

Interactive comment on “Balloon-borne stratospheric BrO measurements: comparison with Envisat/SCIAMACHY BrO limb profiles” by M. Dorf et al.

Anonymous Referee #3

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Review of Dorf et al: Balloon-borne stratospheric BrO measurements: Comparison with ENVISAT/SCIAMACHY BrO limb profiles

General comments

This paper seeks to compare various balloon based observations of BrO with selected data from the SCIAMACHY instrument. In order to undertake such comparisons, photochemical models are required to take into account differences (most notably in local time / solar zenith angle) between the different observations. This paper presents important new work and is certainly suitable for publication. However, I would suggest

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some additions and alterations to the work. In general, I feel the paper is a little longer and more detailed than is probably necessary. If some of the more technical details of individual instruments is already documented in other publications, perhaps these could simply be cited. Also there is quite a bit of repetition in the discussions of the individual comparisons.

Specific comments

Issue 1:

I find that the description of the implementation of the 1D model is hard to follow. I think all the important information is there, however, it is presented in what seems to me is a rather confusing order. As I interpret it, the model is initialized with 3-D model results at an adjacent 48 hour model time step interpolated to the balloon location. Trajectories are then run forward and backward in time and coincidences with SCIAMACHY observations are considered. As far as I can tell, the only aspect of the trajectory that the 1D model is constrained to follow is the evolution of SZA. All the other parameters (O_3 , N_2O etc.) are left at the initialization values. This is I think described around line 13 of page 13026. Perhaps this section could be rewritten to make all this clearer (especially if I've actually come to the wrong interpretation!)

Issue 2:

I am confused by the conclusion (page 13037, line 13) that 'Initial BrO profiles available from SCIAMACHY agree to $\pm 50\%$ with model BrO.' What is meant by that, and how was that conclusion arrived at? Is this simply just an upper limit on any possible bias? A clearer description would be helpful.

Issue 3:

Following on from that I don't see how the statement that 'This should encourage a further improvement of the satellite retrieval' follows, either from the 50% number, or from the individual comparisons shown. I do not recall seeing any discussion of the

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expected precision, accuracy or vertical resolution of the SCIAMACHY data. If the error bars on the red SCIAMACHY profiles indicate precision (a note in the caption needs to be added describing them), then I don't see how one can draw such a conclusion based on the few profiles shown.

In the assumption that the error bars are precision, then each individual case could be argued to be a perfectly acceptable comparison as the comparisons are within the (1-sigma?) error bars. No useful information on accuracy can be derived from these individual comparisons. Only when one averages these comparisons to improve the precision can one draw any conclusions on biases in the SCIAMACHY data. Within individual comparisons, one might be able to argue that the fact that all levels appear biased high is indicative of some bias. However, I'm not sure that such an argument can be made without reference to the vertical resolution of SCIAMACHY due to possible correlations in the noise at different levels.

I would think the SCIAMACHY team would be very interested to have a 'bottom line' average (and standard deviation) of all the comparisons to date as a function of altitude (perhaps in broad latitude divisions). This would be a valuable addition to the paper, and might help explain the origin of this 50% number.

Technical comments

Abstract:

The statement 'all four existing stratospheric BrO profiling instruments' is misleading. For example, Aura MLS measures BrO profiles (though no publications have yet described this, to my knowledge). Other balloon borne profiling instruments may 'exist' but not yet have flown.

The 50% number discussed above is also mentioned here. Any changes to it need to be reflected in the abstract.

Page 13014:

Line 1, why have ... in Bry, why not list them all. I was surprised to see HBr omitted.

Line 11, what is 'organic Bry'? Would 'organic bromine compounds' be better?

Page 13105:

Line 3, why is 'this shortcoming only partially overcome'? Is it because it's a column measurement?

Page 13106: Line 10. It would be good to detail what reactions SLIMCAT used. Just citing the relevant compendium plus any additions/deletions/modified rates would suffice. Such detail is needed as a historical record. Differences in reaction schemes have been known to lead to significant differences in results in past studies.

Page 13028, line 12. What is meant by 'the BrO profile as inferred from matching SCIAMACHY observations'? Why not just say 'the matching BrO profile'.

Page 13036, line 20. Some brief statement of what was found in the comparisons not shown would be helpful. Did they agree with the others, were they different?

Figures: The fonts on the figures are far too small to be easily seen. They should be comparable to the size of the body text. Also rather than using thin horizontal lines to denote the 'altitude range for the match', I'd suggest shading the regions above and below in light grey to make it really clear which altitude range is relevant.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 13011, 2005.

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