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Regional background aerosols over the Balearic Islands over the last 3 years: ground-based concentrations, atmospheric deposition and sources

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In the context of the ChArMEx (The Chemistry-Aerosol Mediterranean Experiment, https://charmex.lsce.ipsl.fr) initiative, a 3-year study over a regional background environment (Can Llompart, CLP) in Mallorca has been conducted. Ground-based PM mass concentrations, gaseous pollutants and meteorological parameters were continuously registered from 2010 to 2012. Since the beginning of the campaign, PM10 daily samples for chemical determinations were obtained every 4 days, and dry and wet deposition samples were collected every week. Moreover, additional instruments (condensation particle counter, multi-angle absorption photometer, airpointer, sequential high and low volume samplers) were deployed during intensive filed campaigns in 2011 and 2012, as well as the sampling frequency was intensified. In the laboratory, PM samples were analyzed for inorganic compounds, and organic and elemental carbon following different approaches. In addition, n-alkanes, iso-alkanes, antiso-alkanes, levoglucosan, alkanoic acids and cholesterol were determined by GC-MS chromatography in a selection of 30 samples.

Mean PM10, PM2.5 and PM1 concentrations in the period 2010-2012 reached 17, 11, and 8 μg/m3 respectively. Mass concentrations displayed marked seasonal trends, with much higher background levels in summer due to stagnant conditions over the western Mediterranean and increased frequency of Saharan dust events. Likewise, diverse-intensity peaks of coarse PM due to African dust inputs were observed along the year. On average, African dust in PM10 accounted for 1.0-1.5 μg/m3. Sporadic pollution events, characterized by most of the particles in the fine mode, were related to the transport of anthropogenic polluted air masses from central and eastern Europe.

Wet and dry atmospheric deposition samples are being analyzed to quantify the deposition fluxes for different soluble and insoluble compounds.

On average, PM10 composition is made up of organic matter (23%), mineral components (17%), sulphate (14%), sea spray (10%), nitrate (7%), NH4 (7%) and elemental carbon (1%), with 21% of the mass unexplained (though as being principally water).

Intensive sampling campaigns were positive to assess the concentrations of black carbon and number of ultrafine particles and their time-variability. Accordingly, black carbon followed a similar pattern to that of PM1 but also displayed fresh anthropogenic inputs from road traffic. Number concentration peaked frequently at midday because of new-formation of particles from photochemical reactions, occasionally at hourly values above 100.000 particles per cm3.

A preliminary source exploration by means of Principal Component Analysis has been done with the 30-samples group characterized more in detail in terms of chemical determinations. This first examination encountered 6 sources: mineral, sea spray, biomass burning, regional pollution, industry and biogenic emissions.

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