ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
2 November 2020

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 conditions are present.*

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

The tropical atmospheric circulation is consistent with La Niña.

La Niña is likely to continue through the Northern Hemisphere winter 2020-21 (~85% chance) and into spring 2021 (~60% chance during February-April).*

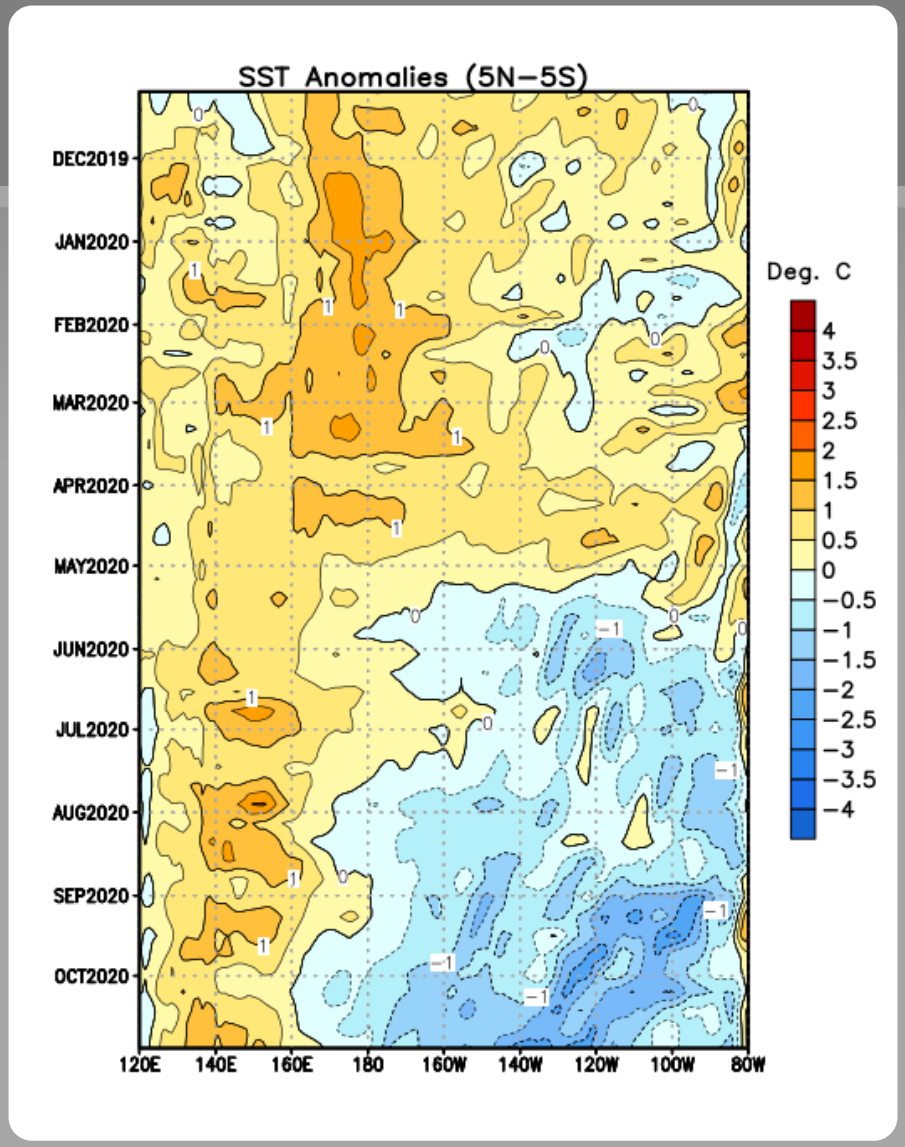
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (ºC)

During November 2019 through April 2020, above-average SSTs were present from the Date Line to the eastern Pacific Ocean.

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

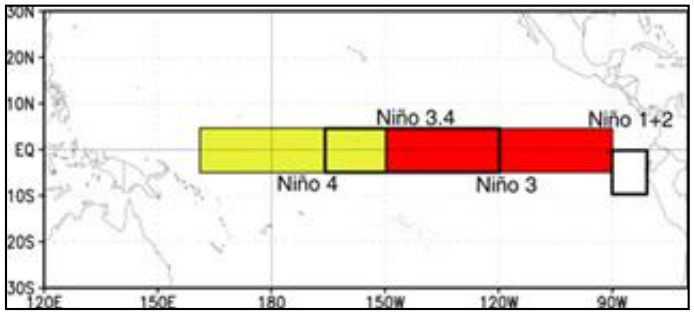
In the last week, negative SST anomalies strengthened in the east-central Pacific Ocean.

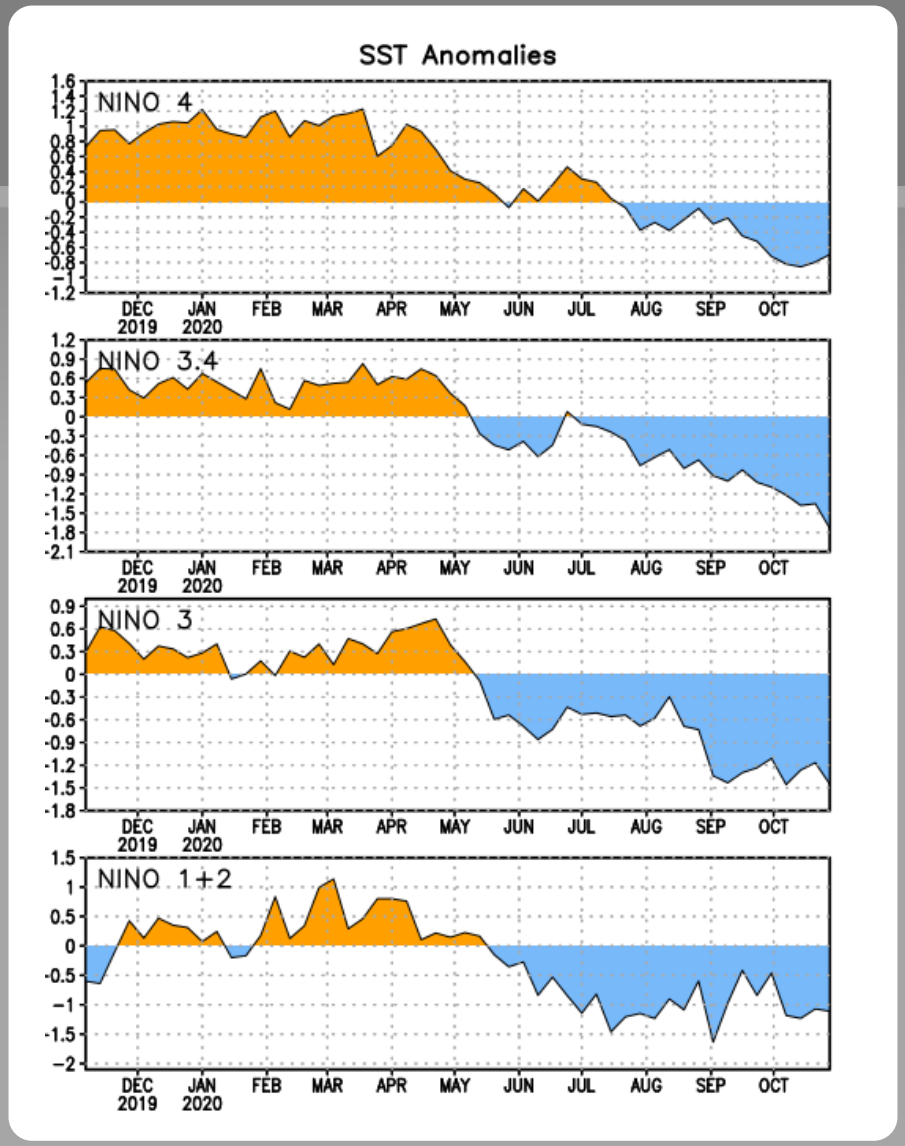


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

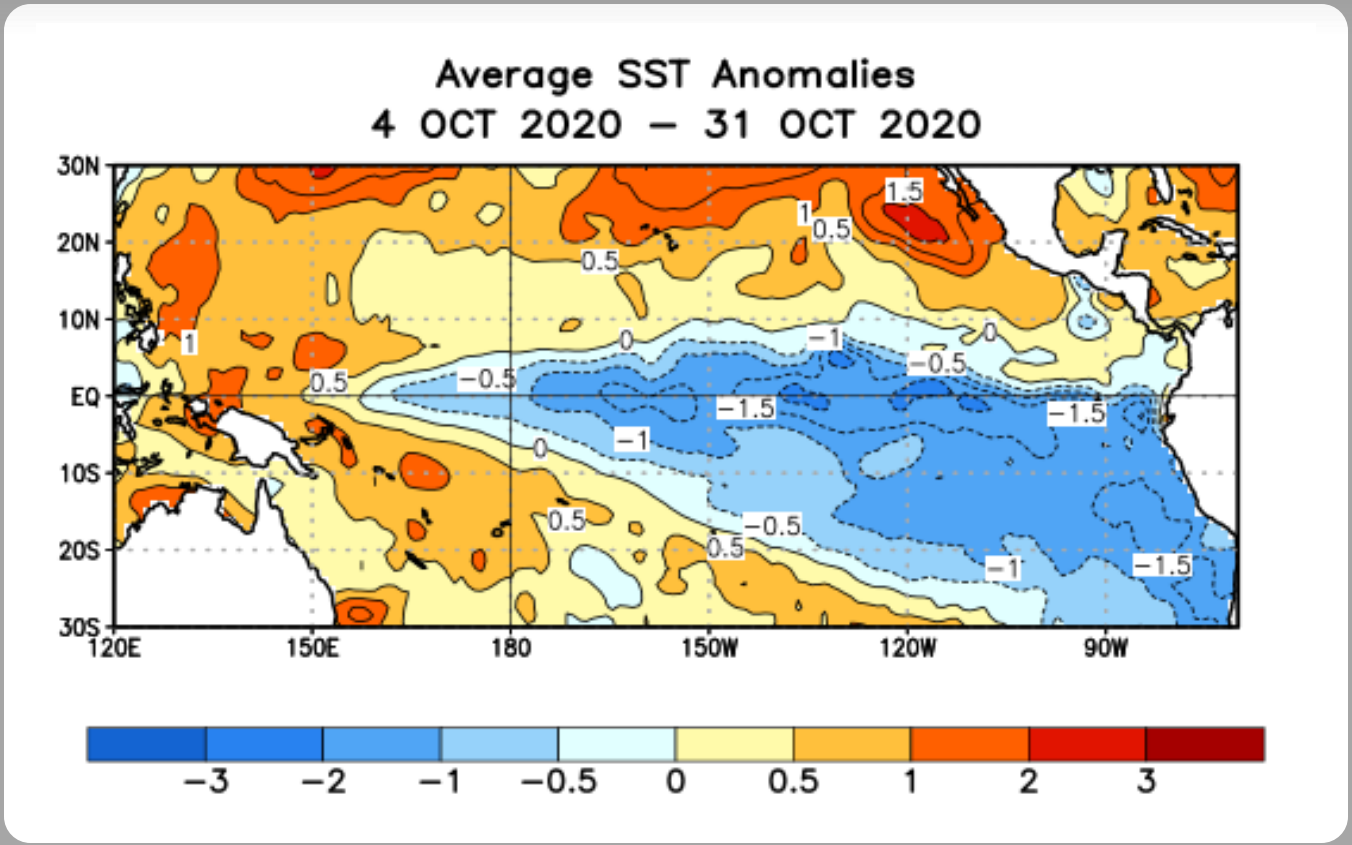
Niño 4	-0.7ºC
Niño 3.4	-1.7ºC
Niño 3	-1.5ºC
Niño 1+2	-1.1ºC





