

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
17 August 2020

Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

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Summary

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ENSO Alert System Status: **La Niña Watch**

ENSO-neutral conditions are present.*

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

The tropical atmospheric circulation is consistent with ENSO-neutral.

There is a ~60% chance of La Niña development during Northern Hemisphere fall 2020 and continuing through winter 2020-21 (~55% chance).*

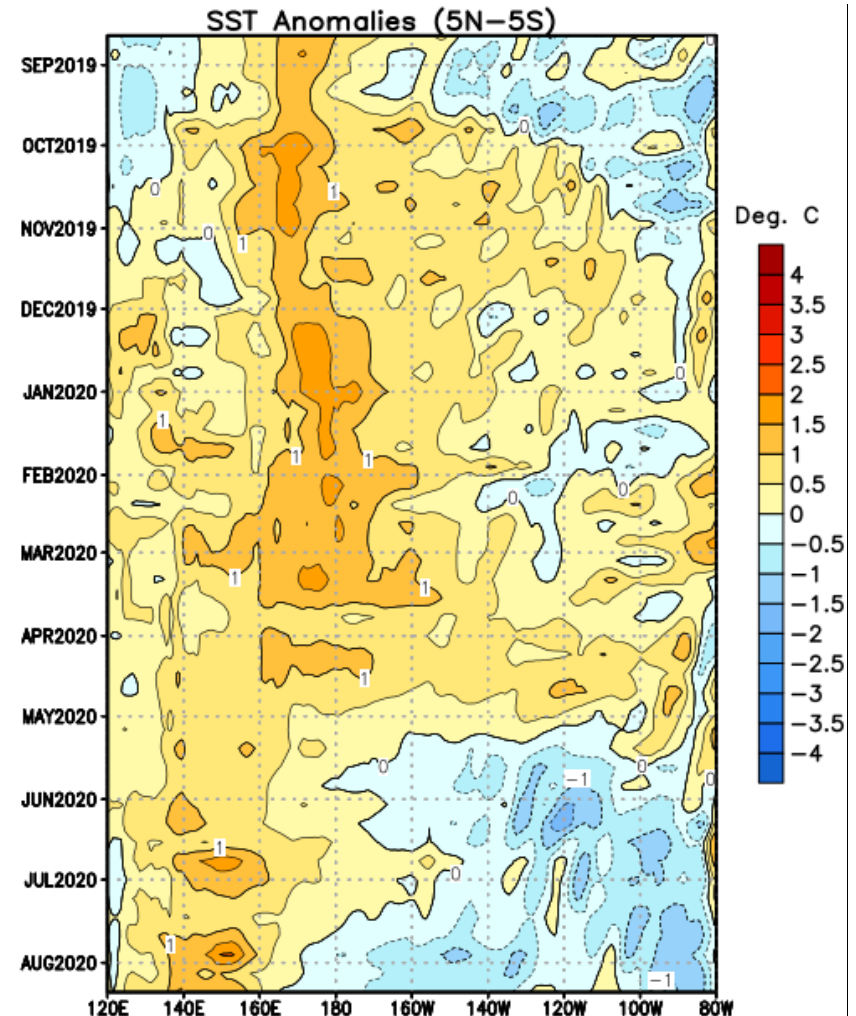
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

Recent Evolution of Equatorial Pacific SST Departures (°C)

From July-September 2019, below-average SSTs expanded westward into the east-central Pacific.

Beginning in mid-September 2019, above-average SSTs expanded from the Date Line into the eastern Pacific Ocean.

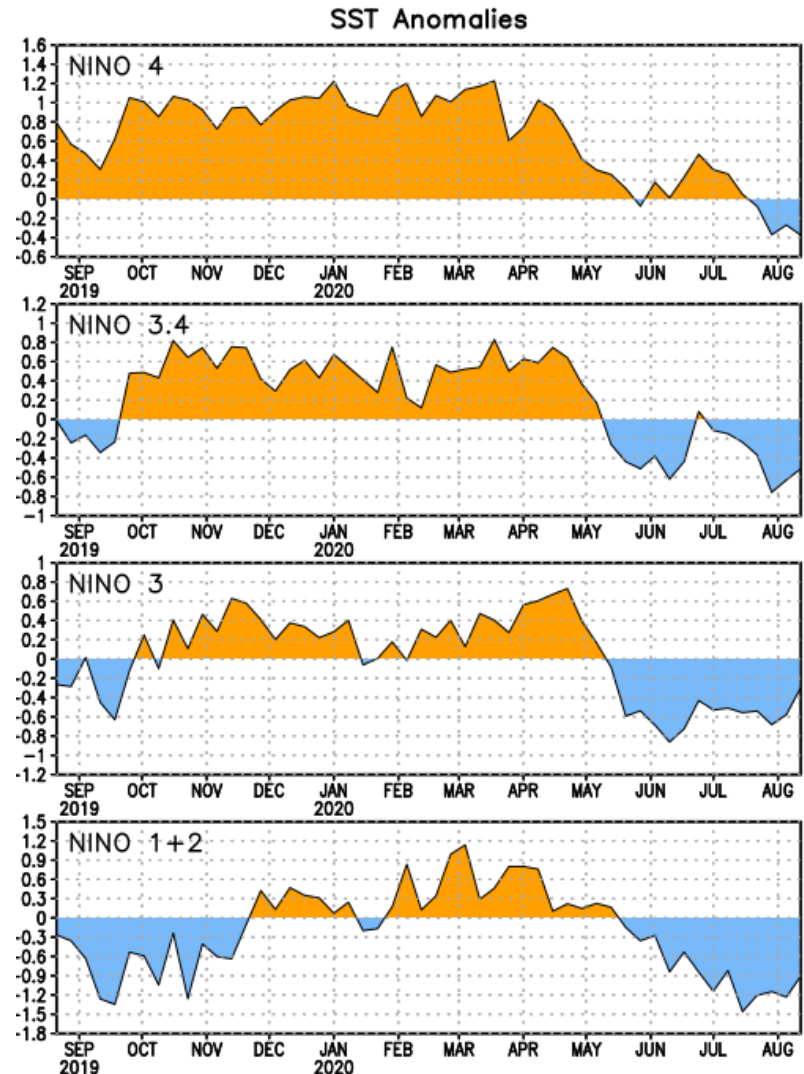
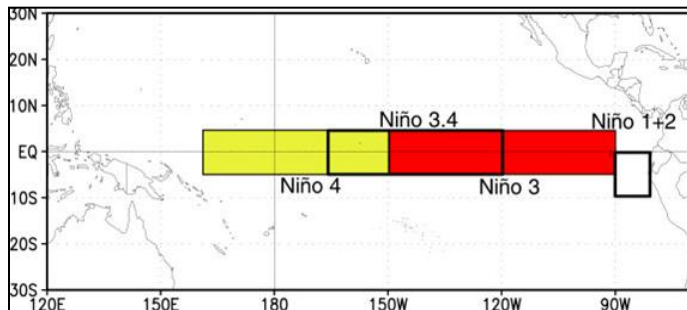
Since early May 2020, equatorial SSTs were near-to-below average from the central to the eastern Pacific Ocean.



Niño Region SST Departures (°C) Recent Evolution

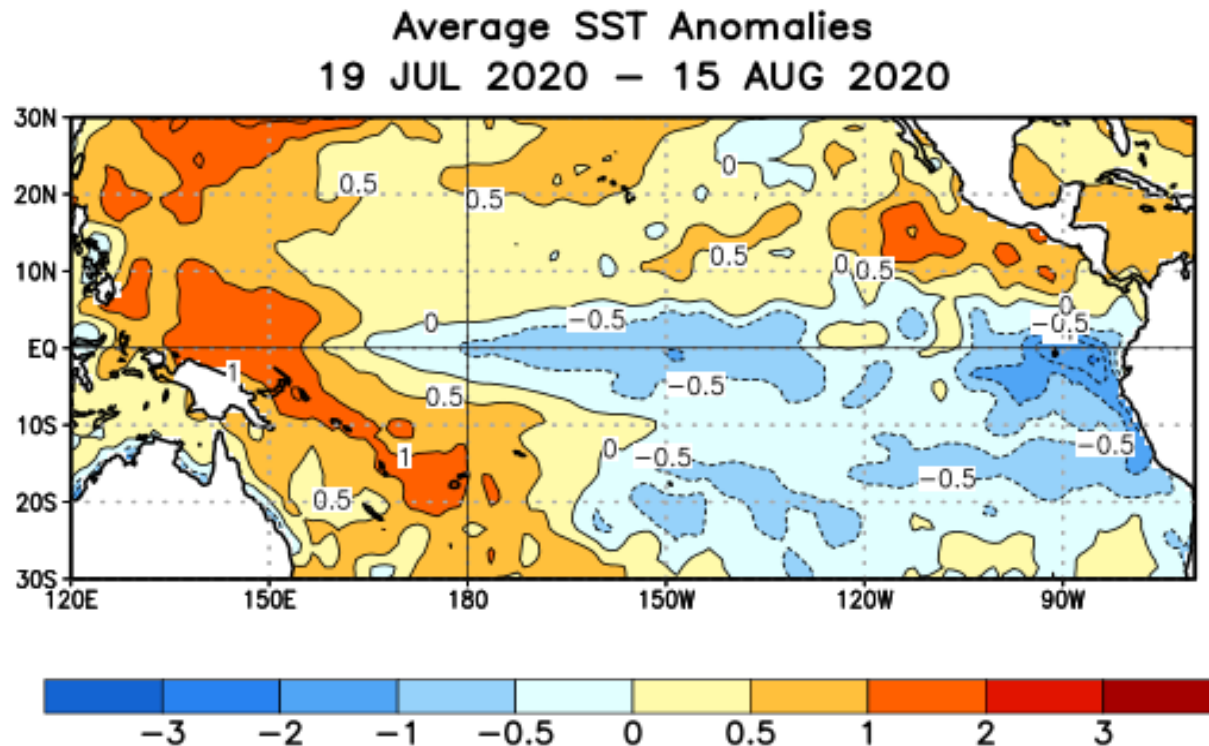
The latest weekly SST departures are:

