

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
10 June 2024

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: **El Niño Advisory** / **La Niña Watch**

El Niño is transitioning toward ENSO-neutral.*

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

A transition from El Niño to ENSO-neutral is likely in the next month. La Niña may develop in June-August 2024 (49% chance) or July-September (69% 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](#).

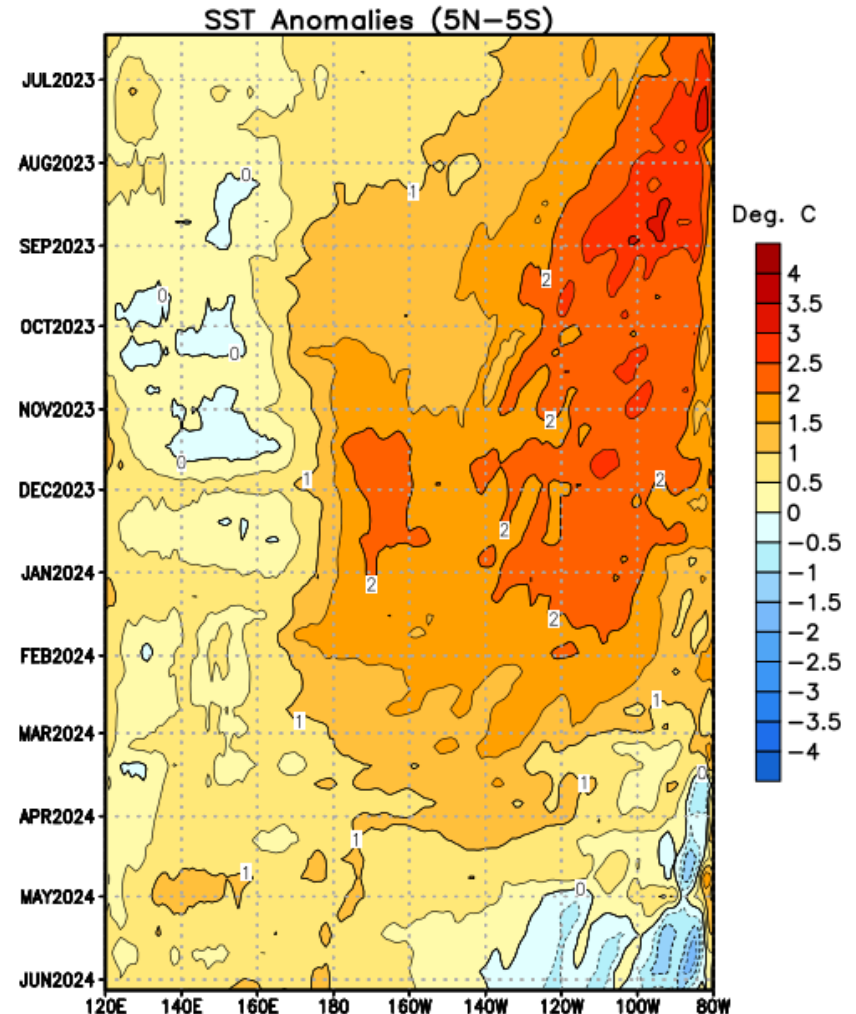
Recent Evolution of Equatorial Pacific SST Departures (°C)

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.

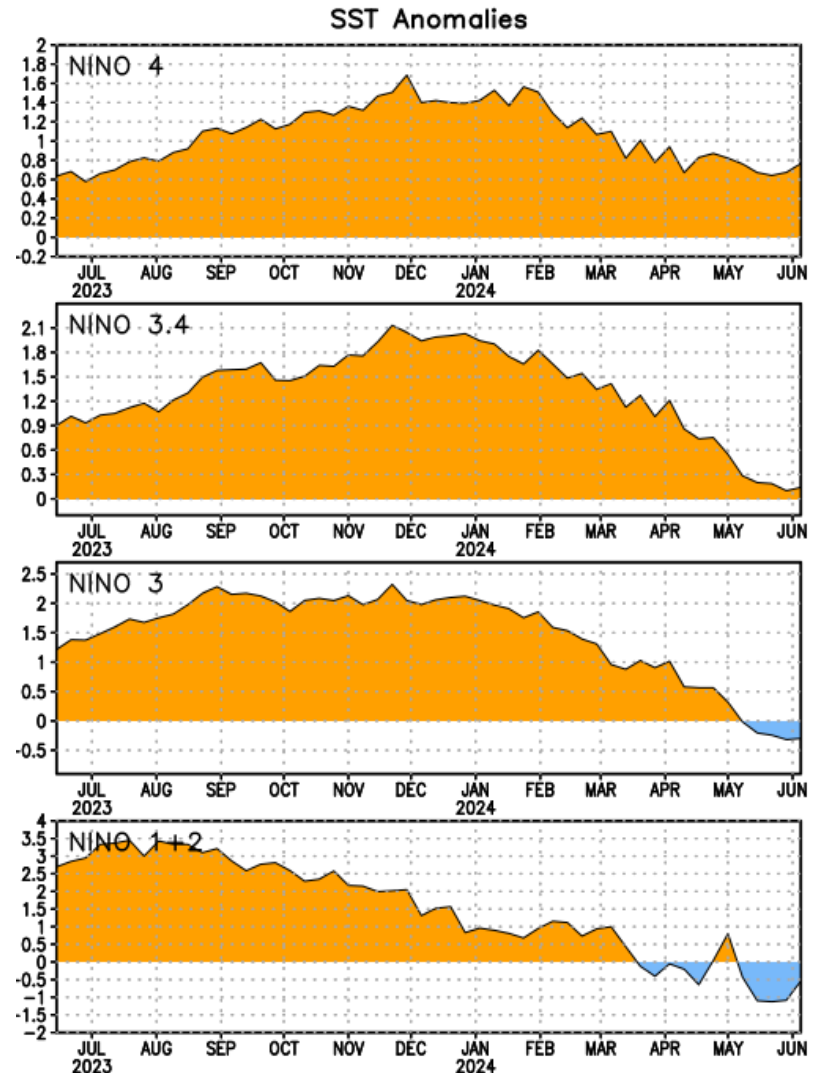
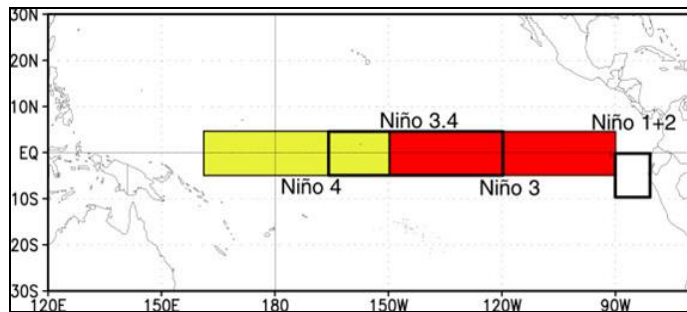
Since mid March 2024, below-average SSTs have emerged in the eastern Pacific and have expanded slightly westward.



Niño Region SST Departures (°C) Recent Evolution

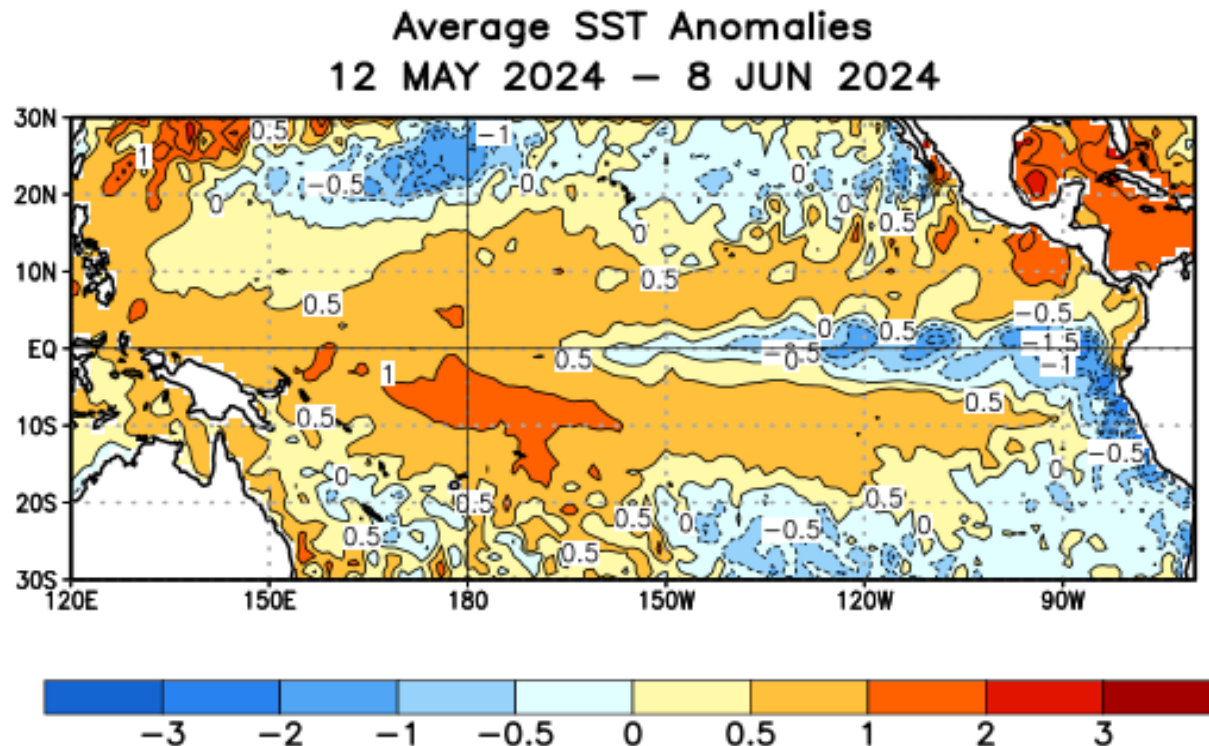
The latest weekly SST departures are:

