

Weekly Climate Update September 9th, 2008

➤ Thus far it has been a very active hurricane season. The July 2008 tropical season was the third most active July on record. Only July 1916 and 2005 were more active (ACE). According to NOAA, the explanation for this high activity has been the lingering La Nina which favors low wind shear in the tropical Atlantic Main Development Region (MDR). In addition sea surface temperature anomalies in MDR have increased from those at the beginning of the tropical season. This was not forecasts by the available models for the tropical Atlantic (such as IRI , CFS forecasts).

➤ While La Niña has officially transitioned to a neutral phase (based on Nino3.4), many aspects of the atmospheric circulation and pattern of tropical convection reflect a lingering La Niña signal in the atmosphere “Some of these lingering effects include reduced wind shear, weaker trade winds, an active West African monsoon system, the winds coming off of Africa and warmer-than-average water in the Atlantic Ocean.” said Gerry Bell, Ph.D., lead seasonal hurricane forecaster at NOAA’s Climate Prediction Center. The strong cold phase of PDO favors La Nina type conditions over El Nino conditions on inter-annual to decadal time scales and likely contributed to the active season so far. Consistent with these lingering La Nina conditions both NOAA and CSU have increased their August prediction of tropical storm activity.

(<http://www.cpc.noaa.gov/products/outlooks/hurricane.shtml>).

(Continue from previous Slide)

➤The North Atlantic Oscillation (NAO) index has been trending downward and is currently negative. A persistent negative NAO index is associated with a greater chance of hurricane landfalls along the Gulf Coast of the U.S. and Florida [Elsner and Bossak, 2004]. The NAO has specific effects upon the Bermuda high pressure system in the Atlantic Ocean. A negative NAO allows for a weaker more westward centered Bermuda High, which acts to steer North Atlantic hurricanes toward the southern United States rather than re-curving toward the open North Atlantic[Slide25].

<http://garnet.acns.fsu.edu/~jelsner/PDF/Research/ElsnerLiuKocher2000.pdf>

➤Summary of current global ocean-climate conditions can be found at the following link: http://ioc3.unesco.org/oopc/state_of_the_ocean/all/

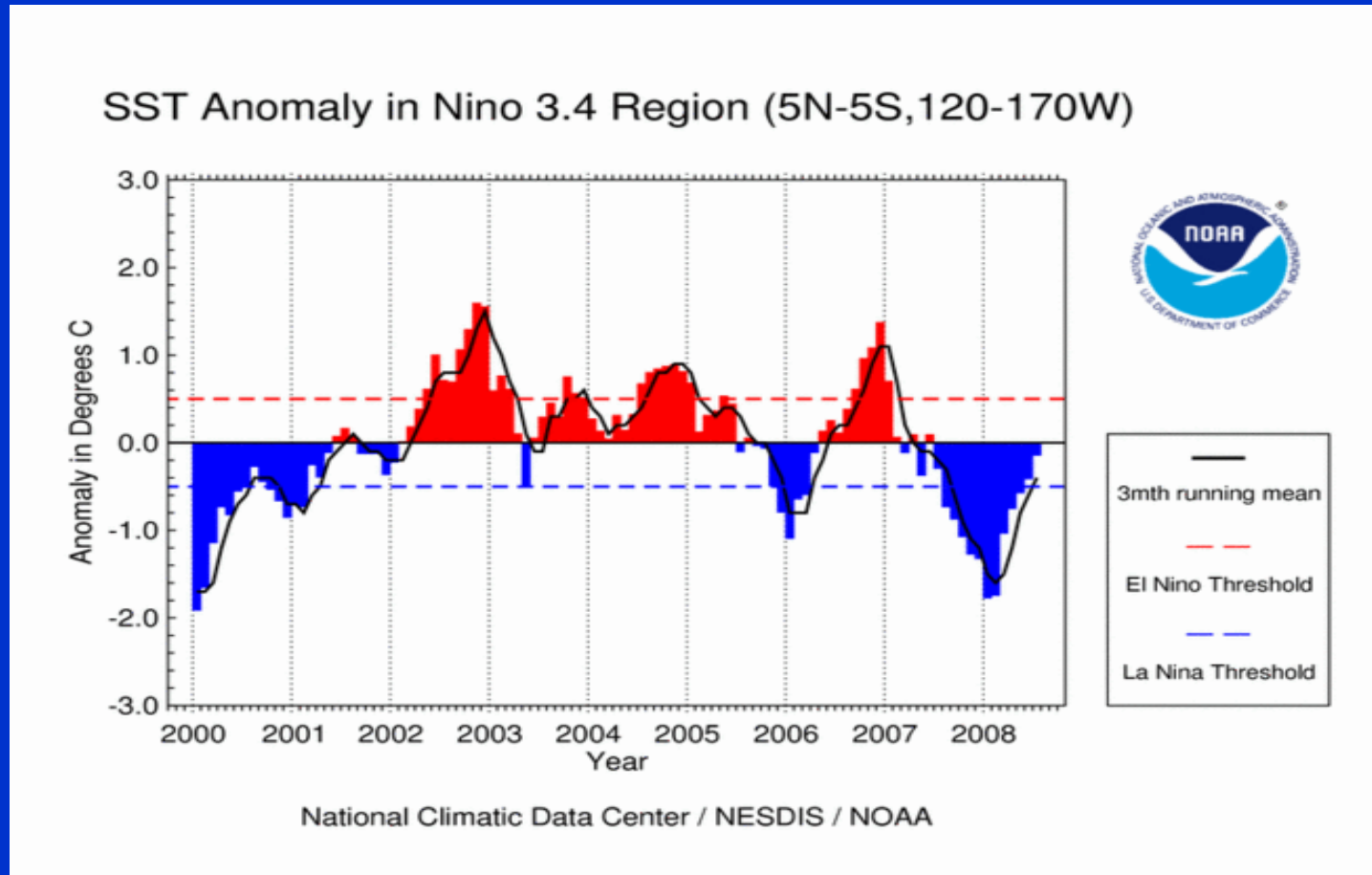
➤The CPC official climate outlook indicates an increased chance for above normal rainfall for the September through November climate window.

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El Nino-Southern Oscillation Index

NINO 3.4



2007-2008 La Nina compared with other ENSO events since 1981.

ENSO is currently in neutral conditions.

http://ioc3.unesco.org/oopc/state_of_the_ocean/sur/pac/nino3.4.php

Recent Evolution of Equatorial Pacific SST Departures (°C)

