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A semi-urban case study of small scale variability of rainfall and run-off, with C- and X-band radars and the fully distributed hydrological model Multi-Hydro

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The complexity of urban hydrology results both from that of urban systems and the extreme rainfall variability. The latter can display strongly localised rain cells that can be extremely damaging when hitting vulnerable parts of urban systems.
This paper investigates this complexity on a semi-urban sub-catchment - located in Massy (South of Paris, France) - of the Bievre river, which is known for its frequent flashfloods. Advanced geo-processing techniques were used to find the ideal pixel size for this 6.326km2 basin. C-band and X-band radar data are multifractally downscaled at various resolutions and input to the fully distributed hydrological model Multi-Hydro. The latter has been developed at Ecole des Ponts ParisTech. It integrates validated modules dealing with surface flow, saturated and unsaturated surface flow, and sewer flow. The C-band radar is located in Trappes, approx. 21km East of the catchment, is operated by Méteo-France and has a resolution of 1km x 1km x 5min. The X-band radar operated by Ecole des Ponts Paris Tech on its campus has a resolution of 125m x 125m x 3.4min.
The performed multifractal downscaling enables both the generation of large ensemble realizations and easy change of resolution (e.g. down to 10 m in the present study). This in turn allows a detailed analysis of the impacts of small scale variability and the required resolution to obtain accurate simulations, therefore predictions. This will be shown on two rainy episodes over the chosen sub-catchment of the Bievre river.