

Interactive comment on “Evaluating biases in filter-based aerosol absorption measurements using photoacoustic spectroscopy” by Nicholas W. Davies et al.

Anonymous Referee #2

Received and published: 5 March 2019

The manuscript presents an evaluation of three correction methods for filter-based particle absorption photometers using a reference method for particle light absorption. The evaluation is based on data of three different types of ambient aerosol. It is the first study of this kind for these correction methods. The study is within the scope of AMT.

The need for research on this issue has been clearly identified. The applied methods and conclusions are conclusive and clearly presented, the relevant literature has been cited. The paper is well structured and easy to read. Tables and figures reflect the key messages of the text.

The reviewer recommends the manuscript for publication in AMT after the authors have

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addressed following comments.

Page 2 line 29: Particles are mainly collected in fibre filters. The penetration depth also depends on the particle size and influences the sensitivity of the photometer (Nakayama et al., 2010; Moteki et al. 2010). This circumstance should be taken into account in the discussion of the results, since different aerosols were present during the three measuring phases.

Page 9 line 11: The scrubber to remove gases may not be known to all readers. Can the author explain the function, also with the background that potentially present volatile organic material could be removed from the particles.

Page 13 line 13: The authors speculate that dust does not influence the measurements due to the impactor. Could this thesis be supported by other measurements? The reviewer assumes that the cutting characteristics refers to $1.3 \mu\text{m}$ aerodynamic diameter?

Chapter 3.3 and Figure 8: The Angström exponent strongly depends on the source and correction schema as the author points out. The reasons cannot be clarified, but the author can deduce further motivation for this manuscript.

It is noticeable that the B1999 and also the V2010 method have the tendency to suppress large absorption Angström exponents. For the "urban" case with high R_{OA}/LAC ratio (c.f. figure 6) it means that the determination of the organic fraction by means of the Angström exponent would show large errors. For the "Fresh BBA" case, high absorption Angström exponents are measured. The R_{OA}/LAC ratio, on the other hand, is very low. Where do the large values for the Angström exponent come from? Could it be an indicator for mineral dust? In this case, all TAPs correction methods show large values for the Angström exponents.

A deeper aerosol characterization is not the focus of this manuscript. However, the presented results provide another good reason why this manuscript is so important.

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The differentiation of aerosol types by absorption Angström exponents is becoming increasingly important, but as the data show, only with great uncertainties if filter-based photometers are used.

References:

Nakayama, T., et al. (2010). "Size-dependent correction factors for absorption measurements using filter-based photometers: PSAP and COSMOS." *Journal of Aerosol Science* 41(4): 333-343.

Moteki, N., et al. (2010). "Radiative transfer modeling of filter-based measurements of light absorption by particles: Importance of particle size dependent penetration depth." *Journal of Aerosol Science* 41(4): 401-412.

Sandradewi, J., et al. (2008). "Using aerosol light absorption measurements for the quantitative determination of wood burning and traffic emission contributions to particulate matter." *Environmental Science & Technology* 42(9): 3316-3323.

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