ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
18 February 2020
Outline

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Recent Evolution and Current Conditions
Oceanic Niño Index (ONI)
Pacific SST Outlook
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Summary
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ENSO Alert System Status: Not Active

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are near-to-above average across the Pacific Ocean.

The tropical atmospheric circulation is generally consistent with ENSO-neutral.

ENSO-neutral is favored through Northern Hemisphere spring 2020 (~60% chance), continuing through summer 2020 (~50% 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.

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: 0.9°C
- Niño 3.4: 0.1°C
- Niño 3: 0.3°C
- Niño 1+2: 0.1°C
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above-average near the Date Line and western Pacific Ocean, with mostly near-average SSTs across the eastern Pacific.
During the last four weeks, equatorial SSTs were above average across the western and central Pacific, the Atlantic Ocean, and the Indian Ocean.
During the last four weeks, above-average SSTs persisted across the western and central equatorial Pacific.
During the last four weeks, equatorial SST anomalies decreased in the east-central Pacific Ocean and 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 increased from late September through mid-October 2019. During mid-October through November, positive anomalies decreased. During December 2019 and early January 2020, positive anomalies increased. Since mid-January, positive anomalies have increased again.
Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have extended to the eastern Pacific in association with downwelling Kelvin waves. Since January, negative subsurface temperature anomalies have emerged in the western Pacific, at depth.
Positive OLR anomalies (suppressed convection and precipitation) were evident over Indonesia and Papua New Guinea. Negative OLR anomalies (enhanced convection and precipitation) were observed around the Date Line.

Low-level (850-hPa) wind anomalies were westerly over the western and central equatorial Pacific Ocean.

Upper-level (200-hPa) wind anomalies were mostly westerly over the east-central and eastern equatorial Pacific Ocean.
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.
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

During December 2019 and January 2020, a downwelling Kelvin wave (dashed line) resulted in above-average subsurface temperatures across the central and east-central equatorial Pacific.

Since mid-December 2019, above-average temperatures have persisted between ~170ºE and ~140ºW.

Recently, a downwelling Kelvin wave increased temperature anomalies east of the Date Line.

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 early January, low-level westerly wind anomalies generally persisted east of the Date Line.

Since mid-December 2019, westerly wind anomalies have mostly persisted over the western Pacific and near the Date Line.
Upper-level (200-hPa) Velocity Potential Anomalies

Eastward propagation of anomalies has, at times, been evident.

Since mid-September 2019, anomalous divergence (green shading) has generally persisted over Africa and the western Indian Ocean.

In the last couple of weeks, anomalous divergence persisted over the Date Line.

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

Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).
Since July 2019, positive OLR anomalies have persisted over Indonesia and, at times, over the western equatorial Pacific.

From mid-November through December 2019, positive OLR anomalies were evident near and just east of the Date Line.

Since mid-December 2019, negative OLR anomalies have been observed near and west of the Date Line.

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.
The most recent ONI value (November 2019 - January 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 Niño Index (ONI) [3 month running mean of ERSST.v5 SST anomalies in the Niño 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 summer 2020.
A majority of models favor ENSO-neutral through the Northern Hemisphere summer 2020.
The CFS.v2 ensemble mean (black dashed line) predicts ENSO-neutral to continue through spring 2020.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid December 2019 through mid January 2020, above-average heights and temperatures were evident over eastern North America. Below-average heights were predominant over portions of western North America.

Since early February, above-average heights and temperatures have prevailed over the western and eastern U.S., with below-average heights and near-to-below average temperatures observed over portions of the central U.S.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 16 February 2020
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 16 February 2020
U. S. Seasonal Outlooks
February - April 2020

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