Backwater Implications for Sediment Transport and Channel Morphology in the Lowermost Mississippi River

Nittrouer, Jeffrey A.[1]; Mohrig, David [1]; Allison, Mead [1]; Kim, Wonsuck [1]; Parker, Gary [2] (1) Jackson School of Geosciences, Univ. of Texas at Austin, Austin, TX. (2) Civil and Environmental Engineering, University of Illinois at Urbana-Champaign, Urbana-Champaign, IL.

Field data and numerical modeling pertaining to water flow and sediment flux in lowermost Mississippi River provide valuable insights into channel morphology and sediment transfer to the system's accompanying river delta. Observational data were collected over a variety of water discharge conditions, and include multibeam channel-bed bathymetry, water column velocities and suspended-sediment concentrations. These data sets provide three independent means to estimate sediment transport conditions via empirical and physics-based numerical models. Combined, the data enable a calculation of bed material sediment flux, which is shown to increase one-hundred fold between low-and flood-water discharge. Driving this substantial change in sediment flux is a ten-fold increase in skin friction shear stress, arising in response to an order-of-magnitude variation in water surface slopes. Ocean-basin-induced backwater moderates water surface slopes during low-water discharge, and this backwater effect is only disrupted during flood-water discharge. Variable stress conditions and the punctuated nature of sand transport in the lowermost Mississippi River limit alluvial coverage of the channel bed. The river bed is fully covered by sand only is channel segments where the thalweg crosses between river banks (<50% of the channel bed). Channel bends display a mixture of exposed bedrock substrate (eroding, consolidated Pleistocene and early Holocene deposits) and sandy alluvium; no sand bed is present in the tightest bends where channel radius-of-curvature/channel width is less than four. We will discuss the implications of these discoveries for the magnitude and timing of sediment transport through the lowermost Mississippi River to its delta. These data will also be used to motivate a physics-based model to assess land building potential in southern Louisiana via controlled river diversions.