

ENSO: Recent Evolution, Current Status and Predictions



Update prepared by:
Climate Prediction Center / NCEP
28 January 2019

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 Watch

ENSO-neutral conditions are present.*

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

The patterns of convection and winds are mostly near average over the tropical Pacific.

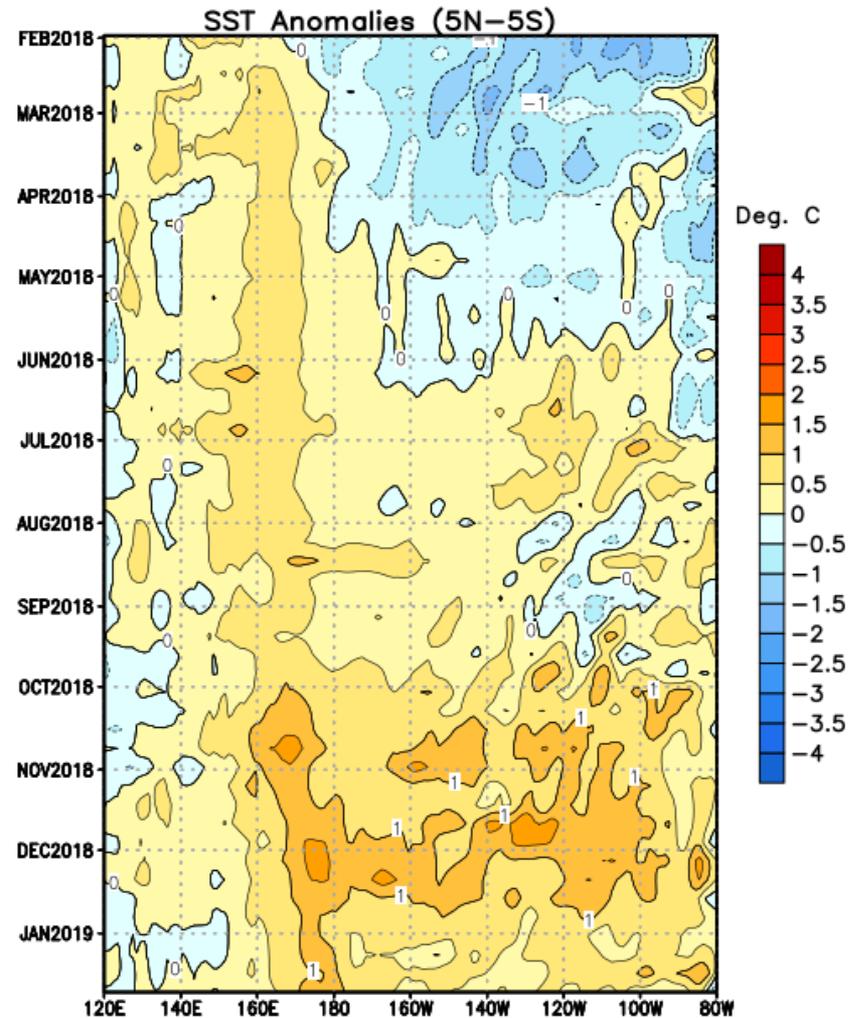
El Niño is expected to form and continue through the Northern Hemisphere spring 2019 (~65% chance).*

* 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)

Since early June 2018, near-to-above average SSTs have been present across most of the Pacific Ocean.

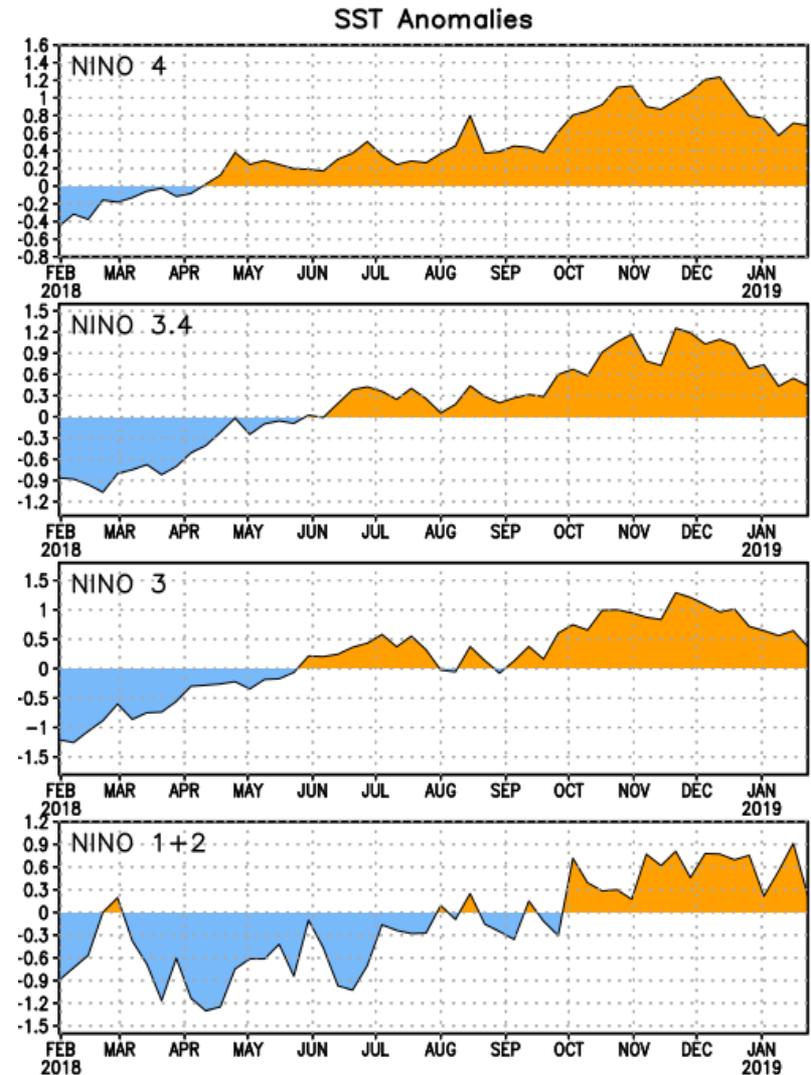
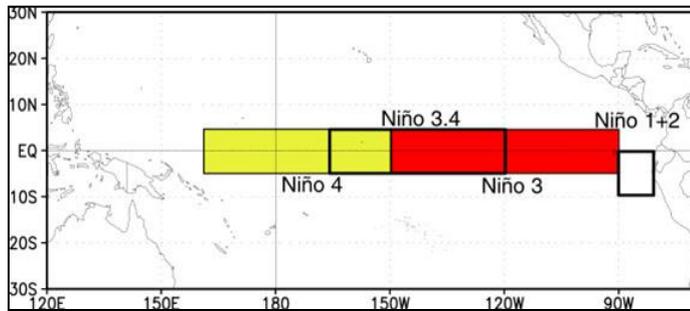
Since mid-December 2018, positive SST anomalies have weakened across most of the equatorial Pacific.



Niño Region SST Departures (°C) Recent Evolution

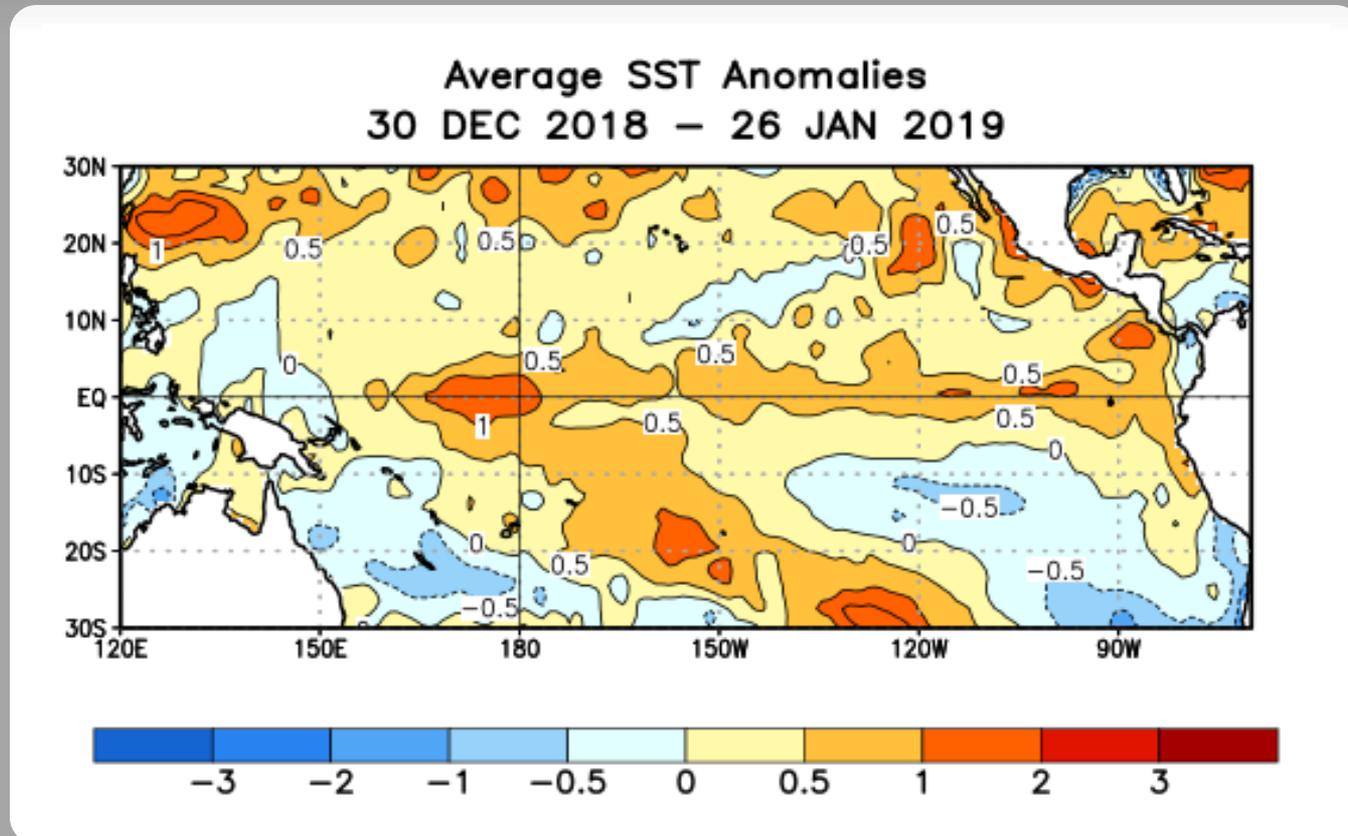
The latest weekly SST departures are:

