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

M. Dorf et al.

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[]letter times amsmath

Author comment on review comment #3 for manuscript acpd-2005-0336

We are grateful to the referee's overall positive comments and suggestions. Please find below our point-to-point reactions in italic.

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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 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.
We tried to keep the text short and to emphasize the essential, and differences or changes compared to previous publications. We agree that the discussion is very detailed, but we wanted to explain in detail what was done in each case, on order to end up with the best possible validation profiles.

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 (O3, N2O 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!)

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You actually understood it right. We agree that the text was not organised very well. It was reorganized now (Page 13025, line 25 to Page 13026, line 19) and some changes were made.

Issue 2:
I am confused by the conclusion (page 13037, line 13) that 'Initial BrO profiles available from SCIAMACHY agree to <+/-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.

The text was changed: 'Initial BrO profiles available from the Harvard-Smithsonian SCIAMACHY retrieval agree on average to around 20% with the photochemically-corrected balloon observations (SAOZ and DOAS). An exception is the Triple profile, in which the balloon and satellite data mostly does not agree within the given errors. In general, the satellite measurements show systematically higher values below 25 km and a change in profile shape above about 25 km.'

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 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

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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.
The SCIAMACHY error bars represent precision, which is now also stated in the text.
The text was changed in the discussion and conclusion:
'For the SCIAMACHY retrievals presented here, it can be observed, that the Harvard-Smithsonian retrieval agrees within the given errors with the exception of the Triple comparison. However, the SCIAMACHY retrieval shows systematically higher values than expected from the photochemically-corrected balloon validation profiles and the model, for lower altitudes (below about 25 km). There is also an apparent change in the profile shape above about 25 km, which is especially obvious in the mixing ratio profiles. Here the SCIAMACHY values tend to decrease rapidly with increasing altitude and to be lower than predicted by the balloon measurements and the model. Disregarding the Triple comparsion, where there seems to be a systematic discrapency, the average agreement in the matching atlitude ranges, between the presented SCIAMACHY retrieval and the remote sensing balloon measurements (SAOZ and DOAS) above and below 25 km, is 20.5% *and* 19.8%*, respectively.'*
Due to low statistics we decided not include a quantitative comparison for different altitude regions.

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

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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.
Text in the abstract was changed.

Page 13014:
Line 1, why have ... in Bry, why not list them all. I was surprised to see HBr omitted.
HBr was added.

Page 13014:
Line 11, what is 'organic Bry'? Would 'organic bromine compounds' be better?
Text was changed.

Page 13015:
Line 3, why is 'this shortcoming only partially overcome'? Is it because it's a column measurement?
Yes. It is only a column measurement and does not allow to derive detailed profile information (as possible with balloons).

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.

The reactions are the same as in Chipperfield et al. 2005.

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'.
Text was changed to 'the matching SCIAMACHY BrO profile'

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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?
Since we do not show these comparisons, we leave the resposibility to the different groups, to make statements about the individual comparisons.

Figures: The fonts on the figures are far too small 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.
We disagree and think that the legends are readable. Information is also given in Table 1 and the text. Open circles are used now for SCIAMACHY data points at altitudes where no match is found.

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