Simulated Temporal Variability of Biogeochemical Processes at the Subarctic North Pacific Time-Series Stations

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Recent studies have been revealed that oceanic biogeochemical processes, such as distributions of nutrients, total carbonate and marine ecosystem dynamics are primarily controlled by physical environments. However, it is little known how the biogeochemical processes are affected the by the variations of the physical environments with longer time scale than the marine ecosystem itself has. To tackle this issue, not only observations but the marine ecosystem modeling can be a powerful method. In this study, a vertically one-dimensional ecosystem model is applied to Stations KNOT (44°N, 155°E) and PAPA (50°N, 145°W), both located in the Subarctic North Pacific. This model has fifteen compartments including two categories of phytoplankton (diatoms and non-diatom small phytoplankton) and three categories of zooplankton (small, large and predatory zooplankton). The model is driven by in situ solar radiation, wind speed, and water temperature and salinity at the sea surface. Observed seasonal features of the physical environments and biogeochemical processes at each site, i.e., larger seasonal variation in each compartment, deeper mixed layer depth in winter, higher surface nutrient concentrations and greater dominance of diatoms at KNOT than at PAPA, are successfully reproduced by the model. The ENSO Events and Pacific Decadal Oscillation, which have longer time scales, might be apt to affect the biogeochemical processes at PAPA compared with at KNOT. However, further information about the biogeochemical processes, such as zooplankton stock sizes and iron concentration is necessary for verification of the differences in the interannual variations of the biogeochemical processes between the two sites.