Global Warming By the Numbers

John R. Christy

Director, Earth System Science Center

Professor, Atmospheric Science

University of Alabama in Huntsville

Alabama State Climatologist

A Lead Author, IPCC 2001, WG I:

Panelist, 2003 AGU Official Statement on Climate Change

William Thompson (Lord Kelvin)

If you can measure that of which you speak, and can express it by a number, you know something of your subject;

But if you can not measure it, your knowledge is meager and unsatisfactory

Sound bytes regarding the Science:

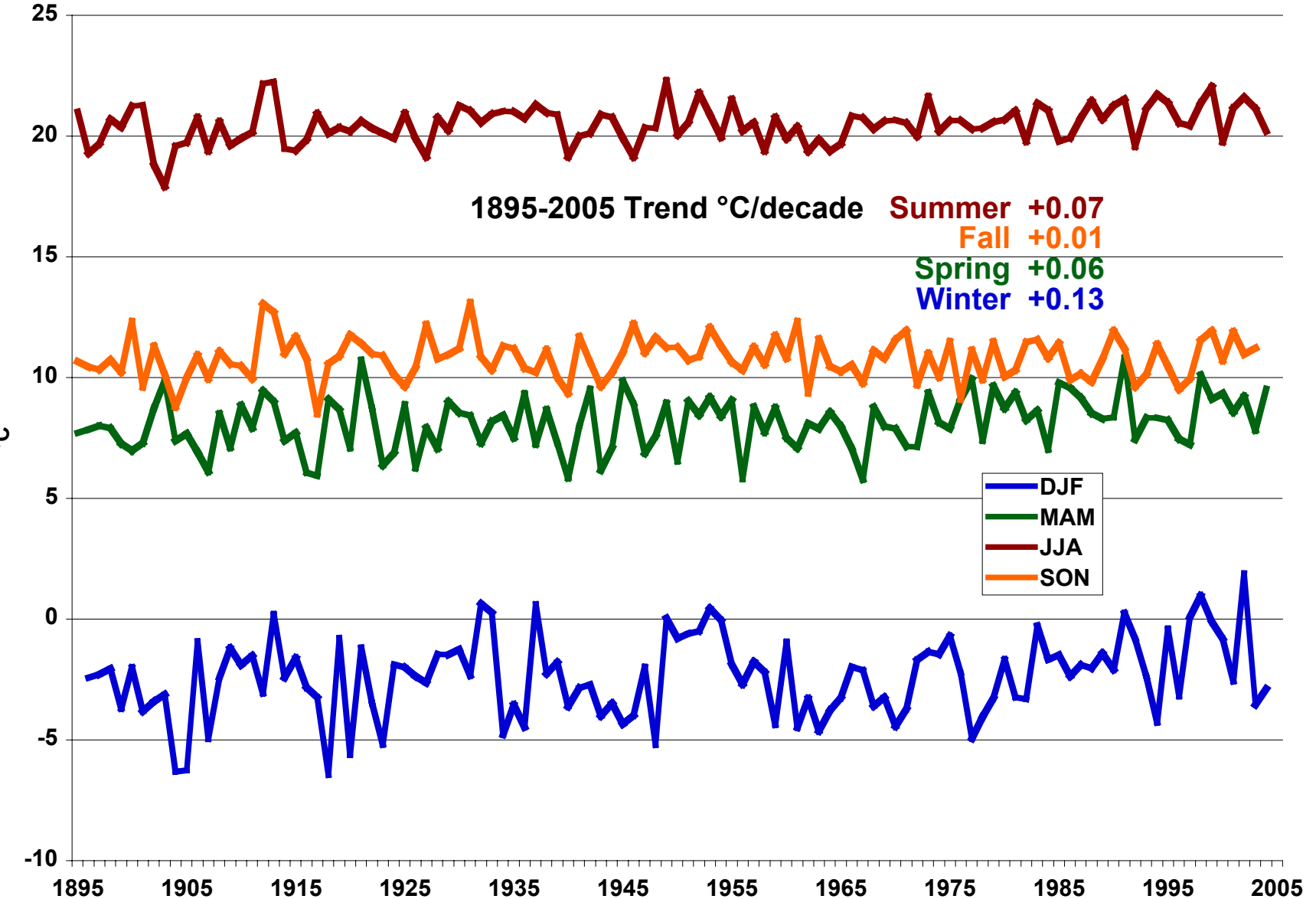
The Earth's surface has warmed a bit, but in a way inconsistent with catastrophe.

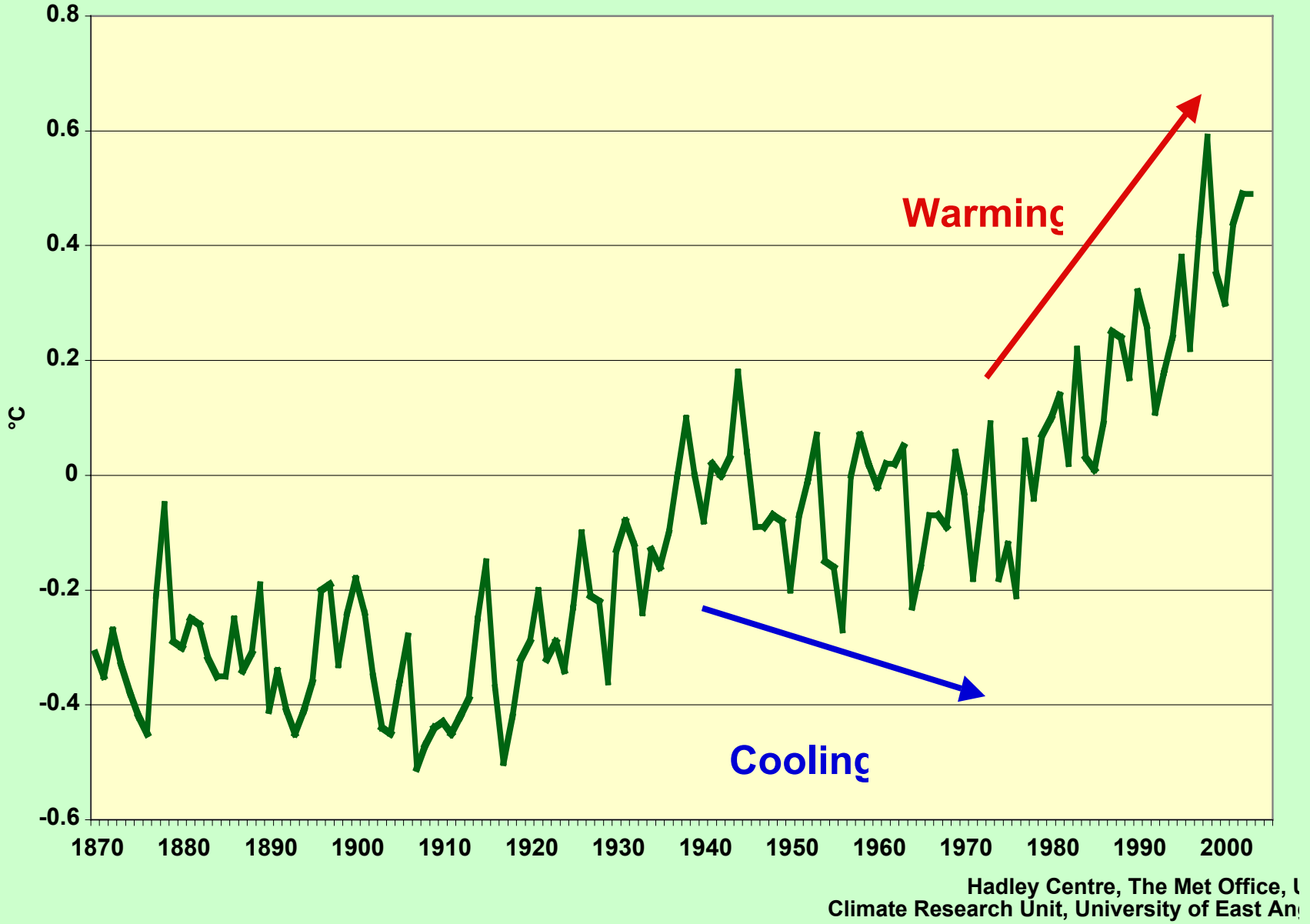
The weather that people really care about is not changing.

The background Climate always changes, and everything around us has already survived through tremendous climate changes in the past and adapted accordingly.

