**Atmospheric
Chemistry
and Physics
Discussions**

Interactive comment on "Sensitivity of stratospheric Br_y to uncertainties in very short lived substance emissions and atmospheric transport" *by* R. Schofield et al.

Anonymous Referee #1

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Overall: this is an intelligent paper with an interesting model approach. I don't have any serious criticisms of the technical aspects of the model. I would recommend publication. However, I think the main conclusions get obscured by the complexity of the figures, and at times, an awkwardness in the writing. The paper would have much more impact if it had a much stronger focus on the main conclusions, and the supporting evidence was presented in a simpler manner.

The paper uses a trajectory model, with episodic convective detrainment, to calculate a distribution of Bry at 400 K. It explores the Bry sensitivity to (1) boundary layer concentrations, (2) an "efficiency" parameter (or fraction of detrained air that is of boundary

layer origin), (3) a washout parameter in the TTL for the soluble species (gamma), and (4) Br species chemical lifetime.

Figures 3, 6, and 7 have an incredible amount of detail that makes the information from these figure hard to digest, and see. Most of this complexity is not directly relevant to the paper. I would suggest replacing some of the geographic variability with seasonal/zonal mean vertical profiles, perhaps of the detrainment rate, perhaps with a breakdown of ocean/continental/coastal.

Figure 8 also has too much information to absorb; there are actually 60 different curves in this figure. I realize that the paper is not in a position to definitively answer how the observed 400 K Bry values are achieved. But there should be a more condensed way of showing the results of these sensitivity studies. E.g. maybe the annual mean 400 K Bry mixing ratio could be shown as a contour plot with the "efficiency" parameter on one axis and the "washout" parameter on another axis, with the observed range shaded (for specific choices of the other two sensitivities). I am not sure if such a contour plot is realistic given the required computer time; just a suggestion.

Just after Equation 1: detrainment and divergence should not be used interchangeably.

Figure 10 : I don't seem much interannual variability here.

some examples of awkward writing: "exemplary trajectories" (example trajectories?), "When the emissions convected ..", "complexer emission pattern".

I have also a general comment about entrained air. It may be true, as the Romps study suggests, that only 10 - 30 % of air in detraining clouds originates from the boundary layer. However, deep convection typically occurs only when the column moisture is very high (papers by Neelin and others) - presumably after having been moistened by mid-level convection. If deep convection occurs under conditions of anomalously high RH, then presumably a background trace species value may not be realistic. One perhaps may want to look at the correlation between RH and a bromine species in the

mid-troposphere, and use an effective entrainment Br mixing ratio which corresponds to the higher RH at which deep convection actually occurs.