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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Towards a climatology of stratospheric bromine monoxide from SCIAMACHY limb observations" *by* N. Sheode et al.

Anonymous Referee #1

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The present manuscript reports on a first attempt to provide a climatology of stratospheric bromine oxide (BrO) using data from the ENVISAT/SCIAMACHY sensor. In principle, such an approach is highly appreciated and valuable if it is well suited to support our present understanding of the stratospheric bromine photochemistry. In part the present study accomplishes this goal, while in other parts it fails, mostly because of a too optimistic assessment of the present methodological and instrumental and capabilities involved (as it is detailed below). In that respect, the paper needs to be carefully iterated before it is suitable for being published.

Major comments:

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Interactive Discussion
Discussion Paper

1. The authors start the paper with a sensitivity analysis on factors and corresponding errors impacting the inferred BrO concentrations. This approach is highly acknowledged. However when further inspecting the details of the study it becomes clear that, only the least problematic conditions were considered, i.e. BrO limb measurements in the tropics implying the smallest solar zenith angles (SZA), where multiple scattering, the curvature of the Earth, refraction et cetera play the least role. In that respect an extension of the sensitivity study to the SZA dependencies (within the range of SZAs used) of all considered factors is highly essential. Also, since the errors are likely to be a function of latitude and season, the error discussion of BrO Limb measurements needs to be concluded with latitude/altitude/season error panels (similar the panels shown in Figure 9). For the error discussion, it is also worthwhile to argue on the precision of the measurement (by Gaussian weighting of all possible error sources) to which the accuracy error(s) has (ve) to be added (c.f., by adding the BrO cross section error). Only if such an error discussion is included, the study will receive the appreciation it potentially deserves. 2. With respect to the comment (1) and the known difficulties of Limb observations under twilight or even (polar) night conditions, it is hard to accept the shown BrO data beyond ˜ 65o north and south for midwinter observations (shown upper left and lower right panel in Figure 9). So this data potentially need to be skipped. In addition, whether a boundary for the observation of ˜ 65o can be accepted, or if in fact it needs to be taken at a lower latitude can only be decided when the investigation suggested in (1) is completed, and a limit for an acceptable error is assumed (explicitly mentioned in the text) and used in the study further on. 3. Taken together points (1) and (2) and the fact that BrO retrievals of SCIAMACHY from competing research groups (c.f. Sioris et al., 2006) come to different conclusions concerning an estimate of total Bry inferred from SCIAMACHY BrO, you need to address potential causes for this discrepancy. 4. The authors hastily ascribe the observed latitudinal variation in BrO (in particular at mid-latitudes) due to the photochemical interaction of BrO with NO2 into BrONO2, while it is evident that the amount of stratospheric BrO is a function (a) release of bromine atoms from the precursor molecules (a process being presumably

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dominant in the tropics and at mid-latitudes), (b) (mostly vertical) transport (a process being presumably dominant in polar winter and spring), and (c) photochemistry (a process being presumably dominant at mid- and high latitudes). Since similar atmospheric processes are responsible for behaviour of NO2, and thus a radical/radical correlation (Figure 10) is in general insufficient to figure out which of the individual processes dominate where and in what season.

Specific minor comments:

A.) Section 2: change 'the main sinks of BrO is believed ĚĚ and reaction with NO2 (instead of NO), or you should qualify the altitude region for which your statement holds true ! B.) section 3.1.: Provide a SZA range and error estimate for the following statement 'In the spherical mode the SCIATRANĚ. C.) section 3.1: Provide information how you infer BrO in your Fraunhofer spectrum (taken at 33 km) and on the likely error of your estimate. D.) Section 3.1 Since your definition of y in equation (4) is different from usual, please provide additional an equation for your definition. E.) Section 3.1: Provide information of the SZA (or range of SZAs) and other atmospheric conditions for which you conducted the sensitivity study. F.) change all 'Reaction' (x, y or z) to reaction (x,y, and z) G.) change Dorf et al. (2005) to Dorf et al., (2006) throughout the text (Atmos. Chem. Phys., 6, 2483-2501, 2006) H.) section 4.1: Skip the '!' behind BrONO2 I.) section 4.2: I doubt that BrONO2 is 40 % of Bry in the upper stratosphere ($>$ 35 km) as stated at the end of the sentenceĚ J.) Provide a figure for the averaging kernels before Figure 1. K.) Figure 1 to 3: Provide information on the SZA and latitude of your simulation L.) Figure 8.) the different lines and symbols are barely visible. Please plot the data on larger panels our color-code them. M.) The same comment as made under L.) holds true for Figure 11.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 6431, 2006.