Weekly Climate Update April 28th 2009

- The 2006-2008 period is the second driest 3- year period in the 113- year period of record extending from 1895 through 2008 for the District. So far 2009 is continuing this unusual dry spell and it appears that the extended period of below normal rainfall has not yet ended.
- Net Inflows to Lake Okeechobee in the 20th Century have tended to vary with solar activity (see slide 2). This tendency has continued into the 21st Century. Solar activity towards the end of 2005 has dropped to much below average and has continued to decline to the present date. Late 2005 is about the same time that the current rainfall drought period began. Currently solar activity is at low levels not seen since the beginning of the 20th Century. The most recent 10- year average dry season rainfall for the District is lower than any other 10- year period of record dating back to 1895.
- The AMO/ENSO hydrologic outlook reflects the median projected Lake Okeechobee inflows that may occur during the wet season. However the net wet season inflows can vary anywhere from a net loss of storage to a net storage gain equivalent to a rise in water elevation in the Lake greater than 8 feet. This is why the tributary condition was put in the operational decision tree. Slide 2 illustrates that the median wet season inflow is less than two (~1.7) feet and net inflows could actually be less than zero during periods of low solar activity even in the positive phase of the AMO. The net inflow outlook contains a large range of uncertainty. This is why the appropriate consideration needs to be given to the ongoing drought conditions in the Lake tributary before discharging water from the Lake.

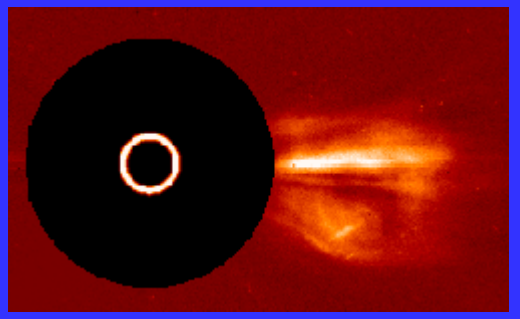
Solar Variability and Climate Shifts

SOLAR **Cycle** VARIABILITY, OZONE**, and** CLIMATE

DREW SHINDELL[1*], **David Rind [1], Nambeth Balachandran [1], Judith Lean [2], Patrick Lonergan [3]**

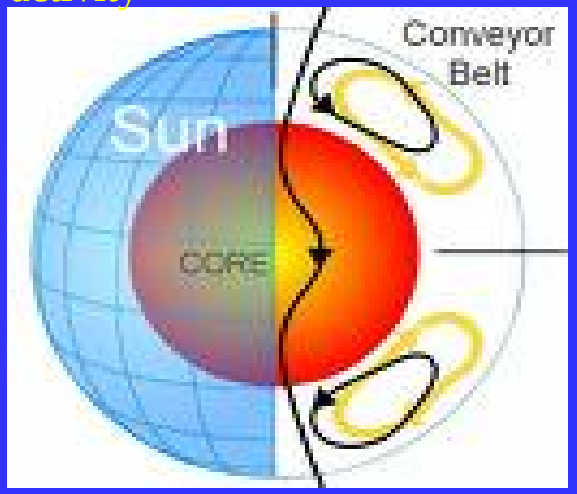
http://www.sciencemag.org/cgi/content/abstract/284/5412/305

Coronal Mass Injections



Slowing of the Solar Conveyor

has been associated with extended periods of lower solar activity



Hurricane intensity changes associated with geomagnetic variation

James B. Elsner and S. P. Kavlakov

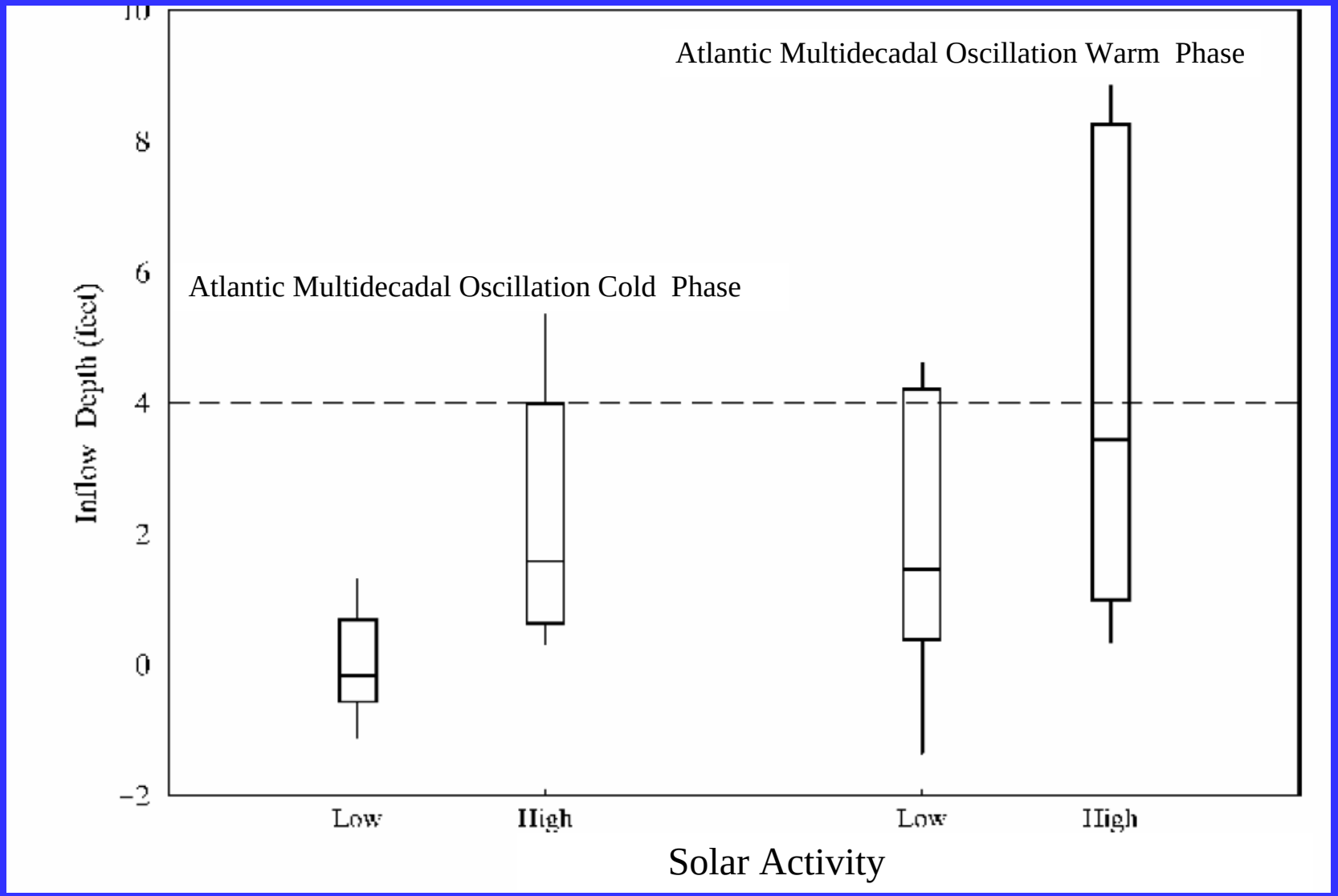
http://dpnc.unige.ch/ams/ICRC-07/icrc0321.pdf

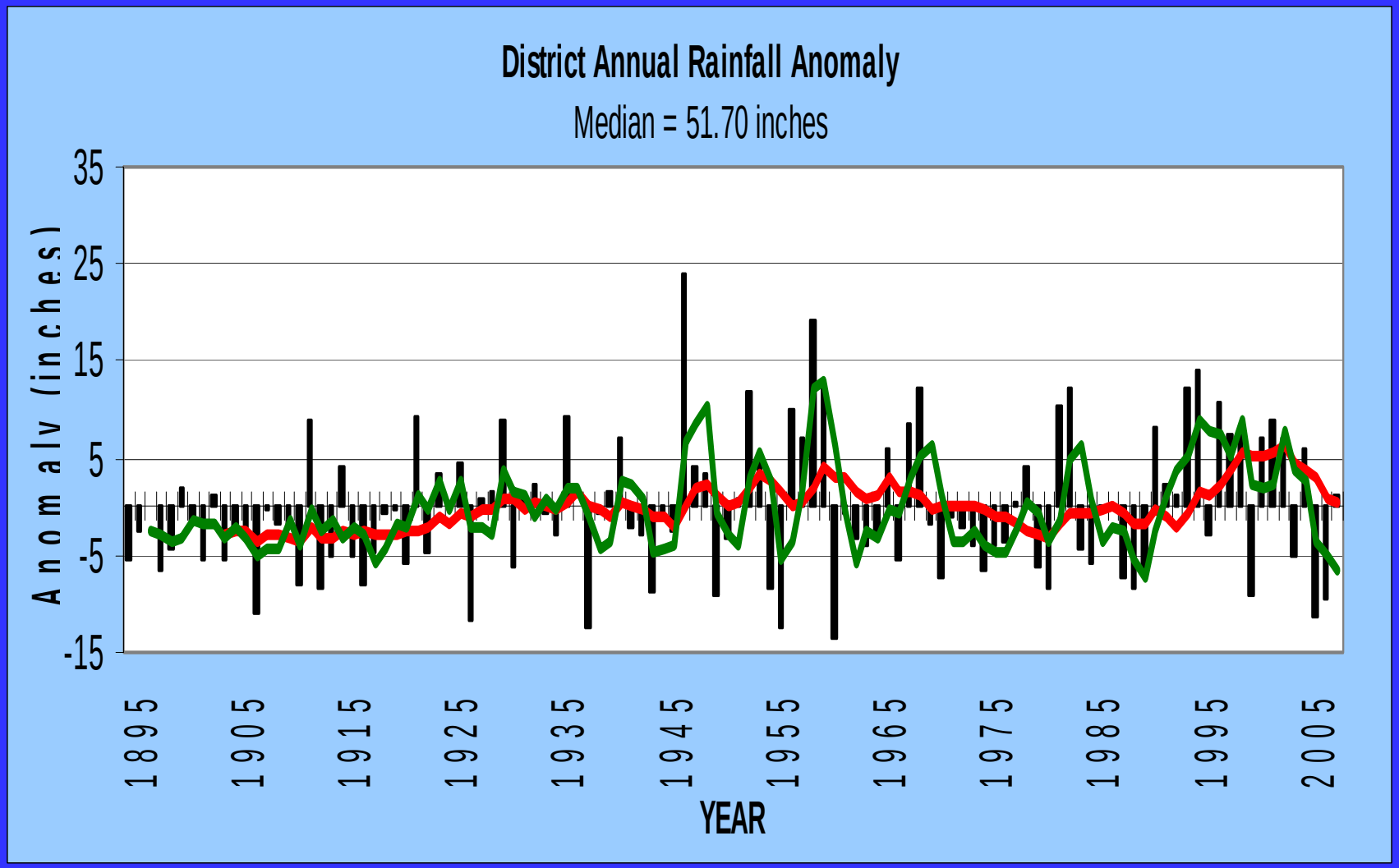
http://mailer.fsu.edu/~jelsner/PDF/Research/ElsnerKavlakov2001.pdf

http://adsabs.harvard.edu/full/2001ICRC...10.4169K

1 NASA Goddard Institute for Space Studies (GISS) and Center for CLIMATE Systems Research, Columbia University, \2880 Broadway, New York, NY 10025, USA.
2 E. O. Hulburt Center for Space Research, Naval Research Laboratory, Washington, DC 20375, USA.
3 Space Science and Applications Inc., 2880 Broadway, New York, NY 10025, USA

