Characterizing Groundwater Flow Across the Barrier Island-High Marsh Interface

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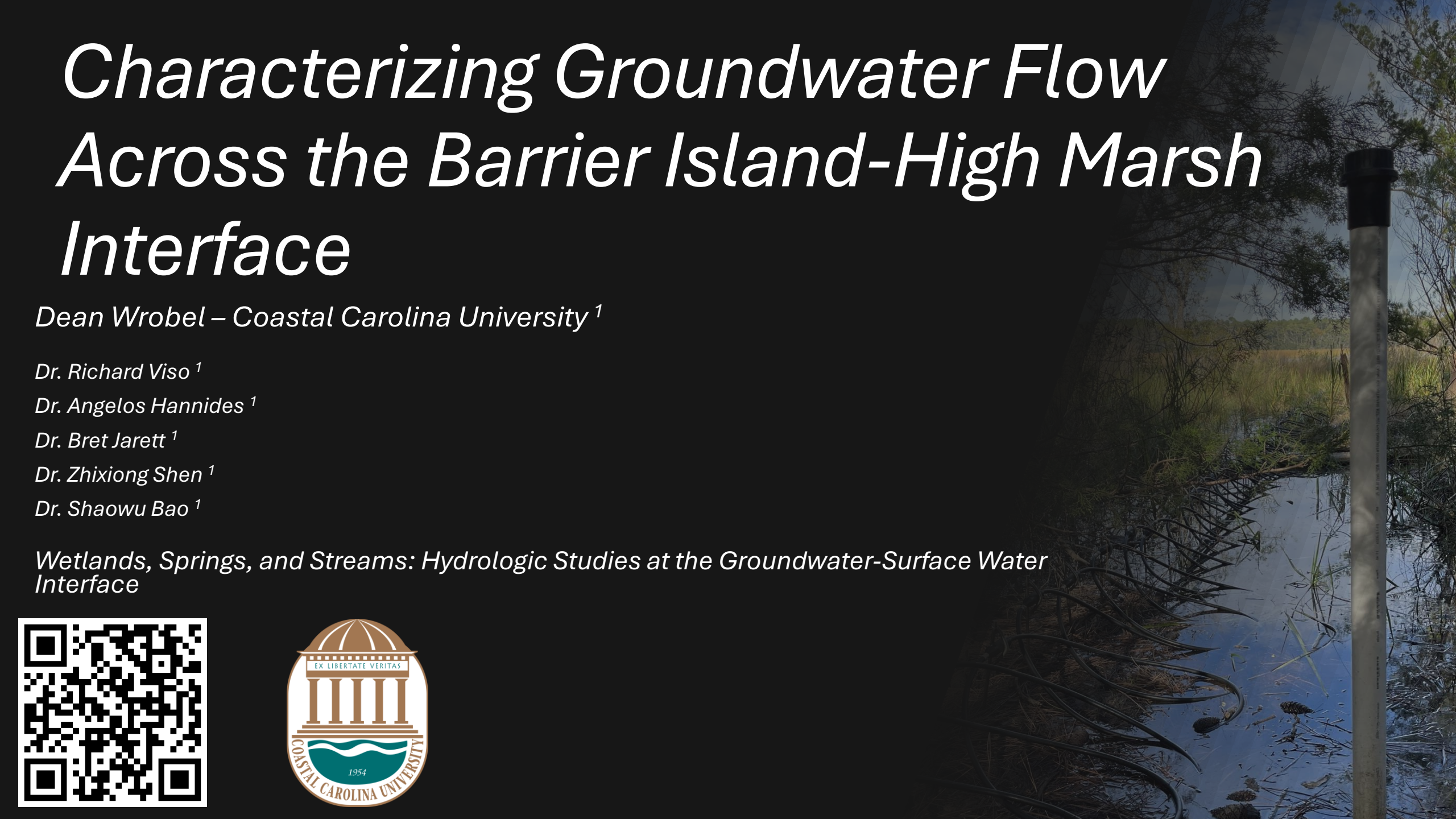
Wetlands, Springs, and Streams: Hydrologic Studies at the Groundwater-Surface Water Interface



Conclusions

- Primary
  - Tidal fluctuation in the water table propagated into the maritime forest well, nearly 270 meters away from the creekbank.
  - Electrical Resistivity can be utilized to image geologic structures in the saltmarsh and identified the groundwater mixing zone within the marsh.
- Secondary
  - Signal decomposition methods are suitable for the analysis of hydrologic drivers of groundwater level.
  - Modelers must incorporate nuances in local geology and system-specific drivers to obtain accurate representations of groundwater flow.

