ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
5 July 2016

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Recent Evolution and Current Conditions

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ENSO Alert System Status: Final El Niño Advisory/ La Niña Watch

ENSO-neutral conditions are present.*

Equatorial sea surface temperatures (SST) are near or below average in the east-central and eastern equatorial Pacific Ocean.

La Niña is favored to develop during the Northern Hemisphere summer 2016, with about a 75% chance of La Niña during the fall and winter 2016-17.*

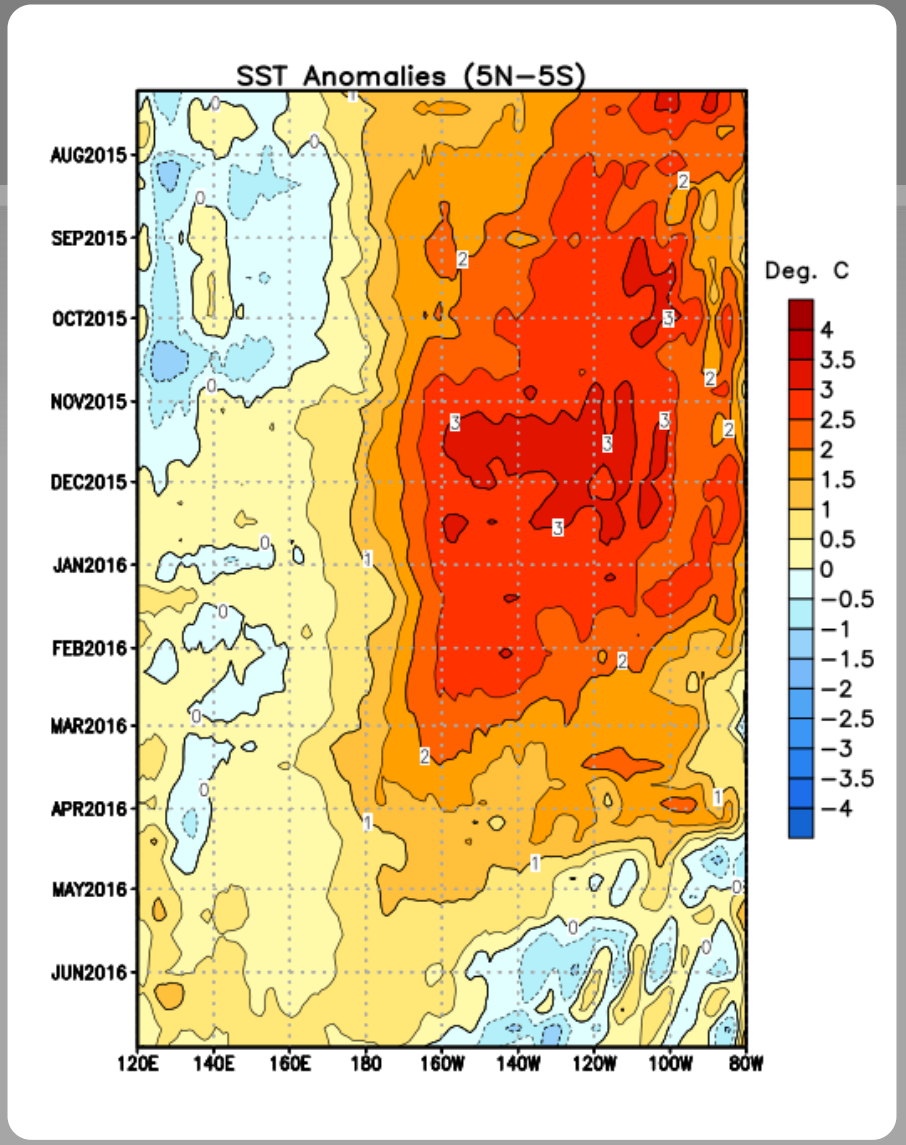
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (ºC)

From June 2015 through September 2015, the largest positive sea surface temperature (SST) anomalies shifted westward.

Since January 2016, SST anomalies have decreased in the eastern equatorial Pacific Ocean.

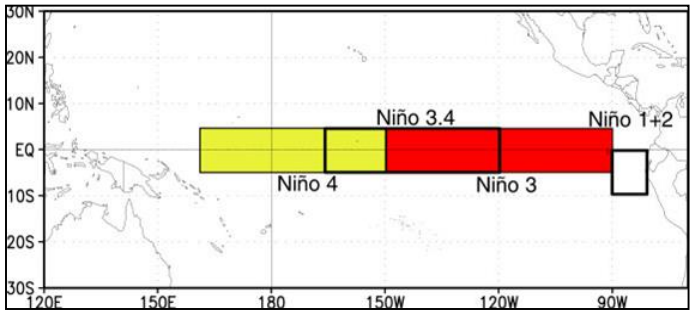
Since mid-April, near-to-below average SSTs are apparent in the eastern Pacific, while above-average SSTs remain near and west of the Date Line.

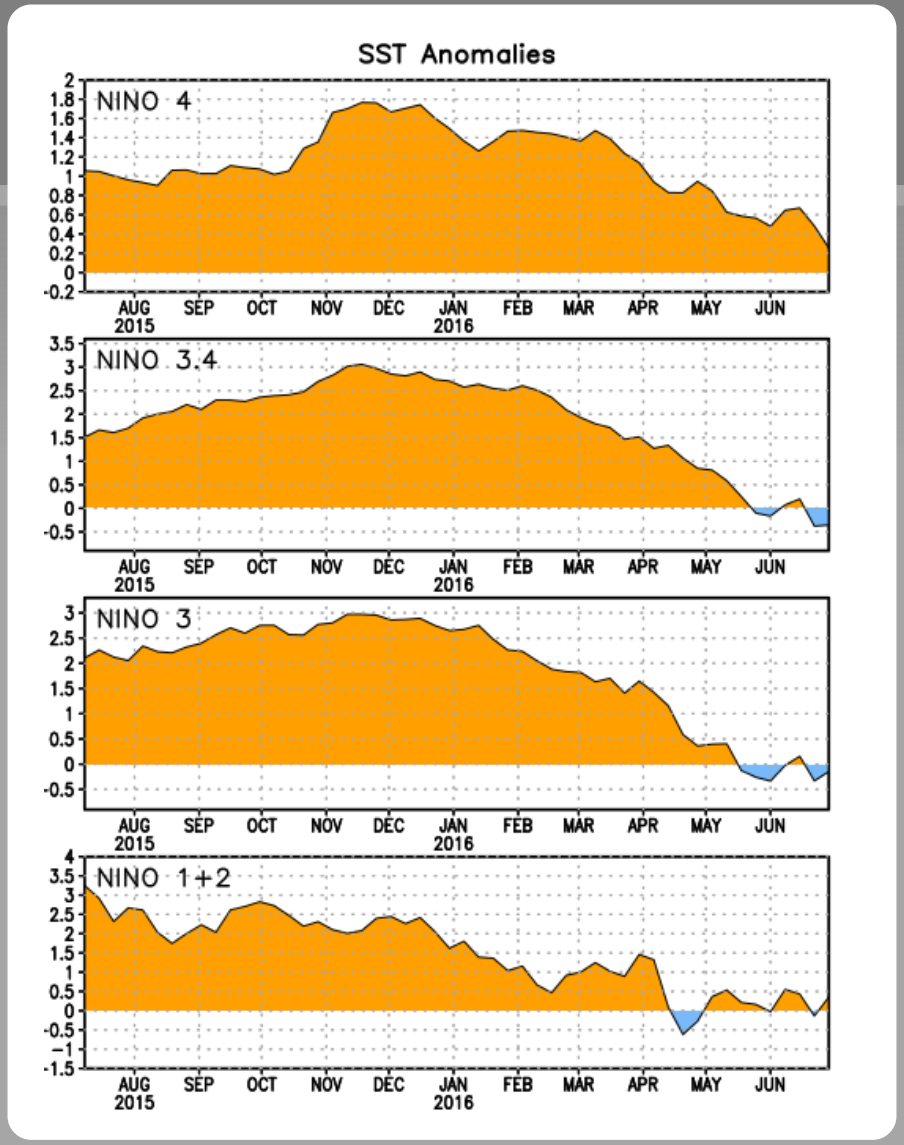


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

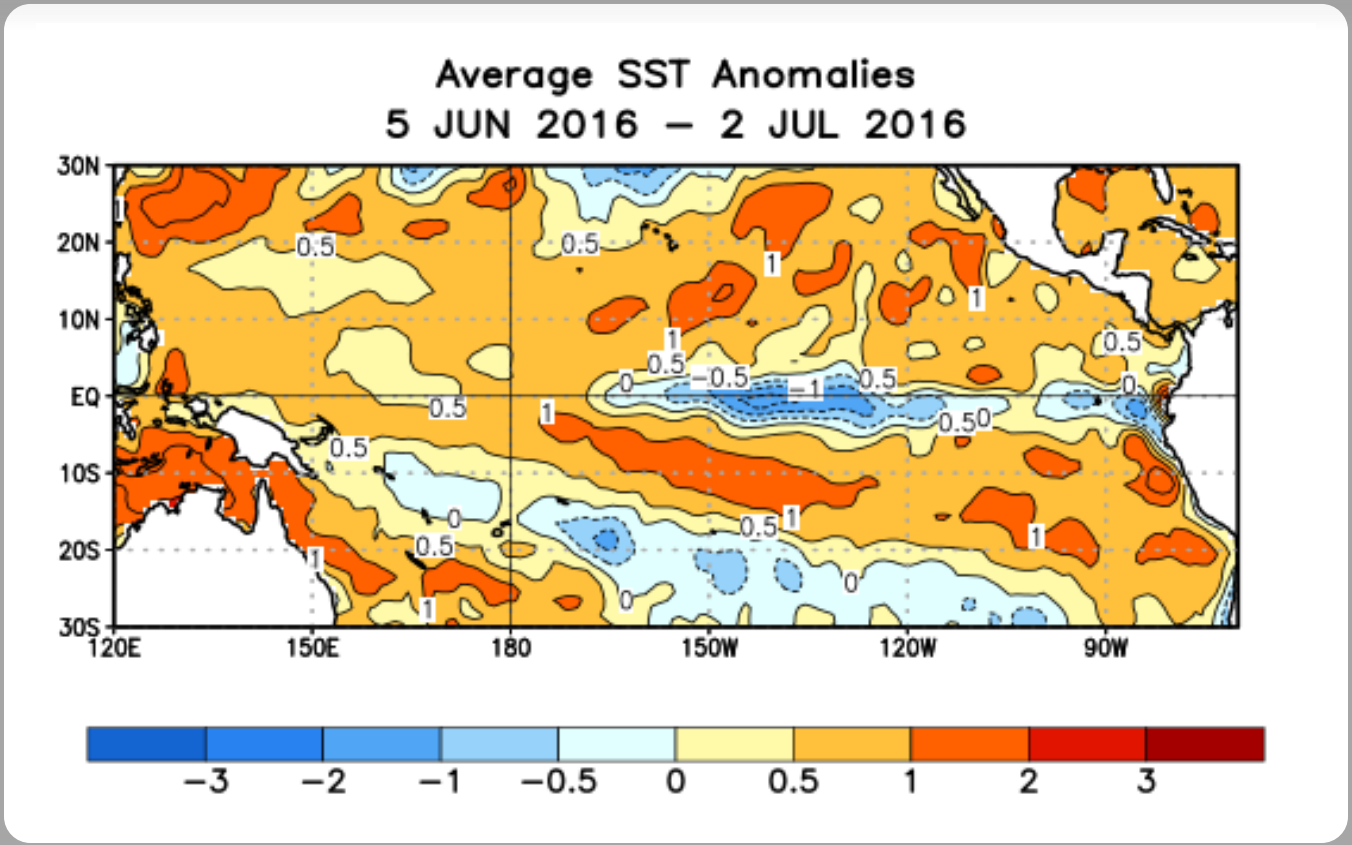
Niño 4	0.3ºC
Niño 3.4	-0.4ºC
Niño 3	-0.1ºC
Niño 1+2	0.4ºC





