High-Resolution Mapping of Vegetation, Elevation, Salinity and Bathymetry to Advance Coastal Habitat Management in Georgia

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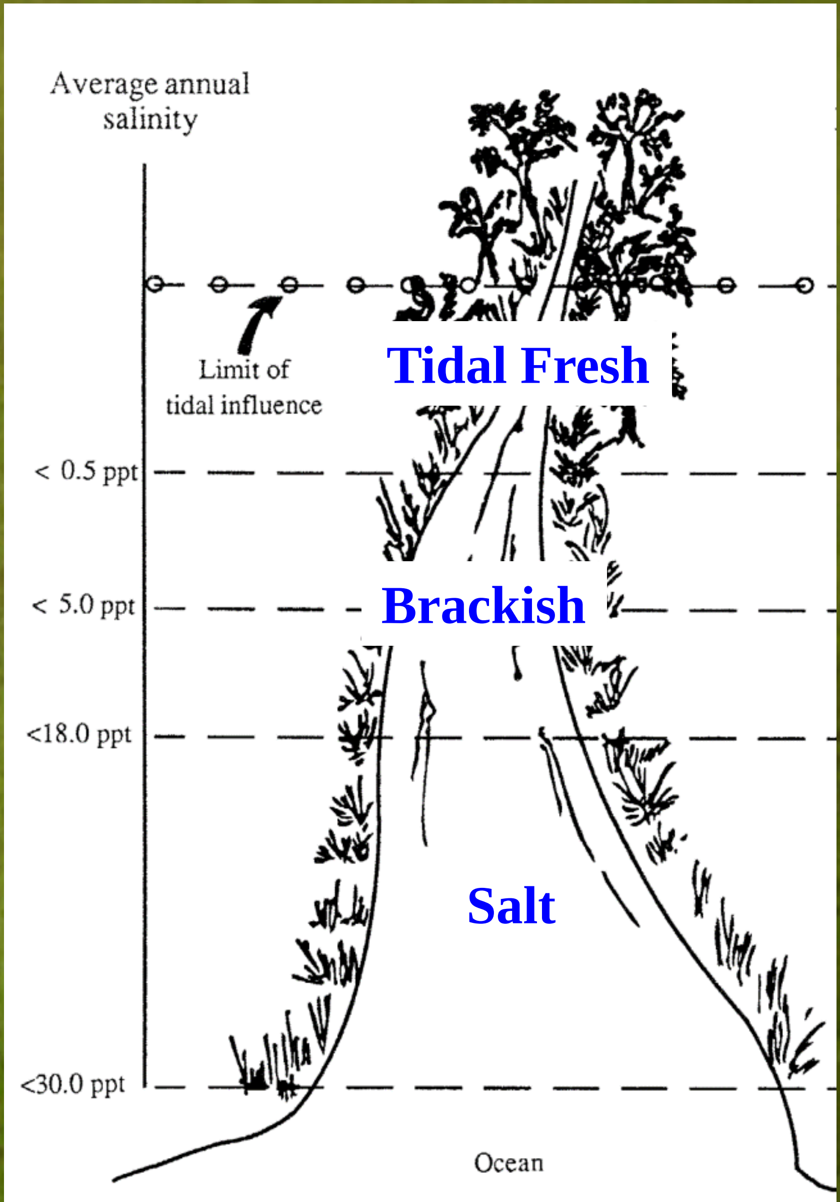
Tidal marshes

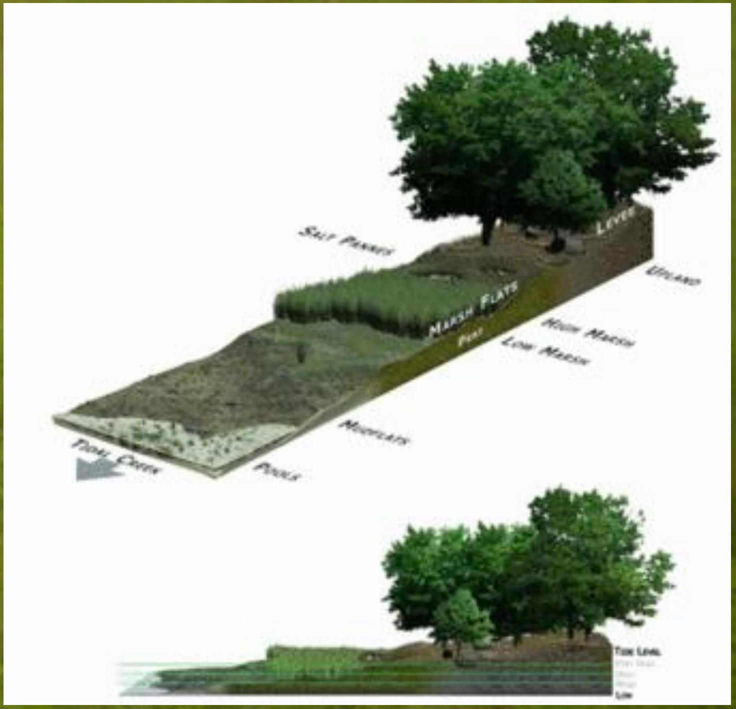
- Structured by salinity
  - Salt: > 18 PSU
  - Brackish: 0.5 – 18 PSU
  - Tidal Fresh: < 0.5 PSU
- Variation in ecosystem services
  - Brackish and tidal fresh
    - > Biomass
    - > C, N, P storage
    - > Accretion
    - > Denitrification
- Implications for SLR and salt water intrusion



