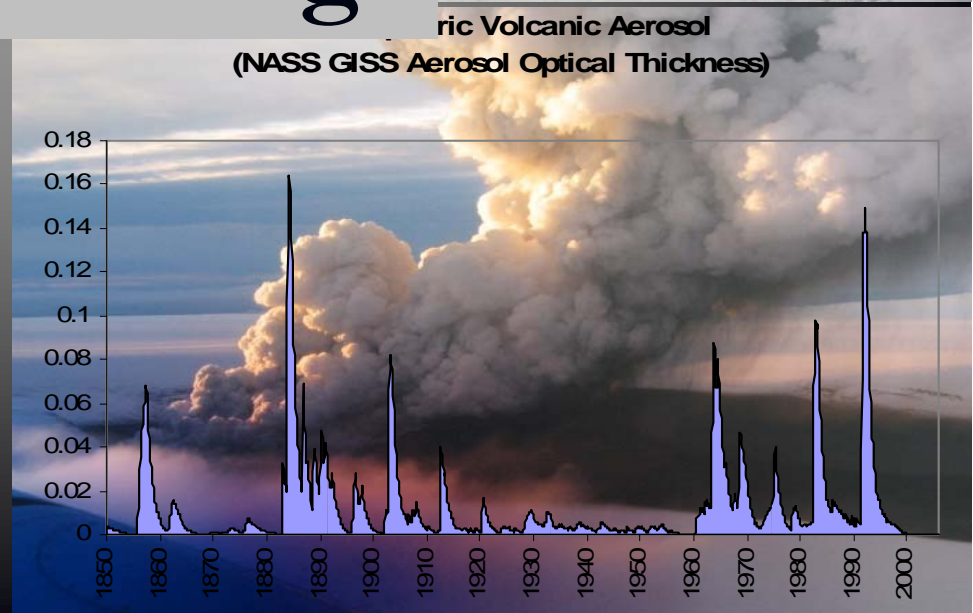
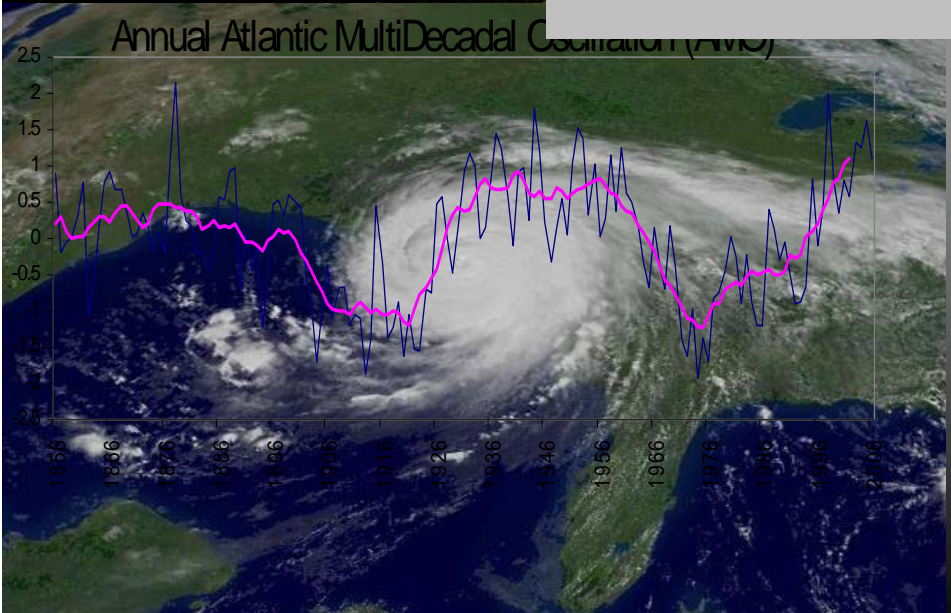


# Climate Change





By far the most terrifying film  
you will ever see.

# an inconvenient truth

A GLOBAL WARNING

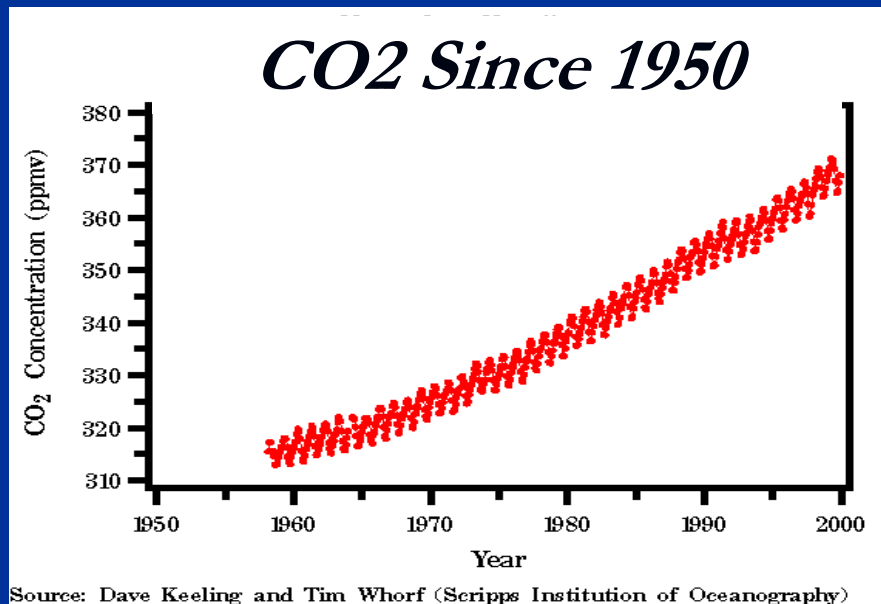
LOREM NOSTRUD PRESENTS A DOLOR AMET PRODUCTION A CORPER SUSCIPIT FILM CONSECT ETUER "AUTEM VENSLET" LOBORTIS NISL MAGNA MINIM COMMODO CONSEX  
VENTAME NOSTUD MARCH BY DOLORE MAGNA ASSISTANT ESSE MOLESTIAE VISUAL EFFECTS EOSE T. ACCUSAM EDITED BY ISMOD TINCIDIUM A.C.E. PRODUCTION EXER CITATION DIRECTOR OF UTAGNA LASEOR A.S.C.  
EXECUTIVE PRODUCER LORTIS NAJEYDI XUIS NOSTUD STORY BY VOLUPTATE VELIT SCREENPLAY BY ACCUSAM ADIPSCING PRODUCED BY DOLOR AMET DIRECTED BY CORPER SUSCIPIT

# The Movie's/Media's Premise

- Global warming no longer in question but action to remedy it is being undermined by political inertia and because of doubt created by big oil and a few remaining 'skeptics'
- The warming is unprecedented and is already having major effects on our weather and climate and the environment, and we are nearing a 'tipping point' which could trigger catastrophic consequences

# Greenhouse Effect

- A warming due to the presence in the air of gases (water vapor, methane, carbon dioxide) which are relatively transparent to solar incoming radiation, but which are in selective ranges opaque to the thermal radiation back out from the ground
- These gases behave like the glass in a greenhouse and act to trap the heat



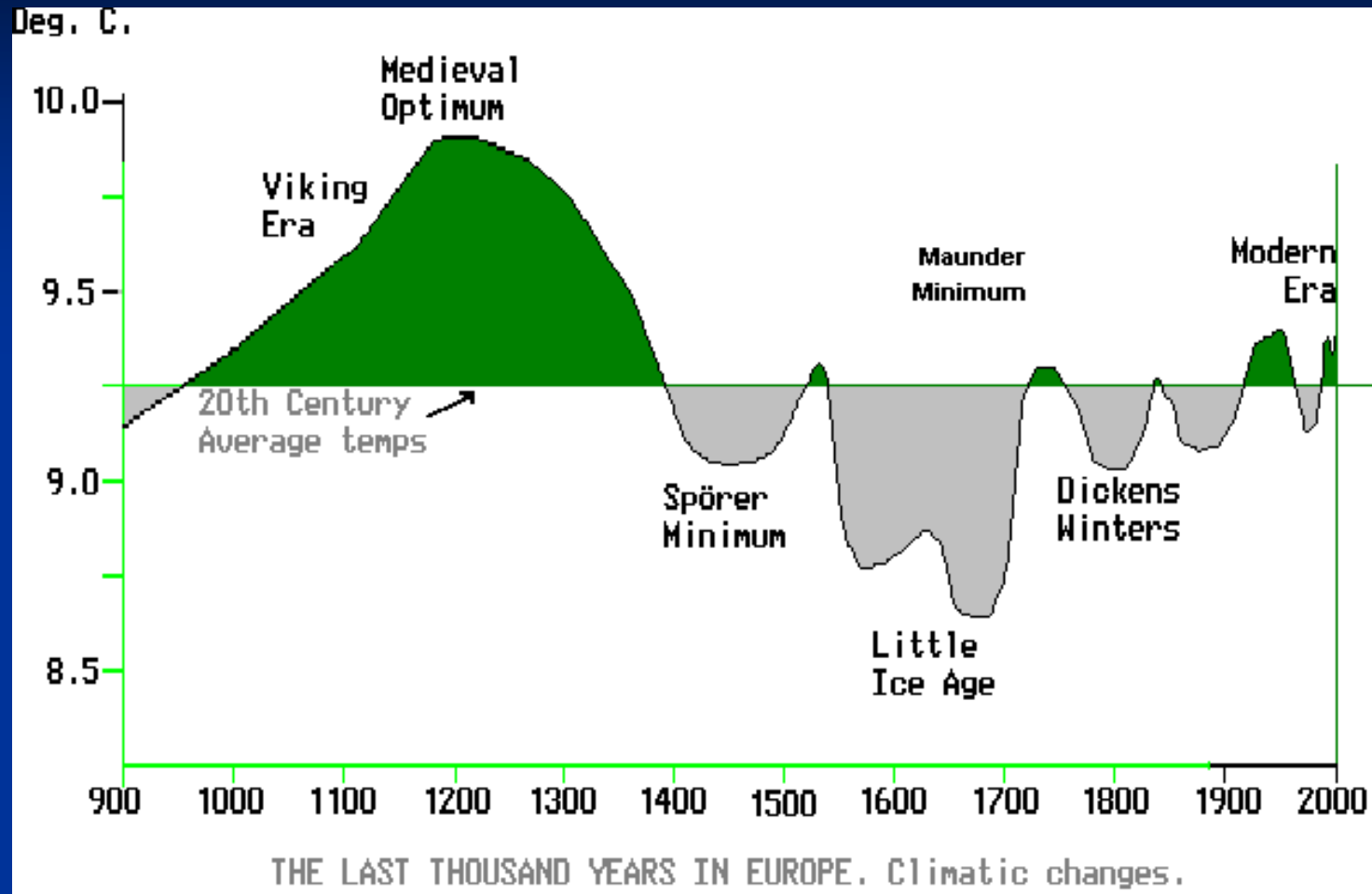
Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)

Al got this right

# Greenhouse Effect

- Though is very real and is likely having an effect on our climate, CO<sub>2</sub> is in fact a 'minor' greenhouse gas (0.054% concentration with man's contribution just 5.53% of that and is increasing at rates less than half assumed by the climate models (0.43% vs 1%))
- The most important greenhouse gas by far is water vapor (95% of greenhouse) and some of the models predicting major warming make the wrong assumptions how much water vapor increases with warming and/or how much population will grow
- Latest IPCC report has cut back the warming to 1.8 to 4.5C. Many scientists (Gray, Lindzen, Hoyt) believe with the proper assumptions and feedbacks, the real change for a doubling will be the order of 0.2 to 1C

# Only Constant in Nature is Change

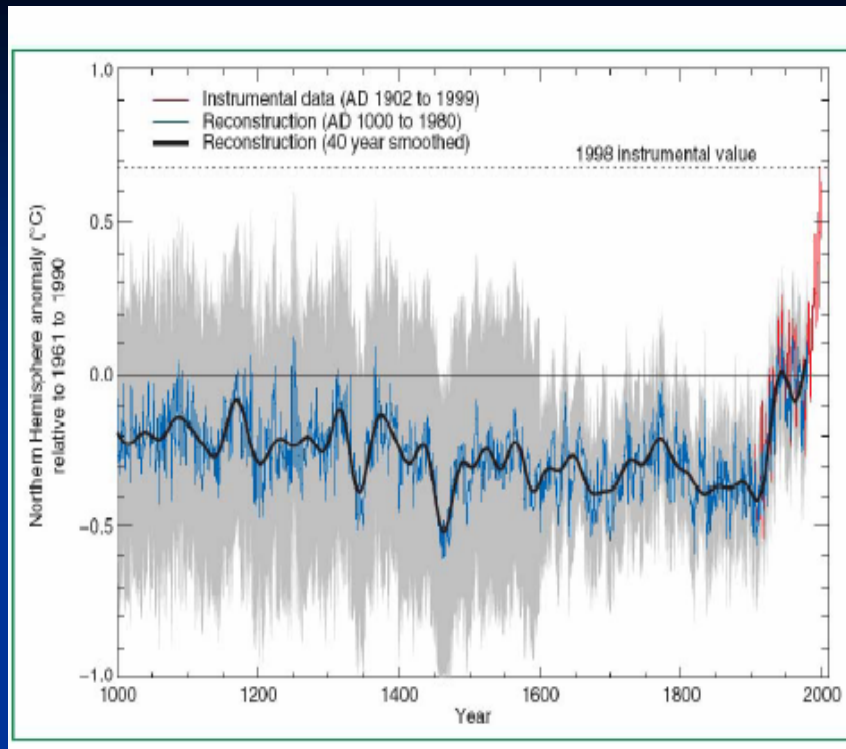


Until 1998, the accepted historical record. Made recent warming look insignificant.

# Medieval Warming Dilemma

- Dr. David Deming (University of Oklahoma)

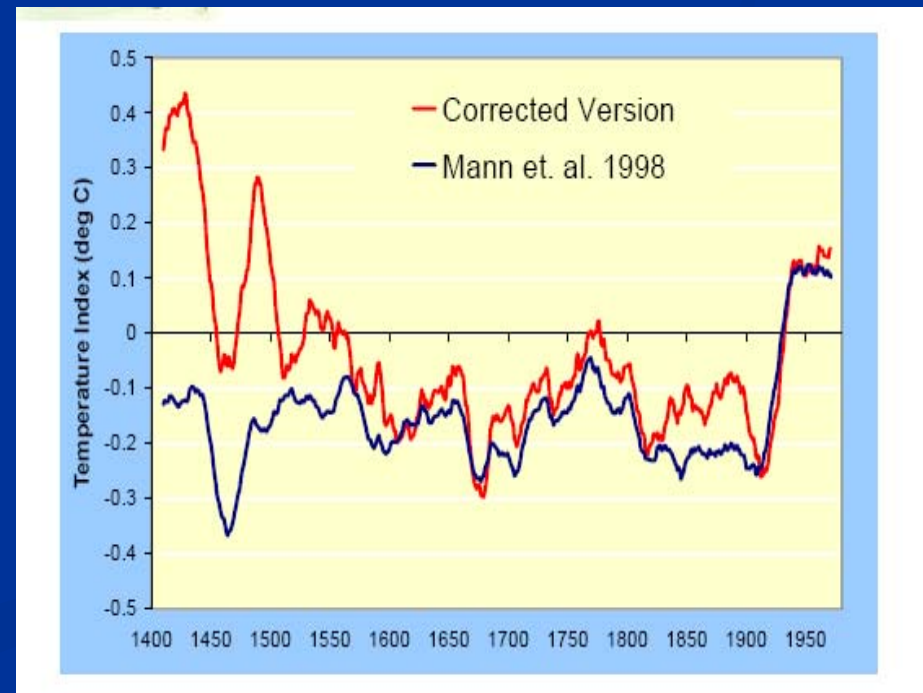
“ Around 1996, I became aware of how corrupt and ideologically driven current climate research can be. A major researcher working in the area of climate change confided in me that the factual record needed to be altered so that people would become alarmed over global warming. He said, "We have to get rid of the Medieval Warm Period."



*Solution: Mann et al. '98 paper did away with prior warm period.. The so-called Hockey Stick was published everywhere as proof of Global warming. It was shown prominently in IPCC 3<sup>rd</sup> Assessment and in the movie An Inconvenient Truth*

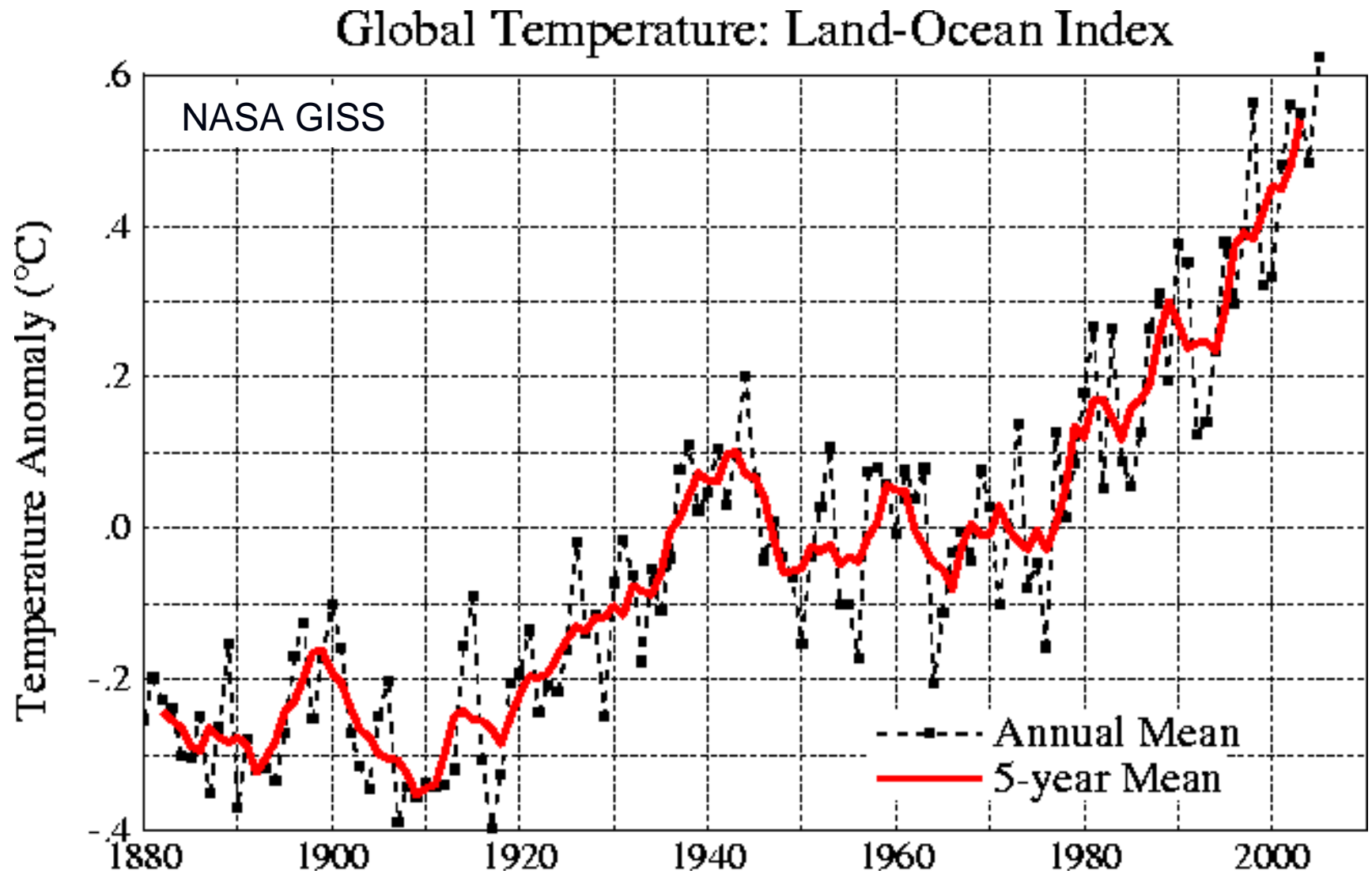
*Many flaws in the MBH work (data and algorithm) were found by McKittrick and McIntyre and then Wegman et al and others which when corrected, restored earlier warmth*

*See [www.climateaudit.org](http://www.climateaudit.org)*





Still the government graphs are alarming...but are they right?



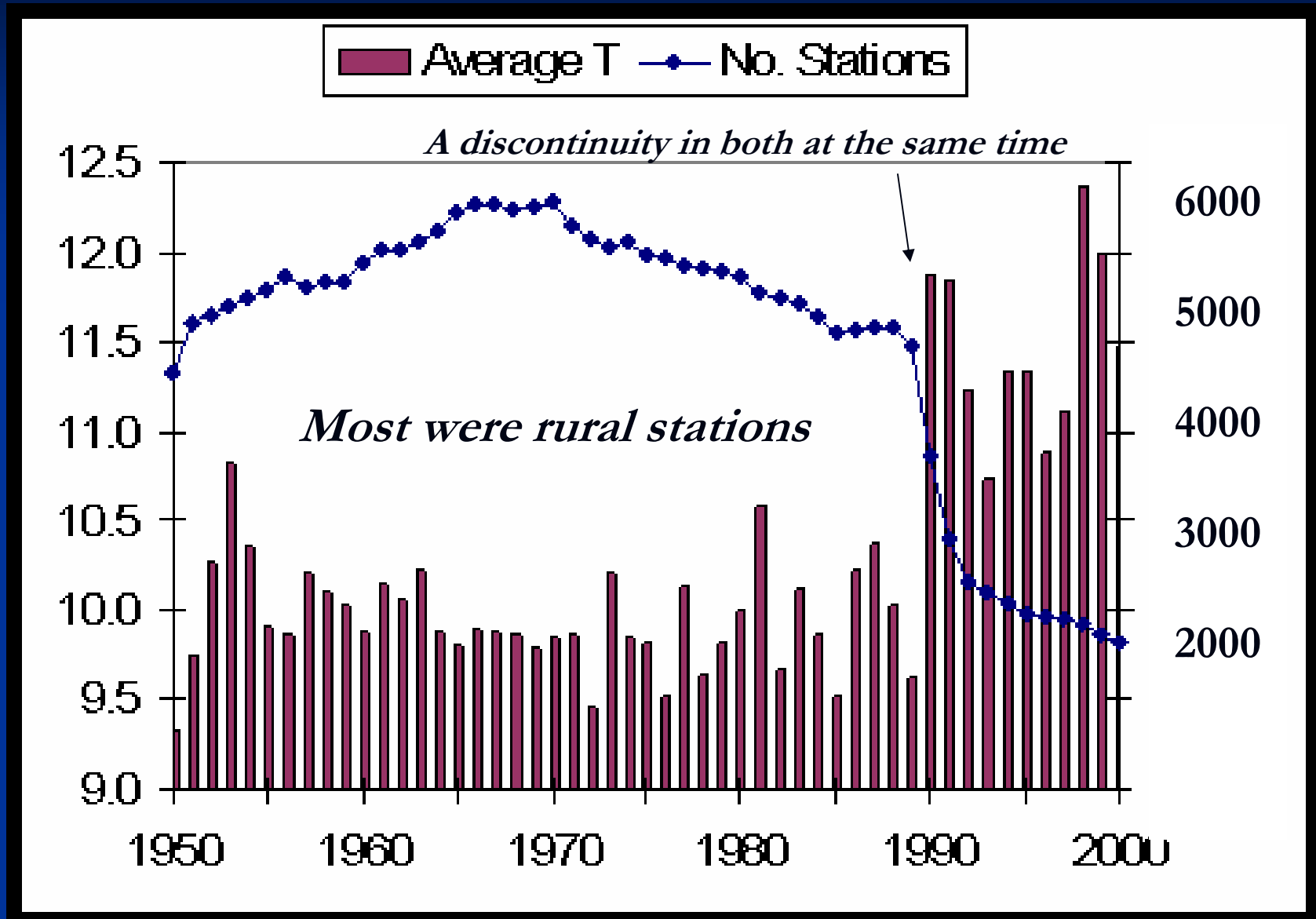
# Issues with the Global Station Data

- Station dropout (6000 to 2000, most significant since 1990). The dropout is shown in a visually striking animation here:

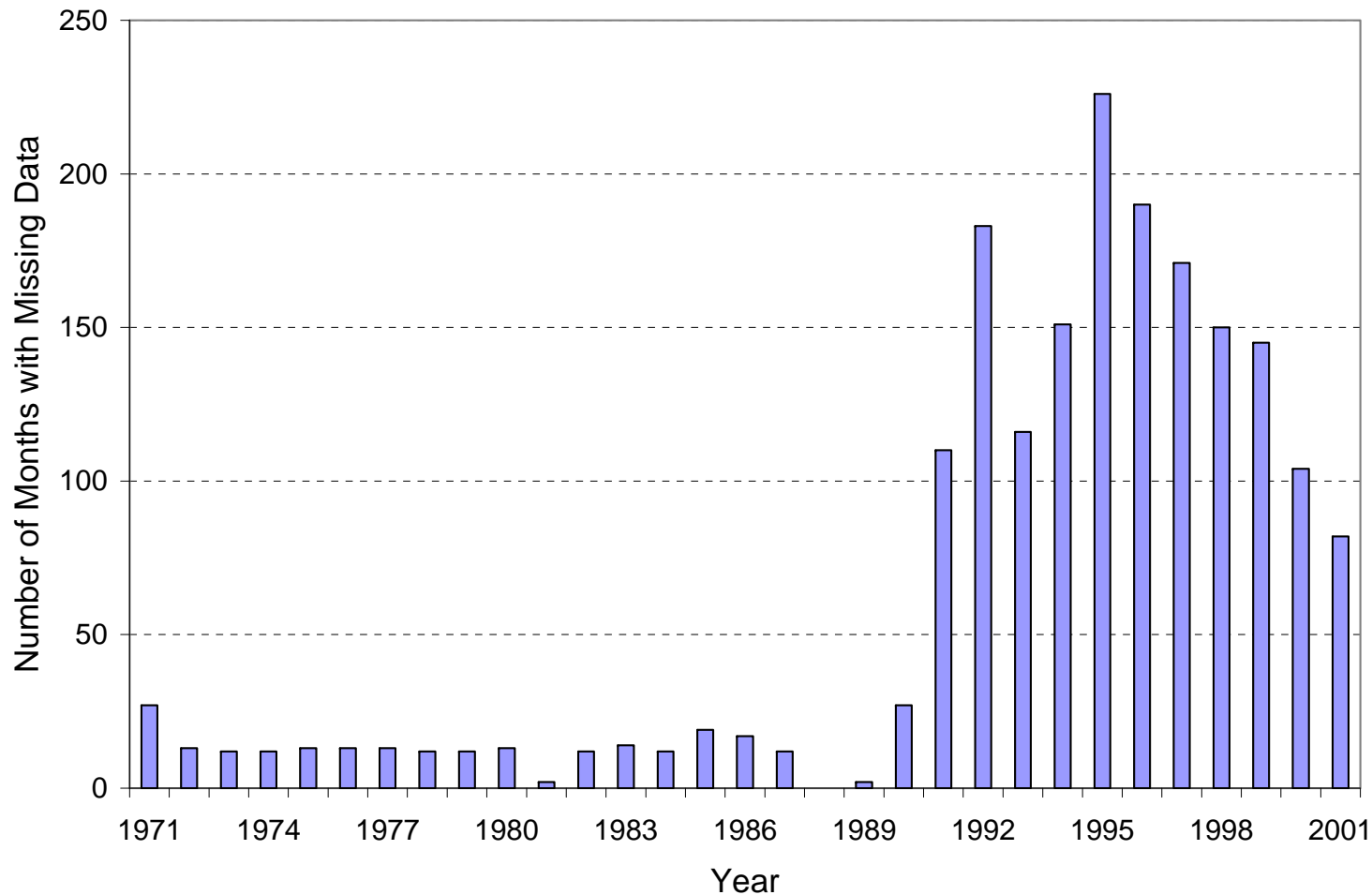
[http://climate.geog.udel.edu/~climate/html\\_pages/Ghcn2\\_images/air\\_loc.mpg](http://climate.geog.udel.edu/~climate/html_pages/Ghcn2_images/air_loc.mpg).

