

Coastal, environmental and ecosystem modeling

CHARACTERISTICS OF PRIMARY PRODUCTION IN A EUTROPHICATED BAY

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The primary production of phytoplanktons produces organic matter in high concentration at Hakata Bay, a semi-closed bay in the western part of JAPAN, even during winter season in spite of low water temperature.

Any simulation results by the improved models for the simulation of water quality in the bay have not shown a good agreement with the observed data in any winter seasons. We, therefore, tried to formulate the primary production rate of phytoplanktons in winter in order to resolve this discrepancy with a simple model.

In general, the phytoplankton takes some nutrients such as N and P from water for photosynthesis with light energy. In winter, the conditions of sea water seem not to be always favorable for the photosynthesis because of low water temperature and low sunlight intensity.

Nutrients, however, are high in concentration, especially $\text{NH}_4\text{-N}$, in this bay in winter. Then, we assumed that $\text{NH}_4\text{-N}$ makes phytoplanktons grow more efficient than $\text{NO}_3\text{-N}$ even under the winter's low sunlight intensity because they do not need to produce extra enzymes for reducing $\text{NO}_3\text{-N}$ to $\text{NH}_4\text{-N}$. We introduced this concept into our model, simulated the change of organic matter in concentration at the bay and succeeded in showing that the simulated results corresponded very well with the observed data.

Since it had been thought that water temperature mainly controls the primary production rate of phytoplanktons, we could not initially explain organic matter in high concentration in the winter season. We, however, explained the characteristic of changes of primary production rate by using a simple model including a coefficient of the light-absorption-efficiency related with water temperature.

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