

Interactive comment on “Improved ozone profile retrievals from GOME data with degradation correction in reflectance” by X. Liu et al.

Anonymous Referee #3

Received and published: 22 December 2006

This paper presents a novel technique to correct for the degradation in the reflectance data of GOME. Degradation is a major problem for ozone profile retrieval from UV nadir spectral measurements, and hence this work is relevant, especially now that the GOME-2 series has started with the launch of Metop. The technique is computational-wise simple, and does not require radiative transfer calculations, which makes it attractive for implementation in other retrieval schemes.

GENERAL COMMENTS: Although the paper is already quite complete in the presentation of the new technique itself, I believe the paper would benefit from a better introduction in which the purpose and potential usage of GOME ozone profiles is outlined. This introduction should then lead to requirements for the accuracy of the retrievals which are then tested after applying the degradation correction. The authors show that their

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

Interactive
Comment

new degradation correction has an impact on the retrieval but do not show substantial proof of improvements in the retrieval of global 3D ozone fields. Perhaps not the full validation exercise is required here but their thoughts and requirements should at least be outlined in the conclusions. As in the ‘Short Comment’ of Mark Weber, there is currently not enough focus on the profile quality and the checks performed show total column assessments which is not the main goal of this retrieval scheme. Validation including lidar data would be appropriate, especially as the degradation generally affects the shortest wavelengths (van der A, et al., 2002) and hence the upper stratosphere, where sondes can’t reach. Lidar data can be obtained from <ftp://ftp.cpc.ncep.noaa.gov/ndacc/ndsc/> (see also www.ndacc.org, and add their standard acknowledgement).

I have examined the validation results presented in Figure 3 and 5 (page 8296 and 8298) with those recently published by Meijer et al. (2006). The degradation results seem to remove the observed biases in the comparisons presented by Meijer et al. (2006), or at least move in the desired direction (see Figure 6b for OHP, same latitude as Hohehnpeissenberg). However, the results of Meijer et al. are based on a period (1997-1999) for which it was concluded that the degradation didn’t yet have an effect. Can you comment on this?

I am not a native speaker of English, but I believe it would be better to rephrase some of the sentences that start with a verb, i.e., ‘To show..’ and ‘To apply..’. In addition there are quite some instances in which it is better to place the adverb before the verb (except for conjugations of ‘to be’), see e.g., page 8287 line 6 ‘differs substantially’ and page 8287 line 20 and 27.

The authors should explain how they have dealt with the change in channel 1a/1b border when taking the ratio of the reflectance from measurements before and after this change.

It would be good if it is possible to distinct the presented degradation correction scheme from the correction already taken into account by the radiometric calibration in their

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

retrieval algorithm (see end of page 8290). This is important for showing the wider use of this technique and its effect, i.e., in other retrieval schemes. Although the authors mention that this calibration has specifically an effect on the tropical regions, they didn't use this in their Response to the Short Comment of Mark Weber (see ACPD, S3737, 2006) on why they select the 60S-60N range instead of the 15S-15N.

Although most of my comments (also the ones outlined below) might not require major extra analyses or major textual revisions, I consider them important for the paper to be accepted for final publication in ACP. Therefore I recommend that the discussion paper should be accepted after major revisions.

Meijer, Y. J., et al., Evaluation of Global Ozone Monitoring Experiment (GOME) ozone profiles from nine different algorithms, *J. Geophys. Res.*, 111, D21306, doi:10.1029/2005JD006778., 2006.

van der A, R. J., van Oss, R. F., Piters, A. J. M., Fortuin, J. P. F., Meijer, Y. J., and Kelder, H. M.: Ozone profile retrieval from recalibrated GOME data, *J. Geophys. Res.*, 107(D15), 4239, doi:10.1029/2001JD000696, 2002.

Answers to standard ACP requirements: 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, the technique significantly changes the retrieval, but some clarifications to address the origin are required (calibration vs degradation). 4. Are the scientific methods and assumptions valid and clearly outlined? Yes, but some clarifications and justifications are required. 5. Are the results sufficient to support the interpretations and conclusions? No, this can be improved or should be indicated as future studies. The validation is currently only performed for one location for profiles up to 30 km altitude, the total column and the tropospheric column, which is insufficient to draw conclusions for global ozone fields. 6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? Yes, but some

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)

clarifications are required. 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, but some clarifications are required. 10. Is the overall presentation well structured and clear? The presentation of the technique itself is well structured, but the scope of the paper should be better structured indicating the requirements of their technique and usage of the ozone profiles. 11. Is the language fluent and precise? Yes, but some suggestions for improvements are provided. 12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? N/A 13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? Yes, but only clarifications are required and no reductions or eliminations. 14. Are the number and quality of references appropriate? Yes, but I assume that with the required clarifications some additional references will be included. 15. Is the amount and quality of supplementary material appropriate? Yes.

