓



# Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v5

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.v5 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.

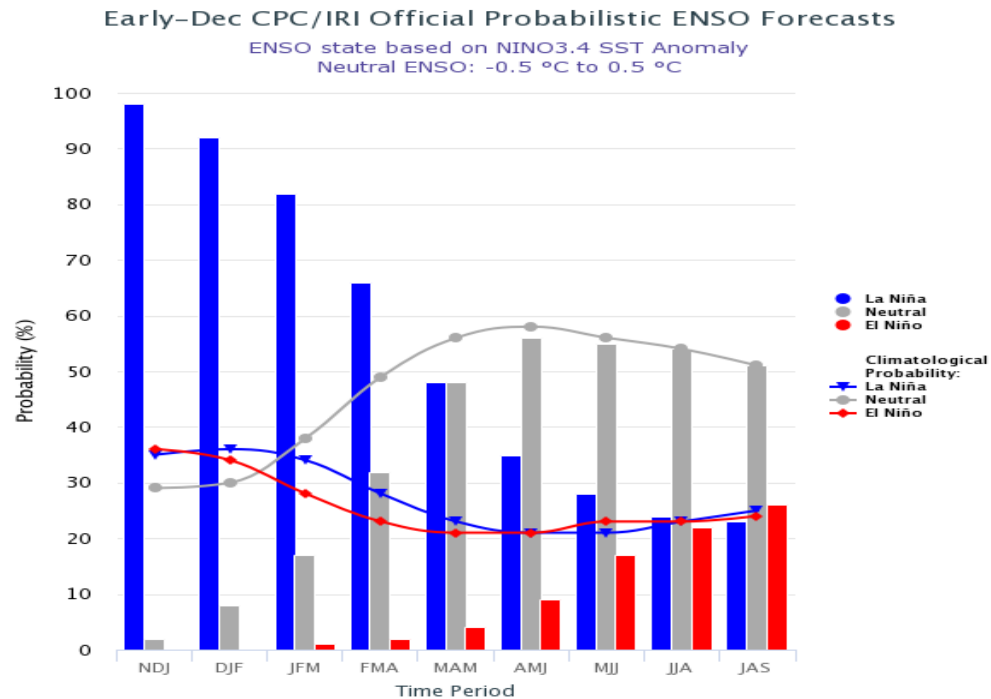
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2005	0.6	0.6	0.4	0.4	0.3	0.1	-0.1	-0.1	-0.1	-0.3	-0.6	-0.8
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.1	-0.2	-0.4	-0.7		

# CPC/IRI Probabilistic ENSO Outlook

Updated: 14 December 2017

La Niña is likely (exceeding ~80%) through the Northern Hemisphere winter 2017-18, with a transition to ENSO-neutral most likely during the mid-to-late spring.



# IRI/CPC Pacific Niño

## 3.4 SST Model Outlook

The majority of models predict La Niña to persist into Northern Hemisphere spring 2018, with a return to ENSO-neutral thereafter.

