

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
7 February 2022

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 is present.*

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

The tropical Pacific atmosphere is consistent with La Niña.

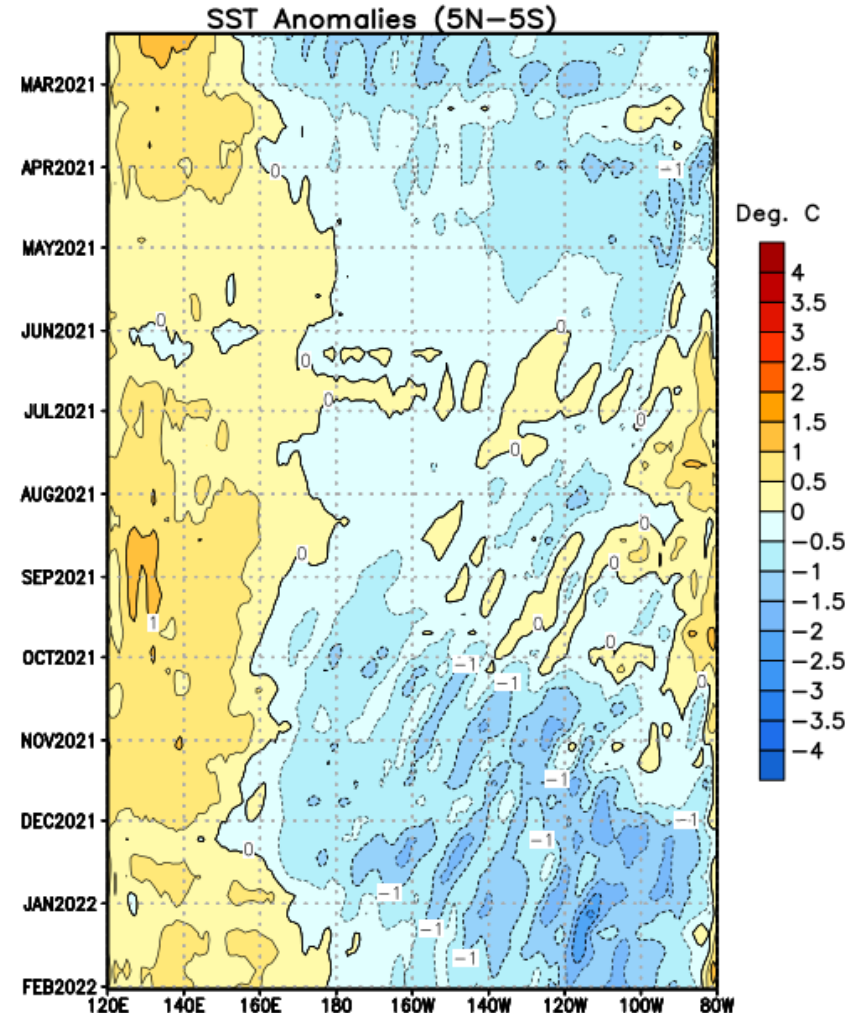
La Niña is likely to continue into the Northern Hemisphere spring (67% chance during March-May 2022) and then transition to ENSO-neutral (51% chance during April-June 2022).*

* 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 to July 2021, equatorial SSTs gradually returned to average over most of the Pacific Ocean.

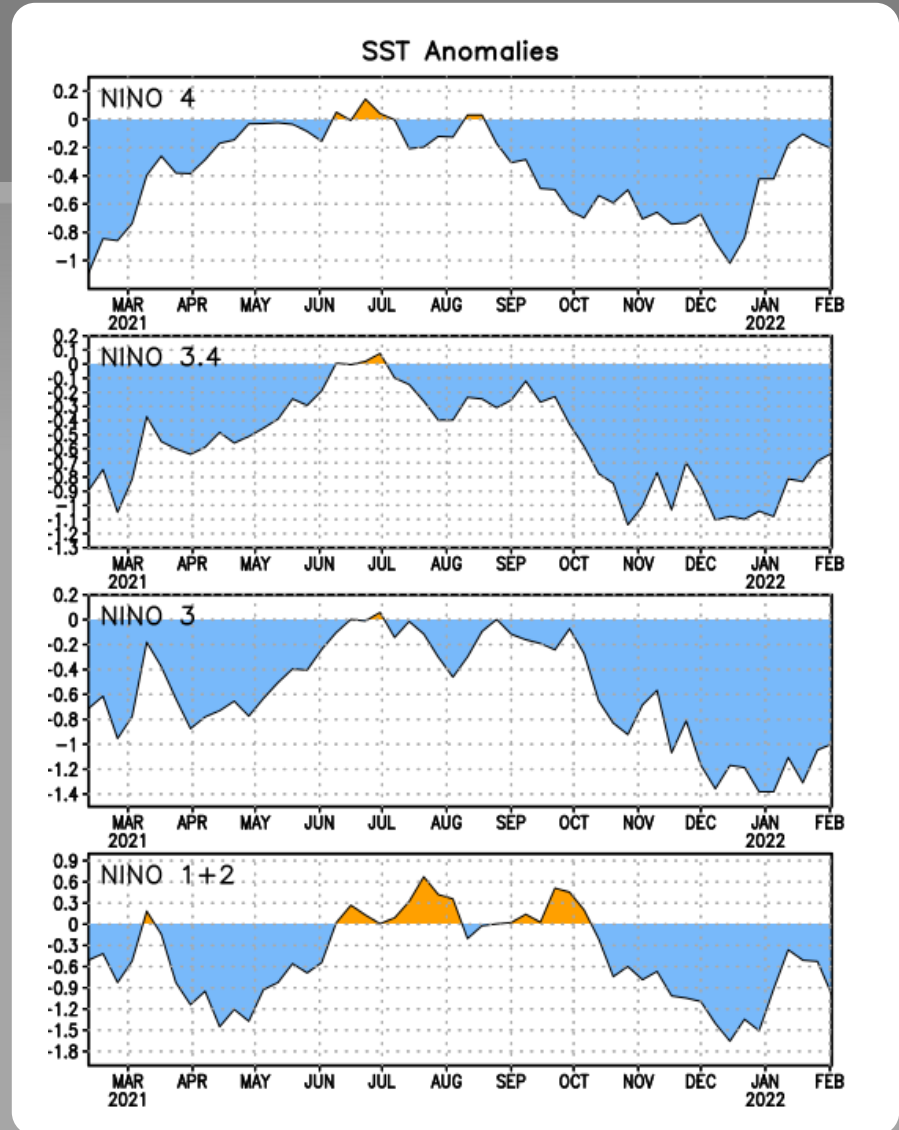
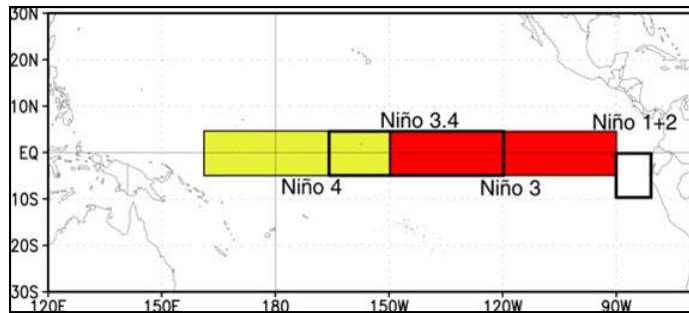
Since the beginning of January 2022, below-average equatorial SSTs have weakened across the central and eastern Pacific Ocean.



Niño Region SST Departures (°C) Recent Evolution

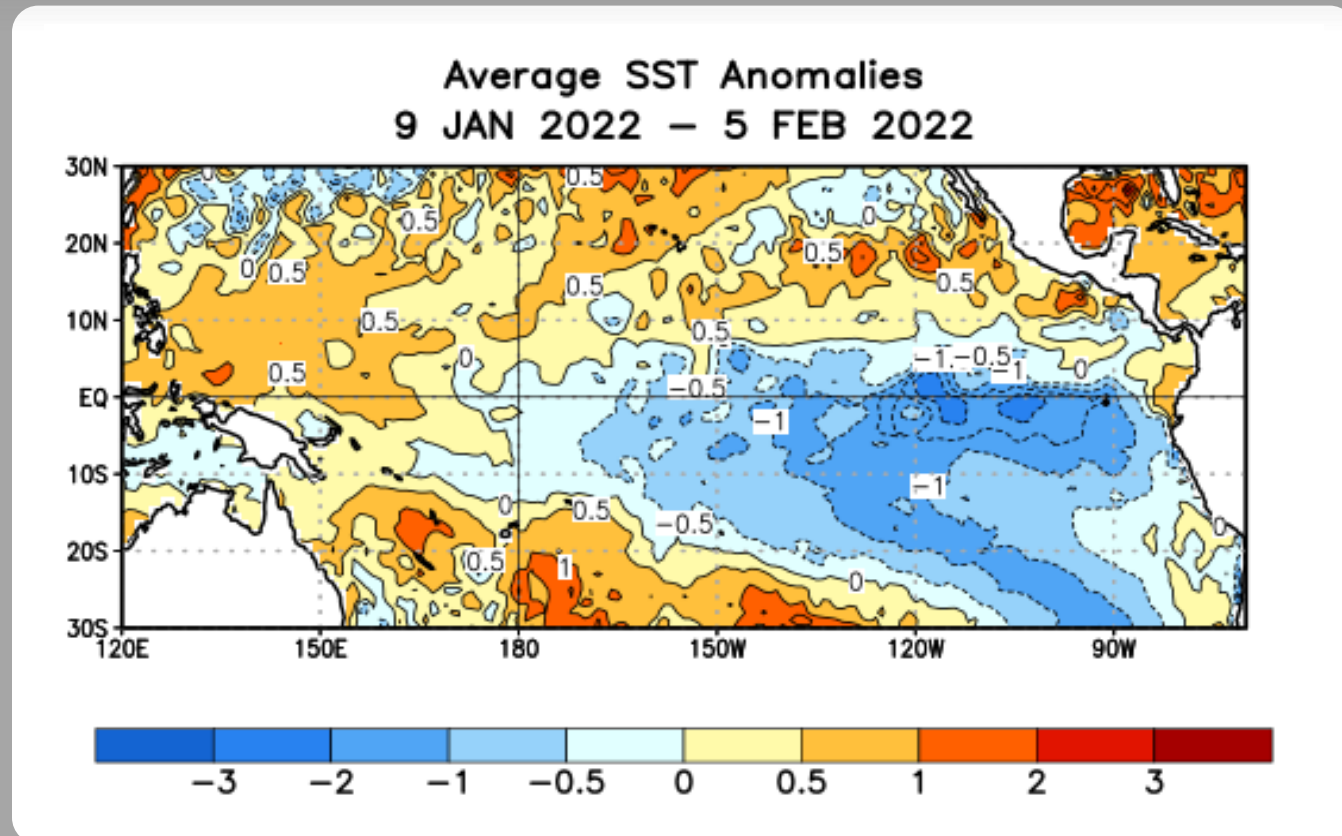
The latest weekly SST departures are:

Niño 4	-0.2°C
Niño 3.4	-0.6°C
Niño 3	-1.0°C
Niño 1+2	-1.0°C



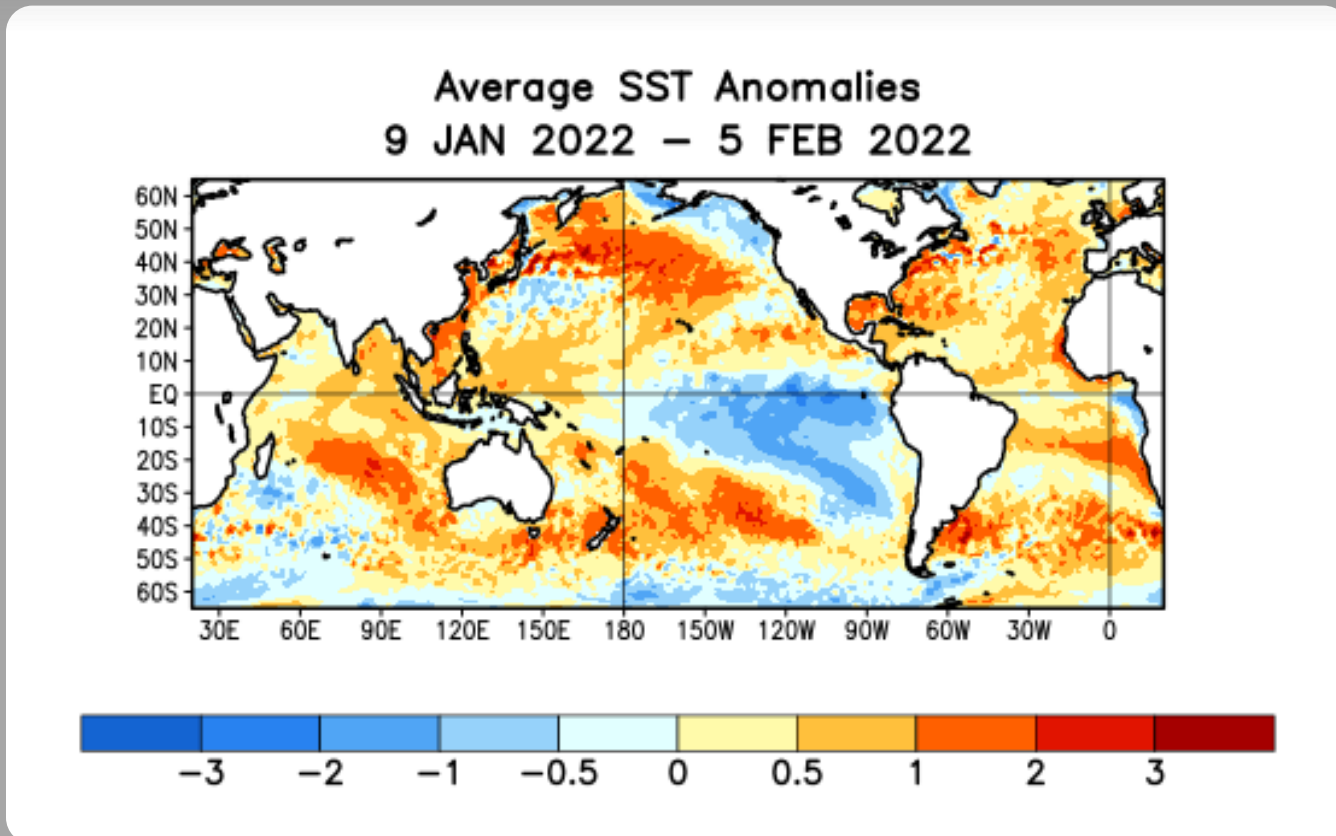
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

In the last four weeks, equatorial SSTs were below average across the east-central and eastern Pacific Ocean and were above average in the western Pacific Ocean and in the far eastern Pacific Ocean.



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

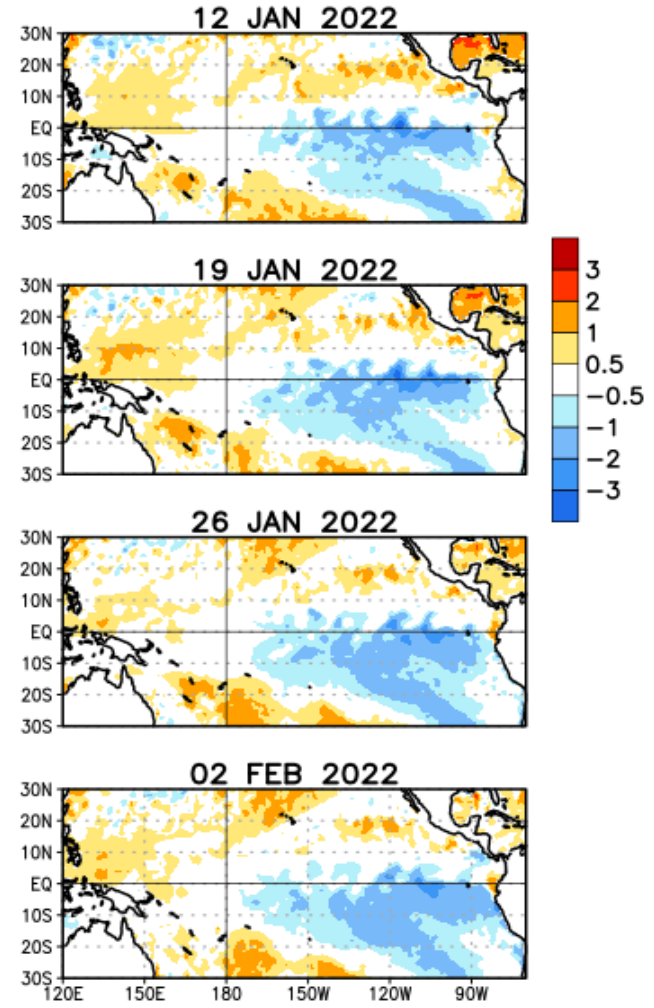
During the last four weeks, equatorial SSTs were below average across the east-central and eastern Pacific Ocean and the eastern Atlantic Ocean. Equatorial SSTs were above average in the central and eastern Indian Ocean.



Weekly SST Departures during the Last Four Weeks

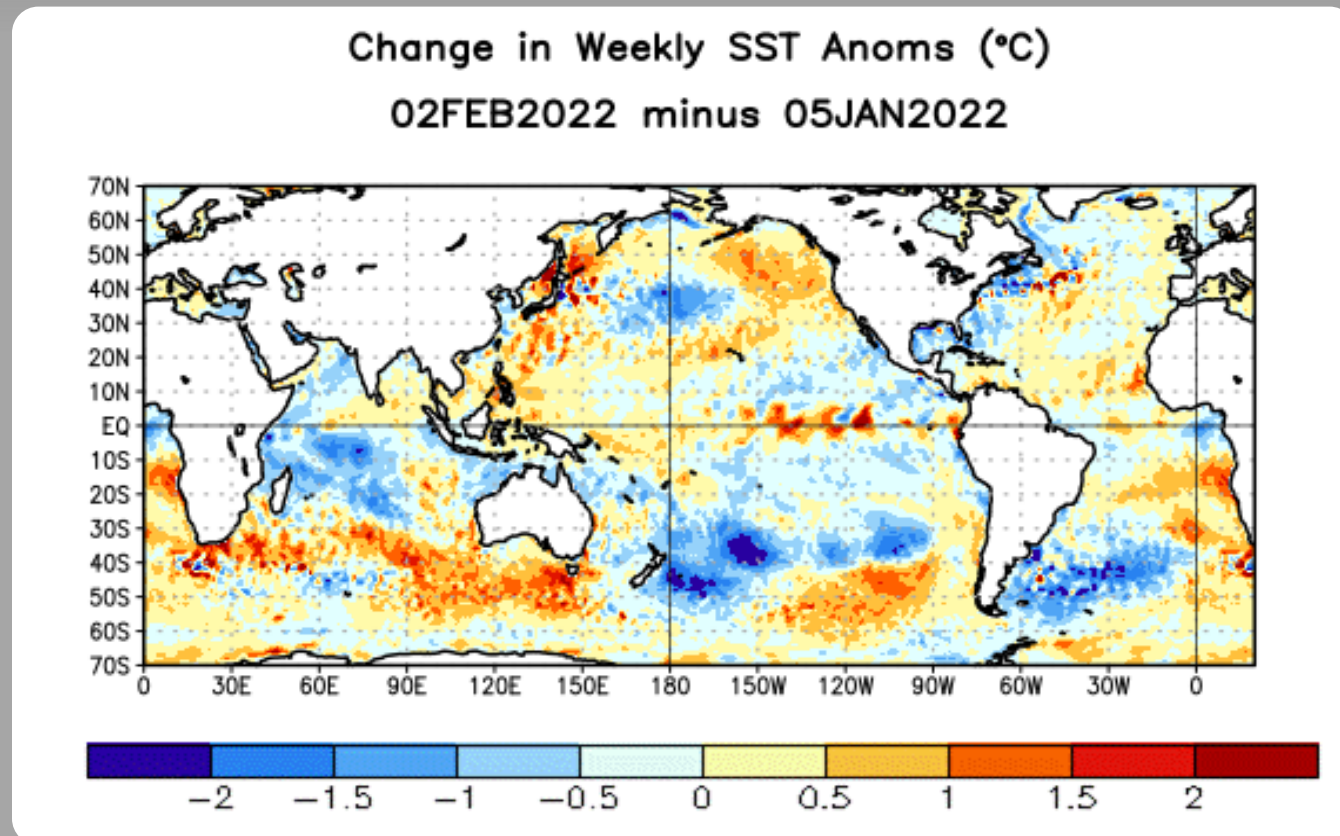
During the last 4 weeks, negative SST anomalies have persisted in the east-central and eastern Pacific Ocean.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, positive changes in equatorial SST anomalies were observed across the east-central and eastern Pacific Ocean.



