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Modeling wetland redox biogeochemistry and vegetation function at site to continental scales

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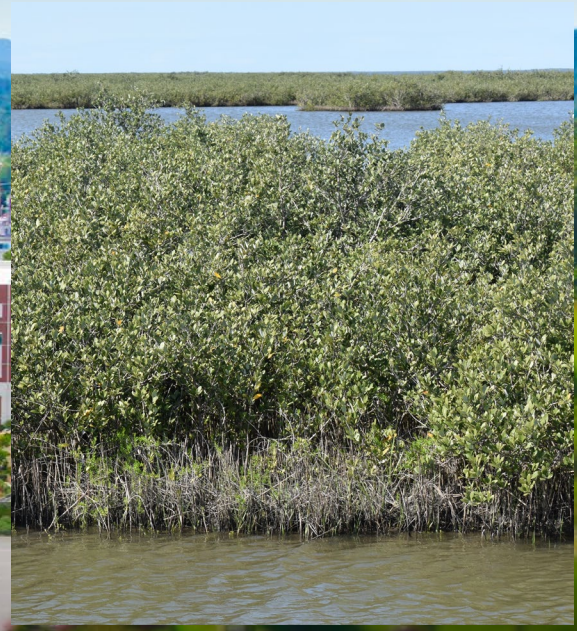

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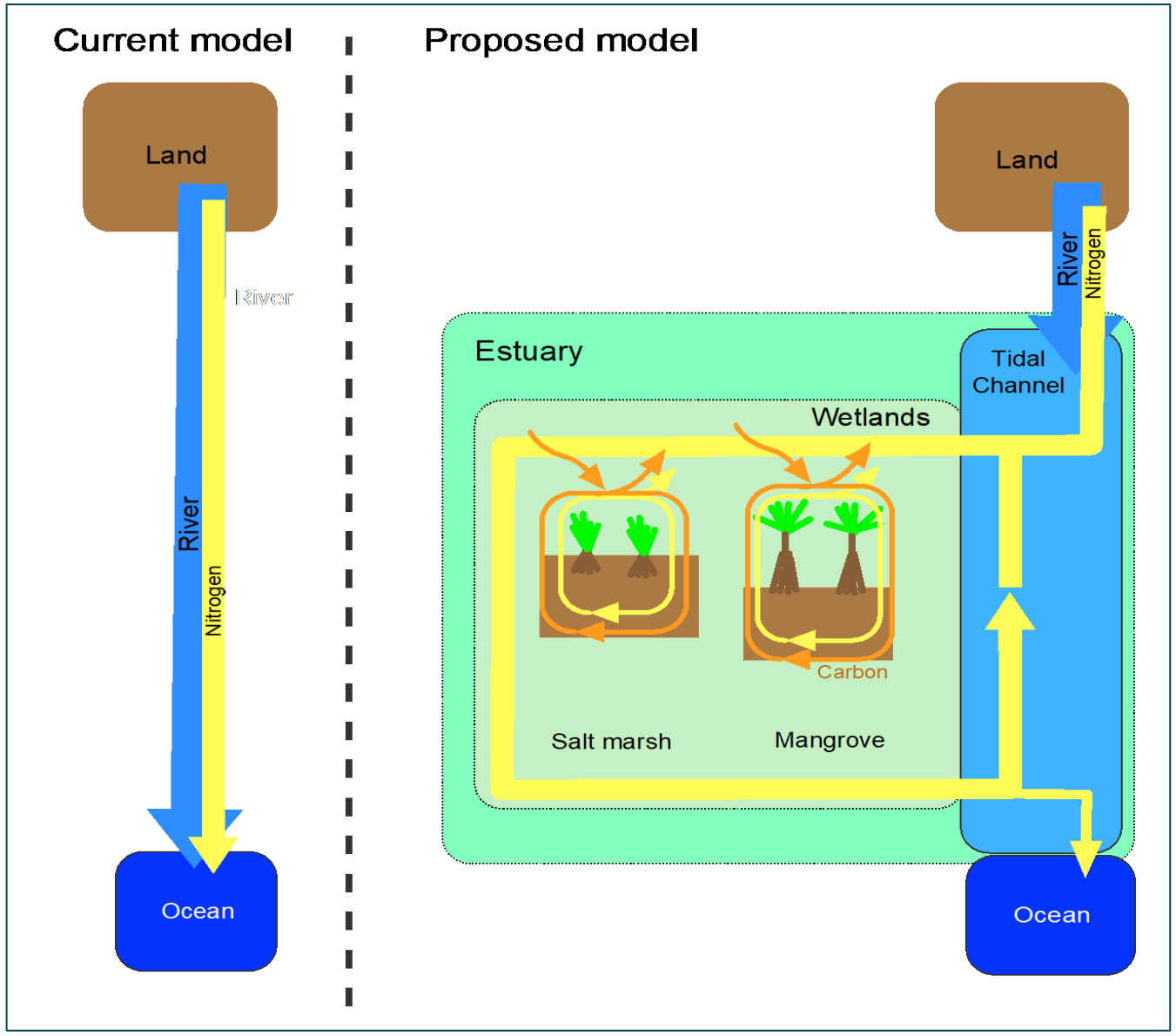
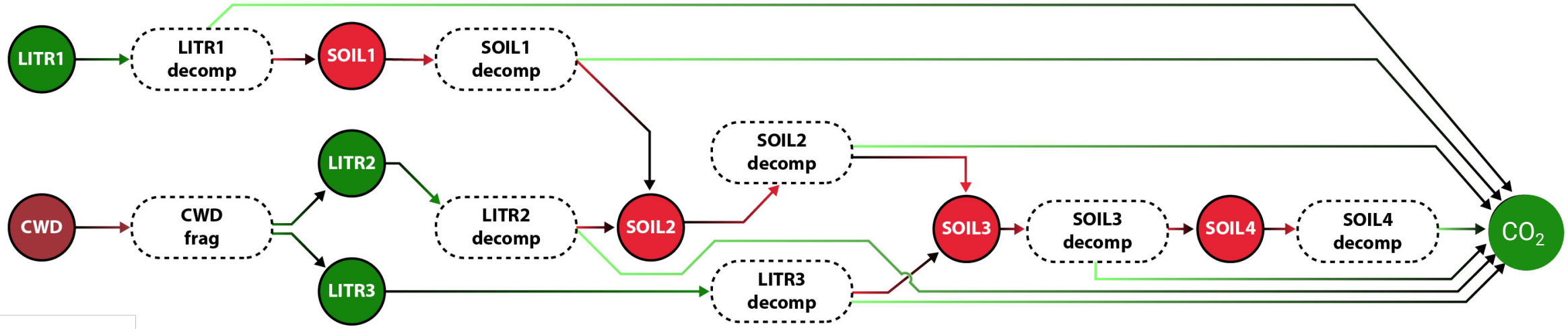
Coastal wetlands are highly productive but vulnerable to sea level rise and saltwater intrusion

