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Multi-Hydro: a multi module physically based model to evaluate effect of implementation of the flood resilience measure.

A. Giangola-Murzyn, A. Gires, J. Richard, I. Tchiguirinskaia, and D. Schertzer
LEESU, Champs-sur-Marne, France (giangola@leesu.enpc.fr)

Nowadays cities are rapidly growing, gradually transforming the nearby rural area into peri-urban area where the urbanization rate increases again and again. Many of these areas are located in the floodplain. In this context and to facilitate the choice of the protection measure of the building of these areas, the European SMARTeST project (Smart Resilient Technologies and System Tools) aims to create a guideline regrouping the different existing system and their conditions of use for different situations.
In this context, the Multi-Hydro model was improved and tested to evaluate the effect of the implementation of the flood resilience measures. This model consists of a coupling between different modules relying on existing and validated hydrological and physically based models for runoff processes, sewer system discharge and subsurface processes. The basic data are rainfall and GIS data of elevation, land use or soil description. However, the data necessary to perform this type of model can be difficult to access. These missing data, which can be evaluated by average values, can cause inaccuracies in the simulated water levels. But if the water level cannot yet able to be connected to survey measurements, the location of this water is very useful to understand the hydrological behavior of the study area. The ability to circle the missing data enables the portability of the model, which is a major advantage for the SMARTeST project. Multi-Hydro can be thus a tool useable by all project partners.
The model was implemented on a case study of the Paris area, the city of Villecresnes. Various scenarios in terms of implementation of protection measures are tested under a fixed rainfall scenario. The results of these simulations, analyzed as series of risk maps and by an advanced statistical analysis, show that depending on the selected measures (single barrier or perimeter), the behavior of the watershed is modified. Indeed, the modifications of the land use of the catchment cause a change in the location of the outlet of it. Furthermore, these changes create a new repartition of the overland water: before the implementation of the protection measures, the water is routed via the thalweg defined by the elevation to the outlet which is the lower point of the catchment, whereas after this implementation, the water route and the outlet are define by the free surfaces. Concerning the sewer system discharge, the changes in the land use didn't create significant change in the load of it.