

# Dynamics of submarine groundwater discharge and fresh-seawater interface in the coastal zone

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Submarine groundwater discharge (SGD) is recently recognized as a potentially significant water and material pathway from the land to the ocean. SGD discharge occurs actively near the fresh-saltwater interface, however, there is a little study on both dynamics of SGD and saltwater-freshwater interface in the coastal areas. Recent field works revealed that SGD is influenced by tidal change of high tide and low tide. However, there is a little study on influence of tidal change of neap-spring tide on SGD. The purposes of this study are to evaluate the effects of variations of saltwater-freshwater interface on SGD, and effects of tidal change of neap-spring tide on SGD and fresh-saltwater interface.

Study area is a coastal zone of Yatsushiro Sea in Kyushu island, Japan. The average of tidal change of Yatsushiro sea is from 3 to 5m. Therefore, the study area is a region where it is expected that influence of tidal change on SGD is large. Continuous measurements of SGD rates, conductivity and temperature of SGD by automated seepage meters and CT sensors have been done in the study area. Resistivity measurements also have been made across the coastal aquifer by resistivity cable. As the results, different variations were found in SGD rates, temperature and conductivity of SGD between sea side and land side from the fresh-saltwater interface. The separation of SGD into the fresh terrestrial groundwater discharge and recirculated seawater discharge were also made by using the electric conductivities of the water of two end members, groundwater in the coast and seawater. This result revealed that fresh terrestrial groundwater discharge rates are high in near shore front of the fresh-saltwater interface. SGD was simulated by groundwater discharge model based on the function of the distance from the coast. Calculated SGD agreed with observed SG within the interface, however not offshore the fresh-saltwater interface. According to SGD measurement from spring tide to neap tide, higher SGD rates were observed in spring tide than neap tide. On the other hands, fresh terrestrial groundwater rates were higher in neap tide than spring tide. Moreover, resistivity measurements showed that the fresh-saltwater interface moves more greatly toward offshore in spring tide than neap tide.