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Lower-trophic level ecosystem dynamics in the western Seto Inland Sea, Japan

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We studied the ecosystem and nutrient dynamics in the western part of the Seto Inland Sea from the both field observation and numerical modeling. We investigated spatiotemporal variations in the group composition of phytoplankton and the nutrient concentrations in the Iyo-Nada, Hoyo strait and Bungo channel (parts of the Seto Inland Sea) with monthly field observations in 2009. From the spring to early summer, nano- and pico-phytoplankton dominated in all the three regions. From the late summer to autumn, micro-phytoplankton (diatom) was blooming in the Iyo-Nada and Hoyo strait, while distinguished bloom was not observed in the Bungo channel. This autumn diatom bloom was probably caused by nutrient supply associated with breakdown of the cold water dome. For understanding the mechanisms of the nutrient cycle and plankton dynamics, we developed a plankton functional types model eNEMURO (4Nutrient, 4Phytoplankton, 4Zooplankton, 4Detritous), which was an extend version of NEMURO [a standard lower-trophic-level marine ecosystem model of PICES (The North Pacific Science Organization)] by introducing the microbial food web and the phosphorous cycles and dividing diatoms to two compartments according to temperature dependency. eNEMURO was coupled with 5box physical models (2boxes in the Iyo-Nada, 1box in the Hoyo strait, and 2boxes in the Bungo channel). Model successfully reproduced the nutrients and phytoplankton dynamics observed in the both Iyo-Nada and Bungo channel. Difference between the ecosystems in the Iyo-Nada and Bungo channel was mainly caused by nutrient supply mechanism. Nutrients supply in the Iyo-Nada might be dominated by the horizontal transport from the Hoyo strait, on the other hands, those in the Bungo channel might be dominated by the vertical transport from the deep layer. We also introduce results from observations in 2012, especially in ecosystem responses to the torrential rain in the summer.

Keywords: meteorological disturbance, ecosystem, phytoplankton, Seto Inland Sea, ecosystem model