ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
28 November 2022

Outline

Summary

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 is present.*

Equatorial sea surface temperatures (SSTs) are below average across most of the Pacific Ocean.

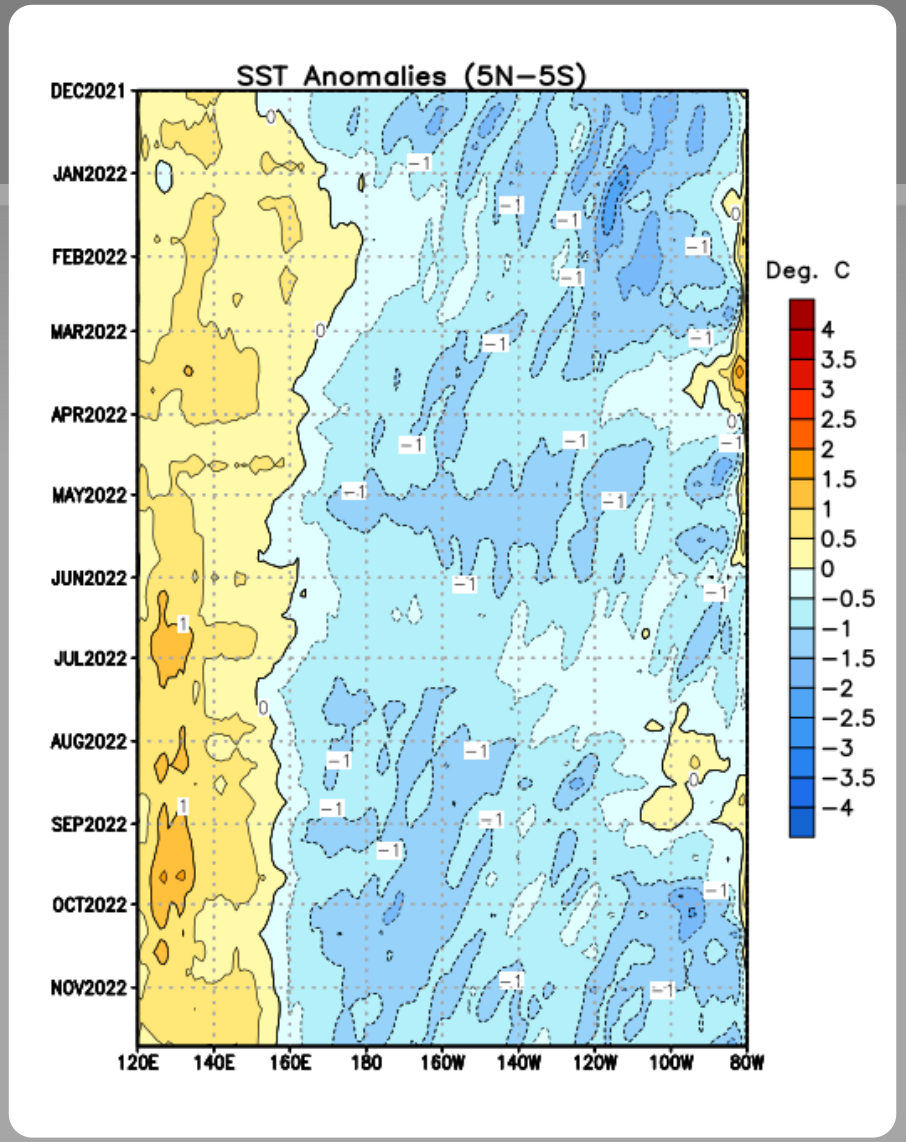
The tropical Pacific atmosphere is consistent with La Niña.

There is a 76% chance of La Niña during the Northern Hemisphere winter (December-February) 2022-23, with a transition to ENSO-neutral favored in February-April 2023 (57% 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 (ºC)

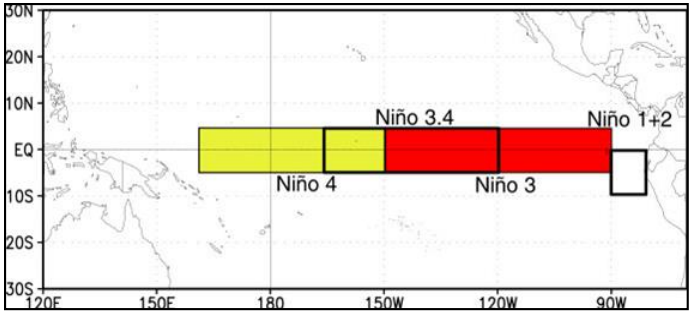
In the last week, negative SST anomalies persisted across the equatorial Pacific Ocean.

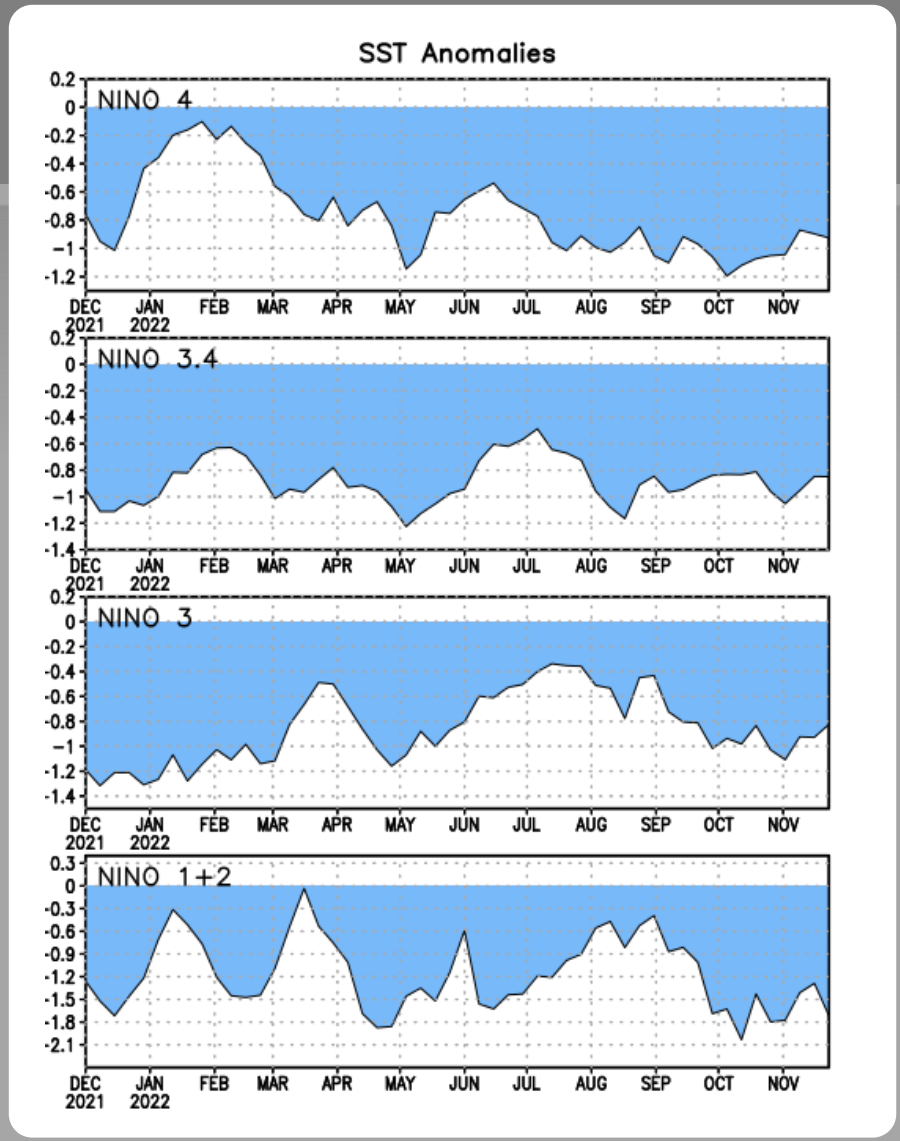


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

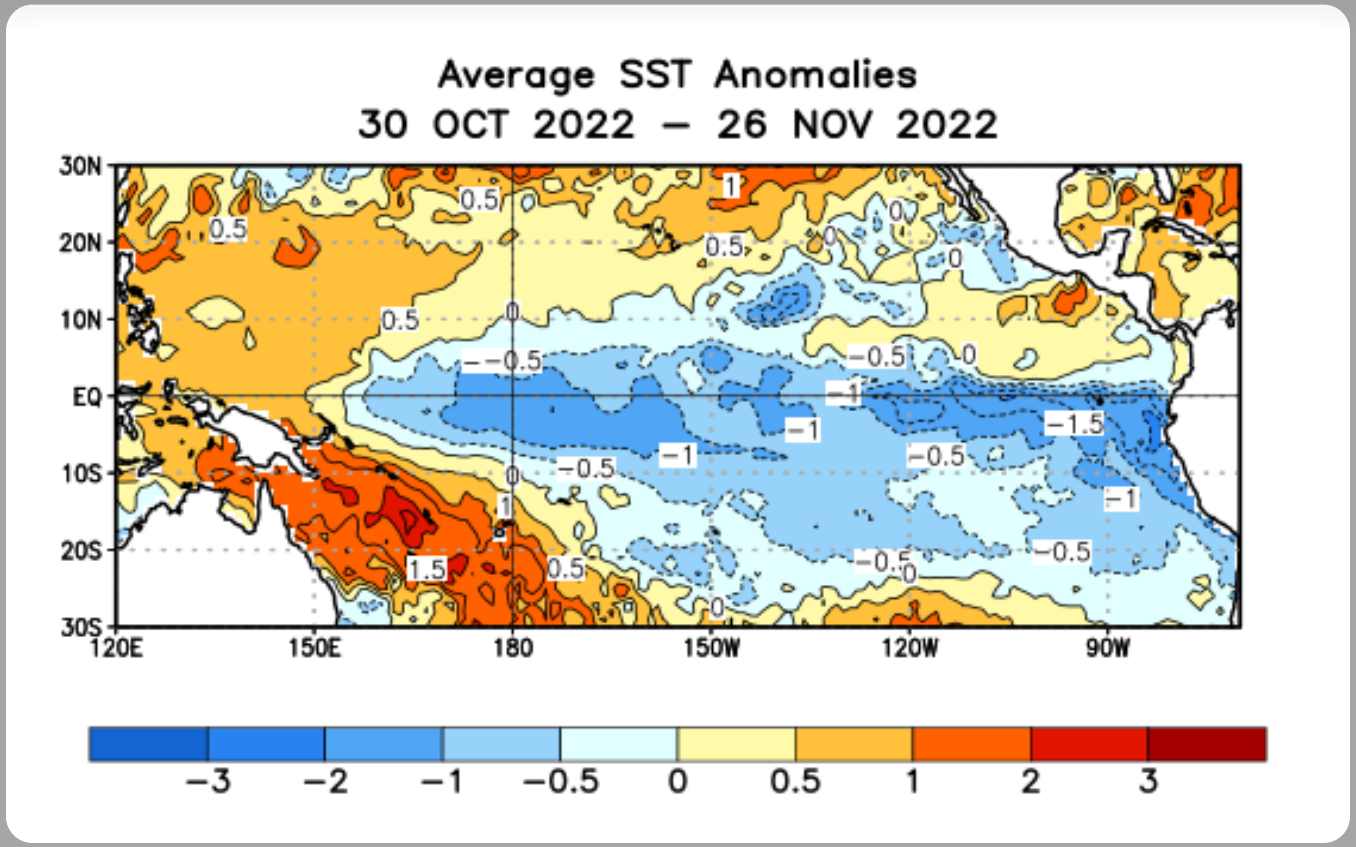
Niño 4	-0.9°C
Niño 3.4	-0.8°C
Niño 3	-0.8°C
Niño 1+2	-1.7°C





