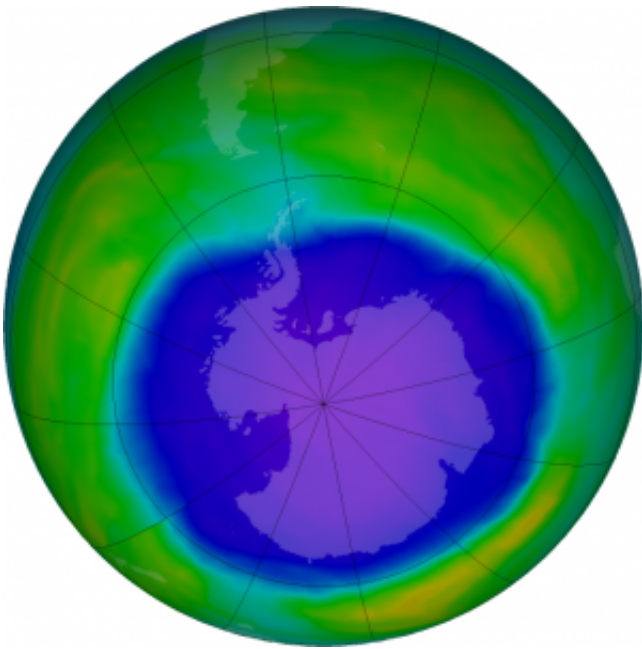


Ozone treaty taking a bite out of US greenhouse gas emissions

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The ozone hole over Antarctica, captured by NASA's Aura satellite on October 2, 2015. A new study shows the Montreal Protocol, the international treaty adopted to restore Earth's ozone layer in 1989, has significantly reduced climate-altering greenhouse gas emissions from the U.S. Credit: NASA Earth Observatory

The Montreal Protocol, the international treaty adopted to restore Earth's protective ozone layer in 1989, has significantly reduced emissions of ozone-depleting chemicals from the United States. In a twist, a new study shows the 30-year old treaty has had a major side benefit of

reducing climate-altering greenhouse gas emissions from the U.S.

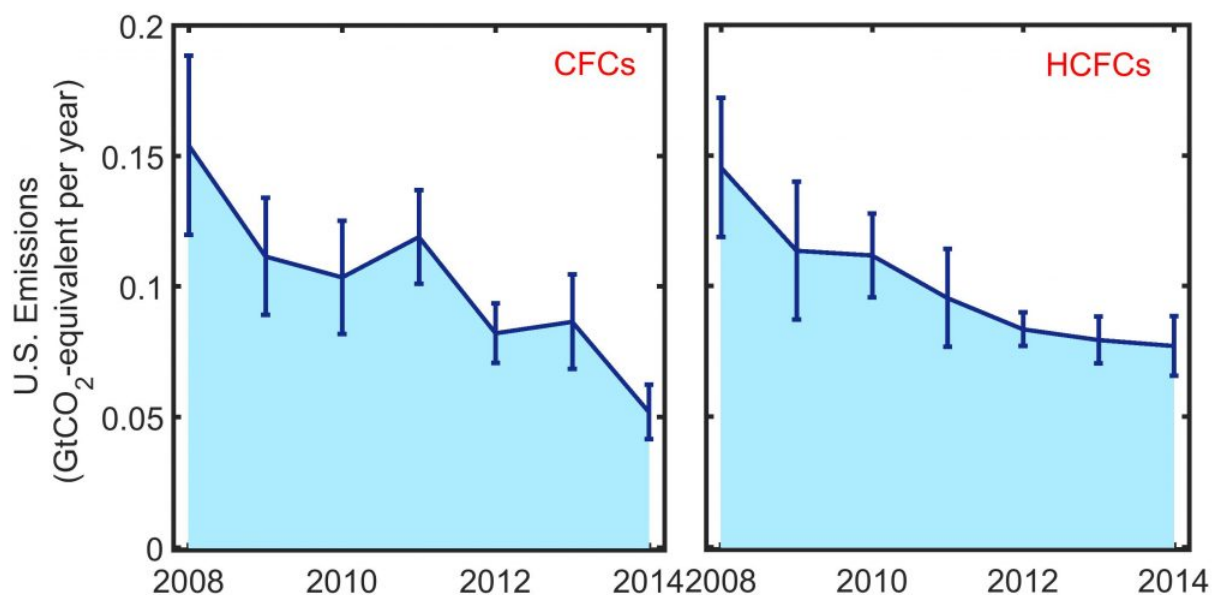
That's because the [ozone-depleting substances](#) controlled by the treaty are also potent [greenhouse gases](#), with heat-trapping abilities up to 10,000 times greater than carbon dioxide over 100 years.

