

Many slides prepared by the Kansas Geological Survey, whose help is appreciated.

DISCLAIMER!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

- I have accepted no funding from anyone for my research.
- I have no vested interest in the outcome of the debate.
- I only care that solid science rules in the debate resolution
- Much of this research was conducted while I was at the KGS; many graphics were prepared by the Kansas Geological Survey.

We are pretty tired of fraudulent ad hominem attacks assuming we are funded by any industry. This work was not funded except for graphical assistance of the Kansas Geological Survey and the research I conducted under their auspices.

History of Astronomical Theory

Pre- 600 B. C.	The Ancients	Geocentric Universe
600 B.C.	Pythagoras	Heliocentric Universe
ca. 150 A.D.	Ptolemy	Geocentric Universe
ca. 1500 A.D.	Copernicus	Heliocentric Universe
ca. 1575 A.D.	Tycho Brahe	Geocentric Universe
1610 A.D.	Galileo	Heliocentric Universe
<u>ca. 1990 A.D.</u>	<u>Yuppies</u>	<u>Humanocentric Universe</u>

Humans try to be in charge and in control; the universe doesn't care about humans.

THE HUMAN CURSE

- Humans abhor change.
- They object to change.
- They feel responsible for change.
- They feel omnipotent.

Humans have egos.

Global Population Growth History



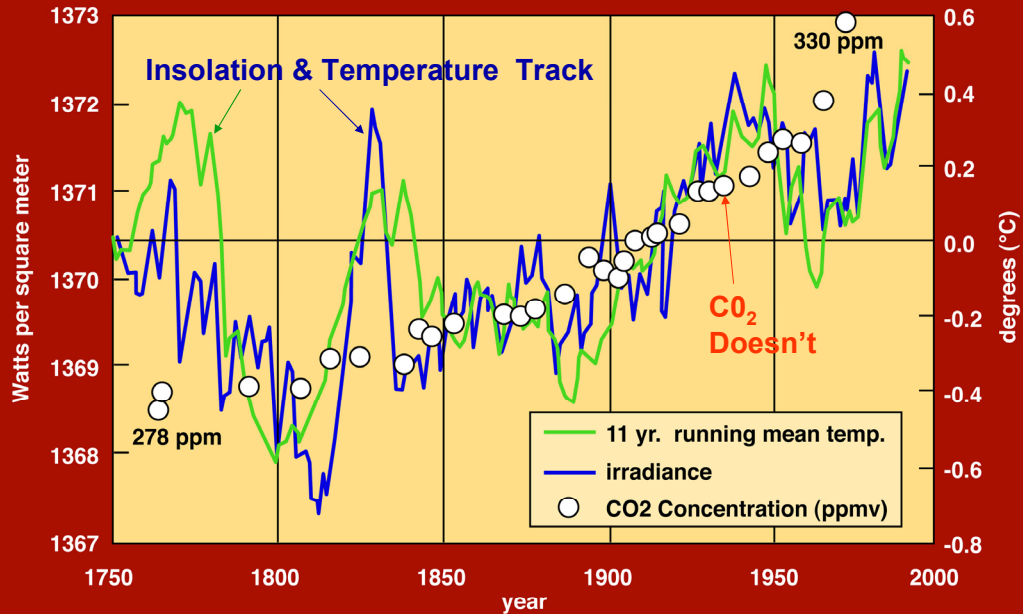
Nothing we do about our environment will make any difference in the long run if we don't address population.

There is no clear discernible
effect of human activities on
global
temperature.



A theory we shall test in this presentation.

Northern Hemisphere Temperature VS. Solar Irradiance



Adapted from D.V. Hoyt, personal communication, 2007

The correlations are obvious- CO₂ and temperature don't co-vary. Solar energy and temperature do co-vary. Now let's look at data and theory. Other references: Hoyt, D.V., and Schatten, K.H., 1997, *The Role of the Sun in Climate Change*: Oxford, NY, Oxford University Press, 279 p.; Solanki, S.K., and M. Fligge, 2000, *Reconstruction of past solar irradiance*: *Space Science Review*, v. 94, p. 127-138.

GEOLOGY

is a temporal

science



Geologists are trained to think in 4 dimensions, unlike most scientists. This is especially important in assessing changes in dynamic earth processes which occur over time, such as temperature and climate.

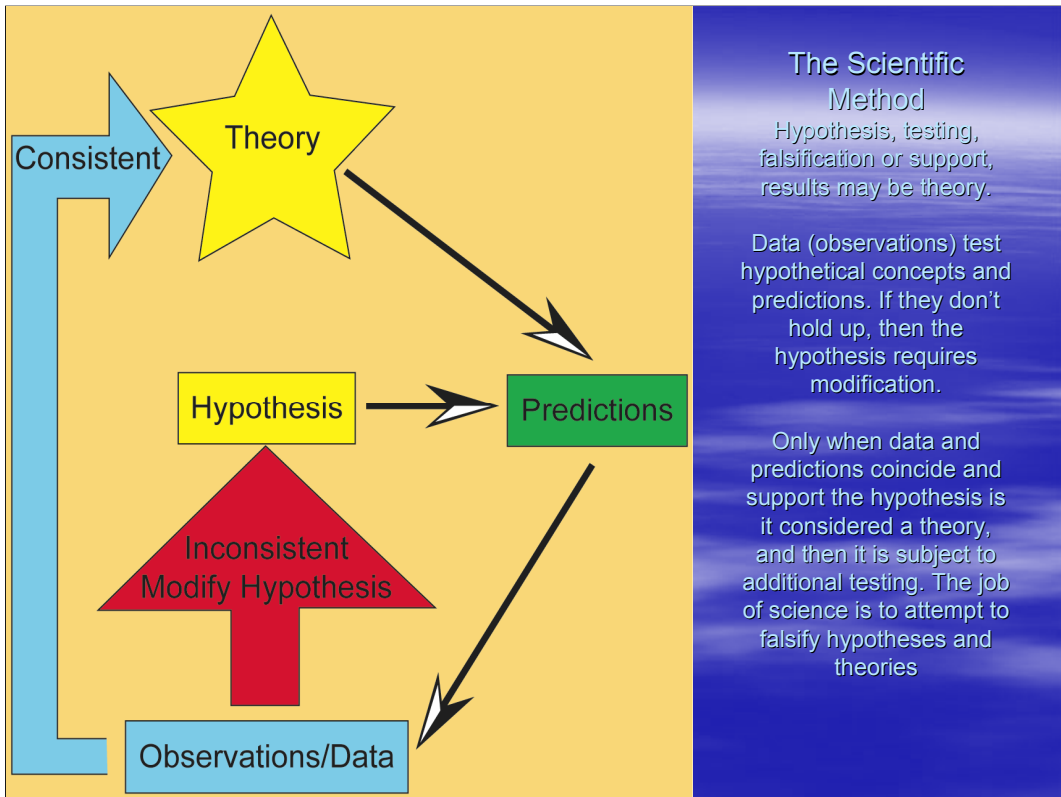


If earth processes were in equilibrium, this would be a dull and uninteresting place to live.

How Science is Done:

- Theory advanced
- Scientists attempt to falsify theory with data
- If falsified, develop new theory
- If not falsified, continue testing with new data. It is not possible to “prove” a theory

Science is a matter of continually trying to disprove hypotheses.



http://physics.ucr.edu/~wudka/Physics7/Notes_www/node6.html#SECTION02121000000000000000. Accessed 6-3-06.

Three hypotheses:

1. Climate is changing, and is warmer over the last 250 years.
2. Anthropogenic emissions of greenhouse gases are the most significant driver of climate change.
3. Natural processes are the most significant climate drivers.

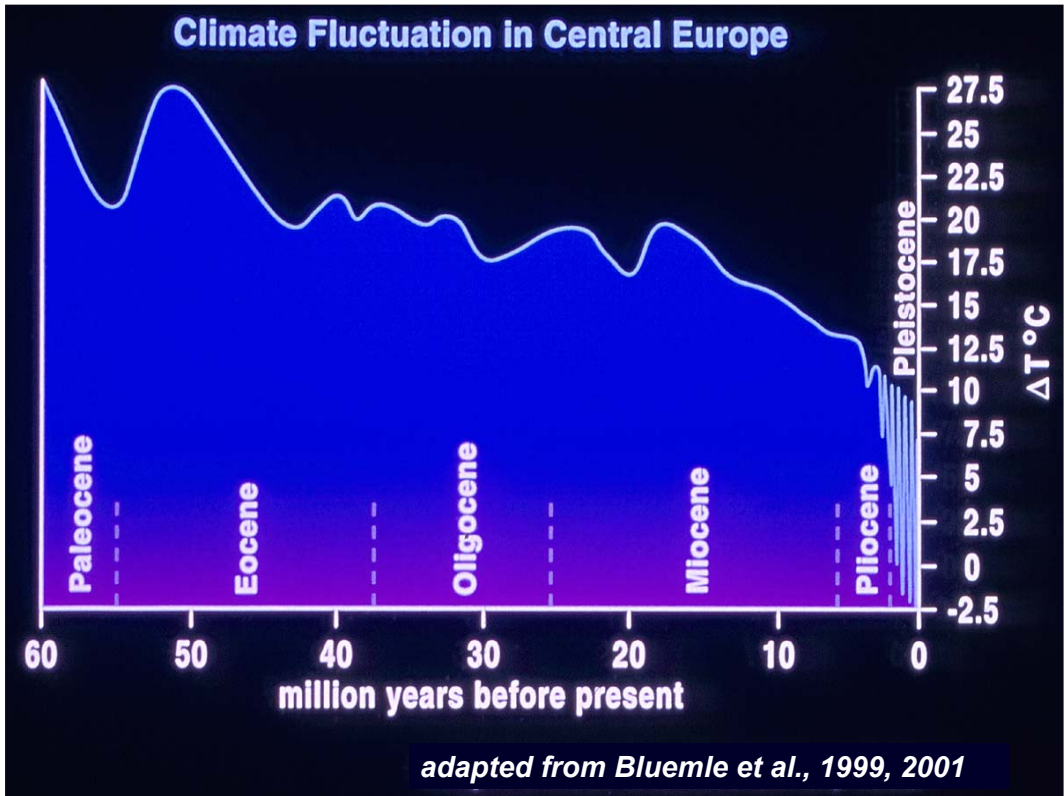
The three hypotheses we shall test in this presentation.

Theory 1: Is climate changing?

1. Climate is changing, and is warmer over the last 250 years.

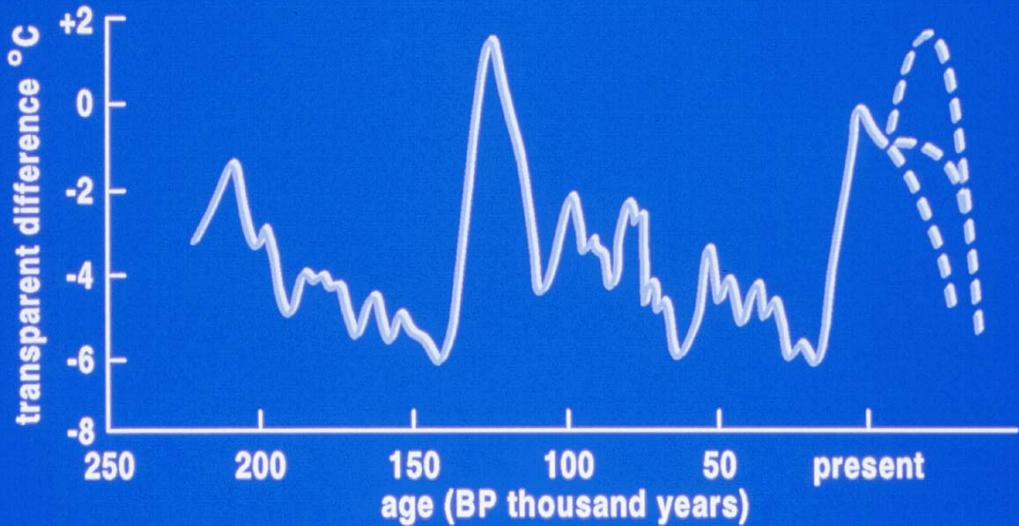
Test: does comparison of theory to all historical records demonstrate that climate is always changing, in both directions, and at many intensities?

Is climate changing?



Overall, the earth's climate has been cooling for 60 million years, but that is only an average – temperature goes up and down, constantly.

