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

Prepared by

Climate Prediction Center, NCEP

**September 7, 2007**

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

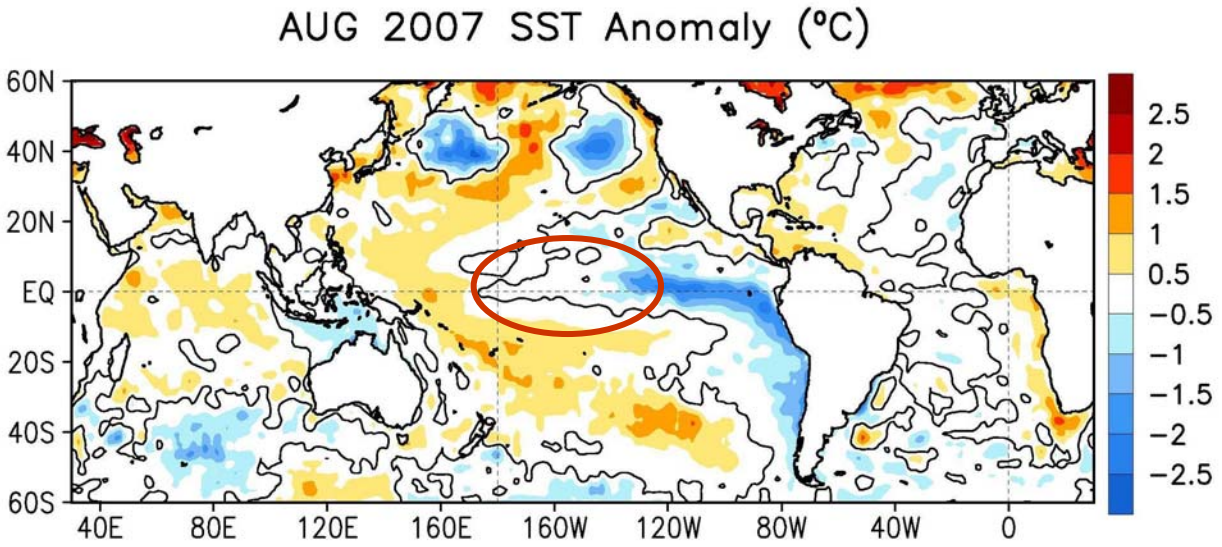
# Outline

- **Overview**
- **Recent highlights**
  - **Pacific Ocean**
  - **Indian Ocean**
  - **Atlantic Ocean**
- **GODAS and CFS SST Predictions**
- **Analysis of special events of interest**

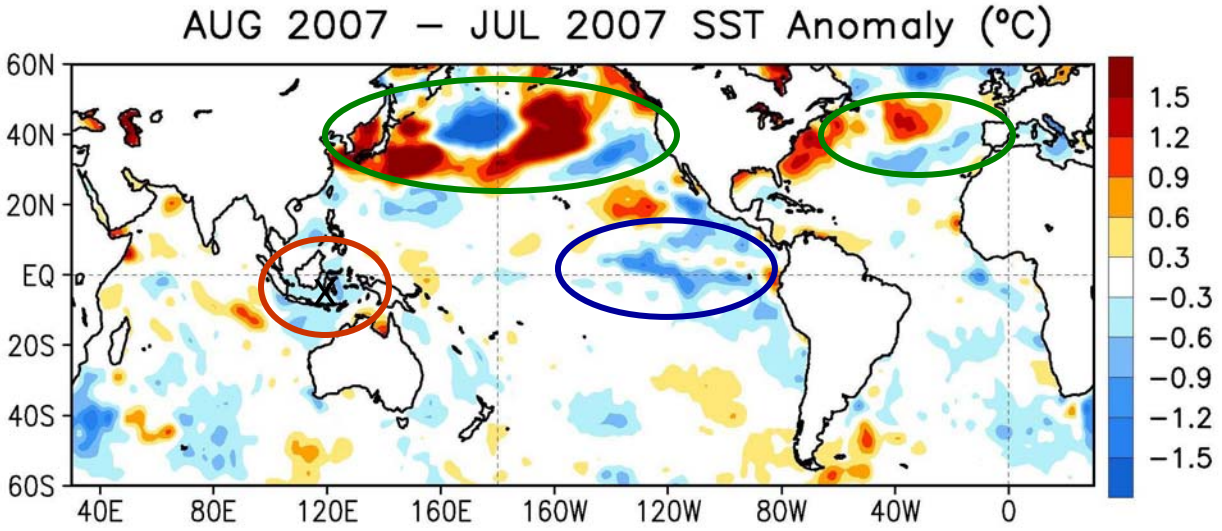
# Overview

- **Pacific Ocean**
  - Cold SST anomalies propagated westward towards the dateline
  - CPC's prognostic assessment: La Niña conditions will further develop during the next 3-months
  - Development of positive SST anomaly tendency over the west coast of South America
  - Large SST changes in the NH extratropics
- **Indian Ocean**
  - Near normal SST conditions prevailed
  - Negative SST anomalies developed near the maritime continent
- **Atlantic Ocean**
  - Near normal SST conditions prevailed in equatorial Atlantic.
  - SST anomalies are smaller than for the last year
  - Large SST changes in the NH extratropics

# SST Anomaly (ºC) and Anomaly Tendency

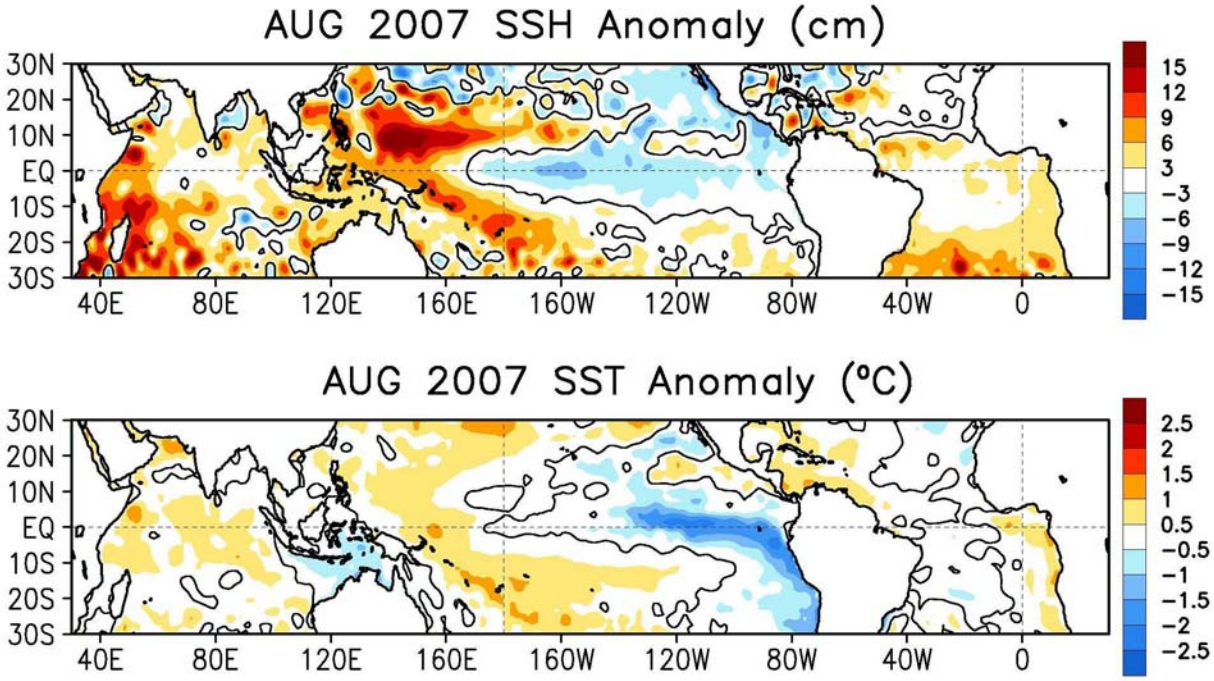



- **Eq. Pacific cold SST anomalies moved westward… a classic horseshoe pattern**
- **Weak positive SST anomalies in the Indian and Atlantic Ocean**