Lake Okeechobee Net Wet Season Inflow

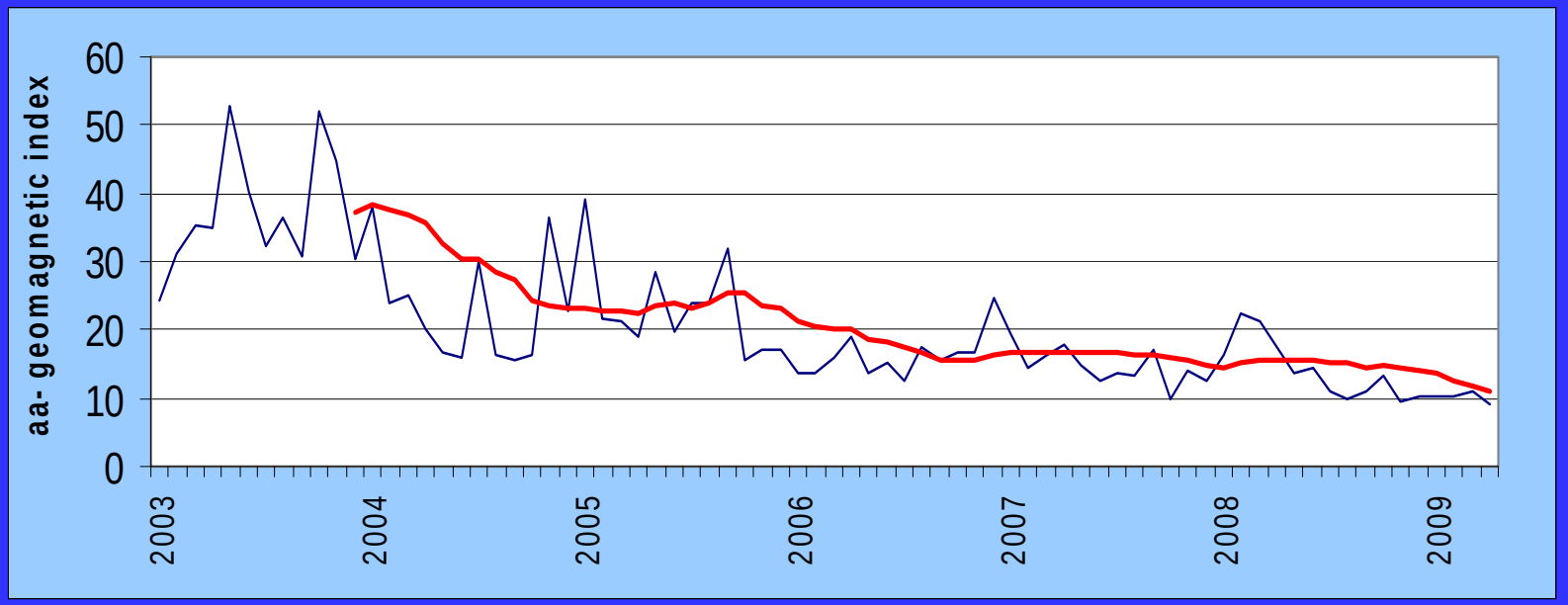




3- year moving average

10- year moving average

Recent Solar Activity

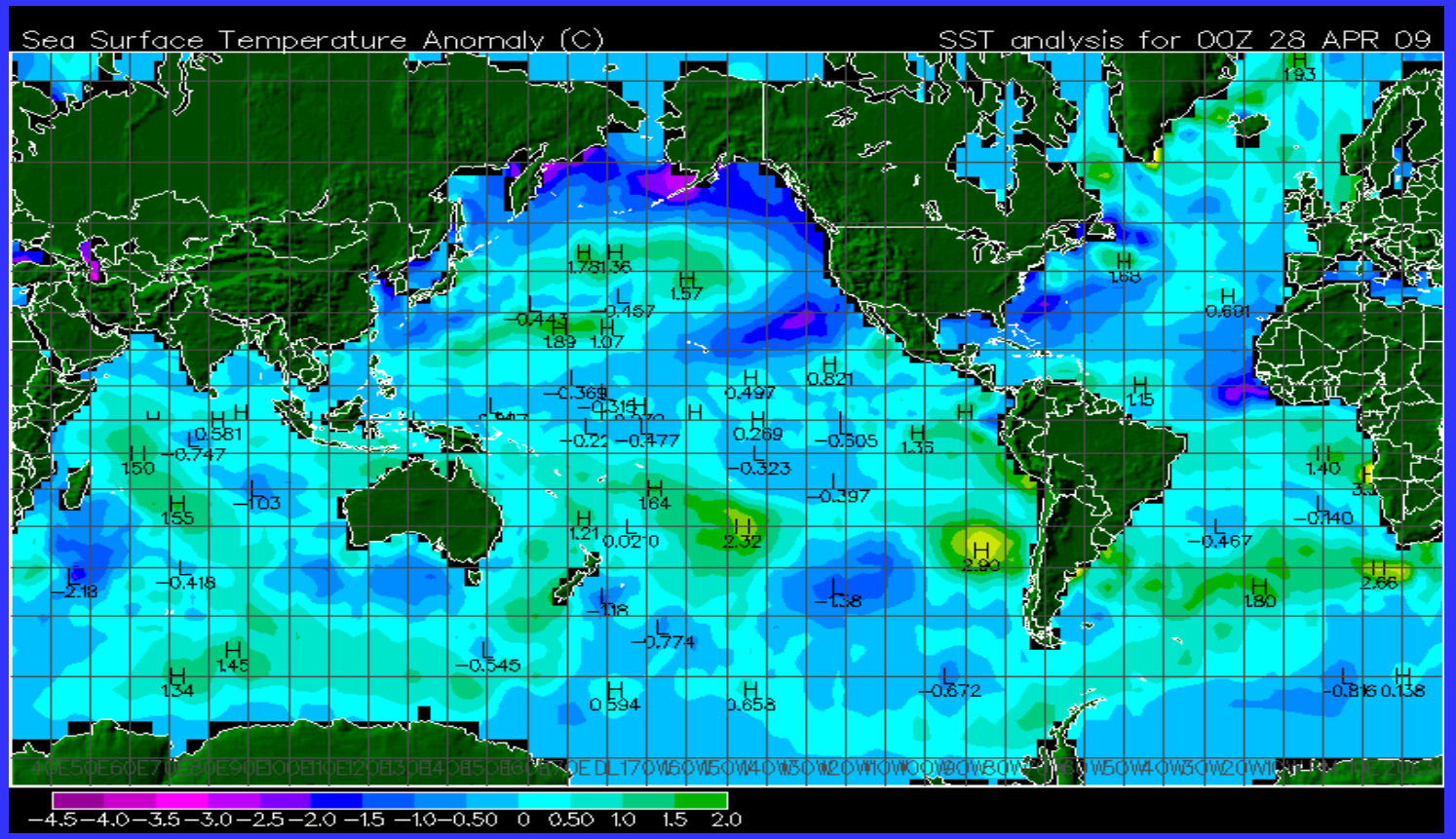


Suggestions that changes in the state of the earth's climate system could be measured by the aa- geomagnetic index (as a surrogate for solar eruptive activity) were first proposed by MIT scientist Hurd C. Willett (in *Climate, History, Periodicity, and Predictability*, ed. Michael r. Rampino et al., Van Nostrand Reinhold, 1987). The mean value of the aa- index for the period 1895-2005 is ~20 with a standard deviation being ~8. During the period from 1994 to present the aa- index has gone from very high values greater than 50 in 2003 to a very low value near 10 that currently exists. The last time such low solar activity occurred was very early in the 20th Century. During this same period the District's rainfall has gone from the wettest 10- year period (1994-2003) to the second driest 3- year period (2006-2008) in the 113 year period extending from 1895-2008. 2009 has been very dry to date.

Table of Contents

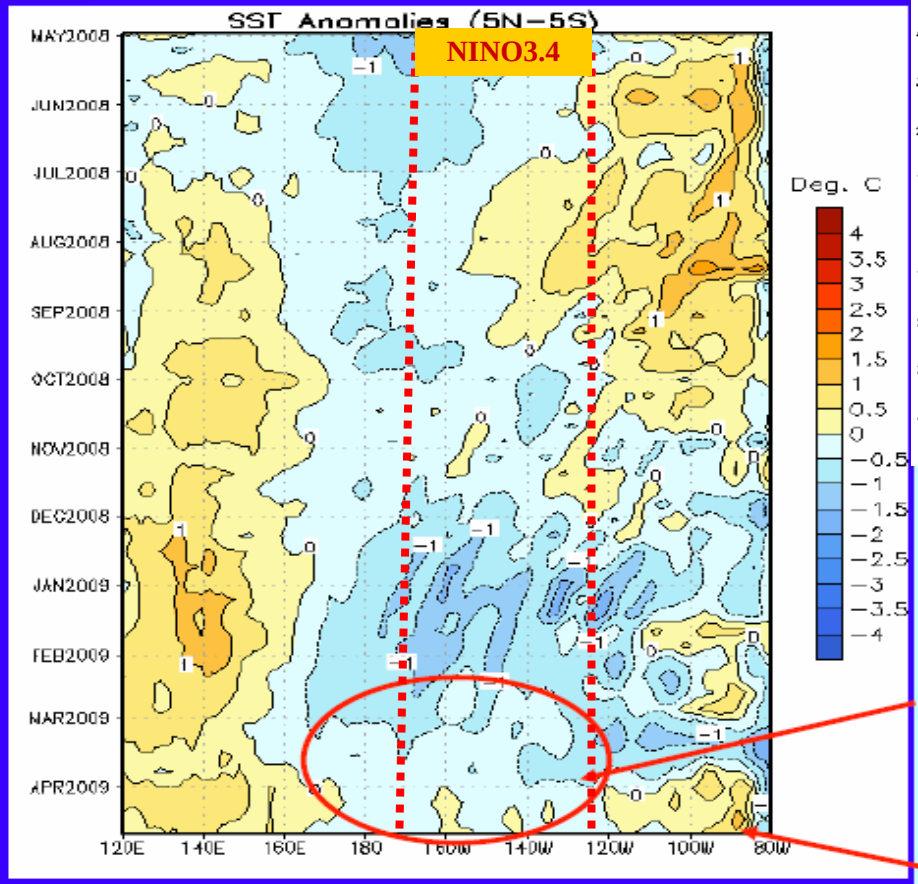
Latest Weekly Sea Surface Temperature Anomaly

International Research Institute



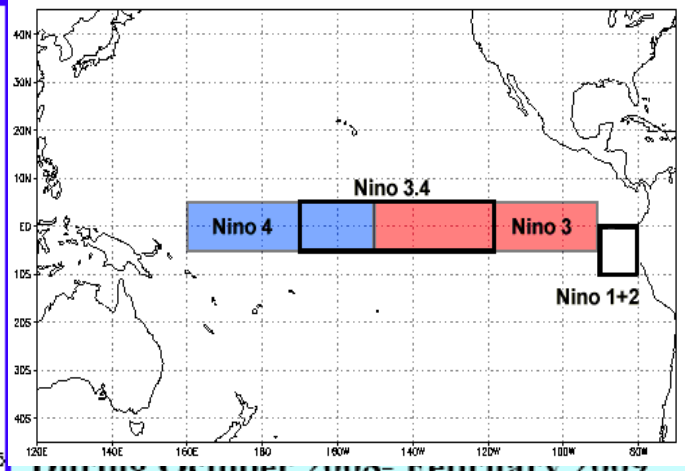
Cooler than normal sea surface temperatures along the west coast of North America are a result of the cold phase of the Pacific Decadal Oscillation. Tropical Atlantic somewhat cooler than normal

Recent Evolution of Equatorial Pacific SST Departures (°C)



Time

Longitude



During October 2008- February 2009, negative sea surface temperature (SST) anomalies dominated across the central and east-central equatorial Pacific Ocean.

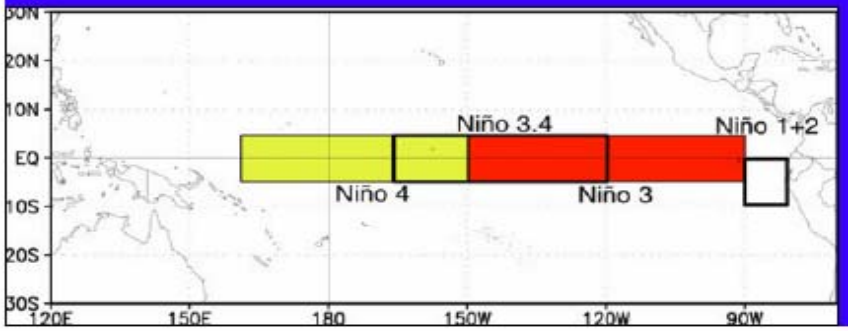
Since February 2009, negative SST anomalies have weakened in the central and east-central Pacific.

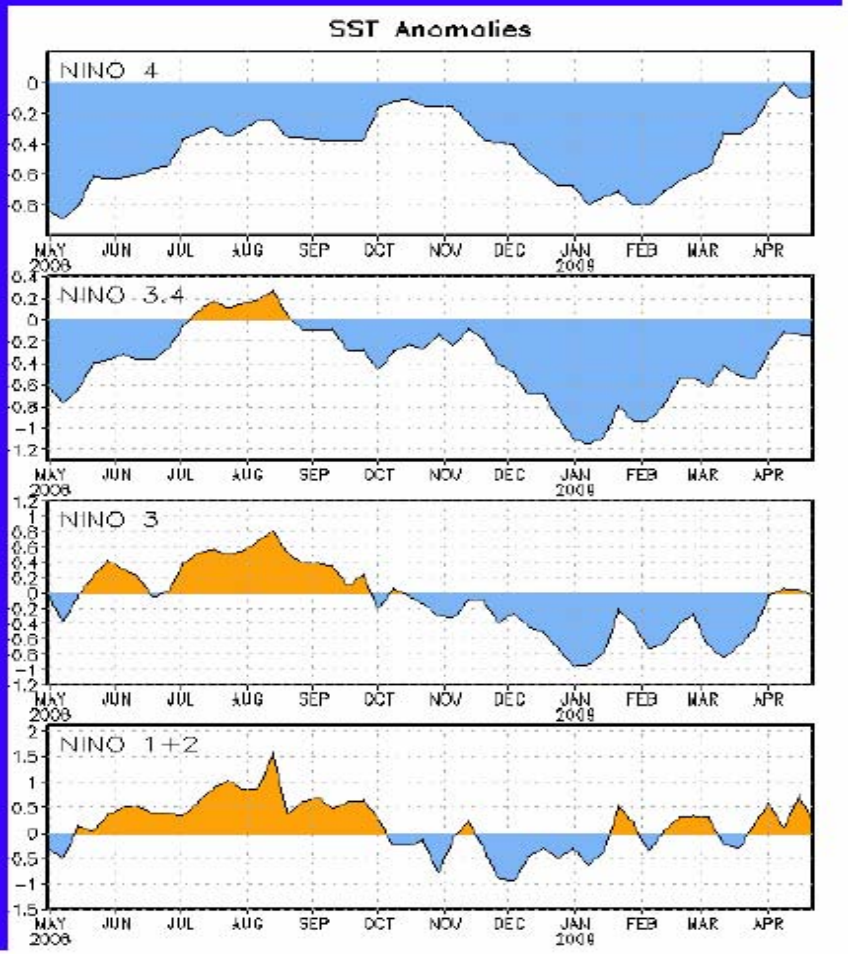
Recently, SST anomalies in the eastern Pacific have increased.

Niño Region SST Departures (°C)
Recent Evolution

The latest weekly SST departures are:

