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Sent: Thursday, August 09, 2007 2:10 PM
Subject: Global Warming - A Chilling Perspective

http://mysite.verizon.net/mhieb/WVFossils/ice_ages.html



Global Warming: A Chilling Perspective

- A Brief History of Ice Ages and Warming
- Causes of Global Climate Change
- Playing with Numbers
- A Matter of Opinion
- Unraveling the Earth's Temperature Record
- Stopping Climate Change

A Brief History of Ice Ages and Warming

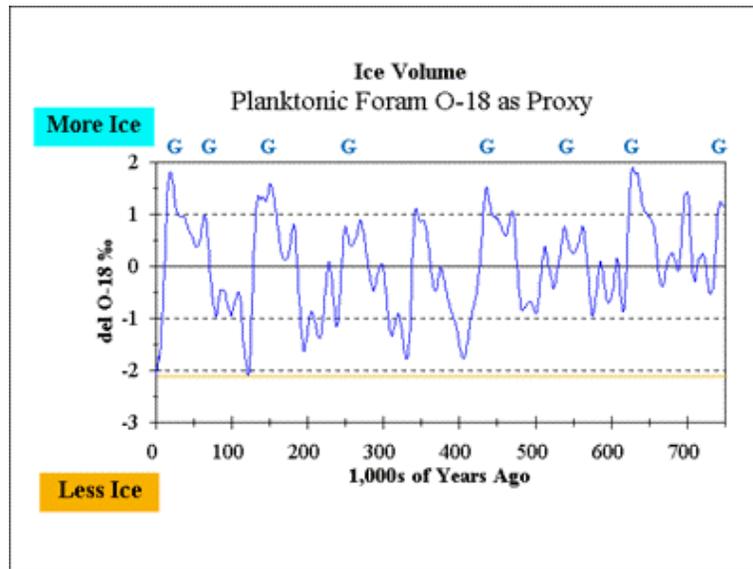
Global warming started long before the "Industrial Revolution" and the invention of the internal combustion engine. Global warming began 18,000 years ago as the earth started warming its way out of the **Pleistocene Ice Age**-- a time when much of North America, Europe, and Asia lay buried beneath great sheets of glacial ice.

Earth's climate and the biosphere have been in constant flux, dominated by **ice ages and glaciers** for the past several million years. We are currently enjoying a temporary reprieve from the deep freeze.

Approximately every 100,000 years Earth's climate warms up temporarily. These warm periods, called **interglacial periods**, appear to last approximately 15,000 to 20,000 years before regressing back to a cold ice age climate. At year 18,000 and counting our current interglacial vacation from the Ice Age is much nearer its end than its beginning.

Global warming during Earth's current **interglacial warm period** has greatly altered our environment and the distribution and diversity of all life. For example:

- Approximately 15,000 years ago the earth had warmed sufficiently to halt the advance of glaciers, and sea levels worldwide began to rise.
- By 8,000 years ago the land bridge across the Bering Strait was drowned, cutting off the migration of men and animals to North America.
- Since the end of the Ice Age, Earth's temperature has risen approximately 16 degrees F and [sea levels have risen a total of 300 feet!](#) Forests have returned where once there was only ice.



Over the past 750,000 years of Earth's history, Ice Ages have occurred at regular intervals, of approximately 100,000 years each.

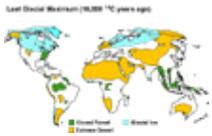
Courtesy of [Illinois State Museum](#)

During ice ages our planet is cold, dry, and inhospitable-- supporting few forests but plenty of glaciers and deserts. Like a spread of colossal bulldozers, glaciers have scraped and pulverized vast stretches of Earth's surface and completely destroyed entire regional ecosystems not once, but several times. During Ice Ages winters were longer and more severe and ice sheets grew to tremendous size, accumulating to thicknesses of up to 8,000 feet!. They moved slowly from higher

elevations to lower-- driven by gravity and their tremendous weight. They left in their wake altered river courses, flattened landscapes, and along the margins of their farthest advance, great piles of glacial debris.