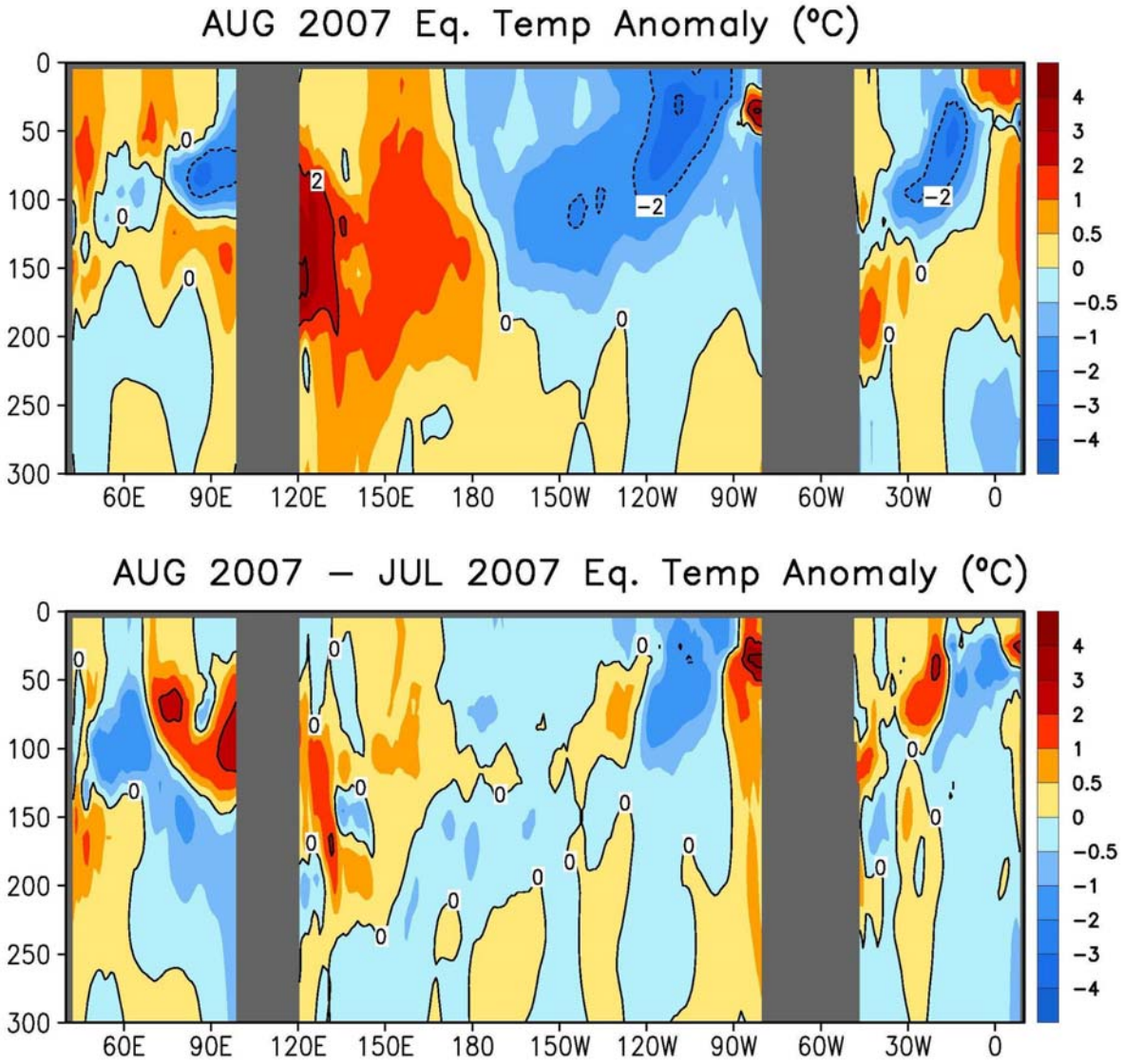

- **SSTs in the Eq. Pacific cooled**
- **Substantial changes in the NH extratropics**
- **Cooling near the maritime continent**

# SSH Anomaly (cm) v.s. SST Anomaly ($^0$C)



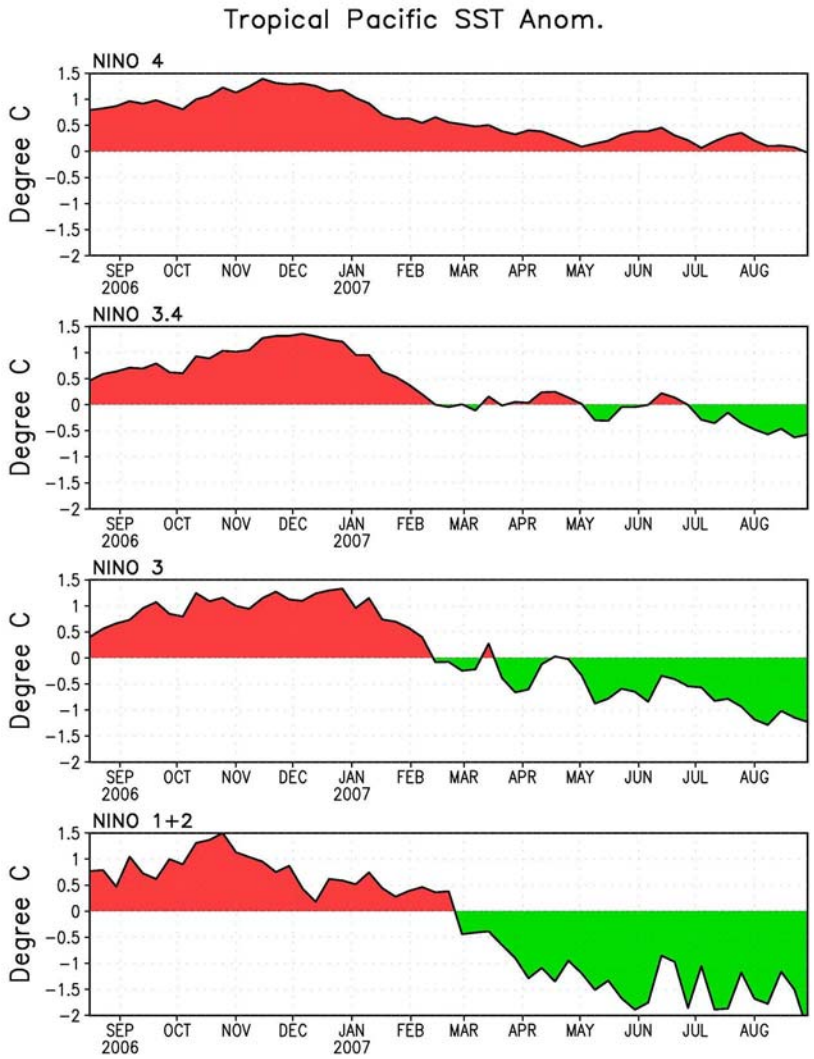

- **Good consistency between SSH and SST in the equatorial latitudes**
- **Changes in the SH extratropical latitudes in the SSH may reflect warming trends in the deeper oceans**

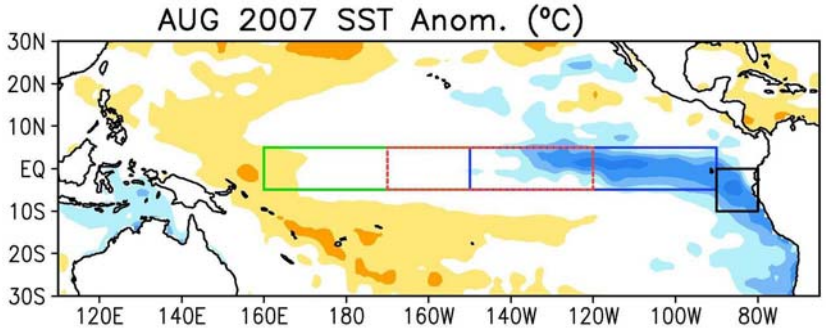
# GODAS Equatorial X-Z Temperature



# Pacific Ocean

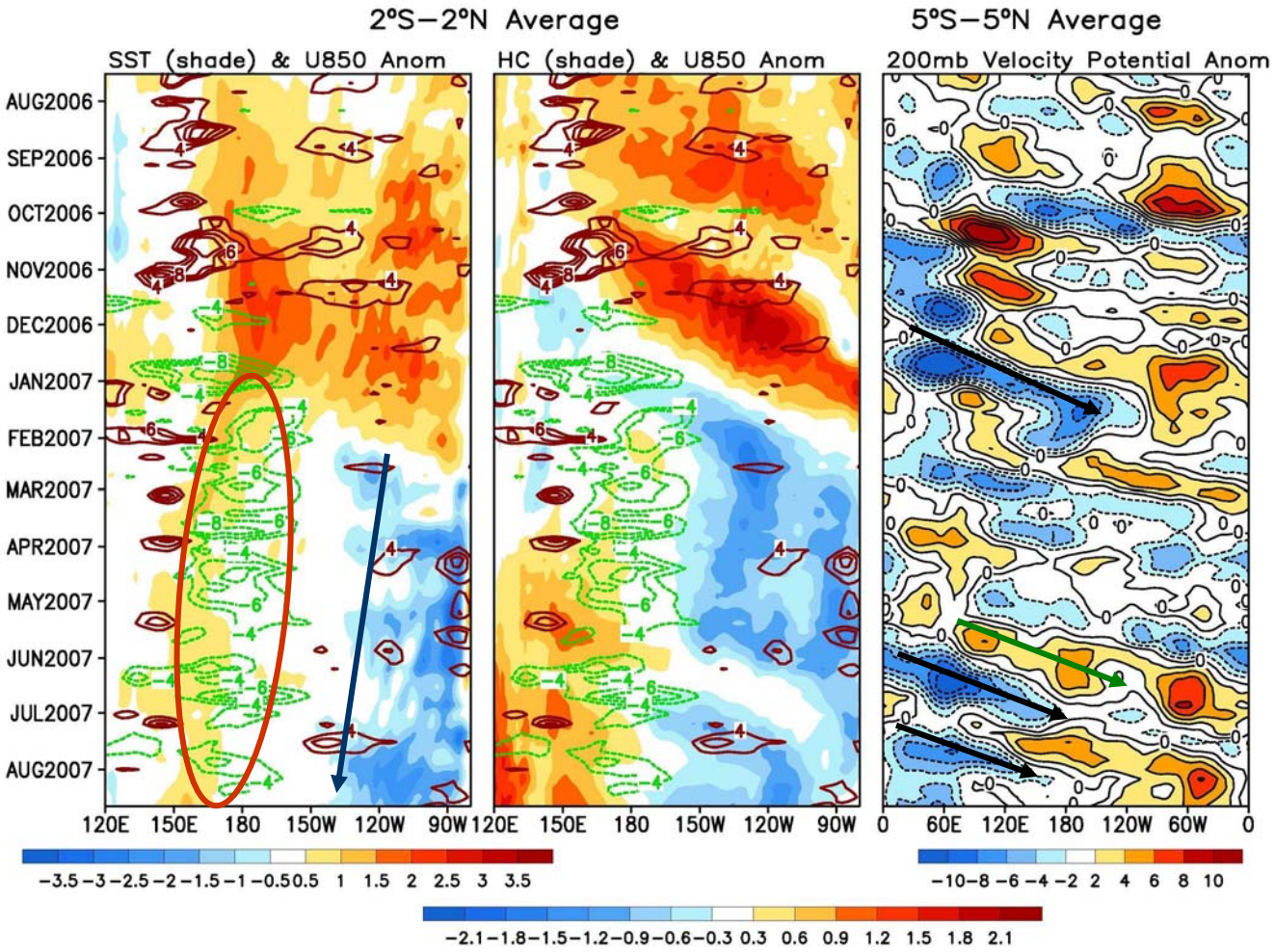
# Recent Evolution of Pacific NINO SST Indices



