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Sources of organic carbon in fine particulate matter in northern European urban air

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Abstract. A major fraction of fine particle matter consists of organic carbon (OC) but its origin is still inadequately known. In this study the sources of OC were investigated in the northern European urban environment in Helsinki, Finland. Measurements were carried out over one year and they included both filter (PM₁) and online methods. From the filter samples OC, elemental carbon (EC), water-soluble OC (WSOC), levoglucosan and major ions were analyzed. Filter data together with the concentrations of inorganic gases were analyzed by Positive matrix factorization (PMF) in order to find the sources of OC (and WSOC) on an annual as well as on a seasonal basis. In order to study the diurnal variation of sources, OC and EC were measured by a semicontinuous OC/EC analyzer and major ions were determined by a Particle-into-Liquid Sampler coupled to ion chromatographs. According to PMF, OC concentrations were impacted by four sources: biomass combustion, traffic, long-range transport and secondary production. On an annual basis the OC concentration was dominated by secondary organic aerosol (SOA). Its contribution to OC was as high as 64% in summer, which besides anthropogenic sources may also result from the large biogenic volatile organic carbon (VOC) emissions in the boreal region. In winter biomass combustion constituted the largest fraction in OC due to domestic wood combustion for heating purposes. Traffic contributed to OC from 15 to 27%. Regarding the diurnal variation, the contribution from traffic was higher from 08:00 to 18:00 on weekdays