Master's Internship Subject (2025–2026)

Title : Source apportionment and oxidative potential of atmospheric particles in Paris: Multi-tracer deconvolution and health-relevance assessment.

Keywords: air pollution, source apportionment of PM, oxidative potential, air quality and health

Duration: up to 6 months, starting January 2026

Scientific context :

Particulate matter represents the most significant risk to human health among air pollutants, yet designing efficient mitigation strategies remains challenging. This difficulty arises both from the diversity of PM source (road traffic, domestic combustion, biogenic..) and from their varied geographical origins. Consequently, the relative contribution of each source to total PM mass is complex to quantify. In the Île-de-France region, there is a strong political commitment to reduce the impacts of air pollution, however, there is still a need to deepen our understanding of the links between emission sources and health effects for PM. Understanding the sources of particulate matter (PM) and their associated oxidative potential (OP), a proxy for PM capacity to induce oxidative stress in the lung is a crucial step toward mitigating the health impacts of urban air pollution. Within the framework of the POPARTS/RI-URBANS/URBHEALTH projects, a unique database combining chemical, toxicological and regulatory data has been compiled for Paris, covering both PM10 and PM2.5. This resource enables a detailed apportionment of PM mass, a quantification of OP by source, and extensive intercomparisons with national and European datasets.

Objectives of the Internship

The aim of this Master's project is to conduct an in-depth deconvolution of PM and OP sources in Paris and include some comparison with other online source apportionement data. The internship will focus specifically on:

PM source apportionment : identifying major emission sources by applying source apportionment techniques. Particular attention will be given to the inclusion of specific tracers such as benzothiazoles in order to refine the resolution of traffic-related emissions and tyre or brake wear.

OP deconvolution : Measurements obtained with the OP measurements will be analysed to attribute OP to the sources identified in the first step using inversion models already mastered in the host team.

Comparison offline/online source apportionment techniques : Temporal dimension of source contributions and the consistency of the results across measurement techniques will be explored. These comparisons will help to refine the interpretation of the chemical composition and to harmonise off-line and on-line source apportionment methods, thereby contributing to the definition of European standards for source attribution within RI-URBANS.

Expected results

The expected outcome is a comprehensive set of source profiles for both PM mass and oxidative potential in Paris, together with an assessment of the health-relevant burden attributable to PM sources. The study will also evaluate the performance of PMF in separating direct and indirect vehicular emissions and will provide a framework for harmonising off-line and on-line approaches to source apportionment.

Student Experience & Learning Outcomes

- Hands-on experience with **large environmental datasets** and **geochemical source apportionment tools**.

- Development of skills in statistical data analysis, air quality research, and health-oriented environmental science.
- Opportunity to contribute to scientific publications and to work within an interdisciplinary network involving research institutes and regulation institutes (Ineris) and Air Parif monitoring network.
- Insight into pressing societal issues on air pollution and human health, with direct policy relevance.

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