Geophysical Research Abstracts
Vol. 13, EGU2011-3277, 2011
EGU General Assembly 2011

Modelling the effects of climate change and sea-level rise on the evolution of incised coastal gullies.

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Incised coastal gullies intersect the highly dynamic boundary between the coastal- and terrestrial- process zones. The processes controlling their evolution are dominated by episodes of coastal cliff retreat and the head-wards erosion of in-stream knickpoints. Incised coastal gullies along the South West Coast of the Isle of Wight, UK, are internationally recognised (Heritage Coast designation, SSSI) as being important for both ecology and geomorphology, providing habitats for many specialist and endangered plant and invertebrate species. To underpin meso-scale (c.100 years) management strategies, elucidating the future evolution of these gully environments involves understanding the combined effects of sea-level rise and climate change, likely to be manifested through increased storminess and precipitation intensity and duration.

Landscape Evolution Models (LEMs) provide a useful tool to explore such future changes of geomorphic systems. However, until recently most prior LEM work has focused exclusively on terrestrial processes such as fluvial erosion and hillslope processes. This makes understanding the interactions between these terrestrial processes and coastal erosion challenging. To address this, the CHILD LEM has been modified to include a representation of the lateral retreat of a sea cliff. In this representation the rate of cliff recession is assumed to be a linear function of the cumulative wave energy over a threshold that is imparted to the foot of the cliff. We have determined this wave energy threshold using historical cliff retreat data, digitised from aerial photos and maps, with wave height data for corresponding periods used to integrate the energy spectra. Once the accumulated excess energy has the ability to remove a section of cliff equal to or greater in length than the underlying mesh cell, the cell height is adjusted to represent an episode of cliff retreat. Here we present details of the development of the excess wave height cliff retreat module and its implementation within CHILD. Preliminary results showing how changes in synthetic storm duration and intensity alter cliff retreat patterns and hence the evolution of the incised coastal gully systems are also presented.