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The impact of compaction of clastic sediments on fluvial-dominated delta morphology

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Only a limited amount of data is available to quantify the impact of syn-depositional compaction on delta depositional patterns. In this study, we investigate numerically how different scenarios for compaction rate (0 - 10 mm yr^{-1}) drives morphological variations in mud- and sand-rich fluvial-dominated deltas. To do this, a 1D grain-size dependent compaction model was implemented into the open-source Delft3D. This implementation allows deposited sediment to decrease in thickness over time due to the accumulation of newly deposited sediments above. The resultant sedimentary deposits of a prograding delta are post-processed to highlight the changes in depositional patterns under different compaction scenarios. Deposits are classified into sub-environment (e.g., delta top, delta front, and pro delta). The delta top geometry (e.g., area, shape, and rugosity) and the distribution of sediment between different sub-environments are compared. The modeling results verify that the larger compaction-induced subsidence affects accommodation provision. We show that this results in more significant sediment deposition and more evenly distributed sediment across the delta top. Larger compaction results in a smaller area with a more semi-circular shape and less rugose delta top. The modeling results presented here bridges the knowledge gap on the effects of syn-depositional compaction on delta morphology evolution.