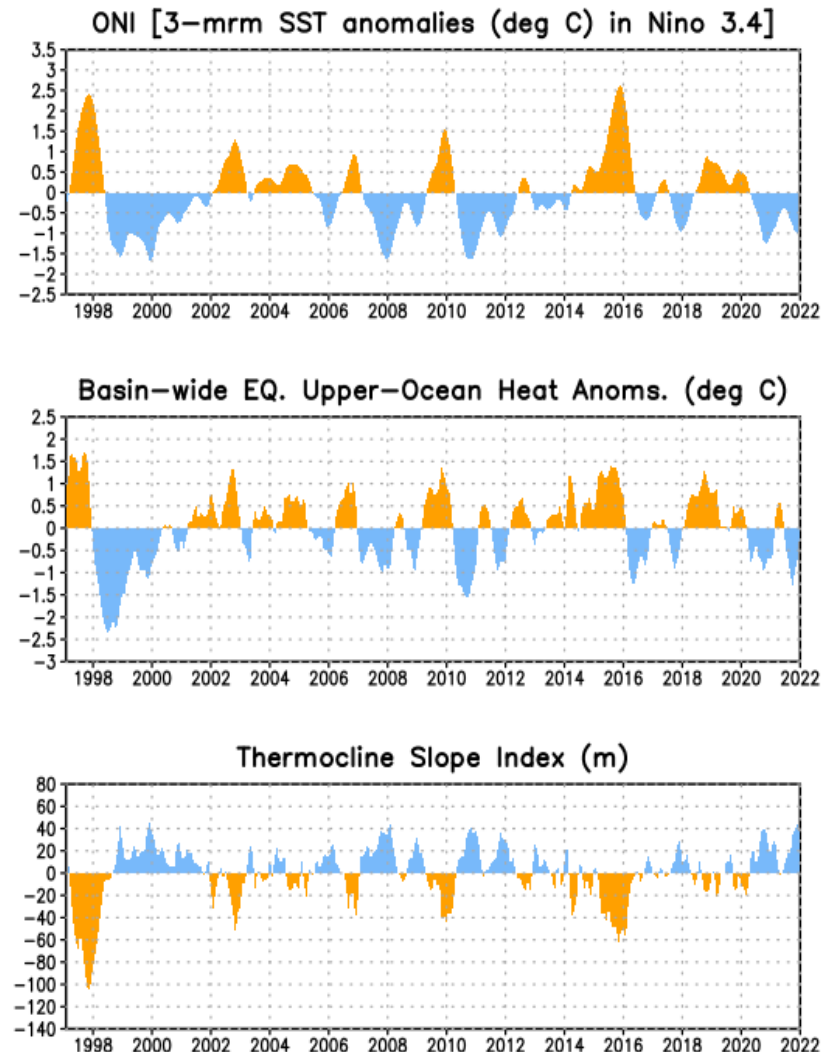
Upper-Ocean Conditions in the Equatorial Pacific

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.

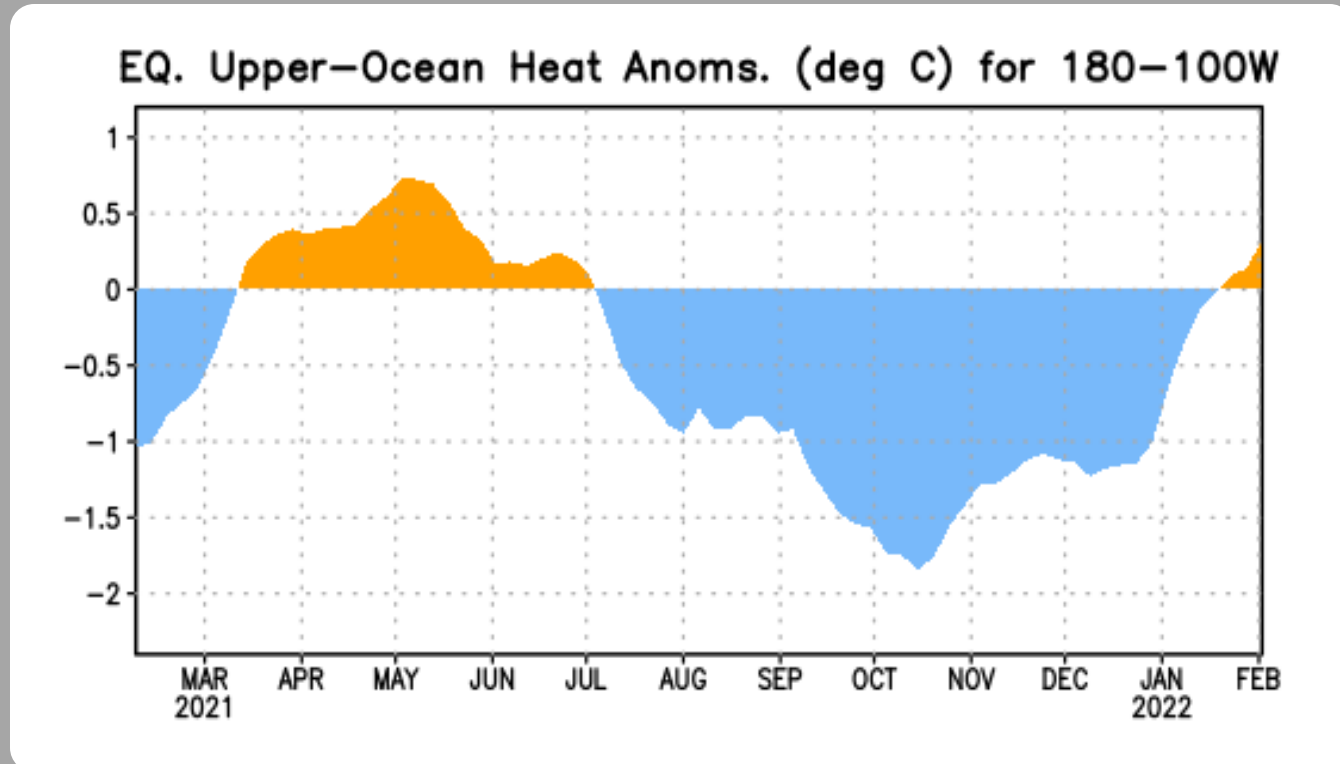
Recent values of the upper-ocean heat anomalies (below average) and thermocline slope index (above average) reflect La Niña.

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).



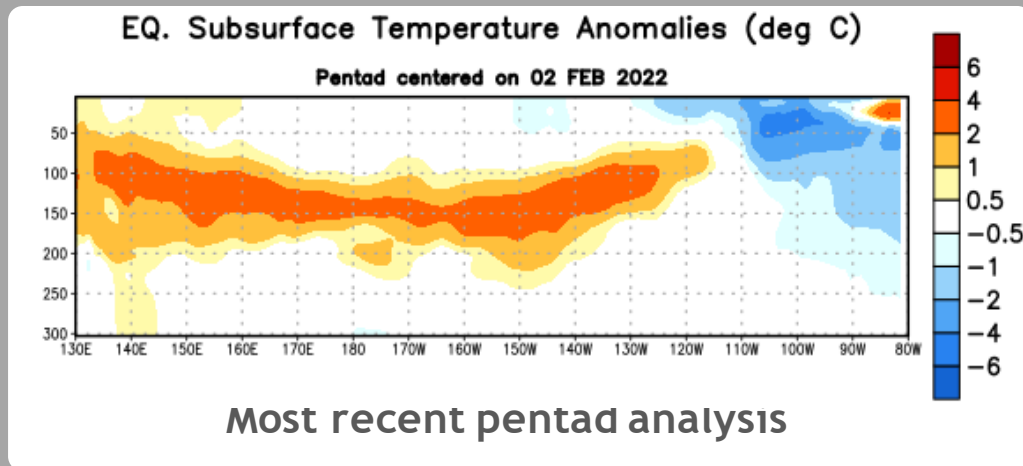
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

From mid-March to early July 2021, subsurface temperature was above average. Negative temperature anomalies returned in July and strengthened in September. From mid-October to mid-November, negative anomalies weakened, followed by persistence through late December. Recently, negative anomalies have weakened and are near average.

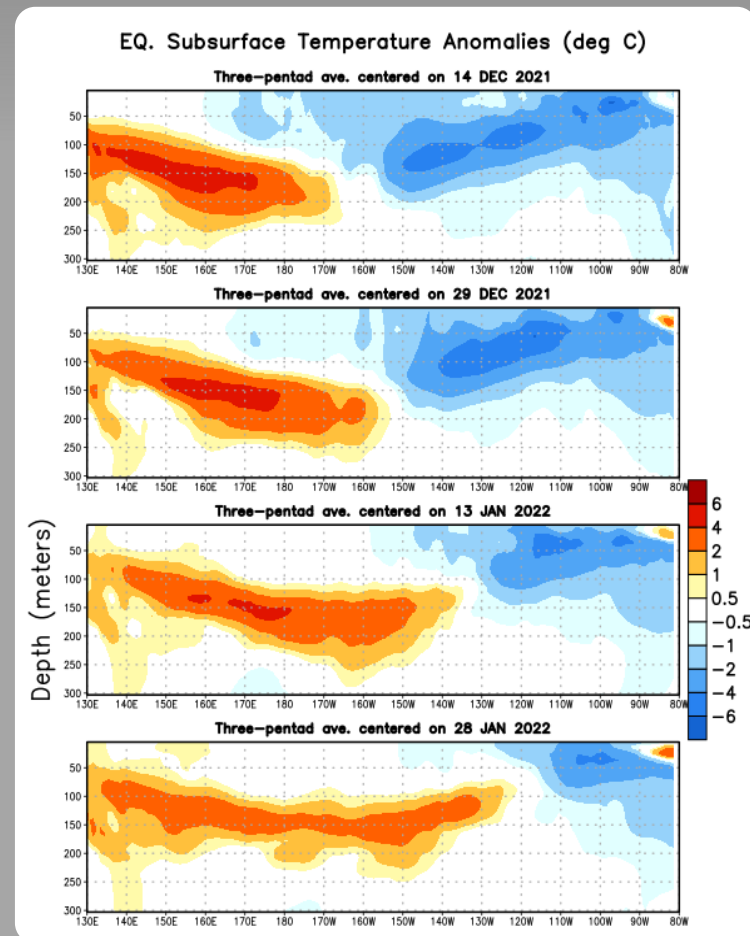


Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive and negative subsurface temperature anomalies have shifted eastward.