- Large increases in missing monthly data in Asia and especially the FSU after 1990
- Questions about sufficient urban and site adjustment

# Station Dropout and Global Temps



# Number of Missing Months



**For the 110 Russian weather stations reporting weather data continuously from 1971 to 2001, the total number of missing monthly observations each year (McKitrick and Michaels)**

# SVERDLOVSK, RUSSIA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1987	-18.6	-8.3	-5.5	0.9	14.9	20	19.3	16.2	8.6	2.1	-11.2	-11.5
1988	-12.7	-9.6	-2.6	4.8	10.3	19.5	22.6	18.3	9.7	3.9	-7	-9.9
1989	-15.1	-9.6	-0.3	1.5	11.9	21.4	22.8	14.2	10.2	2.8	-4.2	-10.2
1990	-14.2	-6.8	0.1	5.3	9.6	999.9	19	16.4	999.9	1.2	-5	-8.3
1991	999.9	-12.6	-7.1	9.2	15.5	999.9	17.6	13.6	10.6	7.2	-3.6	-13.6
1992	-12	-9.2	-4.1	1.8	10.1	14	16.3	13.8	10.9	2.1	-5.3	999.9
1993	-8.9	-11.8	-6	3.2	10.8	17.9	18.6	16.5	5.8	2.4	-13.2	-9.9
1994	-10.2	-17.2	999.9	999.9	11.4	999.9	999.9	14.9	11	6.6	-7	-14
1995	-10.2	-4.2	-0.6	10.7	13	17	999.9	16.9	999.9	3.9	-3.7	-12.7
1996	-14.1	-11.2	-3.9	0.6	12.2	19.1	19.2	999.9	7.1	1.9	-2.3	-10.2
1997	-18.4	-9.4	-2.1	6.2	12	16.7	15.9	14	11.2	5.9	-7.3	-14.7
1998	-11	-14.8	-3.3	-1.4	11.8	18.5	21.6	17.6	8.3	3.5	-12.7	-7.1
1999	-12.6	-7.8	-8.6	4.8	9	15.1	20.2	15.6	9.3	7	-10.4	-6.4
2000	-12.9	-6.9	-1.7	7.2	8.3	19.1	20.5	999.9	8.9	2.3	-6.5	-12.2
2001	-12.1	-14.9	-3.4	6.8	13	14.6	17.9	999.9	10.7	0.6	-4.6	-12.3
2002	-9.2	-4.2	-1	3	9.3	14	19	13.1	11.1	2.1	-3.7	-18.5

# Station Dropout and Missing Data

- Since many of the stations that dropped out were the smaller stations, the bias in the remaining stations is towards larger metro area stations where there is more warmth
- Infilling of data is very difficult. Some of the methods used (NASA GISS substitutes annual average anomaly) can introduce a warm bias

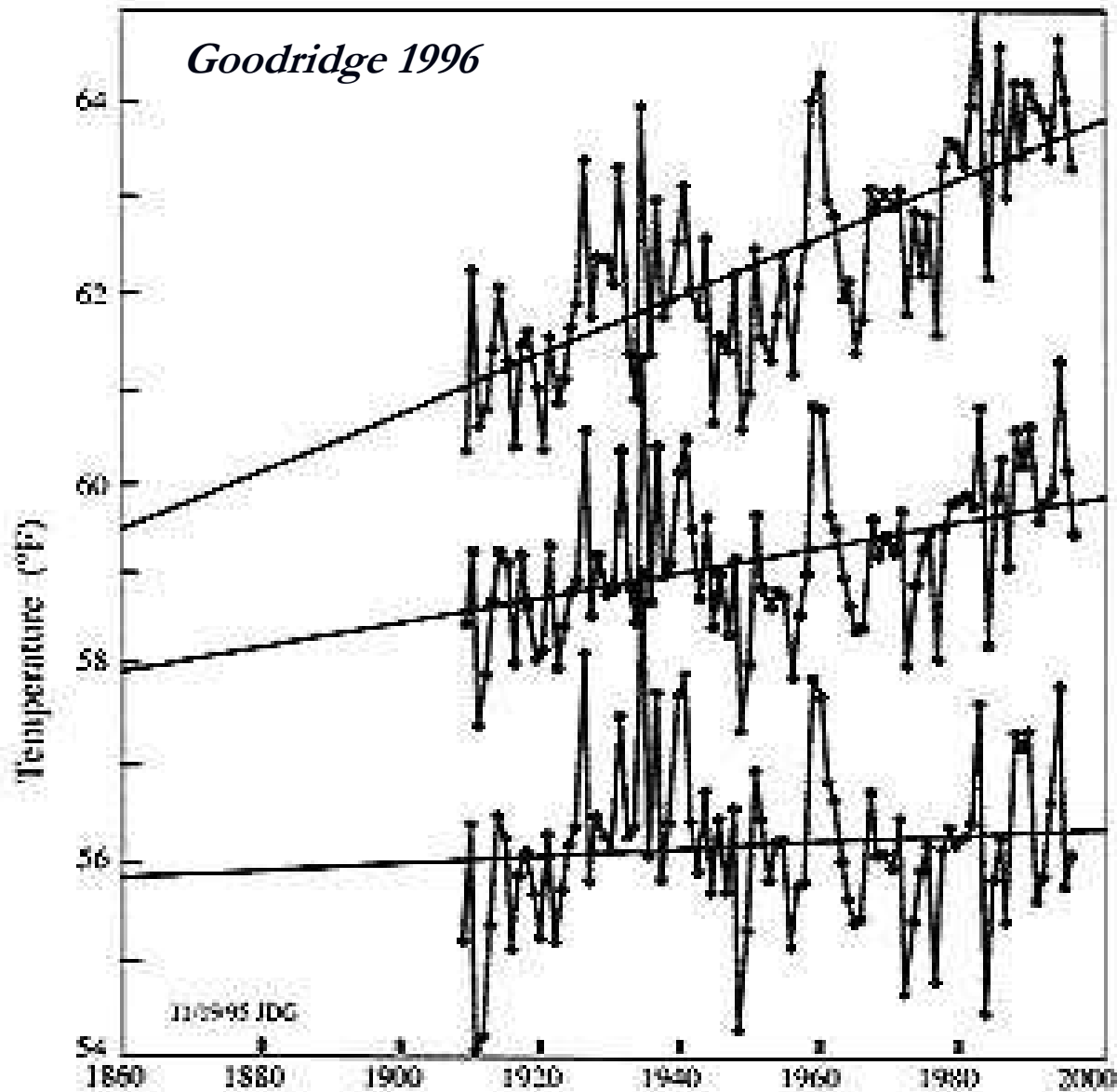
# Urban Heat Island Effect



# Urban Heat Island Effect

- In cities, vertical walls, steel and concrete absorb the sun's heat and are slow to cool at night, which can be 10 or more degrees warmer in cities than in rural areas
- More and more of the world is urbanized
- Cities grow around airports where we measure temperatures
- Urban areas with population >10,000 are adjusted in global data
- Oke (1973) and Hoyt (2002) have shown towns with much smaller populations can have warming (town of 1000 up to 2C or 3F) especially in winter
- Hinkel et al (2003) showed even the village of Barrow, Alaska with a population of 4600 has shown a warming of 2.2C (3.4F) in winter over surrounding rural areas
- Insufficient adjustments introduces a warm bias in data





*Counties in CA  
with >1 million  
Population  
(+4F since 1910)*

*Counties in CA  
with between  
100,000 and  
1 million  
population  
(+1F since 1910)*

*Counties in CA  
with less than  
100,000  
Population  
(0F since 1910)*

# Siting Issues

- Pielke and Davey have found a majority of stations including climate stations in eastern Colorado did not meet WMO requirements for proper siting
- State climatologist teams found siting issues in surveys in Georgia, Alabama, Kentucky, Oregon and New England.
- Even in Oklahoma where the Oklahoma Mesonet is the gold standard for observation networks, issues developed with time (growth of vegetation that changed wind and temperature profiles)
- All these siting issues introduce a warm bias



# Contamination of the Data Bases

- A number of peer-reviewed papers ignored by the IPCC have estimated that these problems with the observing networks may account for up to one half the warming since 1880 (Michaels and Balling, Michaels and McKittrick, Kalney and Cai, de laet and Maurellis, Pielke and Davey)

# NCDC USHCN Data

- National Climate Data Center maintains a database of 1221 stations across the contiguous 48 United States. Adjustments have been made to account for changes over time in the time of observations, missing data, type of instrumentation, changes in station siting, and urban warming (Karl, 1988)
- It WAS the 'best' available station data set for assessing change as unlike the global data bases, there is not a big station dropout, less missing data and there was a better urbanization adjustment (although some siting adjustment issues may remain (Pielke et al 2005, 2006)



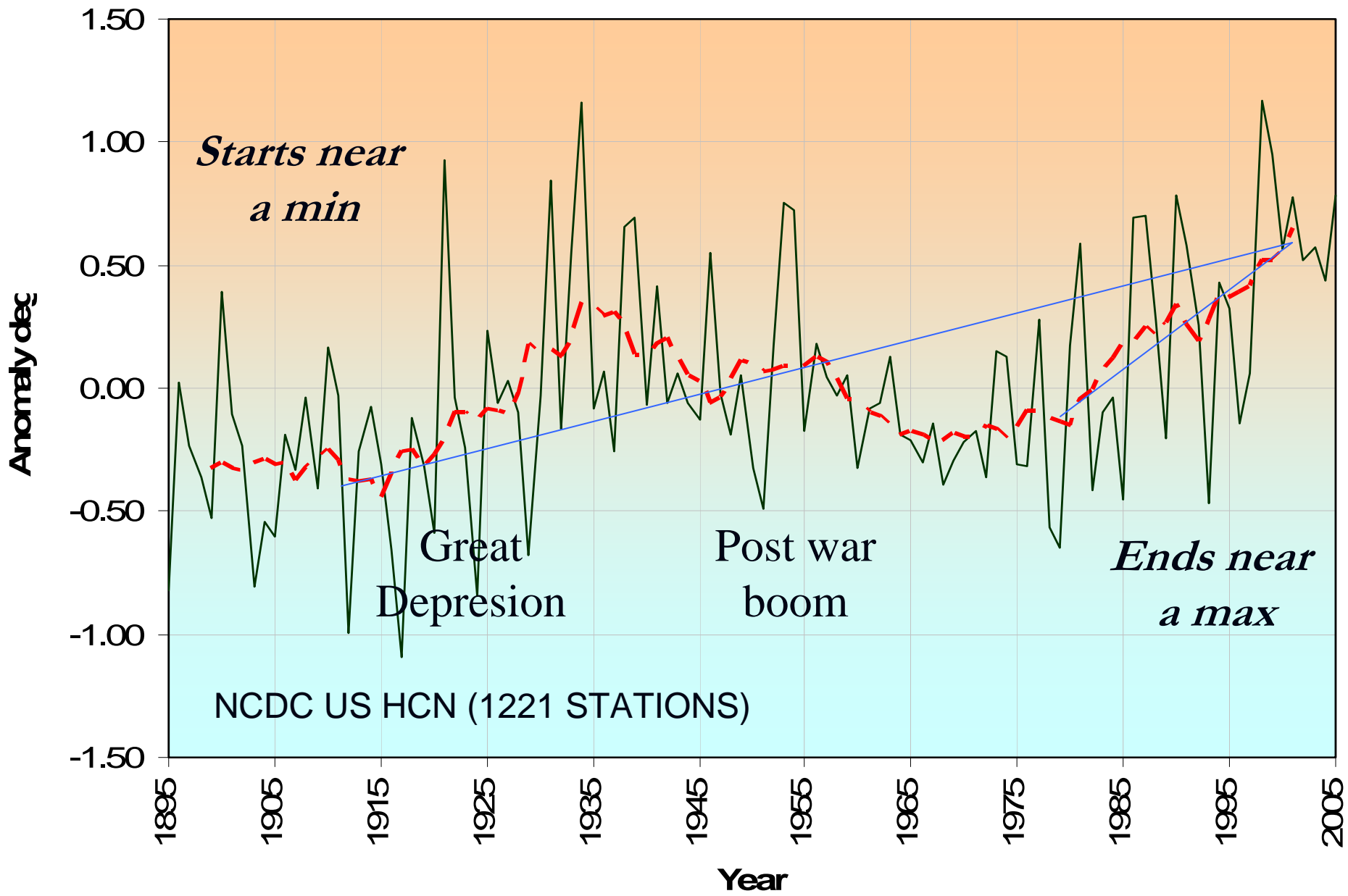
*USHCN Station Hopkinsville, KY  
(Pielke et al 2006)*



*Max/Min sensor near John Martin  
Reservoir, CO (Davey 2005,*

# USA Annual Mean Temperatures

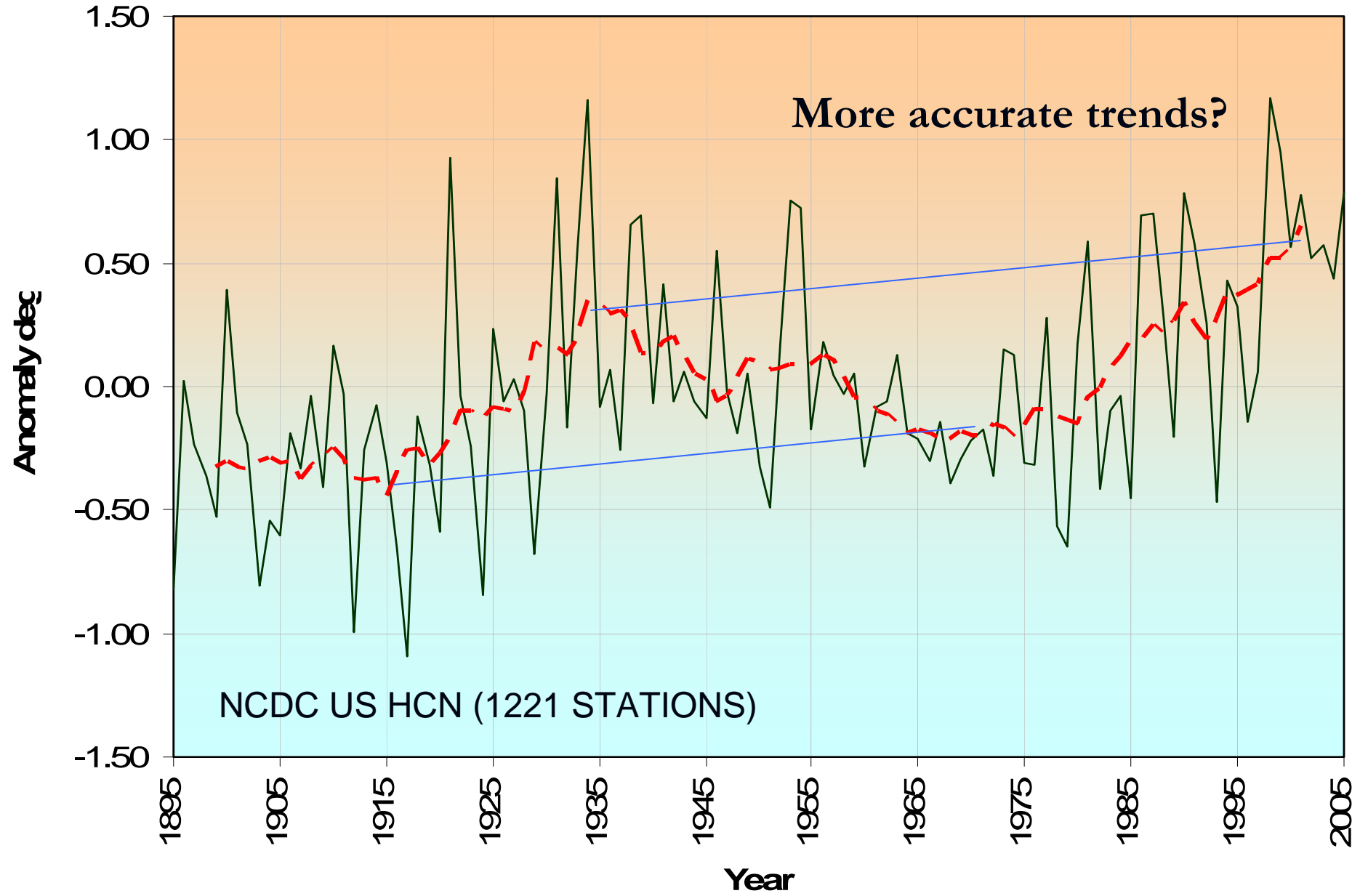
— USA — 10 year Running Mean



# USA Annual Mean Temperatures

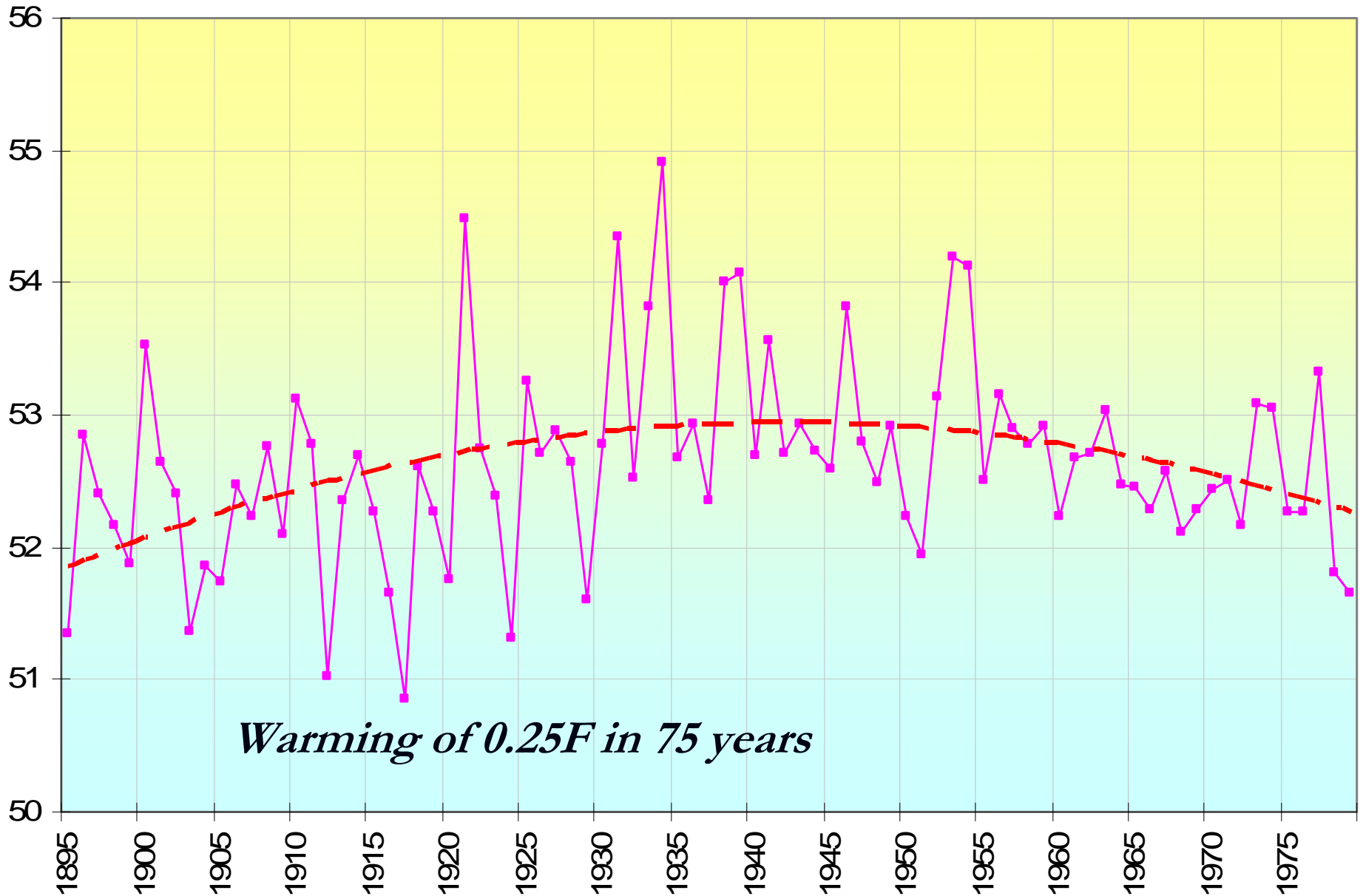
— USA — 10 year Running Mean

More accurate trends?

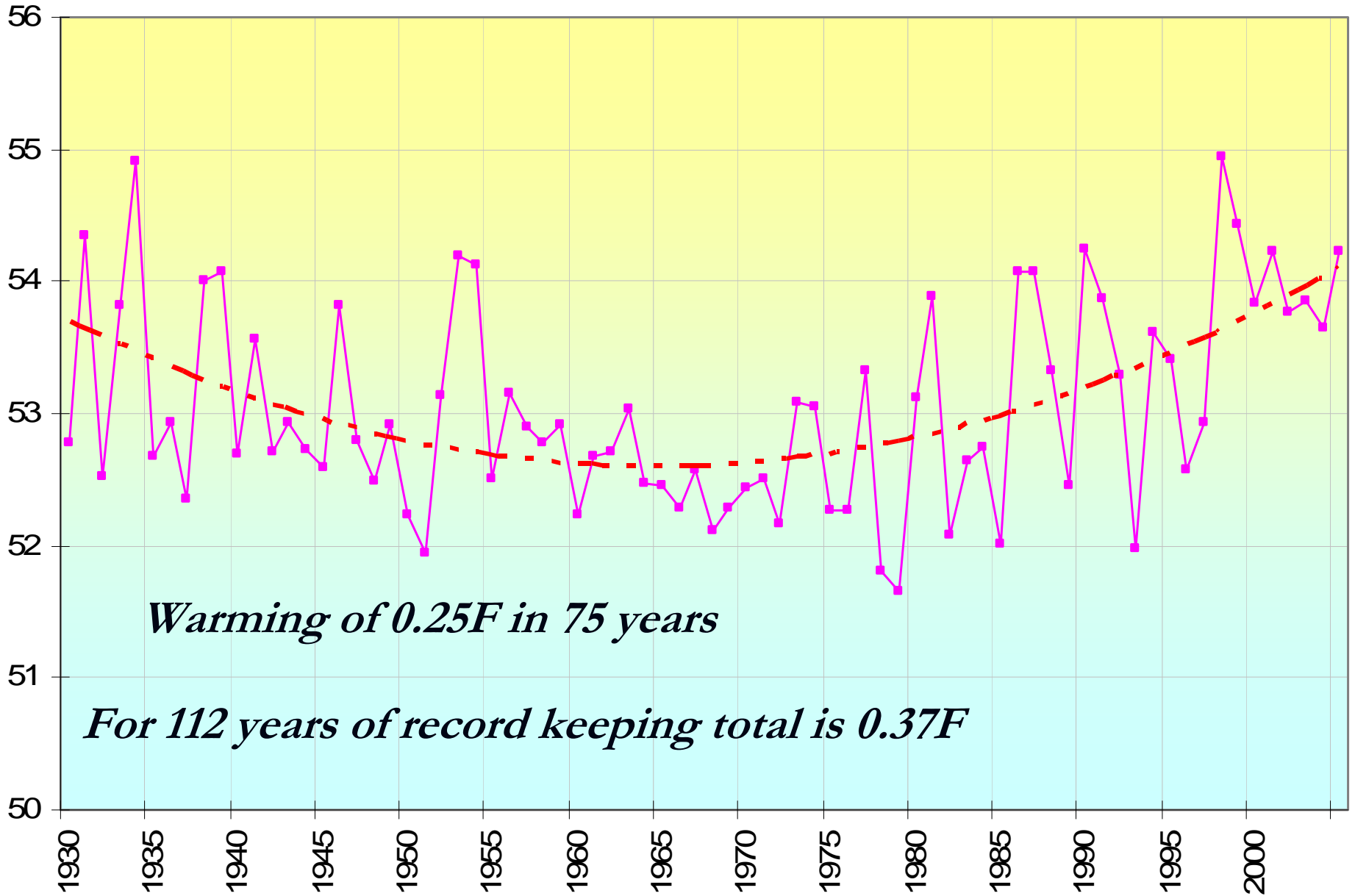




# NCDC Annual Mean Temperatures



# NCDC Annual Mean Temperatures

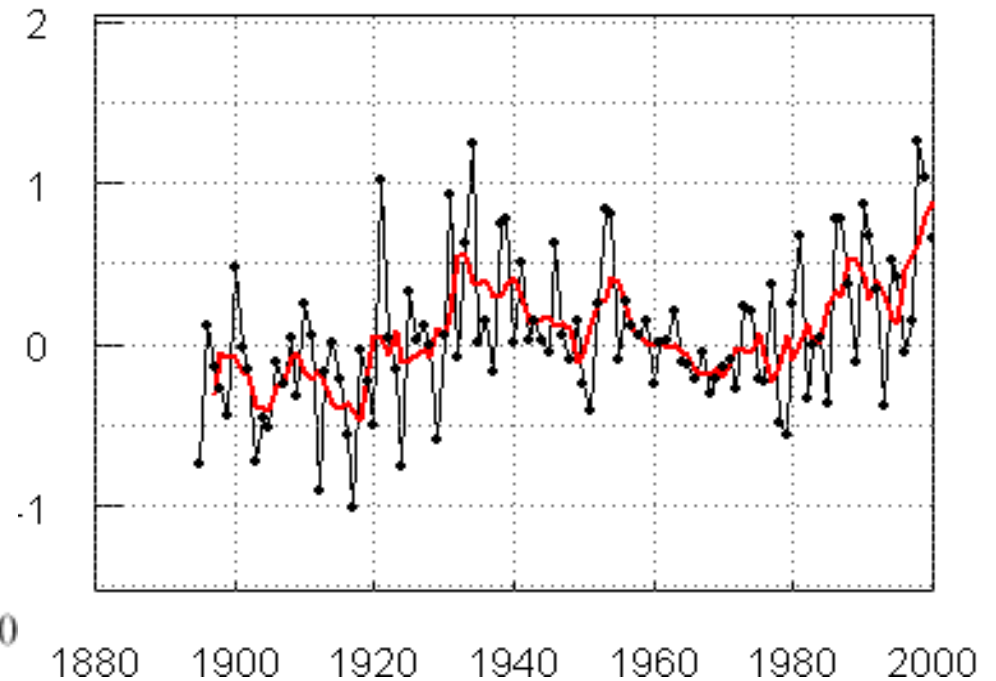
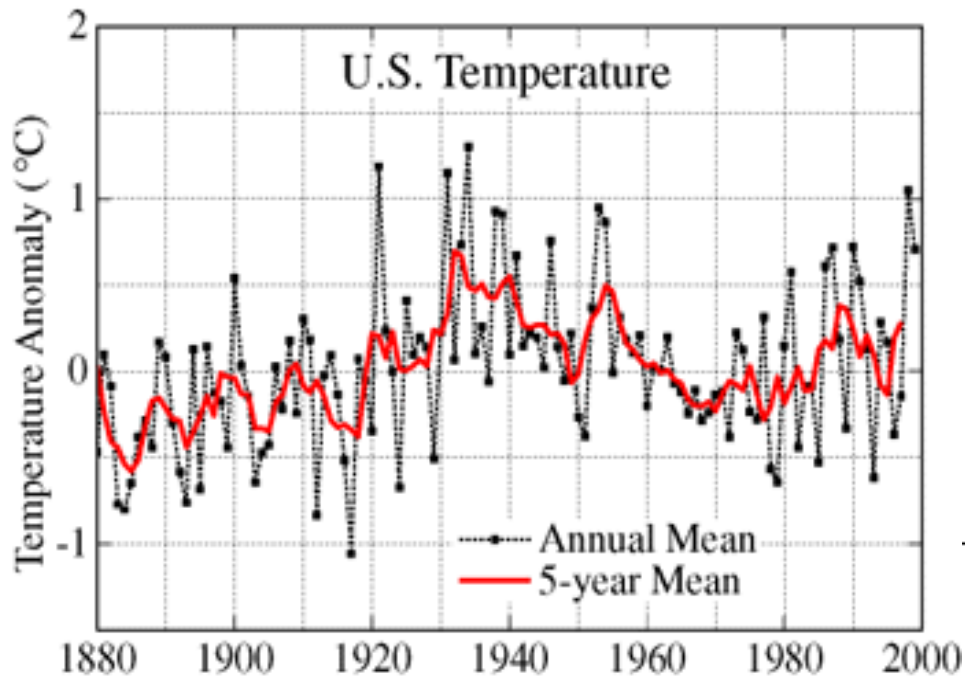


*Warming of 0.25F in 75 years*

*For 112 years of record keeping total is 0.37F*

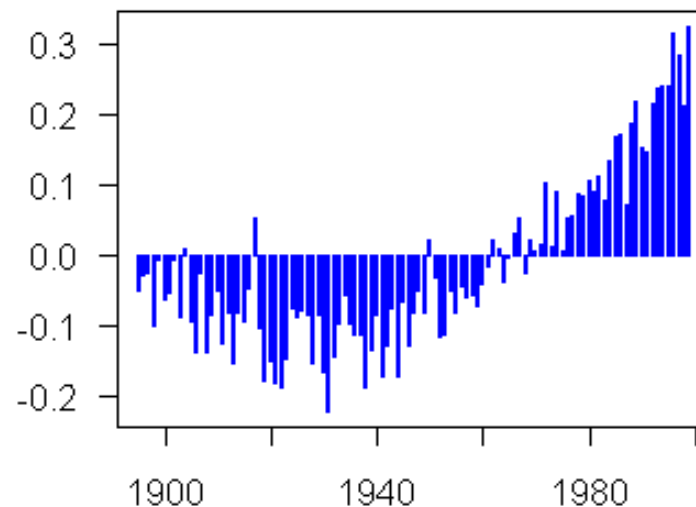
# Solution for the Discrepancy

- Instead of fixing the global data (GHCN) with all its flaws, NOAA (NCDC) has inexplicably chosen in 2007 to adjust the US HCN data – cooling the 1920s and 1930s and warming the 1990s, 2000s.



