

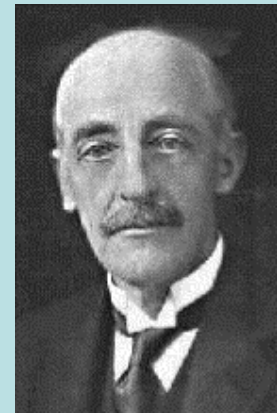
# Science Controversies and “Consensus”



George H. Taylor

# Consensus science

Three people who landed on “the wrong side of consensus”





**Alfred Wegener**  
**“Astronomer/Meteorologist**  
**Playing Geologist”**



# Alfred Lothar Wegener

Born on November 1, 1880

Earned a Ph.D in astronomy from the University of Berlin in 1904.

Became fascinated with the developing fields of meteorology and climatology.

Made several key contributions to meteorology:

(1) pioneered the use of balloons to track air circulation; (2) wrote a textbook that became standard throughout Germany.



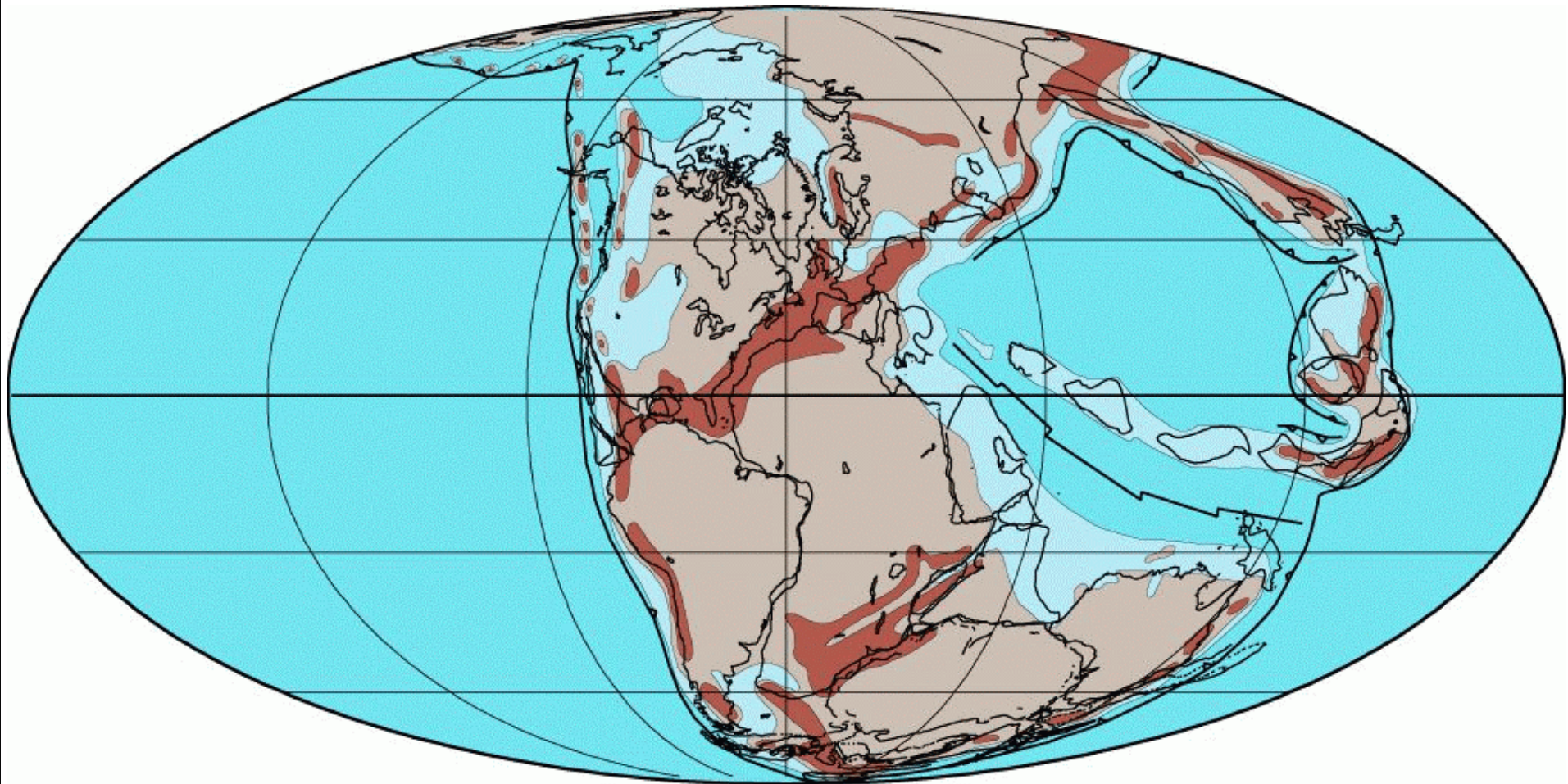
In 1911, Wegener was browsing in the university library when he came across a scientific paper that listed **fossils of identical plants and animals** found on opposite sides of the Atlantic.

Wegener began to look for, and find, more cases of similar organisms and geological matter separated by great oceans.

**Orthodox science** at the time explained such cases by postulating that land bridges, now sunken, had once connected far-flung continents.



- Close fit between the coastlines of Africa and South America
- Diamonds in southwest Africa and eastern South America
- Appalachian mountains of eastern North America match the Scottish Highlands
- Distinctive rock strata of the Karroo system of South Africa are identical to those of the Santa Catarina system in Brazil



**Pangaea**

**“All the Earth”**



In 1915 the first edition of *The Origin of Continents and Oceans*, a book outlining Wegener's theory, was published.

Reaction to Wegener's theory was almost **uniformly hostile**, and often exceptionally **harsh and scathing**.





"Wegener's hypothesis in general is of the footloose type, in that it takes considerable liberty with our globe, and is less bound by restrictions or tied down by awkward, ugly facts than most of its rival theories."

Dr. Rollin T. Chamberlin, U. of Chicago



What vindicated Wegener?

Increased exploration of the Earth's crust, notably the ocean floor, beginning in the 1950s and continuing on to the present day.

By the late 1960s, **plate tectonics** was well supported and accepted by almost all geologists.



It is only by combining the information furnished by all the earth sciences that we can hope to determine 'truth' here.

Further, we have to be prepared always for the possibility that each new discovery, no matter which science furnishes it, may modify the conclusions we draw.

Alfred Wegener. *The Origins of Continents and Oceans* (4th edition)

The best scientists are  
continually trying to prove  
themselves wrong.

Richard Feynman



**J. Harlan Bretz,  
“Catastrophist”**





“Something really  
big happened here”



# Giant ripples (air photo)





Bretz's first experience in the Columbia Gorge was in the summer of 1915.

In more than a dozen geological reports published between 1923 and 1932, Bretz built a case that the Gorge and the “scablands” had been eroded by a truly cataclysmic flood from a then-unknown source.





By the 1870s, science had embraced wholesale Charles Lyell's **uniformitarianism** -- that landscapes form from slow, gradual, everyday processes operating over millions and millions of years.

Bretz's cataclysmic flood explanation was a heretical return to **catastrophism**, "flaunting catastrophe too vividly in the face of the uniformity that had lent scientific dignity to interpretation of the history of the earth."



Finally, in the 1940s, the source of “all that water” was identified -- ancient Lake Missoula, in Montana.

Today the floods are known as the “Missoula Floods” or the “Bretz Floods.”

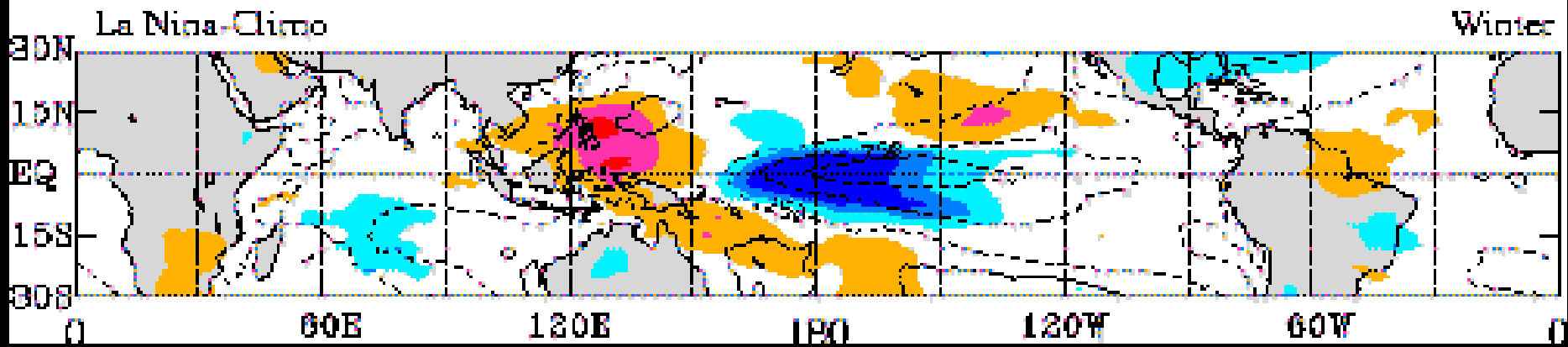
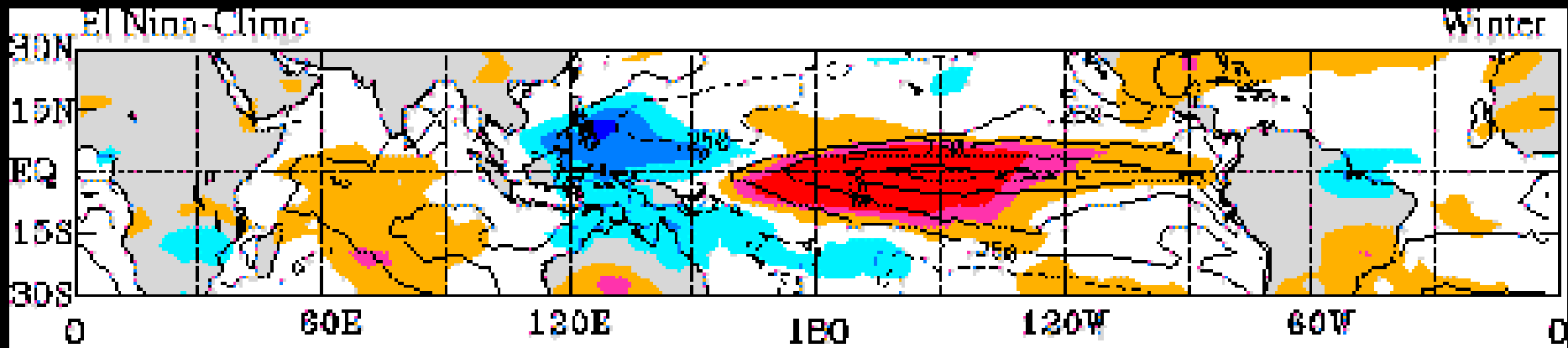


1965, an international field expedition of geologists saw the channeled scabland at the end of a trip and telegraphed [Bretz] with a message: "We are now all catastrophists."



