

## ***Interactive comment on “Size-selected black carbon mass distributions and mixing state in polluted and clean environments of northern India” by Tomi Raatikainen et al.***

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We would like to thank Genlin He for the short comment. The comments below are shown with italicized font and our replies with the upright font. The changes to the manuscript and Supplementary Material are given as a supplement with replies to Referee #1.

*I have three short comments:*

*1. Page 1, Line 20: “..., but this also depends on the structure of the particle.” Here, the authors missed several more recent studies on the morphological effects on BC optical properties. For example, He et al. (2015, 2016) showed that different structures for*

*both fresh and coated BC particles can lead to substantial variations in BC absorption and scattering. I suggest including these two studies as references here.*

*References:*

*He, C., Liou, K.-N., Takano, Y., Zhang, R., Levy Zamora, M., Yang, P., Li, Q., and Leung, L. R.: Variation of the radiative properties during black carbon aging: theoretical and experimental intercomparison, Atmos. Chem. Phys., 15, 11967-11980, doi:10.5194/acp-15-11967-2015, 2015.*

*He, C., Takano, Y., Liou, K.-N., Yang, P., Li, Q., and Mackowski, D. W.: Intercomparison of the GOS approach, superposition T-matrix method, and laboratory measurements for black carbon optical properties during aging, J. Quant. Spectrosc. Radiat. Transfer, in press, 2016.*

These two references have been added.

*2. Page 2, Line 17: "..., anthropogenic emissions such as biomass burning ..." Typically, biomass burning is referred to wildfire emission, which is not included in the anthropogenic (i.e. fossil fuel and biofuel burning) emissions. Here, are you referring to agricultural burning? Please clarify.*

Biomass is replaced by biofuel.

*3. Page 9, Lines 12–25: as stated in my first comment, recent studies (He et al., 2015, 2016) have shown that nonspherical/fractal structures of both fresh and coated BC particles can significantly affect BC optical properties and hence optical size during measurement. This could introduce large uncertainty into the optical method. The authors also showed results suggesting highly fractal BC aggregates in the measurement. In addition, the authors assumed the core-shell structure to quantify BC mixing state, which could also bring some uncertainty to their results due to the irregular coating structures in the real atmosphere. Thus, I suggest adding some discussions on how*

*fractal aggregating structures could possibly increase the uncertainty in measurements and analysis.*

We have added discussion about optical sizing uncertainty. Even with these uncertainties, there is a clear difference between optical and mobility sizes, which shows that rBC-containing particles are not spherical. Due to these sizing uncertainties (both optical and mobility), we are not anymore trying to estimate particle compositions.

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