ENSO: Recent Evolution, Current Status and Predictions

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

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Recent Evolution and Current Conditions

Oceanic Niño Index (ONI)

Pacific SST Outlook

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Summary

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ENSO Alert System Status: La Niña Advisory

La Niña conditions are present.*

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

La Niña conditions are expected to persist through February-April 2025 (59% chance), with a transition to ENSO-neutral likely during March-May 2025 (60% chance).

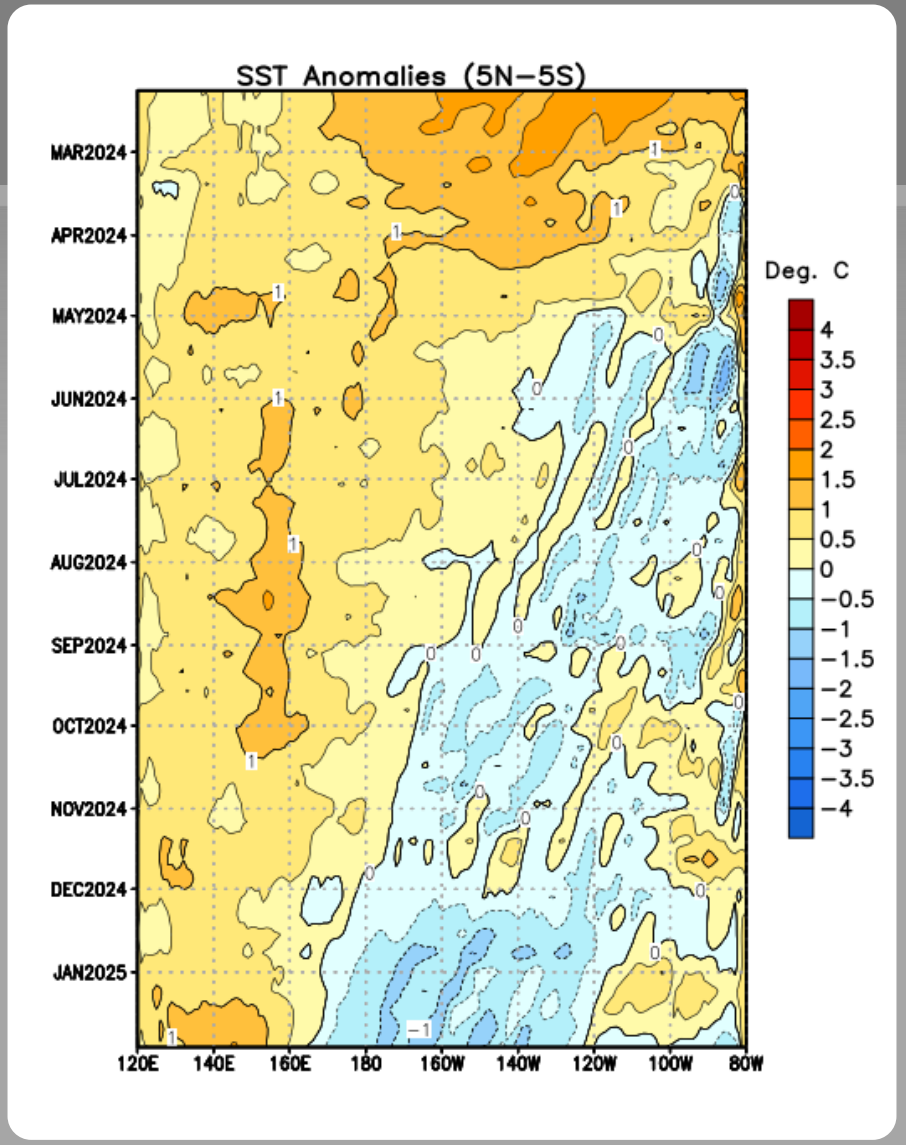
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

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.

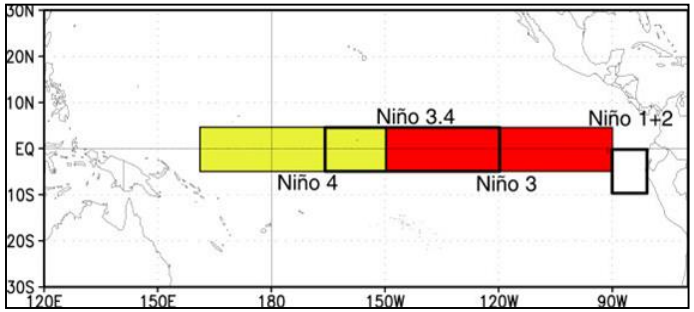
Since early December 2024, below-average SSTs persisted across the central and east-central Pacific Ocean.

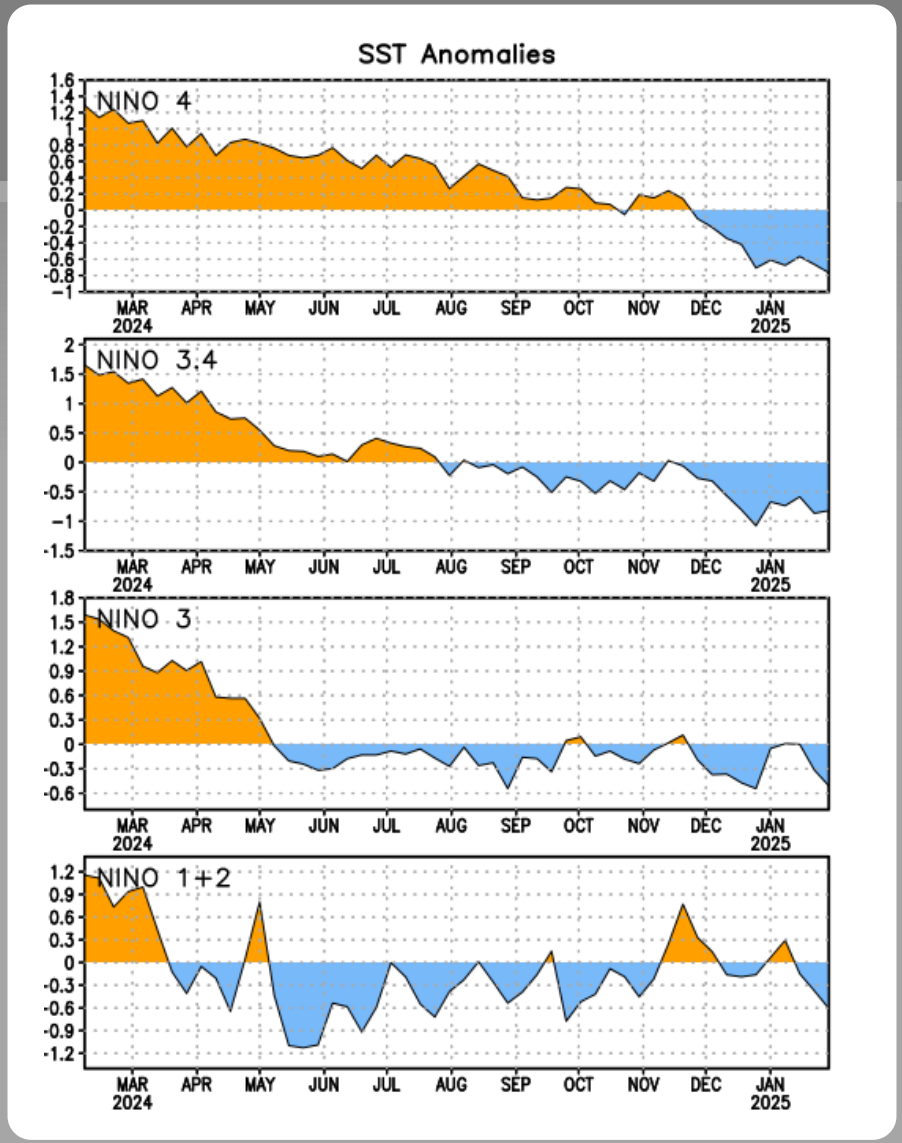


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

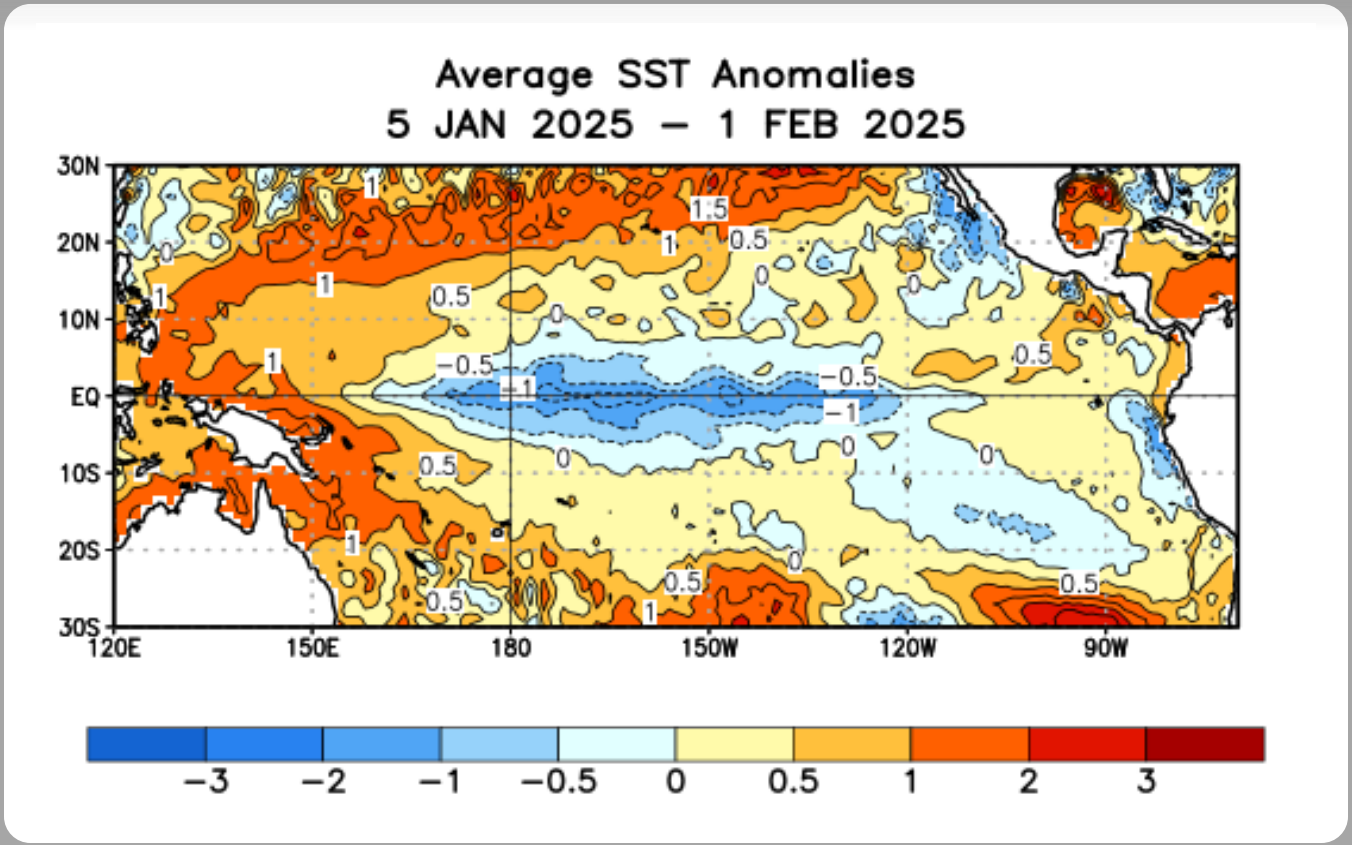
Niño 4	-0.8ºC
Niño 3.4	-0.8ºC
Niño 3	-0.5ºC
Niño 1+2	-0.6ºC





