French Network on Ultrafine Particles Monitoring: first results

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Since 2012, various projects have been dedicated to airborne ultrafine particles by French regional air quality monitoring networks (in Rhône-Alpes, Aquitaine, and Provence-Alpes-Côte d'Azur), constituting the first French UFP monitoring "observatory".

These projects were carried out in close collaboration between each network and with the French reference laboratory for air quality monitoring (LCSQA), leading to the building up of a national Working Group on UFP.

Several questions are addressed, including the identification and quantification of local industrial sources, the assessment of the impact of industrial, traffic and residential heating emissions on total particle number, as well as the investigation of phenomena's (meteorology, photochemistry, etc...) influencing urban background concentrations.

Method

7 UFP 3031 granulometers (TSI) have been acquired by all the partners. This instrument is based on diffusion charging of particles, followed by size segregation within a Differential Mobility Analyzer and detection of the aerosol via an electrometer. Regular inter-comparison exercises have been conducted (Le Bihan *et al.*, 2016).

Both short term campaigns and long term monitoring programs have been considered, in mobile or fixed air monitoring stations at more than 10 sites. The implementation concerns various typologies of stations (Table 1): close to industry or to traffic, background urban sites.

Table 1. Place and typology of the monitoring sites.

Place	Typology	Nb.	Partner
Grenoble (38)	Urban background	5	AIR RA
Talence (33)		1	AIRAQ
Grenoble (38)	Traffic	2	AIR RA
Fos-Berre (13)	Industry	4	AIR PACA
Mourenx (64)		2	AIRAQ

Other pollutants were also monitored, such as SO_2, NOx, PM2.5, and/or PM10 as well as PMff and PMwb (fossil fuel and wood burning combustion estimated with AE33).

Results

Main results include:

The identification of five specific UFP sources at a metallurgical complex, investigated through the implementation of a UFP 3031 at various places around a steel mill. UFP based wind roses appear to be largely more specific than PM based for identifying the sources. Moreover, a strong correlation between UFP <70 nm and SO_2 has been observed close to a chemical area.

UFP size distribution and concentration monitored close to heavy traffic roads appeared to be mainly leaded by traffic variations, regardless of seasonal or meteorological conditions. UFP < 50 nm roughly represent 50% of the total number concentration.

At urban background sites, UFP characteristics are primarily influenced by meteorological parameters. During wintertime, PMwb (wood burning) part presents a very good correlation with UFP > 70 nm (especially 100-200nm canal). By contrast, in summer, a good correlation is observed between PMff (fossil fuel) and UFP > 70 nm This hot season also corresponds to the formation of new particles in the afternoon due to photochemical reactions.

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Reference

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