Complex coastlines responding to climate change: do shoreline shapes reflect present forcing or ‘remember’ the distant past?

Christopher W. Thomas1, A. Brad Murray2, Andrew D. Ashton3, Martin D. Hurst4, Andrew K. A. P. Barkwith4, Michael A. Ellis4

1British Geological Survey, Lyell Centre, Edinburgh, EH14 4AP, Scotland, UK.

2Division of Earth and Ocean Sciences, Nicholas School of the Environment and Earth Sciences and Center for Nonlinear and Complex Systems, Duke University, Durham, North Carolina, 27708, USA.

3Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts, 02543 USA.

4British Geological Survey, **Nicker Hill, Keyworth, Nottingham, NG12 5GG, England, UK.**

Correspondence to: Christopher W. Thomas ([cwt@bgs.ac.uk](mailto:cwt@bgs.ac.uk))

**Supplementary Information**

**Simulation animations**

Animations of the key models run for this study, and from which the results are derived, are presented as MP4 format videos. There are videos for capes and spits. These run on Windows machines, using Windows Media Player. They should work with any video software

*Filename convention* Each video filename is labelled systematically, so as to describe the run conditions. The following is an example:

**250YrsU0.7-0.45A0.5NoTrans.mp4**

**250Yrs**: the length of the model run in model years (365 days). In the 250 year models, initial conditions were run for 50 years. Initial conditions for 500 year models were run for 125 years. Nine hundred and 1000 year models had initial conditions run for 250 years.

**U0.7-0.45**: This indicates the change in the proportion of high-angle (> 45°) waves in the model wave climate. In this example, 0.7 is the starting condition and 0.45 the changed condition. If there is just a single number after U, this is a model run with a constant wave climate; the word ‘**Static**’ will appear at the end of the filename.

**A0.5**: This indicates the asymmetry in the wave climate; in this case the wave climate is symmetrical, resulting in the development of capes.

**Trans**, **NoTrans**: This indicates whether the wave climate was change instantaneously (NoTrans) or gradually. In cases where the wave climate is changed gradually, the number following ‘Trans’ indicates the number of years over which the transition occurred.

*Animations* The .mp4 video animations comprise time-stacked ‘snapshots’ of coastlines as they evolved in the model domain during CEM simulations. The ocean is dark blue, and land is red. The cells that form the coastline vary in colour, depending on the percentage of sand; the colour map used in the animations is the default ‘Jet’ implemented in plt.imshow() in Python:



Fully red cells represent land, fully blue cells represent ocean.

Beginning at Year 0 – represented by a flat coastline with random noise – coastline models are saved at specified intervals. For the 250 year simulations, the frame interval is 5 years (1825 daily steps); for all other models, the interval is ten years (3650 daily steps).