Topographic effects of Ryukyu Islands on the enhancement of submesoscale anticyclonic eddies on the eastern side of Kuroshio in East China Sea

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A synoptic regional downscaling experiment on Kuroshio off Ryukyu Islands, Japan, exhibits the evident predominance of submesoscale anticyclonic eddies over cyclones in the narrow strip between Kuroshio and the islands (Uchiyama *et al*., 2013). An eddy heat flux analysis demonstrates that the anticyclones substantially enhance the lateral mixing and thus influences of Kuroshio to the islands that are responsible for coral network of the area. In the present study, we conduct a twin submesoscale eddy-resolving experiment to investigate the mechanism of the anticyclone dominance by focusing on topographic effects of the islands. The model consists of a double-nested ROMS (Shchetpetkin and McWilliams, 2005) at horizontal resolutions of 3 km (ROMS-L1) and 1 km (ROMS-L2), forced by the assimilative JCOPE2 reanalysis (Miyazawa *et al*., 2009). Surface wind stress is provided by the JMA's GPV-MSM atmospheric reanalysis while surface heat and freshwater fluxes are from the COADS monthly climatology. SST and SSS are weakly restored towards the 20 day-averaged JCOPE2 field for the surface flux correction. The model results are extensively validated against a variety of data including shipboard hydrography and satellite altimetry and temperature data to show a good agreement. The alternative experiment named "no island case" is designed by eliminating all the island topography above $z > -1000$ m for directly examining the topographic effects on the anticyclones, while the other configurations are held unchanged as in the original L2 model. The no island case yields much less negative relative vorticity than the original case after a sufficient spin-up period, and the population of the anticyclones is reduced to be comparable to that of cyclones. The result clearly shows that topographic eddy shedding leads to the enhanced lateral mixing between Kuroshio and Ryukyu Islands associated with predominant submesoscale anticyclonic eddies.

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