During the last 3 million years glaciers have at one time or another covered about 29% of Earth's land surface or about 17.14 million square miles ([44.38 million sq. km.](#)) . What did not lay beneath ice was a largely cold and desolate desert landscape, due in large part to the colder, less-humid atmospheric conditions that prevailed.

During the Ice Age summers were short and winters were brutal. Animal life and especially plant life had a very tough time of it. Thanks to global warming, that has all now changed, at least temporarily.

 <p>(view full size map)</p>	<h3>The World 18,000 Years Ago</h3> <p>Before "global warming" started 18,000 years ago most of the earth was a frozen and arid wasteland. Over half of earth 's surface was covered by glaciers or extreme desert. Forests were rare.</p> <p>Not a very fun place to live.</p>
 <p>(view full size map)</p>	<h3>Our Present World</h3> <p>"Global warming" over the last 15,000 years has changed our world from an <i>ice box</i> to a <i>garden</i>. Today extreme deserts and glaciers have largely given way to grasslands, woodlands, and forests.</p> <p>Wish it could last forever, but</p>

In the 1970s concerned environmentalists like Stephen Schneider of the National Center for Atmospheric Research in Boulder, Colorado feared a return to another **ice age** due to manmade **atmospheric pollution blocking out the sun**.

Since about 1940 the global climate did in fact appear to be cooling. Then a funny thing happened-- sometime in the late 1970s temperature declines slowed to a halt and ground-based recording stations during the 1980s and 1990s began reading small but steady increases in near-surface temperatures. Fears of "**global cooling**" then changed suddenly to "**global warming**,"-- the cited cause:

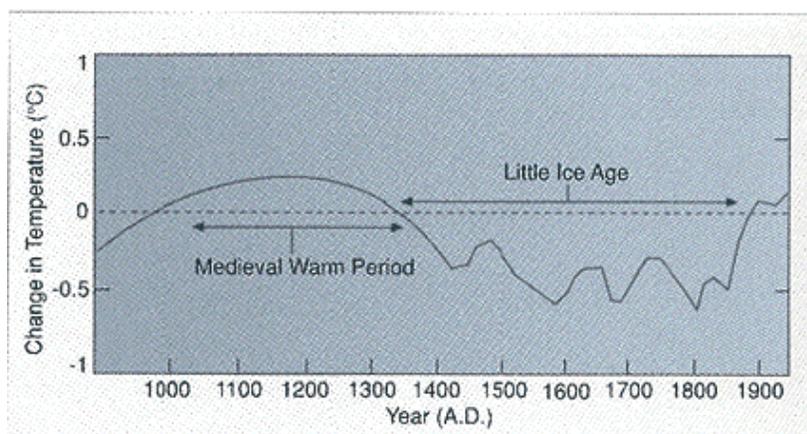
manmade atmospheric pollution causing a runaway **greenhouse effect**.

What does geologic history have to offer in sorting through the confusion?

Quite a bit, actually.

📌 "If 'ice age' is used to refer to long, generally cool, intervals during which glaciers advance and retreat, we are still in one today. Our modern climate represents a very short, warm period between glacial advances." [Illinois State Museum](#)

Periods of Earth warming and cooling occur in cycles. This is well understood, as is the fact that small-scale cycles of about 40 years exist within larger-scale cycles of 400 years, which in turn exist inside still larger scale cycles of 20,000 years, and so on.



Example of regional variations in surface air temperature for the last 1000 years, estimated from a variety of sources, including temperature-sensitive tree growth indices and written records of various kinds, largely from western Europe and eastern North America. Shown are changes in regional temperature in °C, from the baseline value for 1900. Compiled by R. S. Bradley and J. A. Eddy based on J. T. Houghton et al., *Climate Change: The IPCC Assessment*, Cambridge University Press, Cambridge, 1990 and published in *EarthQuest*, vol 5, no 1, 1991. Courtesy of Thomas Crowley, [Remembrance of Things Past: Greenhouse Lessons from the Geologic Record](#)

Earth's climate was in a cool period from A.D. 1400 to about A.D. 1860, dubbed the "**Little Ice Age**." This period was characterized by harsh winters, shorter growing seasons, and a drier climate. The decline in global temperatures was a modest 1/2° C, but the effects of this global cooling cycle were more pronounced in the higher latitudes. The Little Ice Age has been blamed for a host of human suffering including crop failures like the "Irish Potato Famine" and the demise of the

[medieval Viking colonies in Greenland.](#)

Today we enjoy global temperatures which have warmed back to levels of the so called "**Medieval Warm Period**," which existed from approximately A.D. 1000 to A.D. 1350.

