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A remote sensing approach for connecting the historic 2011 Mississippi River flood to wetland sedimentation on the Delta

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Wetlands in the Mississippi River deltaic plain are deteriorating in part because levees and control structures starve them of sediment. In Spring of 2011 a record breaking flood brought discharge on the lower Mississippi River to dangerous levels, forcing managers to divert additional water to the adjacent Atchafalaya River Basin. Here we quantify differences between the Mississippi and Atchafalaya River inundation and sediment-plume patterns using field-calibrated satellite data, and assess the impact these outflows had on wetland sedimentation.
Since standard products available from MyOcean were not suitable for this purpose an ad hoc processing was developed to establish a relationship between field suspended sediment concentration (SSC) data and the corrected MODIS reflectance at 645 nm. We show that the focused, high-momentum jet from the leveed Mississippi delivered sediment far offshore. In contrast, the plume from the Atchafalaya was more diffuse; diverted water inundated a large area, and sediment was trapped within the coastal current.
Maximum sedimentation (up to several centimetres) occurred in the Atchafalaya Basin despite the larger sediment load carried by the Mississippi. Little accumulation occurred along the shoreline between these river sources. The correspondence between zones of high shoreline deposition, and coastal SSC patterns indentified from satellite data, is strongly suggestive of plume-derived deposition on marshes.
Our findings allow us to set an hydrodynamic theory that provides a mechanistic link between river-mouth dynamics and wetland sedimentation patterns, which is relevant for plans to restore deltaic wetlands.