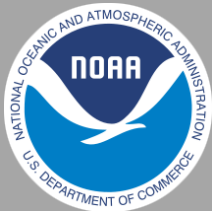


ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
15 July 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 generally consistent with El Niño.

A transition from El Niño to ENSO-neutral is expected in the next month or two, with ENSO-neutral most likely to continue through Northern Hemisphere fall and winter.*

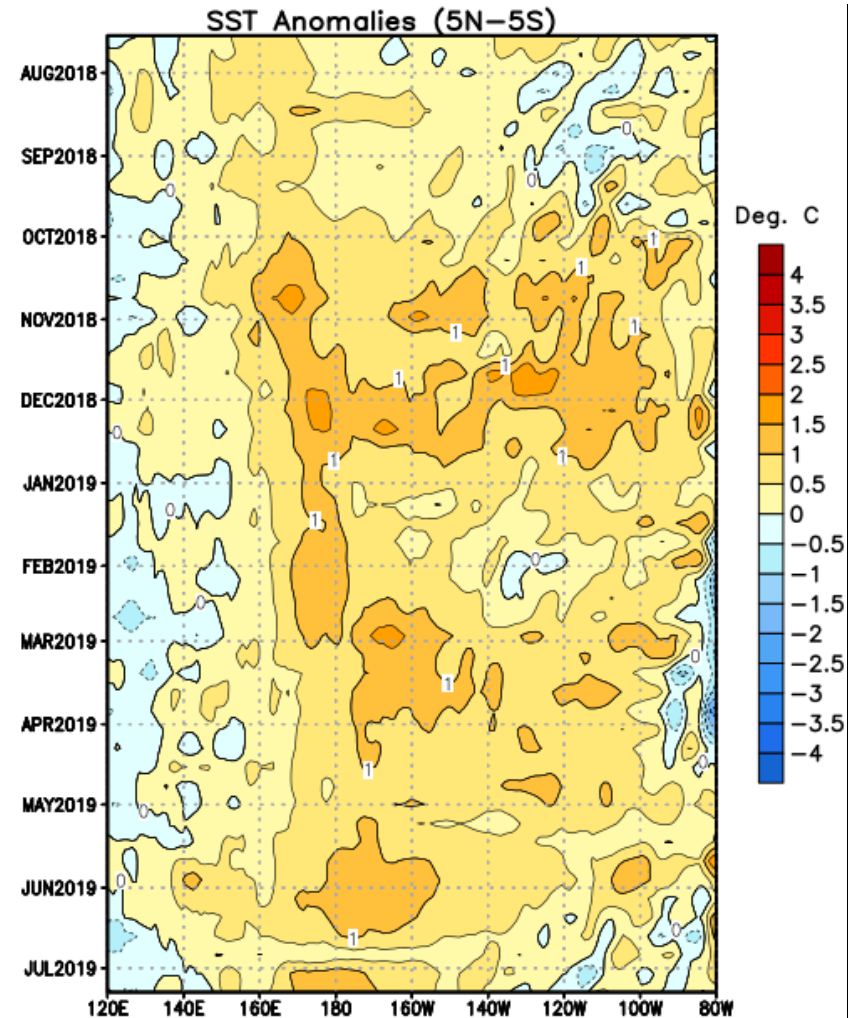
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

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.

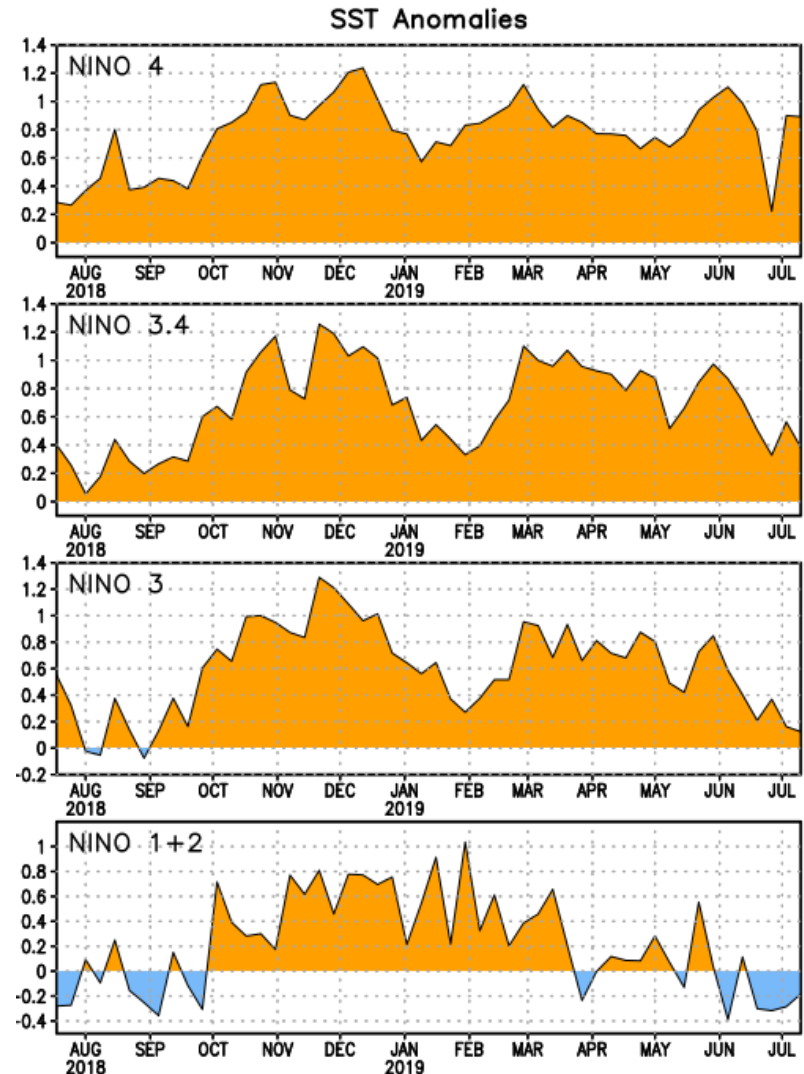
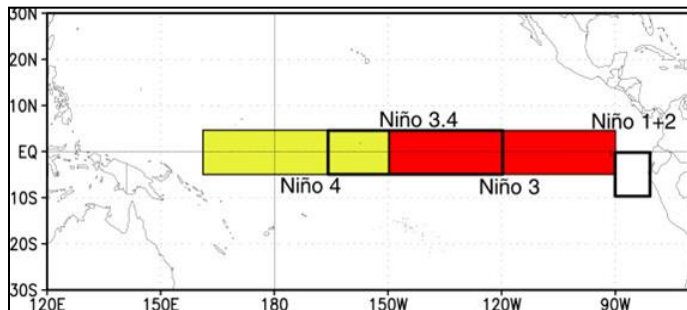
In the last week, positive SST anomalies weakened in the eastern Pacific.



Niño Region SST Departures (°C) Recent Evolution

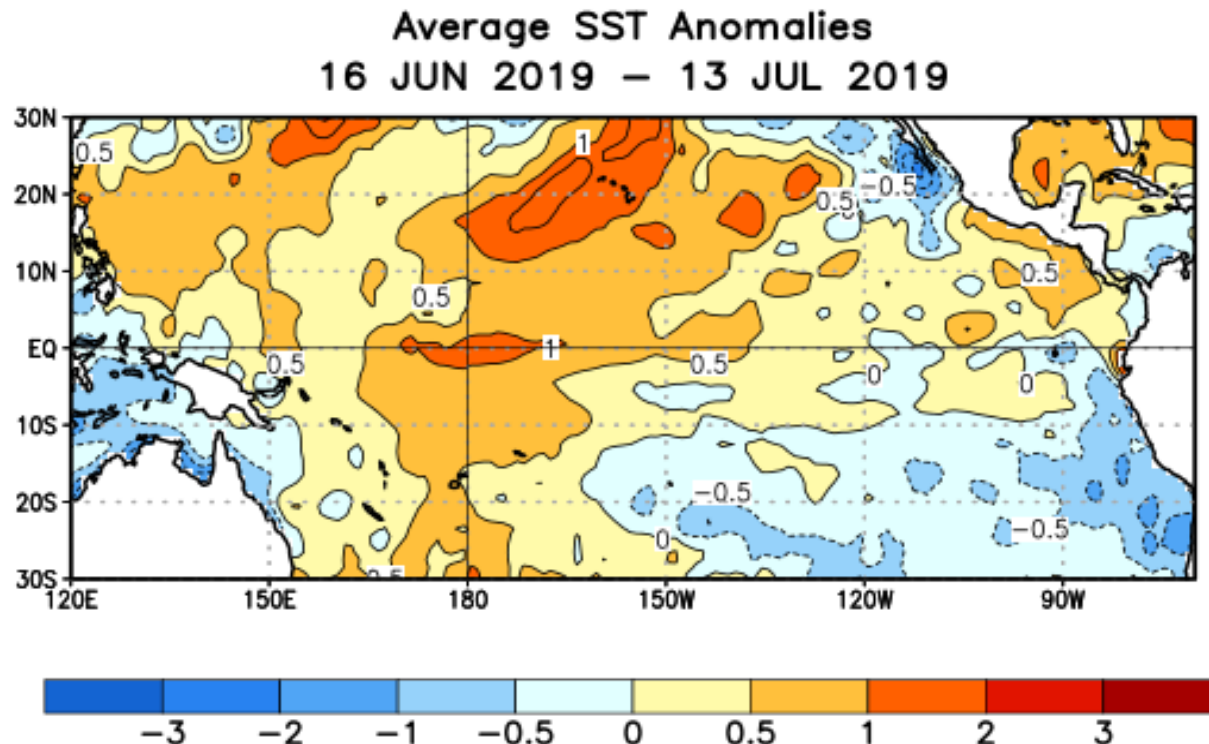
The latest weekly SST departures are:

Niño 4	0.9°C
Niño 3.4	0.4°C
Niño 3	0.1°C
Niño 1+2	-0.2°C



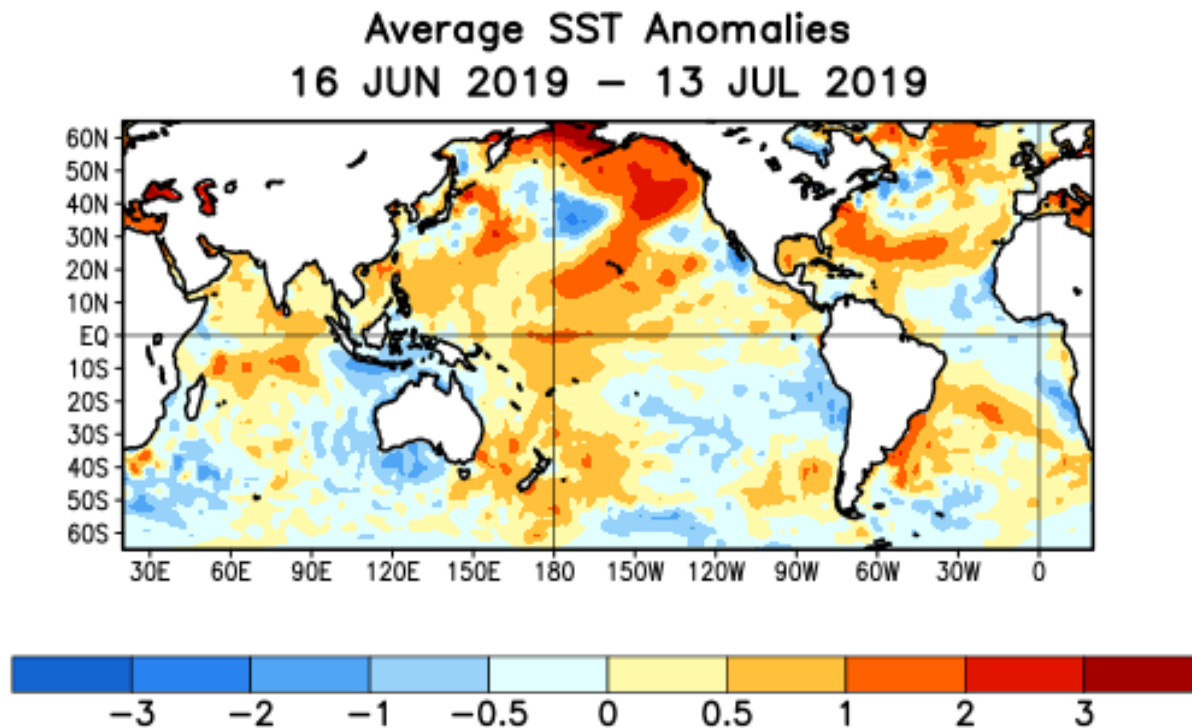
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the central Pacific Ocean, with the largest departures between 170°E and 170°W. Near-to-below average SSTs were evident in parts of the eastern Pacific.



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

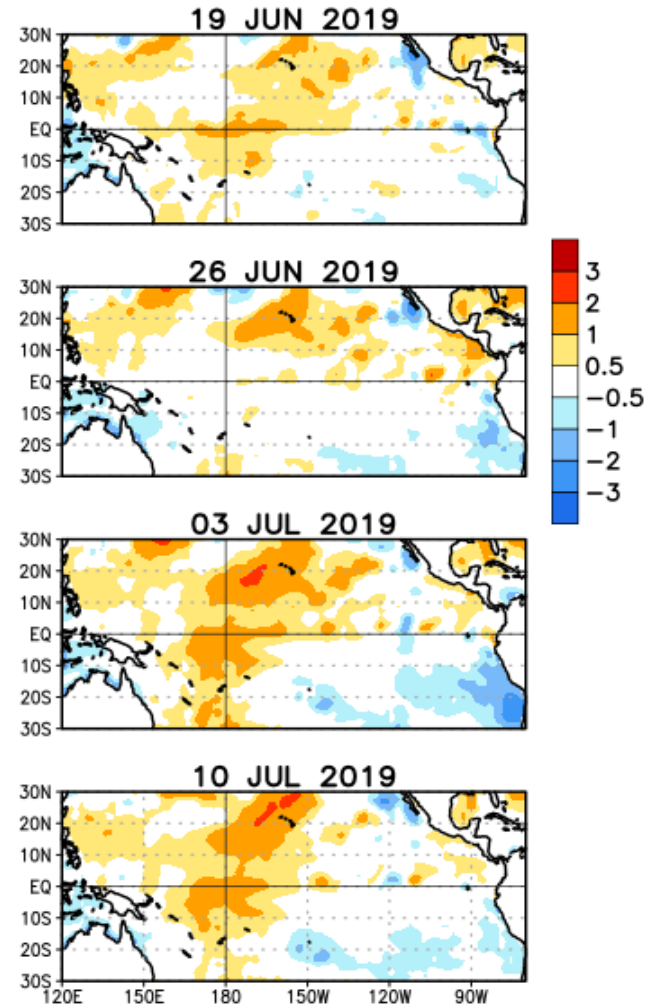
During the last four weeks, equatorial SSTs were above average across the central Pacific Ocean and Indian Ocean. SSTs were near-to-below average near Indonesia and in parts of the eastern Pacific and Atlantic.



Weekly SST Departures during the Last Four Weeks

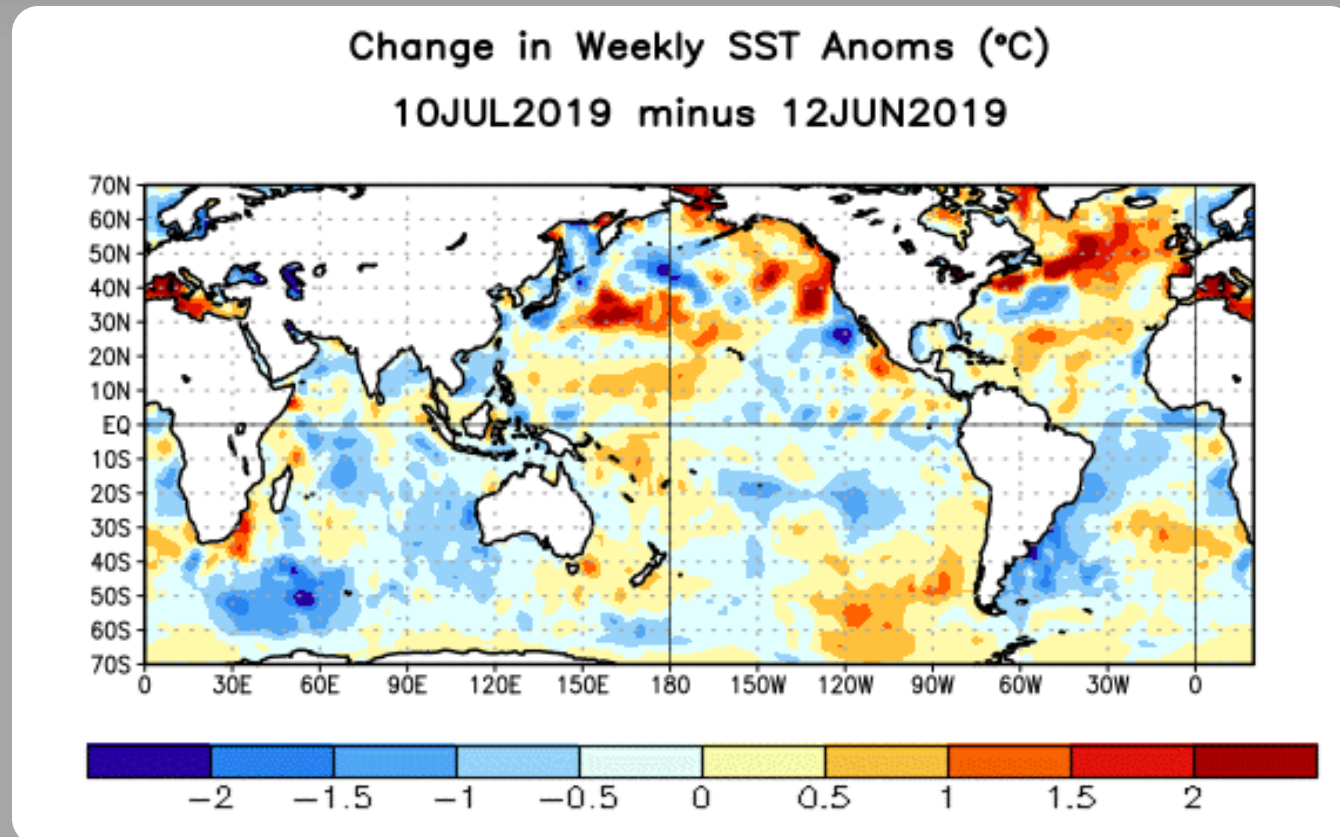
During the last four weeks, above-average equatorial SSTs weakened in the eastern Pacific. SSTs in the central Pacific were variable.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, a decrease in equatorial SST anomalies was evident across most of the Pacific Ocean.



