ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
21 April 2025

Outline

Summary

Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

U.S. Seasonal Precipitation and Temperature Outlooks

Summary

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

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SSTs) are near-to-below average in the east-central and central Pacific Ocean and are above-average in the eastern Pacific Ocean.

ENSO-neutral is favored during the Northern Hemisphere summer, with a greater than 50% chance through August-October 2025.

* 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.

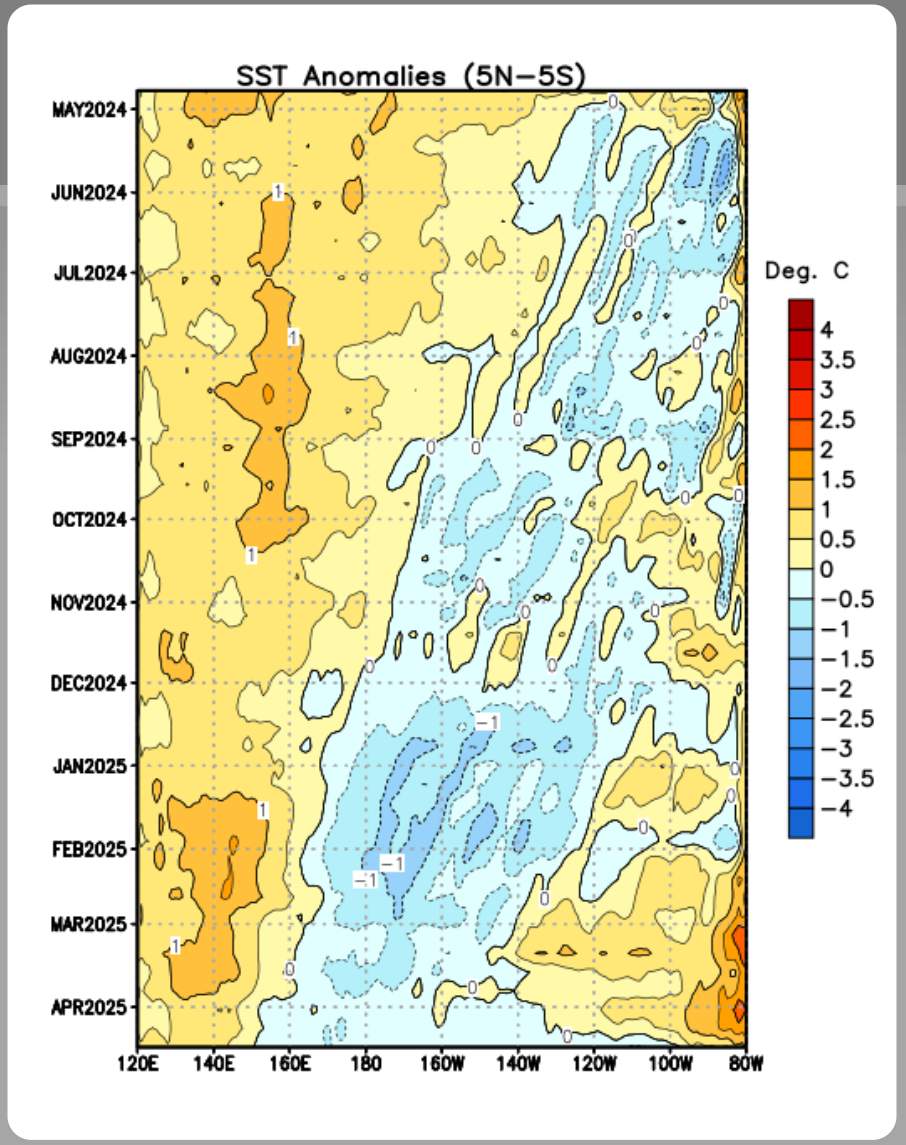
Recent Evolution of Equatorial Pacific SST Departures (°C)

Beginning in mid-March 2024, mostly near-to-below-average sea surface temperatures (SSTs) emerged in the eastern Pacific Ocean and expanded westward.

Since early December 2024, below-average SSTs persisted across the central Pacific.

During February and March 2025, SST anomalies increased across most the equatorial Pacific.

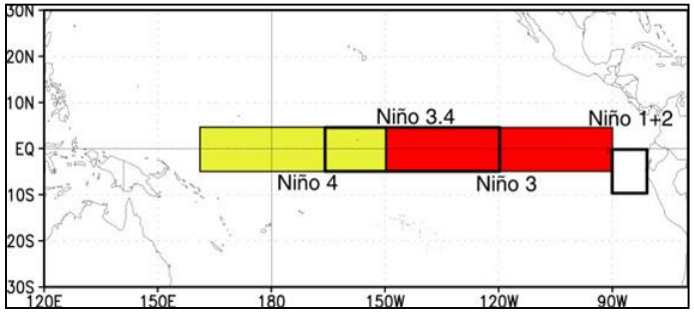
In the last couple weeks, SST anomalies have decreased in the east-central and eastern Pacific.

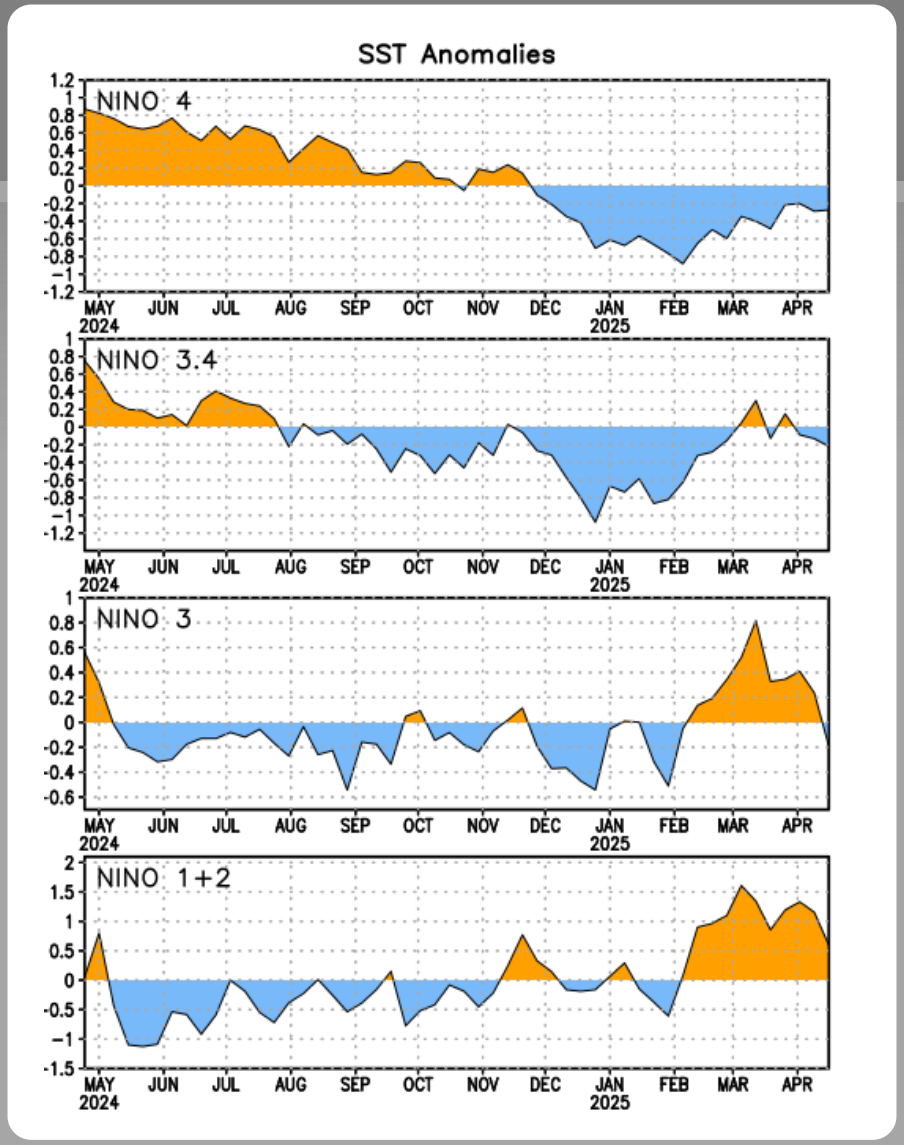


Niño Region SST Departures (°C) Recent Evolution

The latest weekly SST departures are:

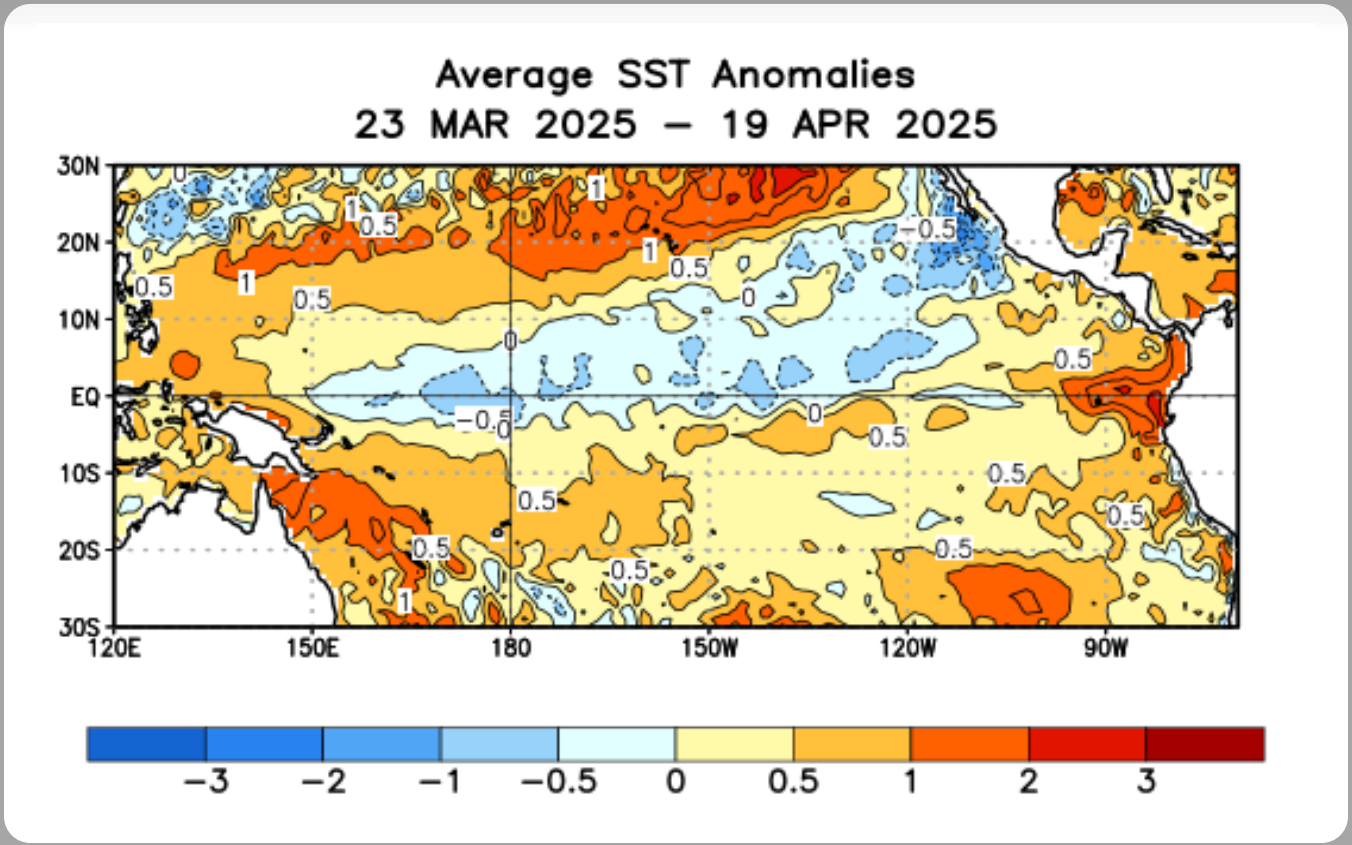
Niño 4	-0.3°C
Niño 3.4	-0.2°C
Niño 3	-0.2°C
Niño 1+2	0.6°C





