Intertidal salt marshes: A diminishing source of buffering capacity to the coastal ocean

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Interestingly, tidal water after exchange with intertidal salt marshes contains higher total alkalinity (TA), but lower pH and higher carbon dioxide (CO_2). These highly productive vegetated wetlands are deemed to export both alkalinity and dissolved inorganic carbon (DIC) to the ocean. This creates an apparent paradox in that salt marshes are both an acidifying and alkalizing source to the ocean. It has been argued that coastal salt marshes provide buffering capacity against coastal ocean acidification. Limited studies suggest that the marsh DIC and alkalinity export might matter a great deal to carbon cycling and carbonate chemistry, but the current estimates are still far too uncertain to be conclusive, largely due to lack of measurements that truly capture their variability. Unfortunately this ecosystem type and chemical source has been dramatically diminished in the recent past, and is likely to diminish much further, due to sea level rise, land development, eutrophication, and other anthropogenic pressures. To assess the potential impacts of this future change, it is imperative to understand its current status and accurately evaluate its significance to other parts of the carbon cycle. This study uses high-resolution in-situ measurements along with modeling to significantly improve assessment of DIC export fluxes from intertidal salt marshes over minutes to seasonal scales. Carbon isotope measurements are also used to identify source of inorganic carbon over tidal and seasonal cycles. We also characterize and evaluate a previously unnoticed, but potentially important effect of organic alkalinity in dissolved organic carbon (DOC) on carbonate chemistry. This study is one of the first in-depth analyses of how marsh export of alkalinity and DIC impacts carbonate chemistry of coastal waters.