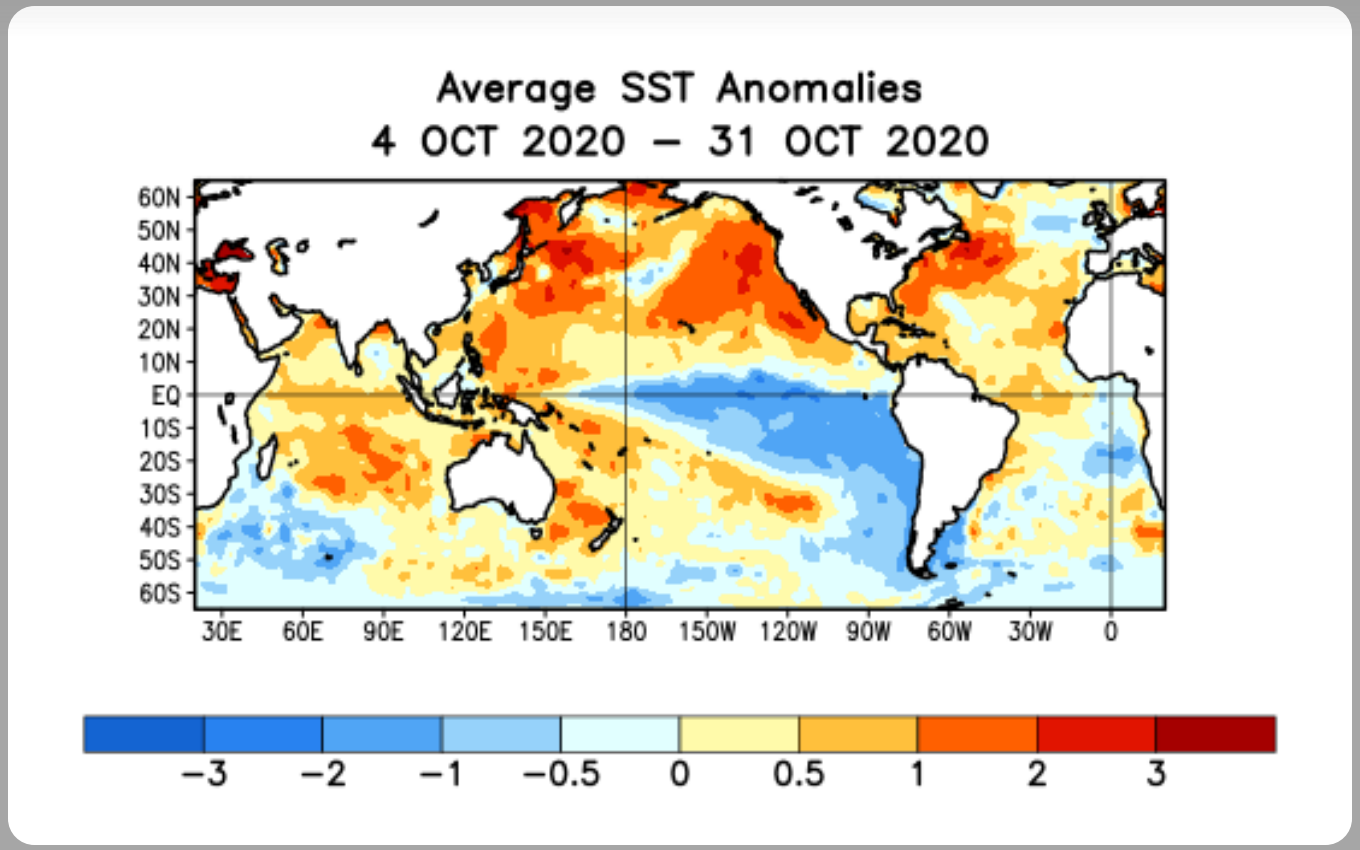
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

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



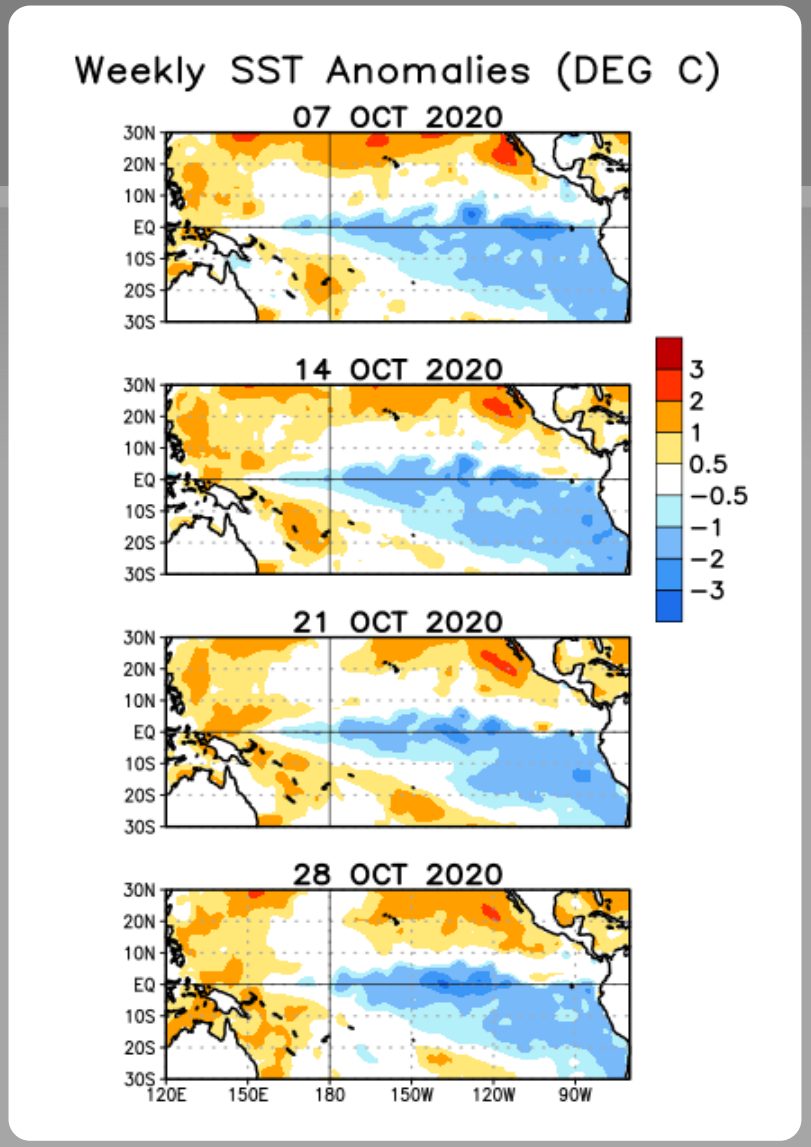
Global SST Departures (ºC) During the Last Four Weeks

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



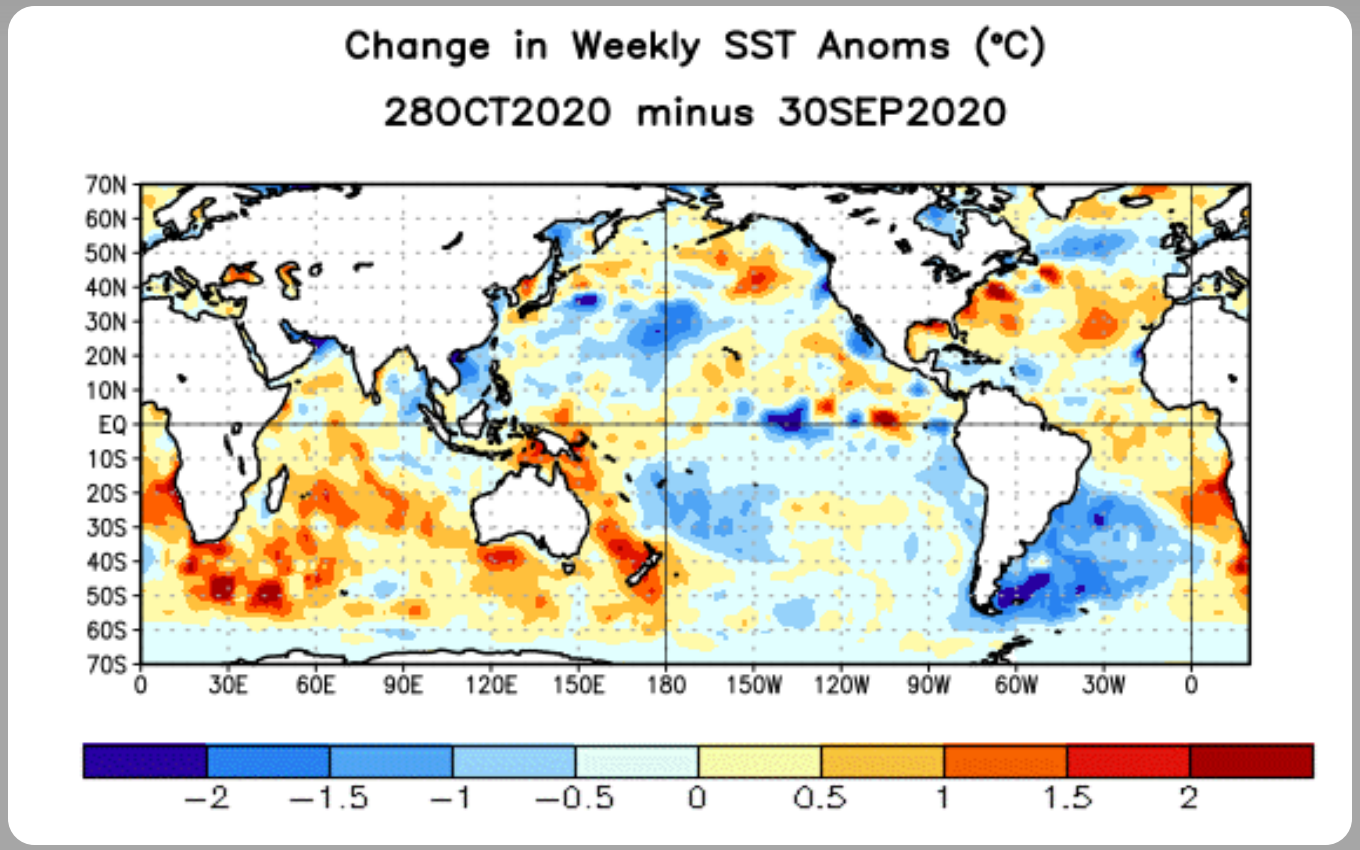
Weekly SST Departures during the Last Four Weeks

During the last four weeks, below-average SSTs have strengthened in the east-central Pacific Ocean.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, the changes in equatorial SST anomalies were mostly negative in the eastern Pacific, with a positive change near 100˚W.