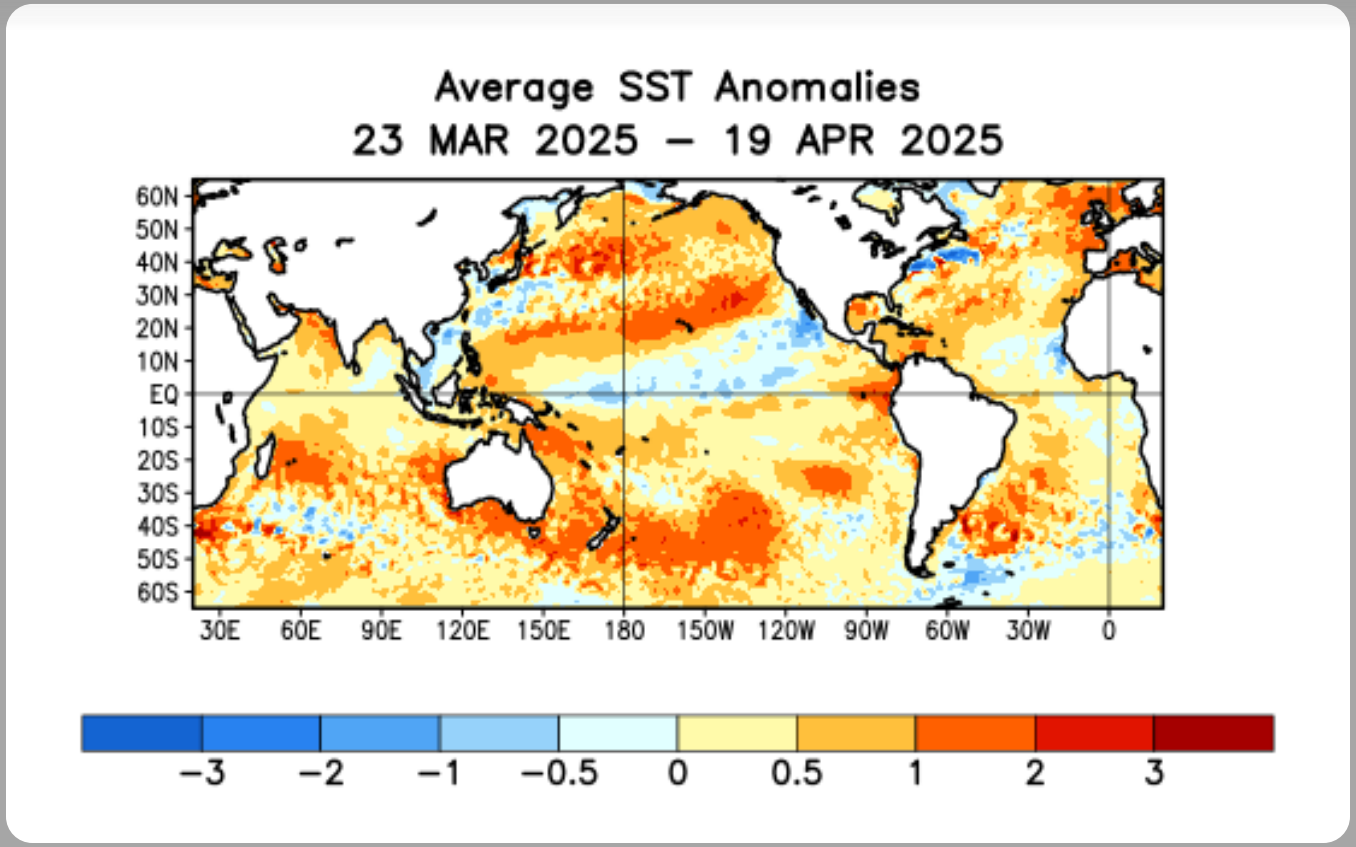
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were above average in the eastern and far western Pacific Ocean. Below average SSTs were evident in the central and east-central Pacific Ocean.



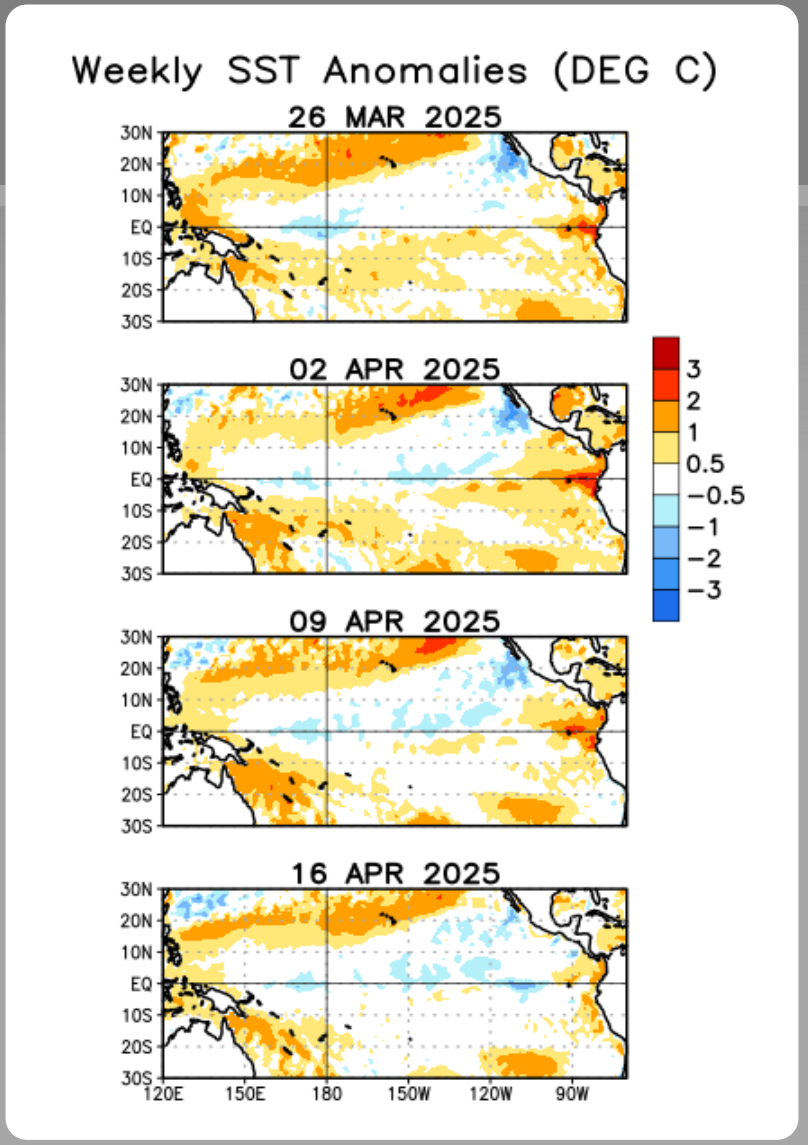
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average in the eastern and far western Pacific Ocean. Below-average SSTs were evident in the central and east-central Pacific Ocean.



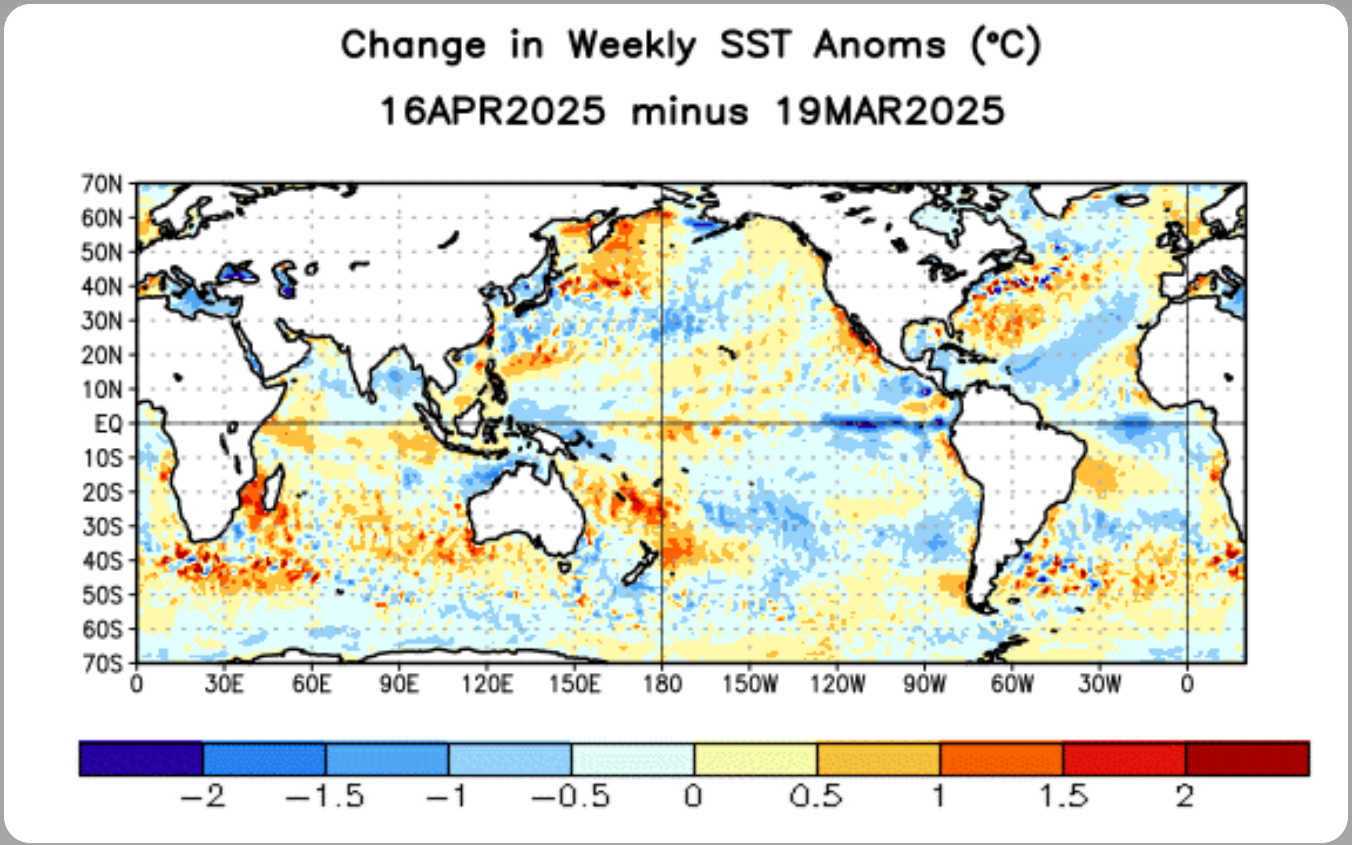
Weekly SST Departures during the Last Four Weeks

During the last 4 weeks, near-to-below-average SSTs persisted in the central equatorial Pacific Ocean. In the eastern Pacific, above-average SSTs weakened.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative SST anomaly changes were evident in the eastern and far western equatorial Pacific Ocean.



