

Global Warming Mania



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The earth has one primary energy source -- the Sun.

The climate of the earth has had large changes throughout time.

- * The geologic record, plant remains, sediment records and a host of other sources of information show that periods of far cooler climates have existed.
- * The last major ice age ended around 10,000 years ago.
- * The global temperatures are now reaching the values that were "observed" in about the year 1100 A.D.

Since large changes of Global Temperatures are recorded in the past:

What are the causes of "Global Cooling?"

Will there be future Ice Ages?



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Only three sources of Climate change will be discussed in this presentation.

- * Solar Variability.
- * Albedo Variability.
- * Salinity Driven Heat Transfer.



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Potential Sources of Global Climate Change

Solar Variability

This cause of short term Global Temperature change has been proposed due to a time correlation between the Minder sunspot minimum and the Little Ice Age. The prime argument is that increased solar activity causes an increase in sunspot activity.

Until the advent of space born observations most earth based measurements of solar variability were suspect because of changes in atmospheric transmission that made the data hard to interpret. Recent simultaneous observations near both Earth and Mars show that there is some variability of solar output. Since decreases of solar output strong enough to cause an Ice Age have not been seen, I tend to place solar activity changes in the undecided column as a source of Global temperature changes.



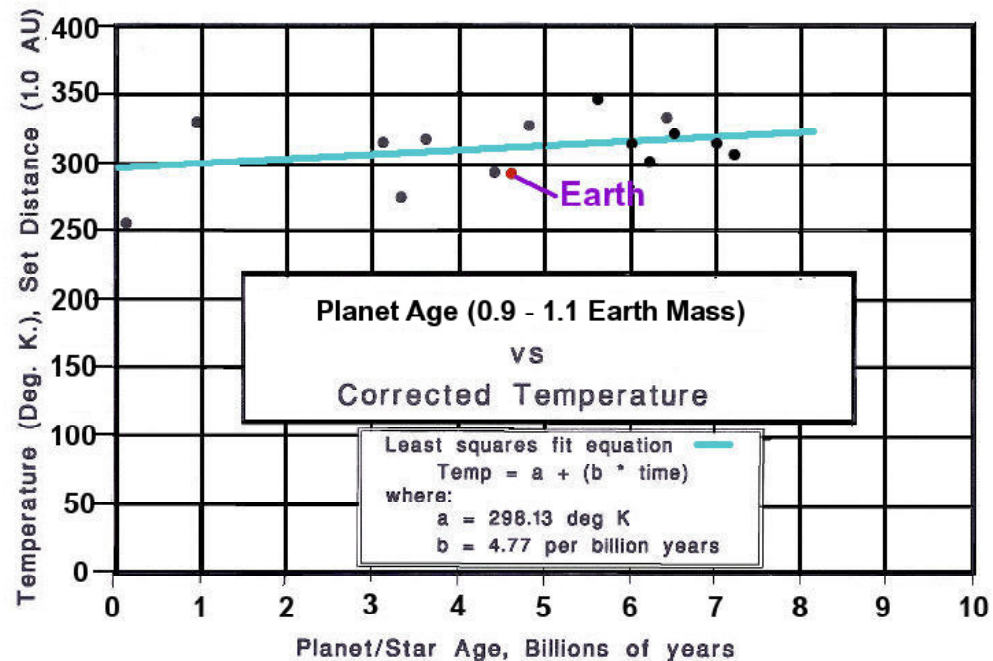
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Potential Sources of Global Climate Change Solar Variability

The temperature of stars increase slowly as they burn hydrogen into helium. There is a growing body of data on the temperature of potentially habitable planets that are located at about the distance of the earth from Sol (1 AU). The following graph shows the corrected planet temperature of planets orbiting stars similar to Sol and of the size of earth as a function of the star age.

The table is adapted from work by Dr. Theodore Fay of Phi Applied Physical Sciences, that is in preparation for publication. The present data shows that there is evidence that star output does change with age but the rate, 4.77 deg. K per Billion years probably does not account for the amount of Global Warming that is of present concern.





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Potential Sources of Global Climate Change

Albedo changes

Albedo is the ratio of the reflected light from an object to the light incident on the object. The albedo of the earth is normally dominated by cloud cover. Short term changes of the albedo of the earth are normal.

