ENSO: Recent Evolution, Current Status and Predictions

Update prepared by:
Climate Prediction Center / NCEP
31 August 2015

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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 a greater than 90% chance that El Niño will continue through Northern Hemisphere winter 2015-16, and around an 85% chance it will last into early spring 2016.*

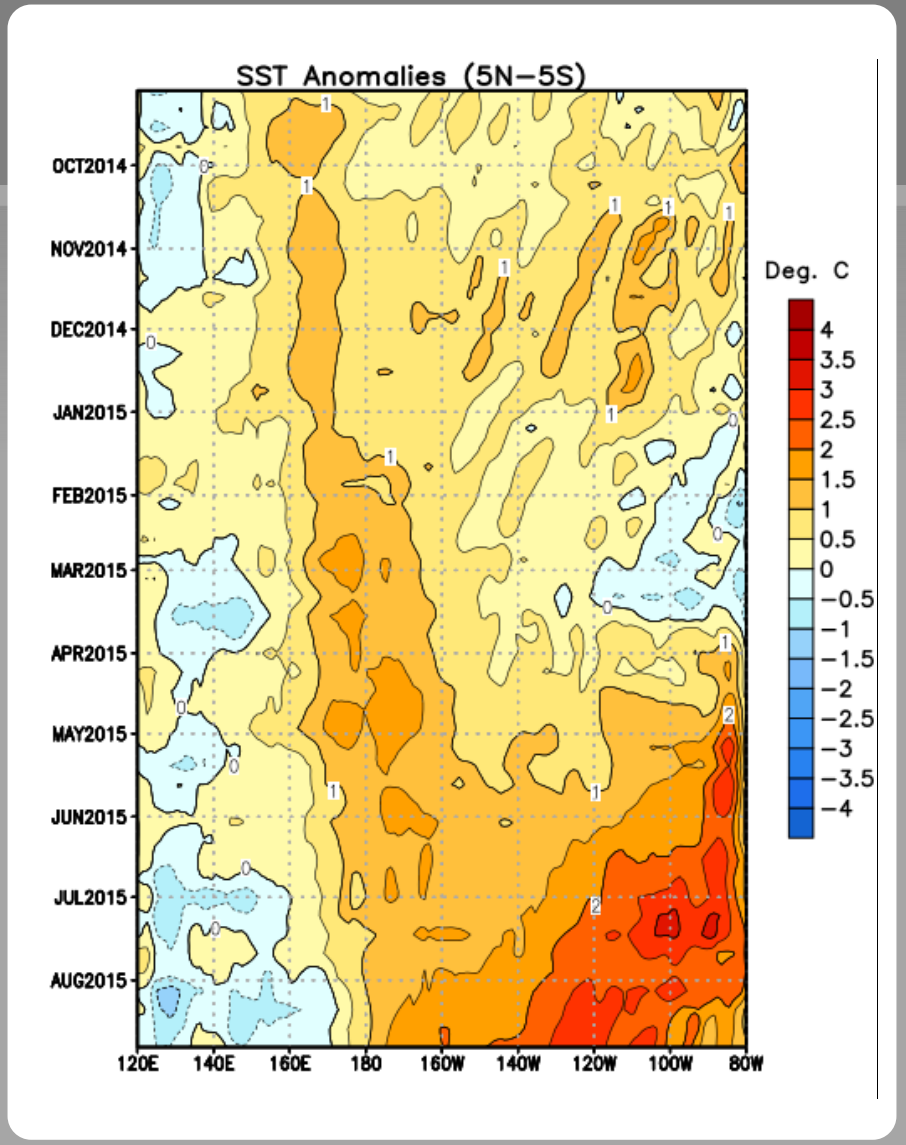
* Note: These statements are updated once a month (2nd Thursday of each month) in association with the ENSO Diagnostics Discussion, which can be found by clicking here.

Recent Evolution of Equatorial Pacific SST Departures (°C)

During September-December 2014, positive SST anomalies covered most of the equatorial Pacific.

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.

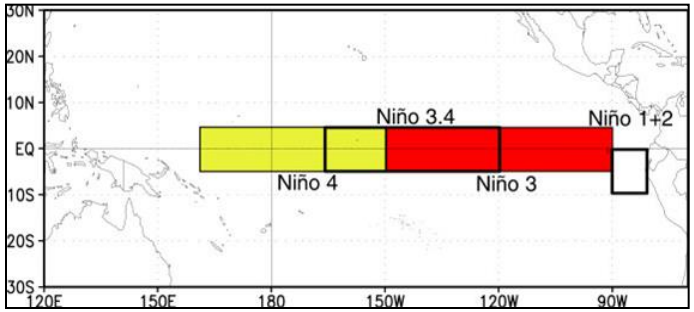
Since April 2015, positive SST anomalies strengthened across the east-central Pacific.

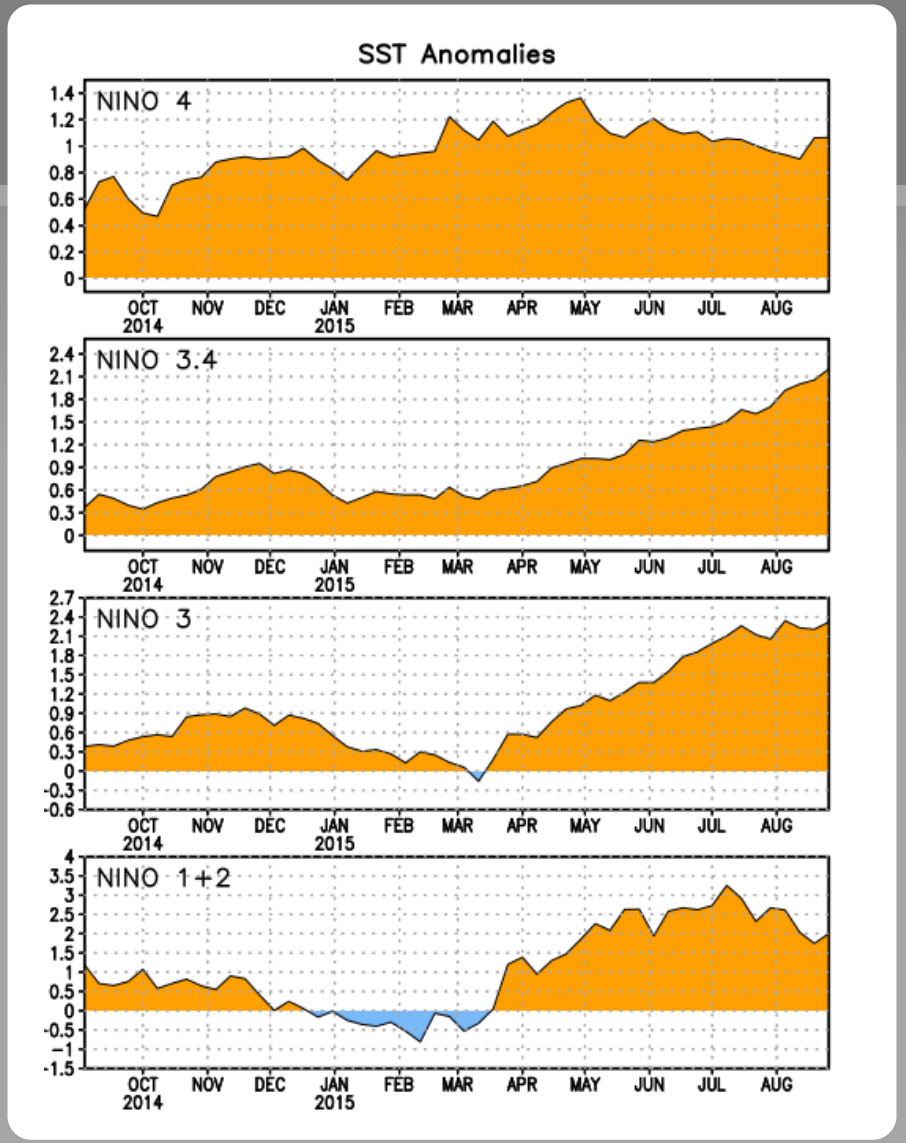


Niño Region SST Departures (ºC) Recent Evolution

The latest weekly SST departures are:

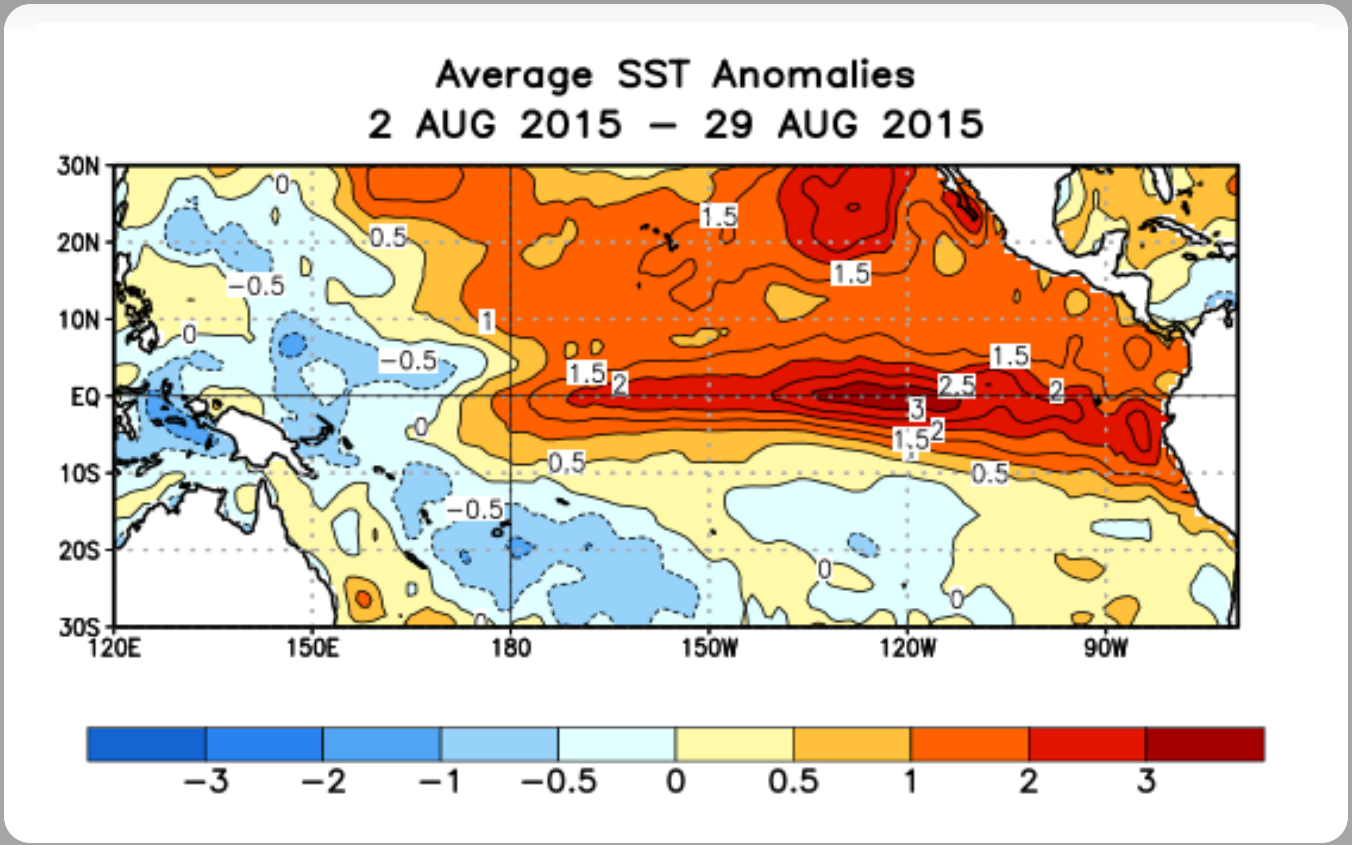
Niño 4	1.1ºC
Niño 3.4	2.2ºC
Niño 3	2.3ºC
Niño 1+2	2.0ºC