Niño 4	0.8°C
Niño 3.4	0.1°C
Niño 3	-0.3°C
Niño 1+2	-0.5°C



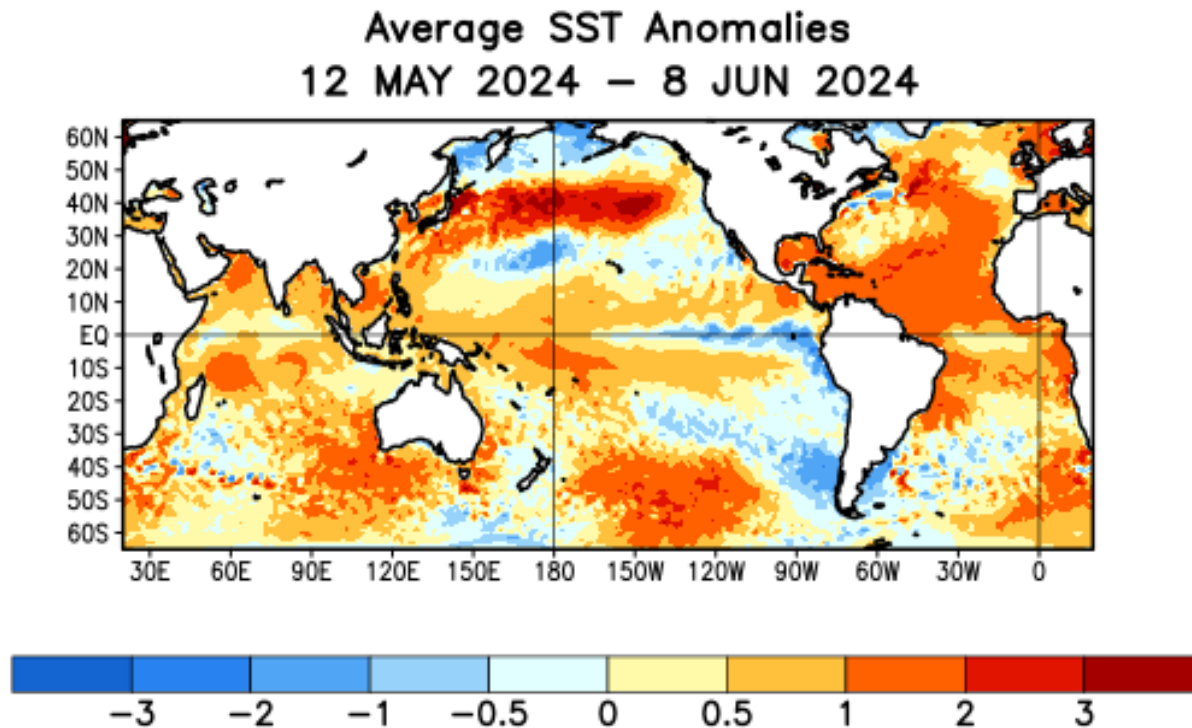
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

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

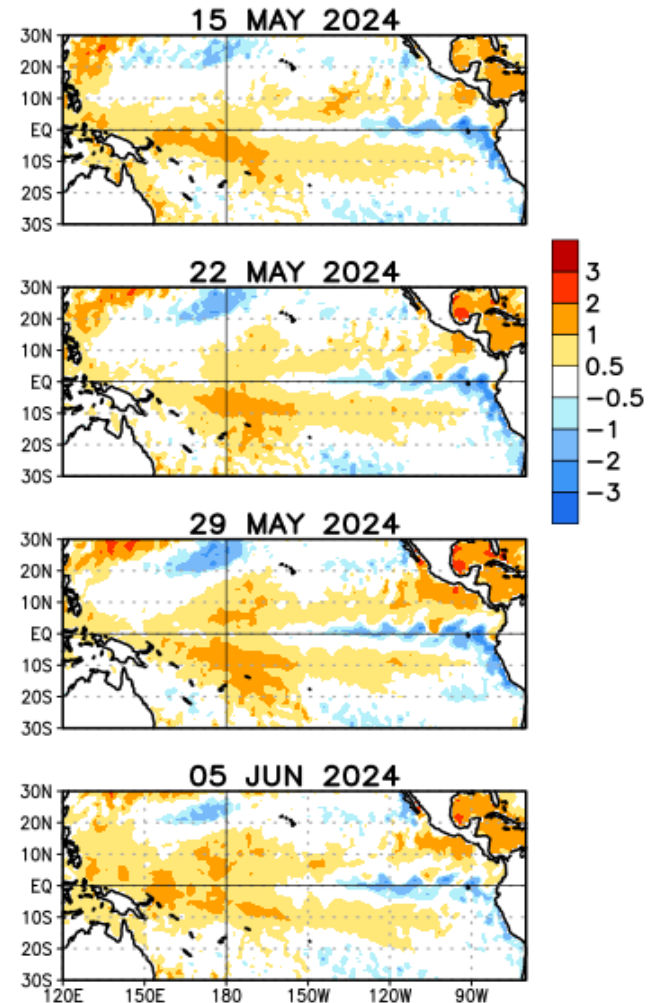


Weekly SST Departures during the Last Four Weeks

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

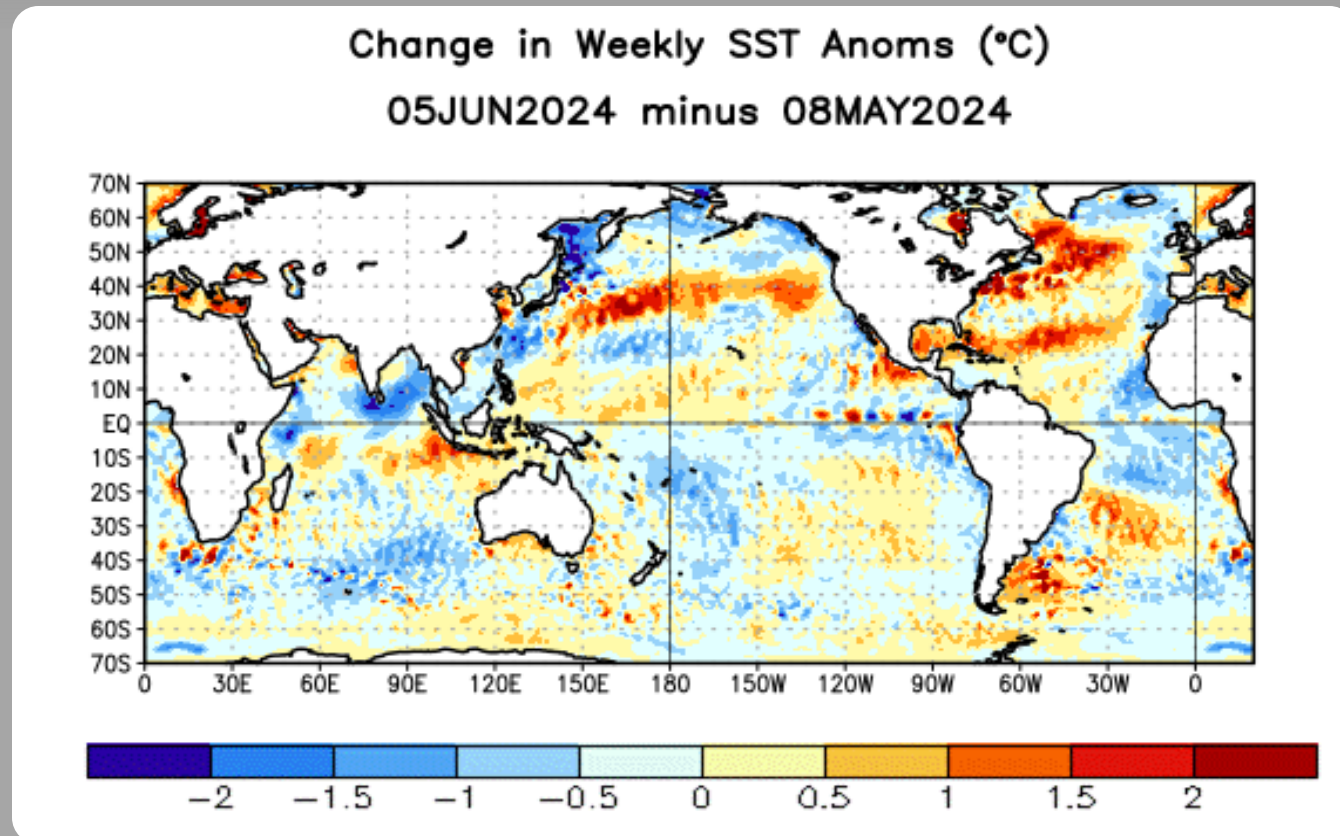
Below-average SSTs have strengthened in the east-central and eastern Pacific Ocean.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, positive and negative SST anomaly changes were observed in the eastern equatorial Pacific Ocean.



