

# ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:  
Climate Prediction Center / NCEP  
1 April 2019

# 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: El Niño Advisory

El Niño conditions are present.\*

Equatorial sea surface temperatures (SSTs) are above average across most of the Pacific Ocean.

The pattern of anomalous convection and winds are consistent with El Niño.

Weak El Niño conditions are likely to continue through the Northern Hemisphere spring 2019 (~80% chance) and summer (~60% chance).

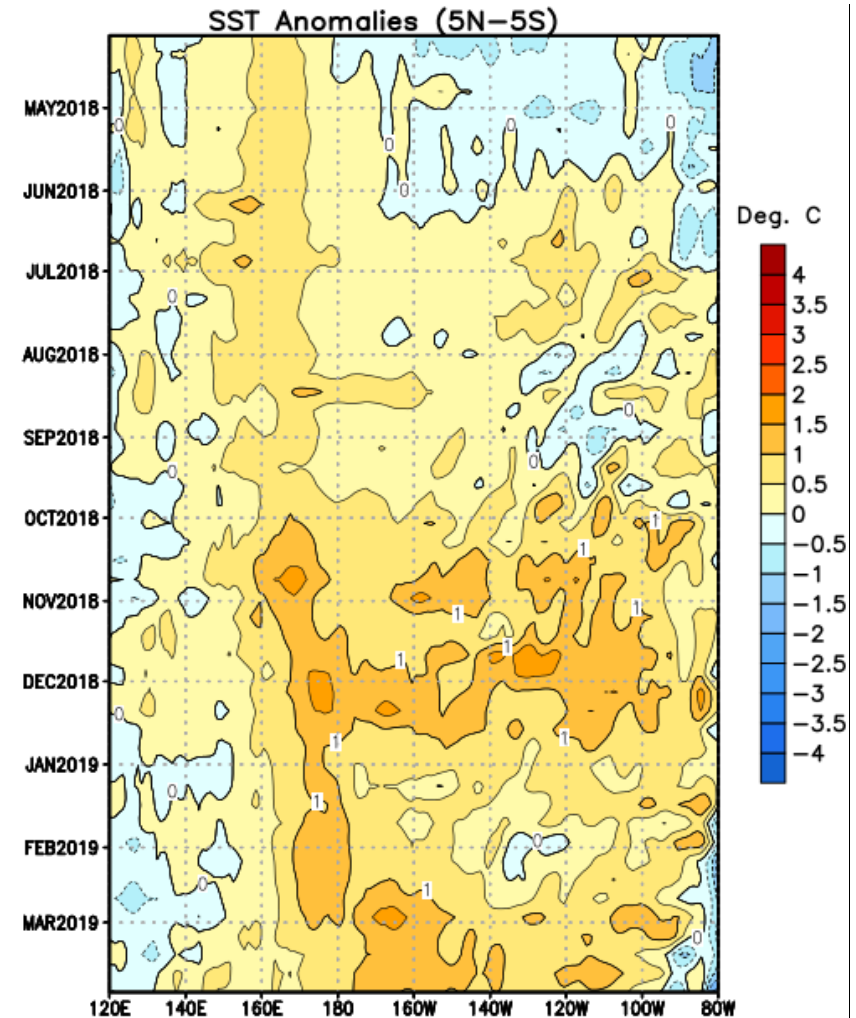
\* Note: These statements are updated once a month (2<sup>nd</sup> Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

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

Since early June 2018, near-to-above average SSTs have been present across most of the Pacific Ocean.

During February 2019, positive SST anomalies strengthened across most of the equatorial Pacific.

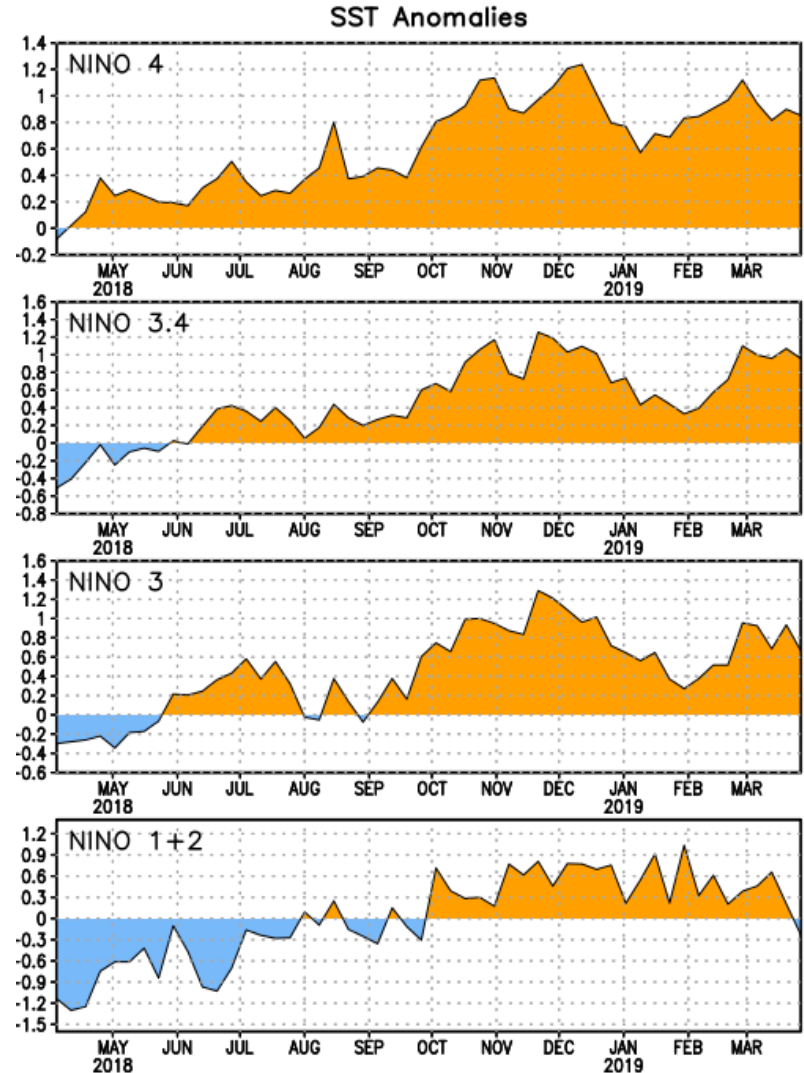
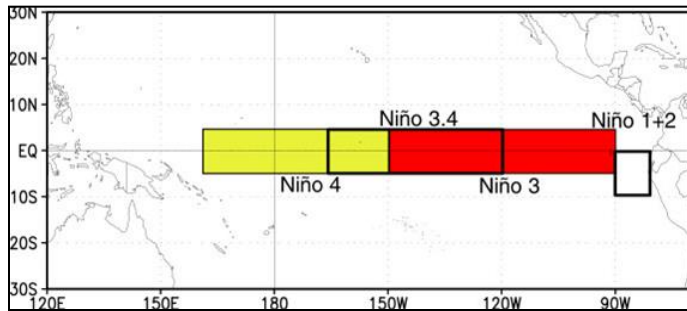
Recently, positive SST anomalies have persisted across much of the Pacific.



# Niño Region SST Departures (°C) Recent Evolution

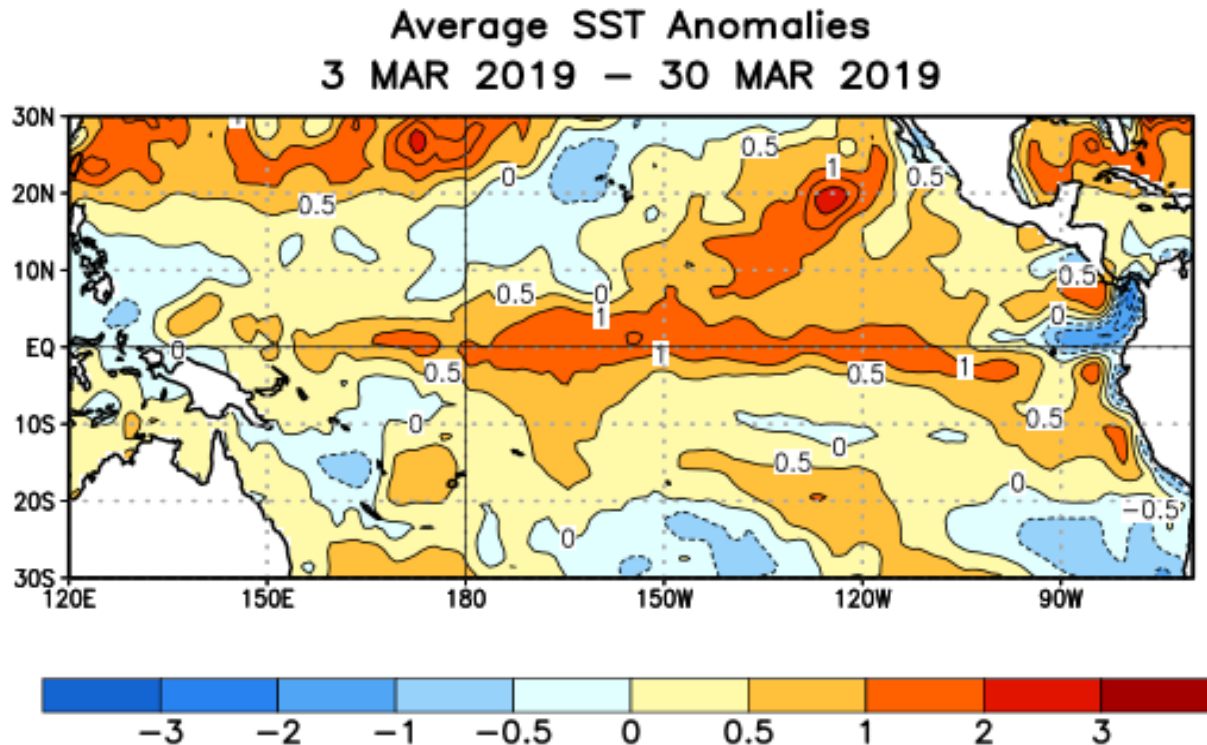
The latest weekly SST departures are:

Niño 4	0.9°C
Niño 3.4	1.0°C
Niño 3	0.7°C
Niño 1+2	-0.2°C



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

During the last four weeks, equatorial SSTs were above average in the central and east-central Pacific Ocean. SSTs were below average around Indonesia and in parts of the far eastern Pacific.

