Modelling dune erosion under climate change scenarios.

Alejandra R. Enríquez, Marta Marcos, Albert Falquès, Dano Roelvink

In this work we assess the vulnerability and risk erosion of a dune area in a micro-tidal environment as a result of a combination of five oceanographic drivers, including four storm wave parameters (wave high, peak period, direction and storm duration) and mean sea level rise up to 2100. The study area corresponds to Son Bou beach-dune system, located in Menorca Island (Western Mediterranean Sea), which has been long time monitored and for which a detailed bathymetry has been measured. We apply a probabilistic framework to simulate large sets (~10000) of statistically consistent storm states that, combined with projected mean sea level rise, allow calculating the run-up evolution over 12 different beach profiles through the 21st century. The response of each selected profile to increased mean sea level has been calculated using the Q2D-morfo numerical model (Falquès et al., 2008), which represents the progressive shift of the beach equilibrium state in response to changing mean sea level, thus avoiding the stationary bath-tub approach. The effect of waves and mean sea level rise under RCP4.5 and RCP8.5 scenarios is then quantified in terms of vulnerability of the dunes (duration/number of events reaching the dune toe, changing probability of overwash). On the other hand, dune erosion volume has also been evaluated using the XBeach model (Roelvink et al., 2009) for selected storm return periods and for different time slices. Finally, some possible temporal evolution of the beach-dune are also provided based on the combination of Q2D-morfo and XBeach models to quantify successive beach erosion/recovery episodes.