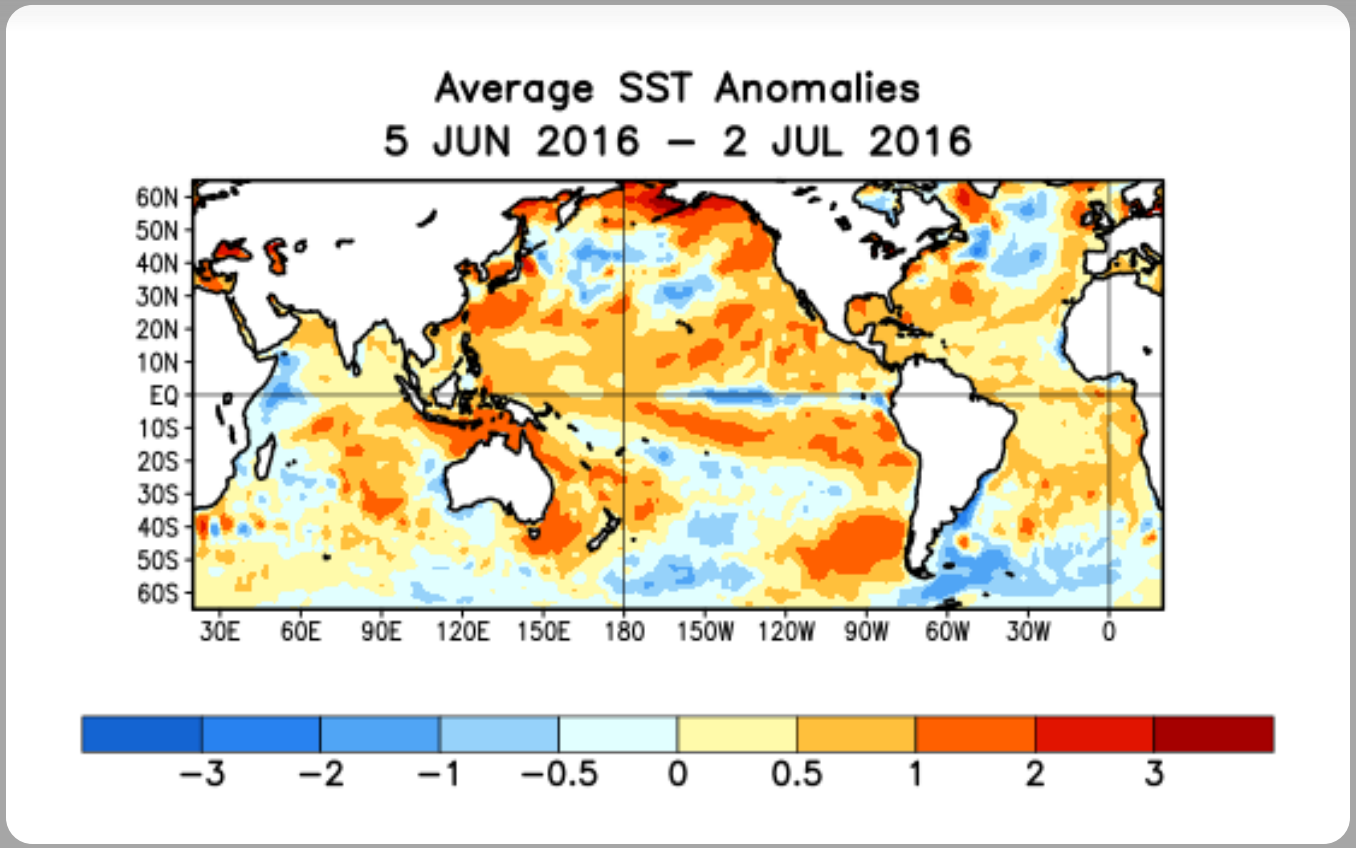
SST Departures (ºC) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, equatorial SSTs were above average near and west of the International Date Line, and near or below average across the east-central and eastern Pacific.



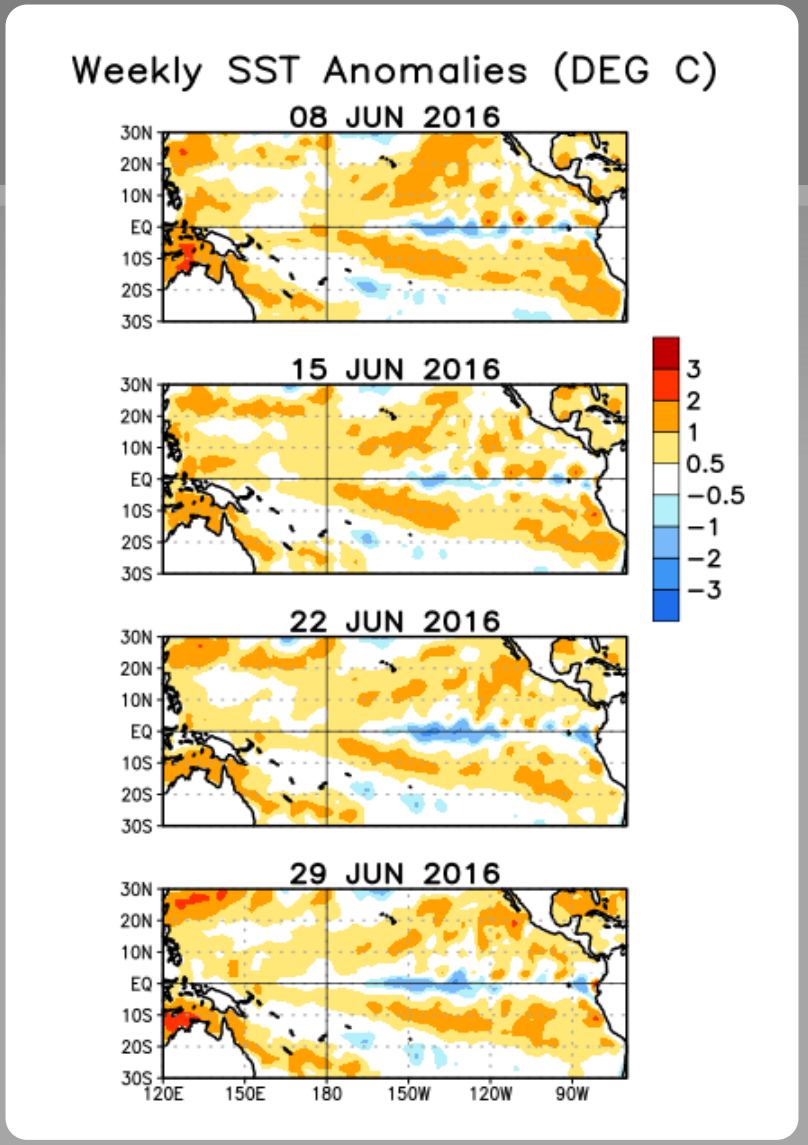
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, tropical SSTs were above average near the Date Line, the eastern Indian Ocean, and the Atlantic. Equatorial SSTs were near or below average in the east-central and eastern Pacific Ocean and the western Indian Ocean.



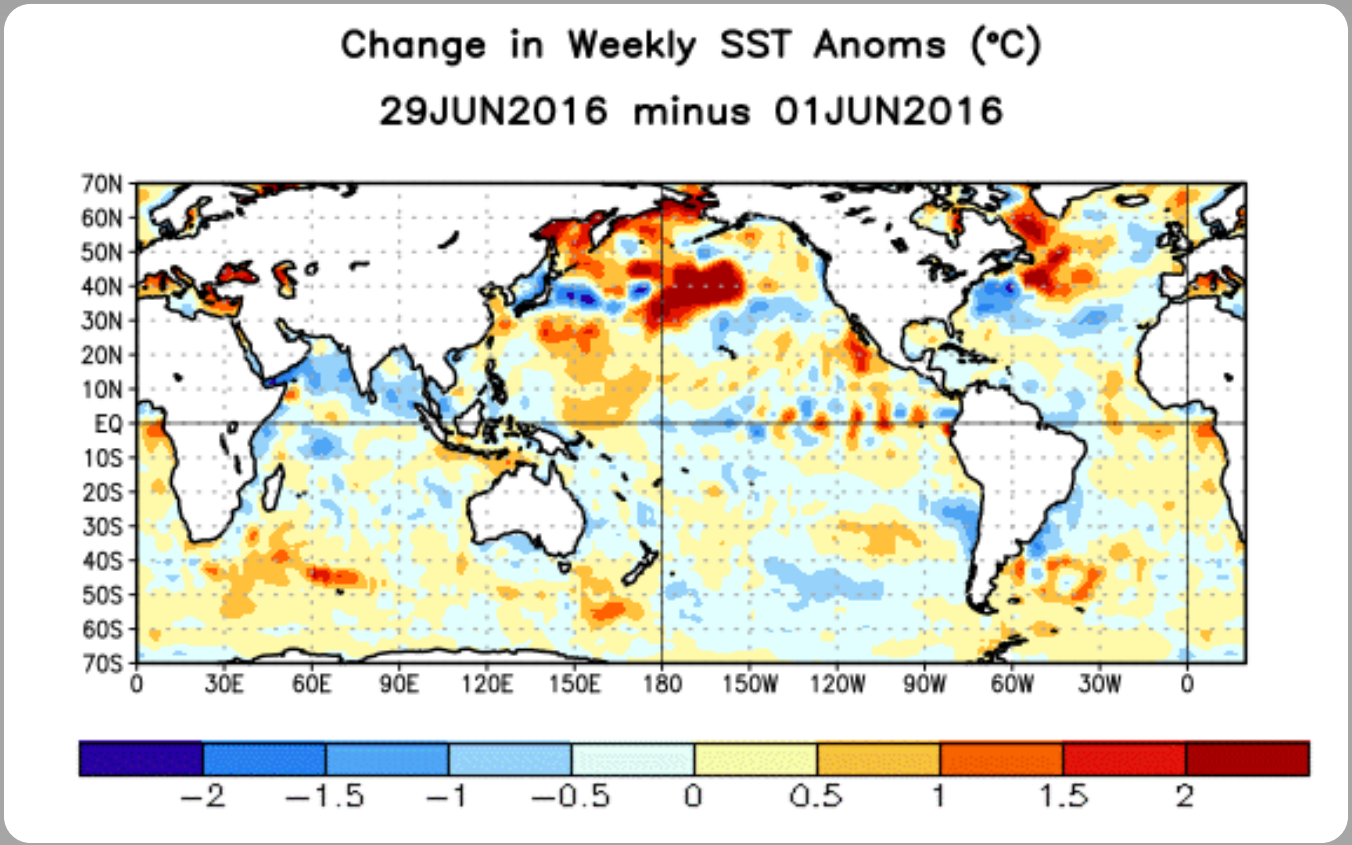
Weekly SST Departures during the Last Four Weeks

During the last four weeks, positive SST anomalies persisted in the western Pacific and weakened in the central Pacific, while the extent of negative anomalies fluctuated in the eastern Pacific.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, equatorial SST anomalies increased in the western Pacific and decreased in the central Pacific. Small regions of increases and decreases were observed in the eastern Pacific.



