

Interactive comment on “Differences in ozone retrieval in MIPAS channels A and AB: a spectroscopic issue” by Norbert Glatthor et al.

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We thank reviewer 1 for her/his helpful comments. Please find below our responses describing how the manuscript has been modified with respect to the comments. **Blue passages** denote the changes or updates in the revised manuscript.

Specific Comments

Comment: *“Pag.4, Section 3. The description of the errors in MIPAS spectroscopic databases should be moved before Sect.7.1, where differences between several spectroscopic databases are quantified, and hence the estimation of the errors on line*

Reply: Similar to the description of the MIPAS experiment and of the retrieval setup in Section 2, the error estimates for ozone lines in the MIPAS and HITRAN spectroscopic databases are a prerequisite for our investigations. Therefore we find it more appropriate to leave the description of these errors in Section 3 prior to the retrieval section. To address the reviewer's point, we will compare the spectroscopic errors with the VMR differences in Sections 4 and 7.1 by adding the sentences "This difference is larger than the relative error in line intensity given in Eqs. 1 and 2 for the strongest and medium scale ozone lines (at least for transitions with low to medium-sized rotational quanta JU and KU)." at page 4, line 26, and "Consequently, these differences are also larger than the relative errors in line intensity given in Eqs. 1 and 2." at page 7, line 15.

Interactive comment

Comment: "Pag. 5, line 17: what 'completely different forward models' means ?"

Reply: This phrase is maybe a bit incomprehensible, because the forward model KOPRA we use at IMK/IAA has not been introduced before. For this reason we will replace the first sentence of the second paragraph of Section 2 by "To reinvestigate the channel AB-A bias in retrieved ozone, retrievals using the the processor of the Institut für Meteorologie und Klimaforschung and the Instituto de Astrofísica de Andalucía (IMK/IAA) were performed for 59 MIPAS orbits from January 3, April 1, July 2 and October 2-3, 2009. This processor uses the Karlsruhe Optimized and Precise Radiative Algorithm (KOPRA) (Stiller, 2000) for radiative transfer calculations and the Retrieval Control Program (RCP) of IMK/IAA for inverse modelling of spectra. ". Further we will change the critisised phrase into "a different radiative transfer model". Because by these modifications the acronym KOPRA is already explained in Section 2, we will change the subsequent sentence (page 5, lines 19/20) into "This agreement widely excludes the hypothesis that the bias is caused by deficiencies in the KOPRA

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Comment: "Pag. 5, lines 9-14: I think that these sentences may be misleading in the paper. Indeed, Laeng et al., 2014 shows that from the comparison between MIPAS Ozone with ACE-FTS and MLS, MIPAS is larger than both of them. Since O3 retrieved from channel AB is larger than O3 retrieved from channel A, we can deduce that the use of only spectral intervals in band A may reduce the differences with respect to ACE-FTS and MLS. However, we have to consider that positive differences between MIPAS and ACE-FTS are probably not due, or at least not only due, to spectroscopic issues, since ACE-FTS performs measurements in the same spectral regions as MIPAS and for the O3 retrieval mainly spectral points in the region of MIPAS band AB are used (see http://www.ace.uwaterloo.ca/misc/ACE-SOC-0027-ACE-FTS_Spectroscopy-version_3.5_Jan222016_Rev1A.pdf). Furthermore, the tests reported in this paper do not indicate which of the two bands A and AB has smallest spectroscopic errors, but only that there are inconsistencies between the two bands. Finally, the change of used spectral intervals in order to reduce the bias with other correlative measurements, that do not represent the true, may not always be correct."

Reply: We do not quite understand the referee's arguments in this comment. First of all, Laeng et al. (2014, Fig. 5) indeed show that the MIPAS ozone VMRs are larger than those of MLS at nearly all altitudes, but there is no general positive bias with respect to ACE-FTS. MIPAS ozone VMRs are up to 3% larger than those of ACE-FTS below 30 km, but up to 2% lower between 30 and 45 km. Between 45 and 55 km MIPAS ozone is even more than 10% lower than ACE-FTS ozone. Secondly, ACE-FTS does not perform measurements (ozone retrievals) in the same spectral region as MIPAS. ACE-FTS uses the spectral region 1027–1059 cm^{-1} (see document cited above), but MIPAS (data version O3_V5R_224) the region 687–791 cm^{-1} . Only above 50 km two channel AB microwindows at 1029–1031 and 1038–1039 cm^{-1} are added.

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Thus, differences between ACE-FTS and MIPAS can well have spectroscopic causes. We agree with the referee's statement that "the tests reported in this paper do not indicate which of the two bands A and AB has smallest spectroscopic errors". Just as he/she concludes, we only want to show "that there are inconsistencies between the two bands." Further, the referee might be right by stating that "the change of used spectral intervals ... may not always be correct". But there is justification for such a change, if a similar bias to several correlative instruments can be reduced in doing so. With this we can at least provide an explanation of the discrepancies encountered.

Comment: *"MIPAS spectroscopic database pf 3.2 sometime is mentioned in the paper (e.g. Pag.9, line 4) as MIPAS spectroscopy, other times (e.g. Caption of Fig.5) as Mipas pf 3.0. Please use consistent terminology."*

Reply: We agree and will speak of MIPAS pf3.2 throughout the updated manuscript. We were a bit unprecise, because the ozone spectroscopy in MIPAS pf3.2 is the same as in MIPAS pf3.0.

Comment: *"Last sentence of the paper: 'as far as ozone is concerned we recommend to use version pf3.2 of the MIPAS spectroscopy and not the latest update pf4.45, because the ozone data set in this compilation is identical with HITRAN-2008.' A reference to the spectroscopic database pf4.45 should be added. The presence of 'inappropriate halfwidths' in HITRAN 2008 and following versions seems to involve only the 790- 850 cm-1 spectral region."*

Reply: We will add the reference "[Flaud, J.-M., Perrin, A., and Ridolfi, M.: New release of the MIPAS spectroscopic database: hitran_mipas_pf_v4.45, Presentation at MIPAS QWG 38, ESA-ESRIN, 18-19 February 2015.](#)" for the spectroscopic database pf4.45.

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Concerning inappropriate halfwidths in HITRAN-2008: We showed one example of an obviously unphysical step in halfwidths at 797.05 cm^{-1} in HITRAN-2008 and subsequent editions. However, we can not draw general conclusions about the spectral ranges of inappropriate halfwidths in the HITRAN data bases. This issue has to be left to spectroscopists.

Technical Corrections

The requested technical corrections will be performed. Fig. 4 will be interchanged with Fig. 3 to obtain a consecutive discussion of the figures. In figures with several plots each plot will be identified with a letter. Finally, “diff / ppmv” will be replaced by “diff / km” in Fig. 1.

References

Laeng, A., et al.: Validation of MIPAS IMK/IAA V5R_O3_224 ozone profiles, *Atmos. Meas. Tech.*, 7, 3971–3987, www.atmos-meas-tech.net/7/3971/2014/, 2014.

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