2023 COASTAL MASTER PLAN
COMMITTED TO OUR COAST

STORM SURGE AND WAVE MODEL UPDATE

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JANUARY 12, 2021

TOPICS

STORM SURGE AND WAVES

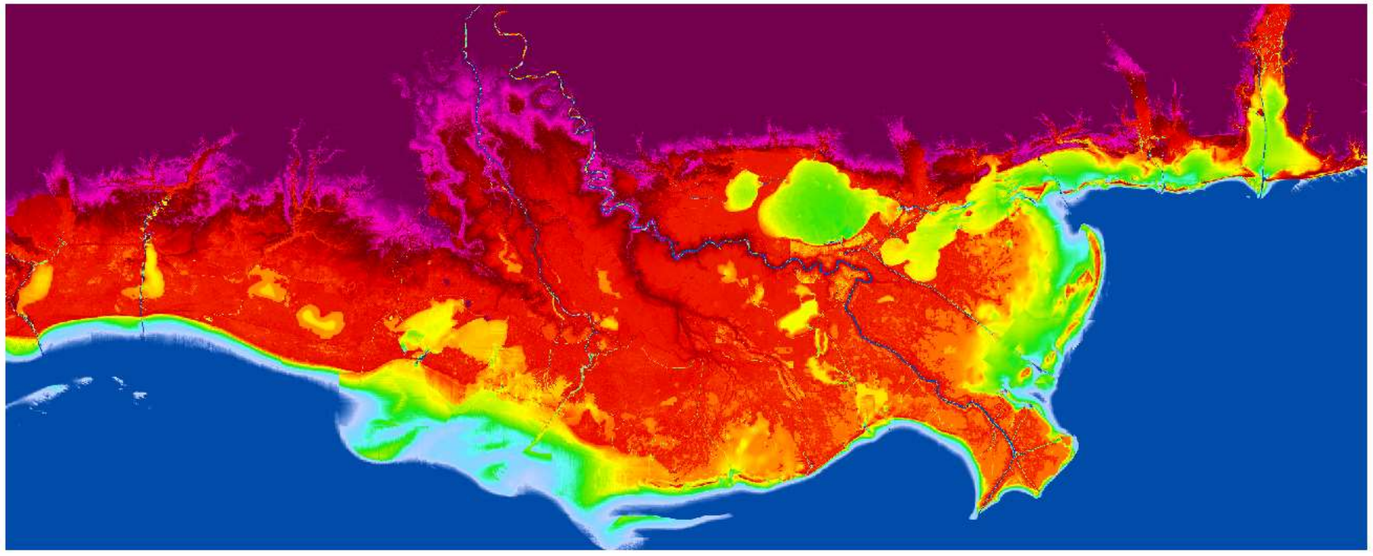
- Updates to model topography/bathymetry
- Updates to land use classes
- Updates to levee assumptions and survey
- Model re-validation
- Storm suite simulations

