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Comment on acp-2021-49

Anonymous Referee #1

Referee comment on "Rapid transformation of ambient absorbing aerosols from West African biomass burning" by Huihui Wu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-49-RC1, 2021

Wu et al. presented the field aircraft campaign results in investigating a half-day evolution of flaming burning dominated smoke aerosols over the Senegal region. The chemical and optical properties of the smoke aerosols during transport were monitored and analyzed to depict the rapid transformation of the absorbing particles, and they found increasing contribution from secondary BrC in bulk aerosol absorption during the initial aging procedure. There is enormous amount of publications in studying the emission and evolution of biomass burning related light absorbing carbonaceous particle. This study is surely a good addition. **I suggest publication after addressing the following minor comments**.

Minor comments:

- More background information is suggested to provide in the manuscript, including aging environment, exact time profile for the smoke transport and flights (morning or afternoon). Figure S2 should be better moved to manuscript.
- In discussing organic characters as measured by AMS systems, it should be described how to check the possible influence of so-called Pieber effects/artefacts (i.e., Pieber et al., ES&T, 2016; Freney et al., AST, 2019), especially for inorganic salts contributing to a considerable portion of the bulk aerosol.
- Did the authors consider the influence of dynamic inorganic mixing in absorption characterization of smoke aerosol?

Specific comments:

- Page 2 Line 60: change to “though both estimates are associated with considerable

uncertainties."

- Page 2 Lin 61: delete "than this"
- Page 3 Line 75: add "coated" or "internal mixed" before "BrC"
- Page 5 Line 161: where was the impactor installed? Ahead of the PAS?
- Page 6 Line 164: check equation 1, AAE is positive value
- Page 7 Line 198: "Further details in the processing ……"
- Page 8 Line 248: MCE of 0.9 is a simple threshold to classify burning phase, MCE of 0.9 and beyond roughly indicates flaming burning dominated in a fire event.
- Page 10 Line 307: chemical formulas for these specific ions should be added
- Page 18 Line 560-561: Work by Li et al. (2020) was nighttime NO_3 radical reaction that enhanced light absorption by BB-BrC, the reaction pathway should be different from the photochemical aging in the manuscript. Saleh et al. (2003) reported secondary BrC formation in photochemical aging of BBOA, but these secondary BrC had less absorption than primary BrC at wavelength beyond 400 nm. Commonly, OH radical photochemical oxidation diminishes light absorption by primary BrC, unless NOx involving to prohibit the bleaching via new chromophore formation (Li et al., 2019. DOI:10.5194/accp-18-1-2018).
- Page 20 Line 634-635: confused. Do you mean that 20% of the observed aerosol is background one after half-day transport?
- Page 21 Line 661: levoglucosan is not chromophore, the positive correlation between absorption and marker fragment ratio indicated primary BrC emission from biomass burning, and the aging played a major bleaching role.
- Page 21 Line 665: confused. "Chemical reaction loss" means absorption decrease due to reaction or levoglucosan decomposition indicated by *f*60 decrement in aging?
- Page 21 Line 670: do you mean smoldering burning is more efficient in primary BrC emission?