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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effects of internal mixing and aggregate morphology on optical properties of black carbon using a discrete dipole approximation model" *by* B. Scarnato et al.

Anonymous Referee #3

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In this paper, the optical characteristics of the internal mixtures of black carbon (BC) and sodium chloride (NaCl) are studied using the discrete dipole approximation (DDA) computations methods. 2 types of aggregates from SEM and TEM images are presented: bare BC particles composed of monomers of the same size and refractive index; the internal mixtures of the BC with larger non-absorbing NaCl particles. The mass absorption coefficients (MAC), absorption Angstrom exponent (AAE), single scattering albedo (SSA), S11 and S12 are computed, which can be agreed with the experimental data. At last the effects of complex morphological and chemical parameters on the optical characteristics of the aggregates aerosols are discussed. The results of manuscript are very useful to study the climate effect of aerosol, and to improve the accuracy of

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Interactive Discussion

Discussion Paper

aerosol remote sensing retrieval. This manuscript could be recommended for publication at ACP after revision. While you revise the paper, please take the following into consideration.

1. What is the difference between NaCl-containing mixture and sulfate-containing mixture? Previous studies (e.g., Kahnert et al, 2012, see reference on p. 26420) have discussed the aerosol optical properties (AOP) of BC aggregate encapsulated in sulfate shell using DDA method. The morphologies and refractive indices of such simulated aerosol models are quite close. With the same DDA algorithm, the optical properties of NaCl-containing mixture and sulfate-containing mixture should be similar. Though the optical characteristics of BC internal mixed with NaCl may be useful for coastal areas, the support experimental data is lack.

2. In Tab.1 and 2 (P.26424-26425), the comparisons of bare BC and mixtures are not distinct. The input parameters of those bare BC aggregates (e.g., Nm, P) are similar. The monomer numbers of those BC aggregates are also small. If the Nm=50, 100, 200 and 500, the results of those aggregates can be more persuasive. Moreover, the optical properties are averaged for 64 random target orientations in this paper. Kahnert et al computed the sulfate-containing mixtures with 864 discrete angles for obtaining accurate orientation-averaged results. The fewer monomer numbers may lead to less random orientations needed. Furthermore, the porosity of the BC aggregates is introduced for the measurement of the compactness. The commonly used Df should be listed in Tab.1 and 2 if possible to validate it.

3. Fig.1 (P.26426) can hardly show the lacy and compact structures from SEM images. Both bare BC aggregates are chain-like clusters. In my opinion, the main difference between the two images is the monomer numbers. However, the Fig.2 (P.26427) can effectively depict the compactness of bare BC models. Thus, the image of compact BC aggregates should be replaced as the right SEM image in Fig.1.

4. In Fig.3 (P.26428), these curves computed discretely, what is the spectral resolution?

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Interactive Comment

If the spectral samples are few, please mark those points in figures, or explain these wavelengths in detail. Meanwhile, the curves in Fig.3a are close, so different line styles are needed, or the morphologies of models can be simulated more different.

5. The internal mixing types of BC aggregates and NaCl are three, as shown in Fig.4 (26429). Why ignore the type (c) in simulation and analysis? NaCl immersion in BC would be different from the bare BC aggregates and other mixtures. It can be useful for the BC aggregates with considerable monomer numbers with smaller NaCl particles.

6. In Fig.8 and 9 (P.26433-26434), the X-axis should be set from 0 to 180 degree. Please mark 180 degree for these figures. And the legend is not proper located for Fig.8b.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 26401, 2012.