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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Iodine monoxide in the Antarctic snowpack" *by* U. Frießet al.

Anonymous Referee #1

Received and published: 21 January 2010

Frieß et al. present very interesting measurements of IO from Neumayer, Antarctica. They interpret these measurements with the help of a radiative transfer model that treats the atmosphere and the snowpack in a coupled way and come to the conclusion that iodide release from the snow pack and transport into the atmosphere would be sufficient to explain their atmospheric IO measurements. The paper is of suitable quality but I do have a number of comments that should be addressed before final publication. A main comment is that there are significant differences compared to another recently published year-long record of IO measurements in coastal Antarctica (Saiz-Lopez et al., 2007), such as higher mixing ratios in non-continental air masses. This is not commented on in this manuscript but it would be important to show a wind-speed – IO correlation in order to be able to tell if any such correlations exist at Neumayer as well.

The strong seasonal difference in snow iodide concentration is interpreted as an in-

dication for post-depositional loss of iodine. Could iodine also be released from the aerosol/ice particles due to photochemistry before it is being deposited in the snow?

Specific comments:

p. 25362, l. 8: The snow pack is identified as the main source for iodine radicals; I would suggest to change the wording somewhat as ultimately the source is elsewhere – are marine emissions sufficient to account for the deposition of iodine with the snow?

p. 25362/3: I didn't understand at all why meteorites are of relevance in this discussion. Please make this clear or if there is no relevance, please delete this discussion.

p. 25363: The discussion of meteorites is directly followed by a discussion of Heumann et al – how is this related?

p. 25363, l. 17: Change "inlands" to "inland" and "deposed" to "deposited" if that's what you mean.

p. 25363: The discussion about the chemistry of iodine oxides is outdated. Please see the recent publications about OIO photolysis etc by Gomez-Martin et al. GRL, 2009. Based on this it is very likely that OIO photolyses with a very short photolytic lifetime. IO has been detected in the Arctic (Leeds group, COBRA campaign) but I'm not sure about the state of publications. Organic iodine is not of importance for coastal IO events such as those observed at Mace Head or in Brittany.

p. 25365, l. 2: Please add a reference.

p. 25365, l. 4: Please change "form" to "from"; why does this suggest that CH_3I is the main carrier for iodine? It might very well be transported in the particulate phase and then deposited as snow, which might, given your data, be more likely.

p. 25365, l. 11: Add "air" after snow interstitial

p. 25365, l. 16-18: Sentence seems to be incomplete

p. 25365, l. 25: Please replace “this summer” with the year. Here and elsewhere: it would be easier for the reader who is not very familiar with Antarctica if you referred to “summer 2008” as summer “2007/2008” as the austral summer spans two calendar years.

p. 25366, l. 21: Is the height of the instrument above the snow constant over the 10 years of the instrument operation?

p. 25367/2, Equations 1 and 2 and related text: please use the same symbol in the equation and in the text, i.e. ρ or ρ_i.

p. 25372, l. 7: Please don’t use double brackets for the references. If using latex/bibtex this can be automatically be done with the command citep.

p. 25372, list: Please start each bullet with capital letters.

p. 25375, l. 24: Are 10,000 photons really enough to cover the whole radiation field?

p. 25379, 2nd para: Did you also test the case of radiative transfer within the snowpack in the presence of blowing snow?

p. 25382, l. 10: Delete “it”.

p. 25382, l. 12: The loss of nitrate in snow is also dependent on photolysis as shown by many field and lab studies.

p. 25382, l. 14-16: Please add a reference for this statement.

p. 25382, l.20 – 22: In order to make it easier for the reader, could you please add the mid-lat concentrations?

p. 25382, l.25-30: This can also point to seasonally varying deposition of iodine with the snow; if deposition were indeed seasonally varying you could not use the winter concentrations as “minimum”. Please discuss this point.

p. 25383, l. 4-7: This statement needs more proof/discussion. What year and season

is the Heumann data for?

p. 25383, bottom: Again you are not referring to the latest kinetic information about iodine oxides, see above.

p. 25384, l. 18: OIO has been detected by MAS-DOAS, just not at Neumayer; please clarify.

p. 25384, l. 21-23: Please add a reference for these lifetimes. The discussion of kinetics is outdated.

p. 25383, l. 1: OIO photolyses to yield I atoms which react with ozone to form IO, so there is an almost immediate formation of IO from OIO.

p. 25385, l. 20: You might also want to cite the review on snow photochemistry by Grannas et al, ACP, 2007.

p. 25385, l. 23: Are you referring to figure 10?

p. 25388, l. 5: The second point has been shown to be the case; please update this discussion with the latest kinetic information (see above).

Figures:

Please explain – for clarity – the abbreviations that you use in the captions. This makes it easier for the reader to understand the paper if they don’t read the whole paper. This is especially true for uncommon abbreviations such as SAA.

Figure 4: The comment about the highest dSCD doesn’t seem to be correct at all times, please explain better what you meant

Figure 9: There is a substantial difference in the iodide concentration in the 2 summers plotted. Can you explain this? Is it caused by large differences in deposition rates or in cloudiness which could impact snow photochemistry?

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 25361, 2009.