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

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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.