Université de Lille

FACULTÉ DES SCIENCES ET TECHNOLOGIES

International Master 2 Atmospheric Sciences: Research Training 2022-2023

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Eventually CaPPA Work Package: WP-3 Aerosol observations

In-situ observation of light absorbing organics in Lille and their relationship to particulate organic nitrates

Aerosol chemical composition is known to play a key role on its physical properties, including how it interacts with sunlight (through scattering and absorption). Most of aerosol light absorption is typically attributed to Black Carbon (e.g. soot), however light absorbing organics known as Brown Carbon can be an important contributor, yet with high associated uncertainty. Brown Carbon has been previously associated with nitrogen-containing functional groups, however such analysis is yet limited to very few atmospheric conditions and pollutant types (e.g. Jiang et al, 2019; https://doi.org/10.1021/acs.estlett.9b00017).

Northern France is particularly subject to high particulate pollution events due to the combination of heavy traffic, population density, industrialized areas and long-range transport from nearby countries. Ground-based in situ observations are routinely carried out at the ATOLL platform (ATmospheric Observations in liLLe) located on the rooftop of the LOA (University of Lille campus) since 2014. Since the end of 2016, those observations include an Aerosol Chemical Speciation Monitor (ACSM) to determine the chemical composition of non-refractory submicron particles, from which the contribution of particulate organic nitrates can be derived, and a 7-wavelength Aethalometer measuring PM_1 absorption coefficients to derive Black and Brown Carbon concentrations.

The Master student will analyze the temporal variability of Brown Carbon and organic nitrates and study whether these can be correlated and under which environmental conditions. The analysis shall include use of other tracers (as biomass burning diagnostic tracer from ACSM), as well as back-trajectories obtained using HYSPLIT. Basic experience with scientific programming (such as Python, Matlab, Igor, etc.) is preferable to deal with the multi-annual dataset.

This analysis shall provide rich new insights into aerosol atmospheric processing and its climatic impact through interaction with sunlight.

Key words: Aerosol particles, Brown Carbon, Mass Spectrometry, Absorption Properties