別紙４－１（課程博士（英文））

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Abstract (Doctor)

Title of Thesis	Evaluation of Phytoplankton Growth in Estuary as Effect of Nutrient Inputs during Rainfall Using Ecological Model

Approx. 800 words

Eutrophication is currently one of most popular water environment issues in the world. This problem has been occurred and could be seen in several countries with high development in infrastructure, industrial, and agricultural. It is associated with rapid population and economic growth where the development has been pressing provision of human needs in form of food and settlement. To accelerate the provisioning process, the used of various biological and chemical substances including nutrients in the form of nitrogen (N) and phosphorus (P) are massively increased. In its application, most of those substances are, directly or indirectly, leached into aquatic environment as diffuse pollution. Particularly in agricultural sector, the high frequency of fertilizer application and increase of non-point nutrient loads from agriculture has been associated to the impairment of surface and ground water qualities. Leaching process of nutrient from agriculture soil into surface water bodies significantly influenced by rainfall. During rainfall, soil nutrients are flushed out by rainfall run-offs into river and transported into estuaries and extending seaward. Enrichment of nutrients loads in waterbodies are resulting in acceleration of phytoplankton growth by the response of nutrient uptake by phytoplankton itself and photosynthesis. Phytoplankton growth could lead to an imbalance of algal production and consumption, which followed by enhanced sedimentation of algal-derived organic matter, stimulation of microbial decomposition and oxygen consumption, depletion of oxygen, and further affecting mass mortalities of marine animals and leave bad impact on aquaculture and local socio-economic conditions. Eutrophication and phytoplankton growth, especially red tide, has become one of the major pollution problems in several estuaries in Japan including Atsumi Bay, Aichi prefecture. For over 40 years, eutrophication accompanies red tide and hypoxia occurred in every summer season as effect of huge nutrients inputs from industrial and agricultural areas around the bay. Several studies have investigated water quality and phytoplankton growth around Atsumi bay areas. However, effect of huge river inputs in estuaries during rainfall still less investigated. In current study, our purpose is to evaluate nutrient dynamics and phytoplankton growth on estuarine waterbodies with focus on huge river inputs effect during rainfall. Here, the pre- and post- rainfall conditions were at normal meteorological conditions, with heavy rainfall and gentle wind induced water bodies, where salinity and concentration alteration mostly occurred at the surface layer. The evaluations methods of this research are based on field measurement and numerical simulation. In our simulation, we developed depth-averaged two-dimensional ecological model. The model has ability to simulate nutrient dynamics in form of dissolved nutrients, and phytoplankton growth over estuary. Biochemical parameter fitting becomes important part of the simulation in order to figure out dissolved nutrients cycles and

phytoplankton growth. The model simulation is including distribution and transformation of dissolved nitrogen (DN), dissolved phosphorus (DP), and primary production of phytoplankton (Chl a). From field measurement result, we found that freshwater inputs during rainfall had changed post rainfall salinity stratification in the Umeda river transect of Atsumi bay. Post rainfall, an increase of nutrients and a decline in salinity after rainfall proved that a large amount of freshwater, mixed with nutrients, affected water quality conditions in the estuary. The decrease of dissolved nutrients is from the effects of freshwater dilution and phytoplankton uptake which verified by the increase of Chl a and decrease of DN and DP. Moreover, the influence of freshwater was dominant at river mouth station rather than at other the stations. The further the station was from the river mouth, the lower the influence which depicts the large proportion differences between Chl a, dissolved nutrients, and particulate nutrients concentrations at river mouth station and at the open sea station. In addition, the surface layer was supplied to more than the bottom layer, because the inputs were more influencing horizontal circulation than vertical circulation. It resulted in a small alteration of nutrients and Chl a concentrations compared to the surface layer. In the other hand, our ecological model has provided reasonable results and well correlation with observation data. The evaluation showed, in compare to pre-rainfall condition, increase of dissolved nutrients availability post-rainfall has gained production of phytoplankton in the Bay.