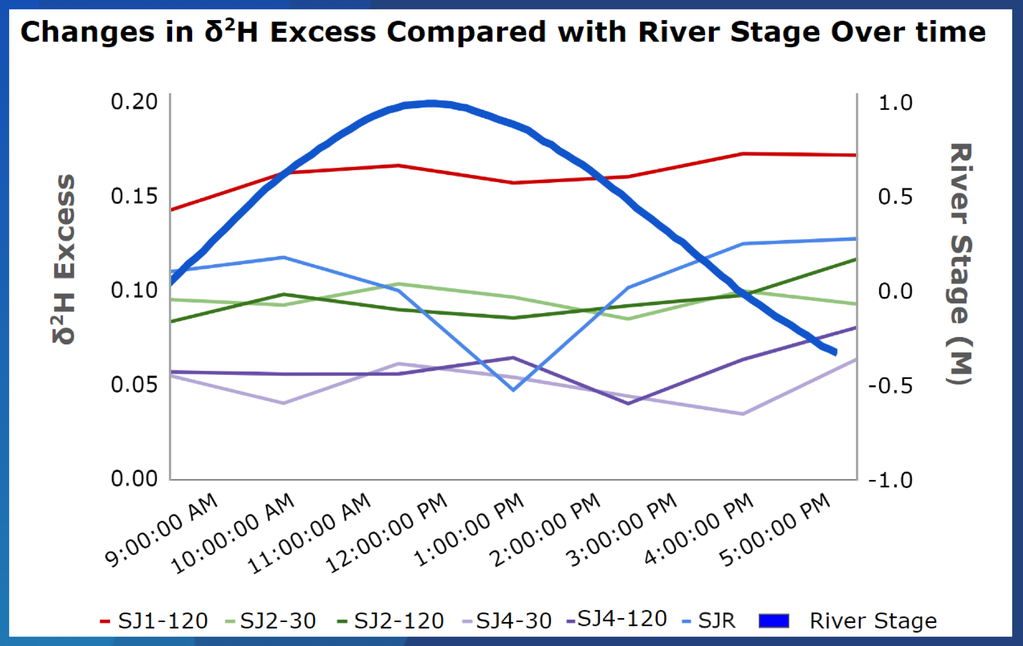
Stable water isotopes offer a powerful means to quantify the salt and freshwater dynamics in tidal salt marshes



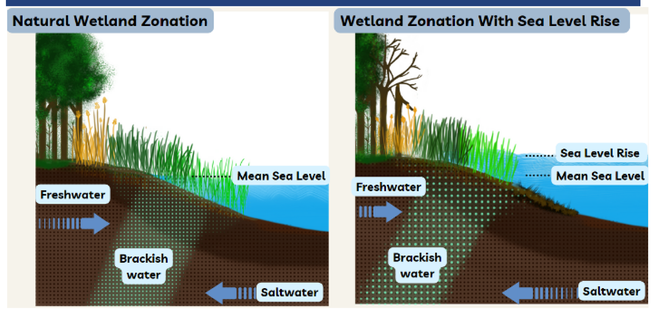
Using Stable Water Isotopes to Estimate Source Water Contribution in a Tidal Marshland

Authors & Affiliations:
Sophia Bradach, Jing Yan, Sunendra Joshi, Mohammad Afsar, and Yan Jin.
University of Delaware , USA.

This presentation participates in OSPP
Outstanding Student & PhD candidate Presentation contest
Sharing is encouraged

