# Has the Greenhouse Taken Effect?

By RICHARD MONASTERSKY

The envelope, please. And the winner in the category of warmest year on record is . . . 1987.

That's right, last year. In more than a century of temperature measurements, 1987 takes the prize, scientists report in the April 28 NATURE. Based on average global temperatures for land and ocean areas, last year was warmer than any other year, beating by 0.05°C 1981 and 1983, which tied for second. In fourth and fifth place on the temperature record are 1980 and 1986 respectively. All told, the 1980s have so far accounted for the five warmest years in the history of global measurements.

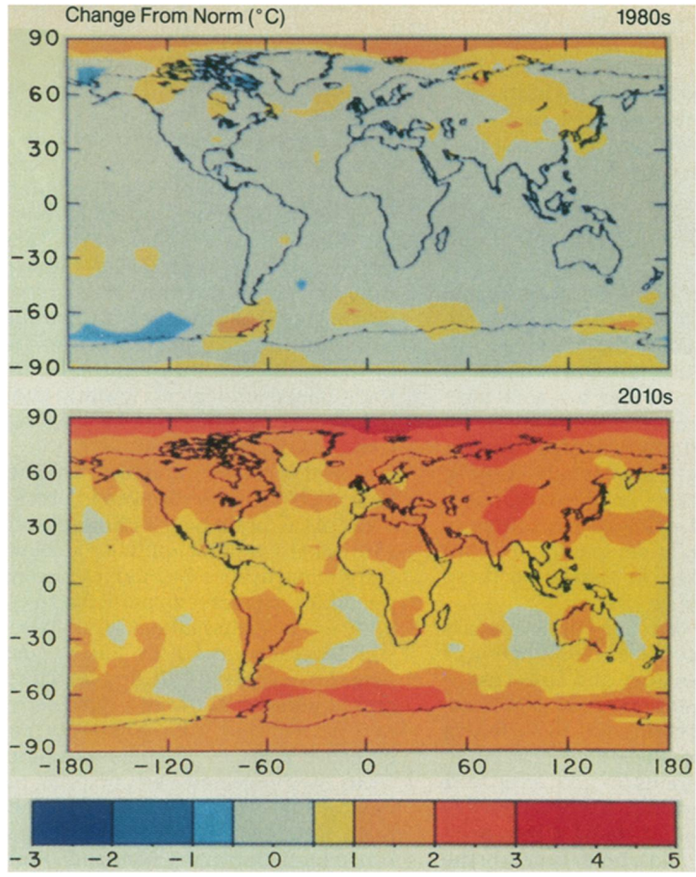
"It's pretty clear that the 1980s — in terms of the global mean record — are far and above the warmest collection of years in this hundred-odd-year record," says climatologist Thomas M.L. Wigley from the University of East Anglia in Norwich, England, who was an author of the recent report.

But while the earth's surface obviously has warmed this decade, scientists cannot yet definitively blame this trend on their leading suspect — the greenhouse effect, a predicted warming of the earth's surface caused by the accumulation of trace gases in the atmosphere.

For more than 50 years, experts have suggested that humans were knocking the delicate climate system off balance by increasing the atmospheric concentration of infrared-absorbing gases such as carbon dioxide, methane, nitrous oxide and more recently human-made chlorofluorocarbons. According to the greenhouse theory, earth's average surface temperature should climb as these heat-absorbing gases thicken in the lower atmosphere (SN: 8/9/86, p.87).

In a number of ways, the warming trend in the 1980s appears to confirm several predictions of the greenhouse theory, says Wigley. According to these predictions, the region of the lower atmosphere called the troposphere should warm up along with the earth's surface. In contrast, the upper layer of the atmosphere, the stratosphere, should cool off. Using balloons to measure the temperature of the atmosphere, scientists have found out that temperature trends are indeed confirming their expectations, says Wigley.

At the same time, however, experts are puzzled by other aspects of the global warming trend that are not following the basic tenets of the greenhouse theory. Traditionally, scientists have regarded the world's oceans as the inertia of the climate system. Because of their great capacity to store heat, the oceans are expected to warm at a slower rate than the land masses, retarding the whole climate system as it reacts to the growing concentrations of trace gases.




*Temperatures in 30 years may look like this. Computer models of the climate predict that the average temperature of the earth's surface will climb substantially during the next few decades, particularly at the poles. Color shadings represent (in °C) how the predicted temperatures will differ from a norm defined by temperatures from 1951 to 1980. To remove year-to-year variability, the predicted temperatures are decade averages.*

But the combined land and ocean measurements show the Southern Hemisphere, which is mostly ocean, has warmed faster than the Northern Hemisphere. "Now that is clearly inconsistent with a simple interpretation of the greenhouse effect, and what it means is that there are other things going on," Wigley says. "We don't understand what's causing that sort of difference, but it's pretty important. It's just one of the factors that prevent the interpretation of this warming in the 1980s from being open-and-shut."

Complicating the issue even further are the natural variations in the global climate records. Since the 1880s, the average global temperatures for land masses have climbed more than 0.7°C, according to a report in the April GEOPHYSICAL RESEARCH LETTERS by James Hansen and Segej Lebedeff from the NASA Goddard Institute of Space Studies in New York City. But the rise in temperature has not been simple and steady. In fact, after reaching a peak around 1940, temperatures dropped slightly for the next 20 years. These kinds of swings in the temperature record are a natural part of the variable climate.

Although the string of hot years in the 1980s seems to be a warning of predicted greenhouse warming, it is possible — though not probable — that they are just random variations in the climate, says Hansen.

Climate experts believe the events of the next decade will provide many answers about the greenhouse effect. According to V. Ramanathan, a climatologist at the University of Chicago, "it's too soon to call [the warming] a trace gas effect. But if a similar trend were to continue for the next decade, then I think the case would become very compelling."

Based on the current concentration of trace gases in the atmosphere, Hansen's models predict the global temperature rise will accelerate during the next decade. If temperatures don't follow the predicted path, it will mean the models are overestimating the greenhouse effect, Hansen says.

On the other hand, he adds, "if the temperature trend of the last 20 years continues for another 20 years, it will be warmer than it has been in the last 100,000 years." □