



Emergent Biogeomorphic Patterns in Tidal Environments

Marco Marani

Duke University and University of Padova (marco.marani@duke.edu)

Tidal environments, such as lagoons and estuaries, exist in a constant pursuit of sea level rise. In the process they generate ubiquitous and robust geomorphic structures, such as marshes, tidal flats, and sub-tidal platforms. These structures are shown to be bio-geomorphic in nature, as they emerge from the coupled dynamics of biotic and abiotic processes. At intermediate scales, tidal landforms and the associated ecosystems are shown to emerge as multiple, competing, equilibrium states from the interplay of erosion, deposition, and biostabilization. At a smaller scale, biogeomorphic features in tidal marshes are seen to stem from the ability of vegetation species to actively engineer the landscape by tuning soil elevation within preferential ranges. Each vegetation patch corresponds to one of many competing stable states, which display a varying robustness to changes in the rate of sea level rise, with implications for the overall resilience of marsh ecosystems.