Adapted from Odum et al. 1984

Tidal marshes

- Elevation influences flooding regime and abiotic variables
- Determines vegetation type
  - Longitudinally along the salinity gradient
  - Vertical zonation of vegetation
- Need high accuracy data to predict:
  - Vegetation
  - Storm surge
  - SLR
  - Erosion



http://oceanservice.noaa.gov

Light Detection and Ranging (LIDAR) in Tidal Marshes

Salt Marshes

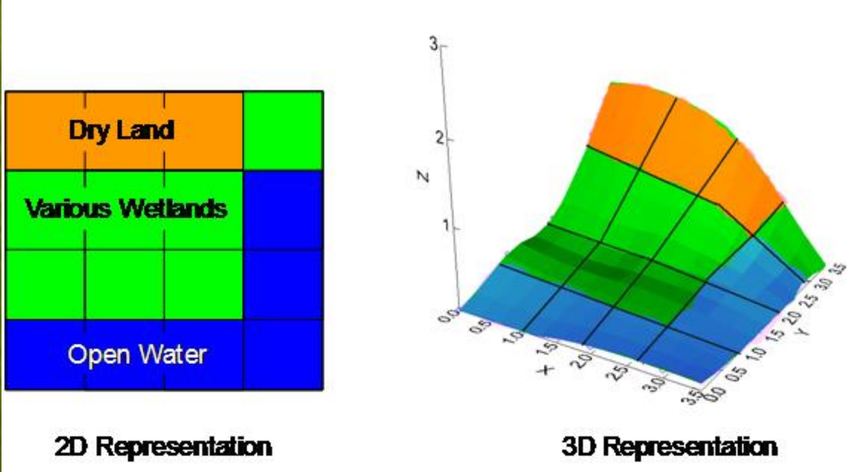
- Mean vertical errors of:
  - 0.07 to 0.17 m in Southeastern marshes
  - 0.03 to 0.25 m in Georgia
- Species-specific and increases with height

Brackish/Tidal Fresh

- Mean vertical errors of:
  - 0.11 to 0.98 in San Francisco Bay, CA
  - 0.33 to 0.76 m St. Johns River, FL wetlands
- Species-specific and increases with height

Predicting Marsh Distributions

- Sea Levels Affecting Marshes Model (SLAMM Version 6.2)
  - Habitat shifts due to SLR and salinity based on elevation
  - Improvements: accretion, salinity, FW flows
  - Coastal management and resiliency
- To model future marsh distributions need accurate:
  - DEMs
  - Habitat maps
  - Salinity
  - Bathymetry



Project Objectives

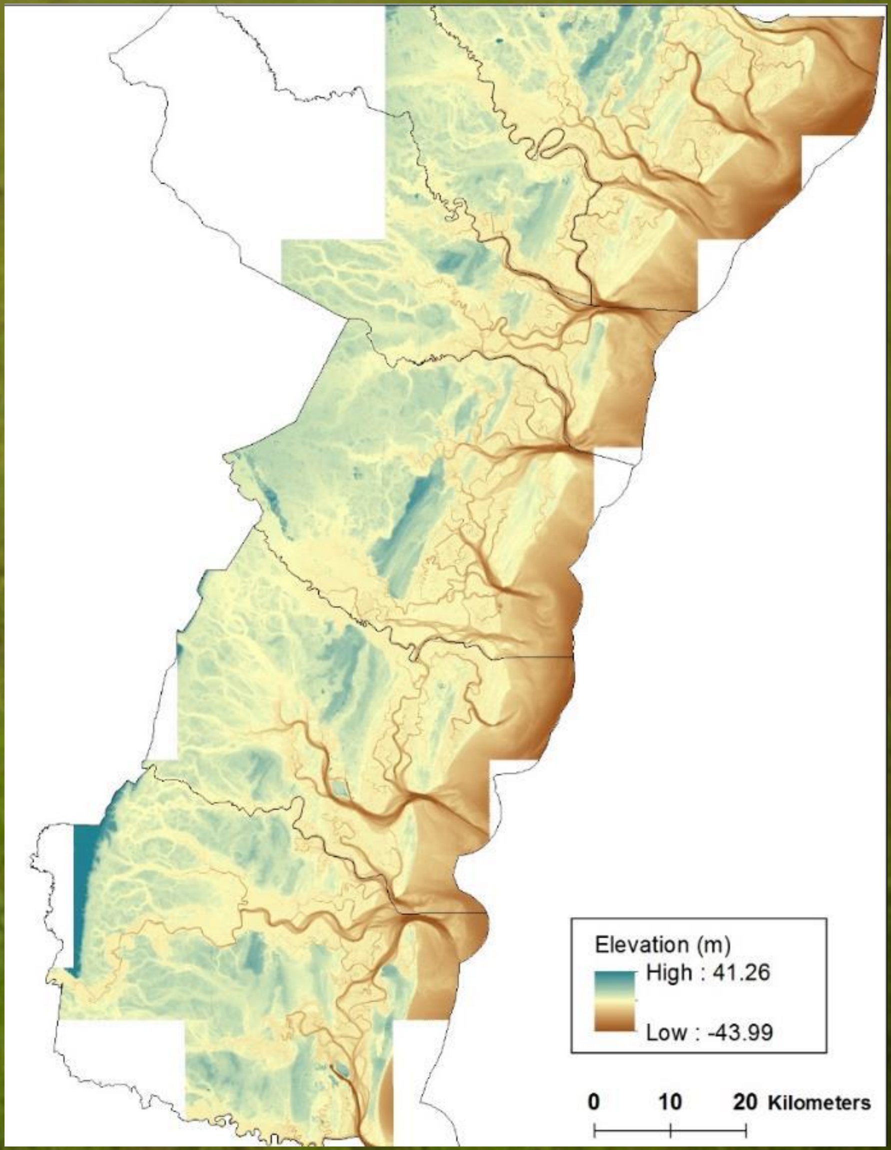
Overall goal: Provide datasets needed to effectively model future wetland distributions

1. Evaluate accuracy of LIDAR-derived DEMs
2. Delineate salt and brackish marsh habitat
3. Derive and apply habitat-specific correction factors to produce corrected DEMs
4. Document the extent of high-water salinity intrusion
5. Update detailed bathymetry of the five major Georgia rivers

