Atmos. Chem. Phys. Discuss., 15, C625–C628, 2015
www.atmos-chem-phys-discuss.net/15/C625/2015/

Atmospheric Chemistry and Physics Discussions
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ACPD
15, C625–C628, 2015

Interactive Comment

Interactive comment on "Perturbations of the optical properties of mineral dust particles by mixing with black carbon: a numerical simulation study" *by* B. V. Scarnato et al.

Anonymous Referee #2

Received and published: 10 March 2015

The article addresses the effect of the aerosol particle shape and mixing on the aerosol optical properties, in particular for BC aggregates attached to dust particles. This topic is highly relevant for climate modelling and remote sensing applications.

Based on the particle morphologies found in aerosol samples collected in field campaigns synthetic particles are generated. Their optical properties are then calculated and studied using the discrete dipole approximation.

This method reasonably links particle shape observations and numerical simulation, which certainly is a good strategy to approach this important subject (albeit not entirely new, see Scarnato et al. (2013)), hence I generally recommend publication in ACP after considering the following suggestions and including minor corrections.

- Because the subject is relevant for climate modelling and remote sensing, it would be convenient for readers working in these fields to compare the optical properties calculated here with such based on approximations commonly applied in climate models and inversion algorithms, e.g., to results from Mie calculations for spherical particles with volume equivalent radius.

- Introduction, end of 1st paragraph: further studies considering core-shell particles (and combinations of internal and external mixing) in global climate models:

Kim, D., C. Wang, A. M. L. Ekman, M. C. Barth, and P. J. Rasch (2008), Distribution and direct radiative forcing of carbonaceous and sulfate aerosols in an interactive size-resolving aerosol–climate model, J. Geophys. Res., 113, D16309, doi:10.1029/2007JD009756.

Klingmüller, K., Steil, B., Brühl, C., Tost, H., and Lelieveld, J.: Sensitivity of aerosol radiative effects to different mixing assumptions in the AEROPT 1.0 submodel of the EMAC atmospheric-chemistry–climate model, Geosci. Model Dev., 7, 2503-2516, doi:10.5194/gmd-7-2503-2014, 2014.

- Technically, the generation of the synthetic BC aggregates is not outlined in detail. What code is used? Is it publicly available? If yes, this would improve the traceability of the results.

- The aspect ratio of the synthetic dust particles is given, but what is the relation between all three side lengths/diameters of the rectangular prisms and ellipsoids? The terms "spheroid" and "ellipsoid" seem to be used synonymously here. However, if in fact spheroids are used (ellipsoids with two of three diameters being equal) as stated in l 6, p. 2496, this should be made clear in Table 1 and also, if they are oblate or prolate. Accordingly, please check the consistent usage and appropriateness of the

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term "rectangular prism".

- In Fig. 1, BC and dust should be clearly distinguishable, e.g., by using different colour tints or markers.

- In Fig. 4, the results are indistinguishable. Colours could help.

- In Fig. 8 (a) for BL2S3 the MAC seems to be plotted instead of the MEC. Generally, Fig. 8 is confusing because some curves and symbols are hard to identify; also the sub-captions only refer to the internally mixed case.

- In Fig. 9, the results for S3 and S5 are drastically different from the results for S1 and S2. Because S2 and S3 differ only by a (moderate) change in the size of the dust particles, at first sight this looks surprising, however the discussion in the last paragraph of p. 2503 is vague. Is it possible to provide a simple qualitative explanation (e.g., does in l 26 "small particles sizes (small size parameter)" indicate that combining small BC particles and big dust particles to big internally mixed particles simply removes all particles from a size range of efficient extinction, analogously to the range 2 pi r / lambda $\sim$ 4 for spherical particles)?

- Table 5 and Fig. 11 are not explicitly referenced in the text (p. 2500, l 27 should probably refer to Table 5, not 4).

- Some typos are in the text, e.g.:

p. 2489, l 24: "indeces" should read "indices"

p. 2492, l 14: "same" should read "some"

p. 2495, l 24: "randomly" should read "random"

p. 2496, l 21: "indeces" should read "indices"

p. 2498, l 7: "Califonia" should read "California"

p. 2500, l 20: "asymmeter" should read "asymmetry"

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p. 2500, l 24: "wavelenghts" should read "wavelengths"

p. 2503, l 26: "small particles sizes" should read "small particle sizes"

p. 2504, l 24: "unpollutted" should read "unpolluted"

p. 2518, Table 2: "indeces" should read "indices"

p. 2523, caption Fig. 1: "Califonia" should read "California"

p. 2529, caption Fig. 7: "repressented" should read "represented"

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 2487, 2015.