The new study is the first to quantify the impact of the Montreal Protocol on U.S. greenhouse gas emissions with atmospheric observations. The study's results show that reducing the use of ozone-depleting substances from 2008 to 2014 eliminated the equivalent of 170 million tons of [carbon dioxide emissions](#) each year. That's roughly the equivalent of 50 percent of the reductions achieved by the U.S. for carbon dioxide and other greenhouse gases over the same period. The study was published today in *Geophysical Research Letters*, a journal of the American Geophysical Union.

"We were surprised by the size of the decline, especially compared with other greenhouse gases," said Lei Hu, a researcher with the Cooperative Institute for Research in Environmental Sciences (CIRES) working at NOAA and lead author of the new study.

Hu added that the benefits of the Montreal Protocol on greenhouse gas emissions would likely grow in the future. By 2025, she projects that the effect of the Montreal Protocol will be to reduce U.S. greenhouse gas emissions by the equivalent of 500 million tons of carbon dioxide per year compared with 2005 levels. This reduction would be equivalent to about 10 percent of the current U.S. emissions of carbon dioxide.

Previous studies have demonstrated that the Montreal Protocol has been more effective at curtailing global [greenhouse gas emissions](#) than any other international effort - even though climate change was not a consideration during the initial treaty negotiations in the late 1980s.



NOAA's atmospheric measurements show a steady decline of two major ozone-depleting substances controlled by the Montreal Protocol in recent years. Credit: NOAA

The new analysis, based on data collected by NOAA's atmospheric monitoring network, confirms that the Montreal Protocol has been highly successful in the U.S. in its primary goal - reducing emissions of manufactured chlorine-based chemicals that, in addition to depleting ozone world-wide, create a hole the size of the continental U.S. in the Earth's protective ozone layer over the Antarctic each September and October.

Those chemicals—chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), and their substitutes, the hydrofluorocarbons (HFCs)—have been widely used as refrigerants, foam blowing agents, aerosol propellants, fire retardants, and solvents.

Chlorine from CFCs was first identified as capable of destroying stratospheric ozone in 1974. The Montreal Protocol has controlled the production and consumption of these chemicals since the late 1980s.

Implementation of the Montreal Protocol in the United States, largely through the Clean Air Act, led to a near complete phase-out of U.S. production and consumption of chlorofluorocarbons (CFCs) beginning in 1996 and a 95 percent decline of hydrochlorofluorocarbons (HCFCs) production since 1998.

As a result, total emissions of CFCs in the U.S. have decreased by two-thirds from 2008 to 2014, while emissions of HCFCs declined by about half, the study authors said.

Another indication of the treaty's impact is increasing U.S. emissions of ozone-friendly chemicals, such as hydrofluorocarbons or HFCs. However, some HFCs are also potent greenhouse gases, and their increased use is offsetting some of the climate benefit of the Montreal Protocol, said Stephen Montzka, a researcher at NOAA and co-author of the new study.

Countries adhering to the Protocol, including the U.S., agreed to limit future production and consumption of HFCs in 2016.

"This shows what can be achieved by concerted and thoughtful international effort," said Scott Lehman of the Institute of Arctic and Alpine Research at the University of Colorado Boulder and co-author of the new study. "Hopefully, the Protocol can serve as a model of the international cooperation that we need to tackle the real problem - [carbon dioxide](#)."

More information: Lei Hu et al, Considerable contribution of the Montreal Protocol to declining greenhouse gas emissions from the

United States, *Geophysical Research Letters* (2017). [DOI:
10.1002/2017GL074388](https://doi.org/10.1002/2017GL074388)

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