

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
20 May 2019

Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

U.S. Seasonal Precipitation and Temperature Outlooks

Summary

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ENSO Alert System Status: El Niño Advisory

El Niño is 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.

El Niño is likely to continue through the Northern Hemisphere summer 2019 (70% chance) and fall (55-60% chance).*

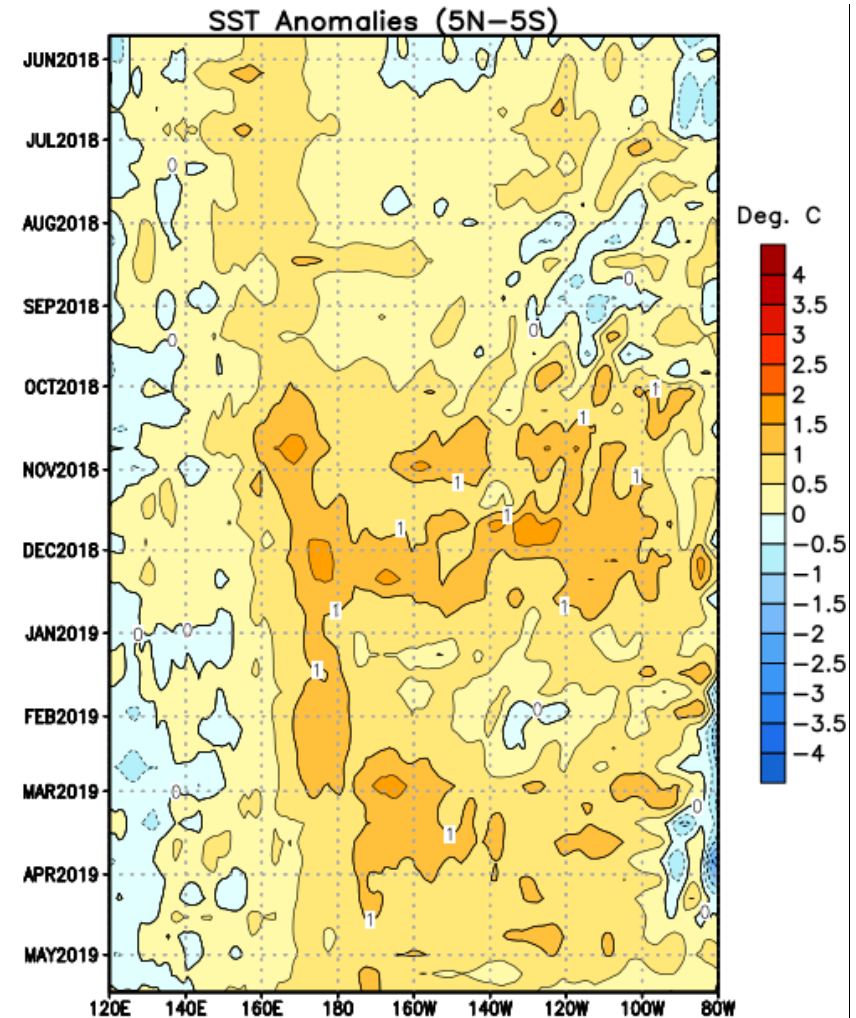
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

Recent Evolution of Equatorial Pacific SST Departures (°C)

Since 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.

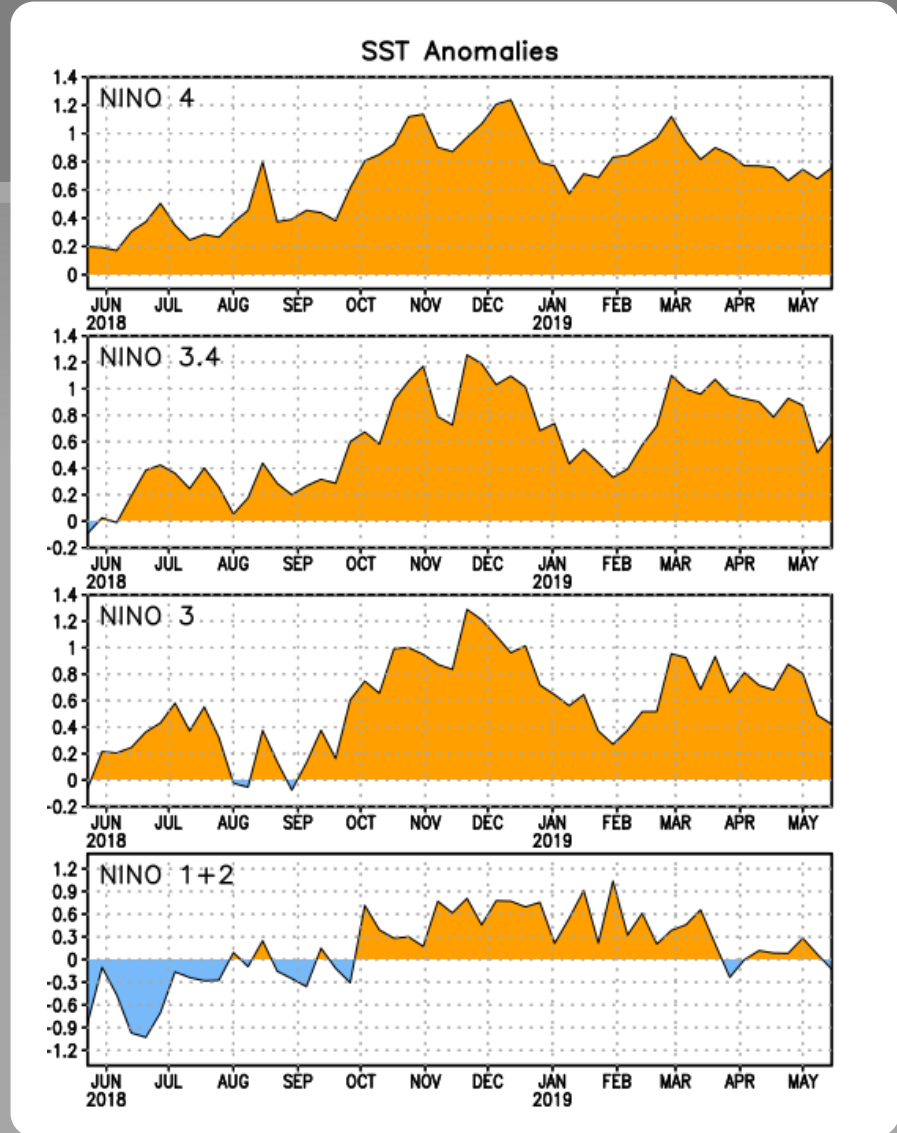
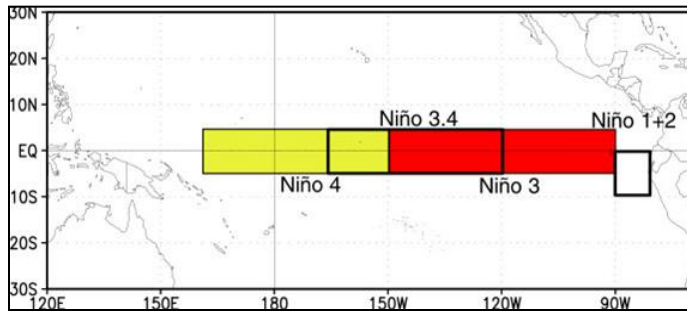
In the last month, positive SST anomalies weakened across the east-central Pacific Ocean.



Niño Region SST Departures (°C) Recent Evolution

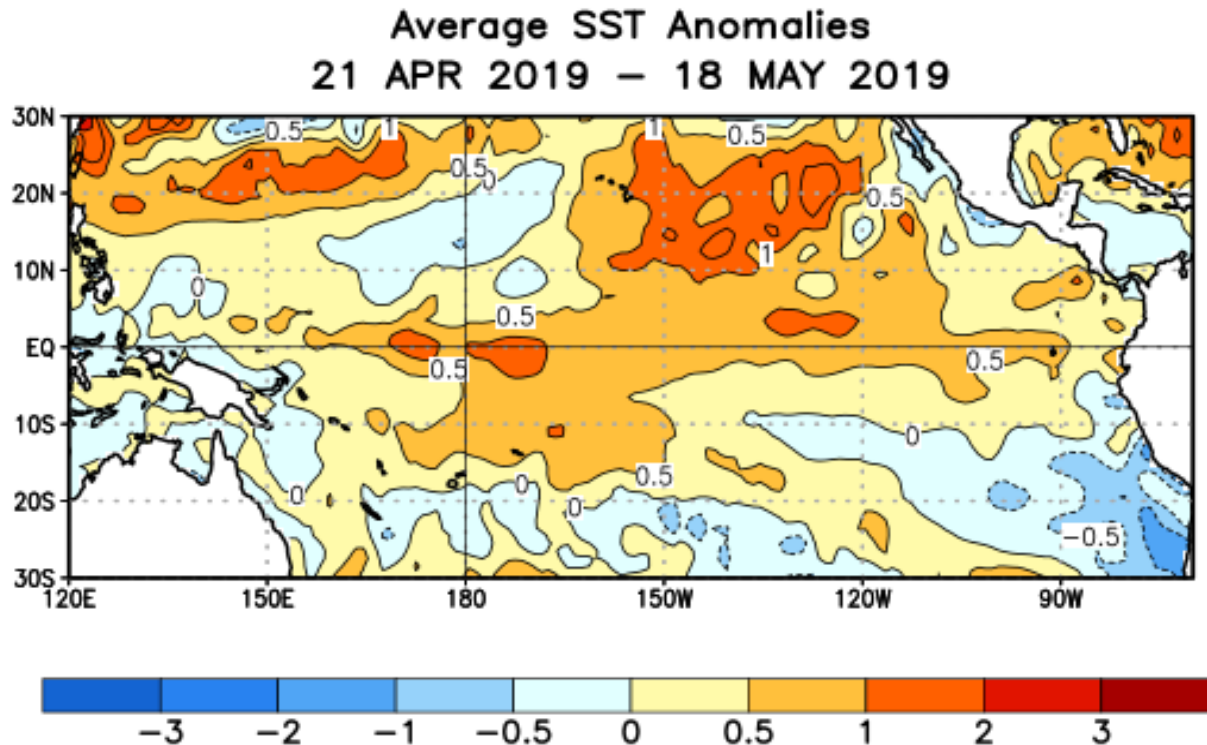
The latest weekly SST departures are:

Niño 4	0.8°C
Niño 3.4	0.7°C
Niño 3	0.4°C
Niño 1+2	-0.1°C



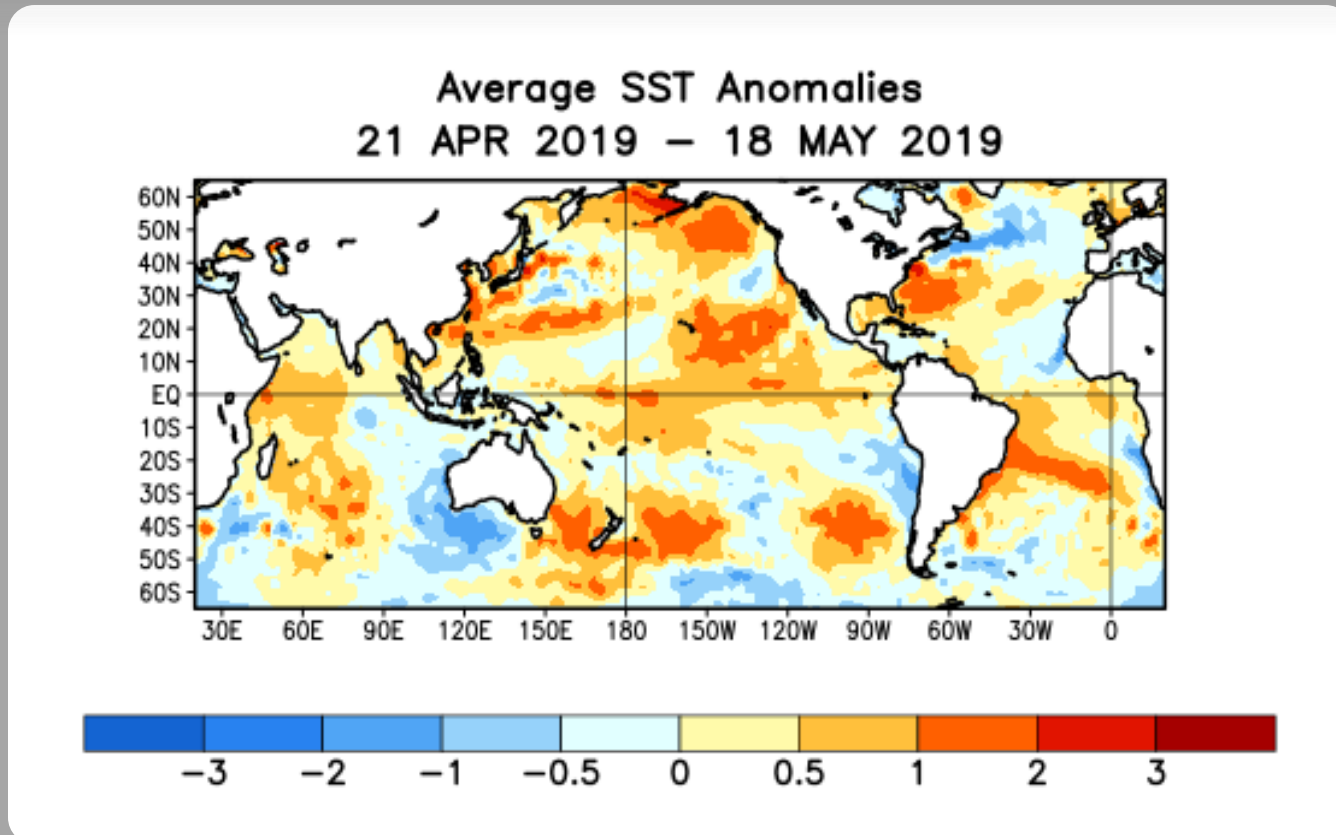
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, with the largest departures near the Date Line. SSTs were near-to-below average around Indonesia.



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

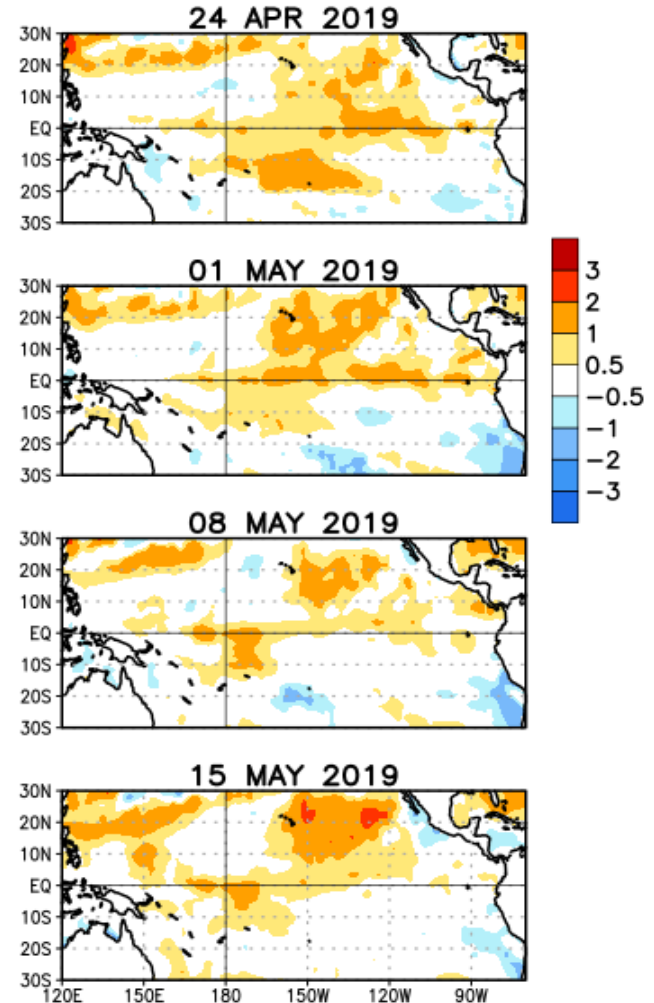
During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, Atlantic Ocean, and western Indian Ocean. SSTs were near-to-below average near Indonesia and the eastern Indian Ocean.



Weekly SST Departures during the Last Four Weeks

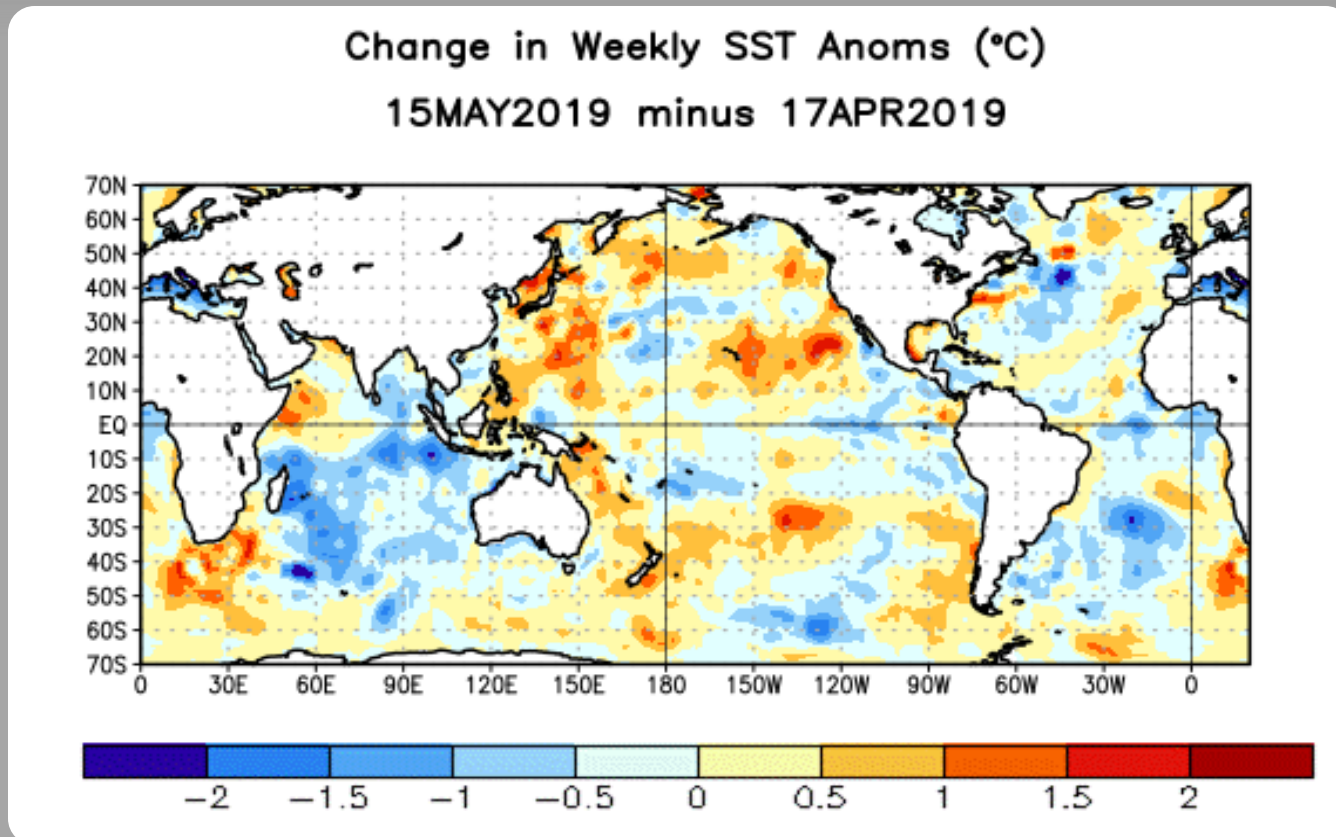
During the last four weeks, above-average equatorial SSTs have weakened in the east-central Pacific Ocean, while persisting near the Date Line.

