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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.

Anonymous Referee #1

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GENERAL COMMENT

The topic of the paper is certainly relevant to ACP, since the paper's aim is to investigate the potential of SCIAMACHY for aerosol remote sensing. MERIS is a good instrument to perform a comparison (or validation) of reflectances and aerosol products with, since MERIS has exact colocation with SCIAMACHY and thus offers the potential for a large statistical comparison.

However, the paper is disappointing in various respects. First, the SCIAMACHY data and literature references are not up to date. Secondly, the dataset used for the

SCIAMACHY-MERIS comparison is very small, and is limited to low radiances. This could give a bias in the SCIA/MERIS reflectance ratios, because of nonlinear effects in the performance of MERIS and/or SCIAMACHY. In fact, for a reflectance intercomparison it is much better to have a range of bright and dark scenes than to focus on dark scenes as is done in this paper. The resulting AOT results for SCIAMACHY are strongly dependent on the quality of the reflectance calibration, so it is still premature to conclude much about these aerosol products.

MAIN COMMENTS:

1. The relevant literature is not well referenced. In Sect. 1, p. 675, when introducing the comparison between SCIAMACHY and MERIS reflectances, relevant earlier work should be referenced. This is primarily:

J.R. Acarreta and P. Stammes, 2005, “Calibration comparison between SCIAMACHY and MERIS on board ENVISAT”, IEEE Geoscience and Remote Sensing Letters (GRSL), Vol. 2, No. 1, pp. 31-35, doi: 10.1109/LGRS.2004.838348.

and

J.R. Acarreta, P. Stammes, and L.G. Tilstra, "Reflectance comparison between SCIAMACHY and MERIS", In: Envisat Validation Workshop Proceedings (ACVE-2), ESA Special Publication SP-562, May 3-7, 2004, Frascati, Italy.

In these papers the calibration error of SCIAMACHY in the visible-nearIR is discussed. The reference to De Graaf and Stammes (Envisat Validation Proceedings, 2003) on pp. 675, 678, 684, is not relevant, because it is about the calibration of SCIAMACHY in the UV, relevant for the AAI. This proceedings paper is superseded by: M. de Graaf and P. Stammes, SCIAMACHY Absorbing Aerosol Index - calibration issues and global results from 2002 - 2004, Atmos. Chem. Phys., SRef-ID: 1680-7324/acp/2005-5-2385, 2005. http://www.copernicus.org/EGU/acp/acp/5/2385/acp-5-2385.htm

2. The SCIAMACHY data version that is used is outdated. On p. 675, l. 4, it is said that

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version 4.02b is used in this paper. This version is outdated. The current (2005) operational L1 processor version of SCIAMACHY is version 5. Especially the polarization correction was not good in version 4.02b (see L. G. Tilstra, P. Stammes, "Alternative polarisation retrieval for SCIAMACHY in the ultraviolet", Atmos. Chem. Phys., 5, 2099-2107, 2005). The study should be repeated for version 5 data of SCIAMACHY, or an analysis of the impact of the processor update should be made.

3. In Sect. 2, the presented results of the SCIAMACHY-MERIS reflectance comparison should be quantitatively compared to the results of Acarreta et al., by including them in Table 2 and/or Figure 5. The ratio MERIS/SCIAMACHY reflectance from Acarreta et al. (2004, 2005) is shown in the following Table:

Table. Mean values and 1sigma error for the ratio between MERIS and SCIAMACHY reflectances, for two SCIAMACHY orbits. The first column shows the wavelength in nm (between parenthesis is the corresponding MERIS channel).

Wavelength (channel)	Mean	Std. Deviation
442 nm (2)	1.13	0.04
510 nm (4)	1.13	0.04
665 nm (7)	1.15	0.02
708 nm (9)	1.18	0.02
885 nm (14)	1.21	0.03

It appears that the conclusion on p. 684, l. 22 ff. that the "correction factors are consistent with findings ... of Acarreta and Stammes (2005)" is not true for spectral channel 4 of SCIAMACHY.Please correct this conclusion.

4. p. 677, l. 21 ff; p. 678, l. 7-8: Why is it assumed that the correction factors are constant over a spectral channel of SCIAMACHY? Since the cause of the calibration error of SCIAMACHY is probably a wrong characterisation of the external illumination con-

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ditions during the preflight calibration, there is no reason to assume that the calibration error is constant over the (wide) spectral channels of SCIAMACHY.

5. p. 675, Eq.(1), and p. 676, l. 6: It is very unusual in RT theory to define the reflectance using an airmass factor. If an airmass factor is used in the definition of reflectance, e.g. the formula of Kasten and Young as done here, the reflectance becomes model dependent, since the airmass factor (of Kasten and Young) uses an atmospheric model. However, if the same definition of reflectance is used to transform measured and modelled radiances, the airmass factor will drop out in the ratio of the two reflectances.

6. p. 679, l. 7: The key data of the NASA integrating sphere measurements were less good than those of the spectralon diffuser measurements. So the latter are proposed for the new key data. See G. Lichtenberg et al., SCIAMACHY Level1 data: Calibration concept and in-flight calibration Atmos. Chem. Phys. Discuss., 5, 8925-8977, 2005

7. Please give an error estimate for the correction factors of Table 2.

8. Figure 4: the value of the reflectance ratio MERIS/SCIA for band 4 (1.05) is very different from the value of C1 for band 4 given in Table 2 (1.12). Please discuss this in the paper.

9. English should be checked.

MINOR COMMENTS:

p. 674: l. 2: quite accurate > accurate

p. 680, Eq. (4). The azimuth angle dependence is missing in the path radiance term.

p. 682, l. 8: which RT model is used for making the LUT ?

p. 683, l. 11: how is the cloud screening performed in SCIAMACHY data?

p. 685, l. 9: wrong reference; the paper by Acarreta and Stammes is not about the

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spectralon key data. See Lichtenberg et al.

p. 689, the table layout is unclear on l. 10-11.

Fig. 7: the scale is missing on the color bar on the right side of the figure.

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 673, 2006.