ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
15 April 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.

A weak El Niño is likely to continue through the Northern Hemisphere summer 2019 (65% chance) and possibly fall (50-55% 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.

Recently, positive SST anomalies have weakened across much of the Pacific.
Niño Region SST
Departures (°C) Recent Evolution

The latest weekly SST departures are:

- Niño 4 0.8°C
- Niño 3.4 0.9°C
- Niño 3 0.7°C
- Niño 1+2 0.1°C
During the last four weeks, equatorial SSTs were above average in the central and east-central Pacific Ocean. SSTs were below average around Indonesia and in parts of the far eastern Pacific.
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the central and eastern Pacific Ocean, Atlantic Ocean, and central Indian Ocean. SSTs were below average near Indonesia and in parts of the far eastern Pacific.
During the last four weeks, above-average SSTs have persisted across most of the equatorial Pacific Ocean.
During the last four weeks, negative changes in SST anomalies were apparent near Indonesia.
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 conditions.

*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 have been present for more than a year, with a peak in October and a minimum in early January 2019. Positive anomalies increased in January and February, and then decreased during March and early April.
Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have persisted across most of the equatorial Pacific Ocean.

Negative subsurface temperature anomalies have shifted to the far eastern Pacific (85°W-80°W).

The recent cooling in the central Pacific at 150-200m depth reflects an upwelling equatorial oceanic Kelvin wave.
Positive OLR anomalies (suppressed convection and precipitation) were evident around the Philippines and Malaysia. Negative OLR anomalies (enhanced convection and precipitation) were present around the Date Line and western equatorial Pacific.

Anomalous low-level (850-hPa) westerly winds were evident over the far western equatorial Pacific.

Upper-level (200-hPa) westerly wind anomalies were present across the central and western 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.
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.

In early August, October, and November 2018, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

Since early January 2019, a downwelling Kelvin wave has led to an eastward progression across the Pacific of increased positive subsurface temperature anomalies. The passage of this wave has been associated with a decrease in those positive anomalies.

In the last few weeks, positive subsurface temperature anomalies have increased in the eastern Pacific.
At times, the Madden Julian Oscillation (MJO) contributed to the eastward propagation of low-level wind anomalies.

During January-February 2019, westerly wind anomalies generally persisted over the west-central equatorial Pacific Ocean.

Since mid-March, westerly wind anomalies have generally persisted over the western equatorial Pacific, while easterly wind anomalies have persisted over the eastern Pacific.
Upper-level (200-hPa) Velocity Potential Anomalies

Since October through mid-March, eastward propagation has been evident in the anomalies.

Since early-to-mid March 2019, anomalous upper-level divergence (green shading) has persisted near the Date Line and western Pacific, while anomalous upper-level convergence (brown shading) was evident over 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).
From mid-October to late November 2018 and again between mid-December to mid January 2019, negative OLR anomalies persisted over the western Pacific.

During February 2019, positive OLR anomalies were over Indonesia, while negative OLR anomalies were near the Date Line.

More recently, negative OLR anomalies have persisted near the Date Line, while positive OLR anomalies were present over the Indian 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.
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 (January - March 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 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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El Niño conditions are favored to continue through fall 2019 with diminishing chances (~50% in October-November-December).
The majority of models predict a weak El Niño to continue into the Northern Hemisphere fall 2019.
The CFS.v2 ensemble mean (black dashed line) predicts El Niño to end during the Northern Hemisphere fall 2019.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid-February to mid-March, an anomalous ridge was present over the Alaska, and a downstream amplified trough was present over Canada and the northern U.S. These conditions contributed to well above-average temperatures in Alaska, and to below-average temperatures across much of Canada and the U.S.

Since mid March, a more zonal flow has been present across the U.S., resulting in near- or above-average temperatures over much of the country.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 13 April 2019
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 13 April 2019
U. S. Seasonal Outlooks
April-June 2019

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