THE CARBON DIOXIDE STORY

Conventional wisdom among environmentalists is that the increased carbon dioxide emissions by man since 1850 are causing global warming, and that increased carbon dioxide is on the verge of resulting in numerous catastrophes, such as ***acidification of the ocean***s (destruction of ocean life), ***runaway global warming***, ***massive flooding of the seacoast***, ***loss of species in the Arctic*** due to melting of the Polar Ice Cap, etc. ***But, is this "Conventional Wisdom" really just the "Mass Ignorance" of these concerned, well-meaning individuals?***

Before one makes an effort to control the levels of carbon dioxide, the following questions should be asked---**and answered**:

A. How well do the levels of carbon dioxide correlate to the temperature levels of the Earth?
B. How much of the greenhouse gaseous heating of the Earth is contributed by carbon dioxide?
C. How much does man actually contribute to this global warming?
D. What is the highest level of carbon dioxide seen by the Earth when a healthy animal and plant life environment occurred?
E. Would doubling the carbon dioxide actually cause a measurable rise in global temperatures?
F. Will the increase in the carbon dioxide level expected in the next 50 years:
    (1) Cause runaway global warming like the planet Venus?
    (2) Cause acidification of the ocean, essentially destroying life in the ocean as we know it?
    (3) Adversely affect plant life?
    (4) Cause uncontrolled flooding and damage to our coastal communities?
G. What is the desirable temperature of the Earth?
H. How does global warming affect seasonal temperatures?
I. Does global warming result in more hurricanes and cause more severe hurricanes to impact United States?
J. Can we really cause a meaningful reduction of global temperatures at a modest cost to the economy by decreasing America's carbon dioxide emissions?
K. Can we economically sequester carbon dioxide, preventing it

from reaching the atmosphere?

L. If carbon dioxide is not the cause of warming, what is?

M. What do the planets tell us about global warming?

N. What have we learned about carbon dioxide from ice core data?

A. Carbon Dioxide vs. Temperature Data

If the environmentalists and IPCC are correct, one would expect an excellent correlation between carbon dioxide levels and temperatures. However, ***it is very difficult to find any correlation***. For example, the National Oceanic and Atmospheric Administration and the National Climate Data Center released the 2006 Annual Climate Review—US Summary on 21 June 2007--- in which they listed the 25 hottest years in United States in the 110 years for which reliable records have been kept (1895-2006). I have listed these with their carbon dioxide levels.

Hottest Years	Carbon Dioxide Levels (ppm)
1. 1998	366
2. 1934	307
3. 2006	381
4. 1999	367
5. 1921	304
6. 1931	305
7. 1990	354
8. 2001	371
9. 1953	313
10. 1954	314
11. 2005	379
12. 1987	349
13. 1986	347
14. 1939	307
15. 1938	307
16. 1981	340
17. 1991	355
18. 2003	375
19. 2000	369
20. 1946	310
21. 1933	307
22. 2002	373

23. 2004	377
24. 1994	360
25. 1941	307

As you can see, the year 1934, with carbon dioxide levels of 307 ppm, was hotter than 108 of the remaining 109 other years! Similarly, 1921 and 1931, with carbon dioxide levels of 304-305 ppm were hotter than 105 other years, including 17 that had carbon dioxide levels of 349-381 ppm. In the 15 hottest years, 7 of them had carbon dioxide levels of 314 or lower, while 8 had levels of 345-381.

Hardly a correlation, but a random occurrence!

If you check the 2008 New York Times World Almanac, you will find that 21 states recorded their ***all-time temperature highs*** in the 1930's (306-308 ppm CO_2), which NASA recently admitted was the hottest decade. These data cover all temperatures recorded since 1883 (124 years). Only 6 of the states recorded ***all-time highs*** in the decade of the 1990's (354-367 ppm CO_2), while only 1 was recorded in the 2000-2006 period. Again, there is no correlation.

Now, let's compare the carbon dioxide and solar radiation levels with temperatures in the Arctic region. These data were compiled by Dr. Willie Soon, a Harvard-Smithsonian astrophysicist (Reference 3).

CO_2 AND ARCTIC TEMPERATURES

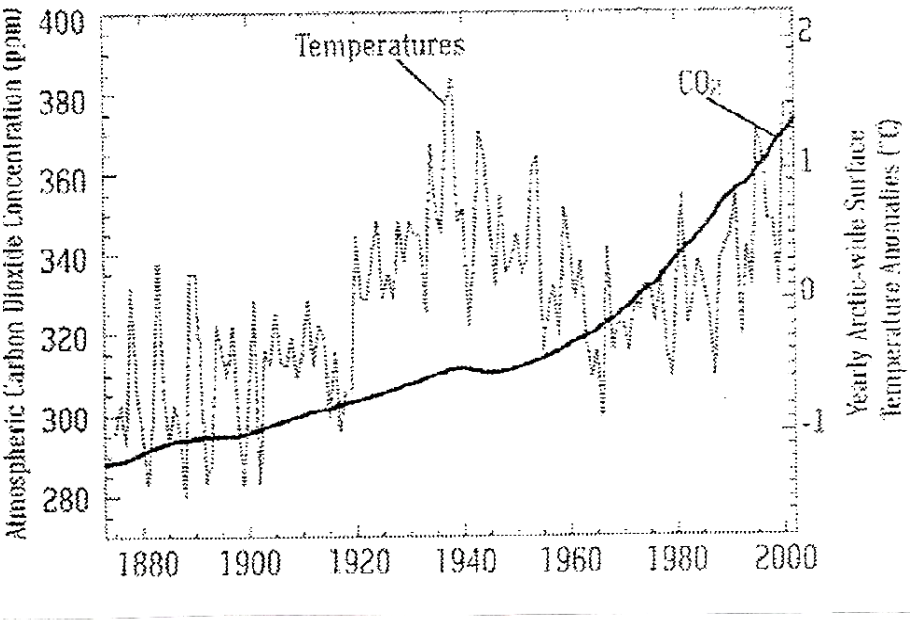

Figure 8. CO_2 vs. Arctic Temperatures---1875-2000

SOLAR RADIANCE vs. ARCTIC TEMPERATURES

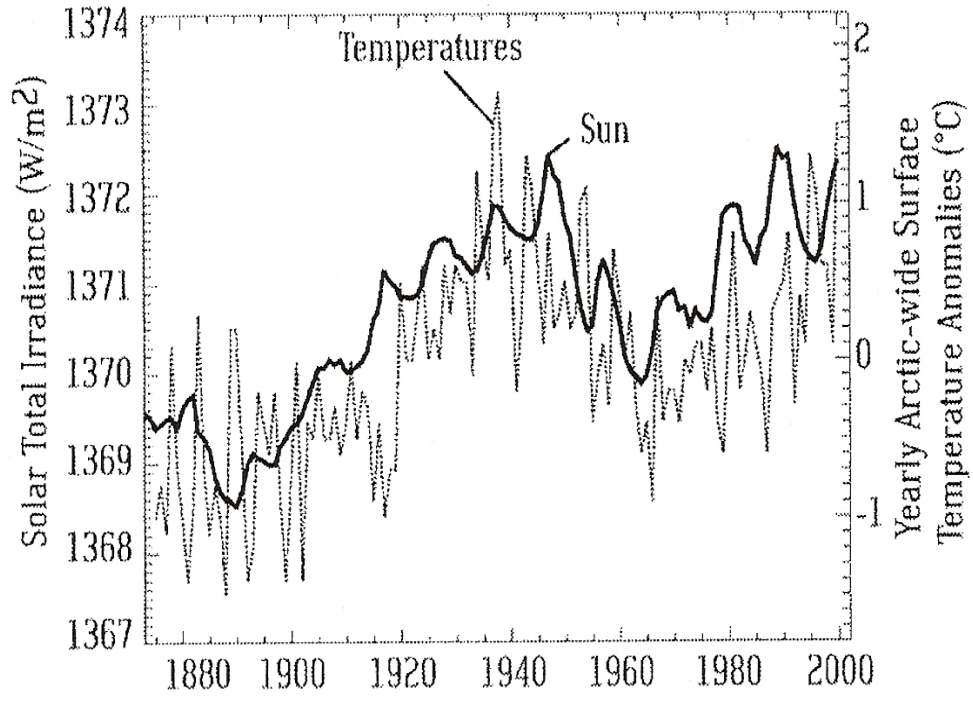

Figure 9. Solar Radiance vs. Arctic Temperatures---1875-2000

CONCLUSION: There is virtually no correlation between carbon dioxide levels and the temperature, but there is an excellent correlation between the solar flux and the temperature.

