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Emergent radar technologies and innovative multifractal methodologies for new prospects in urban hydrology

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To make our cities weather ready and climate proof has become a fundamental societal issue in the context of an on-going urbanization and growing population density (http://www.nws.noaa.gov/com/weatherreadynation/). This is a challenging question in a region like Île-de-France, which corresponds to one of the largest, if not the largest, concentration of assets and infrastructures in Europe. More than ever, there is an urgent need to cross-fertilise research and operational hydrology, whereas they have both suffered from a long-lasting divorce (Schertzer et al., 2010). A preliminary step is to use the best available measurement technologies.
In this presentation we discuss the potentials of the polarimetric X-band radar technology to measure small scale rainfalls in urban environment. Particularly intense rainy episodes have struck hard various regions of France during the period of May-June 2016, notably Ile-de-France and its neighbourhoods. The data collected during those days by the X-band radar of Ecole des Pont ParisTech (http://www.enpc.fr/hydrologie-meteorologie-et-complexite) allow to observe the fast aggregation of strong cells of small sizes in a multi-cellular thunderstorm. Certain cells make initially hardly more than a radar pixel (250m x 250m), while just three quarters of hour later they form a multi-cellular well-organised thunderstorm over tenths of kilometres. These observations have triggered the development of new methods of immediate forecast taking into account the multi-scale and strongly intermittent character of such rainfall fields to better manage the crises, particularly for strongly vulnerable urban systems.
We present the results of the multifractal analysis and simulations of the polarimetric X-band radar data that first contribute to better understanding of the three-dimensional dynamics of such events, and then allows representing of how strong cores of haste precipitation contribute to the rainfall amounts striking the ground. The overall message of this presentation is that it seems to be timely and possible to improve the present polarimetric radar products to widen their actual use in every day urban hydrology practices.