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Comment on acp-2021-766

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Community comment on "Measurement report: Determination of Black Carbon concentration in PM2.5 fraction by Multi-wavelength absorption black carbon instrument (MABI)" by Anna Ryś and Lucyna Samek, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-766-CC1, 2021

This study (acp-2021-766) reported a one-year eBC measurement study in Poland using a multiwavelength absorption black carbon instrument (MABI). MABI is a newly developed offline filter-based absorption photometer that provides more wavelengths (7λ) than the existing OT-21 (2λ) and MWAA (3λ). The application of MABI could provide more information to study the spectral characteristics of light-absorbing aerosols. However, the following concerns need to be addressed.

- Line 105. The assumption of the multi-scattering correction factor C_{ref} =1 is arbitrary. C_{ref} is not only filter type specific (Presler-Jur et al., 2017), but also site specific (Coen et al., 2010). Teflon filter usually has a C_{ref} value smaller than the quartz filter (Pandey et al., 2019). The exact value of C_{ref} can only be determined through co-located field comparisons with a reference instrument (e.g. photo-acoustic spectrometry).
- The MAE_{eBC} used in this study (6.036 m^2g^{-1} @ 639 nm) lacks scientific evidence. Neither the MABI manual nor the recent MABI paper (Manohar et al., 2021) had shown how MAE_{eBC} was derived. The key question is that for the MAE_{eBC} used in MABI, which EC protocol is aligning with? For example, the MAE_{eBC} used in the aethalometer was aligning with EC determined by Lawrence Berkeley Laboratory evolved gas analysis (EGA) protocol (Gundel et al., 1984). The MAE_{eBC} used in MAAP was aligning with EC determined by VDI part 1 protocol (Petzold and Schonlinner, 2004). How MAE_{eBC} was derived was not clear in the current manuscript.
- The use of the delta-C approach for BB-derived eBC was questionable. A study in the UK has shown that the delta-C approach derived BC_{bb} is unreliable (Harrison et al., 2013). The Aethalometer AAE model has its limitations for resolving BC from BB, which is only valid when the variability of AAE is dominated by primary brown carbon. The study by Lack and Langridge (2013) had shown that a transparent coating on BC can also lead to an increase of AAE of BC up to 1.5. As a result, the Aethalometer model/delta-C method is only valid when the primary brown carbon contribution is much higher than the lensing effect. The BC_{bb}/eBC ratio found in this study was lowest in winter, which is unreasonable. Since BB emissions were active during winter, BC_{bb}/eBC ratio is expected to be higher than other seasons. The authors should provide more evidence (e.g. a good correlation between delta-C and levoglucosan or potassium) to prove that this method is suitable for the samples used in this study.

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