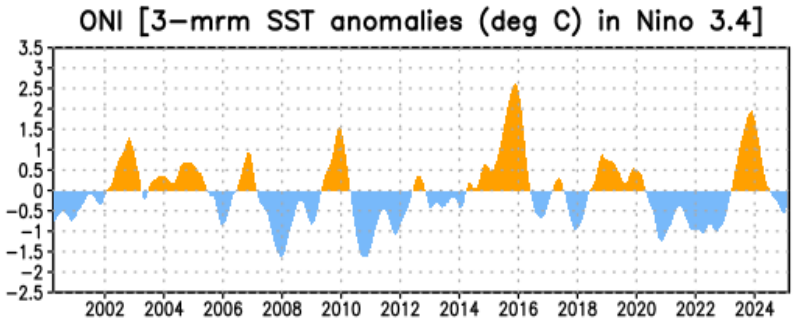
Upper-Ocean Conditions in the Equatorial Pacific

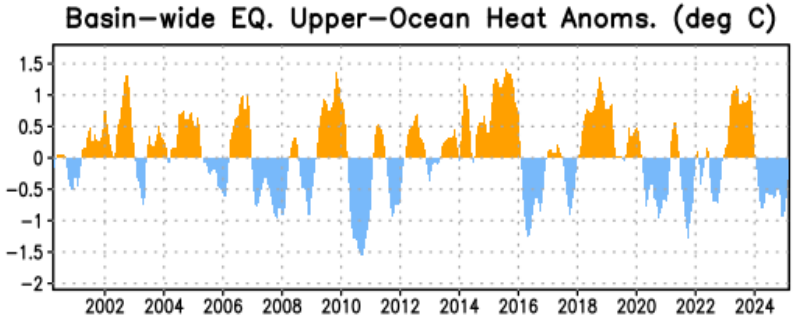
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

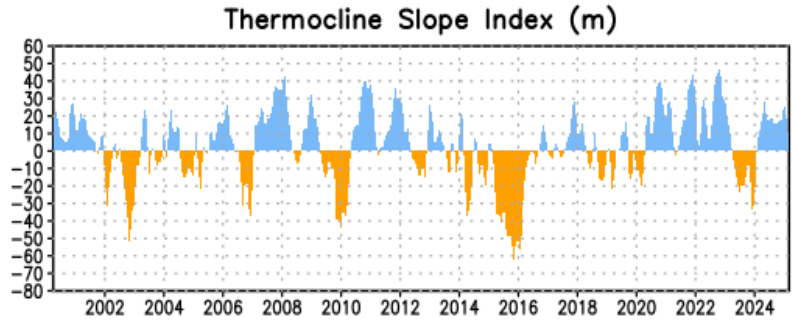
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (near-to-below average) and thermocline slope index (near-to-above 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).

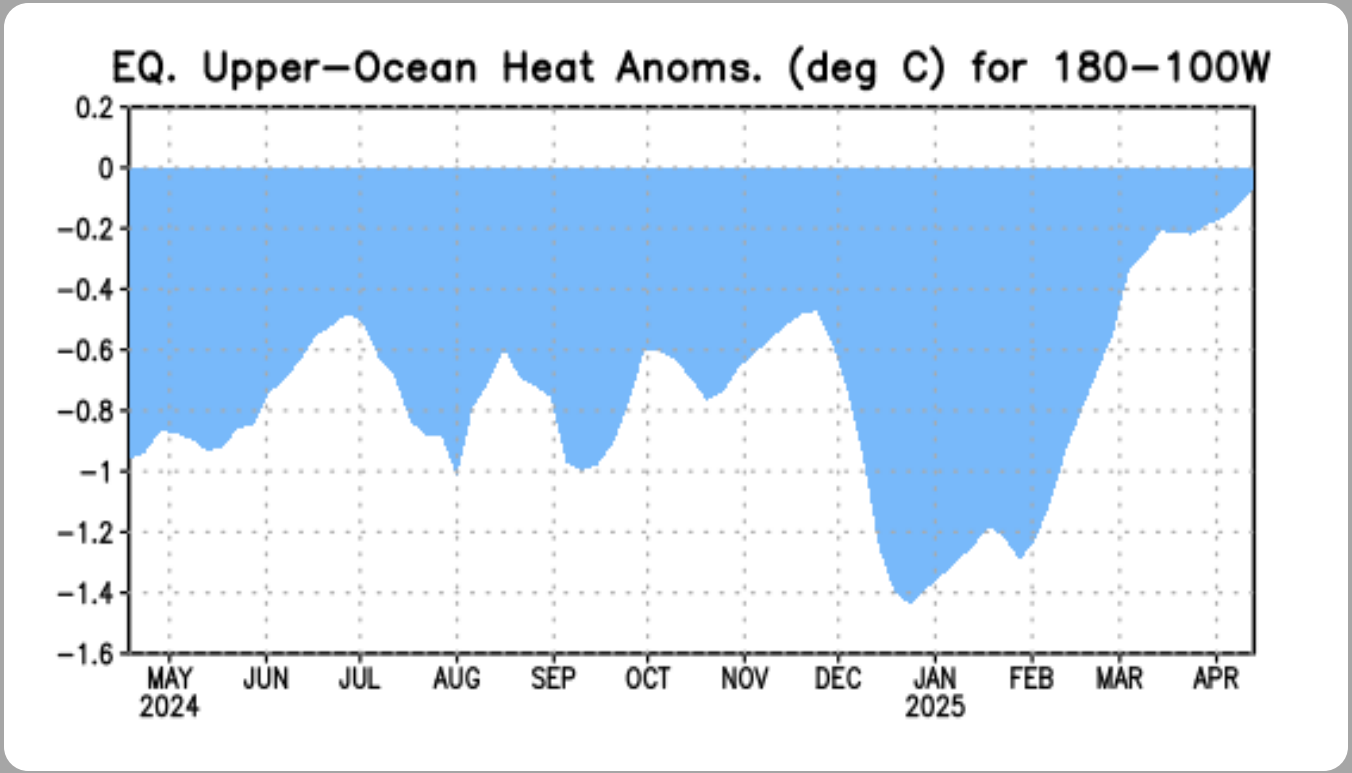






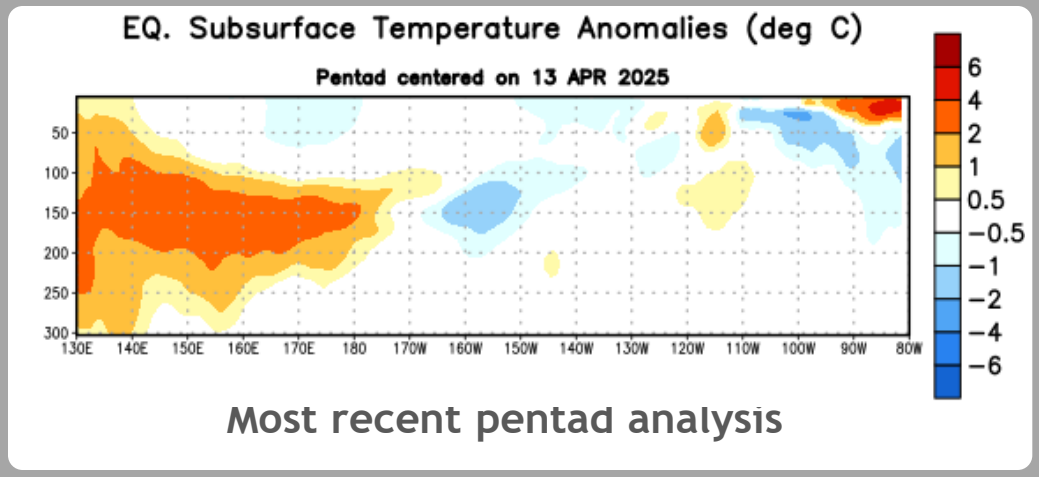
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Since the start of the period, negative subsurface temperature anomalies have dominated. Negative anomalies strengthened in December 2024, reaching a minimum late in the month. In February and March 2025, negative anomalies significantly weakened, but remain slightly negative.



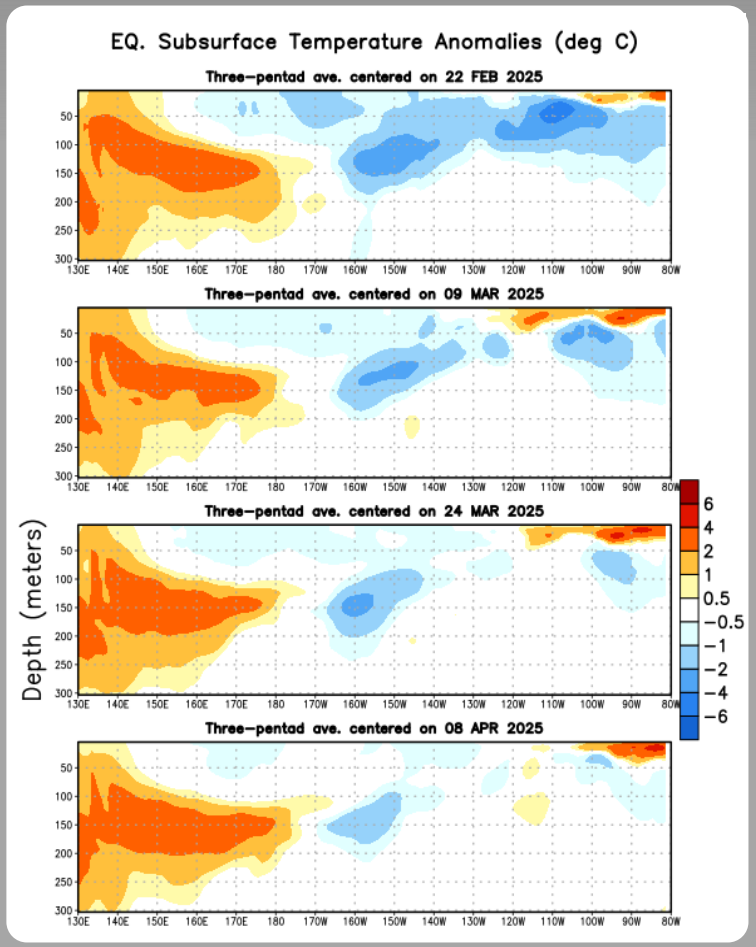
Sub-Surface Temperature Departures in the Equatorial Pacific

Over the last couple of months, negative subsurface temperature anomalies weakened in the central and eastern equatorial Pacific Ocean.



