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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The semianalytical cloud retrieval algorithm for SCIAMACHY II. The application to MERIS and SCIAMACHY data" *by* A. A. Kokhanovsky et al.

Anonymous Referee #2

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General comments

The topic of cloud detection using SCIAMACHY and MERIS is relevant, since both instruments on board of Envisat are quite complementary for cloud studies: SCIAMACHY has a high spectral resolution resolution and large spectral range but low spatial resolution, whereas MERIS has a high spatial resolution but low spectral resolution. Combined use of these instruments could seriously advance cloud research.

The SACURA algorithm can be applied to reflectances of both instruments, but only under the assumption that the clouds are optically thick, because the asymtotic ap-

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proximation for the cloud reflection function is used. This limits the use of the SACURA algorithm to fully cloudy scenes with large cloud optical thickness (larger than 5).

Despite the relevance of the subject and its potential, the paper is lacking scientific quality in several respects:

- The paper is written sloppy in contents, style, and structure.

- No quantitative information on the cloud product retrievals from SCIAMACHY and MERIS are given; no sensitivities of the algorithm, and no error estimates on the retrieved values are given.

- The literature is not referenced appropriately: of the 11 references, 8 are to papers of co-authors. Published papers to the SCIAMACHY calibration status and calibration work of others (SCIA-MERIS comparison), are missing.

- The SCIAMACHY L1 data version used, version 3.51, is very outdated. Currently there is version 5.04. So, possibly the conclusions about the L1 data quality are not correct anymore. This should be verified, because it affects the calibration part of the paper in an essential way.

- The SACURA retrieval results on cloud effective radius, liquid water path and optical thickness, shown in Figures 14, 15, and 16, are not discussed at all. These results should be compared to known climatological values,or independently measured values of these important cloud parameters. The following points are striking:

- The effective radius in Fig. 14 seems very high, also for the new calibration.

- The cloud optical thickness distribution of Fig. 16 looks better, but the optical thickness values retrieved at the left end of the distribution cannot be reliable, because of the SACURA algorithm limitation of cloud optical thickness.

- The liquid water path is probably computed by combining the cloud optical thickness and effective radius, but nothing is said about this calculation.

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Interactive Comment

There should be a (critical) discussion of the cloud retrieval results shown in the paper.

Specific comments

page 1815, l. 3-8: How does SACURA find an optimal solution? Probably also via minimization, which is however critized by the authors when discussing the LUT algorithms. The advantage of SACURA is that it does not needs LUTs. But this has probably as disadvantage that it is more time consuming than other algorithms. Please discuss this point here.

page 1816, l. 11-12: Calibration is not only discussed in section 5, but also - and extensively - in section 2. So please combine these two sections to improve the structure of the paper.

section 2: SCIAMACHY and MERIS have very different spectral resolutions. Were the SCIAMACHY spectra integrated over the MERIS spectral response function or not? Otherwise the reflectance comparison of Fig. 3 is not correct.

section 2: Here an essential reference is missing, namely to Acarreta and Stammes (2005). That paper already shows the reflectance comparison between SCIAMACHY and MERIS for the data of two full orbits. For 442 nm the MERIS/SCIA reflectance ratio is 1.13 +/- 0.04.That agrees well with the 1.12 found in this paper.

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.

page 1819: please explain the physical background of the CPI.

page 1818, l. 10-112: what is the effect on the ice cloud particle size retrievals by incorrectly assuming that ice particles are spherical?

page 1818, l. 25: What about the reflectance spectrum of vegetation? Soil is not relevant here, because the SCIAMACHY states chosen (see Fig. 1) are mostly over

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vegetated land, if not over sea.

section 5: Here the current calibration status of SCIAMACHY is not presented correctly. Please refer to:

G. Lichtenberg, J.M. Krijger, G. van Soest, R. van Hees, L.G. Tilstra, J.R. Acarreta, I. Aben, B. Ahlers, H. Bovensmann, K. Chance, A.M.S. Gloudemans, R.W.M. Hoogeveen, R. Jongma, S. Noël, A. Piters, H. Schrijver, C. Schrijvers, C.E. Sioris, J. Skupin, S. Slijkhuis, P. Stammes, and M. Wuttke, SCIAMACHY Level1 data: Calibration concept and in-flight calibration, Atmospheric Chemistry and Physics Discussions 5, 8925-8977, 2005, http://www.copernicus.org/EGU/acp/acpd/5/8925/acpd-5-8925.htm

as a source of information. The missing point is that the NASA sphere is NOT the chosen calibration data set for the new data processing, but the spectralon diffuser data set. Is the NASA sphere calibration shown in Fig. 13? These spectral features might not be realistic (see Fig. 13).

page 1822, l. 3: this factor 1.07 is not sufficient to explain the calibration deviation of 1.12 found earlier in the paper. Please discuss.

captions of Fig. 3, 4 and 6: which wavelength?

caption of Fig. 6: via $>$ versus

caption of Fig. 5: what is the dotted line?

caption of Fig. 7, 9-16: mention that SCIA data is used.

caption of Fig. 13: where is this calibration curve based on?

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 1813, 2006.