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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biomass-burning-derived particles from a wide variety of fuels: Part 2: Effects of photochemical aging on particle optical and chemical properties" *by* Christopher D. Cappa et al.

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1. The authors refer significantly to the 6 SSA classes and the corresponding particle optical properties. However, they do not make any reference to the underlying particle size distributions as if these optical values should be taken as some size-independent constant. The authors allude to their assumption that these properties are size independent on Line 280 – "suite of intensive optical (e.g. SSA, MAC, AAE)" – which is physically unreasonable. They again treat these properties as size independent in their conclusions. Significant discussion of the underlying particle sizes and their con-

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tributions to the observed optics is warranted.

2. Page 8, Line 221: “The MACBC,pure = 11.8 m2 g-1 (405 nm), 8.8 m2 g-1 (532 nm) and 5.5 m2 g-1 (781 nm).” What are the uncertainties associated with these values? Also, by using a campaign-specific average, the authors are suggesting that the MACBC is a constant (and hence the particle monomer dimensions, etc.) for all the different fuel-stocks involved? The authors should provide a justification or say that it is necessary due to data limitations especially considering that MACBrC is dependent upon these values. The authors allude to this on Line 254, but never provide values or an estimation of this dependence.

3. Page 9, Line 241: “This suggests that the majority of the variability in the MACBC,781nm derives from varying contributions of BrC, rather than in Eabs,coat, and that Eabs,coat is near unity.” While this statement may be true, considering the arguments that the authors have provided, it seems more accurate to say that the individual contributions cannot be separated and therefore it is assumed that Eabs,coat is near unity.

4. Page 10, Line 273: “Grouping experiments by SSA classification is justified given the substantial variability in the primary particle properties between individual burns.” I agree that there is substantial variability between individual burns, but from the data presented in the SI it seems that these ranges are assigned solely to agree with those from McClure et al. (2019) and otherwise appear somewhat arbitrary. My point being, if we were to include uncertainties on some of these derived parameters, e.g. MACBrC, with what level of statistical certainty are these values actually different? Further, how are these parameters affected by the measured size distributions?

Please also note the supplement to this comment:
https://www.atmos-chem-phys-discuss.net/acp-2020-137/acp-2020-137-SC2-supplement.pdf

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