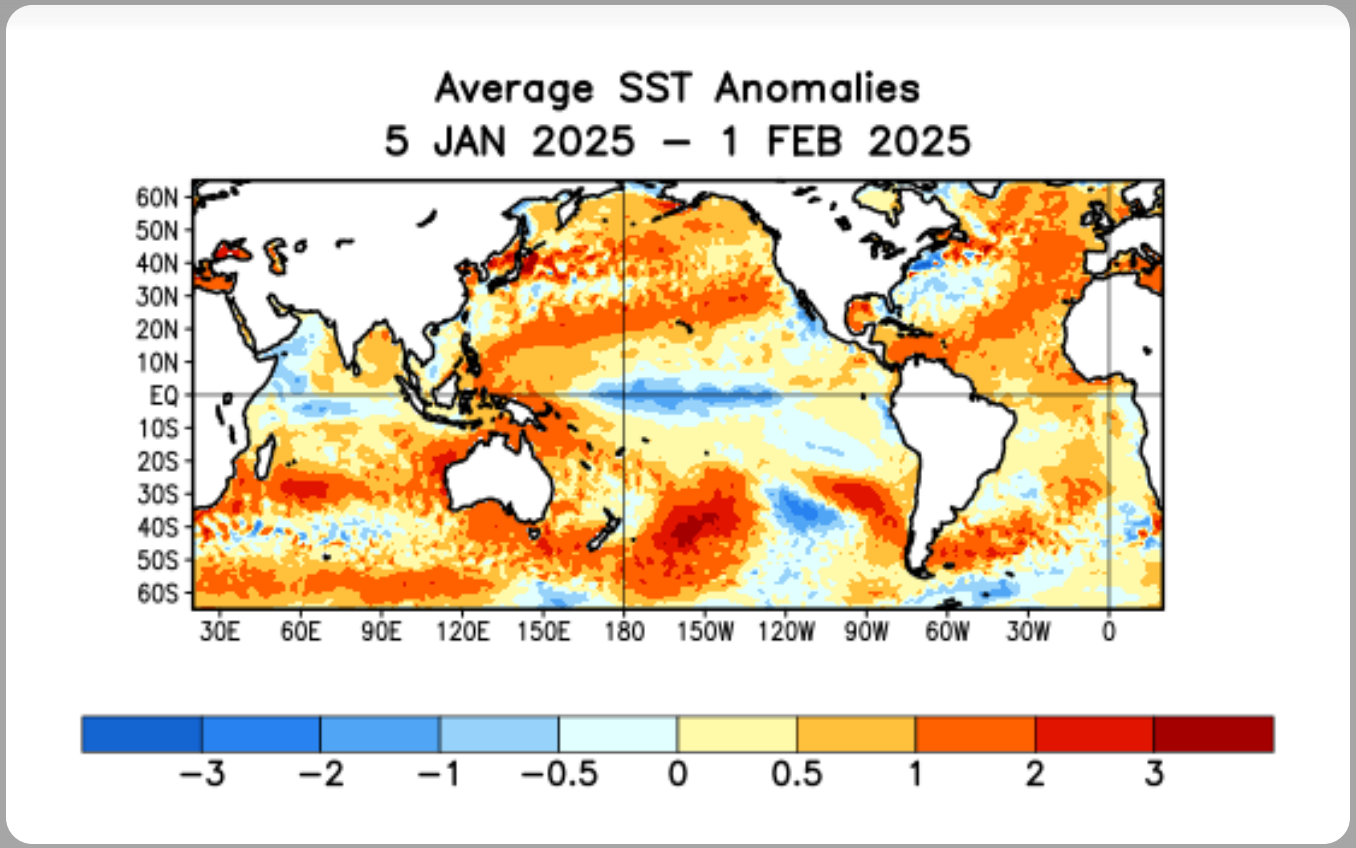
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

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-average SSTs observed in the eastern Pacific Ocean (120° - 90° W).



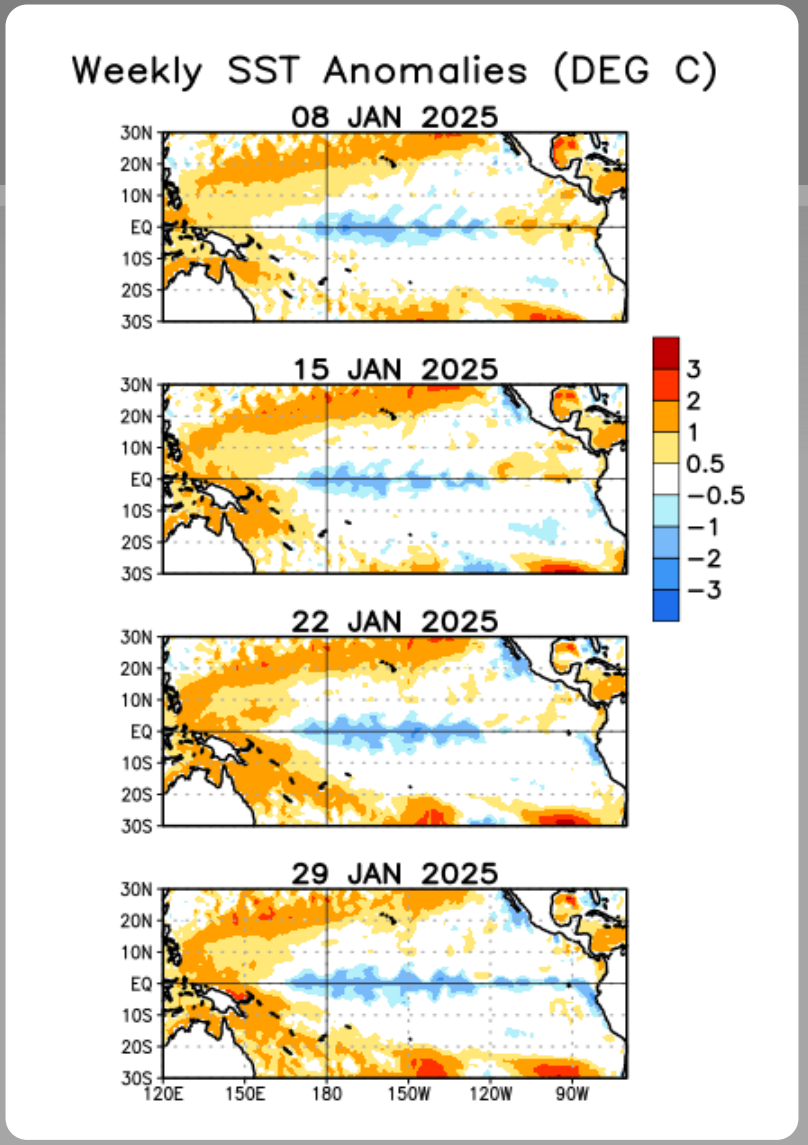
Global SST Departures (°C) During the Last Four Weeks

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 most of the central and east-central Pacific Ocean and in parts of the west-central Indian Ocean.



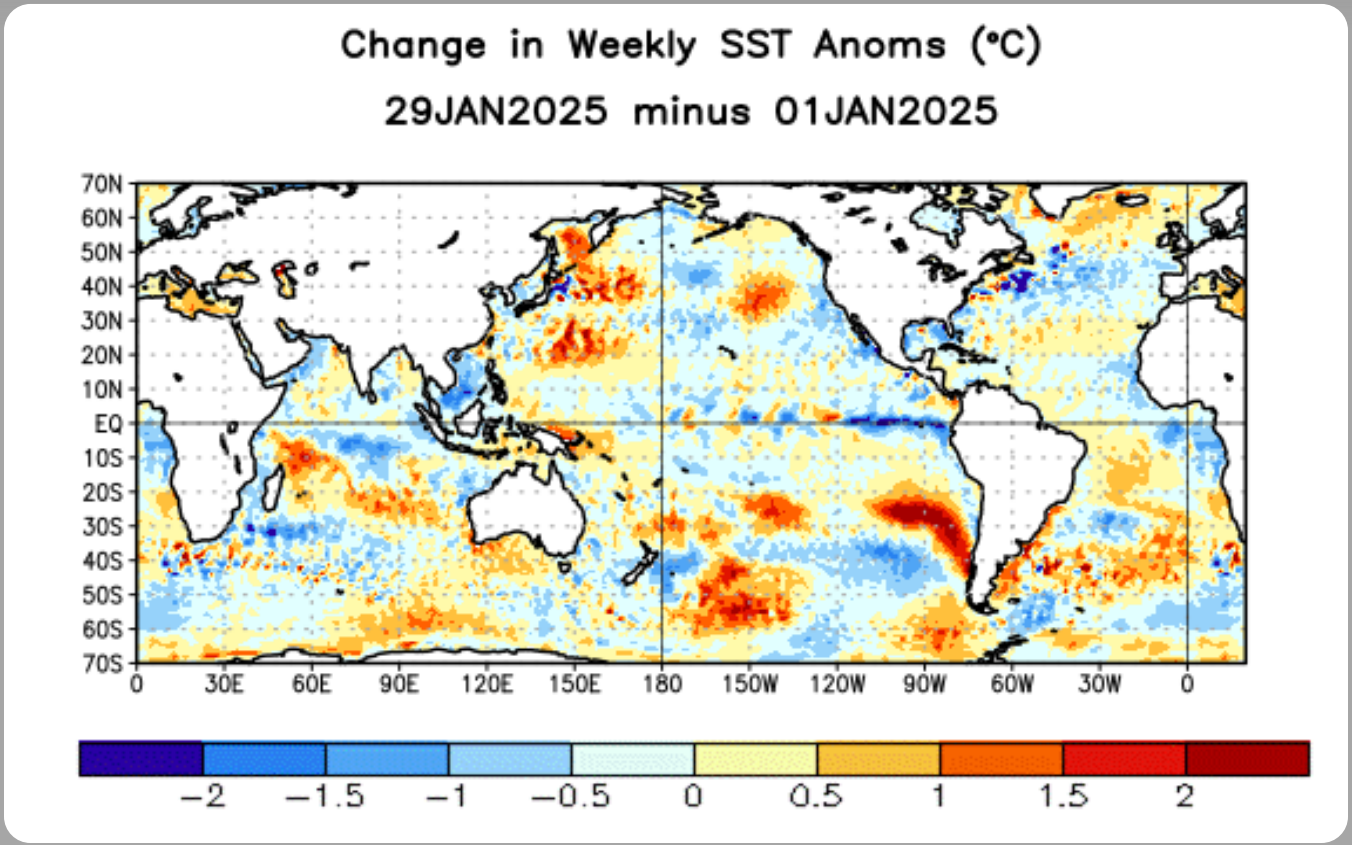
Weekly SST Departures during the Last Four Weeks

