

Observations of Mercury Species and Halogens at Summit, Greenland

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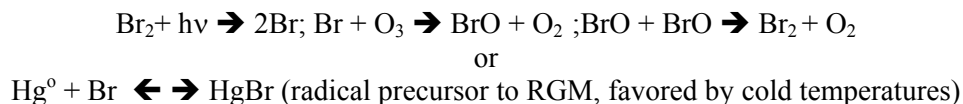
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During May and June 2007 a field campaign was carried out at Summit, Greenland, to investigate the importance of halogens and mercury chemistry in this remote environment. Instruments were deployed to obtain a large suite of observations that included: Hg (gaseous elemental, reactive gaseous, and particulate-bound), BrO, OH, RO₂, CO, NO, O₃, HCl, HNO₃, HO₂NO₂, SO₂, soluble bromide, snow ionic composition, and J values. Significant levels of BrO (up to 5 pptv) were often observed by both a differential optical absorption spectrometer (DOAS) and a chemical ionization mass spectrometer (CIMS). Depletion of elemental mercury and production of reactive gaseous mercury was observed daily. These results indicate that halogen-mercury chemistry is active at Summit during summer.

These were the first-ever monitoring of reactive gaseous mercury (RGM), fine particulate mercury (FPM), and gaseous elemental mercury (GEM) concentrations at Summit. Under sunlight conditions bromine gas dissociates, catalyzes the destruction of ozone, and oxidizes gaseous elemental mercury (GEM or Hg⁰) to reactive gaseous mercury (RGM) via:



The newly formed RGM then deposits rapidly to the snow pack with a high deposition velocity (~1-2 cm/s), or becomes bound to airborne particles forming fine particulate mercury (FPM). At Summit we detected well-defined RGM peaks at maximum solar elevations, and broad FPM enhancements at minimum solar elevations. After midday RGM production, when the surface snow was greatly enhanced with oxidized mercury, GEM concentrations in the near surface air commonly showed sharp peaks caused by mercury photoreduction within the top few centimeters of the snow pack.

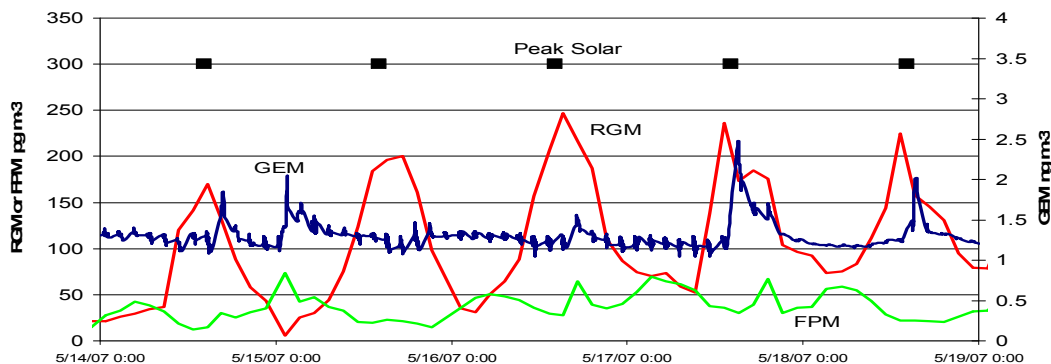


Figure 1. Mercury Speciation at Summit May 14-19, 2007.