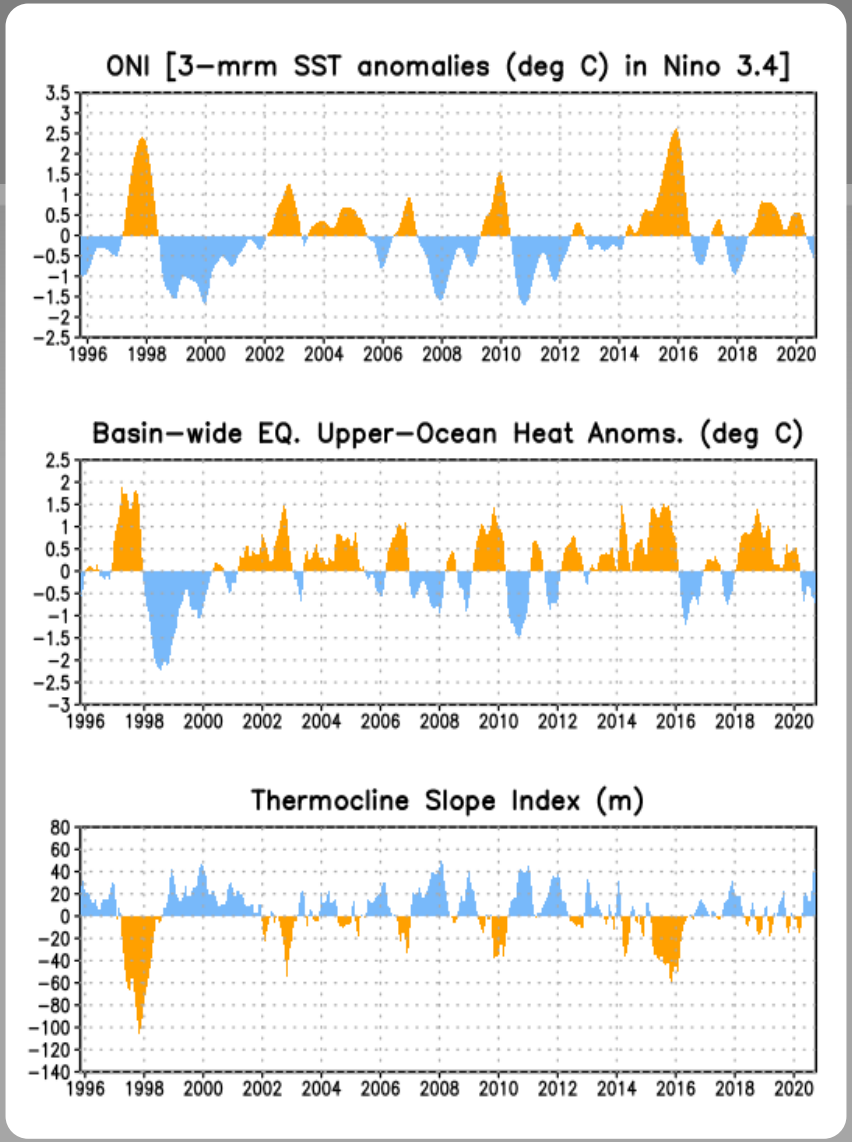
Upper-Ocean Conditions in the Equatorial Pacific

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.

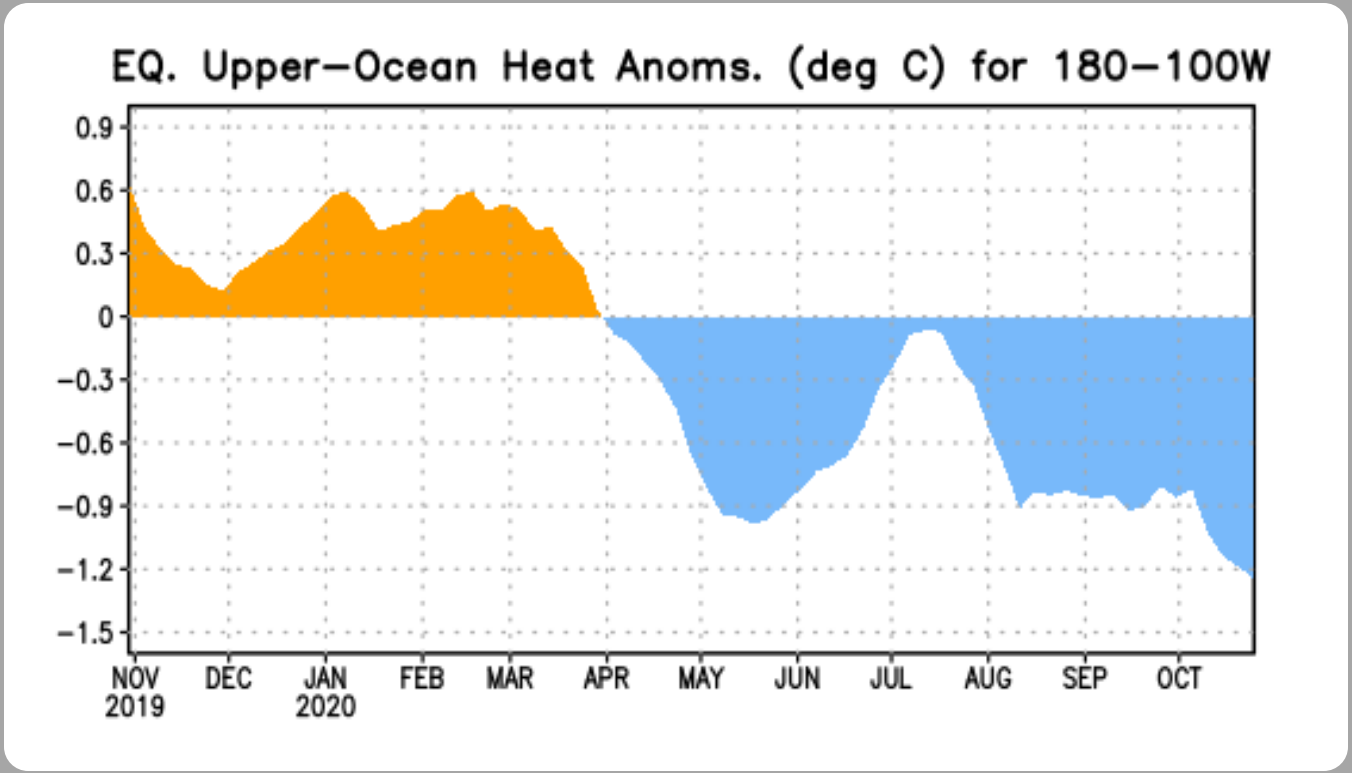
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (above average) reflect La Niña.

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).



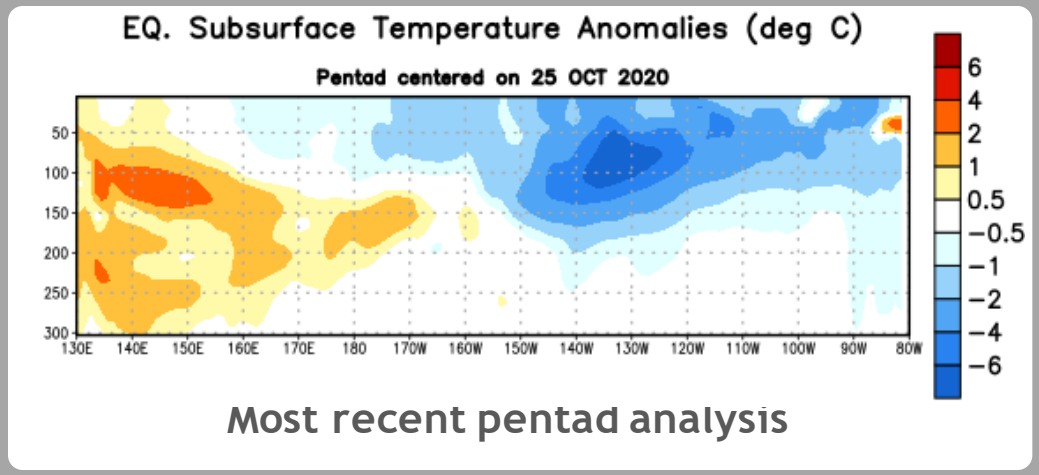
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Subsurface temperature anomalies were positive from October 2019 - March 2020. During April and early May, negative anomalies strengthened. Starting in mid-July, negative anomalies strengthened and then persisted through early October. Since early October, negative anomalies have strengthened again.



