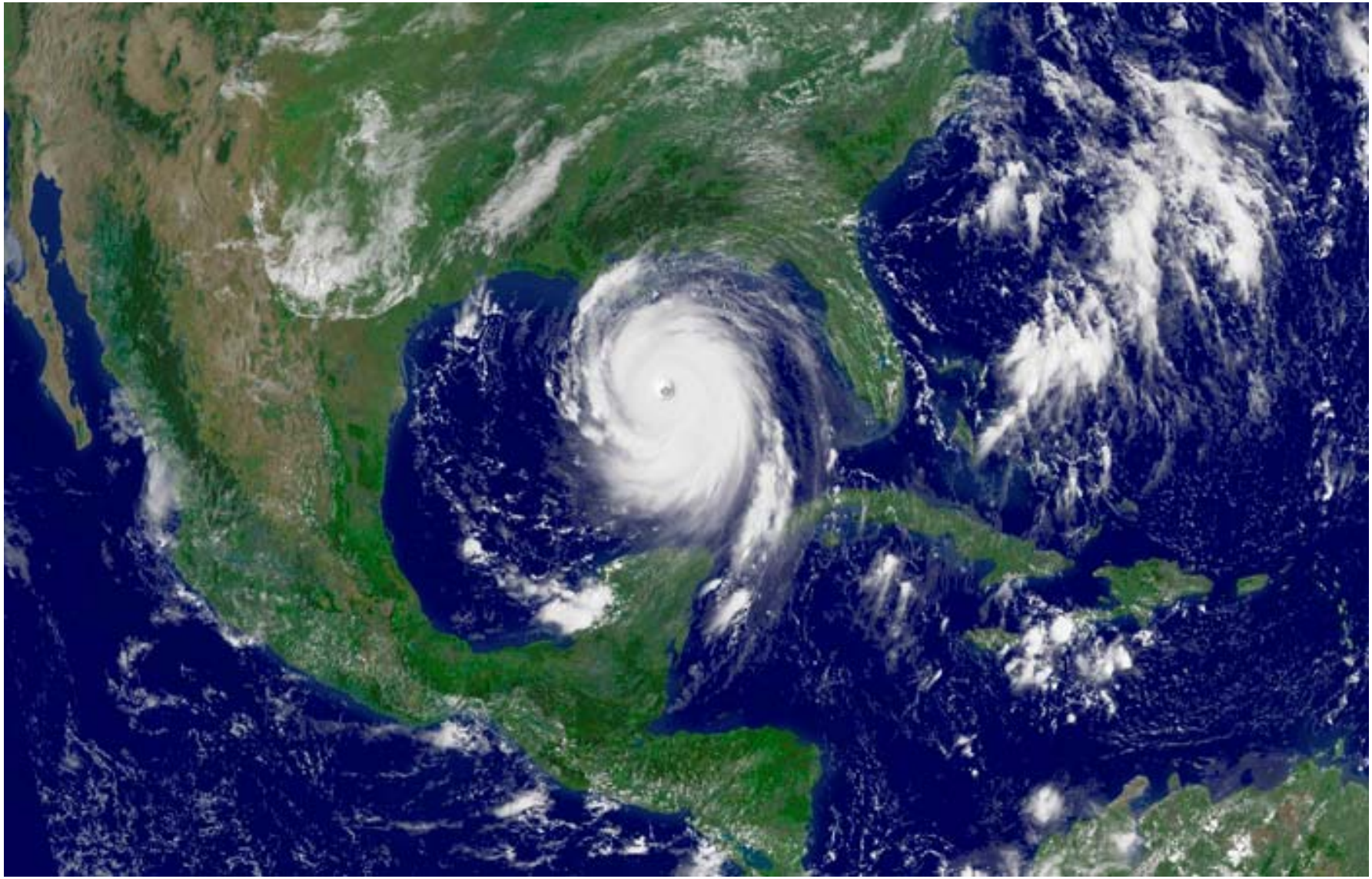
Hurricanes, CO_2-Global Warming, and the Sun

Willie Soon

The views expressed are solely of the author and do not represent those of any institution with which the author is affiliated.



Hurricane Katrina August 28, 2005 at 11:45 a.m. EDT (Photo credits: NOAA)

"Events such as Hurricane Katrina and other high-impact TCs of recent years have naturally raised a lot of questions about TCs and climate change. The main conclusion we [WMO Tropical Meteorology Research Program Panel]† came to was that none of these high-impact tropical cyclones could be specifically attributed to global warming. Whilst there is no conclusive evidence that climate is affecting the frequency of TCs worldwide, there is an ongoing debate as to whether it is affecting their intensity." – Julian Heming in UK Met Office's February 20, 2006 press release

†members of the WMO panel include: Julian Heming, Johnny Chan, Kerry Emanuel, Greg Holland, Chris Landsea, Tom Knutson, Hugh Willoughby, John McBride, Jeff Kepert

What were said about hurricane frequency and intensity and what we really do know: A de-confusion guide

Hurricane frequency: We really do not know anything about frequency of occurrence and its probable future under CO_2 forcing.

Facts: We have evidence for multidecadal modulation of intense (categories 3-4-5) Atlantic hurricanes. Also, the most robust expectation of a CO_2-warmed world is a decrease in global frequency of tropical storms and hurricanes.

Hurricane intensity: We can expect an increase in the maximum intensity of hurricane under the CO_2-global warming scenario (based on maximum potential theory).

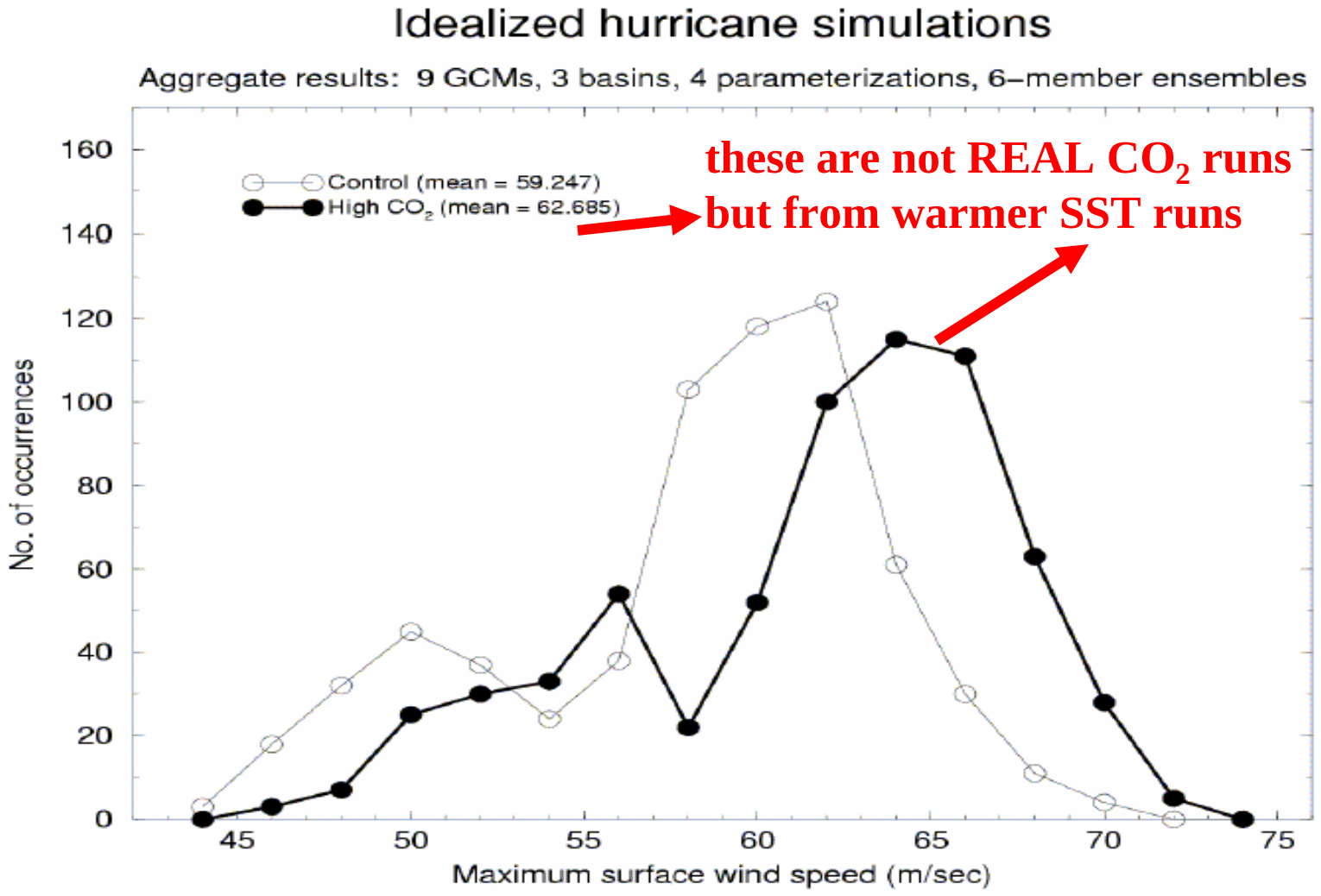
Facts: Simulations of maximum intensity of TCs, even as individual entity, require grid resolution as small as 1 km or better and therefore currently not so reliably produced by models. Also, the expected small increase (a few percent in maximum wind speed) is hard to detect in the real world.

Why is such a predicted increase in intensity of hurricanes, based on case-study of artificially-seeded vortices, unreliable?

(Knutson and Tuleya, 2004, Journal of Climate, vol. 17, 3477-3495)

From June 20, 2005 presentation by Tom Knutson sponsored by AMS

Maximum surface wind speeds:

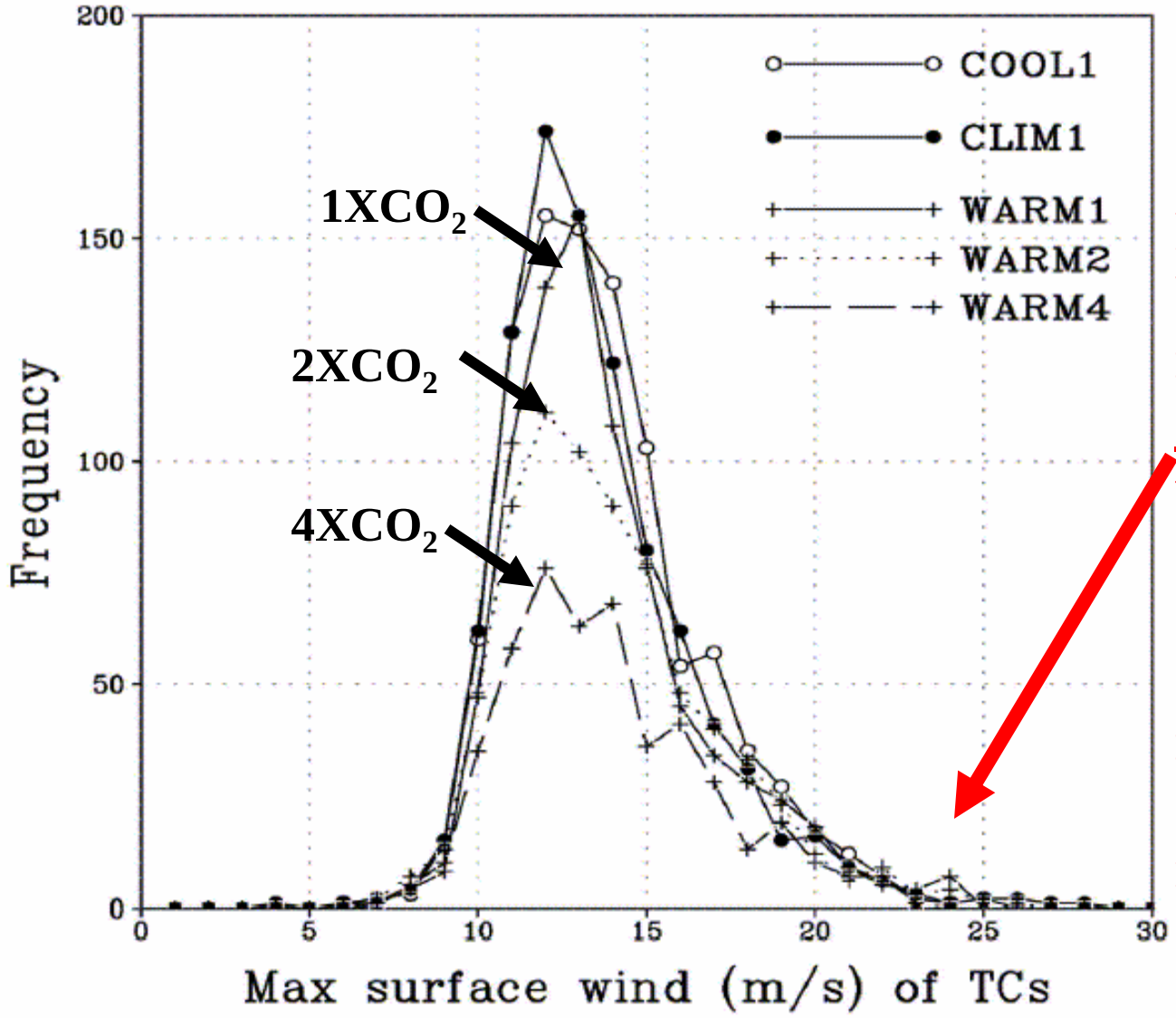


Tue Aug 5 14:51:19 2003

Note: Maximum instantaneous surface wind speed, average of the day 5 values.

“From our standpoint, the small 0.9 degree Fahrenheit [or about 0.4°C] warming observed in the Atlantic since 1900 implies only a 2-3 miles per hour intensity increase to date. Such a small increase is hard to detect. It is difficult to attribute the upswing in strong hurricane activity this past season to global warming. Season-to-season variability is very large”—Robert Tuleya, hurricane expert and developer of the Princeton’s GFDL hurricane model, also co-author of Knutson and Tuleya (2004) in Old Dominion University’s newsletter QUEST Fall 2005

No clear shift or increase in the intensity of tropical cyclones as CO_2 increases or as sea surface temperature warms significantly



Although intensity of TCs is not adequately calculated in such a high-resolution (110 km grid) global model, the lack of shift or increase in the maximum wind speed in the simulated TCs clearly contradict results shown in the case-study-based model of Knutson and colleagues

Yoshimura and Sugi (2005) SOLA, vol. 1, 133-136; Yoshmura et al. (2006) Journal of the Meteorological Society of Japan, in press

What are the current states of understanding and modeling of tropical cyclones and hurricanes?

- both global-scale and case-study-regional-scale models are used
- global characteristics of TCs can be studied only with very high-resolution GCMs (100 to 20-km)
- global frequency of TCs, under various forcing scenarios, can be reasonably calculated mainly because of the fundamental constraint by large-scale circulation
- simulations of maximum intensity of TCs, even as individual entity, require grid resolution as small as 1 km or better and therefore currently not so reliably produced by models contradicting common claims
- **multiple remote and *in-situ* factors like ENSO+QBO+vertical+meridional wind shears and temperatures, other than forcing by CO_2, predominate**

Number of tropical storms

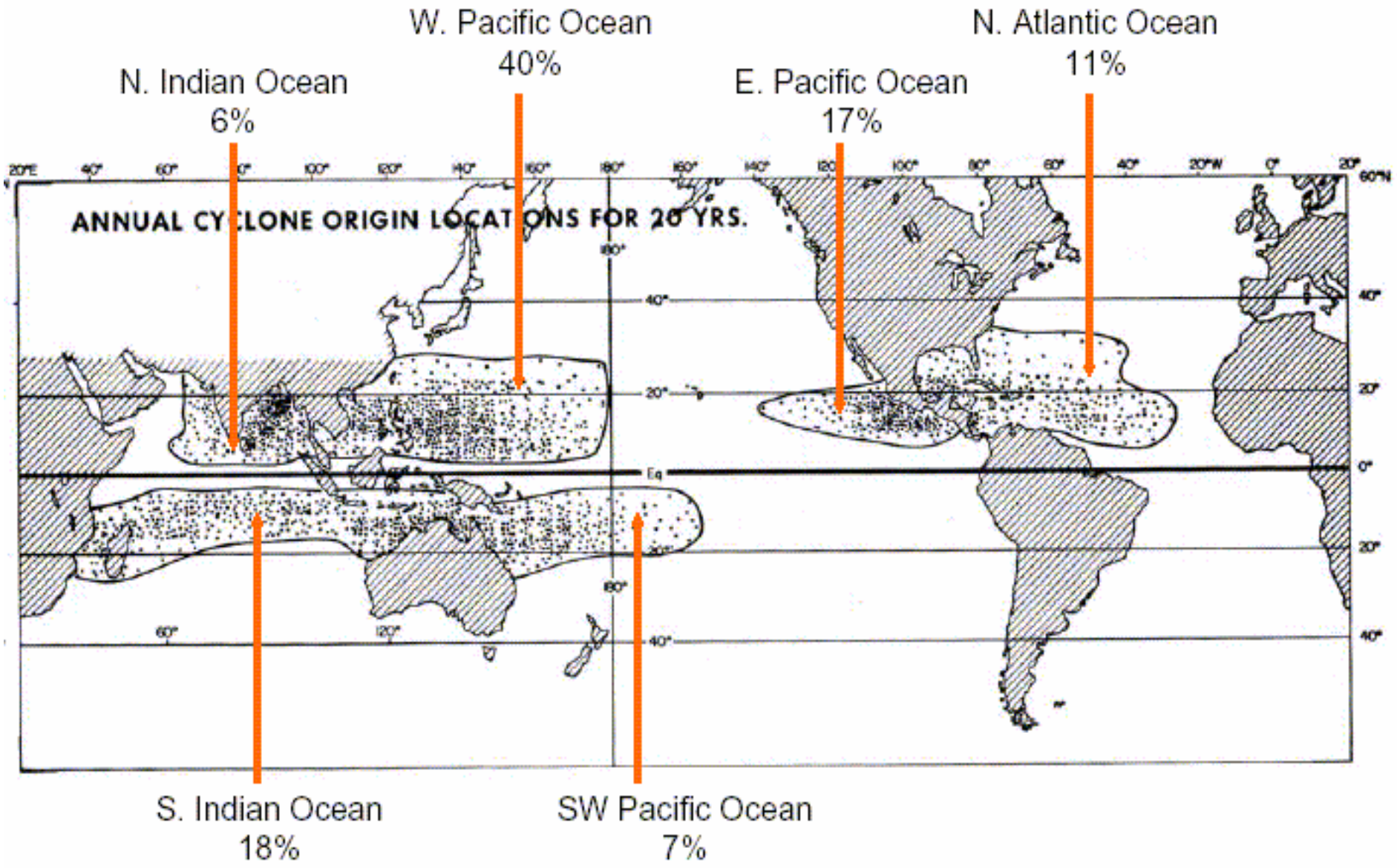


chart adopted from J. Curry's October 25, 2005 presentation at an AMS briefing

Power Dissipation by Atlantic Hurricanes Has Doubled Over the Past 30 Years

chart shown in the February 2006's talk, "Legislation to Balance Energy Policy and Climate Policy: Need and Prospects", by Robert M. Simon, Democratic Staff Director, Senate Committee on Energy and Natural Resources

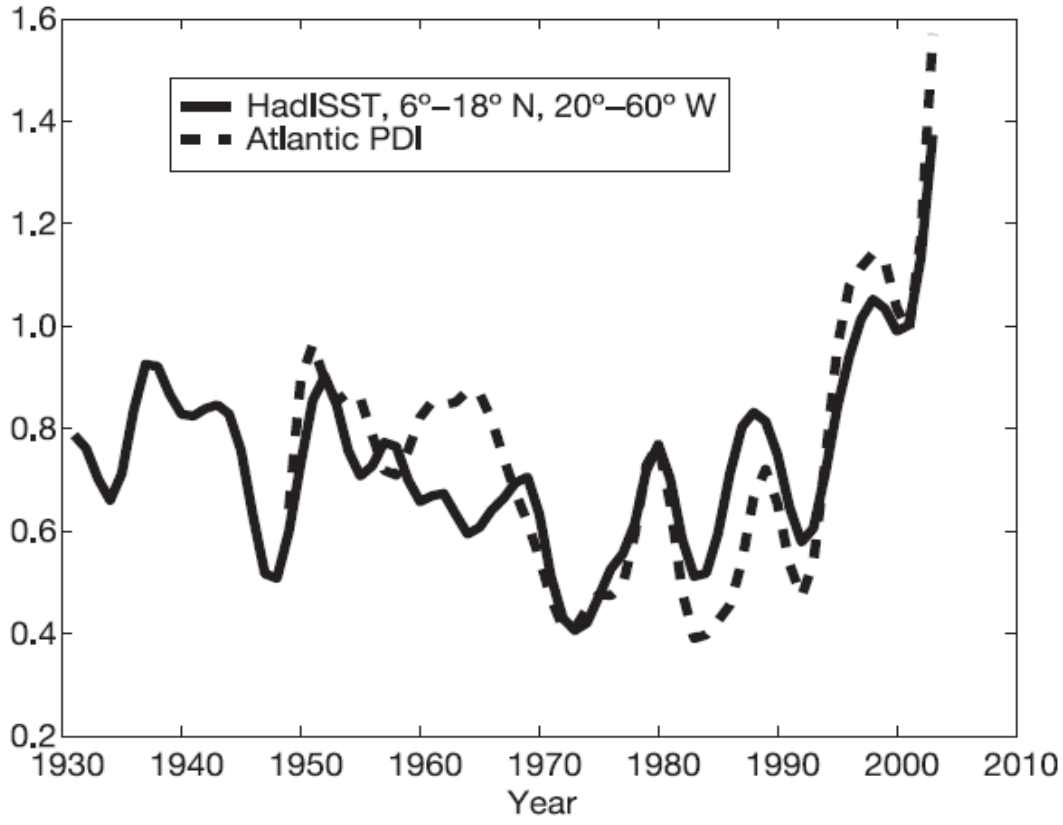
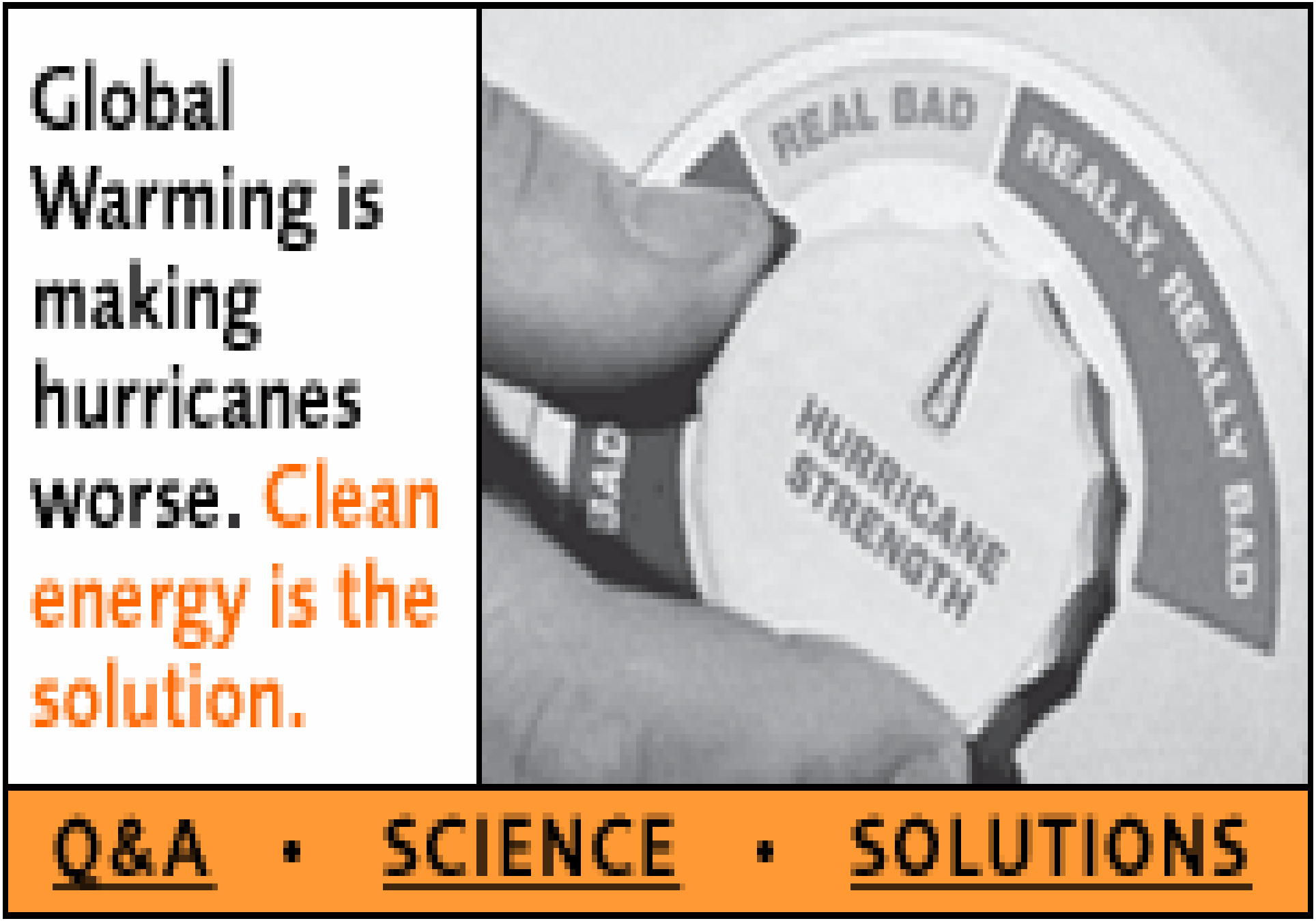


