

Interactive comment on “MERIS albedo climatology for FRESCO+ O₂ A-band cloud retrieval” by C. Popp et al.

Anonymous Referee #1

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Review paper amtd-3-4603-2010 by C. Popp et al., “MERIS albedo climatology for FRESCO+ O₂A-band cloud retrieval”

General remarks:

The authors describe in this paper the generation and integration of a new albedo data base based on MERIS observations into the FRESCO+ algorithm. FRESCO+ is an established algorithm for cloud properties retrieval from high-resolution O₂A-band satellite observations. Typically, GOME and its successor instruments use this spectral band for retrieving cloud information (coverage, height, pressure, optical thickness, albedo). Here, it is applied to SCIAMACHY/ENVISAT measurements and retrieved cloud parameters are compared with another cloud properties retrieval scheme called

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HICRU. Furthermore, it is shown how the new albedo data base performs with respect to cloud properties if results are compared to FRESCO+ simulations using the pre-existing GOME-LER data base.

The paper is well written and organized and of some relevance for the scientific community. Cloud properties need to be known for accurate trace gas column retrievals but are also relevant as a stand-alone data set. Improvements in this field are welcomed and appreciated. The authors could improve their paper if a more elaborated discussion on the impact of the main product of GOME-like sensors would be added. Even if the new MERIS-based albedo climatology does not cover the most important spectral range (for trace gas retrievals of several reactive species like O₃, SO₂, BrO, HCHO, OCIO) between 315 and 380 nm there will be an indirect effect via the cloud coverage on trace gas results. How does the new climatology improve retrieved (total and tropospheric) trace gas columns? This is actually the most interesting question but it remains unanswered. That is why I assign only “some scientific relevance” to this paper. I recommend adding a section on this topic and showing some results, maybe two figures. Also the conclusions should contain a corresponding paragraph. If results show a minor impact only it should clearly be said here. I recommend publication of this paper after minor revision.

Some specific comments and remarks follow hereafter:

p4604/13: The authors describe the generation of a monthly data base. Is there any (which type of?) interpolation (in time) performed when the data is allocated to the SCIAMACHY observations? If not, how is this justified?

p4604/25: The authors mention the importance of scenes with small cloud fractions when errors of retrieved trace gas columns become large. The discussion of this issue could be more elaborated. It could be added to the actually missing discussion of the impact of the differing cloud properties from two albedo data bases on retrieved trace gas columns.

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p4605/20: I would give credit to the first paper on stage dealing with cloud property retrievals in the O2A-band. The paper of Kuze and Chance (1994) could easily be added here.

A. Kuze and K.V. Chance, "Analysis of Cloud-Top Height and Cloud Coverage from Satellites Using the O2 A and B Bands", JGR, 99, p14481-14491, 1994.

p4608/25: The authors mention application of the new method/algorithm within OCRA/ROCINN. Maybe there would be some improvement since the albedo data base there is based on the PMD measurements which have lower spatial resolution. One could however think about the other way round: FRESCO+ might use the ROCINN-based cloud-top albedo, in order to overcome the often questioned fixed cloud-top albedo of 0.8 which finally leads to an effective cloud coverage only. Although this quantity is now well-understood it is a drawback when using the cloud data set from FRESCO+ as independent data source (for clouds). Can the authors comment on this ?

p4609/12: European Space "Agency" instead of "Administration" ?

p4610/1: Here, and only here, the authors mention (too) briefly the impact of wrong cloud coverage results on NO2 trop. columns. This discussion should be enhanced and results should be presented. See also the general comments.

p4613/19: This means that the data base does not account for solar zenith angles of larger than 50 degrees ? If yes, this limitation should clearly be stated in the abstract and in the conclusions.

p4613/20: To say that something is "difficult to calculate" is quite honest but not an argument for not doing it. In principle, it would be possible to use the blue-sky albedo provided that for example the high variation of the AOD is parameterized or a climatology is used or another sensor is used or ...

p4617/18: Now I'm a bit puzzled: If the average difference between the data sets is

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such as small, it should be better explained and highlighted why using this new data base is such an improvement over existing methods. Again, this could be done by showing the impact on retrieved trace gas columns using different albedo data sets within FRESCO+.

p4618/1-12: I like this extra evaluation, also because the authors finally say here something about the impact on trace gas columns.

p4618/21: It is maybe better to change the order of sentences hereafter. I think it is better to argue first with the better temporal sampling, presumably having the larger impact, than with the different length of analyzed data sets. In the sense of a "climatology" (what we would like to use) these data sets are anyway too short.

p4619/25: Are there any radiative transfer calculations/results quantifying the effect of mineral aerosols ?

p4620/1pp: A general remark about the cloud (types) "seen" by FRESCO+ would be helpful. GOME-like sensors often fail when detecting optically thin (cirrus) clouds. These contribute especially in the tropics to the total cloud coverage although partially being semi-transparent in the VIS spectral range. MODIS on the other hand detects these clouds. The MODIS and MERIS footprint resolution is much higher which will also have an impact on cloud detection.

p4625/15: A discussion of the impact of the different albedo climatologies and retrieved cloud parameters on further retrieved trace gas columns should be added.

p4625/13, item 3: Yes, but please present such results in the paper. See also the comment to p4625/15.

p4636: Fig 2: Larger images needed ! One image per double-column ?

p4640: Fig 6 a-d): Especially Figures b) and d) are not very conclusive since they look like blue-filled squares only. At least the coast lines should be visible for better orientation. Maybe it is even better just showing images e) and f).

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