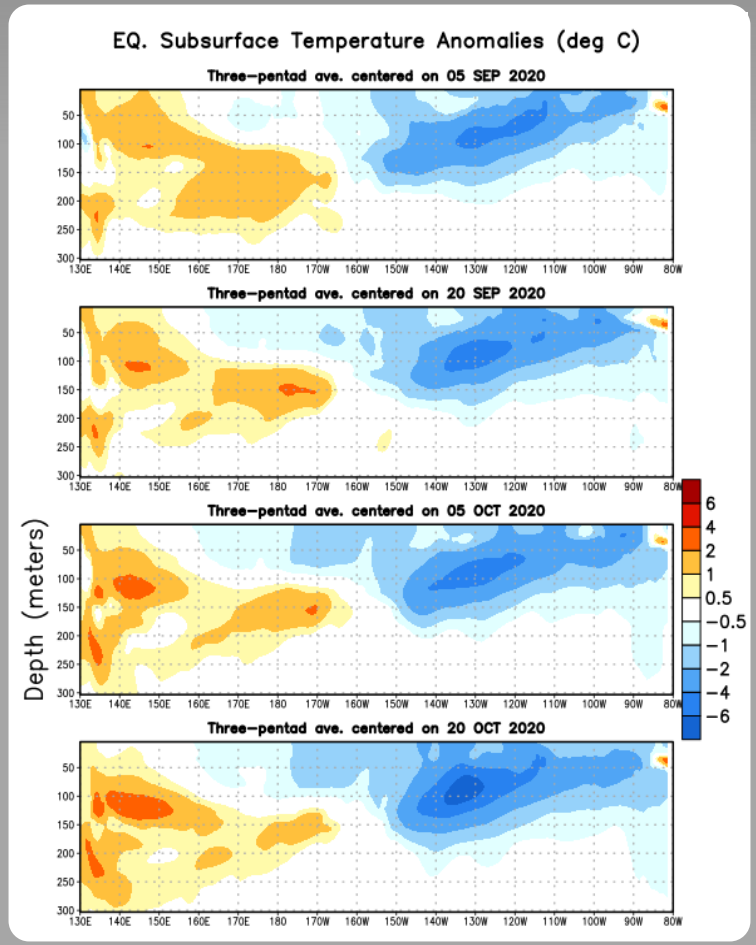
Sub-Surface Temperature Departures in the Equatorial Pacific

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



Most recent pentad analysis

Meanwhile, positive subsurface temperature anomalies have persisted in the western Pacific Ocean and at depth near the Date Line.

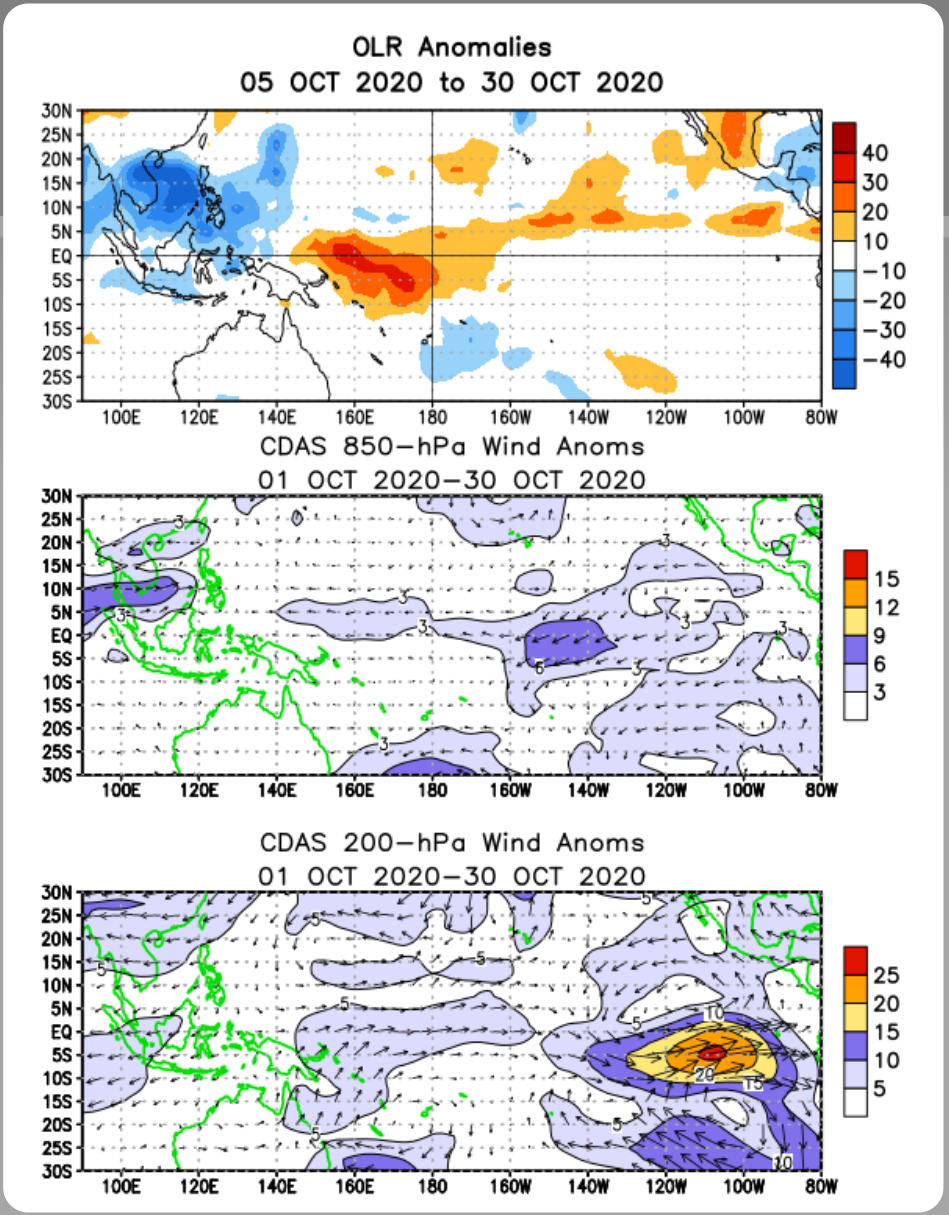


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) extended from the western Pacific Ocean to the Date Line. Negative OLR anomalies (enhanced convection and precipitation) were observed over Indonesia and the Philippines.

Low-level (850-hPa) easterly wind anomalies were evident across most of the equatorial Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies were present over most of the 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.

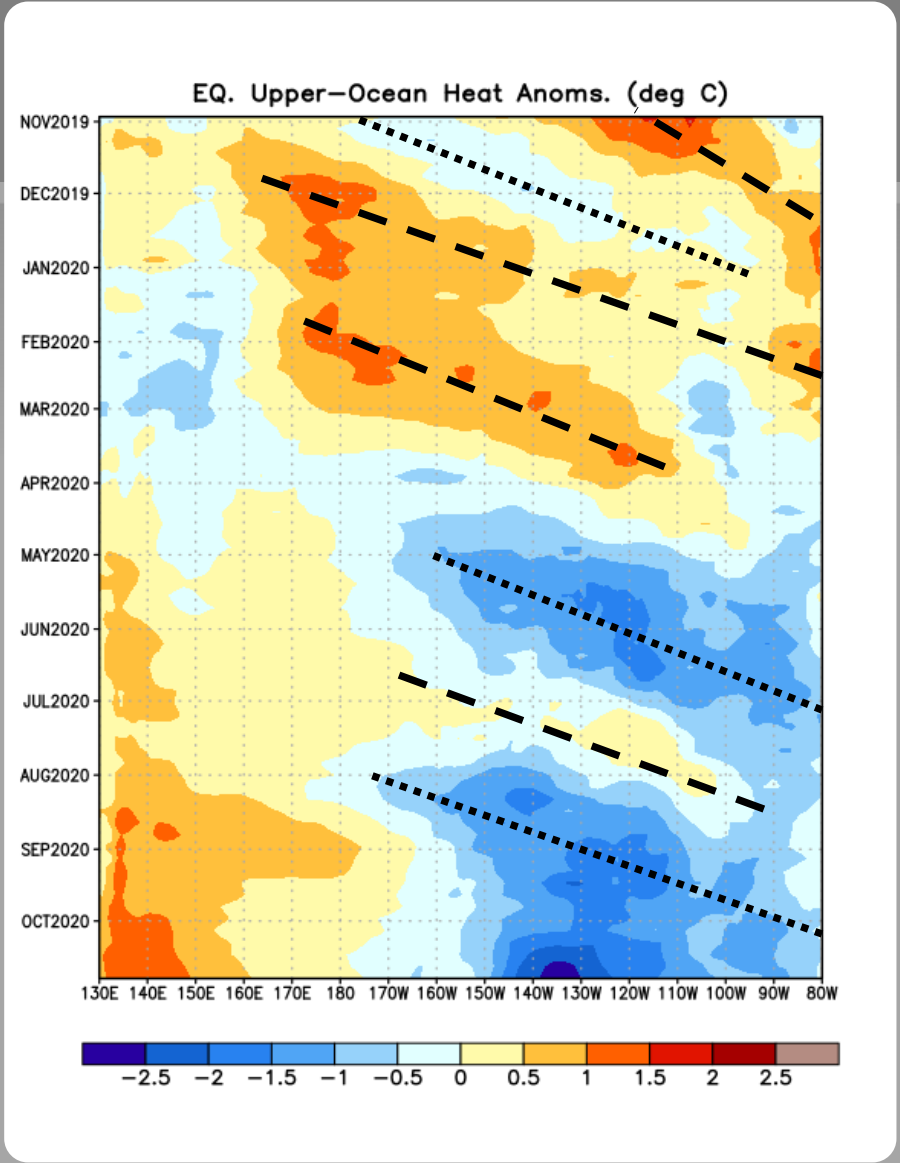
Weekly Heat Content Evolution in the Equatorial Pacific

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

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

During April-June and August-September 2020, negative subsurface temperature anomalies were associated with upwelling Kelvin waves.

Since August 2020, negative anomalies have persisted in the eastern half of the Pacific Ocean.



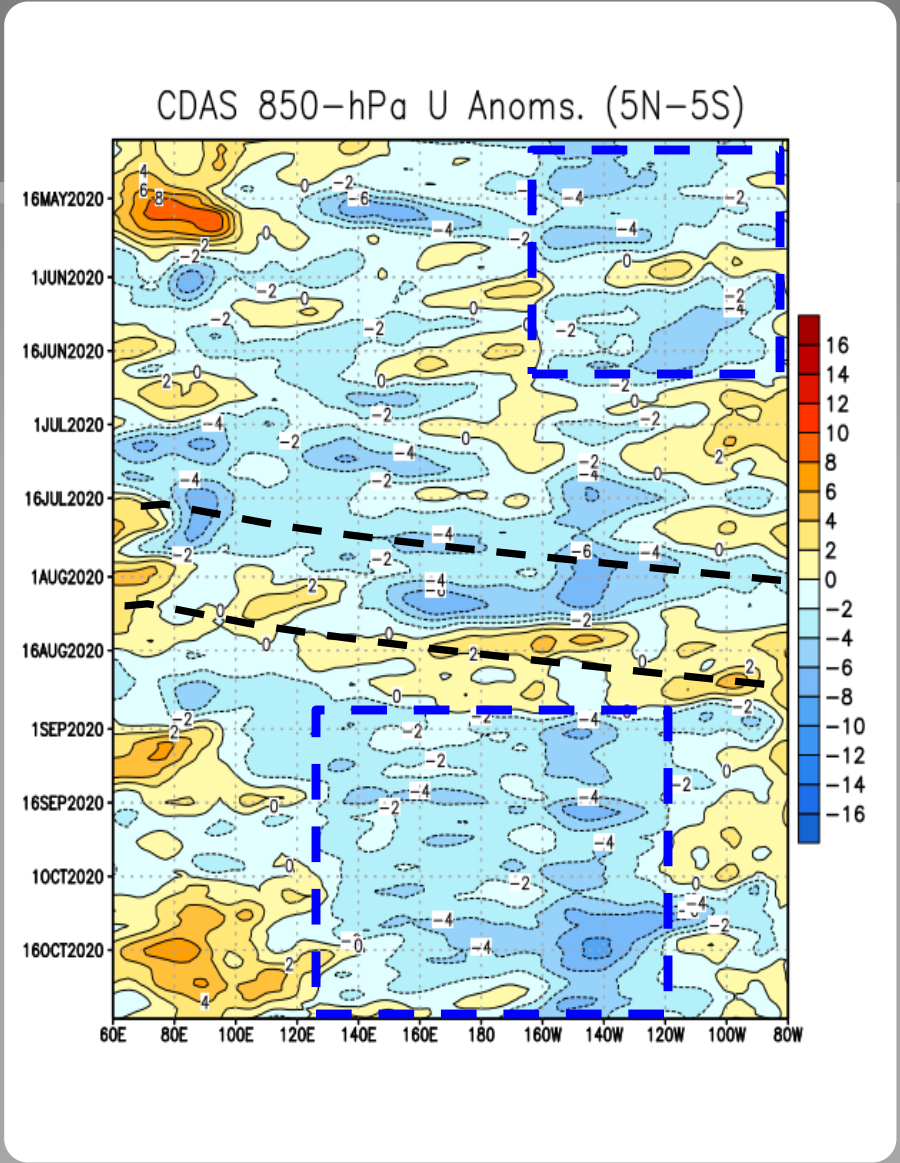
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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 Ocean.

