

A GEOLOGICAL VIEW OF CLIMATE CHANGE AND GLOBAL WARMING

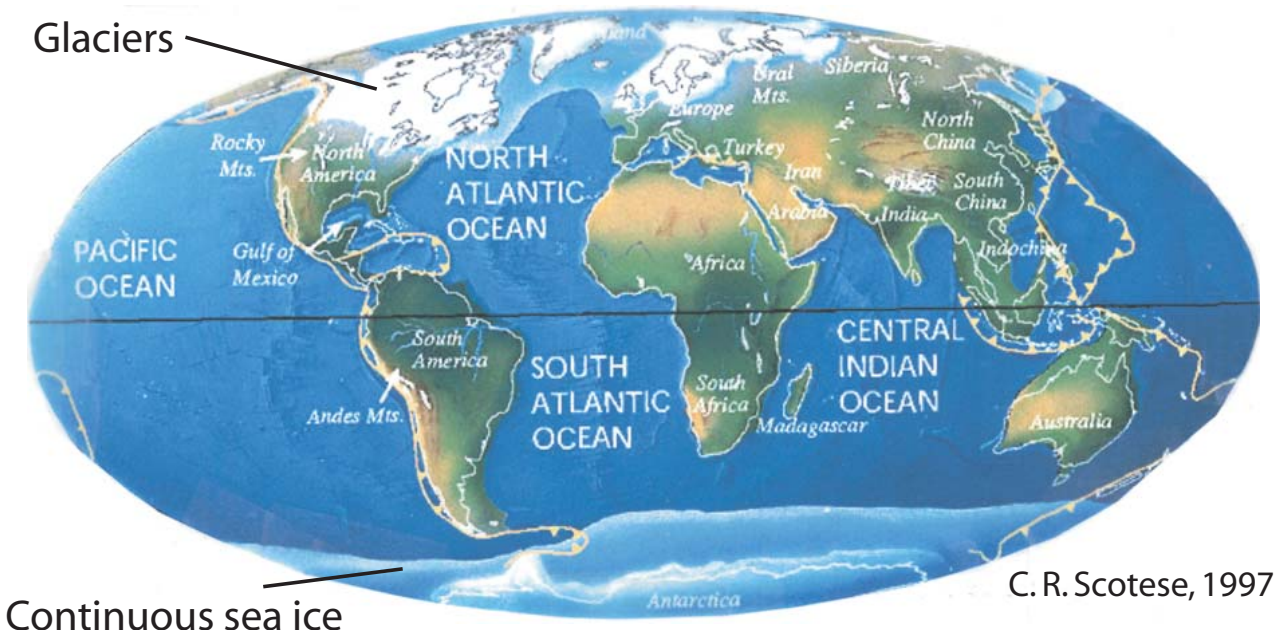
Compiled by

William D. Pollard, M Ray Thomasson PhD, and Lee Gerhard PhD

THE ISSUE - Does the increase of carbon dioxide in the atmosphere, resulting from the use of fossil fuels, significantly contribute to current global warming?

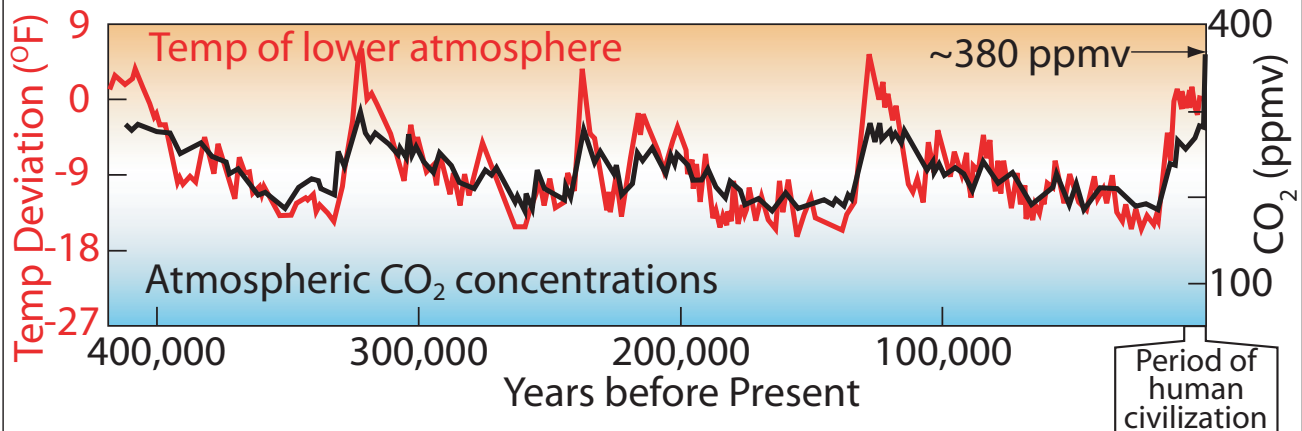
CONSIDER - Climate change is natural and has been continuous throughout earth's history, with innumerable warming and cooling cycles, which could not have been caused by human activity.