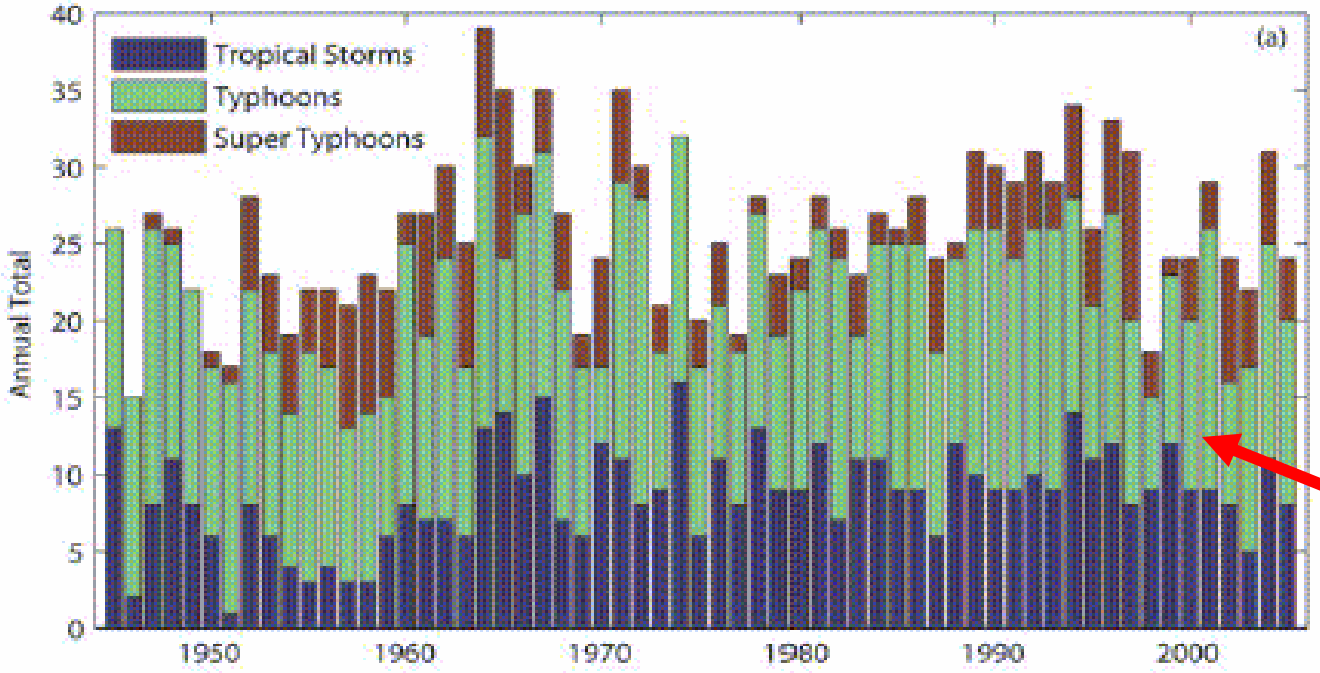
Figure 1 | A measure of the total power dissipated annually by tropical cyclones in the North Atlantic (the power dissipation index, PDI) compared to September sea surface temperature (SST). The PDI has been multiplied by 2.1×10^{-12} and the SST, obtained from the Hadley Centre Sea Ice and SST data set (HadISST)[22], is averaged over a box bounded in latitude by 6° N and 18° N, and in longitude by 20° W and 60° W. Both quantities have been smoothed twice using equation (3), and a constant offset has been added to the temperature data for ease of comparison. Note that total Atlantic hurricane power dissipation has more than doubled in the past 30 yr.

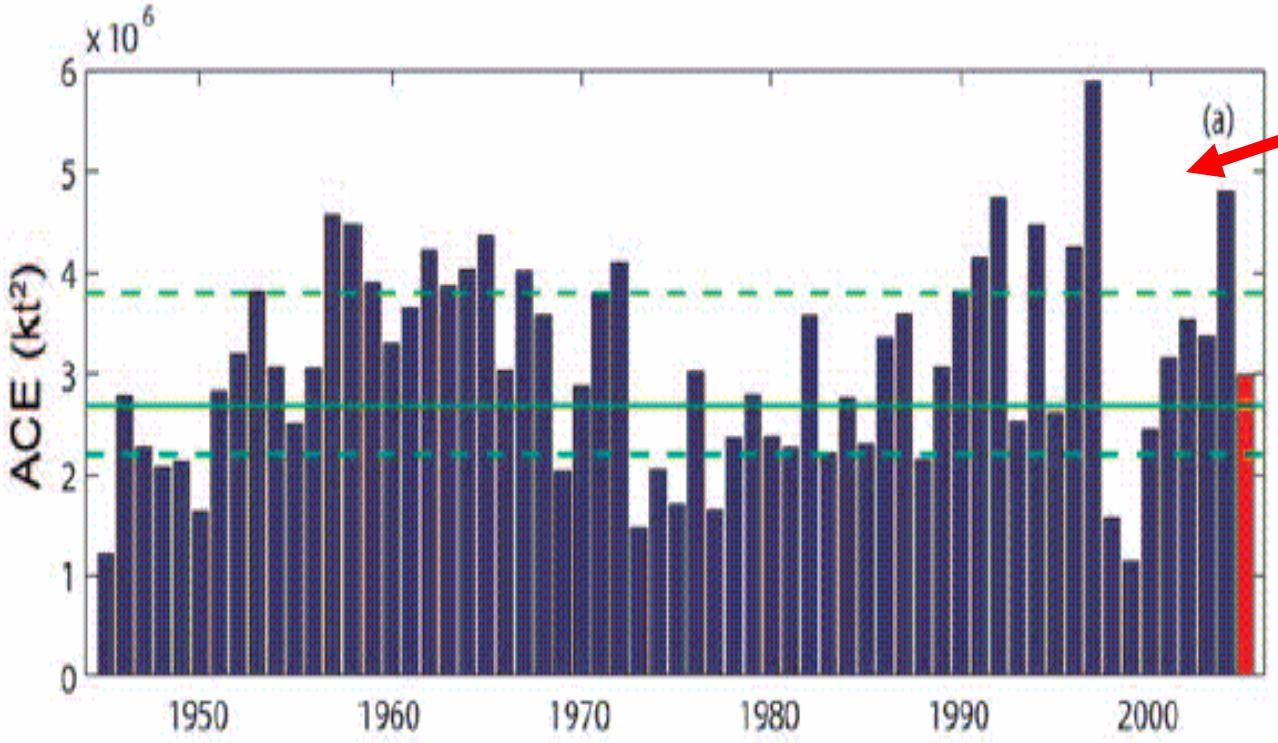
His paper has a fantastic impact on the policy debate. Emanuel's this conservative, apolitical guy, and he's saying, "Global warming is real."

– Stephen H. Schneider, in January 10, 2006's NY Times article by Claudia Dreifus



From Roger Pielke Jr.'s March 22, 2006 posting on his blog Prometheus

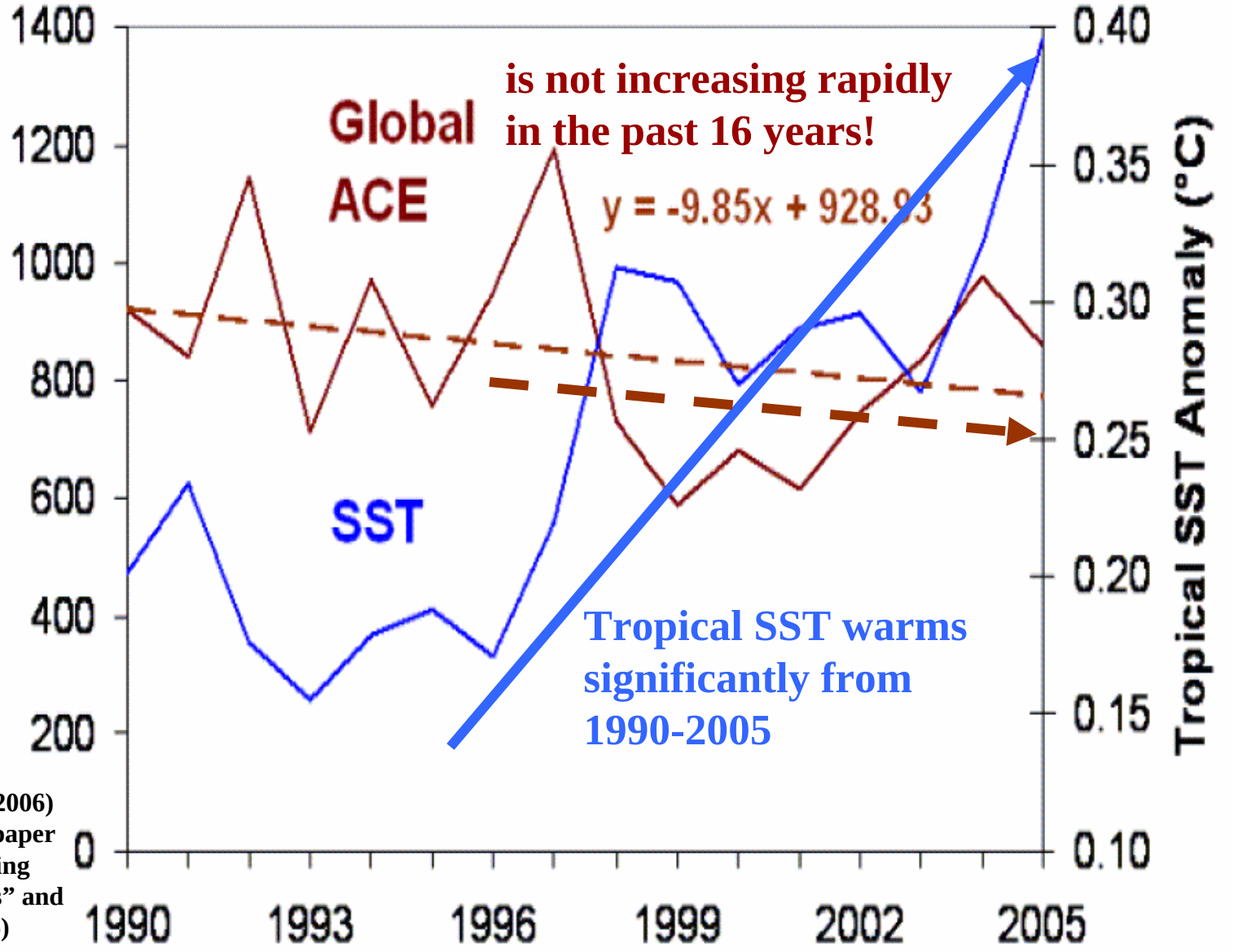




Nothing exceptional nor alarming in the numbers of TCs, typhoons, super typhoons or the energetics of the TCs occurred in Western North Pacific basin in recent years

Camargo (2006) BAMS, vol. 87, S39-S40

The global intensity and longevity of tropical cyclones, averaged over all ocean basins (global ACE), is definitely not increasing rapidly as the tropical SST warms dramatically in the past 16 years



Source: Gray (2006) AMS April 06 paper "Global Warming and Hurricanes" and Klozbach (2006) GRL, in press

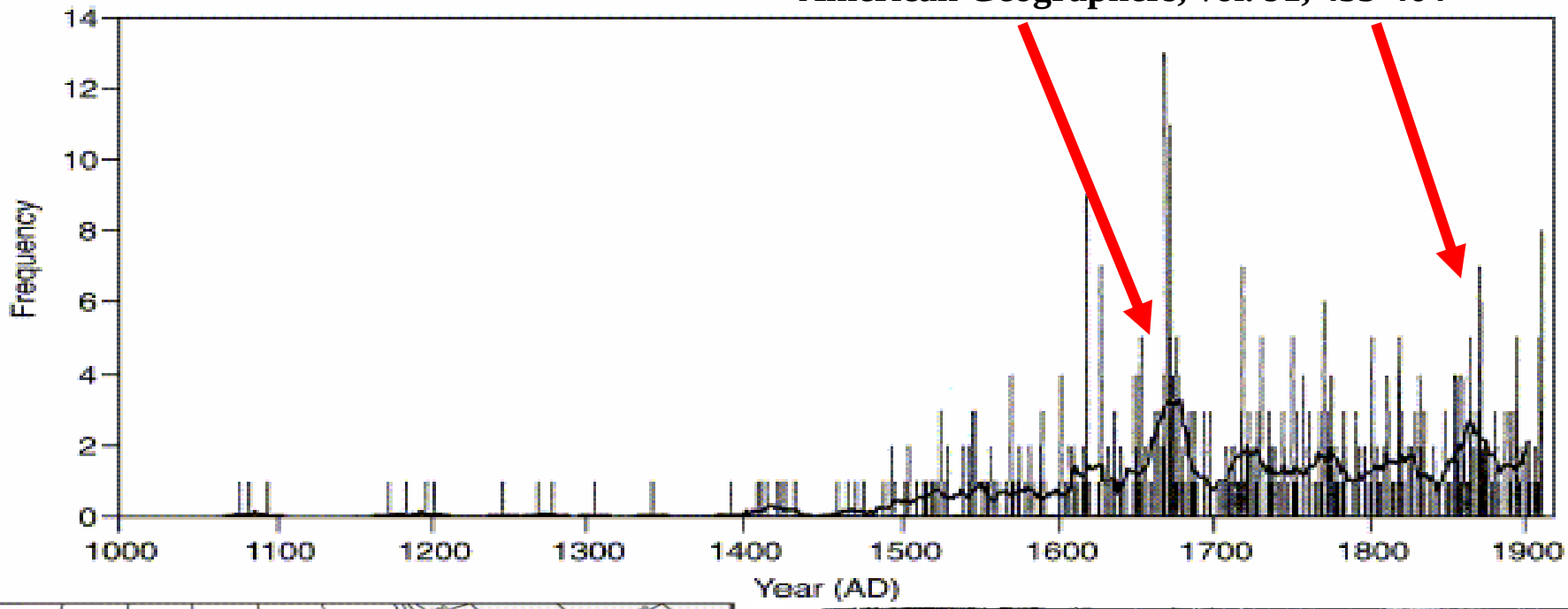
Begging for more emotions in climate science ???

"Forecasts of the AMO [Knight et al., 2005] and other Atlantic variability [Molinari and Mestas-Nunez, 2003] also indicate that future SSTs in the critical region [Atlantic hurricane MDR region] will not go up remorselessly, as variability will continue." – Trenberth and Shea (2006)

(in the concluding paragraph of Trenberth and Shea, 2006, June 27's Geophysical Research Letters, vol. 33, 2006GL026894)

“Remarkably, the two periods of most frequent typhoon strikes in Guangdong (AD 1660-1680, 1850-1880) [Southern China] coincide with two of the coldest and driest periods in northern and central China during Little Ice Age”

Liu et al. (2001) Annals of the Association of American Geographers, vol. 91, 453-464



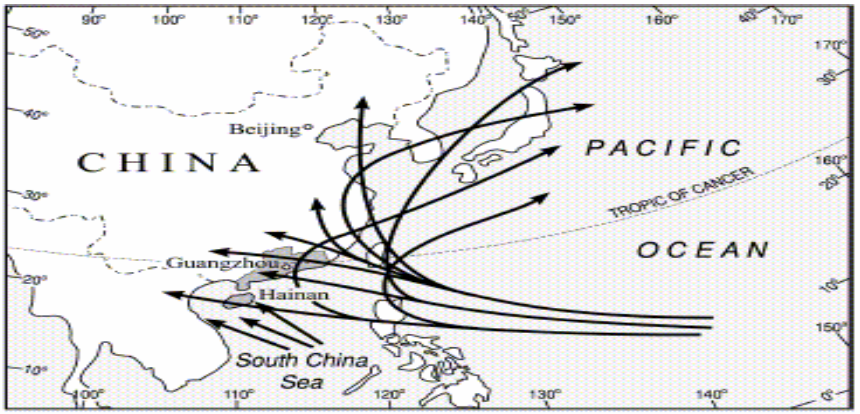
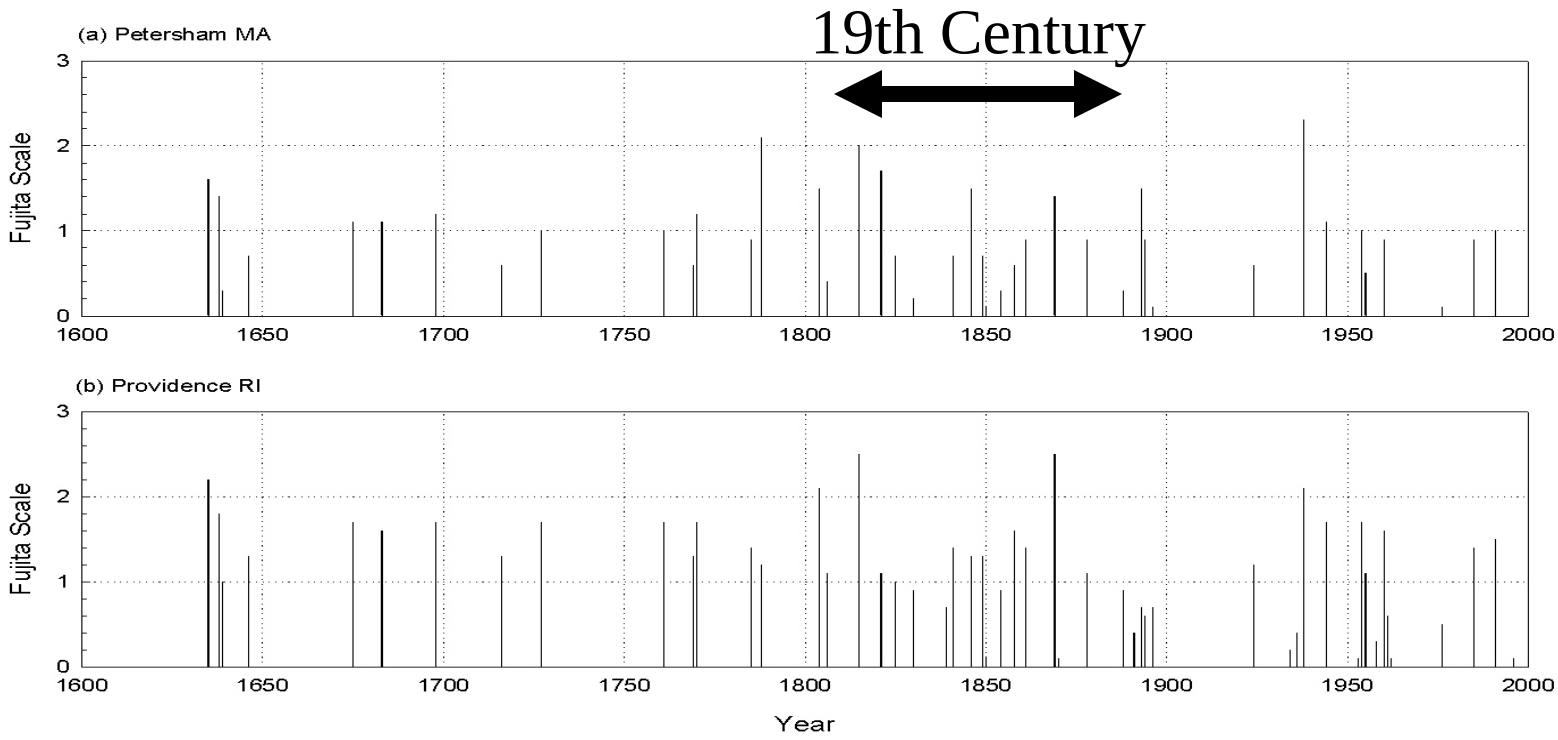


Figure 2. A page from the “Official History” of the Song dynasty (*Song Shi*, chapter 67), containing a record of a typhoon strike in AD 975 (highlighted section). At least four other typhoon strikes at different locations are also recorded on this page.

