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Sediment retention in river deltas and feedbacks with delta morphology

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Fluvial sediments have collectively formed about 900,000 km² of deltaic land since Holocene sea-level rise slowed down. The rate at which deltas have retained fluvial sediment to build deltaic land, however, has varied greatly between different deltas. Here we quantify sediment retention in the delta topset and foreset for 3,556 deltas globally. We estimate retention from data on delta morphology and cross-sectional area, combined with WBMSed data on fluvial suspended sediment supply. Deltas, on average, retain 25±2% (standard error of the mean) of the fluvial sediment in their topset and 31±2% in their foreset. Because topset sediment retention reduces the sediment delivery to the river mouth, it sets up a feedback with processes that build delta morphology. Waves reduce topset sediment retention whereas tides increase it. Tide dominated deltas retain 61±24% on their topset, on average, compared to 21±3% and 24±2% for river- and wave-dominated deltas, respectively. Larger deltas trap more sediment, but not in comparison to their larger sediment loads, making them relatively inefficient sediment traps.