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Advanced GIS data assimilation interface for evaluation of flood resilient systems

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The runoff in peri-urban catchments results from complex interactions of multi-component, multi-functional systems. These interactions increase the space-time variability of the flow depth and discharge. The Geographic Information System (GIS) technologies are well-established tools for the storage, display and interpretation of spatially distributed data required for spatially distributed hydrological modelling. An advanced GIS data assimilation interface is a requisite to obtain a distributed hydrological model that is both transportable from catchment to catchment and is easily adaptable to the data resolution. This should be achieved both for the cartographic data and the linked information data. Spatial distribution of the flow parameters during the storm event under different numerical scenarios is indispensable to evaluate the efficiency of flood resilience technologies, including for providing predictive tools for flood resilient urban system management.

In the case of Multi-Hydro-Version2 that has been developed within the EU FP7 SMARTesT project, several types of information are to be distributed on a regular grid. The grid cell size has to be chosen individually for each of the project case studies and each cell has to be filled up with information. The main requested data are topography and land use. The former corresponds to a quantitative information (elevation) to be as precise as possible, whereas the latter correspond to a qualitative description done with the help of a series of discrete classes, e.g.: house, road, gully, water,etc. The refinement of the class number is in fact limited by the grid resolution. Pedology is also very important, but reliable data are much less available, in particular in an electronic format. The model uses also the runoff that occurred before the event, the initial soil moisture and the elevation of the water in water bodies (e.g. puddles). These parameters are not easily accessible for a large studied area, so they have to be defined stochastically or manually according to the user needs. Because all the information does not come usually from the same source, a phase of data homogenisation is often required.

The afore mentioned diversity of input data, as well as the needed flexibility of the studied area and grid size, requires that the GIS interface must be easy to take in hand and also practical. The solution of hierarchical menus coupled with checkboxes was chosen. We will illustrate the potentiality of the resulting Multi-Hydro interface of input data on a few case studies of peri-urban catchments of widely different sizes and characteristics. A combination of GIS data together with the cell-distributed structure of Multi-Hydro gives time evolution of such spatially distributed information for each of the cells within an urban catchment. The obtained results enable us to validate the capacity of Multi-Hydro with its GIS interface to evaluate flood resilient systems.