

ABSTRACT

Infrared Aircraft Measurements of Stratospheric Composition
over Antarctica during September 1987

G.C. Toon, C.B. Farmer, L.L. Lowes, P.W. Schaper, J.-F. Blavier and R.H. Norton
California Institute of Technology, Jet Propulsion Laboratory,
4800 Oak Grove Drive, Pasadena, CA 91109

The JPL Mark IV Interferometer recorded high resolution, infrared solar spectra from the NASA DC-8 aircraft during flights over Antarctica in September 1987. The atmospheric absorption features in these spectra have been analyzed to determine the overburdens of O_3 , NO , NO_2 , HNO_3 , $ClONO_2$, HCl , HF , CH_4 , N_2O , CO , H_2O and CFC-12. The spectra were obtained at latitudes which ranged between $64^\circ S$ and $86^\circ S$, allowing the composition in the interior of the polar vortex to be compared with that at the edge. The figure summarizes the latitude dependence observed for NO , NO_2 , HNO_3 , $ClONO_2$, HCl and HF . The solid lines South of $65^\circ S$ are derived from the ensemble of Antarctic measurements. The values at $30^\circ S$ were observed on the ferry flight from New Zealand to Hawaii. The dashed lines connecting the two have been interpolated across the region for which we have no measurements. The chemically perturbed region is seen to consist of a "collar" of high HNO_3 and $ClONO_2$ surrounding a "core" in which the overburdens of these and of HCl and NO_2 are very low. Clear increases in the overburdens of HF and HNO_3 were observed during the course of September in the vortex core. HCl and NO_2 exhibited smaller, less significant increases. The overburdens of the tropospheric source gases, N_2O , CH_4 , CF_2Cl_2 , CO and H_2O , were observed to be much smaller over Antarctica than at mid-latitudes. This, together with the fact that HF over Antarctica was more than double its mid-latitude value, suggests that downwelling has occurred.

SUMMARY OF LATITUDE VARIATIONS
OF STRATOSPHERIC TRACE GASES

