

Global Ocean Monitoring: Recent Evolution, Current Status, and Predictions

Prepared by
Climate Prediction Center, NCEP/NOAA
November 7, 2014

<http://www.cpc.ncep.noaa.gov/products/GODAS/>

This project to deliver real-time ocean monitoring products is implemented by CPC in cooperation with NOAA Ocean Climate Observation Program (OCO)

Outline

- **Overview**
- **Recent highlights**
 - **Pacific/Arctic Ocean (ENSO evolution and prediction)**
 - **Indian Ocean**
 - **Atlantic Ocean**
- **Global SST Predictions**

Overview

▪ Pacific and Arctic Oceans

- ENSO-neutral conditions continued during Oct 2014 (although NINO3.4= +0.5C, the tropical Pacific atmosphere was near-normal).
- The consensus forecast suggests 58% chance of El Niño during the Northern Hemisphere winter, which is favored to last into the Northern Hemisphere spring 2015.
- Positive PDO phase strengthened with PDO= +1.4 in Oct 2014.
- Arctic sea ice was near-normal on the Atlantic side and below-normal on the Pacific side

▪ Indian Ocean

- Indian Ocean Dipole switched from negative to near-normal in Oct 2014.

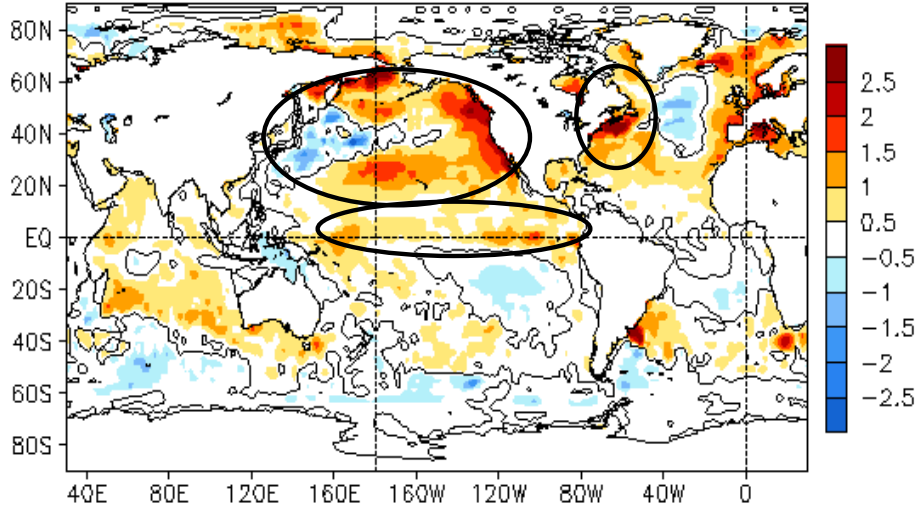
▪ Atlantic Ocean

- NAO phase switched from positive to negative with NAO=-0.87 in Oct 2014.
- 2014 Atlantic hurricane season had 7 tropical storms (TSs), 6 hurricanes (Hs) and 2 major hurricanes (MHs), which is below the average (12 TSs, 6 Hs, 3 MHs). The ACE is 67% of normal.
- 2014 Eastern Pacific hurricane season had 22 TSs, 17 Hs and 6 MHs, which is well above the average (15 TSs, 8 Hs, 4 MHs). The ACE is 147% of normal.

Global Oceans

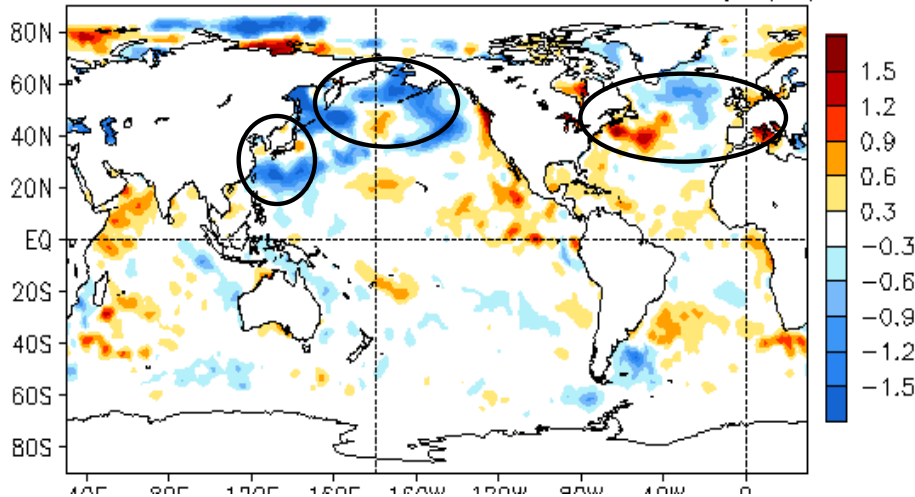
Global SST Anomaly (°C) and Anomaly Tendency

OCT 2014 SST Anomaly (°C)
(1981–2010 Climatology)



- SST was about 1 degree above-normal in the western and eastern tropical Pacific.
- Positive PDO pattern dominated in N. Pacific
- Strong positive SST anomalies presented along coast of northeast U.S.

OCT 2014 – SEP 2014 SST Anomaly (°C)

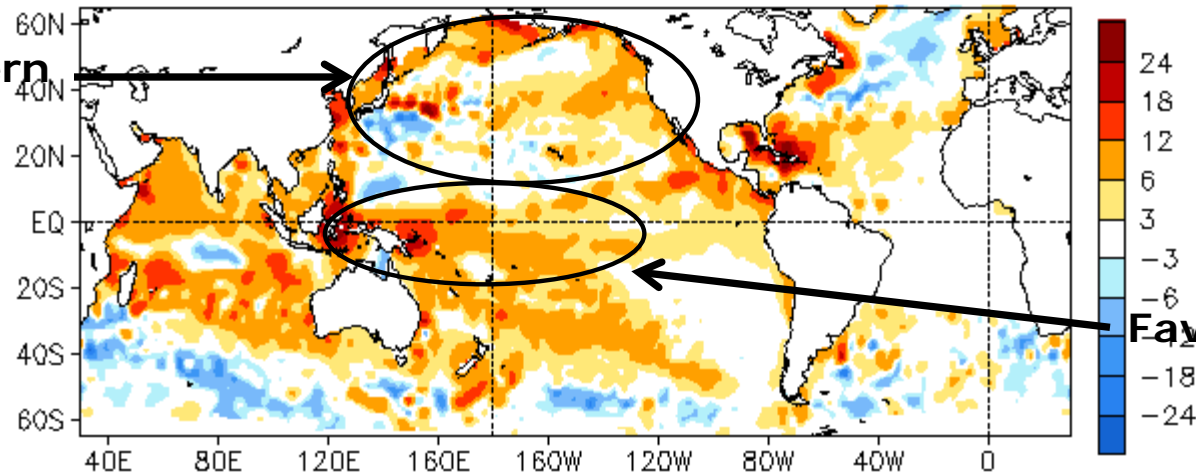


- Strong cooling tendency presented in western N. Pacific and high-latitude N. Pacific.
- A cooling (warming) tendency was observed in subpolar N. Atlantic (Gulf Stream extension).

Fig. G1. Sea surface temperature anomalies (top) and anomaly tendency (bottom). Data are derived from the NCEP OI SST analysis, and anomalies are departures from the 1981-2010 base period means.

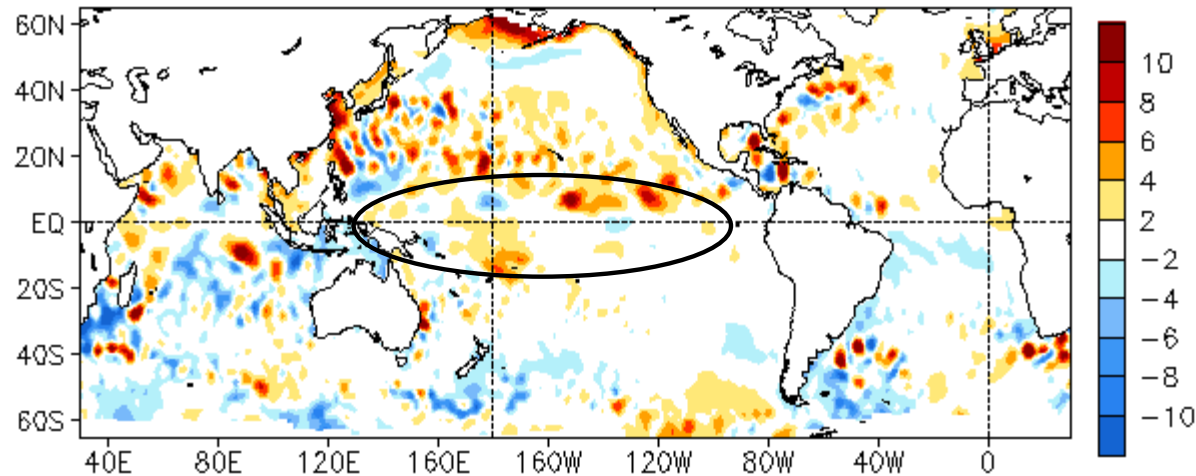
Altimetry Sea Surface Height Anomaly and Anomaly Tendency

OCT 2014 SSH Anomaly (cm)
(AVISO Altimetry, Climo. 93-05)



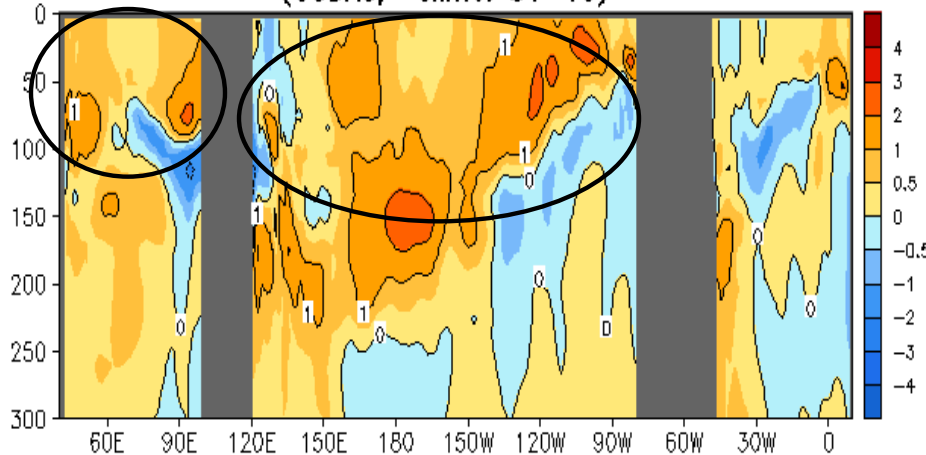
Favourable for El Niño

OCT 2014 - SEP 2014 SSH Anomaly (cm)



Longitude-Depth Temperature Anomaly and Anomaly Tendency in 2°S-2°N

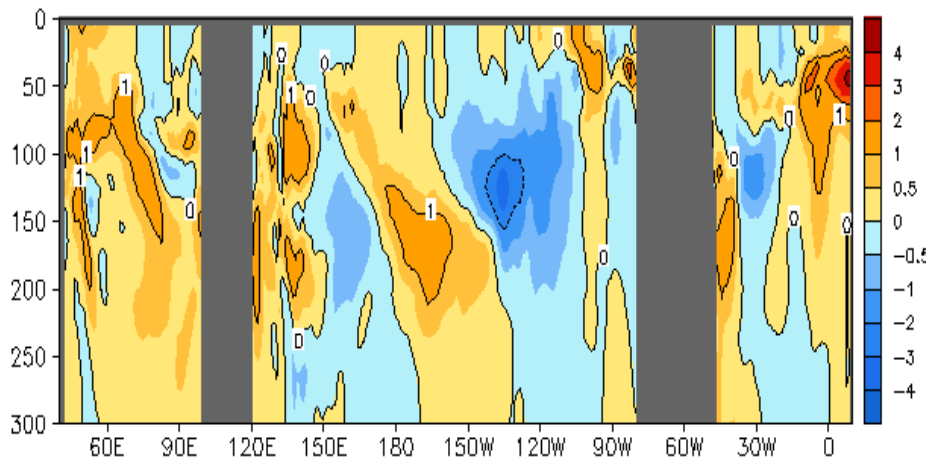
OCT 2014 Eq. Temp Anomaly (°C)
(GODAS, Climo. 81-10)



- Temperature was 2 degree above-normal near the thermocline and 1 degree above-normal near surface west of Dateline.

- Positive anomalies dominated at the upper 100m of equatorial Indian Ocean.

OCT 2014 - SEP 2014 Eq. Temp Anomaly (°C)

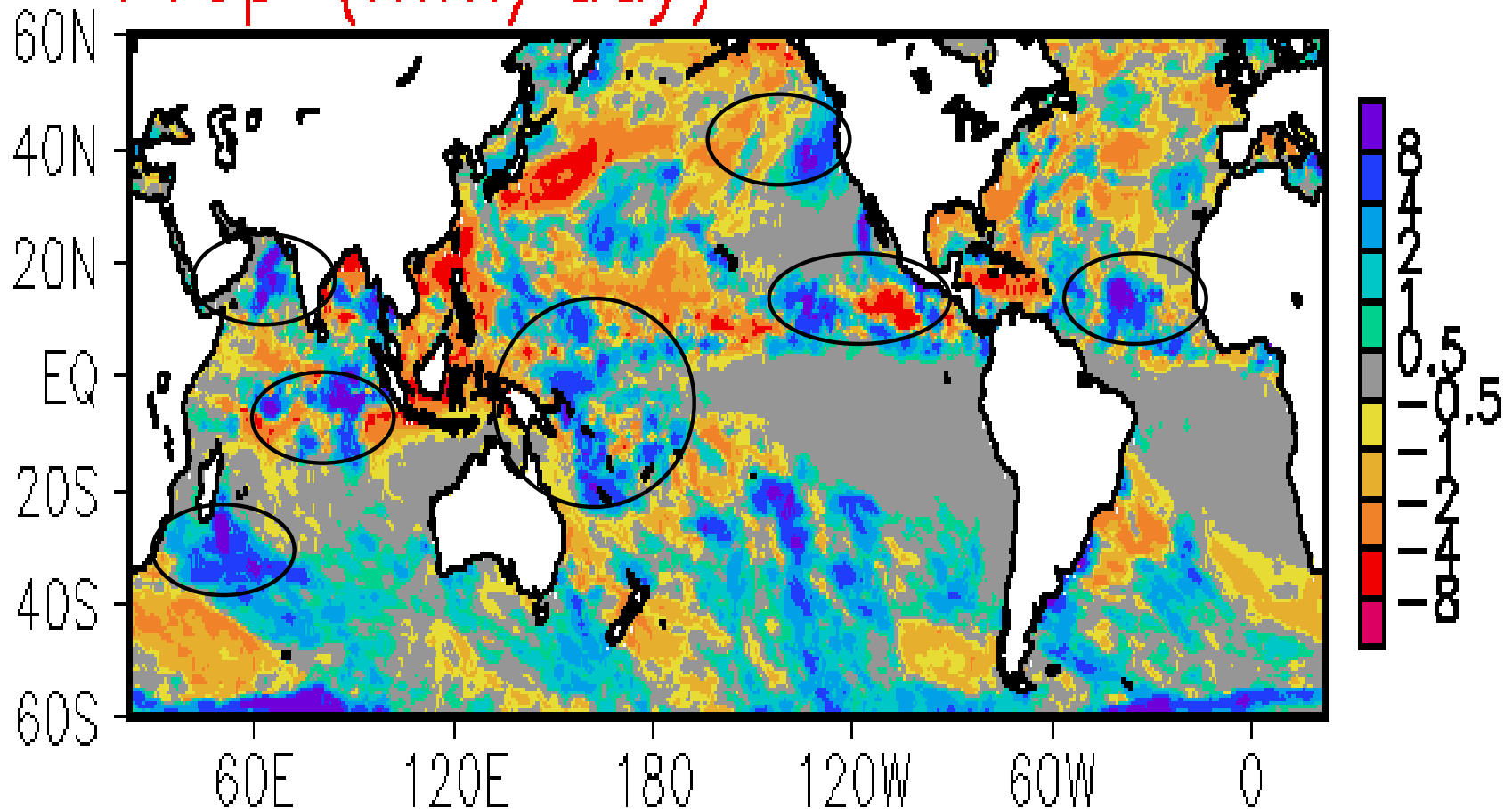


- A cooling (warming) tendency was observed in the eastern (central) equatorial Pacific near the thermocline, largely due to propagation of oceanic Kelvin waves (slide 12).

Fig. G3. Equatorial depth-longitude section of ocean temperature anomalies (top) and anomaly tendency (bottom). Data are derived from the NCEP's global ocean data assimilation system which assimilates oceanic observations into an oceanic GCM. Anomalies are departures from the 1981-2010 base period means.

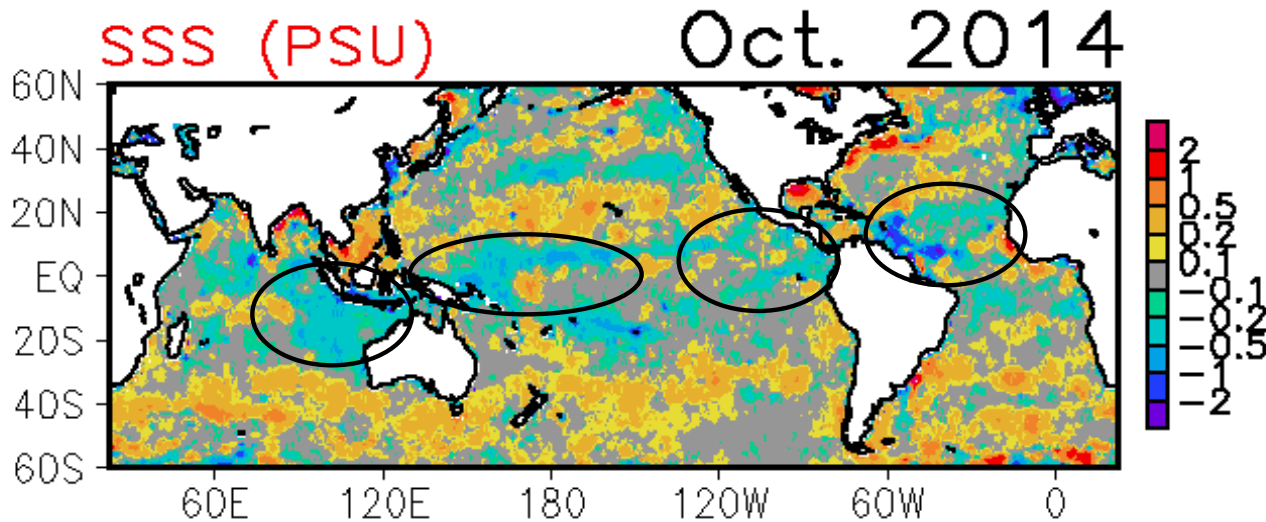
Precipitation Anomaly

Prcp (mm/day)

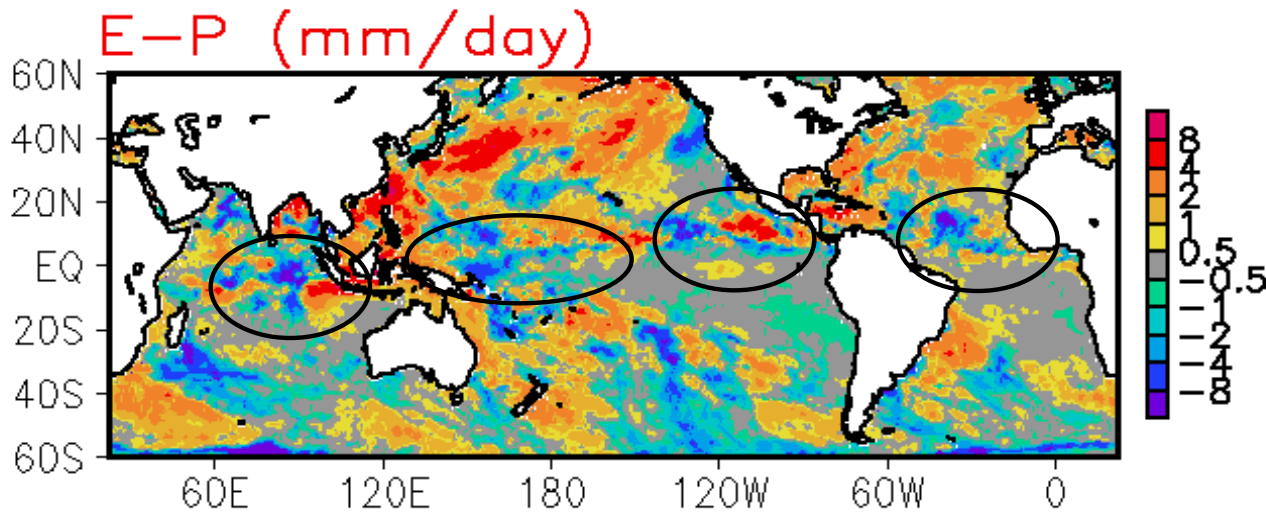


- Above-normal precipitation was observed in all three tropical oceans in Oct 2014.