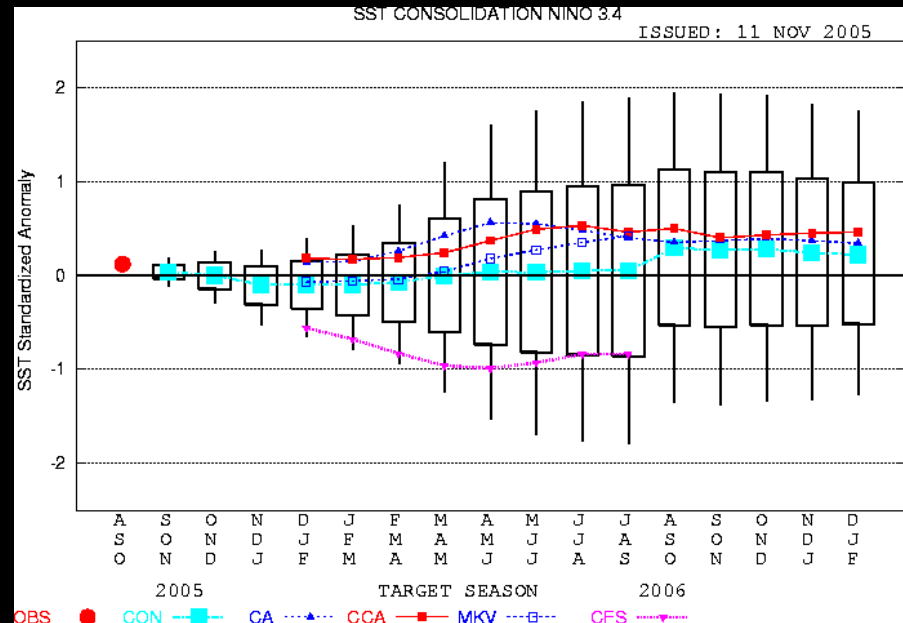
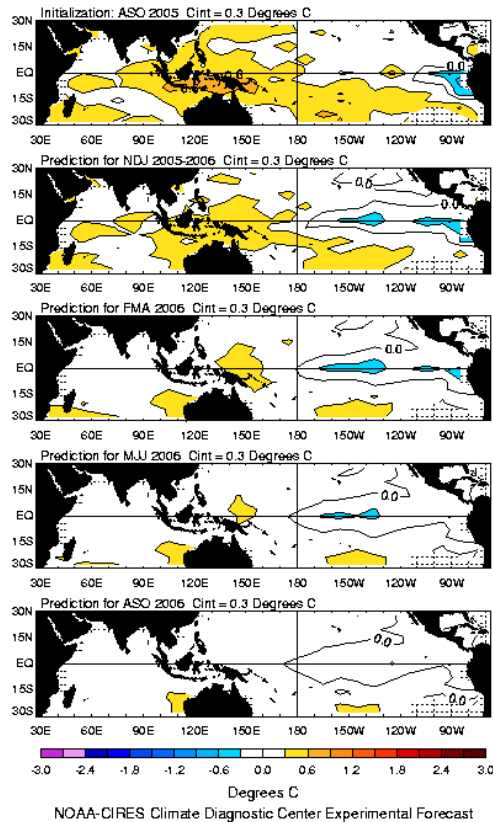
**Sir Gilbert Walker**

El Niño's "Daddy"



- Between 1923 and 1937 Walker and his associates published many papers and reports, and successfully found correlations between the Indian monsoon and weather in various parts of Africa, Asia, North America, and the Atlantic and Pacific oceans.
- Unfortunately, the attempts to produce a **prediction scheme** failed.
- This lack of a prediction scheme, and a good physical explanation for the cause-effect relationship, caused Walker's contemporaries to be very **skeptical** of his work.

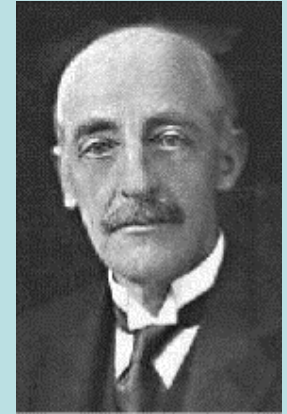
# The irony: we still can't predict it!





During the International Geophysical Year of 1957-58, the first global measurements of the atmosphere and oceans were made. This happened to coincide with a strong "warm event," and Walker was vindicated.





## Conclusion:

The history of science is replete with unpopular ideas, which conflicted with consensus, but which proved to be true.

# Consensus science

“There is no such thing as consensus science. If it's consensus, it isn't science. If it's science, it isn't consensus. Period.”

Michael Crichton, 2003

# Global Warming Consensus

“the **vast majority** of the most respected environmental scientists from all over the world have sounded a clear and urgent alarm. ...these scientists are telling the people of every nation that global warming caused by human activities is becoming a serious threat to our common future.”

Al Gore, MoveOn.org, January 2004

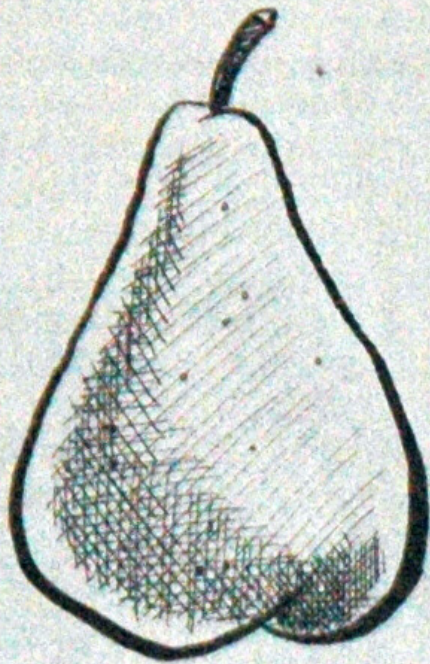
# Global Warming Consensus

What happens to those who differ?



“I acknowledge that there is a human influence on climate. However, I believe that natural variations have been the main cause of climate change, even in recent years.”

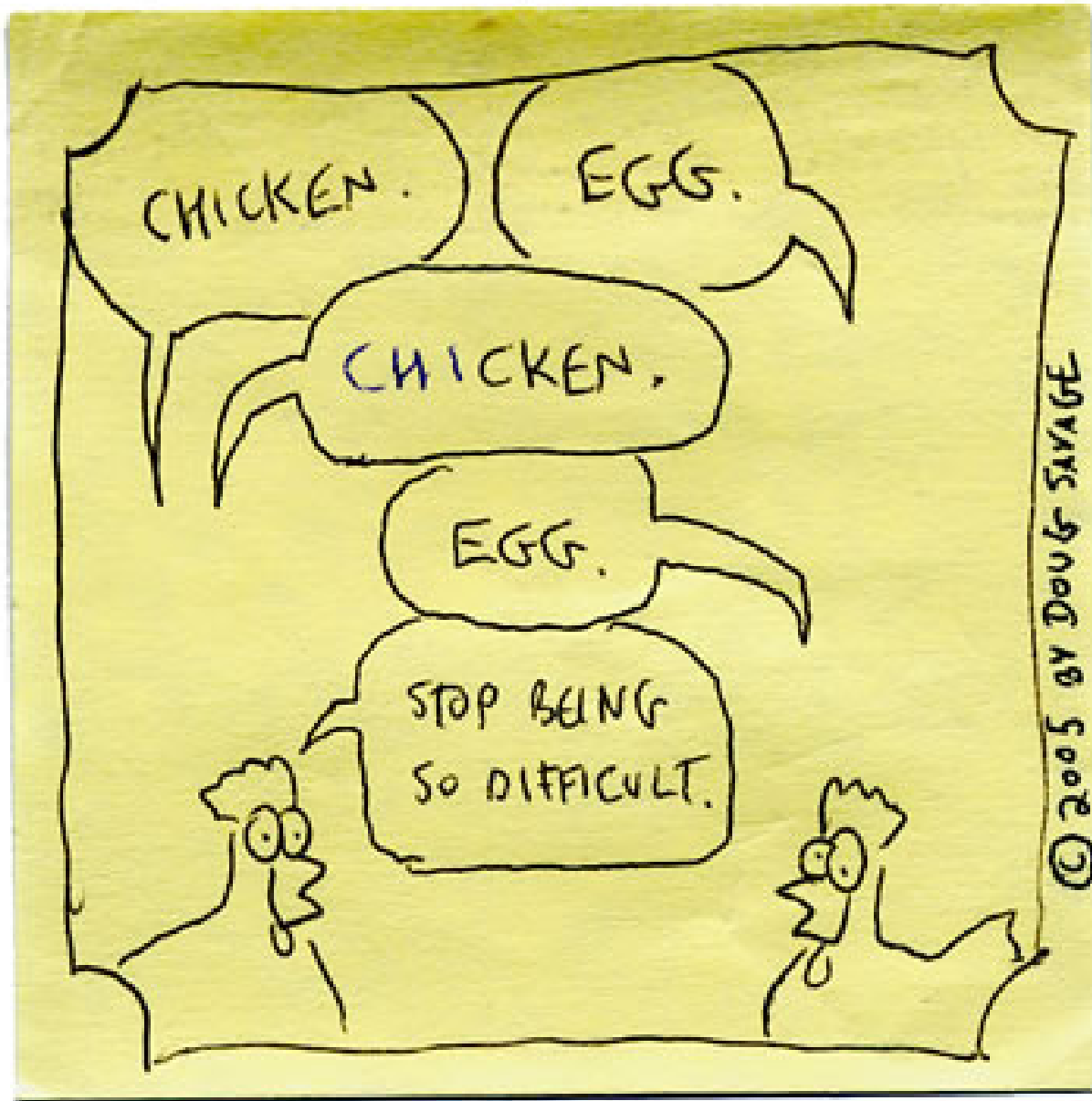
OREGON'S NEW  
STATE FRUIT.



OREGON'S NEW  
STATE NUT.