Barrier Islands – Complex Sites of Hydrogeology

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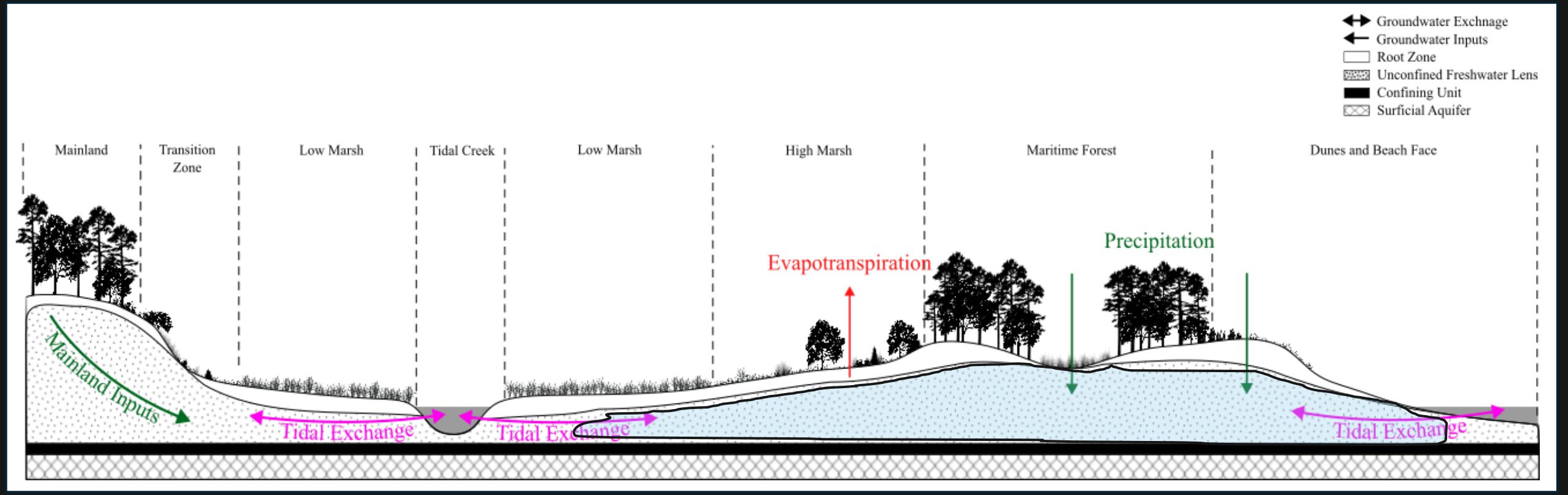
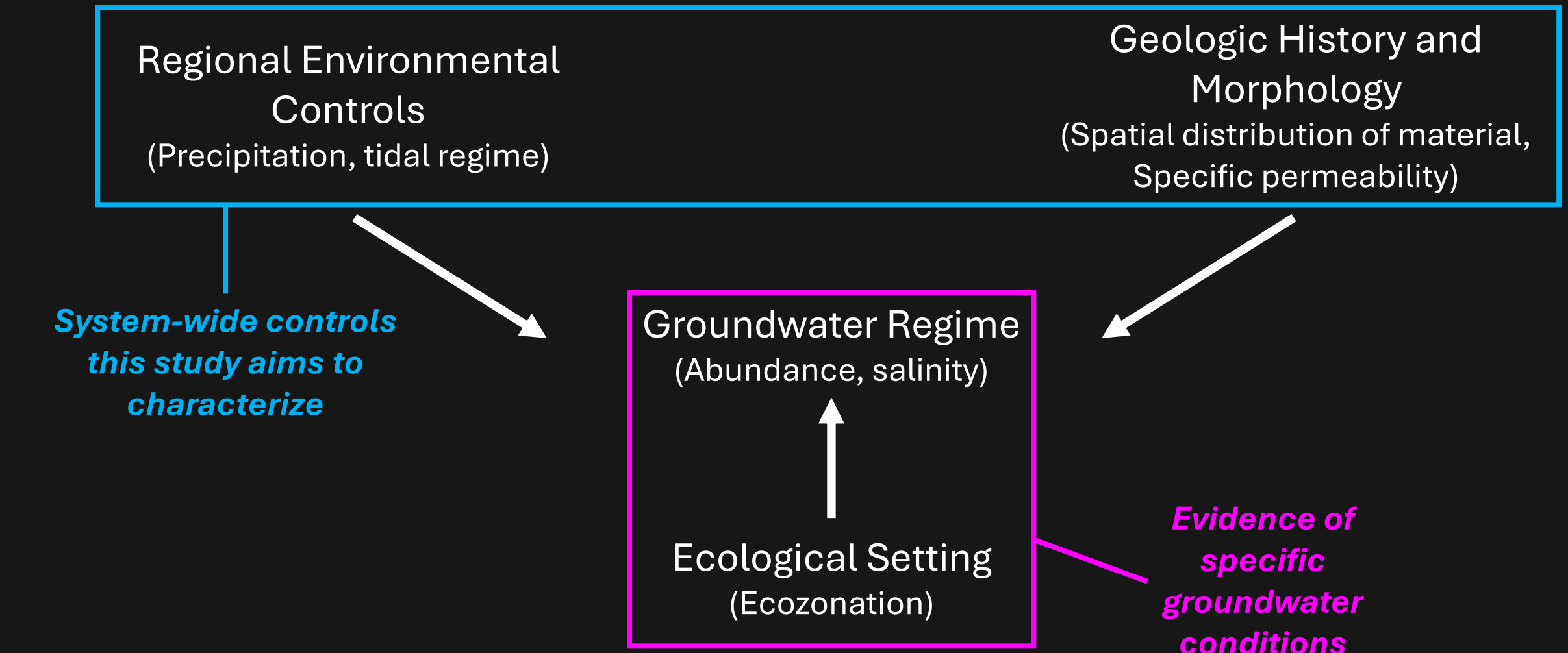
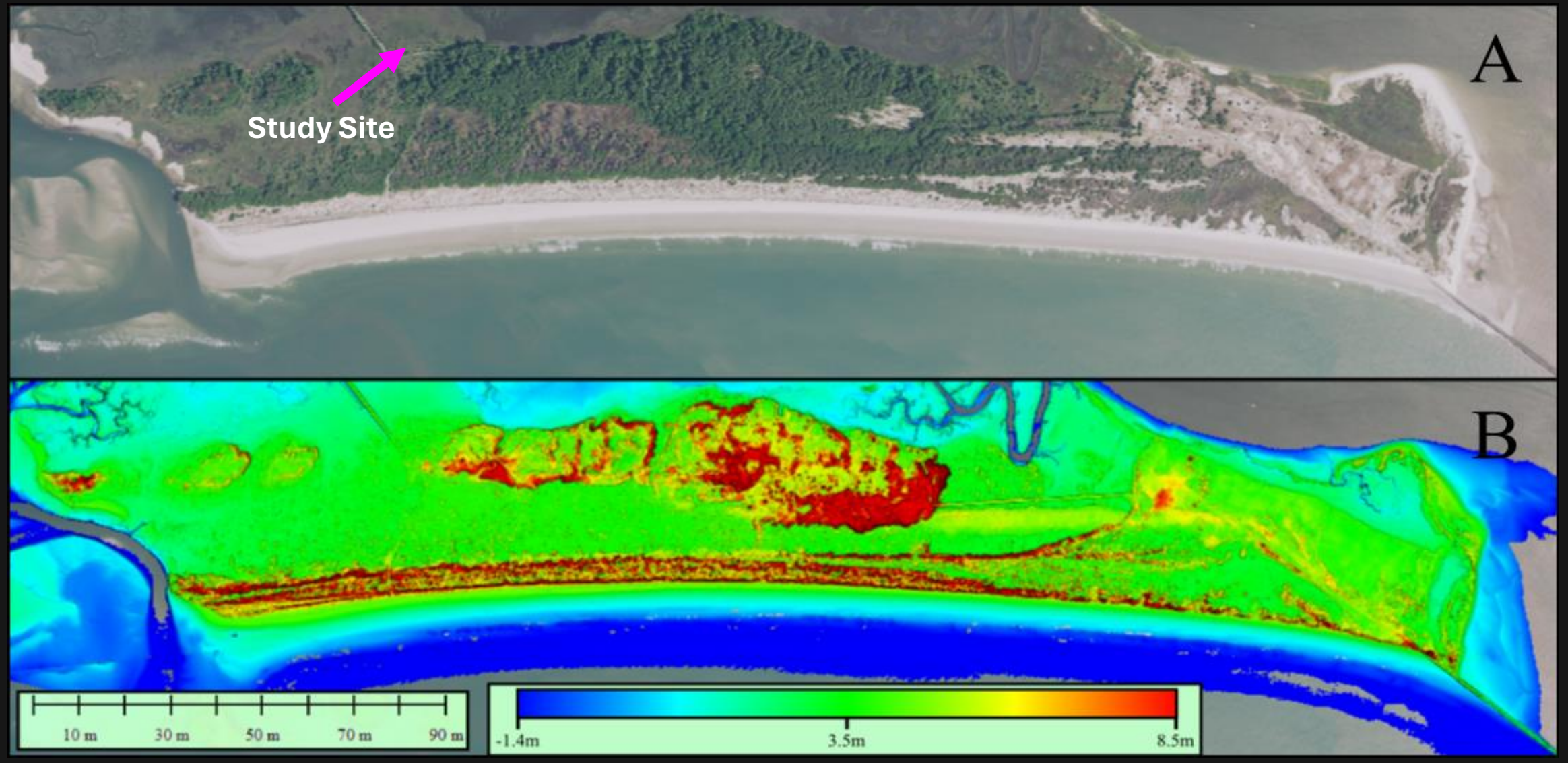
A — A’



