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Modelling the morphodynamics and co-evolution of coast and estuarine environments

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The morphodynamics of coast and estuarine environments are known to be sensitive to environmental change and sea-level rise. However, whilst these systems have received considerable individual research attention, how they interact and co-evolve is relatively understudied. These systems are intrinsically linked and it is therefore advantageous to study them holistically in order to build a more comprehensive understanding of their behaviour and to inform sustainable management over the long term.

Complex environments such as these are often studied using numerical modelling techniques. Inherent from the limited research in this area, existing models are currently not capable of simulating dynamic coast-estuarine interactions. A new model is being developed through coupling the one-line Coastline Evolution Model (CEM) with CAESAR-Lisflood (C-L), a hydrodynamic Landscape Evolution Model. It is intended that the eventual model be used to advance the understanding of these systems and how they may evolve over the mid to long term in response to climate change.

In the UK, the Holderness Coast, Humber Estuary and Spurn Point system offers a diverse and complex case study for this research. Holderness is one of the fastest eroding coastlines in Europe and research suggests that the large volumes of material removed from its cliffs are responsible for the formation of the Spurn Point feature and for the Holocene infilling of the Humber Estuary. Marine, fluvial and coastal processes are continually reshaping this system and over the next century, it is predicted that climate change could lead to increased erosion along the coast and supply of material to the Humber Estuary and Spurn Point. How this manifests will be hugely influential to the future morphology of these systems and the existence of Spurn Point.

Progress to date includes a new version of the CEM that has been prepared for integration into C-L and includes an improved graphical user interface and more complex geomorphological processes. Preliminary results from simulations of the Holderness Coast and Spurn Point support findings of other authors, who suggest that changes to the wave climate influences sediment transport patterns in the nearshore zone. The angle of wave approach to the Holderness shows particular significance compared to the height of waves, with an optimum volume of material transported at 42 degrees. Further applications and results of this new model will be presented and discussed.