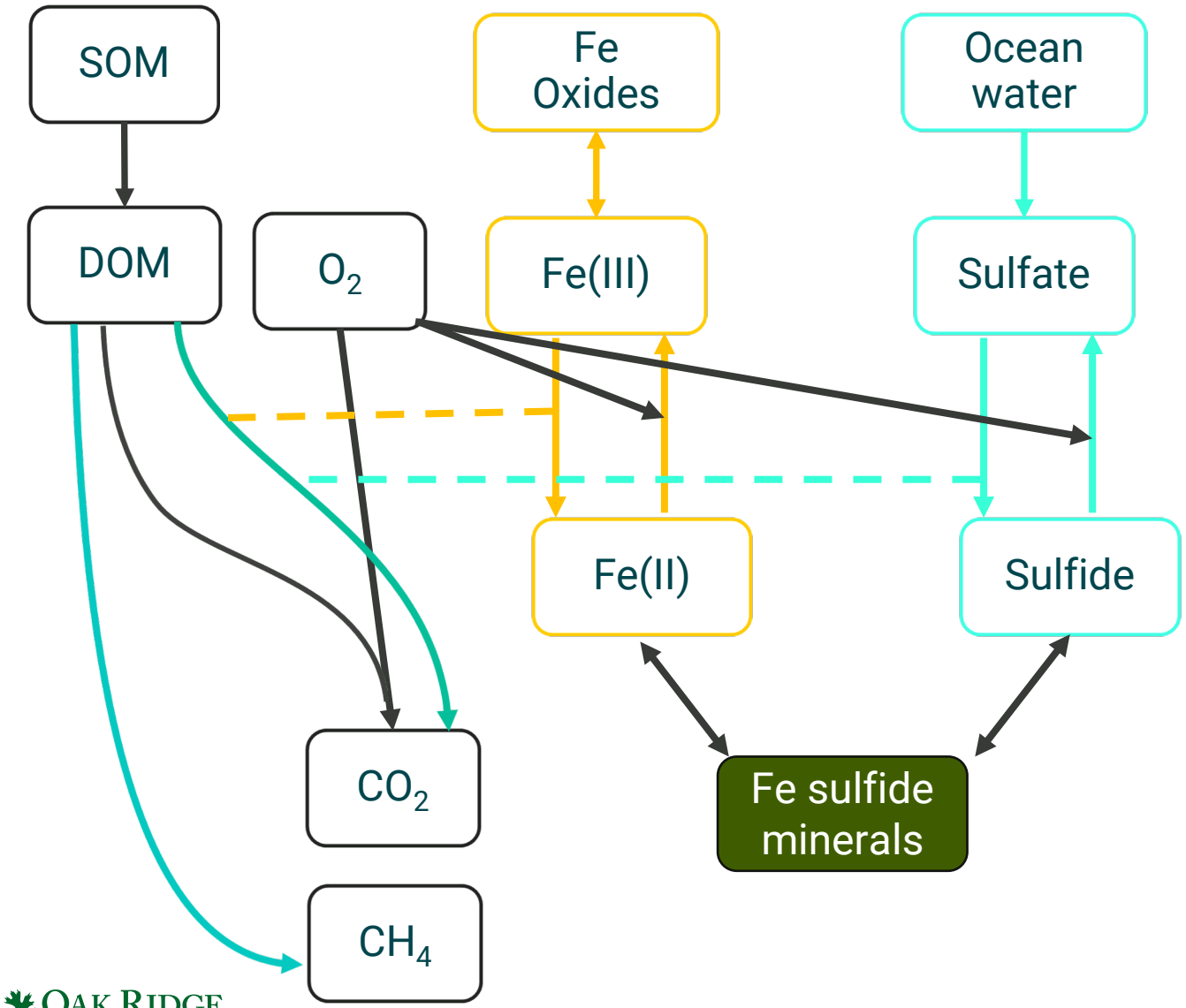
Land surface models lack representation of coastal wetland vegetation, biogeochemistry, and hydrological interactions