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 evident in the east-central equatorial Pacific.



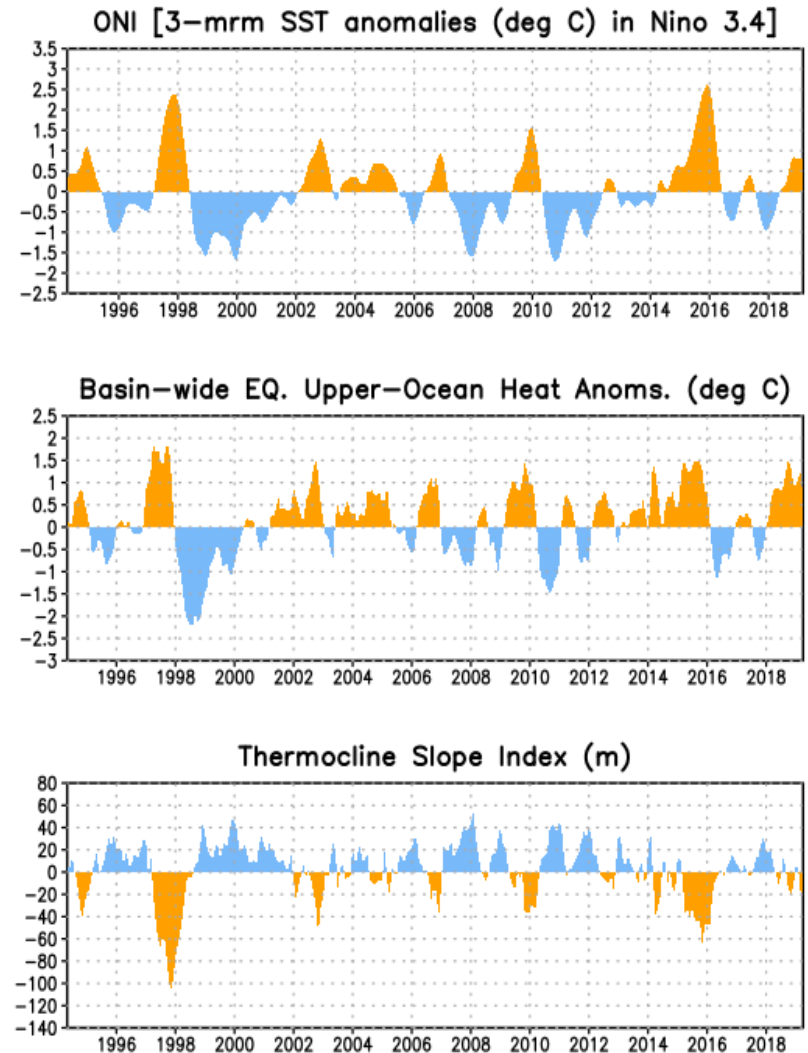
Upper-Ocean Conditions in the Equatorial Pacific

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.

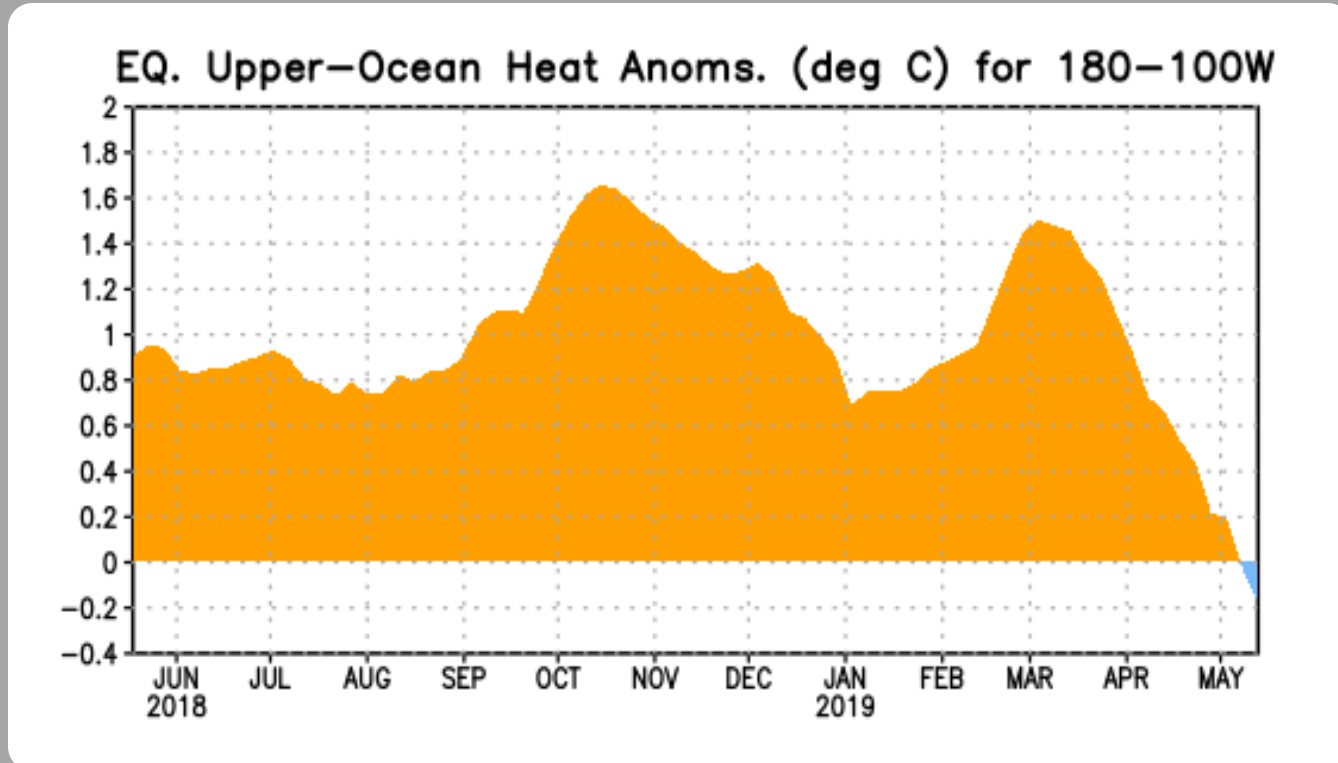
Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (below average) reflect El Niño.

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).



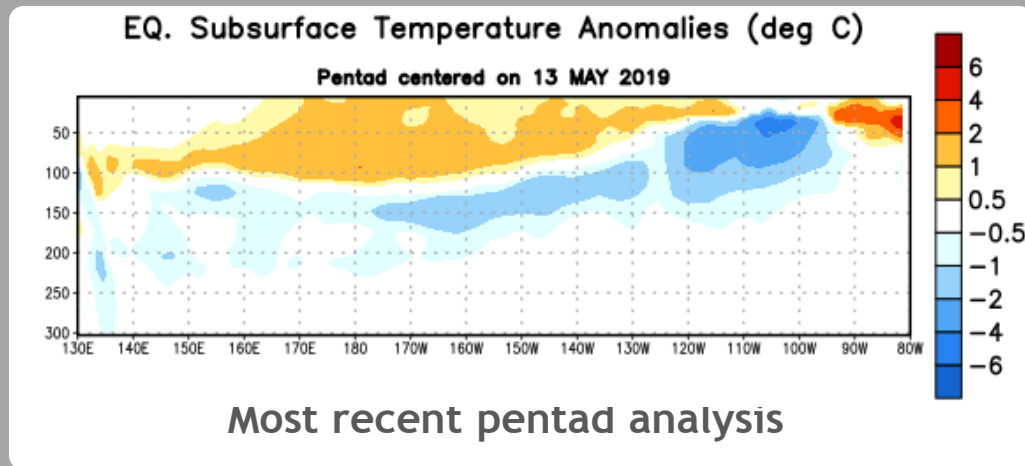
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

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 have decreased since March. In the last couple of weeks, temperatures were near average.

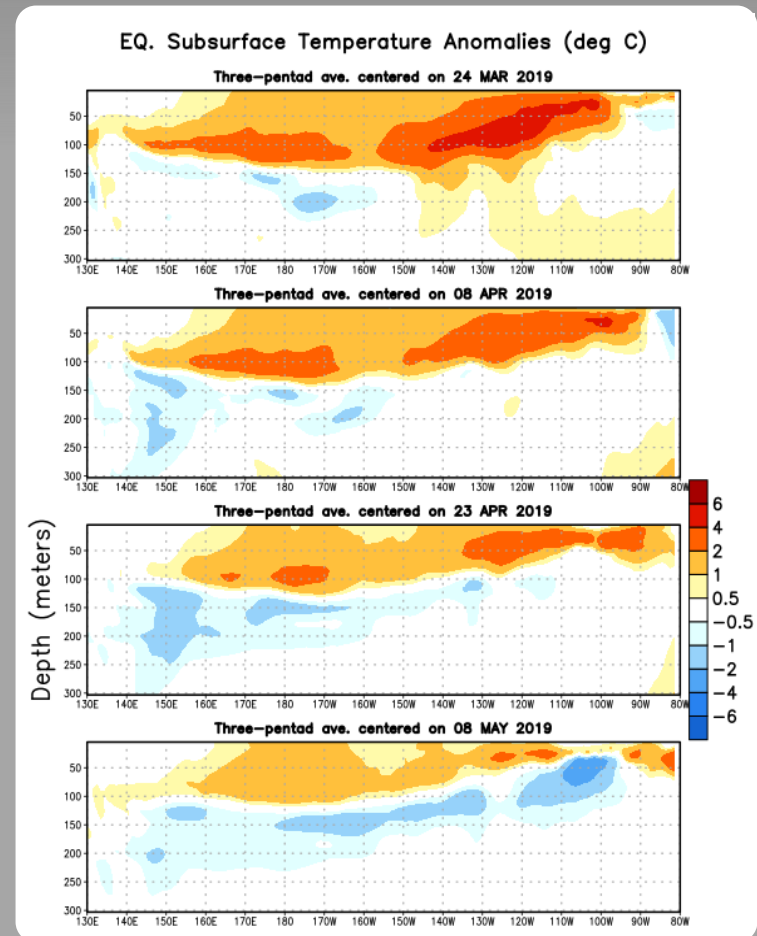


Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have weakened, but still reside near the surface across most of the Pacific.



