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Atmospheric Measurement Techniques Discussions

Interactive comment on "New Aura Microwave Limb Sounder observations of BrO and implications for Br_y" *by* L. Millán et al.

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We thank the reviewer #2 for his thoughtful comments and suggestions that have helped to improve the paper. In addition to enacting changes he suggested, as detailed below, we have also made some additions and updates to the paper to improve clarity and underscore areas where our product represents a significant improvement on earlier versions.

In the course of making our modifications, we recognized that the averaging kernel plot (figure 3) was incorrect in the submitted draft. The earlier version indicated the new product had more sensitivity to the lower stratosphere than is in fact the case. In the light of this we have revised our estimate of the valid vertical range of the product to 10-4.6 hPa. We note that our estimate of total Bry is unaffected by this update.

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However, the vertical range over which the new MLS observations usefully overlap with the other sensors is narrower, restricting the range of interest for the analysis shown in the comparison with other datasets.

Reviewer comments:

This paper describes an improved MLS algorithm for the retrieval of BrO. It briefly describes the algorithm, some error analyses, comparisons with models, comparisons with other BrO datasets, and an estimate of total Bry and the portion from very short lived bromine-bearing species. A key aspect of this new algorithm is that profiles now extend into the mid-lower stratosphere. It is a solid enough paper and easy to follow, but perhaps a little light. There is one major point that needs to be addressed, and a few minor ones.

The major point relates to the comparisons with other datasets. The two datasets used for comparison (SCIAMACHY & OSIRIS) are made at different local times. The authors acknowledge that such "comparisons ... must be made with caution" (p. 334, line 10-11). So does this invalidate the comparisons, and if not, what does it mean?

Generally for these types of comparisons one profile is scaled to the local time of the other instrument using output from a chemical model. Since this is effectively done in section 6 (to estimate Bry), it is curious that it was not done here. This should be added in order to make the comparisons meaningful.

To address this problem we used a tabulated photochemical model to map the SCIAMACHY and OSIRIS datasets to the MLS local time. The section 5.1 of the new version of the paper will explained the details.

Other points: page 326, line 4: "presented" should be "present"

Corrected

page 326, line 21: Mention that inorganic bromine is much less abundant than chlorine. Otherwise one might get the impression chlorine is not nearly as important.

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It the new version is mentioned.

page 327, line 19: change "on" to "in", or give the day in July

Changed to “in”

page 329, line 14: Given the large random errors associated with a retrieval (based on one day of coadding spectra), why not average over a longer persiod, say 10 days? It seems like one could not use a single profile (with a random error of 25 ppt, from section 3.2) anyways. A statement clarifying this choice would be helpful.

In section 3.2 (error assesment), it was added that: Although significant averaging is needed to be able to get a usable BrO estimate, such as months or even years, this retrieval uses daily zonal mean radiances instead of weekly or monthly to give the user the flexibility to average different combination of days as needed.

section 3.1: What is the vertical resolution? State here. It the new draft it is stated that the resolution is 5km all through the upper stratosphere.

page 330, section 3.2: Were forward model input parameter errors considered?

Yes, those are cataloged as part as the forward model uncertainties.

page 331, lines 17-18: "typically small error sources" - what are these?

In that section was added that: Examples of these error sources are, but are not limited to, errors due to the filter position uncertainties, errors due to the spectrometer nonlinearity and errors due to the interaction of spectrometers sharing the same power supply, etc).

page 331, line 23: "retrieval numerics"? This seems vague; what are these?

In the paragraph explaining the systematic error calculations it was added that: the difference between the unperturbed run and the model atmosphere estimates the errors due to the retrieval, the error known as retrieval numerics.

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page 332, line 16: These simulations are based on older JPL rate constants. How would more recent ones impact results, and are any relecant reactions missing?

The only relevant reaction for BrO chemistry missing from the JPL2002 catalog is the one added (BrONO2 + O —> BrO + NO3). This reaction was added to the JPL2006 catalog.

section 6: The dervied value of 5+/-4.5 from VSLS is important. More discussion on this is warrented. For example, more deatil on how this compares with the other estimates from WMO (2010) would be very useful.

A new figure was added to show all the estimates of Bry from VSLS as disccused in the chapter 1 of WMO (2010) plus the Bry from VSLS from this study.

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 325, 2012.