Contribution of traffic to the formation of organic aerosols in urban areas

Context:
Transport pollution is a major societal and regulatory issue. Particulate transport emissions and secondary aerosols produced after emissions have considerable consequences on climate (IPCC, 2011), building, agriculture, visibility, and especially public health.

In France, particulate pollution levels have not decreased significantly since 2007 despite various source reduction measures (Ministry 2013), the dominant fraction being composed of secondary aerosols, formed through various atmospheric processes (Tsigaridis et al, 2014). Road transport contributes to secondary organic aerosols through oxidation processes of volatile organic compounds (VOCs) and semi-volatiles (SVOCs) into less volatile species that condense on pre-existing particles.

The contribution of road transport to atmospheric aerosols is clearly poorly quantified, due to metrological and methodological difficulties in characterizing emissions (Kim et al., 2016), and difficulties in estimating secondary organic aerosol formation (AOS).

These uncertainties affect air quality models, which systematically underestimate the fraction of secondary organic aerosol, especially in urban areas (Tisgaridis et al., 2014, Bergström et al., 2012, Hallquist 2009). This underestimation can be linked on the one hand to the lack of knowledge of the emissions of gaseous precursors, volatile organic compounds (VOCs) and semi-volatiles (SVOC) (Sartelet et al., 2018, Couvidat et al., 2012), and of on the other hand, to a limited or incomplete representation of the mechanisms of aerosol formation and aging in the atmosphere in the models (Tsigaridis et al, 2014).
In order to reduce the uncertainties on particle concentrations related to road traffic, experiments are carried out on a 2-axle roller bank (measurement of emissions) and coupled to a simulation chamber of atmospheric evolution of pollutants under controlled conditions.
Innovative complementary gas and particle phase AOS formation measurements have also been conducted in an aerosol flow tube reactor (AFT) to understand oxidation and atmospheric aging of a pure compound.

Objectives:
Using the observations of the experiments mentioned above, the work will concern the improvement of the modeling of the fate of regulated and unregulated pollutants emitted by recent vehicles (nomes Euro 5 and Euro 6). Based on the measured emissions of the various SOA precursors, the parameterizations used for the aging of the different compounds (Majdi et al., 2019, Chrit et al., 2017 and Couvidat et al., 2012) will be reviewed to represent the measurements in the chamber. Wall effects will be taken into account for the different compounds.
In a second step, the urban air quality model will be modified to include the emissions and parameterizations of the aging of SOA precursors of recent vehicles.

Collaboration:
Collaborations with IFTSTTAR and “Laboratoire Chimie Environment” experimenters are to be expected for model comparisons to chamber measurements. Collaborations with INERIS are to be expected in the framework of joint development of a 0D model of aerosols (ssh-aerosol).

Profile:
The candidate must have a thesis in air quality modeling and / or aerosols, and have demonstrated abilities to publish first author in scientific journals of rank A. Strong skills in thermodynamics and chemistry are desirable. Good knowledge and programming experience in C ++, Python and Fortran

are also essential.

Duration: 2 years from the autumn of 2019. The post-doc will be based on the CEREA site at Ecole des Ponts (Champs sur Marne).

How to apply: Please send a cv and motivation letter to karine.sartelet@enpc.fr

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