NUMERICAL MODELING TO INFORM SEAGRASS HABITAT MANAGEMENT AND MONITORING AT THE CHANDELEUR ISLANDS

Presented by: Martijn Bregman

State of the Coast

Thursday, May 22

9:30 – 11:00 a.m.

Room 284

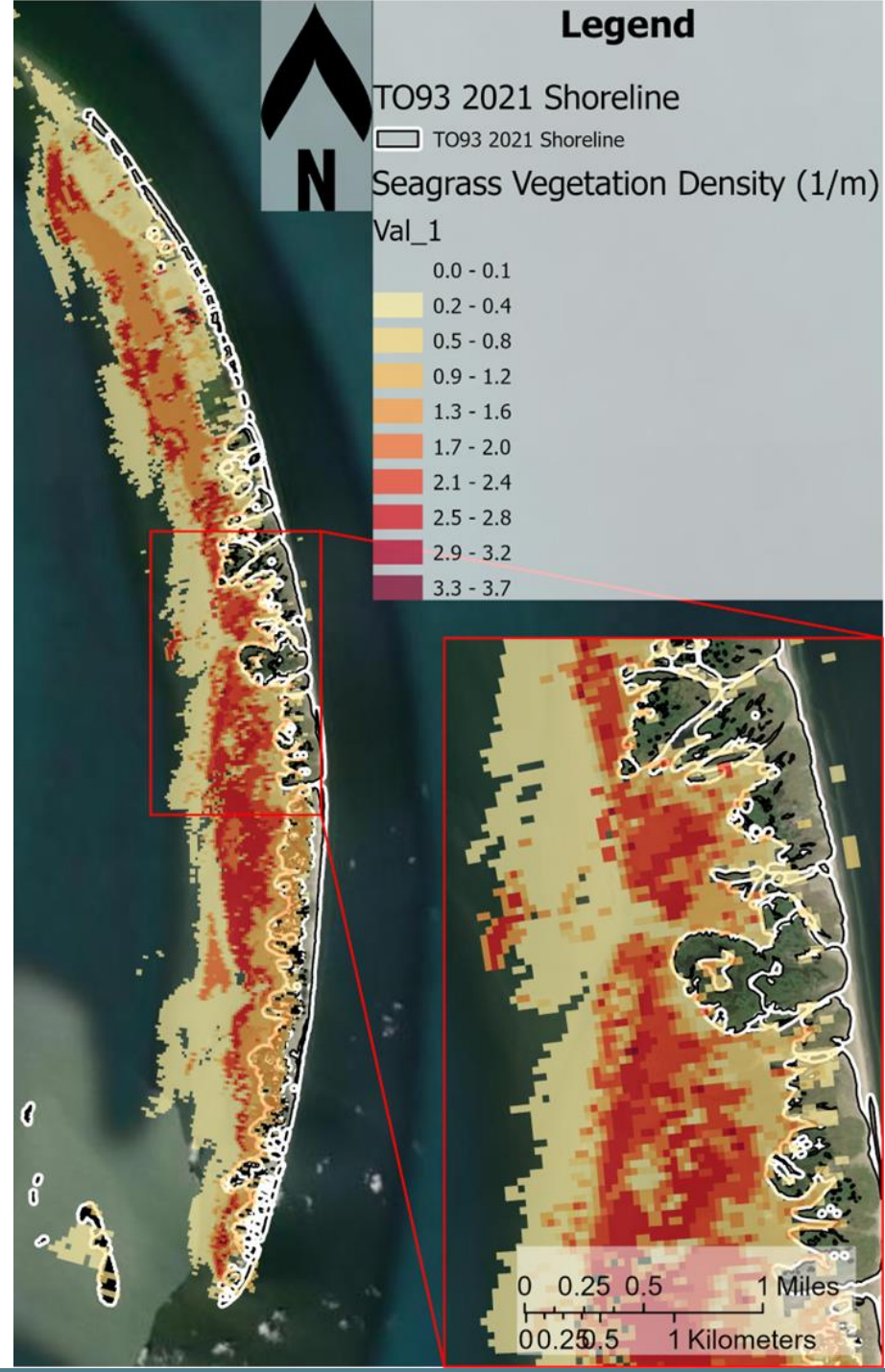
NUMERICAL MODELING

- Hypothesis:
  - Seagrass decline is driven by a loss of island protection (indirect storm impact)
- Goal:
  - Understand environmental conditions (currents, waves, bed shear stress) that cause post-storm seagrass loss
- Approach:
  - Delft3D Flexible Mesh model
    - Hydrodynamics (including wave modeling with SWAN)
    - Sediment transport & morphology