Niño 4	-0.4°C
Niño 3.4	-0.5°C
Niño 3	-0.3°C
Niño 1+2	-0.9°C



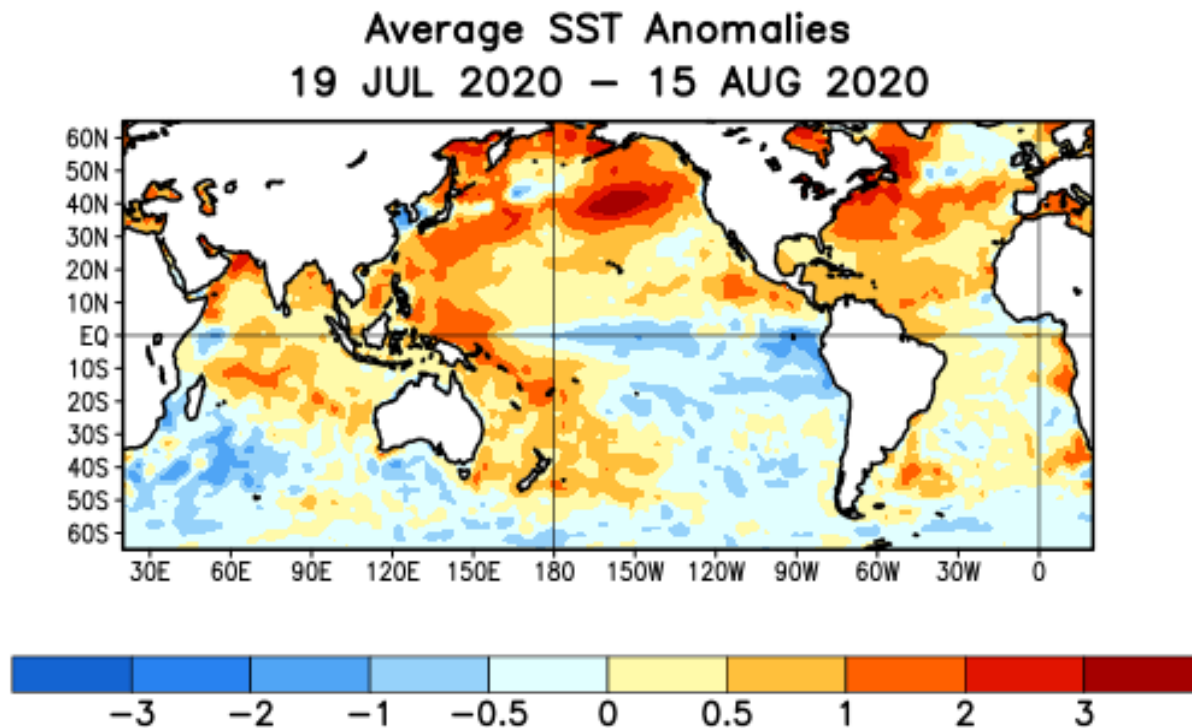
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were below average from the Date Line to the eastern Pacific, and were above average in the western Pacific.



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

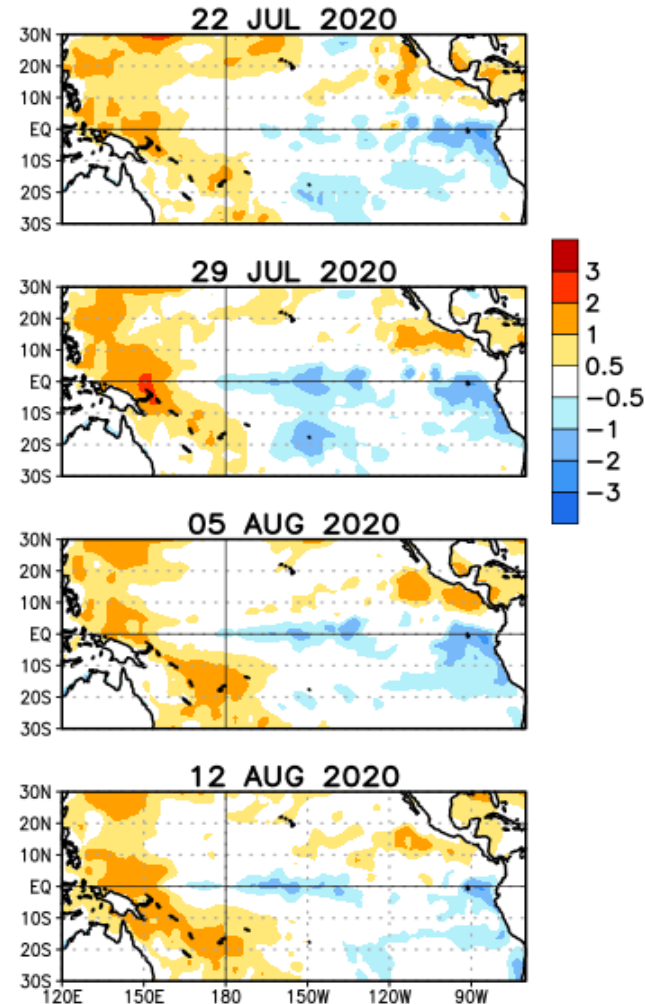
During the last four weeks, equatorial SSTs were above average across the western Pacific Ocean and central Indian Ocean. SSTs were below average from the central to the eastern Pacific Ocean.



Weekly SST Departures during the Last Four Weeks

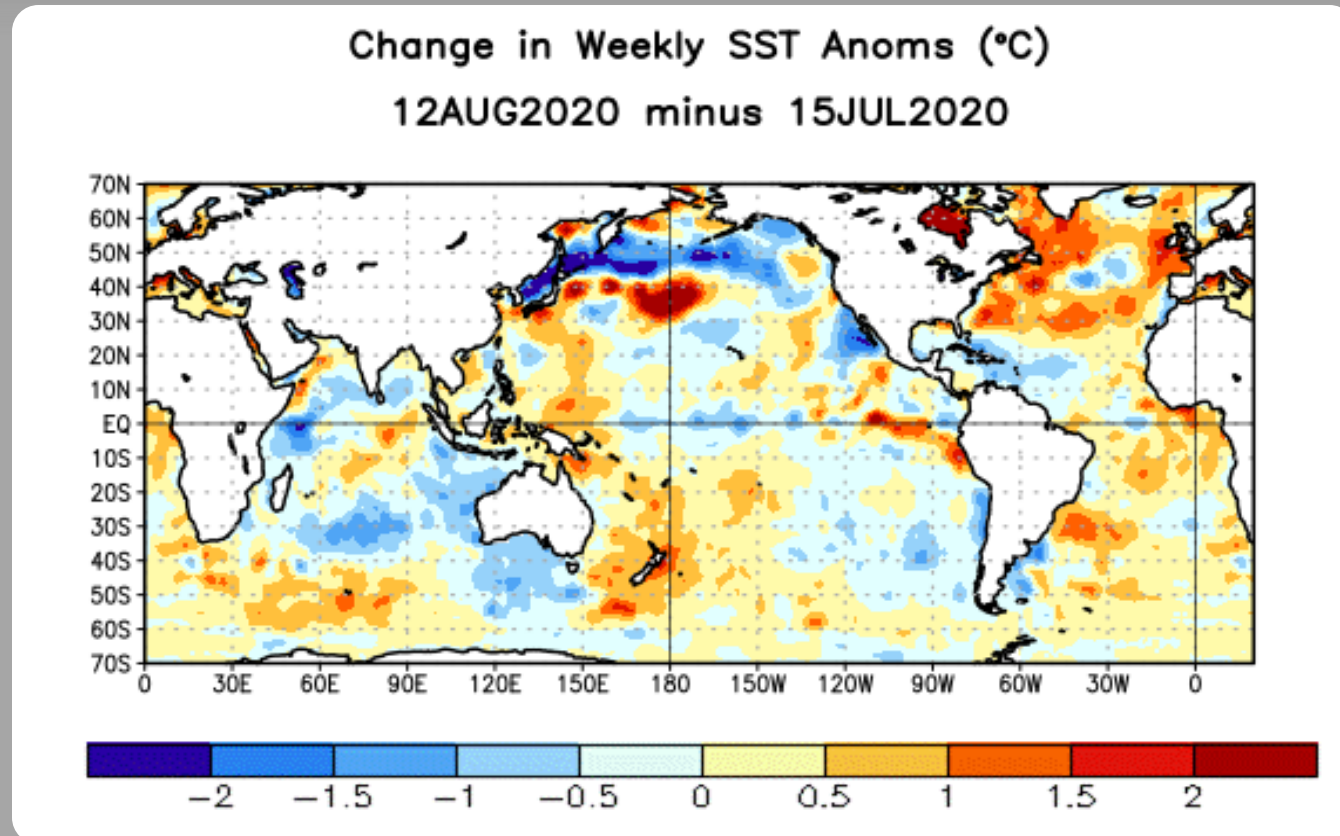
During the last four weeks, near-to-below-average SSTs have persisted in the central to eastern equatorial Pacific.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, the changes in equatorial SST anomalies were negative in the central Pacific, with positive changes in the eastern and western Pacific.