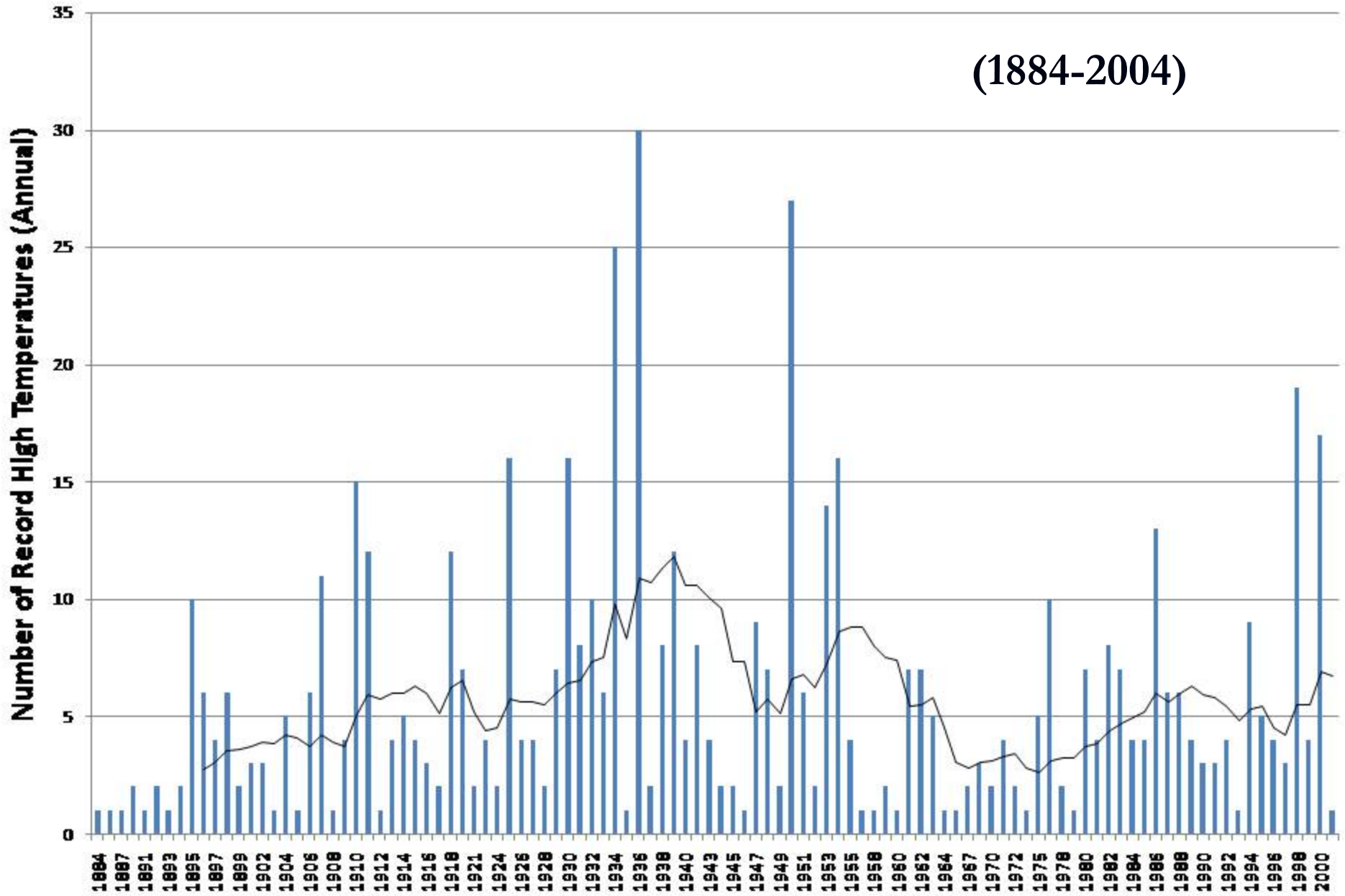
*In order to reconcile some of the differences between the USHCN and global data, the USHCN was adjusted in 2007*

*The difference  
(2000-2007) is  
not small (McIntyre)  
The changes since  
1930 would be nil  
with the 2000 data*



# Total 50-State Record High Temperatures

(1884-2004)

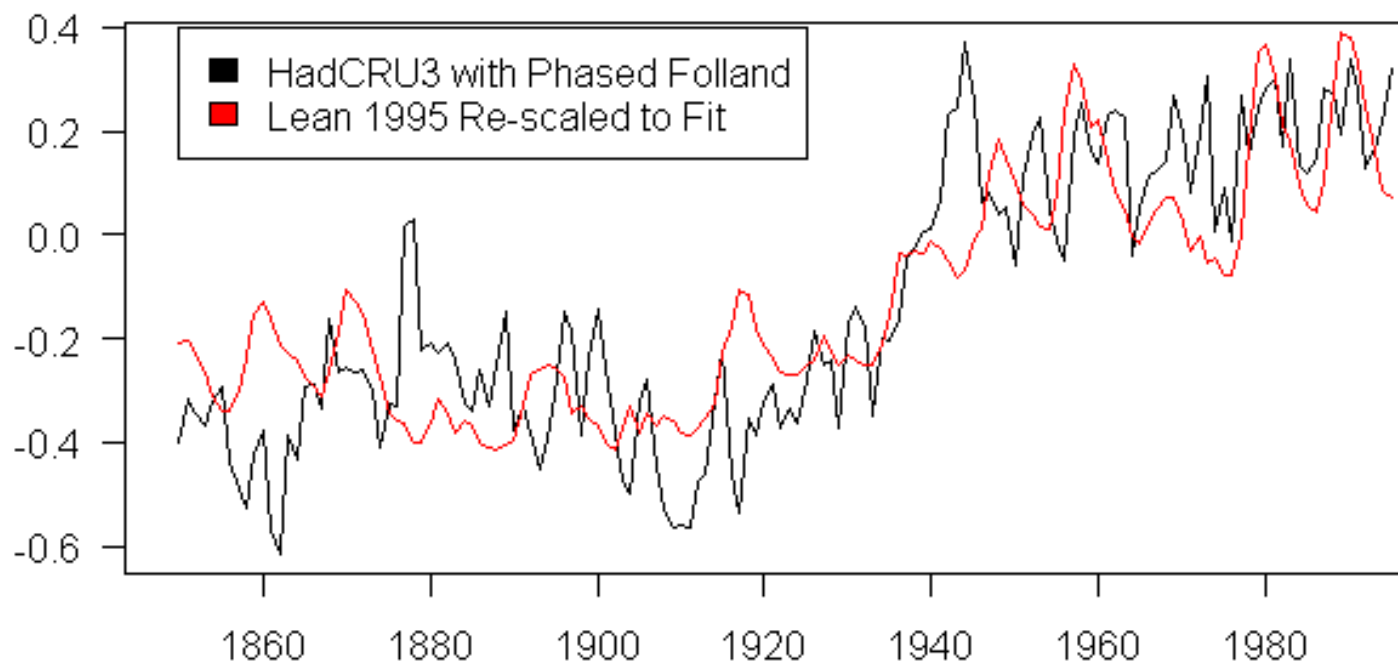
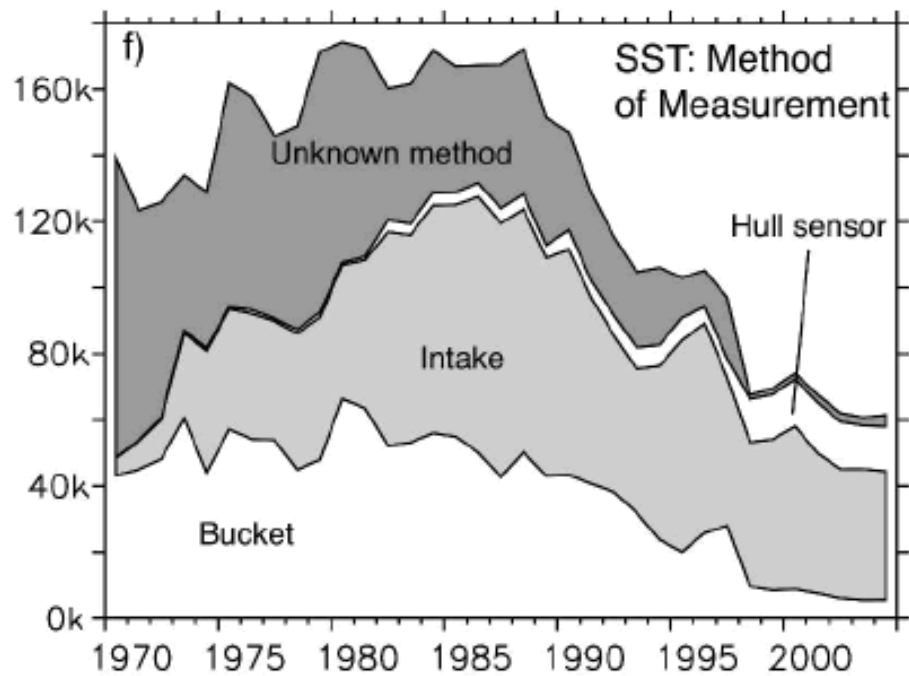


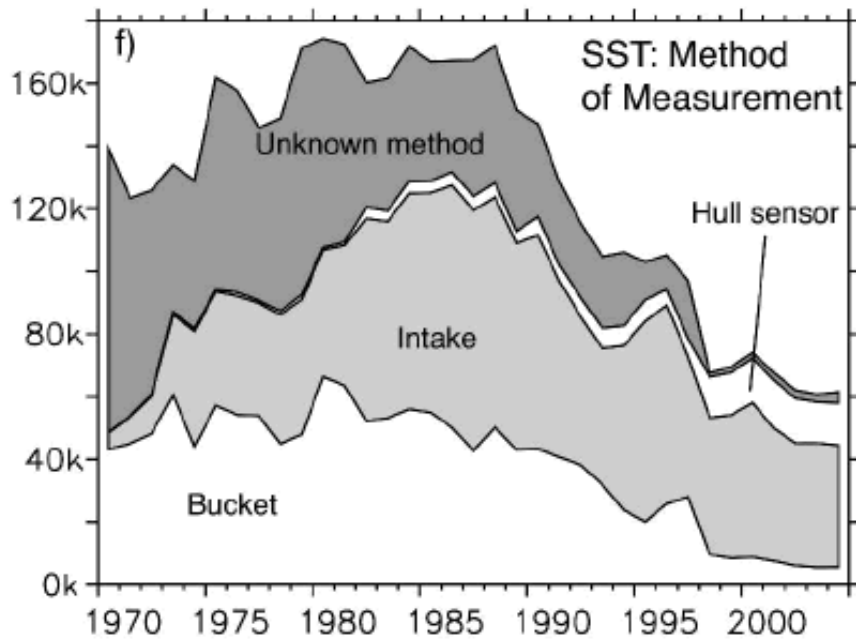
■ Total — 10-Year Moving Average

*Bruce Hall*

# Oceans Also Not Warming

- Hoyt reports in “The Collapse of Arguments for High Climate Sensitivity”\* <http://www.warwickhughes.com/blog/?p=87> that because of
  - Gouretski and Koltermann’s (2007) finding “the ocean heat content increase since the 1950s must be reduced by a factor of 0.62” due to instrumental errors
  - Lyman et al (2006) finding that “20% of the original warming since the 1950’s disappeared in 2003-2005”,  
that the total net warming of the ocean surface to 3000 meters depth is **just 0.03 C since 1948!**\*
- Hoyt believes the works of Gouretski and Koltermann and Lyman are very important and have essentially invalidated all the climate models.
- This suggests a sensitivity to CO2 doubling of just 0.4C. Most of that may have already occurred!

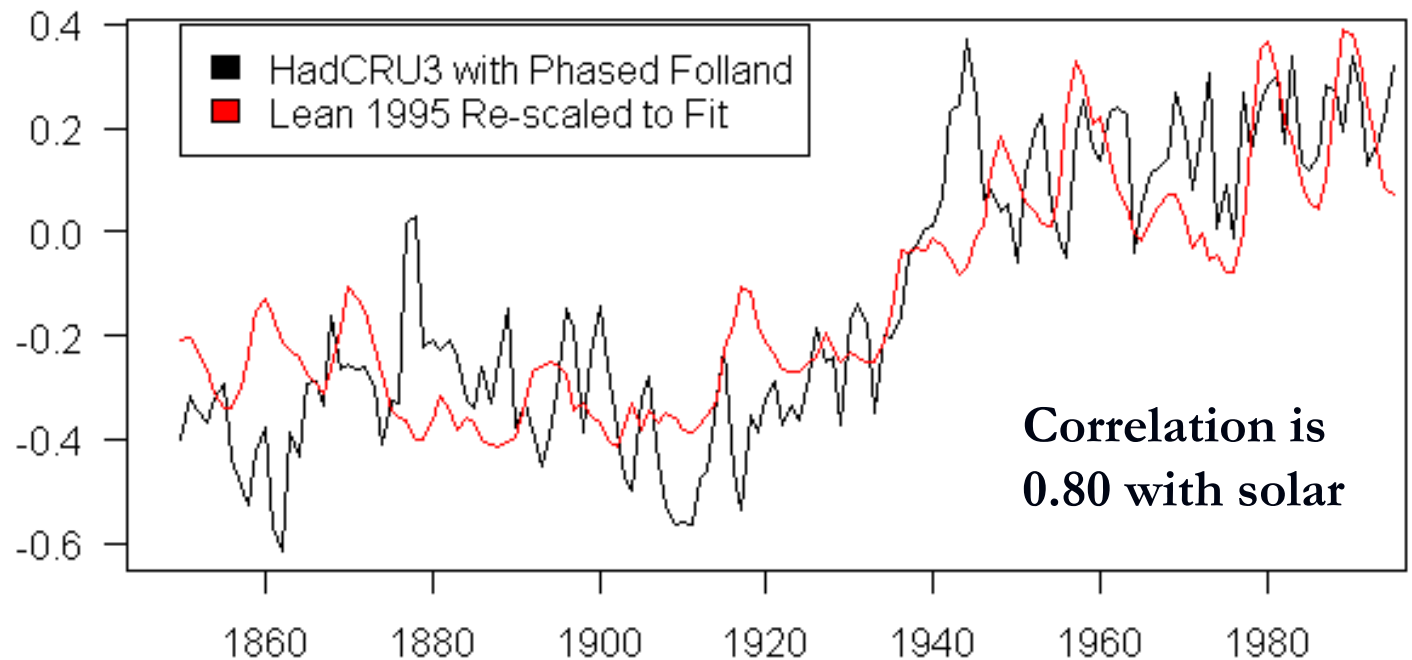




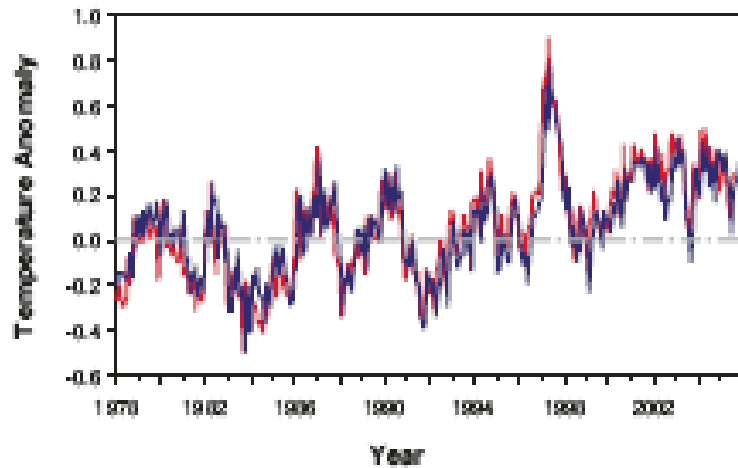
Adjusting sea surface temperatures for slower transition from bucket to ship intake. Global Temperatures assumed abrupt transition WWII 1941 (Folland)

## McIntyre Climate Audit

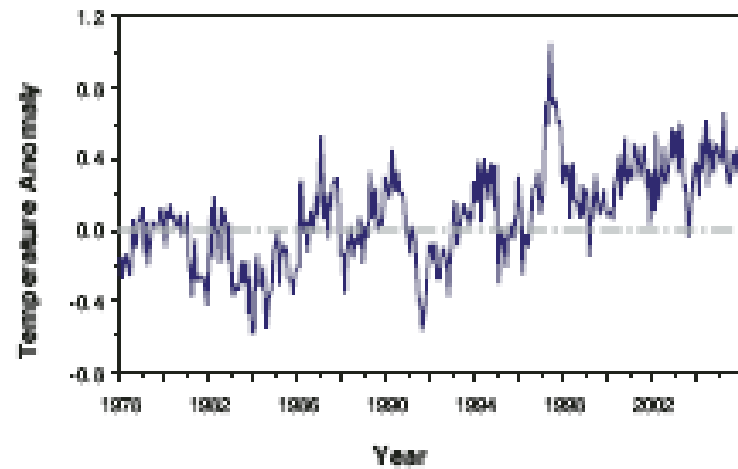
<http://www.climateaudit.org/index.php?p=1276&cp=3#comments>



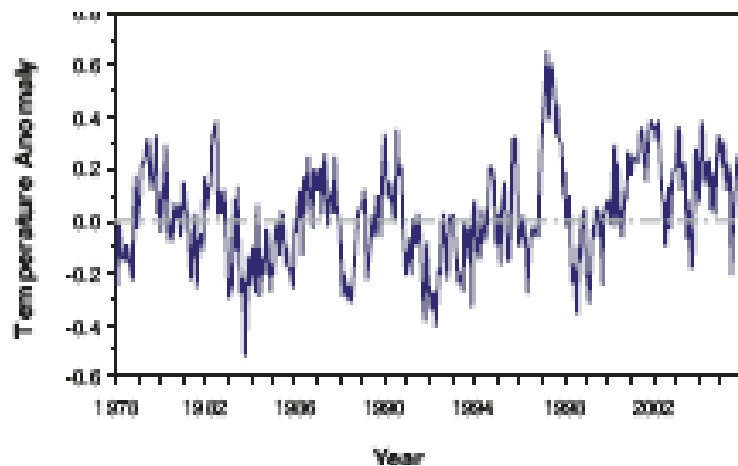




Global



Northern Hemisphere



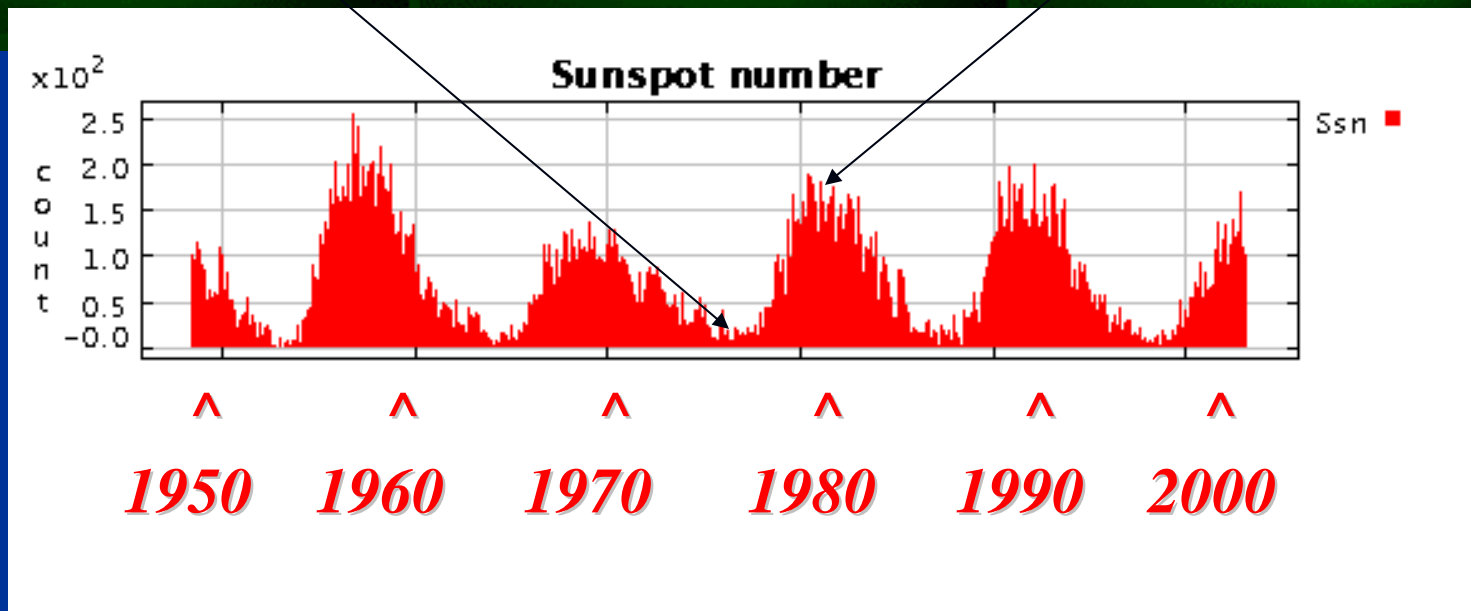
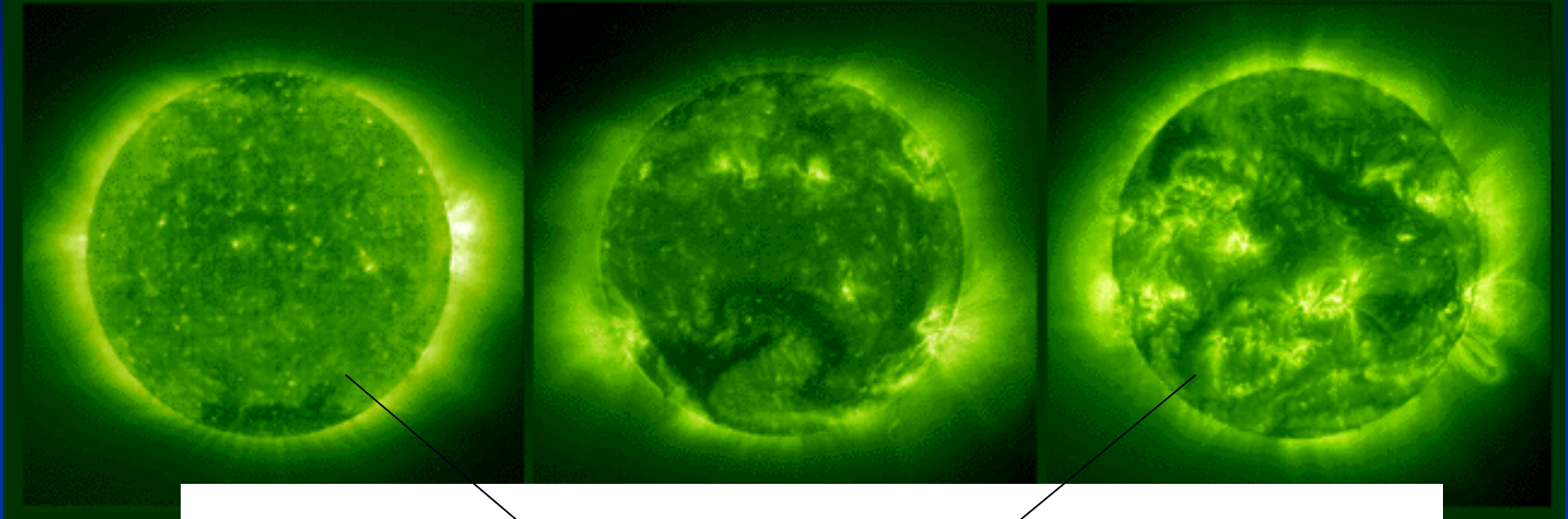
Southern Hemisphere

*Satellite derived  
lower  
atmospheric  
temperatures  
since 1979 also  
rising much  
less.*

