Laboratoire Inter-universitaire des Systèmes Atmosphériques

NOyBOx – integrated instrument for nitrogenous compounds measurements during field campaigns

Chemical compounds that are released into the atmosphere undergo a variety of multi-phase chemical and physical processes leading to their transformation into many products. These substances can negatively affect air quality and thus human and ecosystem health. It is critically important to understand the factors that control the pathways by which compounds are converted from their emitted forms into new ones while producing ozone and oxidized substances and influencing creation and/or growth of particles. Direct observations of key primary and secondary species are therefore critical to advancing knowledge of atmospheric chemical and physical processes.

In this context, the ACROSS (**A**tmospheric **C**hemist**R**y **O**f the **S**uburban fore**S**t) project is designed to improve understanding of atmospheric oxidation through a carefully planned observational field campaign that will take place in summer 2022 in Ile-de-France region. This project aims more precisely at improving our knowledge of the chemical evolution of mid-latitude urban plumes when they mix with surrounding biogenic emissions primarily to better assess the impacts of pollutants on the environment, the climate and human population. This project is collaborative and seeks at including lots of other research teams than LISA, especially from Ile-de France region, therefore including IPSL partners (LSCE and LMD already contacted), but also outside the region, working on atmospheric chemistry and dynamics, health impact, building of emission inventory, air quality numerical modeling...

Among all the atmospheric pollutants, nitrogenous compounds have a key role in tropospheric chemistry. These species that include NO, NO_2, NO_3, N_2O_5, HONO, PAN, HNO_3 or organic nitrates, which sum is called NOy, are linked into complex reactive cycles that lead to the formation of secondary pollutants such as ozone or oxygenated organic compounds. They are also involved in the regulation of the oxidative capacity of the atmosphere and play a role in the formation and aging of secondary organic aerosol. For these reasons, measuring these compounds and their speciation is crucial for the understanding of the atmospheric chemical processes and of the impacts of air quality on health and climate. The development of a common ensemble integrating the state-of-the-art tools for NOx and NOy measurements in a common rack (hereafter called NOyBOx) is therefore ongoing to perform coherent measurement following common strategies (eg. Vertical profiling along a tower, ground measurements…). LISA has a long experience in measuring those species and some of these measurement are already available (NO, selective NO_2, NO_3 radical measurements at trace level).

The under graduated student will participate to the development of instruments for individual measurement of the missing species: N_2O_5 and HONO by IBBCEAS (Incoherent broad-band cavity-enhanced absorption spectroscopy) technique (taking advantage of our expertise in this field) and the sum of nitrogen containing species (NOy) by ozone chemiluminescence analyzer coupled with a gold-converter. After these developments, the under graduated students will perform the characterization of these instruments at the laboratory and possibly on the field.

Desired skills:

The candidate must have a solid background in atmospheric physics and chemistry. Knowledge in spectroscopy would be appreciated.

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