### ENSO: Recent Evolution, Current Status and Predictions



### Outline

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: El Niño Advisory / La Niña Watch

El Niño conditions are observed.\*

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

The tropical Pacific atmospheric anomalies are weakening.

A transition from El Niño to ENSO-neutral is likely by April-June 2024 (85% chance), with the odds of La Niña developing by June-August 2024 (60% chance).\*

\* Note: These statements are updated once a month (2<sup>nd</sup> Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

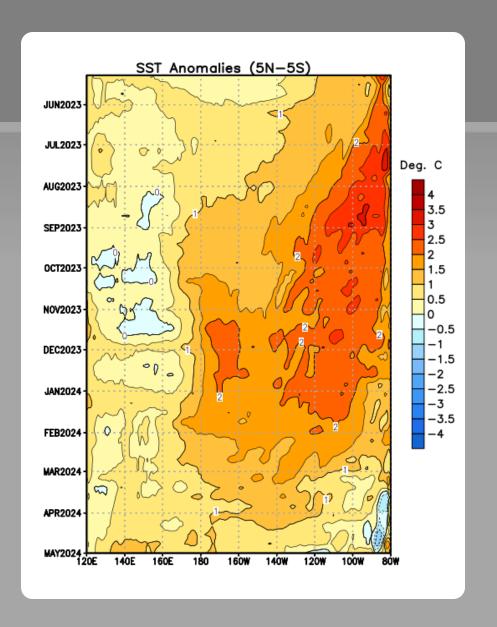
#### Recent Evolution of Equatorial Pacific SST Departures (°C)

From March-October 2023, positive sea surface temperature (SST) anomalies in the eastern Pacific Ocean expanded and shifted westward.

In October and November 2023, SST anomalies increased in the central and east-central Pacific.

Since late December 2023, positive SST anomalies have weakened across most of the Pacific.

Recently, below-average SSTs emerged in small regions of the eastern Pacific.



#### Niño Region SST Departures (°C) Recent Evolution

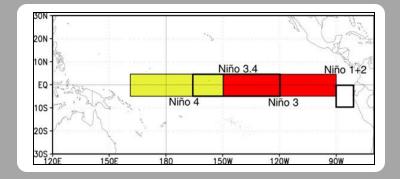
### The latest weekly SST departures are:

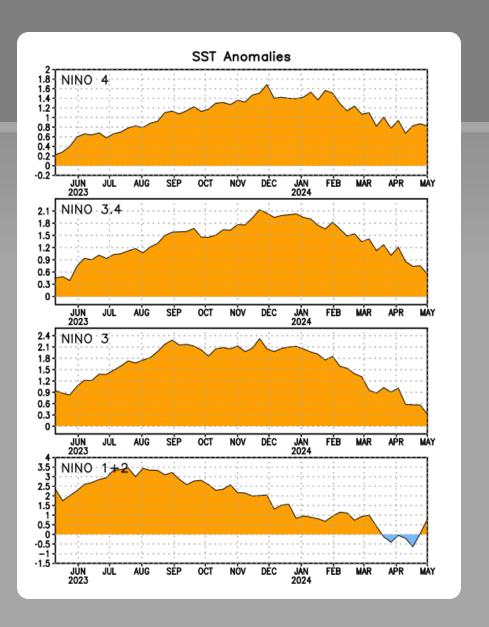
 Niño 4
 0.8°C

 Niño 3.4
 0.5°C

 Niño 3
 0.3°C

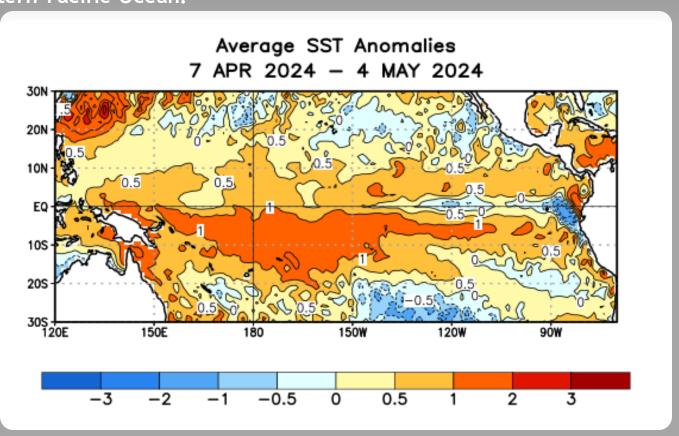
 Niño 1+2
 0.8°C





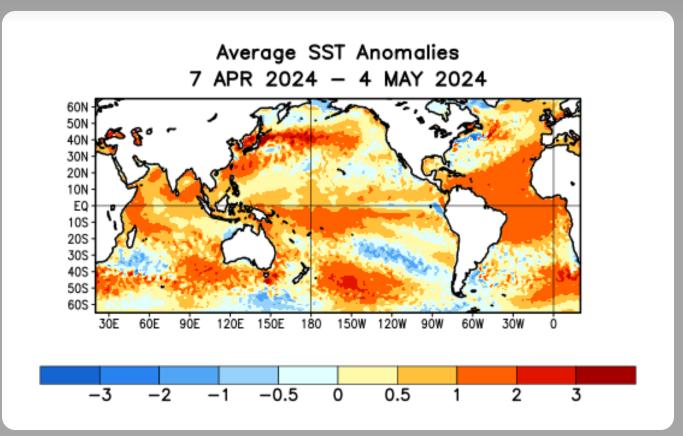
#### SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were above average the central and western Pacific Ocean. Near-to-below-average SSTs were evident in parts of the east-central and eastern Pacific Ocean.



#### Global SST Departures (°C) During the Last Four Weeks

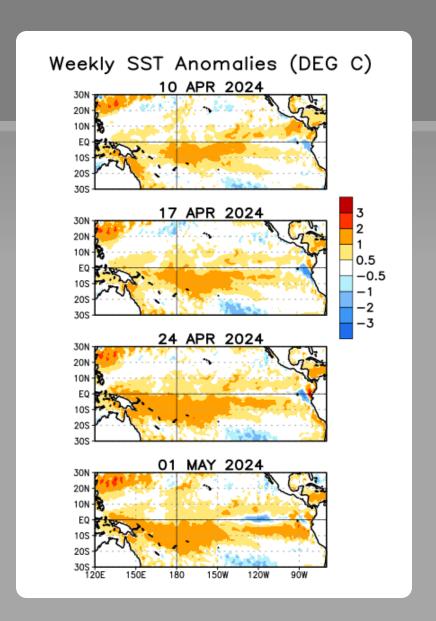
During the last four weeks, equatorial SSTs were above average across the western and central Pacific Ocean, the Indian Ocean, and the Atlantic Ocean. Near-to-below-average SSTs were evident in parts of the eastern Pacific Ocean.



# Weekly SST Departures during the Last Four Weeks

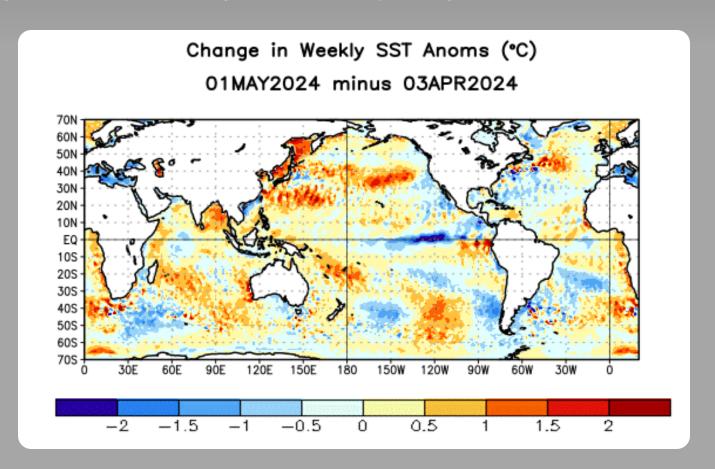
During the last 4 weeks, above-average SSTs weakened across most of the equatorial Pacific Ocean.