During the last 4 weeks, below-average SSTs persisted in the central and east-central equatorial Pacific Ocean. Above-average SSTs weakened in the eastern Pacific Ocean and are now below average.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, mostly negative SST anomaly changes were evident from the central to eastern equatorial Pacific Ocean.



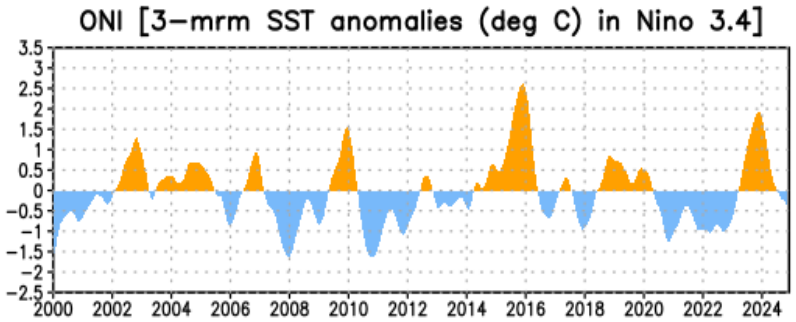
Upper-Ocean Conditions in the Equatorial Pacific

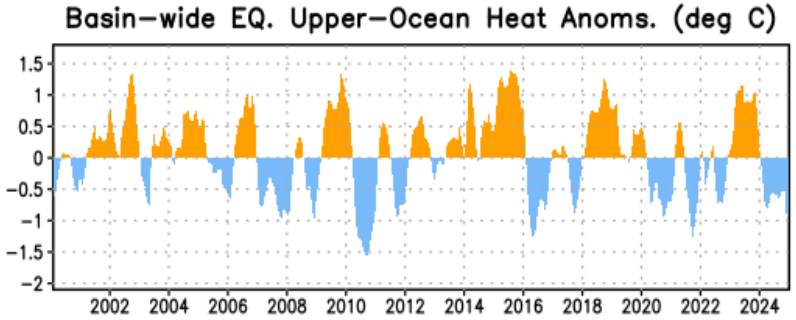
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

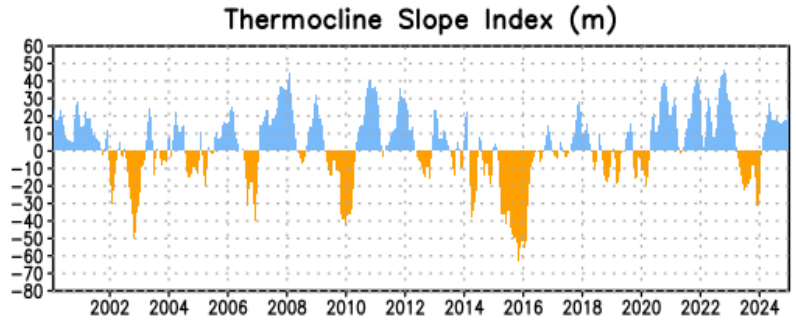
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

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).

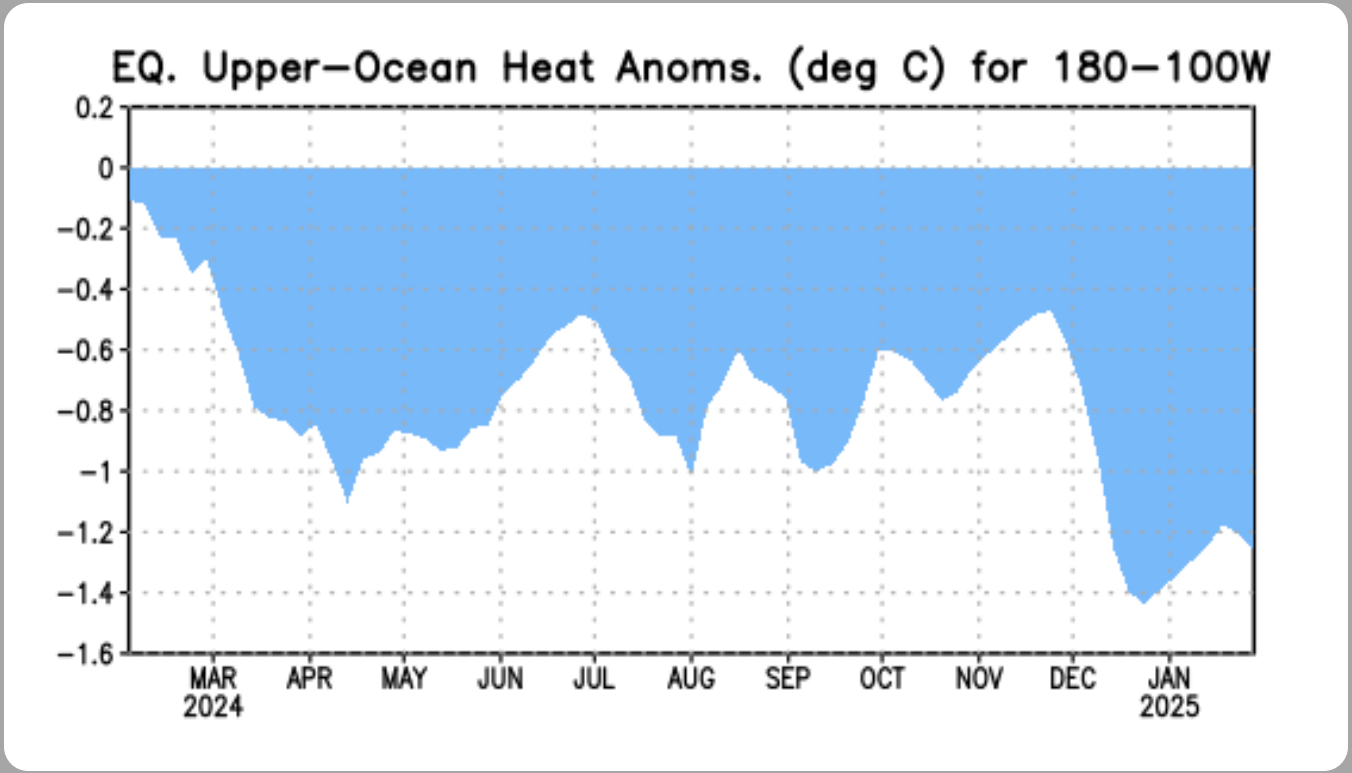






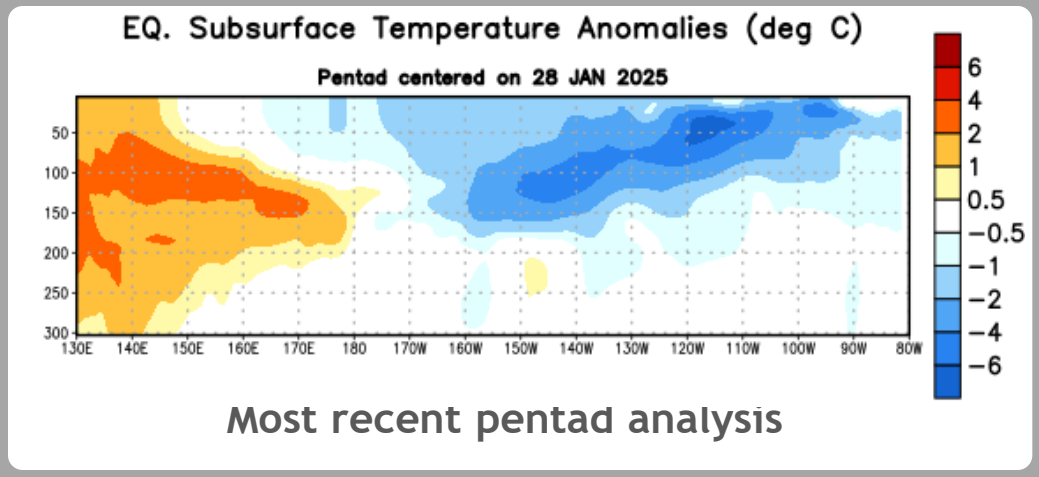
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

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 2025, negative anomalies weakened, but remained significantly negative.



