

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
3 May 2021

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: **La Niña Advisory**

La Niña is present.*

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

The tropical atmospheric circulation is consistent with La Niña.

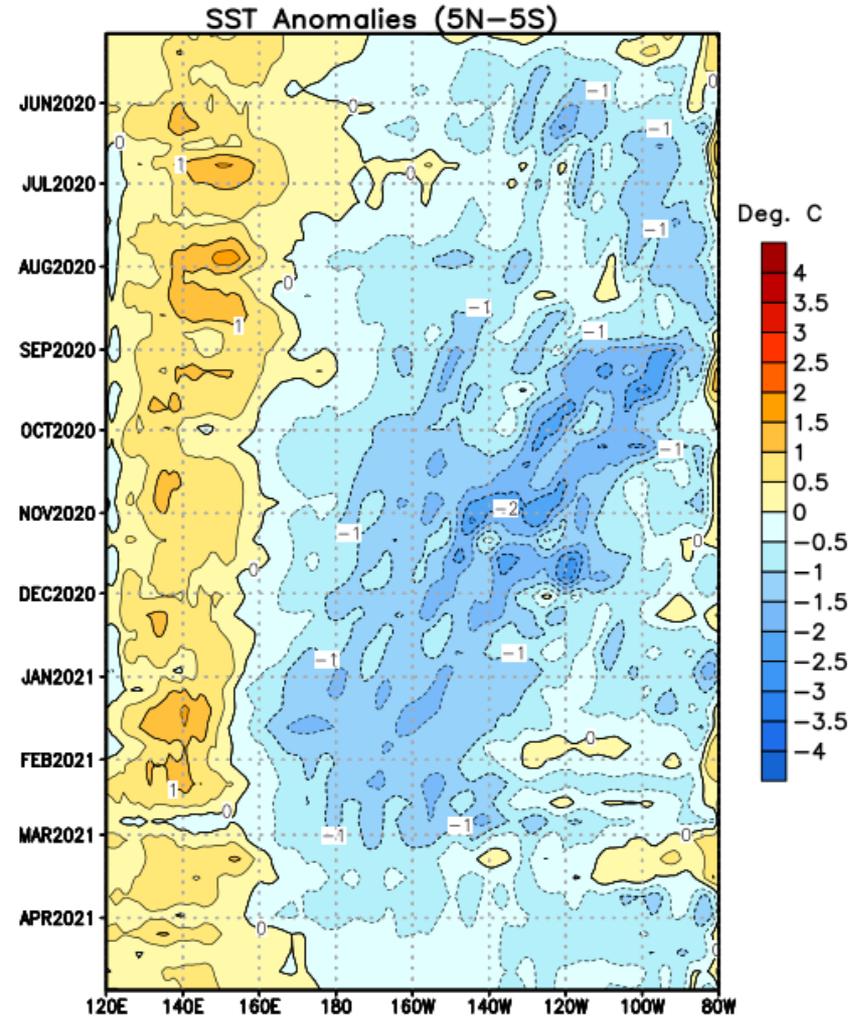
A transition from La Niña to ENSO-Neutral is likely in the next month or so, with an 80% chance of ENSO-neutral during May-July 2021.*

* 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)

Beginning in mid-May 2020, negative SST anomalies emerged in the east-central and eastern Pacific Ocean.

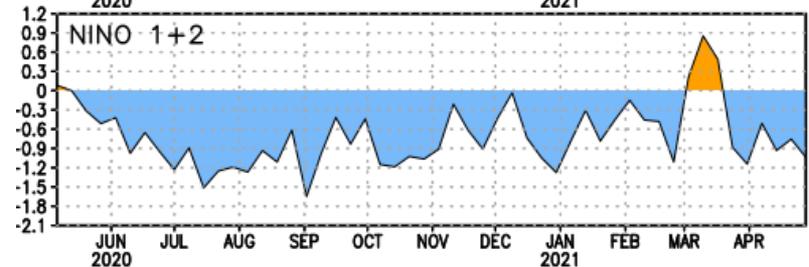
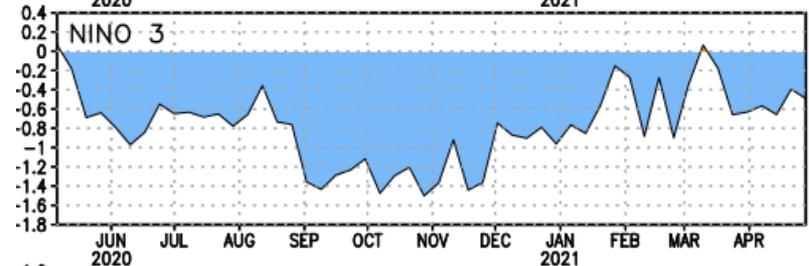
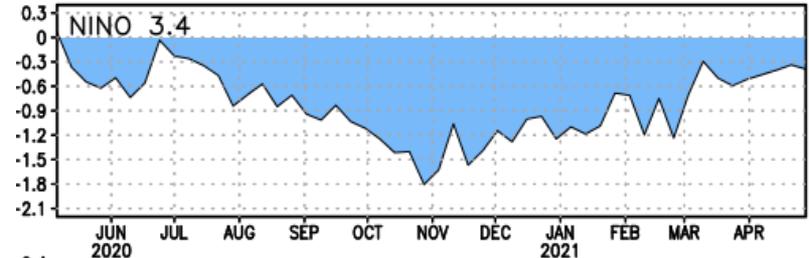
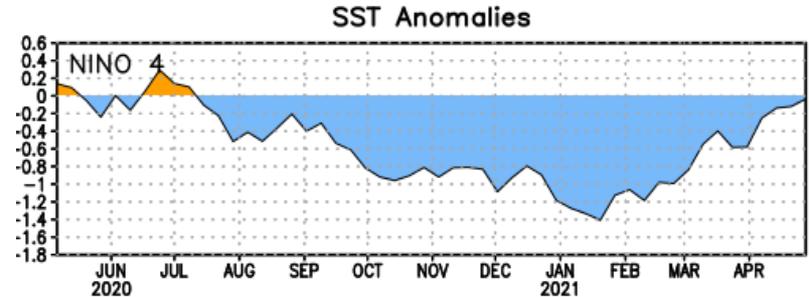
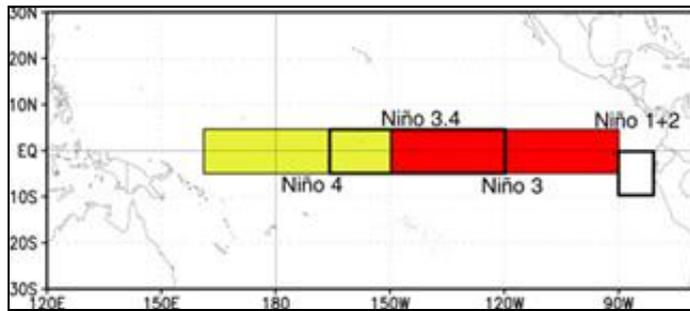
Since early March 2021, negative anomalies have weakened across the equatorial Pacific Ocean.



Niño Region SST Departures (°C) Recent Evolution

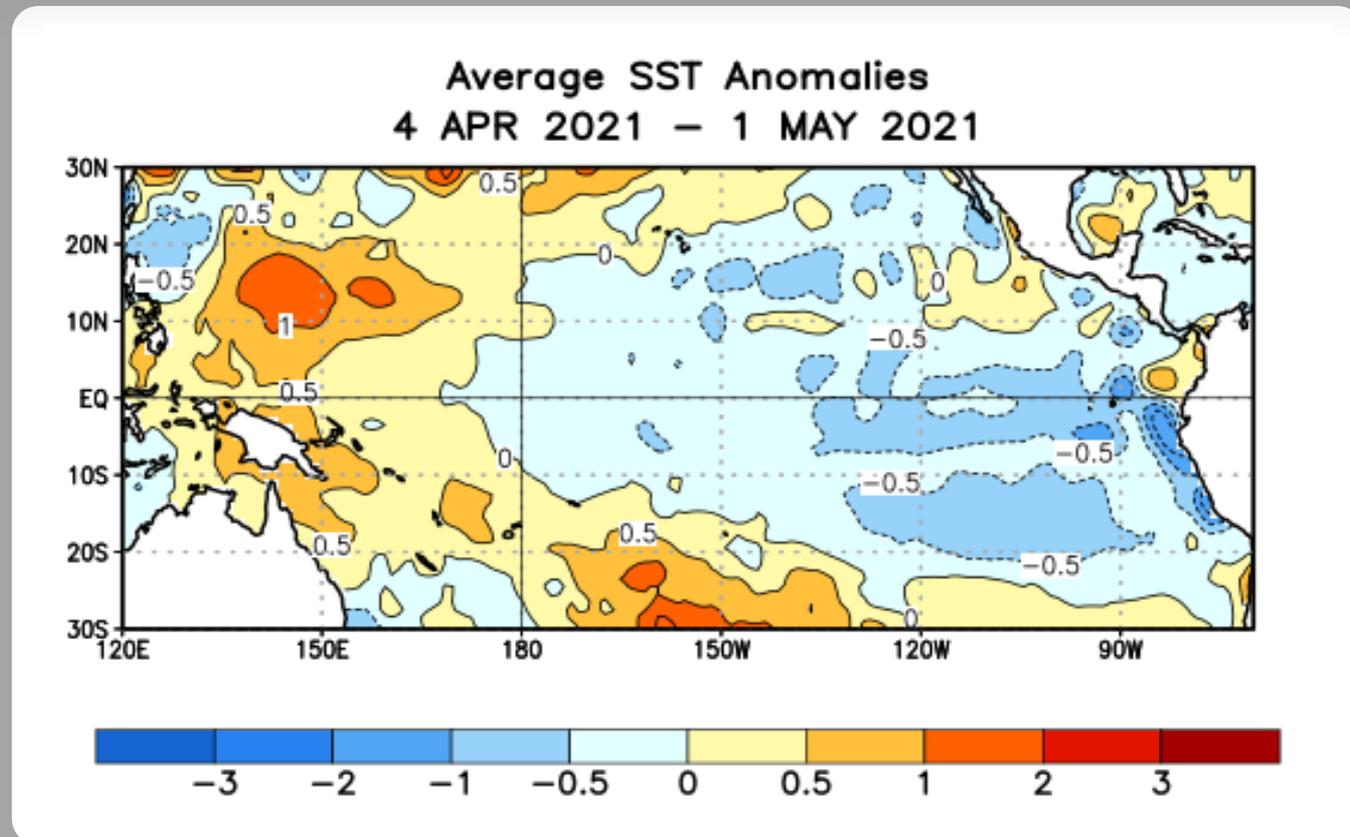
The latest weekly SST departures are:

Niño 4	0.0°C
Niño 3.4	-0.4°C
Niño 3	-0.5°C
Niño 1+2	-1.0°C



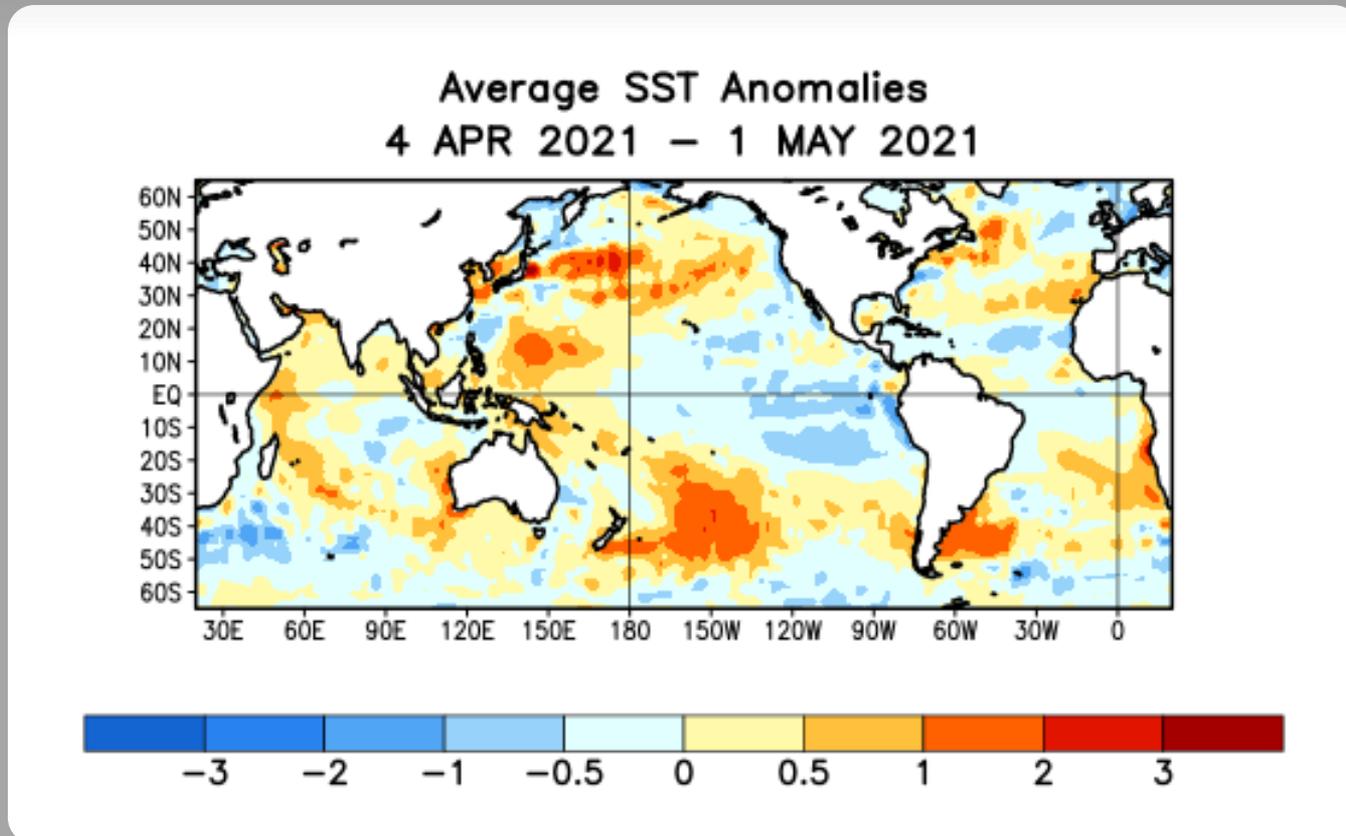
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were below average in the east-central and eastern Pacific Ocean.



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

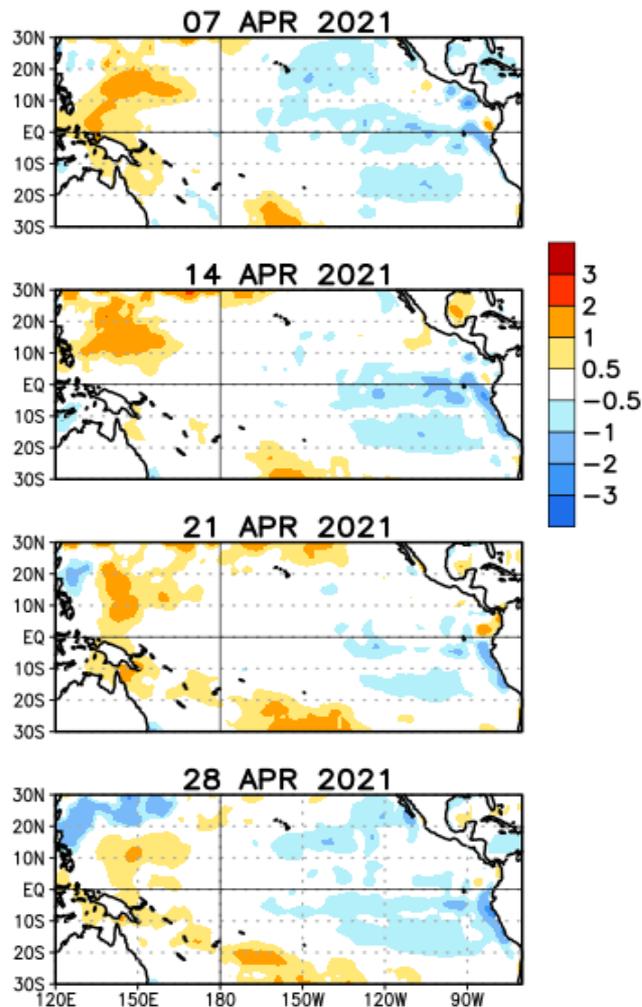
During the last four weeks, equatorial SSTs were below average in the east-central and eastern Pacific Ocean. SSTs were above average in the western Indian Ocean.



Weekly SST Departures during the Last Four Weeks

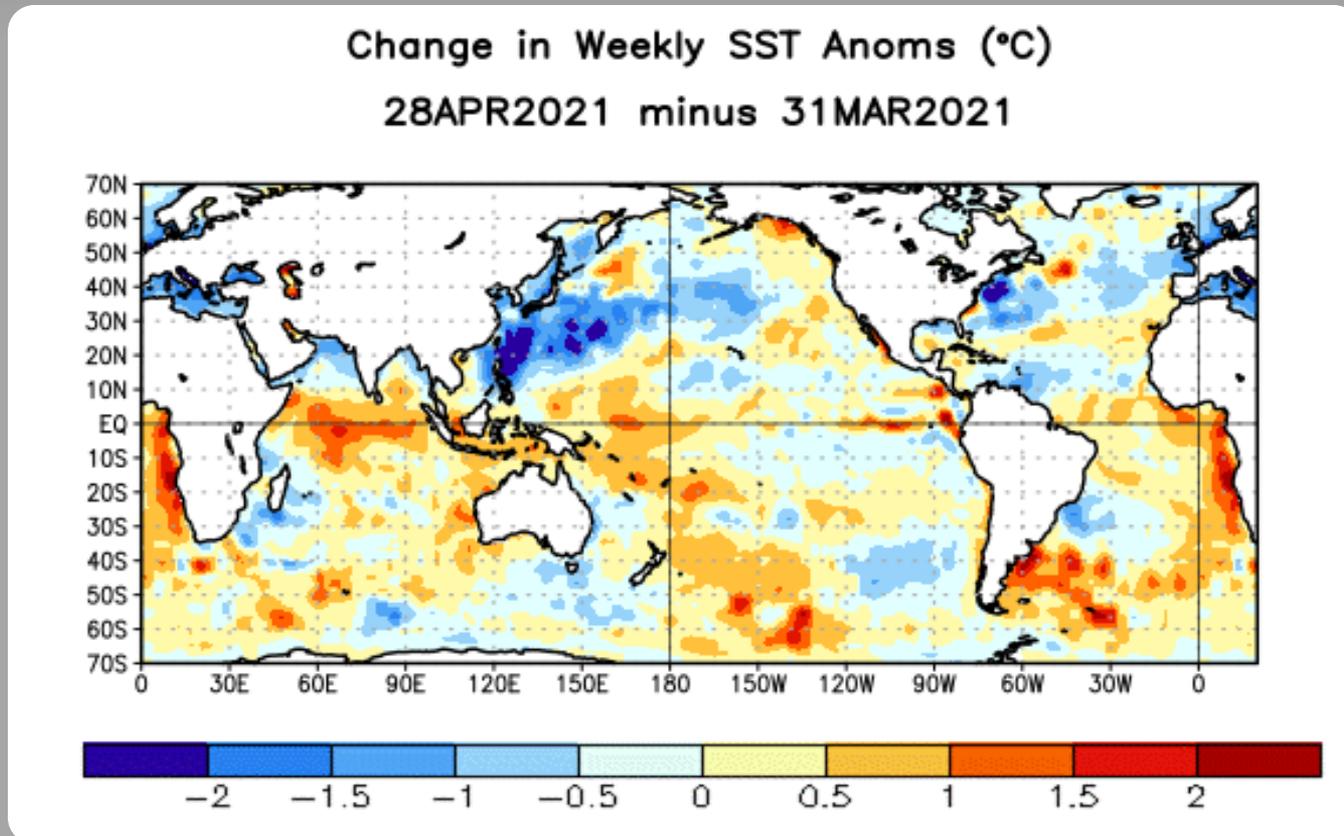
During the last 4 weeks, below-average SSTs generally weakened in the east-central equatorial Pacific Ocean.