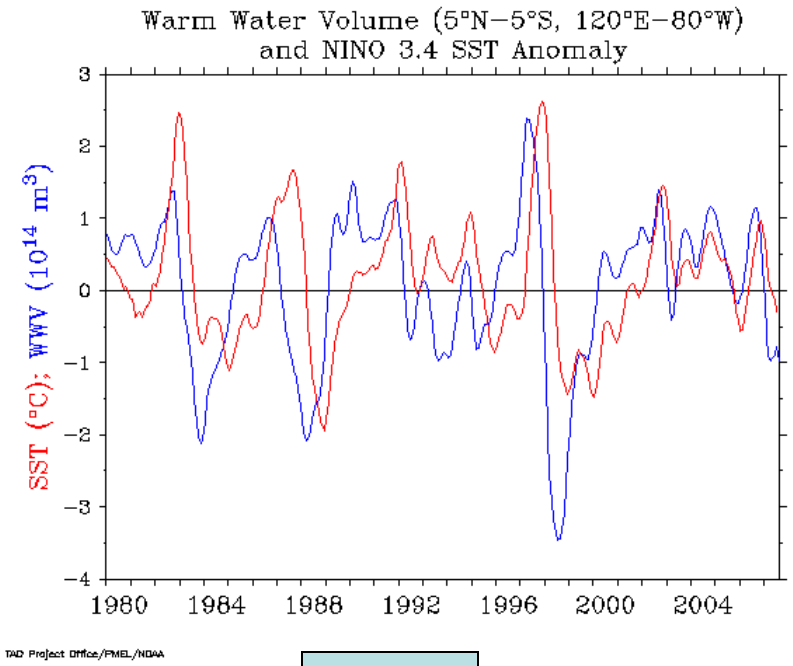

- **All Niño SST indices had a cooling trend**
- **Westward shift in cooler SSTs**
- **CPC's ENSO Prognostic Statement: La Niña conditions will further develop during the next 3 months.**

# Evolution of Equatorial Pacific SST (°C), 850-mb Zonal Wind (m/s), 0-300m Heat Content (°C) and MJO Activity

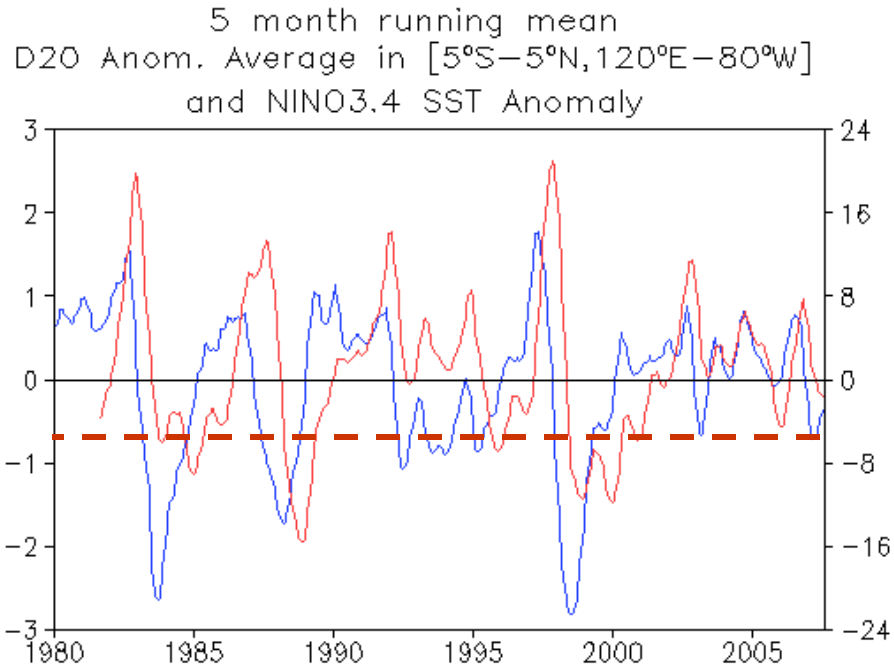



- Easterly low-level wind anomalies have steadily moved westward
- Caused by above normal precip. near the maritime continent?
- Western edge of the negative SST anomalies also moved westward

