Modelling the Holderness Coastline: Past, Present and Future

A. Barkwith[1], P. Limber[2], C.W. Thomas[1], A.B. Murray, H. Evans[1] and M. Ellis[1]

1. British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, NG12 5GG, UK

2. Nicholas School of the Environment, Duke University, Durham, North Carolina, NC 27708, USA

Introduction and Background needed

An adapted version of the Coastline Evolution Model (CEM) was developed for the study, allowing an ensemble of simulations to be undertaken based upon modified offshore wave climate, initial conditions and forcing factors. The CEM follows a standard one dimension modelling approach, where the cross-shore dimension is collapsed into a single data point, and allows the dynamic morphology of a two dimensional plan view shoreline to be simulated. The version of CEM utilised for this study varies from the standard model, facilitating study of a rocky coast with variable erosion rates and enabling simulation of coastline evolution when sediment is supplied from an eroding shoreface. The CEM was further adapted to use a daily averaged, observed, two year, offshore wave climate input that is repeated over the length of each simulation.

Initial work concentrated on the reconstruction of the current coastline shape from an ensemble of hypothetical post LGM shoreface positions and past wave climates. Reconstruction of the shoreline shape was possible using several differing initial conditions and wave climates, although time taken to reach the required state varied by up to three thousand years. For the majority of simulations that reached the required shape, a steady state was noted for proceeding years where erosion proceeds at an equal rate along the length of the coast south of the headland. Together with a sensitivity analysis, the derivation of the current coastline provided initial conditions for the second body of work; simulating the morphological reaction of the Holderness coastline to possible future changes in climate over the next century. The ensemble approach was utilised for creating the future wave climates, that drive the model, based on current predictions of the North Sea response to climate change. These perturbations were applied linearly to the wave climate as each simulation progressed, with full application at the end of a model run. The ensemble output was compared to a baseline simulation, run for a century under current wave climate, to assess the impact of predicted future climate on coastal erosion. Although this study does not currently take into account the changes in storm frequency, rises in sea level or the anthropogenic inputs that could influence the results, the initial output indicates erosional rates over the next century are likely to be retarded for the Holderness coastline under a changing climate.