Climate Prediction Center

El Nino-Southern Oscillation Weekly Update

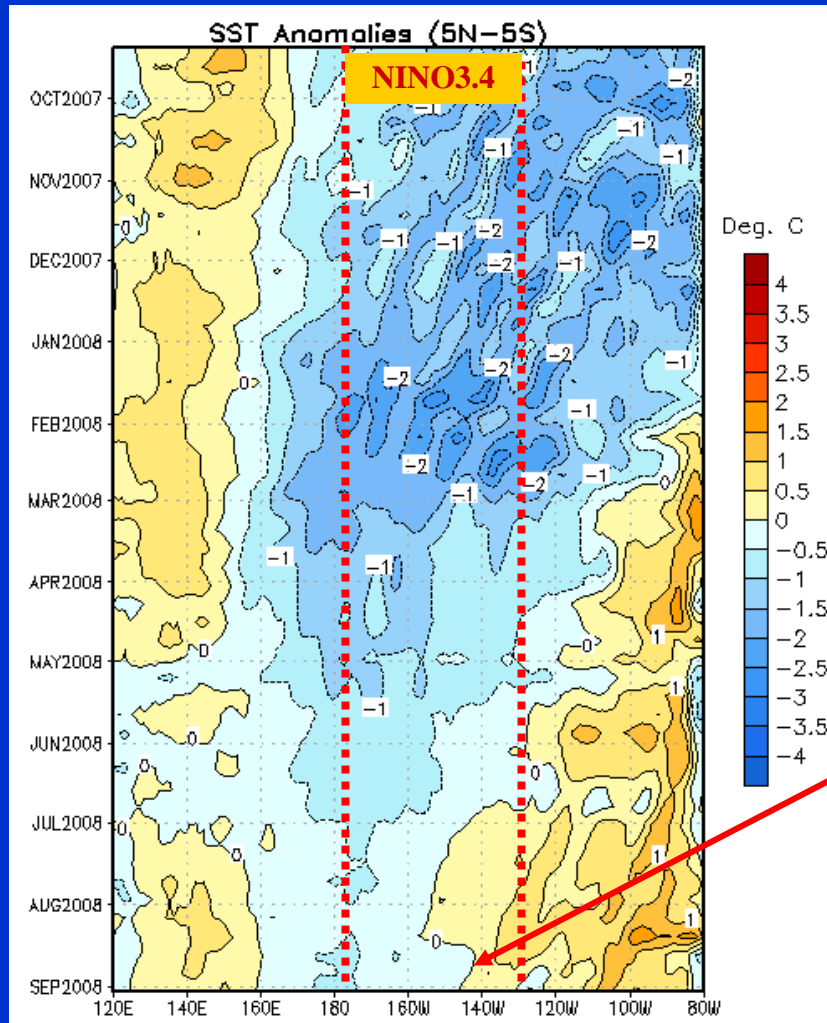
August
2007

November
2007

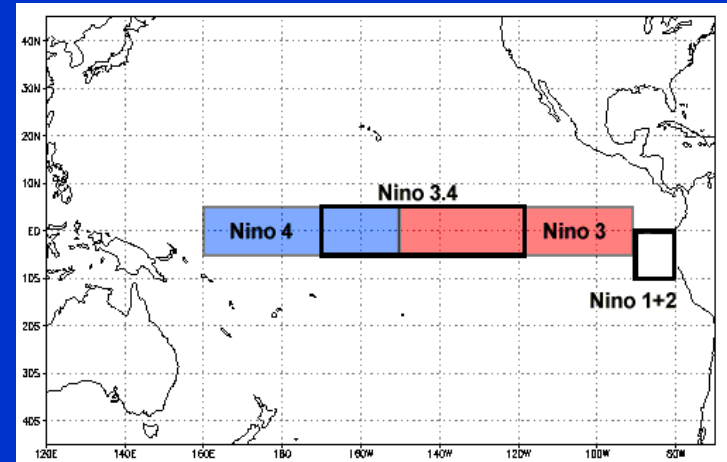
Time



July
2008



Longitude



Since February 2008, negative sea surface temperature anomalies have weakened over the central and east-central equatorial Pacific Ocean.

Recently, positive anomalies have weakened over the eastern Pacific.

Niño Region SST Departures (°C) Recent Evolution

Climate Prediction Center

El Nino-Southern Oscillation Weekly Update

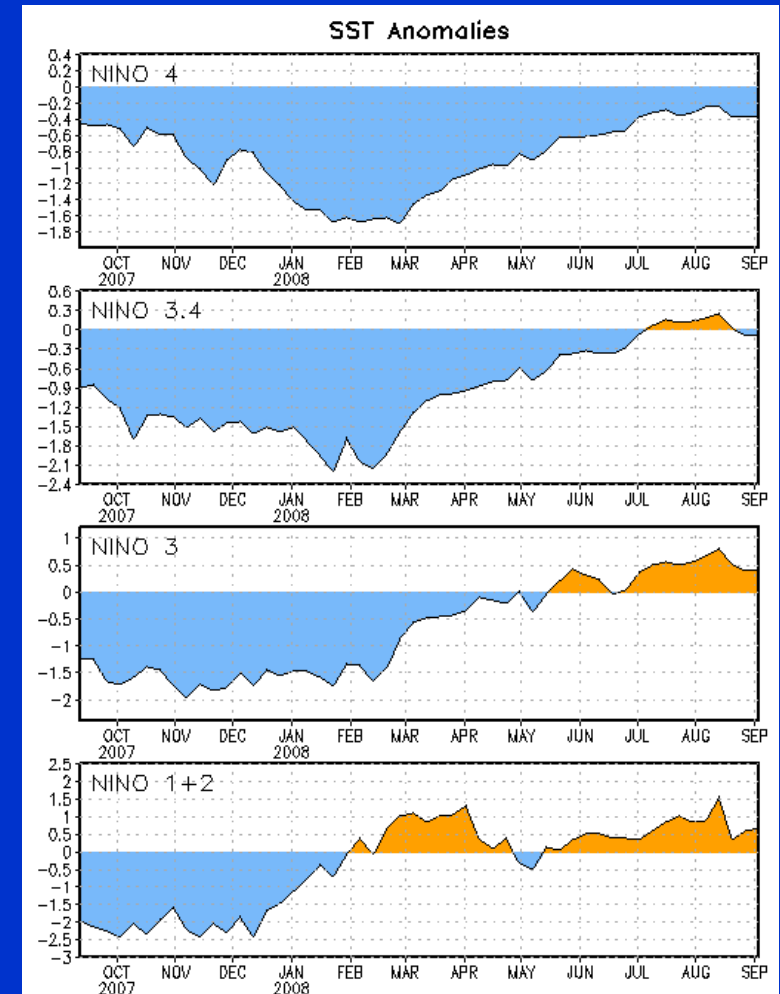
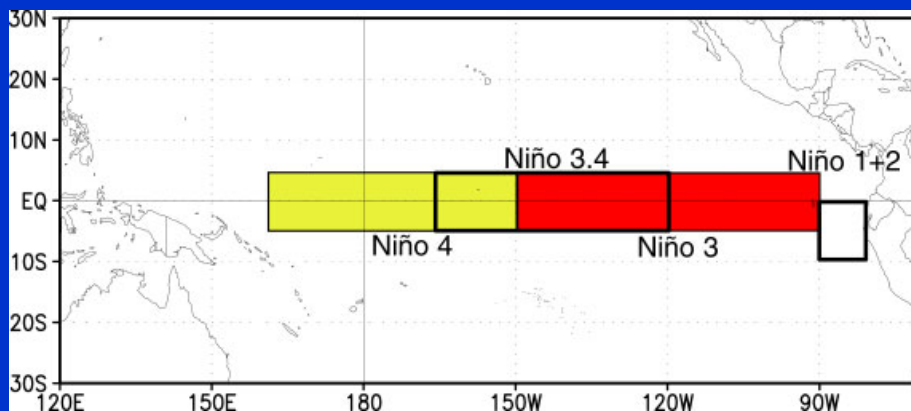
The latest weekly SST departures are:

Niño 4 -0.4°C

Niño 3.4 -0.1°C

Niño 3 0.4°C

Niño 1+2 0.7°C



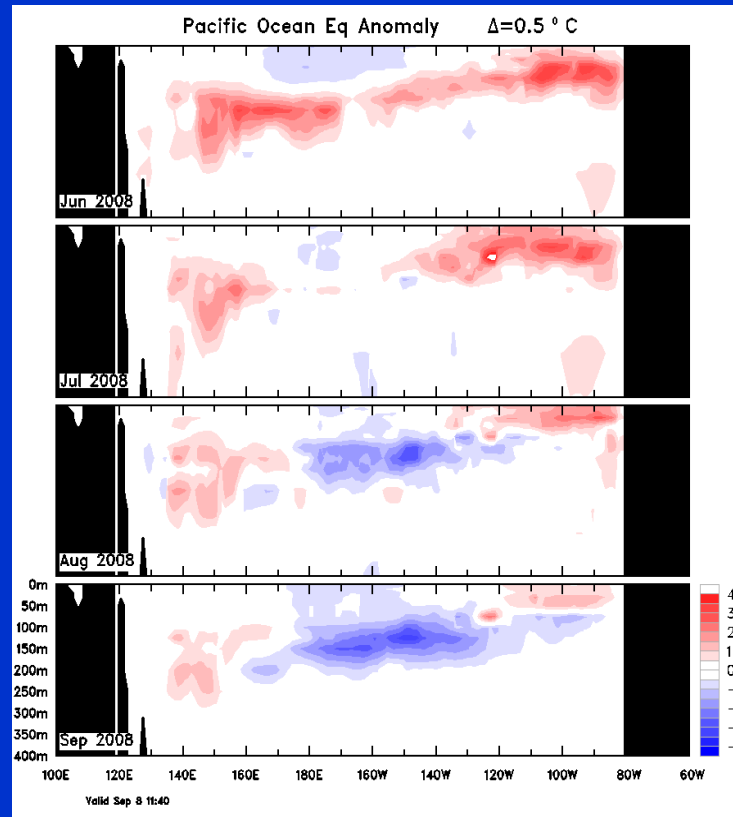
Sub-Surface Temperature Departures ($^{\circ}\text{C}$) in the Equatorial Pacific Ocean (August 18th, 2008) Bureau of Meteorology Research Centre

Jun

Jul

Aug

Sep



Longitude

At this time neutral conditions are indicated by sea surface temperature (sst). However, La Nina conditions have continued to persist in the atmosphere. Recently cool subsurface anomalies have appeared in the equatorial Pacific. These anomalies have begun to expand towards the surface in the central Pacific.

