Atmos. Chem. Phys. Discuss., 10, C15062–C15065, 2011
www.atmos-chem-phys-discuss.net/10/C15062/2011/

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.

S. K. Mishra et al.

snt@iitk.ac.in

Received and published: 21 April 2011

Reviewer#1

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

Response: All the computations have been performed at wavelength 550 nm and the same has been incorporated in the introduction while discussing about different sec-

tions of the paper in the revised manuscript. (5th para of Introduction section, line # 175-178)

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

Response: The modeled particles are 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.

Response: The authors are thankful to the reviewer for pointing at the revised refractive index of BC at 550 nm. The error has been estimated using suggested black carbon refractive index (1.85-0.71i) for a given effective radius (0.577 μm) and 4% hematite content. The error has been manifested in the Table A (attached as supplement to the comment). The maximum error was found to be 3.8 % in SSA and 3.0% in g for BCBCBC system while maximum error in Qext was found to be 2.4% for two-sphere BCD (composed of black carbon and dust sphere) system.

(3)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?

Response: Section 6.1.1 has been restructured for better interpretation. The effective radius (reff) is fed as the input in the DDA code and the shape parameters (in the input file) are arranged such that the ratio, RBC/Rdust, could be within 1.5-0.9 for the effective radius 0.1-0.8 μm, respectively. In the output file, the number of dipoles (N) and the lattice spacing (d) corresponding to dust and black carbon sphere in the two-sphere system help to calculate volume of the individual sphere (VBC = NBC dBC3 and Vdust=Ndustddust3). Volume of the polluted dust system is given as Vsystem = (4/3) pi reff3 = Vdust+VBC. The ratio RBC/Rdust is calculated from ratio VBC/Vdust. If is outside the considered range for a given effective radius, the shape parameters are modified till RBC/Rdust falls in the considered range.

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

Response: In the two-sphere BC-dust system, the optical properties have been studied for the ratio RBC/Rdust for a given effective radius and for varying hematite content (0, 2, 4, 6 and 8%). The RBC/Rdust is calculated for a given effective radius of BC-dust system with a given hematite content in dust sphere. So, to check the consistency of the model calculated RBC/Rdust for different hematite content, Figure 2 has been demonstrated. It is clear from figure 2 that the RBC/Rdust is independent of hematite content for a given effective radius. The color code in figure 2 shows the variation of RBC/Rdust with varying effective radius. RBC/Rdust is independent of hematite content. As the figure 2 does not add any scientific merit to the paper it has been removed from the revised manuscript and the Figure numbers have been changed accordingly.

(5)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".

Response: The authors are thankful to the reviewer for the valuable suggestion. The size averaged optical properties of the polluted dust systems have been discussed under section 6.3 in the revised manuscript. The final results have been summarized in the Table 3 and 4.

Please also note the supplement to this comment:
http://www.atmos-chem-phys-discuss.net/10/C15062/2011/acpd-10-C15062-2011-supplement.pdf

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