ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
31 December 2018

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Recent Evolution and Current Conditions

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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 winter 2018-19 (~90% chance) and through spring (~60% chance).*

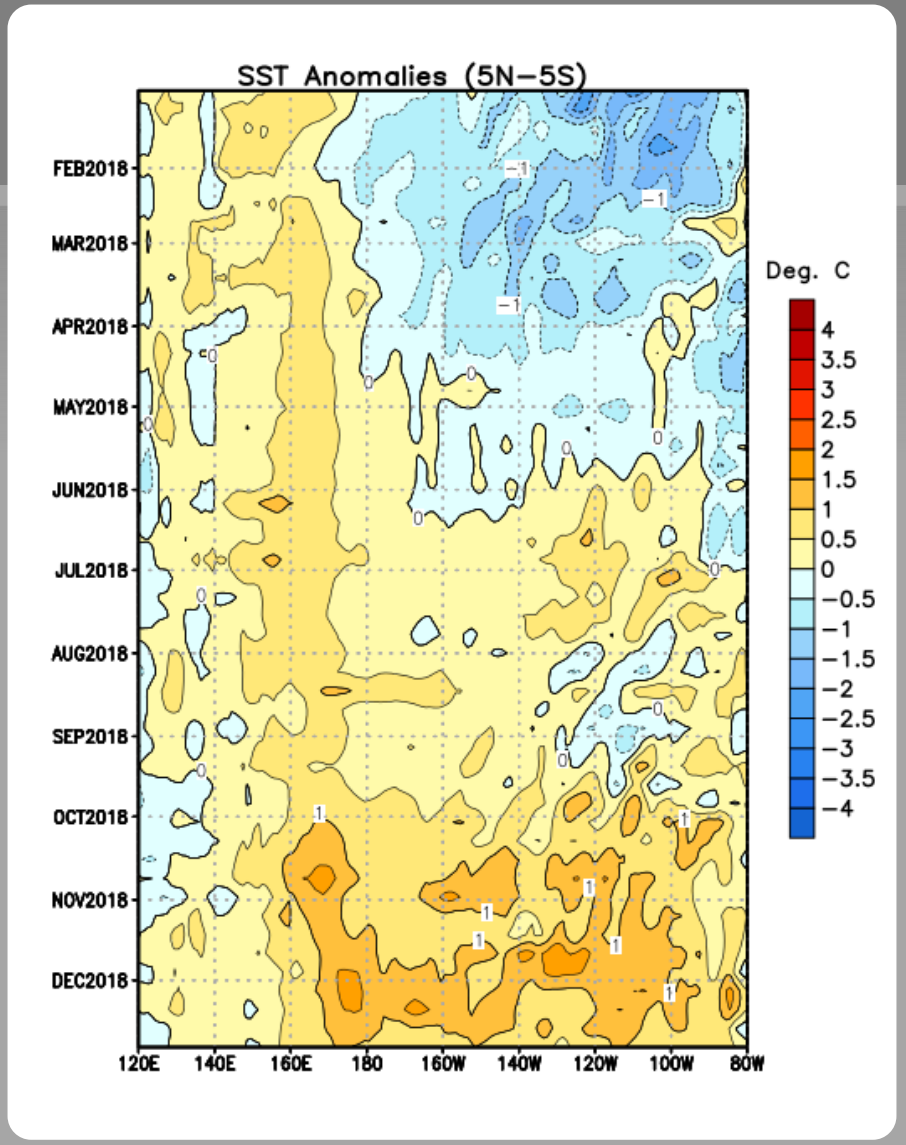
*** Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.**

Recent Evolution of Equatorial Pacific SST Departures (°C)

From September 2017 to late March 2018, below-average SSTs persisted across the central and eastern Pacific Ocean.

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

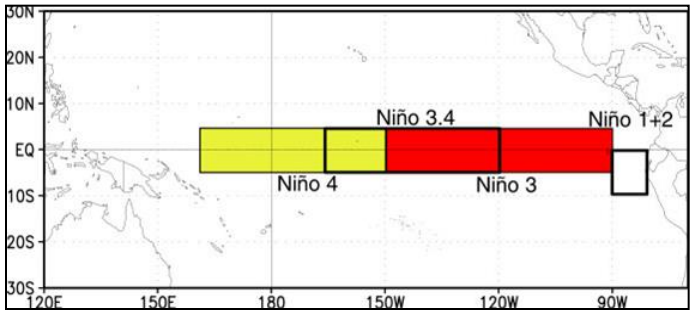
In the last week, positive SST anomalies weakened across most of the equatorial Pacific.

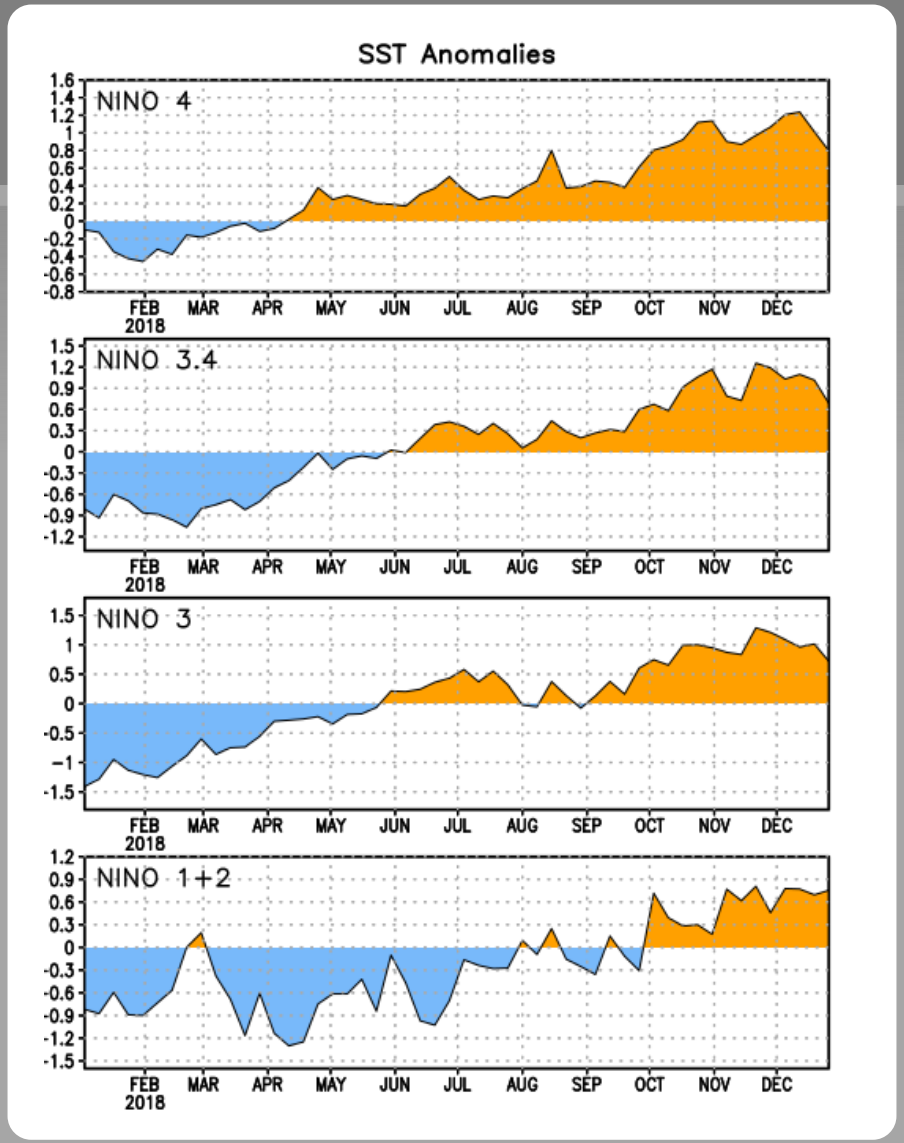


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

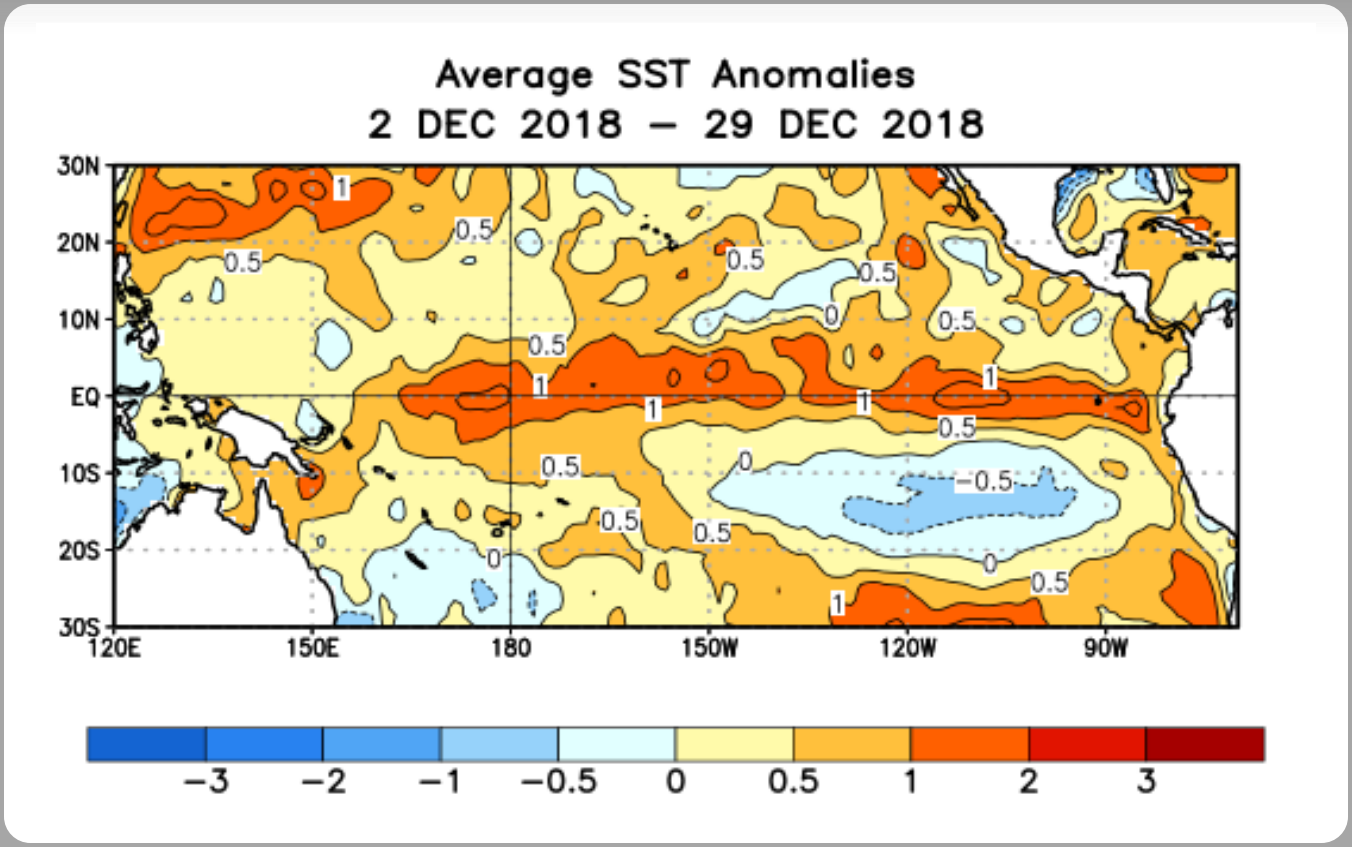
Niño 4	0.8ºC
Niño 3.4	0.7ºC
Niño 3	0.7ºC
Niño 1+2	0.8ºC