E3SM Land Model biogeochemistry



Wetland microbes can use iron or sulfate metabolisms under anoxic conditions



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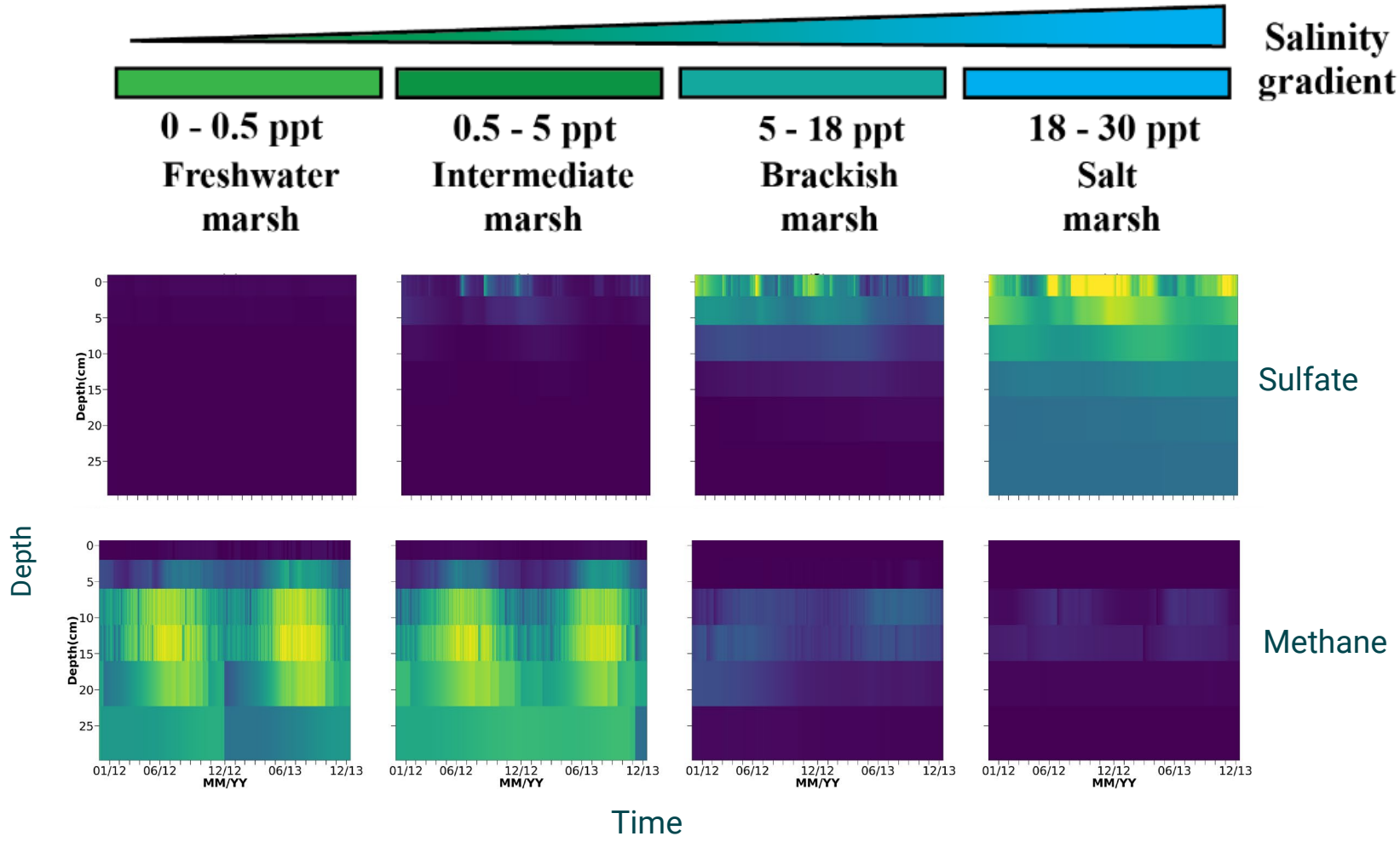
Biogeochemistry varies across salinity gradients

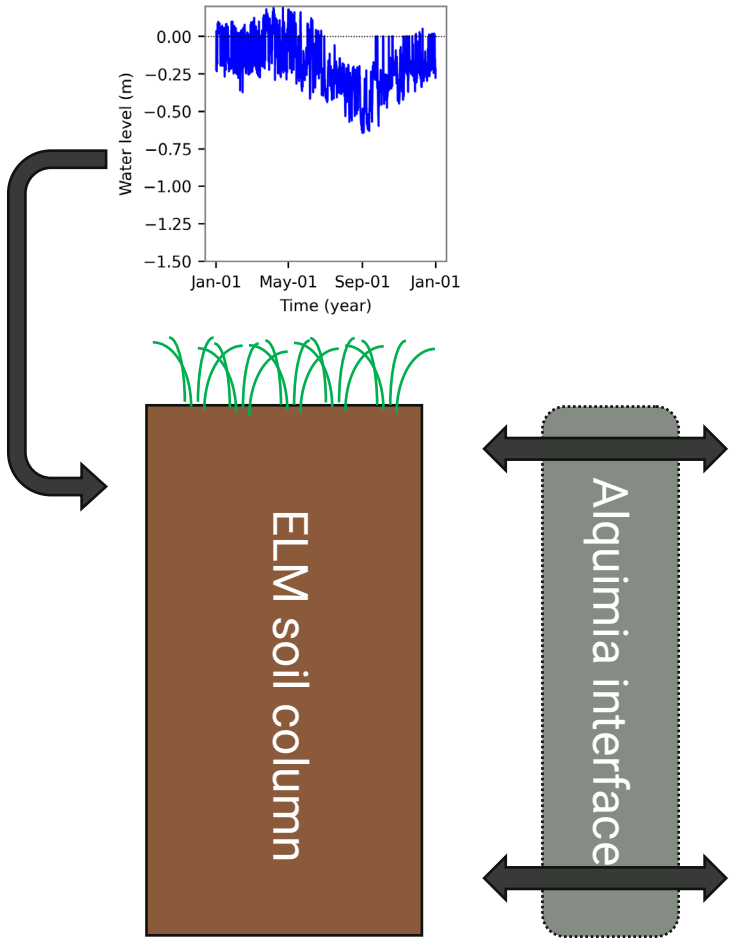
Mississippi Delta simulations by Jiaze Wang



