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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of aerosols on polarized sky radiance: model development, validation, and applications" *by* C. Emde et al.

Anonymous Referee #2

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General comments:

This paper describes the implementation of polarization in a 3D radiative transfer Monte-Carlo model called MYSTIC. As, currently, few radiative transfer models have these two specifities (3D + polarization), it is worthy and very useful to develop and present such work. In addition, the paper is well written and the results are clearly presented.

I was just a little disappointed because the capability of computing 3D polarized radiances was not used. The paper presents and describes instead examples of multi-angular behavior of ground polarized radiances obtained from plane-parallel atmosphere composed of different types of particles such as molecular, water cloud and different types of aerosols. These examples allow to validate the newly developed

model and show that the behavior of multi-angular polarized radiances is sensitive to the types of particles. Even if this is already used in many remote sensing applications, the results have the advantage of being here clearly presented and described.

Specific comments:

1) The paper is about using polarization measurements to get information on aerosols properties. References about works done for aerosol retrieval from polarized radiances measurement should be added and in particular them from ground-based measurement such as sun photometer. For example, Li et al., 2006, 2009 and some references therein should be included. 2) As suggested by the other referee, it would useful to have more information about the aerosol size distribution used. Indeed, some people may not known OPAC database and, in addition, multi-angular radiances at different wavelength can be used to retrieve aerosol size distribution (Dubovik et al., 2002). It can thus be informative to have the shape and the characteristics of the aerosol size distributions used in the paper. 3) More detailed explanation and/or references about the computation of the new direction after a scattering event and about the method called the importance sampling would be interesting to people who wants developed such code. Indeed, why dividing by P11 (eq 13) solves the problem concerning the dependence of Z on incoming and scattered angles. Moreover, it is certainly just a notation problem but in eq. 9 and eq. 13, Isca is equal to two different things.

Technical comments:

- P.4 : delete or complete the sentence "OPAC does not include any information about particles shape ...." as you finally test your model with the spheroid aerosol model of Kuik et al.

-Fig3 and 4: add in the figure legend the significance of the errors bars.

-p. 1, secund paragrah: exit – > exist

-p.5, part 2.6, resulty –> results; orieneted –> oriented; devided–> divided

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- fig. 10, include in the legend that dashed line are for results with delta-M method and correct the typing error "the is wavelength..."

References:

Zhengqiang Li, Philippe Goloub, Claude Devaux, Xingfa Gu, Jean-Luc Deuze, Yanli Qiao and Fengsheng Zhao, Retrieval of aerosol optical and physical properties from ground-based spectral, multi-angular, and polarized sun-photometer measurements, Remote Sensing of Environment, Volume 101, Issue 4, 30 April 2006, Pages 519-533.

Zhengqiang Li, Philippe Goloub, Oleg Dubovik, Luc Blarel, Wenxing Zhang, Thierry Podvin, Alexander Sinyuk, Mikhail Sorokin, Hongbin Chen, Brent Holben, Didier Tanre, Marius Canini, Jean-Pierre Buis: Improvements for ground-based remote sensing of atmospheric aerosol properties by additional polarimetric measurements, Journal of Quantitative Spectroscopy and Radiative Transfer, 2009, doi: 10.1016/j.jqsrt.2009.04.009

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 17753, 2009.