

# ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:  
Climate Prediction Center / NCEP  
27 February 2017

# 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: Final La Niña Advisory

ENSO-neutral conditions are present.\*

Equatorial sea surface temperatures (SSTs) are near-average across the central and east-central Pacific. They are above-average in the eastern Pacific Ocean.

ENSO-neutral conditions have returned and are favored to continue through at least the Northern Hemisphere spring 2017.\*

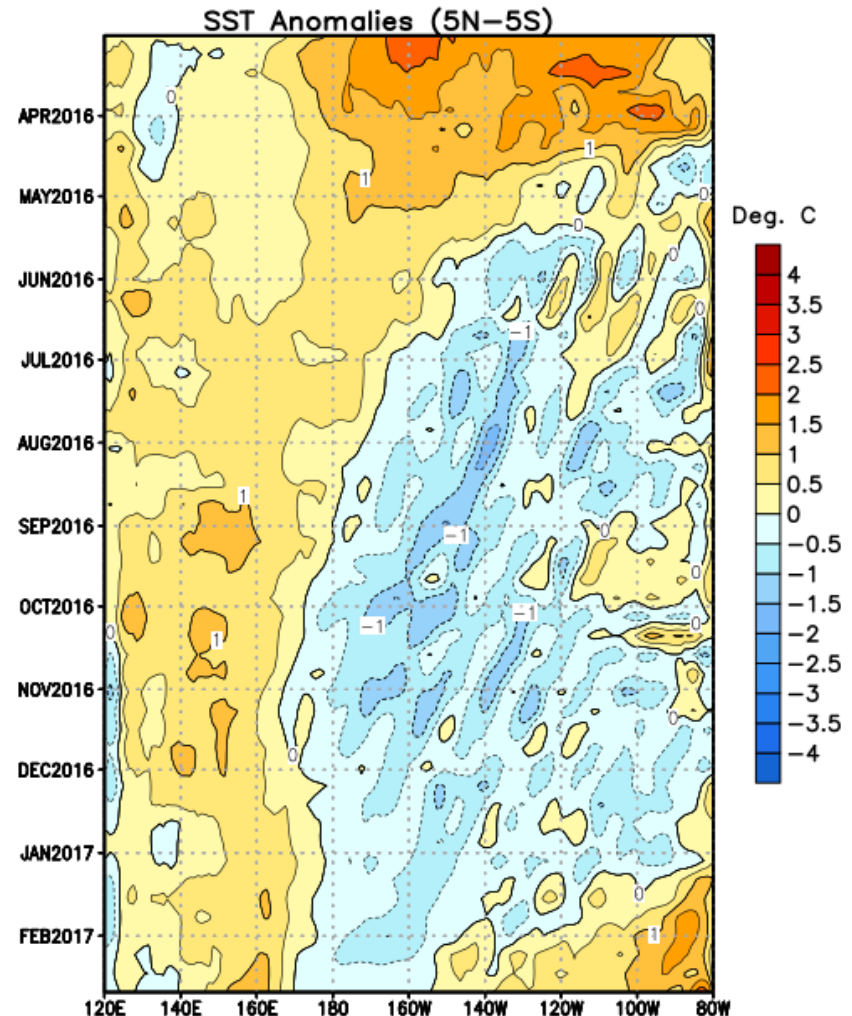
\* Note: These statements are updated once a month (2<sup>nd</sup> Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

# Recent Evolution of Equatorial Pacific SST Departures (°C)

From July through December 2016, below average SSTs were observed over most of the central and eastern Pacific Ocean.

Since early January 2017, above-average SSTs have expanded westward from the far eastern Pacific.

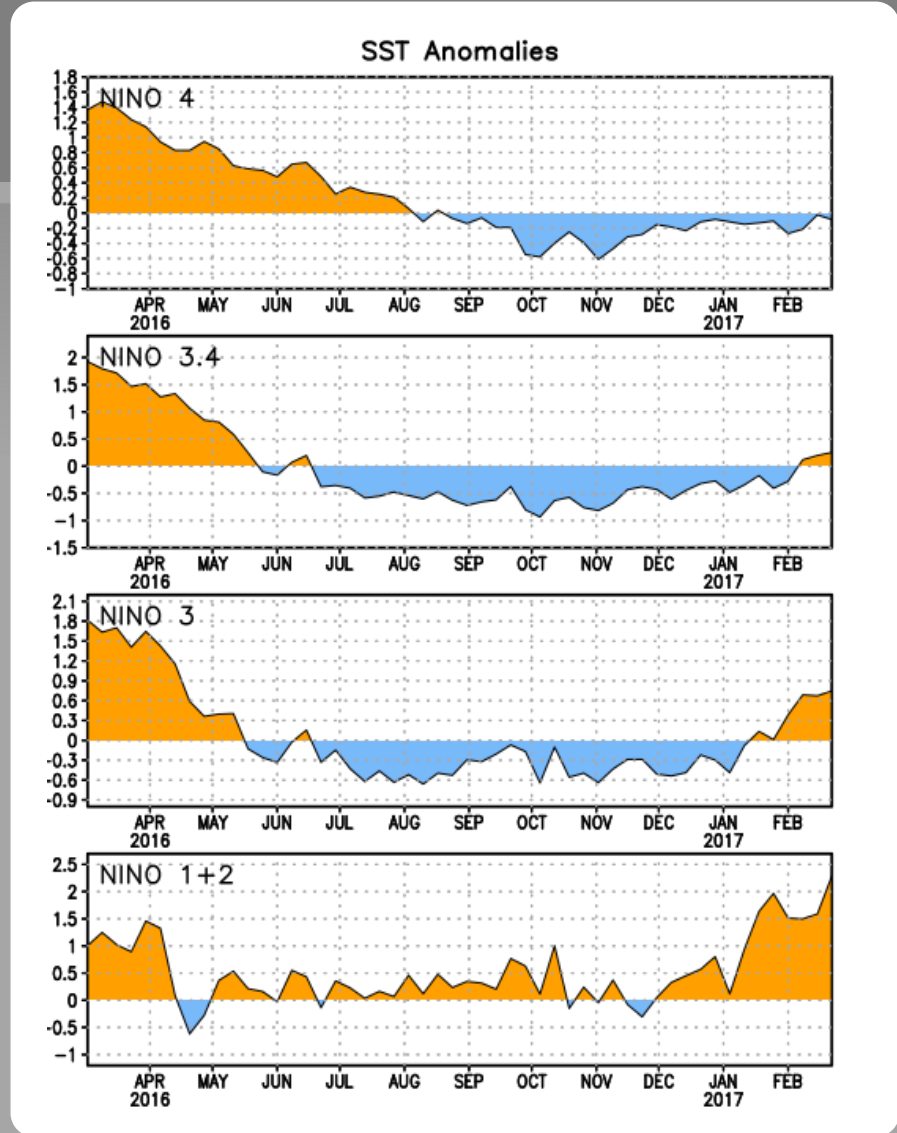
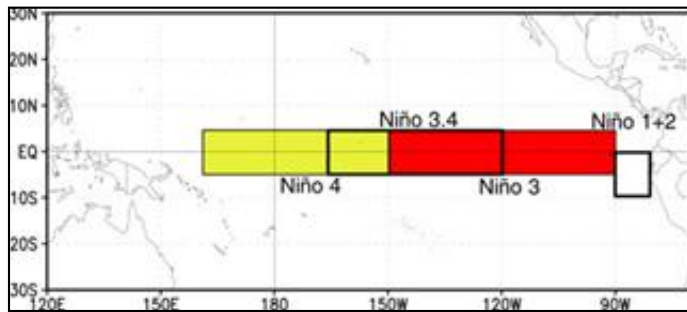
Near-average SSTs remain in the central Pacific Ocean.



