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## Background

Mercury (Hg), a persistent and toxic element, is found both naturally and as an anthropogenically-produced compound in the environment. In the atmosphere, gaseous elemental mercury (Hg<sup>0</sup> or GEM) is the predominant form of mercury (>95%) [1]. GEM can be converted to divalent mercury species (Hg(II)) by oxidation processes [1]. Divalent mercury is subject to rapid wet and dry deposition to snow surfaces. Hg exchanges between atmosphere and cryosphere are still poorly quantified, leading to a lack of understanding about the role of the cryosphere in the global mercury cycle.

The goals of this study were (i) to investigate if GEM could be sampled automatically at the current snowpack sampling platform operated at the Summit Flux facility (i.e., the snowtower), and (ii) to evaluate if GEM could provide new insights on the oxidation chemistry in the snowpack at Summit.

## GEM sampling in firn air at the Summit FLUX facility

During July 2009 a GEM analyzer (model 2537B Tekran) was interfaced with the current snowpack sampling platform operated at the Summit FLUX facility (i.e., the snowtower). Interstitial air was sampled in air from one ambient inlet above the snow, and from 7 inlets below the surface, reaching to 2.1 m depth, sequentially for 10 min at a flow of 0.75 l min<sup>-1</sup>. Ozone, nitrogen oxides (NO<sub>x</sub>), and snowpack temperature were measured along with GEM at the seven depths in the snowpack air.

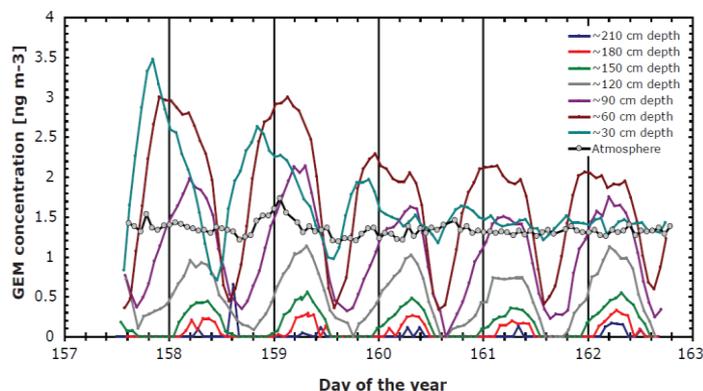


### References

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## Diurnal pattern of GEM in snowpack air



⇒ GEM concentrations above the snow surface are stable (~1.4 ng m<sup>-3</sup>)

⇒ Within the snowpack, GEM shows a highly dynamic behavior, with GEM concentrations varying with depth and time of day.

⇒ Profile data imply nighttime production of Hg<sup>0</sup> and daytime destruction of Hg<sup>0</sup> in the snow.

⇒ The deep snow is a sink of GEM at all times.

⇒ **Automated, continuous sampling of GEM was successful**

## Chemical processes driving GEM exchanges at the snow-air interface

### GEM production

⇒ Likely related to photoreduction of Hg(II) species [2]

### GEM destruction

⇒ Coincides with ozone destruction in the snowpack air [3]

⇒ Photochemically initiated reactions involving bromine species result in simultaneous destruction of ozone and GEM in the polar marine boundary layer [4]. Similarly, Br radical chemistry is speculated to be the cause of the losses of ozone and GEM in the snow air at Summit, despite the much lower sea-salt concentrations at this continental site [5]

## What could we learn from GEM sampling in the snow air at Summit ?

⇒ How the perennial snow surfaces of Greenland can impact the tropospheric budget of mercury?

⇒ How the chemical processes involving GEM at the snow-air interface can influence the long-term record of atmospheric Hg<sup>0</sup> recorded in deep firn air (and ice bubbles)?

⇒ **Can we use GEM as a proxy to characterize halogen-driven oxidation processes occurring in snowpack air ?**