Volcanic events have resulted in temporary cooling of the earth. The prime mechanism for this effect is the injection of fine particulates and SO_2 into the stratosphere.

Three events that have been documented to have caused cooling periods are:

Tambora (1815)

Krakatoa (1883)

Pinatubo (1991)

The eruptions that created the Columbia Basalt Flow, Dekkan Traps in India and the Russian Traps probably caused climatic changes. There are claims that these events resulted in major ice ages.



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Albedo Changes

Tambora

The eruption of Tambora in 1825 is credited with being the cause of the "year without a summer". This eruption in Indonesia left a caldera about the size of the Jemez caldera near Los Alamos New Mexico. It is estimated that about 100 km^3 of material was ejected. The eruption column is estimated to have reached around 42 km. Global temperatures dropped around 0.3°C . The temperatures in the United States and Europe dropped around 4°C . About 70,000 people died as a direct result of the eruption and many more died throughout the world as a result of crop failure.





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Albedo Changes

Krakatoa

The eruption of Krakatoa in 1883 received much better documentation due to the advances in technology that took place since 1815. For instance, the atmospheric pulse generated by this eruption reverberated around the world 7 times. About 20 km^3 of material were ejected and the eruption column reached 25 to 30 km. Around 30,000 people died as a direct result of the eruption and the Global temperature dropped about 0.3°C . Far fewer people died as a result of crop failure because food preservation methods had advanced since 1815.

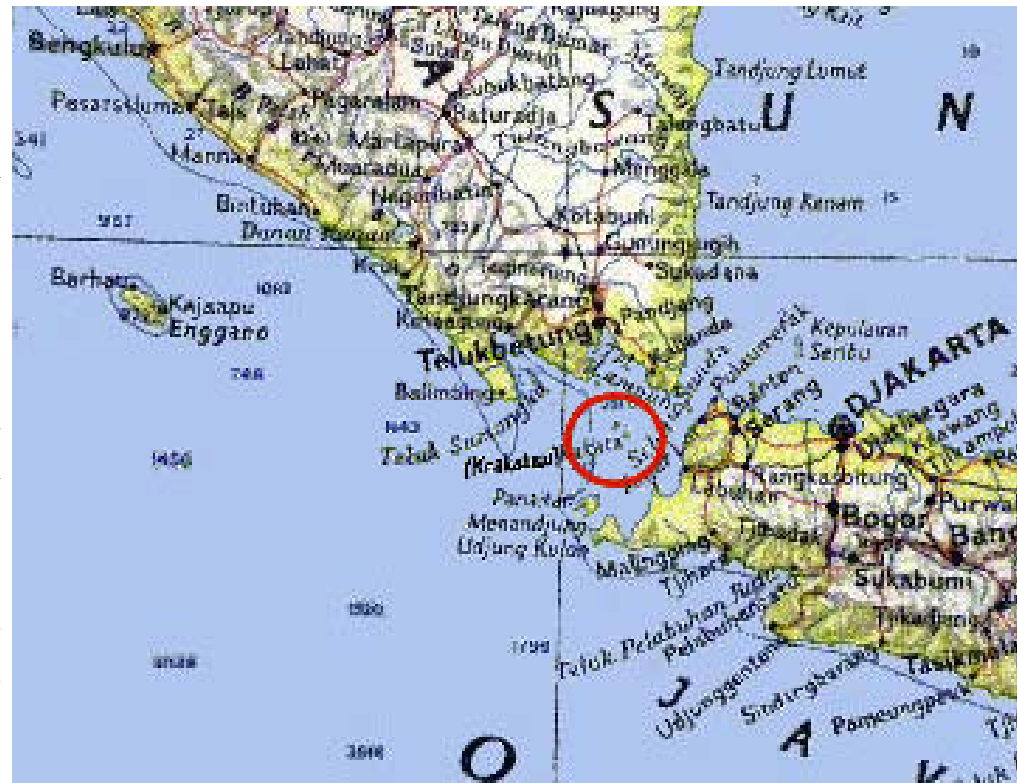


Figure 2 Krakatoa was an island in the Sunda Strait about 50 miles west of Djakarta.



