

# ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:  
Climate Prediction Center / NCEP  
24 February 2025

# 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: **La Niña Advisory**

La Niña conditions are present.\*

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

La Niña conditions are expected to persist in the near-term, with a transition to ENSO-neutral likely during March-May 2025 (66% chance).

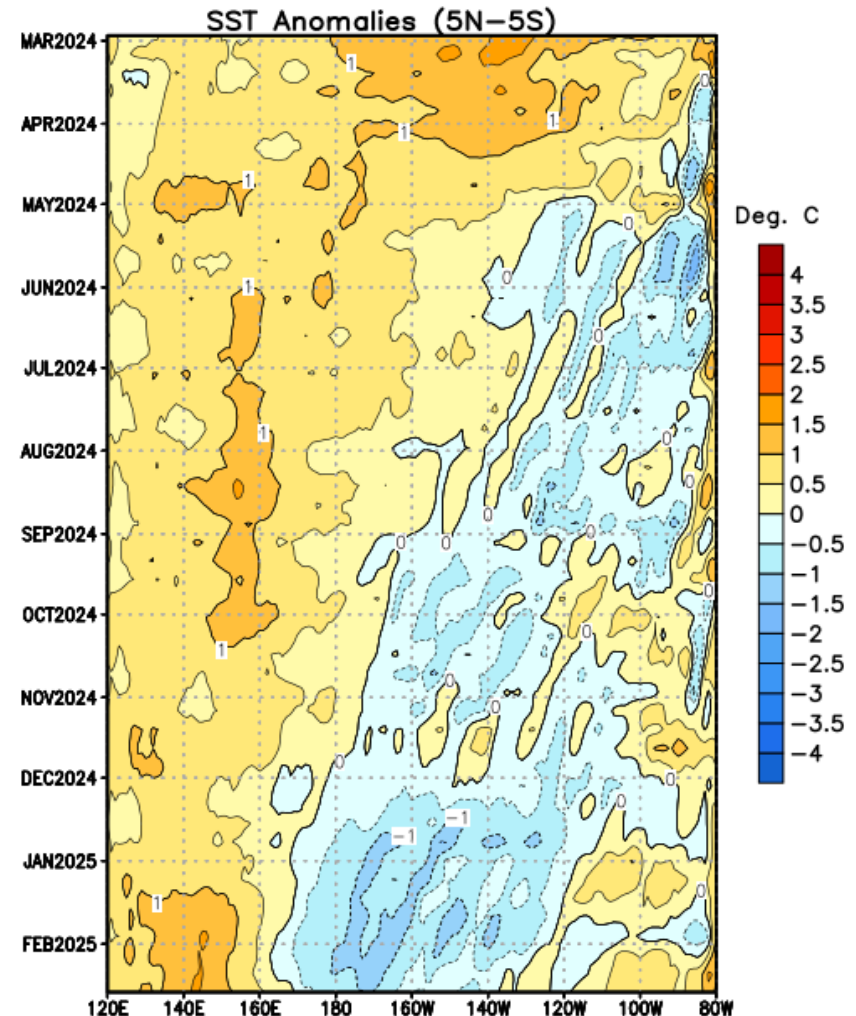
\* Note: These statements are updated once a month (2<sup>nd</sup> Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking [here](#).

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

Positive sea surface temperature (SST) anomalies persisted across most of the eastern and central Pacific Ocean from the beginning of the period until April 2024.

Since mid-March 2024, mostly near-to-below-average SSTs emerged in the eastern Pacific and expanded westward.

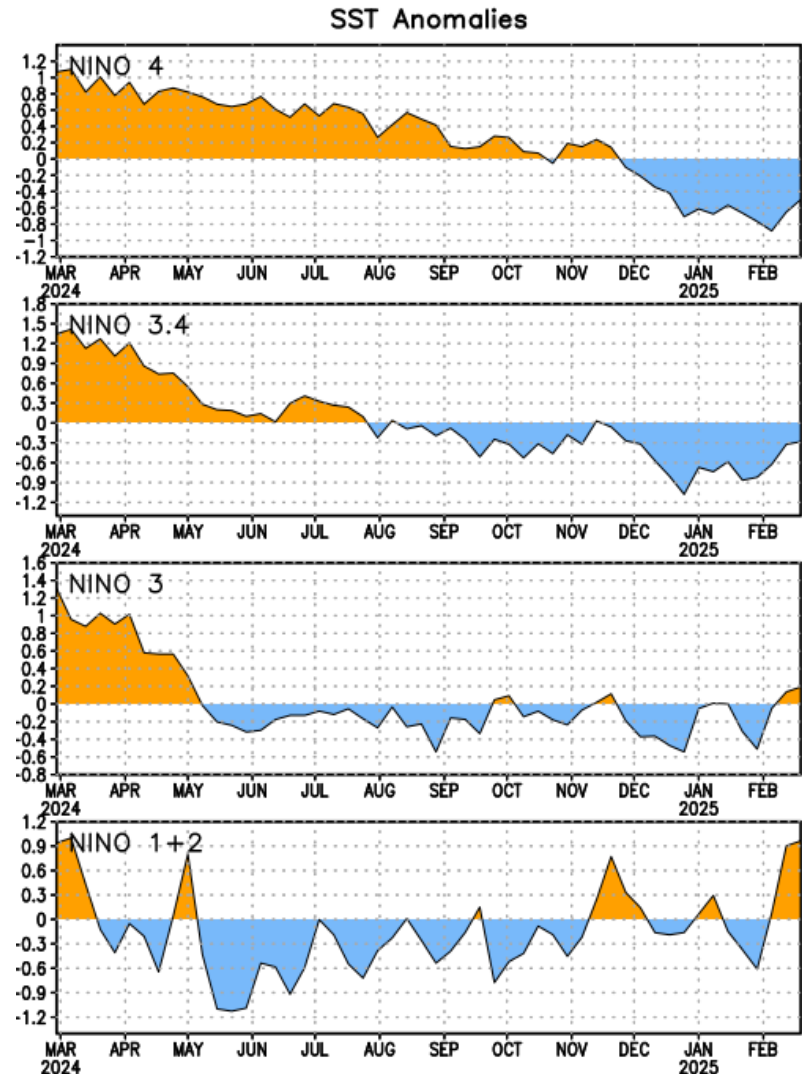
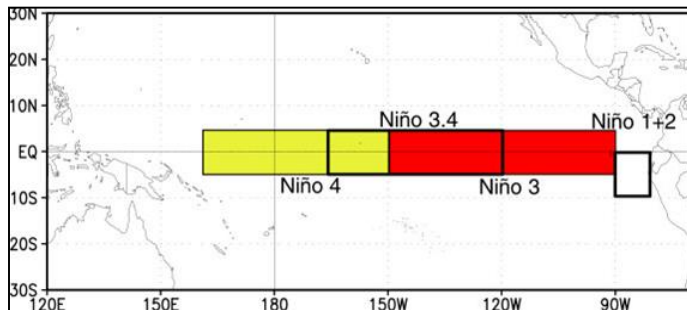
Since early December 2024, below-average SSTs persisted across the central Pacific Ocean. Above average SSTs have periodically strengthened in the eastern Pacific.



# Niño Region SST Departures (°C) Recent Evolution

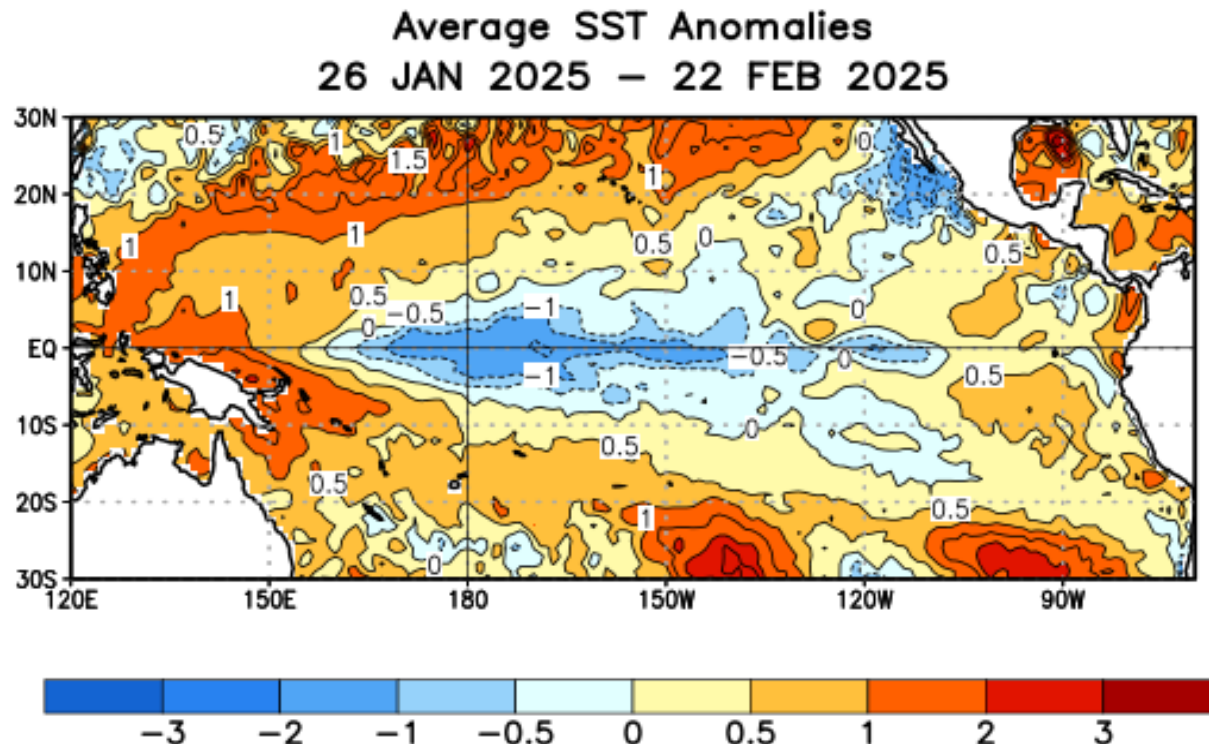
The latest weekly SST departures are:

Niño 4	-0.5°C
Niño 3.4	-0.3°C
Niño 3	0.2°C
Niño 1+2	1.0°C



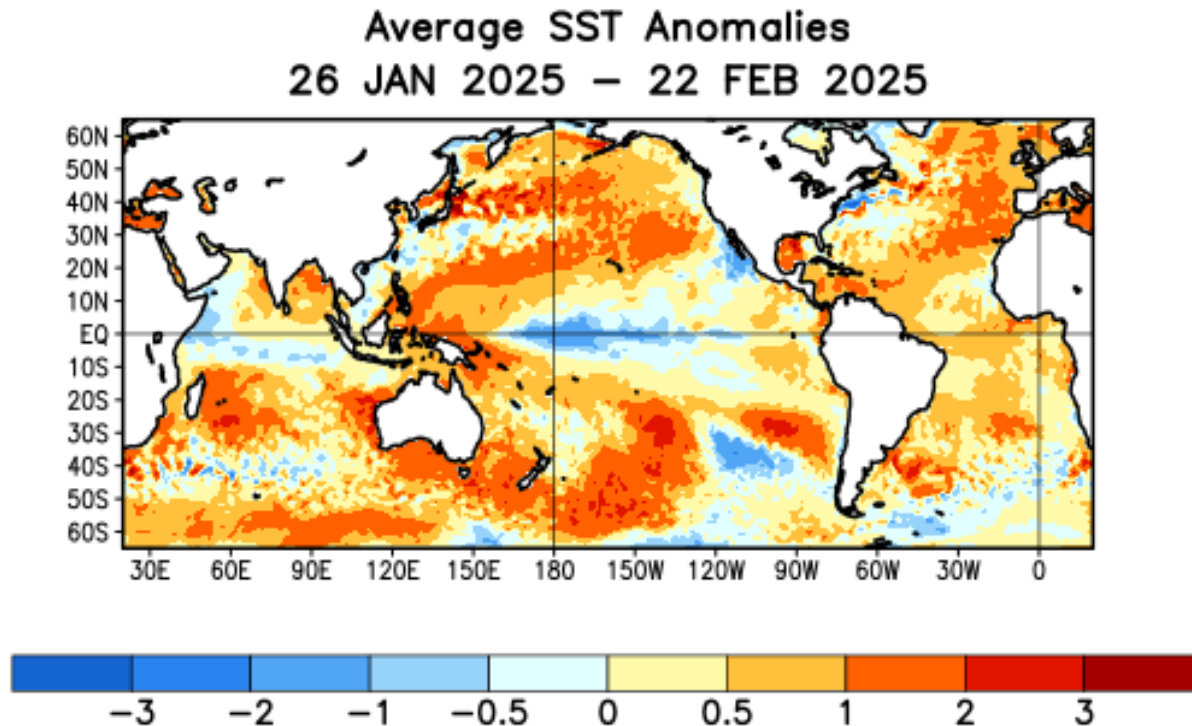
# SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

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



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

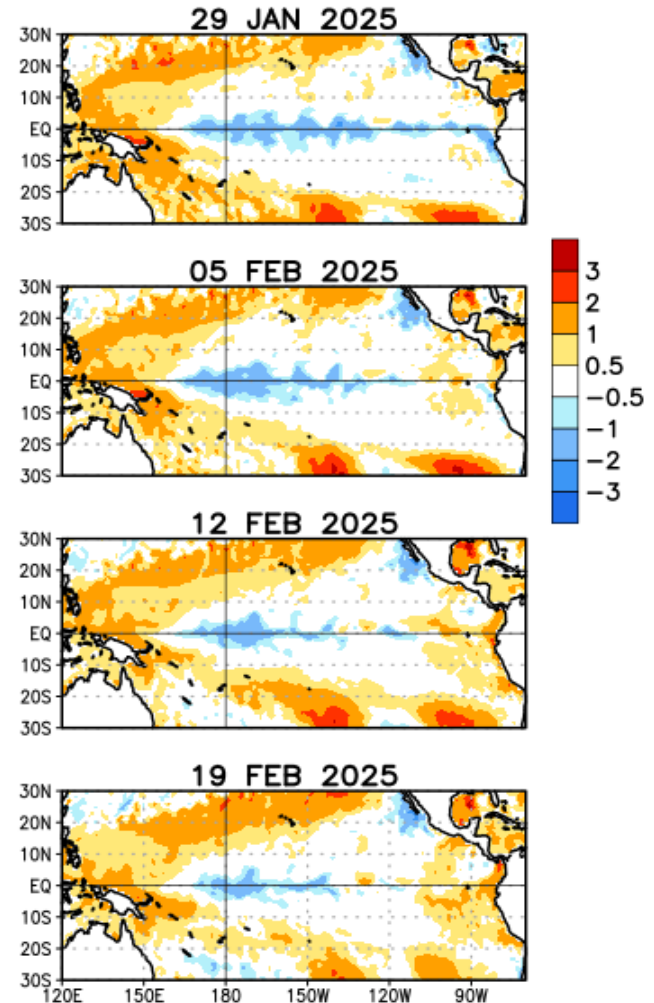
During the last four weeks, equatorial SSTs were above average in the far western Pacific Ocean and in most of the Atlantic Ocean. Below-average SSTs were evident in the central and east-central Pacific Ocean and in the western Indian Ocean.



# Weekly SST Departures during the Last Four Weeks

During the last 4 weeks, below-average SSTs persisted in the central equatorial Pacific Ocean. Above-average SSTs strengthened in the eastern Pacific Ocean.

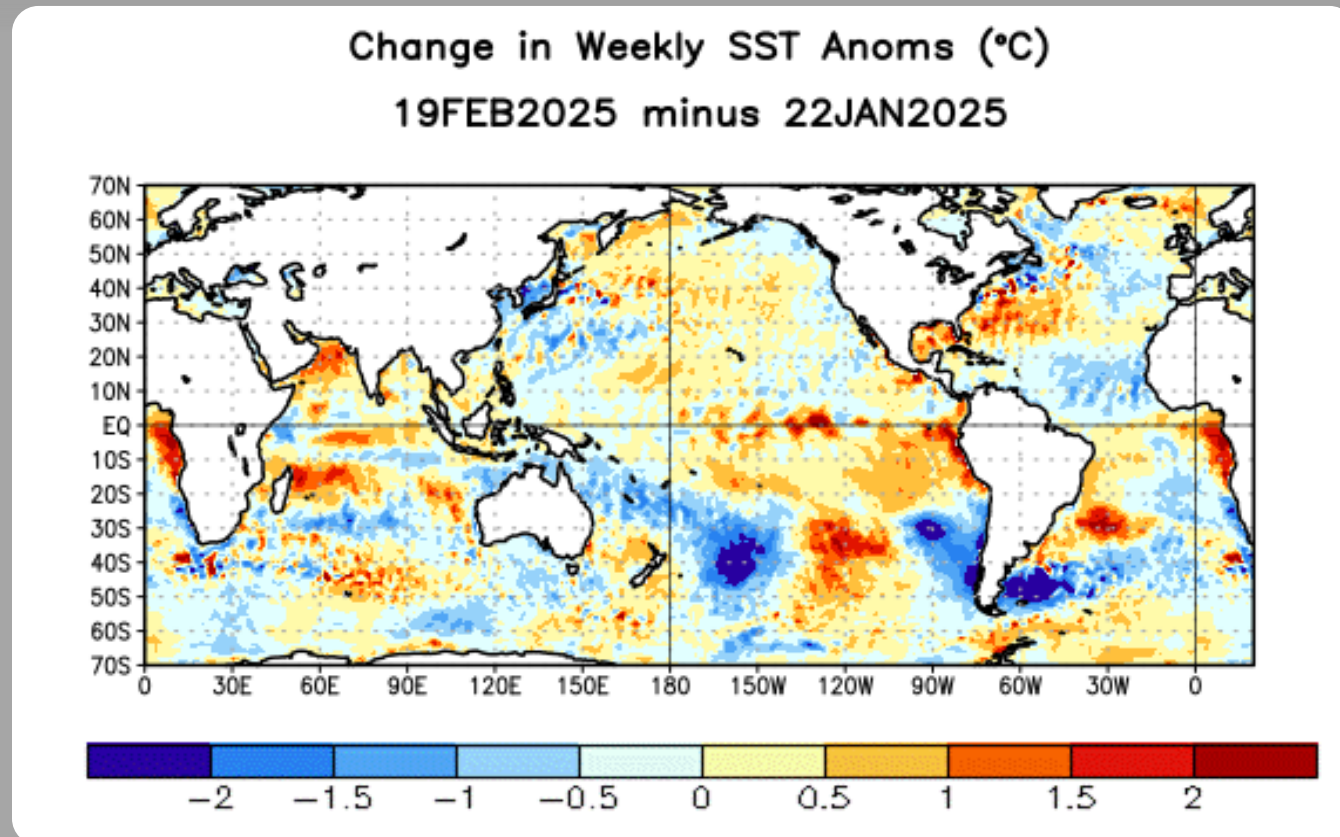
## Weekly SST Anomalies (DEG C)





# Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, mostly positive SST anomaly changes were evident in the central and eastern equatorial Pacific Ocean.



