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Puzzling Heights of Polar Clouds Revealed

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Scientists have discovered why icy clouds found at the edge of space are higher at the South Pole than at the North. The answer to this puzzle is that the intensity of solar radiation at the South Pole is six percent higher than at the North Pole during the austral summer, as the Earth comes closer to the sun. New research from British Antarctic Survey and University of Illinois is reported in this month's Geophysical Research Letters (online 29 January 2004). This research helps understand the role of these clouds as indicators of climate change.

Polar mesospheric clouds form at an altitude of 52 miles at the summertime polar caps when temperatures in the mesosphere fall below -125 degrees Celsius. Scientists were puzzled why clouds at the South Pole were on average consistently two miles higher than those found in the North. To confirm these geographic differences, measurements were taken at British Antarctic Survey's Rothera Research Station, 1500 miles from the South Pole, at the same latitude as measurements made in the northern hemisphere (68°). Using a laser radar (LIDAR) to bounce light pulses off the clouds and measure their distance from earth, the researchers demonstrated that even though the clouds were slightly lower at Rothera than at the South Pole, they were considerably higher than at similar latitudes in the northern hemisphere.

Since the Earth's orbit is not exactly circular, solar radiation at the South Pole is six percent higher that at the North as the Earth orbits the Sun. Using a model to explore temperature and vertical wind distribution, the researchers concluded that this increased solar input heats the polar ozone and creates a vertical upwelling that forces the clouds up higher than in the north.

Polar mesospheric clouds have brightened by approximately 15% over the last twenty years demonstrating a cooling of the mesosphere. This cooling intensifies as the atmosphere near the Earth's surface warms, so polar mesospheric clouds may be an indicator of long-term global climate change.

Pat Espy, scientist at the British Antarctic Survey explains: “The growing brightness of polar mesospheric clouds is attributed to increasing levels of atmospheric carbon dioxide and methane, which in the upper atmosphere lead to cooler temperatures. By understanding more about how and where these clouds form scientists can use them as a measurement of long-term global climate change.”

Espy and his team took measurements using a LIDAR (Light Detecting and Ranging System), which transmits a light beam up to 52 miles into the mesosphere.

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Contact:

Athena Dinar
British Antarctic Survey
44-122-322-1414
a.dinar@bas.ac.uk

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