Positive subsurface temperature anomalies have shifted eastward to 115°W and remain at depth, while negative anomalies have contracted to the eastern Pacific.

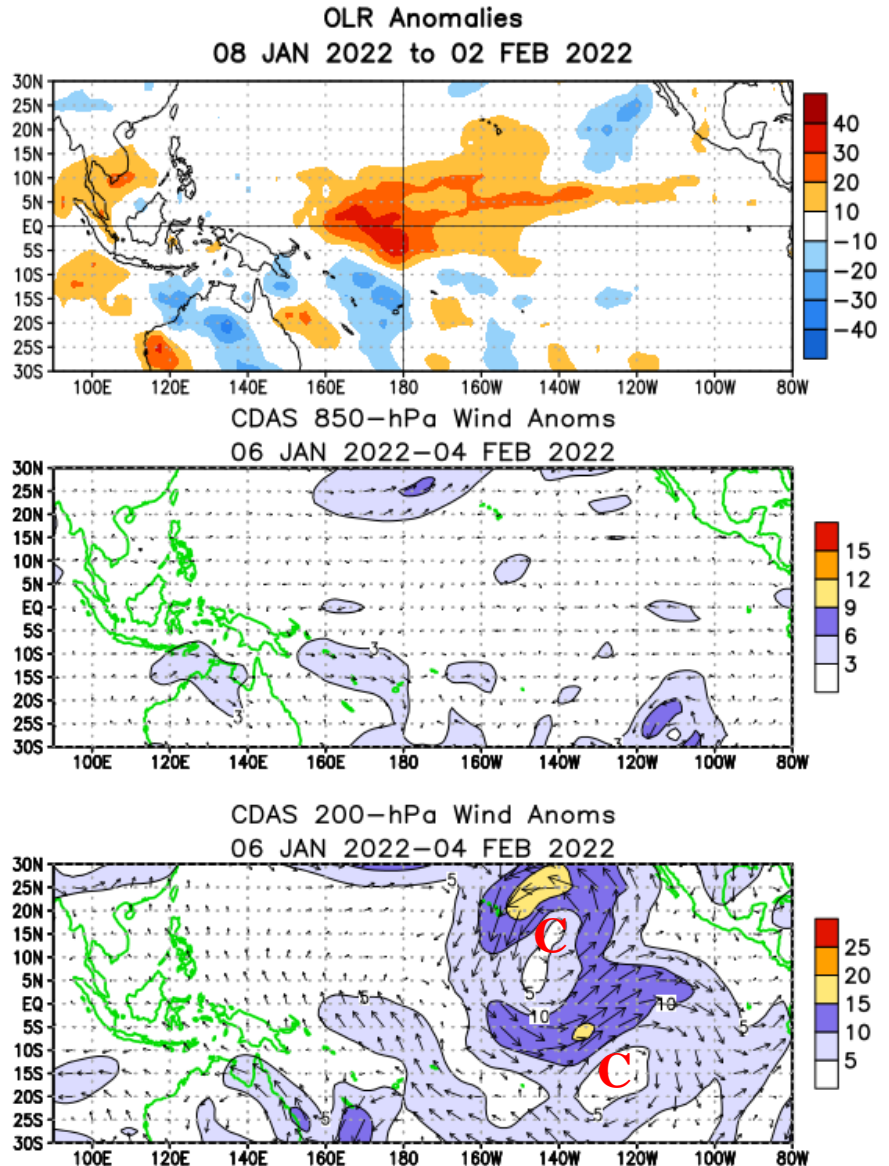


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were located over the central Pacific Ocean. Weak, negative OLR anomalies (enhanced convection and precipitation) were observed over parts of Indonesia.

Low-level (850-hPa) winds were near average over most of the equatorial Pacific Ocean.

Upper-level (200-hPa) westerly wind anomalies and an anomalous cyclonic couplet were observed over the east-central 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

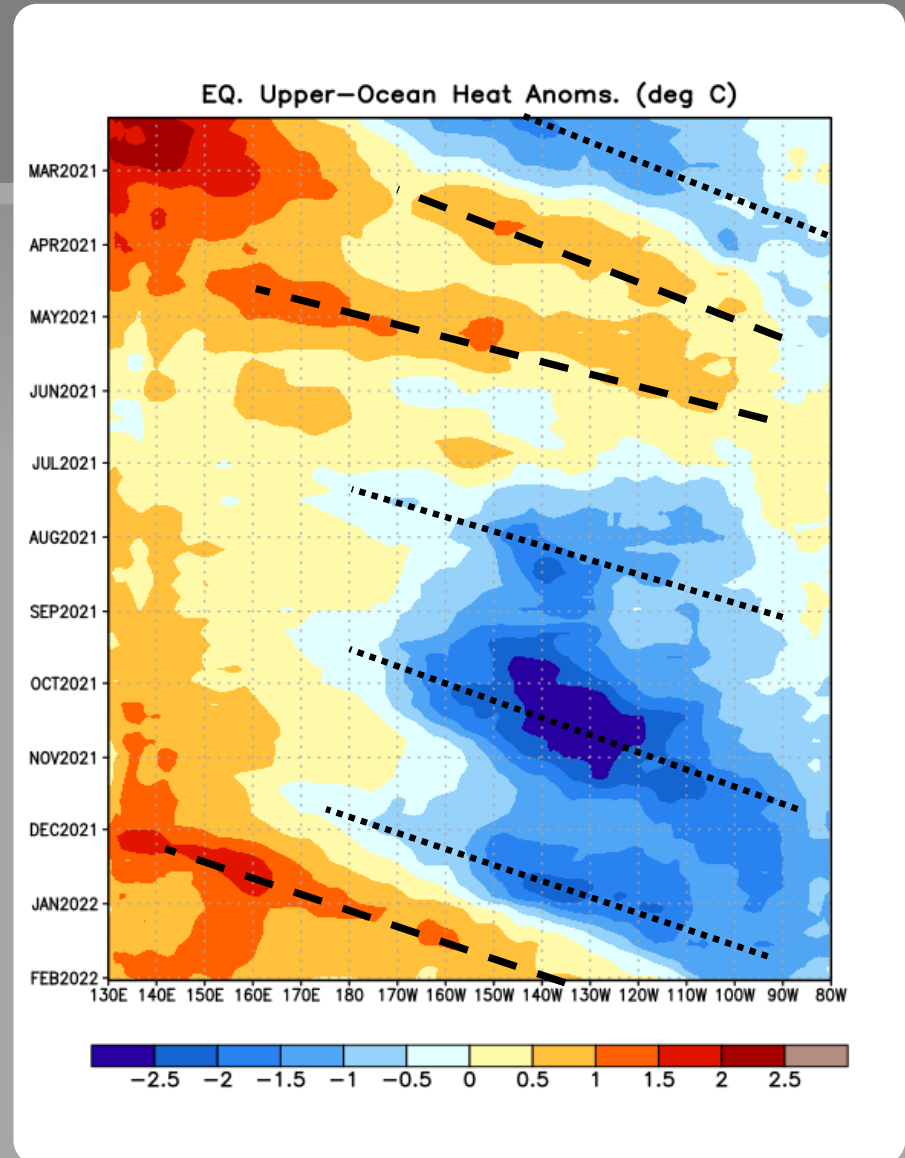
Significant equatorial oceanic Kelvin wave activity (dashed and dotted lines) has been present throughout the period shown.

During March through May 2021, positive anomalies shifted eastward in association with two downwelling Kelvin waves.

In July 2021, September 2021, and November 2021 negative subsurface temperature anomalies shifted eastward associated with three upwelling Kelvin waves.

Since mid-December 2021, a downwelling Kelvin wave is apparent and is shifting eastward.

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



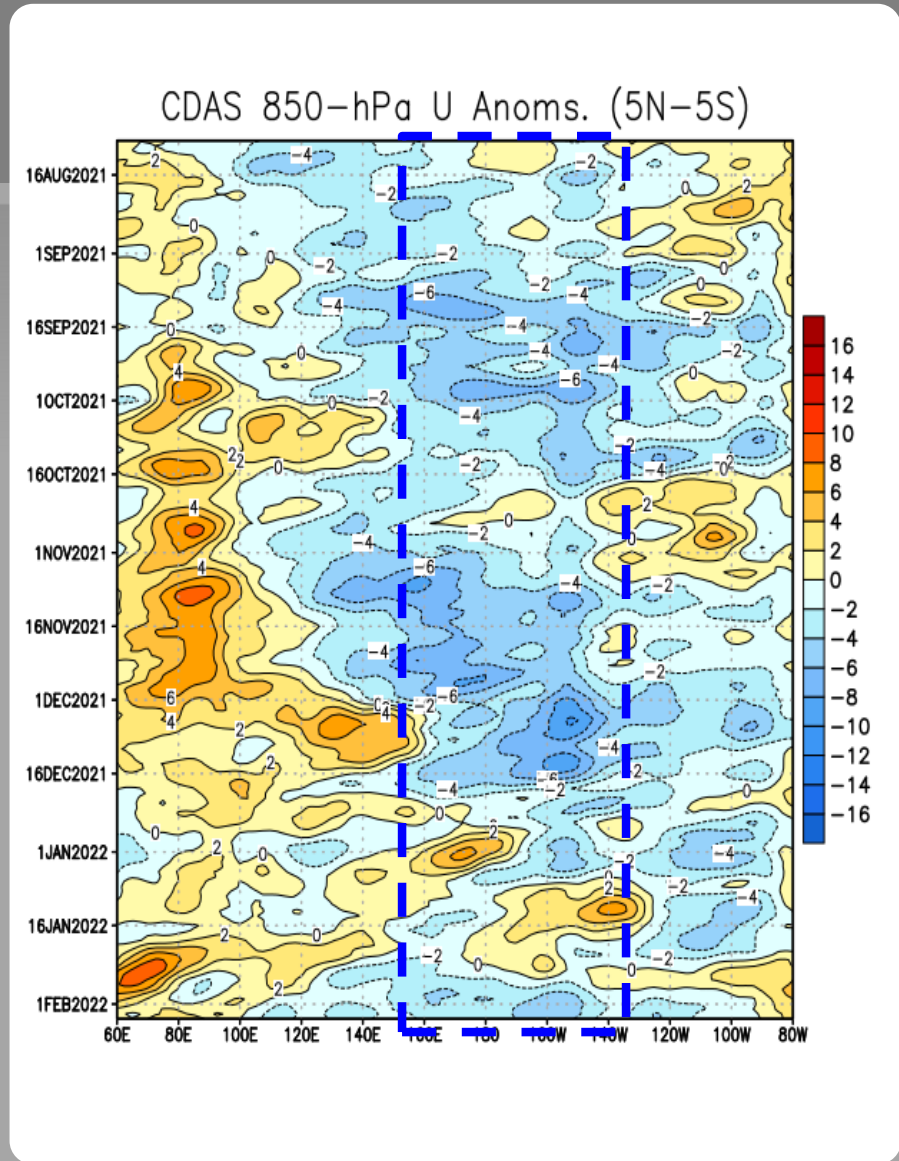
Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