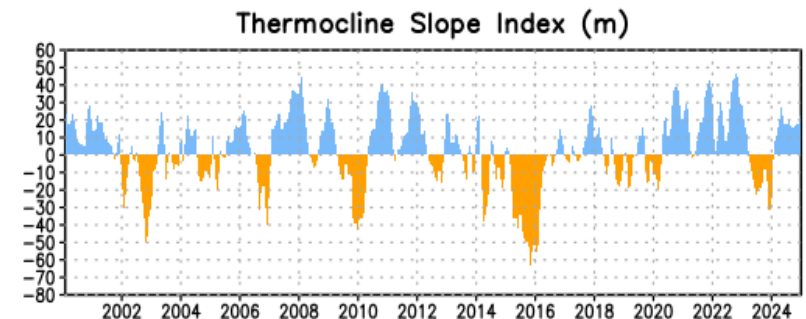
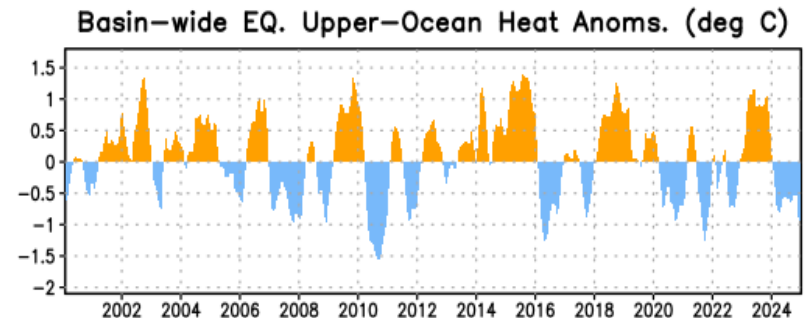
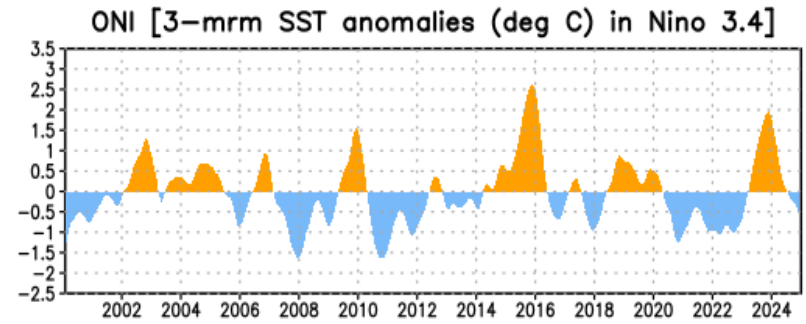
# Upper-Ocean Conditions in the Equatorial Pacific

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.

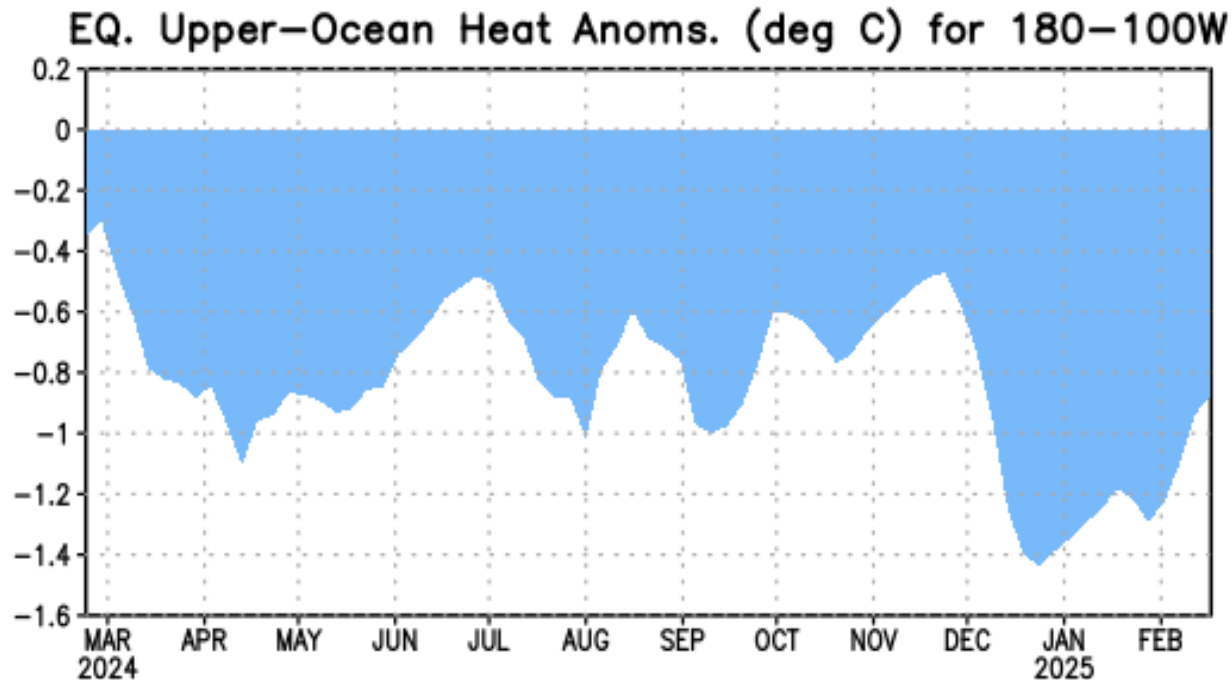
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (above average) reflect La Niña conditions.

*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).*



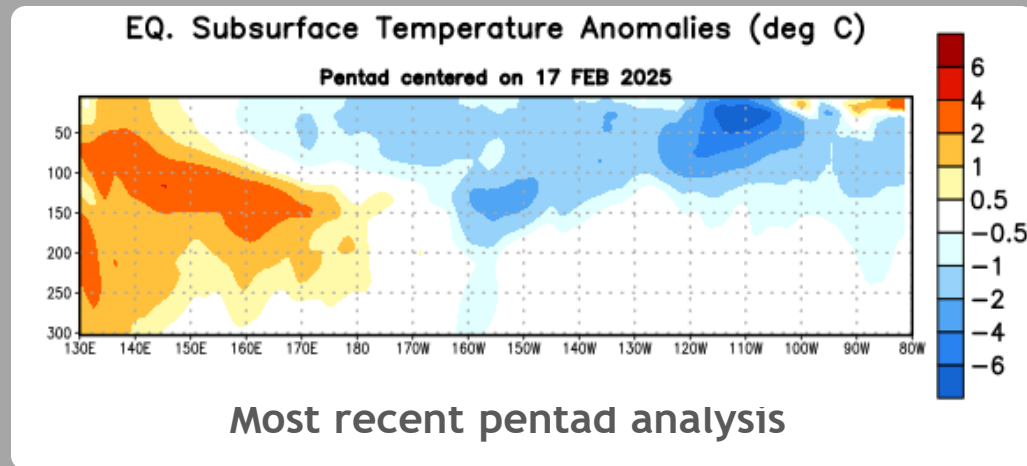
# Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies emerged in late January 2024 and have dominated since then. Negative anomalies strengthened in December 2024, reaching a minimum late in the month. During January and February 2025, negative anomalies weakened.

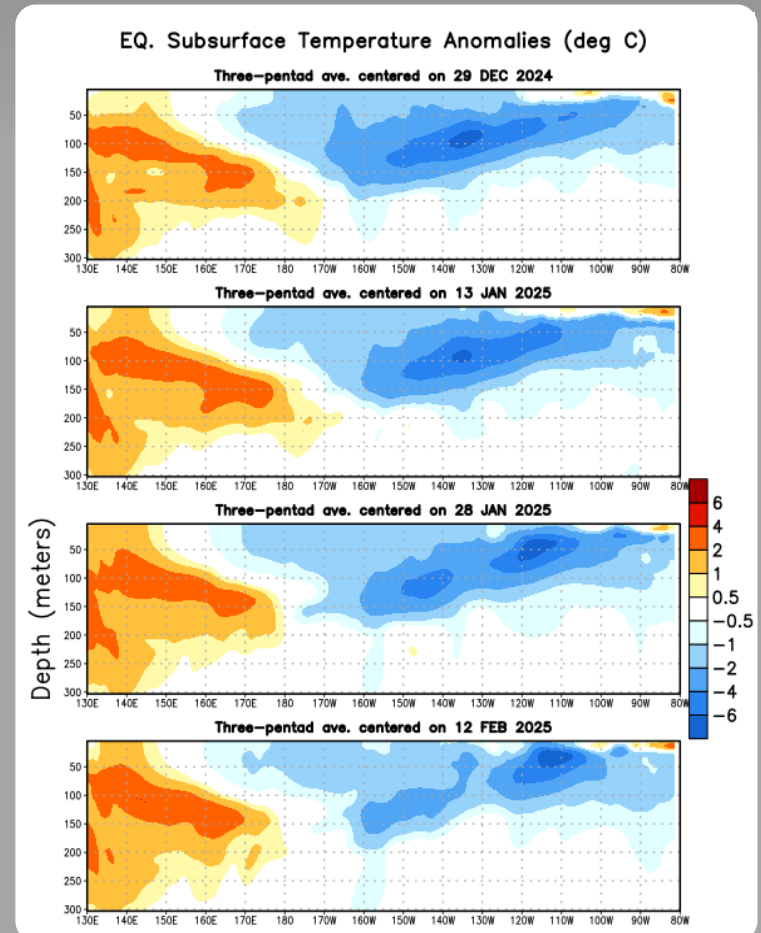


# Sub-Surface Temperature Departures in the Equatorial Pacific

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



Above-average temperatures prevailed in the far western Pacific and at depth west of the Date Line.