Negative subsurface temperature anomalies have strengthened and expanded at depth across the Pacific. Recently, negative anomalies have shifted near the surface to around 110°-100°W

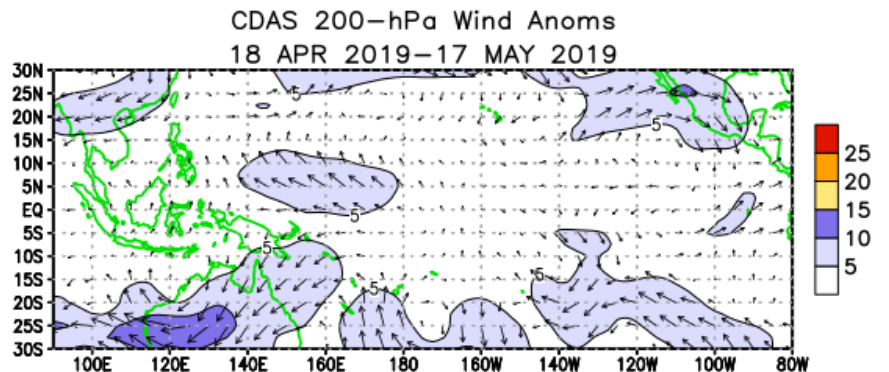
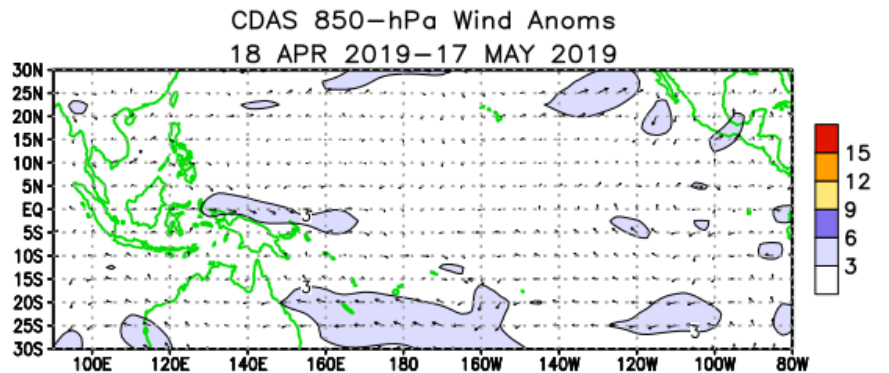
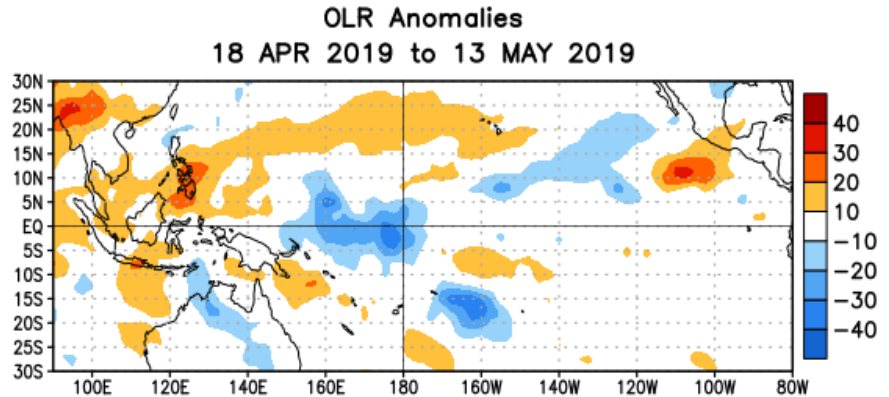


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident around the Philippines and Indonesia. Negative OLR anomalies (enhanced convection and precipitation) were present over the Date Line and western equatorial Pacific.

Low-level (850-hPa) westerly wind anomalies were evident in the western equatorial Pacific Ocean.

Upper-level (200-hPa) easterly wind anomalies were present across the western equatorial Pacific, while westerly wind anomalies were observed over the far eastern 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

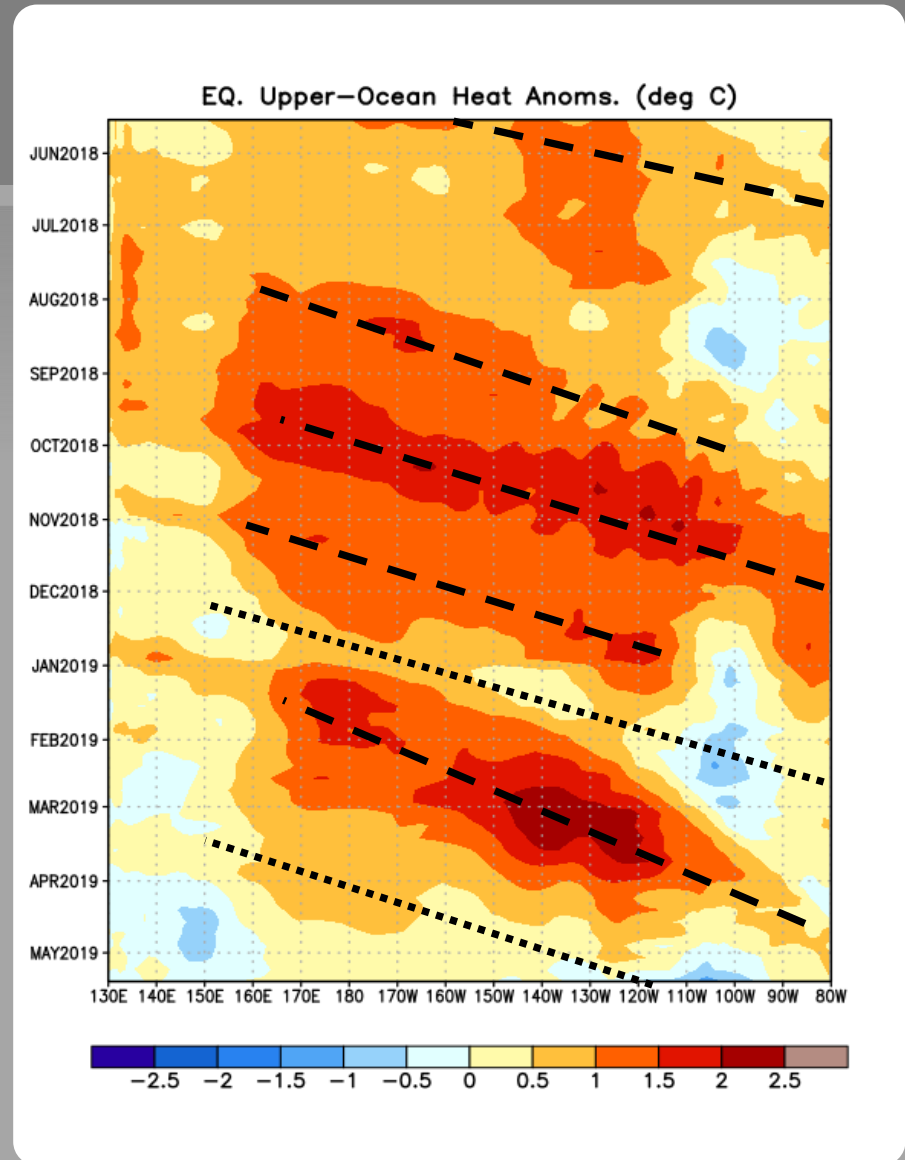
Equatorial oceanic Kelvin wave activity has been especially prominent since August 2018.

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

During January-March 2019, another downwelling Kelvin wave led to an eastward progression of large positive subsurface temperature anomalies.

In the last month or so, an upwelling Kelvin wave contributed to the reduction of positive subsurface anomalies and emergence of negative anomalies around 110°-100°W.

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 (m s^{-1})