Methods: LIDAR Data

FEMA DEM-Bathymetry

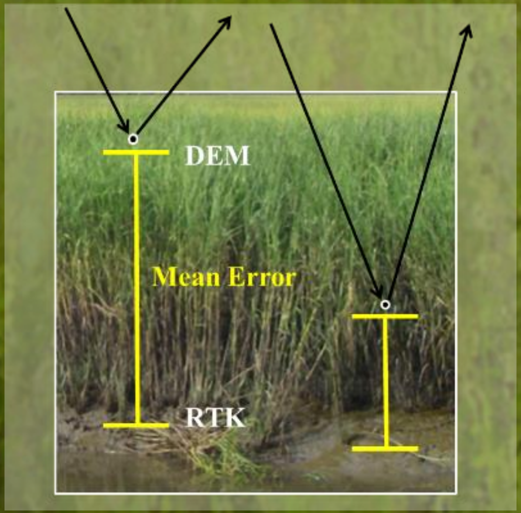
- Data sources
  - Coastal GA Elevation Project (2010)
  - Chatham (2009)
  - Liberty (2006)
  - Glynn (2001)
- 1 m point spacing
- 4 m DEM
- NAVD 88 vertical datum

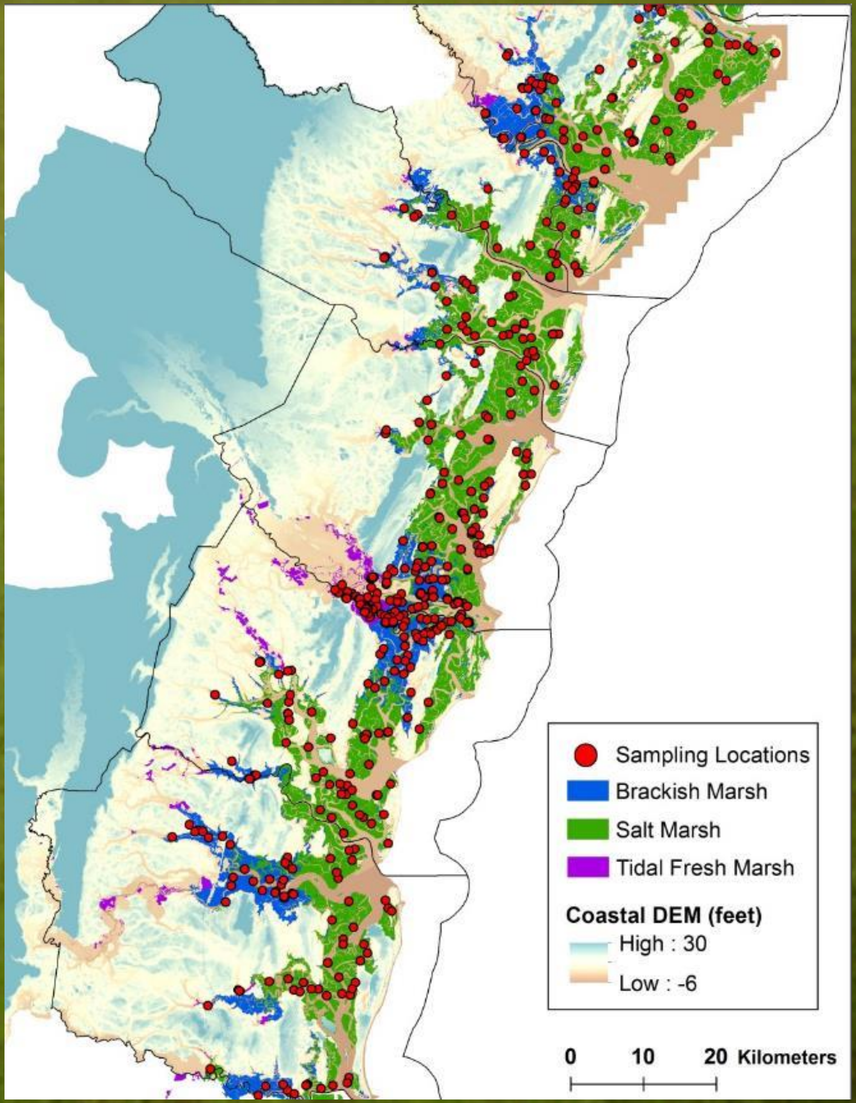


Methods: DEM Accuracy Assessment

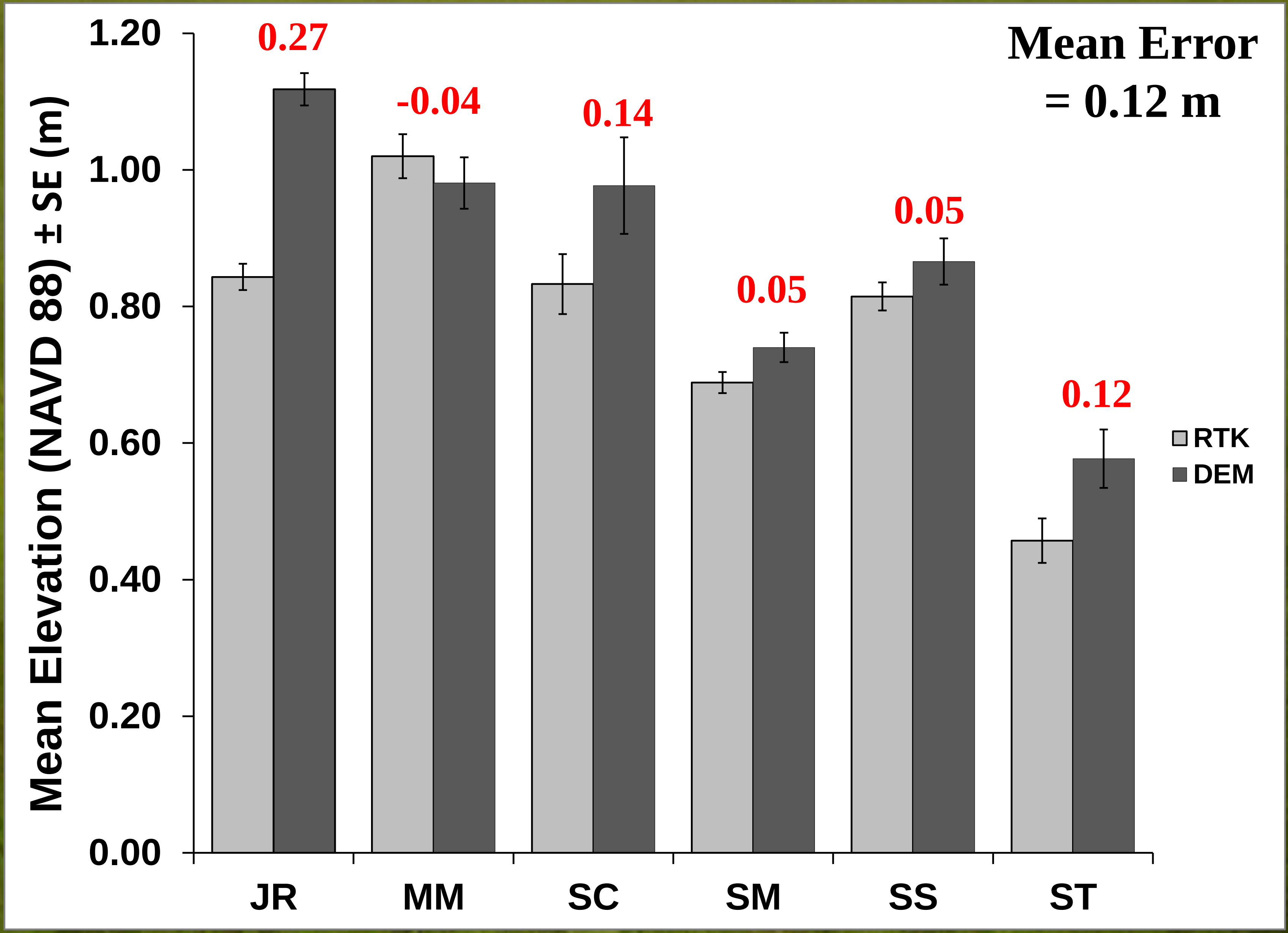
- 596 RTK sampling locations
  - *J. roemerianus/Schoenoplectus sp* (JR)
  - Marsh meadow (MM)
  - *S. cynosuroides/S. tabernaemontani* (SC)
  - Medium *S. alterniflora* (SM)
  - Short *S. alterniflora* (SS)
  - Tall *S. alterniflora* (ST)
- Training (297) and validation (299)