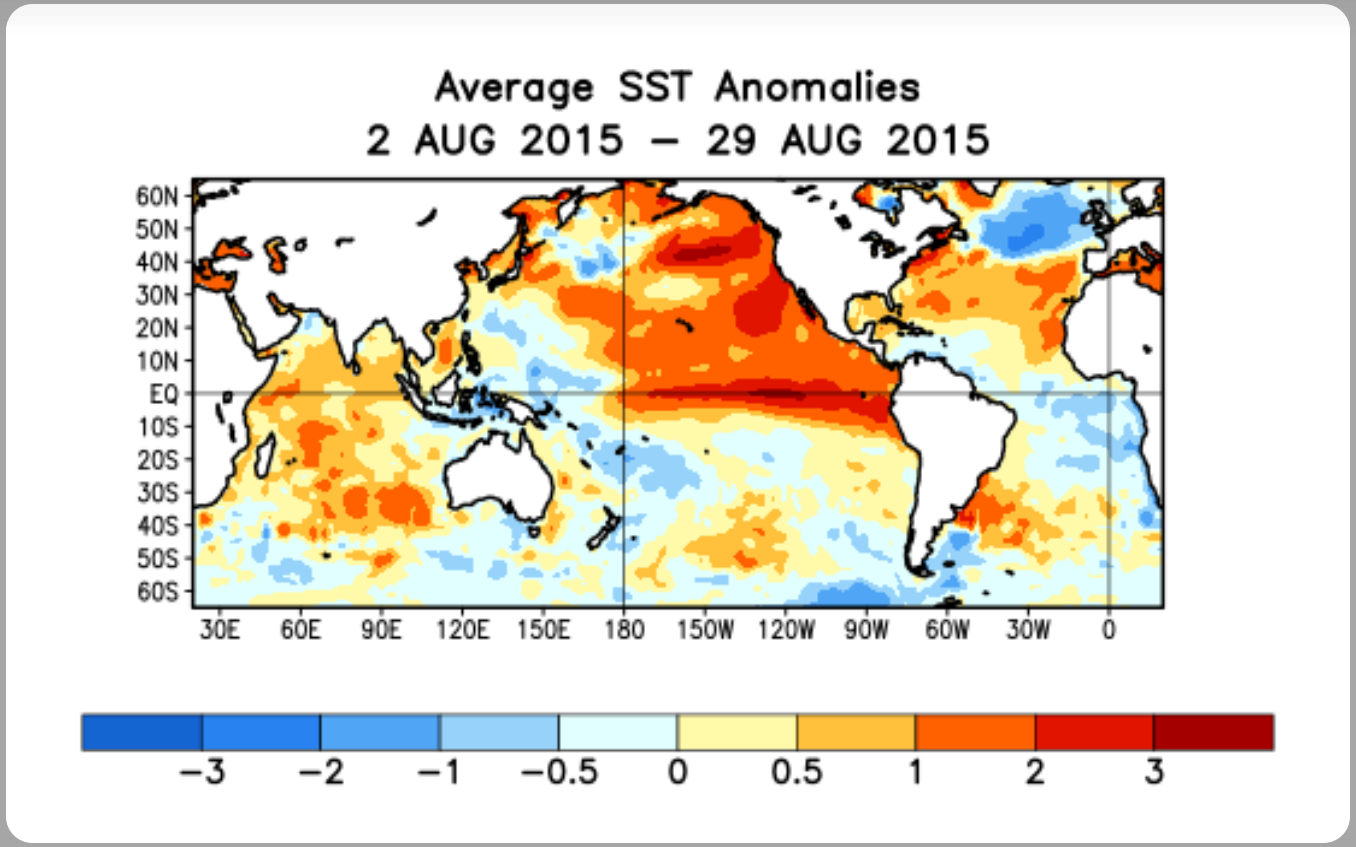
SST Departures (°C) in the Tropical Pacific During the Last Four Weeks

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



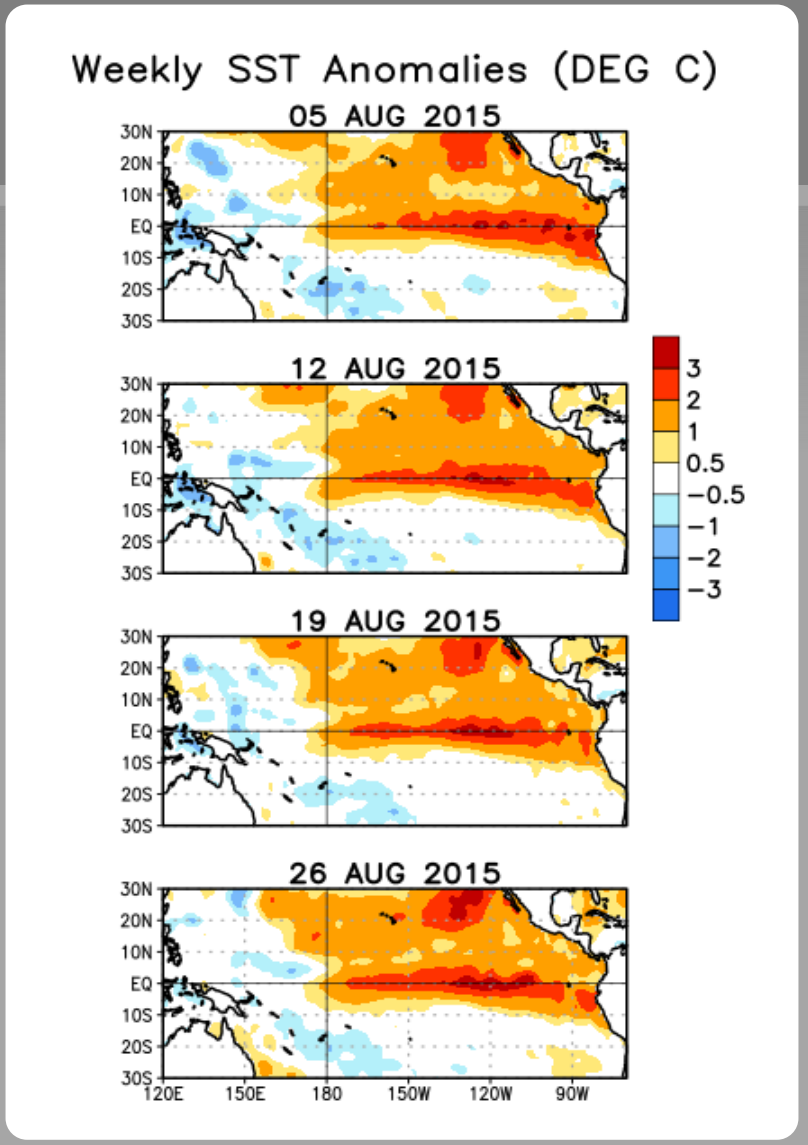
Global SST Departures (°C) During the Last Four Weeks

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



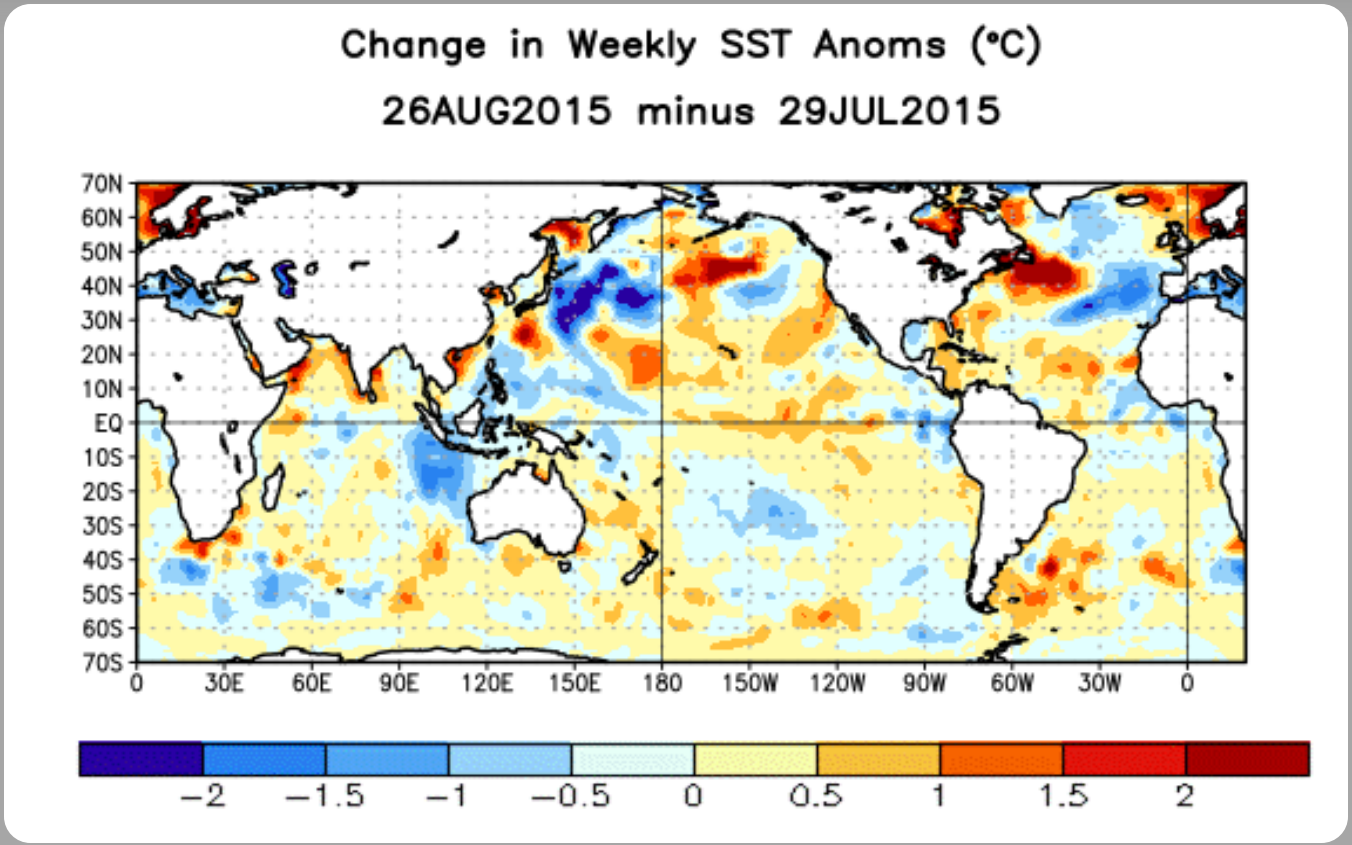
Weekly SST Departures during the Last Four Weeks

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



Change in Weekly SST Departures over the Last Four Weeks

During the last four weeks, positive SST changes were evident in the east-central equatorial Pacific, while negative changes were evident in the western and far eastern Pacific.



