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Design of offline reservoirs for flood mitigation by using a structure-based risk framework

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In this work, we present a general framework for design and risk assessment of hydraulic structures for water control. The framework relies on a “structure-based approach”, accounting for both the statistical behavior of the hydrological load acting on the river system and the hydraulic response of the structure to the environmental load. This approach allows for the reduction of a multivariate and complex statistical problem to a univariate one, focusing on the damage. The framework is applied to an offline detention basin for flood mitigation based on a general, yet simplified routing model. Furthermore, a real-world case study application is presented, with the specific aim of discussing the role of the design parameters and their effect on the probability distribution of damage. Results show the robustness and the effectiveness of the approach for applications to real cases and provide design guidance for practitioners.