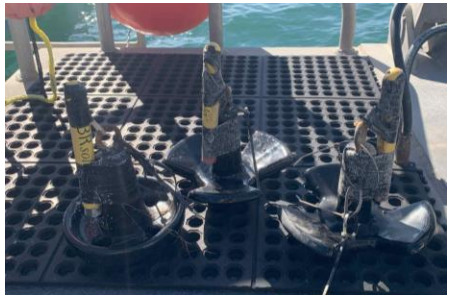
MODEL DOMAIN

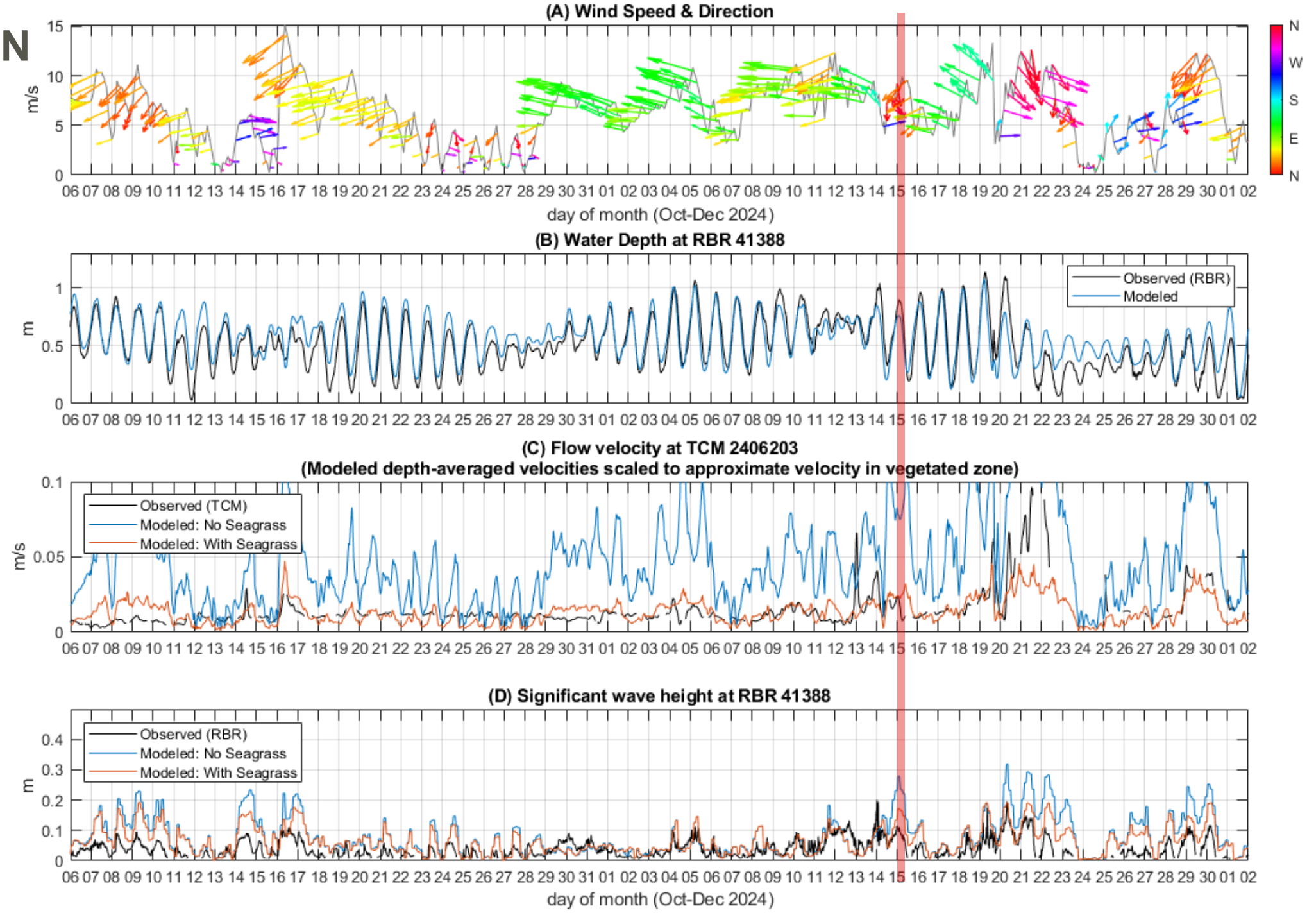
MODEL REPRESENTATION OF SEAGRASS

- Two effects of seagrass:
  1. Flow resistance
     - Baptist et al. (2007)
  2. Wave attenuation
     - Dalrymple (1984), Mendez and Losada (2004)
- Formulations directly represent vegetation
- User-defined inputs:
  - Vegetation height
  - Vegetation density (stem density & stem diameter)
- Seagrass in model based on:
  - Remote sensing (seagrass coverage)
  - Field data (stem density, height, etc.)



