# Submarine groundwater discharge in the Osaka Bay

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Submarine groundwater discharge (SGD) is recently recognized as a potentially significant material pathway from the land to the ocean. There are several methods to evaluate the SGD rates, such as tracer methods, water balance methods, numerical simulation methods, and the methods using piezometers and seepage meters. The only method to measure SGD directly is the use of seepage meters However, the most serious disadvantage for evaluating SGD directly is that the traditional manual seepage meters are very labor intensive. Some automated seepage meters have been recently developed using heat pulse method, ultrasonic measurements, and continuous heat flow measurements. The newly developed automated seepage meters can provide longer-term and higher-resolution measurements of SGD, which helps us to understand temporal scale issues on SGD and the relevant hydrological and coastal oceanographic processes.

Submarine Groundwater Discharge (SGD) in the Osaka Bay were continuously measured by automated seepage meters and analyzed to evaluate the seawater – groundwater interactions. Fast Furrier Transfer and Power Spectrum Density methods are applied to analyze the dominant periods of the SGD variations. Diurnal and semi-diurnal periods of SGD were found due to tidal effects. According to the separation of SGD using terrestrial groundwater analyses, the fresh groundwater components in SGD were evaluated to be 1 to 30 % at Tannowa, Osaka, therefore, SGD rates depend on volume of recirculated seawater. Correlation analyses between SGD and sea level show that SGD delays by 4 to 5 hours after sea level changes.