

Turbulence Modeling and Wave-Current Interactions

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Abstract : The mechanics of rip currents are complex, involving interactions between waves, currents, water levels and the bathymetry, that present particular challenges for numerical models. Here, the effects of a grid-spacing dependent horizontal mixing on the wave-current interactions are studied. Near the shore, wave rays diverge from channels towards bar crests because of refraction by topography and currents, in a way that depends on the rip current intensity which is itself modulated by the horizontal mixing. At low resolution with the grid-spacing dependent horizontal mixing, the wave motion is the same for both coupling modes because the wave deviation by the currents is weak. In high-resolution case, however, classical results are found with the stabilizing effect of the flow by feedback of waves on currents. Lastly, wave-current interactions and the horizontal mixing strongly affect the intensity of the three-dimensional rip velocity.

Keywords : numerical modeling, wave-current interactions, turbulence modeling, rip currents

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