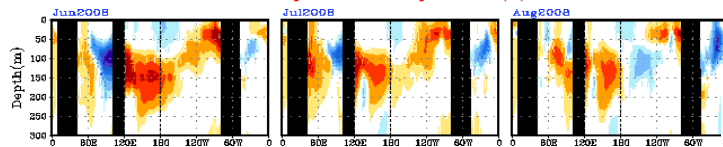
Equatorial Pacific SST and Subsurface Temperature Anomaly Forecast

NCEP Climate Forecast System Issued September 9th 2008

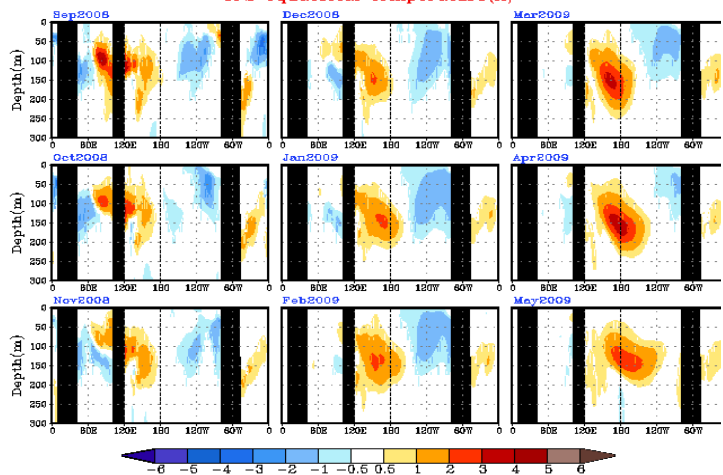


Last update: Mon Sep 8 2008
Initial conditions: 28Aug2008-06Sep2008

GODAS equatorial temperature(K)



CFS equatorial temperature(K)

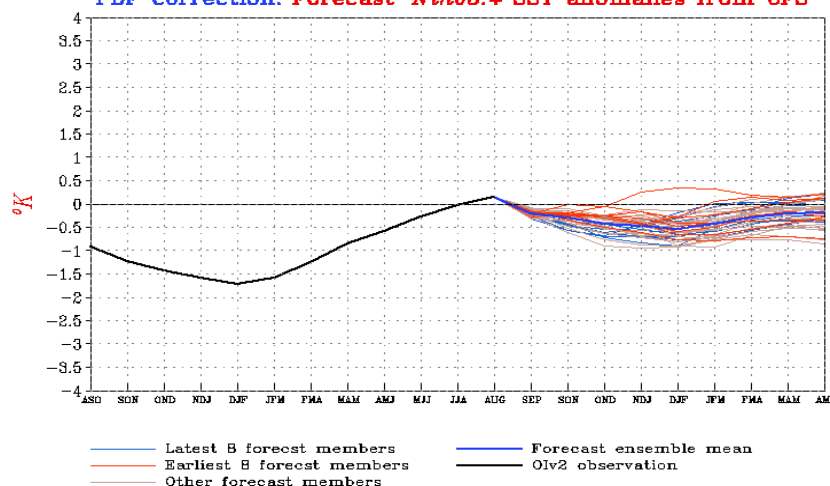


The CFS ensemble mean (heavy blue line) predicts La Niña most likely will be in neutral conditions for the remainder of the tropical season.



Last update: Tue Sep 9 2008
Initial conditions: 29Aug2008-07Sep2008

PDF correction: Forecast *Nino3.4* SST anomalies from CFS



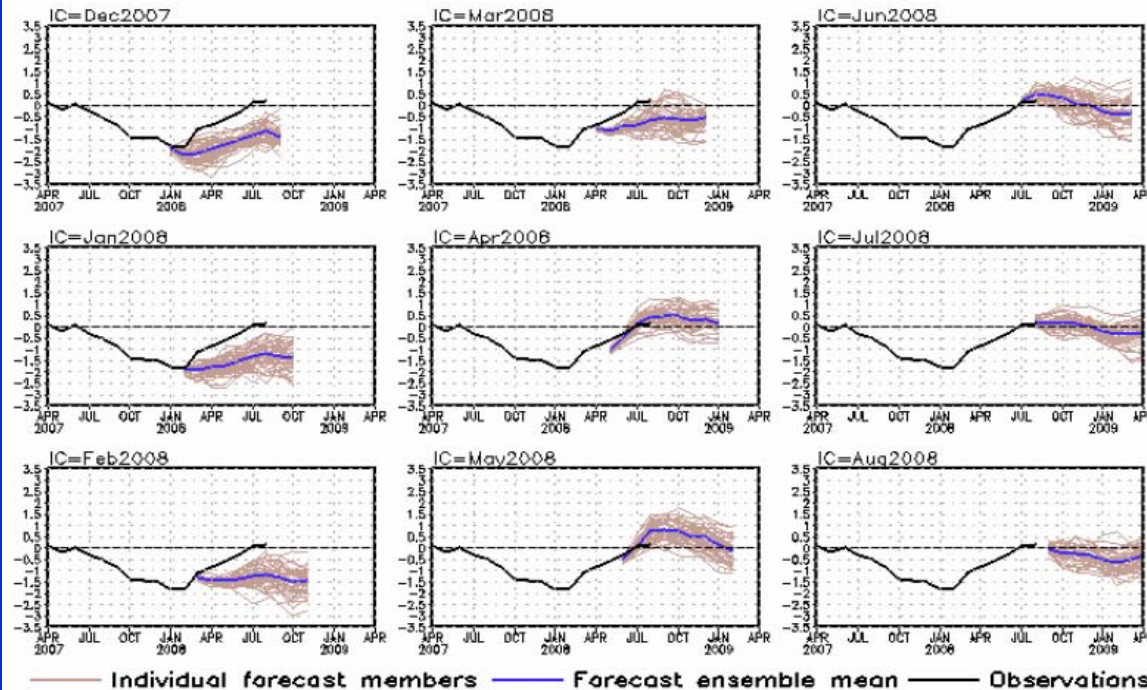
Regions illustrated above are the Indian, Pacific, and Atlantic tropical oceans subsurface temperature anomalies.

The CFS ENSO ensemble forecast has had a significant upward shift during recent weeks.

Verification of Nino 3.4

CFS Niño3.4 SST Predictions from Different Initial Months

NINO3.4 SST anomalies (K)



- Latest forecasts are calling for ENSO-neutral to weak La Nina conditions.

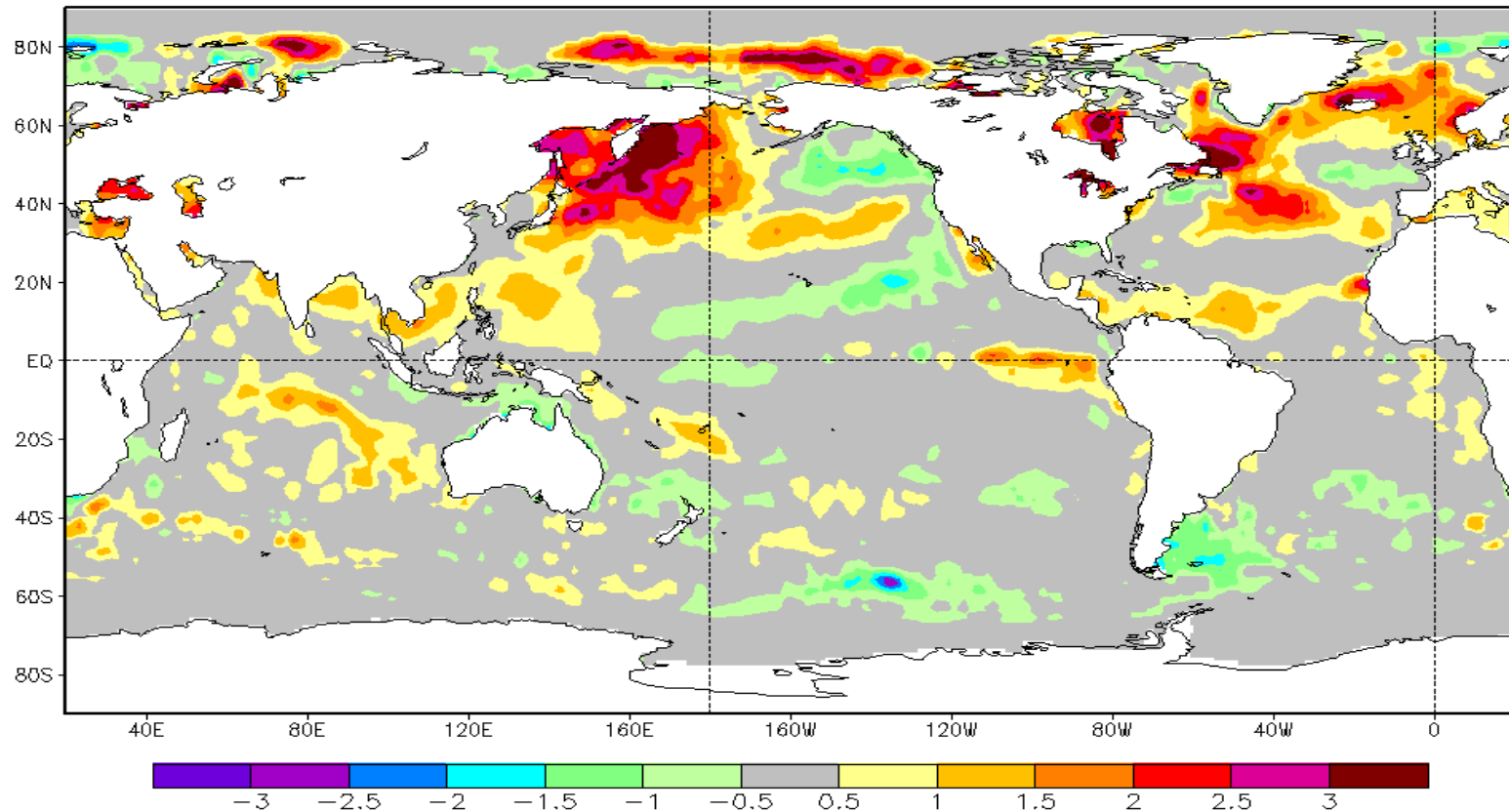
Fig. M1. CFS Niño3.4 SST prediction from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labeled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). The hindcast climatology for 1981-2006 was removed, and replaced by corresponding observation climatology for the same period. Anomalies were computed with respect to the 1971-2000 base period means.