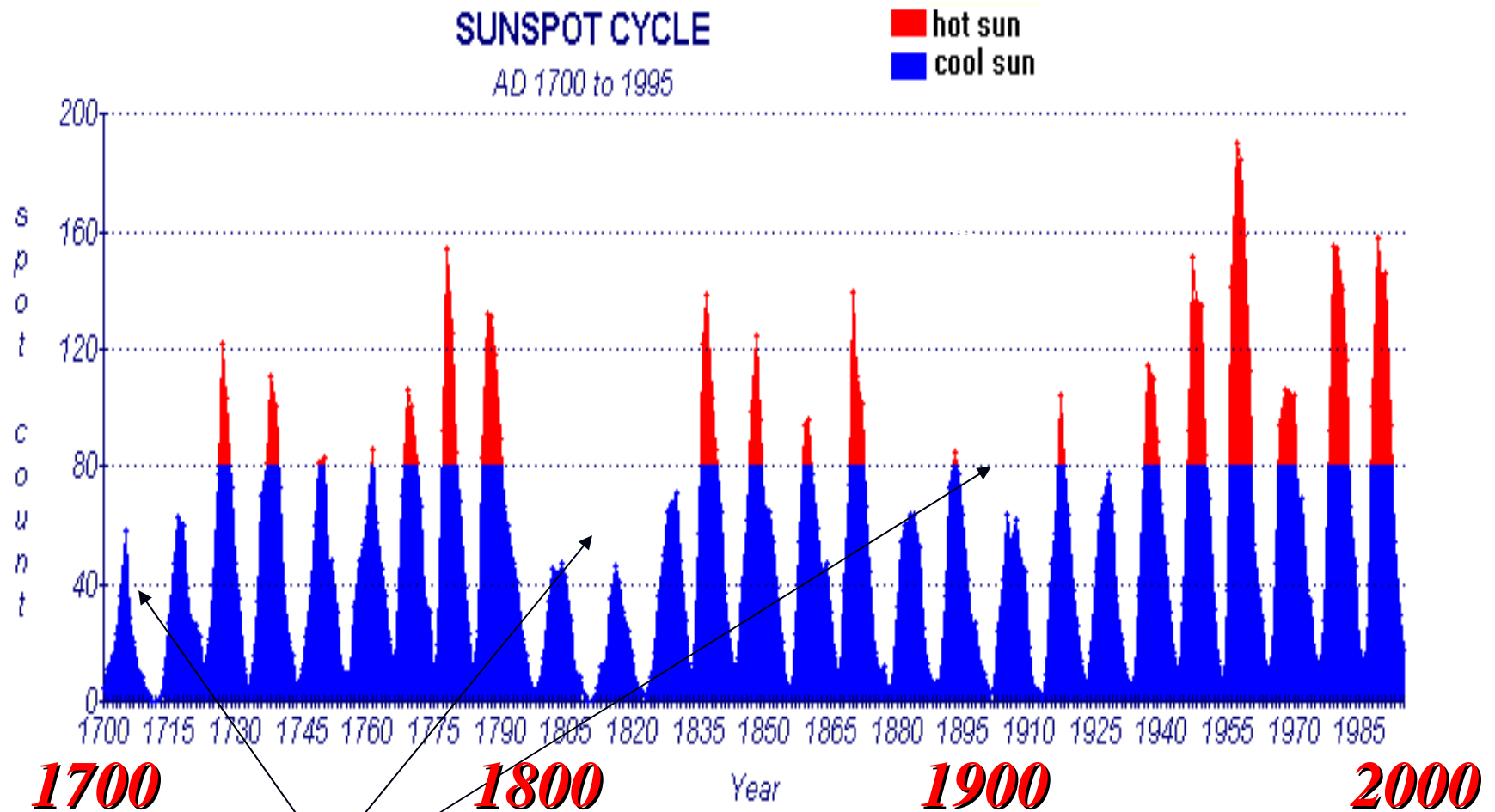
*But again we are  
not denying  
any recent  
warming only  
the amount and  
the causes*

# Cyclical Factors

# 11 YEAR SOLAR SUNSPOT CYCLE



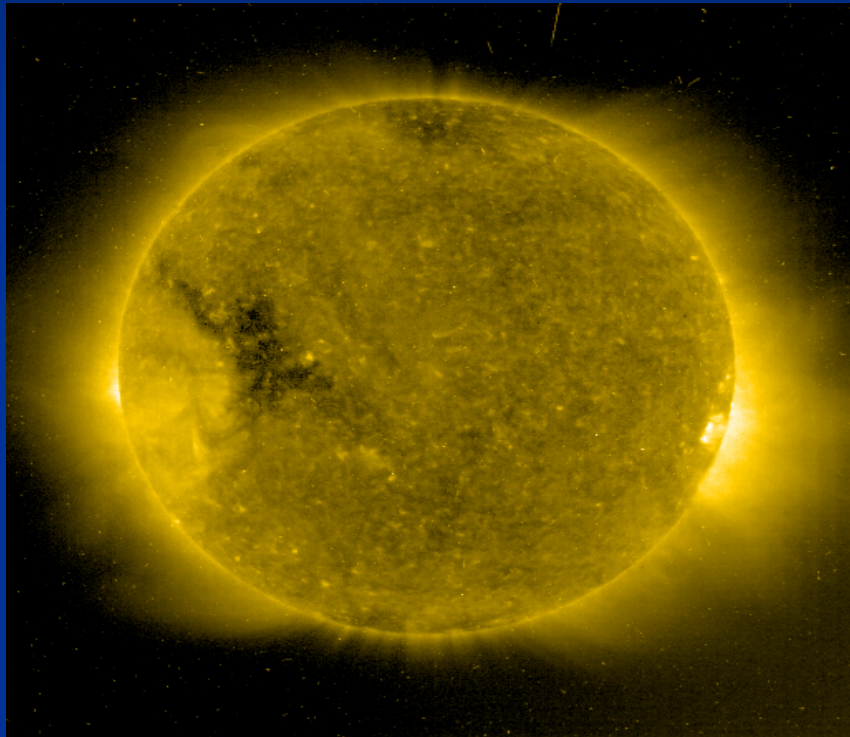
*11 year solar cycles themselves vary in their strength on a longer term with cycles of 80 to 100 years*



Quieter cycle periods — Wolf Sunspot Number

***Gleissberg Cycle***

# The Solar Connection



## ■ *DIRECT EFFECTS*

- Direct effects of changes in solar brightness or irradiance likely relatively small

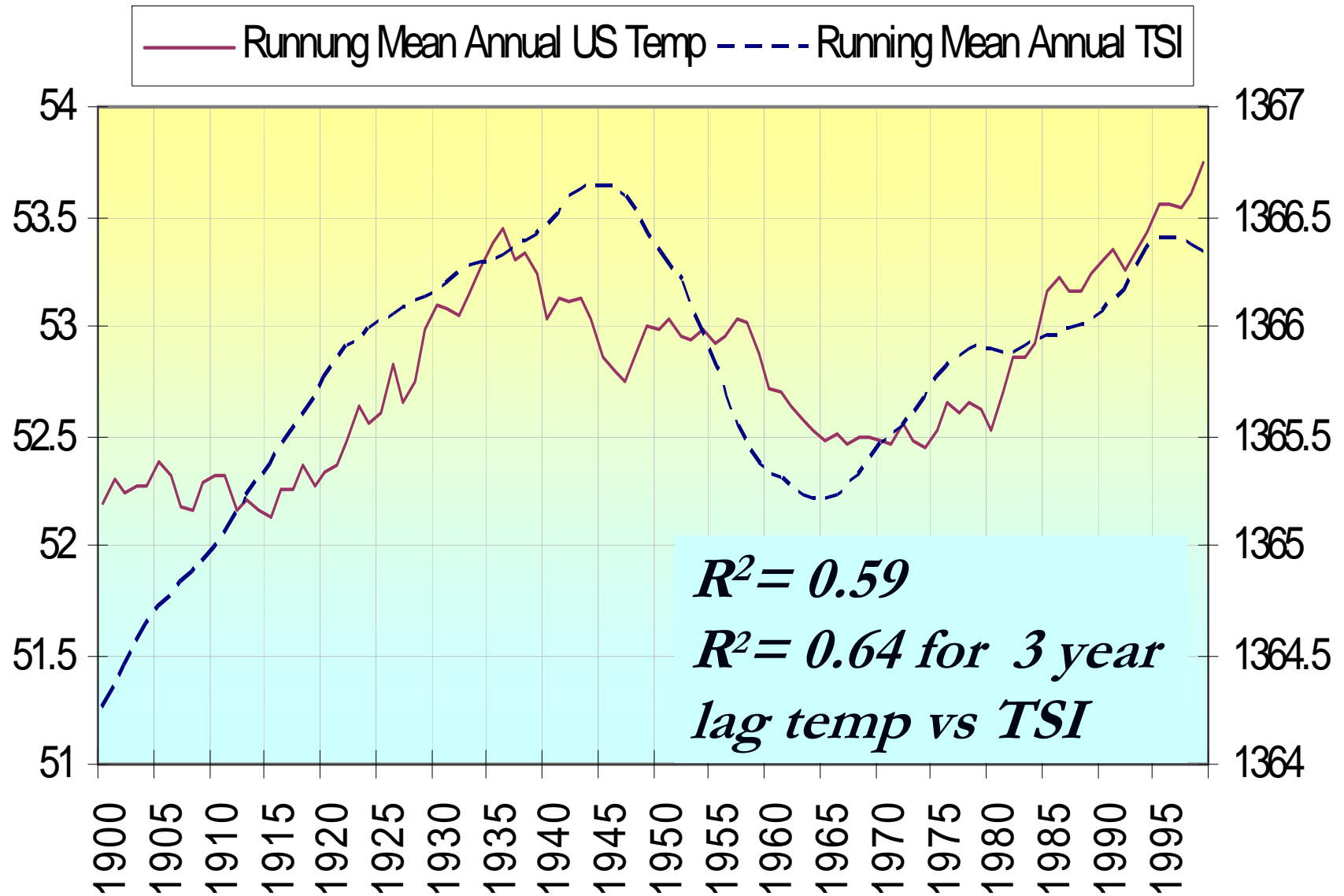
## ■ *INDIRECT EFFECTS*

- UV warming through ozone chemistry high up in low and mid latitudes
- Geomagnetic activity / solar wind effects that warm higher latitudes and may reduce low clouds through reduction of cosmic rays

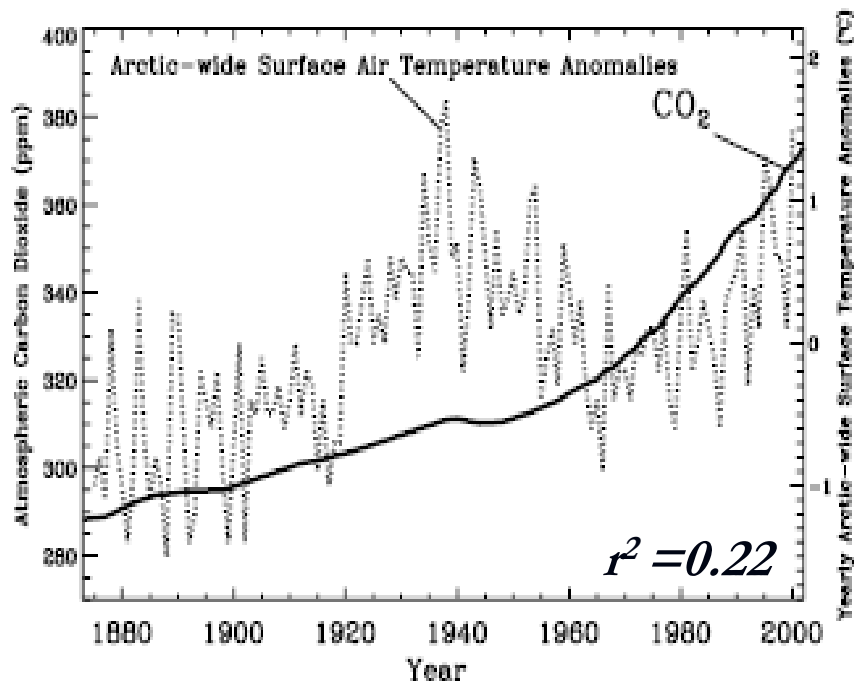
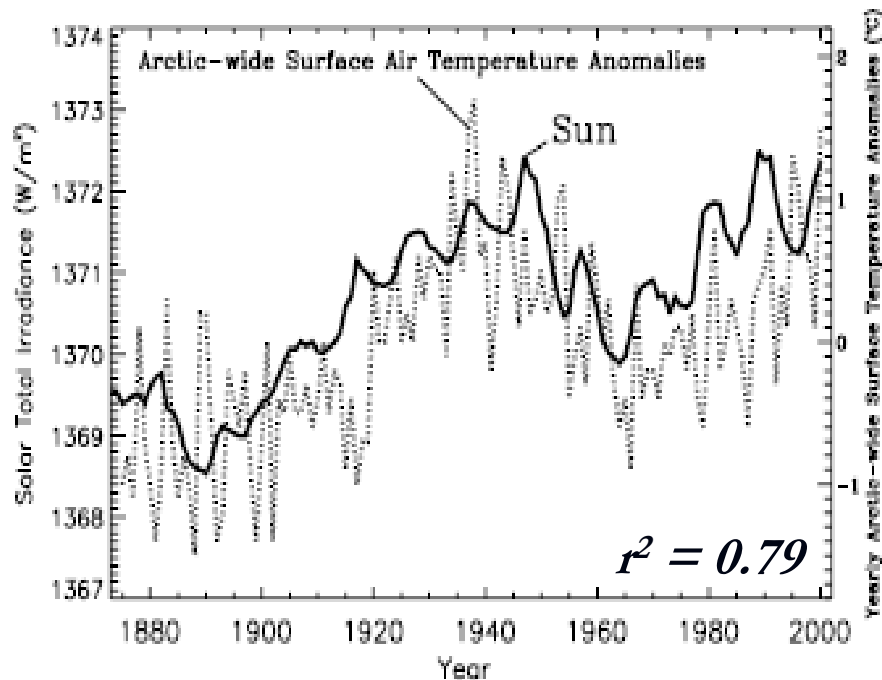
# Solar Irradiance (Brightness)

- Scafetta and West (GRL 2006) assumed that the Total Solar Irradiance (Lean) was a proxy for the total solar effect (direct and indirect). They estimated the changes in the sun could account for 50% of the Northern Hemispheric changes since 1900
- Shaviv (2005) estimated that the combination of cosmic ray cloud effects and brightness related increases in irradiance since 1900 could account for 77% of the changes in global temperatures. He found relationship held going back 600 million years.

# NCDC Annual Mean US Temperature vs Hoyt Schatten TSI



Gleissberg Cycle



## Arctic Annual Mean Temperatures vs Solar Irradiance

(Soon GRL 2005)

Fit is much better of solar irradiance with arctic temperatures (Polyakov) than with  $\text{CO}_2$

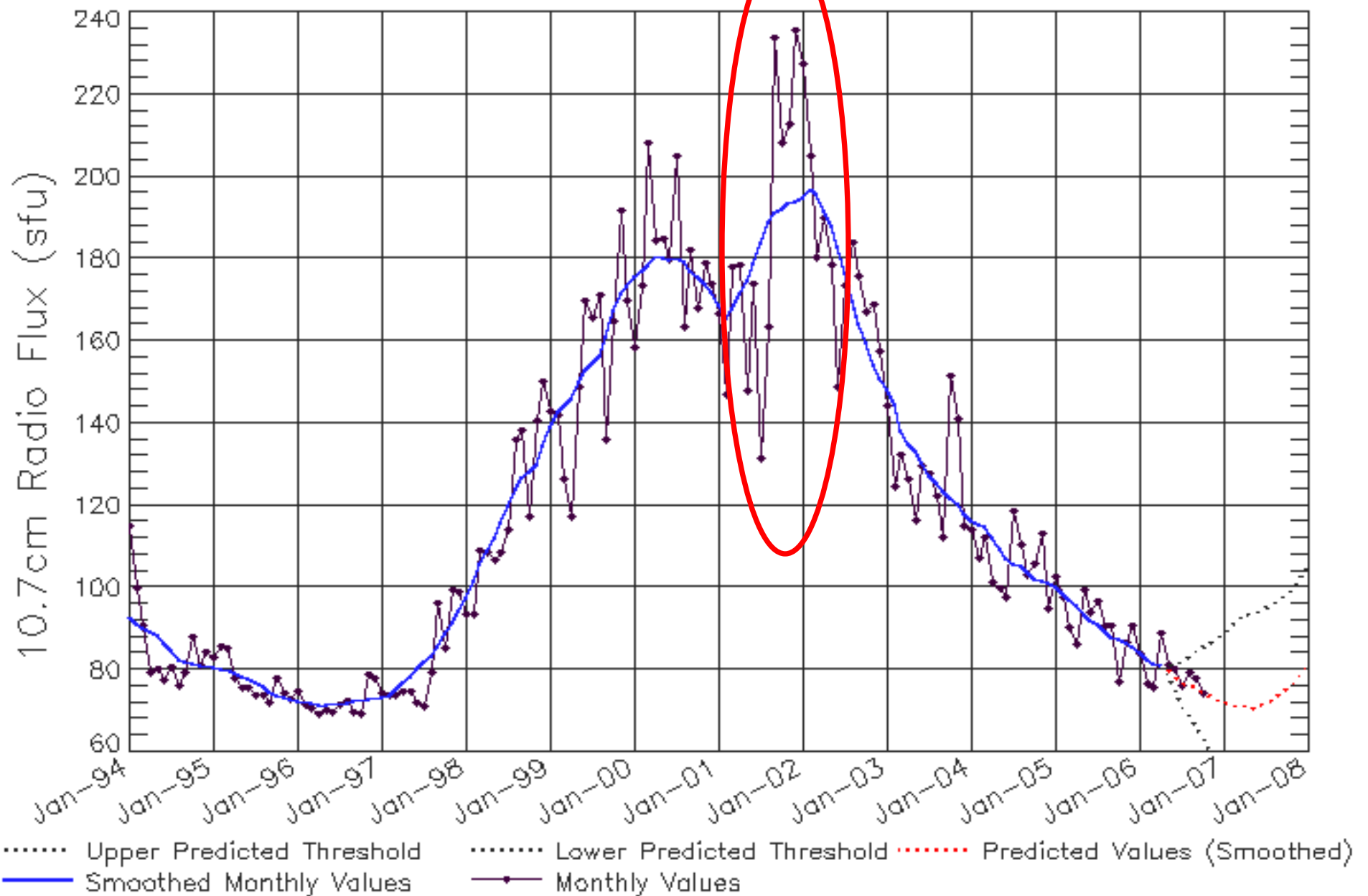


# Ultraviolet Radiation and Ozone

- Though solar irradiance varies only 0.1% over the 11 year cycle, radiation at longer UV wavelengths are known to increase by several percent with still larger changes (factor of two or more) at extremely short UV and X-ray wavelengths (Baldwin and Dunkerton, JAS 2004).
- Labitzke has shown statistically significant differences of heights and temperatures in the lower stratosphere into the middle troposphere with the 11 year solar cycle (using solar flux which correlates well with UV radiation)
- Shindell et al NASS GISS (1999) showed results from a global climate model including a parameterization of stratospheric chemistry, how UV induced stratospheric ozone changes may amplify observed irradiance effects and have them penetrate into the troposphere, in effect confirming Labitzke's findings

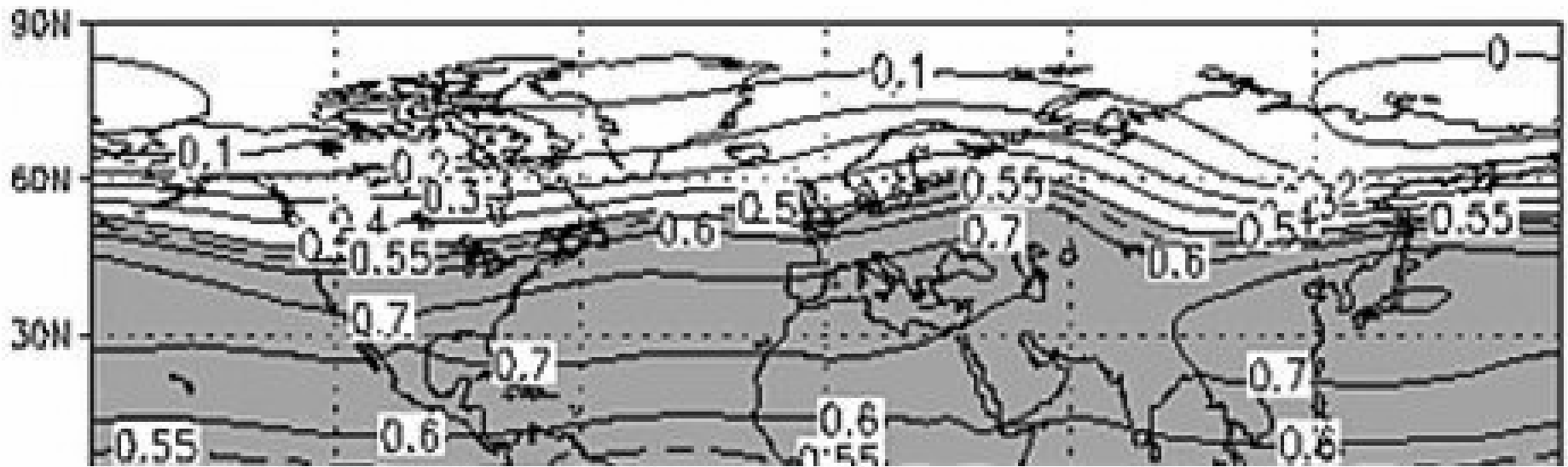
# ISES Solar Cycle F10.7cm Radio Flux Progression

Data Through 31 Oct 06

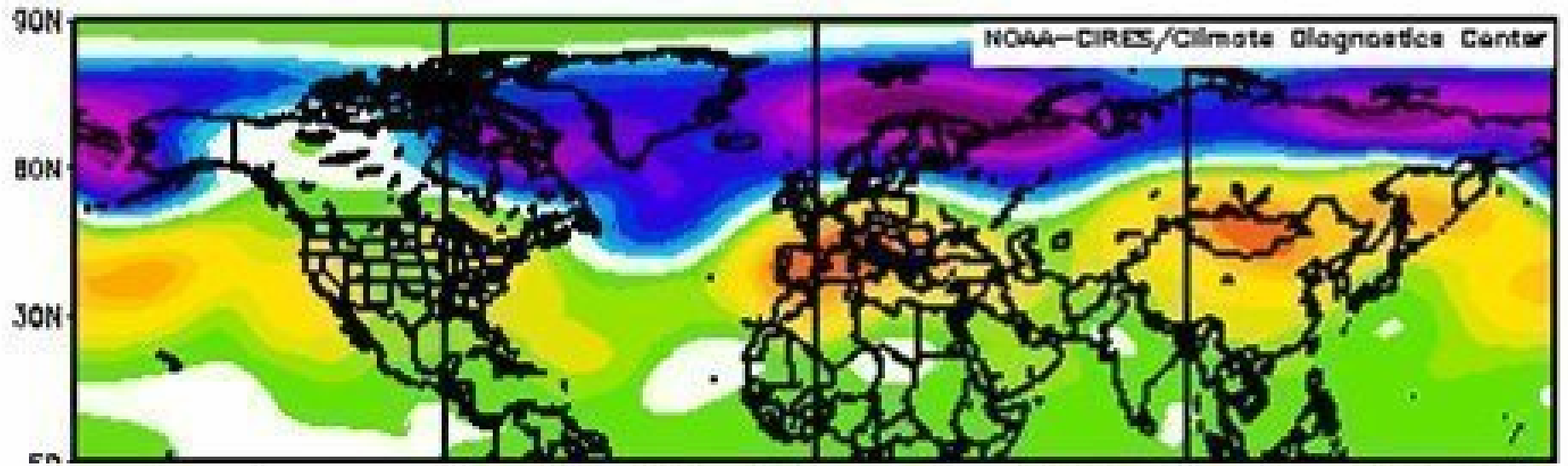


Updated 2006 Nov 2

NOAA/SEC Boulder, CO USA



*Correlation high atmosphere heights with solar flux (Labitzke)*  
*Pattern fit the findings of Labitzke and Shindell's models*



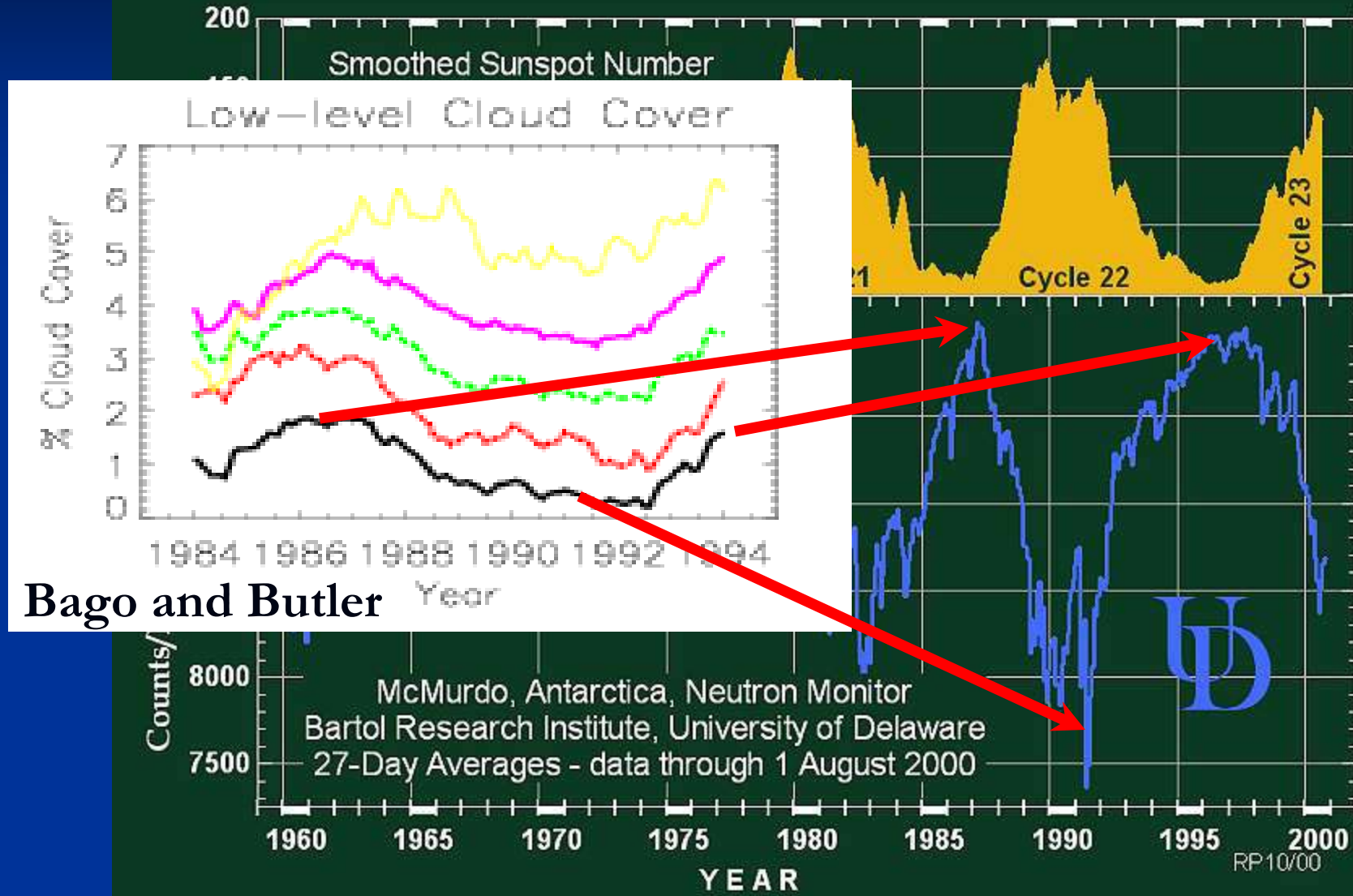
*Actual anomalies 500mb heights during high flux Jan/Feb 2002*

# *Cosmic Rays and Low Clouds*

- *Also an active sun leads to less cosmic rays and a reduction in the amount of low level (water droplet) cloudiness. Low clouds have a cooling effect by reflecting energy back to space.*
- *This was first proposed by Svensmark (1997), Bago and Butler (Astronomy and Geophysics 2000), and Yu and Tinsley (AGU 2002).*
- *Recently Svensmark was able to replicate water cloud droplet nucleation in a laboratory (Royal Society Proceedings A 2006)*
- *Shaviv (2005) estimated that the combination of cosmic ray cloud effects and brightness related increases in irradiance since 1900 could account for 77% of the changes in global temperatures.*