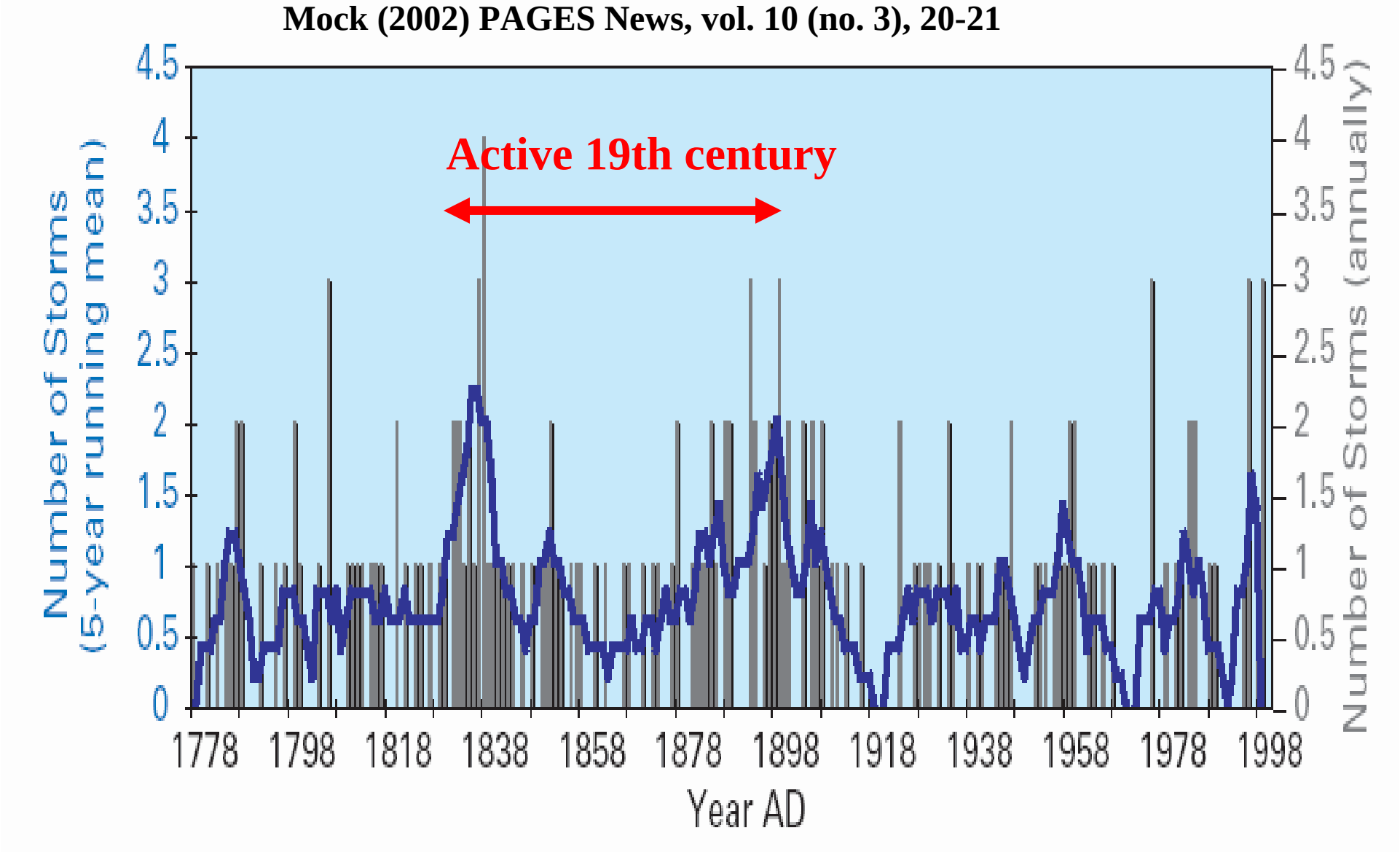
Historical Impacts of Hurricanes in New England: 1620-1997
19th century was the most hurricane-active period



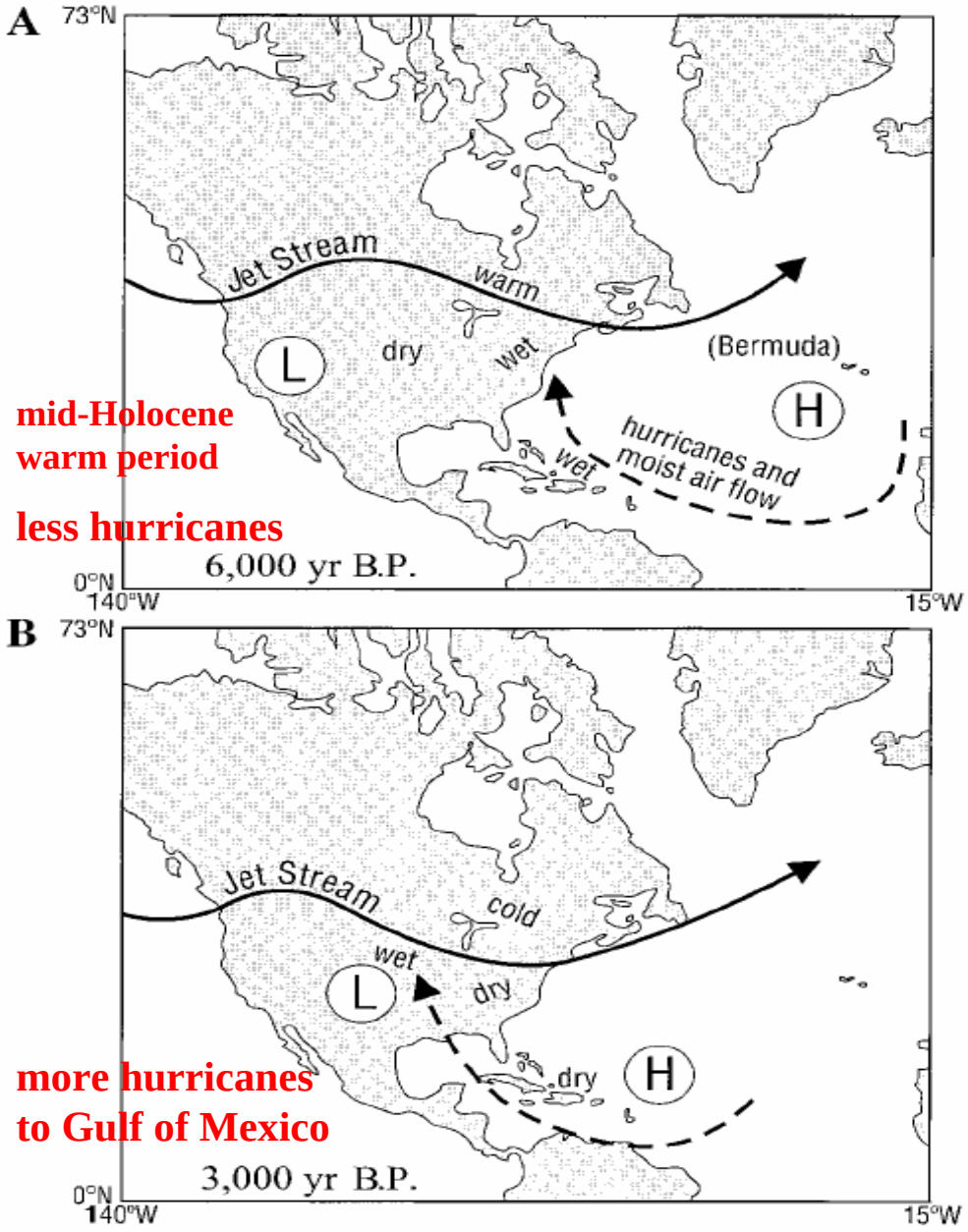
Boose et al. (2001) Ecological Monograph, vol. 71, 27-48

Tropical cyclones impacting Charleston, South Carolina are particular active during 19 century: Mean recurrence of once every 1.3 years for 1780-1870 versus once every 1.8 years for 1870-2000

Mock (2002) PAGES News, vol. 10 (no. 3), 20-21



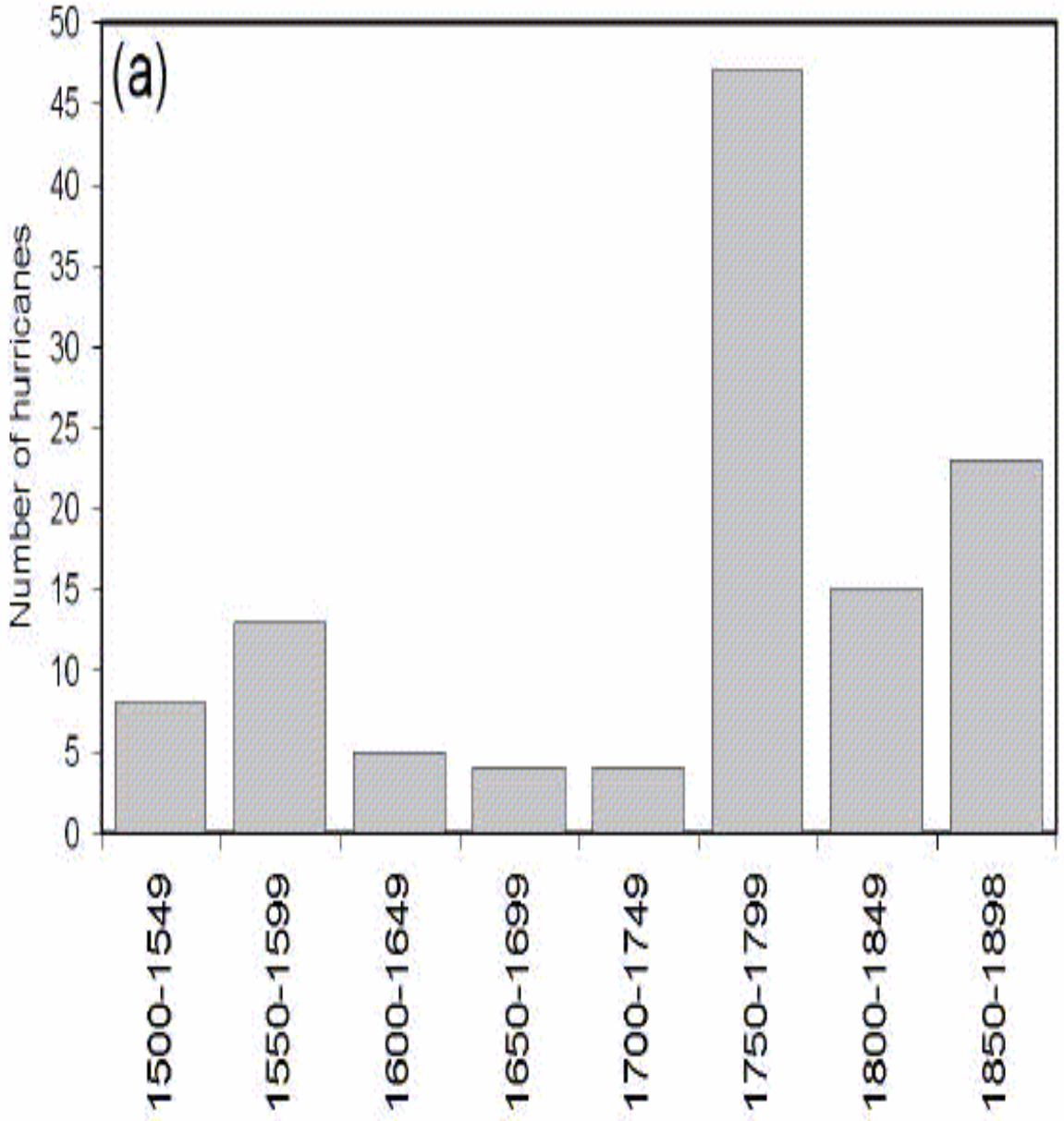
"Hyperactive" Gulf Coast Landfalling Hurricane Period (with 5 times higher probability than present) during relatively cool period, 1000-3400 ^{14}C B.P.



"No catastrophic hurricane of category 4 or 5 intensity has made landfall in the Western Lake area during the last 130 yr of documentary record, but the sediment stratigraphic data suggest that 12 such hurricanes directly struck Western Lake during the past 3400 yr, yielding a long-term frequency of approximately one hurricane every 280 yr. Therefore, the Florida Panhandle on average has a 0.36% probability of being struck by a catastrophic hurricane of category 4 or 5 intensity in any particular year. More importantly, the Western Lake record reveals that significant variability in landfall probabilities occurs at the millennial timescale. During the past 5000 yr, the frequency of catastrophic hurricane landfalls on the northeastern Gulf Coast was low between 3400 and 5000 ^{14}C yr B.P. and since 1000 ^{14}C yr B.P., but increased dramatically between 1000 and 3400 ^{14}C yr B.P. During the 'hyperactive' period of 1000-3400 ^{14}C yr B.P., especially in the first millennium A.D. (ca. 1000-2000 ^{14}C yr B.P.), catastrophic hurricanes directly struck the Western Lake area about five times per 1000 yr, hence with a landfall probability of ca. 0.5% per yr. By contrast, the annual landfall probability for the recent, more quiescent, millenium is only about 0.1%."

Liu and Fearn (2000) Quaternary Research, vol. 54, 238-245

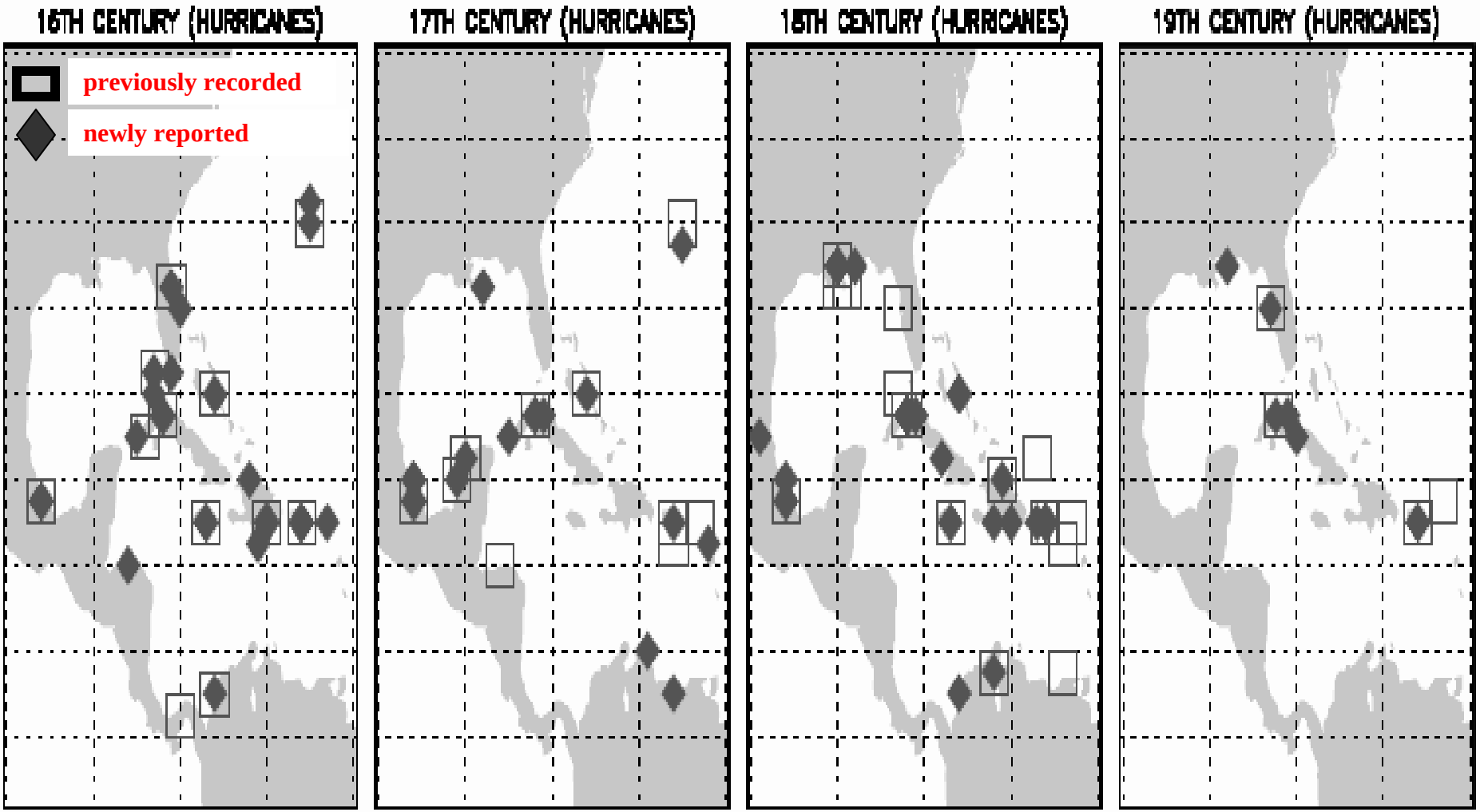
Newly re-discovered incidences of Atlantic hurricanes from Spanish (and British) documentary sources



"Spanish historical documents from the Archivo General de Indias have been used to identify Caribbean hurricanes and storms from 16th to 19th centuries. ... Our works adds 70 hurricanes not previously identified ... The results suggests that the 17th century may have been less active than 16th and 18th centuries, with the most active period occurring between 1766 and 1780."

Garcia-Herrera et al. (2005) Journal of Geophysical Research, vol. 110, 2004JD005272 + Garcia-Herrera et al. (2004)

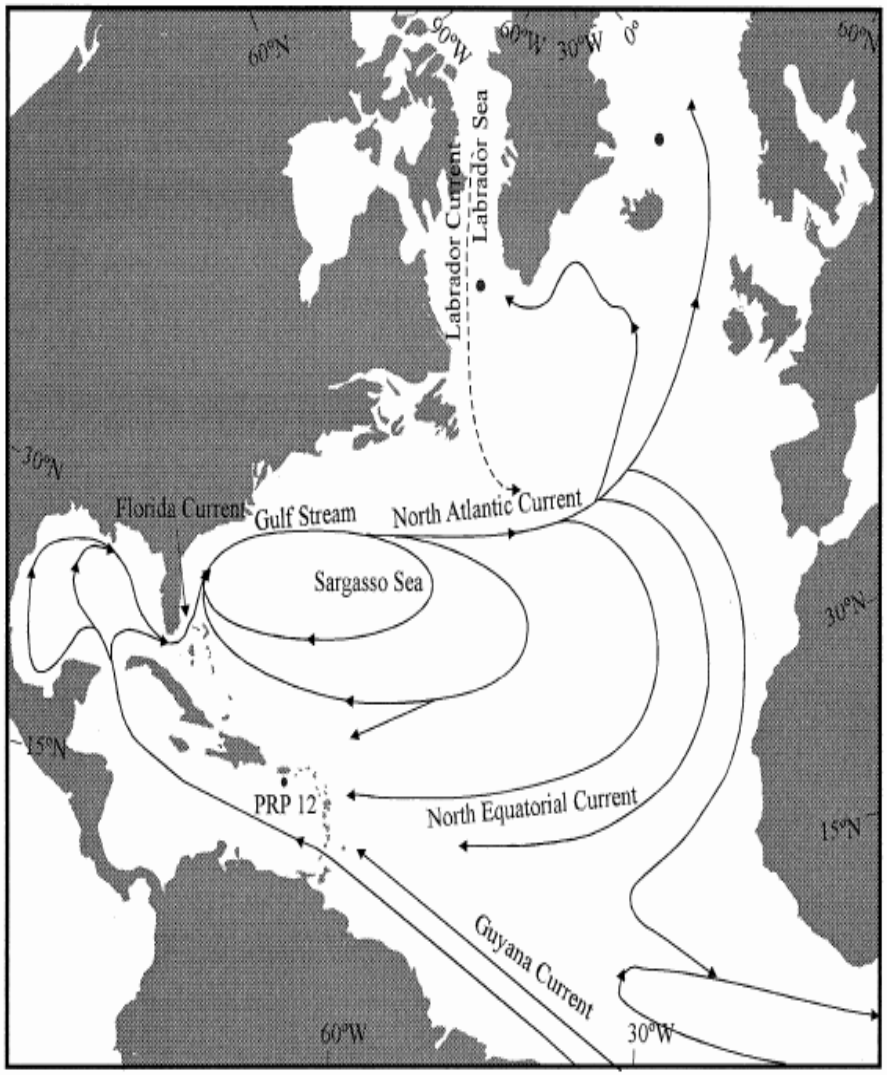
Newly re-discovered incidences of Caribbean hurricanes from Spanish documentary sources including 5 hurricanes affected New Orleans area for (1) Aug. 18, 1789, (2) 1793, (3) Aug. 10-11, 1794, (4) July 20, 1795, (5) Aug. 26-27, 1796, and 2 additional hurricanes affected (6) Mobile Alabama on Aug. 15-16, 1801 and (7) Pensacola Bay, Florida on Oct. 11, 1811

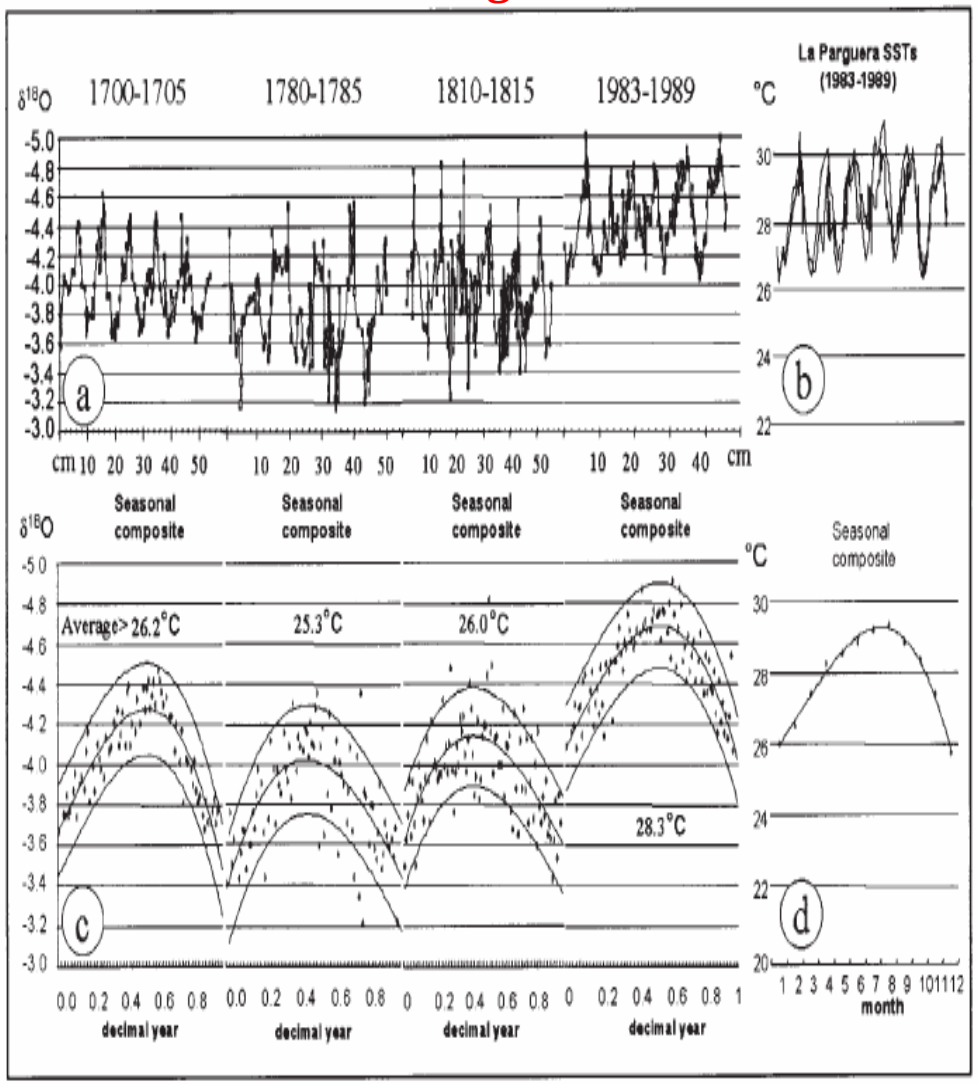


Garcia-Herrera et al. (2005) Journal of Geophysical Research, vol. 110, 2004JD005272 + Garcia-Herrera et al. (2004)

Two key factors explaining the relatively active hurricane period in the last-half of the 18th century: (1) no moderate, strong or very strong El Nino 1762-1776 and (2) OVERALL cool period with pulses of warm peaks?

