Polar Regions Give Cold Shoulder to Theories

TSUKUBA, JAPAN—While a United Nations' panel surveying global temperatures sees the first signs of greenhouse warming (see main text), scientists searching for such evidence in the polar regions are coming up empty-handed. Climate models forecast that even minor warming from the buildup of greenhouse gases in the atmosphere would lead to a retreat of polar ice and snow cover, reducing the albedo, or reflectance, of the Earth's surface. That, in turn, would result in greater absorption of solar radiation, which would boost surface temperatures and cause a further retreat of snow cover. The result would be a greater temperature rise at the poles than in the equatorial regions.

But evidence of such a high-latitude warming is proving hard to find. Seasonal and regional variations in the polar regions make it difficult to separate suspected greenhouse signals from the noise of natural fluctuations. Last month, at a 4-day international conference here,* researchers agreed that detecting climate change in a single region is a lot trickier than was thought just a few years ago. "We are seeing changes, but whether these are the result of human activity or within the range of natural variability is not yet clear," says oceanographer Nobuo Ono, deputy director of Japan's National Institute of Polar Research. Adds Gunter Weller of the University of Alaska, Fairbanks, "we're seeing glimpses" of greenhouse signals, "but it's all very ambiguous."

LONNIE G. THOMPSON

Tibetan tales. Ice cores from the Qinghai-Tibetan Plateau supplement records from the poles.

The conference provided researchers with the chance to mull over the significance of a growing body of data on such indices as extent and thickness of land and sea ice, snow cover, and sea and air temperatures. Cryospheric data specialist Roger Barry of the University of Colorado reviewed surveys of snow cover and sea ice, including data recently made available on snow depth in the former Soviet Union. His conclusions: "There is no evidence of a recent warming trend" in these data and "no clear evidence of a trend" in the thickness of polar sea ice. Barry noted that one exception, a documented thinning of ice in the past 3 to 4 years in the East Siberian Sea, seems to be related to changes in air temperature patterns from an increase in the number of cyclones south of the sea. But it's not clear whether cyclone activity is itself an indicator of climate change, he said.

H. Jay Zwally, a glaciologist at Goddard Space Flight Center in Maryland, said his search for long-term trends in ice cover, based on a review of satellite-based remote sensing of polar ice, "has given ambiguous results." There have been tremendous variations since he began his observations in 1973, he noted, with sea ice cover in some regions fluctuating by as much as 30% over several years.

Confusing signals are also coming from ice cores, which researchers had once hoped would prove to be reliable records of historic climate variability. Ice-core specialist Roy M. Koerner of the Geological Survey of Canada pointed to problems arising from comparisons of data from the Greenland Icecore Project (GRIP) with other indicators of climate change in the Holocene period, which extends back 10,000 years. He suggested that GRIP's Holocene record of the levels of oxygen-18, an isotope trapped in the ice that is used to deduce the history of atmospheric temperatures, is not representative of the northern circumpolar region. "Ice sheets are so big they generate their own climate," he said.

Although Antarctic and Greenland ice cores provide good records for major climate changes, he said, they may not reflect the more subtle shifts that take place on shorter time scales. A record of these short-term variations is needed to establish the natural variability of interglacial periods.

Another expected signal of warming—the increased occurrence of abnormal weather—is also proving to be hard to pin down. Atmospheric scientist Hiroshi Tanaka of the University of Tsukuba's Institute of Geoscience has studied a few days in early 1989 when Arctic air temperatures switched from 10°C colder than normal to 20°C warmer than normal and found the sharp rise in temperature stemmed from a shift in wind currents above the Beaufort Sea. But "we don't know [whether there is] a trend," he said, because of a lack of historical data.

A second purpose of the conference was to try to reconcile observations with predicted results from current models. University of Illinois climatologist John Walsh, who helped to organize the conference, said he has found spotty matches from a comparison between observed Arctic temperatures, precipitation, and extent of sea ice and predictions from a prominent global climate model developed by Princeton's Geophysical Fluid Dynamics Laboratory. The model predicted that the current buildup of greenhouse gases would result in warmer temperatures and increased precipitation over the Arctic Ocean in autumn. Such changes were observed at the predicted levels, but, Walsh said, they occurred over land in the spring. Walsh also noted the absence of retreating sea ice, as the model implies.

But climate modeler Howard Cattle of Britain's Hadley Centre for Climate Prediction and Research defended the models, saying that "it's not clear to me that at this stage of the game you would expect to see a greenhouse signal." He noted that past models often were too simple, in particular overlooking the cooling effect of pollutant sulfate aerosols that tends to offset CO_2 warming (*Science*, 16 June, p. 1567). When the effects of aerosols are factored in, he said, they capture this century's warming trend, including a gradual rise in atmospheric temperatures into the 1950s, a leveling-off, and then a resumption of warming in the 1970s. However, the aerosol effect "pushes the [warming] curve back and may delay the onset of any observable signal," Cattle said. Another problem, he said, is that the models are not yet precise enough to accurately reveal the regional signals sought by polar observers.

Surrounded by all the unanswered questions, some researchers are wondering if the polar regions may not be the right place to look for early signs of global climate change. Indeed, Philip Jones, a climatologist from the University of East Anglia in the U.K., said that the extreme natural variability in the polar climate makes it more difficult to get a clear picture of trends than in other more stable regions. "The first specific region to look at may be the tropics," he said. Illinois's Walsh acknowledged that the idea is worth considering. But given the title of the conference, he said, such suggestions would have to be handled "in a subtle way."

–Dennis Normile

* Wadati Conference on Global Change and the Polar Regions, Tsukuba, Japan, November 7–10.