Analysis of harmful phytoplanktons in Yodo River mouth by the numerical ecosystem model

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Red tide of Alexandrium tamarense occurred in Yodo River estuary in Japan in 2007, 2011 and 2013. A. tamarense is marine phytoplankton and causes shellfish poisoning. We had made in-situ observation on April 2-3, 2012, and analyzed the temporal variation of marine phytoplankton by using the numerical ecosystem model. CTD and ADCP observation and water sampling were carried out with the tidal change. Nutrient and Chl.a concentrations and the cell density of A. tamarense were analyzed. Seawater ran to upstream in the surface layer. And fresh water went to the sea in the bottom layer. It is the typical estuary circulation. The estuary which have 2800m in length was divided to three layers, 0-0.5m, 0.5-1.5m and 1.5m-bottom. The thickness of the bottom layer is changed with the tidal change. Nutrient, phytoplankton, the dissolved organic matter and the particulate mutter are in each layer, and the bio-chemical process, photosynthesis, mortality, decomposition and so on, were formulated. Diurnal migration, salt limitation and utilization of organic matter for the photosynthesis and mortality by low salinity were considered in the bio-chemical process of A. tamarense. Then the temporal variations of each morphology and A. tamarense were calculated. The variation of phytoplankton in each layer was almost reproduced in-situ data. Marine phytoplankton was not hardly produced in Yodo River estuary and was supplied from the ocean. Phytoplankton which cannot swim by oneself almost floated by the horizontal advection, it is the estuary circulation. But only 27% of A. tamarense transported from the ocean to the bottom layer go through upstream. 36% of it returned to the ocean in the middle and the surface layer, and other 36% died in the surface layer. Weak estuary circulation is effective to the transport limitation to the upper stream of tamarense in Yodo River estuary.

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