

Consistency of urban background black carbon concentration measurements by portable AE51 and reference AE22 aethalometers: effect of corrections for filter loading

ABSTRACT

Located duplicate portable AE51 Aethalometers and a UK Government reference AE22 Aethalometer (the data for the latter were corrected for filter darkening effects using a standard procedure), at an urban background site in Glasgow, UK. The AE51 and the reference concentrations were highly correlated ($R^2 \geq 0.87$) for the combined deployment periods. The application of a previously reported method for correcting the AE51's underestimation of concentrations, associated with filter loading, generally led to an overestimation of values (specifically, the normalised mean bias values for the two AE51s increased from -2% and $+3\%$ to $+14\%$ and $+25\%$ across the full range of measurements after correction). We found only limited and inconsistent evidence that the AE51 Aethalometers (attenuation $[AE51_ATN] \leq \sim 52$) underestimated the eBC concentrations compared to the reference measurements. Thus, our observations indicate that the AE51 can achieve close agreement with the reference AE22 monitor without applying corrections for filter loading at relatively low AE51_ATN values in environments with low eBC concentrations.

Keyword: Air pollution; Equivalent black carbon; Aethalometer; Micro-Aethalometer; Attenuation; Filter loading