Temperature Curve of the Past 200,000 Years, with or without the Greenhouse Effect



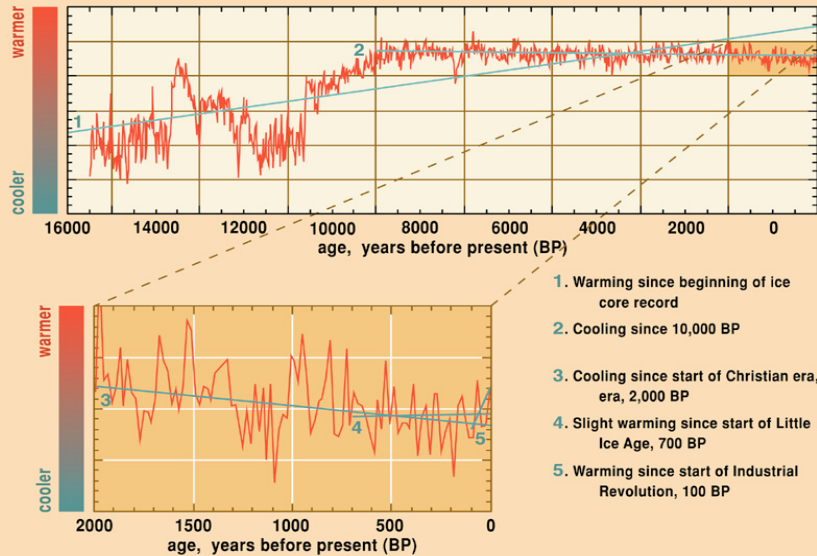
oxygen isotope data

adapted from Moore et. al., 1996

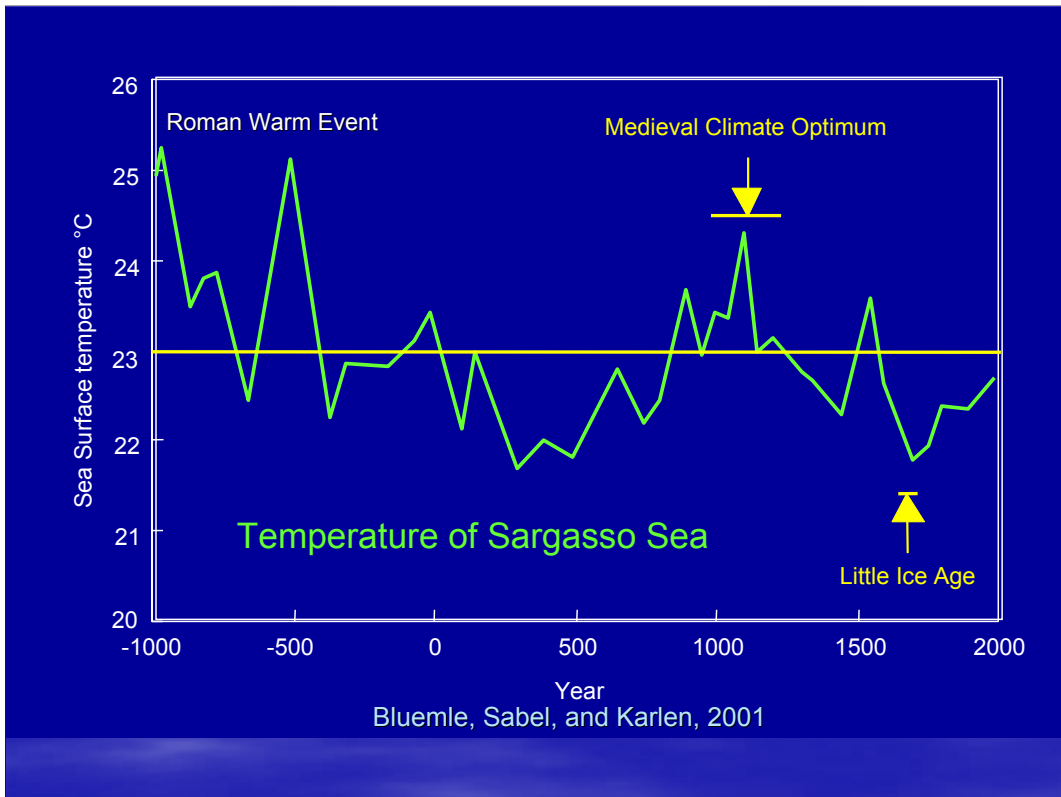
(www.blackwellpublishing.com)

This diagram shows that temperature rapidly rises, then slowly cools naturally; this is called the sawtooth effect. The dashed lines are possible computer model projections of temperature. Reference: Moore, Peter D., Bill Chaloner, and Philip Stott, 1996, *Global Environmental Change*: Blackwell Science, Oxford, England, 244 p.

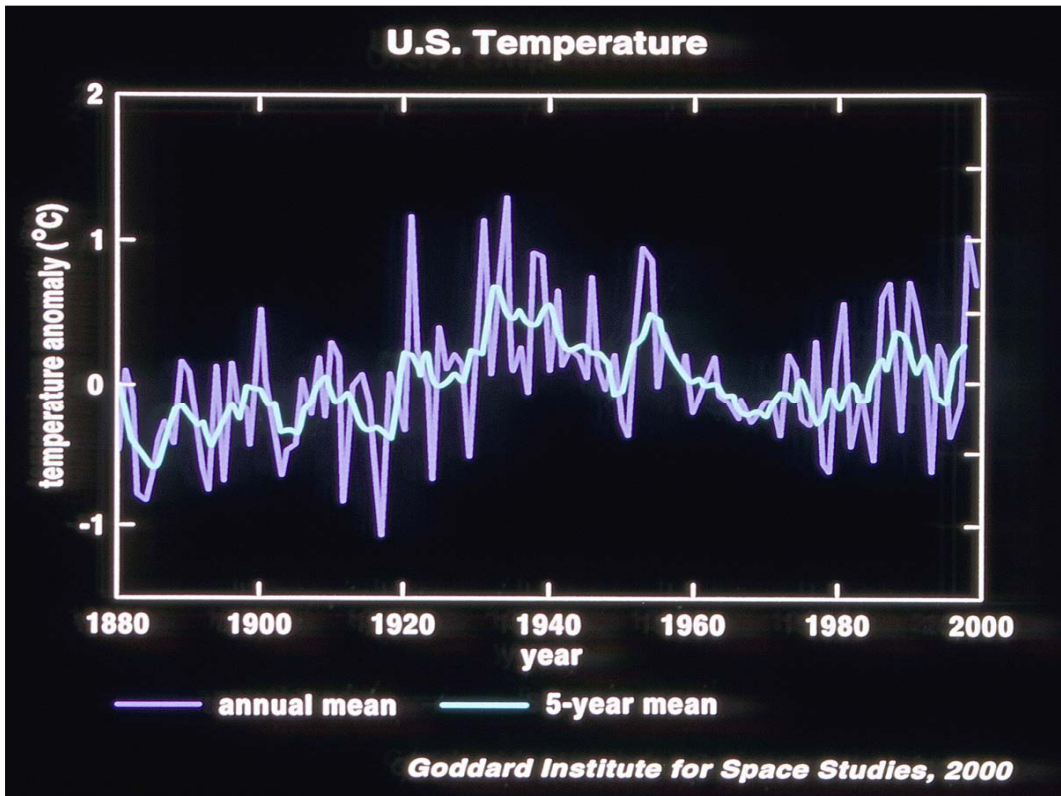
Earth temperature history from Greenland ice core data



This diagram shows the highly variable nature of earth temperature over 16,000 years, with detail for the last 2000 years. Depending on the period of the earth's history that is chosen, the climate has either been warming or cooling. Choosing whether earth is warming or cooling is simply a matter of picking end points. Reference: Davis, John C., and Geoffrey Bohling, 2001, *The Search for Patterns in Ice-Core Temperature Curves*, in Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds., 2001, *Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47*, Tulsa, OK, p. 213-230.



Although the earth appears to be warming now, recently past events were warmer than the present one. See slide 18 for another example. Reference: Bluemele, John P., Joseph Sabel, and Wibjorn Karlen, 2001, Rate and Magnitude of Past Global Climate Changes, *in* Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds., 2001, *Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47*, Tulsa, OK, p. 193-212.



Even the last 120 years show significant variation in temperature for the United States. Data from NOAA and NASA. Note that the warm period of the 1930's exceeds current temperatures. This was also the dust bowl period.

Hypothesis 1: Substantiated

- Climate changes constantly, both warmer and colder, at variable intensities & rates
- All paleoclimate records demonstrate constantly changing climate

The Real Climate Question: (Separate the Issues)

- The question is not: Is the climate changing? It constantly does, based on geological and historical data. It is likely warmer now than in 1880. Global warming exists. Global cooling will follow.
- The debatable question is: Do humans control earth's dynamic climate system? Or does nature, through normal physical processes?

Hypothesis 2

- Anthropogenic emissions of greenhouse gases are the most significant driver of climate change.
- Test: Correlation with temperature history?

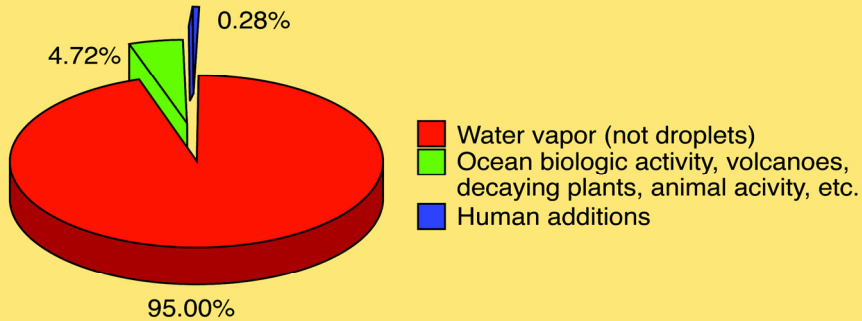
Carbon Dioxide is a Trace Gas (.0325%)

Currently this has risen to about 0.0380%

Carbon dioxide is only one of many greenhouse gases, now about 380 parts per million concentration, and rising.

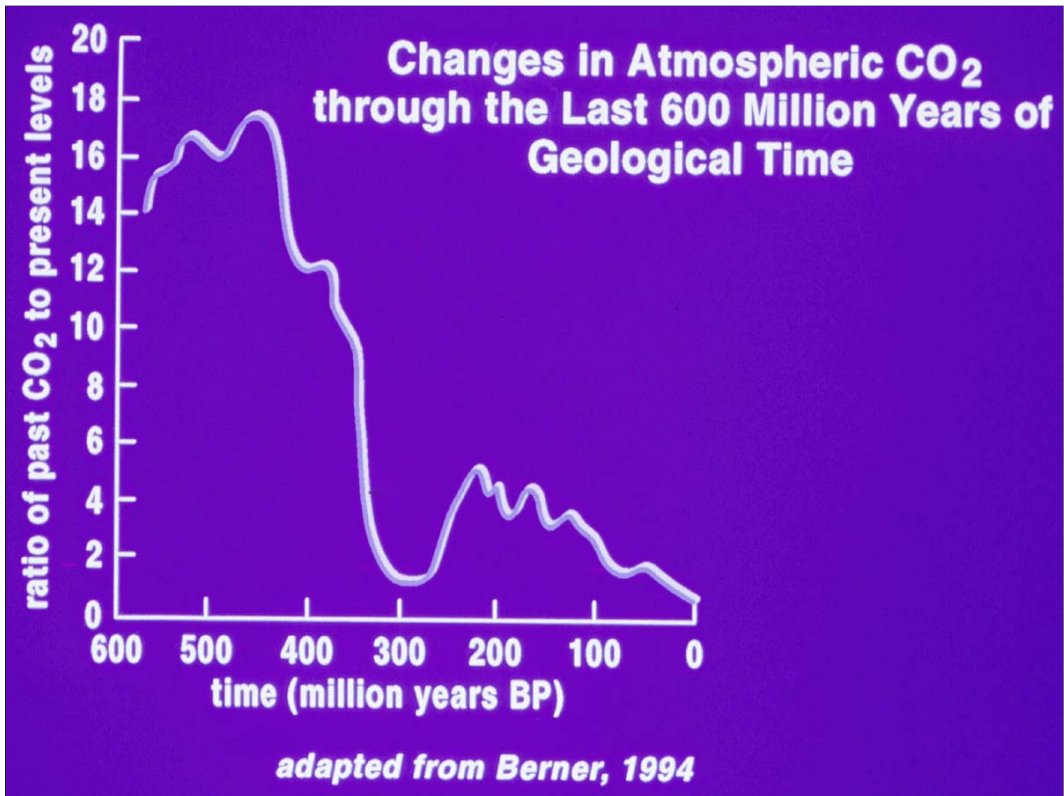
Sources of Greenhouse Gases

Contributions to the "Greenhouse Effect" expressed as % of total

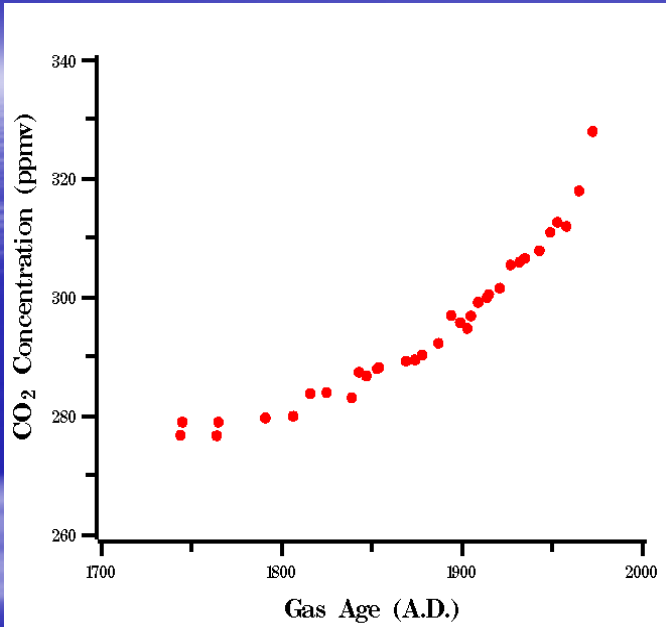


NOTE: "Contributions" are defined as concentrations adjusted for GWP (global warming potential, relative to CO₂)

