Inorganic carbon chemistry chemistry in the groundwater– ocean continuum

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There is increasing evidences that submarine groundwater discharge (SGD) controls the chemistry of coastal waters, especially with respect to the inorganic C system. Inputs of groundwater enriched in CO_2 significantly contribute to the air-sea flux of CO_2 in the coastal zone even if groundwater discharge rates are often low. Other studies, however, have highlighted that fresh inland groundwater was clearly not a source of carbon, but act as a conveyor for inorganic carbon (IC) and total alkalinity (TA) produced along the flow path in the unconfined beach aquifer. While the role of coastal systems as a sink or a source of CO_2 is not well defined, it is critical to develop a better understanding of the chemical transformations of SGD-derived IC and TA. Within the context of inevitable sea-level rise, the impact of buried terrestrial horizons on carbon fluxes needs to be understood in order to assess the consequences of the landward migration of the coastline on the acidification of coastal water.

Here, we present vertical and horizontal distributions of pH, alkalinity (TA = carbonic and non-carbonic alkalinity), and dissolved inorganic carbon (DIC) to explore IC chemistry in unconfined coastal aquifer of the Magdalen Island (Gulf of St. Lawrence, Canada). The objectives of this study are 1) to document IC chemistry in a quartz coastline submitted to recent submerging processes; and 2) to discriminate the relative contribution of vertical CO_2 degassing to the lateral SGD-derived DIC fluxes. This study combines marine chemistry and hydrogeology, and proposes an integrated view of the IC chemistry in the groundwater–ocean continuum.