Numerical ecosystem model including two types of red tide species

Mitsuru HAYSHI* and Tetsuo YANAGI**

*Research Center for Inland Sea, Kobe University, 5-1-1 Fukaeminami, Higashinada, Kobe 658-0022, Japan, mitsuru@maritime.kobe-u.ac.jp

**Research Institute for Applied Mechanics, Kyushu University, Kasuga 816-8580, Japan

Abstract

Red tides in Osaka Bay in Japan occur more than 20 times every year. The number of occurrence of red tide of non-diatom is many in the first period of 1990s. But that of diatom is many in the latter period of 1990s. Much nutrient is loaded from Yodo River to Osaka Bay. Organic matter accumulates in the bottom of Osaka Bay and nutrients are released from bottom sediment. Osaka Bay is one of the eutrophic areas of Japan, and the lower trophic level ecosystem of Osaka Bay is complex. Therefore, material cycling in Yodo River estuary in August, summer in Japan, from 1991 to 2000 was analyzed by using the numerical ecosystem model and field observation data to clarify the reasons of change of red tide species. The box is assumed in the surface layer of Yodo River estuary. The ecosystem model consists of the bio-chemical processes in the box, the physical processes by the estuary circulation, and the boundary conditions, and have five compartments, nutrients (nitrogen, phosphorus and silicon), phytoplankton (diatom and non-diatom), zooplankton, detritus and dissolved organic matter (nitrogen and phosphorus).

Year-to-year variation in calculated concentration ratio of diatom and non-diatom corresponds to the variation in observed ratio of red tide day of diatom and non-diatom. Limiting nutrient of primary production is phosphate over the period. *Skeletonema c.* dominated from 1991 to 1993, but it was difficult for non-diatom to grow due to the limitation by physical condition. Non-diatom was able to grow because of good physical and nutrient conditions from 1994 to 1996. *Thalassiosira spp.* dominated under the good physical condition, and phosphorus supply was not enough for non-diatom to grow from 1998 to 2000. Phosphate concentration in the lower layer of Yodo River estuary was important to the variations of phosphate flux which changed the red tide species in the upper layer there.

Key words : Yodo river estuary, Red tide, Ecosystem model, Nutrient