Geophysical Research Abstracts
Vol. 20, EGU2018-5587, 2018
EGU General Assembly 2018

Interactions between three-dimensional flow structure and bed morphology in large elongate meander bends

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This presentation focuses on interactions between the spatial pattern of three-dimensional flow structure and bed morphology within two elongate meander loops of the Wabash River, located along the Illinois-Indiana border, USA. These two meander bends differ in their floodplain vegetation, extent of exposed bedrock and vegetation within the channel, and differences in the near-bank flow field and channel morphology, resulting in substantial differences in the rates of bank erosion and channel migration. To characterize the interactions between flow structure and channel bed morphology, three-dimensional velocities, detailed channel bathymetry, and bedform geometry were obtained for multiple discharge events, ranging from mid-bankfull to overbank flow from 2009-2013. In both meander bends, the flow structure is characterized by strong topographic steering by the point bar, helical motion associated with channel curvature, and acceleration of flow within bedrock reaches. In the meander bend absent of large woody debris, multiple outer bank pools are evident and can be linked to the spatial variations in channel curvature. In contrast, the meander bend with abundant large woody debris exhibits one large outer bank pool, likely reflecting the influence of the woody debris on the near-bank flow structure. Differences in bedform morphology are also observed between the two bends, and do not appear to be consistent with experimental studies of elongate meanders.