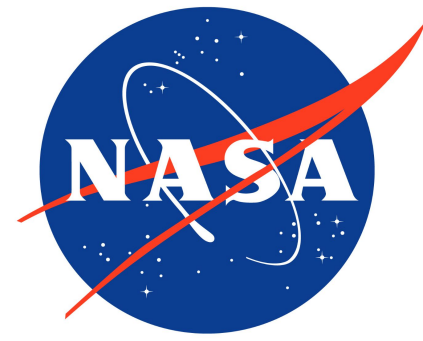


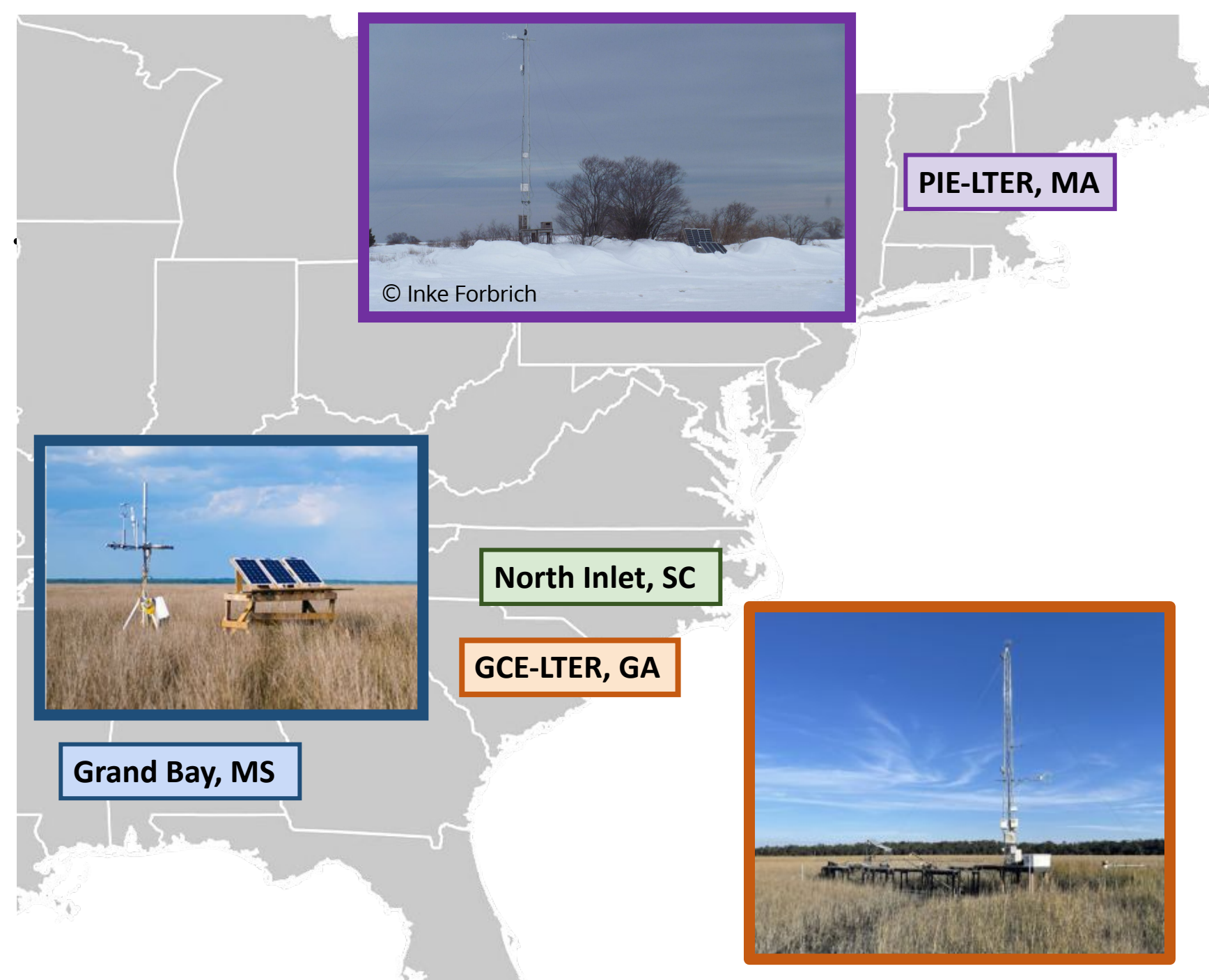
# NASA CMS 2023: A tide-robust high-resolution blue carbon product for fragmented coastal marshes



