Numerical Model on the Material Circulation for Coastal Sediment in Ago Bay, Japan

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Ago Bay is an enclosed coastal sea located in the central part of Japan. The bay was formed out the ragged coastline known as Rias coast, which protects the waters of the bay from ocean waves. This bay is famous with the pearl oyster, which is in this bay Mr. Koichi Mikimoto created the first cultured pearl in 1905. The pearl produced here called as Akoya pearl, which cultivated from Akoya oyster, but since 1994 something has been killing off the Akoyas of Ago Bay. Expert suspect this because of the deterioration of the bay system. This can be seen as the observed data of sediment shows that COD value gradually increases and sediment quality become worse from time to time. Many attempts are being made to develop a method in order to enhance the self-purification ability of the bay system. To meet this goal, one part of the attempts is to develop the sediment model to study the material circulation in the sediment.

The develop model is time dependent and one-dimensional transport-reaction. The transport and nutrient cycling takes place in depth interval of 0-10 cm and numerous layers decompose the seabed. The diffusive boundary layer has 0.03 cm in depth, below this layer is a 0.3 cm with equal cell width, deeper down this layer up to 10 cm with cell width exponentially increases. The vertical material transports consist of molecular diffusion, bioturbation, bioirrigation and burial transport. The production and consumption of substances consist of primary and secondary reaction in aerobic and anaerobic condition. The degradation of organic material or primary reactions takes places through bacterial respiration with oxygen, nitrate, manganese, iron and sulphate. The secondary reactions deal with the decomposition of the remaining metabolic products that released as result of primary reactions.

Finally, we hope this model provides a better understanding to the transport process and biogeochemical reaction in the sediment. Furthermore, this model can be used as predictive tools to evaluate the management alternative to the improvement of the bay system. The present study is a part of the Ago Bay Environmental Restoration Project under the program of Japan Science and Technology Agency.

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