Wang et al., 2023, JAMES

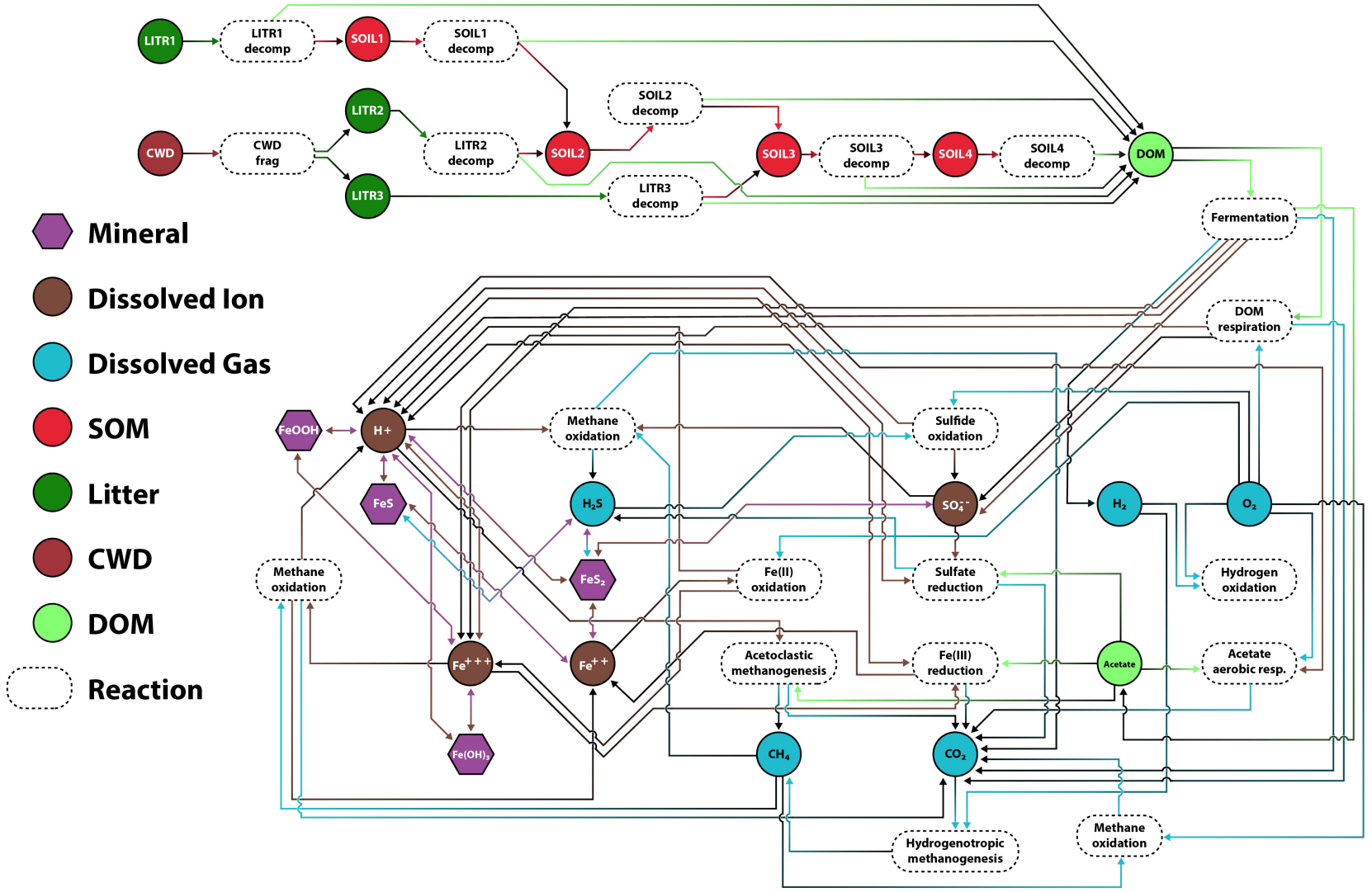
We coupled the E3SM Land Model to the PFLOTRAN reactive transport model to simulate hydro-biogeochemical interactions.