Since late August, easterly wind anomalies have persisted over most of the equatorial Pacific Ocean.



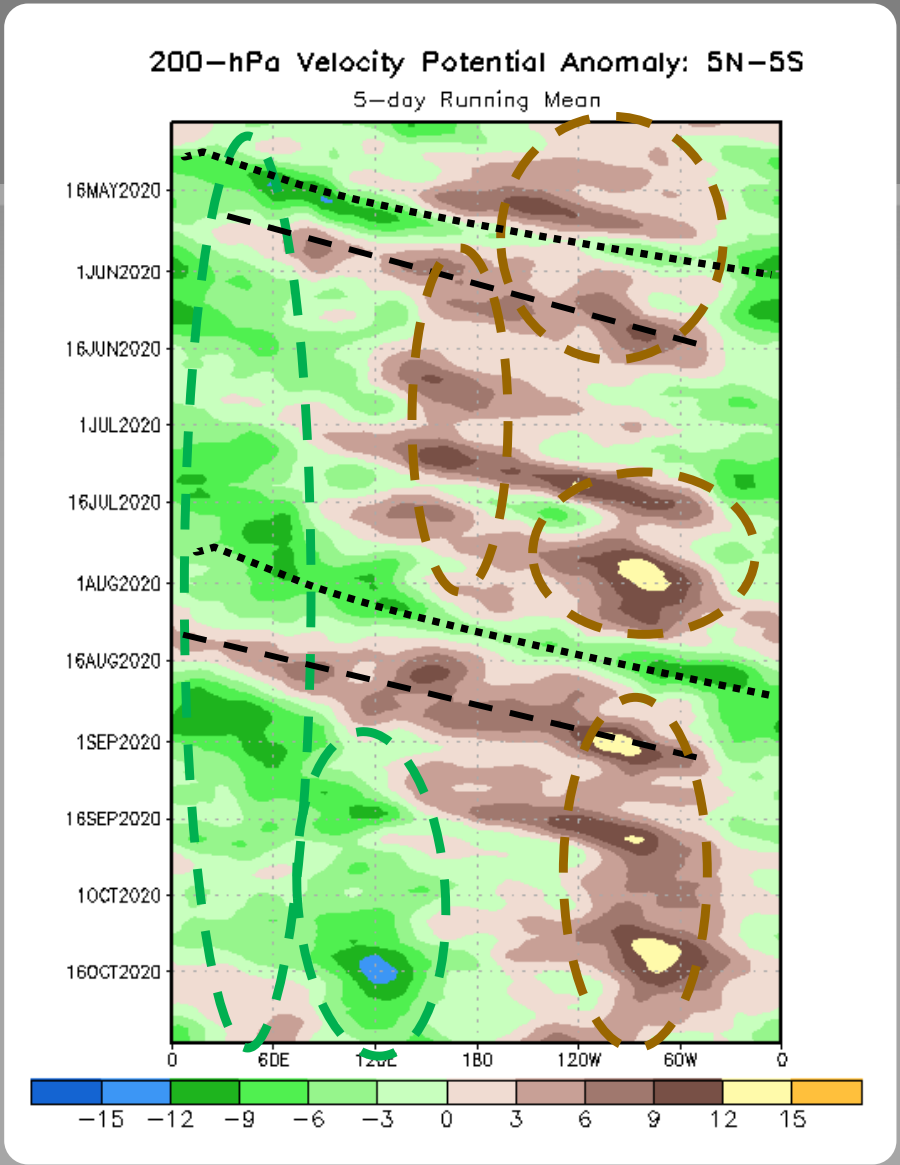
Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

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) was observed over the Date Line.

Since mid-August 2020, anomalous convergence has persisted over the eastern Pacific Ocean, while anomalous divergence has remained near Indonesia and the Indian Ocean.



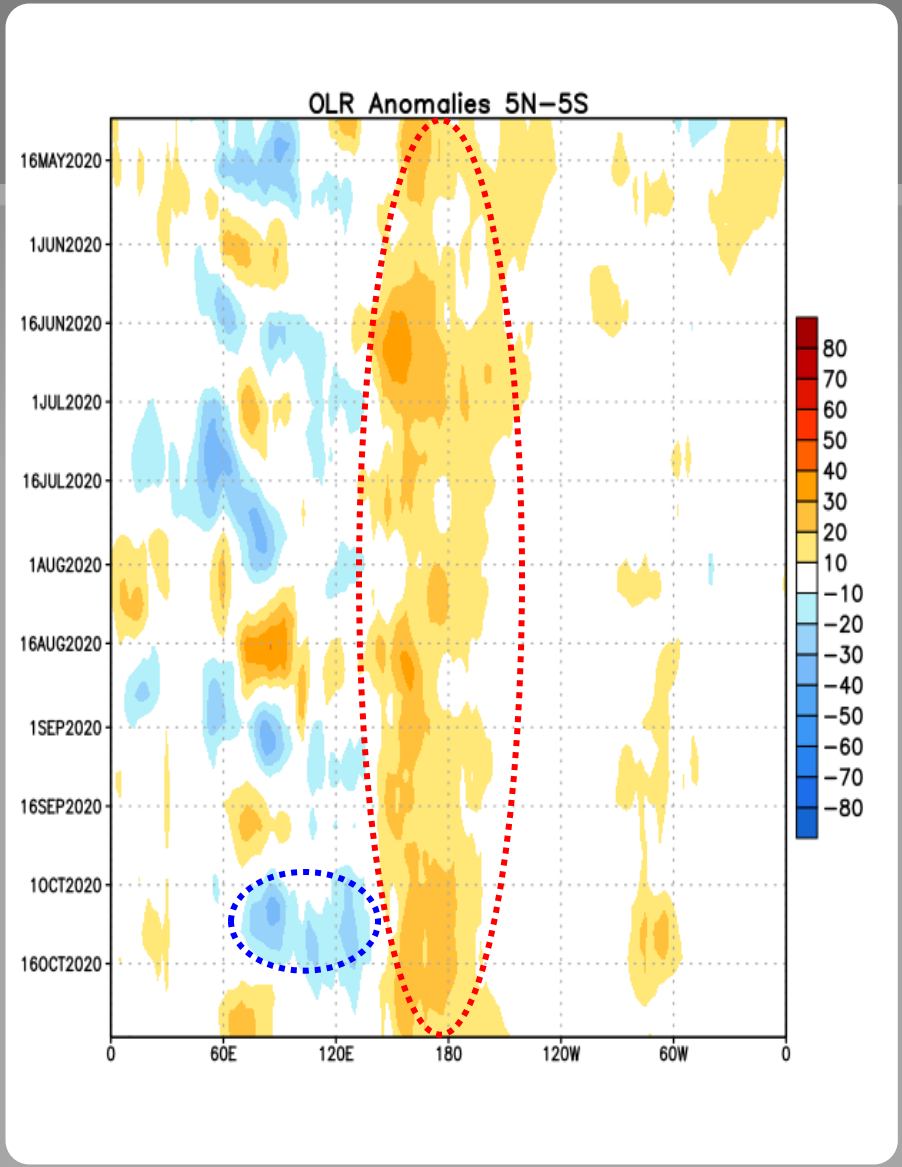
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

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

Outgoing Longwave Radiation (OLR) Anomalies

Since late April 2020, positive OLR anomalies have been observed at the Date Line and over the western Pacific Ocean.

During the first half of October 2020, negative OLR anomalies were evident over Indonesia and the 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°C.

