Study of PM10 in a polluted area in Tuscany in the proximity of a waste incinerator

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Montale is a small town in Tuscany characterized by high PM10 levels. There are many concerns in the population and in the press about the causes of the high levels of pollution in this area, mainly because there is a waste incinerator plant close to the town. The Regional Government promoted an extensive field campaign for the aerosol characterization in Montale, to give to policymakers the knowledge and the tools for a significant reduction of the main anthropogenic emissions.

Standard (daily) sampling allow the study for a long period covering all the seasonal changes in aerosol composition; nevertheless, the composition itself may also change in a few hours because of the variability of the different sources and of the weather conditions.

Daily PM10 samples were collected for 1 year by a FAI Hydra Dual sampler and analysed by different techniques in order to obtain a complete chemical speciation (elements by PIXE and ICP-MS, ions by Ion Chromatography, elemental and organic carbon by a thermo-optical instrument). Hourly fine (< 2.5 μm) and coarse (2.5-10 μm) PM samples were collected for shorter periods (in winter and in summer) by the Streaker sampler and hourly elemental concentrations were obtained by PIXE analysis.

Positive Matrix Factorisation (PMF) was applied to the data set (daily and hourly samples separately) aiming at the identification and quantification of the major aerosol sources, using the EPA PMFv5 software.

The concentrations of PM10 were lower in spring/summer, with values usually between 10 and 20 μg /m^3. PM10 levels in winter were far higher with many concentration peaks around 100 μg /m^3 (up to 174 μg/m^3 on December 20th). This is due to the typical local weather conditions with higher atmospheric stability, a reduced height of the boundary layer and a poor dispersion of the pollutants themselves.

PMF identified 10 sources for PM10.

Biomass burning, mainly correlated with OC and EC and tracers as K, Zn, Br and Pb, was the source that gave the most important contribution to the PM10 mass (30% as annual average and more than 40% during the most polluted days with PM10 > 50 μg/m^3). The contribution of the incinerator source, mostly composed by EC, OC, ammonia and traced by specific elements (Cl, Pb, Cd, Zn), was present during all the campaign and it was estimated as only 2% of PM10.

Hourly time resolution and size segregated data allowed a better identification of the different sources. For example, K in the fine fraction is characterised by peaks in the late afternoon due to biomass burning for domestic heating, while the coarse fraction shows a completely different trend, correlated with those of the other crustal elements.

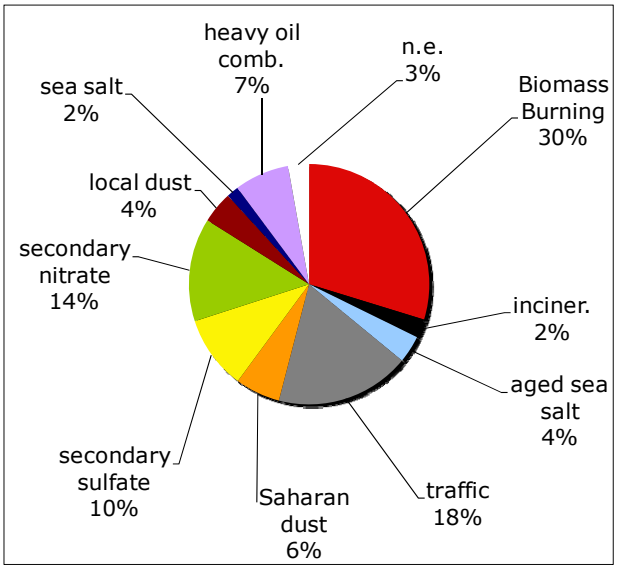

Figure 1. Percentage contributions of the different sources of PM10 (average on all the sampling period).

PMF identified 7 sources for fine fraction and 5 for coarse fraction, with similar source profiles as those obtained for daily data.

Source polar plots, indicating the correlations between the sources and the main wind directions and velocities, reinforced the identification of the sources.

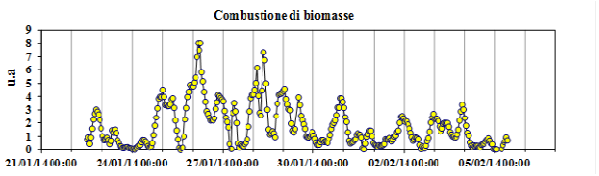

Figure 2. Hourly contribution of the biomass burning source obtained by the streaker data.

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