MODEL UPDATES

MODEL TOPOBATHY UPDATES

STORM SURGE AND WAVES

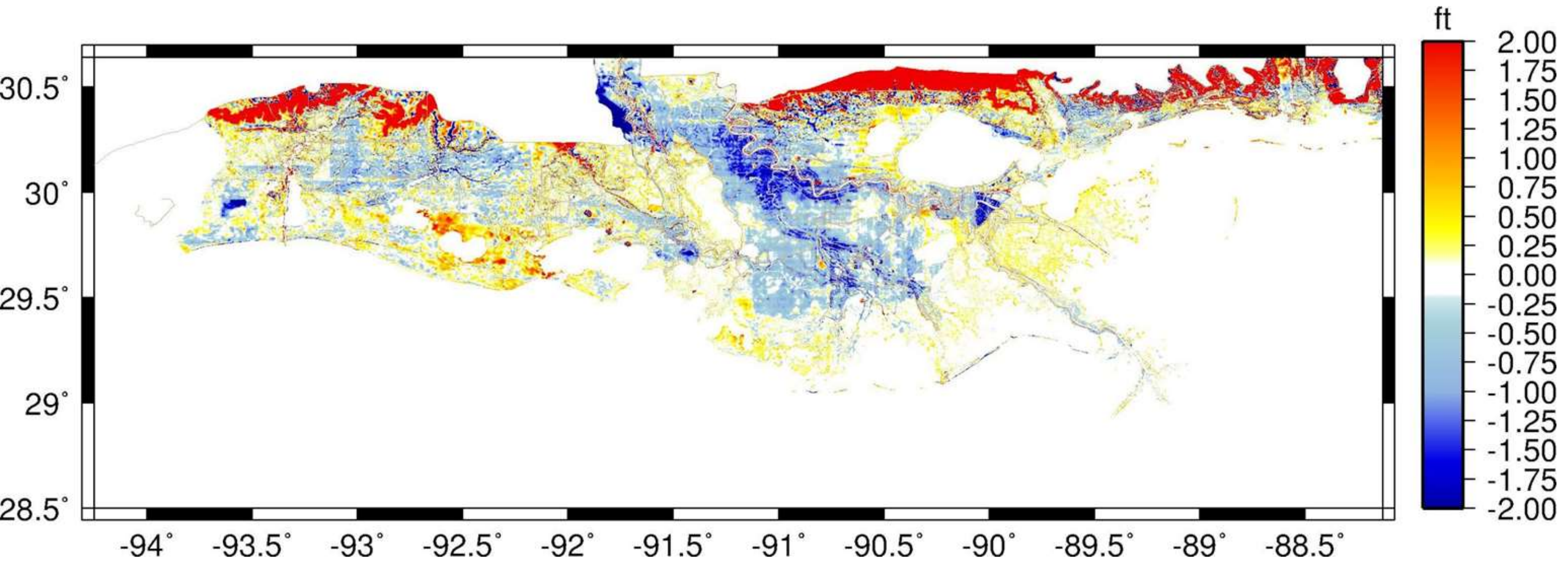
- Model updated for 2017 plan using 3m NGOM data
  - Water bodies left untouched (compared to the 2012 model), use data from FEMA/USACE studies
- For 2023, utilize beta 30m topo+bathy DEM developed by USGS
  - Updated from 2017 model where 30m DEM is best available data
- Changes reflected in ADCIRC data largely from vertical realignment in different tiles