Most recent pentad analysis

Near-to-below-average subsurface temperatures continue in the central Pacific Ocean, while above-average temperatures remain in the western Pacific and in a shallow layer near the surface in the eastern Pacific Ocean.

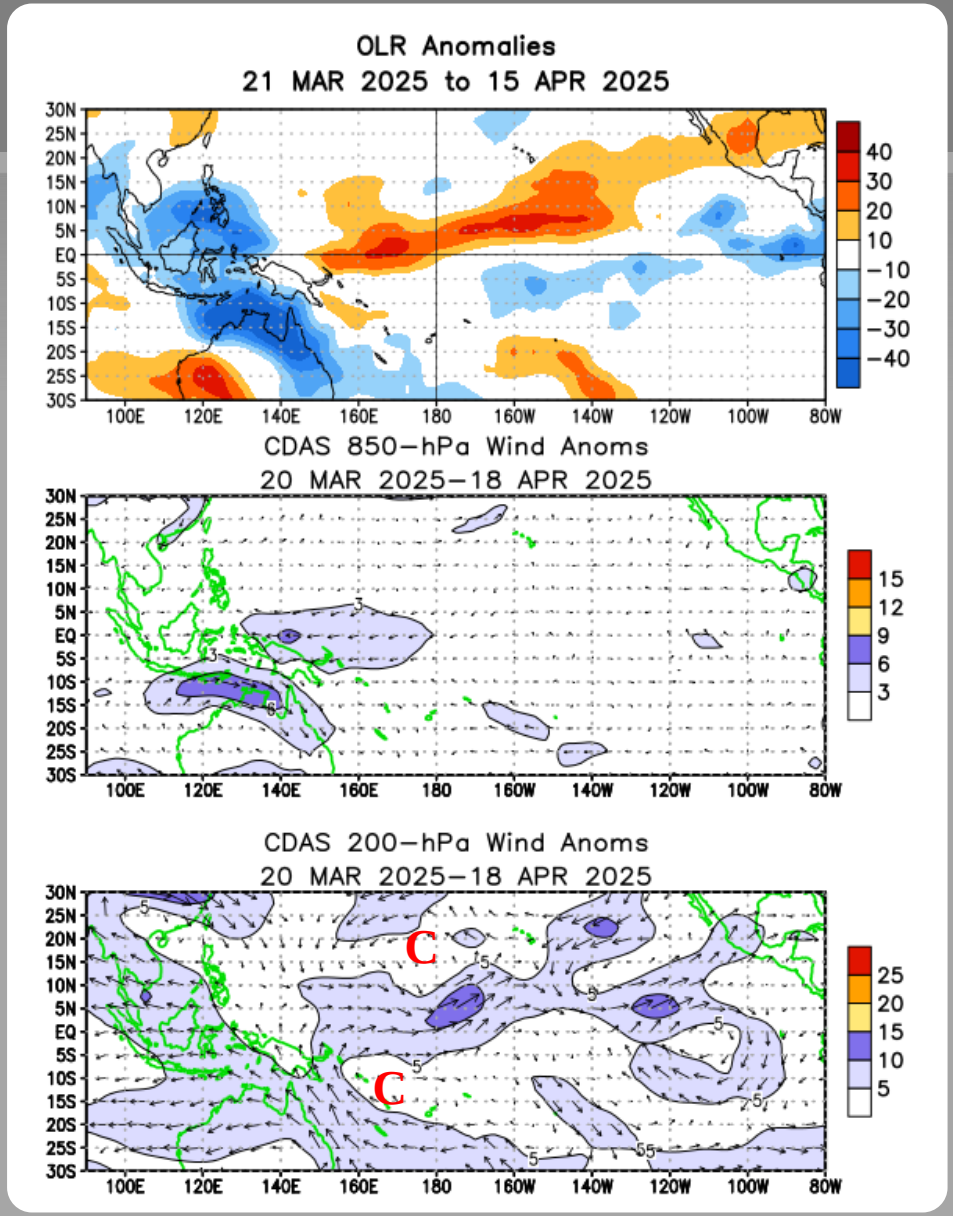


Tropical OLR and Wind Anomalies During the Last 30 Days

Above-average OLR (suppressed convection and precipitation) was observed around the Date Line and western Pacific. Below-average OLR (enhanced convection and precipitation) was evident over Indonesia, the Philippines, northern Australia, and the eastern Pacific.

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

Upper-level (200-hPa) wind anomalies were westerly over the western and central equatorial Pacific Ocean. An anomalous cyclonic couplet straddled the equator over the central Pacific Ocean.



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

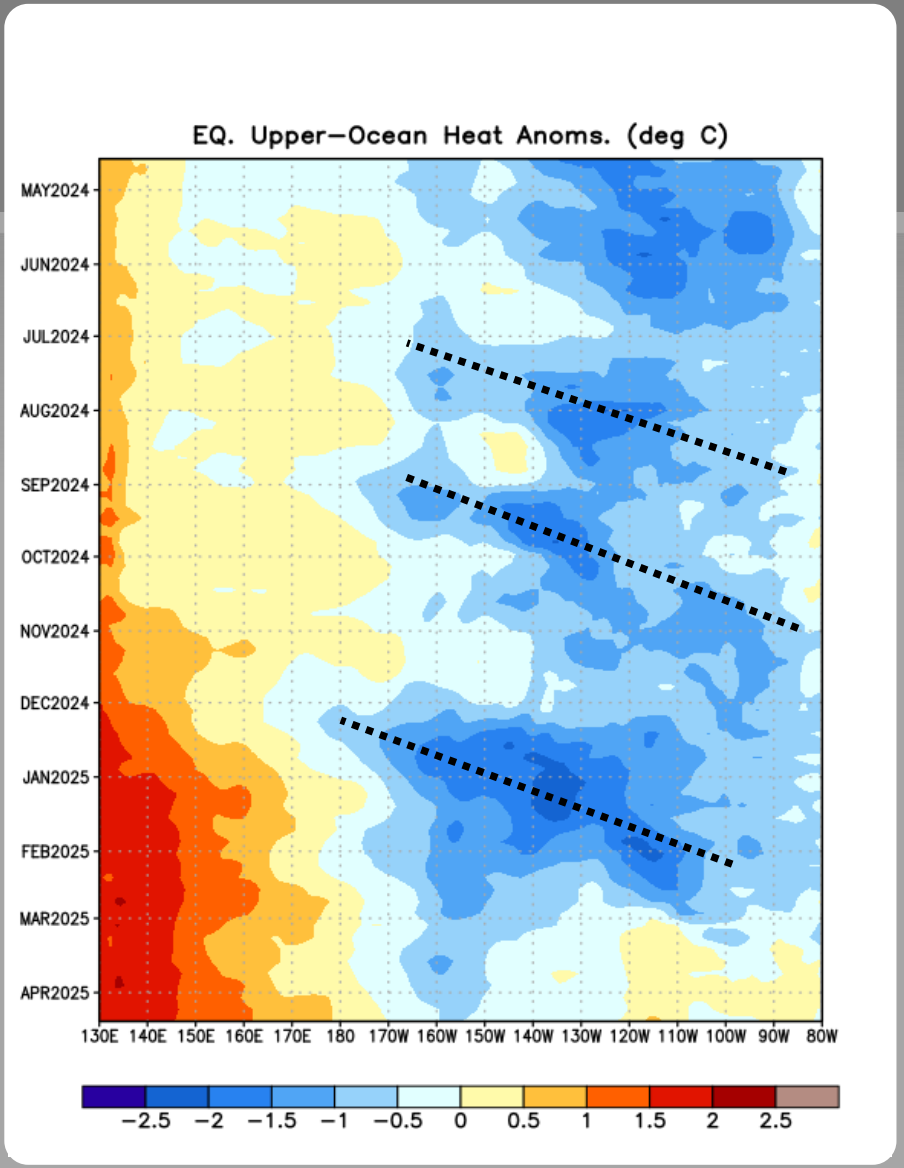
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

Since the beginning of the period, below-average subsurface temperatures have dominated in the east-central and eastern Pacific.

Upwelling Kelvin waves were initiated during March, July, September, and December 2024.

Since February 2025, below-average subsurface temperatures have weakened in the east-central and eastern Pacific Ocean, but persist in the central Pacific Ocean.

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.

