

Postdoctoral position - IDEX 2019 Exploitation of satellite imagery for urban climate modelisation

Candidates are invited for a 24 month-postdoctoral fellowship conducted in the IMAGE/EPAC teams of the Laboratory Image, Ville, Environnement CNRS UMR 7362 at the University of Strasbourg, France (<http://live.unistra.fr>). IDEX Strasbourg funds this position.

Context:

According to the latest GIEC report, the global goal should be to limit the warming of the atmosphere to 1.5°C compared to the pre-industrial era. Even by reducing greenhouse gas emissions, our societies are not developing enough efforts to achieve this goal and must therefore prepare for more and more heat waves. The scorching summers will become more frequent and will arrive earlier in the year. Added to this global phenomenon, local effects such as Urban Heat Island (UHI) are also increasing. UHIs are controlled by the urban structure: according to the nature, height and spatial organization of buildings, the solar energy received by the city, during the day, is more or less quickly returned to the atmosphere, and urban areas are warmer than natural areas (a few degrees on average). Identifying urban patterns by analysing spatial relationships between their “grey” and “green” components that are favourable for the reduction of UHIs becomes a necessity.

Research objectives:

The objective of this post-doctoral research is to improve knowledge on the urban climate, and specifically on the interactions between surface temperature, air temperatures and land use patterns. Satellite imagery are still an under-exploited data source, whereas their availability is currently increasing with the multiplication of sensors and data distribution hubs at local (Kalideos), national (THEIA, PEPS) or European (Copernicus) level.

This research aims to answer to the following scientific questions:

- (1) What is the contribution of thermal satellite imagery to improve knowledge of surface temperatures in the city;
- (2) What is the contribution of high-resolution multispectral satellite imagery to characterize the urban climate? and specifically how to allow a modelling linking surface temperature and air temperature?
- (3) Which urban patterns (including green and grey networks) can contribute to local reduction of air temperatures?

The recruited candidate will have to develop a 3-step methodology that can be tested on the metropolitan area of Strasbourg with strong relationships with urban services. He/she will be asked to:

- Exploit thermal infrared Imagery to estimate surface temperatures. This work will be carried out in collaboration with ONERA - Toulouse in order to obtain good emissivity estimation to deduce a temperature map of very heterogeneous urban surfaces. A prototype algorithm to be further tuned to an operational service for estimating quickly surface temperature from very frequent satellite imagery will be developed.
- Develop machine-learning methods to identify and analyze the relationships between surface temperatures and urban patterns.

- Exploit the simulations of an air/surface mesoscale model and an urban canopy model (Kohler, 2014; Mauree, 2014) to better represent near-surface atmospheric exchanges.

Develop / propose reduction scenarios of the UHI by taking into account the ongoing “greening” projects of developed by the metropolitan area of Strasbourg.

Offer Requirements:

- Ph.D. in Remote Sensing, Geography/Geomatics, Computer Science, Data Science, Artificial Intelligence/Machine Learning, Physical Science or a related field.
- Strong experience in remote sensing and/or image processing of thermal imagery
- Experience in machine learning methods (classical or deep learning techniques)
- Experience in programming language (Python and/or C++)
- Experience in urban climate modelling
- Sense of initiative, autonomy, and organisation
- Work in collaborations with others partners
- English and/or French languages (written/oral)

Conditions and remuneration terms:

- The position is for two years (12+12 months) and the starting date is **January 2020**.
- To have obtained his PhD Thesis:
 - o Either in an University out of the Strasbourg Site (Unistra ou UHA)
 - o Either in the University of Strasbourg or UHA if the PhD thesis has been followed by a first international post-doctoral experience of at least two years

Application procedure:

- Enquiries should be directed to Pr. Anne Puissant (anne.puissant@live-cnrs.unistra.fr)
- Applications deadline is **December 6, 2019**. Please send as a single PDF including a CV, a motivation letter with an approximately two-page description of research interests. Applicants should also send references from 2 experts who worked previously with the candidate (to be sent to the same address).