🔦 "...the Earth was evidently coming out of a relatively cold period in the 1800s so that warming in the past century may be part of this natural recovery."

[Dr. John R. Christy](#)

(leading climate and atmospheric science expert- U. of Alabama in Huntsville) (5)



Global warming alarmists maintain that global temperatures have increased since about A.D. 1860 to the present as the result of the so-called "**Industrial Revolution**,"-- caused by releases of large amounts of **greenhouse gases (principally carbon dioxide)** from manmade sources into the atmosphere causing a runaway "**Greenhouse Effect**."

Was man really responsible for pulling the Earth out of the Little Ice Age with his industrial pollution? If so, this may be one of the greatest unheralded achievements of the Industrial Age!

Unfortunately, we tend to overestimate our actual impact on the planet. In this case the magnitude of the gas emissions involved, even by the most aggressive estimates of atmospheric warming by greenhouse gases, is inadequate to account for the magnitude of temperature increases. So what causes the up and down cycles of global climate change?

Causes of Global Climate Change

Climate change is controlled primarily by **cyclical eccentricities in Earth's rotation and orbit**, as well as **variations in the sun's energy output**.

"**Greenhouse gases**" in Earth's atmosphere also influence Earth's temperature, but in a much smaller way. Human additions to total greenhouse gases play a still smaller role, contributing about **0.2% - 0.3%** to Earth's **greenhouse effect**.

Major Causes of Global Temperature Shifts

(1) Astronomical Causes

- 11 year and **206**  year cycles: Cycles of **solar variability** ([sunspot activity](#) )

- **21,000 year cycle:** Earth's combined **tilt** and **elliptical orbit** around the Sun ([precession of the equinoxes](#))
- **41,000 year cycle:** Cycle of the +/- **1.5° wobble in Earth's orbit** ([tilt](#))
- **100,000 year cycle:** Variations in the **shape of Earth's elliptical orbit** ([cycle of eccentricity](#))

(2) Atmospheric Causes

- **Heat retention:** Due to atmospheric gases, mostly gaseous water vapor (not droplets), also carbon dioxide, methane, and a few other miscellaneous gases-- the "**greenhouse effect**"
- **Solar reflectivity:** Due to **white clouds, volcanic dust, polar ice caps**

(3) Tectonic Causes

- **Landmass distribution:** Shifting continents (**continental drift**) causing changes in circulatory patterns of ocean currents. It seems that whenever there is a large land mass at one of the Earth's poles, either the north pole or south pole, there are ice ages.
- **Undersea ridge activity:** "**Sea floor spreading**" (associated with continental drift) causing variations in ocean displacement.

For more details see:

<http://www.ngdc.noaa.gov/paleo/milankovitch.html>

http://www.abc.net.au/science/news/enviro/EnviroRepublish_233658.htm

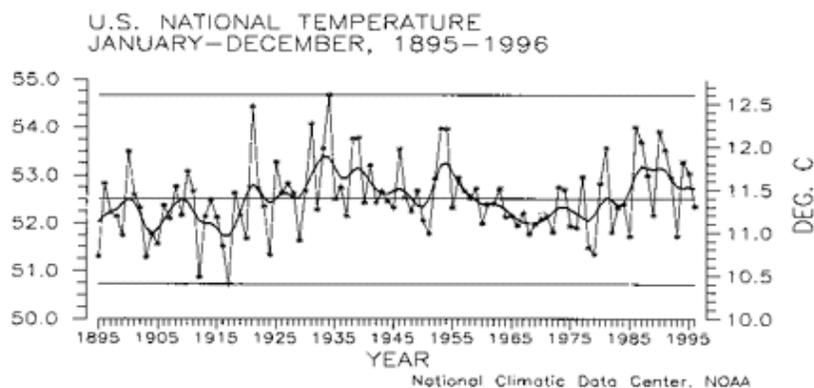
Playing with Numbers

Global climate and temperature cycles are the result of a complex interplay between a variety of causes. Because these cycles and events overlap, sometimes compounding one another, sometimes canceling one another out, it is inaccurate to imply a statistically significant trend in climate or temperature patterns from just a few years or a few decades of data.