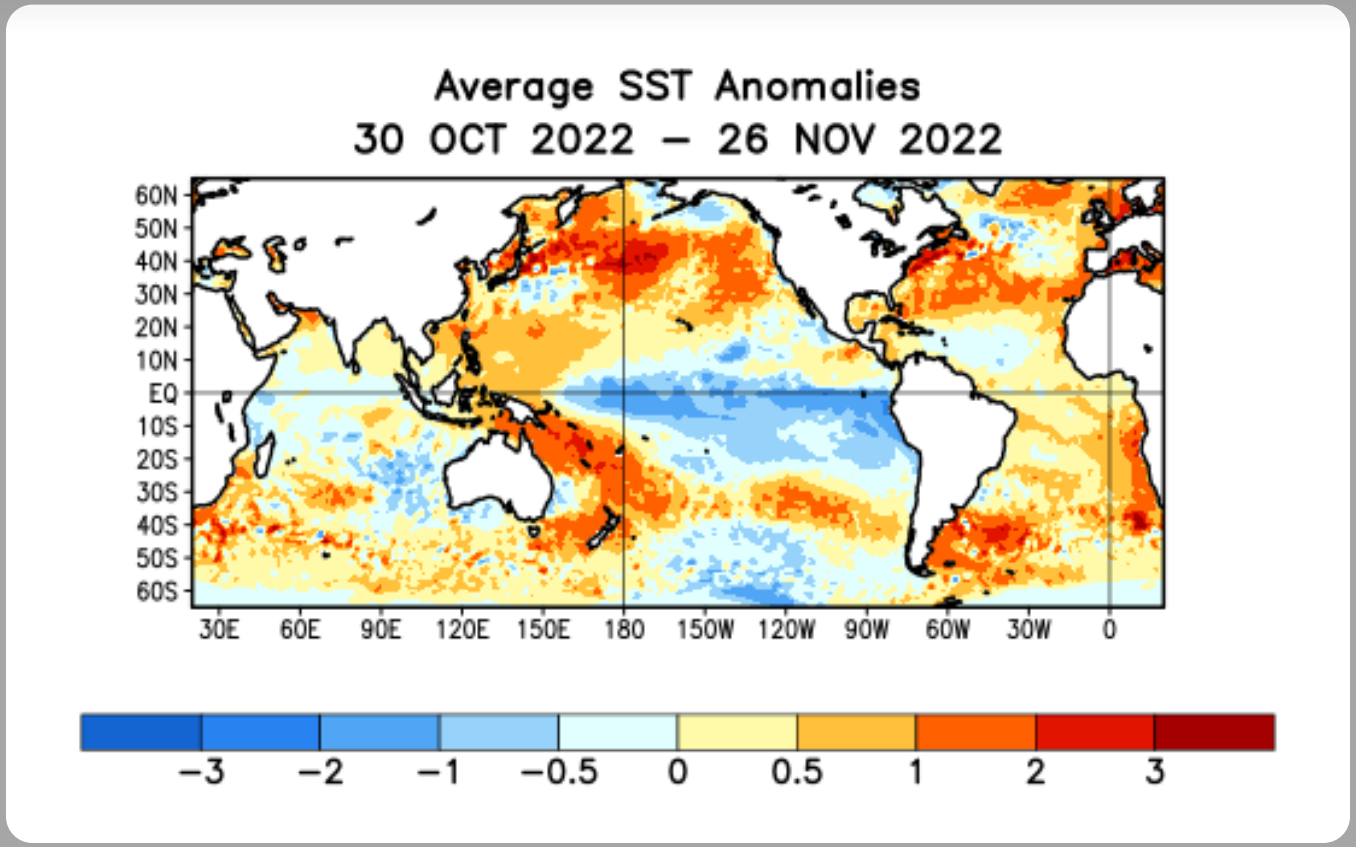
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were below average across most of the Pacific Ocean.



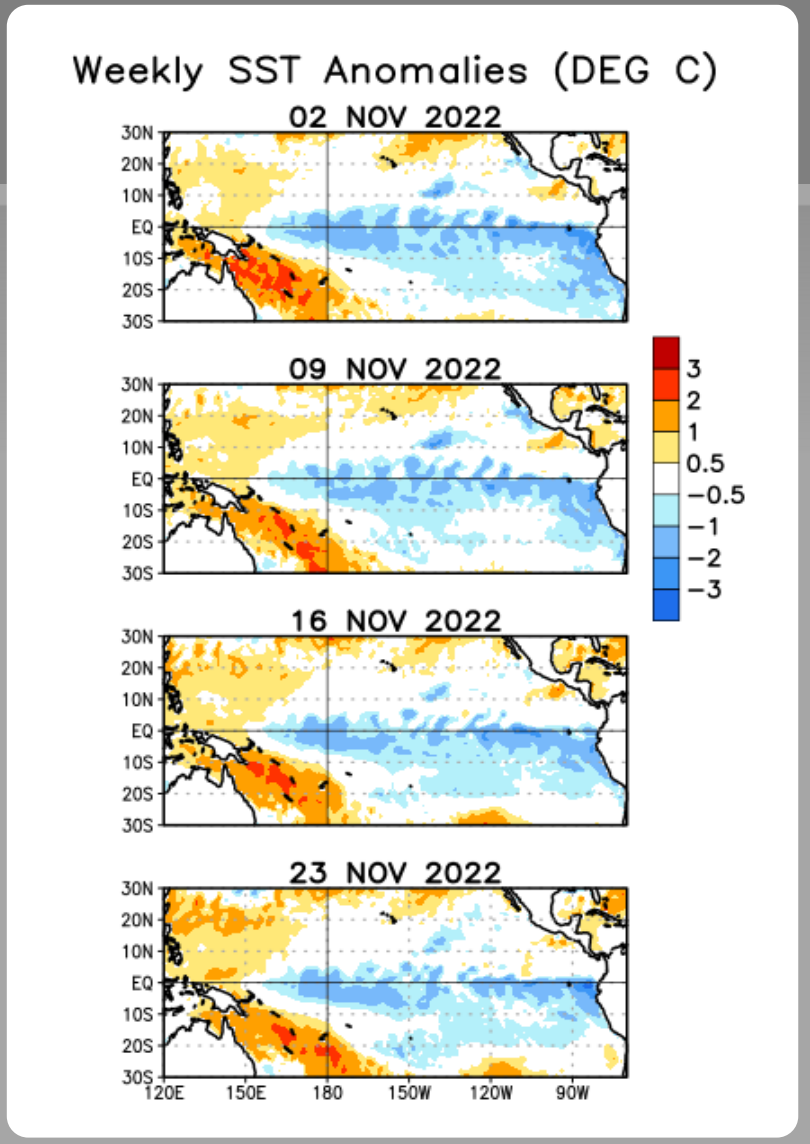
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were below average across most of the Pacific Ocean. Equatorial SSTs were above average around Indonesia.



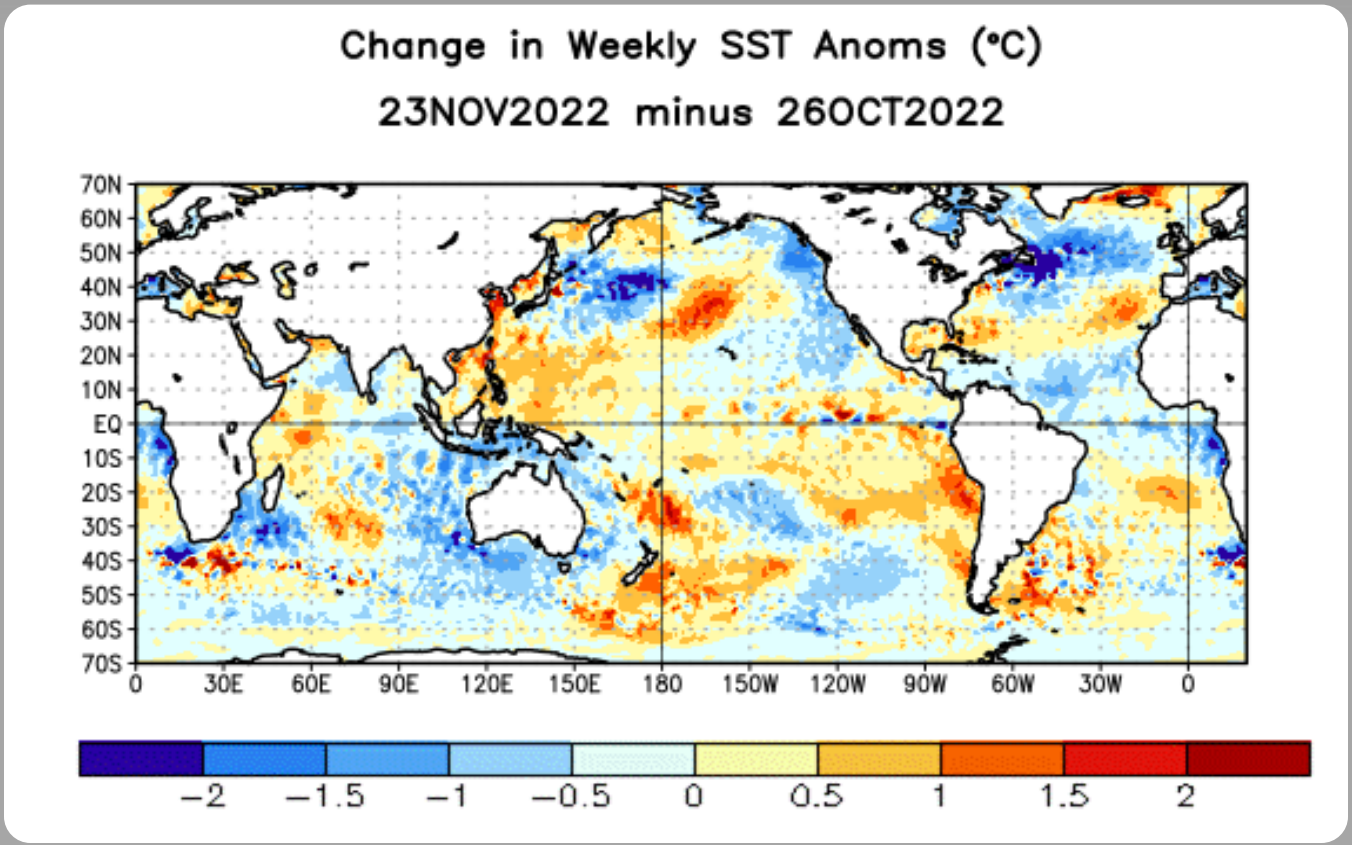
Weekly SST Departures during the Last Four Weeks

During the last 4 weeks, negative SST anomalies persisted in the central and eastern equatorial Pacific Ocean.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, small regions of positive and negative changes were evident across the equatorial Pacific Ocean.



