Lateral carbon transport during surface water-groundwater interaction at an onshore aquacultural farm

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Many coastal areas are hotspots for aquaculture expansion, where large amounts of organic carbon are often present in aquaculture ponds to maximize the product. Often, the over use of artificial feeds resulted accumulation of organic carbon. After harvest, aquaculture wastewater rich in organic carbon is transported to the nearshore waters through artificial ditch or groundwater discharge. The physical and chemical processes of ditch water control the magnitude of lateral carbon transport. We used high-frequency in-situ monitoring of groundwater levels and velocity profiles of surface water to obtain year-round water fluxes through surface and groundwater. The particulate organic carbon (POC) and dissolved organic carbon (DOC) concentrations in surface water and groundwater was measured from water samples at different time scales. And then we estimated carbon transport at tidal and seasonal scales based on water fluxes and concentration. Our results showed that the transport of POC and DOC are influenced by the types of tides. Disturbing the coastal carbon balance by aquaculture activities increases lateral carbon losses and facilitates carbon-rich fluid exchange between onshore farm and nearshore estuary. This study provides insights into improved understanding on the mechanism of the coastal carbon cycle where aquaculture is expanding across Asia and the globe.