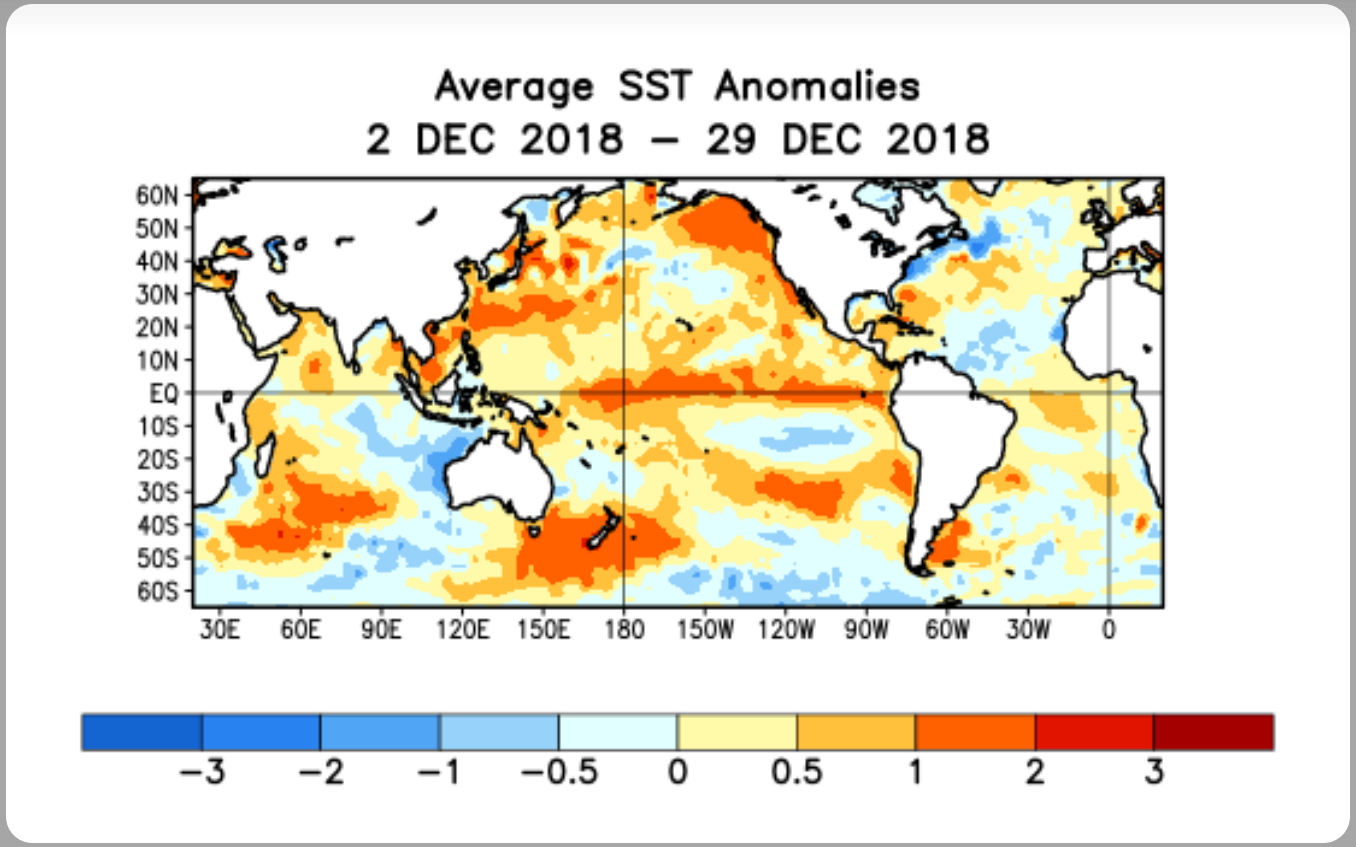
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

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



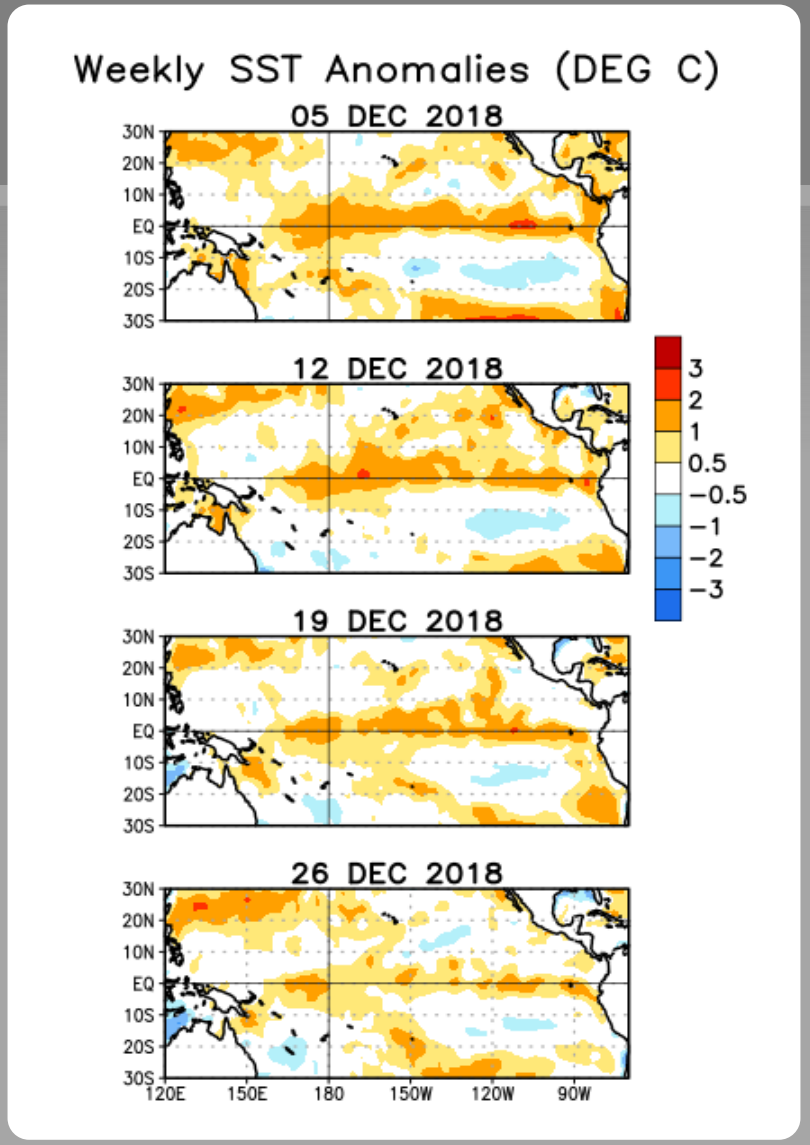
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average across the Pacific, central Indian, and central Atlantic Oceans.



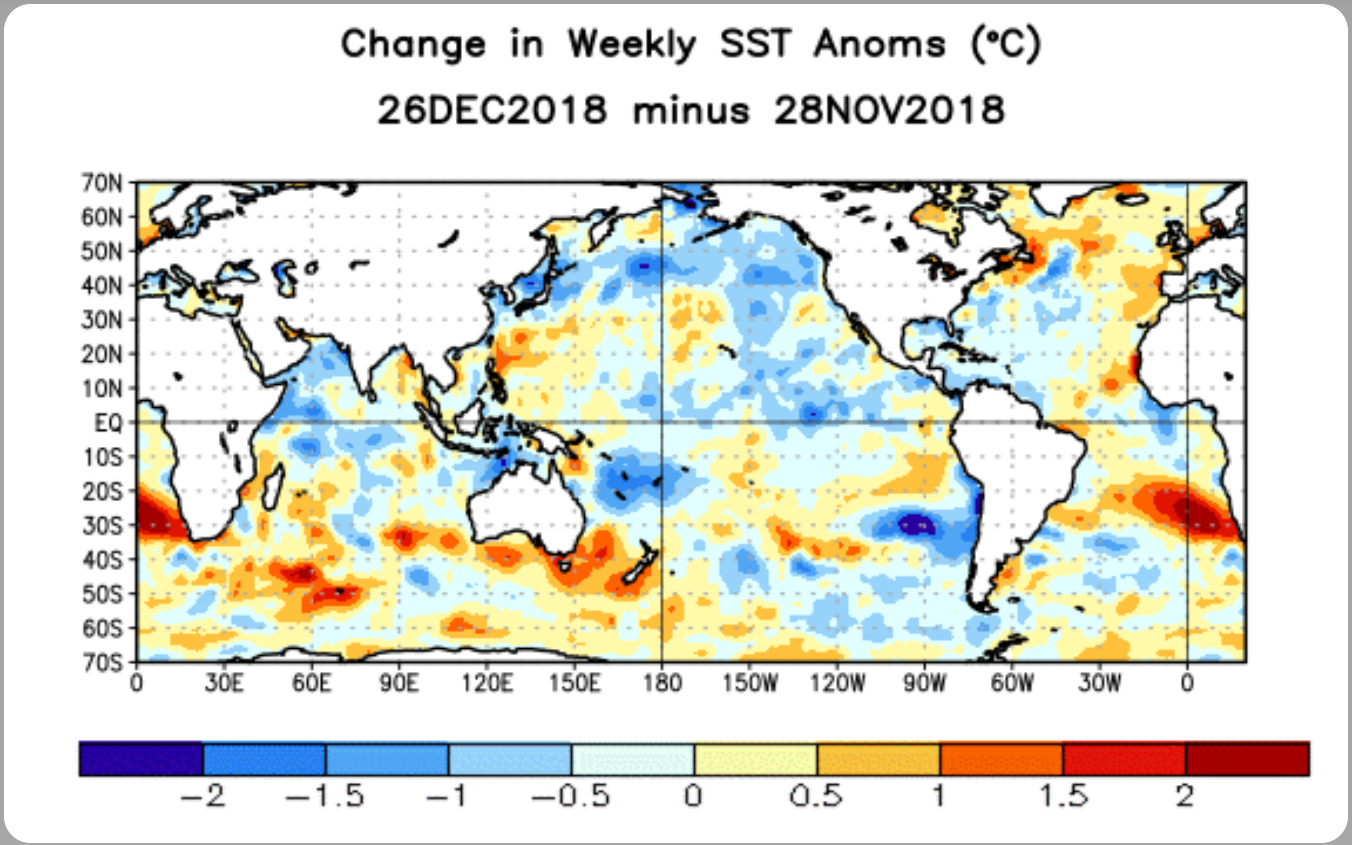
Weekly SST Departures during the Last Four Weeks

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



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.



