

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
8 April 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 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 (83% chance), with increasing odds of La Niña developing in June-August 2024 (62% 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](#).

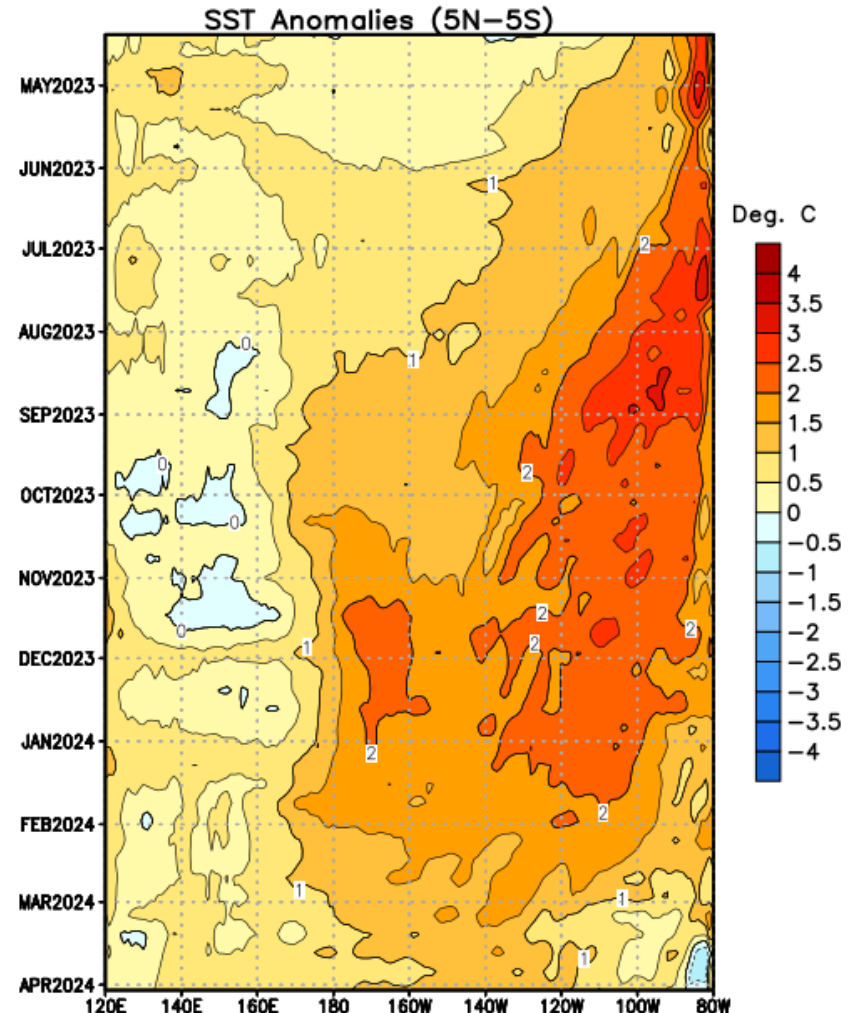
Recent Evolution of Equatorial Pacific SST Departures (°C)

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.

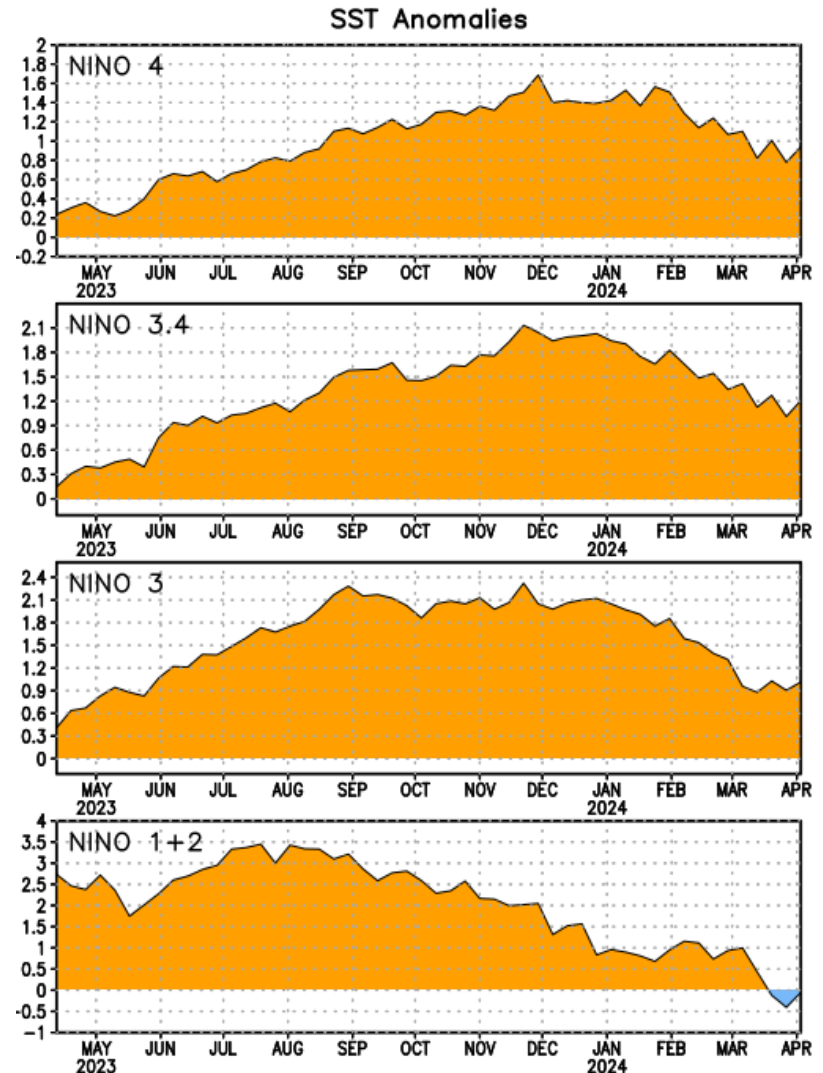
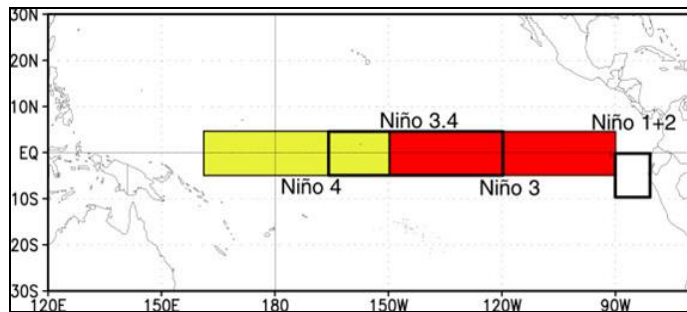
Recently, below-average SSTs emerged in the far eastern Pacific.



Niño Region SST Departures (°C) Recent Evolution

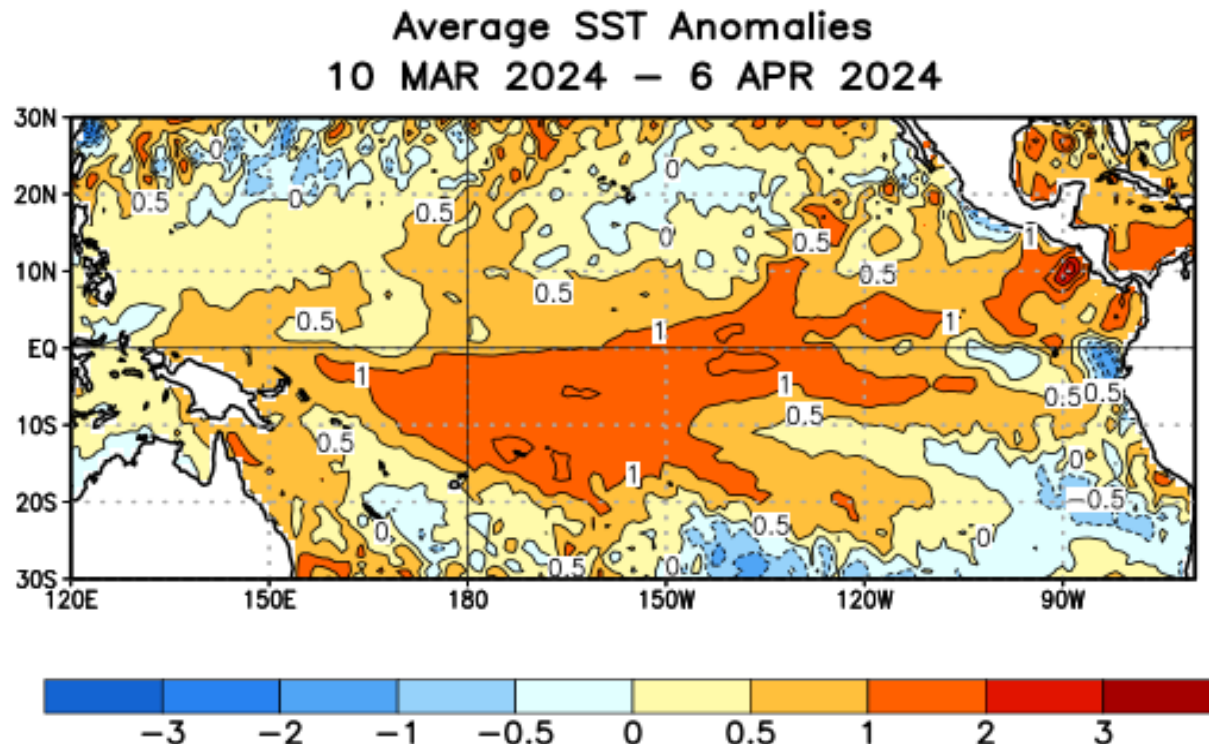
The latest weekly SST departures are:

Niño 4	0.9°C
Niño 3.4	1.2°C
Niño 3	1.0°C
Niño 1+2	-0.1°C



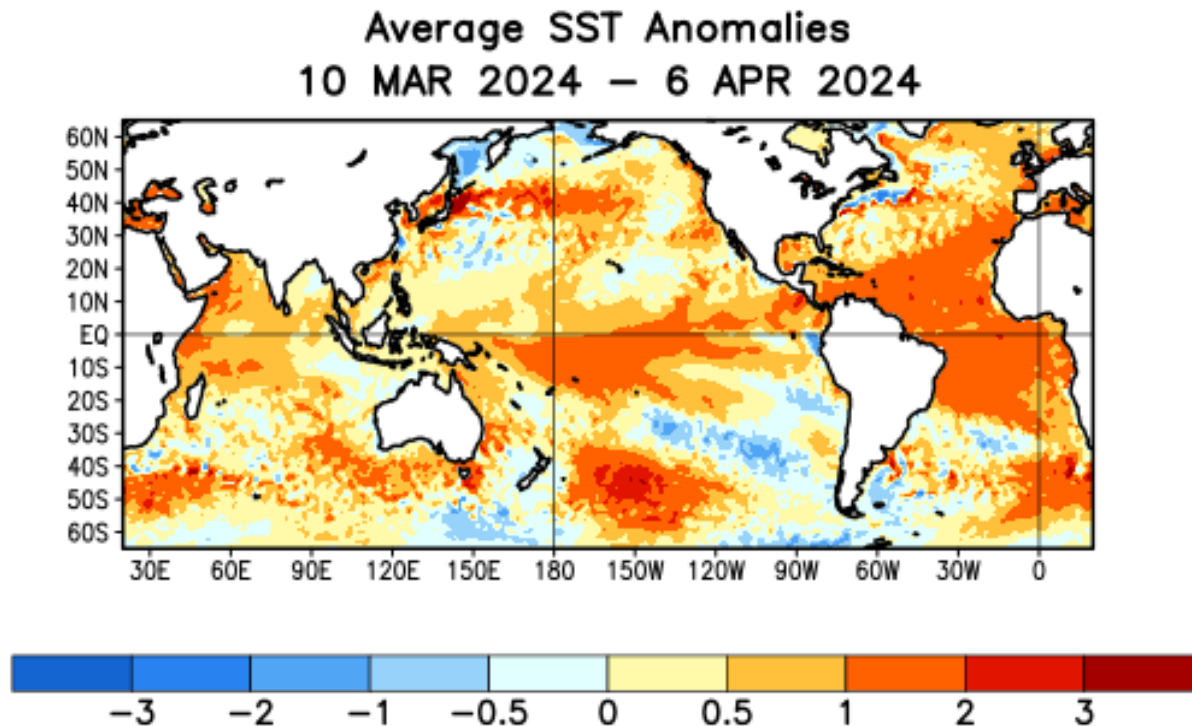
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, with the largest anomalies in the east-central Pacific. Below-average SSTs were evident in parts of the eastern Pacific Ocean.



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

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, most of the Indian Ocean, and the Atlantic Ocean.

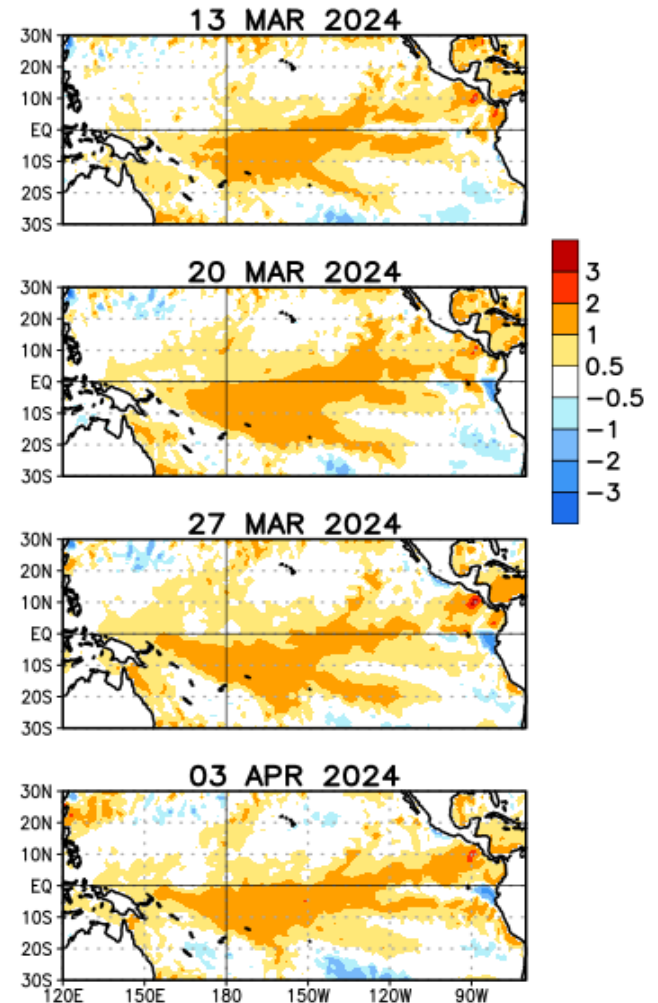


Weekly SST Departures during the Last Four Weeks

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

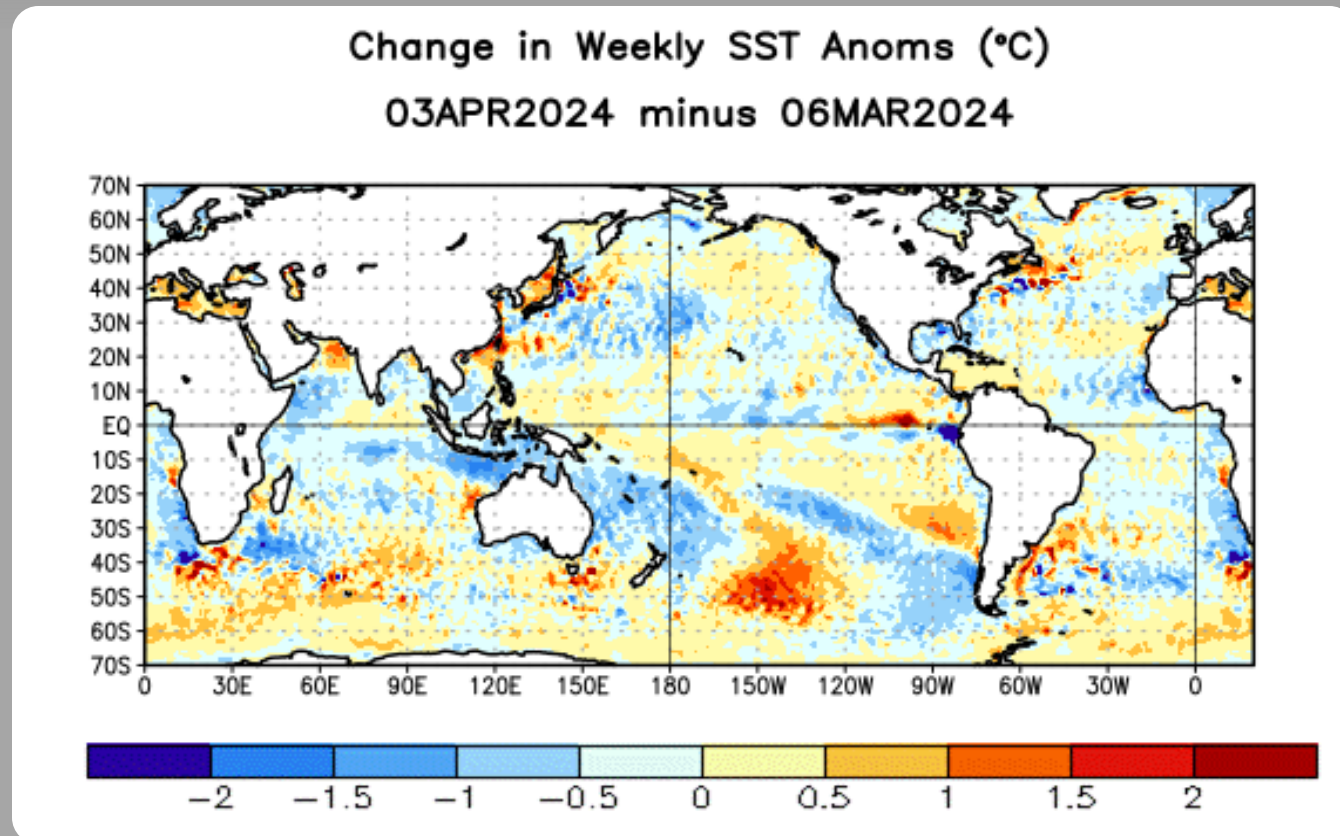
Below-average SSTs emerged in small regions of the eastern Pacific Ocean.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative SST anomaly changes were observed over most of the equatorial Pacific, with a small region of positive change near 120-90W.



