Estimation of Submarine Pore Water Exchange in the Intertidal Zone Based on the Marine and River Observations

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Submarine pore water exchange in the intertidal zone of Omae beach was estimated by the budget analysis using the observation data. Omae Beach is located in the Shuku River mouth in Nishinomiya and Ashiya City, Japan. It is natural beach and the coastline is about 900m. The length of the inter-tidal zone is about 150m. It is surrounded by reclaimed land and connects to the northeastern part of Osaka Bay. These arias are eutrophication seas. Groundwater in the seaside part of Nishinomiya City is abundant. Therefore, it is considered that the submarine fresh groundwater is discharged from the sea bottom of the intertidal zone of Omae beach.

Marine and rivers observations were carried out in October 10 and 11, 2007. The water level was recorded at offshore of the intertidal zone during about 24 hours. Salinity was measured by CTD at 5 stations and current was measured by ADCP on 2 lines (L1 and L2) in high tide, mean level and low tide. The flow speeds of two rivers were measured in high and low tide. Water budget of the box which is surrounded by ADCP lines and Omae beach is represented by dVx=Vq+Vp- $Ve+Vg+V_{Ll}+V_{L2}$. dVx is the variation of the box's volume (m³) during a period (dt). Vq is the river discharge. Vp is precipitation volume. Ve is evaporation volume. Vg is submarine pore water exchange volume, which is the total of fresh and recirculated saline groundwater discharge and groundwater recharge. V_{L1} and V_{L2} are the through water volume of the boundary section. We can estimate dVx by the observed water level, Vq by the river observation data, Ve by the bulk equation, V_{L1} and V_{L2} by ADCP data. It is no precipitation in the observation day. Then the temporal change of V_g is calculated and is compared with the tide level. Calculation results agreed with submarine groundwater discharge observed by the seepage meter. Vg was discharged during low tide and was recharged during high tide. As another method, the temporal change of water, salt and total phosphorus budgets will be estimated.

Keywords: Submarine groundwater; budget analysis; intertidal zone