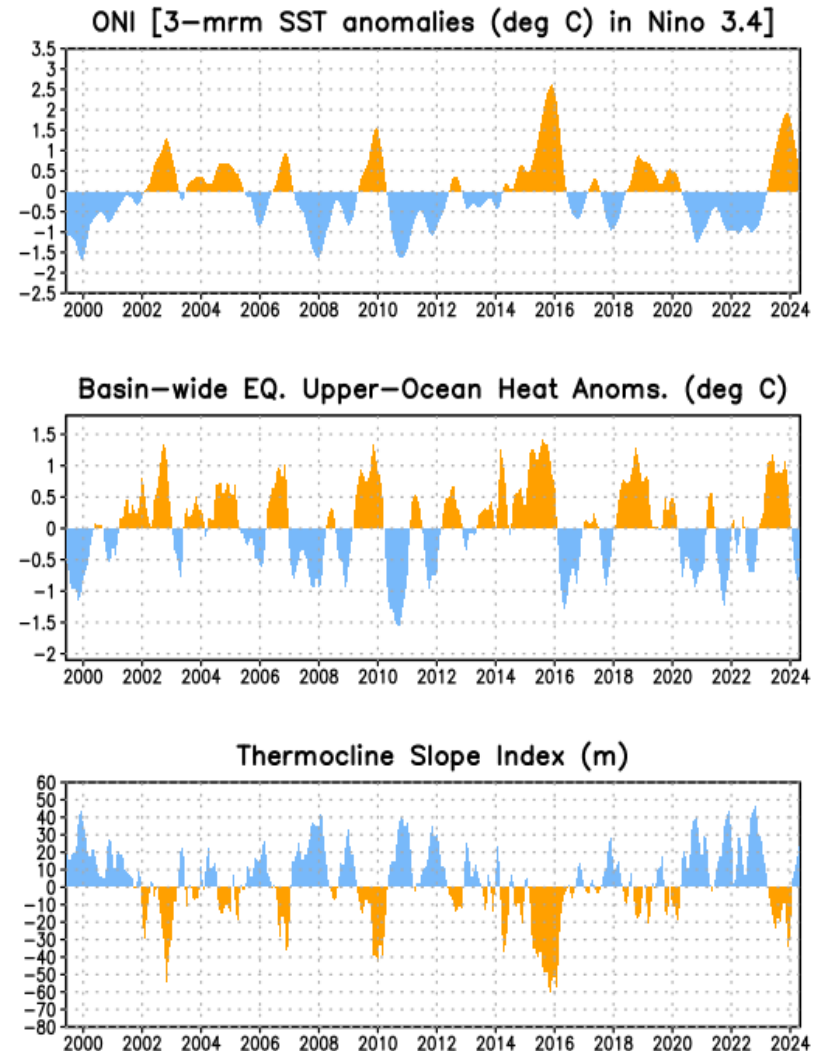
Upper-Ocean Conditions in the Equatorial Pacific

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.

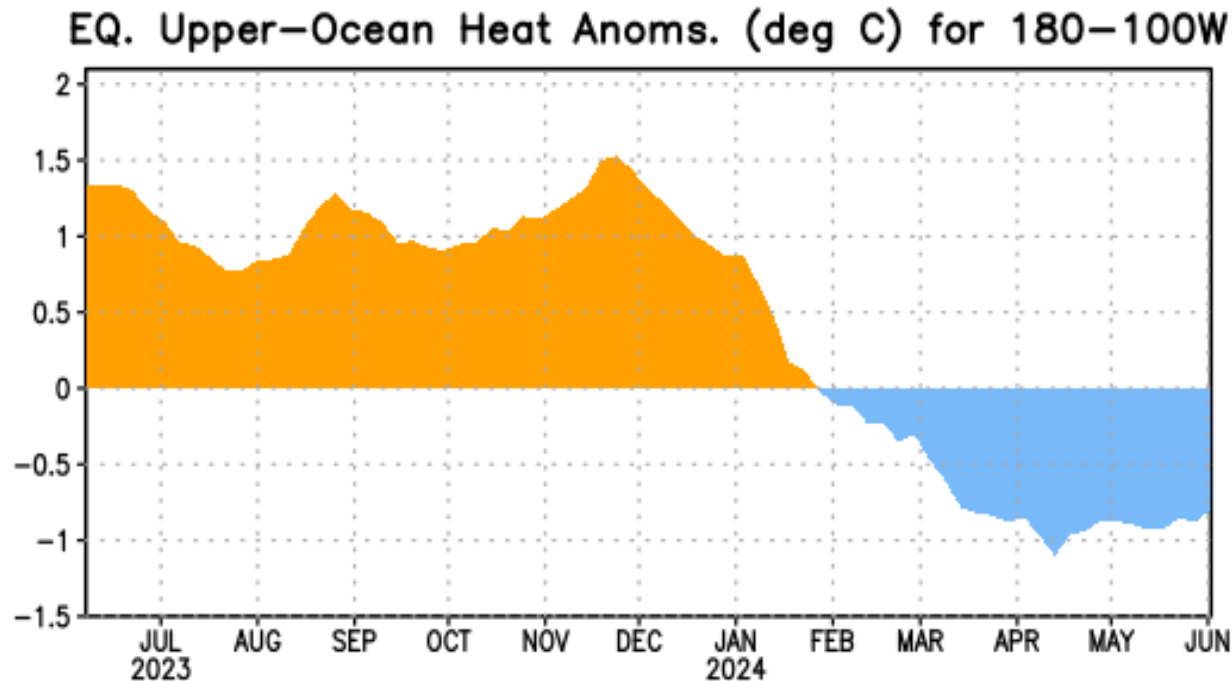
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (slightly above average) reflect a transition toward ENSO-neutral.

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).



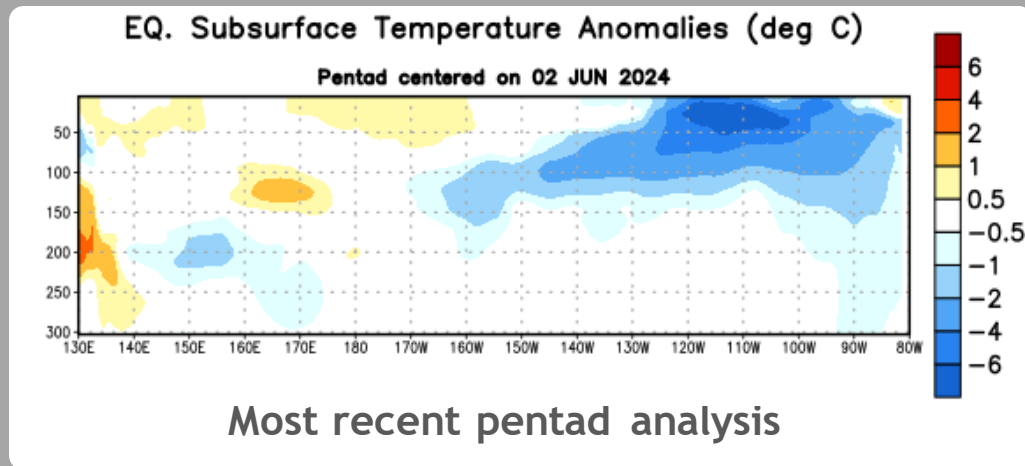
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive subsurface temperature anomalies persisted through mid-January 2024. Variability in the positive anomalies was associated with several oceanic Kelvin waves. Starting in November 2023, positive subsurface temperature anomalies weakened to near zero. From late January to mid-April 2024, negative temperature anomalies emerged and strengthened. For the last month or so, negative anomalies have persisted.

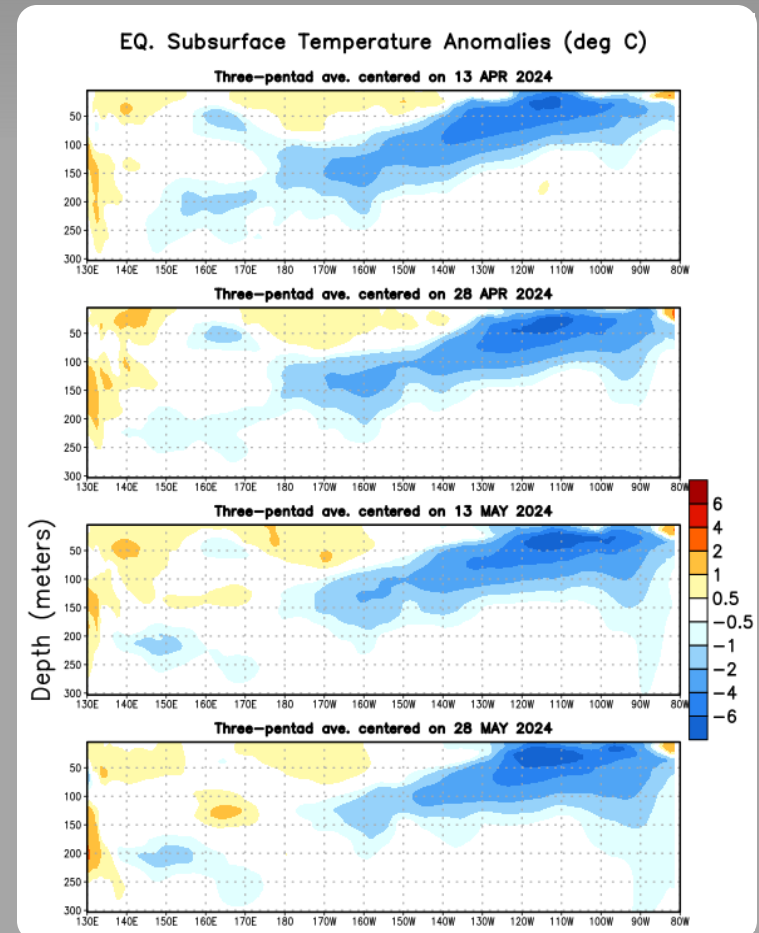


Sub-Surface Temperature Departures in the Equatorial Pacific

Over the last couple months, negative subsurface temperature anomalies have dominated the equatorial Pacific Ocean.