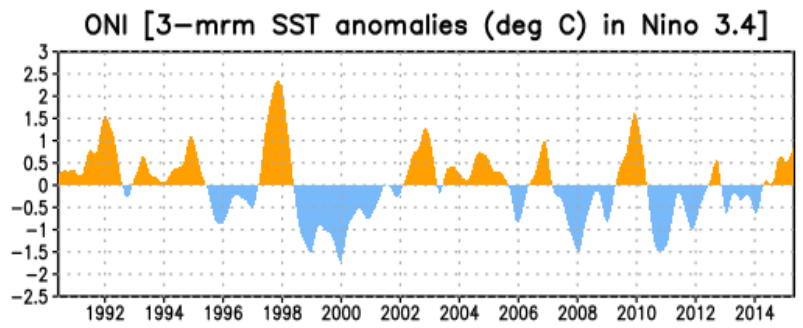
Upper-Ocean Conditions in the Equatorial Pacific

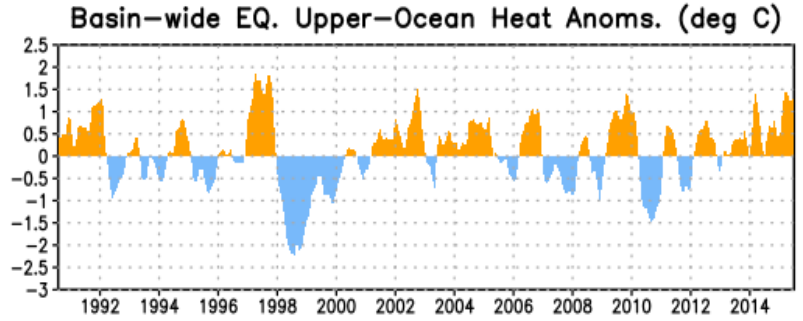
The basin-wide equatorial upper ocean (0-300 m) heat content is greatest prior to and during the early stages of a Pacific warm (El Niño) episode (compare top 2 panels), and least prior to and during the early stages of a cold (La Niña) episode.

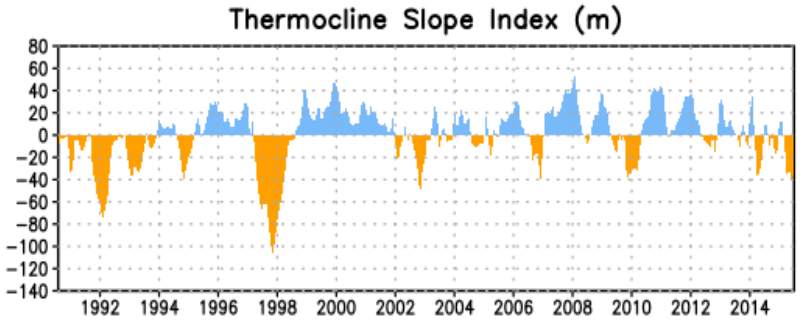
The slope of the oceanic thermocline is least (greatest) during warm (cold) episodes.

Recent values of the upper-ocean heat anomalies (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).

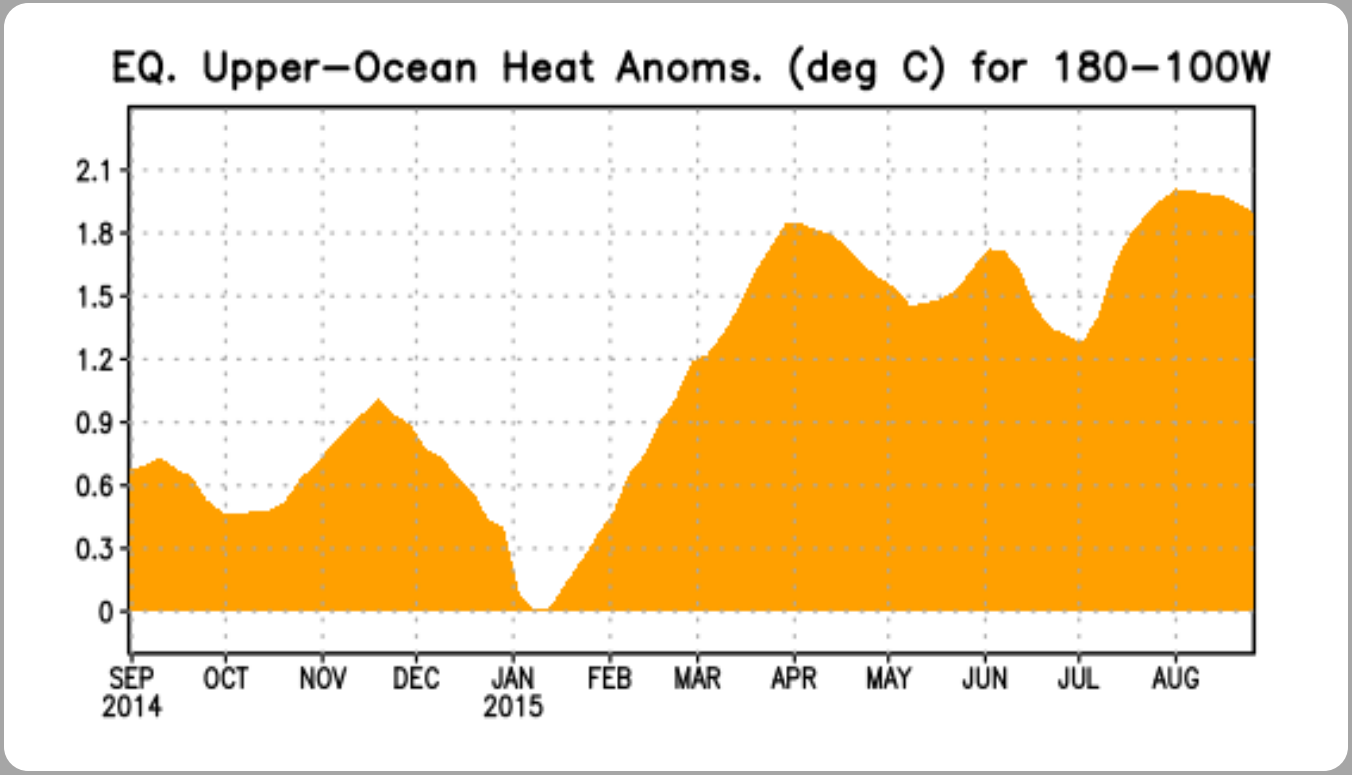






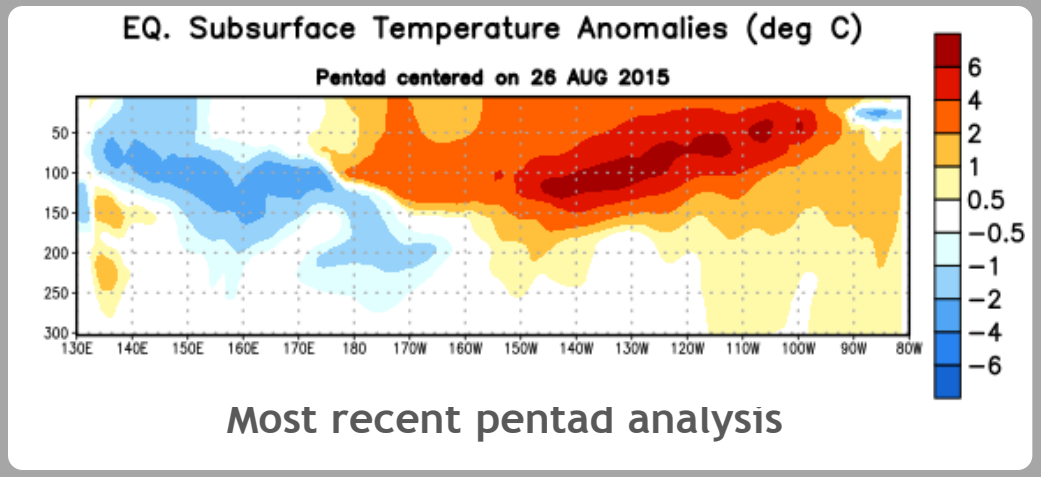
Central and Eastern Pacific Upper-Ocean (0-300 m) Weekly Average Temperature Anomalies

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. Following a drop in June, the anomalies increased in July. Since early August, positive anomalies have persisted.