# Pacific Warm Water Volume

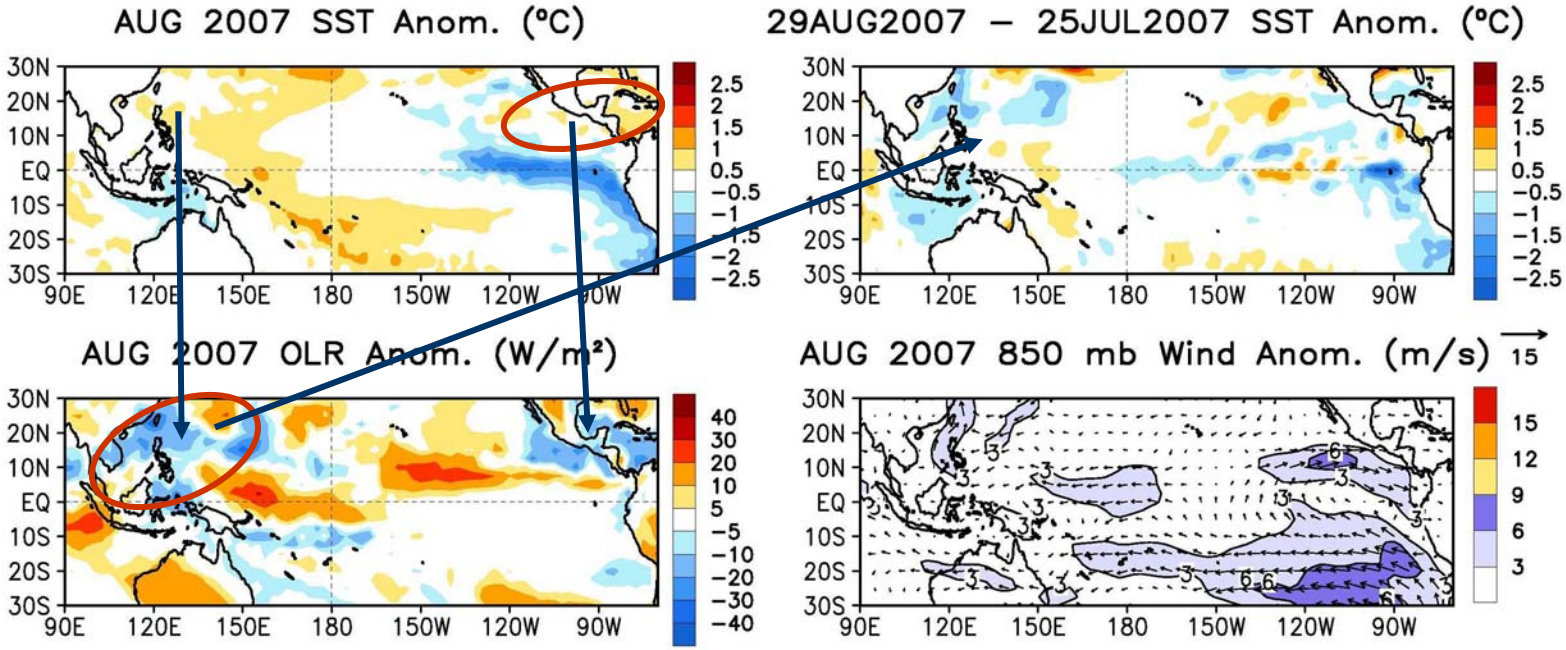



PMEL



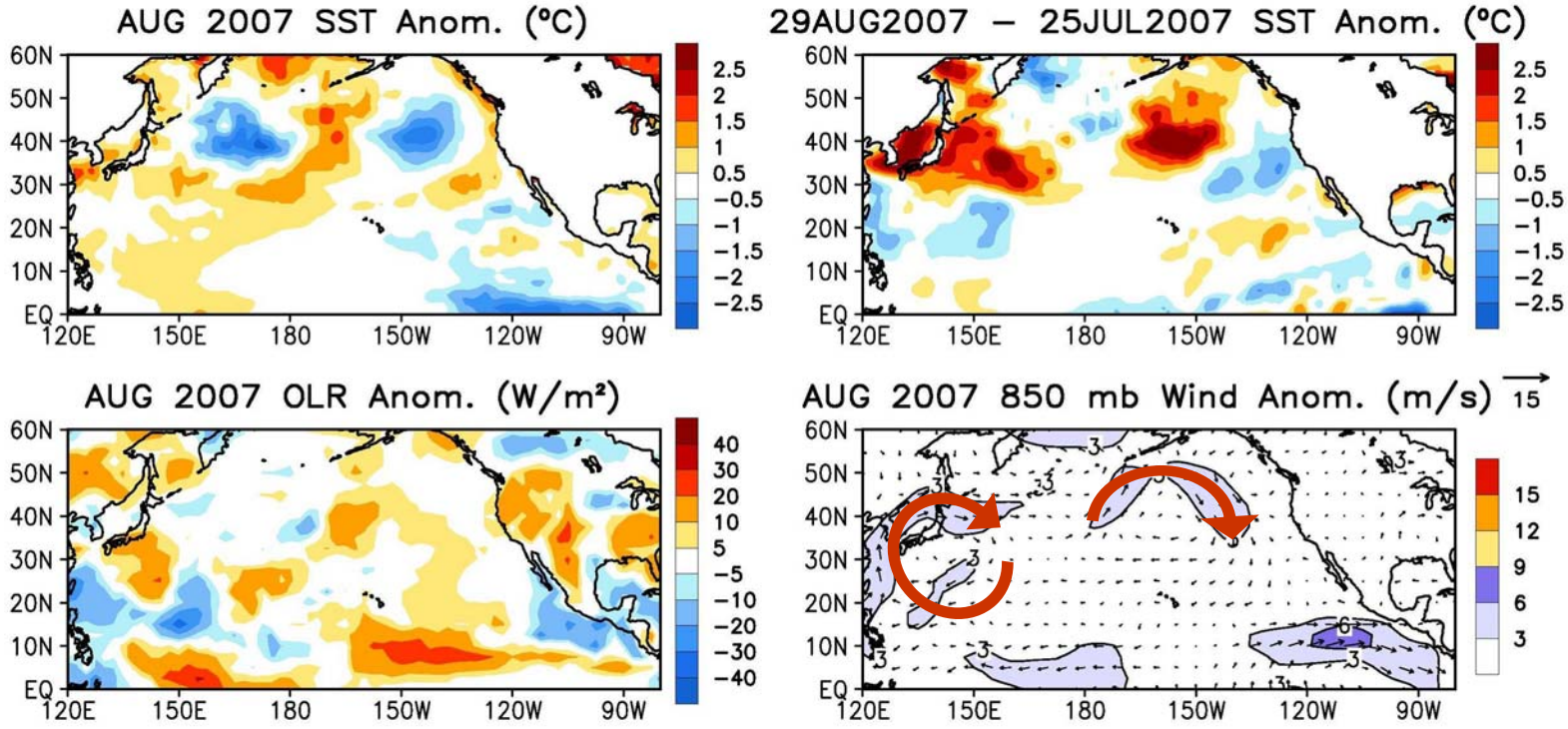

GODAS

# Tropical Pacific: SST Anom., SST Anom. Tend., OLR, 850-mb Winds



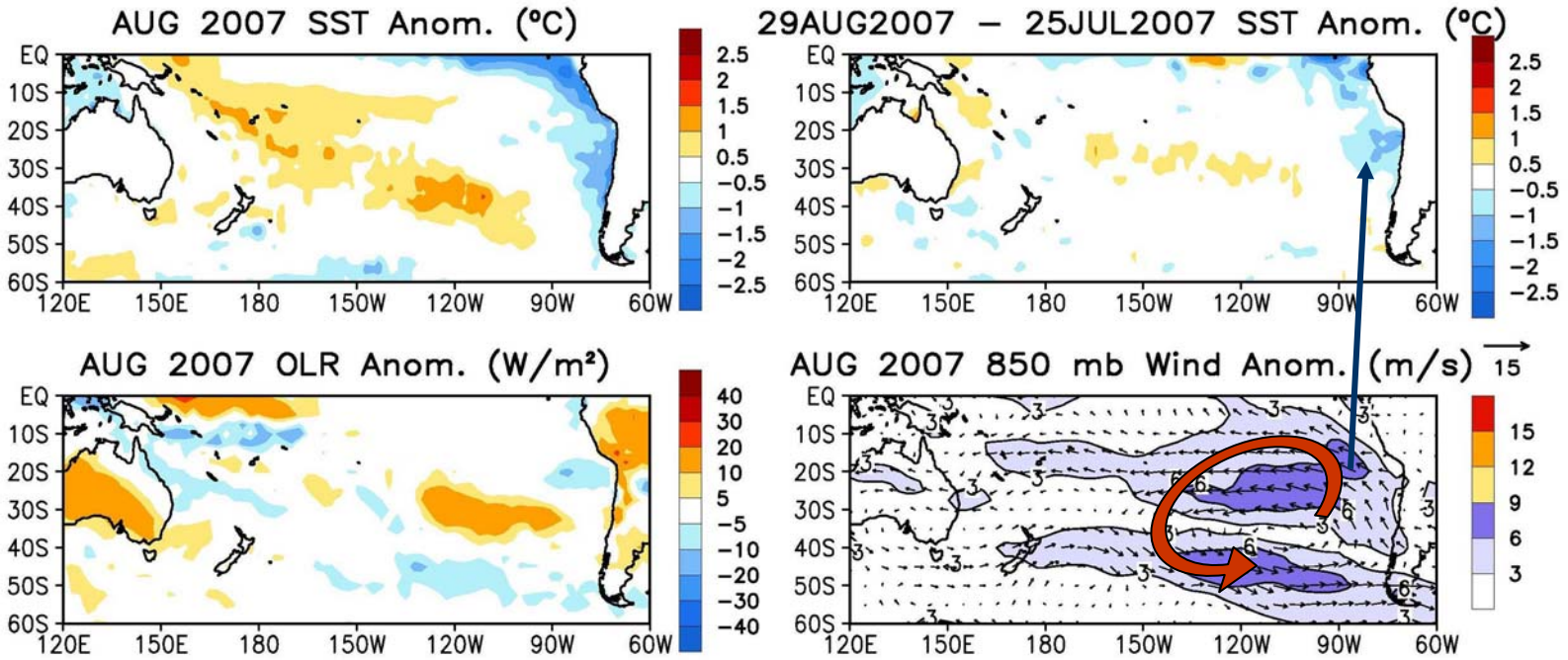

- **Above normal OLR anomalies in the Eq. Pacific (consistent with below normal SSTs)**
- **Below normal OLR near (120E , 20N)→ leading to negative SST tendencies?**

# North Pacific: SST Anom., SST Anom. Tend., OLR, 850-mb Winds

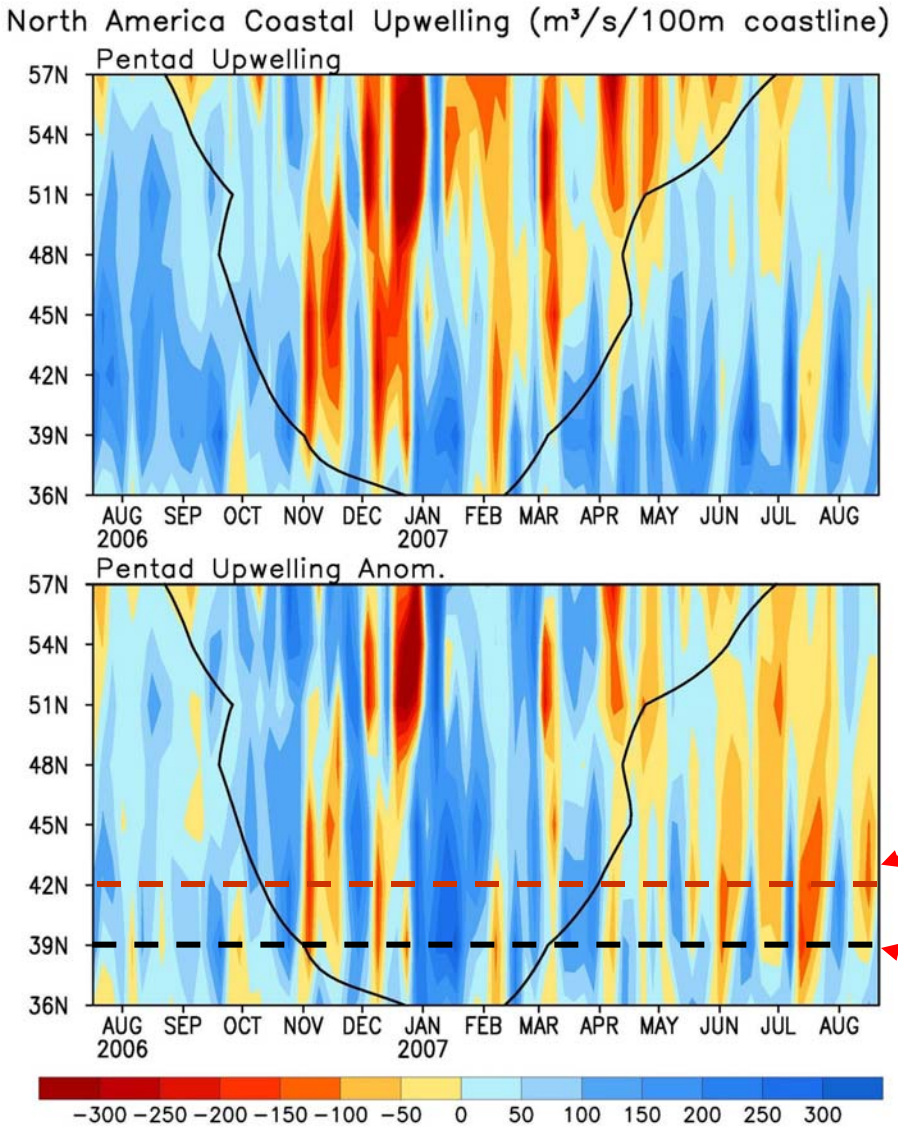


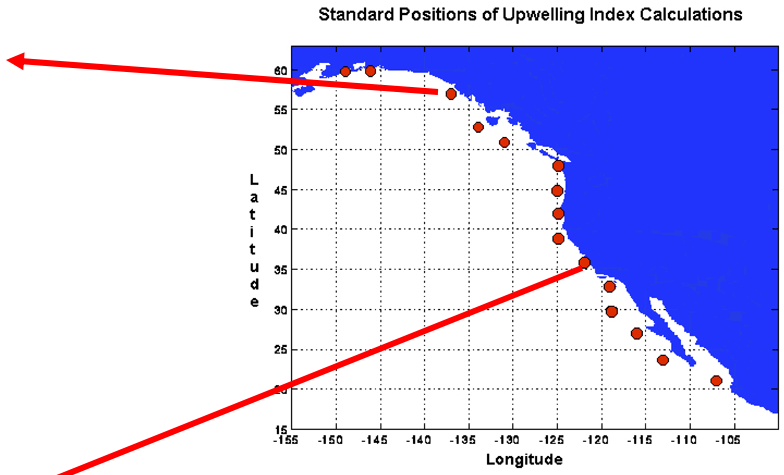

- **Large changes in the northern (summer) hemisphere… shallower mixed layer**
- **Need surface heat fluxes and Ekman transport for better understanding**

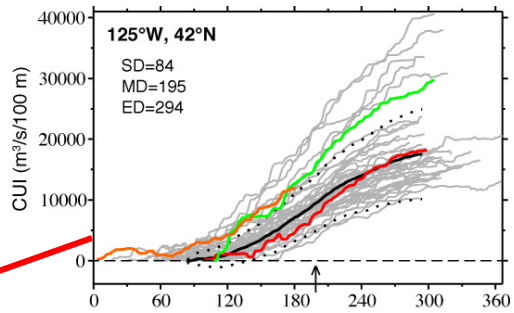
# South Pacific: SST Anom., SST Anom. Tend., OLR, 850-mb Winds

