The Science of Climate Change

The Emphasis on Man-made Global Warming

The possibility that CO_2 may affect climate was first put forward nearly 100 years ago. More recently, James Hansen focused attention on anthropogenic (man-made) CO_2 as a cause of global warming. In that same year (1988) the United Nations established the Intergovernmental Panel on Climate Change (IPCC). The Panel has issued three Assessment Reports, in 1990, 1996 and 2001, hefty collections of scientific papers by individual researchers with a variety of opinions. With the Assessment Reports the IPCC typically issues a "Summary For Policy Makers" (SPM) for the media and policy makers. Unfortunately, these contain very little science, are compiled largely by UN bureaucrats and political representatives and do not convey the lack of consensus on science questions that often exist. The net result is that politicians and the media ignore the scientific panel reports (which are confusing to them) and read only the politically biased SPMs.

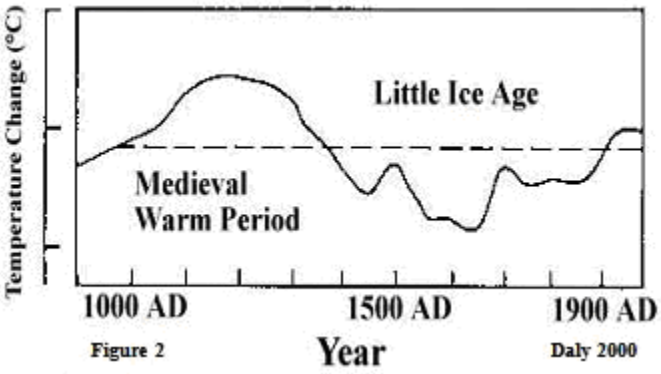
These reports and SPMs are available on the IPCC's web site http://www.ipcc.ch . Scientists objecting to the SPM bias signed the Oregon Petition and a typical scientists critique is shown here.

The CO_2 - Global Warming Hypothesis

Hansen (1988) suggested that increasing levels of CO_2 produced from burning of fossil fuels would lead to catastrophic warming of the earth's atmosphere. To support that claim, some scientists point to the increase of atmospheric CO_2 from 280 ppm to 370 ppm over the last 100 years, and suggest this was the cause of a global temperature rise, purported to be on the order of 0.6°C.

Computer simulation models of the atmosphere, called General Circulation Models (GCM's), incorporate projections of ever-increasing CO_2 levels with many other parameters in efforts to forecast climate into the future. These models suggest increasing temperature levels, which the IPCC and others attribute to CO_2.

Problems with the CO_2 - Global Warming Hypothesis



Global temperatures for the past 1000 years
IPCC 1995

An examination of published scientific data show many inconsistencies between the climate record and the CO_2 - Global Warming hypothesis. Some of these are:

- The major greenhouse gas is water vapour, and the nature of CO2 / water vapour interactions is not clearly understood. Moreover, James Hansen (2000) downplayed the role of CO2 as a greenhouse gas.
- Antarctic ice cores in one study show carbon dioxide concentrations increased by 80 to 100 ppm about 600 years after the warming of the last three deglaciations, while in another study Antarctic ice core data show that CO2 levels lag an increase in temperature by 900 to 1200 years.
- World Climate Report shows that annual growth in concentrations of CO2 in the atmosphere have remained essentially flat from 1975 to the present - during a time of maximum production of CO2 from fossil fuels. This casts doubt on the claim that rapid and dramatic build-ups of CO2 will occur in the future.
- We know that CO2 from the burning of fossil fuels was not the cause of dramatic historical climate changes, for example, 1000 years ago, in the Medieval Warm Period or in the Little Ice Age that followed from about 1350 to about 1860. We are still emerging, in an oscillating fashion, on the warming trend that came after the Little Ice Age. Global historical temperature data is readily available, for example Canada, Mediterranean, Alaska, China and Canadian Rockies.
- In the 20th century, there was little correlation between temperature changes and CO2 levels. Some surface temperature measurements show a 0.5°C rise over the past 100 years. However, that average hides some significant details. From 1905 to 1940, a rise of about 0.5°C was measured, during which time there was an imperceptible rise in CO2. From 1940 to 1975, the temperature decreased about 0.2°C, while CO2 levels started to increase more rapidly. The out-of-sync relationship is obvious.

Observations on Climate Change

Global climate change has been a constant throughout the history of the Earth, driven by a variety of global and astronomical natural factors. The variability of and interactions among these factors are the subjects of active research, but are still very poorly understood by climate scientists. Observations of past climatic variations show much better correlation with astronomical variables such as solar activity and orbital changes than they do with atmospheric CO2 levels. Bruno Wiskel does an excellent job of explaining, in laymans language, these complex natural factors and their historical effect on climate in his publication "THE EMPEROR'S NEW CLIMATE".