Niño 4	**-0.1°C**
Niño 3.4	**-0.1°C**
Niño 3	**0.0°C**
Niño 1+2	**0.2°C**





Sea surface temperatures in the tropical Pacific are near normal

Equatorial Pacific Subsurface Temperature Anomalies

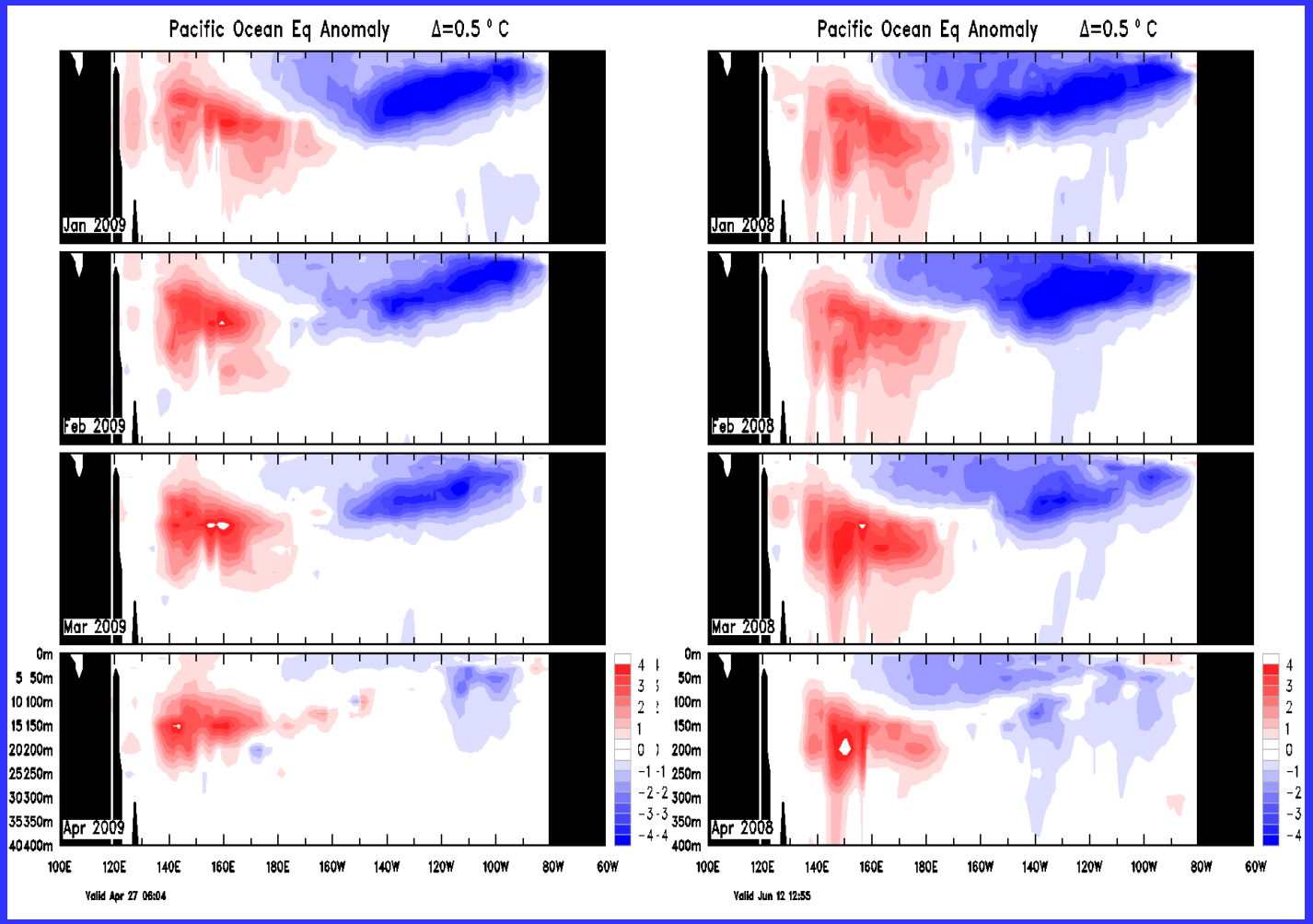
Current 2008

January

February

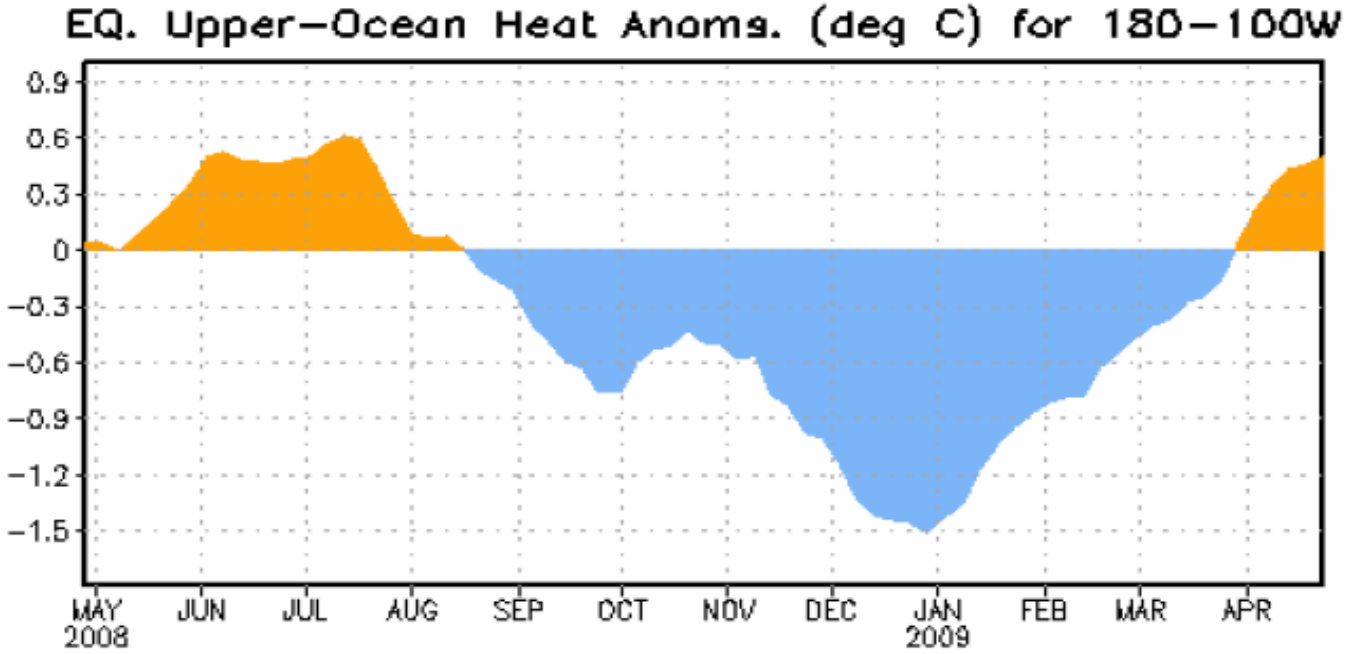
March

April



Subsurface temperatures are similar but with smaller anomalies than last year

Central & Eastern Pacific Upper-Ocean (0-300 m) Weekly Heat Content Anomalies

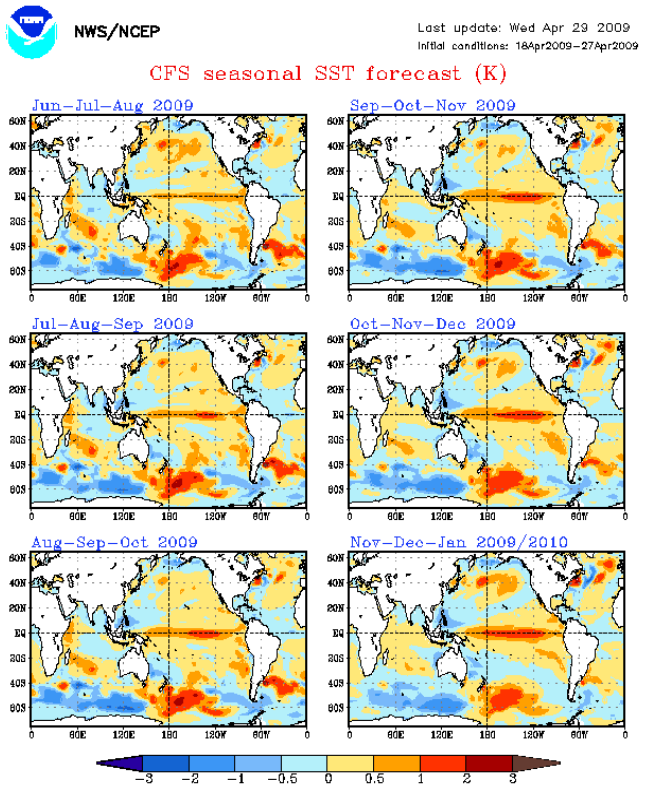


The upper ocean heat content was below-average across the eastern half of the equatorial Pacific Ocean between mid-August and March 2009. Heat content anomalies have weakened since late December 2008 and have recently become positive.

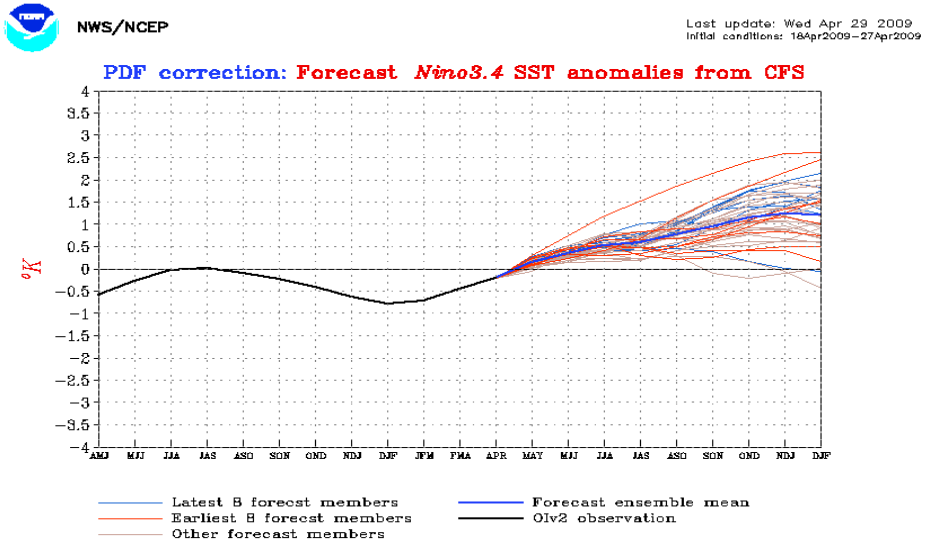
Predicted Sea Surface Temperature Anomalies

Issued April 28th

Global

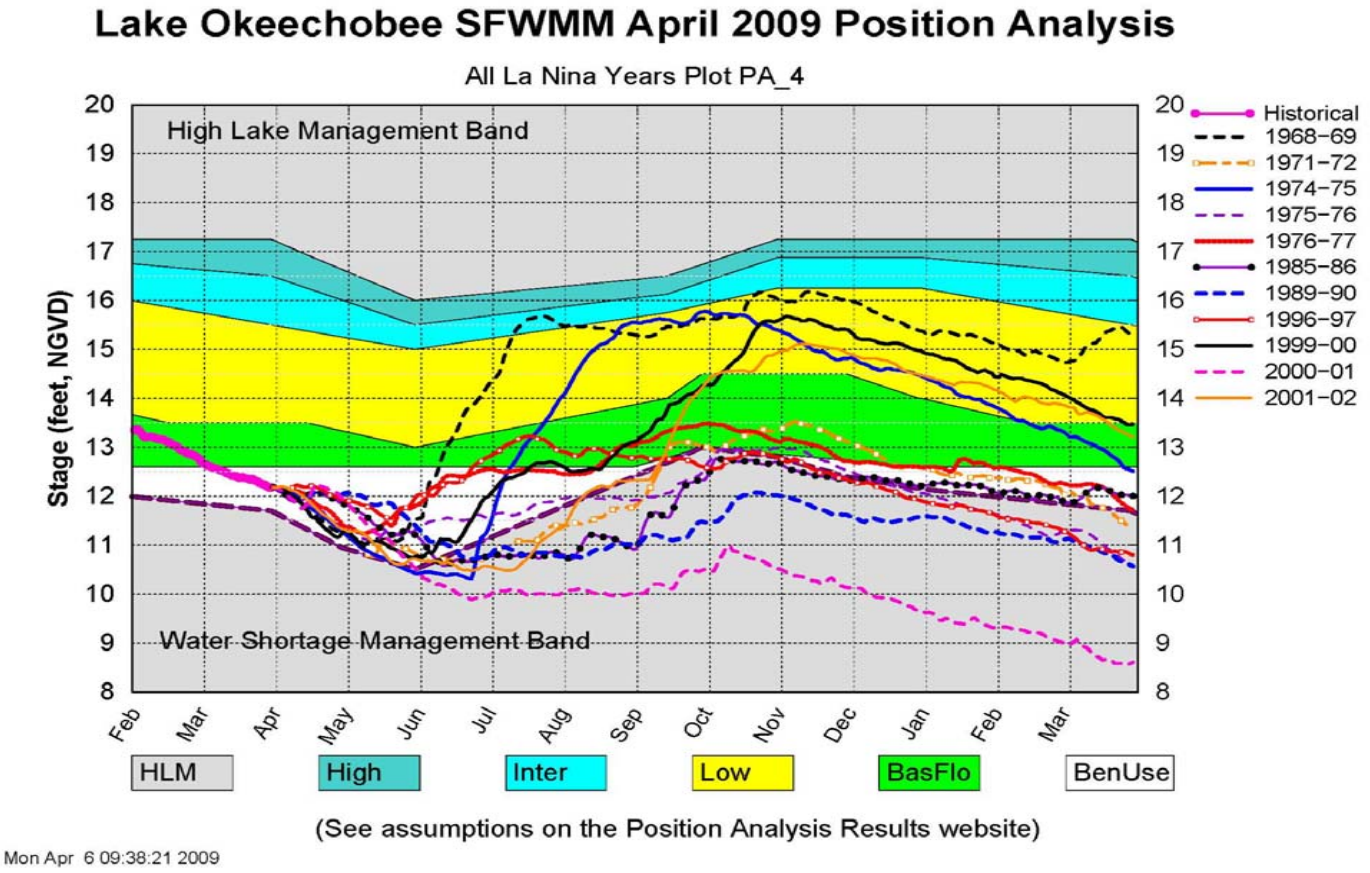


NINO 3.4 Ensemble

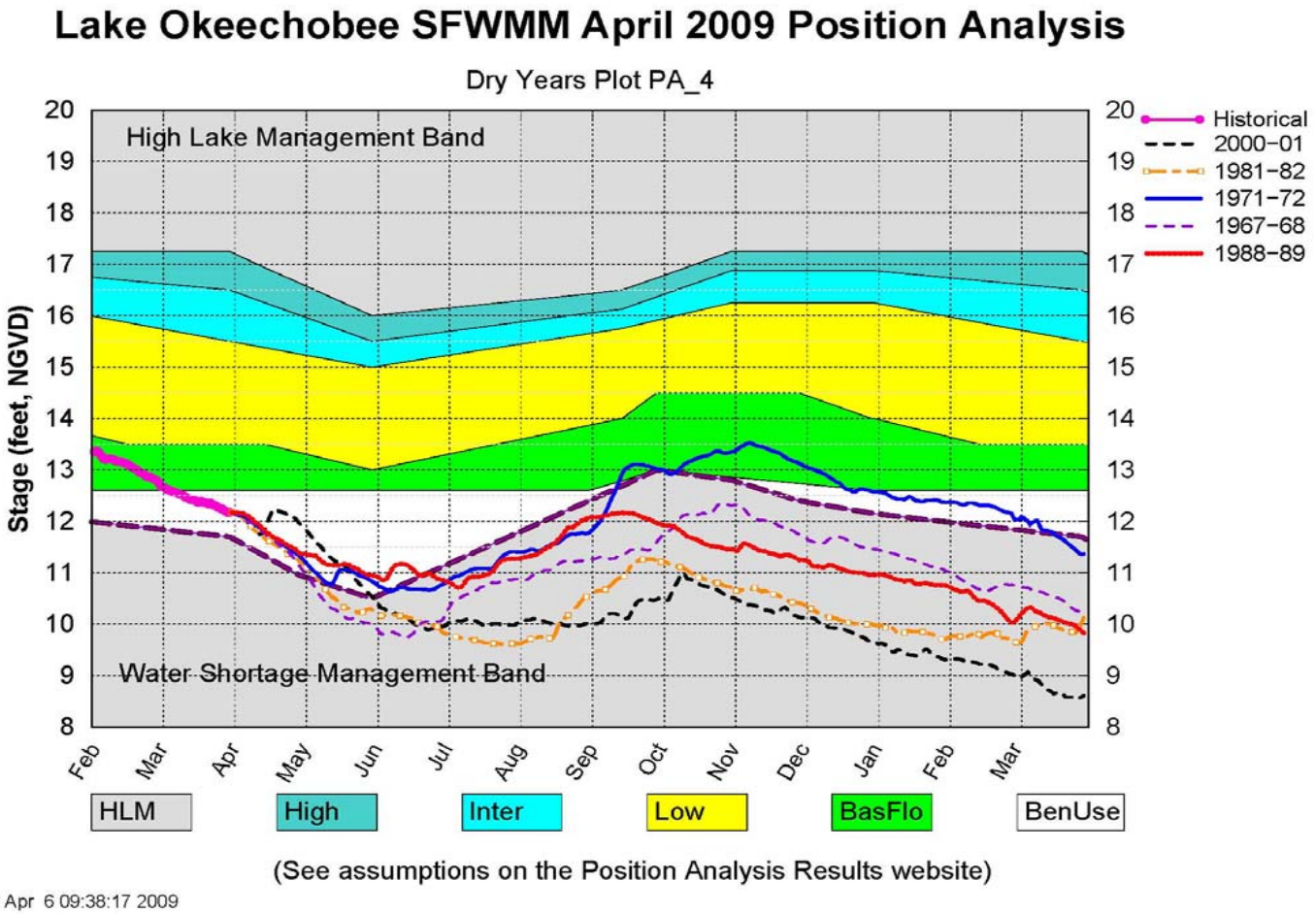


The CFS ensemble mean (heavy blue line) predicts La Niña will end during April 2009, followed by positive SST anomalies in the Niño 3.4 region during the last half of 2009.

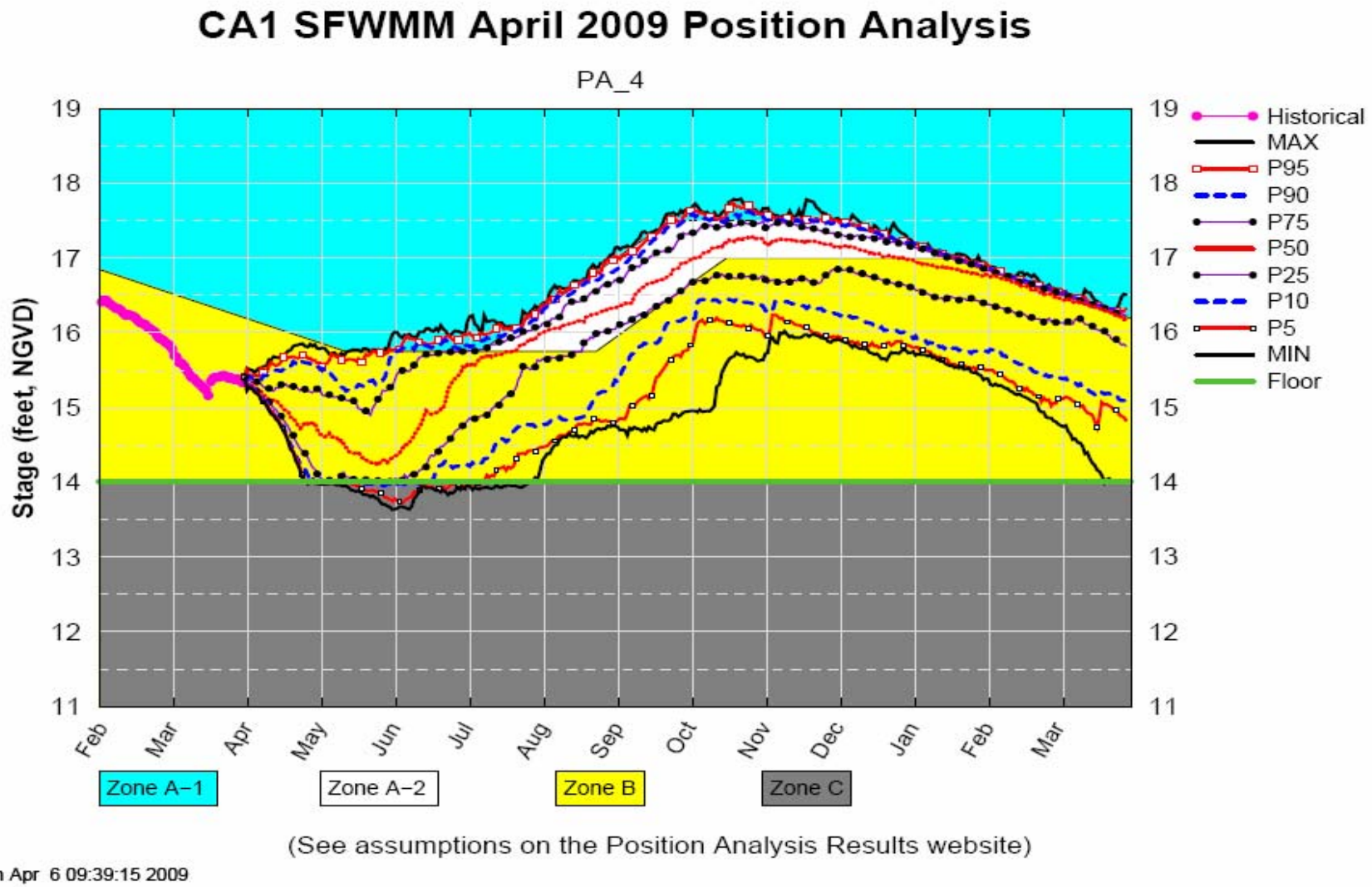
April Position Analysis for La Nina Years



