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Overview of tidal pumping along the French coastline: focus on carbon and nutrients

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Intertidal areas, including salt marshes, are considered key ecosystems due to the wide range of services they provide. These areas are hotspots for carbon sequestration in various forms, such as burial or alkalinity production. The capacity of marshes to purify water by removing nitrogen and chemicals is also frequently highlighted. Tidal pumping has recently been described as a major process involved in the flux of carbon and nutrients in intertidal areas. The French Atlantic and Channel coasts are home to a variety of these ecosystems, each with a different biogeochemical context that defines their capacity for carbon sequestration and nutrient fluxes. This study aims to compare tidal pumping of alkalinity, DOC, and nutrients in several intertidal ecosystems along the French coast. Five marshes along the French coast were sampled at low tide to investigate the hydrology and chemical composition of waters draining to the sea. For each sample, water from tidal creeks supplied by the seepage of pore water from marsh sediments was collected, and discharge rates were measured. The different ecosystems exhibit clear hydrological and water biogeochemical variations, which can be attributed to factors such as their relative altitude, vegetation, catchment area, freshwater inputs, and geological characteristics. Brackish waters are enriched in alkalinity and nutrients in most ecosystems. Net alkalinity fluxes ranged from 0.01 to 3.22 mmol m^{-2} d^{-1}, highlighting the significance of tidal pumping in carbon sequestration. Therefore, tidal pumping is an important yet generally overlooked process in coastal biogeochemical cycles.