## JPL (MLS Team) Scientific Publication

Scientific Theme: Atmospheric Dynamics and Transport

**Simulations of Dynamics and Transport During the September 2002 Antarctic Major Warming,** G. L. Manney, J. L. Sabutis, D. R. Allen, W. A. Lahoz, A. A. Scaife, C. E. Randall, S. Pawson, B. Naujokat, and R. Swinbank, *J. Atmos. Sci.*, **62**, 690–707, March 2005.
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**Summary**

Stratospheric sudden warmings are common in the Arctic winter stratosphere, but before 2002 were unheard of in the Antarctic. In a paper appearing in a special issue of *Journal of the Atmospheric Sciences* on the 2002 Antarctic winter and major warming, a detailed model of the stratosphere was used to simulate the dynamics and transport during this unprecedented event. A very successful model simulation, capturing the three-dimensional structure and evolution of the polar vortex, including the vortex split, allowed us to examine in detail the conditions necessary for this warming to occur. The immediate trigger for the warming was an extremely strong pulse of energy propagating up from the troposphere – if this pulse were slightly reduced, the major warming would not have happened. The model simulation also allowed examination of anomalous transport during the warming, at a time when few trace gas observations were available for detailed transport studies.

This research benefits society by improving our understanding of mechanisms of dynamics and transport during extreme events such as stratospheric sudden warmings. This improved understanding can help determine the origins of such events and in turn their influence on weather and possible relationships to climate change.


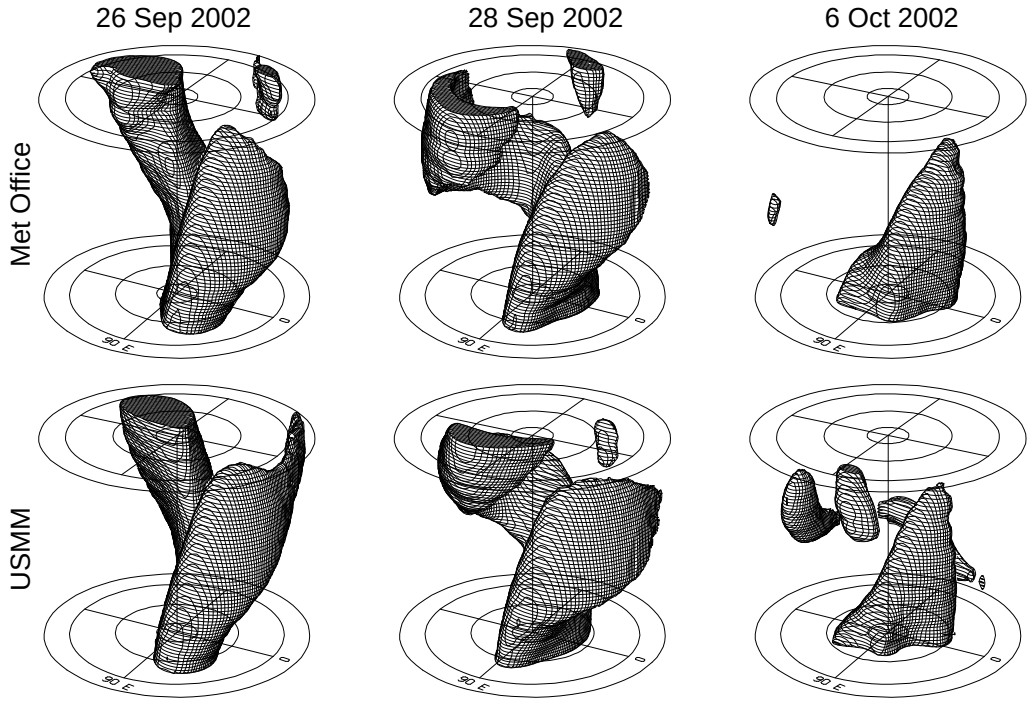


Figure 5. An isosurface of potential vorticity, representing the edge of the polar vortex, from observation-based meteorological analyses (top) and from detailed model simulations (bottom), during (26, 28 September 2002) and after (6 October 2002) the southern hemisphere major warming. The vertical range is (in isentropic coordinates) from 450 to 1600 K (about 17 to 48 km altitude), covering most of the stratosphere.