

*Re-evaluating the  
Ozone Layer*

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**W**e don't hear much about the hole in Earth's ozone hole these days, and for good reason. Collective international action has been successful in reversing a decades-long deterioration of the protective layer in the stratosphere. The hole, which grows and shrinks seasonally over Antarctica, is expected to close by sometime mid-century.

Now, however, models and observations of Earth's atmosphere are showing that the ozone hole might have an effect on global climate patterns that may be masking the full impact of global warming. "The ozone hole has been ignored for the past decade as a solved problem," said Lorenzo Polvani. "But we're finding it has caused a great deal of the climate change that's been observed."

Polvani, who also holds an appointment in the Department of Earth and Environmental Sciences, has studied atmospheric dynamics from the surface to the upper stratosphere and from both poles to the equator. In the last few years, he has focused on understanding the effects that ozone depletion, and its eventual recovery, have on Earth's climate.

Ozone—a molecule made up of three atoms of oxygen—absorbs much of the sun's UV-B radiation. In the mid-1980s, it was discovered that chlorofluorocarbons, a chemical used as aerosol propellants, were breaking down the planet's ozone. In 1987, world governments signed the Montreal Protocol to ban chlorofluorocarbons.

Ozone warms the stratosphere when it absorbs UV radiation. Its relative absence over Antarctica for the past 40 years has had a cooling effect on the upper atmosphere over the South Pole that is as much as 10 times as strong as the warming effect associated with increasing carbon dioxide concentrations.

The effects of this cooling already appear to be affecting the location of the Southern Hemisphere's mid-latitude jet stream. Cooling of the upper troposphere—the highest part of the lower atmosphere—has been connected to a shift of the southern jet stream towards the south by a few degrees.

This shift has resulted in precipitation patterns moving south as well, and in the tropical dry zones expanding. Polvani's next task is to find out what will happen as the ozone hole closes and the full brunt of global warming is felt throughout the atmosphere.

"These next couple of decades are going to be interesting times," said Polvani. "We're going to see these climate changes play out in our lifetimes."

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