B25C-1456 - Carbon dioxide Uptake Fluxes in Coastal Salt Marshes Reveal Ecological Similitudes and Environmental Regimes

Tuesday, 14 December 2021

17:00 - 19:00

Convention Center - Poster Hall, D-F

Abstract

We tested the hypothesis that carbon dioxide (CO_2) uptake fluxes in coastal salt marshes follow ecological similitudes (parameter reductions) and distinct environmental regimes. The hypothesis was evaluated utilizing data from four salt marshes in Waquoit Bay, MA, USA collected during May-October 2013. Using dimensional analysis method from fluid mechanics and engineering, we reduced five flux and ecological variables (CO_2 uptake, light, soil temperature, salinity, and atmospheric pressure) into two mechanistically meaningful dimensionless groups: (a) light use efficiency number (LUE = CO_2 uptake normalized by daylight) and (b) biogeochemical number (BGC = interactions among soil temperature, salinity, and atmospheric pressure). Graphical exploration of the dimensionless numbers with the observed data revealed an emergent pattern that was distinctly characterized by high, transitional, and low LUE regimes. Transitions among the identified regimes were dictated by thresholds of soil temperature and salinity. Low LUE regime corresponded to unfavorable environmental conditions (soil temperature ≤ 17°C and salinity > 30ppt), whereas high LUE regime was governed by favorable conditions (soil temperature > 17°C and salinity ≤ 30ppt). The identified emergent pattern and environmental thresholds would provide key insights into the underlying organizing principles of CO_2 uptake and the major environmental drivers in coastal salt marshes.

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