A possible explanation for the lack of correlation between carbon levels and temperature is that it only takes a small level of carbon dioxide to completely absorb the 15-micron radiation band from the Earth. Some Internet sources say this frequency is totally absorbed by the carbon dioxide in the first 10 feet of the atmosphere (others say it is absorbed totally in the first 100 feet of the atmosphere). Any additional carbon dioxide can't absorb more than the 100% of the 15-micron radiation emitted. However, since I cannot verify this, I put my trust in the actual testing of Dr. Heinz Hug (See section E, below).

B. Carbon Dioxide's Contribution to Global Warming

As previously discussed, greenhouse gases, by transferring heat back and forth between the Earth and the atmosphere, delays the loss of infrared radiation to outer space. Carbon dioxide absorbs this long-wave radiation primarily in a 15 micron band (actually14.7-16.5 microns). Greenhouse gases add 59F to the Earth's heating. Carbon dioxide accounts for only 5% of this or 2.95^{o}F, water vapor accounts for ~94.5% of this or 55.75F, while methane accounts for about 0.5% or 0.295^{o}F (Reference 1).

Conclusion: Carbon dioxide, as a greenhouse gas, contributes less than 3 degrees to the heating of the Earth by greenhouse gases.

C. Man's Contribution to Global Warming

Yearly carbon emissions by **man** into the atmosphere are 6.3 BT (billion tons) of carbon. (Note that emissions are only recorded in all scientific articles on global warming as carbon weight, not carbon dioxide weight,) The carbon dioxide weight is 44÷12 times as much, or in this case, ~23 BT). By a change of land use, such as plowing the ground, man also adds 1.6 BT of carbon into the atmosphere per year.

Each year **Nature** puts 200 BT of carbon into the atmosphere (Figure 10). The ocean contributes 90 BT from heating and agitation. Plant respiration contributes 50 BT, and bacterial decay of organic material contributes 60 BT.

(Note: Other sources in the literature on the "carbon cycle", show slightly different values, yet they all are close to the carbon cycle shown below.)

Each year nature removes 204.7 BT of carbon. Photosynthesis by plants removes 111 BT, the oceans remove 92 BT, and unknown sources remove 1.7 BT. This leaves a net increase of 3.2BT of carbon or a 1.54 ppm carbon dioxide increase going into the atmosphere.

Man accounts for only ~3.2% of the of the yearly carbon emissions, so, conservatively, one could say that each year man accounts for 3.2% of the yearly heating increase. If we concur that the global temperatures increased by 0.88F in the last 158 years (Page 21), then the temperature increased an average of ~0.0058F per year. ***Man could have contributed 3.2% of this or 0.000186^{o}F per year or 186 millionths of a degree Fahrenheit per year***. This assumes that carbon dioxide increases actually do result in temperature increases, which they don't seem to correlate per the previous section.

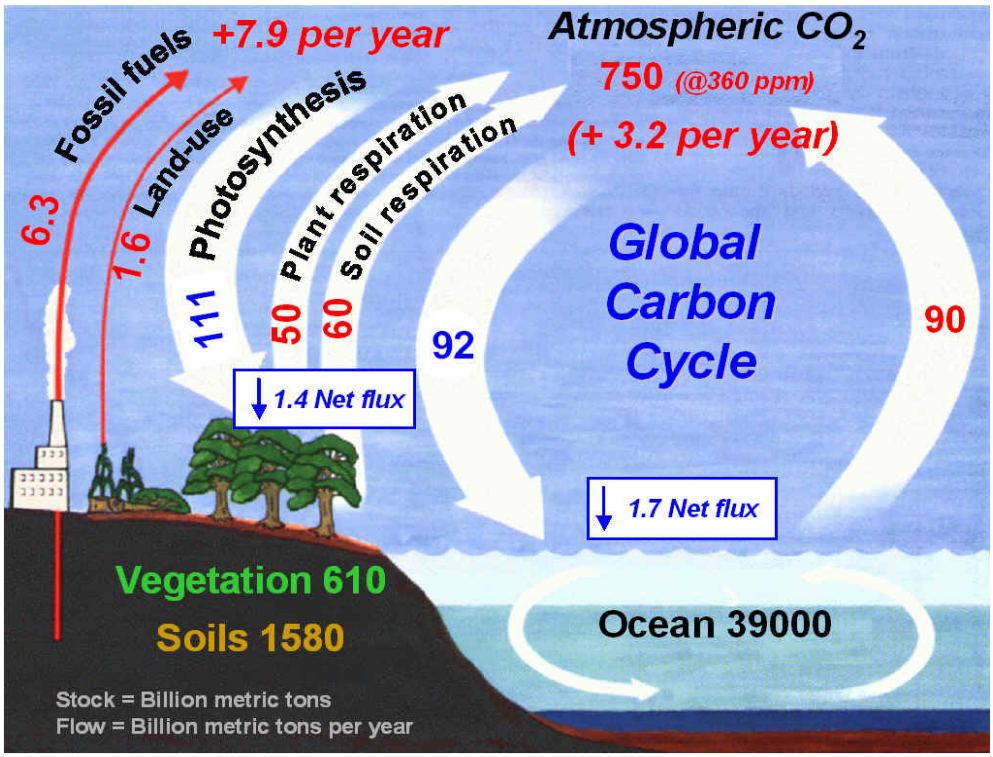

Figure 10. Global Carbon Cycle*

*Present atmospheric carbon levels are 790BT and CO_2 levels are 380 ppm.

CONCLUSION: ***Reducing the carbon dioxide emissions to 1990 levels, as specified by the Kyoto Treaty are virtually useless in controlling the temperature increase, even if it were caused by carbon dioxide, which it isn't. Why spend the money to cut emissions for essentially no gain?***

D. Historic Levels of Carbon Dioxide on the Earth

Many scientists believe that Venus, Earth, and Mars all started out with about the same atmosphere, resulting from the release of gases from the molten cores of the planets. If you consider a standard atmosphere to have a pressure of 14.7psi (like the Earth does), Venus has about 91 standard atmospheres of carbon dioxide and about 3.5 standard atmospheres of nitrogen. The Earth has 1.23 times the mass of Venus, and probably started with 112 atmospheres of carbon dioxide (Reference 4) some 4.65 billion years ago. This is almost 300,000 times as much carbon dioxide as we have now in the atmosphere. Obviously, it didn't stop life from forming 3.5 billion years ago. What happened to all the carbon dioxide? Where did it go?

Rain took carbon dioxide out of the air as carbonic acid. Carbonic acid reacted with silicates, resulting in 65,000,000 BT (billion tons) of carbon as mineral carbonates. Some 39,000 billion tons ended up in today's ocean, and ~790 BT in today's atmosphere. Decay products of early plant life account for an estimated 4000 BT of coal, 500 BT of oil, and 500 BT of carbon as natural gas.

