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# Contributions from transport, solid fuel burning and cooking to primary organic aerosols in two UK cities

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Abstract. Organic matter frequently represents the single largest fraction of fine particulates in urban environments and yet the exact contributions from different sources and processes remain uncertain, owing in part to its substantial chemical complexity. Positive Matrix Factorisation (PMF) has recently proved to be a powerful tool for the purposes of source attribution and profiling when applied to ambient organic aerosol data from the Aerodyne Aerosol Mass Spectrometer (AMS). Here we present PMF analysis applied to AMS data from UK cities for the first time. Three datasets are analysed, with the focus on objectivity and consistency. The data were collected in London during the Regent's Park and Tower Environmental Experiment (REPARTEE) intensives and Manchester. These occurred during the autumn and wintertime, such that the primary fraction would be prominent. Ambiguities associated with rotationality within sets of potential solutions are explored and the most appropriate solution sets selected based on comparisons with external data. In addition to secondary organic aerosols, three candidate sources of primary organic aerosol (POA) were identified according to mass spectral and diurnal profiles; traffic emissions, cooking and solid fuel burning (for space heating). Traffic represented, on average, 40% of POA during colder conditions and exhibited a hydrocarbon-like mass spectrum similar to those previously reported. Cooking aerosols represented 34% of POA and through laboratory work, their profile was matched with that sampled from the heating of seed oils, rather than previously-published spectra derived from charbroiling. This suggests that in these locations, oil from frying may have contributed more to the particulate than the meat itself. Solid fuel aerosols represented 26% of POA during cold weather conditions but were not discernable during the first REPARTEE campaign, when conditions were warmer than the other campaigns. This factor showed features associated with biomass burning and occurred mainly at night. Grid-scale emission factors of the combustion aerosols suitable for use in chemical transport models were derived relative to CO and $NO_x$. The traffic aerosols were found to be 20.5 μg $m^{-3}$ $ppm^{-1}$ relative to CO for Manchester and 31.6 μg $m^{-3}$ $ppm^{-1}$ relative to $NO_x$ for London. Solid fuel emissions were derived as 24.7 μg $m^{-3}$ $ppm^{-1}$

relative to CO for Manchester. These correspond to mass emission ratios of 0.018, 0.026 (as NO) and 0.021 respectively and are of a similar order to previously published estimates, derived from other regions or using other approaches.

Final Revised Paper (PDF, 766 KB) Supplement (576 KB) Discussion Paper (ACPD)

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