Tidal boundary condition



Sulman et al., 2024, JAMES

ELM-PFLOTRAN Decomposition and Redox Reaction Network



Biogeochemistry in fresh and saline simulations

Sulfate

↓

Reduced to sulfide

↓

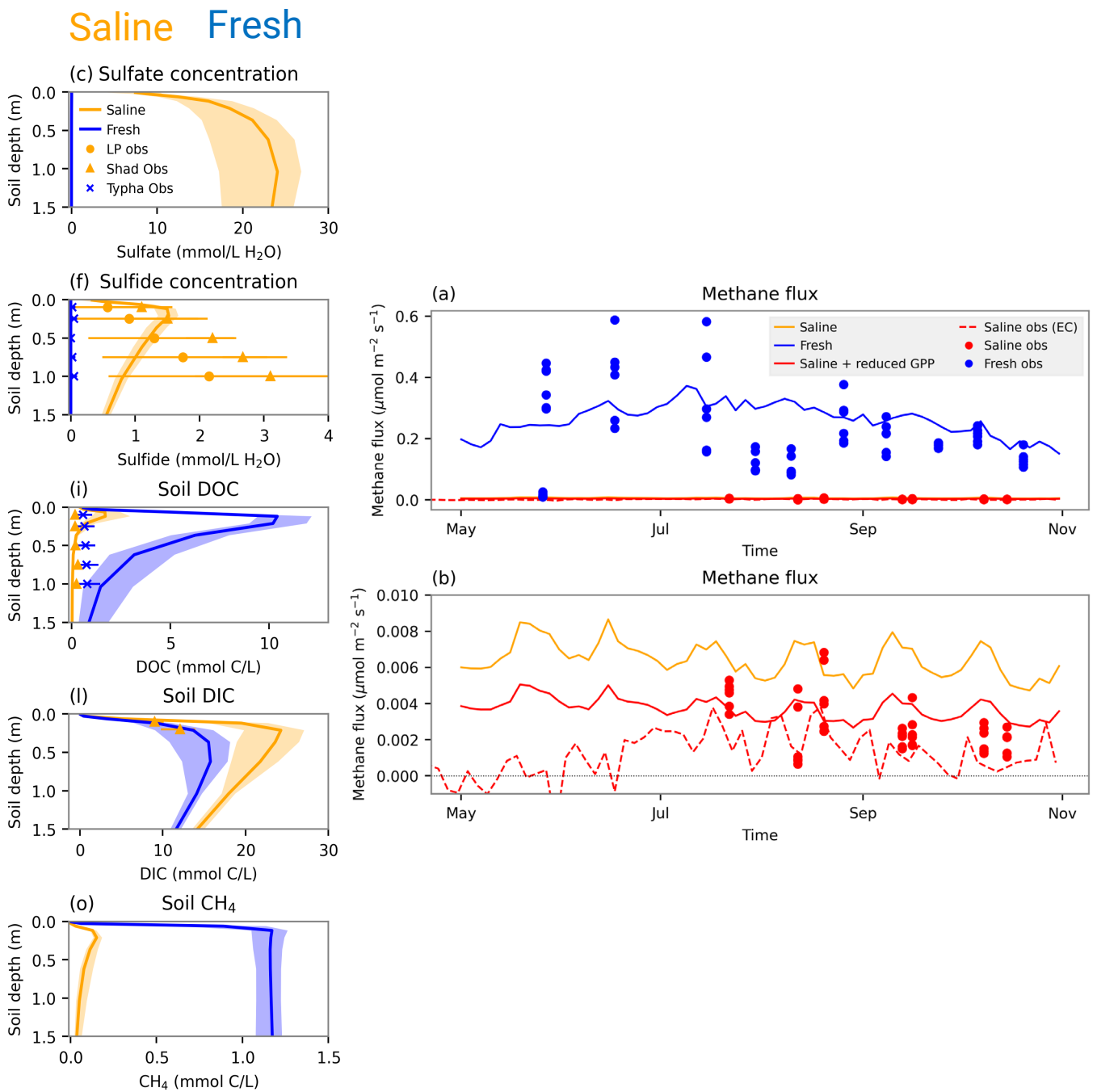
Consuming DOC

↓

Producing DIC

↓

Reducing methane production and increasing oxidation