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

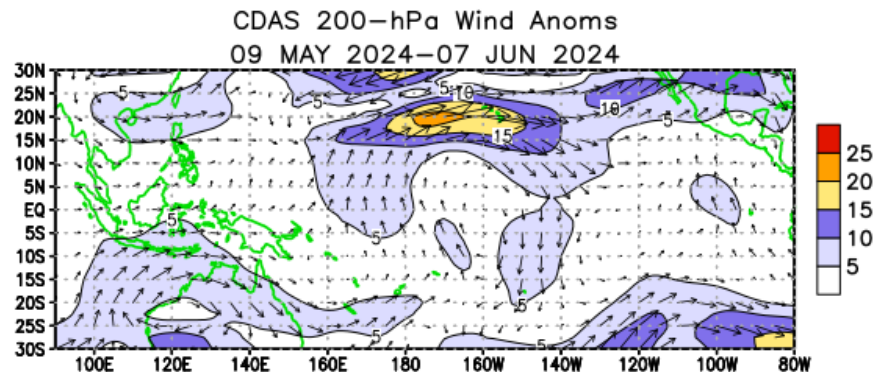
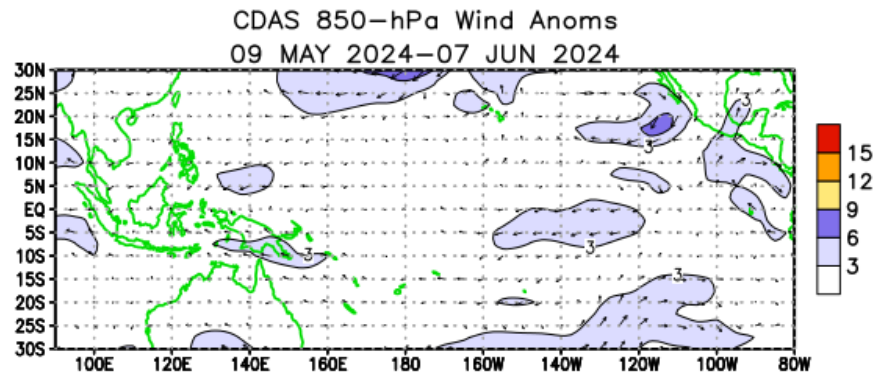
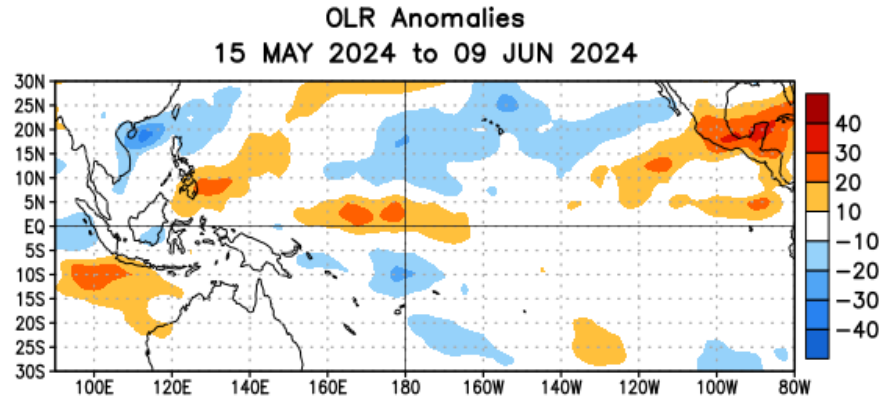


Tropical OLR and Wind Anomalies During the Last 30 Days

Above-average OLR (suppressed convection and precipitation) was evident over parts of Indonesia, the Philippines, and the Date Line.

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

Upper-level (200-hPa) wind anomalies were cross equatorial near the Date Line and 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

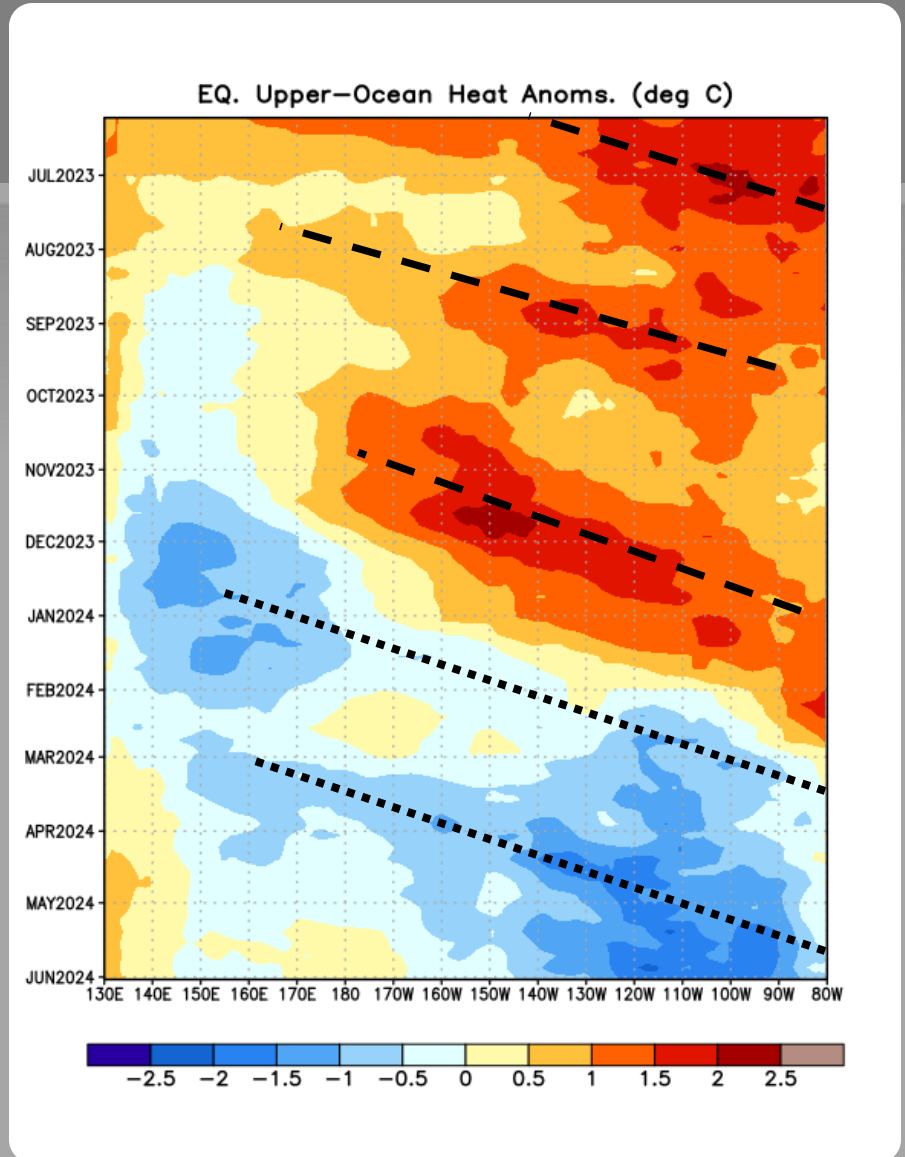
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

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

Since December 2023, two upwelling Kelvin waves have shifted eastward.

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

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.



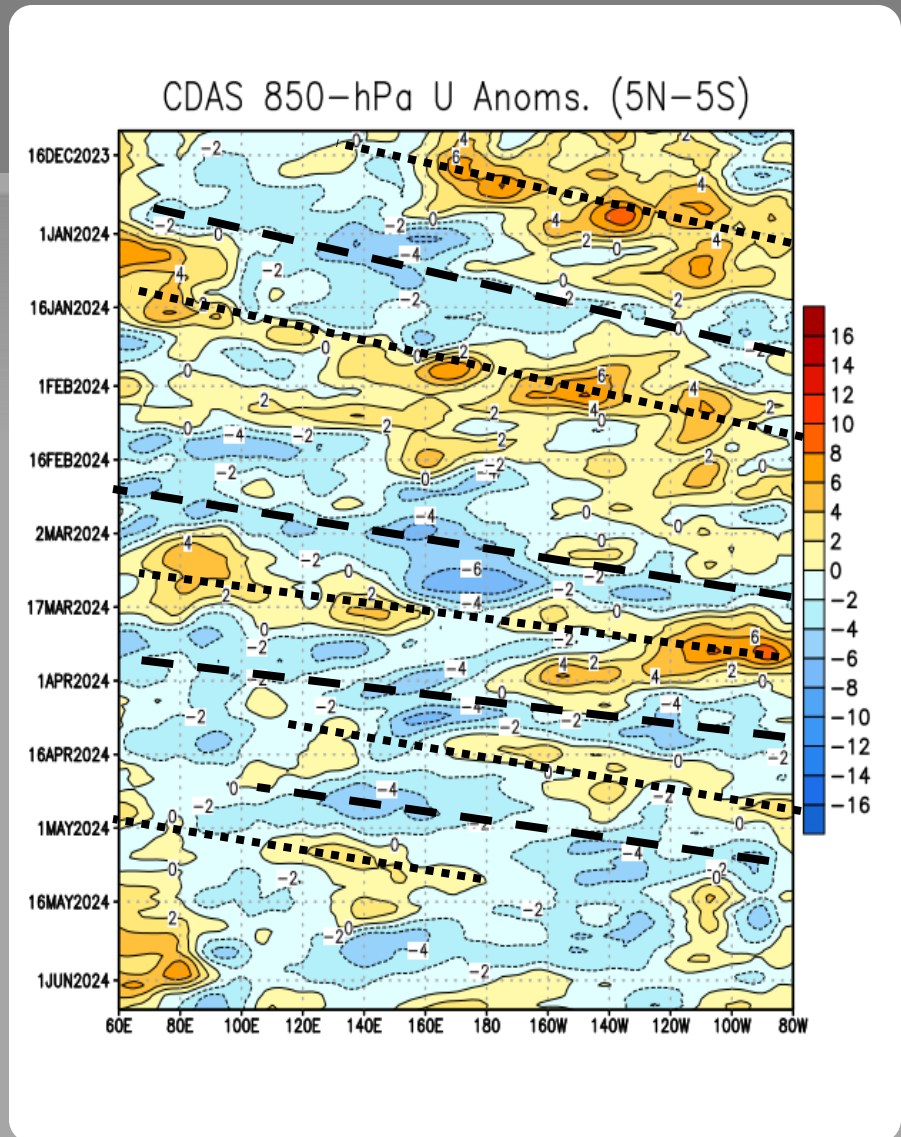
Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

