

Ozone-depleting gases might have driven extreme Arctic warming

The far north is heating up twice as fast as the global average.



Climate change in the Arctic is shrinking the region's cap of sea ice. Credit: Arterra/Universal Images Group/Getty

Gases that deplete the ozone layer could be responsible for up to half of the effects of climate change observed in the Arctic from 1955 to 2005.

The finding could help to explain the disproportionate toll of climate change on the region, which has long puzzled scientists. The Arctic is warming at more than twice the average rate of the rest of the globe — a phenomenon known as Arctic amplification — and it is losing sea ice at a staggering pace.

Ozone-depleting substances, including chlorofluorocarbons (CFCs), are known to warm the atmosphere thousands of times more efficiently than carbon dioxide. But most of the research on these chemicals has focused on their effects on the planet's protective ozone layer — especially over the Southern Hemisphere, where they are responsible for the formation of the Antarctic ozone hole, says Mark England, a climate scientist at Scripps Institution of Oceanography in La Jolla, California. He co-authored the study, published on 20 January in *Nature Climate Change*, which he says is “really reframing a lot of the discussion on a more global basis”.

England and his colleagues compared climate simulations both with and without the mass emission of CFCs that began in the 1950s. Without CFCs, the simulations showed an average Arctic warming of 0.82 °C. When the presence of ozone-depleting compounds was factored in, that number jumped to 1.59 °C. The researchers saw similarly dramatic changes in sea-ice coverage between the two sets of model simulations. By running the models with fixed CFC concentrations while varying the thickness of the ozone layer, the team was able to attribute the warming directly to the chemicals — rather than changes these substances caused in the ozone layer.

England's team has “done a careful study in a single model”, says Marika Holland, a climate scientist at the National Center for Atmospheric Research in Boulder, Colorado. “I think that it makes a lot of sense.” She says that the warming effect of ozone-depleting substances in the atmosphere is a well-documented phenomenon. However, she notes, the complexities of climate models make it hard to say for certain what the exact magnitude of the effect on the Arctic is.

Susan Strahan, an atmospheric scientist at NASA's Goddard Space Flight Center in Greenbelt, Maryland, says that

the work is “interesting and provocative”, but she is not yet convinced of its conclusions. A stronger argument could be made, she continues, if the team had been able to provide a clear physical explanation for the modelled amplification.

Both Strahan and Cecilia Bitz, a climate scientist at the University of Washington in Seattle, say that replicating these results in multiple climate models will be crucial for improving estimates of just how much responsibility CFCs bear for heating the Arctic.

Global CFC concentrations have been on the decline since the turn of the millennium, following the 1989 adoption of the Montreal Protocol, which called for a phase-out of the substances. Although many other factors contribute to Arctic amplification, the result suggests that Arctic warming and sea-ice melt might be tempered in the future as ozone-depleting substances continue to leave the atmosphere, Bitz says. “It’s a very important paper because it has a little shred of optimism.”

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References

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Polvani, L. M., Previdi, M., England, M. R., Chiodo, G. & Smith, K. L. *Nature Clim. Change* [https://doi.org/](https://doi.org/10.1038/s41558-019-0677-4)

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Unusual Arctic warming explained by overlooked greenhouse gases

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The same gases that caused holes in Earth’s ozone layer in the past century are responsible for the rapid warming of the Arctic as well, according to a new study published in *Nature*. Scientists looked at the effect of these gases in climate simulations between 1955 and 2005. They found that the gases accounted for **up to half of the warming and sea-ice loss of the Arctic** during that period, *Nature* reports. These so-called ozone-depleting substances (ODSs) are considered potent greenhouse gases and include organic chlorine and bromine compounds such as chlorofluorocarbons. The researchers also concluded that **the warming was caused directly by the gases** and not because of their interactions with the ozone layer. ODSs in the atmosphere are declining since they were banned in the 1980s, following concerns over the ozone layer hole over Antarctica. Scientists would need to replicate these findings in order to explore the contribution of ODSs to global warming during the past decades.