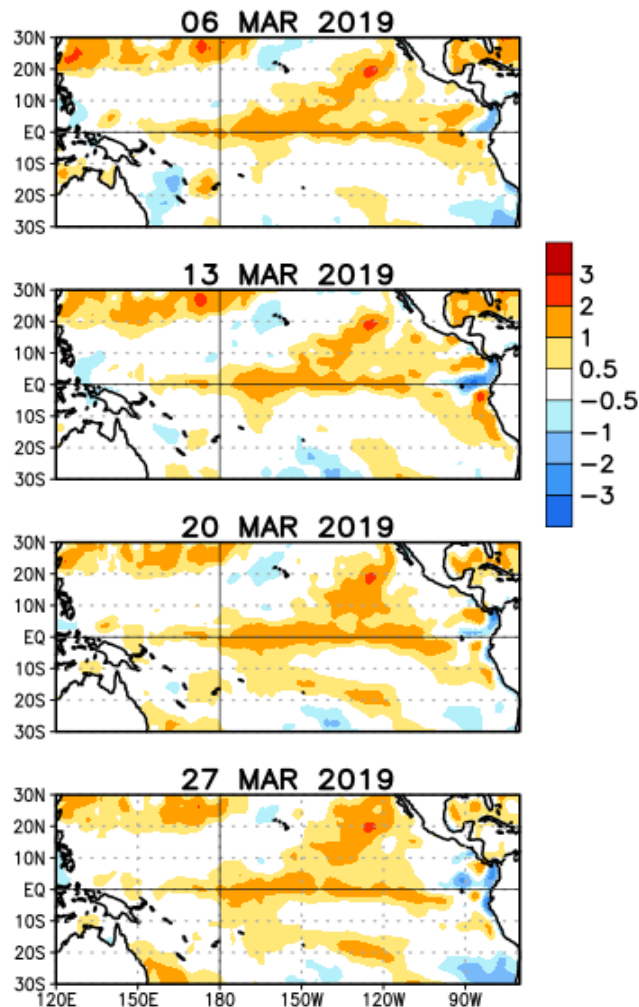




# Weekly SST Departures during the Last Four Weeks

During the last four weeks, above-average SSTs have persisted across most of the equatorial Pacific Ocean.

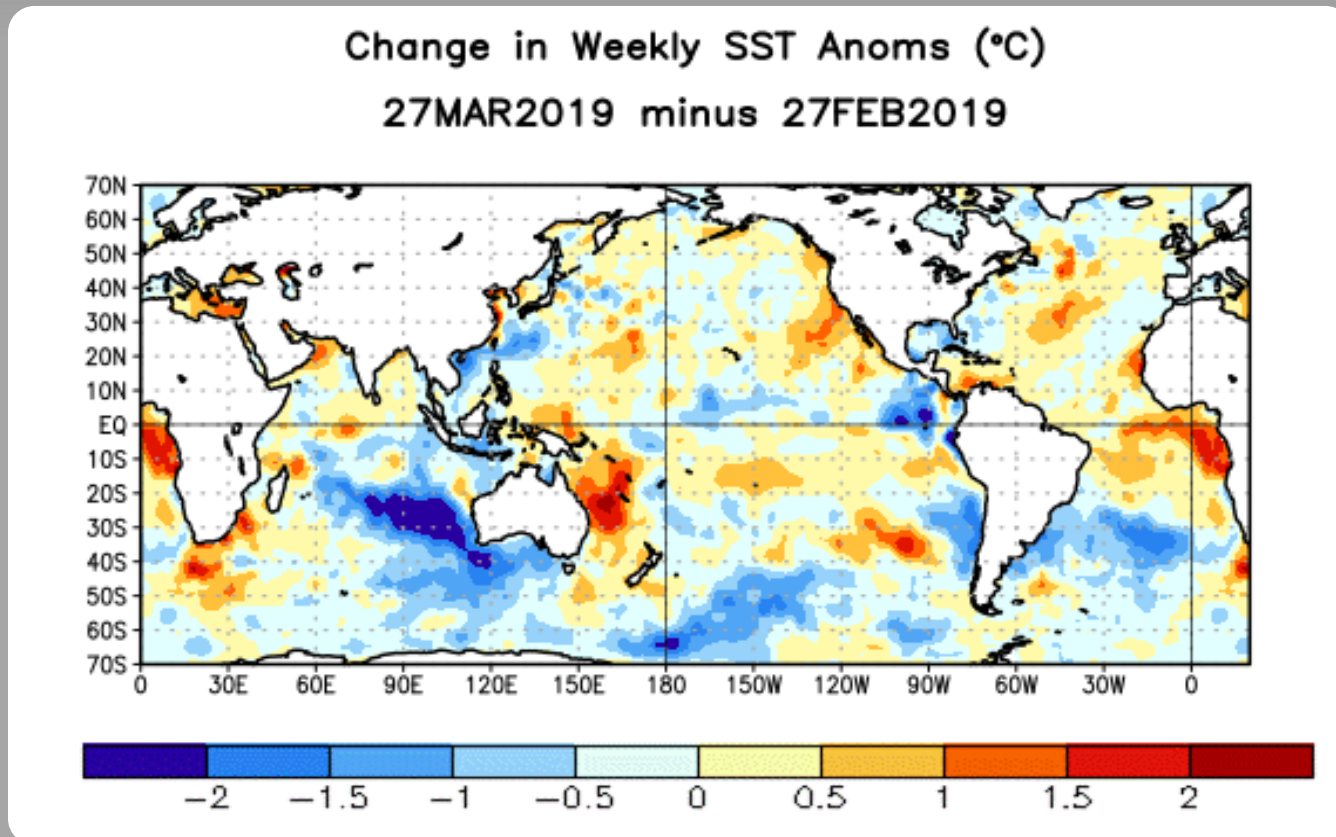
### Weekly SST Anomalies (DEG C)





# Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative changes in SST anomalies were apparent near the Date Line and in the eastern equatorial Pacific Ocean.



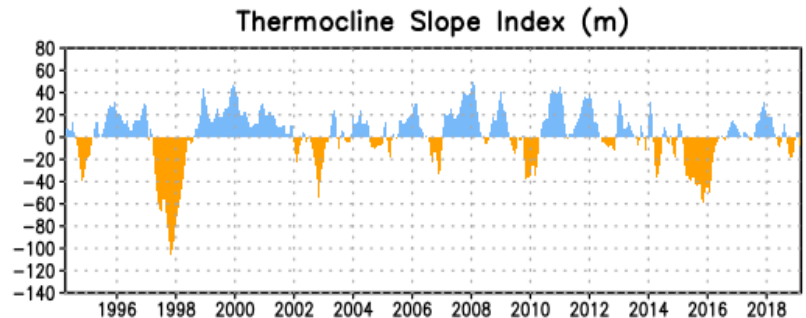
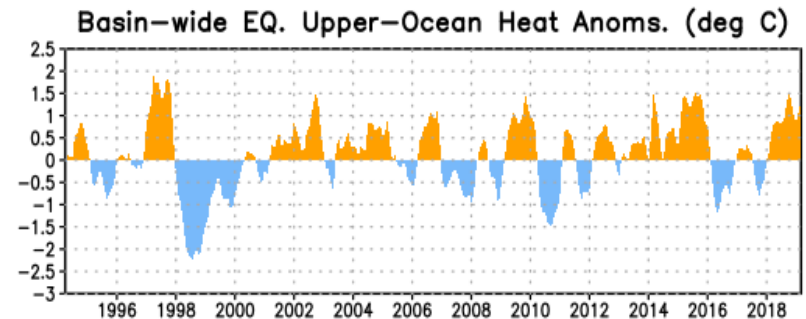
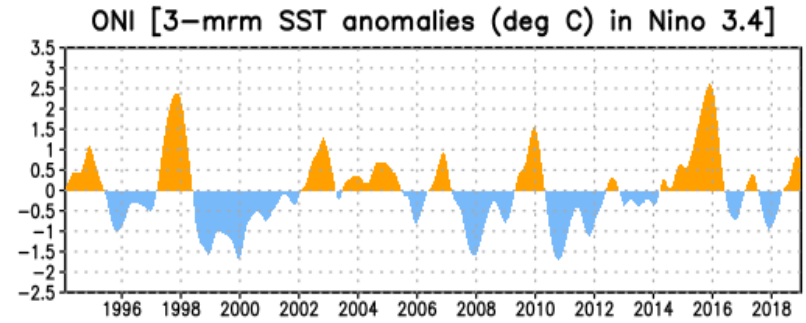
# Upper-Ocean Conditions in the Equatorial Pacific

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.

