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Calibration method for a photoacoustic system for real time source apportionment of light absorbing carbonaceous aerosol based on size distribution measurements

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In this study, we introduce a calibration method with which sources of light absorbing carbonaceous particulate matter (LAC) can be apportioned in real time based on multi wavelength optical absorption measurements with a photoacoustic system. The method is primary applicable in wintry urban conditions when LAC is dominated by traffic and biomass burning. The proposed method was successfully tested in a field campaign in the city center of Szeged, Hungary during winter time where the dominance of traffic and wood burning aerosol has been experimentally demonstrated earlier.

With the help of the proposed calibration method a relationship between the measured Aerosol Angström Exponent (AAE) and the number size distribution can be deduced. Once the calibration curve is determined, the relative strength of the two pollution sources can be deduced in real time as long as the light absorbing fraction of PM is exclusively related to traffic and wood burning. This assumption is indirectly confirmed in the presented measurement campaign by the fact that the measured size distribution is composed of two unimodal size distributions identified to correspond to traffic and wood burning aerosols. The proposed method offers the possibility of replacing laborious chemical analysis with simple in-situ measurement of aerosol size distribution data.