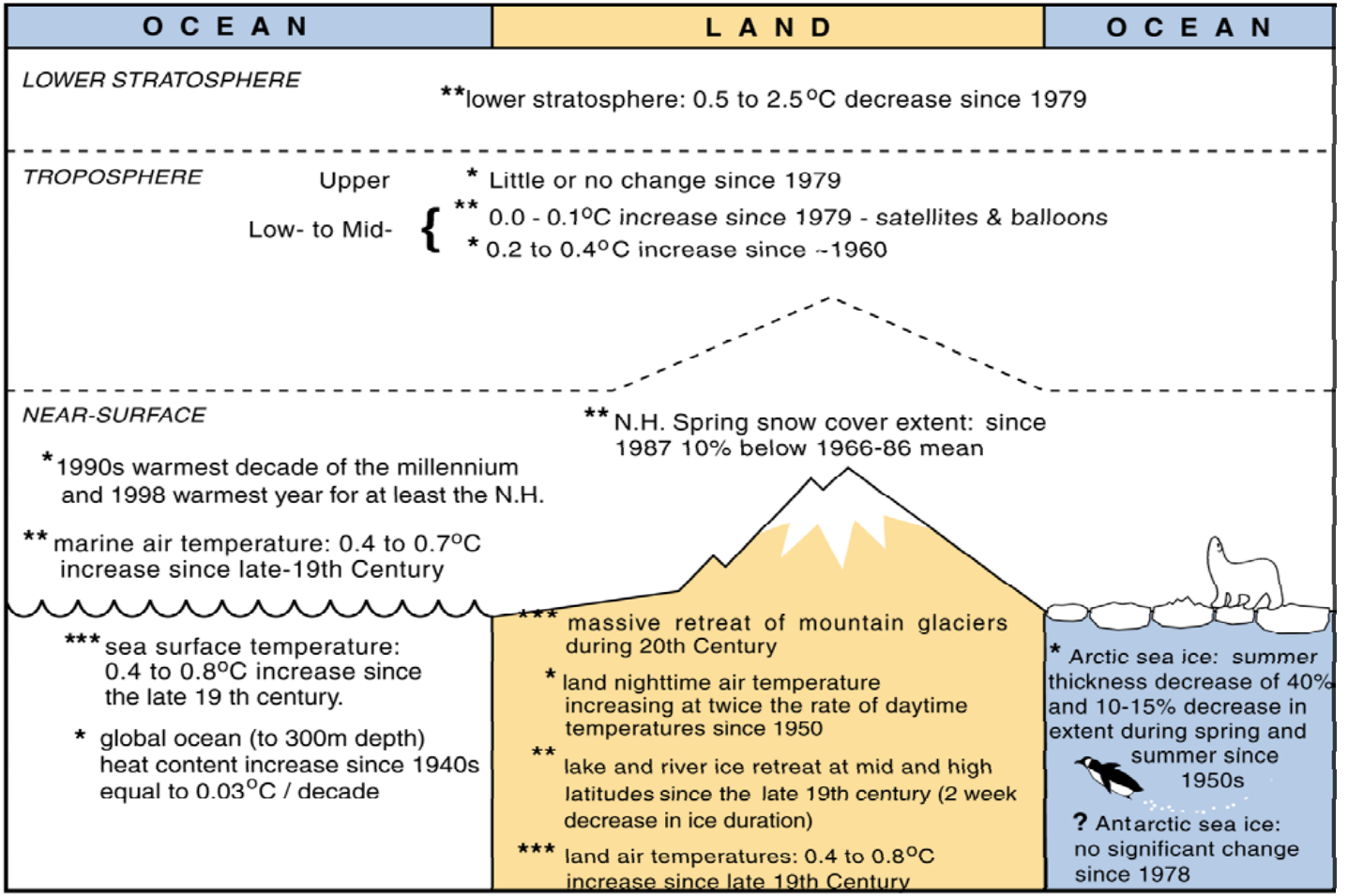
Any sea level rise will be very, very slow (as it has been for the past 6,000 years) while over the last 25 years, sea ice declined at one pole, but increased at the other.

Central Connecticut Temperature




"Global" Surface Temperatures 1870-20
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
°C
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Warming
Cooling
Hadley Centre, The Met Office, U
Climate Research Unit, University of East Ang

Temperature Indicators

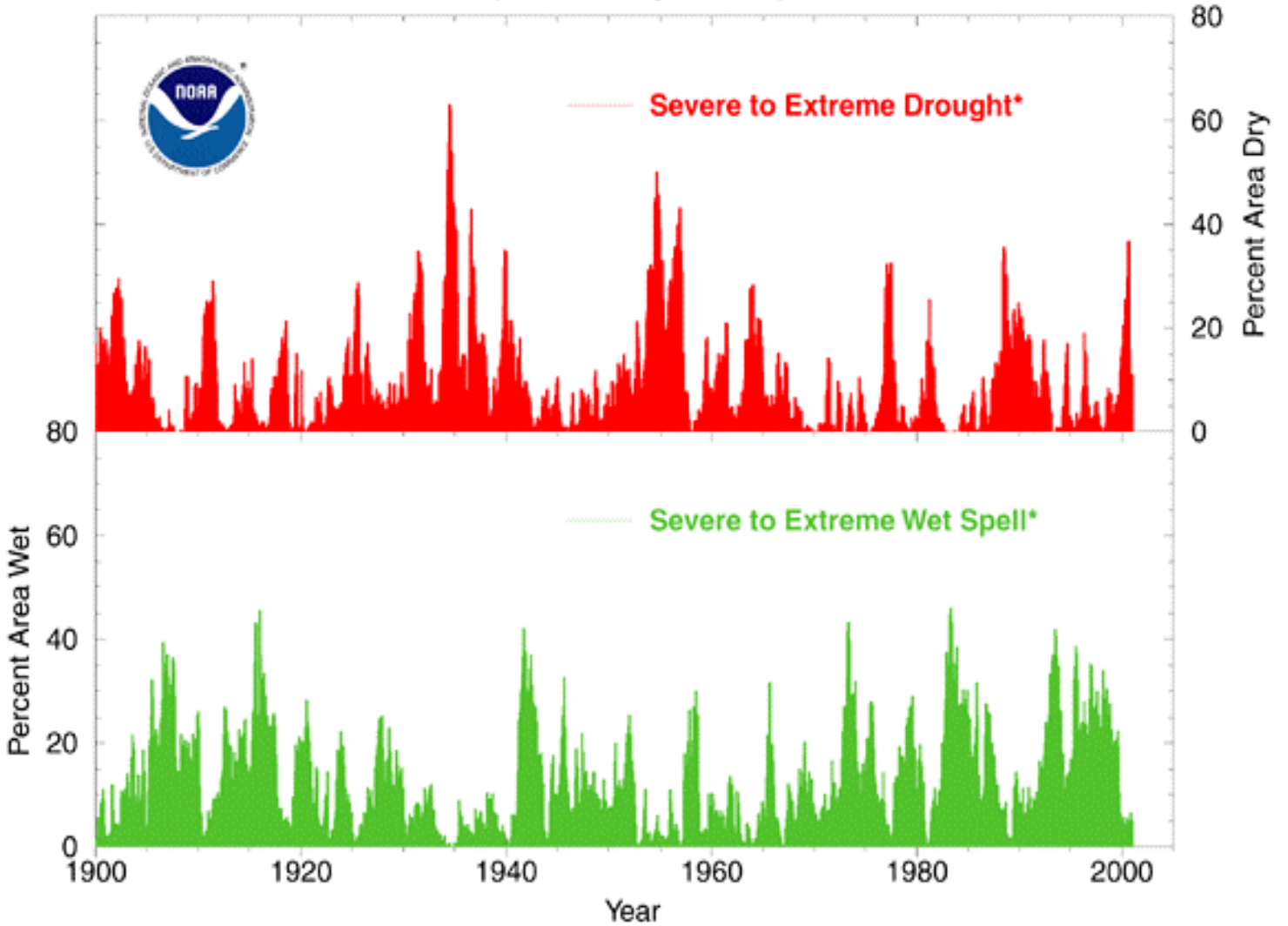


Likelihood:

- *** **Virtually certain (probability > 99%)**
- ** **Very likely (probability ≥ 90% but ≤ 99%)**
- * **Likely (probability > 66% but < 90%)**
- ? **Medium likelihood (probability > 33% but ≤ 66%)**