- Mean error (correction factor)
  - Predicted (DEM) – Observed (RTK)

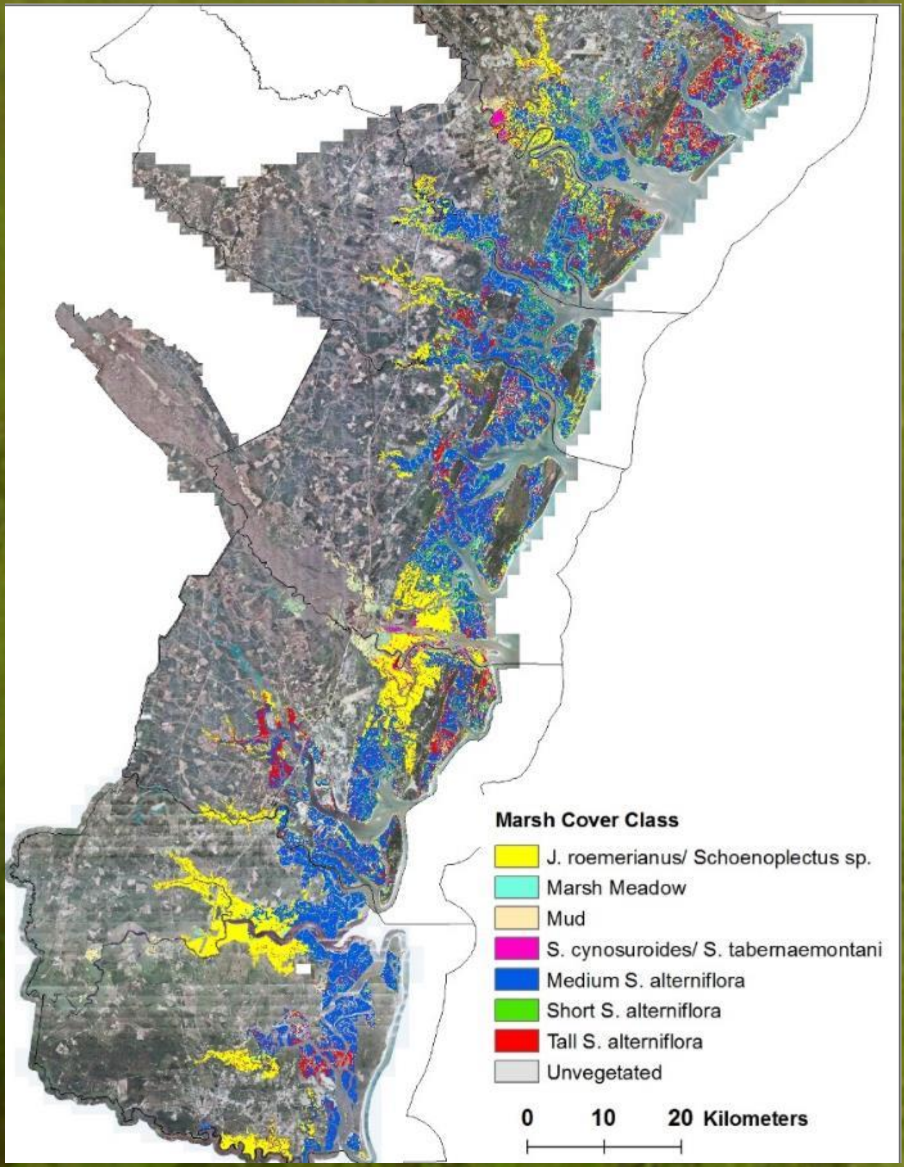




Results: Training Data RTK vs. DEM

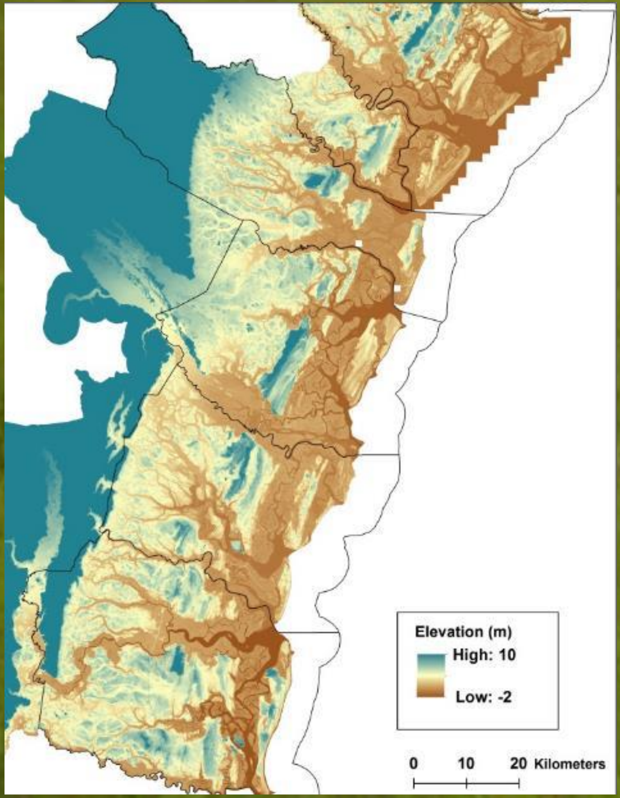


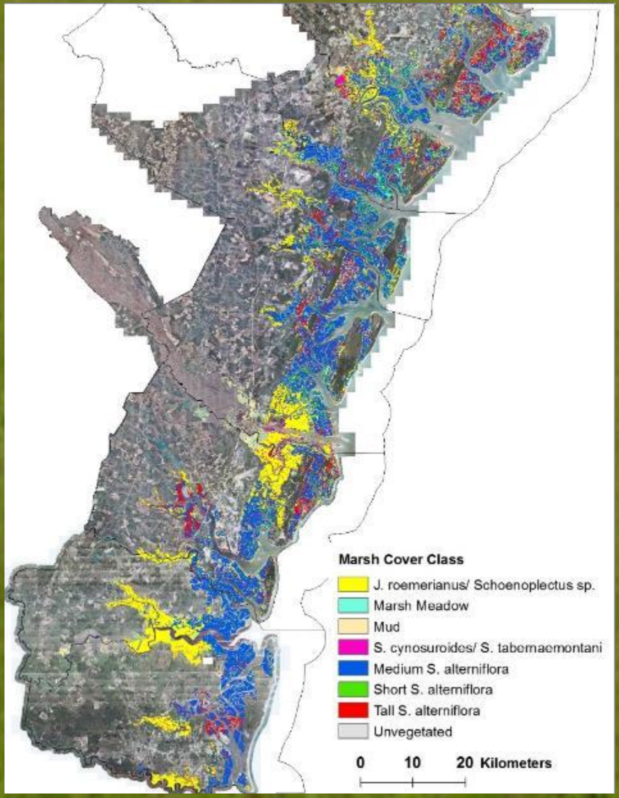
Habitat Delineation

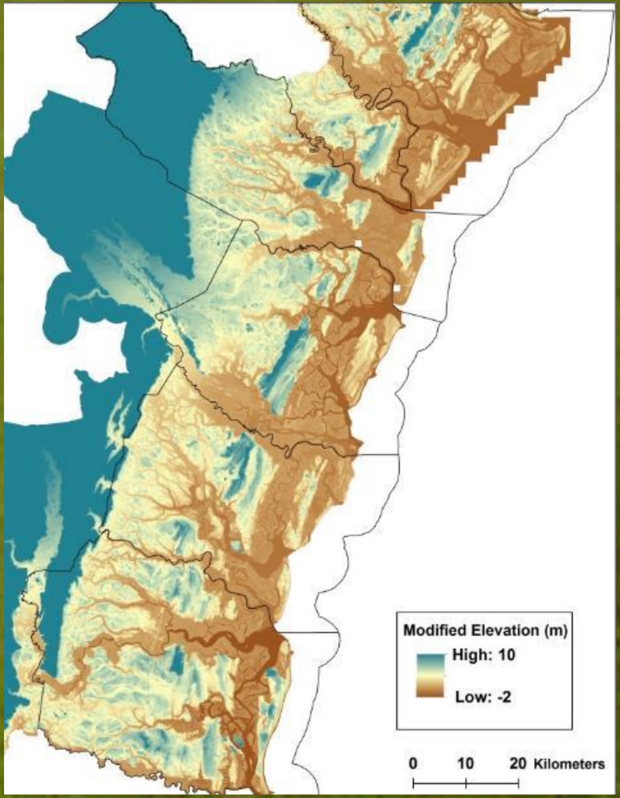


- Orthoimagery (0.15 m)
  - Coastal Imagery Project and Camden
  - 3 or 4 bands (B, G, R, NIR)
- Classification
  - Eight classes
  - Training/validation data digitized from field maps
  - Random forest classifier
    - Orthoimagery
    - DEM
    - NWI
  - Overall accuracy of 90%
    - Class accuracies of 55-99%
    - JR: 97%
    - SM: 88%
  - DEM and NIR most important