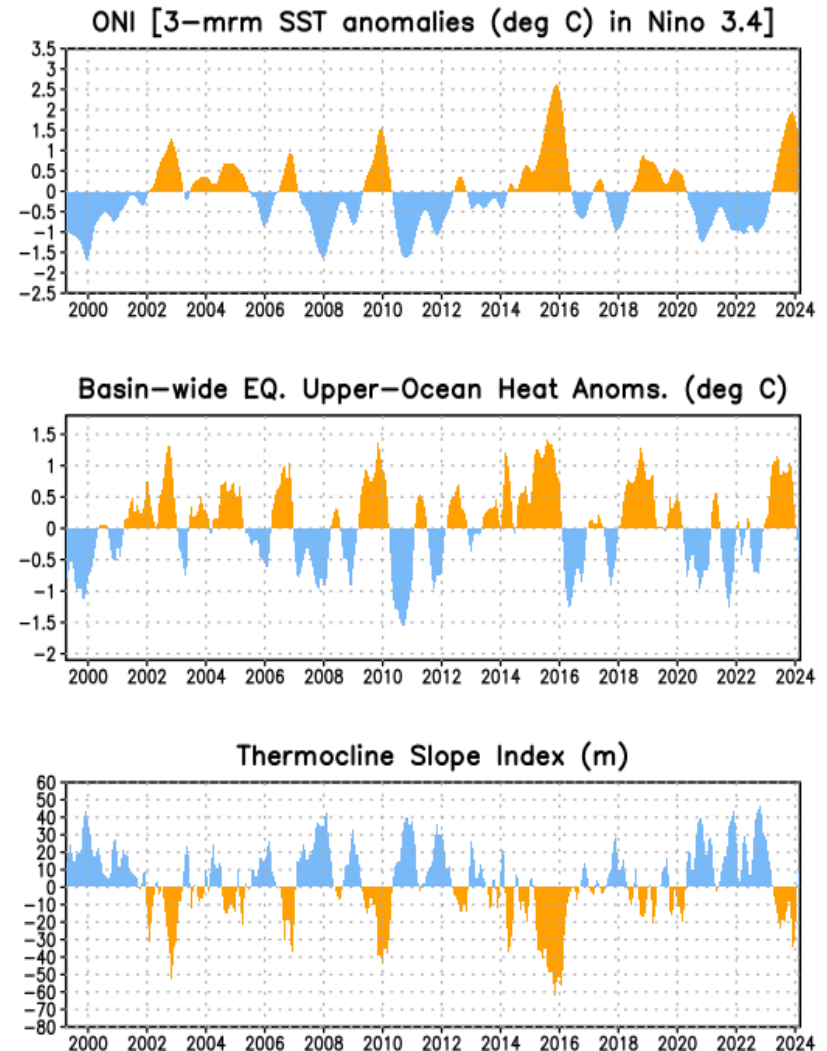
Upper-Ocean Conditions in the Equatorial Pacific

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.

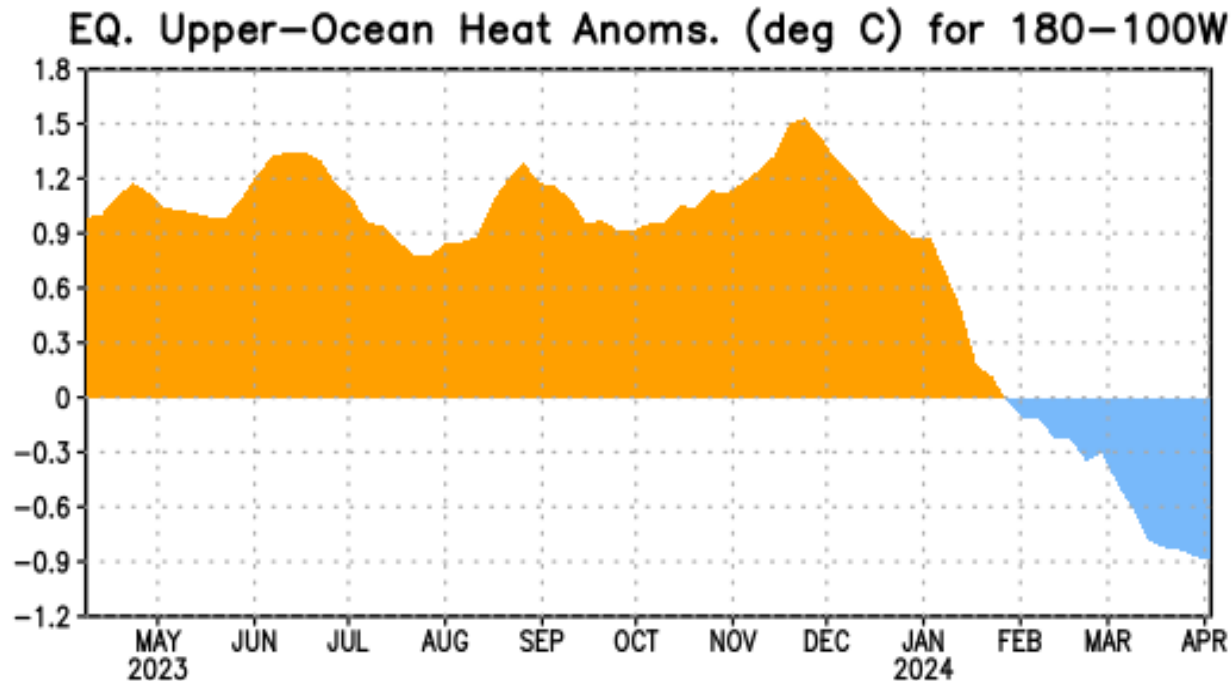
Recent values of the upper-ocean heat anomalies (near average) and thermocline slope index (slightly below average) reflect a weakening El Niño.

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).



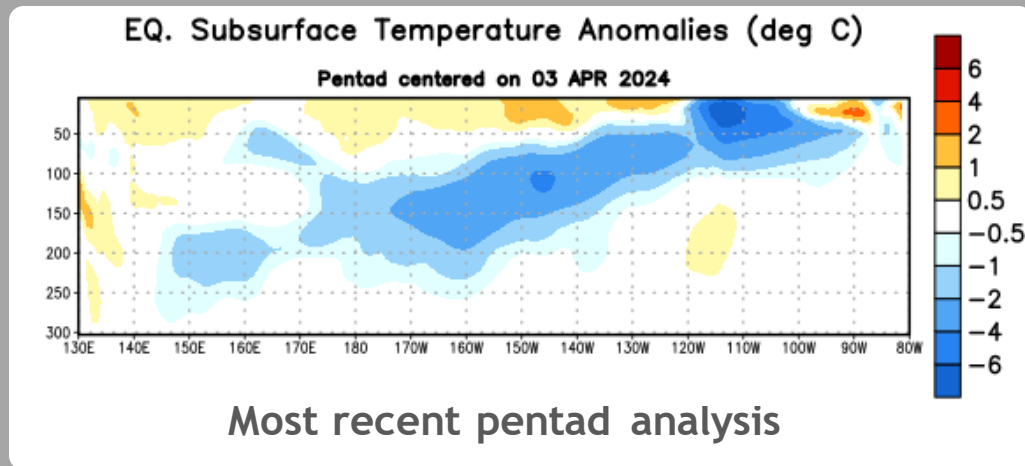
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

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. Since late January 2024, negative temperature anomalies have gradually strengthened.

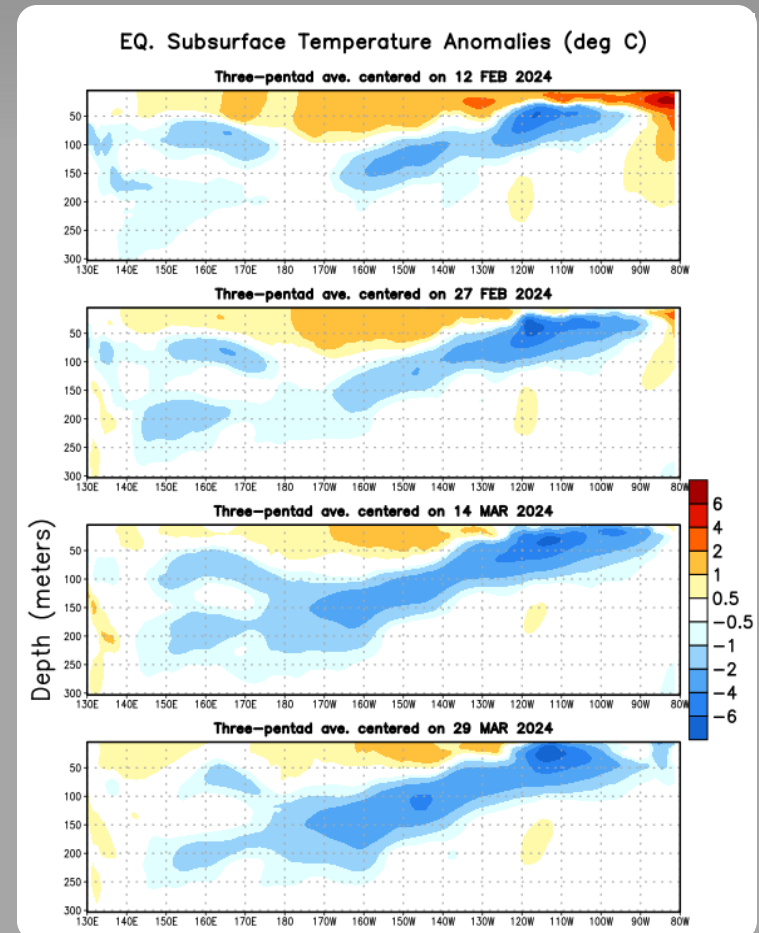


Sub-Surface Temperature Departures in the Equatorial Pacific

Over the last couple months, near-surface positive subsurface temperature anomalies have weakened across the equatorial Pacific.



Negative subsurface temperature anomalies expanded across the equatorial Pacific. Below-average temperatures reached the surface in the eastern Pacific Ocean (near 120°-100°W).