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

An eastward propagating pattern of westerly and easterly wind anomalies was evident starting in November 2023. Since early May 2024, this pattern has weakened.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

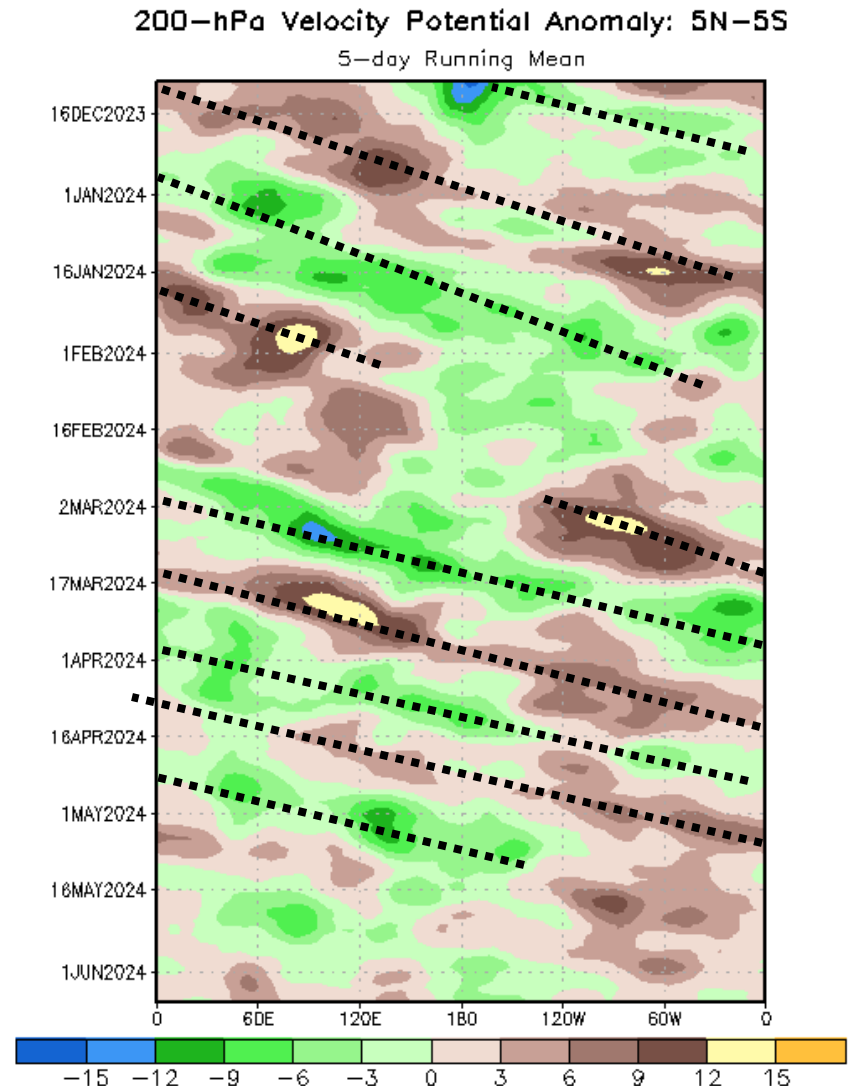
From the beginning of the period, regions of anomalous divergence (green shading) and convergence (brown shading) were shifting eastward. Since early May 2024, this pattern has weakened.

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

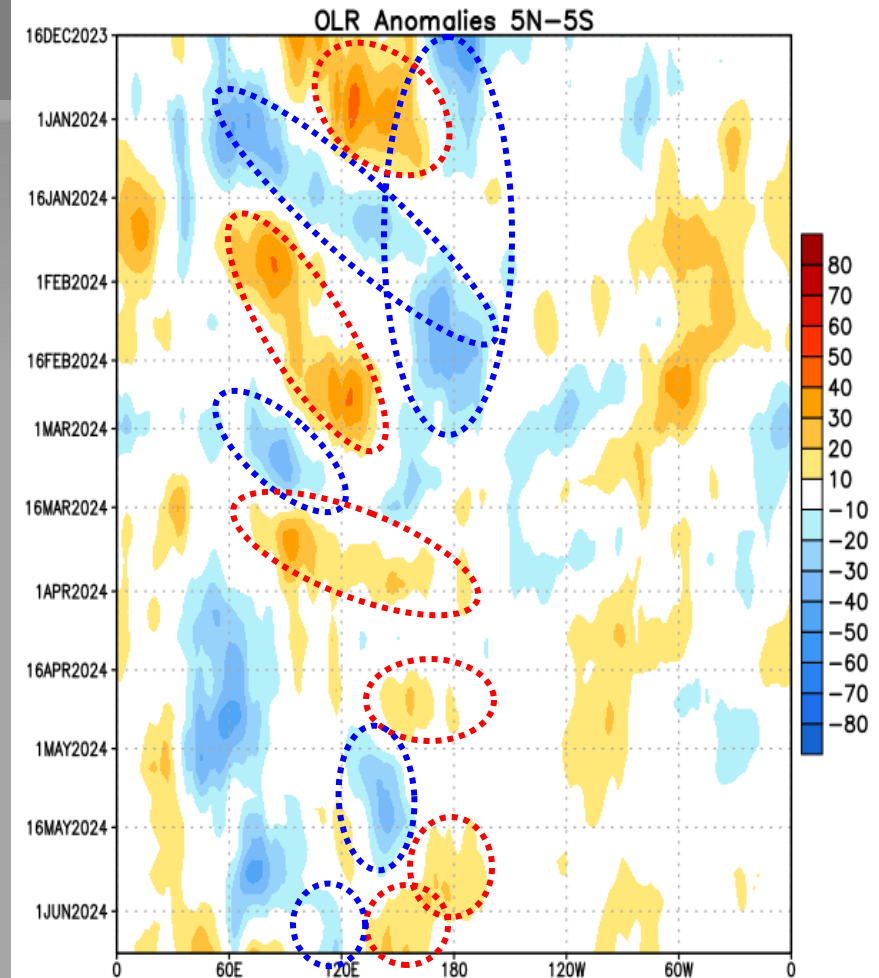
Through December 2023, positive OLR anomalies persisted around Indonesia.

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

Since mid-May 2024, OLR was above-average near the western Pacific or Date Line.

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°C .

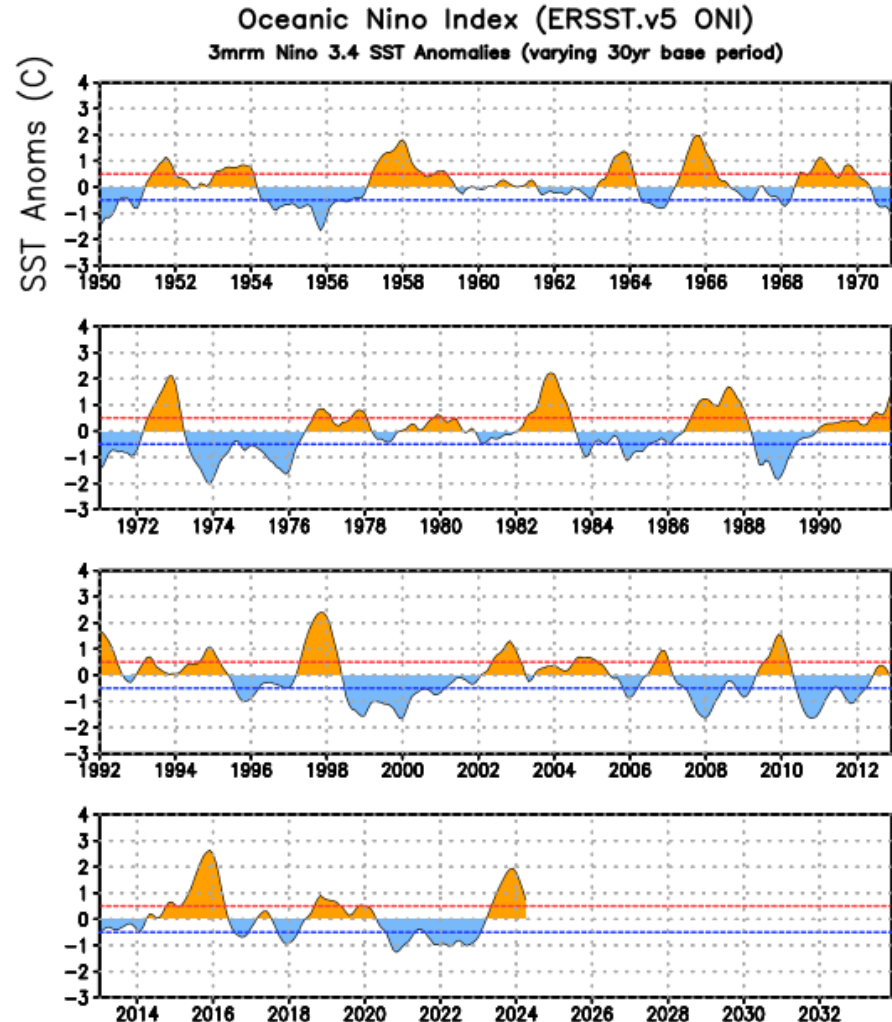
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (March - May 2024) is 0.7°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 ± 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.