Sea Surface Salinity (SSS) and E-P Anomaly



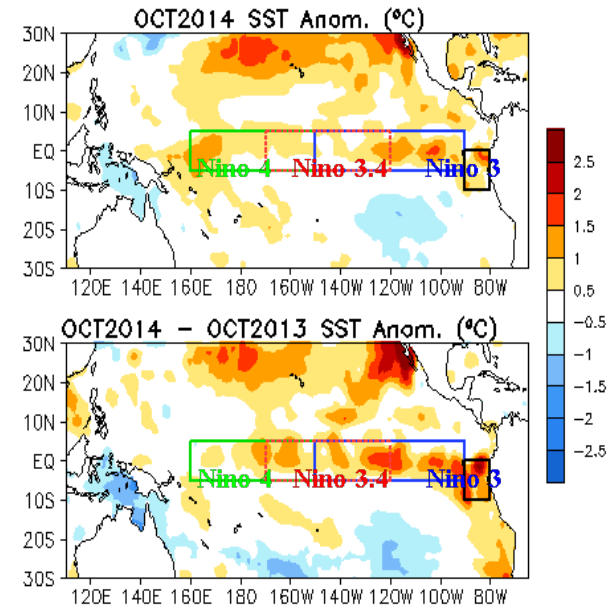
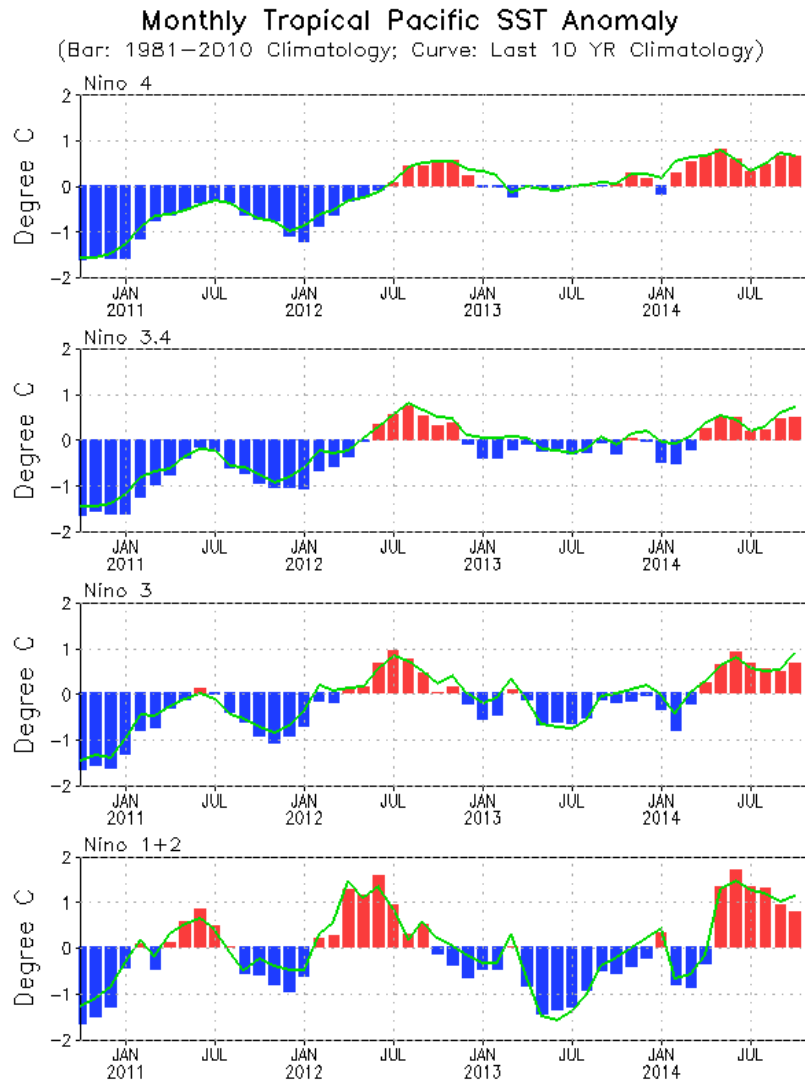
- SSS was more than 0.1 PSU below-normal (fresher than normal) in E. Indian Ocean, W. Pacific, E. Pacific and tropical Atlantic Ocean.



- The negative SSS was associated with negative E-P resulted from above-normal precipitation in E. Indian Ocean, W. Pacific, E. Pacific and tropical Atlantic.

Tropical Pacific Ocean and ENSO Conditions

Evolution of Pacific NINO SST Indices

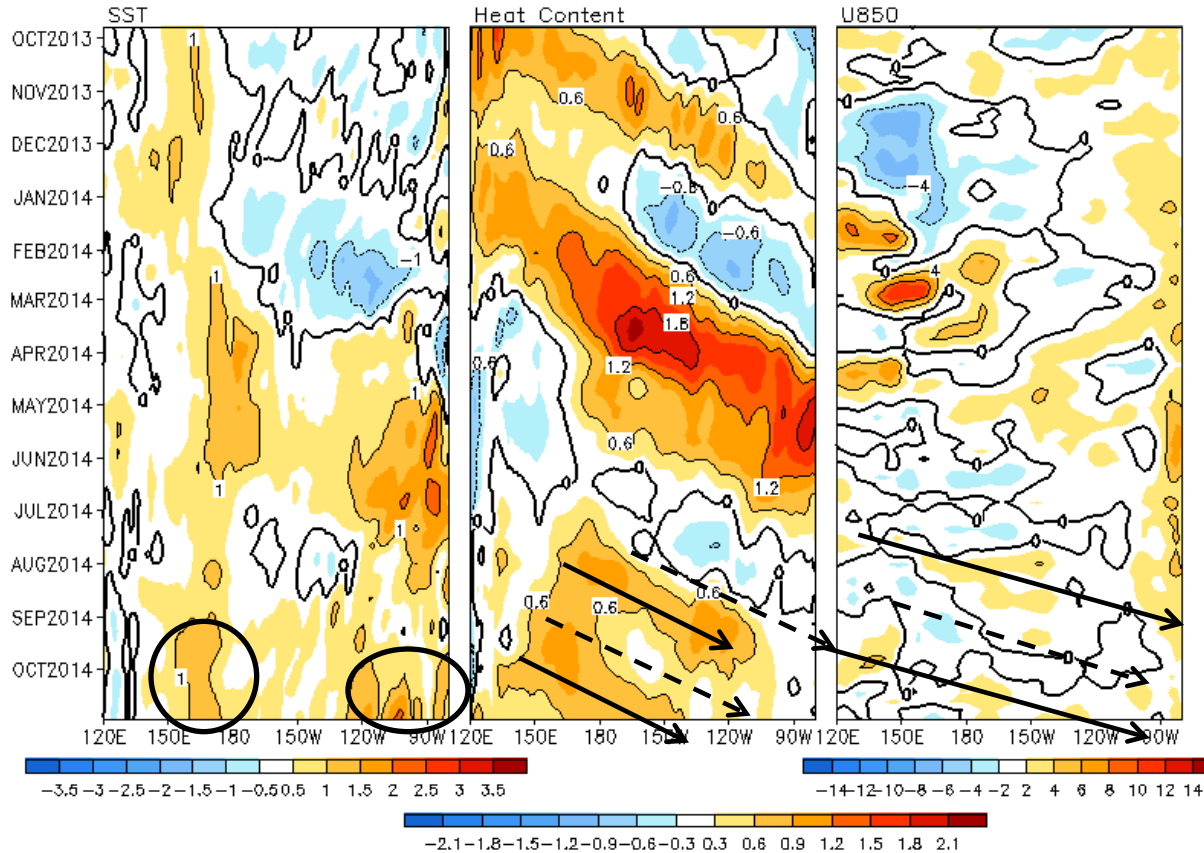


- All Nino indices were above-normal:
NINO1+2= +0.8, NINO3= +0.7, NINO3.4= +0.5,
NINO4= +0.6
- NINO3.4 reached +0.5 in May-Jun and Sep-Oct.
- The indices were calculated based on OISST.
They may have some differences compared with
those based on ERSST.v3b.

Fig. P1a. Nino region indices, calculated as the area-averaged monthly mean sea surface temperature anomalies (°C) for the specified region. Data are derived from the NCEP OI SST analysis, and anomalies are departures from the 1981–2010 (bar) and last ten year (green line) means.

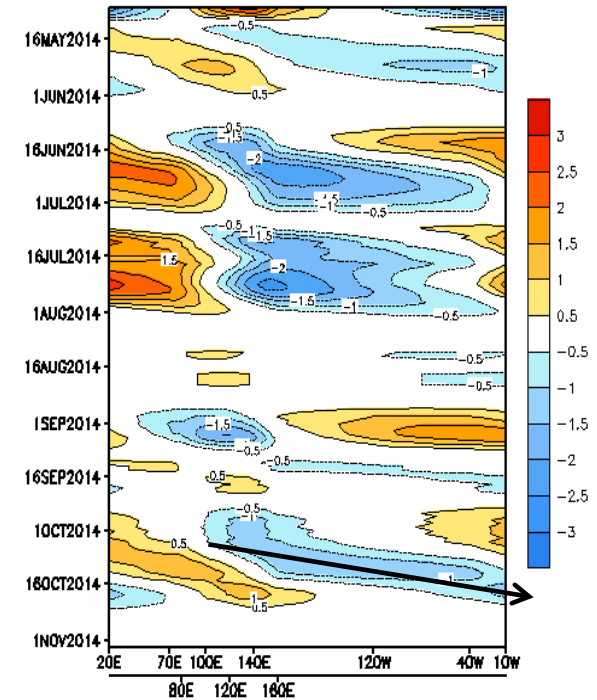
Equatorial Pacific SST ($^{\circ}\text{C}$), HC300 ($^{\circ}\text{C}$), u850 (m/s) and OLR(W/m^2) Anomalies

2 $^{\circ}\text{S}$ –2 $^{\circ}\text{N}$ Average, 3 Pentad Running Mean



CPC MJO Indices

5 -day Running Mean

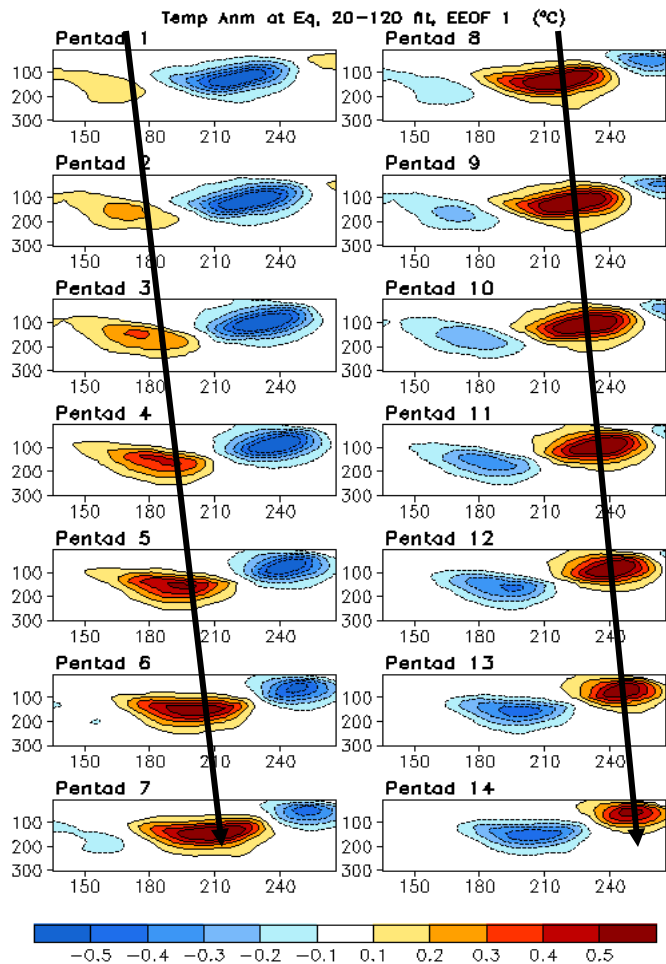


http://www.cpc.ncep.noaa.gov/products/p/recipe/CWlink/daily_mjo_index/mjo_index.shtml

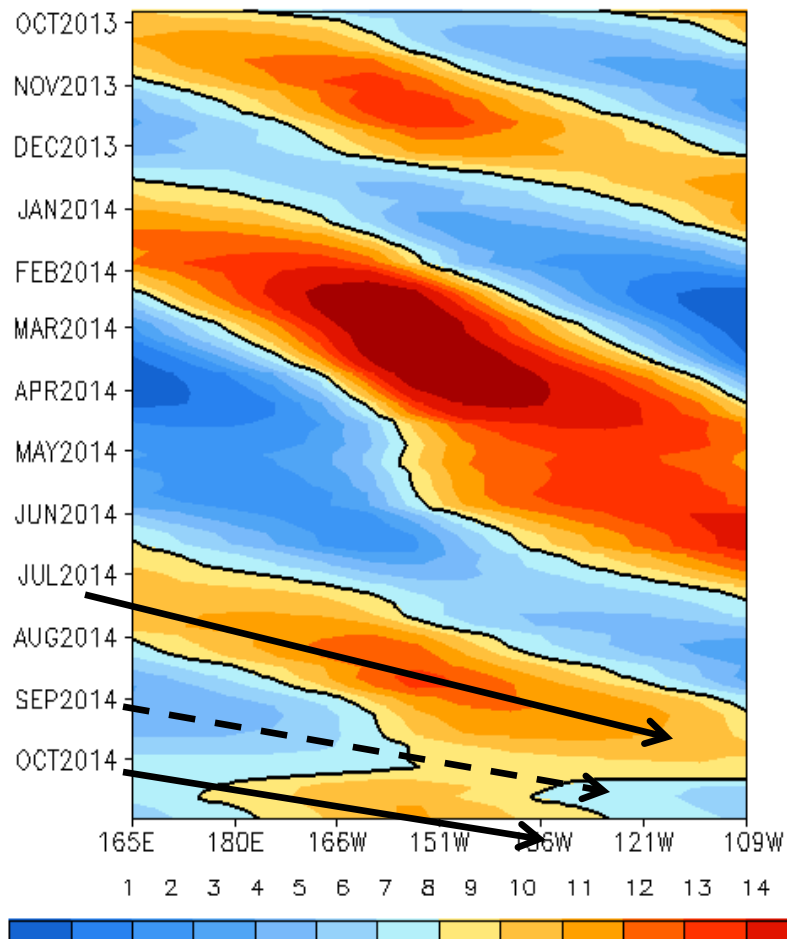
- Positive SSTA more than +1 $^{\circ}\text{C}$ persisted near 170E and east of 120W.
- Positive HC300 anomalies propagated eastward and reached 150W, due to downwelling oceanic Kelvin waves forced by westerly wind anomalies.
- Westerly wind anomalies, emerged in the far western equatorial Pacific in late Sept 2014, were associated with the positive phase of MJO (blue color in CPC MJO indices).

Fig. P4. Time-longitude section of anomalous pentad sea surface temperature (left), upper 300m temperature average (heat content, middle-left), 850-mb zonal wind (U850, middle-right) averaged in 2 $^{\circ}\text{S}$ -2 $^{\circ}\text{N}$ and Outgoing Long-wave Radiation (OLR, right) averaged in 5 $^{\circ}\text{S}$ -5 $^{\circ}\text{N}$. SST is derived from the NCEP OI SST, heat content from the NCEP's global ocean data assimilation system, U850 from the NCEP CDAS. Anomalies for SST, heat content and U850/OLR are departures from the 1981-2010 base period pentad means respectively.

Oceanic Kelvin Wave Indices



Standardized Projection on EEOF 1

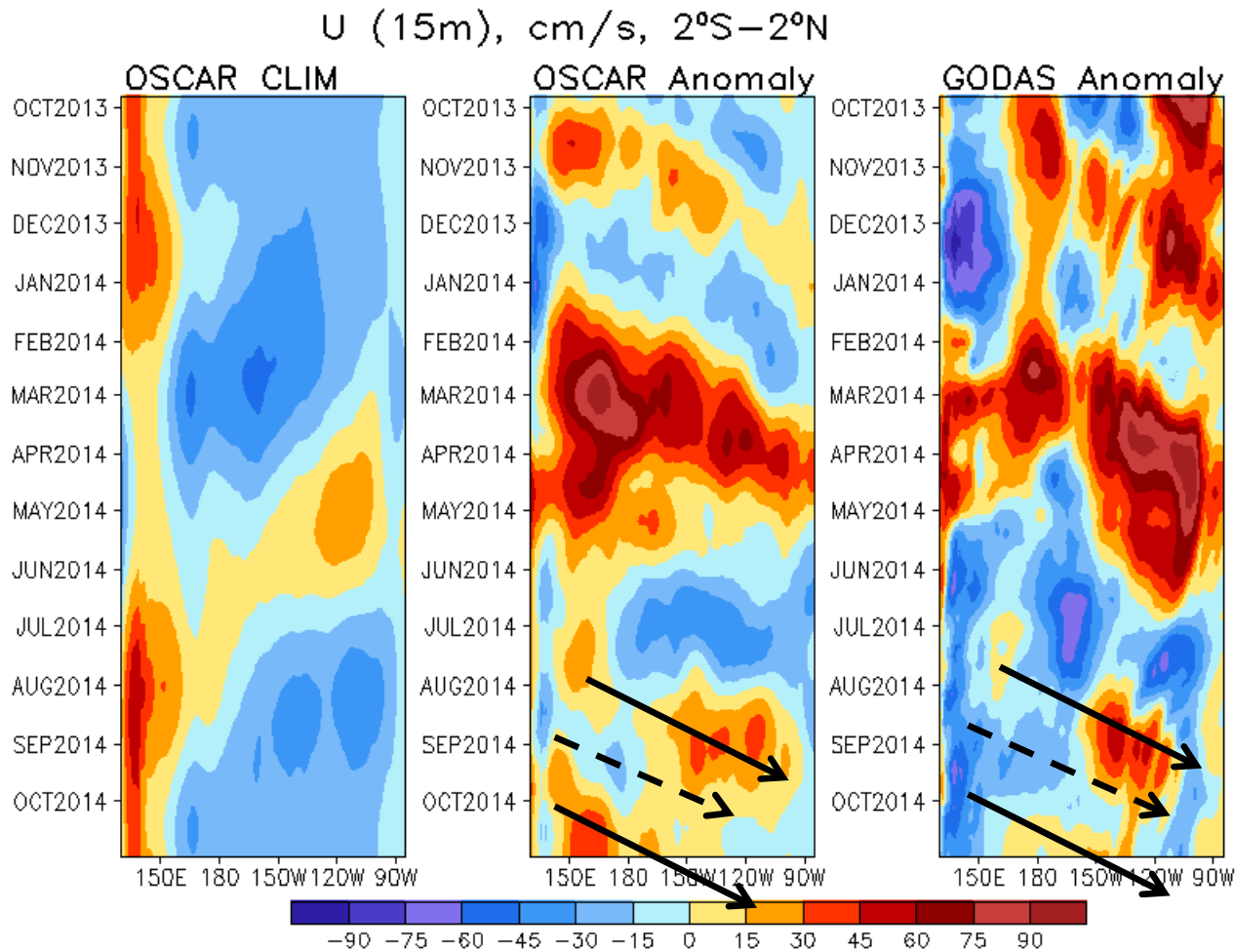


- Downwelling oceanic Kelvin wave (OKW, solid line) emerged in mid-Jul in the W. Pacific and propagated eastward.

- Another downwelling OKW (solid line) emerged in mid-Oct in the C. Pacific and propagated eastward.

- Oceanic Kelvin wave indices are defined as standardized projections of total anomalies onto the 14 patterns of Extended EOF 1 of equatorial temperature anomalies (Seo and Xue, GRL, 2005).

