ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
11 July 2022
Summary
Recent Evolution and Current Conditions
Oceanic Niño Index (ONI)
Pacific SST Outlook
U.S. Seasonal Precipitation and Temperature Outlooks
Summary
Summary

ENSO Alert System Status: **La Niña Advisory**

La Niña is present.*

Equatorial sea surface temperatures (SSTs) are below average across most of the Pacific Ocean.

The tropical Pacific atmosphere is consistent with La Niña.

Though La Niña is favored to continue through the end of the year, the odds for La Niña decrease into the Northern Hemisphere late summer (52% chance in July-September 2022) before slightly increasing through the Northern Hemisphere fall and early winter 2022 (58-59% 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 mid-May, below-average SSTs have weakened across most of the equatorial Pacific Ocean.
Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

- Niño 4  -0.8°C
- Niño 3.4 -0.5°C
- Niño 3  -0.4°C
- Niño 1+2 -1.2°C
In the last four weeks, equatorial SSTs were below average in the central and eastern Pacific Ocean, but had returned to near-average in the east-central Pacific.
During the last four weeks, equatorial SSTs were below average across much of the Pacific Ocean. Equatorial SSTs were above average near Indonesia, across much of the Atlantic Ocean, and in the central Indian Ocean.
During the last 4 weeks, negative SST anomalies have weakened in the east-central and eastern equatorial Pacific.
During the last four weeks, positive changes in equatorial SST anomalies were observed across the east-central Pacific Ocean, while negative changes were evident in the west-central 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 (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).
From early July 2021 to mid-January 2022, negative subsurface temperature anomalies were observed. During February 2022 through mid-March, subsurface temperature anomalies decreased. Since then, negative anomalies have gradually weakened and are now slightly positive.
During the last two months, positive subsurface temperature anomalies have expanded eastward and extend across most of the equatorial Pacific Ocean.

Negative subsurface temperature anomalies remain near the surface in the central Pacific Ocean, and also are evident to ~200m depth in the eastern Pacific Ocean.
Positive OLR anomalies (suppressed convection and precipitation) were located over the central and western Pacific Ocean. Negative OLR anomalies (enhanced convection and precipitation) were observed over parts of Indonesia.

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

Upper-level (200-hPa) westerly wind anomalies were observed over the central and east-central tropical Pacific, along with an anomalous cyclonic couplet.
Intraseasonal Variability

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. 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.

During March-May 2022, an upwelling Kelvin wave shifted eastward into the eastern Pacific Ocean, which was followed by a downwelling Kelvin wave in the last couple of months.

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

During most of the period, anomalous divergence (green shading) generally remained near Indonesia, 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).
Outgoing Longwave Radiation (OLR) Anomalies

Since late July 2021, positive OLR anomalies were evident over the western and/or central Pacific Ocean.

Negative OLR anomalies were evident over Indonesia during February to early March 2022, from mid-March to early April, the first half of May, and, more recently, in June.

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.

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.
The most recent ONI value (April - June 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 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.

