Atmos. Chem. Phys. Discuss., 10, C13811–C13812, 2011
www.atmos-chem-phys-discuss.net/10/C13811/2011/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Modeling chemistry in and above snow at Summit, Greenland – Part 1: Model description and results" *by* J. L. Thomas et al.

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Received and published: 17 February 2011

The paper of Thomas et al. presents a very nice comparison between measured nitrogen and bromine oxide measurements at Summit, Greenland to the modeling results from a new coupled, 1-D atmosphere-snow chemistry model. An important aspect of the chemistry in the model is nitrate photolysis to form both NOx and OH; the OH radicals then go on to oxidize bromide. H2O2 photolysis is another important source of OH radicals. The authors illustrate that significantly less bromine activation occurs if the reaction between aqueous OH and bromide is turned off in their model.

I'd like to point out that this reaction, i.e. photochemical formation of OH in ice-salt substrates leading to bromine activation, has recently been demonstrated by our group to occur with near unity efficiency, i.e. within experimental error all OH radicals generated react to form Br2 under our experimental conditions.[1] Similarly, earlier studies by George and Anastasio have also shown that the same chemistry occurs in aqueous (i.e. non-frozen) solutions.[2] While the substrates used in the lab studies will certainly not fully match snow/ice conditions in the environment, it may validate some of the inherent model assumptions if reference is made to experiments that show that this chemistry has actually been demonstrated to occur, as least with frozen and liquid solutions in the lab.

1. J. Abbatt, N. Oldridge, A. Symington, V. Chukalovskiy, R.D. McWhinney, S. Sjostedt and R.A. Cox, Release of Gas-Phase Halogens by Photolytic Generation of OH in Frozen Halide-Nitrate Solutions: An Active Halogen Formation Mechanism?, J. Phys. Chem. A., 114, 6527-6533, 2010. 2. I.J. George and C. Anastasio, Release of Gaseous Bromine from Photolysis of Nitrate and Hydrogen Peroxide in Simulated Sea-Salt Solutions, Atmos. Environ., 41, 543-553, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 30927, 2010.