Quantification of organic and inorganic particles by LAAP-ToF-MS

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Laser Ablation Aerosol Particle Time-of-Flight Mass Spectrometer (LAAP-ToF-MS) is a novel instrument intended for on-line and continuous measurements of atmospheric particles with diameter > 150 nm by an analysis time in the order of milliseconds per particle. LAAP-ToF-MS, based on laser desorption and ionization, provides information on the aerodynamic diameter and chemical composition of individual aerosol particles.

We tested the performances of the instrument and we developed an analytical methodology for continuous monitoring of particle size distribution and their composition using this instrument which allows both qualitative information on single particle and quantitative information about ambient particle ensembles (Gemayel et al., 2016).

Here we present, the results of an experimental campaign conducted in the city center of Marseille. The development and validation of two analytical methodologies allowing the quantification of nitrate, sulfate, chloride, elemental carbon and organic aerosol, are described. These methodologies were validated by intercomparison (figure 1) with a High Resolution Time of Flight Aerosol Mass Spectrometer (HR-ToF-AMS). , The emerged results of this campaign allowed a comprehensive understanding of the chemical composition and temporal evolution of different particle clusters.

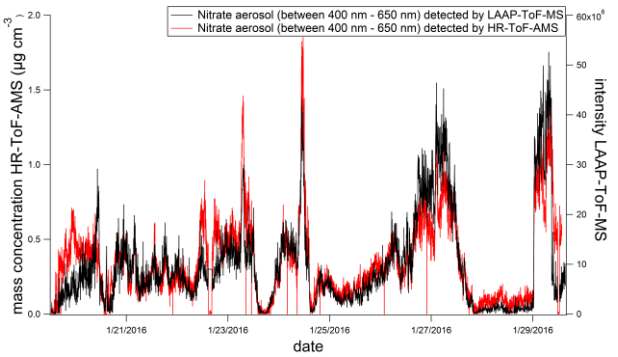

Figure 1: Evolution of the intensity of nitrate specific ions (NO_2^- and NO_3^-) detected by the LAAP-ToF-MS for aerosols between 400 nm and 650 nm in an interval time of 5 min and the evolution of the mass concentration of nitrate present in aerosols between 400 nm and 650 nm detected by the HR-ToF-AMS in an interval time of 2.5 min.

The analytical LAAP-TOF-MS methodology enables quantitative, high temporal resolution measurements of the chemical composition of ambient particles, and offers a novel approach for chemical characterization of single atmospheric particles, providing new insights in aerosol science and atmospheric chemistry and physics, in close relation to health effect studies.

Gemayel, R., Hellebust, S., Temime-Roussel, B., Hayeck, N., Van Elteren, J. T., Wortham, H., and Gligorovski, S.: The performance and the characterization of Laser Ablation Aerosol Particle Time-of-Flight Mass Spectrometry (LAAP-ToF-MS), Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2015-356, 2016.