Since the beginning of the 20th century, the concentration of CO2 in the atmosphere has increased, but it is impossible to determine how much this increase is due to human activities. The best attempts to remove biases from temperature data still do not show a good correlation between changes in atmospheric CO2 and changes in global temperatures.

Global circulation models attempt to represent climatic influences with numerical equations, and are used to predict future climate variations. However, they are hampered by our poor understanding of the relationships and feedback loops among many of the key variables.

These observations suggest that global climate change is a natural and fundamental part of earth history, and that the effects of human activities on global climate are no more than a poorly understood fourth-order factor.

In terms of the recent public debates about global climate change, there is no body of evidence, and certainly no consensus in the scientific community, that man-made CO2 emissions are a significant contributor to climate change.

Possible Explanations For Global Climate Change

If the burning of fossil fuels was not the cause of earlier changes in climate, what might the possibilities be?

Total Solar Irradiance (TSI): Soon *et al* (1996) found an excellent correlation between global temperatures and the sun's variable radiant energy, while Baliunas and Soon (1996) found a near perfect fit between solar magnetic cycle length and earth temperature and Usoskin describes in Physical Review Letters (91/21) a millennium scale sunspot reconstruction; evidence for an unusually active sun since the 1940s. Click here

Orbital Cycles: Earth's distance and angle of exposure to the sun vary in several fashions: Orbital eccentricity; precession of the equinox, the so-called "wobble"; and variations in the tilt of the earth's spin axis.

Ice Sheets: The interactions of ice sheets and global temperature variations are not well understood. Increasing temperatures would increase oceanic evaporation, and thus may increase accumulation rates of snow and ice on the polar ice caps.

Ocean Currents: Currents are critical agents in the distribution of heat across the Earth's surface. Broecker and more recently, Gagosian of the Woods Hole Institute, have highlighted the possibility that a reorganization of the Gulf Stream in the North Atlantic might cause an abrupt cooling in North America and in Europe.

Solar Activity Most Likely The Principal Driver Of Climate Change

Dr. Jan Veizer, Ottawa-Carleton Geoscience Centre, University of Ottawa, Canada, and Institut fuer Geologie, Mineralogie und Geophysik, Ruhr-Universitaet Bochum, Bochum, Germany, reinforces the concept of natural causes for climate change in an important article published in GSA TODAY on July 2003. It deals with cloud formation through charged nuclei provided by cosmic ray flux, which itself is subject to variation in the sun's magnetic field.

*A later article by Dr. Jan Veizer: "**Celestial Climate Driver: A Perspective From Four Billion Years Of The Carbon Cycle" -** SOLAR ACTIVITY MOST LIKELY THE PRINCIPAL DRIVER OF CLIMATE CHANGE was published in March 2005 in GEOSCIENCE CANADA. Full Article Here*
Other scientific articles which provide evidence of the importance of solar activity include The Varying Sun & Climate Change by Soon & Baliunas, and Length of Solar Cycle- An Indicator of Solar Activity Closely Associated With Climate by E.Friis-Christensen & K. Lassen.

The Media and Perceptions of Climate Change

***Global Circulation Models**: As noted above, interpretive information and climate forecasts are provided by the Summary for Policymakers (SPM) and Environment Canada. These are given wide media coverage commonly with extreme warming forecasts of 5 to 6 degrees C. These predictions rely heavily on general circulation models (GCM's). It has been observed that computer simulations must track over 5 million parameters, and such simulations require accurate information on two major natural greenhouse factors - water vapour and clouds - whose effects we still do not understand. Simulation programs are of great complexity as they must accommodate numerous poorly known feedback interactions between various parameters. It is not surprising that the IPCC forecasts for temperature have had to be revised downwards several times in the last 10 years. An excellent discussion of the hazards of computer simulation in Climate Science appears in: Essex, C. & McKitrick, R, :"**Taken by Storm**", Key Porter Books, Toronto 2002.*

Other references confirm the deficiencies of GCM's. The fact that there are too many unknowns involved is discussed here; difficulties in simulating clouds is a significant shortcoming as discussed here; several other problems with climate models is reviewed here.

The Destruction of the Hockey Stick ?

***The Hockey Stick** has been one of the most beguiling arguments in the Kyoto proponents' repertoire and it still appears on many websites. It originates with Michael Mann (1999) and co-workers and shows a rather flat temperature line over the last 1000 years, until in the late 1800s, when a sharp increase is evident, presumably because of man-made greenhouse gases.*

Over the years, the graph has been subject to many criticisms from other scientists, for a number of reasons. Some complained that the well-documented Medieval Warm Period (approx. 1000-1400) and the even better known Little Ice Age (approx. 1450-1850) do not register on Mann's chart. Others took issue with the tree ring proxy methods being used for the time span before thermometer readings were available, or with the inaccuracy of the temperature readings themselves. They maintain that instrument errors are often larger than the anomalies measured, or that the urban heat island issue skews surface data badly.

