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Marsh-Delta Interactions: The strong influence of marsh deposition on delta slopes and mass partitioning

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River deltas and the vast marshes that they host are impossible to separate. However, the sediment dynamics of rivers (channel- and lobe-based deposition) and marshes (elevation-based deposition) have not been investigated as a coupled system. We investigate this coupling by comparing a laboratory delta experiment with proxy marsh accumulation to a proxy-less control. The proxy adds just 8% mass to the system but clearly influences delta slopes and mass partitioning. Slopes in the marsh window (elevations around sea level where marsh accumulates) are reduced by 40%, as marsh deposition away from channels smooths topography. While riverine sedimentation continues to be 85% of the deposit in the marsh window, the reduced slopes increase the area in this zone such that 1.3 times more clastic volume is deposited in this window. The area above the marsh window and the mass fraction deposited at these high elevations is correspondingly reduced as if the marshes are “stealing” riverine sediment from upstream. Comparing experimental elevation distributions to the field, we show that large deltas might also exhibit this signature. Given that coastal risk is tied to elevation, these findings show that the coupling between marshes and deltas significantly impacts how they should be managed.