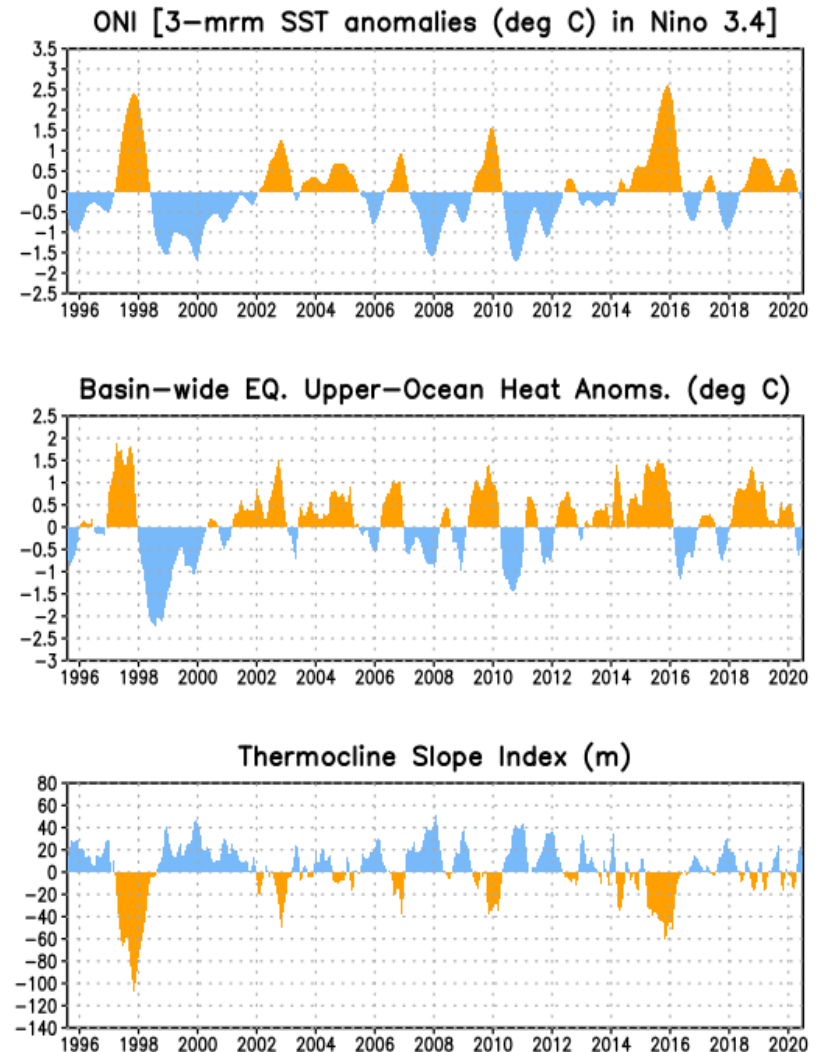
Upper-Ocean Conditions in the Equatorial Pacific

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.

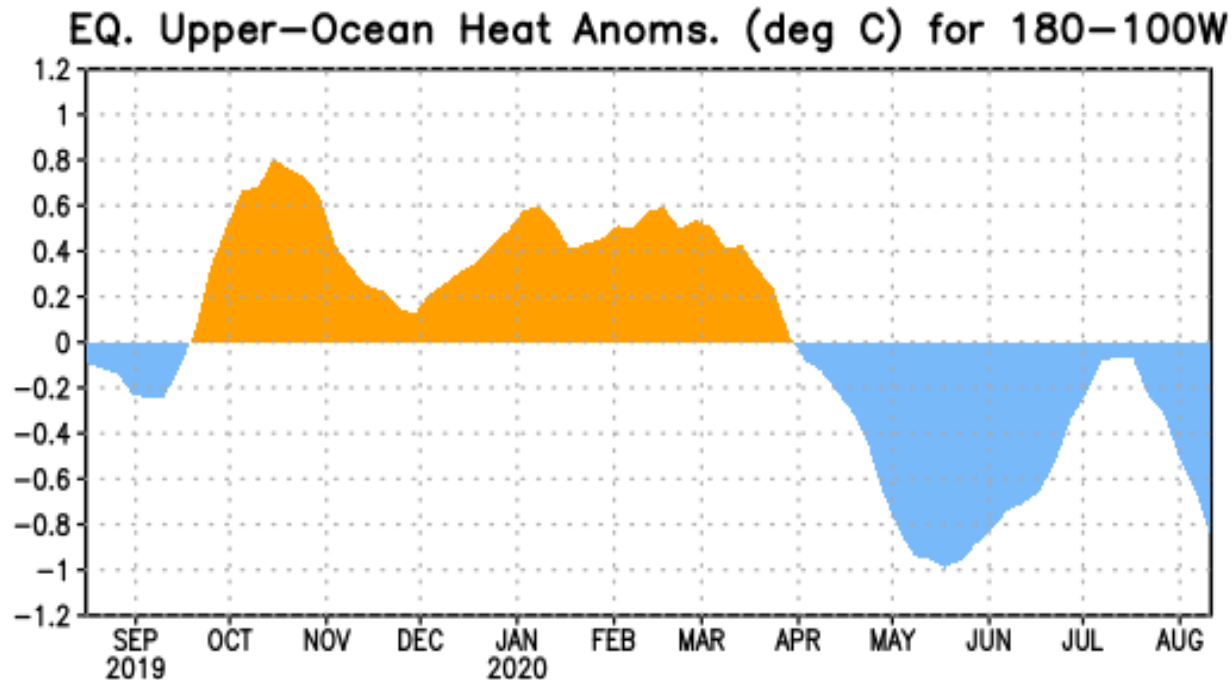
Recent values of the upper-ocean heat anomalies (near average) and thermocline slope index (near average) reflect ENSO-neutral.

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).



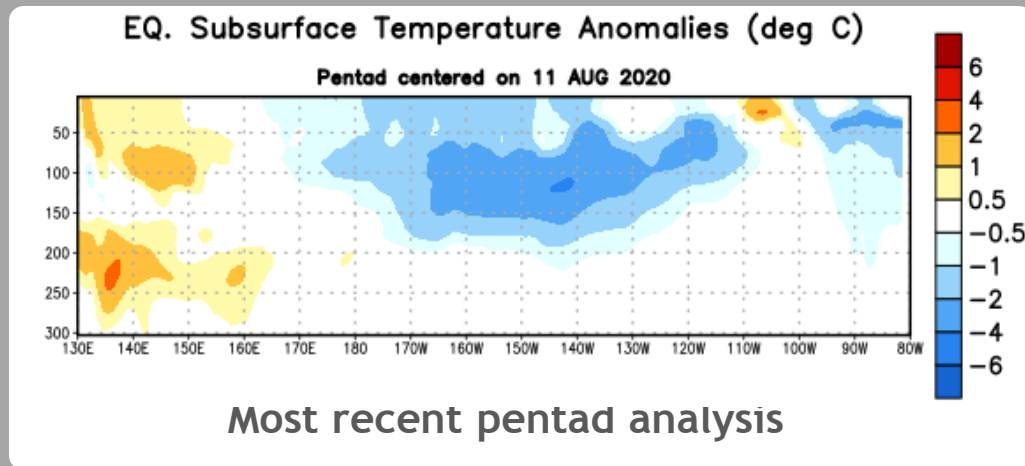
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Subsurface temperature anomalies peaked during October 2019 and during January-February 2020. In March, positive anomalies weakened and returned to zero. During April and early May, negative anomalies strengthened. From mid-May to early July, anomalies weakened to near zero. Since mid-July, negative anomalies have strengthened.

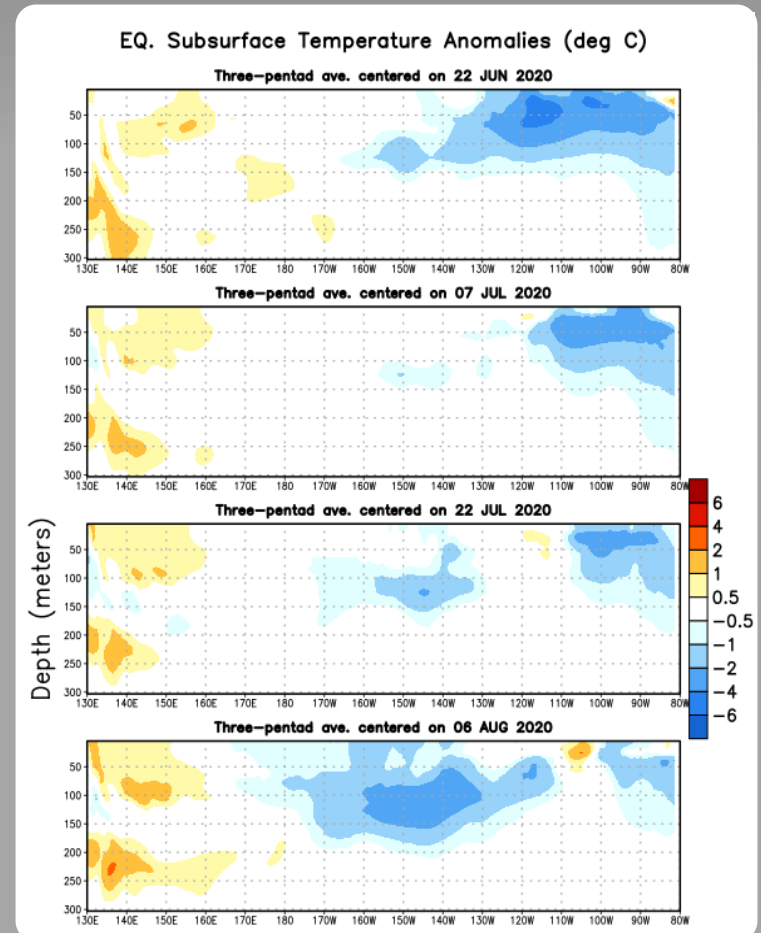


Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, negative subsurface temperature anomalies have strengthened in the east-central Pacific Ocean.



Also, negative subsurface temperature anomalies have remained in the far eastern Pacific Ocean.