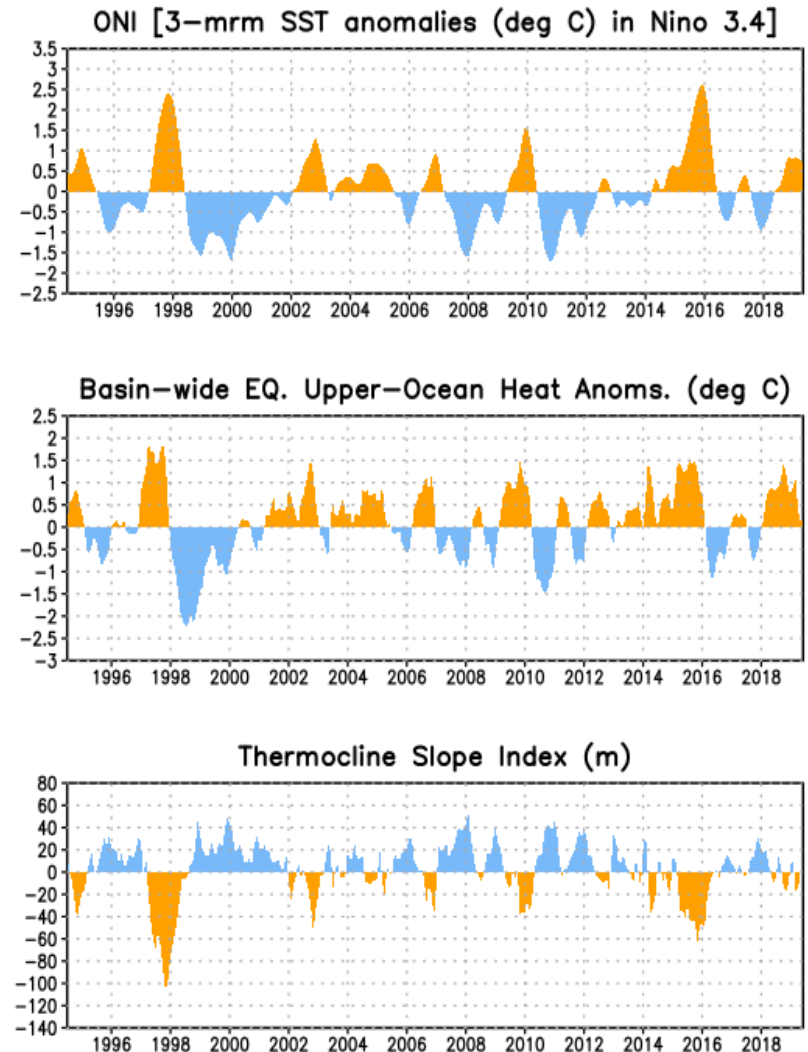
Upper-Ocean Conditions in the Equatorial Pacific

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.

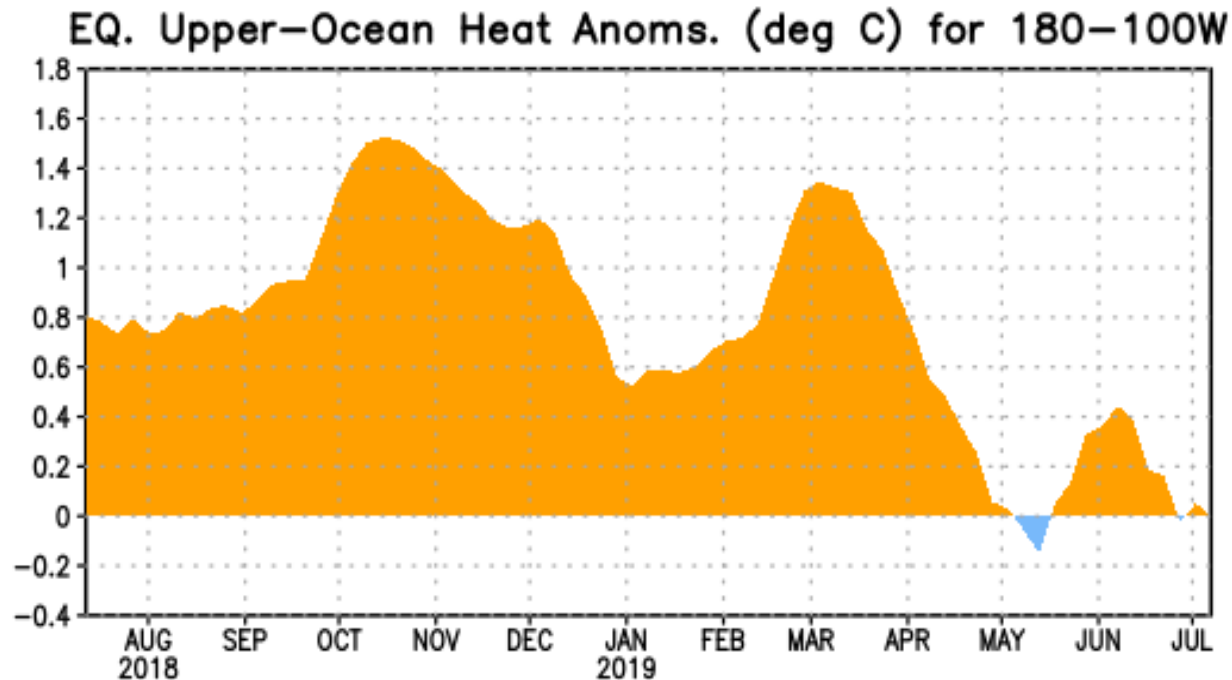
Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (below average) reflect El Niño.

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).



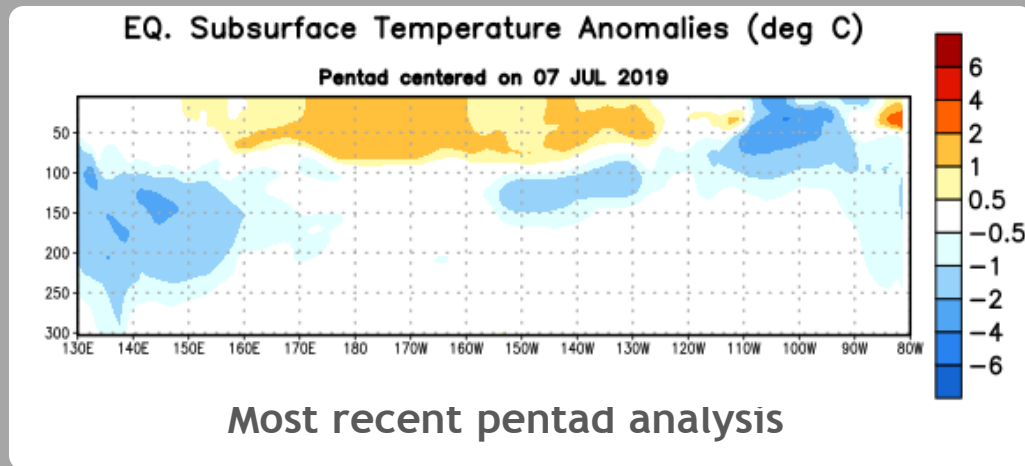
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies have been present through most of the period. Anomalies decreased to near-average values in late April before positive anomalies returned in late May. During June, anomalies decreased and temperatures are currently near average.

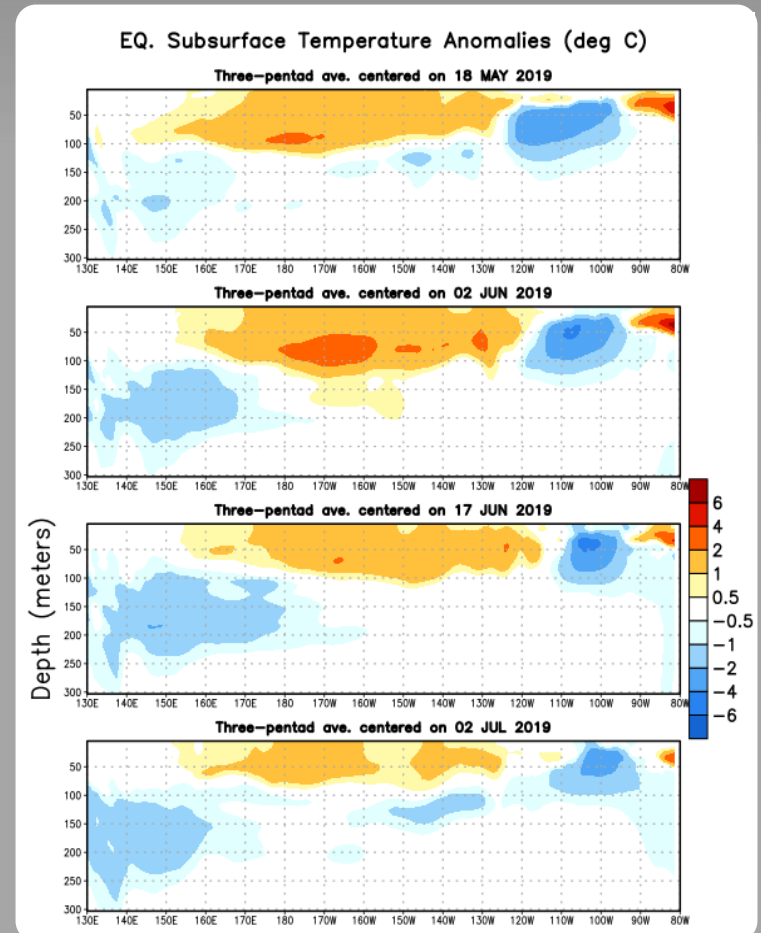


Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have weakened in the central and east-central Pacific.



Negative subsurface temperature anomalies have strengthened at depth across the Pacific, and are strongest near and below the surface around 110°-90°W.