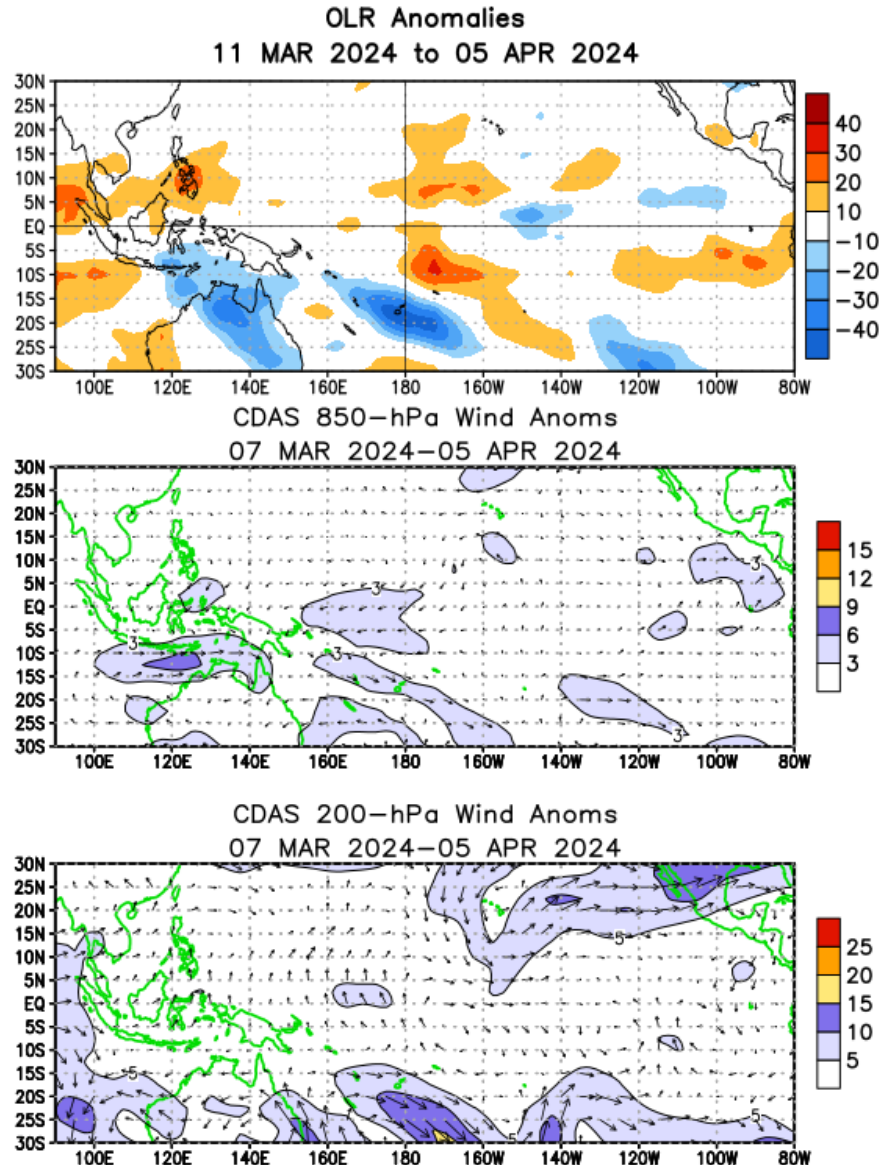


Tropical OLR and Wind Anomalies During the Last 30 Days

OLR was slightly above average (suppressed convection and precipitation) near the Date Line and around the Philippines and Malaysia.

Low-level (850-hPa) wind anomalies were easterly over the west-central tropical Pacific Ocean and Date Line.

Upper-level (200-hPa) winds were near average over most of the 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

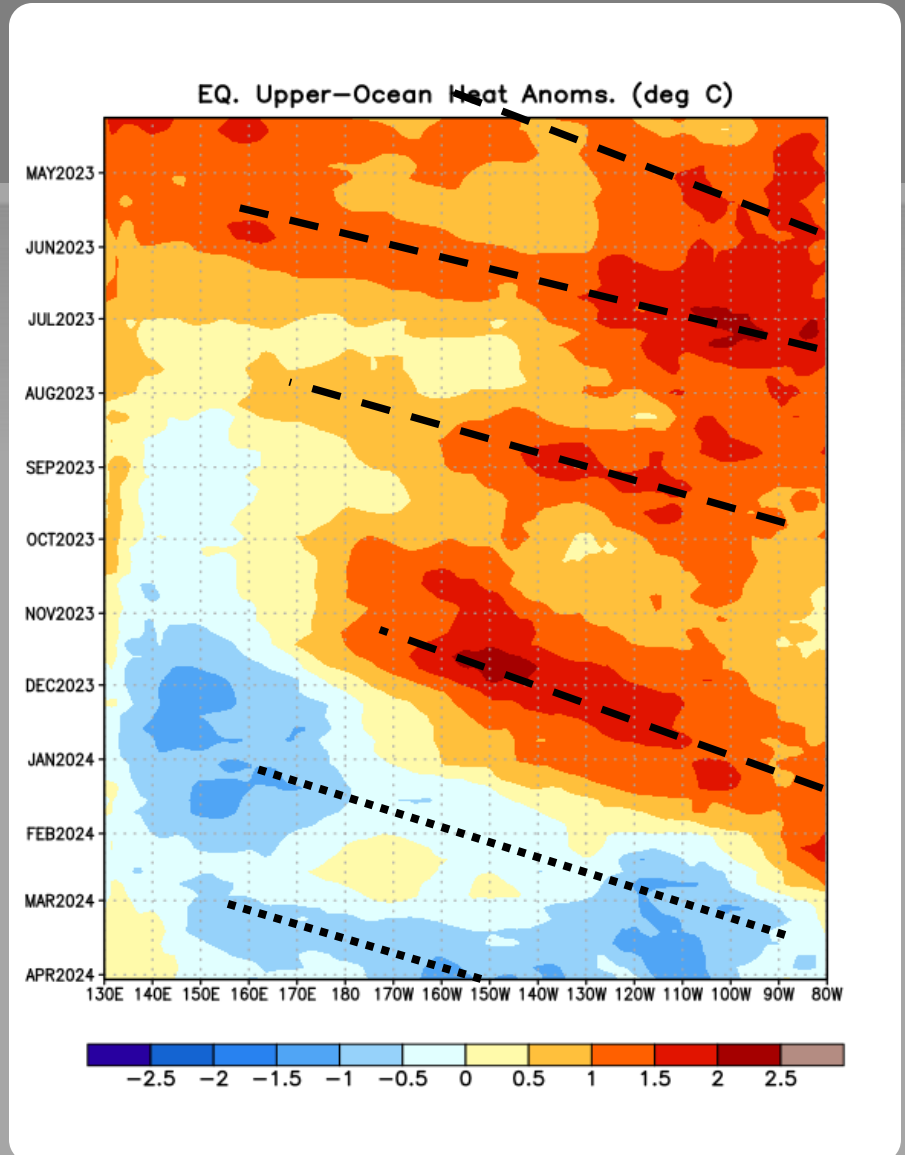
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

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

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

Since early March 2024, a second 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.



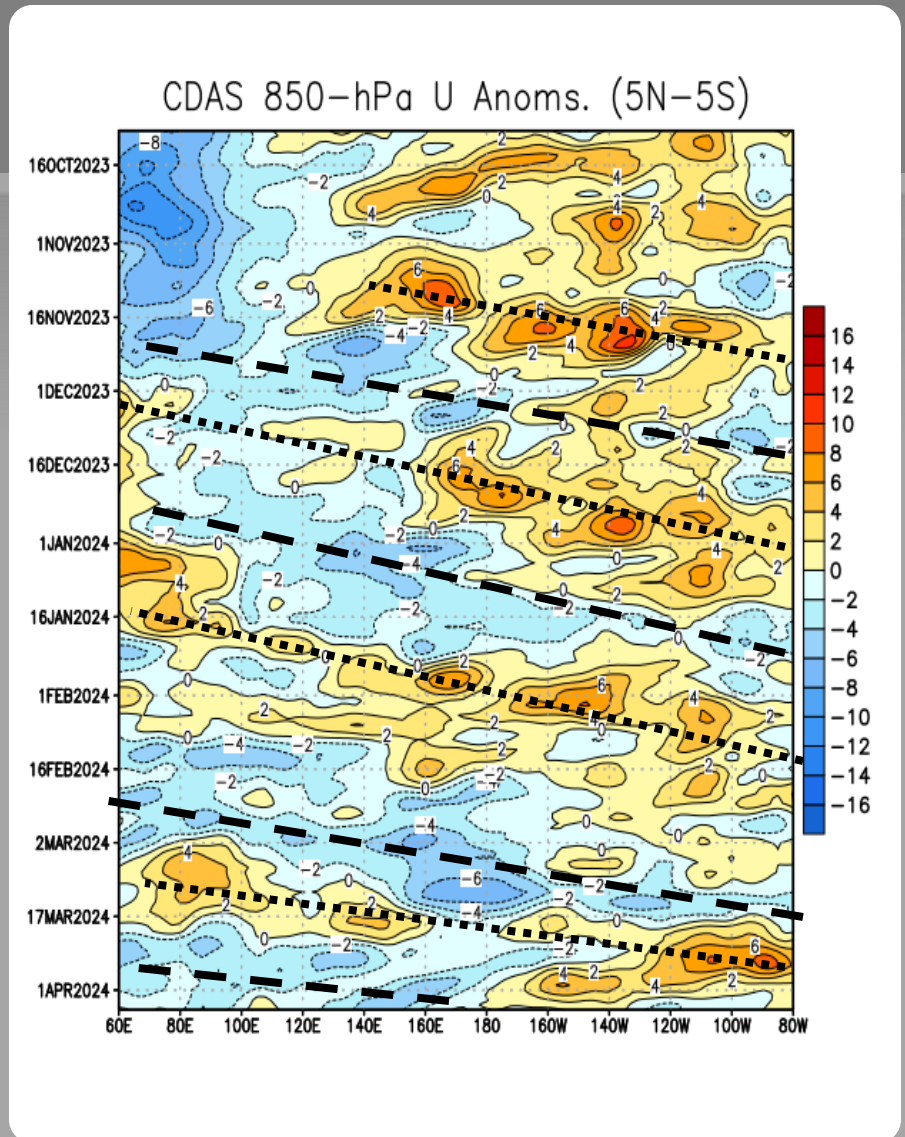
Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

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.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

Since the beginning of the period through mid-November 2023, anomalous divergence (green shading) persisted near the Date Line, while anomalous convergence (brown shading) was mostly observed over South America.

