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北太平洋低次生態系モデリング I: 渦解像 OGCM と PFT モデルの結合
Modeling North Pacific lower trophic ecosystem. I: Coupling an eddy-resolving OGCM with a PFT model

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An eddy-resolving ecosystem model of the North Pacific is used to investigate the impact of mesoscale eddies on the basin-scale nitrate circulation and supply to the euphotic zone. A simple Plankton Functional Type (PFT) model, i.e., a NPZD ecosystem model with iron limitation on nutrient uptake is coupled to a three dimensional off-line ocean circulation model. The model horizontal resolution is about 10 km in latitude and longitude. The focus is on the North Pacific Subtropical Gyre (NPSG) where nitrate in the euphotic zone is low by downwelling due to the Ekman convergence. Recent observational and model studies reveal that the mesoscale eddies have significant impact on oceanic biological production in subtropical gyres. Although there are many studies on mesoscale eddies, a basin-scale picture of impact of mesoscale eddies on nitrate circulation and supply to the euphotic zone is presently poorly known. In the Kuroshio Extension (KE) region, the mesoscale eddies exchange water across the front and affect the biological production. In addition, recent model studies show that the mesoscale eddies contribute to the formation and transport of the Subtropical Model Water (STMW). Although it is suggested that the STMW forms in the KE region and is transported to the NPSG, the effect of the STMW on the nitrate circulation and impact on the biological production in the NPSG is not clear. In addition, the STMW is thought to be important in forming of the Subtropical Countercurrent (STCC) which has large mesoscale eddy activities in the NPSG. It is expected that the seasonal variability of the STCC dominates the seasonal variability of biological production. The results from the eddy-resolving model are compared with results from a low-resolution model. The results of sensitivity experiments to model parameters model parameters are also shown. It is expected that tracer experiments and analysis of nutrient budged reveal eddy effect on the basin-scale nutrient circulation and supply to the euphotic zone in the NPSG.

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