Niño 4	0.7°C
Niño 3.4	0.4°C
Niño 3	0.4°C
Niño 1+2	0.2°C



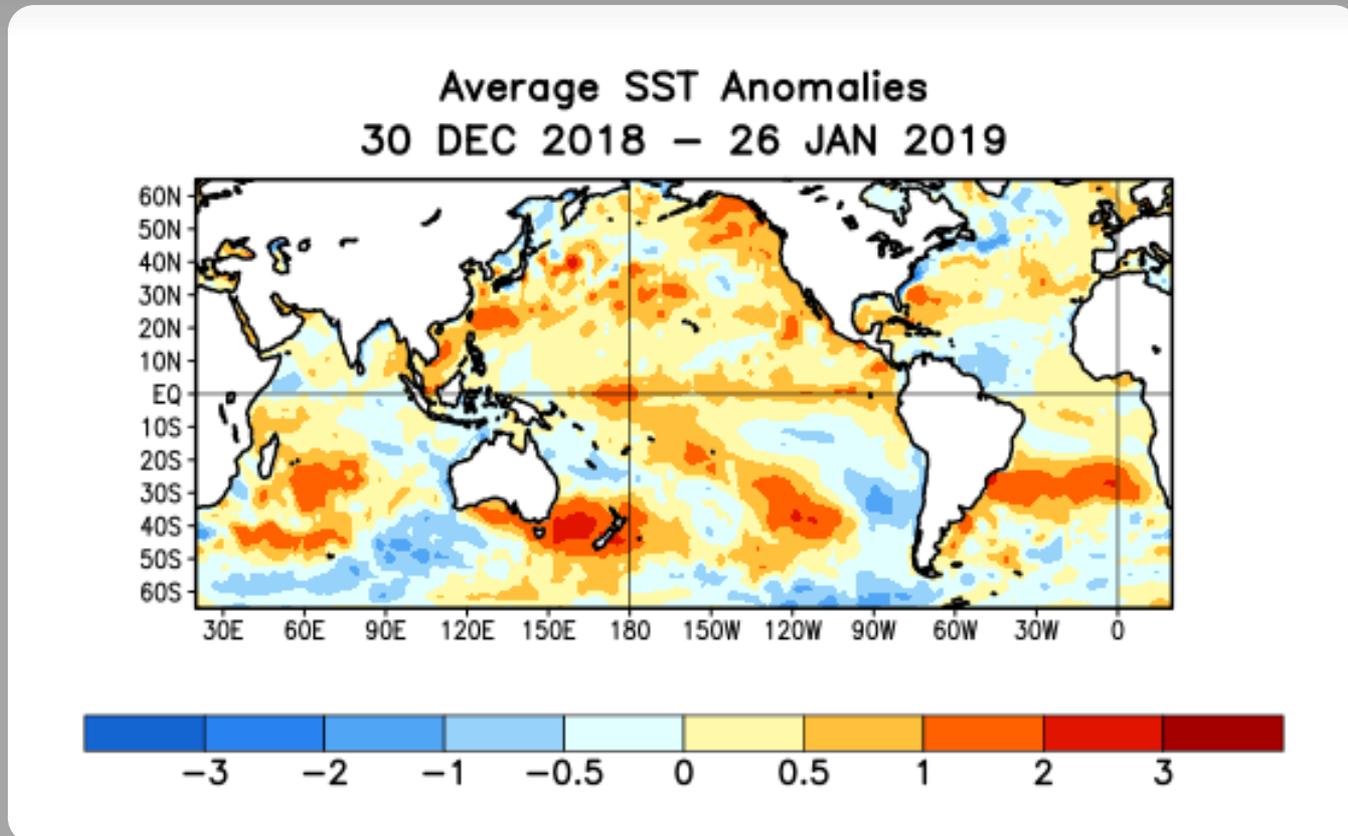
SST Departures ($^{\circ}\text{C}$) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the Pacific Ocean.



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

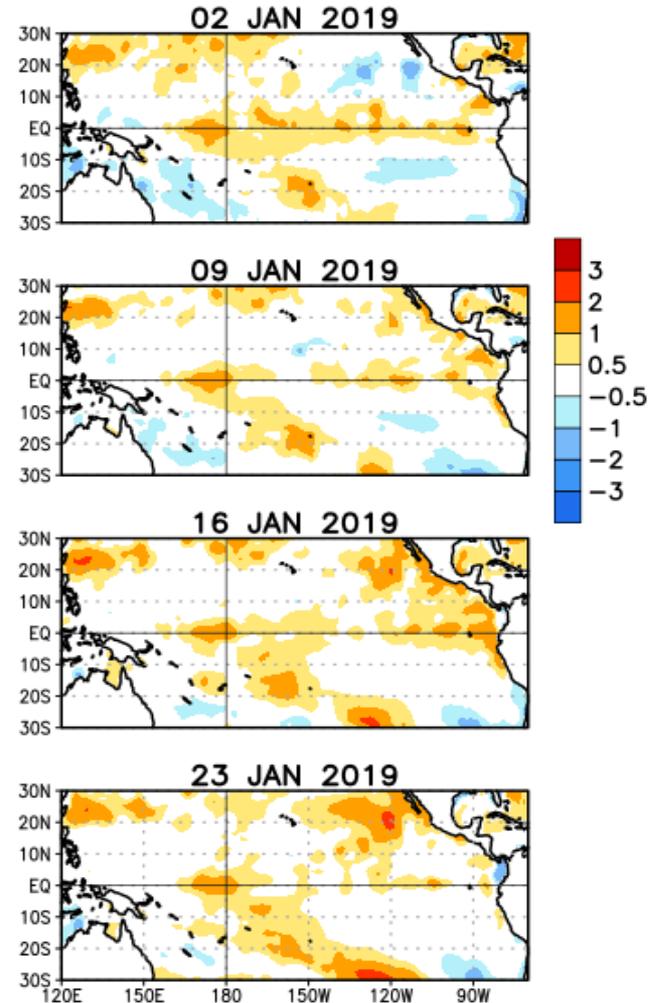
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Weekly SST Departures during the Last Four Weeks

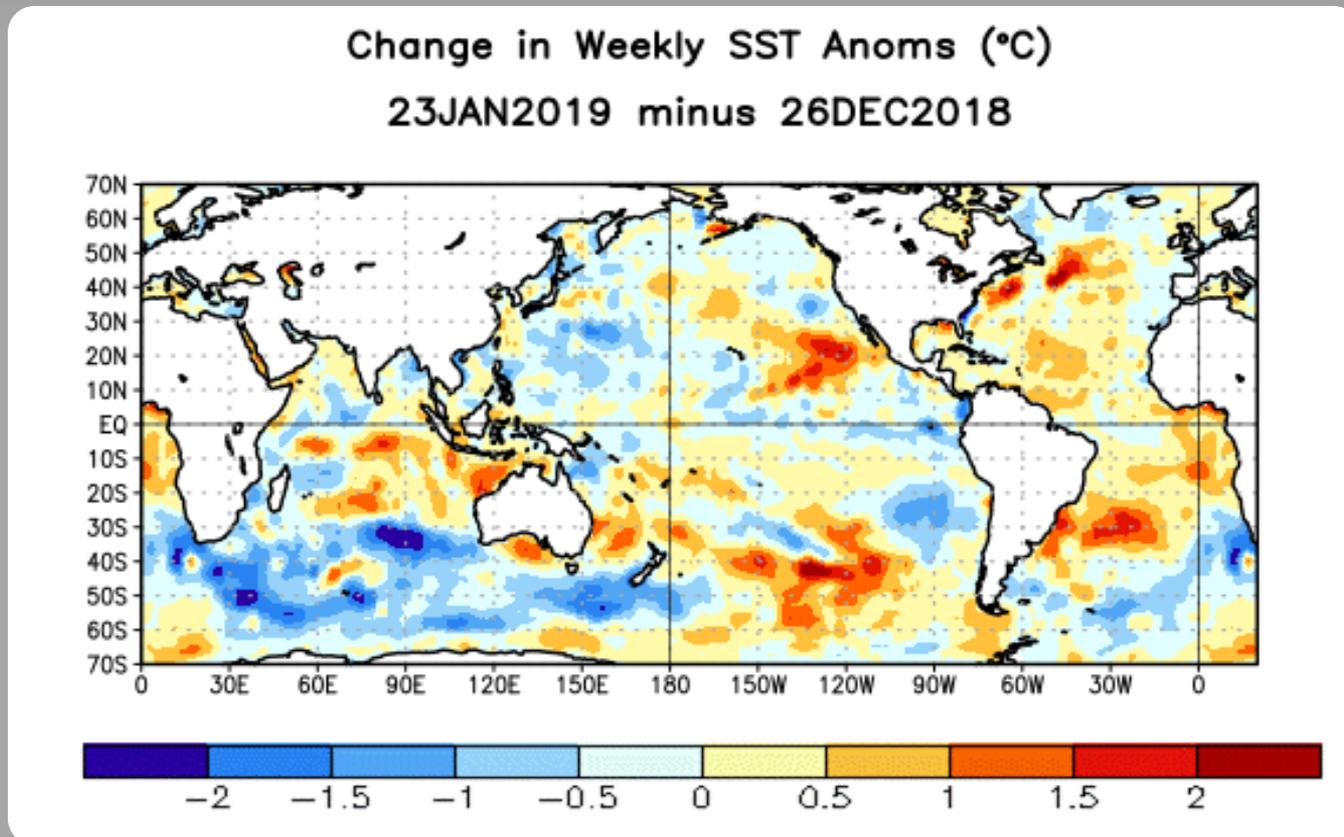
During the last four weeks, above-average SSTs weakened across most of the Pacific Ocean.

Weekly SST Anomalies (DEG C)



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative changes were observed across most of the equatorial Pacific Ocean.



