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Modelling of the peri-urbain catchments with the help of a modular physically-based model : Mutli-Hydro

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Hydrological processes at stake in urban areas (rainfall, surface runoff, sewer flow and sub-surface flow) are intrinsically non linear and exhibit different characteristic spatial and temporal scales. These two basic features lead to non-trivial complex interactions. Another level of complexity is the constant evolution of the catchments features associated with anthropogenic effects. Few illustrations are the rapid urbanisation of available areas in peri-urban zones, and the implementation of artificial systems to cope with storm water. This alters the hydrological responses of the catchments and makes it hard to accurately model it especially since the range of spatio-temporal scales that needs to be taken into account is widened.

In order to provide an efficient representation of the urban water cycle, Multi-Hydro was developed at Ecole des Ponts ParisTech in the framework of the closed FP7 SMARTesT and current NWE Interreg 4 RainGain projects. This model is based on physical equations solved by coupled distributed models. It has been designed as a modular, scalable and easily transportable tool. Each module represents a hydrological process and relies on an open source software package. A dedicated GIS tool (MH-AssimTool), enables to easily generate, at the resolution chosen by the user, the model inputs from the currently available geographical and physical information. Indeed, special attention was paid to the observables with the least scale dependence. Tools for multi-scale analysis are used to represent their variability at smaller scales than their own scales, thus allowing an evaluation of the hydrological behavior of the studied areas through different scales.

The abilities of the model are presented through the study of a small peri-urban catchment (arround 1 km2) in the Paris area. Several scenarios of soil properties are tested to fill the missing data for this area. Advanced statistical tools are implemented on the model outputs; i.e. time series of flow in pipes, and maps of surface runoff and infiltrated water, which enables to enhance the understanding of the impact of the soil properties on the hydrological behaviour of peri-urban areas.