

Winds trigger increases in ozone destroying gases in upper stratosphere

September 28 2006

A surprising new University of Colorado at Boulder study indicates winds circling high above the far Northern Hemisphere have a much greater impact on upper stratospheric ozone levels than scientists had thought.

According to Associate Professor Cora Randall of CU-Boulder's Laboratory for Atmospheric and Space Physics, the winds allowed near-record amounts of ozone-destroying nitrogen oxide gases, collectively known as NO_x, to descend some 30 miles to the top of Earth's stratosphere in March 2006.

Because NO_x destroys ozone, which heats up the stratosphere by absorbing ultraviolet radiation, the naturally occurring gases could trigger atmospheric changes that could have unanticipated climate consequences, she said.

In February 2006, winds in the polar upper stratospheric vortex -- a massive winter low-pressure system that confines air over the Arctic region -- sped up to rival the strongest such winds on record, said Randall. The only time more NO_x was observed in the upper stratosphere was in the winter of 2003-04, when huge solar storms bombarded the region with energetic particles, triggering up to a 60 percent reduction in ozone molecules, said Randall.

"We knew strong winds would lead to more NO_x in the stratosphere if there were solar storms," said Randall, who also is associated with CU-

Boulder's atmospheric and oceanic sciences department. "But seeing that much NO_x come down into the stratosphere when the sun was essentially quiet was amazing."

Randall is the chief author of a paper on the subject being published in the Sept. 27 online issue of *Geophysical Research Letters*, published by the American Geophysical Union. Researchers from the University of Waterloo in Ontario, Canada, and the University of Michigan also contributed to the study.

The upper stratosphere lies several miles higher than the ozone hole region, which forms in the lower stratosphere and is caused by emissions of man-made gases like chlorine and bromine over the decades that are still gobbling up ozone molecules, she said. Because there is significantly less ozone in the upper stratosphere, the ozone-destroying NO_x gases are unlikely to cause immediate health threats, such as increases in skin cancer, she said.

But the destructive NO_x gases -- created above the stratosphere when sunlight or energetic particles break apart oxygen and nitrogen molecules -- appear to be important players in controlling the temperature of Earth's middle atmosphere, according to Randall. "If human-induced climate change leads to changes in the strength of the polar vortex, which is what scientists predict, we'll likely see changes in the amount of NO_x descending into the stratosphere," said Randall. "If that happens, more stratospheric NO_x might become the rule rather than the exception.

"The atmosphere is part of a coupled system, and what affects one layer of the atmosphere can influence other layers in surprising ways," she said. "We will only be able to predict and understand the consequences of human activities if we study the entire system as a whole, and not just in parts."

Source: University of Colorado at Boulder

Citation: Winds trigger increases in ozone destroying gases in upper stratosphere (2006, September 28) retrieved 26 April 2024 from <https://phys.org/news/2006-09-trigger-ozone-gases-upper-stratosphere.html>

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