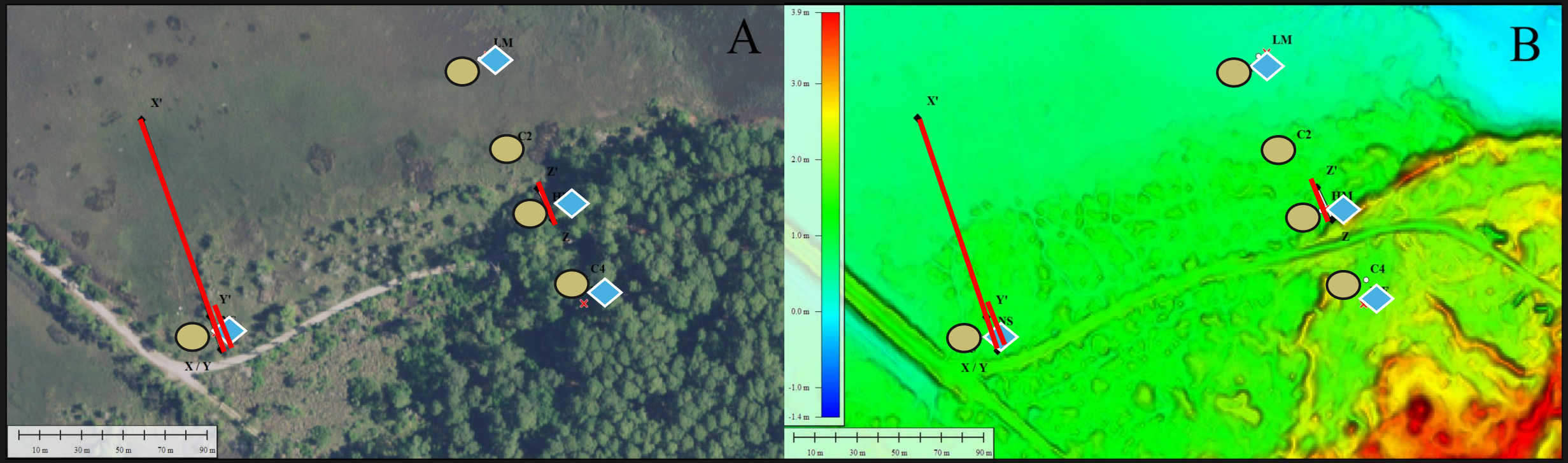
Barrier Islands – Complex Sites of Hydrogeology