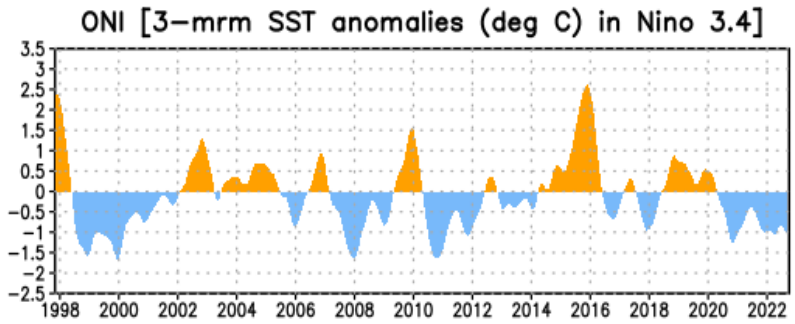
Upper-Ocean Conditions in the Equatorial Pacific

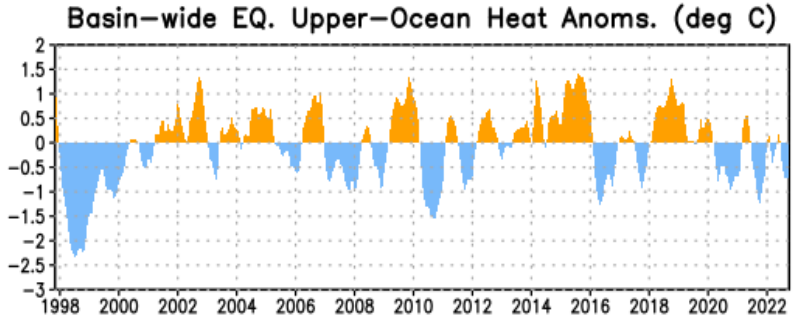
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

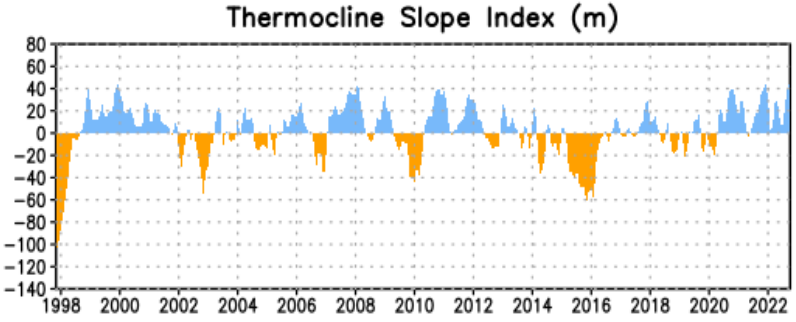
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

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

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).

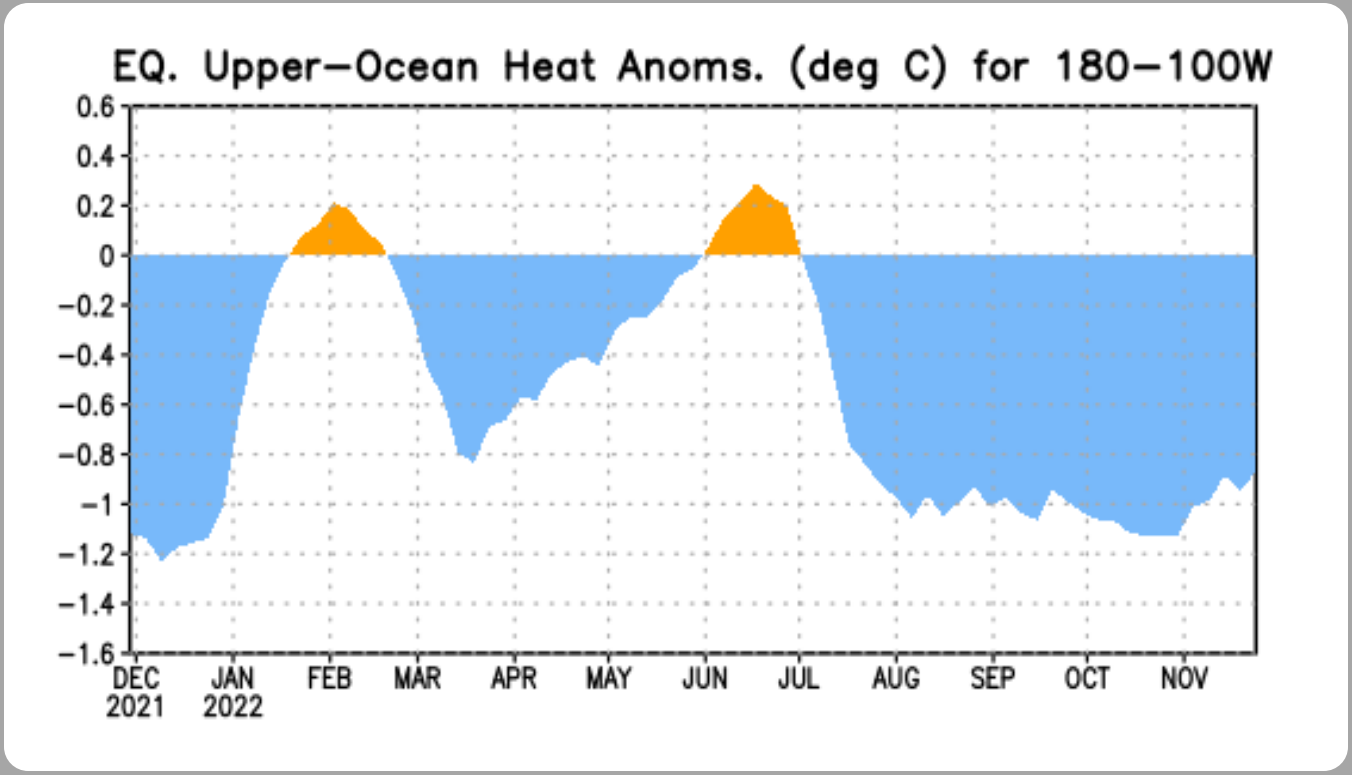






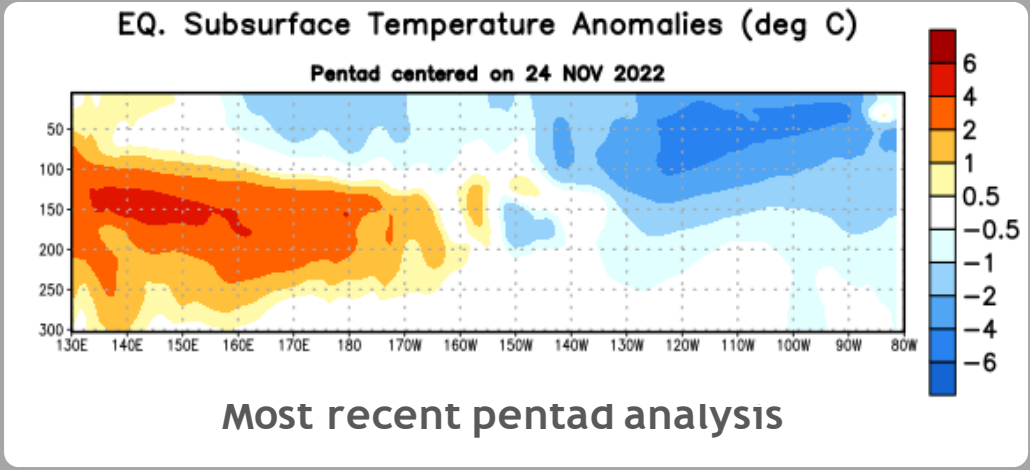
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

During February 2022 through mid-March, subsurface temperature anomalies decreased and were negative. From mid-March to mid-June, subsurface temperature anomalies increased from negative to positive. Anomalies rapidly decreased from mid-June through July, and since then have generally persisted.



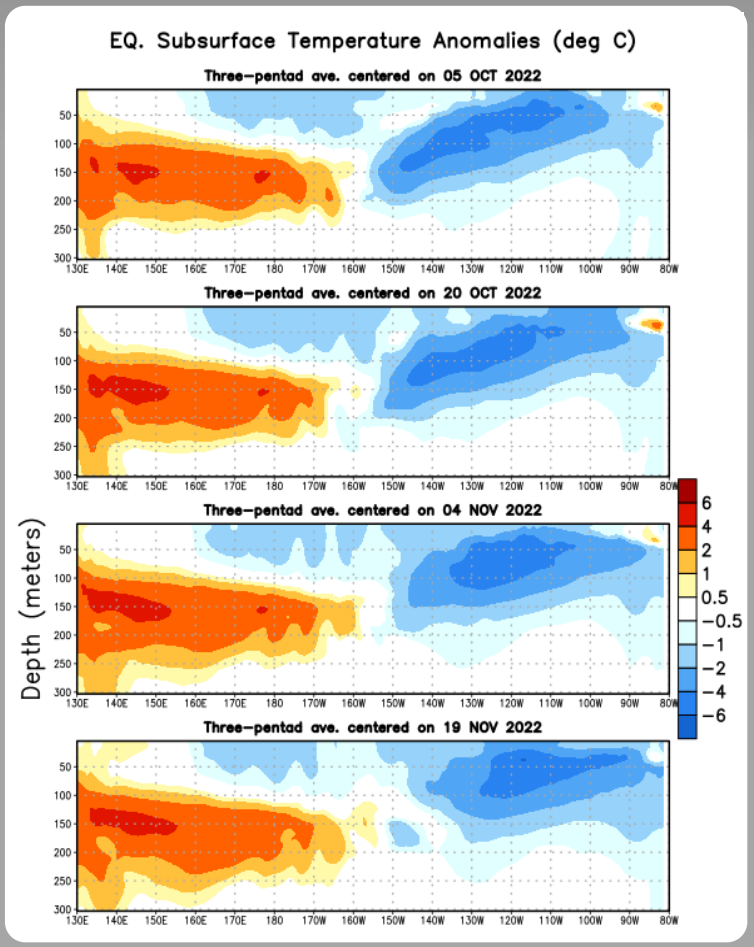
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, negative subsurface temperature anomalies persisted near the surface and at depth in the eastern and east-central Pacific.