Coral-isotope records from SW Puerto Rico shown that SST from 1780-1785 is nearly 2-3°C cooler than during 1983-1989

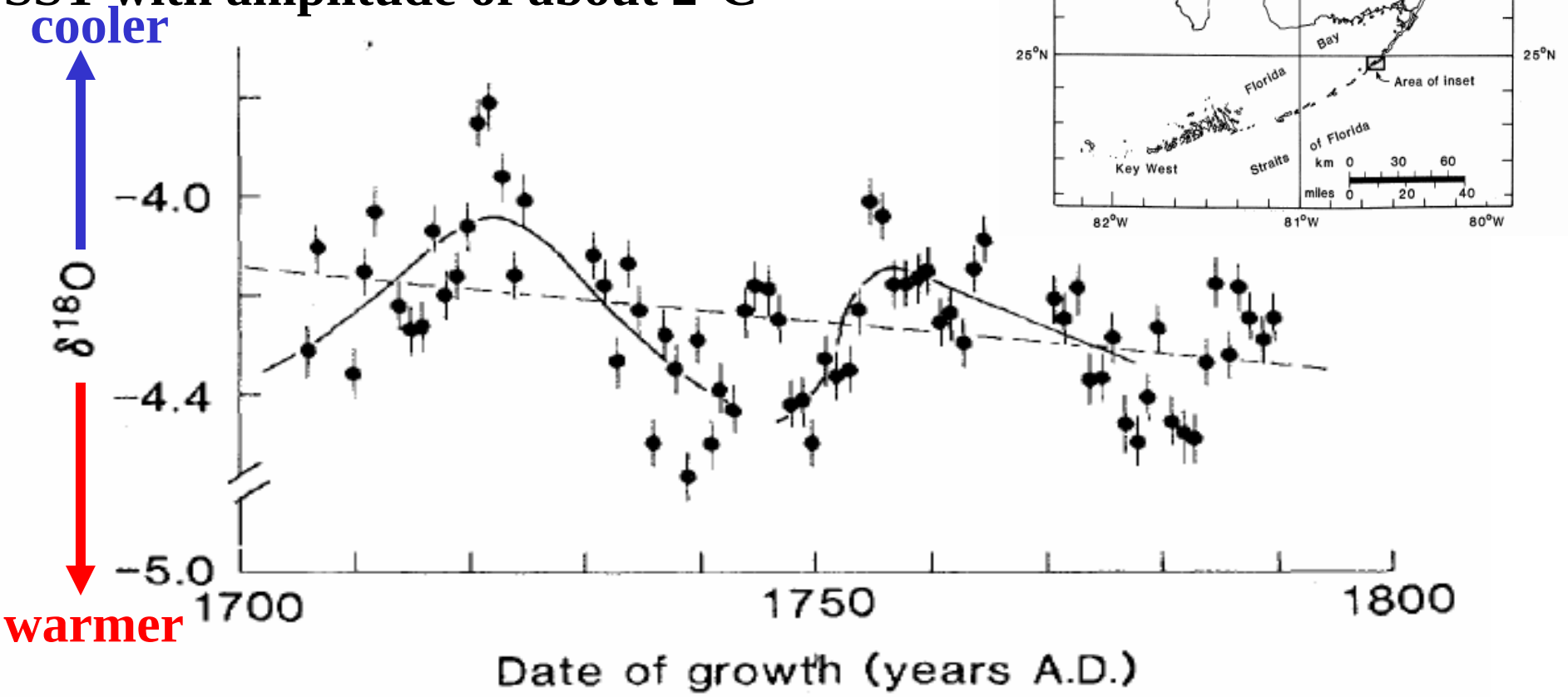




Winter et al. (2000) Geophysical Research Letters, vol. 27, 3365-3368; Nyberg et al. (2002) PPP, vol. 183, 25-41

Two key factors explaining the relatively active hurricane period in the last-half of the 18th century: (1) no moderate, strong or very strong El Nino 1762-1776 and (2) OVERALL cool period with pulses of warm peaks?

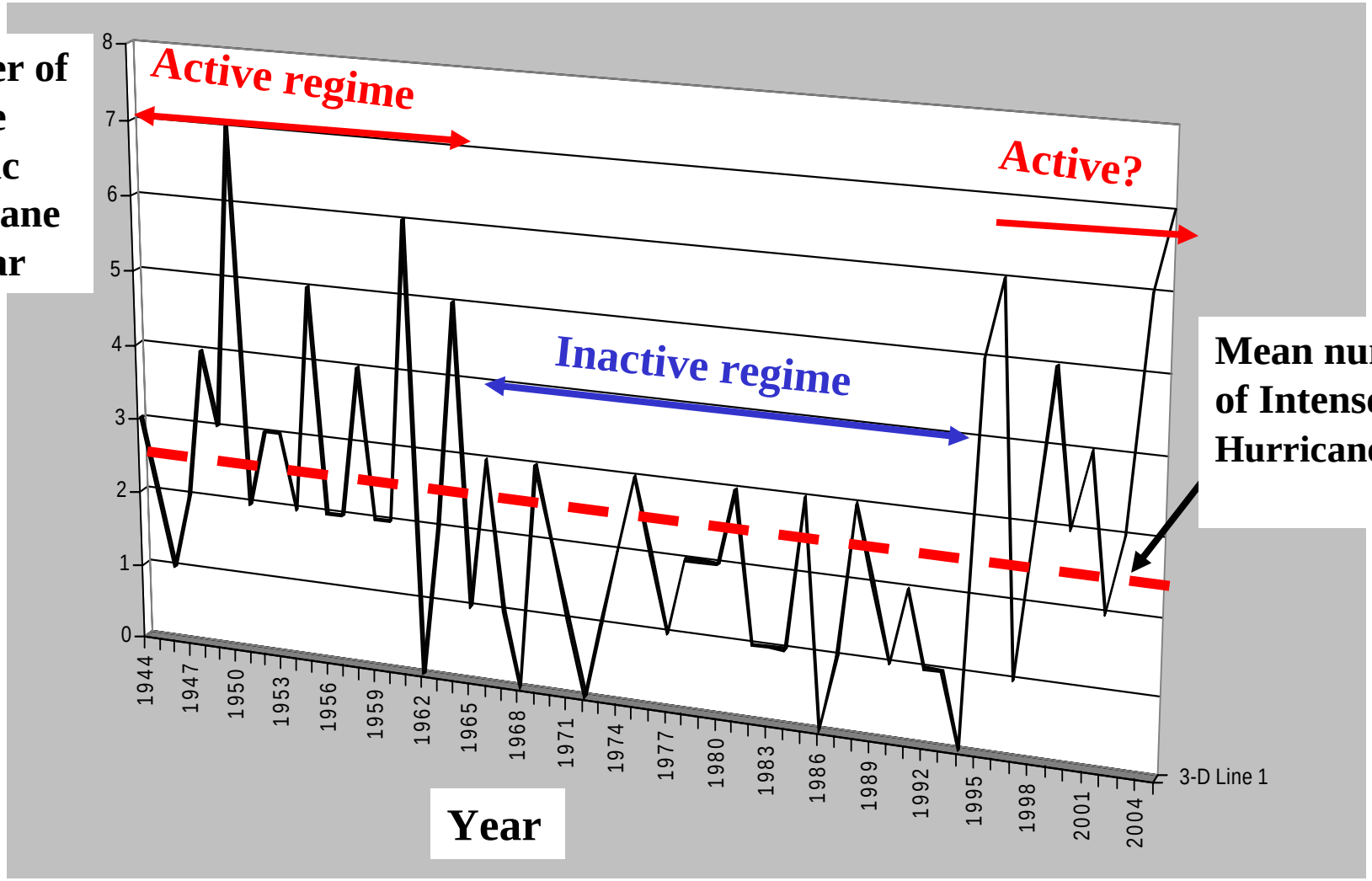
Coral-isotope records from Florida Straits shown that SST warm gradually from 1700-1800 by about 1°C but the period is punctuated with warm and cold pulses of SST with amplitude of about 2°C



Druffel (1982) Science, vol. 218, 13-19

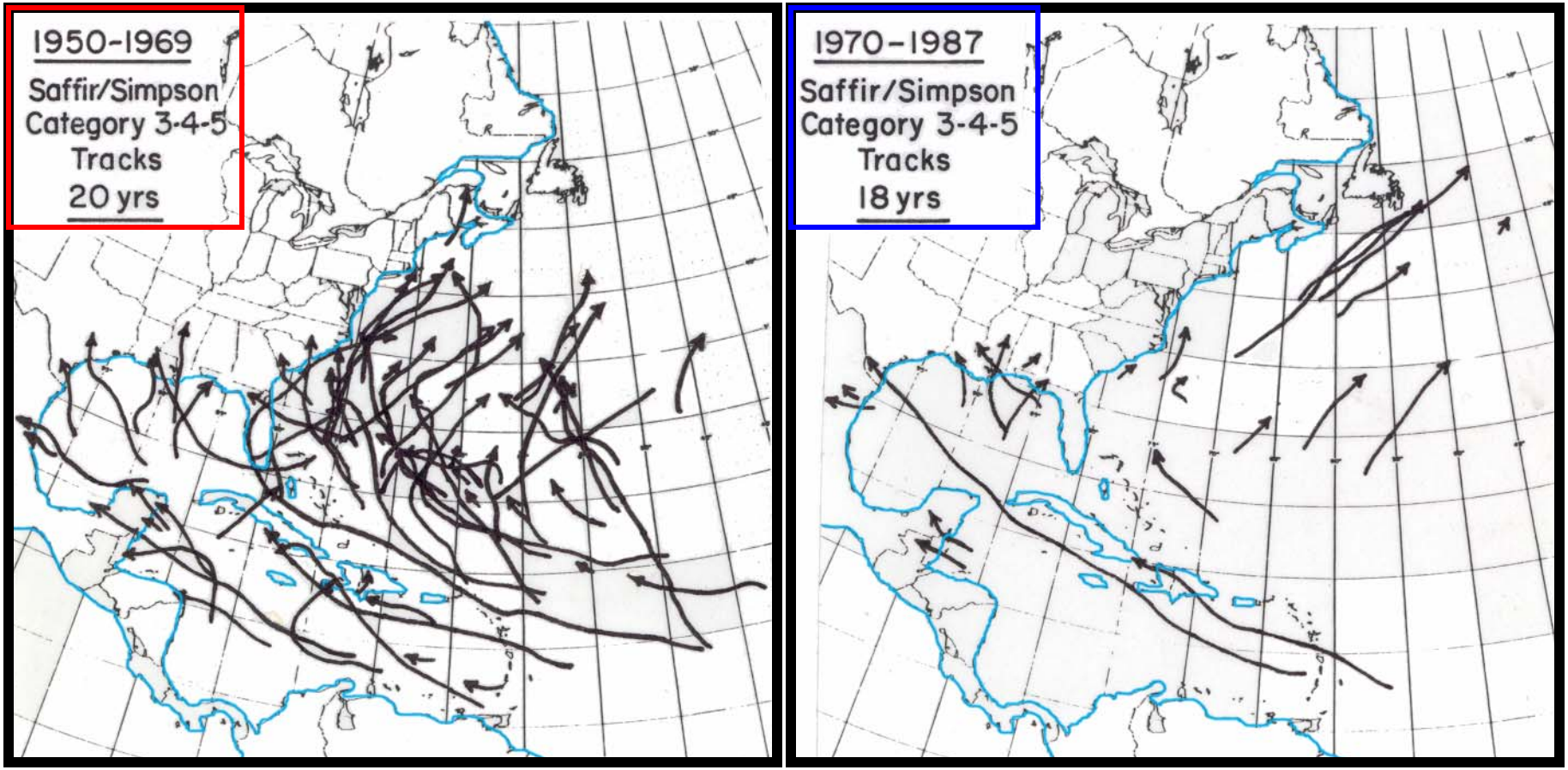
Statistics of Intense Atlantic Hurricanes and its Multidecadal Variations + Detailed Explanation on the Recent Claim in Figure 1 of Emanuel (2005)

Multidecadal changes in the most intense (category 3-5) Atlantic hurricanes: Active regime 1944-1964, Inactive regime 1965-1994, Active regime again since 1995?



Source: Goldenberg et al. (2001) Science, vol. 293, 474-479; http://www.aoml.noaa.gov/hrd/basin/index.html

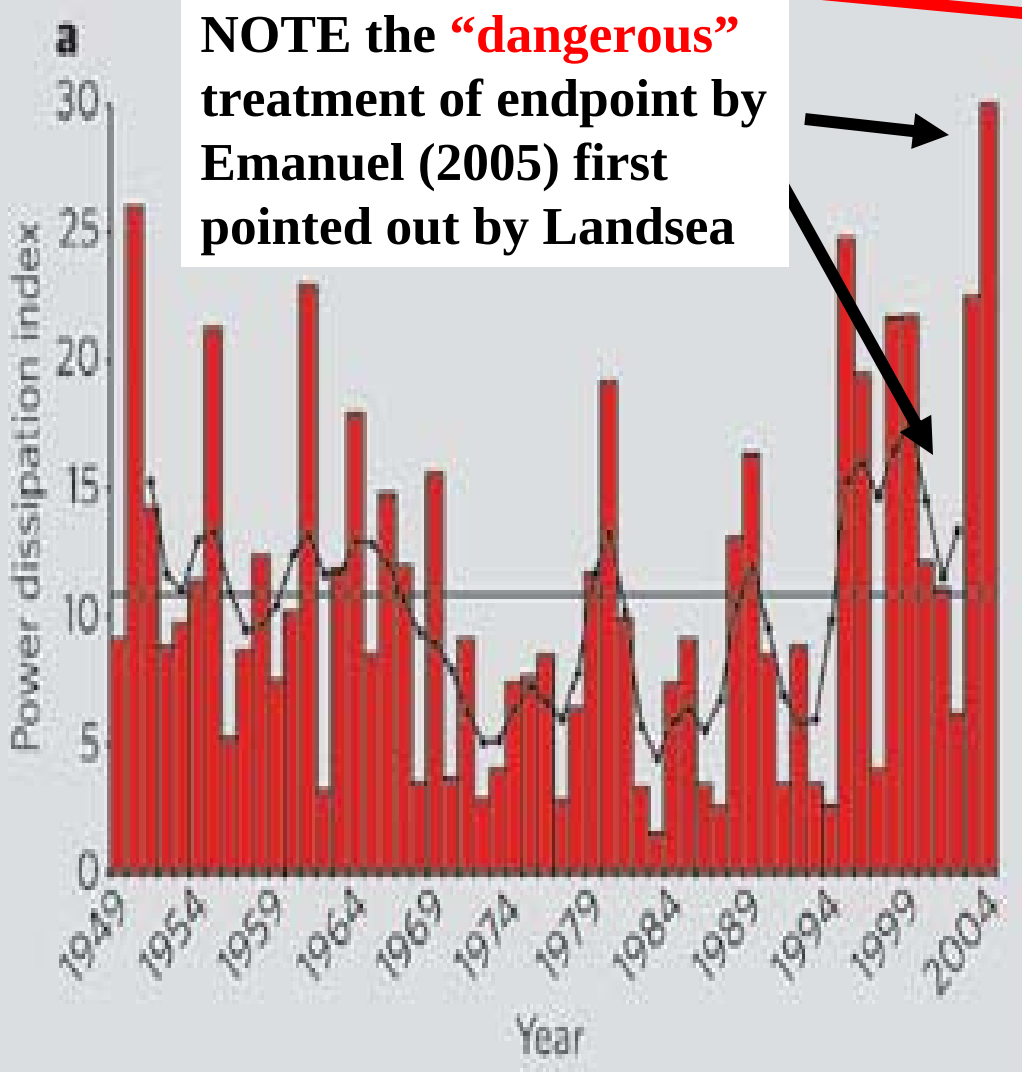
TRACKS OF CATEGORY 3-4-5 HURRICANES

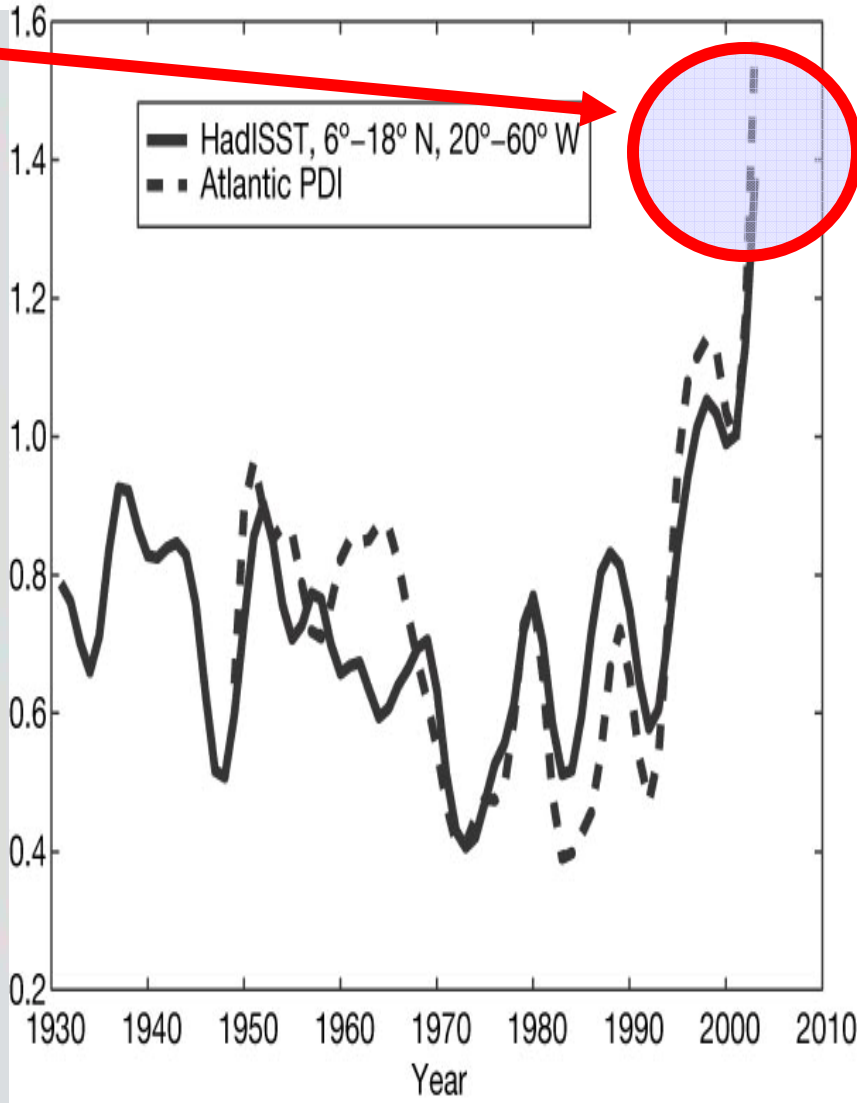


Charts Courtesy of Professor Bill Gray (June 29, 2006)

The power dissipation (or destructive potential) index for Atlantic tropical cyclones simply does not suggest any alarming trend even including the 2004 data

NOTE the "dangerous" treatment of endpoint by Emanuel (2005) first pointed out by Landsea





Landsea (2005) Nature, vol. 438, E11-E13

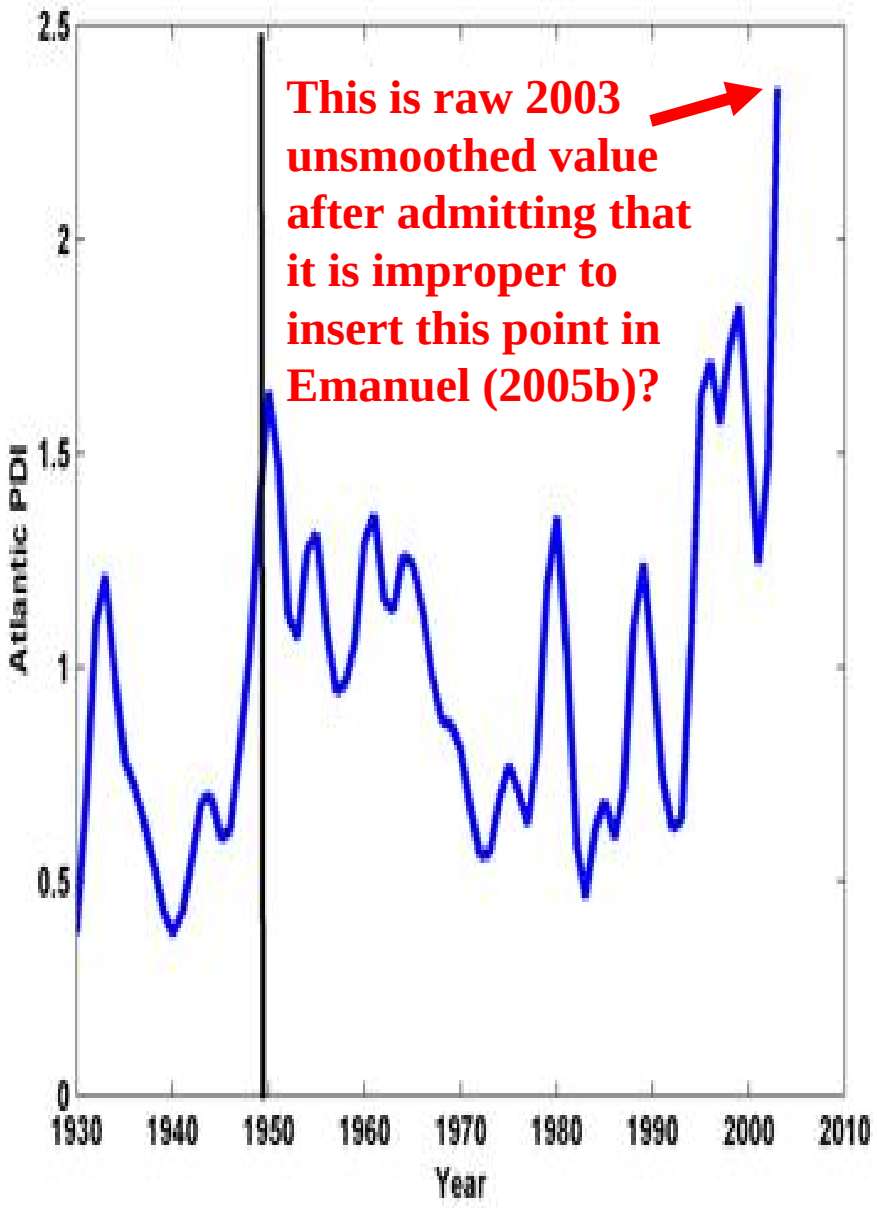
Emanuel (2005) Nature, vol. 436, 686-688

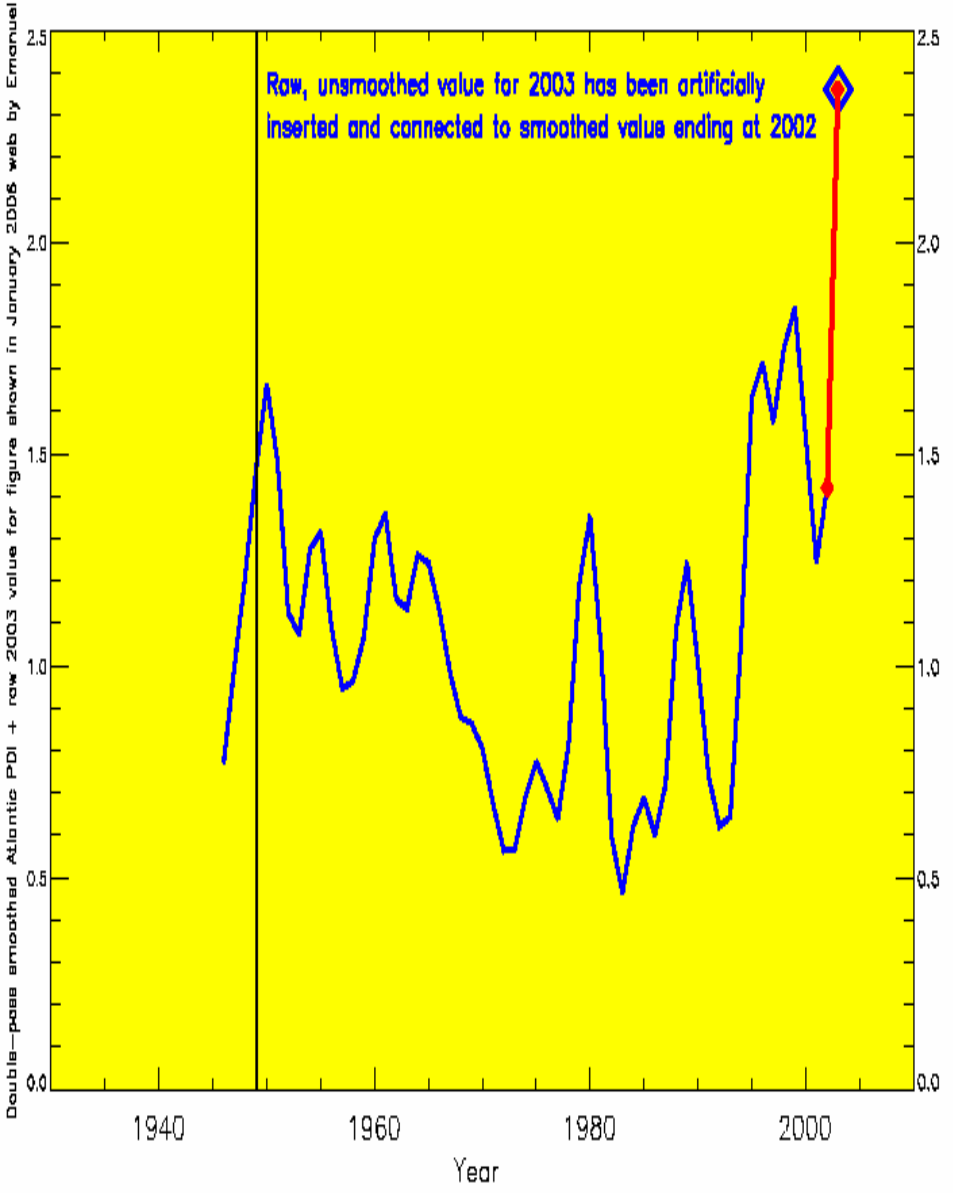
The implication for the incorrect, high-end of Atlantic's PDI index by Emanuel (2005) is clear: A link to CO_2 global warming!