Below-average SSTs have persisted in parts of the east-central and eastern Pacific Ocean.



### Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative SST anomaly changes were observed in the east-central equatorial Pacific, with positive anomaly changes in the far eastern Pacific.



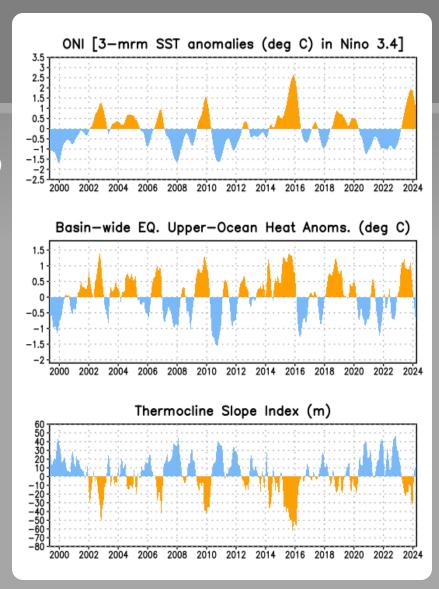
### Upper-Ocean Conditions in the Equatorial Pacific

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.

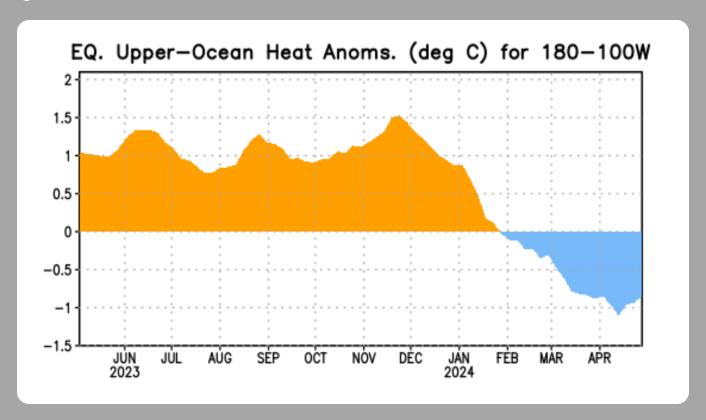
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (slightly above average) reflect a weakening El Niño.

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).



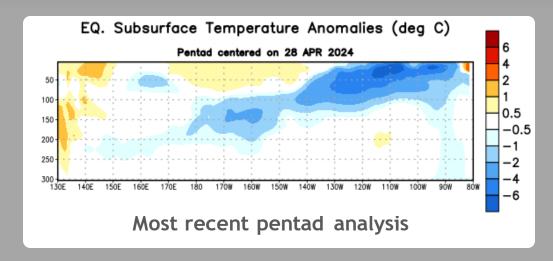
### Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies persisted through mid-January 2024. Variability in the anomalies was associated with several oceanic Kelvin waves. Subsurface temperature anomalies have weakened since late November 2023. From late January to mid-April 2024, negative temperature anomalies strengthened.

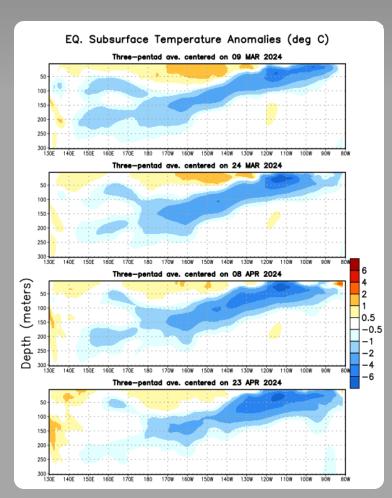


### Sub-Surface Temperature Departures in the Equatorial Pacific

Over the last couple months, negative subsurface temperature anomalies strengthened across the equatorial Pacific Ocean.



Below-average temperatures reached the surface in the eastern Pacific Ocean (near 130°-90°W).