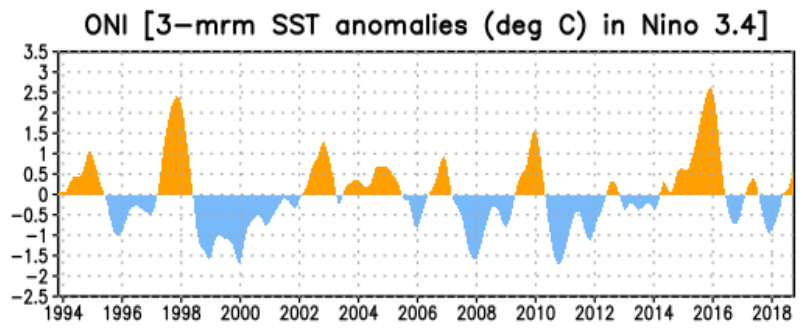
Upper-Ocean Conditions in the Equatorial Pacific

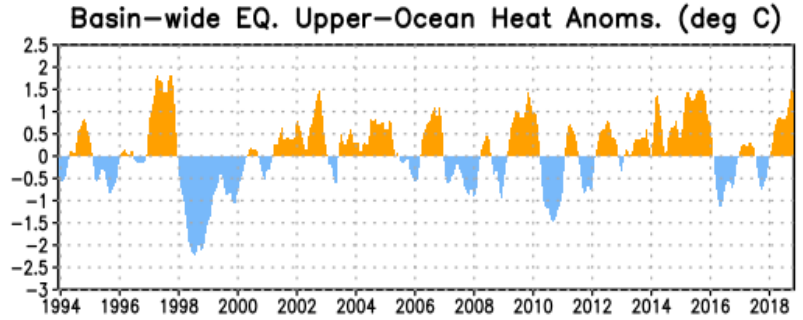
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

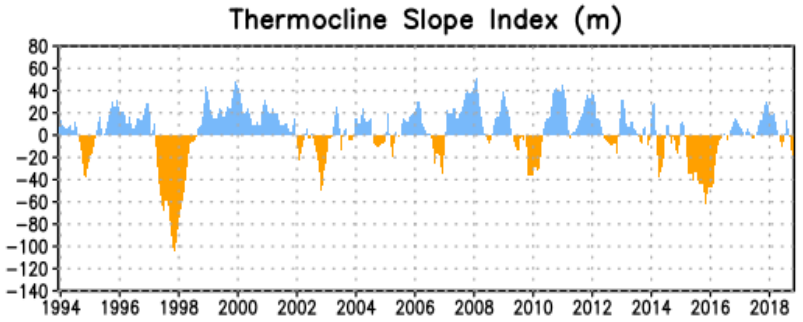
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (above average) and thermocline slope index (near average) reflect the trend toward 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).

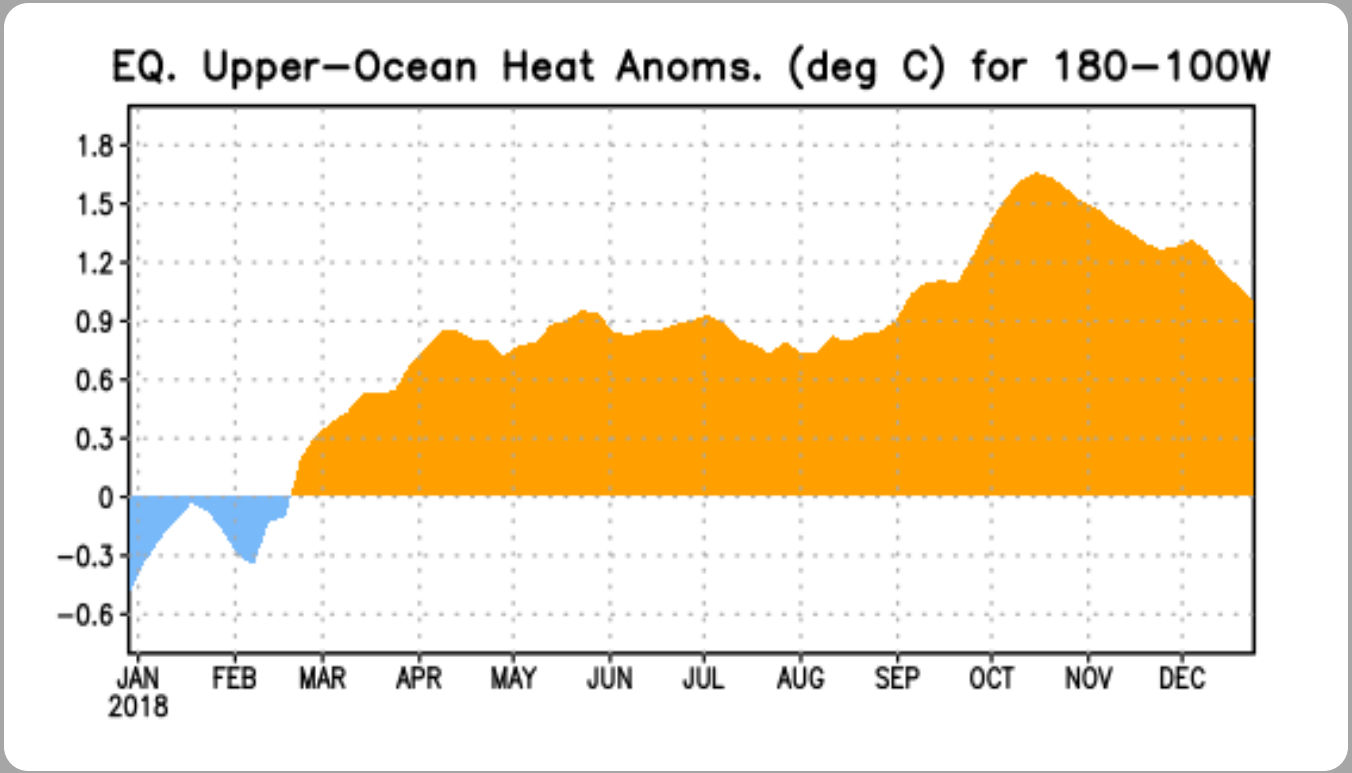






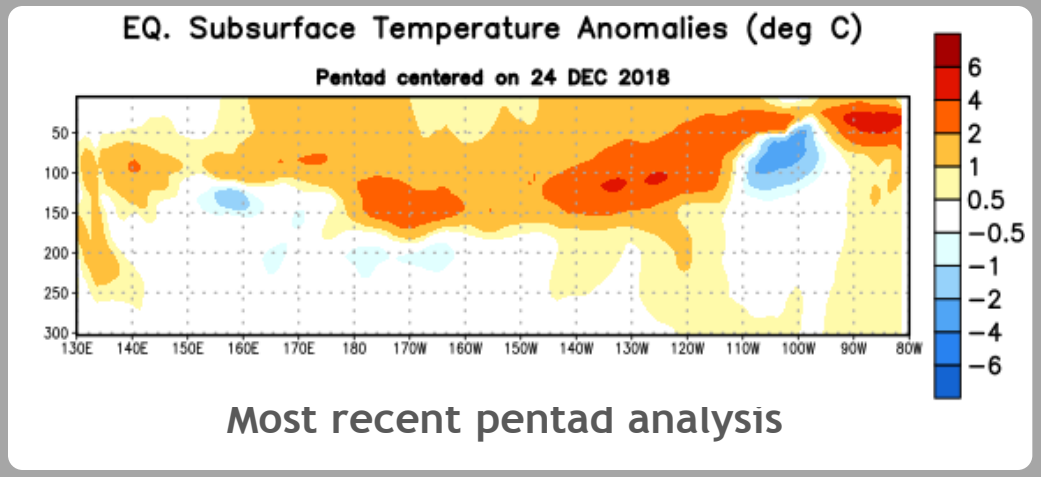
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Negative subsurface temperature anomalies lasted until February 2018. Since the end of February, temperature anomalies increased and have been positive. From September to early October, positive anomalies increased. Since late October, positive anomalies have decreased.