Unfortunately, a lot of disinformation about where Earth's climate is heading is being propagated by "scientists" who use improper statistical methods, short-term temperature trends, or faulty computer models to make analytical and anecdotal projections about the significance of man-made influences to Earth's climate.

During the last 100 years there have been **two general cycles of warming and cooling** recorded in the U.S. We are currently in the second warming cycle. Overall, U.S. temperatures show **no**

significant warming trend over the last 100 years (1). This has been well - established but not well - publicized.



Each year Government press releases declare the previous year to be the "hottest year on record." [The UN's executive summary on climate change, issued in January 2001](#), insists that the 20th century was the warmest in the last millennium. The news media distribute these stories and people generally believed them to be true. However, as most climatologists know, these reports generally are founded on ground-based temperature readings, which are misleading. **The more meaningful and precise orbiting satellite data for the same period (which are generally not cited by the press) have year after year showed little or no warming.**

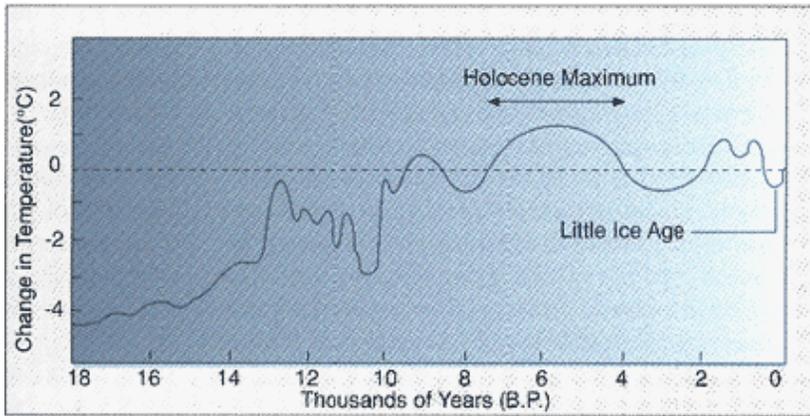
Dr. Patrick Michaels has demonstrated this effect is a common problem with ground- based recording stations, many of which originally were located in predominantly rural areas, but over time have suffered background bias due to urban sprawl and the encroachment of concrete and asphalt (the ["urban heat island effect"](#)). The result has been an upward distortion of increases in ground temperature over time(2). Satellite measurements are not limited in this way, and are accurate to within 0.1° C. They are widely recognized by scientists as the most accurate data available. **Significantly, global temperature readings from orbiting satellites show no significant warming in the 18 years they have been continuously recording and returning data (1).**

A Matter of Opinion

Has manmade pollution in the form of carbon dioxide (CO₂) and other gases caused a runaway Greenhouse Effect and Global Warming?

Before joining the mantra, consider the following:

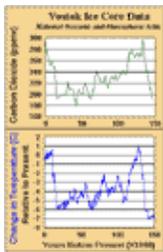
- 1.** The idea that man-made pollution is responsible for global warming is not supported by historical fact. The period known as the **Holocene Maximum** is a



good example-- so-named because it was the hottest period in human history. The interesting thing is this period occurred approximately 7500 to 4000 years B.P. (before present)-- long before humans invented industrial pollution.

Compiled by R.S. Bradley and J.A. Eddy based on J.T. Houghton et al., *Climate Change: The IPCC Assessment*, Cambridge University Press, Cambridge, 1990 and published in *EarthQuest*, vo. 1, 1991.