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## Motivation

This work builds from our recently completed NASA-funded project that developed a species-specific 500-m MODIS GPP algorithm for southeastern US coastal marshes. Our previously-developed marsh GPP algorithm was novel because it accounted for the species-specific influence of tidal inundation on plant photosynthesis, light use efficiency, and gas exchange. However, it did not account for the influence of lateral carbon exchange, which can be substantial, and was too coarse to estimate fragmented marshes, which dominate many coastal areas. This work addresses these challenges and develops open-source tools to support local C assessment and continuity of the longer-term blue carbon-related time series



## Objective

Adapt our MODIS tidal marsh GPP algorithm to Sentinel-2 data and generate fine-resolution maps of blue carbon related ecosystem functions for Gulf and Atlantic coast tidal marshes.

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## Activity Overview

### Data Collection

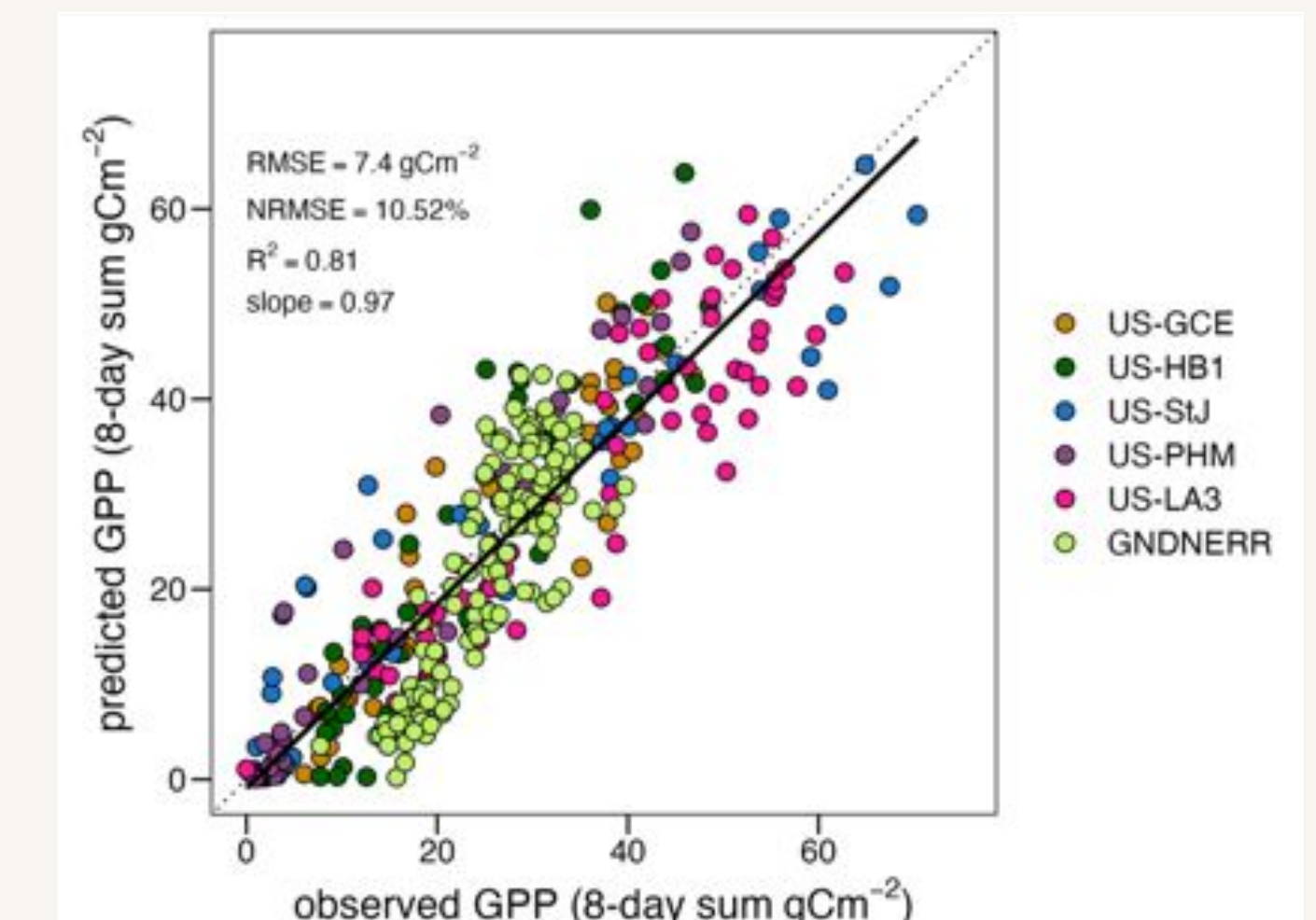
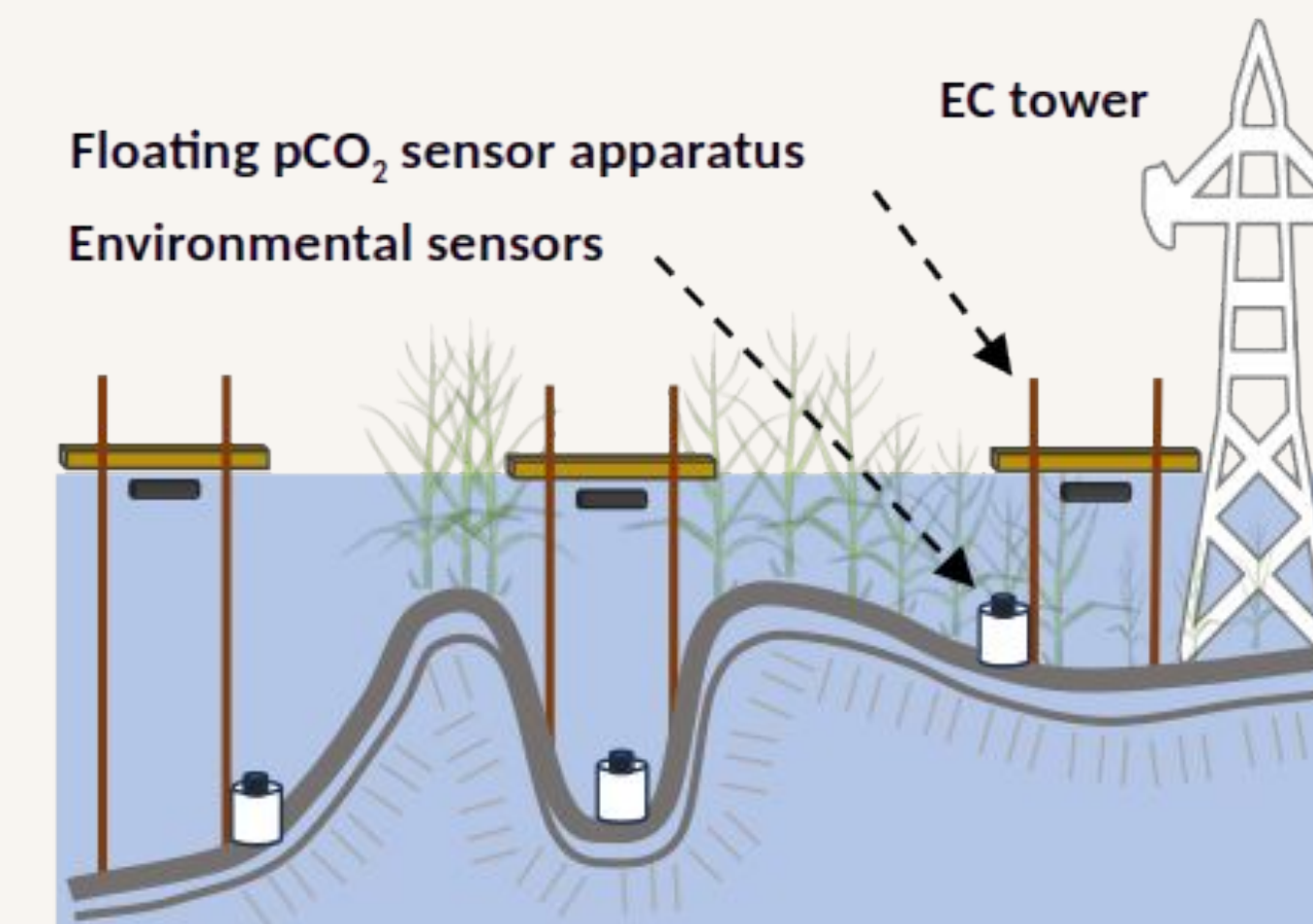
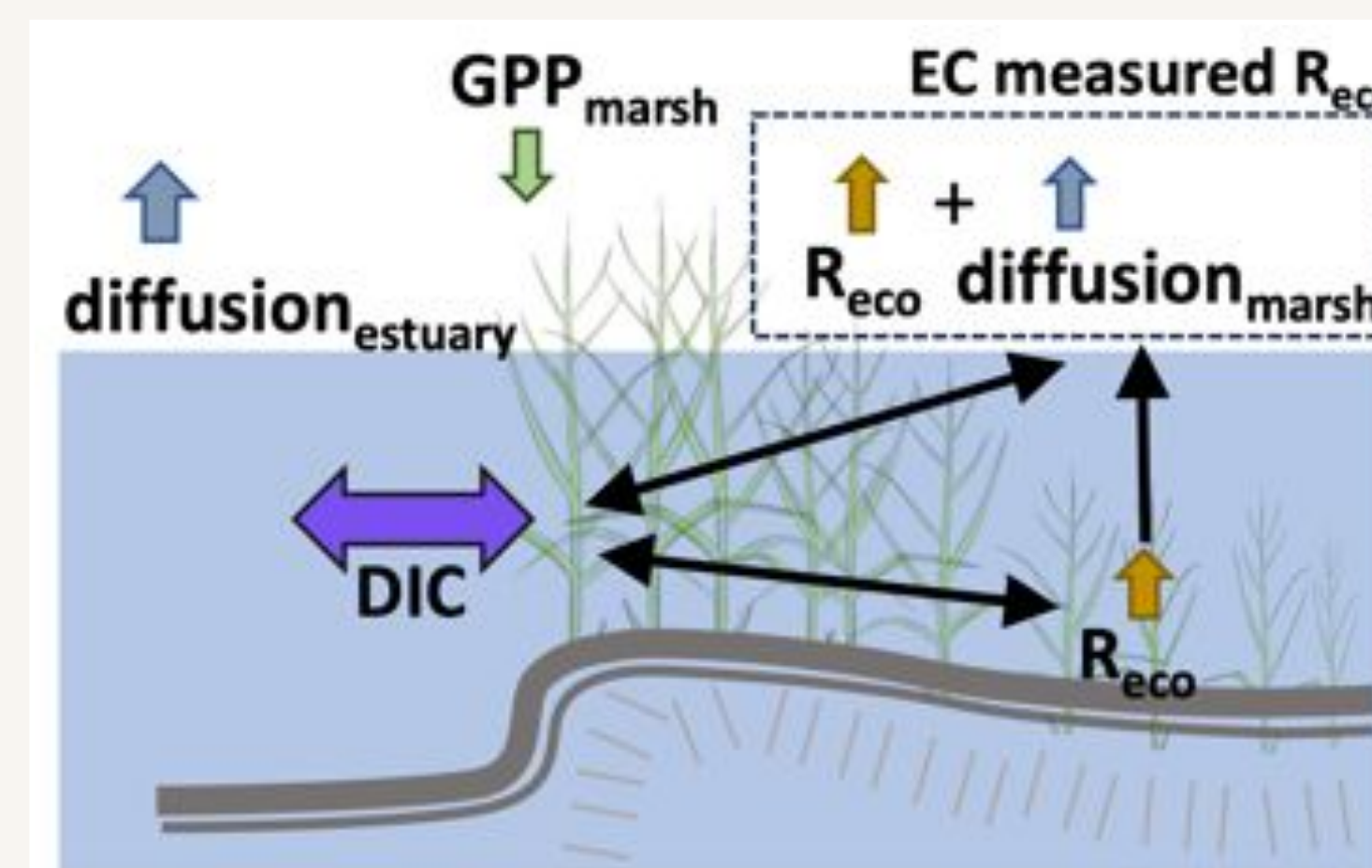
- Eddy covariance (EC) carbon fluxes and environmental variables
- Water column sensor network for lateral carbon fluxes
- Vegetation sampling and biophysical properties (biomass, reflectance, leaf area, etc.)