# *An inverse relationship*

## Cosmic Rays and the Solar Cycle



# Warming on Other Planets

- MIT astronomers in a report in Nature found Neptune's moon Triton seems to have warmed significantly since 1989
- A UC Berkeley study showed Jupiter has a new red spot and may be in midst of a climate change with a warming of 10F or more
- NASA using Mauna Loa Observatory telescope has shown Pluto may have warmed 3.5 degrees over the past 14 years
- National Geographic story showed how NASA Mars Global surveyor discovered the Mars polar ice caps have been diminishing in the last several years

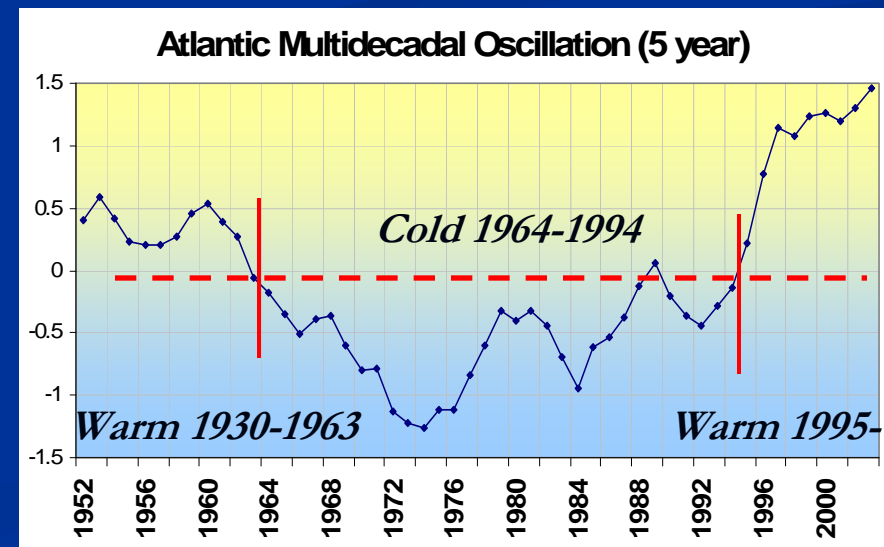
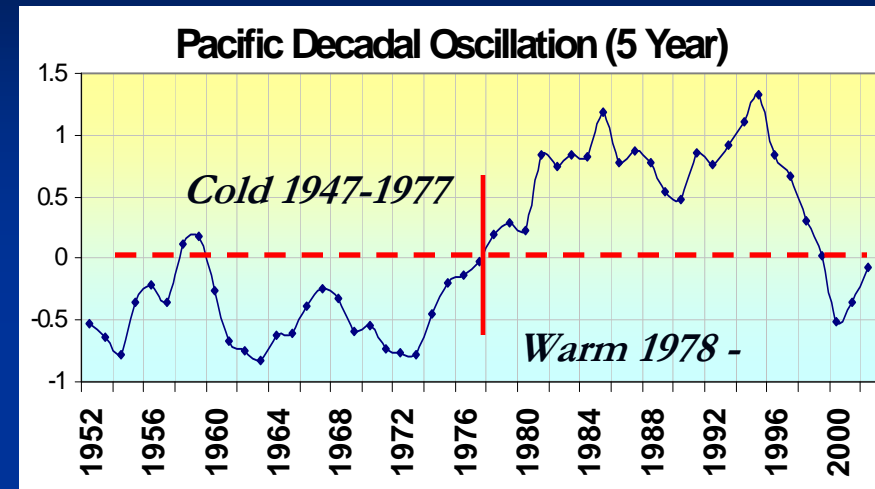
**All these point to the role of the sun!!!!**

# Solar in Climate Models

- Only the small direct brightness changes have been used for historical
- For the future, the small direct average solar irradiance is the only forcing factor and it is assumed constant

# Cyclical Factors - Oceans

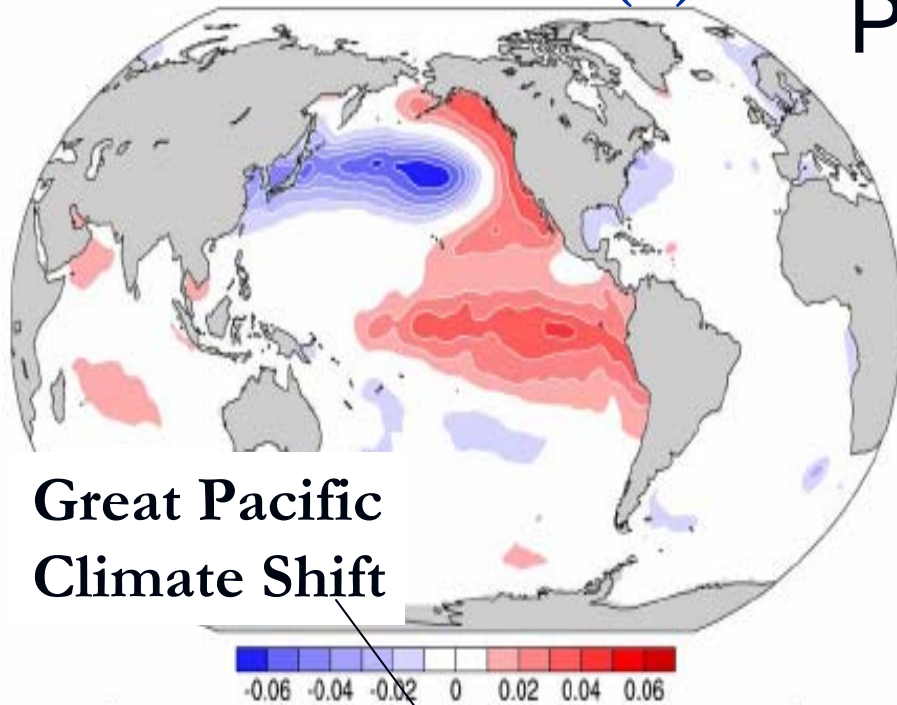
- Multi-decadal cycles in the ocean temperature patterns in both Pacific and Atlantic
  - Pacific Decadal Oscillation
  - Atlantic Multidecadal Oscillation
- These are due to multi-decadal changes in the thermohaline circulation
- They have a major influence on temperatures over adjacent land areas



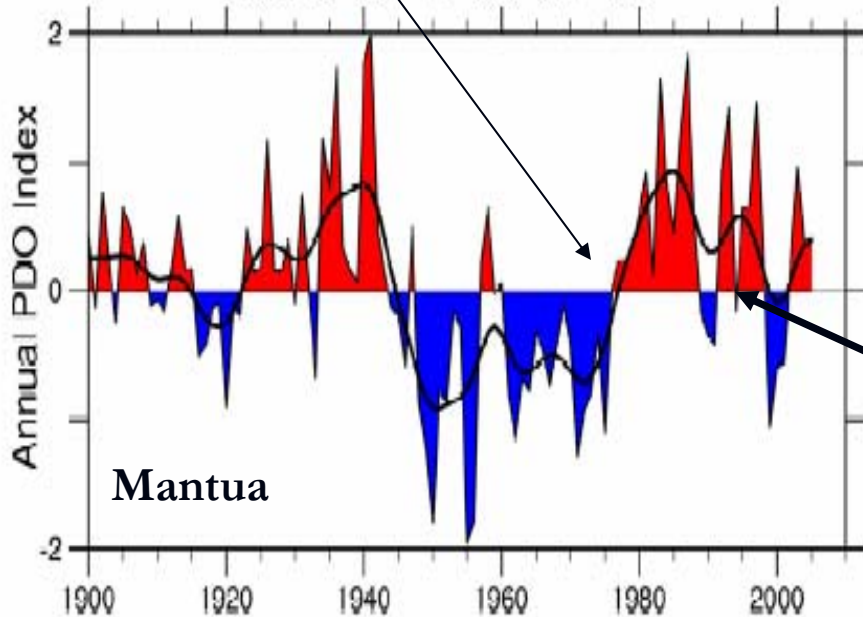


Warm Mode (+)

# Pacific Decadal Oscillation

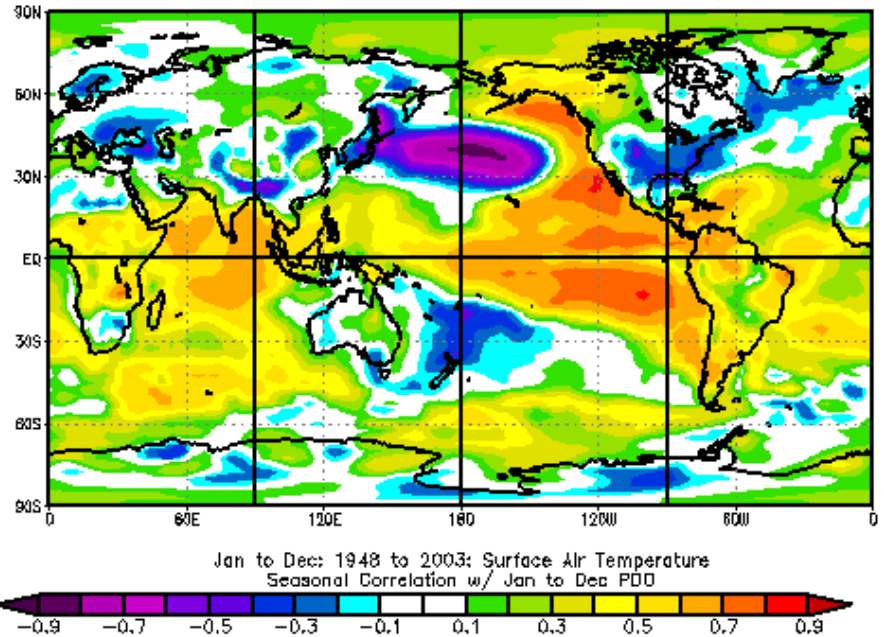


Great Pacific  
Climate Shift

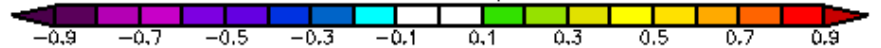


## Annual Temperature Anomaly

NCEP/NCAR Reanalysis



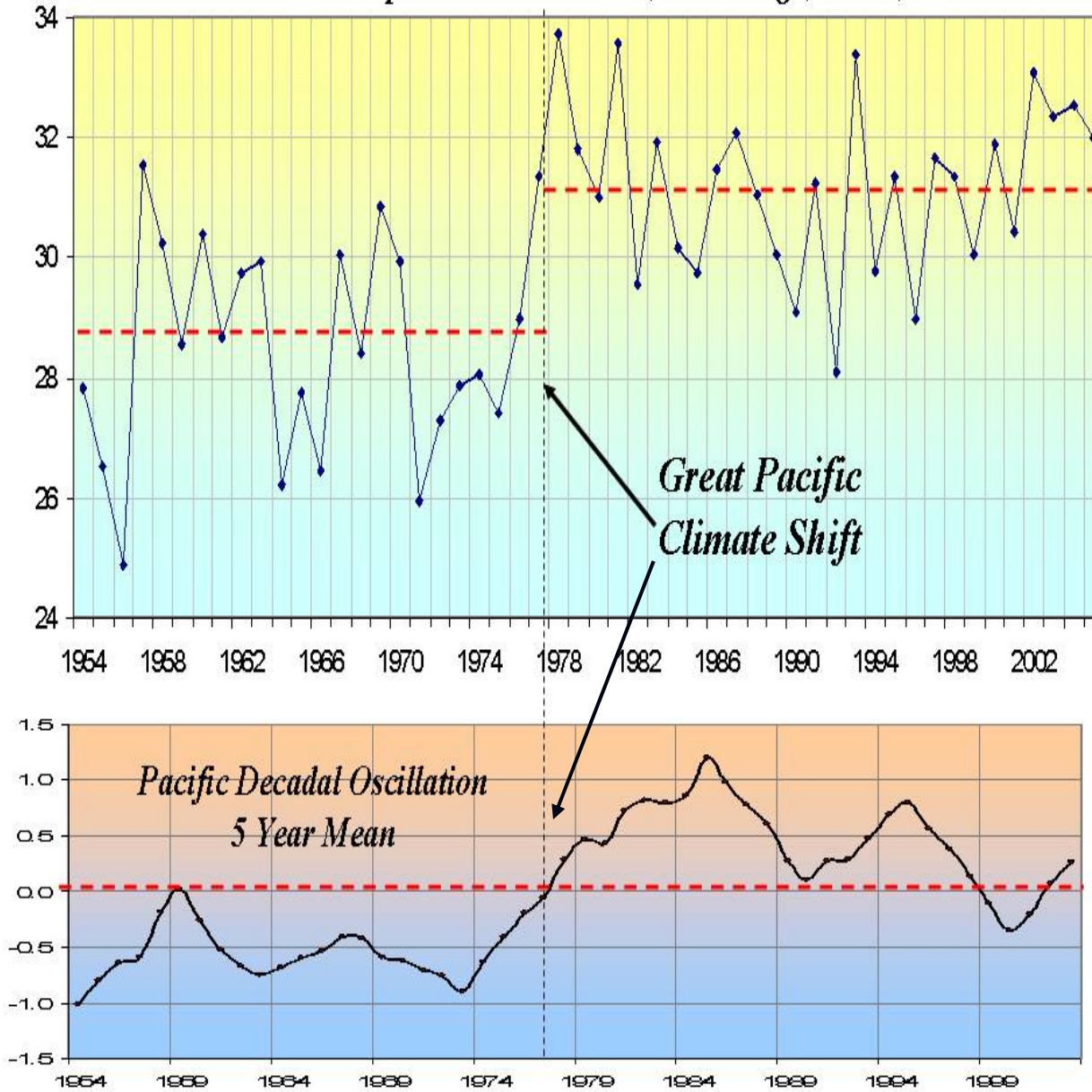
Jan to Dec: 1948 to 2003: Surface Air Temperature  
Seasonal Correlation w/ Jan to Dec PDO

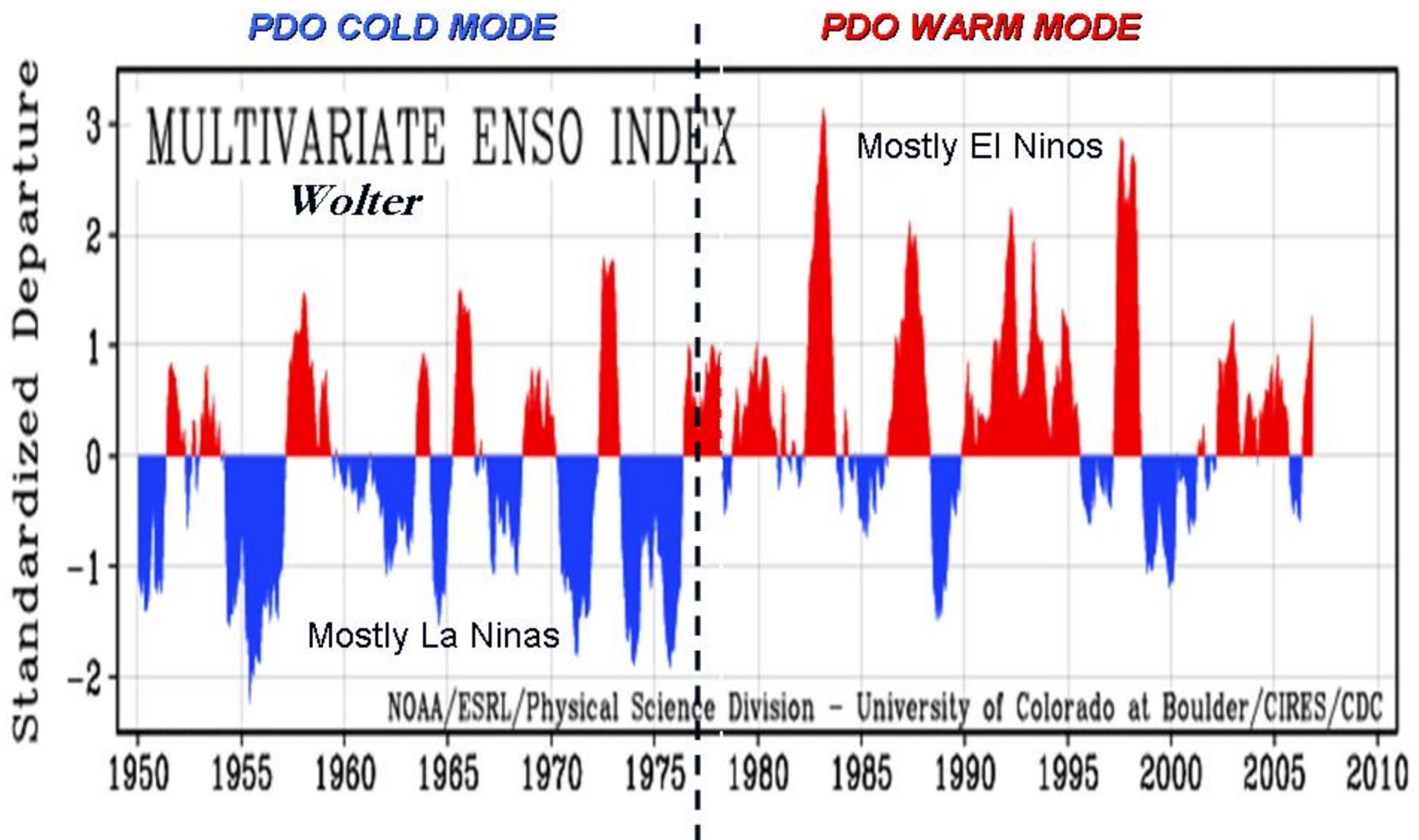


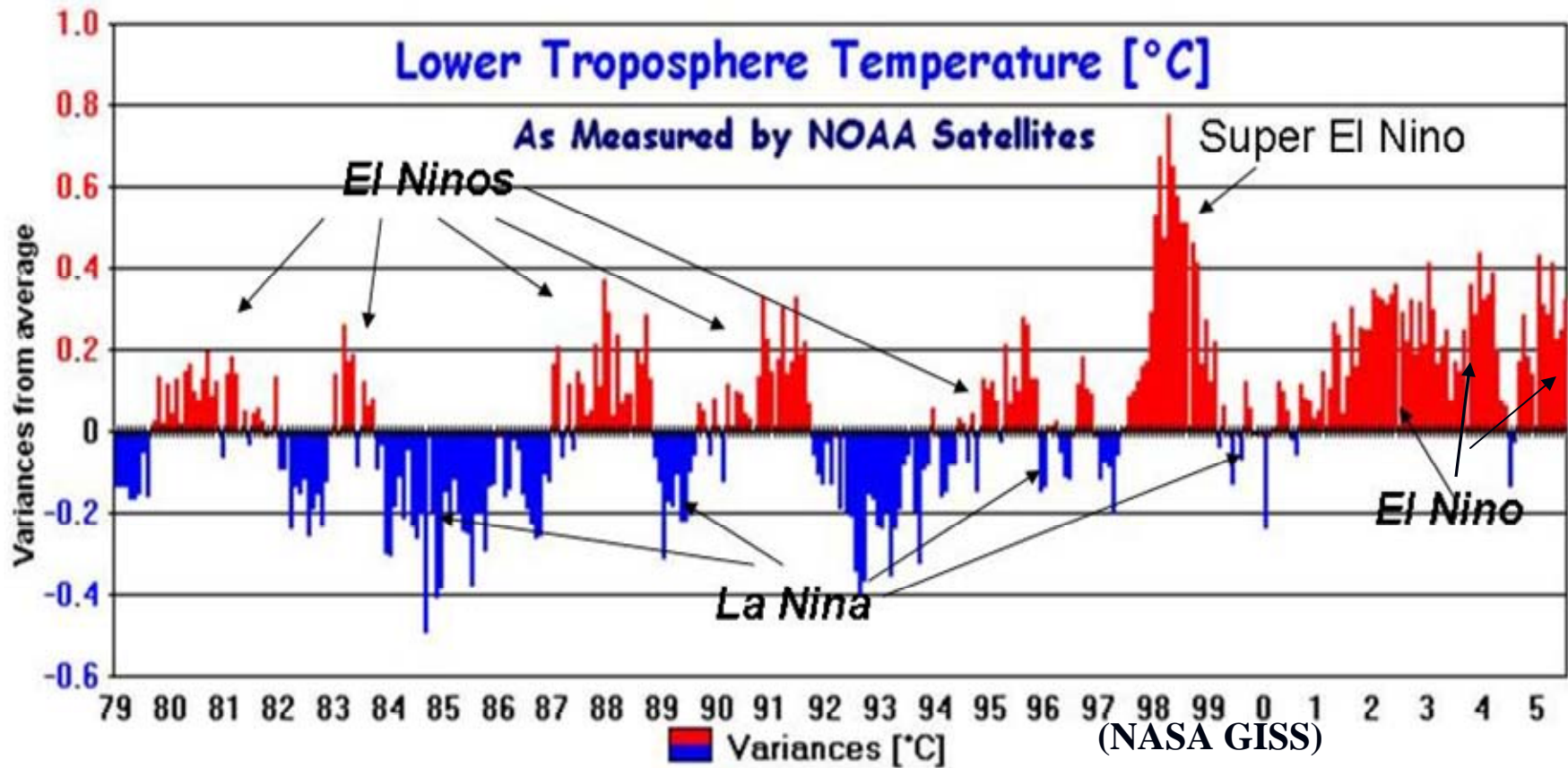
NOAA-CIRES/Climate Diagnostics Co

*Warm PDO (since 1978) favors  
warm Alaska, cool southeast and  
more El Ninos*

*Mean Annual Temperatures Fairbanks, Anchorage, Nome, Alaska*

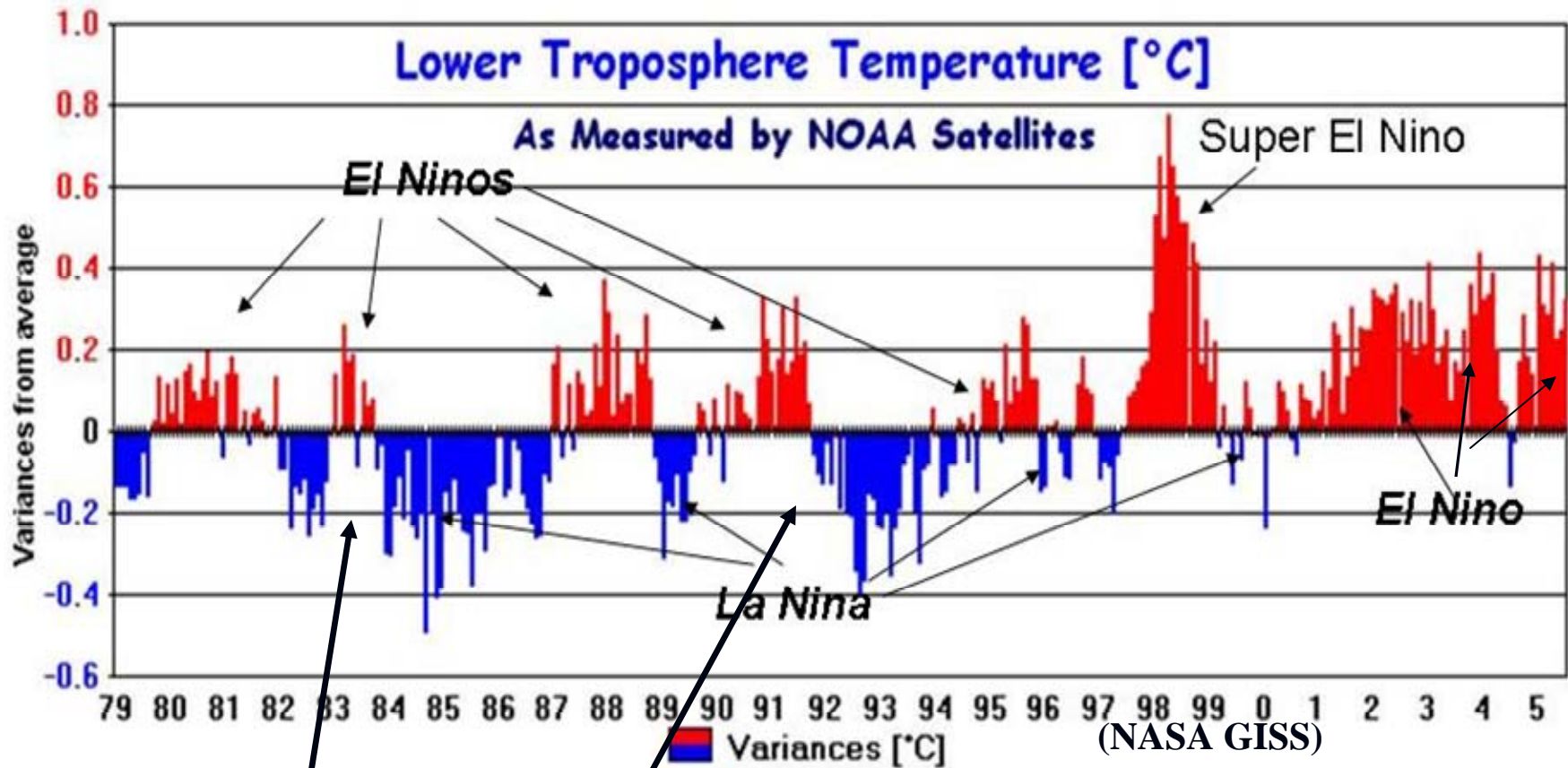




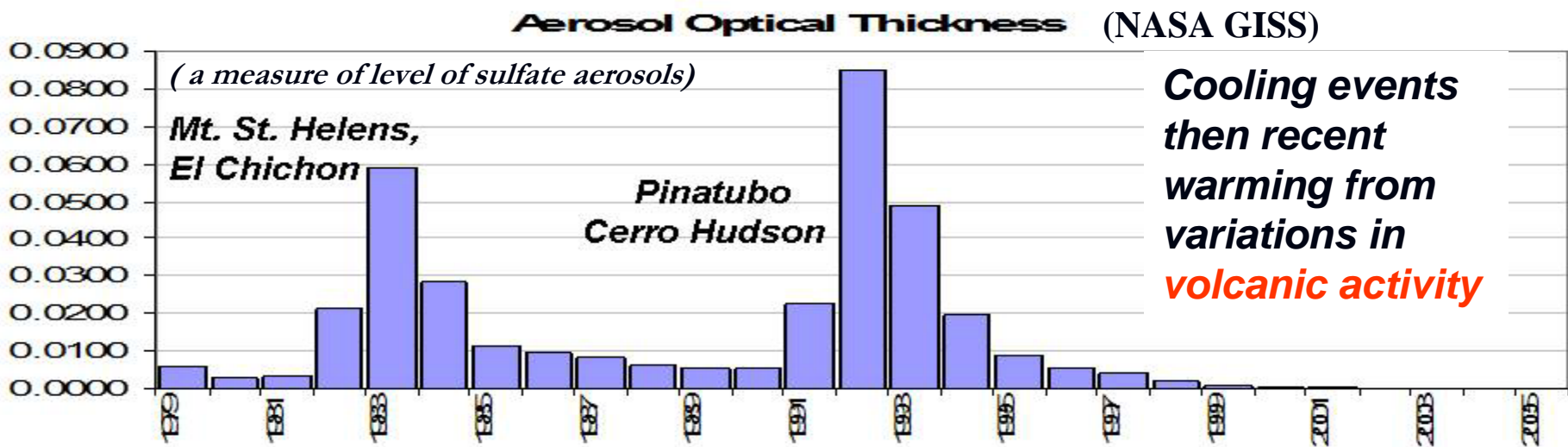
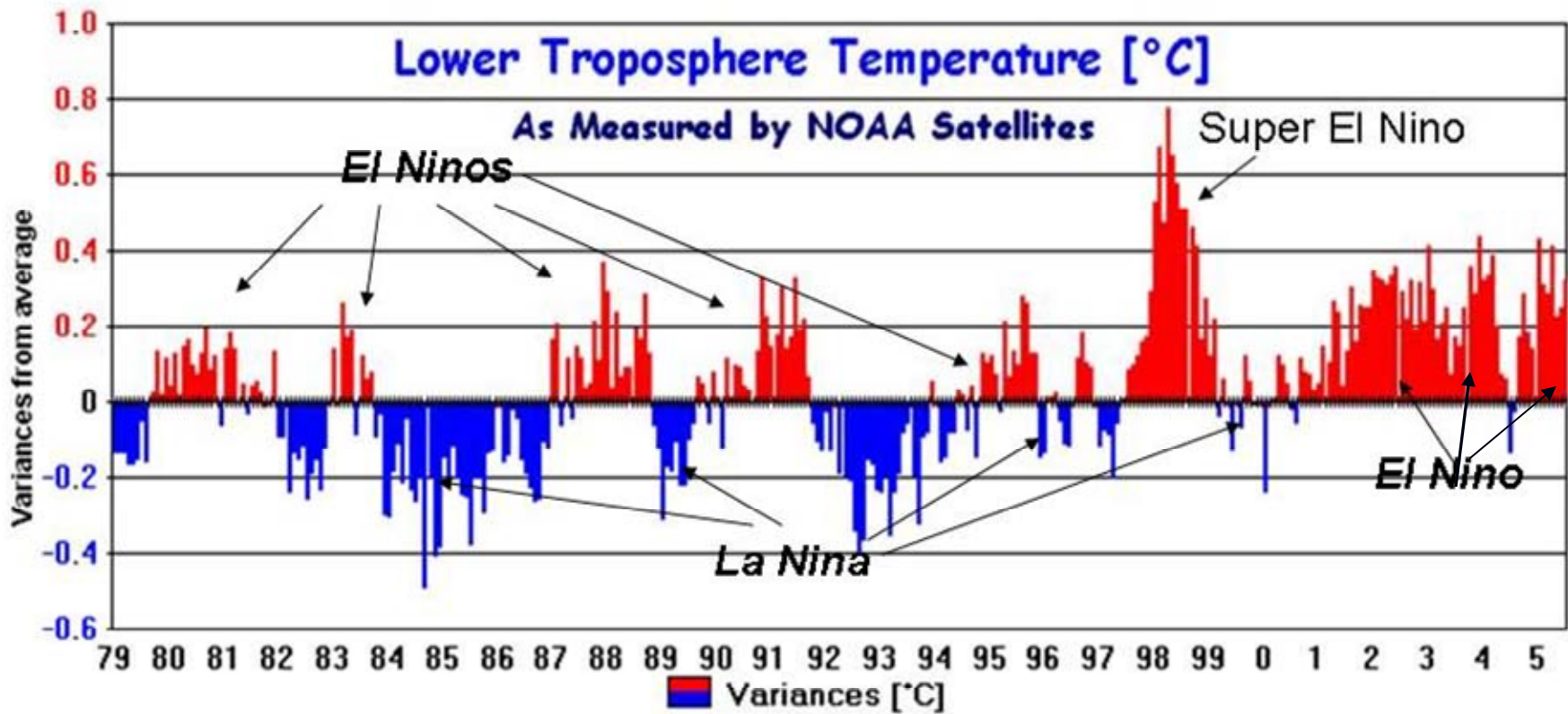


