SUBMARINE GROUNDWATER DISCHARGE AND ASSOCIATED NUTRIENT FLUXES INTO SMITHTOWN BAY

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Inputs of submarine groundwater discharge (SGD) were quantified into Smithtown Bay, Long Island, NY during the spring and summer of 2014/2015 *via* radium mass balance. Airborne thermal infrared overflights resolved high-resolution temperature anomalies along various shoreline segments that were influenced by mixed fresh-saline SGD; these locations were used to collect nearshore surface water and pore water samples. Surface water transects from the shoreline into open Long Island Sound revealed high activities of Ra isotopes along the shoreline that decreased with increasing distance offshore. There was a seasonality in the surface water Ra signal, where activities were greater during the summer than spring. Accordingly, ^{224}Ra derived total SGD fluxes into Smithtown Bay were seasonally variable, with greater discharge during the summer (46 – 53 $*10^8$ m^3 y^{-1}) compared to the spring (5 – 27 $*10^8$ m^3 y^{-1}); this difference is likely due to the migration of the freshwater/saltwater interface, where greater saline SGD fluxes occur during the summer when aquifer recharge is lower. SGD fluxes from long-lived Ra isotope mass balances were greater than short-lived Ra mass balance SGD fluxes (7 – 78 $*10^8$ m^3 y^{-1} during the spring and 77 – 200 $*10^8$ m^3 y^{-1} during the summer), suggesting that there may be an additional deep, offshore component of SGD that is not captured by the short-lived Ra isotopes. A deeper offshore discharge may occur from the confined Magothy Aquifer, a previously ignored yet substantial groundwater input to Smithtown Bay. Within the first 50 m of the shoreline, the fresh component of SGD was approximately 11 – 23% of the total, which equals between (0.1 – 0.5) $*10^8$ m^3 y^{-1}, similar to the annual discharge of the Nissequogue River (~0.4 $*10^8$ m^3 y^{-1}). Fresh SGD NO_3^- fluxes within the first 50 m of the Smithtown Bay shoreline equal (0.3 – 0.8) $*10^5$ kg y^{-1} while saline SGD NO_3^- fluxes vary from (0.04 – 0.5) $*10^5$ kg y^{-1}. Large volumetric SGD inputs to Smithtown Bay, both fresh and saline, have broad implications for nutrient, metal and carbon fluxes to Smithtown Bay and Long Island Sound.