But of all the greenhouse gases, carbon dioxide represents only about ¼ of 1% of the greenhouse effect, hardly a device to drive the massive energy system of earth's climate. Hieb, M., 2003, Global Warming: A Closer Look at the Numbers, *in* Hieb, M. and Hieb, H., 2003, Global Warming: A Chilling Perspective: http://www.clearlight.com/~mhieb/WVFossils/Ice_Ages.html; accessed 2/14/06

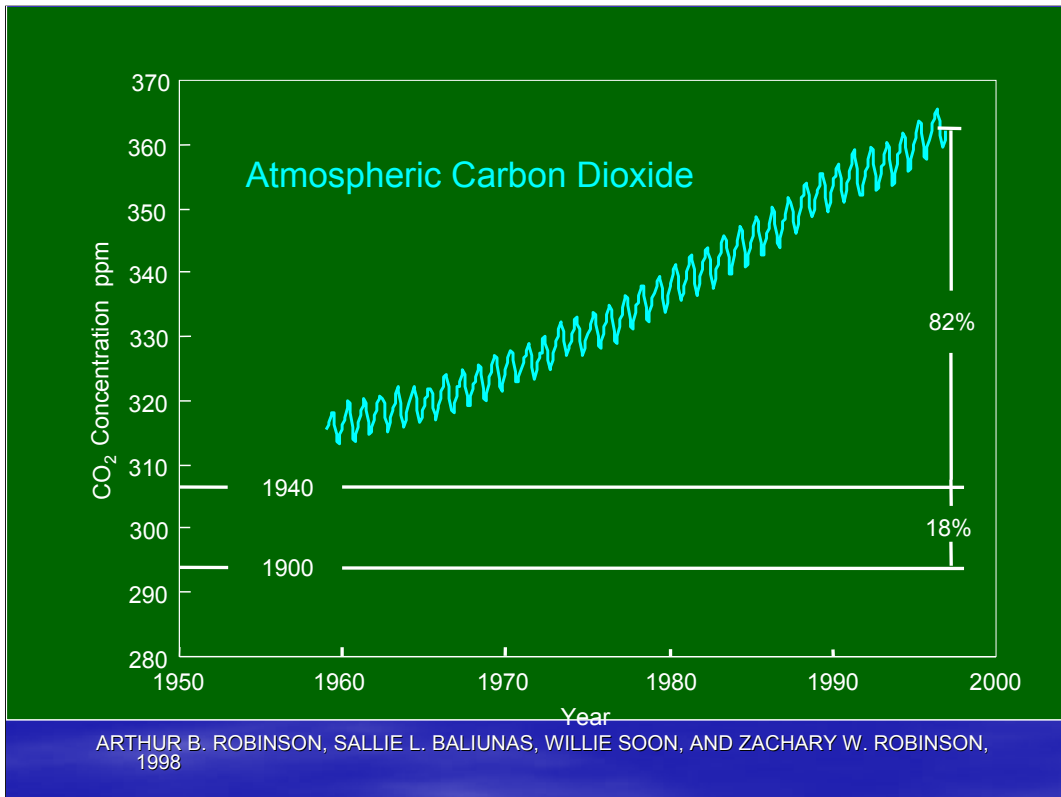


Carbon dioxide once was 18 times the amount now in the atmosphere, but that has declined episodically to modern times, to now, very low levels. When it was 18 times ambient, there was also glaciation. Reference: Berner, R.A., 1994, 3Geocarb III: A revised model of atmospheric CO₂ over Phanerozoic time: American Journal of Science, v. 291, p. 56-91. Also, Moore, Peter D., Bill Chaloner, and Philip Stott, 1996, Global Environmental Change: Blackwell Science, Oxford, England, 244 p.

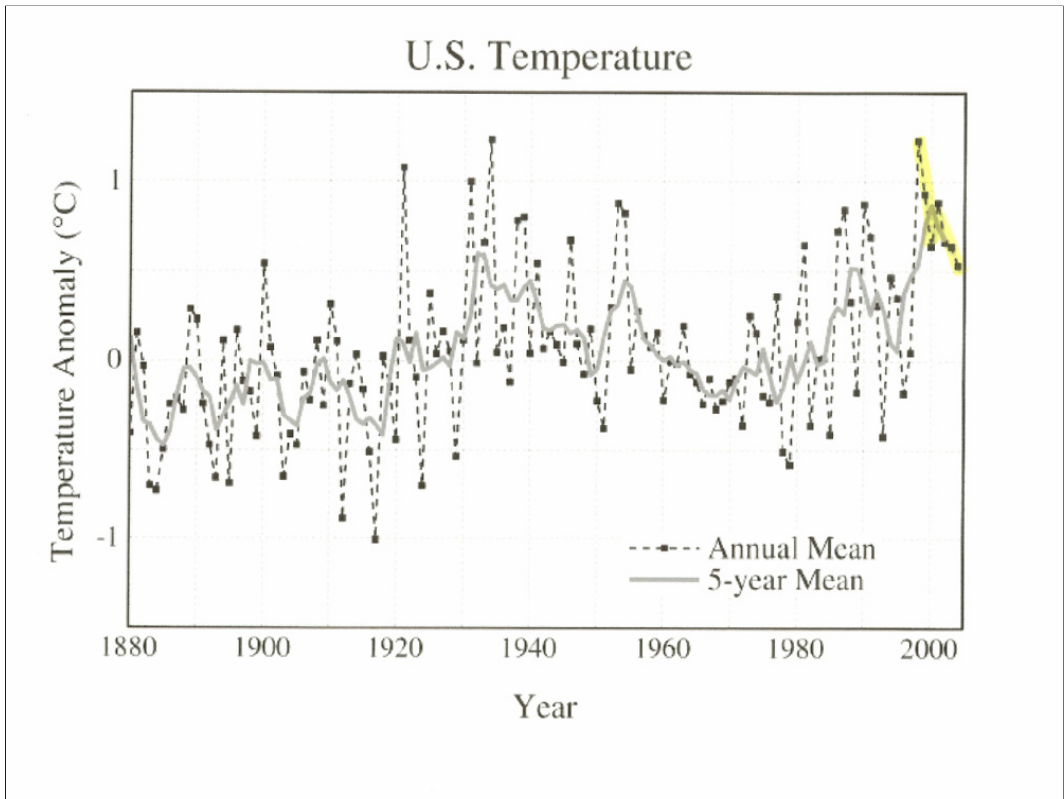


CO₂
from
Siple
Ice
Core
vs. age.

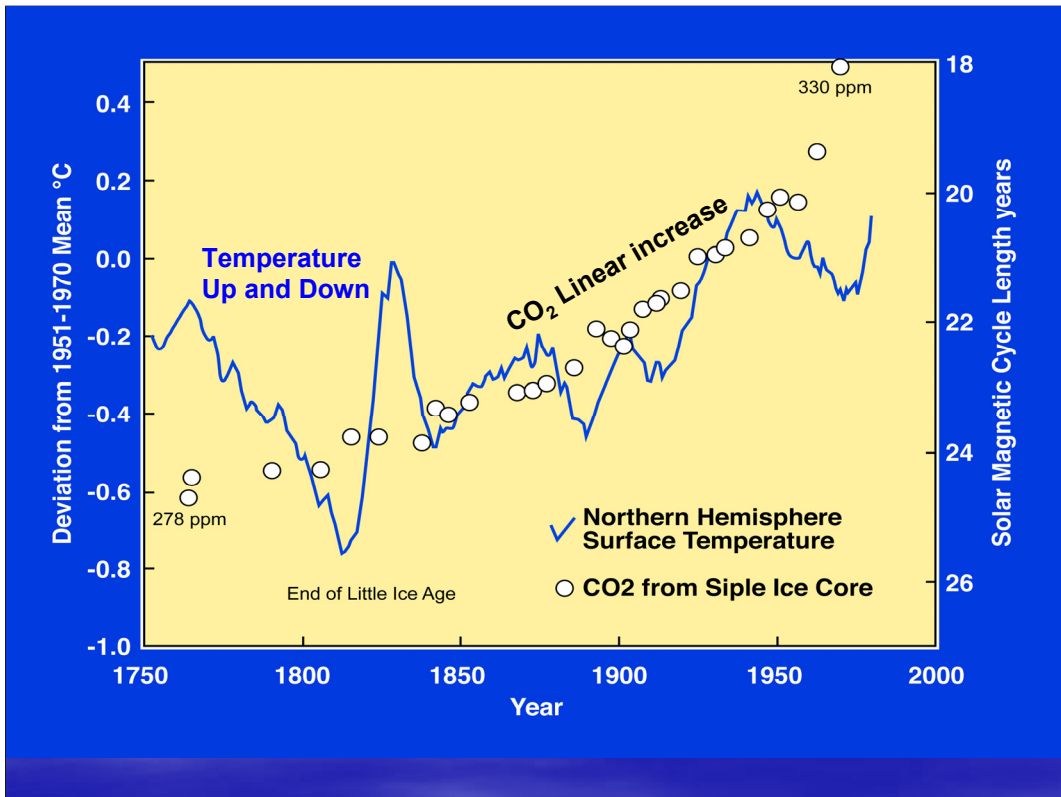
NOAA data.



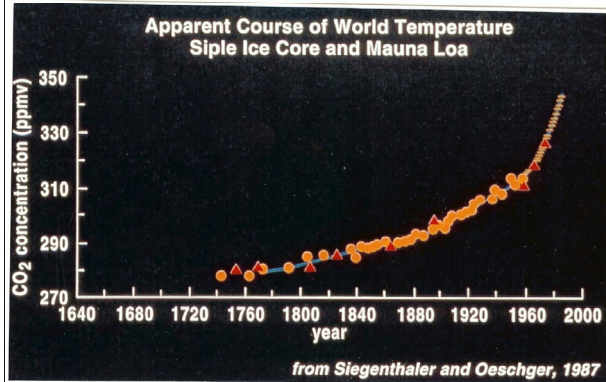
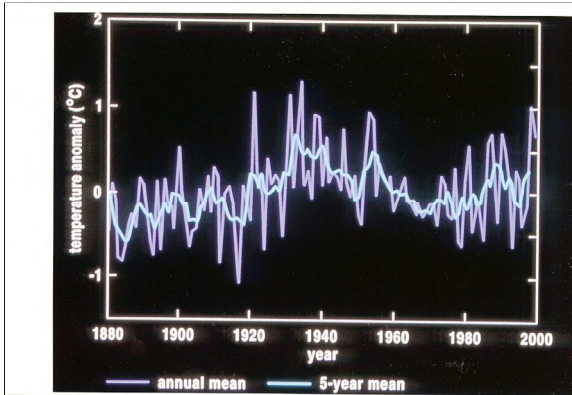
Reference: Robinson, Arthur B., Sallie L. Baliunas, Willie Soon, and Zachary W. Robinson, 1998, Environmental Effects of Increased Atmospheric Carbon Dioxide: Petition Project, La Jolla, CA.; Also Keeling, C.D., T.P. Whorf, M. Wahlen, and J. van der Plicht, 1995, Interannual Extremes in the Rate of Rise of Atmospheric Carbon Dioxide since 1980: Nature, v. 375, p. 666-670.