"Note that total Atlantic hurricane power dissipation has more than doubled in the past 30 years. ... The Atlantic multi-decadal mode discussed in ref. 10 [Goldenberg, Landsea et al., 2001] is evident in the SST series, as well as shorter period oscillations possibly related to El Nino/Southern Oscillation and the North Atlantic Oscillation. But the large upswing in the last decade is unprecedented, and probably reflects the effect of global warming."

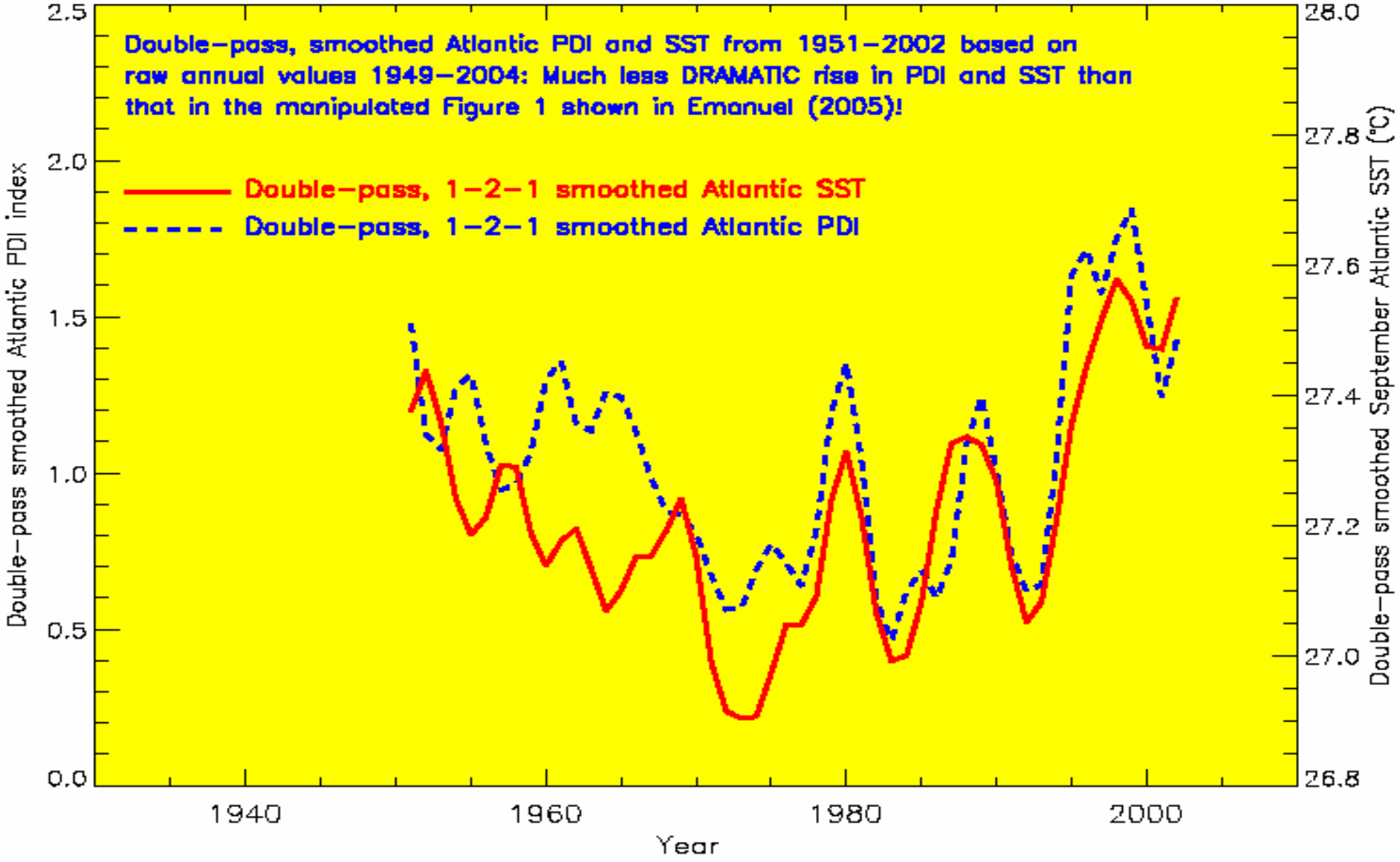
Emanuel (2005) Nature, vol. 436, 686-688

A successful replication of Atlantic PDI in Emanuel's webpage: But 2003 annual value is artificially inserted again?





Without the improper insertion of raw 2003 annual point, the Atlantic PDI and SST curves do not look so DRAMATIC as originally rendered in Figure 1 of Emanuel (2005)!



Admission of error by the author: But how many take notice?

"Landsea correctly points out that in applying a smoothing to the time series, I neglected to drop the end-points of the series, so that these end-points remain unsmoothed. This has the effect of exaggerating the recent upswing in Atlantic activity."
— Emanuel (2005)

Landsea and Emanuel in December 29, 2005's issue of Nature (vol. 438, pp. E11-E13)

"I wasn't even looking for it. The trend was just so big that it stood out like a sore thumb. I didn't feel comfortable saying what we said a year ago. I think I see a strong global-warming signal."

(Emanuel in September 8, 2005's Chronicle of Higher Education)

"I wasn't looking for global warming. But it stuck out like a sore thumb."

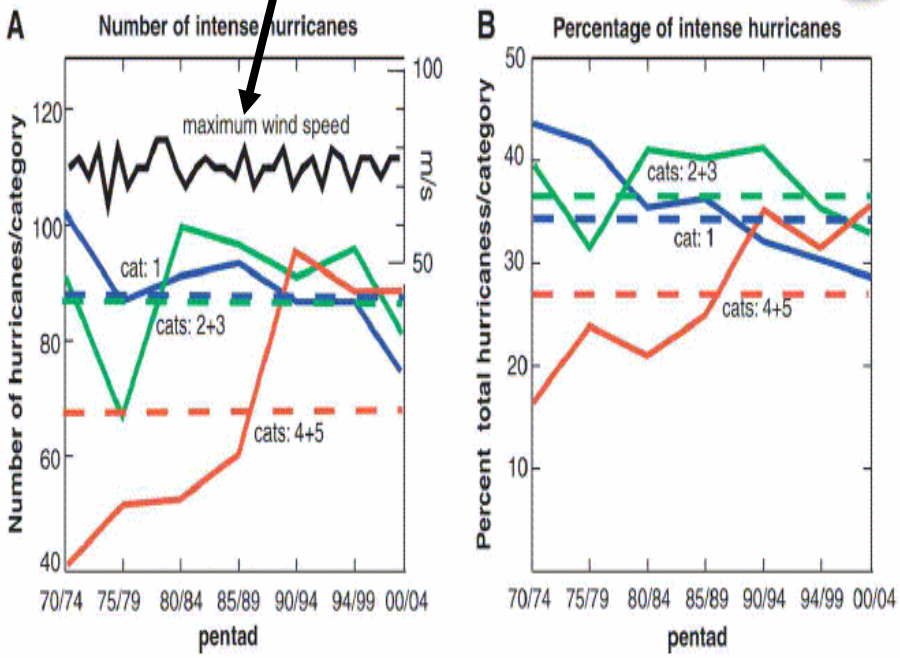
(Emanuel in September 24, 2005's Boston Globe)

Confusions caused by the recent publication of Webster et al. (2005) are not limited to non-specialists?

Webster et al. (2005) actually said: *"This increase in [the numbers of] category 4 and 5 hurricanes has not been accompanied by an increase in the actual intensity of the most intense hurricanes: The maximum intensity has been remarkably static over the past 35 years (solid black curve, Fig. 4A)."* Hence, directly contradicting Dr. Schmidt's conclusion that "There is evidence for intensity increase (since 1970) in global statistics"!

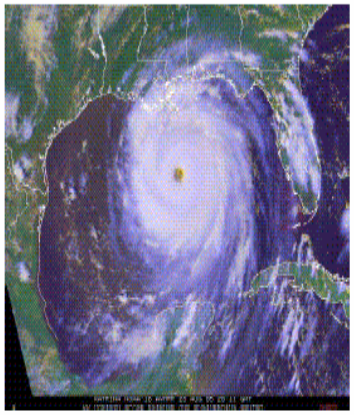
Global changes in intensity from 1970

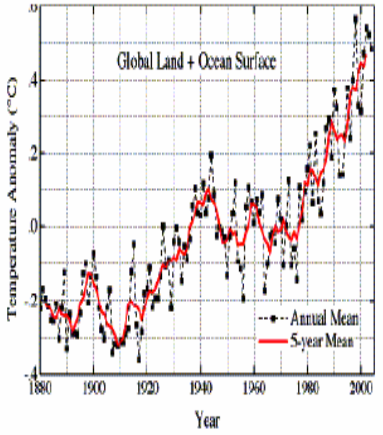
CEI Nov 2005



Webster et al (2005)

Hurricanes and global warming?





Gavin Schmidt
NASA GISS and Center for Climate Systems Research, Columbia University, New York

"Global warming is sending sea-surface temperatures up, so we're looking at an increase in hurricane intensity globally."

–Judith Curry in March 16, 2006's National Geographic News

"This increase in [the numbers of] category 4 and 5 hurricanes has not been accompanied by an increase in the actual intensity of the most intense hurricanes: The maximum intensity has been remarkably static over the past 35 years (solid black curve, Fig. 4A) [see previous page]."

– p. 1846 of Webster et al. (2005) in which Curry is a co-author

More manufactured confusions: **Now, why would Professor Judith Curry, also a co-author, erase the wind-speed series plotted in the original figure published in Science by Webster et al. (2005)?**

This was shown in the July 20th, 2006 testimony by Curry at the House Government Reform committee

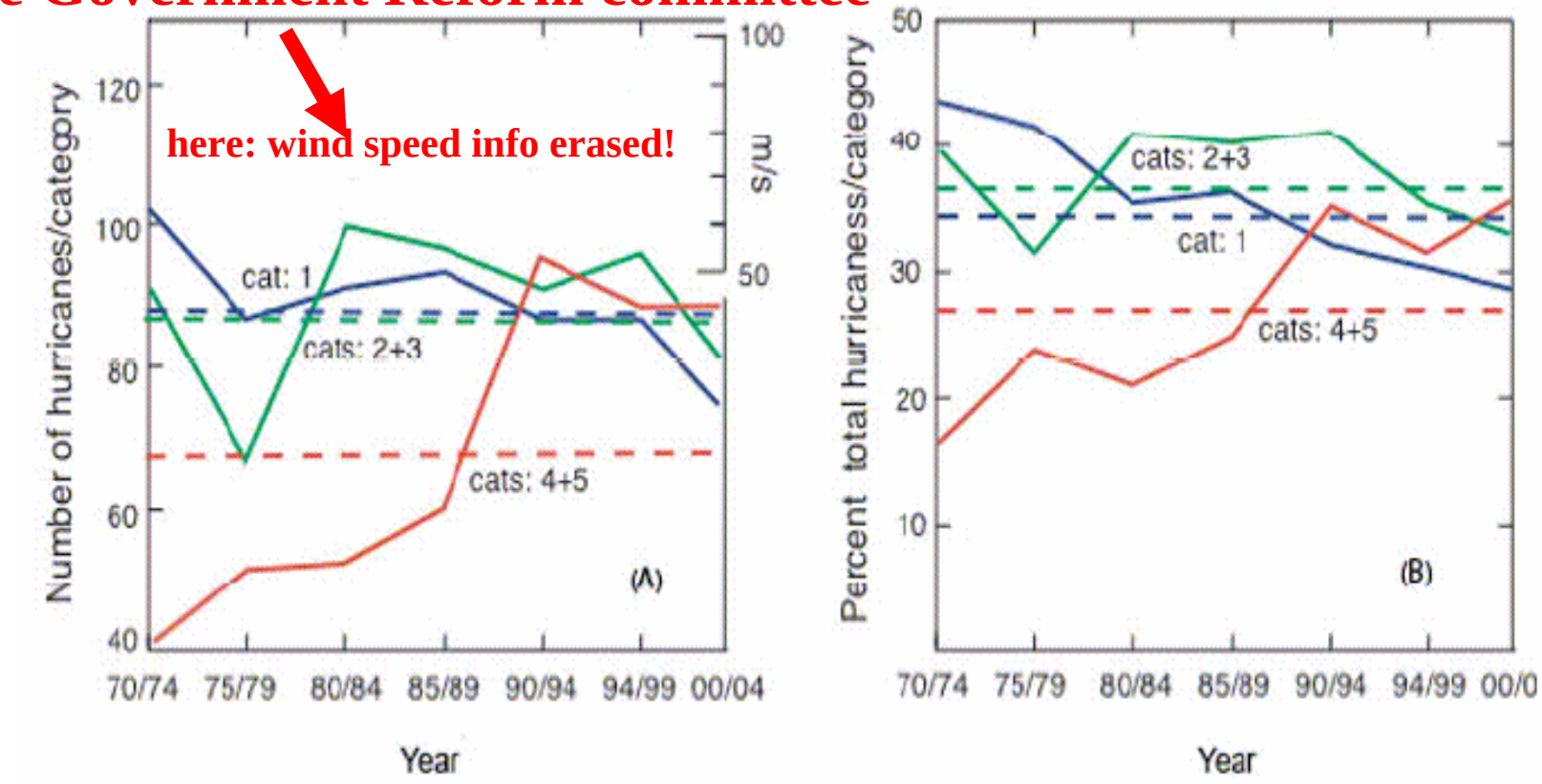
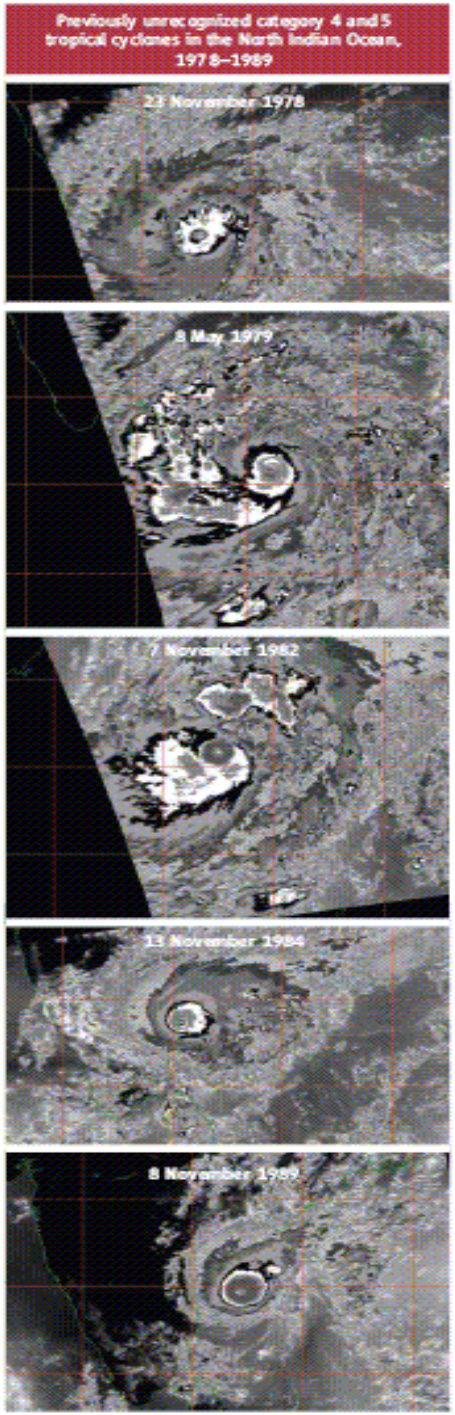


Figure 5: Intensity of global hurricanes according to the Saffir-Simpson scale (categories 1 to 5), in 5 year periods. (A) The total number of storms and (B) the percent of the total number of hurricanes in each category class. Webster et al. (2006).

Source: http://reform.house.gov/GovReform/Schedule/EventSingle.aspx?EventID=46863



Previously unrecognized category 4 and 5 tropical cyclones in the North Indian Ocean, 1978-1989: Failure from subjective measurements and variable procedures

"Another major tropical cyclone, the 1970 Bangladesh cyclone--the world's worst tropical-cyclone disaster, with 300,000 to 500,000 people killed--does not even have an official intensity estimate, despite indications that it was extremely intense. ... These examples are not likely to be isolated exceptions. Ongoing Dvorak reanalyses of satellite images in the Eastern Hemisphere basins by the third author suggest that there are at least 70 additional, previously unrecognized category 4 and 5 cyclones during the period 1978-1990. The pre-1990 tropical cyclone data for all basins are replete with large uncertainties, gaps, and biases. Trend analyses for extreme tropical cyclones are unreliable because of operational changes that have artificially resulted in more intense tropical cyclones being recorded, casting severe doubts on any such trend linkages to global warming."

Landsea, Harper, Hoarau. Knaff (2006) Science, vol. 313, 452-454

No mention of "global warming" by Webster et al. (2005) paper in *Science*?

"How have people misconstrued your paper?

People have accused us of linking global warming with Katrina. We didn't even use the expression 'global warming' in the paper. We talked about an increase in global tropical sea surface temperature."– Judith Curry, co-author of Webster et al, in the October 20, 2005 interview with Paul D. Thacker in *Environmental Science & Technology* Online News

In the early released version (dated September 8) of Webster et al., the following curious place-holder was set-up as blanks on p. 1845: "The simultaneous increase in SST in the North Atlantic at the same time as increasing SST has led to speculations of xxxxx xxxxx xxxxx (3). [citing Trenberth 2005's Perspective in *Science* published in June 2005]"

The final version filled in with: "The observation that increases in North Atlantic hurricane characteristics have occurred simultaneously with a statistically significant positive trend in SST has led to the speculation that changes in both fields are the result of global warming."
The expression "global warming" was used two more times in Webster et al. (2005)–that is the fact.

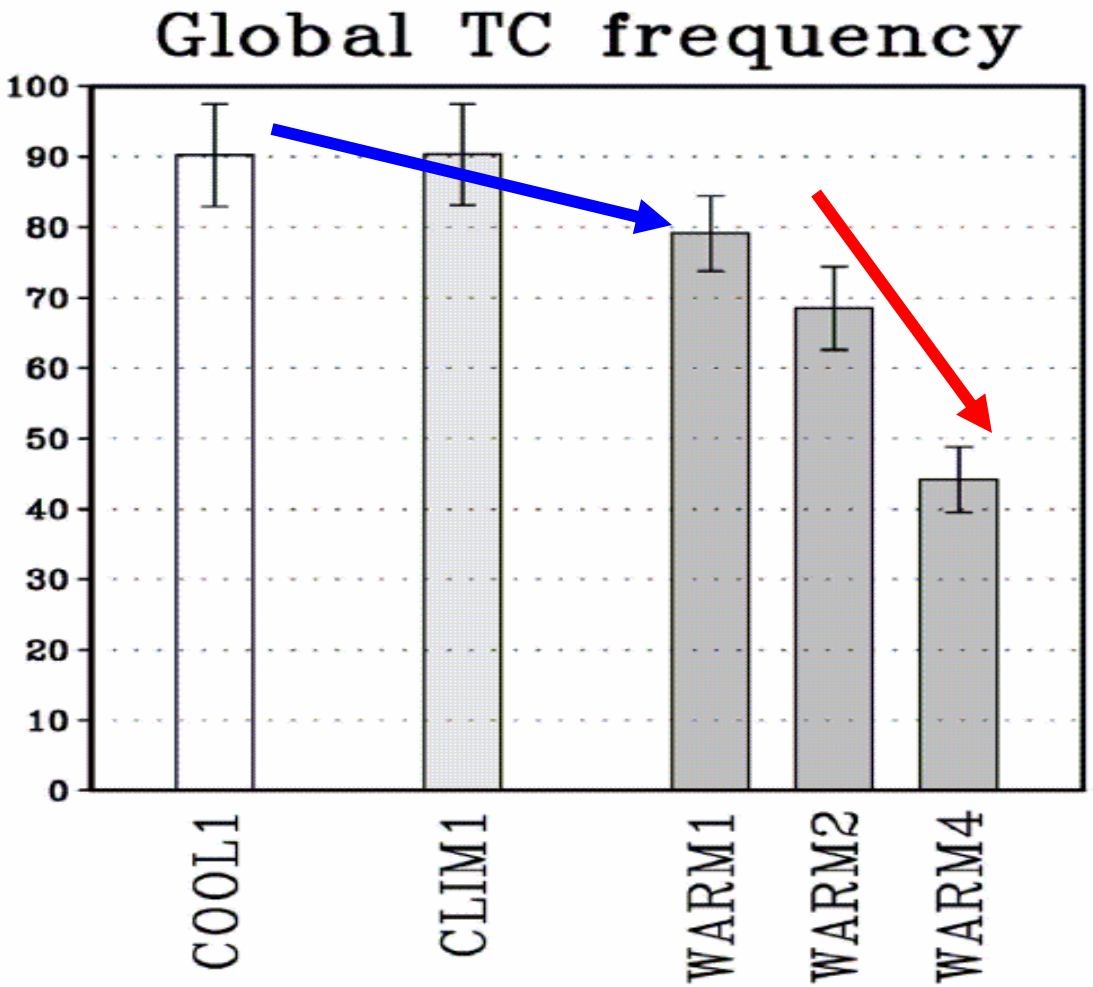
The danger of invoking personal opinions and emotions for a scientific question: Best return to the root of hypothesis testing and rejection!