GLACIAL EXTENT - LAST ICE AGE



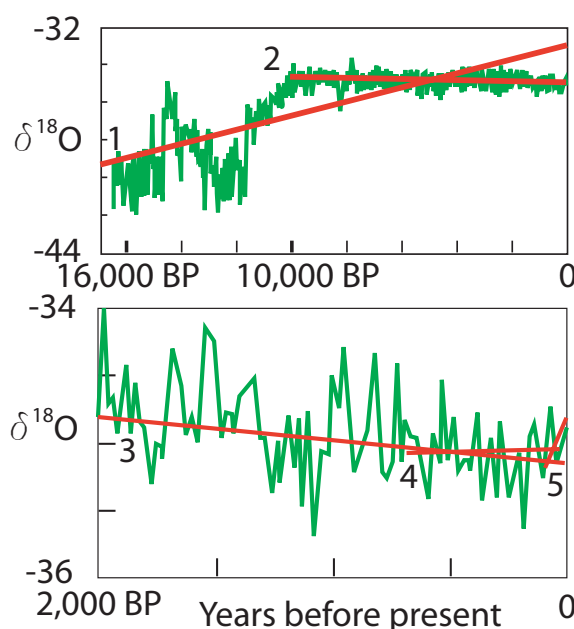
- About 21,000 years ago, at the height of the last **ice age**, immense sheets of glacial ice thousands of feet thick covered all of present day Canada, the Northern United States, and Northern Europe.
- Sea level has risen nearly 400ft since the last ice age; "a harsh terrain that resembled modern Antarctica was transformed gradually into the forests, grasslands, and wetlands we know today".(Pelou, 1991)

TEMPERATURE AND CARBON DIOXIDE LEVELS CALCULATED FROM ANTARCTICA AIR AND ICE CORE MEASUREMENTS



- Pre-historic rises in CO₂ concentrations lag several hundred years behind temperature increases (Siegenthaler et al 2005) **CO₂ did not drive temperature increases.**
- The earth is currently in an **inter-glacial** (global warming) cycle. The warming cycle began at the end of the last ice age about 18,000 years ago, as the result of natural processes. The current warm period will end with the onset of another glacial cycle.

TEMPERATURE TRENDS CHANGE DEPENDING ON THE TIME PERIOD STUDIED



(rising slope = rising temperature)

Trend 1 - Over the past 16,000 years, average temperature has increased.

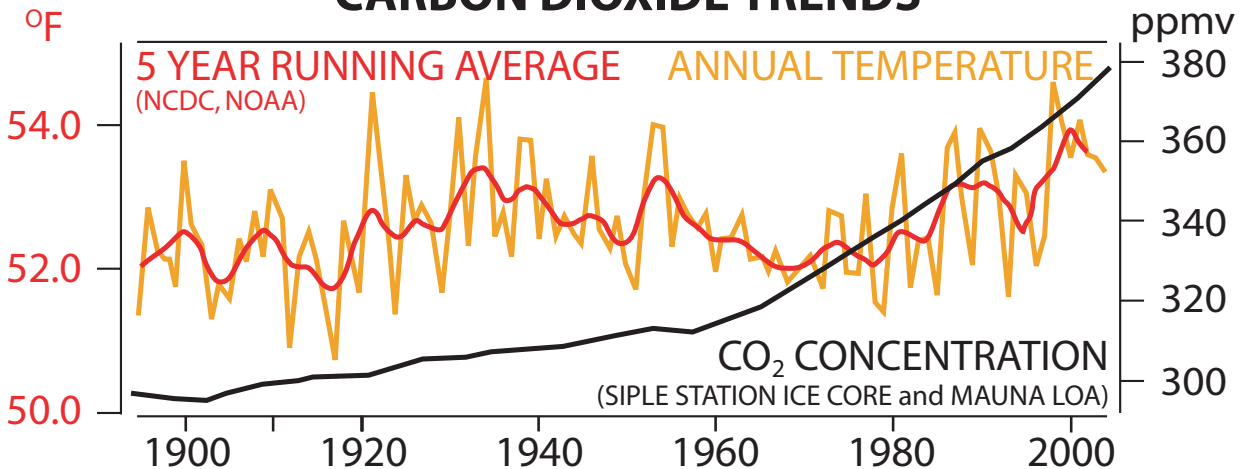
Trends 2, 3 & 4 - In the past 10,000, 2,000 and 700 year periods, average temperatures have decreased suggesting a change toward glacial conditions.

