Simulating estuarine wetland vegetation and biogeochemistry in ELM

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Estuaries are characterized by interactions between freshwater from rivers and saltwater from the ocean, which drives high ecosystem productivity and dynamic carbon and nutrient cycling. Estuaries can act as a filter on flows of nitrogen (N) and other nutrients to the ocean. Estuarine wetlands sequester carbon (C) at high rates but can also be important sources of greenhouse gases such as methane and nitrous oxide. However, estuaries and estuarine wetlands are not currently represented in Earth System Models (ESMs) such as the Energy Exascale Earth System Model (E3SM). This newly-funded project aims to understand the current and future role of estuarine wetlands in coastal C and N cycling at scales from the estuary landscape to the continental coast by simulating estuarine wetland processes in the E3SM Land Model. Model improvements will include simulating chemical and biological interactions in wetland sediments and introducing salt marsh and mangrove vegetation types. Model developments will be evaluated using observational data from existing coastal wetland field sites along the Pacific, Atlantic, and Gulf of Mexico coasts of the United States. This research will enable quantitative estimates of N removal, C sequestration, and greenhouse gas emissions from estuarine wetlands at estuary to continental scales and will improve predictions of coastal C and N cycling responses to changes in wetland area, river flows, and sea levels.