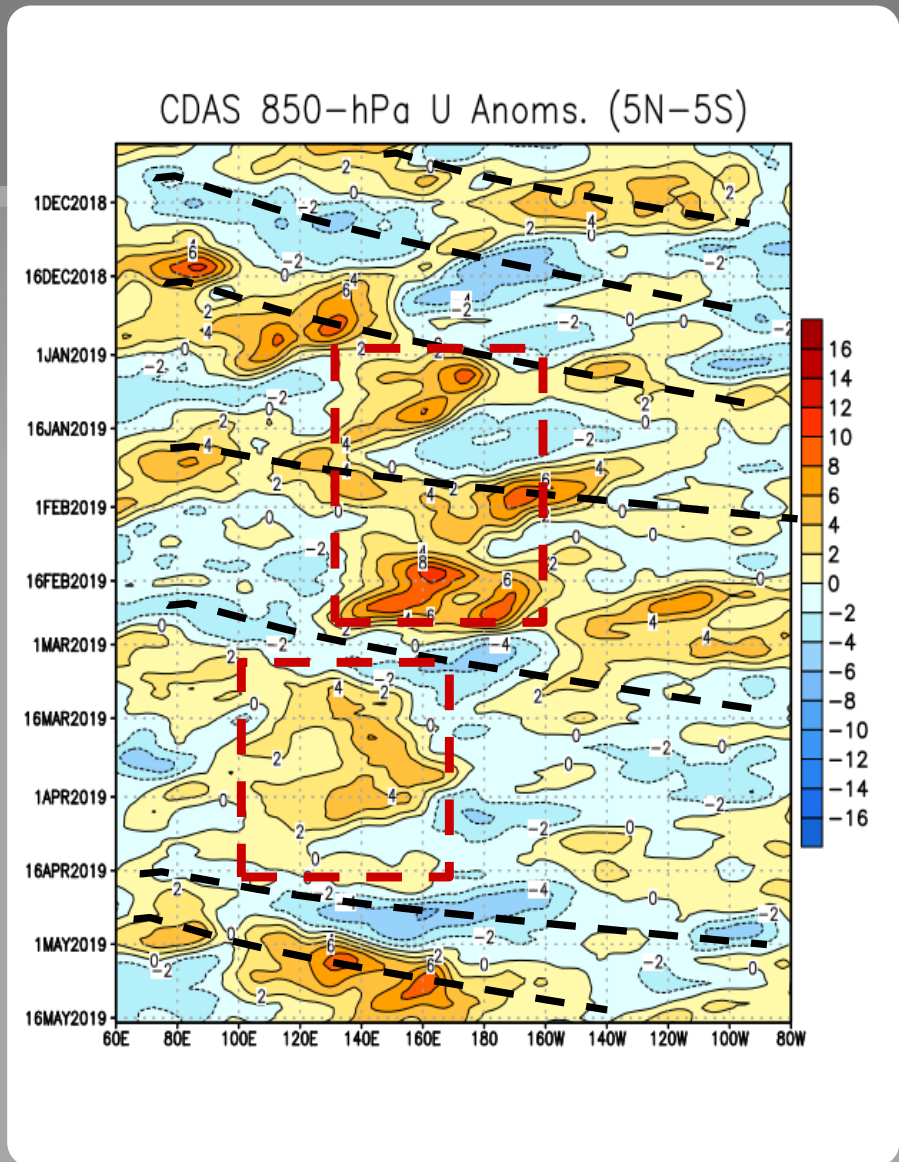
At times, the Madden Julian Oscillation (MJO) has contributed to the eastward propagation of low-level wind anomalies.

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

In the last week, westerly wind anomalies were observed most of the equatorial Pacific Ocean.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

From October through mid-March and since April 2019, eastward propagation were evident in the anomalies.

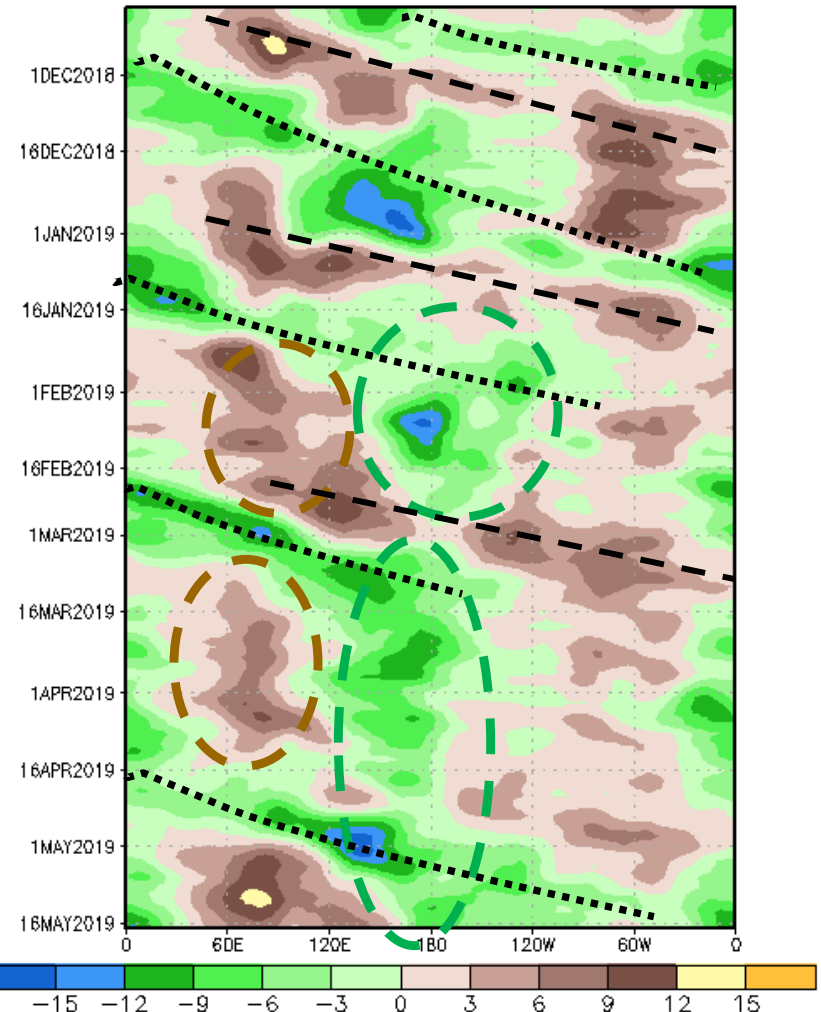
Since early March 2019, anomalous upper-level divergence (green shading) has persisted near the Date Line.

Unfavorable for precipitation (brown shading)

Favorable for precipitation (green shading)

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

200-hPa Velocity Potential Anomaly: 5N-5S
5-day Running Mean



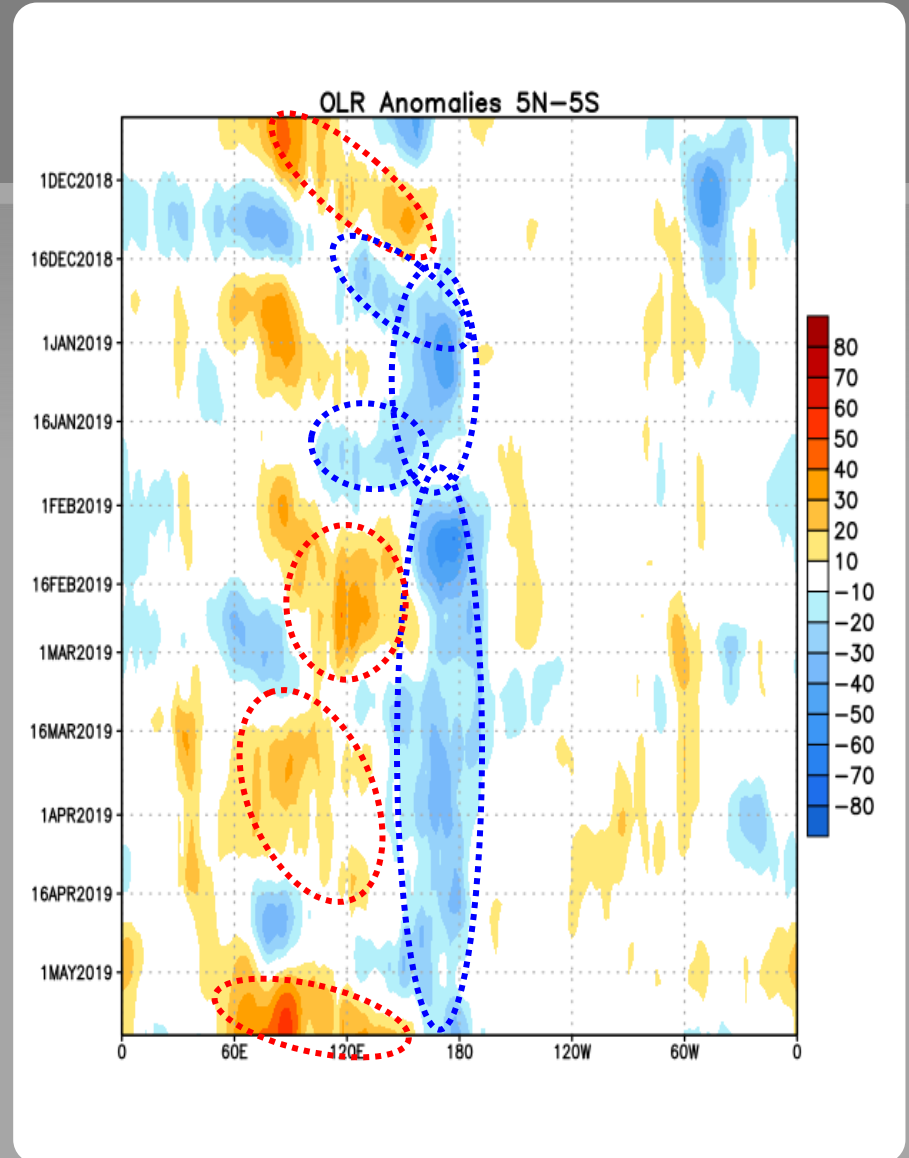
Outgoing Longwave Radiation (OLR) Anomalies

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 near 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°C .