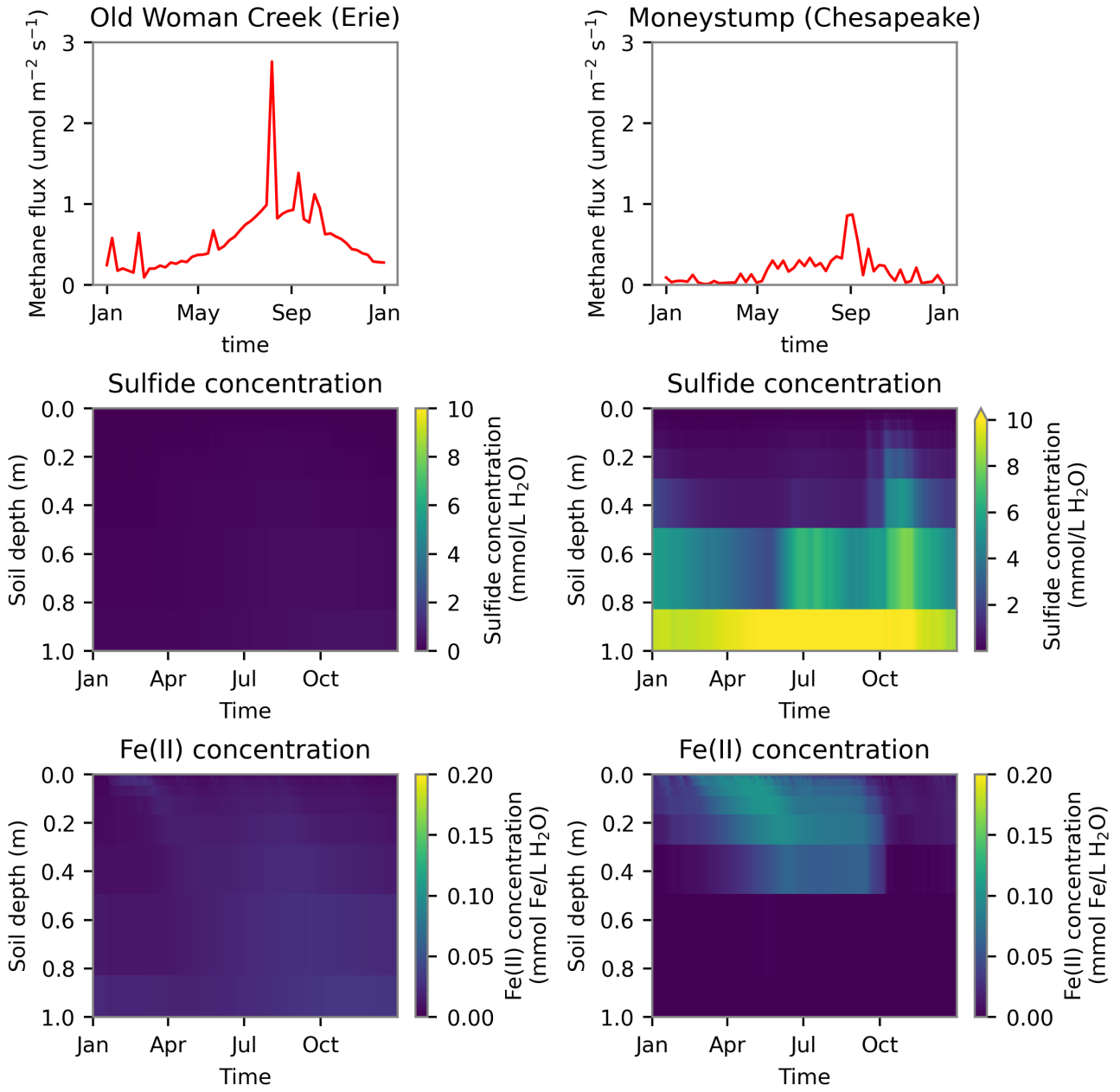


Sulman et al., 2024, JAMES

The model can resolve sulfur-iron-carbon interactions across space and time

Freshwater

Saltwater



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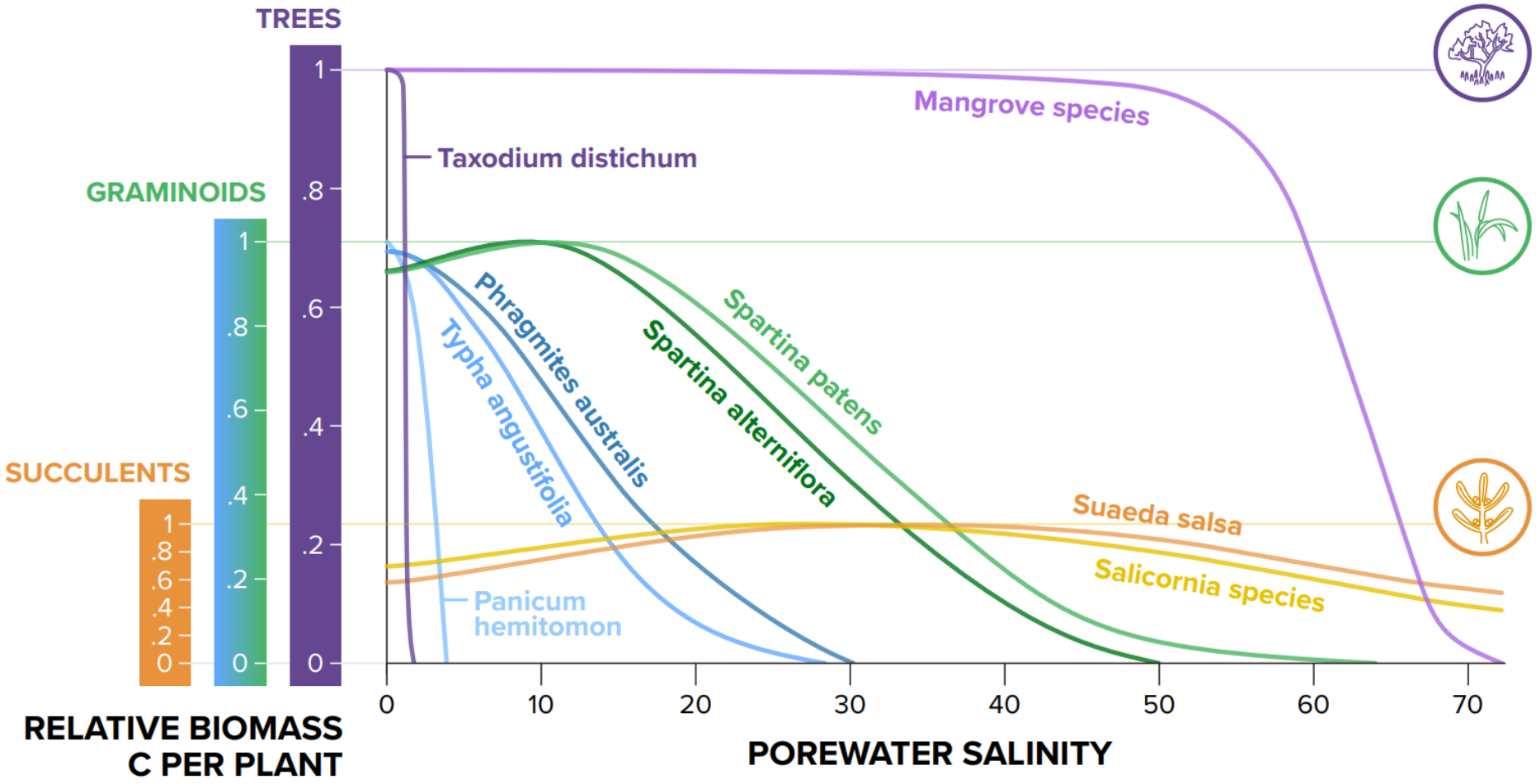
Our model framework also incorporates vegetation responses to salinity and inundation