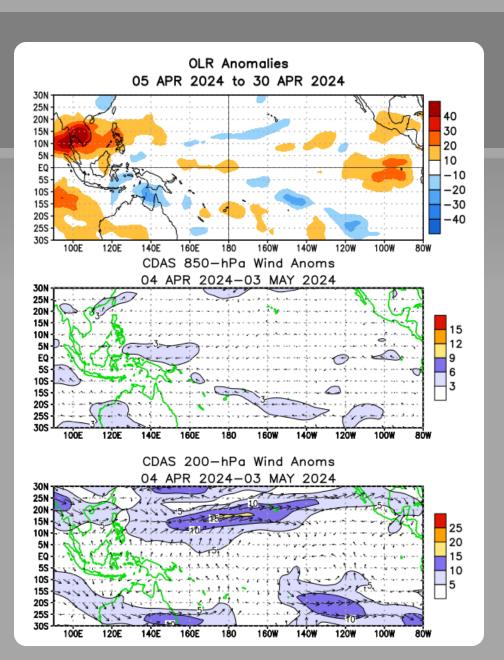


#### Tropical OLR and Wind Anomalies During the Last 30 Days

OLR was near average across most of the equatorial Pacific, and slightly above average (suppressed convection and precipitation) around the Philippines and Southeast Asia.

Low-level (850-hPa) wind anomalies were easterly over the western tropical Pacific Ocean.

Upper-level (200-hPa) wind anomalies were easterly over the east-central equatorial Pacific.



#### 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.

#### Weekly Heat Content Evolution in the Equatorial Pacific

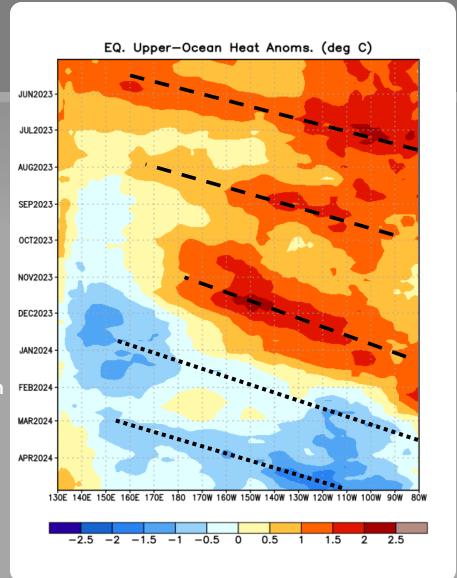
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

Through January 2024, above-average subsurface temperatures persisted across most of the Pacific Ocean.

From November 2023 through March 2024, belowaverage temperatures strengthened in the western Pacific Ocean and shifted into the eastern Pacific.

Since late February 2024, another upwelling Kelvin wave has shifted eastward.

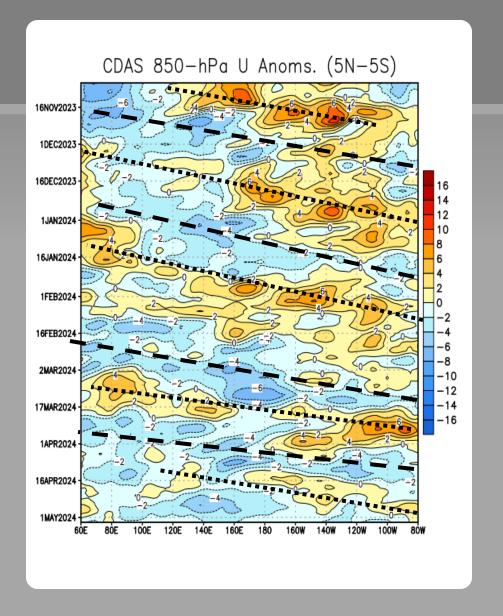
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.



# Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s<sup>-1</sup>)

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

An eastward propagating pattern of westerly and easterly wind anomalies was evident starting in November 2023.

