WATER LEVEL AND OXYGEN DELIVERY/UTILIZATION IN POROUS SALT MARSH SEDIMENTS

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Abstract

Increasing terrestrial nutrient inputs to coastal waters is a global water quality issue worldwide, and salt marshes may provide a valuable nutrient buffer, either by direct removal or by smoothing out pulse inputs between sources and sensitive estuarine habitats. A major challenge in characterizing this ecosystem service is quantifying the role of subsurface nutrient processing, which in turn depends on water infiltration and movement through variably porous layers. Because much of the subsurface biogeochemical processing depends strongly on redox state, the interplay between infiltration (delivering both reactants and oxic water), seepage (removing products and pulling in air by advection), and O2 utilization make this highly dynamic system difficult to model. To address this, we installed in situ optical O2 loggers at various depths in the soil column, coupled with an array of shallow hydrologic wells to examine how overtopping and rain events affect O2 availability. We present data on both oxygen content and water retention over several months from a mesohaline salt marsh in Yaquina Estuary (Oregon, USA) as a function of tide height, rainfall and distance from channel edge. In the permeable upper peaty layer, water drained more slowly with increasing distance from the channel edge, and these data were used to map residence time and estimate water retention as a function of soil depth and time after tidal recession. Soil oxygen varied with tidal immersion/drainage as well as depth, varying in response to spring/neap cycle and episodic heavy rain events. The first overtopping spring tide injected oxic water which mixed with anoxic pore water from previous tidal intrusion, leading to depth-dependent oxygen profiles. These data will be used to develop a spatially and temporally dynamic model of dissolved inorganic nitrogen processing.