HUMAN-CAUSED  
GLOBAL WARMING  
DOES NOT EXIST!





Do climate scientists agree on anything?

An aerial photograph of a dry, cracked desert landscape. The ground is a mix of light brown and tan, with deep, dark cracks forming a grid-like pattern. The sky is a clear, pale blue. A light green rectangular box with a thin black border is centered on the image, containing text.

Climate scientists agree on some subjects but disagree on others.

Despite what you may have heard, there is no “overwhelming consensus.”

Even if there were, that doesn’t prove the consensus correct (Wegener, Bretz, Walker,...)



## Areas of general agreement:

1. Carbon dioxide (CO<sub>2</sub>) is a greenhouse gas.
2. CO<sub>2</sub> is increasing in the atmosphere, largely as a result of fossil fuel emissions.
3. All other things being equal, an increase in CO<sub>2</sub> should cause an increase in temperature.
4. Temperatures in the past 100 years have increased by about 1 deg F.

## Areas of general agreement:

5. By 2050, the Kyoto Accord could reduce temperatures by 0.05 deg C (0.02 if US abstains).
6. Greenhouse gas stabilization requires 60-80% emission cuts worldwide.
7. Irregular growth rates of CO<sub>2</sub> and CH<sub>4</sub> are as yet unexplained.
8. Some major climate forcings are as yet unquantified.
9. Frequencies and intensities of tropical and extratropical storms have not increased.

## Areas of disagreement or disparity:

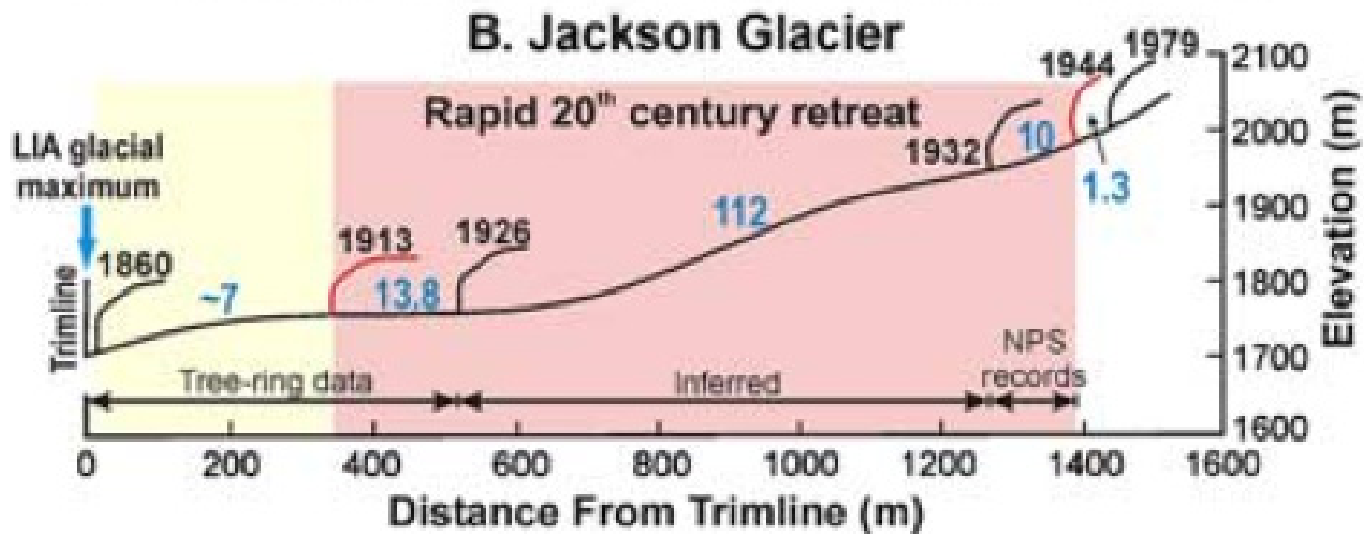
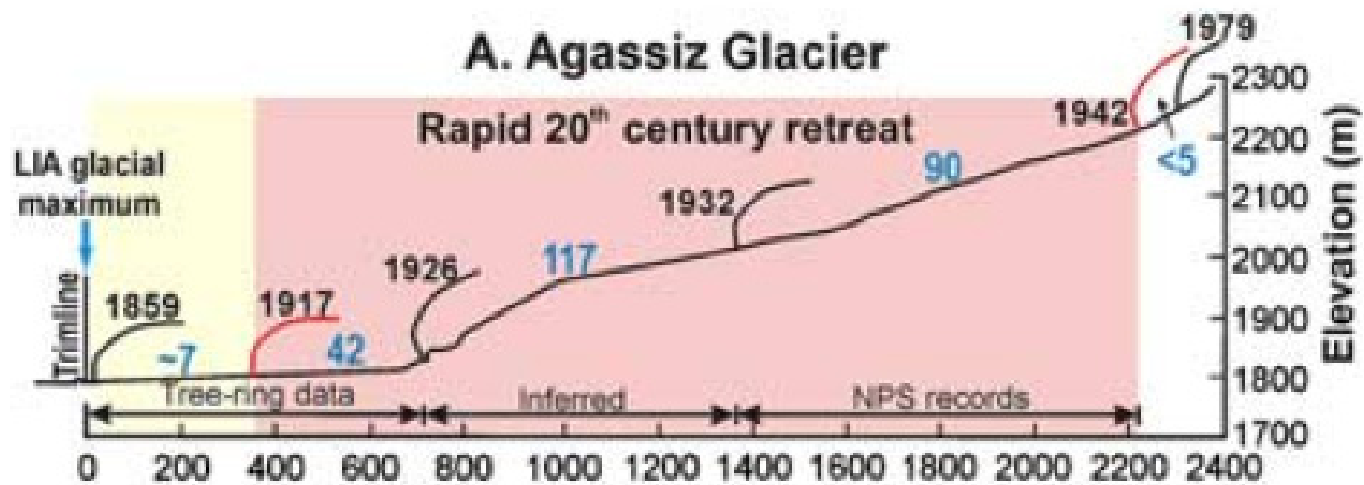
1. Since 1979, global climate has warmed by about 0.3 deg C, according to surface data, but by smaller amounts according to balloon and satellite data; the size of the latter is disputed.
2. There are different values for climate sensitivity (2x CO<sub>2</sub>): about 2.5 to 3.0 deg C from GCMs but only 0.5 to 1.5 from atmospheric observations.
3. Climate models predict increased warming at high latitudes, with maximum warming in polar regions. Observations do not show this.
4. Climate models predict increasing temperature trends with increasing altitude in the troposphere. Observations show the opposite.

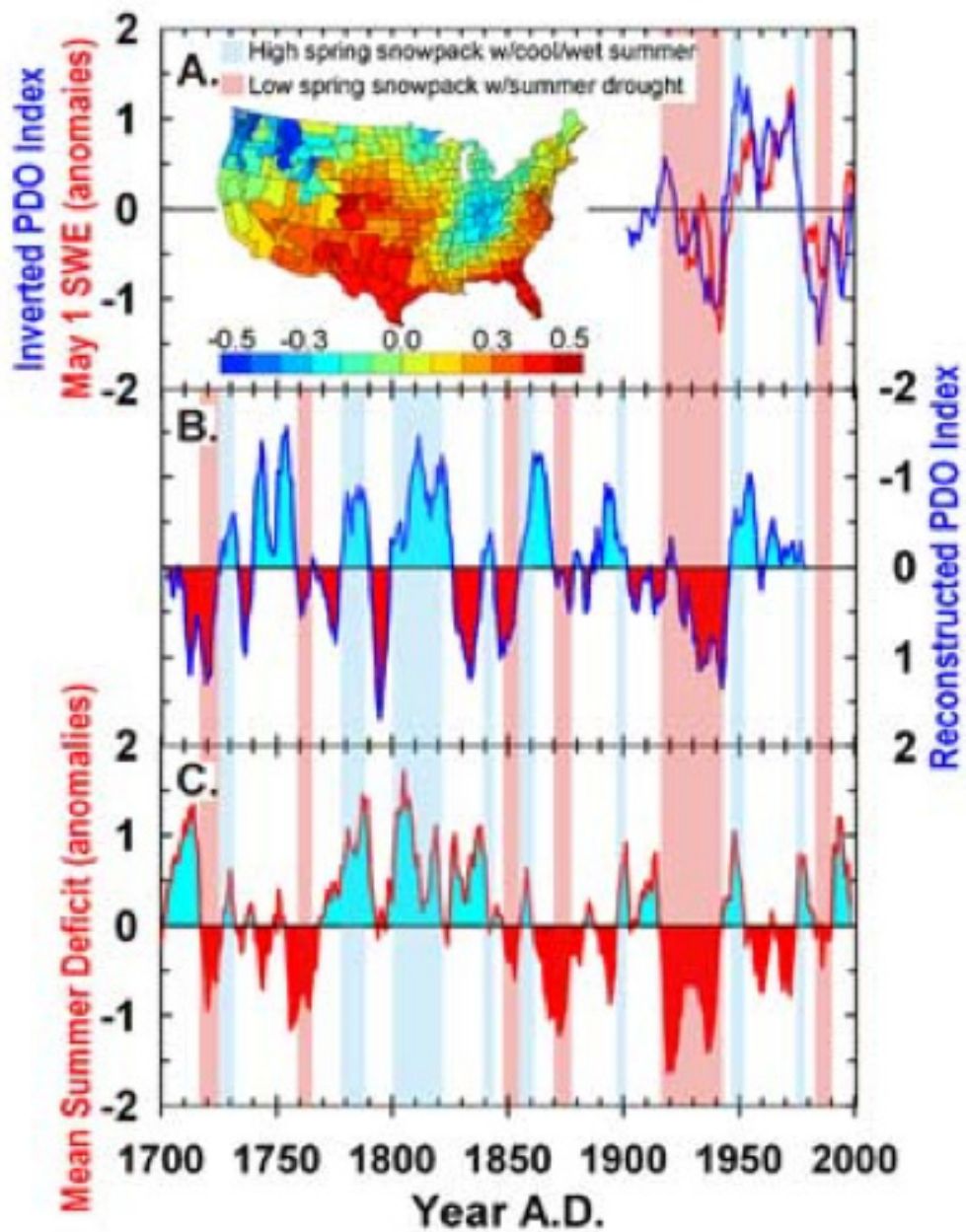
## Areas of disagreement or disparity:

5. Whether 20th century was the warmest in the past 1000 years.
6. Whether shrinking glaciers and sea ice are indicators of greenhouse warming.
7. Whether sea level rise will accelerate because of global warming.
8. Whether future global warming will increase frequency and intensity of tropical and extra-tropical storms, floods, droughts, insect-borne epidemics, coral death , and so on.
9. Whether future global warming will cause agricultural and other economic losses.
10. Whether future global warming will weaken the Gulf Stream and induce a Northern Hemisphere cooling.

