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Ozone Hole Affects Upper-Atmosphere Temperature and Circulation

Observations have shown differences in altitude and brightness between polar mesospheric clouds (clouds made of ice crystals in the upper mesosphere) in the Northern Hemisphere and those in the Southern Hemisphere.

Various mechanisms have been suggested to explain the differences; a new study shows that the ozone hole in the stratosphere above Antarctica could be playing a key role in the temperature and circulation patterns in the mesosphere (an atmospheric layer that begins 50 kilometers above Earth's surface, just above the stratosphere), leading to differences in polar mesospheric clouds.

Using climate model simulations, Smith et al. show that the ozone hole causes a decrease in temperature in the lower stratosphere that persists into the summer. These temperature changes are accompanied by wind changes that modify the upward propagation of small-scale waves, which in turn alter the atmospheric circulation in the mesosphere in the Southern Hemisphere.

The researchers find that the hemispheric asymmetry was small before 1980 but increased at about the same time as the onset of the ozone hole. A model run with no ozone loss showed no increases in the hemispheric asymmetry in mesospheric circulation and temperature, confirming that ozone loss is a likely cause of the hemispheric differences. They suggest that as the ozone hole recovers in upcoming decades, these trends in mesospheric temperature and circulation may change.

Journal Reference:

1. Anne K. Smith, Rolando R. Garcia, Daniel R. Marsh, Douglas E. Kinnison, Jadwiga H. Richter. Simulations of the response of mesospheric circulation and temperature to the Antarctic ozone hole. *Geophysical Research Letters*, 2010; 37 (22) DOI: 10.1029/2010GL045255