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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulation study of the aerosol information content in OMI spectral reflectance measurements" *by* B. Veihelmann et al.

Anonymous Referee #2

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Background:

In this manuscript an attempt is being made to apply Principal Component Analysis to synthetic data to learn about aerosol information content from observations made in the various spectral intervals of the OMI instrument. This in principle is an legitimate attempt and could provide guidance for the analysis of data from actual observations. The manuscript reads well however, some aspects o the work are obscure and need to be clarified. Once that is done, the manuscript can be published.

Major comments

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1. The Abstract is not informative. First, the reader needs to know what OMI is. It starts with telling us what spectral intervals are used for O3 and NO2 and later tells us that the wavelength of 477 nm is added and provides significantly more information than any other individual band but nothing is said what the other bands are. It is stated that: "This information content depends on the observation geometry, the surface albedo spectrum, and on the aerosol parameters themselves". This statement is somewhat confusing regarding the dependence on the aerosol parameters themselves. The Abstract ends with telling us: "The PCA is applied to assess the capability of the aerosol retrieval to discern various aerosol types as well as clouds". First, in order to study aerosols, one needs to get rid of clouds. Later on, it is stated that this is the advantage of this approach of using synthetic information so that one does not need to deal with clouds. How do the clouds enter in the picture and why is it important to mention it in the Abstract while nothing is said about what was learned from the study?

2. It is stated: "Two algorithms are applied to retrieve aerosol parameters from OMI reflectance measurements, referred to as the near-UV algorithm and the multi-wavelength algorithm respectively." Not clear by whom it is applied. The impression is that it is done in this study. Later it I stated that it has been shown by the developers of the OMI algorithms that one or two aerosol parameters, namely the Aerosol Optical Thickness (AOT) and the Single-Scattering Albedo (SSA), can be retrieved independently using the near-UV algorithm. The multi-wavelength algorithm uses up to 20 wavelength bands between 331 nm and 500 nm and synthetic reflectance data allow efficient forward simulations for a broad range of aerosol models. From the following discussion one gets the impression that the present study investigates the information content of OMI reflectance measurements in the multi-wavelength OMI aerosol algorithm using the synthetic data that were generated by the developers of the OMI algorithm. Therefore, it is claimed, the results of the principal component analysis are immediately applicable to the multi-wavelength algorithm, since the PCA is applied to the same synthetic reflectance data. It is also stated that: "The number of DFS obtained from the PCA is representative for the number of aerosol parameters that can be

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retrieved independently from OMI reflectance measurements provided that the surface albedo spectrum is accurately known and the presence of clouds can be completely excluded." This aspect of the methodology needs to be clearly explained, namely, what is the basis for believing that the proposed analysis will add to information that is already available. Later in the manuscript we read: "Optical properties of an atmosphere containing aerosol are computed with the DAK program (Doubling-Adding KNMI) [de Haan et al., 1987; Stammes et al., 1989; Stammes, 2001]. The results of the radiative transfer simulations are stored in the LUT" This means that the authors performed their own simulations. Which one is it? The conflicting statements on clouds need also to be removed. For example, it is stated: "A dedicated sensitivity study has been performed to assess the impact of errors in the surface albedo spectrum on the aerosol retrieval. Cloud models (ice clouds and water clouds) are included in the analysis." One wonders-why clouds?

In summary, there is some problem with the presentation of the topic and justification of the work undertaken. On one hand, the manuscript reads well but at the same time, too many aspects of the work are not presented clearly and unless one dwells deeper into the text, it is difficult to see it.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 1785, 2007.