

The Holocene/Anthropocene Transition in the Mississippi River Delta

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This talk will examine how the Mississippi River Delta (MRD) transitioned from a system dominated by Holocene dynamics, to one dominated by Anthropocene dynamics. Whereas during the Holocene, rates of relative sea-level rise were relatively modest (often $<1 \text{ cm yr}^{-1}$), and relatively constant over regional (1-50 km) spatial scales, during the Anthropocene, rates of relative sea-level rise were greater ($>1 \text{ cm yr}$) and substantially more variable over the 1- 50 km spatial scale. Whereas during the Holocene, the course of the Mississippi River was driven largely by patterns of sediment infilling that drove avulsions, during the Anthropocene the course of the Mississippi River has largely been driven by needs for flood control and economic efficiency. Anthropocene and Holocene dynamics merge in subsurface flow, where levees influence the maximum stage of the Mississippi River, and the historic distribution of sandy channels influence pattern of groundwater flow. The early stages of Anthropocene development of the MRD were marked by nearly 4,900 km² of land loss, about 20% of the deltas area. Looking forward, many plans to restore the Mississippi River involve Anthropogenic activities designed to partially mimic Holocene-era sedimentary dynamics. These involves the formation of artificial crevasses, designed to carry 100 to 2,000 m³ s⁻¹ of freshwater that distribution sediment across 10s to 1000s of km². The efficacy of these systems at providing ecosystem services can be further enhanced by the creation of artificial bars and barrier that enhance sediment trapping and retention. Ultimately, the sustainability of the MRD will require managing the interactions between hydrologic, sedimentary, economic and cultural factors.

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