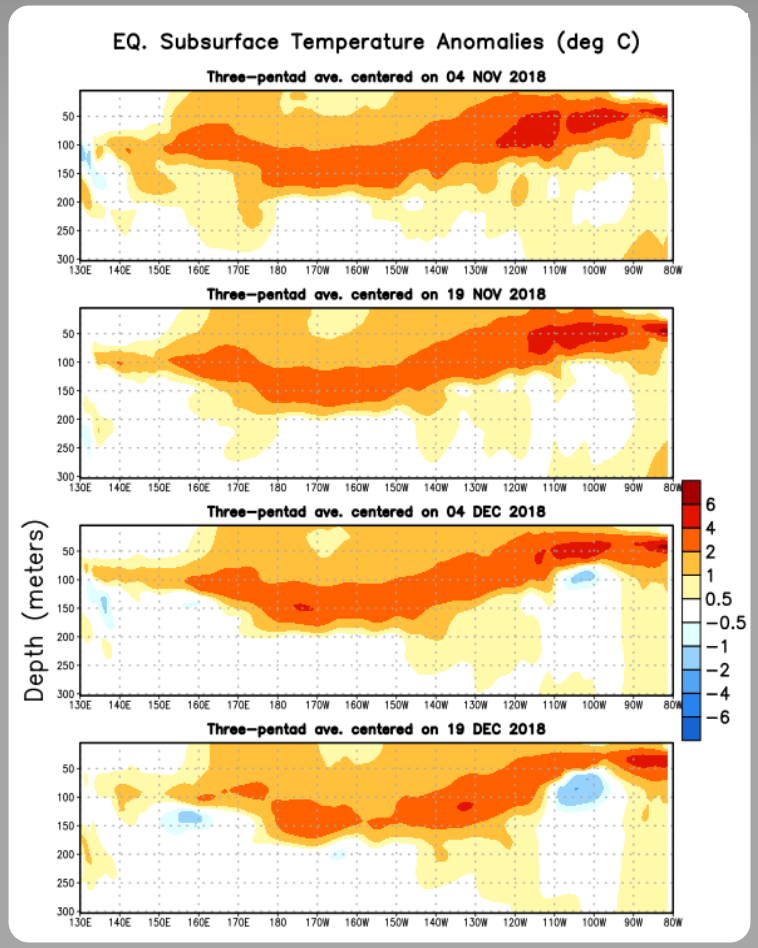
Sub-Surface Temperature Departures in the Equatorial Pacific

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



Most recent pentad analysis

In the last couple of weeks, negative subsurface temperature anomalies expanded near 100-110°W.

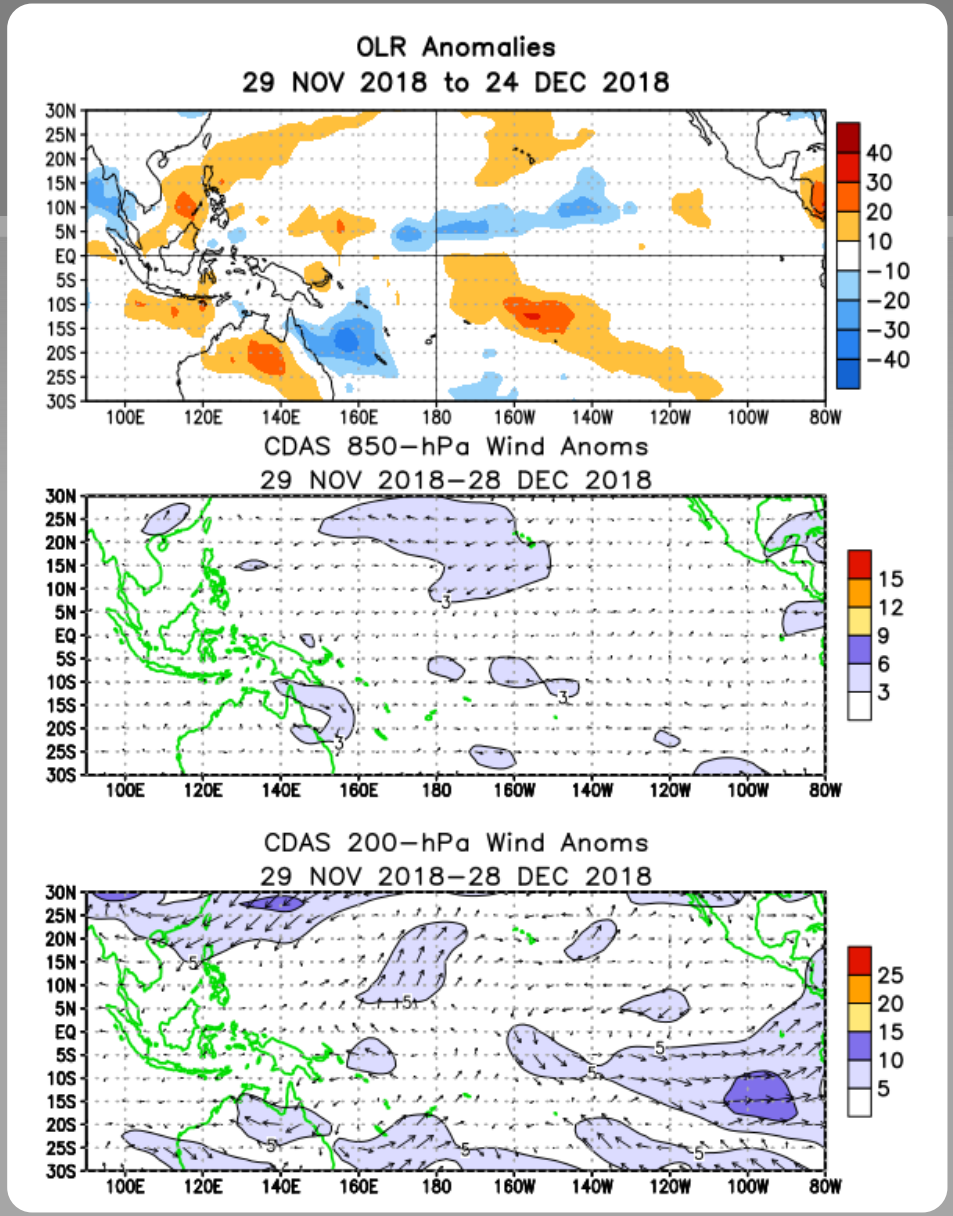


Tropical OLR and Wind Anomalies During the Last 30 Days

Positive OLR anomalies (suppressed convection and precipitation) were evident over the Philippines and Indonesia. Negative OLR anomalies (enhanced convection and precipitation) were evident just north of the equator near the Date Line.

Low-level (850-hPa) winds were mostly near average across the equatorial Pacific.

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

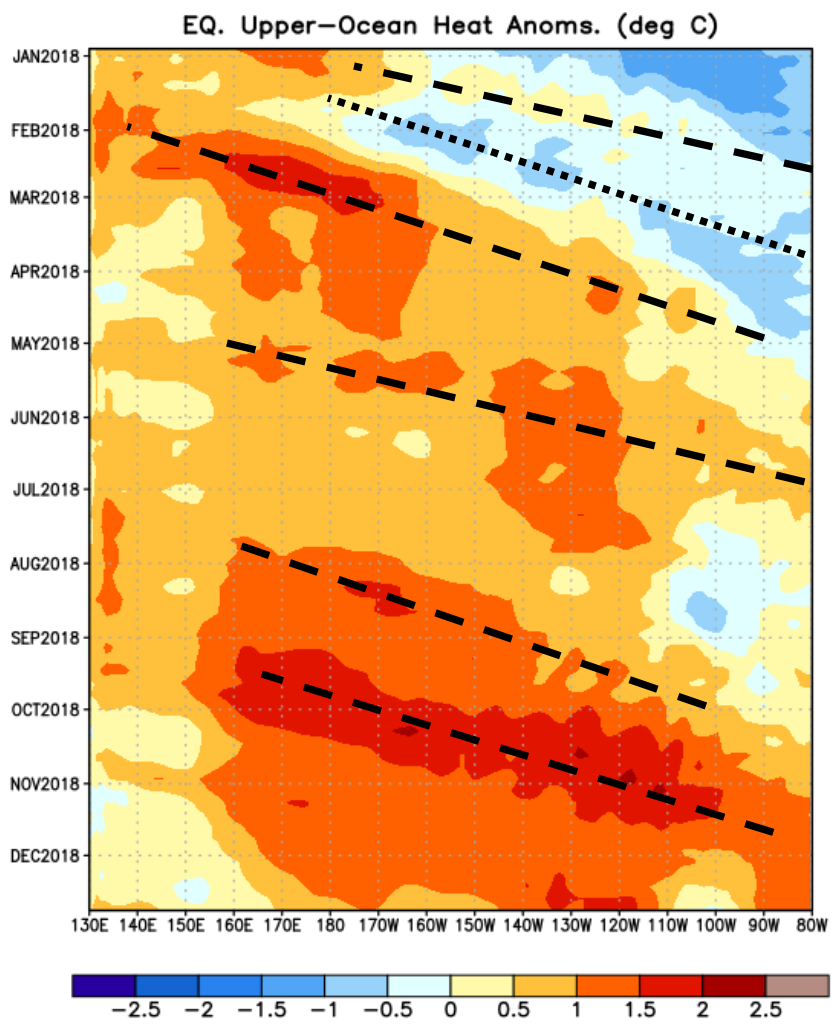
From December 2017- May 2018, successive Kelvin waves contributed to the eastward shift of positive and negative subsurface temperature anomalies.

During July-August 2018, positive subsurface temperature anomalies weakened in the eastern Pacific.

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

In the last couple weeks, positive subsurface anomalies weakened across most of the Pacific (strengthened near 120°-130°W).

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.

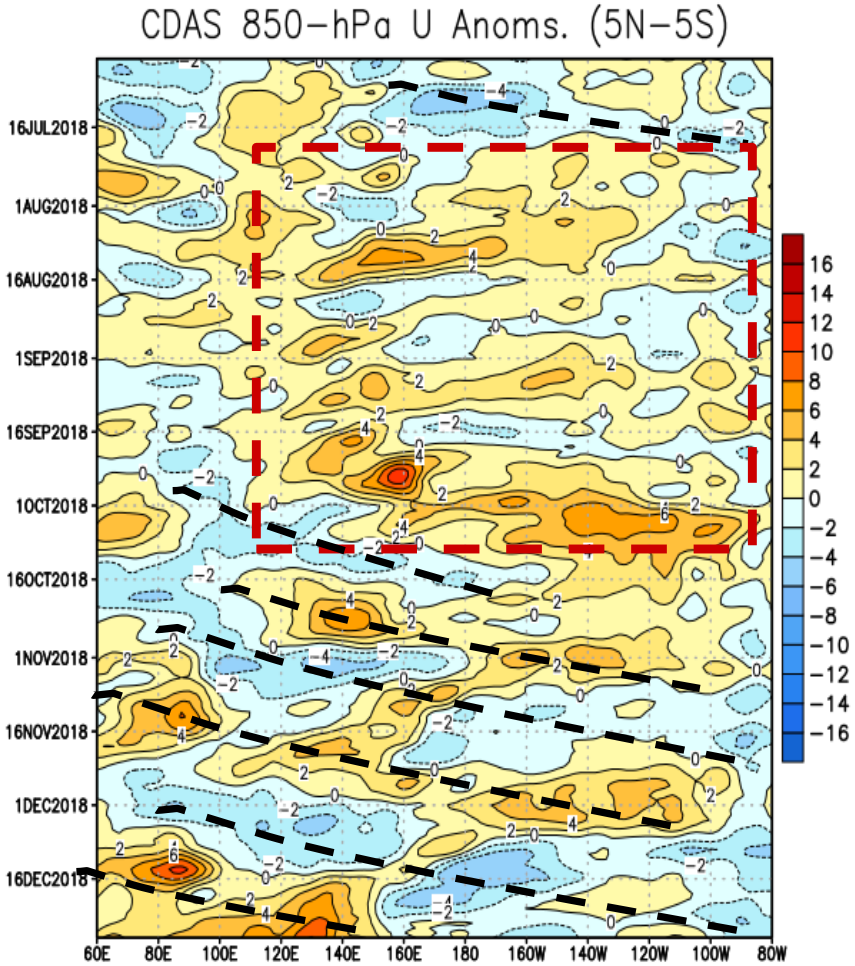


Low-level (850-hPa) Zonal (east-west) Wind Anomalies (m s^{-1})

At times, the Madden Julian Oscillation (MJO) 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 westerly wind anomalies dominating the western equatorial Pacific more recently.