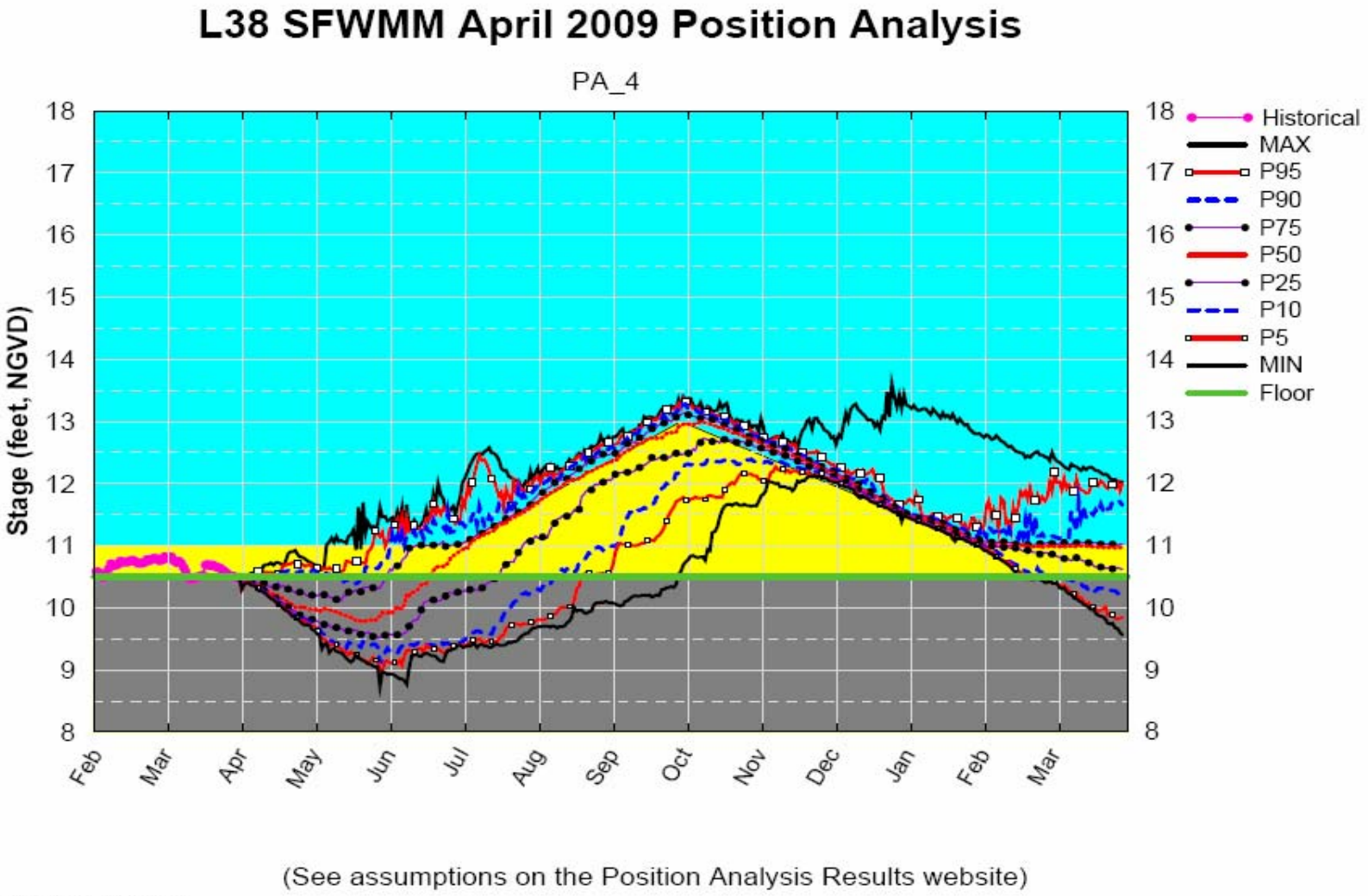
April Position Analysis Dry Years



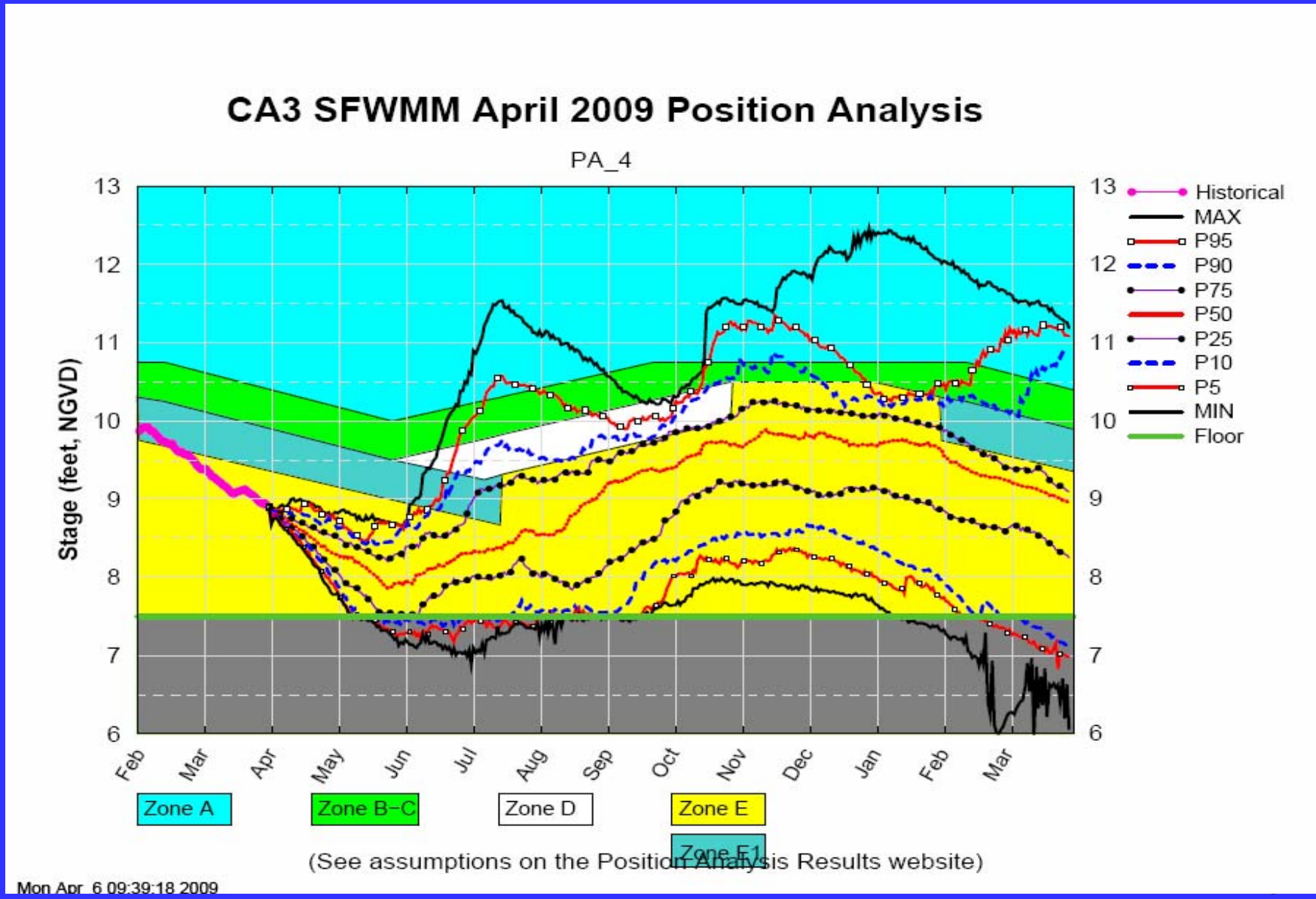
April Position Analysis



April Position Analysis



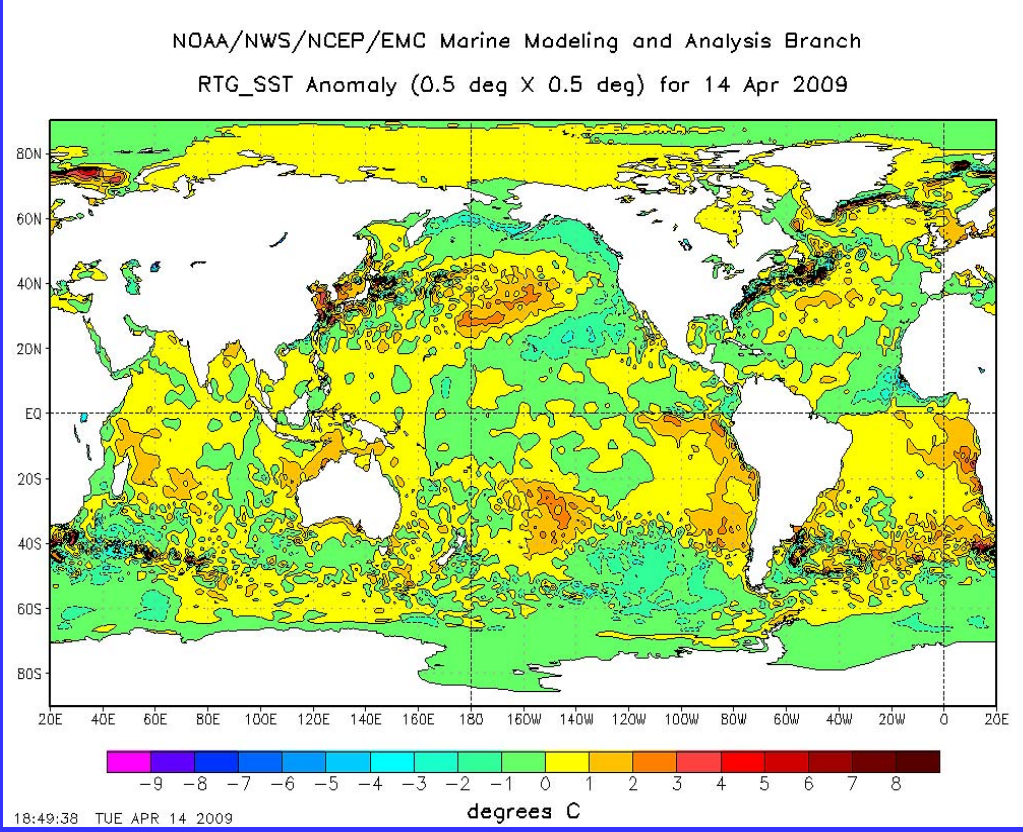
April Position for Water Conservation Area 3

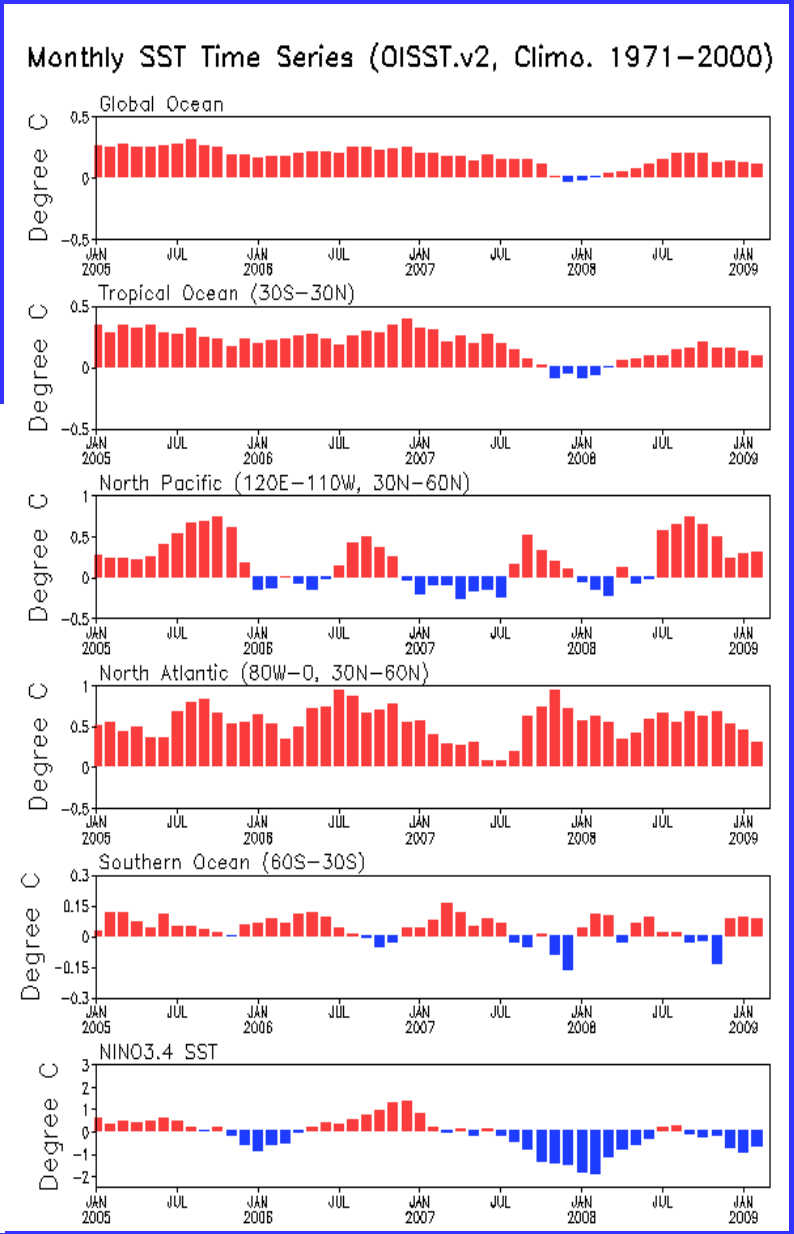


Backup Slides
with additional support material

Summary of Global Sea Surface Temperature Anomalies by Regions

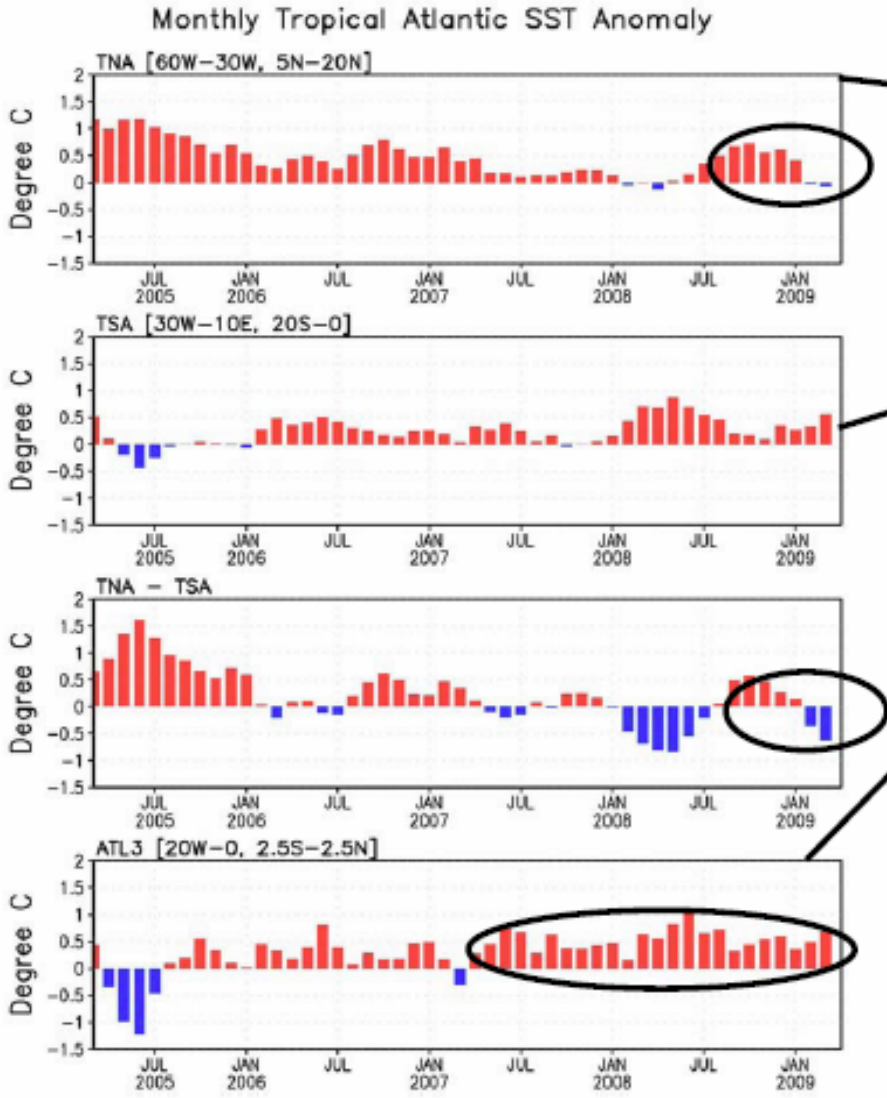
- La Nina conditions
- Tropical North Atlantic cooler than normal