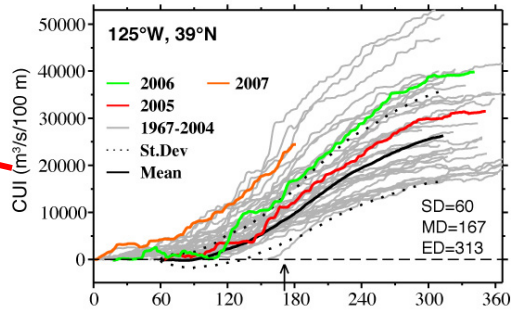


# North America Western Coastal Upwelling



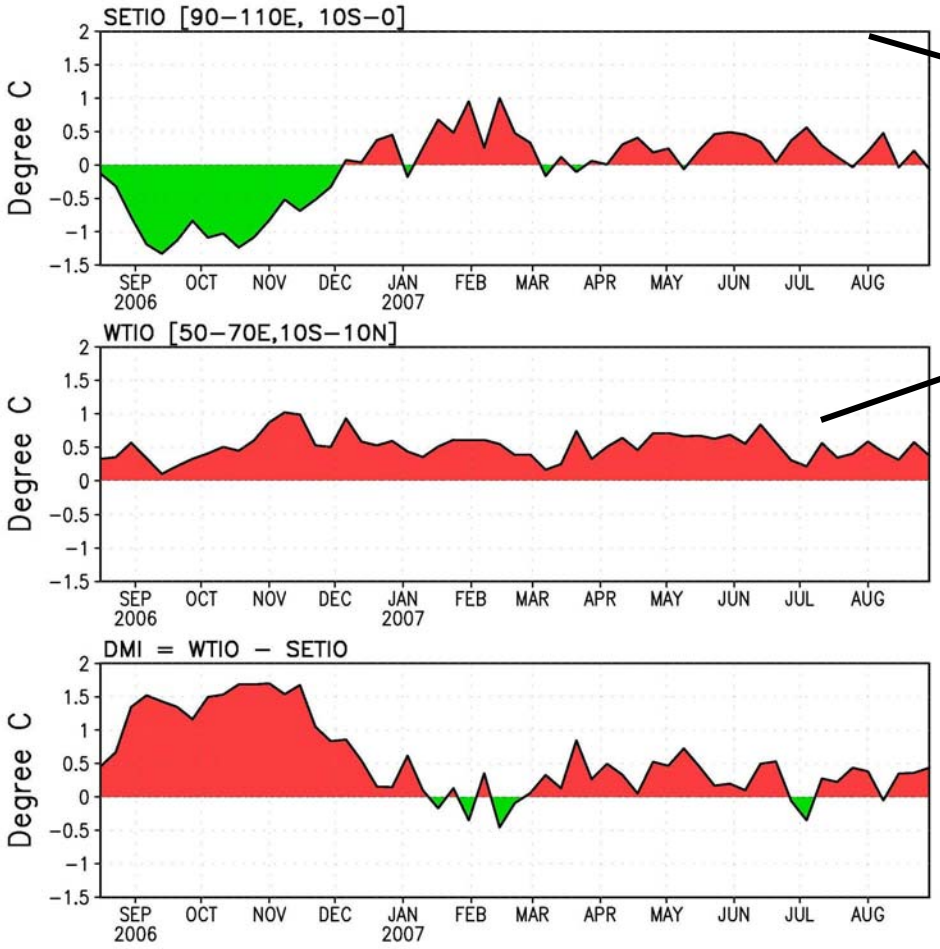



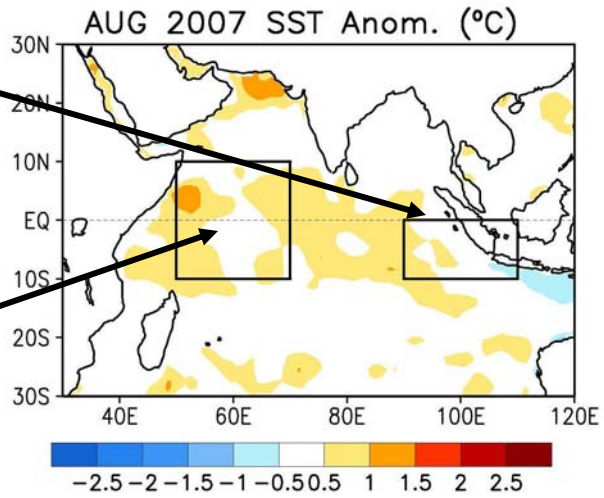




•Climatologically upwelling season progresses from March to July along the west coast of North America from 36°N to 57°N.

# Indian Ocean

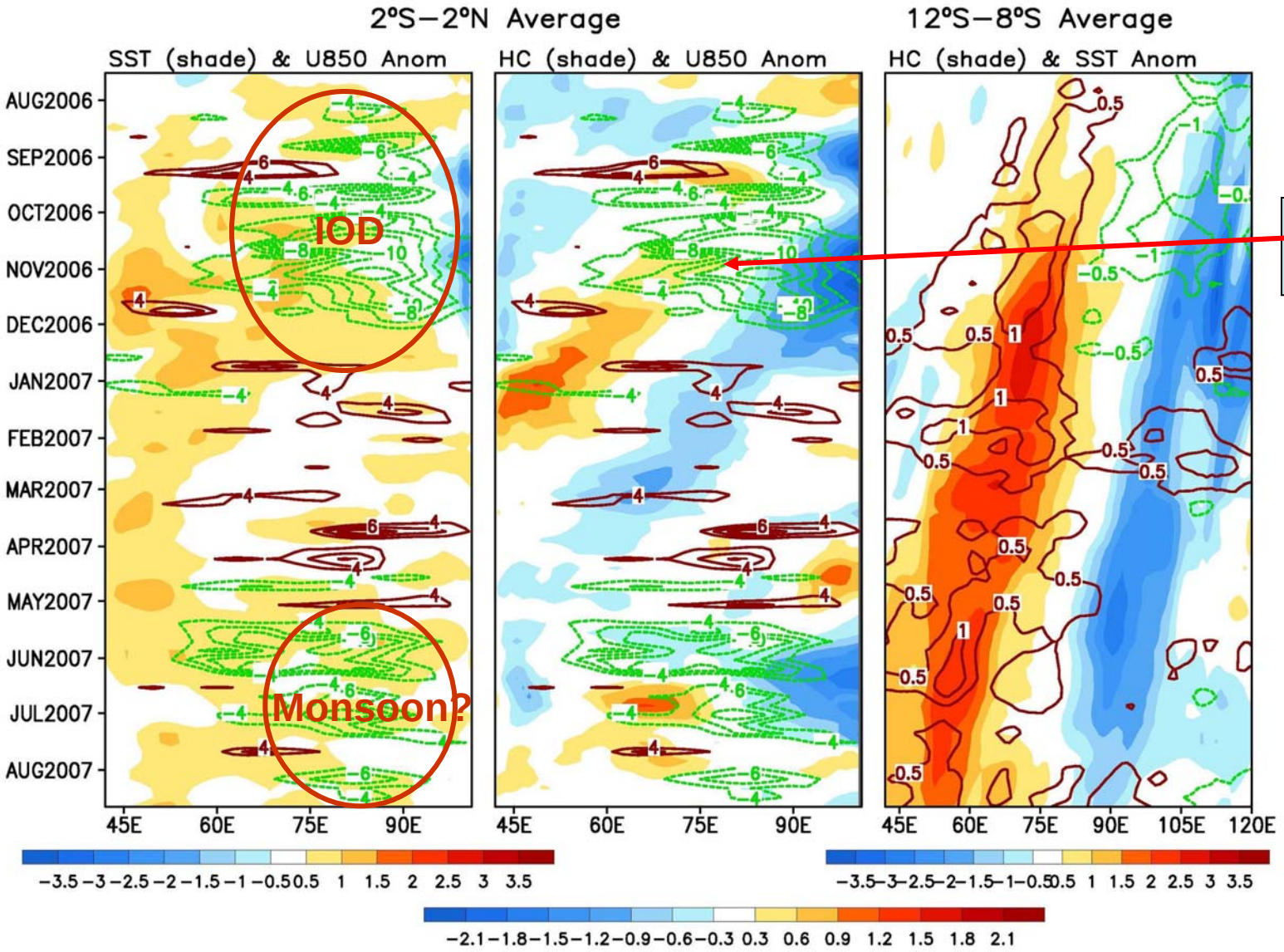
# Recent Evolution of Indian Ocean SST Indices