Most recent pentad analysis

Positive subsurface temperature anomalies have mostly persisted, at depth, in the western and central Pacific Ocean.

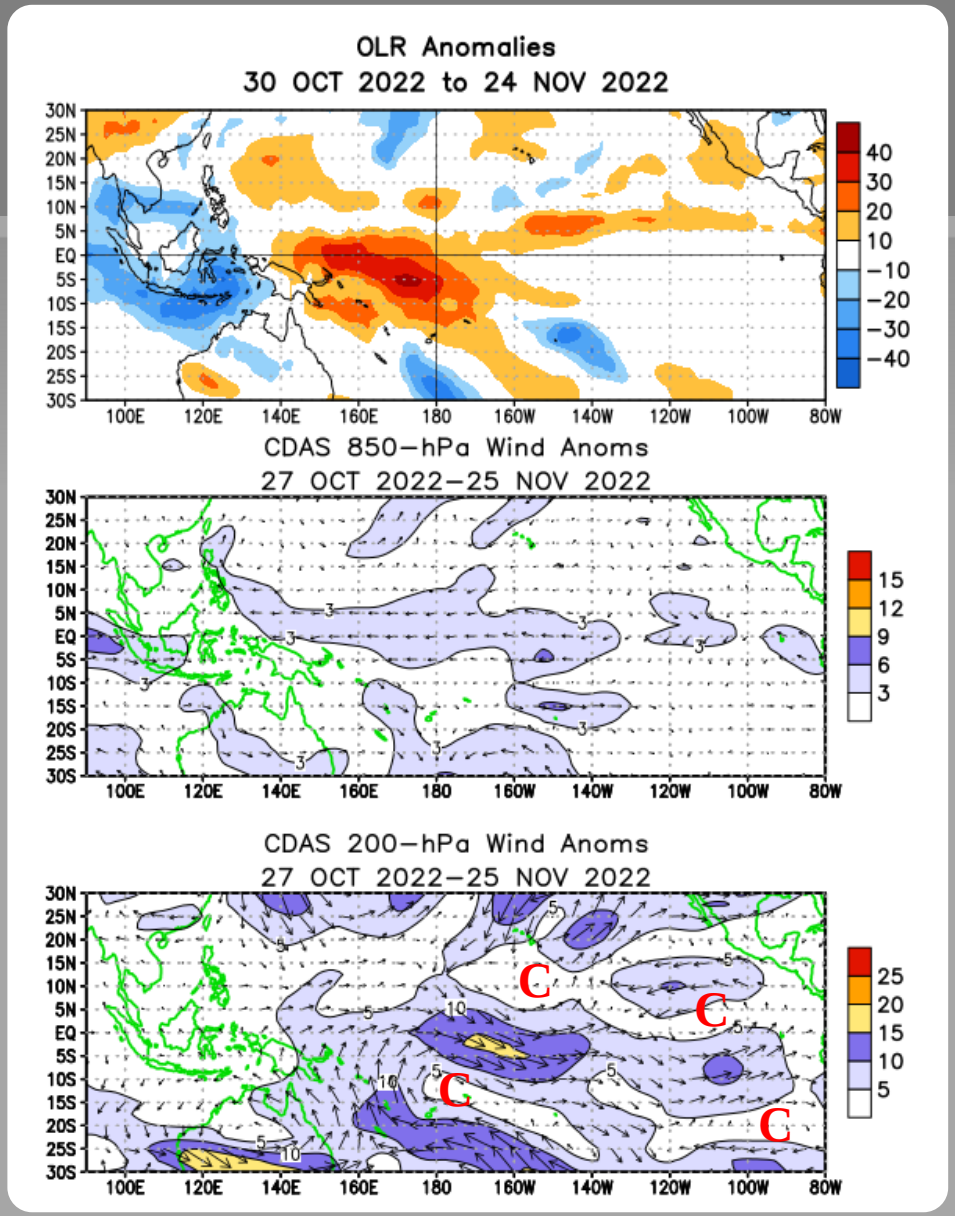


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were located over the central and western tropical Pacific Ocean. Negative OLR anomalies (enhanced convection and precipitation) were observed over Indonesia.

Low-level (850-hPa) easterly wind anomalies were evident across most of the equatorial Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies were observed across most of the equatorial Pacific, with anomalous cyclones on either side of the equator.



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.

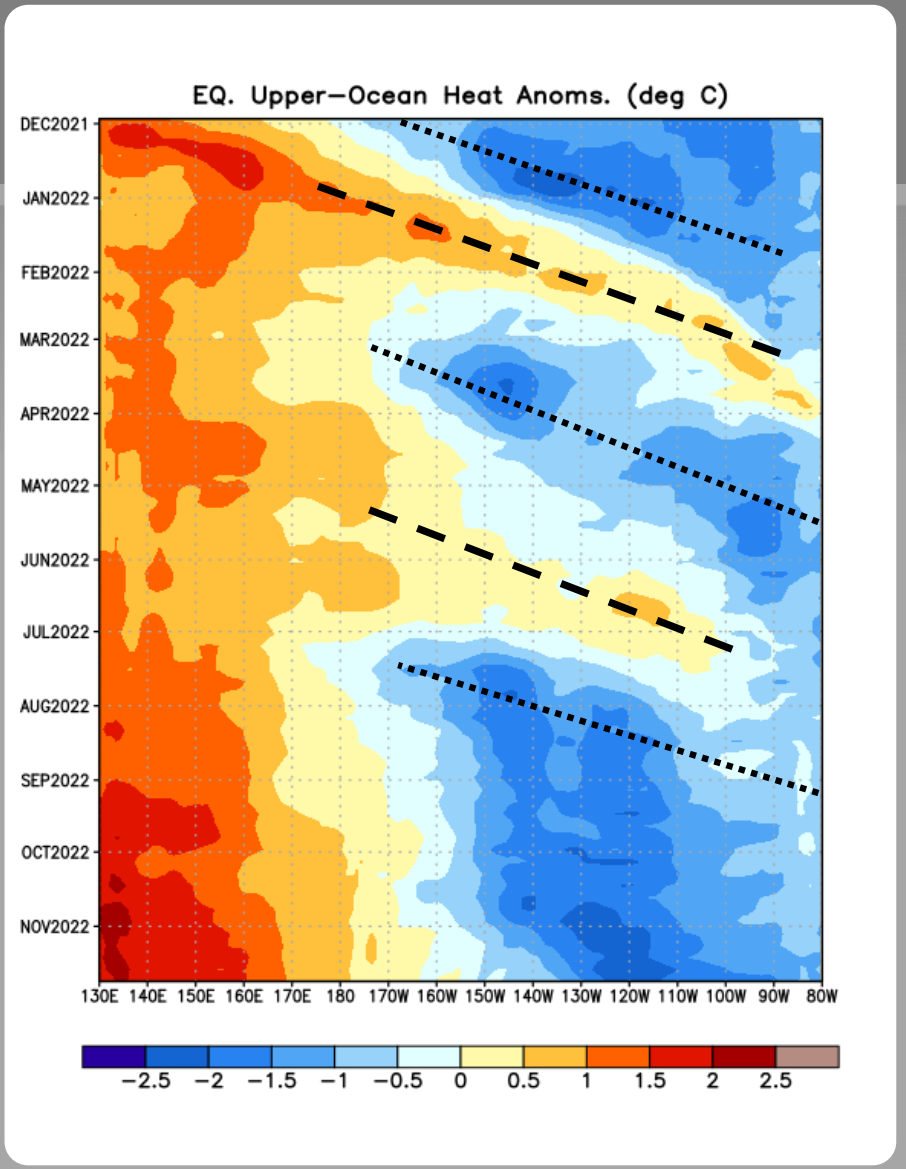
Weekly Heat Content Evolution in the Equatorial Pacific

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

During March- May, an upwelling Kelvin wave shifted eastward into the eastern Pacific Ocean, which was followed by a downwelling Kelvin wave.

During July and August, an upwelling Kelvin wave expanded eastward.

From August through October, negative subsurface temperature anomalies were stationary in the eastern Pacific Ocean. During November, negative anomalies have slightly contracted to the east.

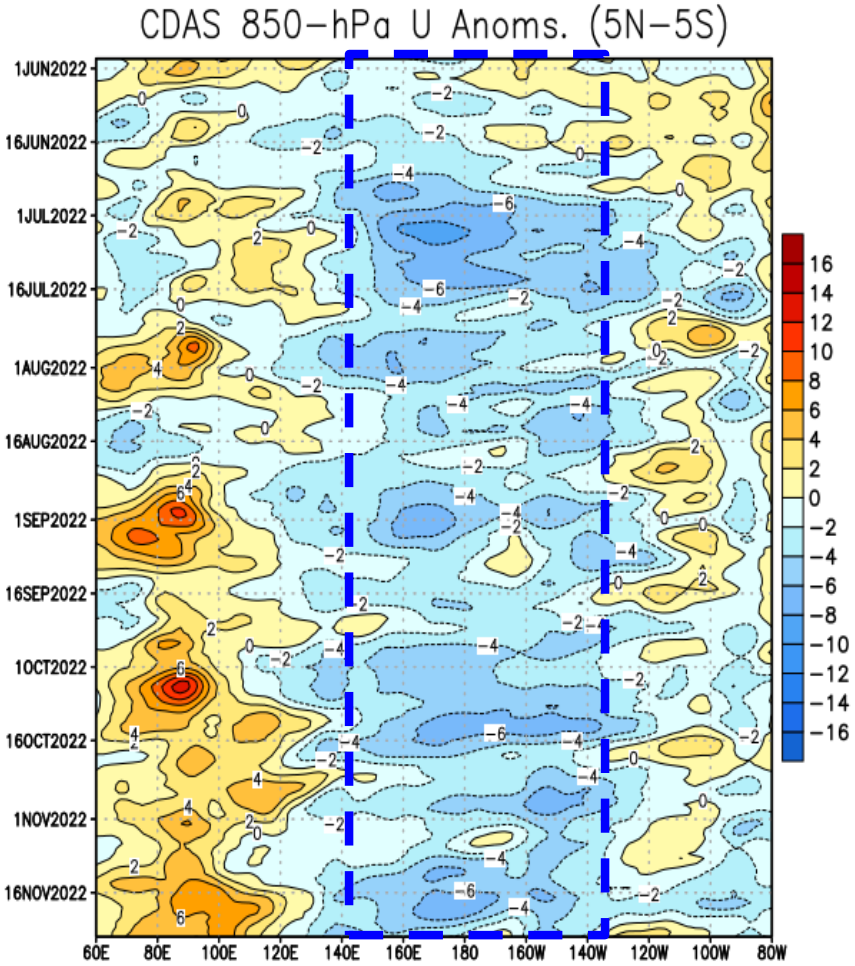


Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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.