# Niño Region SST Departures (°C) Recent Evolution

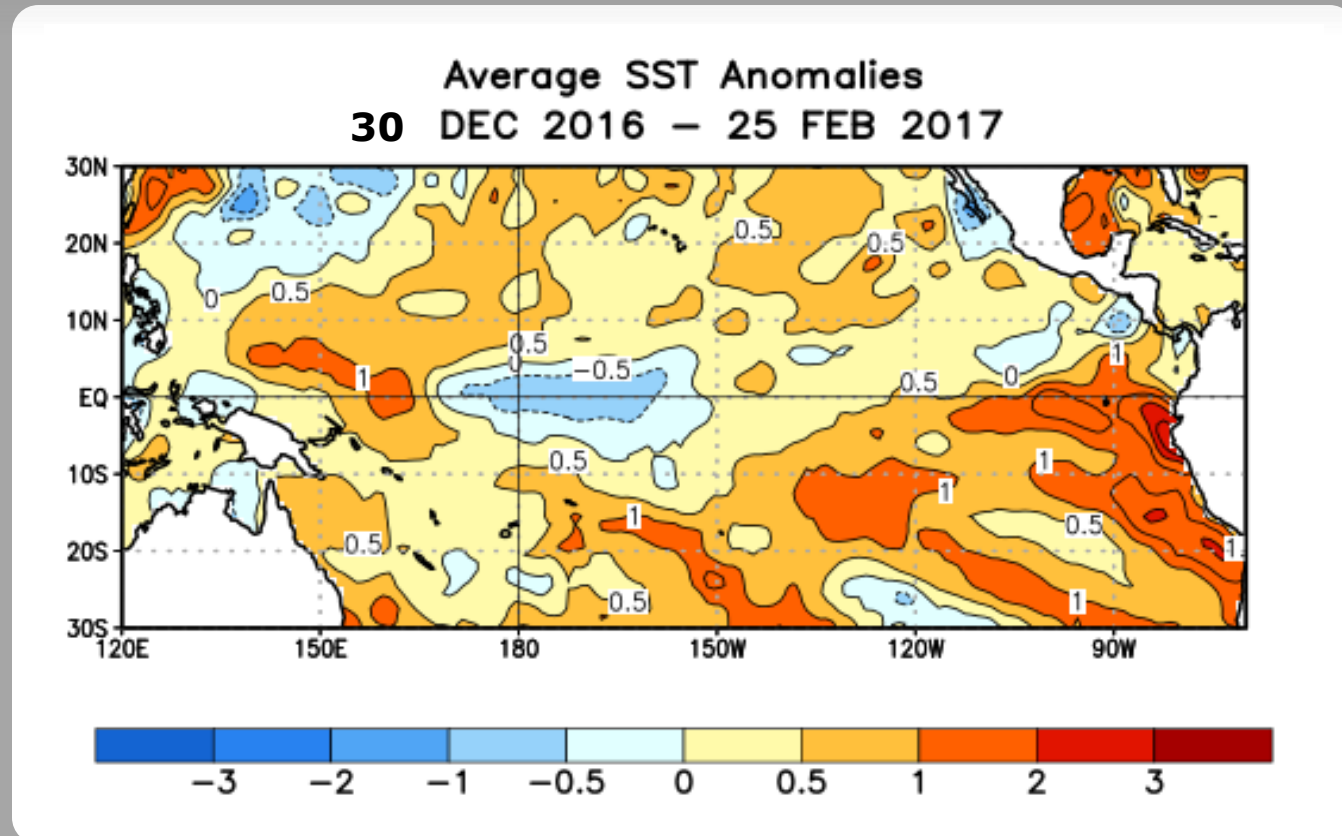
The latest weekly SST departures are:

Niño 4	-0.1°C
Niño 3.4	0.3°C
Niño 3	0.7°C
Niño 1+2	2.3°C



# SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

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

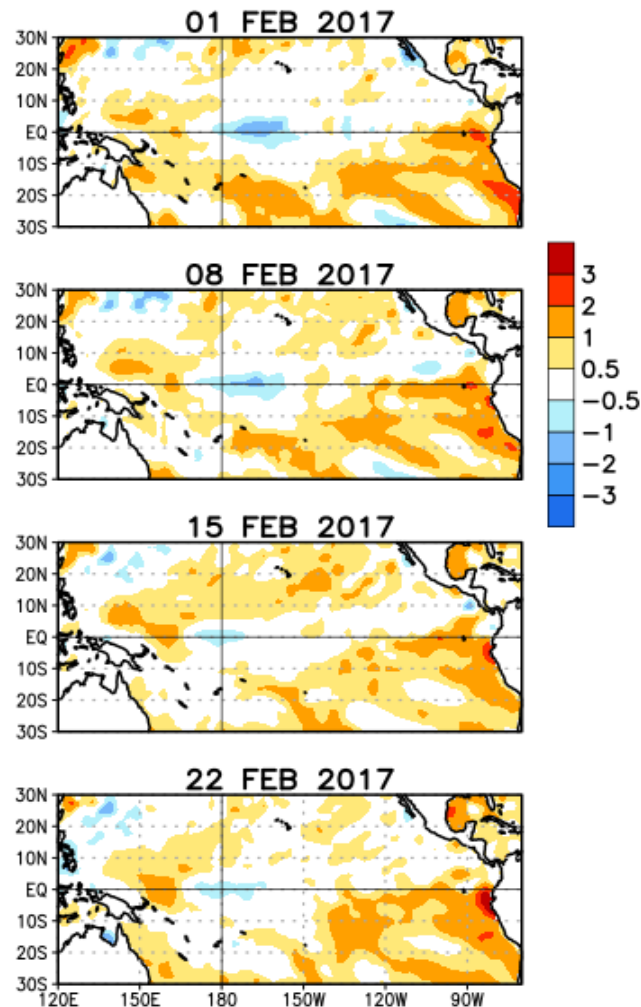




# Weekly SST Departures during the Last Four Weeks

During the last four weeks, negative SST anomalies weakened in the central Pacific. Meanwhile, above-average SSTs increased and expanded westward from the eastern Pacific.

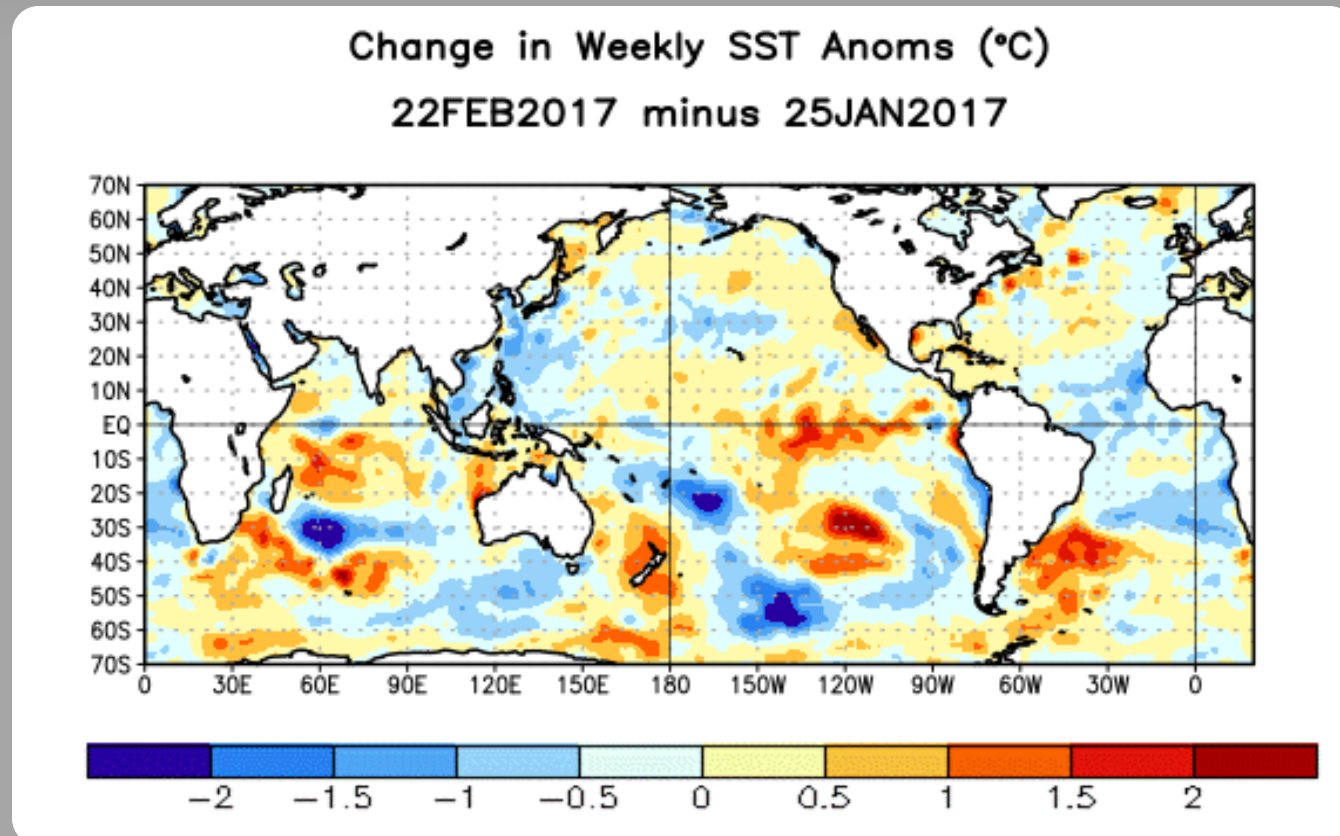
### Weekly SST Anomalies (DEG C)





# Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, changes in equatorial SST anomalies were positive over the east-central and eastern Pacific Ocean.