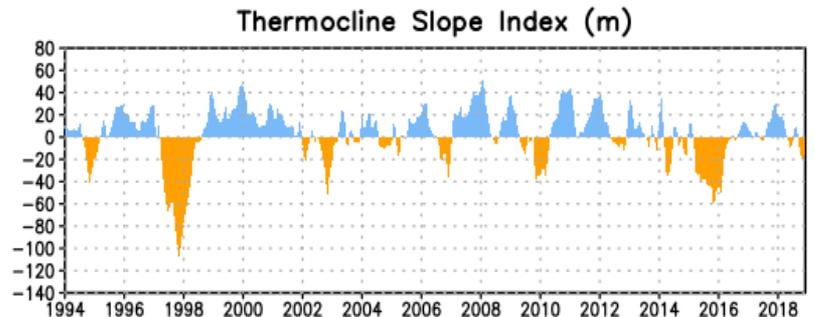
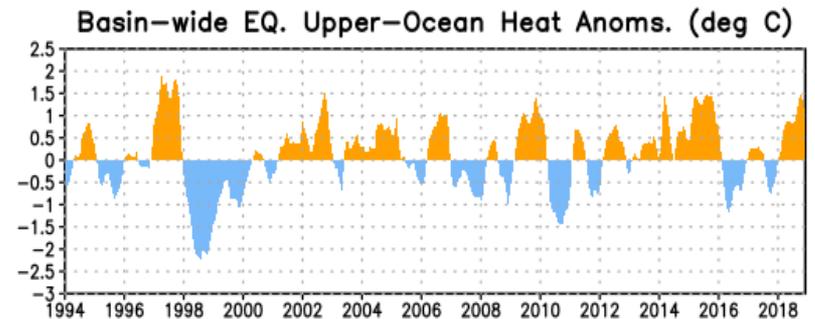
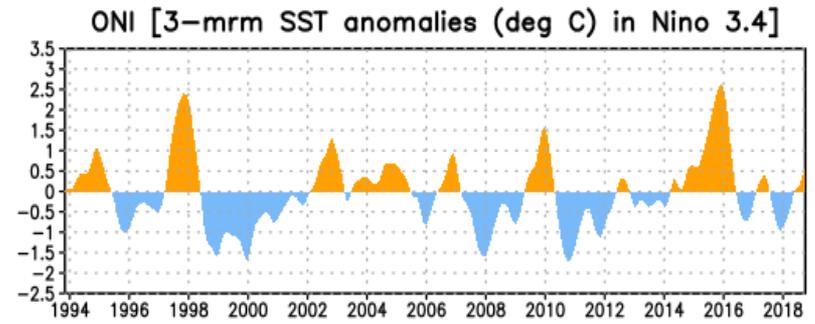
Upper-Ocean Conditions in the Equatorial Pacific

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.

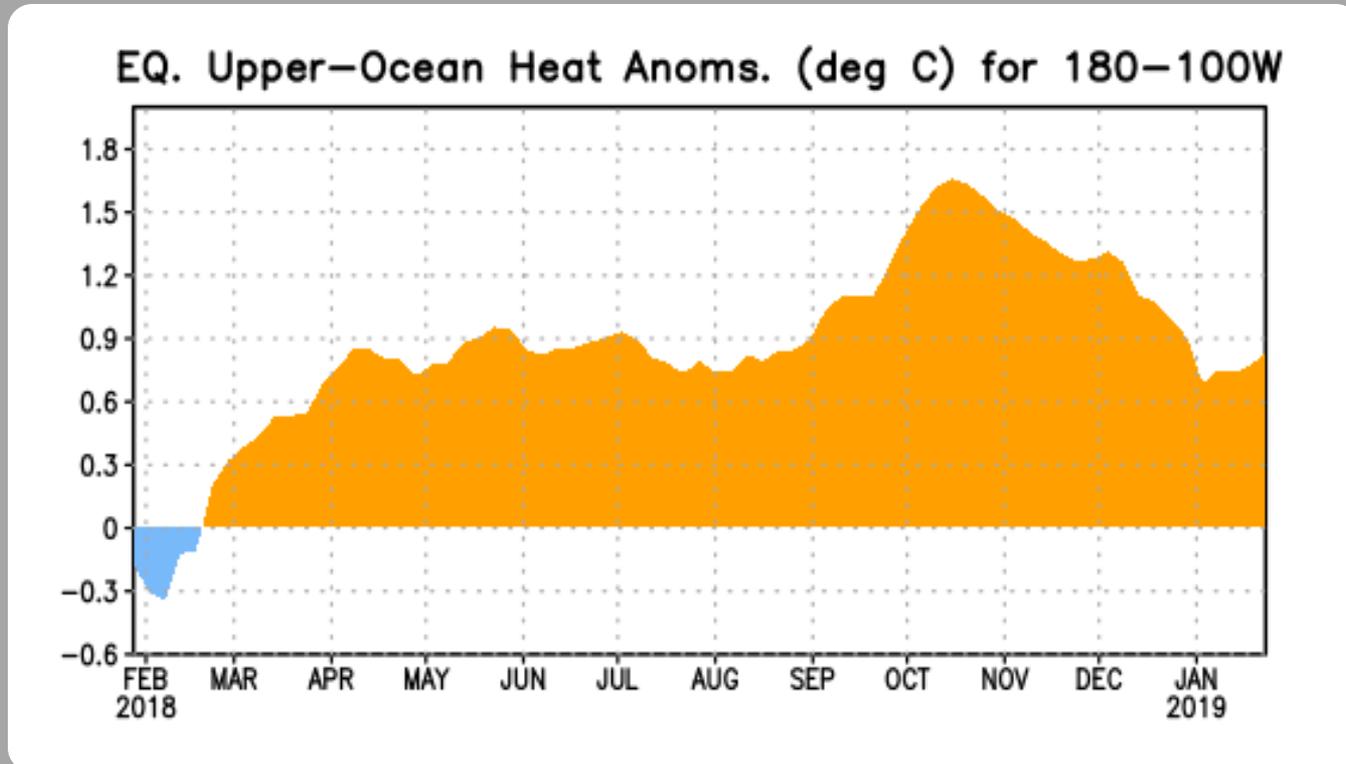
Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (below average) reflect borderline El Niño conditions.

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).



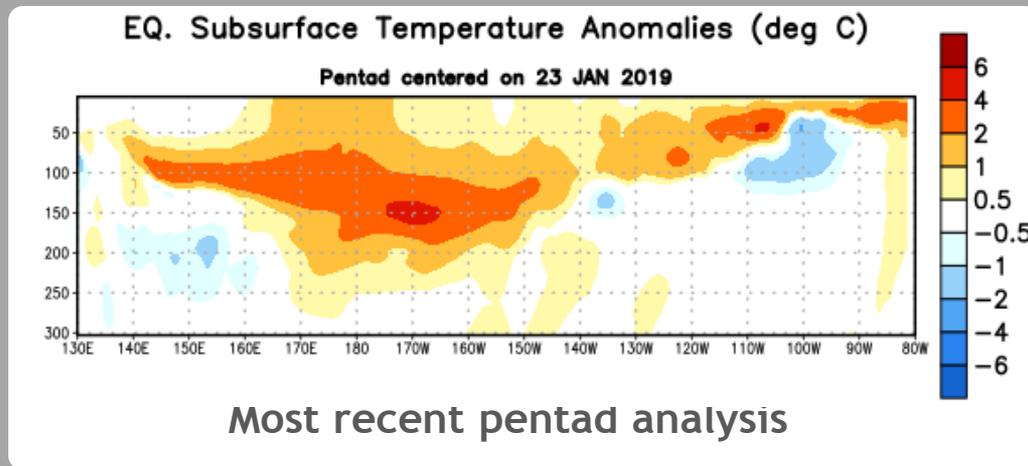
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Since the end of February 2018, subsurface temperature anomalies increased and have been positive. From September to early October 2018, positive anomalies increased. From late October through December 2018, positive anomalies decreased. Positive anomalies have remained relatively unchanged during January 2019.

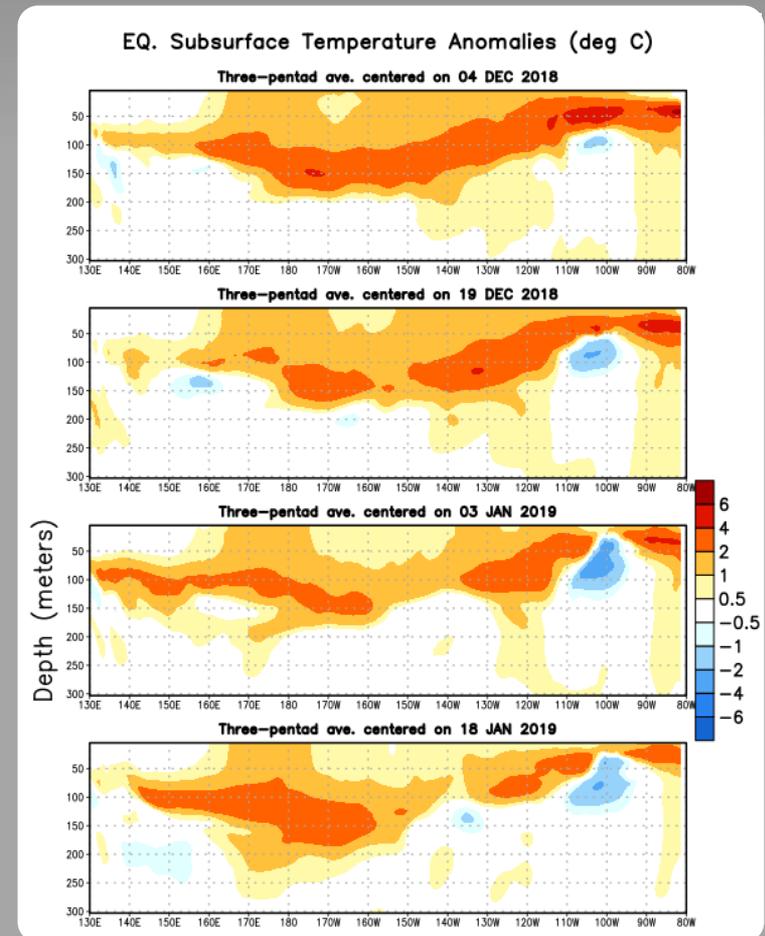


Sub-Surface Temperature Departures in the Equatorial Pacific

In the last two months, positive subsurface temperature anomalies have persisted across most of the equatorial Pacific Ocean.



Since mid-December 2018, negative subsurface temperature anomalies have emerged and persisted between 90-110°W.