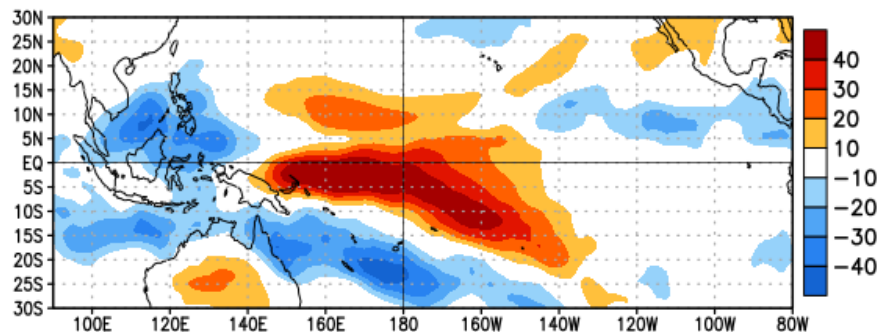
# Tropical OLR and Wind Anomalies During the Last 30 Days

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.

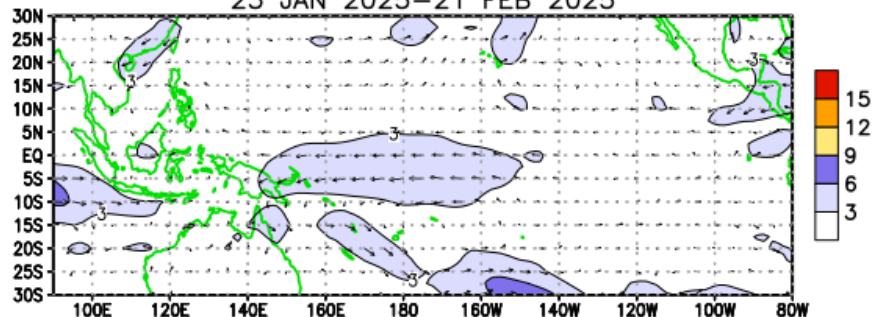
Low-level (850-hPa) wind anomalies were easterly from the western to central equatorial Pacific Ocean.

Upper-level (200-hPa) wind anomalies were westerly over the east-central and eastern equatorial Pacific Ocean, and were easterly over the western Pacific Ocean.

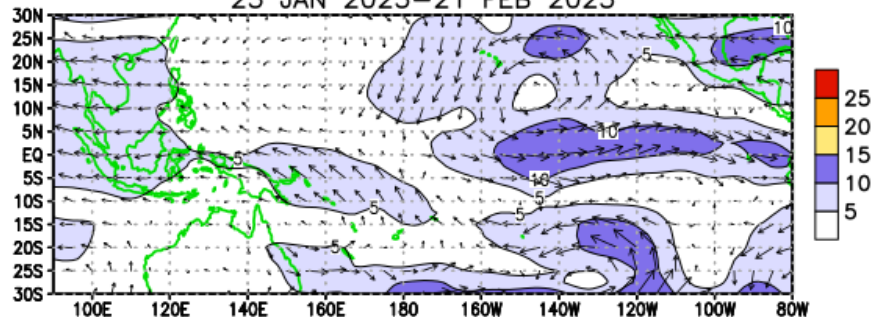
OLR Anomalies  
25 JAN 2025 to 19 FEB 2025



CDAS 850-hPa Wind Anoms  
23 JAN 2025–21 FEB 2025



CDAS 200-hPa Wind Anoms  
23 JAN 2025–21 FEB 2025



# 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.

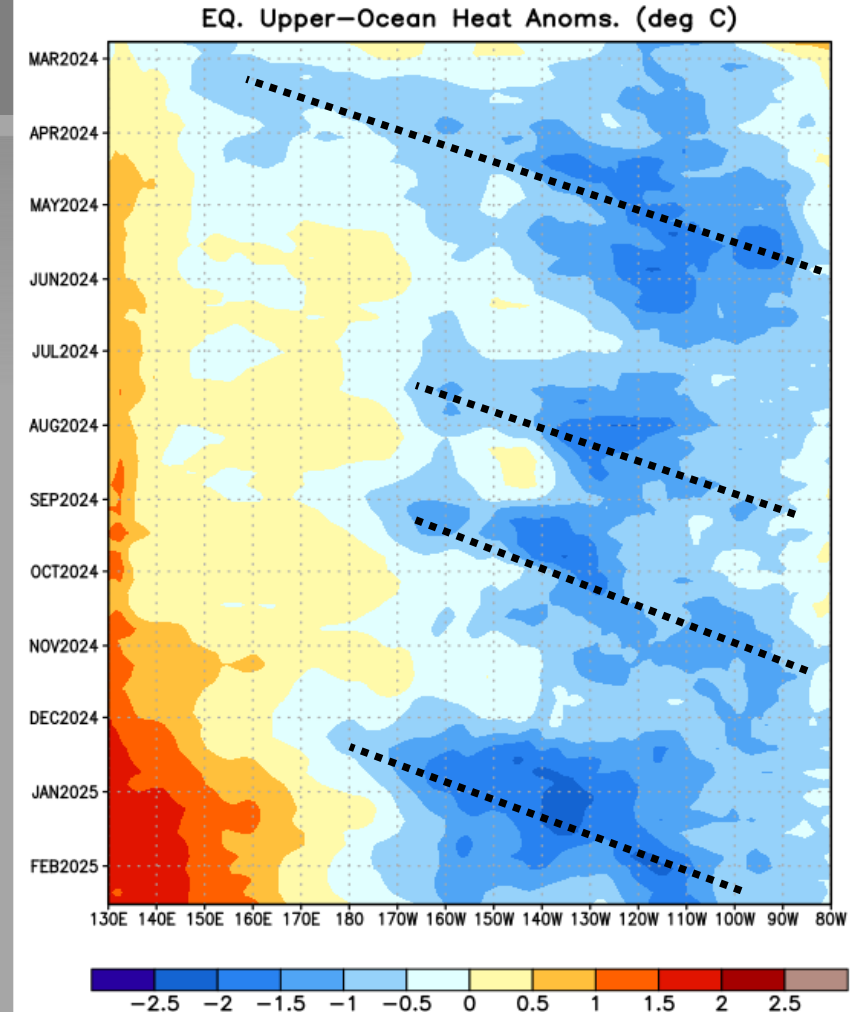
# Weekly Heat Content Evolution in the Equatorial Pacific

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

Since February 2024, below-average subsurface temperatures have persisted in the east-central and eastern Pacific.

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

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.





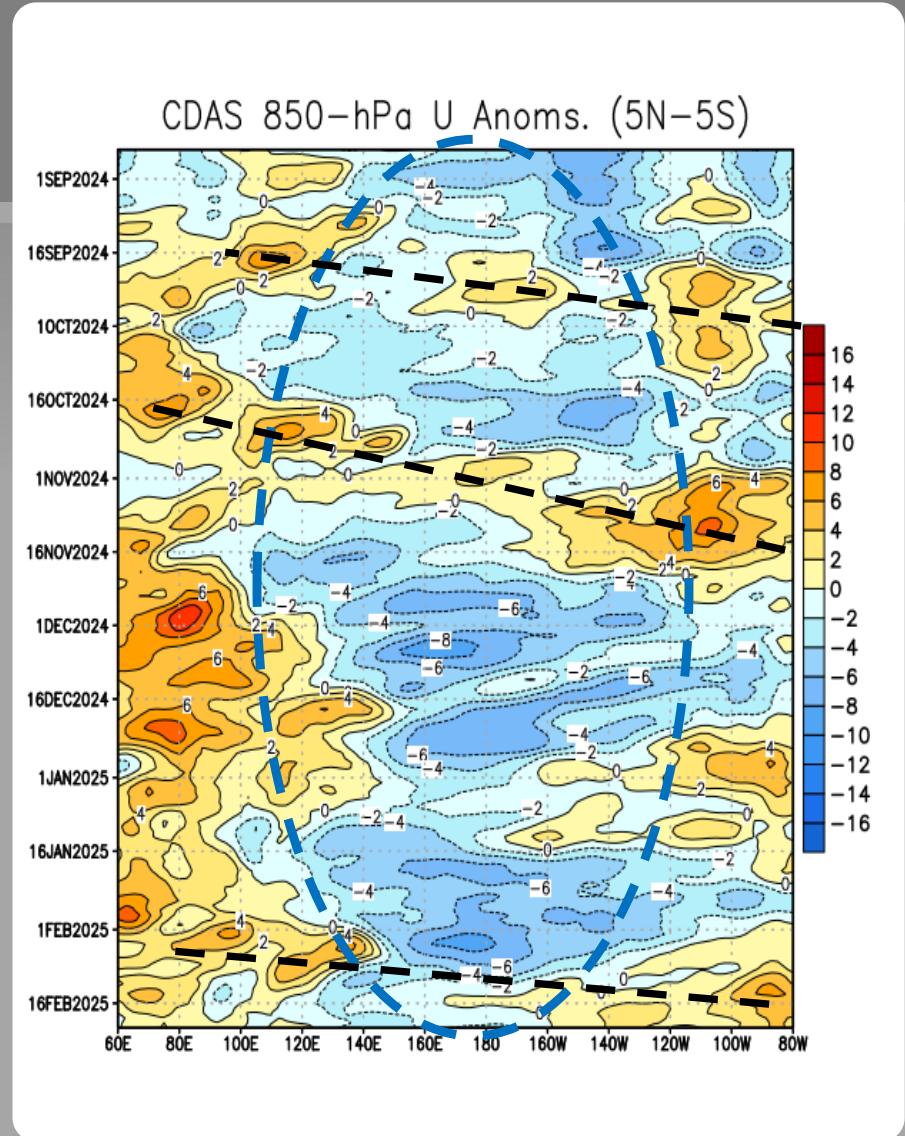
# Low-level (850-hPa) Zonal (east-west) Wind Anomalies ( $\text{m s}^{-1}$ )

