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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Stratospheric $BrONO_2$ observed by MIPAS" *by* M. Höpfner et al.

Anonymous Referee #1

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In this manuscript, Höpfner et al. present the first stratospheric observations of bromine nitrate by the MIPAS instrument on board the European Envisat satellite. Because previous knowledge on the stratospheric bromine chemistry and the total stratospheric bromine loading was based almost exclusively on observations of bromine monoxide, BrO, these new results provide very important additional information. The authors expect that similar procedures can be applied to retrieve BrONO2 from other IR experiments (e.g., ground-based) as well. If this would indeed be possible, this offers a number of great potentials for future research. The paper is in general well written and I recommend publication after consideration of a few, mostly minor, comments.

General comments

If one tries to infer the total stratospheric bromine loading from the observations of bromine nitrate, possible systematic errors need to be addressed carefully. In this

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respect I find the discussion about possible systematic uncertainties in the integrated band intensity of bromine nitrate (section 3.4.1) particularly helpful. If I understand this correctly, the authors argue that any systematic bias in the IR cross section will also apply to the UV/visible cross section of bromine nitrate. Maybe the authors can expand a bit upon this to show how this would affect the comparison with the photochemical model and the comparison with BrO observations from SCIAMACHY: I expect that the results of the photochemical model shown in Fig. 6 are insensitive to the absolute cross section, if the IR and UV cross sections of bromine nitrate are scaled with the same factor?

Specific comments

p. 19682, l. 11: Br2 is sometimes included in the list of inorganic bromine

p. 19682, l. 19: I suggest to move the sentence with the reported decline of stratospheric bromine upward, following the estimated range of total inorganic bromine (l.14), and before the discussion of the partitioning of BrONO2.

p. 19690, l. 5: Why is the error term due to "nlin" so much larger during day than during night? Is simply the concentration of BrONO2 too low? According to Fig. 5, "nlin" is the dominating error above 30 km during day time.

p. 19691, l. 13: Are the SCIAMACHY BrO measurements taken at the same (or at least similar) solar zenith angles as the bromine nitrate measurements? How critical is this?

p. 19691, l. 20: Heterogeneous reactions (in particular the reaction BrONO2 + H2O(aq) -> HOBr + HNO3) can take place not only on polar stratospheric clouds, but also on background sulfate aerosol. (E.g., Lary et al., Heterogeneous atmospheric bromine chemistry, JGR, 101, 1489-1504, 1996.) I don't know if it would be easy to estimate by how much the calculated bromine nitrate profile would be influenced by this reaction, but at least in principle this reaction could be the reason why the calculated

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Interactive Comment

BrONO2 is generally larger than the observed one in the 20 - 24km region.

p. 19691, l. 21: Modelled and measured BrONO2 profiles agree well within the uncertainty range, but I would not call this agreement "very close".

p. 19692, l. 15: Do you have any actual indications of whether or not a retrieval of BrONO2 would be possible from ground-based IR experiments as well, or is this just a general assertion at this stage?

Fig. 4, caption: please define the difference.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 19679, 2008.