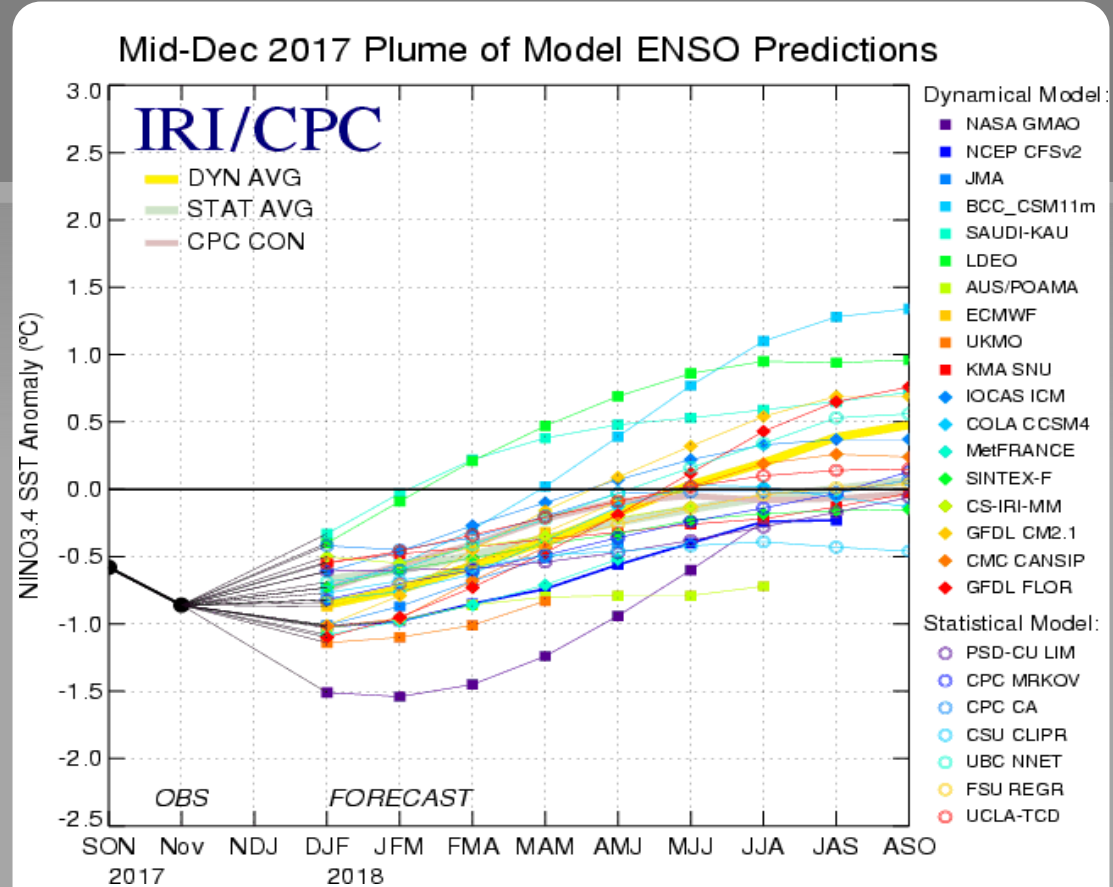


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 December 2017).