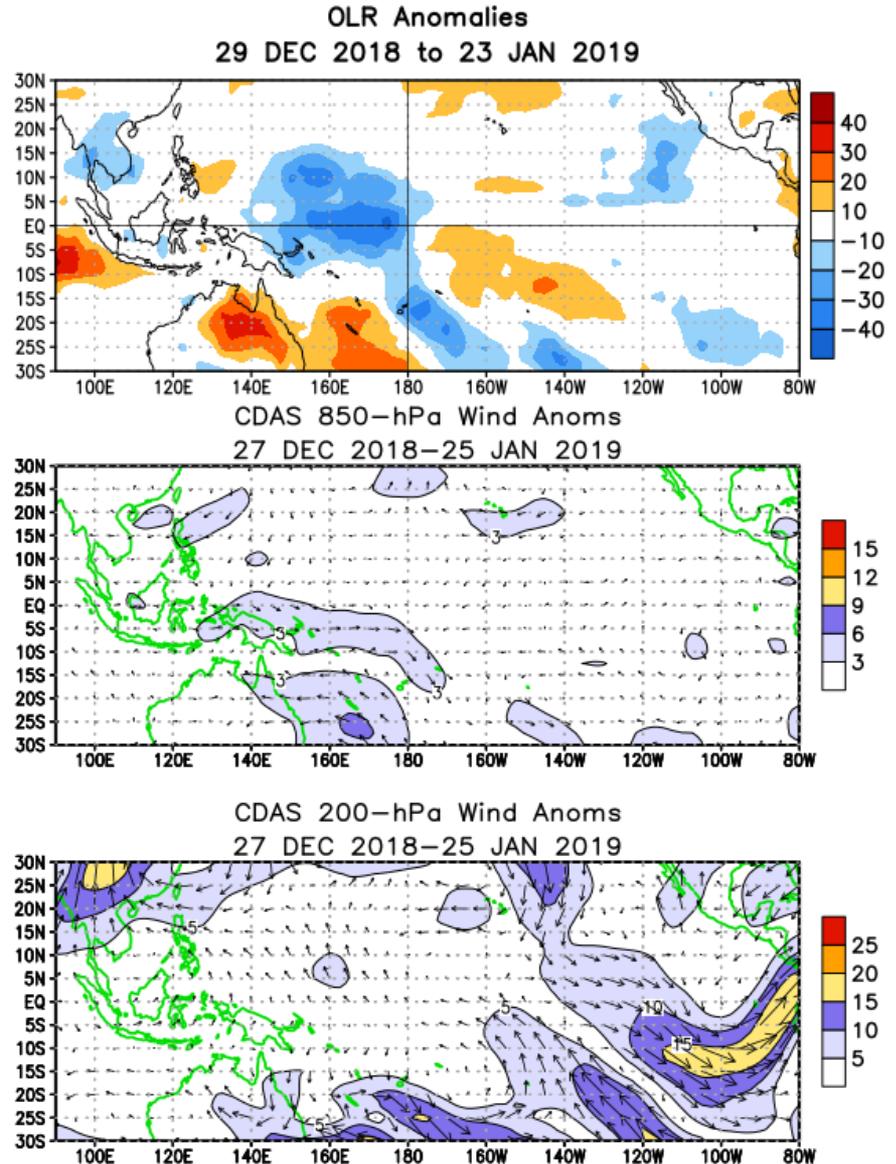


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident over the eastern Indian Ocean. Negative OLR anomalies (enhanced convection and precipitation) were evident near and west of the Date Line.

Anomalous low-level (850-hPa) westerly winds were evident over the western Pacific.

Anomalous upper-level (200-hPa) westerly winds were observed over the eastern 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.

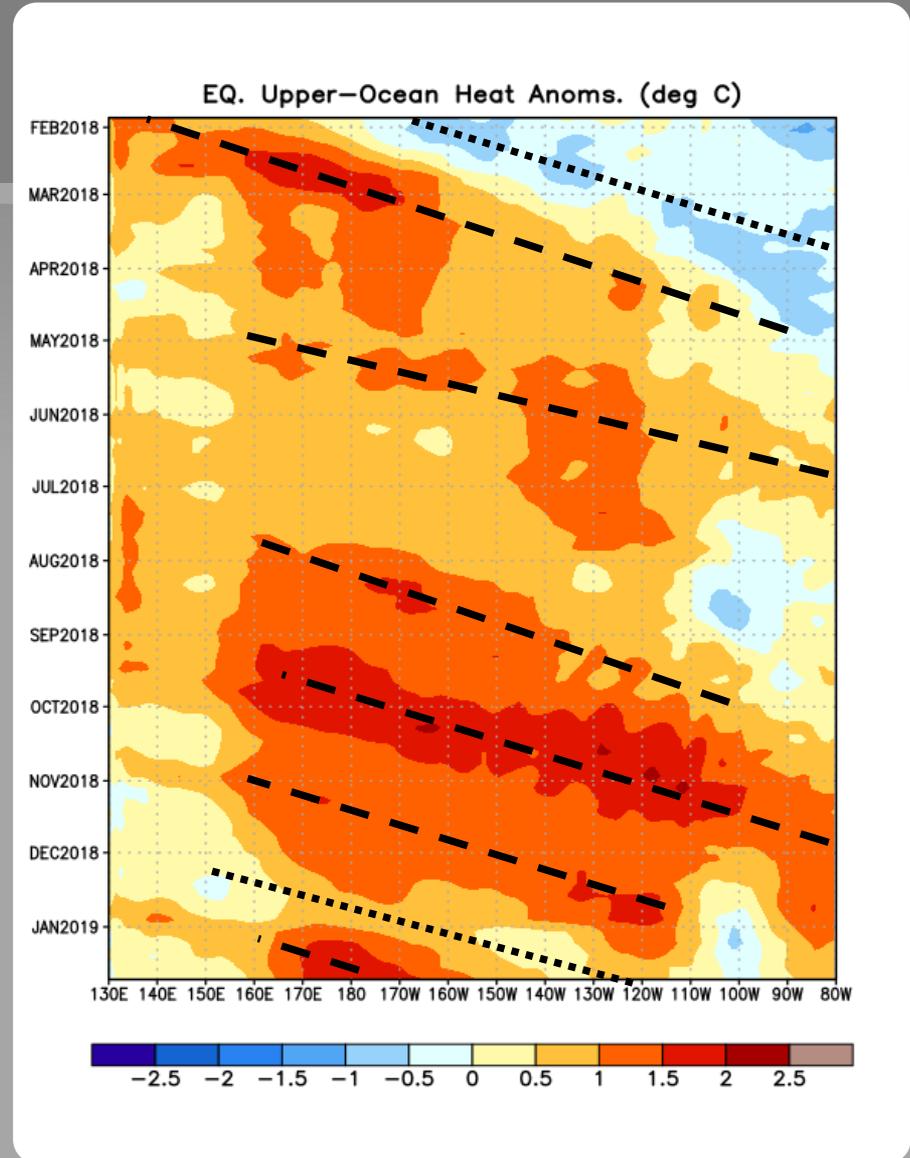
Weekly Heat Content Evolution in the Equatorial Pacific

In early August, October, and November 2018, positive subsurface temperature anomalies increased, partly due to downwelling Kelvin waves.

Since mid-December 2018, positive subsurface anomalies weakened near 140°W and 100°W.

Since early January 2019, a downwelling Kelvin wave increased positive subsurface anomalies near the Date Line.

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})

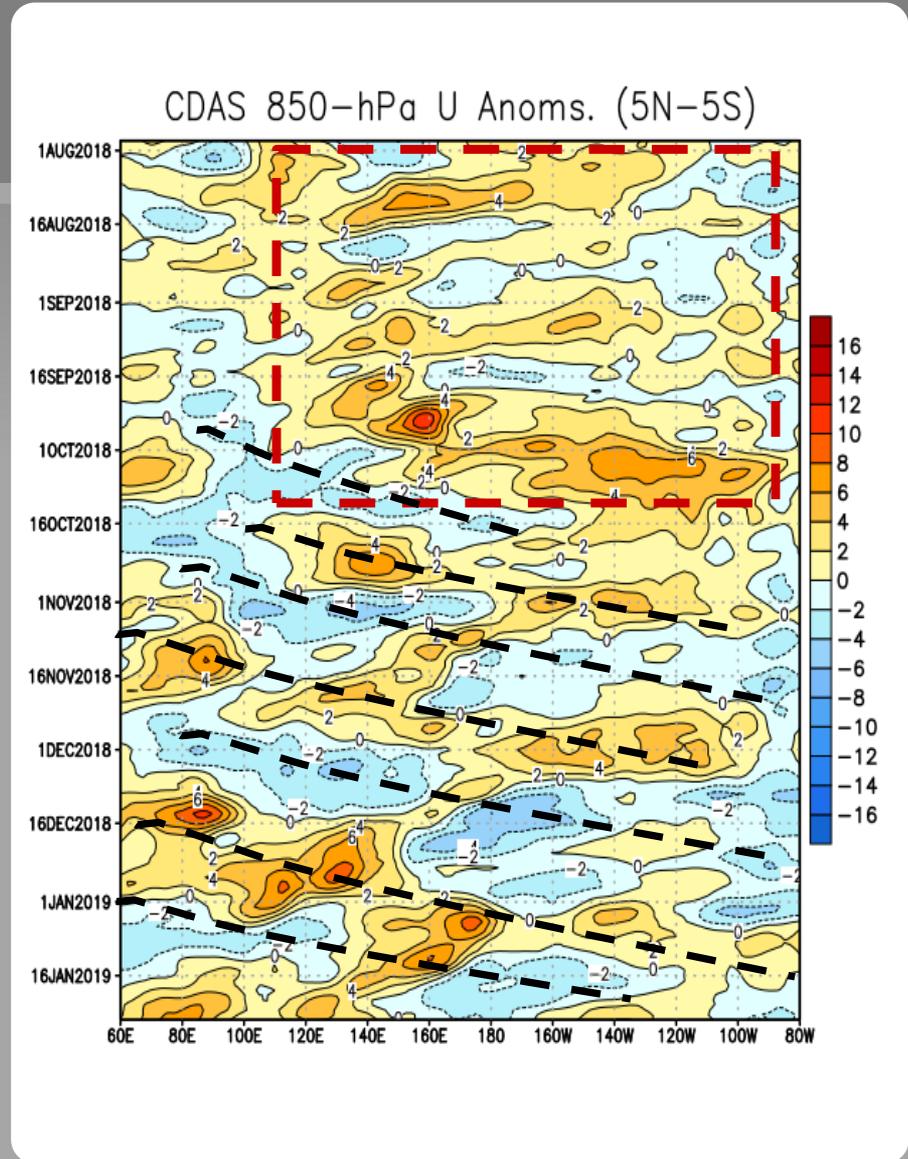
At times, the Madden Julian Oscillation (MJO) contributed to the eastward propagation of low-level wind anomalies.