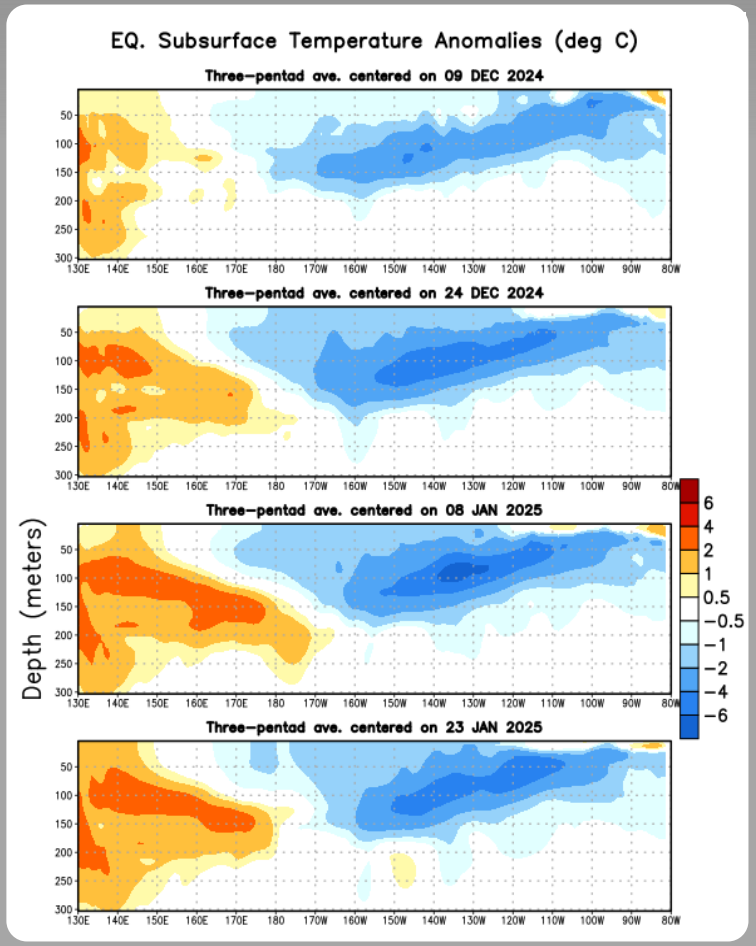
Sub-Surface Temperature Departures in the Equatorial Pacific

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



Most recent pentad analysis

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

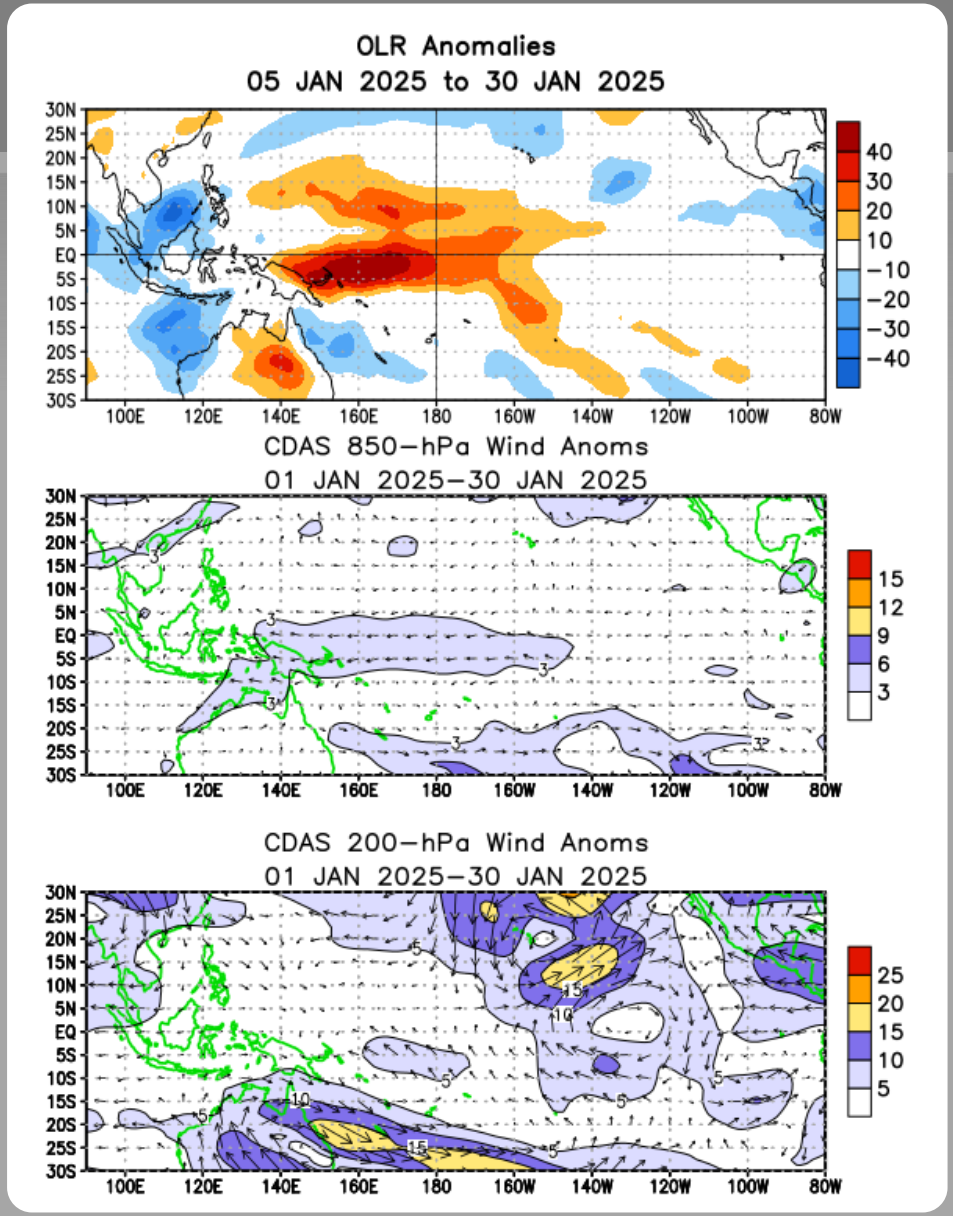


Tropical OLR and Wind Anomalies During the Last 30 Days

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 parts of Indonesia and the Philippines.

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

Upper-level (200-hPa) wind anomalies were mostly cross-equatorial over the east-central and eastern equatorial 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:

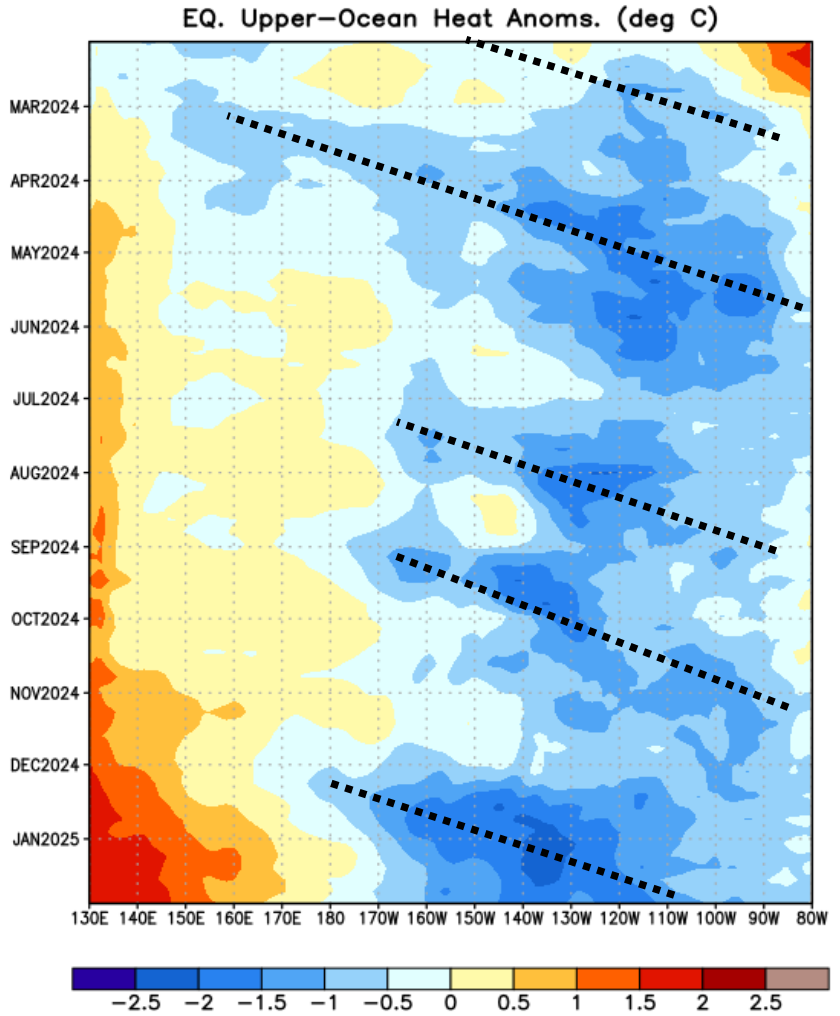
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

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 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.

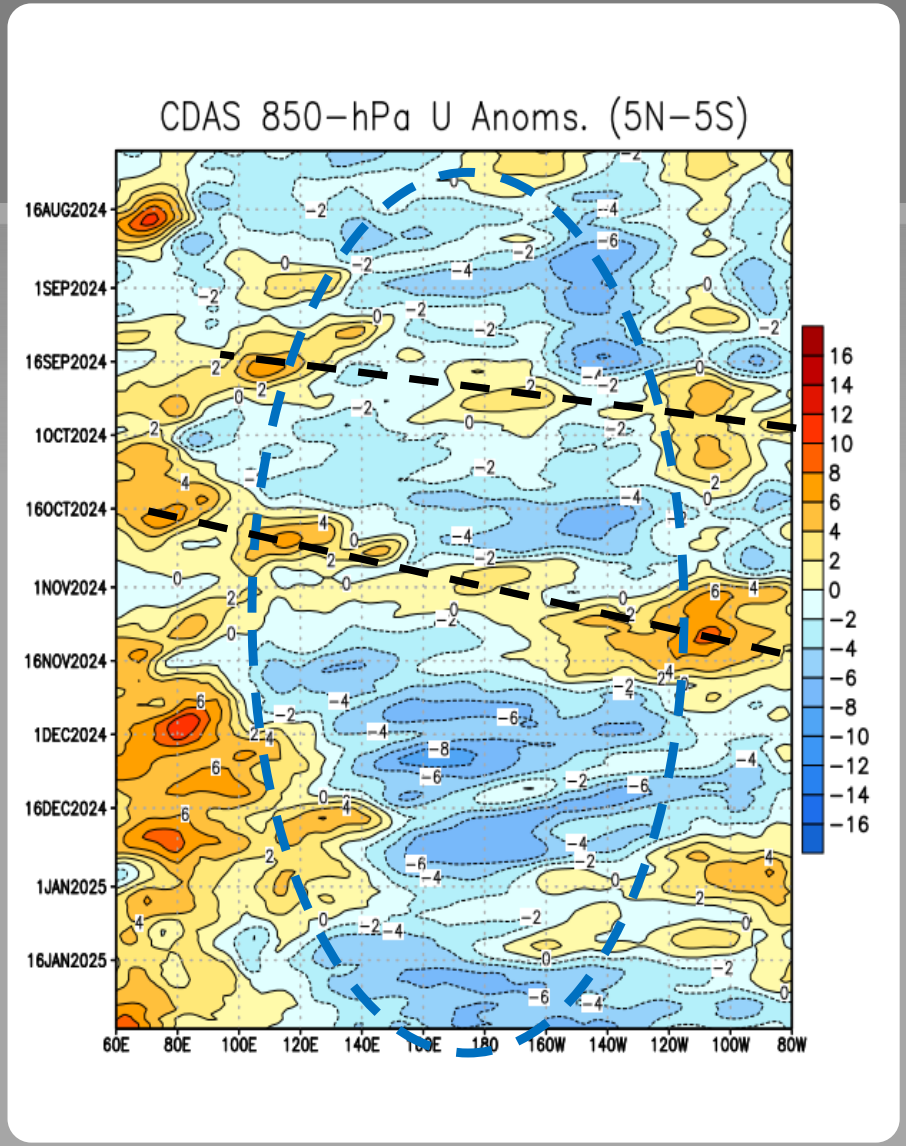


Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

Low-level (850-hPa) Zonal (east-west) Wind Anomalies (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.