U.S. PERCENT AREA WET / PERCENT AREA DRY

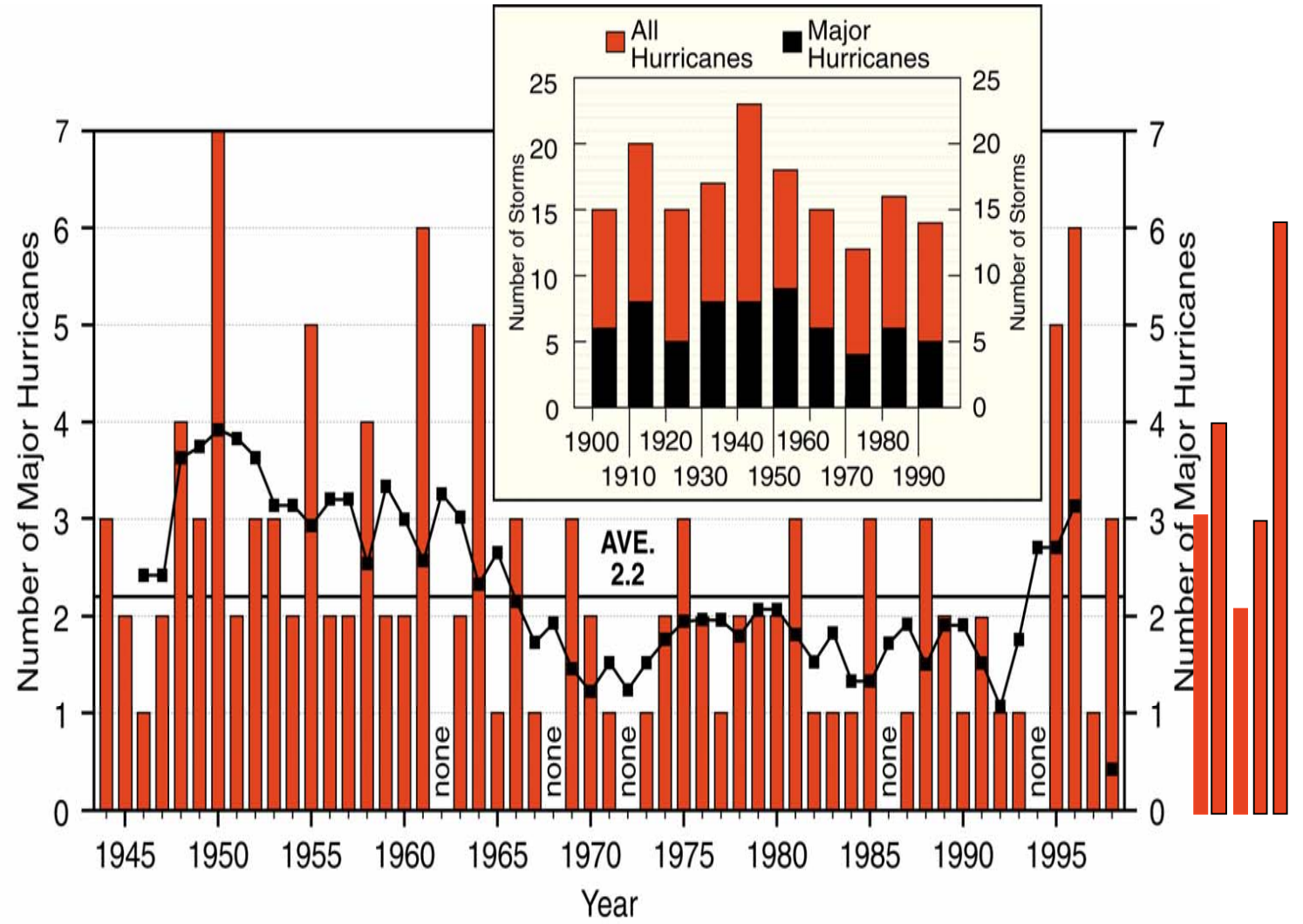
January 1900 through January 2001

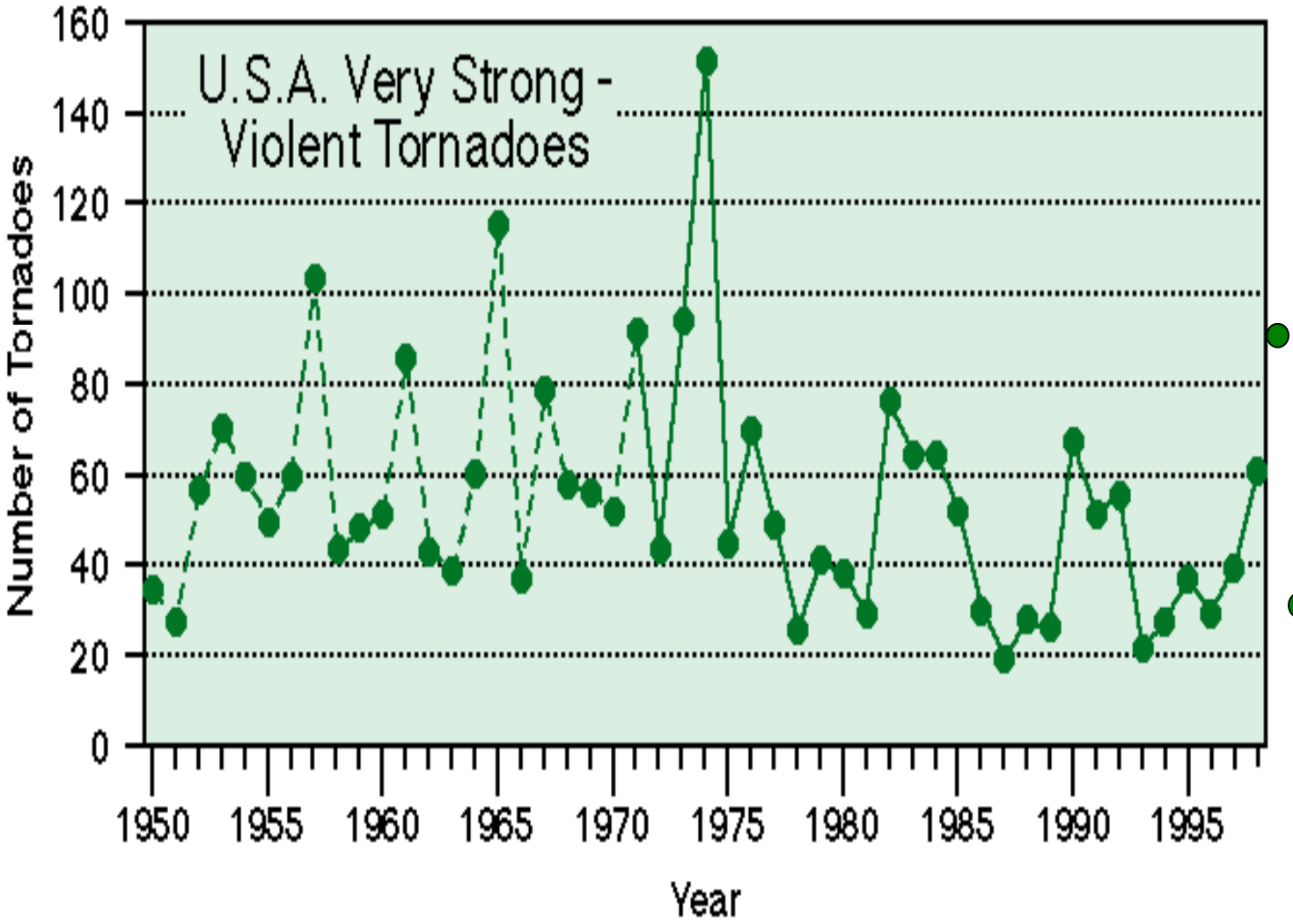


*based on the Palmer Index

