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Interisland coral connectivity across the Nansei Archipelago, the East China Sea: Dynamical influences of the Kuroshio

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Abstract

For the preservation and protection of coral habitats along the Nansei Archipelago in the East China Sea, a submesoscale eddy-resolving downscaling ocean model was developed based on the ROMS in a double nested configuration coupled with a 3-D Lagrangian particle tracking model. Millions of neutrally buoyant particles mimicking coral spawn and larvae were released from 19 major islands and one lagoon every spring (*viz.*, the spawning season of local reef corals) from 2012 to 2015. The model results were compared to satellite data, *in situ* observation, and surface drifters to confirm reasonable agreement.

The population connectivity matrix across the archipelago was quantified using Lagrangian probability density functions of the modeled particle displacement. Most particles remained near the release areas, while some traveled long distances by the northeastward drifting Kuroshio, leading to notable interisland coral transport across the archipelago that promotes *interisland connectivity*. A possible mechanism was examined by analyzing the transition from coastal to pelagic transport of the particles released from the Yaeyama Islands, the southernmost area of the archipelago. The Kuroshio trapped the particles released from the northern coast of the islands with considerable temporal variability in the entrainment rate. By contrast, particles released from the southern coast are markedly affected by the eastward current around the release sites, which significantly reduces their entrainment in the Kuroshio, and thus, long distance transport. Some entrained particles were expelled abruptly from the Kuroshio, trapped by the southwestward-drifting Kuroshio Counter Current developed between the Kuroshio and the archipelago, and subsequently transported eastward to the islands.