The carbon dioxide in today's oceans is in equilibrium with the atmospheric carbon dioxide and is about 52 times the atmospheric levels. This carbon dioxide is the fuel for phytoplankton, the plants which are on the bottom of the food chain in the oceans.

Multi-celled plants and animals came into existence about 700,000,000 years ago. The Cambrian explosion (580 million years ago) saw the rapid formation of millions of plant and animal species. The advent of multi-celled animal species took quite a while to occur (2.8 billion years), because single-celled plants had to first create an oxygen atmosphere in which animals could exist.

CARBON DIOXIDE LEVELS---PAST 600 MILLION YEARS (Black)

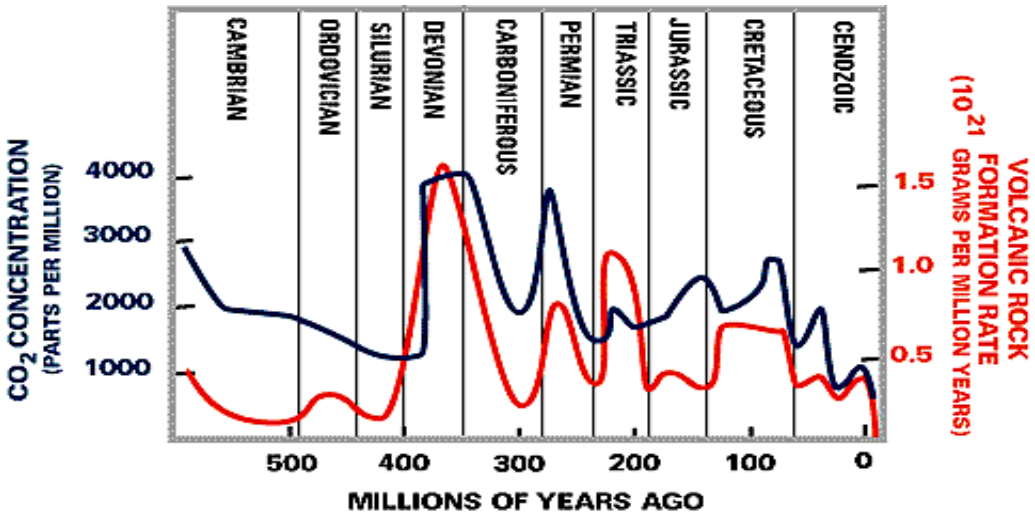

Figure 11. Carbon Dioxide Levels---Past 600 Million Years

Figure 11 is one scientist's analysis of early carbon dioxide levels and many different scientists, as always, differ somewhat from this, but are in the same ballpark.

As you can see, the black line represents carbon dioxide levels. The carbon dioxide level did not drop below 1000 parts per million until just a few million years ago. In other words, during more than 99+% of the existence of multi-celled plants and animals, the carbon dioxide levels were 2.7 to 11 times as high as present levels. Imagine, there was no tipping point!

It was reported in mid-February, 2008, that the present carbon dioxide level is the highest it has been in the last 600,000 years. This is just another way of saying that during 99.9% of the history of multi-celled life, the carbon dioxide levels were above the present levels.

The optimum level of CO_2 for plant growth is ~1000 ppm and this level is actually used in greenhouses to accelerate plant growth. (See http://www.omafra.gov.on.ca/english/crops/facts/00-077.htm.) An interesting observation is that increased carbon dioxide can stimulate plant growth by 84% by simply doubling the carbon dioxide level while reducing the needs for water by 17-27%, depending on the species (Reference 2). We are only at 380 parts per million today. From the plant's point of view, we are not at optimum carbon dioxide levels today! They should be higher. Maybe God is telling us something!

Conclusion: ***The present levels of carbon dioxide represent the lower end of the scale, based on the Earth's history. There is absolutely no reason to panic!***

E. Effect of Doubling the Carbon Dioxide Concentration

Dr. Heinz Hug showed by tests that doubling carbon dioxide concentrations from 357 ppm to 714 ppm resulted in only a 0.17% increase in energy absorption. This is $1/80^{th}$ of the values theoretically calculated by the IPCC for "radiative forcing". ***When test data conflicts with theory, one has to believe the test data!*** **(**http://www.john-daly.com/artifact.htm)

At present, there is one molecule of CO_2 for every 2630 molecules of air. This is the molecule, without which, multi-celled plants and animals cannot survive. It seems that we should have ***higher concentrations*** to ensure the survival of our species. There is one oxygen molecule for every 5 molecules of air.

Conclusion: ***Who cares if the CO_2 levels may double? It will not increase the temperatures, but will actually speed up growth of agricultural produce.***

F. Unfounded Carbon Dioxide Worries

Runaway Global Warming. The planet Venus has more than 90 times the atmospheric pressure of the present Earth's atmosphere. Venus has an average surface temperatures of 867^{o}F. This is supposedly the result of too much greenhouse heating due to the carbon dioxide. Does this mean runaway global heating could occur on the Earth?

There are at least 4 reasons that this will not happen on Earth at our present solar flux levels: (1) Venus is much closer to the sun (67 million miles vs. 92.2 million miles) and receives 90% more heat, (2) Venus has no oceans. Oceans not only heat up very slowly (high heat capacity), but also produce evaporation and clouds that reflect solar radiation. I suspect the oceans on Venus, if they existed, boiled away and the water vapor was blown away by solar winds, (3) Venus has a day that is 116.75 Earth days long, allowing for excessive continuous heating, and (4) The Earth had a similar initial atmosphere of CO_2 and ***runaway global warming simply did not take place.*** In 1 Billion more years, the sun will emit 10% more heat and scientist predict the oceans will evaporate. Life will have perished by then.

Dangerous Acidification of the Oceans. Increased carbon dioxide in the atmosphere, will dissolve into the ocean, increasing its acidity. We know at least 11 times as much carbon dioxide was well tolerated by species during the Cambrian explosion and ocean life has continued for 600 million years. Certain species may indeed be vulnerable, but others will come into existence.

Increasing carbon dioxide may actually increase phytoplankton growth. The extra carbon dioxide also provides for species to make more calcium carbonate shells. In the past 600 million years, the acidification did not destroy the shellfish.

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Adversely Plant Life Effects. As mentioned before, plants will increase their rate of growth if carbon dioxide increases. It is possible that certain plants (weeds) will benefit over other slower growing plants, but that is just nature's way. Life is not stagnant, but dynamic, and the heartier species will survive.

Massive Coastal Flooding. Sea levels will continue to rise, but very slowly. We have observed that oceans have risen 394 feet in the last 20,000 years as the glaciers covering the Northern Hemisphere melted. The oceans rose ~7.2 inches in the last 100 years (based on tidal gages) and may indeed do the same in the next century. Throughout history, the oceans have been up and down, at times being 1300 feet higher than the lowest levels (Reference 5). Much of Europe, Central America, and all of Florida have been submerged at one time or another. This is due to the ocean floor spreading and/or subduction of tectonic plates as well as temperatures. An ocean temperature increase of 1.8F will, due to volume expansion, result in a 24-inch rise in sea levels (Reference 5).

Conclusion: There will not be runaway global warming, dangerous acidification of the ocean, nor conditions adverse to plant life. Some ocean species may be affected by increased acidification, but the species in the oceans have survived much higher levels in the past 600,000,000 years. Carbon dioxide levels are well below optimum levels for plant growth. Oceans may continue to rise slowly, as they have for several thousand years. See Appendix E for predicted sea level rise data.

G. Desirable Temperature of the Earth

Let us examine the climate back to the time soon after multi-celled plants and animals first appeared on Earth some 600-700 million years ago. The figure below tracks climate back 542 million years.