DEM Correction: Habitat-specific corrections







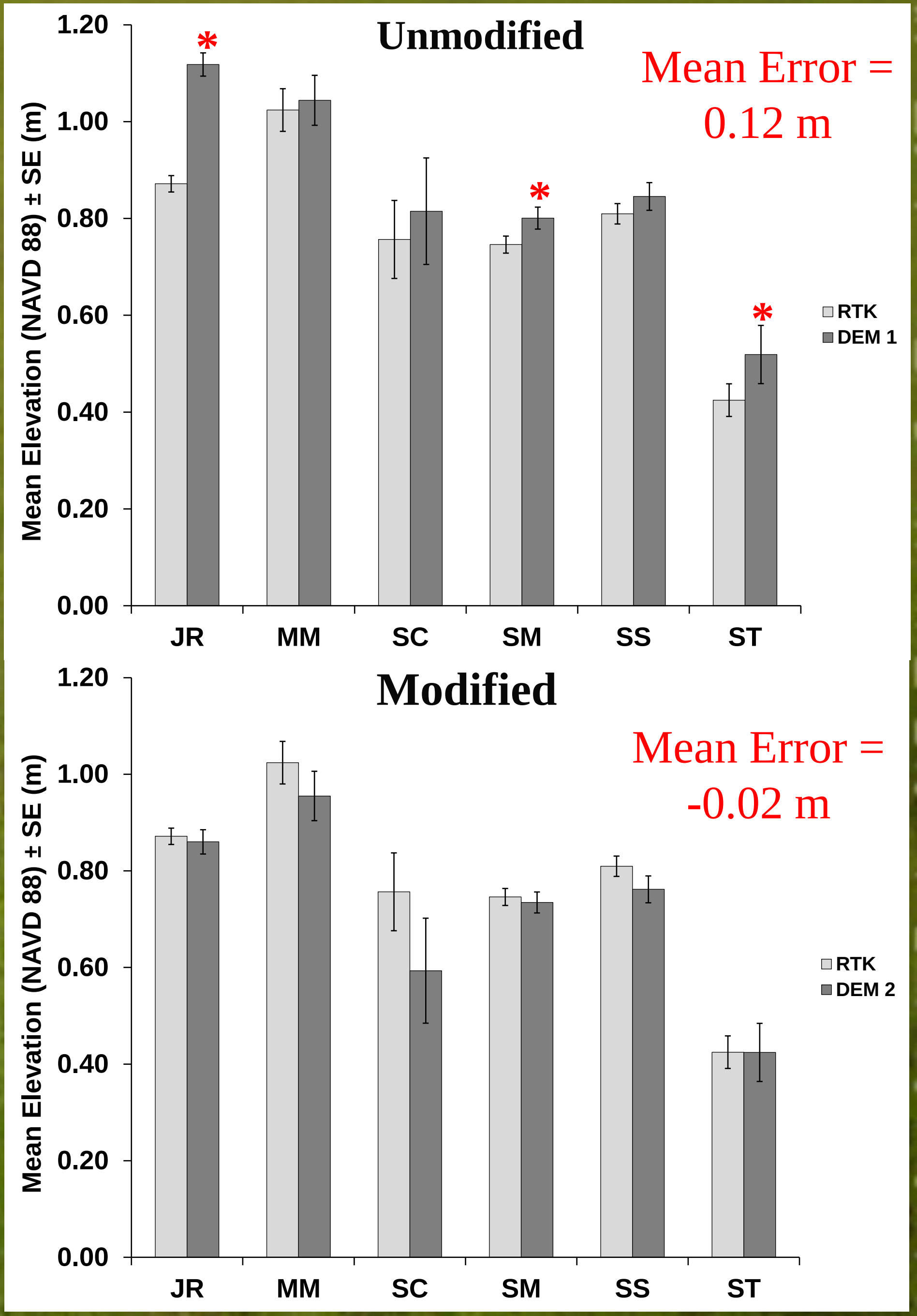
Uncorrected DEM

Classification + Correction Factors

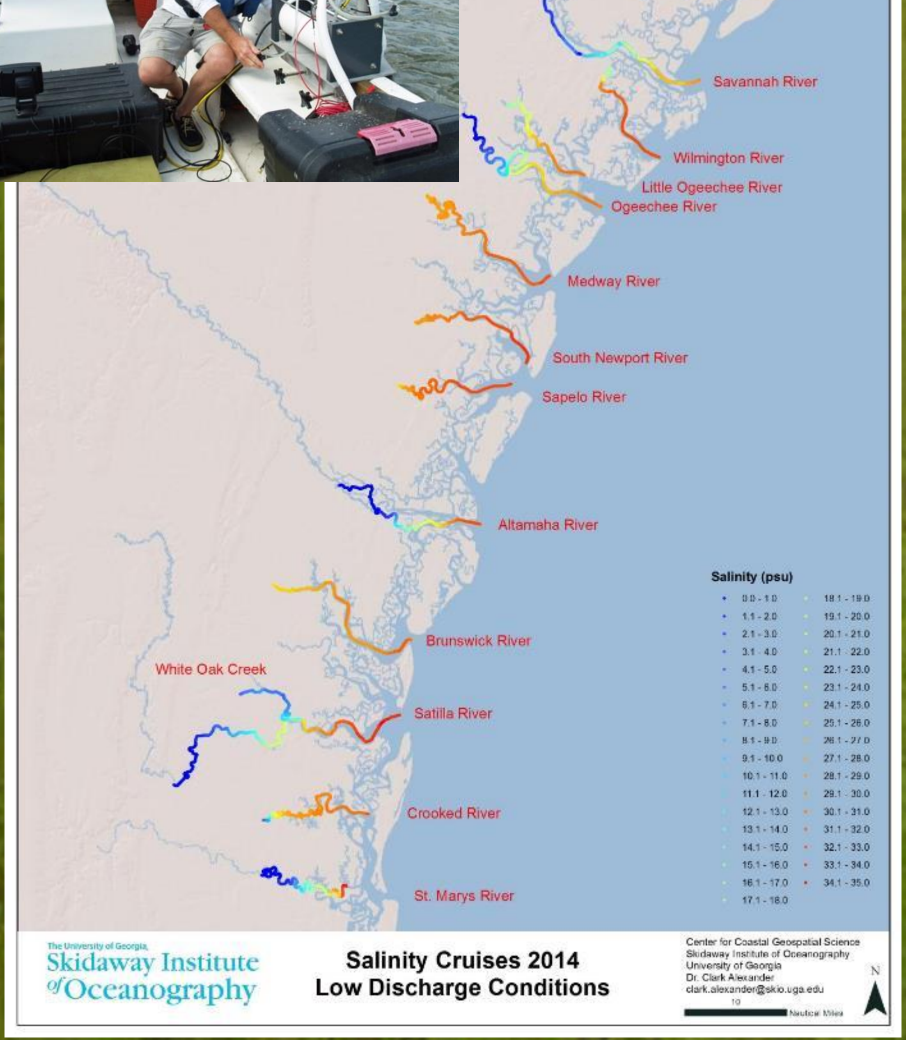
Corrected DEM

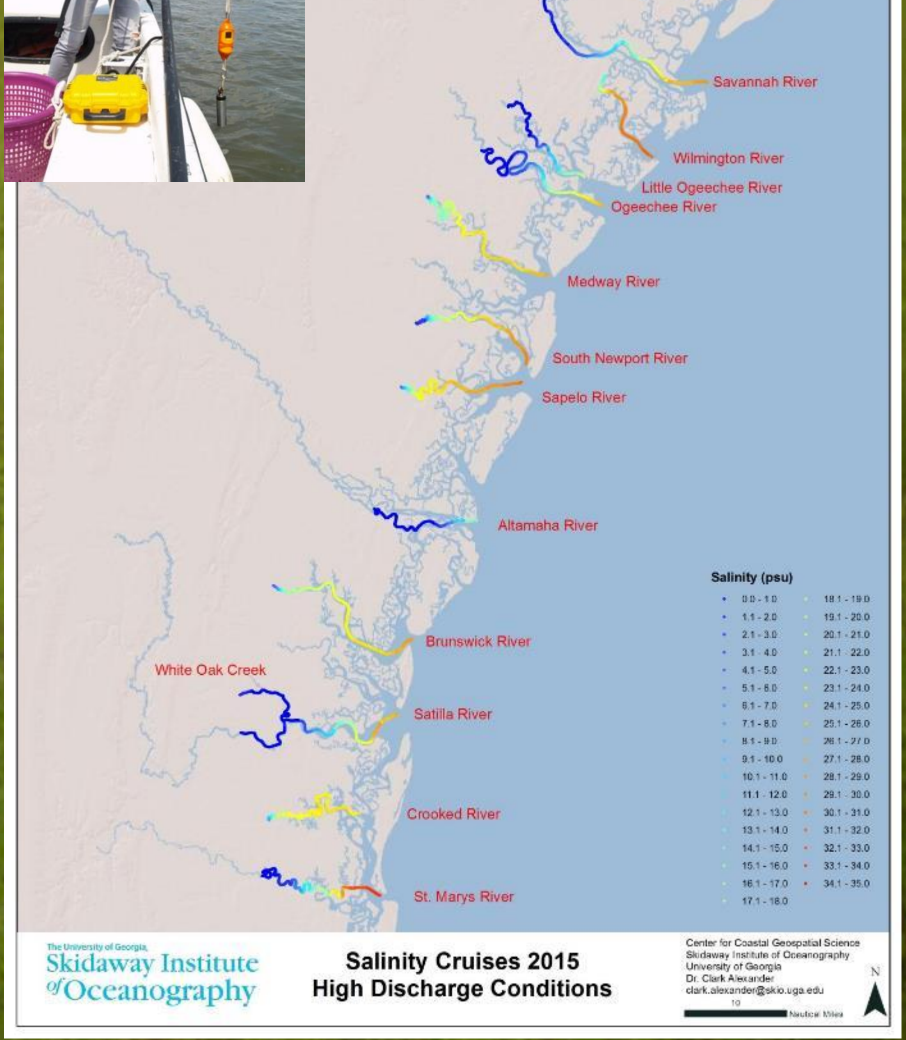
DEM Mean Errors

