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Physico-chemical characterization of Mediterranean background aerosol at the Capogranitola observatory (Sicily)

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The Mediterranean basin is characterized by elevated aerosol amounts and co-existence of different aerosol types, both natural and anthropogenic, while it is one of the most climatically sensitive areas. Therefore, it offers ideal conditions for studying aerosol processes and aerosol-climate interactions.
An intensive aerosol physico-chemical characterization campaign was held at the Environmental-Climatic Observatory at Capo Granitola (Sicily; 37.5753° N, 12.6595° E) during April 2016, under the framework of the project Air-Sea Lab. The Observatory is located at the coast-line, facing the Strait of Sicily, and is part of the national I-AMICA network (http://www.i-amica.it/i-amica/?lang=en).
Sub-micrometer aerosol chemical composition was measured by high resolution time of flight aerosol mass spectrometer (HR-ToF-AMS), for the first time at Capogranitola. Sea-salt concentration was estimated from AMS measurements following Ovadnevaite et al. (2012). For a complete mass closure of the submicron aerosol, black carbon (BC) concentration was derived from multiangle absorption photometer (MAAP) measurements. Positive matrix factorization was deployed to investigate organic aerosol (OA) sources at the site.
Aerosol chemical composition confirms that Capogranitola is a representative background site, with generally low contribution of BC and nitrate and highly oxidized OA. In particular, aerosol sampled in the marine sector (130-310°) is less affected by local sources and it is likely representative of the central Mediterranean background. Aerosol in background conditions is dominated by sulfate and OA (37% and 31%), followed by ammonium (12%), sea-salt (10%), BC (6%) and nitrate (3%). The average reconstructed sub-micrometer aerosol mass in background conditions is 3.7 ± 2.3 μg m^{-3}. OA source apportionment shows a minor contribution from primary sources, with hydrocarbon-like OA (HOA), from fossil fuel combustion, contributing for 3% and biomass burning OA (BBOA) for 2%. Oxidized OA (OOA) dominates the rest of OA mass. In particular, OOA1 and OOA2 (70% in total, OM:OC $\sim$ 2.5) represent the result of prolonged atmospheric processing of OA, while OOA3 (25%, OM:OC $\sim$ 2.0) clearly represents fresher inputs of OOA from land. Investigation of HOA and BC time trends suggests that HOA in background conditions may be strongly contributed by ship traffic more than by land sources.
The representativity of the background aerosol collected at Capogranitola will be discussed by comparing with measurements performed in parallel at the other I-AMICA southern Italy coastal stations and with those acquired in a subsequent cruise (May-June 2016) around the Italian Peninsula. Aerosol climate relevant properties, in relation with chemical composition, will be also presented and discussed.

Ovadnevaite J. et al. (2012), J. Geophys. Res., 117, D16201.