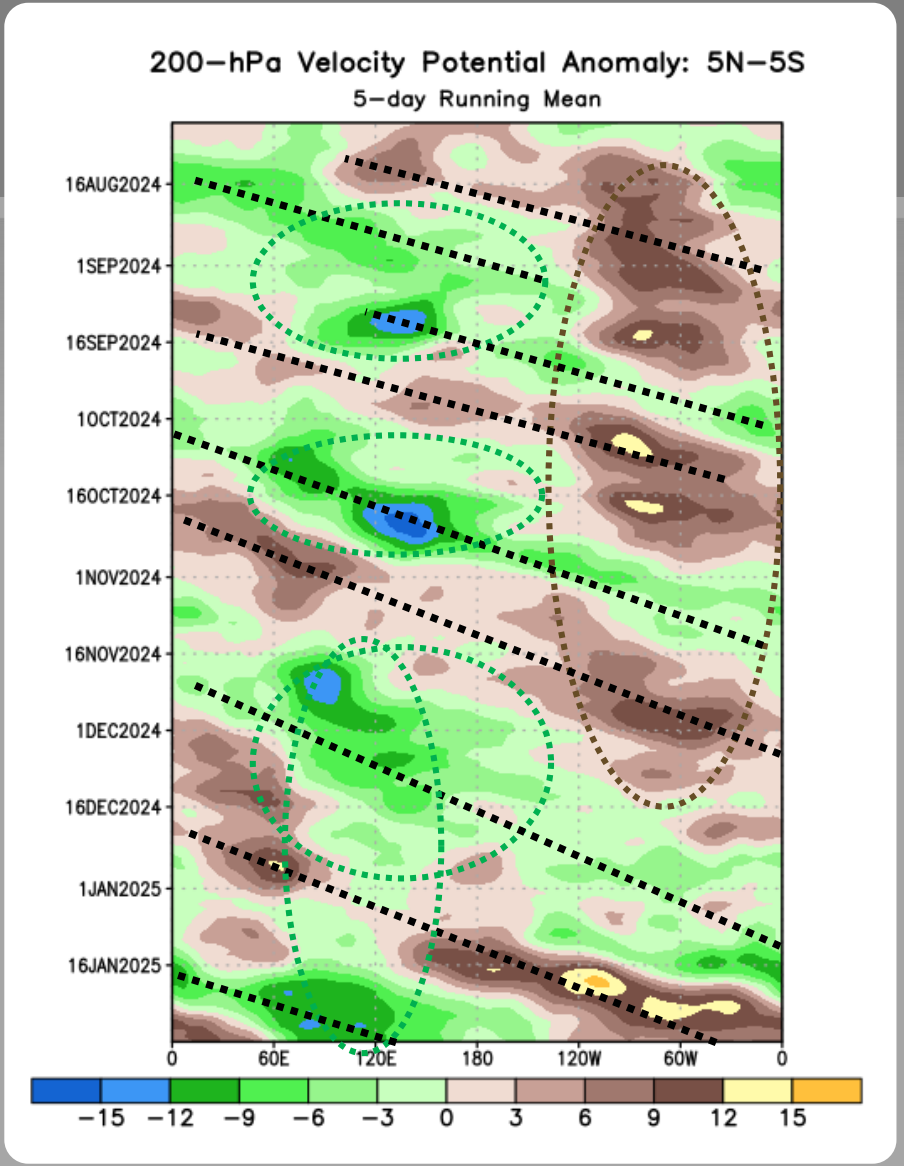


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

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.

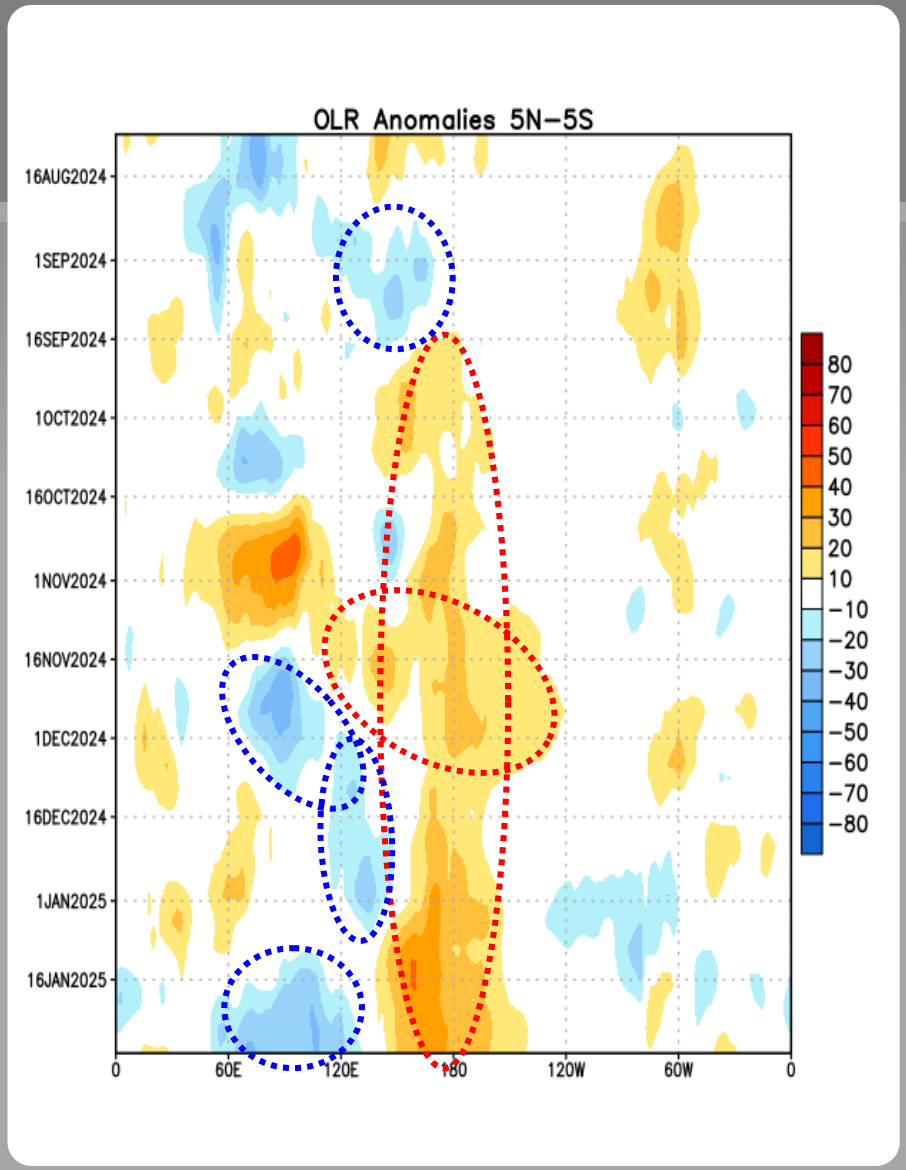


Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)
Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

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°C.

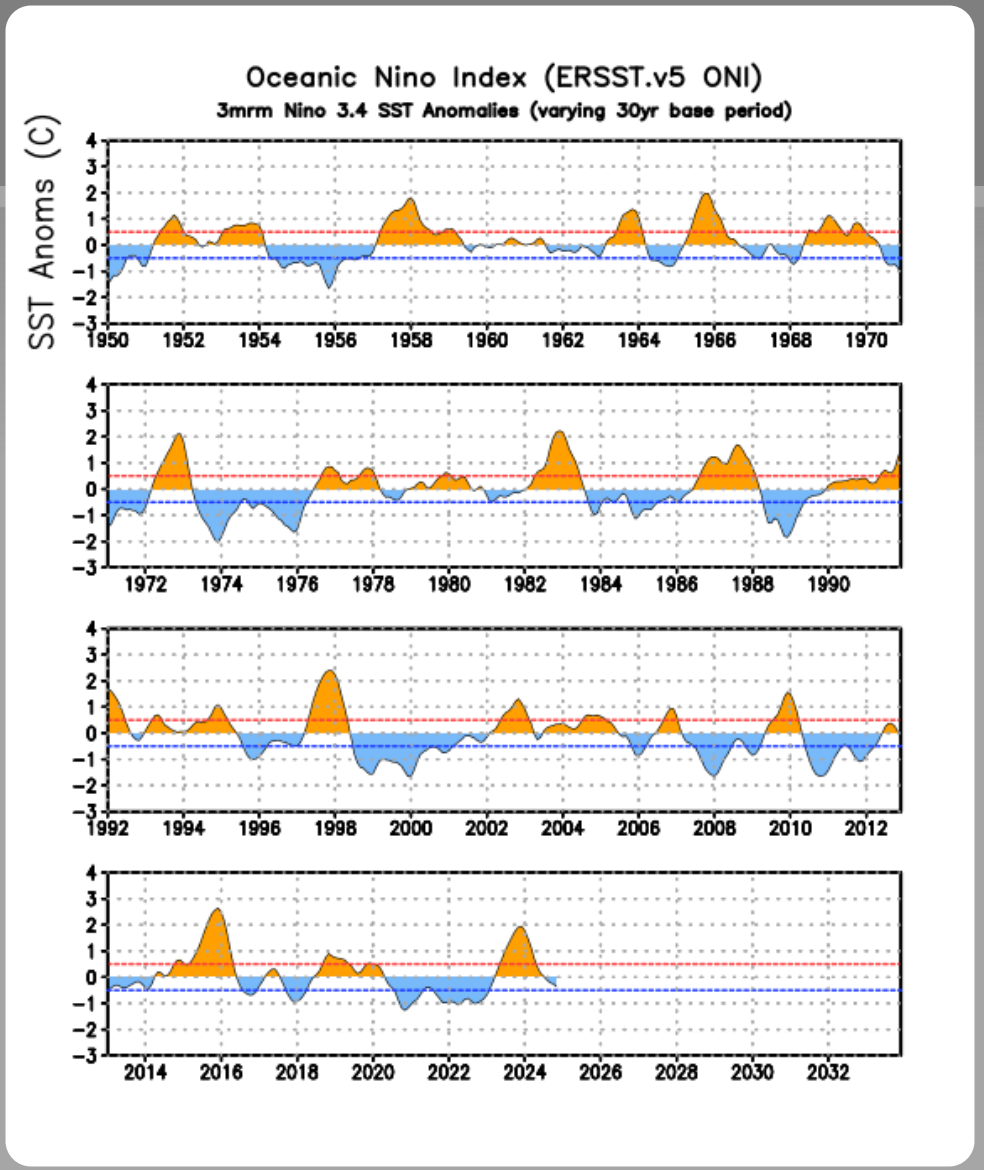
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (October-December 2024) 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.