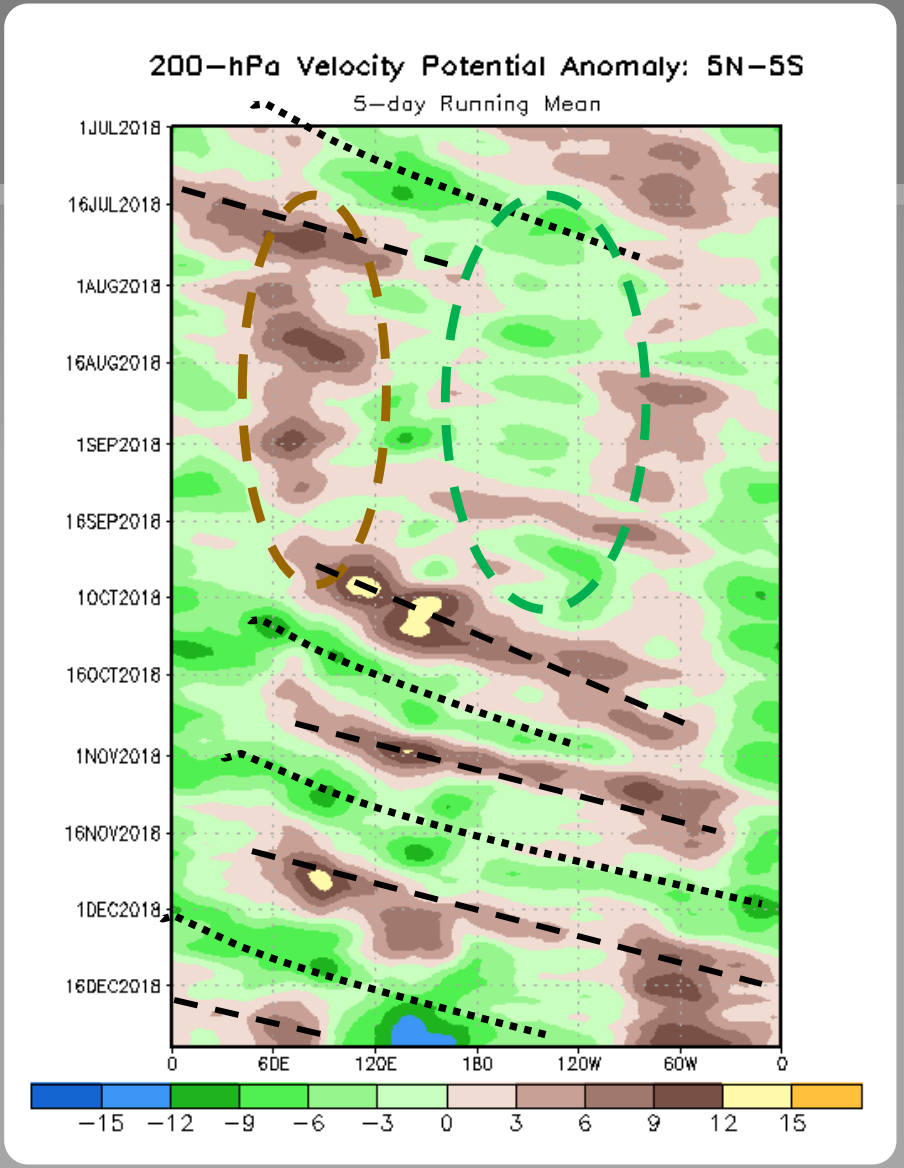


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

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

Since mid December 2018, anomalous upper-level divergence has persisted over the western and central Pacific.



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

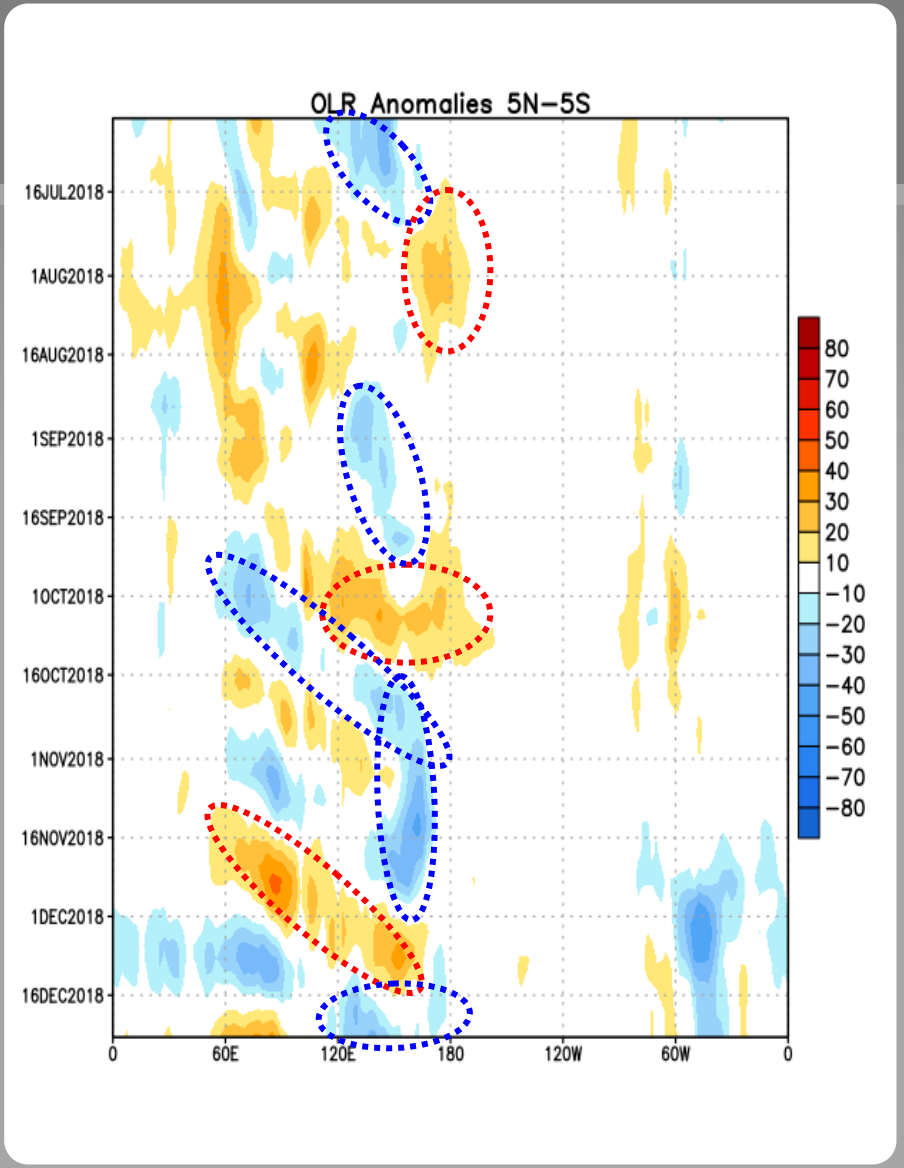
Note: Eastward propagation is not necessarily indicative of the Madden-Julian Oscillation (MJO).

Outgoing Longwave Radiation (OLR) Anomalies

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.

Recently, negative OLR anomalies have emerged near the western Pacific and 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°C.

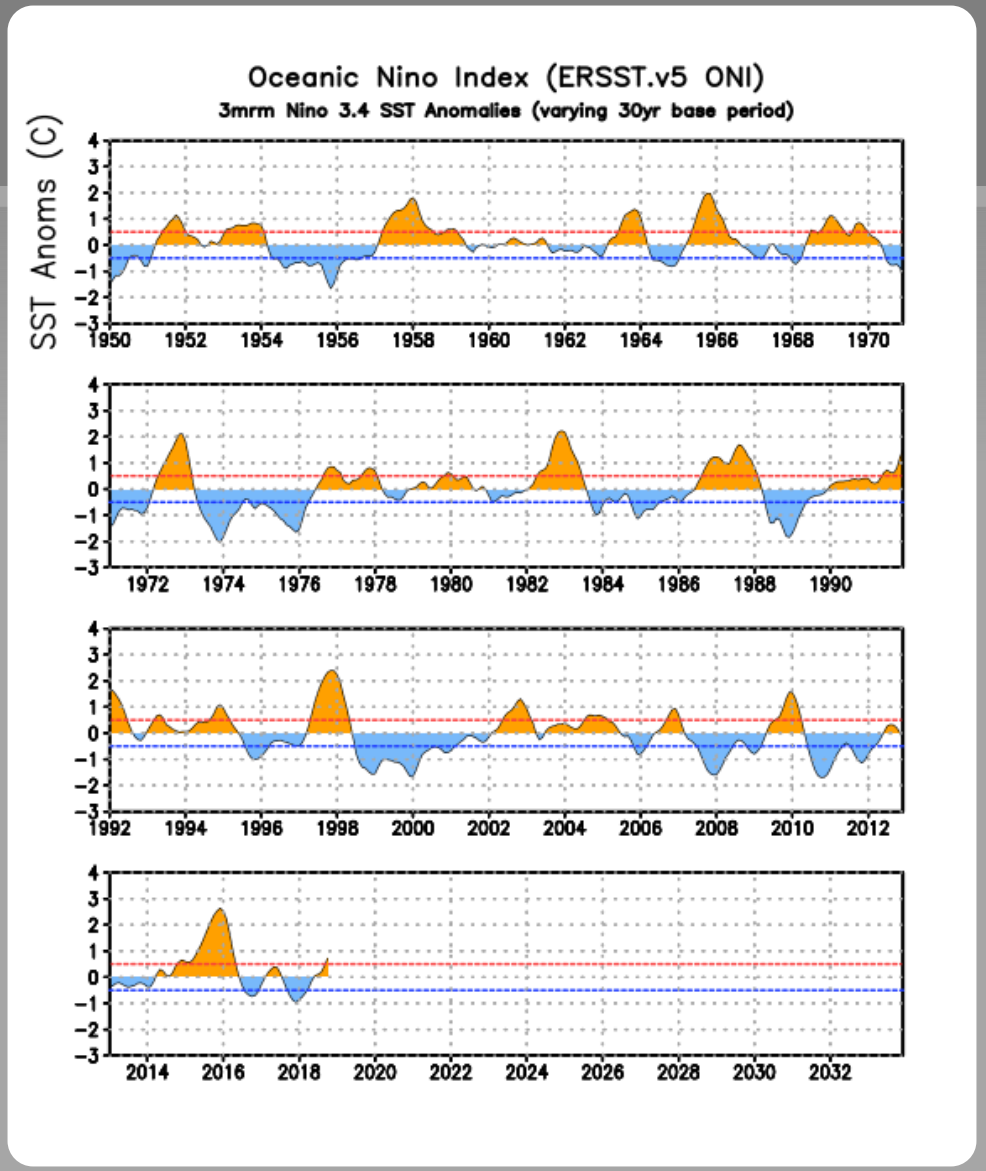
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (September - November 2018) is +0.7°C.