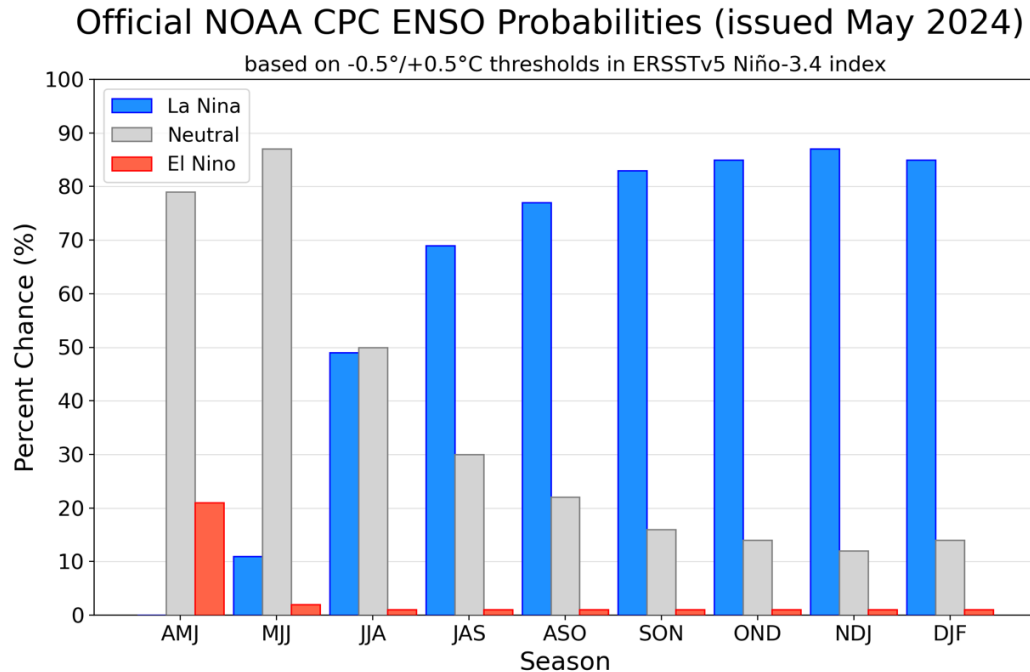
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

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								

CPC Probabilistic ENSO Outlook

Updated: 9 May 2024

A transition from El Niño to ENSO-neutral is imminent, with ENSO-neutral favored in April-June and May-July 2024. La Niña may develop in June-August 2024 (49% chance) or July-September (69% chance).



IRI Pacific Niño 3.4 SST Model Outlook

The majority of models indicate ENSO-neutral will persist through July-September 2024. Thereafter, most models indicate a transition to La Niña around August-October 2024.

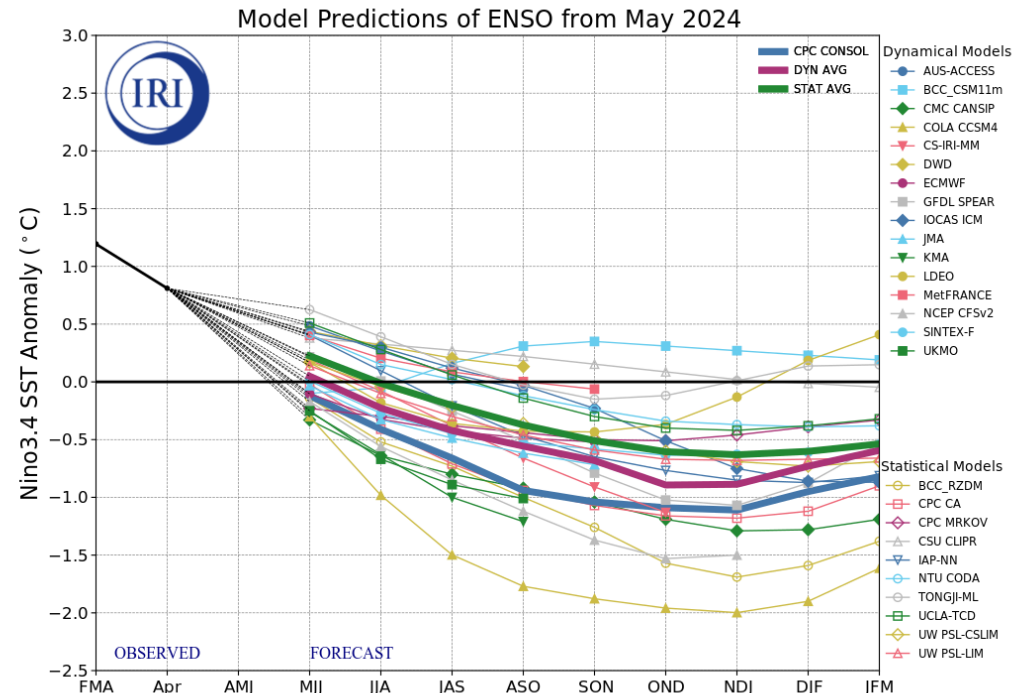


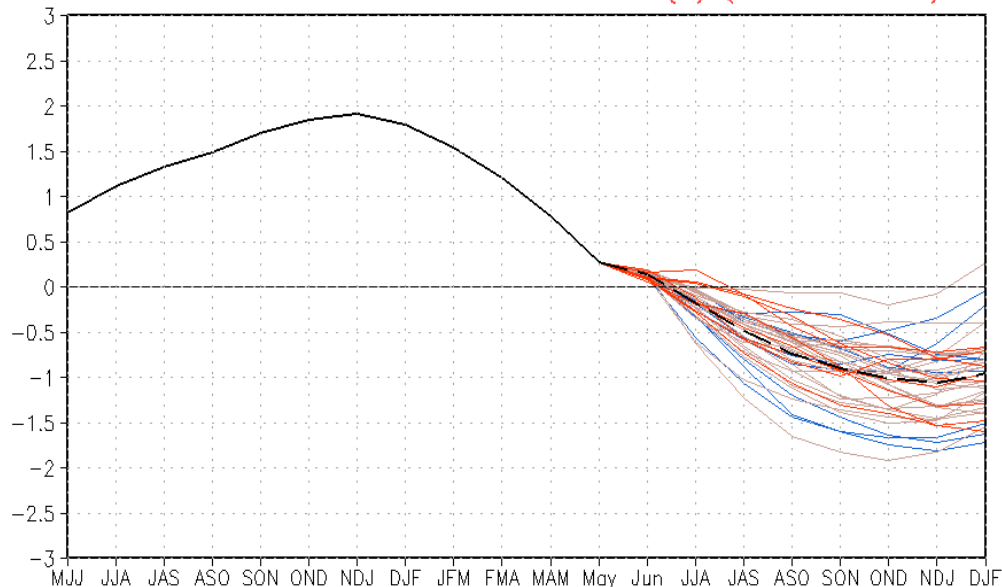
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 20 May 2024).

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

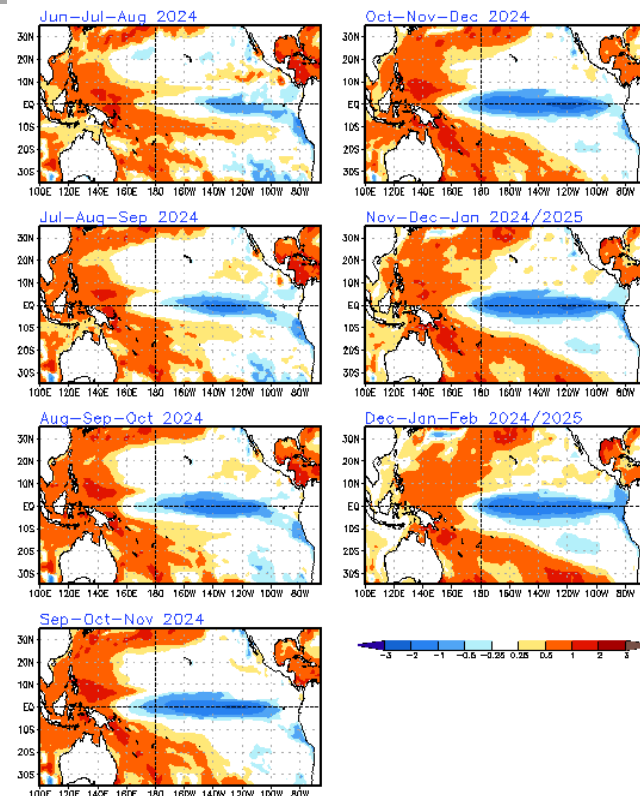
Issued: 10 June 2024

The CFS.v2 ensemble mean (black dashed line) indicates El Niño is transitioning to ENSO-neutral, followed by a transition to La Niña around July-September 2024.

