

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

Anonymous Referee #2

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The paper presents a well-structured and detailed study of the impact of vertical transport and dehydration on the fraction of bromine that is transported by short-lived species to the stratosphere. It reiterates their previous result that loss of inorganic bromine due to dehydration in the TTL region is not significant, and builds upon that result providing a detailed sensitivity analysis quantifying uncertainties in the transport of bromine to the stratosphere. I believe it makes an important contribution to the field, and I recommend the paper be published in ACP after addressing the following minor comments.

Minor Comments

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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.

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.

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.

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 CHBr_3 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.

Technical Corrections:

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 tropo-

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sphere/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'

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

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