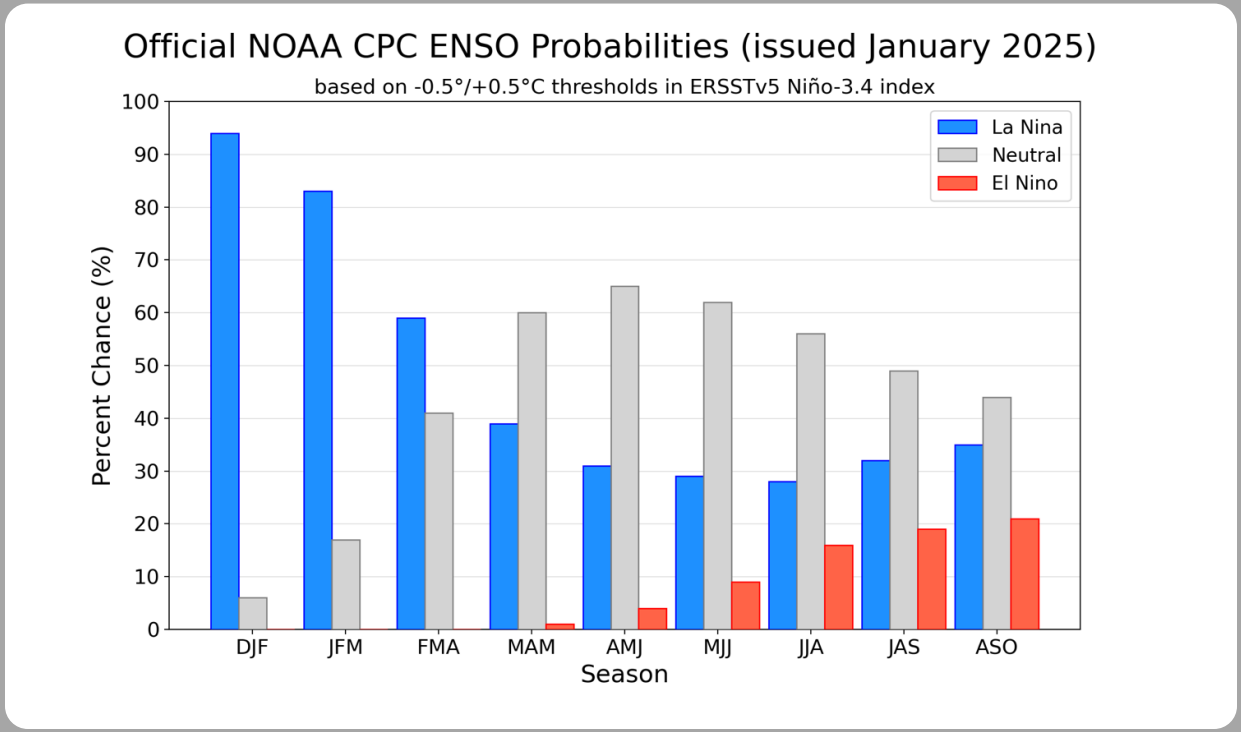
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
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	

CPC Probabilistic ENSO Outlook

Updated: 9 January 2025

La Niña conditions are expected to persist through February-April 2025 (59% chance), with a transition to ENSO-neutral likely during March-May 2025 (60% chance).



IRI Pacific Niño 3.4 SST Model Outlook

Most models suggest La Niña will persist through February-April 2025 and then transition to ENSO-neutral.

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.

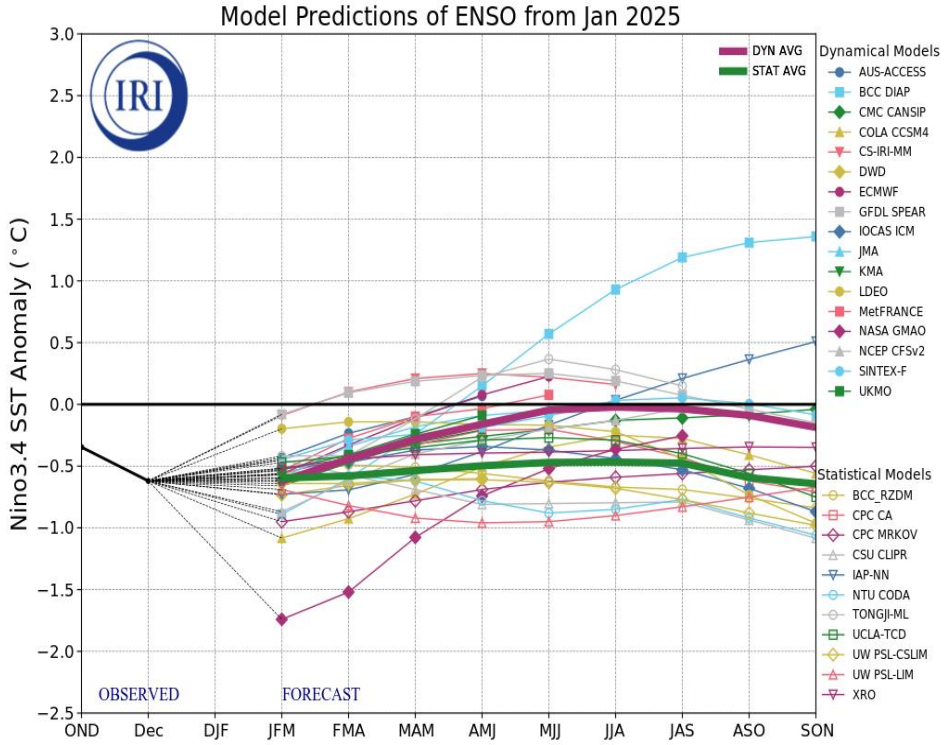
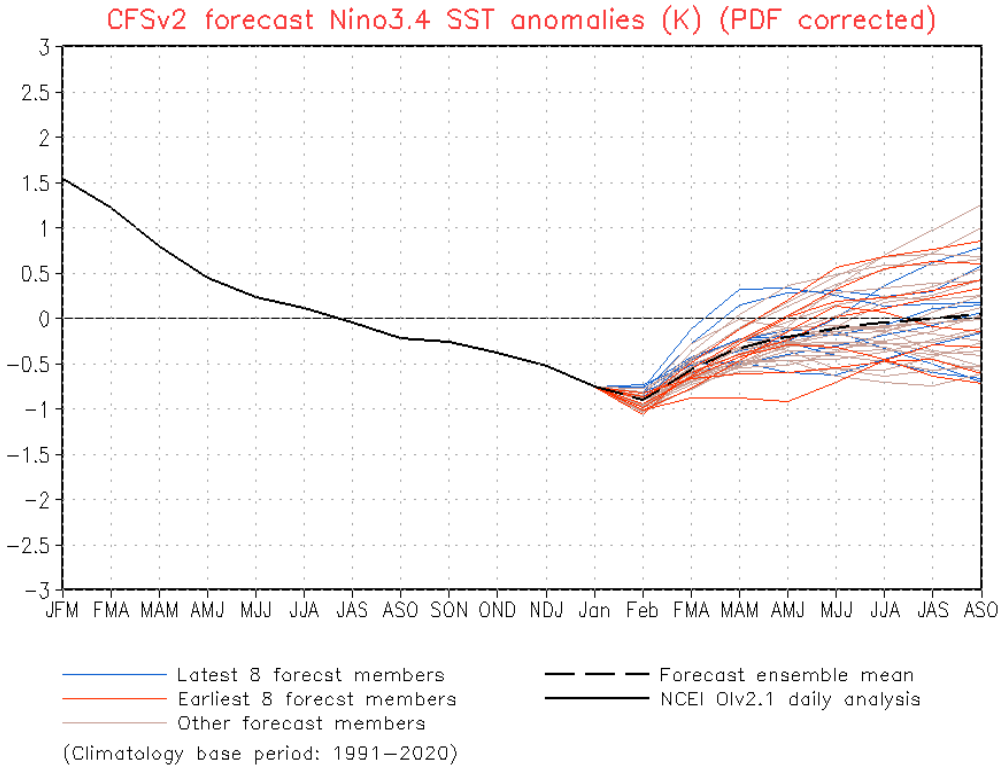


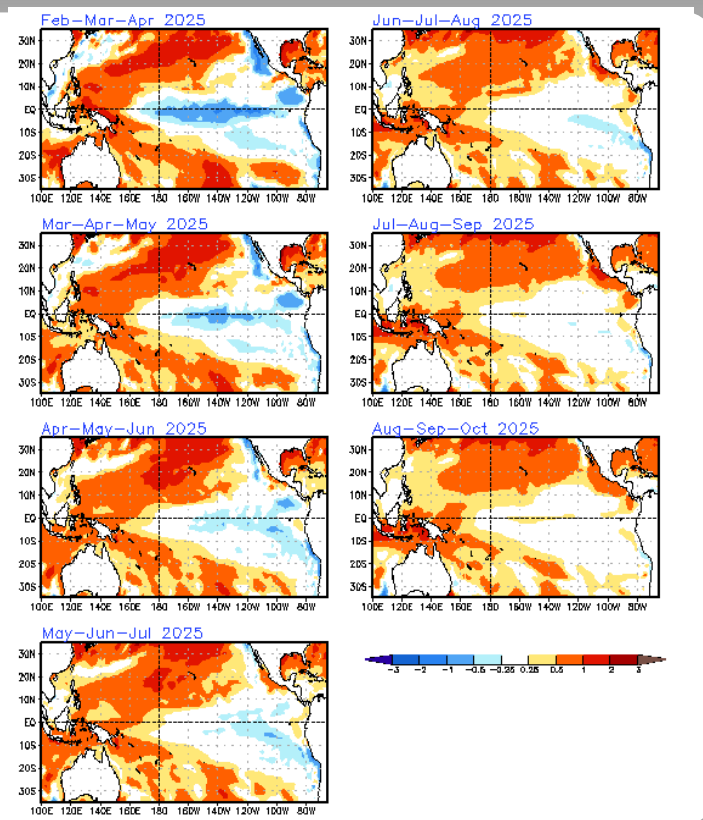
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 21 January 2025).