Waties Island, South Carolina



Study Site – Maritime Forest Saltmarsh Transition

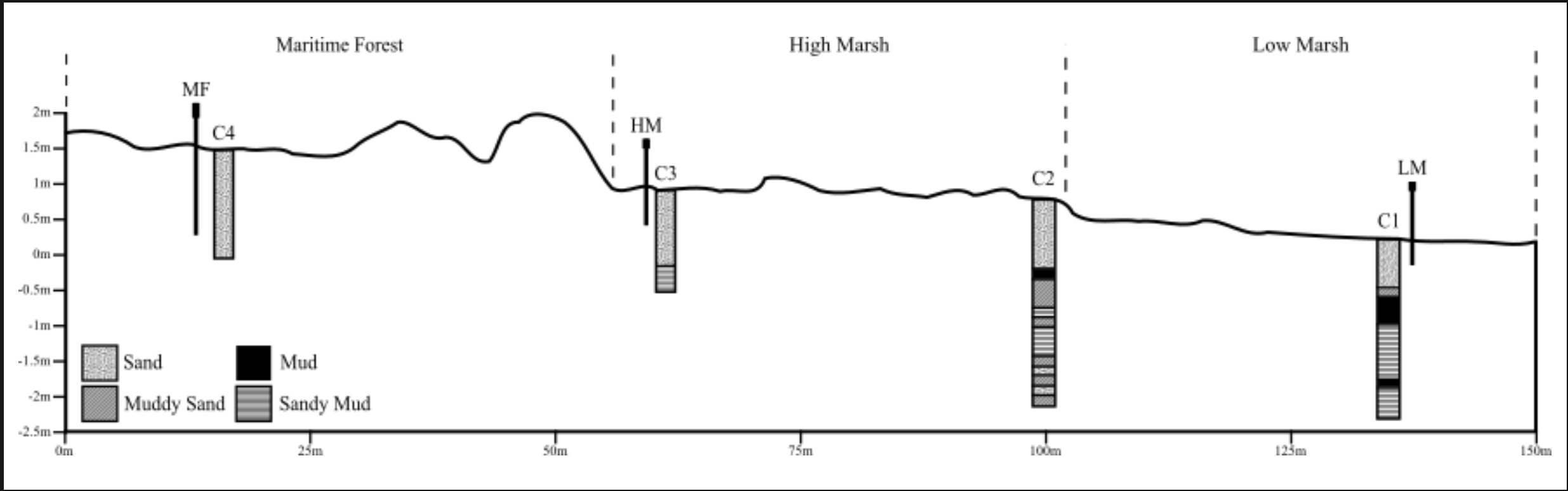


Groundwater Wells

Electrical Resistivity Transects

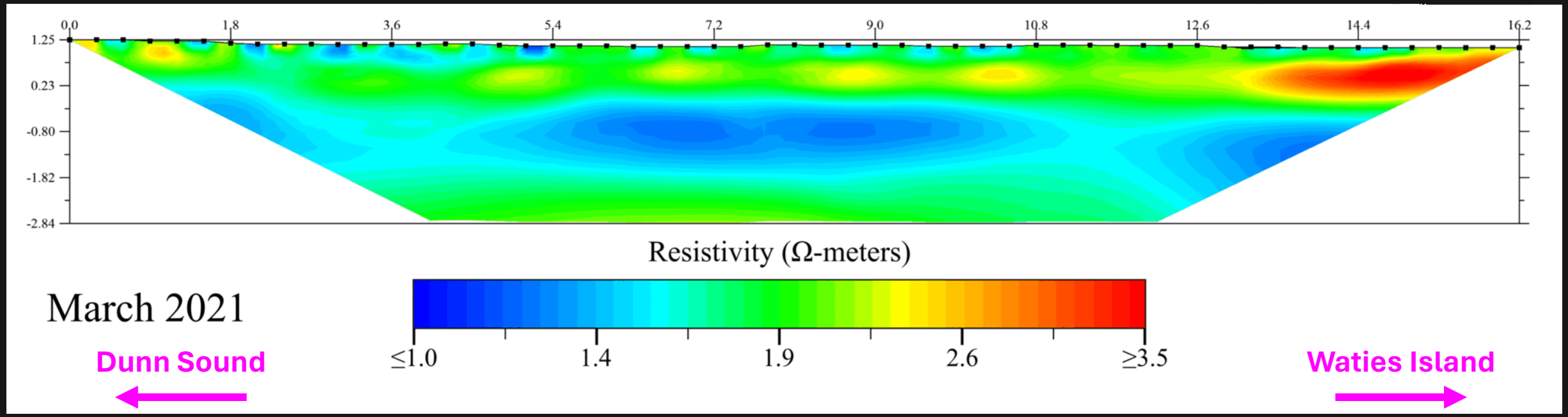
Vibracore Locations

Forest to Marsh – Geologic Framework

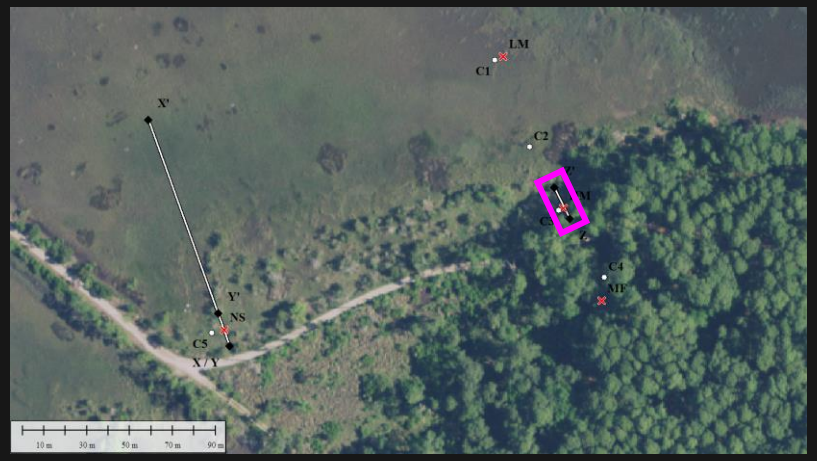


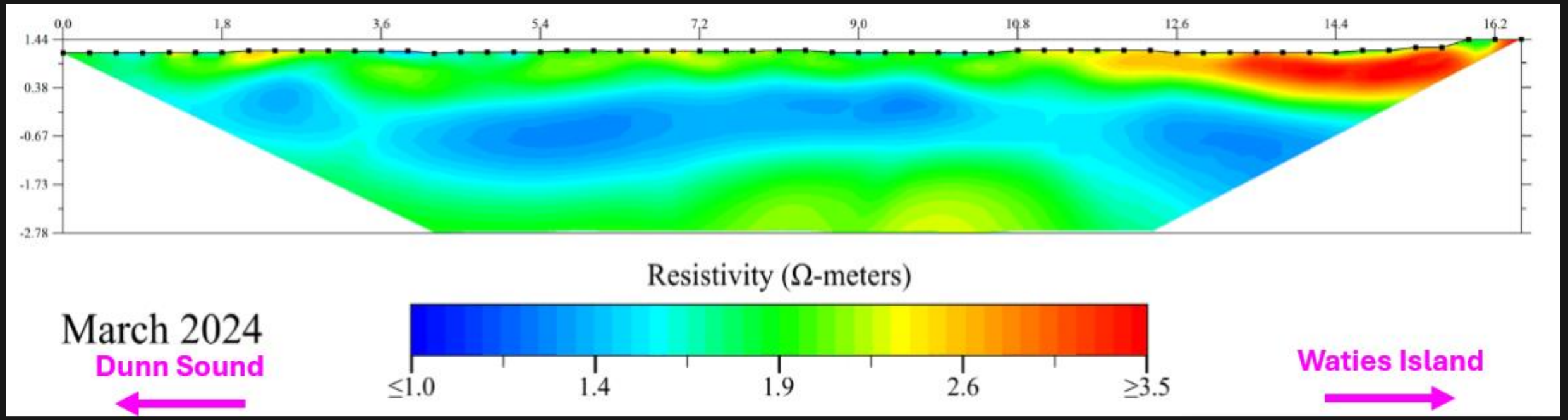
Electrical Resistivity Surveys - Equipment

Electrical Resistivity Surveys – Transect Y



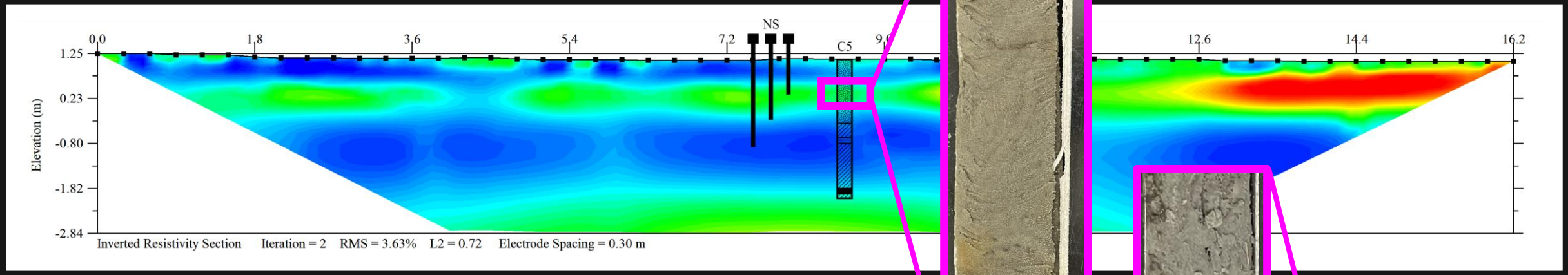
Electrical Resistivity Surveys – Transect Z