From mid-July to early October, westerly wind anomalies prevailed over the eastern Pacific.

Since mid-October, wind anomalies have propagated eastward, with easterly wind anomalies persisting near the Date Line more recently.

Westerly Wind Anomalies (orange/red shading)

Easterly Wind Anomalies (blue shading)



Upper-level (200-hPa) Velocity Potential Anomalies

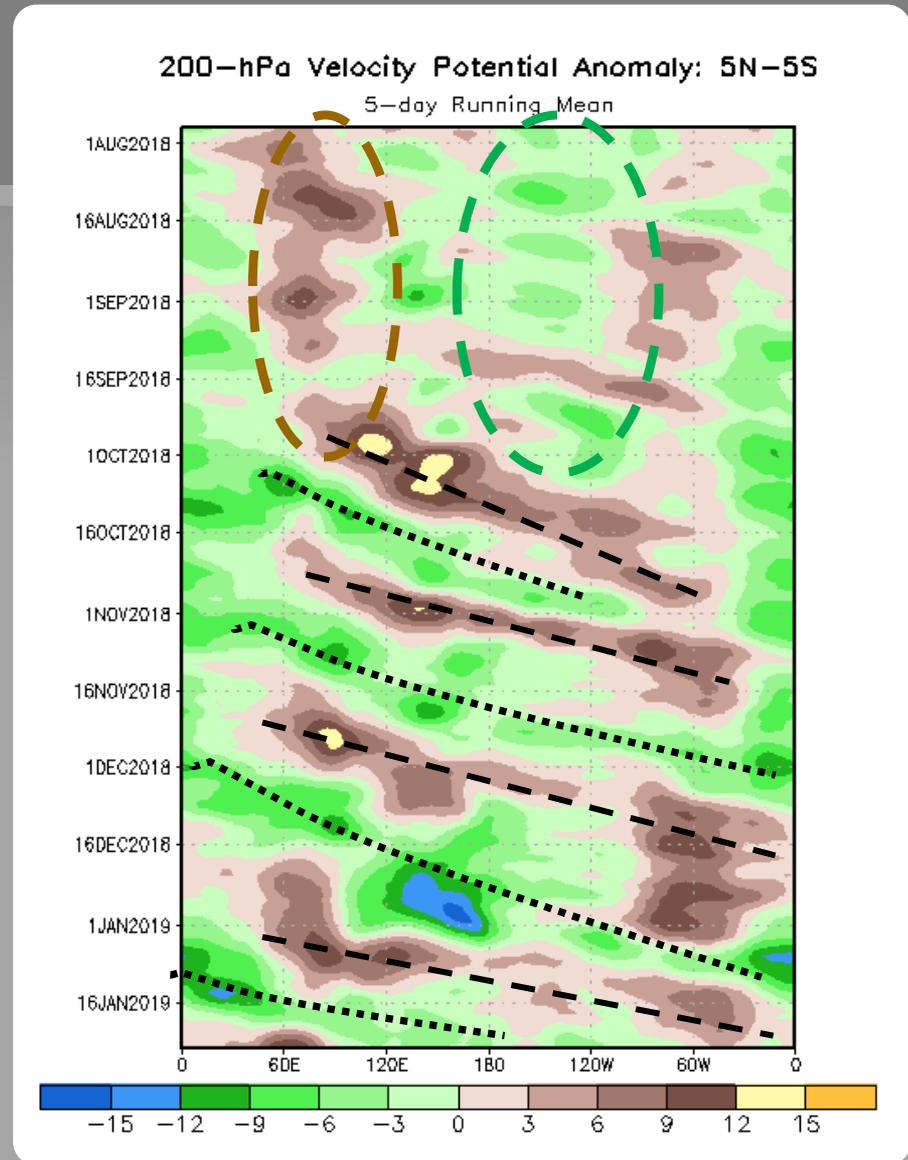
From July through September 2018, anomalous upper-level convergence (brown shading) mostly persisted over the Indian Ocean, while anomalous upper-level divergence (green shading) mostly persisted over the central and east-central Pacific.

Since October 2018, eastward propagation has been evident in the anomalies. More recently, anomalous upper-level divergence is located over most of the Pacific.

Unfavorable for precipitation (brown shading)

Favorable for precipitation (green shading)

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



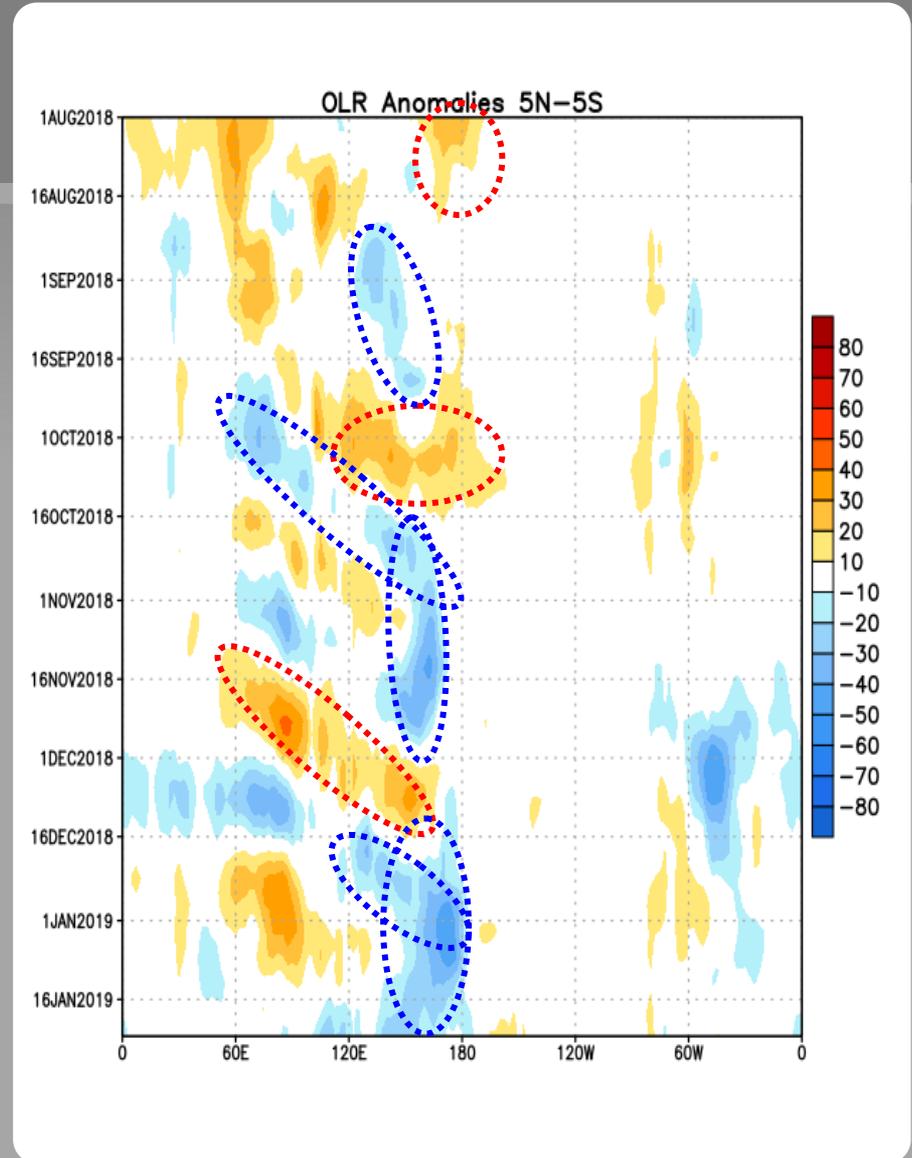
Outgoing Longwave Radiation (OLR) Anomalies

From mid-July to mid-August, positive OLR anomalies persisted over the central Pacific Ocean.

From mid-October to late November 2018, negative OLR anomalies persisted over the western Pacific.

Since mid-December 2018, negative OLR anomalies have persisted near and west of the 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

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 .

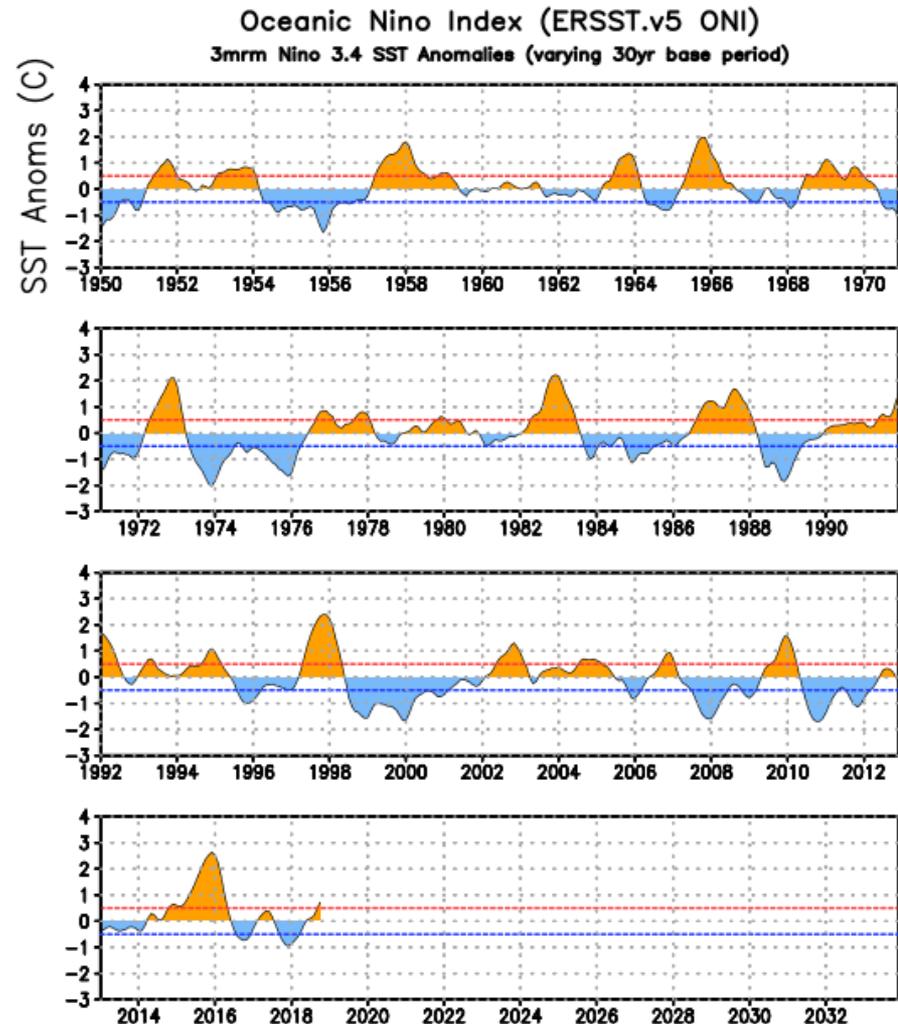
By historical standards, to be classified as a full-fledged El Niño or La Niña episode, these thresholds must be exceeded for a period of at least 5 consecutive overlapping 3-month seasons.