Evolution of Equatorial Pacific Surface Zonal Current Anomaly (cm/s)



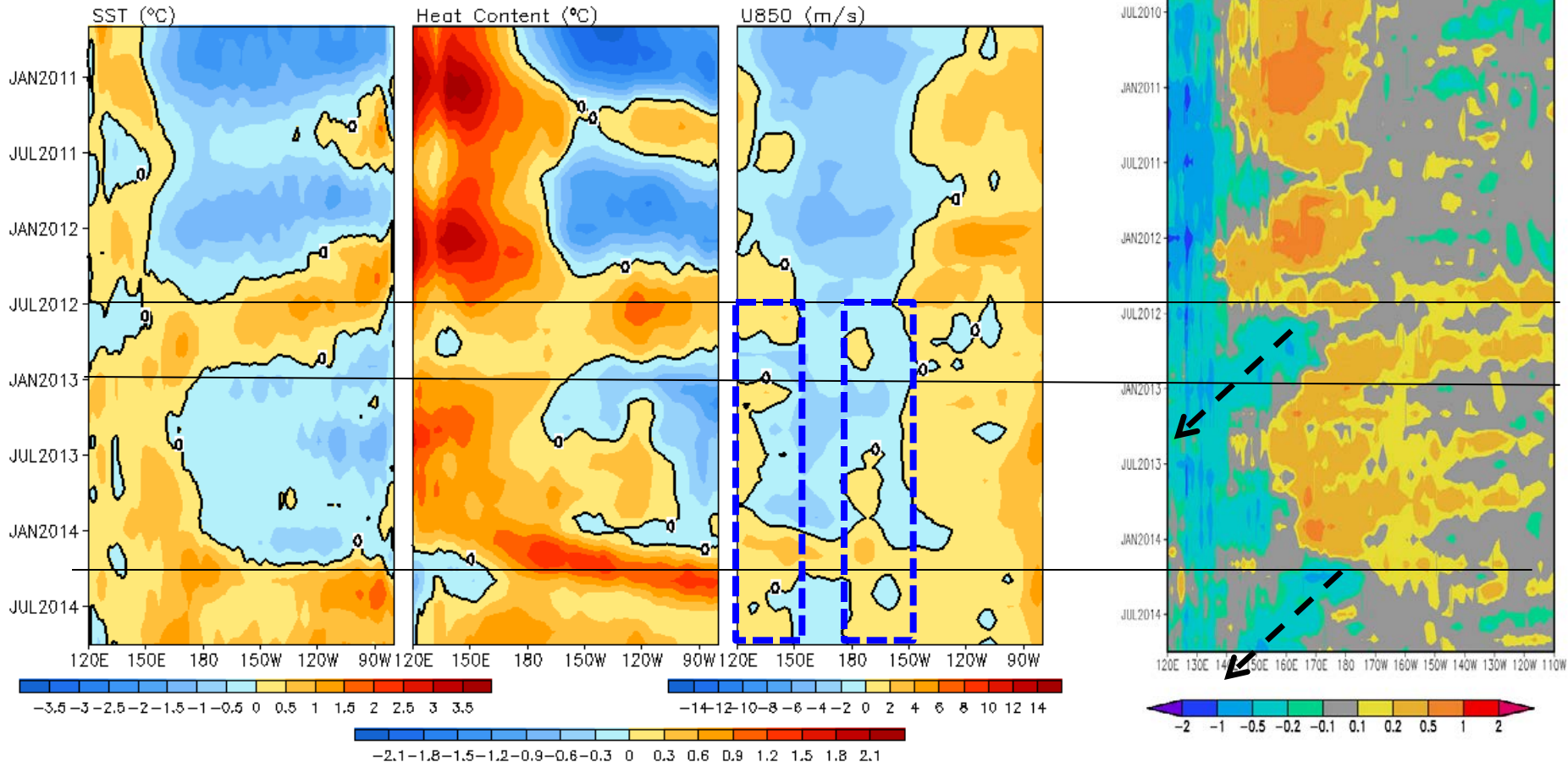
- Positive (negative) zonal current anomalies were associated with downwelling (upwelling) oceanic Kelvin waves.

SST, HC300, U850 Anomaly (2S-2N)

Sea Surface Salinity Anomaly (5S-5N)

Sea Surface Salinity

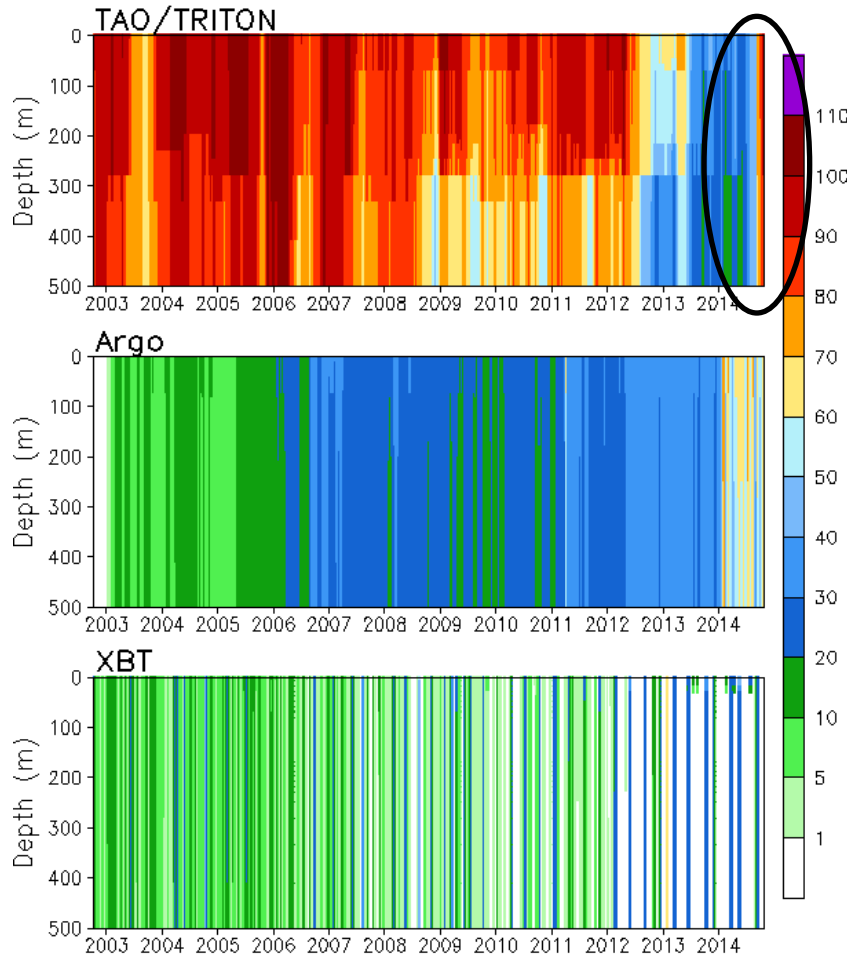
Equatorial Pacific, 2°S–2°N Average, 3 Month Running Mean



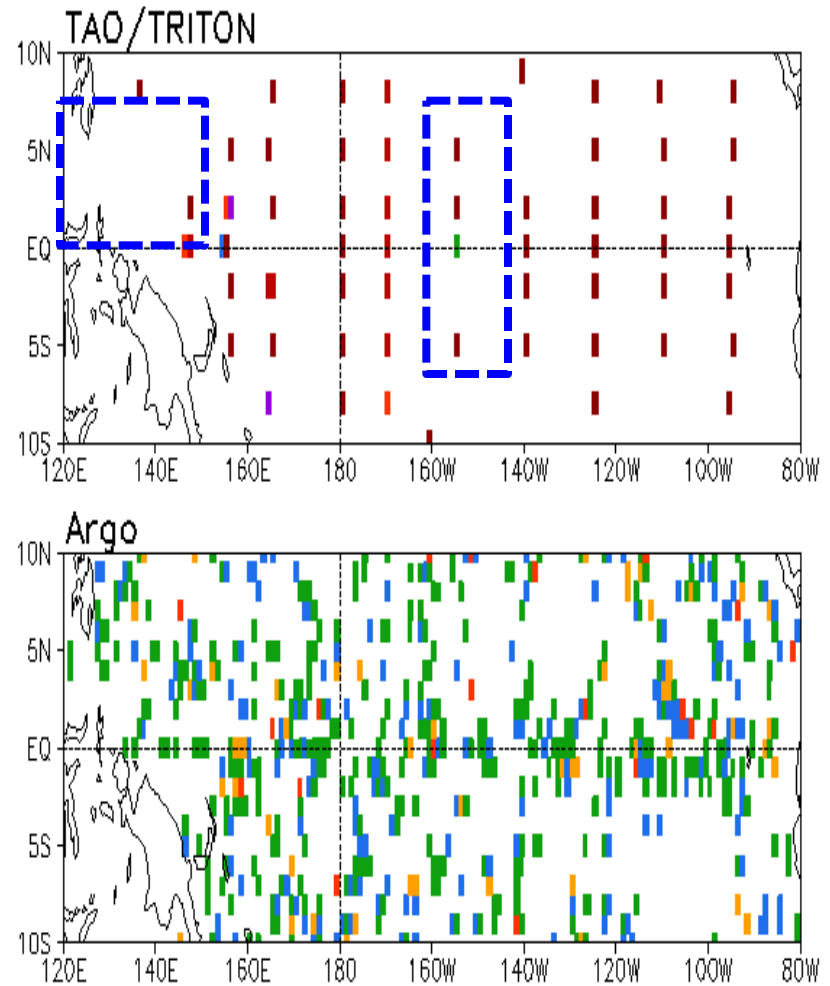
- Negative SSS anomaly extended to near Dateline in summer 2012, probably in response to enhanced convection forced by positive SST anomaly, but it retreated westward in following months, and El Niño was aborted.
- In 2014, negative SSS anomaly also extended to Dateline and retreated westward since spring 2014.
- However, westerly (easterly) wind anomalies occupied in 180-150W in summer 2014 (summer 2012).

Tropical Pacific Observing System

of Daily Temp. Profiles every 5 Days
Accumulated in 170E–80W, 3S–3N



of Daily Temp. Profiles in OCT 2014

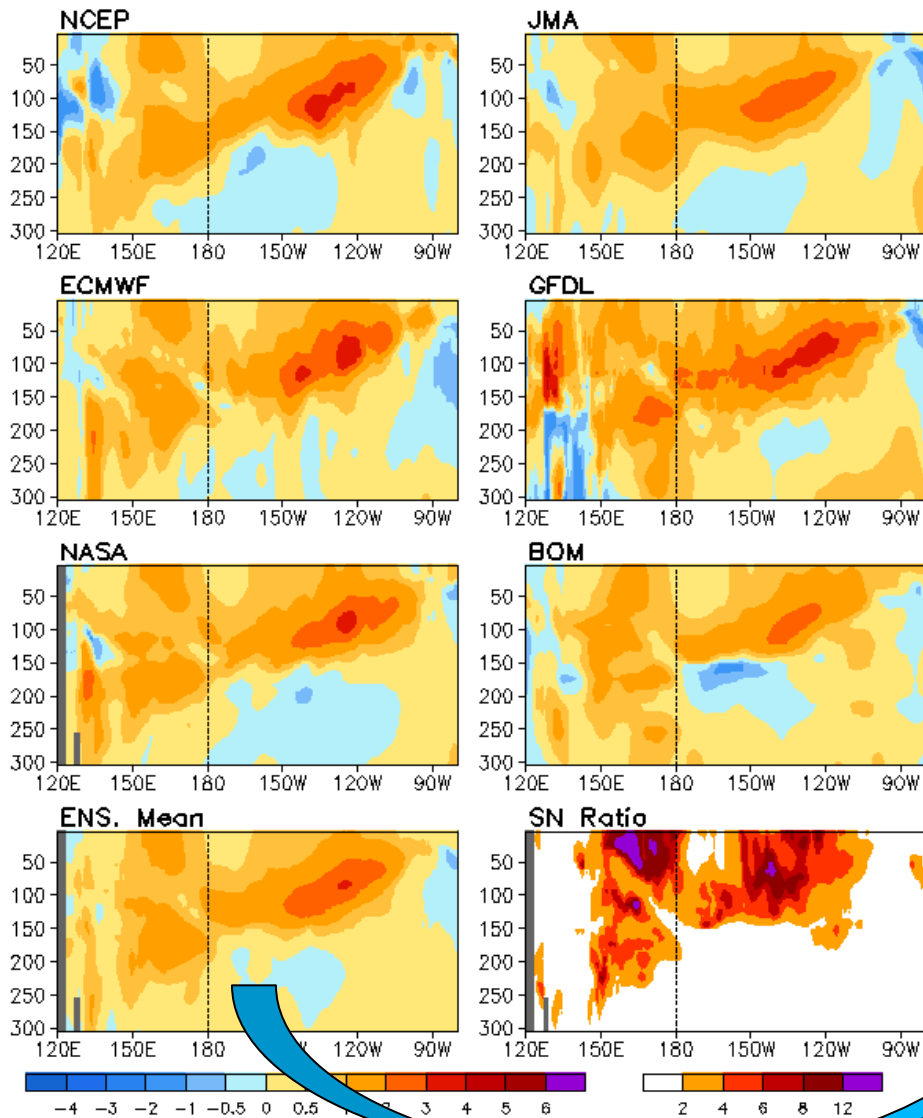


- Data availability from the TAO array has improved dramatically to 83% from 28% in March
- From April 2014 through October, 45 TAO buoys have been replaced on 7 TAO longitude lines (personal communication with Kathleen C. Oneil, NDBC)

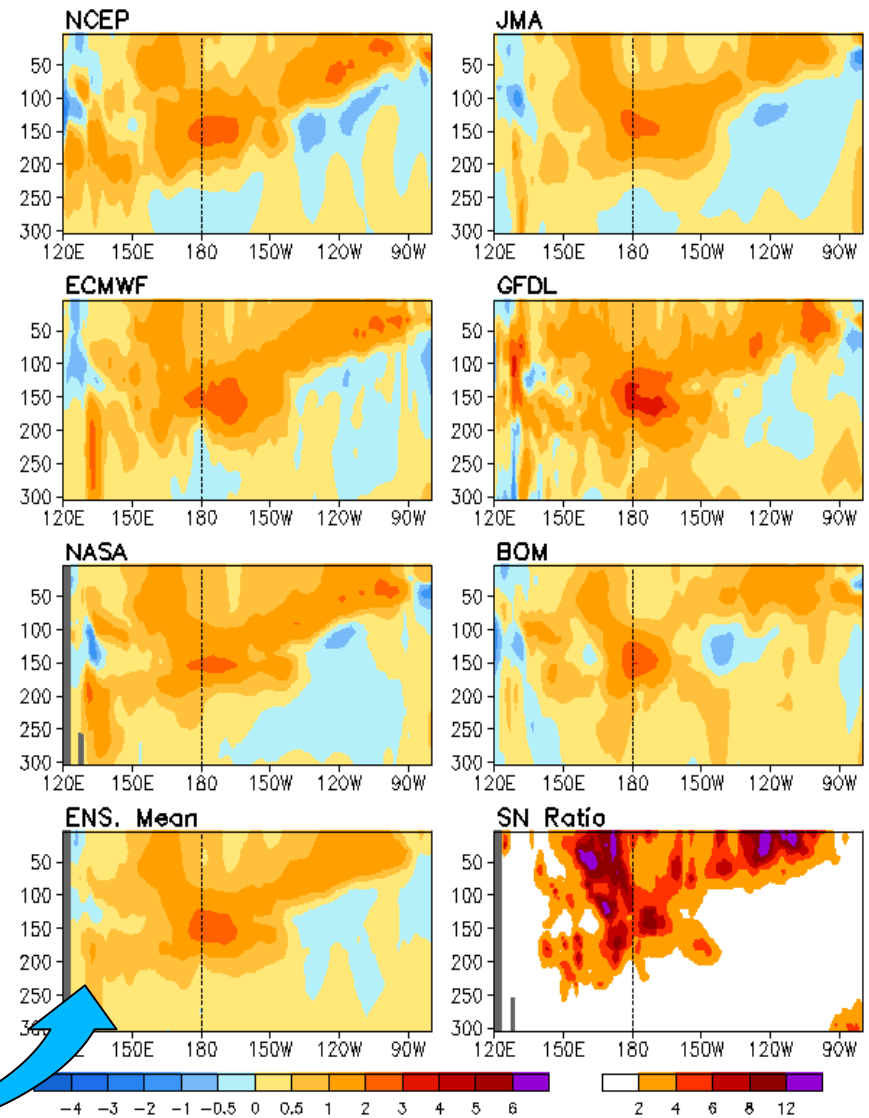
Real-Time Multiple Ocean Reanalysis Intercomparison

(http://www.cpc.ncep.noaa.gov/products/GODAS/multiora_body.html)

Anomalous Temperature (C) Averaged in 1S-1N: SEP 2014

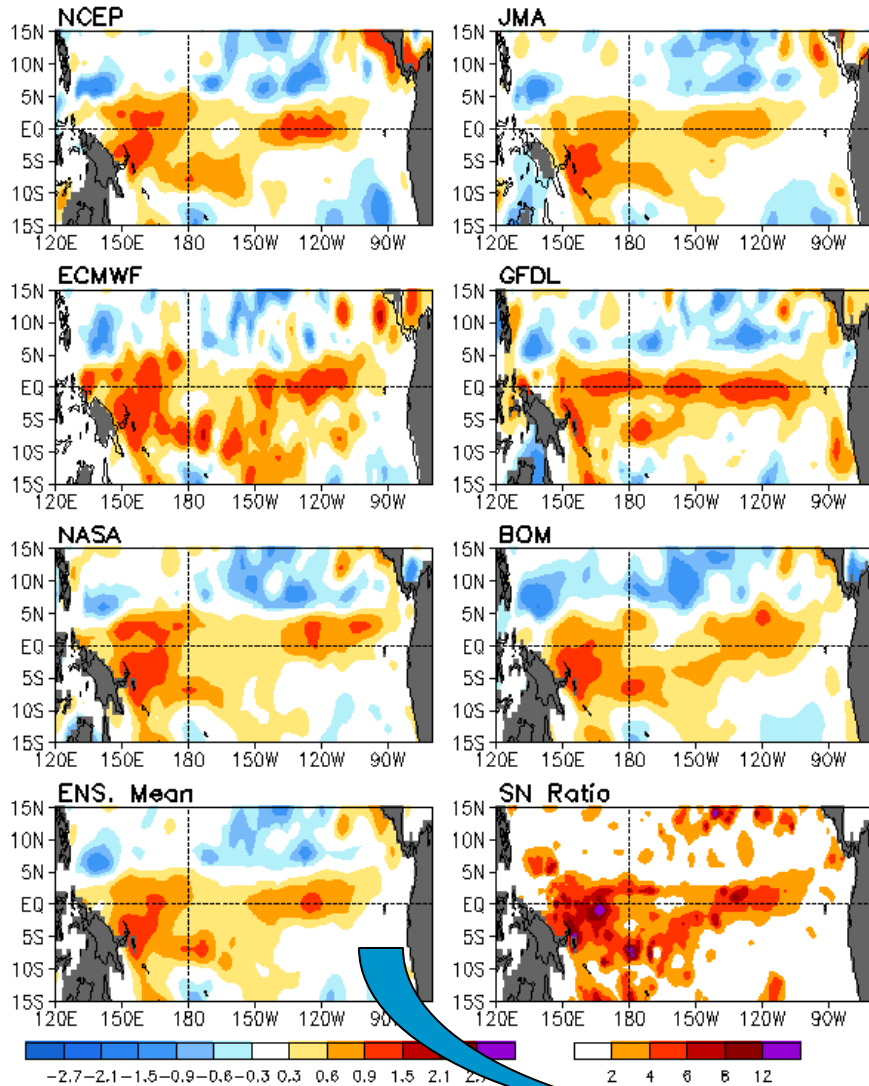


Anomalous Temperature (C) Averaged in 1S-1N: OCT 2014

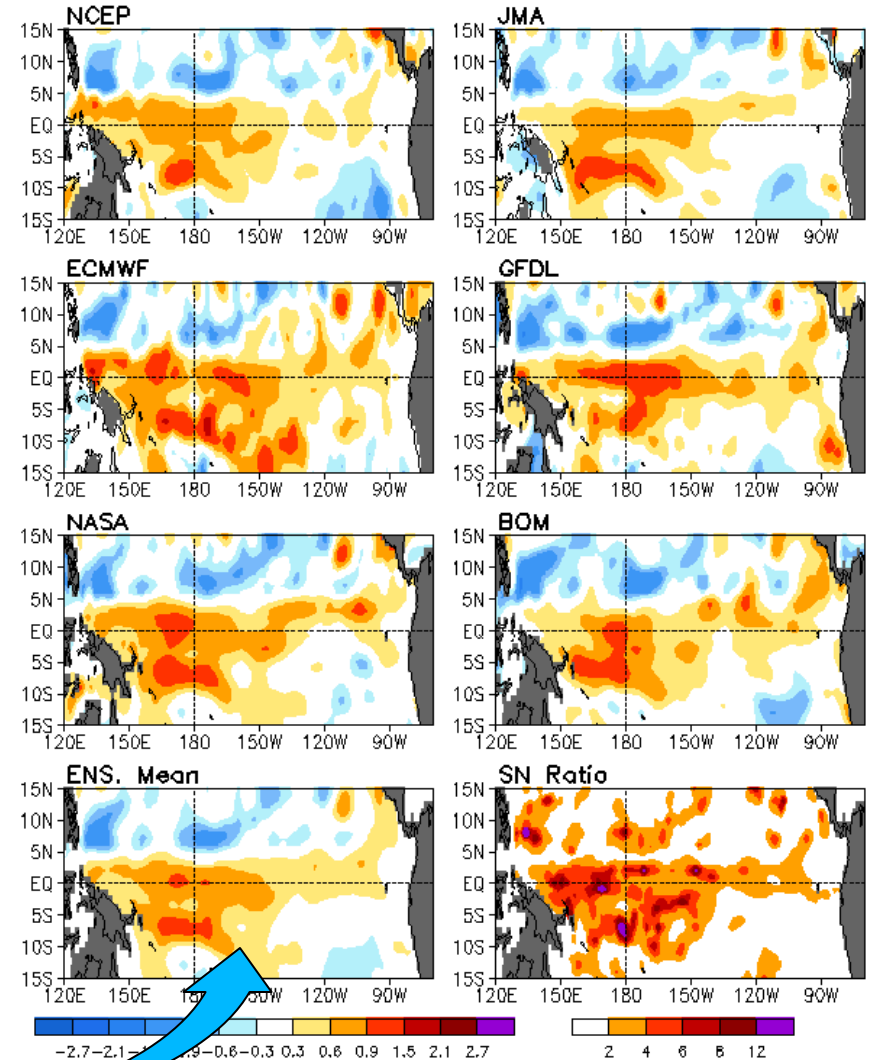


Upper 300m Heat Content Anomaly (1981-2010 Clim.)