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 mostly positive across the Pacific Ocean.



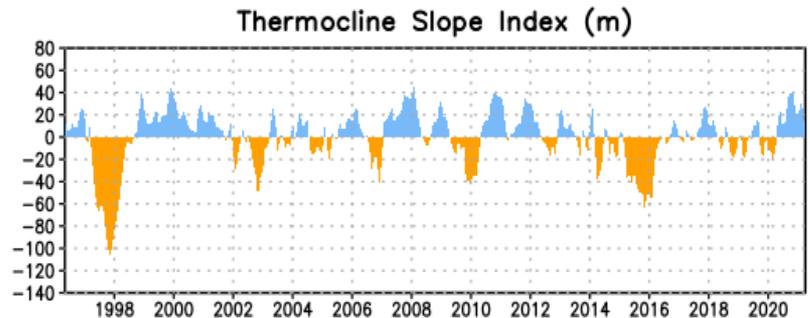
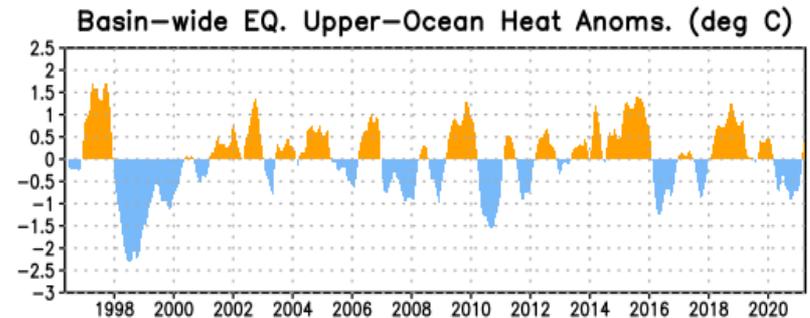
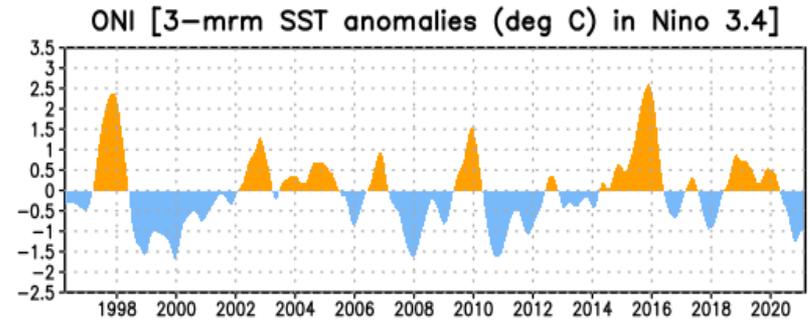
Upper-Ocean Conditions in the Equatorial Pacific

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.

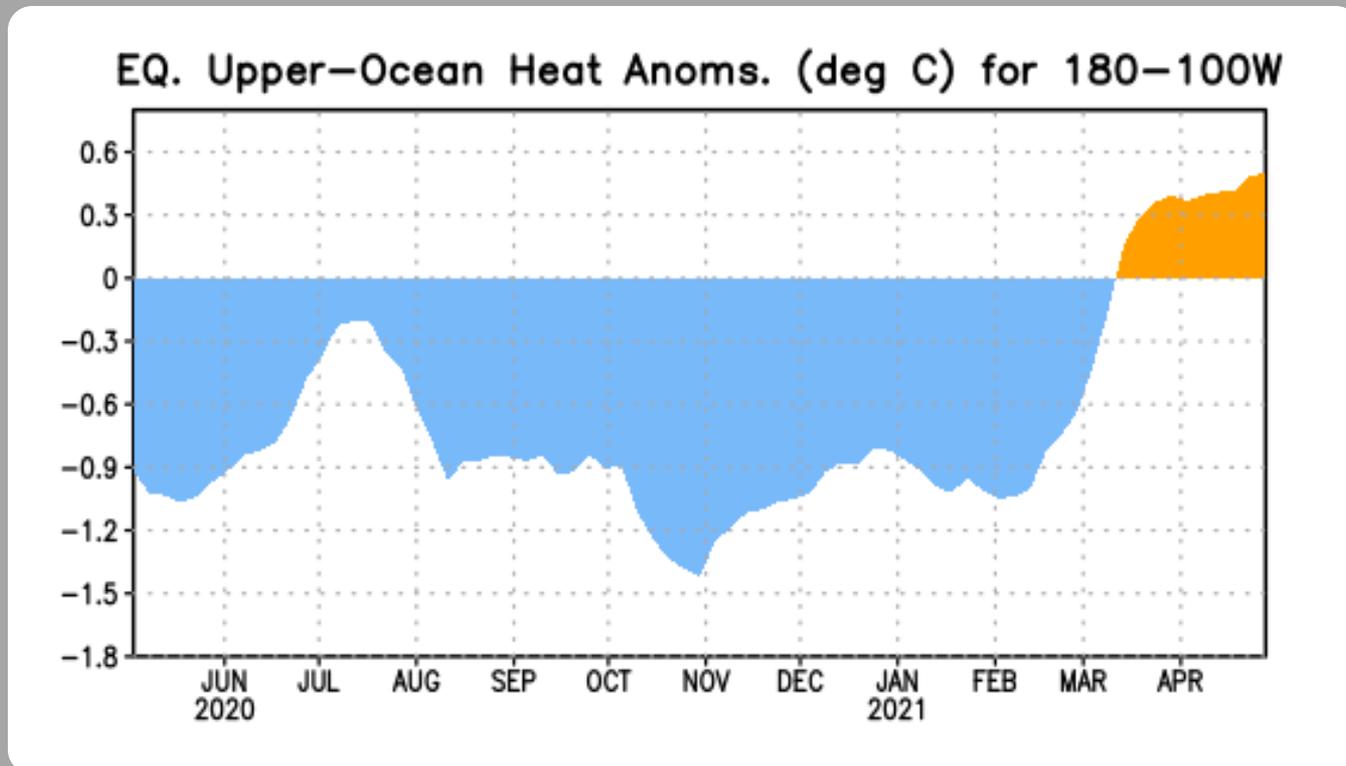
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (above average) reflect La Niña.

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).



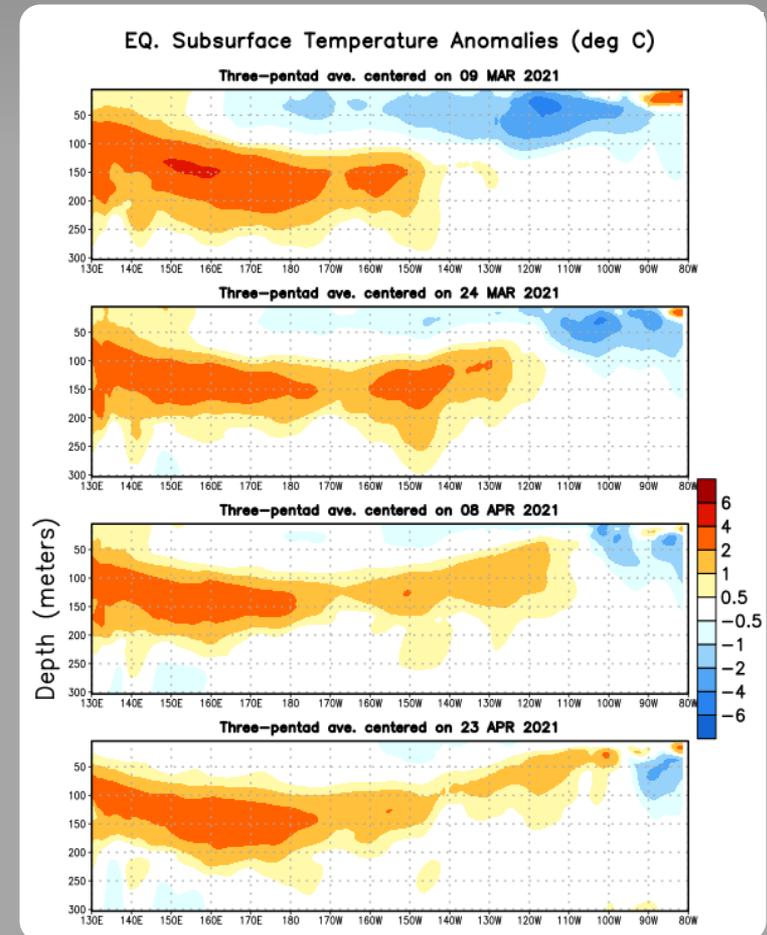
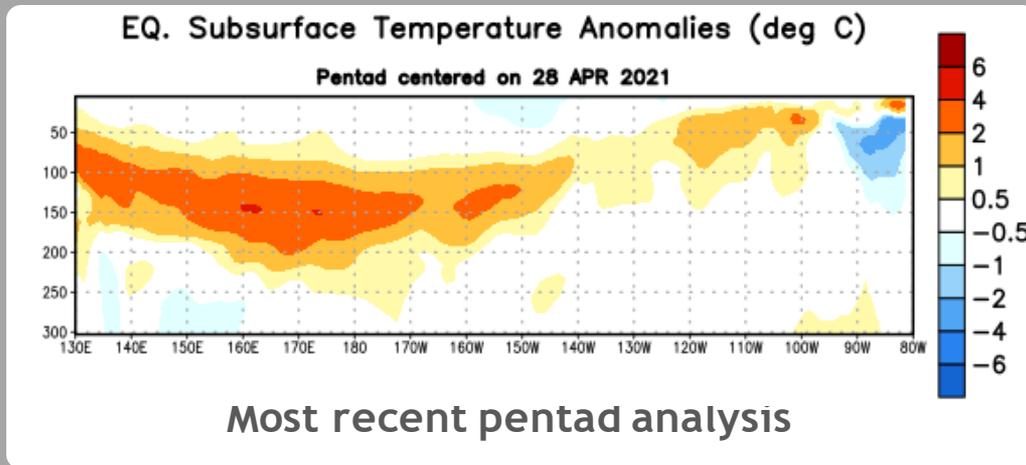
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Subsurface temperature anomalies decreased from March-May 2020, before weakening in June. Starting in mid-July 2020, negative temperature anomalies strengthened and persisted through early February 2021, when the negative anomalies weakened. Beginning in mid-March 2021, subsurface temperature was above average.



Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have shifted eastward and closer to the surface in the eastern Pacific Ocean.



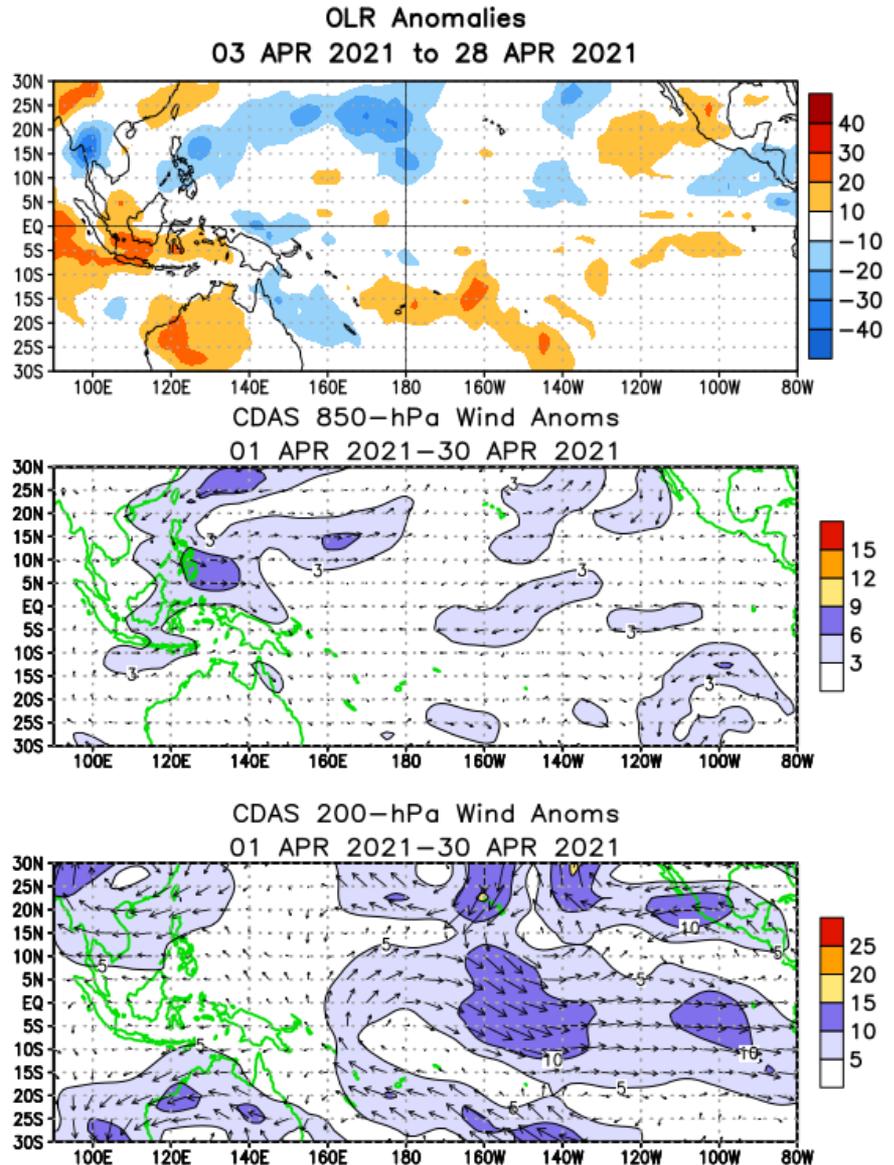
Negative subsurface temperature anomalies linger in a thin layer at the surface across the central and eastern Pacific Ocean and also down to ~100m depth in the eastern Pacific Ocean.

Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were located over Indonesia. Negative OLR anomalies (enhanced convection and precipitation) were evident over the far western Pacific Ocean and over the Philippines.

Low-level (850-hPa) easterly wind anomalies were evident over the east-central equatorial Pacific Ocean and westerly wind anomalies were located in the far western Pacific.

Upper-level (200-hPa) westerly wind anomalies were observed over the central and eastern equatorial 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

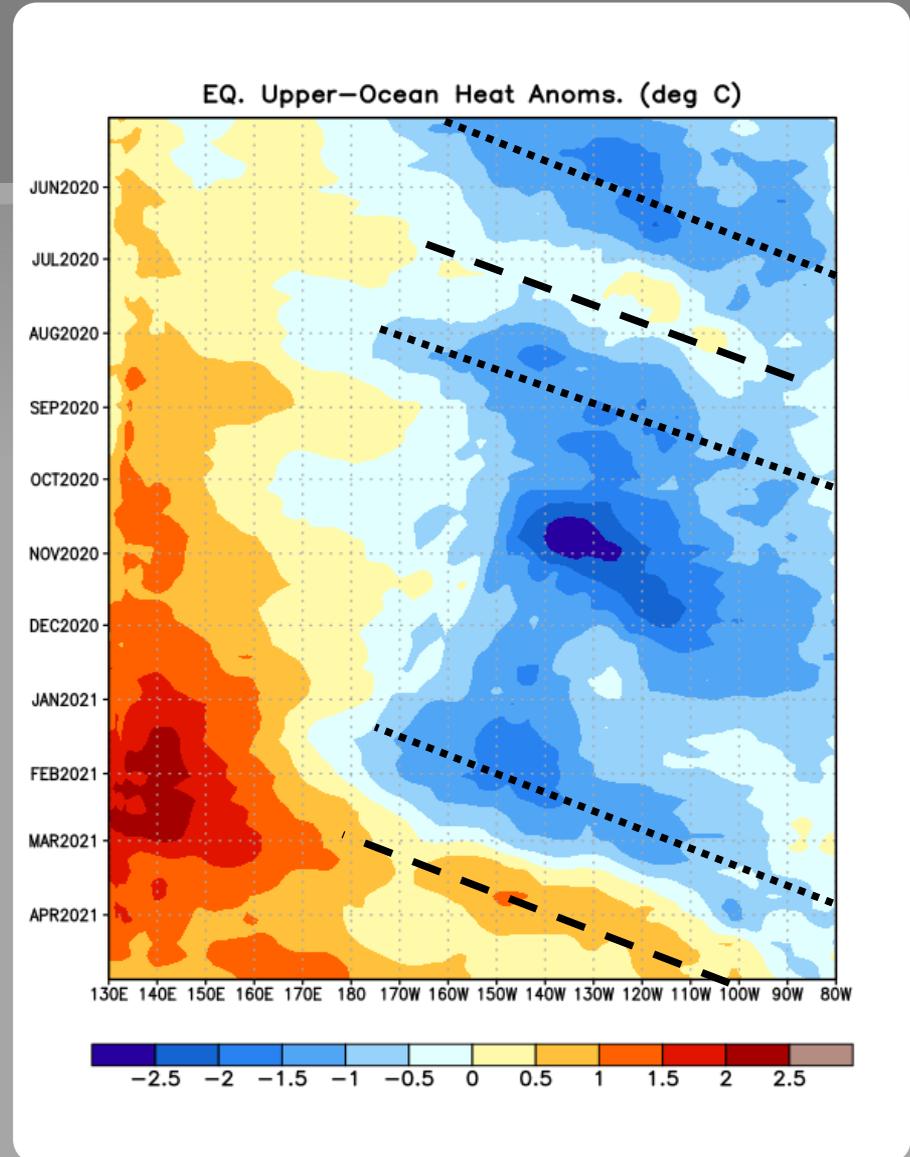
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

From August 2020 to February 2021, negative subsurface temperature anomalies persisted in the eastern half of the Pacific Ocean.

During March and April 2021, positive temperature anomalies shifted eastward in association with a downwelling Kelvin wave.

Recently, another area of positive anomalies have expanded from the western to the 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})

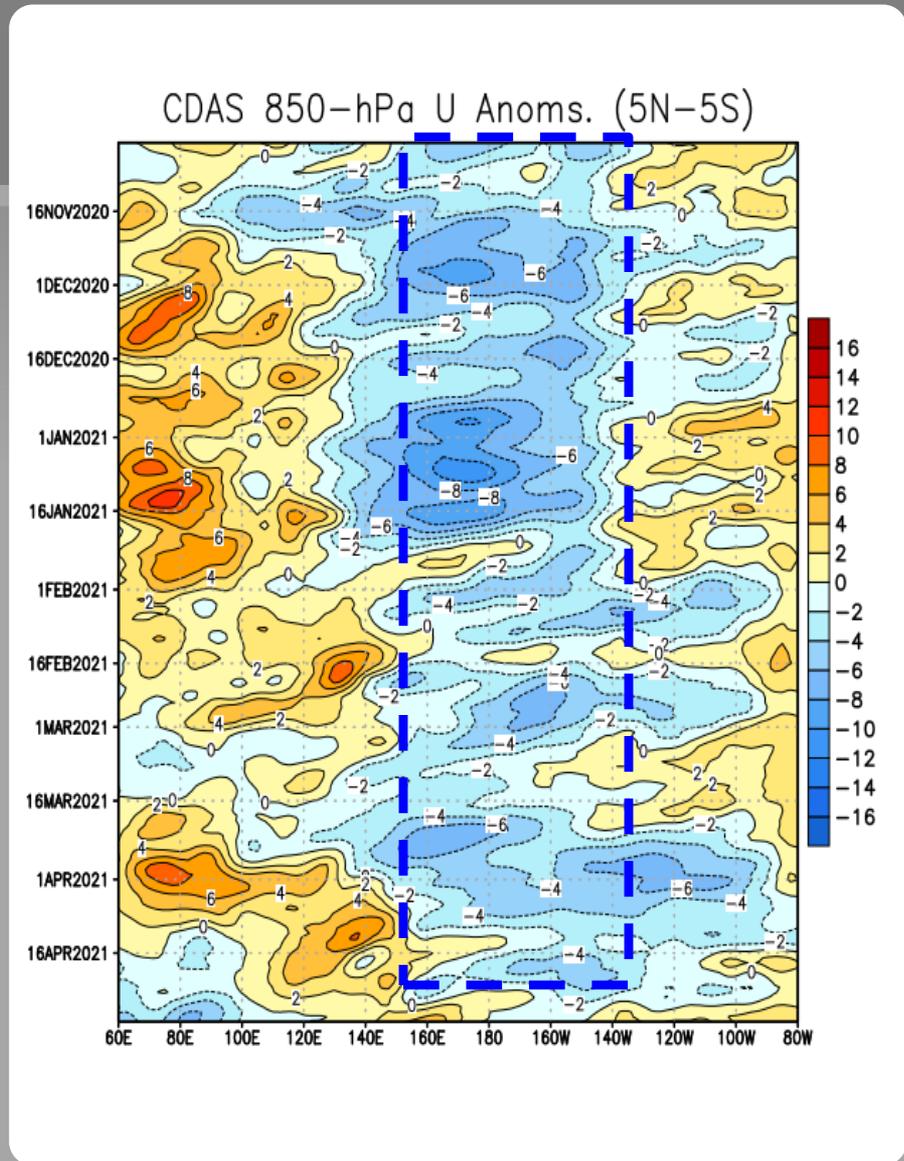
At times, the Madden Julian-Oscillation (MJO) has contributed to the eastward propagation of low-level wind anomalies.