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 (September - November 2018) 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.

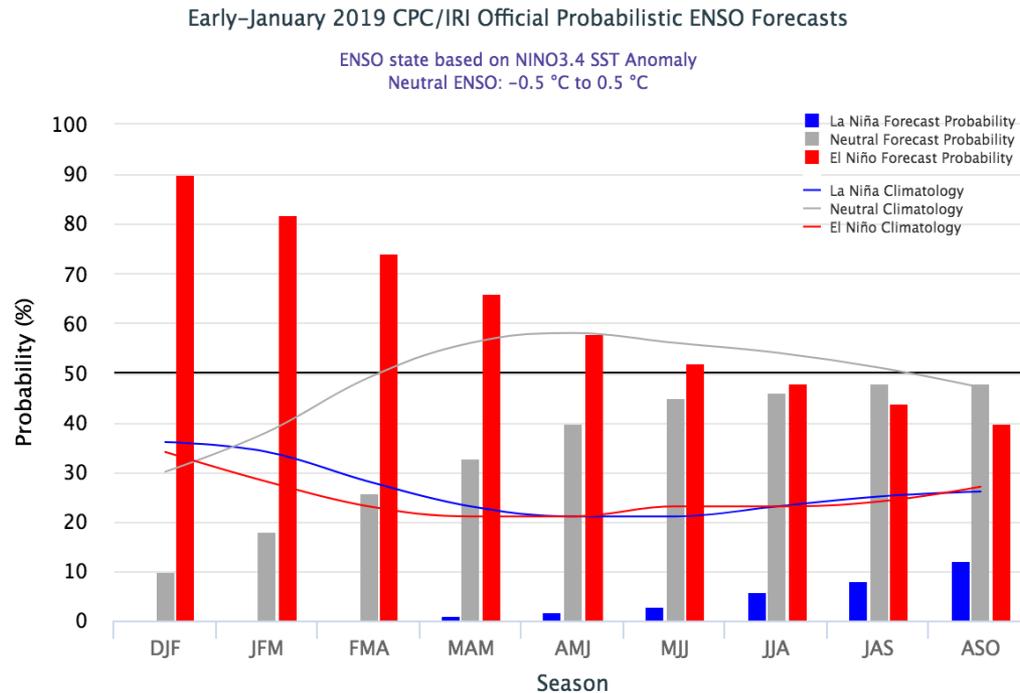
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found [here](#).

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2006	-0.8	-0.7	-0.5	-0.3	0.0	0.0	0.1	0.3	0.5	0.7	0.9	0.9
2007	0.7	0.3	0.0	-0.2	-0.3	-0.4	-0.5	-0.8	-1.1	-1.4	-1.5	-1.6
2008	-1.6	-1.4	-1.2	-0.9	-0.8	-0.5	-0.4	-0.3	-0.3	-0.4	-0.6	-0.7
2009	-0.8	-0.7	-0.5	-0.2	0.1	0.4	0.5	0.5	0.7	1.0	1.3	1.6
2010	1.5	1.3	0.9	0.4	-0.1	-0.6	-1.0	-1.4	-1.6	-1.7	-1.7	-1.6
2011	-1.4	-1.1	-0.8	-0.6	-0.5	-0.4	-0.5	-0.7	-0.9	-1.1	-1.1	-1.0
2012	-0.8	-0.6	-0.5	-0.4	-0.2	0.1	0.3	0.3	0.3	0.2	0.0	-0.2
2013	-0.4	-0.3	-0.2	-0.2	-0.3	-0.3	-0.4	-0.4	-0.3	-0.2	-0.2	-0.3
2014	-0.4	-0.4	-0.2	0.1	0.3	0.2	0.1	0.0	0.2	0.4	0.6	0.7
2015	0.6	0.6	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.5	2.6
2016	2.5	2.2	1.7	1.0	0.5	0.0	-0.3	-0.6	-0.7	-0.7	-0.7	-0.6
2017	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.1	-0.4	-0.7	-0.9	-1.0
2018	-0.9	-0.8	-0.6	-0.4	-0.1	0.1	0.1	0.2	0.4	0.7		

CPC/IRI Probabilistic ENSO Outlook

Updated: 10 January 2019

El Niño is expected to form and continue through the Northern Hemisphere spring 2019 (~65% chance).



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The majority of models predict the Niño-3.4 index to slowly weaken into the Northern Hemisphere summer 2019.

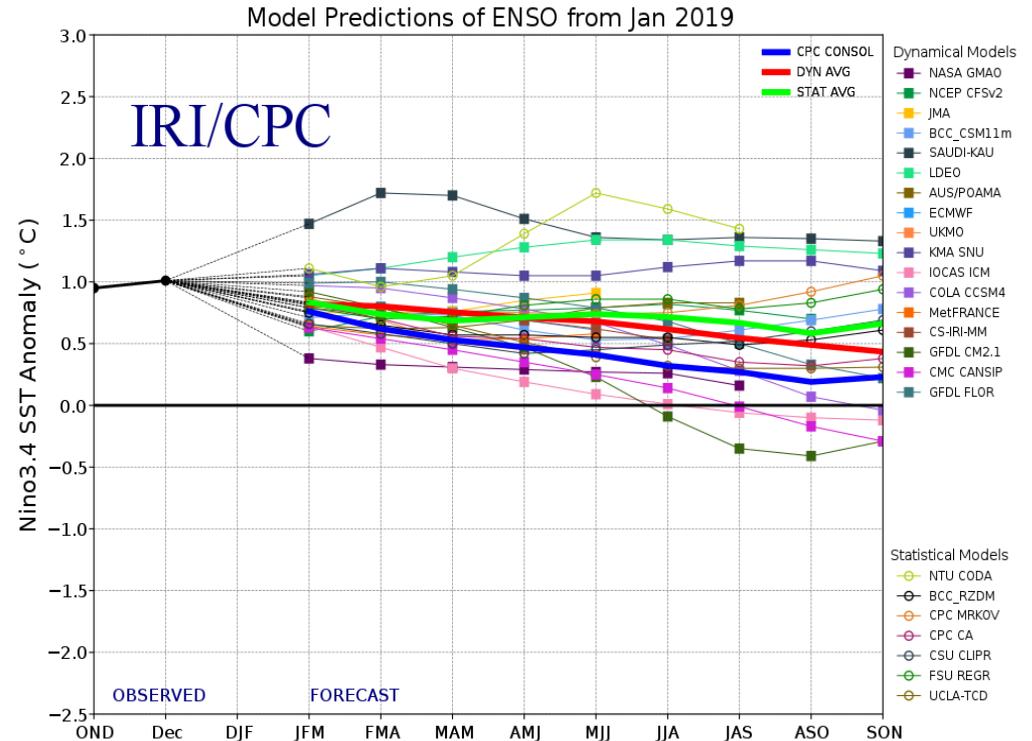


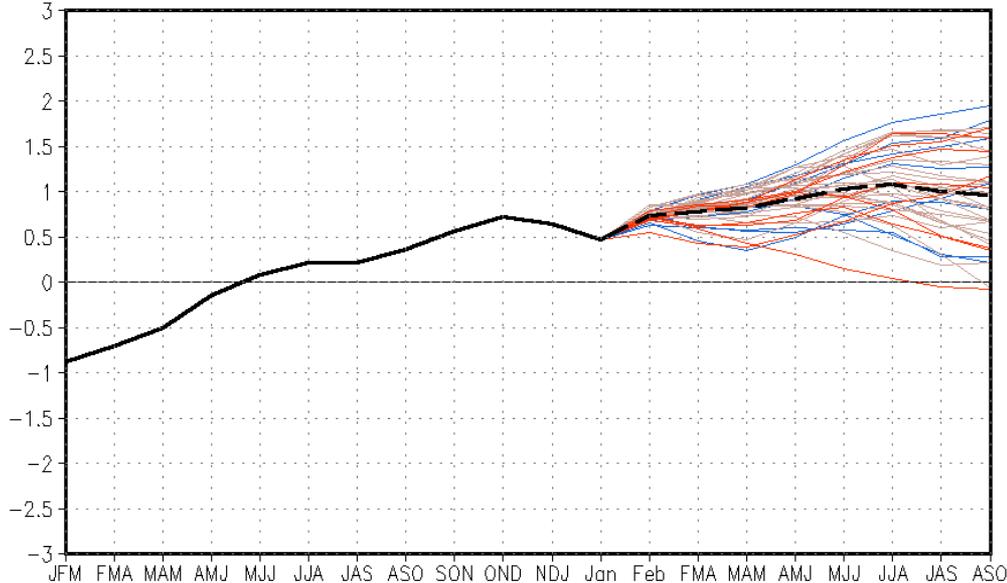
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 January 2019).

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

Issued: 28 January 2019

The CFS.v2 ensemble mean (black dashed line) predicts El Niño through the Northern Hemisphere summer 2019.