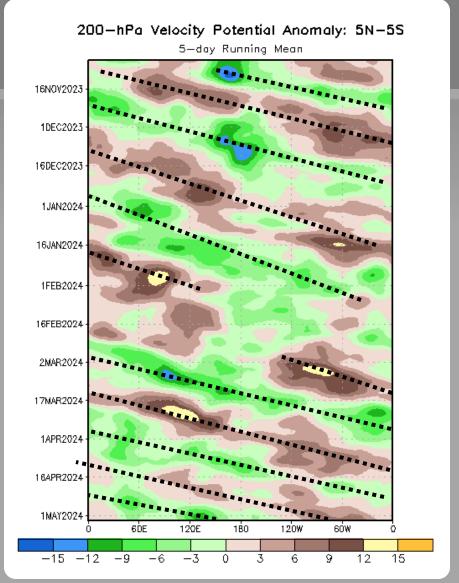


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

# Upper-level (200-hPa) Velocity Potential Anomalies

Since the beginning of the period, regions of anomalous divergence (green shading) and convergence (brown shading) were generally propagating eastward.

From early December 2023 to mid-March 2024, anomalous divergence persisted over the central Pacific.



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

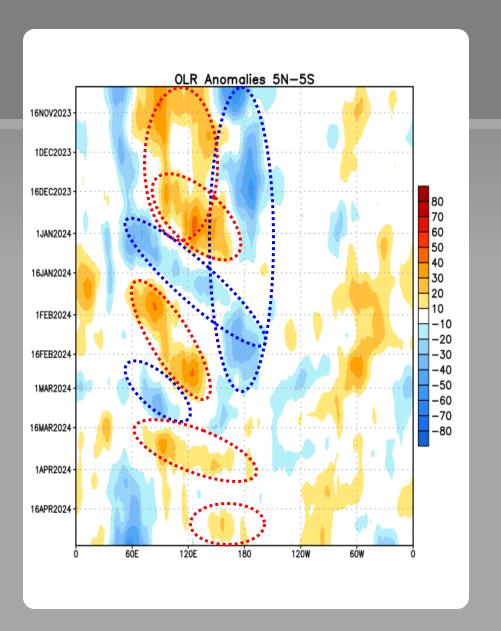
Through early March 2024, negative OLR anomalies (more convection) persisted over the central equatorial Pacific Ocean

Through December 2023, positive OLR anomalies persisted around Indonesia.

From mid-December 2023 through March 2024, OLR anomalies shifted eastward from the Indian Ocean/Indonesia to the western Pacific/Date Line.

Since mid-April 2024, OLR was slightly above-average in the western and central equatorial 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.

Note: a different SST dataset is used for weekly SST monitoring (slides #4-9) and is using OISSTv2.1 (Huang et al., 2021).

#### 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.

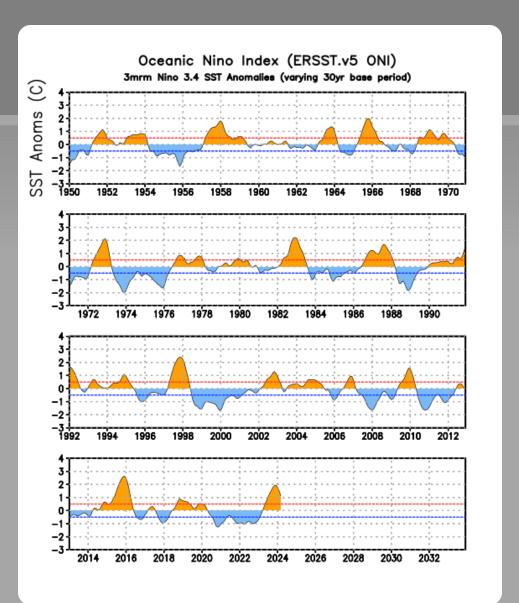
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (February - April 2024) is 1.1°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 over-lapping seasons.

