

## **Analysis of flash flood scenarios in an urbanized catchment using a two-dimensional hydraulic model**

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**Abstract** In Italy, growing urbanization is leading to a higher risk of flooding of small water courses, especially in steep catchments of limited area, where severe flash flood events can occur. The assessment of flash flood hazard requires new modelling tools that can reproduce both the rainfall–runoff processes in the catchment, and the flow processes in the drainage network. In this paper we propose the use of a simple two-dimensional hydraulic model for analysing a flood scenario in a small valley within the urban area of the city of Bologna, Italy. Historically this area has been prone to severe flood events, the most recent of which occurred in 1955 and 1932. Since then there has been a significant increase in urbanization of the lower portion of the catchment, while the natural stream bed has been partially replaced by a culvert. The two-dimensional hydraulic model was therefore applied at catchment scale, in order to simulate the possible effects of historical scenarios in the present catchment configuration. Rainfall and runoff data measured during recent rainfall events were used to calibrate model parameters. Model results show that the current culvert section would be insufficient to drain the runoff produced by intense rainfall events, with potential inundation of surrounding urban areas.

**Key words** flash floods; two-dimensional hydraulic model; urban areas; land-use change