

# Ozone layer decline leveling off, according to new study

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A new global study involving long-term data from satellites and ground stations indicates Earth's ozone layer, while still severely depleted following decades of thinning from industrial chemicals in the atmosphere, is no longer in decline.

Betsy Weatherhead, a researcher with the Cooperative Institute for Research in Environmental Sciences, a joint institute of the University of Colorado at Boulder and the National Oceanic and Atmospheric Administration and corresponding author of the study, said the team documented a leveling off of declining ozone levels between 1996 and 2002, and even measured small increases in some regions.

"The observed changes may be evidence of ozone improvement in the atmosphere," said Weatherhead. "But we will have to continue to monitor ozone levels for years to come before we can be confident."

It most likely will be decades before the ozone layer recovers, and it may never stabilize at the levels measured prior to the mid-1970s, when scientists discovered human-produced chlorine and bromine compounds could destroy ozone and deplete the ozone layer, Weatherhead said.

A paper on the subject involving researchers from CU-Boulder, NOAA, the University of Wisconsin Madison, the University of Chicago and the University of Illinois was published online Aug. 29 in the Journal of Geophysical Research.

The halt in the ozone decline follows the 1987 Montreal Protocol, an international agreement now ratified by more than 180 nations that established legally binding controls for nations on the production and consumption of halogen gases containing chlorine and bromine. Scientists say the primary source of ozone destruction is chlorofluorocarbons, or CFC's, which once were commonly used in refrigeration, air conditioning, foam-blowing equipment and industrial cleaning.

The new statistical study focused on levels of total-column ozone – ozone existing between Earth's surface and the top of the atmosphere. Total-column ozone is a primary blocker of UV radiation in the atmosphere.

The team analyzed data from a cadre of NASA and NOAA satellites as well as ground stations in North America, Europe, Hawaii, Australia and New Zealand.

About 90 percent of total-column ozone is found between 10 miles to 20 miles above Earth's surface in the stratosphere, Weatherhead said. The ozone layer protects the planet from the harmful effects of UV radiation, including skin cancer and cataracts in humans and damaging effects on ecosystems.

Despite the new evidence for the beginnings of an ozone recovery, Mike Repacholi, The World Health Organization's environmental health coordinator in Geneva, warned that precautions such as UV-blocking sunglasses and skin protection remain vital. "This study provides some very encouraging news," he said. "But the major cause of skin cancer is still human behavior, including tanning and sunburns that result from a lack of proper skin protection."

Ozone depletion has been most severe at the poles, with levels declining

by as much as 40 percent on a seasonal basis, said Weatherhead. But there also has been as much as a 10 percent seasonal decline at mid-latitudes, the location of much of North America, South America and Europe.

Other anthropogenic changes to the atmosphere such as methane levels, water vapor and air temperatures will affect future ozone levels, which are naturally maintained by complex chemical processes sparking the continual creation, destruction and redistribution of ozone, said Weatherhead. "Even after all chlorine compounds are out of the system, it is unlikely that ozone levels will stabilize at the same levels."

Scientists warn a return to significantly higher atmospheric ozone levels may take up to 40 years. "Chemicals pumped into Earth's atmosphere decades ago still are affecting ozone levels today," said Sherwood Roland of the University of California, Irvine, who shared the 1995 Nobel Prize in Chemistry with Paul Crutzen and Mario Molina for their work in identifying the CFC threat to the ozone layer. "This problem was a long time in the making, and because of the persistence of these chlorine compounds, there is no short-term fix."

Greg Reinsel, a UW Madison researcher and the lead author of the study, was one of the first scientists to quantify the ozone decline more than two decades ago. He died unexpectedly in May after completing the study.

Other co-authors include NOAA's Alvin Miller, Lawrence Flynn and Ron Nagatani, George Tiao of the University of Chicago and Don Wuebbles of the University of Illinois.

More UV radiation information is available at: [www.srrb.noaa.gov/UV/](http://www.srrb.noaa.gov/UV/)

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