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New insights on aerosol sources and properties of Organics in the west Mediterranean basin

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The Mediterranean basin exhibits high PM concentrations for a marine area, in particular during the dry season (summer), associated with high photochemistry. The large population of the basin is impacted by both natural and anthropogenic aerosols of various sources from Europe and North Africa. Simulations predict significant climate changes in that area, with less precipitation and hotter temperatures, reinforced by an increasing anthropogenic pressure, which will be linked by higher emissions of pollutants and also by higher impacts on the health. Nevertheless the aerosol models in that area currently suffer from large uncertainties, due to a lack of knowledge in organic aerosol (OA) sources and processes.

As part of the French program ChArMEx (The Chemistry-Aerosol Mediterranean Experiment, http://charmex.lsce.ipsl.fr), a 5-week intensive campaign has been performed in June - July 2012 at the new Cape Corsica station (see Dulac et al. in that session), and aiming at a better characterization of anthropogenic versus biogenic aerosols, long range transport versus local influence, with a focus on fine OA.

A complete instrumental strategy was deployed thanks to the contribution of a large French community: PM_1 concentration every 6 min with a TEOM-FDMS 1405 (Thermo), major aerosol components in PM_1 every 30 min (Organics, SO_4, NO_3, NH_4) by Aerosol Chemical Speciation Monitor (Aerodyne), Equivalent Black Carbon every 5 min with a 7-λ aethalometer AE31 (Magee Scientific), on-line major anions and cations (incl. light organics like oxalate & MSA) every 10 min with Particle-Into-Liquid Sampler (PILS, Metrohm) coupled with Ion Chromatographs (Dionex), on-line water-soluble organic carbon (WSOC) every 4 min with a PILS (Applikon) coupled with a Total Organic Carbon instrument (Ionics). Filter sampling in $PM_{2.5}$ and PM_{10} was also performed every 12h for quality purposes (PM, EC/OC, ions) and for complementary measurements (metals by ICP-MS and organic tracers by LC-MS). Additional measurements of reactive gases (CO, O_3 and VOCs), and of aerosol optical/physical properties (scattering, extinction, size distribution) were used for a better identification of air masses origin and optical/number closure studies.

Backtrajectories issued from Hysplit 4.9 revealed the predominance of air masses from North-West to South, with some dust events from North Africa (Morocco, Algeria) and a few anthropogenic events from Italy and from South-East of France. Two intense heat waves, associated with low wind speed, gave the highest levels of OA observed during the campaign, suggesting a possible local biogenic origin. The comparison of these heat waves showed contrasted levels of WSOC, oxalate, OM-to-OC ratio suggesting various sources and/or processes.