From late August 2020 through late April 2021, easterly wind anomalies mostly persisted over the central and east-central equatorial Pacific Ocean.

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

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

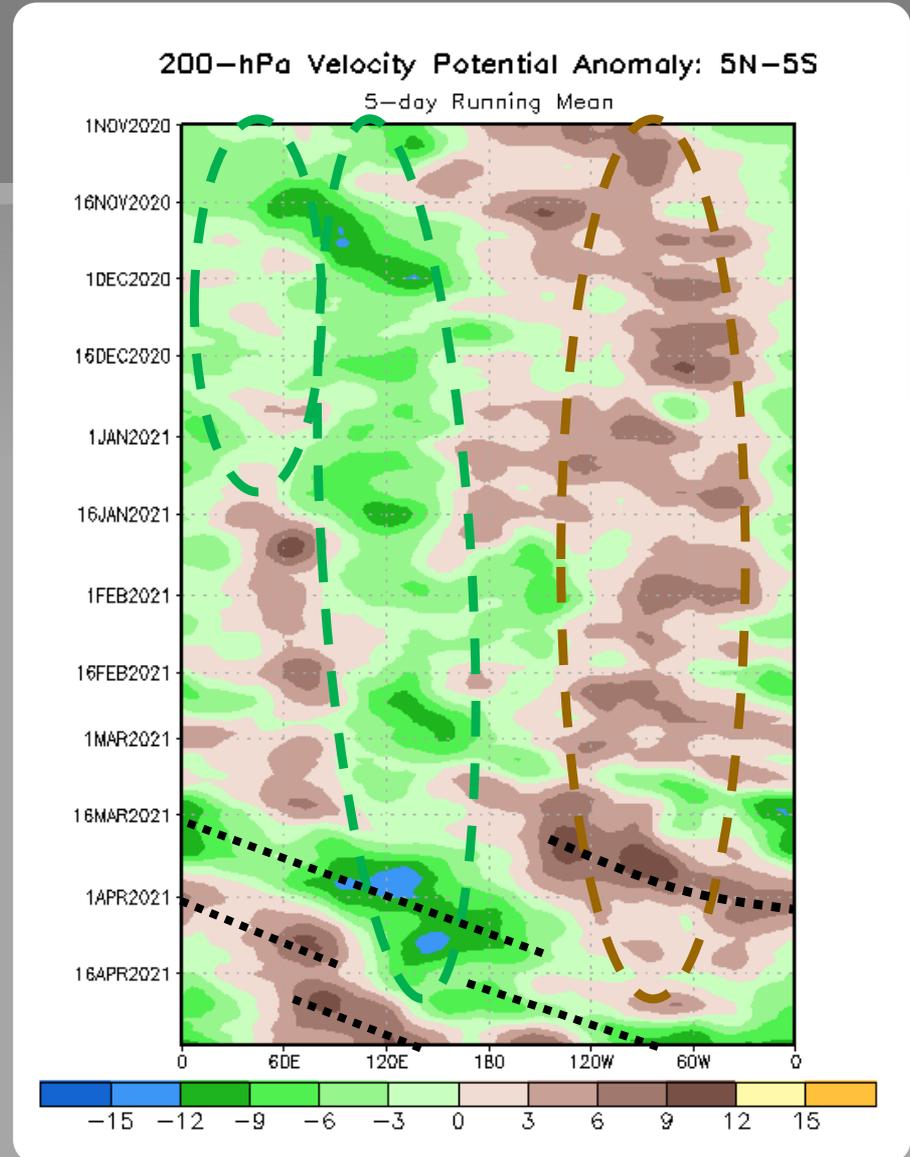
From the beginning of the period through mid-April 2021, anomalous divergence (green shading) remained over Indonesia, while anomalous convergence (brown shading) persisted over the eastern Pacific Ocean.

In the last couple of weeks, anomalous convergence shifted from the Indian Ocean to Indonesia.

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

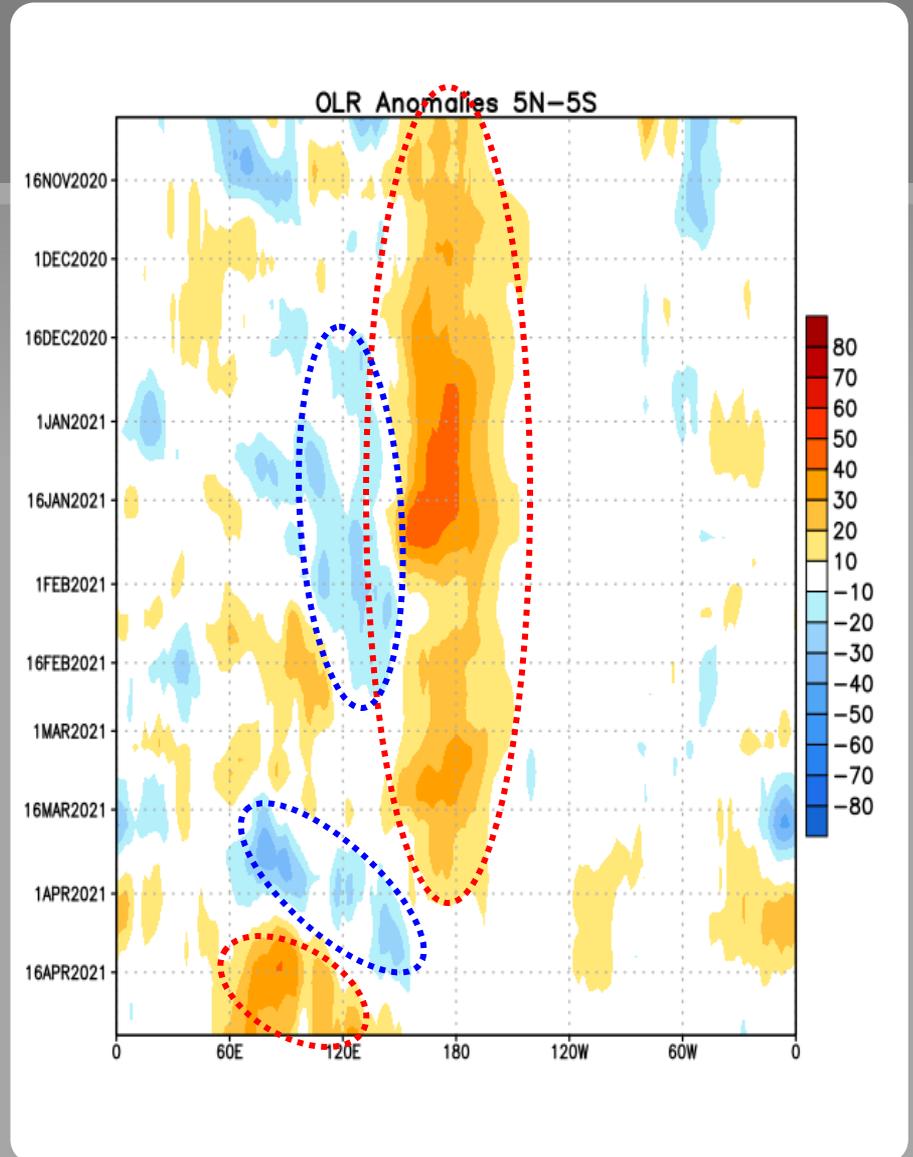
From late April 2020 through March 2021, positive OLR anomalies persisted around the Date Line.

From mid-December 2020 through February 2021, negative OLR anomalies were evident over Indonesia.

From mid-April to the present, positive OLR anomalies have shifted eastward from the Indian Ocean to 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 .

