

## High-time resolved characterization of PM<sub>1.0</sub> in a peri-urban site near Rome, Italy

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Keywords: HR-ToF-MS, PM<sub>1.0</sub>, real-time, chemistry

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The chemistry of sub-micron particles with high time-resolution was investigated in a peri-urban site close to the city of Rome (Italy). The “A. Liberti” Observatory is an experimental facility included in the EMEP network that is located in Central Italy 25 km far from the metropolitan area. The study site is positioned in the eastern edge of the Tiber valley in front of the Sabini mountains (50 m a.s.l.). The area is characterized by a low density of industrial emissions and by particular meteorological conditions that favour the occurrence of anthropogenic aerosols emitted in the metropolitan area (Perrino et al, 2009).

The submicron particulate mass at the considered measuring station is constituted by a large fraction (20 – 90 %) of organic aerosol (OA) whereas the rest of the mass consist of soot, inorganic salts and elements. As well known PM constituents can be divided in primary, directly emitted in the atmosphere by anthropogenic sources (e.g., traffic, industries and domestic combustion), and secondary, that are formed in the air through physical-chemical processes (e.g., oxidation, nucleation or condensation). While submicron secondary inorganic aerosols are mainly composed of ammonium nitrate and sulfate (Seinfeld and Pandis, 2006), secondary organic aerosol (SOA) may be composed of thousands of compounds, many of which are unknown (Goldstein et al, 2008), and further uncertainties exist in SOA formation pathways (Hallquist et al, 2009).

The integration between different techniques, in-line and off-line, highly time resolved and accumulated over long periods, represents a promising approach for filling the cognitive gap about direct emission sources and secondary formation mechanisms.

The experimental campaign (30 days) started in January and terminated in early February of the current year. The scheduling was defined in order to join this activity to the EMEP – ACTRIS intensive measuring winter period. The in-line data were obtained sampling from a Nafion-dried line and analysing the resulting aerosol with an Aerodyne HR-ToF-MS, configured to acquire information in V and W modes, and with a Scanning Mobility Particle Sizer (SMPS). Additional real-time information were obtained using an optical particle counter and gas analyzers (O<sub>3</sub>, NO<sub>x</sub>, CO<sub>2</sub>). Meteorological information were recorded using a standard meteorological station and monitoring atmospheric stability conditions with a Rn-daughters detector (PBL). Off-line determinations were carried out on PM<sub>10</sub> and PM<sub>2.5</sub>, collecting samples on both teflon and quartz membranes, accumulated on a 24h basis and on 3h intervals for only three days. Filters were successively analyzed by X-ray

Fluorescence (XRF), Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Ion Chromatography (IC) and thermo-optical analysis in order to determine major elements, micro and trace metals, soluble ions and elemental/organic carbon content respectively.

This campaign is the first attempt to characterize the submicron aerosol near Roma on real-time. The availability of such large amount of information represents a good opportunity to integrate data derived from AMS measurements and obtained by traditional off-line techniques. In details traditional techniques have been used for obtaining the mass closure and consequently estimating the PM macro-sources (i.e. crustal, organic, anthropogenic, sea-salt and secondary inorganic). At the same time, real-time data have also provided an estimation of different aerosol components. OA can be separated into oxygenated OA (OOA), hydrocarbon-like OA (HOA), and sometimes other components such as biomass burning OA (BBOA). Furthermore, an additional important comparison can be done on the secondary inorganic aerosol (i.e. ammonium, sulphates and nitrates), which are clearly detected by AMS.

This preliminary results evidenced the possibility to complete the description of aerosol dynamics at different time scales. The traditional investigations made on PM<sub>10</sub> and PM<sub>2.5</sub> at daily and at 3 hours basis were integrated with real-time measurements that supported the detection of high-time resolved aerosol variations close to the city of Rome.

Goldstein, A.H., Worton, D.R., Williams, B.J., Hering, S.V., Kreisberg, N.M., Panic, O. and Gorecki, T. (2008) *J. Chromatogr. A*, **1186**, 340–347.

Hallquist, M., Wenger, J.C., Baltensperger, U., Rudich, Y., Simpson, D., Claeys, M., Dommen, J., Donahue, N.M., George, C., Goldstein, A.H., Hamilton, J. F., Herrmann, H., Hoffmann, T., Iinuma, Y., Jang, M., Jenkin, M.E., Jimenez, J.L., Kiendler-Scharr, A., Maenhaut, W., McFiggans, G., Mentel, Th.F., Monod, A., Prevo, A.S.H., Seinfeld, J.H., Surratt, J.D., Szmigielski, R. and Wildt, J. (2009) *Atmos. Chem. Phys.*, **9**, 5155–5236.

Perrino, C., Canepari, S., Catrambone, M., Dalla Torre, S., Rantica, E. and Sargolini, T. (2009) *Atmos. Env.* **43(31)**, 4766–4779.

Seinfeld, J.H. and Pandis, S.N. (2006) *From Air Pollution to Climate Change*, John Wiley & Sons.