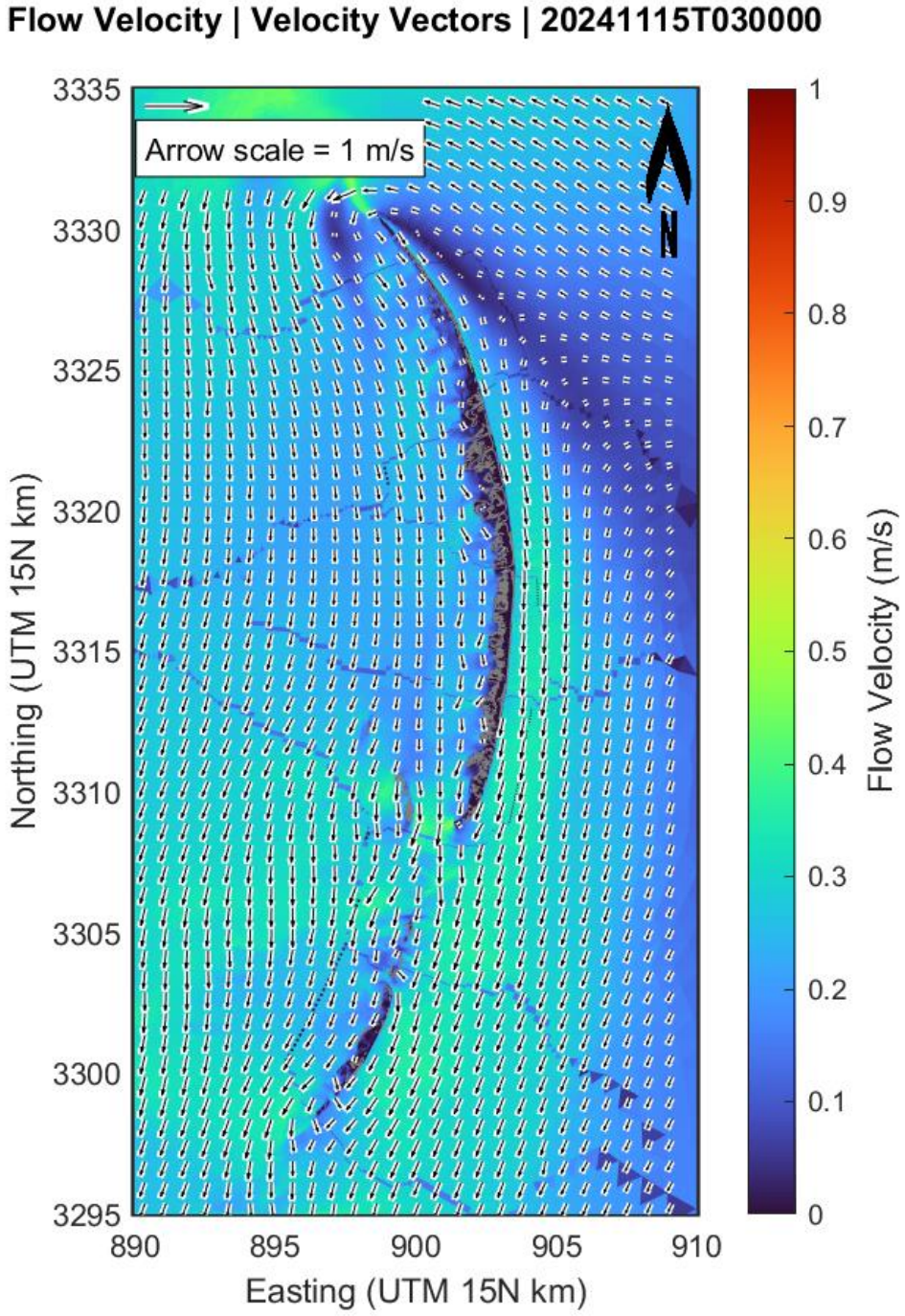
CALIBRATION

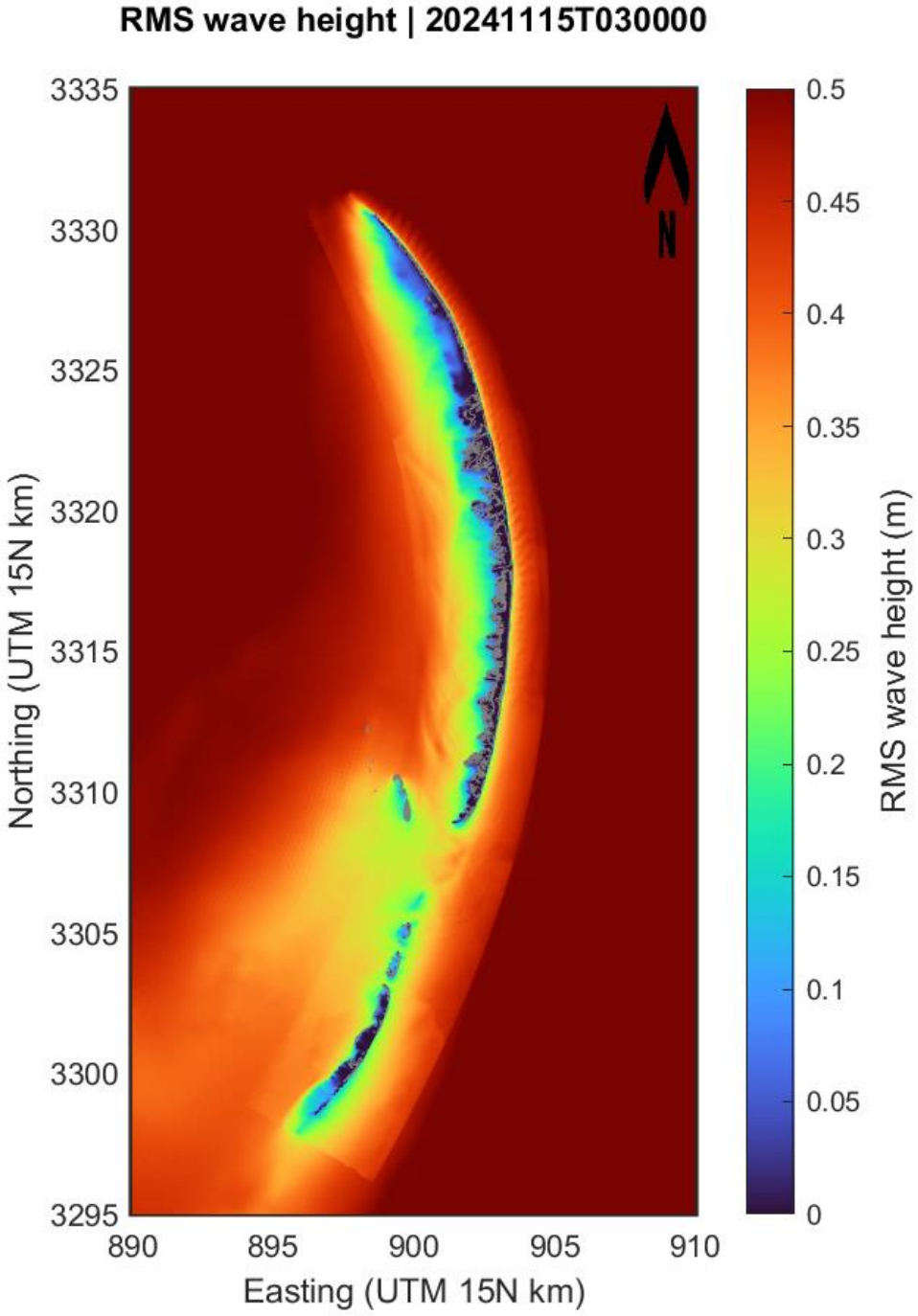




FLOW VELOCITY & WAVE HEIGHT

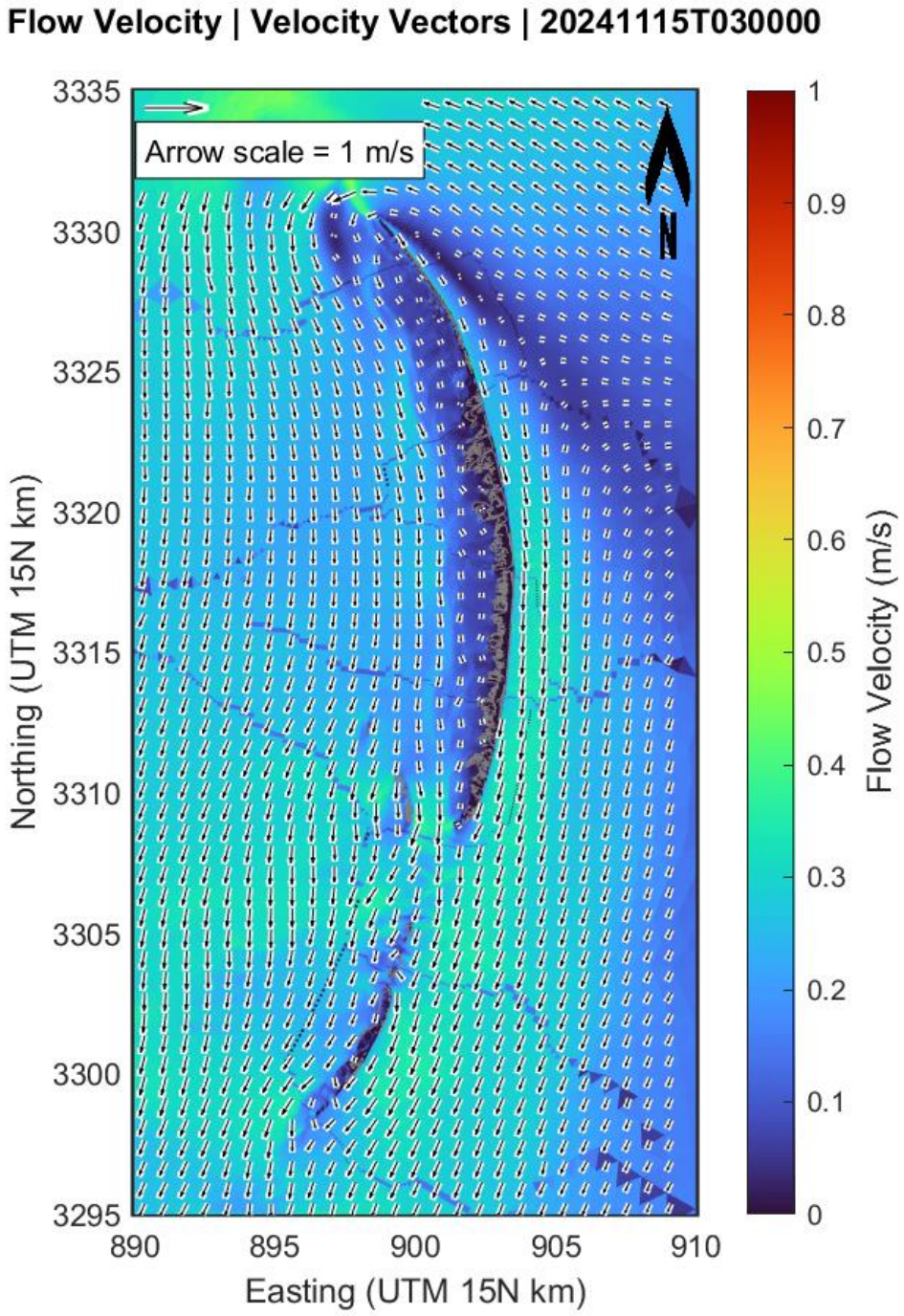