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



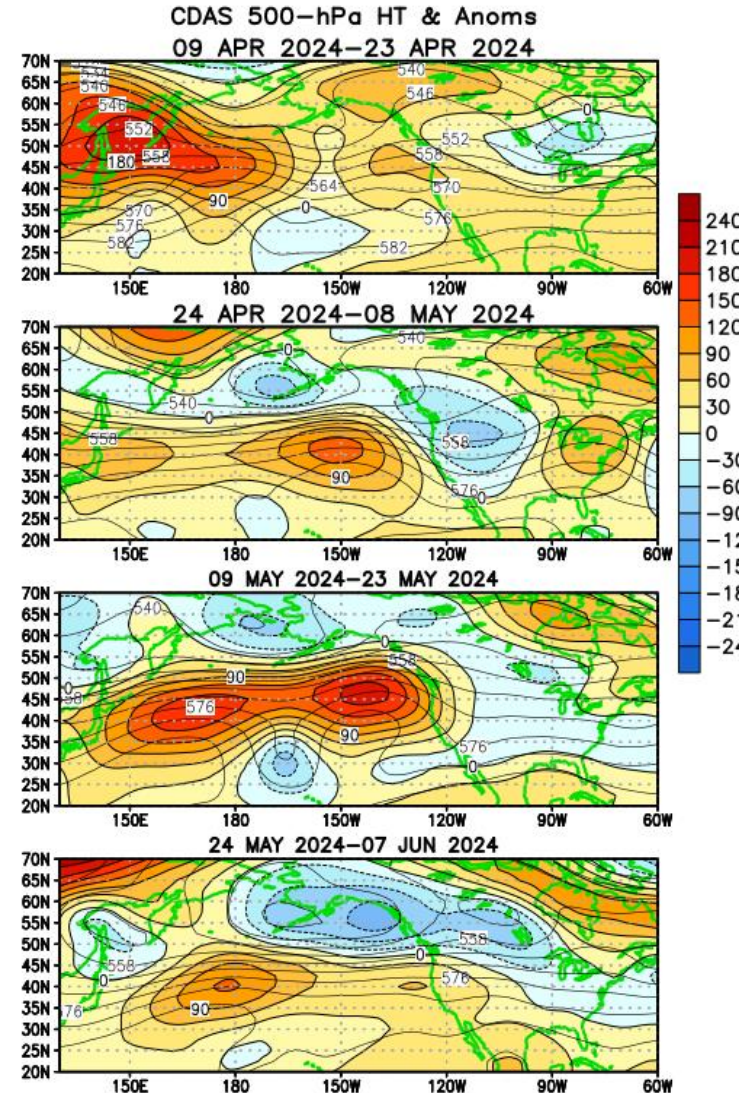
— Latest 8 forecast members
— Earliest 8 forecast members
— Other forecast members
— Forecast ensemble mean
— NCEP Olv2.1 daily analysis
(Climatology base period: 1991–2020)



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

During the period, the circulation and temperature anomalies were variable over the contiguous U.S.

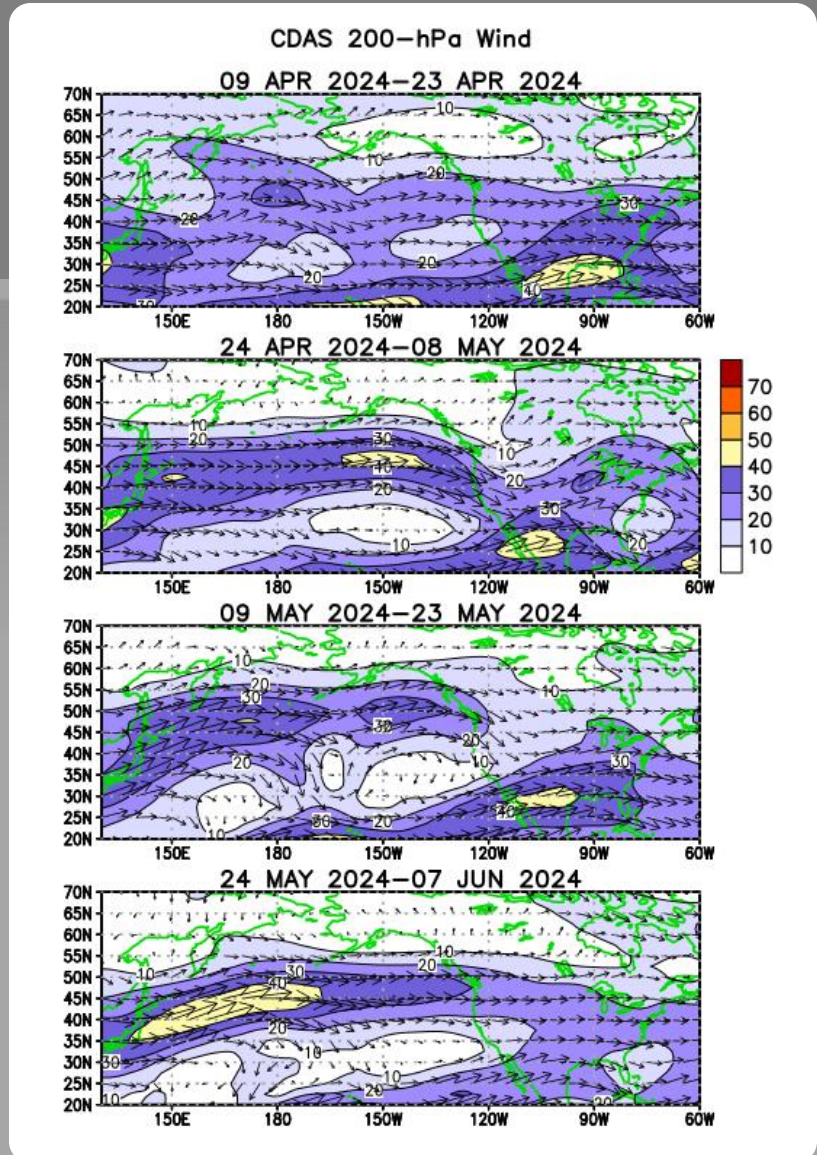
Above-average heights persisted over most of the N. Pacific Ocean.



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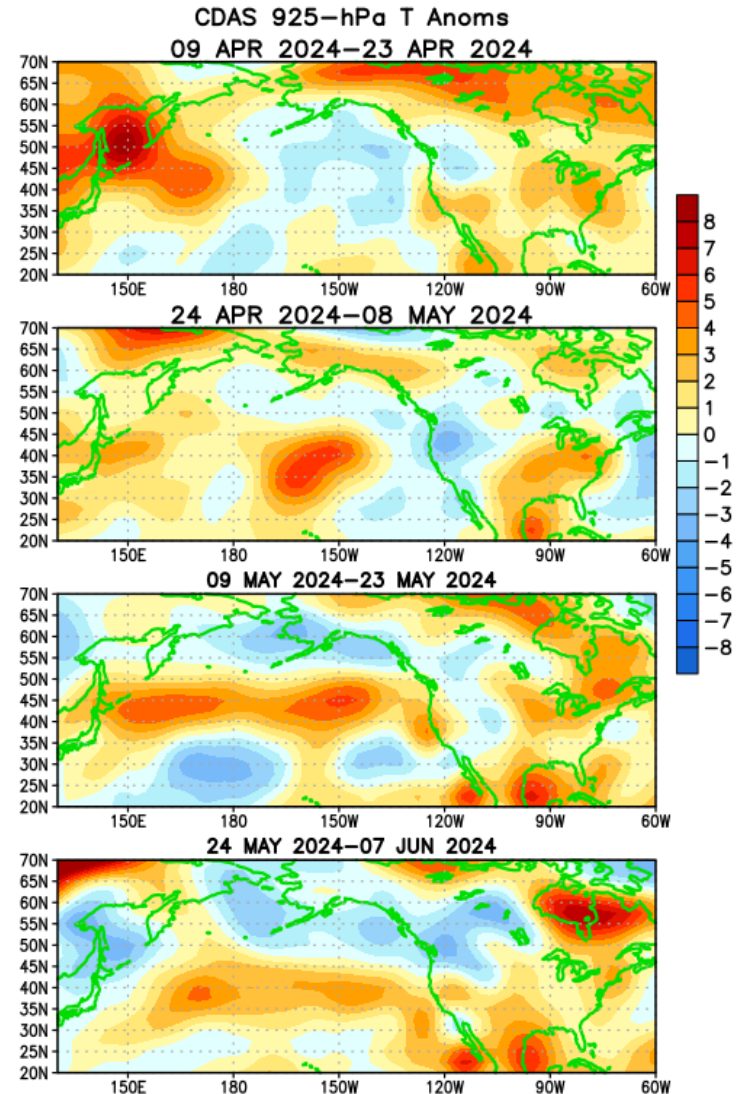
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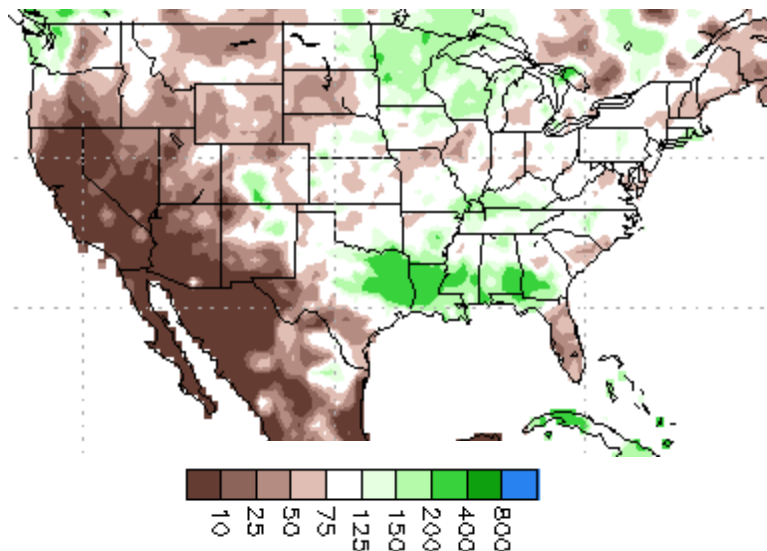
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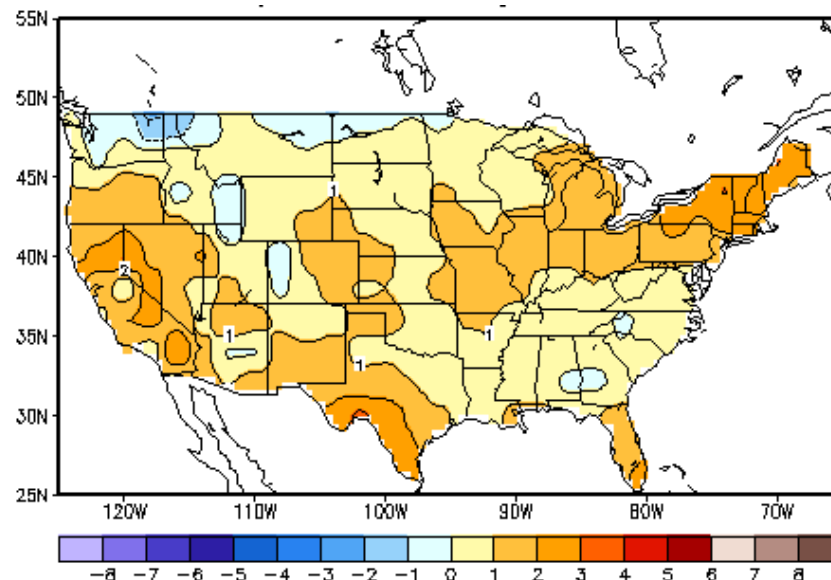
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 8 June 2024

