Atmos. Chem. Phys. Discuss., 7, S7282–S7285, 2007
www.atmos-chem-phys-discuss.net/7/S7282/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Ozone profile retrieval from limb scatter measurements in the HARTLEY bands: methodology, algorithm description, sensitivity studies, and validation" *by* G. J. Rohen et al.

G. J. Rohen et al.

Received and published: 26 November 2007

Response on the general comments of the reviewer: I agree with the reviewer in terms of the phrasing.. The article is now proof-read and hopefully better readable. I added a description of the TRUE algorithm for completeness and reorganized the text and make a proof-read, basically we made a major revision of the paper. The usage of the TRUE tangent height retrieval LUT instead of another is due to the fact that it is still not clear which tangent height retrieval is basically the best. Photochemical properties of mesospheric ozone is in fact a point which are now discussed in the validation section, as well as the possible connection to the overestimation of the SCIAMACHY ozone

concentrations at higher altitudes. In terms of the HALOE comparisons we modeled the diurnal tide of mesospheric ozone. It turned out that ozone is indeed quite variable, but this does not affect the SCIAMACHY scan within about 60 seconds. As Fig. 19 shows, the variation of ozone at 60 km altitude within about one hour between 9 and 10 o’clock in the morning (this is about the local overflight time) is about 5%, and 10 percent at about 70 km. In contrast to this, the tide of ozone at sunrise is extreme and can exceed 90% within half an hour or less. The induced error for the measurements which are taken for the retrieval due to this variability is negligible. We will address this later also in the specific comments in more details and made remarks about this issue in different sections of the article, especially in the introduction. We also provide now a table of the reference tangent heights.

Response on the specific comments of the reviewer: a) Backscatter is incorrect. I exchanged this expression by limb scatter. b) We mentioned that Flittner et al. introduced the triplet method. c) We made comments on that issue in the text. d) Since the measurement signal becomes fairly low (see e.g. the more noisy 230 nm radiance profile in Fig. 4), the radiances are integrated over to times of the FOV, this is 240 km. We made a remark about this in the text. e) The across-track resolution is also affected but to a much smaller extent because only the vertical movements worsens the resolution. f) I plotted the S/N for 60 km TH as modeled by an SCIAMACHY instrument simulator and made some descriptions. In general, the integration over a broader spatial and spectral range makes the signal better. This does not affect the shape of the limb radiance profiles and therefore the quality of the retrieval. I added this figure and made further comments on this issue in the methodology section. g) SCIAMACHY spectral resolution is 0.24 nm in channel 1, but radiances must be integrated to get a reliable measurement signal. The integration is done over 2 nm. I made a note to this in the text. h) 267.5 was also used at the SME retrievals and they made very good experience with this wavelengths although there is a neighbored NO-gamma emission. However, the fits (see Fig. 7) also look very good so we decided to take this wavelength also. I made a remark to this in the text. i) The references are not quoted in the text, but

ACPD

7, S7282–S7285, 2007

they are clearly marked in Fig. 7 and explicitly noted in the figures. I also made a table of those used reference heights. j) The pressure is considered in the sensitivity studies which may vary by about 5%. This may lead to errors in the results which have been surprisingly small, however. l) The fits at different wavelengths are of course not the same for all sample measurements. There hasn’t been done a statistics about the residuals. Wavelengths have been selected more empirically. Statistics are difficult because the number and selection of the underlying measurements are insufficient and are also only an estimate for the complete data set which exceeds the extent of the study. m) I added a paragraph about the usage and appropriateness of TRUE. Basically, TRUE is historically grown with the retrieval and the accuracy of other retrievals promised no much better results, at least at the time I wrote the paper. The change of the accuracy from up to 3 km to below 500 meters was a dramatically improvement for the retrieval. As far as I remember, other TH retrievals did result only partly better results than TRUE. Much better results will hopefully be obtained when the new ESA/DLR L1 processor produces data which are improved by a combination of several TH retrievals. At this moment, those data are only available in test states. I added a brief assessment of TRUE and remarks about the future TH retrievals. n) The ozone scale height is not directly obvious through the ozone profiles due to the logarithmic scale of the x-axis in Fig. 13. The scale height change may be too small for this. o) The error is caused by the fact that the vertical movement of the scan (of about 90 seconds) at large sza is such large, that an averaged sza introduces an error. Certainly you can model the sza, but then you must have also a better vertical resolution of the scan. However, this is more an averaging effect. p) I changed the caption. q) The 1-sigma std-dev is about 15%. Also, the bias increases up to 20 to 30% at 60 km which is within the estimated errors. I mentioned the only slight dependence on the latitude bands. r) Changed this in the conclusions.

Comments on the figures: Fig 1: I produced a new figure, the former one was factually not correct. Fig 2: I think this has no large impact on the results and of course, you are right, oxygen green line is at 557.7 which is also obvious in the figure. Fig 3: 92 km is

ACPD

7, S7282–S7285, 2007

the highest altitude of SCIAMCHY limb measurement (former 105 km until 2003). The emissions can be seen at first at highest altitudes. The reference is the SCIAMACHY irradiance, taken from about 250 km tangent height. We made remarks in the text. Fig. 5: The box should show an enlargement. I made a remark now in the caption. Fig. 7: The lower limit of the retrieval is most likely above 35 km and the reader is already informed due to the previous remarks in the text. However, since the retrieval consists of a fit from 20 to 80 km, the lower altitudes are also of interest. I made a remark in the caption that the fits are different for different measurements. Fig. 13: Indeed, as seen in this figure, the retrieval is only sensitive above 38 or 39 km altitude, I adjusted other statements in the article adequately.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 12097, 2007.