

## ***Interactive comment on “Mercury in the snow and firn at Summit Station, Central Greenland, and implications for the study of past atmospheric mercury levels” by X. Faïn et al.***

### **Anonymous Referee #1**

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#### **\*\* General Comments:**

This manuscript describes measurements of mercury in air and snowpack that is relevant to ice core interpretation. It appears to be careful and well-thought out work, and should be published. The manuscript contains some text that should be further clarified before publication.

#### **\*\* Specific Comments:**

In section 3.3, there is a comparison of GEM at the summit site with measurements at Alert. This comparison appears problematic due to the type of units used. The authors

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use nanograms/m<sup>3</sup> units, which are concentration units and not mixing ratio units. For a generally long-lived gas, it should have constant mixing ratio with altitude, and due to the decrease in total pressure, the partial pressure of mercury should decrease. Therefore, for a surface-based measurement of GEM at Alert, which probably is around 1.7 ng/m<sup>3</sup>, with constant mixing ratio should be decreased by around 675mb / 1000mb = 0.675, and thus one would expect around 1.1 ng/m<sup>3</sup> at Summit. This appears significantly lower than their measurements. However, this could be a true difference due to different airmasses. Please check units and how any pressure or temperature corrections were carried out.

In section 3.4.3, in the paragraph starting "Snow permeability data was not available for summer..." The next sentence mentions a model, but details are not clear here. Please explain the model here if it is "straightforward".

In section 3.4.5, "GEM deletion within the snowpack", the mechanism of halogen-induced oxidation of Hg is not well worked out. Some also claim BrO is active, but I'm not sure it is important here to mention this history. It appears that in the end the authors only want to mention that there is a region of photochemically-active snow which is relatively thin (<60cm). I think that making appropriate reference to the publications, this section could be significantly decreased in size.

\*\* Technical comments / clarification:

In section 2.3, at the bottom of the page, it mentions Dekabon sampling line. Were losses of GEM in this tubing quantified? Blanks are described, which is good, but what about losing GEM in the tube?

In section 3.4.2, I had not previously seen the acronym (SIA). It was probably defined, but was difficult to figure out here. I believe it is meant to be snowpack interstitial air. I would recommend writing this out instead of making an acronym.

In section 3.5.2, it is unclear why the "chemical zone" goes to 2.7 meters. Most of the

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prior discussion mentions 60 cm as the depth of light penetration for summit snow and that pumping on the inlets causes artifacts where deeper snowpack appears to show photochemistry. Why was 2.7 meters chosen, and does it matter? Please clarify this point.

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Interactive comment on Atmos. Chem. Phys. Discuss., 7, 18221, 2007.

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