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Intertidal floodplain controls on centennial-scale morphological channel development

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Intertidal areas disappear in deltas worldwide because of land reclamations. This greatly impacts delta morphology because the presence and physiological characteristics of intertidal areas determine the tidal regime and, as a result, residual sediment transport patterns in tidal basins. Understanding how the interaction between intertidal areas and channels in tidal basins influence morphodynamics is therefore important to predict morphological development and to assess the resilience of delta's to changing boundary conditions.

In the Ems estuary (The Netherlands), the gradual embankment of a large intertidal embayment altered the planform and cross-sectional geometry of the estuary, leading to changes in the tidal regime and associated residual sediment transport patterns. As early as 1952, it was already suggested that these changes eventually caused a shift towards an alternative historical development of the geometric configuration of the channels; from a multiple to a single channel system.

This study shows through centennial-scale morphological modelling that the observed system shift can be hind-casted, while conserving model validity by comparison to the observed gross morphodynamics trends. The results indicate that the system shift is indeed driven by land reclamations. This provides a unique case to study the processes leading to the observed developments and evaluate the value of tidal-asymmetry based stability relationships to predict regime shifts in estuarine development.