Alongshore differential topographically controlled wave-breaking and rip current circulation

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Topographically-controlled rip currents can occur along any wave-dominated beach exhibiting a significant alongshore non-uniform morphology. The classical explanation for rip current circulation is based on the alongshore variations in wave-induced radiation stress gradient. However, this approach is not straightforward because a large part of the wave driving force does not generate currents as it is irrotational. In this communication we present an alternative approach based on the depth-integrated and time-averaged momentum equations given recently by Smith (2006), where the wave driving force is proportional to the broken-wave energy dissipation. From this equation we derive an equation for the mean current vorticity, where the only forcing term is given by the cross-product between the energy dissipation gradient and the wave vector. Using this approach we analyze the dynamics of a rip current on a well-developed inner bar and rip morphology: Biscarosse 2007 field experiment (Bruneau et al., 2009).