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Hydrologic scaling and hydrogeomorphic floodplain delineation in urbanized basins: insights into human-induced disconnectivity of fluvial corridors

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Geomorphic approaches for floodplain identification are proving to be effective tools for managing and evaluating water risks. Hydrogeomorphic models capture the effect of hydrologic, geomorphic and anthropogenic processes on fluvial landscape morphology while dissecting river basins in floodplains and surrounding hillslopes. The increasing availability and accuracy of digital terrain models is supporting the development and testing of novel procedures and algorithms for hydrogeomorphic floodplain modelling in data scarce regions. This work investigates the impact of hydrologic scaling on the performances of a hydrogeomorphic floodplain model. The Susquehanna and the Wabash basins, two large urbanized and gauged river basins in the United States, are selected as case studies. Distributed hydrologic observations from USGS data are gathered and hydrologic data scaling is implemented through regression analyses to calibrate floodplain flow levels. Hydrogeomorphic floodplain modelling results are evaluated and compared to 100-year Federal Emergency Management Agency flood hazard maps. Results show that the geomorphic floodplain identification algorithm is able to identify the fluvial corridor and performances are not significantly impacted by varying hydrologic scaling parametrization. Nevertheless, major differences with standard flood hazard maps are located in the proximity of human-made structures (levees, bridges, etc.) and generally found where the geomorphic signature of fluvial processes is altered by urbanization processes and features. This research explores the value of geomorphic information for floodplain mapping in data scarce regions as well as the ability of hydrogeomorphic models in the evaluation of human-made impacts on floodplain ecosystem disconnectivity.