

Modeling North Pacific lower trophic ecosystem. II: A selection-based model and phytoplankton diversity

Sachihiko Itoh^{1*}, Yuri Hiraike¹, Hiroyasu Hasumi¹

¹Atmosphere and Ocean Research Institute, The University of Tokyo

Structure and variability of marine ecosystems vary from region to region, under the influences of solar radiation, physical circulation and mixing, and input of terrestrial materials. The North Pacific is latitudinally partitioned into the equatorial area, the subtropical gyre, and the subarctic gyres, driven by the large-scale wind system. Whereas, basic fields are also contrastive longitudinally due to the western intensification, the coastal upwelling, mode waters, eddy activities, and dust flux. For the lower trophic ecosystem of the North Pacific, various Plankton Functional Type (PFT) models have been developed, which aggregates various planktonic species into lesser number of compartments based on their function. One of representative PFT models for the lower trophic ecosystem of the subarctic North Pacific, NEMURO (North Pacific Ecosystem Model for Understanding Regional Oceanography), well reproduces plankton productions within the western and eastern subarctic gyres. PFT models including NEMURO have also been applied to various regions by changing model parameters to suit the local ecosystems. However, observational data are often insufficient to determine the model parameters especially in regions south of the subarctic areas. In addition, adjusting the parameters by region preclude the model from evaluating the inter-region movement of materials and biota. Recently, an alternative approach was proposed that express various planktonic species explicitly, instead of tuning the parameters region by region. This approach assuming ubiquitousness and selectivity of planktonic species inhibits arbitrary parameter tuning and is expected to improve reproductivity of the model for multiple ecological provinces. In the present study, we develop a selection-based ecosystem model by including phytoplankton community of various cell-sizes. Selectivity and diversity of phytoplankton in ecological provinces of the North Pacific, and its impact on the carbon cycle are investigated. In the presentation, we will focus on variability within the subtropical and subarctic gyres, and discuss their differences in diversity.

Keywords: selection-based model, biodiversity, North Pacific