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Characterization of PM sources in Cyprus and link with their geographical origin

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Located in the Eastern Mediterranean, Cyprus is surrounded by Middle East countries and lies at the crossroads of long-range transported air pollution from Africa, Europe and Asia¹. Because concentration levels of air pollution and Particulate Matter (PM), especially, are particularly high in the region, they play a critical role in regional climate and have major adverse health effects². However, still very little is known on the main sources of PM affecting Cyprus and their geographical origin, preventing the definition and implementation of efficient local mitigation plans.

In the framework of AQ-SERVE and EMME-CARE research projects, 24-h integrated PM filter samples were collected continuously for a period of one year spanning from summer 2016 until summer 2017 at 4 representative locations in Cyprus (urban backgrounds, traffic, and regional background) and analysed with respect to 10 major ions, elemental and organic carbon, main carbohydrates (5 species), 28 major and trace metals and 104 trace organic compounds. To investigate the main PM sources affecting these different locations, source apportionment was performed using US EPA PMF5.0³ whereas the Lagrangian model FLEXPART along with the Potential Source Contribution Function (PSCF) allowed the identification of their geographical origin. The local and regional contributions to PM mass concentrations were estimated by application of the Lenschow approach⁴.

Although Sahara and Middle East were identified as the main sources of mineral dust in Cyprus, their chemical composition significantly differ, the latter (Middle East) being loaded not only with crustal elements but also with species from anthropogenic sources such as ammonium sulfate and carbonaceous species which made the PM mass the highest among all PM clusters and highlighting a complex dust-pollution aerosol mixture over this region.

Preliminary source apportionment results indicate a predominance of Regionally-processed factor (mainly secondary in nature) contributing alone more than 30% at the urban sites and up to 60% at the regional background station; industrial and power plant emissions from eastern Europe and Turkey being responsible for this high loading in secondary aerosol. Among the identified sources,

traffic and biomass burning are mainly emitted locally (within cities) (85 and 70%, respectively). Surprisingly for a region that is strongly impacted by desert dust, the share of local and regional sources was almost equal for dust (44 and 56%, respectively).

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