NOAA data; yellow emphasizes downturn in temperature from 1998 to 2004. It rose again in 2005, but 2006 looks to have been a colder year. Annual temperatures do not track annual carbon dioxide levels.



CO₂ vs. temperature plot. Smooth CO₂ curve does not correlate except in general with actual temperature over 250 years history. Note CO₂ started to rise prior to Little Ice Age. CO₂ data from Keeling, C.D., and T.P. Whorf. 1996. Atmospheric CO₂ records from sites in the SIO Air Sampling Network, *in* Trends: A Compendium of Data on Global Change. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tenn., U.S.A.



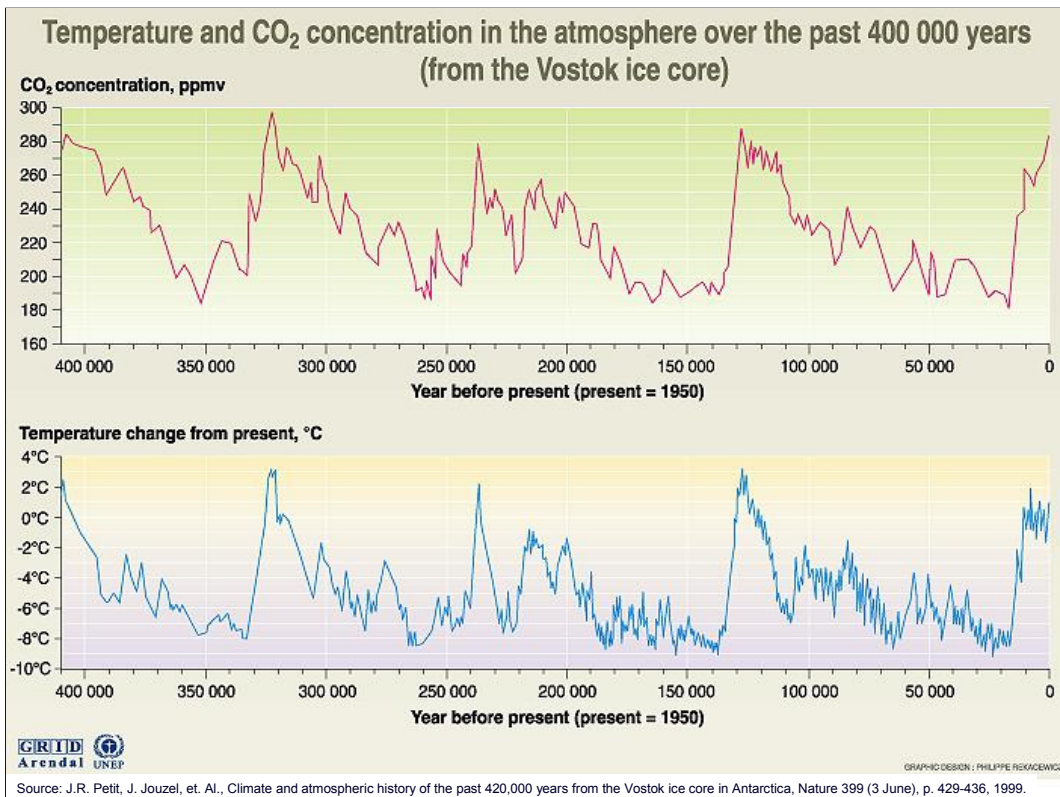
Correlation of
U.S. temperature
to
CO₂
concentration

(www.blackwell-synergy/loi/TEA)

Again, CO₂ against temperature, but note differing time scales. The rise of CO₂ in the atmosphere is not reflected in U.S. temperatures, based on the best instrumental records available. CO₂ curve trails behind the temperature curve and is actually offset by 83 years; the actual data points do not connect, but it is a decent approximation of temperature vs. CO₂.

Can we demonstrate that
greenhouse gas rises
precede temperature rise,
thus inferring them as a driver?





Vostock ice core. The cycles are generally agreed to be driven by orbital variations of the Earth. Careful analysis shows that temperature rises, then CO₂. See literature citations in next slide.

There is an average of 400 years
lag of cause after effect; recent work
suggests 1600 years lag.

Fischer, H., M. Wahlen, J. Smith, D. Mastroianni, and B. Deck, 1999, Ice Core Records of Atmospheric CO₂ Around the Last Three Glacial Terminations: *Science*, v. 283, p.1712-1714.

Siegenthaler, Urs, et al, 2005, Stable Carbon Cycle-Climate Relationship During the Late Pleistocene: *Science*, v. 310, p. 1313-1317.

Hypothesis 2: Falsified

- There is little or no correlation between CO₂ concentration and temperature change.
- Therefore, the theory that human derived CO₂ is the most significant climate driver is falsified.
- That does not mean that there is no effect, but it is likely not measurable against background.

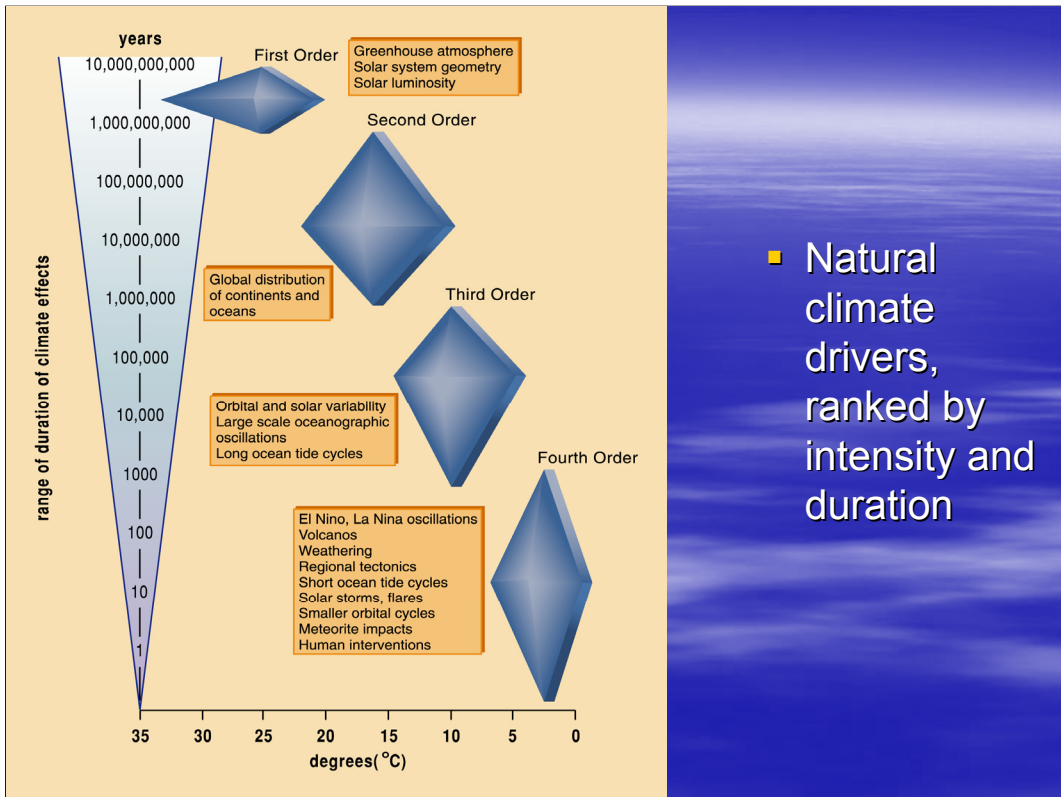
Hypothesis 3

Natural processes are the most significant climate drivers.

Test: Correlation of changes in rates of natural processes with temperature changes.

What natural processes drive climate?

- Many processes.....
- Operating over many time scales.....
- With many scales of influence.

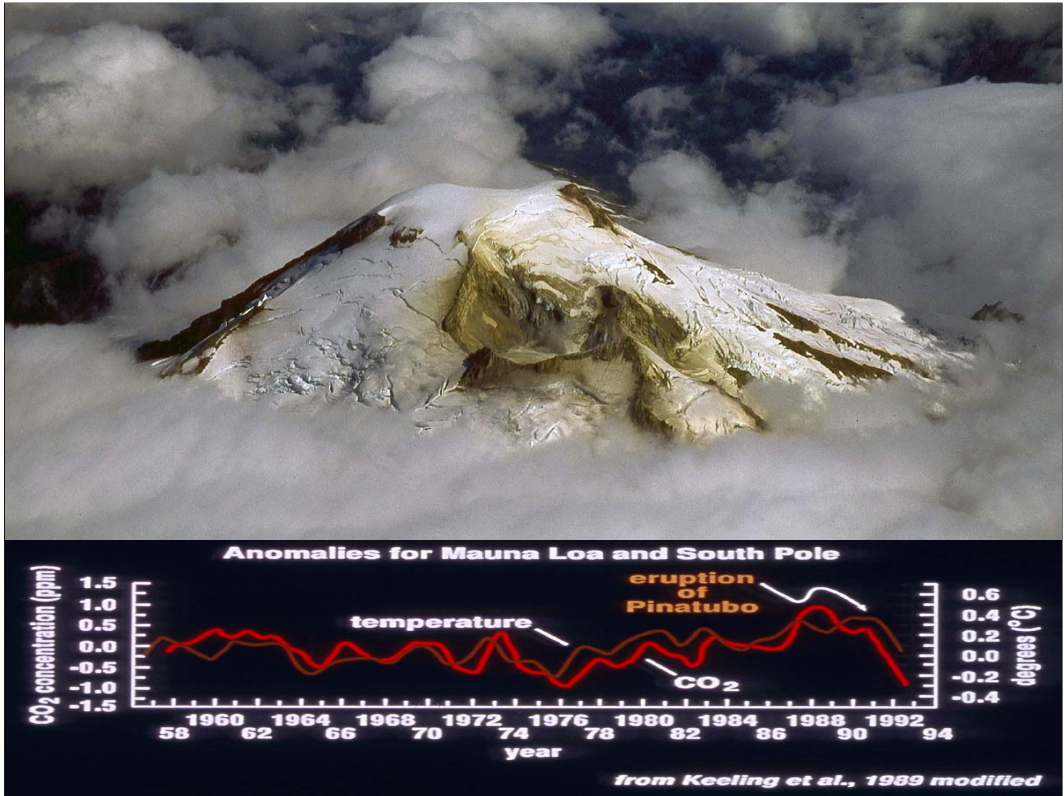


- Natural climate drivers, ranked by intensity and duration

Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds., 2001, Geological Perspectives of Global Climate Change: American Assoc. of Petroleum Geologists Studies in Geology #47, 373 p.



Meteorite impacts throw dust into the atmosphere, causing cooling by reflection.



Volcanic eruptions do the same.

Fourth Order Climate Drivers

- Meteorite impacts and volcanic eruptions are examples of fourth order climate drivers, changing climate a few degrees over a few years.
- If humans have any impact on earth climate, it is fourth order impact, and almost impossible to differentiate from many other natural causes..



Oceans Dominate Earth's Climate

As heat sinks, the world oceans are very important modifiers of climate, and they smooth-out major changes over years. They may be the source of the CO_2 that enters the atmosphere after a warming period starts.