NO SEAGRASS

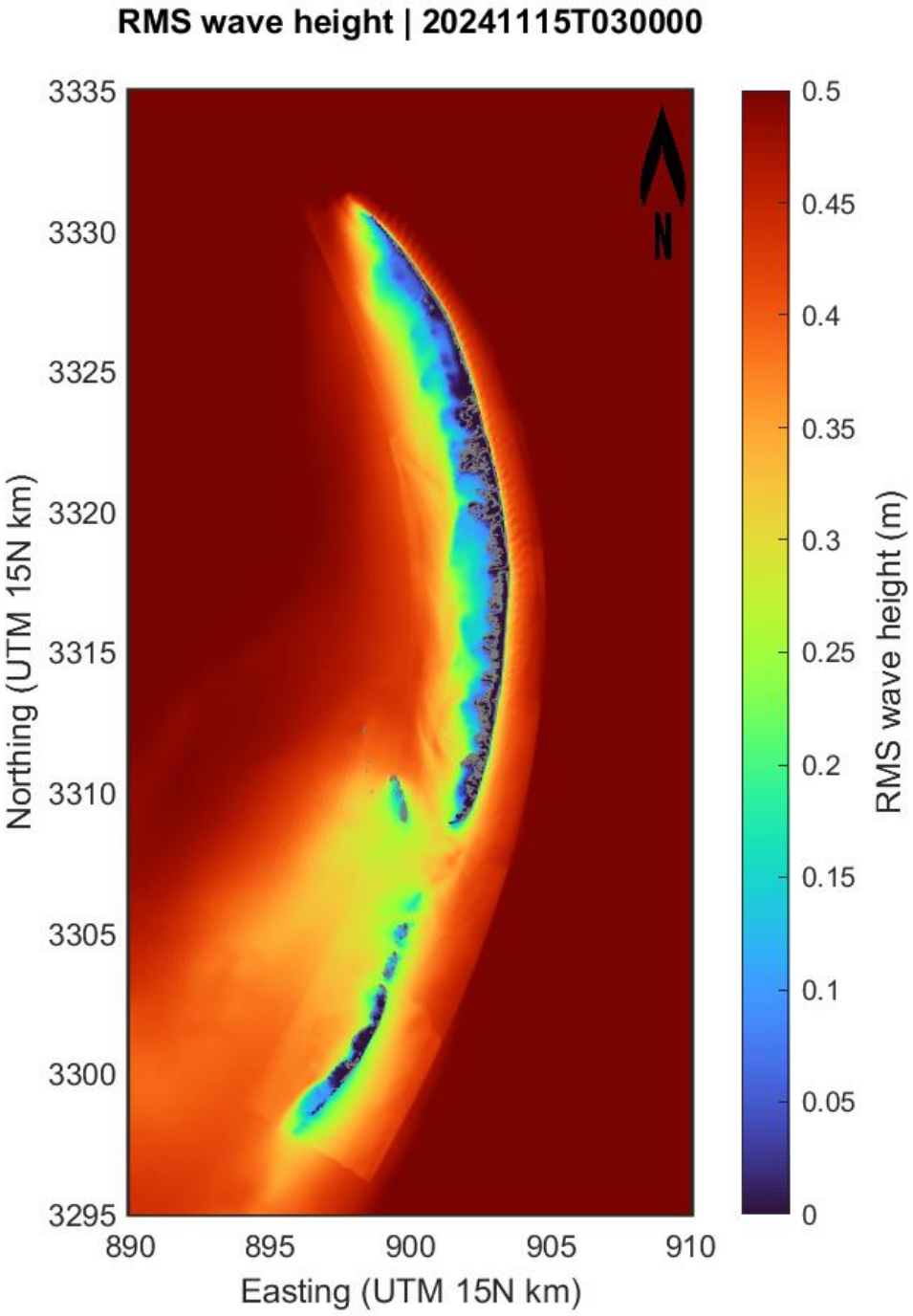




FLOW VELOCITY & WAVE HEIGHT

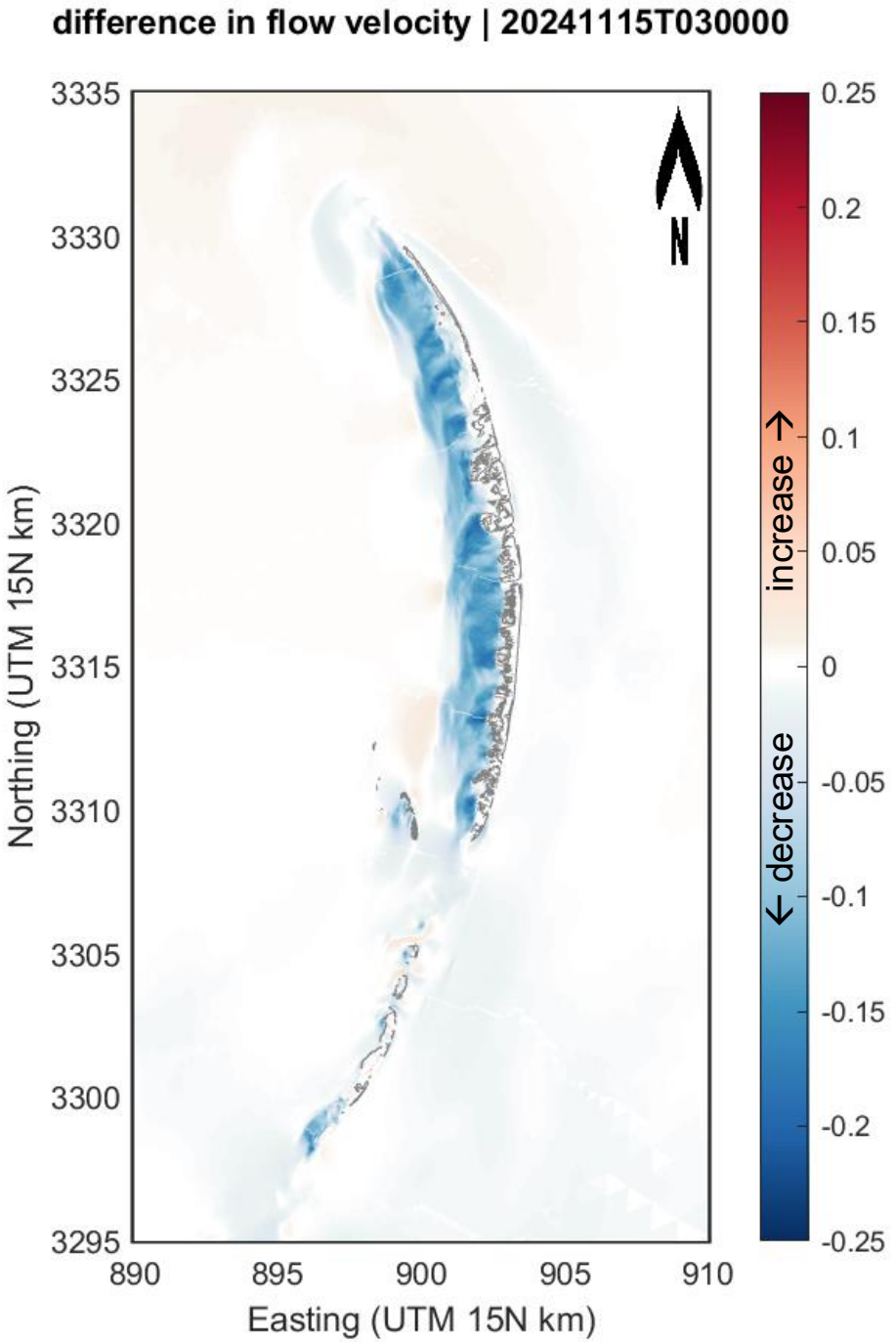
WITH SEAGRASS