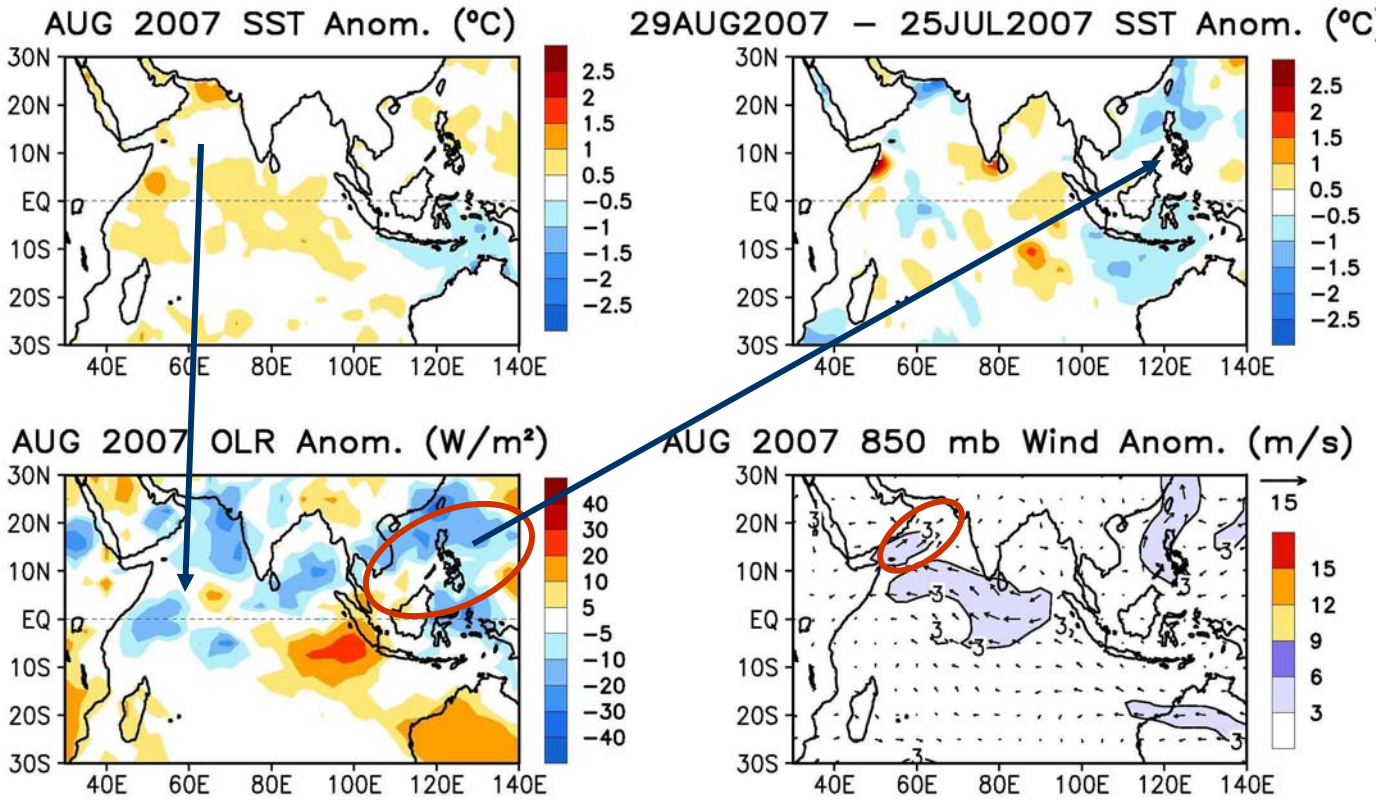

- **Anomalies were weakly positive**
- **IO Dipole Mode Index (DMI) is near normal**

# Evolution of Equatorial/10°S Indian SST (°C), 850-mb Zonal Wind (m/s), 0-300m Heat Content (°C)




…had Westerly Anomaly in the WP (slide #9)

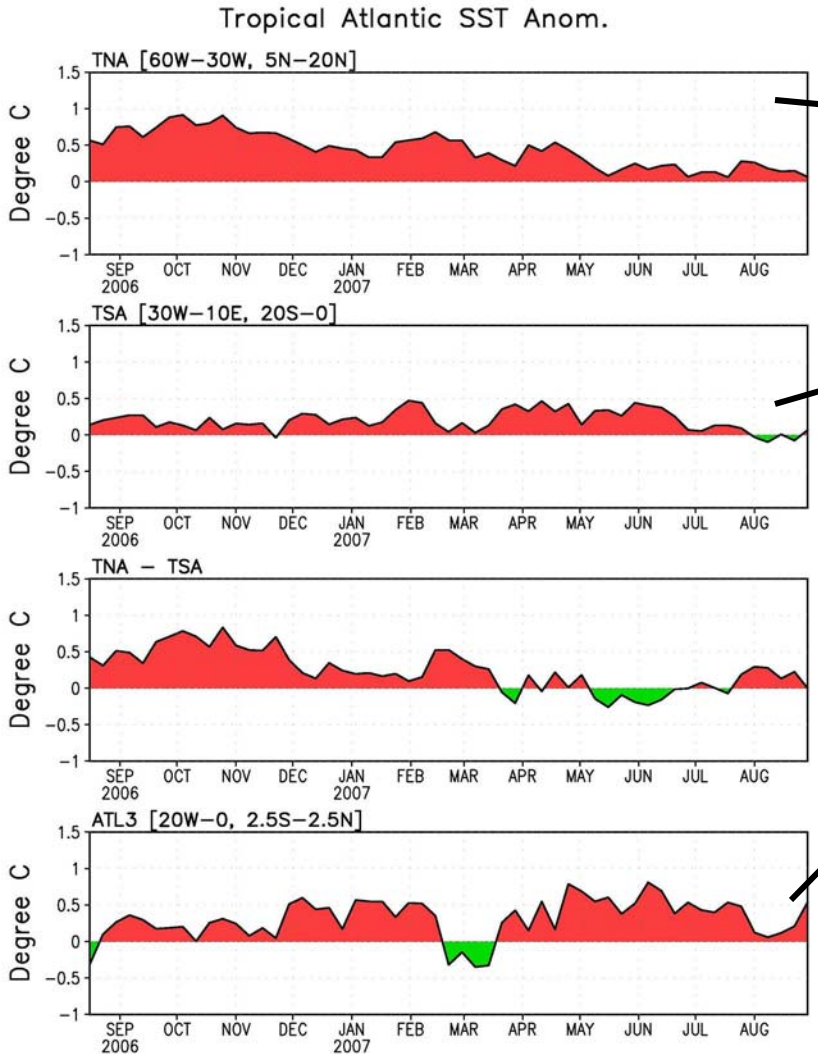
# Tropical Indian Ocean: SST Anom., SST Anom. Tend., OLR, 850-mb Winds

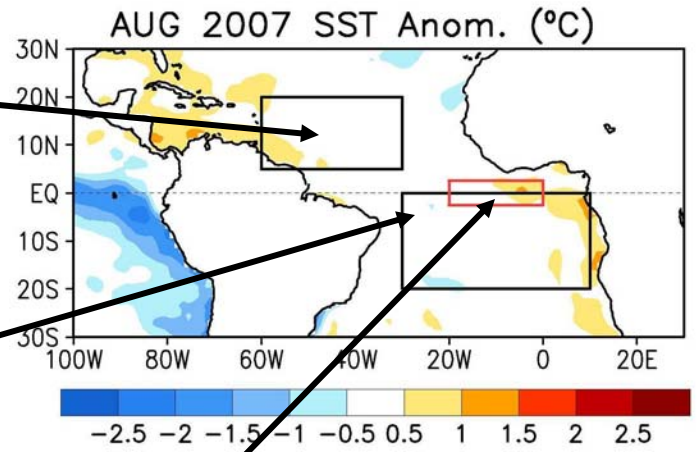



- **Stronger x-equatorial flow…**
- **Stronger Somali jet**

# Atlantic Ocean

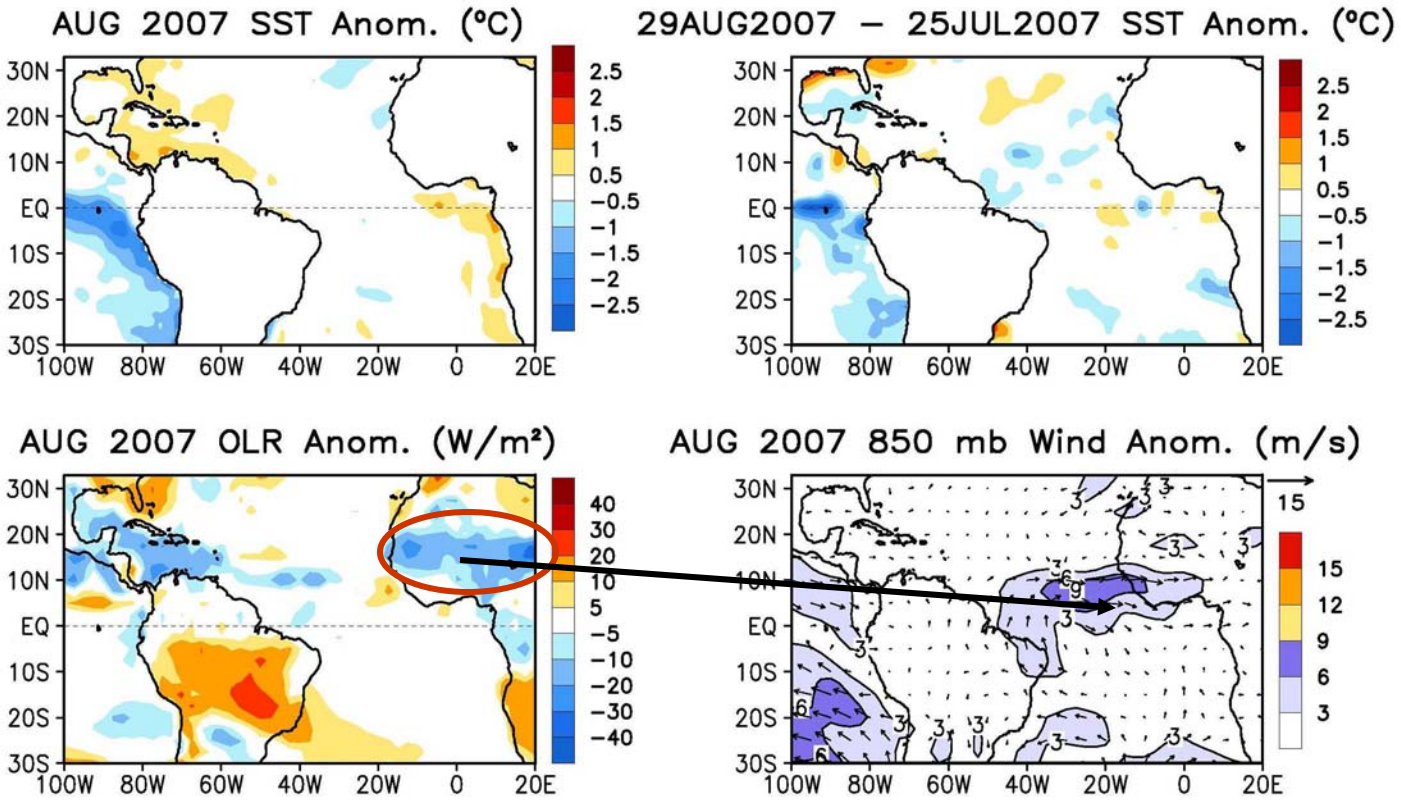
# Recent Evolution of Tropical Atlantic SST Indices