In this article in Energy & Environment (Vol 14/6, 2003) Canadians Stephen McIntyre and Ross McKitrick reject Mann's methodology, point to numerous errors, unjustifiably truncated data and extrapolations, and other defects. They then use Mann's original data and recognized methodology to prove that Mann's graph shape is an artifact and that a proper interpretation finds that temperatures around 1400 were warmer than anything in the 20^{th} century. The widely read work by McIntyre and McKitrick has elicited much discussion in scientific circles. A more definitive version was later published in Geophysical Research Letters.

The U.S. House of Representatives became aware and expressed their serious concerns over the reported flaws and data errors in Mann's work, and wrote this letter to the IPCC and appointed a committee to review the matter. Read their Summary as well as the classical Wegman Report.

Urban Heat Islands

Most of the reported temperature measurements have been taken in the more densely populated areas (which through their normal activity generates heat) while rural and remote areas, let alone oceans, contribute few data points. Balloon and satellite data show no warming beyond our 0.6^{o} C per century rise, as earth awakens from the glacial times. Thus as urban areas have grown and continue to do so, temperature data becomes increasingly skewed.

This general effect has been studied in a number of places in the world, including Asia, U.S.A. and China.

Weather Extremes?

Worldwide, the news media commonly report that weather extremes such as droughts, floods, tornadoes, and hurricanes are becoming much more frequent, and the implication is made that global circulation models support this idea. However, the 1996 IPCC report states that "Overall, there is no evidence that extreme weather events, or climate variability, has increased, in a global sense, through the 20th century…". What has happened is that weather-related damage to human infrastructure has increased as world population rises, and the distribution and value of housing and other buildings increases. Instant media coverage is undoubtedly another factor. Dr. Madhav Khandekar, a retired Environment Canada climatologist deals with extreme weather events extensively in a report for the Alberta Government: Trends and changes in extreme weather events.

Summary of Scientific Arguments

An excellent summary of climate change topics:

Published in the peer-reviewed Bulletin of the CSPG (2002), by Dr. Chris deFreitas, a member of our Scientific Advisory Board. For the PDF version, click here.

Why you should be sceptical of the Kyoto claims:

1. *There has been a natural warming and cooling of the earth during its evolution (geologic time), and more recently during the Medieval Warm and Little Ice Age Periods. The overall warming of the planet over the last 10,000 years has not been caused by human production of CO2.*
2. *In the last 100 years temperature increased noticeably from 1905 to 1940, with little change in CO2. From 1940 to 1975 global temperatures cooled while CO2 increased noticeably. The lack of correlation between CO2 and temperature change is clearly evident.*
3. *Astrophysical factors (the variation of solar radiation reaching the earth), and variations in global deep and shallow ocean currents are in large measure responsible for changes in the planet's climate.*
4. *The supposed main "greenhouse" gas, carbon dioxide, constitutes 0.035 % of the atmosphere. As different scientists have commented, the dominant heat trapping mechanism is water vapour, accounting for 97 % of the so-called greenhouse effect. Moreover, it can be seen in the record of past climates derived from Antarctic ice cores, that increase in CO2 followed temperature increases, rather than preceding them, or causing them.*
5. *The arguments claiming man as a cause of Global Warming are based on computer programs that are incapable of modelling world climate: many of the millions of parameters can only be defined in ranges with arbitrary skewing.*
6. *Examination of weather disasters (floods, droughts, etc.) by scientists show no relevance to climate change.*
7. *Recognition of temperatures recorded by satellites and weather balloons show very minor temperature change in the last 50 years. As well, there is a bias in the geographical distribution of historical surface temperature measurements (so-called "urban heat islands"). It should be noted that the margin of error of temperature field observations is several times that of the average 0.6 degrees Celsius warming that has prevailed since the depth of the Little Ice Age around the year 1700 AD.*
8. *The Intergovernmental Panel (IPCC) with its Summary for Policymakers (SPM) is often quoted as an authoritative source on climate change. However, many climatologists, including scientists working on the IPCC, disagree strongly with some of the conclusions issued in the SPM. It is evident that the SPM information is often political in content. The widely distributed and referenced SPM was compiled by UN bureaucrats that fails to convey the uncertainty of climate change forecasts of the panel scientists.*
9. *The Kyoto Protocol, by focusing on attempts to curtail CO2 at incredible cost, will not stop or reverse climate change.*