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# Soil biogeochemical controls on carbon (de)stabilization and uncertainty in tidal salt marshes

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Tidal salt marshes are considered important reservoirs of soil carbon, storing more carbon per land area than terrestrial environments. This increased rate of storage is due to the slow oxidation of carbon compounds in wetland environments; however, less is known about the stability of this carbon pool. Tidal salt marshes vary in space and time as a result of linked hydrologic and biogeochemical drivers, which influences carbon stability. Whereas some marsh areas that are nearly always saturated may lead to more carbon storage, other areas of the marsh that experience extreme tidal oscillations such as near-channel soils may be prone to more carbon destabilization as a result of mineral control on C storage. Moreover, these hydrologic drivers affect the dominant vegetation across the marsh platform with smaller plants in saturated areas and larger plants in tidally dynamic areas, with consequent differences in root exudation and thus carbon supply. Finally, sea-level rise will likely alter the controlling processes on C storage in tidal salt marsh soils in the future.

This talk will discuss the dynamic controls on carbon cycling in salt marsh soils using data obtained from combined laboratory and field investigations of a Mid-Atlantic mesohaline marsh. We conducted laboratory incubations of marsh soils subjected to tidal oscillations (control) and simulated sea-level rise (treatment) and monitored the fate of carbon and mineral control on C release. At the field scale, we investigated the spatial and temporal gradients of C concentrations, fluxes, and production of greenhouse gases across the marsh platform. We found that soil carbon and fluxes of greenhouse gases near tidal channels are dynamic in space and time. In these soils, sea-level rise simulations and flood tides destabilize C-Fe oxide assemblages. Moreover, phenophases contribute to the dynamic nature of C cycling in these soils. In contrast, soil C is more stable in the marsh interior due to the slow oxidation of soil C under more reducing conditions. Moreover, we observed high levels of methane production that coincided with sulfate reduction, which calls into question the current paradigm of sulfate reduction inhibiting methane production in these important ecosystems.