

A Global Warming Resumed in 1994, Climate Data Show

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Whatever happened to global warming? The question was on many lips a year ago, when the northeastern United States suffered through its bitterest winter in years. Now an exceptionally warm winter has whipsawed perceptions about the world's climate once again.

An answer has become apparent in annual climatic statistics in the last few days: global warming, interrupted as a result of the mid-1991 eruption of Mount Pinatubo in the Philippines, has resumed -- just as many experts had predicted.

After a two-year cooling period, the average temperature of the earth's surface rebounded in 1994 to the high levels of the 1980's, the warmest decade ever recorded, according to three sets of data in the United States and Britain.

The earth's average surface temperature last year closely approached the record high of almost 60 degrees measured in 1990. That was the last full year before the Pinatubo eruption, which cooled the earth by injecting into the atmosphere a haze of sulfurous droplets that reflected some of the sun's heat.

With the haze mostly dissipated, last year ranked as the third or fourth warmest, a fraction of a degree behind 1990, according to British and American records dating to the middle and late 19th century.

The third set of measurements, compiled by the Climate Analysis Center of the National Weather Service, found that most of the surface heating in 1994 occurred after February, making global temperatures from March through December the warmest in the center's records, which date to 1951.

While scientists have not disputed that the climate is getting warmer, they have disagreed about the cause, about how warm it will ultimately get and what the consequences will be.

Some climatologists ascribe the warming to the the growing atmospheric concentrations of carbon dioxide and other man-made gases that trap and retain heat from the sun in a process similar to what happens in a greenhouse. But most scientists say the amount of warming so far, about one degree Fahrenheit in the last century, is still too small to be distinguished from the climate system's natural fluctuations.

The mainstream view among researchers on climatic change is that atmospheric concentrations of greenhouse gases could double by the end of the next century if current rates of emission continue, and that this could produce a global warming of three to eight degrees Fahrenheit, with the most likely figure around four degrees. By comparison, the earth is five to nine degrees warmer now than in the last ice age, which ended about 10,000 years ago.

A four-degree warming, some scientists say, could cause ice at the poles to melt, resulting in rising sea levels. It would also shift climatic zones and make floods, droughts, storms and cold and heat waves more extreme, violent and frequent. Weather extremes have become more frequent since about 1980, climatologists say, but as yet they do not know whether this is linked to the warming climate.

Dr. James E. Hansen, who heads the National Aeronautics and Space Administration's Goddard Institute for Space Studies in New York, said he was "more confident than ever" that there is "a real warming which is not just a chance fluctuation but is a long-term trend, and that trend is due to the greenhouse effect." Dr. Hansen gained notice in 1988 by testifying before Congress that the greenhouse effect was probably causing global warming.

In an interview this week, he said he was confident that the global temperature would rise to a new record at least once in the remainder of the 1990's, and perhaps twice.

Whether the greenhouse effect is causing the warming is "an open question," said Dr. Tim P. Barnett, a climatologist at the Scripps Institution of Oceanography in San Diego, one of whose specialties is detection of the greenhouse effect. The fundamental difficulty, he said, is that not enough is known about the climate's natural variability.

Dr. Hansen's research group reported on the basis of temperature measurements on land that last year tied with 1987 as the fourth warmest year since comparable records were first kept in 1880. In both years, the average surface temperature was 59.58 degrees Fahrenheit. The 1990 record high was 59.85 degrees. The eight warmest years since 1880 have all occurred in the 1980's and 1990's, the Goddard group said.

The British climatologists, led by David Parker of the Government's meteorological office and Phil Jones of the University of East Anglia, reported yesterday that on the basis of preliminary data, 1994 was the third or fourth warmest year since their record-keeping started in 1850. The ranking is to be solidified when final data are in. The British temperature measurements have generally matched those of Dr. Hansen's group.

An analysis of satellite measurements by John R. Christy of the University of Alabama and Roy Spencer of NASA's Marshall Space Flight Center in Huntsville, Ala., showed that the lower atmosphere above the surface was also recovering last year from a post-Pinatubo drop in 1992, but that the temperature was slightly below the 1982-1991 average.

The Christy-Spencer data, which began in 1979, roughly parallel the upward and downward movement of surface temperatures, though the actual values differ. The Alabamians reported, for instance, that 1990's temperature was not a record but was the fourth highest.

Dr. James K. Angell of the National Oceanic and Atmospheric Administration's Air Resources Laboratory in Silver Spring, Md., said that balloon measurements taken one to six miles above the earth also showed a recovery from post-Pinatubo cooling, by the end of last year, of about a third of the distance from the Pinatubo trough to the 1990 record.

As usual, the warming last year was not uniformly distributed around the globe. While Central and Eastern Europe had an exceptionally hot summer, in the United States the Northeast had an especially bitter winter. Still, 1994 averaged out in the United States as the 16th warmest year in the last 100 years, according to the National Climatic Data Center in Asheville, N.C.

The British climatologists attributed the 1994 warmth partly to a natural cause: the continuing climatic influence of El Nino, the great pool of warm water that usually appears near Christmas from time to time in the tropical Pacific.

Besides changing patterns of air circulation that determine regional weather, El Nino is known to elevate global temperatures generally; the British researchers calculated its warming effect at 0.18 to 0.36 degrees in 1994. This could account for as much as a third of the recovery from the one-degree post-Pinatubo cooling.

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