Long-term time series of daily PM_{10} chemical composition in the area of Rome, Italy

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MED-PARTICLES (Particles size and composition in Mediterranean countries: geographical variability and short-term health effects, http://www.epidemiologia.lazio.it/medparticles/index.php/en/) is a LIFE+ project aimed to investigate the health effects of short-term exposure to ambient air pollution in the Mediterranean Basin and to obtain a better understanding of particulate air pollution characteristics in some cities of the Mediterranean area. In the framework of this project, particular attention is drawn to the study of the interconnections between respiratory / cardio-vascular health and chemical composition of atmospheric particulate matter. To obtain this goal of the project, long-term data series of PM components are required.

Two sites in Central Italy provided data to the MED-PARTICLES project: the urban background site of Villa Ada, located inside a green area in the centre of Rome and at the peri-urban site of Montelibretti, sited at the distance of 22 km, NW of the city. At these two sites, both run by the CNR Institute of Atmospheric Pollution Research, daily PM_{10} composition was continuously investigated for three years at Villa Ada (2005 – 2007) and for six years at Montelibretti (2005 – 2010).

Each day PM_{10} was sampled on two side-by-side membrane filters: the first one (quartz) was devoted to the determination of elemental and organic carbon by thermo-optical analysis, the second one (Teflon) was aimed at measuring the mass concentration by the beta attenuation method and at determining element concentration by energy dispersion X-ray fluorescence and ion concentration by ion chromatography. A total of 24 daily chemical determinations were carried out during the six investigated years.

By using a few simple algorithms, the obtained chemical composition data were re-arranged in order to obtain the mass closure (agreement between the determination of the PM mass and the sum of the chemical components) and to estimate the strength of the main PM macro-sources: soil, sea, secondary reactions of inorganic species, combustion processes, biosphere (primary and secondary organics), as described in Perrino *et al.* (2009) and Perrino *et al*. (2010).

Seasonal and annual variations of PM composition were evaluated, both as single chemical components and as macro-sources. Figure 1 reports an example of the variations in the strength of the five macro-sources during the years 2005 and 2006 at the Montelibretti site.

Seasonal variations were observed particularly for soil components (increase during the summer due to higher soil dryness) and for organics (higher values during the winter, up to reach about 50% of the total PM_{10} mass).

The differences in the PM_{10} mass concentration and chemical composition at the urban background and the peri-urban sites were also evaluated. Very similar results between the two sites were obtained for crustal components (mainly for Al, Si and Ti), for secondary species (ammonium, sulphate and, at a less extent, nitrate), which are almost homogeneous on a regional space scale, and for the main sea-spray components (sodium and chloride). Higher values were found at the urban background site for the species that are mainly generated by exhaust and non-exhaust traffic emission (elemental carbon, iron, copper, manganese, lead, zinc, Canepari *et al*., 2008), while variable difference were found for organic components, which are emitted by a variety of different sources.

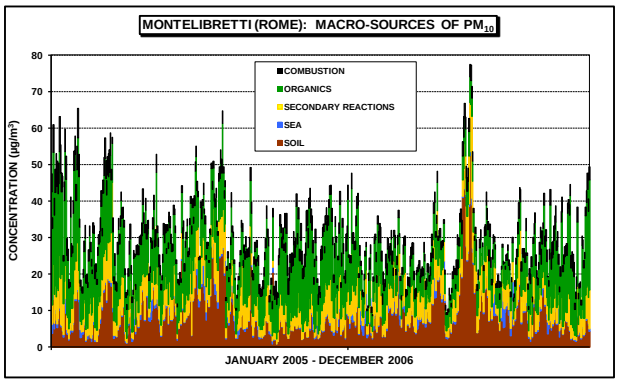

Figure 1. Macro-sources of PM_{10} in the peri-urban site of Montelibrettti during 2005 and 2006.

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