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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The contribution of anthropogenic bromine emissions to past stratospheric ozone trends: a modelling study" *by* B.-M. Sinnhuber et al.

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We thank all the referees for their detailed and helpful comments. We have now revised our manuscript taking into account the specific reviewer comments. In particular we have repeated the model calculations with the now available JPL-06 reaction rate recommendations, as suggested by the referee Ross Salawitch. We also have modified the technical details of how to calculate alpha: calculations are now performed with increased chlorine and bromine loadings of 10, 30 and 50%. With the new calculations the values of alpha have slightly changed (annual averaged alpha is now calculated as 64, in contrast to a value of 69 from our earlier calculations). Below we give a detailed reply to Referee #3's comments.

Reply to the specific comments

1. It is true that the 2-D model has a relatively coarse vertical and horizontal resolution. Improving the resolution may improve the representation of physical and chemical processes in the model but unfortunately is beyond what is feasable for this study. The model does include a PSC parametrization. We have included a note in the text, also pointing out that the model does not include a solar cycle.

2. In our previous calculations we have switched off tropospheric washout for bromine species only. In the updated calculations however, we have now retained the tropospheric washout of inorganic bromine, as we believe this gives a more consistent and more realistic simulation. The effect is, that not all of the additional 6pptv bromine released as VSLS reaches the stratosphere: The stratospheric increase in total bromine is about 4 pptv for the simulation with VSLS included.

3. We have concentrated here on mid-latitudes since the representation of polar processes in a 2-D model is problematic. Even though the model does contain a comprehensive treatment of polar stratospheric chemistry. E.g., using the 1980/81 wave driving the model produces Arctic winters which are relatively warm with have only little Arctic ozone loss. Due to the export of polar air masses this has some impact on mid-latitudes as well.

4. We have now performed all the calculations for perturbations of 10, 30, and 50%. Overall the effect on the calculated global alpha value is small, changing calculated alpha by less than 10%. However, we found that a 10% change resulted in certain locations in an ozone change that was too small to calculate local alpha values reliably. Consequently, we have used the results from the 30% perturbation experiments in the text and have changed the text accordingly.

As described in the text, we have performed the model calculations over 11 years (instead of 7 years as done by Daniel et al., 1999), using 1998 conditions and used only the last year in the calculations of alpha. The way we calculate alpha is thus very

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similar to Daniel et al.

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Interactive Comment