ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
19 October 2015

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: El Niño Advisory

El Niño conditions are present.*

Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

There is an approximately 95% chance that El Niño will continue through Northern Hemisphere winter 2015-16, gradually weakening through spring 2016.*

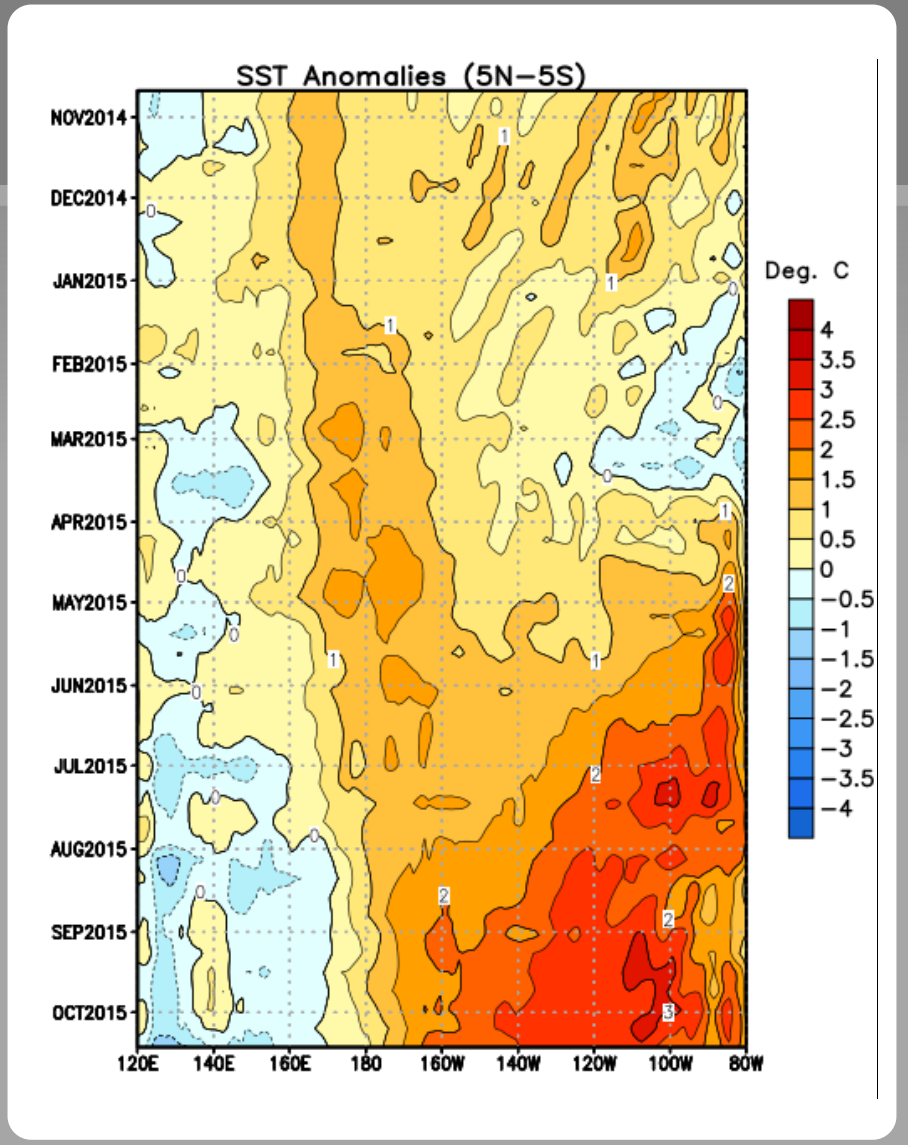
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (ºC)

During January through mid-March 2015, near-to-below average SSTs were observed in the eastern Pacific, and positive SST anomalies persisted across the western and central Pacific.

From June to mid-September, the largest positive SST anomalies shifted westward.

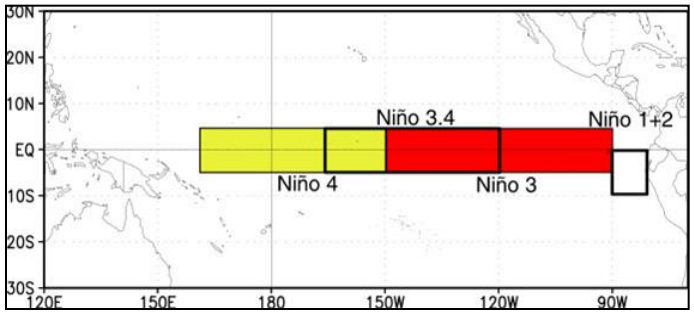
Recently, positive SST anomalies extend from S. America to near the Date Line.

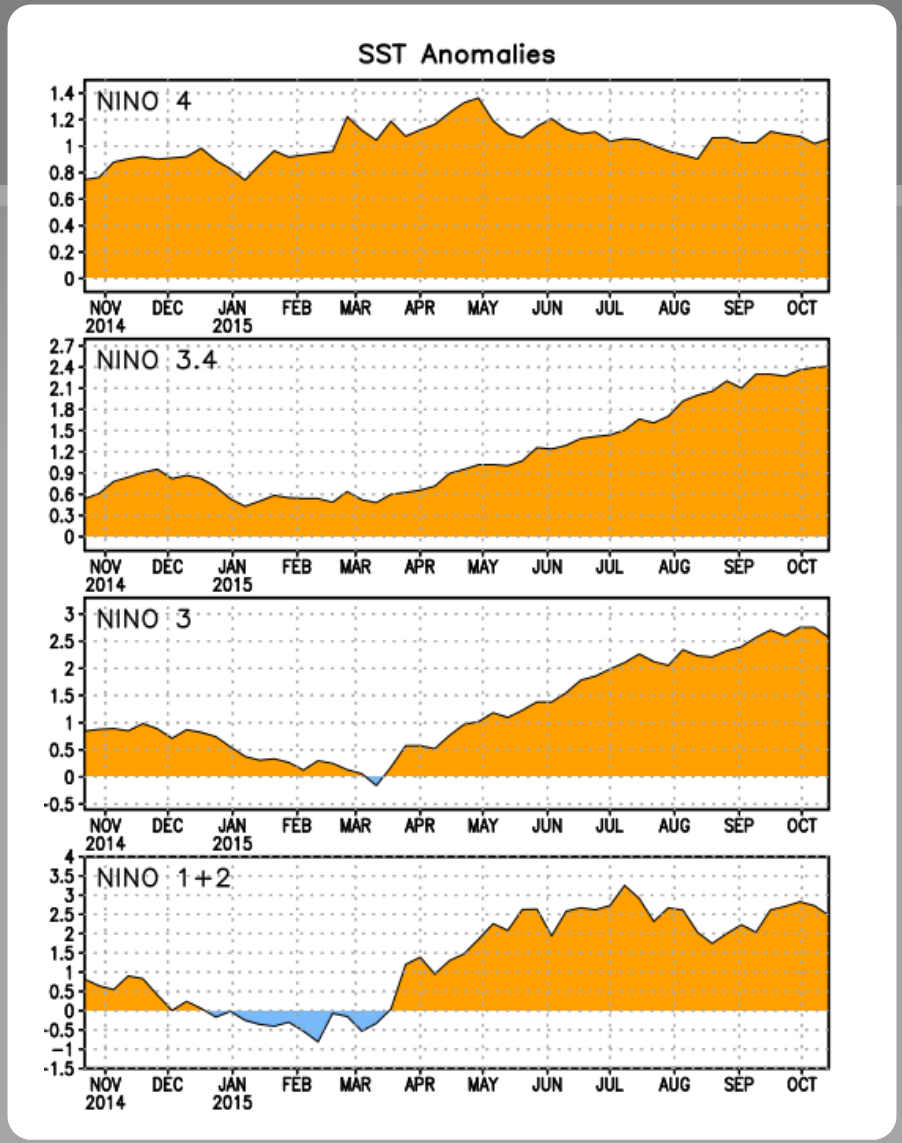


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

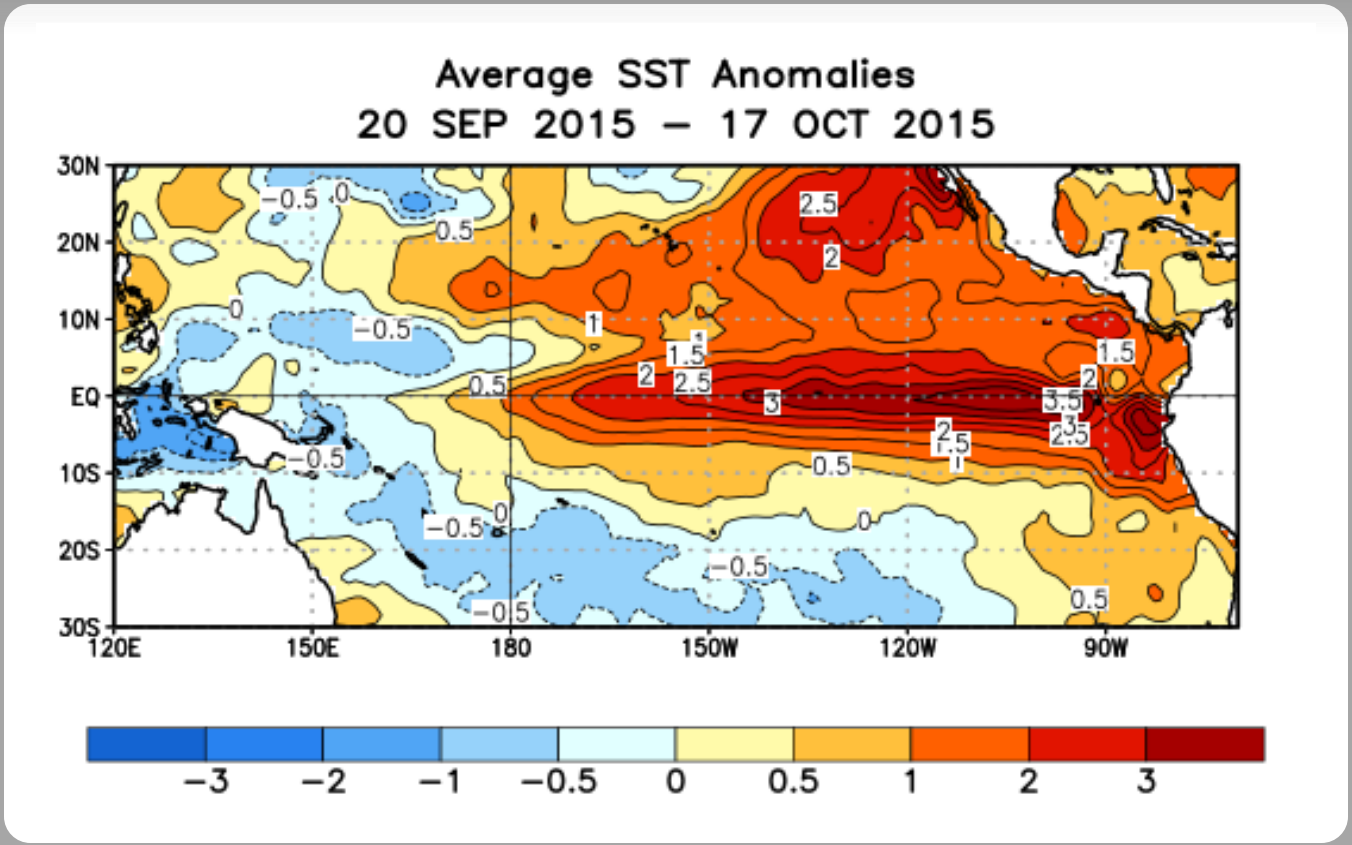
Niño 4	1.1ºC
Niño 3.4	2.4ºC
Niño 3	2.6ºC
Niño 1+2	2.5ºC





