

Interactive comment on “Capability of multi-viewing-angle photo-polarimetric measurements for the simultaneous retrieval of aerosol and cloud properties” by O. P. Hasekamp

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General comments

The main goal of this paper is to explore the possibilities to perform a simultaneous retrieval of aerosol and cloud properties for situations with an aerosol layer located below a broken cloud field and for situations with an elevated aerosol layer which is situated above a homogeneous low level cloud field. Beside, the elucidation of the potentialities of different types of satellite instruments and measurements for the retrieval of aerosol optical and microphysical properties under clear sky conditions is one more objective of the author. The paper consists of three main parts: (1) the

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description of the techniques to retrieve simultaneously aerosol and cloud properties from multi-angle photo-polarimetric measurements; (2) consideration of the information about atmosphere aerosol retrieved under the clear sky conditions using different optical satellite instruments capabilities and (3) the exploration of the retrieval capabilities of the multiple-viewing-angle multiple-wavelength measurements of intensity and polarization for different cloudy conditions. From my point of view, the performed error estimations and the analysis of the accuracy of the aerosol and cloud properties retrieval in different situations using capabilities of different types of satellite optical instruments are extremely important. It is an essential part of this paper. I think this aspect should be reflected in the title of this paper. This paper is very useful for the future development of atmosphere satellite monitoring. It is clearly written, well structured and accurately referred.

Specific comments

1. The author refers to Table 1 at p. 1234, but the caption does not explain what values are given in the Table. This information can be found at p. 1236, but it should be done either in the Table 1 caption or at p.1234.
2. What is the definition of the value of G (the geometrical cross section) in the case of polydispersion at p.1236?
3. The explanation what are 22 aerosol parameters to be retrieved is required (p.1236) (“6 parameters are for the size distribution and 4 parameters are for the real- and imaginary part of the refractive index of each mode”). It may be useful to mention about four aerosol types.
4. Page 1237, Sec.5.1: “ f is the cloud fraction”. It is not clear whether f is a cloud fraction in the given pixel or in the set of pixels? If f is a cloud fraction in the given pixel, the question arises “How does this cloud affect the signals from adjacent pixels?” This effect depends on the pixels sizes, i.e. on the distance from a cloud to the pixel under consideration.

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5. What is the definition of the vector A on p.1239? This notation could be confused with albedo A.
6. Page 1242. What optical parameters of atmosphere (AOT, single scattering albedo) and of underlying surface were used for data given in Fig. 2? Table 1 provides only microphysical data; the capture to Fig. 2 does not contain the required data as well. Something is mentioned in Sec. 4.2, but it should be given earlier. If the accuracy of the measurements is specified, the values of all other parameters including the surface spectral albedo are important and should be specified as well.
7. How is the 3-D effect for a horizontally non-homogeneous aerosol atmosphere included in Sec. 5.1? Or is the atmosphere assumed to be horizontally uniform?
8. What does the statement "Errors on the large mode parameters are not shown here because of the small contribution of this mode" on p.1245 mean? What retrieval error arrives because of "the small contribution of this mode"?
9. Page 1247. Fig.3 arrives only after Fig.6 and is not mentioned before.

Technical corrections

1. P.1236, line 5. Replace "the superscripts l and s" with "the superscripts s and l "
2. P.1237, line 6. Delete word "we".
3. P.1237, line 7. Delete word "we".
4. P.1239, line 17. Replace "Eq. 15 is combines" with "Eq. (15) combines"
5. P.1241, line 9. Delete word "viewing-"

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