

Interactive comment on “Reducing uncertainties associated with filter-based optical measurements of soot aerosol particles with chemical information” by J. E. Engström and C. Leck

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The paper introduces a new correction for optical filter-based measurements using aerosol chemical composition to account for the optical effects of non-absorbing particles or low-absorbing particles deposited on the sampled filter. My main questions refer to the validity and suitability of this new correction.

(I) Nomenclature. Since the PSAP instrument is an optical filter-based method that measures the aerosol absorption coefficient, I strongly suggest you use the term “light-absorbing carbon” instead of “soot” when referring to PSAP measurements as suggested by Bond and Bergstrom (2005) and Andreae and Gelencsér (2006). The term

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“soot” is considered vague since it may include any dark-appearing, carbon-containing compound generated in combustion.

(II) Discussion on the chemical correction. The present study by Engstrom and Leck proposes the use of chemical information to apply an additional correction to PSAP measurements. The results obtained when applying this new correction need further discussion.

As described in the Introduction section (page 1200, lines 22-24), the optical effects of non-absorbing particles or low-absorbing particles (such as sulphate, nitrate, mineral dust and sea salt) are reduced by

(a) monitoring the back-scattered light at 40° due to particles accumulated on the filter with a second sensor (section 2.2) and

(b) quantifying the light scattered by the inorganic fraction of the non-absorbing material present on the filter (sections 2.3.2 and 2.4) The light scattered by the inorganic mass fraction of the particles deposited on the filter was estimated by multiplying the total ion mass concentration (determined by ion chromatography, IC) by the mass scattering efficiency specific to the source.

From my point of view, you have to discuss on the mixing state of the aerosol when applying the chemical correction.

The PSAP is a filter-based optical instrument and measures the attenuation of light transmitted through particles that are continuously collected on a filter (Lin et al., 1973). If a particle deposited on the filter has a light-scattering core coated with light-absorbing material, the PSAP instrument will “see” that particle as an absorber material. However, the IC will reveal an inorganic fraction which would be mainly composed of scattering material. According to your chemical correction, that particle might contribute to the light scattering when in fact the particle is an absorber material for the PSAP.

(III) Comparison with other studies (Table 4). I strongly recommend that the authors

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check other aerosol variables available (e.g. PM₁₀ or PM_{2.5} concentrations, particle number concentrations) which are common to the three experiments during the winter season. This might provide more information to determine whether the higher absorption coefficients observed by Corrigan et al. (2006) are related to different aerosol characteristics compared to the other two studies.

IV) How suitable is this chemical correction for optical filter-based measurements conducted at high frequency? Optical filter-based methods (e.g., Aethalometer and PSAP instruments) were developed to provide continuous measurements of the aerosol light absorption coefficient with high sampling frequency (even in the order of minutes). You should comment on the suitability of the chemical correction method when the PSAP is operated on a high sampling frequency on the field which is a rather different situation compared to the way you operated it in the laboratory.

Minor comments.

(V) Linear regression analysis (measured σ'_{ap} and calculated $\sigma_{sp;ionmass}$), section 2.3.2.

You should provide more information on the linear regression analysis you performed between the measured σ'_{ap} and calculated $\sigma_{sp;ionmass}$ such as correlation coefficient and number of samples.

(VI) Add standard deviations in Tables 1, 2, and 3.

References

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