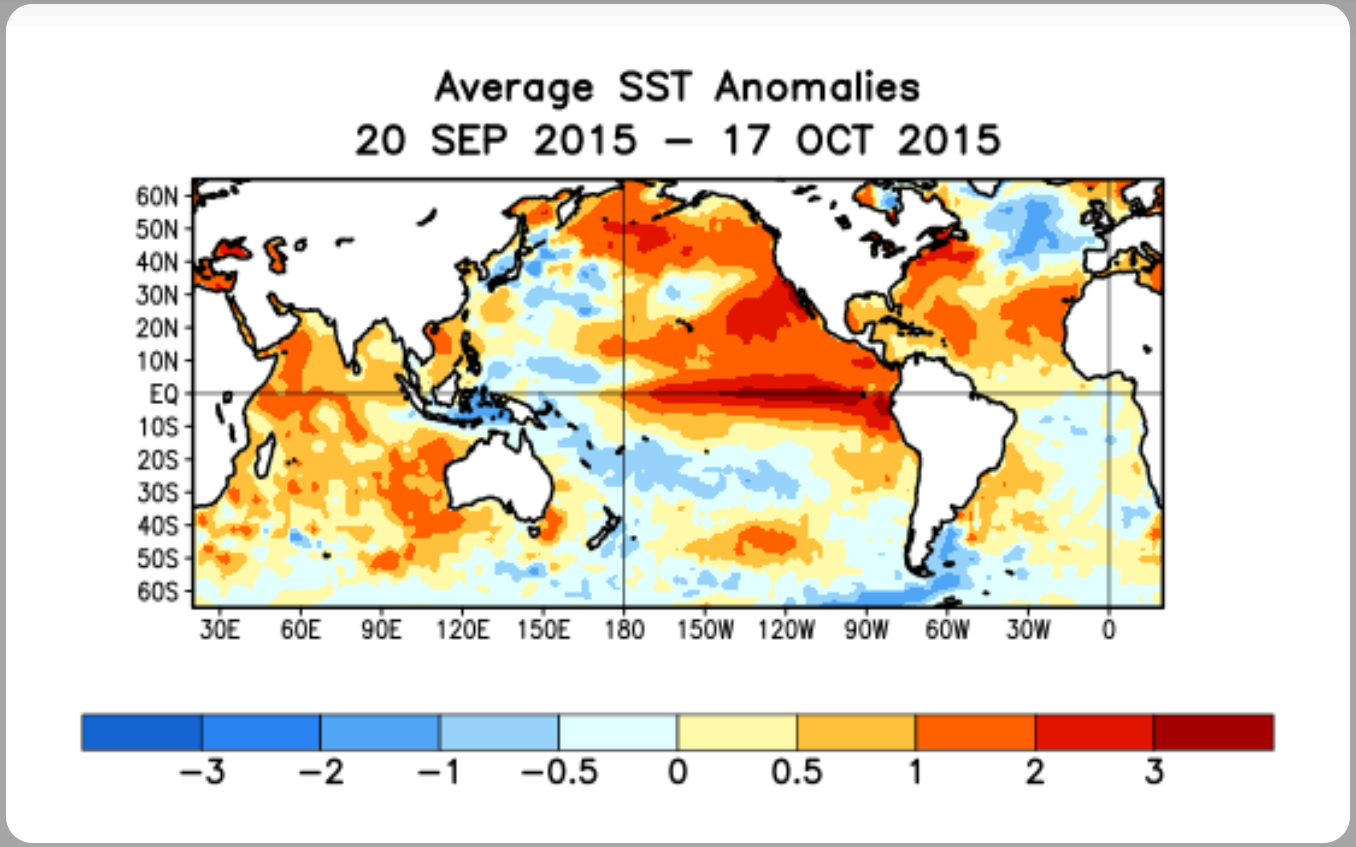
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

During the last four weeks, tropical SSTs were above average across the central and eastern Pacific, with the largest anomalies in the eastern Pacific.



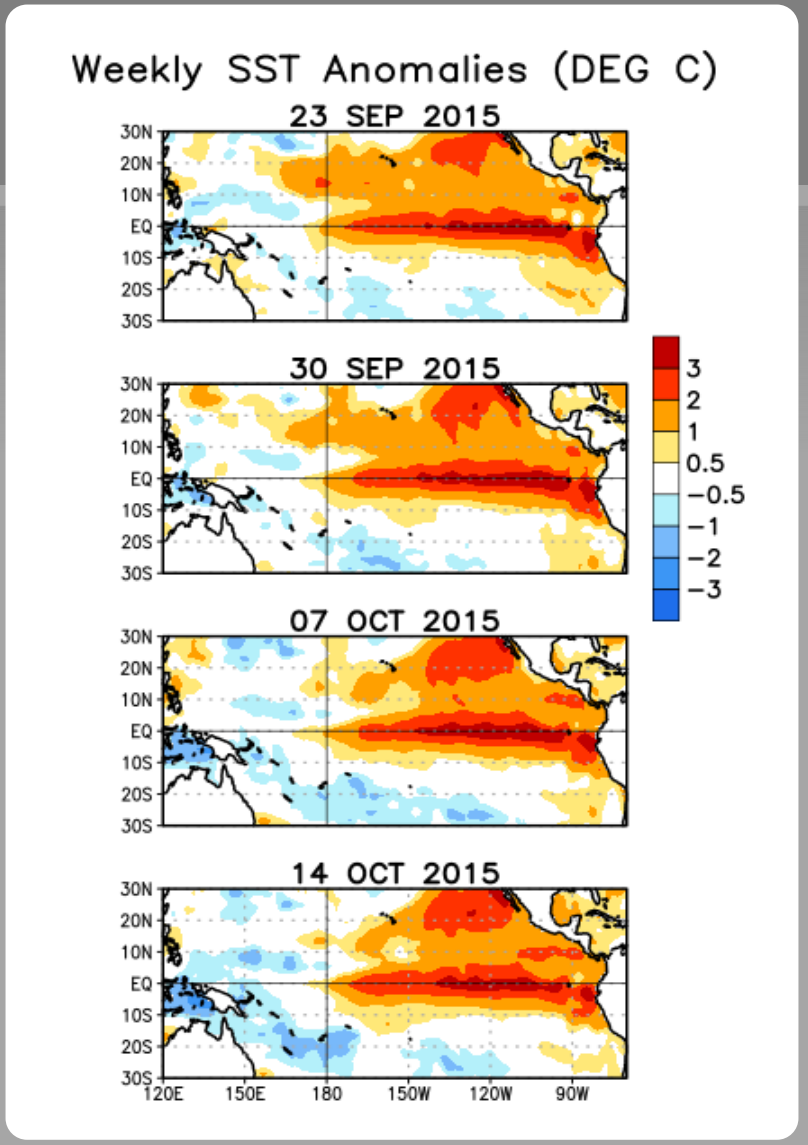
Global SST Departures (°C) During the Last Four Weeks

During the last four weeks, tropical SSTs were above average across the central and eastern Pacific and most of the Indian Ocean. SSTs were below average near Indonesia.



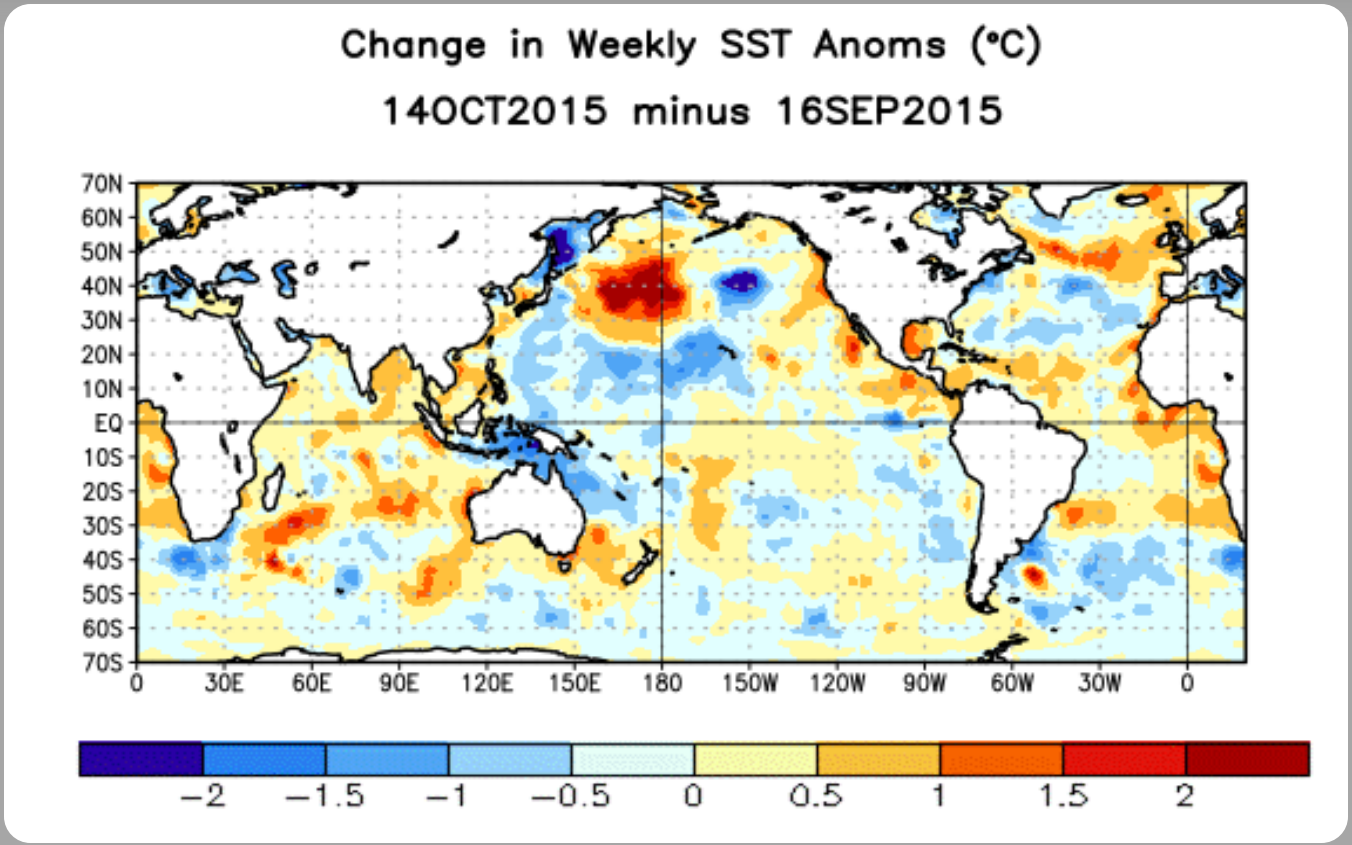
Weekly SST Departures during the Last Four Weeks

During the last four weeks, positive SST anomalies extended across most of the equatorial Pacific.



