Impact of Water Loss on Sustainability of the Mississippi River Channel in its Deltaic Reach

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Abstract

The Mississippi River channel from New Orleans to the Gulf of Mexico (GOM) is a key deep draft navigation channel and an active deltaic lobe. Natural and engineered lateral exits from this reach into adjacent receiving basins historically has provided mineral sediment for wetland accretion in the face of rising relative sea level and supported estuarine-coastal food webs. However, our analysis indicates water losses from the channel have increased by 25% since 2004 due to (1) bank failures during large floods since 2012 that have created several large exit channels downriver of the flood protection levee, and (2) the opening of an engineered diversion at West Bay in 2004. This has resulted in a 60-80% loss in stream power in the lowermost navigation channel that is accompanied by net shoaling between 2012 and 2022 and an increased dredging need. Our 2022 survey in the GOM exit passes indicates that only 20% of the freshwater, 5% of the total suspended sediment (2% of the sand) at New Orleans now reaches the GOM: this supports previous research indicating the delta front is retreating after centuries of progradation. Together these results indicate that (1) river containment and the sustainability of the navigation channel is threatened, (2) sediment load reaching the seaward end of the delta may be insufficient to avoid major degradation, and (3) the increased freshwater flux into adjacent shallow coastal water bodies has unknown implications for coastal hypoxia and food webs, including commercial species (e.g., oysters) and marine mammals. Future acceleration in sea level rise rates and tropical storm frequency/intensity likely will worsen these trends.

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