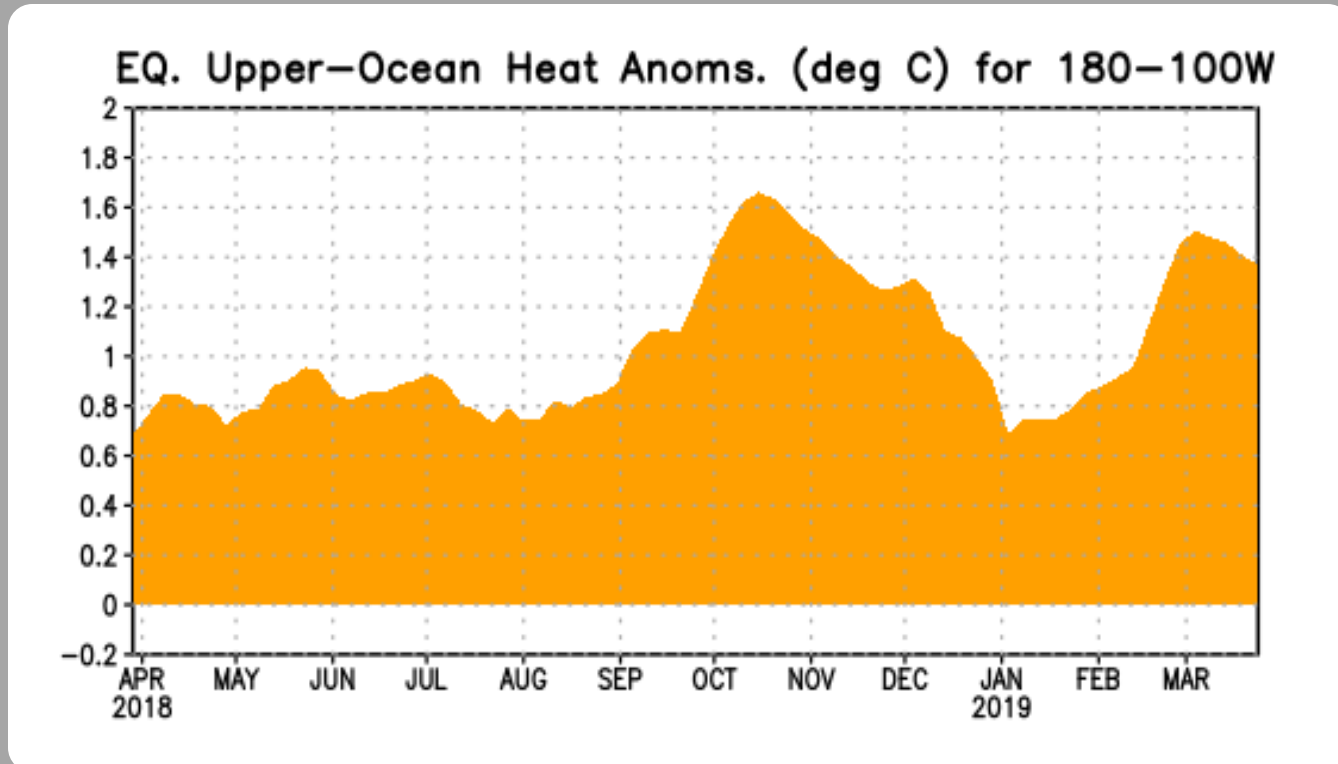
Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (below average) reflect El Niño conditions.

*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).*



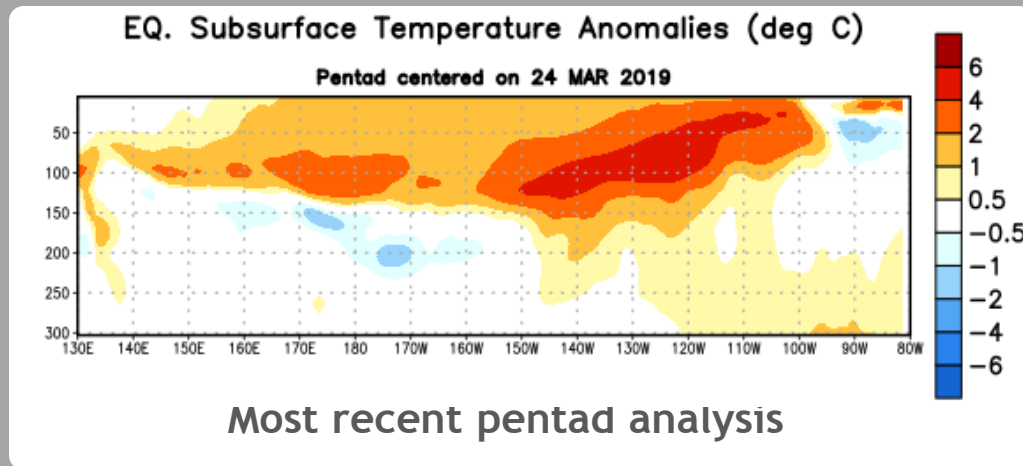
# Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies have been present for more than a year, with a peak in October and a minimum in early January 2019. Positive anomalies increased in January and February, and then decreased slightly during March.

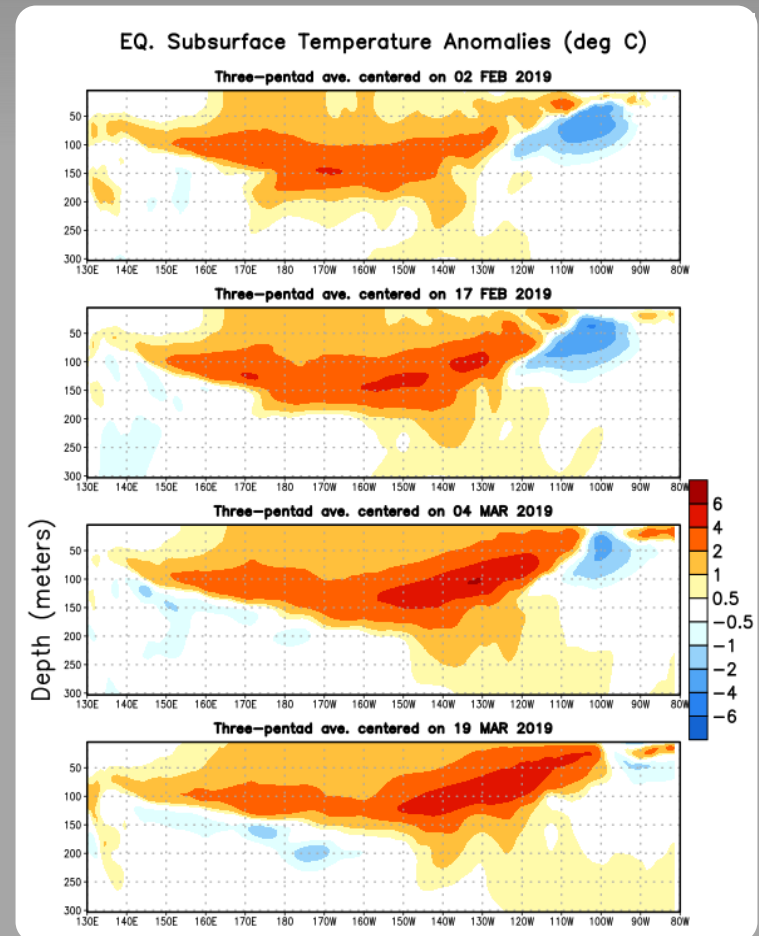


# Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have persisted across most of the equatorial Pacific Ocean.



Negative subsurface temperature anomalies east of 100°W have weakened.

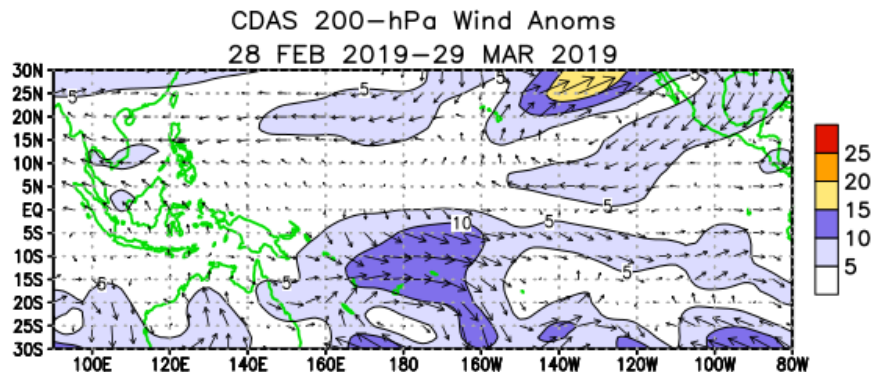
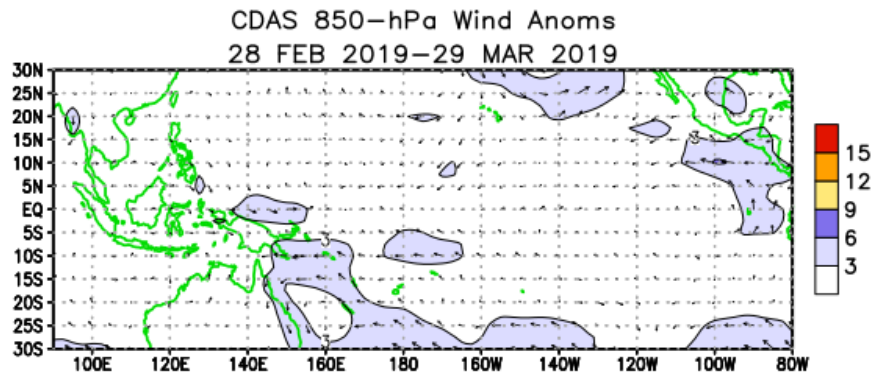
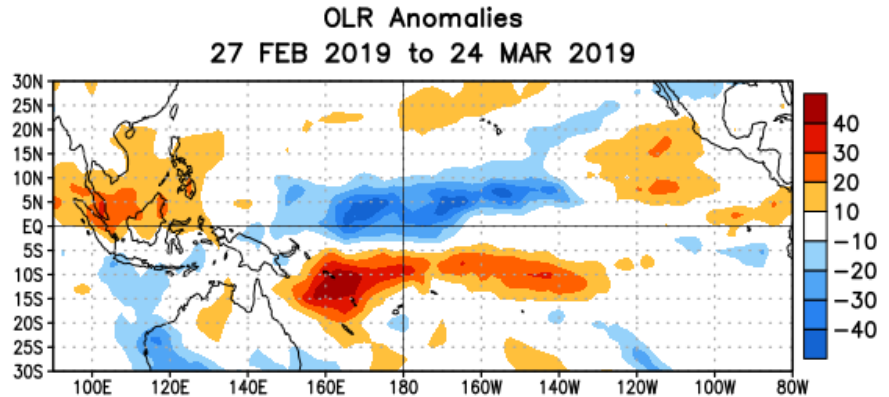


# Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident around Borneo, the Philippines, and Malaysia. Negative OLR anomalies (enhanced convection and precipitation) were prominent around the Date Line.