Trend 5 - **In the past 50 years, average temperatures have been increasing - in the past 2,000 years far greater temperature increases have occurred.**

^{18}O (oxygen isotope) relative values have been related to atmospheric temperature, using ice core records from Greenland and Antarctica

Davis and Bohling, 2001

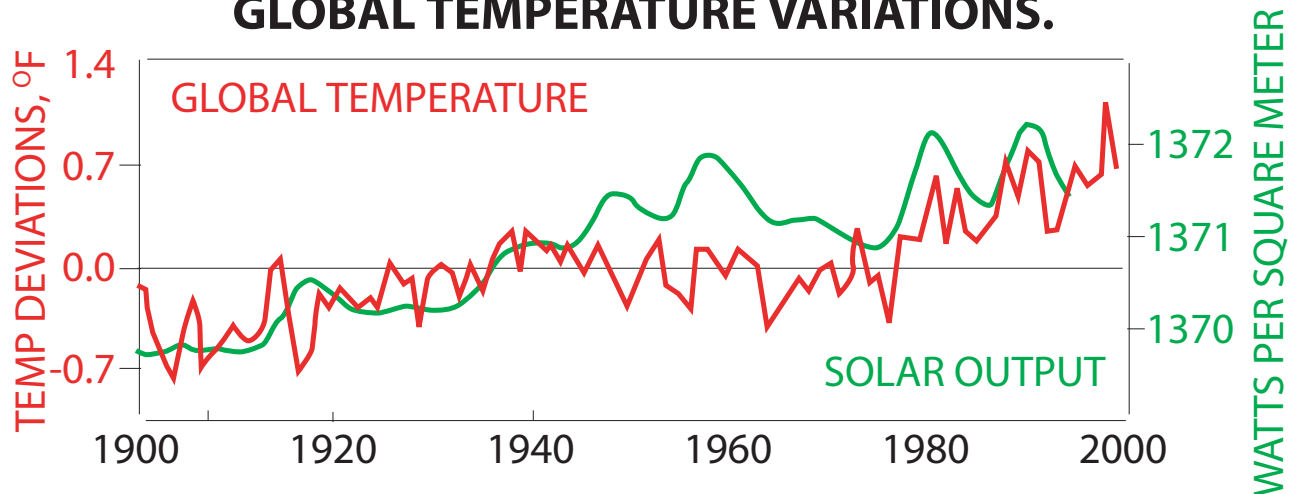
THE LAST CENTURY OF U.S. TEMPERATURE AND CARBON DIOXIDE TRENDS



20th CENTURY U.S. TEMPERATURES ARE HIGHLY CYCLIC -
CHANGES IN CO₂ CONCENTRATION AND TEMPERATURE DO NOT
CORRELATE IN THE SHORT TERM

From 1998 to 2004 the U.S. experienced a decrease in average temperature of 1.26 °F, the reverse of carbon dioxide concentration trend. (G Taylor, 2004)

SOLAR ENERGY VARIANCE AND PERIODIC SHIFTS IN THE EARTH'S ORBIT ARE THE PRIMARY DRIVERS OF GLOBAL TEMPERATURE VARIATIONS.