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, negative changes were apparent in the far eastern equatorial Pacific.



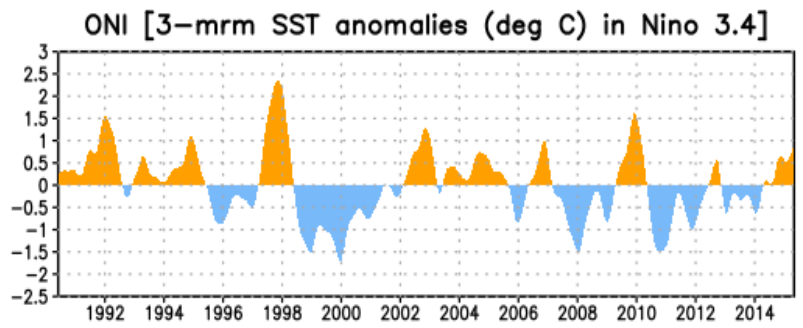
Upper-Ocean Conditions in the Equatorial Pacific

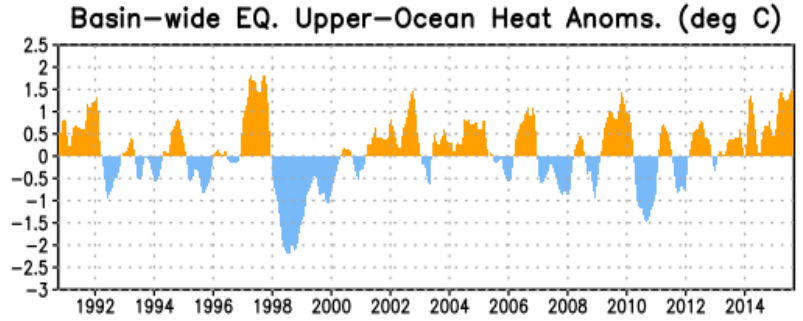
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

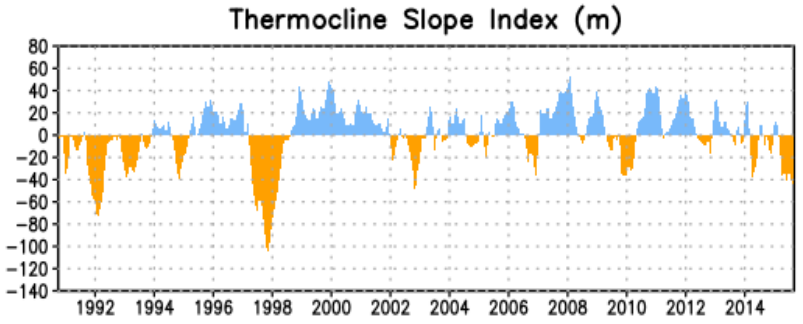
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (positive) and thermocline slope index (negative) reflect El Niño.

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).

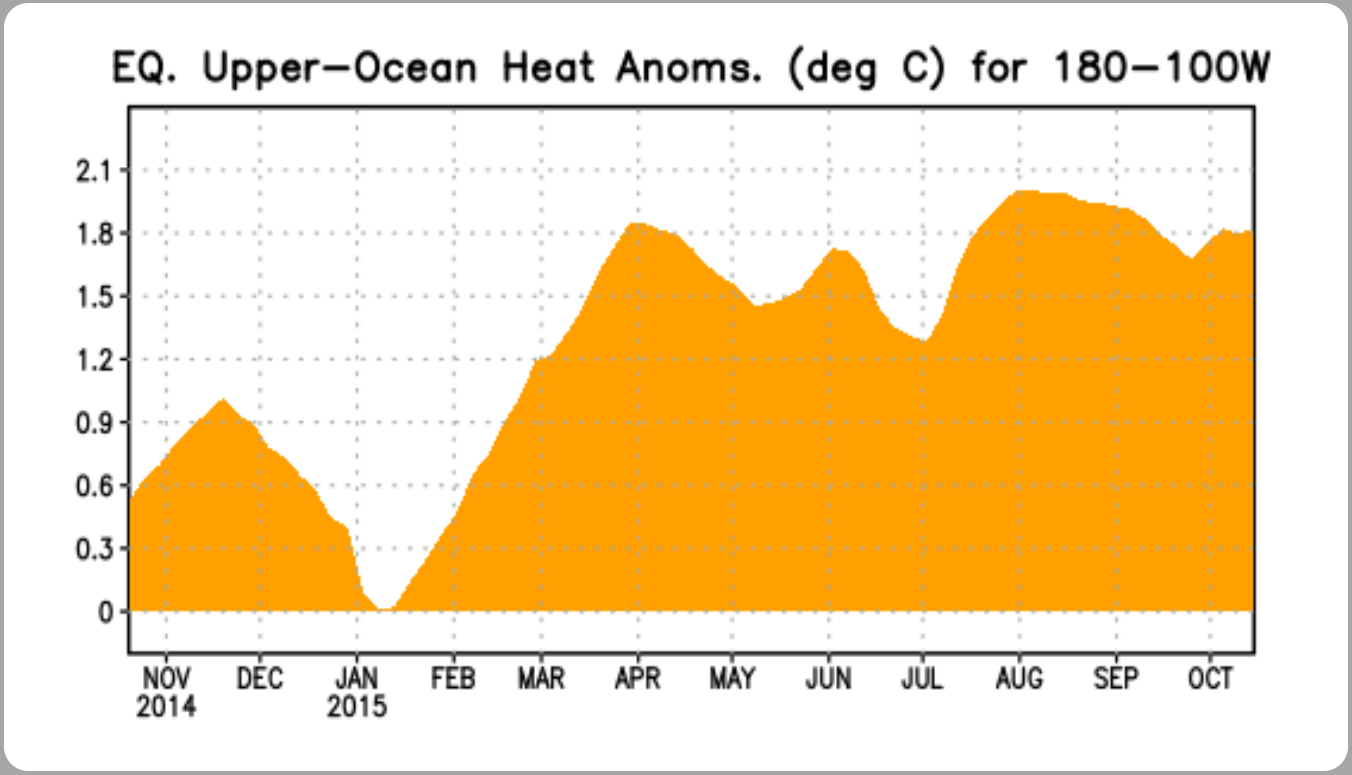






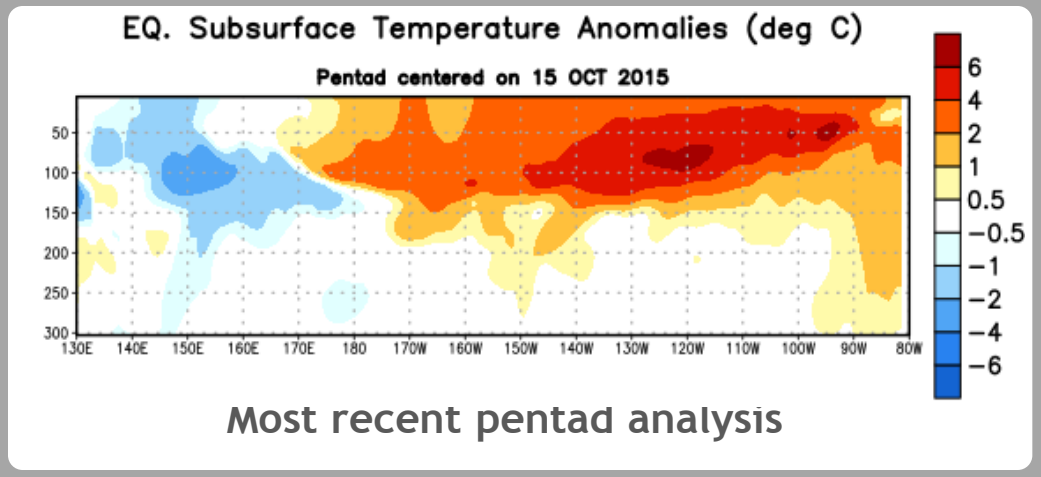
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

During January - March, a significant sub-surface warming occurred across the eastern Pacific. Since March, sub-surface temperature anomalies have remained large, but with some minor fluctuations in strength. During August through late September, positive anomalies decreased. So far in October, positive anomalies remain elevated.



