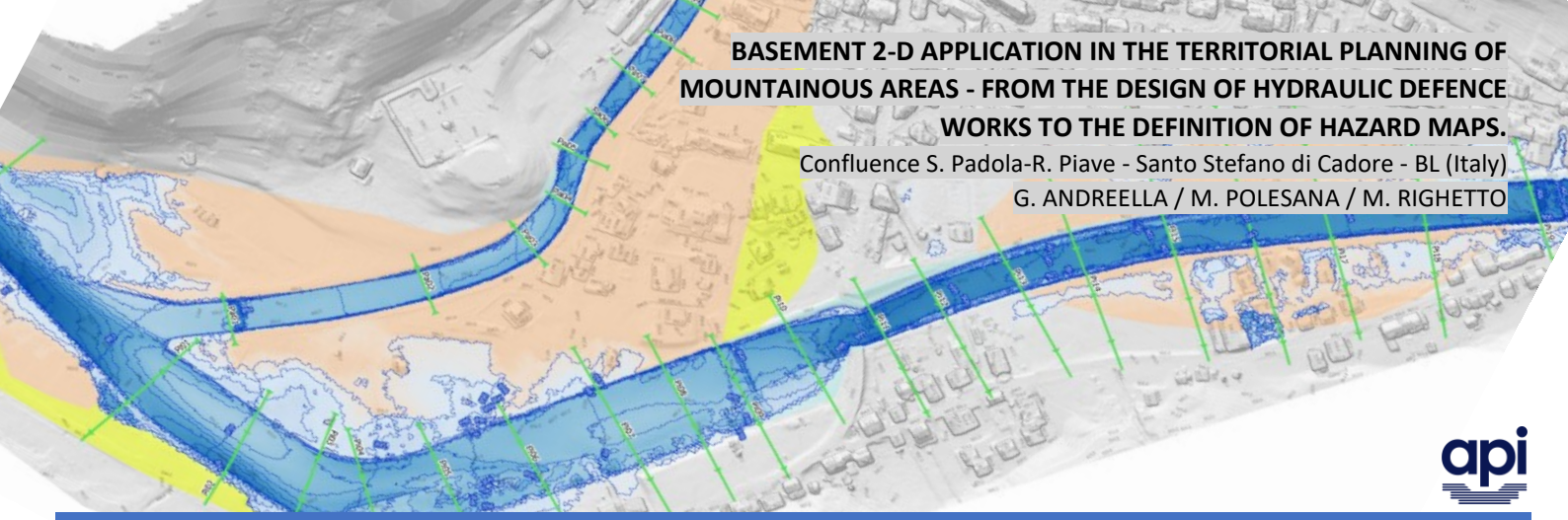

BASEMENT 2-D APPLICATION IN THE TERRITORIAL PLANNING OF MOUNTAINOUS AREAS - FROM THE DESIGN OF HYDRAULIC DEFENCE WORKS TO THE DEFINITION OF HAZARD MAPS.

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INTRODUCTION

This paper illustrates how the 2D morpho dynamic Basement has been applied as a support to the design of hydraulic hazard mitigation interventions and as an analysis tool for the modification of the perimeter of floodable areas and the mapping of the hydraulic hazard of the Basin Authority. The model reproduced the hydraulic and morphological events expected in the river Piave and the stream Padola near the town of Santo Stefano di Cadore (BL), in a mountain territory characterised by watercourses with torrential regime. The model outputs were processed through a bespoke GIS tool created by Studio API (IT) and Lutra Consulting (UK) based on the Buwal matrix (Heinimann, 1998) integrated with assessments related to morphological dynamic processes as bank erosion, bridge obstruction and avulsion.

Thanks to this application the municipality of Santo Stefano managed to obtain the authorisation from the Basin Authority to reduce the hazard classification and therefore the possibility of carrying out their planned public works.

MODEL INFO

The 2D morphodynamical model BASEMENT v.3 was implemented to analyse the dynamics of flood events. The domain covers an area of about 80 ha. The site presented a complex morphology, due to the presence of several hydraulics works and infrastructures and the presence of potentially obstructable bridges. To take into account the geometry of the works it was necessary to apply cells with a very small area of up to 0.8 m^2 It was therefore necessary to apply a procedure for calculating the phenomenon of bridge obstruction based on the analysis of the vegetation available in the riverbed and on the banks and which was simulated by imposing the "*internal wall*" condition in defined control sections.

Overall, the study included 22 simulations and 10 obstruction and avulsion scenarios. The study assumed a single-grain bedload transport, different calibration simulations were carried out based on the variation of the average diameter (D_{50} = 13-20 mm) on the variation of boundary conditions and roughness in order to exactly reproduce the official perimeter of the Basin Authority.

The three return times provided for by the Tr30, 100- and 300-years regulations were considered both in the conditions of maximum peak and in the conditions of maximum solid volume corresponding to the liquid hydrograph both in the conditions of fixed bottom and in the conditions of moving floor in order to evaluate the maximum expected flooding.

PROJECT DESCRIPTION

The project – designed in 2021 and realized in 2023- consisted of raising the levels of the retaining wall on the left bank of the Padola stream and the construction of new sections of the bank wall for a total amount of €1.8 million. The hydraulic study of the project has been updated several times both for the results of new investigations (topographic and geological update) and for the coming into force of the new district legislation (PGRA 2021-2027). Basement modelling is a substantial part of the sizing process of the works, in this specific case the model made it possible to evaluate the expected excavation at the foot of the bank wall and to correctly size the foundation piles and made it possible to identify the optimal solution for the reduction of floodable areas.

RESULTS

The results obtained with the model application were essentially three.

First, the model exactly reproduced the hydrodynamics and morphological evolution of a complex hydraulic node such as the one under study, allowing an accurate perimeter of the flooding of the town of Santo Stefano di Cadore. Second, the model gave useful indications to the design of hydraulic and structural countermeasures. Specifically, the model facilitated the assessment of the excavation next to the retaining wall, supporting the design of the new works. Thirdly, the model made it possible to obtain the reperimeter of floodable areas by processing the output files of a hight number of simulations in a GIS environment.