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RESEARCH INTERN/ STAGE M2 :  
MODELLING OF THERMAL PLUMES IN AND ABOVE URBAN GEOMETRIES

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- **Content of the internship**

Urban areas are increasingly suffering from heat waves. These extreme events are expected to occur more frequently in the coming decades due to global warming. It is, therefore, essential to model and study urban behavior under such extreme conditions.

In this context, the present work is part of a project aimed at reproducing districts and cities at a reduced scale within a monitored experimental setup. This setup consists of a dome seven meters in diameter, where an urban atmosphere is generated in terms of temperature, radiation, and pollution. The goal is to study microclimatic conditions, including urban heat islands and natural convection patterns. However, before constructing this ambitious experimental setup, it is crucial to pre-design certain aspects of the experiment using numerical methods.

The objective of this research internship is to replicate both analytically and numerically the experimental apparatus and its immediate environment. The experimental setup will feature a small-scale district (approximately 1m x 1m) subjected to solar radiation (heat flux conditions). The focus will be on modeling the natural convection induced by the heat source and its interactions within the climatic enclosure.

To achieve this, the candidate will begin with a brief literature review. Following this, analytical and numerical studies will be conducted. Numerical models will be developed using either OpenFOAM or Ansys Fluent. From these studies, the characteristic temporal and spatial scales of the thermal stratification will be determined.

- **Place**

LOCIE Laboratory UMR CNRS 5271 University Savoie Mont Blanc bât. Hélios, 60 av. du lac Léman, Savoie Technolac, 73376 Le Bourget du Lac

- **key-words**

natural convection, thermal plumes, thermal stratification, computational fluid mechanics, urban heatwave

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## Motivations

The candidate must have a **taste for research, fluid mechanics, and numerical modelling**. In the eventuality of a PhD Thesis that would follow this internship, the candidate must be in the top tier of his promotion.

## The context

This internship work will be carried in the framework of collaboration between LOCIE Laboratory (UMR 5271 CNRS – Université Savoie Mont Blanc, Institut National de l’Energie Solaire) and the University of Sydney Department : School of Aerospace, Mechanical and Mechatronic Engineering. The internship will take place at the LOCIE laboratory, 60 av. Du lac Léman, Savoie Technolac, 73376 Le Bourget du Lac.

**This internship can potentially lead to a PhD Thesis, that would be co-supervised between the University of Sydney and the Université Savoie Mont Blanc.**

- **USMB** (Université Savoie Mont Blanc) - With 15,000 students, a rich and multidisciplinary offer of academics and 18 internationally recognised research laboratories, Université Savoie Mont Blanc (Chambéry) is a high-level research and multidisciplinary university which has developed significant expertise in solar energy, energy efficiency in buildings, and modelling and information sciences.
- **CNRS** (French National Centre for Scientific Research) is among the world’s leading research institutions. Its scientists explore the living world, matter, the Universe, and the functioning of human societies in order to meet the major challenges of today and tomorrow. Internationally recognised for the excellence of its scientific research, the CNRS is a reference in the world of research and development, as well as for the general public
- **INES** (National Institute of Solar Energy) is a global leader in R&D, expertise, and training for advanced solar technologies, their integration into systems, and intelligent energy management.
- **USyd** (University of Sydney) - With over 70,000 students, a broad and multidisciplinary range of academic programs, and 90 internationally recognized research centers, the University of Sydney is a leading research institution. It has built substantial expertise in medicine, engineering, business, and social sciences. Located in the heart of Sydney, it combines a rich tradition with cutting-edge innovation, addressing global challenges through impactful research and world-class education.

## Practical information

- **Start date** : Feb/March 2025
- **Supervision** : **Martin Thebault** (CNRS),
- **Duration** : 5-6 months
- **Gratification** : around 575 €/month
- **Application** : As soon as possible, prior to Christmas break is better, ultimate deadline the 15st of January, send CV and short motivation paragraph in the email to **[martin.thebault@univ-smb.fr](mailto:martin.thebault@univ-smb.fr)**