Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC2
https://doi.org/10.5194/acp-2021-766-RC2, 2021

Comment on acp-2021-766

Anonymous Referee #2

Referee 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-RC2, 2021

REVIEW of Rys and Samek

Measurement report: Determination of Black Carbon concentration in PM2.5 fraction by Multi-wavelength absorption black carbon instrument (MABI), Atmos. Chem. Phys. 2021-766

https://doi.org/10.5194/acp-2021-766

The authors present results of a more than 1 year measurement campaign in Krakow, Poland, with a new instrument – the Multi-wavelength absorption black carbon instrument (MABI). While the manuscript is a "measurement report", it still lacks vital information to warrant its publication in ACP. The topic is treated superficially. The manuscript does not meet the standard of publication, and I recommend its rejection.

There have been numerous publications on the state-of-the-art absorption filter photometers, ranging from the characterization of new instrumentation (Bond et al., 1999; Drinovec et al., 2015; Ogren et al., 2017), the methodologies to post-process the data (Park et al., 2010; Virkkula et al., 2007; Weingartner et al., 2003), to the measurements, quantifying the limitations of filter photometers (Bernardoni et al., 2021; Yus-Diez et al., 2021). The interpretation of the data from the presented measurement campaign should address the issues described in the literature. I specify the most blatant

omissions below.

The sampling of the filters was performed for 24 hours. With the concentrations reported, there are significant loading effects present (see for example, Bond et al., 1999; Drinovec et al., 2015; Park et al., 2010; Weingartner et al., 2003). These need to be addresses. The loading effects are wavelength dependent and the reported Angstrom exponent alpha=0.6 (the authors should avoid an excessive number of digits beyond any reasonable measurement uncertainty) will increase once this is addressed. The assumption of C=R=1 is probably wrong, but we do not know how this correction is parametrized as there are no links to the MABI manual in the manuscript, and this shall remain an open question.

It is unclear if the epsilon is the absorption coefficient (units m^{-1}) or the mass absorption cross-section (units m^2g^{-1}). If this is MAC, then the explanation on the measurement of mass is lacking in the manuscript.

The wavelength difference method is a very simplistic and non-quantitative way to perform source apportionment and much more sophisticated methods are available in the literature (starting with Sandradewi et al., 2008). The 11.3% BC apportioned to biomass burning should be reported to the nearest 1% and its uncertainty should be determined.

The source apportionment methods using filter photometers use the PM optical properties to determine the contribution of sources to BC. The presented results do not take into account that coal combustion could also result in PM absorbing strongly at low wavelengths. More sophisticated studies in Krakow (Tobler et al., 2021) have opted to use "solid fuel" rather than specifying the fuel type due to this possibility.

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