Courtesy of Thomas Crowley, [Remembrance of Things Past: Greenhouse Lessons from the Geologic Record](#)



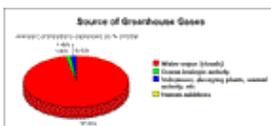
([view full-size image](#))

Figure 1

2. CO₂ in our atmosphere has been increasing steadily for the last 18,000 years-- long before humans invented smokestacks (**Figure 1**). **Unless you count campfires and intestinal gas, man played no role in the pre-industrial increases.**

As illustrated in this chart of **Ice Core data from the Soviet Station Vostok in Antarctica**, CO₂ concentrations in earth's atmosphere move with temperature. Both temperatures and CO₂ have been steadily increasing for 18,000 years. Ignoring these 18,000 years of data "global warming activists" contend recent increases in atmospheric CO₂ are unnatural and are the result of only 200 years or so of human pollution causing a runaway greenhouse effect.

Incidentally, earth's temperature and CO₂ levels today have reached levels similar to a previous interglacial cycle of 120,000 - 140,000 years ago. From beginning to end this cycle lasted about 20,000 years. This is known as the **Eemian Interglacial Period** and the earth returned to a full-fledged **ice age** immediately afterward.



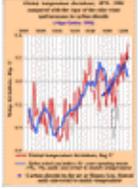
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Figure 2

3. Total human contributions to greenhouse gases account for only about 0.28% of the "greenhouse effect" (Figure 2). **Anthropogenic (man-made) carbon dioxide (CO₂) comprises about 0.117% of this total, and man-made sources of other gases (methane, nitrous oxide (NOX), other misc. gases) contributes another 0.163% .**

Approximately 99.72% of the "greenhouse effect" is due to natural causes -- mostly water vapor and traces of other gases, which we can do

nothing at all about. Eliminating human activity altogether would have little impact on climate change.



[view full-size image](#)

4. If global warming is caused by CO2 in the atmosphere then does CO2 also cause increased sun activity too?

This chart adapted after *Nigel Calder (6)* illustrates that variations in sun activity are generally proportional to both variations in atmospheric CO2 and atmospheric temperature (Figure 3).

Figure 3 Put another way, rising Earth temperatures and increasing CO2 may be "effects" and our own sun the "cause".

FuN FAcTS about CARBON DIOXIDE

- ☛ Of the 186 billion tons of CO2 that enter earth's atmosphere each year from all sources, only 6 billion tons are from human activity. Approximately 90 billion tons come from biologic activity in earth's oceans and another 90 billion tons from such sources as volcanoes and decaying land plants.
- ☛ At 368 parts per million CO2 is a minor constituent of earth's atmosphere-- [less than 4/100ths of 1% of all gases present](#). Compared to former geologic times, earth's current atmosphere is [CO2- impoverished](#).
- ☛ CO2 is odorless, colorless, and tasteless. Plants absorb CO2 and emit oxygen as a waste product. Humans and animals breathe oxygen and emit CO2 as a waste product. Carbon dioxide is a nutrient, not a pollutant, and all life-- plants and animals alike-- benefit from more of it. All life on earth is carbon-based and CO2 is an essential ingredient. When plant-growers want to stimulate plant growth, they introduce more carbon dioxide.
- ☛ CO2 that goes into the atmosphere does not stay there but is continually recycled by terrestrial plant life and earth's oceans-- the great retirement home for most terrestrial carbon dioxide.
- ☛ If we are in a global warming crisis today, even the most aggressive and costly proposals for limiting industrial carbon dioxide emissions would have a negligible effect on global climate!

The case for a "greenhouse problem" is made by environmentalists, news anchormen , and special interests who make inaccurate and misleading statements about global warming and climate change. Even though people may be skeptical of such rhetoric initially, after awhile people start believing it must be true because we hear it so often.

📌 "We have to offer up scary scenarios, make simplified, dramatic statements, and make little mention of any doubts we may have. Each of us has to decide what the right balance is between being effective and being honest."

Stephen Schneider (leading advocate of the global warming theory)
(in interview for *Discover* magazine, Oct 1989)

📌 "In the United States...we have to first convince the American People and the Congress that the climate problem is real."

former President Bill Clinton in a 1997 address to the United Nations

📌 "In the long run, the replacement of the precise and disciplined language of science by the misleading language of litigation and advocacy may be one of the more important sources of damage to society incurred in the current debate over global warming."

Dr. Richard S. Lindzen
(leading climate and atmospheric science expert- MIT) (3)

📌 "Researchers pound the global-warming drum because they know there is politics and, therefore, money behind it. . . I've been critical of global warming and am *persona non grata*."

