Atmos. Chem. Phys. Discuss., 5, S3460–S3463, 2005
www.atmos-chem-phys.org/acpd/5/S3460/
European Geosciences Union

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Improving cloud information over deserts from SCIAMACHY O_2 A-band" *by* N. Fournier et al.

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Received and published: 27 October 2005

First, we would like to thank the referee for the helpful review. Here, we reply to all the comments addressed.

Reply to "Specific comments"

1- The referee suggested to analyse further the results from FRESCO after improvement of its surface albedo database over deserts. He focused especially on the low retrieved values of cloud fraction. These low values obtained with the new version of FRESCO are directly caused by the correction of 20% on the surface albedo. That was, indeed, the objective of this development to correct the surface albedo database to then allow FRESCO to retrieve more accurately the cloud-free pixels over desert

areas. By implementing this correction, FRESCO retrievals match better the results of both the co-located image from MODIS and OCRA. To illustrate more clearly this point, the MODIS image of the studied orbit (12472) will be added in Section 4.1. Moreover, the comparison with OCRA is not such a pertinent validation as its results are also uncertain for low cloud fraction. Therefore, Figure 9 (comparison between OCRA and new version of FRESCO) and Figure 5 (comparison between OCRA and old version of FRESCO) will be updated by including also the retrievals from another PMD algorithm, HICRU, described in section 2.4. This shows that FRESCO improvement drives its retrievals from previously overestimating results of both OCRA and HICRU to produce, now, cloud fractions between the values of both algorithms.

2- The referee asked for some clarifications on the validity of the correction amplitude of 20%. In this study, seventeen SCIAMACHY orbits at different times of the years 2003 and 2004 crossing the Sahara region have been investigated. Twelve of them correspond to cloud-free conditions over the Sahara while five are cloudy scenes. The state of cloudiness is defined by using a co-located MODIS image at the same time. A correction of 20% on the surface albedo is the minimum correction to insure a better and reasonable match of FRESCO, in all the different conditions of these twelve cases, with both MODIS image and OCRA retrievals. To illustrate better the validity of this correction intensity, the results obtained for another orbit (11326; 30/04/2004) will be added in the comparison plot between FRESCO and OCRA. Moreover, the manuscript is amended to take on-board this comment. This choice of 20% also ensures that the accurate amount of clouds is retrieved in the 5 cases of cloudy scenes over Sahara. An example is shown in the paper with the orbit 7591 (13/08/2003).

3- Concerning the FRESCO cloud-top pressures used in Figure 4, they are issued from the old version of FRESCO without correction. In this case (Orbit 2510, 23/08/2002), the use of the new version of FRESCO would not affect significantly the results as this orbit does not include large desert areas. Secondly, the SCIAMACHY Level 2 operational product of cloud-top pressure is not retrieved but issued from the ISCCP

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climatology. Section 3.2 gives more details about this dataset. The legend of Figure 4 will be amended to precise the version of FRESCO used as well as the origin of the SCIAMACHY operational product.

4- As pointed by the referee, Figure 4 also shows important differences between the operational SCIAMACHY cloud-top pressure and the retrievals of FRESCO and MODIS. As underlined in the previous point, this is due to the fact that the operational product uses the monthly mean cloud-top height from the ISCCP climatology. The correlation between MODIS and FRESCO is much better but still exhibits differences for low cloud top pressures as already observed by Koelemeijer et al. (2001). These can be explained by the different methods used to derive the cloud top pressure (Oxygen A-band for FRESCO and Infra-Red for MODIS). There is also a systematic time difference of 1 to 2 hours between the co-located measurements of MODIS and SCIAMACHY.

5- As the referee adviced, Figure 13 will be completed with the cloud-top product from MODIS over the Sahara. However, this Figure focuses especially over the Sahara. Thus, it can not been compared directly with Figure 4 which shows a similar plot but for a different orbit where only a few pixels are over the Sahara.

Reply to "Additional comments"

a) The color scale of the Figures 10,11,12 will be improved.

b) Section 4.1 : The MODIS image of the Sahara for the 19/07/2004 will be added, as stated previously in Comment 1. That will allow to see clearly the state of the cloudiness over Sahara at roughly the same time as SCIAMACHY overpass.

c) The term Absorbing Aerosol Index will be defined in Section 4.2 as follows : The AAI from GOME uses the reflectances at two UV wavelengths, 335 and 380 nm. The color of the scene at these two wavelengths is compared to the color of a purely Rayleigh scattering atmosphere. The color difference, expressed as the AAI, indicates the presence of absorbing aerosols like desert dust (De Graaf et al., 2005).

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 6013, 2005.

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Interactive Comment