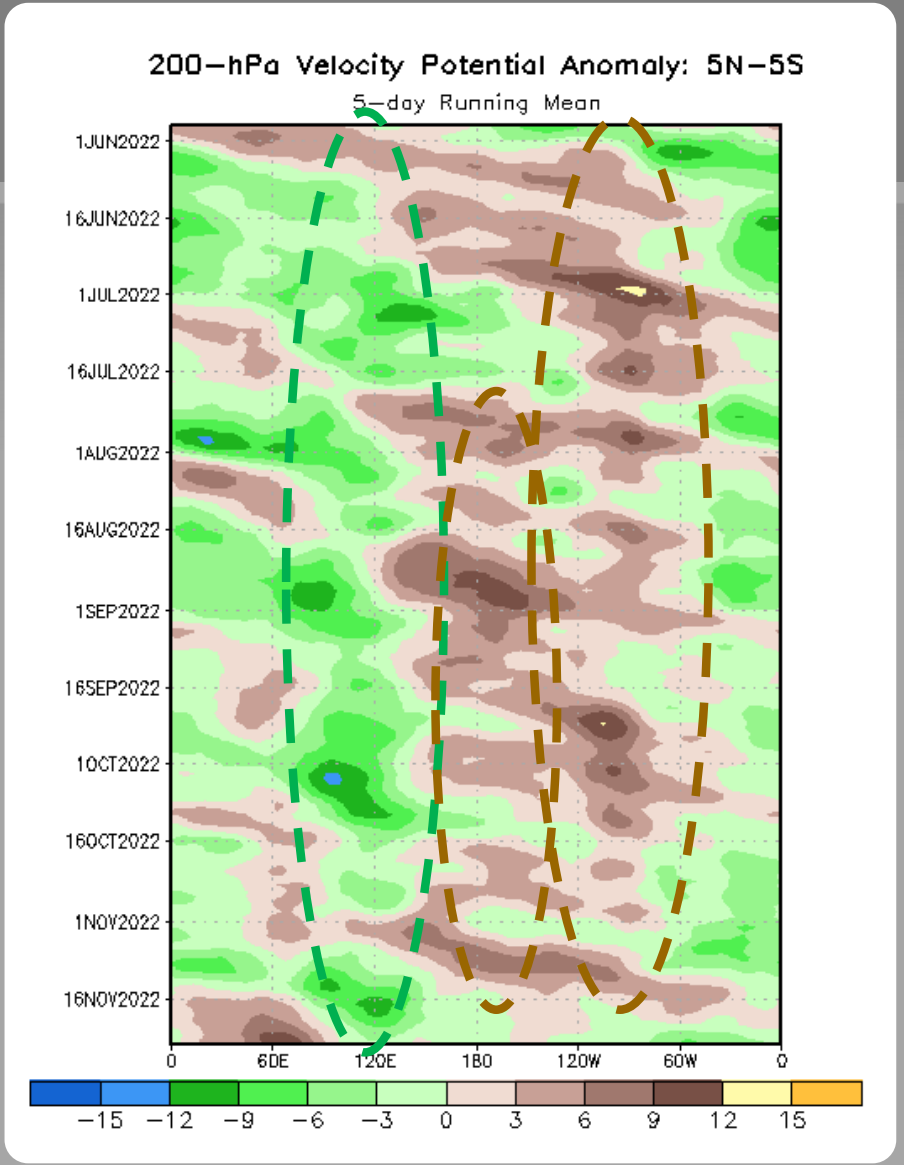
Since the beginning of the period, easterly wind anomalies have generally dominated over the central and east-central Pacific, except for breaks during early-to-mid June 2022, early September 2022, early and late November 2022.



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

Upper-level (200-hPa) Velocity Potential Anomalies

During most of the period, anomalous divergence (green shading) generally remained near Indonesia, while anomalous convergence (brown shading) persisted over the central and eastern Pacific Ocean.



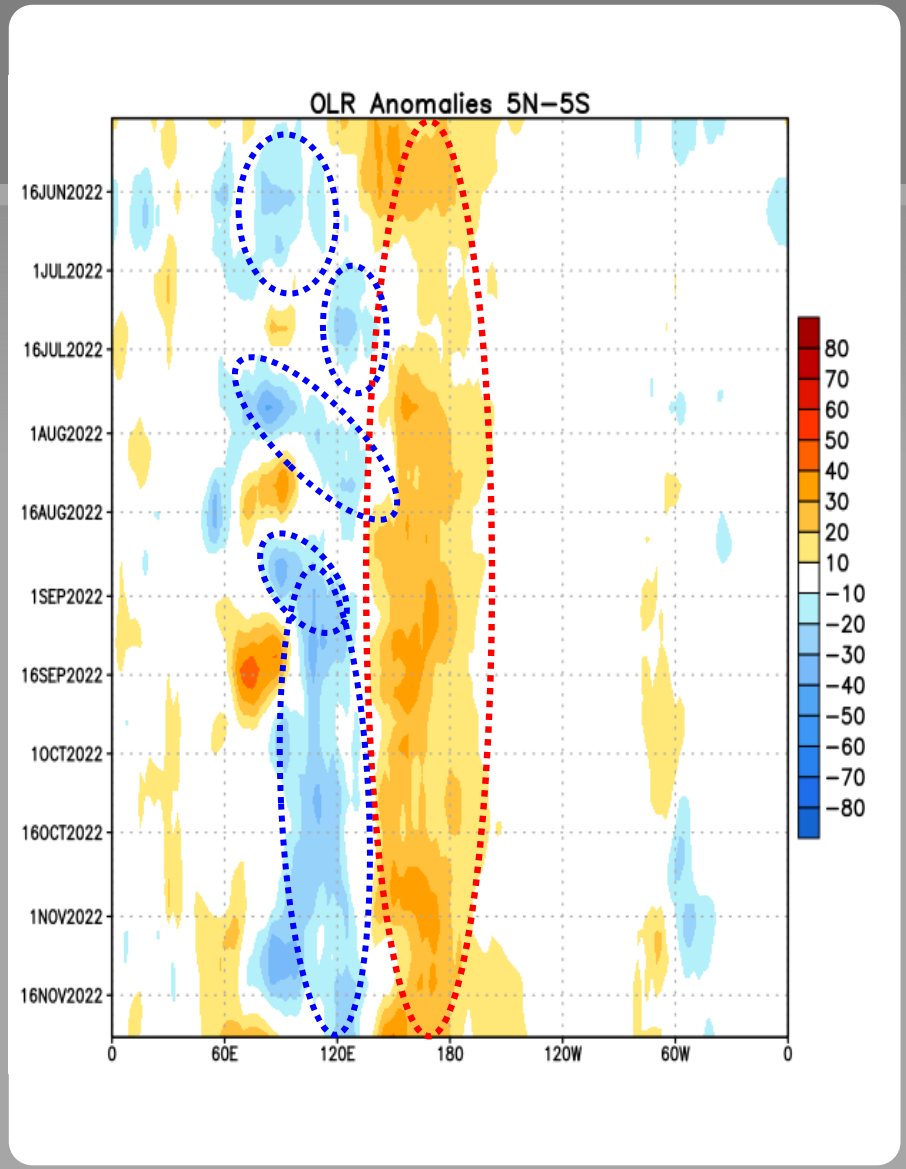
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

Since the beginning of the period, positive OLR anomalies were evident over the western and/or central Pacific Ocean.

Negative OLR anomalies were periodically observed over Indonesia until late August 2022 when anomalies became more persistent.



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.

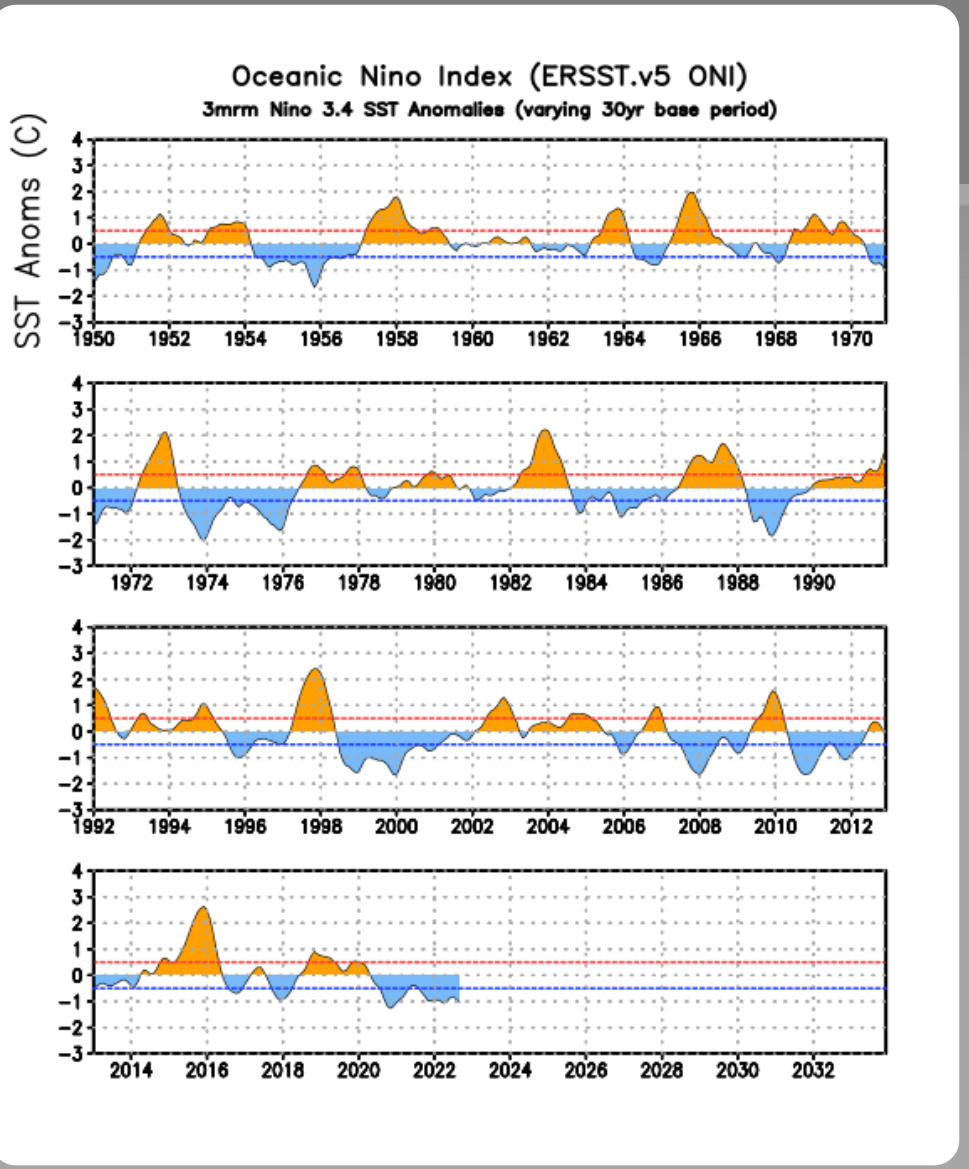
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (August - October 2022) is -1.0°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.