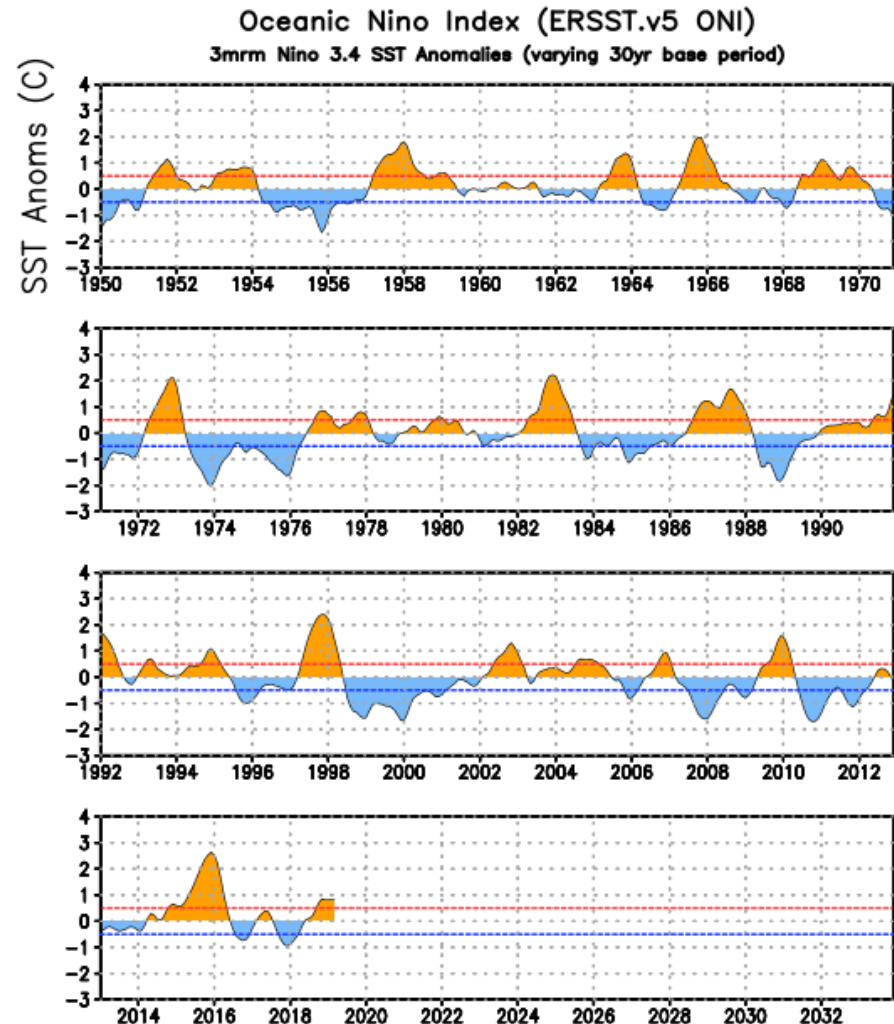
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (February - April 2019) is +0.8°C.

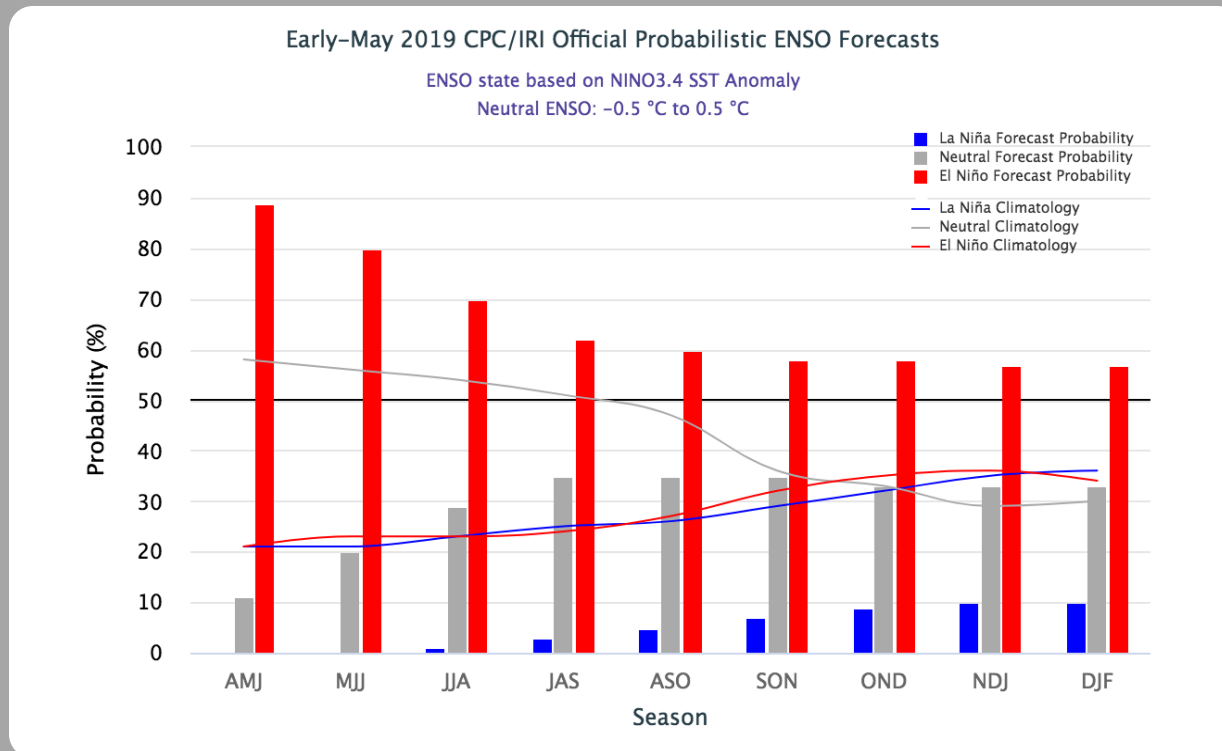
El Niño ↑
Neutral
La Niña ↓



CPC/IRI Probabilistic ENSO Outlook

Updated: 9 May 2019

El Niño conditions are favored to continue through fall 2019 with diminishing chances.



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.

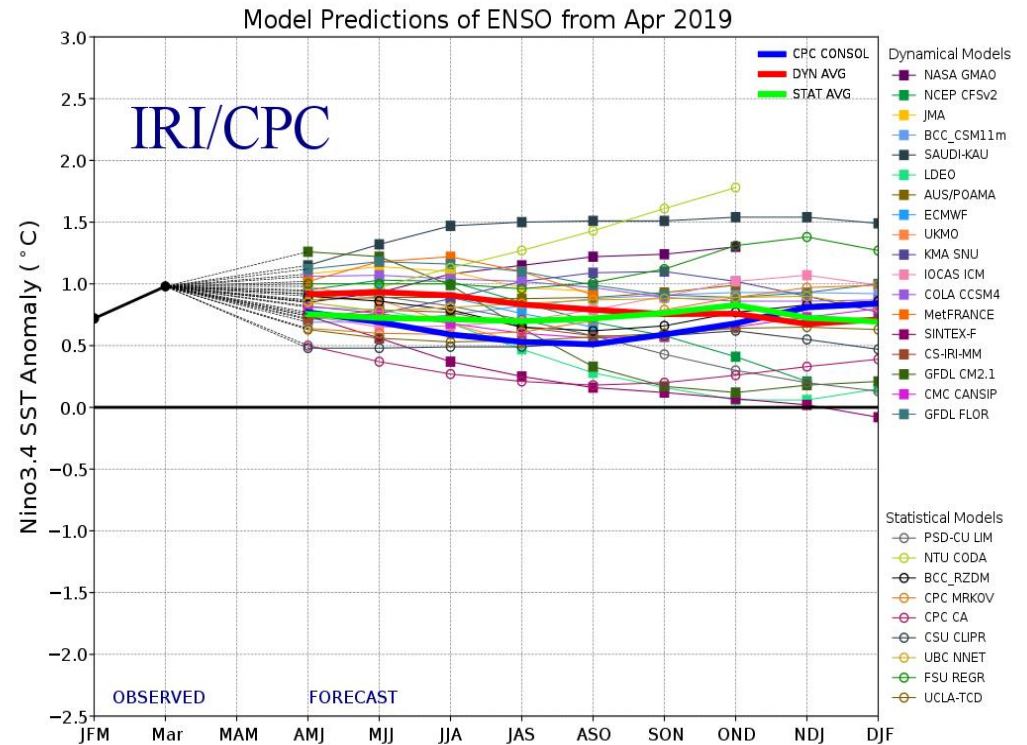


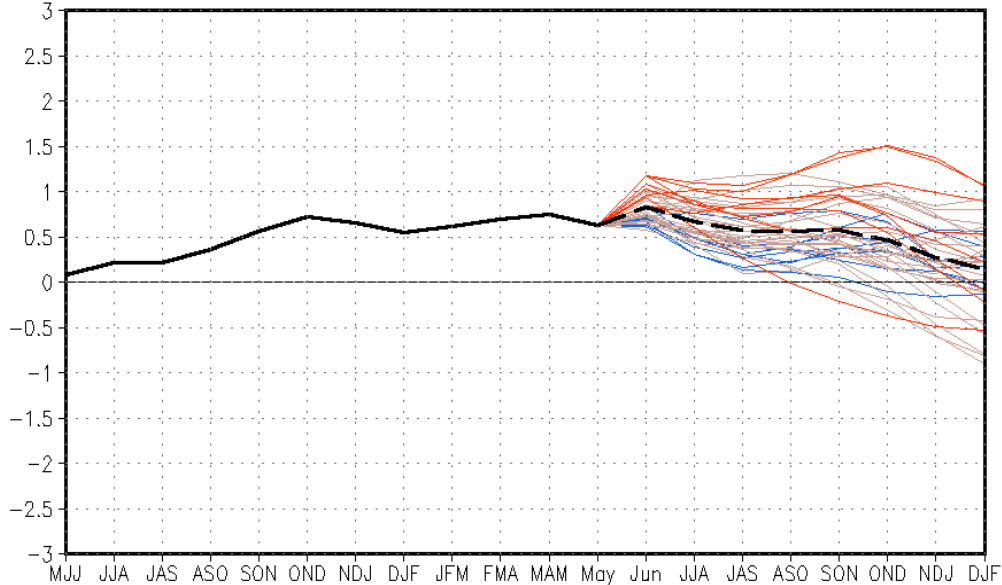
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 April 2019).