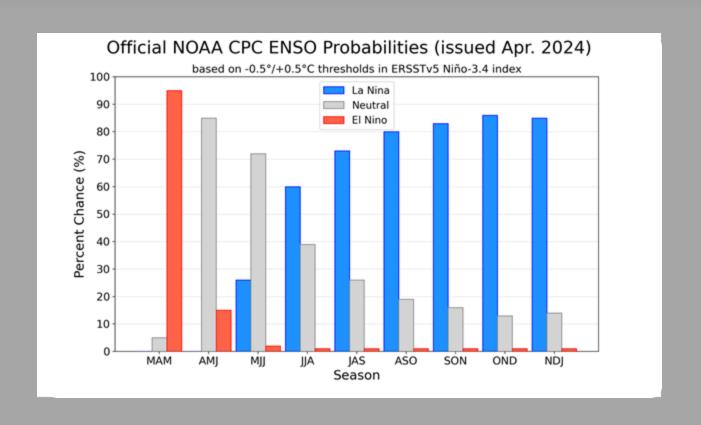
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found <a href="https://example.com/here">here</a>.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2012	-0.9	-0.7	-0.6	-0.5	-0.3	0.0	0.2	0.4	0.4	0.3	0.1	-0.2
2013	-0.4	-0.4	-0.3	-0.3	-0.4	-0.4	-0.4	-0.3	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.5	-0.3	0.0	0.2	0.2	0.0	0.1	0.2	0.5	0.6	0.7
2015	0.5	0.5	0.5	0.7	0.9	1.2	1.5	1.9	2.2	2.4	2.6	2.6
2016	2.5	2.1	1.6	0.9	0.4	-0.1	-0.4	-0.5	-0.6	-0.7	-0.7	-0.6
2017	-0.3	-0.2	0.1	0.2	0.3	0.3	0.1	-0.1	-0.4	-0.7	-0.8	-1.0
2018	-0.9	-0.9	-0.7	-0.5	-0.2	0.0	0.1	0.2	0.5	0.8	0.9	0.8
2019	0.7	0.7	0.7	0.7	0.5	0.5	0.3	0.1	0.2	0.3	0.5	0.5
2020	0.5	0.5	0.4	0.2	-0.1	-0.3	-0.4	-0.6	-0.9	-1.2	-1.3	-1.2
2021	-1.0	-0.9	-0.8	-0.7	-0.5	-0.4	-0.4	-0.5	-0.7	-0.8	-1.0	-1.0
2022	-1.0	-0.9	-1.0	-1.1	-1.0	-0.9	-0.8	-0.9	-1.0	-1.0	-0.9	-0.8
2023	-0.7	-0.4	-0.1	0.2	0.5	0.8	1.1	1.3	1.6	1.8	1.9	2.0
2024	1.8	1.5	1.1									

#### **CPC Probabilistic ENSO Outlook**

Updated: 11 April 2024

A transition from El Niño to ENSO-neutral is likely by April-June 2024 (85% chance), with the odds of La Niña developing by June-August 2024 (60% chance).



### IRI Pacific Niño 3.4 SST Model Outlook

The majority of models indicate a transition to ENSO-neutral during April-June 2024.

After a brief period of ENSOneutral conditions, most models indicate a transition to La Niña around July-September 2024.

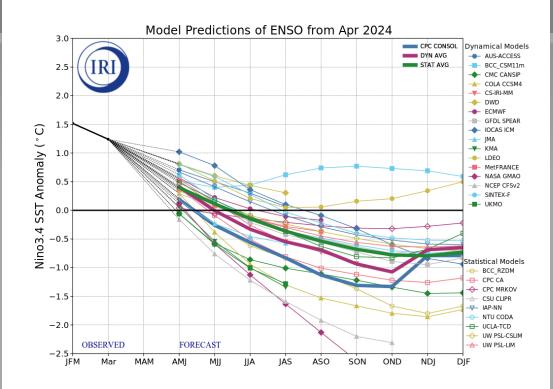
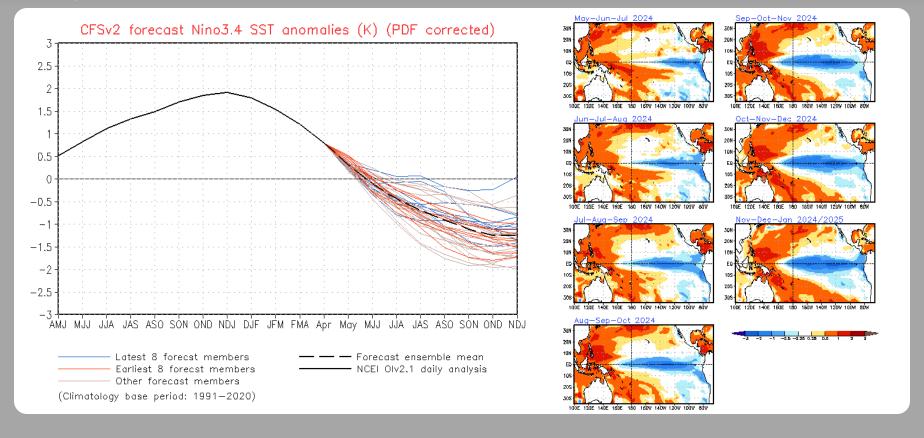


