Longshore variation in coastal foredune growth on a megatidal beach from UAV measurements

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Coastal dunes are both a vital natural coastal defence and a key ecological habitat; therefore, understanding their evolution is important to inform coastal management. Megatidal environments are the world largest tidal ranges and hence provide a unique endmember of the tidal range continuum. A study site at Crymlyn Burrows, Swansea Bay, UK is monitored here; the area was originally of applied interest due to its identification as a key receptor of the Swansea Bay Tidal Lagoon project. The study site comprises of 2km of dune frontage bounded to the west by hard sea defences and to the east by the River Neath estuary. The intertidal is characterized by a shallow slope and crescentic intertidal bars. Mean spring tidal range at the nearby Mumbles tide gauge is 8.46m; mean wave heights at a wave buoy offshore of the site (depth 9m LAT) are 0.66m and storm wave heights exceed 3m; predominant wind direction is in an alongshore – onshore direction.

A Sensefly Ebee-RTK drone with a Sony RGB camera has been used to map the dune system and the mid to upper intertidal beach on a monthly – bimonthly frequency since October 2018. Initial post-processing was conducted in the Sensefly Emotion3 software; Pix4D was then used to generate a point cloud from the georeferenced images. RTK-GPS surveyed ground control points distributed over the study area were used to improve the accuracy of the solution. Point clouds were cleaned to remove noise using Cloud Compare, an open source point cloud editor, before being interpolated onto a gridded surface. Comparison of the gridded surface against RTK-GPS surveyed points gave a vertical mean absolute error (MAE) of 0.05m over the beach area. Comparison in the dune area is more complex since the raw point cloud includes the vegetation and hence over-estimates height compared to the bare earth. Based on the raw point cloud, MAE over the dune area was 0.22m; however, when vegetation points were removed using artificial neural network based colour discrimination, the MAE was 0.05m.

Longshore variation in dune evolution is clearly evident. At the eastern and western ends of the dune system, dune progradation can be observed whereas in the central portion the frontal dune is cliffed and the dune foot position is static or eroding landward. Pressure transducers have been deployed in a longshore array at the neap high tide level to assess variation in wave energy reaching the upper intertidal over the study area.
This presentation will explore whether this variation in behavior is due to longshore variation in wave energy (erosion potential), variation in sediment availability (accretion potential) or the persistence of antecedent morphology.