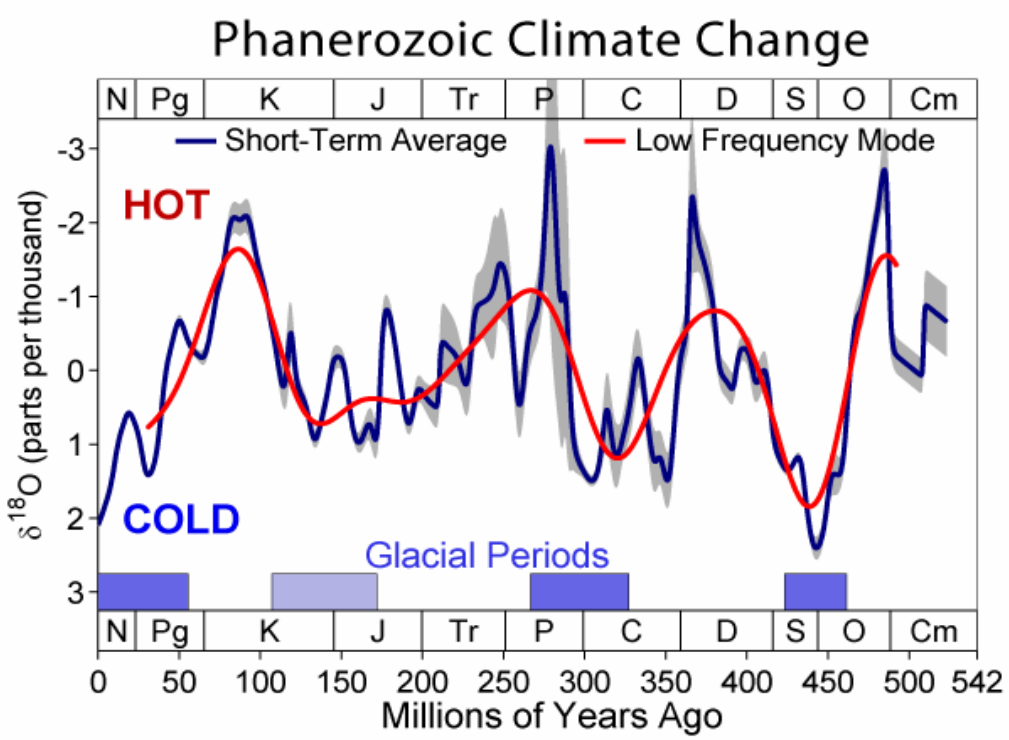

Figure 12. Climate Temperature Changes---Past 542 Million Years

In the upper graph, the vertical scale plots the difference of the heavy oxygen isotope, ^{18}O, from its level in a standard sample of water. This can be correlated with temperatures. In essence, the warmer it is, a greater percentage of ^{16}O is evaporated from the seas, resulting in higher concentrations of the heavier ^{18}O isotope in the ocean. This is then picked up by the shells of marine life. Although the correlation with temperature is somewhat complex, the isotopic concentration does offer an excellent proxy for temperatures.

The blue line represents short term averages. The red line is an attempt to find a repeated long-term cycle for temperature changes. Notice the correlation of ^{18}O levels and glacial periods. From Figure 12, we see that the Earth has been growing progressively cooler over the past 80 million years. About 50 million years ago, a glaciation period started---a period marked by ice age cycles. From Figure 13, we see that the difference of 2 ppm of ^{18}O is equivalent to a10^{o}C (18F) temperature change.

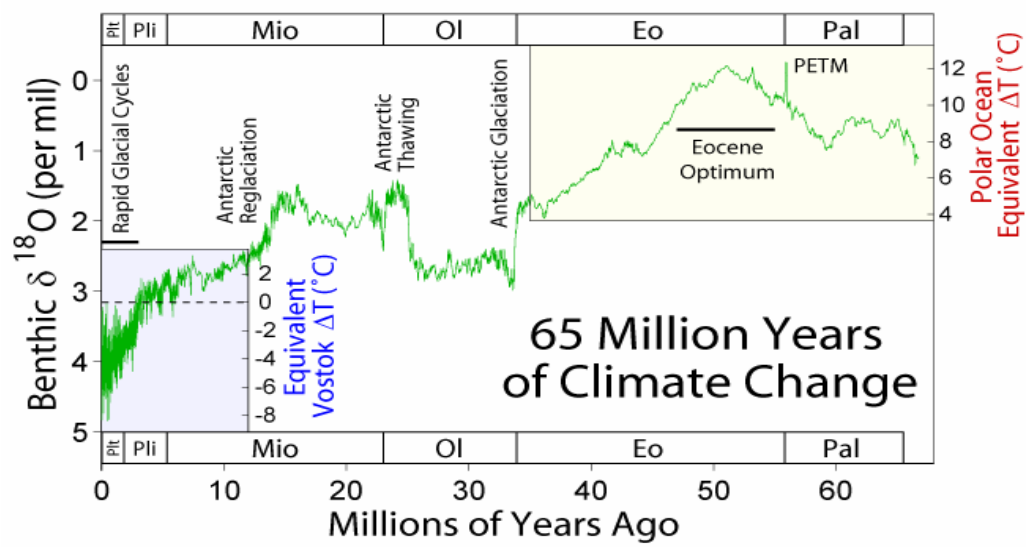

Figure 13. Climate Temperature Change---Past 65 Million Years

This is a chart of the South Polar Regions. This is important because it tells the history of Antarctica. Antarctica carries millions of years of ice core data on the climate and greenhouse gases. Some 65 million years ago Australia broke away from Antarctica. At the time Antarctica was still connected to the southern end of South America. You can see the Earth's south polar sea temperatures 50 million years ago were up to 16°C (28.8°F) hotter than it is now. Antarctic glaciation started about 32 million years ago. About 23 million years ago, Antarctica separated from South America, allowing a polar current to flow completely around it, unimpeded.

The temperature in the last 6 million years is shown in the **Ice-Age** chart below, Figure 14. It is reflected in the lower left of Figure 13, based on ice core data from Antarctica.

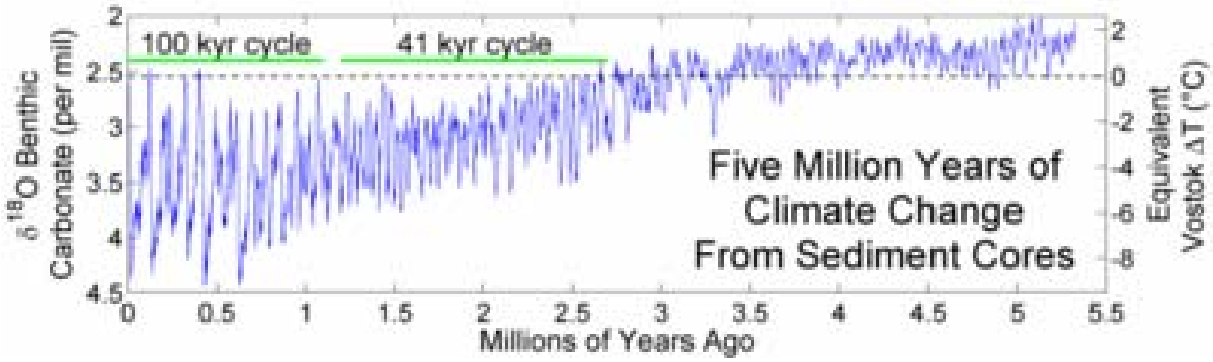

Figure 14. Ice Core Temperature Data---Past 5.3 Million Years

Notice that Ice Ages occurred in 41,000 year cycles up to a million years ago, then, mysteriously, the cycles lengthened to 100,000 years per cycle (Again, you can't blame man for that!). You may recall in the discussion of Ice Ages on page 8 that the tilt in the Earth's axis goes through a 41,000-year cycle, and the eccentricity of the Earth's orbit around the Sun goes in a 95,000-year cycle. Notice, also, that the average global temperature excursions during an Ice Age have been increasing and that the slope of the Ice-Age curve has tended downward in the last three million years toward colder global average temperatures.

