

## Biomass burning influence in the urban environment of southern Spain

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The presence of ambient aerosols has adverse effects on human health and affect climate. Fine particulate matter (PM<sub>1</sub>, particles with an aerodynamic diameter <1 µm) may have its origin in several sources and is mainly comprised of secondary inorganic compounds and carbonaceous aerosols, the latter reaching up to 90% of the mass.

The city of Granada is a medium-sized city located in the southeast of Spain and surrounded by mountains. Large seasonal temperature differences throughout the year are registered due to the near continental conditions. The carbonaceous aerosol in Granada accounts for 40% of the bulk PM<sub>1</sub> concentration in winter, and it has been attributed to traffic exhaust and regional recirculation (Titos *et al.*, 2014), hence the necessity to investigate its sources with state-of-the-art instrumentation to better identify the sources becomes evident. Therefore, the present study aims at assessing the submicron aerosol chemical composition and organic sources in Granada during an intensive 2-months campaign by using on-line measurements.

An aerosol chemical speciation monitor (ACSM, Aerodyne Research Inc.) was deployed at an urban background site (37.18°N, 3.58°W, 680 m.a.s.l) from 16 December 2015 to 15 February 2016 to measure real-time submicron inorganic (nitrate, sulphate, ammonium and chloride) and organic aerosol (OA) concentrations. Real-time black carbon (BC) concentrations were calculated from the absorption measurements carried out by a multi-angle absorption photometer (MAAP). The particle number size distribution was measured using a Scanning Mobility Particle Sizer (SMPS, TSI), set to sample between 12 nm and 600 nm. 24-h PM<sub>10</sub> and PM<sub>1</sub> samples were collected on filters every third day and subsequently chemically analyzed. The organic mass spectral data matrix from the ACSM will be used to carry out the source apportionment of OA applying Positive Matrix Factorization (PMF) using the Multilinear Engine (ME-2) with the toolkit SoFi (Canonaco *et al.*, 2013).

The ACSM + BC concentrations agreed reasonably well with the estimated mass concentration from the SMPS measurements, with a squared Pearson correlation coefficient  $R^2=0.88$  and a slope of 1.69. The 70% difference may be due to the different upper cut sizes of the two instruments, i.e. whereas the ACSM samples up to 800-1000 nm, the SMPS was set to sample up to 600 nm, so the mass in this size range could be the

responsible. Other factors affecting this difference will be investigated.

The PM<sub>1</sub> average concentration during the campaign (calculated as ACSM + BC concentrations) was 24 µg m<sup>-3</sup>. It was dominated by OA, accounting for 50% of the PM<sub>1</sub>, followed by the contribution of BC (17%), nitrate (16%), sulphate (9%) and ammonium (6%). This distribution did not change significantly between weekdays and weekends.

The OA and BC concentrations correlated relatively strongly ( $R^2=0.55$ ), which points to common sources, either road traffic emissions or biomass burning emissions. The relative amount of the biomass burning tracer at  $m/z$  60 reaches values up to 0.9% of the total OA, which is well above the threshold determined by Cubison *et al.* (2011), so the influence of wood burning is clear. The source apportionment to the OA fraction will further confirm the existence of these sources and will quantify their different contributions.

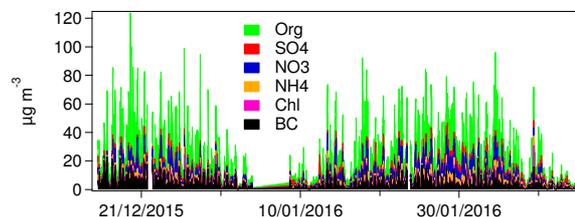


Figure 1. Time series of BC, OA (Org), sulphate, nitrate, ammonium and chloride concentrations.

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