IN SITU OBSERVATIONS OF *BrO* OVER ANTARCTICA: ER-2 AIRCRAFT RESULTS FROM 54°S to 72°S LATITUDE

W.H. Brune and J.G. Anderson
Department of Chemistry
and
Department of Earth and Planetary Science
Harvard University
Cambridge, MA 02138

Bromine monoxide was observed in situ at ~ 18 km altitude during nine flights of the NASA ER-2 aircraft from Punta Arenas, Chile (54° latitude) to 72°S latitude over the Palmer Peninsula, Antarctica. The first flight for the *BrO* detection system was on 28 August. We report here the results from the flights over Antarctica and from the ferry flights from Punta Arenas to Moffett Field, California (37°N latitude).

Bromine monoxide is a major component of the total inorganic bromine abundance throughout the lower stratosphere because homogeneous bromine photochemistry partitions inorganic bromine into basically only two species *BrO* and $BrONO_2$. How much of the total inorganic bromine content, which is thought to be (5 - 15) pptv, is *BrO* depends strongly on the NO_2 abundance in the air parcel. Inside the antarctic polar vortex, where NO_2 is low, *BrO* should be essentially the only inorganic bromine species. A measurement of *BrO*, however, may not be an accurate measure of the total inorganic bromine because the heterogeneous chemistry of bromine, which is virtually unknown, may act to reduce or redistribute bromine.

A key question concerning *BrO*, then, is how it is distributed with respect to the "chemical containment vessel" defined by elevated *ClO* mixing ratios. This question is answered with greatest statistical significance if the data are averaged into five regions:

outside the vessel, aircraft heading south; inside the vessel on the same potential temperature surface; in the "dive" region; inside the vessel on a given potential temperature surface, aircraft heading north; and outside the vessel on the same surface. The result is that the BrO distribution inside the "chemical containment vessel" was different from that found outside. Inside, the BrO mixing ratio was (5.0 ± 1.1) pptv between the 400 K and 460 K potential temperature surfaces, decreasing only slightly with potential temperature, and was less than 3.6 pptv below the 400 K surface. The abundance of BrO inside the "chemical containment vessel" showed no discernible temporal trend during the course of the nine flights. Outside the vessel, the BrO mixing ratio was (4.7 ± 1.3) pptv near the 450 K surface, but decreased to (2.8 ± 1.0) pptv near the 420 K surface. Bromine monoxide was clearly enhanced in the "chemical containment vessel", and the average enhancement was a factor of 1.7 ± 0.8. This difference was greatest near the 420 K potential temperature surface, and was almost negligible near the 450 K surface.

Away from the south polar region, the BrO mixing ratio was (1.0 - 3.0) pptv at latitudes between 45°S and 37°N and potential temperatures between 435 K and 500 K (18.5 km and 20.7 km altitude). These data were taken on the ferry flights north on 29 September, and 1 and 3 October. Unlike ClO which was ~ 500 times larger inside the antarctic polar vortex than at midlatitudes, BrO was less than five times larger inside the vortex than on comparable potential temperature surfaces at lower latitudes.