Surf zone retention in rip current systems and implications for beach safety: a laboratory experiment

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Here we present a 30 m * 30 m laboratory experiment of topographically-controlled rip current circulations over a moveable bed. The rip current characteristics over 8 distinct beach morphologies, exhibiting more or less developed nature-like bar-rip morphologies, were investigated. The same offshore shore-normal waves (Hs = 18 cm, Tp = 3.5 s) were generated by the wavemaker with the same mean water level in order to study the sensitivity of the rip current characteristics as a function of the beach morphology only. In each case, a 1-hour video run was used to track a large number (~30) of drifters released within the surf zone. Image coordinates were rectified to still water level Cartesian coordinates to compute drifter velocities, mean characteristics and surf zone retention rates.

Results show the presence of classic rip current patterns with counter-rotating cells and a relatively narrow offshore-directed jet varying from symmetric to strongly asymmetric. Rip current intensity was found to linearly increase with increasing beach alongshore non-uniformity. Conversely to what was previously hypothesized, drifters exiting the surf zone compartment were not systematically caught by a pulsating jet. The computed surf zone retention rates (~85% on average) were on the order of those previously observed in the field and do not depend on rip current intensity. Asymmetric rip currents appear to retain much less drifters within the surf zone compartment than symmetric rip currents. We will present these results and will discuss their implications from the perspective of beach safety and lifeguarding.