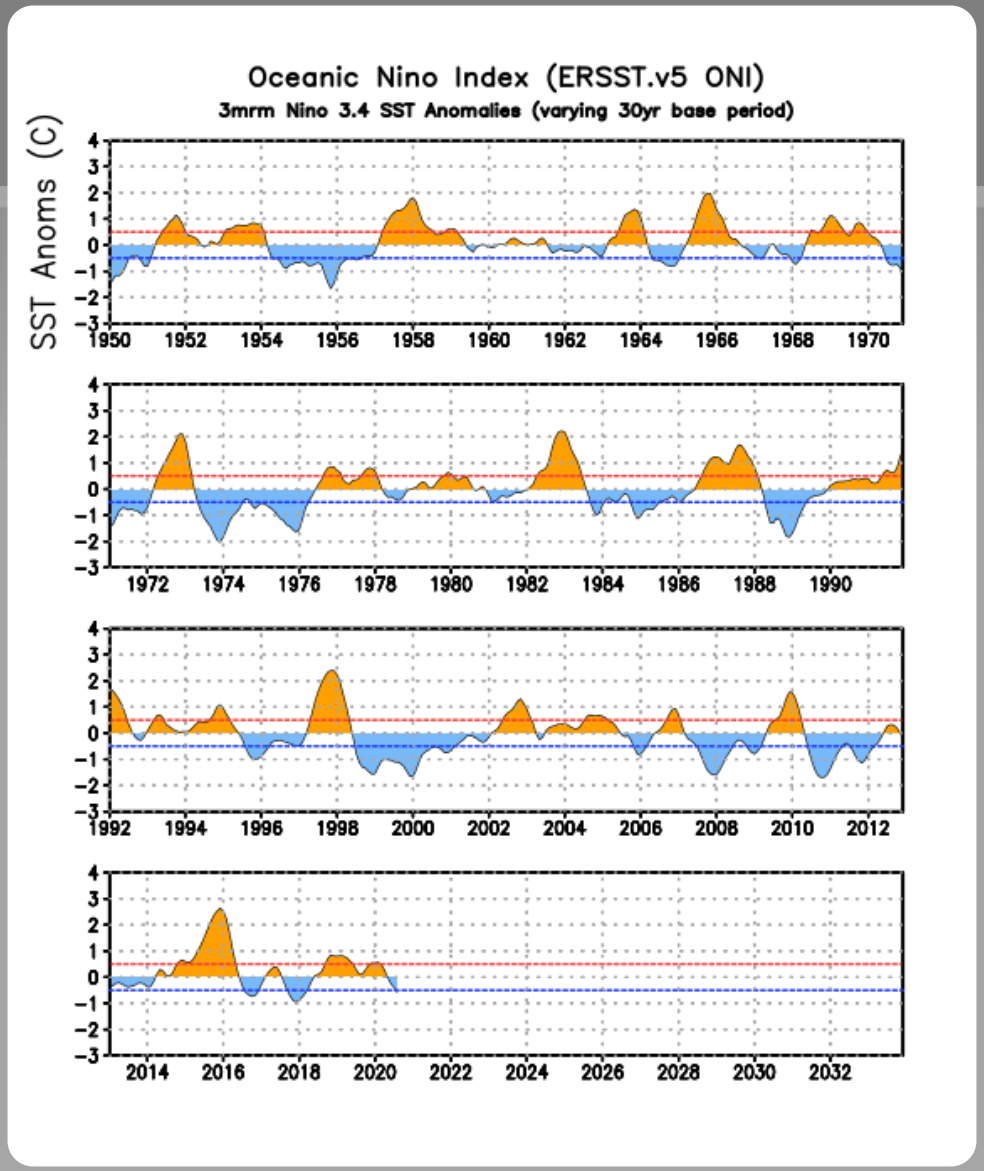
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 +/- 0.5°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 (July - September 2020) is -0.6°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.

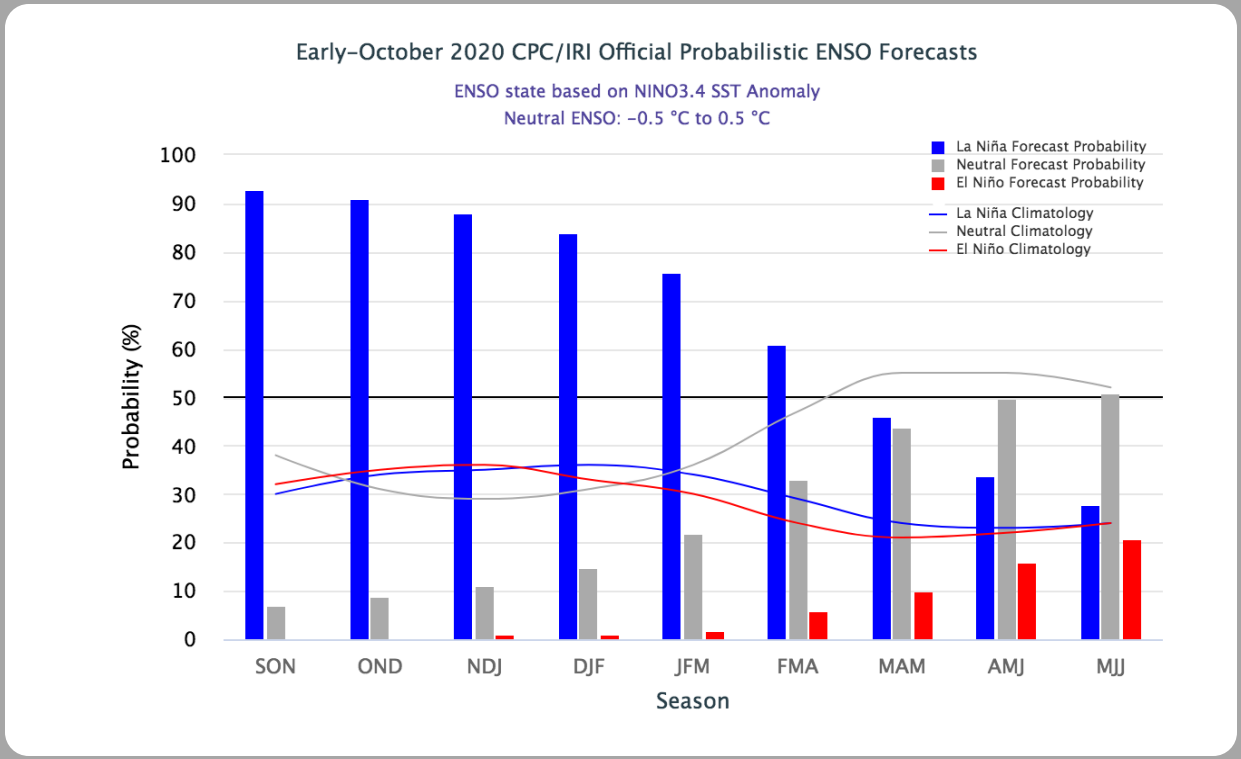
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

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	-0.4	-0.6				

CPC/IRI Probabilistic ENSO Outlook

Updated: 8 October 2020

La Niña is likely (> 80% chance) from September-November 2020 to December-February 2020-21, with a ~60% chance of continuing through February-April 2021.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The model averages predict La Niña to continue into the Northern Hemisphere spring 2021.

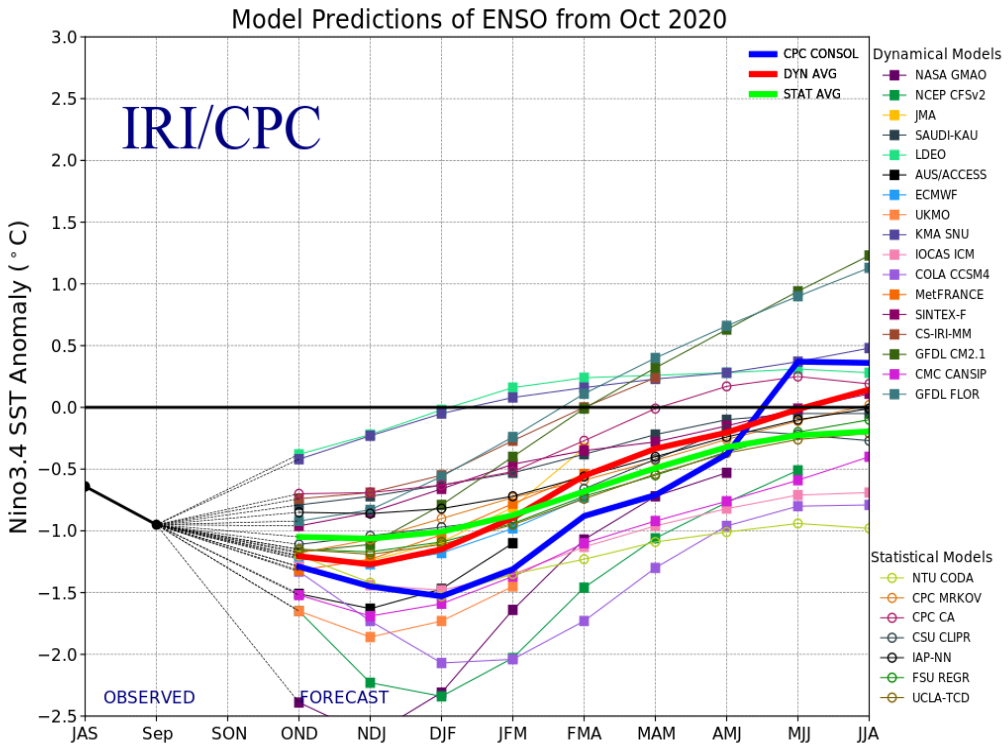
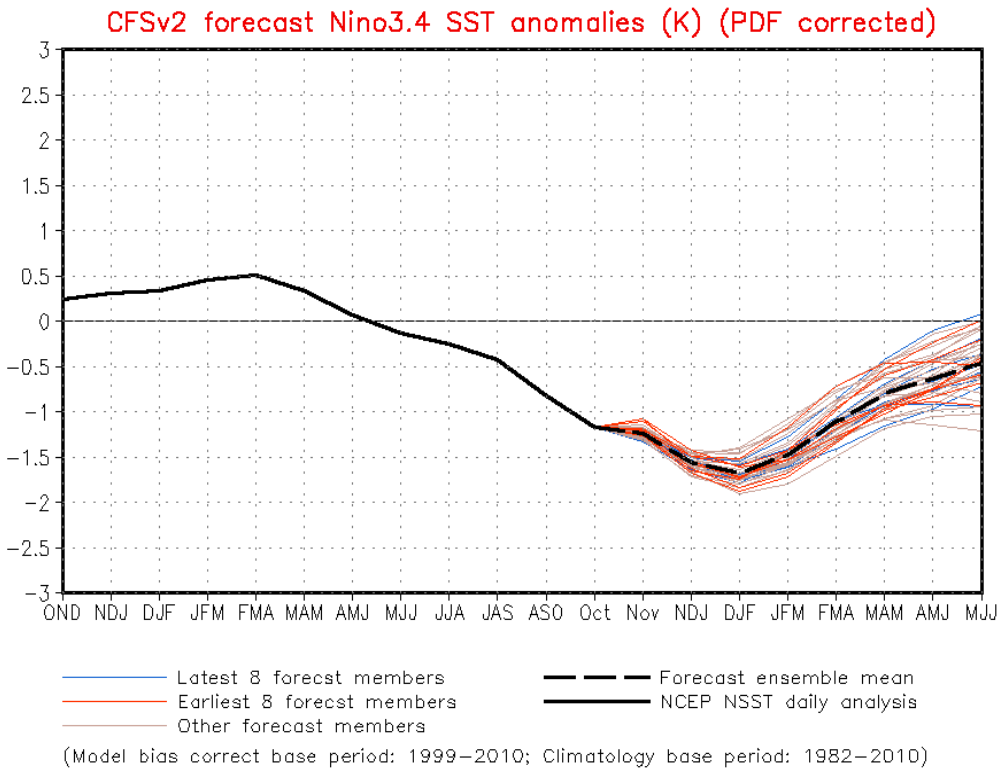


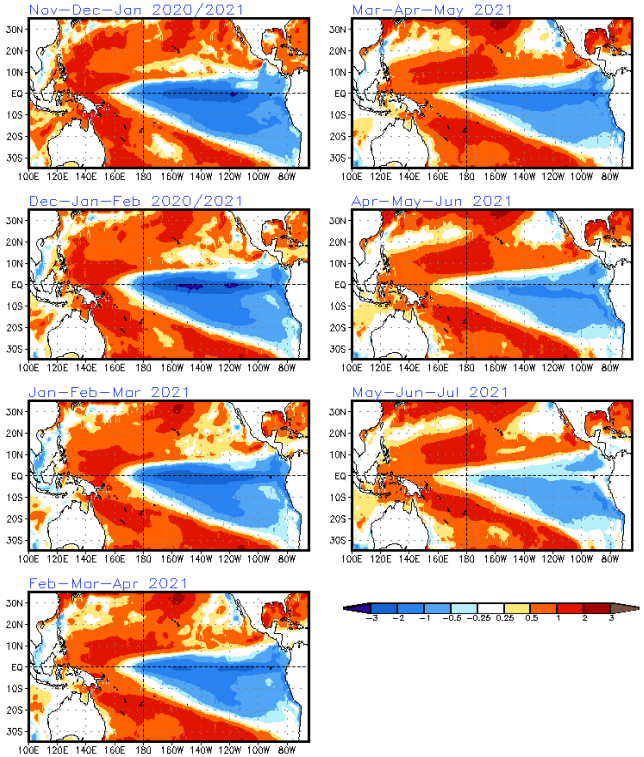
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 October 2020).

