

Heat-flux from the submarine groundwater discharge at the coastal area: A case from the Obama Bay, Japan

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Various studies regarding submarine groundwater discharge (SGD) have been performed. Although SGD has been recognized as an important pathway for nutrients transport from land to coastal ocean, SGD also supplies other chemical compositions as well as heat in the form of thermal energy. Especially, there is a difference in water temperatures of SGD and seawater, since groundwater temperature is almost constant throughout the year and seawater temperature varies. However, it is not clear that how much heat energy is supplied by SGD and its associated impacts on coastal ecosystems. Several studies assessing the impact of drainage water from the power plants have indicated that the water temperature has a significant impact on the coastal ecosystems. It highlights the need for assessing the impact of SGD on coastal ecosystems not only by considering the nutrient influx but also by giving equal importance to inflow water temperatures. To investigate this hypothesis, we undertook a study in a coastal area of Obama Bay, Fukui Prefecture, Japan.

In Obama Bay, SGD rate has been estimated using ^{222}Rn and salinity mass balance model (Sugimoto et al., 2016). We calculated the heat quantity from SGD by using the formula $[E = Q * C_p * \Delta T]$, where, E is the heat quantity from SGD; Q is the SGD rate from Sugimoto et al. (2016); C_p is the specific heat at constant pressure; and ΔT is the difference between seawater and groundwater temperatures. The following results are obtained from this study: The SGD resulted in hot and cold heat influx to the coastal areas during winter and summer seasons, respectively. Although SGD rate is observed much less than the river discharge, cold heat flux from SGD was greater than the river during summer. SGD resulted in lowering the sea water temperature at the bay during the summer. In this presentation, we will additionally discuss about the magnitude of this heat-flux as compared to the results of SGD heat-flux at another study site.

Keywords: submarine groundwater discharge, heat flux, coastal area