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Quantify the Influence of the Ocean Current on the Submarine Groundwater Discharge

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In recent years, much attention has been paid to submarine groundwater discharge (SGD) for its important role on solute transport near coastal aquifer systems. Ocean currents are common phenomena that typically occur near the coastal line and can be one of the important factors that influence the SGD. To quantify the influence of the ocean current flow on the SGD, this study uses HYDROGEOCHEM (Hydrologic Transport and Geochemical Reactions Model) numerical model to simulate the interactions between fresh and salt water in a coastal aquifer. A synthetic two-dimensional profile model with 100m in length and 32.5m in depth is considered for illustration purpose. The beach slope is 10% for the intertidal zone. Based on the energy conservation equation (Bernoulli's equation) for groundwater flow, the velocity heads influenced by ocean current are not negligible in this study because the velocities of ocean currents are typically several orders of magnitudes greater than the velocities of groundwater. With a variety of ocean current velocity values (from 0.2 m/s to 2.0 m/s) applied to the numerical model, we found great changes of total SGD rates for the test example. The ocean current will increase the SGD rate up to 280% if the ocean current is increased to 2.0 m/s in the simulation. The simulation results suggest recalculations of SGD rates for coastal aquifers, especially for coastal lines with high ocean current velocities. However, field observations of current velocities near ocean bed are required for accurate simulations.