

## OBJECTIVES

- Optimization of an operational forecast system for hazards, e.g. flooding, water quality reduction and beach erosion.

## INTRODUCTION

Research Area: Guana-Tolomato-Matanzas (GTM) estuary

- An ecosystem with interconnected and diverse habitats.
- Affected by major hurricanes and storms.

Table 1. Storms affecting the area

Year	Storms	Impacts
2004	Charley	-
2004	Frances	-
2005	Wilma	-
2008	Fay	-
2016	Matthew	Overwash, breaching
2017	Irma	-
2019	Dorian	Overwash, breaching

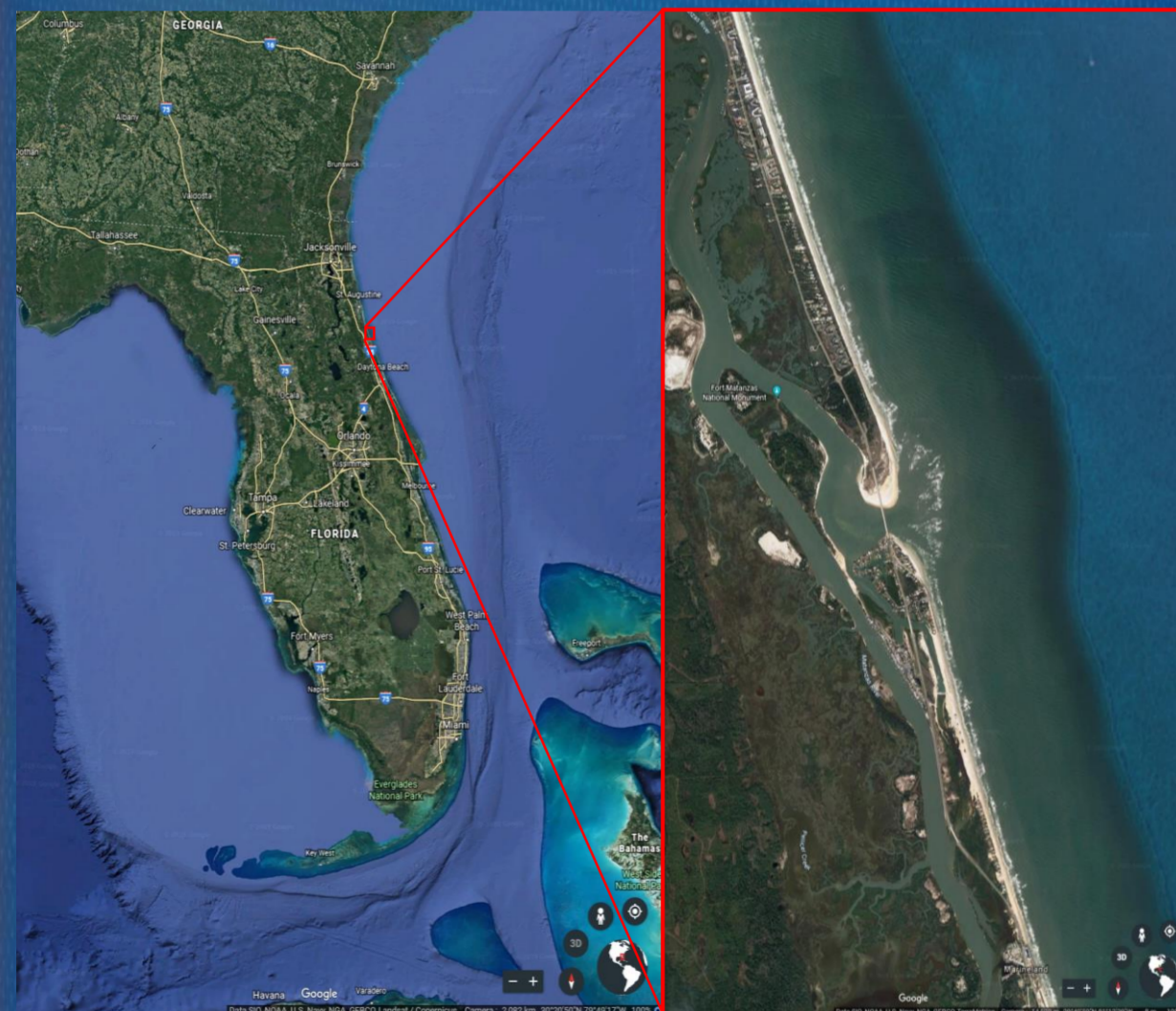


Figure 1. Map of GTM estuary (from Google Earth).