*El Ninos lead to global warming and La Ninas to cooling*

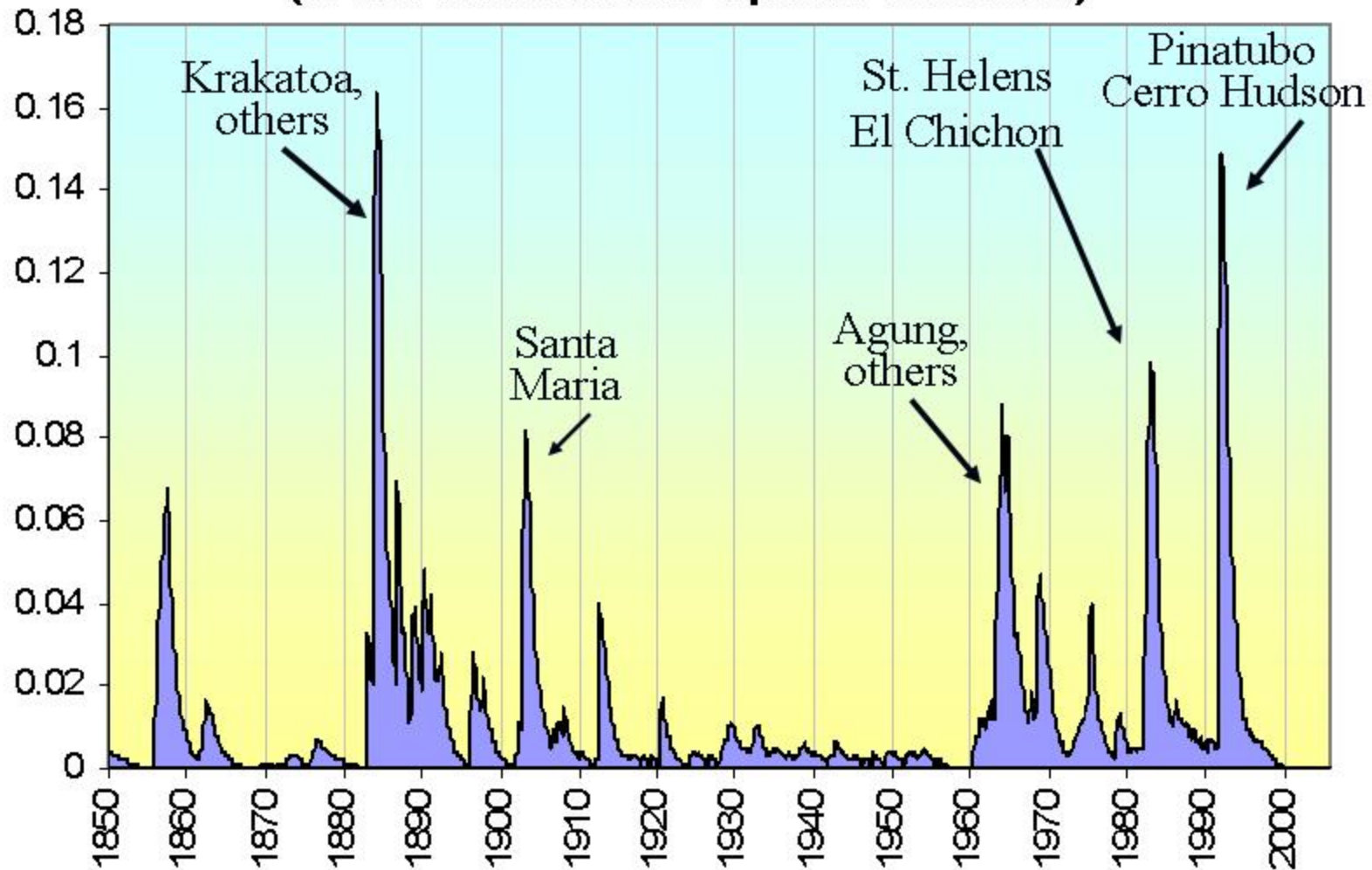
*MSU data Spencer Christy*



*What about the minor warming then cooling after of the super El Nino of 1982/83 and the cooling with and following the El Nino of 1992/93?*



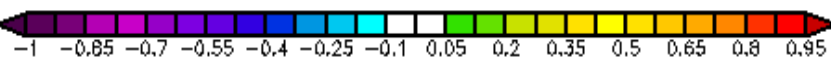
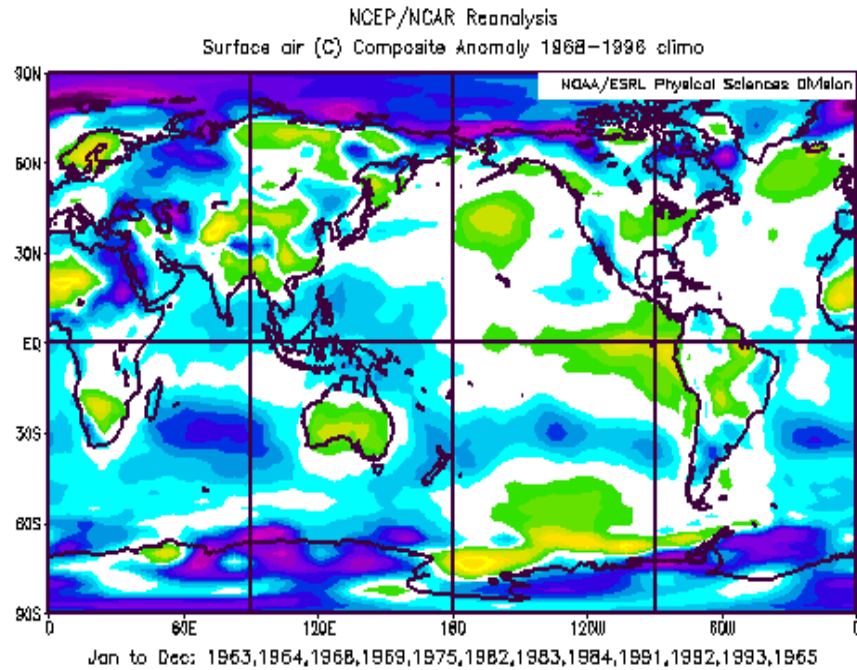
## Stratospheric Volcanic Aerosol (NASS GISS Aerosol Optical Thickness)



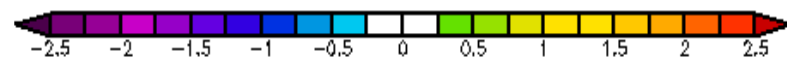
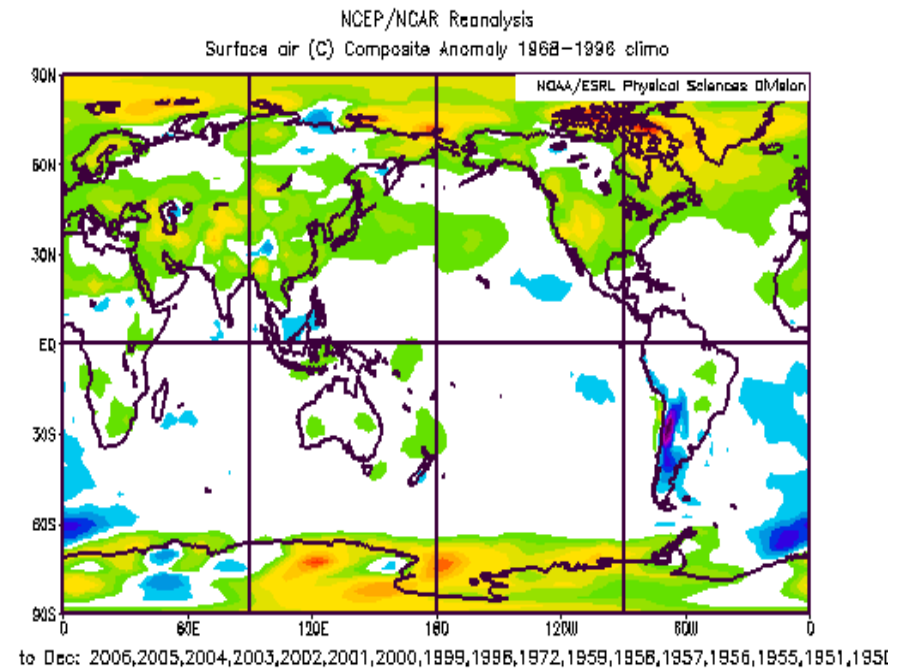
***Volcanic aerosols in the high atmosphere block solar radiation and increase cloud cover leading to widespread cooling, especially significant in summer***

# *Years with more than 1/2 STD departures stratospheric aerosols*

## More than 1/2 STD Above



## More than 1/2 STD Below

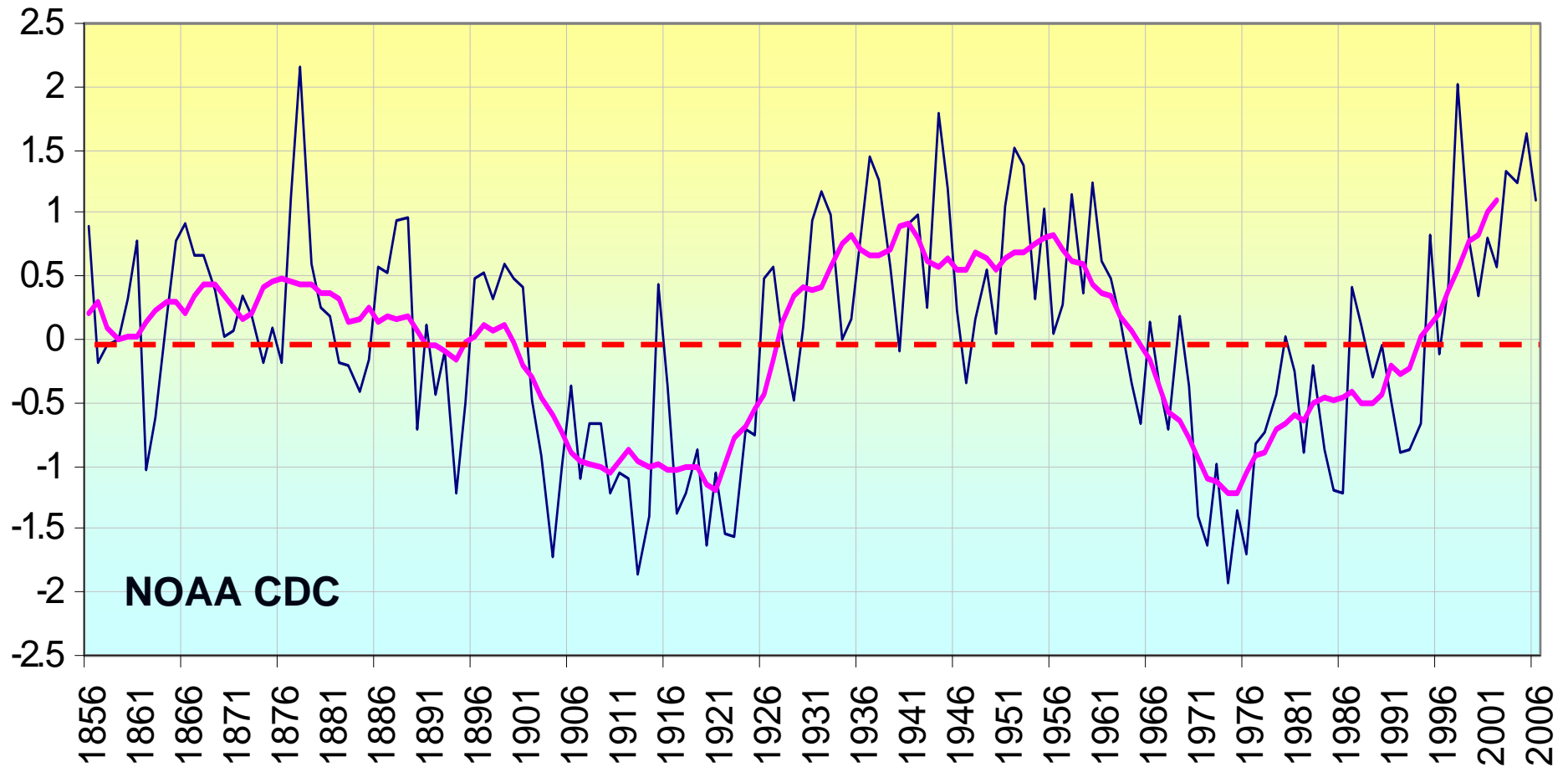


## January to December Annual Temperature Anomalies

*Data NASA GISS, CDC*

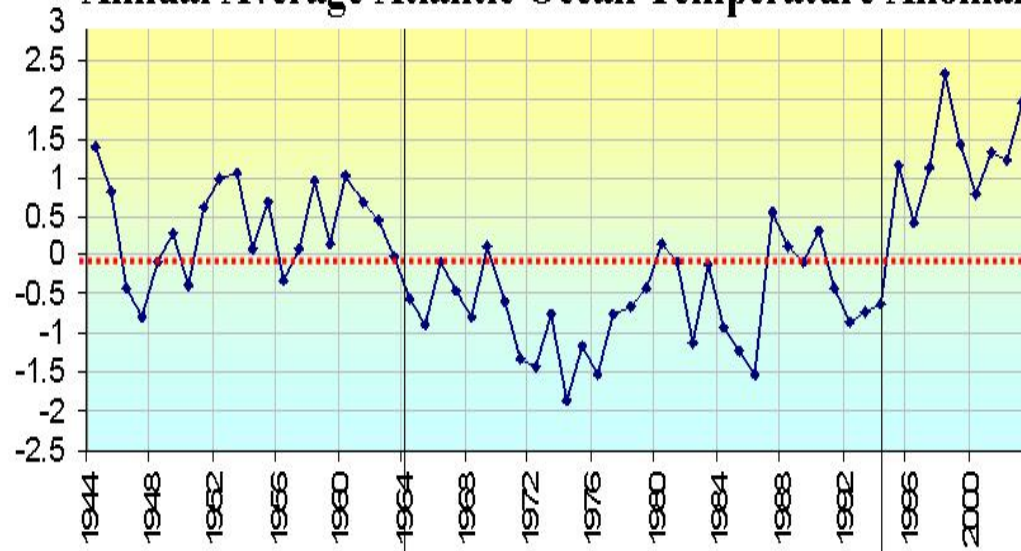


# Annual Atlantic MultiDecadal Oscillation (AMO)

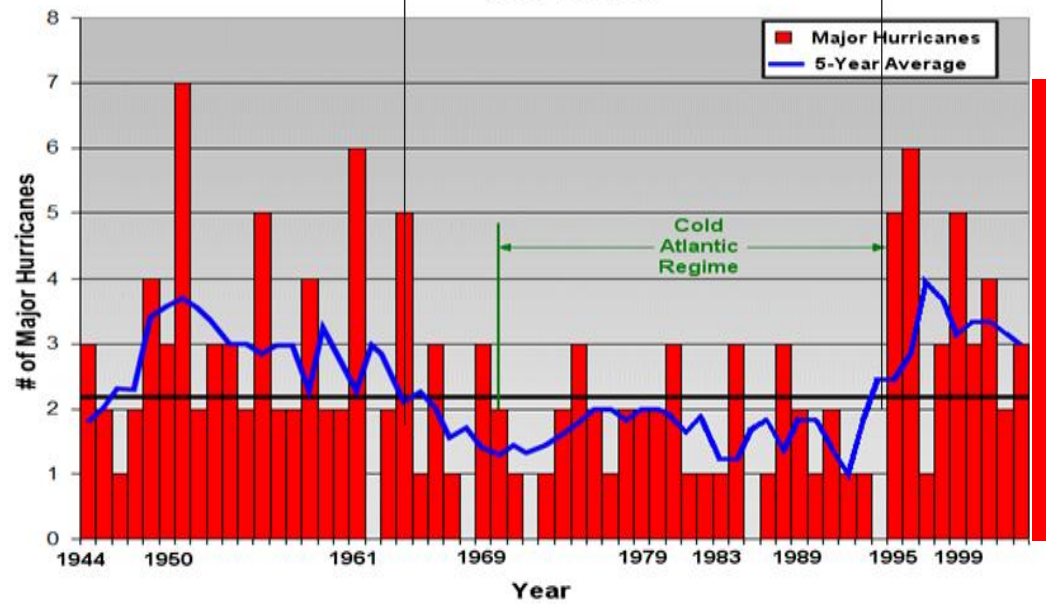


*Mean ocean temperature anomalies in the Atlantic from 0 to 70N*

## Annual Average Atlantic Ocean Temperature Anomaly

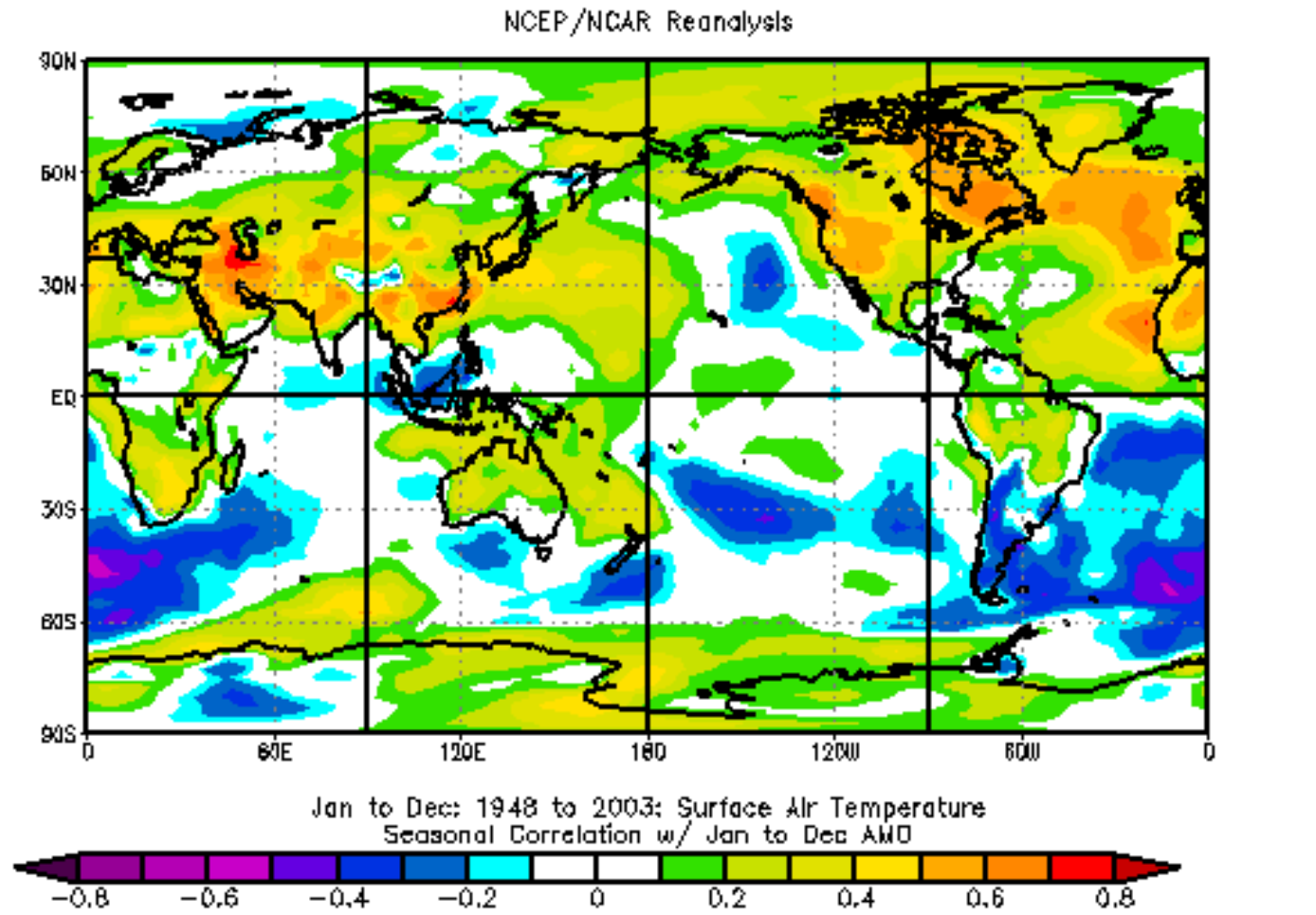


## Major Atlantic Hurricanes 1944 to 2003



# Atlantic Multidecadal Oscillation

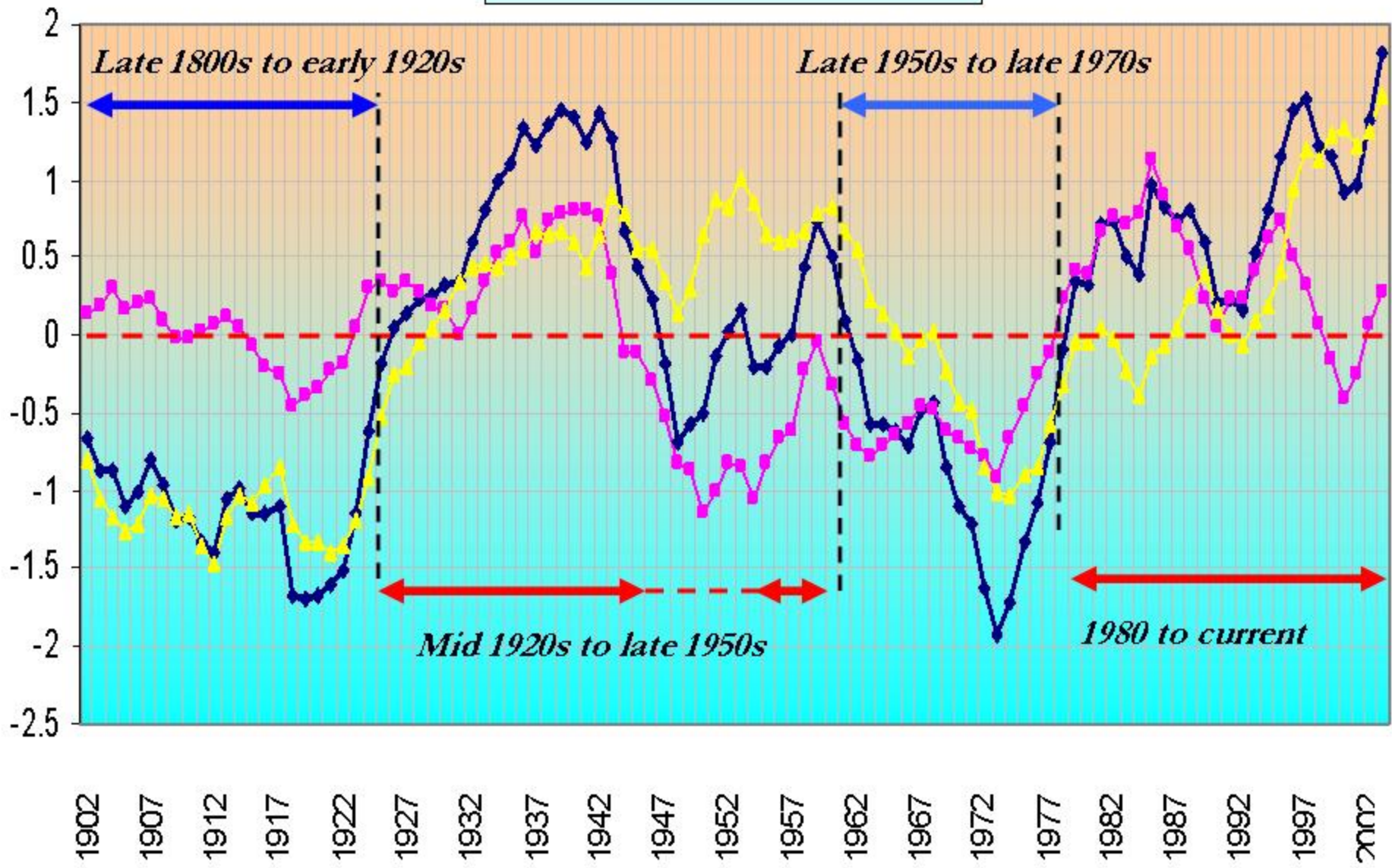
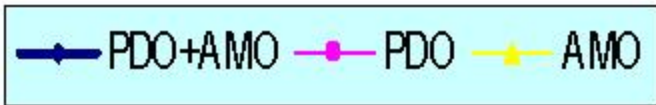
*Correlates with general warmth, statistically significant in places*