“Consensus” says:

Before long the glaciers in Glacier Park and similar places will be gone.





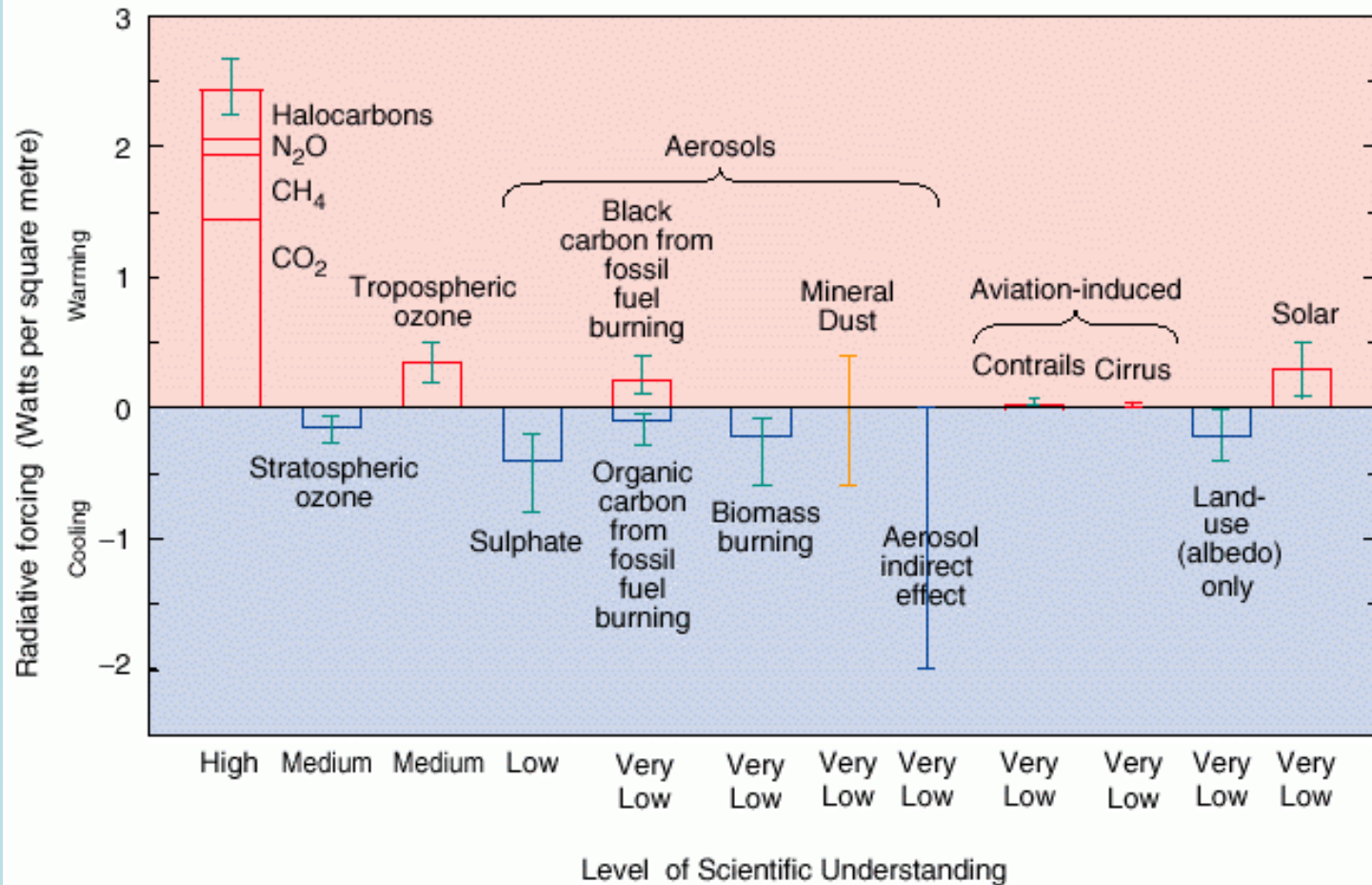
“Consensus” says:

Most recent climate change is due to human activities, especially CO2 emissions.



# According to IPCC:

The global mean radiative forcing of the climate system for the year 2000, relative to 1750



# Roger Pielke Sr.'s analysis:

- “ozone was responsible for one-third to half of the observed warming trend in the Arctic during winter and spring”.
- “methane emissions may account for a third of the climate warming from well-mixed greenhouse gases between the 1750s and today”.
- The contribution of CO<sub>2</sub> to temperature changes is at most 28% of the positive forcings. Its fractional contribution is significantly less when the negative radiative forcings are included.
- “Attempts to significantly influence regional and local-scale climate based on controlling CO<sub>2</sub> emissions alone is an inadequate policy.”

“Consensus” says:

The Arctic is melting and warming up. Greenland and Antarctica are melting and will contribute heavily to sea level rise.

