From The State Geologist

By John P. Bluemle

CLIMATE CHANGE

Elsewhere in this issue of the *NDGS Newsletter* is an article I wrote, titled "Global Warming: A Geological Perspective." It is a greatly condensed version of a technical paper that appeared in the journal Environmental Geosciences in June, 1999. I co-authored that paper with two colleagues, Joe Sabel and Wibjörn Karlén. Joe is a geologist with the U.S. Coast Guard in Oakland, California, and Wibjörn is a geographer at the University of Stockholm, Sweden. Both have done extensive work in the study of ancient climates.

I've used two diagrams from my article (Figures 1 and 2, below). These diagrams also appear with more explanation, in the article beginning on page 8. A comparison of the two diagrams helps put the current rise in global temperatures into a more realistic perspective. Figure 1 refers to temperatures in central Europe and illustrates how the average temperature there has changed through Tertiary time — the past 60 million years — as the earth's temperature gradually lowered. The gradual drop in global temperature culminated in repeated glaciations during Pleistocene time — the "ice age." Due to scale considerations, I haven't attempted to show the frequency of temperature fluctuations during the Pleistocene. I've shown only five periods of glaciation, but I know there were actually several more than that, both in Europe and in North Dakota. We have documented at least six separate periods of glaciation in North Dakota, but it's likely the state was glaciated closer to a dozen times during Pleistocene time.

During each major glacial event, global temperatures dropped between 10° and 15° Celsius, and they rose again by a comparable amount during each interglacial period. We are currently in an interglacial period, the Holocene Epoch, and have been since the most-recent glacial epoch ended about 10,000 years ago.

Figure 2 refers to temperatures world wide (not temperatures specifically in central Europe) so it can't be directly compared to figure 1. The diagram shows that the average, world-wide temperature, reported by the Goddard Institute for Space Studies, rose from approximately 13.8°C to about 14.6°C between the years 1866 and 1998, slightly less than a total of 1 degree Celsius (compare that rise to the much greater change in temperature during Tertiary time).

It is apparent that the amount of recent global warming (since 1866), when compared to the broad fluctuations in the temperature during the Tertiary Epoch, or even the more recent Ice Age, is tiny, almost too small to be noticed. I can suggest several conclusions:

1. Natural variability in temperatures has been demonstrated to far exceed any supportable estimate of human-induced variability. Geologists who study past climate variations understand that current climate warming projections fall well within the documented natural variations in past climate.

2. The earth is still emerging from the Little Ice Age. Significant additional rises in global temperature are a possibility. The current level of global warming is real and can be

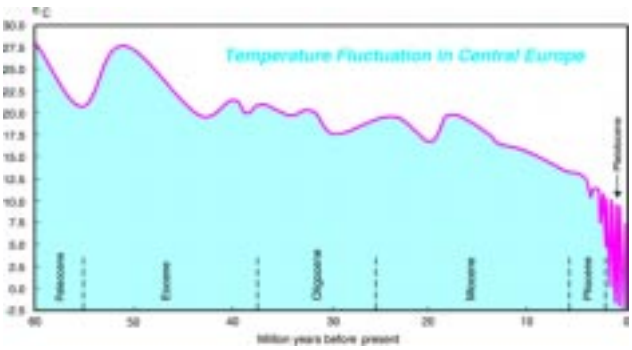

Figure 1. Temperature fluctuation in central Europe.

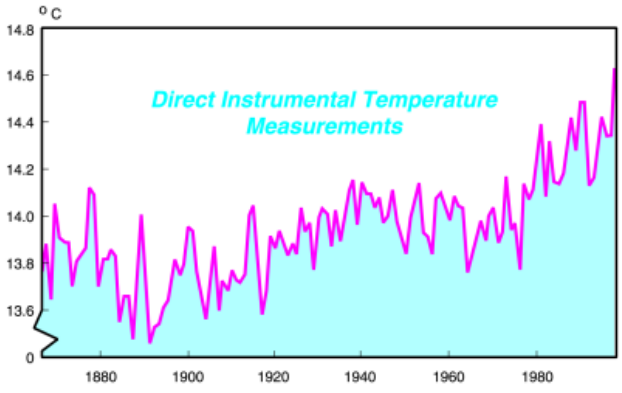

Figure 2. World wide temperatures.

explained by natural rise in temperature as the earth recovers from the Little Ice Age. But it's also possible that global temperatures could peak at any time and begin falling toward a new period of glacial conditions.

3. Geologic controls on climate are significant. Long-term changes can be demonstrated to occur congruently with geologic tectonic changes. Little is truly understood of the controls on short-term changes. Solar variability, for example, is significant in centennial to millennial changes, and possibly even over shorter time periods. There are a variety of other geologic factors that can contribute to long-term changes in climate.

4. Attempts to engineer Earth's very complex climate before understanding natural controls on climate are dangerous, if not impossible.

5. The reason most-often cited by the media for global warming is increased emissions of the greenhouse gas carbon dioxide (CO_2), due to human activity, especially the burning of fossil fuels since the beginning of the Industrial Revolution. Anthropogenic (human-caused) CO_2 emissions amount to about 3% of the total carbon cycle. Furthermore, changes in atmospheric CO_2 have shown a tendency to follow, rather than precede, global temperature increases. In fact, the observed increases in CO_2 in the atmosphere are of a magnitude that can be easily explained by oceans giving off gases naturally as temperatures rise. That is, the increasing amount of CO_2 in the atmosphere may well be a result of, not a cause for rising global temperatures.

6. Human-induced global temperature influence is a supposition that can neither be proven nor disproven. *There is exactly zero reliable scientific data supporting the claim that the world is warming as a result of human-caused greenhouse gas emissions*.

It's tempting (so tempting in fact, that it's done all the time) to confuse long-term climate trends with short-term and local weather situations. A few evenings ago, I heard the first mention on the national news about the latest hurricane, Hurricane Lenny, the 12th of the 1999 season. The news announcer noted that the large number of hurricanes this year was probably a result of global warming. Furthermore, the announcer said that a hurricane so late in the season is a unique event and further "proof" of human-caused global warming (actually there have been 46 hurricanes documented in November since official record-keeping began). The announcer went on to say that "mainstream" scientists believe the warming is a response to human activity. A week ago the same evening news program had a piece on La Nina. Again, the announcer said that "mainstream" scientists believe the La Nina is being caused by global warming and, furthermore, we can expect more-frequent and serious La Ninas and El Ninos in the future, unless we get busy and ratify the Kyoto Treaty. The "mainstream" adjective is a recent twist, obviously intended to portray scientists who dissent from the advocacy of human-caused global warming as somehow being out-of-step with reality.

As I write this on November 15 in my Bismarck office, I look out my window at near-record high temperatures and wish I was outside. Is our beautiful, warm autumn weather this year due to global warming? It's been suggested, of course. I suppose it's possible our warm weather may continue all winter, but I think it's unlikely. Will anyone in North Dakota be expounding on the immediate effects of global warming by the time this newsletter is in our reader's hands? I hope so, but I wouldn't bet on it.