Dr. William Gray
(Professor of Atmospheric Sciences at Colorado State University, Fort Collins, Colorado and leading expert of hurricane prediction)

(in an interview for the *Denver Rocky Mountain News*, November 28, 1999)

"Science should be both compelling and widely accepted before Federal regulations are promulgated."

Dr. David L. Lewis

(27-year veteran of the U.S. Environmental Protection Agency and critic of the agency's departure from scientific rationale in favor of political agenda)
(in an interview for *Nature Magazine*, June 27, 1996)

"Scientists who want to attract attention to themselves, who want to attract great funding to themselves, have to (find a) way to scare the public . . . and this you can achieve only by making things bigger and more dangerous than they really are."

Petr Chylek

(Professor of Physics and Atmospheric Science, Dalhousie University, Halifax, Nova Scotia)
Commenting on reports by other researchers that Greenland's glaciers are melting.
(*Halifax Chronicle-Herald*, August 22, 2001) (8)

"Even if the theory of global warming is wrong, we will be doing the right thing -- in terms of economic policy and environmental policy."

Tim Wirth, while U.S. Senator, Colorado.

After a short stint as **United Nations Under-Secretary for Global Affairs** (4)
he now serves as **President, U.N. Foundation**, created by [Ted Turner](#) and his \$1 billion "gift"

"No matter if the science is all phony, there are collateral environmental benefits.... Climate change [provides] the greatest chance to bring about justice and equality in the world."

Christine Stewart, Minister of the Environment of Canada
recent quote from the *Calgary Herald*

Unraveling the Earth's Temperature Record

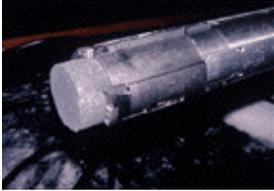


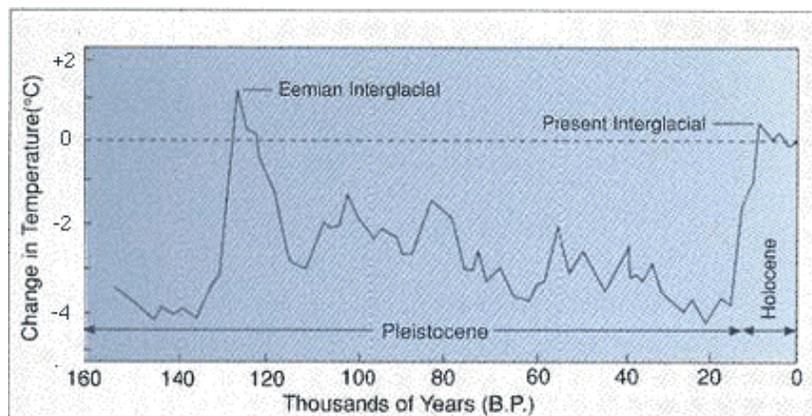
photo by: Vin Morgan

[Palaeo Environment \(Ice Cores\) Field Work](#)

Because accumulating layers of glacial ice display annual bands which can be dated, similar to annual rings of a tree, the age of ice core samples can be determined. Continuous ice cores from borings as much as two miles long have been extracted from permanent glaciers in Greenland, Antarctica, and Siberia. Bubbles of entrapped air in the ice cores can be analyzed to determine not only carbon dioxide and methane concentrations, but also atmospheric temperatures can be determined from analysis of entrapped hydrogen and oxygen.

Based on historical air temperatures inferred from ice core analyses from the Antarctic Vostok station in 1987, relative to the average global temperature in 1900 it has been determined that from 160,000 years ago until about 18,000 years ago Earth temperatures were on average about 3° C cooler than today.