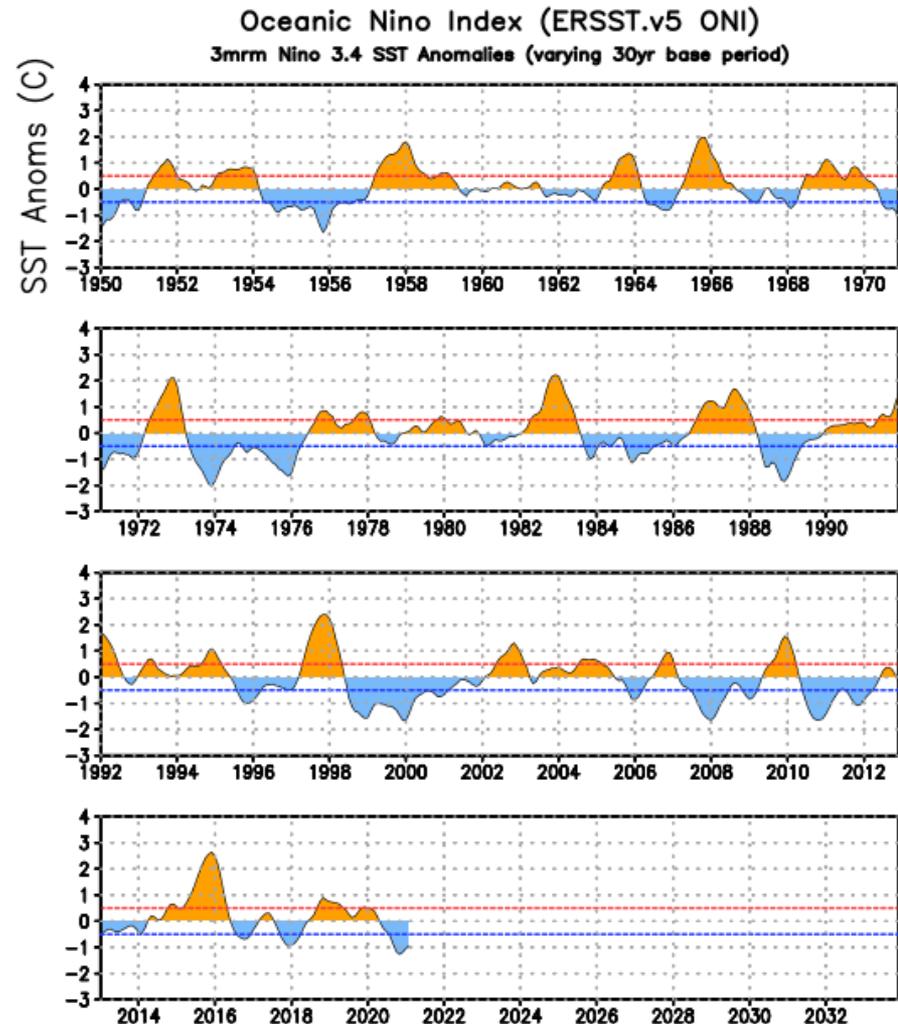
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (January - March 2021) is -0.9°C .

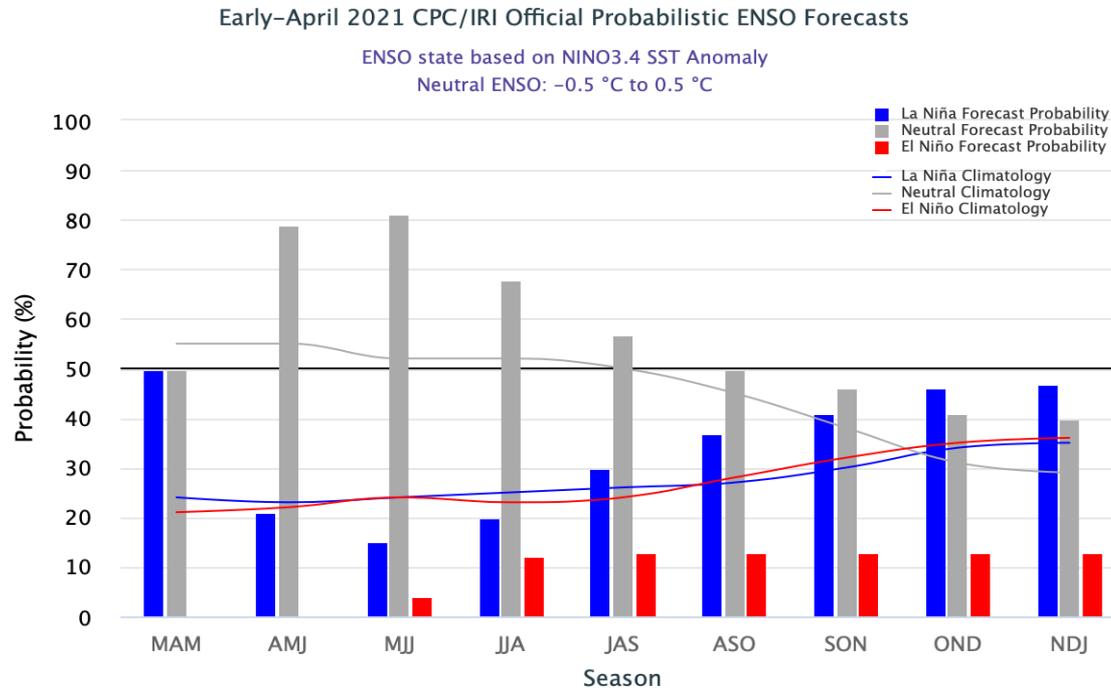
El Niño ↑
Neutral
La Niña ↓



CPC/IRI Probabilistic ENSO Outlook

Updated: 8 April 2021

A transition to ENSO-neutral is likely in the next month or so, with ENSO-neutral then favored through September-November 2021.



IRI/CPC Pacific Niño

3.4 SST Model Outlook

The model averages predict La Niña to continue into the Northern Hemisphere spring 2021, returning to ENSO-neutral during April-June 2021 and continuing into winter 2021-22.

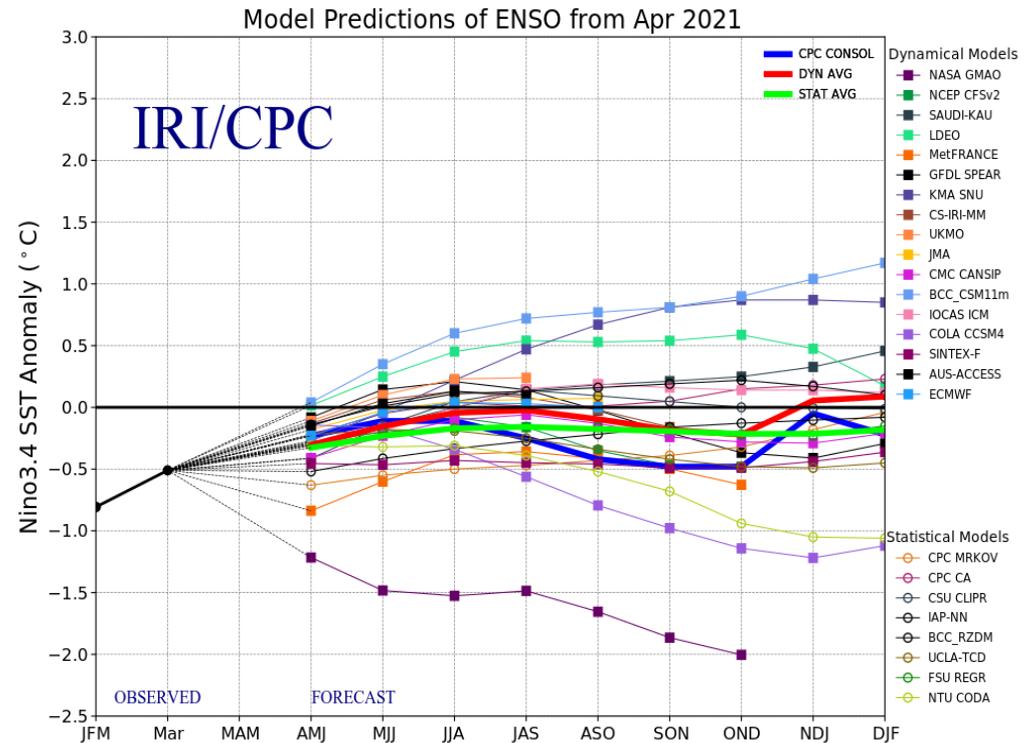


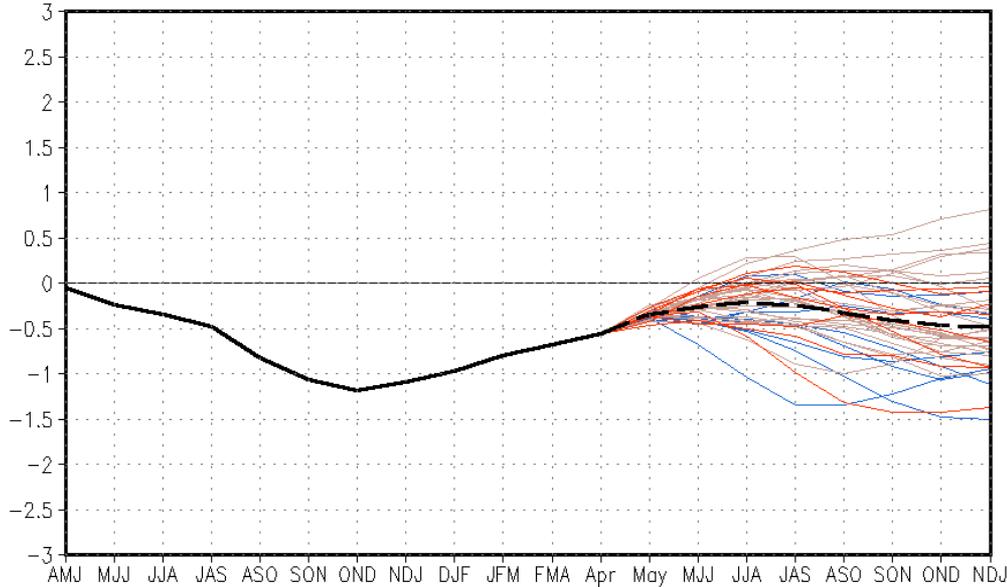
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 April 2021).