Conclusion: The Earth has undergone many temperature changes since multi-celled plants and animals have come into existence. Currently, we are at the coldest period in 450 million years. A major cooling phase started 80 million years ago. It resulted in a glacial period starting about 50 million years ago, during which there have been over 1000 ice age cycles. Average temperatures have continued to go down. Ice age cyclic periods and temperature excursions have also changed in the last million years. The Earth has been up to 25C (45F) hotter than it is now. We just have to live in whatever temperature environment the Earth offers. There is no magic temperature for the Earth. It is what it is!

H. Global Warming and Seasonal Temperatures

Doesn't global warming result in hotter summer days? You may think this is a no-brainer, but you may be surprised at the answer! The measured temperature effect of global warming since 1930 in the United States is as follows per Reference 3:

Summer----0.03F ***cooler*** per decade
Fall----------0.01F ***cooler*** per decade
Winter------0.13F warmer per decade
Spring------0.16F warmer per decade

Global warming results in increasing evaporation of moisture, increasing cloud formation, and the moderating of temperatures. You remember how hot it gets on a cloudless summer day and how much cooler it is on a cloudless night. Global warming actually results in cooler days in summer!

An important feed-back loop in summer days is that increased temperatures *cause* increased cloud cover, which reduces incident solar energy by reflecting it to outer space. That reflected solar energy more than makes up for the trapped energy under the clouds due to greenhouse gases!

Warmer nights are due to the greenhouse gas effect. Winters become milder, again because of the clouds slowing down the heat loss to outer space.

I. Global Warming and Severe Hurricanes

IPCC states in their last report: "The intensity of tropical cyclones (hurricanes) in the North Atlantic has increased in the past 30 years, which correlates with increases in tropical sea surface temperatures."

A number of extremely severe hurricanes were predicted to hit United States in 2006. Not a single hurricane came ashore in US. Again, similar predictions were made for 2007. Again not a single hurricane, not even a category 1, hit the United States coast in 2007.

What went wrong with the IPCC predictions? First, they wanted to gain traction for their global warming agenda by playing up the public's concern from the hurricanes seasons of 2004 and 2005. Second, they made an *assumption* that warmer seas result in more severe hurricanes. Third, they "cherry-picked" their data to support this assumption by using only a 30-year period for analysis of hurricane data.

Let me explain. Had they made their analysis in 2003 and covered the last century, they would have concluded that:

1. The first half of the 20th century had 26 Category 3 hurricanes, while the second half had just 22. (Major hurricanes decreasing.)
2. The first half of the 20th century had 10 Category 4 hurricanes, while the last half had just 5. (Severe hurricanes decreasing.)
3. Regarding the Category 4 hurricanes since 1950, four of these (Hazel-1954, Audrey-1957, Donna-1960, and Carla-1961) occurred within a period of 7 years. Only one other Category 4 hurricane (Hugo-1989) occurred in the next **42** seasons (1962 through 2003). (Severe hurricanes decreasing.)
4. One Category 5 hurricane ("The Labor Day Hurricane of 1935") occurred in the 1900-1950 years, while 2 occurred in the 1951-2000 year period (Camille-1969, Andrew-1992). (Not statistically significant.)

Thus, an analysis at the end of the 2003 season, using a century of data, would have concluded that the number of intense hurricanes was diminishing.

Along came the 2004 season with 2 Category 3 hurricanes (Celia, Jeanine) and one Category 4 hurricane (Charlie), which surprised everyone. This was followed in 2005 by 3 Category 3 hurricanes (Dennis, Katrina,

Rita) and the public's attention was captured. The IPCC was anxious to point out that at one time, all three of these were rated as Category 5, ***but they only hit the shore as Category 3 hurricanes***. (All of US hurricane records are based on the Category at which they actually come ashore.) But the absence of hurricanes in 2006 and 2007 blew apart the assumption that hurricane strength increases with sea temperatures. In fact, a current theory under a great deal of study today, is that higher sea temperatures cause greater vertical wind velocities which "blow off" the tops of the hurricanes, as one investigator stated.

One must also ask, why did those 3 hurricanes in 2005 (Dennis, Katrina, and Rita) weaken so greatly at sea ***before*** coming ashore? The seas were still warm! The public perception is that hurricanes only lose strength ***after*** coming ashore. Apparently we do not fully understand hurricanes.

The mystery of hurricanes continues. What do we know? First, the hurricanes that reach the United States result from low pressure air masses which develop as tropical storms about 15 degrees north of the Equator off the Cape Verde Islands along the west coast of Africa. These storms may wander for up to 28 days to become hurricanes before reaching the United States.

Second, the yearly average number of storms in the Atlantic Basin is 9.7 of which 5.4 reach hurricane strength. (In 1933, a record year, 21 storms developed, 9 of which became hurricanes. In 1995, of the 19 tropical storms in the Atlantic, 11 reached hurricane status.)

Third, ***there are no tropical storms in the South Atlantic, so Brazil and Argentina never experience hurricanes.***

Fourth, winds of low pressure air masses in the Northern Hemisphere rotate counter-clockwise while winds of high pressure air masses rotate clockwise. Low pressure systems will steal the winds from nearby high pressure systems, increasing their severity.

Fifth, world-wide there is an average of 84 tropical storms, of which 45 reach hurricane strength (75 mph winds or greater). There has been no increase in hurricanes or tropical storms world-wide, since the "global warming" concept was first introduced. Incidentally, a total of 152 hurricanes hit the United States coastline between 1900 and 1991.

There is a saying in engineering: "All data, sufficiently tortured, will confess a relationship." In the case of IPCC's data analysis of hurricanes after the 2005 season, this was certainly the case. They tortured their data and these data confessed to a relationship which turned out to be false.

Conclusion: Data does not support an increase in hurricanes or hurricane severity due to global warming.

J. Cost of Reducing Future Carbon Dioxide Levels

The greatest myth on this planet is that we can economically restrict CO_2 emissions.

First, it is doubtful that reducing carbon dioxide emissions will have any measurable effect on temperatures. The 790 billion tons (BT) of carbon in the atmosphere today only contributes a total of 2.95F to greenhouse gas warming of the Earth. Every year man contributes only 3.2% of the carbon dioxide emissions (nature contributes the other 96.8%). The total yearly increase of carbon dioxide emissions in the atmosphere is about 3.2 billion tons of carbon. Even if additional carbon dioxide could increase the greenhouse effect in the same proportion (which it cannot), the yearly temperature rise would be 3.2BT÷790BT multiplied by (2.95F) = 0.0119F per year. Man is responsible for 3.2% of this or 0.00038F increase per year.

Even if we reduced our CO_2 emissions, China and India, and undeveloped nations have refused to limit their emissions, so all we would be doing is penalizing our economies for no significant temperature avoidance. Several European nations found they could not abide by the CO_2 reduction agreements specified in the Kyoto Protocol that they signed up for and are subject to massive fines by the United Nations. (See Appendix F, page 90 for more details.)

Nevertheless, the Senate tried in 2005 to solve this problem, factoring in the loss to the Gross Domestic Product (GDP), by the year 2025 versus the temperature avoidance by the year 2050. Senators, McCain, Bingaman, and Lieberman proposed bills to reduce man-made carbon dioxide emissions (Reference 3):

Bill	Loss to GDP by 2025	CO_2 Avoidance	Warming Avoidance
S132	$1.34 Trillion	17-34 BT	0.04-0.07F
SA 2028	$ 776 Billion	11-21 BT	0.027-0.052F
S 1151	$ 331 Billion	3-6 BT	0.0072-0.0144F

Conclusion: There is no economical way to reduce CO_2 emissions without paying a significant price, yet most of the rest of the world would increase their CO_2 emissions without restraints. No matter what we do, the temperature avoidance is minuscule, but the costs can be prohibitive.

