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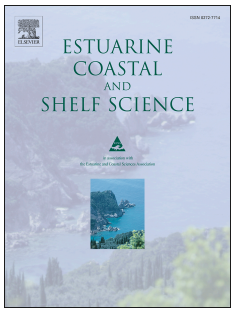

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Nearshore hydrodynamics at pocket beaches with contrasting wave exposure in southern Portugal

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Abstract

Pocket beaches on rocky coasts with headlands that control hydro-sedimentary processes are considered to be constrained sedimentary systems, generally with limited sediment inputs. Pocket beaches face severe changes over time. Under worst-case scenarios, these changes can result in the loss of the beach, causing waves to directly attack adjacent cliffs. Studies of nearshore hydrodynamics can help to understand such changes and optimise sediment nourishment procedures. The present work contributes to the knowledge of hydrodynamic forcing mechanisms at pocket beaches by providing a comprehensive description of the nearshore circulation at two beaches with contrasting wave exposures. Two pocket beaches in southern Portugal were studied by combining field measurements of waves and currents with numerical models (STWAVE and BOUSS-2D). The aim of this analysis was to evaluate nearshore hydrodynamics under different wave exposure forcing conditions (e.g. variable wave heights/directions and different tidal levels). The results show that the beach circulation can rapidly shift from longshore- to rip-dominated depending on changes in both the offshore wave direction and tidal levels. Waves with higher obliquity (for both low and moderate wave energy conditions) tend to generate longshore circulation in all considered tidal stages, while waves with lower obliquity tend to produce rip flow with higher-velocity rip currents during low to intermediate tidal stages. The results indicate that the location and intensity of rip currents strongly depend on geomorphological constraints, that is, the control exerted by shore platforms. A larger morphological control is observed at mean sea level because most platforms are submerged/exposed during high/low tide and therefore exert less control on nearshore circulation.

Keywords: Pocket beach; rip current; nearshore circulation; numerical modelling

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