Final Report: NAGW-1160:
Title: Theoretical Support for the Airborne Antarctic Ozone Experiment
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Introduction

This investigation was to provide theoretical support during and after the deployment of NASA research aircraft to Punta Arenas, Chile during August and September of 1987 to conduct the Airborne Antactic Ozone Experiment.

Performance:

The PI traveled to Punta Arenas, Chile to participate in the field phase of the experiment. During the experiment the PI conducted analysis of the data, as they were received and participated in the planning of the missions and discussion of results and conclusions. Upon returning from Chile, the PI conducted research with the data, and attended many meetings of the experiment team to discuss and evaluate the results and conclusions. A graduate student, Mark Wensman, was employed during the analysis of the data after the experiment.

Results:

The experiment was very successful in demonstrating the role of anthropogenic chlorine in producing the ozone hole over Antarctica during September and October of 1987. The PI worked primarily on using tracer data from the ER-2 aircraft to show that transport could not have caused the ozone hole in 1987, and that transport of chemical species into the polar vortex was very weak during the period of the experiment (Hartmann, et al., 1989b). The presence of gravity waves was also very apparent in the ER-2 data, and a second paper was published on this analysis (Hartmann, et al., 1989a). The PI also contributed to a joint paper with Schoeberl, et al. (1989) regarding the use of meteorological analysese to position the aircraft within the vortex. Copies of these papers are attached. Schoeberl and Hartmann(1991) also published a review article in *Science* describing some of the results from the investigation relating to the role of dynamics in the ozone hole phenomenon.

Publications resulting from this Grant:

Hartmann, D.L., K.R. Chan, B.L. Gary, M.R. Schoeberl, P.A. Newman, R.L. Martin, M. Loewenstein, J.R. Podolske and S.E. Strahan, Potential vorticity and mixing in the south polar vortex during spring, *Journal of Geophysical Research*, 94, 11625-11,640, 1989.

Hartmann, D.L., L.E. Heidt, M. Loewenstein, J.R. Podolske, J. Vedder, W.L. Starr, and S.E. Strahan, Transport into the south polar vortex in early spring, *Journal of Geophysical Research*, 94, 16,779-16,795, 1989.

Schoeberl, M.R., L.R. Lait, P.A. Newman, R.L Martin, D.L. Hartmann, M. Loewenstein, J. Podolske, S.E. Strahan, M. Proffitt, J. Anderson, K.R. Chan and B. Gary., Reconstruction of the constituent distribution and trends in the antarctic polar vortex from ER-2 flight observations, *Journal of Geophysical Research*, 94, 16,815-16,845, 1989.

Hartmann, D.L., Dynamical properties of the Antarctic circumpolar vortex inferred from aircraft observations, in *Dynamics, Transport and Photochemistry in the Middle Atmosphere*, A. O'Neill Ed., Kluwer, 117-134, 1990.

Schoeberl, M.R., and D.L. Hartmann, The Dynamics of the Polar Vortex, *Science*, 251, 46-52, 1991.