

# Greenhouse Warming Hurts Arctic Ozone

Although nations have started weaning themselves off ozone-depleting chemicals, a seemingly unrelated problem threatens to foil their efforts. Greenhouse warming in coming decades will alter global winds in ways that significantly slow the recovery of the ailing ozone shield, according to computer climate simulations by NASA scientists.

"Our research says that it won't get better starting in a couple of years [as predicted], but it will actually continue to get worse for the next 10 or 15 years or so," says Drew T. Shindell of the NASA Goddard Institute for Space Studies in New York City. "It is an interesting example of how global warming is such a big effect that it can have all sorts of unforeseen implications," he adds. Shindell's group reports its findings in the April 9 NATURE.

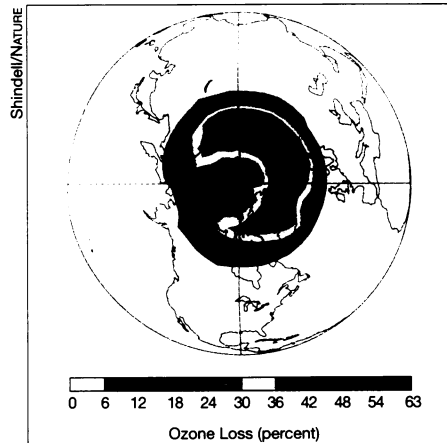
The NASA scientists explored the subtle influences of greenhouse warming by running experiments on a climate model that divides the atmosphere into boxes measuring 8° by 10°, stacked in 23 vertical layers. Shindell and his colleagues

built in simplified ozone chemistry—a first for computer climate modelers.

Ozone destruction depends on cold conditions in the stratosphere, and Shindell's computer simulations showed two ways in which greenhouse warming abets this process by cooling the lower stratosphere.

First, the trapping of heat near the ground blocks radiation from reaching the stratosphere—a straightforward effect well known to scientists. A more potent and unanticipated cooling influence comes from the way that greenhouse gases alter winds in the lowest layer of air, the troposphere. Warming in the tropics strengthens the jet streams circling the globe in the midlatitudes, says Shindell. These enhanced winds prevent disturbances from migrating toward the Arctic and Antarctic, effectively sealing off the polar skies and allowing them to cool.

In the model, the lower temperatures in winter helped bring about massive ozone loss in the Arctic from 2010 to 2019, even as the instrument of the



Predicted Arctic ozone loss in March for the years 2010 through 2019.

destruction—chlorine pollution—became scarcer in the skies.

Because computer simulations represent simplified versions of the real atmosphere, researchers find it difficult to judge the reliability of model forecasts. Yet recent history has added credence to the NASA study, according to Shindell. During the 1990s, the Arctic stratosphere has remained more stable and colder than during the 1980s, a pattern similar to that exhibited by the model. Individual years vary tremendously, however, and the winter of 1998 in fact saw only meager ozone loss in the Arctic, says Shindell.

Other research groups are reaching conclusions similar to NASA's as they start to examine the interplay between global warming and ozone chemistry, says Neal Butchart of the United Kingdom Meteorological Office in Bracknell. In unfinished studies, both its model and a French one show the polar stratospheres growing more isolated and colder. "This looks like it could be a fairly robust feature in the models," says Butchart.

The details of the winds in the NASA model do not resemble those in other computer models, however, including one at the National Oceanic and Atmospheric Administration's Fluid Dynamics Laboratory in Princeton, N.J. The lab's director, Jerry D. Mahlman, argues that the NASA model splits the atmosphere too coarsely to investigate the intricacies of how winds will respond to global warming. "Pieces of their work are almost certainly correct, and other pieces are highly questionable."

The NASA study, he adds, didn't include several factors that will further delay ozone recovery. "The problem is even scarier than this paper suggests," says Mahlman. —R. Monastersky

## Drug prevents some cancer, poses risks

For "the first time in history," evidence indicates "that breast cancer can not only be treated but also prevented," says Bernard Fisher of Allegheny University of the Health Sciences in Pittsburgh.

Fisher is referring to the finding that women at especially high risk of breast cancer appear to halve their chances of developing the malignancy by taking tamoxifen, a synthetic hormone. These results, reported Monday, come from a federally funded trial directed by Fisher.

For 25 years, tamoxifen has been used to limit breast cancer recurrence in women treated for the disease. In 1992, the National Cancer Institute (NCI) in Bethesda, Md., launched a trial to see whether the drug could also prevent the scourge in women who had never had the disease. Half of some 13,000 volunteers received the drug; half got an inactive substance, or placebo.

While 154 of the women taking the placebo developed invasive breast cancer during the trial, only 85 women who were taking tamoxifen did.

Hailing the trial as a "historic" success, NCI Director Richard D. Klausner also noted that the drug poses serious risks. Among the women taking tamoxifen, a known carcinogen (SN: 3/2/96, p. 132), 33 developed uterine cancer, compared to 14 in the placebo group. The

17 pulmonary blood clots among tamoxifen users were almost triple the number in the placebo group and included two deaths. Clearly, Klausner said, "this drug is far from ideal," and the need to evaluate its benefits and risks individually for each patient "cannot be emphasized enough."

The increased risks showed up only in women over 50, notes NCI's Leslie Ford. Moreover, "none of the risks were unanticipated, and none were higher than expected" (SN: 5/9/92, p. 309).

Because two earlier studies suggested that taking tamoxifen for many years increases cancer rates and mortality (SN: 12/9/95, p. 391), NCI recommends that breast cancer survivors take it for no more than 5 years. Klausner said no one knows whether cancer-free women will need to adhere to the same limit.

"I'm glad they found a very substantial benefit in [breast] cancer prevention, because the drug's adverse effects in healthy women are very troubling," says breast cancer epidemiologist Trudy Bush of the University of Maryland in Baltimore.

Adds Cynthia Pearson of the National Women's Health Network in Washington, D.C., it's too early to know whether the tamoxifen group's lower cancer rate represents "a true prevention of disease versus just a delay." —J. Raloff