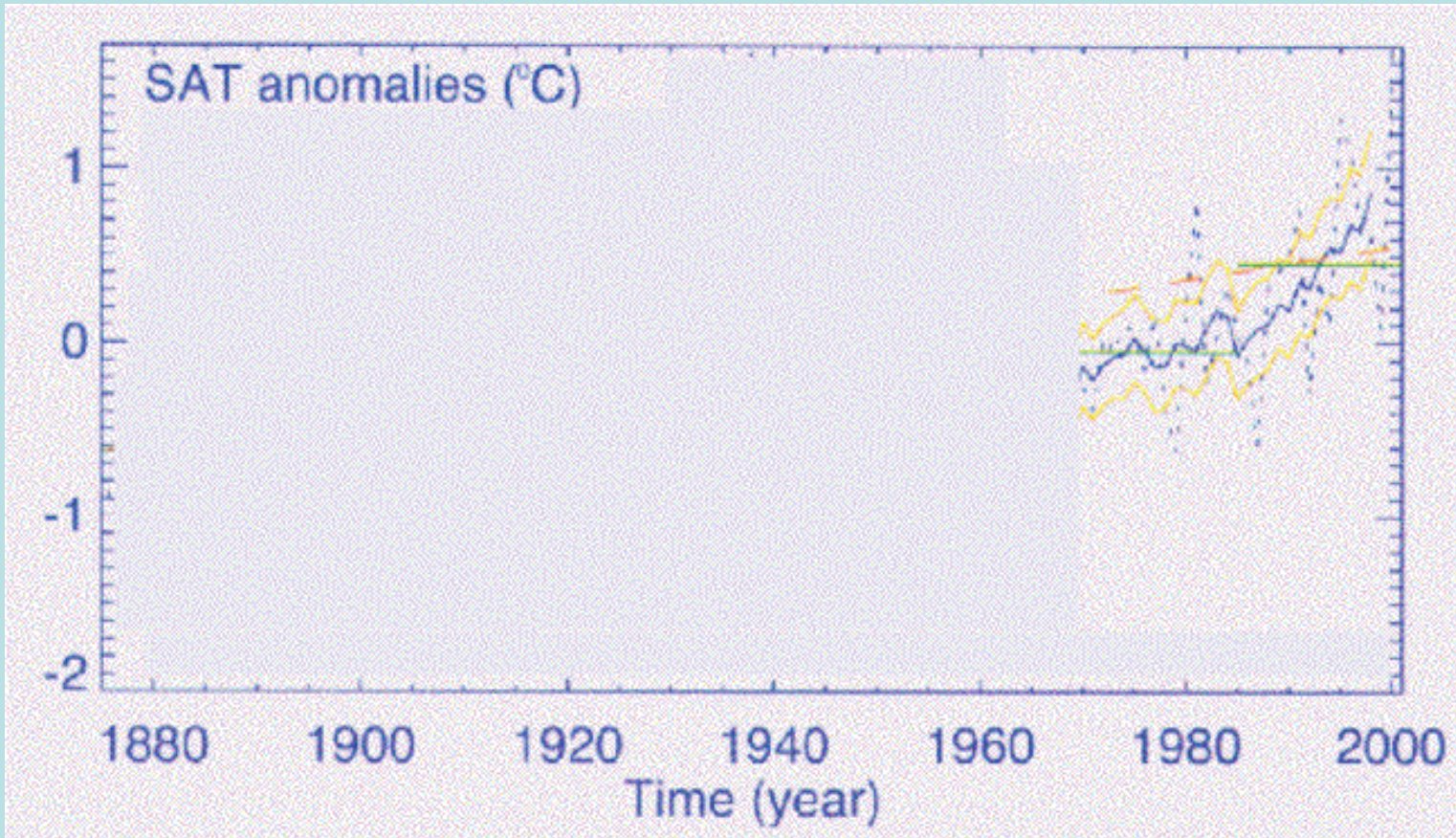
# IMPACTS OF A WARMING ARCTIC



## 1. Arctic climate is now warming rapidly and much larger changes are projected.

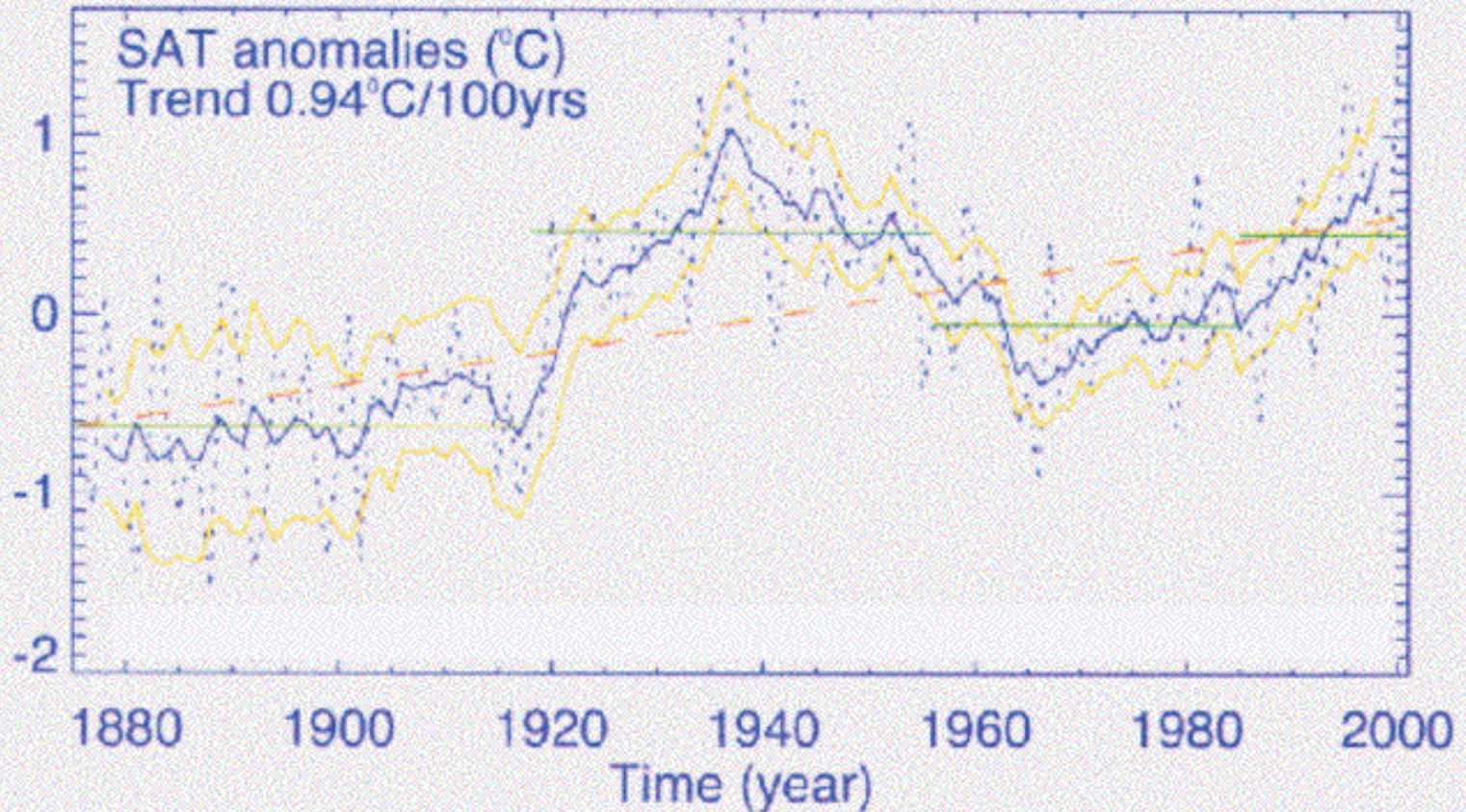
- Annual average arctic temperature has increased at almost twice the rate as that of the rest of the world over the past few decades, with some variations across the region.
- Additional evidence of arctic warming comes from widespread melting of glaciers and sea ice, and a shortening of the snow season.

In the Arctic, temperatures in recent decades have gone up



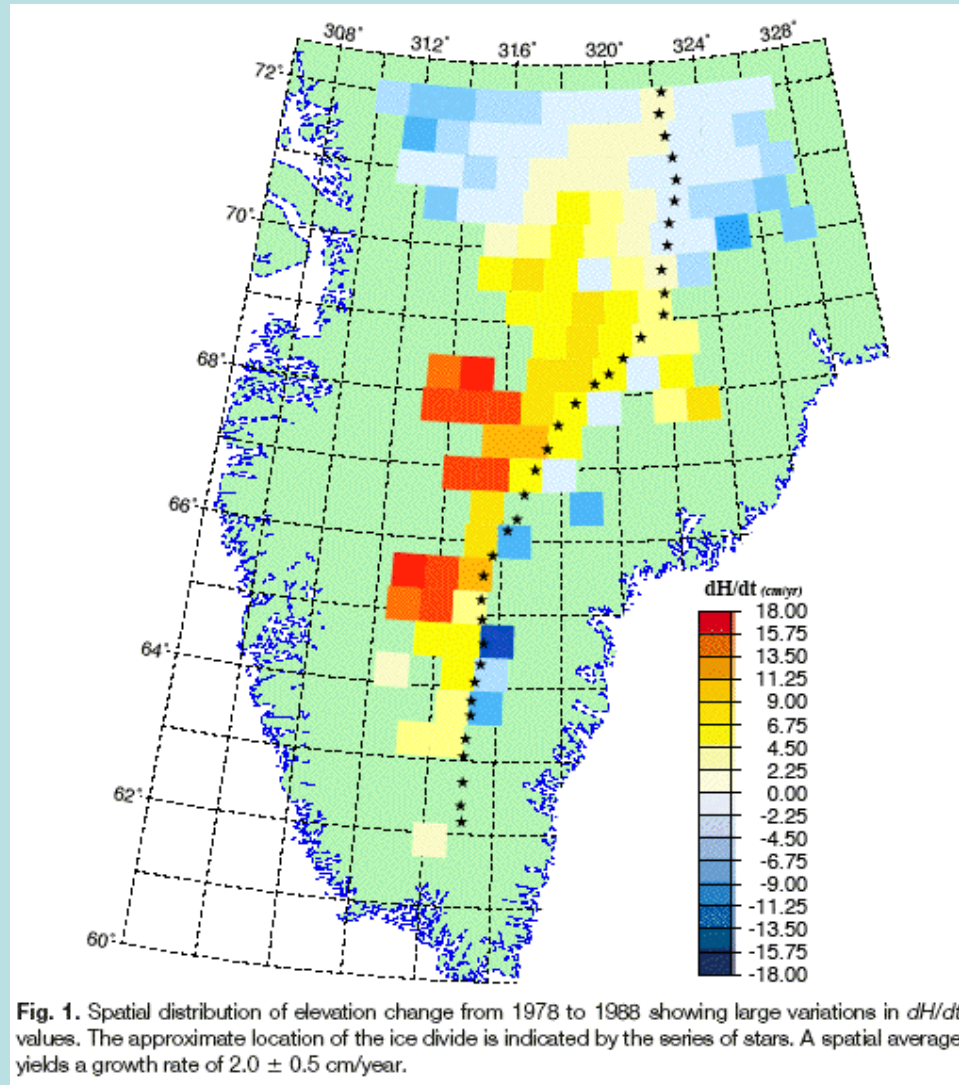
Polyakov, I, et al., 2002. Trends and Variations in Arctic Climate Systems. EOS, Transactions, American Geophysical Union, Vol. 83, 547-548.

But an examination of the entire record shows a different story:

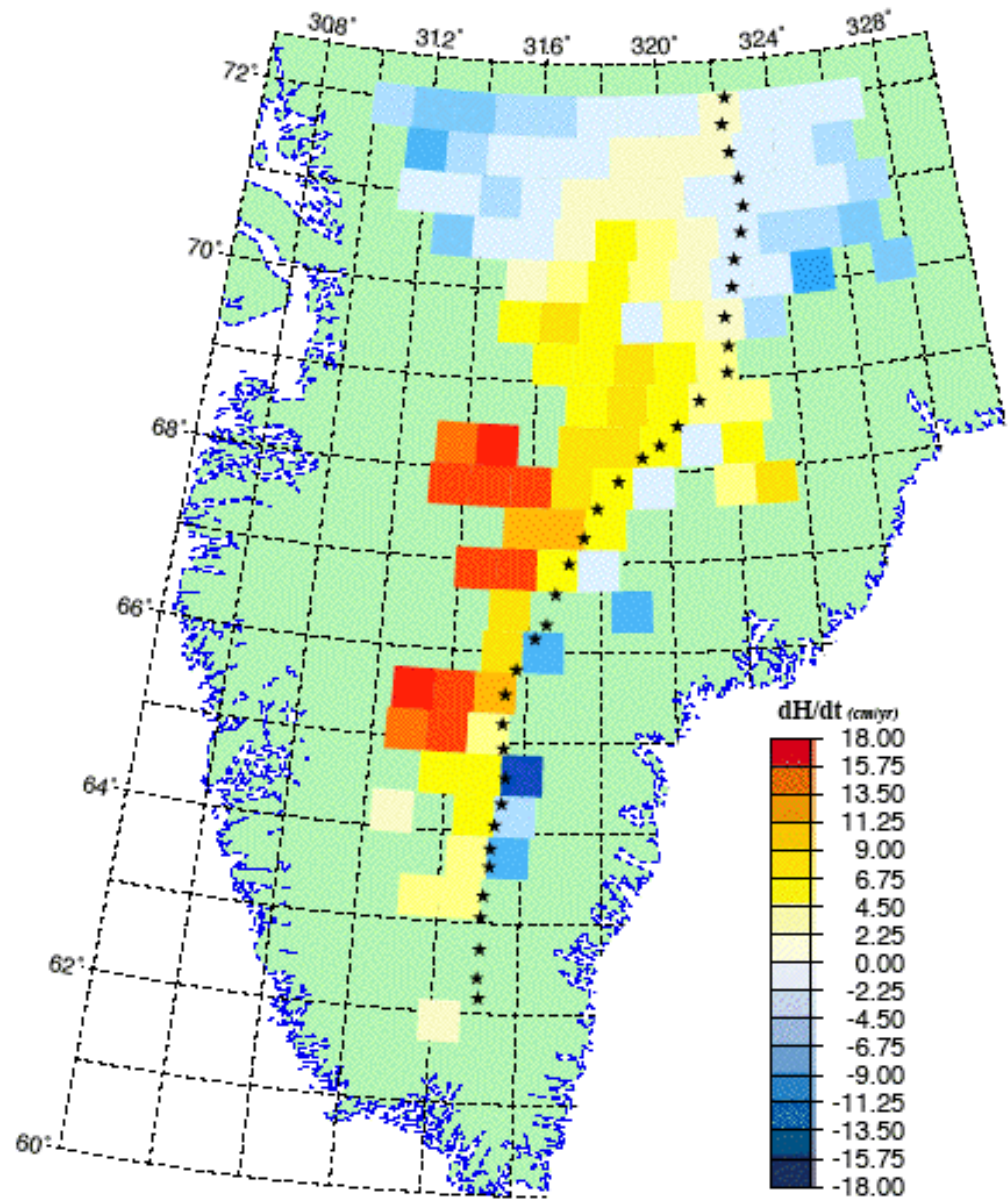


Polyakov, I, et al., 2002. Trends and Variations in Arctic Climate Systems. EOS, Transactions, American Geophysical Union, Vol. 83, 547-548.