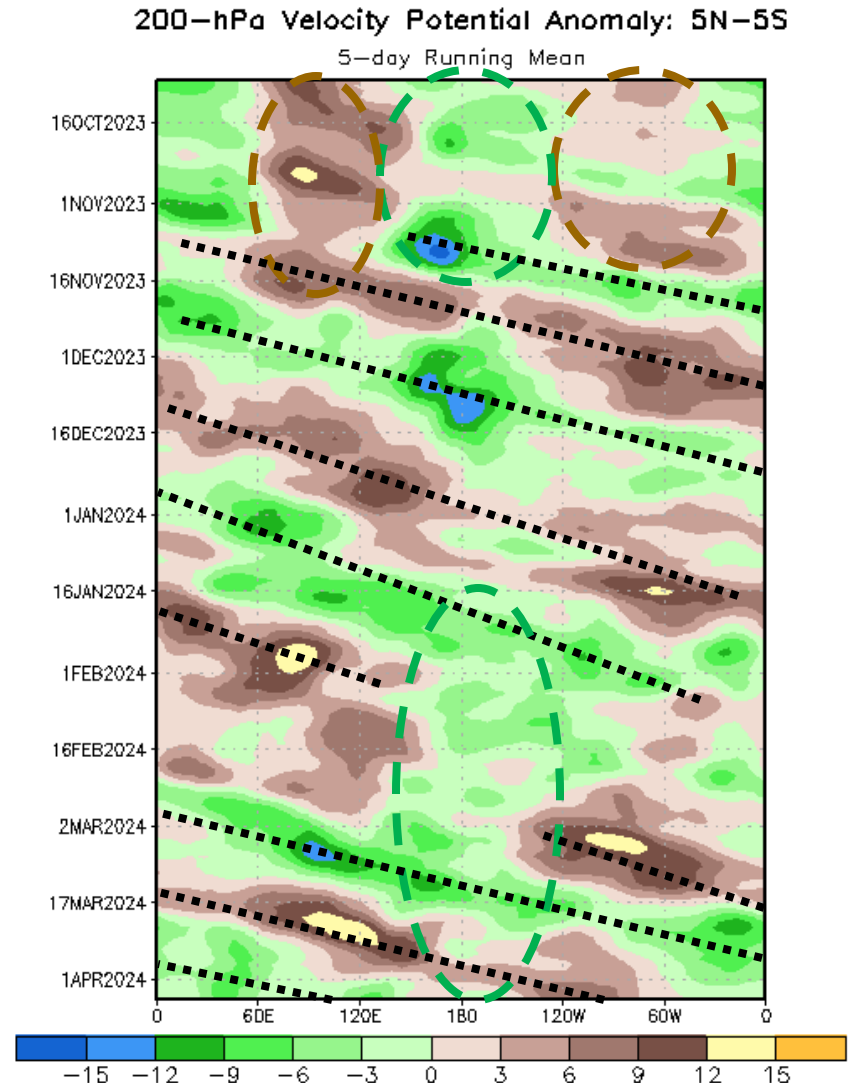
From November 2023-January 2024, eastward propagation in the velocity potential anomalies was evident.

Since mid-January 2024, anomalous divergence has generally 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

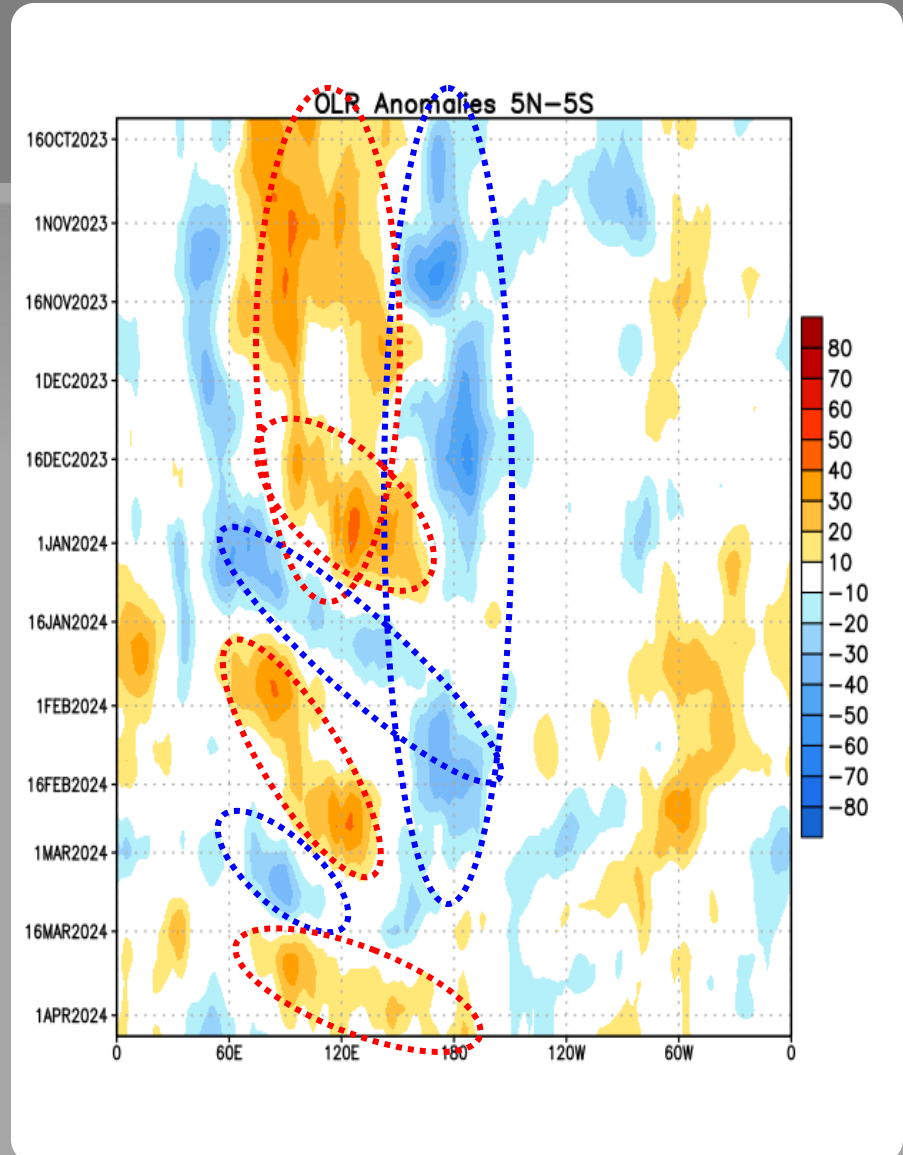
Through early March 2024, negative OLR anomalies (more convection) persisted over the central equatorial Pacific Ocean

Through December 2023, positive OLR anomalies persisted around Indonesia.

Since mid-December 2023, an alternating pattern of OLR anomalies has shifted eastward from the Indian Ocean/Indonesia to the western Pacific/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 .

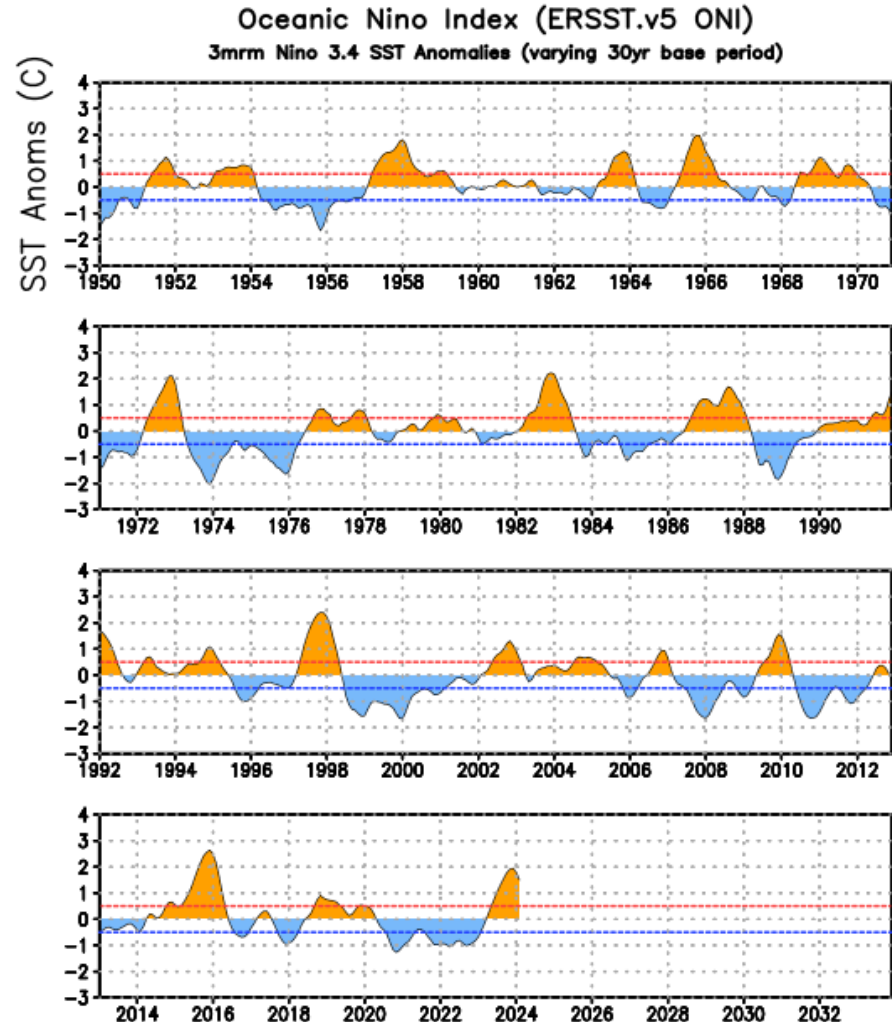
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (January - March 2024) is 1.5°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 $\pm 0.5^{\circ}\text{C}$ 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.