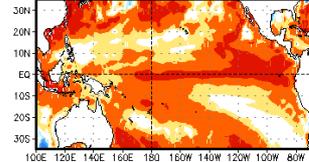
CFSv2 forecast Nino3.4 SST anomalies (K) (PDF corrected)



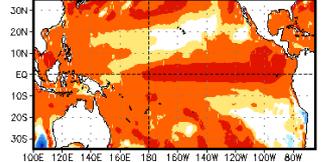
— Latest 8 forecast members
— Earliest 8 forecast members
— Other forecast members
- - - Forecast ensemble mean
— NCDG daily analysis

(Model bias correct base period: 1999–2010; Climatology base period: 1982–2010)

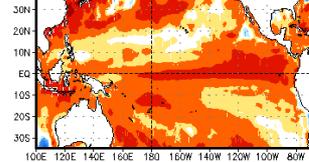
Feb–Mar–Apr 2019



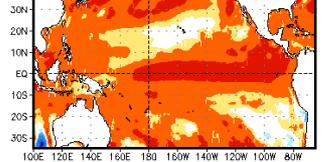
Jun–Jul–Aug 2019



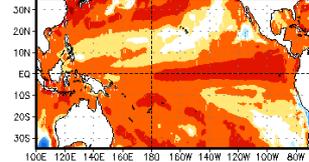
Mar–Apr–May 2019



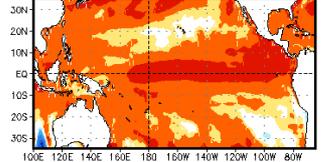
Jul–Aug–Sep 2019



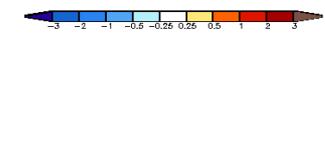
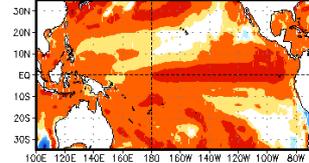
Apr–May–Jun 2019



Aug–Sep–Oct 2019



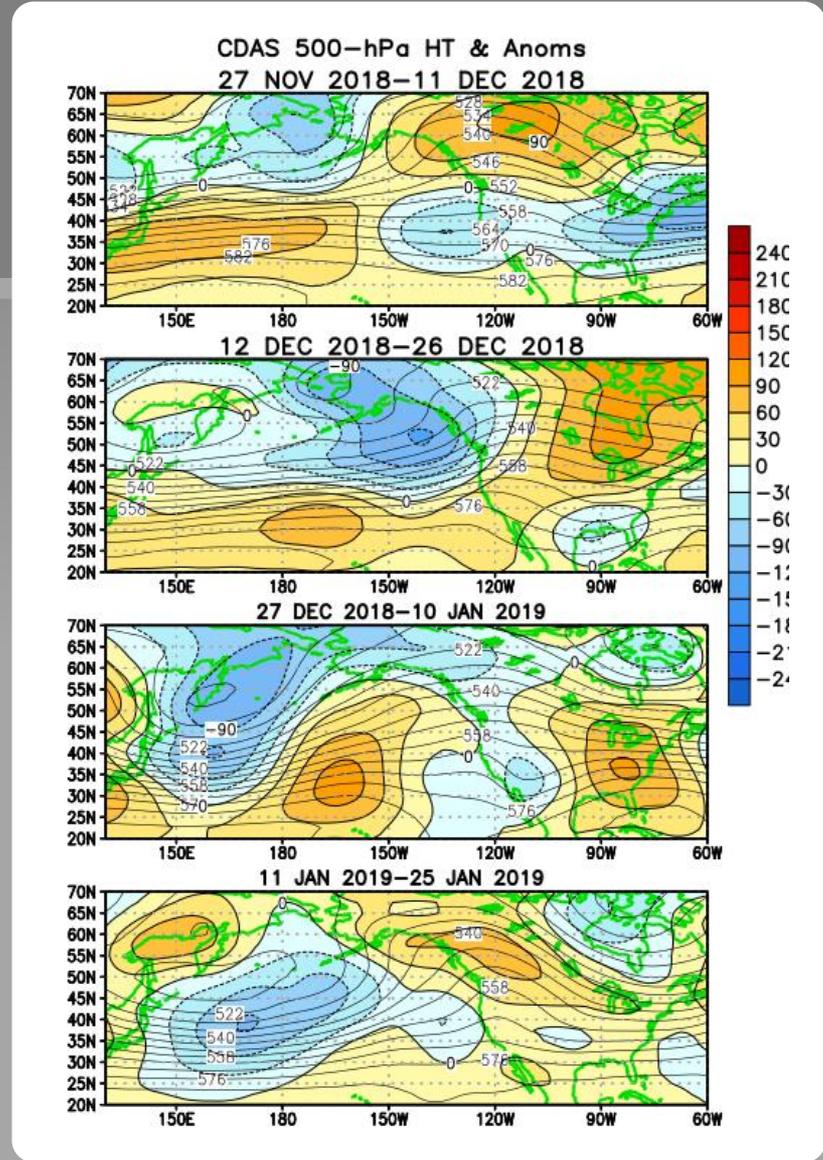
May–Jun–Jul 2019



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

During late November to early December, below-average heights (and temperatures) were present across most of the contiguous U.S.

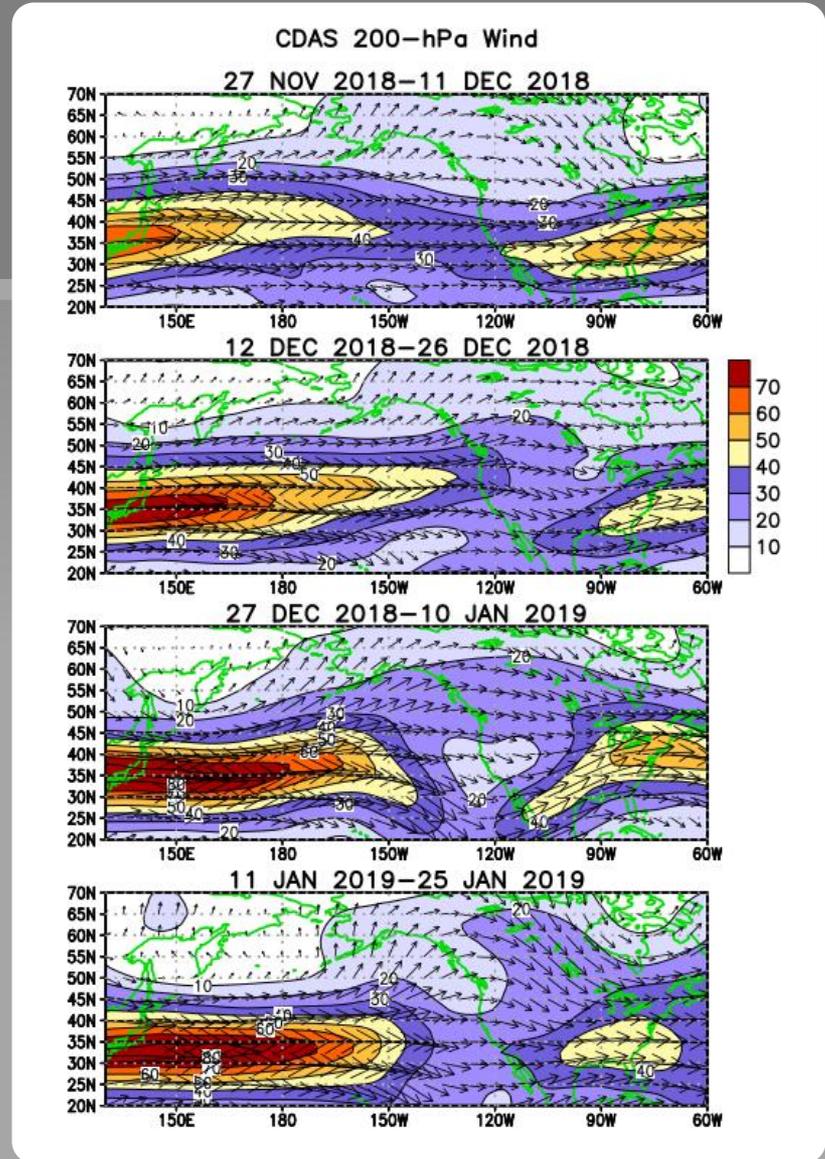
From mid December to mid January, anomalous ridging (and above-average temperatures) were evident over the central/eastern U.S., while the pattern in the western U.S. reversed from anomalous troughing (and below-average temperatures) in late December - early January to above-average temperatures since early January.



