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Atmospheric Measurement Techniques Discussions

Interactive comment on "New retrieval of BrO from SCIAMACHY limb: an estimate of the stratospheric bromine loading during April 2008" *by* J. P. Parrella et al.

Anonymous Referee #1

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The manuscript by Parrella et al. describes a new retrieval scheme for bromine monoxide (BrO) from ultraviolet limb observations of the SCIAMACHY instrument onboard the ENVISAT satellite. Retrieved BrO profiles are compared to balloon-borne observations, using a photochemical model to account for different local times of the observations. Another photochemical model is then used to infer the stratospheric bromine loading from the SCIAMACHY BrO observations.

BrO profile retrievals from SCIAMACHY observations have already been performed and published by other groups, as acknowledged by the current manuscript. However,

relatively large differences in terms of total bromine inferred from SCIAMACHY observations exist between the different approaches that have not been reconciled so far. Providing another independent or improved retrieval of BrO from SCIAMACHY is certainly very valuable and the effort of Parrella et al. should be highly acknowledged. Unfortunately, in the present form the current manuscript leaves me a bit puzzled what we have learned from the new retrieval. What has been improved on the technical side to reduce uncertainties in the new retrieval compared to existing BrO profiles from other groups? How do the new BrO retrievals compare to existing BrO retrievals from SCIAMACHY? How does the new estimate of stratospheric bromine presented here provide new constraints? As cited in the manuscript, the total bromine loading was previously estimated to be between 16.5 and 29 ppt (p.8019, l.3); the present study infers a loading of 23.5 +/- 6 ppt, which is basically the same range.

In order to really help reducing existing uncertainties the manuscript should provide more details of how and why the current approach leads to improved BrO retrievals. Ideally I would like to understand why there are differences to previous BrO retrievals, see how the new retrieval compares to existing retrievals and how the comparison with the balloon-borne observations improves for the new retrieval. This would require some major revisions to the current manuscript. However, I believe such an effort is worthwhile and I would like to encourage the authors to consider submitting a revised manuscript.

Specific comments

1. More information should be given regarding the comparison with the balloon observations. How/why were the five balloon profiles selected for comparison? Are these observations in 2003 and 2004 all the available balloon-borne BrO profiles? Please provide more details on the BrO retrieval from the balloon observations to give the reader an idea of whether these observations can be regarded as fully independent, or, e.g., if they both depend on the same spectroscopy, i.e. uncertainties in the cross sections cancel out to first order. Little is said about the photochemical correction here.

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How critical is this? How different are the local times of observations? It is stated (p.8034) that uncertainties in the photochemical modeling dominate the uncertainty in inferred total bromine. Does this represent also a major uncertainty here in the comparison with the balloon observations? In any case, the comparison should be made more quantitative. How does this study compare to the numbers given by Rozanov et al. (2011)?

2. The BrO/Bry ratio is largely controlled by O3 and NO2 (p.8033, l.28) and uncertainties in O3 and NO2 may contribute to the overall uncertainty in modeled BrO/Bry. It is stated (p.8032, l.1) that for the BrO retrieval O3 and NO2 are simultaneously fitted. Have these O3 and NO2 results (or O3 and NO2 from any other SCIAMACHY retrievals) been used to constrain, or at least test, the O3 and NO2 in the photochemical calculation of BrO/Bry? The final sentence (p. 8035, l. 23) states that uncertainties in chemical kinetics dominate the uncertainty in inferred bromine loading, which is a strong statement! Does this include uncertainties in the concentration of O3 and NO2?

3. It is stated that "including cross sections for O2-O2, OClO and additional temperatures for ozone ... occasionally caused strong correlations with BrO" (p.8025/8026). Shouldn't that worry one that there are spectral interferences with these other absorbers and how was this accounted for?

4. SCIAMACHY/ENVISAT (p.8020): I suggest including information for which time period SCIAMACHY provided data and to specify a bit clearer which different BrO profile products already exist. All relevant papers are given, as far as I can tell, but it is not spelled out so clearly which studies have provided BrO from SCIAMACHY observations.

Minor comments / technical corrections

p.8018, l.26: remove "and to the stratosphere"

p.8019, l.5: the reference to Brinckmann et al. (2012) seems out of place here as this

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study did not deal with limb geometry satellite observations.

p.8032, l.10: "these errors are dominated" or "these are errors dominated"

p.8034, l. 11: What is DOFS? Plural of DOF (degrees of freedom)? This is currently introduced in the caption of Fig.2 and should be introduced also in the text.

Fig. 6: What causes the low values of BrO at high northern latitudes for April 10-12? Is this a plotting artefact?

Fig. 8: It is regrettable that calculated BrO/Bry ratios are available only for the northern hemisphere. In this case the figure range can be restricted to northern hemisphere only.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 8017, 2012.