J. Capturing and Sequestering Carbon Dioxide

Is it possible to store CO_2 underground or in the oceans to keep it out of the atmosphere? **Yes!** Can it be done economically? **No!**

Carbon dioxide is a heavy molecule with a molecular weight of 44 compared to that of water which is 18. One would believe that liquid carbon dioxide would sink to the bottom of the ocean and be kept there by gravity. Actually, this has occurred in nature at depths greater than 4000 feet. A large lake of carbon dioxide was found off Taiwan recently. Its surface contains hydrated carbon dioxide, while its subsurface is liquid carbon dioxide.

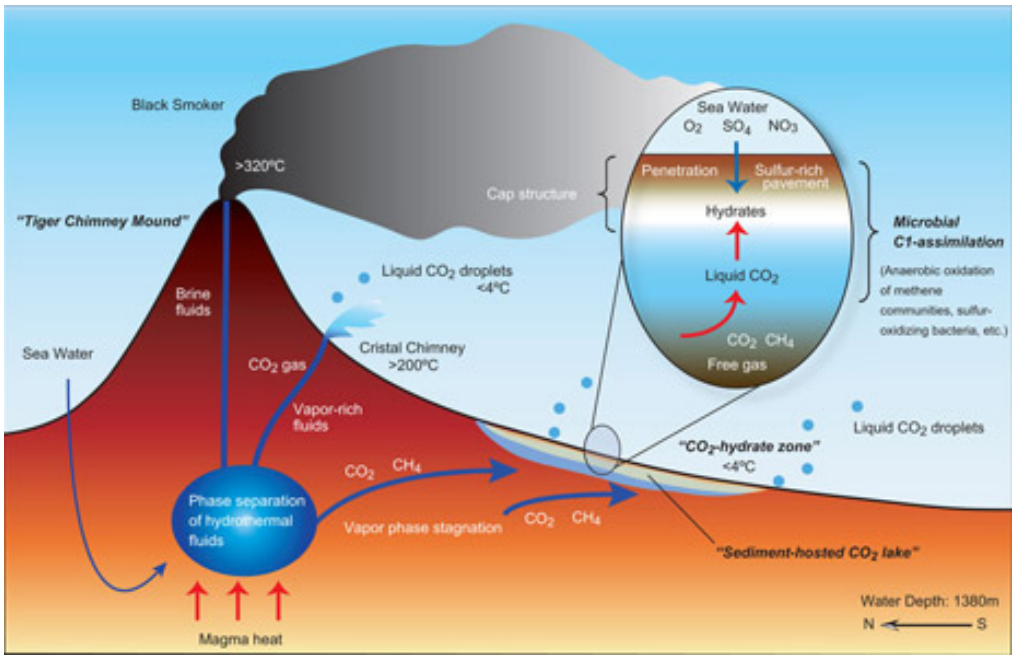

Figure 15. Submerged Carbon Dioxide Lake off the Coast of Taiwan

Is it economical to sequester carbon dioxide in the ocean? No. ***A typical 1000-megawatt electrical power plant will generate 50 million barrels of carbon dioxide.*** The problems and cost of containing, shipping and sequestering it defy any sound economical approach. Carbon dioxide gas is often injected into oil fields to increase the production of oil. It seems like an excellent opportunity to keep carbon dioxide out of the atmosphere, for those who believe it to be a problem (Which I don't). Yet, plants which burn carbon for electricity in US have 3000 times the capacity of a 1000-

megawatt plant (up to 3000 times 50,000,000 barrels of carbon dioxide). Are you willing to pay for that in your electric bill? I'm surely not willing!

Conclusion: Although there are ways to capture (sequester) carbon dioxide to prevent it from returning to the atmosphere, they are not economical.

L. Alternate Cause(s) of Global Warming

On page 17, Figure 2 shows that we have undergone relatively minor cycles of heating and cooling since the last 11,000 years due to the natural variation of the interglacial cycle. This is the most probable cause of our so-called "global warming". We are well within these natural variations. There is some evidence that coal dust from China is landing on our Arctic Ice Cap, increasing the melting. Analysis of Greenland's ice core data, however, shows the Medieval Warm Period was not driven by carbon dioxide nor by methane. It must have been driven by some sort of solar cyclic perturbations.

As previously mentioned, in the 1920's Melutin Milankovitch, a Yugoslavian geophysicist, showed evidence that factors affecting the Earth's tilt and Earth's orbital precession around the sun cause significant variations in the solar flux that occurs at intervals of roughly 22,000, 40,000 and 100,000 years. Repeating some of the pertinent information from page 8 and Figure 1,the change in the tilt of the Earth's axis between 21.5-24.5 degrees occurs in ~4l,000-year periods. ***At 65 degrees north latitude, this results in as much as a 25% change in solar flux from 400 to 500 Watts/m^2. (Internet: Wikipedia under "Ice Age".)***

We learned on page 8, the Earth also wobbles around its axis like a slowing top every 25,800 years. As previously mentioned, the precession of the Earth's orbit around the sun happens every ~95,000 years in which the Earth changes its distance from the sun due to increasing the elliptical nature of its orbit. At present, the Northern Hemisphere is closest to the sun in the winter. Eventually the Northern Hemisphere will be closest to the Sun in the summer. The tidal forces on the Earth from the sun and the moon cause nutations (wobbling) in the angle of the axis. The major tidal force is from the moon and occurs every 18.6 years.

In summary, changes in solar energy occur periodically, and can increase the Earth's solar flux and temperature. We know the 41,000-year and 100,000-year ice age cycles of the past resulted from this. (See page 35, Figure 14).

Conclusion: Warming of the Earth is well within the historic experience with interglacial warming periods which follow an ice age.

M. Global Warming on Planets

Mars has lost ***billions of tons*** of CO_2 ice from the South Polar ice cap in the last few years, as air temperatures have increased +4C (7.2F). ***Man did not cause this!*** The explanation for this is that dust storms on Mars deposited dust, changing the albedo of the ice caps, decreasing their reflectance of sunlight. (Sources—National Geographic, Science News, and NASA---See Science@NASA, Dr. Tony Phillips, August 2003).

Jupiter has indicated a temperature increase of +10F in the last few years, based upon storms which have grown above the clouds. (Source--Imke de Pater and Philip Marcus**,** University of California at Berkeley, June 2004.

Conclusion: You don't need man around for planets to record sharp changes in global warming! These planetary changes are 7-10F in just a few years, compared to our 0.88F increase in the last 158 years!

