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Atmospheric Measurement Techniques Discussions

Interactive comment on "Statistically optimized inversion algorithm for enhanced retrieval of aerosol properties from spectral multi-angle polarimetric satellite observations" *by* O. Dubovik et al.

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We thank the Reviewer for his/her valuable and positive comments.

We have carefully analyzed the Reviewer comments and tried to address her/his questions and comments in the revised manuscript and in the present response.

Responses to the Reviewer specific questions :

1. Reviewer comment: "-The paper is quite long, I see some possibilities to shorten

the manuscript. First, the method to include spheroids in the retrieval is extensively described in Dubovik et al., 2002b; 2006, so a shorter description would be sufficient here."

Answer: The idea of this paper was to provide a clear description of all main aspects of the proposed approach and algorithm. We tried to use our experience from communications with users of AERONET and POLDER products and create a document providing comprehensible answers to the anticipated questions. Majority of those questions are usually about the assumptions made in the forward calculations, especially about assumptions that are not commonly employed. The approach used in AERONET retrieval to account for aerosol particle non-sphericity that adapted in this algorithm is not used in other remote sensing algorithms. As rightly pointed by the Reviewer, the approach was introduced by Dubovik et al. [2002b] and further elaborated in paper by Dubovik et al. [2006]. However, the paper by Dubovik et al. [2006] shows diverse aspects of the methodology, and many users have difficulties to extract the actual scheme employed in the AERONET retrievals. Therefore, we think the clear summary of "spheroid approach" is really necessary in this paper and can even be helpful for AERONET users.

2. Reviewer comment: "Also, to my opinion the description on p 4979-4980 of the single scattering solution is not really necessary. Condensing these parts of the paper would put more focus on the key aspects of presented work."

Answer: We agree that for an expert in radiative transfer calculations this description of the single scattering solution does not appear necessary in this paper. However, in our opinion, keeping these formulations in the paper helps to the clarity of the algorithm description. Although the paper is long, the forward model, which is quite elaborated, is described only at $\sim$20 pages of total 110 of AMTD format. We believe that reducing this description will make paper too technical and less clear.

3. Reviewer comment: "The authors include the PARASOL 443 nm channel, while the

PARASOL home- page (http://smsc.cnes.fr/PARASOL/A_calibration.htm) states that the use of these is "strongly not recommended". Is the information on the PARASOL-page outdated, are the problems not as severe as stated there, or did the authors apply an extra calibration step?"

Answer: It is correct that PARASOL 443 nm channel data are not recommended for use. Nonetheless, we believe that in the framework of the present algorithm these data can be useful for the aerosol retrieval. In order to minimize possible effect of this uncertainty on the retrieval we have introduced a correction coefficient. We have added a paragraph in Section 6 of the paper that provides detailed explanations of our decision to use 443 nm channel data.

4. Reviewer comment: "-The results of the synthetic study in Fig.7 indicate that the errors in the single pixel retrievals all correspond to an underestimation, which is very unlikely for random noise. It seems the same noise realization was used for all retrievals (e.g. same initialization of random generator) in this figure. If so, it would be much better to put a truly random noise on the measurements. In Fig. 11 the results look more random, so maybe there is another explanation?"

Answer: The statement of the Reviewer is correct, the same initialization of random generator was used for generating random errors for all different single pixel retrievals. This was helpful for observing possible tendency of the random error effect on the retrieval errors appearing with the increase of optical thickness of aerosol. Such tendency would be less clear if different realizations would be used. At the same time, in order not to bias our sensitivity studies by such way of modeling random noise we have conducted similar tests with 100 different initializations of random generator. The outcome of those tests is shown in Figs. 15 – 18 (Figs. 16 -19 in the revised manuscript).

5. Reviewer comment: "-The paper focuses on retrieval of aerosol properties over land (which is the most challenging problem), but also mention that the algorithm is suitable for retrievals over the ocean. Here, it is mentioned that the reflection matrix

of the ocean is modeled using the windspeed dependent model of Cox and Munk (1954). So, I assume that the contribution of underlight is not taken into account, which introduces significant errors at the shorter wavelengths (in particular 443 and 490 nm). Do the authors exclude these shorter wavelengths for retrievals over the ocean? Is the algorithm tested over the ocean? Please clarify"

Answer: As requested, we have included several paragraphs Sections 3.2 and 5 explaining the concept of the algorithm for aerosol retrieval over ocean.

6. Reviewer comment: "-I am not a native speaker, but the term 'enhanced retrieval' appears a bit strange to me. Further, it seems that at a number of places adverbs are missing or not at the correct position. I suggest to carefully go through the manuscript while preparing the final version."

Answer: As suggested, the text of the paper has been reviewed and corrected by a native speaker.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 4967, 2010.