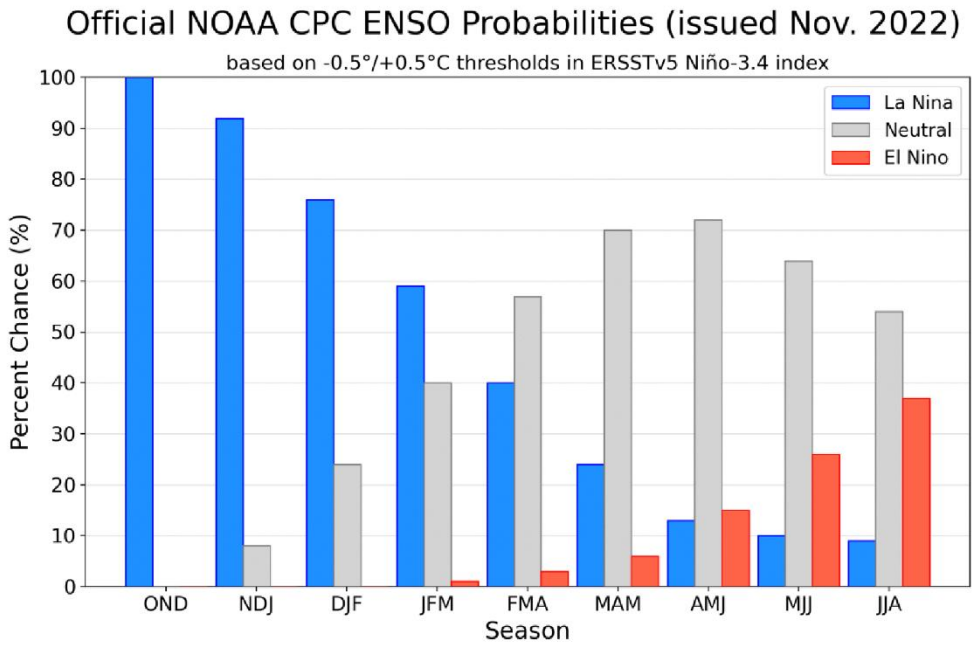
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2010	1.5	1.2	0.8	0.4	-0.2	-0.7	-1.0	-1.3	-1.6	-1.6	-1.6	-1.6
2011	-1.4	-1.2	-0.9	-0.7	-0.6	-0.4	-0.5	-0.6	-0.8	-1.0	-1.1	-1.0
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			

CPC Probabilistic ENSO Outlook

Updated: 10 November 2022

Chances of La Niña gradually decrease through the Northern Hemisphere fall and winter, with ENSO-neutral favored beginning in February-April 2023.



IRI Pacific Niño 3.4 SST Model Outlook

According to the dynamical model average (green thick line), La Nina is expected to persist into the Northern Hemisphere winter 2022-23 and then transition to ENSO-neutral in January-March 2023. For the statistical model average (red thick line), the transition to ENSO-neutral is around February-April 2023.

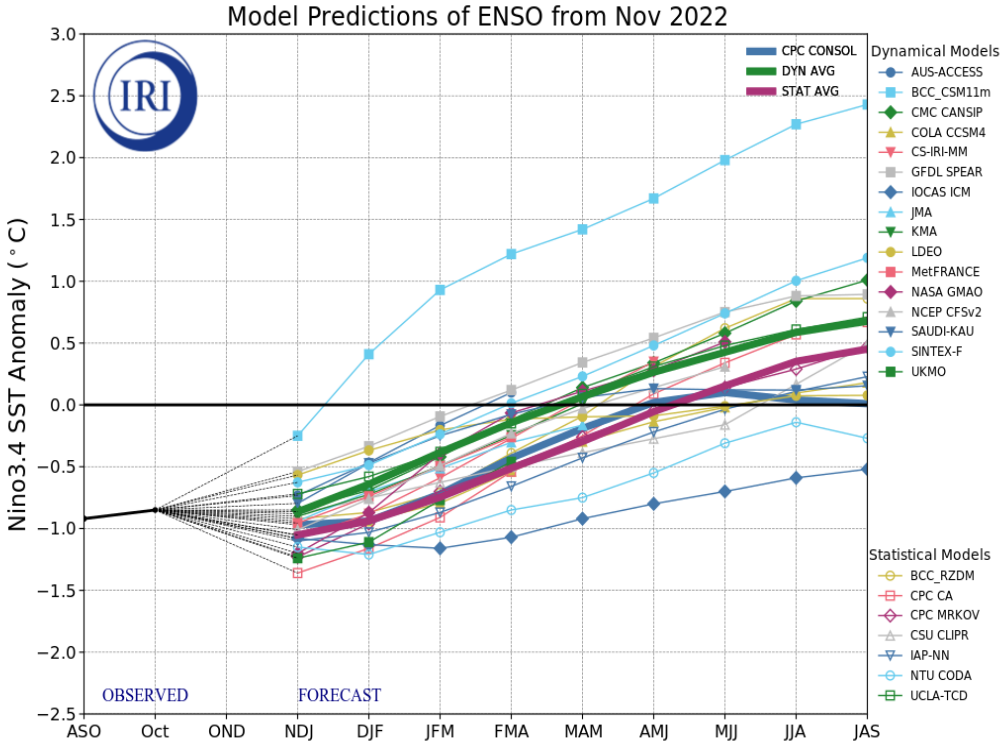
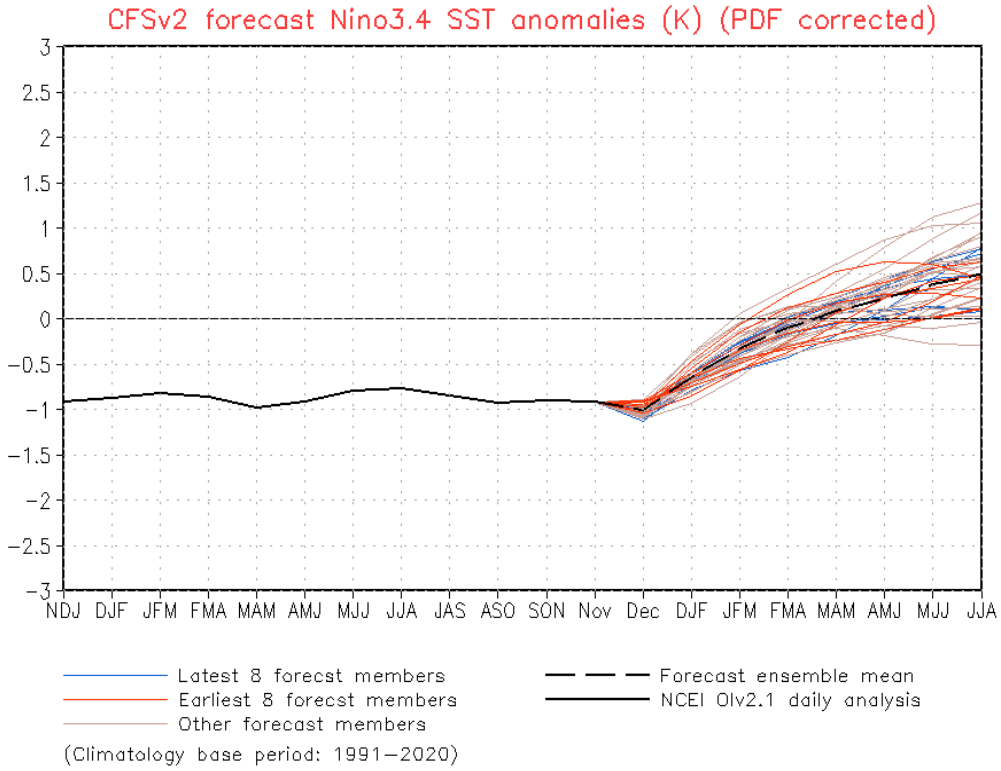


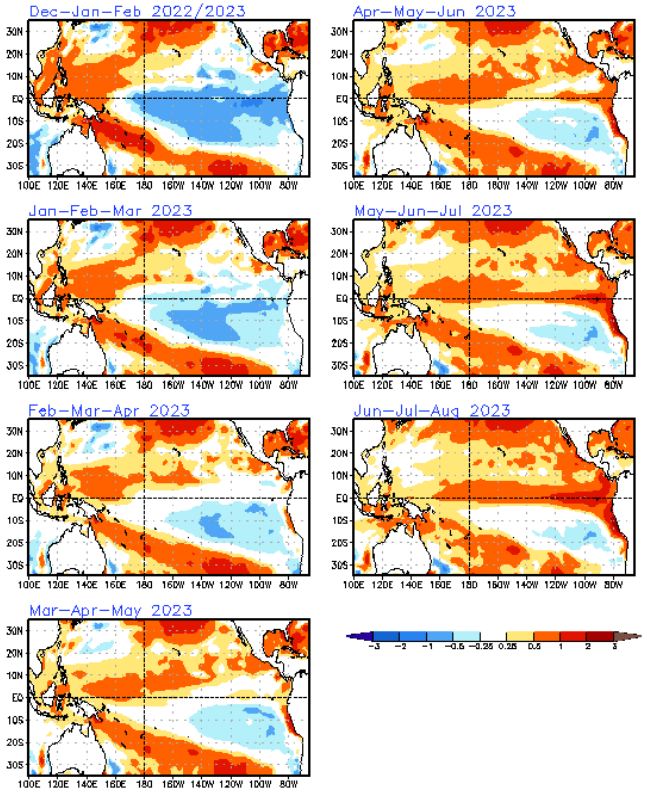
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 November 2022).

