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Atmospheric Chemistry and Physics Discussions

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.

X. Faïn et al.

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We would like to thank the reviewer for his interest in our manuscript. We answer here his three comments.

1. In section 3.4.5 (page 18329, lines 2-4), we cited previous studies showing that the boundary layer at Summit is likely to be periodically impacted by halogens. We then discussed the role of bromine as an oxidant for GEM in the snow interstitial air (SIA). Divalent mercury complexes present in the atmosphere could be deposited on snow surfaces by dry or wet processes. Such complexes could associate Hg and halogens, for example HgCl2, HgBr2...

2. Frost flowers grow on newly-formed sea ice from a saturated water vapor layer. It

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has been suggested that frost flowers could be involved in processes causing tropospheric ozone and mercury depletion events during the polar sunrise. These events can be explained by heterogeneous autocatalytic reactions taking place on salt-laden ice surfaces which exponentially increase the reactive gas phase bromine (the so-called "bromine explosions") (more details are given by Simpson et al., 2007). Bromine explosions could not be observed at Summit, which is located in Central Greenland, and not on the seashore. Because Ozone Depletion Events (ODEs) have never been observed at Summit (see section 3.3 for references), we assume that bromine explosions occurring in the Arctic could not directly influence the Summit atmospheric boundary layer. Thus, we decided not to mention bromine explosions in our discussion, as they had no strong link with the phenomena we reported. However, we mentioned in our manuscript that transport of halogen compounds from the Arctic Ocean boundary layer to the Summit atmosphere is likely and has been suggested before (read section 3.4.5). Recently, Saiz-Lopez et al. (2007) have reported high concentrations of iodine oxides in the coastal Antarctic boundary layer where they also measured ODEs. However, these authors did not investigate iodine oxides on the plateau of the Antarctic ice cap. We agree that measurements of such species at Summit could be of great interest.

3. Our data obviously demonstrate that photo-induced oxidation processes play an important role in the dynamics of gaseous elemental mercury in the SIA at Summit. Both during spring and summer, we observed diel variation of GEM concentrations in the SIA with oxidation during the day, and reduction at night (see Fig. 4 and 5). However, we also observed dark destruction of GEM during spring 2006. In section 3.4.5, we discussed oxidation processes involving GEM in the SIA. We first discussed photo-induced processes, and then dark mechanisms. We recognize that the paragraphs related to photo-induced processes are short, mostly dealing with the role of bromine radicals as potential oxidants for GEM. Photo-induced oxidation of GEM has been investigated before but some references will be added. In the same section (3.4.5), we preferred to emphasize the discussion about the dark oxidation processes involving

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GEM deeper in the SIA because they have been poorly investigated before.

The manuscript was read by a native English speaker in order to correct the remaining English errors.

References:

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