**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Estimating the contribution of bromoform to stratospheric bromine and its relation to dehydration in the tropical tropopause layer" *by* B.-M. Sinnhuber and I. Folkins

Anonymous Referee #2

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This paper addresses a timely subject matter. I only have some minor comments.

Would it be better to assume a constant washout for BrY below 10 km to represent large-scale removal by precipitation, and use a separate parameter for washout between 15.5 km to 17 km to simulate removal by ice?

A minor point. It would be less confusing if the authors try to make the distinction between tropospheric concentration and stratospheric concentration. The mixing ratio

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in equation(1)should really be averages for the troposphere. The tau-chem term in equation (1) refers to the average lifetime below 17 km. It would be better to use a different notation to distinguish that from the tau-chem in equation (2) which is the local photochemical loss as a function of altitude. Finally, the expression on line 25 of p. 12941 is the steady state mixing ratio of BrY in the stratosphere, not the amount of bromine transported to the stratosphere. To get that, one would have to divide by the residence time in the stratosphere.

The following will not change the conclusion of the paper. I have some difficulty understanding some of the results. I look upon equation (2) as a 1-D equation for three separate domains: ground to 15.5 km, 15.5 km to 17 km, above 17 km. (1) It is not clear to me whether 1 pptv was imposed as a fixed mixing ratio boundary condition for CHBr3 in solving the equation in the first domain. I would like to know if one solves the equation without the bottom fixed mixing ratio boundary condition, what value would one gets depending on the imposed flux boundary condition (zero flux, or an estimated emission rate to balance the downward advection to obtain 1 pptv). If a fixed mixing ratio boundary condition is used, one has to do a sanity check to see if the flux is reasonable. One can do this by comparing the integrated detrainment source and see whether it balances the photochemical plus detrainment loss. The difference is the artificial source in the boundary layer. to the first domain. (2) Above 17 km, there is no washout for BrY, and the detrainment rate is zero. CHBr3 in the stratosphere is maintained by the boundary mixing ratio at 17 km, balanced by local photochemical loss. For BrY, there is no local loss. The question then is how does one reach a steady state condition. If one looks at total bromine, there is no production and removal term. There is an upward advection velocity at 17 km. One can get a steady state with constant mixing ratio only if the advection at the top boundary balances the inflow at 17 km. (3) Finally, I wonder if numerical diffusion is affecting the solution.

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