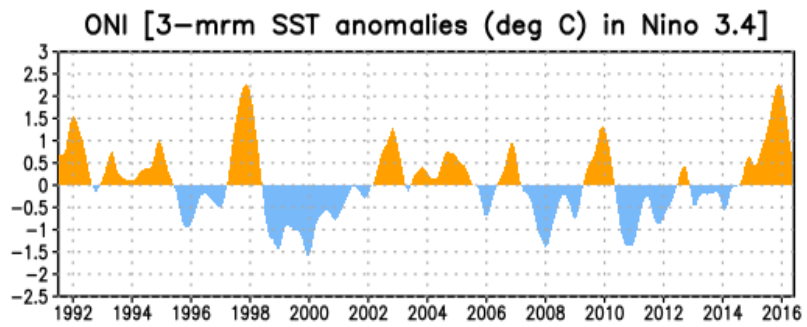
Upper-Ocean Conditions in the Equatorial Pacific

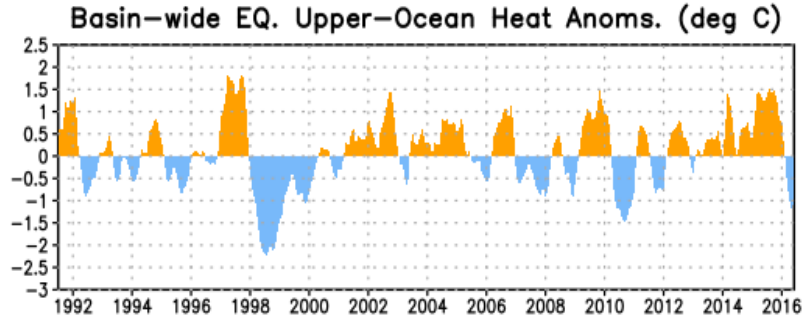
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

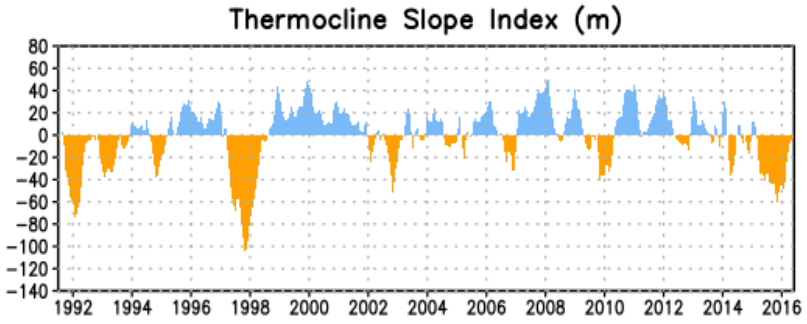
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (negative) and thermocline slope index (near zero) reflect ENSO-neutral 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).

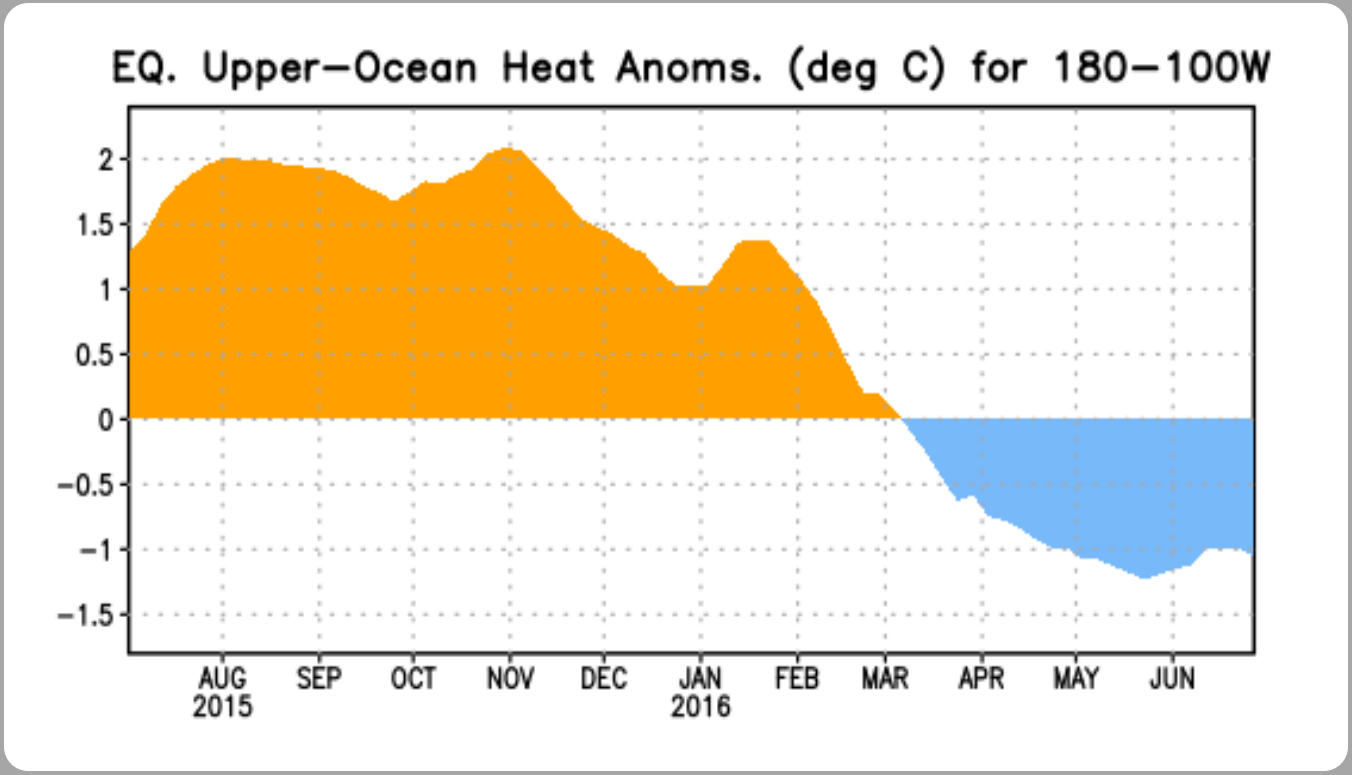






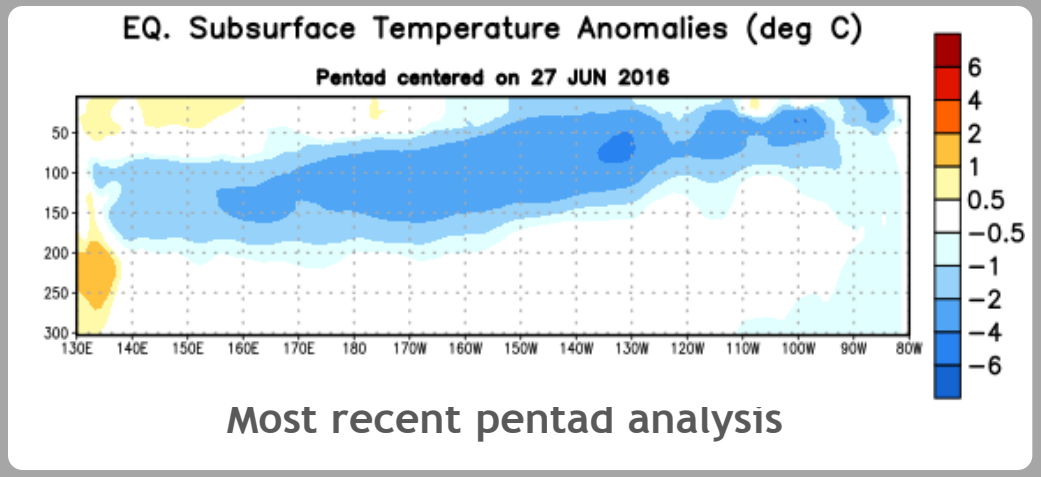
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

Positive anomalies decreased during November and December, increased during the first half of January 2016, and then decreased significantly from late January through early May with negative values evident since early March. Since late May, the negative anomalies have weakened slightly.



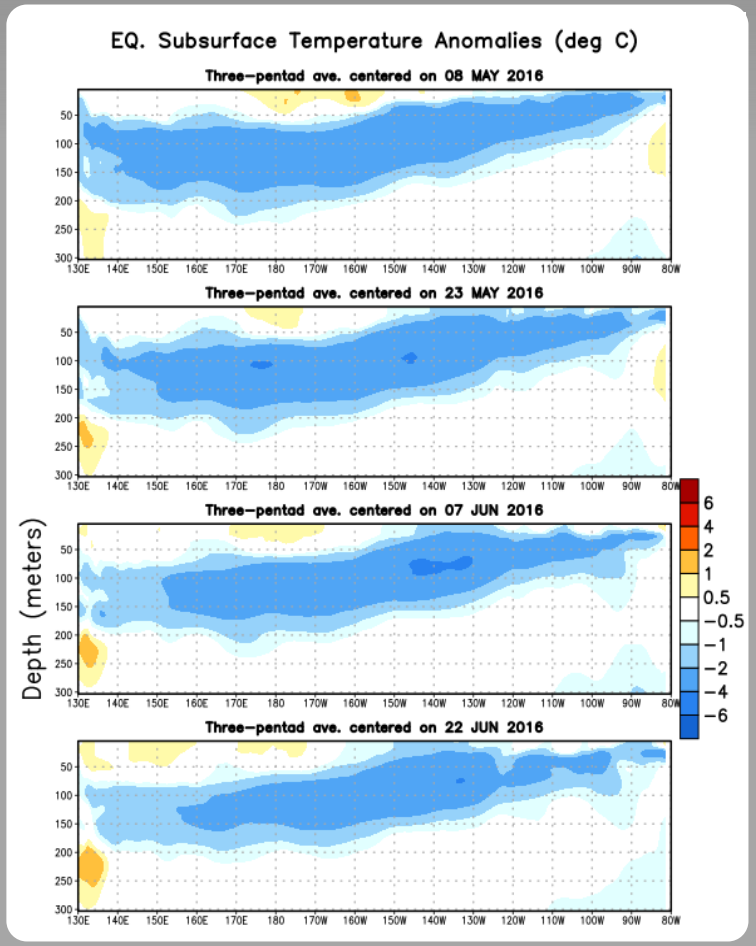
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, below-average subsurface temperature anomalies were evident across the equatorial Pacific, extending to the surface in the east-central and eastern Pacific.