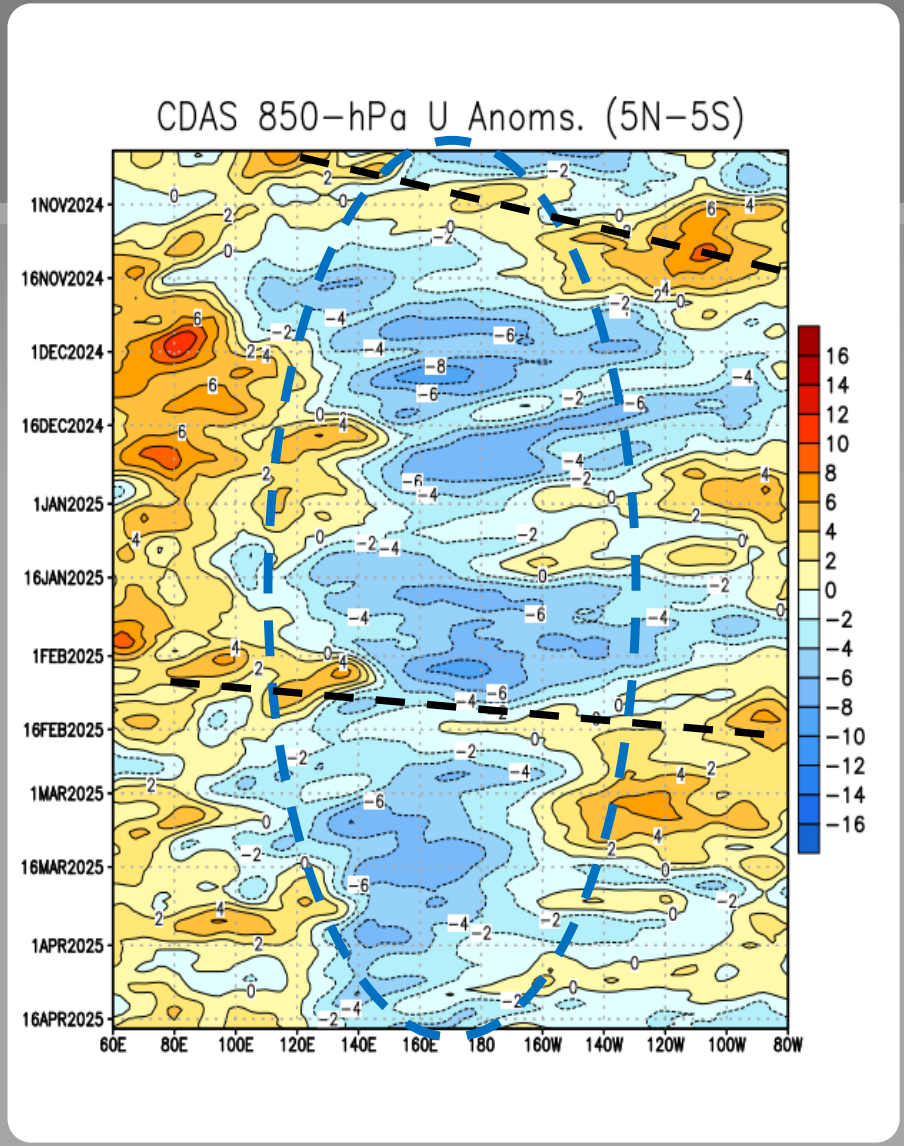


Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

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

Since July 2024, easterly wind anomalies have mostly dominated over the central and east-central Pacific Ocean, with some shorter-lived periods of westerly wind anomalies.

In February and early March 2025, westerly wind anomalies strengthened over the eastern Pacific Ocean.

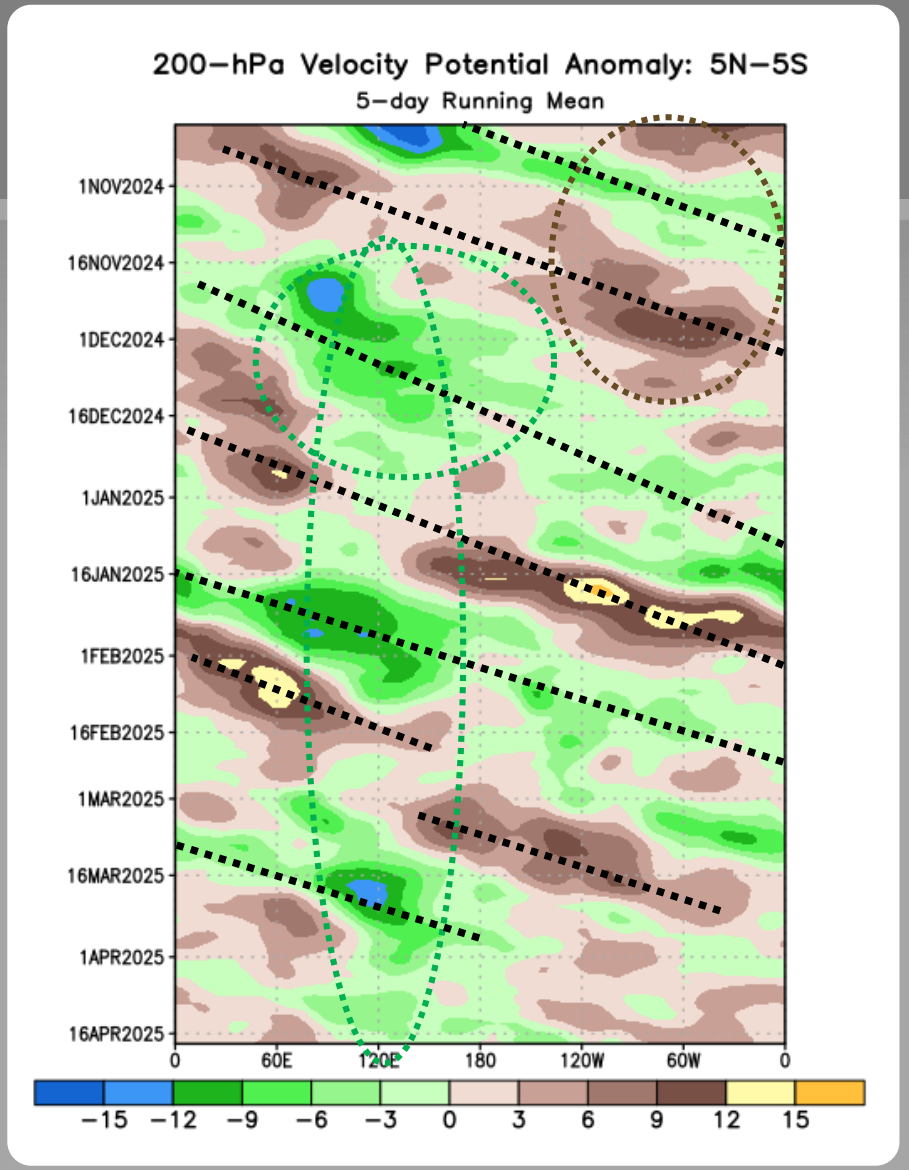


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

At times, regions of anomalous divergence (green shading) and convergence (brown shading) shifted eastward.

Since the beginning of the period, anomalous divergence has been periodically evident over Indonesia and/or the western Pacific.



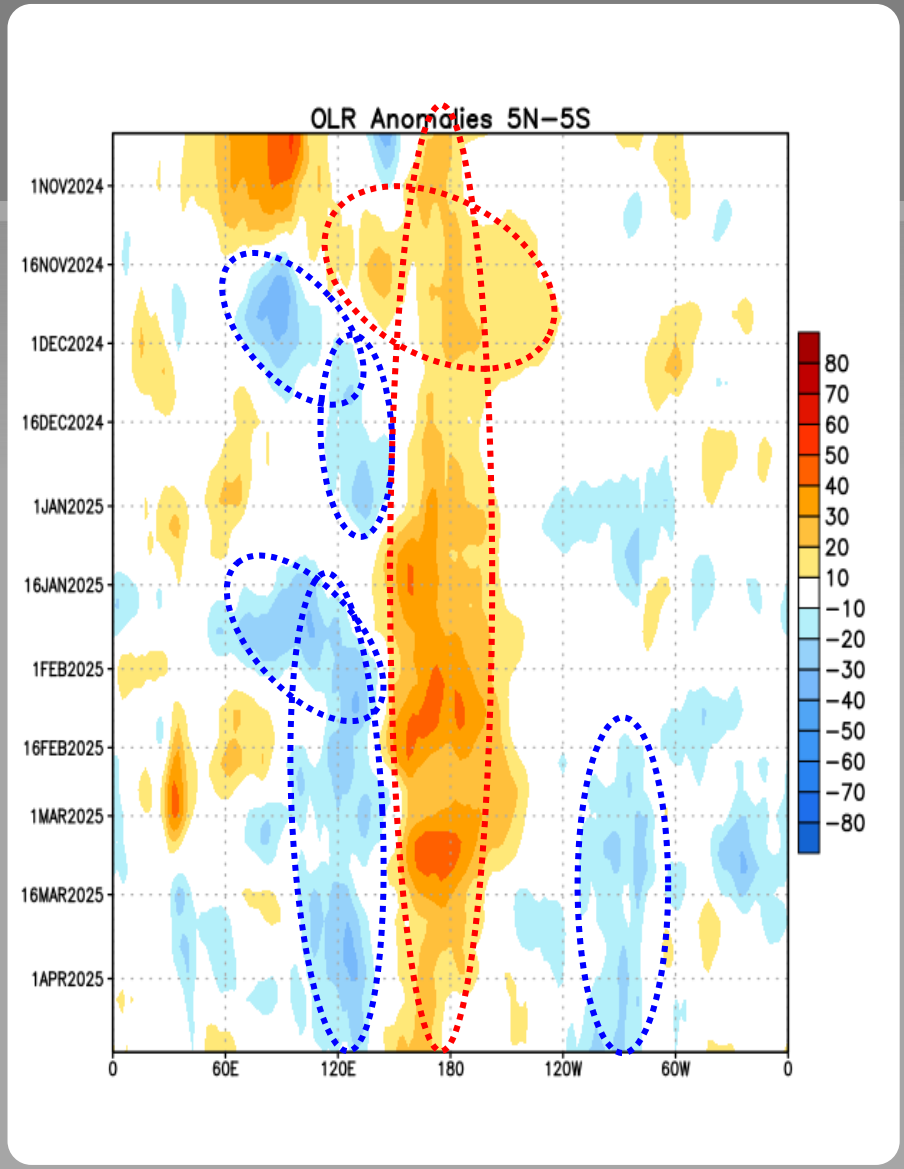
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)
Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

Since mid-September 2024, positive OLR anomalies (suppressed convection/rainfall) have persisted near the Date Line.

Beginning in early December 2024, negative OLR anomalies (enhanced convection/rainfall) emerged over Indonesia.

Since mid-February 2025, negative OLR anomalies have persisted over the eastern Pacific Ocean.



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.

