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Analyzing the spillway failure of the Montedoglio dam in Central Italy

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The Montedoglio dam, built in the 1980s for irrigation and drinking water purposes, is an important reservoir on the Tiber River located in central Italy. The earth-fill dam is 64.30 m high with a drainage area of 276 km^2. The water storage volume, with the water at the height of the spillway, is approximately 153 millions m^3. On December 29, 2010 during final tests of the dam consisting to raising the reservoir level to the spillway crest, three concrete blocks of the spillway collapsed causing large damages in the territory downstream mainly to agriculture, infrastructures and other constructions (over 100 millions of euros of economic losses), luckily without casualties thanks also to timely action of the national/regional Civil Protection system. The discharge hydrograph following up the Montedoglio spillway collapse and its routing along the Tiber river valley are investigated here. The mathematical modelling of the reservoir depletion allows advancing well-founded hypotheses on the breach formation and in particular on the time interval in which the spillways collapsed found equal to 0.02 hours. The analysis is based on the recorded water reservoir level during the catastrophic event and on the comparison between the computed outflow discharge hydrograph and the one recorded at Gorgabuia equipped section located just downstream Montedoglio dam. The consequent dambreak flood wave is propagated downstream by using a one-dimensional model for flood wave routing and, based on the comparison between the flooded area extension estimated by the hydraulic model and the one observed through surveys and inspections carried out during the catastrophic event, the roughness calibration is addressed assessing different Manning roughness coefficient values for the main channel and the floodplains, respectively. For the analysis of the catastrophic event, data on water reservoir levels, river cross-sections geometry, discharges recorded at two gauged river sites and flooded area extension have been collected, thus getting a valuable knowledge which can be of support to improve the understanding and the management of dambreak events.