3RD INTERNATIONAL WORKSHOP ON Waves, Storm Surges, and Coastal Hazards

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UNIVERSITY OF GEORGIA
Coastal Ocean Analysis and Simulation Team

National Oceanographic Partnership Program

COAMPS-TC ENSEMBLE DRIVEN STORM SURGE SIMULATIONS FOR HURRICANE IAN

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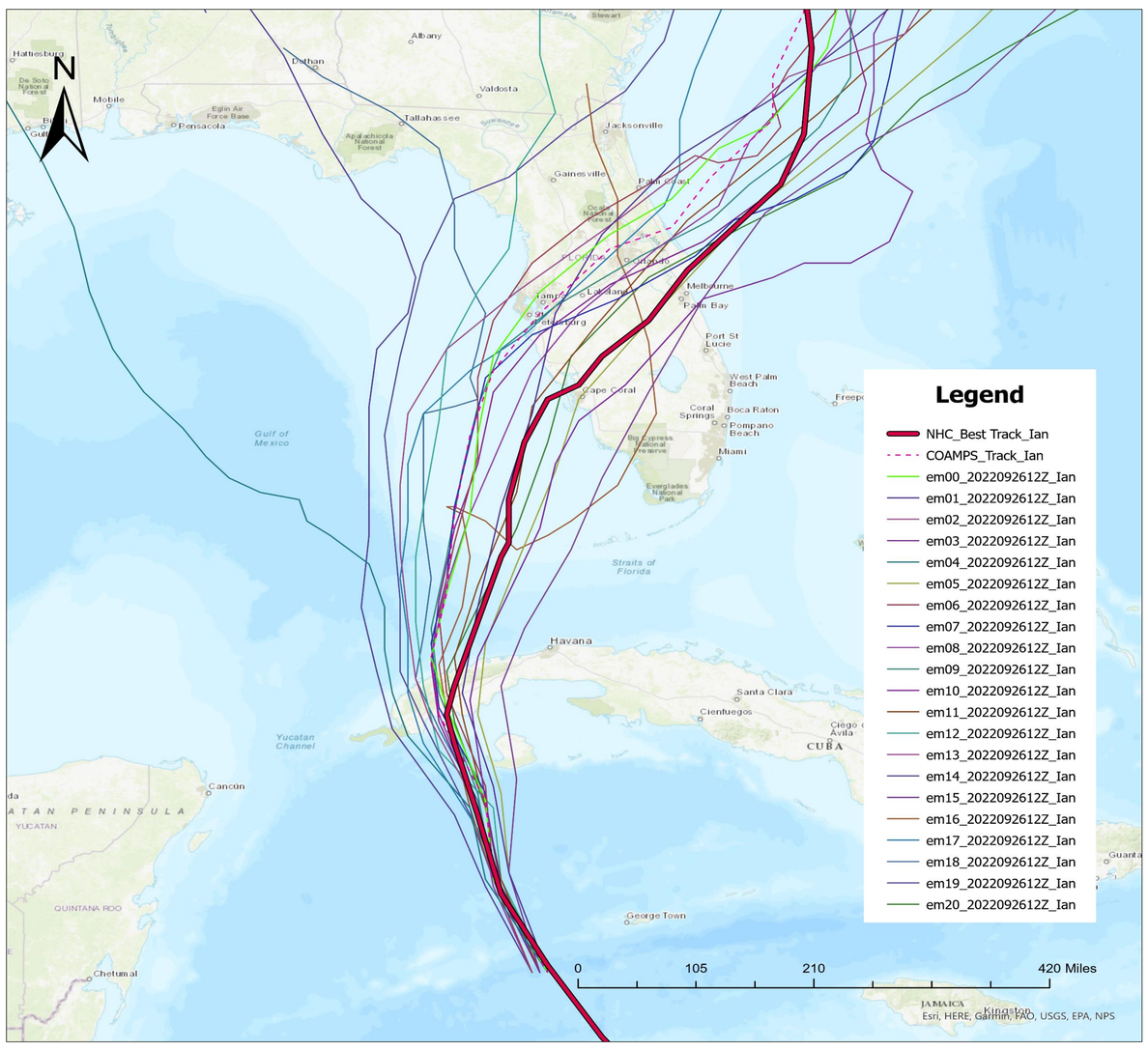
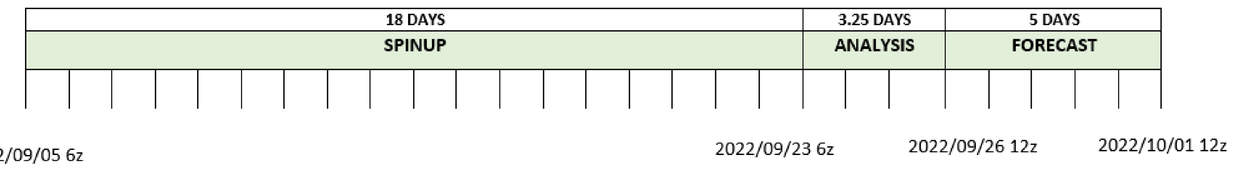
1. Introduction