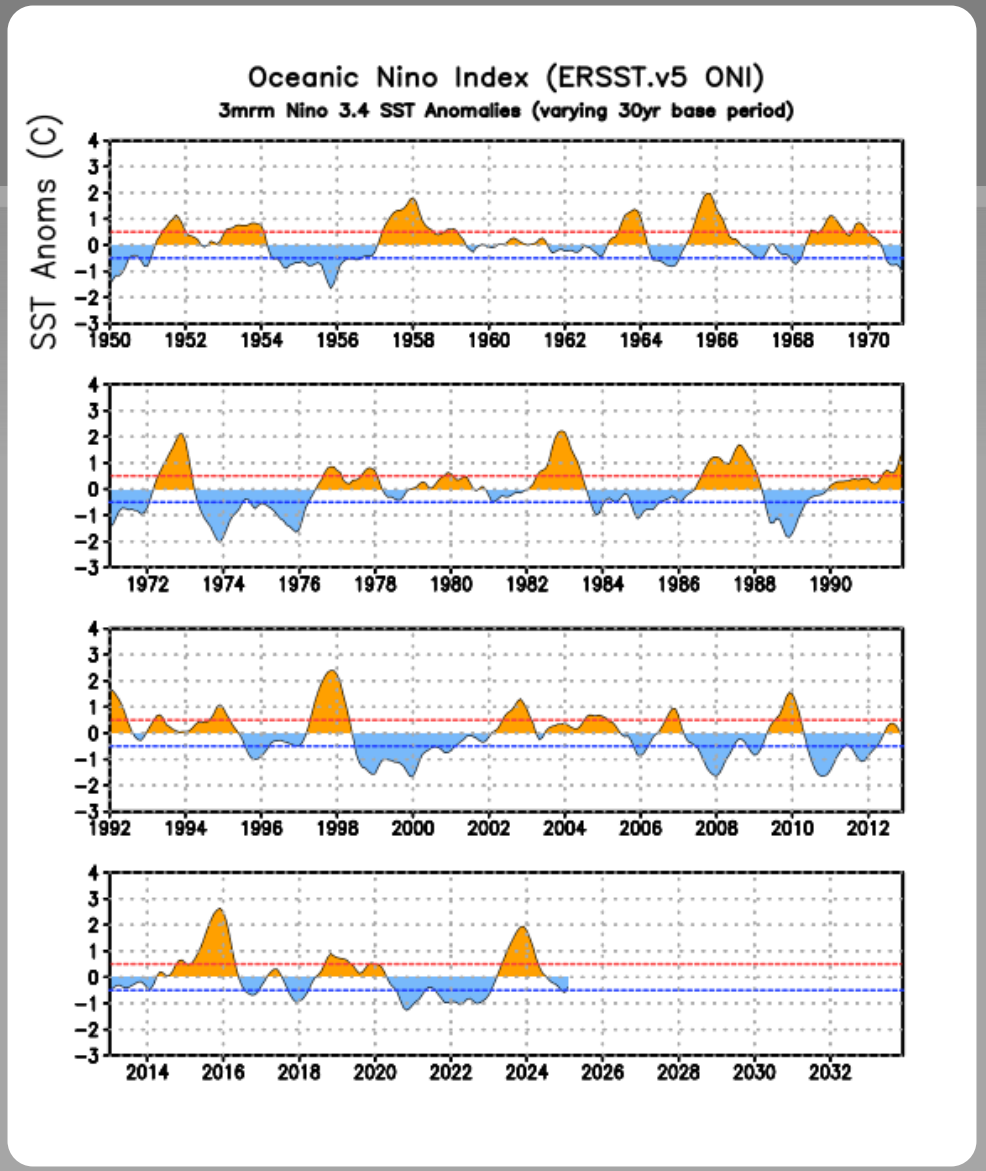
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (January - March 2025) is -0.4°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.

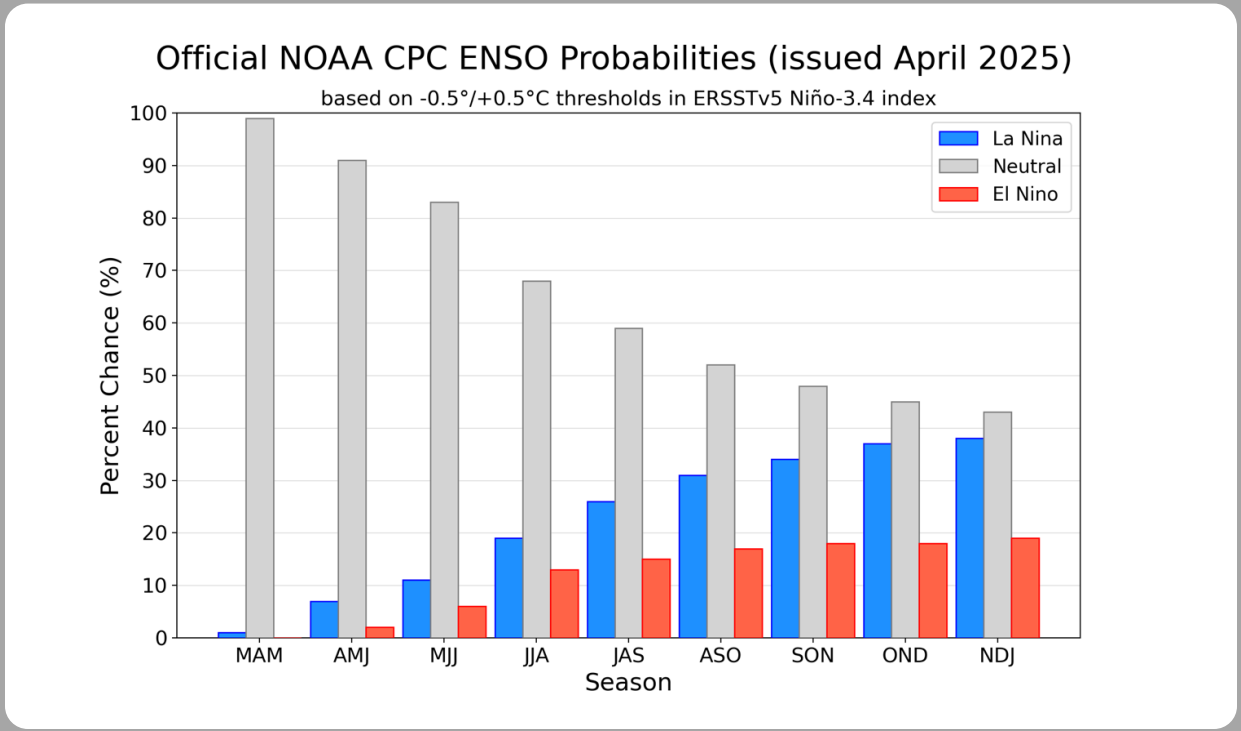
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
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	0.7	0.4	0.2	0.0	-0.1	-0.2	-0.3	-0.4	-0.5
2025	-0.6	-0.4										

CPC Probabilistic ENSO Outlook

Updated: 10 April 2025

ENSO-neutral is favored to persist through the Northern Hemisphere summer 2025, with a greater than 50% chance through August-October 2025. During the fall and early winter, ENSO-neutral is slightly favored over the possible return of La Niña.



IRI Pacific Niño 3.4 SST Model Outlook

Most models favor ENSO-neutral to prevail through the Northern Hemisphere fall 2025.

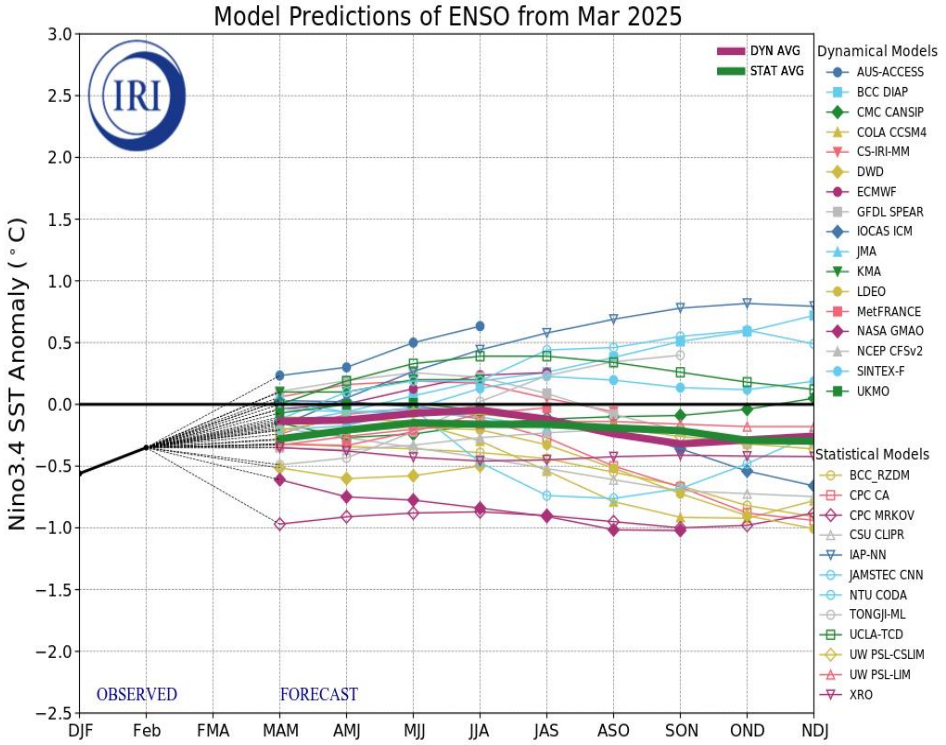
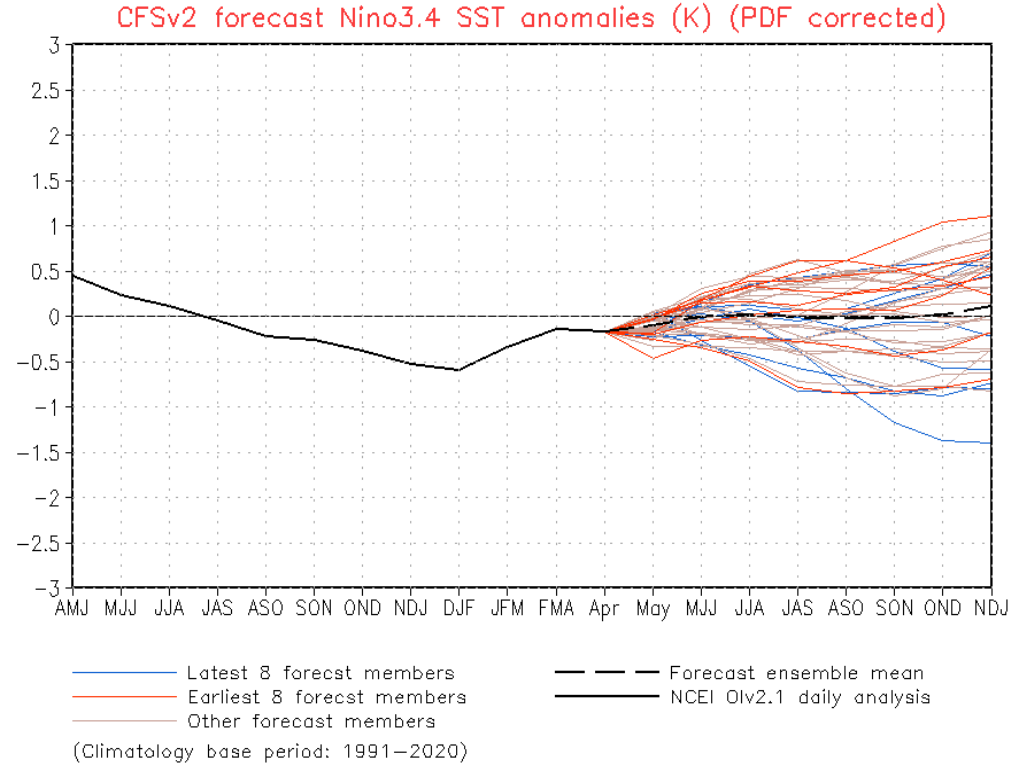


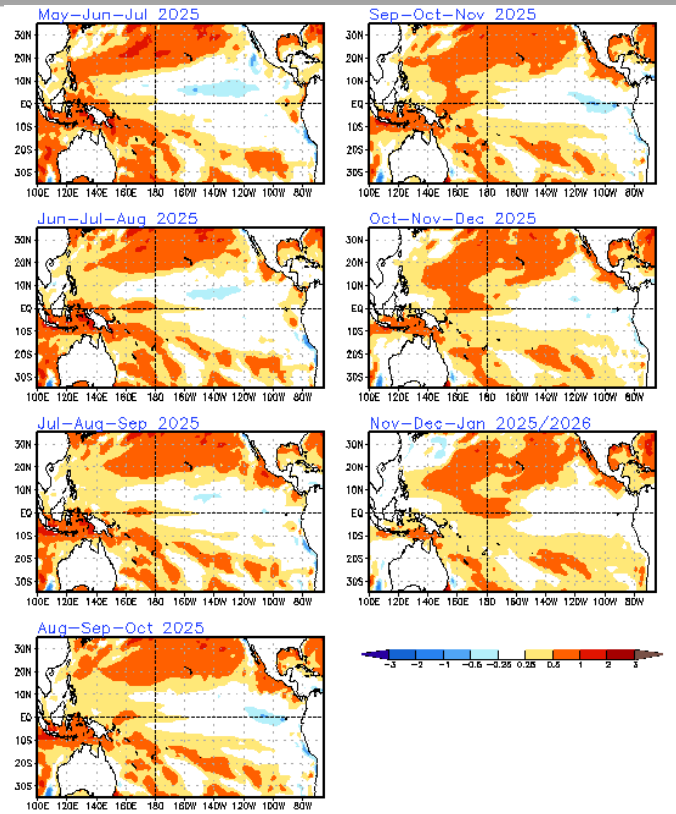
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 March 2025).