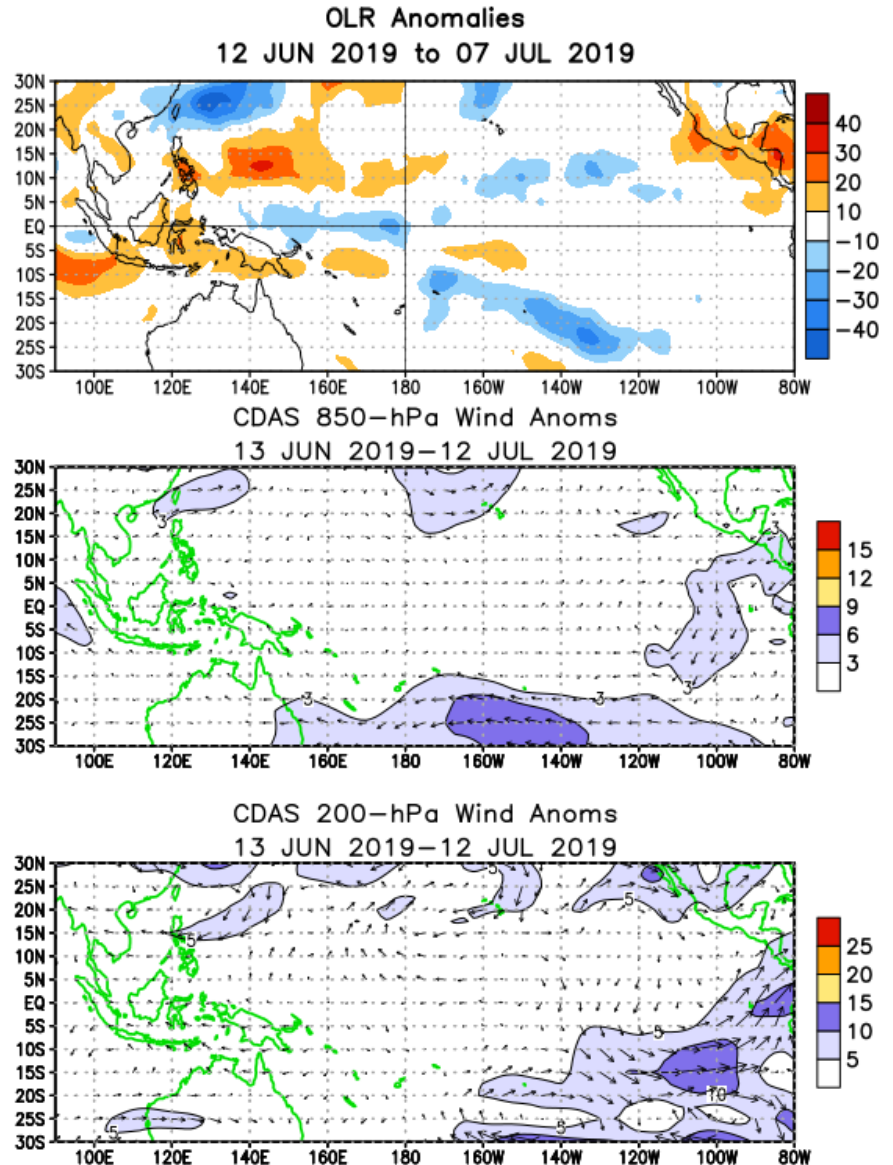


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident around the Philippines and Indonesia. A small region of weak, negative OLR anomalies (enhanced convection and precipitation) were present near the Date Line and western Pacific Ocean.

Low-level (850-hPa) cross-equatorial wind anomalies were evident in the eastern tropical Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies were present across the eastern tropical 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.

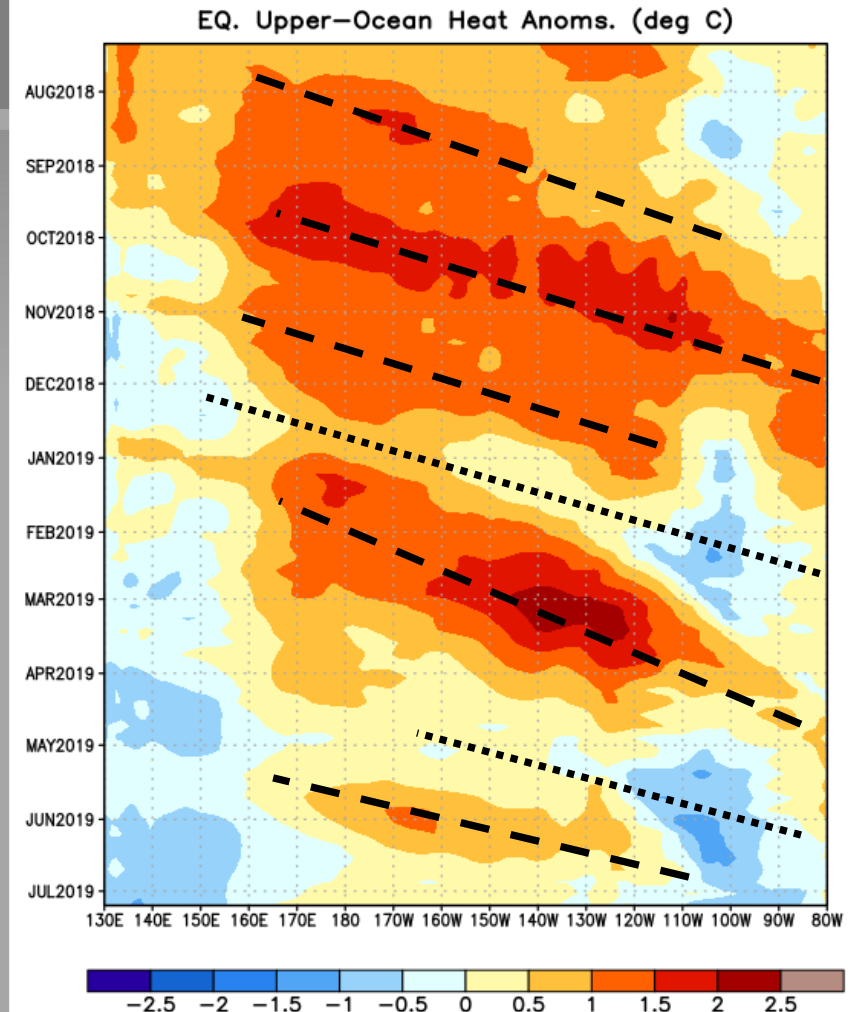
Weekly Heat Content Evolution in the Equatorial Pacific

In early August, October, November 2018 and in January-March 2019, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

During May 2019, an upwelling Kelvin wave contributed to the reduction of positive subsurface anomalies and emergence of negative anomalies around 110°-90°W.

From mid-May through June, a downwelling Kelvin wave resulted in the increase of positive subsurface anomalies across the central and east-central 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 (m s^{-1})

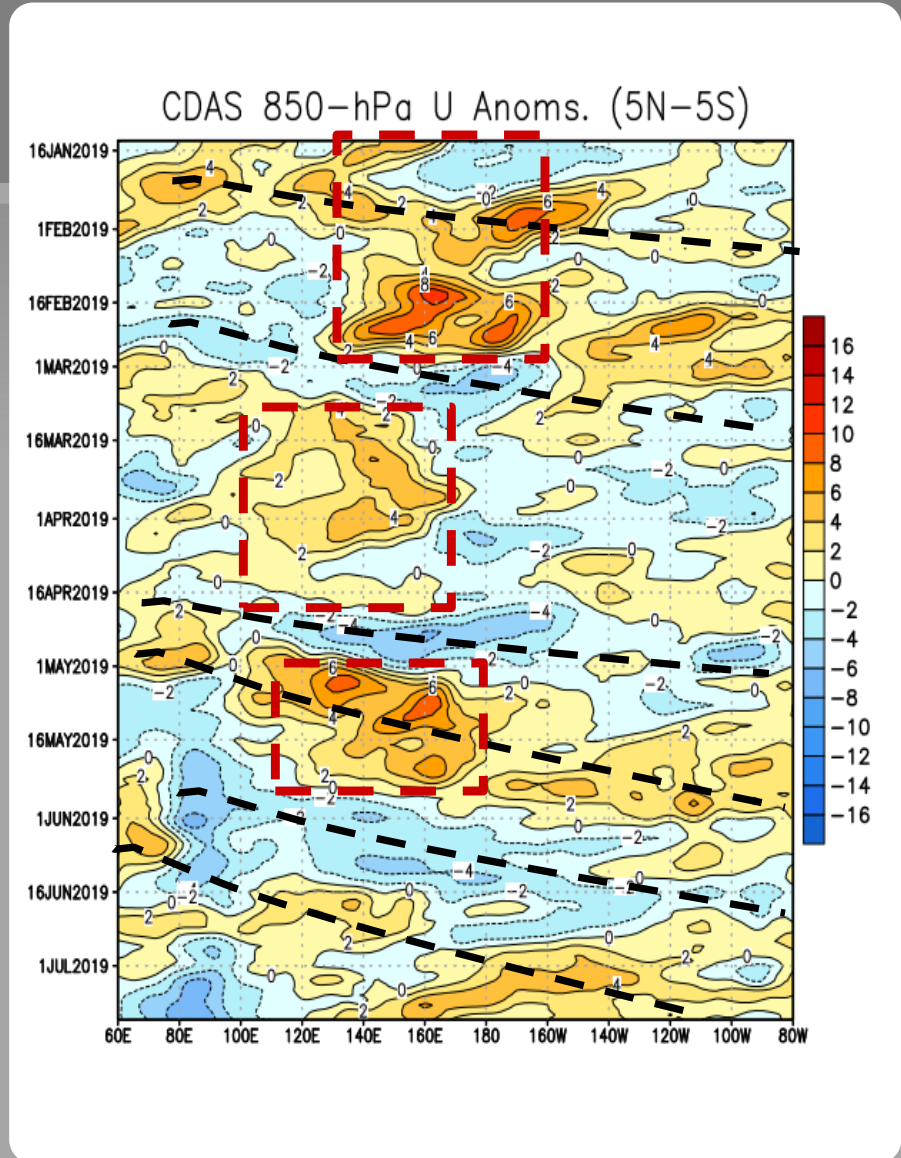
At times, the Madden Julian Oscillation (MJO) has contributed to the eastward propagation of low-level wind anomalies.