El Nino never formed in the wet season. If it had this would have cut down on the number and strength the 2008 hurricane season.

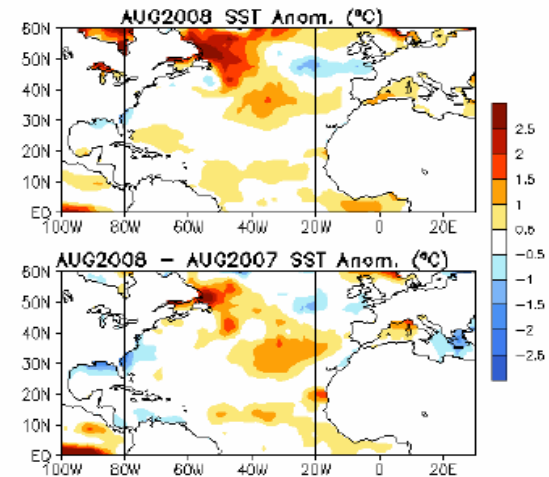
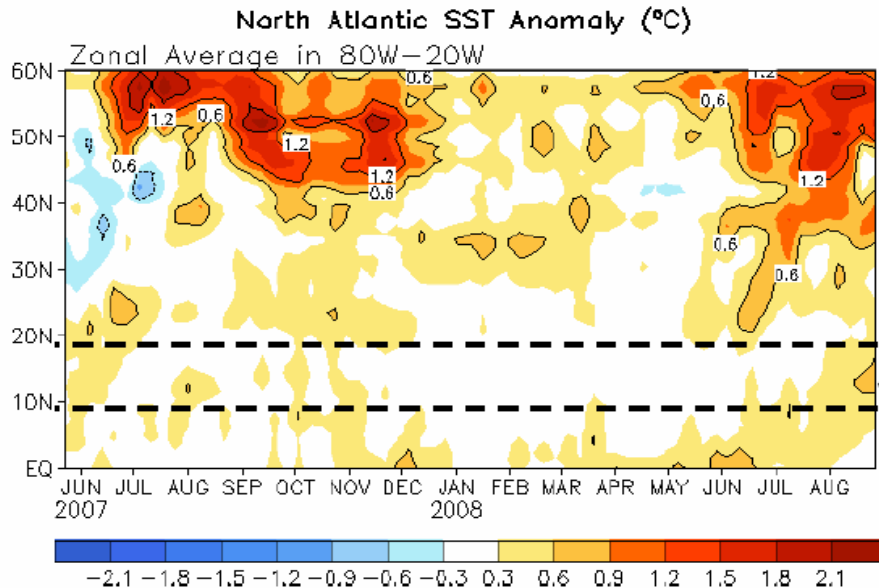
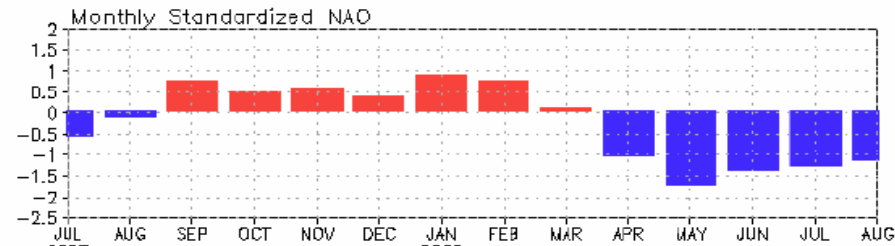
Latest Weekly Sea Surface Temperature Anomaly

National Climate Data Center

Sea Surface Temperature Anomaly ($^{\circ}\text{C}$), Base Period 1971–2000
Week of 3 SEP 2008



NAO and SST Anomaly in North Atlantic



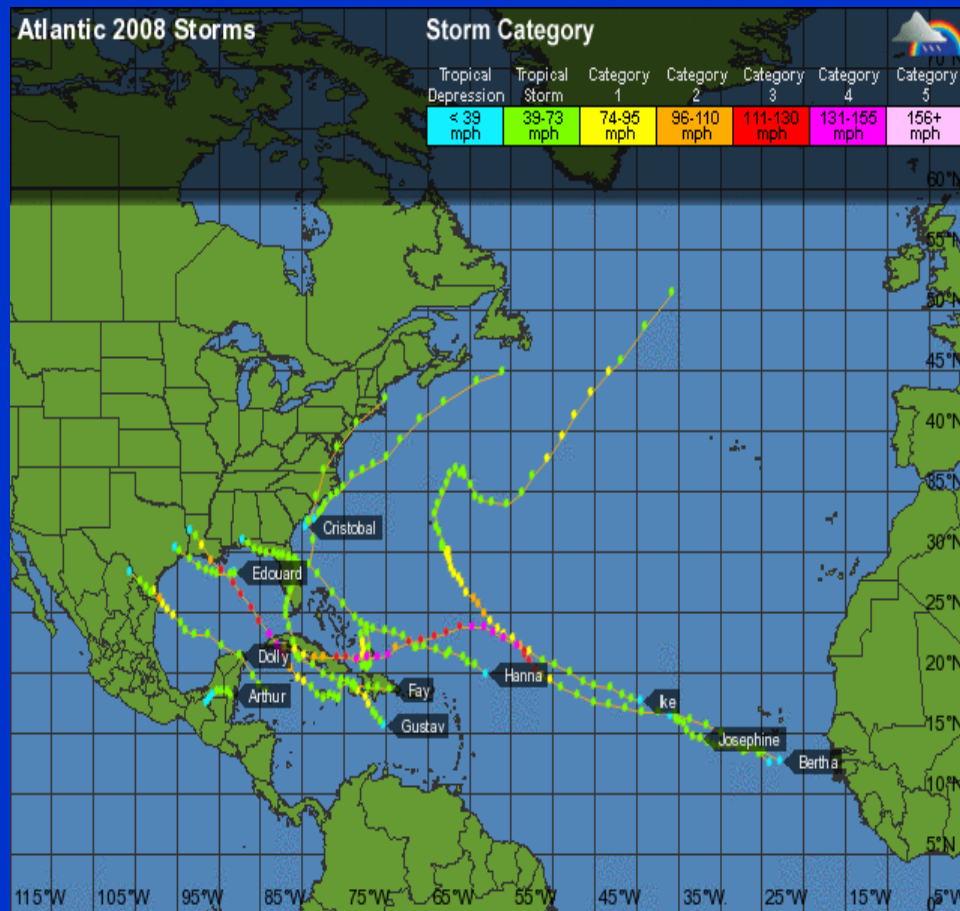
- High-latitude North Atlantic SSTA are closely related to NAO index – negative (positive) NAO leads to SST warming (cooling).
- Negative NAO index persisted over last 5 months has caused large warming in high-latitude North Atlantic, and possibly also the recent warming in hurricane main development region.

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 1971-2000 base period means.

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Negative NAO index caused warming in high latitudes north Atlantic and possibly this wet season warming MDR

Path and Strength of 2008 Tropical Storms and Hurricanes



Negative NAO anomalies tend to direct storms and hurricanes further west with landfall often occurring before recurvature