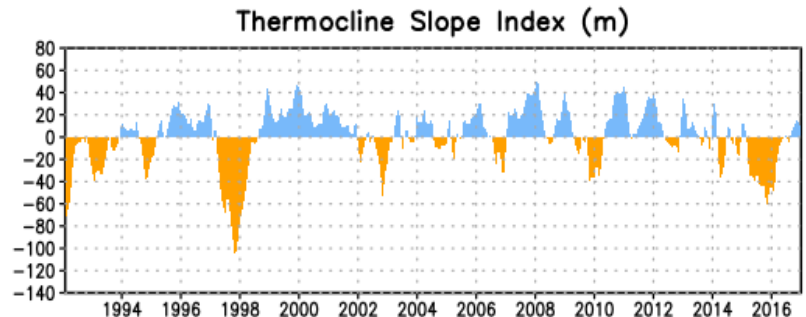
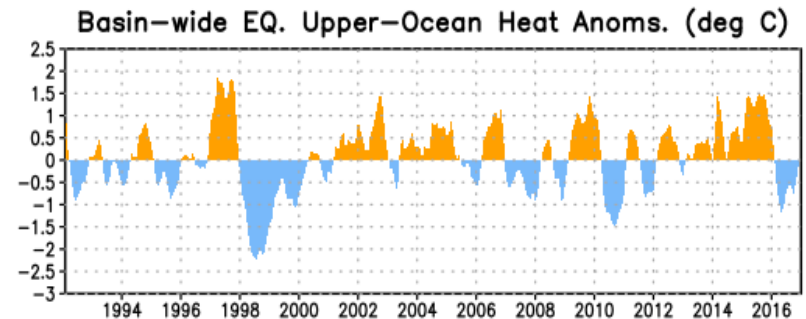
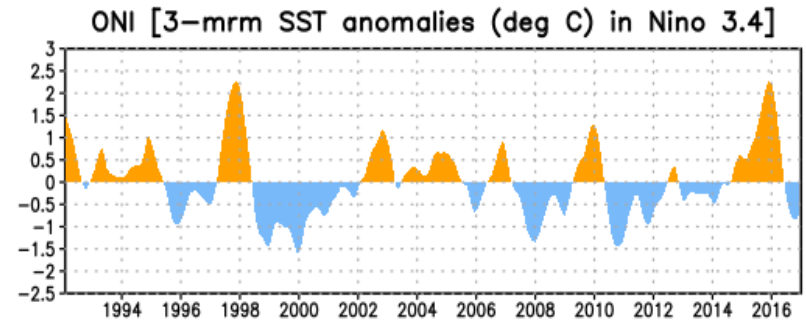
# Upper-Ocean Conditions in the Equatorial Pacific

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.

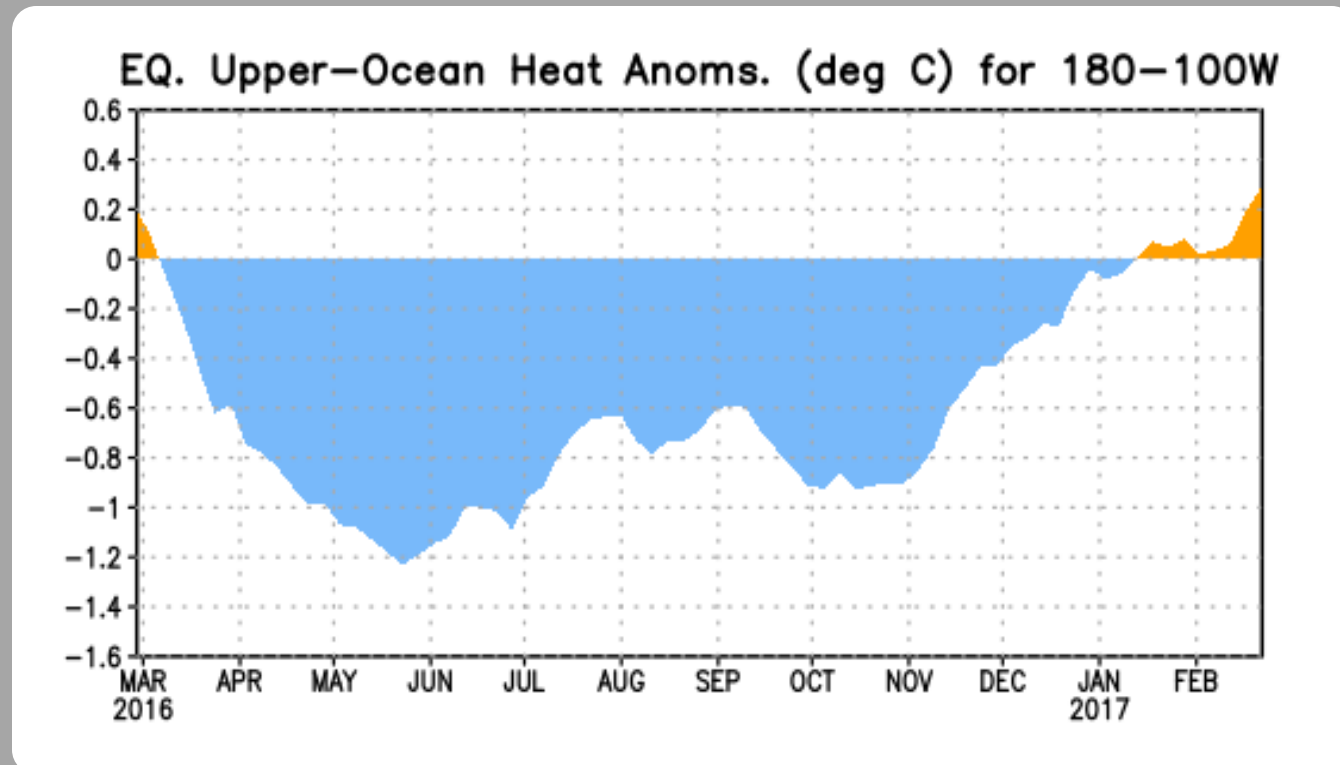
Recent values of the upper-ocean heat anomalies (near average) and thermocline slope index (slightly positive) reflect ENSO-neutral conditions.

*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).*



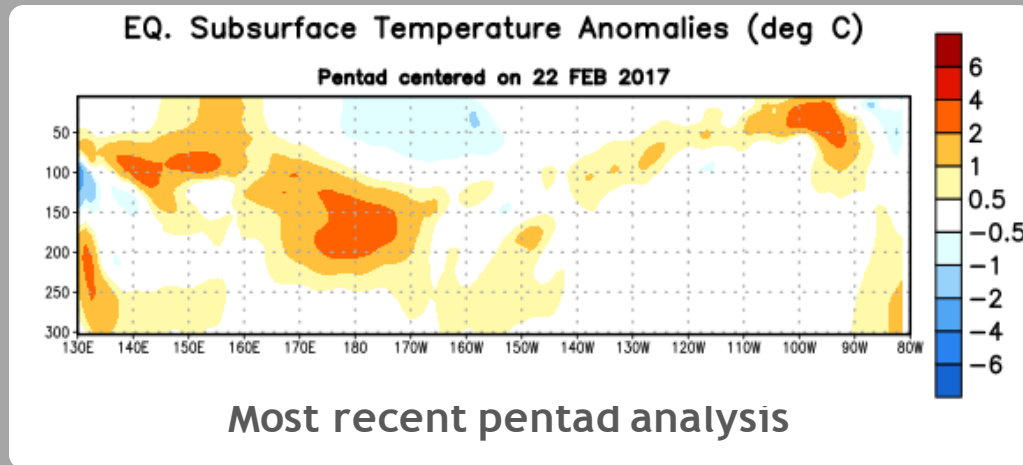
# Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies were present from March 2016 through December 2016. Since mid-January 2017, anomalies have become positive.

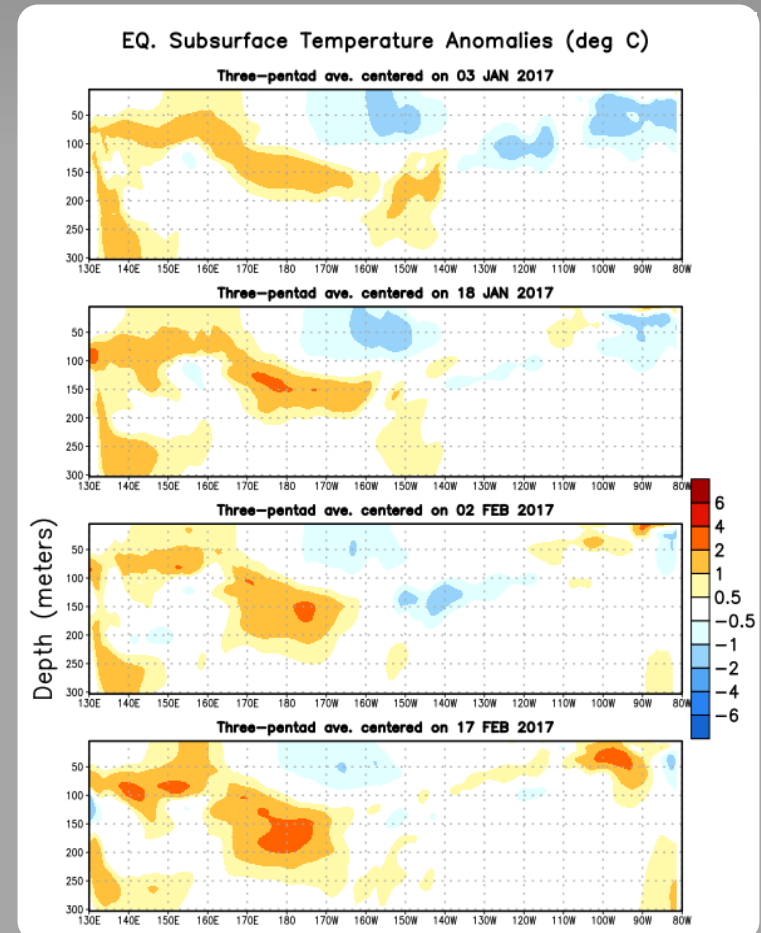


# Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, negative subsurface temperature anomalies have dissipated across the equatorial Pacific Ocean.