National Climatic Data Center, NOAA

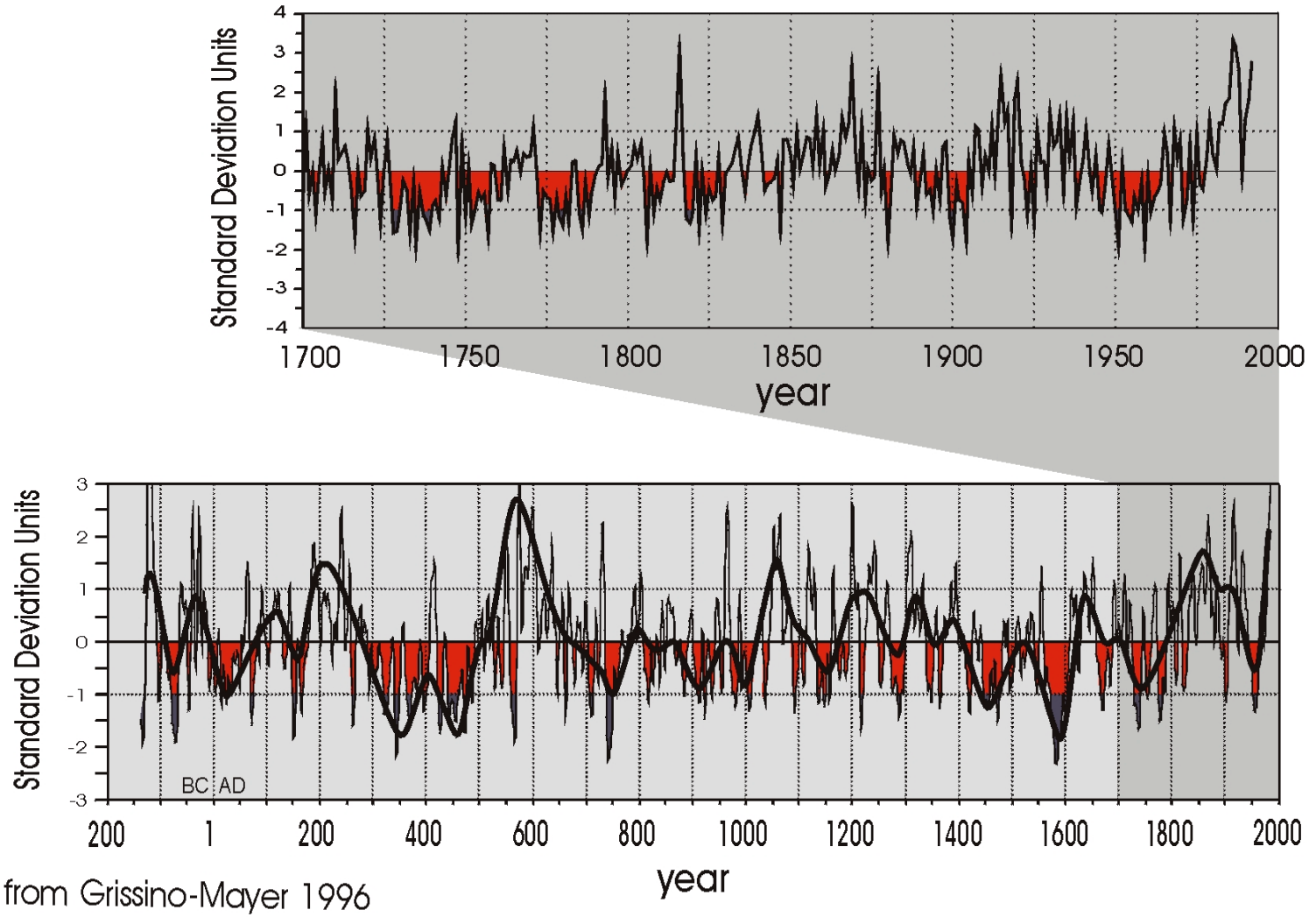
Atlantic Hurricanes





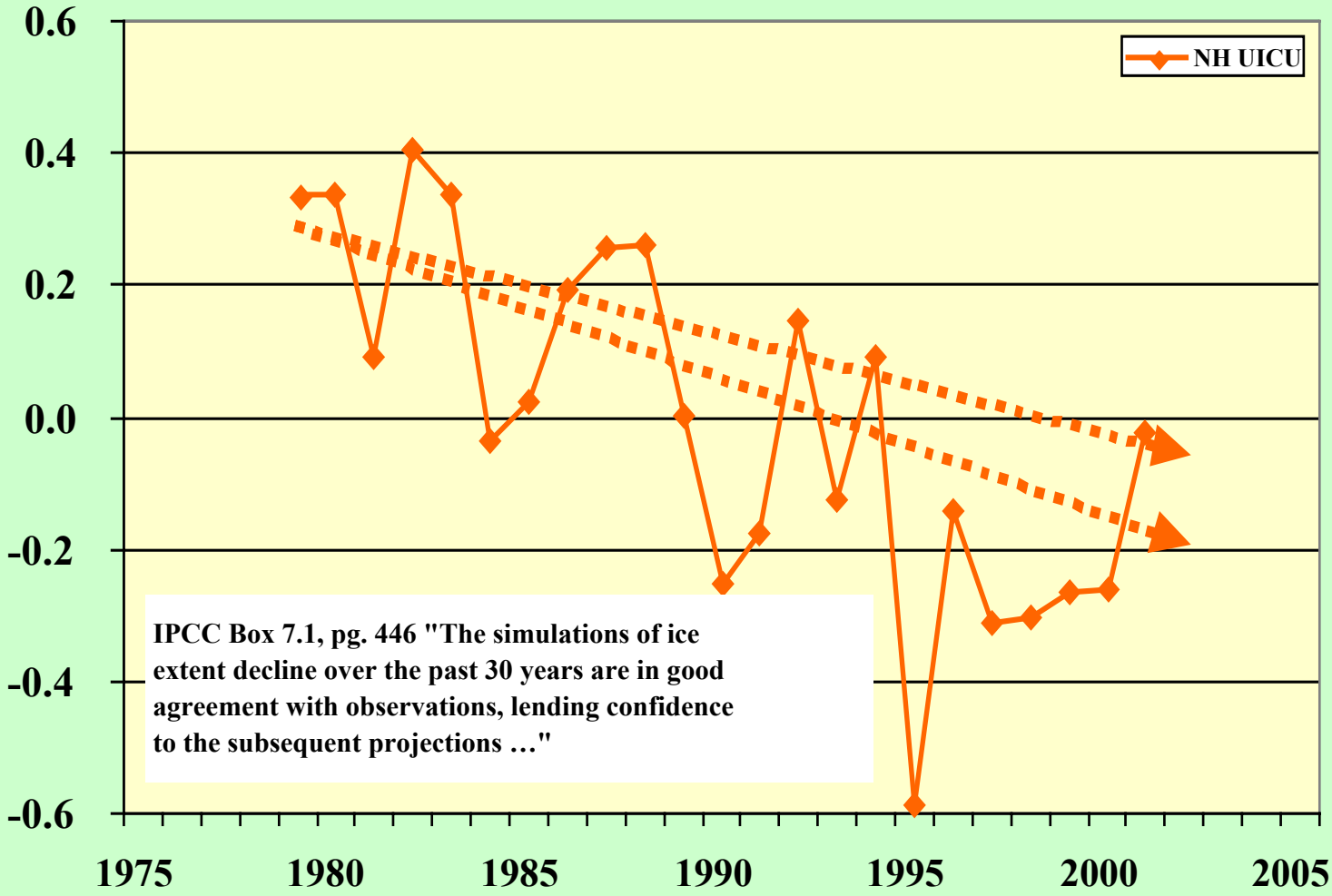
Oklahoma - record long period without a tornado 2003-04