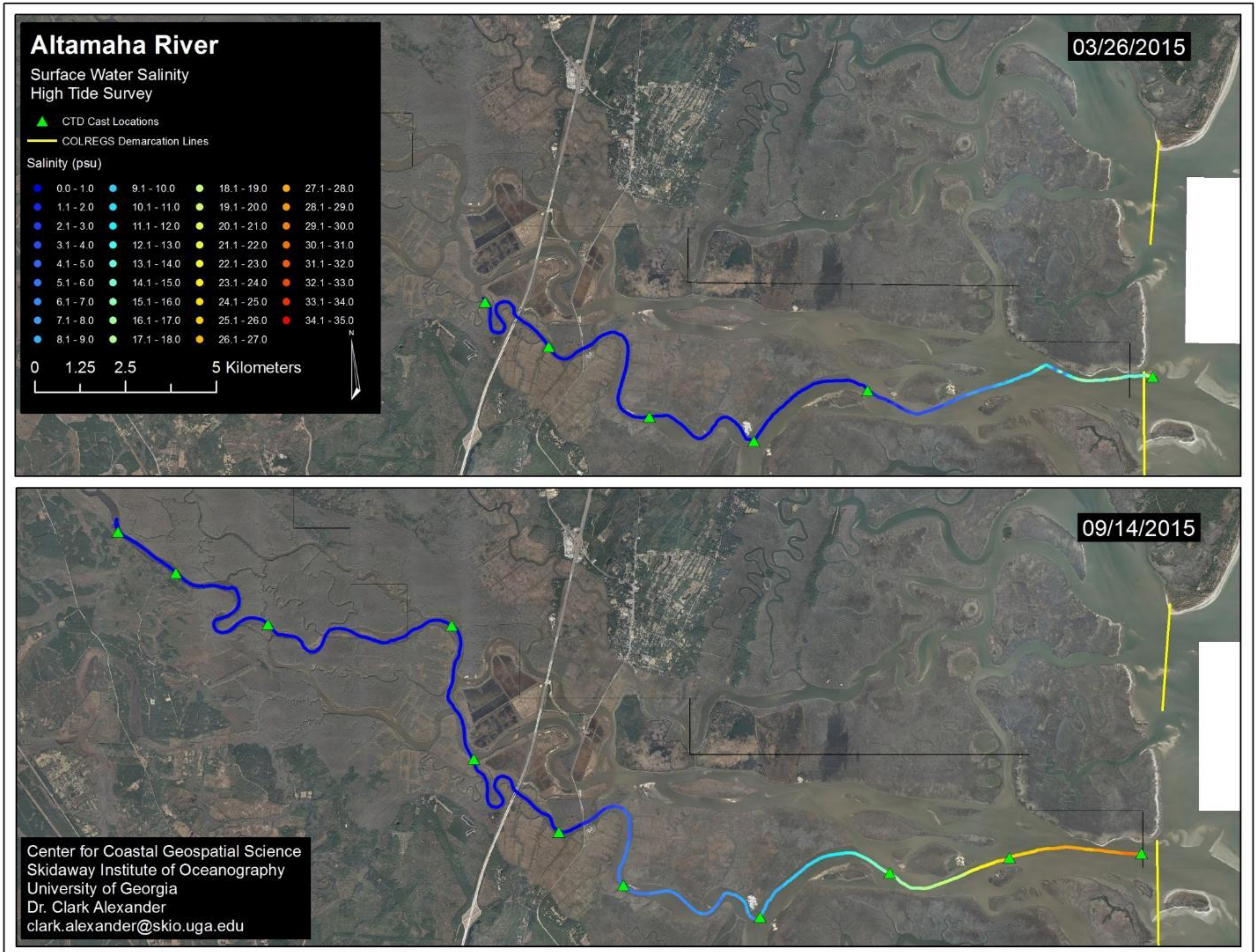
- Unmodified DEM
  - Over-predicted
  - Brackish had the largest errors (0.25 m)
  - Taller vegetation significantly different from RTK
- Modified DEM
  - Slightly under-predicted
  - Not significantly different from RTK



