The geometries of salt marsh erosion

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The most vulnerable part of an eroding salt marsh is its interface with the tidal flat, which takes the form of a steep scarp. There, unvegetated sediment is exposed to the direct action of stressors such as waves, tidal currents and decompaction. Variations in stress type and platform stability will cause scarps to fail according to different modes, such as bloc toppling or rotational sliding, leading to different morphologies of the marsh margin. Furthermore, the magnitude of these stresses also influences the planar geometry of marsh margins at a regional scale, suggesting a connection between margin geometry and erosion rates and processes.

Using the Topographic Identification of Platforms (TIP) method, we sample multiple retreating salt marsh platforms in the United Kingdom, the United States and continental Europe. Sites were selected to cover a broad range of tidal amplitude and wave exposure and climate. After simplifying the platform outline to eliminate creek mouths, we generate swaths expanding seaward and landward of the scarp line and characterise local scarp height, steepness and position in the tidal frame. Each swath is then linked to local hydrodynamic conditions such as tidal amplitude and significant wave height and direction. This systematic method allows us to map local variability in eroding geometries and attempt to relate the steepness of the scarp facies to the relative importance of tidal forcings versus incident wave power. We also explore the relations between morphology and dynamic landscape evolution and discuss the possibility of inferring retreat rates from scarp geometry.