Geophysical Research Abstracts
Vol. 19, EGU2017-19174, 2017
EGU General Assembly 2017

The Spatial Variability of Organic Matter and Decomposition Processes at the Marsh Scale

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Coastal salt marshes sequester carbon as they respond to the local Rate of Relative Sea Level Rise (RRSLR) and their accretion rate is governed by inorganic soil deposition, organic soil production, and soil organic matter (SOM) decomposition. It is generally recognized that SOM plays a central role in marsh vertical dynamics, but while existing limited observations and modelling results suggest that SOME varies widely at the marsh scale, we lack systematic observations aimed at understanding how SOM production is modulated spatially as a result of biomass productivity and decomposition rate. Marsh topography and distance to the creek can affect biomass and SOM production, while a higher topographic elevation increases drainage, evapotranspiration, aeration, thereby likely inducing higher SOM decomposition rates. Data collected in salt marshes in the northern Venice Lagoon (Italy) show that, even though plant productivity decreases in the lower areas of a marsh located farther away from channel edges, the relative contribution of organic soil production to the overall vertical soil accretion tends to remain constant as the distance from the channel increases. These observations suggest that the competing effects between biomass production and aeration/decomposition determine a contribution of organic soil to total accretion which remains approximately constant with distance from the creek, in spite of the declining plant productivity. Here we test this hypothesis using new observations of SOM and decomposition rates from marshes in North Carolina. The objective is to fill the gap in our understanding of the spatial distribution, at the marsh scale, of the organic and inorganic contributions to marsh accretion in response to RRSLR.