IN SITU OBSERVATIONS OF *ClO* IN THE WINTERTIME NORTHERN HEMISPHERE: ER-2 AIRCRAFT RESULTS FROM 21°N TO 61°N LATITUDE

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We report here measurements of lower stratospheric *ClO* taken during a NASA ER-2 flight between Moffett Field, CA (37°N, 122°W) and Great Slave Lake, Canada (61°N, 116°W) on 13 February 1988. Northbound, the aircraft was flown at ~ 20 km altitude from 39°N to 56°N, at 18 km from there to 58°N, in a descent to 15 km at 60°N, and in a rise and turn at the northernmost point. The southbound leg was flown in a gradual climb from 20 km to 21.5 km. On this day, the central position of the Arctic polar vortex, as determined by an NMC analysis of heights and temperatures at the 50 mb and 70 mb levels, was approximately (79°N, 100°W). Because the vortex was located on the North American side of the pole, the aircraft was able to reach a point slightly inside the maximum horizontal wind region where wind speeds were (80 - 90) knots.

The general pattern for the observed *ClO* is that it increased with both latitude and altitude, and attained a maximum of ~ 55 pptv at 61°N latitude and 20.5 km altitude. This value is ~ 20 times smaller than the maxima observed over Antarctica, but is comparable to those seen just outside the "chemical containment vessel" located inside the Antarctic Polar vortex. On the other hand, in a comparison with northern midlatitude data taken on

this and three other February flights, ClO mixing ratios observed north of 55°N latitude are 2 to 5 times larger at all flight altitudes (15 - 20 km). We will discuss possible reasons for this enhancement over midlatitude and consider the evidence for whether or not the instruments sampled Arctic polar vortex air.

A second feature of the data is the strong positive correlation between ClO and O_3 during the entire flight. This relationship holds for all observable spatial scales and at all altitudes. A negative correlation, as observed first over Antarctica on 16 September 1987, implies photochemical loss of ozone and is not expected to occur in the air sampled during this flight. With ClO at $\sim$ 60 pptv, the chlorine photochemical mechanisms proposed for the Antarctic ozone hole are too slow to reduce ozone in the course of a few months.

Three other flights were made on 12 February, 16 February, and 19 February. On 12 February, night-to-day transitions of ClO and BrO were measured; day-to-night transitions were measured on 16 February. The aircraft was flown northward to $\sim$ 47°N and back for both flights. The 19 February flight was directed south to 21°N latitude in an altitude "sawtooth" pattern — allowing us to establish a coarse grid of ClO and BrO with respect to altitude between 17 and 21 km and latitude between 21°N and 61°N.