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Exploring mechanisms of phytoplankton coexistence using a marine ecosystem model with eddy-resolving resolution

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Observational studies estimate that there are over 70,000 phytoplankton species. Various mechanisms which enable phytoplankton coexistence are proposed. Niche segregation are inspected under pelagic environment, using a numerical model. Since we considered that variation of pelagic environment resulted in mesoscale eddies plays an important role on phytoplankton diversity, an eddy-resolving model is employed. Based on NEMUEO and MEM, we developed a marine ecosystem model which can express a few hundred phytoplankton species and combined it to a physical oceanic model, MRI.com. The physical field represents idealized subpolar and subtropical gyres in a rectangular model domain of 30 by 30 degrees. To explore niche segregation, we seeded 240 phytoplankton species which have different trait for temperature, light and nutrient. After 10 years integration, 31 species are survived. In the subpolar (subtropical) region, species favorable high (low) nutrient condition are survived. Segregation with temperature is also confirmed.

Keywords: Phytoplankton diversity, Marine ecosystem model, Mesoscale eddy