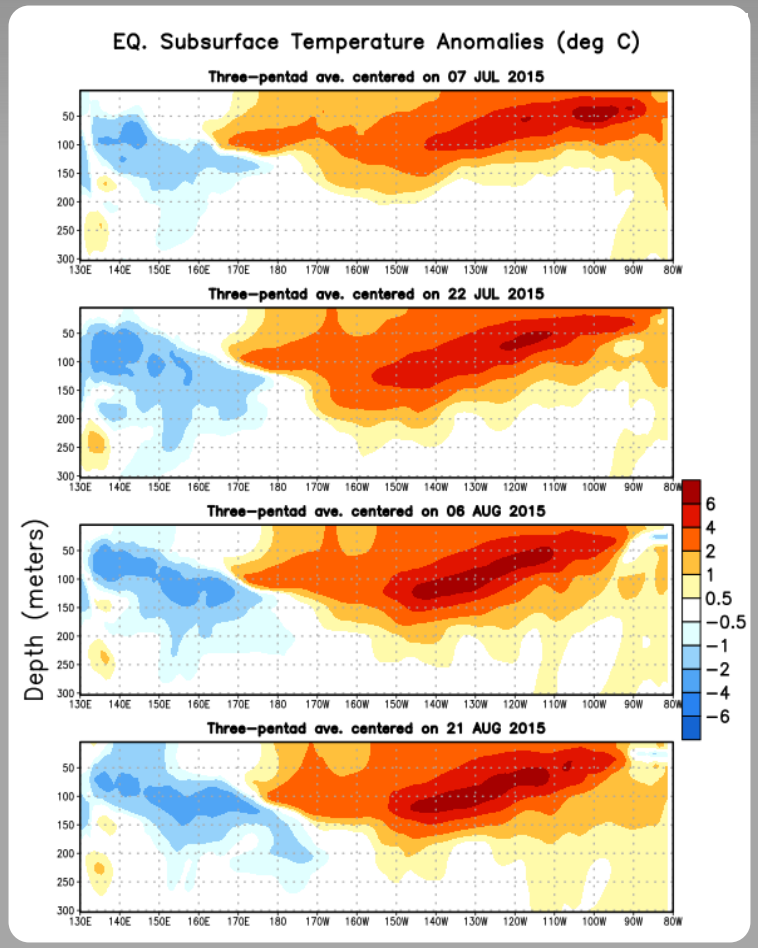
Sub-Surface Temperature Departures in the Equatorial Pacific

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



Most recent pentad analysis

Recently, negative anomalies were evident in the far eastern Pacific and western Pacific, while positive anomalies have persisted across the central and eastern Pacific.

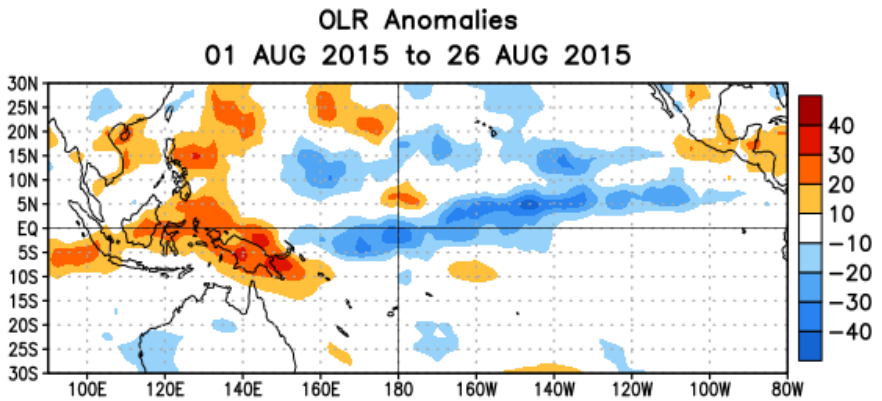


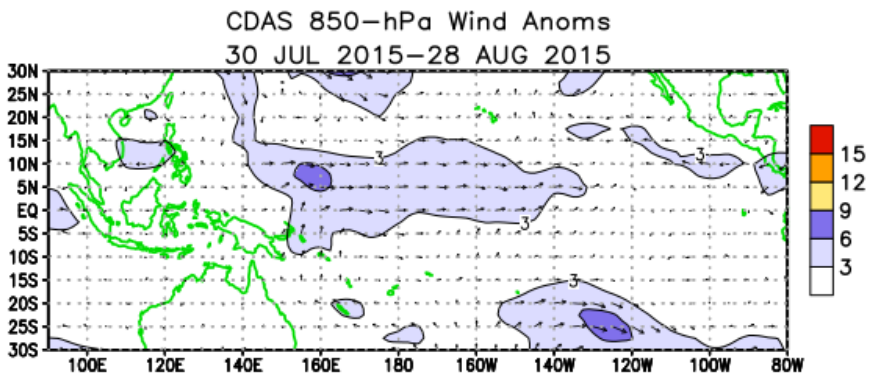
Tropical OLR and Wind Anomalies During the Last 30 Days

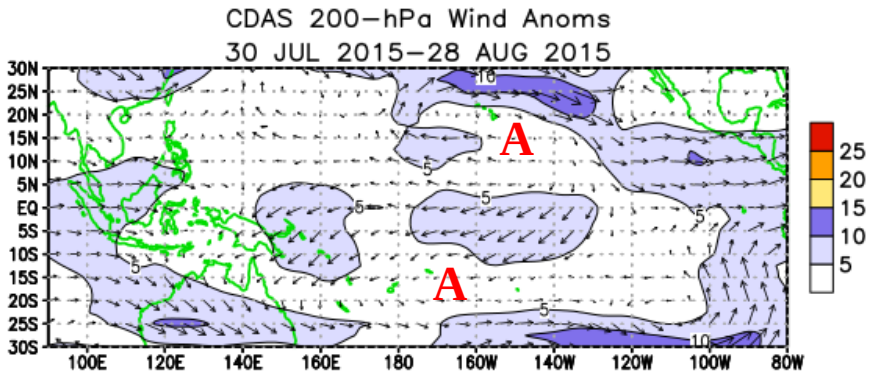
Negative OLR anomalies (enhanced convection and precipitation) were evident across the central and eastern tropical Pacific. Positive OLR anomalies (suppressed convection and precipitation) were observed over Indonesia, the Philippines, and Papua New Guinea.

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 and central equatorial Pacific. An anomalous anti-cyclonic couplet straddled the equator over the east-central tropical 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:

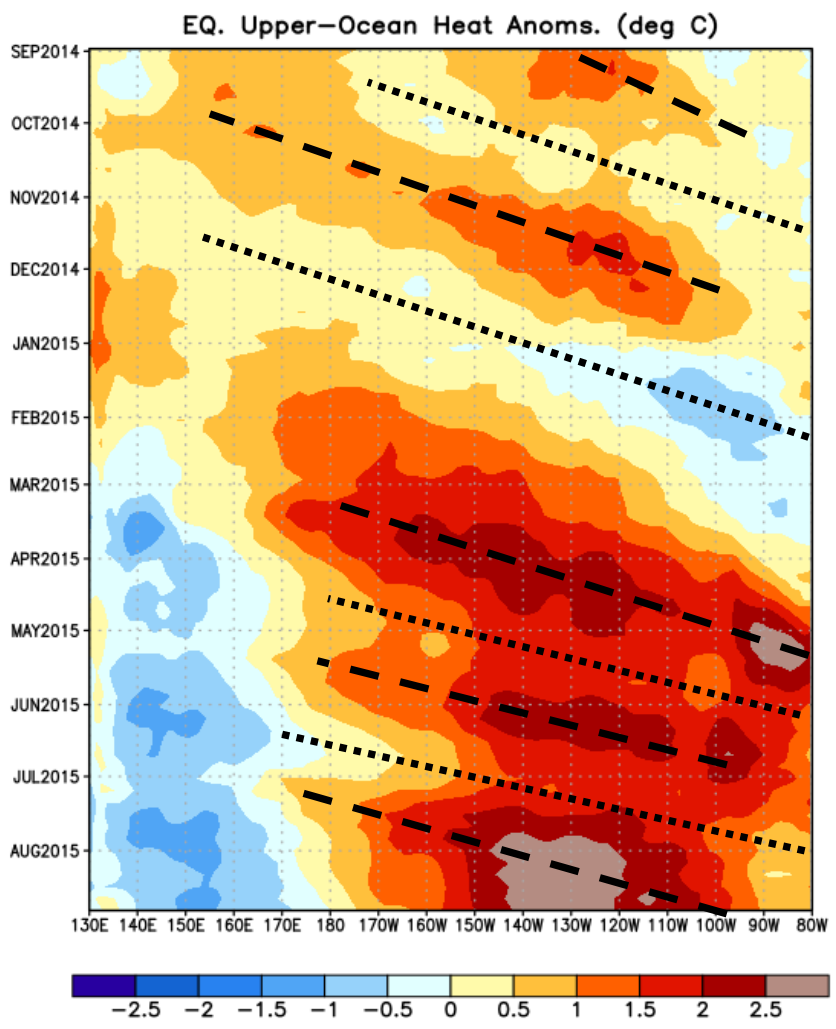
Significant weakening of the low-level easterly winds usually initiates an eastward-propagating oceanic Kelvin wave.

Weekly Heat Content Evolution in the Equatorial Pacific

During November - January, the upwelling phase of a Kelvin wave shifted eastward. This was followed by the downwelling phase of a Kelvin wave in March-April.

From mid-May to late June, another Kelvin wave crossed the Pacific.

Since early July, the downwelling phase of a third Kelvin wave during 2015 is evident.

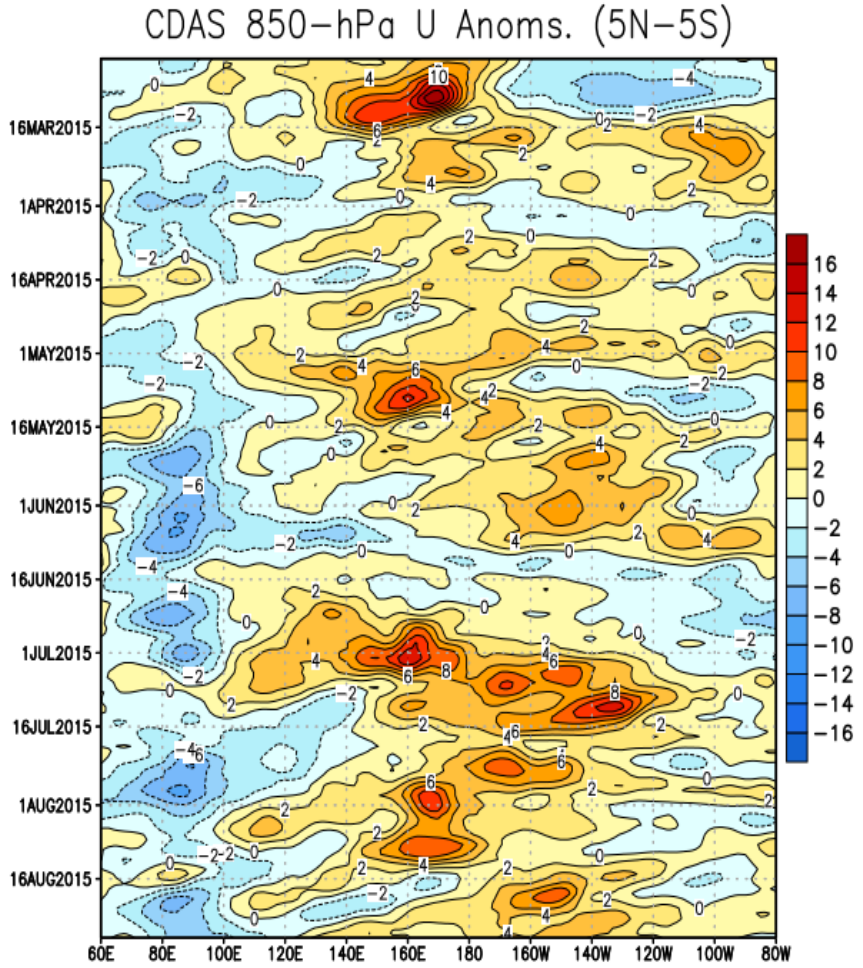


Oceanic Kelvin waves have alternating warm and cold phases. The warm phase is indicated by dashed lines. Down-welling and warming occur in the leading portion of a Kelvin wave, and up-welling and cooling occur in the trailing portion.