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 late October 2021, and late December-to-January 2022.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)

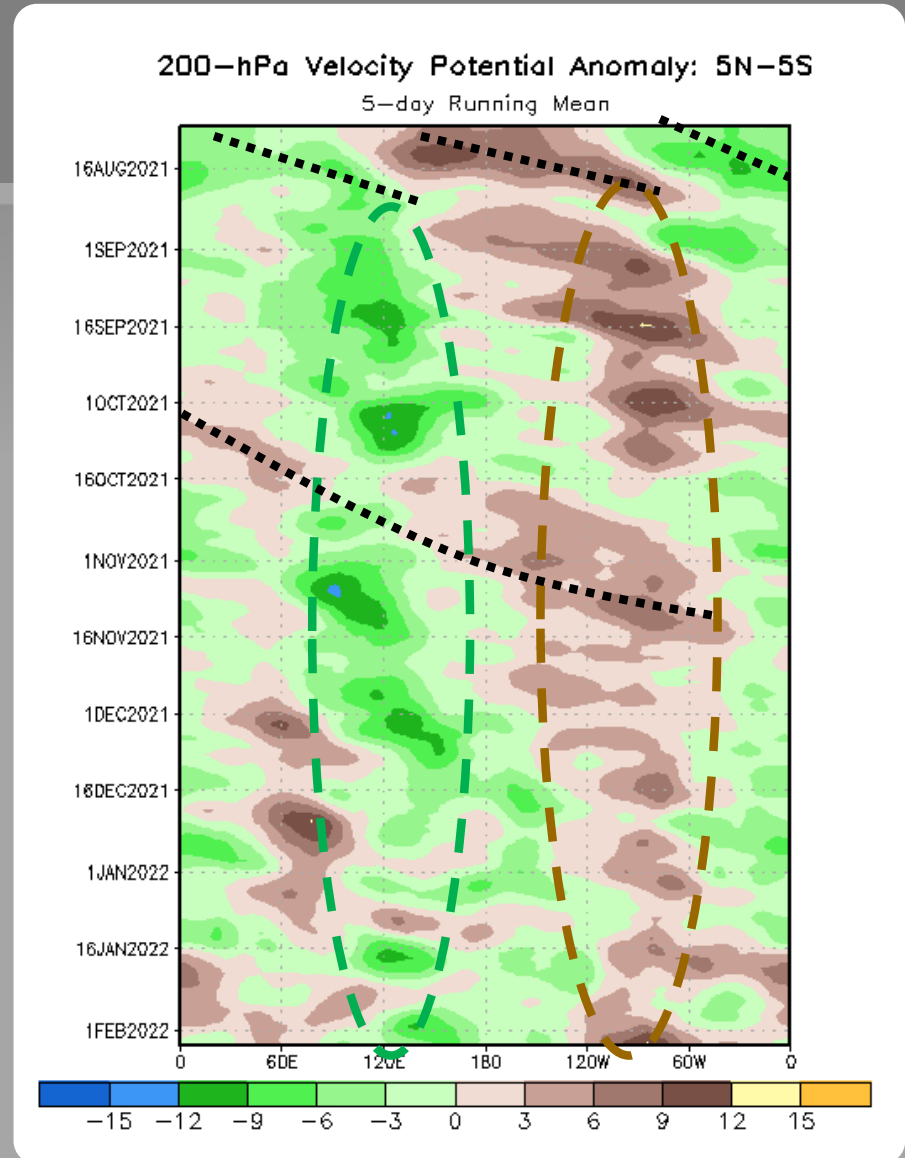


Upper-level (200-hPa) Velocity Potential Anomalies

During most of the period, anomalous divergence (green shading) generally remained over Indonesia or the western Pacific, while anomalous convergence (brown shading) persisted over the 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).

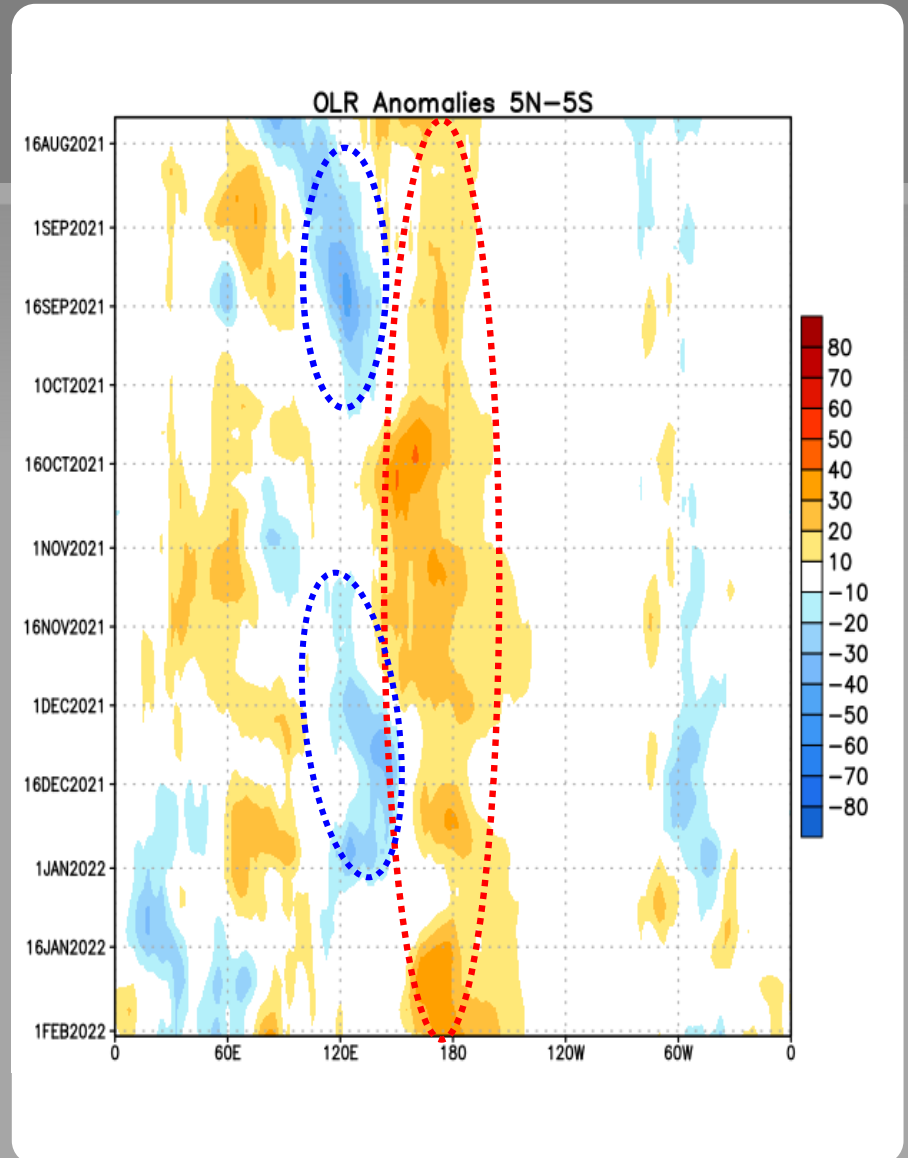


Outgoing Longwave Radiation (OLR) Anomalies

Since late July 2021, positive OLR anomalies were evident over the western and/or central Pacific Ocean.

Negative OLR anomalies were evident over Indonesia from mid-August to early October 2021, and again from early November 2021 through early January 2022.

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 .

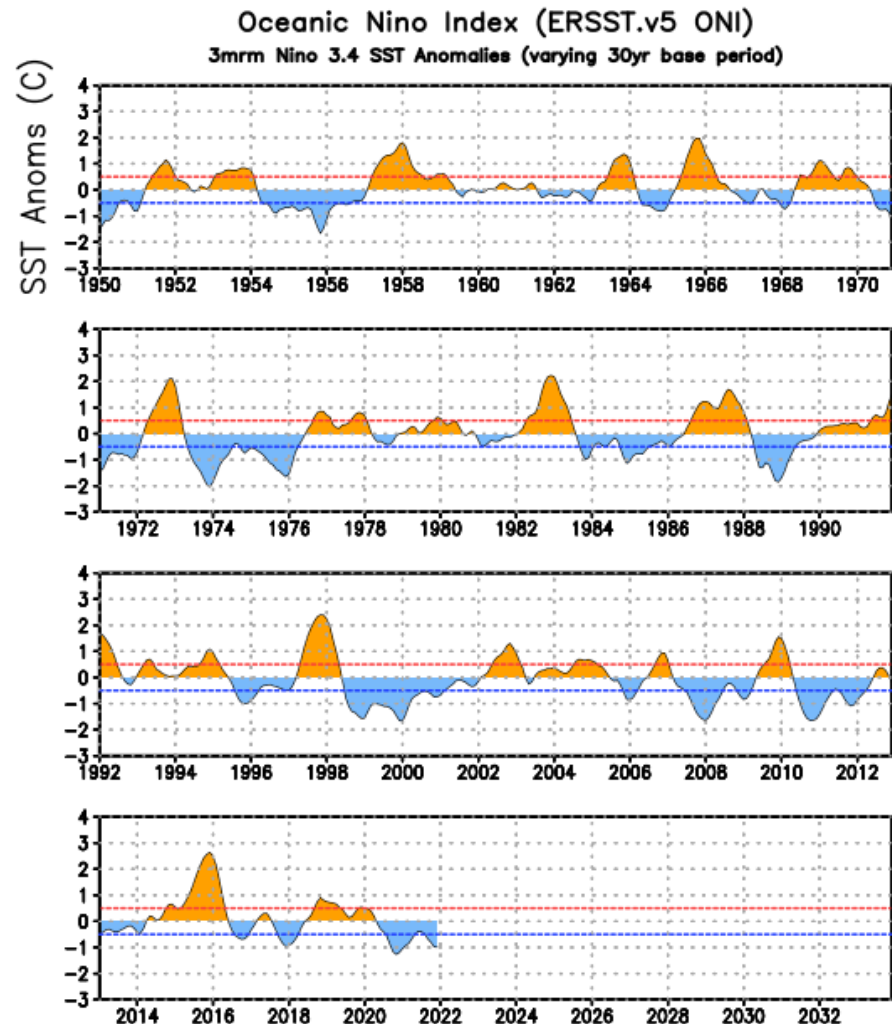
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (November 2021 - January 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 Niño Index (ONI) [3 month running mean of ERSST.v5 SST anomalies in the Niño 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.