From January to May 2019, westerly wind anomalies have periodically emerged over the west-central equatorial Pacific Ocean.

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

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

Eastward propagation of anomalies has, at times, been evident throughout the period.

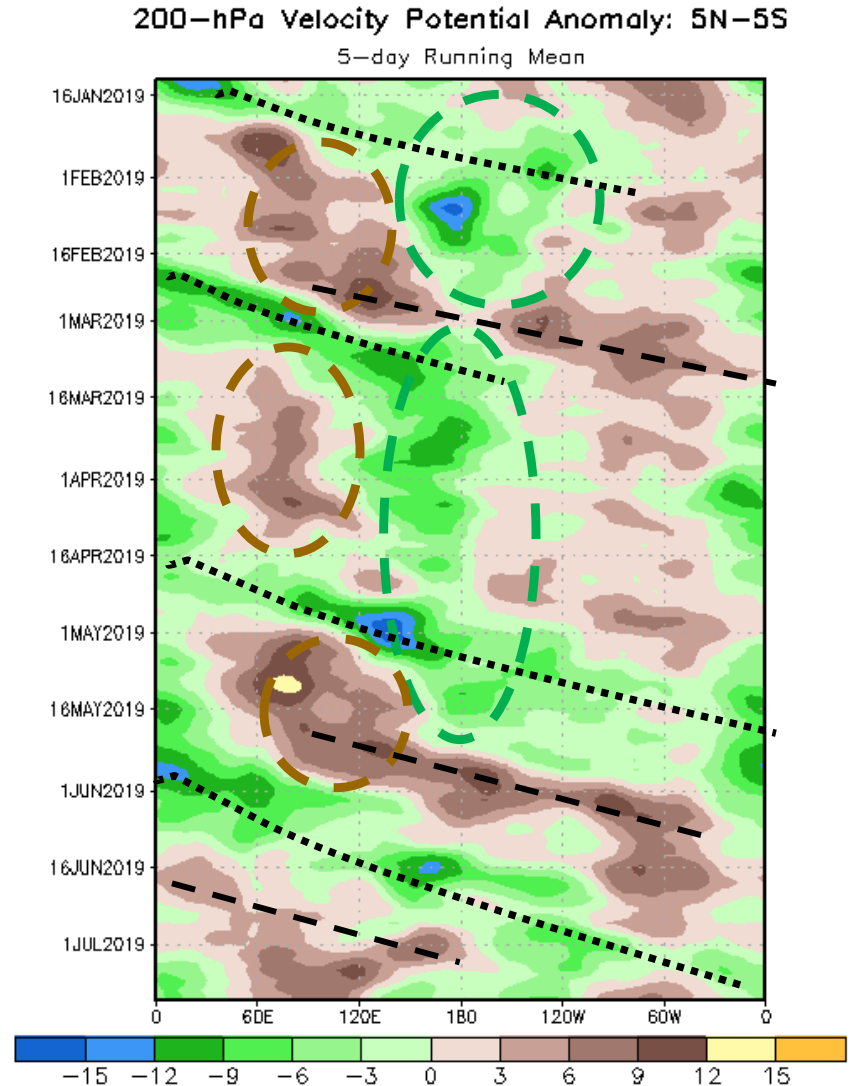
From early March to mid May 2019, anomalous upper-level divergence (green shading) persisted near the Date Line.

In the last week, anomalous upper-level divergence was observed in the central Pacific, while anomalous upper-level convergence (brown shading) was located over Indonesia and the eastern Pacific.

Unfavorable for precipitation (brown shading)

Favorable for precipitation (green shading)

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



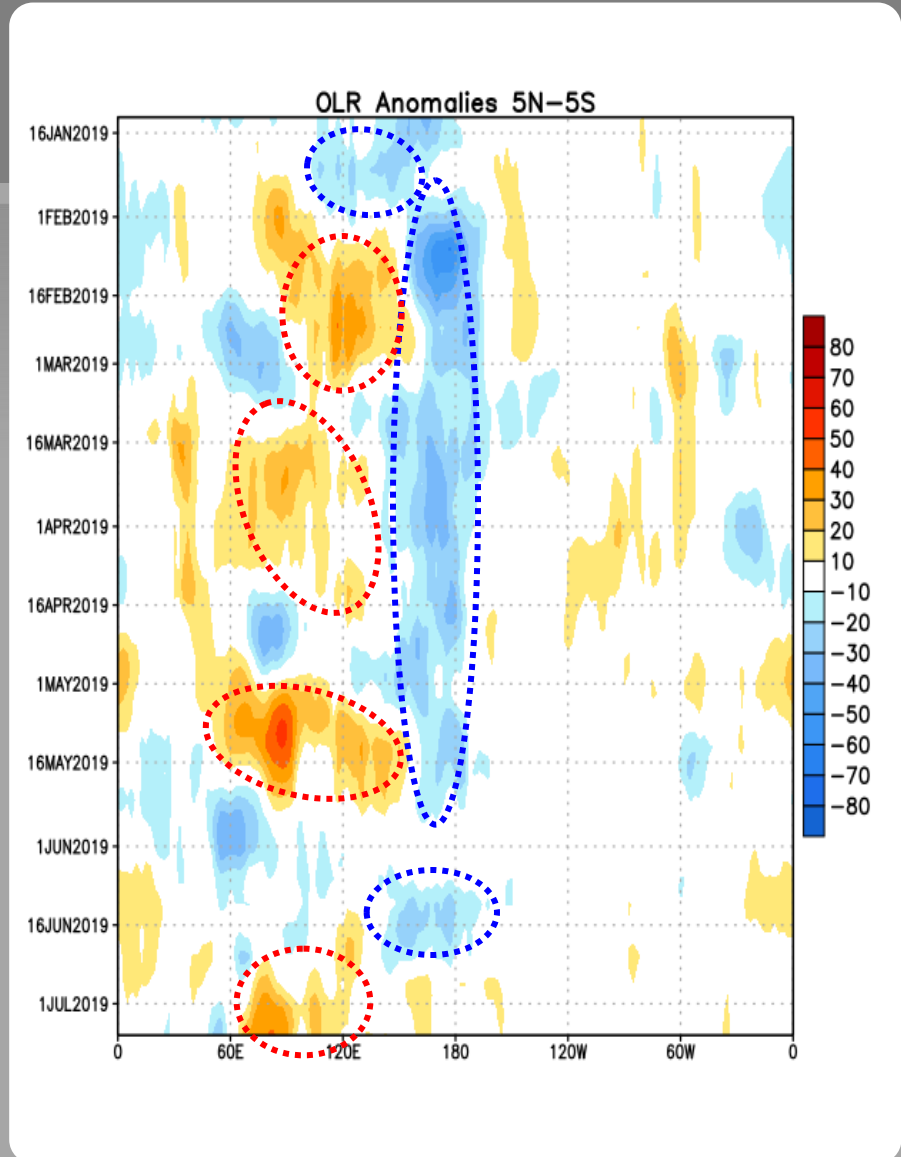
Outgoing Longwave Radiation (OLR) Anomalies

From mid-December 2018 to mid-June 2019, negative OLR anomalies have largely persisted near the Date Line.

Since early February 2019, positive OLR anomalies have, at times, been evident over Indonesia.

In the last week, convection was suppressed near Indonesia and the eastern Indian 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.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 .

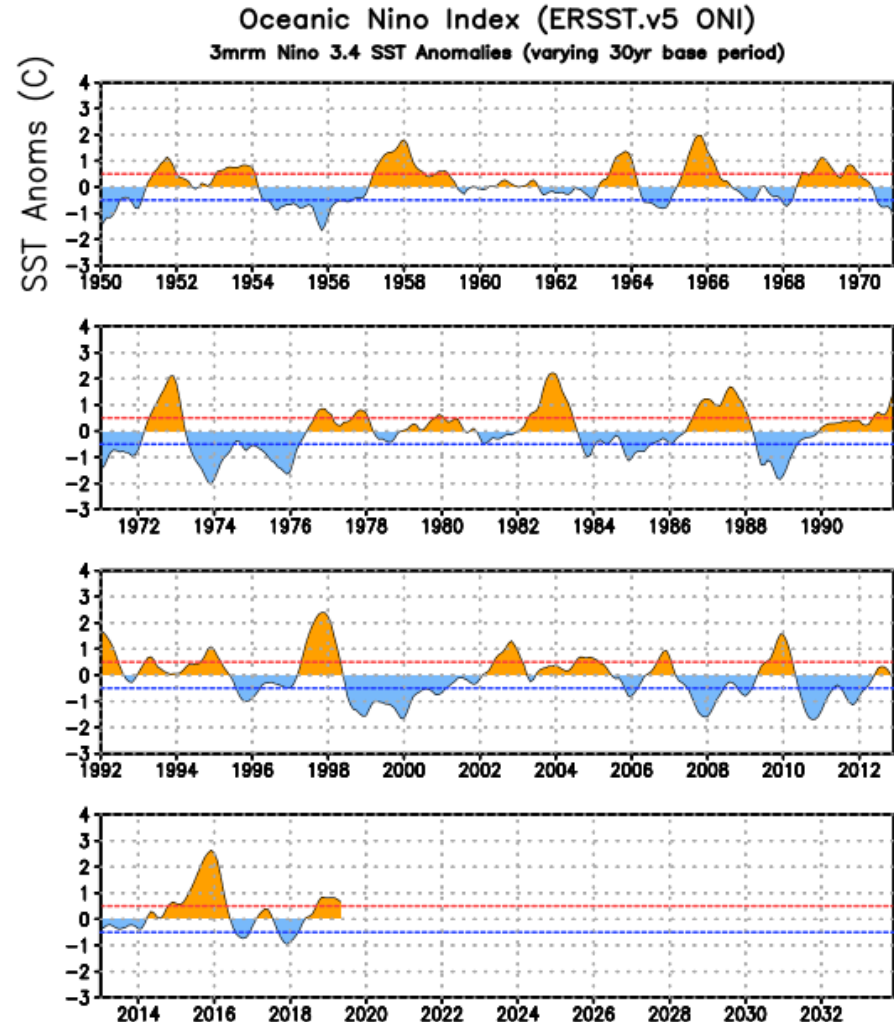
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (April - June 2019) is +0.7°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.