Evolution of Tropical Atlantic SST Indices

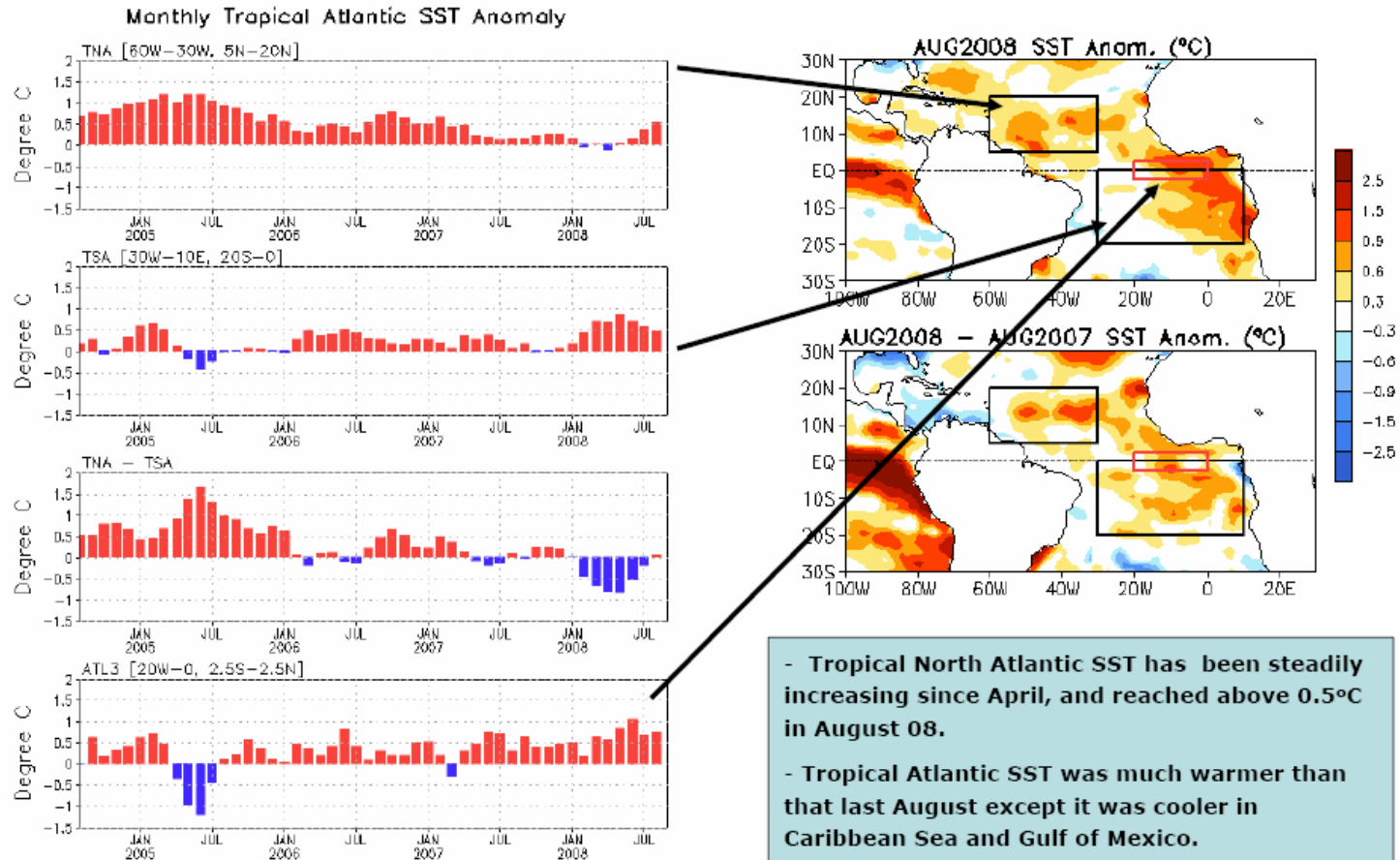
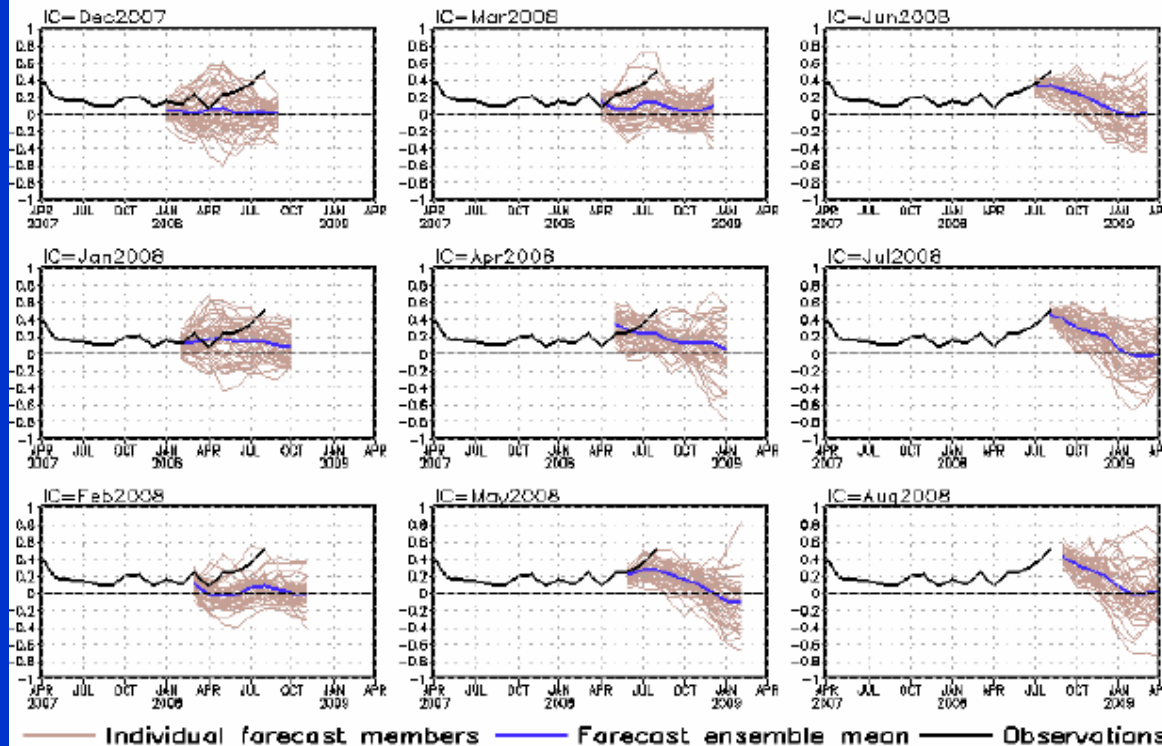


Fig. A1a. Tropical Atlantic Variability region indices, calculated as the area-averaged monthly mean sea surface temperature anomalies (°C) for the TNA [60°W-30°W, 5°N-20°N], TSA [30°W-10°E, 20°S-0] and ATL3 [20°W-0, 2.5°S-2.5°N] regions, and Meridional Gradient Index, defined as differences between TNA and TSA. Data are derived from the NCEP OI SST analysis, and anomalies are departures from the 1971-2000 base period means.

Verification of the Tropical Atlantic

CFS Tropical North Atlantic (TNA) SST Predictions from Different Initial Months

Tropical N. Atlantic SST anomalies (K)



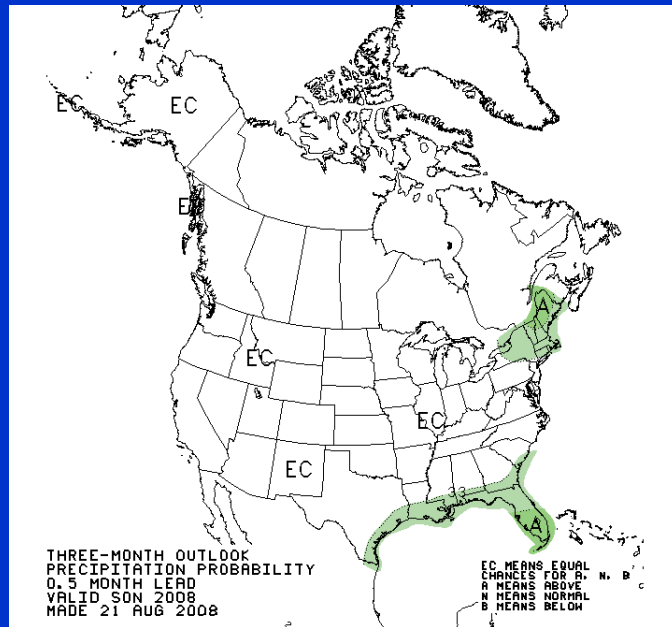
TNA is the SST anomaly averaged in the region of [60°W-30°W, 5°N-20°N].

- CFS always damps SSTA in I.C., suggesting either the SSTA is unpredictable or the model has systematic errors in predicting SSTA in hurricane main development region.

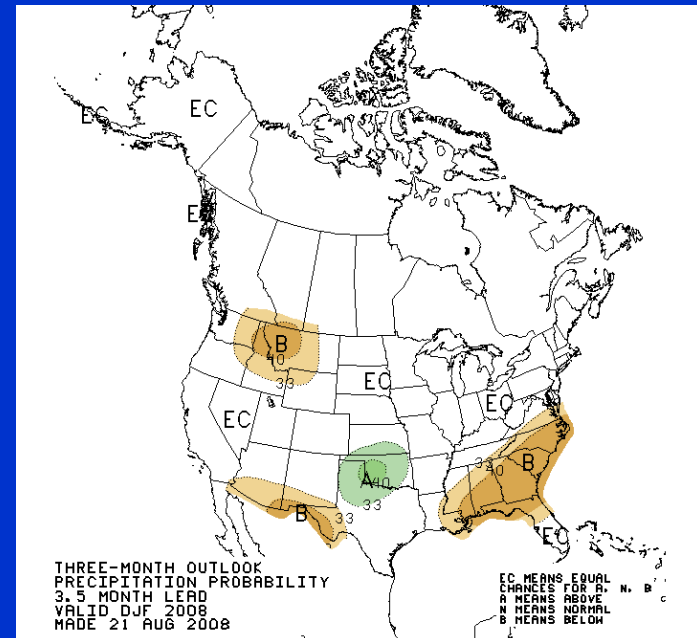
Fig. M3. CFS Tropical North Atlantic (TNA) SST predictions from the latest 9 initial months. Displayed are 40 forecast members (brown) made four times per day initialized from the last 10 days of the initial month (labeled as IC=MonthYear) as well as ensemble mean (blue) and observations (black). The hindcast climatology for 1981-2006 was removed, and replaced by corresponding observation climatology for the same period. Anomalies were computed with respect to the 1971-2000 base period means.

