Poster #110

Coastal Wetland Carbon Sequestration in a Warmer Climate

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Coastal wetlands are global hotspots of carbon storage. Marshes, mangroves and seagrass meadows account for about half of the total marine soil carbon pool and annual sequestration due to interactions among three primary factors: high rates of plant production, low rates of decomposition, and sea level rise. The future sink strength and carbon stock stability of these systems is uncertain because global change drivers such as temperature and elevated CO_2 perturb the complex biotic and abiotic feedbacks that drive high rates of soil carbon sequestration. Despite the leverage these ecosystems exert over the global carbon cycle, the dynamics of coastal wetland carbon pools are not presently represented in Earth system models.

In June 2016, we initiated an *in situ*, active, whole-ecosystem warming experiment and two integrated modeling activities focused on coastal wetlands. Our objectives were to: (i) examine interactions between warming, elevated CO_2 and inundation frequency, (ii) test the hypothesis that warming will increase both plant production and decomposition, but the net effect will be an increase in soil carbon sequestration rate, (iii) modify a well-established marsh carbon model to incorporate new insights gleaned from the experiment, and (iv) integrate aspects of the marsh carbon model into a wetland-enabled ACME model.

The experiment has a gradient design with air and soil warming treatments ranging from 0 to +5.1 ^{o}C, to a soil depth of 1.5 m. Elevated CO_2 will be crossed with the temperature treatment extremes (0, +5.1) beginning in May 2017. Replicate transects (n=3) are located in each of two plant communities yielding a plant community treatment that corresponds to changes in inundation across the wetland landscape. The heating treatment performed extremely well during the first season of operation.

Warming suppressed net ecosystem exchange of CO_2 (NEE, measured at 3-4 week intervals) at the site dominated by the C3 sedge *Schoenoplectus americanus*, but had no effect on the site dominated by the C4 species *Spartina patens* and *Distichlis spicata*. NEE suppression at the C3 site increased progressively with rising temperature treatment. The effect of temperature on the C3 community switched in Oct when warming began to increase NEE, a response that corresponded to delayed plant senescence. Because warming had no effect on ecosystem dark respiration in either community, we propose that temperature suppressed NEE by decreasing gross primary production. Mechanisms of warming-induced plant stress in this brackish ecosystem include stomatal closure due to lower vapor pressure deficit or higher soil osmotic potential, and nitrogen limitation due to increased sulfide production. These mechanisms will be investigated further in the second year of the experiment.

Warming increased CH_4 emissions from Jun-Nov in the C3 community site but had little effect on emissions from the C4 community. We propose that this effect is due to a decrease in rhizosphere CH_4 oxidation, which we are testing through analysis of stable isotopes. Early indications from this experiment are that responses to warming may cause radiative forcing in C3-dominated, but not C4-dominated, coastal wetland ecosystems.