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Atmospheric Chemistry and Physics Discussions

Interactive comment on " Effects of particle shape, hematite content and semi-external mixing with carbonaceous components on the optical properties of accumulation mode mineral dust" *by* S. K. Mishra et al.

Anonymous Referee #1

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General Comments:

This paper is based on the assumption that aerosol dust (D) interacts with other aerosol constituents (such as black carbon [BC], brown carbon [BrC], etc.) to form a "semi-external" mixture. These mixtures consist of distinct particles, each with a single chemical composition, which are in contact with one another to form an aggregate. For example, a spherical BC particle attached to a spherical dust particle would be

a semi-external mix. The authors then go on to calculate aerosol optical properties (extinction, single scattering albedo [SSA], and asymmetry parameter [g]) based on a number of hypothetical semi-externally mixed aggregates. These calculations are an effort to understand how the semi-external mix affects aerosol optical properties (particularly when compared with stand-alone spherical particles). The paper is interesting, important, and merits publication, subject to a number of major concerns listed below.

Main Specific Comment:

My main problem with the paper is the exposition. The paper is long and very tedious to read. There are innumerable places where sub-standard English and typos are found (these errors are just too numerous to list). I understand that the English may not be the native tongue of the authors, but there are so many errors that I am suggesting a native English speaker edit the paper, if this is at all possible.

Other Specific Comments:

(1) At what wavelength are the calculations being made? 550 nm?

(2) Using the DDA radiative transfer calculations, are the particles assumed to have random orientations?

(3) What might be the error in say, SSA calculations, stemming from assuming specific values of complex indices of refraction? For example, Bond and Bergstrom (2006, Light absorption by carbonaceous particles: A critical review, Aerosol Sci. Tech., 41(1), 27-47.) provide a range of plausible refractive indices for BC, and go on to state:

"The value commonly used by climate modelers (m= 1.74−0.44i at 550 nm) represents none of the possible refractive indices and should be retired."

Note that this implausible value (1.75 -0.44i) is essentially the one used in the paper. The authors even cite Bond and Bergstrom and I am a little surprised that they did not use an updated value; for example, 1.85-0.71i, which represents the midpoint values of the plausibe ranges of real and imaginary refractive indices.

(4) Section 6.1.1: This section needs more explanation. What exactly is the relationship between Rbc/Rdust and the effective radius? How does the ratio Rbc/Rdust change as the effective radius changes?

(5) Fig. 2.: What's being plotted? What do the color codes mean in this Figure?

(6) Finally, the results could be summarized by integrating the optical property results over an assumed, reasonable size distribution. Then the reader could more easily tell the effect of shape, composition, etc., on the aerosol optical properties. The graphs (Fig. 6 through Fig. 11) are nice, but do not compactly summarize the results. The authors could make a table containing the integrated results, which could provide the reader a lot of information "at a glance".

Technical comments:

These are, alas, too numerous to list. There must on the order of 10ˆ2 or even 10ˆ3 corrections, including typos, which are necessary. Still, the authors have made a good effort to write standard English, and they should be commended for that effort.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 31253, 2010.