Particle characterization using two on-line instruments (PILS and AMS) during MEGAPOLI intensive campaigns in Paris

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During the MEGAPOLI (Megacities: Emission, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation) intensive campaigns (summer 2009 and winter 2010), a Particle-into-Liquid-Sampler (PILS) and an Aerodyne Aerosol Mass Spectrometer (AMS) were deployed at the MEGAPOLI urban station (LHVP). The PILS was directly connected to Ion Chromatographs (PILS-IC) and a Total Organic Carbon Analyser (PILS-TOC) (Orsini et al., 2003; Sullivan et al., 2004). Measurements of ions (anions & cations) and Water Soluble Organic Carbon (WSOC) were obtained using this setting with a time resolution of 12 and 4 minutes, respectively, and with a $PM_{2.5}$ cut size. The AMS, which is commonly considered as a non-refractory (NR) PM_1 analyser (Canagaratna *et al.*, 2007) sampled a dried aerosol after a PM_{10} inlet with a time resolution of 5 minutes.
The AMS provides artefact-free non refractory concentrations of sulfate, nitrate, ammonium, chloride, and organic matter. The PILS-IC-TOC provides artefact-free measurements of water soluble sulfate, nitrate, chloride, ammonium, sodium, potassium, magnesium, calcium, and organic carbon.

Most of the time, AMS and PILS nitrate and sulfate concentrations were similar during the winter campaign (Fig. 1) suggesting a major submicron distribution for these 2 species. During summer, nitrate was mainly observed with the PILS instrument suggesting a major source between 1 and 2.5µm.

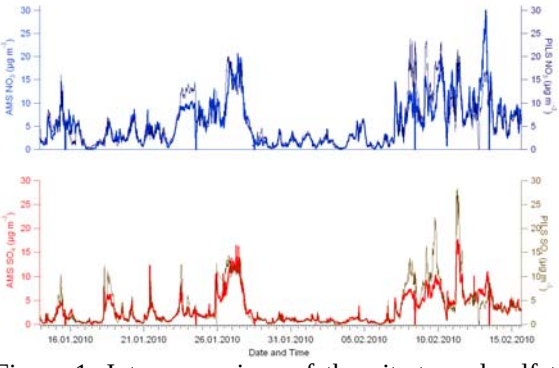

Figure 1: Intercomparison of the nitrate and sulfate mass concentrations measured by AMS (left) and PILS-IC (right) during MEGAPOLI winter campaign.

The major discrepancies between AMS and PILS instruments during wintertime corresponded to the presence of larger particles of nitrate and sulfate (above 0.8µm) observed during continental processed air masses episodes. During the summer campaign, differences between the two instruments are observed for nitrate which compound appears to be located mainly in the supermicron mode. This is confirmed by the nearly full neutralisation of sea salt sodium by chloride and nitrate as determined by the PILS instrument.
The dual approach ($PM_{2.5}$ PILS and NR PM_1 AMS) performed during the MEGAPOLI field experiments has shown to be a useful tool to document the chemical composition of fine particles below and above 1µm.

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