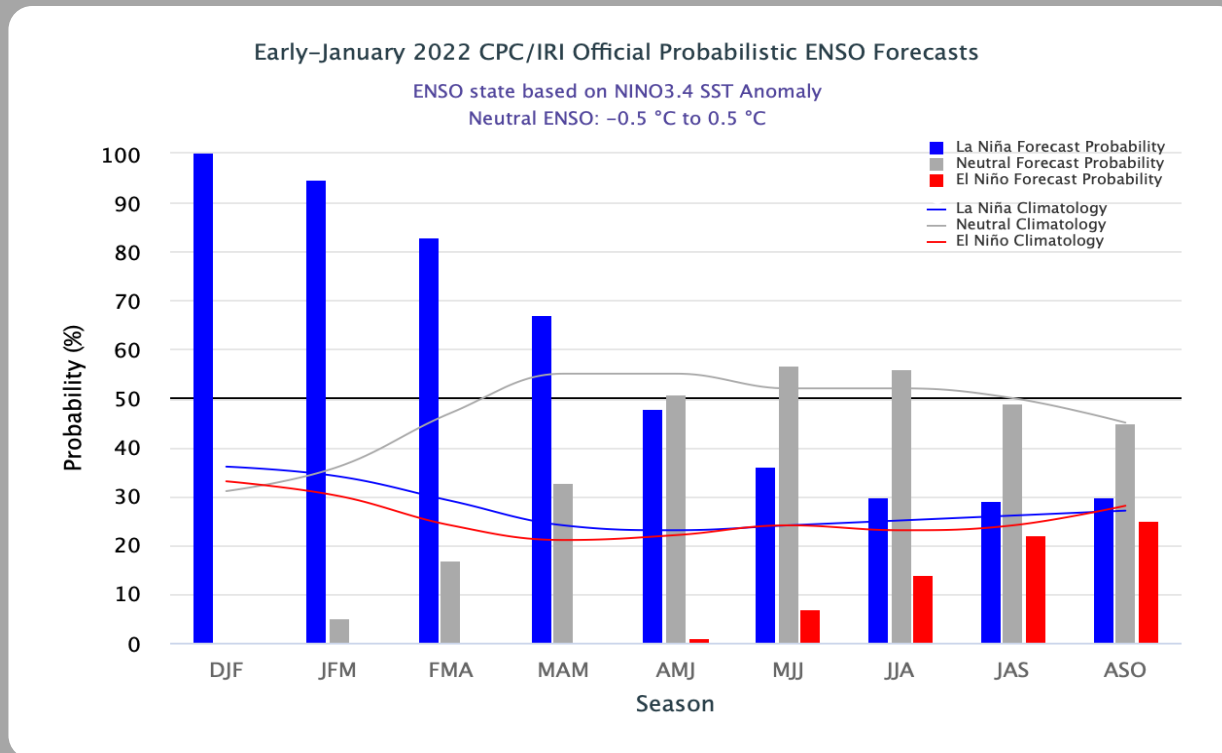
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2009	-0.8	-0.8	-0.6	-0.3	0.0	0.3	0.5	0.6	0.7	1.0	1.4	1.6
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

CPC/IRI Probabilistic ENSO Outlook

Updated: 13 January 2022

La Niña is expected to continue through Northern Hemisphere spring 2022. A transition to ENSO-neutral is expected by April-June 2022.



IRI/CPC Pacific Niño

3.4 SST Model Outlook

A majority of models indicate La Niña is expected to continue into spring 2022 and then transition to ENSO-neutral.

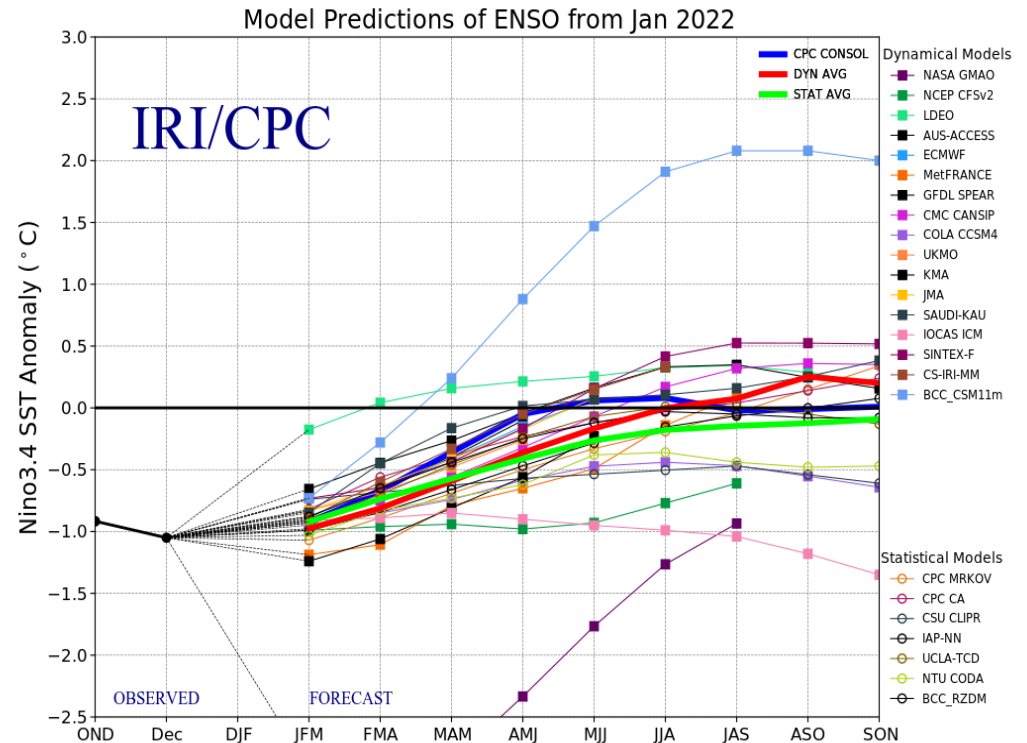


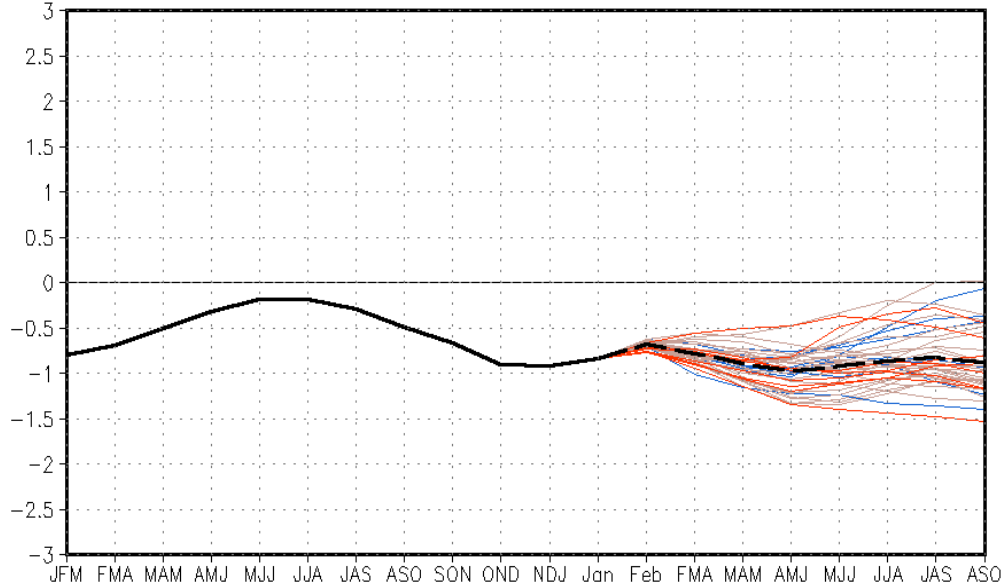
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 January 2022).

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

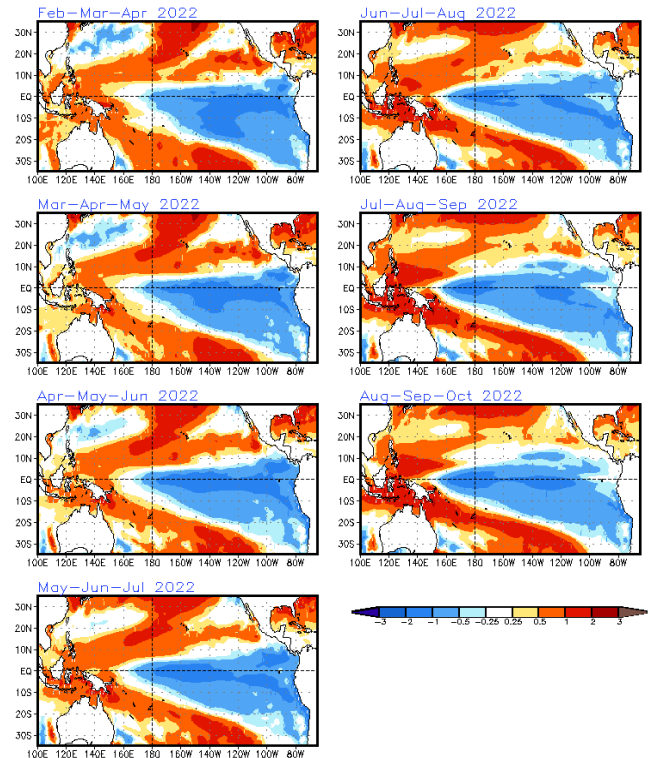
Issued: 7 February 2022

The CFS.v2 ensemble mean (black dashed line) predicts La Niña to continue into autumn 2022.