Tree-Ring Reconstruction of Rainfall, Western New Mexico



from Grissino-Mayer 1996

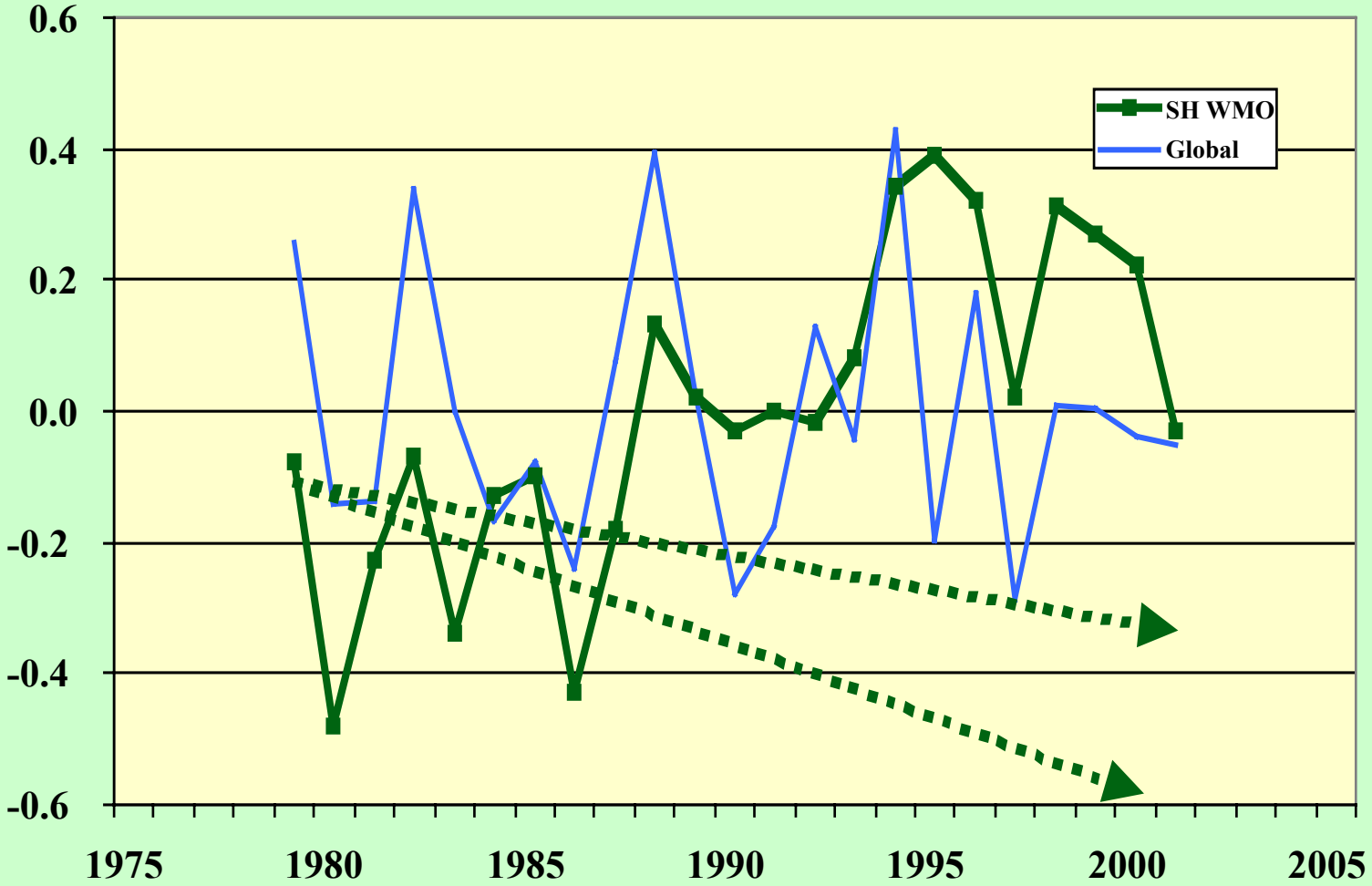
NH Sea Ice Extent Anomaly
1979-2001, 10^6 km^2



Mean NH: Obs: ~12.5, GFDL ~12.0, HadCM ~9.5

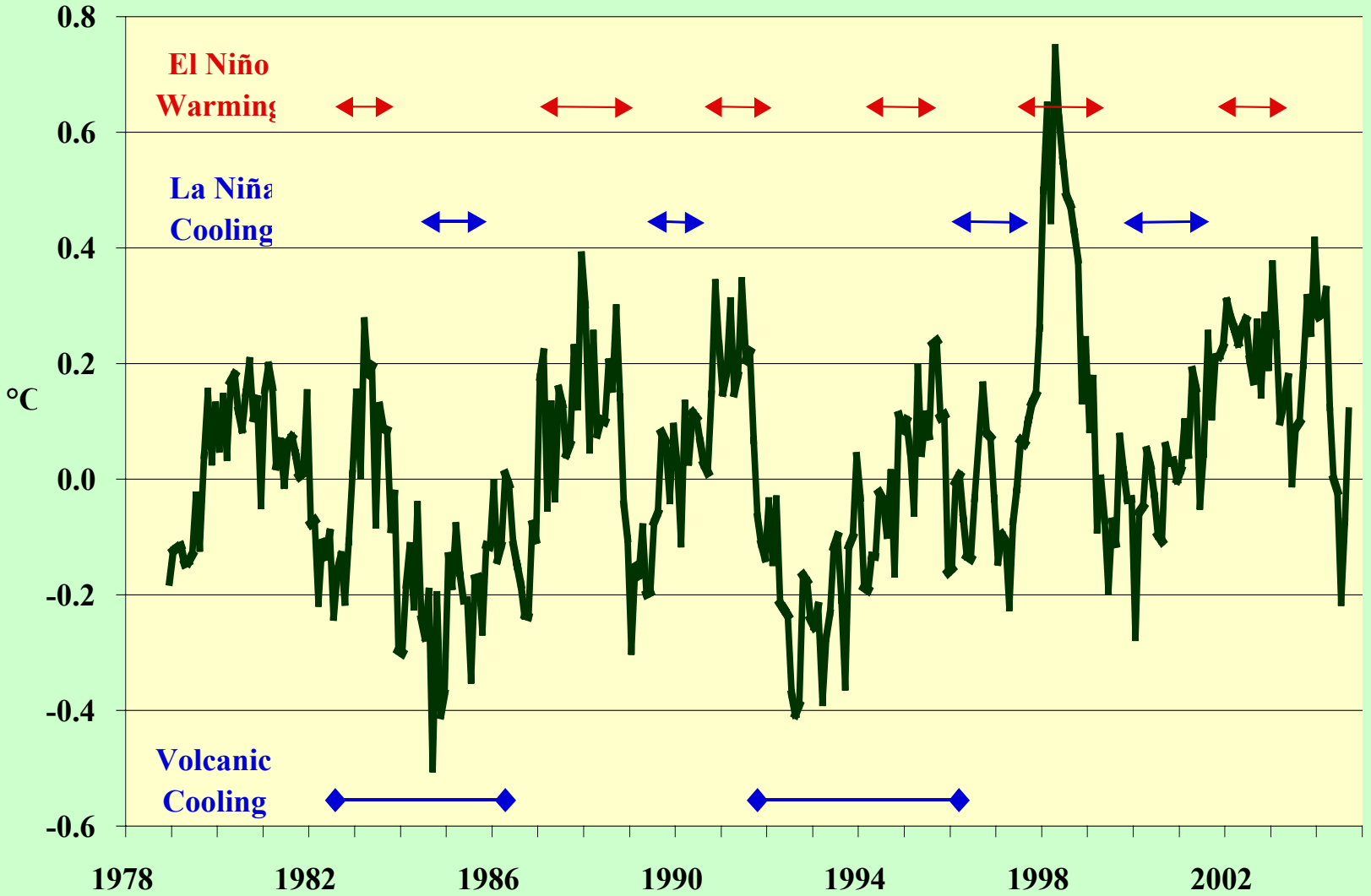
Models: Vinnikov et al. 1999

SH Sea Ice Extent Anomaly
1979-2001, 10^6 km^2



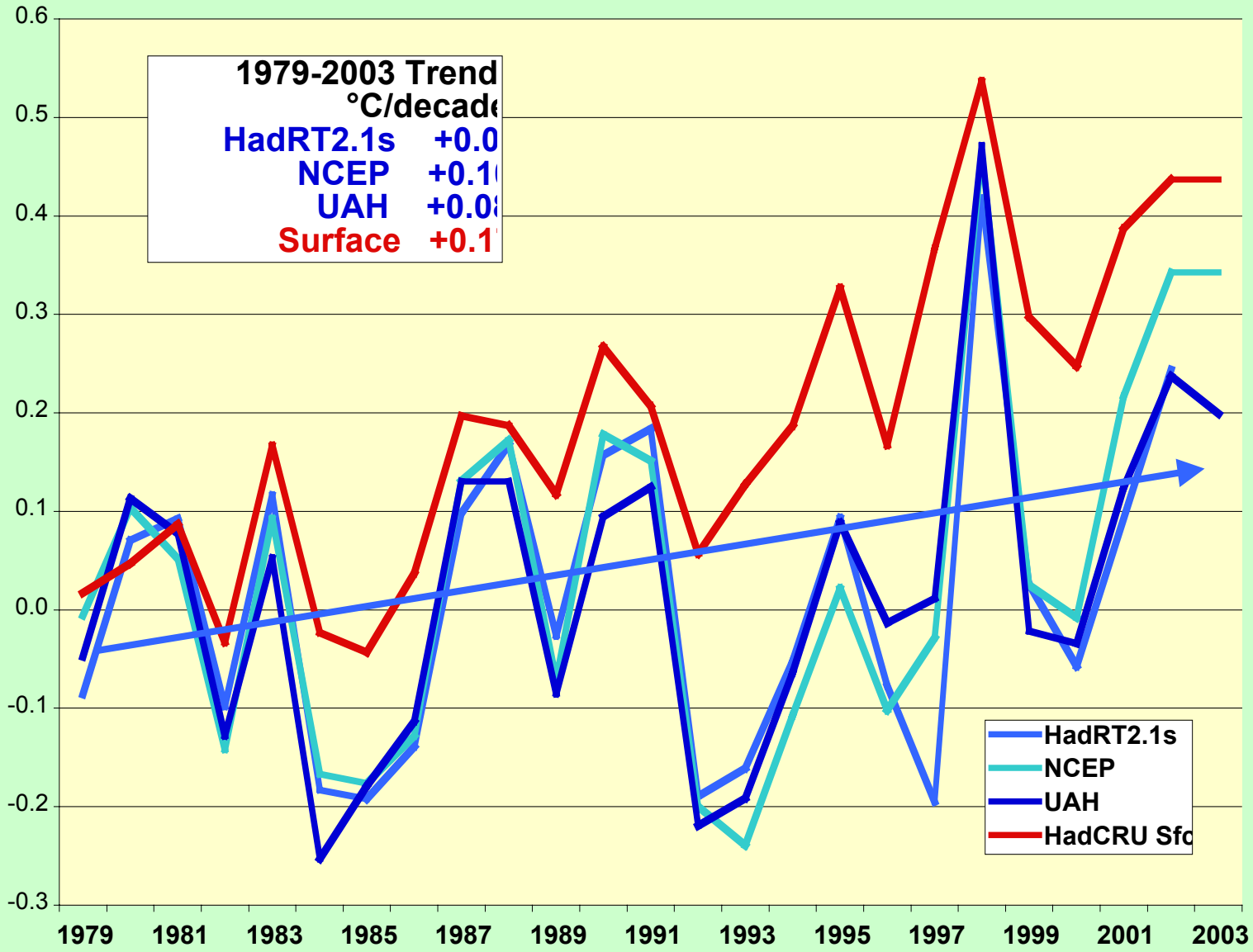
Mean SH: Obs~11.5, GFKL ~15.2, HadCM ~17.3

