

Statistical models indicate significant global warming

The question rages in some circles about whether we are actually seeing the effects of the greenhouse warming due to CO₂ and other gases in the recent warm years. The answer cannot be given unequivocally.

I wrote recently here in the Camera about Ed Lorenz' talk at NCAR about the matter. Based on his knowledge of theories of chaos, to which he has made monumental contributions, Lorenz believes the chaotic behavior of the climate system could possibly produce a global warming as large as the one we observe. His view is that the strongest reason to believe in the greenhouse warming is the theory of the greenhouse effect itself, which says that the more than 20 percent rise of greenhouse gases since 1890 would produce about the magnitude of warming we observe.

No one seriously doubts that the CO₂ rise is real or that other greenhouse gases are also on the rise. There are also provocative signs of warming other than global average temperatures, which are hard to determine. For example ice on Lake Hoare in Antarctica's dry valley has steadily thinned since 1978, and is now 2 meters less than it was. Furthermore, disappearance of snow at Point Barrow in Alaska, the signal of spring, has been gradually coming earlier and now vanishes in late May instead of mid June as it was in the

THOUGHTS OF A SCIENTIST



WALTER ORR ROBERTS

1940s.

There is, however, a hot controversy raging between some Bush administration spokesmen, like White House chief of staff John Sununu, and strong environmentalist advocates who favor controlling CO₂ to slow down the climate warming. The effects of the warming are far more important than just a few degrees of heat. It means disturbing agricultural impacts, troublesome sea level height increases, dislocating climate changes and a host of other effects, some of which we can only speculate about. It will make the world hotter than

anything in human history if the temperature trend is indeed from the greenhouse gases, and continues as these gases increase. Recently, in the Hague in Holland, the United States joined the Soviet Union and Japan in opposing a strong international push to enact an agreement to limit CO₂ emissions by the year 2000 AD. And I am sure we have not seen the end of the arguments for and against such a treaty.

A key position that some people close to the administration take is that we need more research, and thus more certainty, before we undertake costly control measures that may have negative economic implications. And this leads to a tough policy question about how strong the evidence must be to justify expensive corrective measures. This is precisely why I, personally, focus on the desirability of immediately adopting measures that will provide insurance if there is a bigger warming in our future, but that have a fighting chance of paying their way without further warming. I have outlined some of these in past columns. Politically they're far easier to swallow.

Two University of Wisconsin scientists, Tsonis and Elsner, last August published an interesting paper ("Testing the Global (See STATISTICAL, Page 2B)

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Warming Hypothesis," Geophysics Research Letters, August 1989), which I have just read. It says, in essence, that even though we cannot say whether the greenhouse effect is responsible, we can determine how extreme is the recent decade of warming, and how statistically probable is it to have come about by a chance fluctuation of the climate over the 108 years since 1881 for which we have good records.

They point out that since 1980 six years (1980, 1981, 1983, 1986, 1987 and 1988) are equal to or greater in global average temperature than any prior years in the record. Even considering problems of changing urbanization, different sites of recording and the like, this is unusual. The measures have, moreover, been analyzed carefully to eliminate spurious trends so far as possible. Several independent methods of sophisticated statistical analysis indicate that the possibility of so extreme a clustering of warm years has between a 1.0 percent and 3.2 percent chance of occurring as a result of natural variability of the system. Thus, they say, there is pretty high confidence for the assumption that we're in a significant global warming.

Is it due to the greenhouse effect? That cannot be stated for sure. However it is just about the amount that straightforward application of greenhouse effect theory predicts. Does it justify taking measures to control further greenhouse gas buildup? That is the matter in dispute. My own presumption is that the tough control measures won't be taken unless a far clearer environmental crisis is at hand. By then it may be

too late to do much good. Perhaps we'll have to start learning to live with and love a warmer world!

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