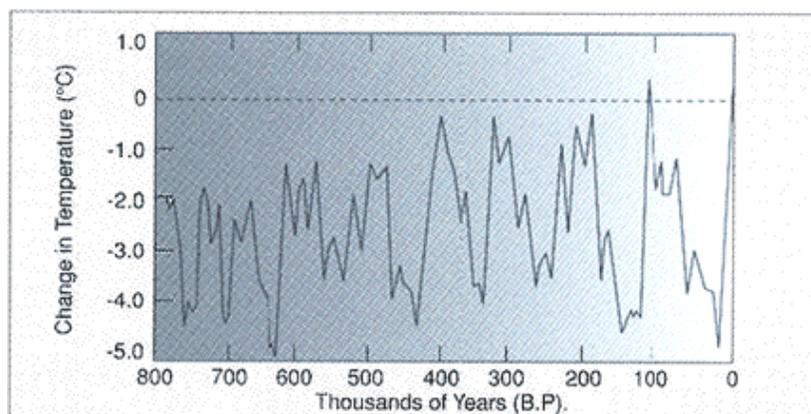
Except for two relatively brief interglacial episodes, one peaking about 125,000 years ago (Eemian Interglacial), and the other beginning about 18,000 years ago (Present Interglacial), the Earth has been under siege of ice for the last 160,000 years.



Compiled by R.S. Bradley and J.A. Eddy based on J. Jouzel et al., Nature vol. 329. pp. 403-408, 1987 and published in EarthQuest, vol. 5, no. 1, 1991. Courtesy of Thomas Crowley, [Remembrance of Things Past: Greenhouse Lessons from the Geologic Record](#)

As illustrated in this final graph, over the past 800,000 years the Earth has undergone major swings in warming and cooling at approximately 100,000 year intervals, interrupted by minor warming cycles at shorter intervals. This represents periods of glacial expansion, separated by distinct but

relatively short-lived periods of glacial retreat.



Temperature data inferred from measurements of the ratio of oxygen isotope ratios in fossil plankton that settled to the sea floor, and assumes that changes in global temperature approximately tracks changes in the global ice volume. Based on data from J. Imbrie, J.D. Hays, D.G. Martinson, A. McIntyre, A.C. Mix, J.J. Morley, N.G. Pisias, W.L. Prell, and N.J. Shackleton, in A. Berger, J. Imbrie, J. Hays, G. Kukla, and B. Saltzman, eds., *Milankovitch and Climate*, Dordrecht, Reidel, pp. 269-305, 1984. Courtesy of Thomas Crowley, [Remembrance of Things Past: Greenhouse Lessons from the Geologic Record](#)

The Polar Ice Cap Effect



As long as the continent of Antarctica exists at the southern pole of our planet we probably will be repeatedly [pulled back into glacial ice ages](#). This occurs because ice caps, which cannot attain great thickness over open ocean, can and do achieve great thickness over a polar continent-- like Antarctica. Antarctica used to be located near the equator, but over geologic time has moved by [continental drift](#) to its present location at the south pole. Once established, continental polar ice caps act like huge cold sinks, taking over the climate and growing bigger during periods of reduced solar output. Part of the problem with shaking off the effects of an ice age is once ice caps are established, they cause solar radiation to be reflected back into space, which acts to perpetuate global cooling. This increases the size of ice caps which results in reflection of even more radiation, resulting in more cooling, and so on.

Continental polar ice caps seem to play a particularly important role in ice ages when the arrangement of continental land masses restrict the free global circulation of equatorial ocean currents. This is the case with the continents today, as it was during the [Carboniferous Ice Age](#) when the supercontinent **Pangea** stretched from pole to pole 300 million years ago.

Stopping Climate Change

Putting things in perspective, geologists tell us our present warm climate is a mere blip in the history of an otherwise cold Earth. Frigid Ice Age temperatures have been the rule, not the exception, for the last couple of million years. This kind of world is not totally inhospitable, but not a very fun place to live, unless you are a polar bear.

Some say we are "[nearing the end of our minor interglacial period](#)", and may in fact be on the brink of another Ice Age. If this is true, the last thing we should be doing is limiting carbon dioxide emissions into the atmosphere, just in case they may have a positive effect in sustaining present temperatures. The smart money, however, is betting that there is some momentum left in our present warming cycle. Environmental advocates agree: resulting in a shift of tactics from the "**global cooling**" scare of the 1970s to the "**global warming**" threat of the 1980s and 1990s.

Now, as we begin the 21st century the terminology is morphing toward "**climate change**," whereby no matter the direction of temperature trends-- up or down-- the headlines can universally blame humans while avoiding the necessity of switching buzz-words with the periodicity of solar cycles. Such tactics may, however, backfire as peoples' common sensibilities are at last pushed over the brink.