Anomalous low-level (850-hPa) westerly winds were evident over the far western equatorial Pacific.

Upper-level (200-hPa) winds were mostly near average across the 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.

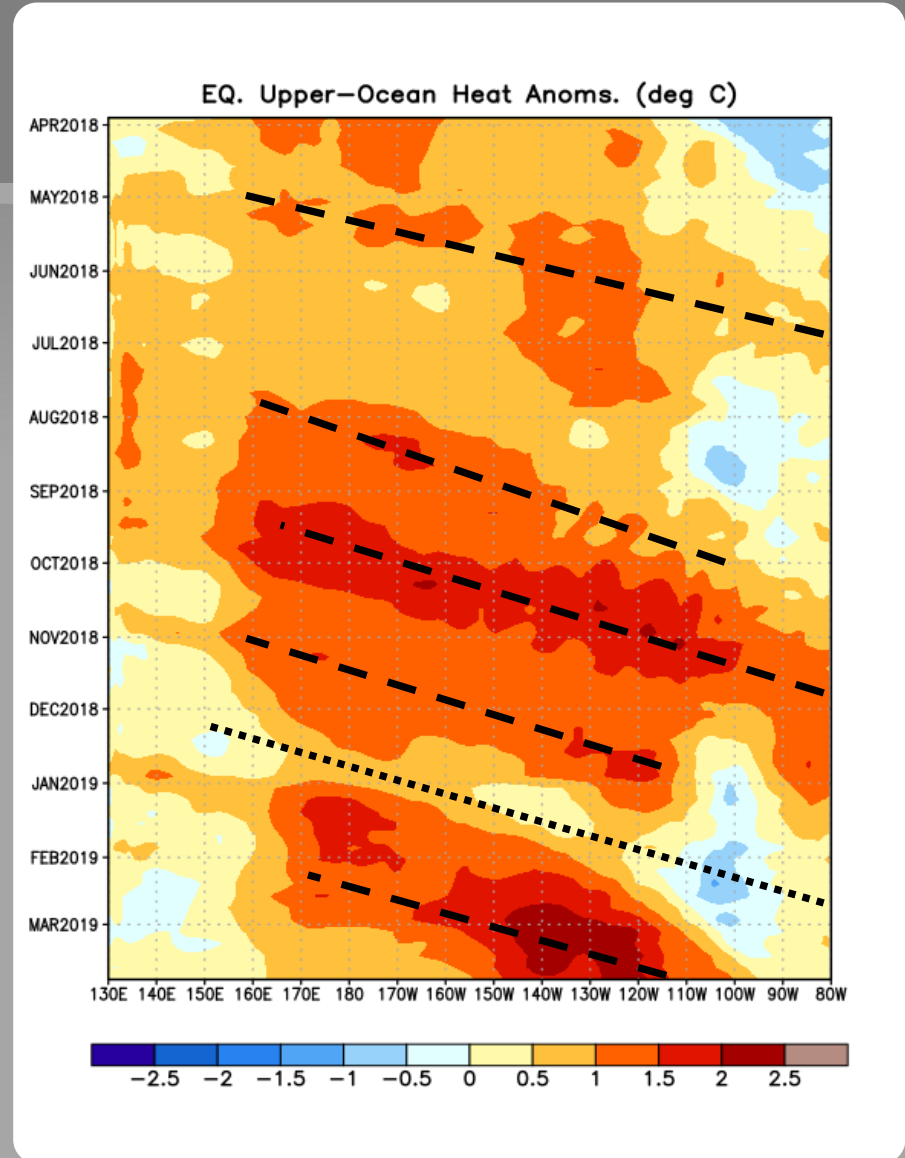
# Weekly Heat Content Evolution in the Equatorial Pacific

In early August, October, and November 2018, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

Since early January 2019, a downwelling Kelvin wave increased the positive subsurface temperature anomalies across the Pacific.

In the last couple of weeks, positive subsurface temperature anomalies have increased in the eastern Pacific.

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 up-welling and cooling occur in the trailing portion.



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

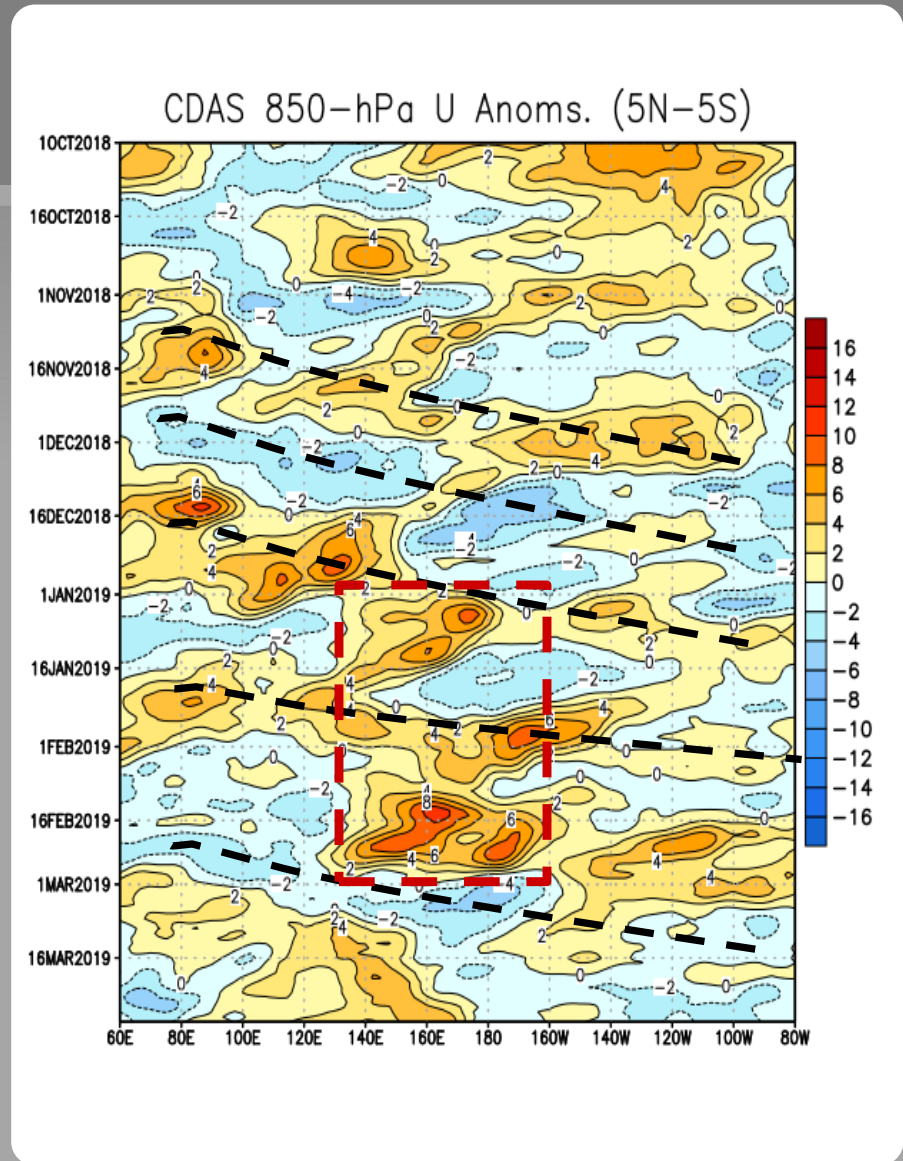
At times, the Madden Julian Oscillation (MJO) contributed to the eastward propagation of low-level wind anomalies.

During January-February 2019, westerly wind anomalies generally persisted over the west-central equatorial Pacific Ocean.