Global Lower Tropospheric (sfc to 8km) Temperature from MSU/AMSU TLT, 12/1978 - 09/2004



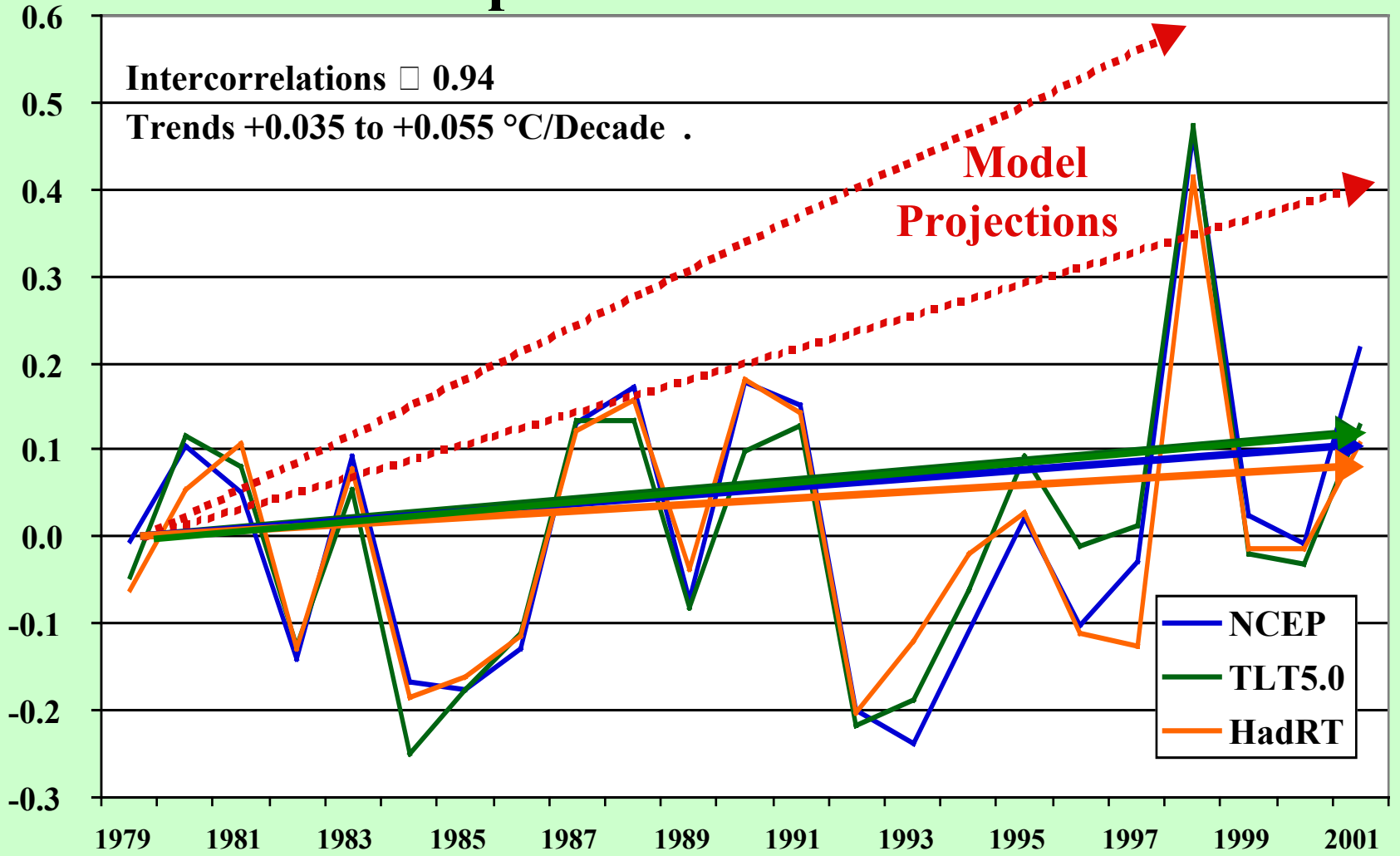
John R. Christy and Roy W. Spencer
University of Alabama in Huntsville

