ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
5 October 2020
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Recent Evolution and Current Conditions
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ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.*

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

The tropical atmospheric circulation is consistent with La Niña.

La Niña conditions are present and are likely to continue through the Northern Hemisphere winter (~75% 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.
During October 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 expanded westward and strengthened in the central Pacific Ocean.
Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

- Niño 4  -0.7°C
- Niño 3.4 -1.1°C
- Niño 3  -1.1°C
- Niño 1+2 -0.5°C
SST Departures (°C) 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.
During the last four weeks, equatorial SSTs were above average from the far western Pacific to the Indian Ocean. SSTs were below average from the central to the eastern Pacific Ocean and in the eastern Atlantic Ocean.
During the last four weeks, below-average SSTs have expanded to the Date Line.
Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, the changes in equatorial SST anomalies were negative from the western to the central Pacific Ocean and were positive near coastal South America.
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).
Subsurface temperature anomalies were positive from October 2019- March 2020. During April and early May, negative anomalies strengthened. From mid-May to early July, anomalies weakened to near zero. From mid-July to early August, negative anomalies strengthened and have since persisted.
Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, negative subsurface temperature anomalies have persisted in the eastern Pacific Ocean. Meanwhile, positive subsurface temperature anomalies have continued 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. Weak, negative OLR anomalies (enhanced convection and precipitation) was observed over Indonesia.

Low-level (850-hPa) easterly wind anomalies were evident from the western to the east-central Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies were apparent over the east-central and eastern 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.

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

Starting in late July 2020, negative anomalies strengthened in the east-central and eastern 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 upwelling and cooling occur in the trailing portion.
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.
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) persisted over the Date Line.

Since mid-August 2020, anomalous convergence has generally persisted over the eastern Pacific 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 early-April 2020, positive OLR anomalies have been 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°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.
The most recent ONI value (July - September 2020) is -0.6°C.
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.

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La Niña is likely (> 70% chance) from August-October 2020 to December-February 2020-21, with a ~50% chance of continuing through February-April 2021.
The model averages predict La Niña to continue through the Northern Hemisphere winter 2020-21.
The CFS.v2 ensemble mean (black dashed line) predicts La Niña will continue through winter 2020-21.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From early August to early October, above-average heights and temperatures have persisted over the western U.S., while below-average heights and temperatures have been evident, at times, in the eastern U.S.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 3 October 2020
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 3 October 2020
The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.
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