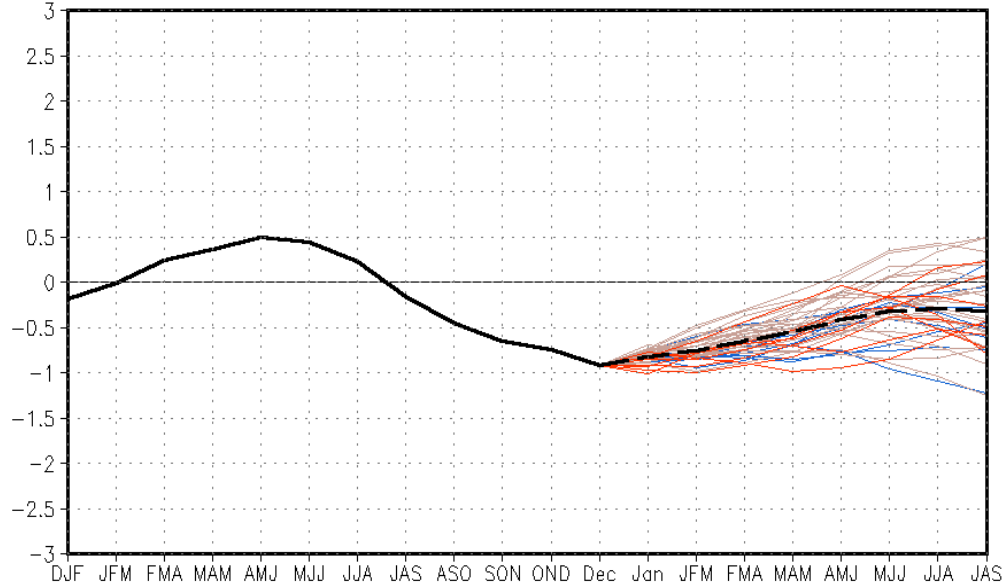


# SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 2 January 2018

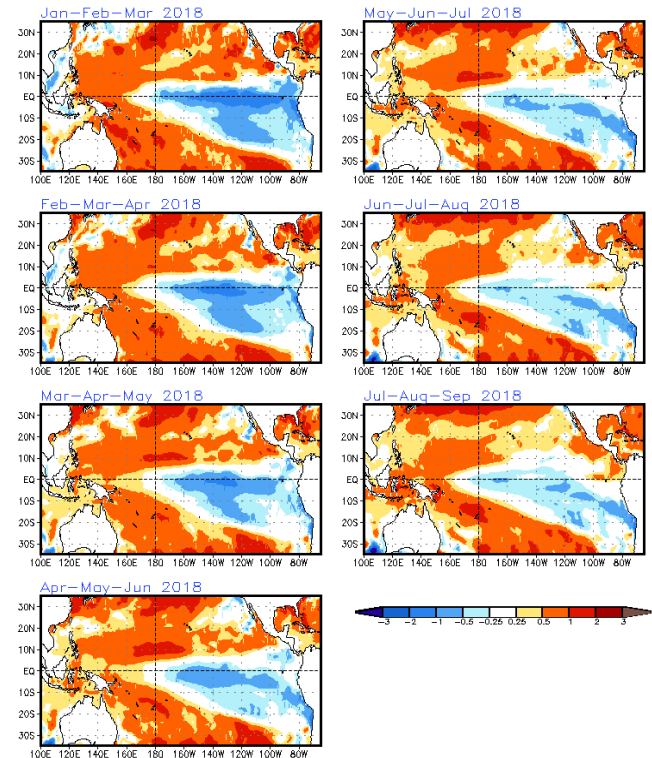
The CFS.v2 ensemble mean (black dashed line) favors La Niña into the Northern Hemisphere spring 2018.

CFSv2 forecast Nino3.4 SST anomalies (K) (PDF corrected)



— Latest 8 forecast members  
— Earliest 8 forecast members  
— Other forecast members  
- - - Forecast ensemble mean  
— NCDc daily analysis

(Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)

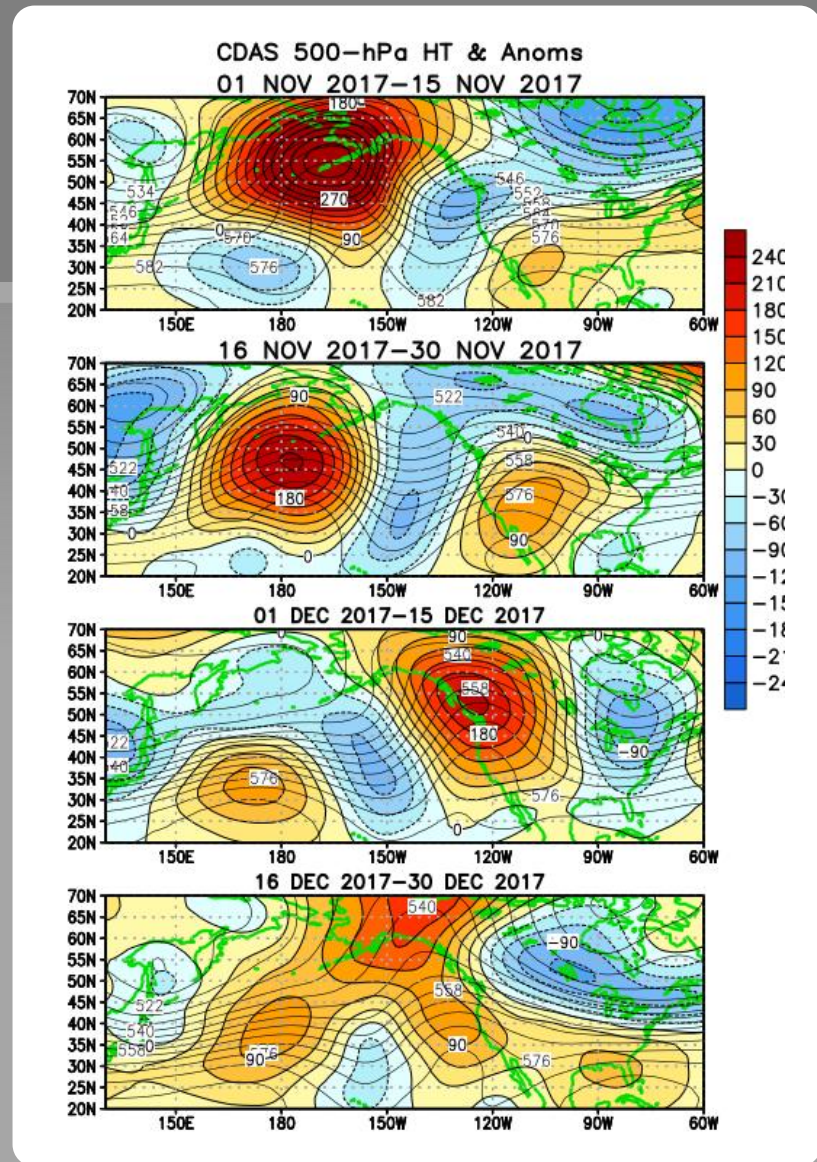


# Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since early November 2017, a retracted jet stream over the North Pacific and a strong anomalous ridge has been mostly associated with below-average heights (and temperatures) downstream over Canada and parts of the northern United States.