Anomalous Upper 300m Heat Content (C): SEP 2014

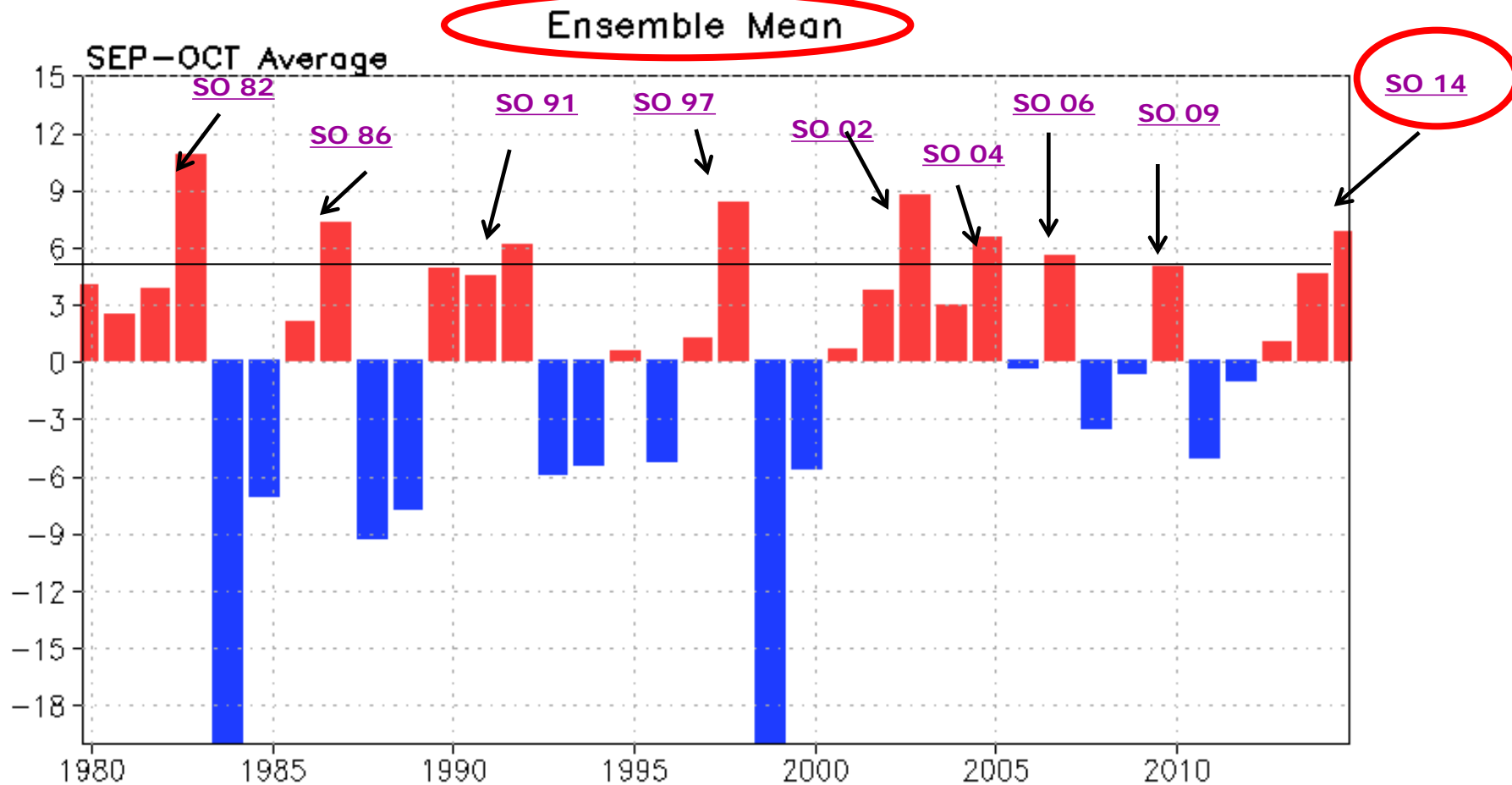


Anomalous Upper 300m Heat Content (C): OCT 2014



Warm Water Volume Index Derived From Ensemble Mean of Ocean Reanalyses

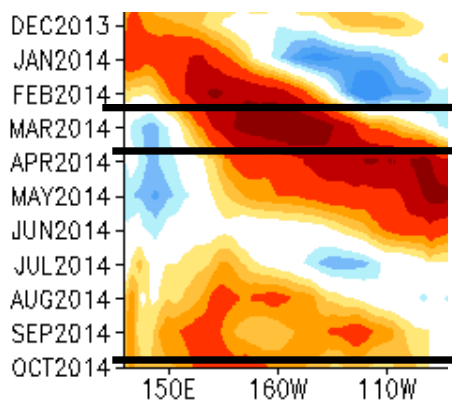
Anomalous Depth (m) of 20°C Isotherm Averaged in [120E-80W, 5S-5N]



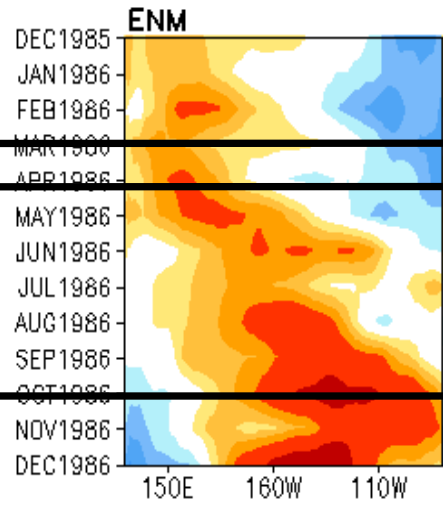
- Warm Water Volume averaged in Sep-Oct 2014 is similar to that in Sep-Oct of 1986, 1991, 2004, 2006, 2009.

Upper 300m Heat Content Anomaly Averaged in 1S-1N

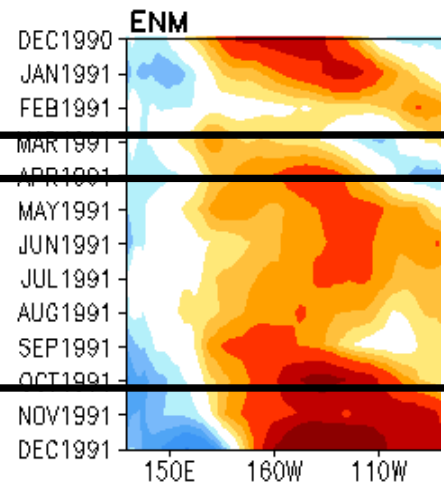
14/15



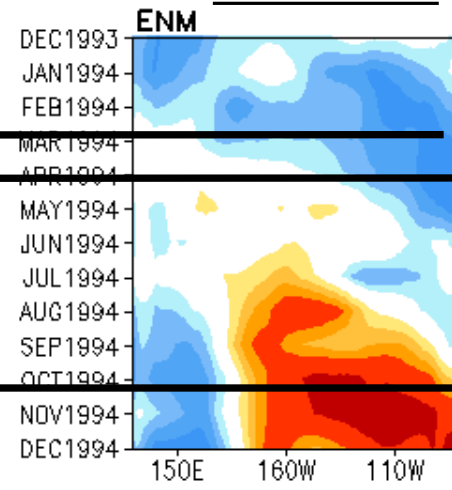
86/87



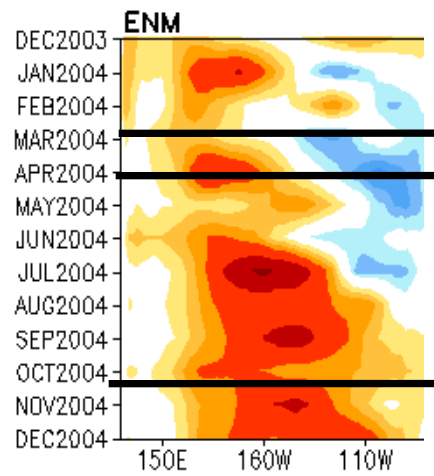
91/92



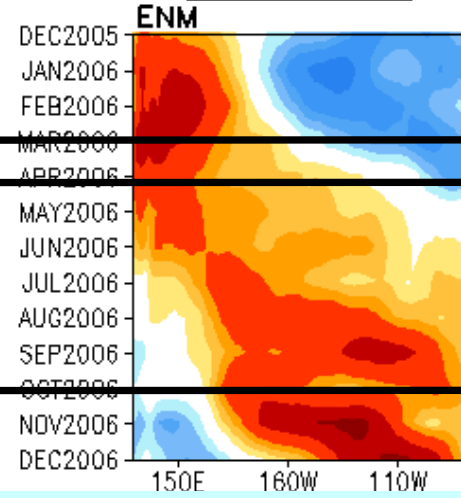
94/95



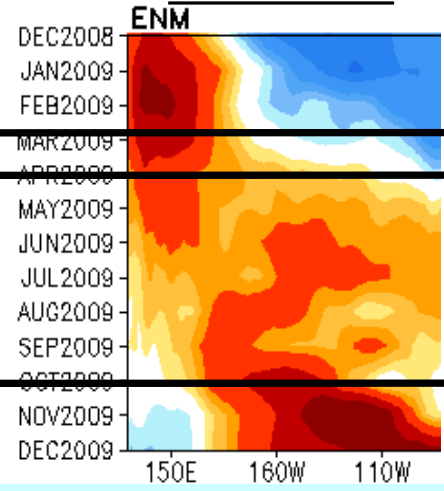
04/05



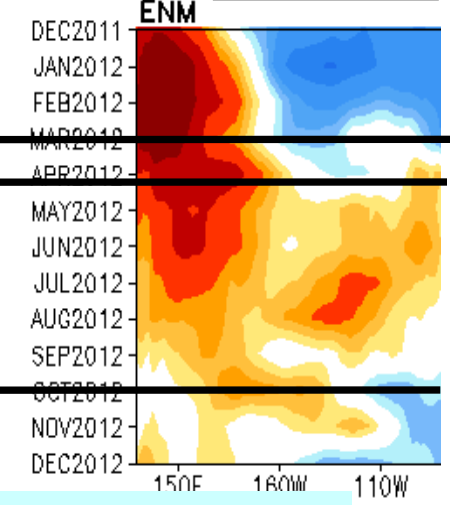
06/07



09/10



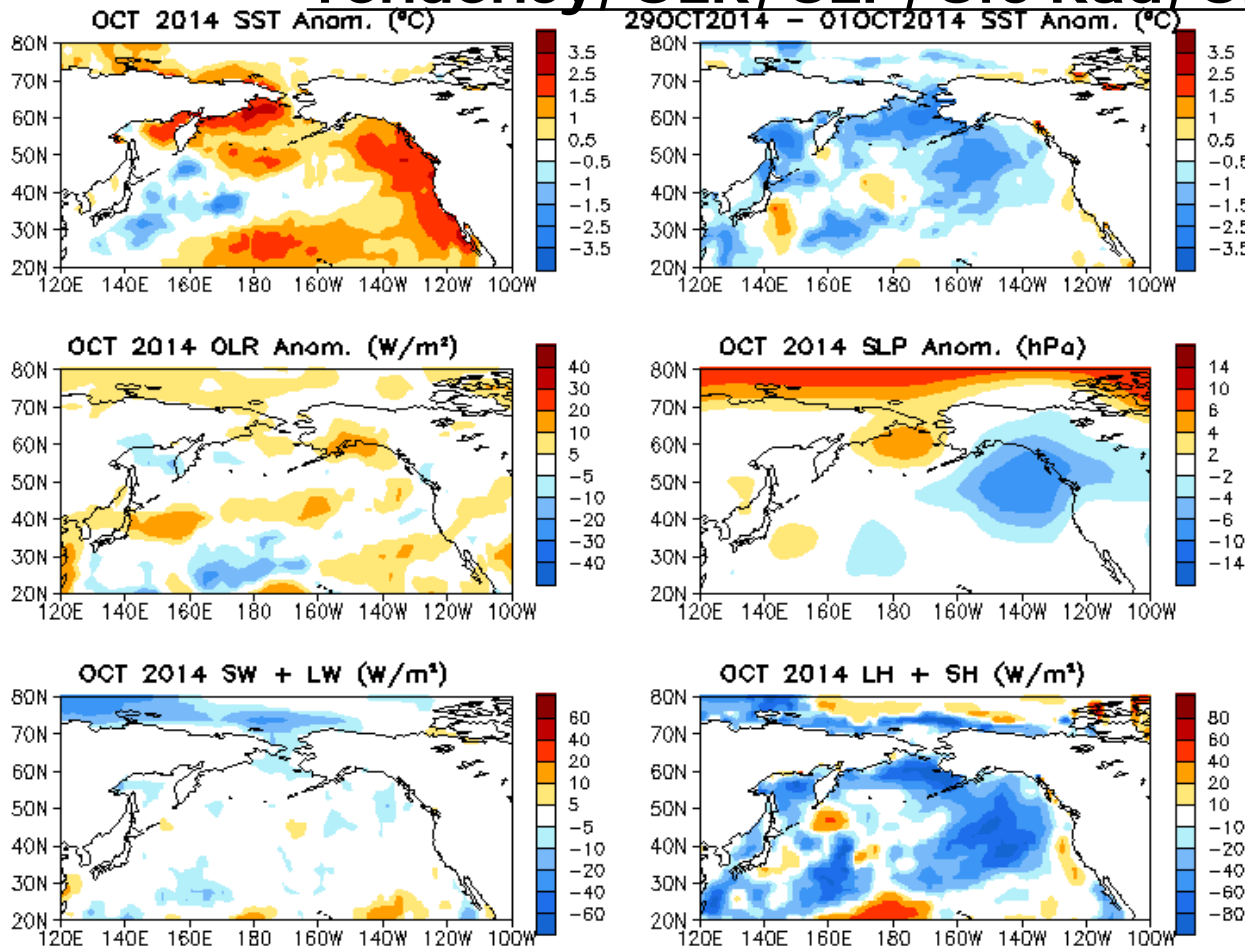
12/13



- Positive heat content anomaly in Oct 2014 was centered near 180W. However, positive heat content anomaly from other El Niño events was centered near 140W or further eastward.

North Pacific & Arctic Oceans

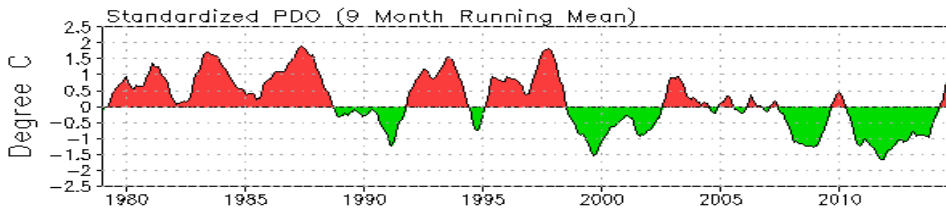
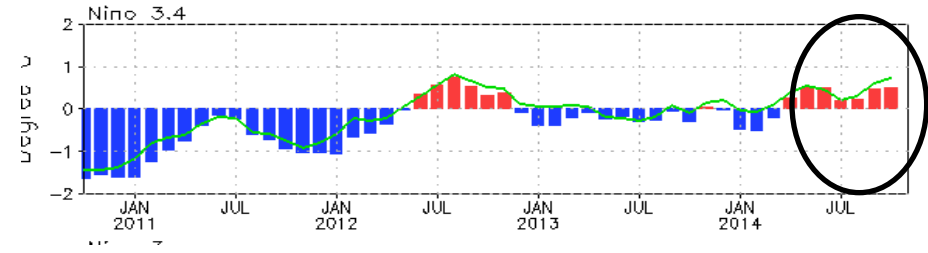
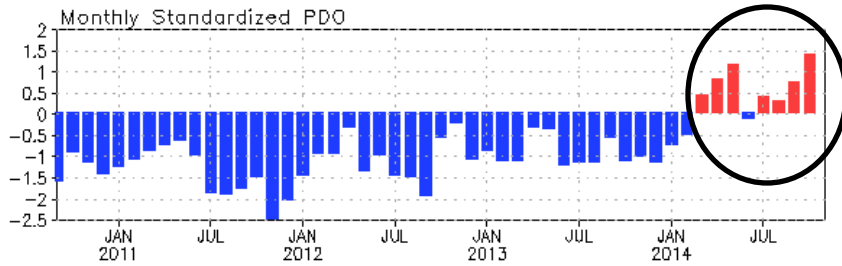
North Pacific & Arctic Ocean: SST Anom., SST Anom. Tendency, OLR, SLP, Sfc Rad, Sfc Flx



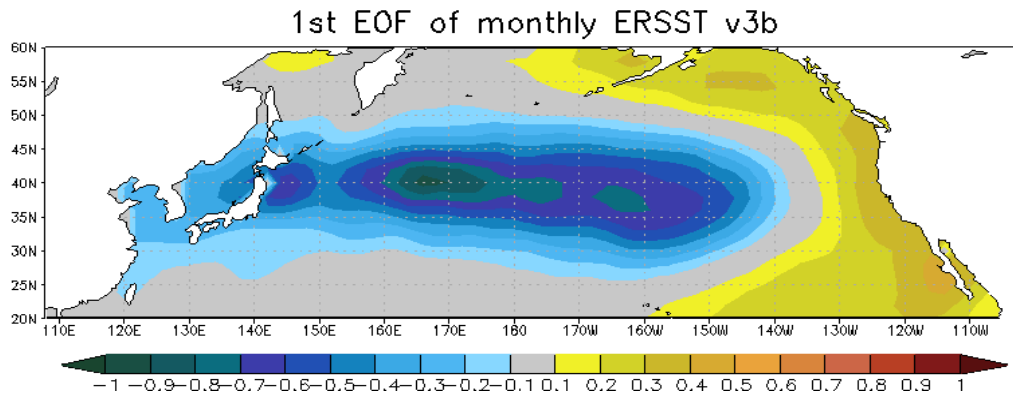
- Positive PDO pattern dominated in N. Pacific
- The SST cooling tendency was consistent with latent and sensible heat flux forcing.
- There was an anomalous low sea level pressure center in Gulf of Alaska.

Fig. NP1. Sea surface temperature (SST) anomalies (top-left), anomaly tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sea surface pressure anomalies (middle-right), sum of net surface short- and long-wave radiation anomalies (bottom-left), sum of latent and sensible heat flux anomalies (bottom-right). SST are derived from the NCEP OI SST analysis, OLR from the NOAA 18 AVHRR IR window channel measurements by NESDIS, sea surface pressure and surface radiation and heat fluxes from the NCEP CDAS. Anomalies are departures from the 1981-2010 base period means.

