Research Topic for the ParisTech/CSC PhD Program
(one page maximum)

****Field (cf. List of fields below):***
5 Environment Science and Technology, Sustainable Development, Geoscience
9. Mathematics and their applications
Subfield: (
Precipitation, remote sensing
Statistics, stochastic processes

Title: Precipitation stochastic forecasts based on high resolution radar data, applications to olympic games

ParisTech School: Ecole des Ponts ParisTech

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Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)
We are witnessing the deployment of the recent technology of polarimetric X band radar, especially around large cities. It is already strongly advanced around the 10 largest cities of Japan. This technology makes it possible to obtain a factor 10 in spatial resolution, a greater measurement sensitivity and hydro-meteorological radars much more compact and therefore significantly less expensive.
New short term forecasts (nowcasts) need to be developed to take advantage of this technology at its full extent. It is proposed to develop stochastic nowcasts based on multifractal cascade processes that enable to be as close as possible to the intrinsic limit of predictability. The Olympic Games of 2020 (Tokyo) and 2024 (Paris) will be important cases of experimentation to which this thesis will contribute.

Required background of the student: (Which should be the main field of study of the applicant before applying)
Some familiarity with hydro-meteorology and/or with stochastic processes. A first part of the thesis will be devoted to update knowledge in both domains.

A list of 5(max.) representative publications of the group: (Related to the research topic)
Lovejoy, S. and Schertzer, D. (2013) The Weather and Climate: Emergent Laws and Multifractal Cascades. Cambridge U.K.: Cambridge University Press. p.1-491

Ochoa-Rodriguez, *et al.*, D. Schertzer, 2015: Impact of spatial and temporal resolution of rainfall inputs on urban hydrodynamic modelling outputs: A multi-catchment investigation. *Journal of Hydrology*, 531(2), 389–407.

Paz, I., *et al.* and Schertzer, D. (2018), Multifractal comparison of reflectivity and polarimetric rainfall data from C- and X-band radars and respective hydrological responses of a complex catchment model, Water, 10, 269.

Schertzer, D., I. Tchiguirinskaia, S. Lovejoy, 2012. Getting higher resolution rainfall estimates: X-band redar technology and multifractal drop distribution. In R. J. Moore, ed. *Weather Radar and Hydrology*. Walingford, U.K.: IHAS Press, pp. 105–110.

Schertzer, D. and Tchiguirinskaia, I.,(2017), An Introduction to Multifractals and Scale Symmetry Groups, in Fractals: Concepts and Applications in Geosciences. Ghanbarian, B. and Hunt, A. (eds) CRC Press, 1-28.