**PHD studentship**

**“Simulation of the aerosol oxidative potential: a new health related indicator of air quality”**

**Abstract**

The mass of fine particles with a diameter of less than 2.5 µm (PM2.5) has traditionally been used as an indicator of the health impact of particulate matter pollution. Nevertheless, it is well known that the health impact of particulate matter depends on its size and chemical speciation. In particular, carbonaceous species with high oxidizing power and certain transition metals can exert oxidative stress on cells, and promote inflammatory reactions. This oxidative potential (OP) can be characterized in ambient air samples by extracellular tests, and varies according to the source of the aerosol and in particular of organic aerosol.

The LISA modelling group is co-developing the CHIMERE air quality model, widely used for air quality studies and forecasting. LISA has extensive experience in simulating different pollutants in a context of urban pollution or regional/continental scale. Among other things, the group has carried out development and evaluation of various organic aerosol modules and data assimilation. A new focus of research in the coming years is to make these simulations as relevant as possible to the assessment of the air pollution impact on human health. The IGE Atmospheric Chemistry Group develops a multidisciplinary approach at the boundaries of geochemistry, toxicology, epidemiology and modelling to validate/invalidate the OP as a new air quality metric. This subject will benefit from the complementary know-how of the supervisors of the two laboratories.

In this context, the proposed thesis aims at modelling the oxidative potential of the aerosol and its organic fraction with the CHIMERE air quality model. We seek at determining if and how the spatial and temporal variability of the oxidative potential differs from the mass concentrations of PM2.5 and to quantify its main sources (traffic, residential heating, industry, biogenic, etc.). Such a modelling approach is highly novel has not yet been undertaken in France.

Modelling of the oxidative potential (PO) can be carried out in two steps: first, empirical relationships between the type of (organic) aerosol and the oxidative potential from the literature will be introduced into the model. They will be based on the literature, and above all on the unique database created by the IGE led by Gaëlle Uzu. Consisting of about 5000 samples, it now includes annual series (about 100 sampling points per year) at more than 20 sites worldwide (Bolivia, India, China, 5 Swiss sites, the Netherlands and about 15 French sites) allowing, among other things, to calculate intrinsic POs by type of source. This part of the work will be partially performed in Grenoble. For this, a source tracking module (tagging source apportionment) adapted to CHIMERE at LISA will also be used.

In a second step, the main agents of the oxidative potential could be explicitly taken into account in the simulations, in particular transition metals (Cu, Fe, Mn, etc.). To do so, proper emission inventory including these traces should be set-up. This could allow to improve the source tracking and prepare the explicit modelling of OP.

This thesis should ultimately contribute to a transformation of air quality management policies through the implementation of a new predictive variable relevant to health exposure in order to provide France with a more effective tool to reduce population exposure.

**Profiles**

Applications are invited from Masters students in environmental or atmospheric sciences. Some knowledge of computer programming (Fortran, Unix, Python, shell script, R), data analysis, running models and written/spoken English is desirable. If interested please send your CV including email addresses of 2 referees to beekman@lisa.u-pec.fr, foret@lisa.u-pec.fr and gaelle.uzu@ird.fr.

\*\*\*Important\*\* \*Please note that there is a selection procedure – the candidate selected for this PhD topic will have to submit a full application to the French PhD School ED129 by 28 May. Due to the limited number of student grants available, panel interviews will then take place end-June/beg. July 2020 (see

<http://www.ed129.upmc.fr/fr/allocations-et-bourses/financements-de-l-ed-129.html>).

Note also that other requests for fundings have been addressed to the French ADEME agency and the Paris Region. For thee later procedures only a CV of the candidate is requested.

**Administrative**

The studentship will take place at LISA (University Paris Est Créteil/ University of Paris) with some travels in Grenoble at IGE (University J. Fourier).

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