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Estimation of nutrient supply by groundwater to the tidal river using 222 Rn tracer method

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Ground water discharge to the oceans is significant as nutrient supply (Slomp et al, 2004 etc). In coastal urban area, land fill has generally been conducted in offshore and tidal flat. Groundwater gradient is generally declined by these constructions of new lands, and submarine groundwater discharge tends to stop in coastal areas. On the other hand, groundwater would discharge to rivers in a terrestrial area. In the research, we aimed to estimate the nutrient supply by groundwater to the tidal river. The study area is located on the river mouth area of Asahi River in Seto Inland Sea watershed, western Japan. We collected water samples at one station of the river mouth area for the analysis of 222Rn, nutrient and inorganic elements at two hours interval from a low tide to the next low tide in a low and high flow period, respectively. In addition, groundwater near the river sampling station, bottom sea water in Seto Inland Sea, and river water at 4 points from the station to the 4km upstream area were collected.
The hourly changes in 222Rn and nutrient concentrations at the river mouth station in low flow period of July 13, 2009 are shown in Figure 1. The low tides were at 9:00 and 21:00. The 222Rn concentration was lower at the high tide, and this value was almost same to the concentration at the point of 4km upstream. On the other hand, the 222Rn concentration was highest at the low tide, and it was twice of that at the high tide. The 222Rn of groundwater was one order higher than that of the river. These results suggested the groundwater discharges to the river at the low tide and it would stop at the high tide, respectively. In addition, comparative variations of dissolved nitrate and phosphorus were indicated that the nitrate was almost constant, however the phosphorus changed along with the 222Rn variation. This suggests that nitrate source was the river water from the upstream area, while phosphorus source was the groundwater. In the high flow period, the river discharge was one order larger than that in the low flow period. Therefore, 2 22Rn and phosphorus signals would became smaller than that in the low flow period.

Keywords: tidal river, nutrient, groundwater discharge, 222Rn