Effects of wave-current interaction on the inner-shelf eddying flows

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Wave-current interaction (WCI) on the inner-shelf eddying circulations is investigated with a wave-averaged ROMS based on a vortex-fore formalism (McWilliams *et al*., 2004; Uchiyama *et al*., 2010). The model is tightly coupled with a spectrum-peak refraction wave model to account for the two-way WCI, consisting of current effects on wave (CEW) and wave effects on current (WEC) (Uchiyama *et al*., 2009). It is well known that CEW has a pronounced importance in the surfzone. For instance, offshore extent of rip currents connecting the surf zone with the offshore marginal seas is significantly reduced by CEW. Nevertheless, dynamical interactions between the surfzone and inner-shelf have not been fully investigated yet.

In the present study, we examine WEC and CEW on the submesoscale eddies evolved by baroclinic frontal instability due to upwelling induced by fluctuating alongshore wind in an idealized inner-shelf configuration typical in the Southern California Bight. Alongshore topographic variations with wave forcing are imposed to generate persistent rip currents that frequently interact with the offshore eddies. Inner-shelf eddies hardly enter the surfzone with WEC but without CEW as for developed littoral currents counteract them, which can be viewed as rectification by WEC. In contrast, offshore eddies reach the surfzone readily without WEC because of the lack of isolated surfzone recirculation. With both WEC and CEW, the littoral currents and the associated rectification are attenuated by CEW, resulting in inner-shelf eddies being extensively enhanced and interacting with surfzone eddies. The key mechanism to induce the surfzone-shelf interaction is considered to be CEW that weakens the littoral currents to let the front evolve into submesoscale shelf eddies. In addition, offshore eddies are found to generally be reduced by WEC, suggesting that WCI plays an essential role not only in the sufzone as known but also in the shelf region.

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