

Measurements and Analysis of Atmospheric Mercury Observations Aboard the DC-8 During ARCTAS (UNHMERC)

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The UNHMERC investigation will provide detailed information on atmospheric mercury in the North American Arctic during the NASA ARCTAS DC-8 spring/summer campaigns in 2008. Measurements of total gaseous mercury (TGM) and gaseous elemental mercury (Hg°) will be performed simultaneously with one minute time resolution using a custom four-channel atomic fluorescence spectrometer (Table 1). The relative amount of reactive gaseous mercury (RGM = $\text{HgCl}_2 + \text{HgBr}_2 + \text{HgOBr} + \dots$) will be assessed through careful examination of the difference between TGM and Hg° . TGM is defined as the sum $\text{Hg}^\circ + \text{RGM}$. Targeted aerosol sampling will also be conducted for particulate-phase mercury (Hg^{P}). Detailed data analysis facilitated by our mercury box model will be conducted to identify and understand the salient features of the dataset. Our analysis will separate springtime and summertime observations, and utilize comparisons of vertical profiles in the two seasons. In particular, we will examine: 1) the regional distribution of the TGM/ Hg° pair, 2) the vertical extent of surface mercury depletion events (MDEs) and scope of Hg° depletion in the upper tropospheric-lower stratospheric region, and 3) the seasonality in Hg° chemical transformations. Our measurements from INTEX-B showed essentially zero Hg° above the tropopause region^{1,2}, ARCTAS data will reveal whether this also occurs at high latitudes. The possible link between Hg° depletion and BrO will be diagnosed using spatial distributions determined from SCIAMACHY and possibly *in situ* measurements aboard the aircraft. Furthermore, we will study four important broad scientific areas: 1) springtime MDEs and summertime re-emission of deposited mercury, 2) wild fires as a source of mercury, 3) long-range transport of anthropogenic emissions, and 4) potential cloud impacts on mercury cycling.

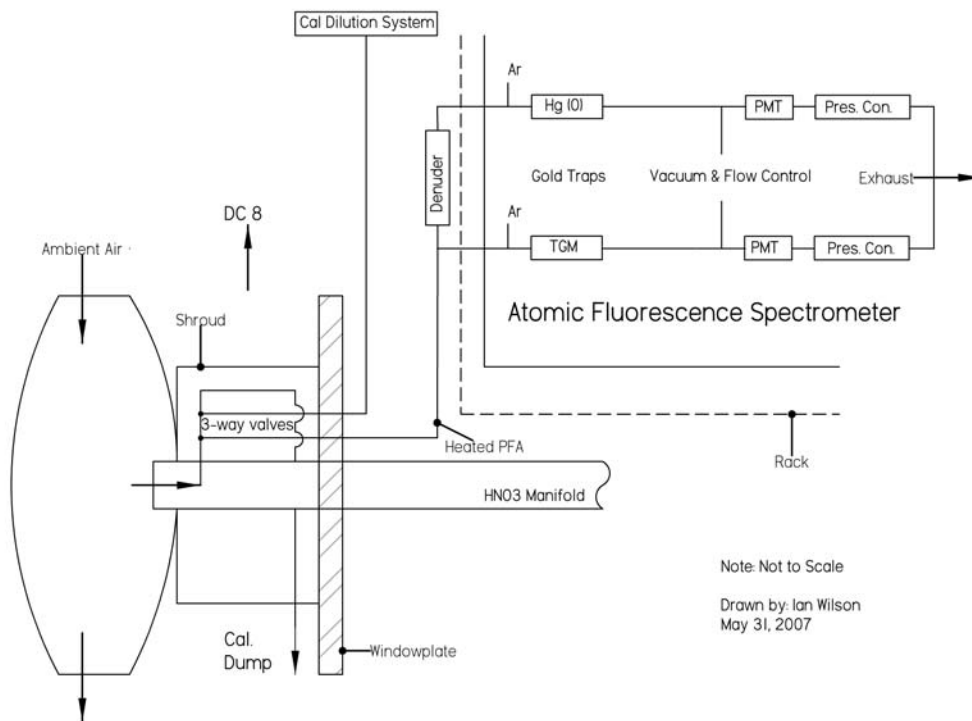
Table 1. Details of UNHMERC Measurements

Species	Resolution	Uncertainty
TGM	1 min.	15%
Hg°	1 min.	15%
RGM	1 min.	30%
Hg^{P}	10 min.	30%

¹ Talbot, R., H. Mao, E. Scheuer, J. Dibb, and M. Avery (2007), Total depletion of Hg° in the upper troposphere – lower stratosphere, *Geophys. Res. Lett.*, *34*, L23804, doi:28 10.1029/2007GL031366.

² Talbot, R., et al. (2007), Factors influencing the large-scale distribution of Hg° in the Mexico City area and over the North Pacific, *Atmos. Chem. Phys. Discuss.*, *7*, 15,533 – 15,563.

Custom Atomic Fluorescence Spectrometer - Conceptual Representation



UNHMERC instrument onboard the NASA DC-8 during the INTEX-B mission over the North Pacific. Note that we will fly a new custom built instrument in ARCTAS (see above).