Positive subsurface anomalies have increased along the thermocline across the tropical Pacific Ocean.

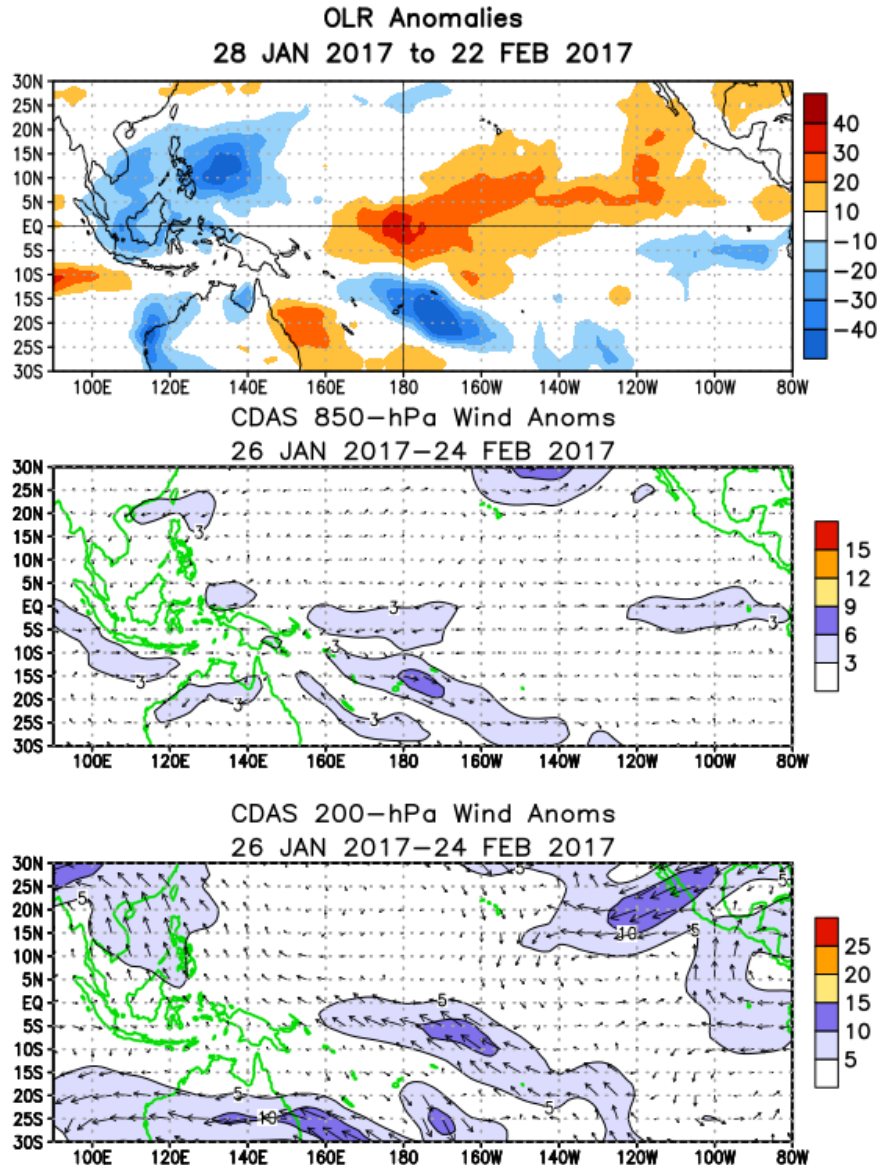


# Tropical OLR and Wind Anomalies During the Last 30 Days

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

Low-level (850-hPa) anomalous westerlies were evident over the eastern tropical Pacific Ocean, while anomalous easterlies were observed near the Date Line.

Upper-level (200-hPa) winds were anomalously easterly over the west-central and eastern 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:

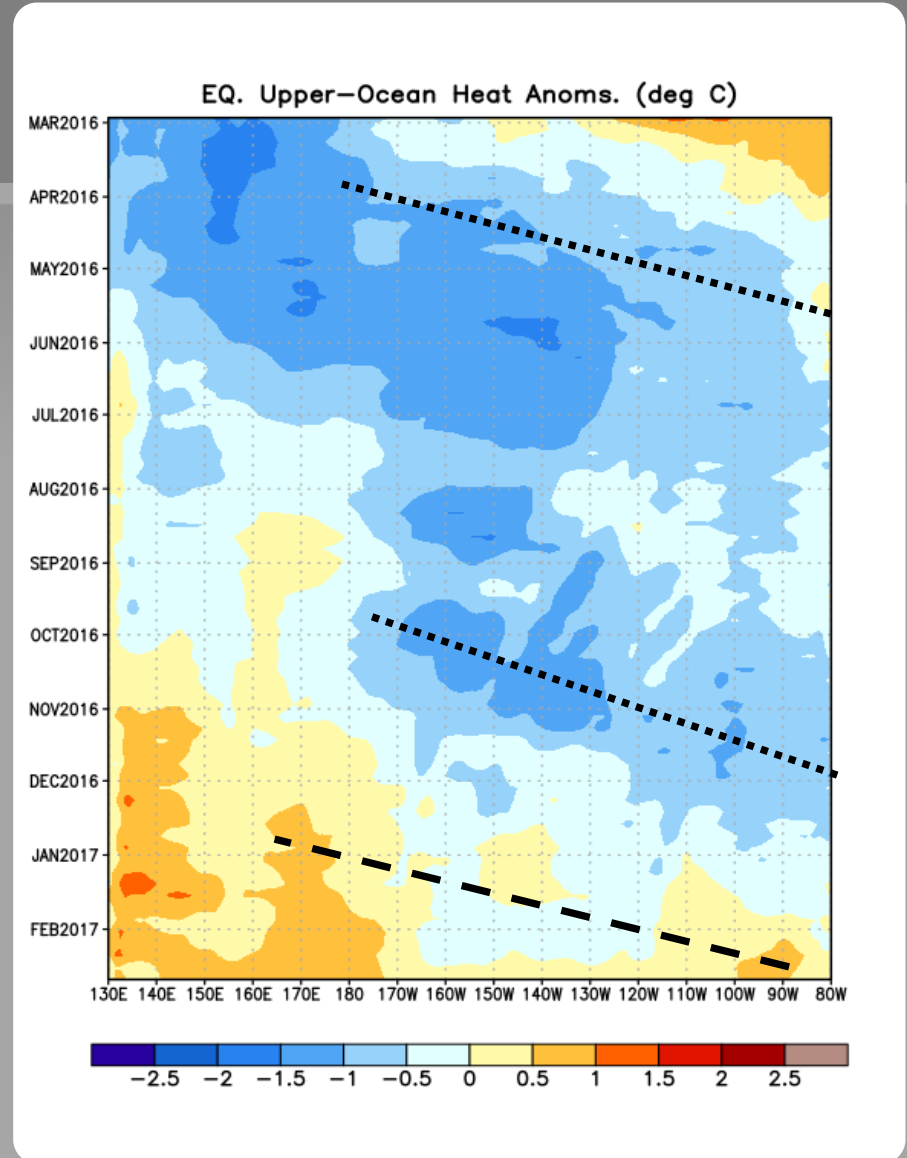
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

# Weekly Heat Content Evolution in the Equatorial Pacific

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, weakly positive subsurface temperature anomalies have expanded into the eastern Pacific Ocean.

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









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

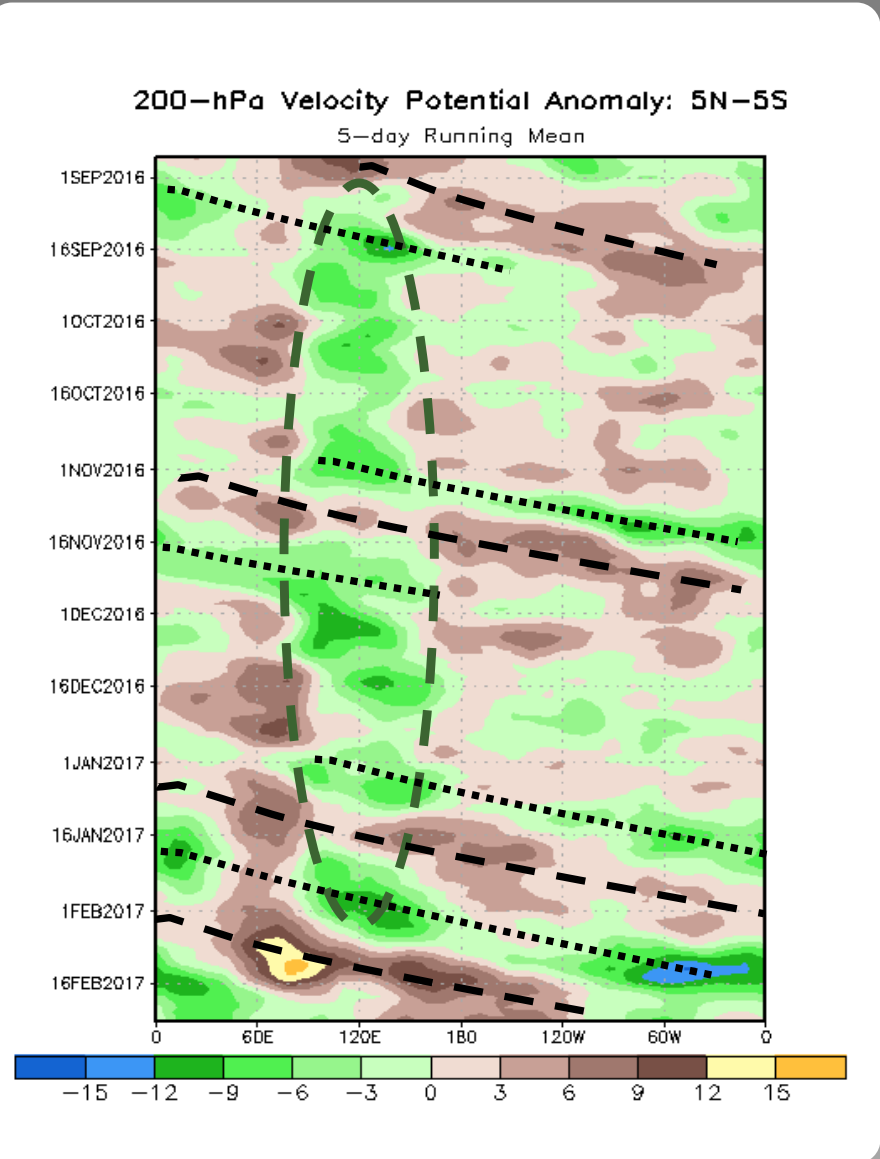
Eastward propagation of regions of upper-level divergence (green shading) and convergence (brown shading) are particularly evident during September 2016, during November 2016, and since early January 2017.