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

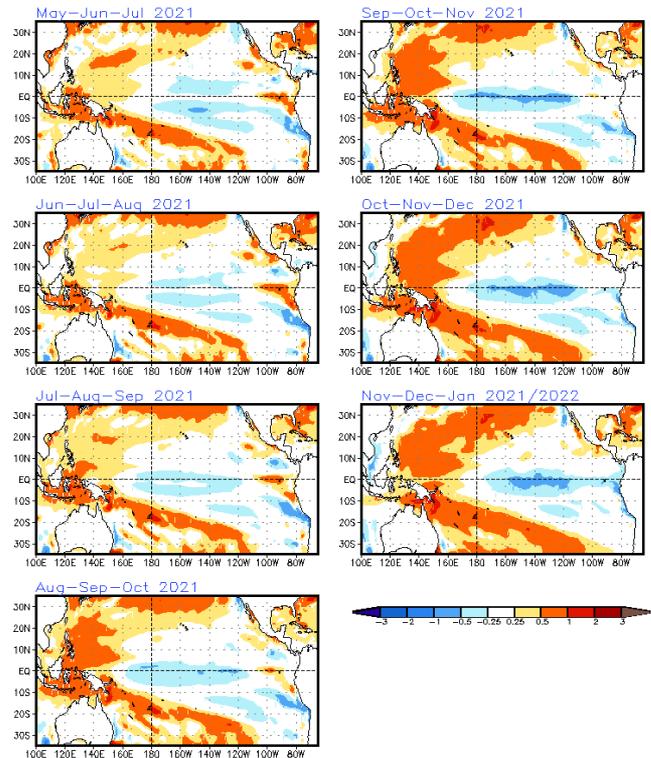
Issued: 30 April 2021

The CFS.v2 ensemble mean (black dashed line) predicts an imminent transition to ENSO-neutral and continuing into fall 2021. Borderline La Niña conditions are predicted during the late fall or winter 2021-22.

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



- Latest 8 forecast members
 - Earliest 8 forecast members
 - Other forecast members
 - Forecast ensemble mean
 - NCEI Olv2.1 daily analysis
- (Climatology base period: 1991–2020)

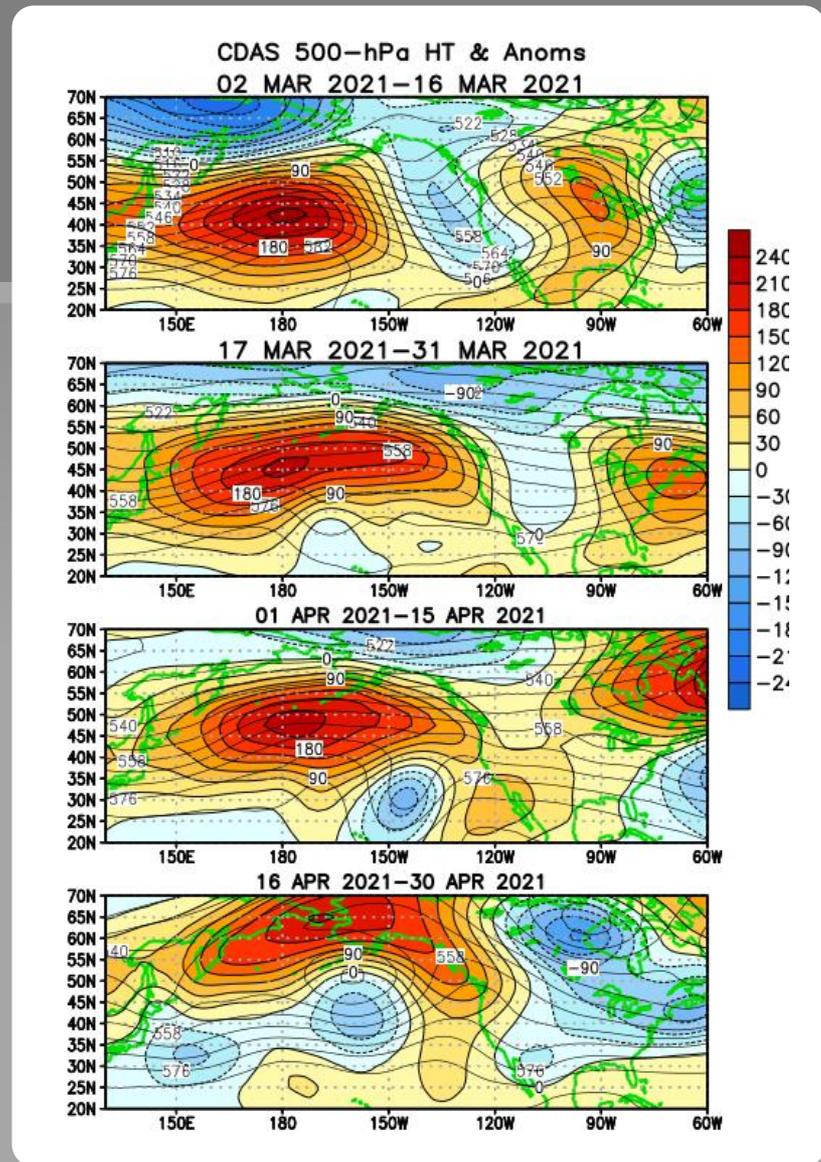


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During the period, anomalous ridging over the North Pacific Ocean has been associated with a retracted Asia-Pacific jet stream.

During March and the first half of April, above-average heights and temperatures were observed over the central and/or eastern U.S.

Since mid-April, below-average heights and temperatures have dominated most of the contiguous U.S.

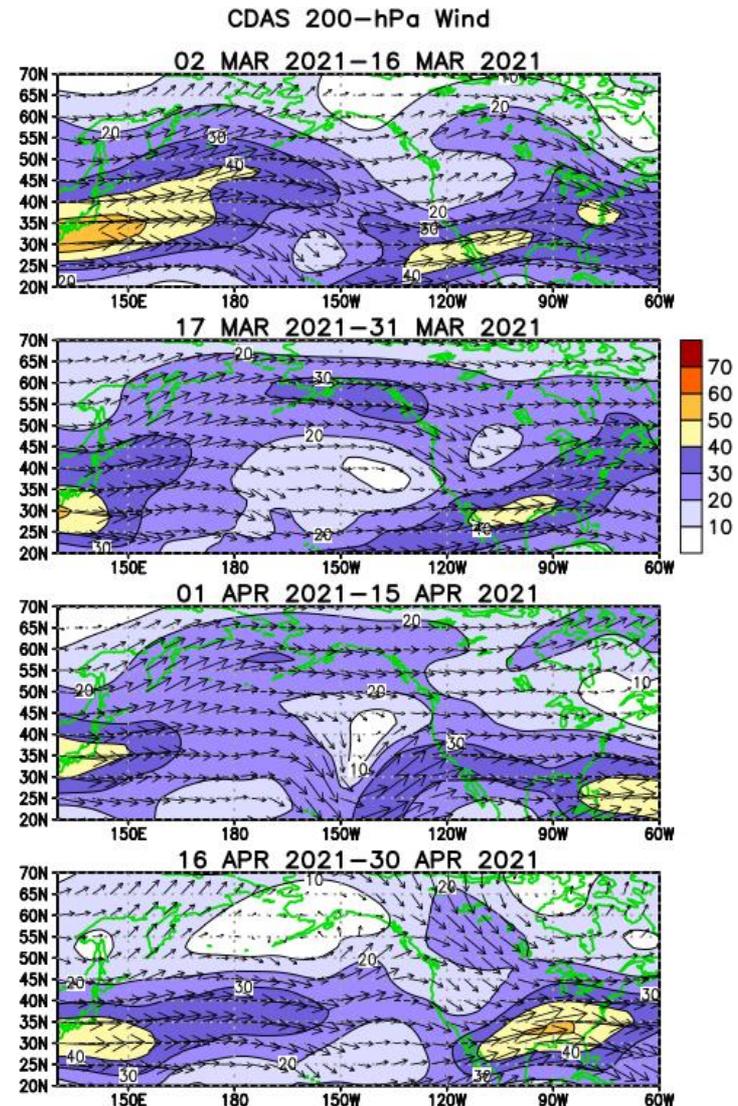


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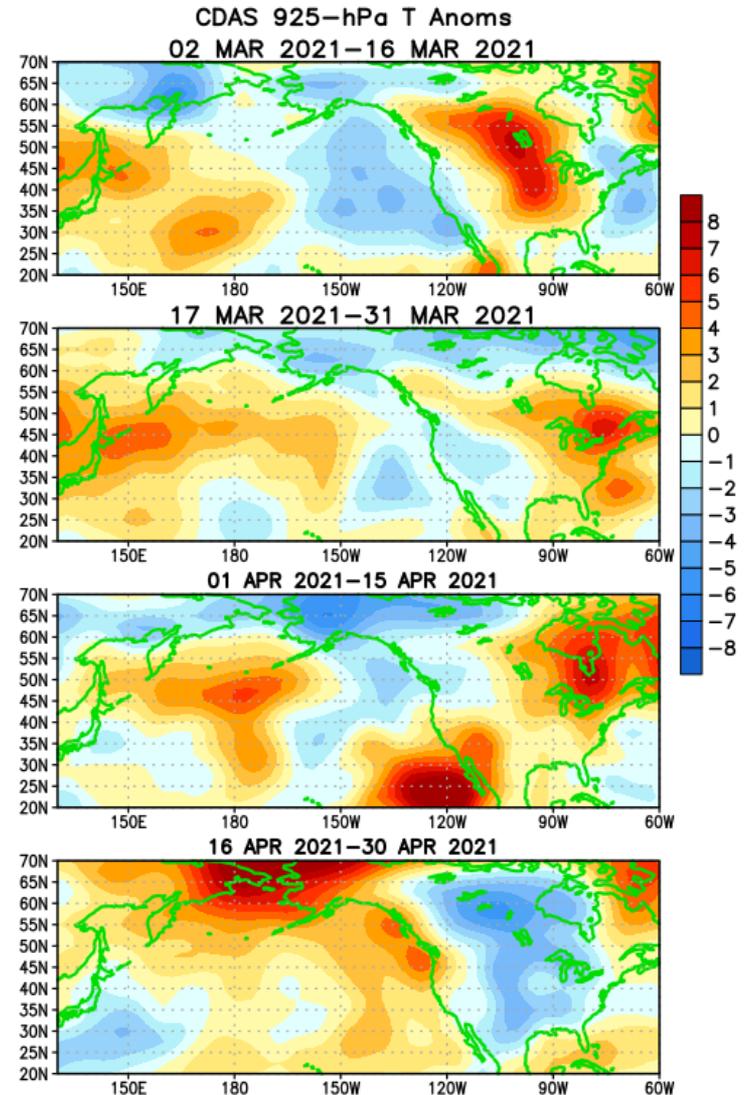