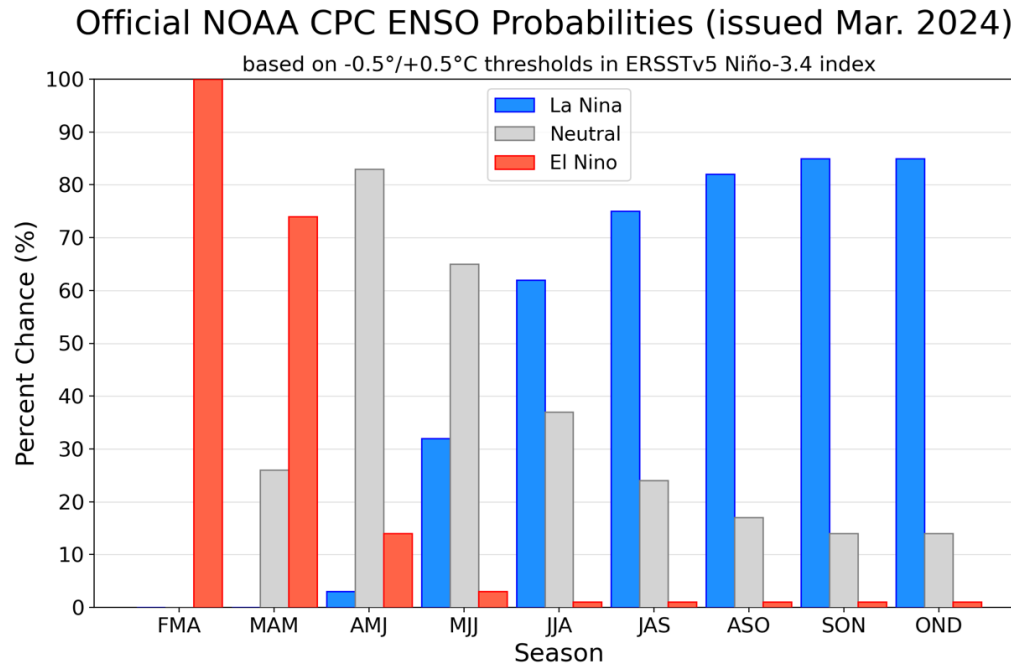
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

[illegible]

CPC Probabilistic ENSO Outlook

Updated: 14 March 2024

A transition from El Niño to ENSO-neutral is expected by April-June season 2024, with ENSO-neutral persisting through May-July 2024. Thereafter, La Niña is favored in June-August, and chances increase through the October-December season.



IRI Pacific Niño 3.4 SST Model Outlook

The majority of models indicate El Niño will persist through March-May 2024 and then transition to ENSO-neutral during April-June 2024.

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

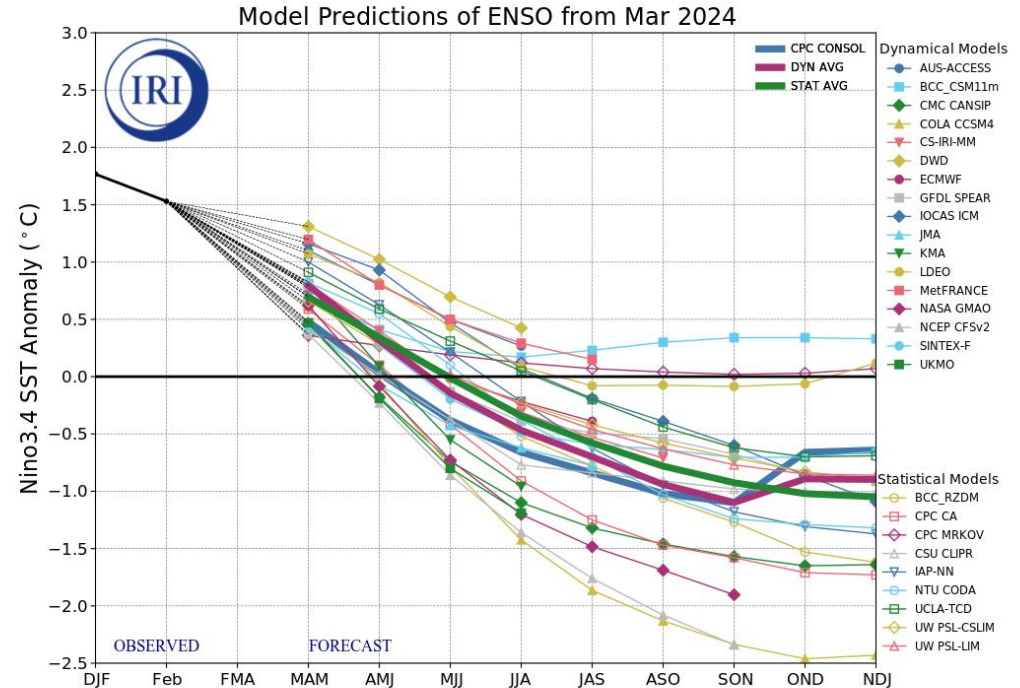


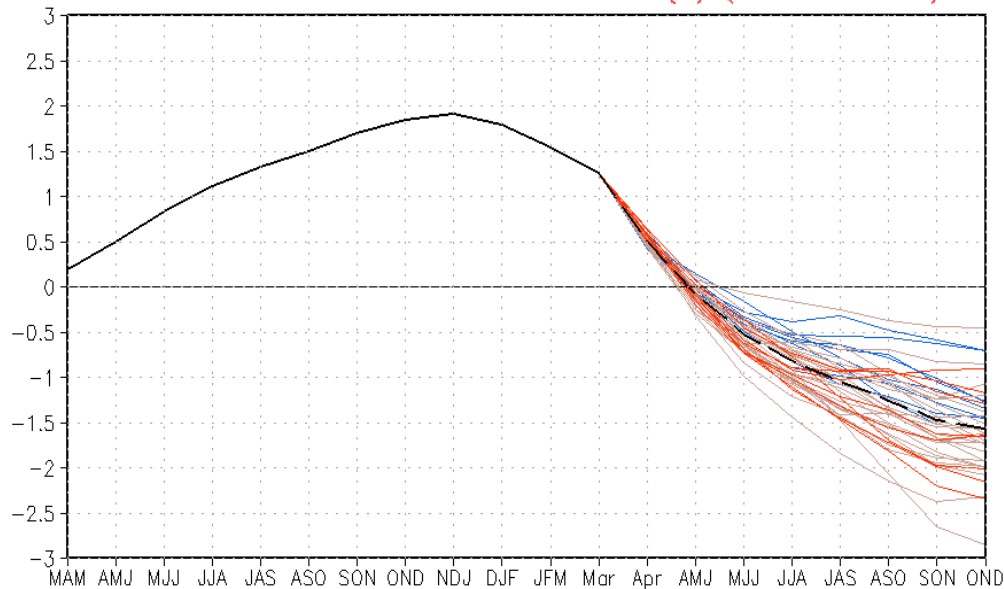
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 March 2024).

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

Issued: 8 April 2024

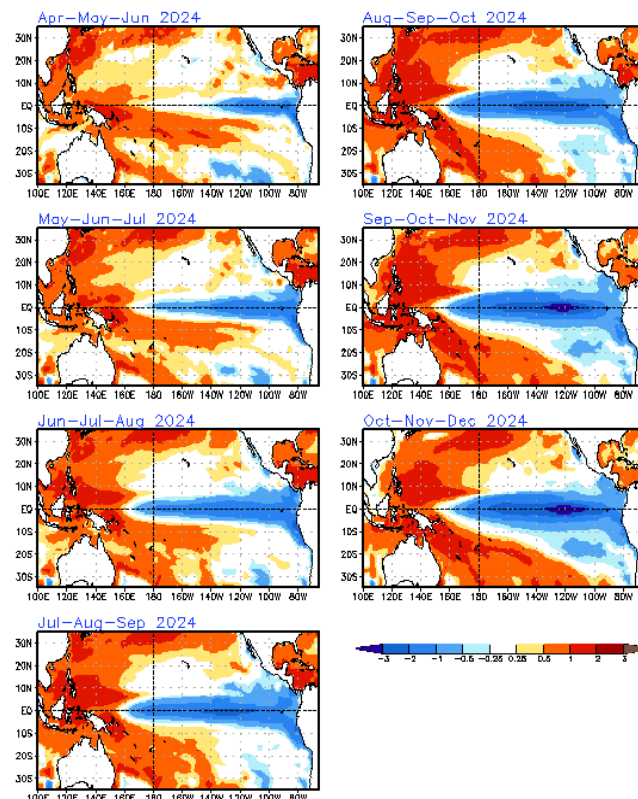
The CFS.v2 ensemble mean (black dashed line) indicates El Niño may transition to ENSO-neutral around April, followed by a transition to La Niña around May-July 2024.