## METHODOLOGY

Numerical Modeling System

- Coupled-Ocean-Atmospheric-Wave-Sediment Transport (COAWST) model (Warner et al., 2008)
- HiPerGator – Research Computing of University of Florida

Atmospheric Forcing

- Global Forecast System (GFS)
- RAPid refresh (RAP)
- North American Mesoscale forecast system (NAM)
- High-Resolution Rapid Refresh (HRRR)

Hydrodynamic Forcing

- Wave Watch III (WW3)
- OSU TPXO Global Tidal Model
- Hybrid Coordinate Ocean Model (HYCOM)
  - Free-surface elevation
  - Current velocities
  - Salinity
  - Temperature

Table 2. Daily schedule for operational forecast system

Time	Procedure	Actions
23:00	Preprocessing	1) Download data from website 2) Create input forcing files
01:00	Simulation	Submitting COAWST simulation for 1-day forecasting
05:00	Postprocessing	Process output files and compare results with observation

Table 3. Spatial and temporal resolutions of databases

Database	Spatial Res. (KM)	Time Res. (Hour)
GFS	50	3
RAP	13	1
NAM	12	1
HRRR	3	1
HYCOM	8	3
WW3	16	3

## MODEL VALIDATION USING HINDCAST DATA

Case Study for Hurricane Dorian (2019)

- Large-domain simulation with two nested grids
  - US-East Coast
  - South-Atlantic Basin
- NOAA tidal gauges
- National Data Buoy Center (NDBC)

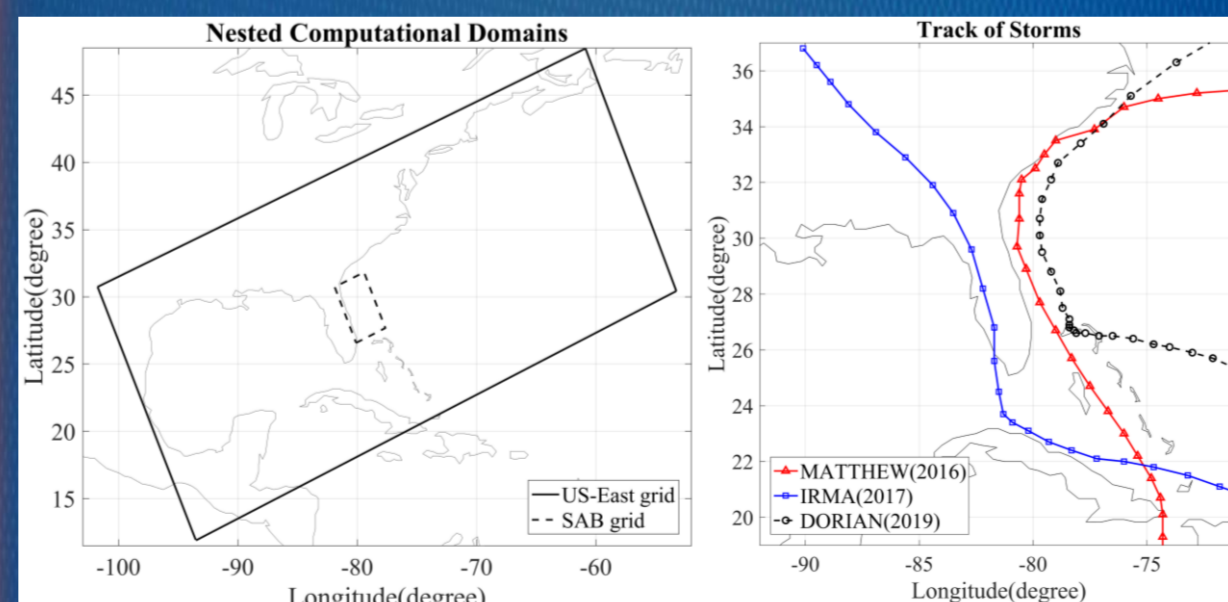


Figure 2. Nested grids and the tracks of three storms affecting GTM region (storm track data from National Hurricane Center)