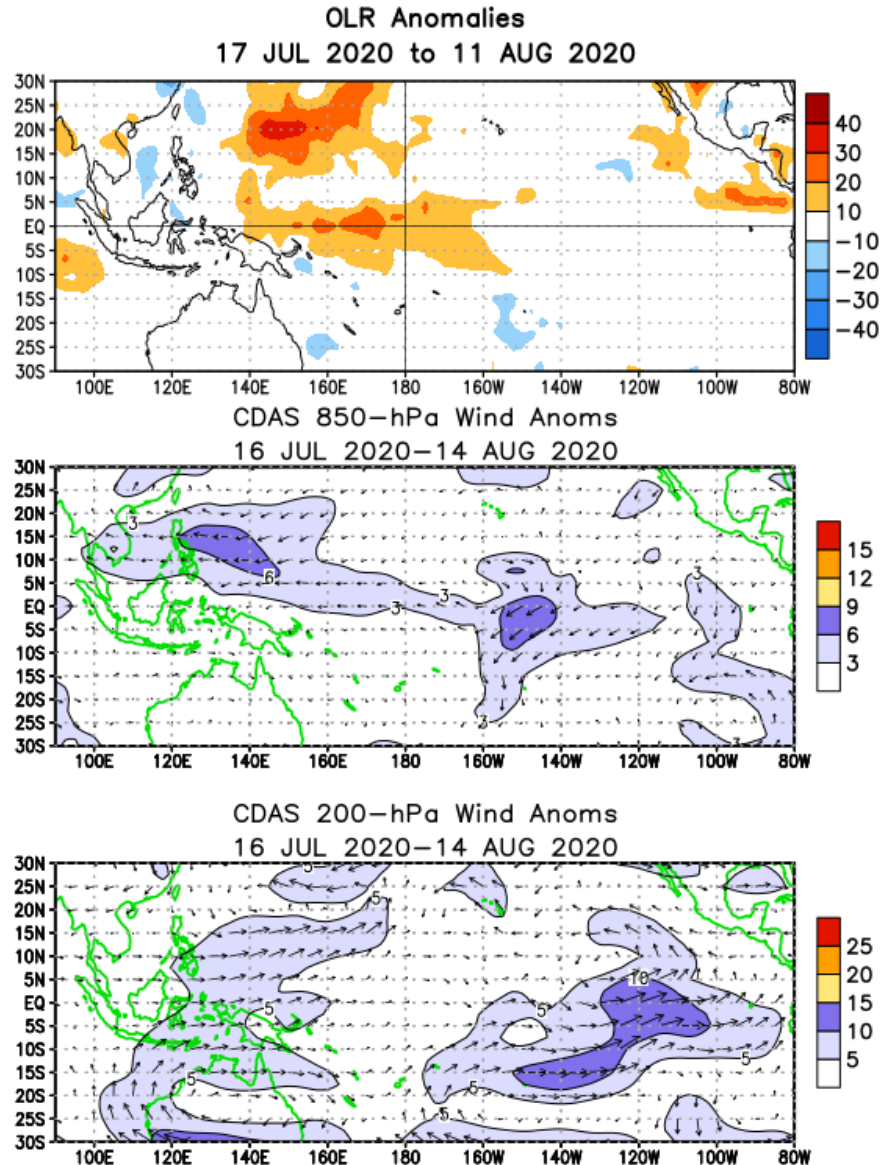


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) extended from the western Pacific to ~160°W.

Low-level (850-hPa) wind anomalies were easterly over most of the equatorial Pacific Ocean and were cross-equatorial over the east-central and eastern tropical Pacific.

Upper-level (200-hPa) wind anomalies were westerly over the western and 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

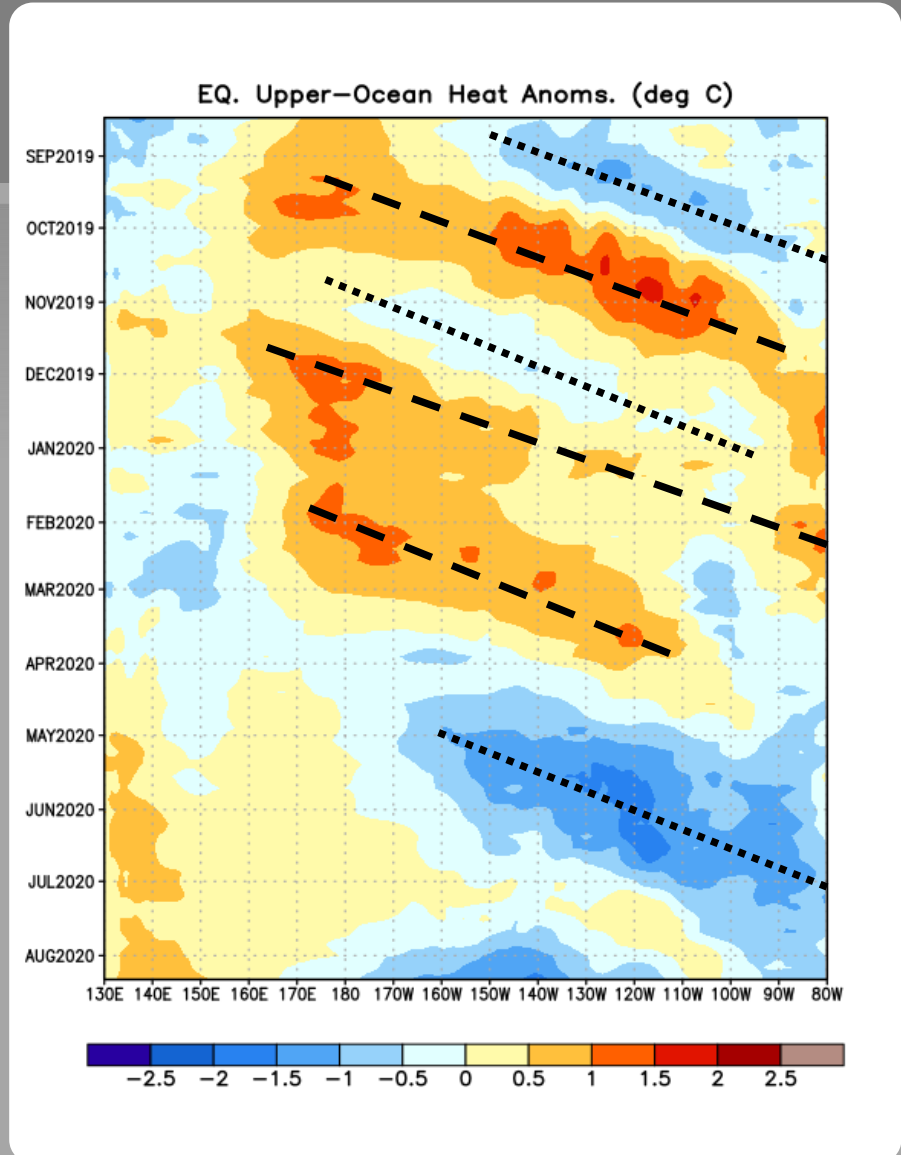
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

From December 2019 to February 2020, downwelling Kelvin waves (dashed line) resulted in above-average subsurface temperatures across the central and east-central equatorial Pacific.

From April-June 2020, negative subsurface temperature anomalies expanded eastward in association with an upwelling Kelvin wave.

In July 2020, negative anomalies strengthened in the east-central 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 up-welling and cooling occur in the trailing portion.



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

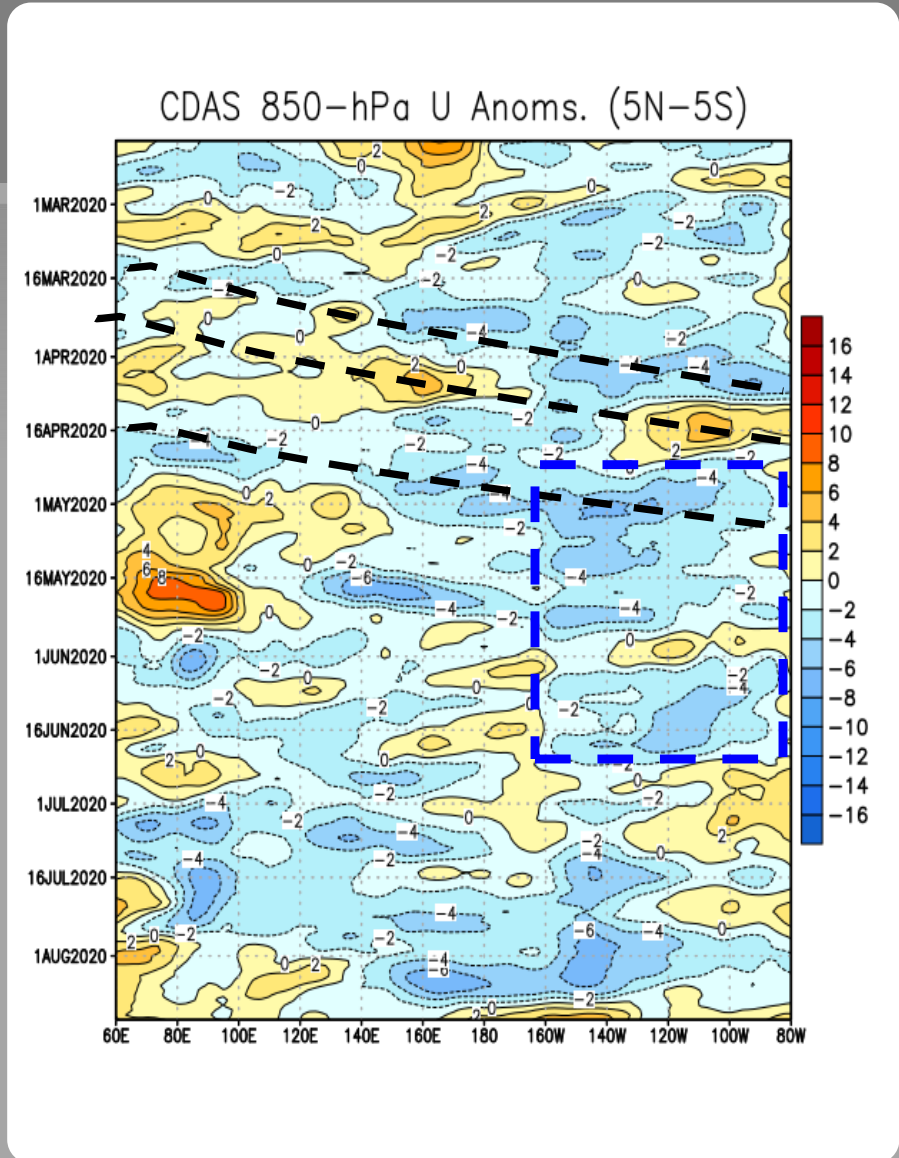
At times, the Madden Julian-Oscillation (MJO) has contributed to the eastward propagation of low-level wind anomalies.

