5-year continuous on-line monitoring of the submicron aerosol chemical composition at the SIRTA-LSCE ACTRIS supersite (Paris area, France)

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Long-term detailled investigations of atmospheric pollutants are required to better evaluate and tackle their health and radiative impacts. To do so, the European ACTRIS community have been putting strong efforts to build up a committed research network of advanced monitoring stations since 2011. The SIRTA-LSCE, located 25 km South-West of Paris city centre, has been one of the first station of this network being equipped with a comprehensive set of on-line instruments allowing the real-time measurement of physical and chemical properties of submicron aerosols (PM_1). They notably include the recently developped Aerosol Chemical Speciation Monitor (ACSM, *Aerodyne Research Inc.*) (Ng et al., 2011), and a 7-wavelength aethalometer. Together, both instruments provide an unique opportunity to document diurnal, seasonal and interannual variations of the PM_1 chemical components in one of the most populated urban area in Northern Europe.

Measurements obtained with the ACSM from mid-2011 to 2015 allow a thorough description of the seasonality of the non-refractory PM_1 chemical composition (Fig. 1). Wind and air-mass trajectory analyses have also been performed to refine the understanding of their geographical origins, illustrating the duality between local emissions and long-range transport influences. Moreover, their seasonally-differentiated weekly diurnal profiles is helping to better identify main parameters controlling their temporal variations (sources, meteorological parameters). Finally, the investigation of major pollution episodes indicates various (trans-) formation processes, as different types of particulate pollution occurred.

Among results obtained so far, ammonium sulphate shows a clear advected pattern, whereas ammonium nitrate also exhibits a significant contribution of regional and local emissions. Organic matter (OM) highest concentrations are observed to be associated with local emissions, while regional background remaining significant, especially in spring and summer. Similarly to OM, the wintertime wood burning-related black carbon (BC_{wb}) concentrations have a rather local origin, and other seasons don't exhibit significant BC_{wb} levels. Fossil fuel-related BC (BC_{ff}) shows a clear local origin, as well as contribution from Paris. Significant discrepancies are observed within pollution episodes, which could be associated with atmospheric regimes. For instance, the Scandinavian Blocking regimes in winter may induce strong temperature inversion where local emissions accumulate within the boundary layer, while the Atlantic Ridge regime is generally associated with low BC/sulphate ratio, underlining the importance of transported secondary particulate matter (Petit et al., 2015).

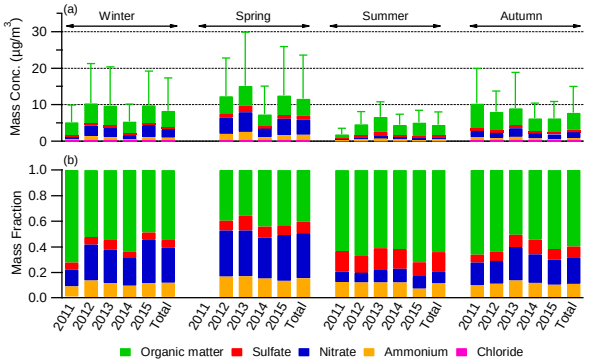

Figure 1. Interannual and seasonal variations of the non-refractory PM_1 mass loadings (a) and mass fraction (b). Uncertainty bars represent the standard deviation (SD).

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