Most recent pentad analysis

Recently, the below-average temperatures have weakened slightly near the surface in the eastern Pacific.

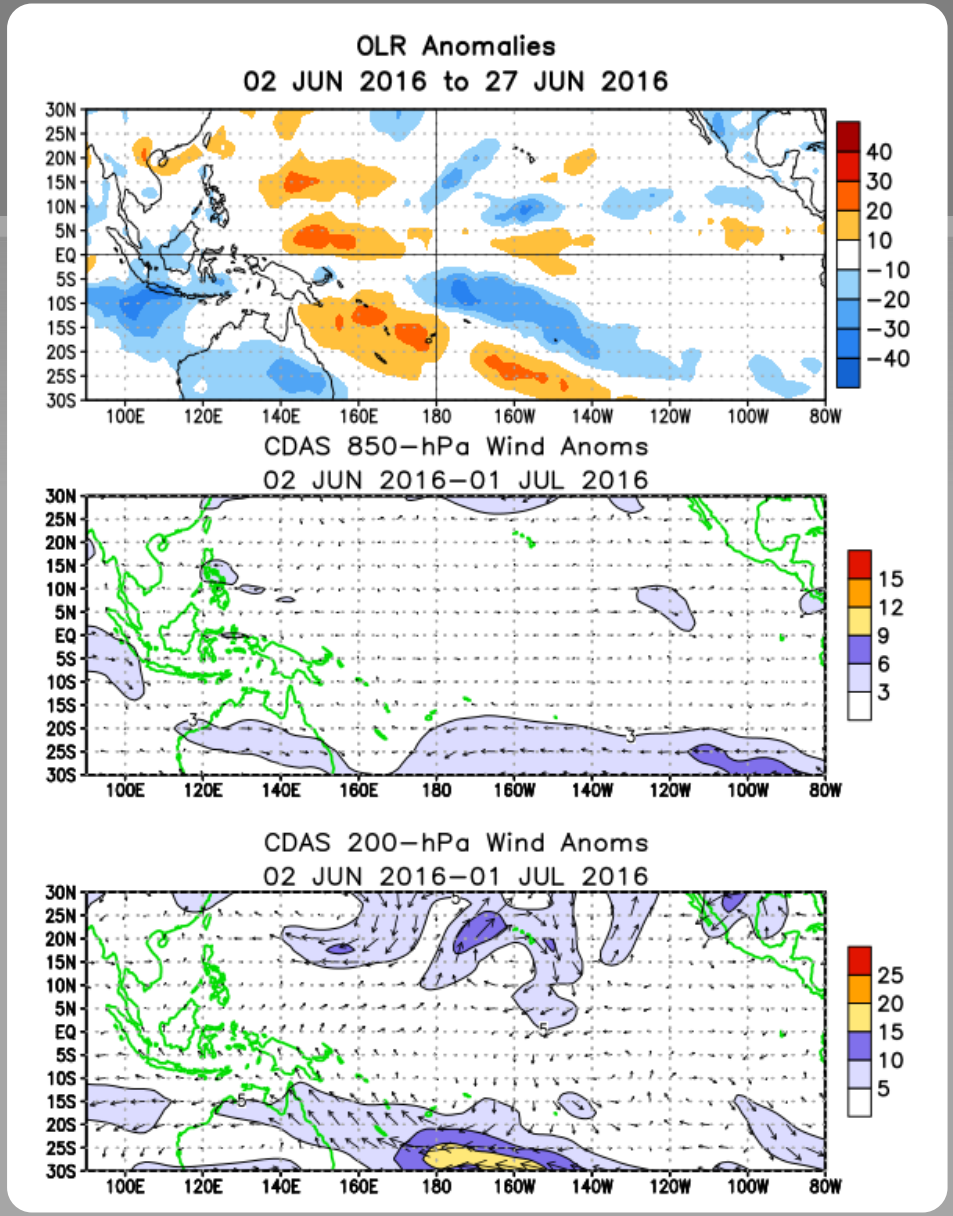


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident just south of the equator near the International Date Line and over western Indonesia. Regions of positive OLR anomalies (suppressed convection and precipitation) were observed over the western tropical Pacific.

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

Upper-level (200-hPa) winds were near average across 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.

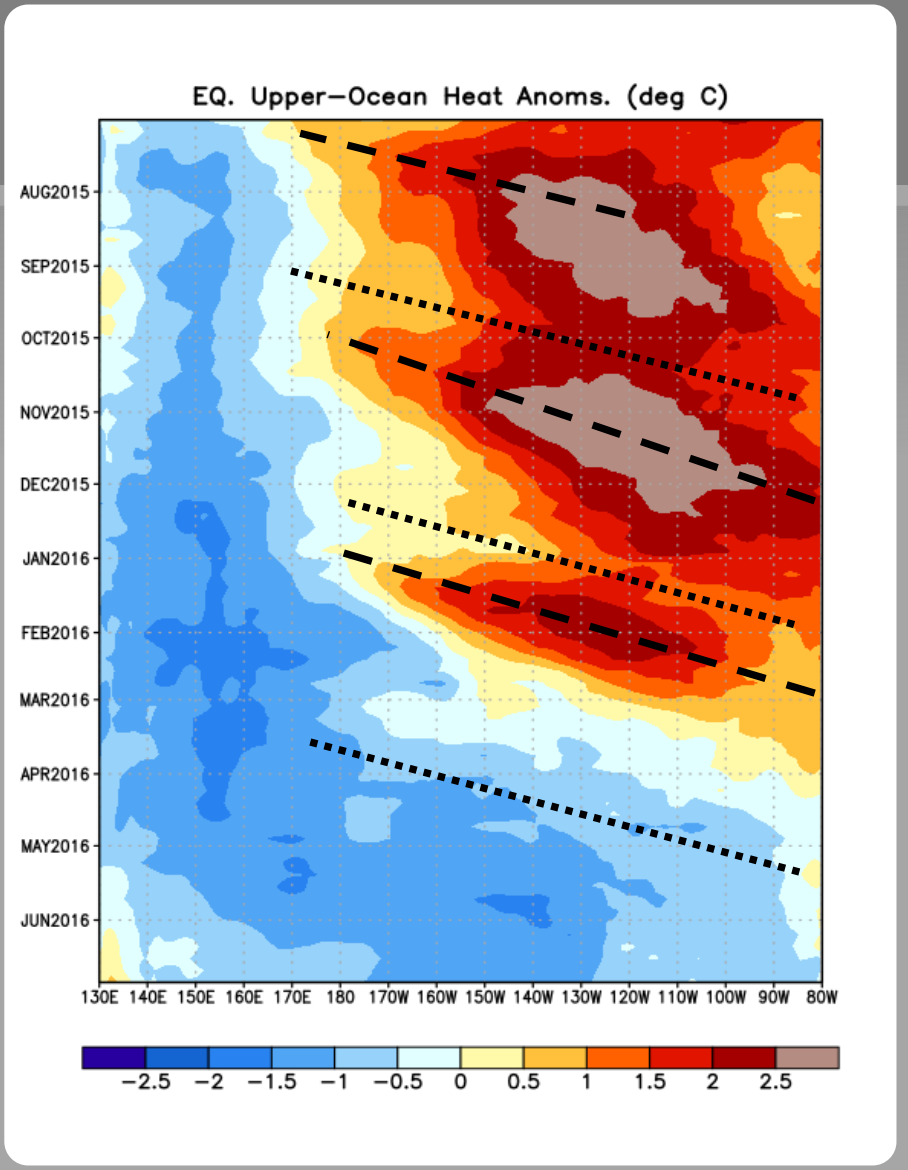
Related to this activity:

Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

Downwelling phases of equatorial oceanic Kelvin waves were observed in July-August, October to November, and January-February 2016.

Since the passage of an upwelling equatorial oceanic Kelvin wave in March 2016, below-average subsurface temperatures have persisted across much of the equatorial Pacific.



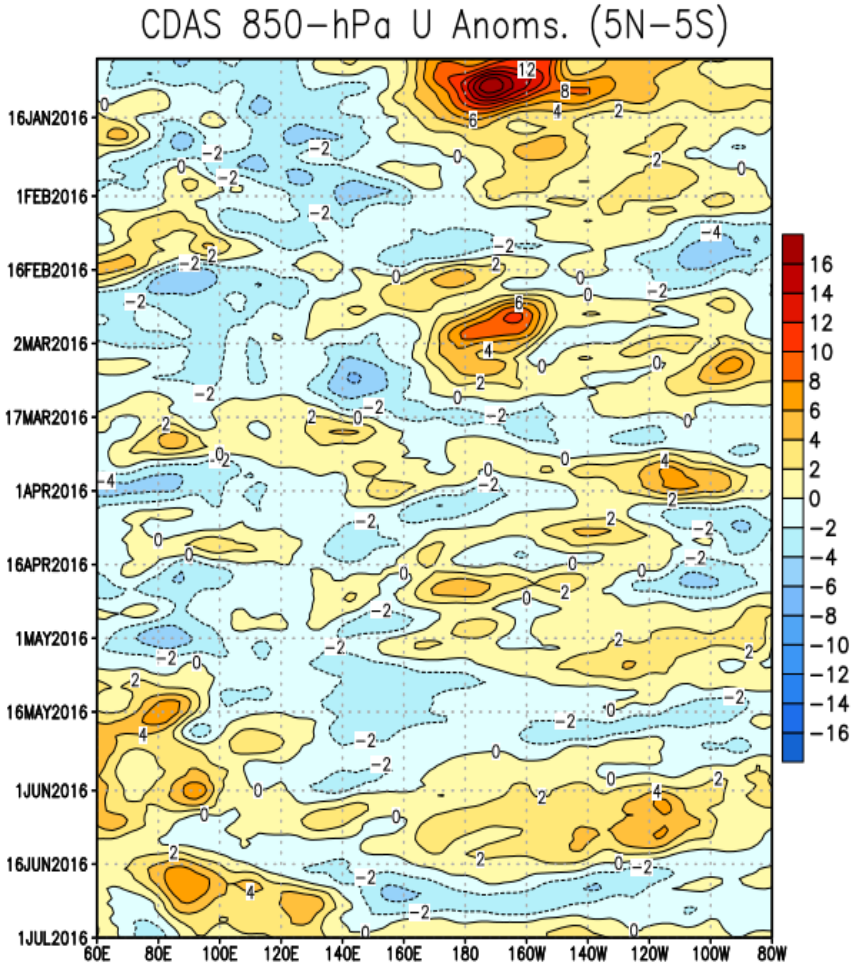
Equatorial oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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

During early January and late February 2016, westerly wind bursts were observed between 140°E and 140°W.

