

Interactive comment on “A global stratospheric bromine monoxide climatology based on the BASCOE chemical transport model” by N. Theys et al.

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Nicolas Theys: Author response to Referee #1

Theys and coworkers present a stratospheric BrO climatology, derived from stratospheric chemical transport model (CTM) calculations, that is specifically designed to be used in the retrieval of tropospheric BrO from satellite observations. The underlying CTM is extensively validated against available observations of ozone, NO₂ and BrO and found to be in agreement with available observations. A novel feature of the constructed BrO climatology is use of ozone and NO₂ columns as a classification of the BrO climatology. I expect that such a climatology will be of great benefit for the retrieval of tropospheric BrO columns. It would have been nice, if an application of this

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newly constructed climatology could have been presented here as well. However, this will probably be done in more detail in a future paper. The manuscript is generally well written and I recommend publication in ACP after taking into account a few (mostly minor) comments.

Reply: We thank the referee for his comments. We agree that it would have been nice to show an application of the climatology, however after careful consideration we came to the conclusion that the application of the climatology to satellite retrievals actually deserved a full paper on its own, since many aspects of the retrieval and of its assessment will have to be treated beyond the issue of the climatology application. This work is currently under progress and will make the subject of another publication.

Specific comments:

Page 17586: Why are reaction rate data from JPL eval 15 are taken only for bromine chemistry into account, and using eval 14 for all other reactions (Actually, the reaction $\text{BrONO}_2 + \text{O}(3\text{P})$ is now part of JPL eval 15.)

Reply: The bromine chemistry (including the reaction $\text{BrONO}_2 + \text{O}(3\text{P})$) has been implemented using the reaction rate data from JPL eval 15, while eval 14 has been used for all other reactions. This approach is of course basically inconsistent, and the authors intend to apply JPL 15 coefficients to the full chemical scheme in coming versions of BASCOE. However, in practice, this homogenization process is expected to only have a small impact on the findings reported in the present study.

Page 17595: Comment: The BASCOE model apparently underestimates BrO in the lowermost stratosphere, when compared to SCIAMACHY (Fig. 7). Could this be partly due to the fact that the model considers all bromine from short-lived compounds to be present in the form of CH_2Br_2 , which has the longest lifetime of all the short-lived compounds listed?

Reply: We agree that BASCOE shows a tendency to underestimate BrO in the LS

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in comparison to SCIAMACHY, but this seems to be the case only at mid- and high-latitudes in the northern hemisphere during winter time. The fact that the short-lived bromine compounds are present in the form of an effective source of CH₂Br₂ can indeed partly explain the observed differences. Nevertheless, some differences possibly attributable to SCIAMACHY retrievals can not totally be ruled out at this point. This being said, and considering the current uncertainties on BrO measurements and model simulations, we believe that it is fair to say that in general the agreement between BASCOE and SCIAMACHY data is remarkably good.

Page 17603: I don't really understand the meaning of section 4.4. Are trends in bromine implemented in the current climatology or not? If not, a few general sentences should be sufficient, without the need to include an extra section.

Reply: The trend in stratospheric bromine has been implemented in the climatology, in the form of a linear correction factor. We agree that it is ambiguous in the text because of the sentence '..the stratospheric BrO climatology can be generalized to account for long-term trend..'. Therefore this has been changed into '..the stratospheric BrO climatology is generalized to account for long-term trend..'.

Technical corrections:

Reply: all the technical corrections have been accounted for and changed in the text. In particular, it has been clarified in sect. 4.2 that the Br_y climatology is constructed using an area weighting for the Br_y profiles to account for the fact that the model cells vary in size with latitude. The paper of Hendrick et al., 2008b has now been accepted for publication in Atmos. Meas. Techn. Discuss. and will be available on the AMT Discussion website soon. Therefore, the reference has been changed.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 17581, 2008.