CPC Seasonal Rainfall Outlook

September- November

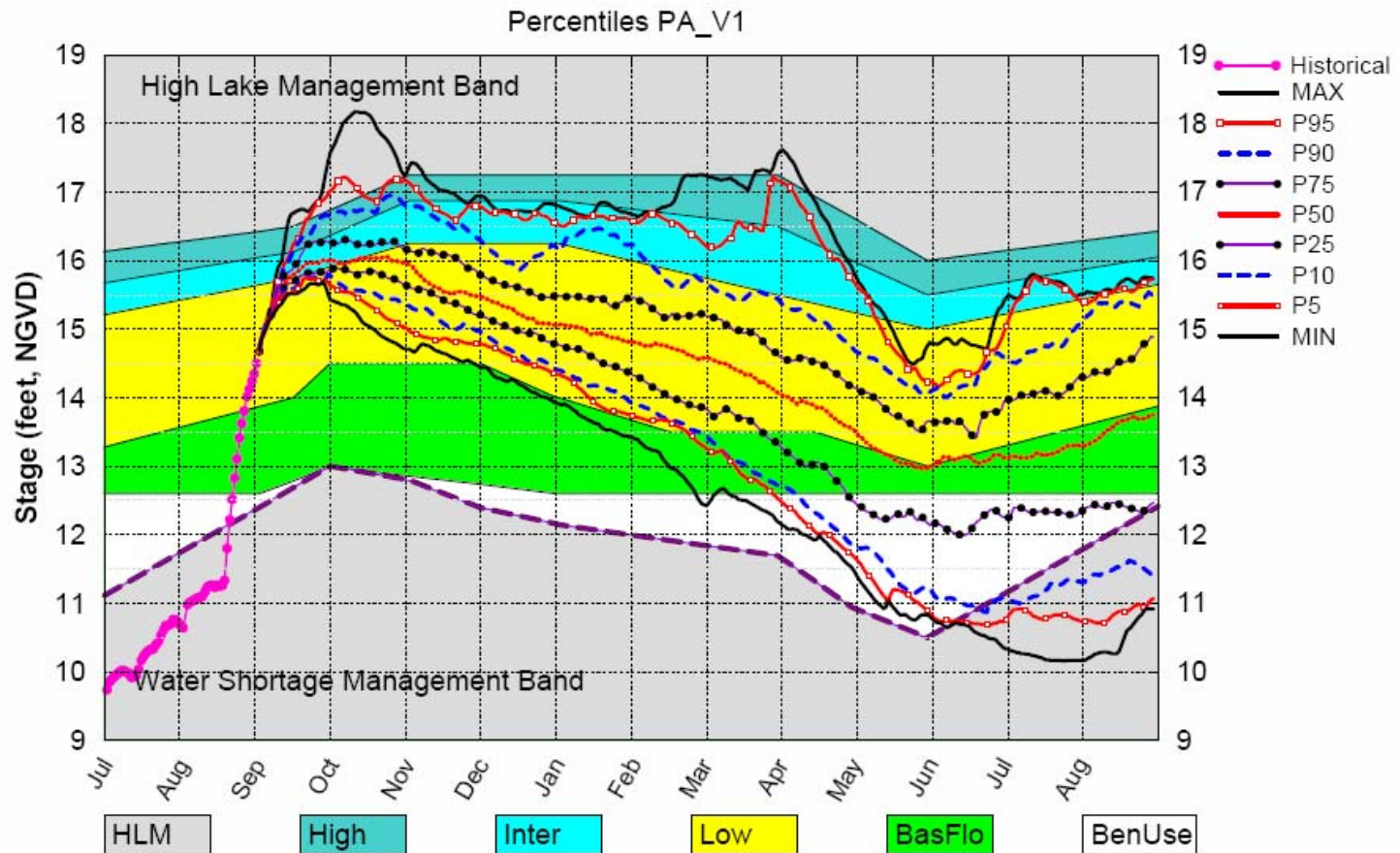


December-February



September 1st Position Analysis

Lake Okeechobee SFWMM September 2008 Position Analysis

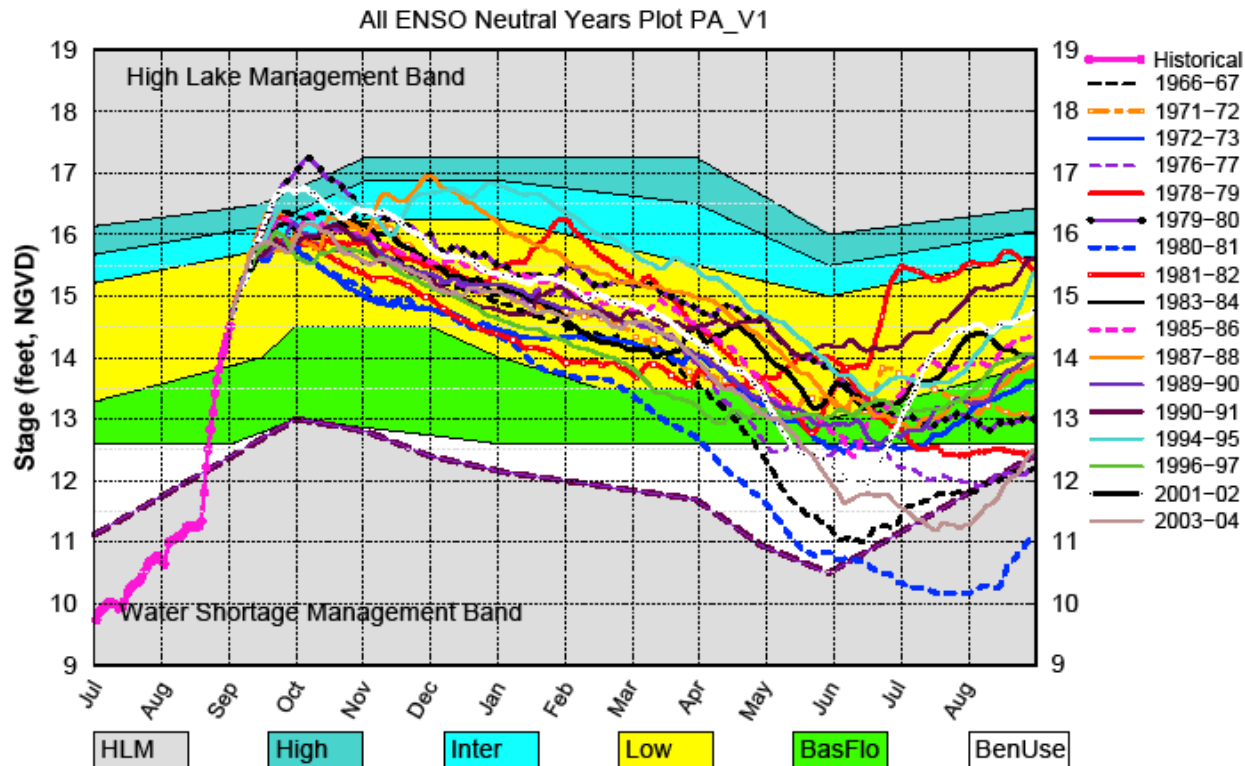


(See assumptions on the Position Analysis Results website)

Fri Sep 5 15:40:25 2008

September 1st ENSO neutral years Position Analysis

Lake Okeechobee SFWMM September 2008 Position Analysis



(See assumptions on the Position Analysis Results website)