Since mid-March, westerly wind anomalies have persisted over the western equatorial Pacific, while easterly wind anomalies have persisted over the eastern Pacific.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)





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

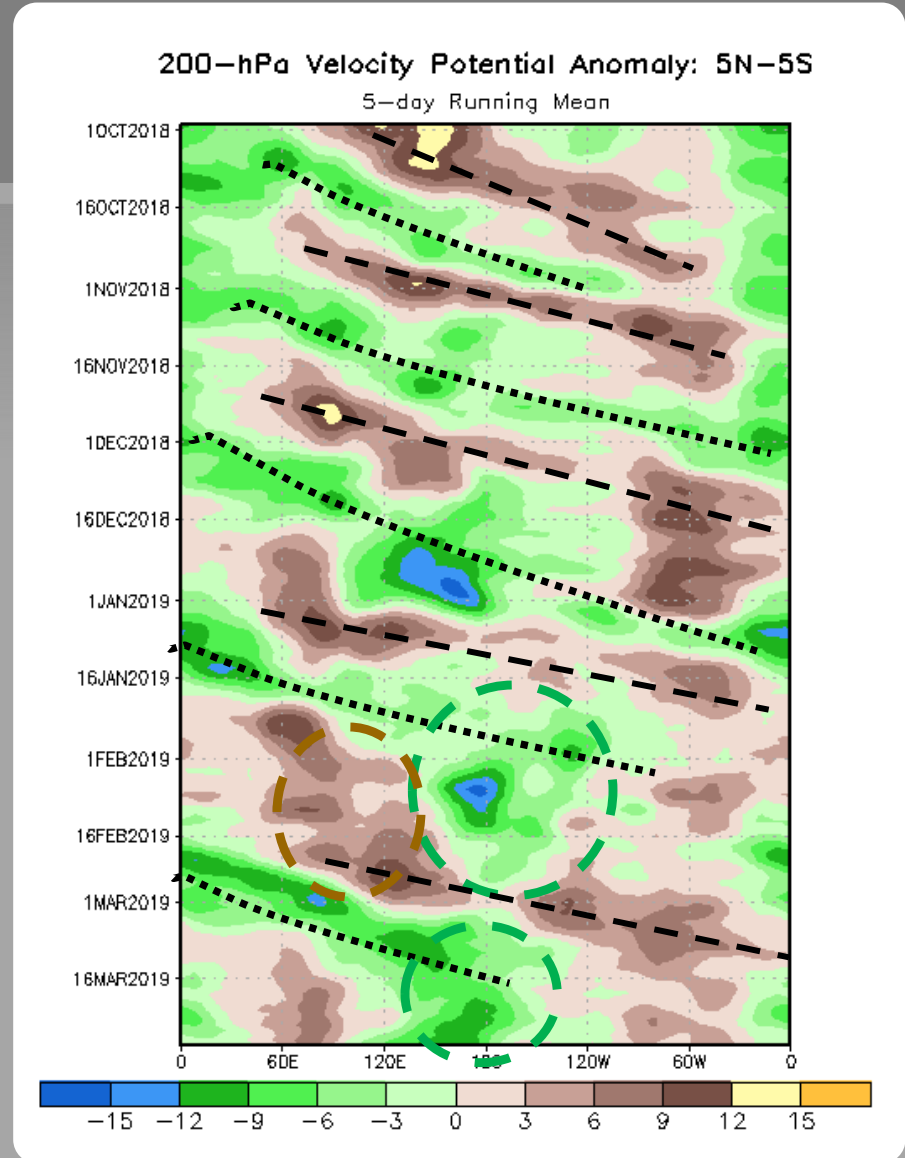
Since October 2018, eastward propagation has been evident in the anomalies.

From mid-January to late February 2019, anomalous upper-level divergence (green shading) persisted near the Date Line, while anomalous upper-level convergence (brown shading) occurred near Indonesia and the eastern Indian Ocean.

Recently, anomalous upper-level divergence has persisted near the Date Line.

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

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



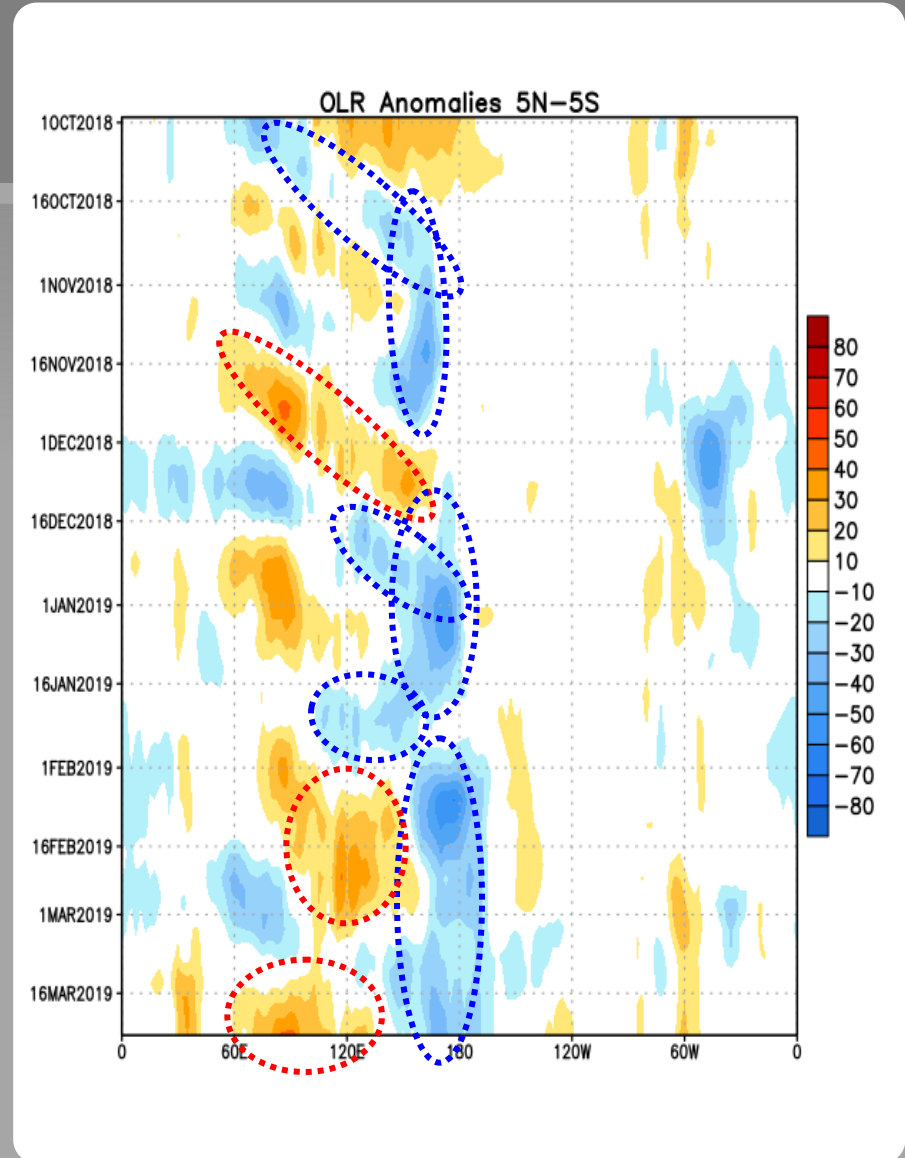
# Outgoing Longwave Radiation (OLR) Anomalies

From mid-October to late November 2018 and again between mid-December to mid-January 2019, negative OLR anomalies persisted over the western Pacific.

During February 2019, positive OLR anomalies were over Indonesia, while negative OLR anomalies were near the Date Line.

More recently, negative OLR anomalies have persisted near the Date Line, while positive OLR anomalies have re-emerged around 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.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  $-0.5^{\circ}\text{C}$ .

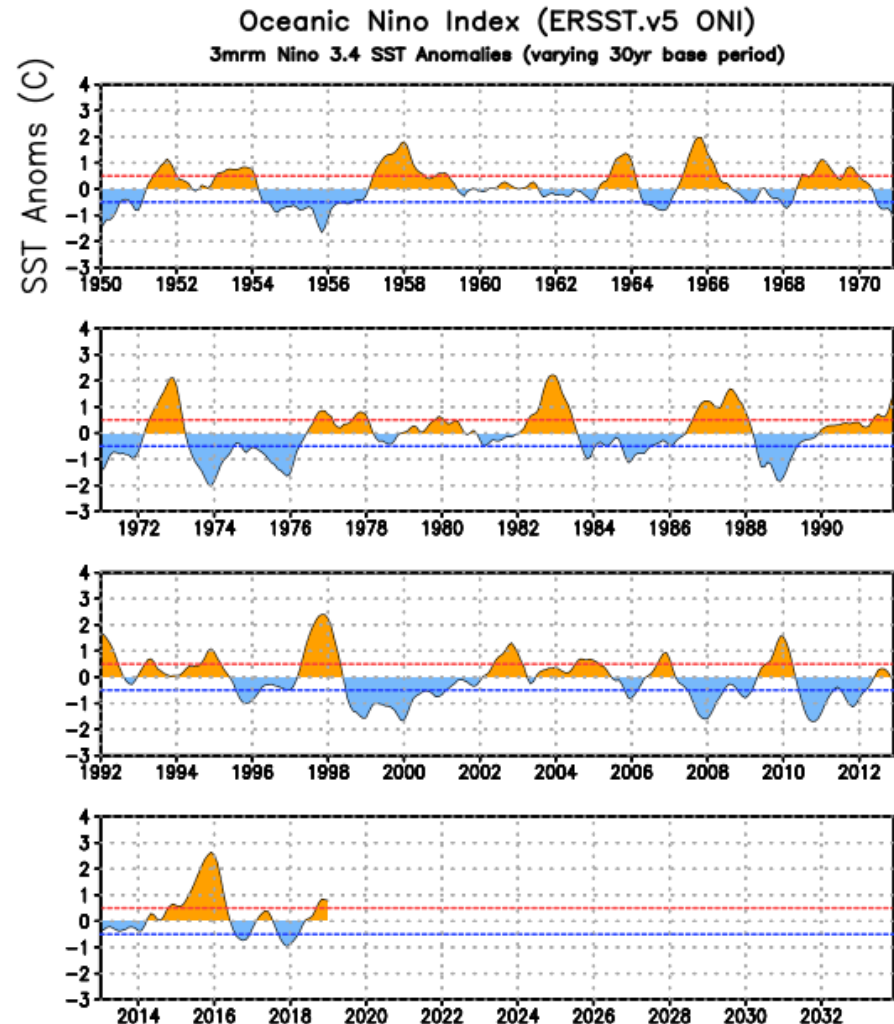
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (December 2018 - February 2019) is +0.8°C.

