Antarctic Ozone Bottoms at Record Low

The infamous hole in the Antarctic ozone layer reached record proportions last week, providing a dramatic reminder of pollution's power to alter the atmosphere. The severe ozone loss largely confirms a prediction made earlier this year by a meteorologist who found a statistical connection between the tropical climate and the severity of polar ozone depletions.

Satellite measurements show that the ozone concentration in the Antarctic stratosphere — 12 to 50 kilometers up — reached 125 Dobson units on Oct. 4, a value on par with the record lows of 121 and 125 Dobson units set in 1987 and 1989 (SN: 9/29/90, p.198). "This is as big an ozone hole as we've seen in the past," says Arlin Krueger, of NASA's Goddard Space Flight Center in Greenbelt, Md.

Ozone molecules in the stratosphere protect life by absorbing damaging ultraviolet radiation from the sun. Every year since 1977, the ozone layer above the entire Antarctic continent has thinned dramatically during September, the beginning of springtime in that region.

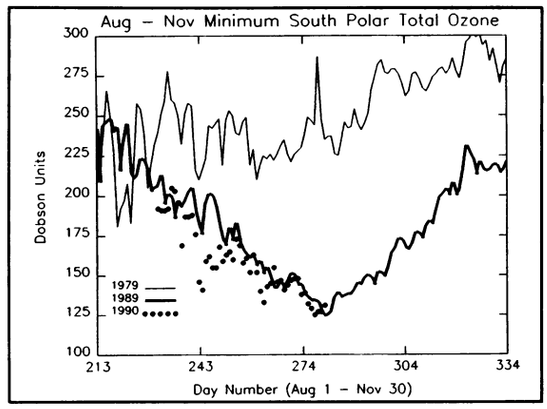
The hole forms because extremely cold temperatures in this part of the stratosphere activate chlorine and bromine pollutants that chemically attack ozone molecules. Persisting for a month or two, the hole finally fills in when a breakdown of winter polar-wind patterns allows an influx of ozone-rich air.

The same pollutants are apparently thinning the ozone layer around the entire globe, although at a slower rate.

Even before ozone levels started dropping this year, meteorologist James K. Angell predicted severe depletions for 1990 in a paper published in the September Geophysical Research Letters. Angell, who works at the National Oceanic and Atmospheric Administration in Silver Spring, Md., based the prediction on a statistical link he found between polar ozone loss and two variables: sea surface temperatures near the equator and a cyclic wind pattern called the Quasi-Biennial Oscillation (QBO).

The QBO refers to stratospheric winds that circle the equator and reverse direction about every 13 months. To examine the QBO since 1958, Angell used records of stratospheric temperatures over Singapore, which indicate the direction and strength of the equatorial stratospheric winds.

Angell concentrated on temperature measurements for June, July and August. He found that when both equatorial stratospheric and sea surface temperatures increased from one summer to the next, ozone depletions in October and November were worse than the year before.



NASA

Satellite measurements of Antarctic ozone loss in 1990 and other years.

Since both stratospheric and sea surface temperatures near the equator rose over the past year, Angell predicted severe depletions for 1990. Several researchers previously have sought a QBO-ozone connection, but none had looked at both winds and sea surface temperature.

Angell's discovery has intrigued scientists, who do not know why equatorial conditions should influence ozone loss in Antarctica. "At this point, there is no good dynamical explanation for the connection between the QBO and the ozone hole," says Paul Newman of NASA Goddard. If the statistical relationship proves real, it can help researchers model and predict polar ozone loss.

— R. Monastersky

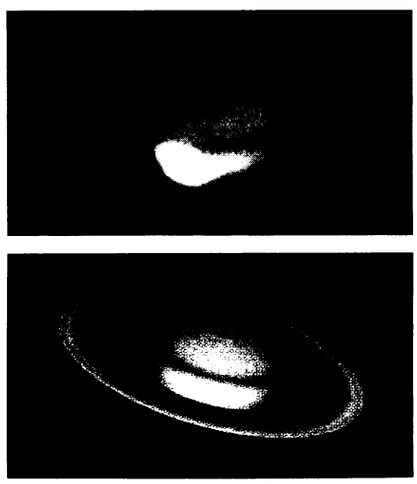
Spotting an ephemeral artifact on Saturn

Astronomers have discovered a giant white spot in the clouds above Saturn, about 22 degrees below the planet's equator. Apparently caused by the rapid emergence of hot material from deep within Saturn's atmosphere, the oval spot extends about 21,000 kilometers in length, or about 5 percent of the planet's circumference. Astronomers observing the ringed planet have not glimpsed a comparable phenomenon on Saturn in 57 years.

Scientists believe the spot formed when an unusually large amount of warm gas rose up from Saturn's lower atmosphere with enough force to penetrate the planet's thick clouds of ammonia ice. As the gaseous material cooled and expanded — adjusting to the lower pressure — fresh ammonia ice crystals formed within it. This gave the spot a white appearance that contrasts with the opalescent, yellow-brown of the older ammonia clouds below. While such bubbles, or hot spots, apparently emerge often from Saturn's inner atmosphere, most remain unsighted from Earth because they do not penetrate the uppermost clouds, says Reta Beebe of New Mexico State University in Las Cruces.

This may explain, she notes, why scientists have not observed a similar white spot on Saturn since 1933, when two spots appeared and lasted several weeks. The size and brightness of the current spot, Beebe adds, enables astronomy buffs to view it through a 6-inch telescope.

Because the spot rotates slightly faster than the planet, Beebe and other researchers expect that Saturn's strong winds will eventually rip it apart. But the white patch could last for several months if it evolves into a storm, rotating with the wind instead of opposing its force. That may provide enough time for the Hubble Space Telescope, which last photographed Saturn in August — before the spot appeared — to focus its eye on this enigmatic feature. Late last week, the Space Telescope Science Institute in Baltimore approved plans for Hubble to photograph Saturn in early November, says Rodger Doxsey, the institute's chief of computer operations. *— R. Cowen*



Scott Murrell/N.M. State

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Image of Saturn (top photo), taken last week from Earth, shows extent of giant spot. Hubble's Saturn image (bottom photo), released last week but taken before the white spot's debut, can't rival Voyager's close-up photos taken a decade ago. But it has the same clarity as if Saturn were only twice the moon's distance from Earth, and viewed with the naked eye.