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A comprehensive multi-scenario based approach for a reliable flood-hazard assessment: a case-study application

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Flood hazard is generally assessed by assuming the return period of the rainfall as a proxy for the return period of the discharge and the related hydrograph. Frequently this deterministic view is extended also to the straightforward application of hydrodynamic models.
However, the climate (i.e. precipitation), the catchment (i.e. geology, soil and antecedent soil-moisture condition) and the anthropogenic (i.e. drainage system and its regulation) systems interact in a complex way, and the occurrence probability of a flood inundation event can significantly differ from the occurrence probability of the triggering event (i.e. rainfall).
In order to reliably determine the spatial patterns of flood intensities and probabilities, the rigorous determination of flood event scenarios is beneficial because it provides a clear, rationale method to recognize and unveil the inherent stochastic behavior of natural processes. Therefore, a multi-scenario approach for hazard assessment should be applied and should consider the possible events taking place in the area potentially subject to flooding (i.e. floodplains).
Here, we apply a multi-scenario approach for the assessment of the flood hazard around the Idro lake (Italy). We consider and estimate the probability of occurrence of several scenarios related to the initial (i.e. initial water level in the lake) and boundary (i.e. shape of the hydrograph, downslope drainage, spillway opening operations) conditions characterizing the lake. Finally, we discuss the advantages and issues of the presented methodological procedure compared to traditional (and essentially deterministic) approaches.