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Scientific Theme: Atmospheric Transport

Unusual Stratospheric Transport and Mixing during the 2002 Antarctic Winter, D. R. Allen, R. M. Bevilacqua, G. E. Nedoluha, C. E. Randall, and G. L. Manney, *Geophys. Res. Lett.*, **30**, 10.1029/2003GL017117, June 2003.

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Summary

Planetary-scale wave activity was unusually strong throughout the 2002 Antarctic winter, culminating in a major stratospheric warming in mid-September 2002; major stratospheric warmings have previously been observed only in the Arctic, so this event was completely unprecedented and unexpected. Diagnostics of transport and mixing derived from meteorological data show that, during the major warming, the polar vortex split in the middle and upper stratosphere, but not in the lower stratosphere, and that mixing of low and mid-latitude air into the polar regions was greatly enhanced. Polar Ozone and Aerosol Measurement III (POAM) ozone observations taken near the south pole (80-88°S) are analyzed to show the effects of this unusual dynamical activity on ozone transport.

A thorough understanding of dynamics and transport in the Antarctic winter stratosphere is the foundation for understanding the "ozone hole" and quantifying ozone changes arising from chemical loss and transport. This work thus benefits society by improving our understanding of dynamics and ozone transport - and how they may depart dramatically from expectations - in the Antarctic winter.

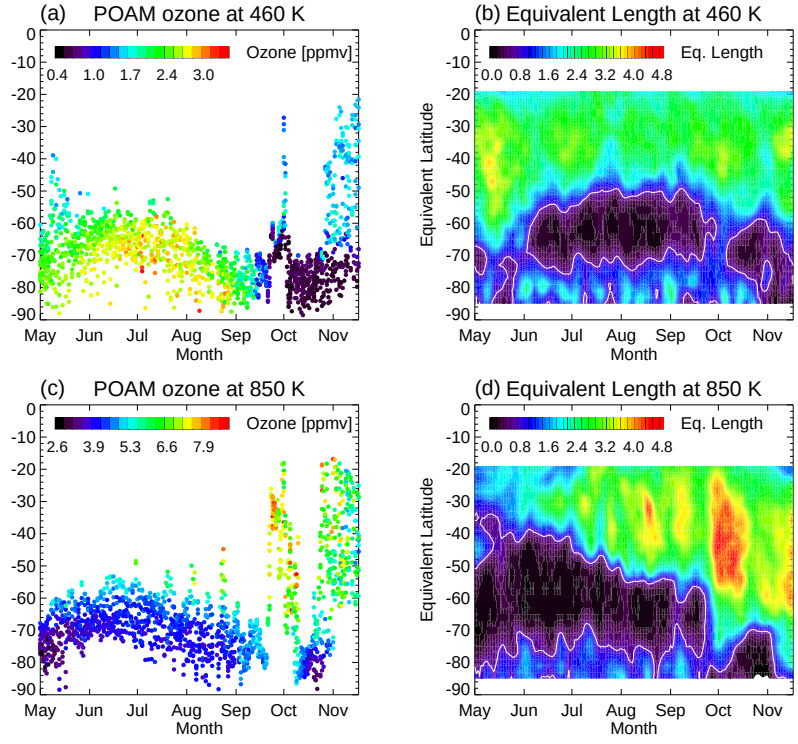

Figure 4. POAM ozone mixing ratios (left panels) and "Equivalent Length" (L_e) calculated from meteorological data (a measure of mixing, right panels) in the lower (top panels) and middle (bottom panels) stratosphere during the 2002 SH winter as a function of "equivalent latitude". The increase in mixing (higher L_e values) during the major stratospheric warming is accompanied by POAM measurements of unusually high ozone at unusually low equivalent latitudes, indicating that POAM observed air in the polar regions that had originated at low latitudes.