From mid-April to mid-June 2020, easterly wind anomalies persisted over the eastern equatorial Pacific.

In the last week, westerly wind anomalies emerged over the central and east-central 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.

Since the beginning of the period, anomalous divergence (green shading) has generally persisted over Africa and the western Indian Ocean.

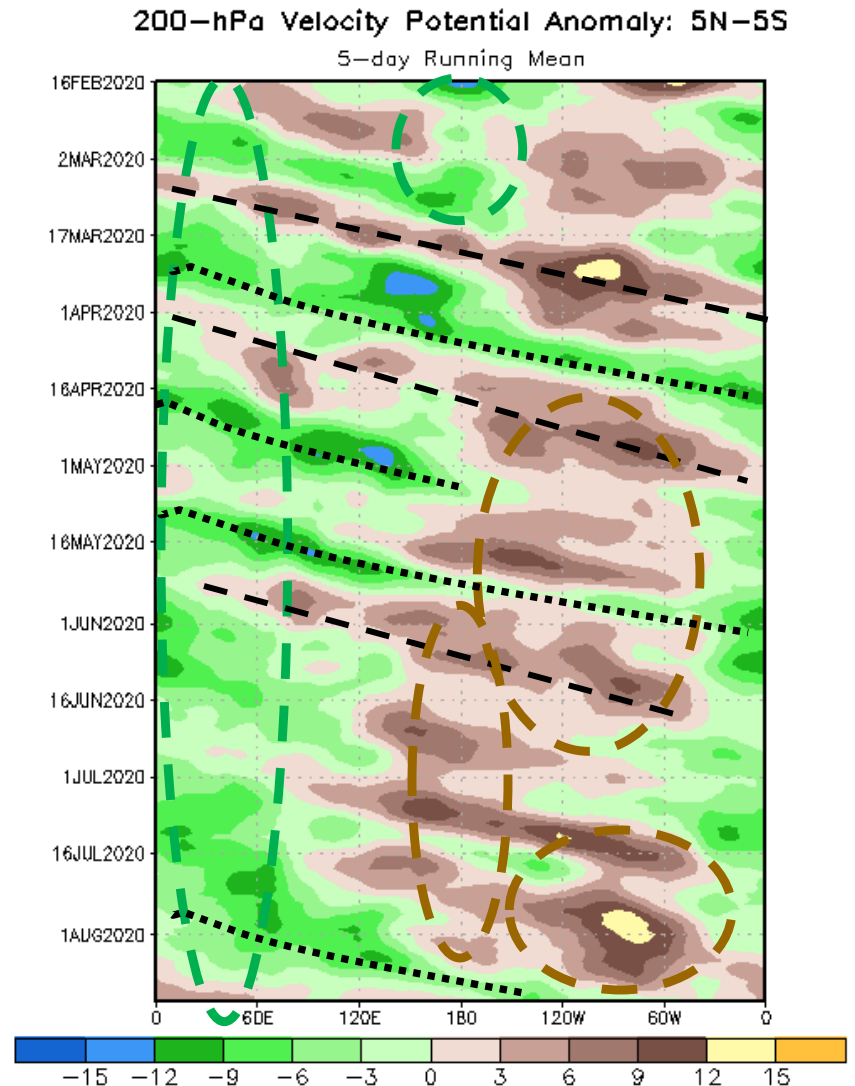
From mid-May through July 2020, anomalous convergence (brown shading) persisted over the Date Line.

In the last week, anomalous divergence shifted eastward into the central and east-central Pacific.

Unfavorable for precipitation (brown shading)

Favorable for precipitation (green shading)

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

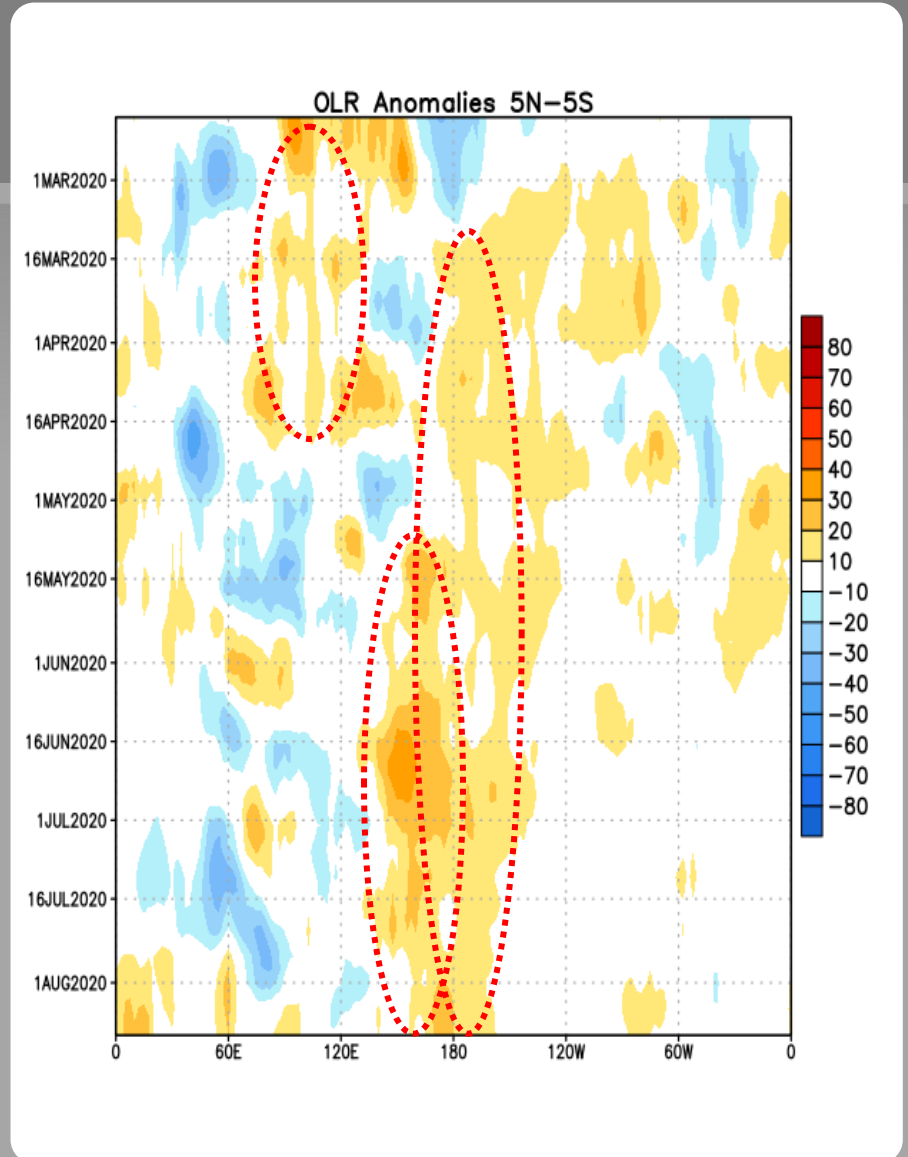


Outgoing Longwave Radiation (OLR) Anomalies

From July 2019 through mid-April 2020, positive OLR anomalies persisted over Indonesia.

Since mid-March 2020, positive OLR anomalies were observed at the Date Line and/or over the 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.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 .

