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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bromoform and dibromomethane in the tropics: a 3-D model study of chemistry and transport" *by* R. Hossaini et al.

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Response to Referee 2:

We thank Referee 2 for his/her comments. The comments are repeated below (*in italics*) and our responses are given in **bold** text.

In the abstract and in section 4.1 the authors say that the vertical motion in the SLIMCAT model is more realistic but then use the TOMCAT runs as the basis for their estimates of the amount of bromine entering the stratosphere. The authors should be clear about their rationale for this choice.

Due to SLIMCAT currently not including treatments of convection and turbulent mixing in the boundary layer, the more complete tropospheric model (TOMCAT) has been employed as the base run.

See also response to Reviewer 1 and below.

Comments:

Abstract: Line 21, clarify the use of cold point. Presumably the authors are using this as the tropopause definition.

'Cold point' will be changed to 'cold point tropopause'.

Line 27, define SGI.

OK, we will do this.

Introduction: Line 3, this seems too strong of a statement. The current measurements suggest this, but there simply isn't enough data to make such a definitive statement.

In the ACP paper 'are known to provide an additional supply of inorganic bromine. . ..' will be changed to 'are currently expected to provide an. . ..'.

Section 3.2 Simulations: p. 16821, how do these profiles compare with measurements and/or previous estimates? Line 19/20, the choice of 1.2 ppt for both source gases needs to be justified, e.g. "seems reasonable" is incomplete. p. 16822, Line 6, use the model name.

The model temperature fields are taken from ECMWF analyses and are expected to be reasonably accurate ($\pm$ a few K). For this study we use monthly averaged 24-hour mean values of [OH]. Tropospheric variability in OH is large and observa-

tions are sparse. However, comparison of OH profiles from the PEM TROPICS-B campaign with the mean model profile presented in figure 3 (not shown), show reasonable agreement. The model OH field in this case was found to be within the min-max variability of the available observations from the surface to $\sim$200 mb. However, we also acknowledge that the model [OH] is uncertain and that is a reason for performing the 2x[OH] sensitivity run.

The use of a surface vmr of 1.2 pptv for $CHBr_3$ and CH_2Br_2 will be justified. We shall include a citation of Quack and Wallace (2003) who report background marine boundary layer $CHBr_3$ in the range 0.5-1.5 pptv. Similarly for CH_2Br_2, we shall include a citation of Butler et al. (2007), who report a mean source gas surface vmr in the range 0.6-1.3 pptv for the tropical marine boundary layer.

There should be a section describing the measurements, e.g. collection techniques, analytical techniques, precision, accuracy, and errors.

OK. We shall include a new subsection with description of the aircraft observation techniques and accuracy of measurements etc.

Section 4.1 Source gas injection p. 16824, Line 27/28 explain HCFC and HFC and their relevance/use for this calculation.

OK.

Section 4.3 Total bromine It would be useful to include the SLIMCAT results in this section to get the full range of model estimations of total bromine, especially since the value of the SLIMCAT simulations are presented throughout the manuscript, including the conclusions.

We will perform 3 additional SLIMCAT simulations with the same prescribed

lifetimes of Br_y as that of TOMCAT sensitivity runs – S_{10}, S_{20} and S_{40} (10, 20 and 40 days). We will then present a range of values of SGI, PGI and total Br reaching the stratosphere from $CHBr_3$ and CH_2Br_2 based on the theta-level model (SLIMCAT) also.

Section 5 Conclusions Line 29/30, the 2.6 ppt shortfall could in part be covered by the SGs mentioned, but the authors should provide a reference for this. There are also a number of uncertainties in the measurements and model runs and the representativeness of the available data, so assigning the 2.6 ppt difference to other SGs, known or unknown, is only one of the possibilities.

OK. The other SGs mentioned (CH_2BrCl, $CHBr_2Cl$ and $CHBrCl_2$) have all been observed in the tropical near tropopause region and thus are likely to contribute to stratospheric Br_y to some extent.

We shall include a citation of Law and Sturges et al. (2007), who in their Table 2-2 present estimates of mixing ratios of these SGs in the tropical upper troposphere based on a compilation of field measurements. These are 0.32 (0.26-0.35) pptv, 0.08 (0.03-0.12) pptv and 0.12 (0.05-0.15) pptv for the SGs listed above respectively.

We shall also highlight that the contribution from these SGs would unlikely explain a shortfall of 2.6 pptv of Br_y as discussed in the manuscript. We shall include discussion of other uncertainties in both observational and model work.

Figures 7 and 11 define the horizontal lines.

OK.

References

Butler, J.H., King, D.B., Lobert, J.M., Montzka, S.A., Yvon-Lewis, S.A., Hall, B.D., Warwick, N.J., Mondeel, D.J., Aydin, M., and Elkins, J.W.: Oceanic distributions and emissions of short-lived halocarbons, Global Biogeochem. Cycles, 21, GB1023, doi:10.1029/2006GB002732, 2007.

Quack, B. and Wallace, D. W. R.: Air-sea flux of bromoform: Controls, rates, and implications, Global Biogeochem. Cycles, 17(1), 1023, doi:10.1029/2002GB001890, 2003.

WMO (World Meteorological Organization), Scientific Assessment of Ozone Depletion: 2006, Global Ozone Research and Monitoring Project-Report No. 50, 572 pp., Geneva, Switzerland, 2007.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 16811, 2009.