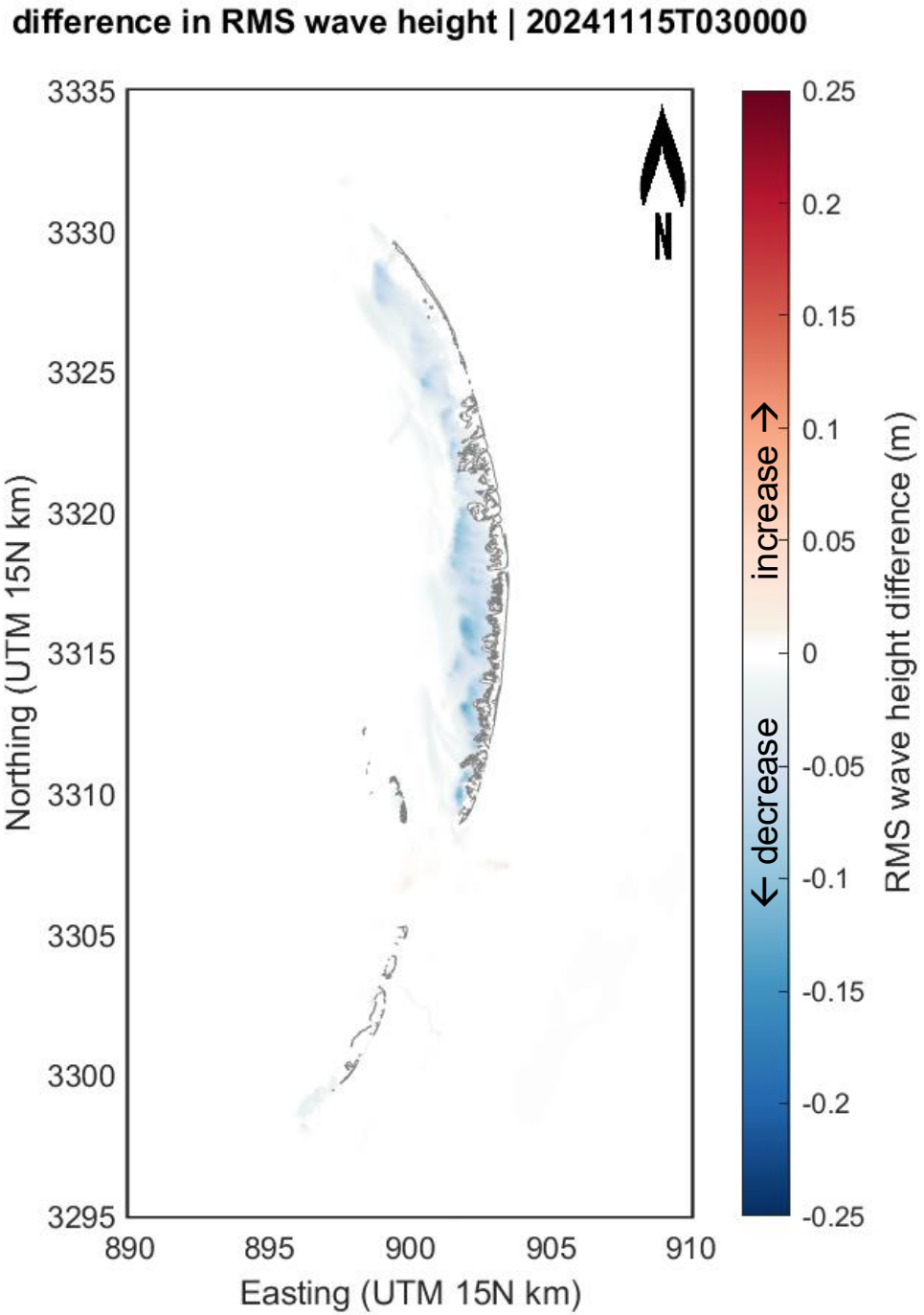




FLOW VELOCITY & WAVE HEIGHT

DIFFERENCE (I.E., SEAGRASS IMPACTS)





ONGOING WORK & NEXT STEPS

- Simulate historical island configurations (topo-bathymetry & seagrass coverage).
  - Years 2015, 2018, and 2022
- Identify conditions in areas with seagrass decline
- Sediment transport & morphology model
- Simulate recent tropical cyclones:
  - Gordon (2018), Ida (2021), Francine (2024)
- Test alternate hypothesis:
  - Loss of seagrass due direct storm impacts (i.e., burial or exhumation of seagrass meadows)

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THANK YOU

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