Since February, the equatorial Pacific has been characterized by weak anomalous westerlies and easterlies.

In the last week, westerly wind anomalies were evident across most of the equatorial Pacific.

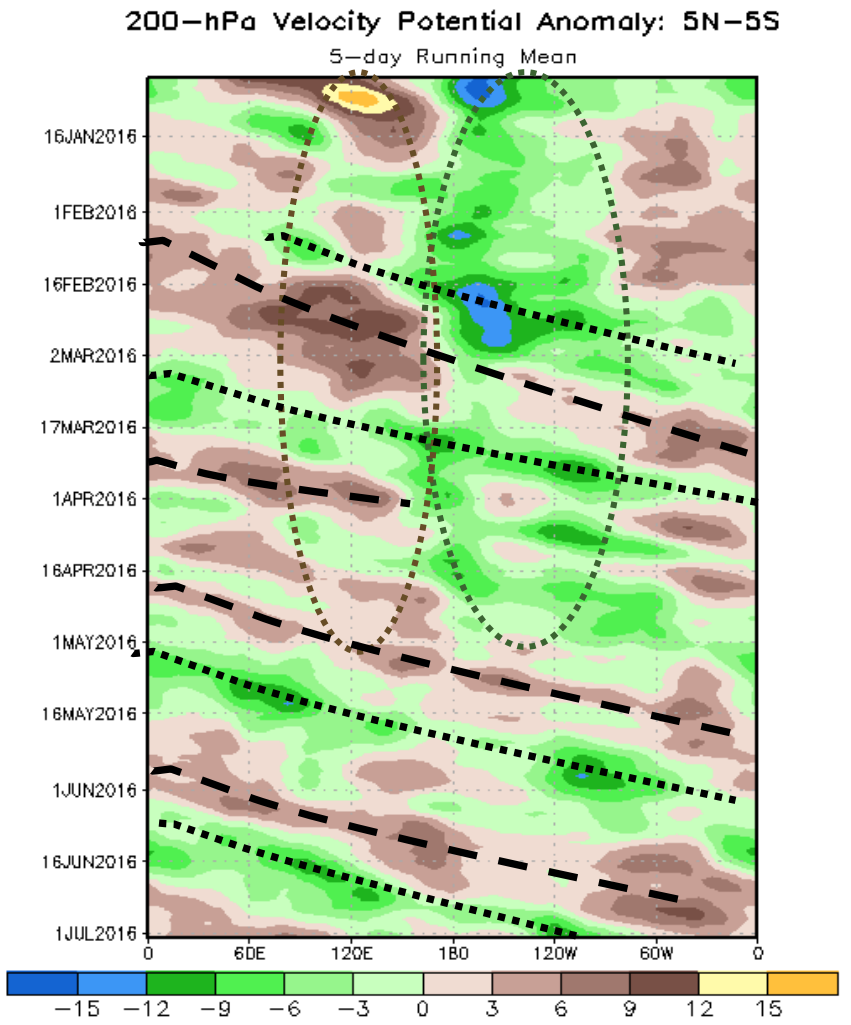


Westerly Wind Anomalies (orange/red shading)
Easterly Wind Anomalies (blue shading)

Upper-level (200-hPa) Velocity Potential Anomalies

Through April 2016, anomalous upper-level divergence (green shading) and convergence (brown shading) generally persisted over the central/eastern Pacific and Indonesia, respectively.

Sub-seasonal or Madden-Julian Oscillation (MJO) activity contributed to an eastward propagation of regions of upper-level divergence and convergence during February-March and from mid April through June.

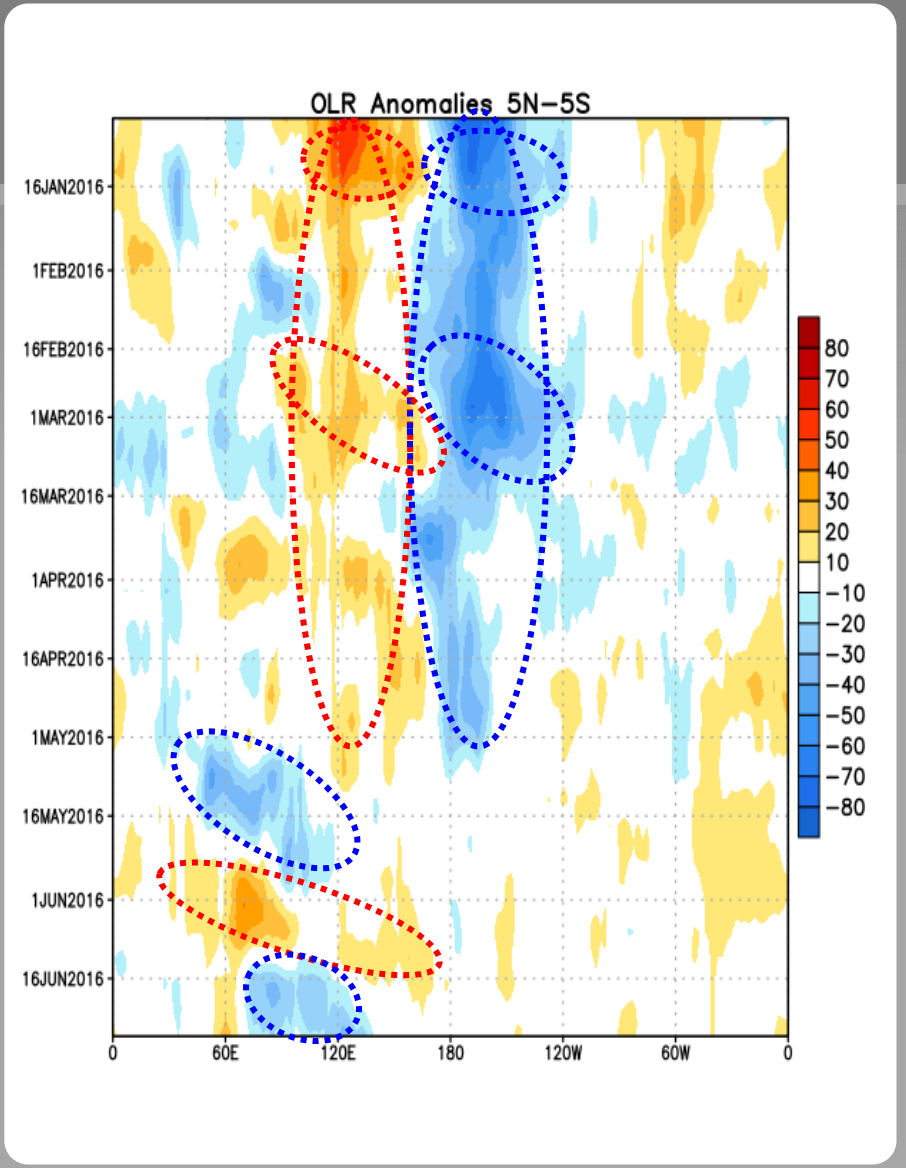


Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)

Outgoing Longwave Radiation (OLR) Anomalies

Through April, negative OLR anomalies were observed over the central Pacific, and positive anomalies persisted near Indonesia or the western Pacific.

Currently, negative OLR anomalies predominate over the eastern Indian Ocean and western Indonesia.



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.v4). The SST reconstruction methodology is described in Huang et al., 2015, J. Climate, vol. 28, 911-930.)

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.

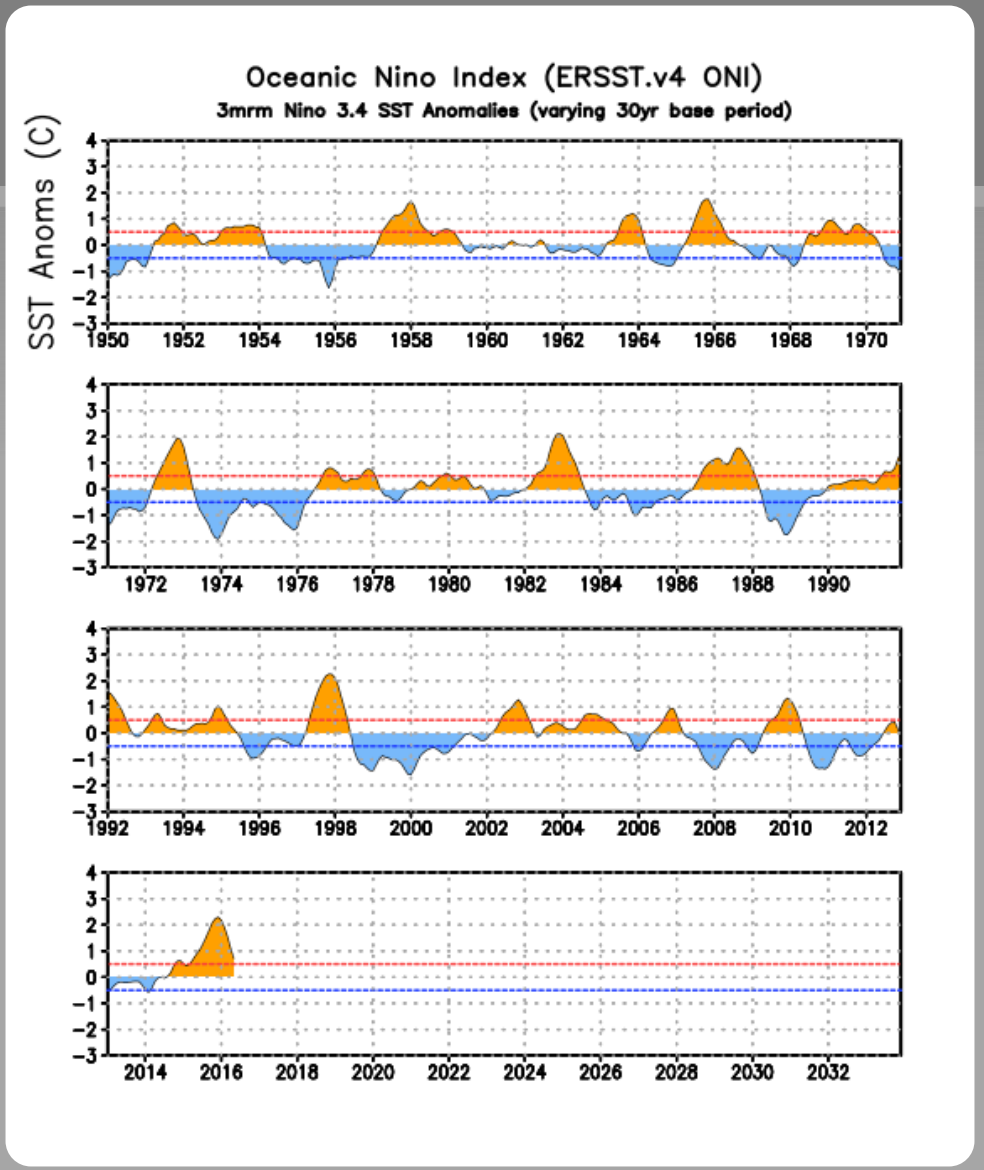
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (April-June 2016) is 0.7°C.