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

Issued: 20 April 2025

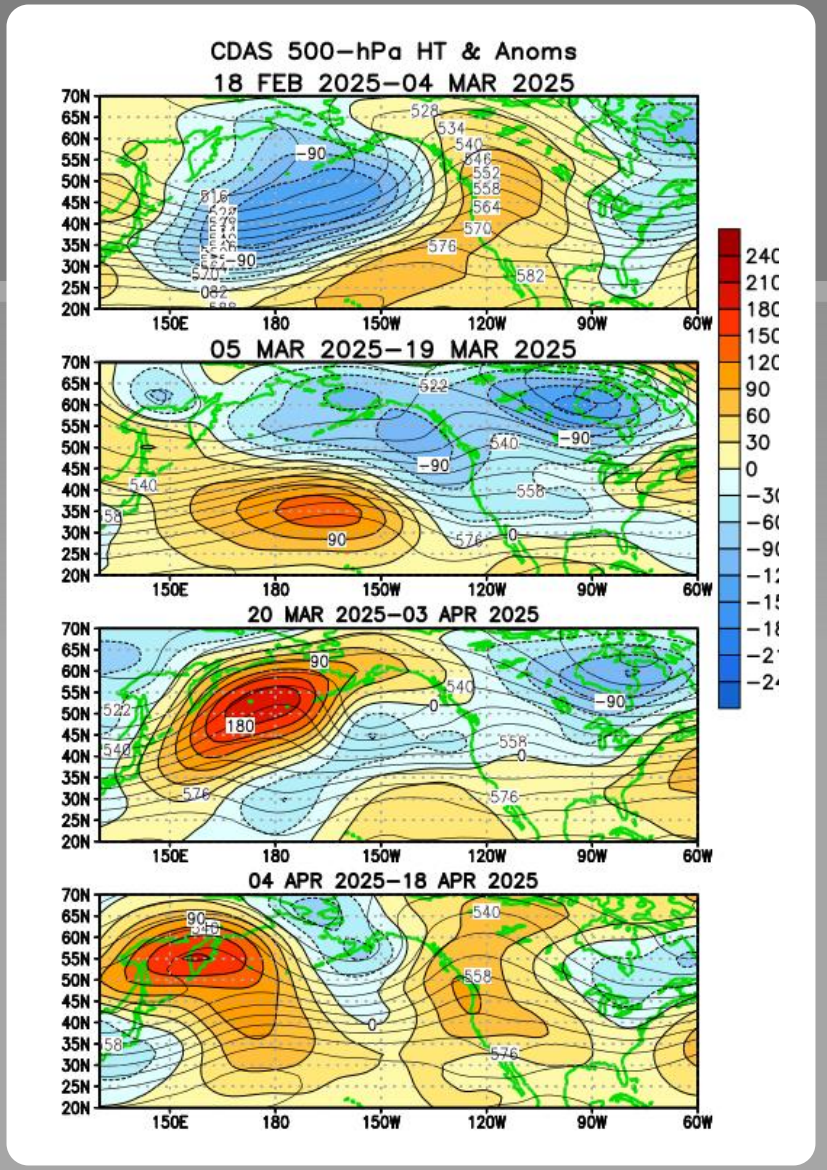
The CFS.v2 ensemble mean (black dashed line) indicates ENSO-neutral is favored to persist through the Northern Hemisphere fall.





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

During the period, below-average heights have mostly persisted near the Gulf of Alaska, with anomalous ridging to the south of the anomalous trough. Above-average heights and temperatures have mostly persisted over parts of the eastern U.S.



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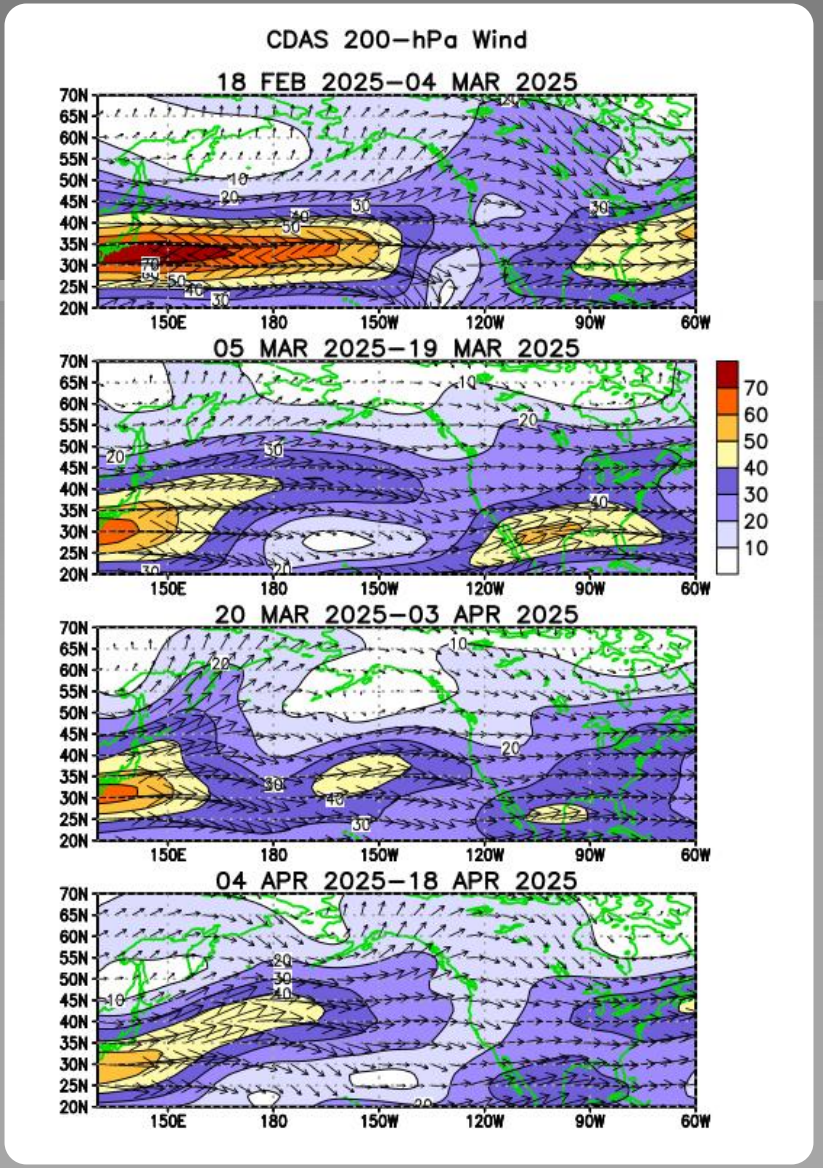

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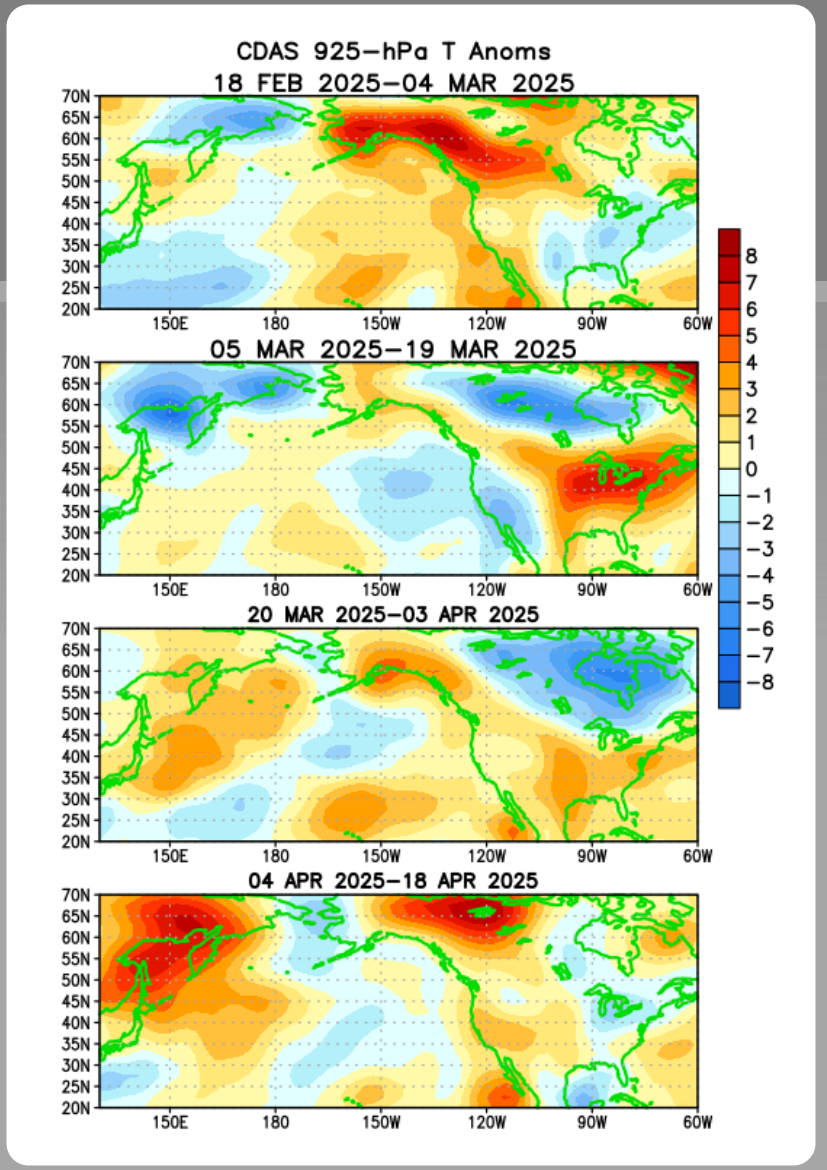
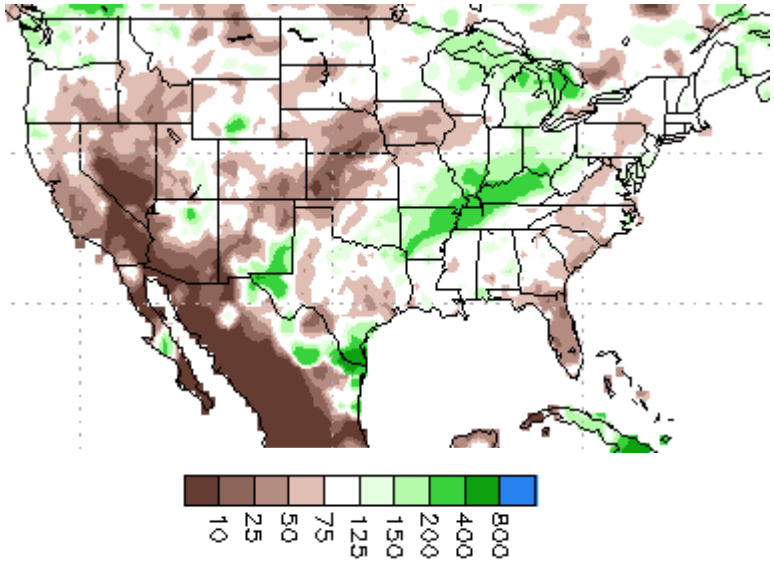


