ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
10 June 2019
Outline

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Recent Evolution and Current Conditions
Oceanic Niño Index (ONI)
Pacific SST Outlook
U.S. Seasonal Precipitation and Temperature Outlooks
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 consistent with El Niño.

El Niño is likely to continue through the Northern Hemisphere summer 2019 (70% chance) and fall (55-60% 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.
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 several weeks, positive SST anomalies strengthened across the central equatorial Pacific Ocean.
Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

Niño 4  1.1°C  
Niño 3.4  0.9°C  
Niño 3  0.6°C  
Niño 1+2  -0.4°C
During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, with the largest departures between 170°E and 140°W. SSTs were near-to-below average around Indonesia.
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean and western Indian Ocean. SSTs were near-to-below average near Indonesia and the eastern Indian Ocean.
Weekly SST Departures during the Last Four Weeks

During the last four weeks, above-average equatorial SSTs have persisted near the Date Line, while strengthening in the east-central Pacific.
Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, an increase in equatorial SST anomalies was evident near and just east of the Date Line.
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).
Positive subsurface temperature anomalies were present until early May 2019. Positive anomalies increased in January and February 2019, and then decreased to near-average values by late April. Positive anomalies have returned and increased since mid-May.
In the last two months, positive subsurface temperature anomalies have weakened, but still reside near the surface across most of the Pacific.

Negative subsurface temperature anomalies have strengthened and are strongest just below the surface around 120°-90°W.
Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident around the Philippines, Malaysia, and Indonesia. Negative OLR anomalies (enhanced convection and precipitation) were present around the Date Line.

Low-level (850-hPa) westerly wind anomalies were evident in the western equatorial Pacific Ocean.

Upper-level (200-hPa) easterly wind anomalies were present across the western and east-central equatorial Pacific.
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.
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 120°-90°W. Since mid-May, a downwelling Kelvin wave resulted in the increase of positive subsurface anomalies in 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 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.

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

In the last week, easterly wind anomalies were observed over most of the equatorial Pacific Ocean.
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 convergence (brown shading) has shifted to the Date Line and eastern Pacific, while anomalous upper-level divergence is located over the Indian Ocean and 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

Since mid-December 2018, 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 or so, tropical convection was near average across the Pacific Ocean and Indonesia.

Drier-than-average Conditions (orange/red shading)
Wetter-than-average Conditions (blue shading)
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.
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 (March - May 2019) is +0.8°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 Niño 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 overlapping 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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El Niño conditions are favored to continue through winter 2019-20 with diminishing chances.
The majority of models predict a weak El Niño to continue into the Northern Hemisphere winter 2019-20.
The CFS.v2 ensemble mean (black dashed line) predicts El Niño to persist into Northern Hemisphere winter 2019-20.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From early April to early May, an anomalous ridge persisted over the western and eastern U.S., associated with above-average temperatures.

Since early May, anomalous troughing and negative temperature anomalies expanded into the central and southwestern U.S., while above-average temperatures have persisted over the eastern U.S. and Pacific Northwest.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 8 June 2019

Percent of Average Precipitation

Temperature Departures (degree C)
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 8 June 2019
U. S. Seasonal Outlooks
June-August 2019

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