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

Issued: 2 November 2020

The CFS.v2 ensemble mean (black dashed line) predicts La Niña will continue through spring 2021.

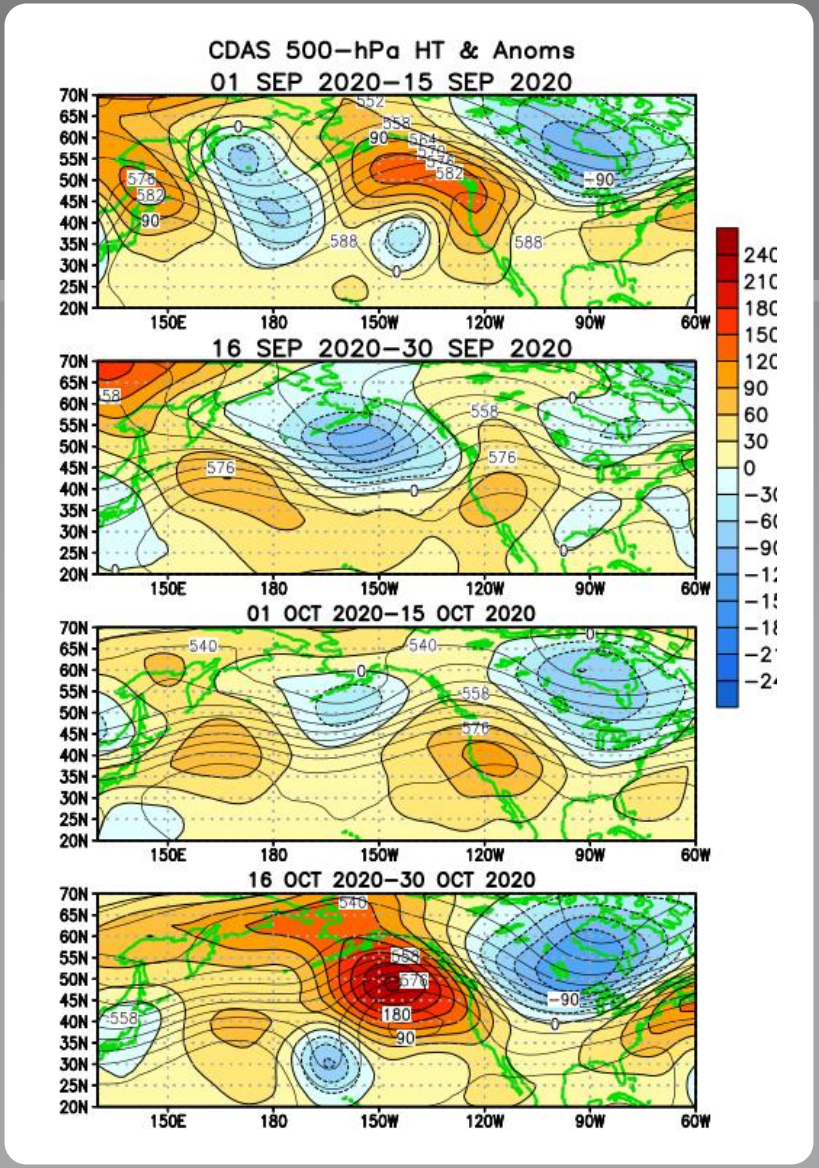




Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From September through October, above-average heights and temperatures have persisted over the western U.S.

The pattern of anomalies has been more variable over the eastern U.S. During late October, an amplified trough was present over the north-central U.S.



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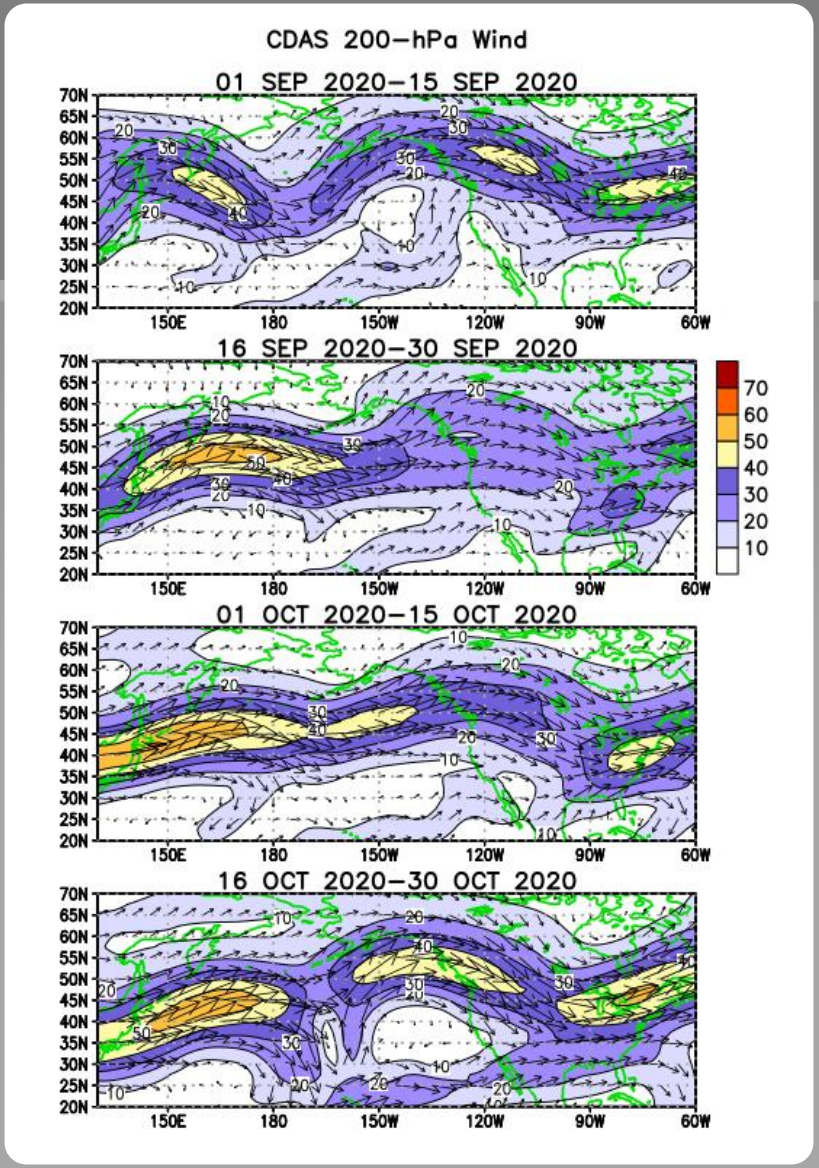

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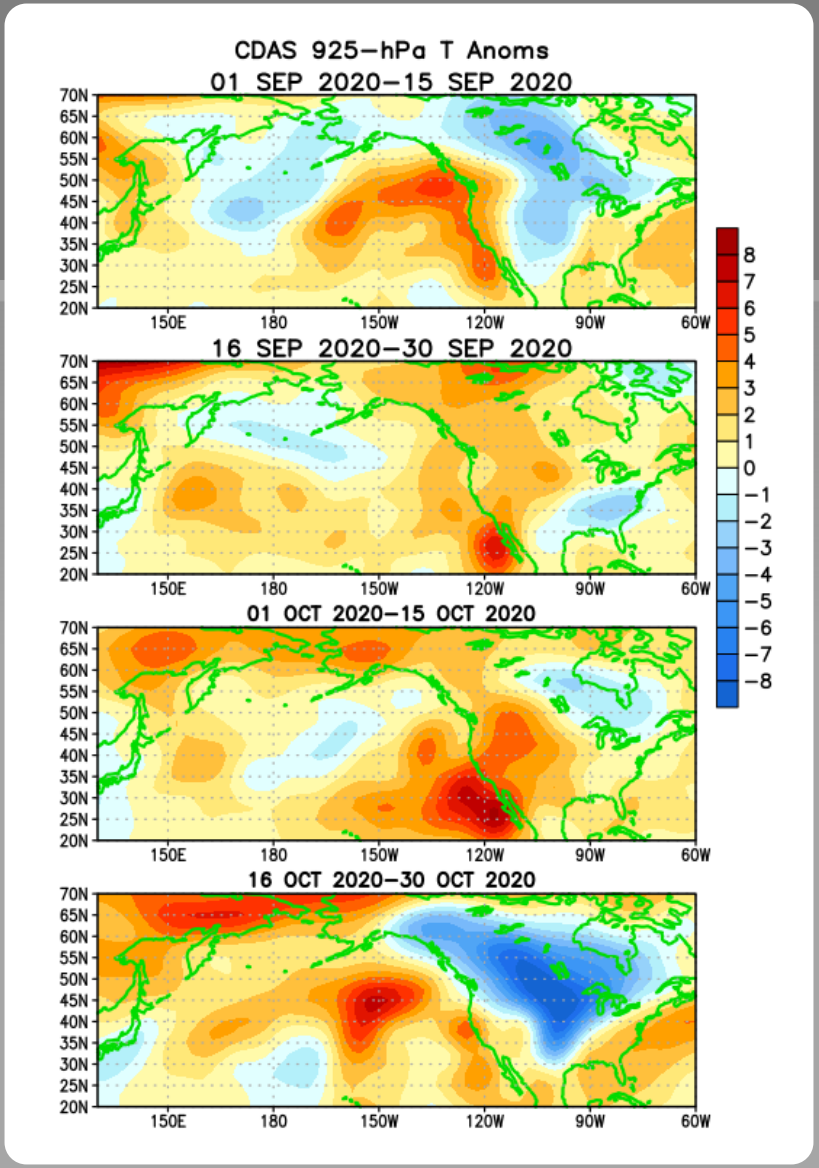
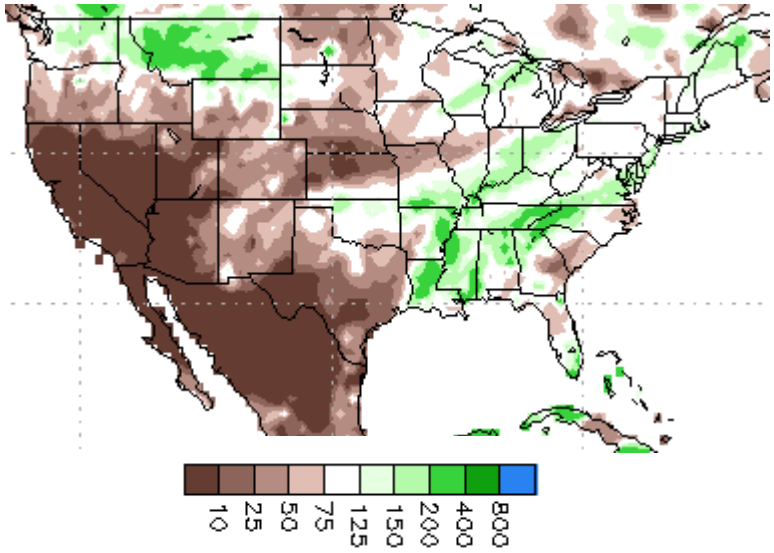