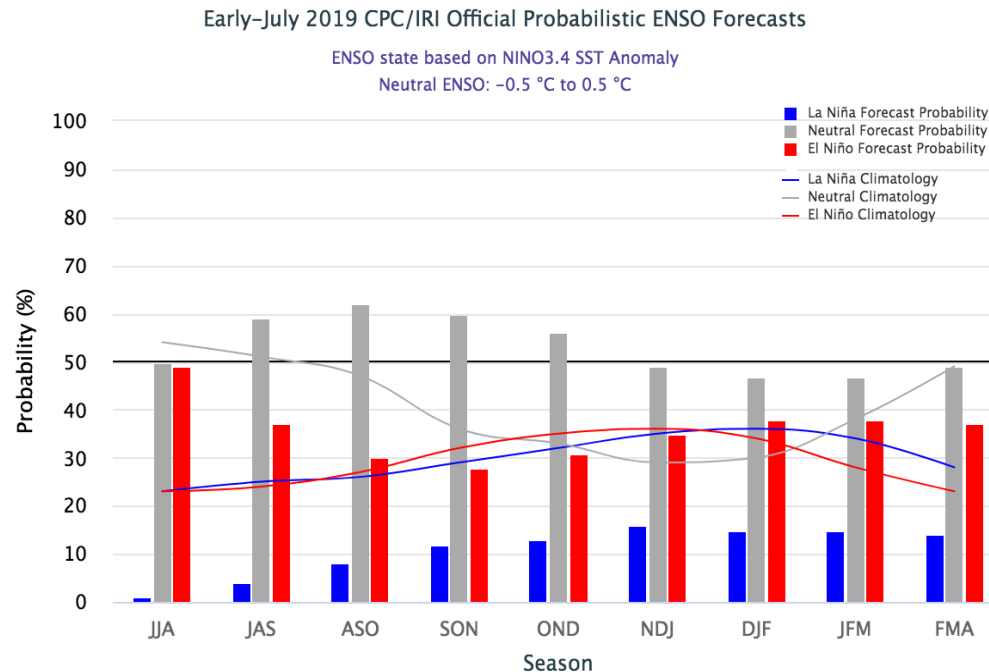
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
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	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7	0.9	0.8
2019	0.8	0.8	0.8	0.8	0.7							

CPC/IRI Probabilistic ENSO Outlook

Updated: 11 July 2019

ENSO-neutral is favored to emerge in the next season and to then continue through winter 2019-20.



IRI/CPC Pacific Niño

3.4 SST Model Outlook

The majority of models predict a weak El Niño to continue into the Northern Hemisphere winter 2019-20.

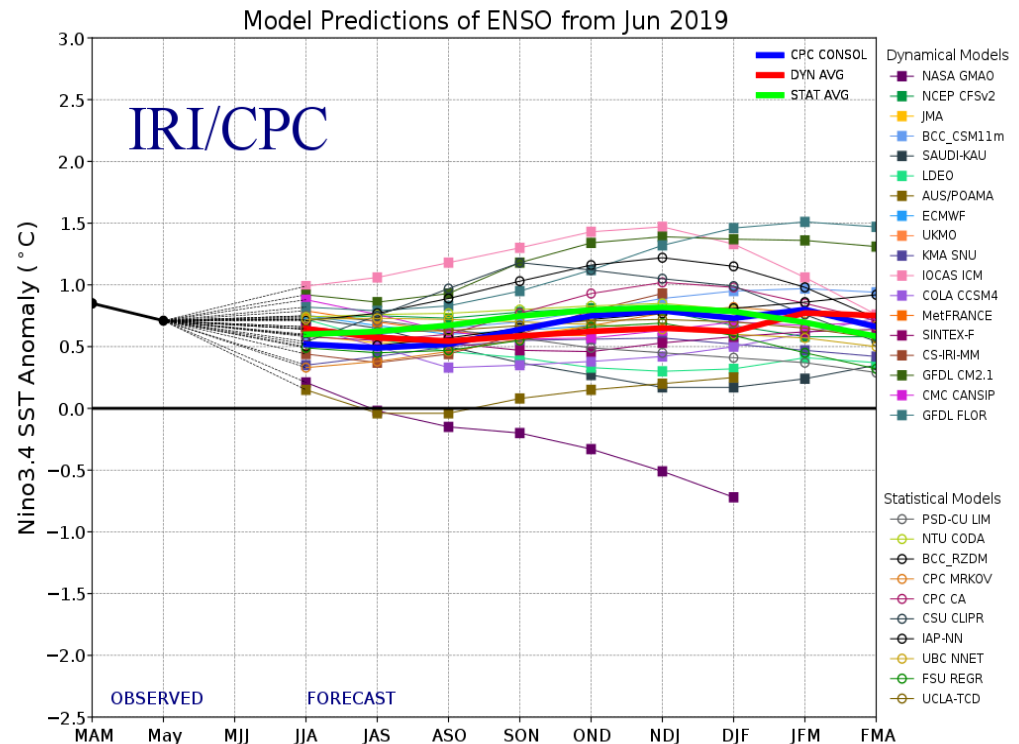


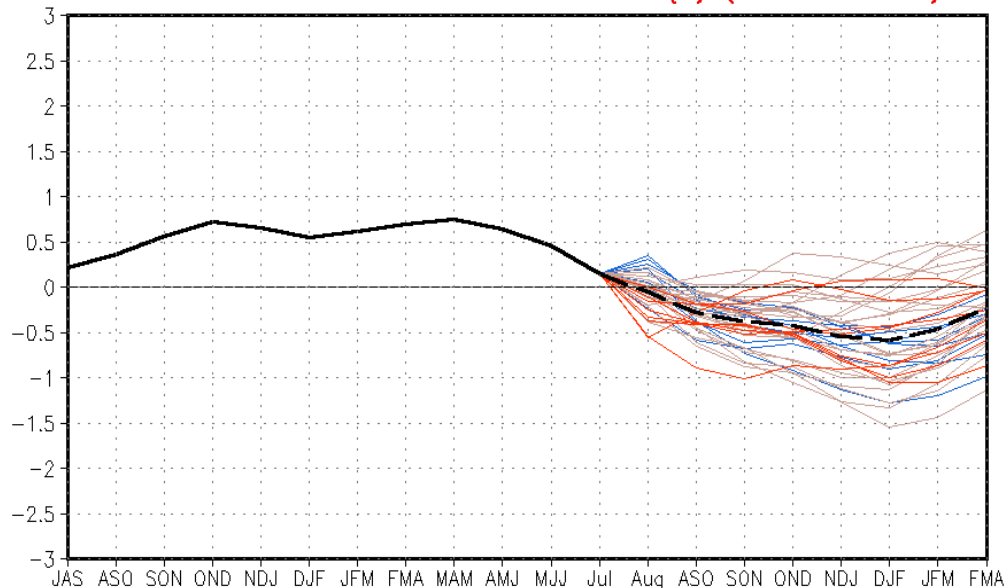
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 June 2019).

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

Issued: 15 July 2019

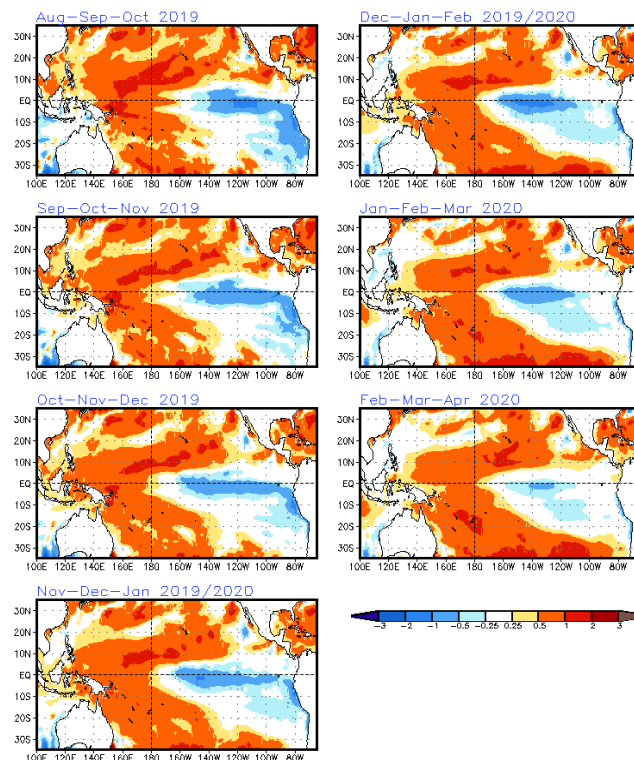
The CFS.v2 ensemble mean (black dashed line) predicts a return to ENSO-neutral in the next month, continuing through the fall 2019, with a chance of La Niña during winter 2019-20.