Pacific Decadal Oscillation Index



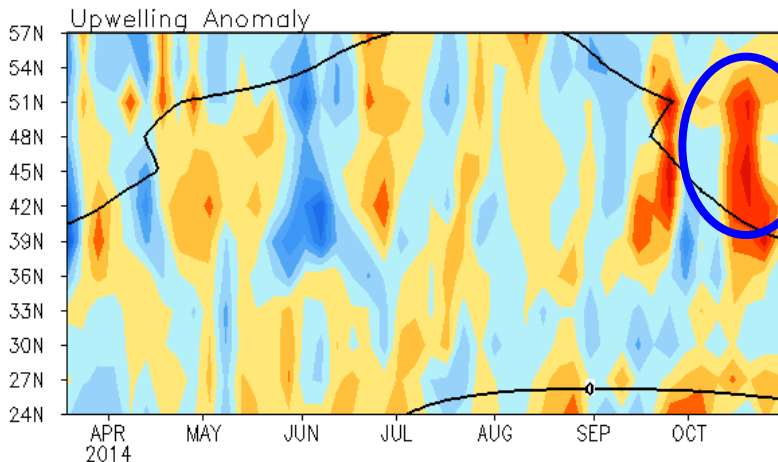
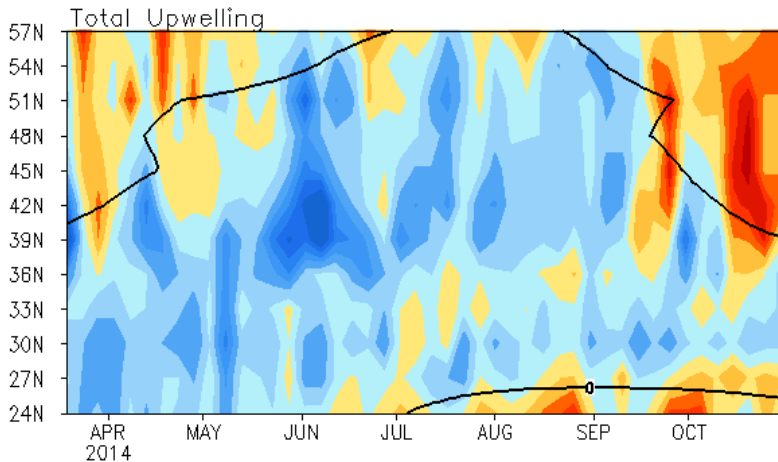
- Positive PDO phase has persisted since Mar 2014, and increased substantially in Oct 2014 with PDO = + 1.4
- The apparent connection between NINO3.4 and PDO index suggest connections between tropics and extratropics.



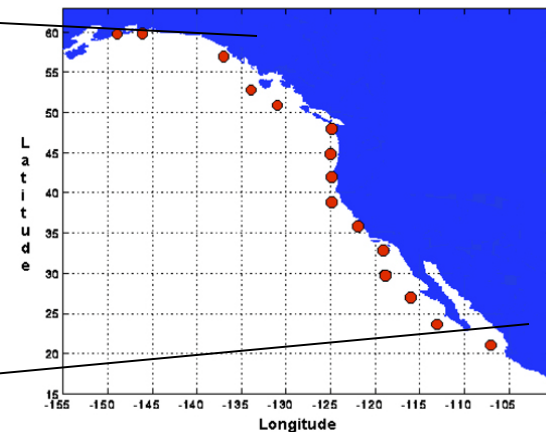
- Pacific Decadal Oscillation is defined as the 1st EOF of monthly ERSST v3b in the North Pacific for the period 1900-1993. PDO index is the standardized projection of the monthly SST anomalies onto the 1st EOF pattern.
- The PDO index differs slightly from that of JISAO, which uses a blend of UKMET and OIv1 and OIv2 SST.

North America Western Coastal Upwelling

Pentad Coastal Upwelling for West Coast North America
($m^3/s/100m$ coastline)



Standard Positions of Upwelling Index Calculations



- Downwelling north of 36N was enhanced.

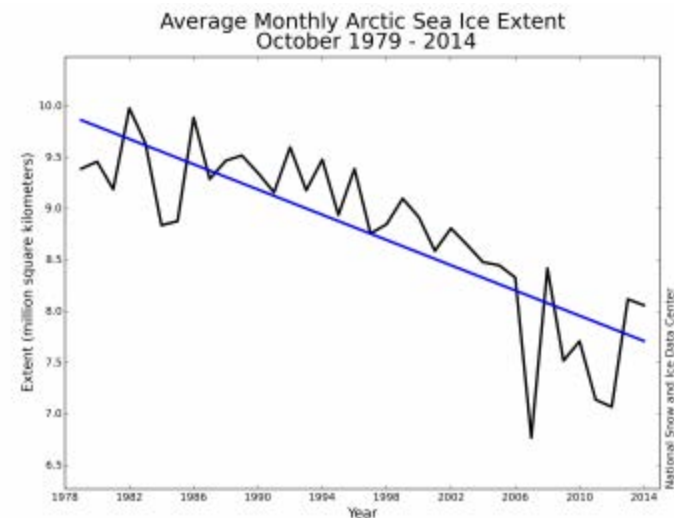
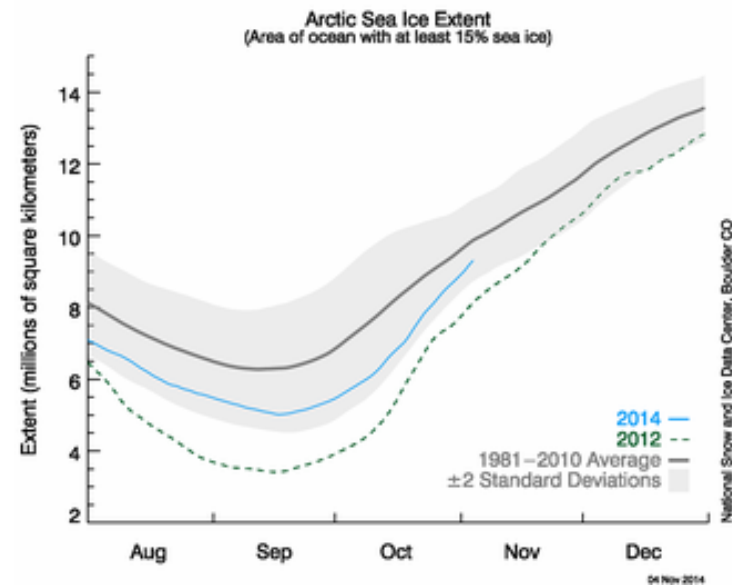
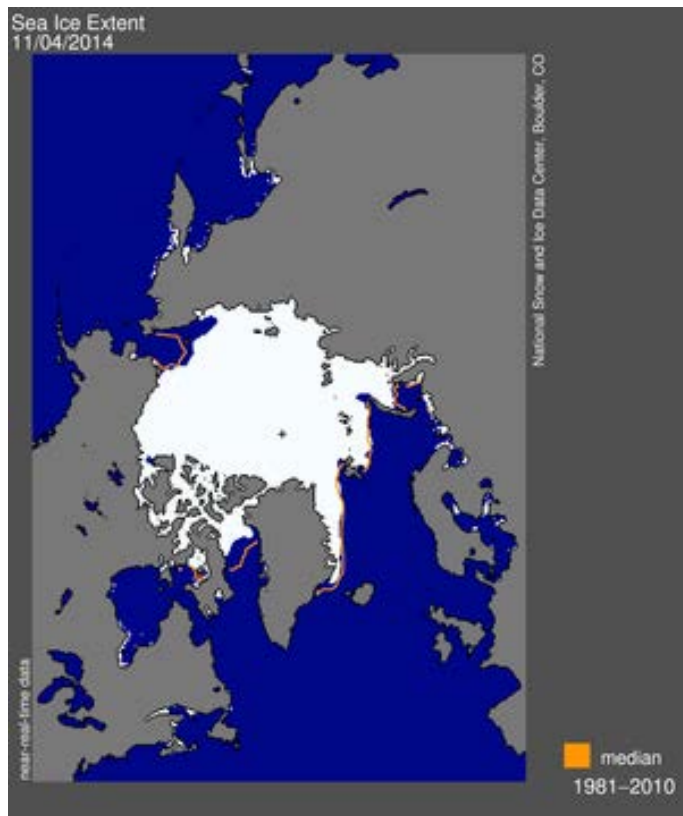
Fig. NP2. Total (top) and anomalous (bottom) upwelling indices at the 15 standard locations for the western coast of North America. Upwelling indices are derived from the vertical velocity of the NCEP's global ocean data assimilation system, and are calculated as integrated vertical volume transport at 50 meter depth from each location to its nearest coast point ($m^3/s/100m$ coastline). Anomalies are departures from the 1981-2010 base period pentad means.

- Area below (above) black line indicates climatological upwelling (downwelling) season.
 - Climatologically upwelling season progresses from March to July along the west coast of North America from 36°N to 57°N.

Arctic Sea Ice

National Snow and Ice Data Center

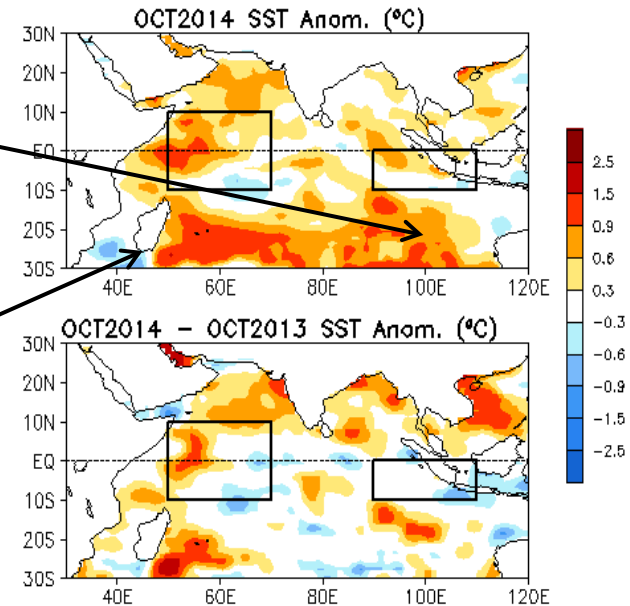
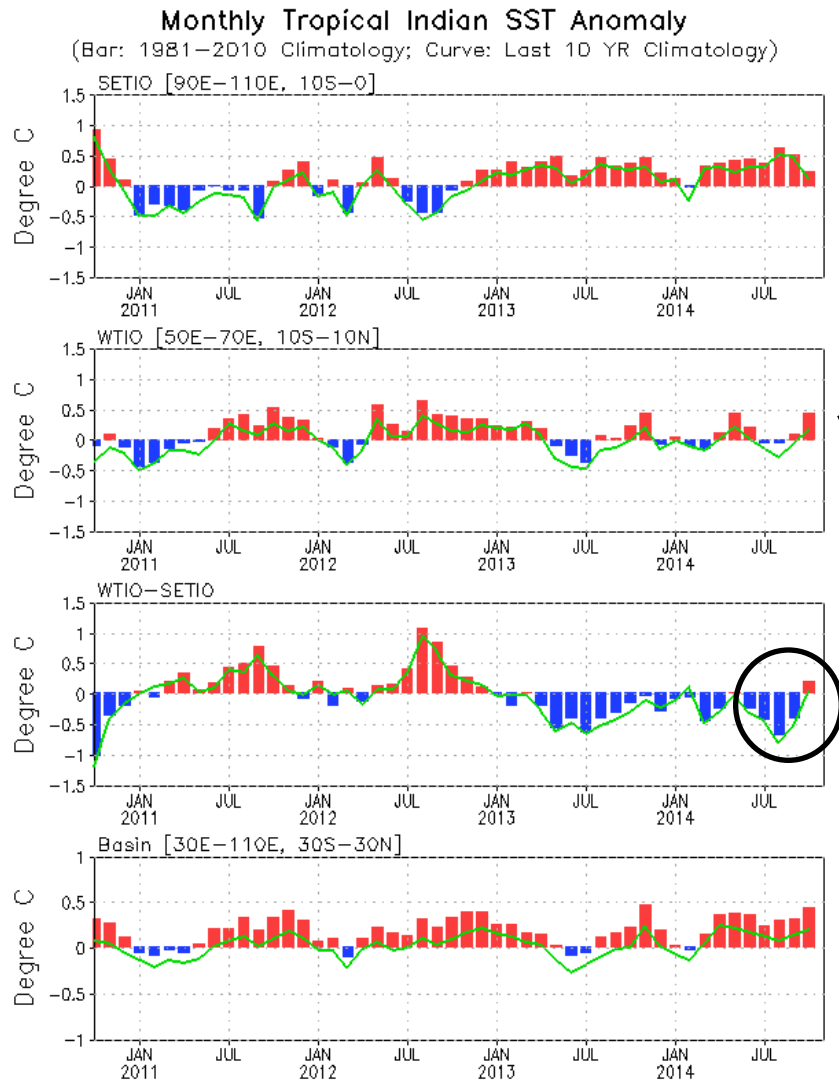
<http://nsidc.org/arcticseaicenews/index.html>



- Arctic sea ice was at near-average levels on the Atlantic side and below average on the Pacific side
- Due to the relatively rapid ice growth during October, Arctic sea ice extent for October 2014 was the 6th lowest in the satellite record.

Indian Ocean

Evolution of Indian Ocean SST Indices

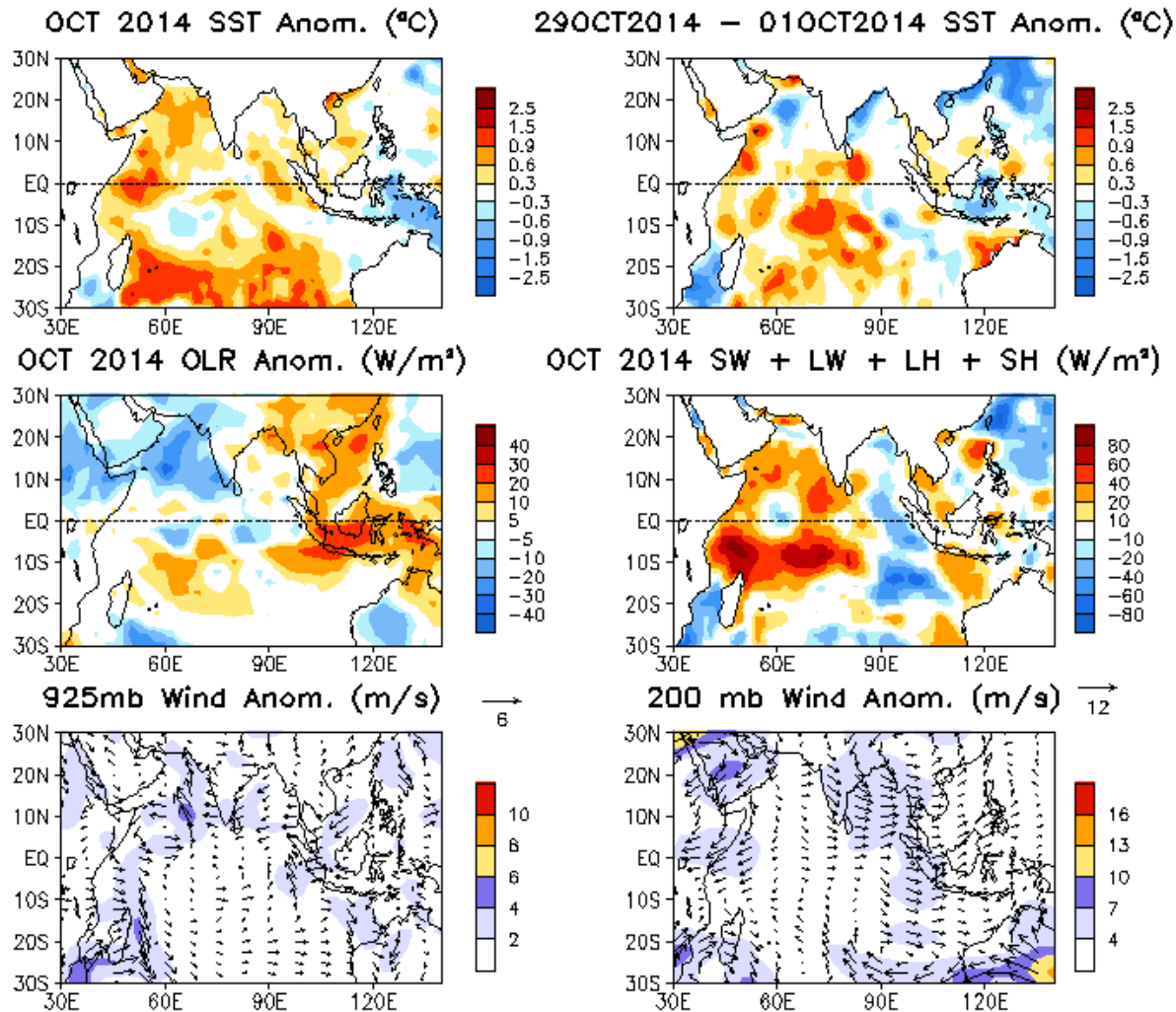


- DMI returned to near-normal in Oct 2014.
- The basin mean SSTA was above-normal.

Fig. 11a. Indian Ocean Dipole region indices, calculated as the area-averaged monthly mean sea surface temperature anomalies (°C) for the SETIO [90°E–110°E, 10°S–0] and WTIO [50°E–70°E, 10°S–10°N] regions, and Dipole Mode Index, defined as differences between WTIO and SETIO. Data are derived from the NCEP OI SST analysis, and departures from the 1981–2010 base period means and the recent 10 year means are shown in bars and green lines.

Tropical Indian Ocean:

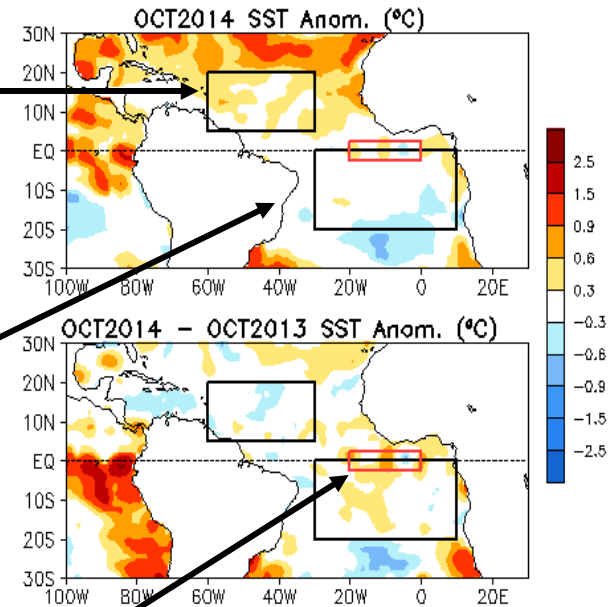
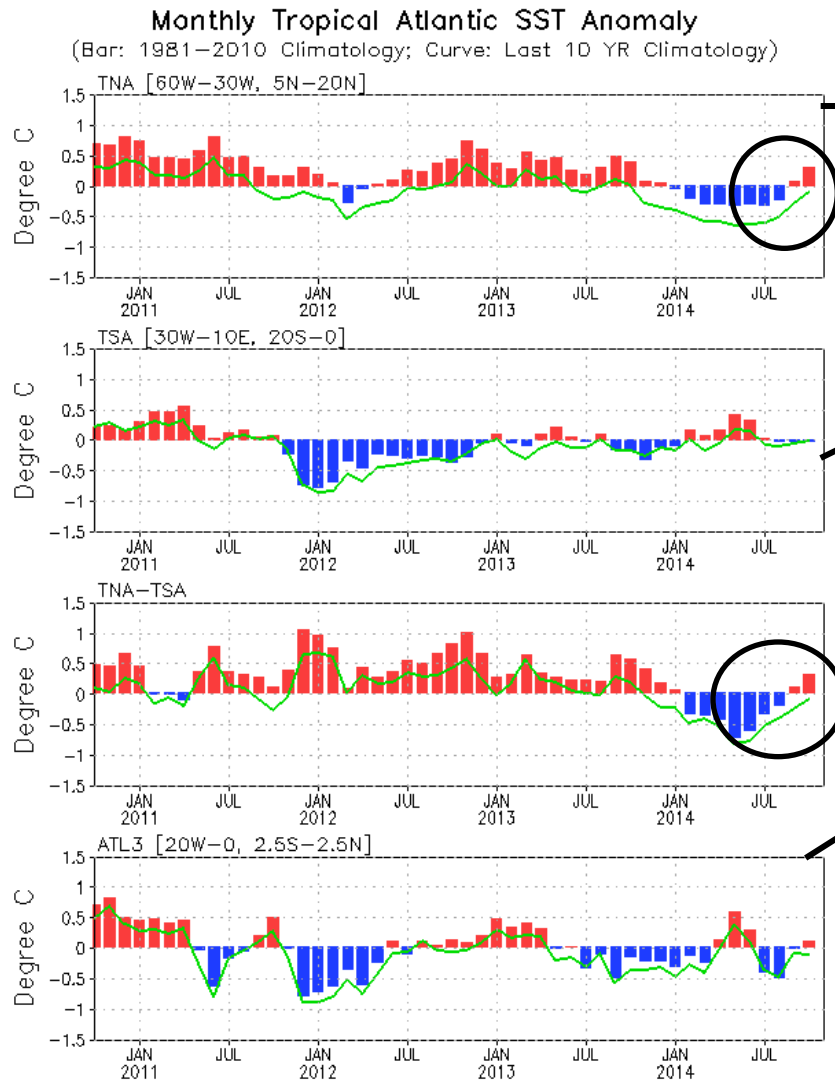
SST Anom., SST Anom. Tend., OLR, Sfc Rad, Sfc Flx, 925-mb/200-mb Winds



- SST warmed up in the west-central tropical Indian Ocean, mostly driven by net surface heat fluxes.
- Convection was suppressed (enhanced) over Maritime Continents (Arabian Sea).