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Albedo Changes

Pinatubo

The Pinatubo eruption in 1991 is still alive in many memories. This eruption was comparable in size to the Krakatoa eruption and injected material into the stratosphere. The Global temperatures dropped about 0.3°C as a result. The direct loss of life was 1207 people and few people were affected by crop losses. The reduced loss of life was primarily due to improved instrumentation, greater understanding of volcano behavior and improved food storage and distribution methods. Also, since Pinatubo was not located in the ocean, no tidal waves were observed. The stratospheric ejecta were visible as the cloud passed over Los Alamos, NM.

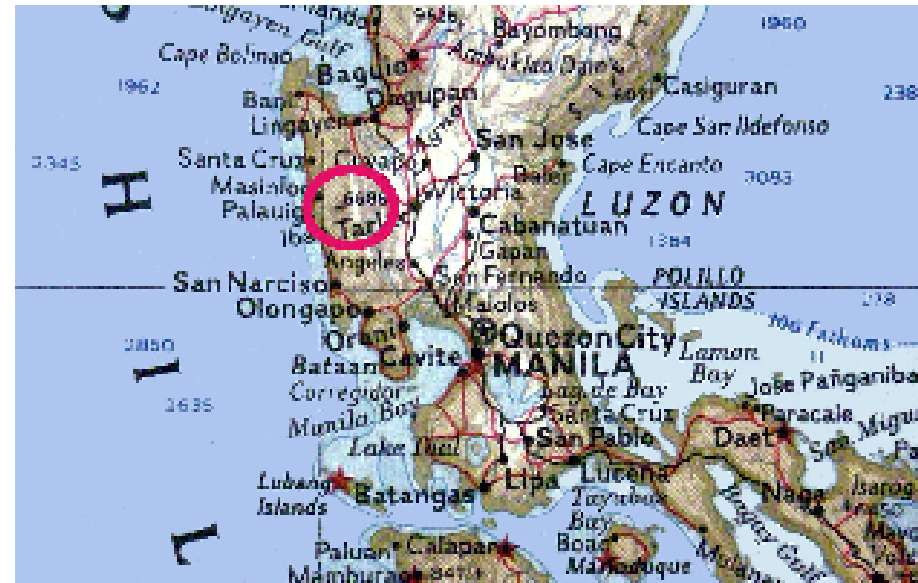


Figure 3 The eruption of Pinatubo in 1991 caused far fewer deaths but it did cause a short term global temperature drop.



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Albedo Changes

Other Volcanic Events

Other, even larger, explosive volcanic events have taken place in the past. These events probably injected material into the stratosphere and caused Global cooling events. This caldera, in north western Indonesia, was featured in a recent NOVA PBS broadcast. The caldera is comparable to the Yellowstone National Park caldera. Events of this magnitude may have affected the Global climate for several years.



Figure 4 Super volcanic eruptions such as this one in northwest Indonesia may affect global climate for a period of several years.



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Albedo Changes

Other Volcanic Events

Some events such as the very liquid flows that created the Columbia basalt flows, Dekkan Traps in India and the Russian traps must have affected the climate of the earth. The Columbia flows left deposits up to 4000 ft deep and covered 10^5 square miles. However, flows such as these were not explosive and probably did not inject much material into the stratosphere.

There are claims that these events resulted in major ice ages. These claims are based on geologic evidence.



Figure 5 Sheep Creek Canyon near Imnaha, Oregon is about 4000 ft. deep at this point. The vents that produced these flows is 50 miles to the northwest.



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Salinity Driven Heat Transfer

Current Research

The main engine that redistributes heat on the planet earth is salinity driven ocean currents. The Gulf stream is the chief factor in the redistribution engine. Solar heating of the surface waters of the Caribbean Ocean and the Gulf of Mexico evaporates water and increases the salinity of the surface water. The Gulf stream is formed by replacement water drawn into the Caribbean and Gulf of Mexico along the north coast of South America. The Gulf stream transfers heat to the coast of England and Norway. The Gulf Stream turns southward in the gap between Denmark and Greenland and travels along the east coast of Greenland and Newfoundland. The Gulf Stream loses heat during this journey, As it loses heat becomes less buoyant, and begins to sink into the deep oceans. The resulting deep ocean current travels around the globe.

