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Scientific Theme: Atmospheric Chemistry and Transport

An Upper Stratospheric Layer of Enhanced HNO_3 Following Exceptional Solar Storms, Y. J. Orsolini, G. L. Manney, M. L. Santee, and C. E. Randall, *Geophys. Res. Lett.*, **32**, L12S01, doi:10.1029/2004GL021588, April 2005.

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Summary

Extraordinary solar storms in the fall of 2003 led to production of unusually large amounts of nitrogen oxides in the upper atmosphere. In this paper, data from the Michelson Interferometer for Passive Atmospheric Sounding (MIPAS) instrument are used to show that these effects were accompanied by an unusual layer of enhanced nitric acid in the upper stratosphere. This layer appeared in late November. It was confined to the polar vortex and descended to the middle stratosphere by early January, disappearing sometime between mid-January and mid-February. Analysis of MIPAS nitrogen dioxide and correlations with geomagnetic indices confirm that energetic particle precipitation from the October-November 2003 solar storms was responsible for the enhanced nitria acid. This was the first time the detailed evolution and morphology of such a distinct, high-altitude nitric acid layer had been observed.

This research benefits society by improving our understanding of how solar processes may affect our atmosphere. The enhanced nitric acid is also related to chemical processes that affect ozone, thus improving our knowledge of how ozone may be affected. Only by understanding both natural (e.g., solar storms) and anthropogenic effects on ozone variability can we hope to understand ozone changes and their causes.

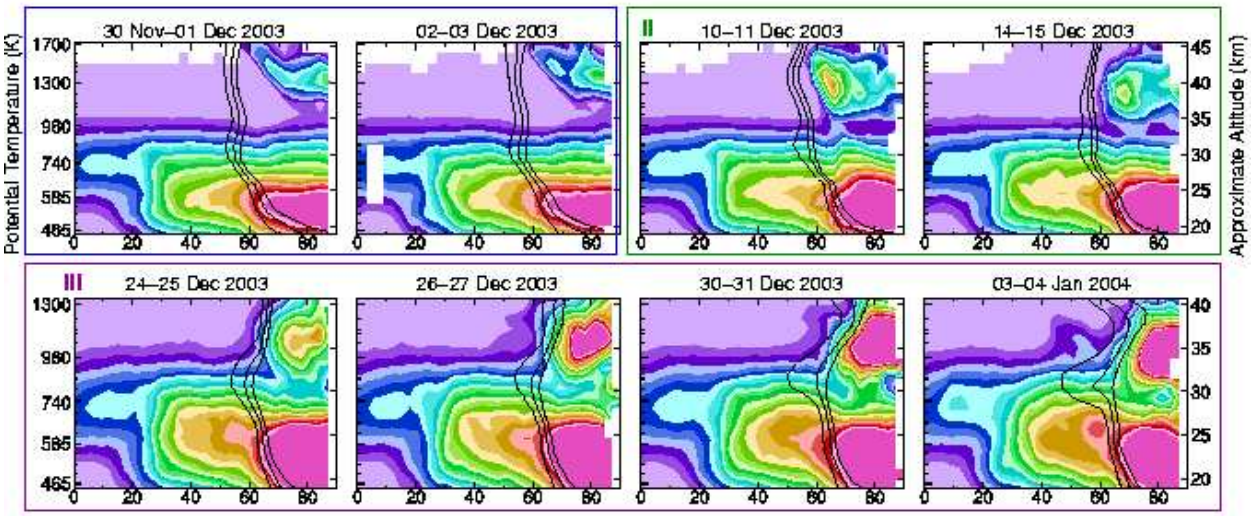

Figure 1. Plots of nitric acid as a function of equivalent latitude (a latitude-like coordinate that separates vortex from extra-vortex values) and potential temperature (an altitude-like coordinate) in December 2003 and early January 2004, showing the development and descent of an unusual upper-stratospheric layer of enhanced nitric acid. Overlaid black contours shown the location of the polar vortex edge, with values to the right inside the polar vortex.