# Greenland?



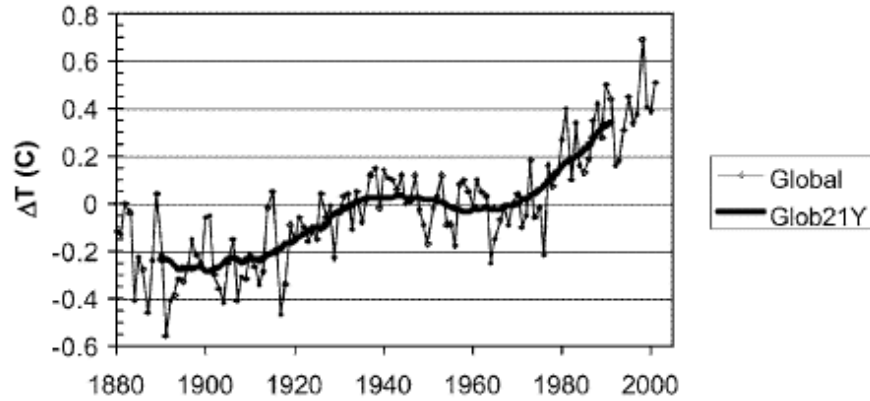




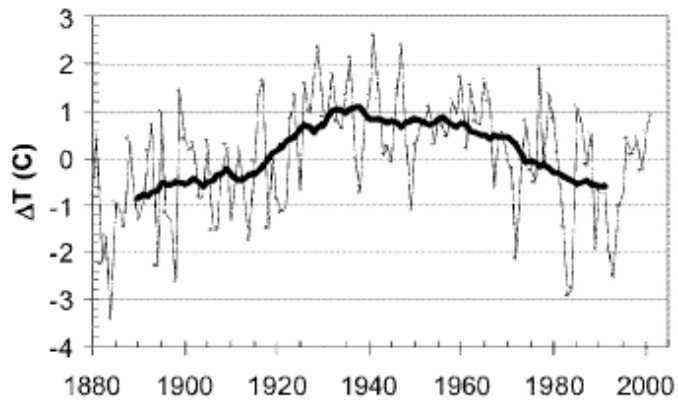
Davis 1998

**Fig. 1.** Spatial distribution of elevation change from 1978 to 1988 showing large variations in  $dH/dt$  values. The approximate location of the ice divide is indicated by the series of stars. A spatial average yields a growth rate of  $2.0 \pm 0.5$  cm/year.

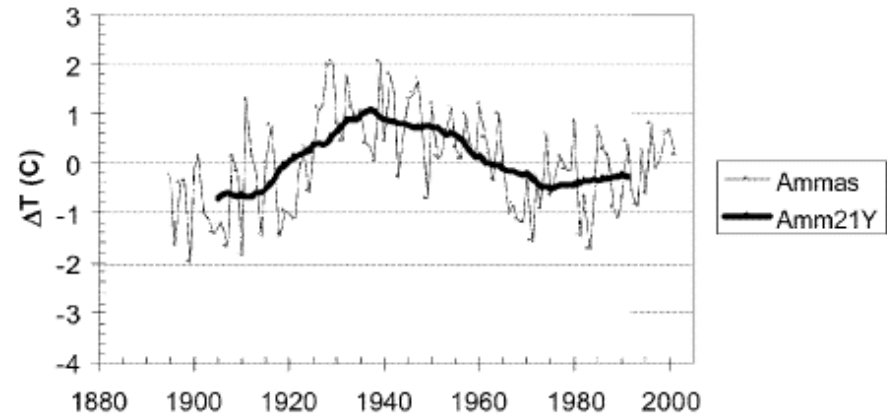
Global Temperature Anomaly



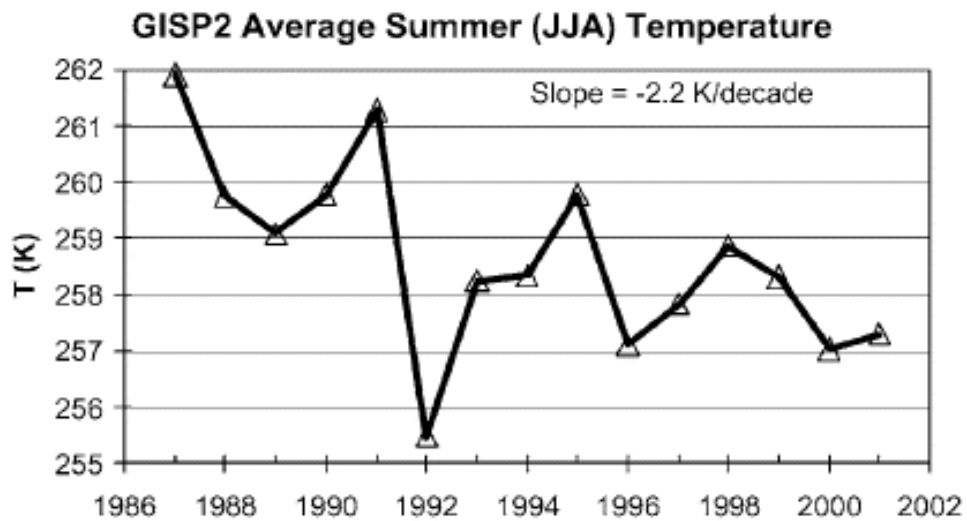
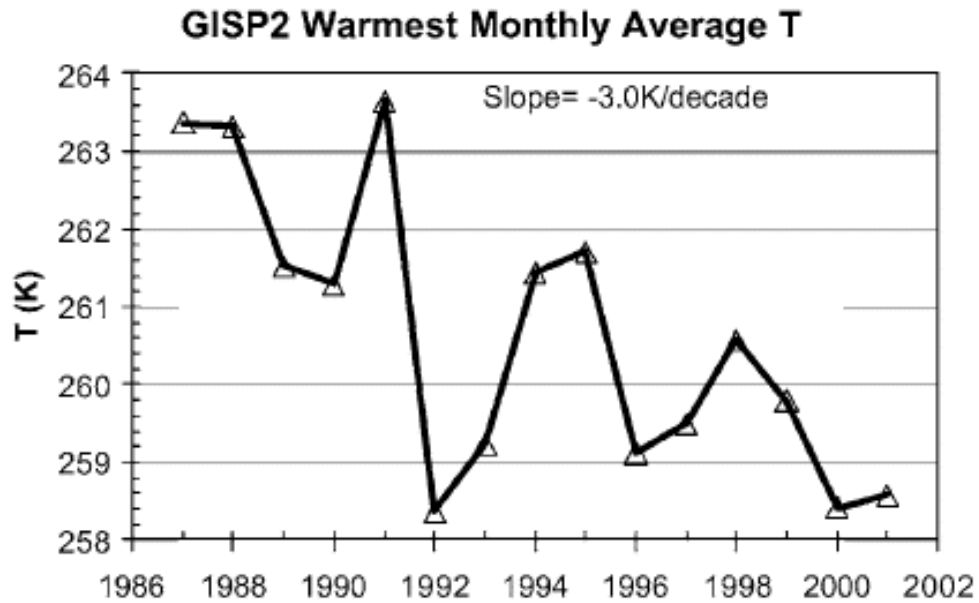
Godthab Temperature Anomaly