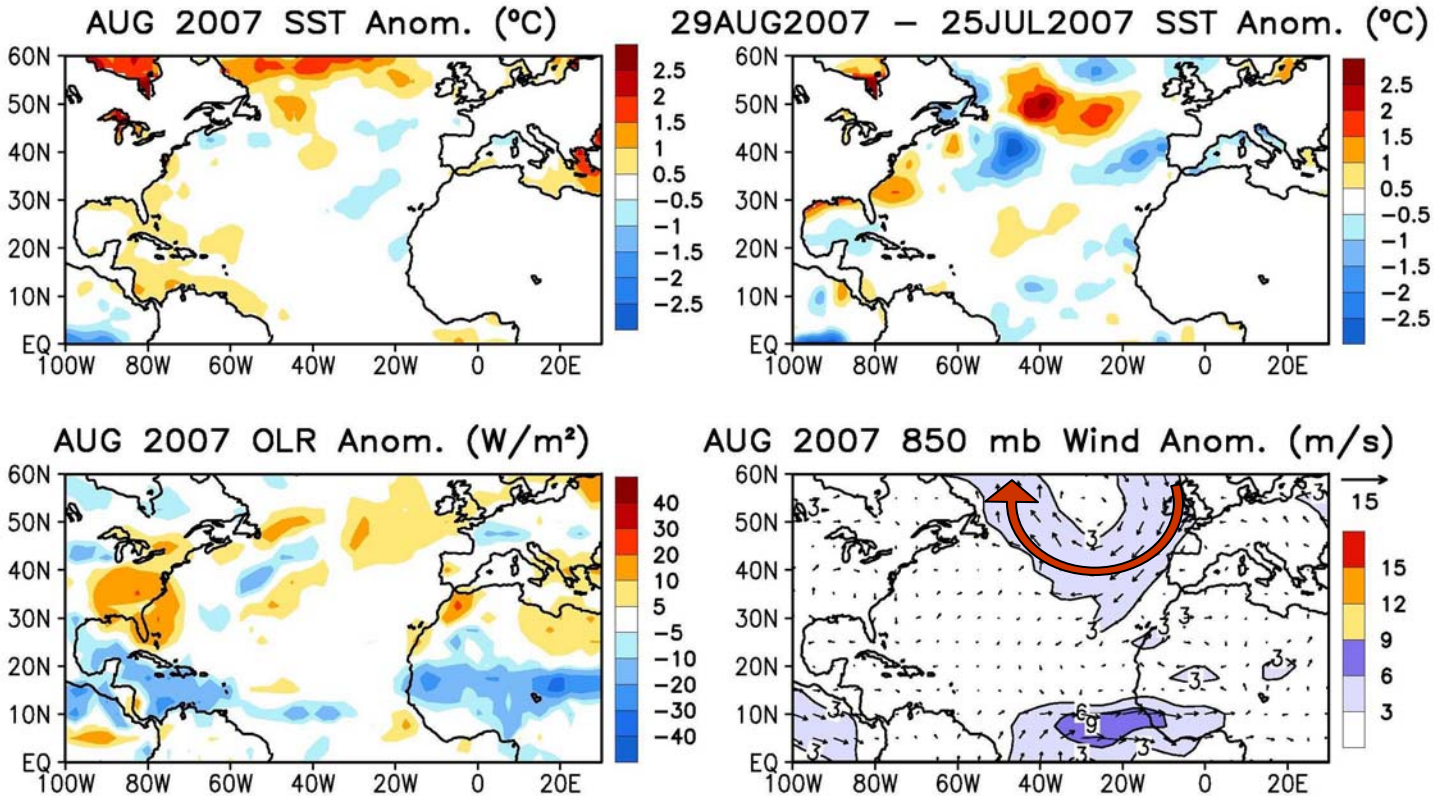




- **TNA SSTs are near normal**
- **TSA SSTs are near normal**
- **Warm SST anomalies weaker than they were last year**

# Tropical Atlantic: SST Anom., SST Anom. Tend, OLR, 850-mb Winds



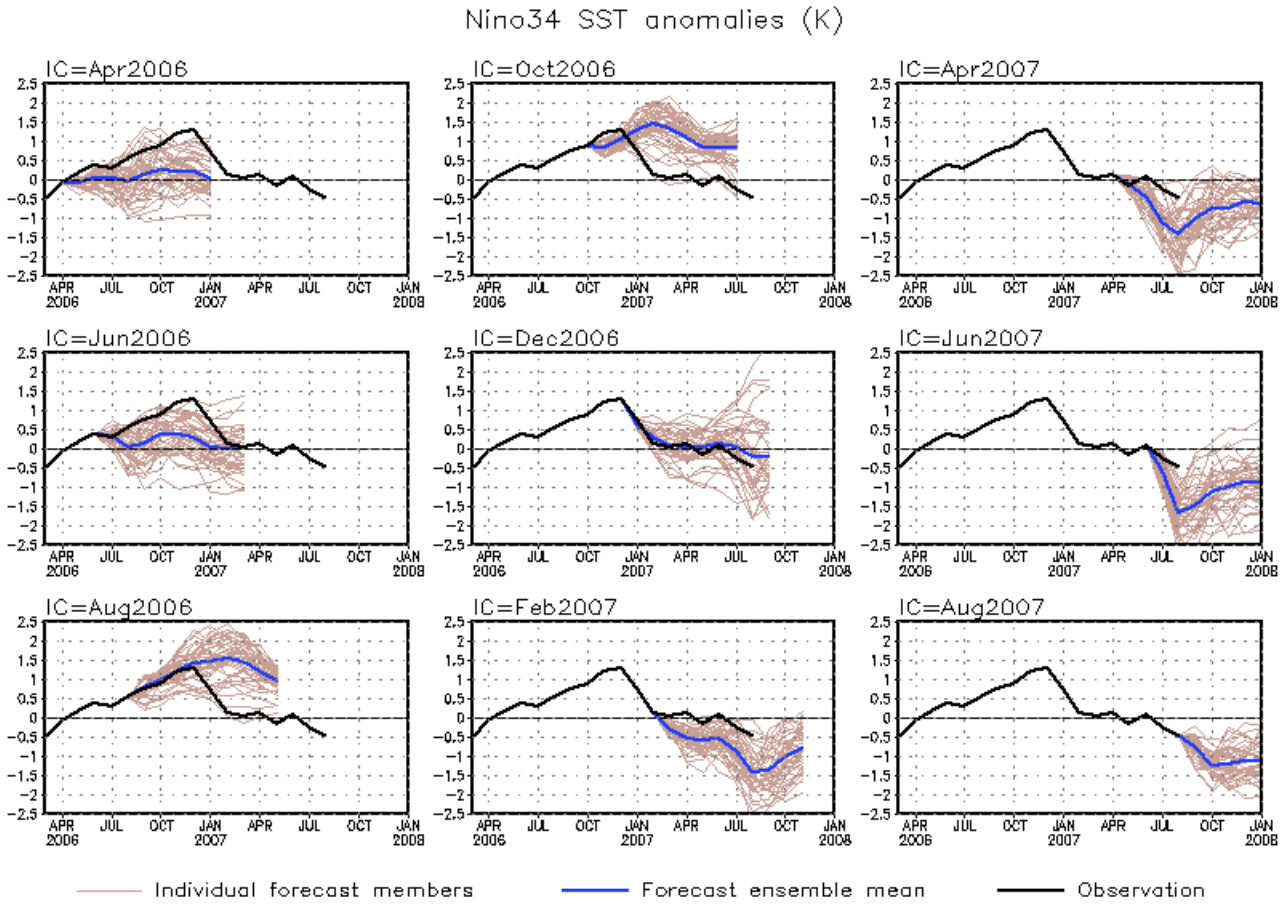
# North Atlantic: SST Anom., SST ANom. Tend., OLR, 850-mb Winds




- Need to display surface heat fluxes

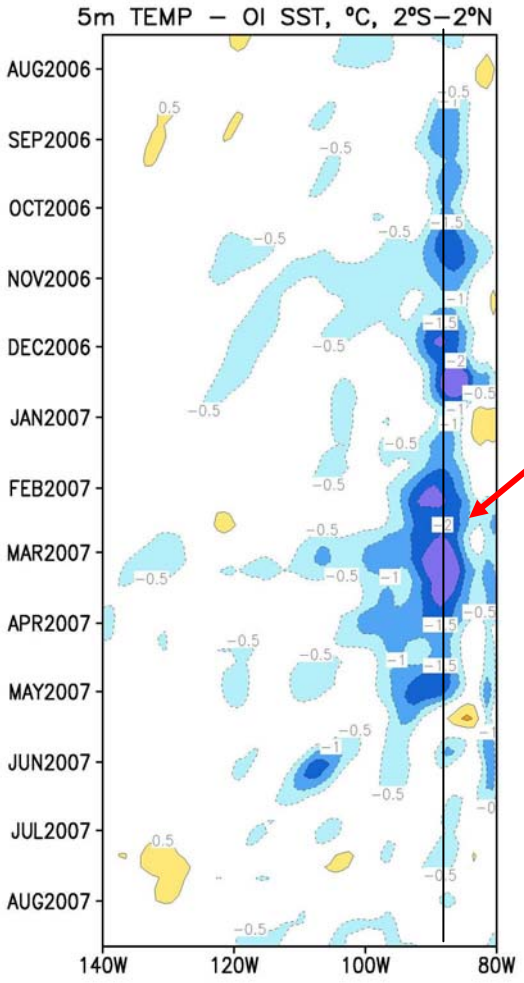
# CFS SST Predictions and Ocean Initial Conditions Biases

# CFS Niño 3.4 SST Predictions from Different Lead Times




- **Earlier onset of cold SST anomalies**

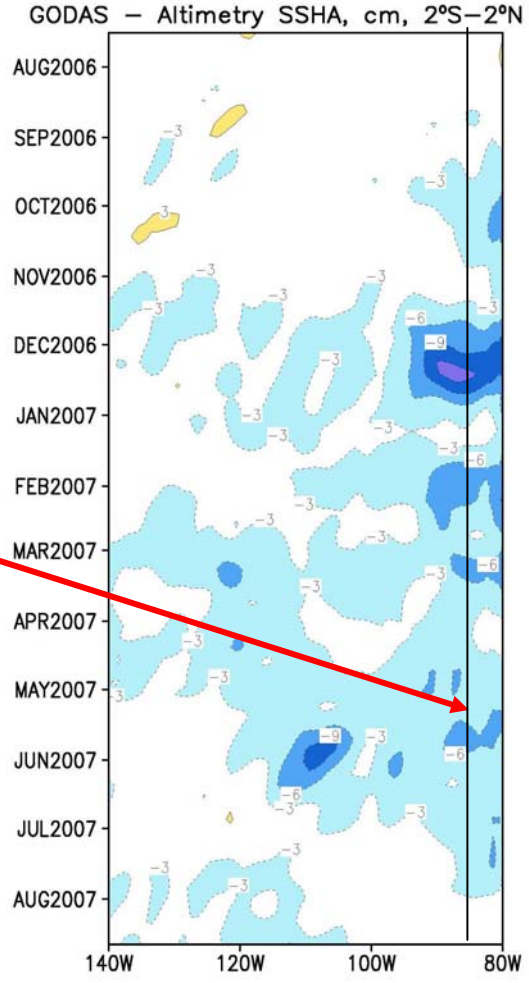
# Recent Evolution of GODAS Biases: Equatorial Surface Temperature (5m) and SSH