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)



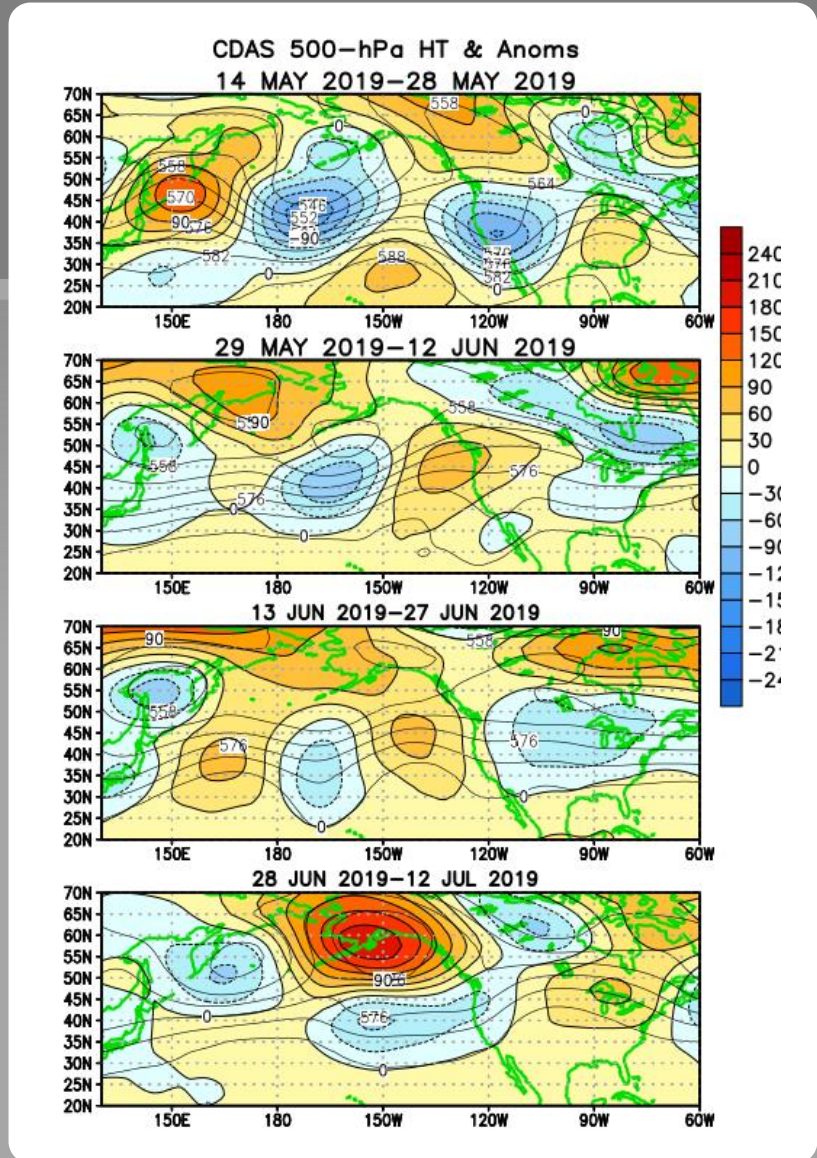
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During the last half of May, anomalous troughing and negative temperature anomalies were observed in into the central and southwestern U.S., while above-average temperatures persisted over the eastern U.S. and Pacific Northwest.

During most of June, anomalous ridging (and above-average temperatures) was observed over the western U.S., while anomalous troughing (and near-to-below average temperature) were evident over parts of the central U.S.

Since late June, near-to-below average heights and temperatures were most evident over the western contiguous U.S, while above average heights and temperatures were evident over the eastern U.S.

1 of 3



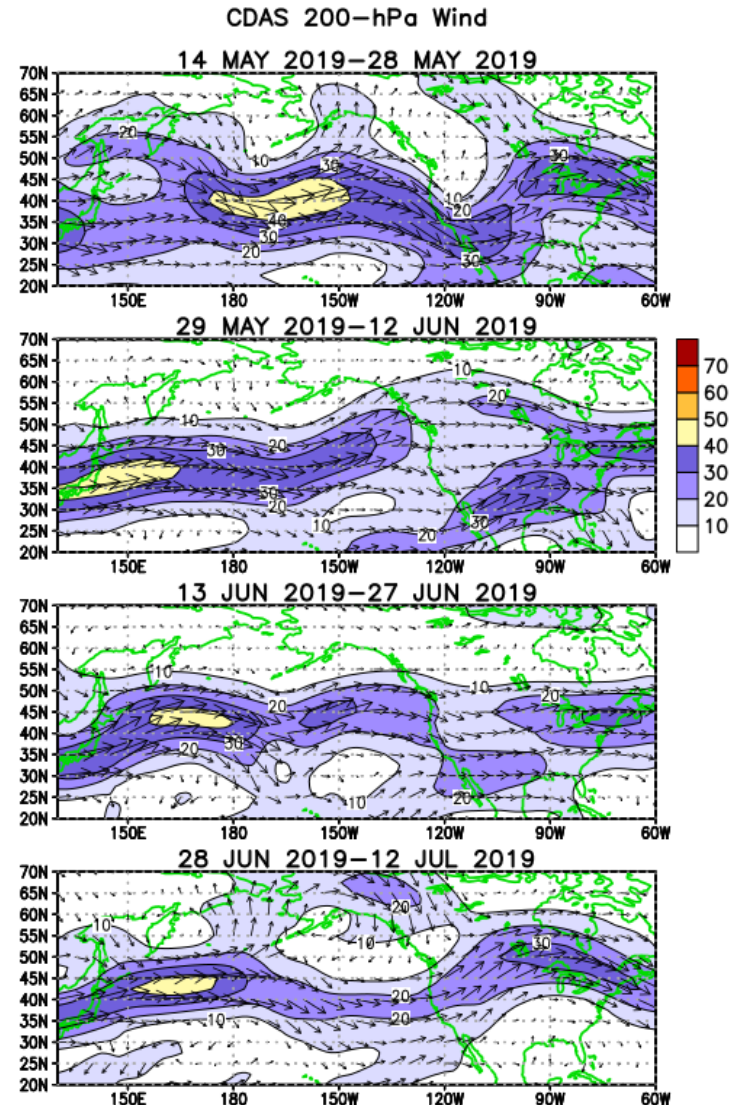
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2 of 3



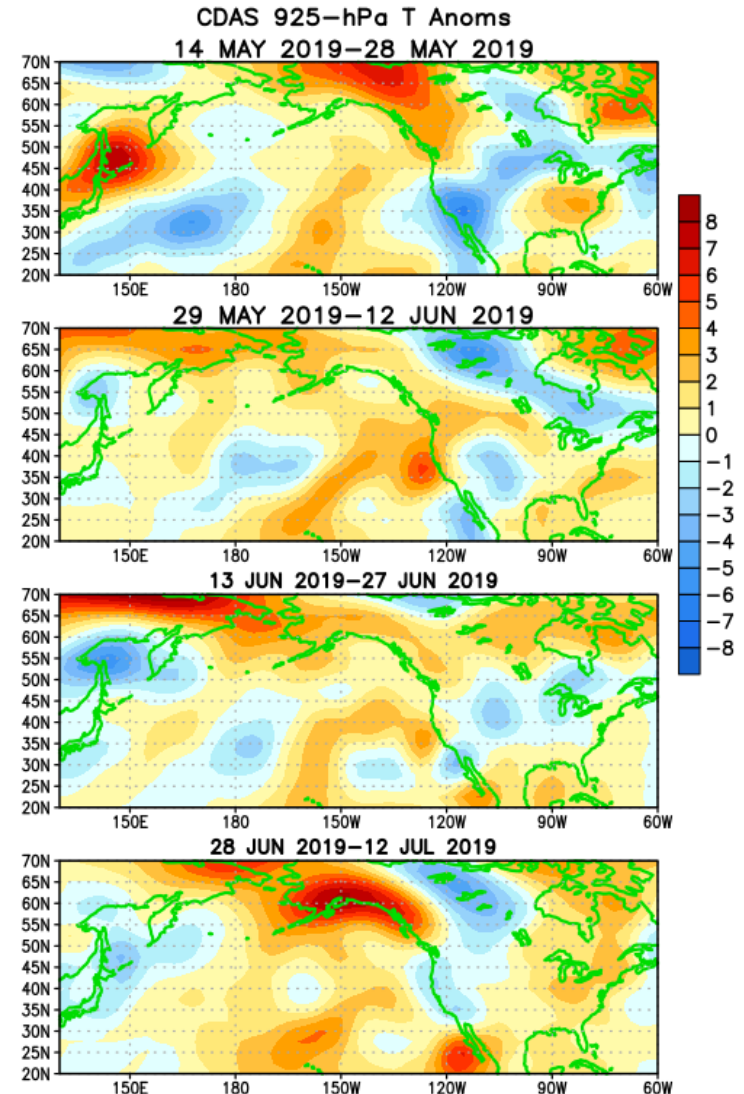
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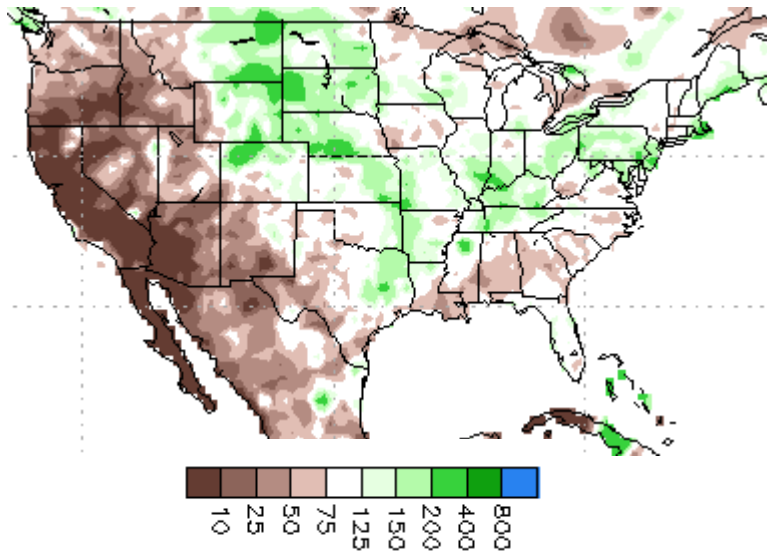
3 of 3



