Impact of simulated storm surge on organic carbon loss in coastal wetland soils

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Coastal wetlands are a critical global carbon (C) sink due to high primary productivity and low rates of decomposition. Increasing sea level exaggerates the risk of storm surges and extreme tidal events in coastal wetlands. Abrupt changes in salinity are expected to uniquely affect soil microbial communities and C cycling, compared to gradual sea level rise. This study investigates the rate of C loss (anaerobic respiration, methanogensis, and dissolved organic C (DOC) export) in 3 coastal wetland soils following short-term pulses of surface water of different salinities. A total of 36 intact soil cores (12 field replicates from a freshwater tidal marsh (0.5 ppt), a brackish marsh (13 ppt), and a salt marsh (26 ppt)), along with 100L of surface water from each location, were collected near Jacksonville, FL. In the laboratory, soil cores were randomly assigned to 1 of 3 salinity treatments in a 3x3x3 mixed model design. Soil respiration and DOC export were monitored throughout the 55-day study, while potential methanogenesis, soil properties, and microbial community indicators were quantified at the conclusion of the study. Pulses of salt water (26 ppt) enhanced soil respiration in the freshwater soil (+28%) and the brackish soil (+82%). Methanogenesis was stimulated in brackish and salt marsh soils following freshwater additions, but remained significantly lower than in freshwater soils. DOC export was highest in the freshwater soil, regardless of surface water salinity. Results indicate the importance of existing soil properties (C availability and nutrient content) in predicting rates of organic C loss.