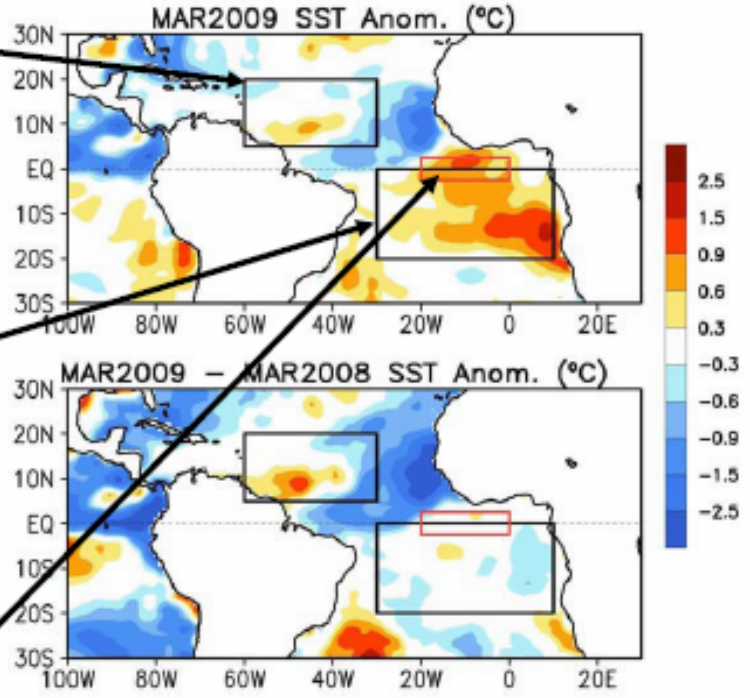




Weekly update: http://ioc3.unesco.org/oopc/state_of_the_ocean/all/

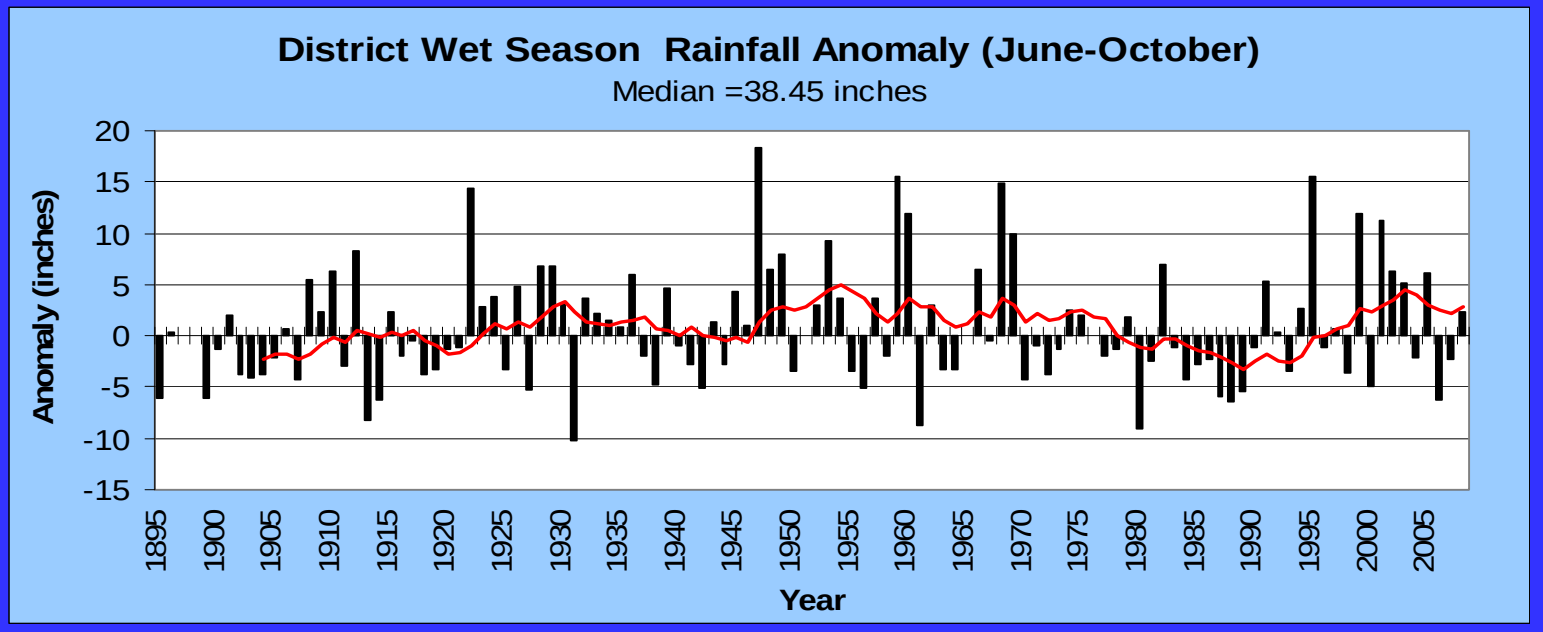
Evolution of Tropical Atlantic SST Indices

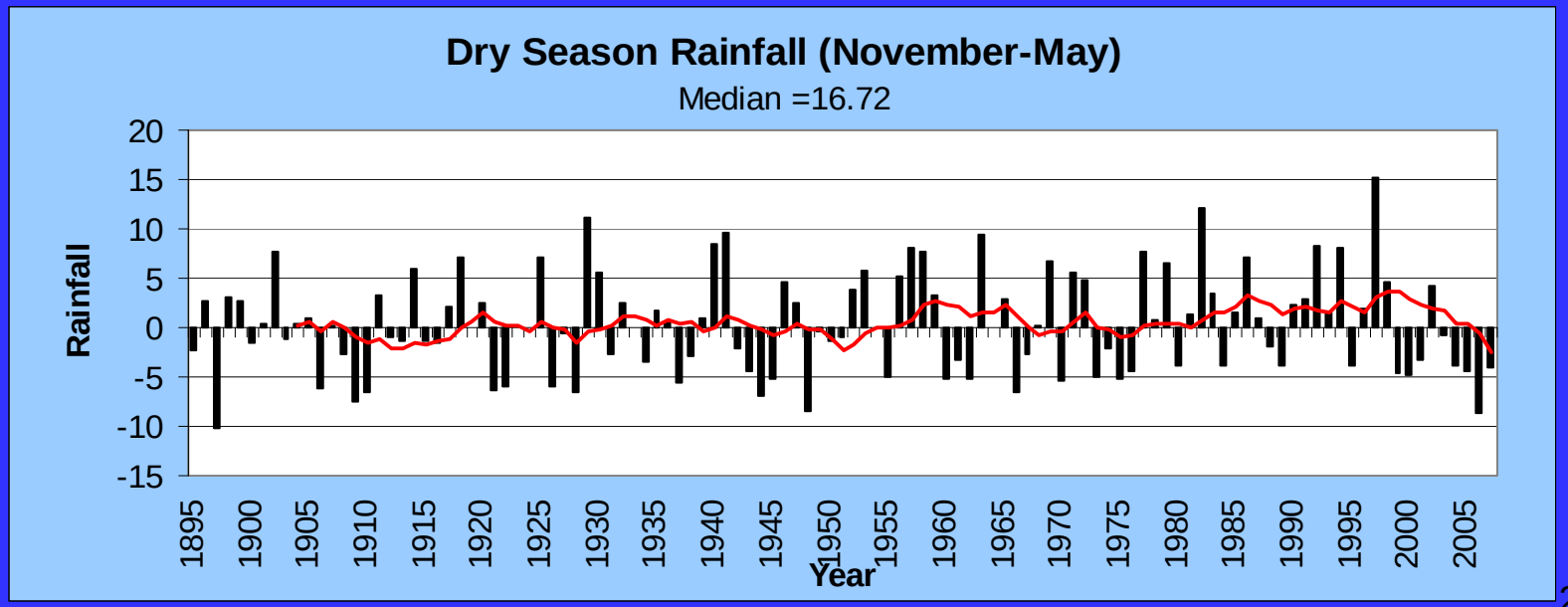




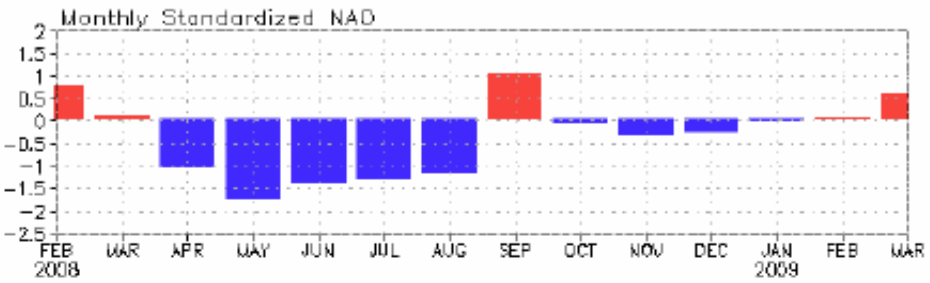
- Tropical North Atlantic SST was near-normal in Feb-Mar 09.
- Tropical South Atlantic SST remained above-normal and warmed up slightly in March.
- Meridional Gradient Mode (TNA-TSA) switched to negative in Feb 09, and deepened further in Mar 09.

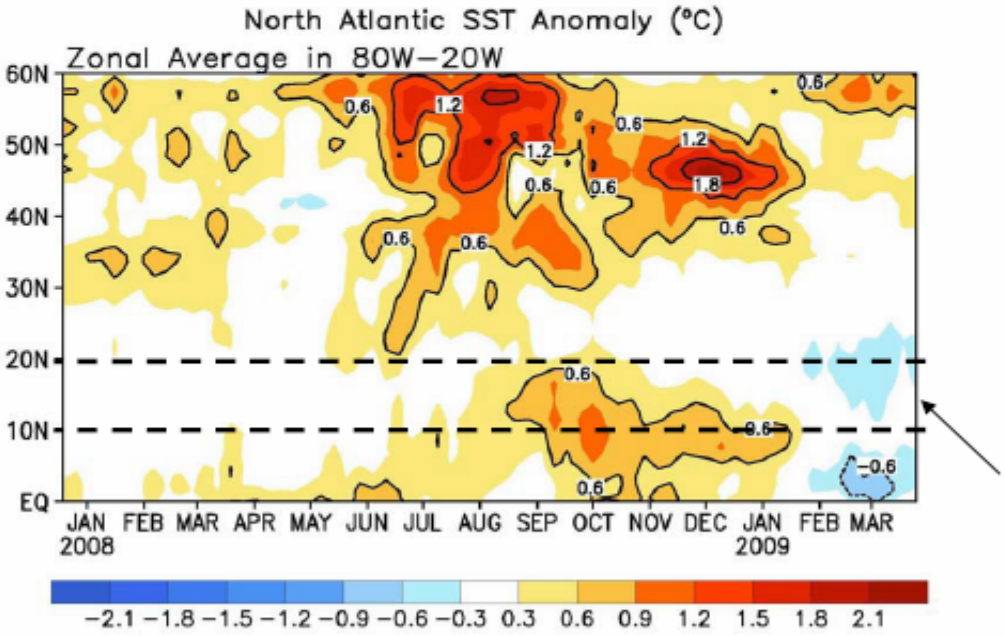
Fig. A1a. Tropical Atlantic Variability region indices, calculated as the area-averaged monthly mean sea surface temperature anomalies (°C) for the TNA [60°W-30°W, 5°N-20°N], TSA [30°W-10°E, 20°S-0] and ATL3 [20°W-0, 2.5°S-2.5°N] regions, and Meridional Gradient Index, defined as differences between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

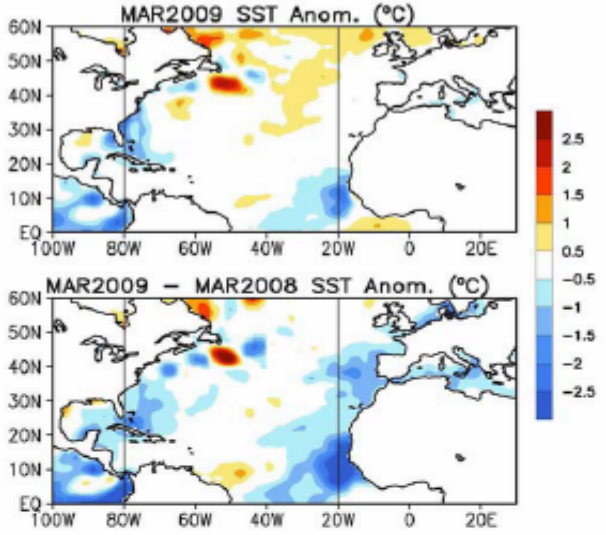

District Wet Season Rainfall Anomaly (June-October)
Median =38.45 inches
Anomaly (inches)
20
15
10
5
0
-5
-10
-15
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


Dry Season Rainfall (November-May)
Median =16.72
Rainfall
20
15
10
5
0
-5
-10
-15
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year