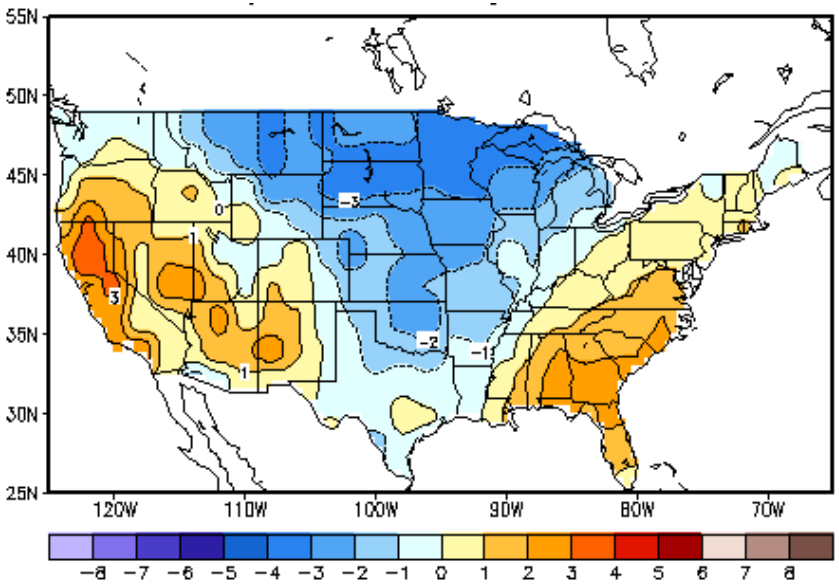
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 1 November 2020

Percent of Average Precipitation



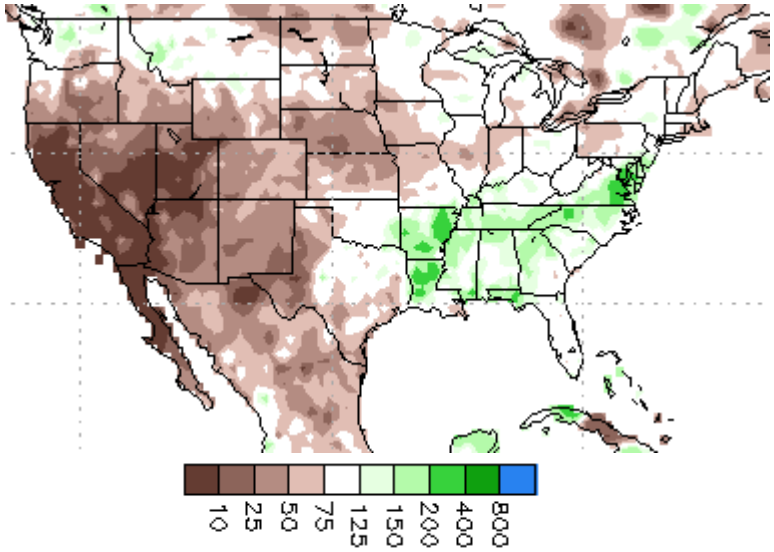
Temperature Departures (degree C)



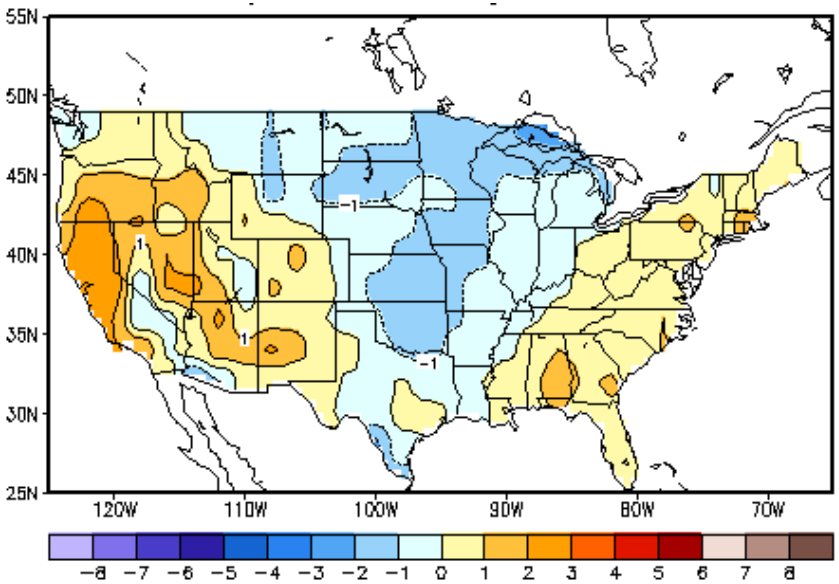
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 1 November 2020

Percent of Average Precipitation



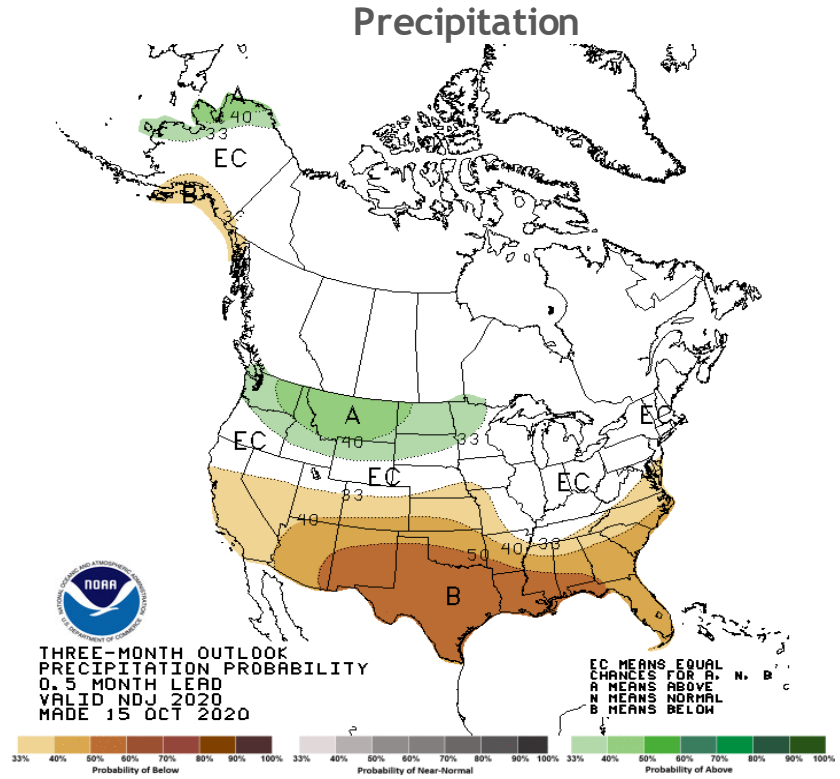
Temperature Departures (degree C)

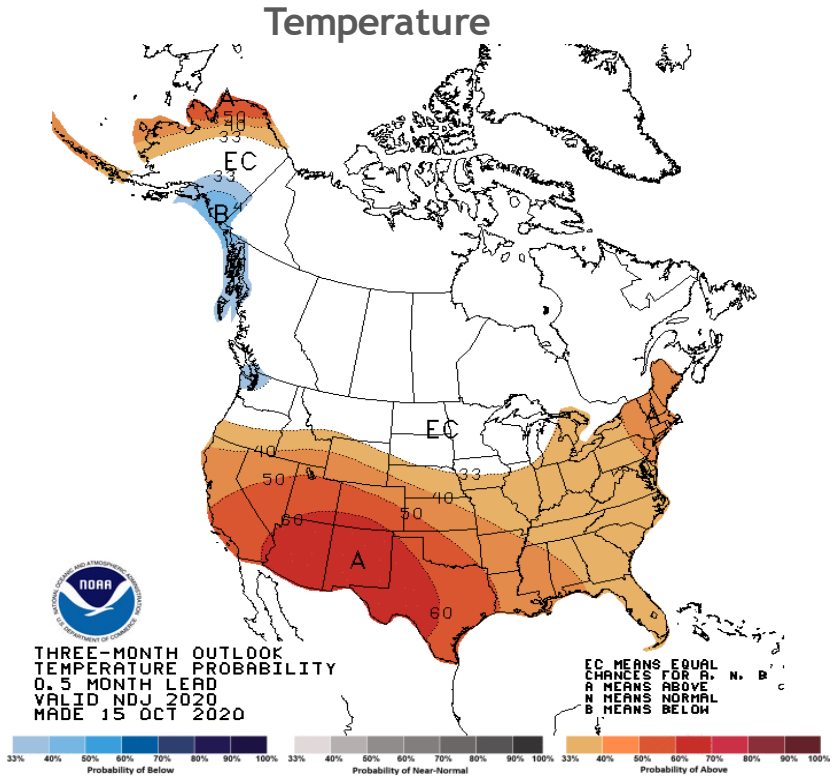


U. S. Seasonal Outlooks

November 2020-January 2021

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





Summary

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The tropical atmospheric circulation is consistent with La Niña.

La Niña is likely to continue through the Northern Hemisphere winter 2020-21 (~85% chance) and into spring 2021 (~60% chance during February-April).*

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