Some of the research at Woods Hole Oceanographic Institute (WHOI) has concentrated on understanding of the ocean currents. Of particular importance to this description are the modeling of ocean currents by Curry et.al. , measurements of freshwater flows in the Arctic basin by Peterson et.al. and studies of deep ocean sediments by Keigwin et.al . A recent television presentation by Scientific American Frontiers has tied these studies together.



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Salinity Driven Heat Transfer

Arctic Basin Water Flow

The main source of water flowing into the arctic basin is fresh water from rivers and melting ice. Russia has recorded the flow of the Lena River, the largest river flowing into the Arctic Basin, for many years. They have found that during the time of their measurements the flow of the Lena River has steadily increased each year. The Lena River also transports sediments into the Arctic basin. Two elements that are carried by the Lena are Protactinium and Thorium. These elements are the by product of the radioactive decay of natural Uranium. The importance of this observation will become apparent in the next viewgraphs.



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Salinity Driven Heat Transfer

Deep Ocean Sediment Studies

Deep ocean sediments contain information that can yield information on the climate of the earth over a long period of time. The shells of Foraminifera are of particular importance in these studies. The type of Foraminifera at a particular depth in the sediment can produce information on ocean salinity and temperature. The shells are mainly made of Calcium carbonate. The isotopic ratios of C_{12} to C_{14} and the ratios of O_{16} to O_{18} provide information on the time that the Foraminifera were alive. Neutron activation analysis of the content of Protactinium and Thorium in the shells yields information on the source of the water the Foraminifera were living in. These elements arrive in the ocean by erosion of on land. Analysis of the data shows that there are distinct variations in the data. The arctic regions have undergone between 6 and 8 cycles of heating and cooling since the last major Ice Age. Moreover, in about 1100 A.D. there was a cooling event in the northern hemisphere.



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Salinity Driven Heat Transfer

Salinity Modeling Studies

Detailed modeling of ocean currents has been carried out by Curry at WHOI which confirms the theories of Salinity driven ocean currents. Of more importance to the arguments of Global climate change she has analyzed the function of fresh water flow into the Arctic and the effects of that flow on Global temperatures. The Bering straits and the channels between the islands west of Greenland are relatively shallow. Most of the water flow from the arctic basin takes place over the Denmark ridge between Greenland and Denmark. The fresh water draining into the Arctic basin is of far lower salinity than the average ocean water and consequently is less dense than ocean waters. The lower salinity waters do slowly mix with the ocean waters but they tend to concentrate near the surface. As global temperatures rise, precipitation increases in the northern lands and ice begins to melt. Eventually the lower salinity waters are forced out of the Arctic basin and they begin to deflect the Gulf stream further to the south. If the Gulf Stream is deflected then the temperatures in Europe and the northern parts of North America begin to fall. When the temperatures begin to fall the fresh water is trapped as ice and the diversion effect of Arctic fresh water subsides.



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Little Ice Age

The Little Ice Age caused major socioeconomic effects in Europe. Wine production in England eventually ceased. the Viking communities in Greenland failed and the population of Iceland began to drop. Viking trade with the near east failed because the Volga River froze for much of the year. During the coldest periods many sea ports froze over and the Thames River froze often enough that "Ice Fairs" were held on the river at London.

The glaciers in the Alps began to rapidly advance and many villages were destroyed by the advancing ice. The Church began to conduct prayers for forgiveness from the supposed wrath of God.

New, cold hardy crops had to be found to sustain the populations. I suppose that a positive note is that the English found that barley was cold hardy enough to provide both food and Ale.



Figure 6 Huntsmen in the snow by Peter Bruegel the elder, 1565.



