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Interactive comment on "Validation of SCIAMACHY top-of-atmosphere reflectance for aerosol remote sensing using MERIS L1 data" *by* W. von Hoyningen-Huene et al.

W. von Hoyningen-Huene et al.

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Answer to Anonymous Referee No. 1

Reply on GENERAL COMMENT

The manuscript was submitted in April 2004. Unfortunately, it disappeared during the review process for a long time as also the paper of Kokhanovsky et al. 2006. Therefore the paper reflects mainly the status of 2004. Thus papers of Tilstra et al.. 2004 and 2005 have been published after them. This is the reason, why some newer references are not included in the

introduction part. Therefore we understand the disappointment of Referee No. 1. Also we have been very unhappy on this delay.

A SCIAMACHY AOT product suffers until now under an insufficient radiometric calibration. This is valid for L1 data of several processor versions, such as version 4.02b, 5.01 or 5.04. First with the release of processor version 6.0 (planned for this year), the new radiometric key data by S. Noël (2004). will be applied.Then the complete spectral range of SCIAMACHY can be accessed and then empirical radiometric correction factors as given by this and the papers of Acarreta et al., 2004, 2005 will hopefully not more required.

For AOT retrievals only clear sky conditions can be used. This is the range of low top-of-atmosphere reflectance, which is considered by our contribution. Cloud retrievals use the range of high reflectance. This is considered by Kokhanovsky et al. 2006 (reference as footnote, still 2004) and not by our contribution.

Reply on MAIN COMMENTS

1. Relevant literature is not well referenced.

   For an update for ACP we plan to include newer references, like Acarreta et al. (2004, 2005), Tilstra et al. (2005), Lichtenberg et al. (2005), Skupin et al. (2004) and others.

2. SCIAMACHY data version that is used is outdated.

   For processor versions 4.02b and also 5.01 (e.g. for all processor versions smaller 6.0) the radiometric calibration requires corrections. The radiometric key data for these processor versions are the same. Repeating the investigations with newer data (with processor version 5) would come the same result. The main improvement from 4.02b to 5.01 was in polarization correction. Only the use of new radiometric key data (test processings of G. Lichtenberg, SRON) considered an improved radiometric calibration. Polarization effects are mainly disturbing in UV.

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3. If there will be an update of the paper for ACP, we plan to include the results of Tilstra et al.

   Sticking on this by the reviewer, we found a disagreement between our table 2 and figure 4. Fig. 4 has to be updated. Then the disagreements with Acarreta and Stammes, 2005, mentioned by the Anonymous Referee No. 1 are much reduced.

   Unfortunately I connot include an updated fig. 4.

4. Why constant factors are used for a band ?

   Although the investigations give for the different spectral regions, selected for the retrival of AOT slightly different factors for one SCIAMACHY band, we used only the average factor. The variations are within the error estimates of item 7.

5. cos(z) is used in RT theory.

   Since for summer time the use of 1/cos z and M(z) is exactly the same, there is no disagreement to write also 1/cos z instead of M(z). However, if one uses data of winter time with large solar zenith angles z, atmospheric curvature has a relevant impact, which is not covered by 1/cos z. The use of a plane parallel atmosphere for such conditions introduces significant deviations to experimental data. Therefore we use in all retrieval M(z) instead of 1/cos z.

6. Which new radiometric key data should be used.

   In 2004 the opinion was, the NASA sphere measurements give better radiometric key data. Now, for test retrievals with reprocessed SCIAMACHY L1 data to retrieve AOT we used the SPECTRALON calibration by recommendation of G. Lichtenberg. For an update of the paper for ACP we will mention this and make the reference. A compilation of the correction factors and considering the SPECTRALON data, changes figure 5 to the new version. This will include the correction factors, published by Acarreta et al. 2005.

7. Error estimate for correction factors are given in table 2.

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The errors are 0.02 for band 3, 0.03 for band 4 and 0.02 for band 5. In the case of an update for ACP these values will be included in table 2.

8. see item 3.

The check of English and the minor comments will be considered in an update for ACP.

The missing number of the colors scale in Fig. 7. It is the same like that of the corresponding MERIS scene. It will be visible in a reprocessed figure 7.

The main conclusion of this consideration is, that in VIS the SCIAMACHY radiometric calibration can be improved by the new radiometric key data. There the deviations in the correction factors are within $\pm$ 1 %. In NIR (in band 5) a significant deviation between new radiometric key data and the correction factors, derived from reflectance inter-comparisons, remains. The discrepancy reaches more than 10 %. This is found by all investigations.

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