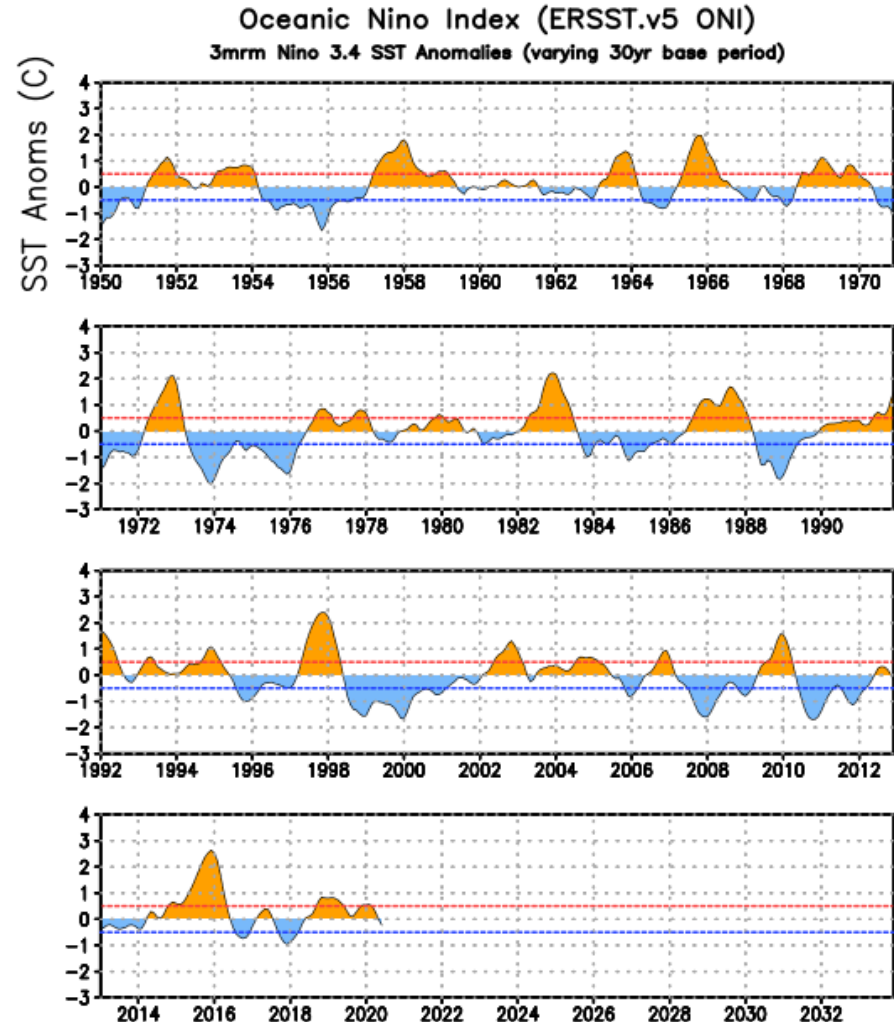
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (May - July 2020) is -0.2°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.

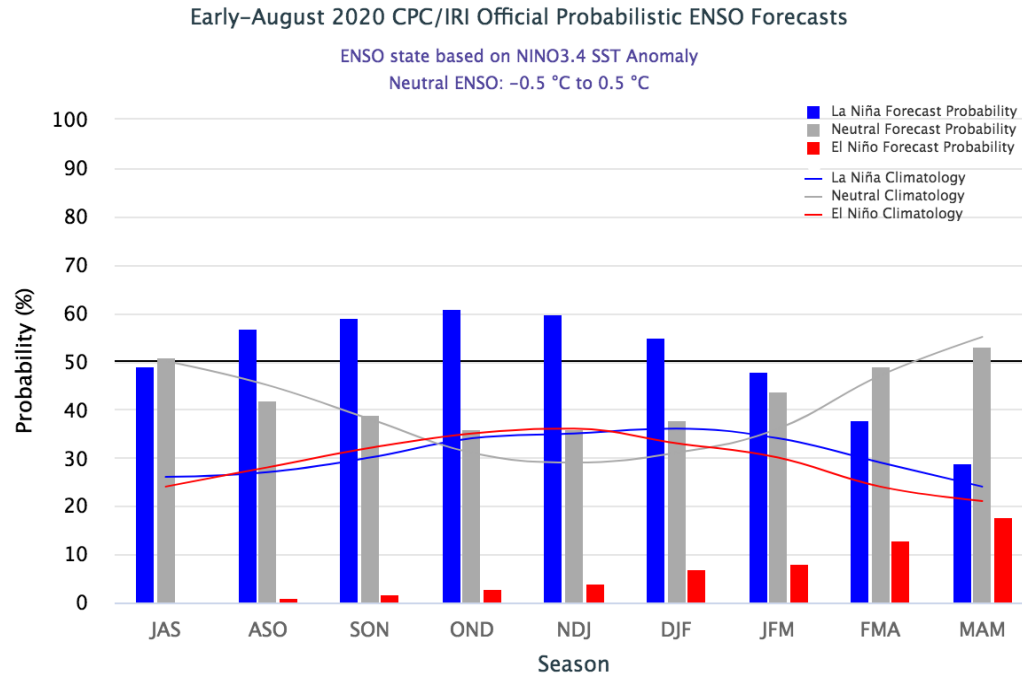
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
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	0.6	0.5	0.3	0.1	0.1	0.3	0.5	0.5
2020	0.5	0.6	0.5	0.3	0.0	-0.2						

CPC/IRI Probabilistic ENSO Outlook

Updated: 13 August 2020

La Niña is favored (~55% chance) beginning in August-October 2020 and continuing through Northern Hemisphere winter 2020-21.



IRI/CPC Pacific Niño

3.4 SST Model Outlook

The averages of the models predict a borderline or weak La Niña into the Northern Hemisphere winter 2020-21.

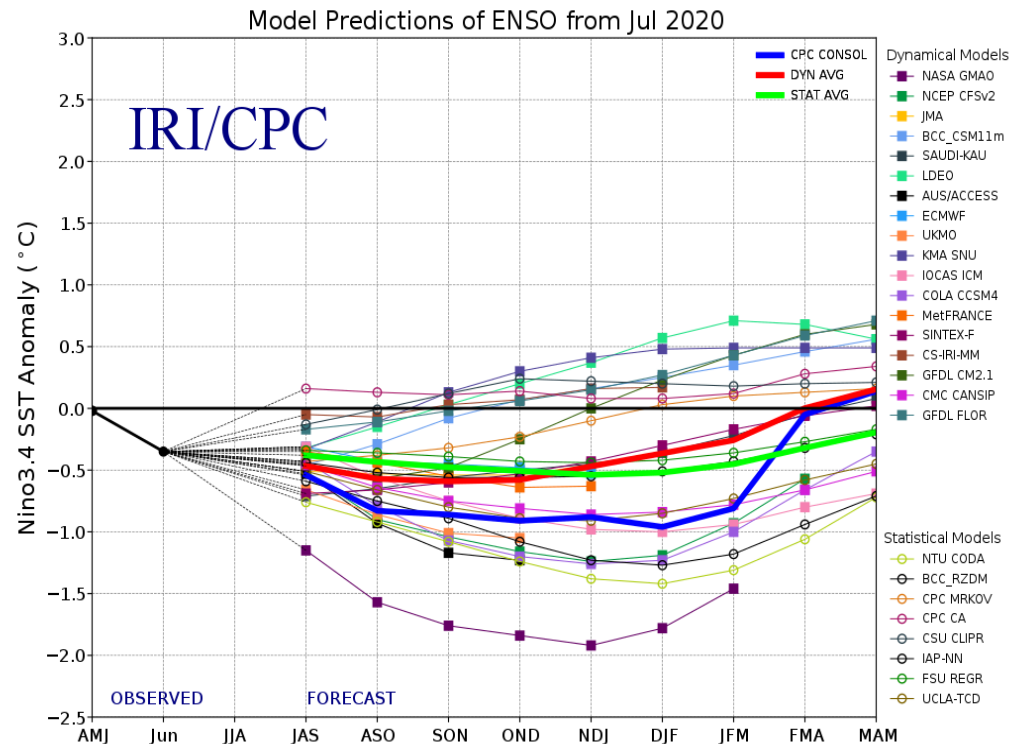
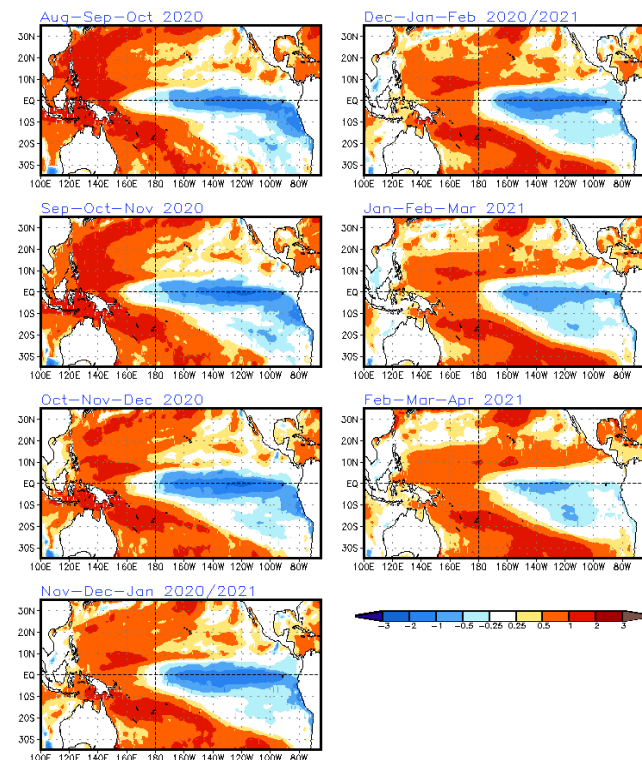
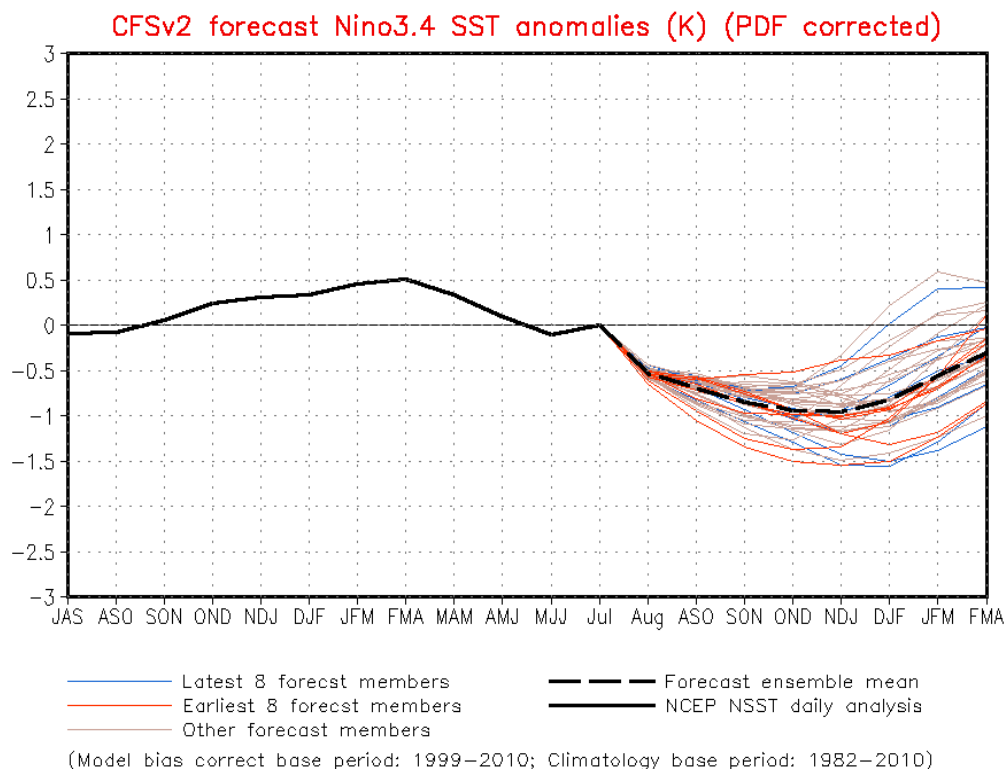


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 20 July 2020).