2023 Initialization DEM (ft, NAVD88 2009.55)

CHANGE IN MODEL TOPOGRAPHY AND BATHYMETRY FROM 2017 MODEL

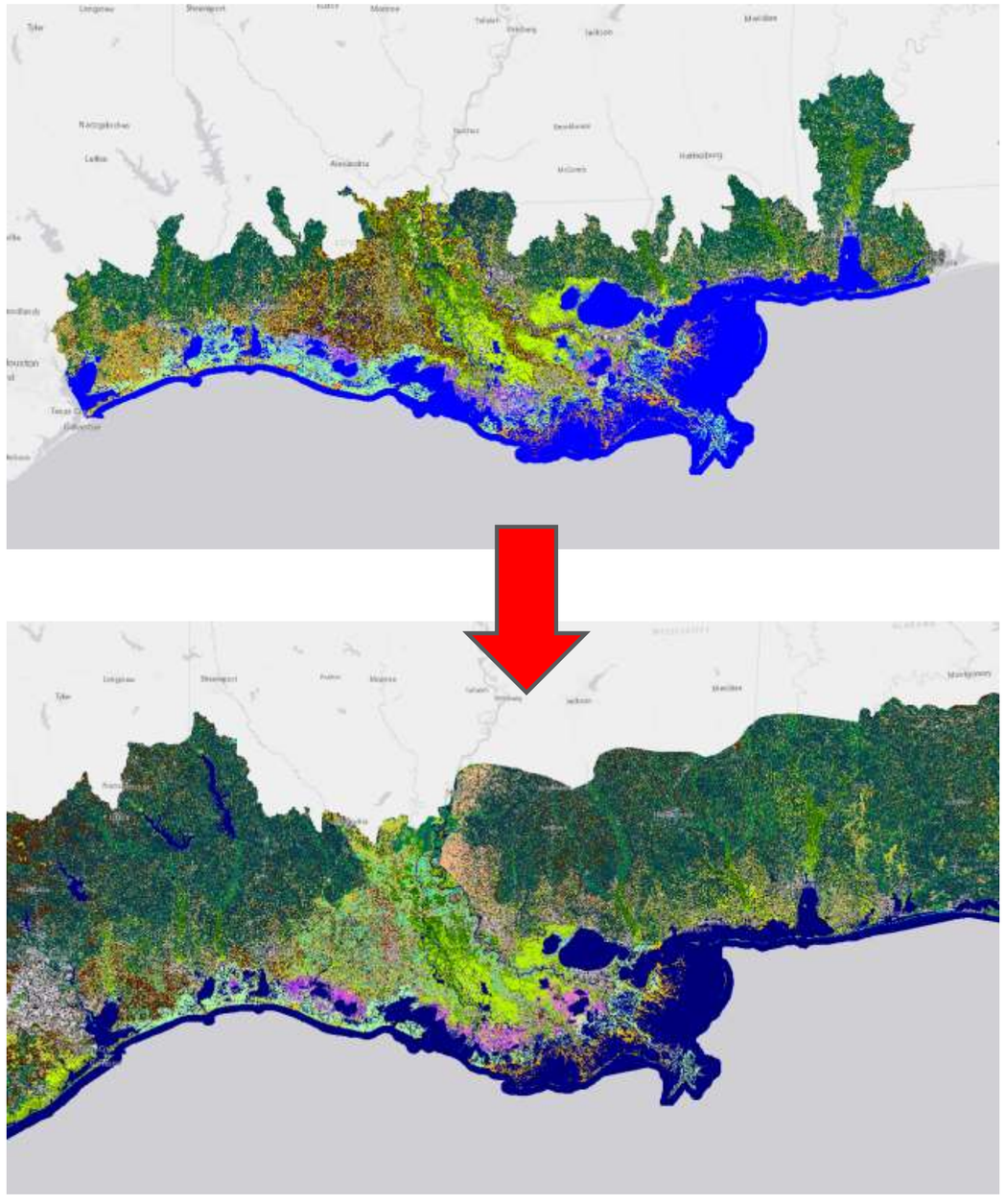
STORM SURGE AND WAVES



CHANGES TO LAND USE CLASSIFICATIONS

STORM SURGE AND WAVES

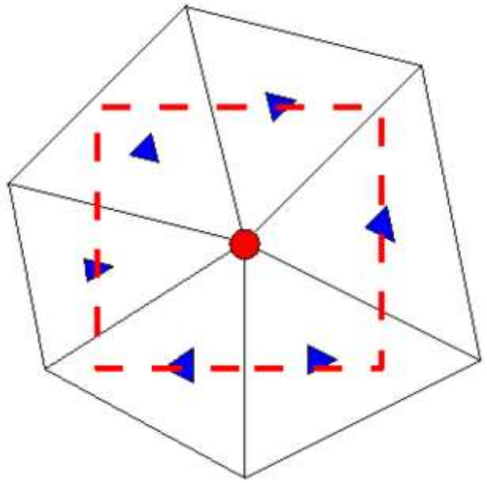
- USGS developed 10m LULC classifications
  - Provides classifications for dominant species rather than more generic land use classes
- LULC does not fully cover extent of ADCIRC model, so coastwide CCAP 2016 data were to fill gaps
  - Refine CCAP 30m to 10m
  - Merged dataset uses 64 classes
- Used to derive Manning's n, surface roughness, and canopy flag



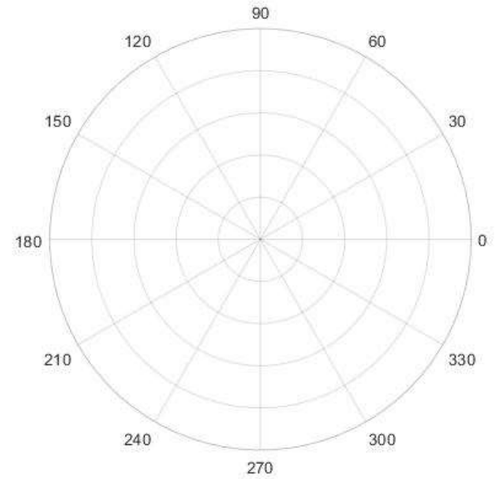
INTERPOLATION METHODS

STORM SURGE AND WAVES

- Manning's n (1)
  - Grid scale averaging
- Surface Canopy (1)
  - Grid scale averaging
  - Binary classification
  - If average >= 0.5, flag as canopied area
- Surface Roughness (2)
  - 12 direction (30 degree) calculation of roughness within 10km radius, weighted by a Gaussian kernel
  - Accounts for roughness impacting marine exposure winds upwind of computational node
  - ~4M LULC pixels used per ADCIRC node



