

Interactive comment on “Retrieval and validation of ozone columns derived from measurements of SCIAMACHY on Envisat” by H. J. Eskes et al.

Anonymous Referee #1

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General comments

This paper describes a new ozone column retrieval algorithm and its application to the SCIAMACHY instrument onboard the ESA platform ENVISAT. The so-called TOSOMI algorithm is an adaptation of the total column ozone algorithm developed for the OMI spectrometer. It includes several improvements in comparison with the algorithm currently used in the ESA operational SCIAMACHY processor. The resulting data product is validated by means of comparisons with ground-based Dobson and Brewer measurements, as well as comparisons with GOME retrievals obtained from similar and different evaluation schemes. In addition, data assimilation is also used as an original diagnostic tool to investigate the dependence of the retrieved values with several

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important parameters, such as solar and viewing angles, cloud fraction, geographical location, etc. It is demonstrated that the accuracy of the TOSOMI retrievals is similar to the one of the most recent TOMS and GOME total ozone products. Such results are undoubtedly of great value for the scientific community since they demonstrate the ability of the SCIAMACHY instrument to complete the existing long-term high quality total ozone record available from the TOMS and GOME instruments.

As a whole the paper is very clear, well structured and (to my appreciation) written in good English. The text is concise in all parts and adequate credit is given to the existing literature. The figures are adequate in number, clearly drawn and properly commented. Therefore I definitely recommend the publication of manuscript 5-4429 in ACP, after attention to the minor remarks listed below, and appropriate revision of the text.

Specific comments

Page 4437, line 13: according to my knowledge the TOMS surface reflectivity is given at 380 nm, while TOSOMI retrievals are performed in the 325-335 nm wavelength region. Please comment on the possible impact of the wavelength dependency of the reflectivity on the retrievals.

Page 4450, lines 1-5: the given explanation for the scan angle dependency of the results is qualitatively convincing, although one would appreciate a more quantitative explanation. E.g. how large is the read-out time delay in comparison with the integration time? Is the resulting error on the viewing angle value consistent with the reported problem? Also it would be useful to know how the TOSOMI algorithm takes into account the geometrical extension of the SCIAMACHY pixels (this could e.g. be addressed briefly in the AMF section).

Page 4446, line 2: the unavailability of daily sun reference spectra is likely to be the source of the problem reported with GDP-4. One plausible reason that would explain the larger sensitivity of GDP-4 to this level-1 related problem is the fact that, unlike

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TOGOMI, GDP-4 retrieves both slant column and effective temperature information from the GOME spectra - hence the GDP-4 algorithm might be more sensitive to time-dependent changes in the spectral response of the instrument that may show up in the absence of a daily sun measurement. Please complete the relevant sentence as follows: “Ė this effect is due to the unavailability of daily solar reference spectra in the GOME level-1 product after 23 May 2003, which might affect the accuracy of the slant column retrieval step in GDP-4.”

Page 4450, lines 14-19: it is striking to note in Fig. 16 (which shows the dependency of the retrieval error on the cloud fraction) that the errors seem to be largest for intermediate values of the cloud fraction. Was this behaviour to be expected? Is this suggesting a possible limitation due to the cloud correction scheme used or possibly to the cloud product itself?

Page 4451, lines 24-25: the fact that the RMS differences with ground-based data is larger than found in the GOME comparisons is not mentioned nor discussed earlier in section 3. Is there any explanation for this behaviour?

Page 4452, line 5: the choice of an ozone profile shape is not relevant for ground-based Dobson or Brewer measurements, since these instruments are looking at the direct-sun so the geometrical enhancement factor is basically independent of the ozone profile shape. For zenith-sky observations, the retrieval is based on LUTs that are constructed empirically.

Page 4431, line 13: concerning GDP-4, please add the following reference:

Van Roozendaal, M., D. Loyola, R. Spurr, D. Balis, J-C. Lambert, Y. Livschitz, P. Valks, T. Ruppert, P. Kenter, C. Fayt, and C. Zehner, Reprocessing the 10-year GOME/ERS-2 total ozone record for trend analysis: the new GOME Data Processor Version 4.0. Paper 1: Algorithm Description, submitted to J. Geophys. Res., 2005.

Page 4444, line 25: similarly add the following reference, after Lambert and Balis,

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2004:

Balis, D., J-C. Lambert, M. van Roozendael, D. Loyola, R. Spurr, Y. Livschitz, P. Valks, P. Gerard, J. Granville, and C. Zehner, Reprocessing the 10-year GOME/ERS-2 total ozone record for trend analysis: the new GOME Data Processor Version 4.0. Paper 2: Product Validation, submitted to J. Geophys. Res., 2005.

Page 4431, line 18: the reference to Coldewey-Egbers et al. is dated 2005 in the reference list, not 2004. Change this throughout in the paper.

Page 4435, line 24: typo: change “On it’s path” by “On its path”

Page 4452-4454: I could not find any trace of the following two references in the core of the text: (1) Eskes and Dethof, 2004; (2) Weber et al., 2004. Please check.

Page 4469, Fig. 10, there is a typo in the last word of the caption : “columns” instead of “coluns”

Page 4471, Fig. 12: it would be nice to add a third plot to this figure, showing the resulting SZA-dependence after correction of the LUT to account for earth curvature at high SZA.

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