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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Bromine in the tropical troposphere and stratosphere as derived from balloon-borne BrO observations" *by* M. Dorf et al.

Anonymous Referee #2

Received and published: 17 July 2008

Review of Dorf et al., Bromine in the tropical troposphere and stratosphere as derived from balloon-borne BrO observations

This paper presents the first tropospheric and stratospheric BrO profile for the tropics derived from balloon-borne DOAS measurements. The total stratospheric inorganic bromine Bry and the contribution from brominated VSLS and inorganic product gases to Bry are inferred using photochemical modelling and compared to previously published estimates. An important result is the absence of a significant amount of BrO in the troposphere, which challenges most previous findings. This study is a valuable contribution to the atmospheric bromine issue. Therefore I recommend the paper for publication in ACP after the following revisions:

General comment:

The paper is written in a very compact manner and there are several places where the reader would be more interested in further details (a few sentences could be enough) than simply references. In particular:

1/BrO DOAS retrieval and profile inversion (Page 13001, lines 17-18)

2/Photochemical calculations (Page 13001, lines 18-24): Which 1-D model is used ? Which photochemical data set is used ? JPL2006 ?

3/The whole-air-sampler BONBON (Page 13002, lines 2-6): The measured SGs should be listed here and not only on page 13004; What is the importance of the SG calibration scales since this could one explanation for the discrepancy between Bry-in and Bry-org (page 13004, line 24) ? Please, develop a bit more.

Specific comments:

Page 13002, lines 23-25: a negligible BrO content is found in the lower and middle troposphere. This is an important result since it challenges most previous estimates, except those from Schofield et al. (2004 and 2006). Therefore, I think it merits a full discussion here in Section 3 than only in the Conclusions and Summary. Possible reasons are given by the authors to explain these contrasting findings. Something which is puzzling me is the discrepancy between the Teresina tropospheric BrO profile (no BrO in the free troposphere) and the Kiruna summer 1998 profile (Fitzenberger et al., 2000; 2+/-0.8 ppt BrO at 5 km altitude). Did you investigate the impact of the reanalysis of the BrO-SCDs (see lines 14-16 on page 13005) on the Kiruna Summer 1998 and Winter 1999 tropospheric BrO profiles ? If not, I think this should be done since your reanalysis seems to give lower BrO concentration values (stratospheric Bry is 2ppt smaller with the reanalysis for the Kiruna Winter 1999 flight).

Page 13004, lines 2-10: Modelled BrO values during solar occultation (SZA larger than 90deg) are up to 15% larger than the measured ones. It would be interesting to test

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the impact of the uncertainties on the photolysis rates (BrO, BrONO2, HOBr) at such large SZAs. Maybe this could help to reconcile the model with the measurements.

Page 13004, lines 24-25: I think the authors should give more details on what is a calibration scale for the SGs and why this scale depends on the laboratory (see also the general comment). This could help the reader.

Page 13004, lines 26-28: The discrepancy between Bry-in and Bry-org could be attributed to a contribution of VSLS changing with time and location. A way to verify this possibility is to perform trajectory calculations in order to determine if the air masses probed by the balloons on 8 June and 17 June 2005 were above area with potentially different VSLS sources on the ground (e.g., the Atlantic Ocean). A contribution of VSLS changing with time (and location) is in contradiction with the assumption made to calculate the potential maximum PG injection (page 13005, lines 20-27). Could the authors clarify this ?

Technical corrections:

Page 13003, line 1: a blank is missing between 'BrO' and 'indicates'.

Page 13007, line 16: 'Boesch, H., ... ' instead of 'Boesch H, ...'.

Page 13007, line 17: 'Pepin, I., Pukite ...' instead of 'Pepin, I. Pukite ...'.

Page 13009, lines 6-11: The title of the Laube et al. reference is not correct. According to the ACPD web site, the right one is 'Contribution of very short-lived organic substances to stratospheric chlorine and bromine in the tropics : a case study'. The list of authors is also not correct: Dorf and Pfeilsticker should be removed and K. Grunow added.

Page 13009, line 24: 'Sturges, W. T': a dot is missing after the T.

Page 13010, line 13: 'tropospheric' instead of 'trophospheric'.

Page 13010, line 24: 'Wamsley, P. R., Elkins, J. W., Fahey, D. W., ...' instead of 'Wams-

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ley, P. R. and Elkins, J. W. and Fahey, D. W., ...'.

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Interactive Comment