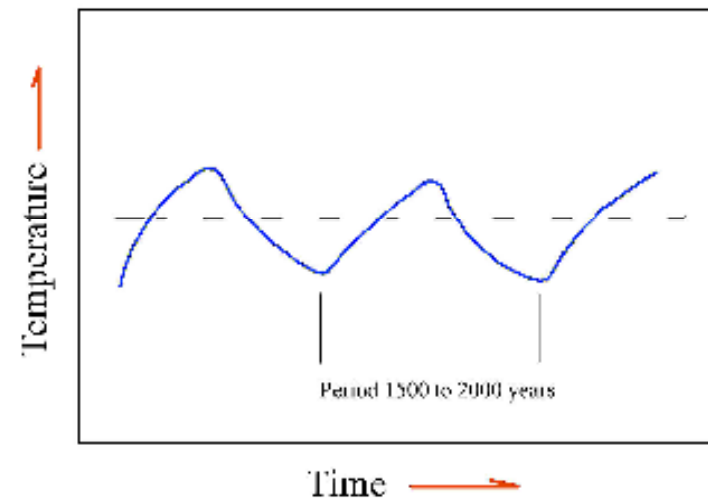
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Little Ice Age

Many sources claim that the Little Ice Age ended around 1850. However, there is evidence that the temperatures in Europe are only now reaching the highs that were observed before the Little Ice Age. For example, the growing season in England is beginning to support a commercial wine industry at the present time. Also, Birch trees that were entrapped in glaciers during the "Little Ice Age" are still being thawed out of retreating glaciers in Norway.

The ocean sediment data obtained by WHOI researchers indicate that between 6 and 8 "Little Ice Ages" have occurred since the last major ice age. Data obtained from ice core samples also correlate with the deep ocean data. The graph on the right shows the type of temperature variations that must have taken place in Europe and elsewhere since the last major ice age. The data indicates that repeated cycles of sudden cooling followed by long periods of warming are common.





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Analysis

The results presented by the Woods Hole researchers indicate that global temperature variations on the order of several degrees centigrade are normal. These cycles appear to have a period on the order of 1500 years. During the last 10,000 years the ability of humans to affect the climate on a global scale has been very small. The "hockey stick" temperature curve that is widely presented in the press is not in agreement with the present growing season and rainfall amounts. Moreover, the hockey stick data has been largely debunked by reputable researches as reported in the Wall Street Journal (WSJ p. A12, July 14, 2006).

The "Global Warming" advocates base many of their arguments on the production of so called "Greenhouse Gases". The integrated absorption of these gasses, based on the data presented in Allen's Astrophysical Quantities, shows that in the near and mid infrared regions the absorption of water vapor has an effect nearly 10 times larger than CO_2 and nearly 500 times stronger than CH_4 (methane). When the total amounts of atmospheric absorbers are taken into account the effect of water vapor is by far the major contributor to the greenhouse effect. Since solar heating of the Caribbean Ocean and the Gulf of Mexico is the prime driver of ocean currents and since the total amount of water vapor in the troposphere over the tropical ocean atmosphere is very high compared to CO_2 and CH_4 it appears that the natural green house gas (water) is the major factor in global climate change.



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Conclusions

Some conclusions can be drawn from the well reasoned information that is available.

- * Large climate changes have resulted from changes in salinity driven ocean currents.
- * Large climate changes will probably continue to occur.
- * The present global climate is probably not much different than the climate that existed just before the Little Ice Age.
- * The supposed Global Warming "crisis" may not be founded in scientific fact.
- * A period of Global Cooling (Little Ice Age) may occur in the next few hundred years.
- * Changes in human activities probably will not affect the changes.



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Conclusions

I believe that much of the present concern over Global Warming, especially by the media and the environmental community, stems from a misunderstanding of the Philosophy of Science. There are two approaches to philosophical analysis. A simple minded characterization of the two approaches is as follows:

- * One branch claims that if we (humans) can conceive of something, then it exists.

Since humans can conceive of almost anything, this branch is very unreliable when dealing with the real world.

- * The Scientific Analysis branch claims that if something exists then it must be measurable.

The confusion is compounded by a misunderstanding of correlation between sets of data and of the concept of cause and effect. Many people feel that a correlation between two sets of data implies a causal relationship between the data. In fact a correlation may exist when there is no causal relationship.



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References

This list of references points users to major sources of information on the web. Each of these sources list a multitude of citations to the literature. While the Wikipedia entries are sometimes of questionable validity the following do contain solid citations and are written by knowledgeable persons.

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