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



— Latest 8 forecast members
— Earliest 8 forecast members
— Other forecast members
(Climatology base period: 1991–2020)

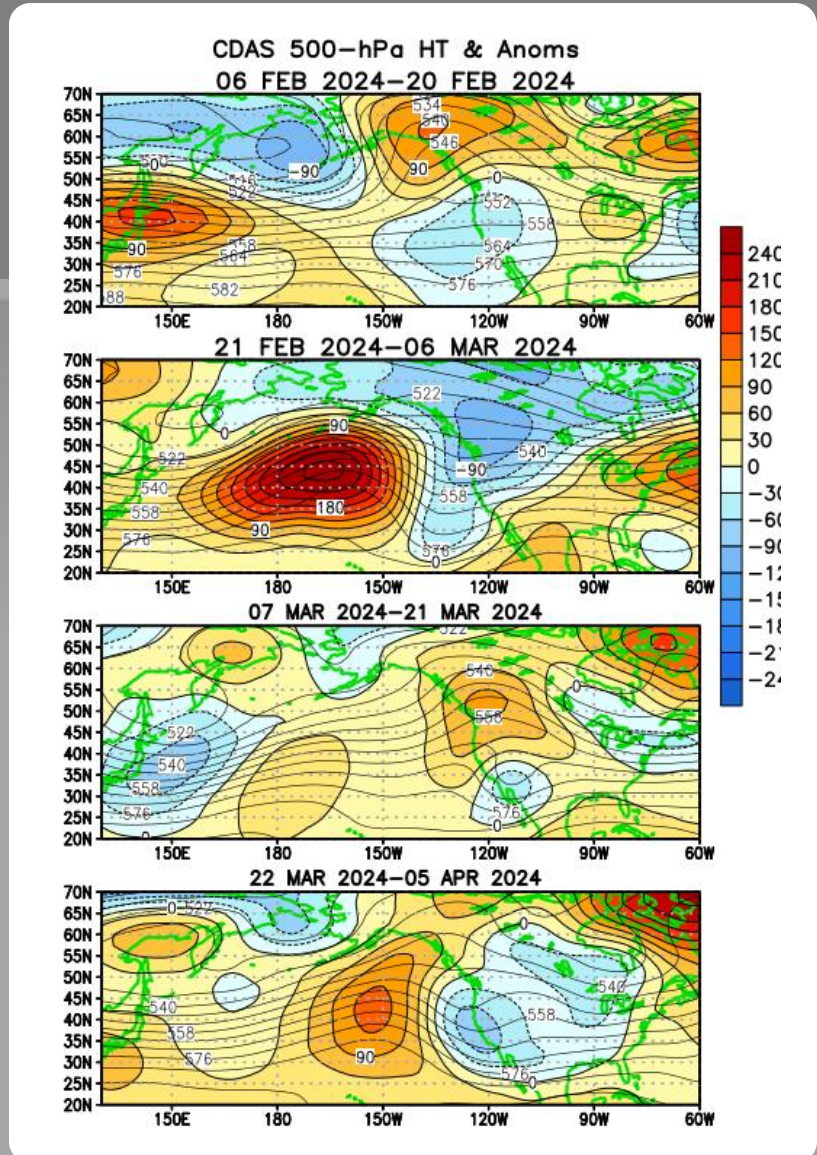
— Forecast ensemble mean
— NCEI Olv2.1 daily analysis



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

During most of the period from early February through early April, below-average heights and temperatures persisted in the eastern North Pacific Ocean and western contiguous U.S.

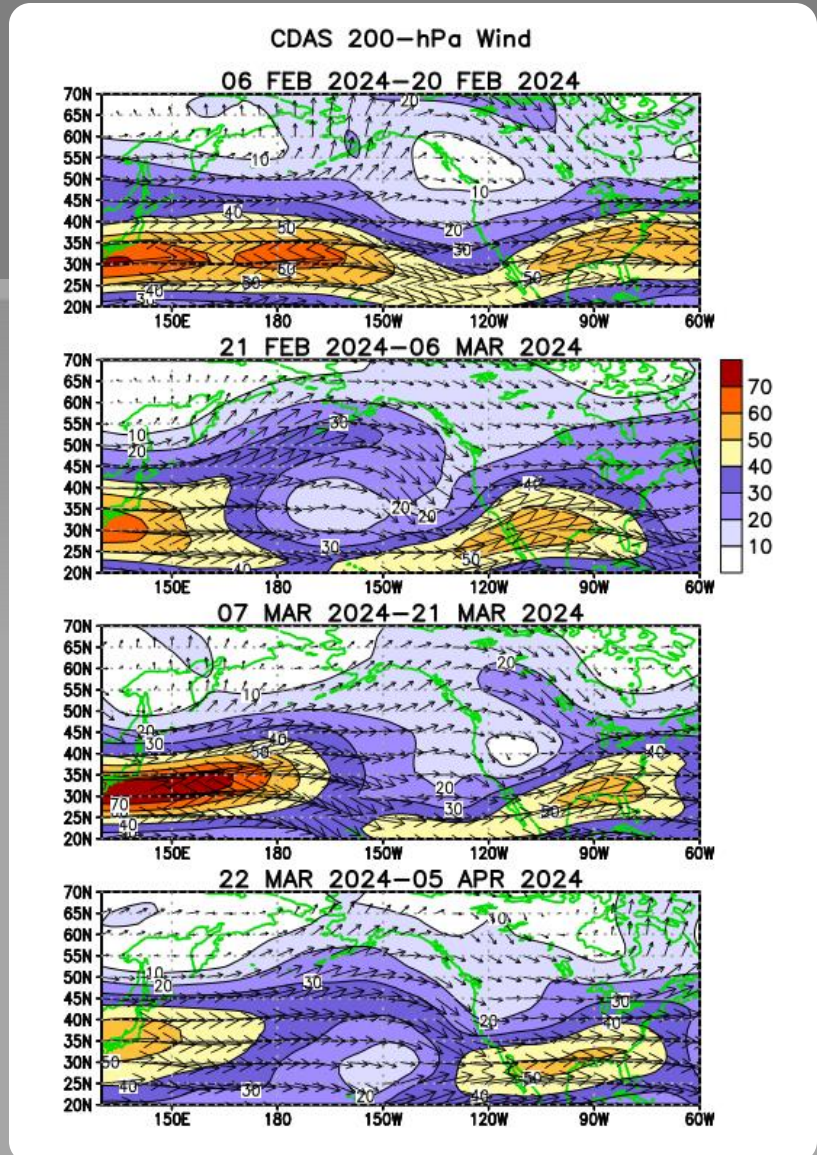
The pattern of heights and temperatures over the contiguous U.S. has been quite variable. More recently, below-average heights and temperatures have dominated the contiguous U.S.



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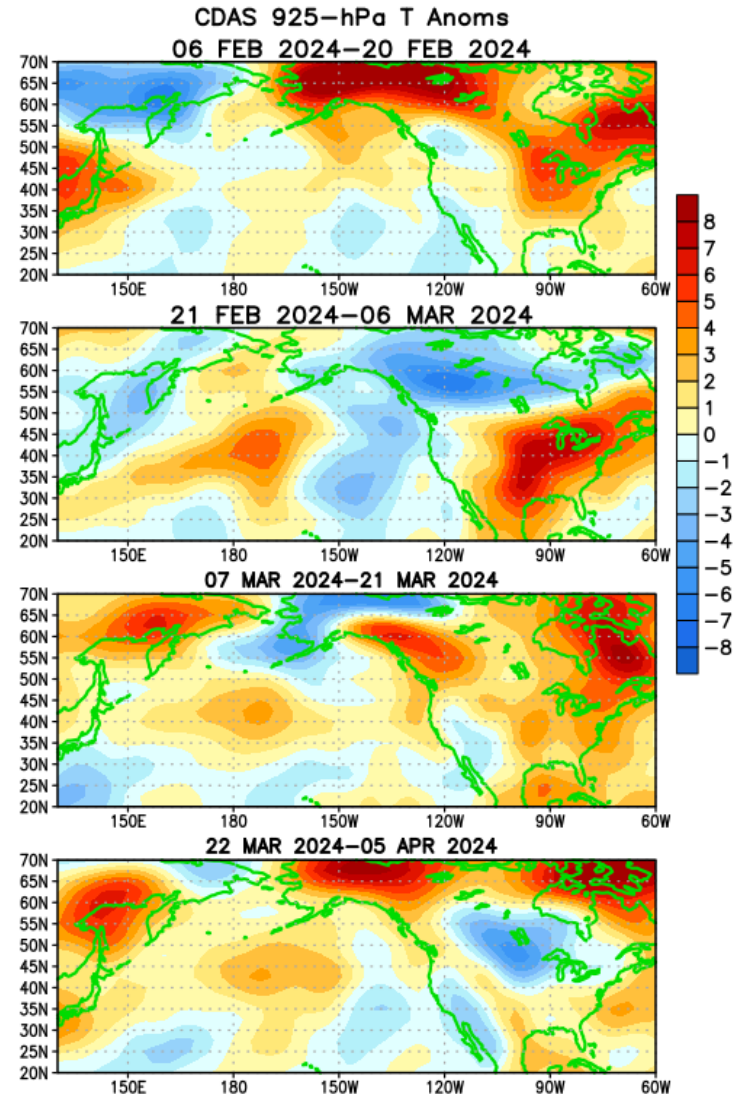
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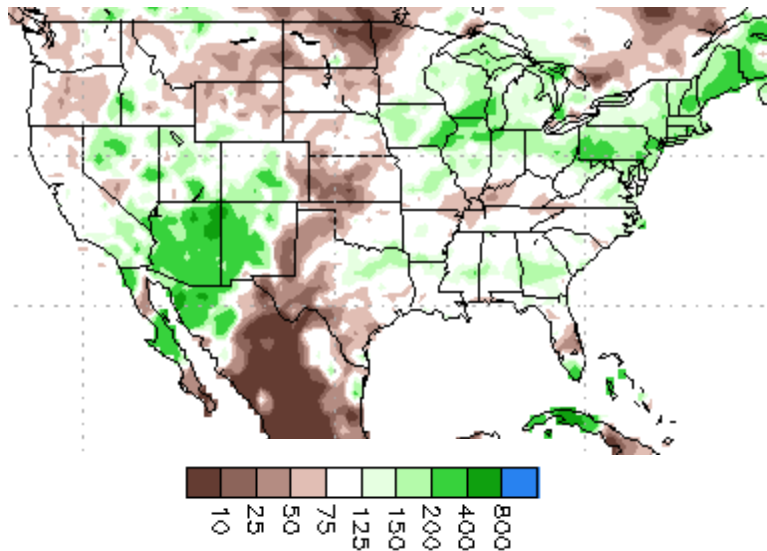
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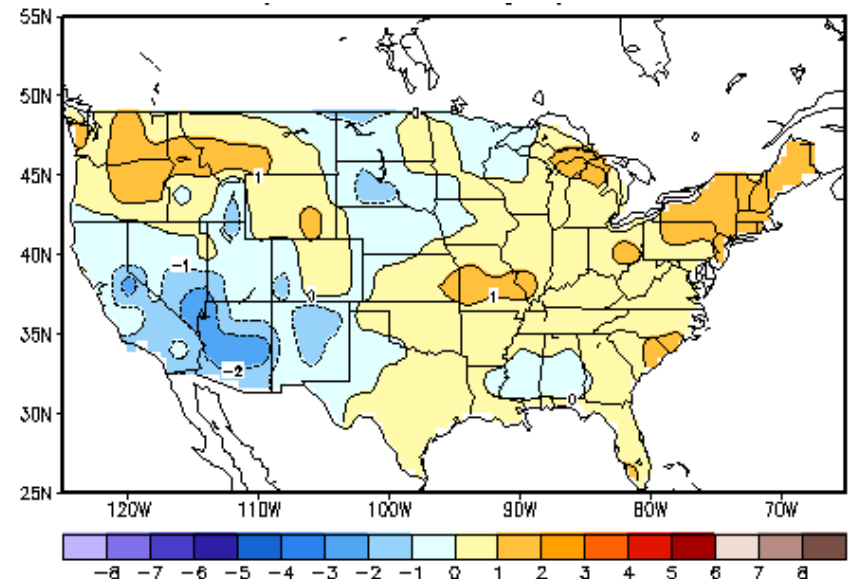
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 8 April 2024

