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Interactive comment on “The “dual-spot” Aethalometer: an improved measurement of aerosol black carbon with real-time loading compensation” by L. Drinovec et al.

Anonymous Referee #4

Received and published: 12 January 2015

Atmos. Meas. Tech. Discuss., 7, 10179–10220, 2014 The “dual-spot” Aethalometer: an improved measurement of aerosol black carbon with real-time loading compensation

General comments:

English syntax is understandable but not always smooth and readable. This should be reviewed and improved throughout the manuscript.

There is frequent mention of source apportionment but no actual source apportionment was done for this study and manuscript. The loading compensation results and

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the resulting improvement in wavelength dependence of absorption may be important for source apportionment since the accuracy of the results may be improved and uncertainty reduced. A presentation and discussion of the uncertainty in the BC, babs and absorption Ångström exponents with and without the two-spot, real-time filter loading correction is needed in the context of source apportionment. Discussion of source apportionment should be limited to this aspect of the discussion and conclusions with reference to published apportionment studies and the effect of reduced uncertainties of absorption Ångström exponent. At a minimum the effect of the two-spot loading compensation from the several sites (and events within that data) on Ångström exponent should be quantified.

The data, figures and tables, are not consistent with regard to using a common wavelength, defining the wavelength presented or explanation of why a particular wavelength was used in the presentation.

The figures and tabular information in the supplement do not materially add to the discussion and conclusions and can be summarized in a few sentences in the main manuscript. See comments below.

Further comments by page and line.

P10183, line 15, The loading effect has been shown in fact, not just possibly, to depend on absorbing aerosol properties such as size distribution and ageing of the black carbon particles. D. Lack et. al.

P 10185 line 10 Is the third significant digit 7.77 valid and needed? The value 7.7 is used later. This applies to the table in the supplement as well. Reference this number absorption cross section number.

Line 20 ATN and ATNmax should be referenced to the basic eqn. (3) in section 2.4.

P10186, line 1 and 2, and figure 1 The details of figure 1 need more explanation. What controls the flow through filter S1? A mass flow meter is shown but no valve or orifice

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is shown in that flow path. Are the flows critical at the orifices? What are the “different modes of operation” and how do the valve positions relate to them? Alternatively, since modes are not mentioned further, and figure 1 is schematic, it could be simplified. See comment to P 10190 below.

line 19 section 2.3 and 2.4 following Without equations presented later, equation 1 and the associated discussion are not clear. The basic equation, eqn. 3, should be presented first then expanded with terms to account for the various additional terms and corrections including the filter loading effects, both past from references and the present results.

P 10187 line 22 Is the supplemental relative slope, BC(ATN) analysis in Table S2 better or more comprehensive than that of Virkkula? If so, it should be summarized somewhere in the main article in terms of mean value and range over the five sites. The table is not needed.

P 10188 line 9 What is meant by “started to saturate”?

P 10190 The meaning of lateral air flow in the chamber is not clear from the discussion or the flow diagram fig. 1. What is lateral air flow in this case? Is it the lateral air flow within the filter matrix? Is mass flow converted to volumetric at atmospheric temperature and pressure or better yet STP? Specify the flow standard in discussions.

P 10191 The table S2 and caption in the supplement can be eliminated and summarized here as “based on $7.8 \text{ m}^2 \text{ g}^{-1}$ and Ångström exponent of one.”

P10192 Provide more details about the TROPOS site. The general weather condition statements can be deleted unless they are germane to and used in the analysis of the data and loading compensation.

P10192 line 25 Section 2.7 is redundant with previous mention of source apportionment.

P110199 This is not a conclusion unless based on the experimental or model results.



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The improvement in spectral dependence would need to be applied to past source apportionment models to quantify and document the improvement in source apportionment. “Improvements in the determination of the spectral dependence of absorption, as described by the Ångström exponent, allows for real-time high time resolution source apportionment by the AE33.”

Table 4 What were the two or three AE33 instruments used for the first set of correlations? Was this part of the Klagenfurt and TROPOS experiments or an external experiment, i.e. USEPA?

Figure 4 What is the abscissa, not labeled, in figure 4b? Is this binned data from figure 4a? Figure 4a has a significant amount of babs data less than 100 inverse megameters while 4b shows very little in that range.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, 7, 10179, 2014.

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