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.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)





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

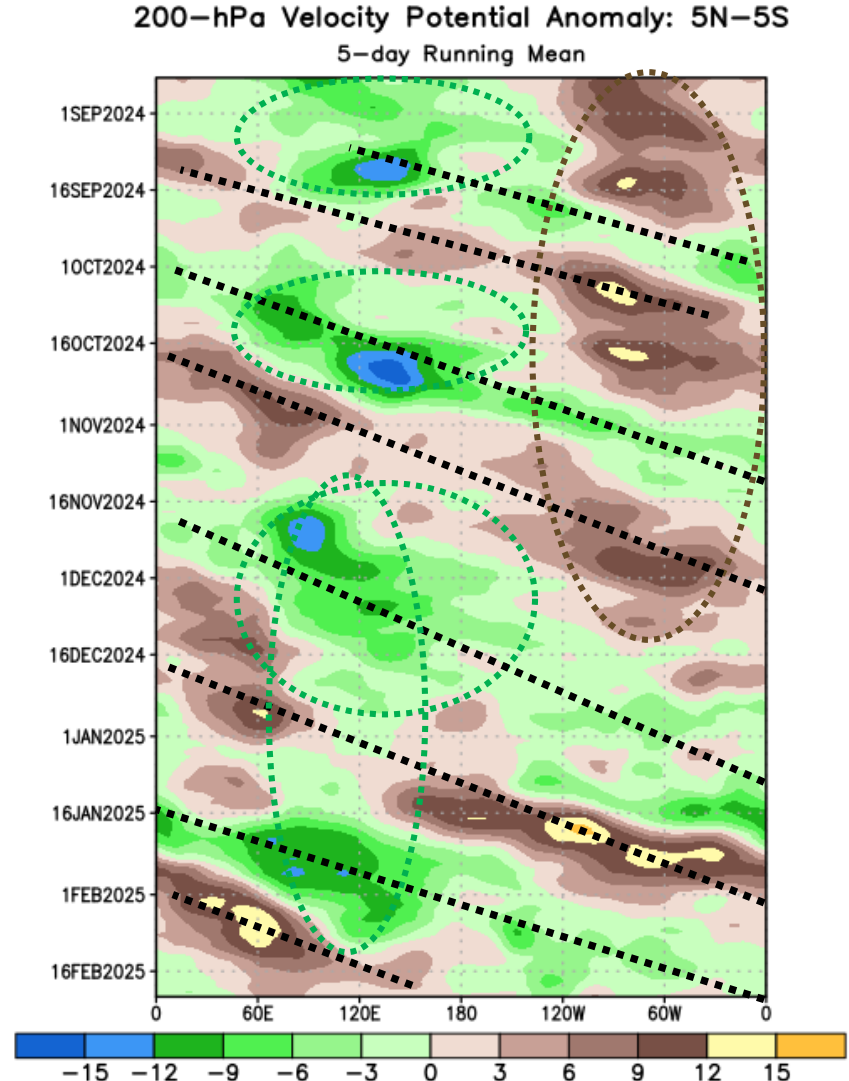
At times, regions of anomalous divergence (green shading) and convergence (brown shading) shifted eastward.

Since July 2024, 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).

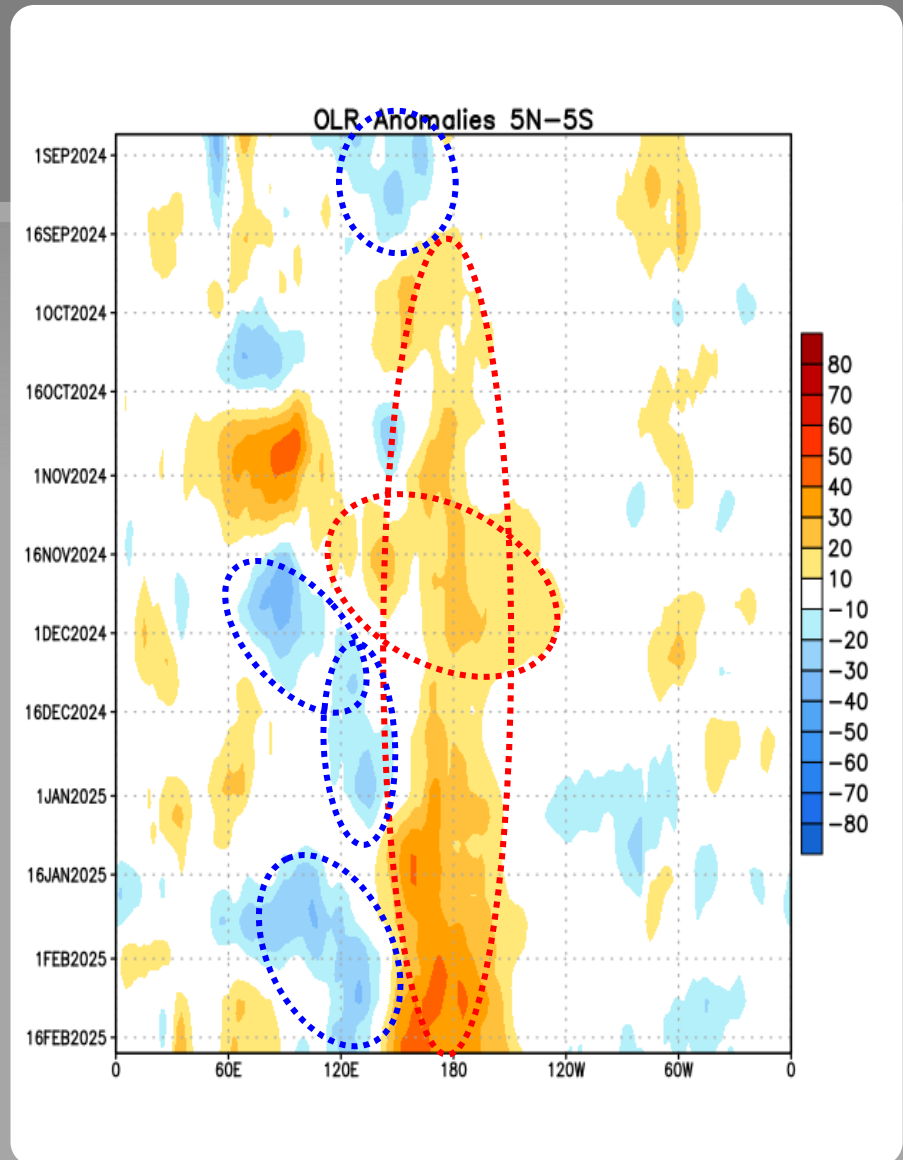


# Outgoing Longwave Radiation (OLR) Anomalies

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

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

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  $+0.5^{\circ}\text{C}$ .

La Niña: characterized by a negative ONI less than or equal to  $-0.5^{\circ}\text{C}$ .

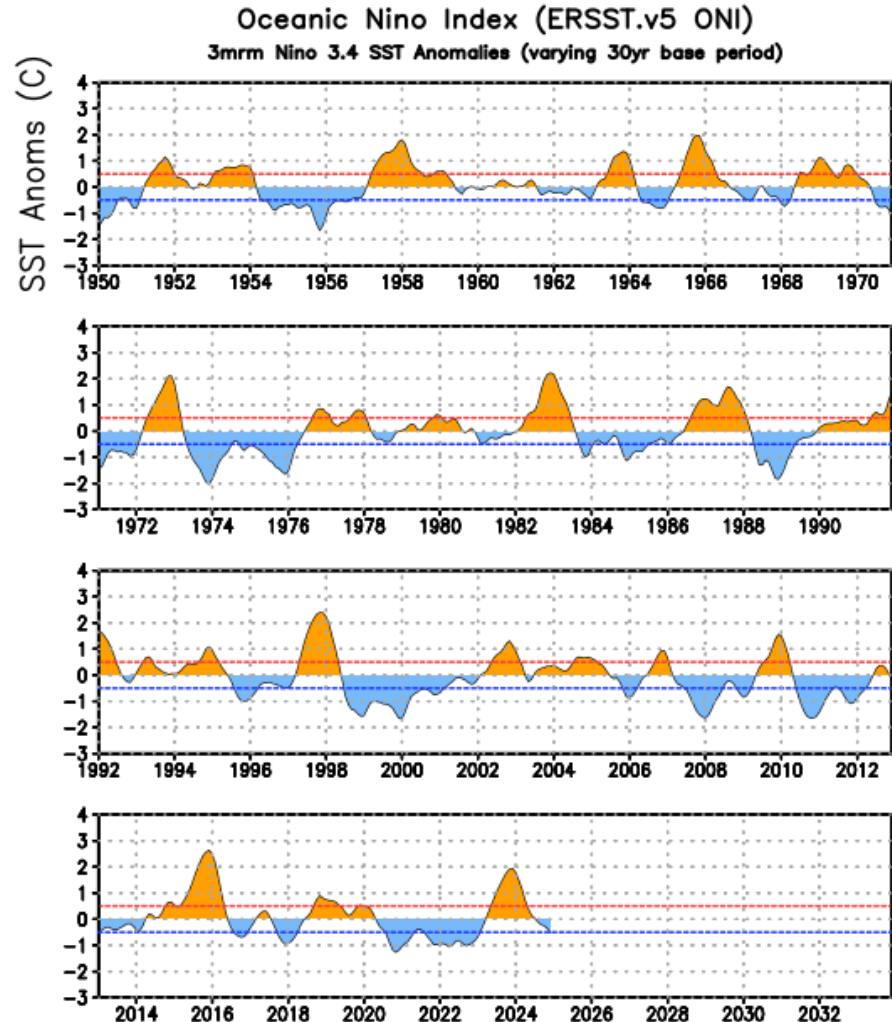
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

CPC considers El Niño or La Niña conditions to occur when the monthly Niño3.4 OISST departures meet or exceed  $\pm 0.5^{\circ}\text{C}$  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 (November 2024 - January 2025) is  $-0.5^{\circ}\text{C}$ .

