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TITLE: A Holistic Modeling Approach to Project the Evolution of Inlet-Interrupted Coastlines Over the 21st Century

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ABSTRACT:

Approximately one quarter of the World?s sandy beaches, most of which are interrupted by tidal inlets, are eroding. Understanding the long-term (50-100 year) evolution of inlet-interrupted coasts in a changing climate is therefore of great importance for coastal zone planners and managers. This study therefore focuses on the development and piloting of an innovative model that can simulate the climate-change driven evolution of inlet-interrupted coasts at 50-100 year time scales, while taking into account the contributions from catchment-estuary-coastal systems in a holistic manner. In this new model, the evolution of inlet-interrupted coasts is determined by: (1) computing the variation of total sediment volume exchange between the inlet-estuary system and its adjacent coast, and (2) distributing the computed sediment volume along the inlet-interrupted coast as a spatially and temporally varying quantity. The exchange volume, as computed here, consists of three major components: variation in fluvial sediment supply; basin (or estuarine) infilling due to the sea-level rise-induced increase in accommodation space; and estuarine sediment volume change due to variations in river discharge. To pilot the model, it is here applied to three different catchment-estuary-coastal systems: the Alsea estuary (Oregon, USA), Dyfi estuary (Wales, UK), and Kalutara inlet (Sri Lanka). Results indicate that all three systems will experience sediment deficits by 2100 (i.e. sediment importing estuaries). However, processes and system characteristics governing the total sediment exchange volume, and thus coastline change, vary markedly among the systems due to differences in geomorphic settings and projected climatic conditions. These results underline the importance of accounting for the different governing processes when assessing the future evolution of inlet-interrupted coastlines.

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