Exploring the drivers of long term development of incised coastal channels (Chines) on the Isle of Wight using a numerical model.

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Incised coastal channels are found in numerous locations around the world where the shoreline morphology consists of cliffs. The incised coastal channels found on the Isle of Wight are known locally as 'Chines' and debouche (up to 45m) through the soft cliffs of the south west coast, maintaining steep side walls subject to deep-seated mass wasting. These canyons offer sheltered locations and bare substrate, providing habitat for plant *(Philonotis marchica, Anthoceros punctatos)* and invertebrate *(Psen atratinus, Baris analis, Melitaea cinxi)* species of international importance. The base level of the Chines is highly dynamic, with episodes of sea cliff erosion causing the rejuvenation of the channel network. Consequently a key factor in Chine evolution is the relative balance between rates of cliff retreat and headwards incision caused by knickpoint migration. To provide a long-term context for these issues, and to clarify which of the factors are the most important in driving evolution of chine form, the Holocene erosional history of the Chines was simulated using GOLEM, a well established landscape evolution model. Application of GOLEM is adapted in a novel way, to include a cliff recession function that controls the position of the outlet boundary; a type of functionality which we believe has not been attempted before with a landscape evolution model. Channel erosion is then simulated by a detachment-limited process law, parameterised with empirically-derived data. However, efforts to constrain plausible hypotheses pertaining to the Chines' erosional history are potentially hampered by the need to explore a wide range of simulation scenarios to account for model parameter uncertainty as well as uncertainty in the driving sea-level and climate change histories. To address this issue we employed a Central Composite Design ('CCD') technique to sample variations in the model driving variables, enabling us to account for the uncertainty inherent in parameterising the driving conditions (e.g. sea-level rise and climate change histories) within model simulation scenarios. This allows the possible different evolution histories of the Chines - in response to different combinations of the driving conditions – to be modelled explicitly. Variations in rates of long-term cliff retreat (forced by Holocene sea-level rise) and climate change were thus simulated. In some of these simulations modelled chine forms conformed closely to those observed in the field. These cases therefore comprise a suite of climate-sea-level scenarios which plausibly explain the evolution of the Chines during the Holocene.

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