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

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

In the last week, westerly wind anomalies remained strongest over the east-central equatorial Pacific.



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

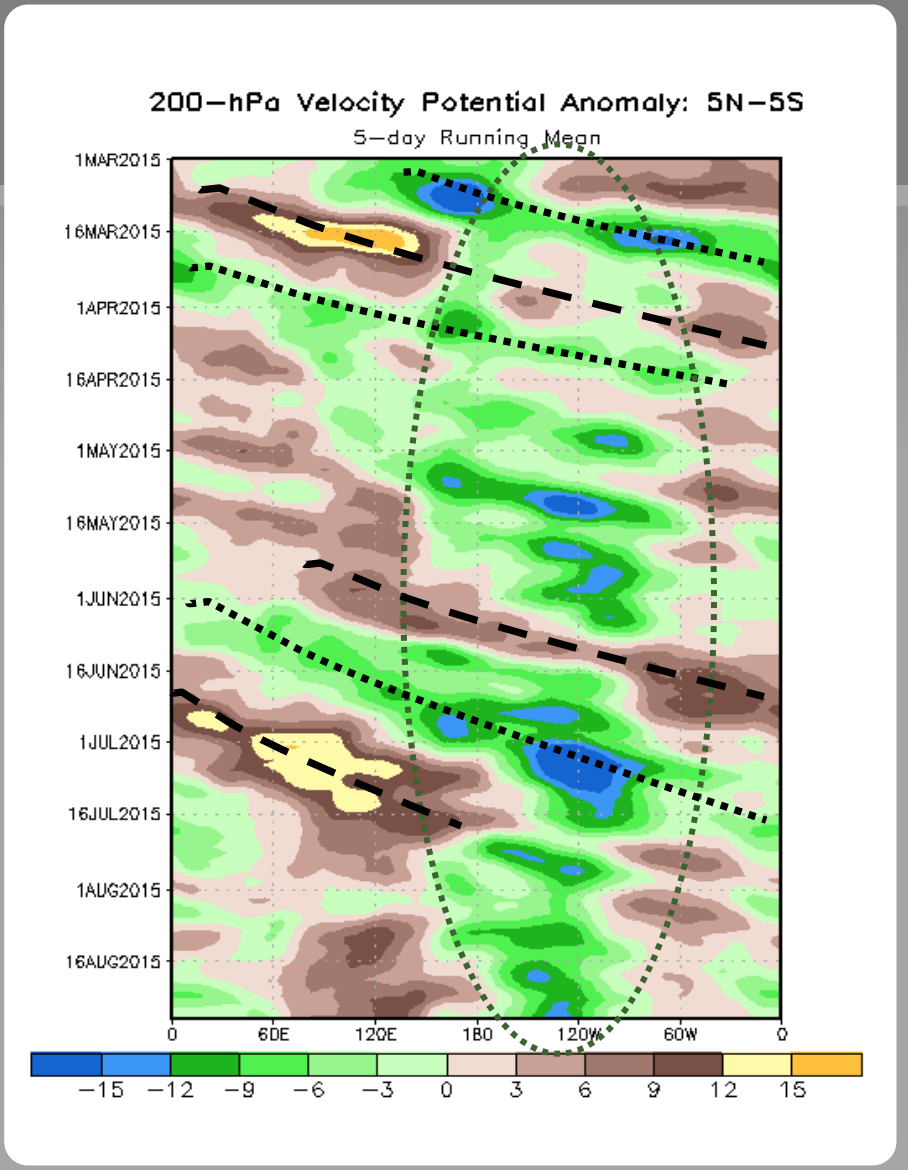
Upper-level (200-hPa) Velocity Potential Anomalies

During March 2015, the Madden-Julian Oscillation (MJO) was associated with eastward propagating velocity potential anomalies.

From late May through early July, the 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.

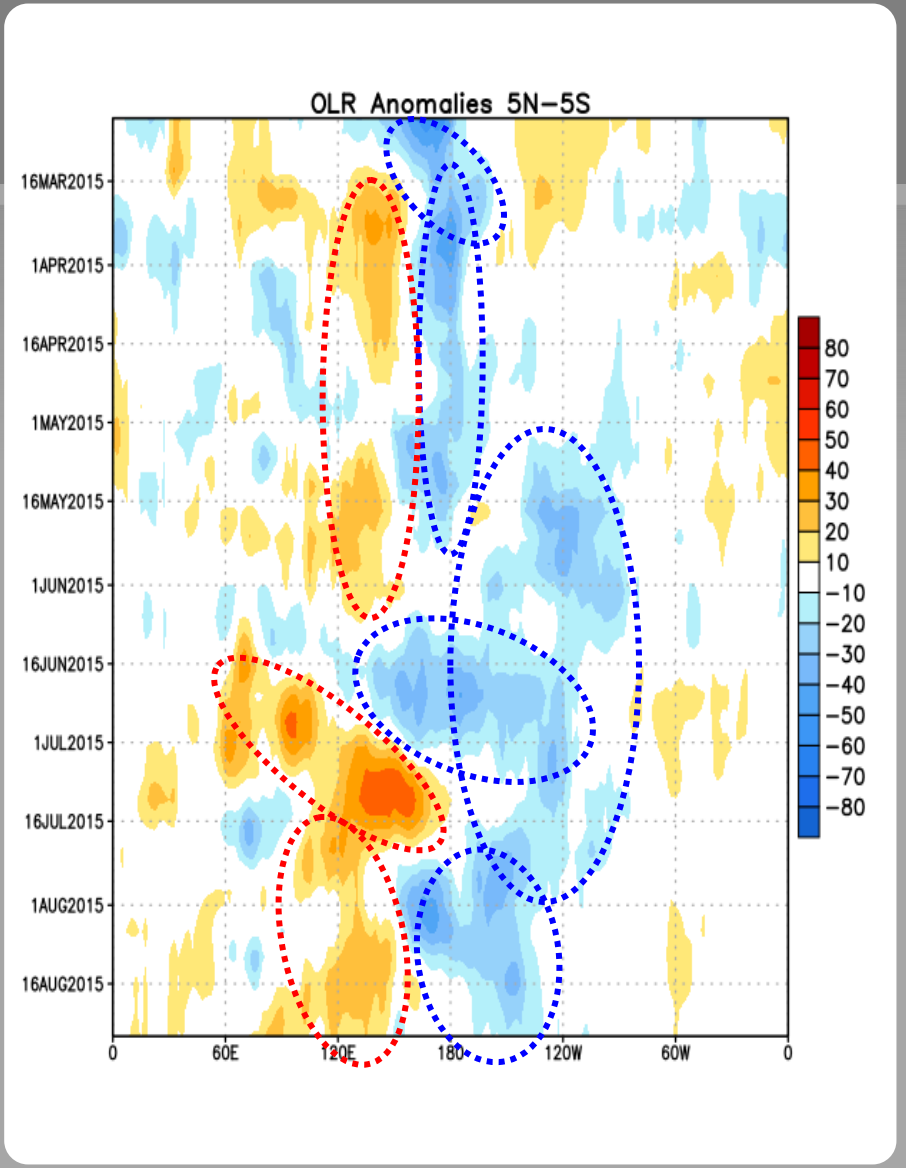
Unfavorable for precipitation (brown shading)
Favorable for precipitation (green shading)



Outgoing Longwave Radiation (OLR) Anomalies

During early March, negative OLR anomalies shifted from Indonesia to the Date Line, where they persisted until late May.

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.

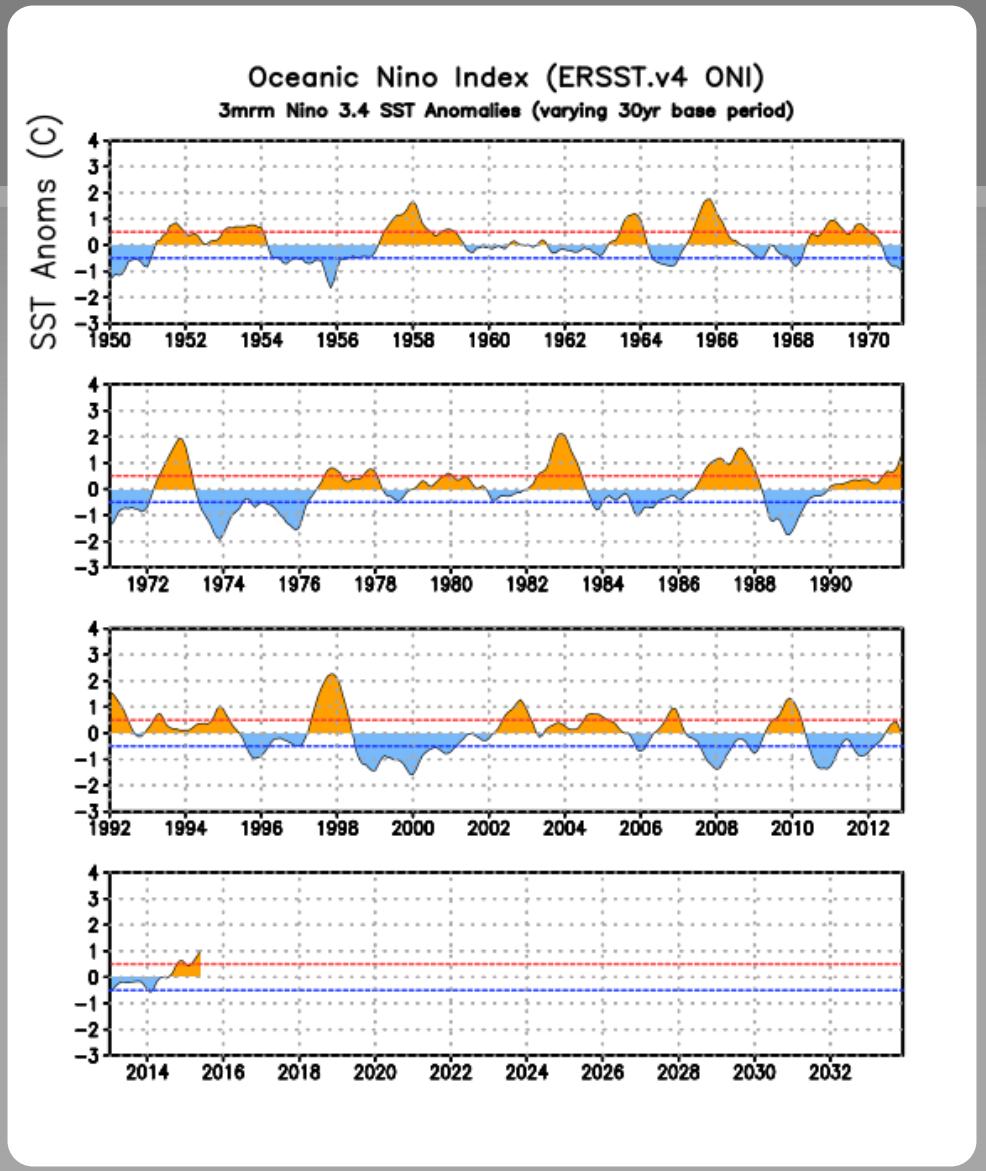
La Niña: characterized by a negative ONI less than or equal to -0.5°C.