From September 2016 to mid January 2017, anomalous upper-level divergence persisted near Indonesia.

Recently, anomalous upper-level convergence has shifted eastward over the central Pacific Ocean.

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

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

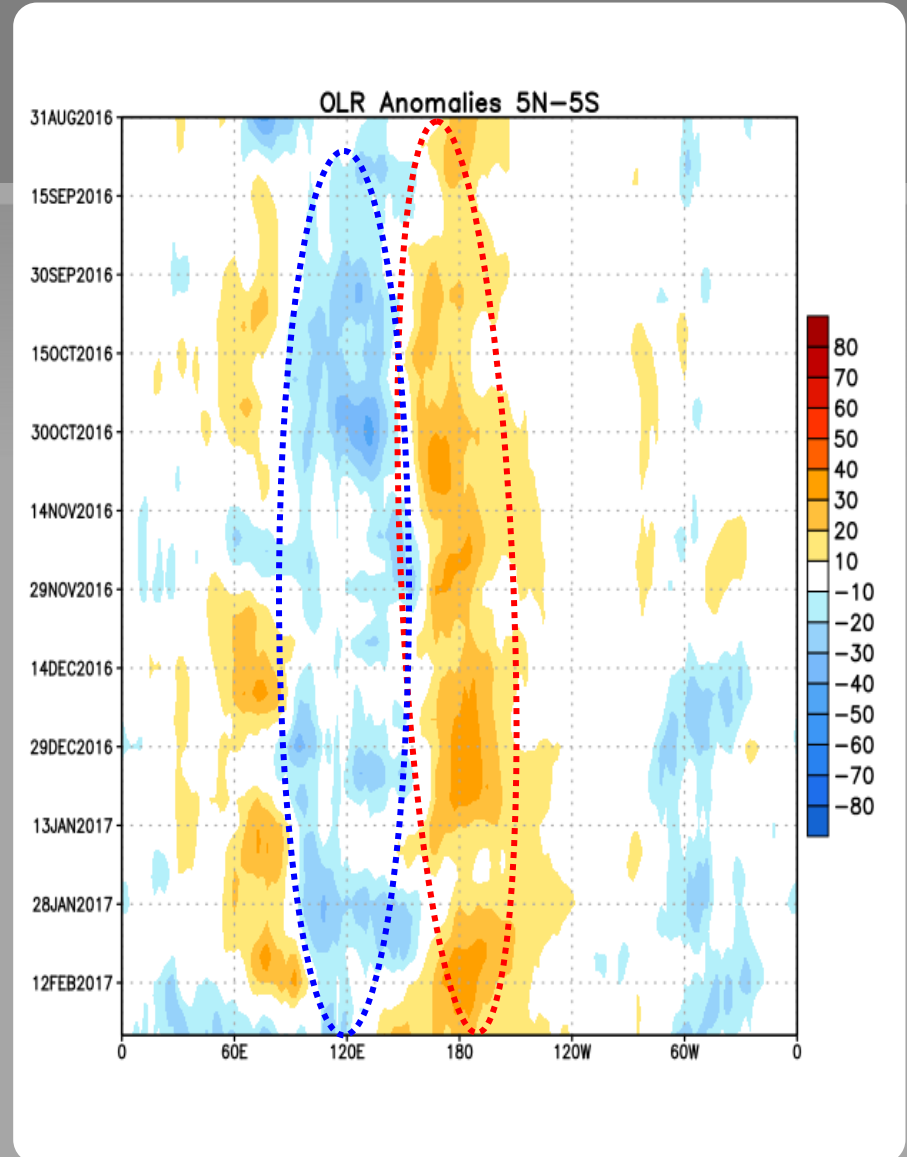


# Outgoing Longwave Radiation (OLR) Anomalies

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

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

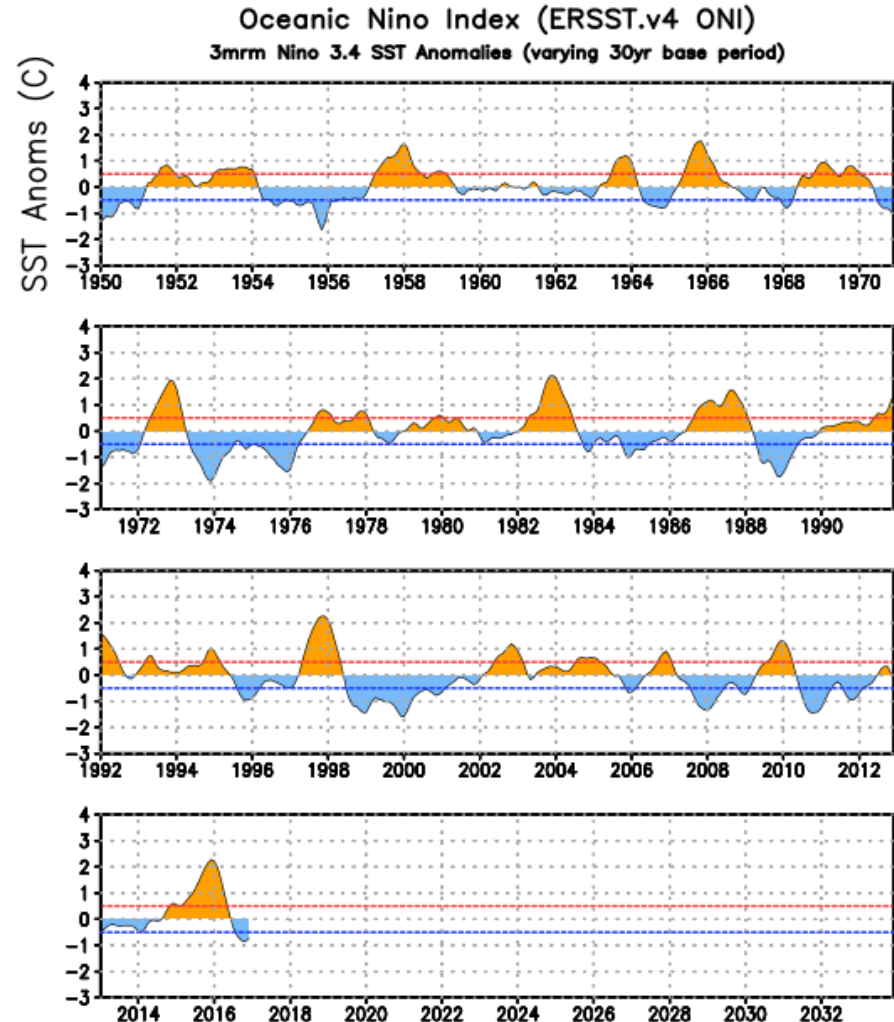
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (November 2016 - January 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.v4

Recent Pacific warm (red) and cold (blue) periods based on a threshold of +/- 0.5 °C for the Oceanic Niño Index (ONI) [3 month running mean of ERSST.v4 SST anomalies in the Niño 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.