Salinity Cruises






Altamaha River
Surface Water Salinity
High Tide Survey
CTD Cast Locations
COLREGS Demarcation Lines
Salinity (psu)
0.0 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 4.0
4.1 - 5.0
5.1 - 6.0
6.1 - 7.0
7.1 - 8.0
8.1 - 9.0
9.1 - 10.0
10.1 - 11.0
11.1 - 12.0
12.1 - 13.0
13.1 - 14.0
14.1 - 15.0
15.1 - 16.0
16.1 - 17.0
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25.1 - 26.0
26.1 - 27.0
27.1 - 28.0
28.1 - 29.0
29.1 - 30.0
30.1 - 31.0
31.1 - 32.0
32.1 - 33.0
33.1 - 34.0
34.1 - 35.0
N
0 1.25 2.5 5 Kilometers
03/26/2015
09/14/2015
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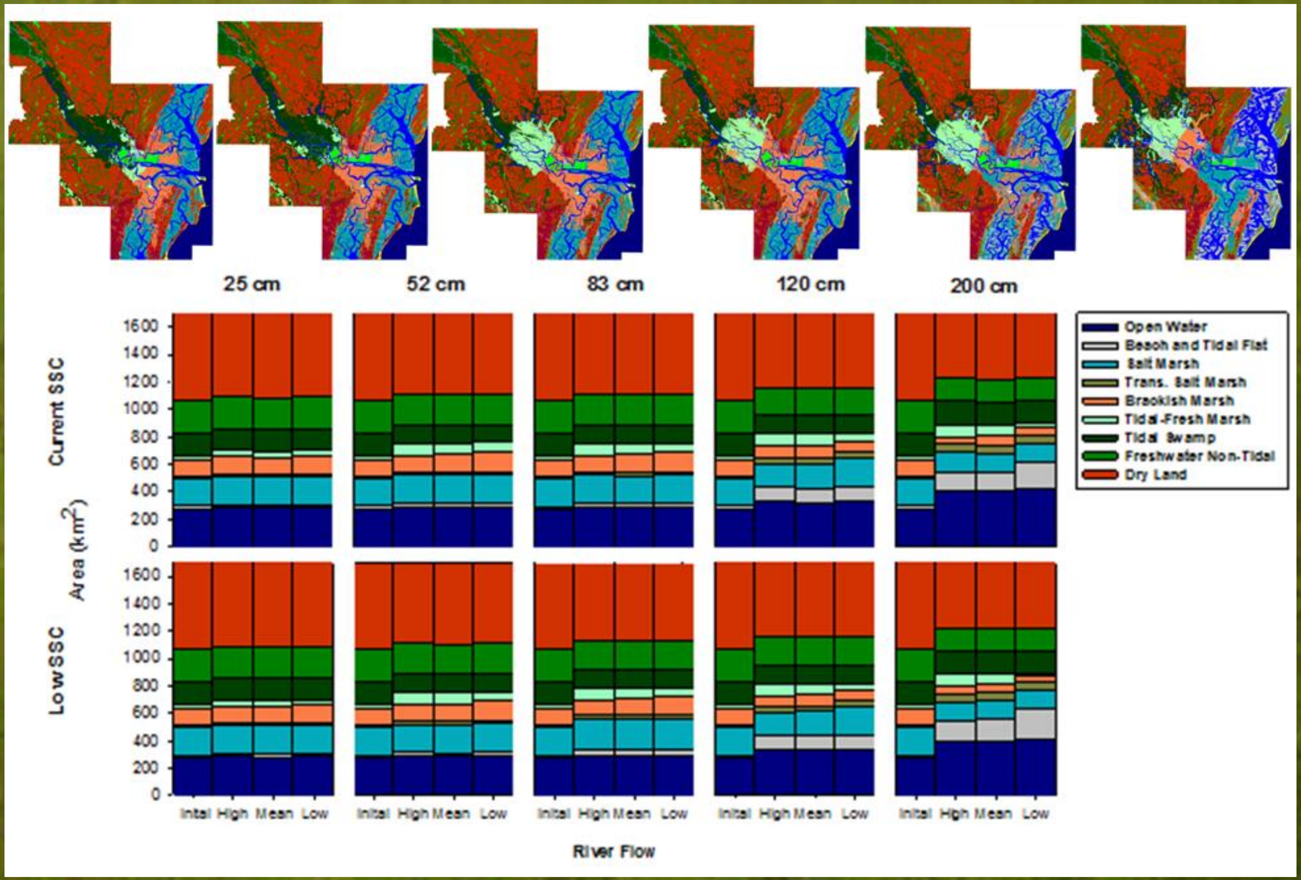
Summary

- Accuracy assessments are necessary in densely vegetated habitats
  - DEM overestimated tidal marsh elevations and need correction
  - DEM interpolation and surface conditions
- Classification of tidal marsh
  - Eight class habitat delineation
  - Ancillary elevation and NIR band
- Bathymetry and salinity
  - New and improved bathymetry
  - Baselines for salt water intrusion in rivers and salt marsh estuaries

Implications and Future Work : SLAMM

- Improved Data
- Ready for SLAMM
- Management:
  - Marsh migration
  - Land use planning
  - Restoration priorities



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