During this period, anomalous ridging and above-average temperatures have generally prevailed over the southwestern U.S.

The overall pattern over the N. Pacific has been consistent with the influence of La Niña and the Madden Julian Oscillation.

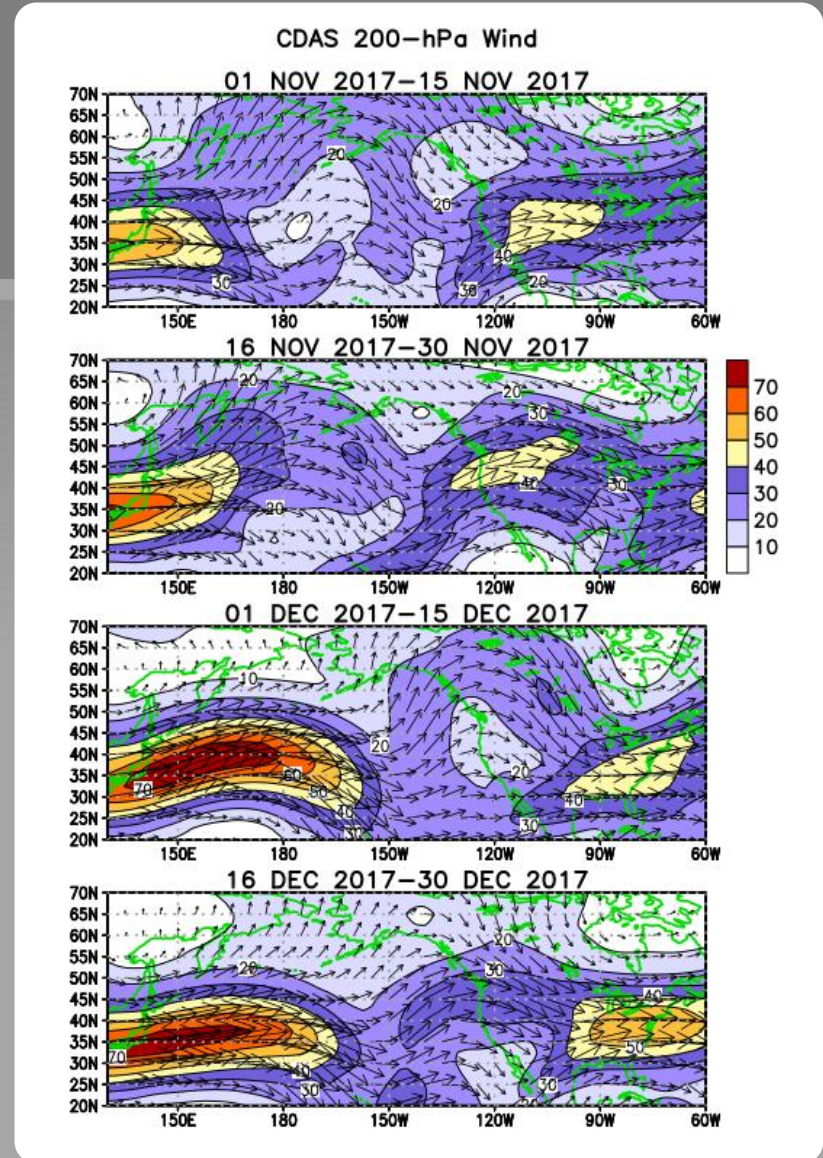


