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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Convective transport of very-short-lived bromocarbons to the stratosphere" *by* Q. Liang et al.

Anonymous Referee #2

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General Comments

This paper presents a well-structured, concise study of the impact of convective transport on the contribution of bromine from VSLS to total stratospheric bromine. It predicts a larger contribution of VSLS-bromine to total stratospheric bromine than previous studies, which is attributed to the inclusion of a full chemistry scheme and thus a better representation of the partition of soluble and insoluble Bry and its diurnal variation. The authors also find that more VSLS-originated bromine reaches the stratosphere when the convection strength is reduced in the model due to the impact of convection on wet scavenging of Bry. I believe it makes an important contribution to the field, and I recommend the paper be published in ACP after addressing the following comments.

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Specific Comments

P655, lines 20-22: Despite the paper's main conclusion that the ratio of soluble and insoluble Bry is critical in determining PGI to the stratosphere, only simple chemistry is considered in the troposphere assuming all tropospheric Bry is highly soluble. Other studies indicate a significant portion of tropospheric Bry is present in insoluble form as BrO. Could the authors justify their use of such a simple scheme, and also be more specific about the regions in which simple and fully interactive chemistry are considered.

P656, lines 20-24: Could more detail be added as to how the convection/precipitation changes in the model between minimum and maximum conditions? They are described as 'extremes', but the resulting profiles do not look that dissimilar. Does 'minimum' convection result in shallower convection, or a reduced geographical area of convection or both? How does precipitation change? The result that more PGI VSLS-originated bromine reaches the stratosphere under 'minimum' convection conditions will be dependent on the representation of precipitation in the model and how this changes between scenarios – how well is precipitation represented in the model?

A comment on how well a relatively low-resolution model simulation (2.5 x 2 degrees) is able to represent precipitation would also be useful (i.e. could it lead to too much precipitation/scavenging in convective regions if the entire gridbox is precipitating, and hence influence the calculated PGI to the stratosphere? Could this influence the calculated difference in PGI between minimum and maximum scenarios?).

P658, lines 2-5: Useful to remind the reader that the fully interactive chemistry scheme is not used in the troposphere.

P660, lines 6-7: Does the model include in-cloud rainout in the lower stratosphere?

P663, line 16: It would be interesting to also say how much of VSLS bromine is removed by wet scavenging in the troposphere as well as TTL. Presumably this is negli-

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gible given the proportion reaching the stratosphere?

P664, line 1: Again, could be authors be specific about the region in which the full chemistry scheme is used.

Figure 5: This figure shows that a significant portion of total VSLS bromine is present in the form of Bry in the troposphere. If all tropospheric Bry is assumed to be highly soluble, how is such a large fraction reaching the stratosphere?

Technical Corrections

P655, line 20: change to 'below the tropopause'

P655, line 21: change 'partition' to 'partitions'

P658, line 13: change to 'and this work are likely due. . .'

P650, line 1: change 'ascend' to 'ascent'

P659, line 19: change 'Aschfold' to 'Ashfold'

P660, line 4: change 'happen' to 'happens'

P661, line 22: change 'enter' to 'enters'

P663, line 28: change 'products in full' to 'products in a full'

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 651, 2014.