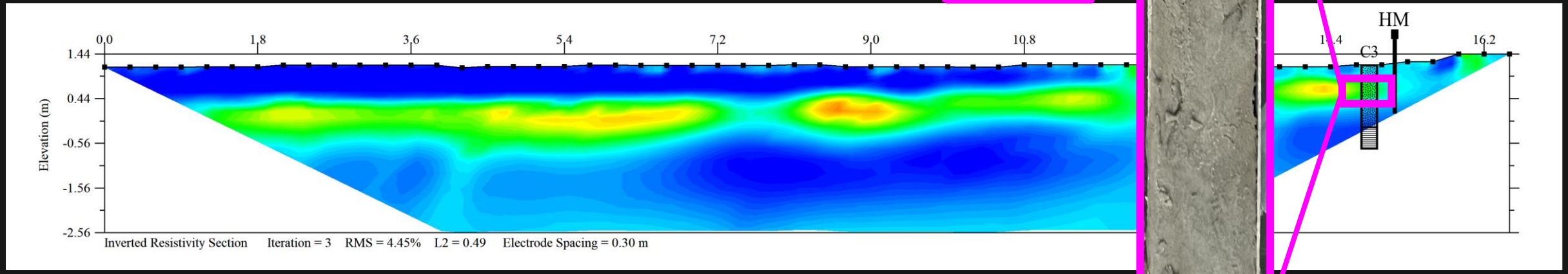


Electrical Resistivity Surveys – Influence of Sand

Transect Y



Transect Z



Electrical Resistivity Surveys – Overwash Fans

Electrical Resistivity Surveys – Permeable Sand

Sand: 97.3%
Mud: 2.7%

Avg. Grain Size: 2.69 ϕ

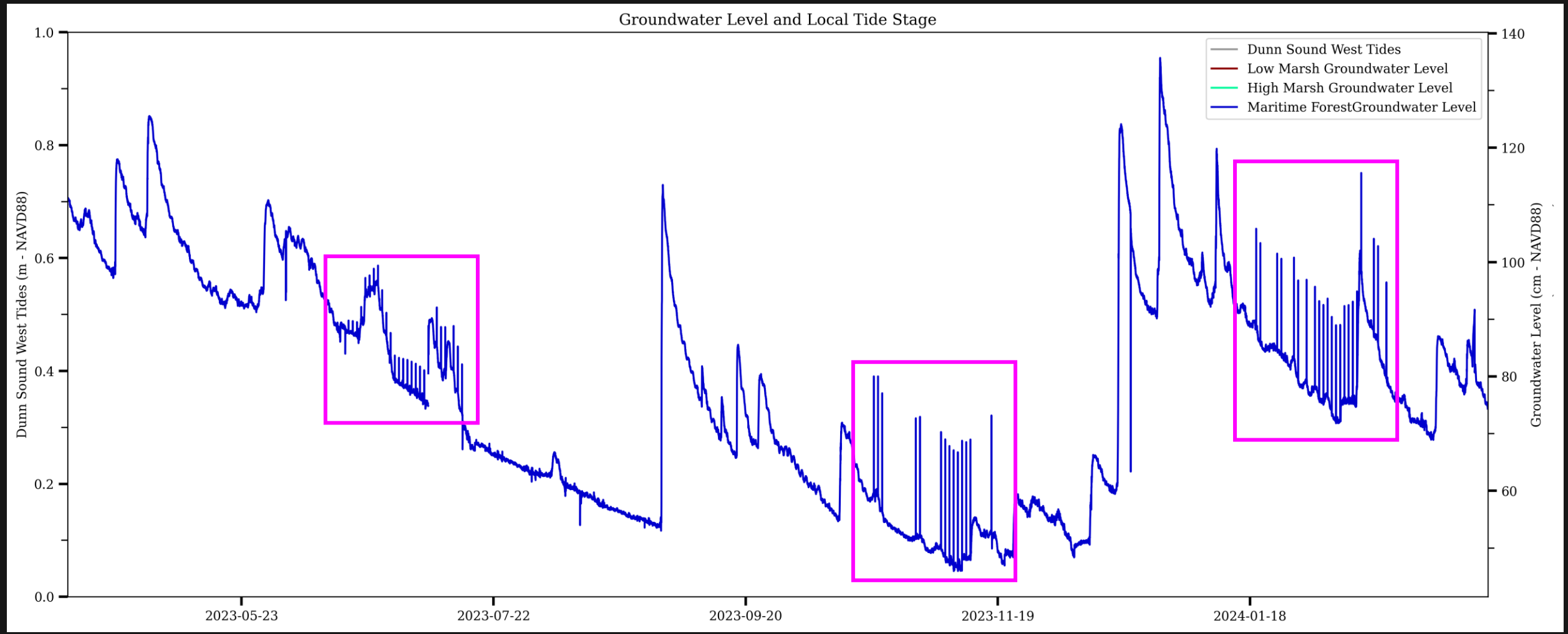
