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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Black carbon fractal morphology and short-wave radiative impact: a modelling study" *by* M. Kahnert and A. Devasthale

M. Kahnert and A. Devasthale

michael.kahnert@smhi.se

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Response to anonymous referee 2:

When I started career as an aerosol researcher, I had no choice but to use Mie theory for calculating optical properties of black carbon (soot) particles. I was able to cite rich 1970s era literature to support the approach. However, from the moment I had seen the first microscopic photograph of soot particles I knew Mie theory could not be a reasonable approximation.

Therefore I am glad I can review one of the papers improving the treatment of black carbon aerosol in radiative transfer computations. I believe this is an important manuscript, presenting novel and useful results. It certainly warrants publishing it in ACP with only some minor corrections.

Being more lazy than Reviewer # 1, I have a simpler task as there is no need to repeat the same comments. There are however a few (minor) points I would like to make.

We thank the reviewer for his positive evaluation of our manuscript. Below we itemize our response to his comments.

1. *Wherever the authors use phrases like "resulting in a lower TOA radiative impact of spheres" (p. 23118), they should make it clear they mean "lower positive". It may seem redundant and unnecessary but aerosol researchers do assume that "lower radiative impact/forcing" in the case of aerosol means "lower negative" one.*

   We agree with the reviewer's suggestion, and we will make appropriate changes to the revised manuscript.

1. *I would not agree with the statement "Multiple scattering becomes increasingly important as the optical depth is increased. Therefore, the compensating effect of the asymmetry parameter is strongest under more polluted conditions." (bottom of page 23118 and the top of the next one). The shape of the phase function (and therefore the asymmetry parameter) becomes less and less important with each order of scattering as the light field becomes more diffuse. I would therefore argue that this is exactly the reason why with more polluted air (greater optical depth), the effects of lacy and compact aggregates are most similar.*

   We believe that our original text was indeed inaccurate. We agree that at high optical depths multiple scattering will smear out the differences between aerosols with different phase functions. We will correct the text in the revised manuscript accordingly.

2. *The first name in Henyey-Greenstein has been misspelled in page 23118 (an extremely unlucky page it seems). I would also suggest citing the H-G 1941 paper directly (L.C. Henyey and J. L. Greenstein, 1941, "Diffuse radiation in the*

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galaxy,", Astrophys. J. 93, 70-83)

We thank the reviewer for pointing out this mistake. We will follow the reviewer's suggestion and cite the original H-G paper.

3. *Finally, I do not like the automatically (?) created references which include the number of page the reference was cited it. I find it highly misleading. I do hope it is not a new obligatory format in ACP.*

   The references were indeed created by using the ACPD style files. We trust that the copy editor will ensure that the citation style in the final version of the manuscript will conform to ACP standards.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 23103, 2011.