(1) Grid Scale Averaging Schematic



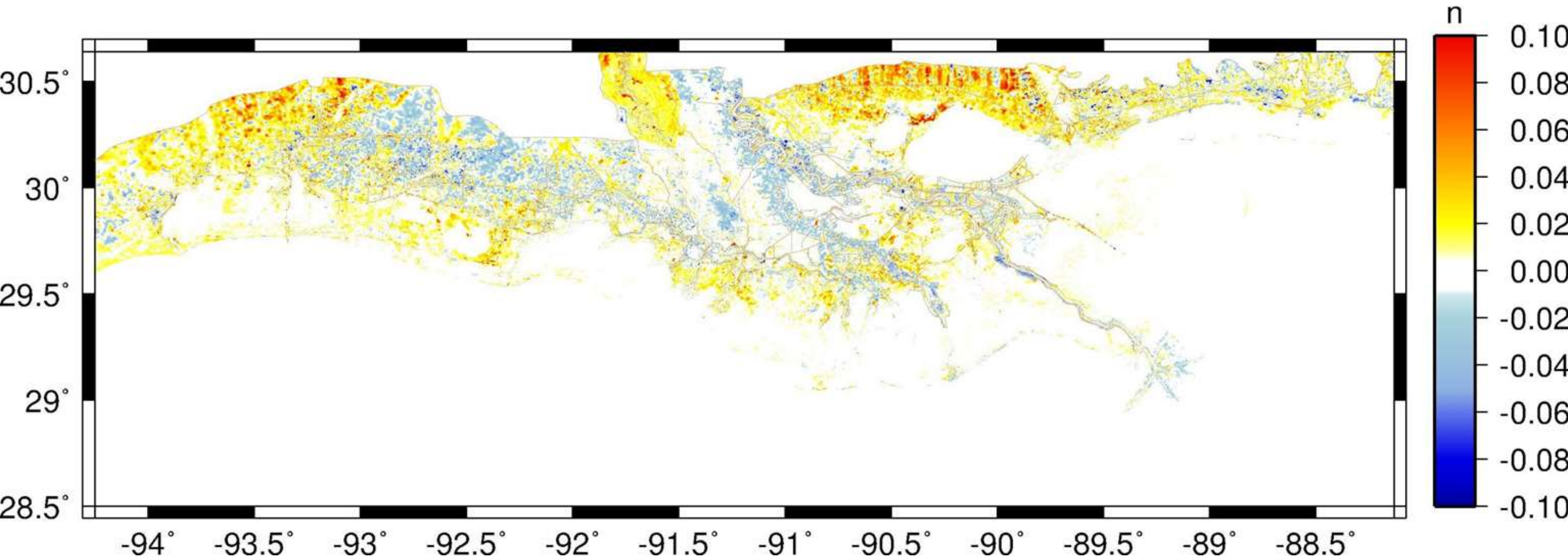
$$s_{node,dir} = \frac{\sum_{i=0}^{n} \frac{z_0(i)}{\sigma\sqrt{2\pi}} e^{\frac{d(i)}{2\sigma^2}}}{\sum_{i=0}^{n} \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{d(i)}{2\sigma^2}}}$$

