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Flood risk management: 2D inundation modelling for evaluating resilience strategies

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Flood risk management strategies based on the construction of levees may be called resistance strategies. Levee systems are usually characterised by an equal safety level. It implies that streamflows above the design discharge may cause flooding anywhere and even at several locations at the same time. Therefore, the evolution of the flood event is unpredictable. Furthermore, it is well known that levee heightening, to protect the flood prone areas, may add a component to the potential damage. A different policy of flood risk management is the so-called resilience strategy. In this approach, flooding is allowed in certain areas, so that the impact of flooding is minimised through policies of land-use planning and management.

We performed a series of numerical analyses by means of a 2D inundation model for evaluating the effects of resilience strategies for flood risk management. The study was performed over a wide flood prone area close to the Reno river, near the town of Ferrara (Northern Central Italy). The study aims at evaluating how a hydraulic structure, that enables a driven and controlled flooding, can significantly change the spatial variability of flood risk of the prone area. The numerical study was performed by using a 2D finite element model for simulating several inundation scenarios corresponding to different levee breach locations, geometries and evolutions in time. Each scenario was characterised by a different probability of levee failure. Then, results of each scenario, in terms of water depth, water flow velocity and residence time, were elaborated in order to generate a flood hazard map. By using this procedure, we generated two different flood hazard maps of the study area: a first one which is associated with the presence of a lateral weir that enables a controlled flooding (resilience policy), and a second one that hypothesizes that no lateral weir is present and refers to a continuous

left levee characterised by a homogeneous safety level (resistance policy).