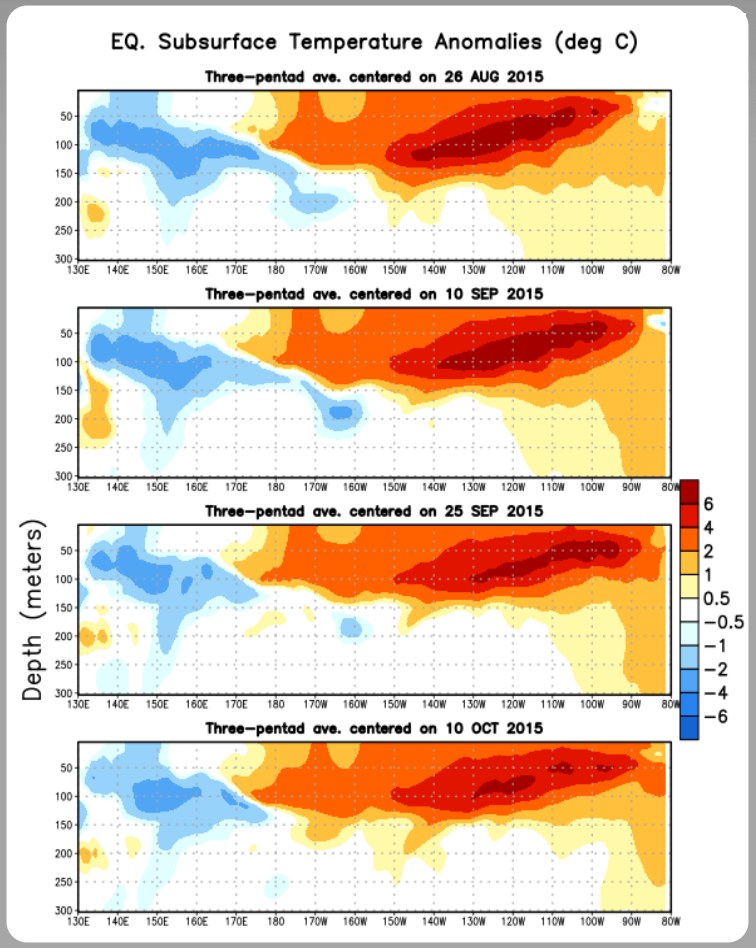
Sub-Surface Temperature Departures in the Equatorial Pacific

During the last two months, positive subsurface temperature anomalies were observed across most of the equatorial Pacific.



Most recent pentad analysis

Negative or near-zero anomalies were evident in the western Pacific, while positive anomalies persist across the central and eastern Pacific.

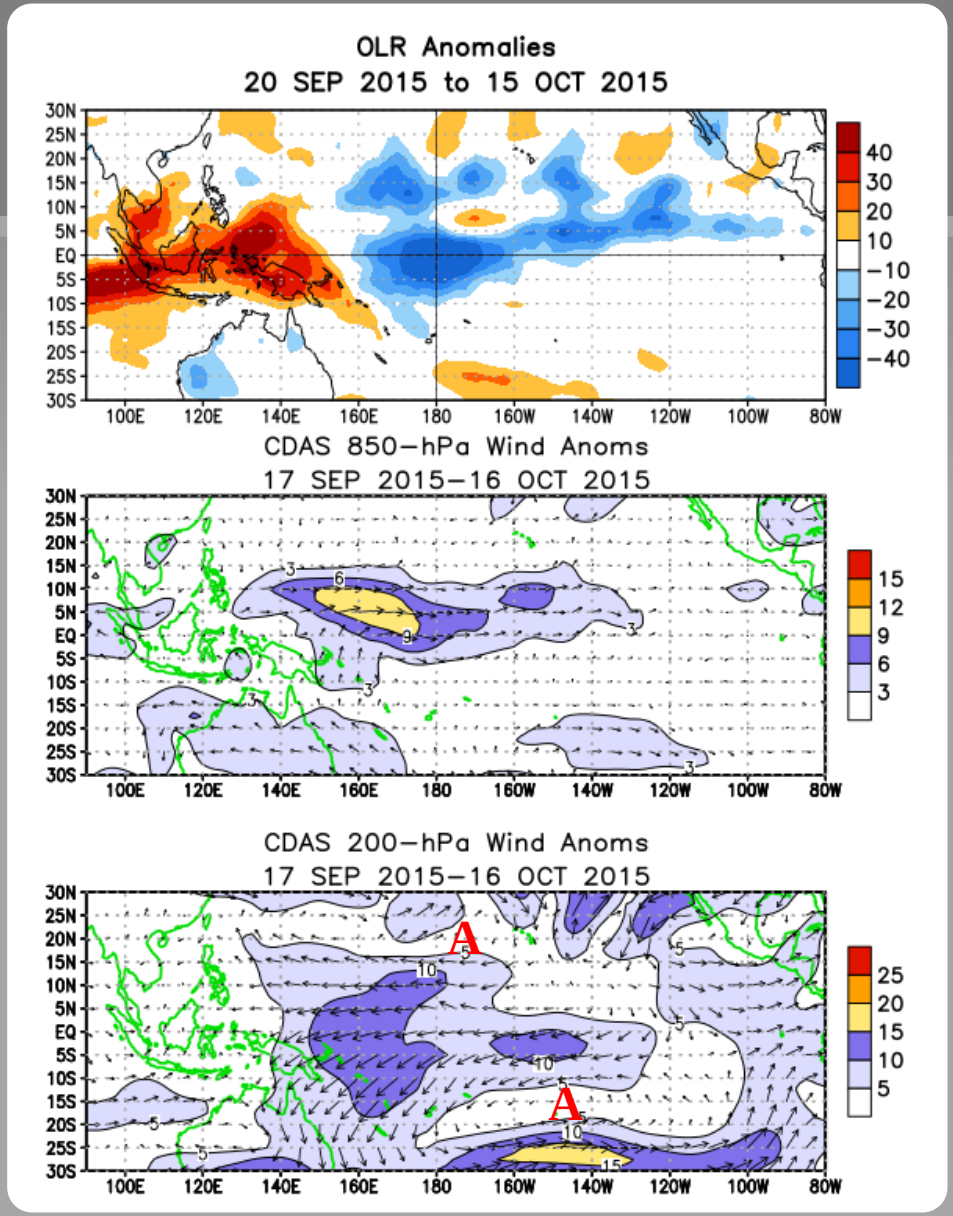


Tropical OLR and Wind Anomalies During the Last 30 Days

Negative OLR anomalies (enhanced convection and precipitation) were evident across most of the tropical Pacific. Positive OLR anomalies (suppressed convection and precipitation) were observed over Indonesia and Papua New Guinea.

Anomalous low-level (850-hPa) westerly winds extended from the western to the east-central equatorial Pacific.

Anomalous upper-level (200-hPa) easterlies persisted in the western to east-central equatorial Pacific, while westerly anomalies were evident over the eastern Pacific. Anomalous anti-cyclones were evident in the subtropics of both hemisphere.



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:

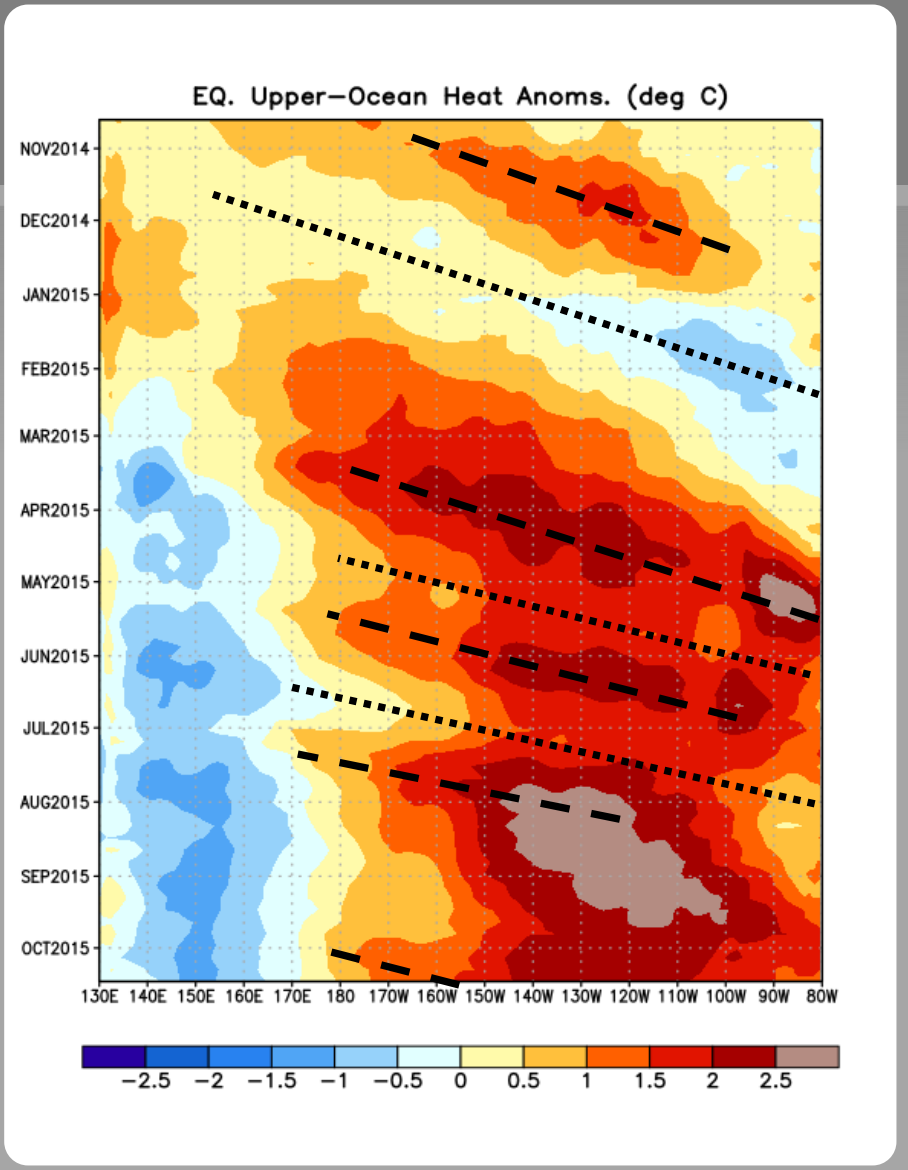
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

Downwelling phases of a Kelvin wave were observed in March-April, mid-May to late June, and July to August.

During August and September, positive subsurface temperature anomalies slowly shifted eastward.

There is recent evidence of another downwelling Kelvin wave, initiated in early October.