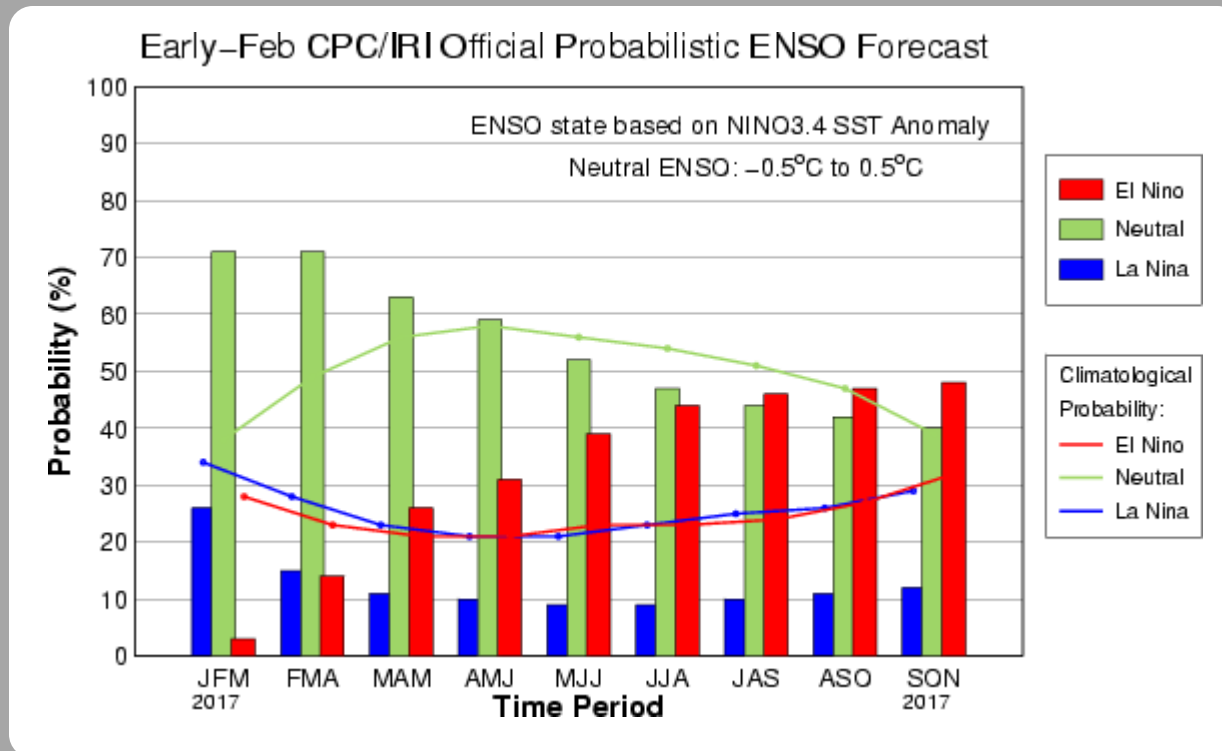
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

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	-0.7

# CPC/IRI Probabilistic ENSO Outlook

Updated: 9 February 2017

ENSO-neutral is favored through mid-2017, with a slight tilt toward El Niño (~50%) by September-October-November (SON) 2017.



# IRI/CPC Pacific Niño

## 3.4 SST Model Outlook

Dynamical models favor El Niño during the early Northern Hemisphere summer 2017, while Statistical models favor ENSO-neutral through the Northern Hemisphere autumn 2017.

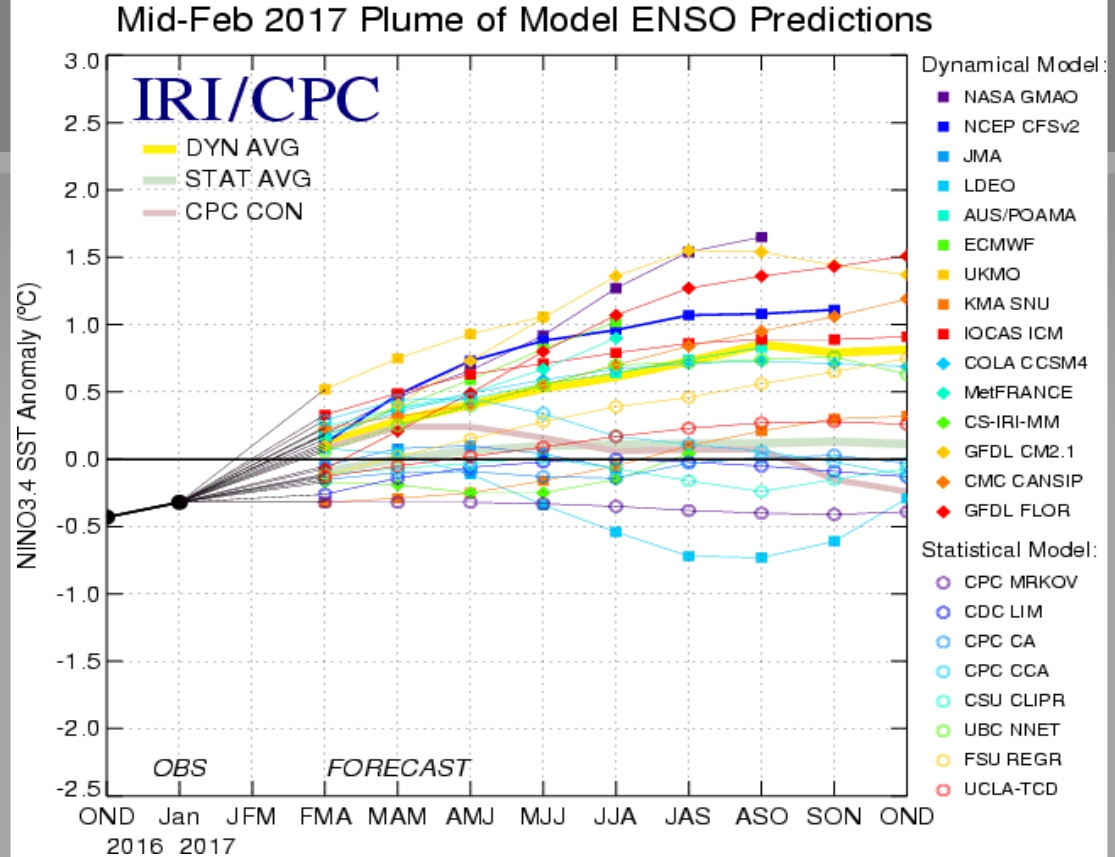


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 15 February 2017).

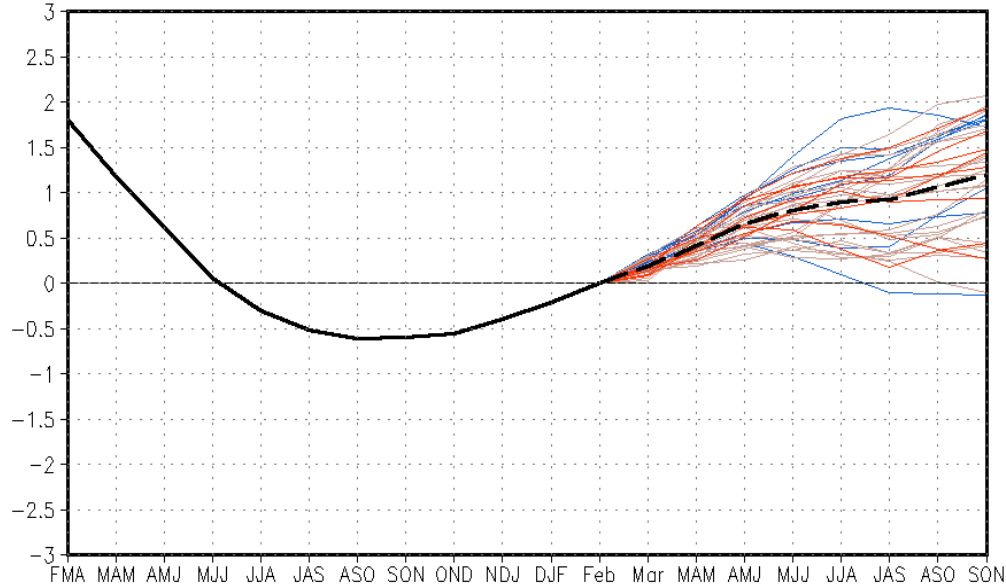


# SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 27 February 2017

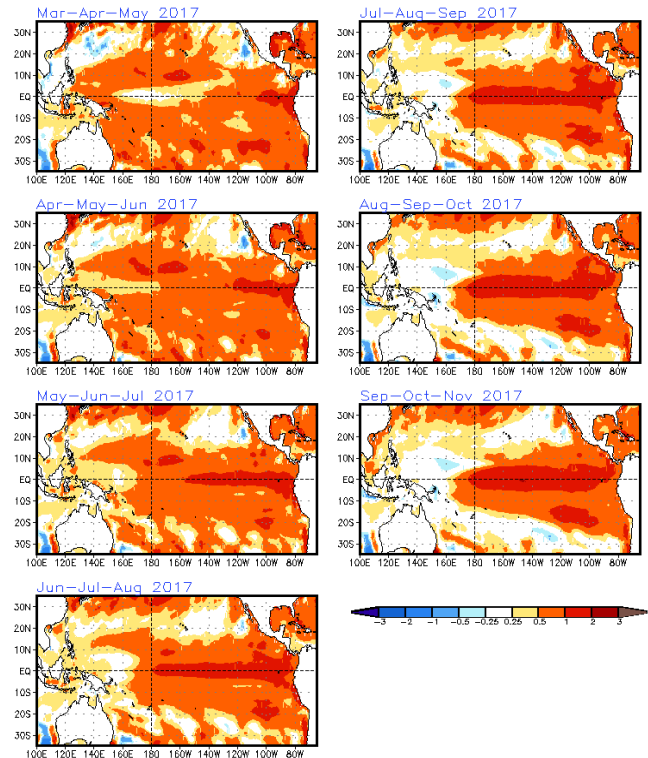
The CFS.v2 ensemble mean (black dashed line) favors weak El Niño conditions to develop during the Northern Hemisphere spring 2017 and strengthen into the autumn of 2017.