- We aim to determine how ensemble storm surge predictions can supplement deterministic storm surge forecasts
- Ensemble predictions are performed by running the storm surge model (ADCIRC) multiple times with tropical cyclone (TC) forcing variations
- Ensemble forecasting provides a potential opportunity to reduce TC forecast error (track and intensity) in storm surge predictions
- Ensemble forecast systems are designed so that each member is equally likely to occur
- In this work, COAMPS-TC ensemble forecasts for Hurricane Ian are used

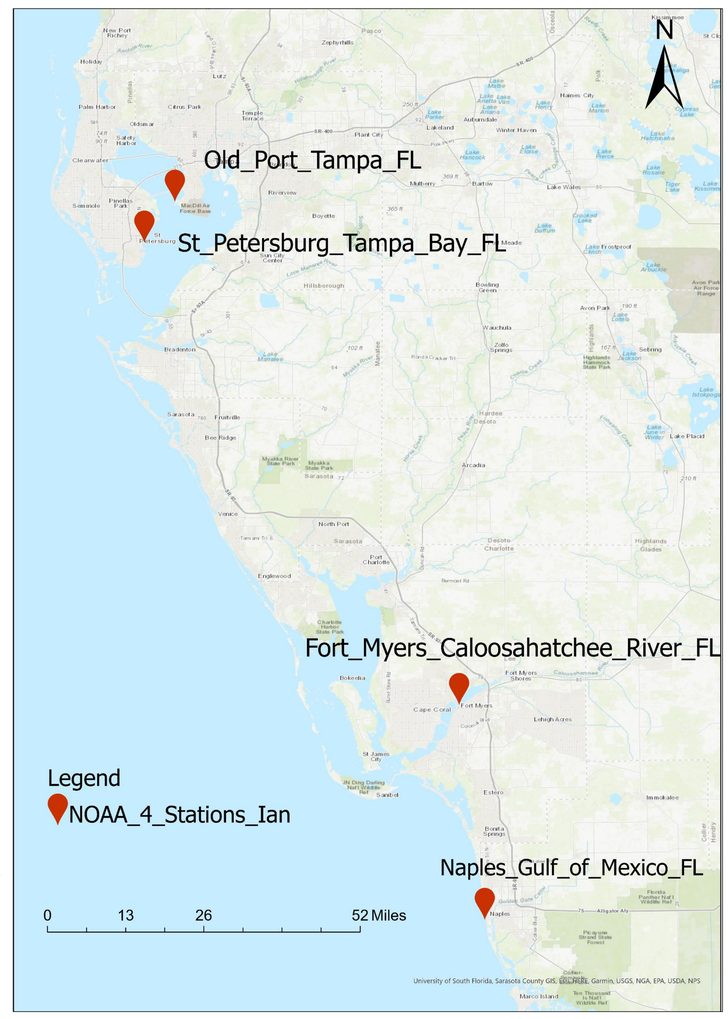


2. Methods

In ADCIRC, a spin-up simulation is run for 18 days before the meteorological forcing of Hurricane Ian. The spin-up solution is the initial condition for the hurricane hindcast simulation, and similarly, the analysis simulation is the initial condition for the five-day forecast simulation.
The timeline of the ADCIRC runs is shown below:

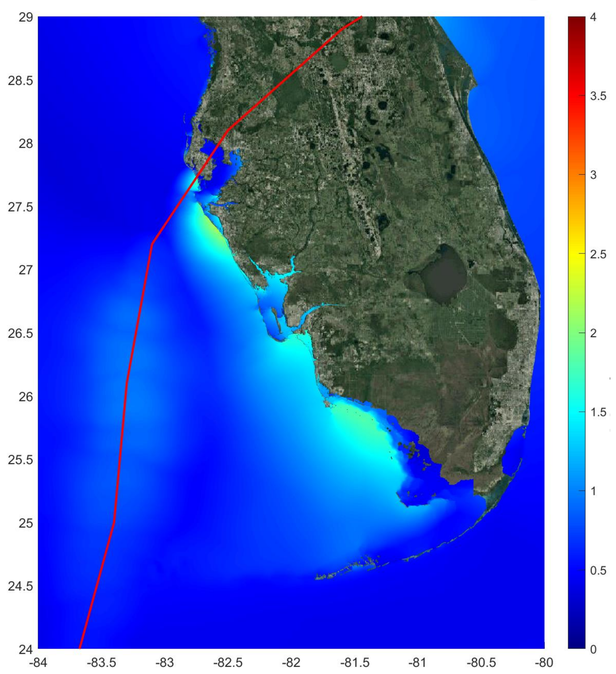


- The em00 member is not perturbed
- The other 20 ensemble members (em01 to em20) were perturbed (wind and pressure), yielding a variety of forecast tracks and intensities
- ADCIRC+SWAN simulations were conducted using all 21 member ensembles
- Plots of the maximum of maximums and average peak storm surge were generated to examine the potential for the results to supplement the non-perturbed simulation
- Water level time-series plots (a) for four NOAA stations in Southwest Florida highlight the varying water level response to each ensemble member
- Additionally, times-series plots (b) of water levels were generated that contain the maximum and minimum water levels among the perturbed ensembles

