Fossil and non-fossil source contributions to atmospheric carbonaceous aerosols during grassland fires

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Wood and grass burning are the major sources of biomass-burning aerosols which are composed mainly of organic matter (Crutzen *et al*., 1979). Approximately 90% of vegetation burning is caused by human-induced fires and only a minor fraction derives from natural processes such as lightning. The main type of biomass burning in Lithuania and surrounding countries in early spring is illegal last year's grass burning for land clearing (Ulevicius *et al*., 2010, Byčenkienė *et al*. 2013).

Continuous air monitoring and time integrated particulate matter sampling were carried out on March 2014 in Preila, Lithuania (55º 55' N, 21º 04' E 5 m above sea level) – a representative coastal background site, an ideal location for studying the long-range transport of air pollutants in the South-eastern Baltic region due to the absence of local sources.

An ACSM (Aerosol Chemical Speciation Monitor, Aerodyne Research, Inc., Billerica, MA, USA) was deployed at site. 1-h time resolution ACSM data were analysed to elucidate the PM1 chemical composition. A graphical user interface SoFi (Canonaco *et al*., 2013), developed at PSI was used to perform a PMF source apportionment of the non-refractory OA mass spectra collected during March 2014. For ^{14}C analysis, the accelerator mass spectrometer MICADAS was used, which was equipped with a gas-capable ion source (Szidat *et al*., 2014). ^{14}C was determined after combustion of filter punches in an elemental analyser, which was directly coupled to the MICADAS. An estimate of fossil and non-fossil primary (POC_f, POC_{nf}) and secondary organic carbon (SOC_f, SOC_{nf}) was achieved by coupling ACSM-PMF results, ^{14}C data and gas chromatography – mass spectrometry organic markers measurements using a CMB approach.

During the event, when grass burning was most intense, the levoglucosan concentration increased up to 683 ng m^{-3}. Concentrations of mannosan varied from 3.10 to 68.0 ng m^{-3} and galactosan 1.02 – 12.0 ng m^{-3}. Organics (46 %, 3.2 µg m^{-3} (σ = 4.8 µg m^{-3})) composed the major fraction of the NR-PM1 aerosol concentration composition with lower contributions from sulphate (17 %, 1.2 µg m^{-3} (σ = 1.1 µg m^{-3})), nitrate (20 %, 1.4 µg m^{-3} (σ = 1.8 µg m^{-3})), ammonium (15 %, 1.00 µg m^{-3} (σ = 0.9 µg m^{-3})), and chloride (2 %, 0.1 µg m^{-3} (σ = 0.3 µg m^{-3})). A further separation between fossil and non-fossil primary and secondary contributions to total carbon (POC_f, POC_{nf}, SOC_f, SOC_{nf}) was obtained (Fig. 1).

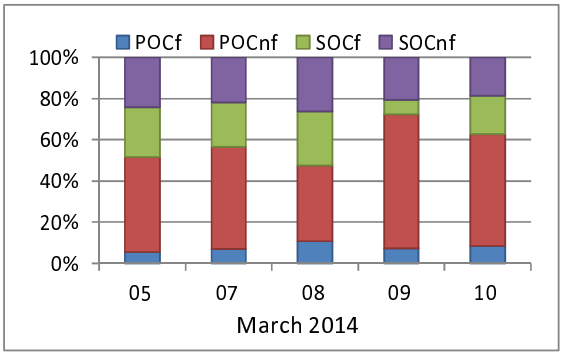

Figure 1. Median percentage contributions of different sources to total carbon.

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