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Separating Submarine Groundwater Discharge by using multi tracers in tidal zone.

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Nutrient through Submarine Groundwater Discharge (SGD) is regarded to play important role rivals river discharge in coastal area. And there are many reports of variety of SGD base on local conditions such as geological compositions and land use(e.g. Slomp and Van Cappelen, 2004). And before now, some methods of estimation for SGD have been developed (e.g. Taniguchi and Fukuo, 1993; Burnett and Dulaiova, 2003). Recently, SGD could be separated as Fresh SGD and recirculated sea water (RSGD). In some case, nutrients production via recirculation is much higher than river discharge or FSGD (e.g. Santos et al., 2009). However, there are few sufficient researches to estimating nutrients supply via each SGD with separating them rigorously. Therefore, objective of this study is estimating nutrients supply via each SGD and flow rate of each SGD with separating them by using multi tracer.

This study is operated in the north side coast of Etajima city, Hiroshima. This area is a granite island located Seto inland sea which is a semi-enclosed sea. Annual rainfall is about 1100mm. Although river discharge is about 10% of rainfall, groundwater discharge is about 20-40% of rainfall (Onodera, 2008). And this area has a large tidal fluctuation. Observed maximum tidal fluctuation is about over 2m.

We use the method of estimation for SGD by using 222-Rn continuous measurement suggested by Burnett and Dulaiova (2003). And surface sea water samples were collected at same point of continuous radon measurement by 1 hour intervals. The flow rate of seawater was measured by laser Doppler anemometer (WH-ADCP: Teledyne RD instruments). Water samples were filtered with syringe filter. After sampling, water samples were preserved in cooler box. After observation, samples were taken back to laboratory, and frozen immediately. And we analyzed the nutrients by flow injection type spectral photometer (SwAAt, made by BLTEC), dissolved anion by ion chromatography.Analysis was operated with multi tracer. Before now, several this type of analysis are operated (e.g. Kim et al., 2005), but most of them analyzed only FSGD, and more widely scale. In this study, we estimated the nutrients flux via mixed SGD with FSGD and RSGD, and their flow rate by calculated mass balance of 222Rn, Cl-, SiO2-Si.

At result of the separation, FSGD was marked at -2.1∗105(m s-) to 1.5∗105(m s-). It was stable relatively. In contrast, RSGD had large fluctuation at -8.1∗105(m s-) to 12.3∗105(m s-). At a result of sum, most of positive values were occupied by RSGD. However, in some case, when RSGD flux was below zero, FSGD occupied 100% of all SGD. SGD was coordinated with tidal pumping in the basically trend. SGD recirculated in short time scale was intruded into the ground by tidal pumping up, and FSGD was increased. And in the ebb tide, much RSGD were confirmed. Over ten times larger RSGD flux was computed by comparison with FSGD flux. Next, the result of computing was compared with the flux calculated by the Radon mass balance method suggested in Burnett and Dulaiova(2003). Most of the flux in the radon mass balance was affected by FSGD flux. So, the possibility that we can get more sensitive result in the tidal zone in which RSGD is causable was replied.

Keywords: 222-Rn, tidal zone, recirculated seawater, submarine groundwater discharge