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# An Empirical Correction Factor for Filter-based Photo-absorption Black Carbon Measurements

An Empirical Correction Factor for Filter-based Photo-absorption Black Carbon Measurements

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Long-term observations of black carbon (BC) aerosol provide important information regarding seasonal variations, emission source attribution, and regional distribution & transport. Filter-based BC measurement techniques such as the Continuous Soot Monitoring System (COSMOS) are particularly well suited to this application, due to their relative robustness and reliability. However, caution is required when determining the threshold transmittance, $Tr_{thresh}$ (proportional to the time interval between filter changes), in order to ensure that acceptable measurement accuracy is maintained throughout the sampling period. We present a new, empirically derived transmittance-dependent correction factor used to interpret the response characteristics of filter-based aerosol absorption measurements performed by COSMOS. Simultaneous measurements of ambient BC aerosol mass ($M_{BC}$) were conducted in Tokyo, Japan, using two identical COSMOS instruments operated with different threshold transmittance, $Tr_{thresh}$, values, of 0.95 and 0.6. The derived values for $M_{BC}$ were consistently underestimated by the COSMOS operating at lower $Tr_{thresh}$, as a function of decreasing filter transmittance. The 1-hour averaged values of $M_{BC}$ were underestimated by around 10 %, incorporating measurements across the entire range of filter transmittance (1 - 0.6), with a maximum underestimation at around 17 % immediately preceding filter advancement (i.e. *Tr* = ~0.60), and a minimum of ~1 % immediately following filter advancement (i.e. *Tr* = ~1). An empirical second-order correction factor was derived from these ambient measurements, and was applied to $M_{BC}$ as a function of filter transmittance, resolving the instruments to within 2 %.

Furthermore, the operational performance of COSMOS was tested for a new quartz fibre filter (HEPA). A comparison of different filter types demonstrated a systematic overestimation of $M_{BC}$ of around 6 - 8 % when using HEPA filters. A sensitivity study of a radiative transfer model indicated that this enhanced absorption was primarily a result of the increased thickness of the HEPA filter.

キーワード: aerosol, black carbon, filter-based measurements, absorption
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