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

Issued: 20 May 2019

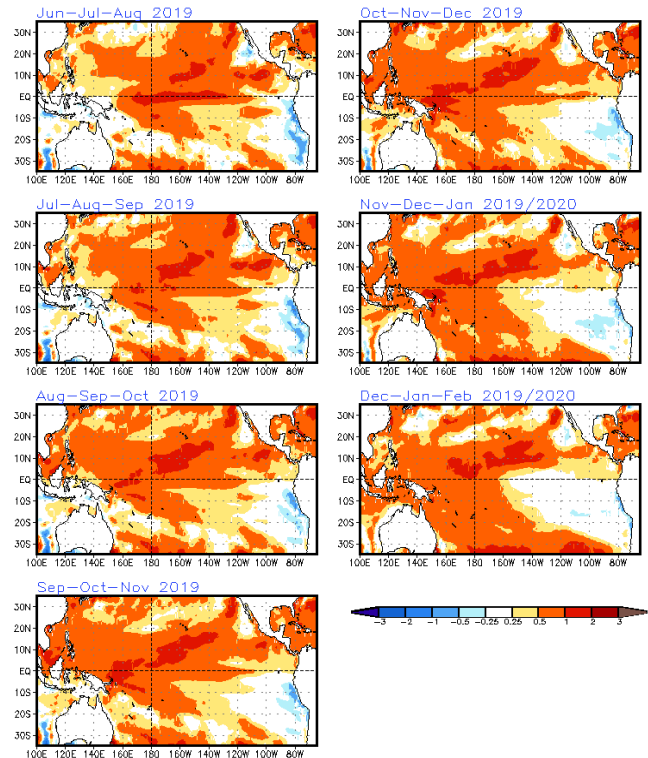
The CFS.v2 ensemble mean (black dashed line) predicts El Niño to persist into the Northern Hemisphere fall 2019.

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



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

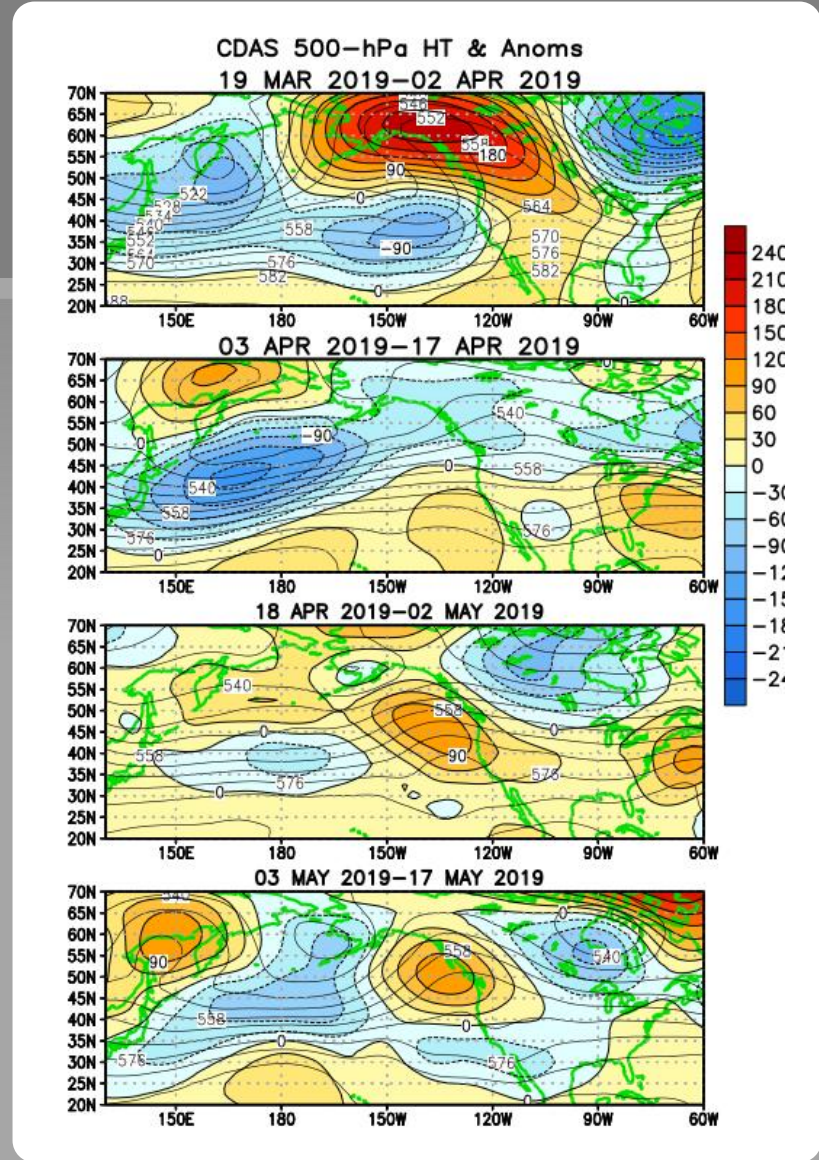
(Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)



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

During most of April, an anomalous trough was present over Canada, and anomalous ridging and above-average temperatures were present over most of the United States.

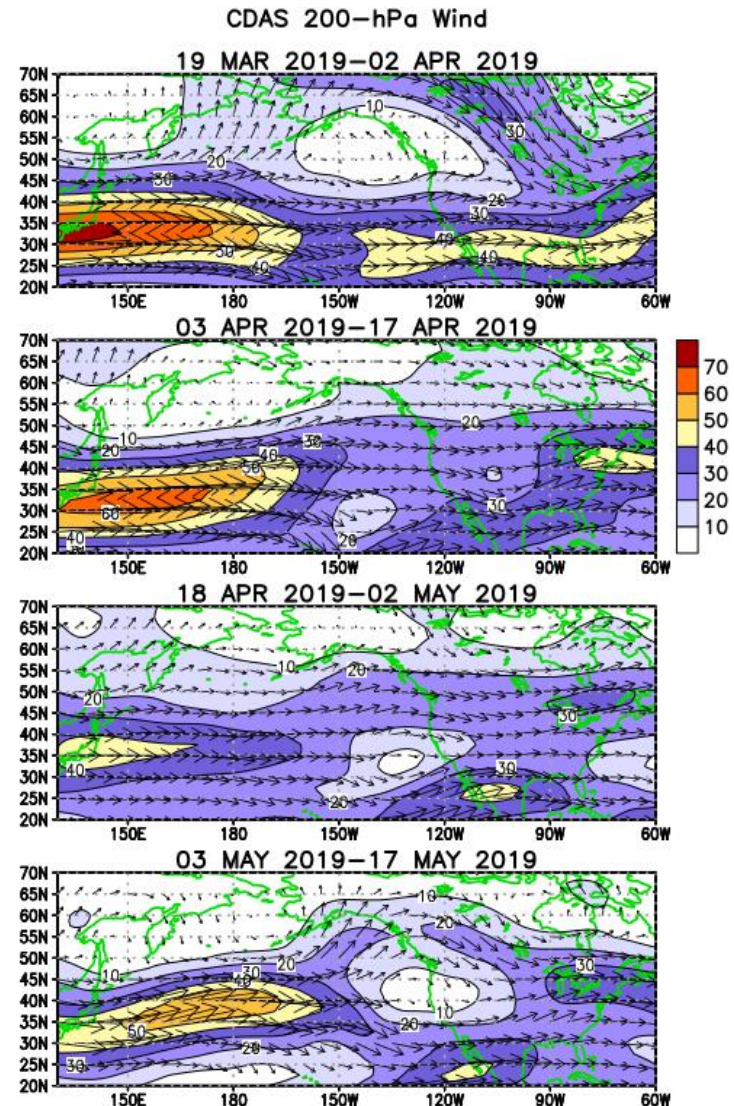
Since early May, anomalous troughing and negative temperature anomalies expanded into the central U.S., while above-average temperatures have prevailed over the western and eastern U.S.