SPECIFIC COMMENTS: Page 8286, line 4, it would be good to add a year (in brackets) after 'beginning of GOME observations'. Page 8286, line 5-6, I believe it is confusing to use the wording 'positive degradation' without further explanation. Page 8286, line 13, the adverb 'generally' significantly weakens your abstract. Page 8286, line 13-15, it should be noted here that the retrieval improvement was observed in comparisons with one station. What is meant with 'consistency'? Page 8286, line 22, please add the upper limit as well (mention stratosphere or 50-km), because quite some satellite observations nowadays reach into the mesosphere. Page 8286, line 26, is it sure that the layer consists of ice? Page 8287, line 25 and 28, as mentioned in the general comments, the use of the verb and word 'proceed' and 'consistent', respectively, seem to indicate a certain goal or retrieval requirement which has not been specified. The paper would benefit from some specific additional comments. Page 8288, line 22-23, how much do your results depend on these settings, i.e., the chosen period and the length of the running mean? I am a bit confused whether the overall ratio is compared to July 1995 or the normalization period July-December 1995. If it is the second

then this period should be consistently used throughout the paper. Page 8289, line 13-14, this sentence is confusing and I don't understand the date March 1996. Page 8290, line 1-2, this is a very important drawback and should perhaps also appear in the abstract as a limitation or further investigated. Page 8290, line 16, add 'near the Hohenpeissenberg station' after 'selected months'. Page 8290, line 19-20, in the ranges mentioned here it is not clear whether you indicate the range of the average values or the individual biases. In either case the supplied ranges do not reflect the values presented in Figure 4. Page 8291, line 5, the use of 600 km is inconsistent with the use of longitude. Change to either something with degrees or East-West, respectively. Page 8291, line 6-7, the applied method for integrating to the GOME grid and use of the averaging kernels (AKs) should be clarified as this can introduce significant differences, especially pre-smoothing and the use of the profile above the burst altitude when convoluting with AKs. In addition, how is the TO and TCO calculated for the correlative data? For the TCO, I would advocate the use of integrated columns based on the high-resolution sonde data avoiding the effect of AKs that information of higher layers is attributed into the troposphere (see Meijer et al, 2006). I also agree with the Short Comment of Mark Weber that the use of LIDAR data would be appropriate. Page 8291, end of section 3 (starting at line 8), I believe a short table would be appropriate in order to distinguish between all the different periods and values. It should also be noted that the overall TO bias, as printed in Figure 6a, has become worse using the correction (1.8 vs 2.4 DU). The selection of certain time periods appears somewhat random but is probably related to the moment of maximum degradation and the period afterwards. This should be mentioned. Page 8291, line 25, change to '..average calibrated reflectance..' Page 8291, line 2, change to '..can be also applied..' Page 8291, line 9, what about the comparison with the results of van der A et al. (2002). Furthermore, as degradation is considered a major problem for ozone profile retrieval and a dedicated study has been performed in the CHEOPS project, as mentioned in the Response to the Short Comment (ACPD, S3736-S3740, 2006). I think it would be good to extend the discussion here a bit further and compare the results. Page 8294, can you

S5650

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

comment on the seasonal variation observed in some of the wavelengths in Figure 1b and on the gap around 312-314 nm (very important range for ozone profile retrieval) in Figure 1b? In the caption, line 1, add 'additionally' after 'positions and', and moreover the SZA (or $\cos(\text{SZA})$) should perhaps be mentioned as secondary axes label in Figure 1a (even if it is also without units). In the caption in line 4 and 5, please add 'selected' after 'for different'. Page 8296, please specify that the presented comparison of for coincidences around the Hohenepeissenberg station. Page 8298, the range 0-10N is missing in this Figure. Page 8300, please add 'convoluted' before 'ozonesonde'.

Meijer, Y. J., et al., Evaluation of Global Ozone Monitoring Experiment (GOME) ozone profiles from nine different algorithms, *J. Geophys. Res.*, 111, D21306, doi:10.1029/2005JD006778., 2006.

TECHNICAL CORRECTIONS: Page 8286, line 7, change to 'and viewing zenith angle'. Page 8286, line 25, change 'damage' to 'damaging' Page 8287, line 1-2, 'Although' should be removed and perhaps after the comma you could use something like 'but then it is assumed' Page 8287, line 4-5, sentence should be rephrased and use of 'however' should be reconsidered. Page 8288 line 6, the comma before 'here' is by mistake in subscript. Page 8288, line 14, (and more instances), it would be better to add 'line' after 'purple' and similar instance throughout the paper. Page 8288, line 15, put 'at 331 nm' directly after 'an example', because I initially thought there would be one example ratio as of two dates. Adding the word 'starting' after 'nadir pixel' and 'only' before 'using', in line 16, would furthermore clarify this. Page 8288, line 17, change 'break' to something like 'failure'. Page 8289, line 21, change 'largely' to 'significantly'. Page 8291, line 2, please change 'features' to 'corrections'.

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 6, 8285, 2006.

[Full Screen / Esc](#)[Printer-friendly Version](#)[Interactive Discussion](#)[Discussion Paper](#)