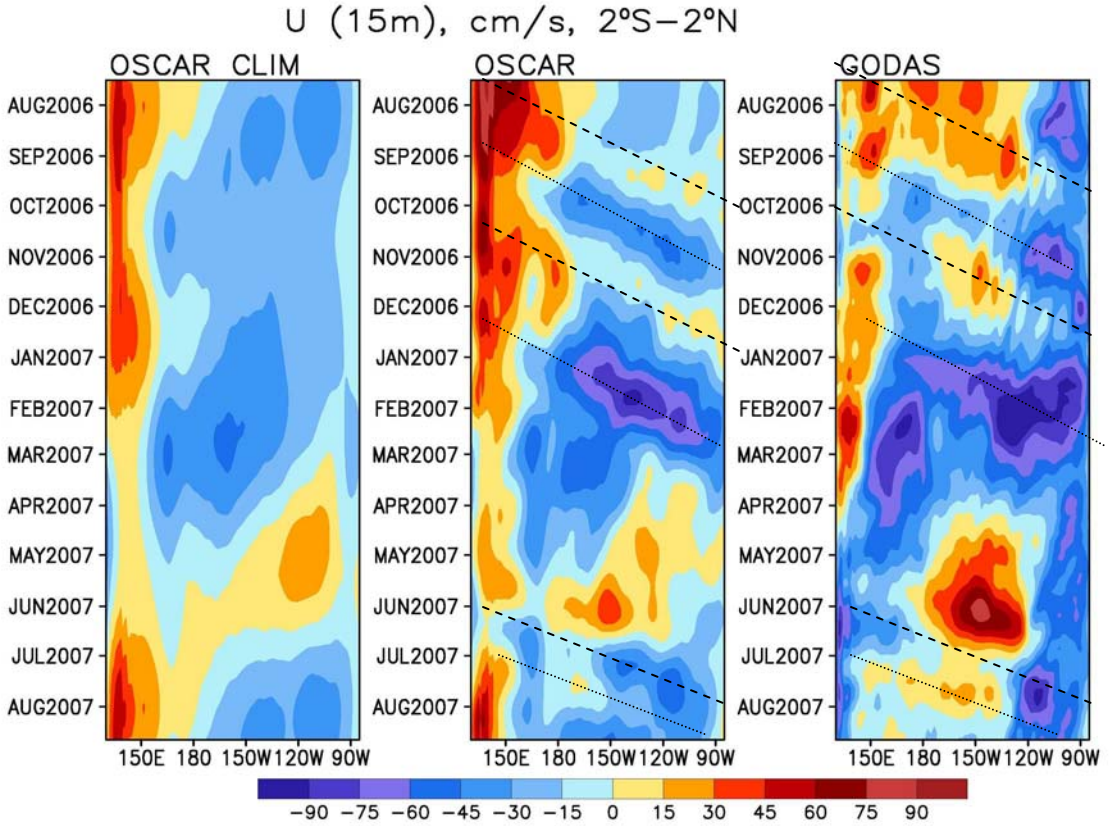

The GODAS temperature at 5 meter depth was more than 2°C lower than the OI SST in the far eastern equatorial Pacific during February to April 2007.

The GODAS SSH anomaly was about 3 cm lower than the Altimetry SSH anomaly in the far eastern equatorial Pacific during November 2006 to June 2007.

Implications for predictions?



# Recent Evolution of GODAS Biases: Equatorial Surface (15 m) Zonal Current




Episodes of Kelvin waves, the warm (cold) phases of which are indicated by the dashed (full) lines, are evident in surface zonal current

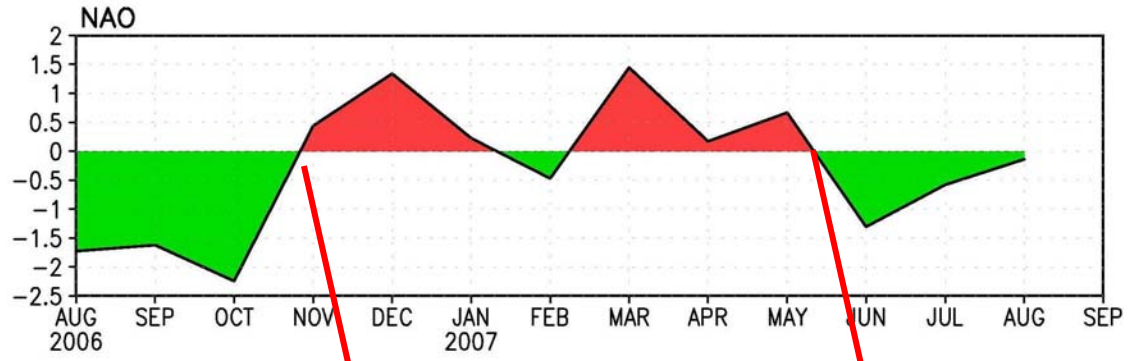
The GODAS surface zonal current was biased westward in the far western Pacific, eastward in the central Pacific and westward in the far eastern Pacific.

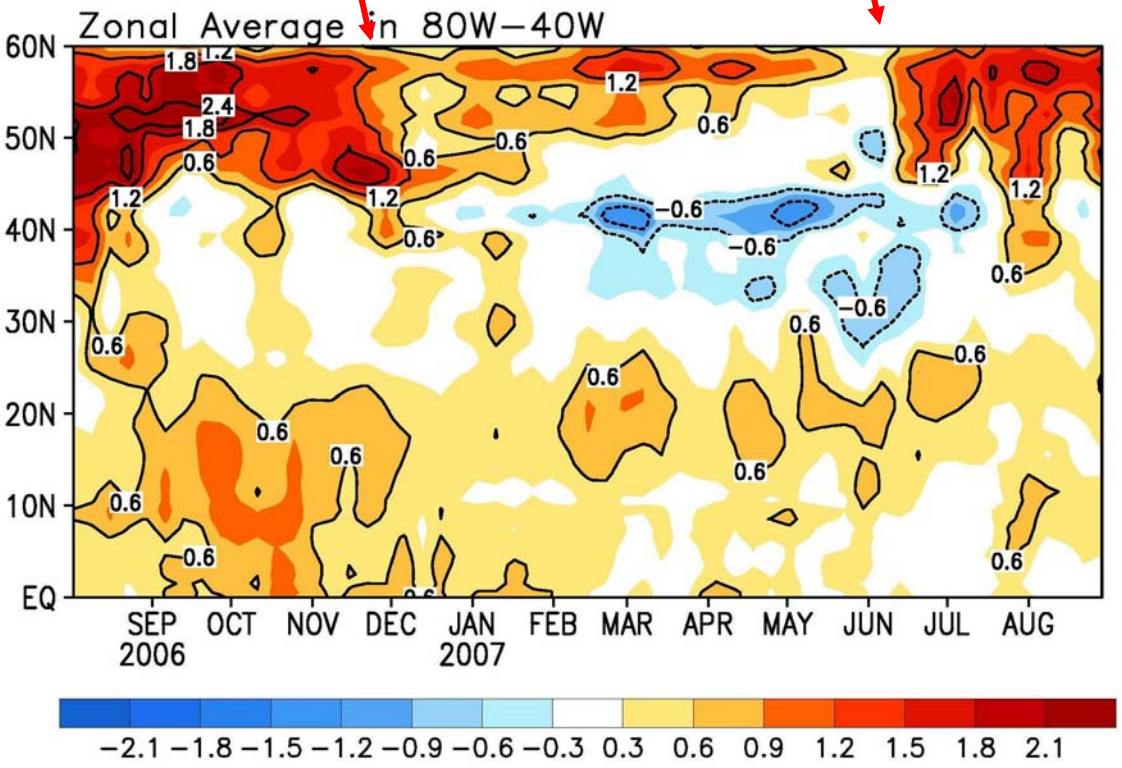
Implications for predictions?

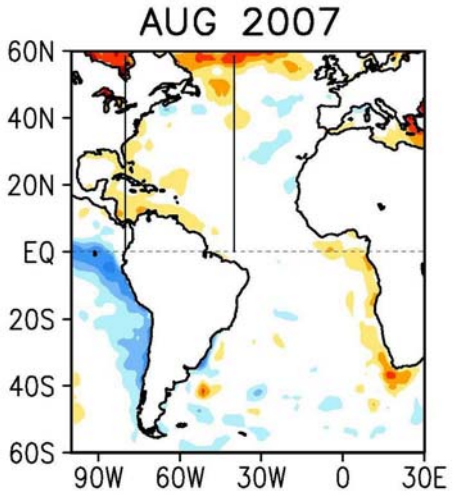
# Analysis of Key Oceanic Events

- **Attribution of North Atlantic SST anomalies**
- Analysis of the onset of cold SST anomalies over the Maritime continent
- Atlantic SST and HC compared to last year
- SSTs and Atmospheric circulation

# Attribution of SST Anomaly in Northwest Atlantic



# Summary

- **Pacific Ocean**
  - Cold SST anomalies propagated westward towards the dateline
  - CPC's prognostic assessment: La Niña conditions will further develop during the next 3-months
  - Development of positive SST anomaly tendency over the west coast of South America
  - Large SST changes in the NH extratropics
- **Indian Ocean**
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  - SST anomalies are smaller than for the last year
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# Thoughts

- **Future Plans:**
  - Add surface heat flux anomalies
  - Add SST advection terms
  - Add SST tendencies related to Ekman transport

- **Some Questions:**
  - Display normalized anomalies?
  - Should have a fixed format or also include (episodic) events of interest?
  - Include SST predictions from other operational centers?