Geophysical Research Abstracts
Vol. 21, EGU2019-15914, 2019
EGU General Assembly 2019

Modelling sensitivity to erosion by waves and tides on an open coast saltmarsh

Elizabeth Christie (1), Iris Möller (1), Mark Schuerch (2), Ben Evans (1), and Helen Brooks (1)

(1) Cambridge Coastal Research Unit, University of Cambridge, Cambridge, UK (ekc28@cam.ac.uk), (2) School of Geography, University of Lincoln, Lincoln, UK

Coastal wetlands play a critical role in protecting people and assets from flooding and erosion, yet there is little understanding of how they will respond to the combination of future sea level rise and potential changes in the frequency/magnitude of storm events, and under precisely what conditions they may suffer erosion themselves.
Future increases in sea level and potentially greater magnitude and more frequently occurring storms may force bed shear stresses to exceed shear strength of marsh soils. The hydrodynamic energy threshold that defines transitions from a 'stable' to an 'eroding' surface during particular inundation events is likely to vary spatially depending on both, (i) morphodynamic feedbacks between intertidal bed topography and wave propagation and (ii) bed stability as a function of sediment and vegetation characteristics. Little is known of either of these influential factors.
Here, we use numerical modelling to predict the spatial patterns of erosion sensitivity as determined by bed topography and vegetation presence on an exposed open coast salt marsh at Tillingham, Dengie Peninsula, Essex, UK. To explore the key conditions under which erosion will occur in particular locations, we test a series of scenarios.
Numerical modelling is undertaken using the wave and morphological model XBeach to understand wave propagation over the intertidal zone. Whilst XBeach does not include cohesive sediment transport, its ability to resolve individual waves in non-hydrostatic mode and the inclusion of representation of vegetation makes it an ideal tool to investigate hydrodynamics over these complex environments. We calibrate the 2D XBeach model against an acoustic wave and current meter (AWAC) for offshore conditions and for vegetation representation and nearshore grid resolution using observed measurements from a wave transect across the marsh consisting of 8 pressure transducers (80m long).
Using detailed observation data from two profiling turbidity sensors on the mudflat and saltmarsh over two storm periods we investigate the empirical relationship between the modelled bed shear stress and sediment concentration.
As XBeach does not include cohesive sediment transport we map the bed shear stress over the saltmarsh platform and edge and analyse the spatial pattern of erosion sensitivity under a range of wave scenarios and with the impact of sea level rise. Representative wave conditions for given years are used to determine the areas of greatest shear stress and link these to observed relative shoreline change to produce a validated map of relative erosion sensitivity at the marsh edge and across the marsh surface. Bearing in mind potential uncertainties, our method paves the way for devising a relative index of the potential for morphological change in future years, as representative wave and water level conditions change.