Design of flood mitigation measures using 2D simulations and validation to a physical model: further optimisations of the system for the case study of the Sesto and the Drava rivers, in South Tyrol (Italy)

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In the contest of designing flood protection measures for and alpine village at the confluence between two rivers (Sesto and Drava), numerical simulations have been complemented with a physical model to optimize the efficiency of the protection system, consisting of an intake point, a hydraulic bypass, an energy dissipator, a channel and a weir.

The protection system is based on the diversion of part of the flood wave along the Sesto river by means of a river check dam and a lateral spillway. The derived flow is discharged through a hydraulic bypass into the Drava River, downstream the confluence with the Sesto river. The bypass is drilled across the mountain which separates the Sesto river valley from the Drava valley.

Since a maximum discharge of 40 m^3/s is allowed downstream the check-dam across the Sesto river, the rest has to be diverted through the hydraulic bypass, which is 500 m long and 8.7% steep. The energy of the flow needs to be dissipated at the end of the bypass before being released to the Drava river by means of a channel endowed with a lateral spillway. This is designed to flood the surrounding fields for events exceeding 1-in-100-year flood with the purpose not to worsen the situation for the dwellings downstream.

The project main elements have been introduced in the computational mesh and simulations with BASEMENT 3 have been performed. A physical model has been build in parallel by the Free University of Bozen-Bolzano and a series of tests has been designed to assess the numerical results. A rating curve for the river check dam was built experimentally and introduced in the numerical simulations as boundary condition.

Different design configurations were simulated in order to find an optimal solution. Results have been used to implement the final version of the project.