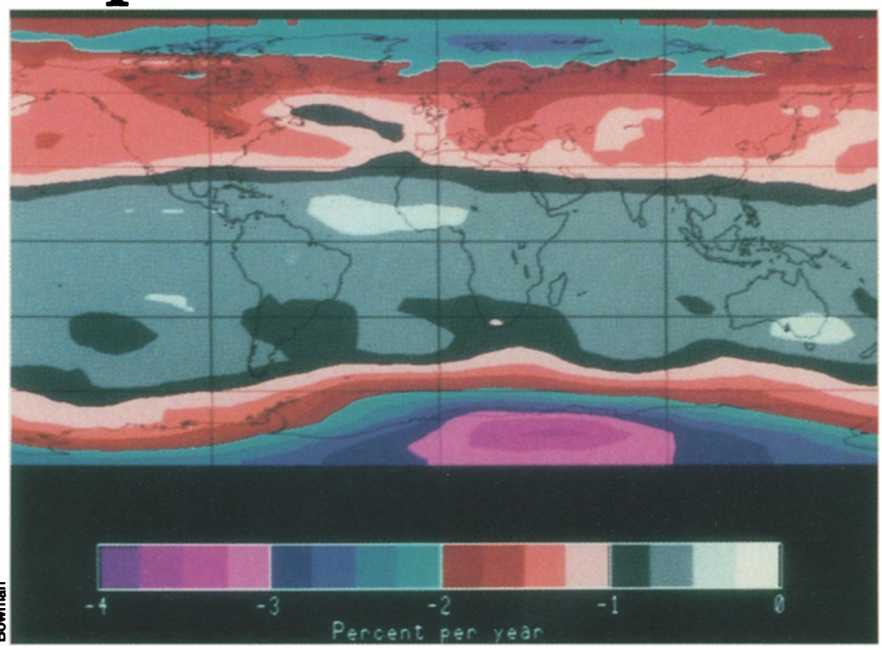
Ozone Reports Stir Debate

The recent discovery that stratospheric ozone levels have plummeted by as much as 50 percent each Antarctic spring since 1979 ensures the southern region a prominent place in the annals of atmospheric sciences.

But Antarctica is not the only region experiencing depletion of the ozone layer that shields the earth from harmful ultraviolet radiation. Scientists now agree that stratospheric ozone levels *worldwide* have been on an annual decline for the last eight years. However, exactly how much ozone has been lost and what natural and/or human activities – a notable possibility being the release of ozone-attacking chlorofluorocarbons (CFCs) – are behind the recent depletion is a sticky issue currently being debated by scores of researchers.



Bowman

From Bowman's preliminary analysis, the greatest ozone loss rates since 1979 are in the polar regions. This is the same kind of latitudinal "fingerprint" produced by models predicting ozone depletion from chlorofluorocarbons.

Some of the first published estimates of the worldwide depletion rate appear in two recent papers. Kenneth P. Bowman of the University of Illinois in Urbana-Champaign concludes in the Jan. 1 SCIENCE that global ozone levels fell by 5 percent from 1979 to 1986. Bowman says his is the first published trend analysis of data from the Total Ozone Mapping Spectrometer – one of two ozone instruments aboard the Nimbus-7 satellite. His rate is comparable to that of an earlier, unpublished analysis of data from the other Nimbus-7 device, the Solar Backscatter Ultraviolet instrument (SN: 6/28/86, p.404).

The rate is also near the range of what James K. Angell at the National Oceanic and Atmospheric Administration (NOAA) in Silver Spring, Md., has derived from ground-based measurements. In the January JOURNAL OF APPLIED METEOROLOGY he writes that there was a 2.7 percent decrease in global ozone between 1980 and 1985.

But in spite of some similarity between these numbers, ozone researchers caution that uncertainties still loom large. In particular, both satellite systems suffer from degradation problems that, in theory, could make the real depletion rate either significantly less or greater than the recent estimates. Partly in hopes of nailing down such calibration errors, NASA, NOAA and a host of other agencies formed the international Ozone Trends Panel a year ago. More than 100 scientists have been scrutinizing the quality of both satellite and ground-based data in order to come up with the best possible depletion rate and its causes. While Bowman – who says he would not have published had he known of the panel's activities – did take some instrument drift into account, some researchers believe his paper is premature, given that the panel's more detailed report is due out by mid-March.

"Bowman is roughly in the right ballpark, but he has not done a thorough analysis of the data," says NASA's Robert Watson. "We put the panel together because it's clear that no single scientist or small group can do a critical evaluation of all the data and all the theory. I think you'll see the result that ozone has indeed changed during the 1980s. Now we have to critically look at exactly what the changes are and if they are consistent with our theories."

A global depletion of a few percent over the last eight years might, at first glance, seem to be cause for alarm: Recent CFC models predict that same amount of depletion to occur, but over a *70-year* time frame. (These models assume a freeze of CFC emissions at today's rate, as well as increases in methane and other chemicals that enhance ozone levels.)

However, most scientists suspect that a few-percent decrease since 1979 could be explained not only by a small, expected depletion due to CFCs, but also by natural phenomena, including volcanic eruptions and the 11-year solar cycle. An ozone decline much greater than a few percent, on the other hand, might mean that scientists have underestimated the effects of CFCs, says Watson.

As for the solar cycle, Watson notes that 1979 coincided with a solar maximum, in which the output of ozone-producing ultraviolet radiation peaked. As the solar output fell from that time to a minimum in 1985-1986, says Watson, ozone probably fell as well. But how much decrease one should expect due to solar variability is a question being investigated. The 1986 satellite data hint at an ozone recovery with the upswing in the solar cycle – a possible indication that the solar cycle does play an important role in determining ozone levels.

Another question being explored by the panel is the extent to which the Antarctic ozone hole may be influencing global ozone levels as ozone-poor air from the South Pole dilutes the air at higher latitudes each year.

In addition to elucidating the forces driving previous ozone depletion, Watson says the panel wants to predict future ozone changes – especially changes in the near future, when nations and industry review the recent international agreement to cut CFC use by 50 percent by 1999 (SN: 9/26/87, p.196). If some of the recent ozone drop is indeed due to solar variability, says Watson, ozone levels could well rise in the next three or four years. If policymakers and industries fail to understand ozone's natural ups and downs, which at best only temporarily counteract the inexorable CFC-induced ozone decline, he says, that could threaten future support for the CFC agreement.

– S. Weisburd