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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Contribution of very short-lived substances to stratospheric bromine loading: uncertainties and constraints" *by* J. Aschmann and B.-M. Sinnhuber

J. Aschmann and B.-M. Sinnhuber

jaschman@iup.physik.uni-bremen.de

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We thank the referee for her/his helpful comments and the invested effort. In the following, the original remarks of the referee are in *italics*.

Page 30286, lines 22 onwards: The authors outline the second major uncertainty as vertical transport and write 'the critical question is what fraction of short-lived gases reach the stratosphere intact', but the following discussion only addresses uncertainties in the fraction of PGI bromine that is scavenged. It would be useful to add a sentence here outlining possible uncertainties in the SGI pathway (e.g.

co-location of emissions and vertical transport, photochemistry) before discussing the PGI pathway.

We totally agree that a discussion of the SGI pathway would be adequate here and we will alter the manuscript accordingly.

Page 30288, line 7-10: Has the vertical transport scheme been analysed/validated in any way? As one of the findings of this paper is that uncertainties in vertical transport are significant in comparison to the photochemistry, some idea of how well vertical transport is represented in the model would be useful.

We have done several tests in the past to evaluate the quality of the vertical transport in the B3DCTM. Most of these were done for our Aschmann et al. (2009) study, where we compared convective turnover times, water vapor tape recorder phases, ozone mixing ratios in the TTL and of course profiles of VSLS with observational data. All mentioned parameters are critically dependent on vertical transport and the comparisons show in general good agreement between the model and the observations. We agree that an additional sentence regarding the quality of vertical transport would be useful in this context and will add one in the revised manuscript.

Results Section: I think this section could benefit from altering some of the section headings, e.g. all of the results could be considered to come under 'Source and product gas injection'; the 'Definitions' and 'Reference simulation' sections are relevant to Section 3.2 as well as 3.1, and the dehydration simulations could also be considered to be 'Sensitivity calculations'. Perhaps the sub-sections in 3.1 could be promoted, and 3.1.3 could be re-titled 'Impact of photochemistry, vertical transport..' etc.

This is a good idea. We will modify the sections for the upcoming revision.

Page 30302, line 15: This difference between modeled and observed bromoform at 380 K could have an important influence on the results from this study since any errors in CHBr3 mixing ratio are multiplied by 3 when considering bromine. It would be good to see a bit more discussion of the possible impact of this difference.

We agree that this is an important point. As stated in a similar comment by referee #1 the absolute amount of bromine from VSLS entering the stratosphere is directly dependent on the assumed sources and whether these sources are collocated with deep convection. As we still lack a clear picture of strength and distribution of VSLS emissions and due to the inherent limitations of our modeling framework we have to rely on relatively simple assumptions (i.e. fixed and uniform detrainment mixing ratios). Therefore, our primary focus in this study is on the relative importance of the associated processes, e.g. the relative fraction of SGI and PGI, which is largely independent from the absolute amount of bromine. We will try to make this more clear in the revised manuscript.

Page 30286, line 21: change to "a significant part must originate from other sources"
Page 30286, line 11: change to "Despite increased scientific effort in recent years"
Page 30288, line 27: Label tables in the order they appear in the text - change Table 3 to Table 1.
Page 30289, line 9: change to: "only at the upmost levels of the upper troposphere/lower stratosphere (around 17 km altitude) does the relative importance of liquid aerosol reactions increase."
Page 30289, line 23: change to "of the model."
Page 30289, line 24: change Table labels, as mentioned above.
Page 30291, line 21: SGI for CH2Br2 is given as 94% here, but is 93% in the abstract. Change to be consistent.
Page 30297, line 13: change to: "represents the loss due to dehydration resulting from

the exclusion of heterogeneous chemistry"
Page 30300, line 13: change to "bromine at 380 K or 1.23 pptv is lost"
Page 30304, line 5: change to "actual loss of bromine in the TTL"

We have fixed all of the editorial comments above and thank again the referee for the careful reading.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 30283, 2012.