Coastal domain analysis for geo-coastal assessment in Great Britain

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Coastal erosion and flooding are an increasing issue in Great Britain and pose a significant threat to people living and working in coastal environments, as well as the associated threats to infrastructure and assets. Recent storms, including Storm Callum in 2018, Storm Frank in 2014 and the east coast tidal surge in 2013, have highlighted these issues and caused widespread flooding, power outages and travel disruption. Repairs to homes, buildings, infrastructure and coastal defences cost tens of millions of pounds and took several months to complete with disruption to life, livelihoods and the national economy continuing long after the events.

The geomorphological variability of Great Britain's ca. 11,000 mile long coastline, from steep, hard cliffs to weak, easily erodible cliffs and wide flat estuaries, is challenging to represent and therefore consider in a modelling environment. Consequently, the variability, particularly in cliff geology, lithology and rock properties, is often under-represented in coastal modelling and coastal management planning. This results in potentially critical factors such as cliff complexity (e.g. multiple lithologies, jointing and bedding structures, permeability), cliff morphology, and the coastal buffer, being overlooked, all of which can influence the way coastal landforms respond to changing climatic drivers. Finding an accessible, objective and multi-scaled way of communicating this variability to a wide range of coastal practitioners is important in helping to address coastal vulnerability and increase resilience regionally and nationally.

Using a novel partitional clustering approach, we have developed a new classification system for the coastline of Great Britain, which divides the coastline into specific domains based on a range of physical variables. This method combines data available from the existing BGS Coastal Vulnerability Dataset which includes geology type, cliff strength, foreshore environment and inundation potential. In addition, open source datasets, including wave power and height, tide height and tidal current speed, have been incorporated. The datasets have been attributed to ca. 4 million transects at 5 m intervals along the coastline. Effective multivariate clustering data driven techniques, with expert assessment, have been used to cluster the dataset in an iterative way. This approach enables the capture of the thoughts and processes that we as geomorphologists consider when comparing one coastal area with another and will provide a tool for communicating variability in the coast and its resilience to erosion and flooding.

This is the first time such a method has been applied nationally in Great Britain and will provide a potential new benchmark for describing the GB coastline and the changes that it may be subject to. The resulting coastal domains dataset will soon be made available to practitioners in the UK.
and will assist in making more informed decisions when considering coastal management.