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



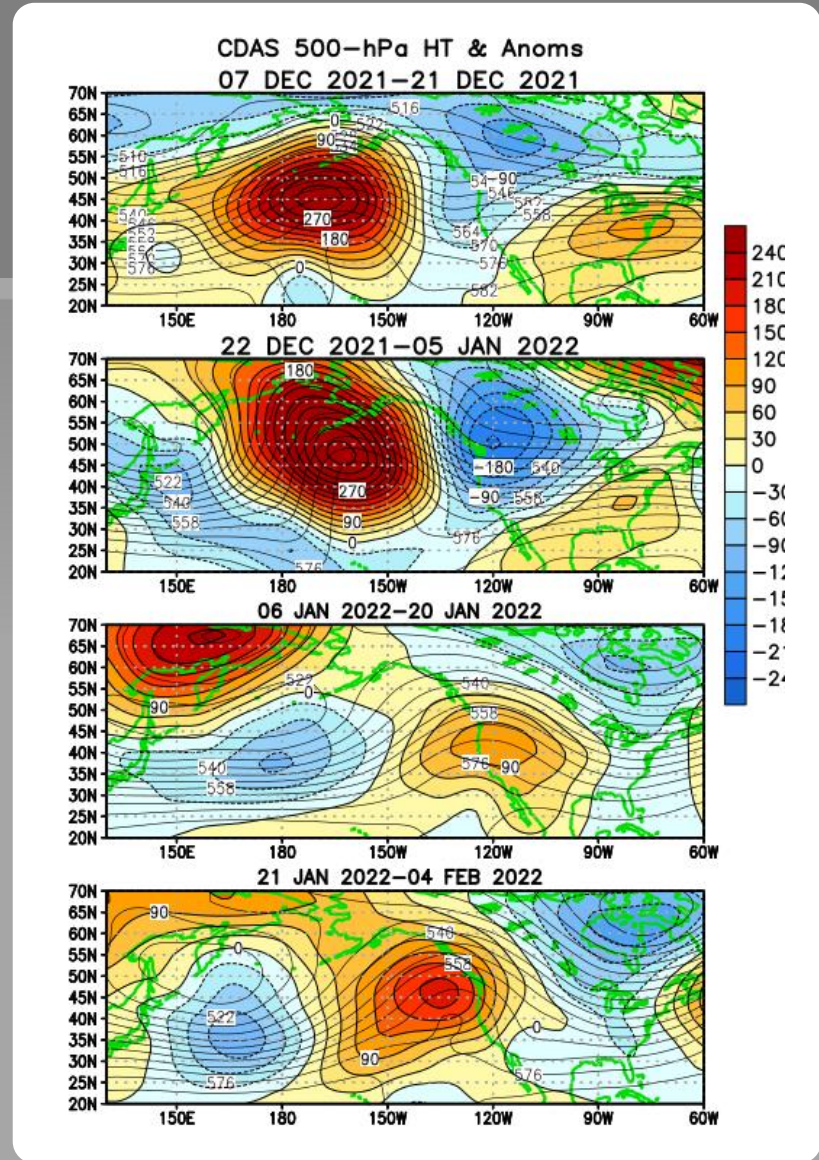
— Latest 8 forecast members
— Earliest 8 forecast members
— Other forecast members
— Forecast ensemble mean
— NCEP Olv2.1 daily analysis
(Climatology base period: 1991–2020)



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

From December 2021 until early January 2022, the retraction of the Asian-Pacific jet stream was accompanied by a strong anomalous ridge over the North Pacific Ocean. An anomalous trough formed downstream over Canada and the western U.S. with an anomalous ridge and above-average temperatures evident over the central and eastern U.S. This pattern was consistent with La Niña.

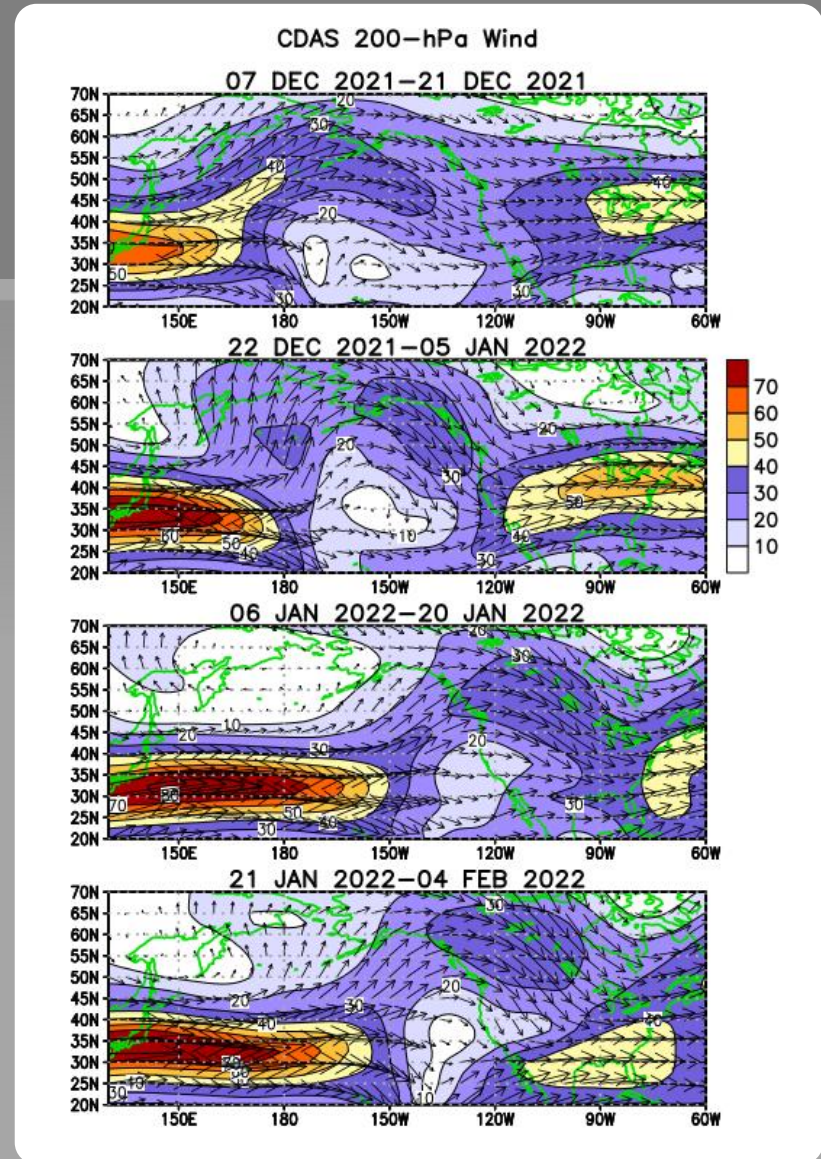
Since early January 2022, the anomalous ridge and above-average temperatures shifted to western North America, and below-average temperatures and heights shifted to eastern North America.



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

From December 2021 until early January 2022, the retraction of the Asian-Pacific jet stream was accompanied by a strong anomalous ridge over the North Pacific Ocean. An anomalous trough formed downstream over Canada and the western U.S. with an anomalous ridge and above-average temperatures evident over the central and eastern U.S. This pattern was consistent with La Niña.

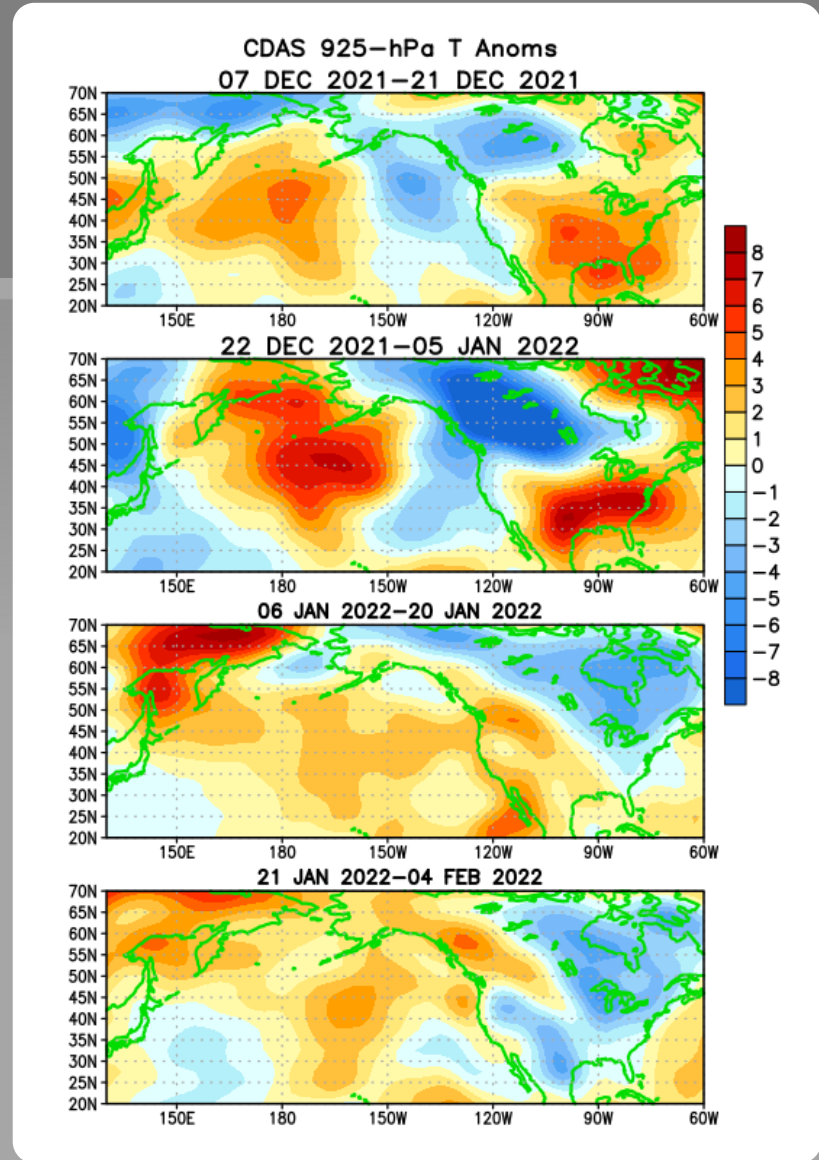
Since early January 2022, the anomalous ridge and above-average temperatures shifted to western North America, and below-average temperatures and heights shifted to eastern North America.



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

From December 2021 until early January 2022, the retraction of the Asian-Pacific jet stream was accompanied by a strong anomalous ridge over the North Pacific Ocean. An anomalous trough formed downstream over Canada and the western U.S. with an anomalous ridge and above-average temperatures evident over the central and eastern U.S. This pattern was consistent with La Niña.