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



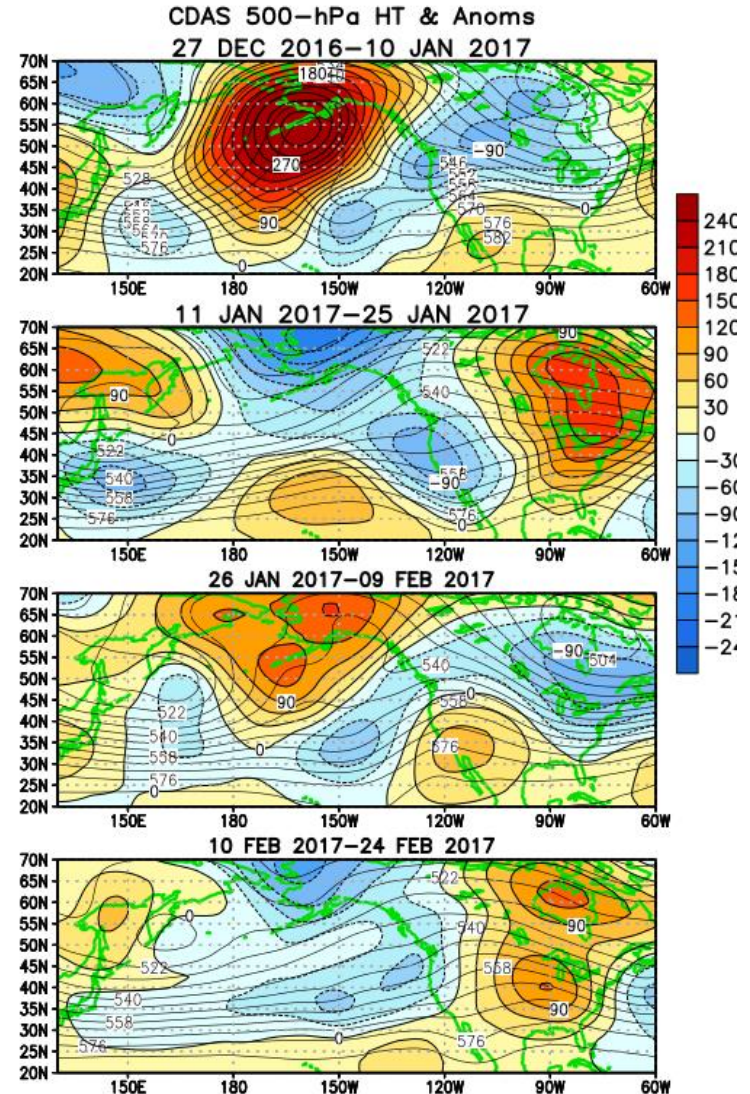
— Latest 8 forecast members  
— Earliest 8 forecast members  
— Other forecast members  
- - - Forecast ensemble mean  
— NCDG daily analysis

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



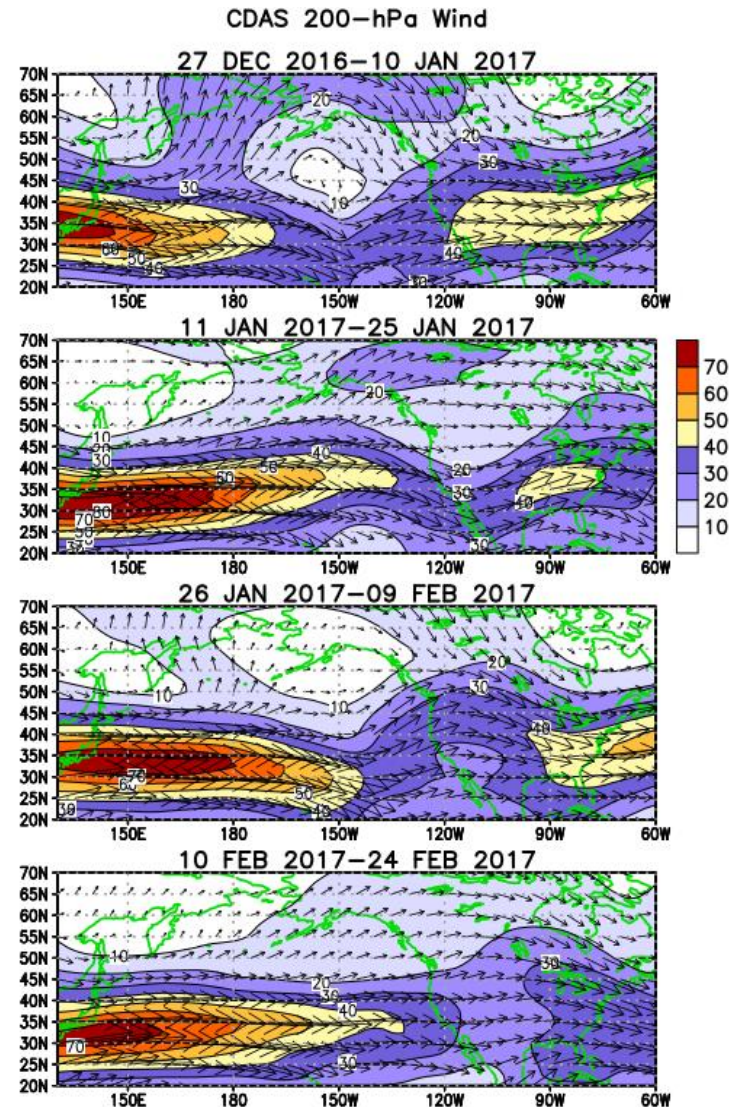
# Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since mid January 2017, below-average heights and temperatures prevailed over the eastern North Pacific Ocean or northwestern United States/western Canada, while heights and temperatures have varied over the eastern U.S.



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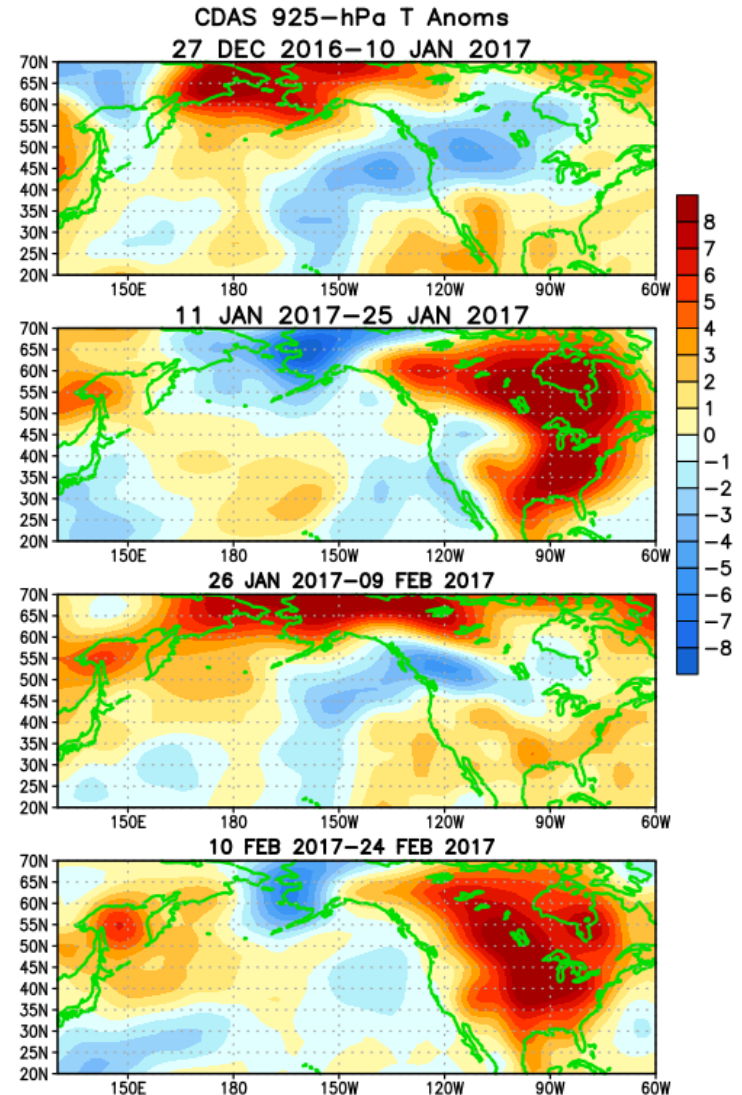
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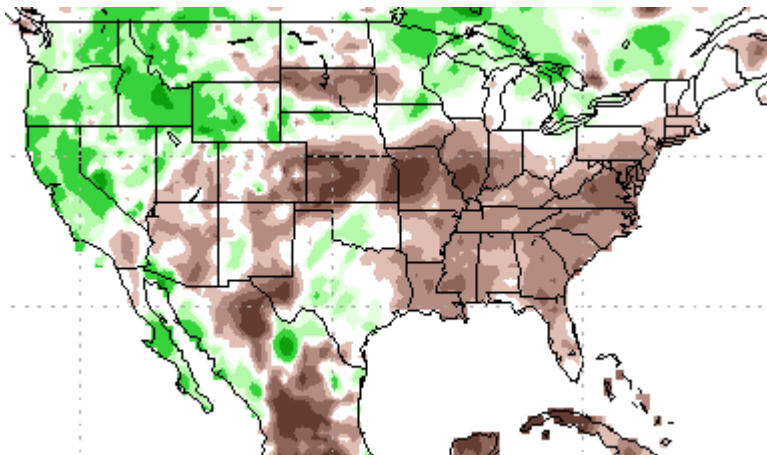
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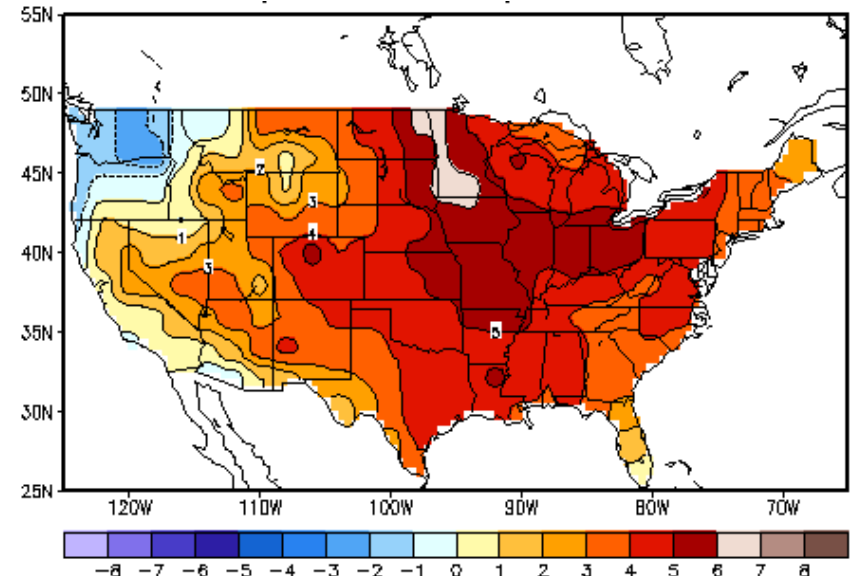
# U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 25 February 2017