### Spatiotemporal advancement of existing models

- High resolution Sentinel-2 products for flooding, emergent Leaf Area Index, chlorophyll activity and aboveground biomass
- Cross-calibrate existing MODIS Tidal Marsh Productivity algorithm with Sentinel-2 for gross primary production continuity

## Planned Products

- Ground-truth data from EC towers, sensors, and field campaigns, including marsh flooding, environmental data, and carbon exchange
- Sentinel-2 models of tide-inundation, vegetation structure, and GPP
- Quarterly maps of marsh biophysical characteristics and GPP for the eastern U.S. from 2015 to 2027 through a Google Earth Engine dashboard
- Comparison of site averaged MODIS GPP vs Sentinel-2 GPP products for the eastern U.S. from 2015 to 2027



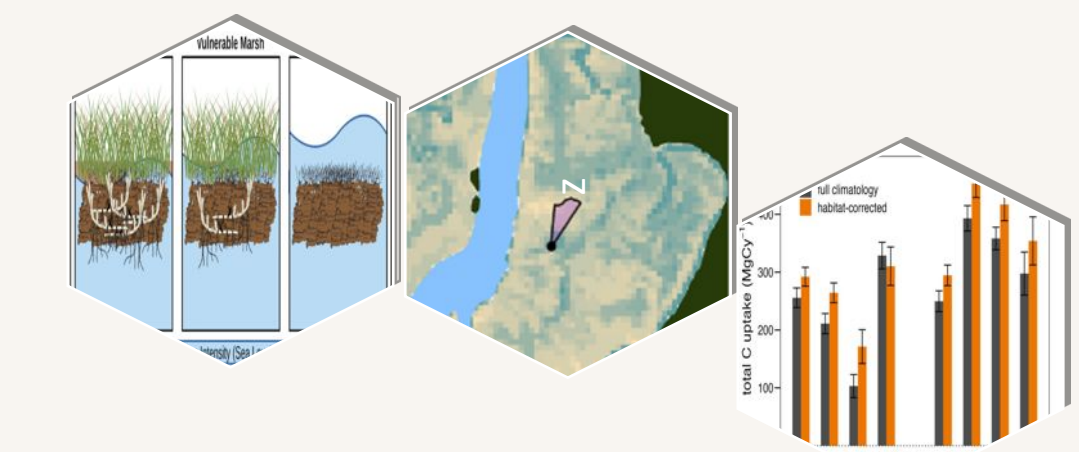
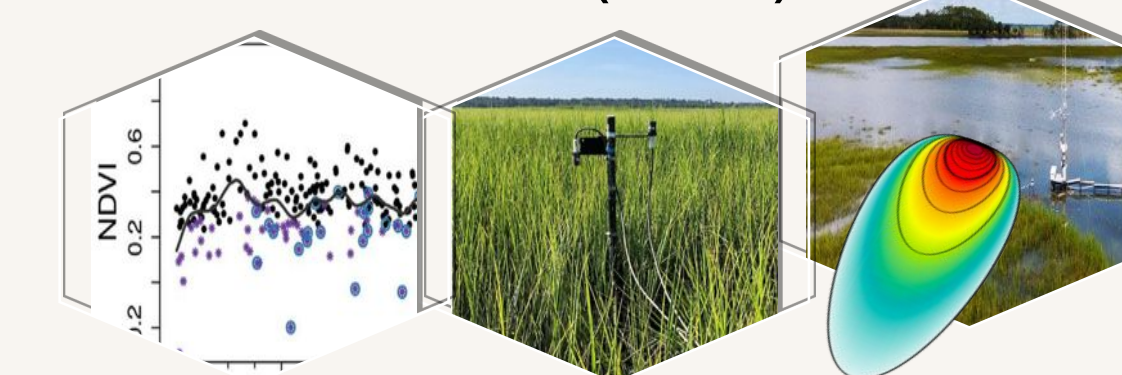
## Engagement Activities and Deliverables

