

Interactive comment on “Impact of using different ozone cross sections on ozone profile retrievals from Global Ozone Monitoring Experiment (GOME) ultraviolet measurements” by X. Liu et al.

Anonymous Referee #1

Received and published: 16 May 2007

This is an interesting study that shows the impact of using different ozone cross sections on the retrieved ozone profiles, using GOME UV measurements.

In my opinion it should be published. However I have a few comments or questions.

1) Page 973: I suggest adding a reference for the general description of the HITRAN database (Rothman et al. 2005)

2) Page 973: The study by Orphal was also published in J. Photochem. Photobiol. A 157, 2003, 185-209. I suggest including this reference since it is public access (and peer reviewed), in contrast to the ESA report, although the latter indeed contains more

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information.

3) Page 973: “measurements characteristics of the these CS” - remove the “the” please

4) Page 974: What was the climatology (a priori ozone and temperature profiles) used?

5) Page 974: What is the typical information content (independent pieces of information) in this problem? 24 layers with 4-6 tropospheric layers are very impressive, I suggest giving also an idea what the information content is.

6) Page 975: The convolution of cross sections was made using the variable slit widths derived in each retrieval. This is a crucial point for the paper and I do not understand why the discussion is so short here. (a) First, what did these slit widths look like and how do they vary over the orbits (and/or time for the comparisons with sondes)? The authors do have this information, so please provide it. How different are these widths for different cross sections, and how do they compare with slit functions determined otherwise? (b) Second, it looks like that the smaller fitting residuals of the BDM cross sections may be, at least in part, due to this methodology. It basically means that your algorithm works better for the BDM cross sections, but not that the BDM cross sections are better for ozone retrieval in general. This is in agreement with your observation that “these biases are significantly larger than those found by Orphal (2002)” (page 975). I agree that smaller fitting residuals mean in general a “better fit” and smaller biases mean in general “less systematic errors”. However the convolution of the cross sections with the slit widths derived from the retrievals is probably a highly non-linear procedure, so I am worried now about the soundness of the conclusions.

7) Page 976: The changes in residuals are small, i.e. 4-7 % relative to the fitting residuals. I suggest giving absolute numbers as well, e.g. “The fitting residuals decrease from 0.405 % to 0.401 %” so that one gets an idea how small these changes are.

8) Page 976: Why is the effect more important in the 326-337 nm window? Isn't it a clear indication of the problem mentioned in Question No. 6 above, i.e. that you

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assess how well you can convolute the cross-sections (with the slit widths derived from the retrieval) in order to minimize the fitting residuals?

9) Page 976: “Unsuccessful retrievals are due to mainly negative ozone values derived at some layers” (see also my Question No. 5 above): what is the uncertainty of the ozone retrievals? Errors bars are missing in all figures. I suggest adding error bars in ALL figures showing ozone profiles and columns.

10) Page 977: The differences shown in Figs. 4-5 and 7-8 are in DU and not in % as in the other figures and the main part of the text. I suggest adding the relative values at least in the text so that it is easier to see what the relative differences for the total (Figure 4) and tropospheric columns (Figure 5) are. Why is the impact of different cross sections smaller for tropospheric ozone columns (Figure 5)?

11) Page 979: I agree with the inclusion of the BDM cross sections in HITRAN. However, besides the restricted temperature range of the BDM cross sections, there is another problem with the wavelength coverage. The BP and BDM cross sections do not cover wavelengths above 345 nm but ozone needs to be included at longer wavelengths when retrieving BrO, OCIO, NO₂ and other species. So I do not understand at all why the HITRAN panel has not yet included ozone cross sections at longer wavelengths, e.g. the GOME or SCIAMACHY data which are used exactly because of this reason in the community. I would not support including only BDM cross sections and nothing else in HITRAN, since for many other applications, an accuracy of 0.1 % is not required.

12) Page 979: This study shows that for ozone profile retrieval from the UV data, there is need for ozone cross sections with very high accuracy (0.1 %) and wavelength resolution and precision. Is this a realistic project? Wouldn't the combination of different wavelength regions in the retrievals (inclusion of the Chappuis band, inclusion of IR ozone bands) reduce this drastic requirement which is probably difficult to achieve in the near future?

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In conclusion this is an interesting paper, but I think that some points need further clarification, as discussed above.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 971, 2007.

ACPD

7, S1815–S1818, 2007

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