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Comment on acp-2020-1290

Anonymous Referee #1

Referee comment on "Optical properties of coated black carbon aggregates: numerical simulations, radiative forcing estimates, and size-resolved parameterization scheme" by Baseerat Romshoo et al., Atmos. Chem. Phys. Discuss.,
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The manuscript by Dr. Romshoo et al. reveals the influences of BC microphysical and coating properties on its optical and radiative properties. Idealized particles and MSTM are used to give optical properties of BCFAs with coating, and a simple estimation on the radiative is used for the radiative forcing. As expected, the results indicate different influences of different microphysical properties on different optical properties, and a parameterization scheme is presented to estimate BC optical properties. Overall, the manuscript is technically solid and well presented. However, most of the findings are not completely new, and the results are not well discussed. The manuscript could be considered for publication with the following concerns being addressed.

- The novelty of the manuscript is not well presented. As also noticed by the authors, there have been a large amount of numerical studies on the optical and radiative properties of BC with complex coating and morphology. Either the fractal aggregate model or coating scheme has been considered before, and most of the conclusions are also noticed before by similar studies. I think there are may be multiple papers with similar titles. Thus, the authors have to better demonstrate the uniqueness of this study.
- The coating model considered in this study is not well described. Core-shell structure for each independent monomer is reasonable if the coating fraction was relative small, while becomes less realistic if the coating fraction is large. Would the results for $f_{\text{coating}}=90\%$ still be reliable?
- The parameterization scheme of the coated BCFA is a simple fitting for the particles considered in this study, and is such parameterization general enough for others' studies? For example, there are still significant uncertainties on BC size and refractive indices, can those variations be considered similarly to those given by previous studies (<https://doi.org/10.5194/acp-18-6259-2018> and

<https://doi.org/10.1016/j.jqsrt.2018.10.021>). This is really important, and is suggested to be better discussed even if the current variability is still relatively limited.

- The abstract and conclusion session generally summarize the findings from the numerical simulations, and they should also briefly discuss how these conclusions serve wide range of applications related to atmospheric and climate studies.
- The manuscript considers both optical properties (e.g., C_{ext} , C_{abs} , SSA and so on) and the radiative effects. To avoid misunderstanding, "optical properties" instead of radiative properties are suggested.
- The radiative forcing of coated BC has been considered by Zeng et al., which also considered the hygroscopic growth of the particles (<https://doi.org/10.1029/2018JD029809>), and the results from this study is suggested to be compared with theirs.
- The Mie and RDG have well be tested to result in significant errors on estimation of BCFA optical properties, and, considering that the manuscript already has a large amount of results, corresponding results on RDG and Mie are not suggested to be considered in this study.