<table>
<thead>
<tr>
<th>Year</th>
<th>DJF</th>
<th>JFM</th>
<th>FMA</th>
<th>MAM</th>
<th>AMJ</th>
<th>MJJ</th>
<th>JJA</th>
<th>JAS</th>
<th>ASO</th>
<th>SON</th>
<th>OND</th>
<th>NDJ</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1.5</td>
<td>1.2</td>
<td>0.8</td>
<td>0.4</td>
<td>-0.2</td>
<td>-0.7</td>
<td>-1.0</td>
<td>-1.3</td>
<td>-1.6</td>
<td>-1.6</td>
<td>-1.6</td>
<td>-1.6</td>
</tr>
<tr>
<td>2011</td>
<td>-1.4</td>
<td>-1.2</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.6</td>
<td>-0.4</td>
<td>-0.5</td>
<td>-0.6</td>
<td>-0.8</td>
<td>-1.0</td>
<td>-1.1</td>
<td>-1.0</td>
</tr>
<tr>
<td>2012</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.6</td>
<td>-0.5</td>
<td>-0.3</td>
<td>0.0</td>
<td>0.2</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.2</td>
</tr>
<tr>
<td>2013</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.3</td>
<td>-0.3</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.3</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td>-0.4</td>
<td>-0.5</td>
<td>-0.3</td>
<td>0.0</td>
<td>0.2</td>
<td>0.2</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>2015</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.7</td>
<td>0.9</td>
<td>1.2</td>
<td>1.5</td>
<td>1.9</td>
<td>2.2</td>
<td>2.4</td>
<td>2.6</td>
<td>2.6</td>
</tr>
<tr>
<td>2016</td>
<td>2.5</td>
<td>2.1</td>
<td>1.6</td>
<td>0.9</td>
<td>0.4</td>
<td>-0.1</td>
<td>-0.4</td>
<td>-0.5</td>
<td>-0.6</td>
<td>-0.7</td>
<td>-0.7</td>
<td>-0.6</td>
</tr>
<tr>
<td>2017</td>
<td>-0.3</td>
<td>-0.2</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
<td>0.1</td>
<td>-0.1</td>
<td>-0.4</td>
<td>-0.7</td>
<td>-0.8</td>
<td>-1.0</td>
</tr>
<tr>
<td>2018</td>
<td>-0.9</td>
<td>-0.9</td>
<td>-0.7</td>
<td>-0.5</td>
<td>-0.2</td>
<td>0.0</td>
<td>0.1</td>
<td>0.2</td>
<td>0.5</td>
<td>0.8</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>2019</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.5</td>
<td>0.5</td>
<td>0.3</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>2020</td>
<td>0.5</td>
<td>0.5</td>
<td>0.4</td>
<td>0.2</td>
<td>-0.1</td>
<td>-0.3</td>
<td>-0.4</td>
<td>-0.6</td>
<td>-0.9</td>
<td>-1.2</td>
<td>-1.3</td>
<td>-1.2</td>
</tr>
<tr>
<td>2021</td>
<td>-1.0</td>
<td>-0.9</td>
<td>-0.8</td>
<td>-0.7</td>
<td>-0.5</td>
<td>-0.4</td>
<td>-0.5</td>
<td>-0.7</td>
<td>-0.8</td>
<td>-1.0</td>
<td>-1.0</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>-1.0</td>
<td>-0.9</td>
<td>-1.0</td>
<td>-1.1</td>
<td>-1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The odds for La Niña decrease into the Northern Hemisphere late summer (52% chance in July-September 2022) before slightly increasing through the Northern Hemisphere fall and early winter 2022 (58-59% chance).
La Niña is expected to weaken, but persist through the Northern Hemisphere summer and into early winter 2022-23.
The CFS.v2 ensemble mean (black dashed line) indicates weak La Niña conditions through the Northern Hemisphere winter.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid-May through mid-June, below-average heights and temperatures were observed over the northwestern and north-central U.S., while above-average heights and temperatures prevailed over the southern and/or eastern U.S.

Since mid-June, above-average heights and temperatures have been evident over most of the contiguous U.S. with the exception of the Northwest and Northeast.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid-May through mid-June, below-average heights and temperatures were observed over the northwestern and north-central U.S., while above-average heights and temperatures prevailed over the southern and/or eastern U.S.

Since mid-June, above-average heights and temperatures have been evident over most of the contiguous U.S. with the exception of the Northwest and Northeast.
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From mid-May through mid-June, below-average heights and temperatures were observed over the northwestern and north-central U.S., while above-average heights and temperatures prevailed over the southern and/or eastern U.S.

Since mid-June, above-average heights and temperatures have been evident over most of the contiguous U.S. with the exception of the Northwest and Northeast.
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 10 July 2022
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 10 July 2022
The seasonal outlooks combine the effects of long-term trends, soil moisture, and, when appropriate, ENSO.
Summary

ENSO Alert System Status:  La Niña Advisory

La Niña is present.*

Equatorial sea surface temperatures (SSTs) are below average across most of the Pacific Ocean.

The tropical Pacific atmosphere is consistent with La Niña.

Though La Niña is favored to continue through the end of the year, the odds for La Niña decrease into the Northern Hemisphere late summer (52% chance in July-September 2022) before slightly increasing through the Northern Hemisphere fall and early winter 2022 (58-59% 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](#).