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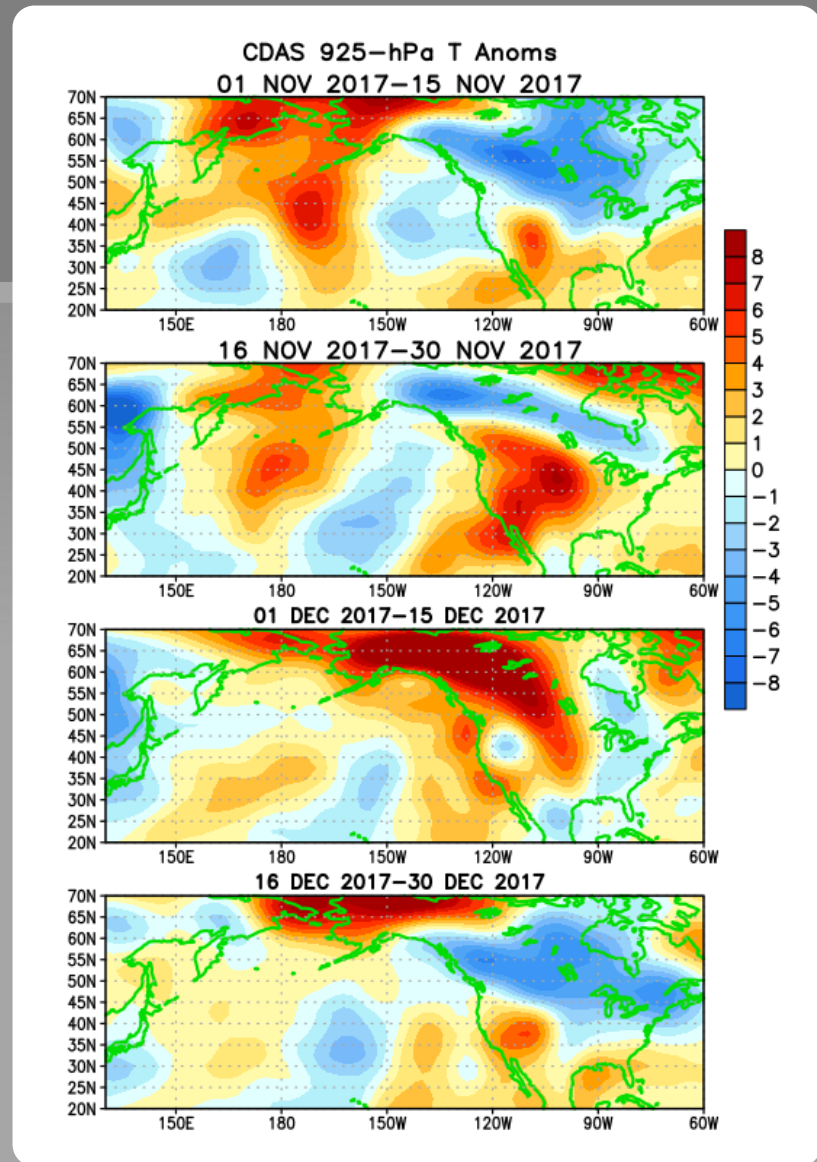


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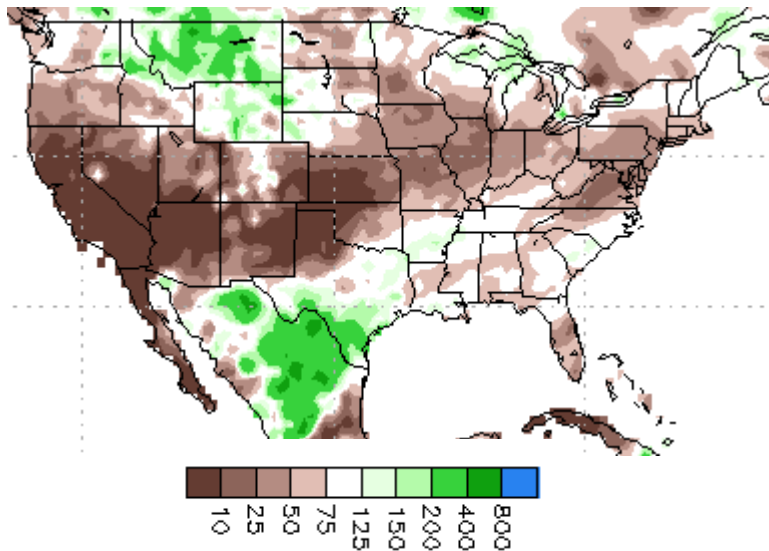
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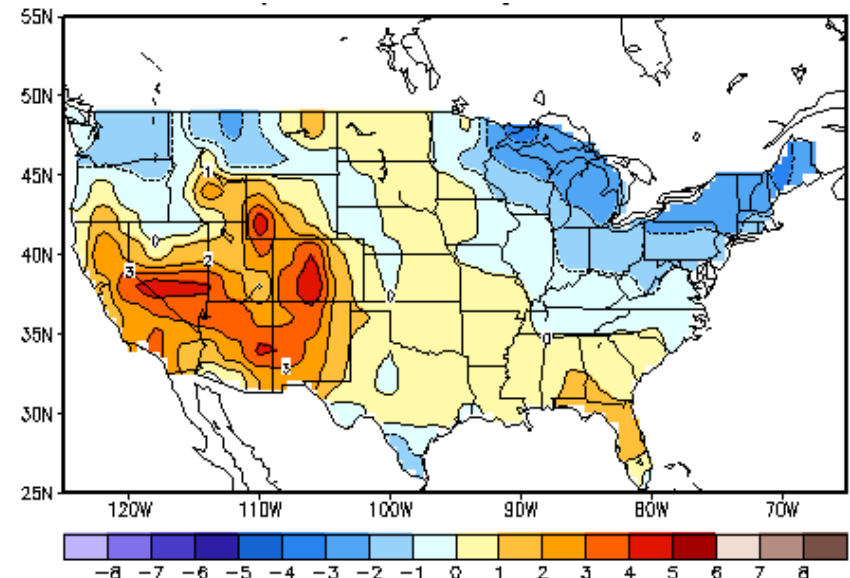
# U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 31 December 2017

