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Atmospheric Measurement Techniques Discussions

Interactive comment on "Multiple scattering in a dense aerosol atmosphere" *by* S. Mukai et al.

Anonymous Referee #1

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This paper is of interesting content. However, I am not sure what this paper is really about: 1) a new radiative transfer solver based on MSOS or 2) a new retrieval?

If 1) is the case, it should be stressed more clearly what is new compared to existing models, and accuracy tests should performed in comparison with independent community models, e.g. DISORT or Monte Carlo, from which is assumed that they are exact. Then dense aerosol layers could be considered under different scenarios to dicuss multiple scattering effects as announced by the title. All this is not included in the present version of the paper. The application in some retrieval is not of interest here.

If 2) is the case, what is new in this regard? The fine mode fraction is the only parameter to be independent. Size distribution and complex refractive index data from AERONET are applied. Thus, the presented retrieval is not really a retrieval and also not independent. On the other hand, Fig. 1 indicates that, e.g., the complex refractive

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index can be derived by the authors' retrieval. Why not comparing their products to AERONET?

Beyond, some more questions arised during reading the manuscript:

i) Why using a mixed aerosol type in the retrieval, while a specific biomass burning event was considered?

ii) Is f not retrieved by AERONET, too? The various aerosol types in Table 1 should also be accompaigned by characteristic mean values of f. How fit the retrieved f to the latter values, in particular to the case of category 2?

iii) Why not considering satellite reflectances directly above the AERONET sites A and B? With regard to Fig. 2 I have the impression that the coloured boxes indicate the area to which the satellite measurements refer? Then it would be mandatory to use data directly above or closest to A and B.

iv) Why is $k(0.46\,\mu m)$ varied and not one of the other three parameters? A change in the AERONET-retrieved refractive index and a simultaneous application of the AERONET size distribution data would lead to inconsistency with respect to the sun photometer measurements which are the basis to derive the AERONET products. Of course, AERONET products might not provide the only set of aerosol parameters to match these measurements, however, the authors changed only $k(0.46\,\mu m)$.

v) Why not applying the size distribution data for the particular case of 21 in September of 2005?

vi) Why comparing the 'polluted marine' case with the retrieval case of $f = 0.185$ and the 'biomass burning' case with $f = 0.31$ in Fig. 4 to state in the main text that it would be 'possible to say that our retrieved aerosol size is reasonable'?

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To state in the Conclusions that the radiative transfer is working 'well', was not shown here. That's why I suggest to revise the paper considering workpackage 1), that is, to test the MSOS solver alone and comprehensively. This would be also in accordance with the title. Only if it is shown that this solver works well, which I suppose, one can conclude that 'new algorithms for aerosol retrievals [...] can be applied'.

Minor corrections:

The captions of all tables and figures should be more self-explaining.
Page 886, Line 8: 'relation' -> 'relations'?
Page 886, Line 13: What does x mean?
Page 888, Eqns. (9) and (12): $R(1)$ should be written consistently as $R(1:...)$?
Page 888, Line 5: I -> I?
Page 896, Line 14: 'concerne3d'
Page 897, Line 23: '0.55gμm'
Table 2: How were these values derived? I downloaded the AERONET data and tried to recalculate them without success.
Figure 3: '[R(λ)]' -> '$R(\lambda)$'; 'size parameter' is misleading, because 'size parameter' is usually $\frac{2\pi r}{\lambda}$

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 881, 2012.