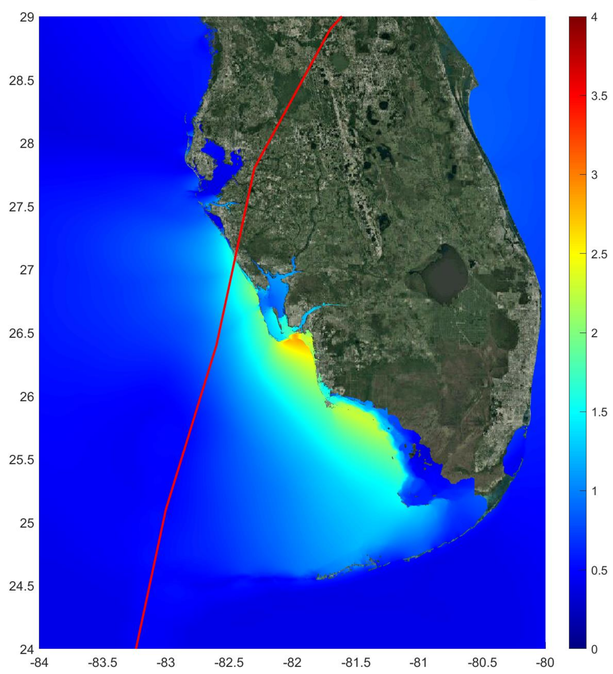


3. Results

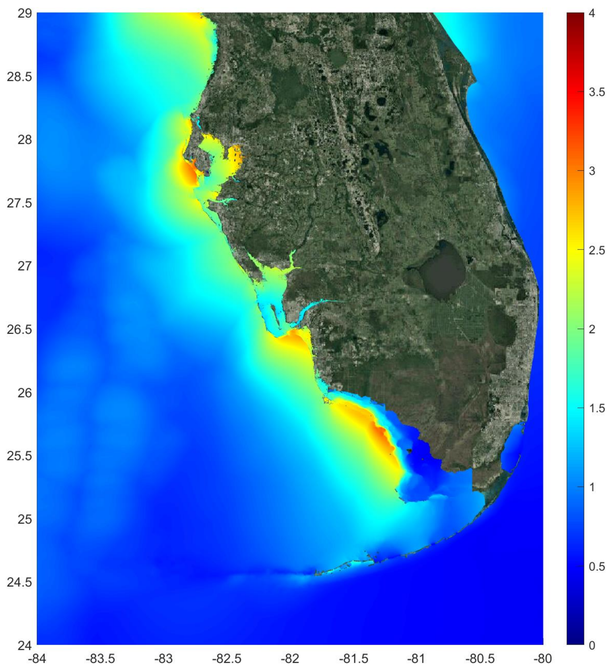
Perturbed (em00) – Peak Surge



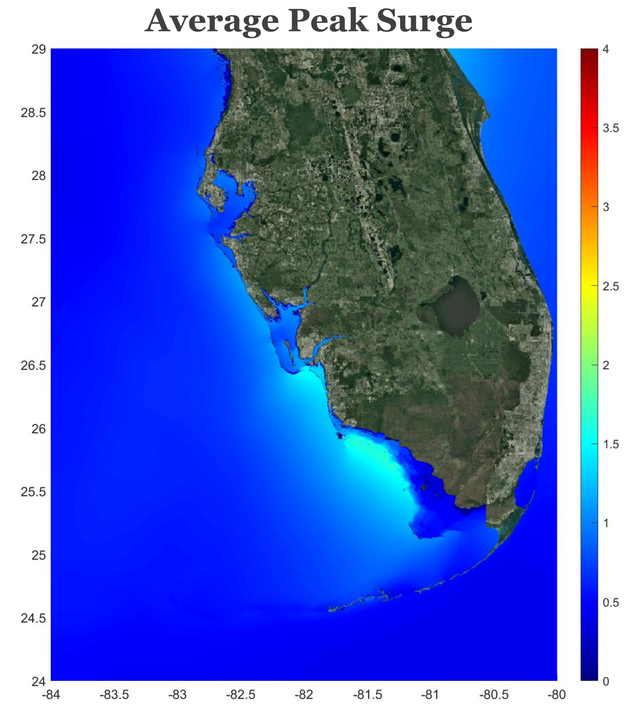
Perturbed (em01) – Peak Surge



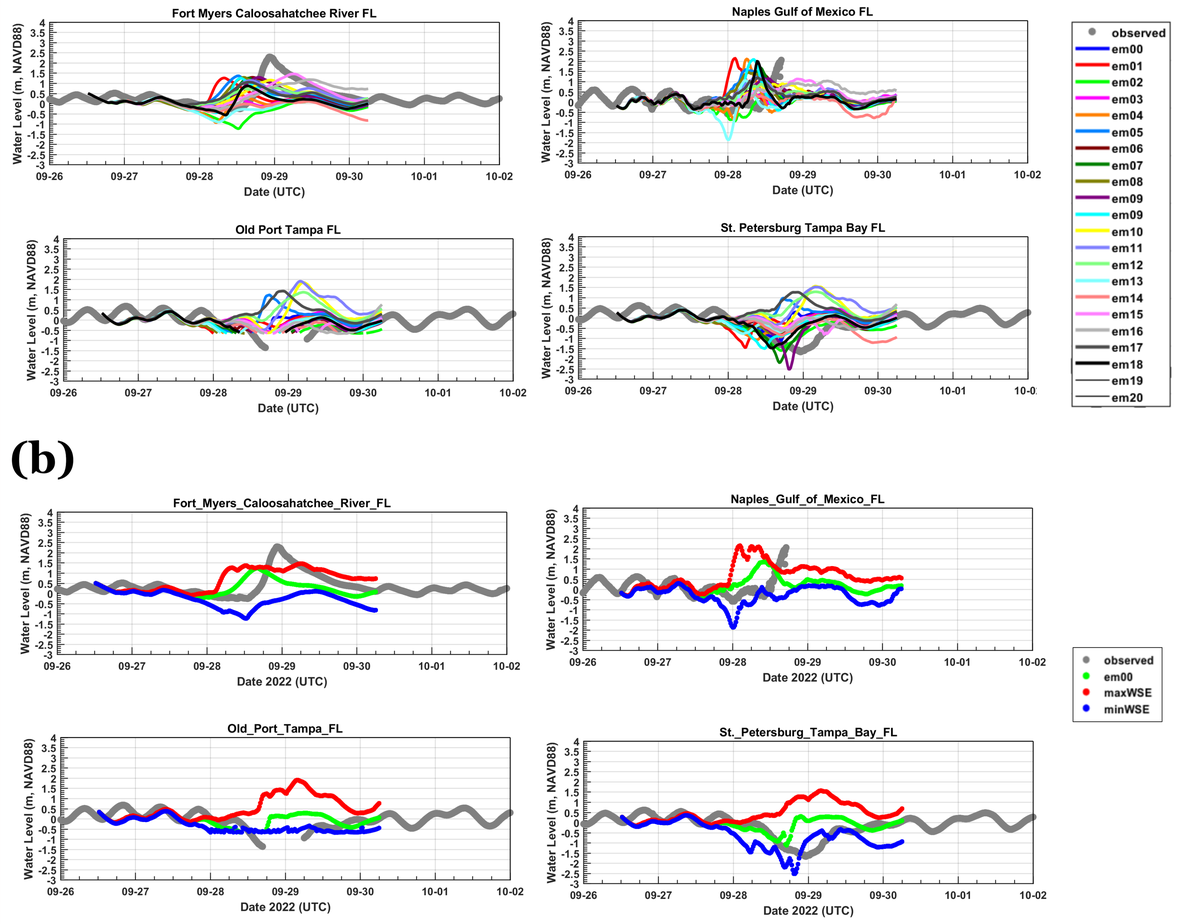
Maximum of Maximums



Average Peak Surge



(a)



(b)

Future work

We are in the early stages of this work. Some of our next steps include:

- Perform ADCIRC ensemble simulations for the forecast period starting on September 27, 2022 12Z
- Physics-Informed Machine Learning (PIML) will be developed to quickly generate probabilistic flood maps as performing ADCIRC+SWAN simulations for each ensemble is computationally expensive and time-consuming.

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