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Numerical analysis of the influences of the meso-zooplankton mortality

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In recent years, marine lower-trophic level ecosystem consisting of phytoplankton and zooplankton has been seriously affected by the various environmental changes due to the climate changes and the human activities. The quantitative assessment of the lower-trophic level ecosystem changes with the environmental changes is important for the human beings in the world. This is because the lower-trophic level ecosystem changes closely links to the fisheries resources and the global carbon cycles. For example, copepod which is one of the meso-zooplankton in the lower-trophic level ecosystem is main food for the fishes of good-catch such as Japanese saury and anchovy. Copepod also exports a huge amount of organic carbon from the surface water to the deep water in the ocean by the seasonal vertical migration to around 1000m depth and the rapid sinking fecal pellet. We have been developing a plankton functional types (PFTs) model which explicitly calculates each functional group of organisms such as copepod above. In particular, we developed a PFTs model eNEMURO (4-Nutrient, 4-Phytoplankton, 4-Zooplankton, 4-Detritous), 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 successfully reproduced the spatio-temporal variations in the lower-trophic level ecosystem around Japan. In this study, we investigated the influences of the meso-zooplankton mortality which was little known from the filed observations and the laboratory experiments on the lower-trophic level ecosystem. We conducted the sensitivity analysis of two parameters of the meso-zooplankton mortality in eNEMURO in five regions with different types of the lower-trophic level ecosystem around Japan. Model result shows that the increase of the meso-zooplankton mortality associated with water temperature rising has large impacts on the nutrients concentrations, the biomasses of phytoplankton and zooplankton, especially in the regions with the high temperature. We also introduce results from the biological parameters optimization of eNEMURO using the genetic algorithm method.