Atmos. Chem. Phys. Discuss., 15, C7656–C7658, 2015
www.atmos-chem-phys-discuss.net/15/C7656/2015/

Atmospheric Chemistry and Physics Discussions

ACPD
15, C7656–C7658, 2015

Interactive Comment

Interactive comment on "Boundary layer new particle formation over East Antarctic sea ice – possible Hg driven nucleation?" *by* R. S. Humphries et al.

R. S. Humphries et al.

rsh615@uowmail.edu.au

Received and published: 7 October 2015

We would like to extend our appreciation to the reviewer for the effort undertaken in the review of our manuscript. The comments have led to a greatly improved manuscript. A summary of the improvements made to the paper while addressing each point is outlined below:

Major comments:

1. (a) Quantified details of the results from the sulfur nucleation modelling have been included as a table in the Appendices. Appropriate edits to paragraphs

3 and 4 of section 3.6.3 have also been made to reference the new table and discuss its results.

(b) Additional limitations associated with the MSA chemistry and other condensable species have been included in the discussion section (now paragraphs 6 and 7 of section 4) that already explored cloud and mercury limitations present in the model. Further details of limitations are also included in cited references.

(c) Additional references have been added to the last paragraph of section 2.6 that add further evidence to the MSA fraction values utilised in the model. The values used were the upper limit of those found in the literature. If the characteristics of the observed particle formation event cannot be reproduced even with the upper limit values chosen, then the importance of sulfur chemistry to this analysis is minimal. , A thorough literature review of the DMS/MSA reaction therefore seems out of the scope of this paper.

(d) The reaction scheme in the TOMAS model has already been included in cited literature (Chang et al., 2011; Chin et al., 1996) and so the reader has been directed to the references, and the details, have not been reproduced in the manuscript.

(e) The pulse of DMS assumption that the model assumes has now been discussed in more detail in the methods section to explain the consequences of this parameterisation in describing reality.

2. The halogen chemistry that the referee is discussing in the review is in reference to possible oxidants that may be involved in the Hg formation chemistry, rather than as a precursor itself to the observed nucleation, as the referee suggests. Indeed, Br and Cl chemistry have never been observed to be precursors for aerosol nucleation to our knowledge. Because of the context in which these two halogens are introduced (and the minor part they play in the manuscript), a more thorough presentation of the MAX-DOAS data, as well as further modelling

ACPD
15, C7656–C7658, 2015

of chlorine chemistry, seems unnecessary. We have, changed the appendix text in order to better quantify the variation of BrO for clarity, and all reports of amount of BrO have been changed to total column amounts, rather than the estimated conversion to ppt.

Minor comments:

1. A discussion of the uncertainties of trajectory analysis was included in the Methods section. However, we agree with the reviewer that it would be useful to reiterate this important point when discussing the results. Consequently, a paragraph that flags the uncertainties in trajectory analyses at these high latitudes has been added to section 3.1 prior to the discussion of the trajectory results.
2. This typo has been corrected. Thank you for picking it up.
3. Thank you for picking this up. This is an error in the encoding from the original tex source file to the final product which was overlooked previously. The references included there should be:
   (a) International Programme on Chemical Safety, I. (2001). INCHEM Mercuric Oxide. Retrieved from http://www.inchem.org/documents/icsc/icsc/eics0981.htm
   (b) United Nations Environmental Programme. (2008). The Global Atmospheric Mercury Assessment: Sources, Emissions and Transport.
   (c) Feddersen, D. M., Talbot, R., Mao, H., Sive, B. C. (2012). Size distribution of particulate mercury in marine and coastal atmospheres. Atmospheric Chemistry and Physics, 12(22), 10899–10909. http://doi.org/10.5194/acp-12-10899-2012

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 19477, 2015.