Avg. Intrinsic Porosity: 8.5×10^{-12}

Sand: 62.4%
Mud: 37.6%

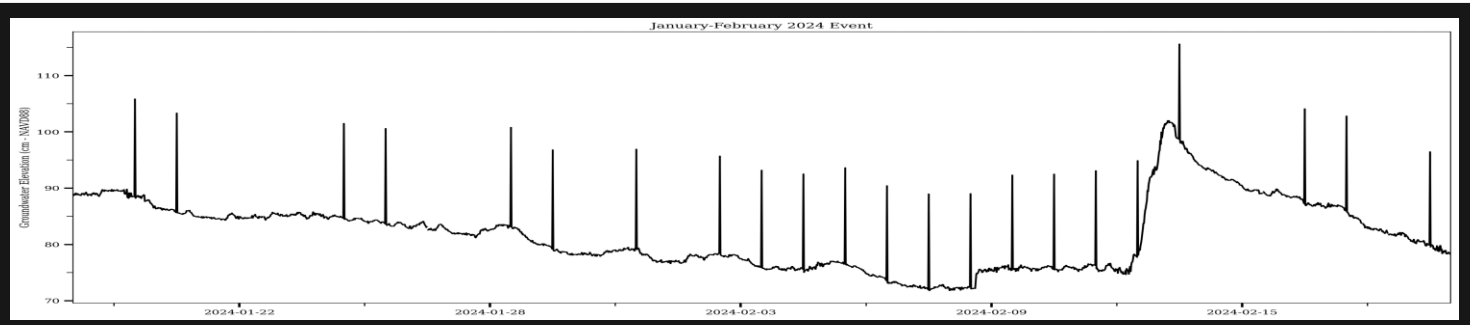
Avg. Grain Size: 2.76 ϕ

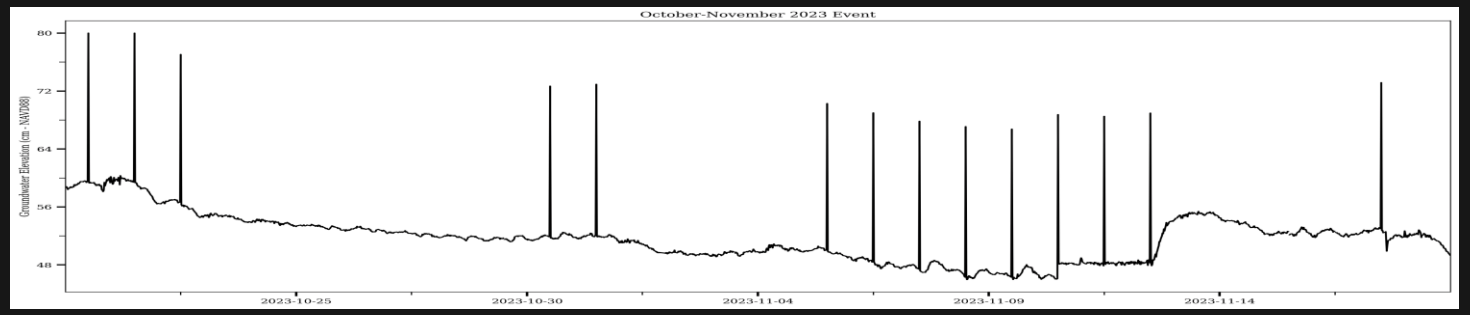
Avg. Intrinsic Porosity: Undetermined

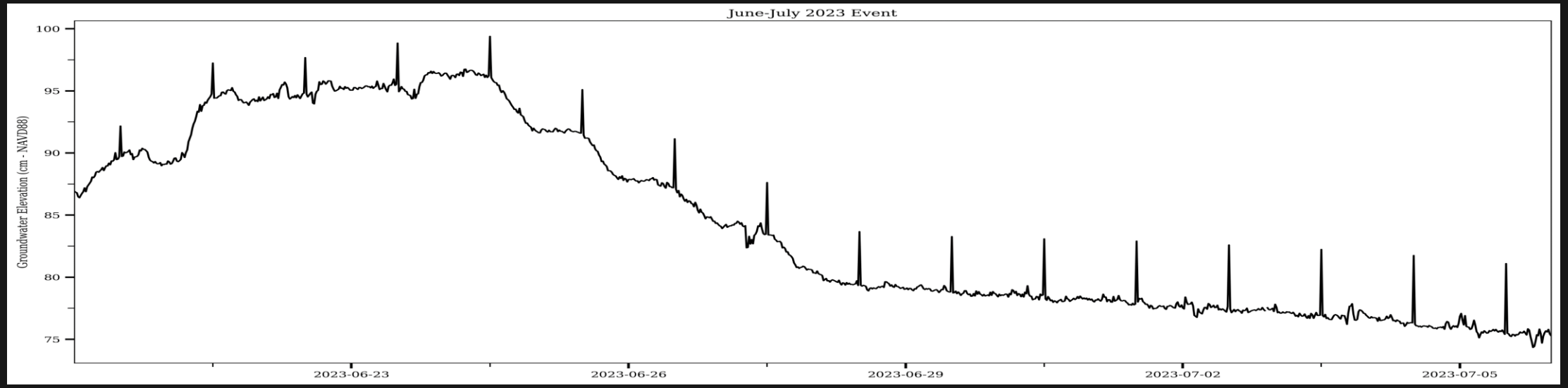
Tidal Propagation In Groundwater Signals