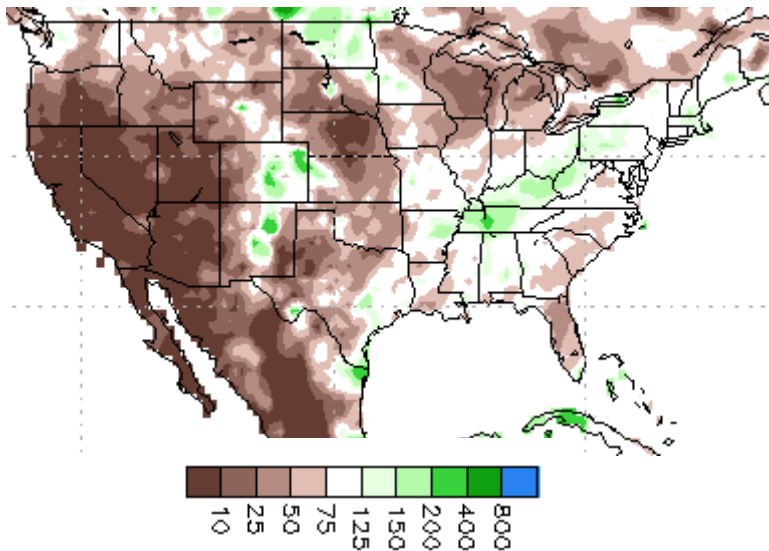
Since early January 2022, the anomalous ridge and above-average temperatures shifted to western North America, and below-average temperatures and heights shifted to eastern North America.



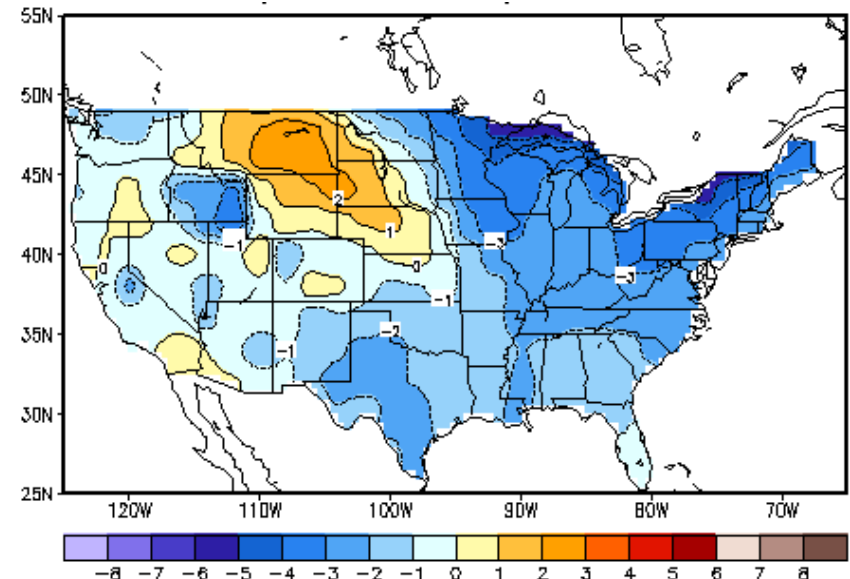
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 5 February 2022

Percent of Average Precipitation



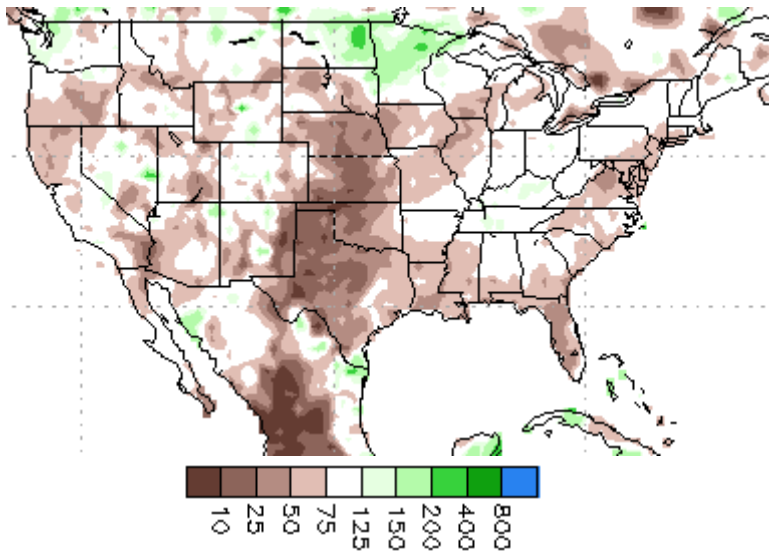
Temperature Departures (degree C)



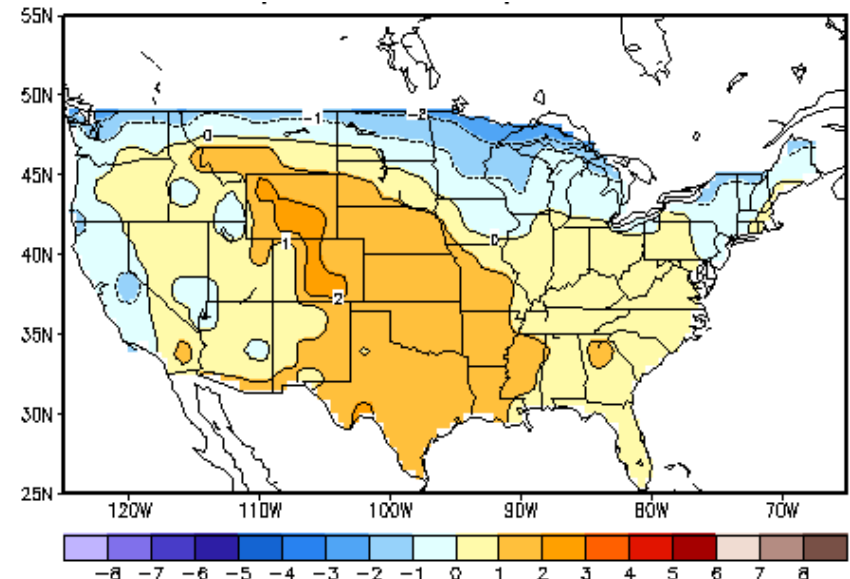
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 5 February 2022

Percent of Average Precipitation



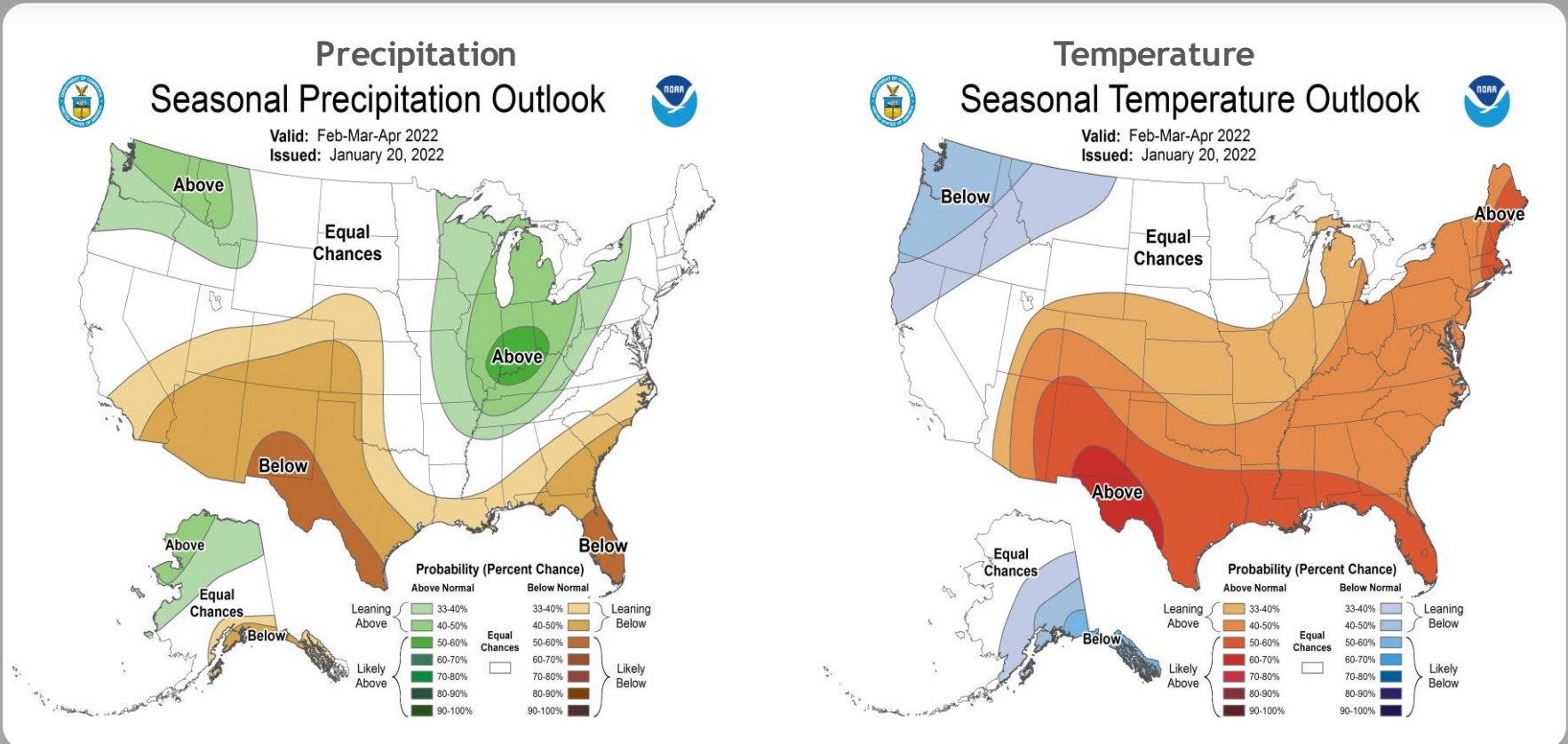
Temperature Departures (degree C)



U. S. Seasonal Outlooks

February - April 2022

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 is present.*

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

The tropical Pacific atmosphere is consistent with La Niña.

La Niña is likely to continue into the Northern Hemisphere spring (67% chance during March-May 2022) and then transition to ENSO-neutral (51% chance during April-June 2022).*

* 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](#).