(2) Gaussian kernel function and direction bins

σ=6.0

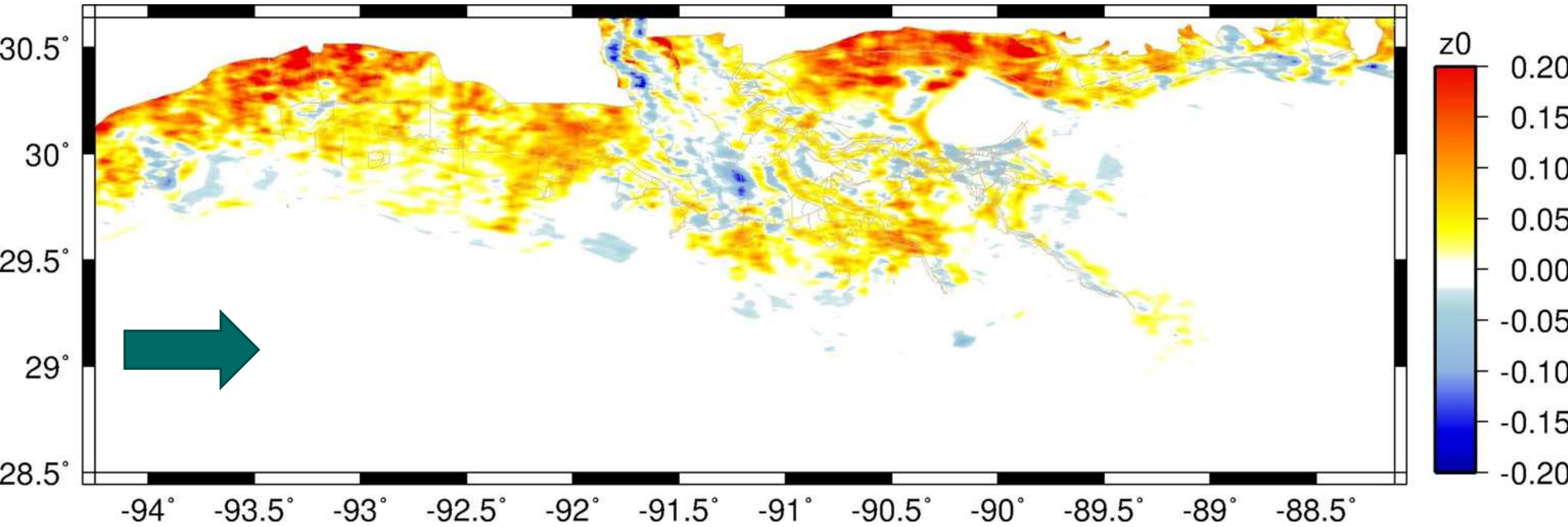
CHANGE IN MANNING'S N FROM 2017 MODEL

STORM SURGE AND WAVES



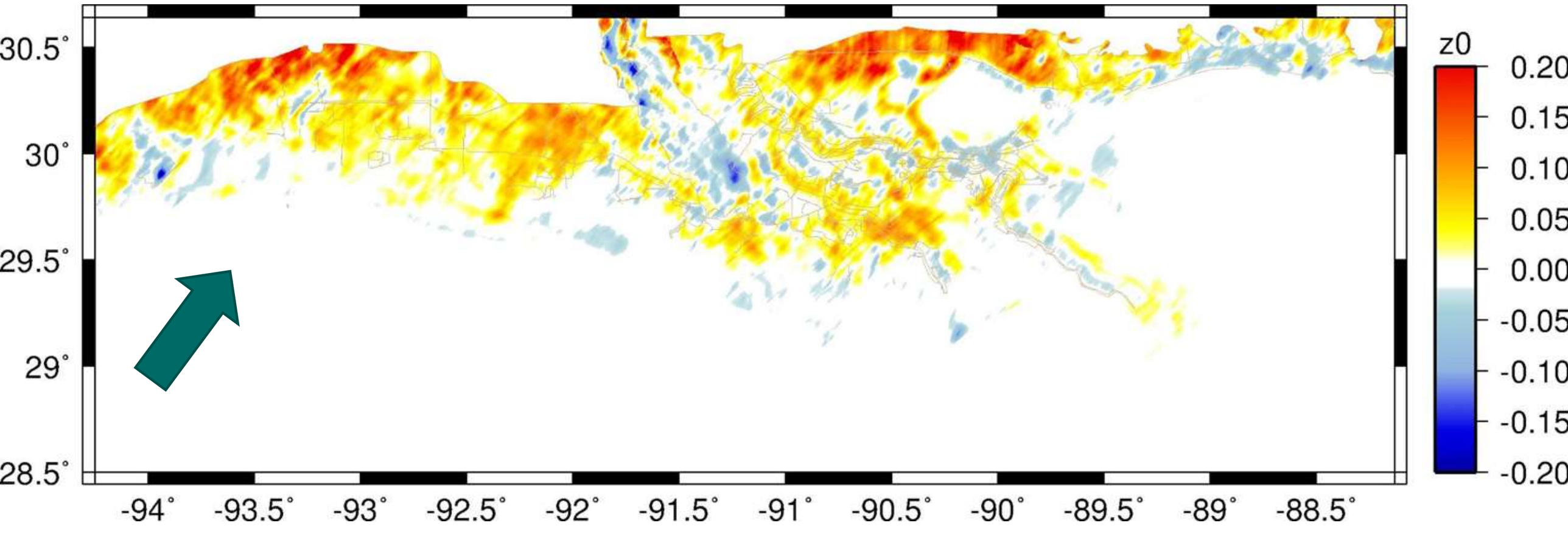
CHANGE IN SURFACE ROUGHNESS (DIRECTION 1) FROM 2017 MODEL

