ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
7 March 2022
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:  La Niña Advisory

La Niña is present.*

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

The tropical Pacific atmosphere is consistent with La Niña.

La Niña is likely to continue into the Northern Hemisphere spring (77% chance during March-May 2022) and then transition to ENSO-neutral (56% chance during May-July 2022).*

* 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 March to July 2021, equatorial SSTs gradually returned to average over most of the Pacific Ocean.

During January 2022, below-average equatorial SSTs weakened across the Pacific Ocean.

In the last week, below-average equatorial SSTs strengthened in the central and east-central Pacific Ocean.
Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

- Niño 4: -0.6°C
- Niño 3.4: -1.1°C
- Niño 3: -1.2°C
- Niño 1+2: -1.3°C
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were below average across the east-central and eastern Pacific Ocean and were above average in the western Pacific Ocean.
During the last four weeks, equatorial SSTs were below average across the east-central and eastern Pacific Ocean. Equatorial SSTs were above average in the western Pacific Ocean, eastern Indian Ocean, and western Atlantic Ocean.
During the last 4 weeks, negative SST anomalies have strengthened across the central and east-central equatorial Pacific Ocean.
Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative changes in equatorial SST anomalies were observed in the central and east-central Pacific.
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).
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

From mid-March to early July 2021, subsurface temperature was above average. Negative temperature anomalies returned in July 2021 and persisted through mid-January 2022. Since mid-January, subsurface temperatures have been near average.
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive temperature subsurface anomalies shifted eastward and weakened the negative anomalies at depth.

Recently, negative subsurface temperature anomalies have re-emerged near 140-150°W at depth, and have expanded across a shallow layer near the surface in the central and east-central Pacific.
Positive OLR anomalies (suppressed convection and precipitation) were located over the central Pacific Ocean. Negative OLR anomalies (enhanced convection and precipitation) were observed over the Philippines and parts of Indonesia, mostly north of the equator.

Low-level (850-hPa) easterly wind anomalies were evident over most of the equatorial Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies and an anomalous cyclonic couplet were observed over the east-central tropical 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 March through May 2021, positive anomalies shifted eastward in association with two downwelling Kelvin waves. In July 2021, September 2021, and November 2021 negative subsurface temperature anomalies shifted eastward associated with three upwelling Kelvin waves. From mid-December 2021 through February 2022, a downwelling Kelvin wave shifted eastward.

In early February 2022, an upwelling Kelvin wave emerged.

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.
Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s⁻¹)

At times, the Madden Julian-Oscillation (MJO) has contributed to the eastward propagation of low-level wind anomalies.

Since the beginning of the period, easterly wind anomalies have generally dominated over the central and east-central Pacific, except for breaks during late October 2021, and late December-to-January 2022.
Upper-level (200-hPa) Velocity Potential Anomalies

During most of the period, anomalous divergence (green shading) generally remained over Indonesia or the western Pacific, while anomalous convergence (brown shading) 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).
Since late July 2021, positive OLR anomalies were evident over the western and/or central Pacific Ocean.

Negative OLR anomalies were evident over Indonesia from mid-August to early October 2021, from early November 2021 through early January 2022, and since mid-February 2022.
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.

Note: a different SST dataset is used for weekly SST monitoring (slides #4-9) and is using OISSTv2.1 (Huang et al., 2021).
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 (December 2021 - February 2022) is -1.0°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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La Niña is expected to continue through Northern Hemisphere spring 2022. A transition to ENSO-neutral is favored in May-July 2022.
A majority of models indicate La Niña is expected to continue into spring 2022 and then transition to ENSO-neutral.
The CFS.v2 ensemble mean (black dashed line) predicts La Niña to continue into autumn 2022.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From early January to early February 2022, an anomalous ridge and above-average temperatures were located over western North America, and below-average temperatures and heights were evident over eastern North America.

Since early February, the pattern has resembled the pattern observed in late December 2021 to mid-January 2022. This pattern is consistent with La Niña and is characterized by height anomalies: 1) ridging over the central and eastern North Pacific Ocean, 2) a downstream trough centered over Canada, and 3) ridging over the southeastern U.S. This pattern is conducive to below-average temperature over the northern tier of the U.S. and above-average temperature over the southeastern and eastern U.S.
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U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 5 March 2022
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 5 March 2022
The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.
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