Historical El Niño and La Niña Episodes Based on the ONI computed using ERSST.v4

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.v4 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.

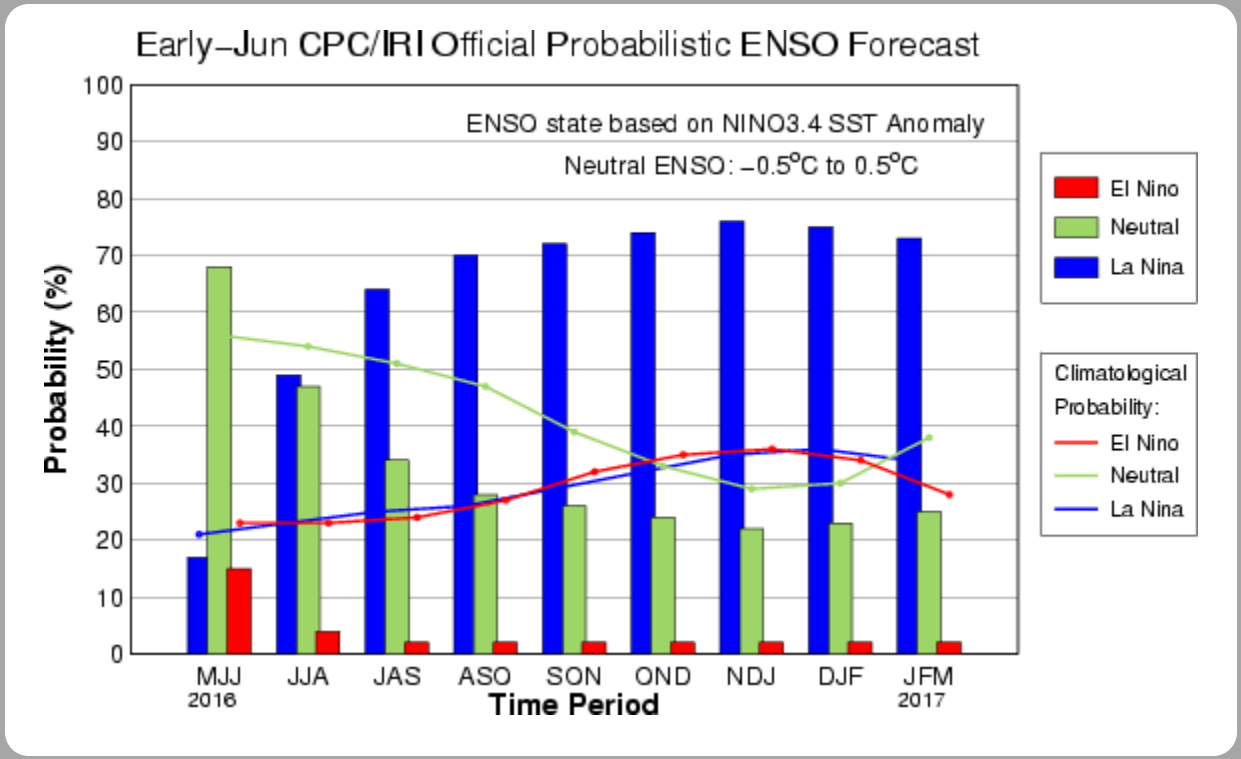
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2004	0.3	0.2	0.1	0.1	0.2	0.3	0.5	0.7	0.7	0.7	0.7	0.7
2005	0.6	0.6	0.5	0.5	0.4	0.2	0.1	0.0	0.0	-0.1	-0.4	-0.7
2006	-0.7	-0.6	-0.4	-0.2	0.0	0.1	0.2	0.3	0.5	0.8	0.9	1.0
2007	0.7	0.3	0.0	-0.1	-0.2	-0.2	-0.3	-0.6	-0.8	-1.1	-1.2	-1.3
2008	-1.4	-1.3	-1.1	-0.9	-0.7	-0.5	-0.3	-0.2	-0.2	-0.3	-0.5	-0.7
2009	-0.8	-0.7	-0.4	-0.1	0.2	0.4	0.5	0.6	0.7	1.0	1.2	1.3
2010	1.3	1.1	0.8	0.5	0.0	-0.4	-0.8	-1.1	-1.3	-1.4	-1.3	-1.4
2011	-1.3	-1.1	-0.8	-0.6	-0.3	-0.2	-0.3	-0.5	-0.7	-0.9	-0.9	-0.8
2012	-0.7	-0.6	-0.5	-0.4	-0.3	-0.1	0.1	0.3	0.4	0.4	0.2	-0.2
2013	-0.4	-0.5	-0.3	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.3
2014	-0.5	-0.6	-0.4	-0.2	0.0	0.0	0.0	0.0	0.2	0.4	0.6	0.6
2015	0.5	0.4	0.5	0.7	0.9	1.0	1.2	1.5	1.8	2.1	2.2	2.3
2016	2.2	1.9	1.5	1.1	0.7							

CPC/IRI Probabilistic ENSO Outlook

Updated: 9 June 2016

La Niña is slightly favored by June-July-August (JJA) 2016. The chance of La Niña is roughly 75% during the Northern Hemisphere fall and winter 2016-17.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

The dynamical model average indicates La Niña by June-July-August (JJA) while the statistical models predict a transition around September-October-November (SON) 2016.

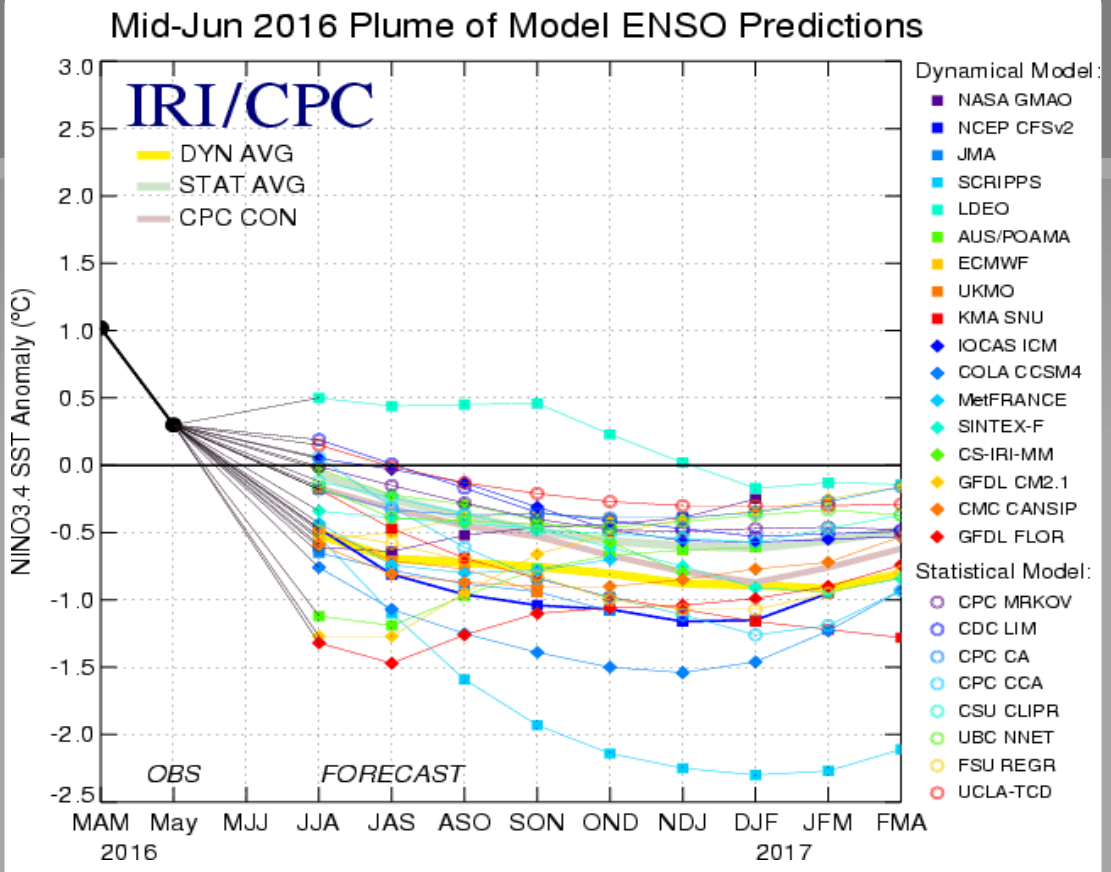
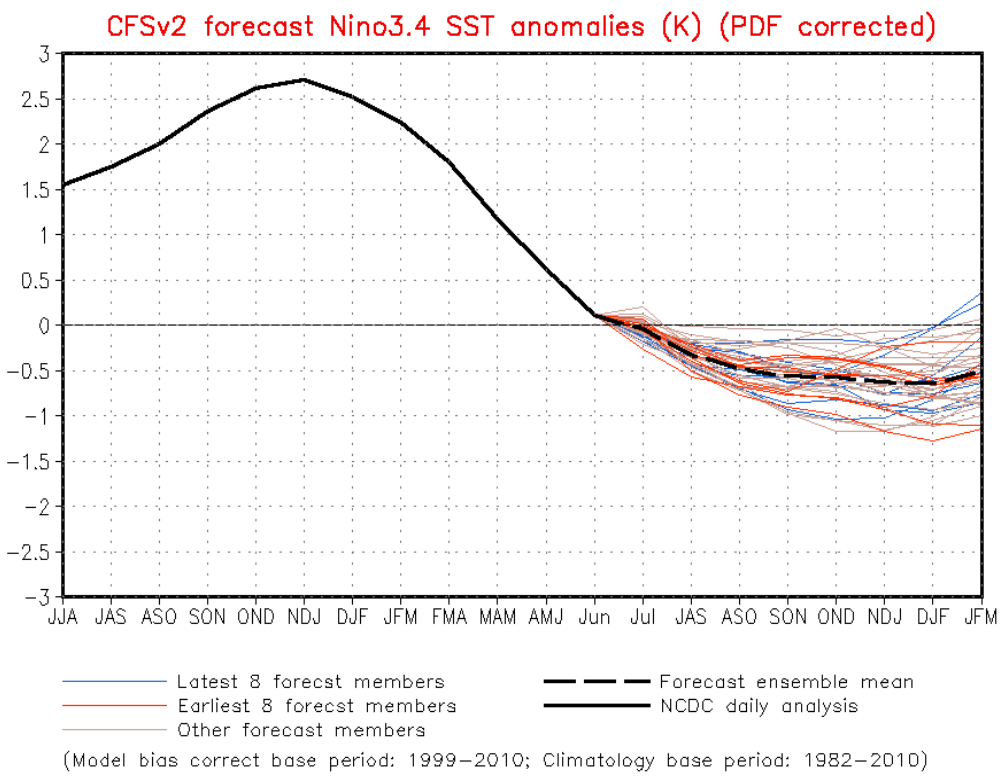