Global Lower Troposphere vs Surfa



John R. Christ
University of Alabama in Huntsvi

Global Lower Troposphere Temperature 1979-2001



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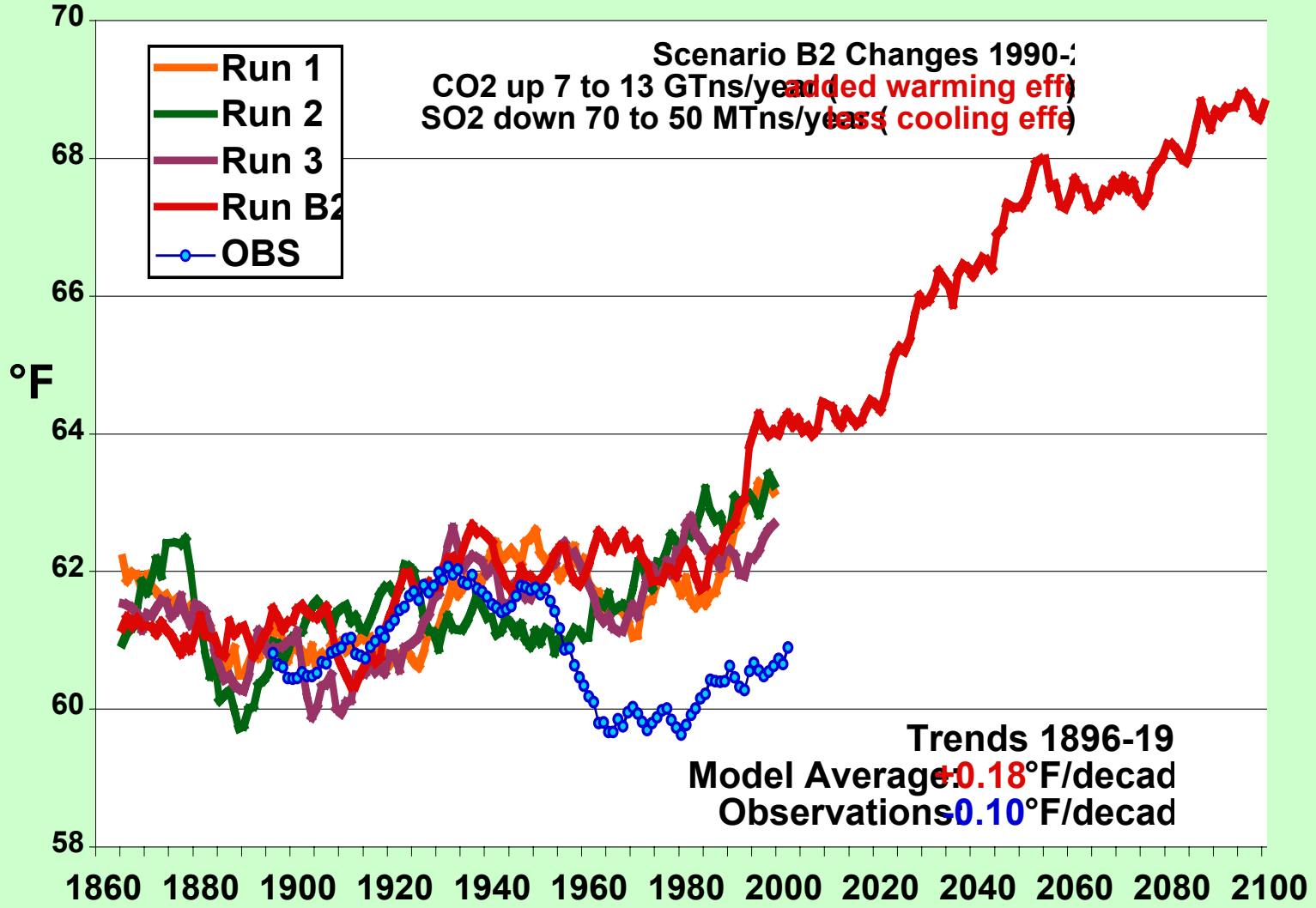
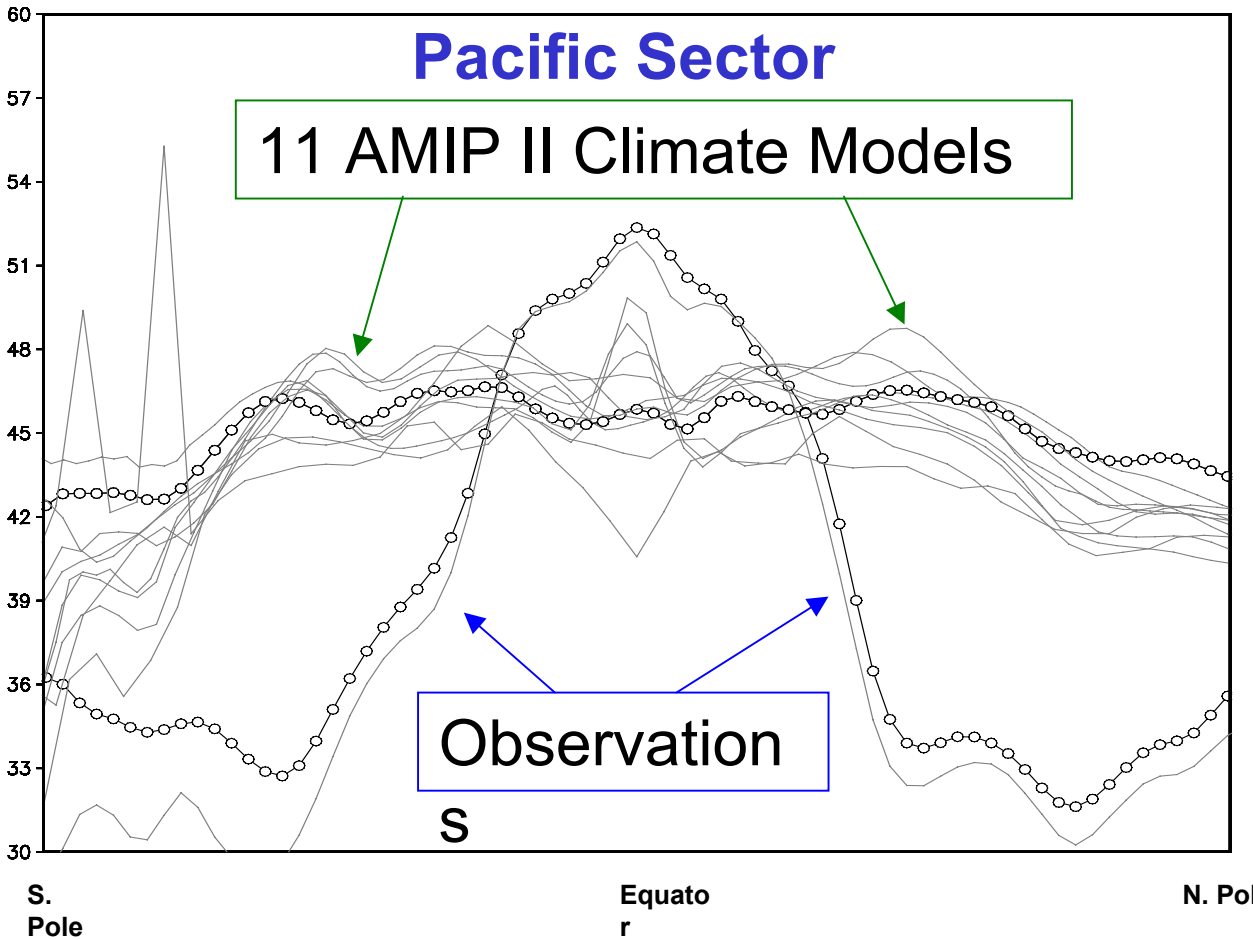
Annual Temperatures



HadCM B2 Peter Stott, Hadley Centre for Climate Prediction and
Observations: National Climate Data Center,

Thickness Sensitivity Index: σ(volume)/σ(temp)

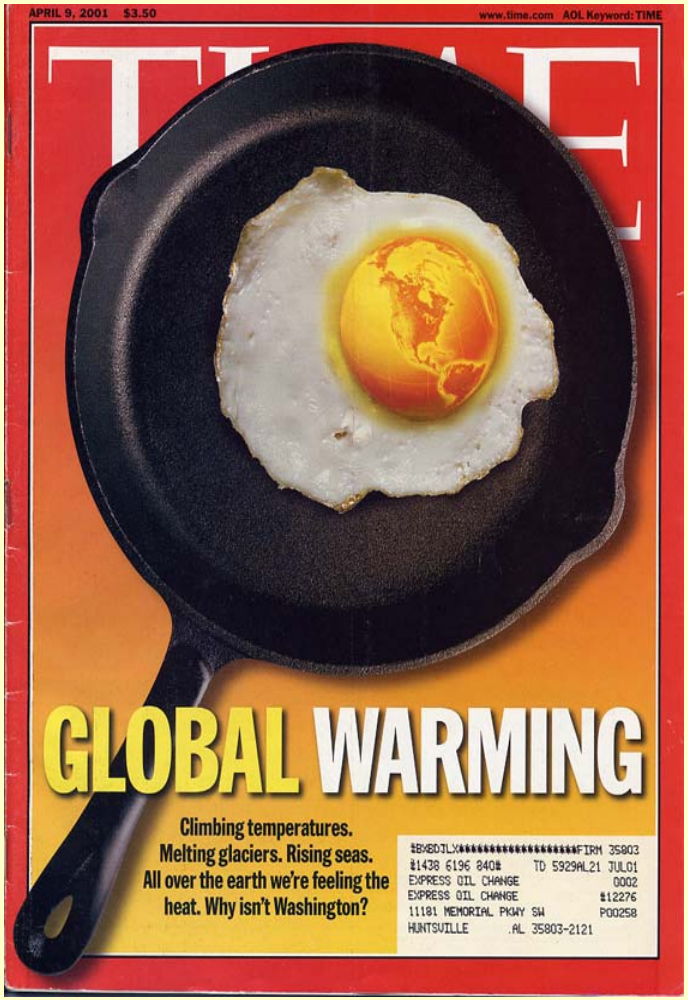
Relative Elevation Heat is Deposited in Atmosphere



J.J. Hnilo, PCMDI, LLNL

In the course of your work, you will from time to time encounter the situation in which the theory and the facts do not coincide. In such circumstances, young gentlemen, it is my sincere advice that you earnestly respect the facts.

Igor Sikorsky



SPECIAL REPORT ■ GLOBAL WARMING

er than they were five years ago. Back in the mid-1990s, climate models didn't include the effects of the El Chichon and Mount Pinatubo volcanic eruptions, which threw enough dust into the air to block out some sunlight and slow down the rate of warming. That effect has dissipated, and the heating should start to accelerate. Moreover, the IPCC noted, many countries have begun to reduce their emissions of sulfur dioxide in order to fight acid rain. But sulfur dioxide particles, too, reflect sunlight; without this shield, temperatures should go up even faster.

The models still aren't perfect. One major flaw, agree critics and champions alike, is that they don't adequately account for clouds. In a warmer world, more water will evaporate from the oceans and presumably form more clouds. If they are billowy cumulus clouds, they will tend to shade the planet and slow down warming; if they are high, feathery cirrus clouds, they will trap even more heat.

Research by M.I.T. atmospheric scientist Richard Lindzen suggests that warming will tend to make cirrus clouds go away. Another critic, John Christy of the University of Alabama in Huntsville, says that while the models reproduce the current climate in a general way, they fail to get right the amount of warming at different levels in the atmosphere. Neither Lindzen nor Christy (both IPCC authors) doubts, however, that humans are influencing the climate. But they question how much—and how high temperatures will go. Both scientists are distressed that only the most extreme scenarios, based on huge population growth and the maximum use of dirty fuels like coal, have made headlines.