Tropical and North Atlantic Ocean

Evolution of Tropical Atlantic SST Indices

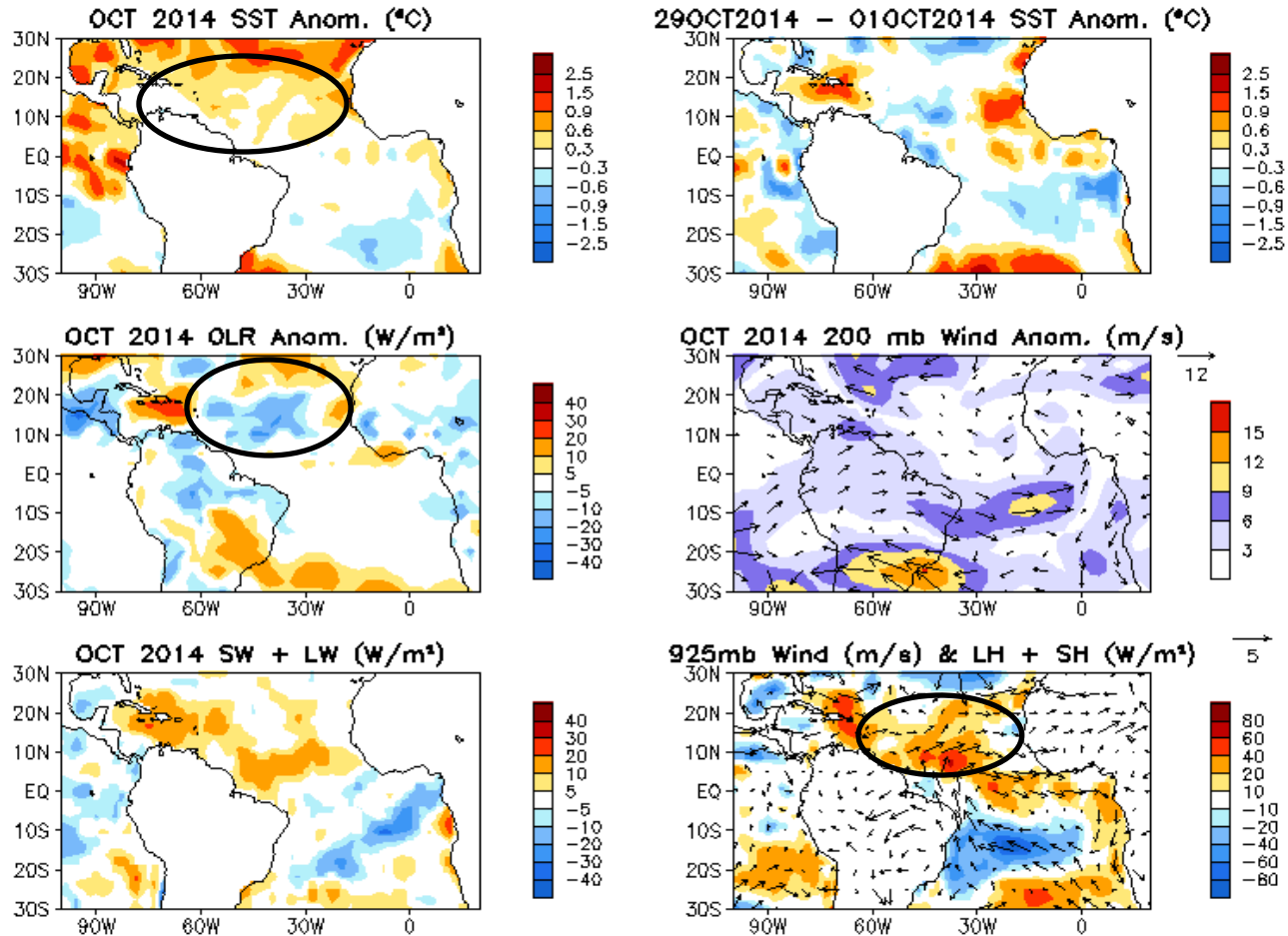


- SSTA in the tropical North Atlantic (TNA) has increased steadily since Jul 2014 and became above-normal in Oct 2014.
- Meridional Gradient Mode index (TNA-TSA) also increased continuously since May 2014.
- ATL3 SSTA was near-normal in Oct 2014.

Fig. A1a. Tropical Atlantic Variability region indices, calculated as the area-averaged monthly mean sea surface temperature anomalies (°C) for the TNA [60°W–30°W, 5°N–20°N], TSA [30°W–10°E, 20°S–0] and ATL3 [20°W–0, 2.5°S–2.5°N] regions, and Meridional Gradient Index, defined as differences between TNA and TSA. Data are derived from the NCEP OI SST analysis, and departures from the 1981–2010 base period means and the recent 10 year means are shown in bars and green lines.

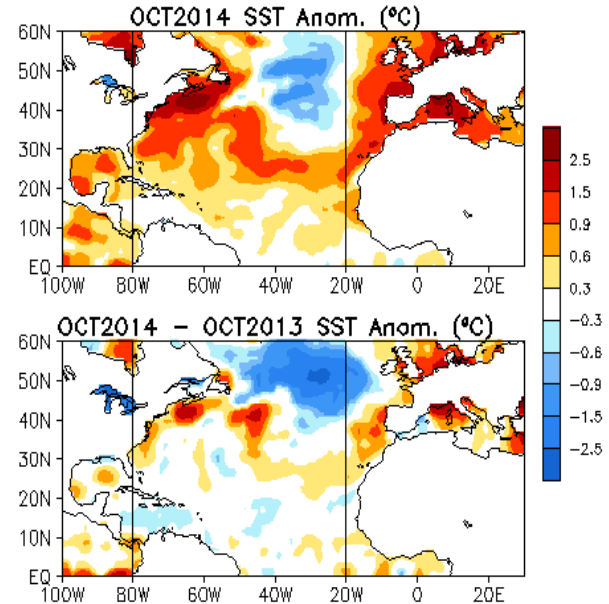
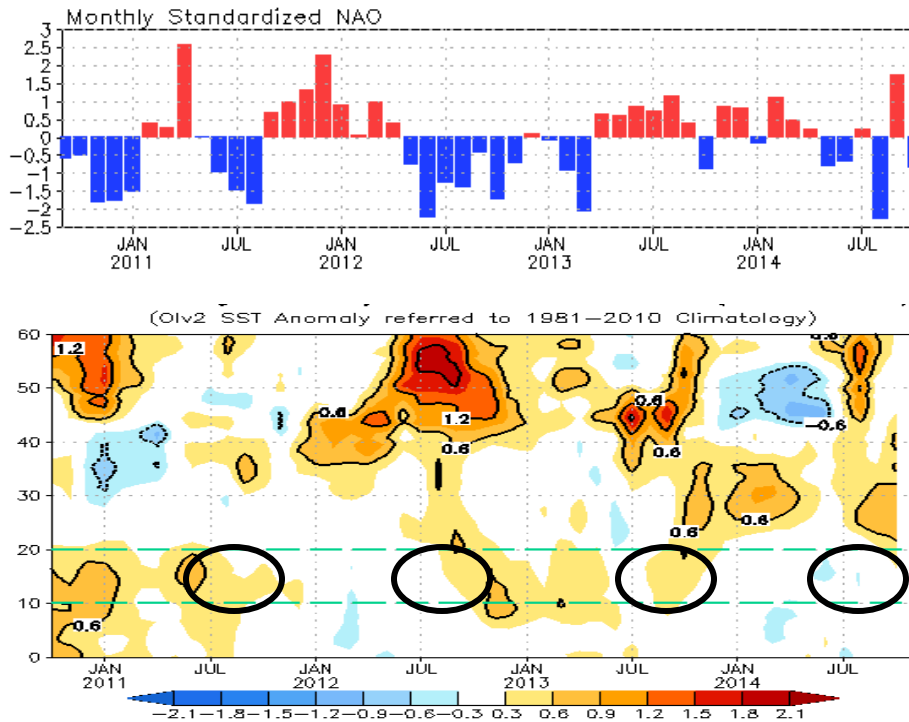
Tropical Atlantic:

SST Anom., SST Anom. Tend., OLR, Sfc Rad, Sfc Flx, 925-mb/200-mb Winds



- SST was weakly above-normal in the hurricane Main Development Region (MDR) .
- Westerly low-level wind anomalies dominated in MDR.
- Convection was enhanced in tropical North Atlantic.

NAO and SST Anomaly in North Atlantic

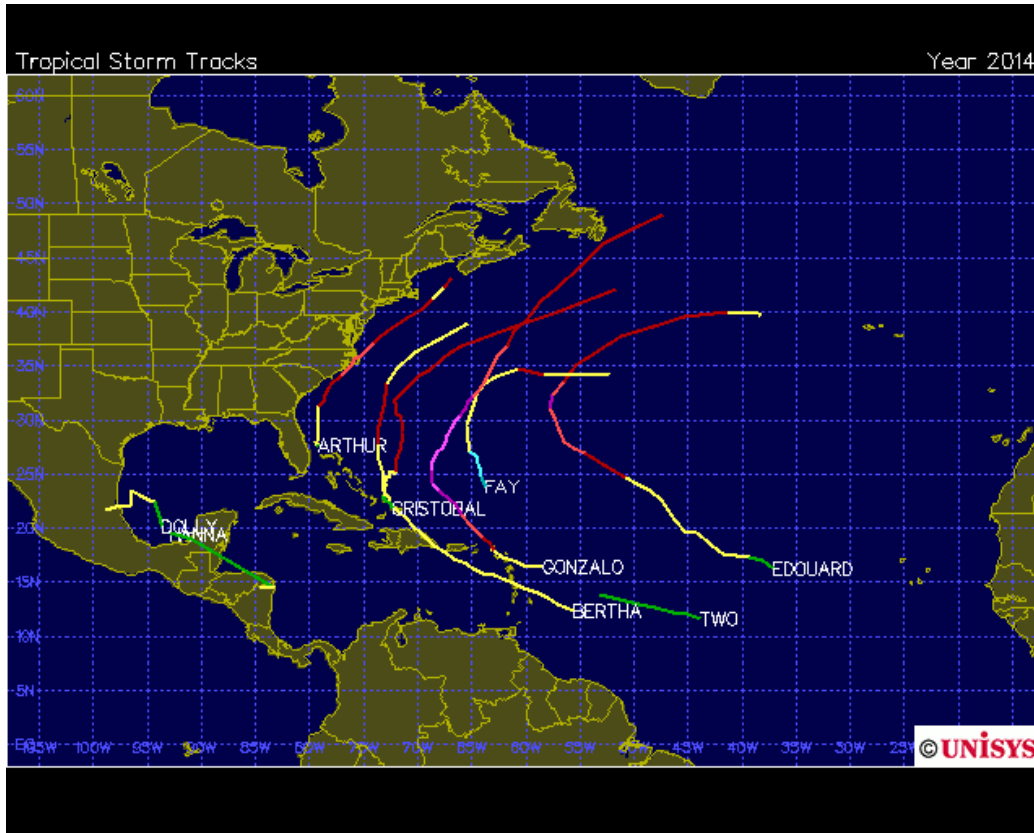


- High-latitude North Atlantic SSTA is generally closely related to NAO index (negative NAO leads to SST warming and positive NAO leads to SST cooling).
- NAO index switched to negative with $NAO = -0.87$.
- SST in MDR in this hurricane season was the coolest during the past four years.

Fig. NA2. Monthly standardized NAO index (top) derived from monthly standardized 500-mb height anomalies obtained from the NCEP CDAS in 20°N-90°N (<http://www.cpc.ncep.noaa.gov>). Time-Latitude section of SST anomalies averaged between 80°W and 20°W (bottom). SST are derived from the NCEP OI SST analysis, and anomalies are departures from the 1981-2010 base period means.

2014 Atlantic Hurricane Counts

(<http://weather.unisys.com/hurricane>)



- Only three seasons since 1995 were below-normal (1997, 2009, and 2013).

- If the current outlook verifies, 2014 will become the fourth below-normal season since 1995.

- It would mark the first time since 1995 that two consecutive seasons were below-normal.

- Atlantic Outlook (Aug update, 70% below-normal):

7-12 Named Storms (12 average)

3-6 Hurricanes (6 average)

0-2 Major Hurricanes (3 average)

40%-90% ACE

- Atlantic Counts by Nov 5:

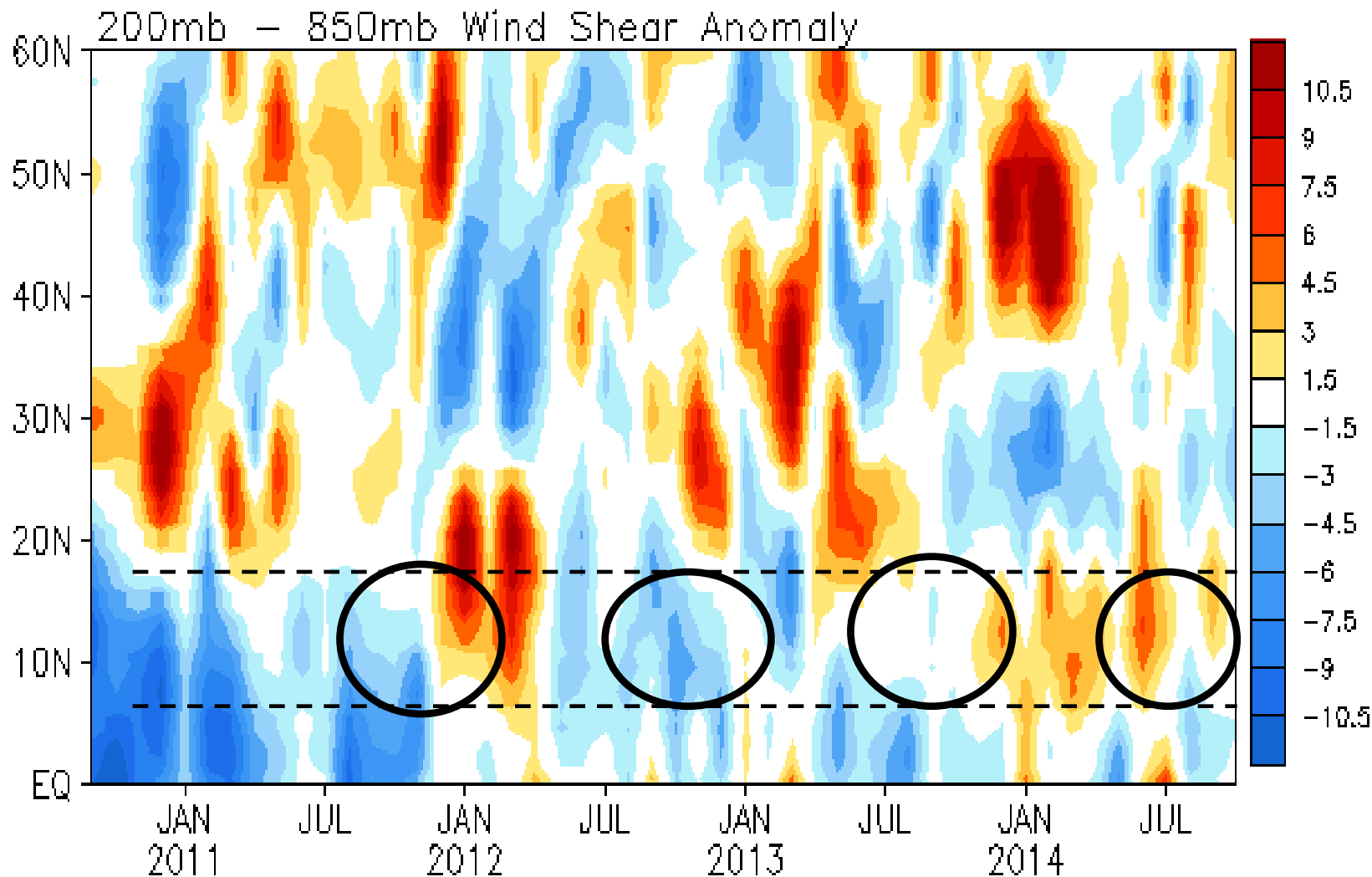
7 Named Storms

6 Hurricanes

2 Major Hurricanes

67% ACE

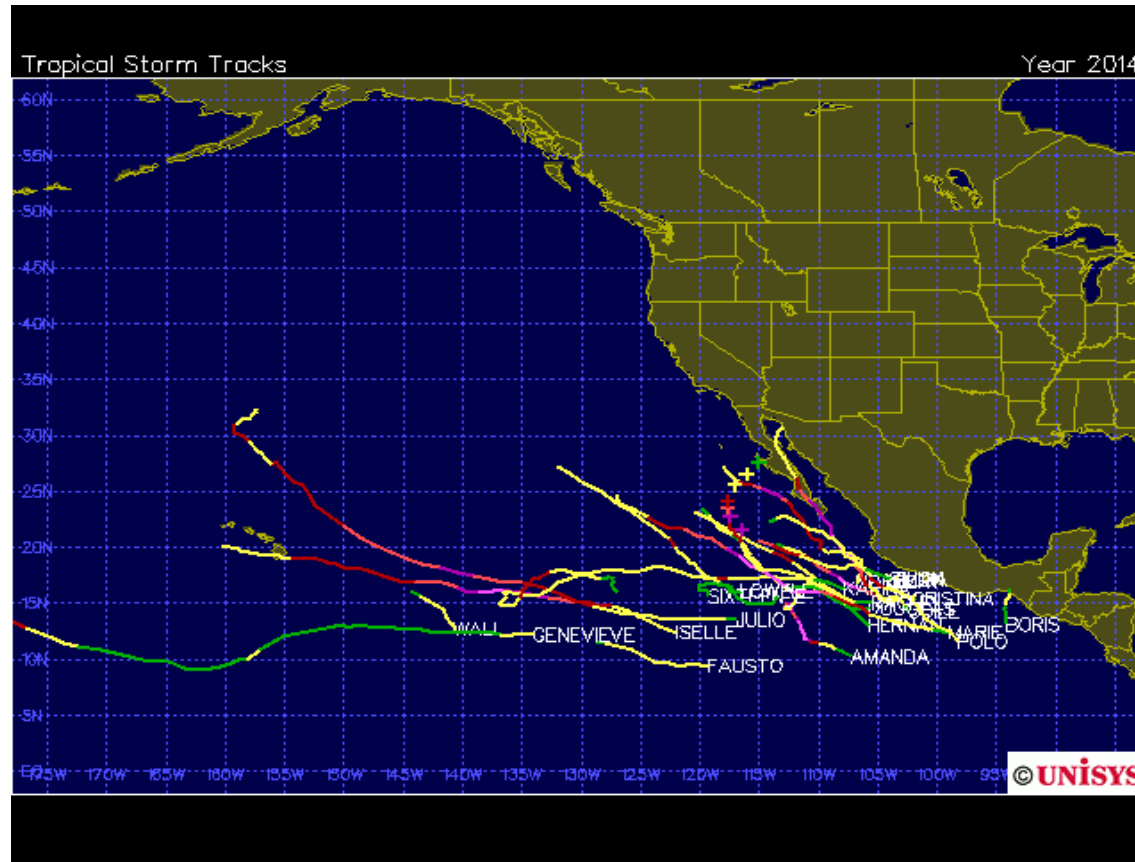
Vertical Wind Shear Anomaly in North Atlantic



- Vertical wind shear in MDR in 2014 was the highest in the past four years.

