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

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

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6 **Abstract**

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

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

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