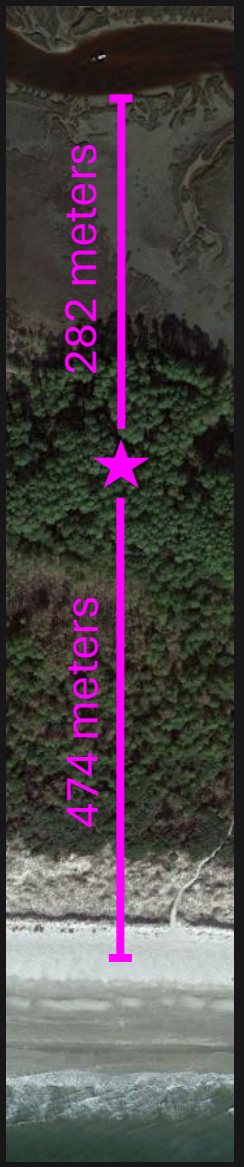


Tidal Propagation – Maritime Forest



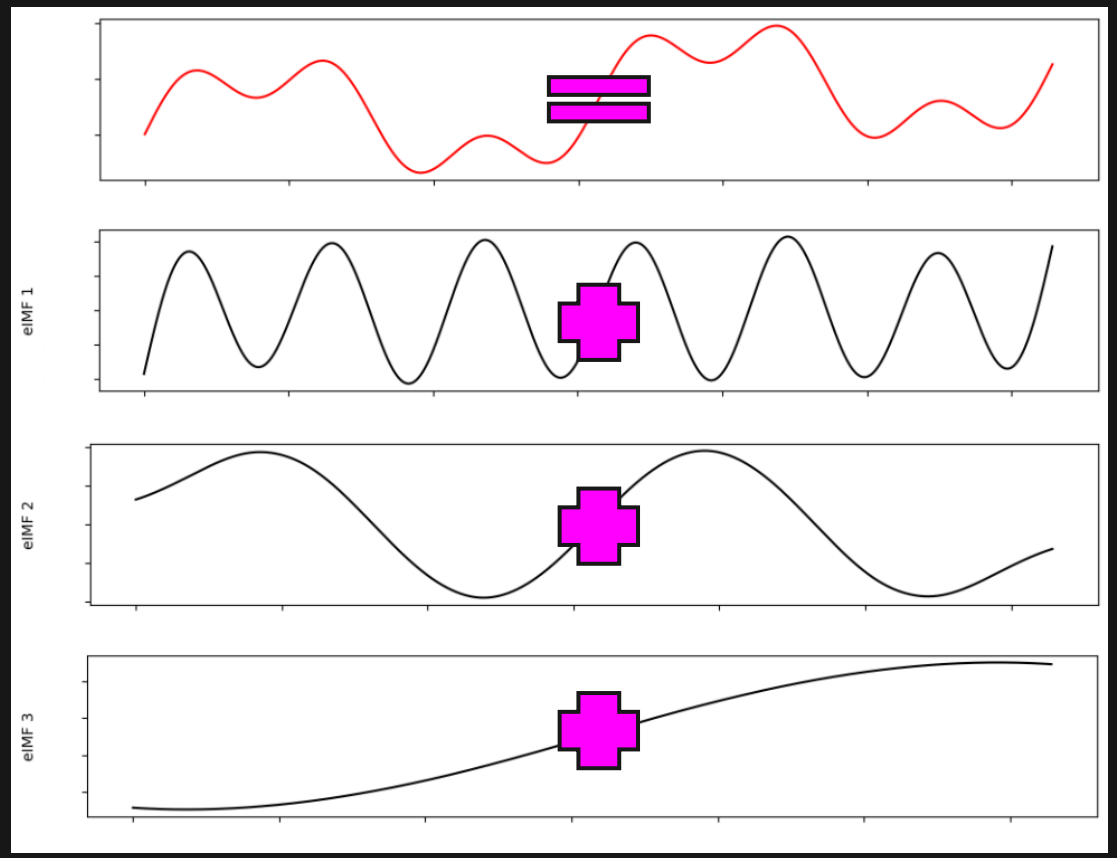




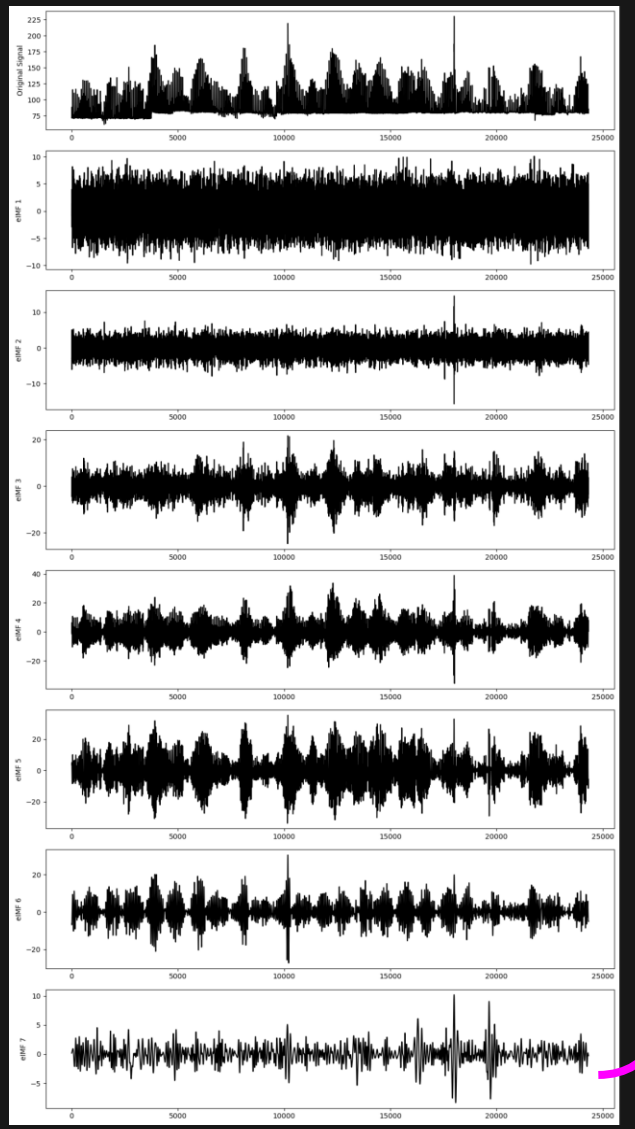


Ensemble Empirical Mode Decomposition

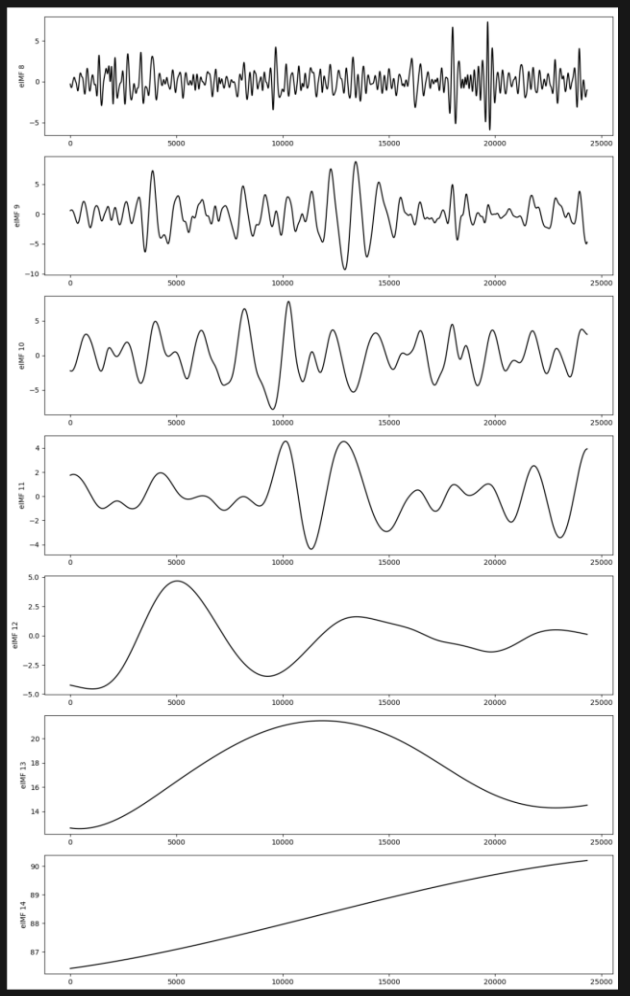
Original Complex Signal



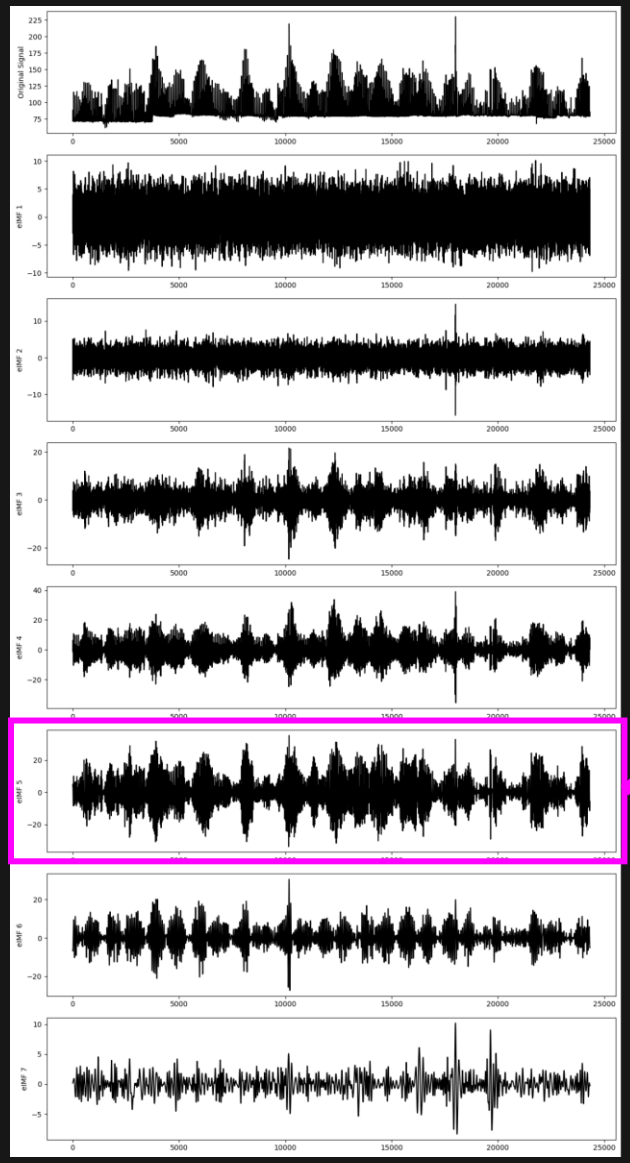
Decomposed into ensemble intrinsic mode functions (eIMFs) and one residual

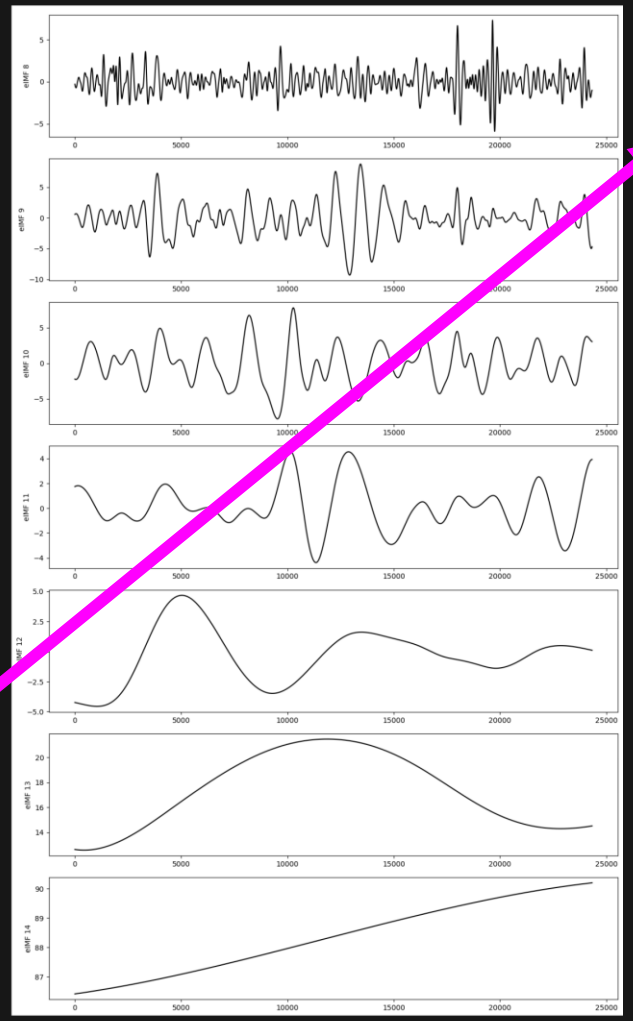


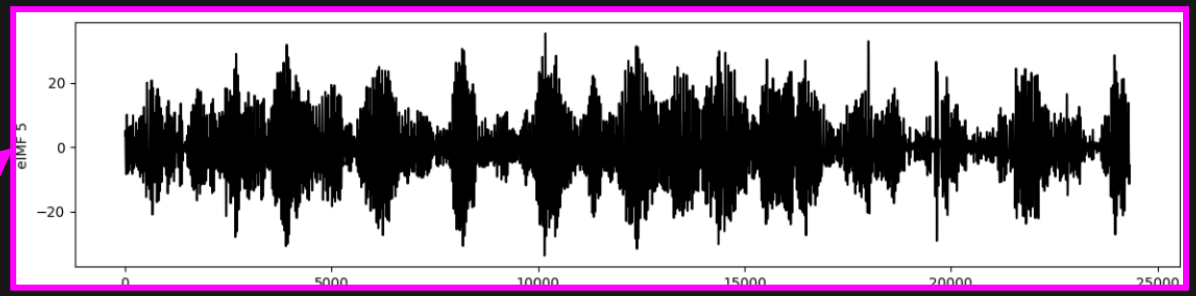
Low Marsh Water Level



Correlating eIMF's to Hydrologic Drivers







Variance Ratio: 0.31
Frequency: 0.17
Hours/Cycle: 5.87

M4 – Overtide Tidal Harmonic
Frequency: 0.167
Hours/Cycle: 6.2

~19-minute lag between signals

Conclusions

Electrical Resistivity is valuable for imaging hydrogeologic boundaries in the saltmarsh.

Small scale coastal processes have the potential to greatly influence local permeability and subterranean flow in the saltmarsh.

In the Waties Island system, tidal forcing is observed throughout the freshwater lens.

Acknowledgements - Questions

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- GSA Southeastern Section
- Coastal Carolina University Graduate and Continuing Studies

Project Contributions
- Dr. Richard Viso
- Dr. Angelos Hannides
- Dr. Bret Jarett
- Dr. Zhixiong Shen
- Dr. Shaowu Bao

Link to project site and manuscript