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 (May - July 2015) is 1.0°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.

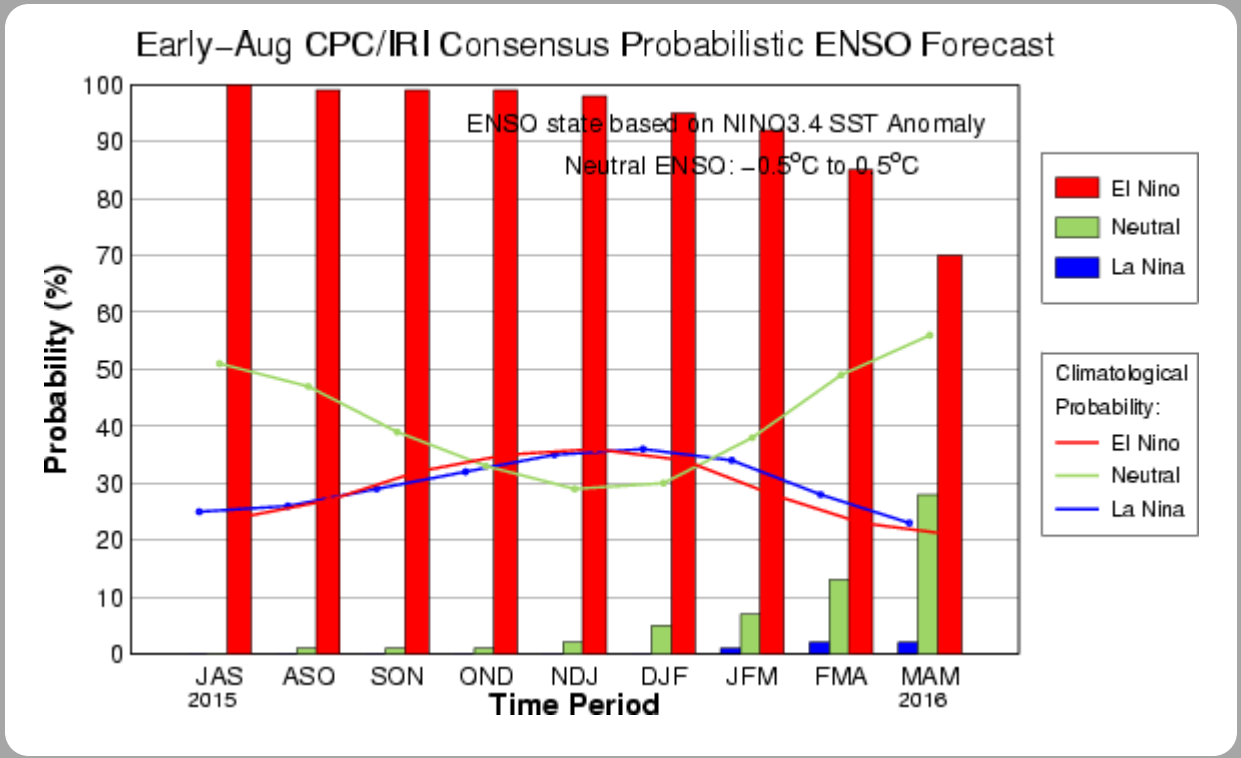
The ONI is one measure of the El Niño-Southern Oscillation, and other indices can confirm whether features consistent with a coupled ocean-atmosphere phenomenon accompanied these periods. The complete table going back to DJF 1950 can be found here.

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						

CPC/IRI Probabilistic ENSO Outlook

Updated: 13 August 2015

The chance of El Niño is greater than 90% through Northern Hemisphere winter and is near 70% through spring (MAM) 2016.



IRI/CPC Pacific Niño 3.4 SST Model Outlook

Almost all of the models indicate Niño 3.4 SST anomalies will remain greater than or equal to +0.5°C through spring 2016.

All multi-model averages indicate that Niño 3.4 will be above +1.5°C (a "strong" El Niño) during late 2015 into early 2016.

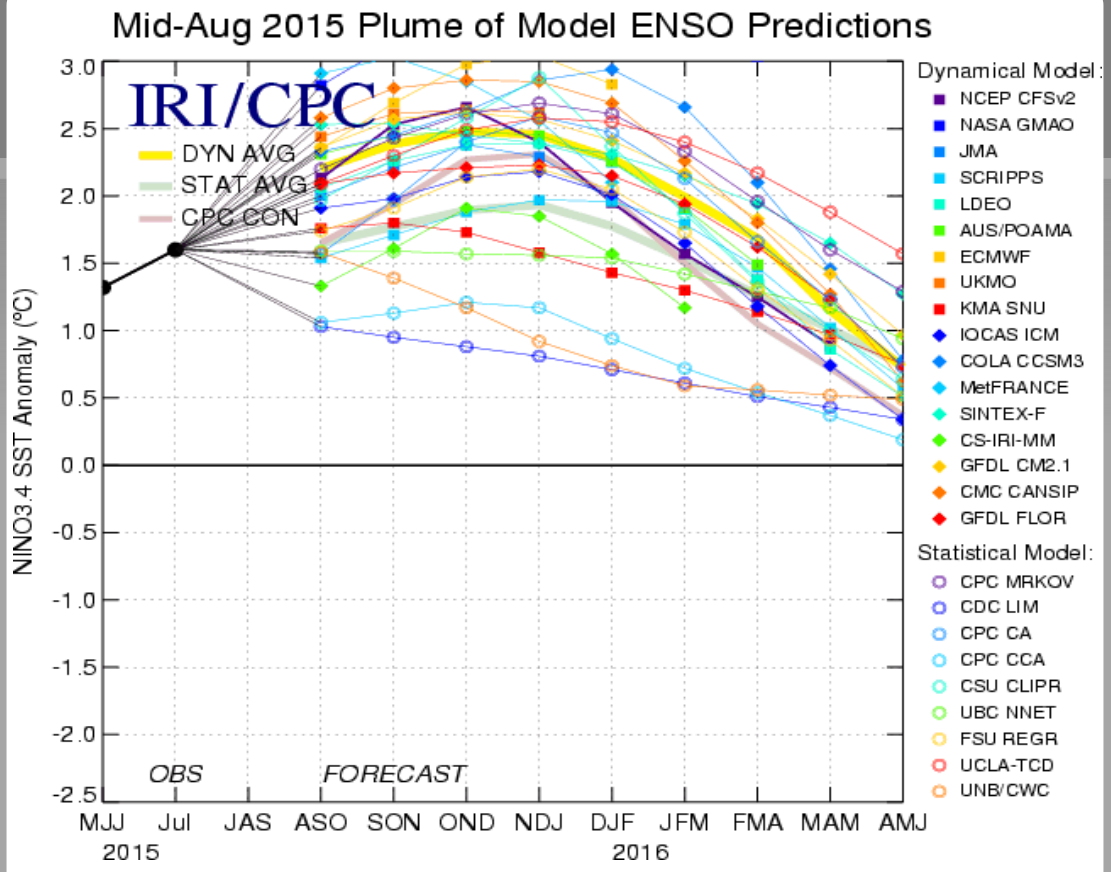
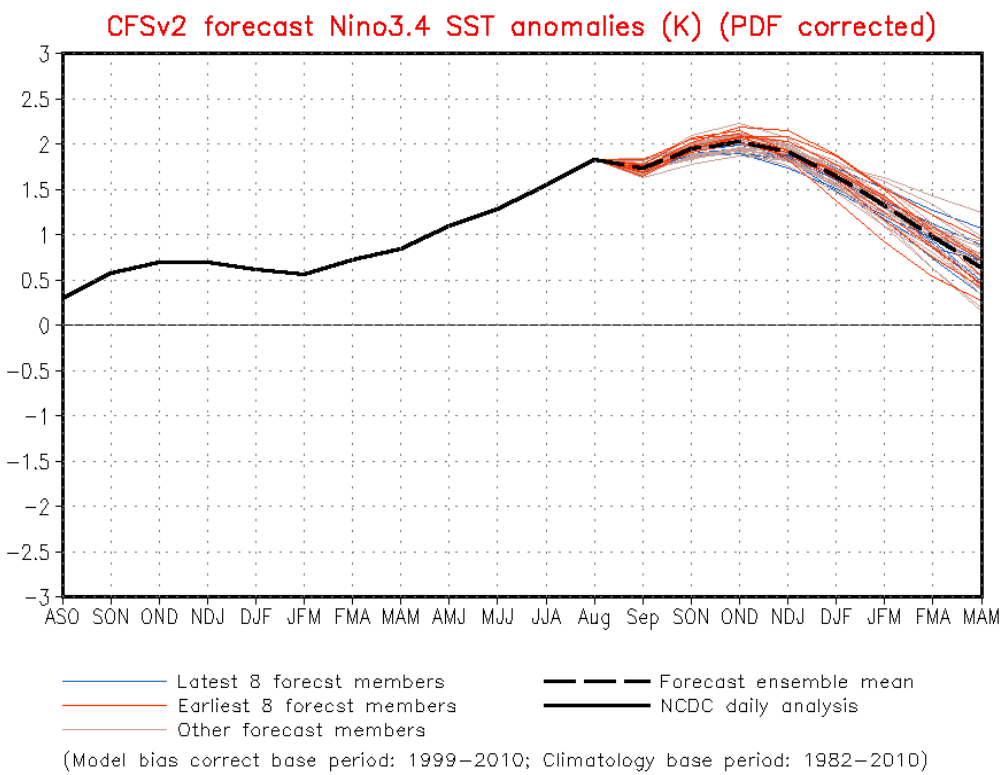