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

Issued: 2 February 2025

The CFS.v2 ensemble mean (black dashed line) indicates La Niña conditions are expected to persist through February-April 2025.

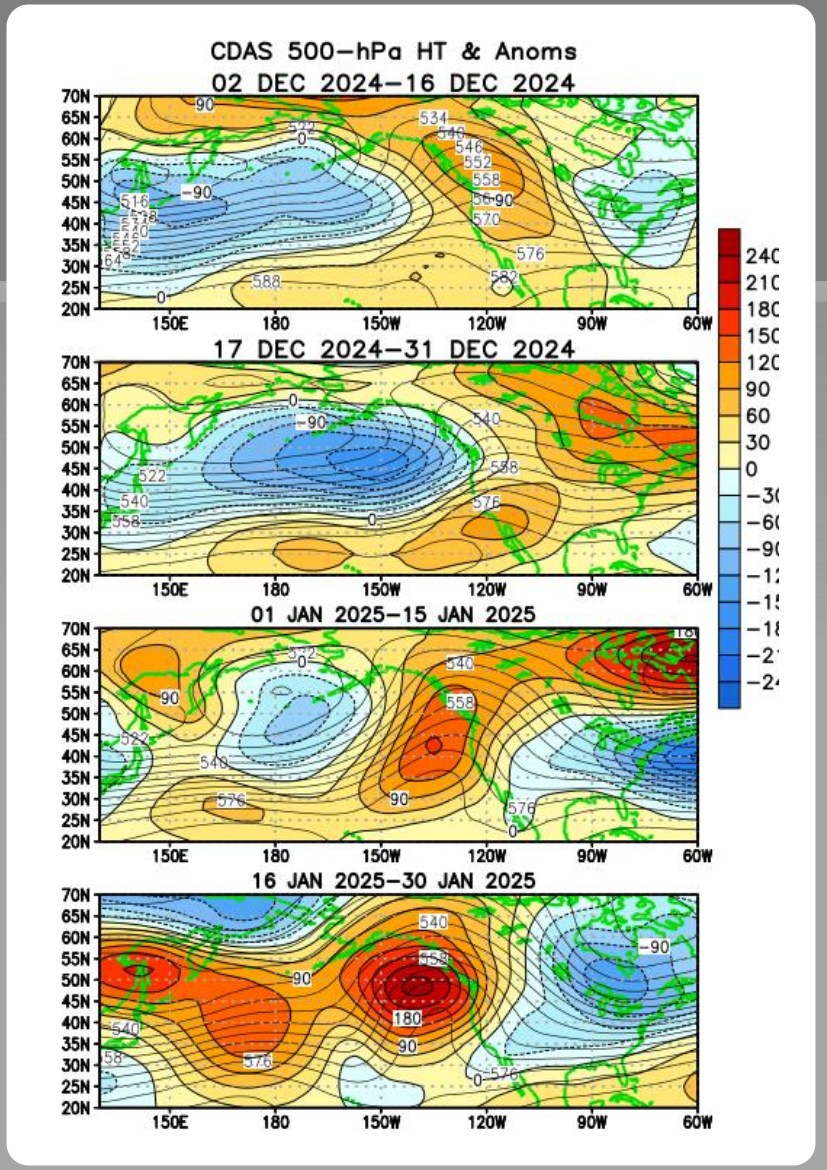




Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During December 2024, the jet stream extended across the North Pacific Ocean, with below-average heights expanding into the Gulf of Alaska during December. Downstream, above-average heights and temperatures mostly dominated over the contiguous U.S.

Starting in early January 2025, above-average heights and temperatures emerged in the Gulf of Alaska, while below-average heights and temperatures dominated the contiguous U.S.



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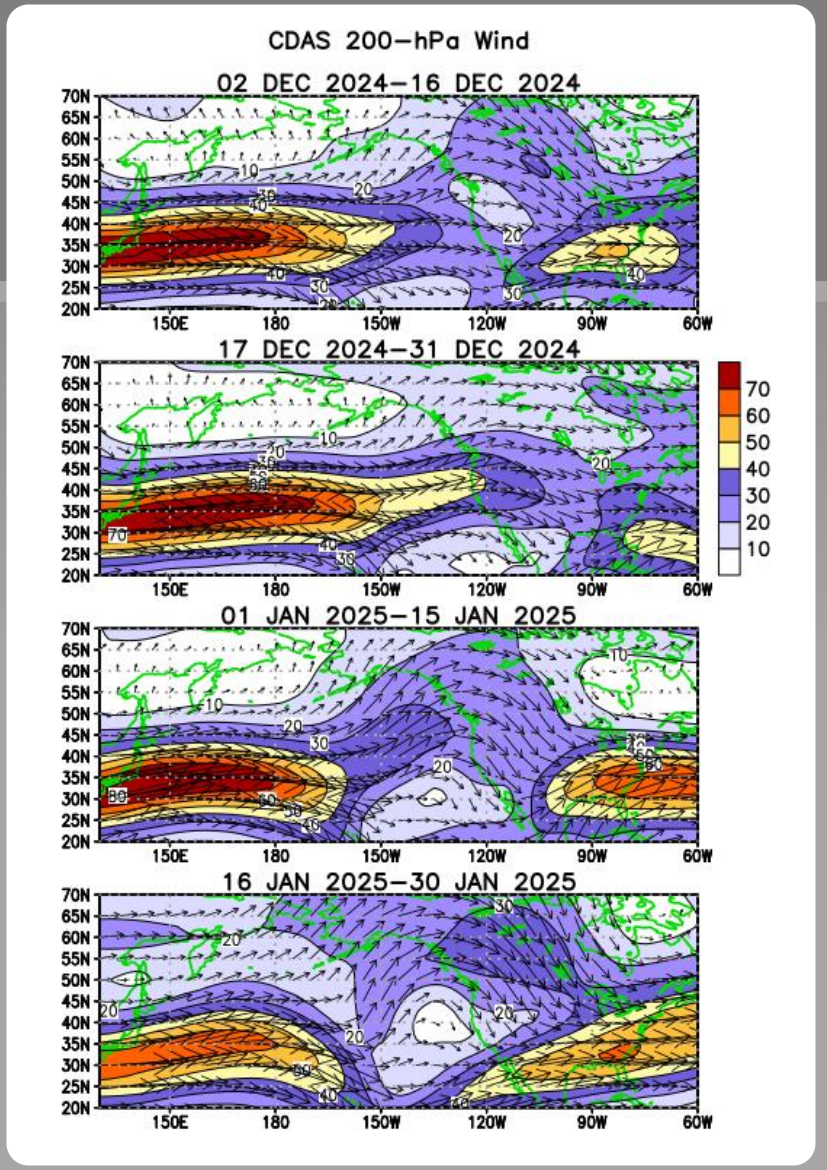

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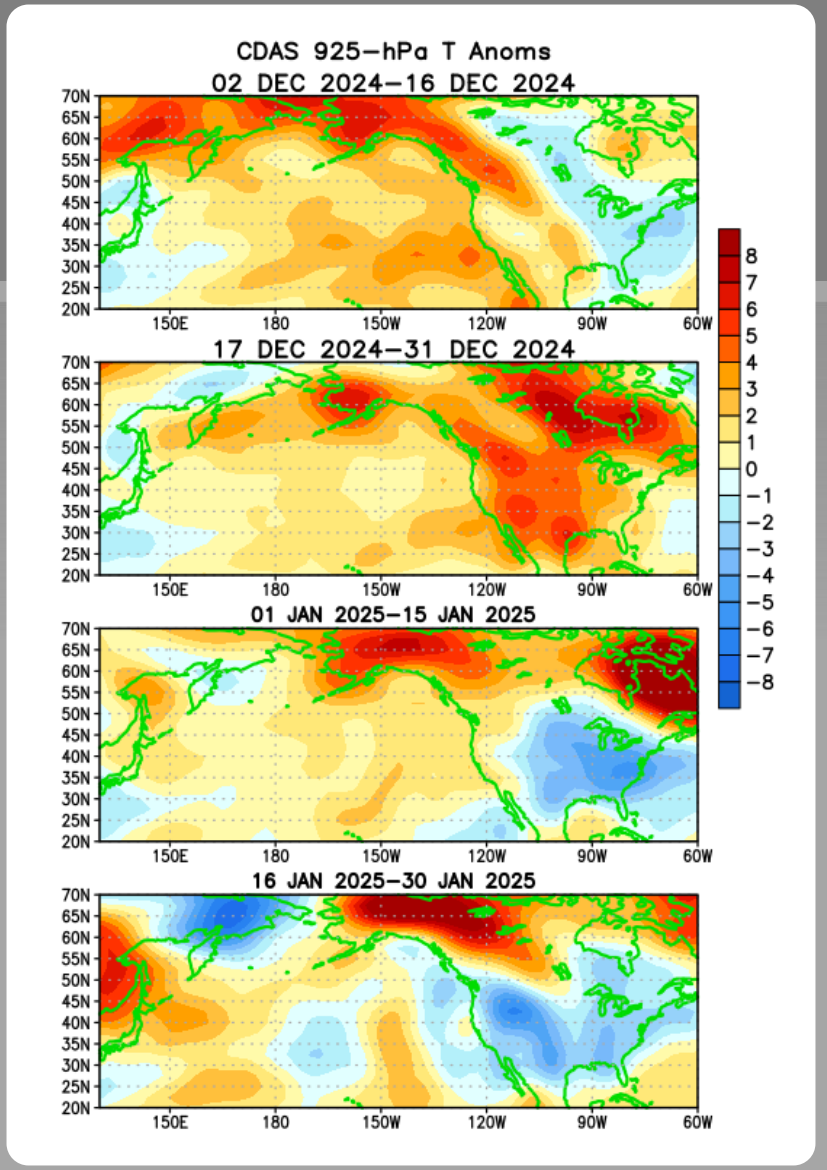
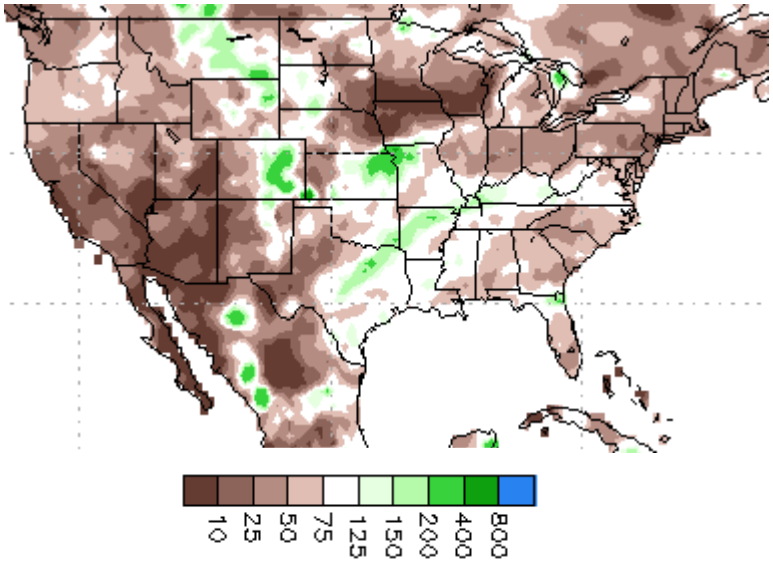