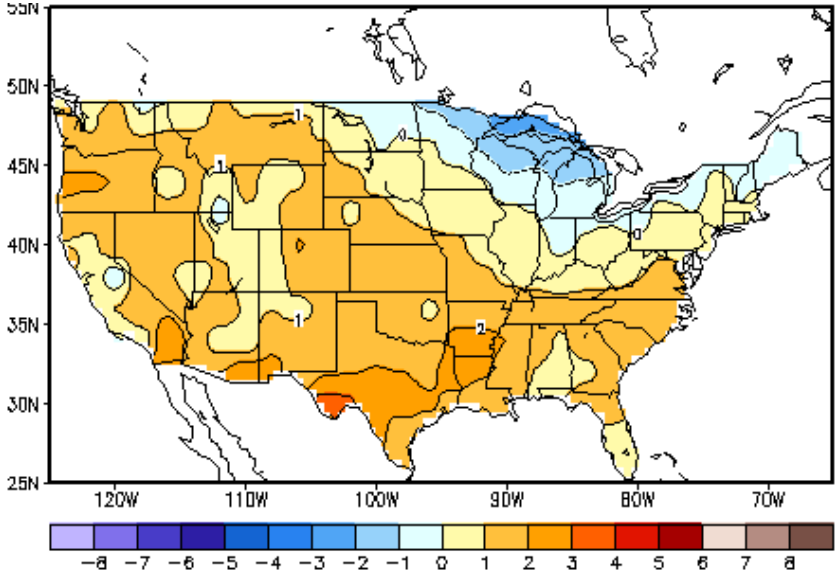
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 19 April 2025

Percent of Average Precipitation



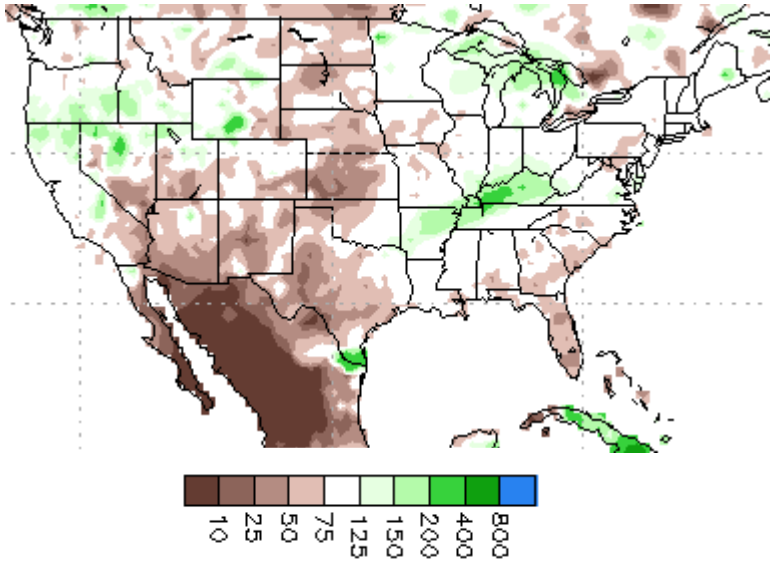
Temperature Departures (degree C)



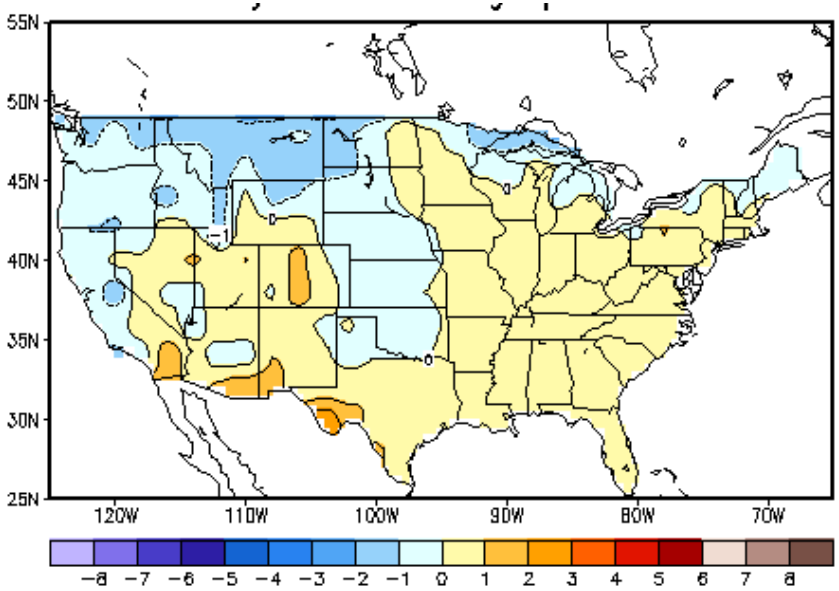
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 19 April 2025

Percent of Average Precipitation



Temperature Departures (degree C)

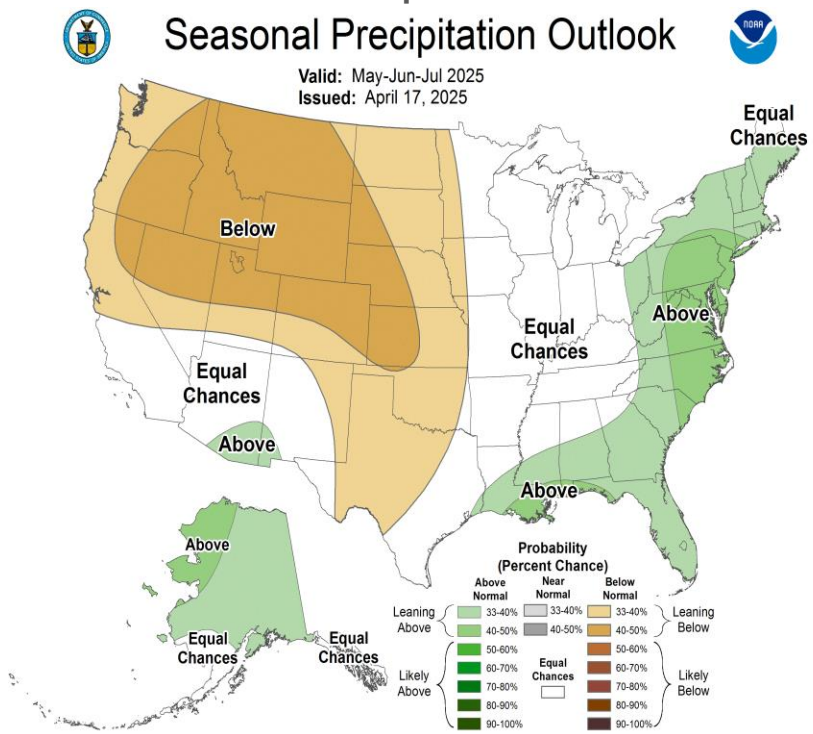


U. S. Seasonal Outlooks

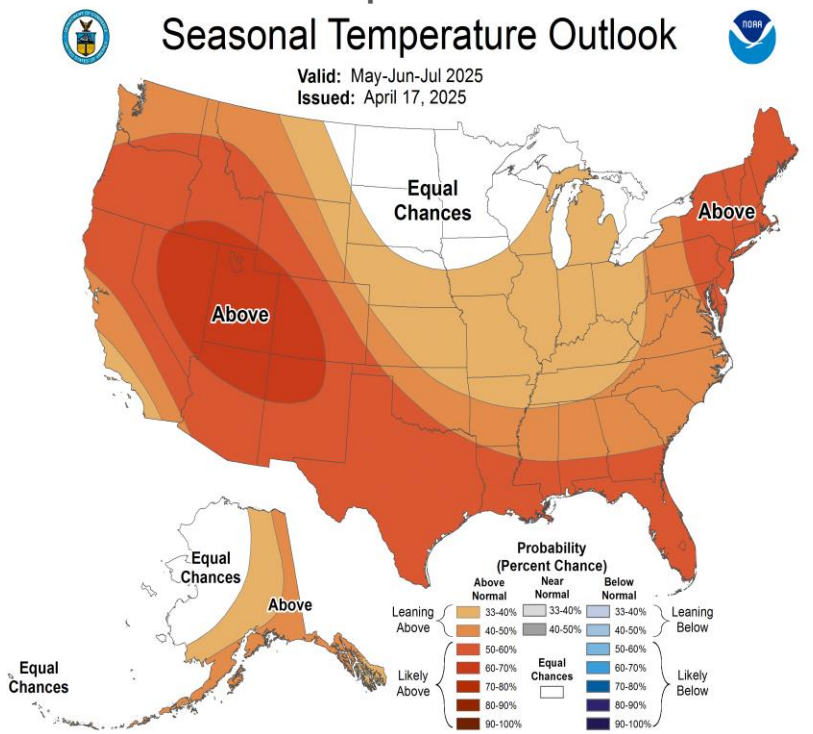
May-July 2025

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

Precipitation



Temperature



Summary

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

ENSO-neutral conditions are present.*

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ENSO-neutral is favored during the Northern Hemisphere summer, with a greater than 50% chance through August-October 2025.

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