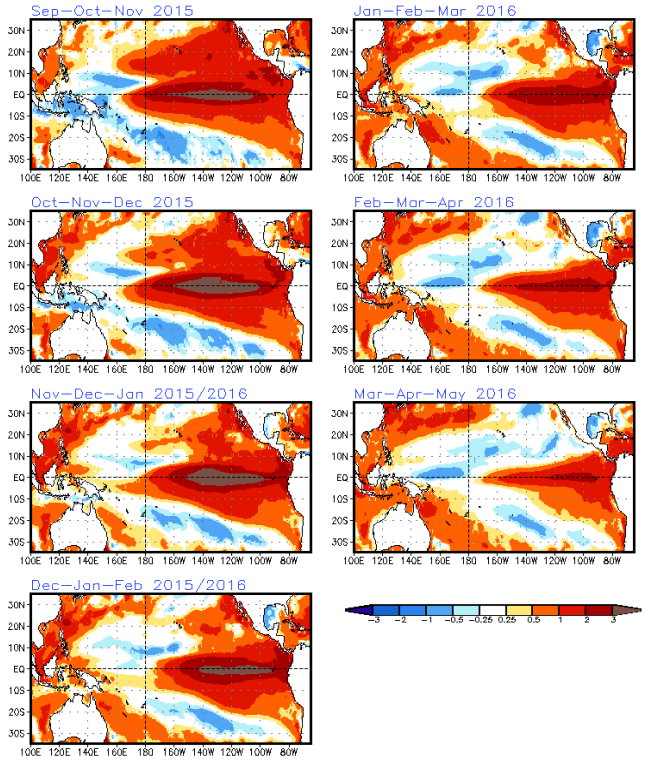
Figure provided by the International Research Institute (IRI) for Climate and Society (updated 18 August 2015).

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

Issued: 31 August 2015

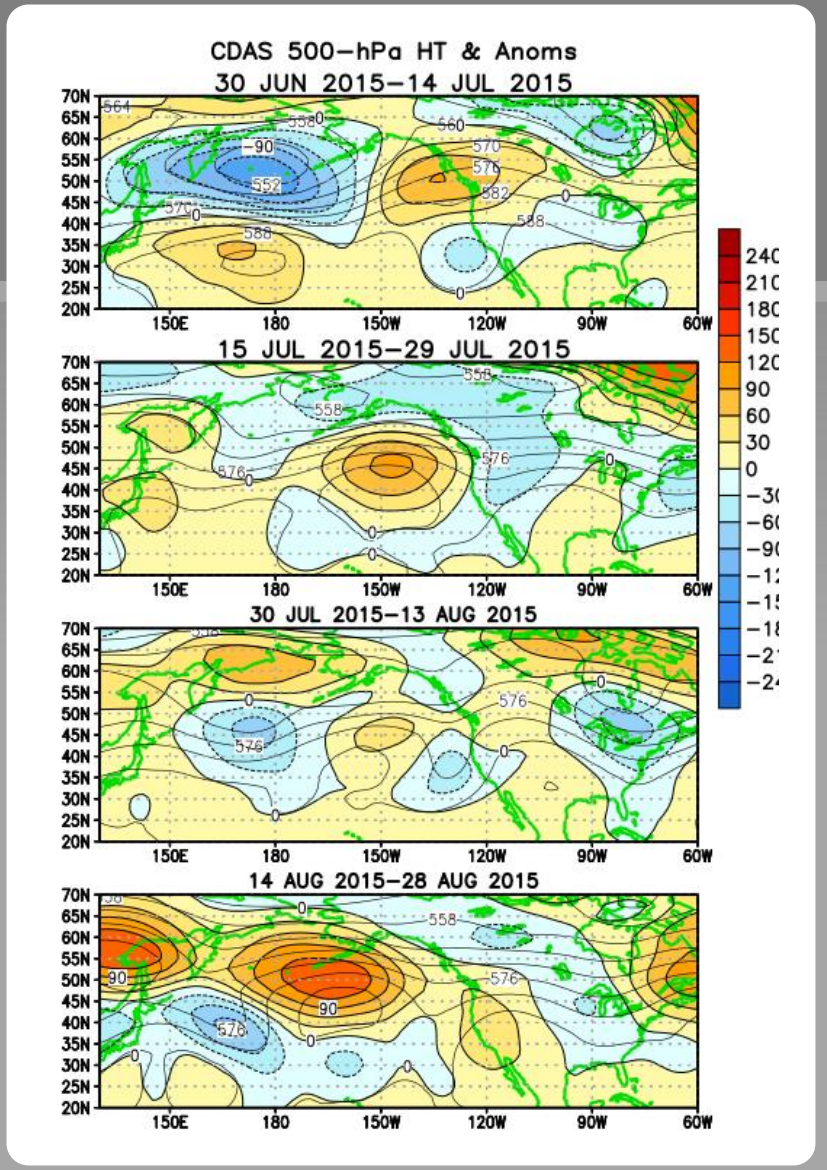
The CFS.v2 ensemble mean (black dashed line) predicts El Niño through MAM 2016.





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

Since late June 2015, below-average heights and temperatures have prevailed over portions of the western U.S. and/or near the Great Lakes.



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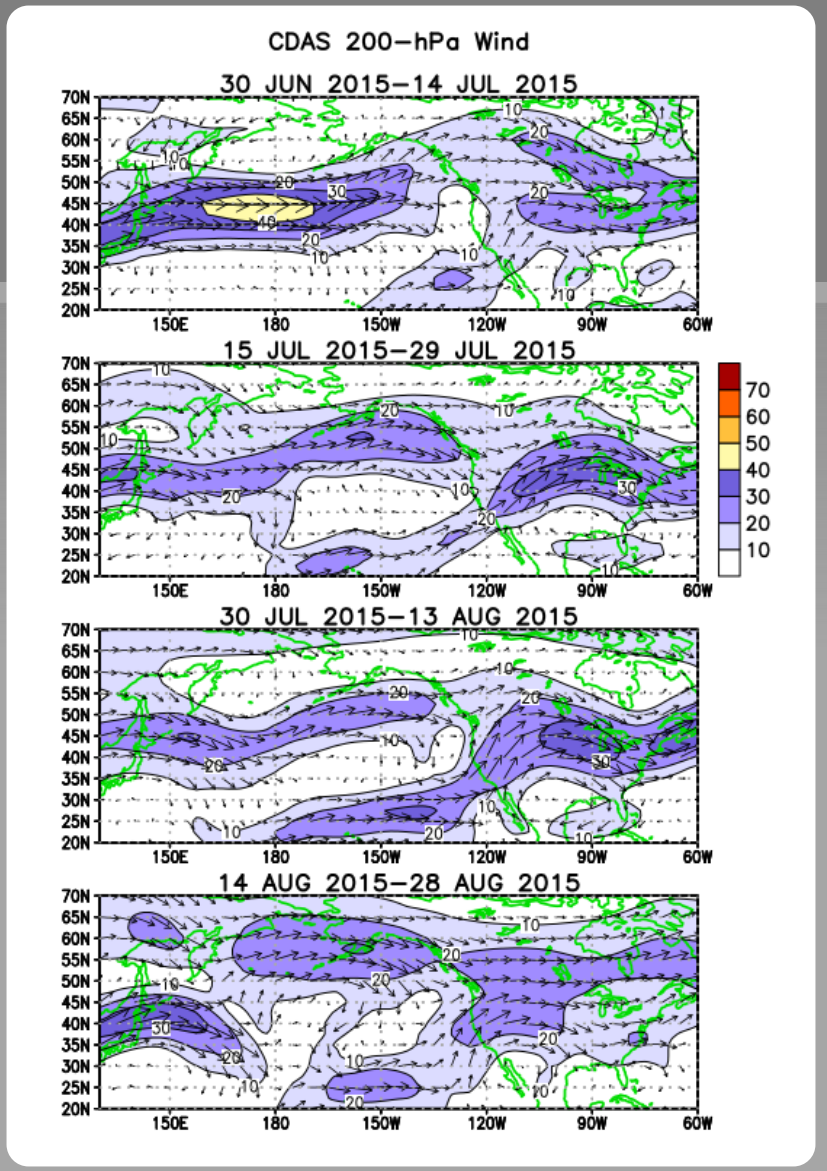

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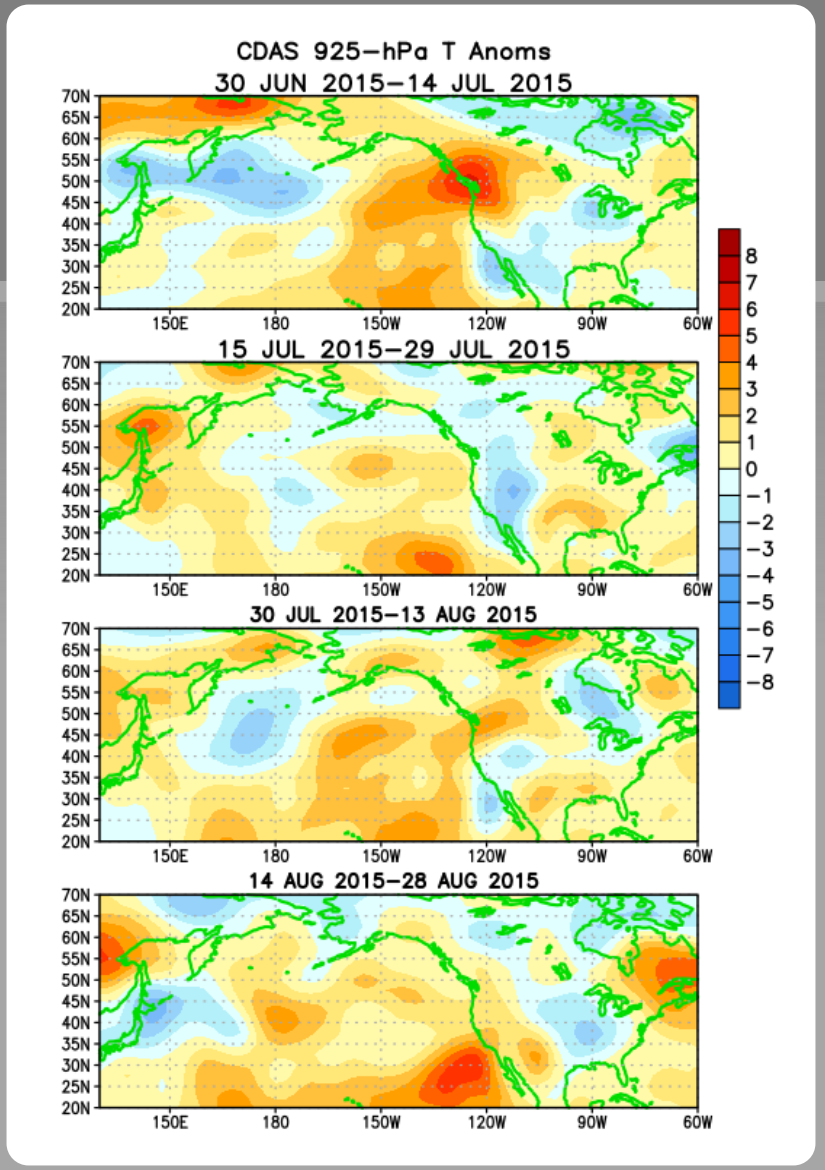
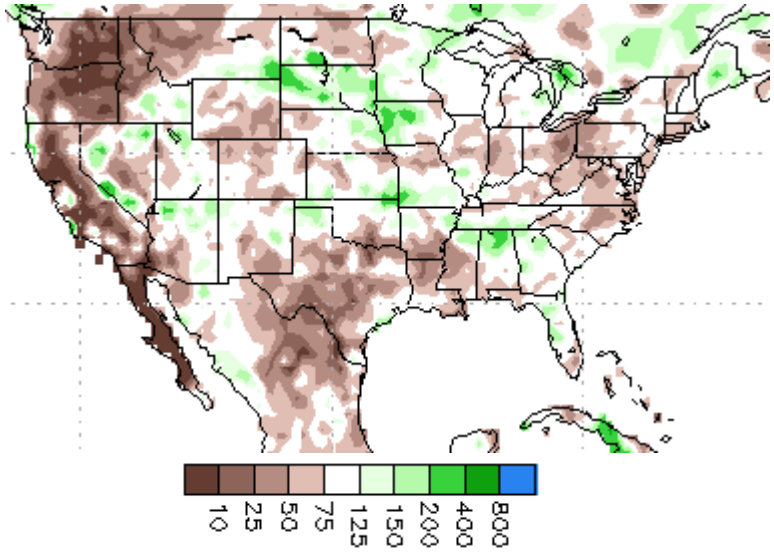