N. Interesting Ice Core Data on Greenhouse Gases

Ice core data, covering the last 160,000 years, obtained from core drillings in Vostok, Antarctica, have shown three remarkable findings. ***First, the simultaneous rise in carbon dioxide, methane, and oxides of nitrogen occurs solely as a result of temperature increases, not as a result of man.***

The following chart is the basis of the IPCC blaming man for the increase in greenhouse gases as a result of industrialization since the year 1850:

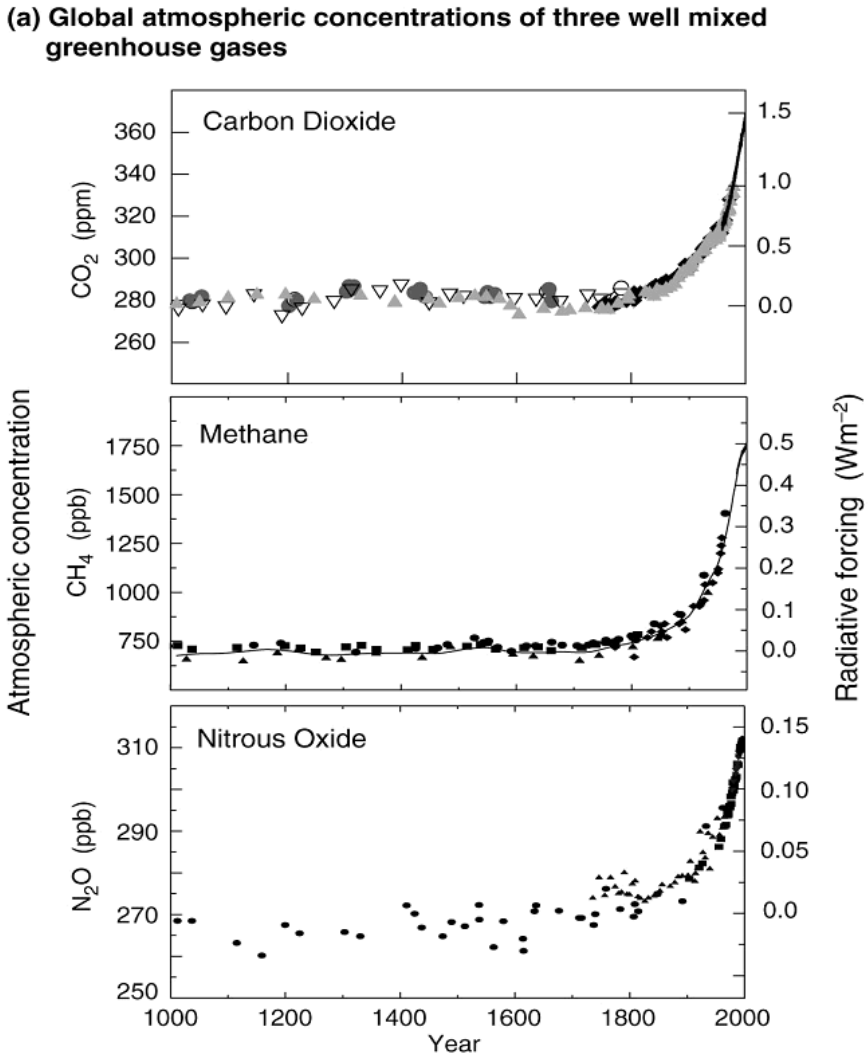

Figure 16. Rise in Greenhouse Gases---Past 1100 Years

Below is a plot of greenhouse gases extracted from ice core samples, going back 600,000 years. Note that the methane (upper plot) and the carbon dioxide (lower plot) rise and fall based on the temperature (middle plot). The temperatures shown were the result of the correlation of the concentration of the heavy ^{18}O isotope. The lower scale plots the years before present time (BP). (Note, similar tracking occurs for oxides of nitrogen, but this was only available on a separate plot, and not included.)

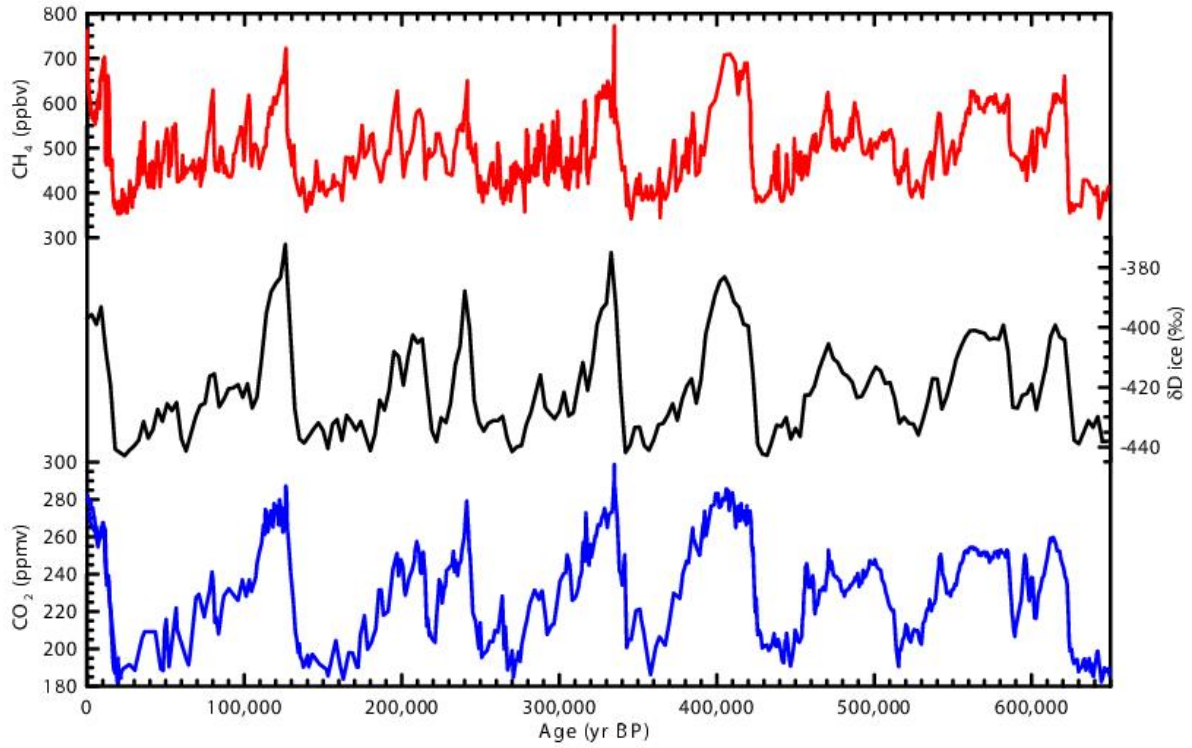

Figure 17. Ice Core Data on Temperature and Greenhouse Gases---Past 650,000 Years.

The second surprise is that the presence of dust in the ice core may be a factor in raising the temperature (Figure 18). Whenever dust (lower plot) gets over ~0.9 parts per million (ppm), significant increases in temperature occur. Note that the CO_2 concentration tracks the temperature rise and fall. One suspects the dust changes the albedo of the ice surface, decreasing reflectivity and increasing absorption of solar energy. This would cause melting. Melting, in turn, further reduces the albedo. This is similar to what happened on the southern ice cap on Mars. As previously mentioned, coal dust from China, depositing in the Earth's Arctic regions, and may be speeding up the melting of the Arctic ice cap! We don't know for certain.