### Percent of Average Precipitation



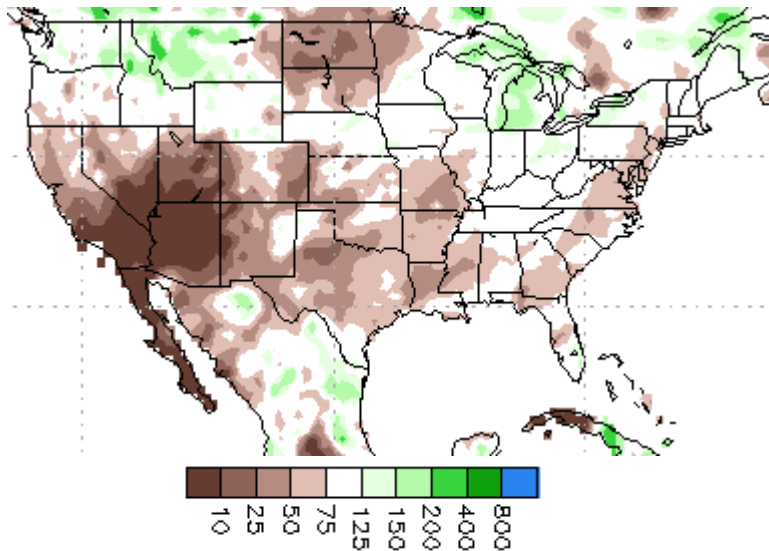
### Temperature Departures (degree C)



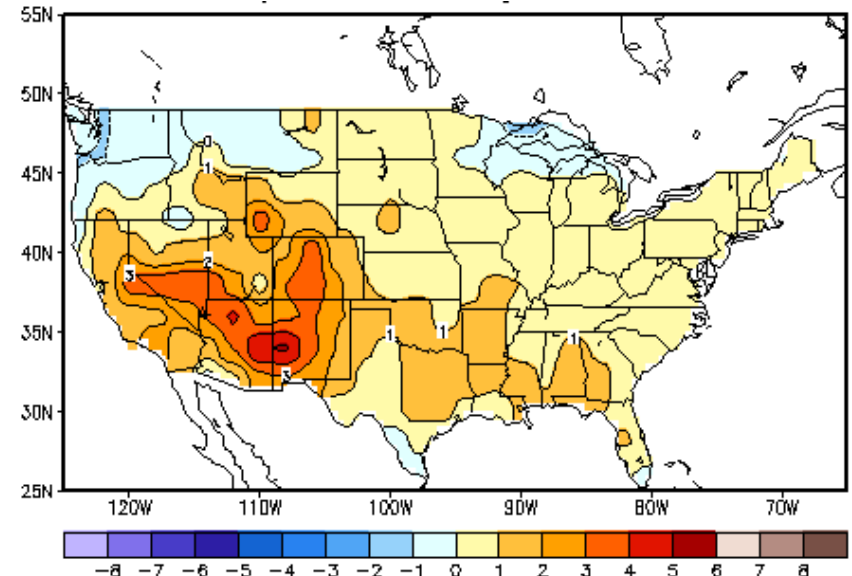
# U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 31 December 2017