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.

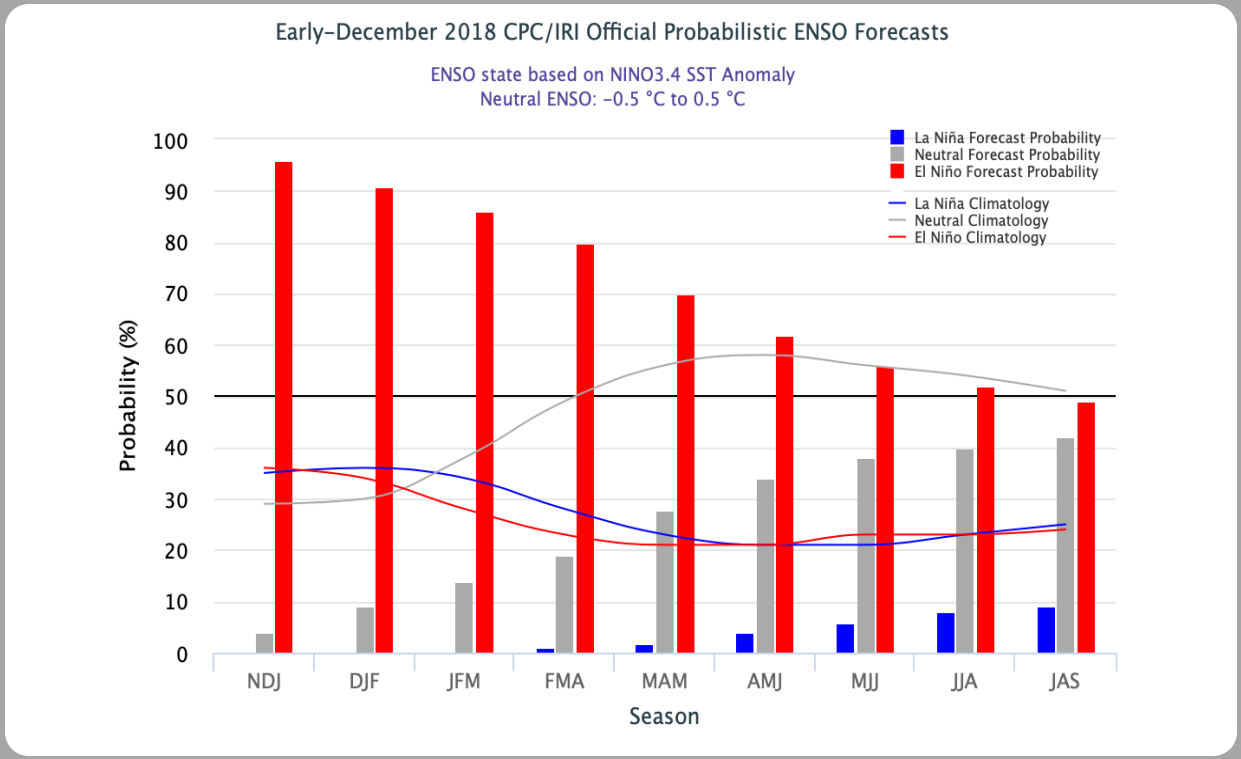
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

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: 13 December 2018

El Niño is expected to form and continue through the Northern Hemisphere winter 2018-19 (~90% chance) and through spring (~60% chance).



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The majority of models predict El Niño to develop and persist into Northern Hemisphere summer 2019.

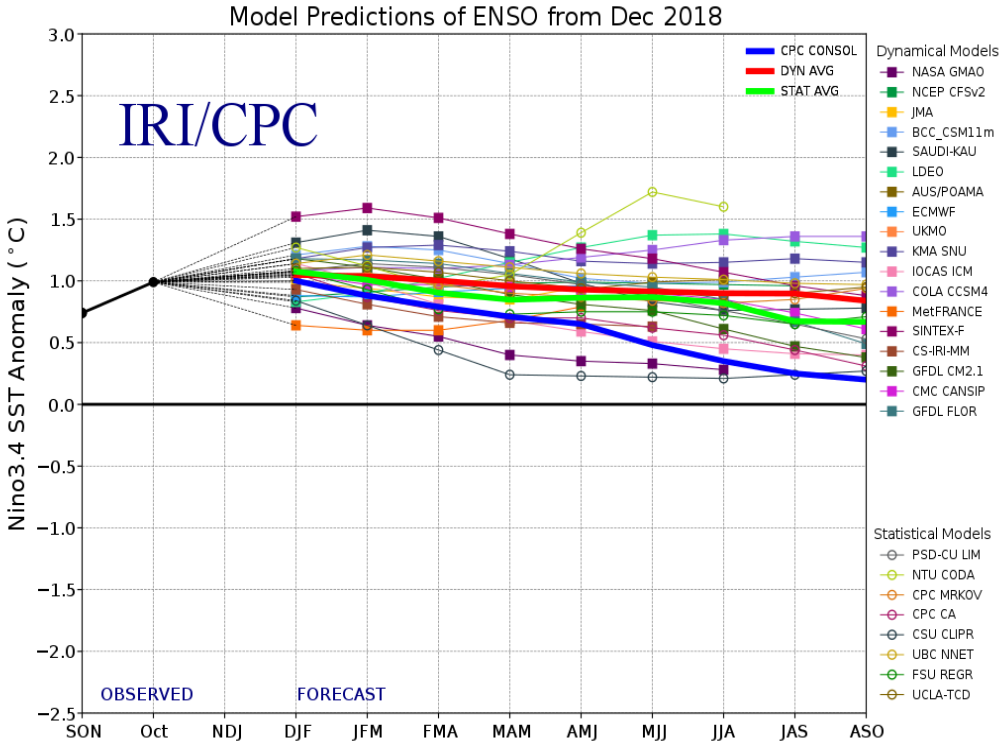
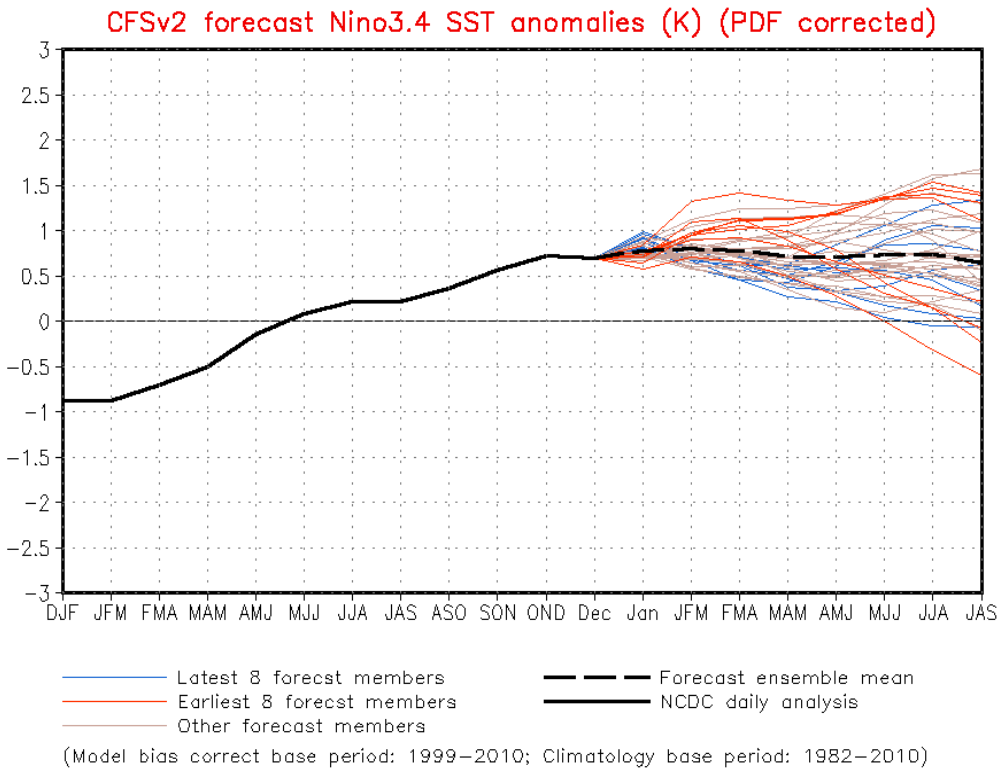


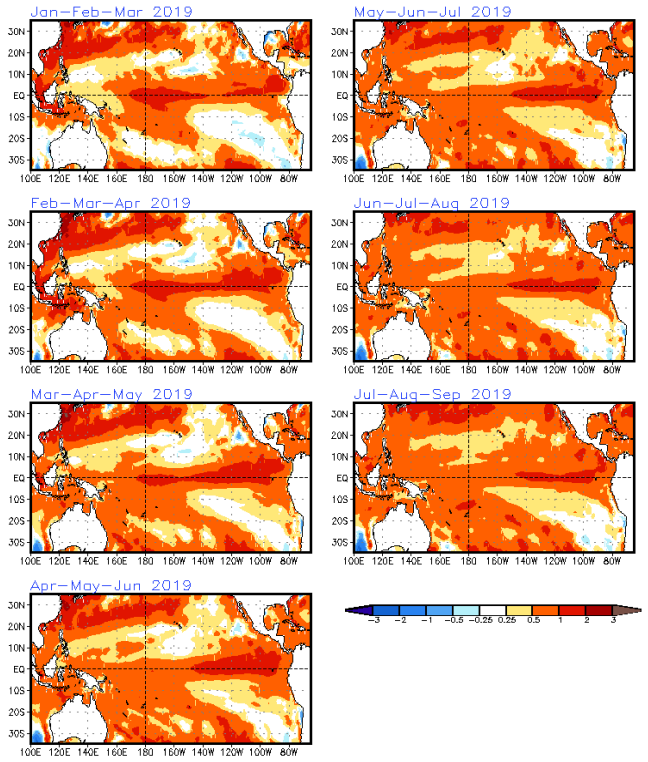
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 19 December 2018).