It won't take the greatest extremes of warming to make life uncomfortable for large numbers of people. Even slightly higher temperatures in regions that are already drought- or flood-prone would exacerbate those conditions. In temperate zones, warmth and increased CO_2 would make some crops flourish—at first. But beyond 3° of warming, says Bill Easterling, a professor of geography and agronomy at Penn State and a lead author of the IPCC report, "there would be a dramatic turning point. U.S. crop yields would start to decline rapidly." In the tropics, where crops are already at the limit of their temperature range, the decrease would start right away.

Even if temperatures rise only moderately, some scientists fear, the climate would reach a "tipping point"—a point at which even a tiny additional increase would throw the system into violent

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EXHIBIT B

Hotter Times

TEMPERATURES SIZZLED from Kansas to New England last May, surprising residents like this Delaware boy with an unusually early heat wave.

CROPS WITHERED and Dallas temperatures topped 100°F for 29 days straight in a Texas hot spell that struck during the summer of 1998.

INDIA'S WORST heat shock in 50 years killed more than 2,500 people in May 1998.

CHERRY BLOSSOMS in Washington bloom seven days earlier in the spring than they did in 1970.

EXHIBIT C

Wild Weather

HEAVY RAINS in England and Wales made last fall Britain's wettest three-month period on record.

FIRES due to dry conditions and record-breaking heat consumed 20% of Samos Island, Greece, last July.

FLOODS along the Ohio River in March 1997 caused 30 deaths and at least $500 million in property damage.

HURRICANE FLOYD brought flooding rains and 130-m.p.h. winds through the Atlantic seaboard in September 1999, killing 77 people and leaving thousands homeless.

ESSAY

A LETTER TO PRESIDENT BUSH

Dear Mr. President,

No challenge we face is more momentous than the threat of global climate change. The current provisions of the Kyoto Protocol are a matter of legitimate debate. But the situation is becoming urgent, and it is time for consensus and action. There are many strategies for curbing greenhouse-gas emissions without slowing economic growth. In fact, the spread of advanced, cleaner technology is more of an economic opportunity than a peril. We urge you to develop a plan to reduce U.S. production of greenhouse gases. The future of our children—and their children—depends on the resolve that you and other world leaders show.

Respectfully,

Jimmy Carter — Mikhail Gorbachev
John Glenn — Walter Cronkite
George Soros — J. Craig Venter
Jane Goodall — Edward O. Wilson
Harrison Ford — Stephen Hawking

88 TIME, APRIL 9, 2001

***TIME* 9 April 2001**

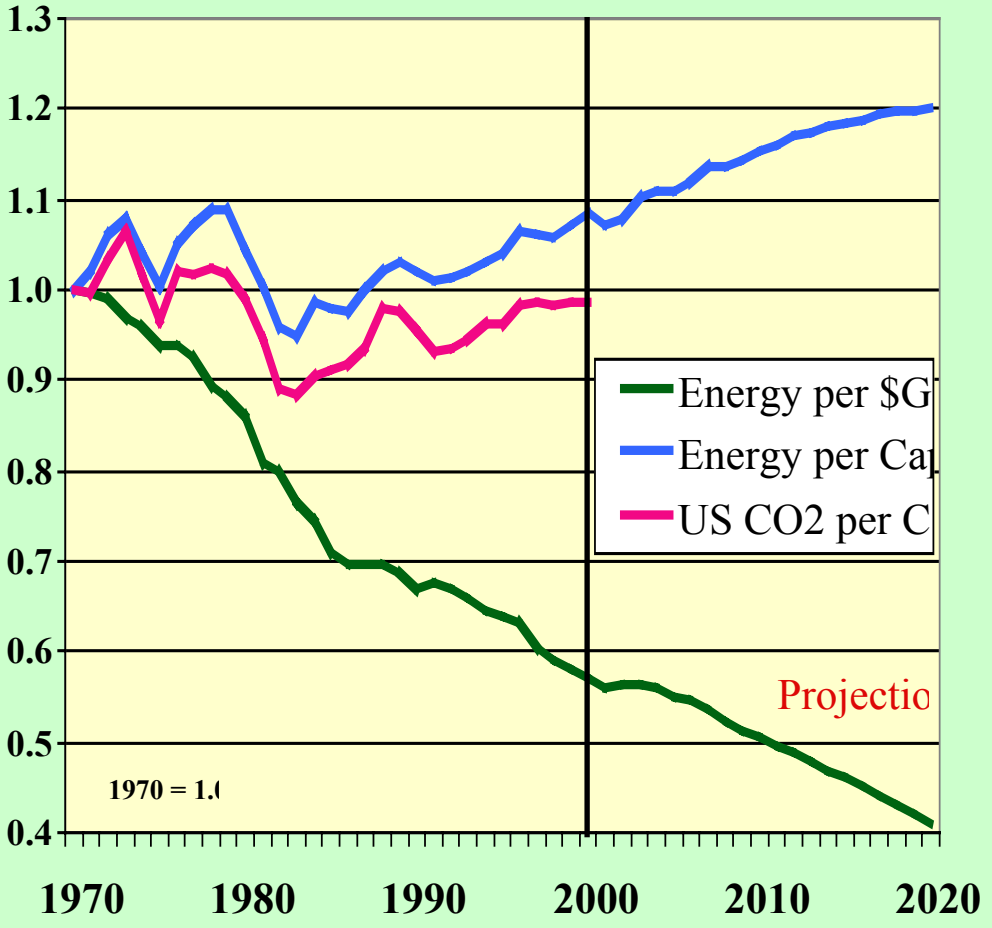
"…the tone of [*TIME's*] package is decidedly alarmist and aimed at bringing pressure to bear on the Bush Administration."

Comment of *TIME* reporter to J. Christy

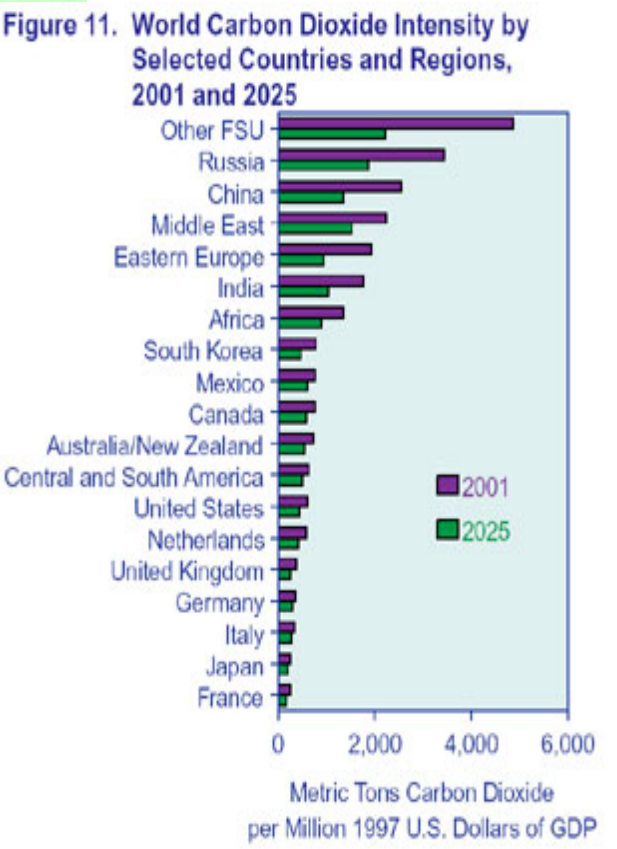
"Silly me ... I thought *TIME* was a news magazine"

J. Christy

US Energy



EIA 2002 Out



The United States produces 23.4% of the world's human-based CO2 emissions*

The U.S. produces 29.9% of the kinds of things people can't live without*:

Agricultural products and research (we feed people)

Medical advances on every front (we fix people)

Technology unimaginable (we fulfil people)

Invest in and aid the world (we fund people)

Defense of Democracy (we free people)

Obnoxious Entertainers (we offend people)

Our CO2 emissions make the world a far better place than it would otherwise be … access to energy means longer and better lives for everyone.

*2002 World total = 24.53M metric tons CO2 U.S. total = 5.75M metric tons CO2 Energy Information Administration	*2003 World total = $ 36,356B U.S. total = $ 10,882B World Development Indicators, World Bank

Some people will do anything to save the Earth

...

except take a science course.

Greenhouse "Affect", *Rolling Stone*

P.J. O'Rourke