Eulerian Rip Current Field Observations: Temporal Modulations

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Rip current flows are partitioned into mean, infragravity (0.004–0.04 Hz; 25–250 s), very low frequency (0.0005–0.004 Hz; 4–30 min), and tidal contributions (>3 hrs), and it is found that each contributes significantly to the total flow and each affects beach safety differently. Field observations from Sand City, CA, Torrey Pines, CA, and Truc Vert, France from fixed-point instrumentation are used to describe the temporal modulations of rip currents. Rip current velocities increase with increasing wave height. For most previously studied field mesotidal (1-3m) rip-channeled beaches, rip current velocities increase with decreases in tidal elevation. However, for some macrotidal (>3m) rip-channeled beaches, the inter-tidal bar morphology is exposed during low tides resulting in a low-tide cut-off of the rip current development. Rip current pulsations are generally associated with wave groups at the infragravity band inducing cross-shore standing waves. The maxima in the wave group envelope occur during the maxima in the offshore velocity. This creates a scenario that is very hazardous for beach-goers, because the larger waves associated with the maxima of the wave group causes the beach-goers to loose footing with the seabed during increased offshore velocities. Very low frequency pulsations are observed on many beaches and contribute to the rip current velocity. For rip currents at Sand City, Monterey Bay, CA, the total rip current velocity is defined as:

$$U_{rip\ current\ velocity}\ (1\text{-}2m/s) = U_{infragravity}\ (0.7m/s) + U_{verylowfrequncy}\ (0.4m/s) + U_{mean}(0.4m/s) + U_{tide}(0.3m/s).$$

The effect each of these temporal modulations on beach safety will be discussed.