

GLOBAL WARMING The Science

Jacques Guertin, Ph.D.
Newark, California
jacquesguertin@juno.com
December 2007

Preamble

This is a summary of a presentation by the author at the November 2005 American Chemical Society northern California meeting

What is the Current Popular Concept Called Global Warming?

- 0.5 °C increase in earth temperature during past 100 years
- The belief that this increase is caused by human activity emitting carbon dioxide (CO₂).

What is the Geological Definition of Global Warming?

It is the warm period between major ice ages.

Greenhouse Gases

What greenhouse gas contributes by far the most to the greenhouse effect? It's *water (vapor)*, H₂O! In fact, atmospheric water vapor contributes 94% of the global warming! Here's the breakdown of contribution from the common greenhouse gases:

| Greenhouse Gas | Concentration | in Air | Contribution to Warming |
|---|---------------|----------|-------------------------|
| H ₂ O | 16,000 ppmv | 1.6% | 94% |
| CO ₂ | 380 ppmv | 0.0380% | 4% |
| CH ₄ | 2 ppmv | 0.0002% | 1% |
| N ₂ O, O ₃ , CFCs | 0.5 ppmv | 0.00005% | 1% |

The "Hockey Stick" Correlates with CO₂ Increase?

The "hockey stick" is the graph of global temperature increase (0.5 °C) versus time from 1900 to present. Over the same time, CO₂ concentration went from 290 ppmv to 380 ppmv. However, CO₂ concentration did not track global temperature from 1940 to 1970 because global *cooling* occurred then! Global warming models have not been able to handle this.

Global Temperature Increase from CO₂ Contribution

—A simple statistical calculation*:

- Earth's surface temperature with no atmosphere = -18 °C (-0.4 °F)
- Current surface temperature = 14 °C (57 °F)
- CO₂ contribution to greenhouse effect = 4%
- Temperature decrease from removing *all* CO₂:
(14 - (-18))(0.04) = 1.28 or about 1¼ °C
- Increase in CO₂ since 1900 increases temperature by 0.3 °C:
((380 - 290)/380)(1.28) = 0.3 °C. Estimated temperature increase from humans = 0.1 °C.

*Water-to-air feedback mechanism is not included in this calculation. But, the effect is small because a small change in temperature at modest temperature (such as 14 °C) does not change the vapor pressure of water appreciably.

Past Climate Changes

Past climate information is obtained from ice core and $^{18}\text{O}/^{16}\text{O}$ in sediment (coral, i.e., CaCO_3). These data indicate CO_2 concentration of about 200 ppmv during the last two ice ages to about 300 ppmv during the interglacial warm period about 125,000 years ago. Such data also indicates cycles of 100,000-year ice ages with 50,000-year interglacial warm intervals.

Cause of Climate Change: Nature

1. Astronomical (cyclical activities)

The following 4 changes in the earth-sun system are the main contributors to climate change:

The *tilt* (obliquity) of the earth's axis varies from 22.1° to 24.5° in 41,000-year cycles. Currently, the axis tilt is 23.4° . This tilt causes seasons and a small change in tilt will produce a huge climate effect.

The *precession* (spinning top type wobble) of the earth's axis occurs in 26,000-year cycles. Presently, the north celestial pole points to Polaris; in 13,000 years it will point toward Vega. This is related to the vernal equinox (first day of spring in northern hemisphere) currently in Pisces; 1,000 years from now it will be in Aquarius—thus, we live in the “Dawning of the Age of Aquarius”. The precession affects the earth's orbit so that in 13,000 years the earth will be closest to the sun during the northern summer.

The *eccentricity* (e) of the earth's orbit (ellipse elongation; $e=0$ is a circle) varies from 0.005 to 0.06 in 100,000-year cycles. Currently, $e = 0.017$ and earth is nearest the sun during the northern winter. When e approaches 0.06, seasons are accentuated.

Sunspots and solar storms are cooler regions on the sun's surface, generating flares that are much hotter, i.e., 0.10% of the sun's heat. They occur in 11-year cycles, resulting in higher solar radiation. At times in the past, no sunspots have occurred. The last known occurrence was the Maunder minimum (1645 to 1715). It is believed that this accelerated the Little Ice Age (1550 to 1750), where it snowed in July and August and European settlements in Greenland were abandoned.

1. Noncyclical Natural Contributors

These include plate tectonics (continents move), changing ocean currents (warm El Niño, cool La Niña) volcanoes, collisions with asteroids, passing of earth through space dust. For example, currently, volcanoes under the Antarctic ice are causing some ice to break off and slip into the ocean, clearly not a global warming effect.

Conclusion

1. There is global warming; we live in a warm interglacial period.
2. Global warming and global cooling (ice ages) occur in 100,000-year cycles caused by astronomical events/cycles.
3. Most of current emitted CO_2 is the result of the earth getting warmer. (The ocean is a huge reservoir of CO_2 .)
4. Climate models are incomplete and inaccurate.
5. *The increase in CO_2 from human activity contributes only slightly to current global warming. Thus, reducing our CO_2 emissions will have little effect on global temperature. This is key!*