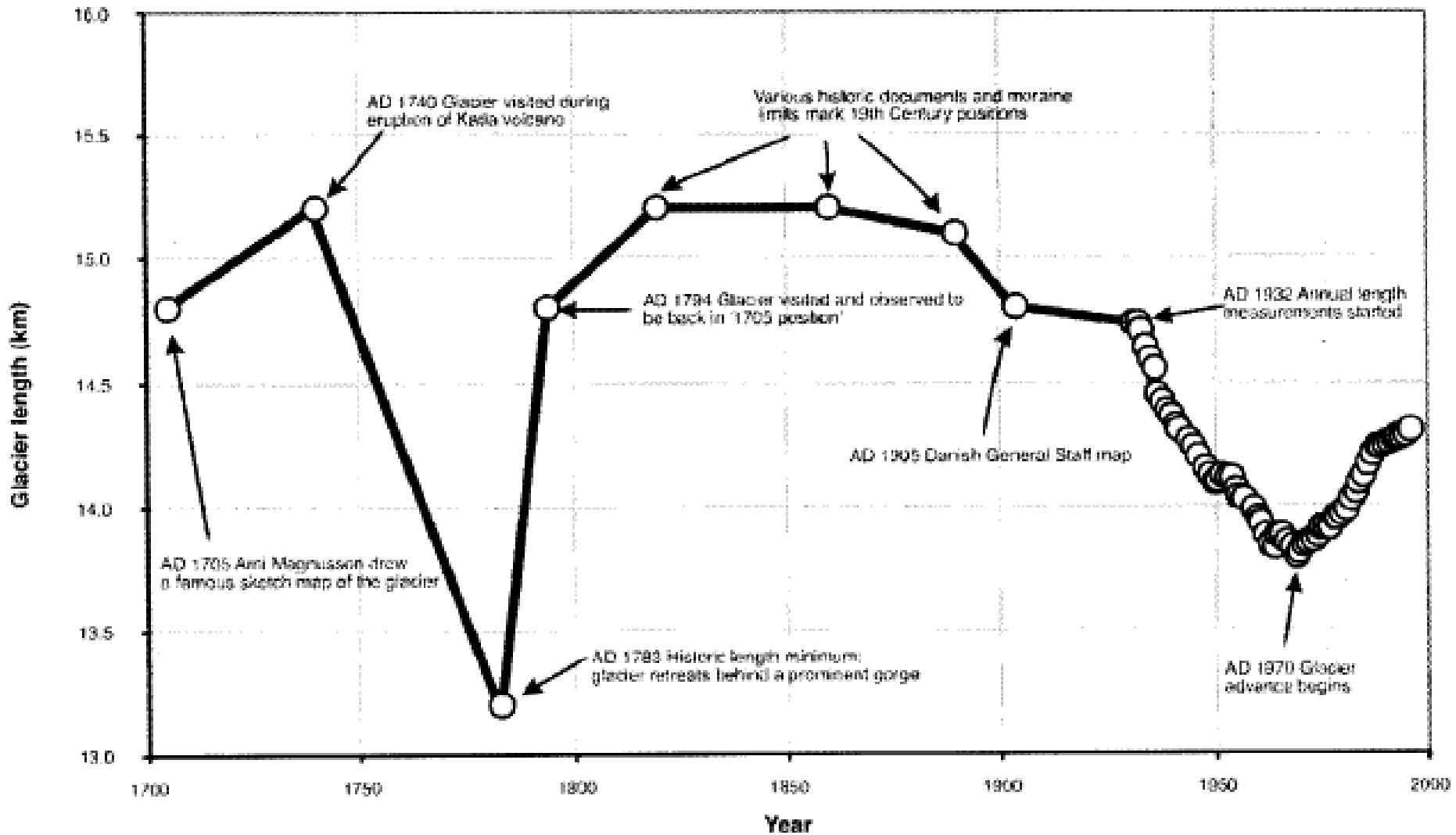
Ammassalik Temperature Anomaly



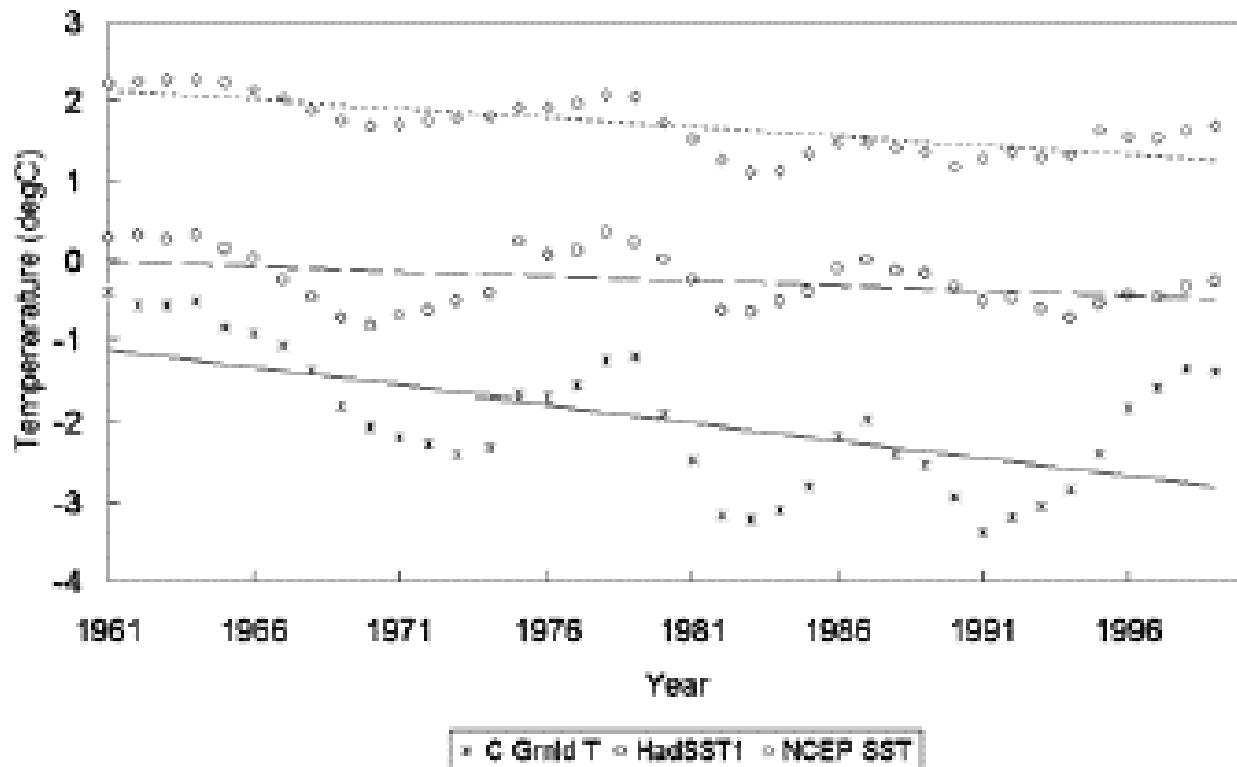
Chylek, 2004



Chylek, 2004

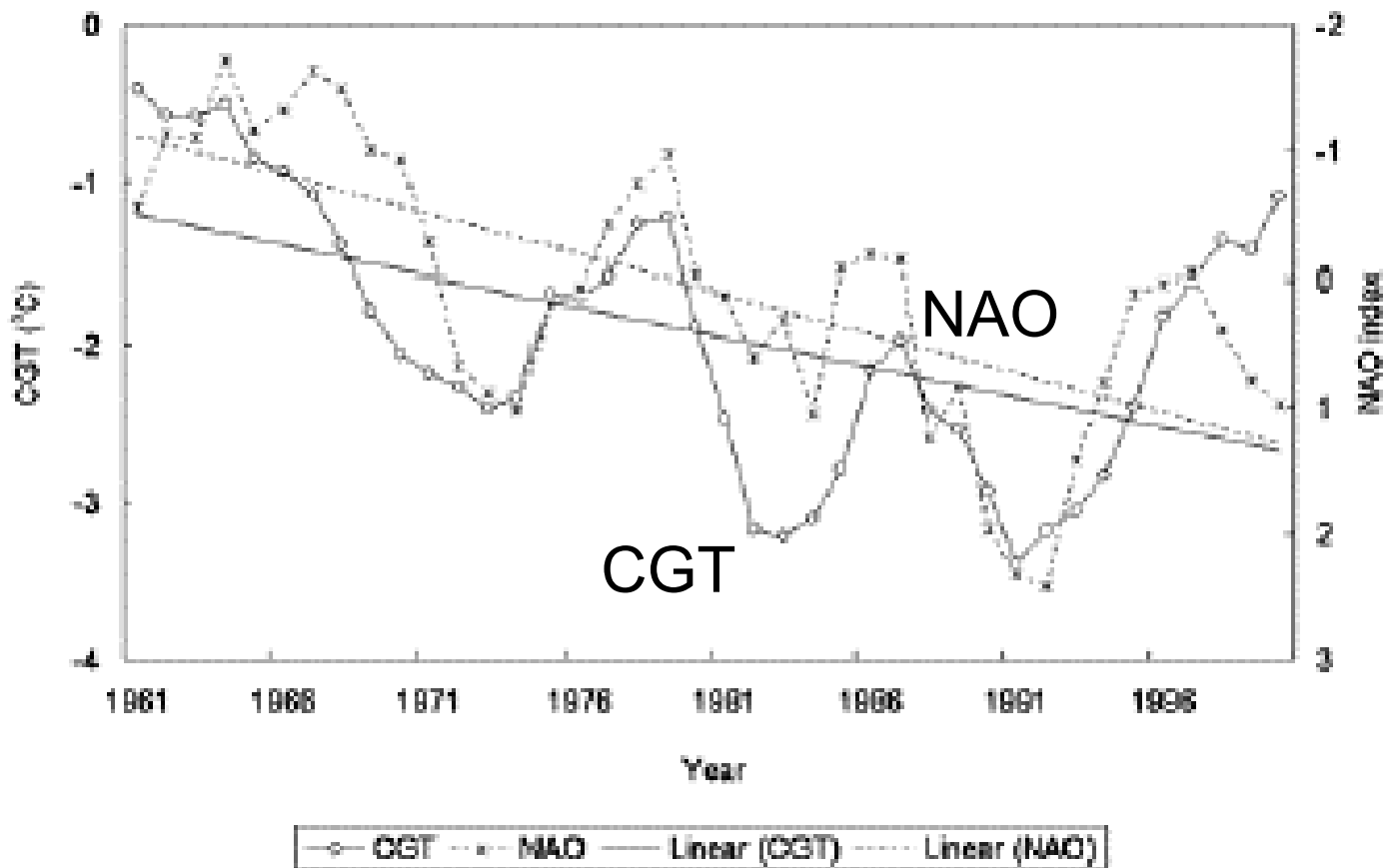


Mackintosh, 2002

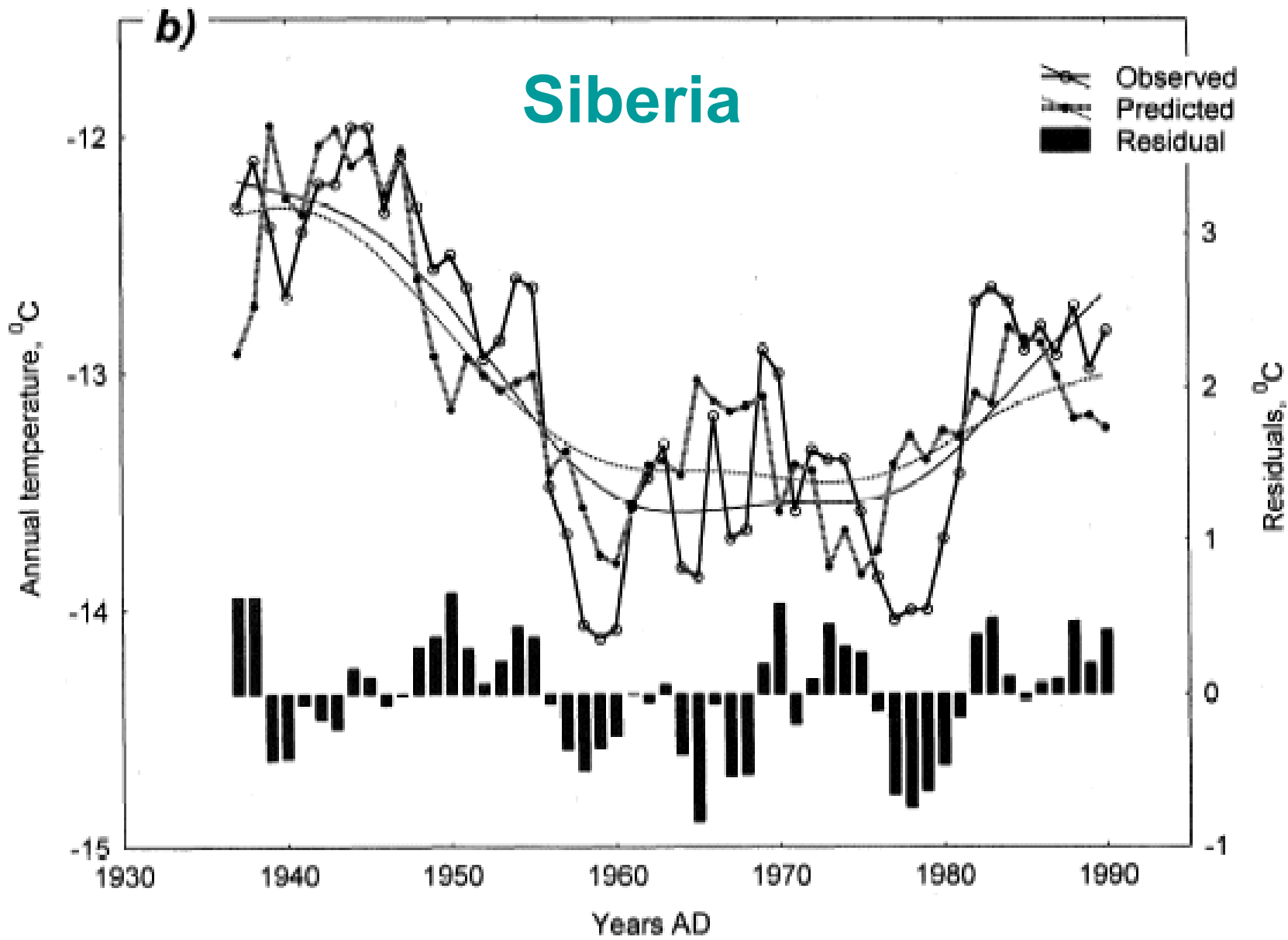


**Figure 3.** Composite Greenland temperature (CGT) and sea-surface temperatures [Hadley Centre (HadSST1) & US National Centers for Environmental Prediction (NCEP)] off SW Greenland, all 5-yr. running means, with trend lines.

