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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Temperature and sunlight controls of mercury oxidation and deposition atop the Greenland ice sheet" *by* S. Brooks et al.

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Dear Steve Brooks

I have enjoyed reading your manuscript on the mercury speciation at the Greenland ice sheet. In particular, I found your discussion on the reduction of RGM and subsequent re-emission of GEM on the snow surface very interesting.

We recently derived the kinetics of this process in well-controlled laboratory experiments [1]. It would be interesting to see if the determined rates of photo-reduction and re-emission can explain your observations. Another aspect that we looked at was the role of halogens in the snow on the photochemistry. We found that Cl- inhibits

the photo-reduction and emission of GEM. Halogens might be lower at your study site compared to coastal locations in the Arctic, which might explain the high fraction of re-emitted mercury. Did you find a correlation of GEM emission and temperature? Our results indicate that the emission decreases at colder temperatures. It's unlikely that this is due to adsorption of GEM on the snow surface, as this process is only occurring at much lower temperatures [2]. I was wondering if you see GEM emission at temperatures below 30 °C.

I hope you find these comments helpful. Please note that we have published our results on Hg(0) adsorption in a peer-reviewed journal in the meantime, see below.

Kind regards, Thorsten Bartels-Rausch

1 Bartels-Rausch et al. Photoinduced reduction of divalent mercury in ice by organic matter. This study focused on the role of organics in the photo-chemistry. (Chemosphere (2011) vol. 82 (2) pp. 199-203.

2 Bartels-Rausch et al. Interaction of gaseous elemental mercury with snow surfaces: laboratory investigation. Environ. Res. Lett. (2008) vol. 3 (4) pp. 045009 (This replaces the citation: Bartels-Rausch, T., Jöri, M., and Ammann, M.: Adsorption of mercury on crystalline ice, Annual Report, Laboratory for radiochemistry and environmental chemistry, Paul Scherrer Institut, Villigen, Switzerland, 2002.)

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