NAO and SST Anomaly in North Atlantic

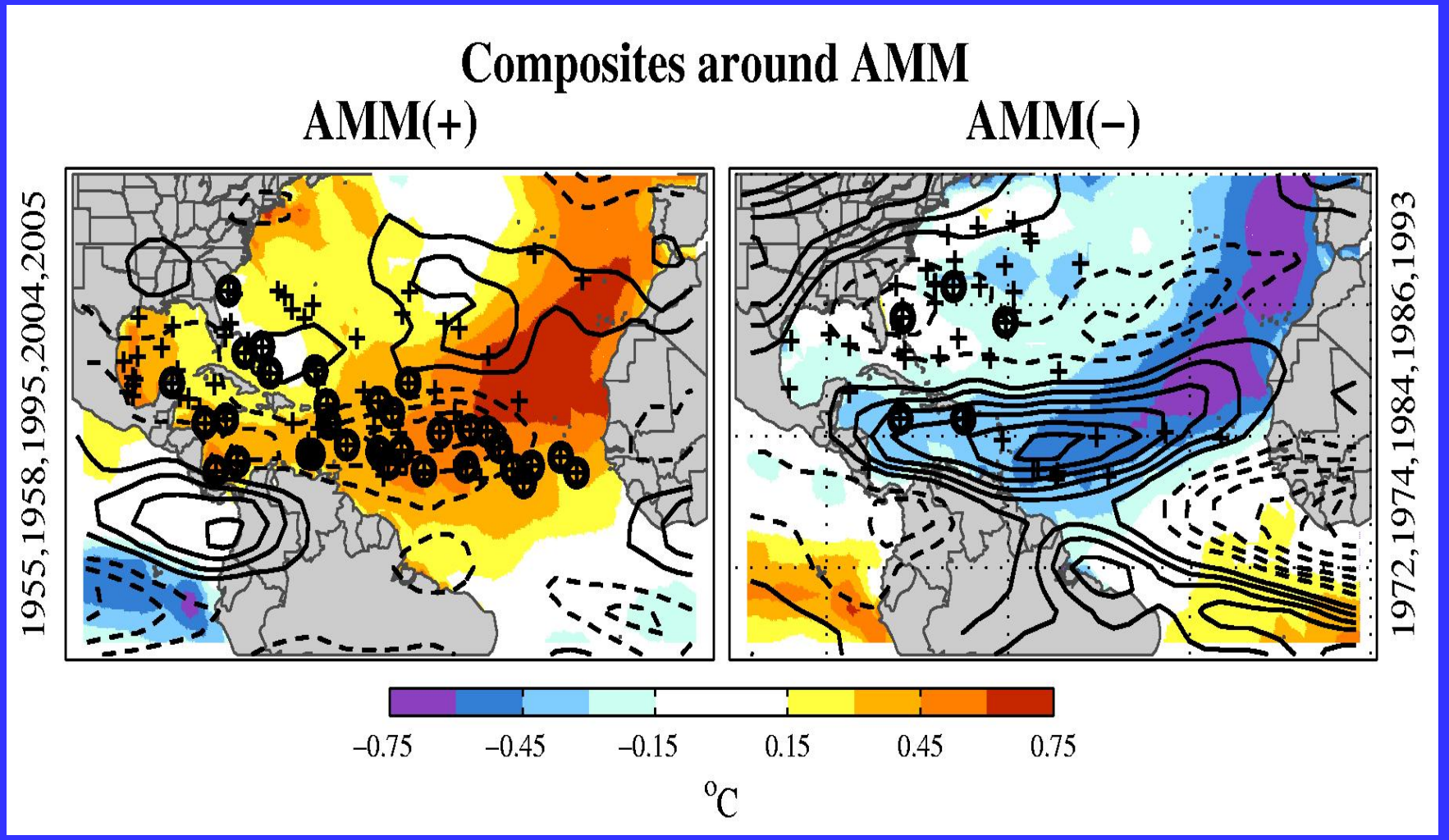


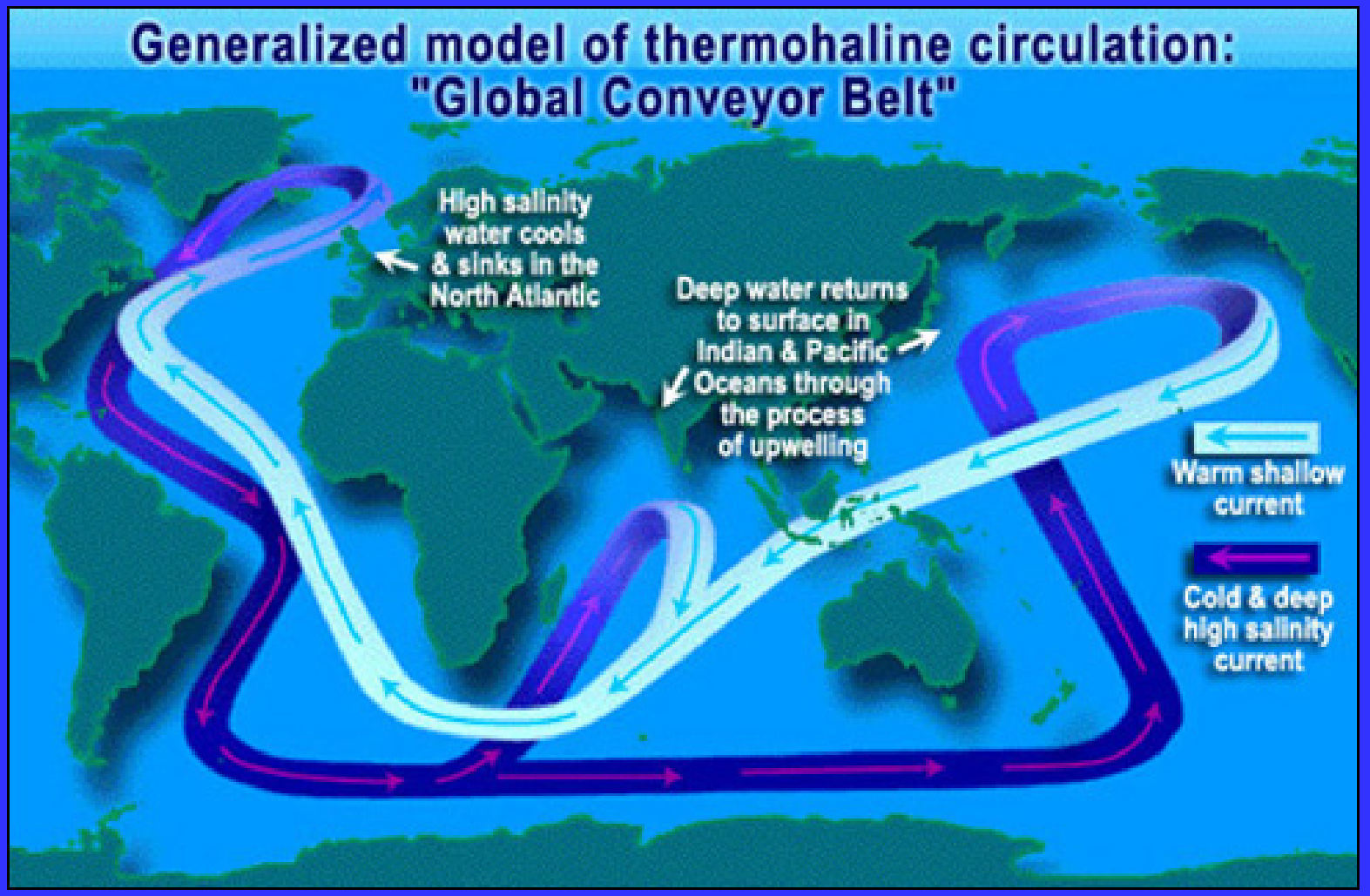




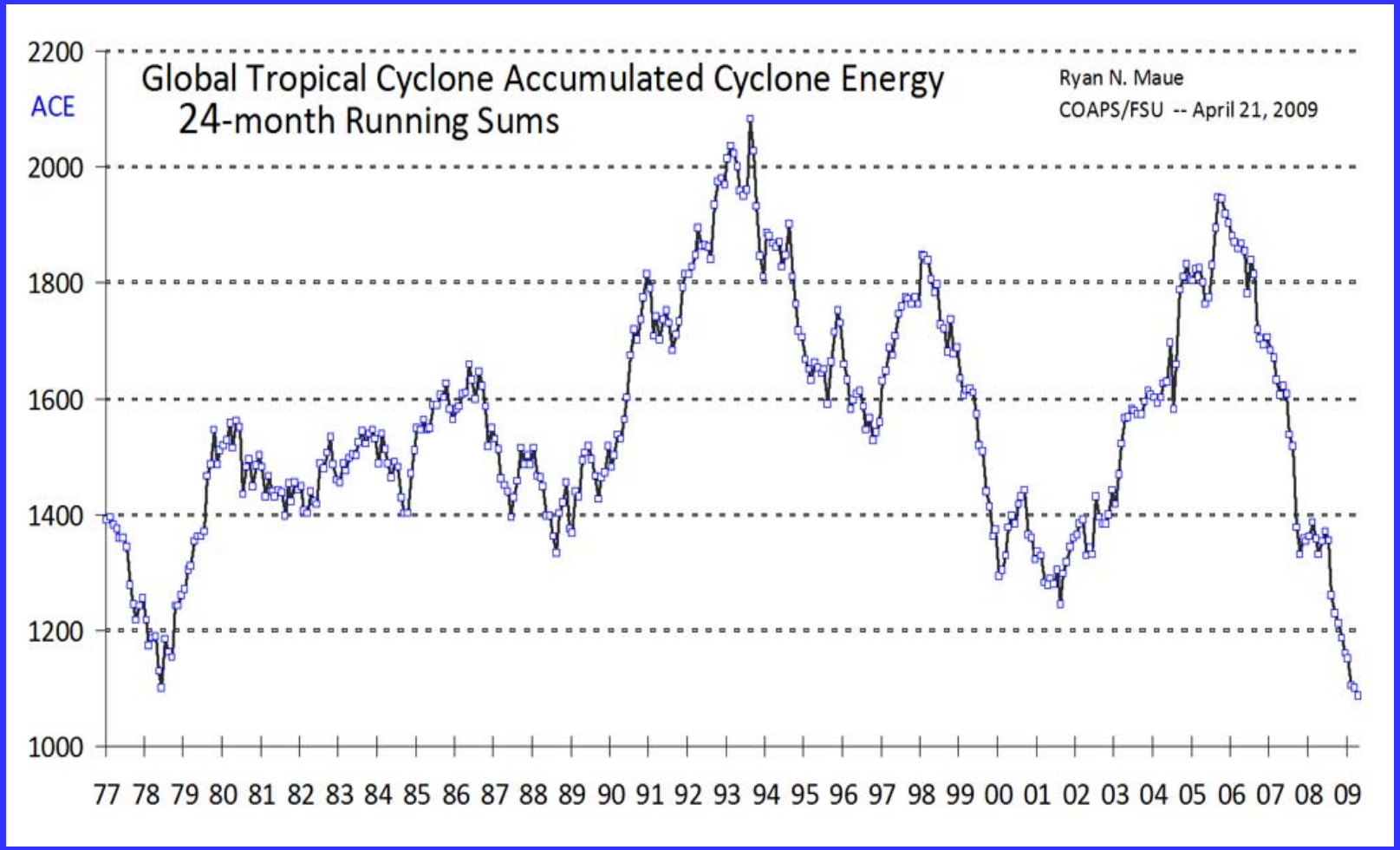
- High-latitude North Atlantic SSTA are closely related to NAO index – negative (positive) NAO leads to SST warming (cooling).
- NAO became above-normal in March 09.
- SSTA in the Hurricane Main Development Region were weakly below-normal in Feb-Mar 09.

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.

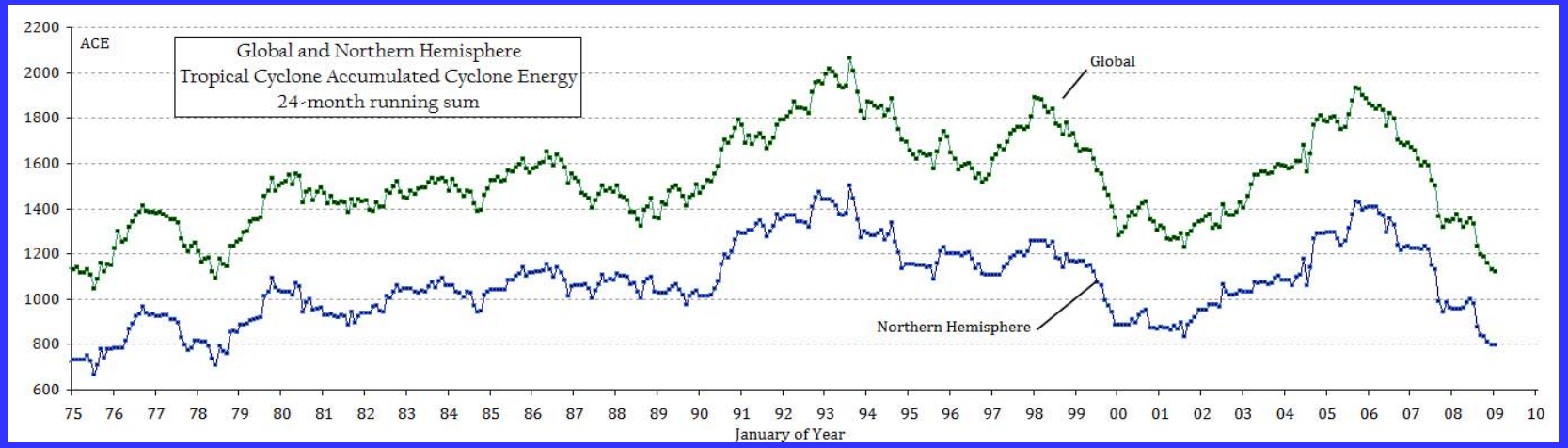

Composites around AMM
AMM(+)
AMM(−)
1955,1958,1995,2004,2005
1972,1974,1984,1986,1993
−0.75
−0.45
−0.15
0.15
0.45
0.75
°C


Generalized model of thermohaline circulation:
"Global Conveyor Belt"
High salinity water cools & sinks in the North Atlantic
Deep water returns to surface in Indian & Pacific Oceans through the process of upwelling
Warm shallow current
Cold & deep high salinity current

Global Accumulated Cyclone Energy

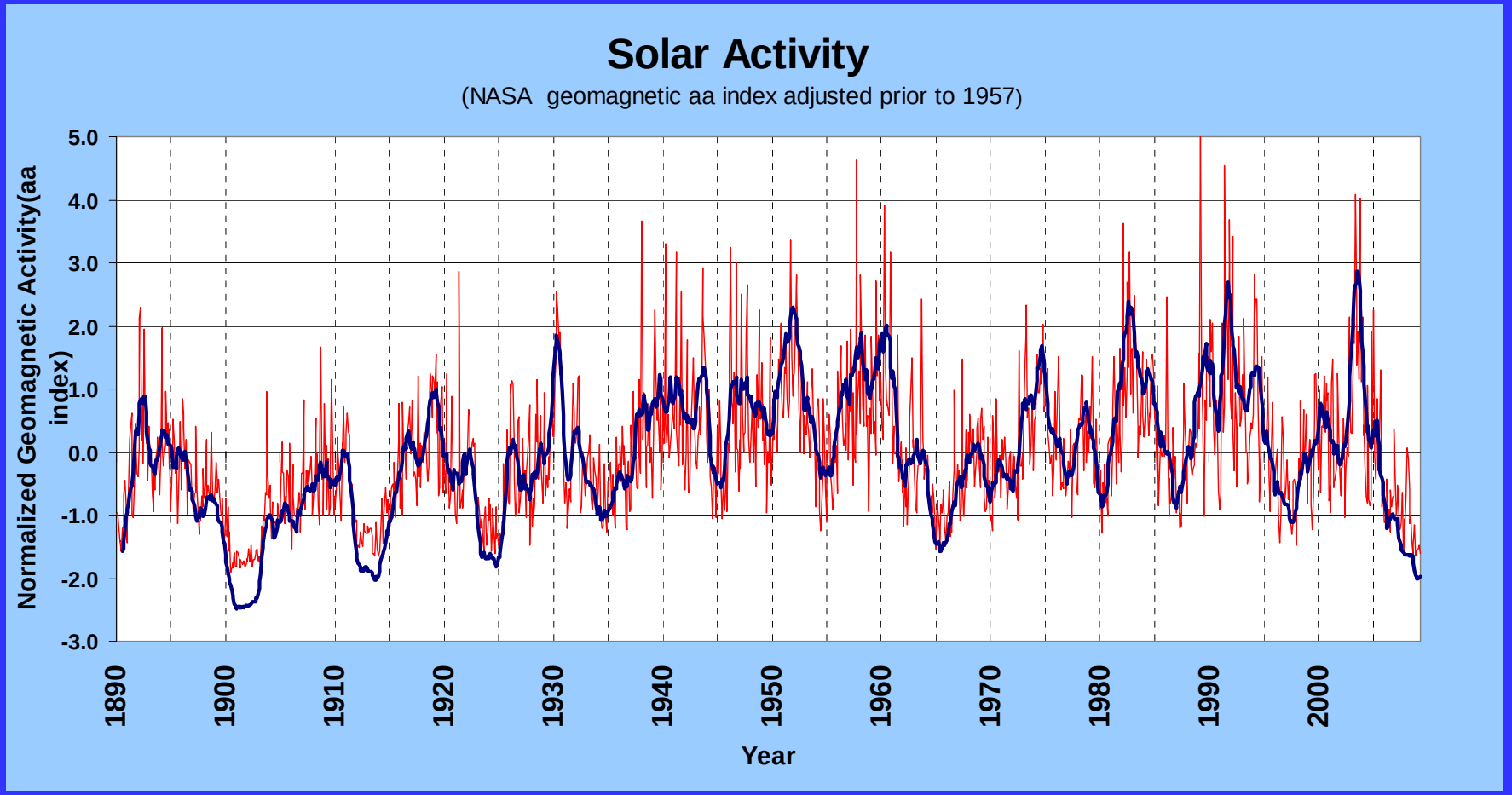


Global and Northern Hemisphere Accumulated Cyclone Energy (ACE) -- 24 month running sum



Analysis shown in the figure depicts tropical cyclone energy continuously summed over 24-month periods from 1975 through 31, January 2009. The top green time series shows the evolution of global Accumulated Cyclone Energy or ACE. Global ACE is at historical lows, and the lowest in 30-years. The Earth is experiencing a prolonged period of severely depressed cyclone activity. The Northern Hemisphere is responsible for 70% of global tropical cyclone ACE *on average* since 1975. Thus, it is no surprise that Northern Hemisphere Tropical Cyclone activity is also at 30-year lows.