Davis 1998



**Figure 4.** Comparison of Composite Greenland Temperature (CGT) and North Atlantic Oscillation (NAO) index (5-yr. running means with trend lines).



Naurzbaev, 2000

“...the second phase of contemporary warming (after 1975) that is common in most parts of the world appears to be very weakly expressed or even absent in the Arctic.”

Pryzbylak, R., 2000. Temporal and spatial variation of surface air temperature over the period of instrumental observations in the Arctic. *International Journal of Climatology*, 20, 587-614.



"almost all decades between 1915 and 1965 were warmer than, or at least as warm as, the 1995 to 2005 decade, suggesting that the current warm Greenland climate is not unprecedented and that similar temperatures were [the] norm in the first half of the 20th century."

Chylek, P., Dubey, M.K. and Lesins, G. 2006. Greenland warming of 1920-1930 and 1995-2005. *Geophysical Research Letters* 33: 10.1029/2006GL026510.

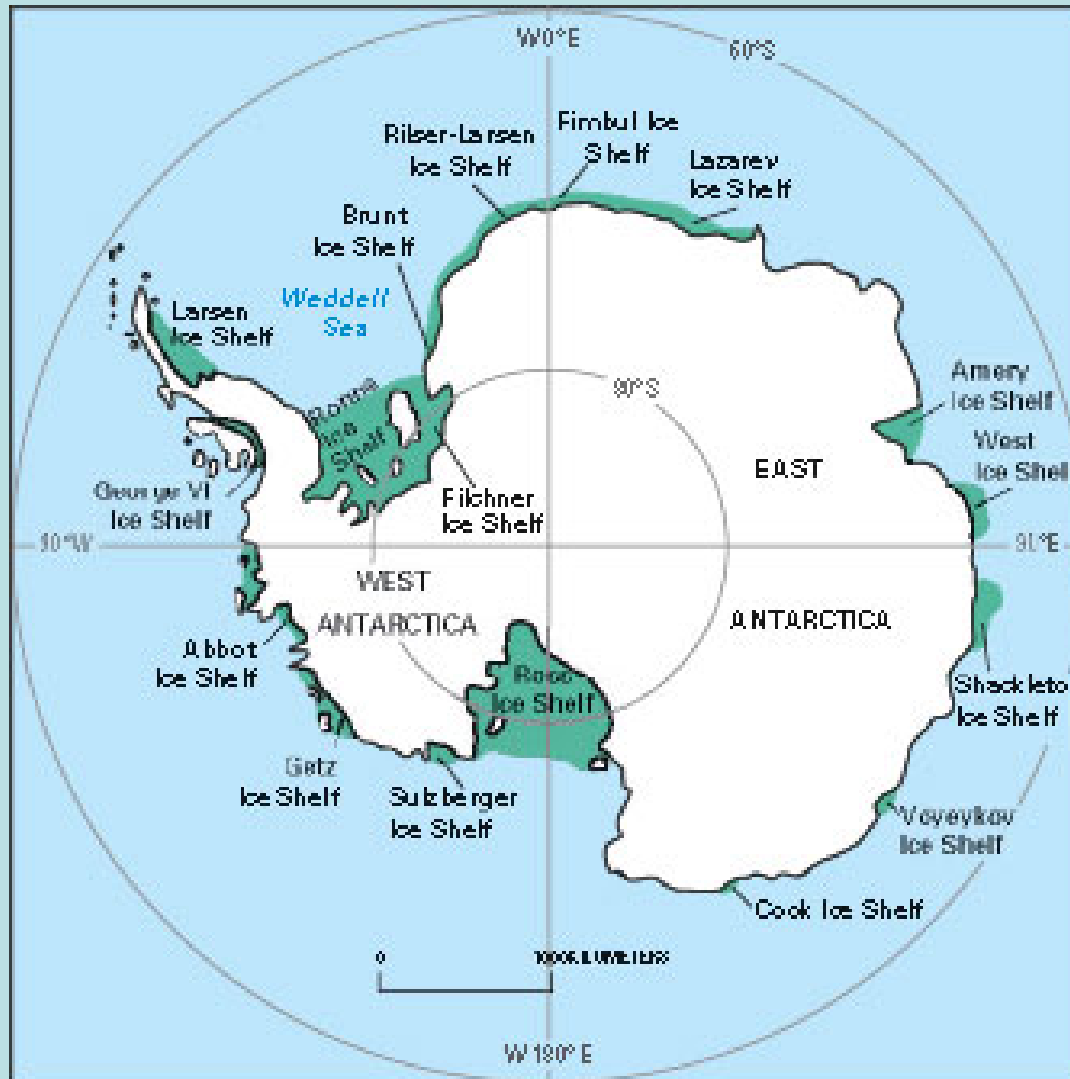
"below 1500 meters, the elevation-change rate is  $-2.0 \pm 0.9$  cm/year, in qualitative agreement with reported thinning in the ice-sheet margins."

"an increase of  $6.4 \pm 0.2$  cm/year is found in the vast interior areas above 1500 meters."

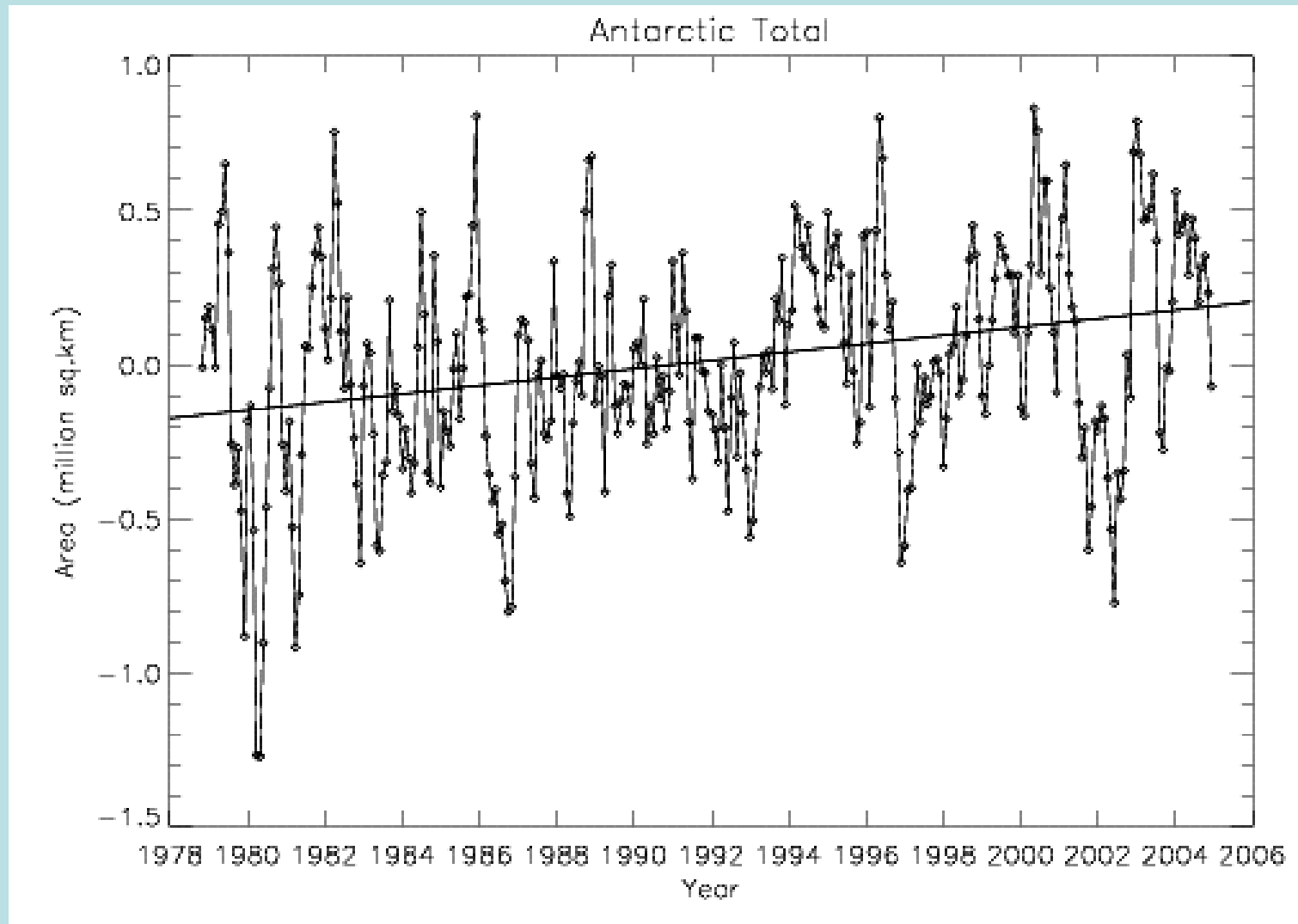
Spatially averaged over the bulk of the ice sheet, the net result is a mean increase of  $5.4 \pm 0.2$  cm/year, "or ~60 cm over 11 years, or ~54 cm when corrected for isostatic uplift."

Johannessen, O.M., Khvorostovsky, K., Miles, M.W. and Bobylev, L.P. 2005. Recent ice-sheet growth in the interior of Greenland. Scienceexpress / [www.sciencexpress.org](http://www.sciencexpress.org) / 20 October 2005.

# Antarctica?



# Antarctic sea ice is increasing



Antarctic Sea Ice Area Anomalies, 1978-2005, from NSIDC (2006)

# Bottom Line:

The science is **NOT** settled.

There is much about the climate system that we do not understand...

...in spite of what “consensus” says.

I could go on and on,  
but I'm out of time!