Source: http://illconsidered.blogspot.com/2006/05/finally-proof-positive.html

Why would the global frequency of TCs decrease as CO_2 doubled and how robust/good are these predictions?

Large decrease in the global frequencies of tropical cyclones as CO_2 increases; less so for a warming of sea surface temperature

Only about a mean decrease of 6% in global TC frequencies as SST increases by 2°C



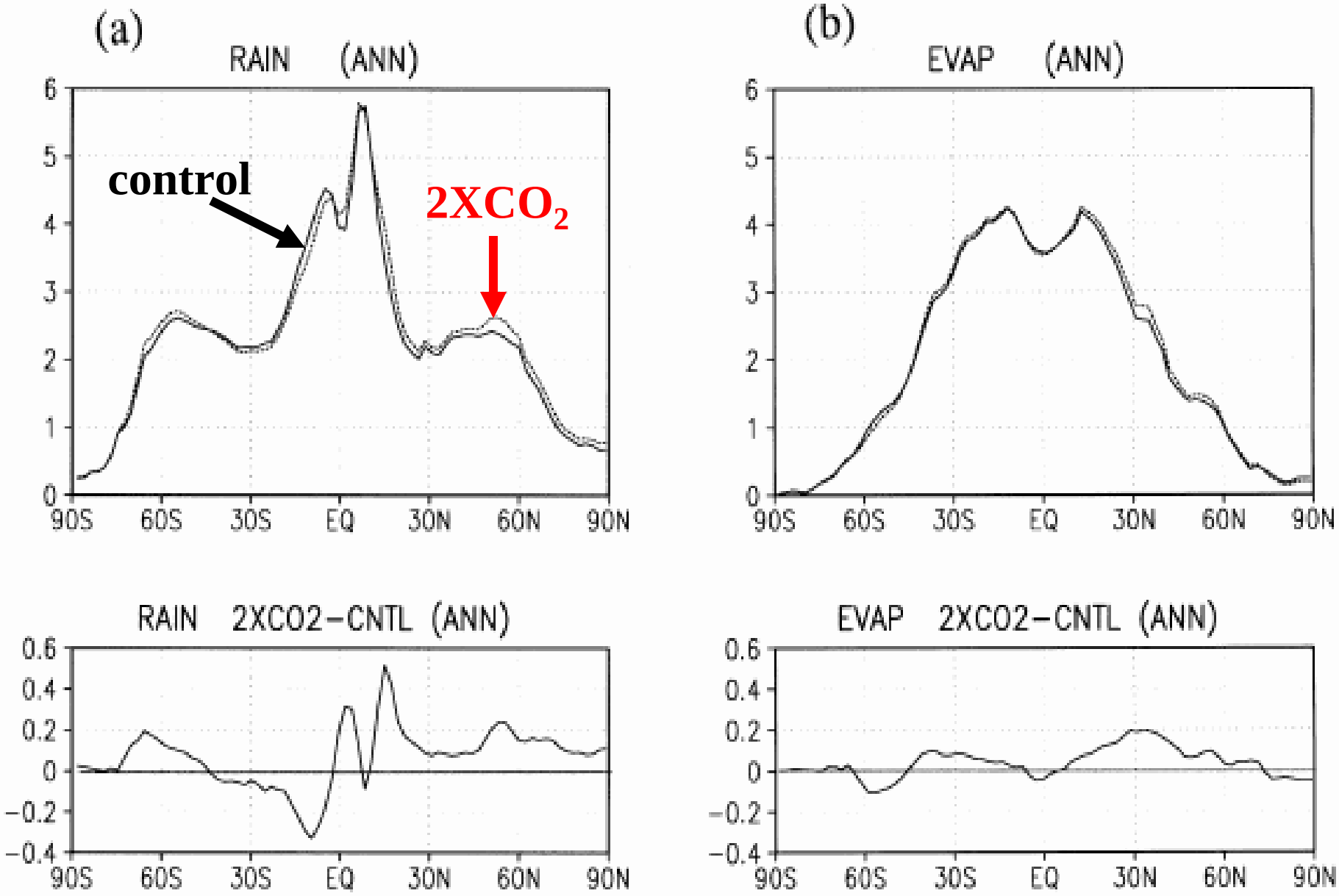
A mean decrease of 22% in global TC frequencies as CO_2 doubles

Global frequencies of TC genesis (annual-mean numbers). The error bars indicate 95% confidence intervals.

Yoshimura and Sugi (2005) SOLA, vol. 1, 133-136; Yoshmura et al. (2006) Journal of the Meteorological Society of Japan, in press

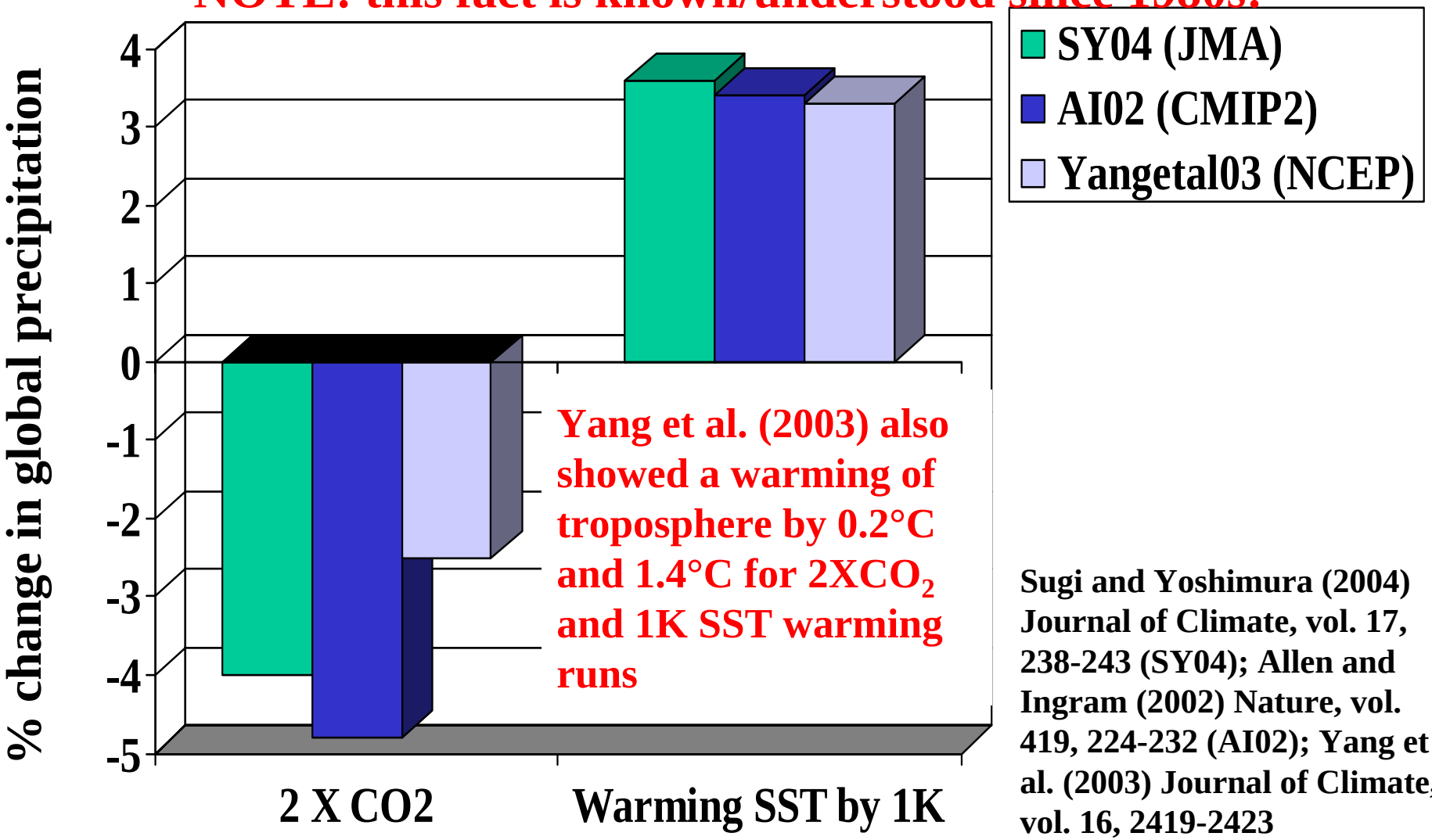
The effects of doubling CO_2 on precipitation and evaporation: Not a large change!

Sugi and Yoshimura (2004), Journal of Climate, vol. 17, 238-243; Sugi et al. (2002) Journal of the Meteorological Society of Japan, vol. 80, 249-272



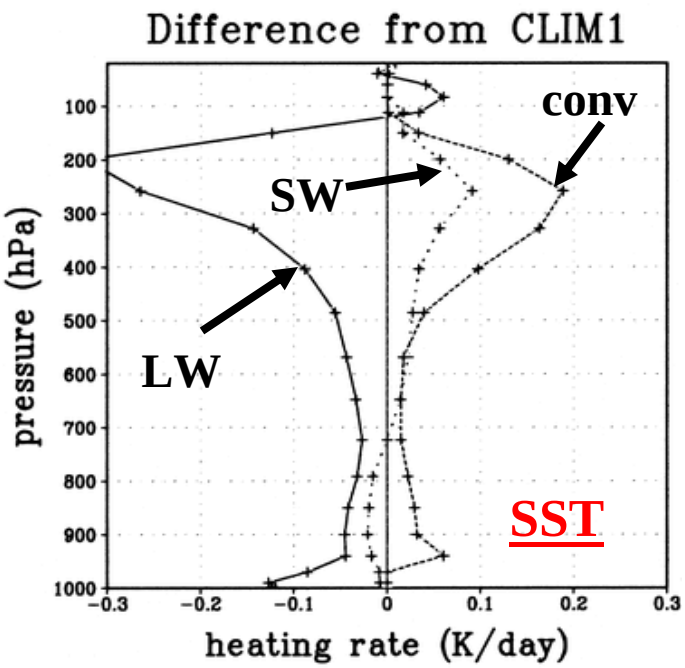
Current climate models robustly predicted an increase in global precipitation for a warming SST but a decrease in global precipitation for doubling atmospheric CO_2

NOTE: this fact is known/understood since 1980s!

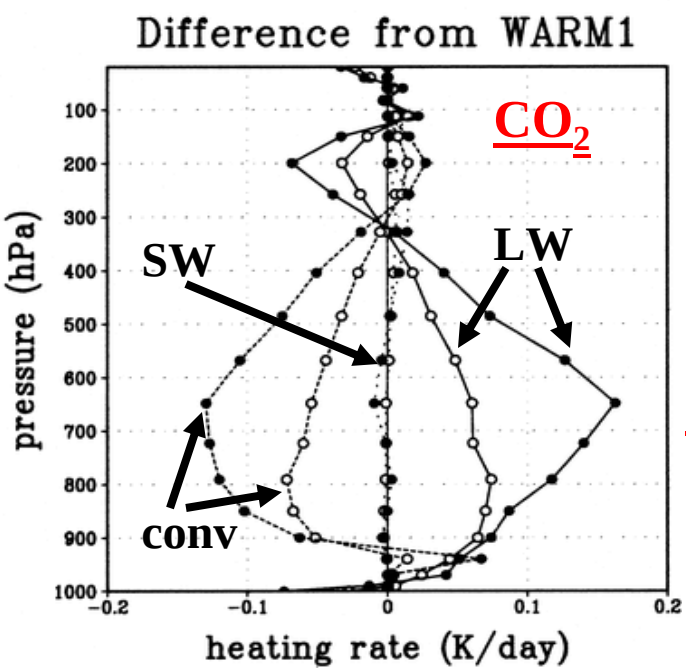


Sugi and Yoshimura (2004) Journal of Climate, vol. 17, 238-243 (SY04); Allen and Ingram (2002) Nature, vol. 419, 224-232 (AI02); Yang et al. (2003) Journal of Climate, vol. 16, 2419-2423

(a)



(b)



Physics for the responses from increase in CO_2 and SST

(a) SST warming ⇒ enhanced tropical convection (positive convective heating) ⇒ increased atmospheric moisture (positive SW) ⇒ increased precipitation ⇒ increased radiative cooling (negative LW)

(b) increase CO_2 ⇒ reduction in radiative cooling (positive LW from overlapped CO_2+water vapor effects) ⇒ decreased precipitation ⇒ decreased convective heating ⇒ little change atmospheric moisture or cloud (little change in SW)

(c) combined SST+CO2 effects: relatively small increase in precipitation and significant increase in static stability causing weaker tropical circulation

Sugi and Yoshimura (2004), Journal of Climate, vol. 17, 238-243

What is really predicted by doubling CO_2?

"[I]n the warmer tropical atmosphere with more moisture and larger dry static stability, the energy balance is achieved by a weakening of the atmospheric circulation"

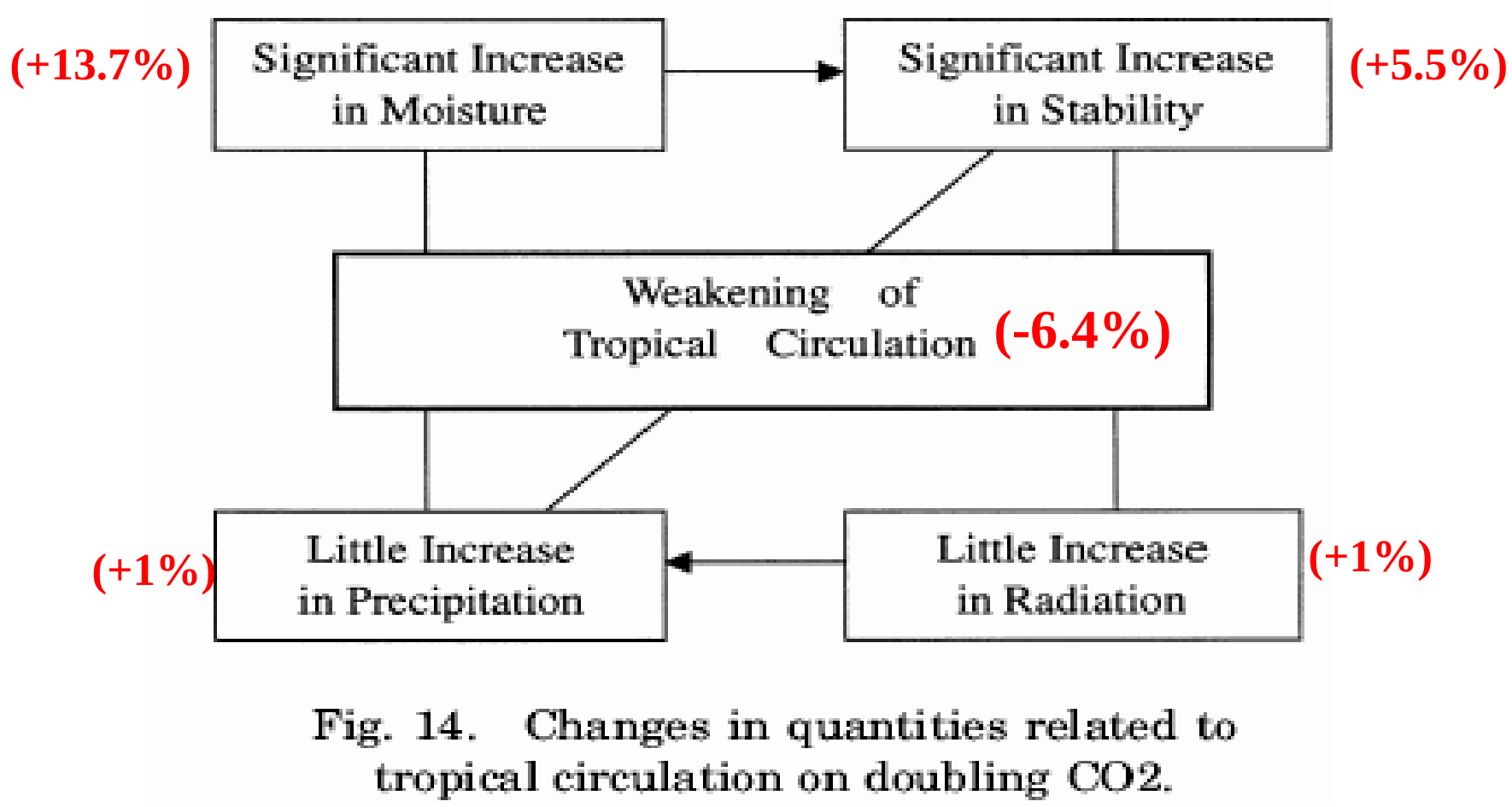
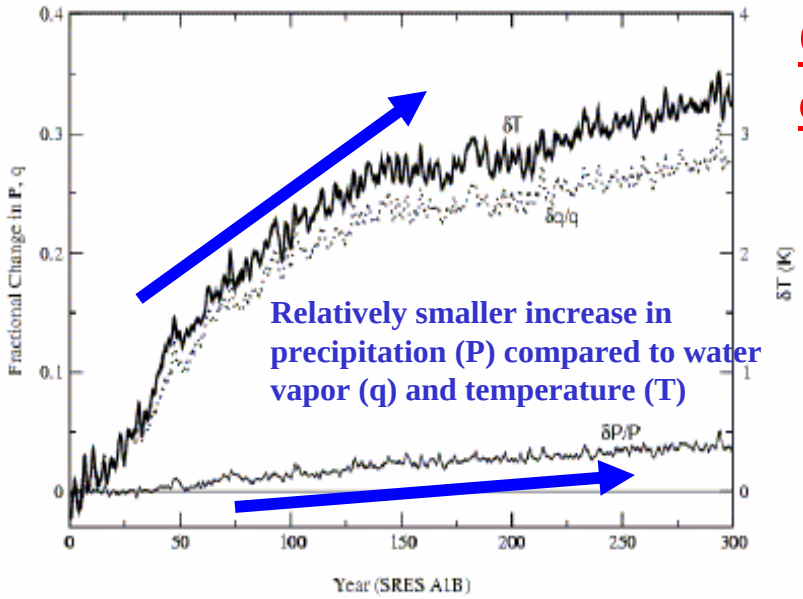
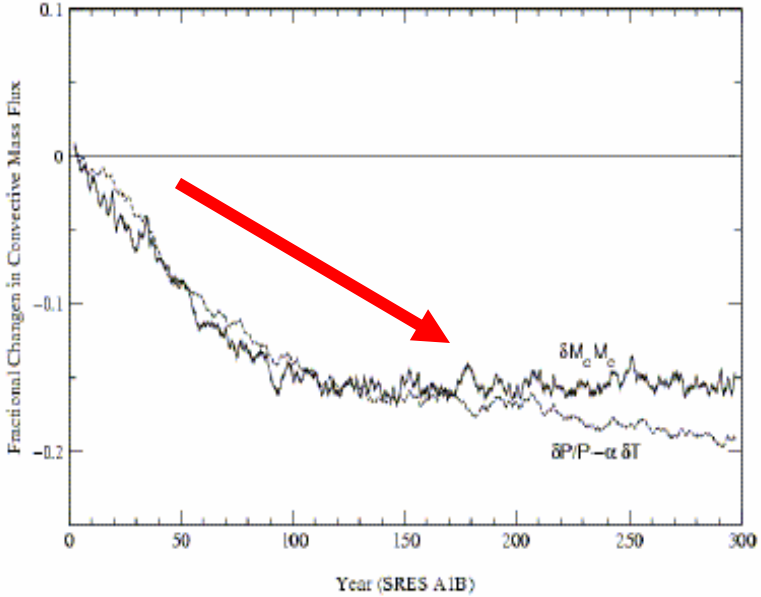


Fig. 14. Changes in quantities related to tropical circulation on doubling CO2.

Sugi and Yoshimura (2004), Journal of Climate, vol. 17, 238-243; Sugi et al. (2002) Journal of the Meteorological Society of Japan, vol. 80, 249-272



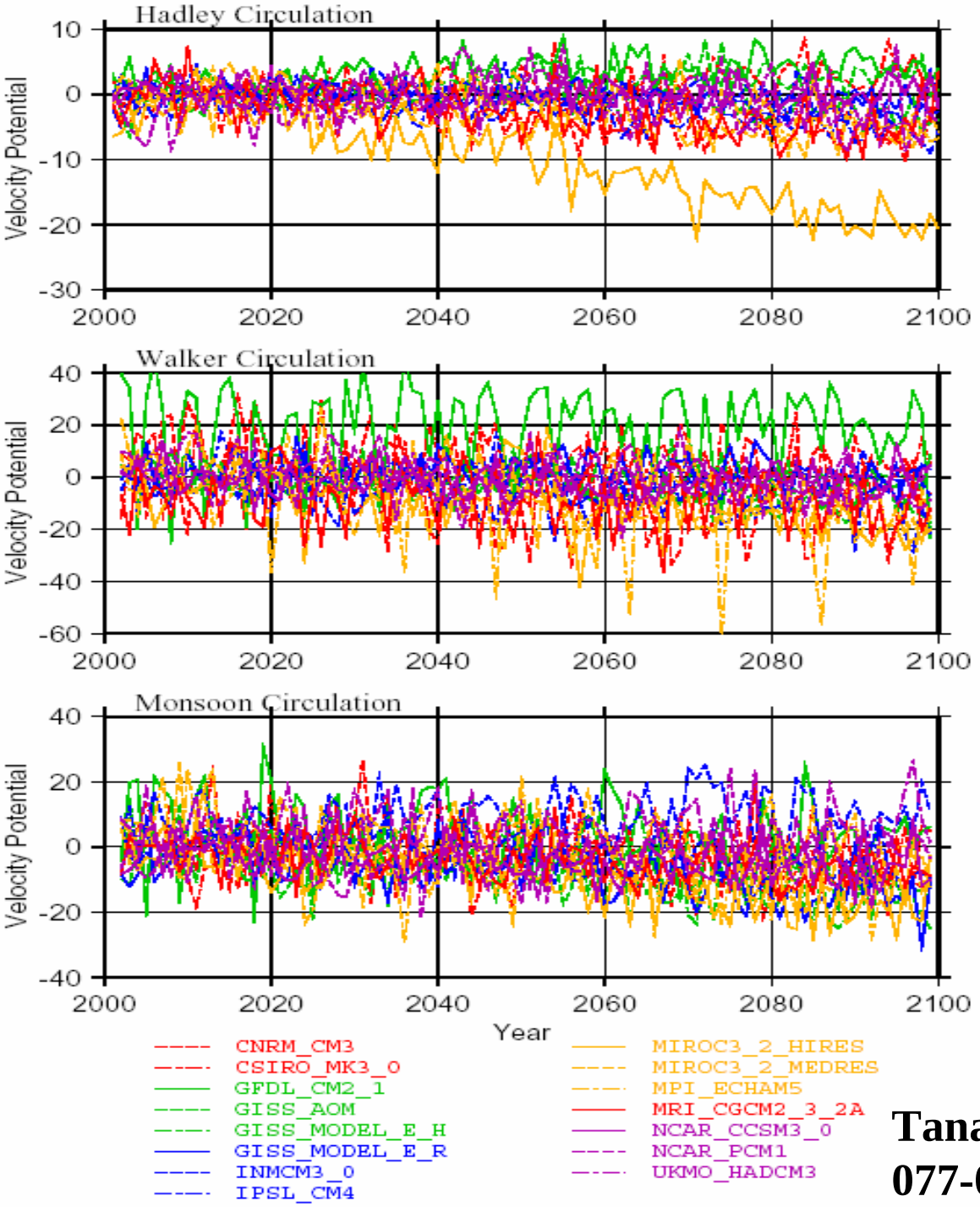
(a) **Robust prediction of the decrease of convective mass flux (M_c) as greenhouse gases forcing increases**



Held and Soden (2006) Journal of Climate's ms.