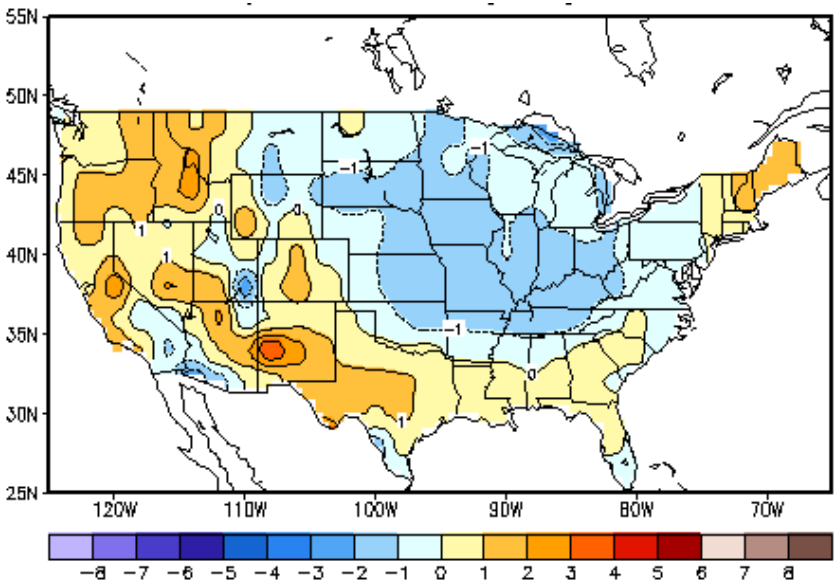
U.S. Temperature and Precipitation Departures During the Last 30 Days

End Date: 29 August 2015

Percent of Average Precipitation



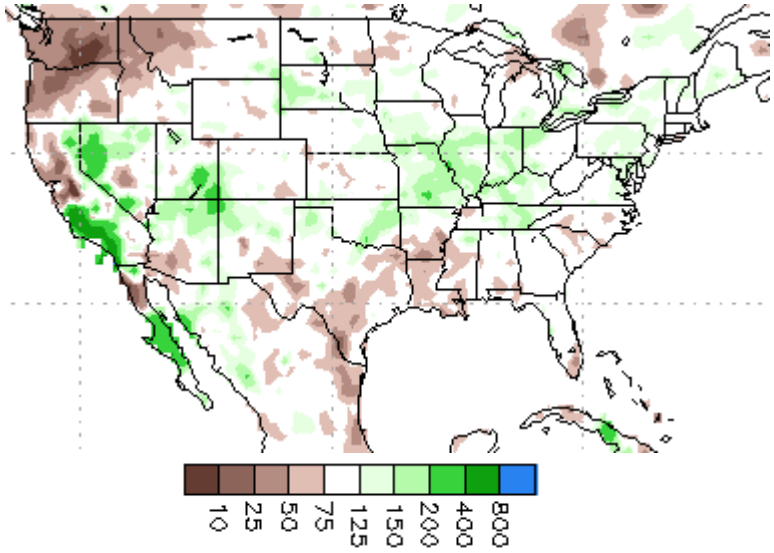
Temperature Departures (degree C)



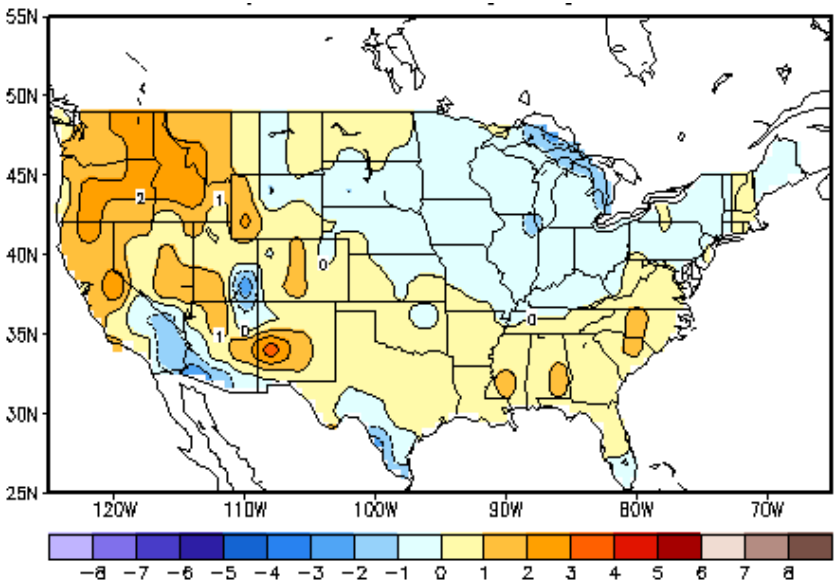
U.S. Temperature and Precipitation Departures During the Last 90 Days

End Date: 29 August 2015

Percent of Average Precipitation



Temperature Departures (degree C)

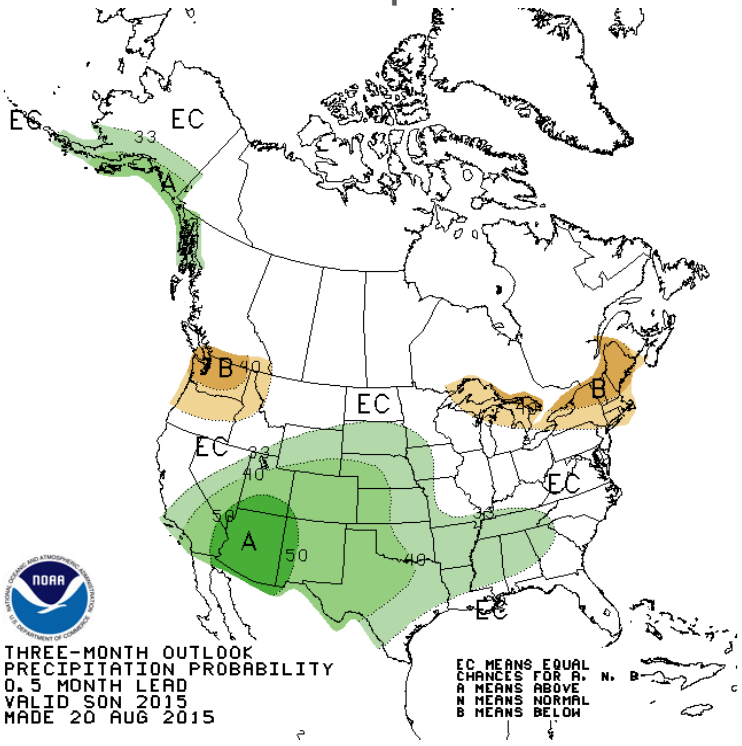


U. S. Seasonal Outlooks

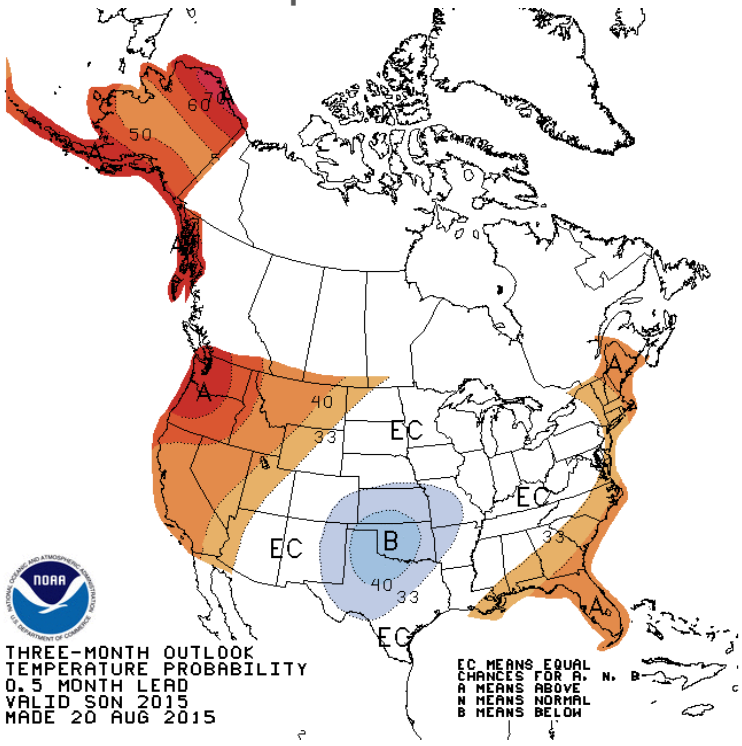
September - November 2015

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

Precipitation



Temperature



Summary

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There is a greater than 90% chance that El Niño will continue through Northern Hemisphere winter 2015-16, and around an 85% chance it will last into early spring 2016.*

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