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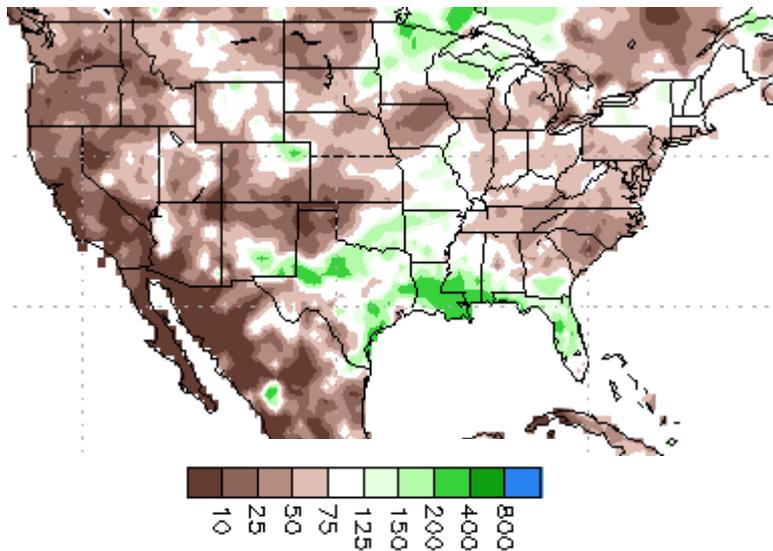
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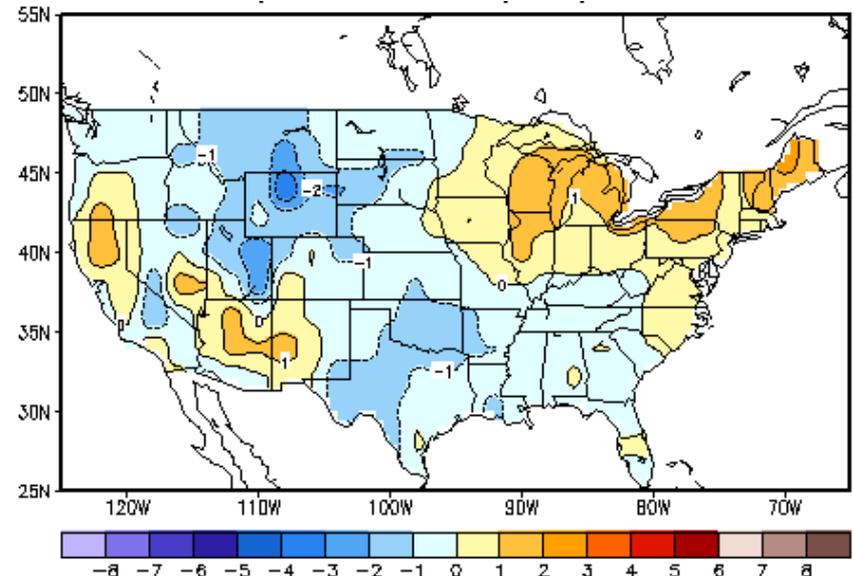
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 1 May 2021

Percent of Average Precipitation



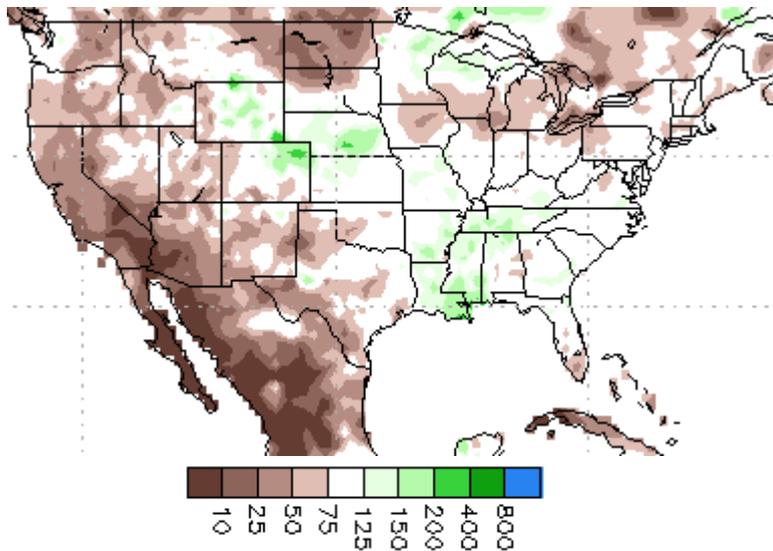
Temperature Departures (degree C)



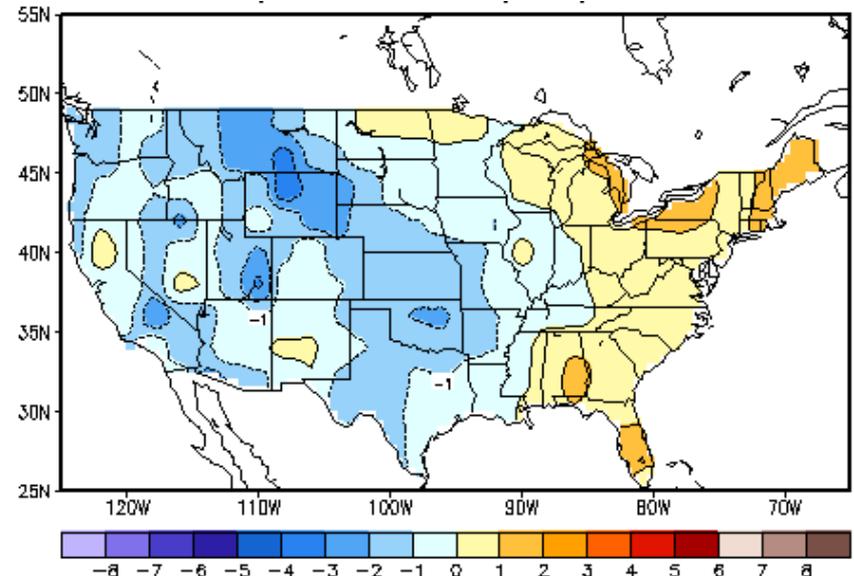
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 1 May 2021

Percent of Average Precipitation



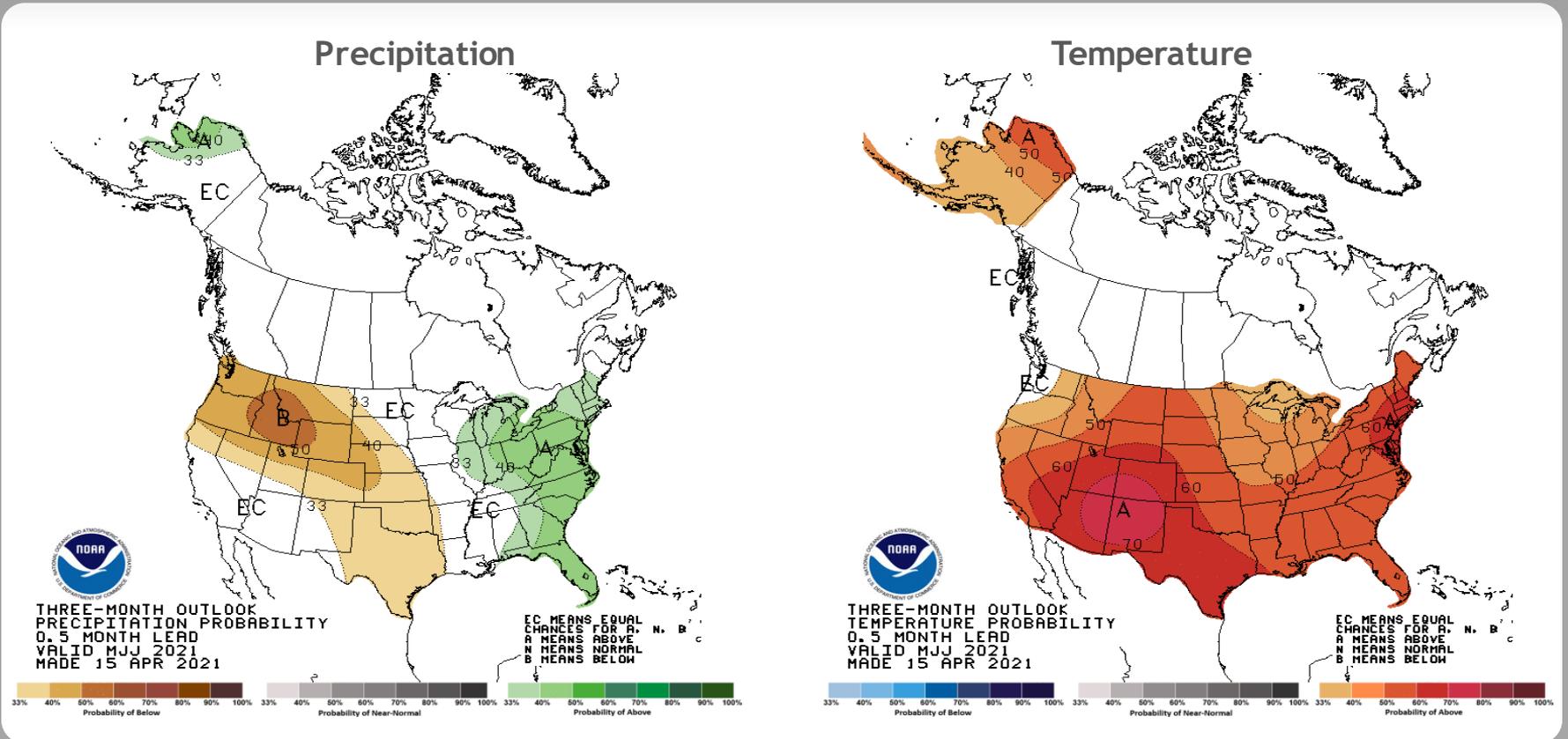
Temperature Departures (degree C)



U. S. Seasonal Outlooks

May - July 2021

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



Summary

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La Niña is present.*

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

The tropical atmospheric circulation is consistent with La Niña.

A transition from La Niña to ENSO-Neutral is likely in the next month or so, with an 80% chance of ENSO-neutral during May-July 2021.*

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