Multiannual seasonal analysis of submicron aerosol variability and organic fraction sources at Magurele site

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Long-term measurements of submicronic non-refractory aerosols are highly valuable to study aerosols hourly, daily or season patterns. The aim of this study is to characterize organic submicronic aerosols variability and their sources for each season based on multiannual data. The ambient measurements have been performed at Magurele site (44.35 North, 26.03 Easth, 93 m ASL), located in the suburbs of Bucharest, representing an eastern European, continental site. It has temperate–continental climate and is usually influenced by heating, agriculture activities and traffic.

Several collocated instruments (aerosol chemical speciation monitor, Aethalometer AE33, meteorological station) are continuously used to measure the concentration, chemical composition and optical properties of aerosols. Source apportionment using positive matrix factorization controlled via the source finder (Canonaco et al., 2013) has been performed for four years (not continuous) of measurements (2014-2018) to identify and quantify the organic aerosols sources. We took into account at least two periods of each season. The aerosol chemical speciation monitor (ACSM) has been periodically inter-calibrated against other European systems in the frame of ACTRIS network (Crenn et al. (2015) for data quality assurance. Additional meteorological and black carbon (BC) data have been used besides ACSM data to validate the results.

The organic aerosols (OA) represented around 60% of the total aerosols concentration during the entire measurement period. This fraction was apportioned into four factors. The primary organic aerosols have been identified to be hydrocarbon OA (HOA, 16.46 % of OA) and biomass burning OA (BBOA, 23.87 %). The secondary components are oxygenated OA (OOA, 33.20 %) and a secondary biomass burning OA (OOA2-BBOA, 26.47%). The diurnal variations of factors (Figure 1 upper panel) show two peaks during morning and traffic hours for HOA factor. The hourly variation of the first factor attributed to fossil fuel is highly correlated to external measurement of BC (dotted line). Correlation of 75% is identified as well between the second factor, BBOA, and BC wood retrieved from the AE33. The OOA factor has similar diurnal trend and significant concentration all over the year. In Figure 1 lower panel are presented the mass spectra of each factor alongside literature spectra and values used to constrain the results.

Source apportionment of organic aerosols divided into seasons revealed three to four characteristic factors. Usually two of them are primary and two secondary OA. Spring season is characterized only by three factors, two primary (HOA, BBOA) and OOA. BC wood has a correlation of at least 0.65 with BBOA factor for all seasons.

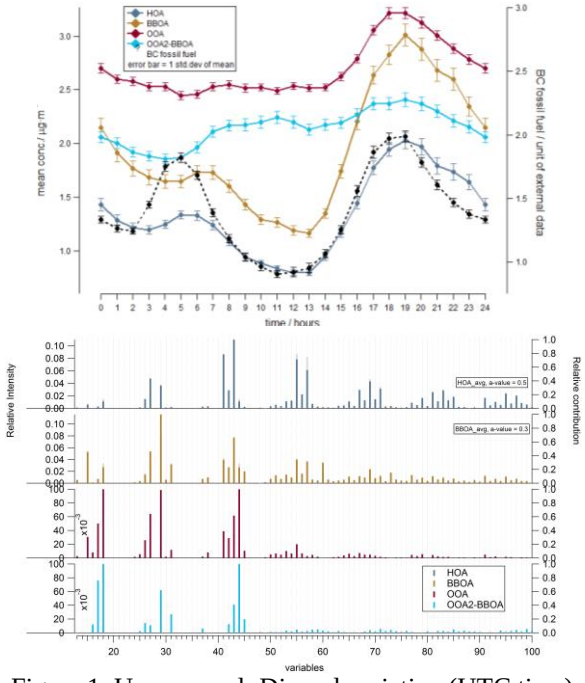

Figure 1. Upper panel: Diurnal variation (UTC time) of organic aerosols factor concentration for the entire period. Lower panel: Mass spectra of factors. Blue: HOA, Yellow BBOA, Red: OOA, Turquoise: OOA2-BBOA, Black: external tracer BC fossil fuel

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