### Percent of Average Precipitation



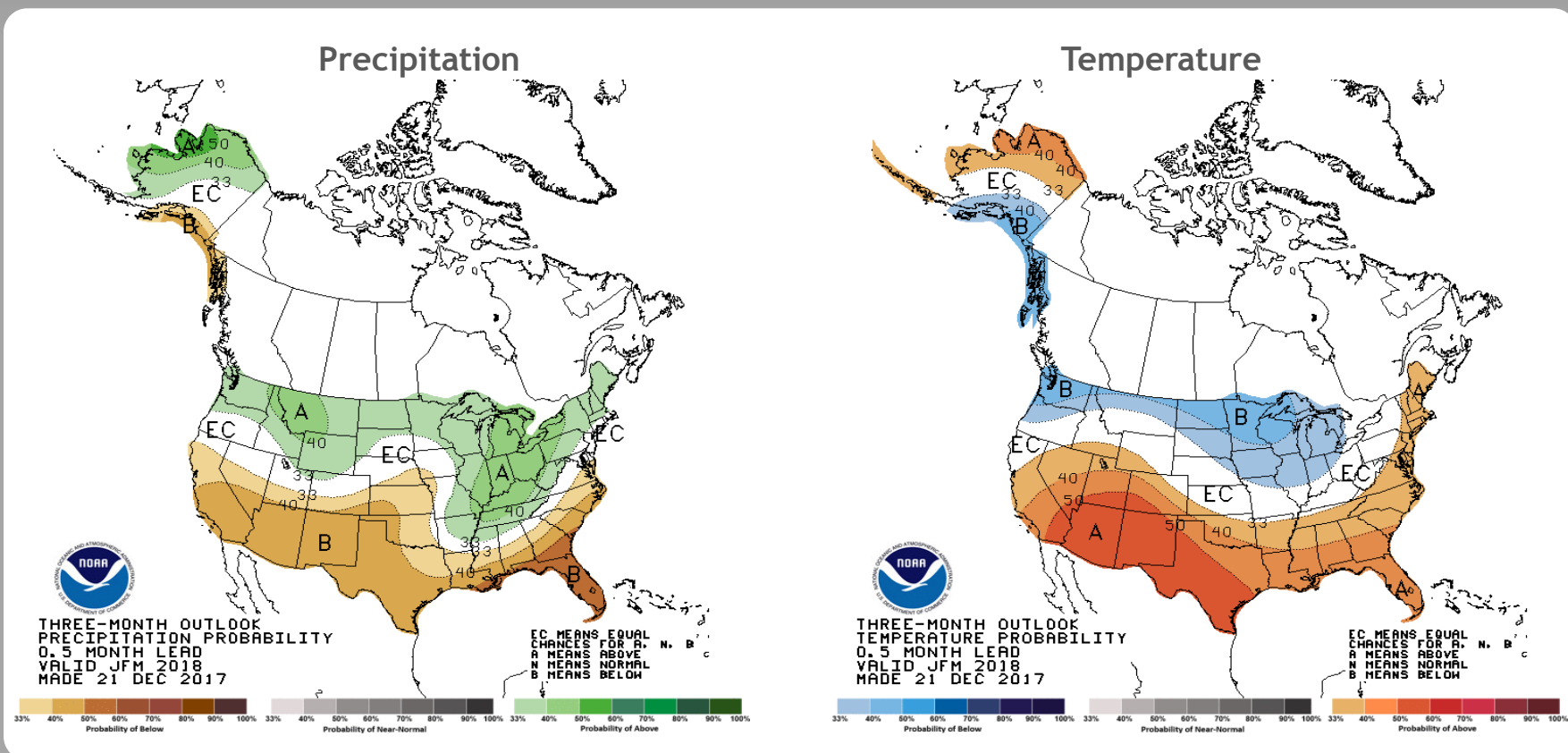
### Temperature Departures (degree C)



# U. S. Seasonal Outlooks

## January - March 2018

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



# Summary

## ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.\*

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

La Niña is likely (exceeding ~80%) through the Northern Hemisphere winter 2017-18, with a transition to ENSO-neutral most likely during the mid-to-late spring.\*

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