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 April 2024).

#### SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

Issued: 6 May 2024

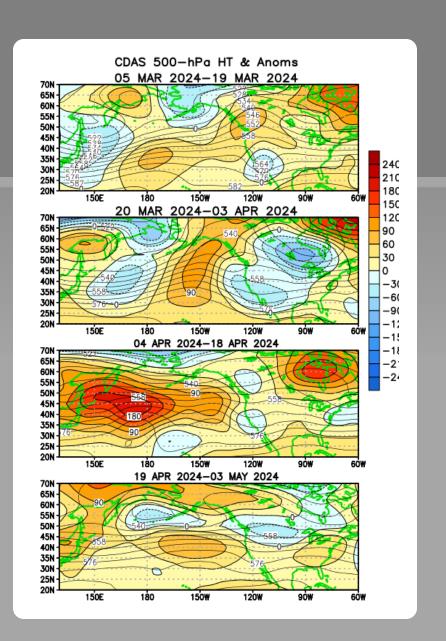
The CFS.v2 ensemble mean (black dashed line) indicates El Niño may transition to ENSO-neutral in May, followed by a transition to La Niña around June-August 2024.



### Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From early March through late April, belowaverage heights and temperatures persisted in the eastern North Pacific Ocean and western contiguous U.S.

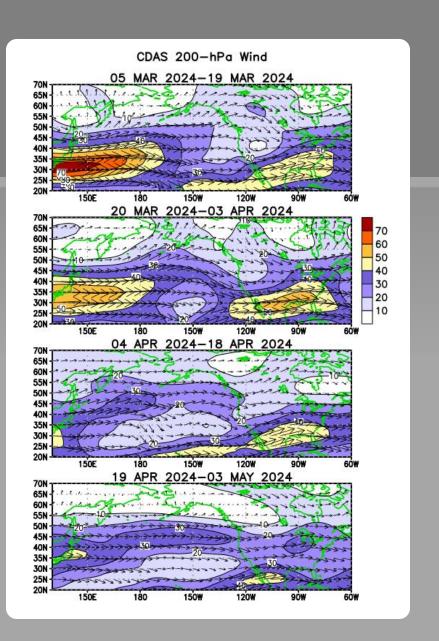
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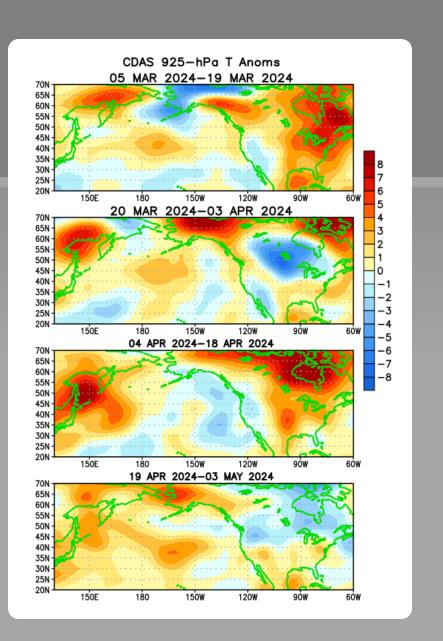
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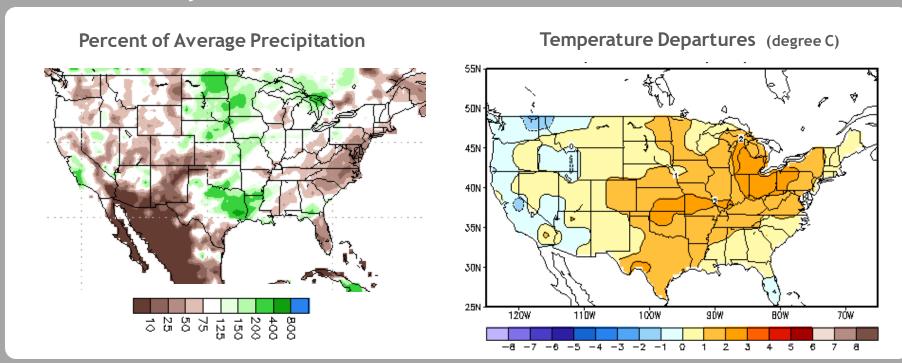