Oceans move heat around the earth

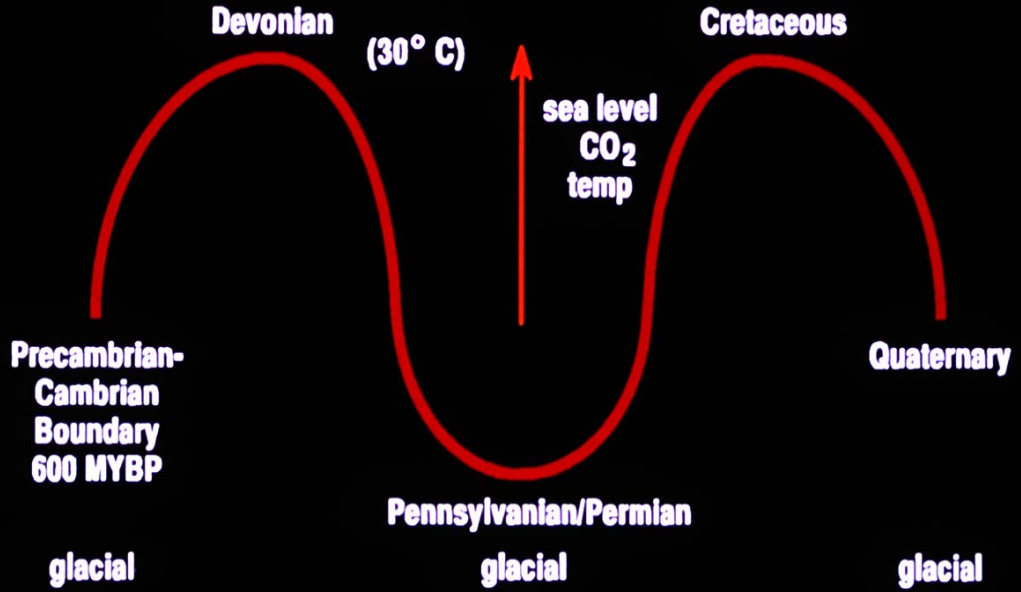
Glaciation occurs when sufficient heat is present at the poles to create an open polar ocean, a source of snow to create glaciers.

This occurs when continents divert heat from the equator to the poles.

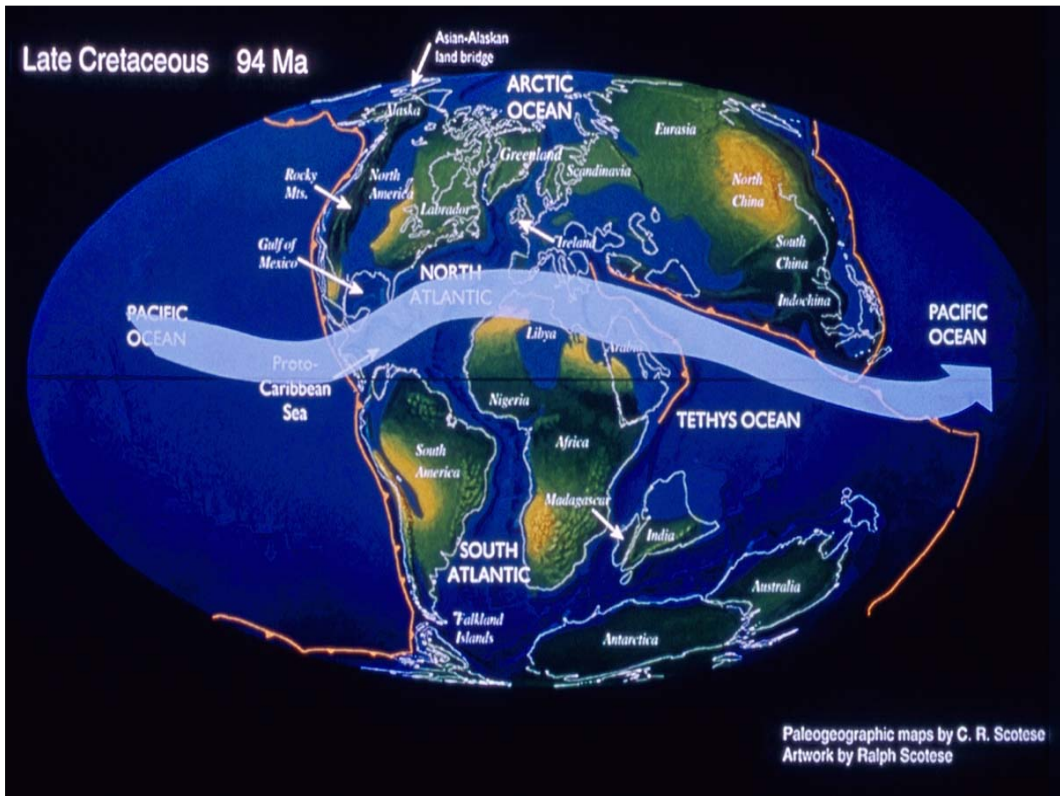
(Ewing and Donn, 1958)

Ewing, M., and W. Donn, 1956, A Theory of Ice Ages: Science, v. 123, p. 1061-1065.

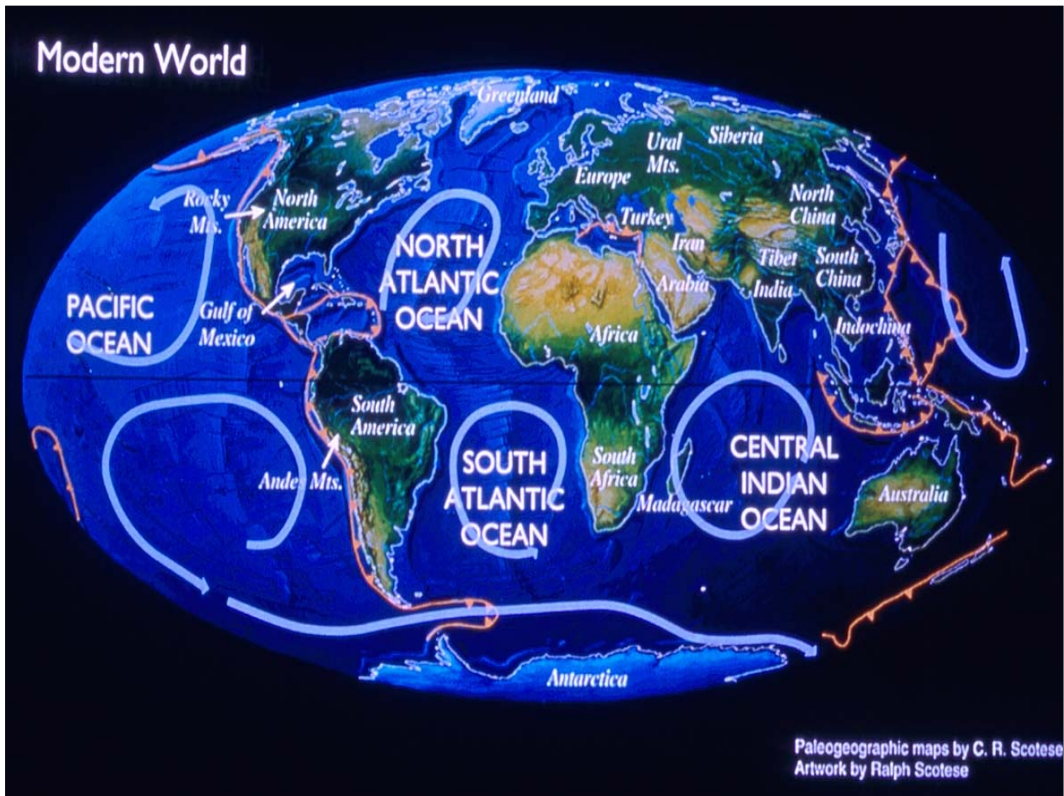
Sea Level Curve



adapted from Vail, MacKenzie

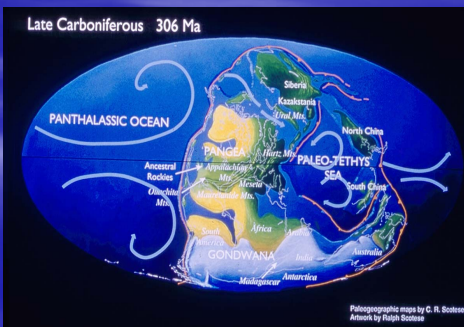
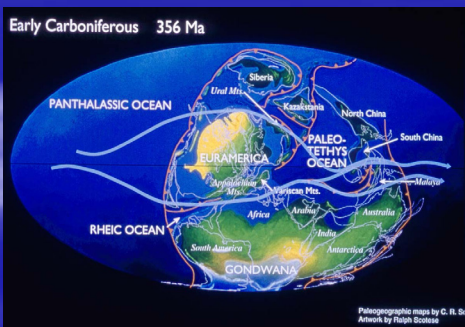
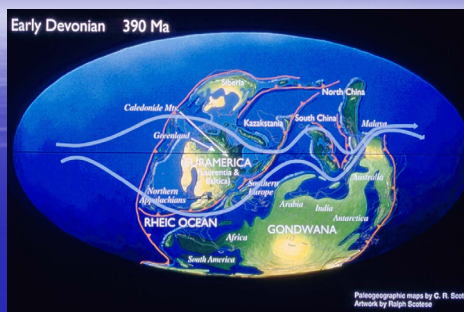
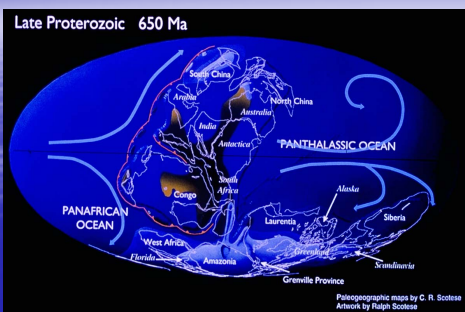


When there are circum-equatorial currents on the earth, there is greenhouse conditions. When blocked, gyres move heat to the poles and glaciation initiates. References: Gerhard, Lee C., and William E. Harrison, 2001, Distribution of Oceans and Continents: A Geological Constraint on Global Climate Variability, *in* Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds., 2001, Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47, Chapter 3, p. 51-82. Maps from Scotese, C.R., 2001, Atlas of Earth History, Volume 1, Paleogeography, PALEOMAP Project, Arlington, Texas, 52 p. Also <http://www.scotese.com/earth.htm>.



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Equatorial currents determine climate (Gerhard and Harrison, 2001)



When there are circum-equatorial currents on the earth, there is greenhouse conditions. When blocked, gyres move heat to the poles and glaciation initiates. References: Gerhard, Lee C., and William E. Harrison, 2001, Distribution of Oceans and Continents: A Geological Constraint on Global Climate Variability, *in* Gerhard, Lee C., William E. Harrison, and Bernold M. Hanson, eds., 2001, Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47, Chapter 3, p. 51-82. Maps from Scotese, C.R., 2001, Atlas of Earth History, Volume 1, Paleogeography, PALEOMAP Project, Arlington, Texas, 52 p. Also <http://www.scotese.com/earth.htm>.

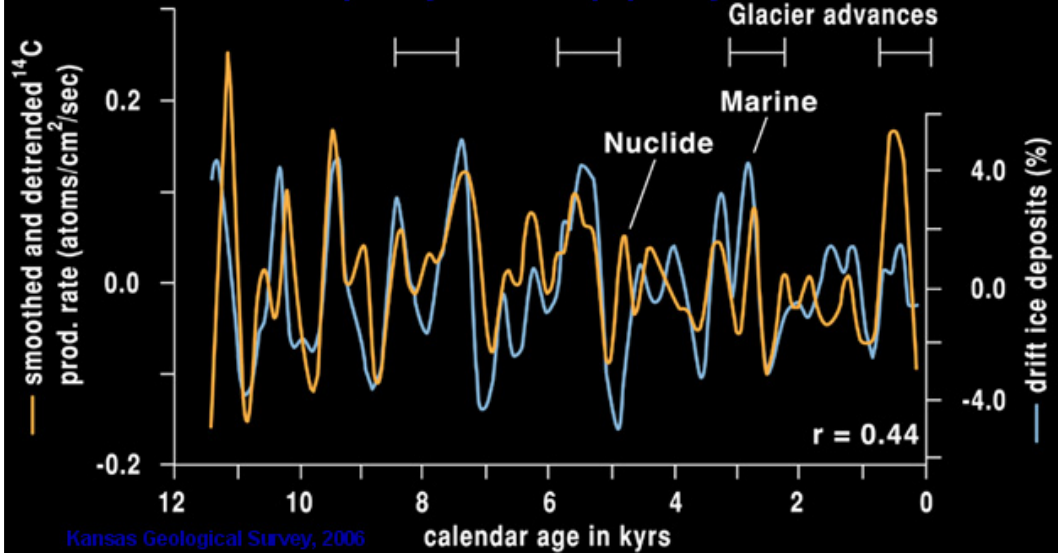
Continental Drift as Climate Driver

- Distribution of oceans and continents on the face of the Earth is a second order climate driver, driving glacial vs. non-glacial periods, by polar vs. equatorial currents
- Continental glaciation occurs via snowfall from evaporation of polar ocean, and consequent earth cooling, until ocean freezes

