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Assessment of submarine groundwater discharge and associated dissolved inorganic carbon into a coastal wetland, western Taiwan via time-series observations of ^{222}Rn

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We investigated submarine groundwater discharge (SGD) and associated dissolved inorganic carbon flux into the Gaomei wetland, which is located south of the Tachia river's mouth, western Taiwan. This area is characterized by a great tidal range (over 3 m at spring tide) and a shallow unconfined aquifer ($\sim$2 m below the seafloor) with high groundwater recharging rates (over 500 mm yr^{-1}) in the hinterland. In this study we argue that in the Gaomei wetland, tidal pumping causes an exchanging between groundwater and seawater, resulting in an overall dissolved inorganic carbon (DIC) flux into the wetland.

Time-series observations of ^{222}Rn were conducted over 2 tidal cycles in both dry (May of 2014) and wet seasons (August of 2014) seasons at a station 500 m offshore. Our result shows a good response to tidal fluctuation with higher ^{222}Rn activities at low tide and lower ^{222}Rn activities at high tide. Based on a ^{222}Rn mass balance model taking all sources and sinks into account, we estimated a SGD flux ranging from -3.86 to 69 cm d^{-1} with slightly higher fluxes during the wet season (average SGD flux 22 cm d^{-1}) compared to the dry season (average SGD flux 16 cm d^{-1}). Our negative SGD flux estimates observed during high tides suggest that seawater infiltrates into the sediments during flood tide and discharges during ebb tide, proving the concept of seawater exchange across the water-sediment interface.

The overall SGD-borne DIC fluxes range between 1.82×10^{6} and 2.48×10^{6} mol d^{-1} in dry and wet seasons, respectively, that are 26 % and 36 % of the river-induced DIC fluxes. Such an export of DIC flux from the groundwater (or recycled seawater) might have an impact on coastal biogeochemistry in the Gaomei wetland.