- Sharable open-source code
- Web-enabled dashboards: Google Earth Engine
- Stakeholder engagement workshops (Grand Bay National Estuarine Research Reserve, MS)
- Presentations with local stakeholders at existing workshops and conferences

## Past and Ongoing Work

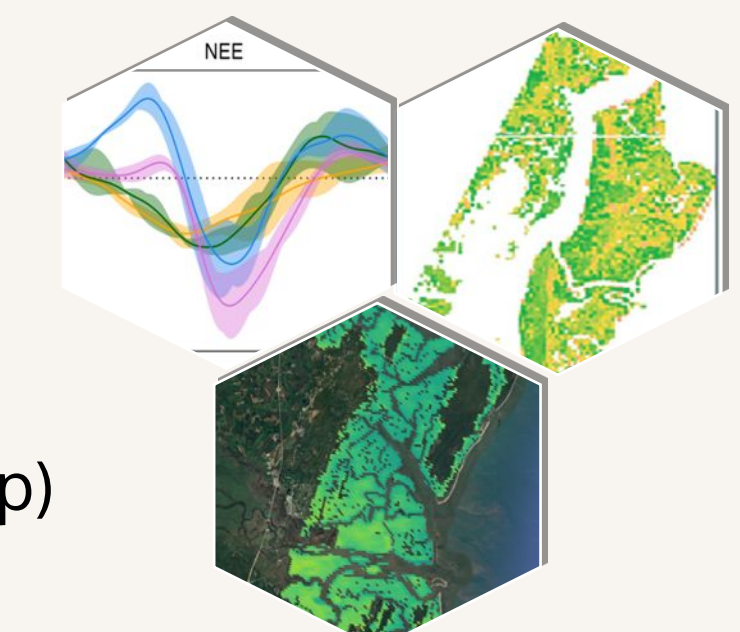
### Tidal flooding & C assimilation

Flood detection - O'Connell et al. (2017)  
 Leaf area - Hawman et al. (2023)  
 PSII - Mao et al. (2023)



### Spatial Variation

Flooding patterns - Narron et al. (2022)  
 C exchange - Hawman et al. (2024)  
 BGB trends - Runion et al. (2025)



### Scaling up

GPP - Hawman et al. (2021, in prep)  
 BERM - O'Connell et al. (2021)  
 BERM 2.0 - Runion et al. (2024)  
 C phenology - Hawman et al. (in prep)