El Niño ↑  
Neutral  
La Niña ↓

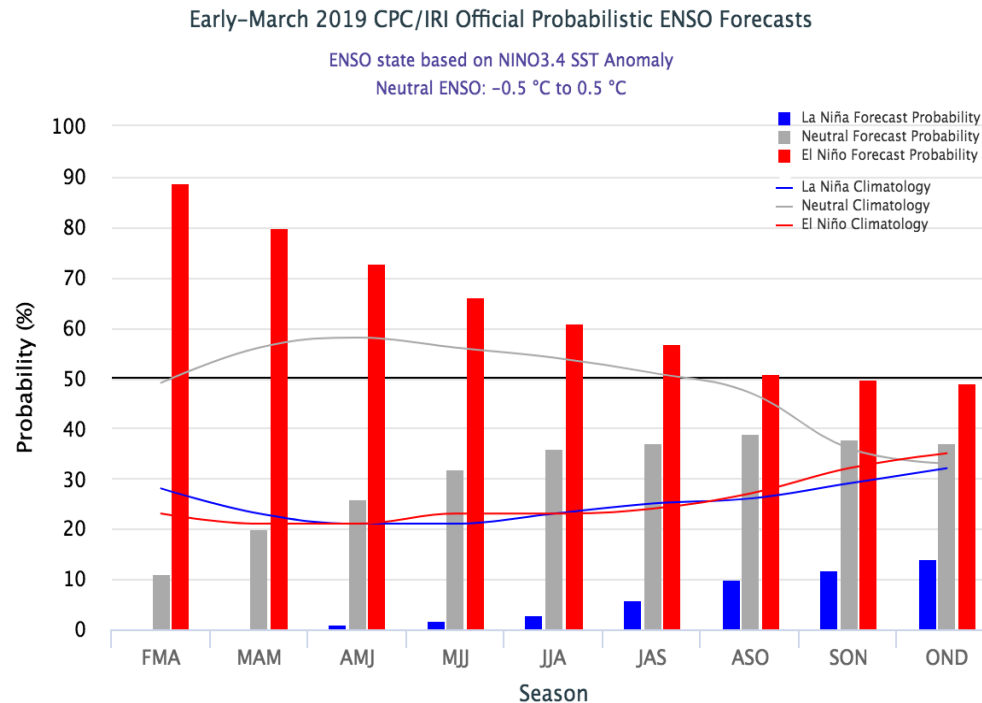




# CPC/IRI Probabilistic ENSO Outlook

Updated: 14 March 2019

El Niño conditions are favored to continue through fall 2019 with diminishing chances (~50% in October-November-December).



# IRI/CPC Pacific Niño

## 3.4 SST Model Outlook

The majority of models predict a weak El Niño to continue into the Northern Hemisphere fall 2019.

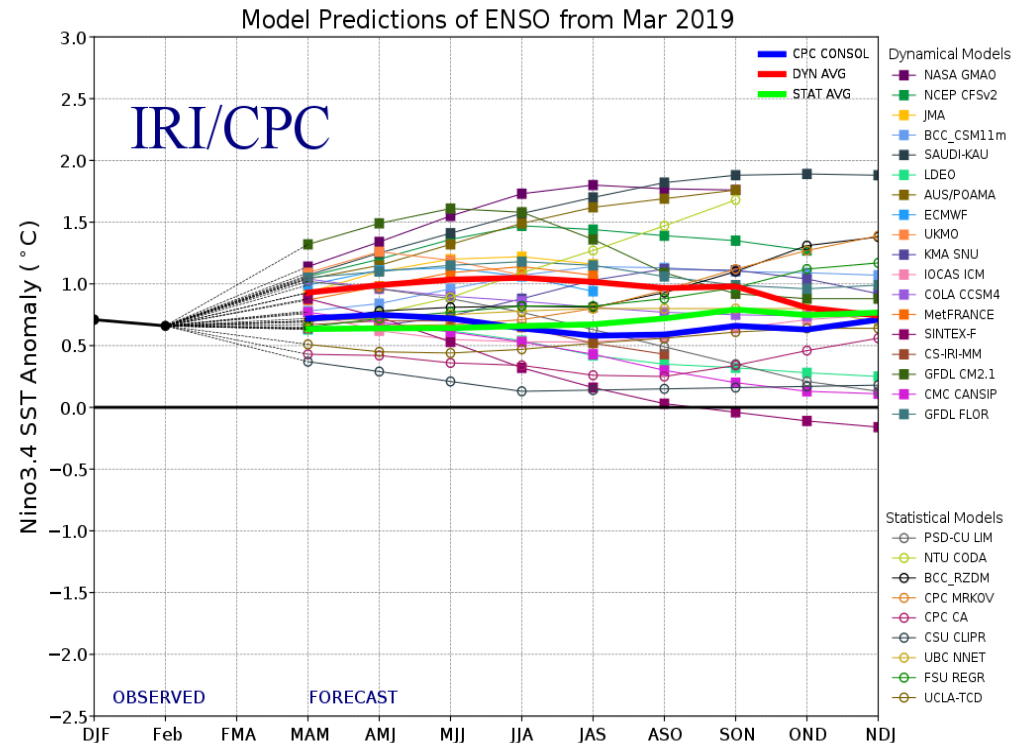


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 March 2019).

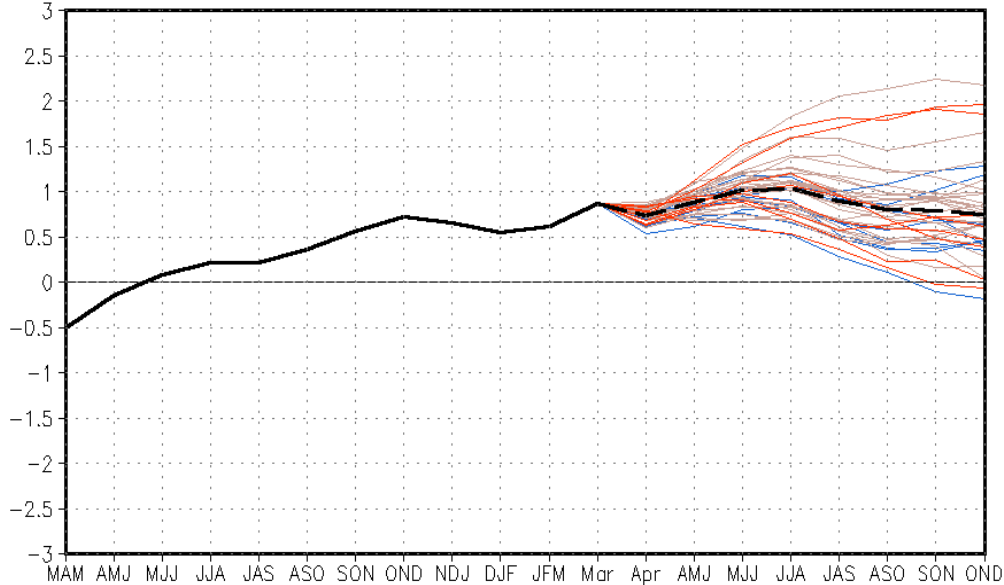


# SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 1 April 2019

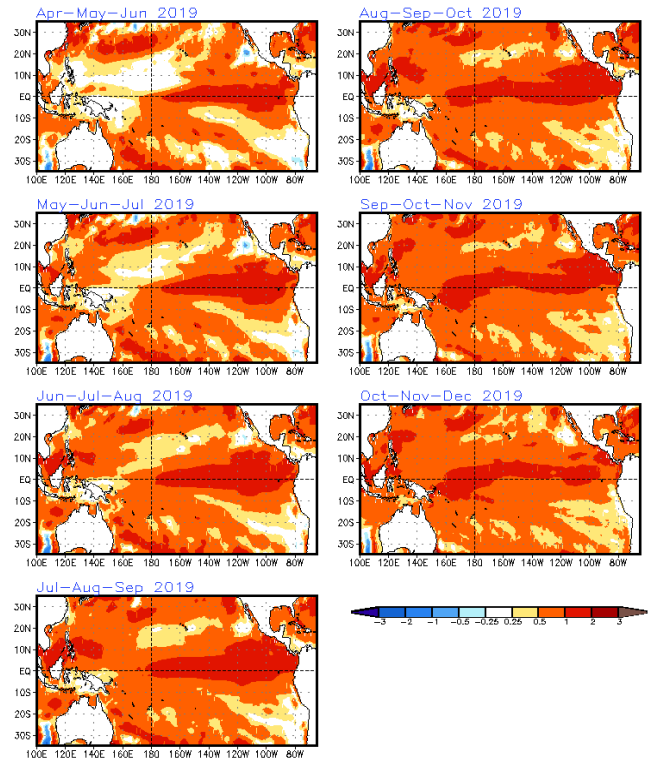
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through the Northern Hemisphere fall 2019.

