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Comment

## ***Interactive comment on “Multi-year comparison of stratospheric BrO vertical profiles retrieved from SCIAMACHY limb and ground-based UV-visible measurements” by F. Hendrick et al.***

### **Anonymous Referee #1**

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The authors present a comparison of BrO profiles retrieved from SCIAMACHY limb observations and different ground based stations. The comparison is performed for three stations (Observatoire de Haute-Provence, Lauder, Harestua) and different time ranges (the longest one is for Harestua from September 2002 to October 2006). The paper is well organized and well written, also the figures are of good quality, and the subject of the article fits very good into the AMT journal. Moreover, it is to my knowledge the first article that compares SCIAMACHY BrO profiles to ground based retrievals for a set of stations at different latitudes on a long term scale. The article is therefore of large relevance for atmospheric sciences. However there are two important issues that need to be improved:

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a) The result of the comparison should be put into the context of current research, in particular the following questions should be addressed: How well do the retrieved profiles agree with those reported by i) Sinnhuber et al., 2005 and ii) Sioris et al., 2006 ? Also a short discussion regarding the Bry could be given, since this is of recent interest. However, such a discussion should of course be made only if the datasets allow such implications.

b) The comparisons should be performed with both retrievals (SCIAMACHY and ground based (GB)) applying the same cross sections for BrO. If this is not possible, then the retrieved profiles for one dataset need to be scaled with a factor that is given by the difference of the cross-sections. Without this scaling, the differences of the profiles that are given in the abstract and also the comparison plots themselves include an offset, and therefore are misleading or to be precise, incorrect. One possibility would be to add a study (and a figure) where the SCIAMACHY retrievals are performed with i) the usual setting and ii) with the Wilmouth et al. cross section for a number of selected matches. The difference in the retrievals (which should be on the order of 10-15 %) could then be applied to scale all the SCIAMACHY profiles. This will in fact also decrease the difference to the GB retrieval. For the revised version it is necessary that all numbers regarding the agreement of the comparison and also the plots of the profiles are give for the same cross sections, or a scaling is performed so that the retrievals can be compared without an arbitrary bias.

Specific points:

Abstract line 6 The comparison extends from Sep. 2002 to Oct. 2006 only for the Harestua station. For the other stations the time of comparison is shorter, in the case of OHP much shorter.

line 14 The large BrO column events should be due to bromine activation not due to chlorine activation.

Introduction line 21 please provide a short explanation (in brackets) of nadir and limb

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p453, line 16 The reference to Dorf et al., 2006 should be given here.

p454, line 27 The authors state that the parameters for the SCIAMACHY retrieval differ quite strongly from those applied for earlier publications. Considering the importance of the BrO profiles for atmospheric sciences (SCIAMACHY is still the only instrument providing global profiles), I suggest to discuss in how far the retrieved BrO profiles are different from those reported earlier. This point could be elaborated in a chapter "discussion", which I think should be added to the article (see below).

p455 line19 What is the spectral correction  $l_0$  ? Probably  $1/l_0$  is meant here.

p455 line20 The reference to Sioris et al., 2006 is fitting for the spectral correction "tilt", but the spectral corrections ring, eta, and  $1/l_0$  are not applied there. One possible reference could be Kühl et al., 2008 (JASR, 42, 1747-1764)

p455 line 22 The term global fit method should be explained.

p456 line 11 Since MIPAS does not measure BrO it should be explained here in how far the BrO climatology is based on these measurements.

p456 line 22 Concerning the settings for albedo, aerosols and clouds: Did you investigate how sensitive the different retrievals are to this assumption ? You are using the same settings for all retrievals, but discrepancies from this assumption should effect the GB and limb observations differently. I recommend to add a chapter "Sensitivity studies and discussion" where this point could be investigated in detail.

p459 line 6 To determine the FWHM of the AK from Figure 1 is a difficult task for the reader. I suggest adding a figure that displays the spread. This would also give additional information on the retrieval quality.

p462 line 4 As mentioned above this point should be corrected for in the plots and the numbers summarizing the agreement. Also, this bias is not additional. A scaling by the difference of the cross sections would decrease the differences to the GB profiles to approx. 0 to -5%. However, it should also be discussed whether such a perfect agree-

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ment is reasonable, considering the different observation geometries and retrieval approach. The best would be to run the GB and SCIA retrieval for simulated spectra with a known BrO profile. Together with sensitivity studies on the impact of clouds, albedo and aerosols this would increase the significance of the found agreement very much.

Technical points:

Chapter 6 and 7 are probably meant as 5.1 and 5.2

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