Percent of Average Precipitation



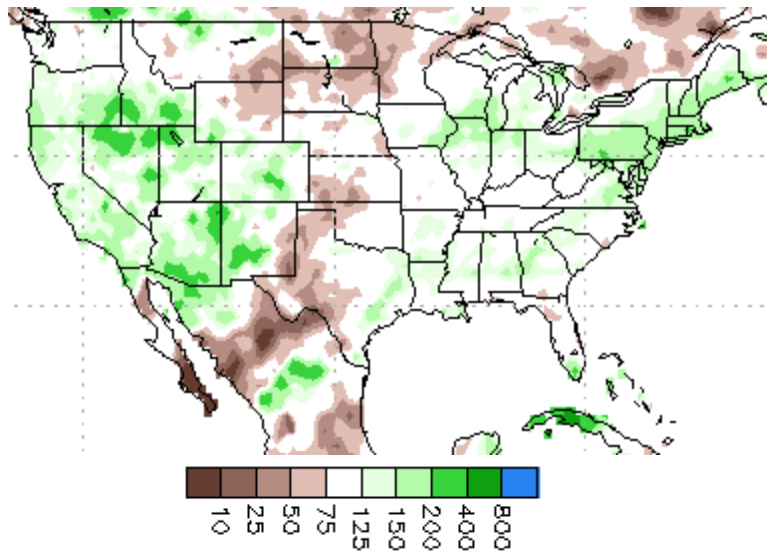
Temperature Departures (degree C)



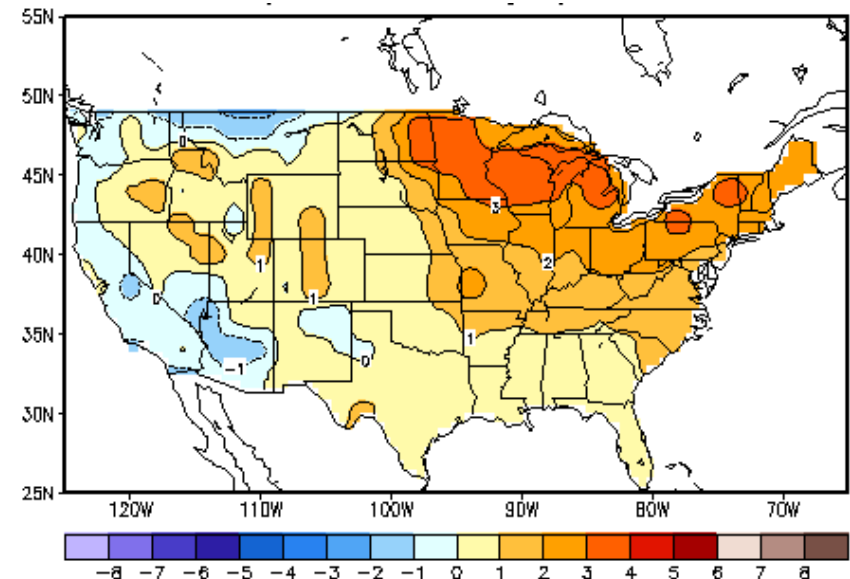
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 8 April 2024

Percent of Average Precipitation



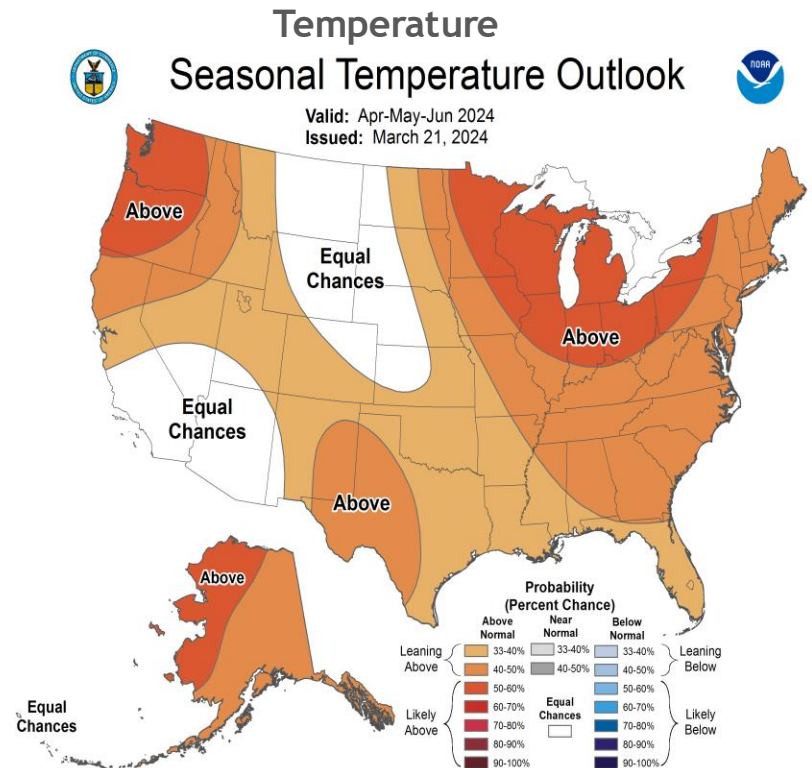
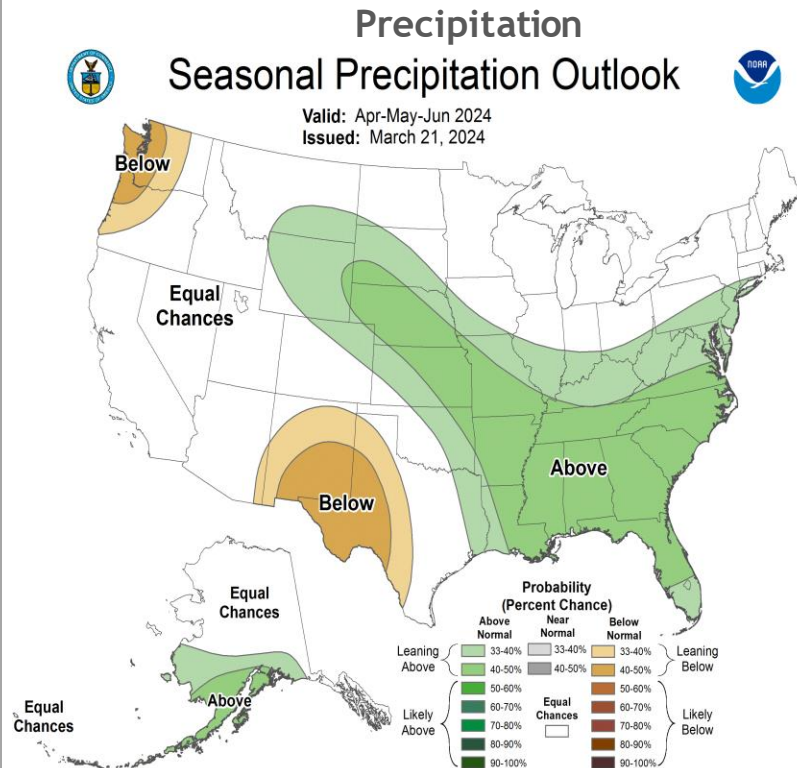
Temperature Departures (degree C)



U. S. Seasonal Outlooks

April - June 2024

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



Summary

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