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

Issued: 31 December 2018

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



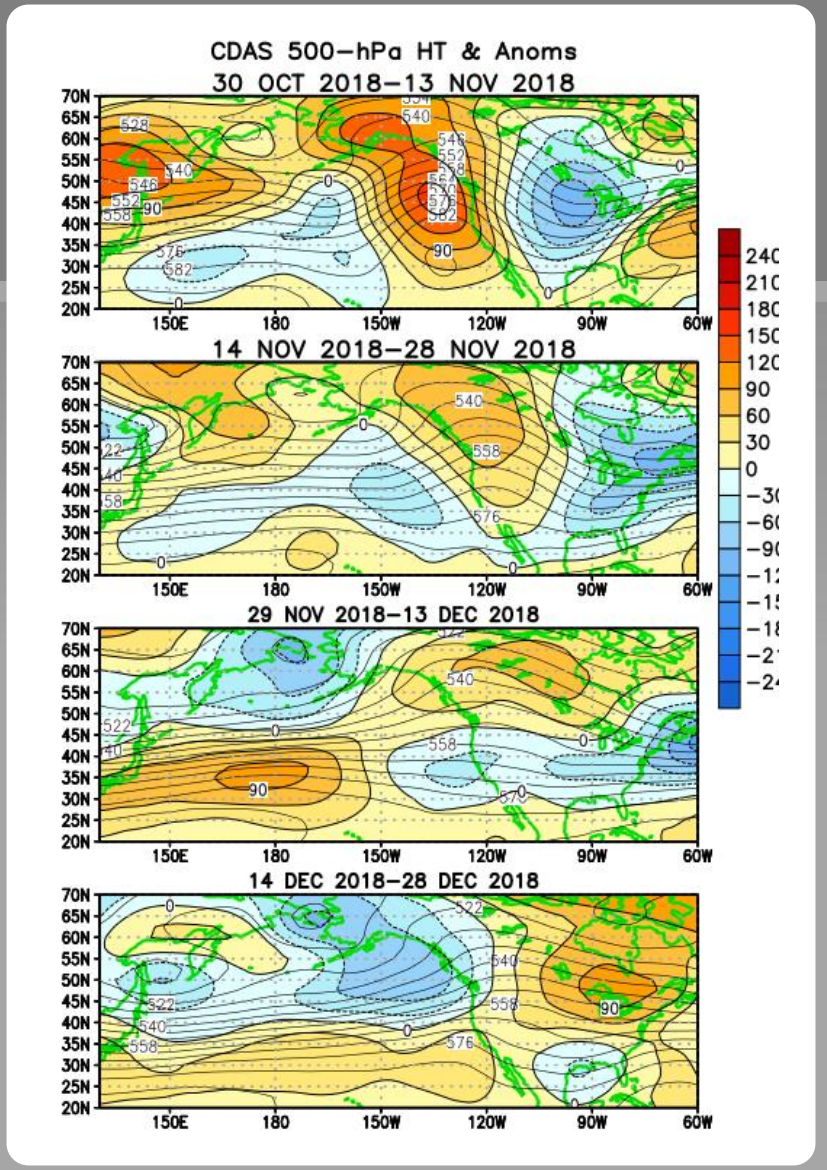


Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

From late October to late November, the pattern was mostly characterized by anomalous ridging (and above-average temperatures) over the western U.S. and anomalous troughing (and below-average temperatures) over the central and/or eastern U.S.

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

Since mid December, anomalous ridging over most of the contiguous U.S. has been associated with above-average temperatures.



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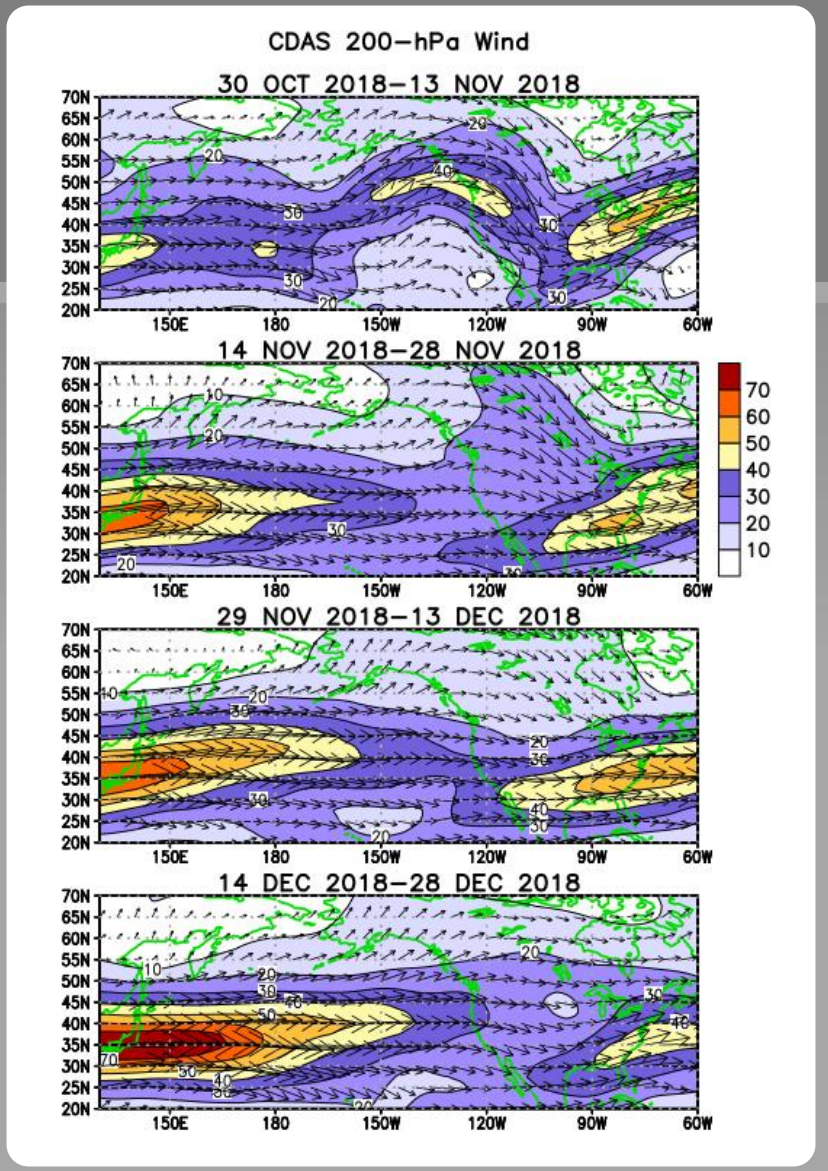

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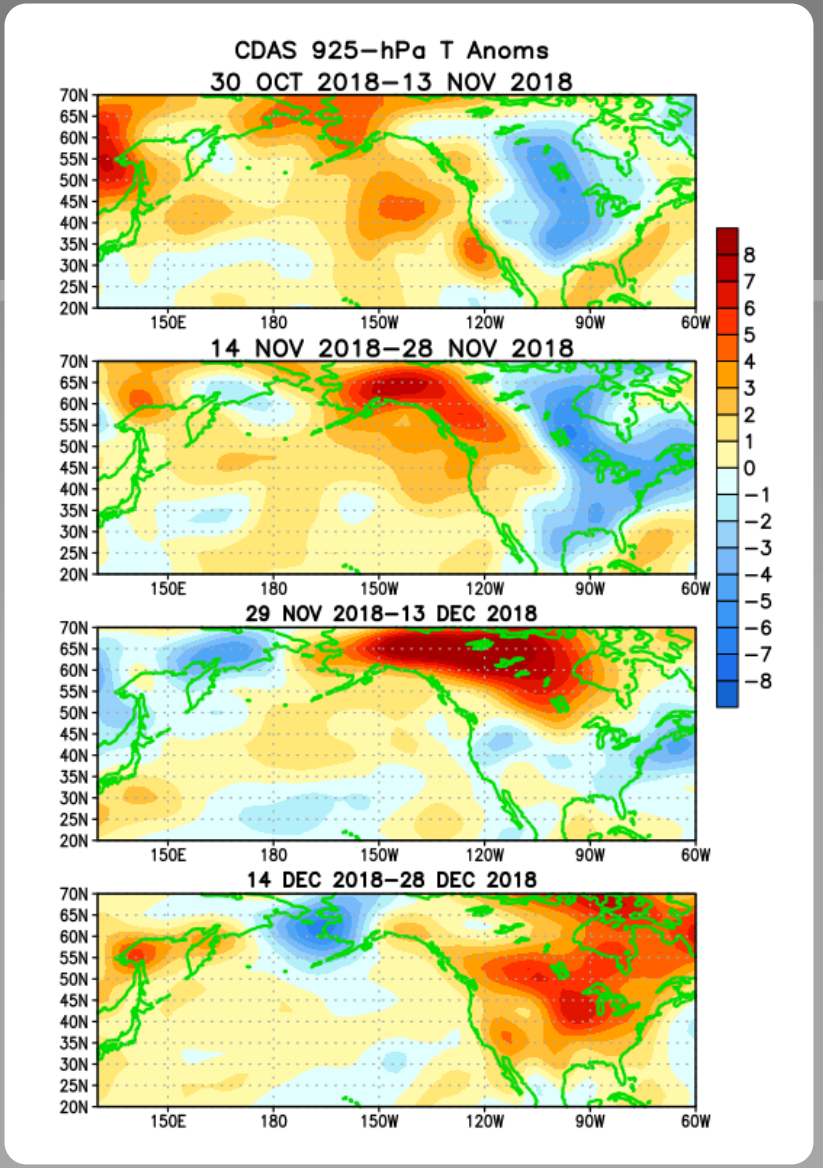
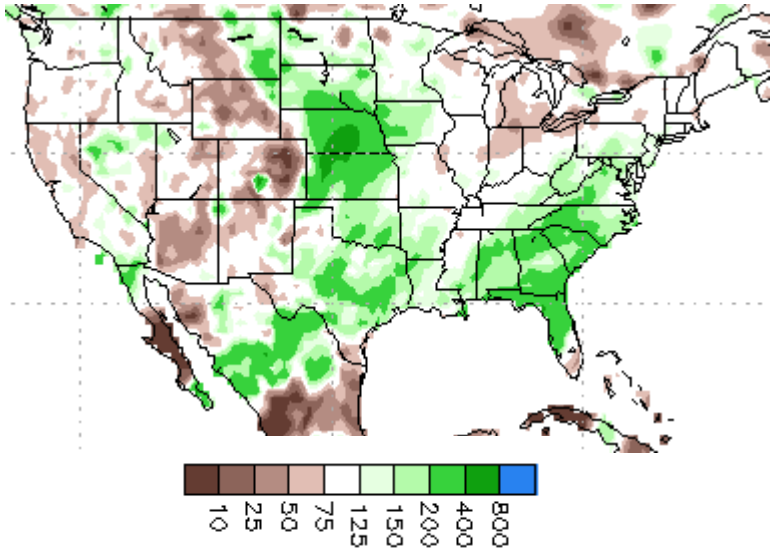


