

Offre de Stage IPSL 2020

(soutenu par le programme EUR IPSL--*Climate Graduate School*)

Titre du sujet de stage: NOyBOx – integrated instrument for nitrogenous compounds measurements during field campaigns

Description du sujet (1 page maximum) :

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, NO₂, NO₃, N₂O₅, HONO, PAN, HNO₃ or organic nitrates, which sum is called NO_y, 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 NO_x and NO_y 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 NO₂, NO₃ radical measurements at trace level).

The under graduated student will participate to the development of instruments for individual measurement of the missing species: N₂O₅ 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 (NO_y) 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.

Résumé en anglais (5 lignes):

Among all the atmospheric pollutants, nitrogenous compounds have a key role in tropospheric chemistry. Indeed, they are linked into complex reactive cycles that lead to the formation of secondary pollutants such as ozone, oxygenated organic compounds, and/or secondary organic aerosols and are also involved in the regulation of the oxidative capacity of the atmosphere. Therefore, this training period aims at participating to the development of instruments for measurement of important nitrogenous compounds on field, i.e. N_2O_5 , HONO and the sum of NOy.

Responsable du stage (Nom/prénom/statut) : Manuela Cirtog (MCF UPEC,
Manuela.Cirtog@lisa.u-pec.fr)

Laboratoire concerné : LISA

Equipe de recherche concernée (si pertinent) :

Niveau du stage (Licence, M1, M2, internship) : M2

Licence ou Master(s) où sera proposé le sujet : Water, Air, Pollution and Energy at local and regional scale (Ecole Polytechnique et ENSTA)

Thème scientifique de l'IPSL concerné : Composition atmosphérique et qualité de l'air

Durée du stage : __6__ mois

Période : 16/03/2020 → 15/09/2020

Est-il prévu une thèse dans le prolongement du stage ? Un sujet de thèse portant sur le projet ACROSS est prévu à l'issue de ce stage et pourra être proposé au candidat.