Tulane study reveals how floods drive river movement amid shifting environmental patterns

December 01, 2025 9:00 AM Stacey Plaisance
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The Lower Mississippi River from just north of Baton Rouge to the Gulf was central to a new Tulane University study on how floods impact the way rivers shift over time. (Photo by iStock)

A new Tulane University study published in *Science Advances* sheds light on how floods influence the way rivers move, offering fresh insight into how changing flood patterns may reshape waterways and the communities that depend on them.

The study, led by Chenliang Wu, a postdoctoral fellow in Tulane's Department of Earth and Environmental Sciences in the School of Science and Engineering, provides a physics-based explanation for how the size and frequency of floods affect river migration.

The research draws on data from 64 river systems around the world, focusing on a stretch of the Lower Mississippi River from just north of Baton Rouge to the river’s end near the Gulf. Some other examples of rivers of vital socioeconomic and environmental importance analyzed in the study include the Amazon (Brazil), Ob (Russia), Sacramento (California) and Brazos
(Texas).

“Our work shows that the rivers shaping our communities aren’t just fixed water channels,” Wu said. “They’re dynamic systems governed by predictable rules. We found that the rate of river movement can be predicted by the composition of the riverbank material: muddy banks resist erosion, whereas sandy banks allow the river to migrate more easily. This is a hypothesis that has long been proposed but has not been systematically tested due to limited data.”

Using detailed data collected by the U.S. Army Corps of Engineers, Wu analyzed how the riverbank composition along the Lower Mississippi changes in response to flood size and frequency. The findings reveal that larger and less frequent floods lead to greater movement of sandy sections of the river, while muddier reaches remain relatively stable.

Kyle Straub, professor, department chair and co-author of the study, said the Mississippi River serves as a “natural laboratory” for understanding how rivers behave under varying flood conditions.

“Communities along riverbanks are facing more frequent swings between floods and droughts,” Straub said. “While artificial levees keep the Mississippi’s course in place, many rivers worldwide, especially those without engineered barriers, are free to shift. As flood cycles intensify, these movements could displace communities or strain infrastructure.”

The study also has implications for river management and policy, Wu said.

“Many rivers form geopolitical boundaries and support extensive agricultural regions,” he said. “When rivers shift, these movements can create disputes over territory and threaten farmland and infrastructure. Understanding how rivers naturally migrate helps ensure that restoration and management efforts work with, rather than against, natural processes.”

Looking ahead, Wu said his next goal is to build on the findings of this study to develop a more comprehensive framework that integrates multiple factors to improve predictions of how rivers will evolve under future environmental conditions.

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Chenliang Wu, School of Science and Engineering