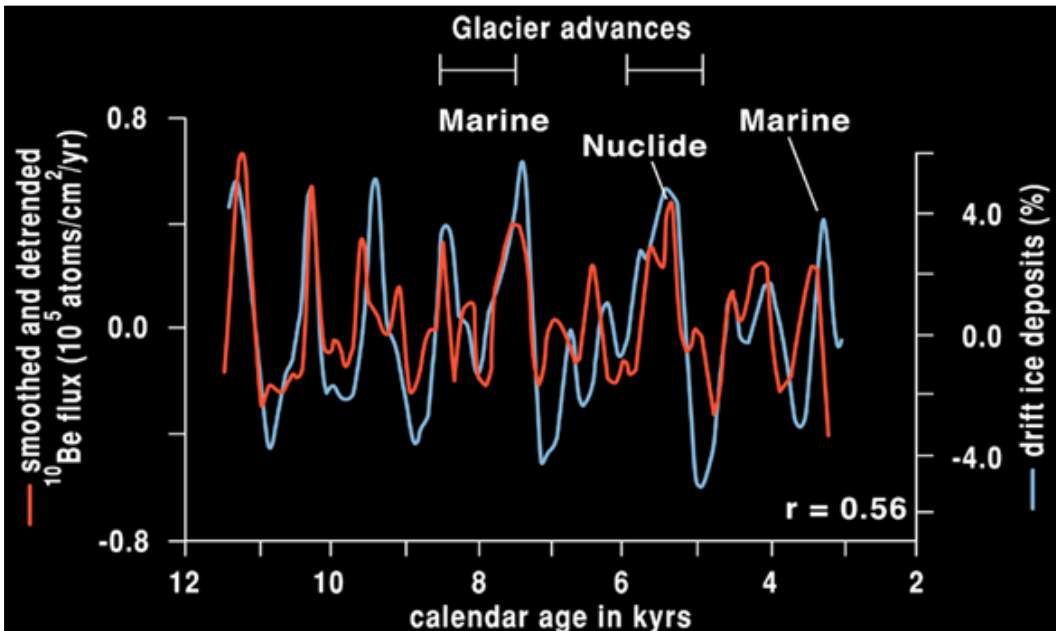


What is the full variability of solar energy?

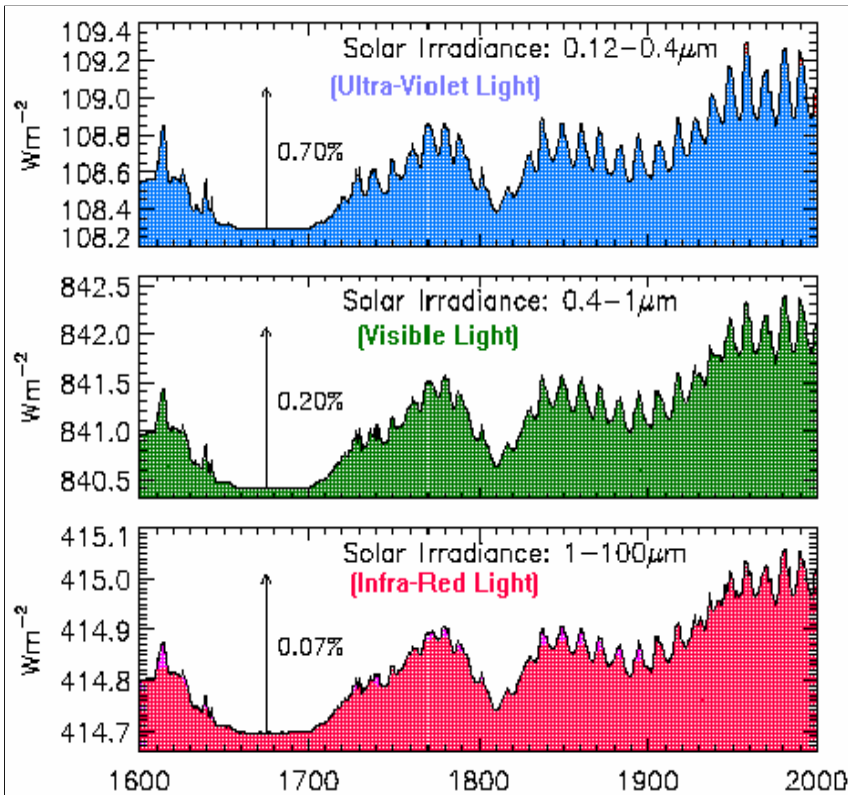
Solar proxy vs. temp proxy vs. time



Correlation of temperature and solar, based on solar C¹⁴. Reprinted with permission from Bond, Gerard, Bernd Kromer, Juerg Beer, Raimund Muscheler, Michael N. Evans, William Showers, Sharon Hoffmann, Rusty Lotti-Bond, Irka Hajdas, and Georges Bonani, 2001, Persistent solar influence on North Atlantic climate during the Holocene: *Science*, v. 294, Issue 5549, p. 2130-2136. Copyright 2001 AAAS. Readers may view, browse, and/or download material for temporary copying purposes only, provided these uses are for noncommercial personal purposes. Except as provided by law, this material may not be further reproduced, distributed, transmitted, modified, adapted, performed, displayed, published, or sold in whole or in part, without prior written permission from the publisher.



Another solar emplaced isotope (Be^{10}) correlates with temperature. Reprinted with permission from Bond, Gerard, Bernd Kromer, Juerg Beer, Raimund Muscheler, Michael N. Evans, William Showers, Sharon Hoffmann, Rusty Lotti-Bond, Irka Hajdas, and Georges Bonani, 2001, Persistent solar influence on North Atlantic climate during the Holocene: *Science*, v. 294, Issue 5549, p. 2130-2136. Copyright 2001 AAAS. Readers may view, browse, and/or download material for temporary copying purposes only, provided these uses are for noncommercial personal purposes. Except as provided by law, this material may not be further reproduced, distributed, transmitted, modified, adapted, performed, displayed, published, or sold in whole or in part, without prior written permission from the publisher.

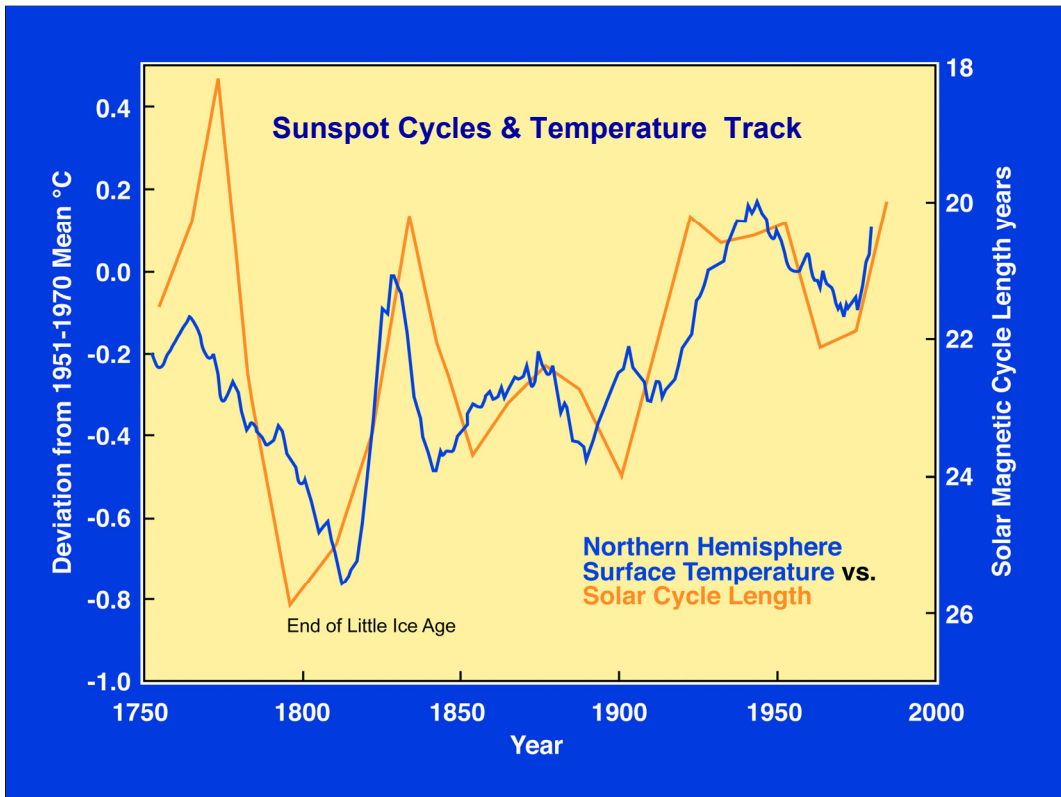


Solar
intensity,
1600-
2000

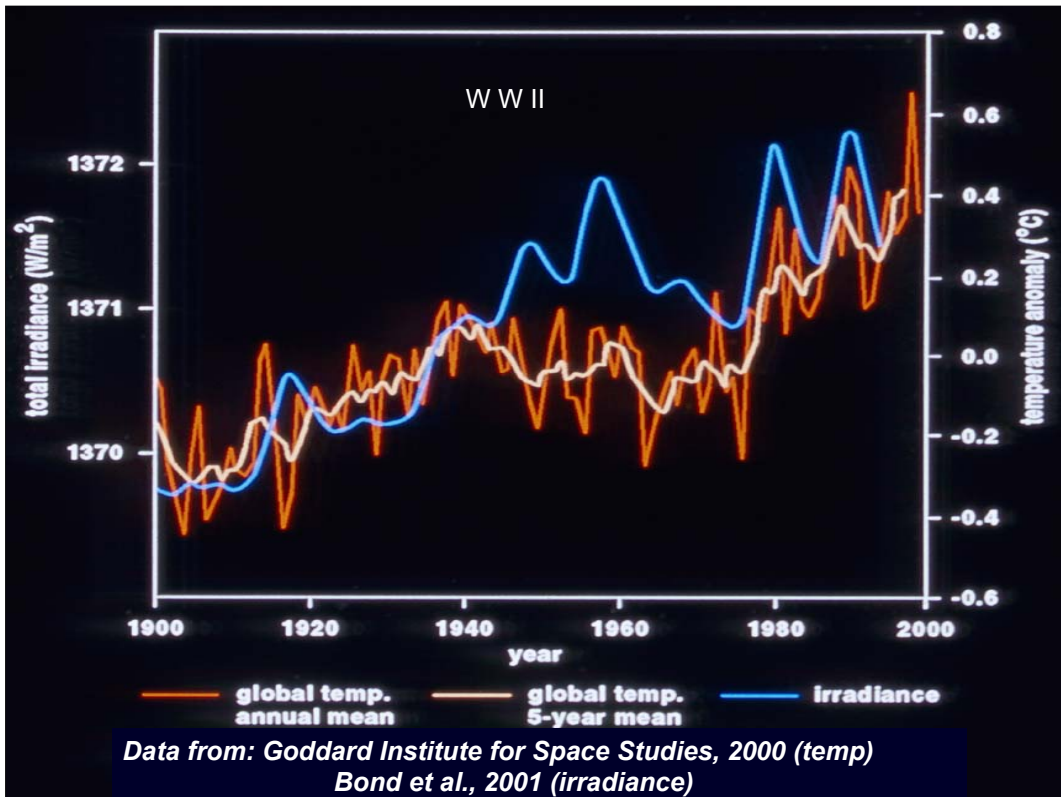
Last
millennial
cycle

Daly,
2005

Solar intensity now is at its highest as it has been in hundreds of years, correlating with warm temperatures. Reference: Daly, John, 2005, The 'Hockey Stick': A New Low in Climate Science: <http://www.john-daly.com/hockey/hockey.htm>; accessed 1/8/2006.



Solar intensity vs. earth temperature: A great correlation. Adapted from D.V. Hoyt, personal communication, 2007. Also see Pekarek, 2001. Solar forcing of Earth's climate, *in* Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47, Tulsa, OK, p. 19-34; Hoyt, D. V., and K.H. Schatten, 1997, The Role of the Sun in Climate Change: Oxford University Press, New York, 279 p.



Note that it is likely WWII and atmospheric nuclear weapon testing had some effect on global temperature: A human effect.

Solar variability is both a third and fourth order climate driver.

- The 1100 year millennial solar cycle is a third order climate driver.
- The 80 year and 11 year solar cycles are fourth order climate drivers.
- Orbital variations are second and third order drivers, accounting for major glacial cycles

Hypothesis 3: Substantiated

- Natural climate drivers correlate well with temperature changes, especially solar variations in sunspots and irradiation.
- Long term orbital cycles are apparent drivers as well, although not illustrated.

Where do computer models fit in this equation?