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

Issued: 28 November 2022

The CFS.v2 ensemble mean (black dashed line) indicates La Niña is likely to persist into Northern Hemisphere winter 2022-23, and then transition to ENSO-neutral around January-March 2023.



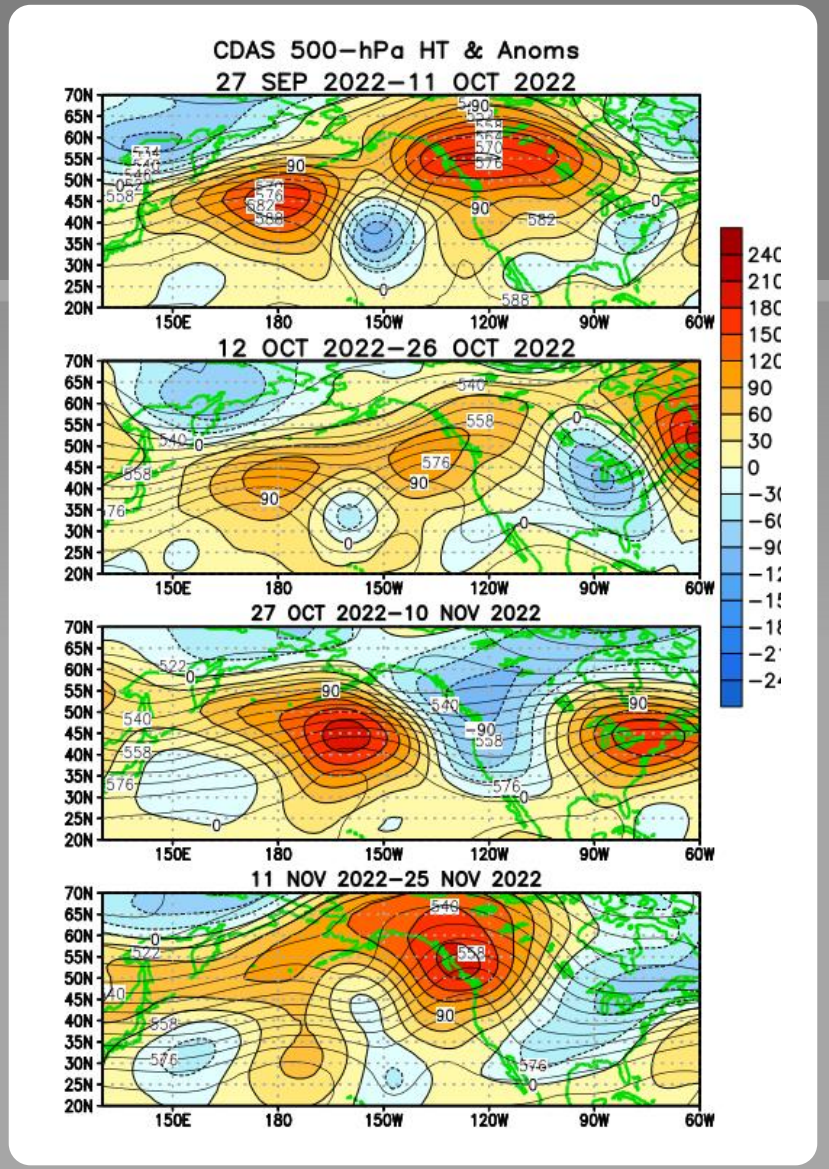


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From late September to late October, above-average heights and temperatures persisted over the northwestern U.S. while below-average heights and temperatures were evident across the eastern U.S.

From late October to early November, the pattern flipped with below-average heights and temperatures evident over the western U.S. and above-average heights and temperatures observed over the eastern U.S.

Since early November, below-average heights and temperatures have dominated most of the contiguous U.S.



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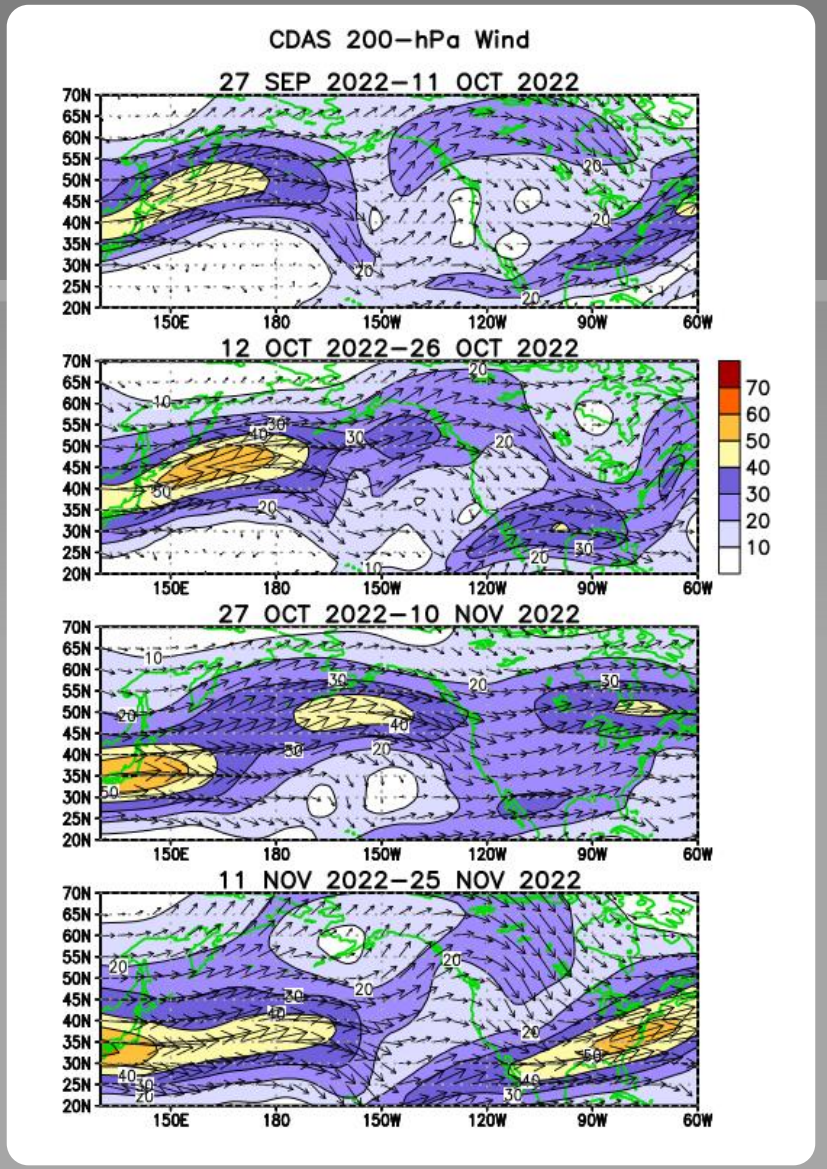

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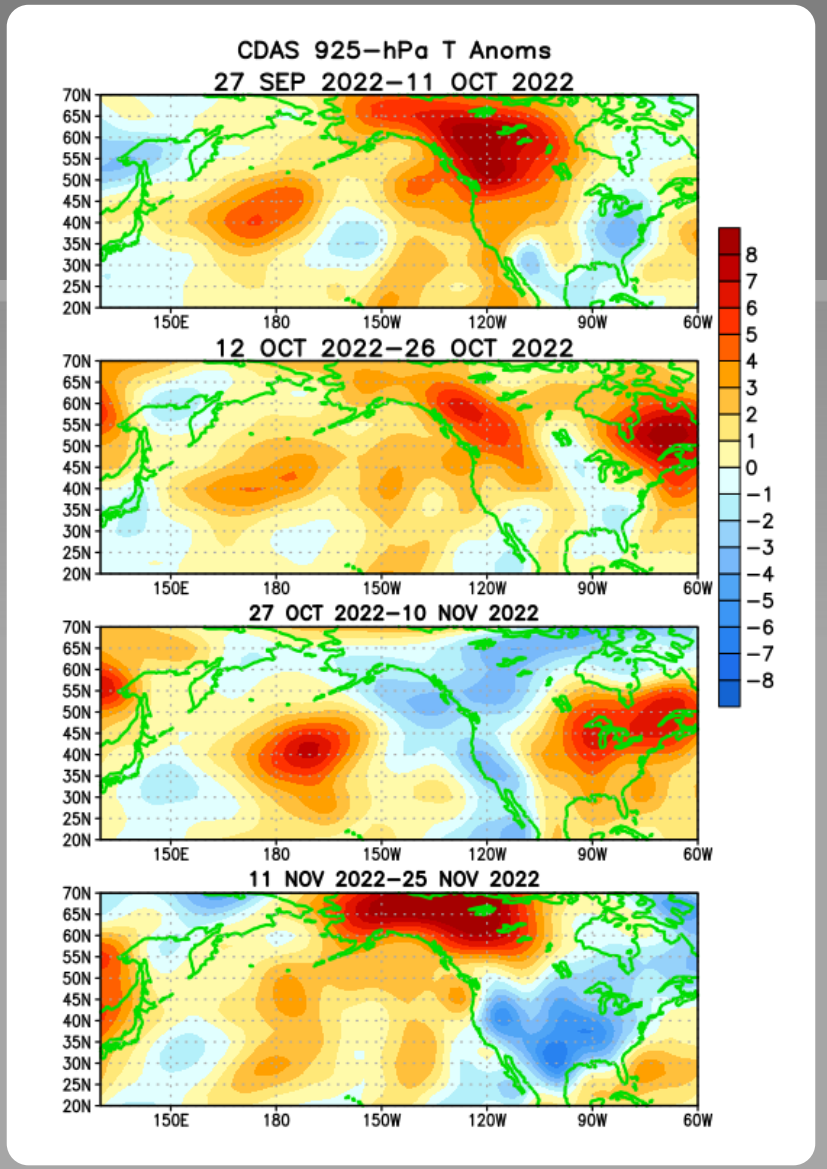
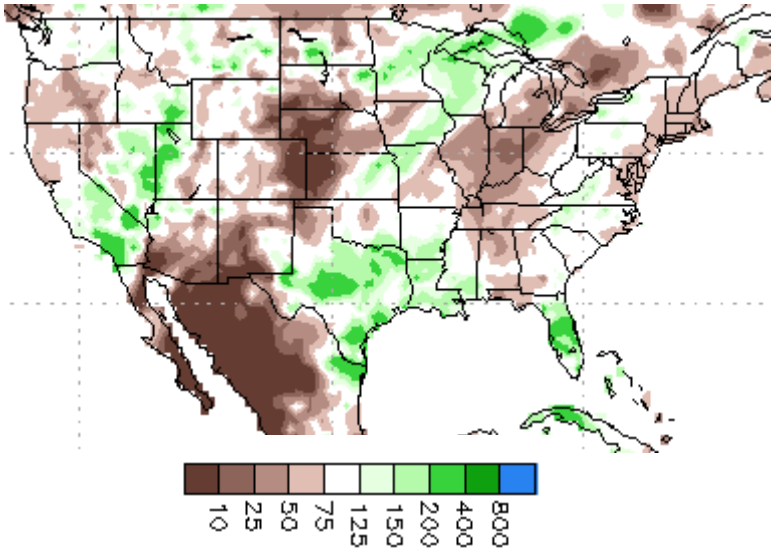