STORM SURGE AND WAVES



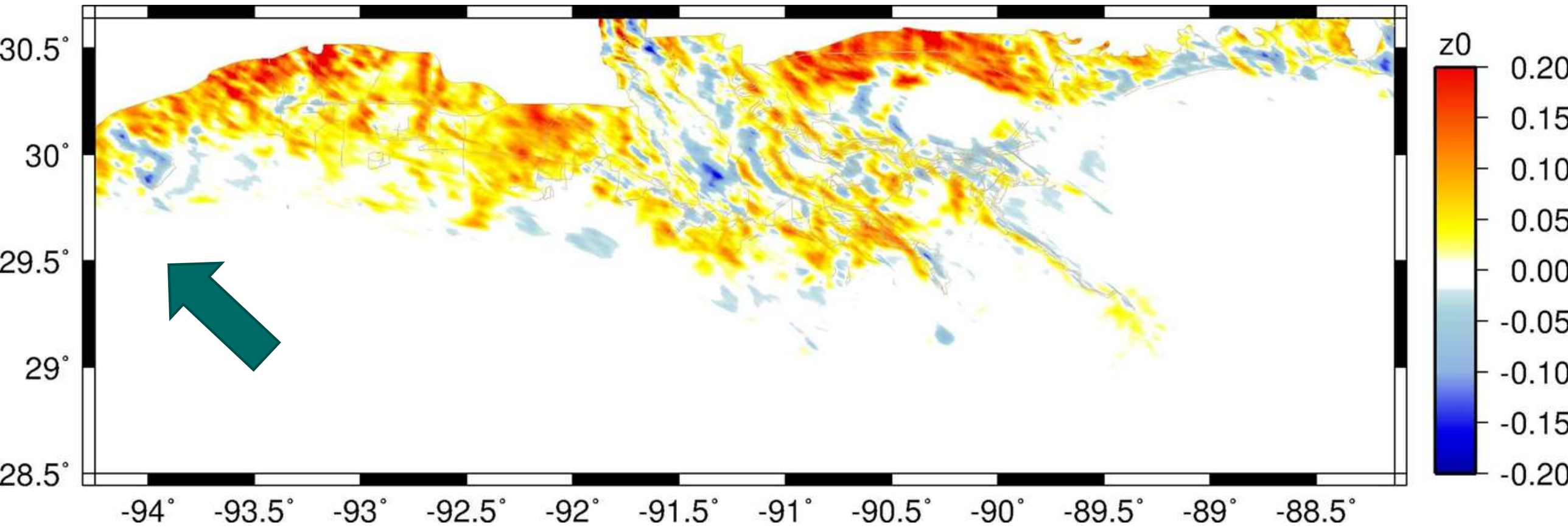
CHANGE IN SURFACE ROUGHNESS (DIRECTION 3) FROM 2017 MODEL