El Niño ↑  
Neutral  
La Niña ↓



# 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  $\pm 0.5$  °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
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	0.7	0.4	0.2	0.0	-0.1	-0.2	-0.3	-0.4	-0.5

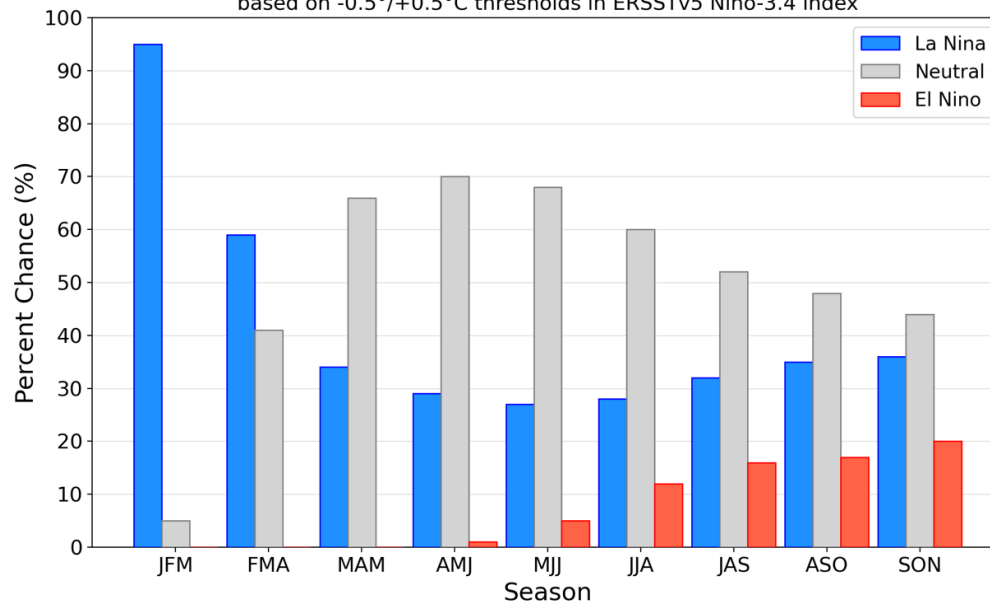
# CPC Probabilistic ENSO Outlook

Updated: 13 February 2025

La Niña conditions are expected to persist in the near-term, with a transition to ENSO-neutral most likely during March-May 2025 (66% chance).

Official NOAA CPC ENSO Probabilities (issued February 2025)

based on  $-0.5^{\circ}/+0.5^{\circ}\text{C}$  thresholds in ERSSTv5 Niño-3.4 index



# IRI Pacific Niño 3.4 SST Model Outlook

Models predict equal chances of ENSO-neutral or La Niña in February-April 2025 and then favor ENSO-neutral in March-May 2025.

During Northern Hemisphere spring and summer, ENSO-neutral is favored by the dynamical model average and La Niña is favored to persist by the statistical model average.

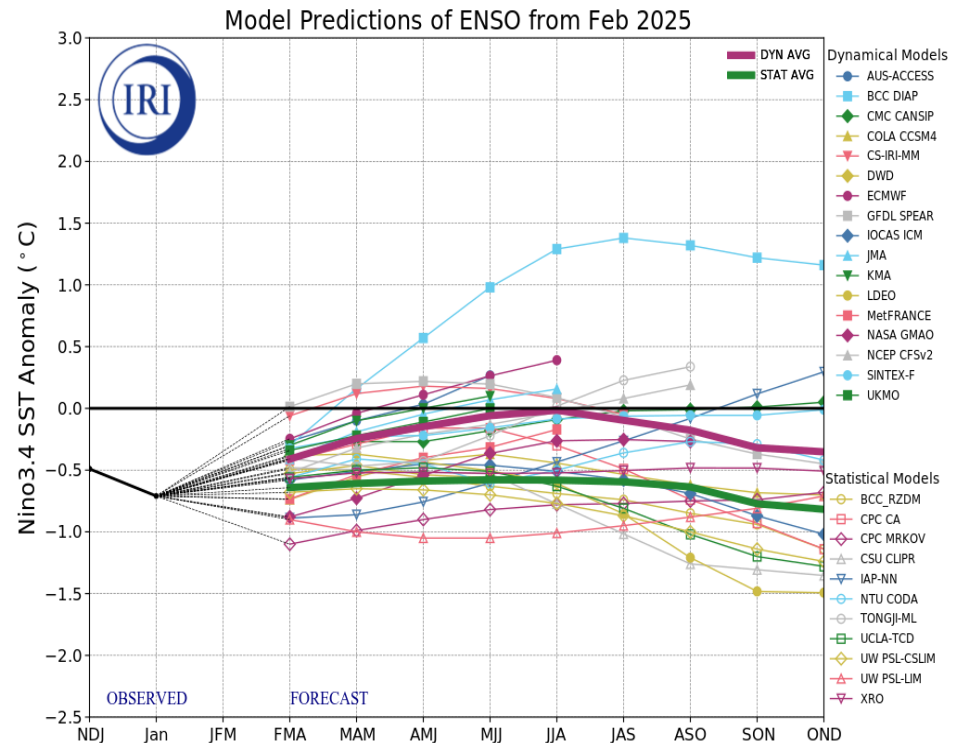


Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 February 2025).

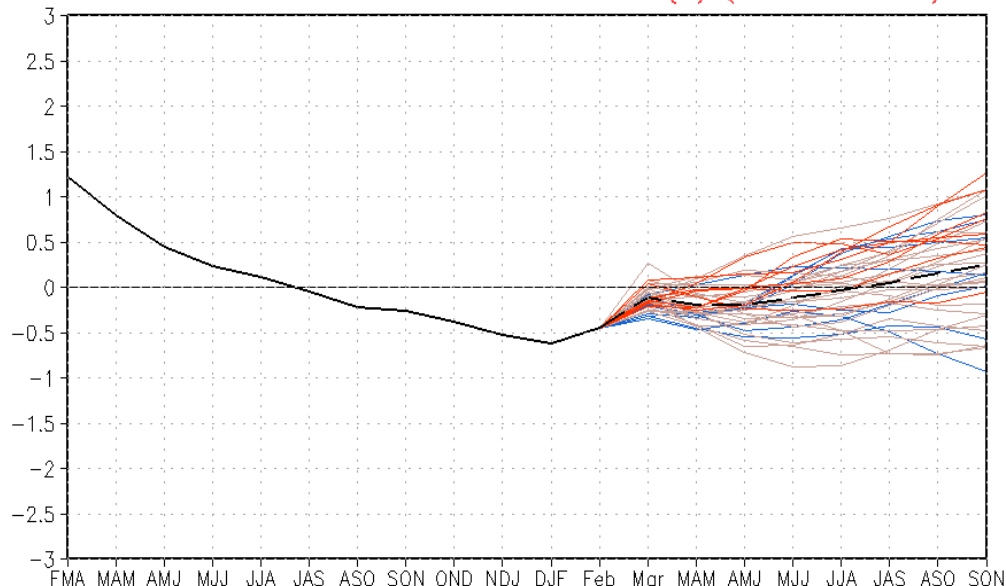


# SST Outlook: NCEP CFS.v2 Forecast (PDF corrected)

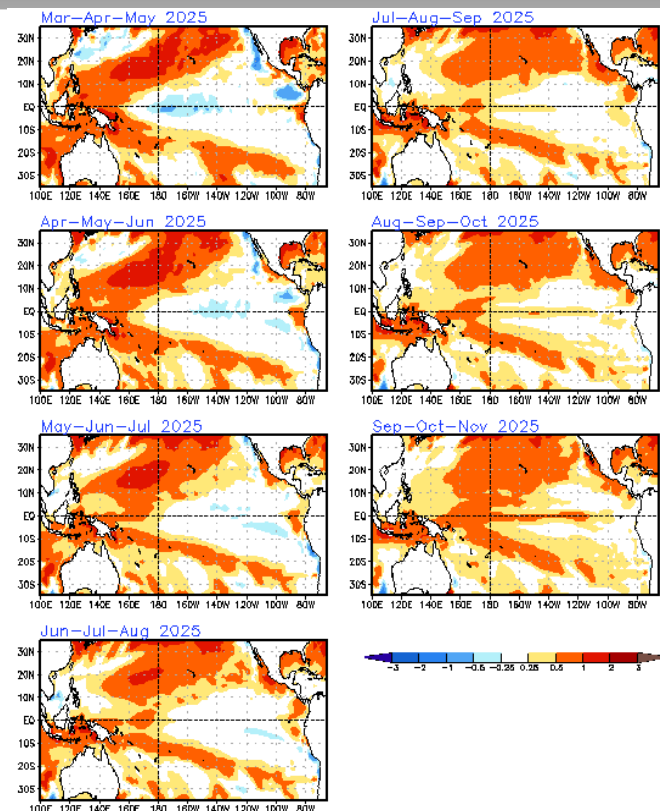
Issued: 23 February 2025

The CFS.v2 ensemble mean (black dashed line) indicates a transition from La Niña to ENSO-neutral in the next month, and ENSO-neutral is favored to persist into Northern Hemisphere fall.