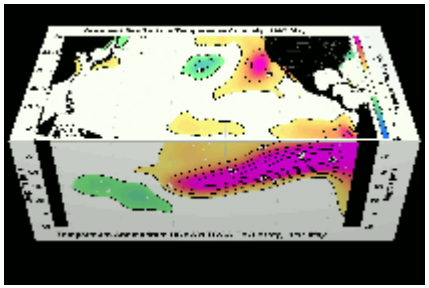
Source: FSU



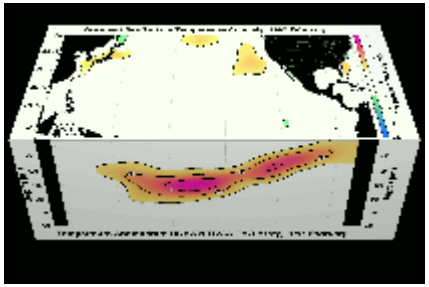
From historical record it can be seen that many of the SFWMD drier periods tend to occur more often during periods of lower solar activity. Examples of such periods are the mid- 1940s, mid-1950s , early to mid- 1960s and early 1980s. Solar activity since the end of 2005 has been very low.

Scripps Institution of Oceanography Climate Prediction Center

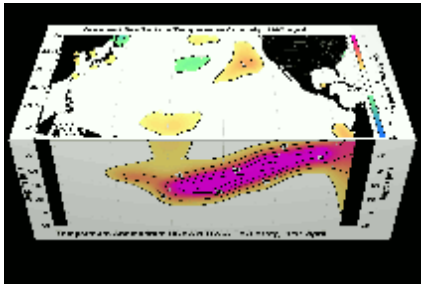
January 1997



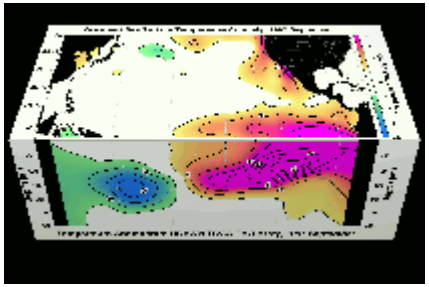
February 1997



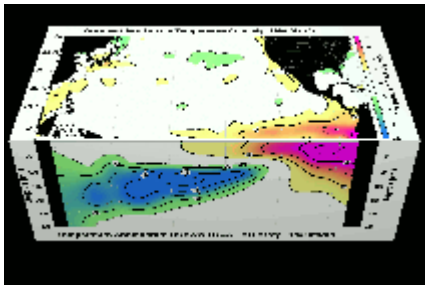
April 1997



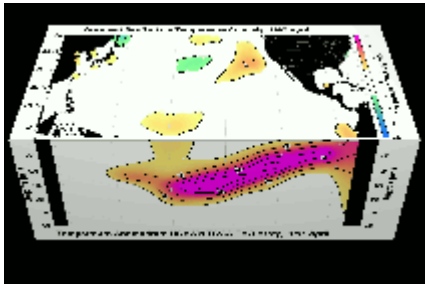
May 1997



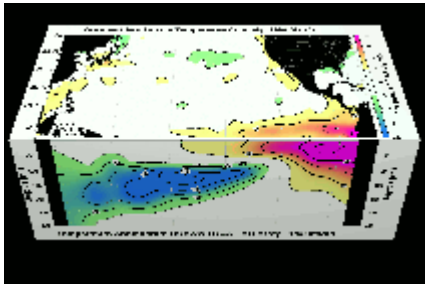
September 1997



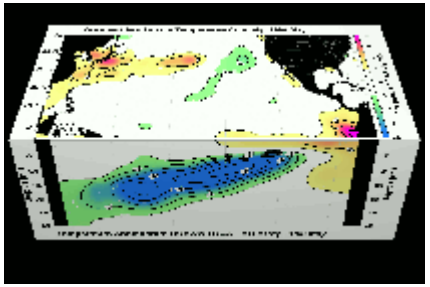
January 1998



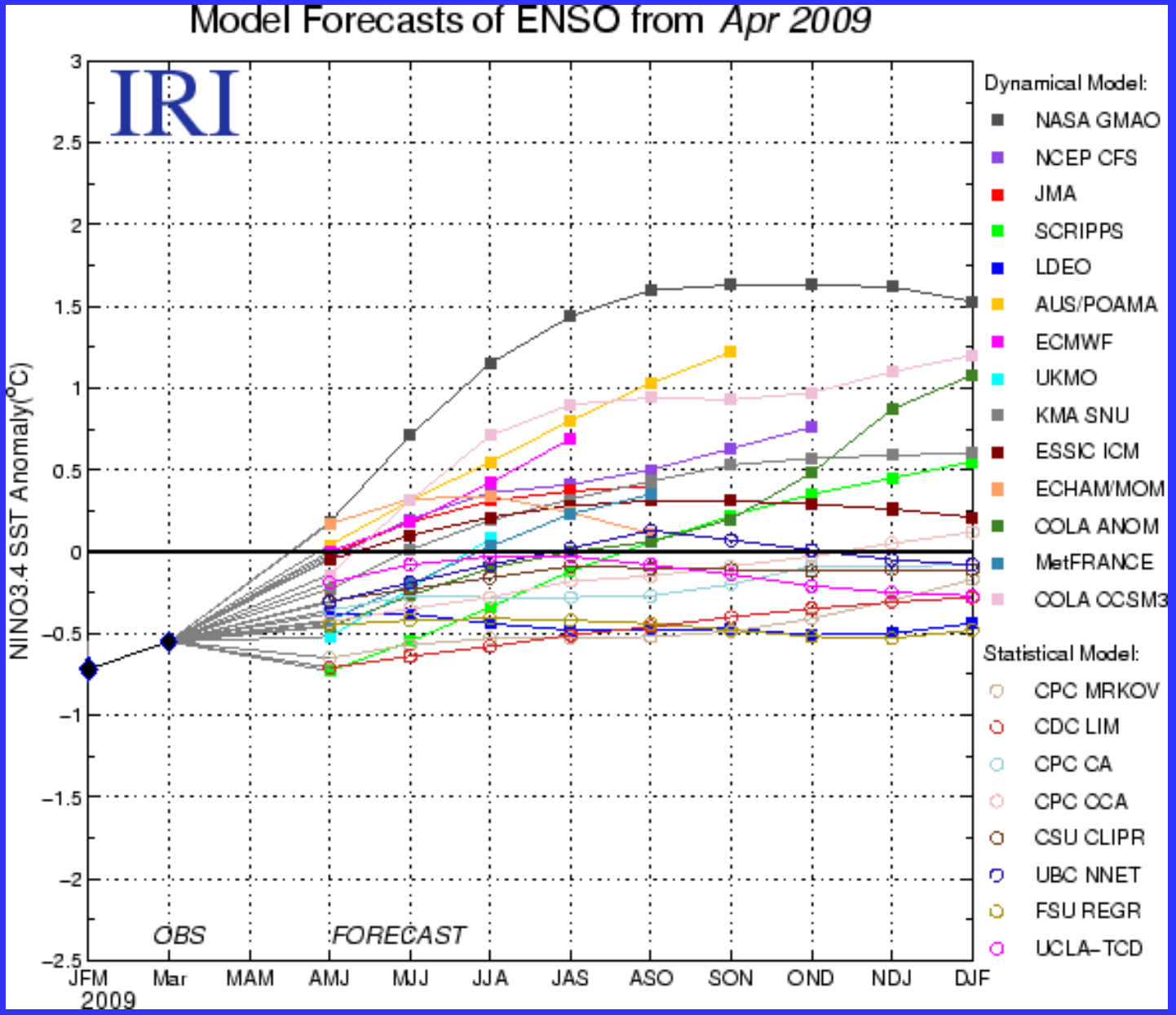
March 1998

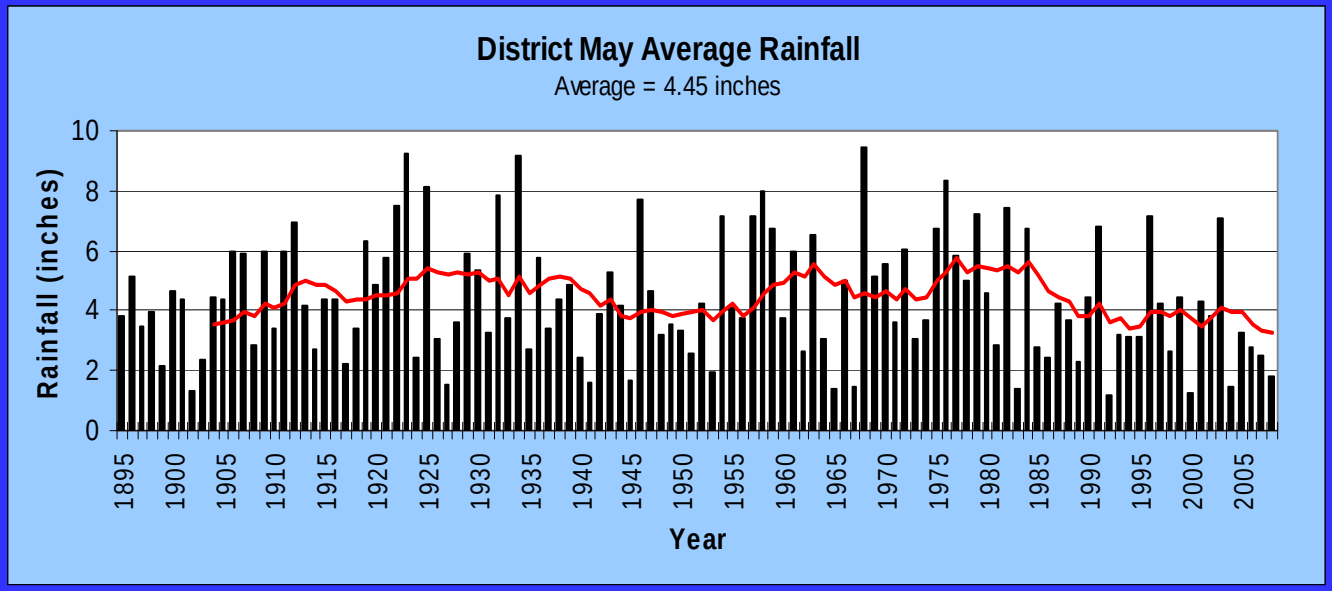


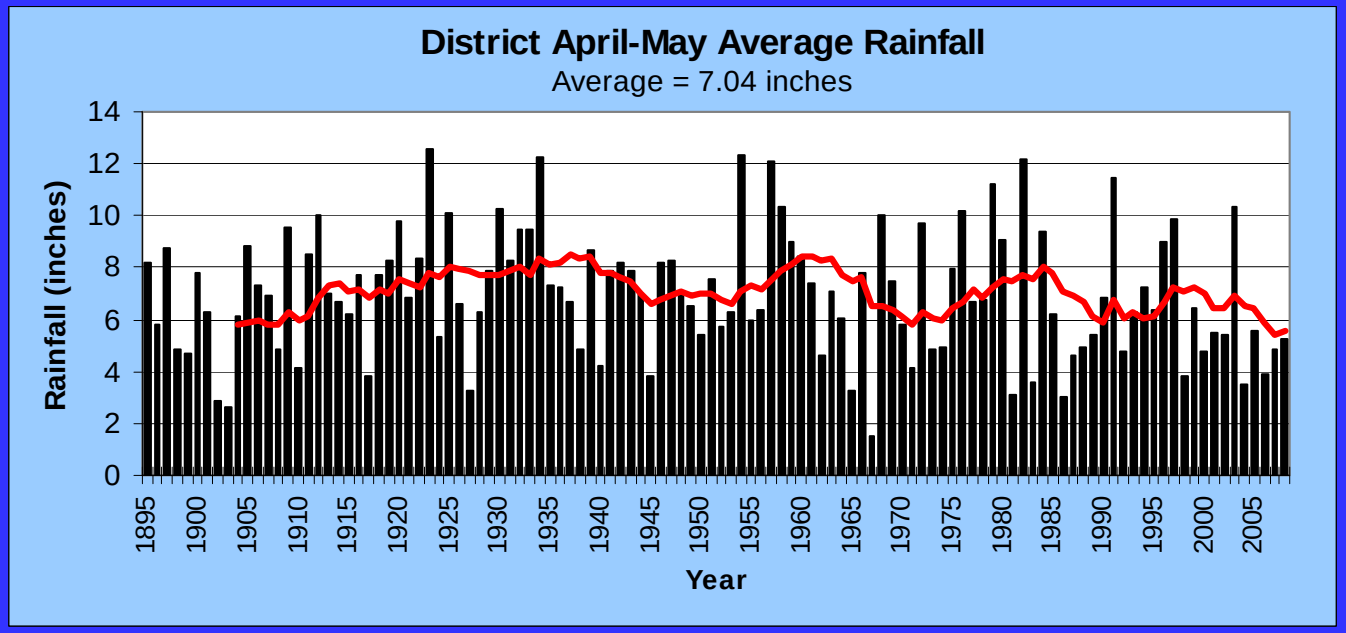
May 1998



➢http://meteora.ucsd.edu/~pierce/elnino/en97/en97.html

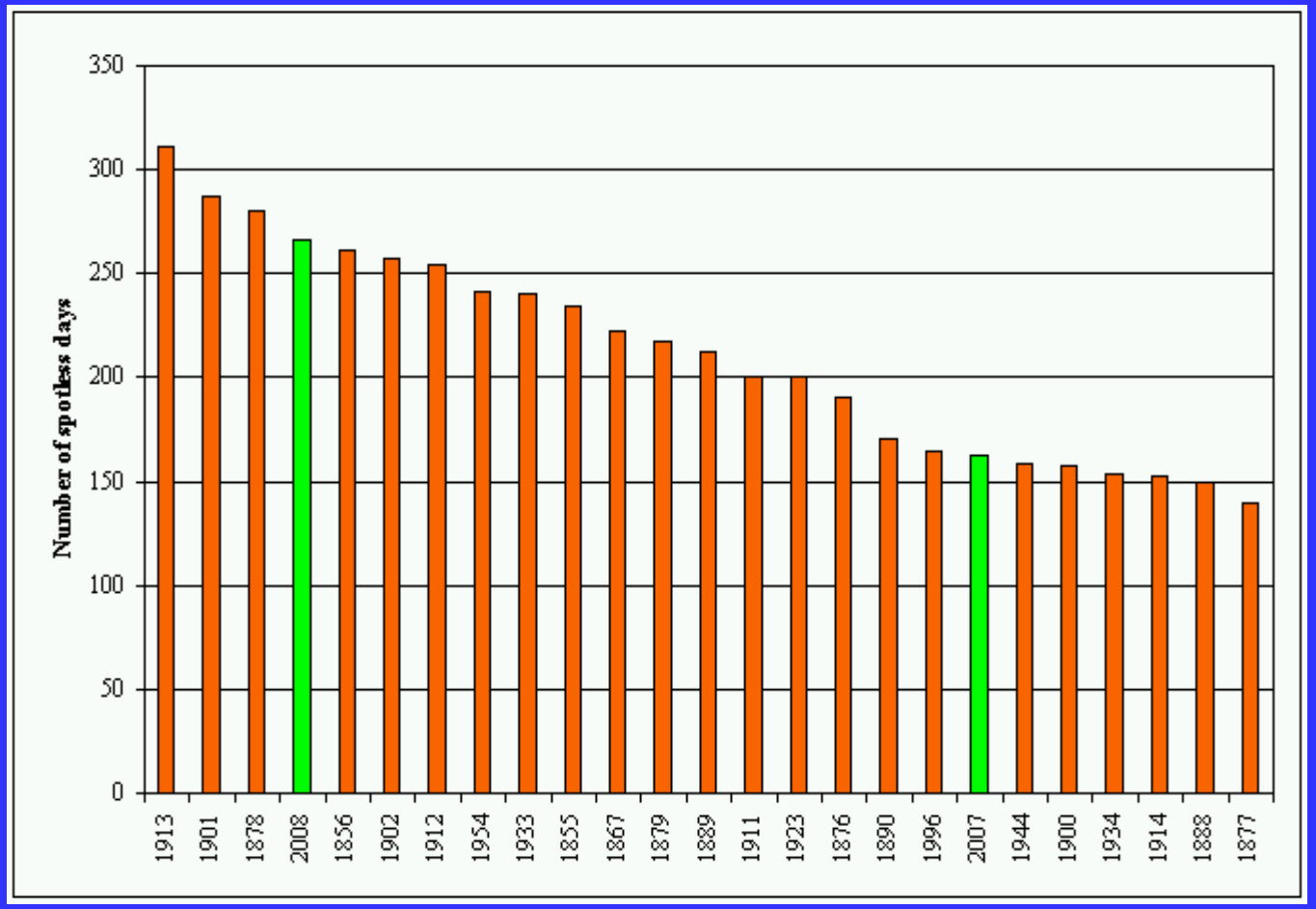

Model Forecasts of ENSO from Apr 2009
IRI
NINO3.4 SST Anomaly(°C)
3
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
OBS
FORECAST
JFM
2009
Mar
MAM
AMJ
MJJ
JJA
JAS
ASO
SON
OND
NDJ
DJF
Dynamical Model:
NASA GMAO
NCEP CFS
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
ESSIC ICM
ECHAM/MOM
COLA ANOM
MetFRANCE
COLA CCSM3
Statistical Model:
CPC MRKOV
CDC LIM
CPC CA
CPC OCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA–TCD