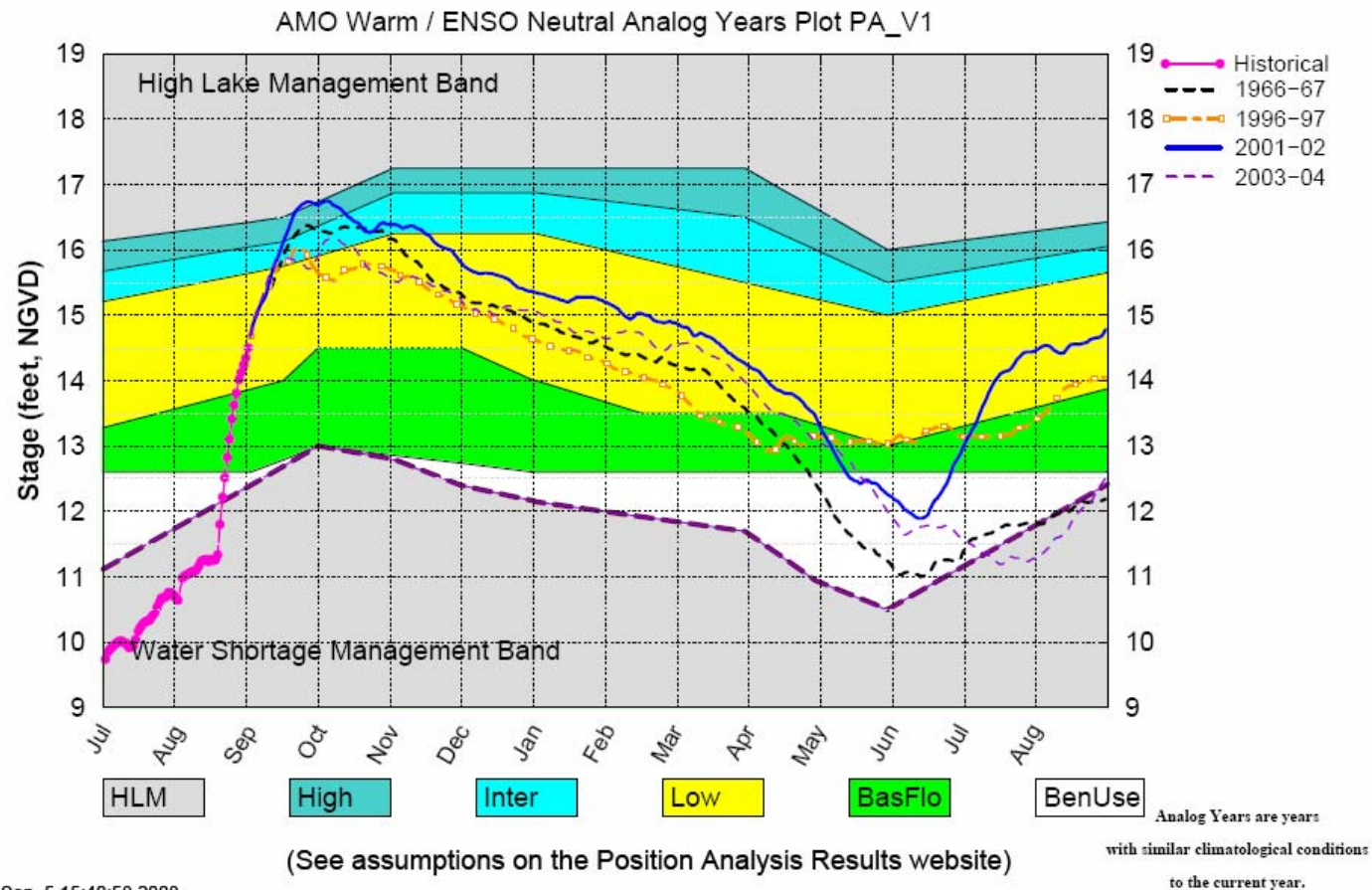
Fri Sep 5 15:40:57 2008

Although ENSO is officially in neutral conditions according to CPC, many of the atmospheric properties of La Nina are still lingering. Therefore caution should be used when considering this plot. However, it is clearly not an El Nino warm event,

September 1st Position Analysis

ENSO Neutral/AMO Warm sub sampling

Lake Okeechobee SFWMM September 2008 Position Analysis

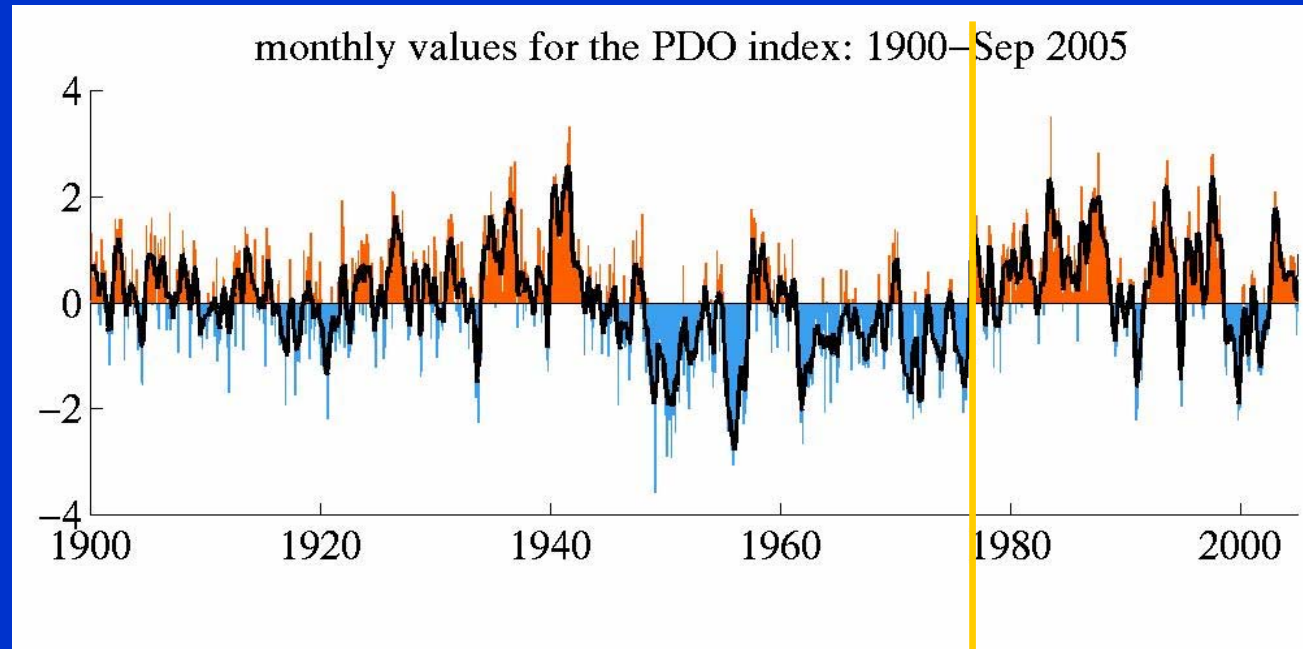


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Backup Slides with additional support material

