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Coupled large-eddy simulation and morphodynamics of a large-scale river under extreme flood conditions[1] ALI KHOSRONEJAD, FOTIS SOTIROPOULOS, Stony Brook University, STONY BROOK UNIVERSITY TEAM — We present a coupled flow and morphodynamic simulations of extreme flooding in 3 km long and 300 m wide reach of the Mississippi River in Minnesota, which includes three islands and hydraulic structures. We employ the large-eddy simulation (LES) and bed-morphodynamic modules of the VFS-Geophysics model to investigate the flow and bed evolution of the river during a 500 year flood. The coupling of the two modules is carried out via a fluid-structure interaction approach using a nested domain approach to enhance the resolution of bridge scour predictions. The geometrical data of the river, islands and structures are obtained from LiDAR, sub-aqueous sonar and in-situ surveying to construct a digital map of the river bathymetry. Our simulation results for the bed evolution of the river reveal complex sediment dynamics near the hydraulic structures. The numerically captured scour depth near some of the structures reach a maximum of about 10 m. The data-driven simulation strategy we present in this work exemplifies a practical simulation-based-engineering-approach to investigate the resilience of infrastructures to extreme flood events in intricate field-scale riverine systems.

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Ali Khosronejad
Stony Brook University

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