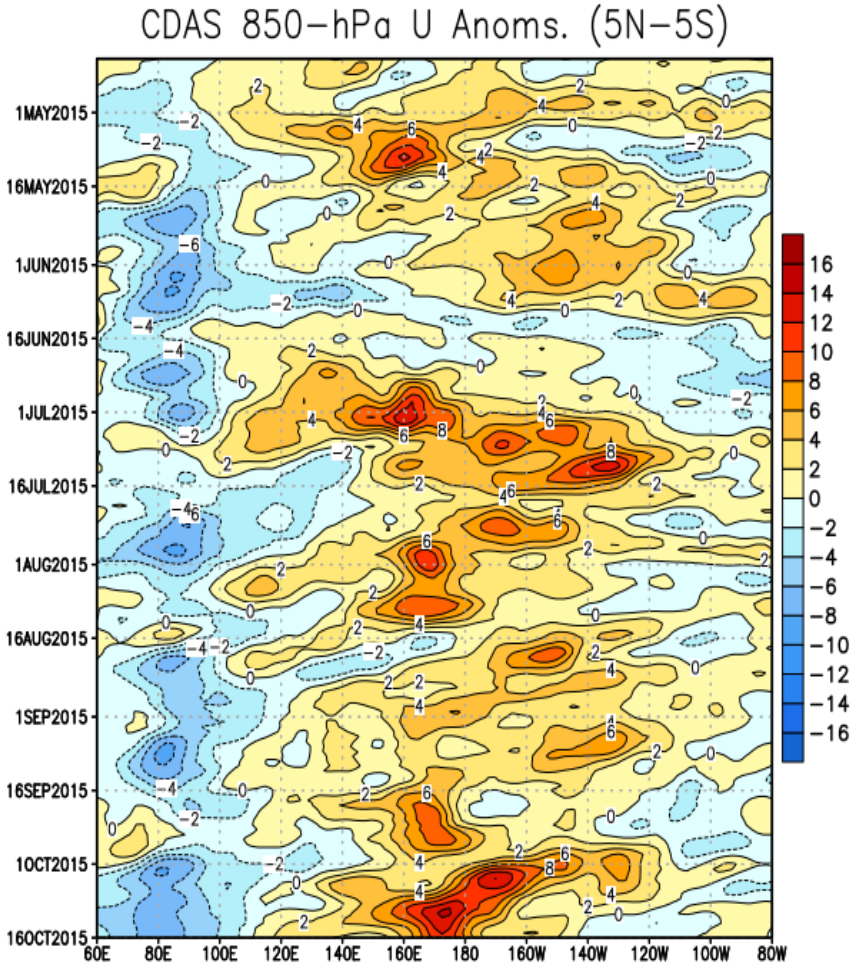


Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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

During early May, late June/early July, early August, and late September westerly wind bursts were observed between 140°E and 180°.

Recently, another westerly wind burst was observed between 160°E and 160°W.



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

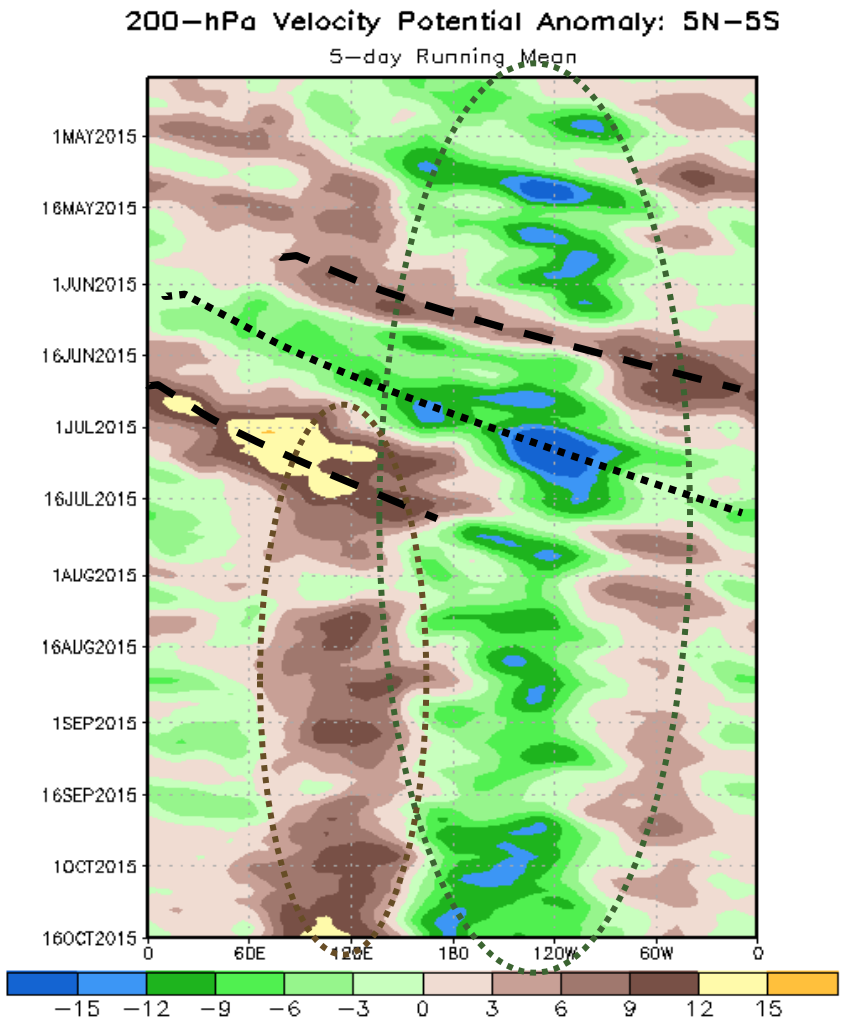
Upper-level (200-hPa) Velocity Potential Anomalies

From late May through early July, the Madden-Julian Oscillation (MJO) contributed to an eastward propagation of regions of upper-level divergence and convergence.

Since mid-January 2015, negative anomalies and anomalous upper-level divergence (green shading) have mostly prevailed near the Date Line and/or eastern Pacific.

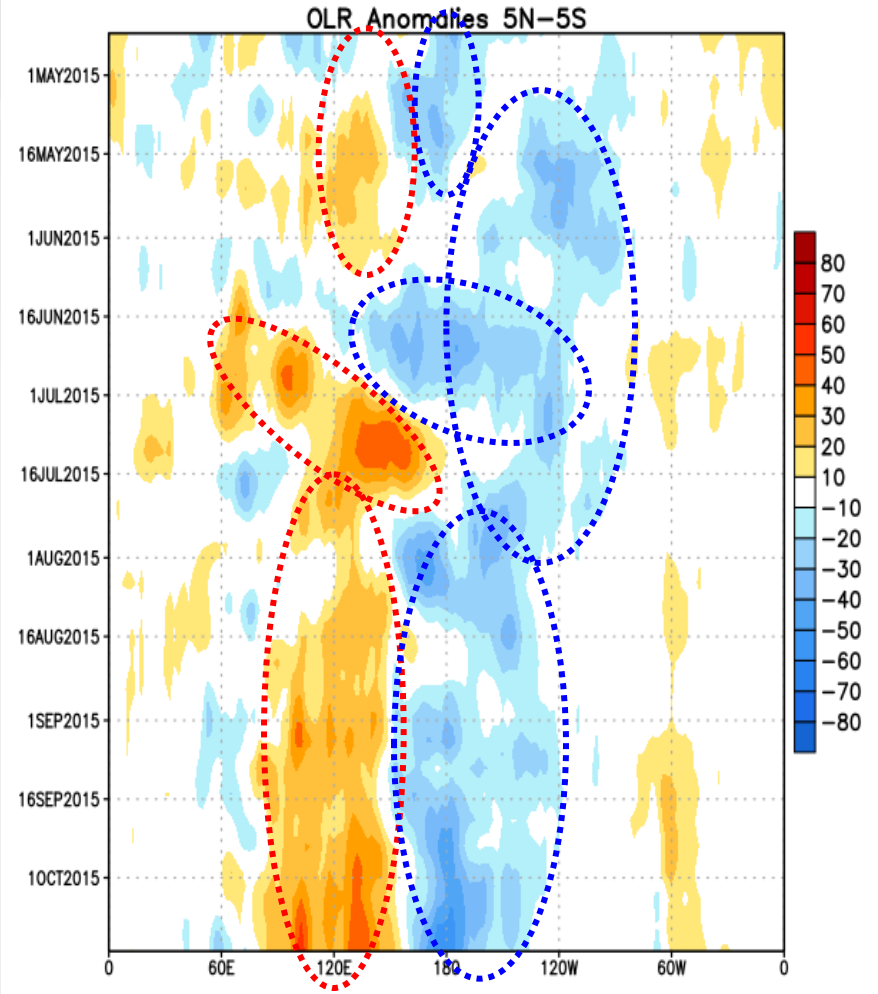
Sine early July 2015, positive anomalies and upper-level convergence (brown shading) have persisted near Indonesia.

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



Outgoing Longwave Radiation (OLR) Anomalies

Since early May, negative anomalies have persisted in the central and/or eastern Pacific. Since early July, positive anomalies have persisted near 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.

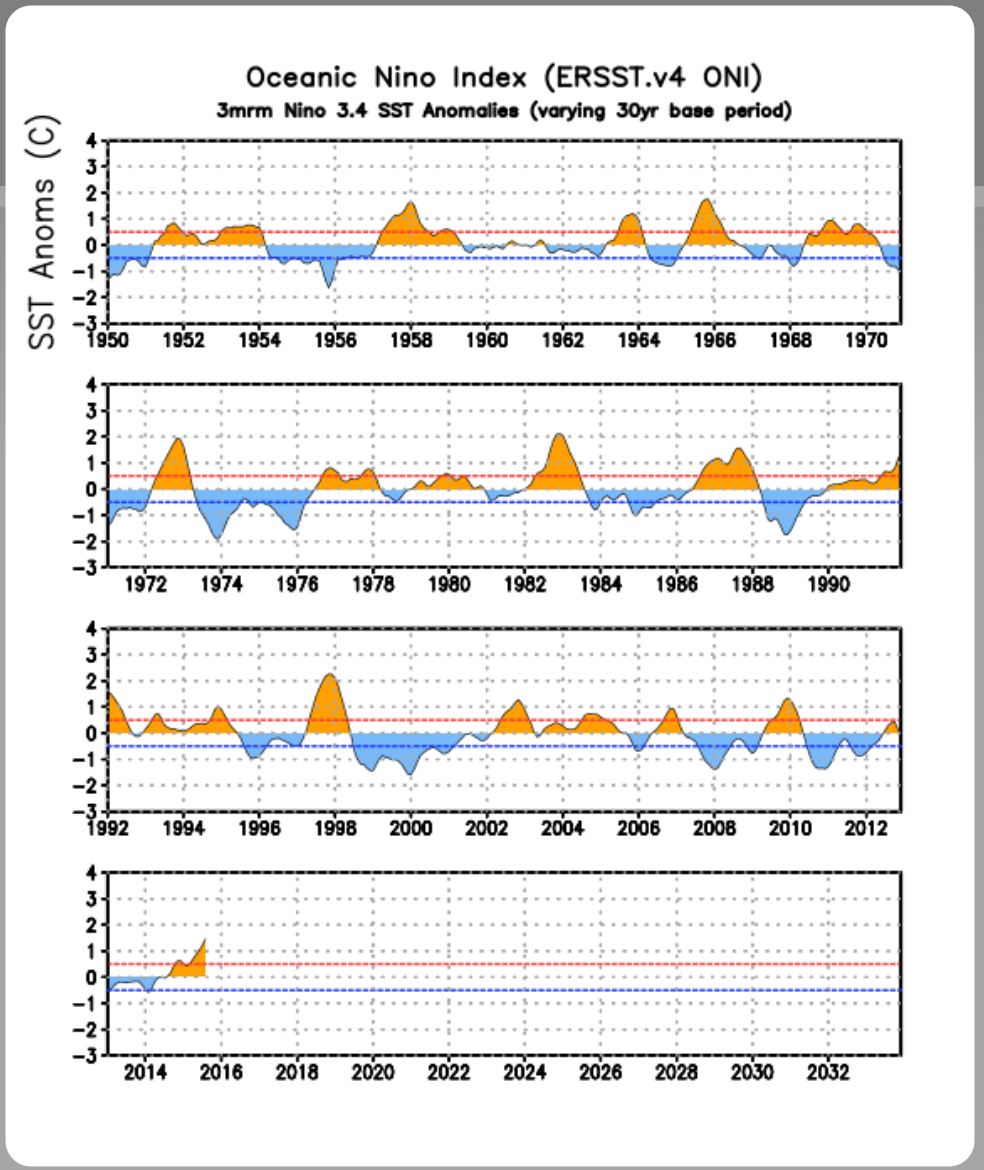
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (July - September 2015) is 1.5°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.

