Direction
des **ressources humaines**
Université de Strasbourg

Position description

1. Position identification

Title: Improvement of urban LST estimations to support short-term urban microclimate prediction using microscale models

Type of contract: Fixed-term contract

Category (A,B or C): A

Contract/project period: Jan 2023 to June 2024

Expected date of employment: Jan 2023

Proportion of work: 100%

Workplace: Icube/TRIO, Bd Sébastien brant, 67400 Illkirch

Desired level of education: PhD

Experience required: 1 or 2 years

Contact(s) for information on the position (identity, position, e-mail address, telephone):

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Closing date for the receipt of applications: Dec 15th, 2023

2. Research project or operation

DIAMS project (DIAgnostic, Modelling & Management of Urban Overheating during Heatwaves: Cross contributions of microclimatic simulation tools and IRT imagery)

3. Activities

Description of the research activities:

The LST (Land Surface Temperature) is a key-parameter to derive the Surface Urban Heat Island (SUHI) or health related indices such as the DI (Discomfort Index). It is therefore an essential prerequisite to understand the urban climate and to support mitigation strategies definition, health risk management plans or public policies among others. The LST is commonly retrieved from data acquired in the TIR (Thermal InfraRed) spectral domain by remote multispectral sensors using algorithms such as Split-Window (SW) or Temperature Emissivity Separation (TES) with about 1K accuracy for natural surfaces. However, over urban areas, the LST retrieval is not

trivial due to several specific effects that alter the algorithm's performances such as high surface roughness or wide material heterogeneity.

These postdoctoral research will be carried out in the framework of the ANR project DIAMS which aims to prepare the use of high spatial and temporal resolution thermal infrared satellite data to support modelling for the diagnosis and short-term forecasting of urban microclimate during heat waves. The final goal of the DIAMS project is to exploit the LST retrieved from satellite date at district scale to derive local air temperatures and urban thermal comfort indicators based on microclimatic modelling. The assimilation of LST derived from satellite images during the simulations will allow to calibrate the surface temperature values calculated by the model, thus correcting the uncertainties related to the parameterization of the thermal and radiative properties of the materials, which are often difficult to obtain in urban areas. The postdoc will mainly contribute to the 3rd work package dedicated to the reduction of the errors inherent to the exploitation of the IRT images at 60 m spatial resolution over urban areas, with the following objectives:

- To set up a method to exploit IRT images taking into account the spatial variability of water vapour in the atmosphere, adjacency effects, a correction for cavity effects and by adapting the LST estimation method to large classes of urban surfaces
- To validate the developed method at the satellite scale using available airborne campaigns
- To propose a method to use satellite LST in microclimate models and to assess the contribution of this data to the accuracy of air temperature results

The postdoc will also contribute to the 4th work package that seeks to demonstrate the feasibility of producing a tool for forecasting hot and cool zones at the neighbourhood level during a heatwave.

This work will be based on the results obtained in the 3rd work package, which will allow targeting the neighbourhoods most sensitive to heat waves. In the event of an announced heat wave, the long-term objective is to run a neighbourhood-scale model on the identified areas in the near future (3-day horizon) with satellite images in initial condition and weather forecasts as input. It will then be possible to produce indicators that will allow the detection of dwellings and outdoor spaces that are sensitive to heat waves as well as cooler outdoor areas in the neighbourhood.

Related activities:
The post doc would be involved in field campaign

4. Skills

Qualifications/knowledge:
The candidate must have knowledge in remote sensing, IR radiometry and radiative transfer
Operational skills/expertise:
The candidate must have expertise in at least one programming language.
Knowledge in image processing is a plus
Personal qualities:
The candidate should be able to interact with others team members

5. Environment and context of work

➢ **Presentation of the laboratory/unity:**

The Laboratory of Engineering, Computer Science and Imaging (UMR7357) brings together two scientific communities at the interface between the digital and physical worlds, giving it a unique configuration. With nearly 650 members, it is a major research force on the Strasbourg site. With its focus on imaging, ICube's main fields of application are engineering for health, the environment and sustainable development.

➢ **Hierarchical relationship**

The post-doctoral student will be under the responsibility of Françoise Nerry and Laure Roupioz.

To apply, please send your CV, cover letter and diploma to:

- **Françoise Nerry, DR CNRS, f.nerry@unistra.fr**
- **Laure Roupioz, IR ONERA, laure.roupioz@onera.fr**