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Influence of wave angle distribution and sediment supply variation on plan-view delta morphology: application to the Ebro Delta, Spain

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The morphology and depositional history of wave-influenced deltas reflects the interplay between the terrestrial and coastal domains. Here, we use the Coastline Evolution Model (CEM) to investigate plan-view delta evolution to study how wave approach angle and changes in sediment delivery can affect their morphology. Simulations demonstrate that the directional spread of incoming waves plays a dominant role over fluvial sediment discharge in controlling the width of an active delta lobe, which in turn affects the characteristic timescales of delta progradation. Furthermore, an asymmetry in the wave approach angle (and a consequent asymmetry in alongshore sediment transport), can lead to asymmetry in the plan-view delta form and development of depositional asymmetry, including an increase in sediment deposition on the updrift delta flank. Variation of sediment supply also affects plan-view geometries, and can result in delta morphologies, including recurved spits on either end of the active river lobe, that are not attained when driving forces are held constant. Further investigations are applied to the evolution of the Ebro Delta, Spain, over the last several thousand years by coupling CEM with HydroTrend, a climate-driven hydrological transport model. These simulations seek to understand how anthropogenic impacts and climate change may be reflected in the evolution of the Ebro River, Spain. Preliminary results suggest that the general morphology and evolution of the Ebro Delta demonstrates marked changes in local sediment input at the active lobe, including a rapid increase in sediment supply followed by a reduction. Continued research addresses whether this change in sediment input can be attributed to climate changes, anthropogenic influence, or natural processes of river avulsion.