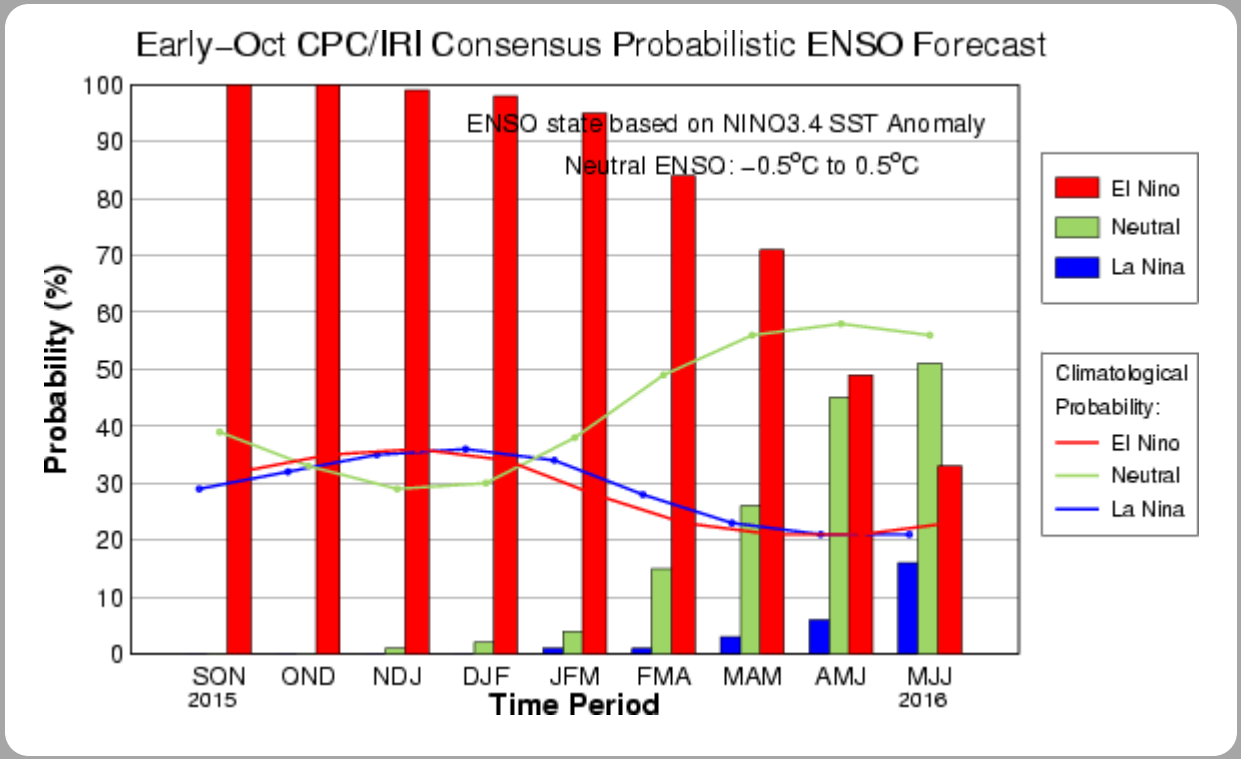
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2003	0.9	0.6	0.4	0.0	-0.2	-0.1	0.1	0.2	0.3	0.4	0.4	0.4
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				

CPC/IRI Probabilistic ENSO Outlook

Updated: 8 October 2015

The chance of El Niño is approximately 95% through Northern Hemisphere winter and is just under 50% by late spring (AMJ) 2016.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Most models indicate that Niño 3.4 will be above +1.5°C (a "strong" El Niño) during late 2015 into early 2016.

Positive anomalies are predicted to weaken through the Northern Hemisphere Spring 2016.

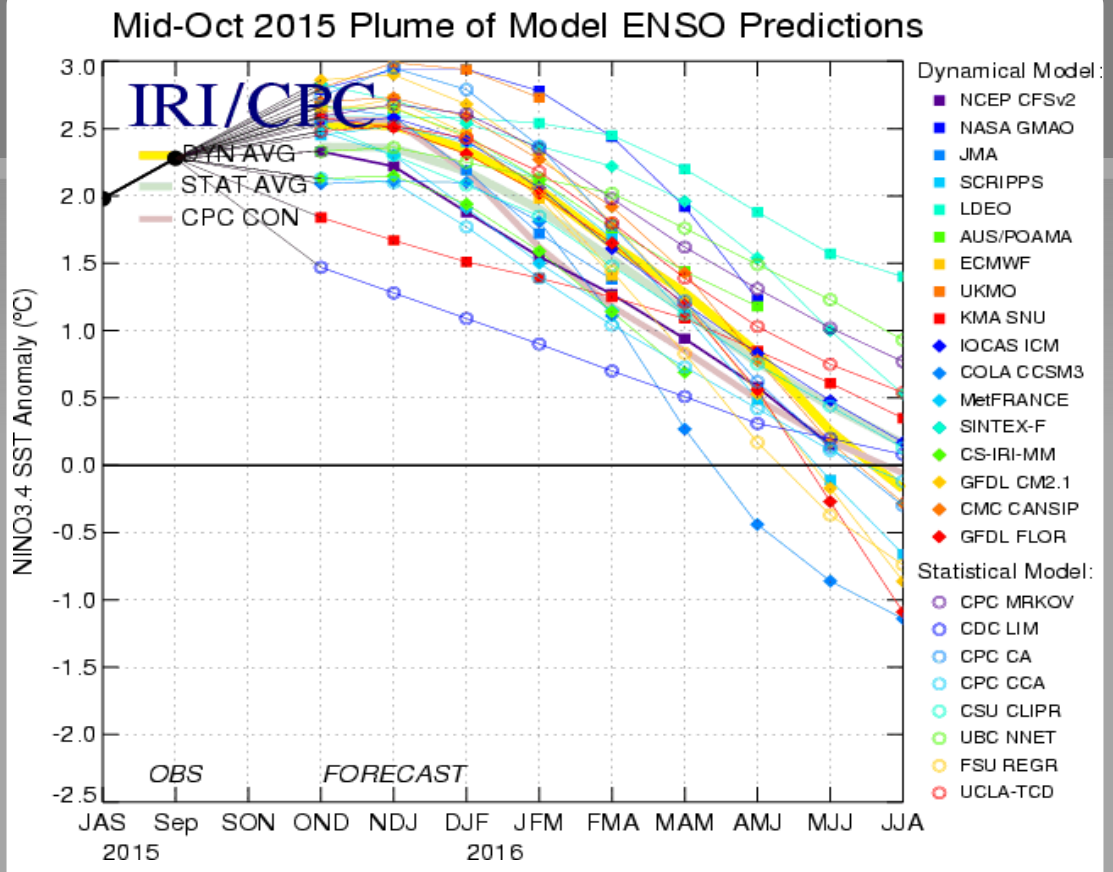
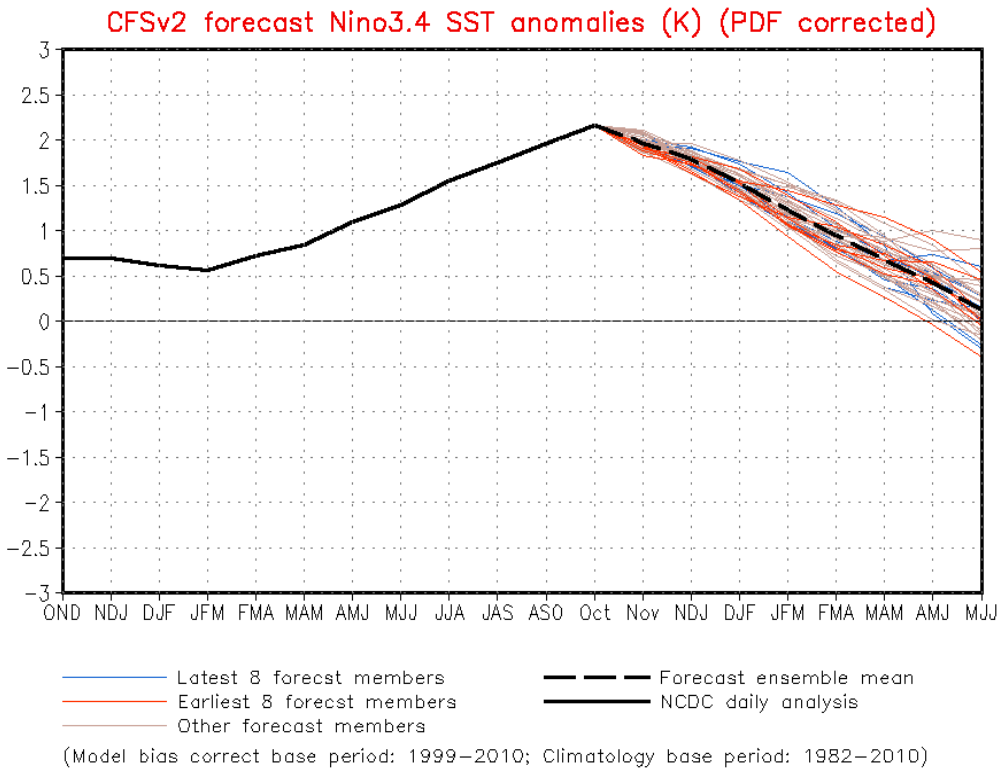


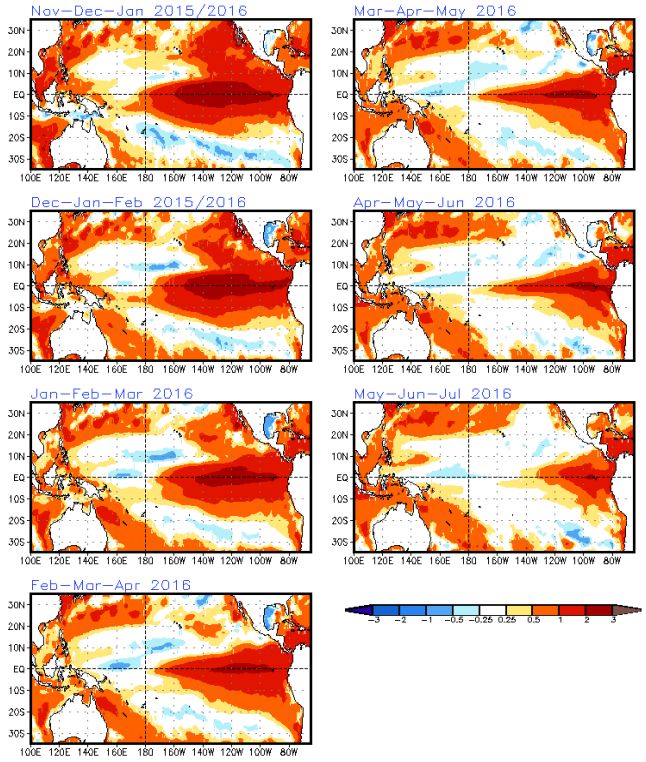
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 13 October 2015).