Percent of Average Precipitation



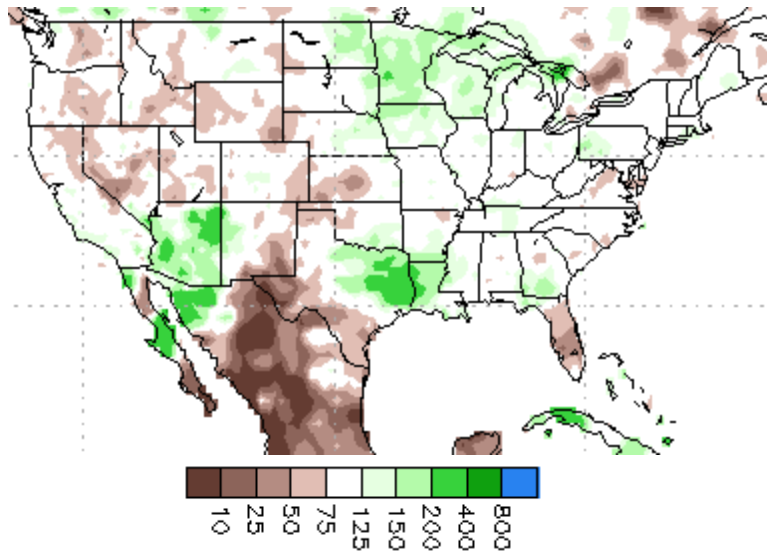
Temperature Departures (degree C)



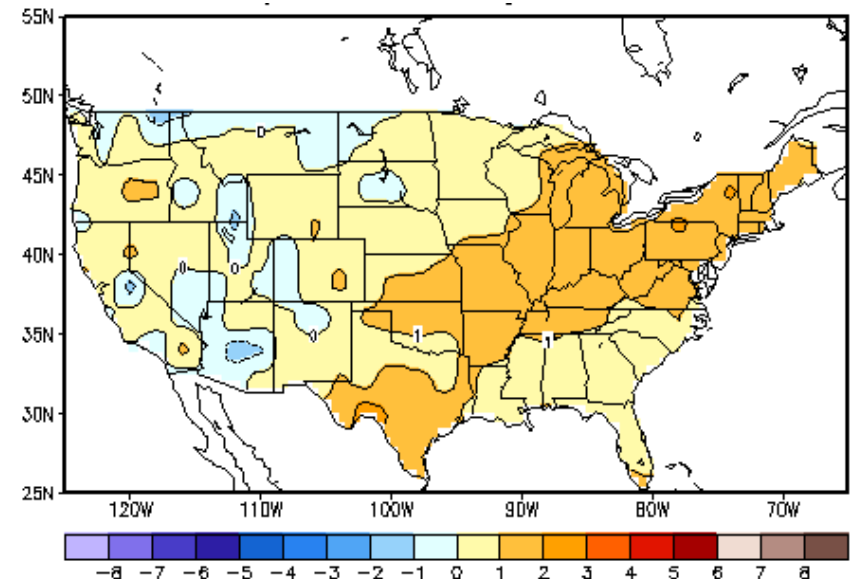
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 8 June 2024

Percent of Average Precipitation



Temperature Departures (degree C)



U. S. Seasonal Outlooks

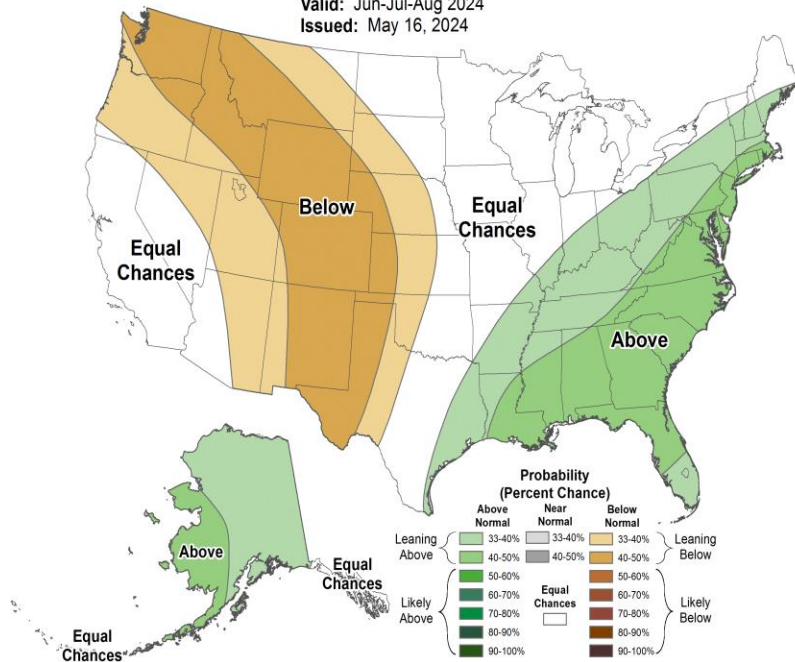
June - August 2024

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

Precipitation

Seasonal Precipitation Outlook

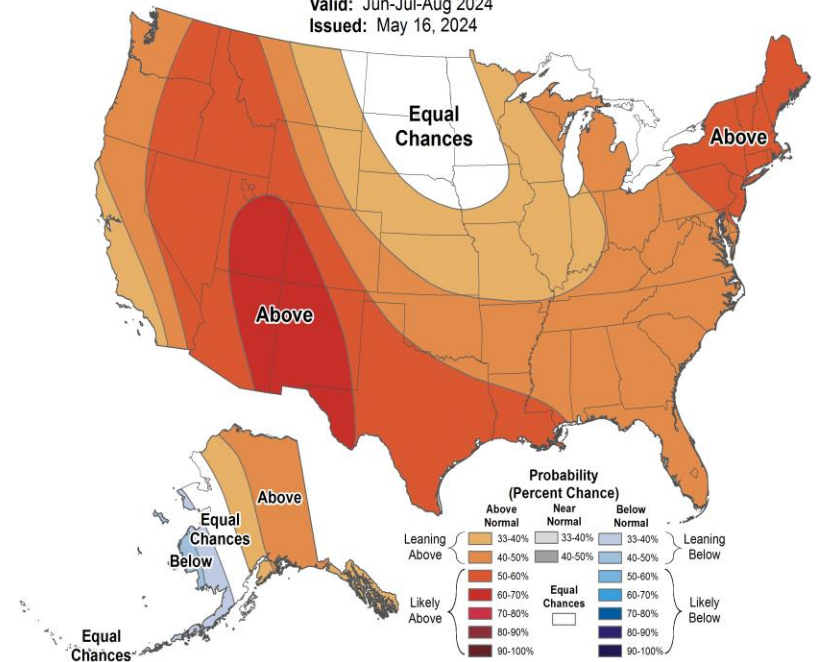
Valid: Jun-Jul-Aug 2024
Issued: May 16, 2024



Temperature

Seasonal Temperature Outlook

Valid: Jun-Jul-Aug 2024
Issued: May 16, 2024



Summary

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