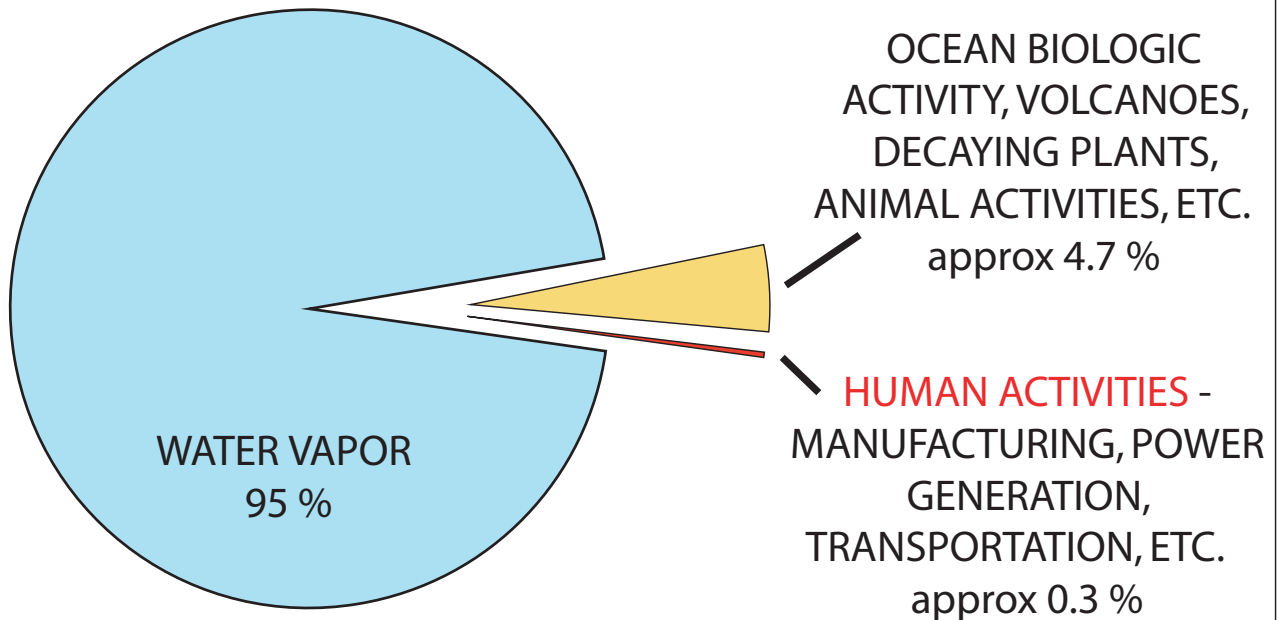
- Solar output (Haigh, Dec 2001)
- Variations in shape of earth's elliptical orbit (Zahn, 2002)
- Slight changes in axial tilt of the earth (Zahn, 2002)
- Changes in position of land masses over geologic time relative to the earth's poles (Gerhard and Harrison, 2001)

RELATIVE IMPORTANCE OF GREENHOUSE GASES

The greenhouse effect makes our earth suitable for life as we know it. Solar energy is trapped, keeping average temperature in a range that supports life.

CONTRIBUTIONS TO THE "GREENHOUSE EFFECT"

(M Hieb, 2002)



CONCLUSIONS

- Many geologists and atmospheric scientists believe climate change is driven by natural causes.
- Human activities have caused carbon dioxide concentrations in the atmosphere to increase.
- The impact of this increase is very minor compared to astronomical and geological causes.
- Current global warming is much less than other periods in recorded history.
- Glacial conditions will return.
- Small increases in atmospheric carbon dioxide promote greater plant growth (food production).

ALL OF THE PRINCIPAL CAUSES OF CLIMATE CHANGE ARE BEYOND THE CONTROL OF HUMAN BEINGS

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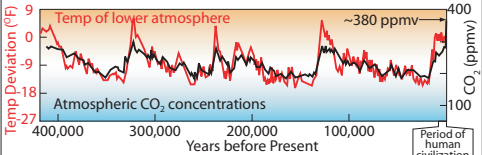
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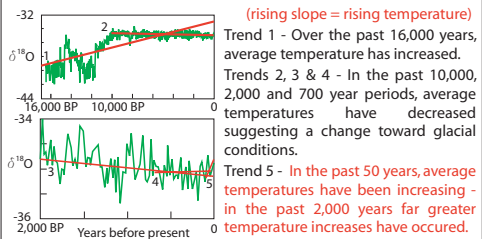
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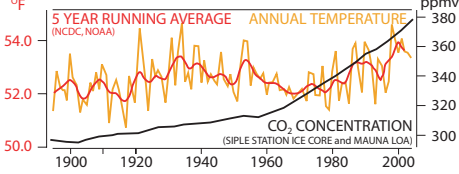
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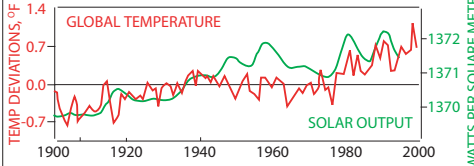
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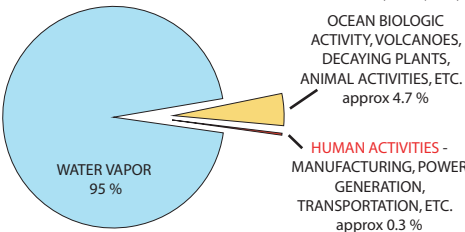
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