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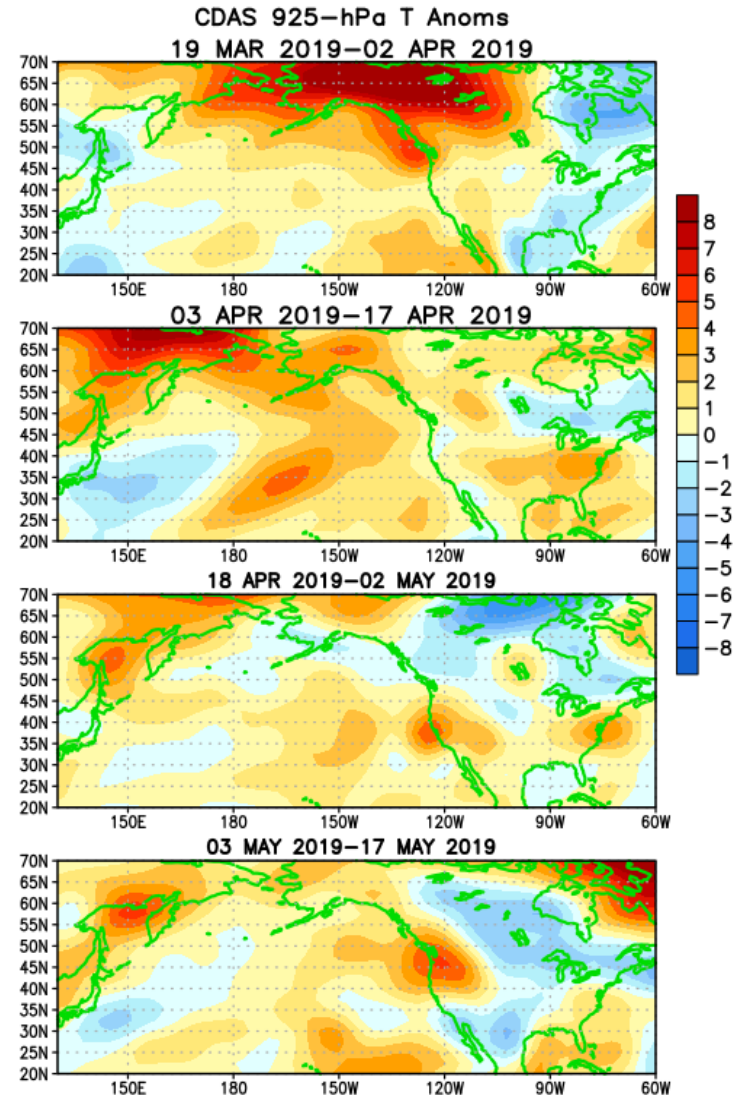
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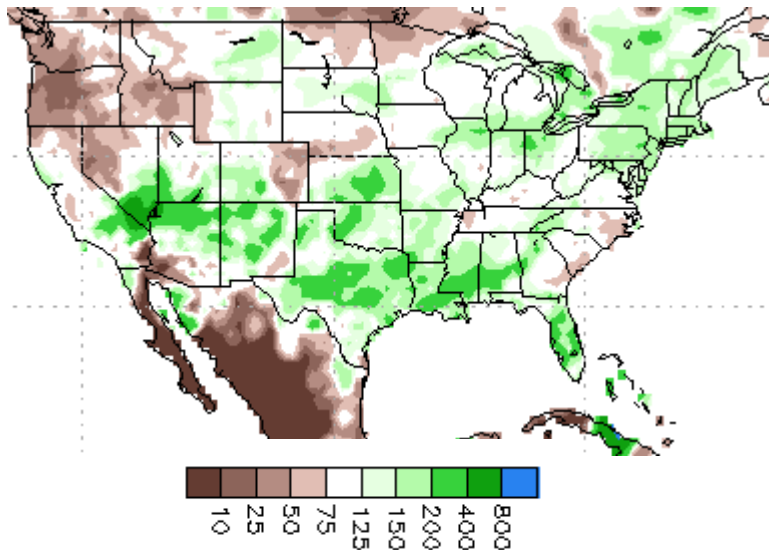
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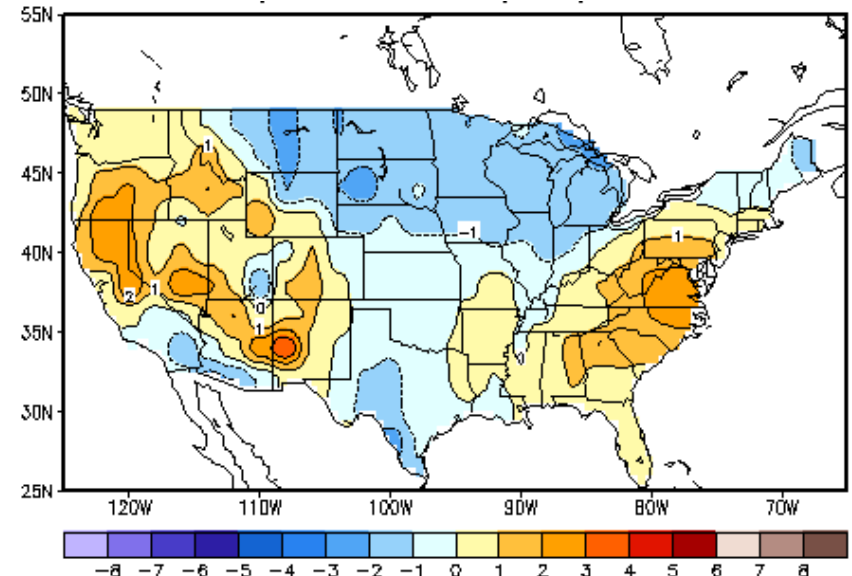
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 18 May 2019

Percent of Average Precipitation



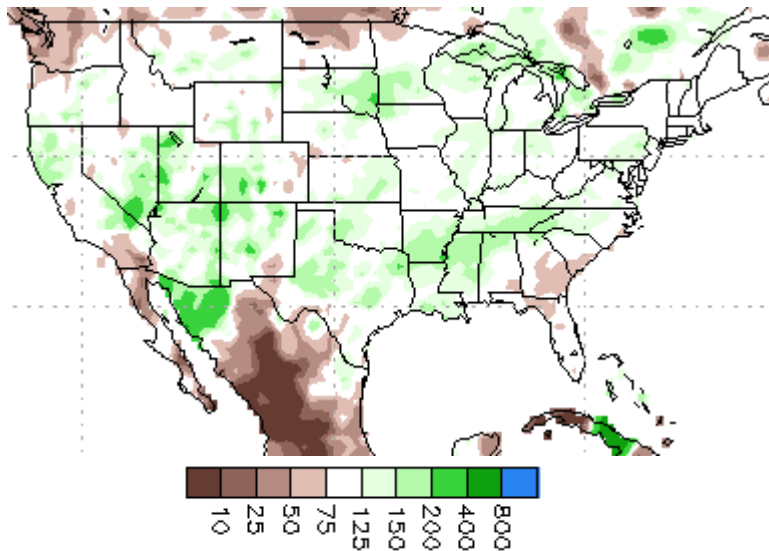
Temperature Departures (degree C)



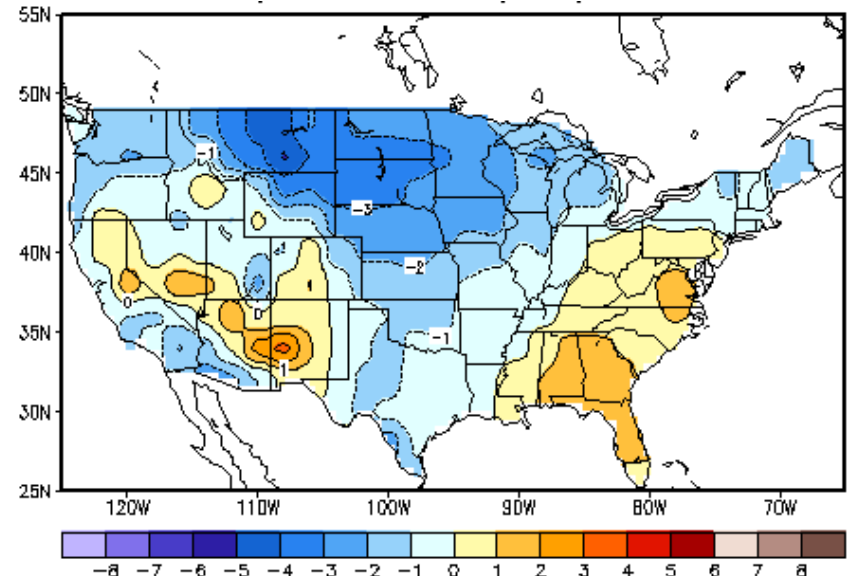
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 18 May 2019

Percent of Average Precipitation



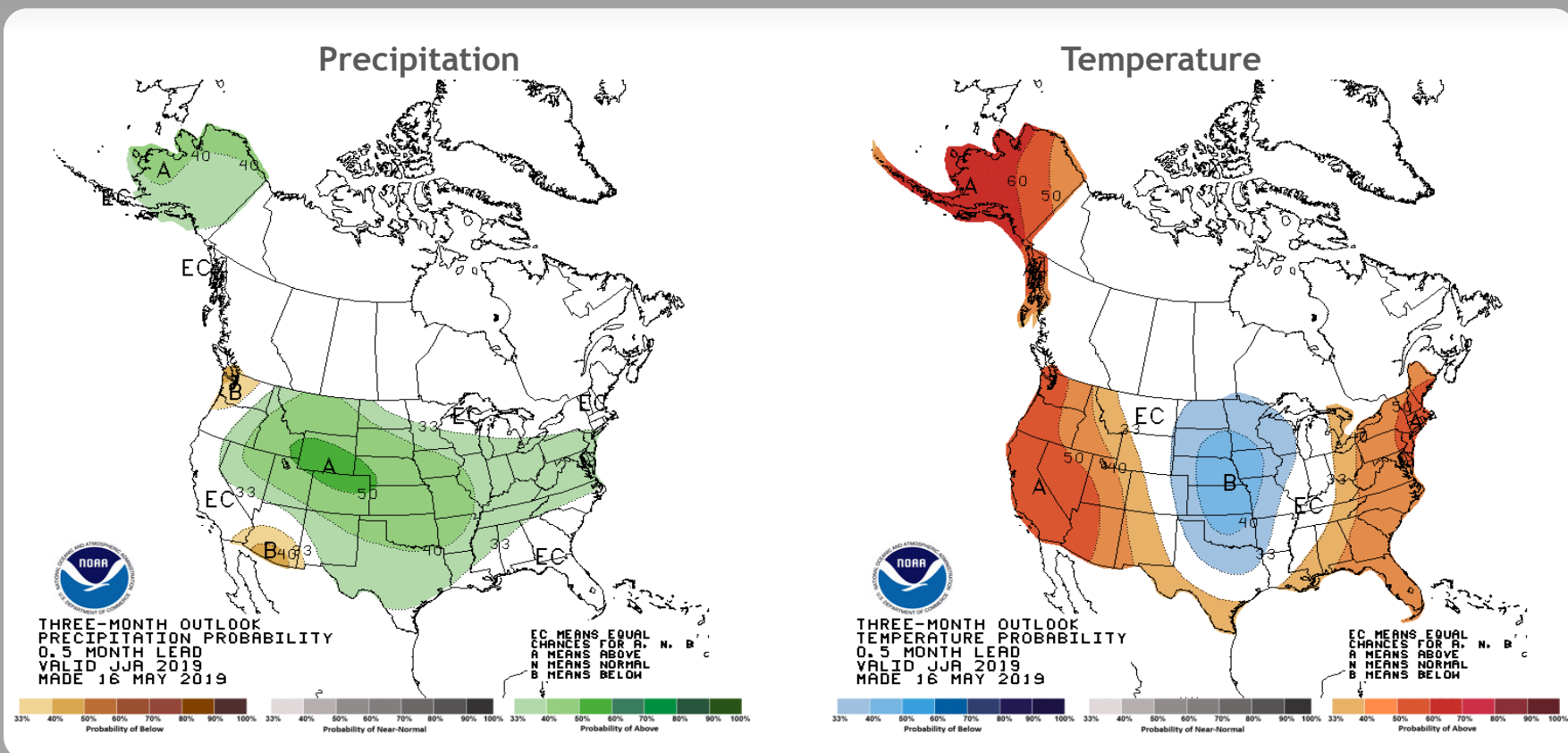
Temperature Departures (degree C)



U. S. Seasonal Outlooks

June-August 2019

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



Summary

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El Niño is 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.

El Niño is likely to continue through the Northern Hemisphere summer 2019 (70% chance) and fall (55-60% chance).*

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