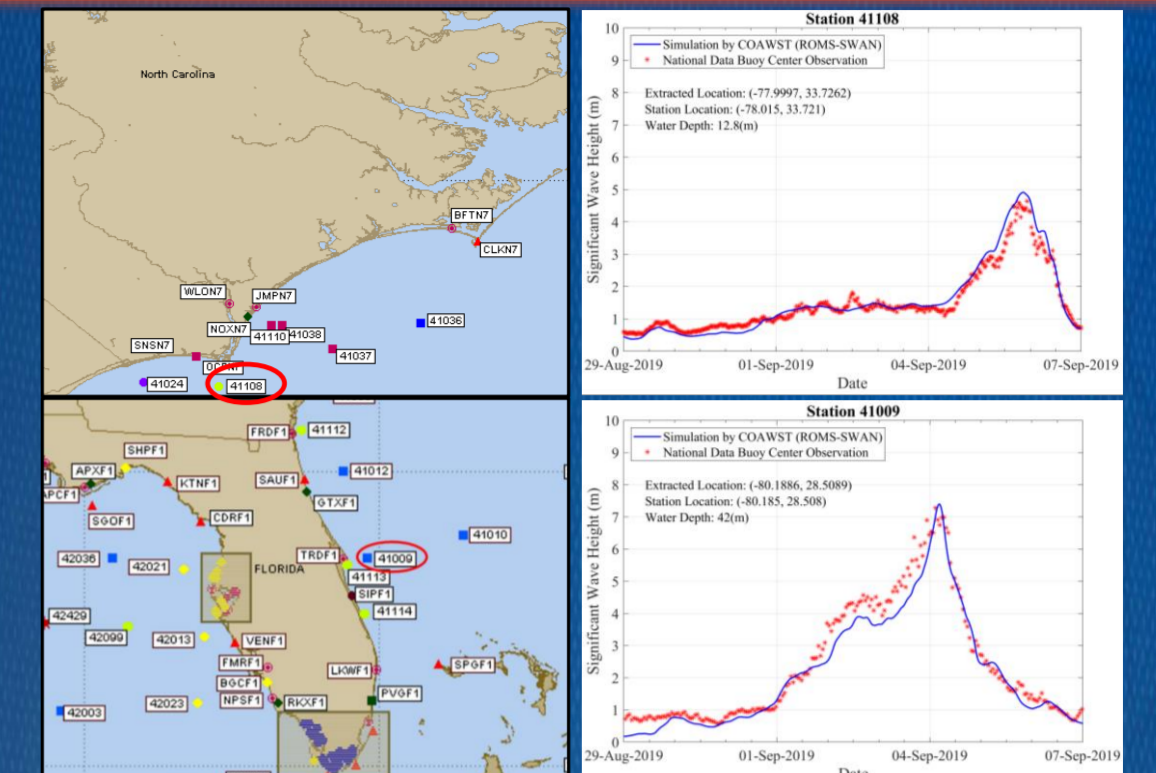


Figure 3. Comparison of wave height between simulation and NDBC observation offshore to NC and FL coasts (map from NDBC website)