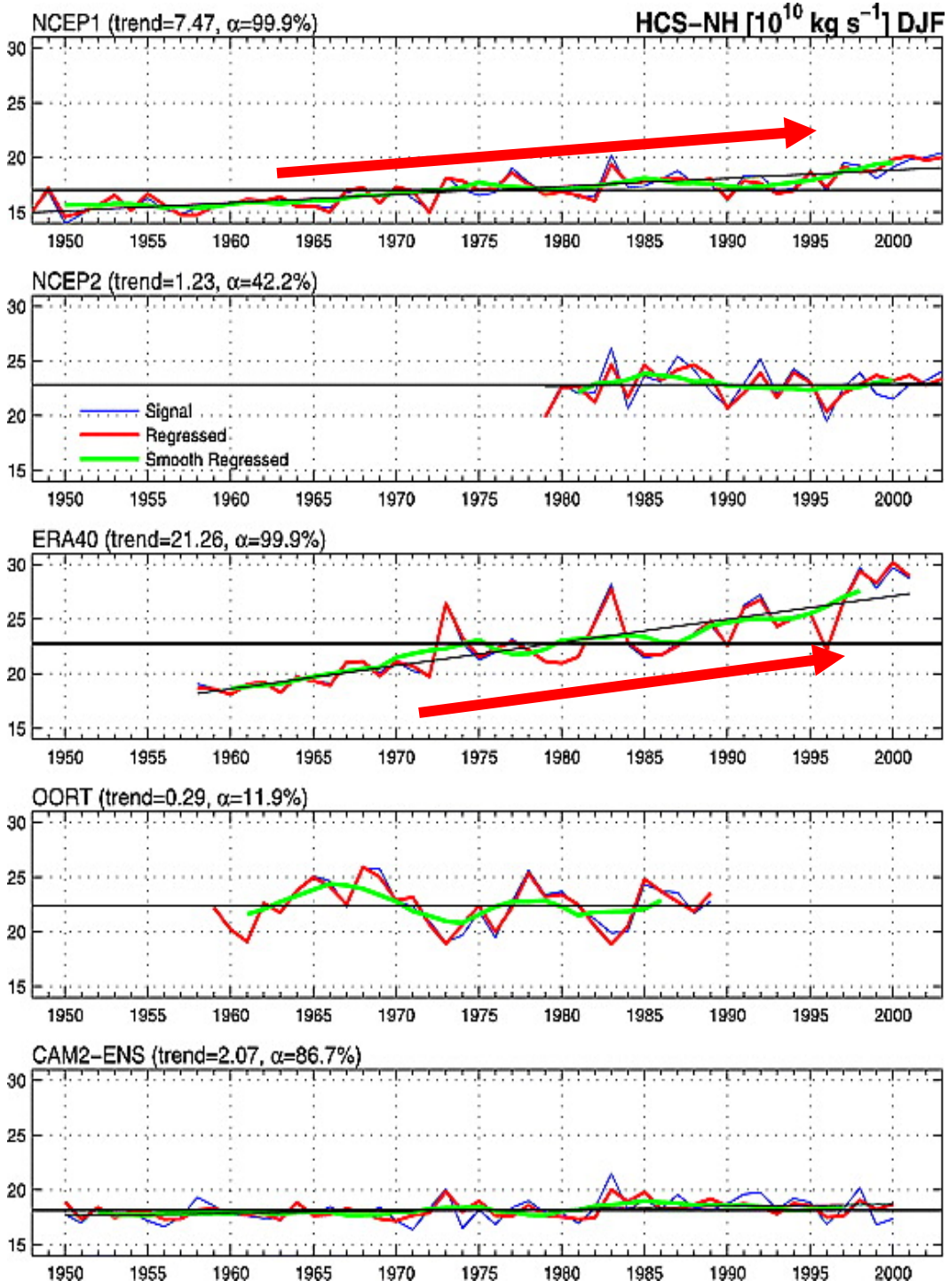
On "Robust responses of the hydrological cycle to global warming":

"A number of important aspects of the hydrological response to warming are a direct consequence of the increase in lower tropospheric water vapor. Because the increase in strength of the global hydrological cycle is constrained by the relatively small changes in radiative fluxes, it cannot keep up with the rapid increase in lower tropospheric vapor. The implication is that the exchange of mass between the boundary layer and free troposphere must decrease, and, since much of this exchange occurs in moist convection in the tropics, the convective mass flux must decrease. In many popular, and in some scientific, discussions of global warming, it is implicitly assumed that the atmosphere will, in some sense, become more energetic as it warms. By the fundamental measure provided by the average vertical exchange of mass between the boundary layer and the free troposphere, the atmospheric circulation must, in fact, slow down."



"In this study, intensities and trends of Hadley, Walker and monsoon circulations are compared for the IPCC 20th Century simulations and for 21st Century simulations (SRES A1B) using the upper tropospheric (200 hPa) velocity potential data. [W]e showed that the mean intensities of the Hadley, Walker, monsoon circulation for the IPCC 20th Century simulations are 35:97:66 (x 10^5 m^2/s) in the ensemble means, which are compared with 40:120:80 for the NCEP/NCAR reanalysis. The same analyses are extended to the IPCC 21st Century simulations to investigate the trends in response to a global warming scenario. It is anticipated that the Hadley circulation becomes weaker by 9%, Walker circulation by 8%, and monsoon circulation by 14% by the late 21st century as an ensemble mean of the IPCC model simulations."

Tanaka et al. (2005), SOLA, vol. 1, 077-080



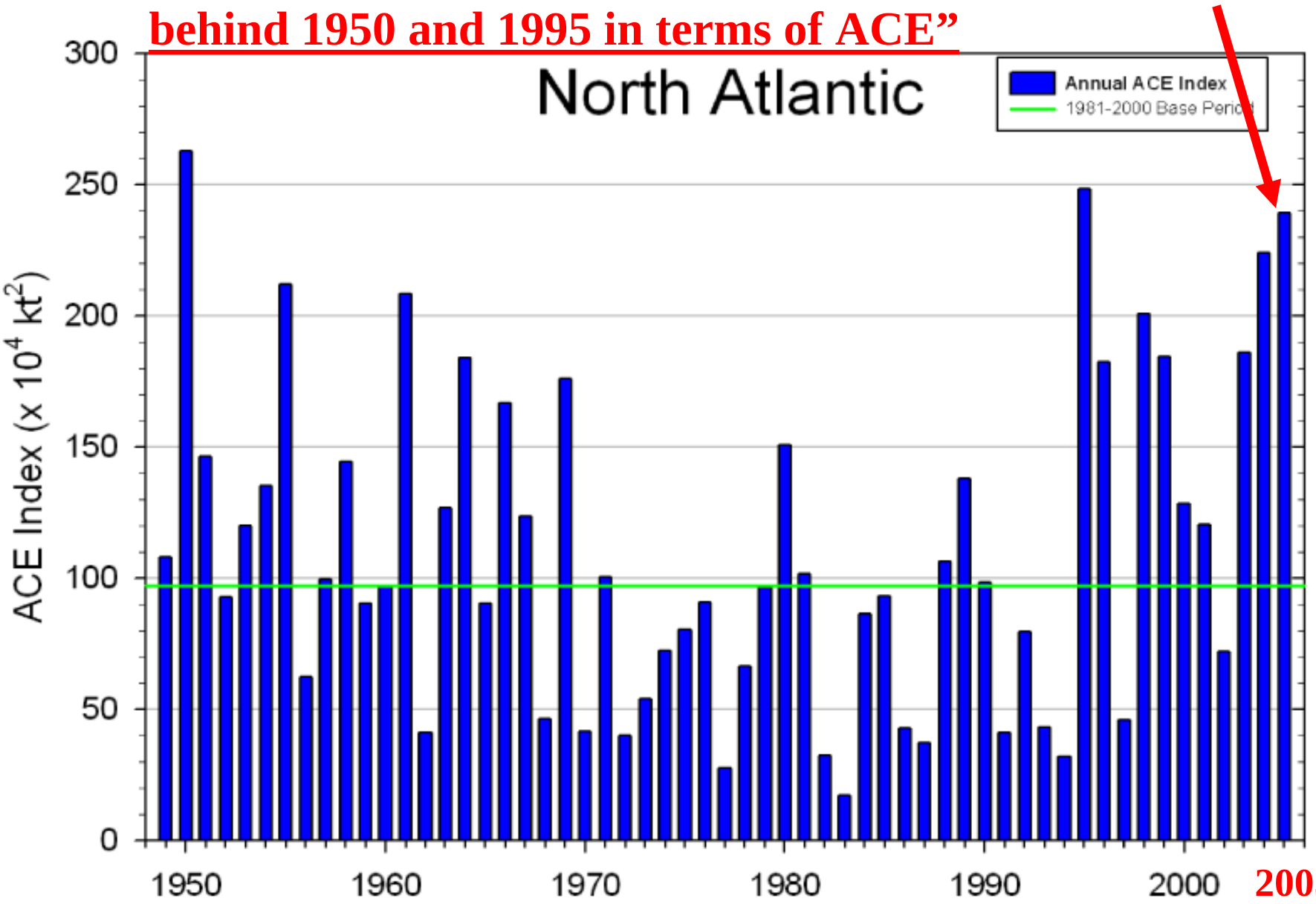
"Two of the major reanalyses projects, NCEP1 and ERA40, show an upward tendency of the Hadley cell strength over the last several decades. This is consistent with the observed satellite radiation measurements [of Wielicki et al. 2002]"

Thus, there are evidence for strengthening atmospheric circulation in the tropics: But note that this fact contradicts the *robust* prediction of weakening convective mass flux as atmospheric CO_2 is doubled or increased! (see Held and Soden 2006)

Mitas and Clement (2005) Geophysical Research Letters, vol. 32, 2004GL021765

The BIGGER picture beyond CO_2:
Solar and historical variability

NOAA (2006): "2005 is the 3rd most active season behind 1950 and 1995 in terms of ACE"



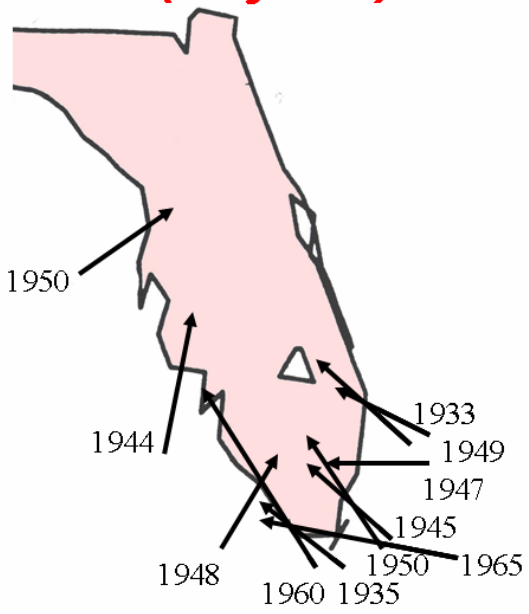
Updated chart from http://www.ncdc.noaa.gov/oa/climate/research/2005/hurricanes05.html

FLORIDA LANDFALLING MAJOR HURRICANES

11

Florida Landfalling Major Hurricanes during 1933-1965

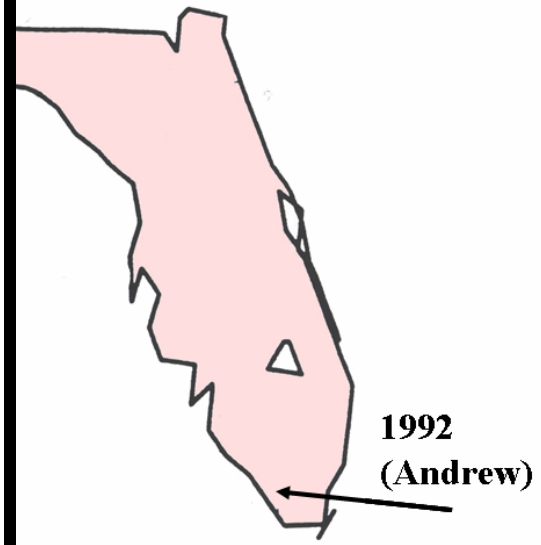
(33 years)



1

Florida Landfalling Major Hurricanes during 1966-2003

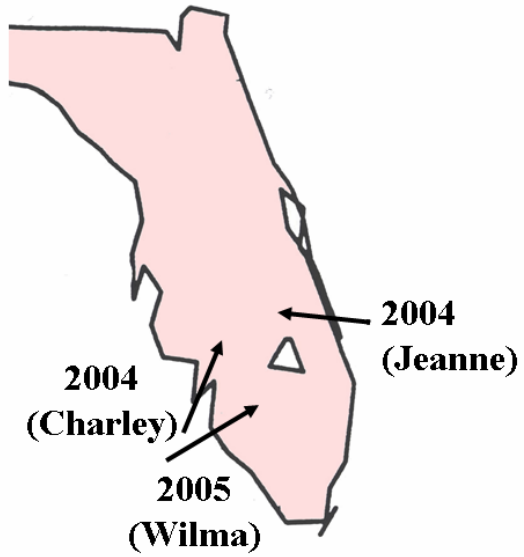
(38 years)



3

Florida Landfalling Major Hurricanes during 2004-2005

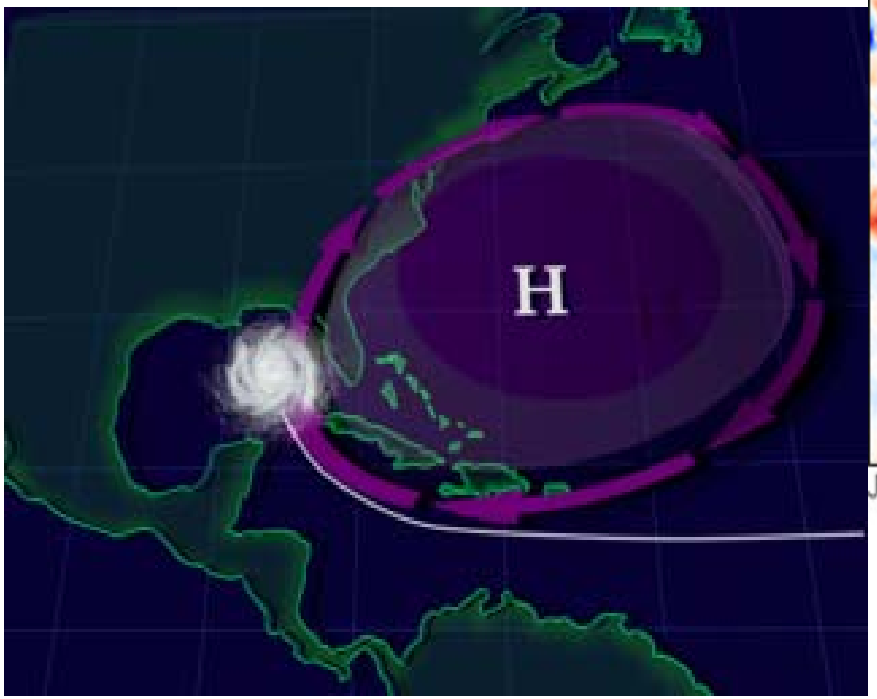
(2 years)



Charts Courtesy of Professor Bill Gray (June 29, 2006)

"I have been dismayed over the bogus science and media hype associated with the human-induced global warming hypotheses. My innate sense of how the atmosphere-ocean functions does not allow me to accept the human-induced global warming ideas or the new scenario that a portion of the US hurricane destruction over the last two years is partly a result of human influences on global temperature. ... We should interpret the last two years of unusually large numbers of US landfalling hurricanes as natural (but very low probability). ... The large increase in hurricane-spawned destruction of the last two seasons has not surprised us as it likely had surprised many others. We have been anticipating a great upsurge in hurricane destruction for many years [as consistently highlighted from Colorado State University's forecast papers: April 1989, August 1996, June 1997, April 2001, August 2001, May 2002, and May 2003]." – Professor William Gray (June 28, 2006 testimony to the House of Representative's subcommittee on Housing and Community Opportunity)

How does the 2006 Atlantic hurricane season look now?



<u>Good news:</u> The cool swath of SST suggests that the Bermuda High has a smaller-than-average extension southward and it has been weaker than normal since June (according to NOAA and NASA---updated July 19, 2006)

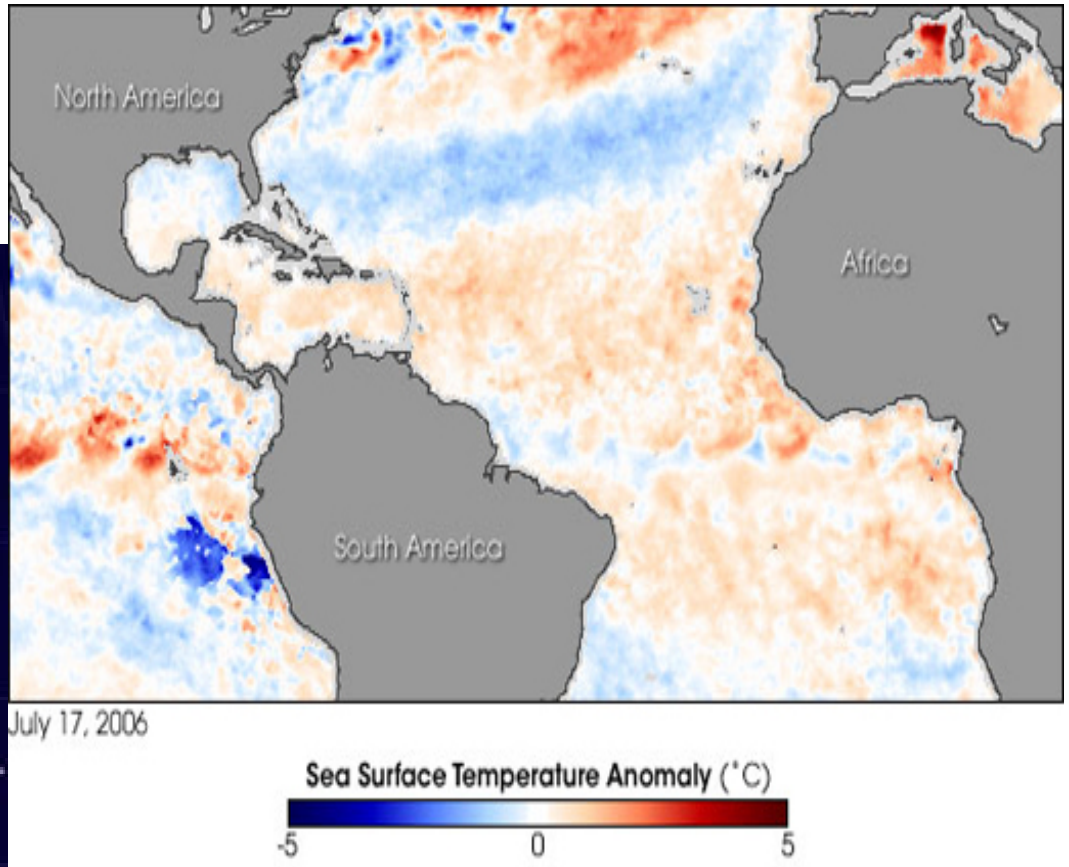
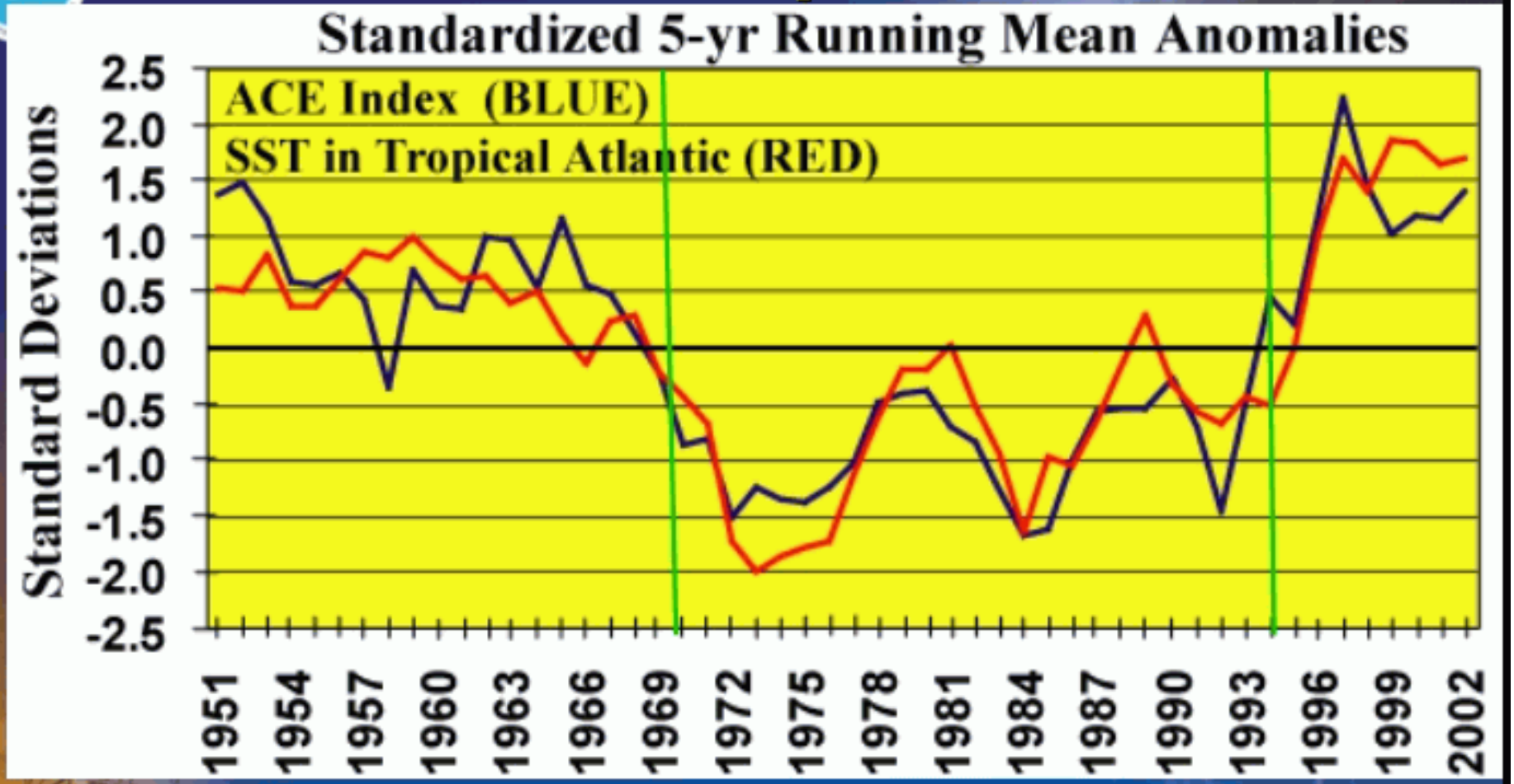


Image Source: NASA

Multi-Decadal Signal in the Atlantic
ACE index and Tropical Atlantic SSTs



Since 1995, warmer tropical Atlantic SSTs (Red curve) have been associated with above-normal Atlantic hurricane activity indicated by NOAA's ACE index (Blue curve). Departures are plotted with respect to the 1951-2000 base period means.