District May Average Rainfall
Average = 4.45 inches
Rainfall (inches)
0
2
4
6
8
10
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year


District April-May Average Rainfall
Average = 7.04 inches
Rainfall (inches)
0
2
4
6
8
10
12
14
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
Year

Ranked years with the most number of Spotless Days

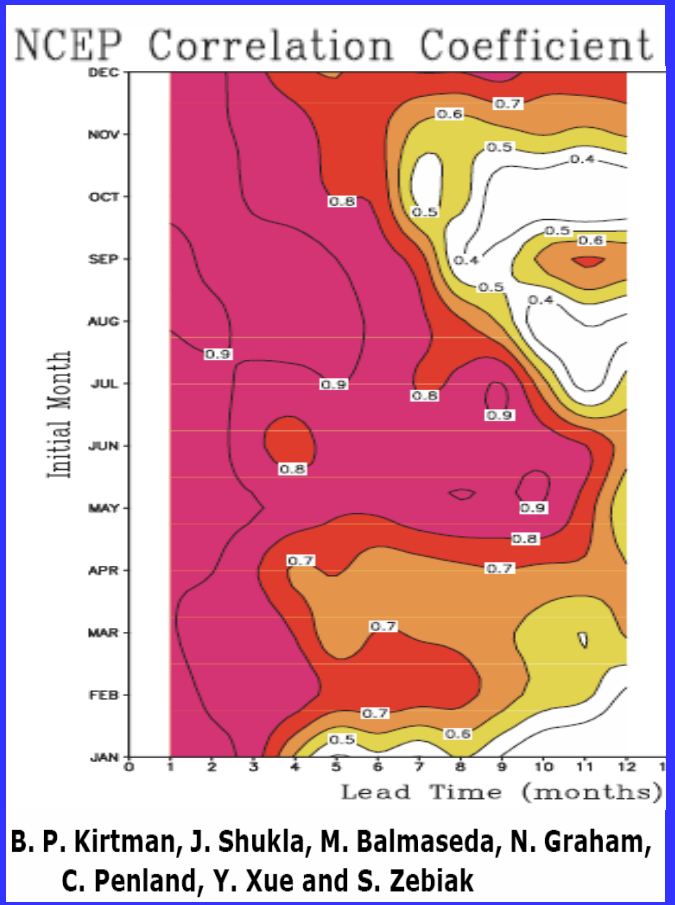
Period 1850-2008

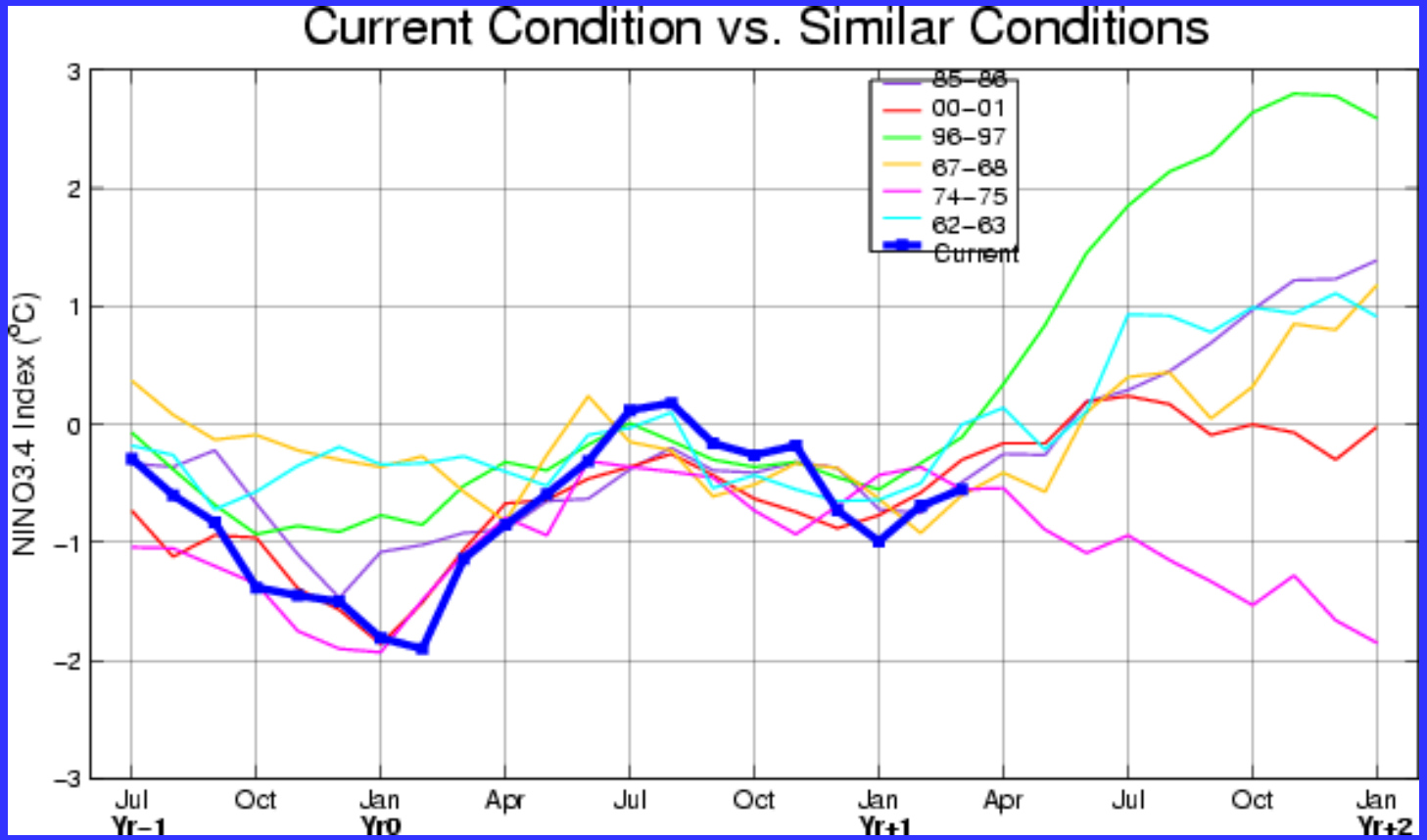


Spring Barrier with ENSO Forecasts

Forecasts skill as a function (month, lead time)

When predicting ENSO the challenge of the spring barrier has been well established over the years. Looking at the graphic, the y- axis indicates the month that the ENSO forecast is made and the x- axis is the lead time. It can be seen that skillful forecast with longer lead times occur starting in the month of May. In most cases when climate outlooks are made they are based on ENSO prediction initiated the previous month. So in the current case during the March Climate Outlook are based on ENSO predictions initiated on February 1st, while the latest April 1st are using March 1st Predictions. It can be seen in the graphic that skilled ENSO prediction skill for longer lead times doesn't increase until May. So expect that the ENSO predictions to improve as we approach summer with Climate outlook skills lagging one month. This is the advantage of the CFS Model as its forecasts are continually updated each day with the most data.




Current Condition vs. Similar Conditions
NINO3.4 Index (°C)
3
2
1
0
−1
−2
−3
Jul
Yr−1
Oct
Jan
Yr0
Apr
Jul
Oct
Jan
Yr+1
Apr
Jul
Oct
Jan
Yr+2
85−86
00−01
96−97
67−68
74−75
62−63
Current

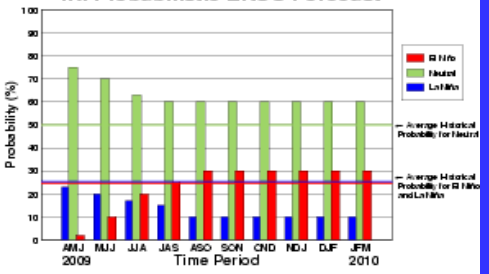
ENSO *QUICK LOOK* **Apr 15, 2009** **A monthly summary of the status of El Niño, La Niña and the Southern Oscillation, or "ENSO"**

The equatorial Pacific has returned to ENSO-neutral this month, after exhibiting weak La Niña conditions since December 2008. During the Apr-Jun season there is an approximately 75 percent probability of maintaining ENSO-neutral conditions, and that is predicted to be the most likely situation through the end of 2009 and into early 2010. The likelihood of returning to La Niña conditions remains below 25 percent probability.

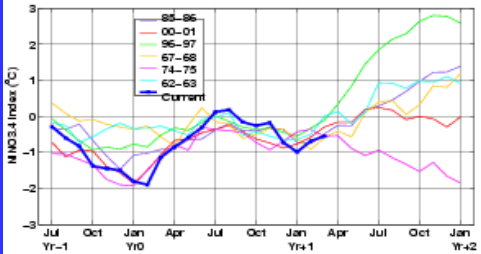
Current ENSO Forecast Summary[1]

Forecast Period:	Aug. 2009 – Oct. 2009
Probability of El Niño	0 50 100 low medium high
Probability of La Niña	0 50 100 low medium high
Probable Magnitude of Event	(not applicable)

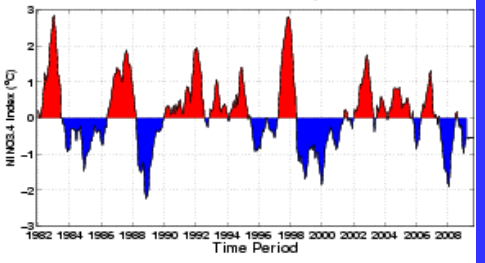
IRI Probabilistic ENSO Forecast[2]



Current Condition vs. Similar Conditions[2]



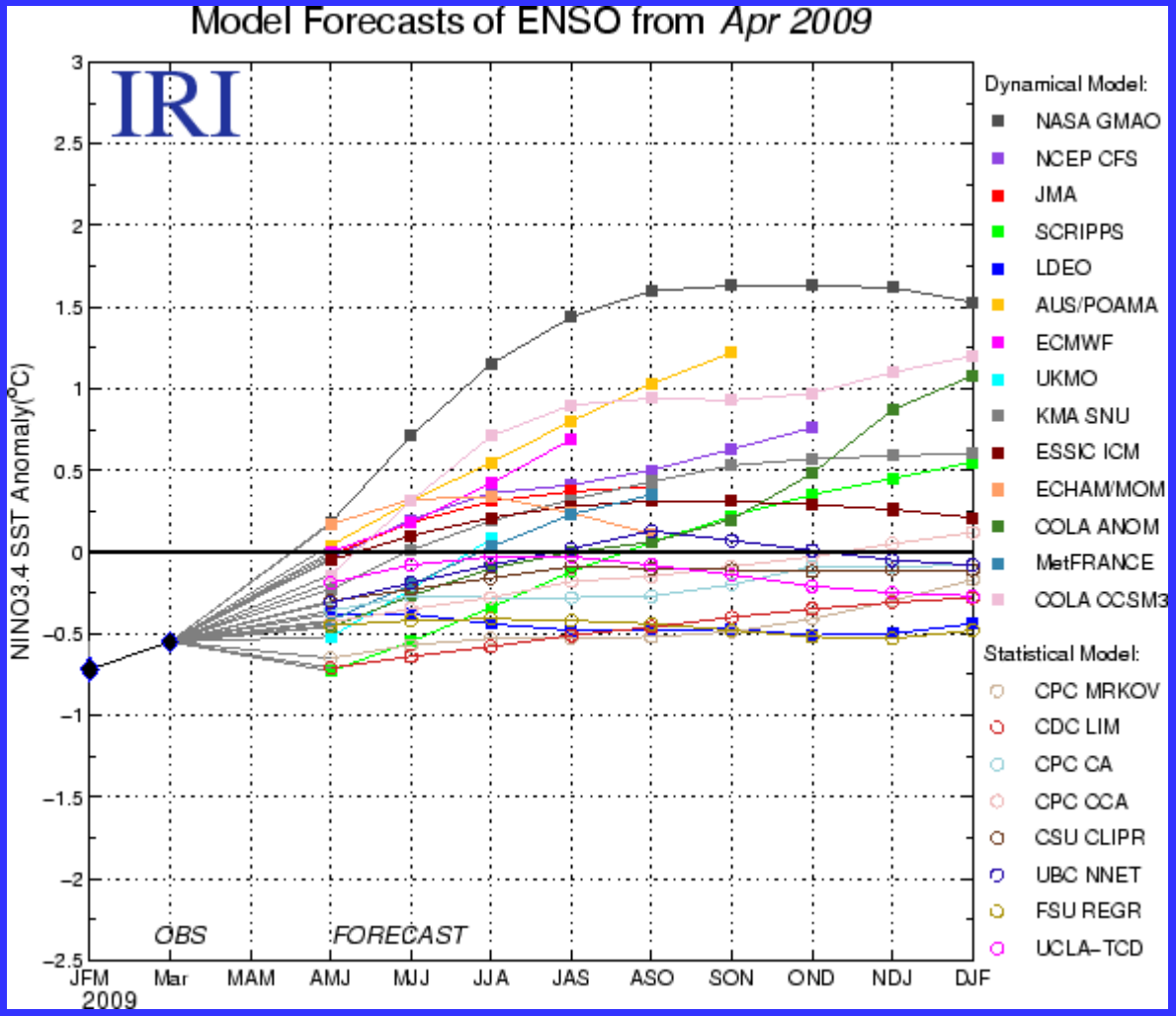
Historical Sea Surface Temperature Index[2]



Historically Speaking

El Niño and La Niña events tend to develop during the period Apr-Jun and they:
- *Tend to reach their maximum strength during Dec-Feb*
- *Typically persist for 9-12 months, though occasionally persisting for up to 2 years*
- *Typically recur every 2 to 7 years*

[1]Probability of an El Niño refers to the likelihood of a sustained (that is, over several seasons) warming across a broad region of the eastern and central tropical Pacific, not just along coastal South America.
[2]Based on sea surface temperature departures from the long-term average over the 'NINO3.4' region (120-170W, 5S-5N).


Model Forecasts of ENSO from Apr 2009
IRI
NINO3.4 SST Anomaly(°C)
3
2.5
2
1.5
1
0.5
0
−0.5
−1
−1.5
−2
−2.5
OBS
FORECAST
JFM
2009
Mar
MAM
AMJ
MJJ
JJA
JAS
ASO
SON
OND
NDJ
DJF
Dynamical Model:
NASA GMAO
NCEP CFS
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
ESSIC ICM
ECHAM/MOM
COLA ANOM
MetFRANCE
COLA CCSM3
Statistical Model:
CPC MRKOV
CDC LIM
CPC CA
CPC CCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA–TCD