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

Issued: 19 October 2015

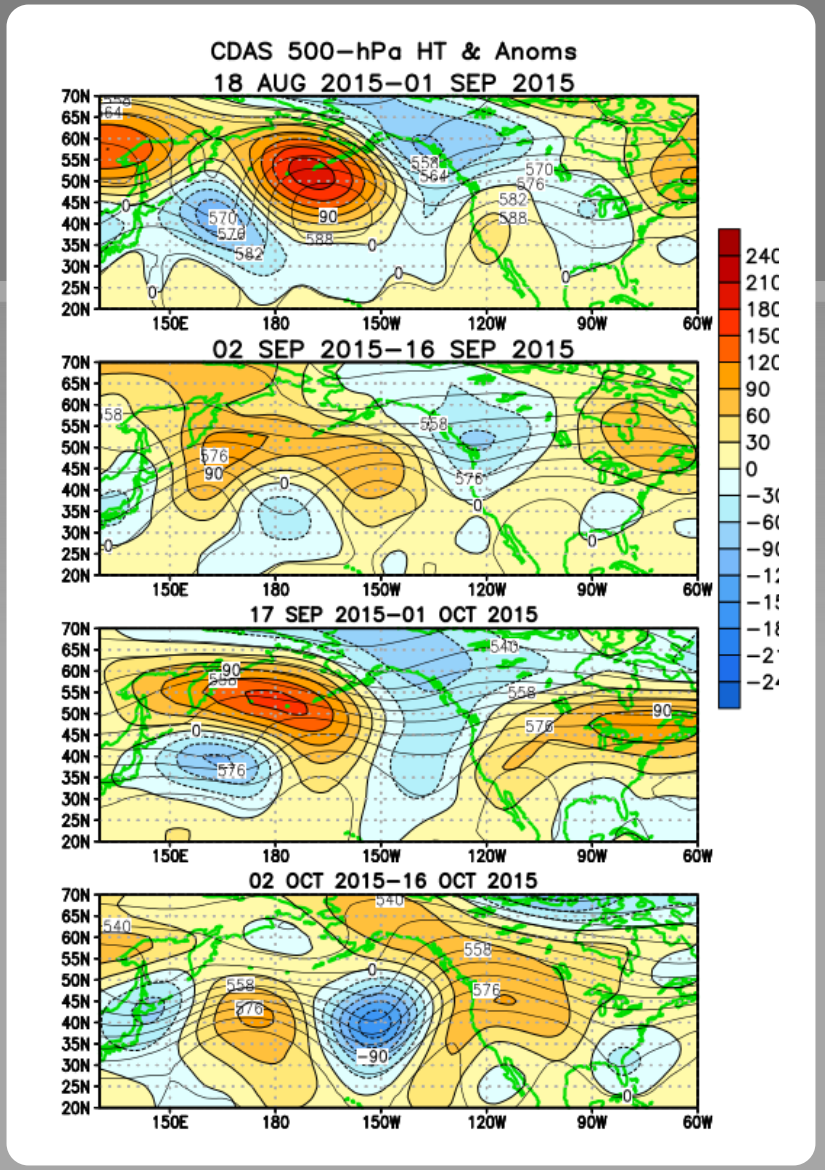
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through MAM 2016.





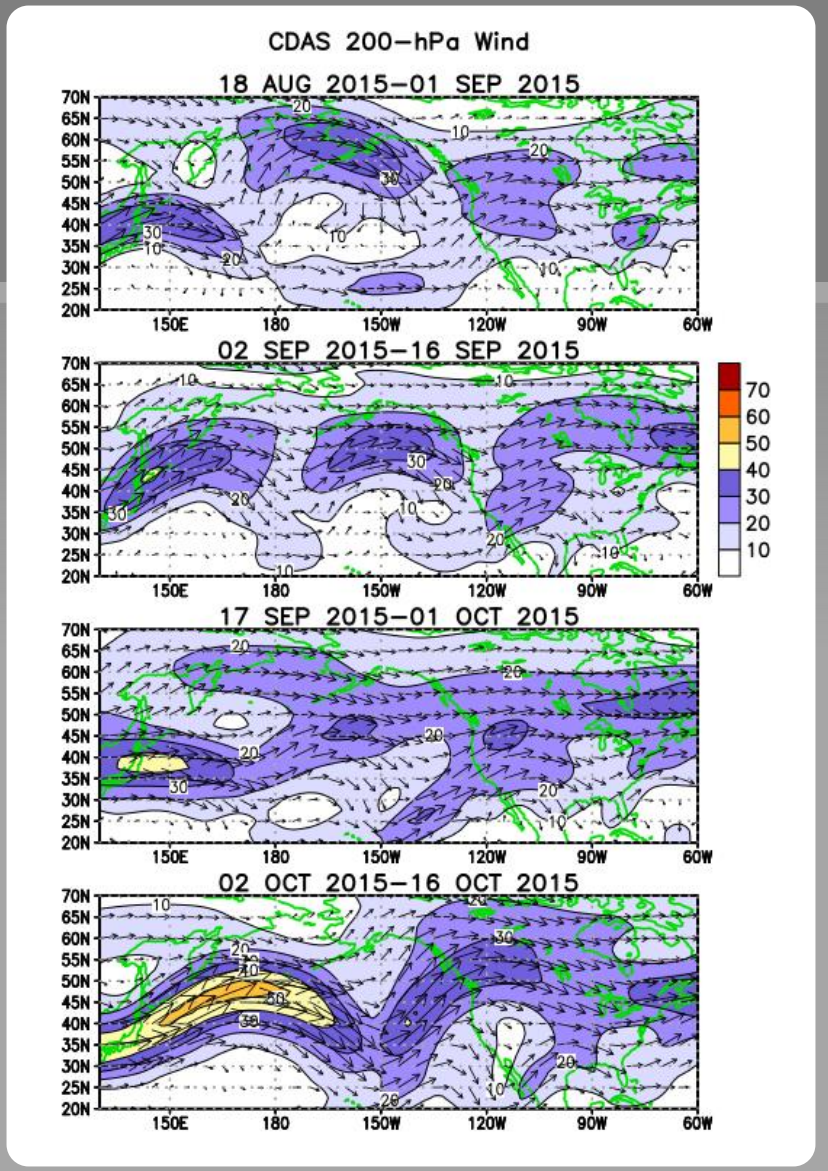
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since mid-to-late September, below-average heights/temperatures prevailed over the southeastern U.S, while above-average heights/temperatures were observed over the western U.S.



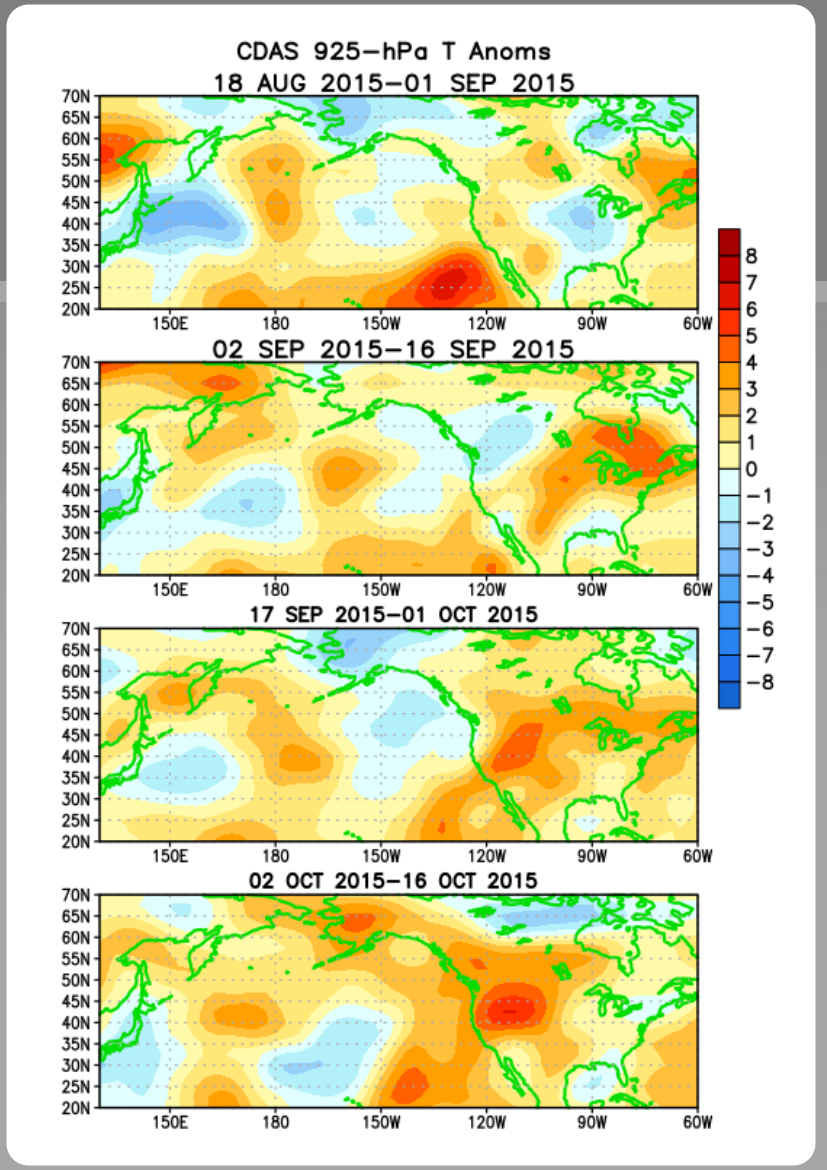
Atmospheric anomalies over the North Pacific and North America During the Last 60 Days

Since mid-to-late September, below-average heights/temperatures prevailed over the southeastern U.S, while above-average heights/temperatures were observed over the western U.S.