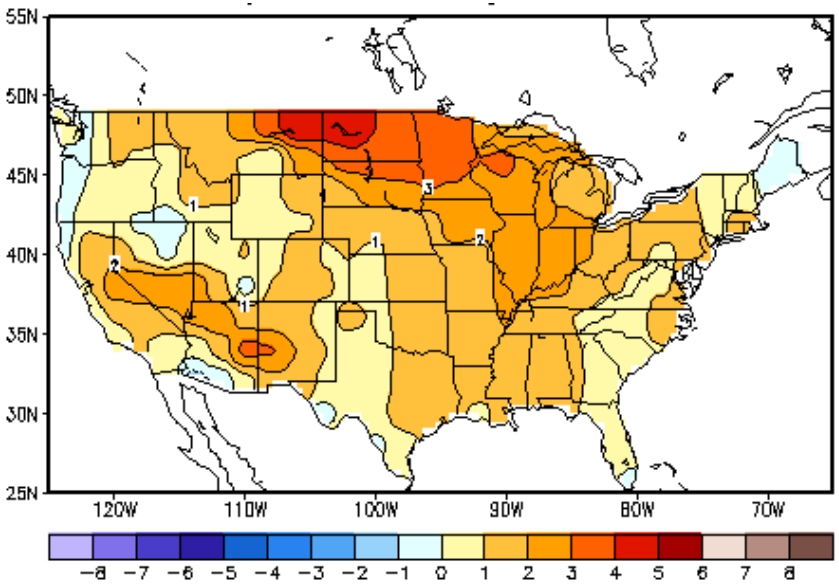
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 29 December 2018

Percent of Average Precipitation



Temperature Departures (degree C)



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

End Date: 29 December 2018

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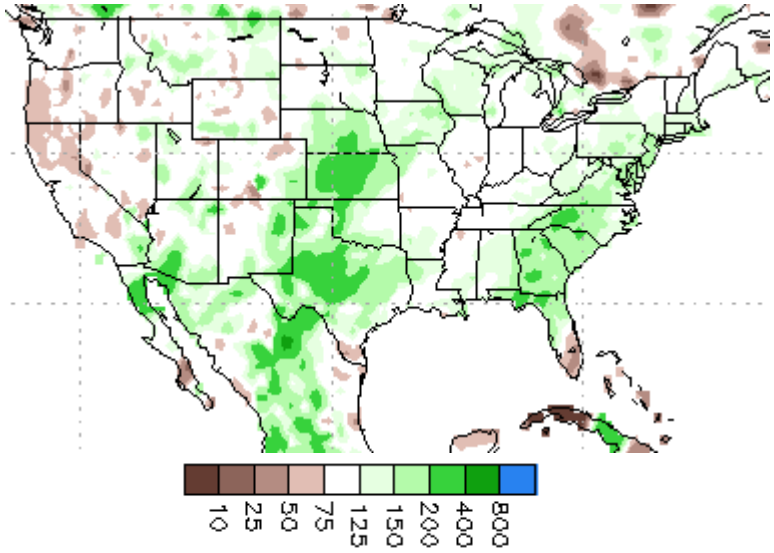
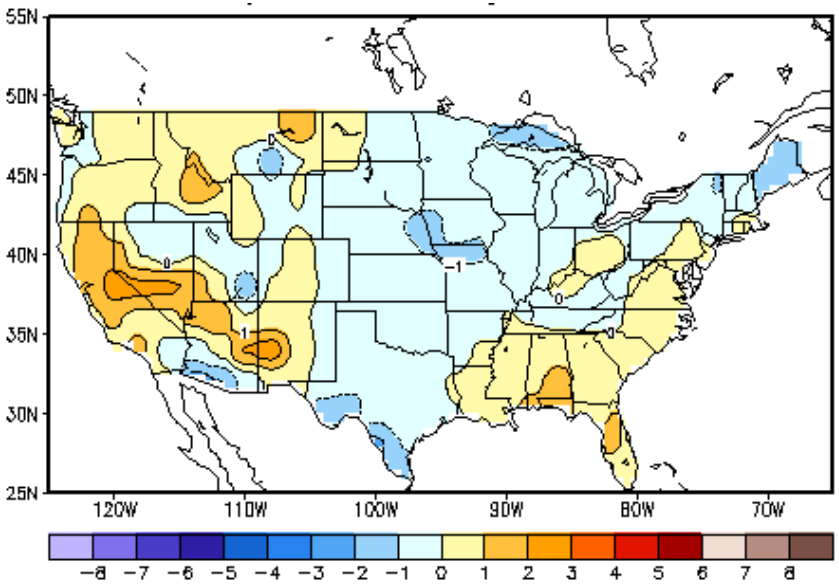


Temperature Departures (degree C)

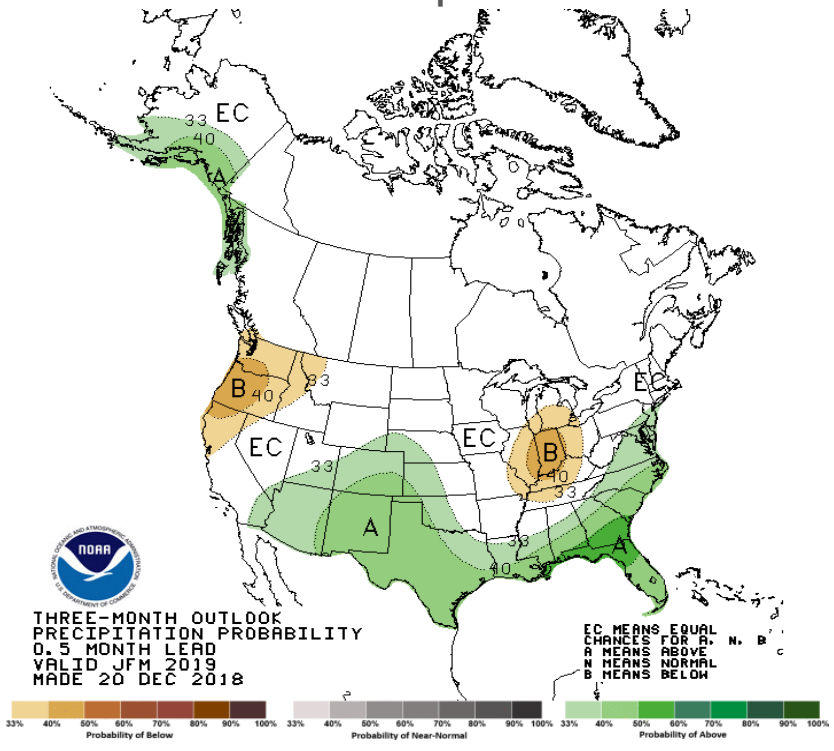


U. S. Seasonal Outlooks

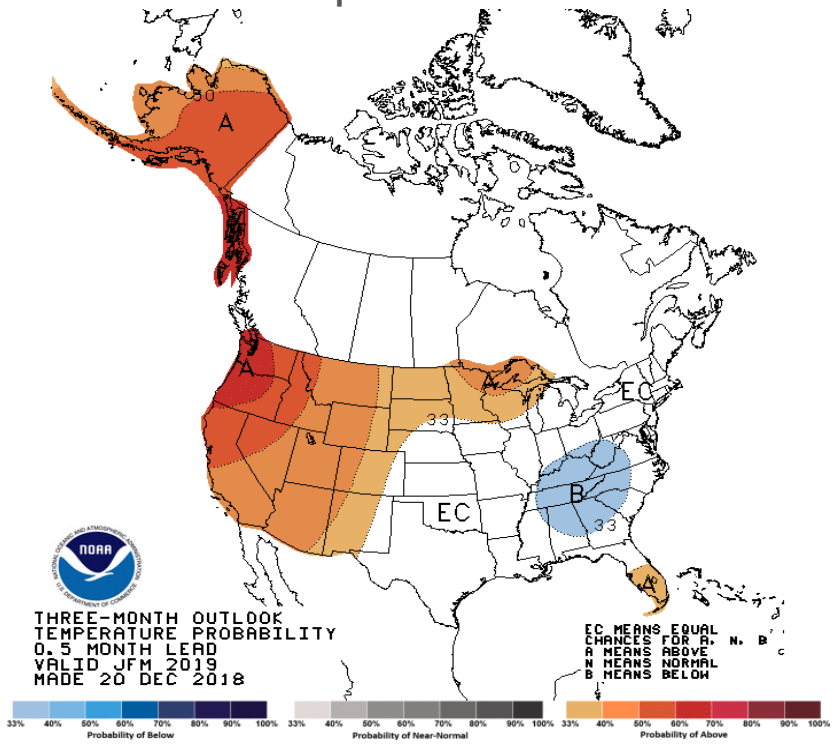
January - March 2019

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

Precipitation



Temperature



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