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Simulation of submarine groundwater discharge to Osaka Bay

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The coastal environment deterioration caused by nutrient discharge from the land area is a serious problem. Previous research made in the last decades has shown that direct groundwater discharge to coastal zone is a significant pathway of water and nutrient form land to ocean (Moore, 1996). For instance, groundwater discharge has often contained higher chronic inputs, which is from fertilizers and sewage. Therefore, groundwater discharge often makes the significant effect to coastal marine eutrophication (Taniguchi, 2002). These types of studies, which are extremely difficult in practice, provide explanations for water quality patterns that cannot be explained by more widely recognized processes such as rainfall or surface water runoff.
Numerical ground water flow modeling is another method that can be used to estimate rates of submarine ground water discharge (Langevin 2001; Smith et al. 2001; Kaleris et al. 2002), but one that is not often used because of limitations in computer speed, data availability, and availability of a simulation tool that can minimize numerical dispersion.
This study focuses on the environmental rehabilitation of Osaka Bay, Japan, where eutrophication has been occurred recently. It is recognized that this problem is caused by an increase of the nutrient input, as fertilizers and wastewater, through direct runoff and groundwater discharge from the residential, industrial and agricultural areas in Osaka Bay catchment. However, groundwater discharge has not yet been quantified as the pathway of nutrients input in this area. This research provides an example of the types of results that can be obtained with a variable density ground water model and demonstrates the approach by presenting estimates of submarine ground water discharge rates to Osaka Bay, Japan.

Keywords: Simulation, Submarine groundwater discharge, Osaka Bay