## Detailed replies to Anonymous Referee #2

**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.**

This is a good point. I added these sentences at the end of the introduction:
To state this more clearly, it is assumed that there is only one type of BC particles that can be called fossil fuel BC in the Aethalometer model terminology. Consequently, any deviations from biomass-burning fraction of BB% = 0 indicate uncertainty in the source appointment.

**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.**

There is definitely not even a slightest mismatch between the goal and the analysis.

It is not the goal of the paper to find out whether some pair of $\alpha_{ff}$ and $\alpha_{bb}$ is better than the other. The whole AE model is based on the use of three absorption Ångström exponents: the measured $\alpha_{abs}$ and the preset constants $\alpha_{ff}$ and $\alpha_{bb}$. Different values for these constants have been presented and are in a wide use. In numerous field studies $\alpha_{abs}$ is measured and these constants are used for source apportionment without any supporting data, especially on BC core size distribution or coating thickness. Here I just use these two well-known $\alpha_{ff}$ and $\alpha_{bb}$ pairs and show how large the uncertainties may become just for these two pairs even if BC particles were coated by purely scattering material, not to claim that either of these two pairs is "better".

The goal is not at all to find a good pair. The analysis shows that no constant values are good since BC particle size distributions are not constant, neither their mean diameter nor their coating. They all vary dynamically in the atmosphere. It really does not matter which values of these constants are selected for showing that any constant values will undoubtedly lead to small or large uncertainties of both the BB and FF fractions if no information on the size of the core or the thickness of the shell is available, even if only purely scattering material is coating BC cores.

That is the whole point of the paper.

There is no reason to make simulations using imaginary refractive indices deviating from zero for the coating material. That would be contrary to the goal of the paper. Even the title of the paper reads

*Modeled source apportionment of black carbon particles* ***coated with a light-scattering shell***

It is another story when measurements are used to constrain model results. Then it makes sense to vary the full complex refractive indices of the core and shell(s).