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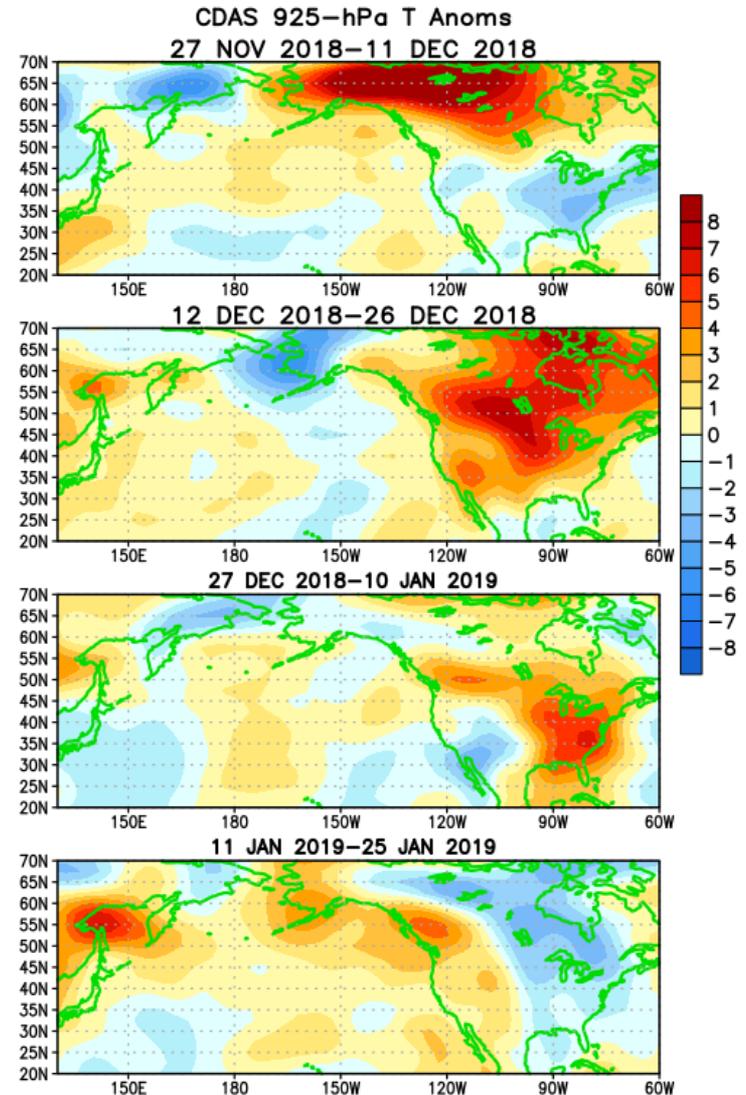
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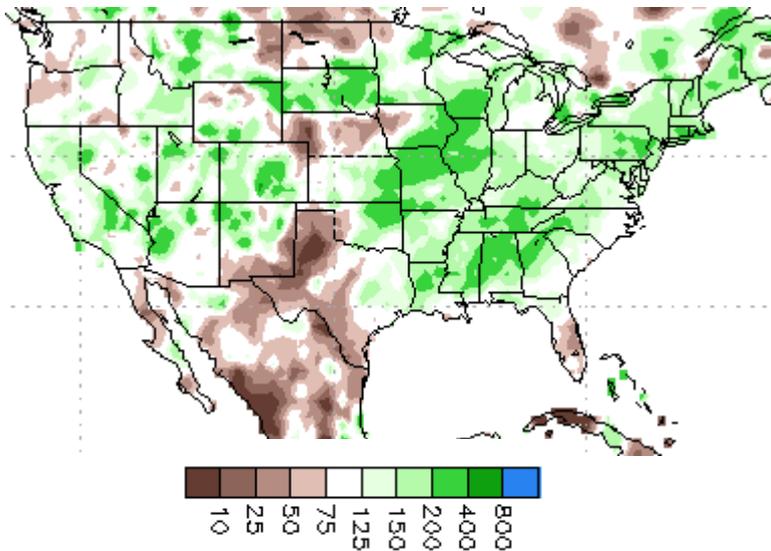
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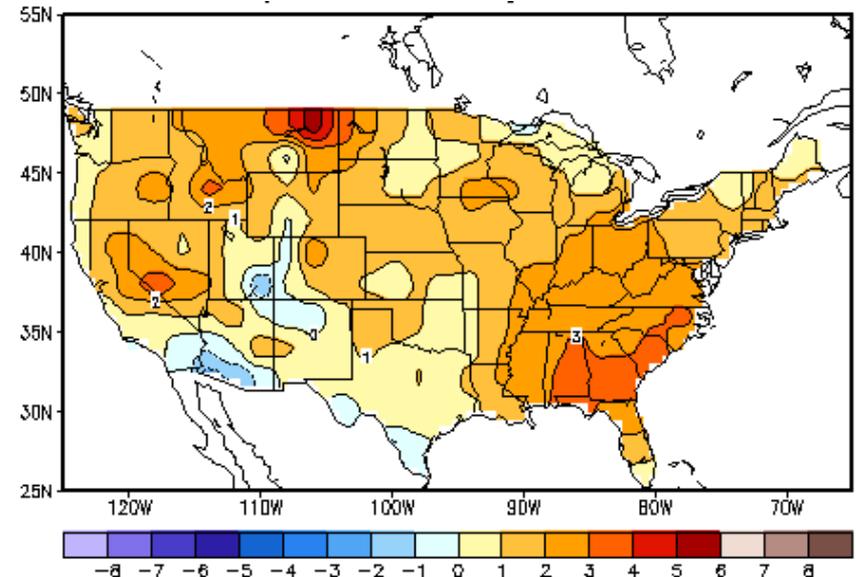
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 26 January 2019

Percent of Average Precipitation



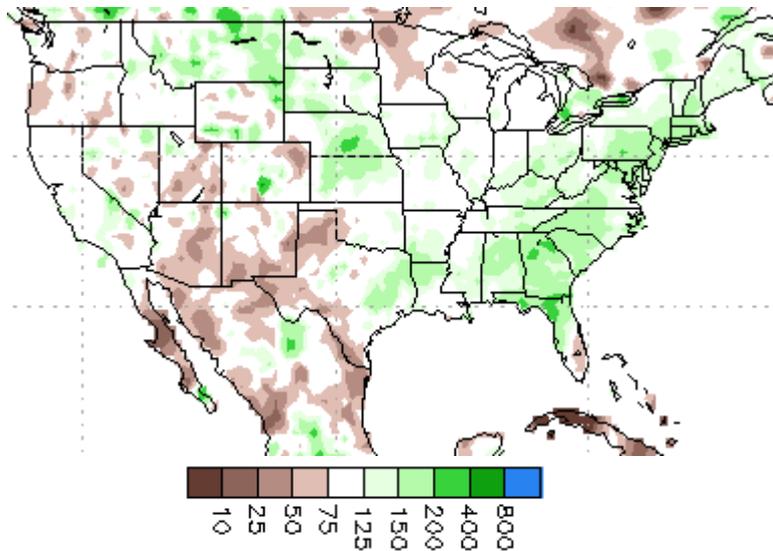
Temperature Departures (degree C)



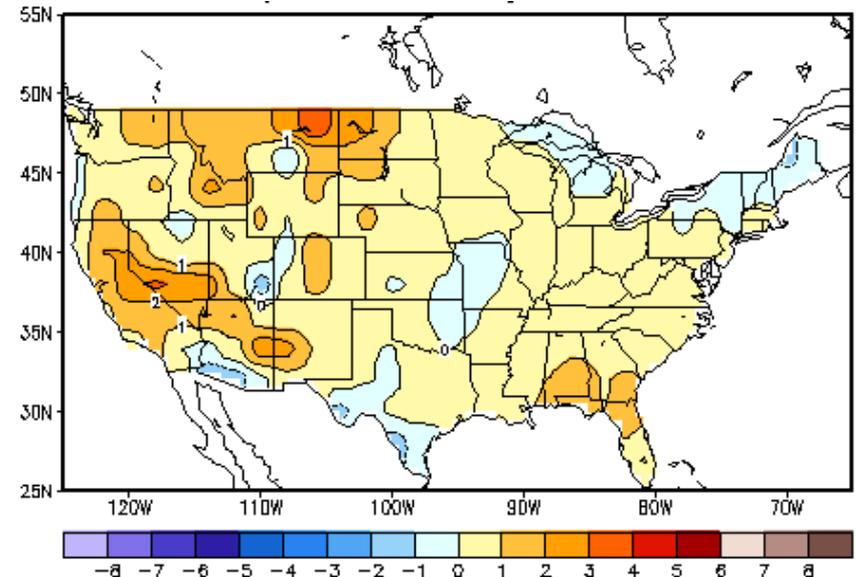
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 26 January 2019

Percent of Average Precipitation



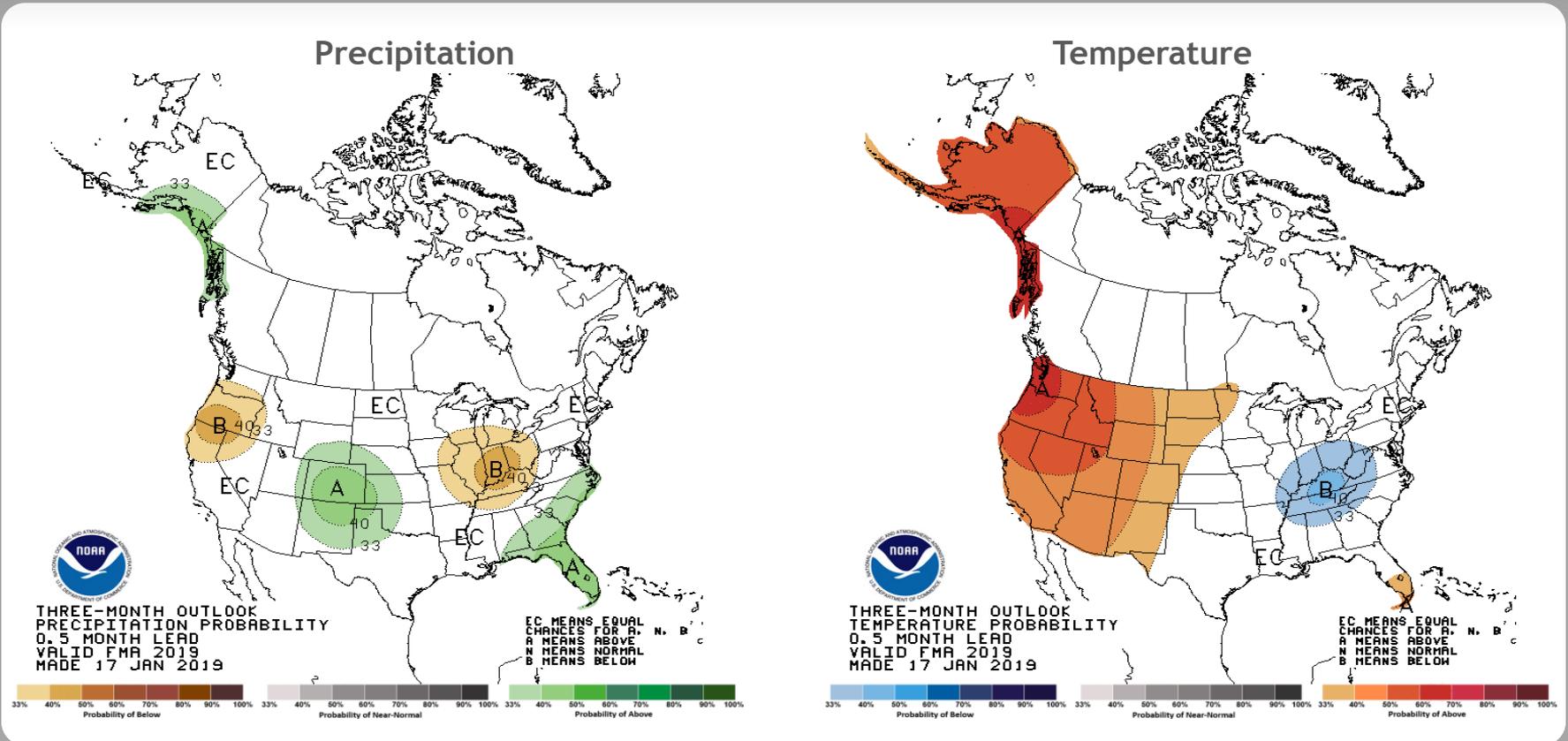
Temperature Departures (degree C)



U. S. Seasonal Outlooks

February - April 2019

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



Summary

ENSO Alert System Status: El Niño Watch

ENSO-neutral conditions are present.*

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The patterns of convection and winds are mostly near average over the tropical Pacific.

El Niño is expected to form and continue through the Northern Hemisphere spring 2019 (~65% chance).*

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