ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
25 November 2019
Outline

Summary
Recent Evolution and Current Conditions
Oceanic Niño Index (ONI)
Pacific SST Outlook
U.S. Seasonal Precipitation and Temperature Outlooks
Summary
ENSO Alert System Status: Not Active

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are above average across much of the Pacific Ocean.

The pattern of anomalous convection and winds are generally consistent with ENSO-neutral.

ENSO-neutral is favored during the Northern Hemisphere winter 2019-20 (~70% chance), continuing through spring 2020 (60 to 65% 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.
From early June 2018 through May 2019, near-to-above average SSTs were present across most of the Pacific Ocean.

During February 2019, positive SST anomalies strengthened across most of the equatorial Pacific.

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

Since mid-September, above-average SSTs expanded from the Date Line into the eastern Pacific Ocean.
Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

- Niño 4: 1.0°C
- Niño 3.4: 0.7°C
- Niño 3: 0.6°C
- Niño 1+2: -0.1°C
During the last four weeks, equatorial SSTs were above average across most of the Pacific. Below-average SSTs were evident in a small region of the eastern Pacific.
During the last four weeks, equatorial SSTs were above average across most of the Pacific, the Atlantic Ocean, and the western Indian Ocean. SSTs were below average near Indonesia and in a small region of the eastern Pacific.
During the last four weeks, above-average equatorial SSTs strengthened in the eastern Pacific, while below-average SSTs weakened.
During the last four weeks, equatorial SST anomalies increased in the eastern 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 (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).
Subsurface temperature anomalies decreased to near zero in late April. Weak anomalies were then present through mid-September. Since mid-September, anomalies have been positive with weakening evident beginning in mid-October.
In the last two months, positive subsurface temperature anomalies have strengthened and shifted eastward to the eastern Pacific.

Negative subsurface temperature anomalies have strengthened at depth in the central Pacific Ocean.
Positive OLR anomalies (suppressed convection and precipitation) were evident over Indonesia and over the Date Line on the equator. Negative OLR anomalies (enhanced convection and precipitation) in the western Pacific Ocean.

Low-level (850-hPa) cross-equatorial wind anomalies were observed in the eastern tropical Pacific Ocean.

Upper-level (200-hPa) wind anomalies were westerly over the eastern 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 January-March 2019, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

During April-May 2019, an upwelling Kelvin wave contributed to a reduction of positive subsurface temperature anomalies and the emergence of negative anomalies around 110°-90°W.

During mid-September to late October, a downwelling Kelvin wave increased subsurface temperature anomalies in the eastern Pacific.

Recently, positive anomalies have persisted in the eastern 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. From early September to late October, low-level westerly wind anomalies persisted over the eastern Pacific. In the last week, westerly wind anomalies prevailed over most of the Pacific.
Upper-level (200-hPa) Velocity Potential Anomalies

Eastward propagation of anomalies has, at times, been evident throughout the period.

From June to mid-September 2019, anomalous upper-level convergence (brown shading) persisted in the far eastern Pacific and over S. America, while anomalous divergence (green shading) persisted over the east-central Pacific.

In the last week, anomalous divergence has persisted over the western Pacific, while anomalous convergence shifted to the eastern half of the 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 July 2019, positive OLR anomalies have been present over Indonesia.

Since late October, negative OLR anomalies have been present over the western Pacific.

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.
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 (August - October 2019) is +0.1°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 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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ENSO-neutral is most likely to continue through the Northern Hemisphere spring 2020.
A majority of models favor ENSO-neutral through Northern Hemisphere summer 2020.
The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral to continue into summer 2020.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From late September to early November, above-average heights and temperatures were generally observed over the eastern U.S., while below-average heights and temperatures were located over the western or central U.S.

Since early November, below-average heights and temperatures have dominated the eastern U.S., while above-average heights and temperatures have persisted over the western U.S.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 23 November 2019
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 23 November 2019
U. S. Seasonal Outlooks
December 2019 - February 2020

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