



Offre de thèse / Thesis offer ESR15

MSCA Cofund - MISCEA

Template EURAXESS

Note for laboratories/potential supervisors : only fill in the *green and italic parts*

Job Information

Organisation/Company : **Ecole nationale des ponts et chaussées (ENPC)**

Department : *Hydrology Meteorology and Complexity (ENPC)*

Research Field : *Domaine de recherche de la thèse proposée / Research area of the proposed thesis* Environmental sciences

Researcher Profile : **First Stage Researcher (R1)**

Country : **France**

Type of Contract : **Temporary**

Job Status : Full-time

Is the job funded through the EU Research Framework Programme? : **Horizon Europe (HE) / Marie Skłodowska-Curie Actions COFUND**

Is the Job related to staff position within a Research Infrastructure? : **No**

Additional information :

The present offer of a doctoral contract in France is for a period of three years.

Full-Time employment : estimated monthly brut salary : ~2700euros (estimated monthly net salary before income taxes: ~2100euros)



Offer Description

Thesis offer :

Multiscale comparison and merging of dual polarization weather radar rainfall measurements

The measurement of rain rate at ground level is usually estimated punctually with the help of rain gauges or disdrometers. The use of weather radars has made it possible to obtain a more representative spatial measurement of the fine structure of precipitation – and Météo-France is generating weather radar maps. The high spatial and temporal resolution of rainfall measurements is a crucial for urban hydrology applications, both for real time applications, post-event analysis or scenario optimization. Hence, since weather radars are the only device providing space-time rainfall measurement, improving there functioning is needed.

Radar maps result from the merging of measurement collected with the help of various radars which operates at various resolution. In the Paris area, Meteo-France operates a C-band radar at Trappes (South West of Paris), and a X-band radar at Roissy Charles de Gaulle airport (North of Paris). ENPC-HM&Co operates a research X-band radar on its campus (East of Paris). This setting offers an exceptional opportunity to generate high resolution rainfall products for the Paris area.

A key challenge for high-resolution radar quantitative precipitation estimation (QPE) is the variability of rain across different spatial and temporal scales and to better account for it. Rain should be understood not only in terms of rain rate but also in drop size distribution. The sampling volume of an operational weather radar in France varies from 0.005 km³ (at a distance of 10 km) to 0.1 km³ (at a distance of 50 km). Conventional methods merges data from multiple radars without considering the rain variability at different scales could yield significant errors in the high-resolution QPE.

In this PhD study, we will compare the measurements from two or three dual-polarization radars of the Paris area, which have different sampling volumes. The revisit period of the two operational radars is 5 minutes. The third research radar may be operated with the antenna stationary and pointing at the direction where we have disdrometers and/or rain gauges below.

Universal Multifractals have been widely used to characterize and simulate geophysical fields extremely variable across a wide range of space-time scales such as rainfall. This physically based and mathematically robust framework will be used to investigate the rainfall variability, in particular to estimate the space-time scale dependence of classical parameters such as raindrop concentration (N_t) and averaged diameter (D_m). Such parameters can be derived from available polarimetric radar measurements as well as ground measurement. Then, eventually in real time, of the scale independent universal multifractal parameters can be used to understand the difference of radar reflectivity (Z_h) and differential reflectivity (Z_{dr}) measured by the radars and to propose a fusion method of their measurements ultimately to create a high-

resolution merging QPE (e.g. at 100 m per 5 min) with uncertainty for the Paris area. Prototype for real time implementation relying on the two/three radar measurements in real-time will be proposed.

Supervision:

HM&Co-ENPC: Auguste Gires (auguste.gires@enpc.fr), and Daniel Schertzer (daniel.schertzer@enpc.fr)

CMR - Météo-France: Nan Yu (nan.yu@meteo.fr) and Ludovic Bouilloud (ludovic.bouilloud@meteo.fr)

The PhD candidate will be recruited by Ecole nationale des ponts et chaussées and work at Hydrology Meteorology and Complexity laboratory (hmco.enpc.fr/) located near Paris. He will have access to all the facilities of the laboratory. He will be co-supervised with a team from CMR (Weather radar center) of Météo-France at Toulouse. Three secondments periods of one months there are planned. The PhD topic was jointly developed between HM&Co and CMR.

Description of the project and the candidates' eligibility criteria :

This position will be part of the EU-funded project [MISCEA](#), which is an ambitious inter- and multidisciplinary Doctoral Training Network under the Horizon-Europe Marie Skłodowska-Curie Actions.

PhD candidates' can be of any nationality but you have to meet these eligibility criteria :

- **Not being a current employee** working at ENPC.
- Not having resided or carried out their main activity (work, studies, etc) in France **for more than 12 months** during the past 36 months immediately before the deadline of the MISCEA Programme's call. Compulsory national service, short stays such as holidays and time spent as part of a procedure for obtaining refugee status under the Geneva Convention are not taken into account.
- **Holding a Master's degree** (or about to obtain one) or having a University degree equivalent to a European Master's degree (5-year duration) at the deadline of the MISCEA Programme's call.
- Researchers must be doctoral candidates, i.e. not already in possession of a doctoral degree at the deadline of the co-funded programme's call. Researchers who have successfully defended their doctoral thesis but who have not yet formally been awarded the doctoral degree will NOT be considered eligible.
- **Signing a declaration** of the veracity of the information provided (Declaration of honour, free of form).

If you comply with the eligibility criteria and you wish to submit your application, you must :

- Contact the thesis supervisor and explain your thesis project to her/him so that she/he validates your application.
- Submit a **5-pages thesis proposal** under the proposed research areas, with the agreement of the future supervisor. Additionally, to the submission of the 5-pages thesis





proposal, the applicant will have to complete an ethics checklist based on ethics guidance from the HorizonEurope programme guide.

- **English-translated transcripts** from the master's degree or equivalent.
- **Any specific requirements of the Doctoral School** corresponding to the targeted MISCEA fellowship offer.
- English curriculum vitae, including information about the level on English language knowledge.
- A motivation letter.
- One letter of reference, at least.

Templates are available on the MISCEA website ([link](#)).

Then your candidature is complete, please send inquiries to miscea-program@enpc.fr





Requirements

Research Field: Environmental sciences

Education Level: Master Degree or equivalent

Skills/Qualifications: Background in environmental sciences, physics, statistics or related topics; and good programming skills would be appreciated.

Languages: ENGLISH

Level: Excellent

Where to apply

E-mail : auguste.gires@enpc.fr ; nan.yu@meteo.fr ; ludovic.bouilloud@meteo.fr



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