Global climate cycles of warming and cooling have been a natural phenomena for hundreds of thousands of years, and it is unlikely that these cycles of dramatic climate change will stop anytime soon. We currently enjoy a warm Earth. Can we count on a warm Earth forever? The answer is most likely... no.

Since the climate has always been changing and will likely continue of its own accord to change in the future, instead of crippling the U.S. economy in order to achieve small reductions in global warming effects due to manmade additions to atmospheric carbon dioxide, our resources may be better spent making preparations to adapt to global cooling and global warming, and the inevitable consequences of fluctuating ocean levels, temperatures, and precipitation that accompany climatic change.

Supporting this view is British scientist [Jane Francis](#), who maintains:

" What we are seeing really is just another interglacial phase within our big icehouse climate." Dismissing political calls for a global effort to reverse climate change, she said, "**It's really farcical because the climate has been changing constantly... What we should do is be more aware of the fact that it is changing and that we should be ready to adapt to the change."**

THIS PAGE BY :



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This site last updated August 28, 2006



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References

- (1) [A scientific Discussion of Climate Change](#), Sallie Baliunas, Ph.D., Harvard- Smithsonian Center for Astrophysics and Willie Soon, Ph.D., Harvard- Smithsonian Center for Astrophysics.
- (2) [The Effects of Proposals for Greenhouse Gas Emission Reduction](#); Testimony of Dr. Patrick J. Michaels, Professor of Environmental Sciences, University of Virginia, before the Subcommittee on Energy and Environment of the Committee on Science, United States House of Representatives
- (3) [Statement Concerning Global Warming](#)-- Presented to the Senate Committee on Environmental and Public Works, June 10, 1997, by Dr. Richard S. Lindzen, Massachusetts Institute of Technology
- (4) Excerpts from, "[Our Global Future: Climate Change](#)", Remarks by Under Secretary for Global affairs, T. Wirth, 15 September 1997. Site maintained by [The Globe - Climate Change Campaign](#)
- (5) [Testimony of John R. Christy](#) to the Committee on Environmental and Public Works, Department of Atmospheric Science and Earth System Science Laboratory, University of Alabama in Huntsville, July 10, 1997.
- (6) *The Carbon Dioxide Thermometer and the Cause of Global Warming*; Nigel Calder,-- Presented at a seminar SPRU (Science and Technology Policy Research), University of Sussex, Brighton, England, October 6, 1998.
- (7) *Variation in cosmic ray flux and global cloud coverage: a missing link in solar-climate relationships*; H. Svensmark and E. Friis-Christiansen, *Journal of Atmospheric and Solar-Terrestrial Physics*, vol. 59, pp. 1225 - 1232 (1997).
- (8) *First International Conference on Global Warming and the Next Ice Age*; Dalhousie University, Halifax, Nova Scotia, sponsored by the Canadian Meteorological and Oceanographic Society and the American Meteorological Society, August 21-24, 2001.

Additional Reading

[Understanding Common Climate Claims](#): Dr. Richard S. Lindzen; Draft paper to appear in the Proceedings of the 2005 Erice Meeting of the World Federation of Scientists on Global Emergencies.

[Geological Constraints on Global Climate Variability](#): Dr. Lee C. Gerhard-- A variety of natural climate drivers constantly change our climate. A slide format presentation. 8.5 MB.

[Thoughts of Global Warming](#): "The bottom line is that climatic change is a given. It is inescapable, it happens. There is no reason to be very concerned about it or spend bazillions of dollars to try and even things out.

[NOAA Paleoclimatology](#): An educational trip through earths distant and recent past. Also contains useful information and illustrations relating to the causes of climate change.

[Cracking the Ice Age](#): From the PBS website-- NOVA online presents a brief tour of the causes of global warming.

[Little Ice Age \(Solar Influence - Temperature\)](#): From the online magazine, "CO2 Science."

[Solar Variability and Climate Change](#): by Willie Soon, January 10, 2000

[Earth's Fidgeting Climate](#): NASA Science News "It may surprise many people that science cannot deliver an unqualified, unanimous answer about something as important as climate change"
