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Interactive comment on "Modeled source apportionment of black carbon particles coated with a light-scattering shell" *by* Aki Virkkula

Anonymous Referee #2

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Using the Core-Shell Mie theory, this study examines the absorption Ångström exponent (AAE)Âăof BC particles with scattering coating (i.e., ammonium sulfate) by for different size and mode configurations. Then, the contributions of fossil fuel (FF) emissions and biomass burning (BB) to equivalent BC (eBC) in terms of biomass-burning contribution (BB%) are calculated from the simulated AAEs by using Aethalometer model. With these analysis, the author aims to study the potential uncertainties in the widely-used Aethalometer model for source appointment of eBCs. The article is well written, results are clearly described and discussed. I have a major concern related to study approach and experiment design.

If I understand correctly, the simulation experiments are for BC particles coated by ammonium sulfate to represent solely the fossil fuel aerosol type. In other words, the

simulated AAEs are for aerosols without biomass burning components, or BB% = 0. As a result, the calculated BB% that deviate from 0 would indicate uncertainty in source appointment. This is an important and basic experiment setting for the entire analysis and should be clearly stated in the article.

As such, there is a mismatch between the performed analysis and research goal that needs to be justified. As stated in article, the goal of this study is to evaluate uncertainties in the Aethalometer model for source appointment of eBCs. And I would expect to see some simulation experiments for BrC (in addition to FF). However, the entire analysis is for FF only and is unable to represent the case for presence of BrC. Therefore, the analysis in my opinion is incomplete, which primarily addressed the uncertainty for the assumption of AAE = 1.0 (or 0.9) for fossil fuel but not for the assumption of AAE = 2.0 (or 1.68) for BB component.

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