

Understanding and Predicting Beach Morphological Change Associated with the Erosion of Cohesive Shore Platforms

Technical Summary: FD1926

Joint Defra / EA Flood and Coastal Erosion Risk Management R&D programme

Background to R&D project

Cohesive shore platforms tend to be located in some of the most rapidly eroding coastal areas of the UK. The erosion and weathering of cohesive shore platforms has three often overlooked, but nonetheless critical, implications on the functioning of the wider coastal system. Firstly, the platform tends to regulate wave energy impinging on the toe of a sea cliff and, over time, the rates of platform downwearing tend to govern the rates of sea cliff recession. Secondly, platform morphology has an important relationship with beach form. Thirdly, platform downwearing processes release significant volumes of sediment into the wider coastal sediment budget system.

Cohesive shore platform behaviour can have implications for the performance of coastal defence schemes since downwearing rates also potentially affect: (i) effective water depth at the toe of shoreline structures, leading to increased loading conditions and overtopping volumes; and (ii) undermining of the toe of defences. The key control on all of the above behaviours and interactions is the rate of vertical lowering of the platform. This 'downwearing' rate, which integrates processes of marine erosion and subaerial weathering (e.g. wave erosion, freeze-thaw cycles, etc.), is influenced by the geology and geotechnical properties of the material, the wave climate and tidal regime, the effect of beach sediment cover and the amount of biological activity.

This research project has aimed to improve our technical understanding of the roles of the different parameters and processes that contribute to the downwearing of cohesive shore platforms through: (i) a detailed review of existing literature; (ii) innovative field work campaigns at two contrasting platform-beach sites, namely Warden Point (Kent) and Easington (Yorkshire); (iii) laboratory analyses of collected field samples; and (iv) a series of numerical model tests.

Results of R&D project

The field investigations and laboratory tests in this study have yielded the first direct measurements of key processes associated with the erosion of cohesive shore platforms in such detail in the UK. Results demonstrate that whilst a range of factors contribute to overall platform downwearing in some way, it is the incident wave energy and presence (or absence) of a beach that are by far the most significant factors. The tidal range, which influences where wave activity impinges on a profile and also influences wetting-drying cycles across the platform, and both biological activity and material strength are also processes of some importance.



Average platform downwearing rates of 18mm/yr and 42mm/yr were measured at Warden Point and Easington, respectively. These rates are much higher than originally anticipated and, to place them in some context, by far exceed typical allowances made for sea level rise in flood and coastal erosion risk management.

The erosion of cohesive shore platforms could have negative consequences for coastal engineering interventions. Continued platform lowering, in the absence of a substantial protective beach, can lead to exposure and ultimately failure of the foundation of coastal defence structures, for example. Elsewhere it is the consequences of the platform erosion on beach levels and cliff recession rates that are of concern to coastal managers. This report considers the possible management responses of: (i) doing nothing; (ii) stopping or limiting the downwearing of the platform; or (iii) managing the consequences of the platform downwearing.

R&D Outputs and their Use

The main output from the study has been R&D Technical Report FD1926/TR. This report describes in detail the background context to the research project, its aims and objectives and the methodology used. It then provides a comprehensive review of existing literature of relevance to cohesive shore platforms before describing the methods and results from the field and laboratory investigations and numerical modelling tests at Warden Point and Easington. The report then draws these findings together to make key conclusions and preliminary management guidance. The report is intended to be used by both coastal scientists, interested in the innovative field, laboratory and modelling work that has been undertaken during the study, and coastal managers, interested in gaining an improved understanding of the processes governing the erosion of cohesive shore platforms, their interactions with beaches and sea cliffs, and appropriate management responses to the erosion processes.

In addition, scientific papers have been presented at the following conferences and published in the accompanying conference proceedings: Littoral Conference '04; Defra Flood and Erosion Risk Management Conference 2006; Institution of Civil Engineers International Coastal Management Conference 2007.

This R&D Technical Summary relates to R&D Project FD1926 and the following R&D output:

R&D Technical Report FD1926/TR – Understanding and Predicting Beach Morphological Change Associated with the Erosion of Cohesive Shore Platforms. Published Nov 2007.

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The above outputs may be downloaded from the Defra/EA Joint R&D FCERM Programme website (www.defra.gov.uk/enviro/fcd/research). Copies are also available via the Environment Agency's science publications catalogue (<http://publications.environment-agency.gov.uk/epages/eapublications.storefront>) on a print-on-demand basis.

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