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

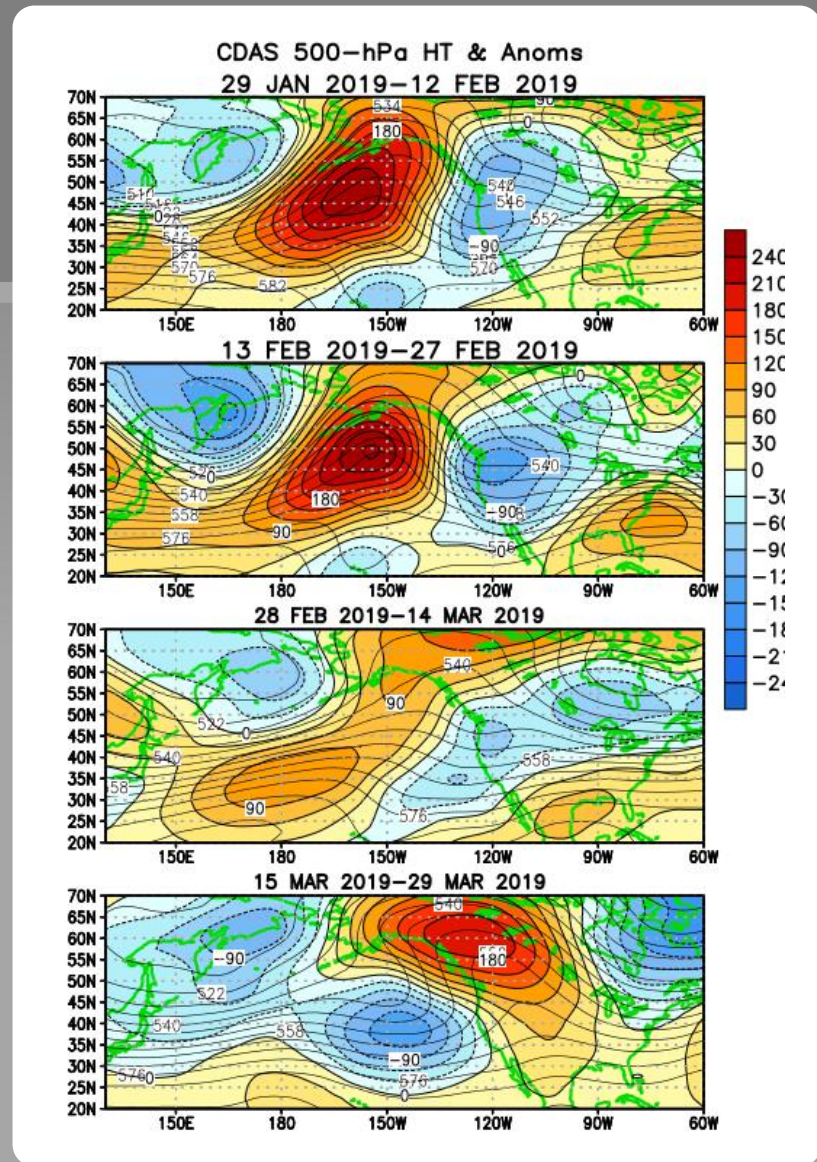
(Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)



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

From early February to mid March, an anomalous ridge strengthened over the Gulf of Alaska, and a downstream amplified trough was present over Canada and the northern U.S. These conditions have contributed to well above-average temperatures in Alaska, and to below-average temperatures across much of Canada and the U.S.

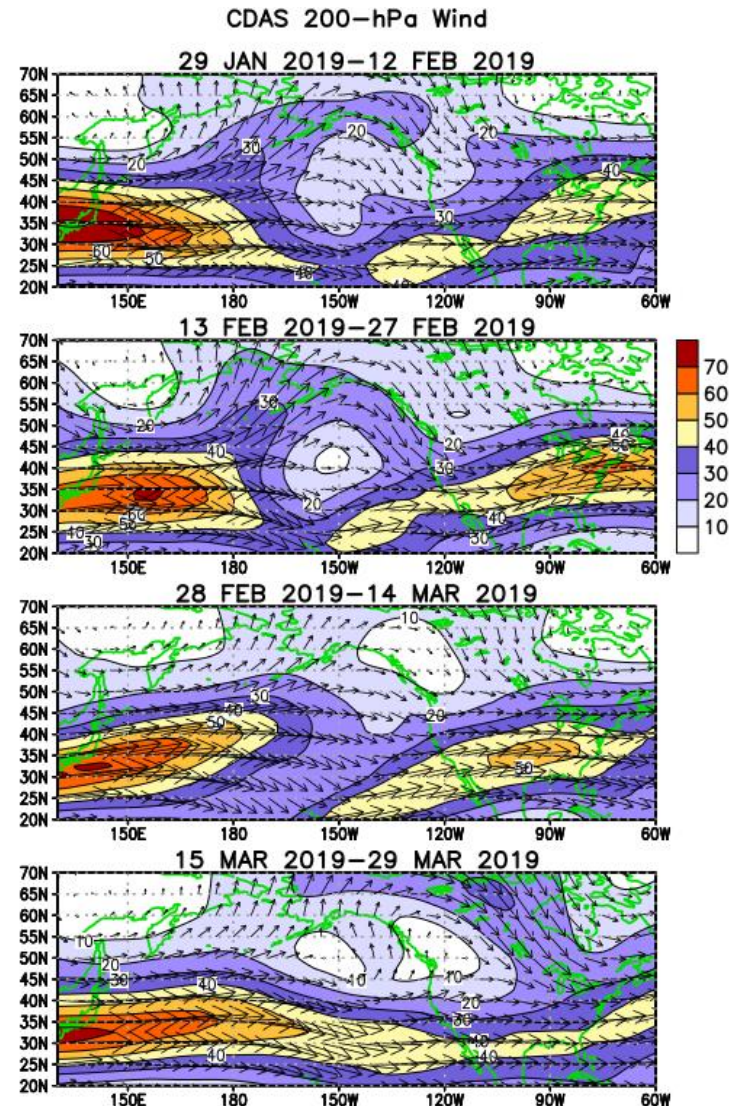
Since mid March, anomalous ridging has been strongest over western Canada, resulting in above-average temperatures over this region.



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

From early February to mid March, an anomalous ridge strengthened over the Gulf of Alaska, and a downstream amplified trough was present over Canada and the northern U.S. These conditions have contributed to well above-average temperatures in Alaska, and to below-average temperatures across much of Canada and the U.S.

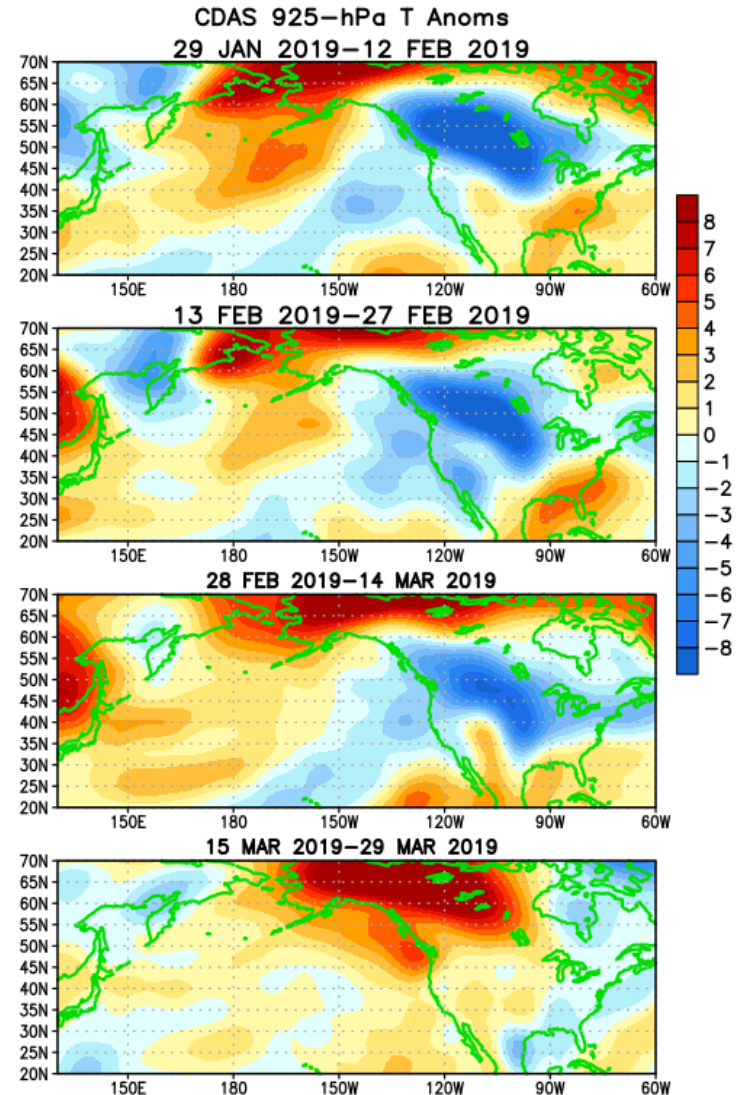
Since mid March, anomalous ridging has been strongest over western Canada, resulting in above-average temperatures over this region.



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

From early February to mid March, an anomalous ridge strengthened over the Gulf of Alaska, and a downstream amplified trough was present over Canada and the northern U.S. These conditions have contributed to well above-average temperatures in Alaska, and to below-average temperatures across much of Canada and the U.S.