2014 E. Pacific Hurricane Counts

(<http://weather.unisys.com/hurricane>)



- E. Pacific Outlook (50% above-normal):

14-20 Named Storms (15 average)

7-11 Hurricanes (8 average)

3-6 Major Hurricanes (4 average)

95%-160% ACE

- E. Pacific Counts by Nov 5:

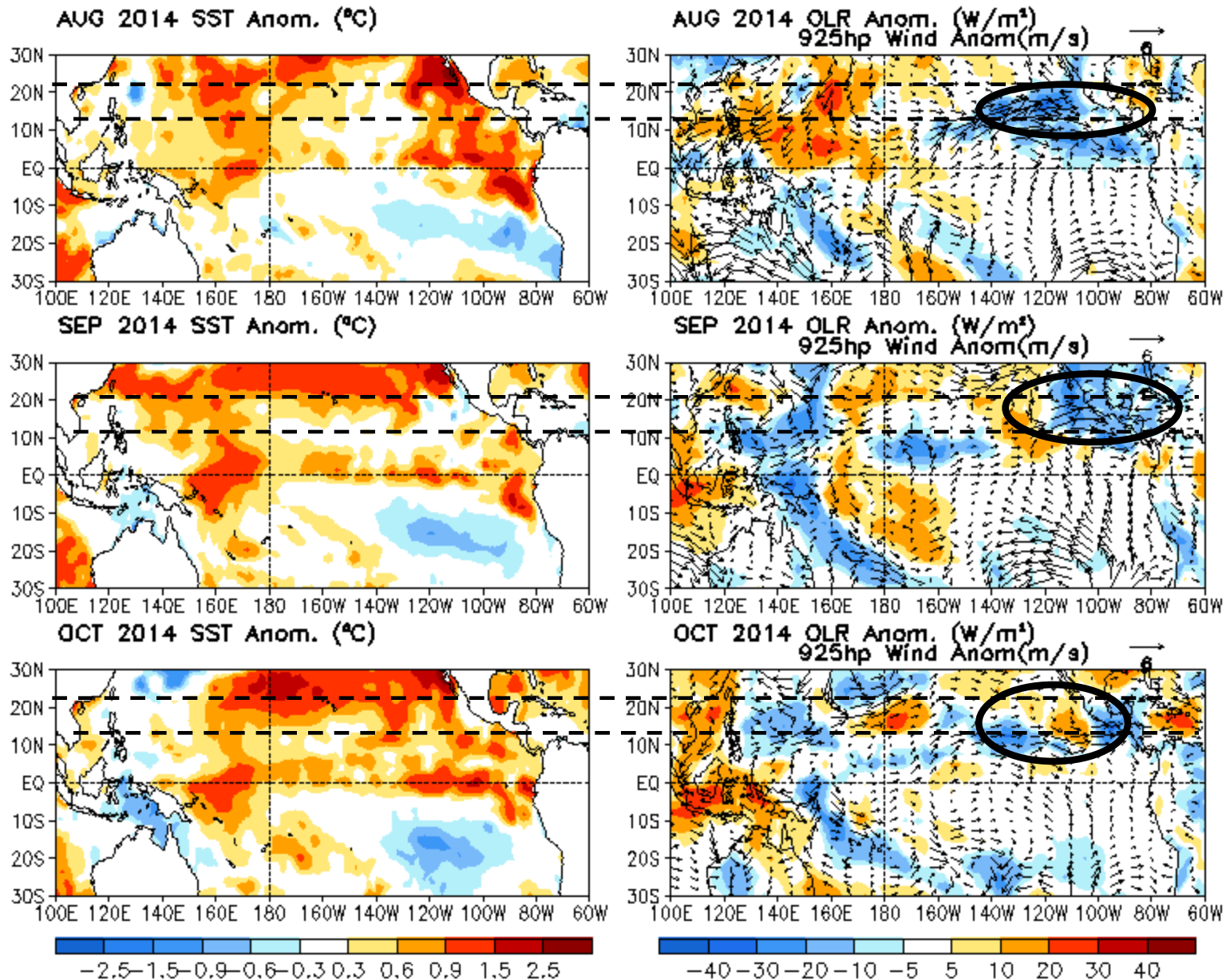
22 Named Storms

17 Hurricanes

6 Major Hurricanes

146% ACE

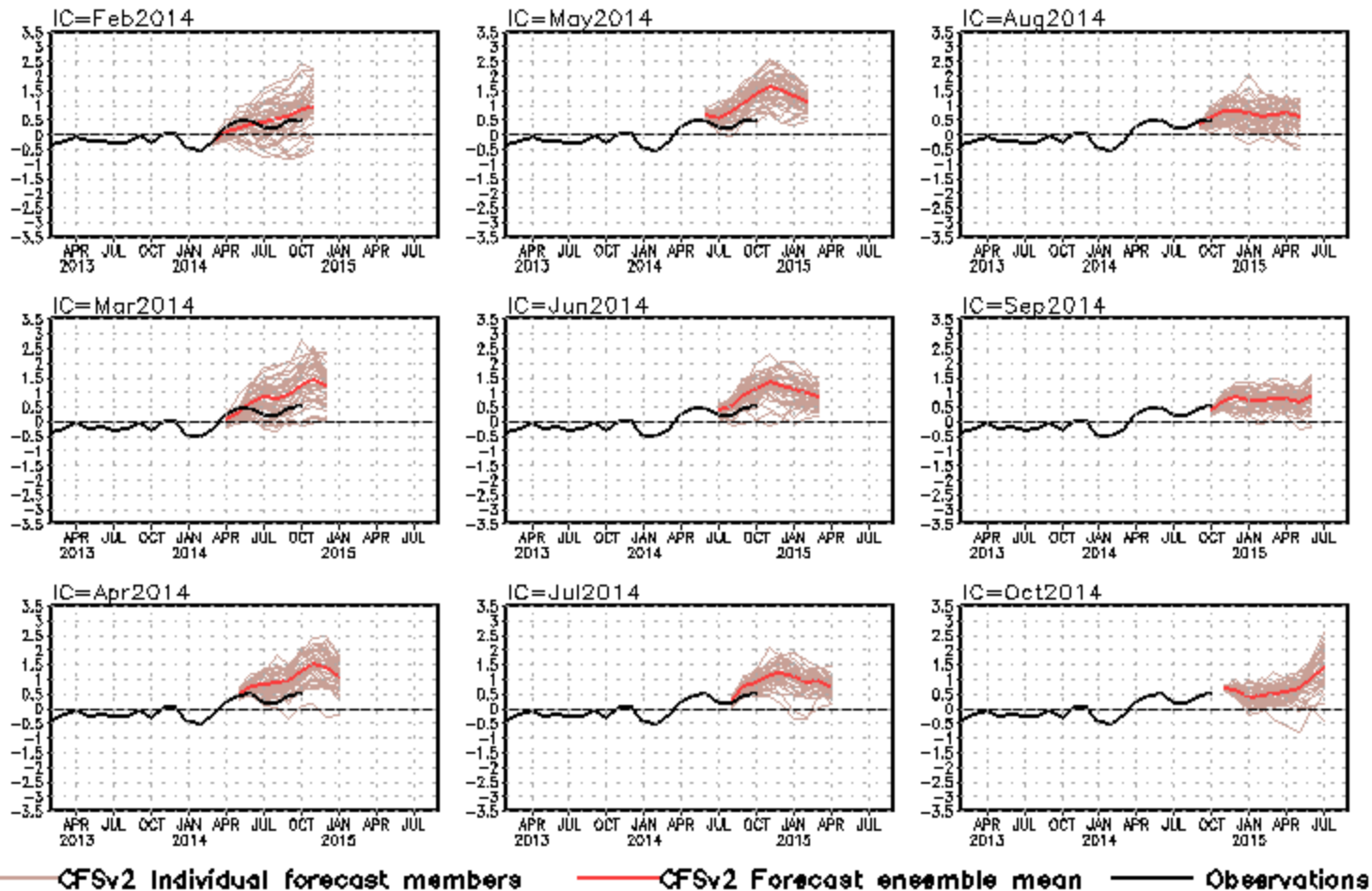
Last Three Month SST, OLR and 925hp Wind Anom.



Global SST Predictions

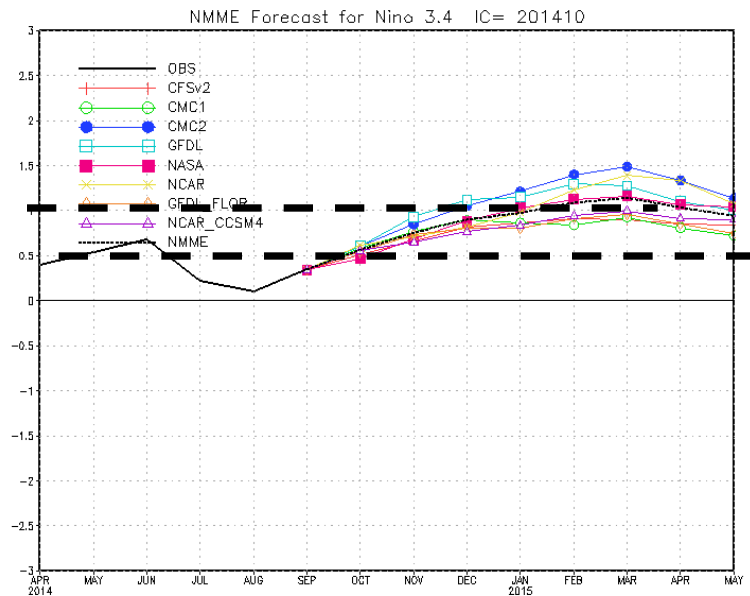
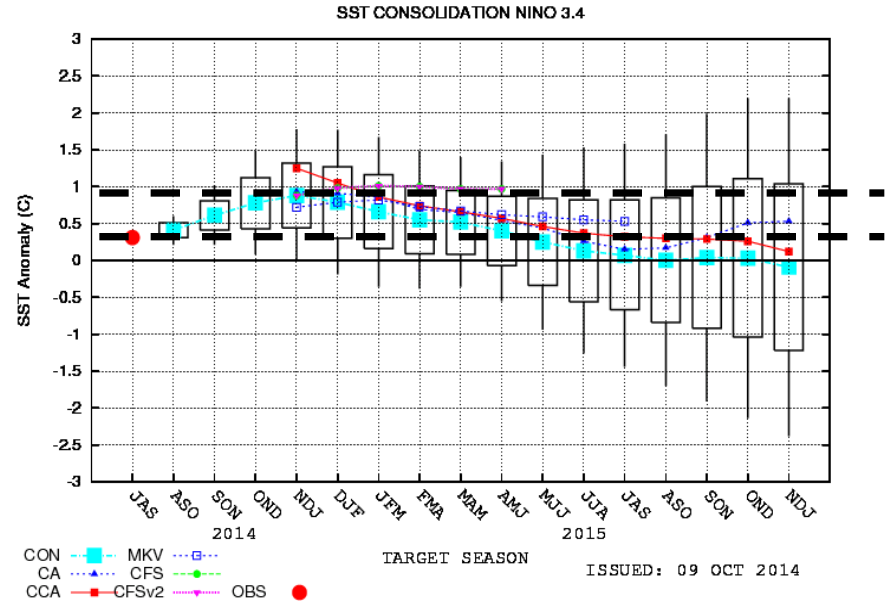
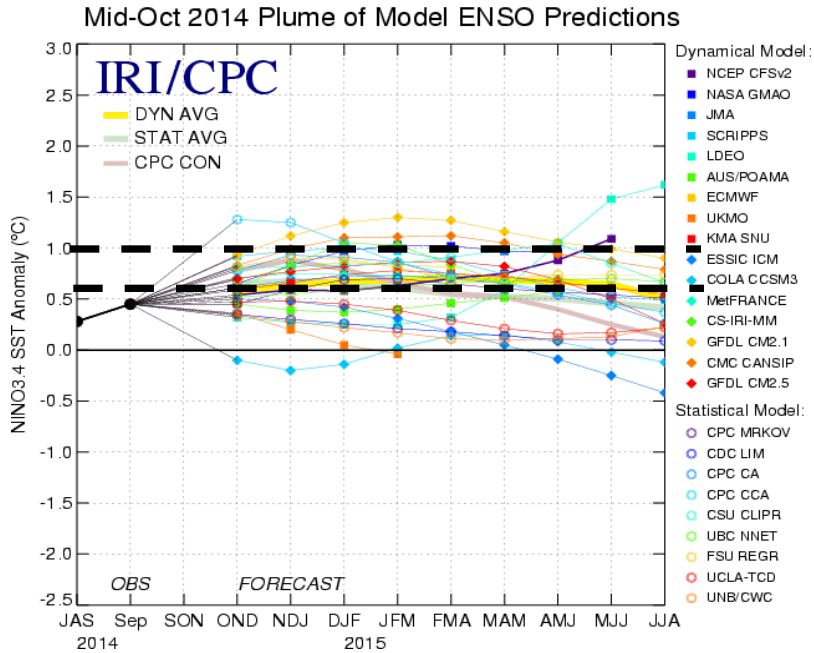
CFSv2 Niño3.4 SST Predictions from Different Initial Months

NINO3.4 SST anomalies (K)

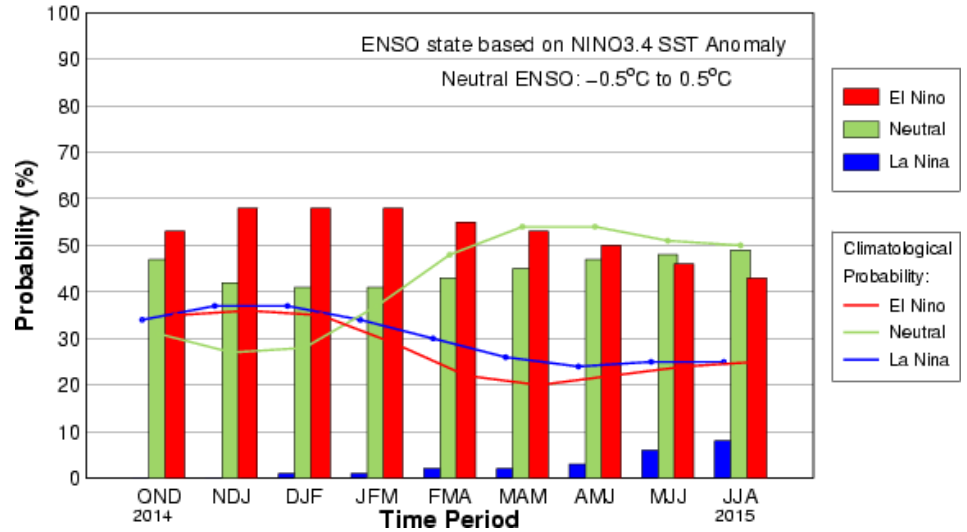


- Latest CFSv2 forecast favored ENSO-neutral conditions to prevail in Northern Hemisphere winter 2014-15, but weak El Nino-conditions to develop in summer 2015.

NINO3.4 Forecast Plums

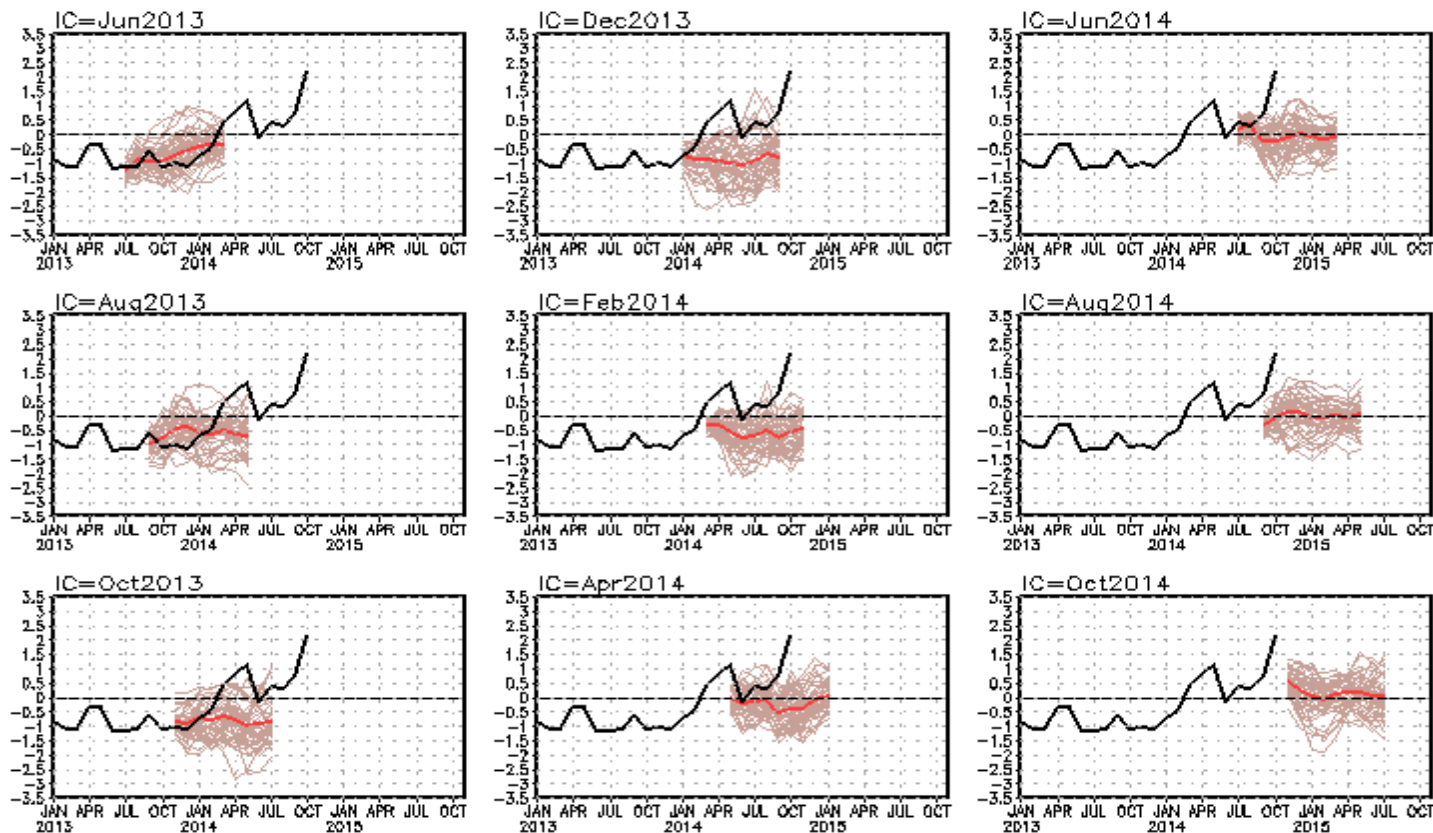


Early-Nov CPC/IRI Consensus Probabilistic ENSO Forecast



NCEP CFSv2 Pacific Decadal Oscillation (PDO) Forecast

standardized PDO index



PDO is the first EOF of monthly ERSSTv3b anomaly in the region of [110°E-100°W, 20°N-60°N].

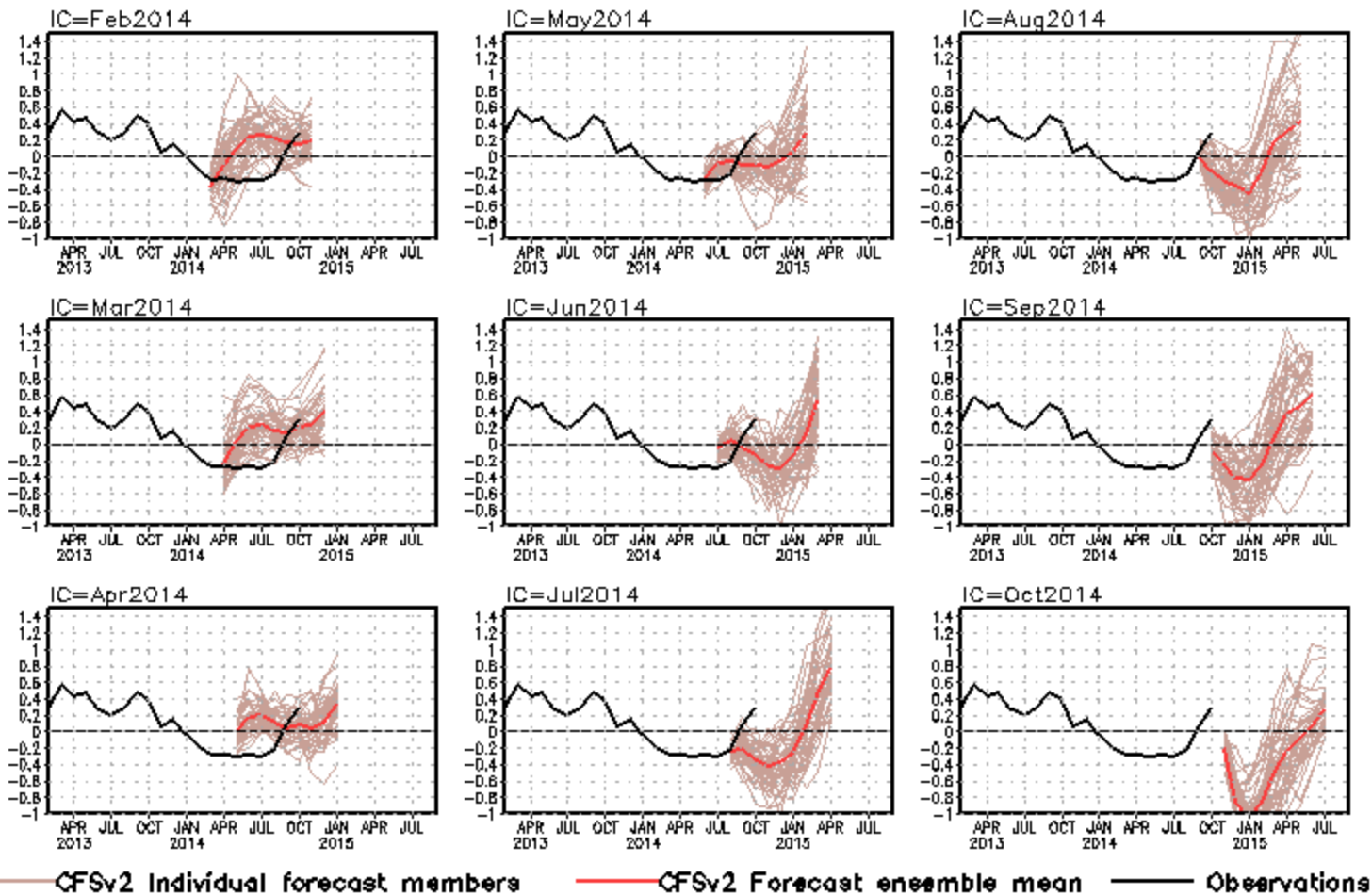
CFS PDO index is the standardized projection of CFS SST forecast anomalies onto the PDO EOF pattern.