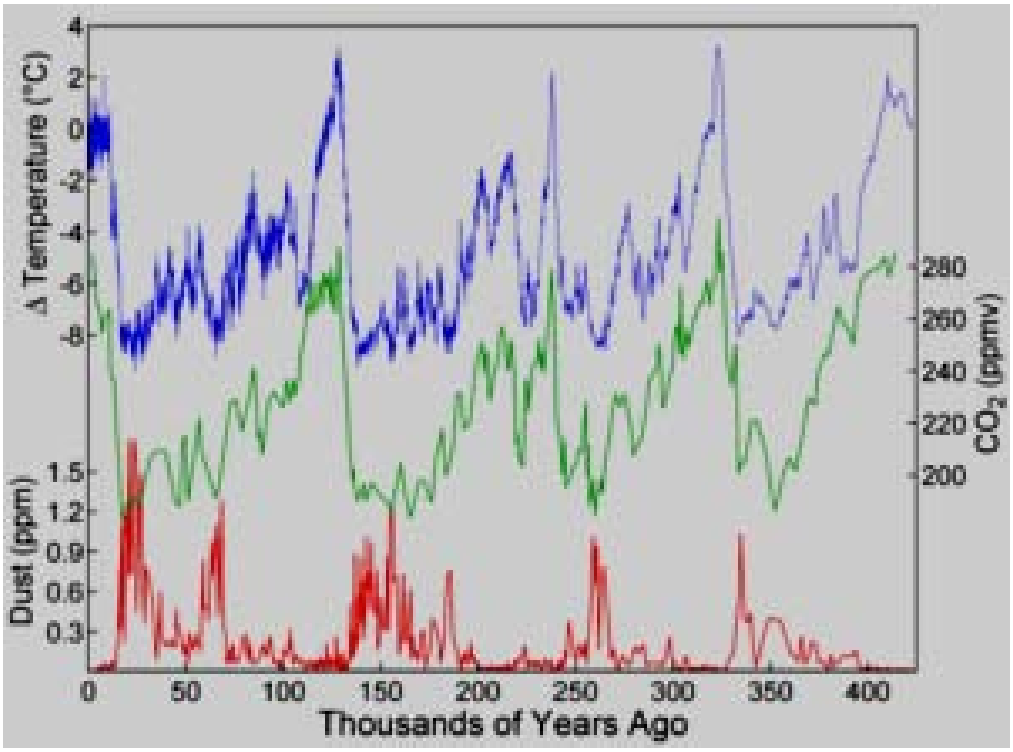

Figure 18. Ice Core Data---CO_2 and Dust---Past 400,000 Years

The third surprise is that it takes about 800 years of warming before the concentration of carbon dioxide rises (Fjgure 19).

One would think that warming, alone, should increase the rate of decomposition of organic material, resulting in increases in CO_2 (where oxygen is present) and methane (where oxygen is not present). Chemical reaction rates typically double for every 10C increase. (This is equivalent to a 7% increase per degree Centigrade, based upon the compounding effect.). Perhaps this would be offset by the increased use of carbon dioxide by plants as weather warms. Increased temperature also causes melting of the permafrost layer in the sub-polar regions, also releasing methane.

If the 800-year delay* figure is correct, it probably indicates the increases of carbon dioxide and methane come from the oceans, because it takes a very long time to heat the oceans to any reasonable depth. The oceans hold 52 times as much carbon dioxide as the atmosphere and carbon dioxide is less soluble as ocean temperatures rise (Reference 10), resulting in the release of carbon dioxide to the atmosphere. (Note: Surface temperatures of the ocean go from ~30F to 104F. The solubility of carbon dioxide changes by a factor of 3.3 over that range!)

*One scientist reports a 140-year delay based on a detailed computer thermal analysis of the Earth!

We must not forget the dissolved CO_2 in the ocean is used by plants (phytoplankton) to photosynthesize the food for ocean species and to make their shells (calcium carbonate). Just as on land, CO_2 is vital to the existence of life and is certainly ***not*** a pollutant! Much of the Earth's oxygen is generated by phytoplankton from carbon dioxide in the ocean, which not only helps preserve ocean species, but also land animals.

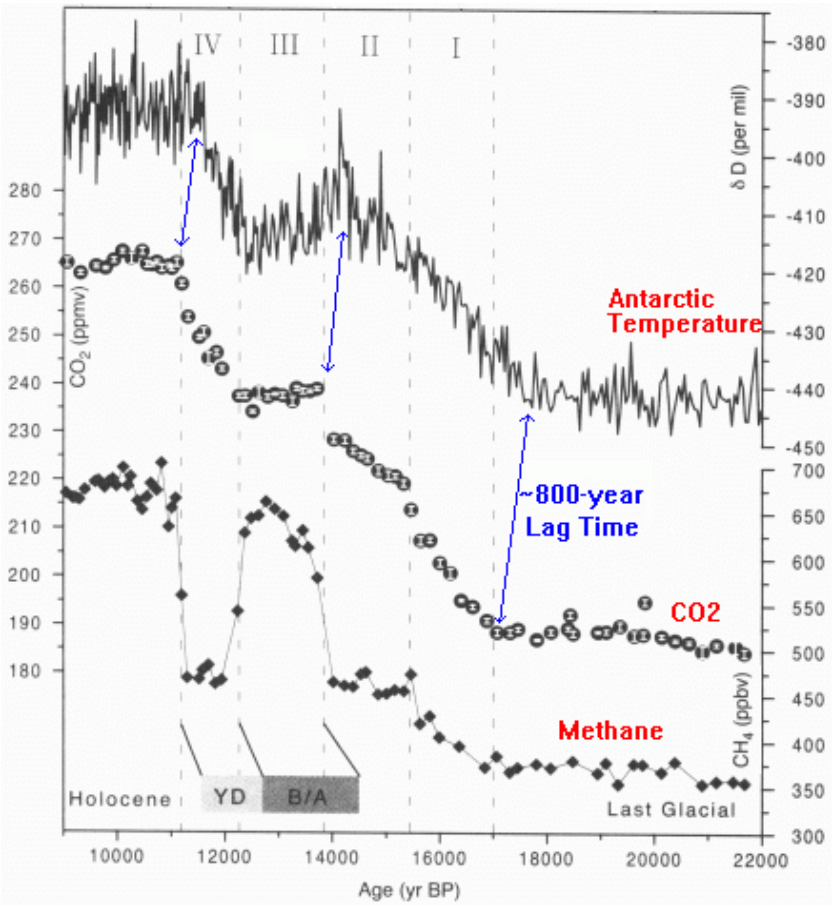

Figure 19. Ice Core Data---Temperature Rise vs. Greenhouse Gas Rise

The ocean also has large stores of methane hydrate which can also be released by warmer temperatures. I do not have proof that the oceans are the sources of the greenhouse gas rises which occur with temperature rises, but it appears to be a logical explanation.

Significant methane hydrate stores exist in the ocean, resulting from the decay of organic material (Figure 20). Some scientists claim there is more energy available as methane hydrate than there is available in oil reserves.

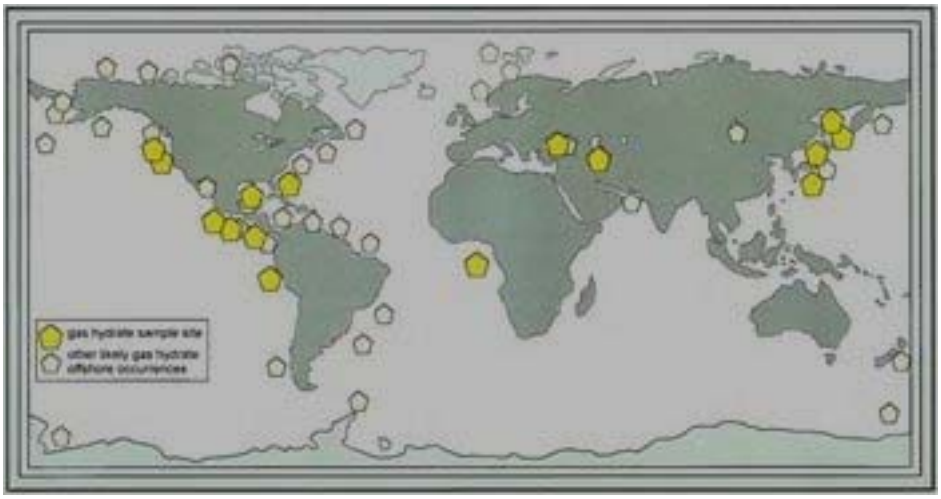

Figure 20. Oceanic Concentrations of Methane Hydrate

Conclusion: It is the increase in temperature that brings about the increase in greenhouse gases, not vice versa. The temperature increases may come from external factors (such as a change in solar constant, change in albedo, or global ice-age cycles.). It is wrong to blame man for these greenhouse gas increases, based upon ice core data going back 600,000 years where the same phenomenon occurred on 8 separate occasions.