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Effects of anthropic changes on the propagation of the Gleno dam break wave in the Valle Camonica floodplain

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The catastrophic flood following the Gleno dam break, which occurred in 1923, has been investigated in the literature (Pilotti et al., 2011, Milanesi and Pilotti, 2021) considering the 20 km long steep alpine valley separating the dam location from the hamlet of Corna. In this contribution, we investigate the propagation of the flood wave from Corna, where the computed hydrograph from previous investigation provides the upstream boundary condition, as far as the Lake Iseo outlet in Sarnico, where two controversial documents attest its effect on the lakeshore. In the middle, the flood crossed 30 km of a wide pre-alpine floodplain that has been deeply modified over the last century and crossed 25 km of a deep lake.

The simulation has been accomplished by coupling 2 different 2D solver of the Shallow Water Equations: the well-known HEC-RAS 2D software was used to cover the floodplain from Corna up to the Lake Iseo inlet, while a finite volume scheme was used to simulate the lake behaviour in response to the incoming flood. The finite volume scheme used to model the lake is based on the WAF solver developed by Toro (Toro, 2001) and further adapted to account for the geometry of lake Iseo using an unstructured mesh. The scheme used retains shock-capturing capabilities and well-balanced properties able to withstand the constantly changing bathymetry of the lake as well as the unsteadiness of the hydrodynamics modelled. As a first step, the simulation was performed on the topography derived from the LIDAR DTM surveyed in 2008-2009. A computational mesh was built with average grid size of 10 m aligned in correspondence of levees and other singularities. This first simulation dramatically shows how the propagation of the flood wave was affected by the presence of linear structures such as levees and road embankments, absent in 1923 as shown by historical maps. For this purpose, the linear structure that affect the flow was removed from the 2008-2009 DTM and a second simulation was performed in order to compare the different flow hydrograph at the inlet of the lake.

An important fallout of the modeling effort is the reconstruction of the 1923 original bathymetry of the river in Valle Camonica, to be compared with the present one, affected by 100 years of river training works. The comparison of the flood propagation using the two bathymetries highlights the consequences of systematic hydraulic works on the hazard distribution for the same event. Paradoxically, the residual risk is now much higher than 100 years ago. Moreover, the simulations show that the claim of a 50 cm high bore at the inlet of the Oglio river is unsubstantiated by the model results and that an important request of damages was probably based on a false

statement.