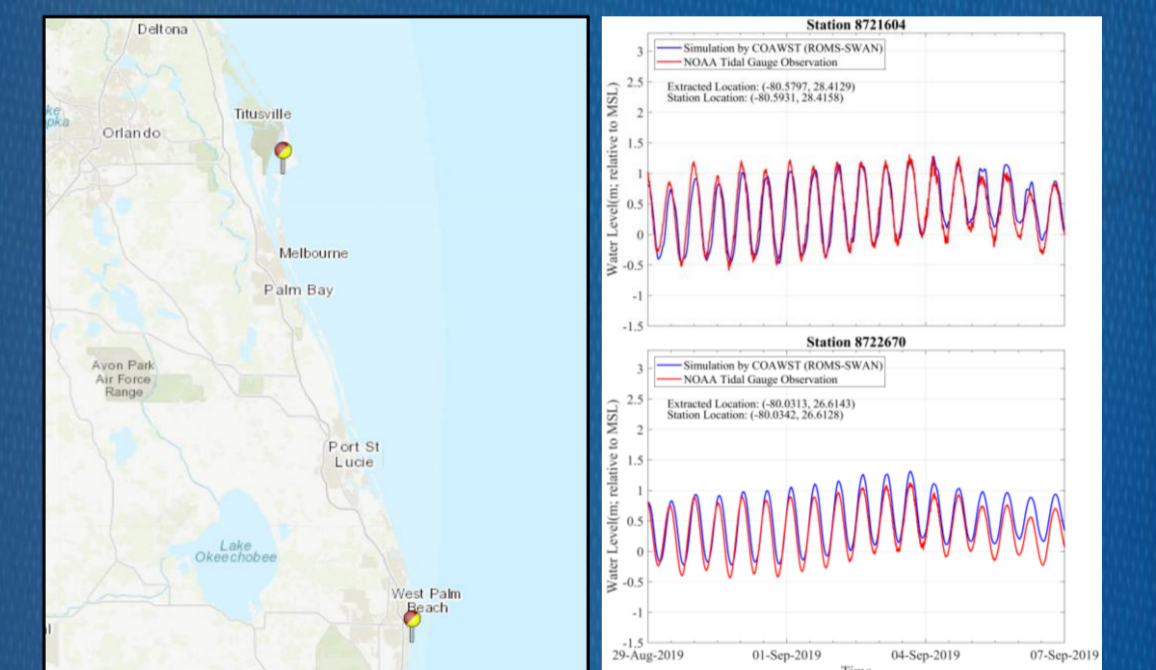


Figure 4. Comparison of water level between simulation and NOAA observation at FL east coast (map from NOAA website)

## DISCUSSION AND FUTURE WORK

Nested-Grid System and Down-Scaling to GTM

- Predicting the generation and arrival of forerunner surges.
- Simulating regional flooding, overwash, and breaching.
- Boundary forcing for GTM computational grid.

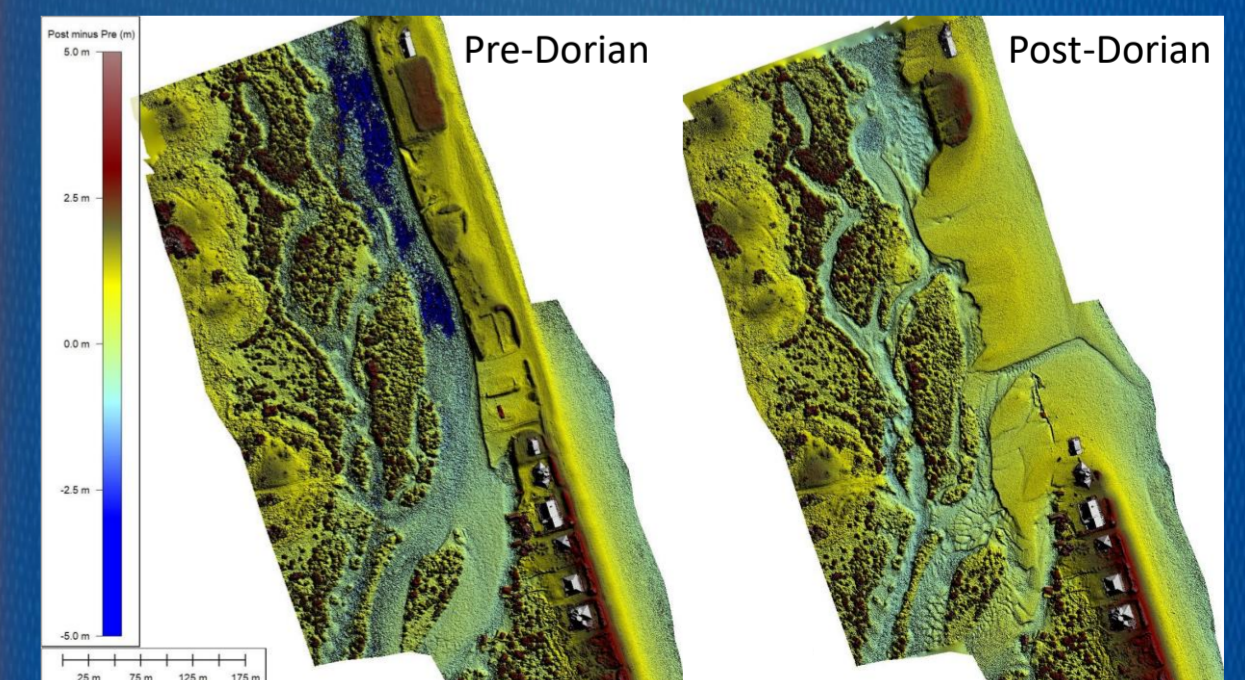


Figure 5. Summer Heaven River DEM derived from UAV images + STRUCTURE FROM MOTION (Data processing done with Dr. Chris Sherwood from USGS Woods Hole)