LaFond-Hudson and Sulman, 2022, New Phytologist

Scaling up to regional scales using wetland maps

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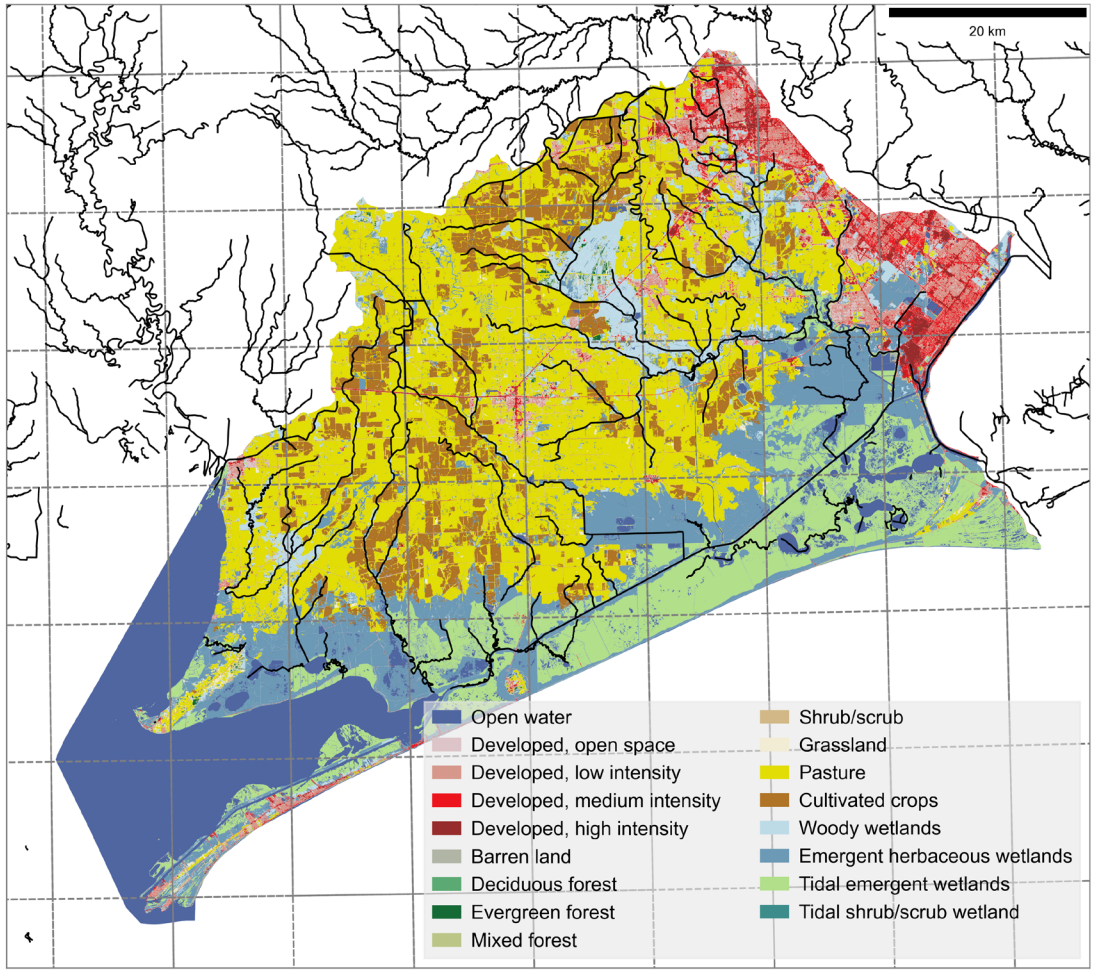

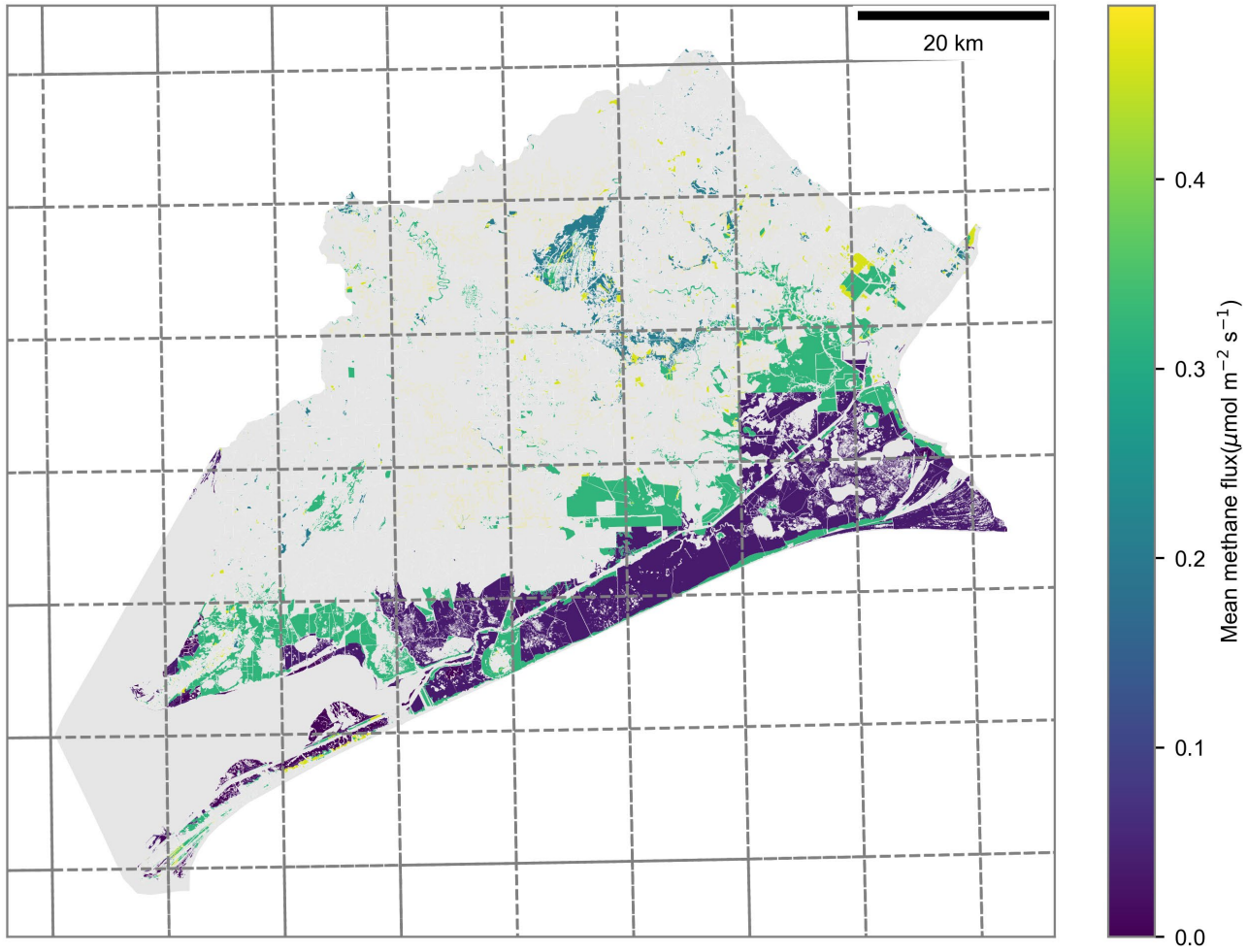

Maps generated using National Landcover Database and National Wetland Inventory (Shannon Jones)

