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Simulating the mesoscale impacts of sea wall defences on coastal morphology

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Solid coastal defences are deployed in many countries to halt or slow coastal erosion. Although the impacts on local sediment fluxes have been studied in detail, the non-local impact of a modified sediment flux regime on mesoscale coastal morphology has received less attention. Morphological changes imparted by defensive structures at these scales (decadal processes over tens of kilometres) can be difficult to quantify or even identify with field data. Difficulties in assessing the impact of these structures arise in the separation of natural and anthropogenic influences, both of which can be highly dynamic and non-linear. Numerical modelling allows these influences to be separated and the impacts of coastal defensive structures to be assessed. We extend previous work (Barkwith et al., 2013) to explore the influences of sea walls on the evolution and morphological sensitivity of a pinned, soft-cliff, sandy coastline under a changing wave climate.

The Holderness coast of East Yorkshire, UK, is one of the fastest eroding coastlines in Europe and is used as a case study for this research. Using a mesoscale numerical coastal evolution model, stochastic wave climate data are perturbed gradually to assess the sensitivity of the coastal morphology to changing wave climate for both the defended and natural scenarios. Comparative analysis of the simulated output suggests that sea walls in the south of the region have a greater impact on sediment flux due to the increased sediment availability along this part of the coast. Multiple defended structures, including those separated by several kilometres, were found to interact with each other, producing a complex imprint on coastal morphology under a changing wave climate. Although spatially and temporally heterogeneous, sea walls generally slowed coastal recession and accumulated sediment on their up-drift side

Barkwith, A., Thomas, C.W., Limber, P.W., Ellis, M. A., and Murray, A. B.: Assessing the natural morphological sensitivity of a pinned, soft-cliff, sandy coast to a changing wave climate, Earth Surf. Dynam. Discuss., 1, 855–889, doi:10.5194/esurfd-1-855-2013, 2013.