Percent of Average Precipitation



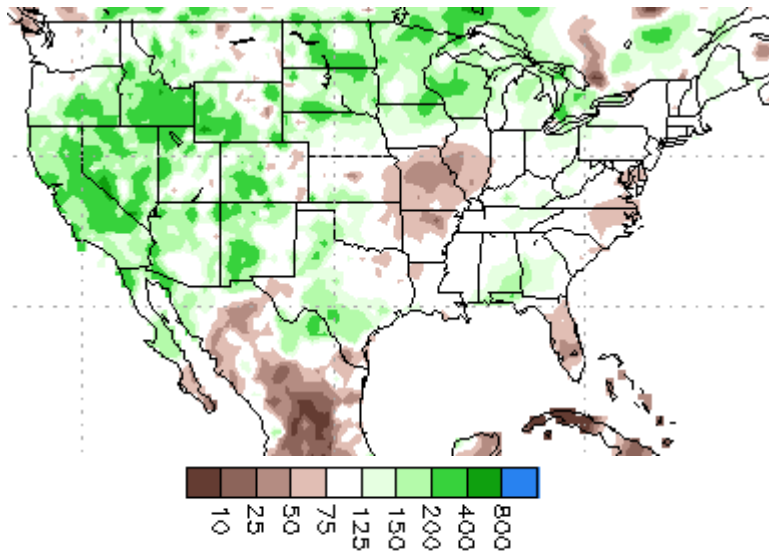
Temperature Departures (degree C)



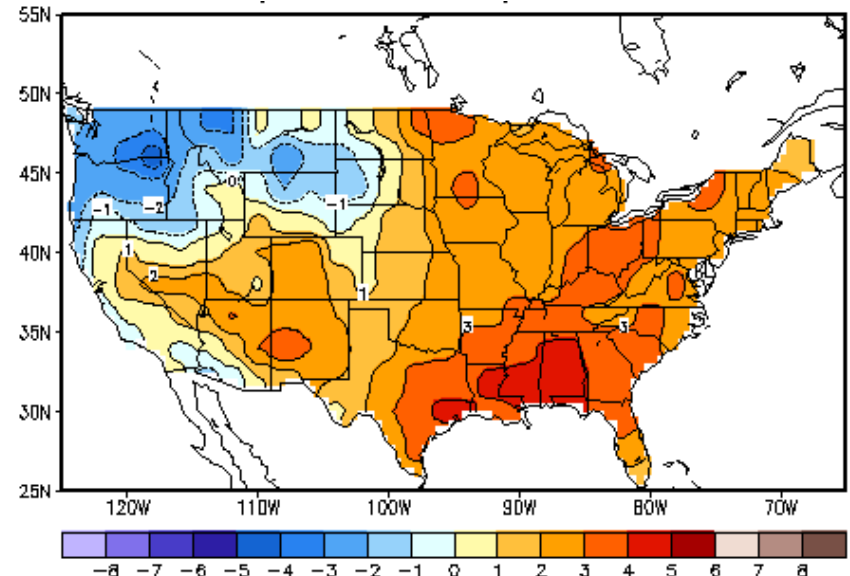
# U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 25 February 2017

### Percent of Average Precipitation



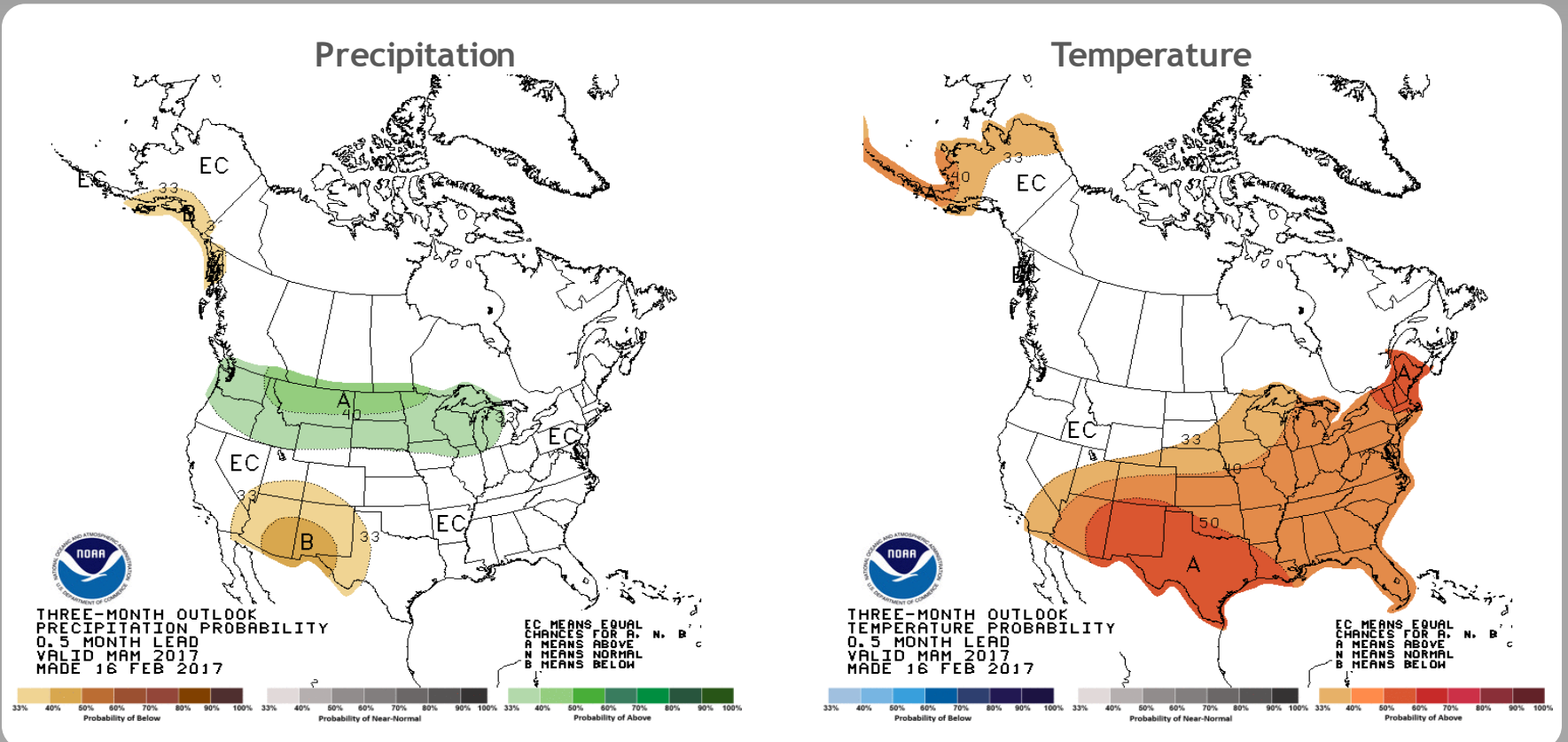
### Temperature Departures (degree C)



# U. S. Seasonal Outlooks

March - May 2017

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



# Summary

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