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

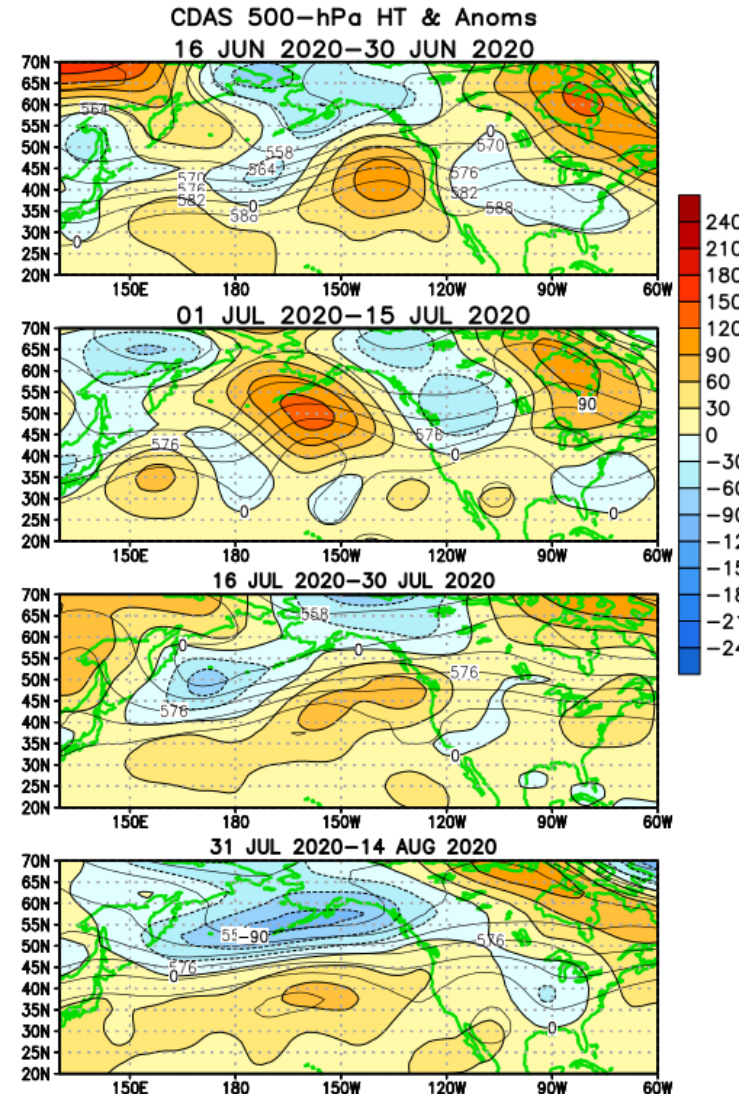
Issued: 17 August 2020

The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral to transition to La Niña beginning in the August-October 2020 season.



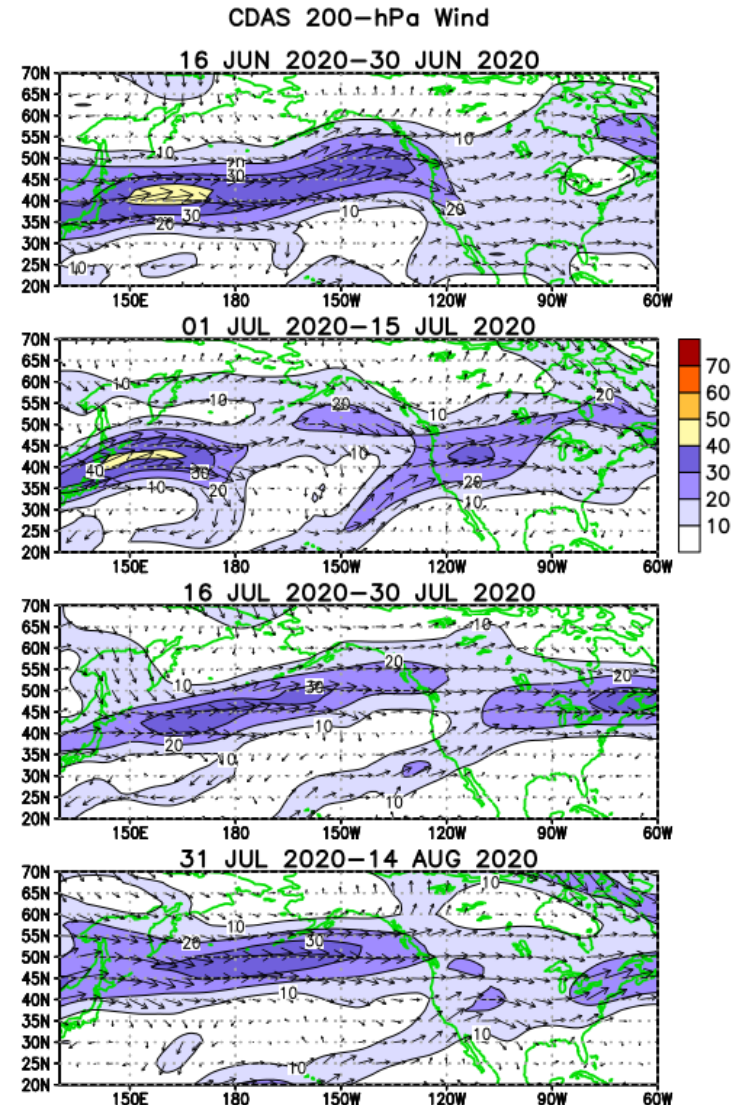
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid June to mid August, above-average heights and temperatures have generally persisted over eastern Canada and the northeastern U.S.



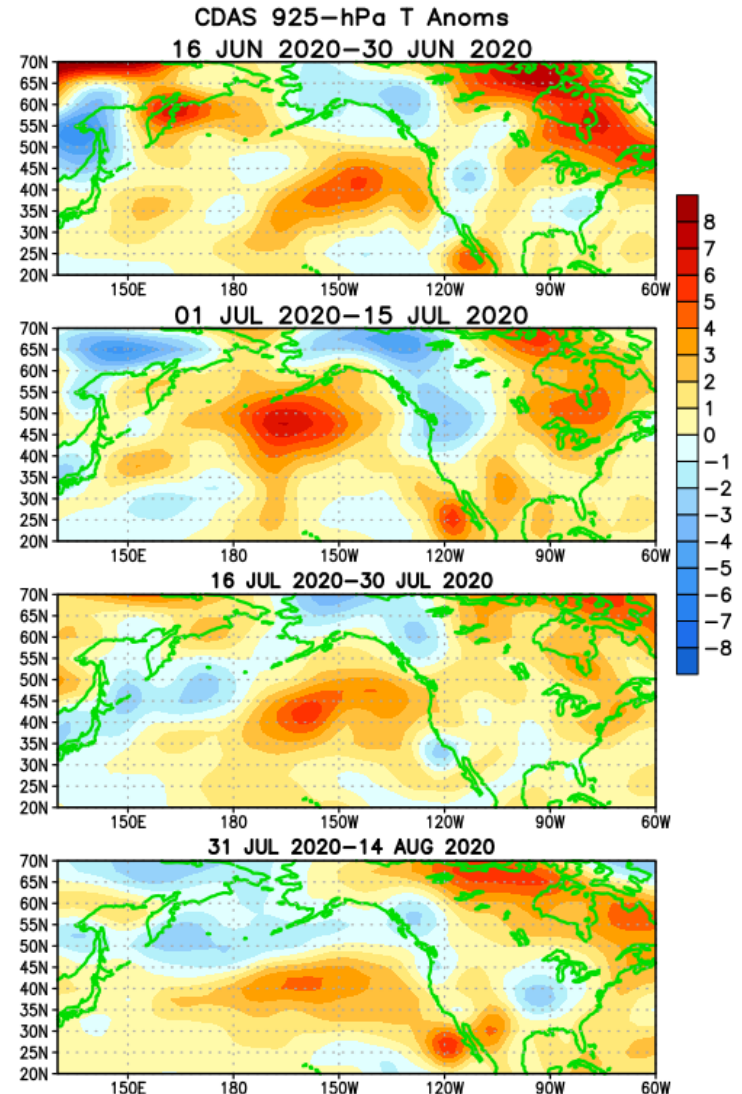
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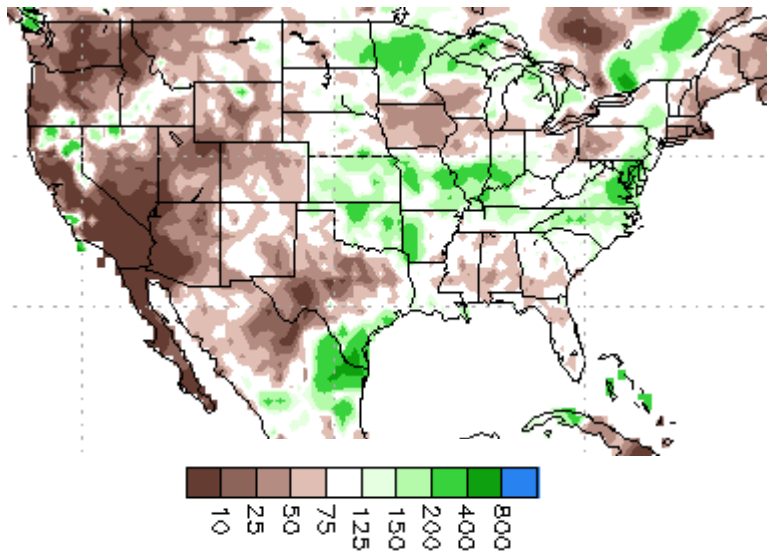
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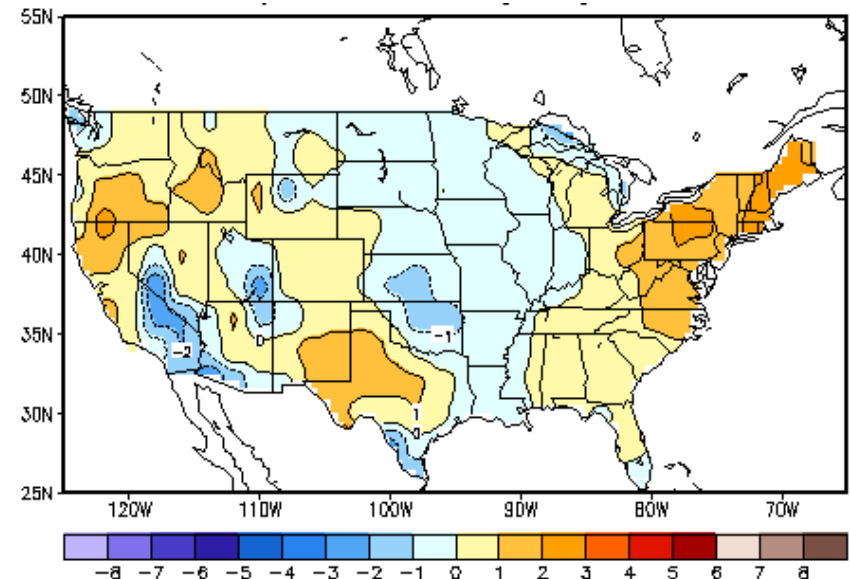
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 15 August 2020