Currently
transitioning
to cold phase of
PDO

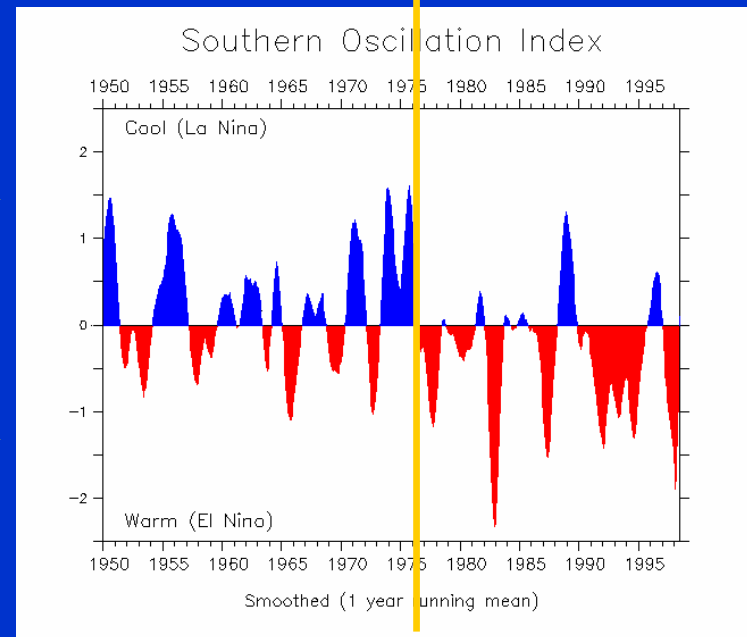
PDO



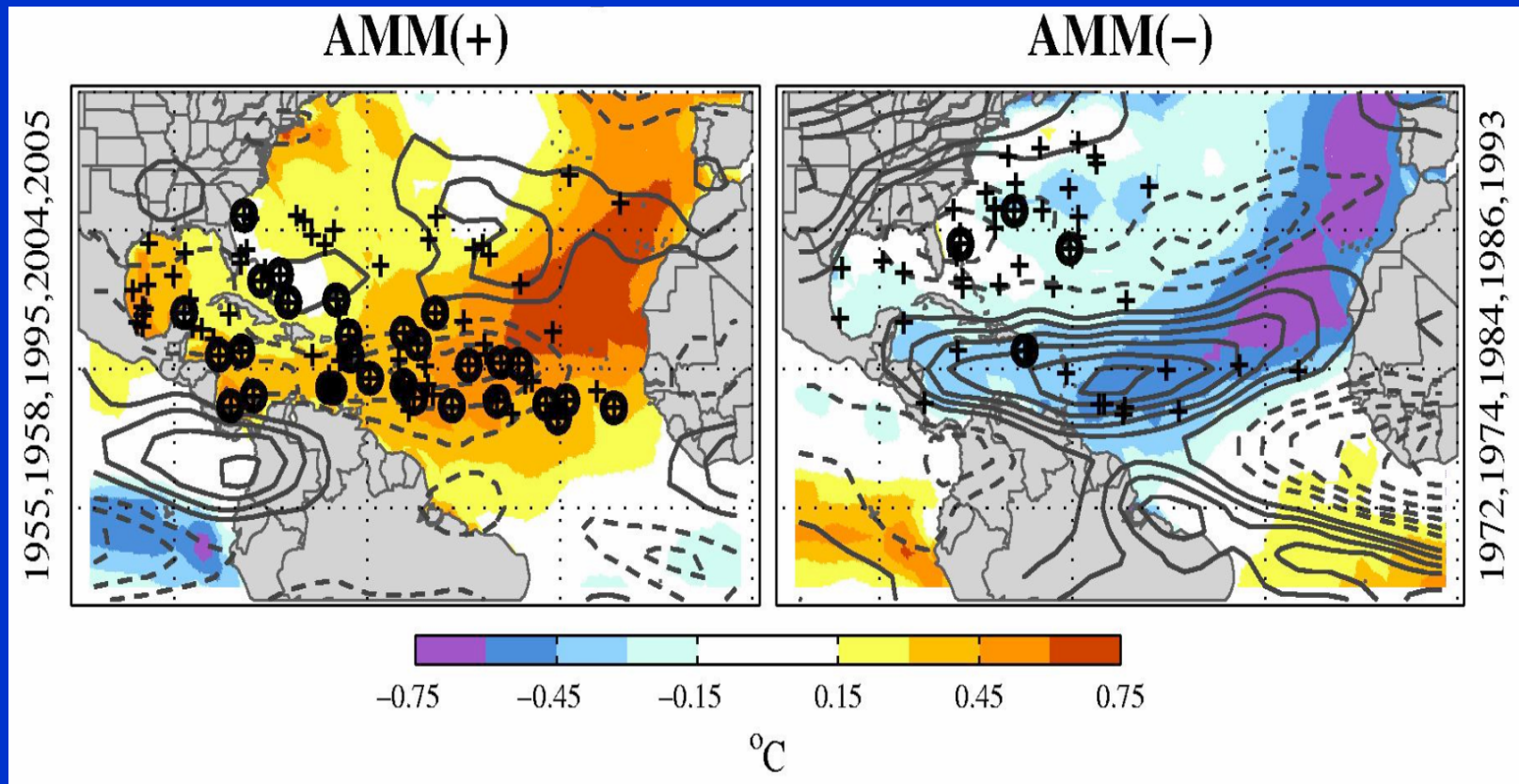
ENSO

La Nina predominates when
PDO is in negative phase →

El Nino predominates when
PDO is in positive phase →



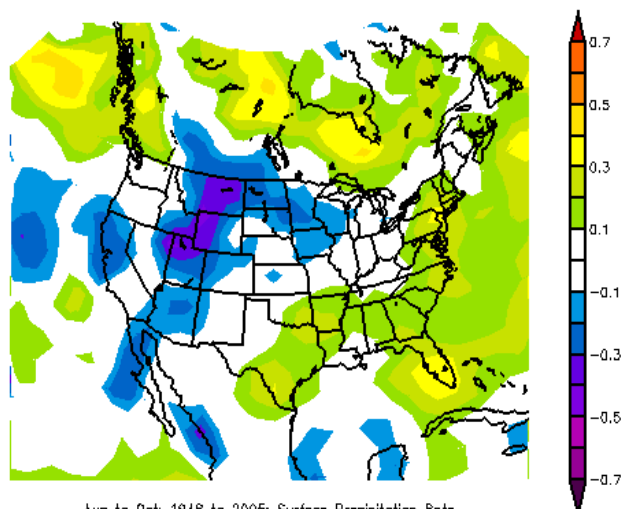
Composites associated strongest AMM (+) and AMM (-)



Tropical cyclo-genesis points for the five strongest and five weakest AMM years, superimposed on composites of SST (shaded) and shear (contours) anomalies. Crosses show the genesis points for all storms that reached tropical storm strength. Storms that reached “major hurricane” strength (maximum sustained surface wind speed $> 49 \text{ m s}^{-1}$) also have a circle around their genesis point. Solid (dashed) shear contours denote positive (negative) values. The contour interval is 0.25 m s^{-1} and the zero-contour has been omitted. Shear was calculated every 6 h as the amplitude of the vector difference between the layer-mean winds in the 300–150 hPa and 925–700 hPa layers, and means were formed around the hurricane season from monthly means.

Correlation between RF and Atlantic Meridional Mode and Atlantic Multidecadal Oscillation

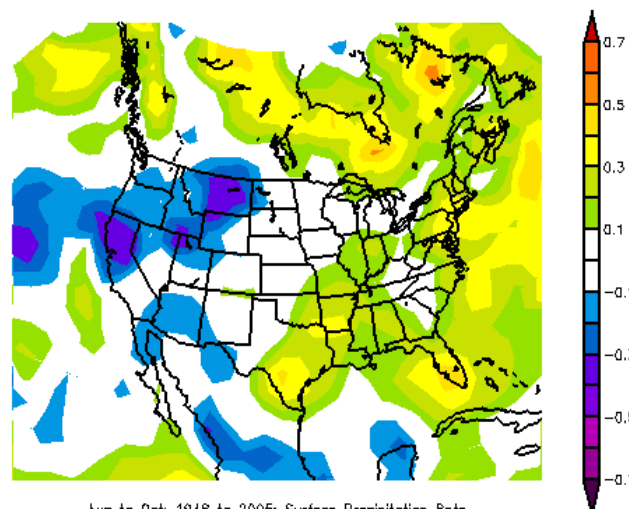
AMM



Aug to Oct: 1948 to 2005: Surface Precipitation Rate
Seasonal Correlation w/ Aug to Oct AMM
NCEP/NCAR Reanalysis

NOAA/ESRL Physical Sciences Division

AMO



Aug to Oct: 1948 to 2005: Surface Precipitation Rate
Seasonal Correlation w/ Aug to Oct AMO
NCEP/NCAR Reanalysis

NOAA/ESRL Physical Sciences Division

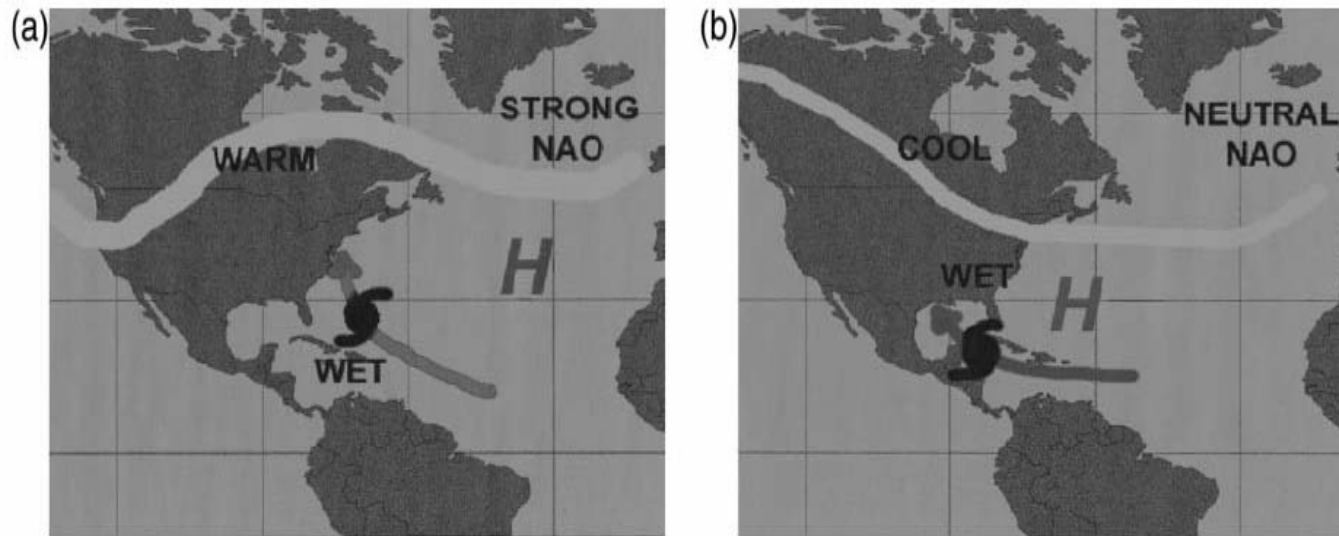


FIG. 3. A sketch of the inferred mean Jul midlatitude jet stream and subtropical high for conditions of (a) strong and (b) neutral NAO. A southwestward shift of the Bermuda high by 3000 yr BP likely brought less precipitation to the northeast Caribbean and more catastrophic hurricanes to the Gulf Coast. Adapted from Liu (1999).

Sea Surface Temperature Anomaly

Tropical Atlantic Main Development Region

