

## DC-8 Flight 10, 17 April 2008

This was the third, and final, sortie by the DC-8 out of Fairbanks during phase 1 of ARCTAS. Primary objective was to sample European pollution that all models forecast should have passed over the north pole and extended to about 85 N on the western side of the Arctic basin. North bound leg along longitude ~ 148 W included a spiral over Prudhoe Bay (coordinated with overflights by both OMI and the B-200) Boundary layer sampling was conducted north of Prudhoe Bay (70-71 N) after a missed approach at Dead Horse and during 2 additional legs before planned turn around point at 89 N (~78.5 – 80 N, and ~ 86.5 – 87 N). Mission scientist decided to turn short at 88.5 N, but pilots wanted to continue onward to the north pole, so we did extend the leg all the way to 90 N before heading toward Barrow. At the northern end of return leg we profiled between 4 and 8 km pressure altitude to characterize the European pollution, prior to our fourth BL leg at ~ 78 – 77 N. Another vertical profile up to 8 km brought us above the tropopause briefly, before an enroute descent for our final BL leg just north of Barrow, followed by a missed approach at Barrow to compare to Bill Simpson's MAX DOAS. Traffic at the airport required that we delay about 15 minutes, extending our sampling interval in the MBL. On the return leg to Fairbanks we profiled up to 6 km through forecasted biomass burning plume (from Asia, perhaps both Siberia and Myanmar).

All objectives were met. Troposphere over Prudhoe Bay was quite clean, but we did get into a very strong Prudhoe Bay pollution plume in the BL over the sea ice after the missed approach at Dead Horse. This leg also included O<sub>3</sub> and Hg depletion, with observations of Br chemistry. In fact, all 5 boundary layer legs of this flight encountered regions with O<sub>3</sub> depletion, including several places with < 100 ppt O<sub>3</sub>. Ga Tech reported BrO in partially depleted air masses, with Br<sub>2</sub> and BrCl observed at lowest levels of O<sub>3</sub>. UNH saw variable amounts of soluble Br<sup>-</sup> in all low altitude legs and Cal Tech reported detectable HOBr in some of them. All 5 boundary layer legs were also characterized by large variations in O<sub>3</sub> mixing ratios over quite small spatial scales. The “European” pollution near the pole was relatively diffuse, though we did observe modestly enhanced CO. More impressive was a layer at ~ 7 km pressure altitude near 85 N that had huge enhancements of sulfur (more than 2 ppb of both SO<sub>2</sub> and fine aerosol SO<sub>4</sub><sup>=</sup>). It should be noted that a similar layer was encountered at about the same place (altitude and location) during flight 7. However, the sulfur layer on flight 7 also had large enhancements in HCN and other BB tracers, these were not observed in the layer on flight 10. On the other hand, CO was enhanced to about 250 ppb in both “North Pole sulfur” layers. Returning to Fairbanks from Barrow did bring us through strong BB plumes through much of the depth of the troposphere.