# PDO, AMO and Global Warming

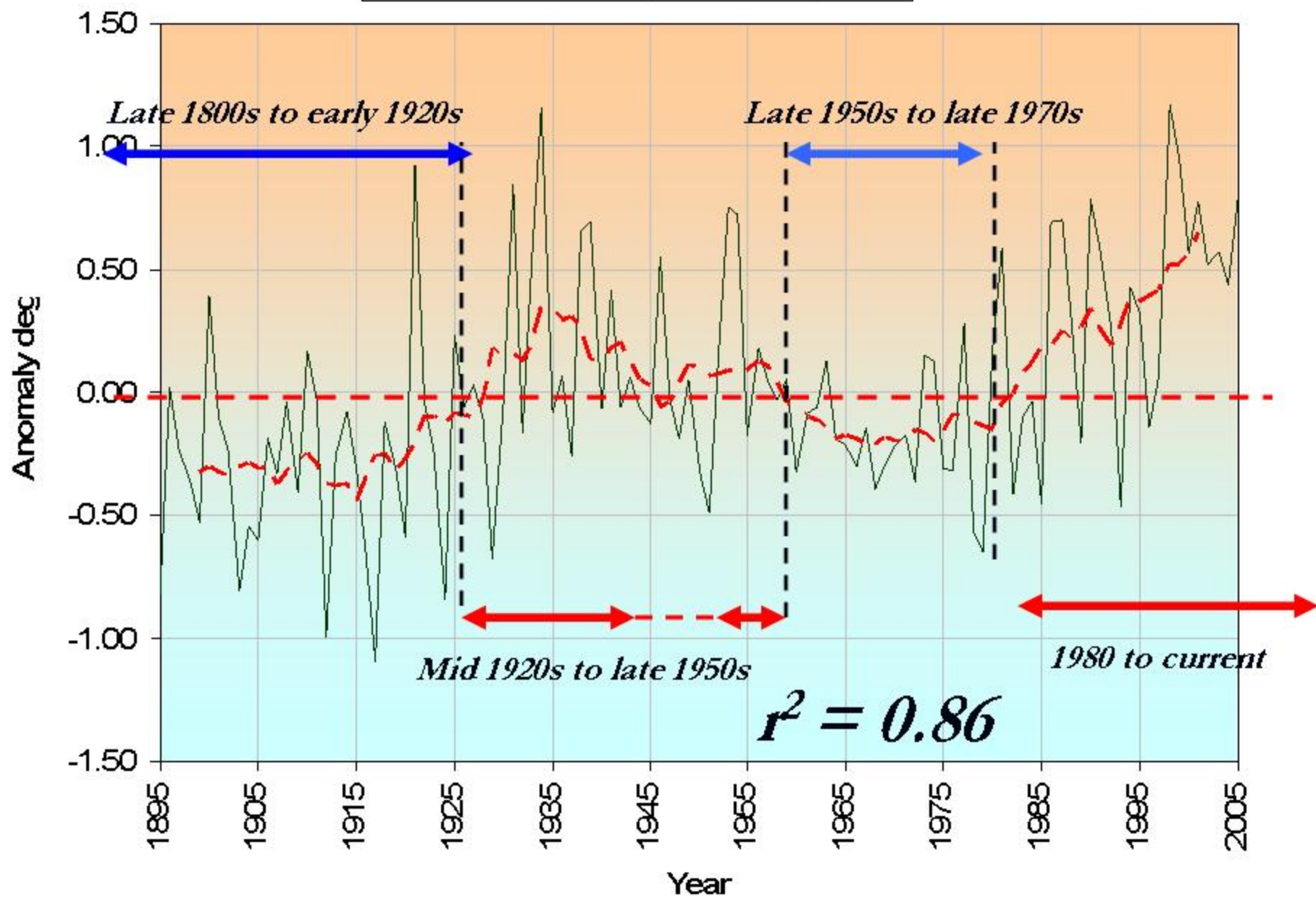
- If + PDO relates to more El Ninos which lead to global warming and if +AMO relates to general global warmth, the sum of the two may be useful in identifying warm periods (and when negative cold periods)

# 5-Year Means AMO+PDO



# USA Annual Mean Temperatures

— USA — 10 year Running Mean



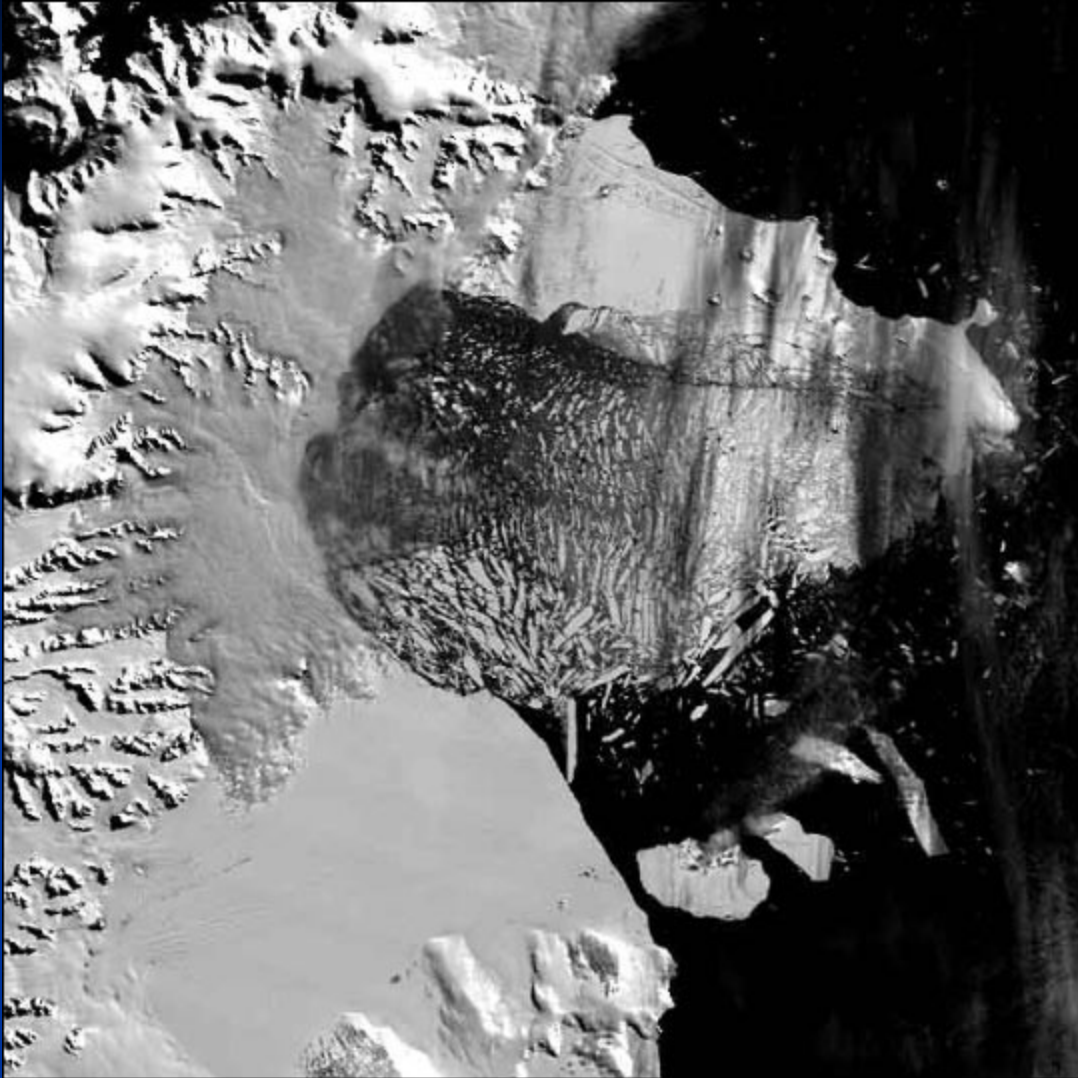
# Oceans and Climate Models

- Though there are coupled ocean and atmospheric models used, they do not fully capture all the important processes involved (salinity changes) that result in multi-decadal shifts
- Indeed they are not able to replicate the warm and cold modes in the Pacific and Atlantic
- So looking forward we see no cyclical behavior in temperatures in the models only a warming

# Icecaps and Glaciers

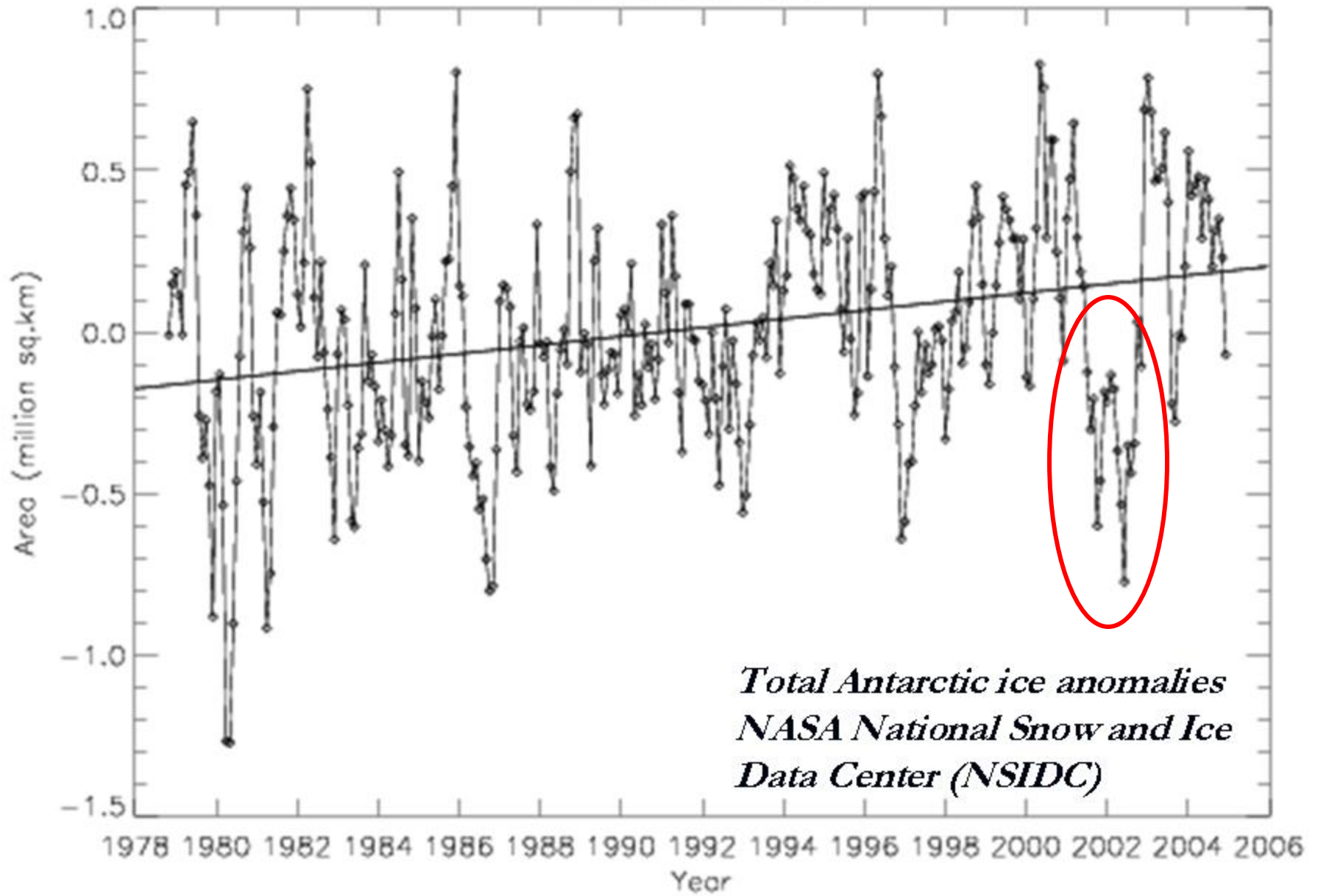
95% of the world's ice is found in the  
Antarctic and Greenland Icecaps



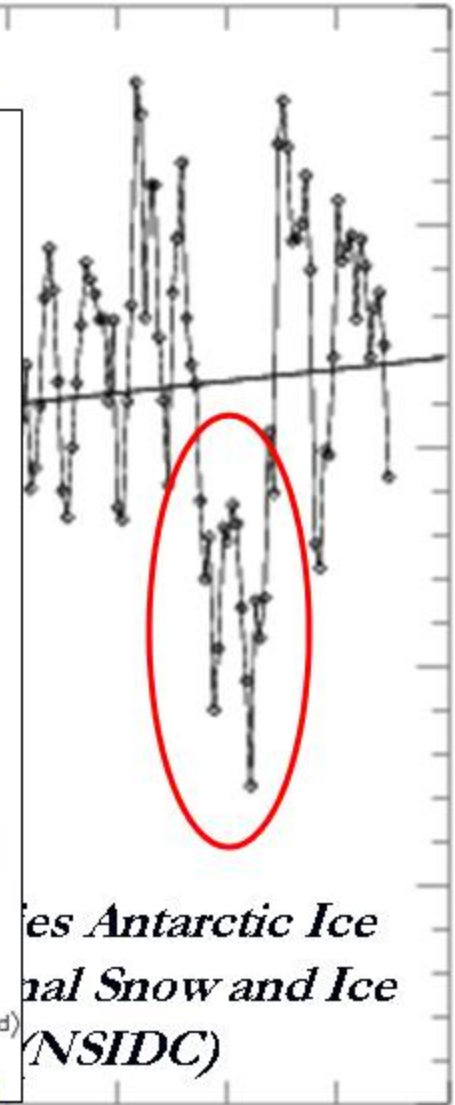
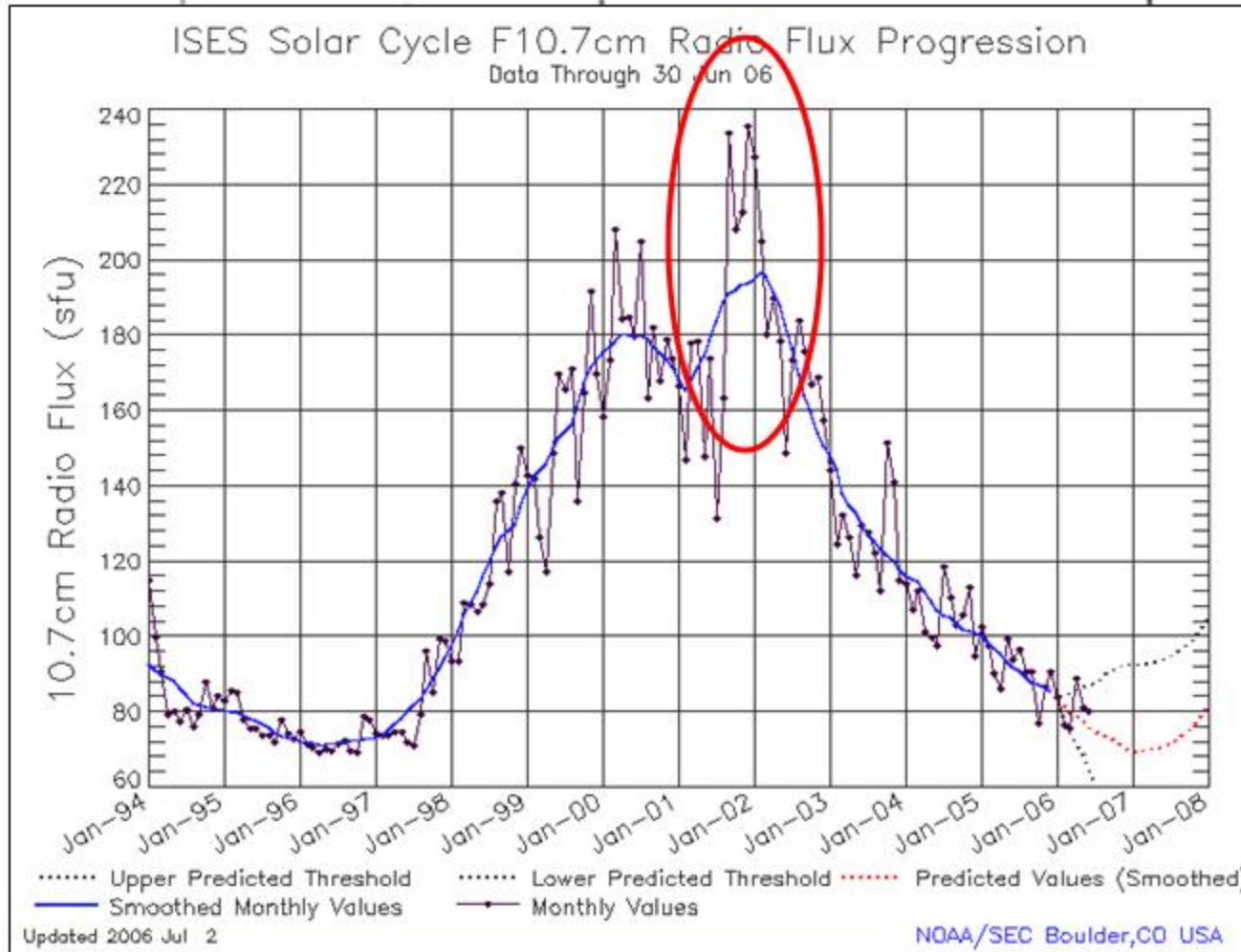


*Antarctica*  
*Summer 2002*  
*Larsen Ice Sheet*  
*Break-up*

### Antarctic Total

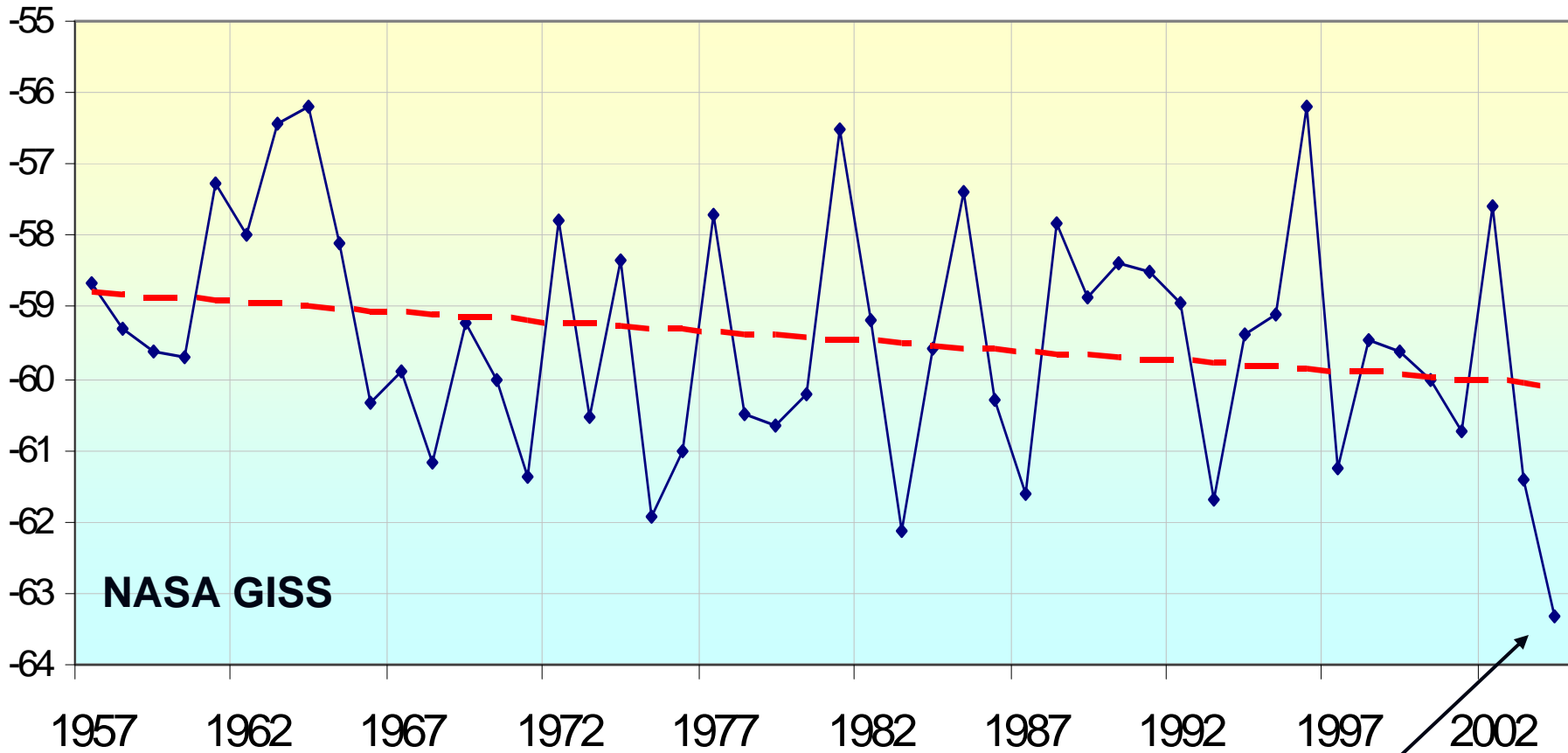


# Antarctic Total



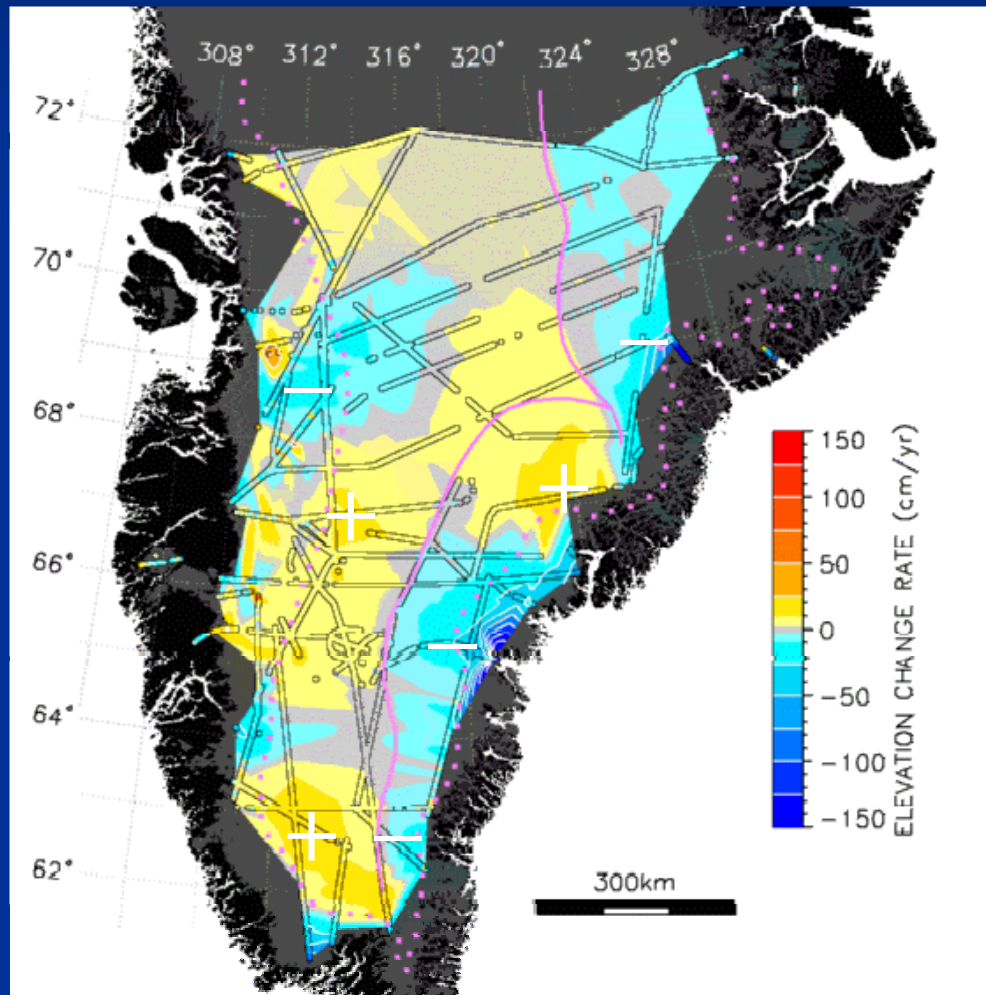
es Antarctic Ice  
al Snow and Ice  
(NSIDC)