CFSv2 forecast Nino3.4 SST anomalies (K) (PDF corrected)

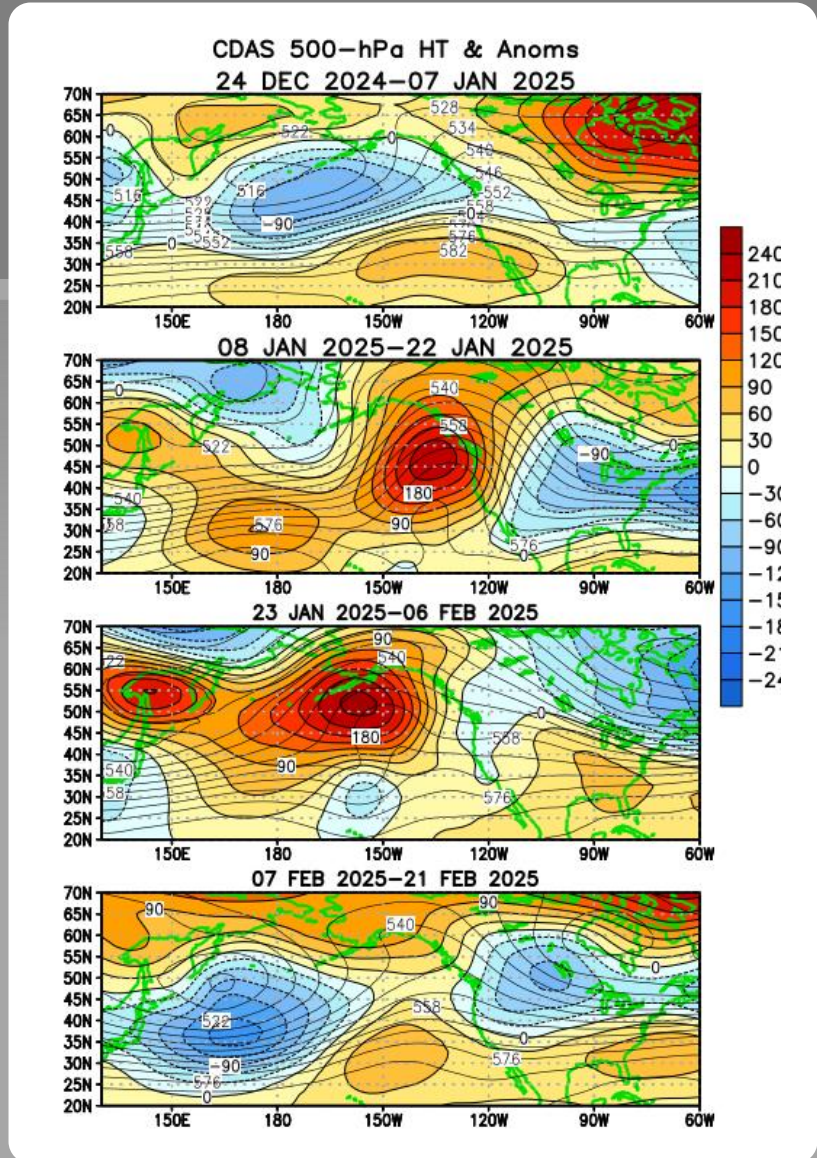


— Latest 8 forecast members  
— Earliest 8 forecast members  
— Other forecast members  
— Forecast ensemble mean  
— NCEI Olv2.1 daily analysis  
(Climatology base period: 1991–2020)



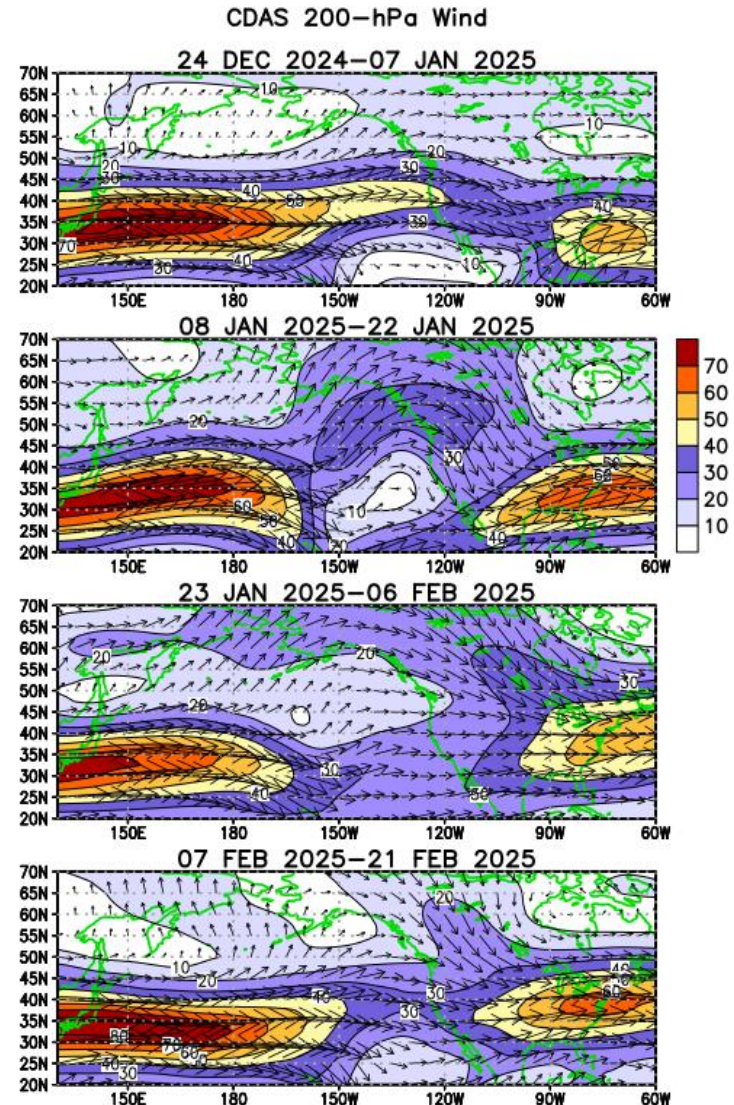
# Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since the beginning of January, the jet stream retracted across the North Pacific Ocean, with above-average heights dominating over the Gulf of Alaska and/or eastern N. Pacific Ocean. Downstream of the anomalous ridge, below-average heights and temperatures generally prevailed.



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

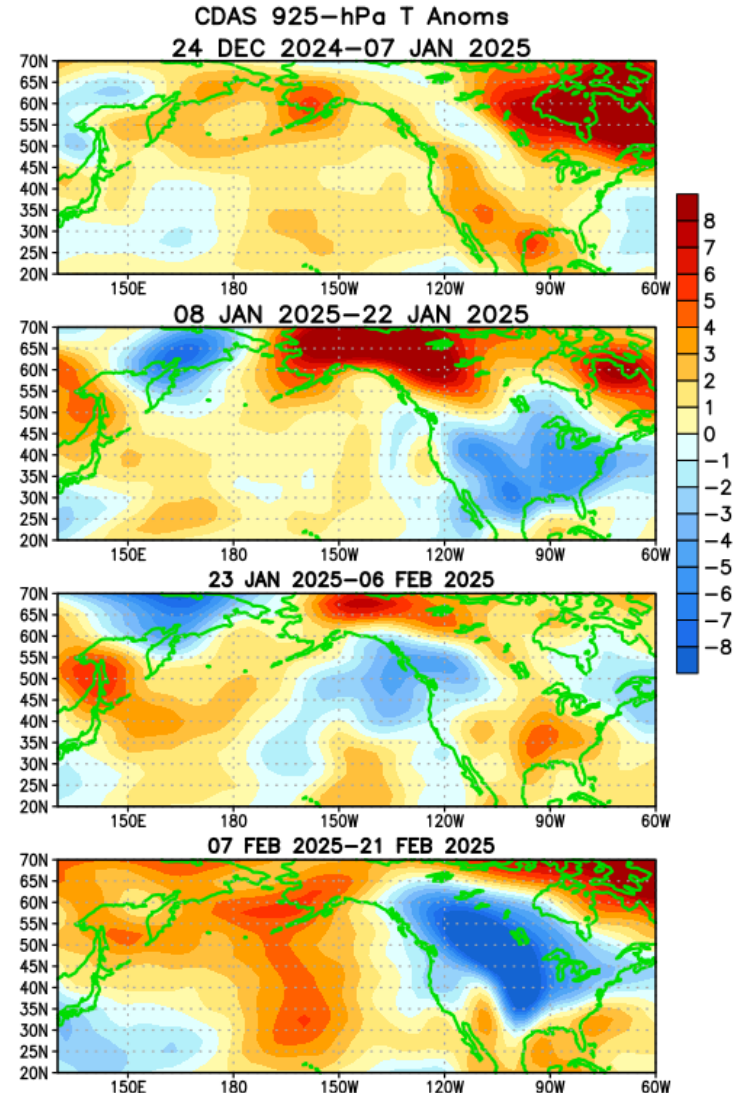
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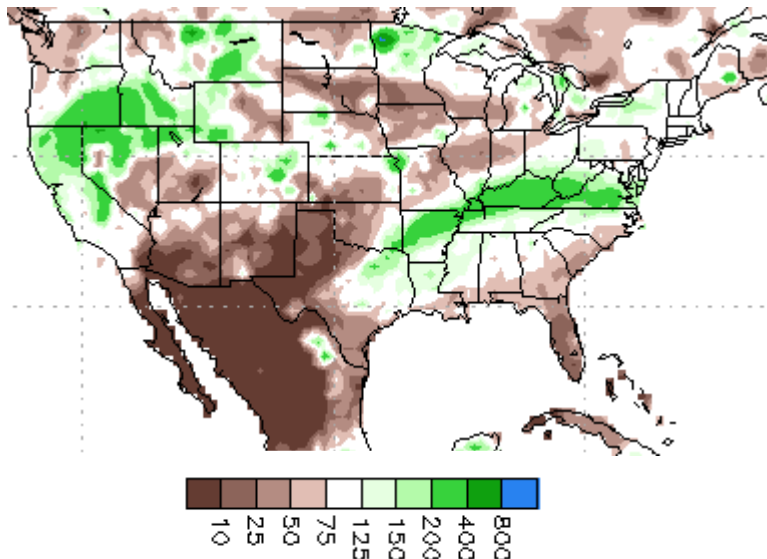
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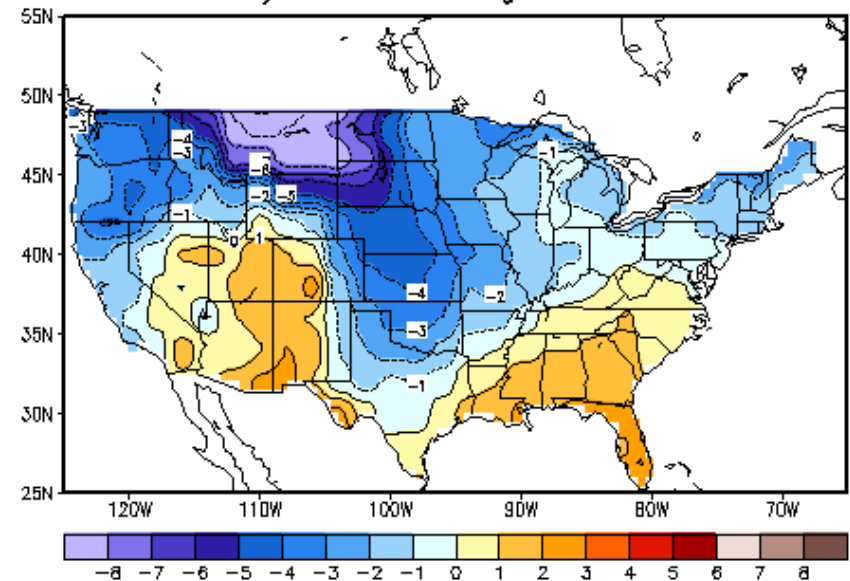
# U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 22 February 2025

