

Interactive comment on “The semianalytical cloud retrieval algorithm for SCIAMACHY – I. The validation” by A. A. Kokhanovsky et al.

Anonymous Referee #2

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The authors validate the already published SACURA cloud algorithm using MODIS data (retrieval of cloud optical thickness, effective radii, liquid water paths) as well as data from GOME, ATSR-2 and air-borne measurements (cloud top height). The authors are discussing an interesting approach for the retrieval of cloud parameters in the case of completely cloudy pixels. But the kind of presentation is hardly acceptable. The paper should be accepted subject to major revisions. I discuss the paper with respect to the guideline of ACP:

1.) Does the paper address relevant scientific questions within the scope of ACP?

Yes. The retrieval of cloud parameters is important for the investigation of climate

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change. The coarse spatial resolution of SCIAMACHY limits the possibilities of cloud retrieval from SCIAMACHY, as the authors describe correctly. But the good spectral resolution makes SCIAMACHY interesting for the application of new methods. Especially for the retrieval of cloud top height the SACURA algorithm could be an interesting approach. But the algorithm cannot be used for the analysis of tropospheric trace gases, because of its limitations to totally cloudy pixels. New algorithms have to be validated and should be compared with existing methods used for cloud retrieval. Therefore the paper address relevant scientific questions.

2.) Does the paper present novel concepts, ideas, tools, or data?

Yes. The paper presents intercomparisons using data from MODIS, ATSR-2, GOME and surface measurements. The authors mention in the conclusion, that there is a further paper dealing with similar intercomparisons using MODIS data. The first author of this paper is co-author of this paper. This paper is in press and is not read by the reviewer.

3.) Are substantial conclusions reached?

Yes, but the conclusions are not carefully worded (see below).

4.) Are the scientific methods and assumptions valid and clearly outlined? and 6.) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

The description of the methods are often insufficient. Without reading the references an appropriate interpretation of the results is sometimes impossible. The authors should provide a short description of the methods the SACURA data is intercompared with. A few sentences describing the major aspects relevant for the intercomparison would be mandatory. The authors often only mention, that they compare SACURA with the LUT approach. But there are other aspects relevant for cloud retrieval. They even do not mention that the GOME retrieval used for intercomparison is based on the

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analysis of RAMAN-scattering, while the algorithms usually used for the retrieval of cloud top height from GOME data are - like SACURA - based on the analysis of the O2-A-Band. They are using an algorithm developed for OMI for the intercomparison. This algorithm is applied to GOME data for validation purposes. The reviewer think it would be better to compare with better-validated GOME data products, e.g. the cloud top height retrieved from oxygen-A-band by the FRESCO algorithm. A short description of the used ATSR-2 retrieval would be also useful.

The method of Nakajima et al. (1995) is widely used, but especially for readers of the SCIAMACHY community who are not specialists in cloud retrieval, a short description would be helpful. Note, that the title indicates that the paper is addressed to the SCIAMACHY community, too. I suppose that they are using an own implementation of Nakajima et. al. 1995, because no further paper is cited. But the authors do not mention details of this implementation. Therefore the reviewer disagrees with the conclusion, that the applicability of the SACURA cloud optical thickness to SCIAMACHY is already proved through the results of this paper only, because the agreement could be due to shortcomings of both algorithms relevant to SCIAMACHY retrieval.

On page 2003 the authors say, that they are using a method similar to (Daniel et al. (2003)) but they do not describe the difference between their method and (Daniel et al. (2003)).

The authors have to add an appropriate description of all the data and methods they are using for intercomparison as described above.

5.) Are the results sufficient to support the interpretations and conclusions?

The conclusion, that SACURA is an accurate and flexible tool for SCIAMACHY is not proven using the results of this paper only. Important aspects for the SCIAMACHY retrieval are not discussed across this paper. The second part of the paper may deal with some of these aspects, like the calibration problems with SCIAMACHY data and how SACURA deals with this. But the second part of the paper is not published at

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ACPD yet. However, a paper which does not use any SCIAMACHY data cannot conclude that SACURA is working for SCIAMACHY. The paper can conclude that some aspects of the SACURA method (the differences to Nakajima et al.) are well validated for the retrieval of cloud optical thickness, effective radius and liquid water paths and that the differences found in the intercomparisons are well understood. The paper can also conclude, that the algorithm retrieve an appropriate cloud top height from GOME data compared to ATSR-2 data over ocean. Note, that the agreement with ATSR-2 is very good especially for the equator region. But the dataset used for this study is quite small. Further on, the reviewer does not understand, why the authors neglect pixels over land for the intercomparison of cloud top height across this paper. The retrieval over land is important for the application to SCIAMACHY. For the intercomparison with GOME they are obviously using the same dataset than [Joiner et. al., fig. 11] . This dataset includes both land and ocean, but the authors neglect the regions over land. With respect to the SACURA documentation known by the reviewer it could be supposed that surface albedo is neglected during the SACURA retrieval. This could be acceptable for clouds with high optical thickness and completely cloudy pixels, but has to be proven for the application to SCIAMACHY.

The authors should rewrite their conclusions with respect to the aspects discussed above.

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.

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10.) Is the overall presentation well structured and clear?

The presentation is well structured. Sometimes the description of the methods are insufficient, as described above.

11.) Is the language fluent and precise?

Yes.

12.) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes.

13.) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

Technical corrections: fig. 3-5: correlation between (typing error) the algorithms used for intercomparisons should be cited in the subtitle of the images too (fig. 3,4,5,10).

page 2001: If the authors mention a cloud cover product in testing phase, they should describe the concept of the algorithm and its impact for the application of SACURA to partial cloudy pixels. Perhaps it is the best to change the last three sentences of section 3.1 to: "In this paper we limit ourself to completely cloudy pixels, because the application of SACURA to partial cloudy pixels is still in development"

14.) Are the number and quality of references appropriate ?

Yes.

15.) Is the amount and quality of supplementary material appropriate?

Yes.

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 1995, 2005.

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