

## RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

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

**Subfield:** Applied Physics

**Title:** Spatio-temporal variability of rainfall drop size distribution across scales: retrieval, characterization and uses

**ParisTech School:** Ecole des Ponts ParisTech

**Advisor(s) Name:** August Gires /Ioulia Tchiguirinskaia

**Advisor(s) Email:** August.Gires@enpc.fr /ioulia.tchiguirinskaia@enpc.fr

**Research group/Lab:** Hydrology Meteorology and complexity, ENPC

**Lab location:** École des Ponts ParisTec, 6 et 8 avenue Blaise- Pascal – Cité Descartes – Champs-sur-Marne – 77455 Marne- la- Vallée cedex 2

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

### **Short description of possible research topics for a PhD**

Rainfall is a geophysical field extremely variable over wide range of spatio-temporal scales which makes it complex to analyse and even to measure. Weather radars are currently the only devices providing a spatio-temporal insight into this field. Radars basically analyse the signal backscattered by the hydrometeors of the atmosphere and derive rainfall maps from it. These conversion algorithms rely on assumed features of the rain Drop Size Distribution (DSD), and notably its homogeneity within a radar gate. DSD is also directly measured with the help of disdrometers.

The student will review and implement techniques to generate DSD maps from radar data. After, he/she develop an appropriate theoretical framework based on Universal Multifractal to explore and quantify the spatio-temporal variability of DSD. This will enable the development and validation of innovative algorithms for rain rate retrieval with weather radars which will account for the variability DSD from large scale to sub-radar gate scale.

**Required background of the student:** geophysics, statistics

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

1. Brandes, E.A., G. Zhang, and J. Vivekanandan, 2004: [Comparison of Polarimetric Radar Drop Size Distribution Retrieval Algorithms](https://doi.org/10.1175/1520-0426(2004)021<0584:COPRDS>2.0.CO;2). J. Atmos. Oceanic Technol., 21, 584–598, [https://doi.org/10.1175/1520-0426\(2004\)021<0584:COPRDS>2.0.CO;2](https://doi.org/10.1175/1520-0426(2004)021<0584:COPRDS>2.0.CO;2)
2. Gires, A., Tchiguirinskaia, I., and Schertzer, D.: Multifractal comparison of the outputs of two optical disdrometers, Hydro. Sci. J., 6, 1641–1651, <https://doi.org/10.1080/02626667.2015.1055270>, 2015.
3. Schertzer, D. and Lovejoy, S., 2011. Multifractals, generalized scale invariance and complexity in geophysics. International Journal of Bifurcation and Chaos, 21 (12), 3417–3456. doi:10.1142/S0218127411030647