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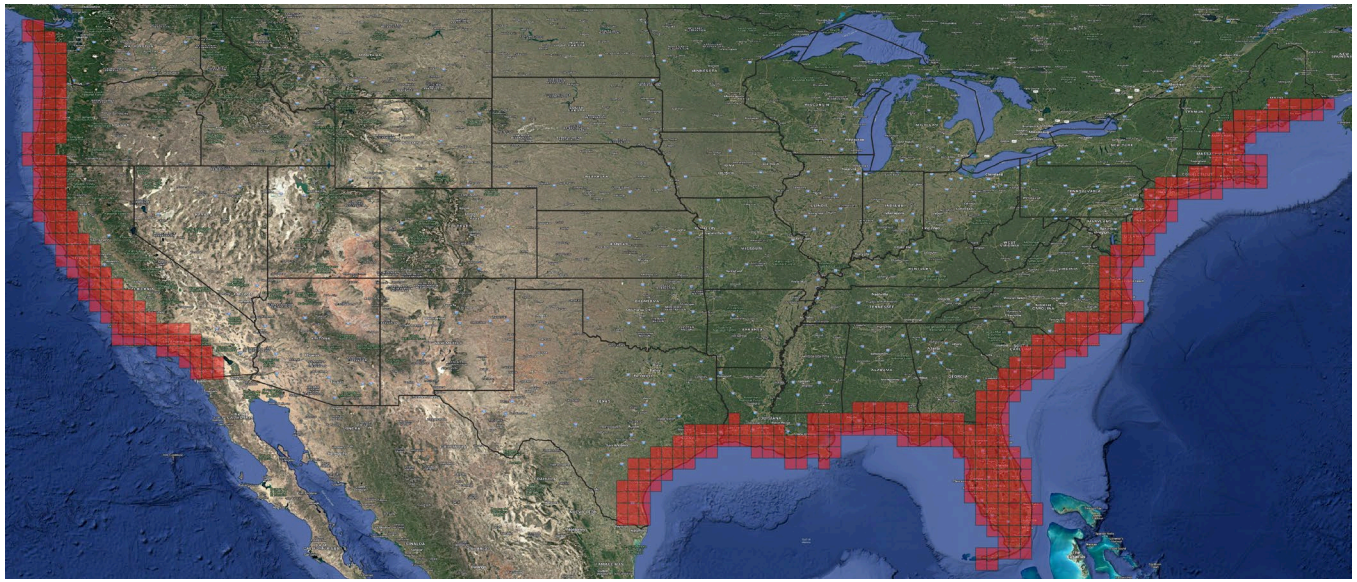
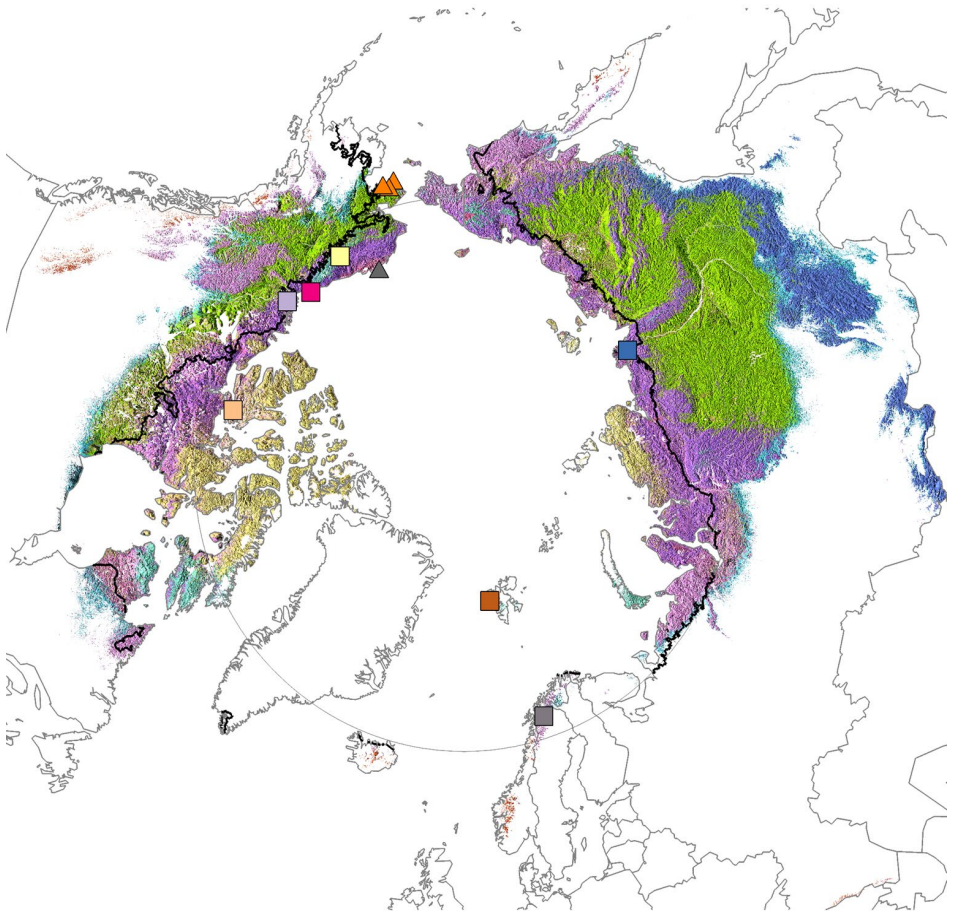
And eventually to the continental scale using larger-scale hydrology and wetland spatial data



Coastal domain of the Continental U.S. (Chucho Gomez Velez)



Pan-Arctic ecological zones (Jitu Kumar)

Thanks to DOE BER ESS and ESMD, Fengming Yuan, Matt Hoch, Teri O'Meara, Glen Hammond, Sergi Molins, Anne Giblin, Zoe Cardon, Jiaze Wang, and Sophie LaFond-Hudson