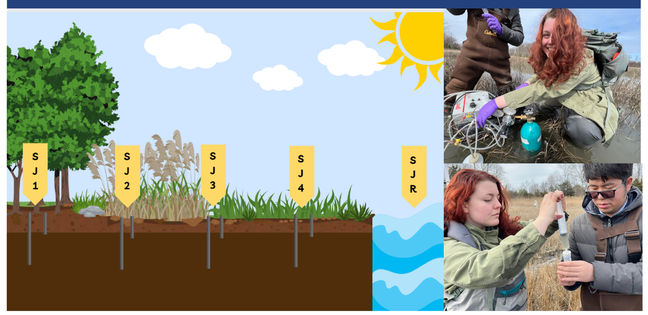
ERDC
ENGINEER RESEARCH & DEVELOPMENT CENTER

BACKGROUND



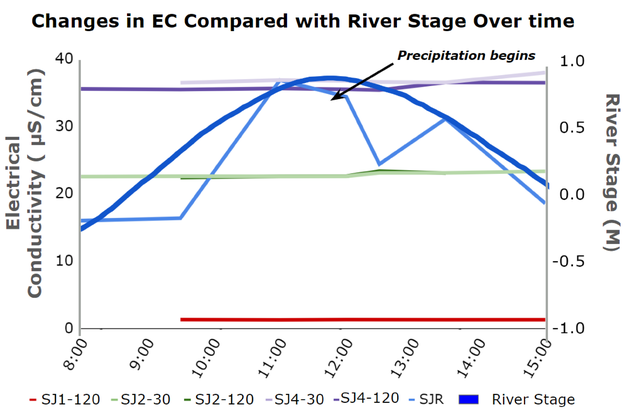
- The Mid-Atlantic region in the northeastern United States faces significant threats from saltwater intrusion, with sea levels rising 2.5-5.0 cm annually and projected to increase ~1.5 m by the century's end.
- The region's vulnerability stems from the low-lying Atlantic coastal plain's topography, exacerbating the impact of storm events and land subsidence.
- The loss of tidal wetlands, critical for buffering against sea level rise, highlights the urgency for improved investigations of hydrological processes in the region's marshlands.

METHODS

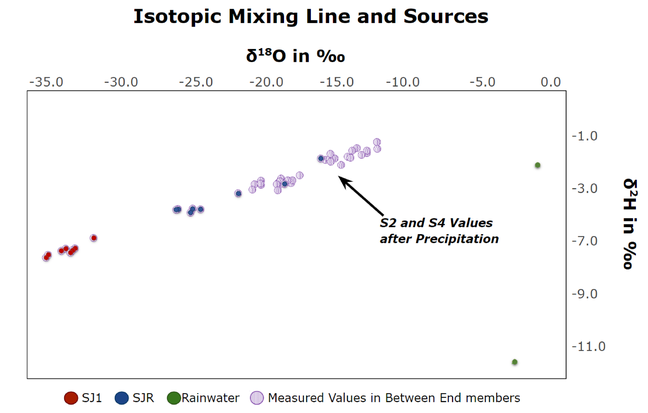


- Monitoring wells (at 30 cm and 120 cm depths) were installed at 4 locations in St Jones Reserve field site in Delaware, USA along a transect from the tidal trench into the upland forest.
- Pore-water samples were collected from the monitoring wells for a semi-diurnal tidal event on December 1st, 2023; over a 12-h duration at 1.5-h sampling intervals.
- The samples were measured for $\delta^{18}O$ and $\delta^{2}H$ using a Liquid Water Isotope Analyzer (LWIA). Porewater EC, pH, and EH were measured in the field.
- A linear Mixing Model (LMM) was constructed from the data using R.

PRELIMANARY RESULTS



- The changes in EC were not observed to change with changes in river stage at the SJ4, SJ1, and SJ2 sites.
- There was a drop in EC in SJR, which may be attributed to input from precipitation



- Linear Mixing using two endmembers does not capture the complexity of the system.
- Precipitation occurred during sampling but was not included in the mixing model. As a result, a shift in the mixing line is observed

IMPLICATIONS

- Excess deuterium variations provide insight into tidal impact on marsh subsurface water fluxes and mixing from different sources.
- Understanding subsurface hydrology and flux is crucial for understanding chemical and physical processes in the marshland.
- Saltwater affects soil aggregation and redox potential; understanding fluxes is key to interpreting these values.

ONGOING WORK

- Additional tidal marshland sites selected using GIS data, categorized by marsh migration impact.
- Sampling is to be conducted throughout the water year to capture tidal and seasonal variation.
- Development of a model of the changing subsurface of low-lying tidal marshlands.

ACKNOWLEDGMENTS

Department Of Defense/U.S. Army Engineer Research and Development Center (ERDC) Grant No:W912HZ-20-2-0041,
University of Delaware Graduate Student Travel Award