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Receptor modelling of boreal wildfire associated $\mathrm{PM}_{2.5}$ in Halifax, Nova Scotia, Canada

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During the summer of 2011, 42 days of contiguous $\mathrm{PM}_{2.5}$ filter samples were collected in Halifax, Nova Scotia as part of an international study (BORTAS) to study boreal biomass burning plumes as they travel across Canada towards the Atlantic. This international study was led by the University of Edinburgh in collaboration with partners in North America and Europe. The aim of the $\mathrm{PM}_{2.5}$ filter sampling was to apportion the source contribution to the total $\mathrm{PM}_{2.5}$ mass concentration in Halifax for the purposes of BORTAS. Sampling was conducted on the roof of a Dalhousie University building at a height of 15 m. The building is located in a residential area of Halifax. Continuous black carbon (BC) was measured using a Magee AE-42 aethalometer. Continuous $\mathrm{PM}_{1.0}$ associated organic carbon was measured using an Aerodyne, Aerosol Chemical Speciation Monitor. Daily teflon filter samples were collected for the determination of fine ($\mathrm{PM}_{2.5}$) and coarse ($\mathrm{PM}_{2.5-10}$) particulate mass. An additional, daily, nylon filter was used for the determination of $\mathrm{PM}_{2.5}$ cations and anions by IC. The $\mathrm{PM}_{2.5}$ teflon filter was analysed for 33 metals by XRF and 10 trace metals by ICP-MS. A quartz filter was analysed for the biomass burning marker levoglucosan by GC-MS following derivatization. Excellent agreement ($R^2 = 0.88$) was observed between continuous and filter based measurements with a gradient of 2.76. Median (min:max) fine and coarse PM mass concentrations were found to be 3.9 (0.08:13.7) and 8.5 (0.6:24.9) $\mu\mathrm{g}/\mathrm{m}^3$ respectively. Median (min:max) continuous $\mathrm{BC} = 0.27$ (0.009:3.20); $\mathrm{SO}_4 = 0.10$ (0:2.0); $\mathrm{NO}_3 = 0.033$ (0:0.45); $\mathrm{OC} = 0.80$ (0:14.6); $\mathrm{NH}_4 = 0.054$ (0:0.79); $\mathrm{Cl} = 0.002$ (0:0.09) $\mu\mathrm{g}/\mathrm{m}^3$ respectively. Receptor modelling was conducted using two methods, USEPA Positive Matrix Factorization and USEPA Chemical Mass Balance. The PMF results showed percent source contribution from biomass burning in Halifax to be 8.0%, vehicles 9.9%, ship emissions 6.0%, surficial material 11.9%, long-range secondary ions 64.1%, sea salt 0.1%. A comparison of PMF and CMB model output will be presented. These data provide insight into the source contribution of boreal wildfire plumes to surface $\mathrm{PM}_{2.5}$ mass in Halifax.