Comments on

" Correcting aethalometer black carbon data for measurement artifacts by using inter-comparison methodology based on two different light attenuation increasing rates"

by Y.-H. Cheng and L.-S. Yang, submitted to AMTD.

Filter-based absorption photometers suffers from several artifacts bounded to the presence of the filter matrix. One of them consists on a BC concentration depending on the loading of the filter. The paper presents a new method to correct for this loading effect by using simultaneously two Aethalometers with different flows leading to different filter loadings and allowing therefore to correct for the loading artifact. The presented method was applied on a one month and three months measurement campaign in winter and summer, respectively, in an urban environment.

General comments:

This paper presents a method to correct for the loading artifact of the "old versions" of the Aethalometer, since the firma MAGEE Scientific developed a new version AE33 using a similar method to correct for the loading effect (Drinovic et al., 2014). One disadvantage of this method is to need 2 Aethalometers to be applied. Climatology analysis need most of the time not the BC but the absorption coefficient as mentioned by the authors (p. 2862, Equ. 12). The main artifact of AE remains however the multiple scattering effect and the fact that the multiple scattering constant C (used in Equ. 12) depends on several factors not yet completely determined, such as the organic content (Lack et al., …), the aerosol size distribution (??) and the aerosol type (Collaud Coen et al., 2010). In this sense, the proposed correction method does not tackle the main artifact of AE's. This point has to be mentioned anywhere,, so that the reader is aware that this method does not improve the major problem!

The last artifact is a dependence of the BC concentration on the aerosol scattering, which is overcome by the MAAP measuring also the backscattering of the embedded filters. The authors claim that their method also compensate for this artifact, what is however not proved in the paper. This artifact is however a much less important one.

Could you also please comment on the "best flow" to use to minimize the loading artifact ? Would it be good to preload the filter to avoid the greatest loading effects at low ATN ?

Is it possible to apply this method with different versions of the AE, for example an AE31 and an AE16?

Detailled comments:

- P. 2852, line 9: "in absence of sampling artifacts": the sampling is performed by the inlet and is not tested in this study. Did you mean "loading artifact" ?
- p. 2854, line 11: "Collaud Coen" instead of "Collaud Cone"
- Equ. 4: I suppose that you consider that t_0=0 (as said in the text) and also ATN_0=0.

- Have the dotted lines in Fig. 5 similar significance as in Fig. 4? Are Fig 4 and 5 done by fitting the results of the experiment ? if yes, how good are the fits ?
- P. 2857 line 18: “ In this model, the correction factor k is assumed to be fixed for an ATN/Q value”: Fig. 5 shows that this is not the case for very low ATN/Q values. These very low ATN/Q corresponds to very low ATN (ex:if Q=2, ATN=0.2 to obtain ATN/Q=0.1). Has it any signification to plot on such a large scale Fig. 4 and 5? Can you give the limits to obtain a k value that does not depend on ATN/Q ?
- P. 2860, last §: It would be interesting to have an idea about the difference between the k of Drinovec and the one of this study, perhaps to give mean, median and standard deviation for each case at high ATN/Q.
- P. 2861 line 3-5: did you calculate the relation between k and ATN/Q from equation 9? Or is figure 4 an experimental result ? When you speak of “analytical results”, did you mean that you can deduce it from equations ? If yes, can you give the equation for k(ATN/Q) ? If no, can you provide a statistical uncertainty from all the measurements? The same comments can be done for Fig. 5 and 6.
- P. 2861 line 11: it seems from Fig. 5 that k is constantly decreasing with ATN/Q and it becomes not constant as stipulated in the text.
- P. 2861 line 15-17: as already said before, the fact that the effect of the light scattering in the filter matrix can be eliminated is not described/proved.
- P.2862 line 7-9: the C constant depends not only on the filter material, but also on the aerosol properties such as the amount of organic content, the single scattering albedo,…
- P.2862, line 24-25: the proposed correction modify (increase) the Angström exponent, but , without have a reference, it is not possible to know if it is an improvement. It had to be noted than that the three given Angström exponents are in the confidence limits of each other, and that the confidence limits increase with the proposed correction. It seems then to me that the conclusions given in p. 2863 should be revised.
- P. 2863, last § and p. 2864 first §: Is it possible to explain this effect by a different depth of deposition into the filter depending on the flow rate ? Otherwise, do you have other possible explanation ? Can the difference between winter and summer be due to the difference in aerosol concentrations ?
- § 3.5: reading the text, one has the impression that there is great differences between both methods, the slopes presented in Fig. 8 are however always =1!
- Fig. 7 and 8: would it be better to decrease the scale range, even if there is some points at high BC