

***Interactive comment on “Finding the missing
stratospheric Br_y:
a global modeling study of CHBr₃
and CH₂Br₂” by Q. Liang et al.***

Anonymous Referee #2

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Review of "Finding the missing stratospheric Br_y: a global modeling study of CHBr₃ and CH₂Br₂"

by Q. Liang and colleagues

This was a very well written paper describing a particularly well executed, important and timely study. The authors have used a well established Chemistry Climate Model (CCM) to quantify the impact of very short lived bromine species on the bromine abundance in the stratosphere. In the first part of the work, the authors perform a 'top down' estimate of the source strengths for CHBr₃ and CH₂Br₂ - the key species of interest. Following this, the authors quantify the impact of these species (typically previously

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accounted for in model studies) on stratospheric inorganic bromine loading.

I only have two substantive comments. Firstly, I would encourage the authors to include some discussion on the implications of their findings for stratospheric ozone depletion. This need only be citing previous works tying additional bromine to ozone loss (typically considered most important in the lower stratosphere I believe), I'm not suggesting additional calculations or model runs.

Secondly, I was a little surprised to learn that this study showed little impact of convective scavenging on stratospheric Br_yVLS (I guess I follow 'conventional wisdom'). A little more discussion of this point would, I feel, help make this clearer to the reader. Am I correct in presuming scavenging of the organic bromine species is negligible? It would be helpful (to me, at least) in the discussion at the end of section 5 to be more specific, and underscore that we are not talking about scavenging of the organic precursor species. Can the authors cite studies and/or model runs that demonstrate that the scavenging scheme in their model is robust. For example, have people looked at model depiction of the behavior of other soluble species such as nitric acid?

Minor comments —————

The standard of writing and illustration is particularly clear in this paper, so I really have very little to contribute.

— Page 23629

Line 14: '2-dimensional' typo.

Line 24/25: Why is 'transported as an individual tracer' in quotes? Is this some standard modelling terminology and quoted as such?

— Page 23630

Line 8-14: It is not clear to me how the 'lifetimes' discussed here relate to those shown in figure 1. Some description would help. Are the single values quoted some kind of

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global/seasonal average? If so, the values are not immediately obvious from the two figures in column three. For the 'average' for CHBr3 to be 20 days seems at odds with how high the values are at higher latitudes (though weighting by area might account for that).

Line 27: Again the quotes for 'atmospheric lifetime Bry' are unexplained.

— Page 23634

Lines 6-10: I found this discussion a little unclear. Are the authors interpolating the model in space and time to each aircraft location (do they have model outputs with sufficient temporal resolution for that)? Or are they taking model mean files for a large time window and interpolating them in space? Fundamentally I'm not quite clear what 'closest point in MAM and JAS' means.

— Page 23635

Line 17: I'd suggest a 'The' before 'mixing ratio of ...'

— Page 23636

Lines 1-5: It would be good to mention if other tracers of biomass burning (e.g., CO, HCN, CH3CN) show similar disagreements between model and observations in this case (assuming the model includes them).

— Page 23639

Line 20: Might it be good to add 'near the Earth's surface' after 'gradient', just to be totally clear we're not talking about any gradients in the mid or upper troposphere.

— Page 23640

Line 1: For clarity it would be good to add '(organic and inorganic)' after 'bromine' (first word) - assuming that this is a correct interpretation.

— Figure 7:

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Why are the observations shown as black symbols with error bars here while in figure 6 black lines with shading were used?

— Figure 12:

Caption line 1: Should one not add 'due to VLSL' after 'bromine'? Also, it would be good to repeat '(organic and inorganic)' here for the readers who skim the text and concentrate on the figure.

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