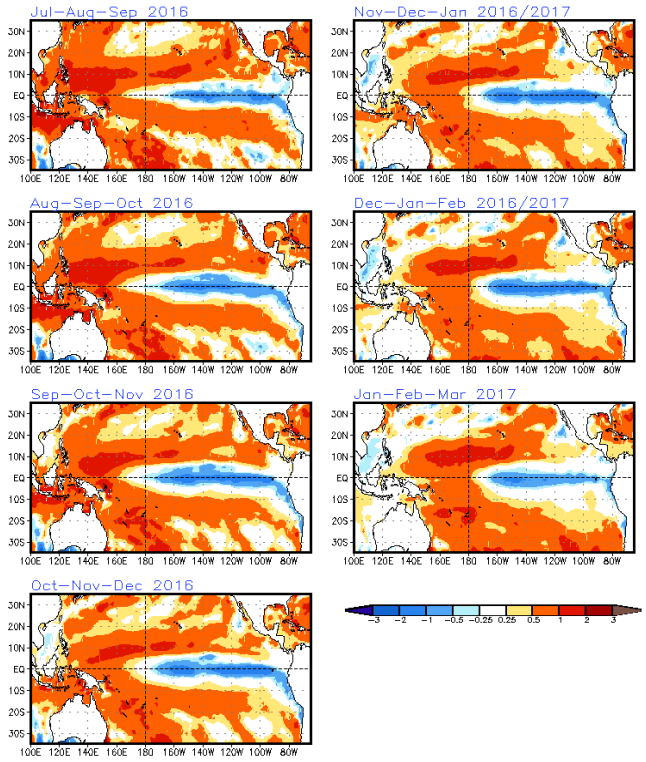
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 16 June 2016).

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

Issued: 4 July 2016

The CFS.v2 ensemble mean (black dashed line) predicts a transition to a weak La Niña by August-September-October (ASO) 2016.

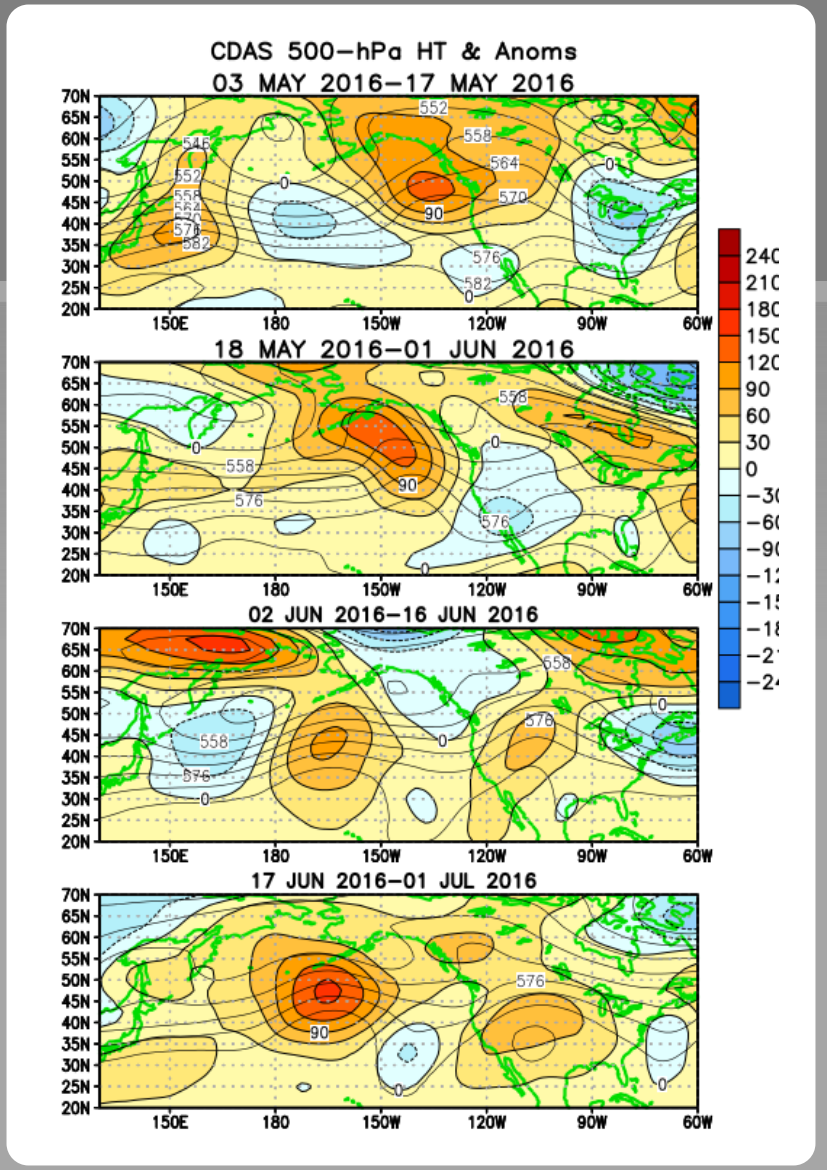




Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

During May-June, the overall pattern was characterized by anomalous ridging and above-average temperatures over portions of western N. America (extending to Alaska).

Recently, above-average heights and temperatures have prevailed over much of the contiguous U.S.



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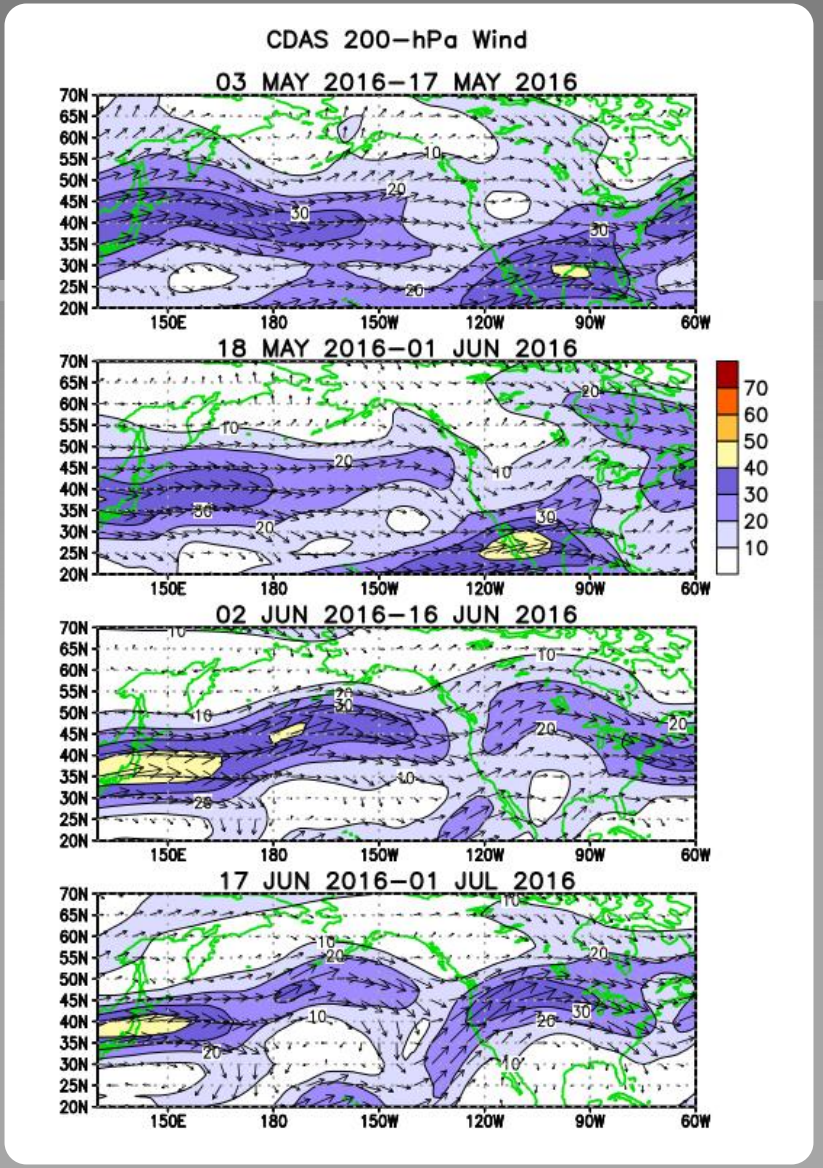