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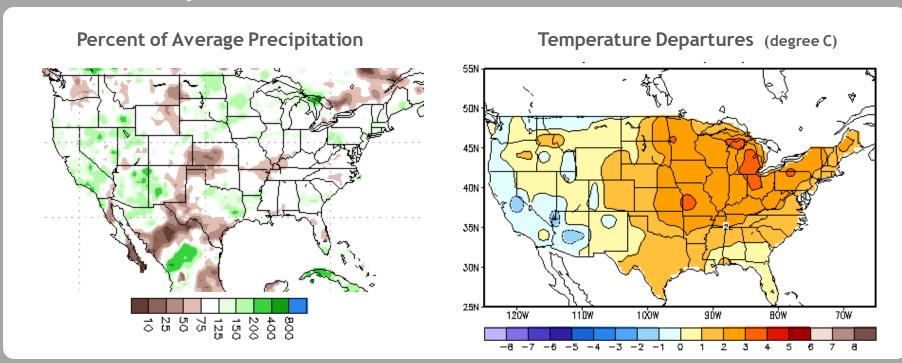
### U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 4 May 2024



### U.S. Temperature and Precipitation Departures During the Last 90 Days

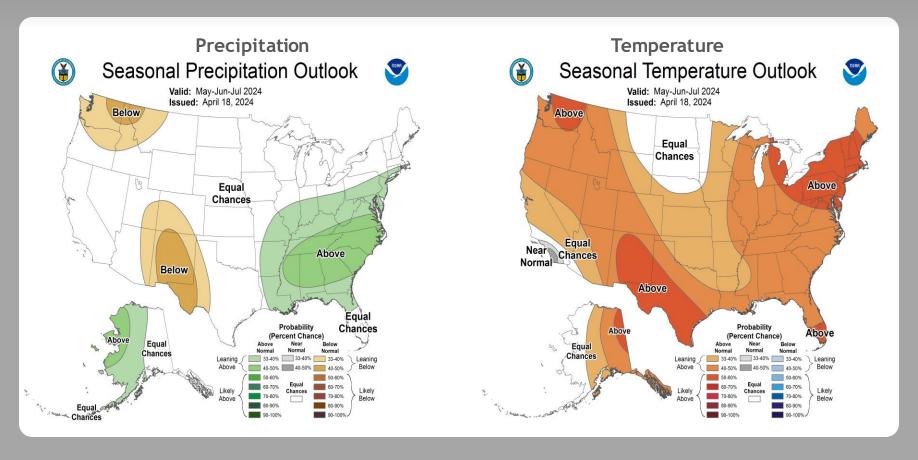
End Date: 4 May 2024



#### U. S. Seasonal Outlooks

May - July 2024

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



## Summary

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El Niño conditions are observed.\*

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

The tropical Pacific atmospheric anomalies are weakening.

A transition from El Niño to ENSO-neutral is likely by April-June 2024 (85% chance), with the odds of La Niña developing by June-August 2024 (60% chance).\*

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