

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: *Environment Science and Technology, Sustainable Development, Geosciences*

Subfield: Hydrology

Title: Optimal implementation of Nature-Based Solutions to mitigate Urban Heat Islands

ParisTech School: Ecole des Ponts ParisTech

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Research group/Lab: HM&Co

Lab location: Champs-sur-Marne

(Lab/Advisor website): <https://hmco.enpc.fr/>

Short description of possible research topics for a PhD:

Urban Heat Island (UHI) is a microclimatic phenomenon occurring in urbanized spaces that tend to have higher temperatures than their surrounding countryside. In a context of climate change, the increase of heat waves, in terms of frequency and intensity, has placed the mitigation of UHI as a priority in many cities. Nature Based Solutions (NBS) as rain garden, green roofs, and parks represent some relevant infrastructures to address this challenge and make cities more resilient. As urban environments are complex and very heterogeneous in space, the implementation of NBS regarding the most vulnerable (hot) areas represents a difficult task. The objective of this PhD subject is therefore to develop a methodology, which helps to optimize NBS implementation with regard to UHI. First, temperature fields and their space-time variability will be analysed at the urban scale. For this purpose, every available data will be used, that they are produced by observation devices (satellite, public and private sensors networks) or models (simulations). A particular effort will be made to valorize crowdsourced and remote sensing data. Second, existing NBS spatial distribution will be studied. Finally, based on both fields' properties, some prospective (urban and climate) scenarios will be proposed to optimize NBS cooling effect.

Required background of the student:

Have skills in the modelling of mechanics (graduated in fluid mechanics or environmental physics), capabilities in computer simulations, and be of interest to urban geophysics.

A list of 5 (max.) representative publications of the group:

1. Versini, P.-A., Kotelnikova, N., Poulhes, A., Tchiguirinskaia, I., Schertzer, D. and Leurent, F., 2018. A distributed modelling approach to assess the use of Blue and Green Infrastructures to fulfil stormwater management requirements. *Landscape and Urban Planning*, 173: 60-63
2. Versini, P.-A., Gires, A., Schertzer, D. and Tchiguirinskaia, I., 2020. Fractal analysis of green roof spatial implementation in European cities. *Urban Forestry & Urban Greening*, 49, 126629