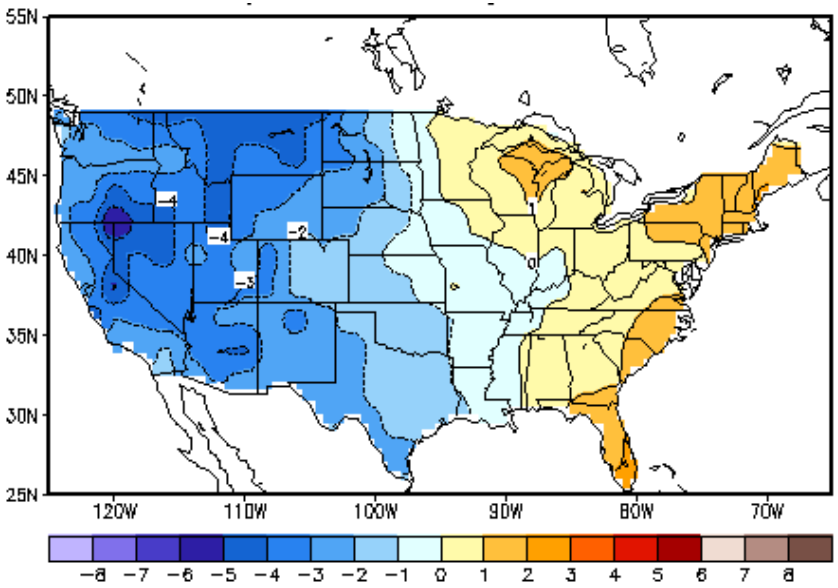
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 26 November 2022

Percent of Average Precipitation



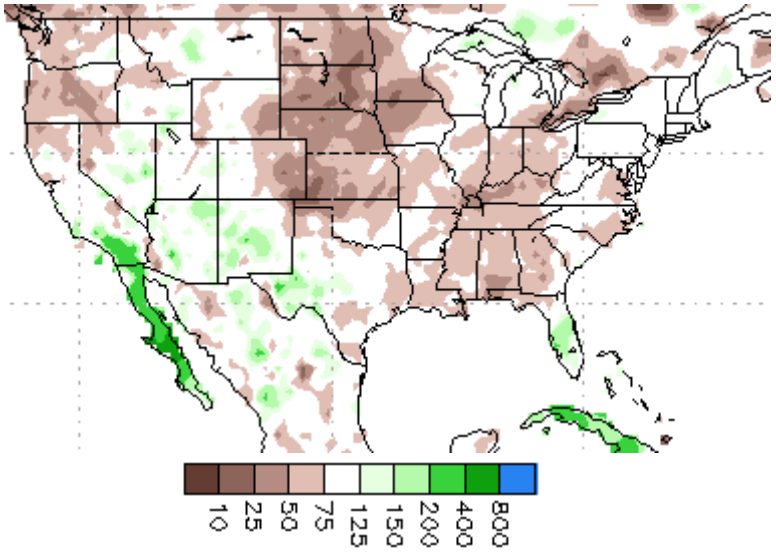
Temperature Departures (degree C)



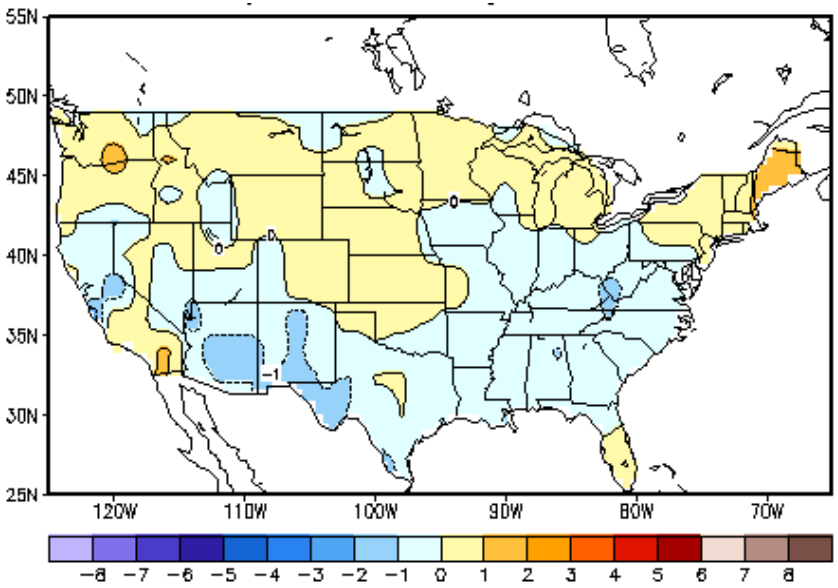
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 26 November 2022

Percent of Average Precipitation



Temperature Departures (degree C)

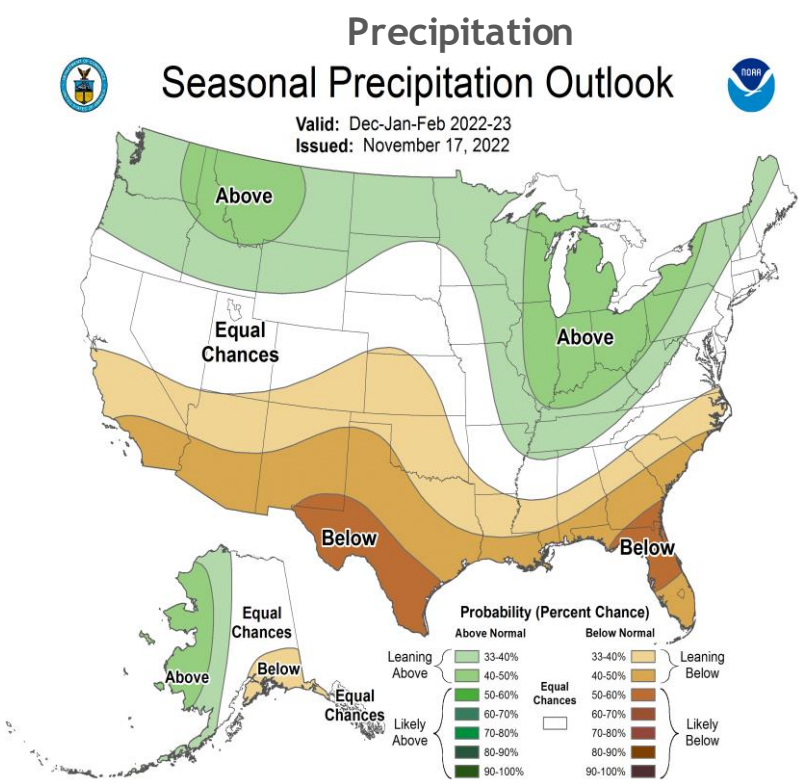


U. S. Seasonal Outlooks

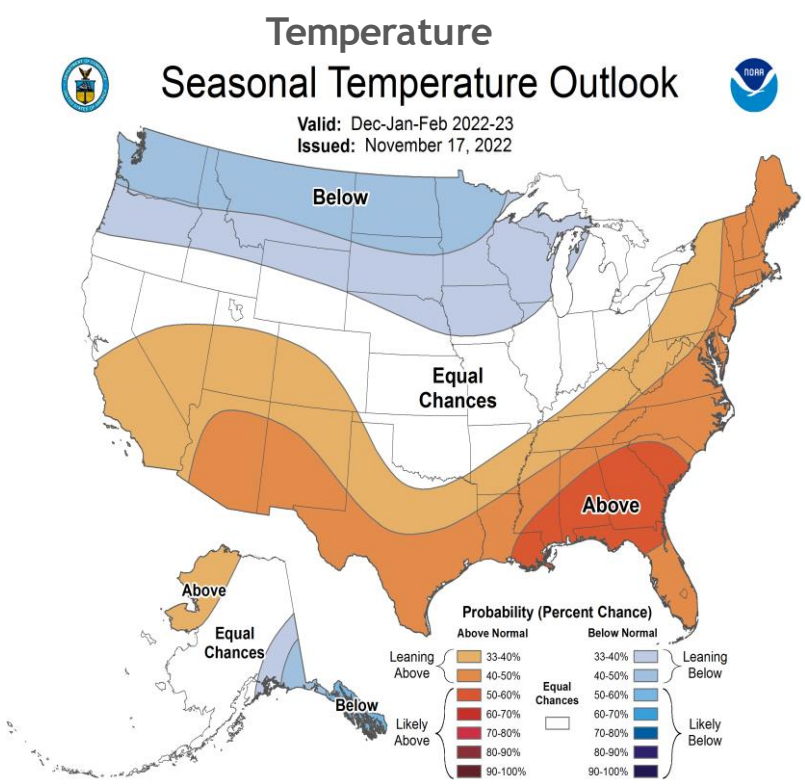
December 2022 - February 2023

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

Precipitation



Temperature



Summary

ENSO Alert System Status: La Niña Advisory

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The tropical Pacific atmosphere is consistent with La Niña.

There is a 76% chance of La Niña during the Northern Hemisphere winter (December-February) 2022-23, with a transition to ENSO-neutral favored in February-April 2023 (57% 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.