- Models must reasonably back-model recorded climate history. No GCM so far has replicated either the Medieval or Roman events.
- Therefore, they cannot be used to predict.
- The reason for their failure is greenhouse assumptions.



Wall Street Journal 9/27/06

Battle of the graphs

Temperature anomaly

Relative to 1960-1990

+1.0

+0.5 °C

0.0

-0.5

-1.0

1000

1200

1400

1600

1800

2000

The IPCC
"hockey stick"

1996

Climatic changes in Europe

Over the past thousand years

10.0

9.5

9.0

8.5

900

1000

1100

1200

1300

1400

1500

1600

1700

1800

1900

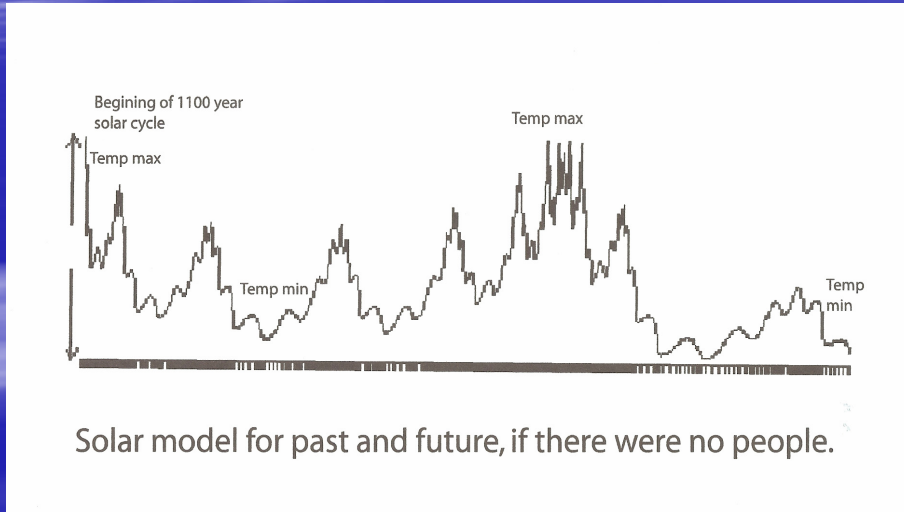
2000

20th-century
average
temperature

Comparative graphs of the discredited IPCC "Hockey Stick" and real world temperatures over the last 1000 years.

Modern Warm, Medieval Warm, Roman Warm, and potential Future Warm solar cycles are spaced about 1100 years apart. Cold minimums also modeled.

Curve from Cross and Lessenger sedimentary 1-D model.



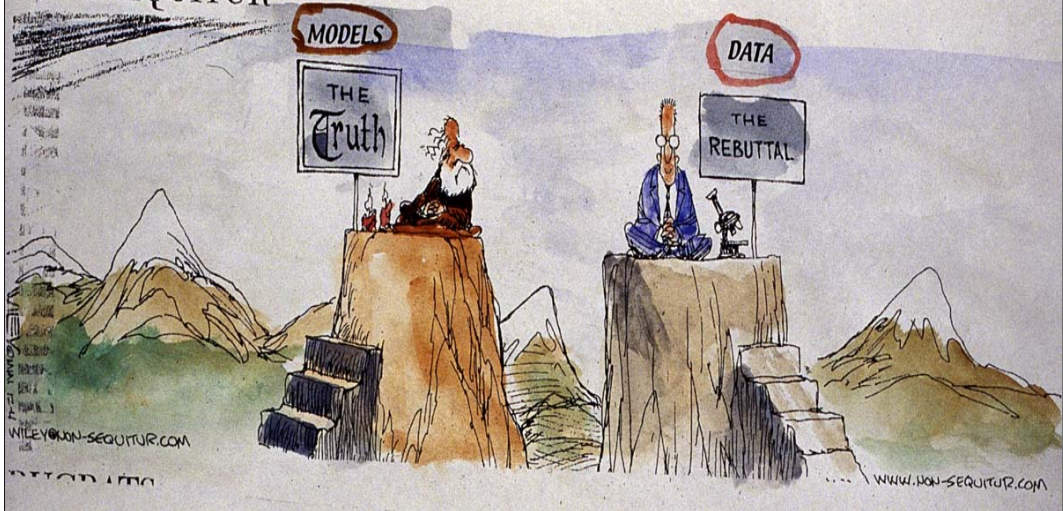
Solar model for past and future, if there were no people.

This primitive model more closely replicates past climate cycles than any GCM. Data input 11 year, 80 year, and 1100 year solar cycles. Cross, T.A., and M.A. Lessenger, Personal communication with T.A. Cross (sstratigraphy@qwest.net).

Why don't all scientists agree that solar variability drives climate?

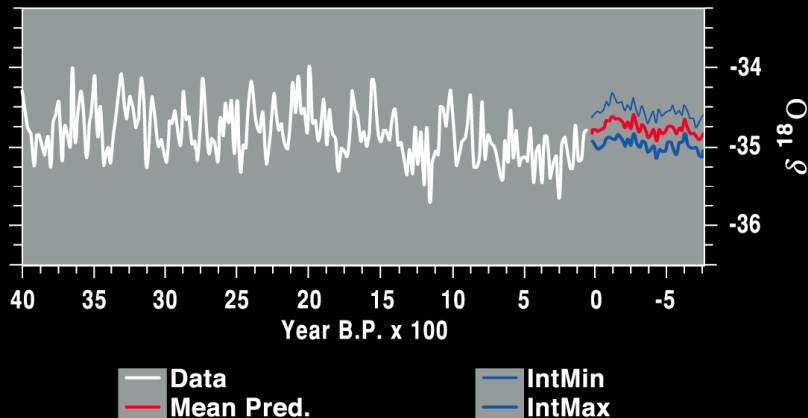
- Measured solar variability is relatively small compared to temperature variation.
- Think about continental drift: Many dismissed it because they couldn't identify a driver.
- Problem: ignoring correlation and data for lack of a causal mechanism.

NON-SEQUITUR



In the game of science, data
always trump theory.

Distribution of $\delta^{18}\text{O}$ for the period 0 - 4,000 years B.P. Data and Prediction



Kotov, 2001

Kansas Geological Survey, 2006

Kotov, Sergey R, 2001, Near-term Climate Prediction Using Ice Core Data from Greenland, *in* Geological Perspectives of Global Climate Change: AAPG Studies in Geology #47, p. 305-316.

What's the resolution of the debate?

- We have substantiated that climate is changing. It is warming from the depths of the LIA, as part of an 1100 year solar cycle
- We have falsified by correlation that humans are the major cause.
- We have correlated climate change to solar and orbital variations and other natural phenomena.

So, If there were no people, how
would climate be different?
It wouldn't be different.

What if humans wish to take action
“just in case?”

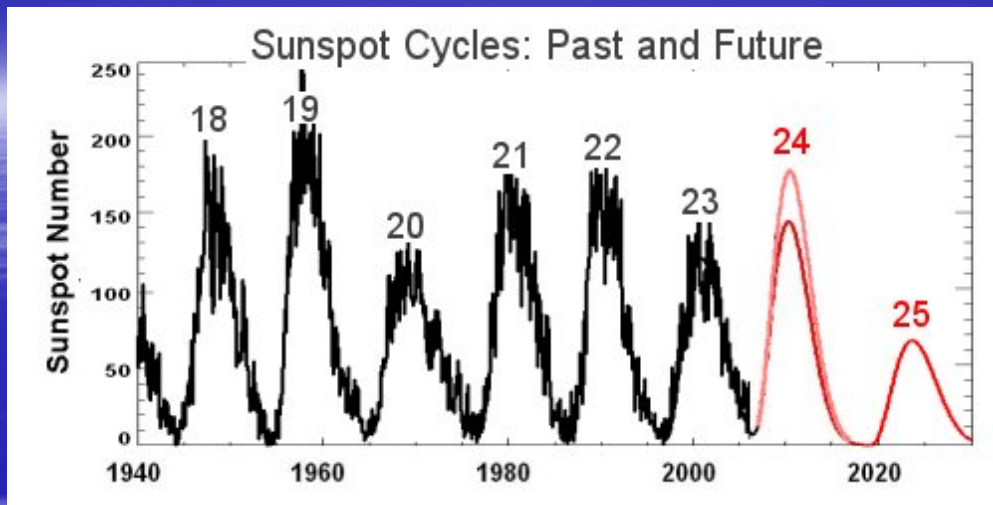
The only solution urged is for U.S. to cut energy use

For Kyoto, cut fossil energy use to 7% below 1990
levels for carbon dioxide. Would require more than
19.8% reduction in energy consumption.(2003
calculations)

The U.S. may not be the problem:

“A North American terrestrial sink is implied by the data because the observed gradient shows a decrease from North Pacific to North Atlantic of about 0.3 ppm.” (CO₂)

Fan, S., M. Gloor, J. Mahlman, S. Pacala, J. Sarmiento, T. Takahashi, and P. Tans, 1998, A Large North American Carbon Sink Implied by Atmospheric and Oceanic Carbon Dioxide Data and Models: *Science*, v. 282, p. 442-446.



- Above: In red, David Hathaway's predictions for the next two solar cycles and, in pink, Mausumi Dikpati's prediction for cycle 24.
- http://science.nasa.gov/headlines/y2006/10may_longrange.htm?list3134
- accessed 16 July 2006

Prediction of solar cycle intensity, suggesting that 2020 will see measurable solar cooling. In red, David Hathaway's predictions for the next two solar cycles and, in pink, Mausumi Dikpati's prediction for cycle 24.

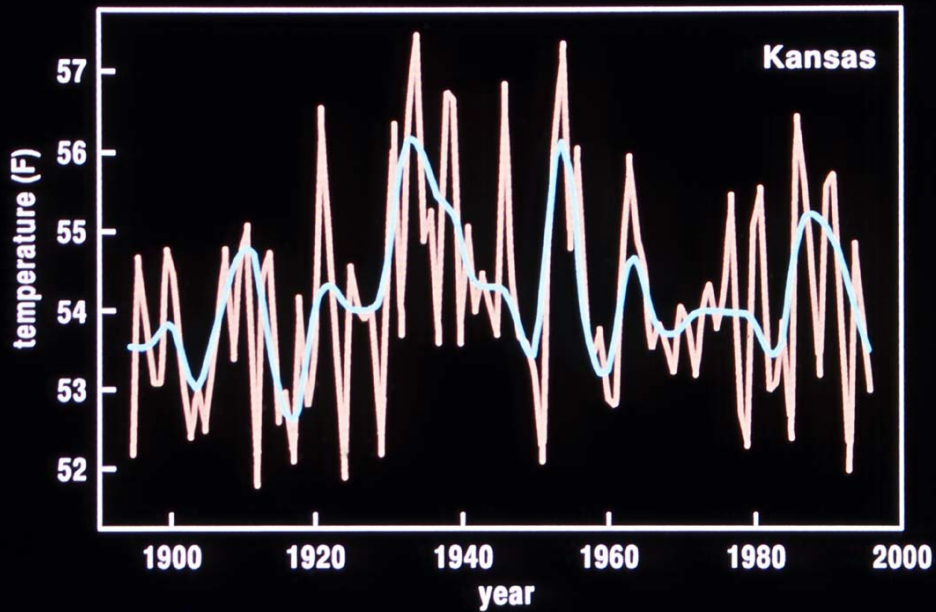
http://science.nasa.gov/headlines/y2006/10may_longrange.htm?list3134

accessed 16 July 2006

A Grand Experiment

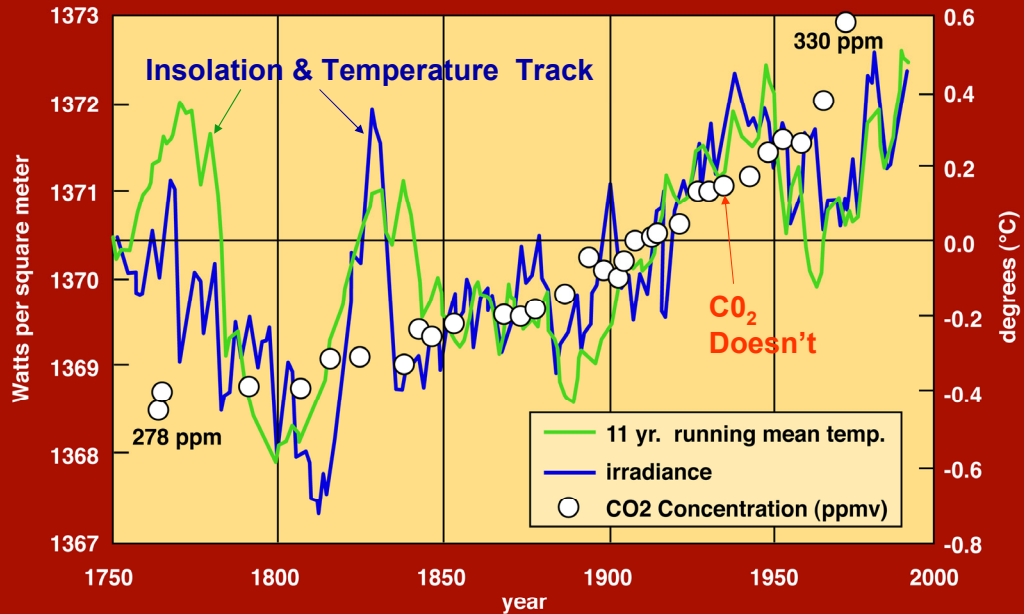
- If sunspot cycle prediction is accurate, then:
- If temperature goes down, solar control and historical data are substantiated.
- If temperature goes up, human influence and computer models are substantiated.
- If neither happens, all science goes back to the drawing boards.

