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Hydrological impacts of the small scale rainfall variability in an urban catchment: CALAMAR vs. X-band radar data

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Increasing urbanization and population density makes dealing with extreme weather events more difficult notably with regards to flood risks and more generally to storm water management. Such challenge requires the development and practical implementation of new technologies and methods. An example is weather radar which has been increasingly applied to hydrological modelling due to their unique ability to grasp both the spatial and temporal variability of rainfall fields.
In this paper 6 radar rainfall products available over the Paris region are compared: CALAMAR and five different X-band radar data products. The first has a resolution of 1 km in space and 5 min in time and is a product provided by RHEA SAS using single polarimetric raw data of a local C-band radar operated by Météo-France and real time adjustment with a network of rain gauges..The latter are obtained from the radar operated by École des Ponts ParisTech currently providing data with a resolution of 250 m in space and 3.4 min in time. Rainfall fields are then inputted in the fully distributed model Multi-Hydro. It is done over a 6.2 km2 urban and peri-urban catchment located in Massy, south of Paris. Simulated outputs are then compared to actual water level measurement in storage basins. Three rainfall events that occurred in May and June 2016 are tested in this study.
The comparison of the simulated hydrographs obtained with different inputs illustrates the benefits of a higher resolution for rainfall fields. The impact of the small-scale variability not measured by the CALAMAR data is quantified, as well as the hydrological consequences of the use of various radar algorithms over the same raw radar data. These results highlight the need to use the data available with the higher resolution such as the one operationally provided by X-band radars, as well as to use it better, i.e. notably with models able to take into account the newly observed small scale rainfall variability.