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Investigation of carbon sequestration and mercury contamination in the Northeastern US salt marshes and the potential impact of anthropogenic activities

Hejia Zhang[1], Mingyu Zhang[1], Bibek shrestha[1], Shou-En Tsao[1], Derrick Vaughn[1], Maodian Liu[2], and Peter Raymond[1]
[1]Yale University, School of the Environment, United States of America (nikki.zhang@yale.edu)
[2]Peking University, College of Urban and Environmental Sciences

Wetlands are recognized as critical sinks of carbon among terrestrial ecosystems. The demand for atmospheric carbon mitigation, exacerbated by climate change, underscores the importance of wetland carbon sequestration. Meanwhile, due to the strong affinity of mercury (Hg) with organic matter, Hg in the atmosphere can also be scavenged and buried in wetlands. However, increased anthropogenic activities, such as urbanization, disrupt sediment dynamics in coastal wetlands, affecting their capacity to sequester carbon and Hg. To explore the urbanization impacts, One-meter sediment cores were collected from five salt marshes in Connecticut and Massachusetts, USA. Sediment samples were collected every 2 cm, and then processed through freeze-drying, sieving, acidification, and weighing. Subsequent laboratory analyses include total organic carbon (TOC), stable carbon isotope ($\delta^{13}C$), carbon/nitrogen (C/N) ratio, and mercury (Hg) concentrations throughout the core. The TOC source (terrestrial vs. marine) was determined using an isotopic mixing model with Monte Carlo simulation. The data indicate a temporal decrease in terrestrial TOC and an uptick in marine-derived TOC. Within the terrestrial fraction, local vegetation is the primary contributor. This shift in TOC source, driven by reduced terrestrial contributions, suggests wetland degradation and a potential decline in carbon sequestration due to urbanization. Furthermore, Hg analysis reveals a negative correlation with TOC in disturbed salt marshes, highlighting Hg dilution by marsh-derived organic matter and the effects of anthropogenic point source releases of Hg. Notably, two sites uniquely showed extremely high Hg concentrations and decoupling between Hg and TOC, tracing back to localized Hg releases from industrial activities in Danbury, Connecticut, during the 19th century. This study demonstrates the temporal shifts in sources of TOC, a decline in carbon sequestration, and historical Hg contamination across Northeast US salt marshes, underscoring anthropogenic impacts on these ecosystems. Future work will incorporate Lead-210 and radiocarbon dating of sediment cores to better understand the temporal variation of carbon sequestration.