Percent of Average Precipitation



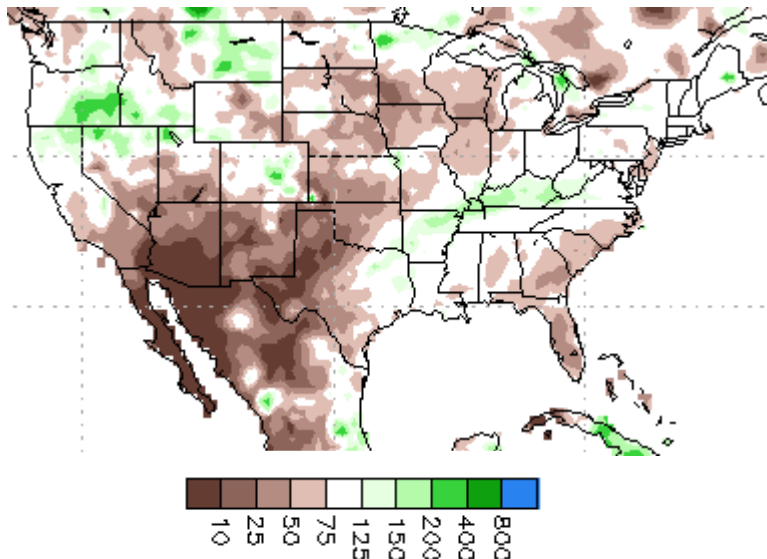
Temperature Departures (degree C)



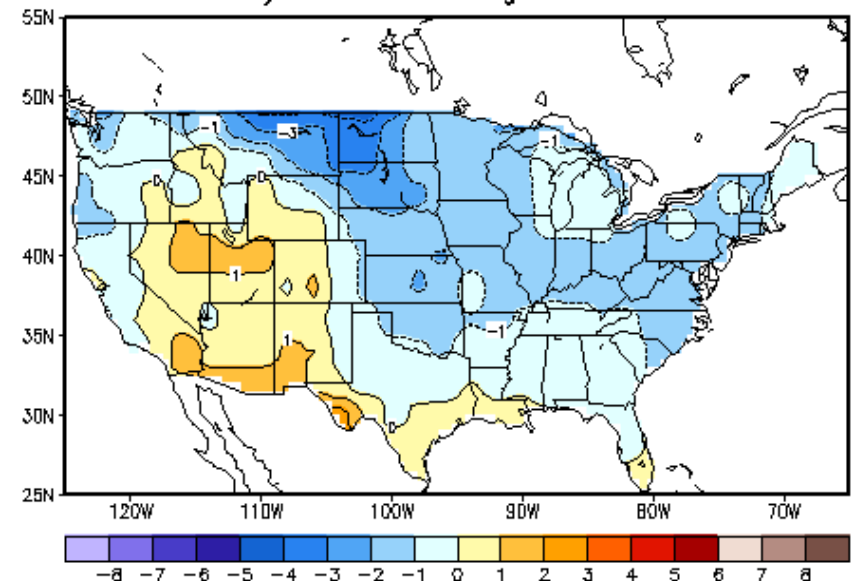
# U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 22 February 2025

Percent of Average Precipitation

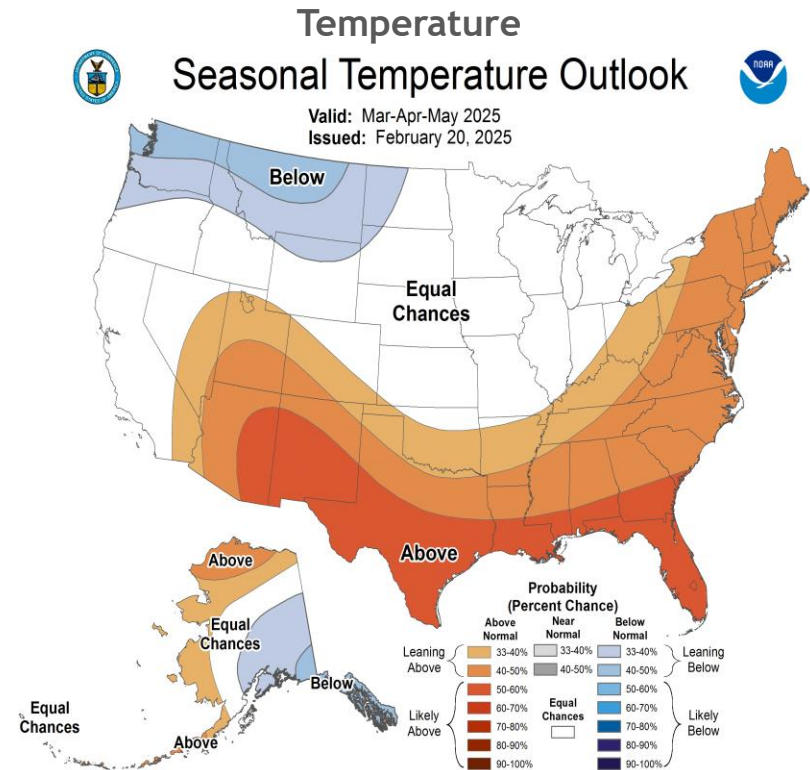
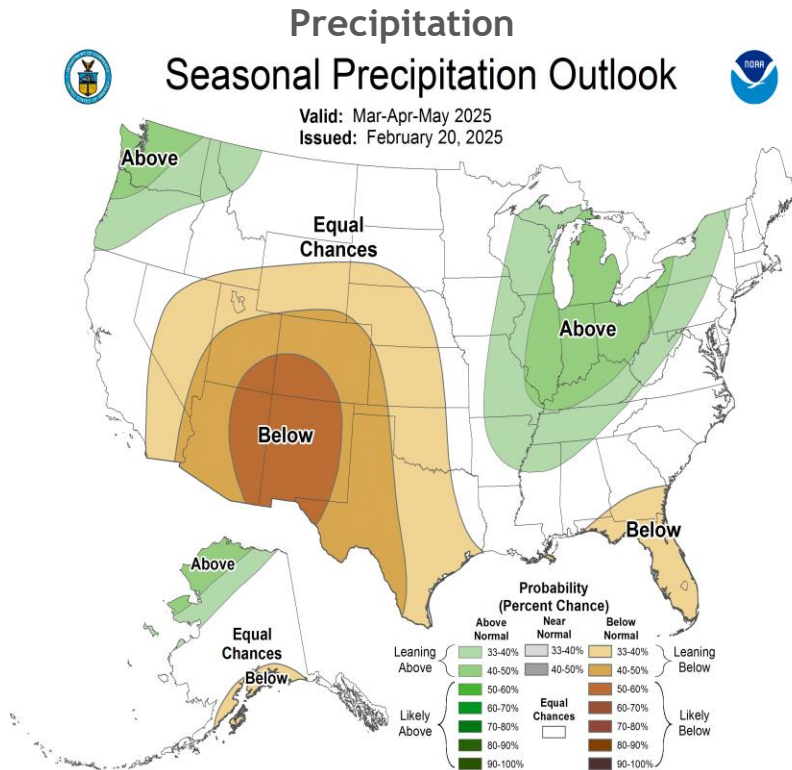


Temperature Departures (degree C)



# March-May 2025

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 conditions are present.\*

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

La Niña conditions are expected to persist in the near-term, with a transition to ENSO-neutral likely during March-May 2025 (66% chance).

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