There is no flat line in climate.



National Climate Center, via. Derek Winstanley, III. State Water Survey

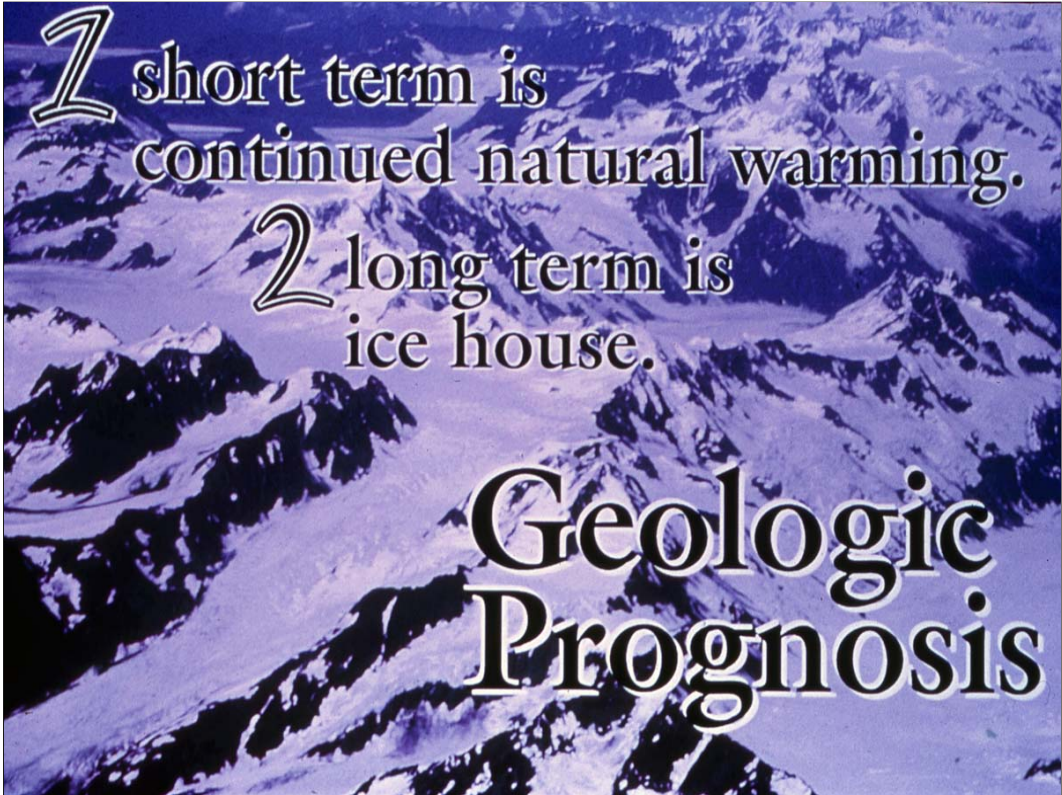
Northern Hemisphere Temperature VS. Solar Irradiance



Adapted from D.V. Hoyt, personal communication, 2007

Also Hoyt, D.V., and Schatten, K.H., 1997, *The Role of the Sun in Climate Change*: Oxford, NY, Oxford University Press, 279 p.; Solanki, S.K., and M. Fligge, 2000, Reconstruction of past solar irradiance: *Space Science Review*, v. 94, p. 127-138.

CO₂ overlay from Keeling, C.D., and T.P. Whorf, 1996, *Atmospheric CO₂ Records from Sites in the SIO Air Sampling Network*, in *Trends: A Compendium of Data on Global Change*: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, Oak Ridge, Tenn., U.S.A.



1 short term is
continued natural warming.

2 long term is
ice house.

Geologic Prognosis

Conclusion:

In the end, even if human-induced climate change were to be verified, it makes no difference – we have no alternative to using fossil fuels.

We must insist that government prepare for the culmination of the Modern Warm Event, similar to the Roman and Medieval Warm Events, but perhaps a bit cooler.



Snowman at
Galveston,
Texas,
Gulf of
Mexico

2005

Global
cooling?

Sun

51,076,119 copies
Vol. 13 - No. 30 July 25, 1993

Summer heat waves
will melt polar ice
caps and result in...

OCEANS RISING 150 FT.

...& flooding
coastal areas

WILL YOUR CITY SURVIVE?

SHOCKING MAP INSIDE SHOWS DANGER ZONES INCLUDING:

New York • Miami • Boston • Vancouver • San Diego • Mobile
San Francisco • Houston • Philadelphia • Baltimore • Halifax
New Orleans • Long Beach • Providence • Savannah • Galveston

\$1.09 / \$1.19 Canada



0001-0871 30

- Some people get their information from the media.....

NEWS

November 26, 1996

\$1.09/\$1.19 CANADA • 70p U.K.

**Man who died for 24 minutes gives
vivid details of frozen netherworld!**



TO HELL & BACK:
Amos Corono, 56,
suffered a massive
heart attack and
visited Hell.

HELL FREEZES OVER

***Satan's domain has
become an Arctic
wasteland, say
religious experts***

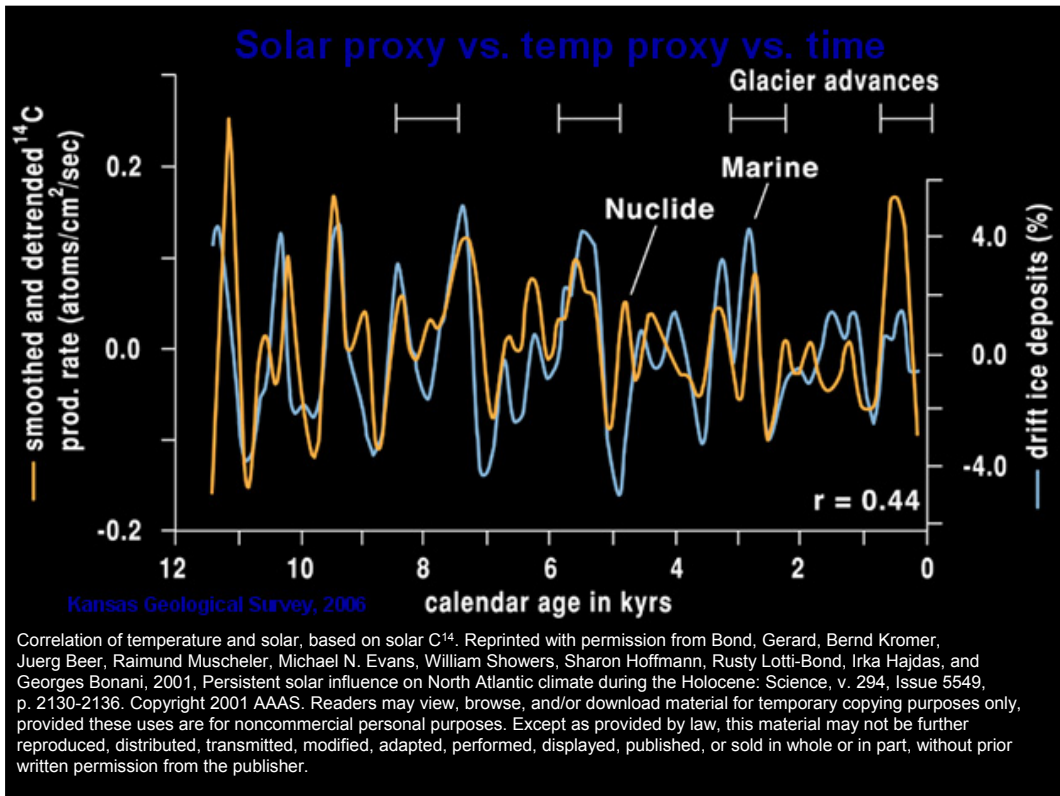


Really
conflicting
media.....

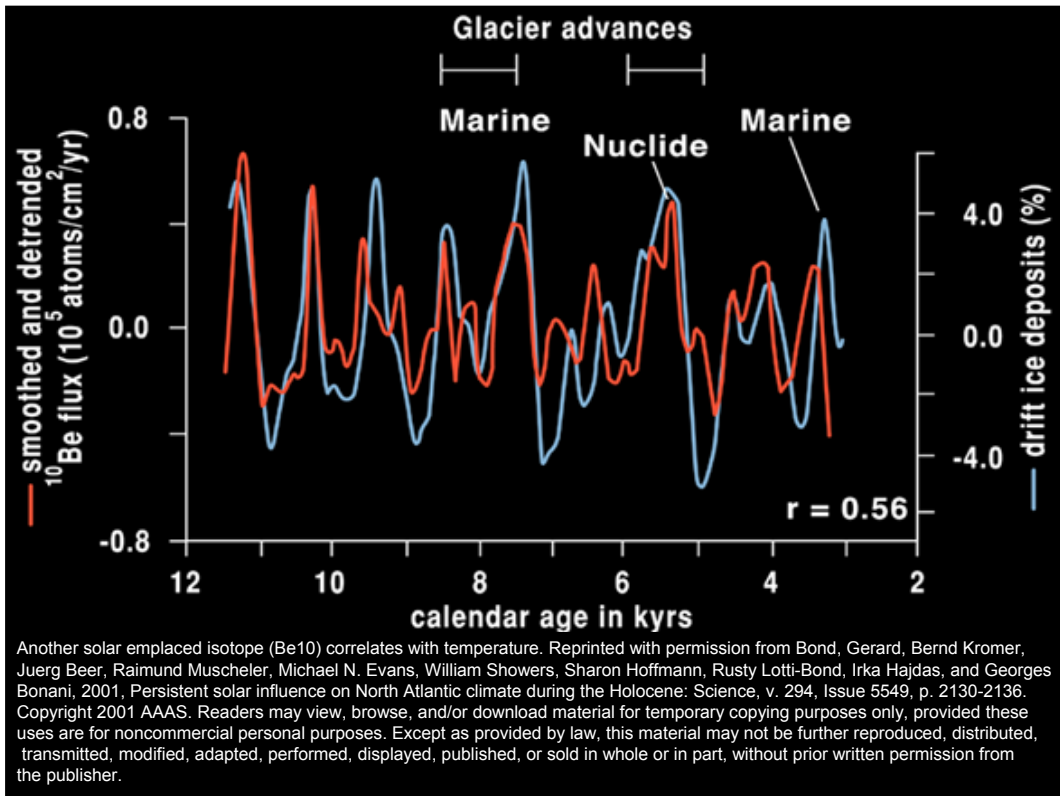


Future
generations
depend on
us to make
good
decisions.

Our job is to maintain the integrity of science in the face of
contrary social agendas.



Correlation of temperature and solar, based on solar C^{14} . Reference: Bond, Gerard, Bernd Kromer, Juerg Beer, Raimund Muscheler, Michael N. Evans, William Showers, Sharon Hoffmann, Rusty Lotti-Bond, Irka Hajdas, and Georges Bonani, 2001, Persistent Solar Influence on North Atlantic Climate During the Holocene: Science, Vol. 294, Issue 5549, 2130-2136.



Another solar emplaced isotope (Be^{10}) correlates with temperature. Reference: Bond, Gerard, Bernd Kromer, Juerg Beer, Raimund Muscheler, Michael N. Evans, William Showers, Sharon Hoffmann, Rusty Lotti-Bond, Irka Hajdas, and Georges Bonani, 2001, Persistent Solar Influence on North Atlantic Climate During the Holocene: *Science*, Vol. 294, Issue 5549, 2130-2136.