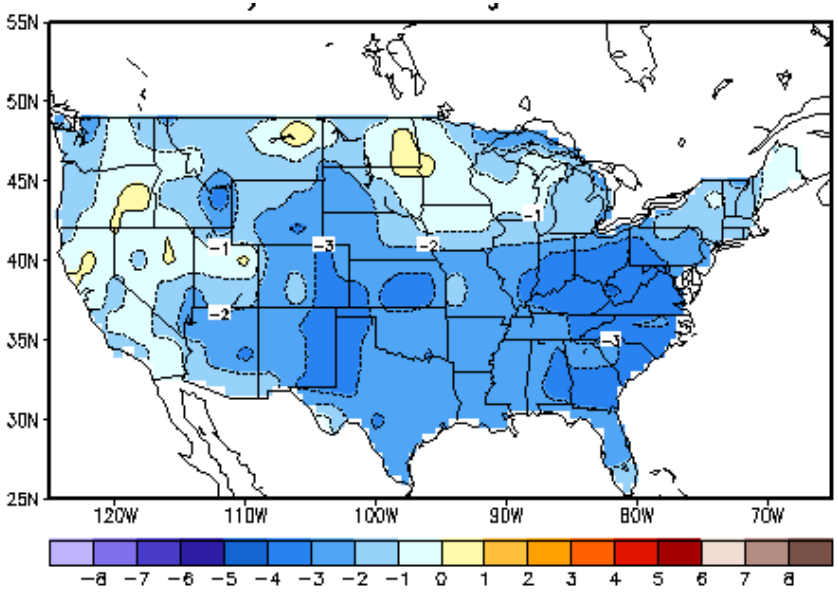
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 1 February 2025

Percent of Average Precipitation



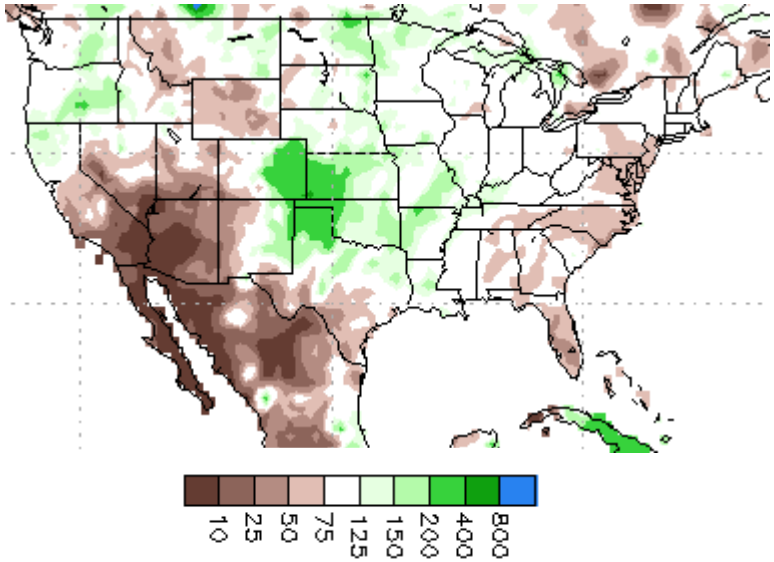
Temperature Departures (degree C)



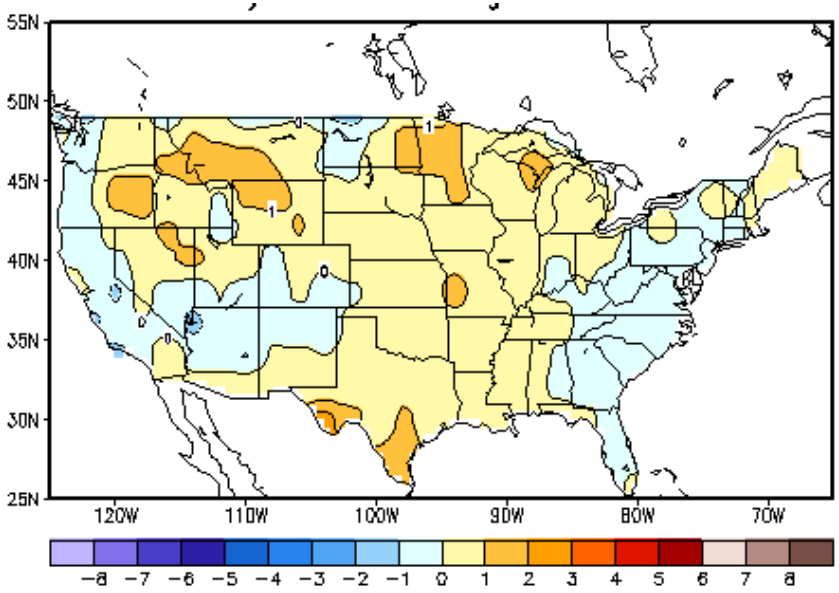
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 1 February 2025

Percent of Average Precipitation



Temperature Departures (degree C)

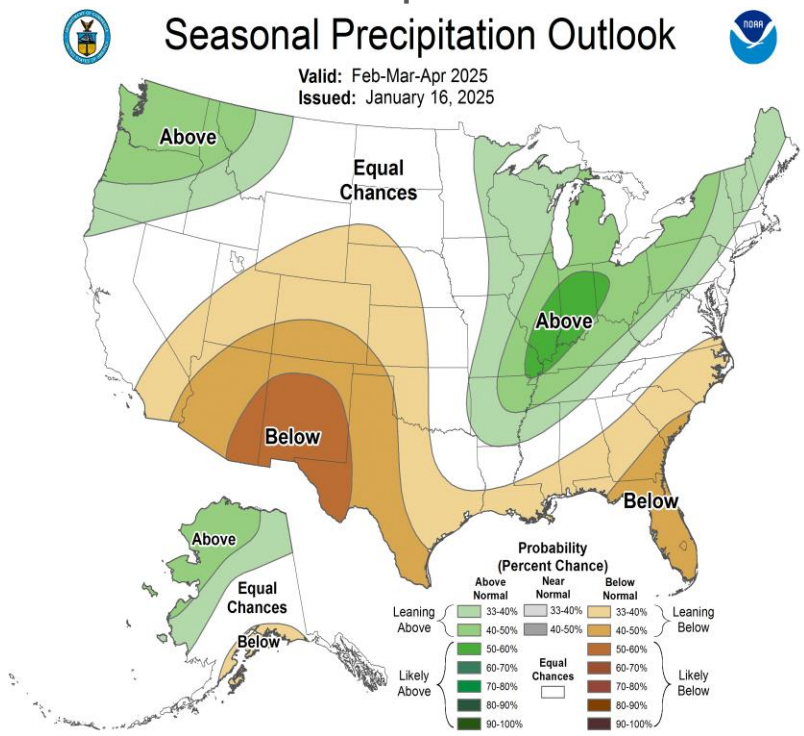


U. S. Seasonal Outlooks

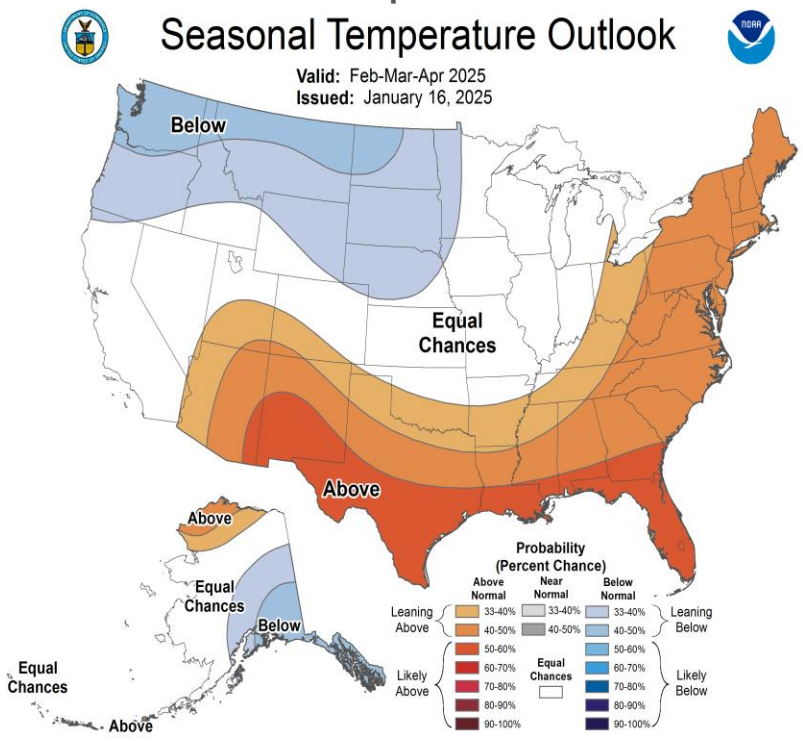
February - April 2025

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

Precipitation



Temperature



Summary

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