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Comment

Interactive comment on “Effects of dust particle internal structure on light scattering” by O. Kempainen et al.

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This is a short comment on the manuscript entitled “Effects of dust particle internal structure on light scattering” submitted to ACPD by Kempainen et al. It is not my intent to provide a full review to the manuscript.

The manuscript describes a sensitivity study to evaluate the optical impacts of some of the typical internal structures of atmospheric dust particles. Rigorous calculations of optical properties of internally-mixed, inhomogeneous dust particles are shown and compared to simple calculations for homogeneous versions of the particles by using an effective-medium approximation (EMA). A simple volume-average of the refractive indices is used here, given by Eq. 7. It is stated that “this simple and straightforward

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mixing rule is chosen instead of any of the more sophisticated ones for simplicity: The more sophisticated EMA's are derived under different assumptions about the mixture, and therefore different EMA's might be optimal for different model particles considered here."

It is true that different mixing rules are appropriate for different mixtures, but it has been shown that the volume mixing of refractive indices is very inappropriate for inhomogeneous mixtures of media with very different real and imaginary refractive indices (Chylek et al., 2000). Thus, the volume-mixing approach is clearly not suitable for the particles studied here, especially for the hematite mixtures. For these particles, the Bruggeman rule is most appropriate or alternatively the Maxwell-Garnett rule (e.g., Lesin et al., 2002). It makes no sense to use a mixing rule that is clearly not appropriate for the investigated cases.

This paper concludes that "based on this work, it seems that it is exceedingly important that the effects of dust particle internal structures on light scattering are accounted for in a wide variety of applications." This conclusion is based on the comparison to the calculations using the inappropriate volume-mixing rule and therefore is not well supported. The authors should compare their rigorous calculations to those using the more appropriate mixing rules in order to investigate the importance of internal scattering processes in dust particles. Whether this simple adaptation would show that the Bruggeman and/or Maxwell-Garnett rules are capable of sufficiently reproducing the rigorous calculations or not, it will greatly enhance the impact of this work in my opinion.

REFERENCE: Lesins et al., A study of internal and external mixing scenarios and its effect on aerosol optical properties and direct radiative forcing, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 107, NO. D10, 10.1029/2001JD000973, 2002

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