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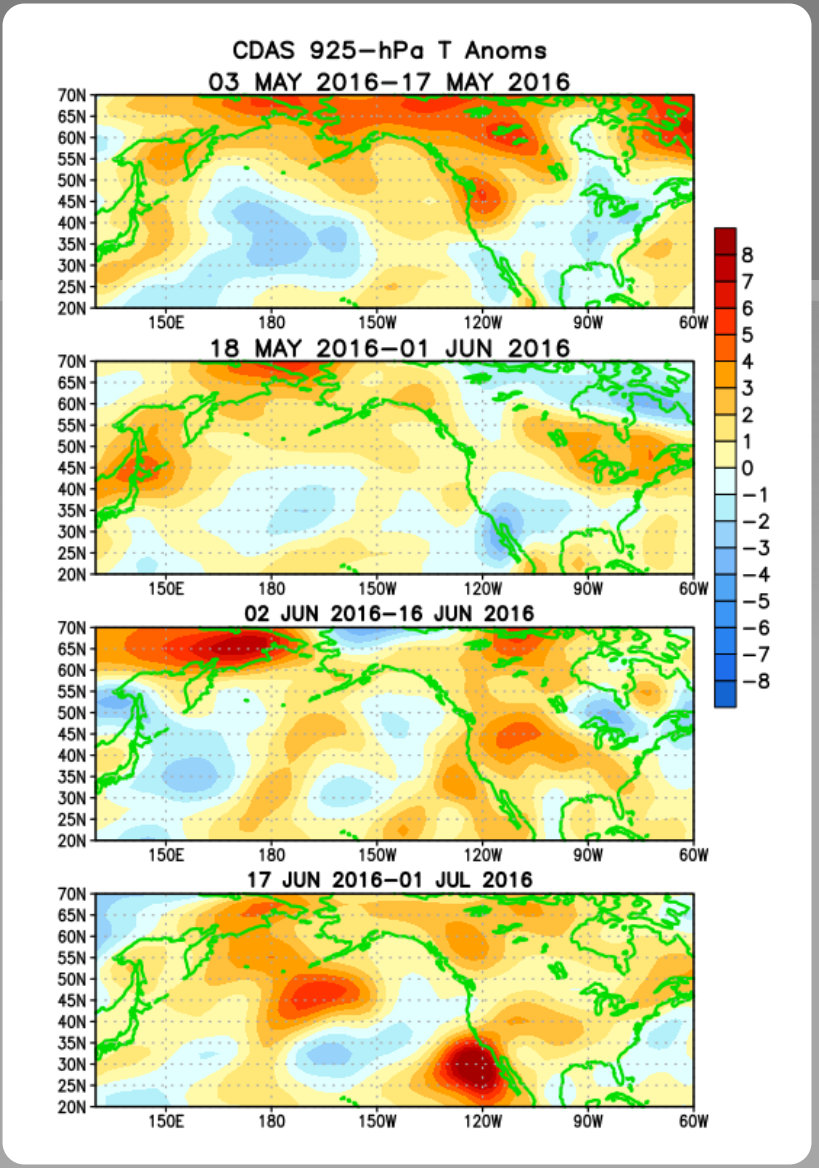
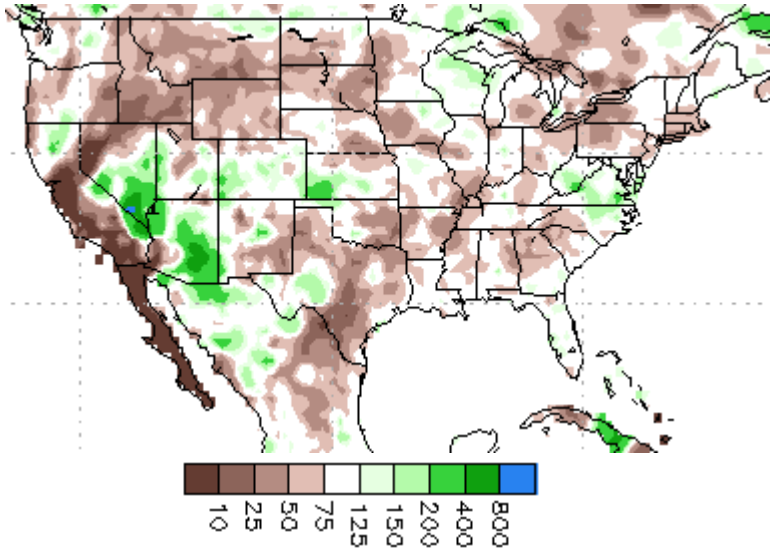


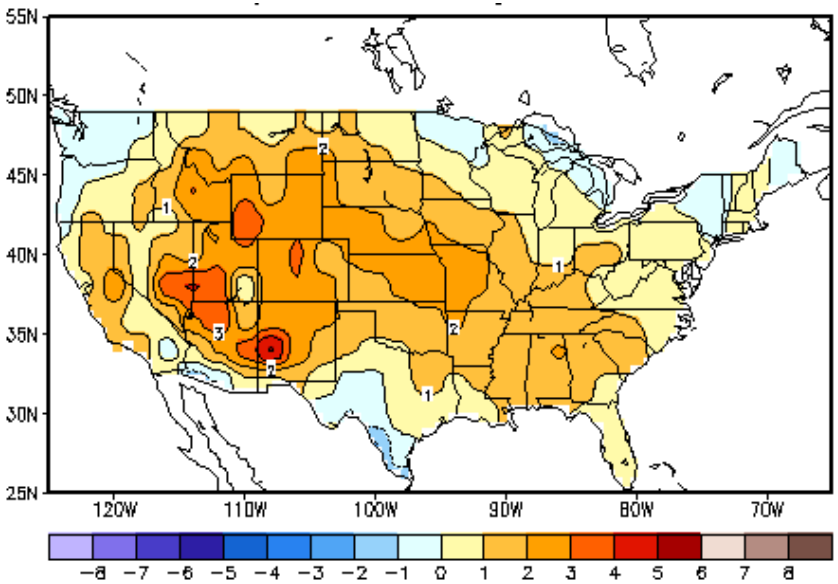
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 3 July 2016

Percent of Average Precipitation



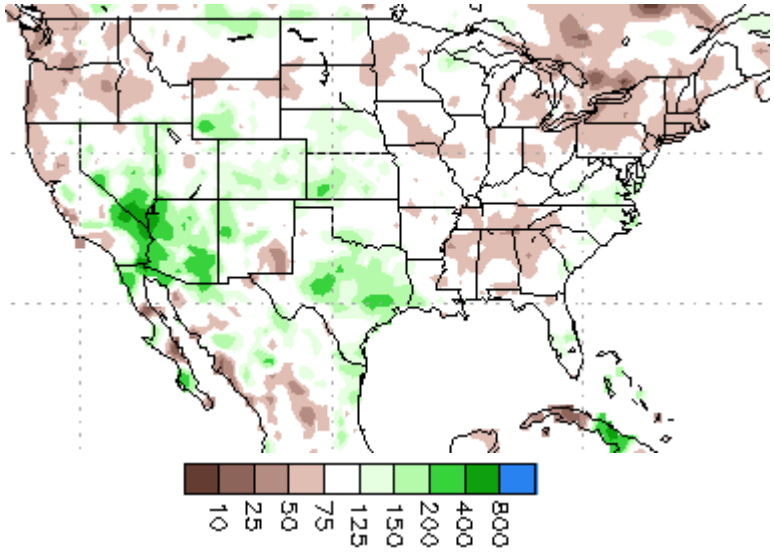
Temperature Departures (degree C)



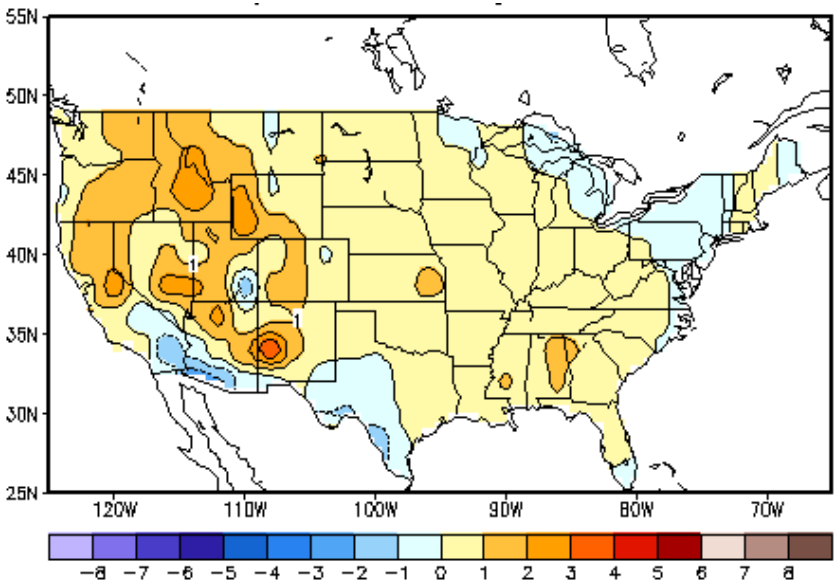
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 3 July 2016

Percent of Average Precipitation



Temperature Departures (degree C)

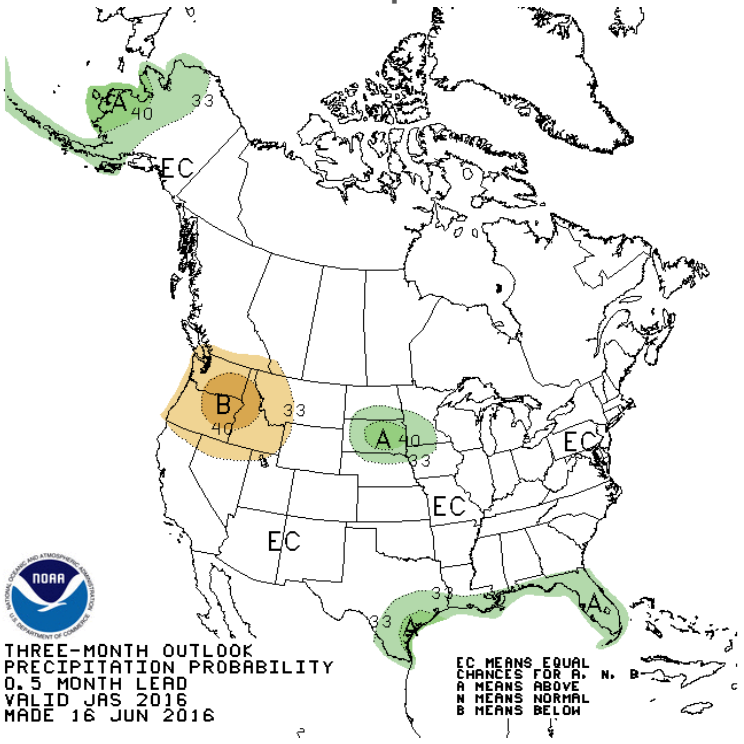


U. S. Seasonal Outlooks

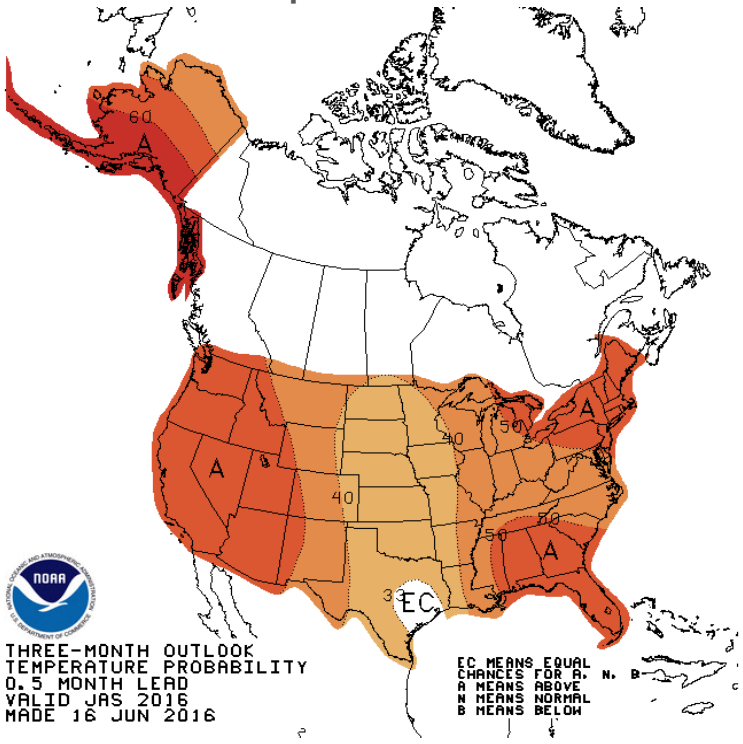
July - September 2016

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

Precipitation



Temperature



Summary

ENSO Alert System Status: Final El Niño Advisory/ La Niña Watch

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