Percent of Average Precipitation



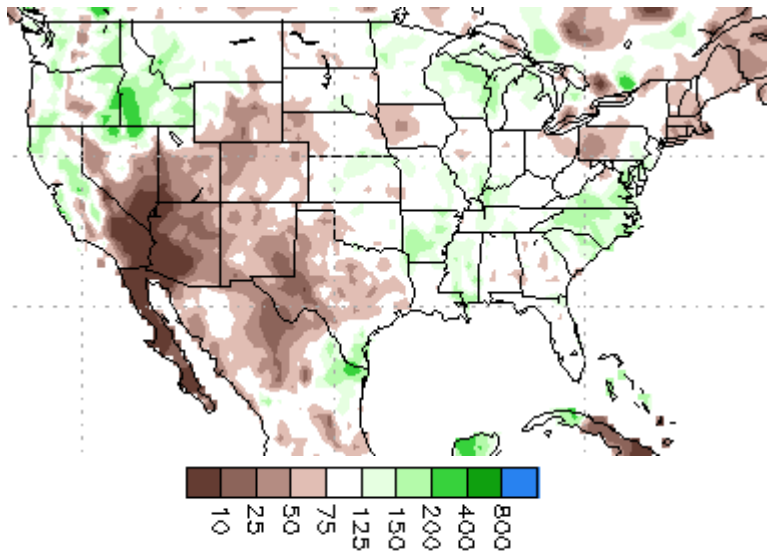
Temperature Departures (degree C)



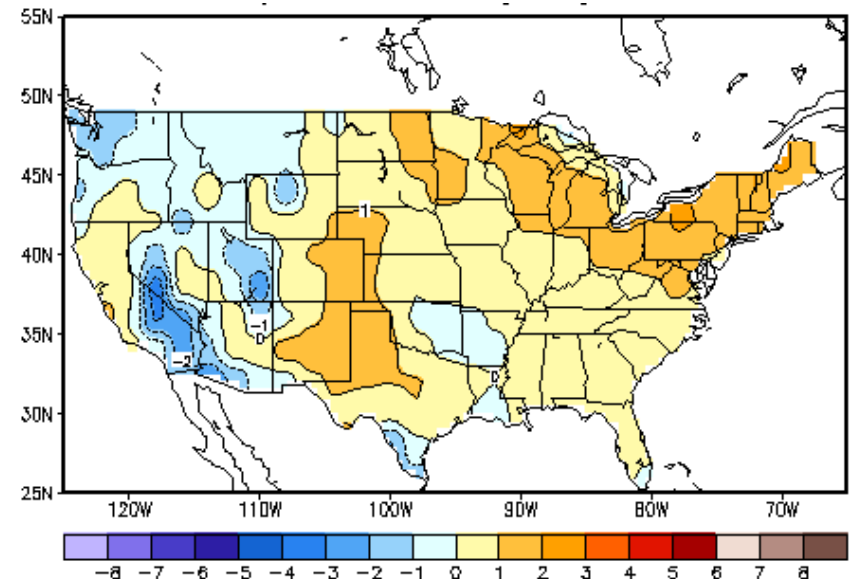
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 15 August 2020

Percent of Average Precipitation



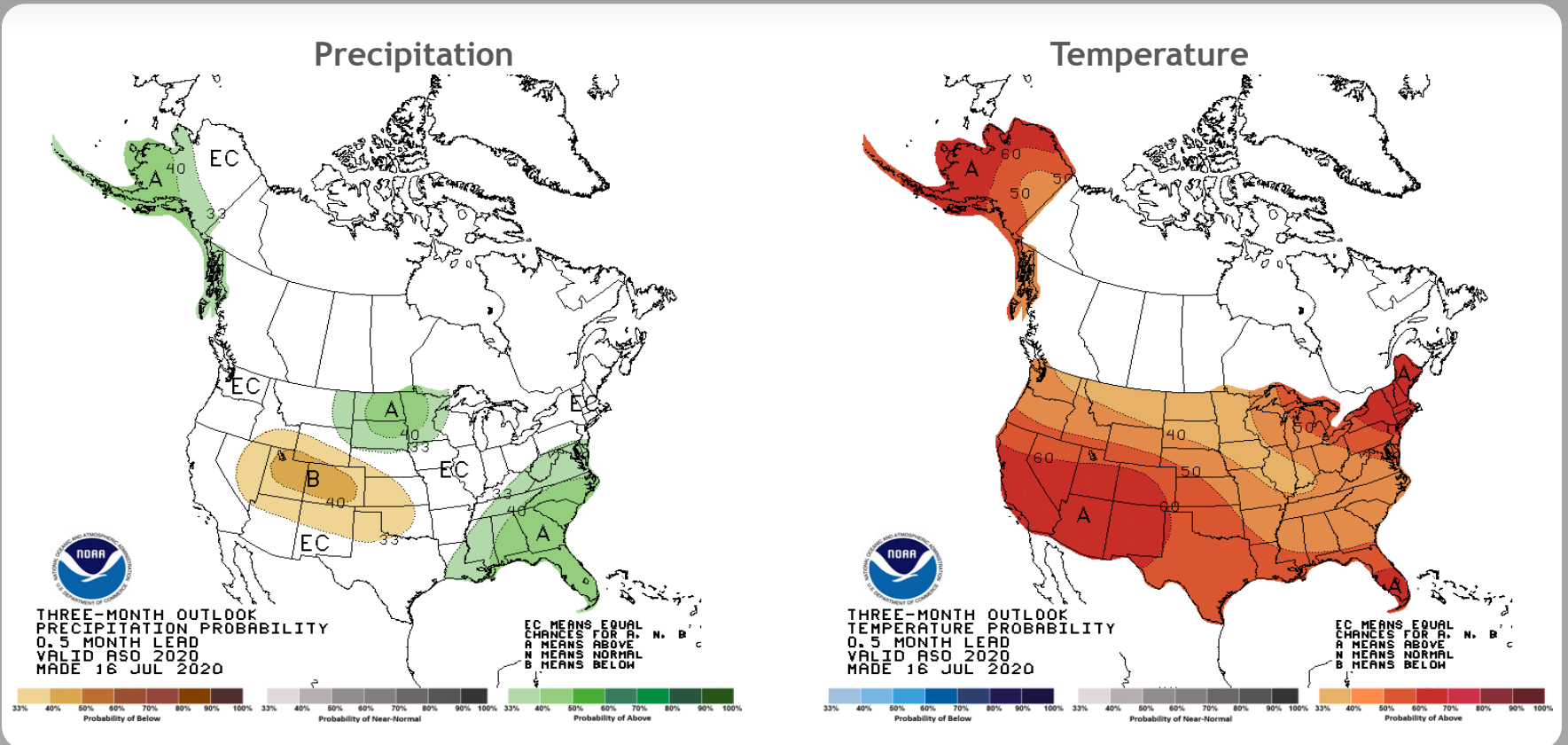
Temperature Departures (degree C)



U. S. Seasonal Outlooks

August-October 2020

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



Summary

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ENSO-neutral conditions are present.*

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The tropical atmospheric circulation is consistent with ENSO-neutral.

There is a ~60% chance of La Niña development during Northern Hemisphere fall 2020 and continuing through winter 2020-21 (~55% chance).*

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