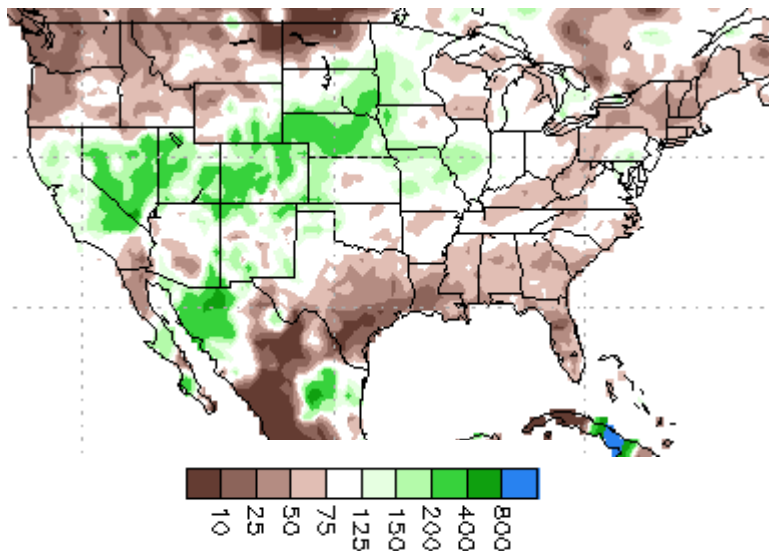
Since mid March, anomalous ridging has been strongest over western Canada, resulting in above-average temperatures over this region.



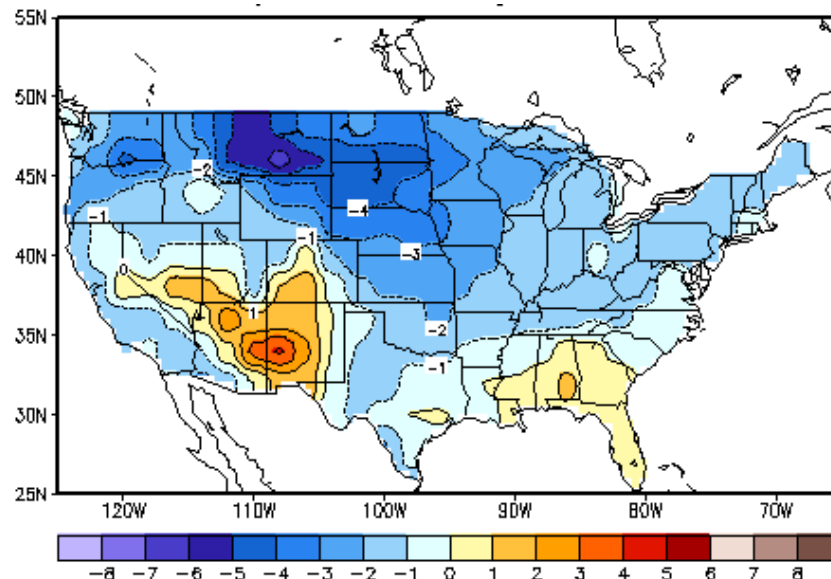
# U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 30 March 2019

### Percent of Average Precipitation



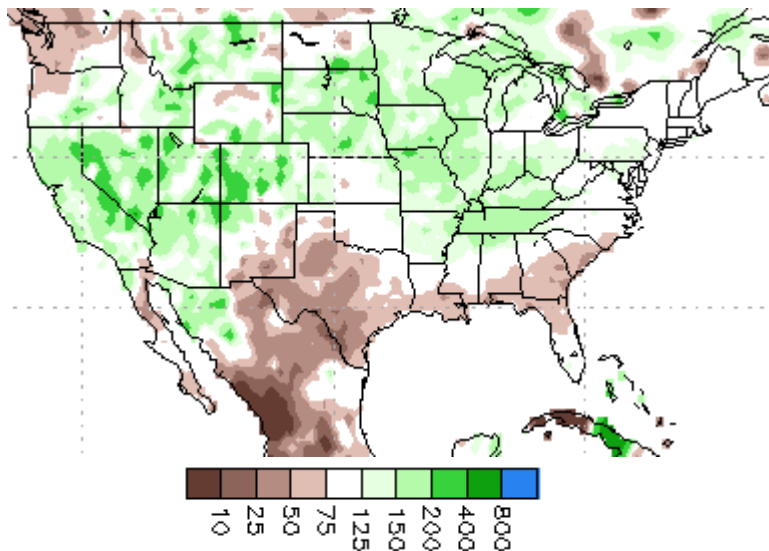
### Temperature Departures (degree C)



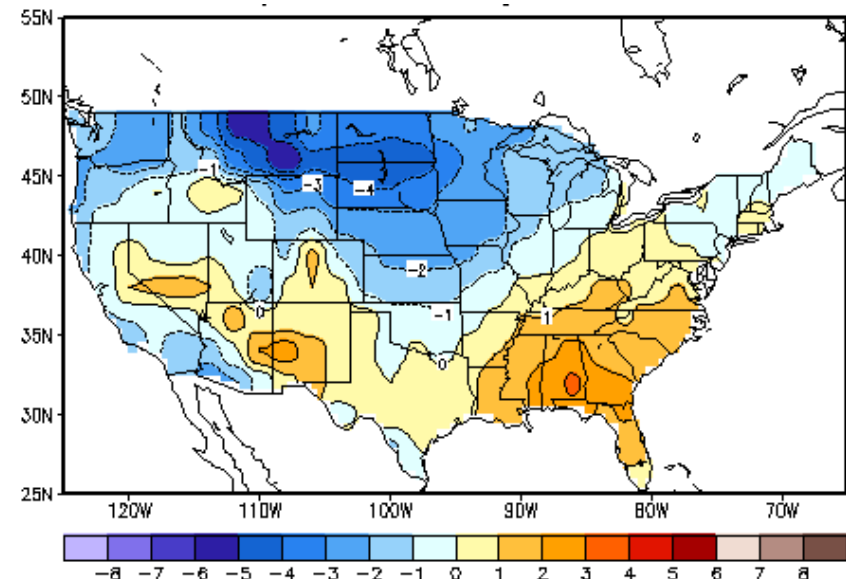
# U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 30 March 2019

### Percent of Average Precipitation



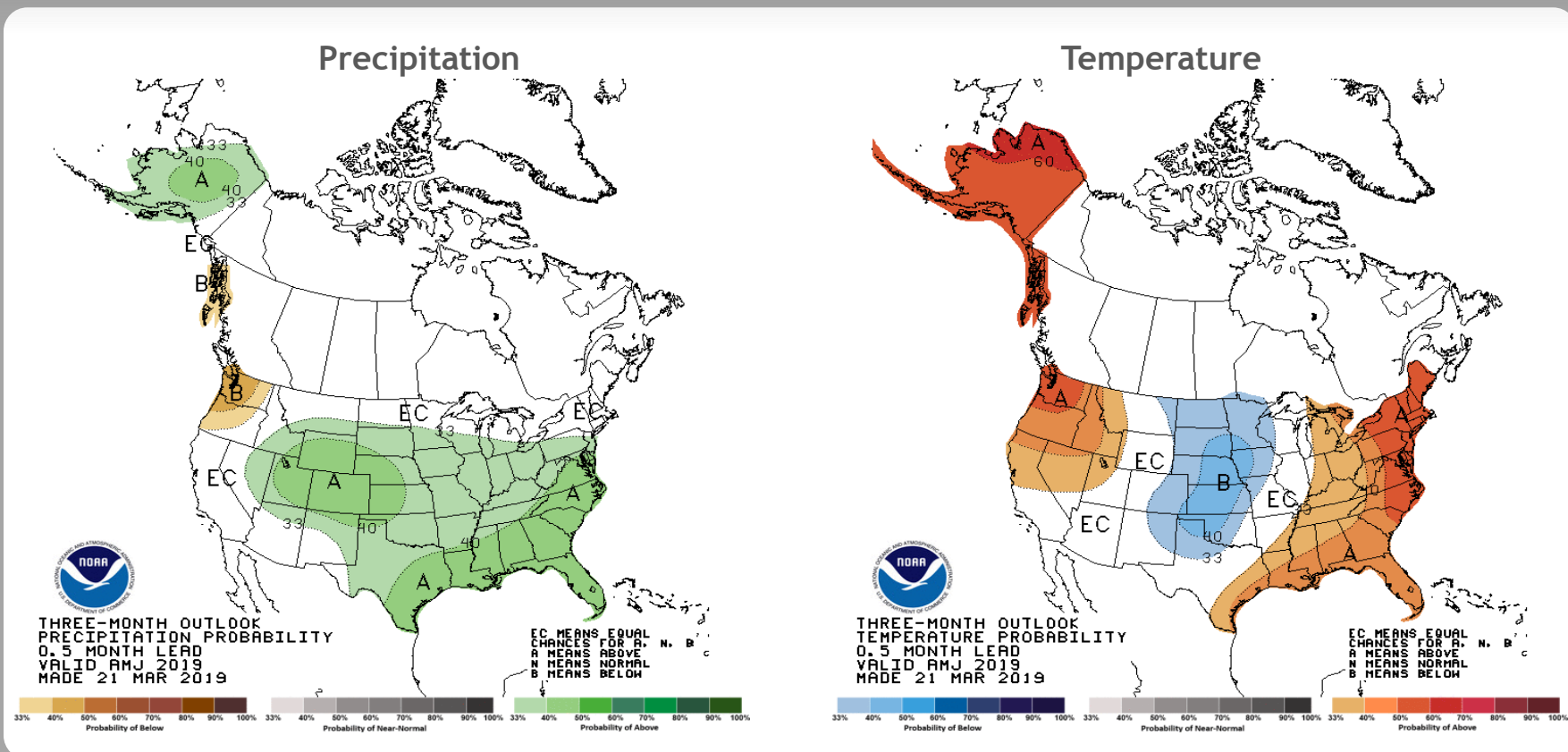
### Temperature Departures (degree C)



# U. S. Seasonal Outlooks

April-June 2019

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



# Summary

## ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.\*

Equatorial sea surface temperatures (SSTs) are above average across most of the Pacific Ocean.

The pattern of anomalous convection and winds are consistent with El Niño.

Weak El Niño conditions are likely to continue through the Northern Hemisphere spring 2019 (~80% chance) and summer (~60% chance).

\* 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](#).