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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.

Anonymous Referee #1

Received and published: 2 October 2007

Review of Paper # MS-NR: acpd-2007-0283, Version: 1 Title: Ozone profile retrieval from SCIAMACHY limb scatter measurements in the Hartley bands: methodology, algorithm description, sensitivity studies, and validation Author(s): G. Rohen, C. von Savigny, J. Kaiser, E. Llewellyn, L. Froidevaux, M. Lopez-Puertas, T. Steck, M. Palm, H. Winkler, and J. Burrows

GENERAL COMMENT: The paper is very badly written. It needs to be extensively edited and corrected by a person who is fluent in English. The technical content is fairly good, with some flaws and omissions as discussed below. There are two important

points I want to make, both of them having to do with your main conclusion regarding the main sources of error: (1) Tangent Height Registration: you need to describe TRUE and how you use it. You need to tell the reader why you use that method, instead of another which may be more accurate (see below) (2) Have a paragraph to state the problem that you are facing with trying to retrieve high altitude ozone: At high altitudes, ozone density is photochemically active, and its density therefore varies with local time , which is in contrast with lower altitude ozone density

SPECIFIC COMMENTS (1) 1) Does the paper address relevant scientific questions within the scope of ACP? YES 2) Does the paper present novel concepts, ideas, tools, or data? YES 3) Are substantial conclusions reached? YES 4) Are the scientific methods and assumptions valid and clearly outlined? YES 5) Are the results sufficient to support the interpretations and conclusions? NOT QUITE 6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? NO 7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? YES 8) Does the title clearly reflect the contents of the paper? YES 9) Does the abstract provide a concise and complete summary? YES. However, the author needs to tone down issue that “this constitutes the highest possible ozone profile using limb scatter”, since his own validation analysis shows that his retrieval above 50-55km is very poor. 10) Is the overall presentation well structured and clear? NO 11) Is the language fluent and precise? ABSOLUTELY NOT 12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES 13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? YES (see below) 14) Are the number and quality of references appropriate? YES 15) Is the amount and quality of supplementary material appropriate? N/A

SPECIFIC COMMENTS (2) (a)The author is always using the term “backscatter”, when in fact he is dealing with limb scatter. “Backscatter” refers to light scattered backwards, ie. at 180 degrees (like a Lidar) (b)Line 21of page

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12098: the “so called visible triplet” is not used in the Hartley bands. Instead, in these and Huggins bands, it is suggested to use doublets, so as to increase the contrast (compare highly absorbing lines to very weakly ones), and reduce sensitivity of method to aerosol, albedo…. (c)Line 5 of page 12099: straylight is mentioned in the list of potential error sources even though in the text it is found not to be an issue (d) Line 25: the FOV is listed as 110x2.6 km. So why is the resolution = 240km at best? (e) The explanation on along track resolution is not clear either (effect of sphericity goes both ways) (f)The reader needs info on SNR for SCIA. Show a plot of SNR for 13 wavelengths vs altitudes from 30 to 70km. SNR becomes an issue later on, and the reader cannot appreciate the quality of the results without a description of SNR. Also, show why you need to use the whole 960km cross track, instead of the FOV 110km, probably because of low SNR (g)Line 8 of page 12100: Is SCIA resolution 0.2nm or 2nm? (h)Line 22 of page 12101: the 267.5 nm wavelength appears to be sitting on an emission line. Why did you select that wavelength? (i)Line 6 of page 12102: The reference height value is never quoted in the paper. Why? It would be difficult to try reproducing results without knowing what reference height the author is using. May need to compile these values vs wavelengths in a table (j)Line 18 of page 12103: I am amazed that the author does not need more accurate info on the background density. The monthly average climatology seems to be completely inadequate. A combination of NCEP/ECMWF tied to climatology for up high may be a better choice. Or using a purely Rayleigh channel (350-357nm) to infer neutral density… (k)Line 6 of page 12104: 30 km seems to be too low for these highly absorbing Hartley bands…. (l)Line 8: Important point. The residuals you are showing on Fig 7 actually shows the inability of the model to reproduce the measured data, either because of instrument artifacts or unaccounted for atmospheric signal. What we need to know is: are these residual maps consistent across all measurements. For example, you are showing that the 250nm is off 5%, the 254nm is off -5%, each wavelength having a TH range between 30 and 60-70km. If this result is consistent across all measurements, I would recommend removing the 250nm, 254 nm

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channels, and limiting the TH range to TH at which the residual is less than a few percent. (m)Line 19 of page 12104: You rely on the TRUE method for Tangent Height (HT) registration , and you state that your main error appears to be due to HT. It seems to me that you could describe how you are using this TRUE method in this work for the reader to appreciate the problem. Have you tried other HT method, which have been shown to be better than TRUE (Taha, 3rd Limb Workshop, Montreal). (n)Line 22: What do you mean with “increasing scale height”? If I look at your own figure 13, the ozone scale height seems to be fairly constant up to 65 km. (o)The “error” on zenith angle: you should be able to model this, since you know the geometry exactly. This should not be an “error”, only a bias that you have not evaluated (p)Line 11 of page 12107: Figure 12 does not refer to ground albedo, but aerosol (q)Line 10 of page 12110: I am not sure what you see wrt latitudes. I see that the 1 sigma is large. I see that the bias is “small” at TH $<$ 50-55km and “high” above (r)The conclusion should state that the Hartley based method described herein will be used (for 40$<$TH$<$55km) in conjunction with a Huggins based method (for 30$<$TH$<$45km) and a Chappuis method (18-35km)

COMMENTS ON THE FIGURES Fig.1. Need clarification. Show/identify the descending part (middle section) and the ascending part (the edges). Fig.2. Why is the figure shown for a 0.1nm resolution when SCIA has a resolution of 0.2nm? Also, atomic O green line at 577.7, or is it 557.7nm? Fig.3 Why using a TH of 92km? Is that your reference height? The last line in the caption is referring to what? Fig. 5: What is the box in the middle? What are the diagonal lines? Fig.7 : See above Fig.11 and 12: do not show below TH = 30-35km… Fig. 13: to show the effect of a priori info on retrieved products, you have to show the averaging kernel matrix, at least, the diagonal values vs HT. Already, your figure 13 shows that your retrieval is good only between TH$>$40km and TH$<$65km Fig. 16: Your horizontal scale should be changed. We are interested in retrievals in the range of -20% to 20%. Also, all figures should be on the same vertical scale (which should extend only from 40 to 65km, due to limitation of averaging kernel [see discussion for Fig.13]). Also, you need to plot the retrieval 1 sigma

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for comparison. Fig.17: In view of large 1 sigma values, I do not see much change between 3 figures: Good from 40 to 52 km, bad above. Please, do not show results below 40km (bad averaging kernels–>you are reproducing a priori) and above 65 km (same reason) Fig. 18: same remarks TECHNICAL CORRECTIONS English is very bad and errors are too numerous to list here. Please, have this paper edited by one of the English co-authors listed above

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