



Assessment of Flood Mitigation Solutions Using a Hydrological Model and Refined 2D Hydrodynamic Simulations

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Following recurrent inundation problems on the Berwinne catchment, in Belgium, a combined hydrologic and hydrodynamic study has been carried out in order to find adequate solutions for the floods mitigation. Thanks to detailed 2D simulations, the effectiveness of the solutions can be assessed not only in terms of discharge and height reductions in the river, but also with other aspects such as the inundated surfaces reduction and the decrease of inundated buildings and roads. The study is carried out in successive phases.

First, the hydrological runoffs are generated using a physically based and spatially distributed multi-layer model solving depth-integrated equations for overland flow, subsurface flow and baseflow. Real floods events are simulated using rainfall series collected at 8 stations (over 20 years of available data). The hydrological inputs are routed through the river network (and through the sewage network if relevant) with the 1D component of the modelling system, which solves the Saint-Venant equations for both free-surface and pressurized flows in a unified way. On the main part of the river, the measured river cross-sections are included in the modelling, and existing structures along the river (such as bridges, sluices or pipes) are modelled explicitly with specific cross sections. Two gauging stations with over 15 years of continuous measurements allow the calibration of both the hydrologic and hydrodynamic models.

Second, the flood mitigation solutions are tested in the simulations in the case of an extreme flooding event, and their effects are assessed using detailed 2D simulations on a few selected sensitive areas. The digital elevation model comes from an airborne laser survey with a spatial resolution of 1 point per square metre and is completed in the river bed with a bathymetry interpolated from cross-section data. The upstream discharge is extracted from the 1D simulation for the selected rainfall event.

The study carried out with this methodology allowed to assess the suggested solutions with multiple effectiveness criteria and therefore constitutes a very useful support for decision makers.