

Interactive comment on “The Vertical Variability of Black Carbon Observed in the Atmospheric Boundary Layer during DAccIWA” by Barbara Altstädter et al.

Anonymous Referee #2

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This paper presents aethalometer measurement from the field experiment DAccIWA conducted in the atmospheric boundary layer in Benin. The campaign is interesting and conducted in a region where better observational coverage is needed, and black carbon in the boundary layer is interesting for a number of reasons. The paper hence provides a topical contribution to the field. However, in my opinion the manuscript needs substantial additional work to improve presentation, message and context.

General comments:

While results are presented clearly and in great detail, I'm struggling to identify and capture the main messages of the study. For instance, the “Conclusion” section does

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not really provide any conclusions or outlooks, and the paper does not contain much in terms of discussion of relevance of results from a broader perspective.

Similarly, a bit more context in terms of why these measurements are important would be useful. E.g., the introduction could focus a bit more explicitly on the importance of BC in the boundary layer in terms of disturbances to turbulence, citing some recent studies such as Wilcox et al. (PNAS, 2016), Talukdar et al. (2019, JGR-atmospheres), Liu et al. (Atmospheric Pollution Research 2018), Gao et al. (ACP 2018).

The language needs to be reviewed and improved. There are a number of somewhat strange and incorrect sentence structures, making the manuscript difficult to follow. And a lot of unnecessary “the”s. Some of the acronyms would be better to spell out.

More specific comments: I think the authors should use the recommendations from Petzold et al. 2013 regarding terminology for reporting measurements of “black carbon” and use EBC here (or at least be clear that the term BC is used as a generic term).

On page 3, it is pointed out that the conditions during the selected cases are unusual for the monsoon period. What does this imply for the representativeness and usefulness of these results?

Suggest combining Figures 1 and 2 as the paper already contains a large number of plots.

Section 2.3.1: a brief introduction to this section about what causes this temperature effect would be very useful for non-experimentalist readers.

Page 6, line 3: how is “acceptable” defined?

Section 2.4: A brief description about the parameterizations of wet and dry removal of the aerosols would be useful.

Page 6, line 31: does the presence of dry and sandy soils present a source of uncertainty in the measurements?

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Page 10, lines 15-17: please check the use of “on one hand (...). On the other hand (...)”.

Page 10, lines 178-19: as the observations do not allow for an investigation of evolution of mixing state, I don't quite see why this information is included.

Page 11, line 3: this statement seems a bit odd – you'd want the observed profile to agree with total modeled BC. Individual size modes may be important for discussion of why the discrepancy with total BC is there.

References: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5081626/>
<https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2018JD029611>
<https://www.sciencedirect.com/science/article/pii/S1309104217306773>
<https://www.atmos-chem-phys.net/18/7081/2018/> <https://www.atmos-chem-phys.net/13/8365/2013/acp-13-8365-2013.pdf>

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