— CFSv2 Individual forecast members — CFSv2 Forecast ensemble mean — Observations

- CFSv2 had a poor skill in forecasting the switch from negative to positive PDO phase.

NCEP CFSv2 Tropical North Atlantic SST Forecast

Tropical N. Atlantic SST anomalies (K)



- CFSv2 had a poor skill in forecasting the recent variations in tropical North Atlantic SST.

Overview

▪ Pacific and Arctic Oceans

- ENSO-neutral conditions continued during Oct 2014 (although NINO3.4= +0.5C, the tropical Pacific atmosphere was near-normal).
- The consensus forecast suggests 58% chance of El Niño during the Northern Hemisphere winter, which is favored to last into the Northern Hemisphere spring 2015.
- Positive PDO phase strengthened with PDO= +1.4 in Oct 2014.
- Arctic sea ice was near-normal on the Atlantic side and below-normal on the Pacific side

▪ Indian Ocean

- Indian Ocean Dipole switched from negative to near-normal in Oct 2014.

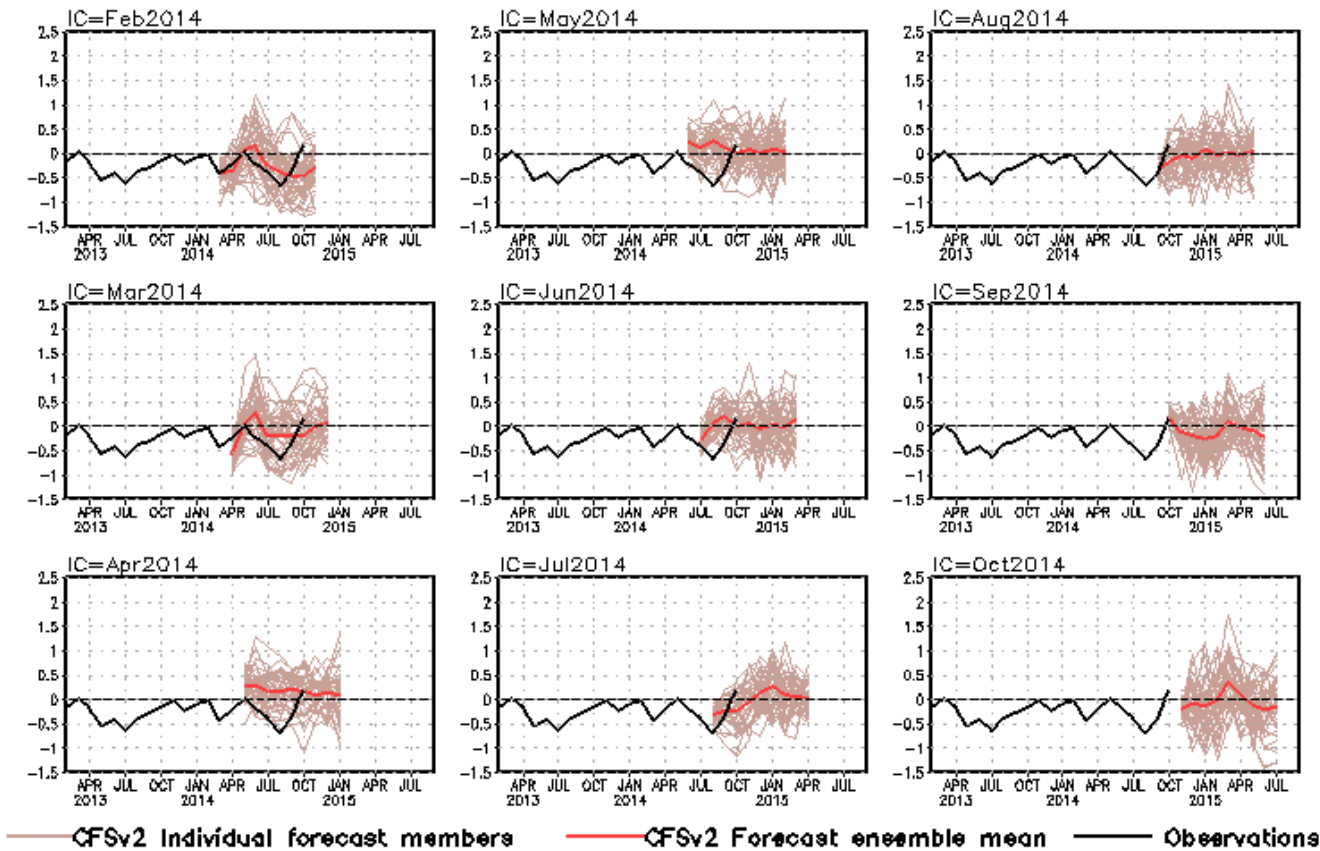
▪ Atlantic Ocean

- NAO phase switched from positive to negative with NAO=-0.87 in Oct 2014.
- 2014 Atlantic hurricane season had 7 tropical storms (TSs), 6 hurricanes (Hs) and 2 major hurricanes (MHs), which is below the average (12 TSs, 6 Hs, 3 MHs). The ACE is 67% of normal.
- 2014 Eastern Pacific hurricane season had 22 TSs, 17 Hs and 6 MHs, which is well above the average (15 TSs, 8 Hs, 4 MHs). The ACE is 147% of normal.

Backup Slides

NCEP CFS DMI SST Predictions from Different Initial Months

Indian Ocean Dipole SST anomalies (K)



DMI = WTIO - SETIO
SETIO = SST anomaly in
[90°E-110°E, 10°S-0]
WTIO = SST anomaly in
[50°E-70°E, 10°S-10°N]

Fig. M2. CFS Dipole Model Index (DMI) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labelled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). The hindcast climatology for 1981-2006 was removed, and replaced by corresponding observation climatology for the same period. Anomalies were computed with respect to the 1981-2010 base period means.

Tropical Pacific: SST Anom., SST Anom. Tend., OLR, Sfc Rad, Sfc Flx, 925-mb & 200-mb Winds

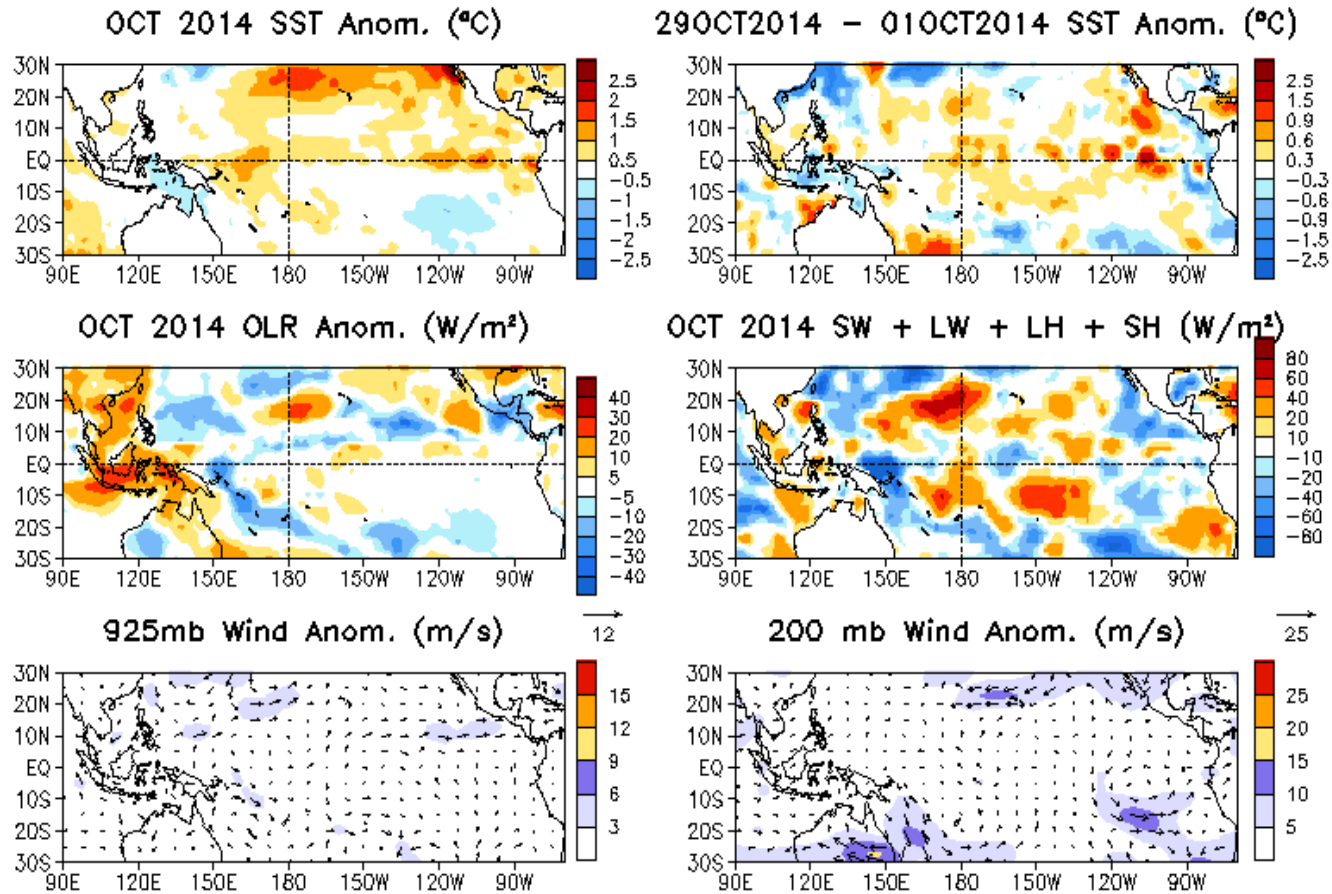


Fig. P2. Sea surface temperature (SST) anomalies (top-left), anomaly tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sum of net surface short- and long-wave radiation, latent and sensible heat flux anomalies (middle-right), 925-mb wind anomaly vector and its amplitude (bottom-left), 200-mb wind anomaly vector and its amplitude (bottom-right). SST are derived from the NCEP OI SST analysis, OLR from the NOAA 18 AVHRR IR window channel measurements by NESDIS, winds and surface radiation and heat fluxes from the NCEP CDAS. Anomalies are departures from the 1981-2010 base period means.

North Atlantic: SST Anom., SST Anom. Tend., OLR, SLP, Sfc Rad, Sfc Flx

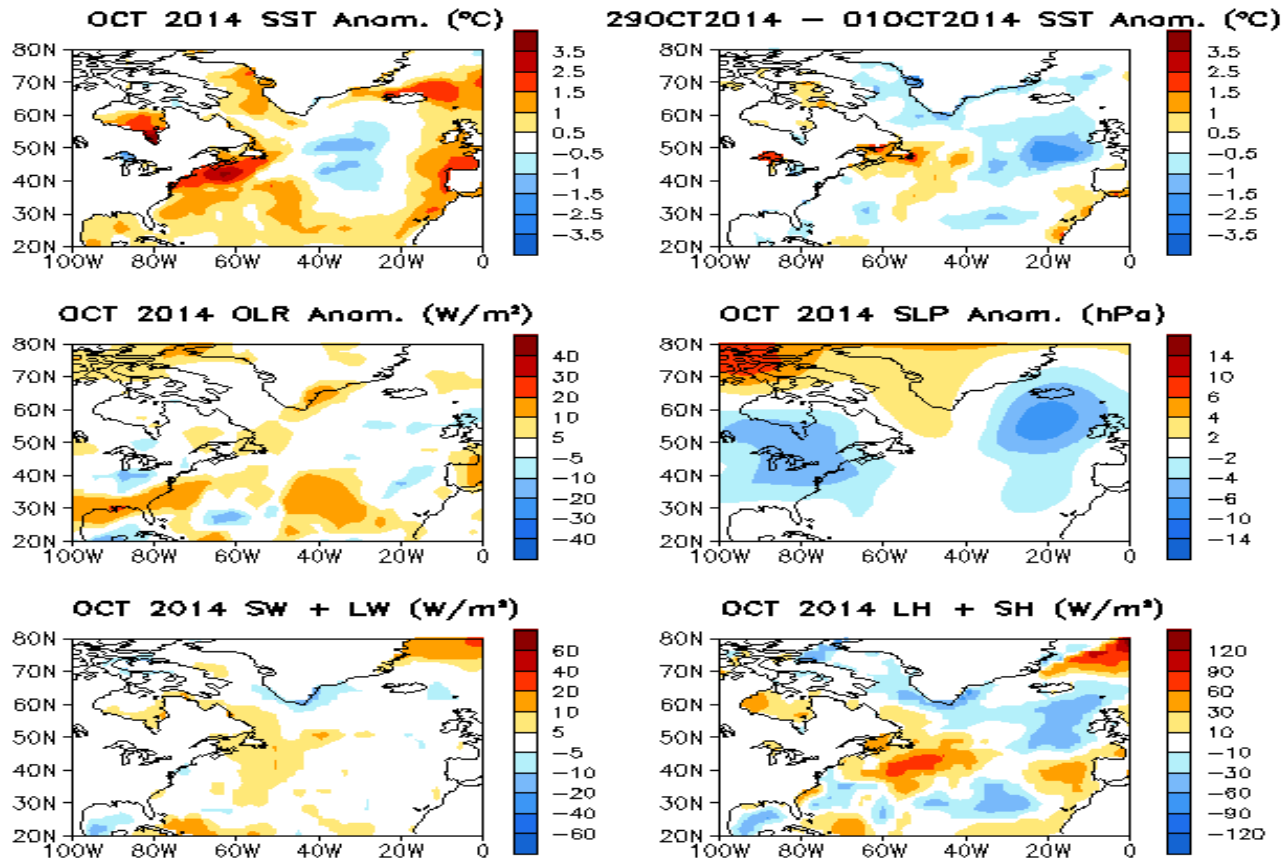


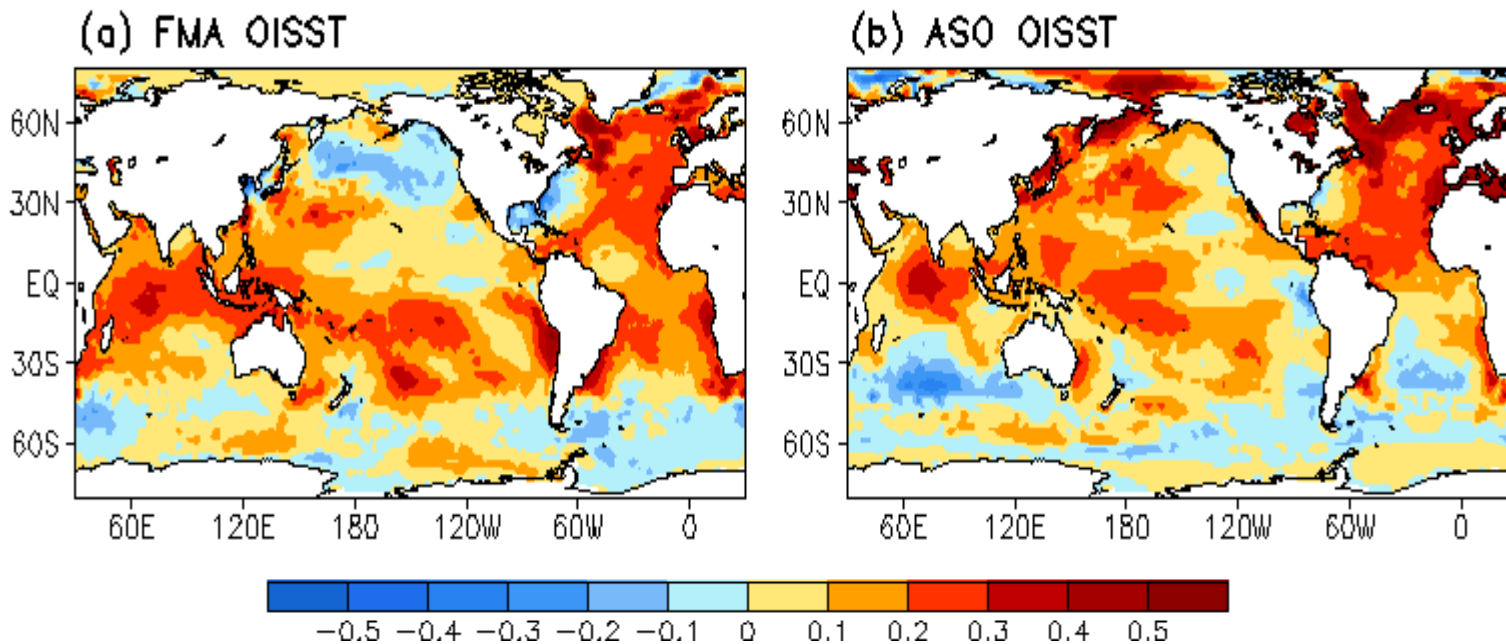
Fig. NA1. Sea surface temperature (SST) anomalies (top-left), anomaly tendency (top-right), Outgoing Long-wave Radiation (OLR) anomalies (middle-left), sea surface pressure anomalies (middle-right), sum of net surface short- and long-wave radiation anomalies (bottom-left), sum of latent and sensible heat flux anomalies (bottom-right). SST are derived from the NCEP OI SST analysis, OLR from the NOAA 18 AVHRR IR window channel measurements by NESDIS, sea surface pressure and surface radiation and heat fluxes from the NCEP CDAS. Anomalies are departures from the 1979-1995 base period means except SST anomalies are computed with respect to the 1971-2000 base period means.

Switch to 1981-2010 Climatology

- **SST from 1971-2000 to 1981-2010**
 - Weekly **OISST.v2**, monthly ERSST.3b
- **Atmospheric fields from 1979-1995 to 1981-2010**
 - NCEP CDAS **winds**, sea level pressure, 200mb velocity potential, surface shortwave and longwave radiation, surface latent and sensible fluxes, relative humidity
 - Outgoing Long-wave Radiation
- **Oceanic fields from 1982-2004 to 1981-2010**
 - GODAS temperature, **heat content**, depth of 20°C, sea surface height, mixed layer depth, tropical cyclone heat potential, surface currents, upwelling
- **Satellite data climatology 1993-2005 unchanged**
 - Aviso Altimetry Sea Surface Height
 - Ocean Surface Current Analyses – Realtime (OSCAR)

Be aware that new climatology (1981-2010) was applied since Jan 2011

SST Climatology Diff. ($^{\circ}\text{C}$): (1981–2010) – (1971–2000)



1971-2000 SST Climatology (Xue et al. 2003):

http://www.cpc.ncep.noaa.gov/products/predictions/30day/SSTs/sst_clim.htm

1981-2010 SST Climatology: <http://origin.cpc.ncep.noaa.gov/products/people/yxue/sstclim/>

- The seasonal mean SST in February-April (FMA) increased by more than 0.2°C over much of the Tropical Oceans and N. Atlantic, but decreased by more than 0.2°C in high-latitude N. Pacific, Gulf of Mexico and along the east coast of U.S.
- Compared to FMA, the seasonal mean SST in August-October (ASO) has a stronger warming in the tropical N. Atlantic, N. Pacific and Arctic Ocean, and a weaker cooling in Gulf of Mexico and along the east coast of U.S.

Data Sources and References

- **Optimal Interpolation SST (OI SST) version 2 (Reynolds et al. 2002)**
- **NCEP CDAS winds, surface radiation and heat fluxes**
- **NESDIS Outgoing Long-wave Radiation**
- **NDBC TAO data (<http://tao.noaa.gov>)**
- **PMEL TAO equatorial temperature analysis**
- **NCEP's Global Ocean Data Assimilation System temperature, heat content, currents (Behringer and Xue 2004)**
- **Aviso Altimetry Sea Surface Height**
- **Ocean Surface Current Analyses – Realtime (OSCAR)**

Please send your comments and suggestions to Yan.Xue@noaa.gov. Thanks!