1995 captures record as warmest year yet

Earth's average temperature in 1995 jumped to a new high in the 140-year-long record of reliable global measurements. At the same time, temperatures in the stratosphere dropped to a new low. Scientists say both records back up the idea that greenhouse gas pollution is altering Earth's climate.

The globally averaged surface temperature for 1995 climbed 0.4°C above the average from 1961 to 1990, edging out 1990 as the warmest year by four-hundredths of a degree Celsius, report researchers from the University of East Anglia in Norwich, England, and the United Kingdom's Meteorological Office in Bracknell. They included data collected from land stations, ships, and buoys.

The global temperature pattern was splotchy last year, with the readings furthest above average in the northern land areas, particularly Siberia and the western half of North America. Eastern North America, southern Europe, and northern Africa remained cool, according to the British records.

The warmth last year continues a 20-year trend of rising temperatures that has accelerated in the 1990s. The 5-year period from 1991 through 1995 is the warmest half decade in the record, surpassing the period of 1986 through 1990. "That's quite amazing," says East Anglia's Phil Jones, noting that the early 1990s was warm despite the eruption of Mount Pinatubo in June 1991, which chilled the globe for 3 years.

According to the British data, the globe has warmed by about 0.2°C per decade since 1975, an amount that appears consistent with estimates of future greenhouse warming made by supercomputers running global circulation models (GCM). In December 1995, the Intergovernmental Panel on Climate Change (IPCC) published a state-of-the-art assessment projecting a 2°C global warming by the year 2100.

The rising temperatures of late, says Jones, "suggest that these GCM estimates of how much the world is warming per decade are probably quite reasonable."

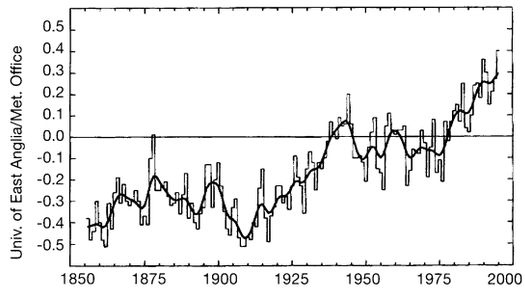
Measurements of atmospheric temperature by satellite, however, do not tell the same story as the surface data, says John Christy of the University of Alabama in Huntsville. Although he lacks data from December, Christy says that 1995 will rank only eighth warmest in the 17 years of temperature measurements from satellites. In fact, global temperatures read from space have actually decreased slightly since 1979.

Because they cover all areas of the globe, the satellites provide a more comprehensive picture of Earth's temperature. But they do not necessarily track conditions at ground level, where people live. The satellite instruments measure an average temperature through much of the lower atmosphere up to an altitude of 7 kilometers.

The globally averaged temperature, whether read by satellite or by surface stations, is only a crude measurement of the climate, says Jones. To monitor the planet more fully, scientists also analyze patterns of temperature change across different regions and seasons.

According to the IPCC report, pattern studies have produced evidence strong enough to conclude that pollutants—both the warmth-inducing greenhouse gases and cooling sulfur emissions—have played a role in producing recent patterns of climate change. "The balance of evidence suggests that there is a discernible human influence on global climate," says the report.

In searching for patterns, researchers examine temperatures in the stratosphere, 12 km to 50 km above the surface, where greenhouse gases are expected to produce a cooling. According to satellite measurements analyzed by Christy, temperatures in the lower stratosphere set a record low during 1995, averaging 0.4°C below average.



Globally averaged surface temperatures (°C) relative to the 1961 to 1990 average.

Stratospheric temperatures have declined markedly since 1991. Christy attributes the first few years of cooling to the debris that Mount Pinatubo blasted high into the air. But the cooling has continued long after Pinatubo's effects dwindled. Christy says the recent cooling could stem in part from ozone loss and from the accumulation of greenhouse gases in the lower atmosphere.

— R. Monastersky

Immune cells primed for cancer vaccine

Patrolling the body's tissues, dendritic cells are watchdogs for the immune system. If interlopers—bacteria or viruses, for example—roam through the body, dendritic cells help alert the rest of the immune system to the invasion.

Investigators inspired by the idea of vaccinating people against cancer are now turning their attention to these cells. In the first study of its kind in humans, injections of specially treated dendritic cells have eliminated the tumors in one patient with non-Hodgkin's lymphoma and have aroused immune responses against the tumors in three other patients with the same cancer.

"These responses have been very strong and intense," says Frank J. Hsu of Stanford University. Hsu and his colleagues, including Ronald Levy and Edgar G. Engelman, report their results in the January NATURE MEDICINE.

One of the guiding principles behind cancer immunotherapy is that cancer cells sport tumor antigens—proteins or other surface molecules that distinguish these cells from healthy cells. Consequently, cancer vaccine developers wish to coax the immune system into killing cells that display these antigens.

To do this, many investigators have injected tumor antigens directly into the bloodstreams of patients, either alone or with compounds designed to elicit a stronger immune response. Dendritic cells would be expected to gobble up these antigens and then display the molecules on their surfaces, thereby telling other immune cells what targets to destroy. But, says Hsu, simple injections of these antigens do not provoke antitumor immune responses in every patient, and the responses that do occur range widely in intensity

To eliminate this frustrating inconsistency, the investigators primed the dendritic cells with a unique tumor antigen from the cancer cells of each patient. They harvested young dendritic cells from a patient, grew them in a solution that contained large amounts of that patient's tumor antigen, and reinfused the cells into the patient.

This, they believed, would guarantee that the dendritic cells present the antigen properly. To further increase the antitumor response, the investigators also followed each cellular treatment with injections of the tumor antigen.

"We think it's a stronger, more potent way of immunizing people," says Hsu, who cautions that the new approach needs refining. Although the vaccine generated immune cells that specifically recognized tumor cells in all four patients, only in one was the response strong enough to cause complete remission.

Other investigators are now testing primed dendritic cells in animals with a variety of cancers, says Hsu. They also plan to treat people with melanoma, a cancer for which there is an identified tumor antigen (SN: 12/14/91, p. 388).

"It's an interesting approach, but it's just one of many ways of immunizing people that we're exploring. It's very difficult to predict which approach will work in humans," says Steven A. Rosenberg of the National Cancer Institute in Bethesda, Md.

— J. Travis