# Amundsen-Scot, South Pole Winter (JJA) Mean Temp

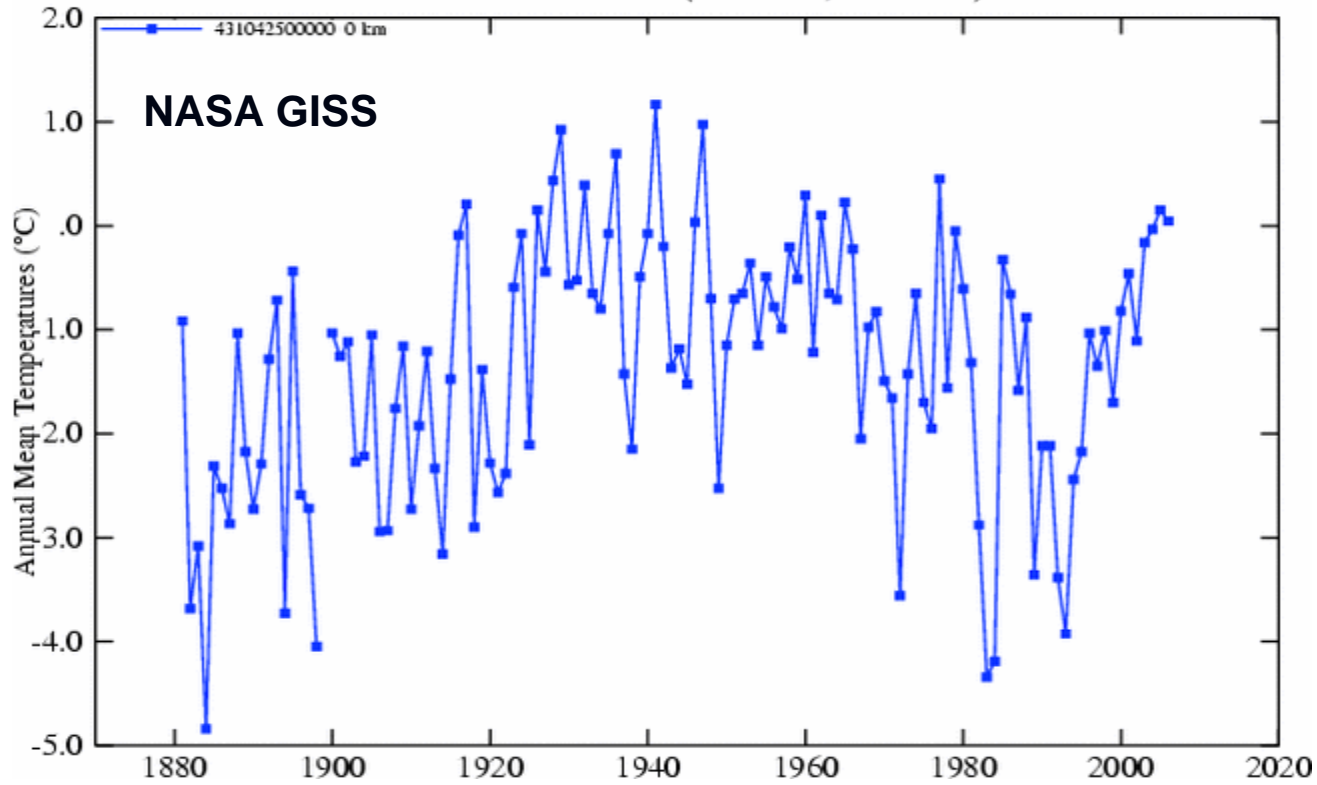


**Note 2004 winter was the coldest of the entire record**

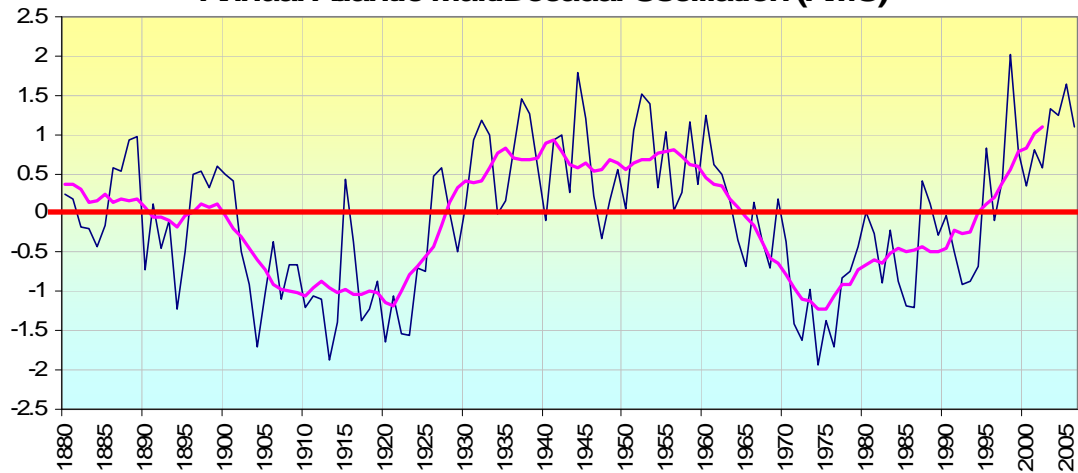
# *Greenland Icecap and Global Warming*



### Godthab Nuuk (64.2 N,51.8 W)



### Annual Atlantic MultiDecadal Oscillation (AMO)

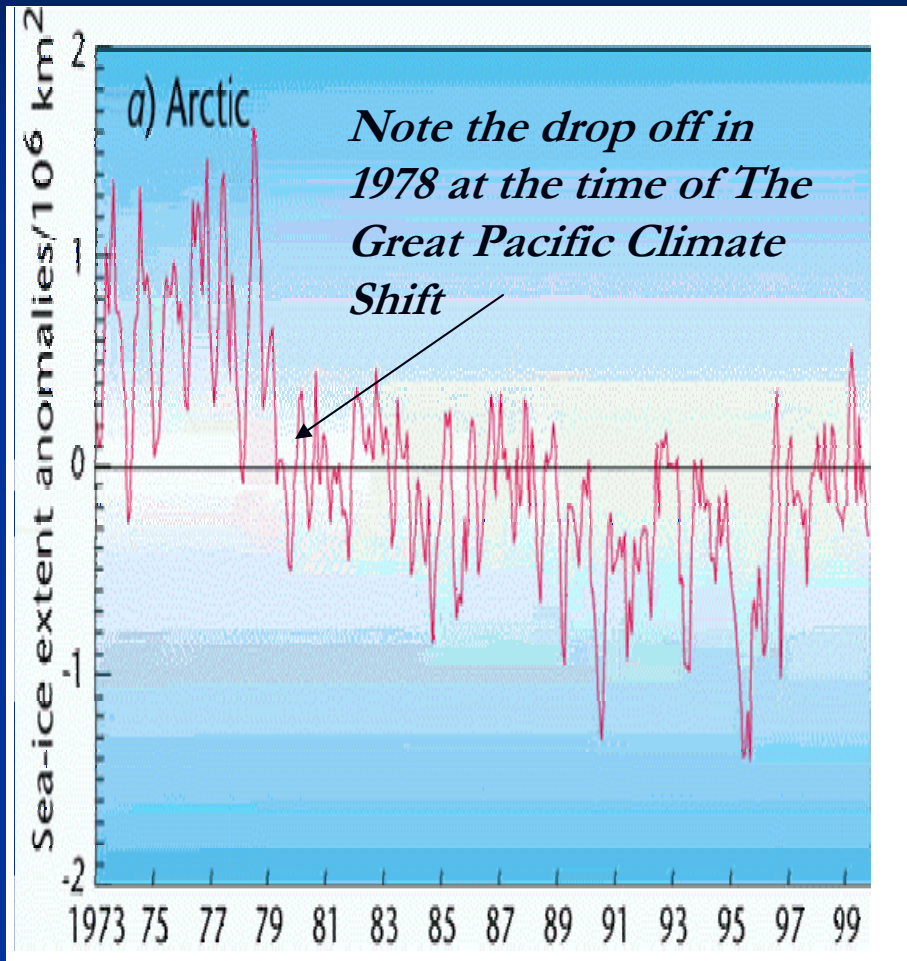


$R^2 = 0.02$   
with  $CO_2$

# Sea Level Rises

- The lack of convincing melting of the Antarctic ice cap (+100 to -200Gt/yr) and the uncertainty about Greenland (+25 to -60Gt/yr) has led the IPCC to reduce sea level rises this century to a range from of 8 to 17 inches
- The rate-of-rise of global sea level over the last half of the 20th century was actually less than the rate-of-rise over the first half of the century (Jevrejeva et al., 2006; Holgate, 2007), which is suggestive of a decelerating rate of global sea level rise.
- This is far short of the 18-20 feet Al Gore and others have proposed

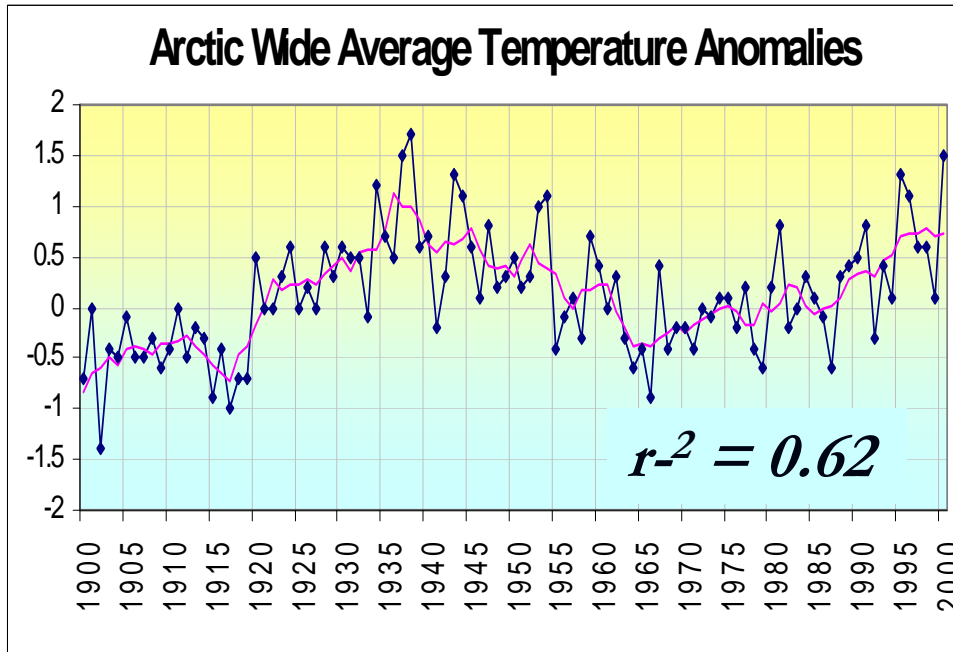
# Arctic



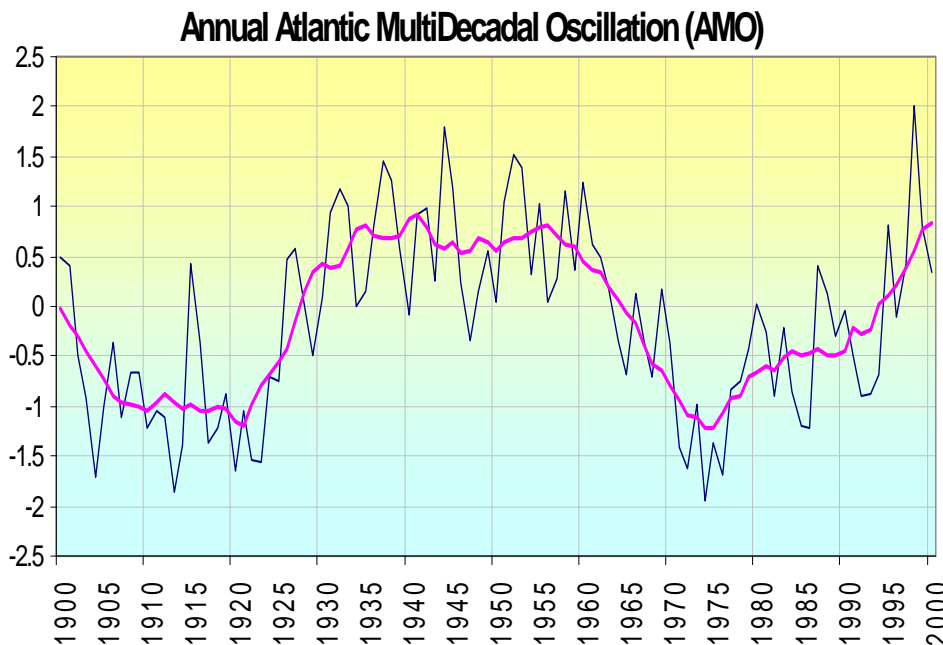
USGRCP, June 2000

- Arctic ice has diminished in thickness and extent in the summer since the Great Pacific Climate shift in 1978 as warming North Pacific water made its way into the arctic through the Bering Straits
- JAMSTEC (2006) has noted another surge occurred after the super El Nino of 1997/98





Dmitrenko and Polyakov tracked warm Atlantic water under arctic ice and noted it is playing a role in ice thinning as it did in 1930s (when thickness decreased by 30% from 1890)



Arctic temperatures correlate well (62%) with the AMO and even better 73% with PDO+AMO

# Kilimanjaro

Africa



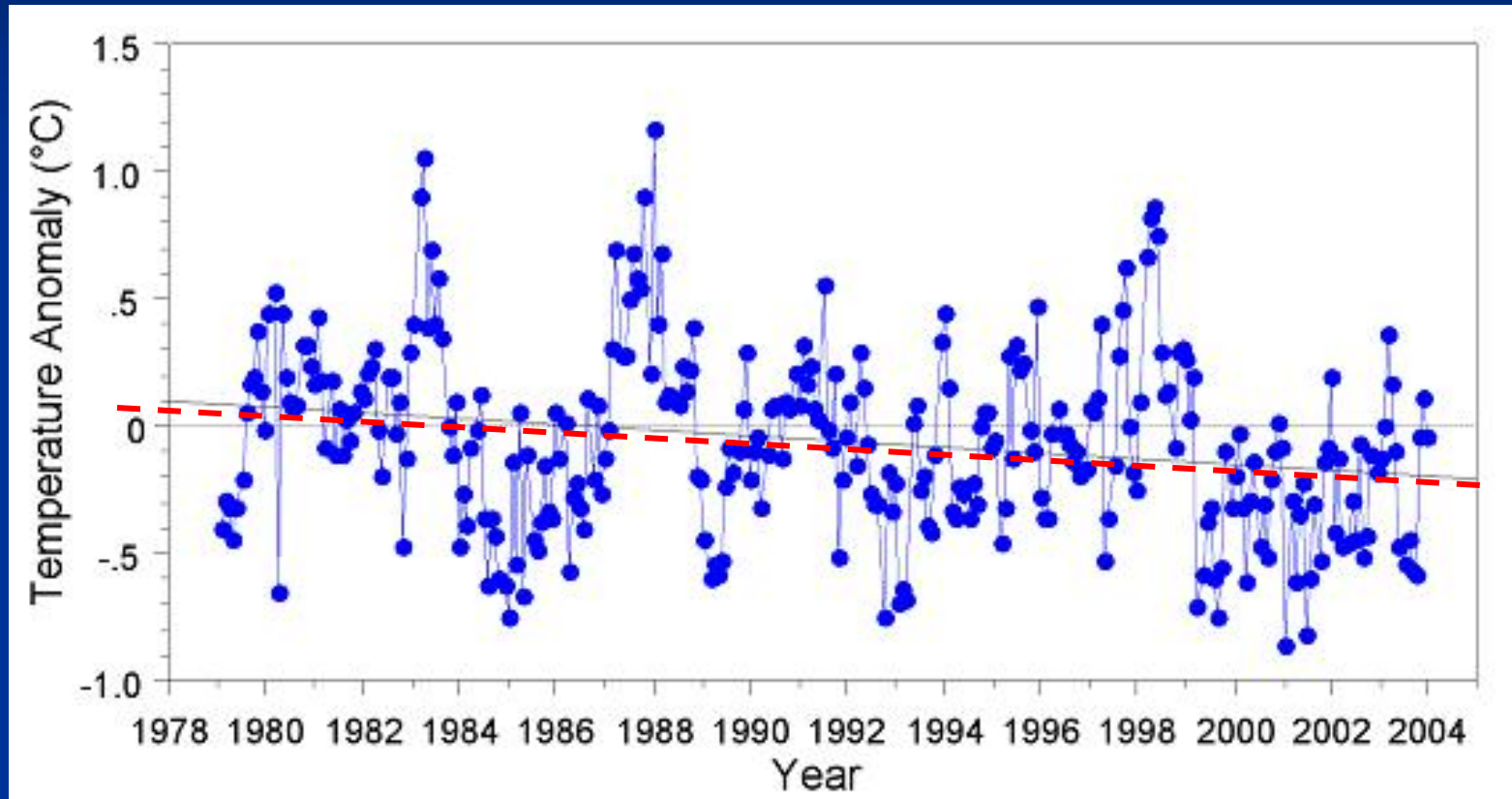
1970



2000

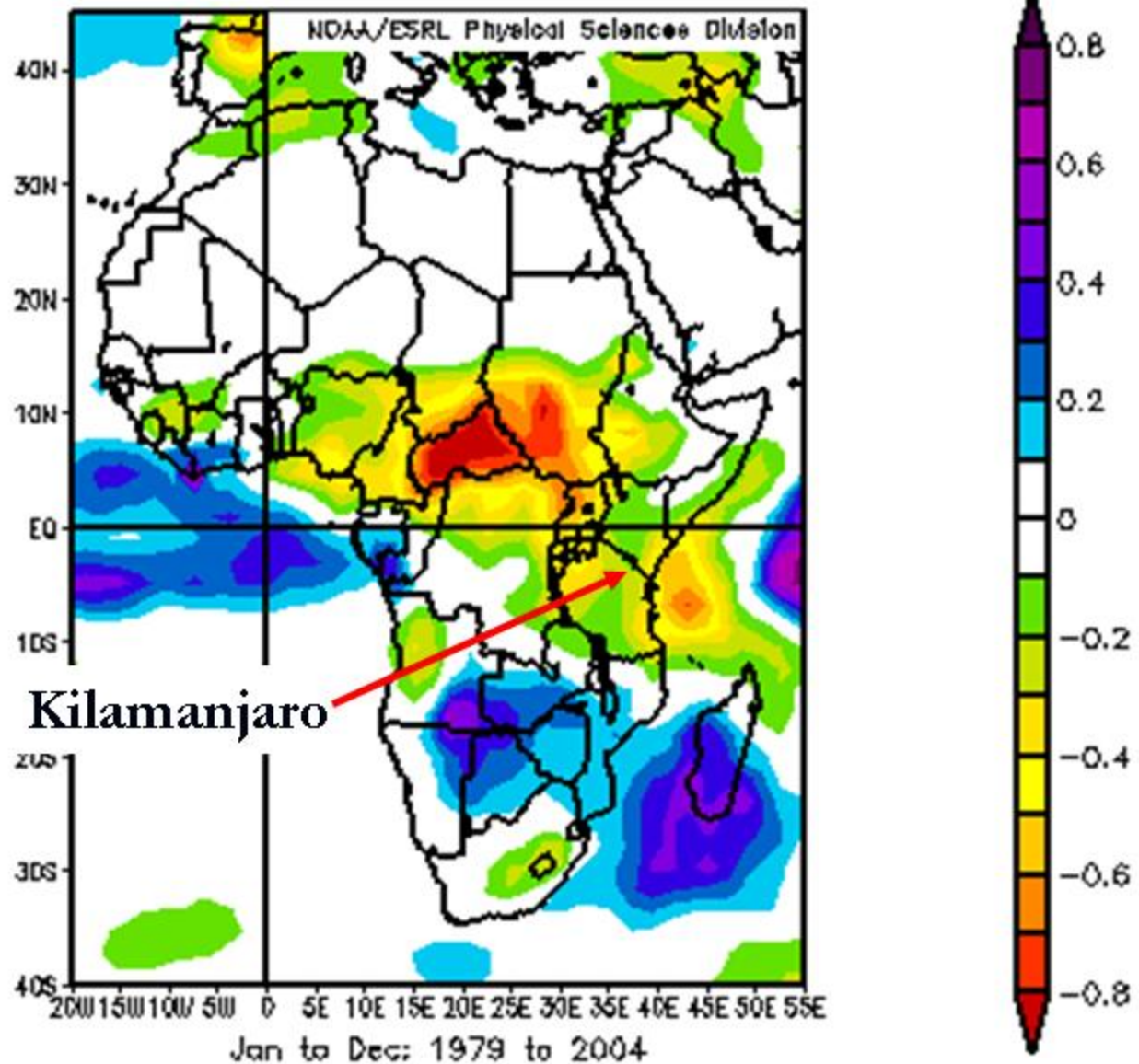
# Kilimanjaro Snowfield

- Certainly not due to global warming – temperatures have been cooling last 25 years



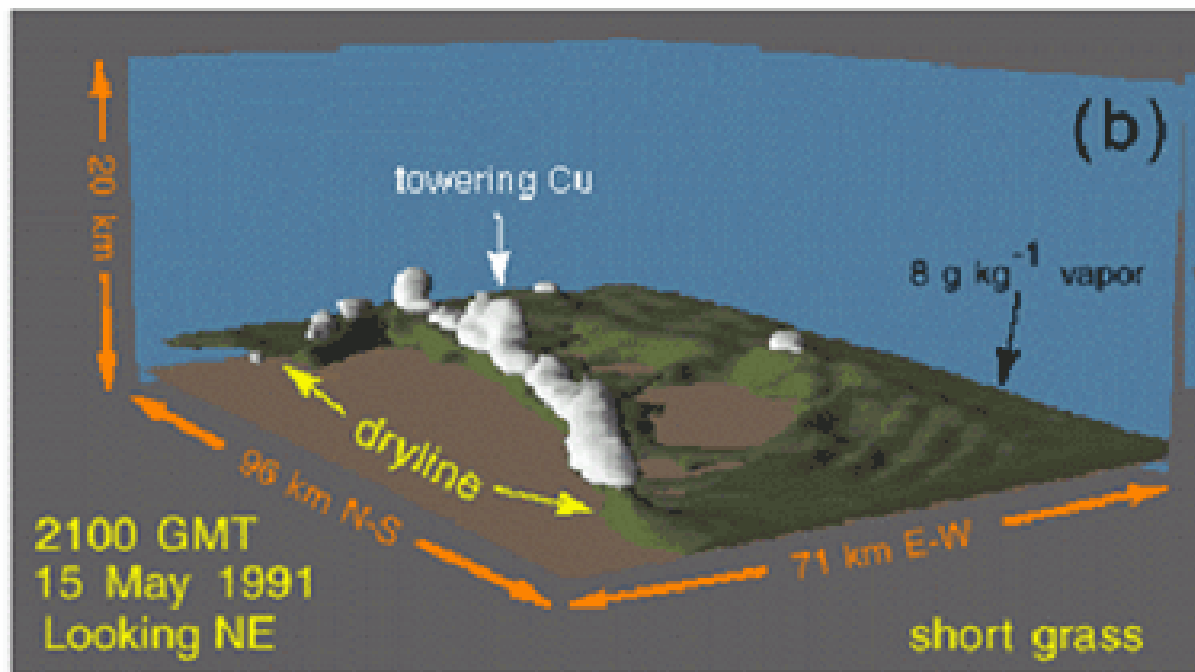
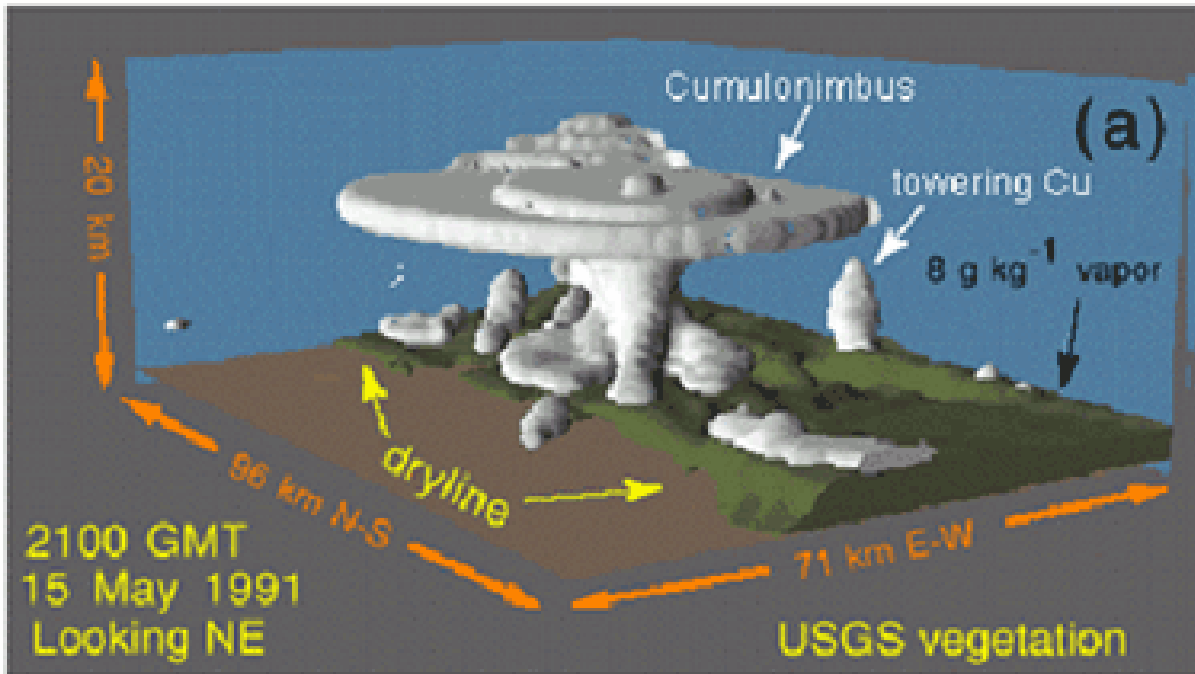
- Ice retreat has been due to less precipitation

NCEP/NCAR Reanalysis  
Surface Precipitation Rate (mm/day) Composite Anomaly 1968–1996 climo



*Precipitation anomalies same 25 years*

*Relates to Atlantic Multidecadal Oscillation and land use changes (deforestation)*



(C. Ziegler, NSSL)

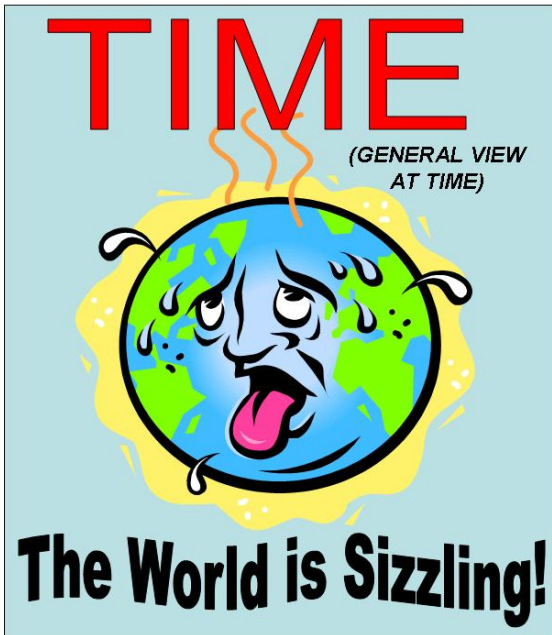
*Shrubs and trees*

*Short grasses*

# Consensus on Global Warming

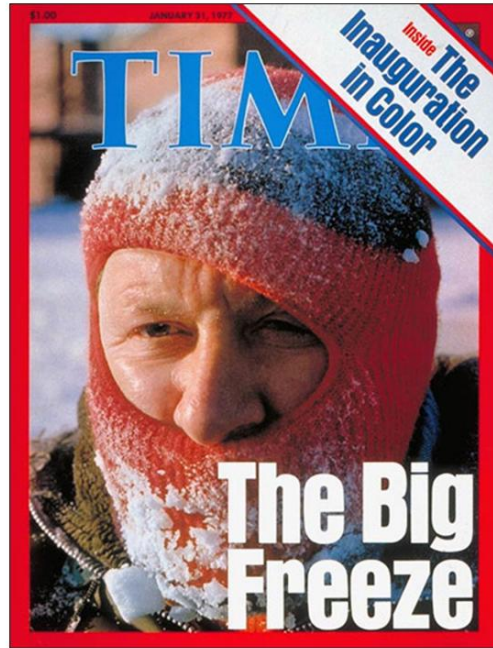
- Most scientists are not climatologists. Most work in other fields and many maybe observing first-hand the effects of climate change. No doubt many have been convinced man is behind it (though 17,200 of them signed petition urging US not to sign Kyoto).
- Many climatologists that work closely with the data see the importance of local factors such as urbanization, land use changes and bad siting and see changes that are cyclical and natural
- I estimate  $2/3^{\text{rds}}$  to  $3/4^{\text{ths}}$  of the forecast and broadcast meteorologists and non-modeler climatologists believe natural factors are important
- Survey of American Association of State Climatologists in 1997 showed 73% felt natural cycles were largely behind climate changes, especially the old-timers who have seen this frenzied overreaction to change before

SEPTEMBER 10



1945

JANUARY 31



1977

APRIL 3



2006

# Al Gore's Own Words

- *“...what is most dangerous for us is not what we don't know, but that which we know for sure which just ain't so”*
- Though meant for the politicians and ‘skeptics’, it really applies to Al Gore and the ‘alarmists’
- By focusing solely on greenhouse gases and discouraging efforts to understand other factors, we stand to be blindsided when other factors change and the climate makes its next quick about face



# Cooling Instead of Warming

- Russian Academy of Science has **warned of an imminent recurrence of a minor Ice Age**, similar to the one in the 17th century, when temperatures dropped in Europe, North America and Greenland, the Thames and Dutch canals froze in winter, and people fled from Greenland because of unbearable cold. The scientists made the conclusion on the basis of a big decline in solar activity expected the next 50 years or so.
- Many solar scientists in Europe, Canada and the US share the same concern but they are not being heard among the shouting and media frenzy about global warming
- The Pacific appears to be heading back into the “cold phase” and Atlantic may follow in a decade.
- Warming may have peaked in 1998, still the warmest year in the global data bases (9 years ago)

# A Climatologist's Viewpoint

- Man plays some role in the world's climate through greenhouse gases and especially urbanization
- Lack of warming in rural areas suggest the greenhouse component is likely small and overall warming estimates overdone. Global data bases are contaminated by siting, urbanization, station dropout and an increase in missing data
- Background temperatures are cyclical in nature and correlate better with natural cycles in the sun and oceans than with greenhouse gases
- The world's icecap and glacial situation is not exactly as portrayed but where changes are occurring they too can be largely explained by these same cycles in sun and oceans
- There is clearly not a consensus among meteorologists and climatologists that greenhouse warming is entirely behind recent changes