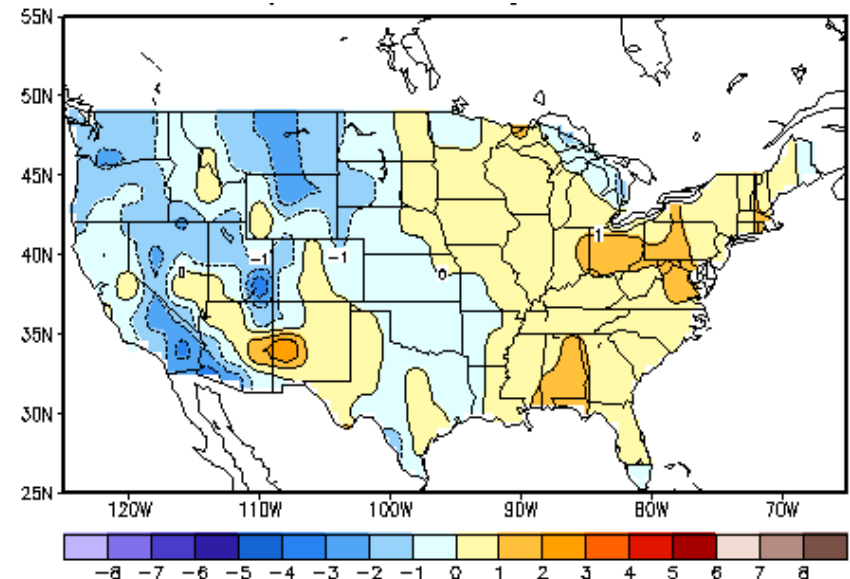
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 13 July 2019

Percent of Average Precipitation



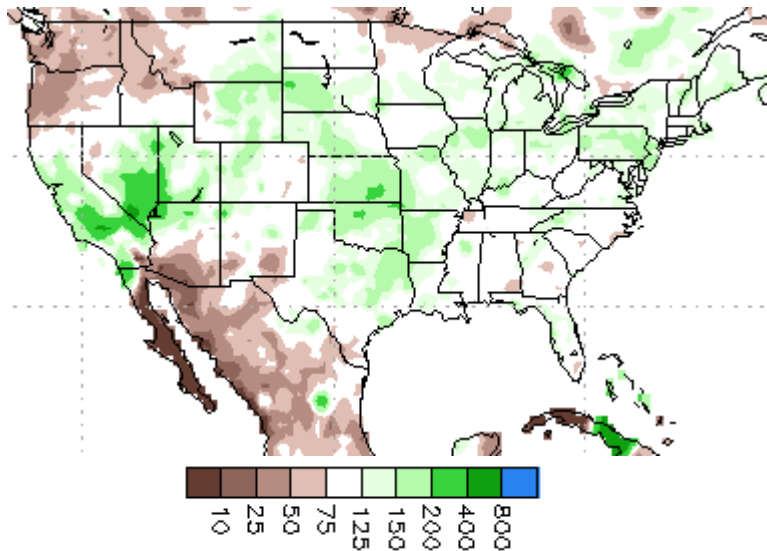
Temperature Departures (degree C)



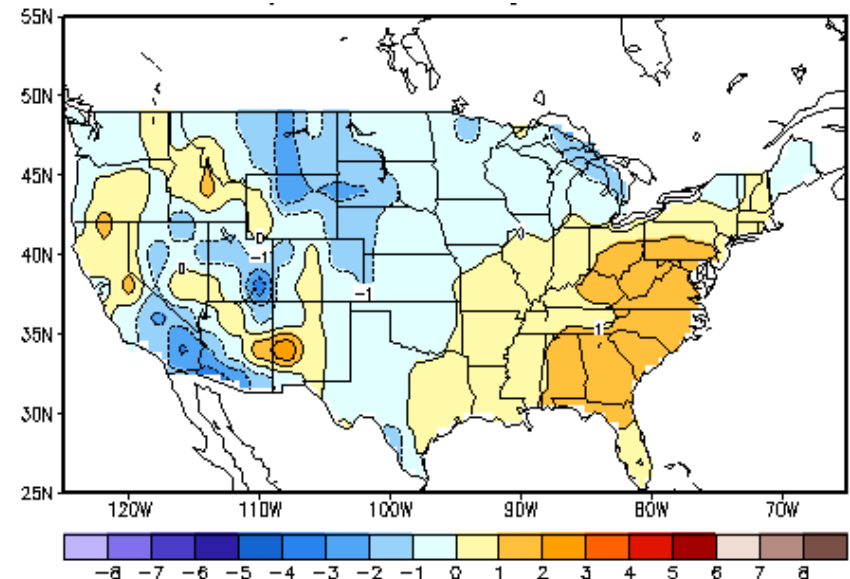
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 13 July 2019

Percent of Average Precipitation



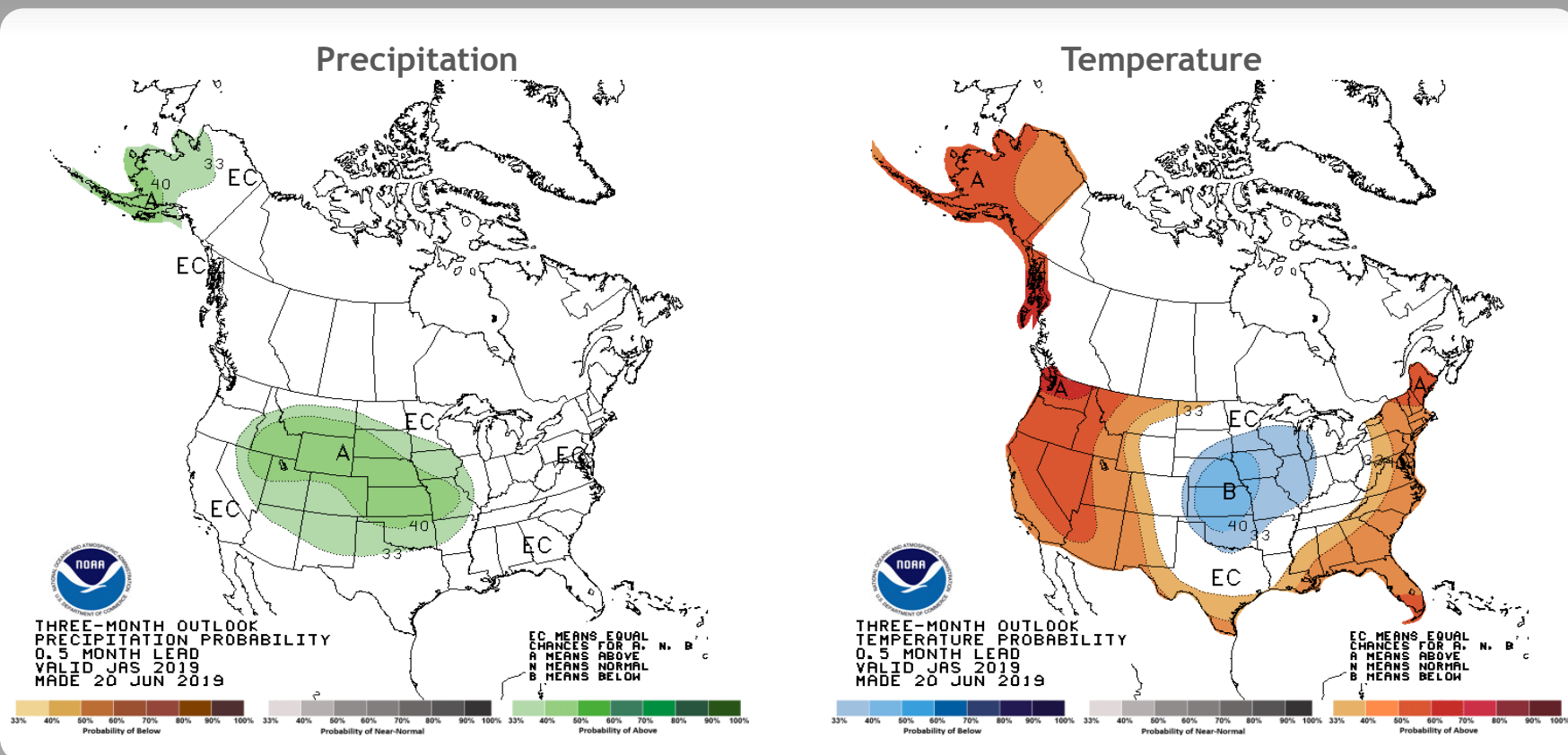
Temperature Departures (degree C)



U. S. Seasonal Outlooks

July-September 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 is present.*

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

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

A transition from El Niño to ENSO-neutral is expected in the next month or two, with ENSO-neutral most likely to continue through Northern Hemisphere fall and winter.*

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