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

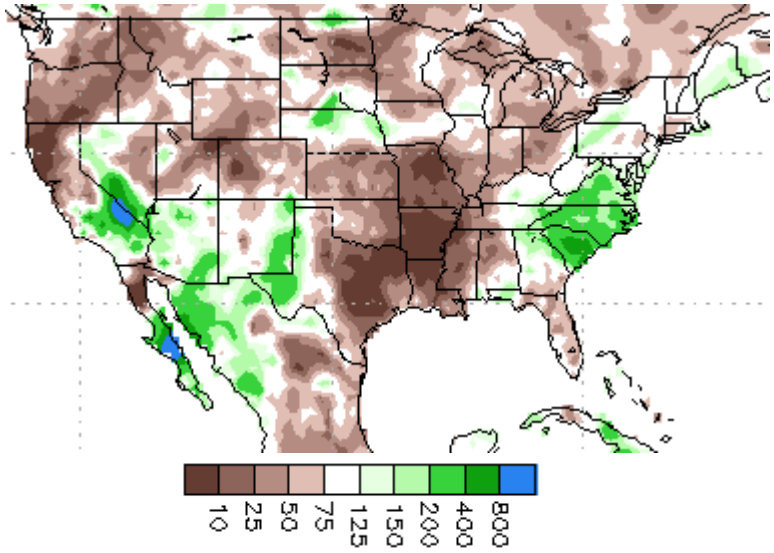
Since mid-to-late September, below-average heights/temperatures prevailed over the southeastern U.S, while above-average heights/temperatures were observed over the western U.S.



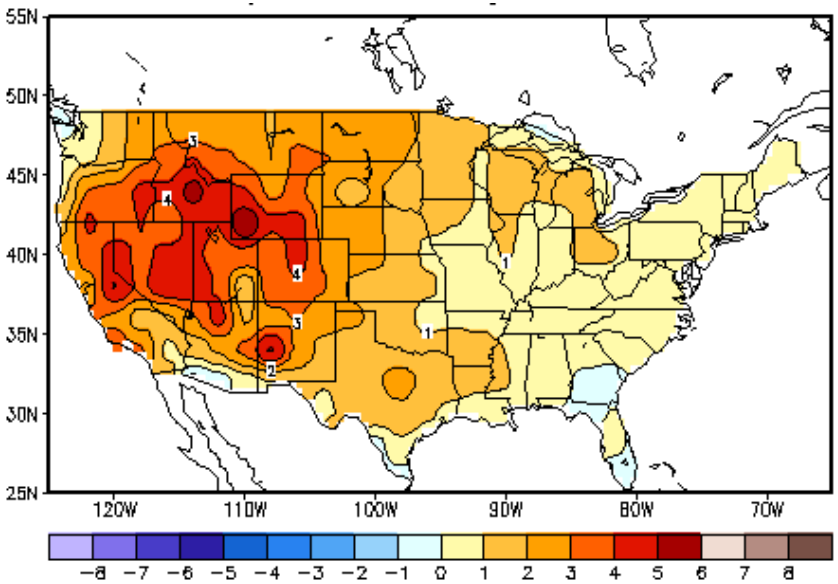
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 17 October 2015

Percent of Average Precipitation



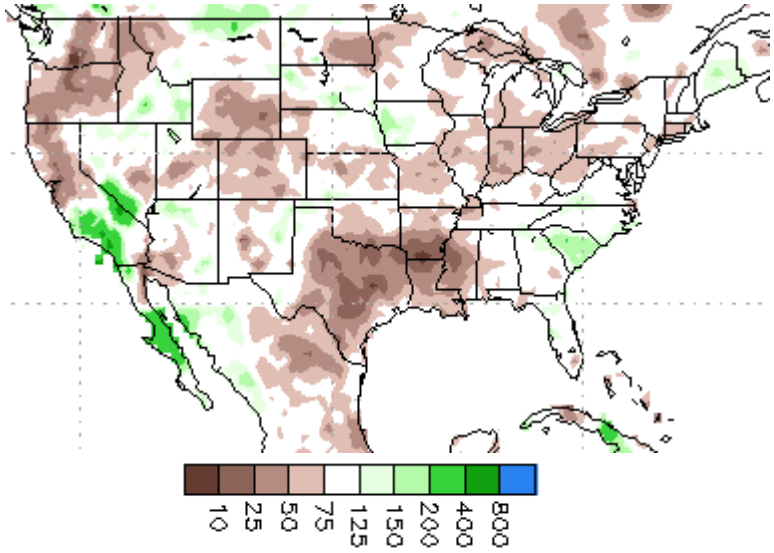
Temperature Departures (degree C)



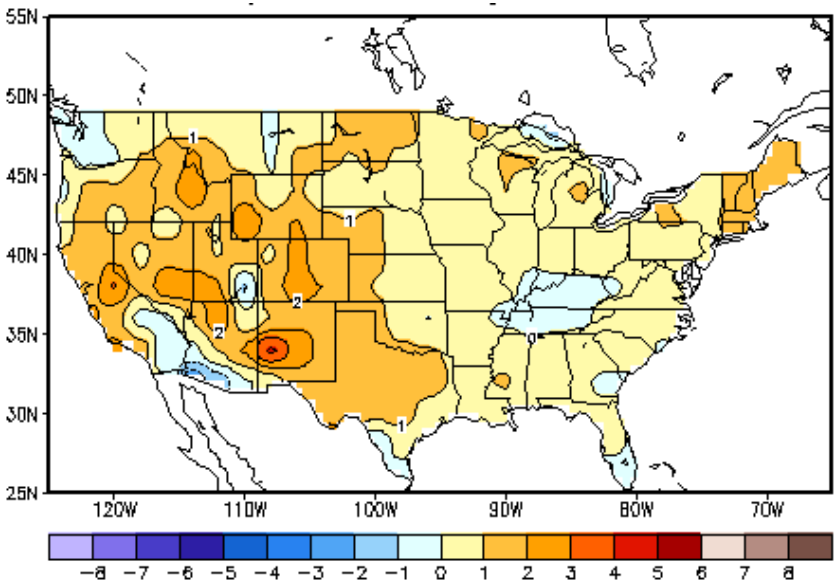
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 17 October 2015

Percent of Average Precipitation



Temperature Departures (degree C)

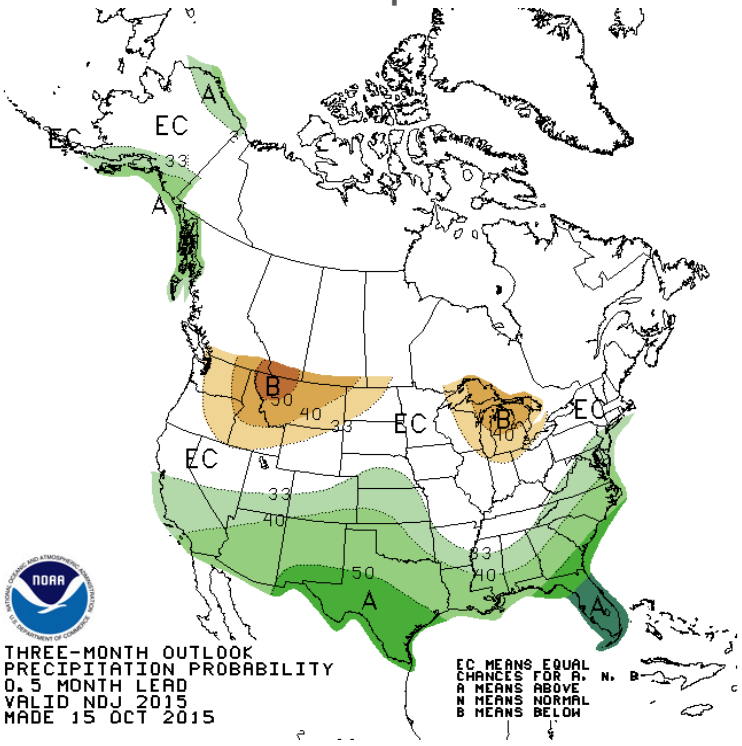


U. S. Seasonal Outlooks

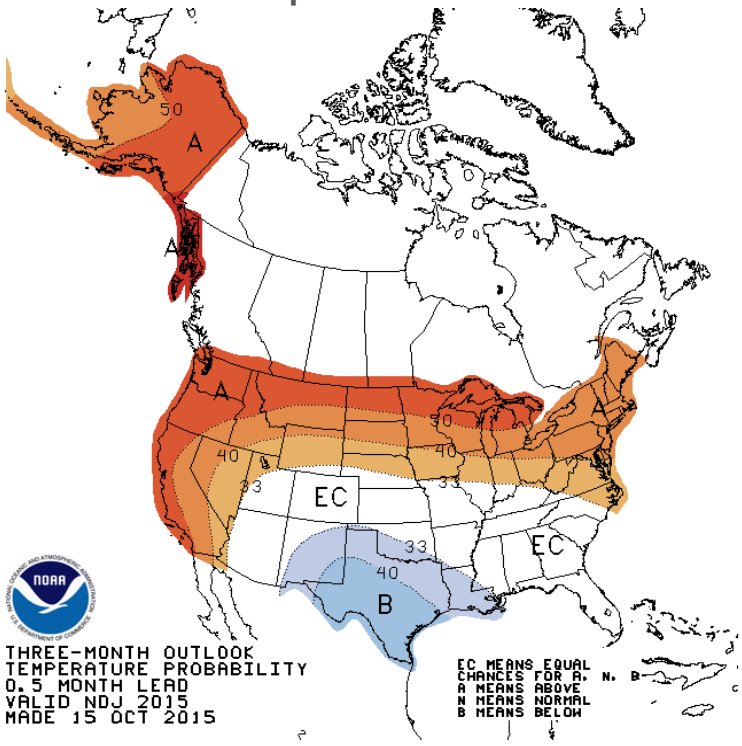
November 2015 - January 2016

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

Precipitation



Temperature



Summary

ENSO Alert System Status: El Niño Advisory

El Niño conditions are present.*

Positive equatorial sea surface temperature (SST) anomalies continue across most of the Pacific Ocean.

There is an approximately 95% chance that El Niño will continue through Northern Hemisphere winter 2015-16, gradually weakening through spring 2016.*

* 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.