ATLANTIC BASIN ANNUAL AVERAGE

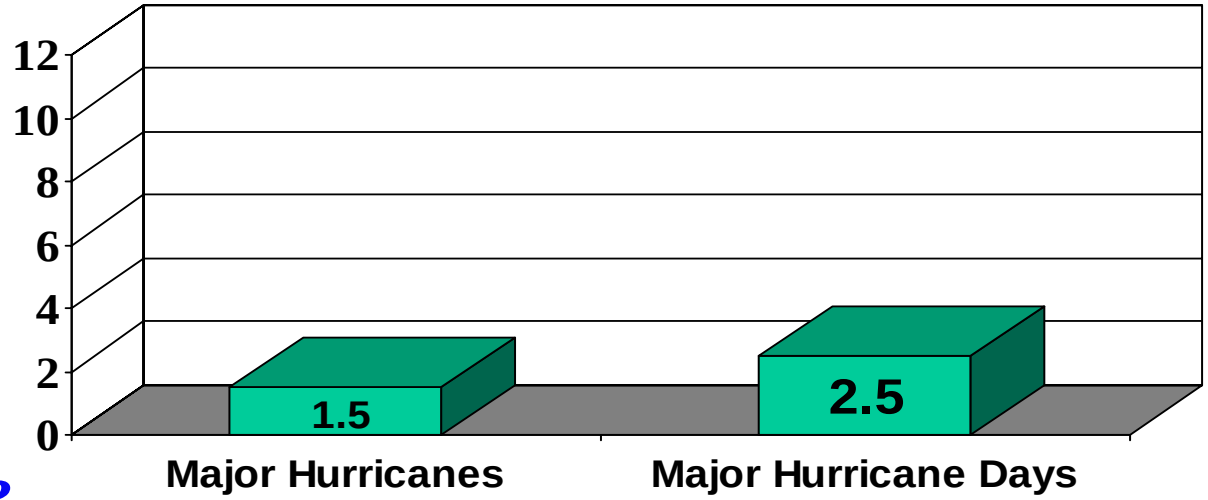
1970-1994

(25 Years)

GLOBAL WARMING

WEAK

Thermohaline



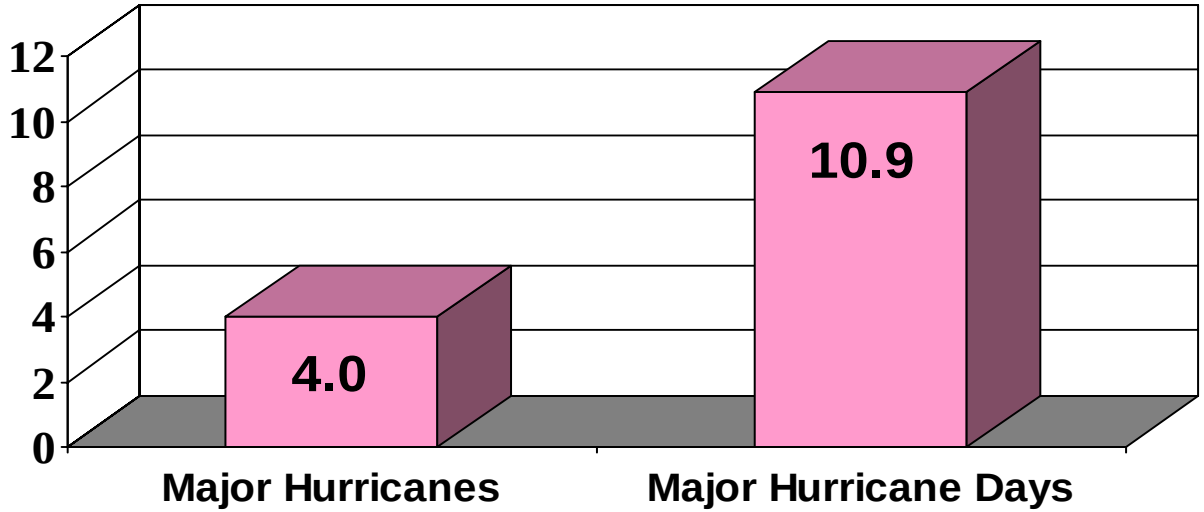
1995-2005

(11 Years)

GLOBAL WARMING

STRONG

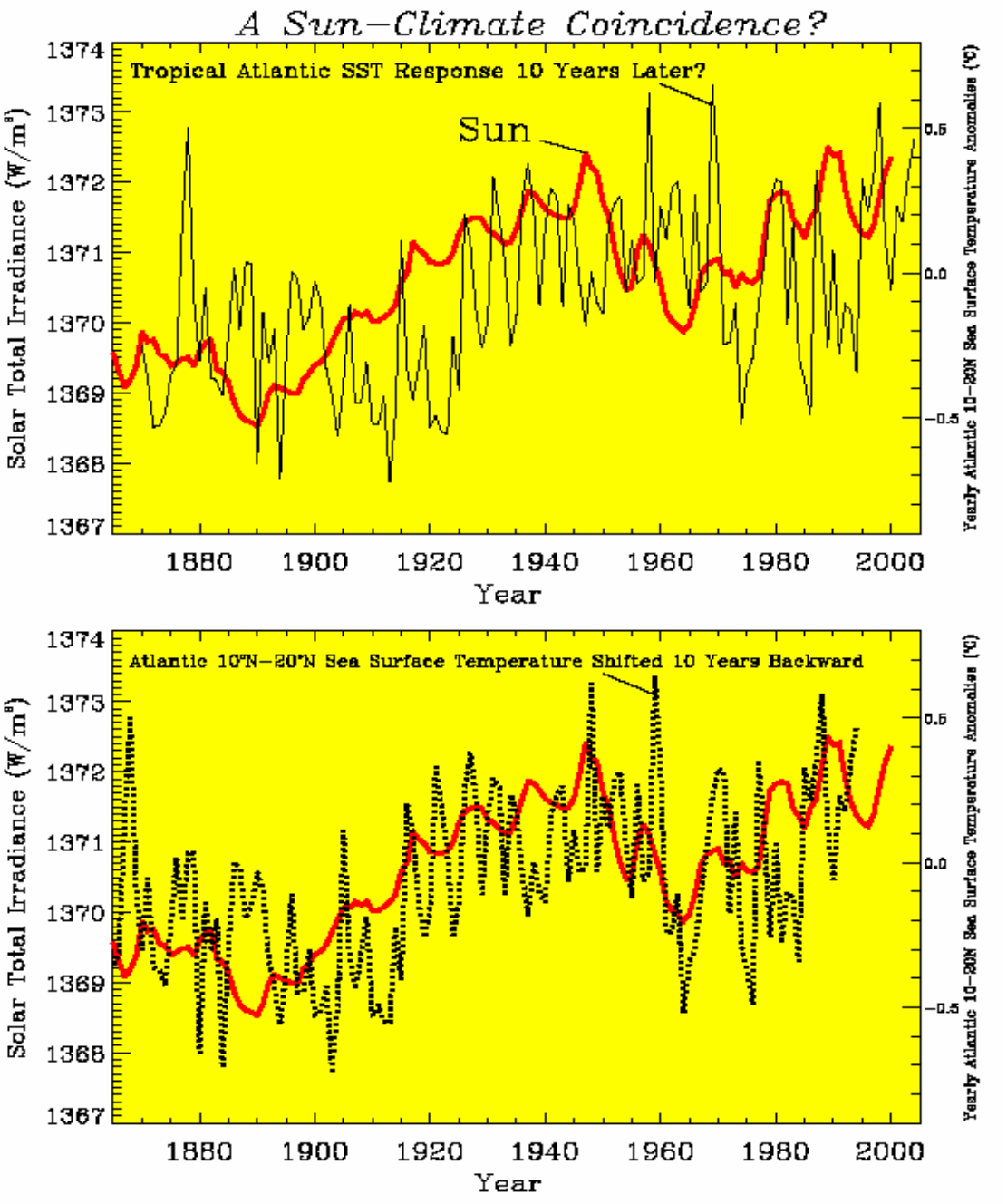
Thermohaline



RATIO of STRONG/WEAK ***2.7*** ***4.4***

Charts Courtesy of Professor Bill Gray (June 29, 2006)

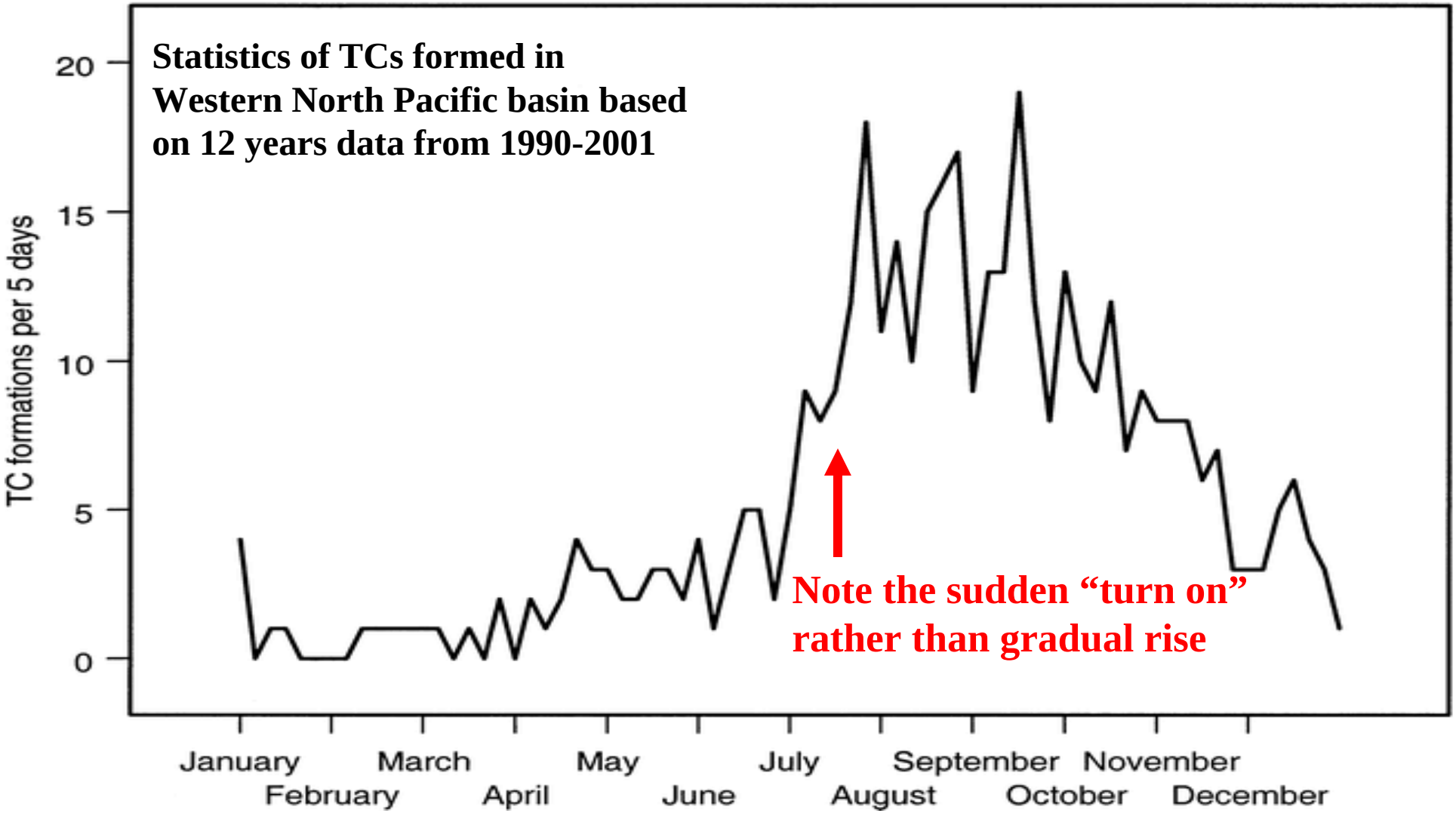
What does the Sun has to do with TCs and hurricanes?



Soon (2006)

Now why+how would sunlight be related to TCs generation?

"It is noted that favorable conditions for the atmosphere and ocean are needed for TC development (Gray 1979). First, an ocean temperature of at least 26°C is needed down to a depth of about 60 m."

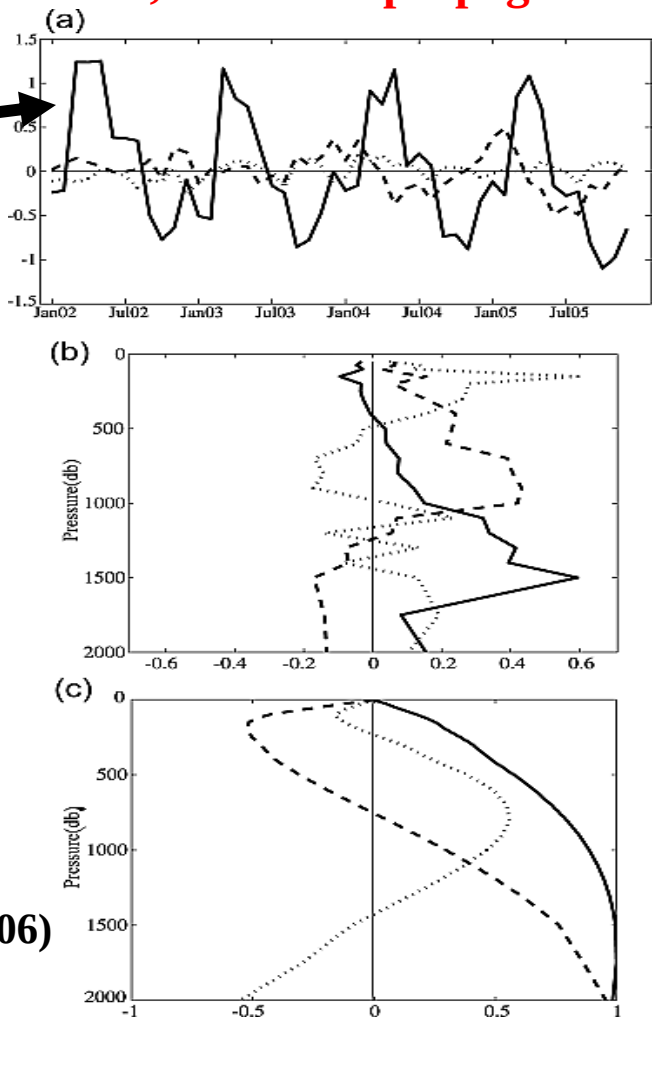


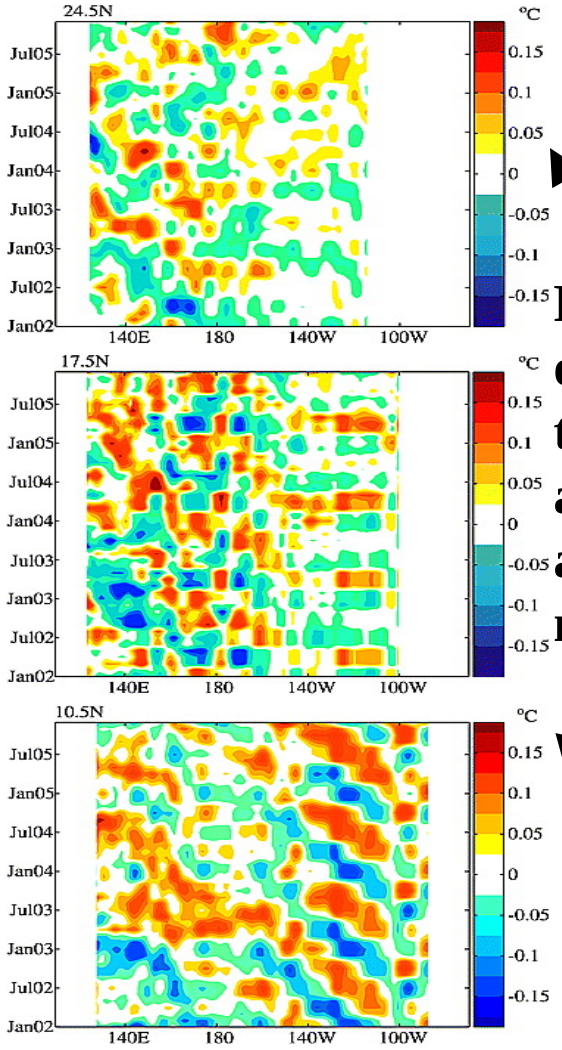
Cheung (2004) Journal of Climate, vol. 17, 466-484; Matsuura et al. (2003) Climate Dynamics, vol. 21, 105-117

Another new surprise of 2006: Detection of strong seasonal temperature variation at 1000 to 2000 meters below the Pacific Ocean

"Strong seasonal temperature variation below the thermocline is detected by Argo profiling floats. ... The result of this study show that seasonal signals can be captured at 1000-2000 dbar not only in the basin boundary regions or deep convection regions but also in the interior ocean. A clear, westward propagation signal is observed. "

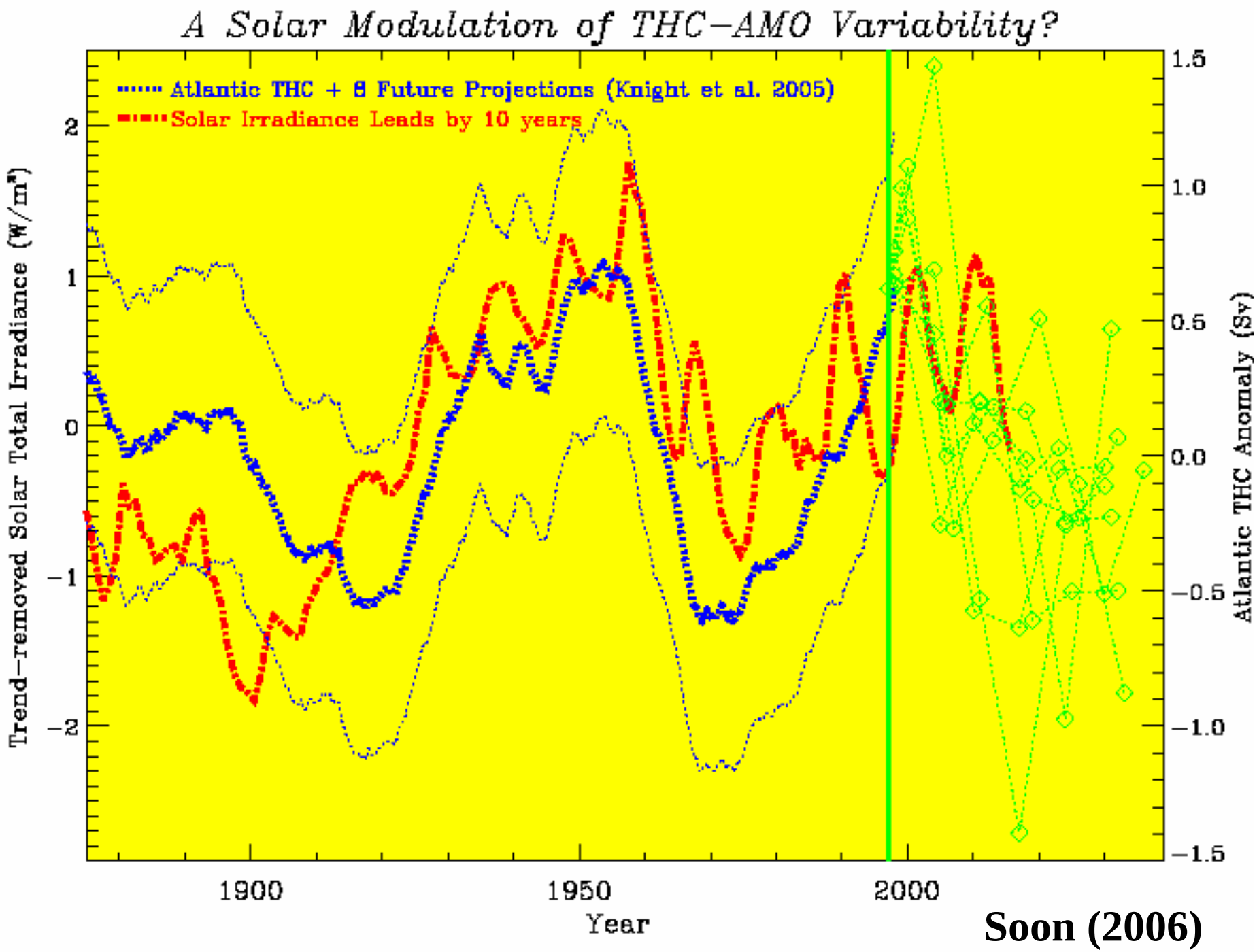
Strong seasonal temperatures detected by ARGO floats at 10.5°N, 130.5°W





Patterns of ocean temperatures at a depth of about 1200 meters

Hosoda et al. (2006) GRL, vol. 33, 2006GL026070


A Solar Modulation of THC–AMO Variability?
Atlantic THC + 8 Future Projections (Knight et al. 2005)
Solar Irradiance Leads by 10 years
Trend–removed Solar Total Irradiance (W/m²)
Atlantic THC Anomaly (Sv)
Year
1900
1950
2000
2
1
0
−1
−2
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
Soon (2006)

What are the current states of understanding and modeling of tropical cyclones and hurricanes?

- **global frequency of TCs, under various forcing scenarios, is robustly predicted to decrease because of the robust prediction of decrease tropical circulation as the globe warms; regional predictions are less reliable**
- **simulations of maximum intensity of TCs are not so reliably produced by models and thus contradicting common claims**
- **past model results that suggests more global TCs, more intense TCs and even new centers for the generation of TCs can be shown to be unreliable and premature**
- **lessons from palaeotempestology: tendencies for more hurricanes and more intense ones during cold periods and near transitional intervals from warm-to-cold + cold-to-warm climate and weather regimes**
- **multiple remote and in-situ factors like ENSO+QBO+vertical+meridional wind shears and possibly solar total and UV irradiance forcing, other than forcing by CO_2, predominate**

The blind adherence to the harebrained idea that climate models can generate "realistic" simulations of climate is the principal reason why I remain a climate skeptic. From my background in turbulence I look forward with a grim anticipation of the day when climate models will run with a horizontal resolution of less than a kilometer. The horrible predictability problems of turbulent flows then will descend on climate science with a vengeance.

—Henk Tennekes (January 6, 2006)

When I die and go to heaven there are two matters on which I hope for enlightenment. One is quantum electrodynamics and the other is turbulence in fluids. And about the former, I am really rather optimistic.

Horace Lamb (1849-1934) “The Grand Old Man of Hydrodynamics” (also grandfather of Hubert Horace Lamb [1913-1997] the distinguished climatologist)

http://www.wspc.com/books/physics/5199.html