STORM SURGE AND WAVES



CHANGE IN SURFACE ROUGHNESS (DIRECTION 6) FROM 2017 MODEL

STORM SURGE AND WAVES



LEVEE SURVEY UPDATES

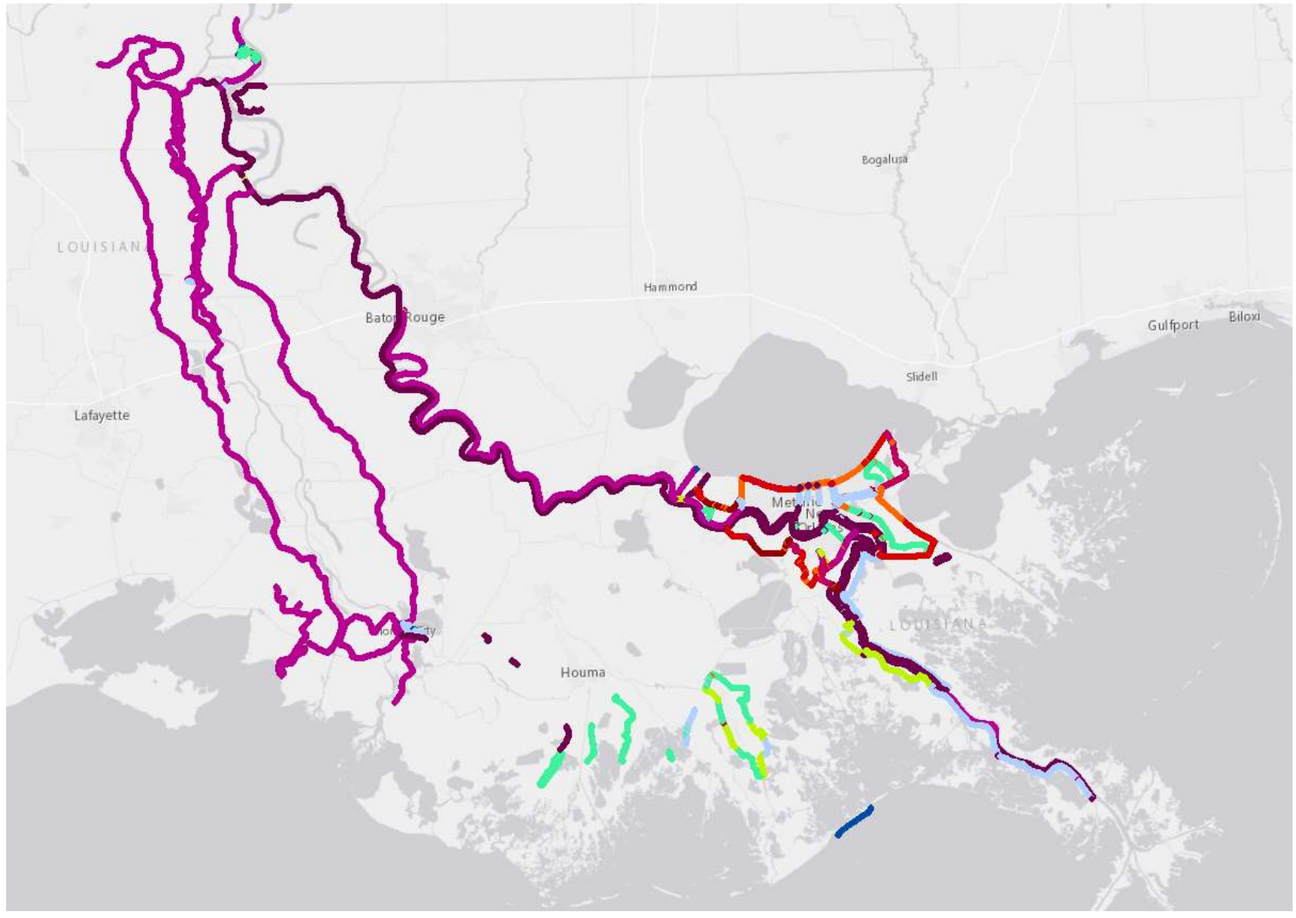
STORM SURGE AND WAVES

- Updated subsidence rates for Louisiana
- Updated and best available survey
  - USACE
  - St. Tammany Parish
  - Sea Grant

USACE LEVEE UPDATES

STORM SURGE AND WAVES

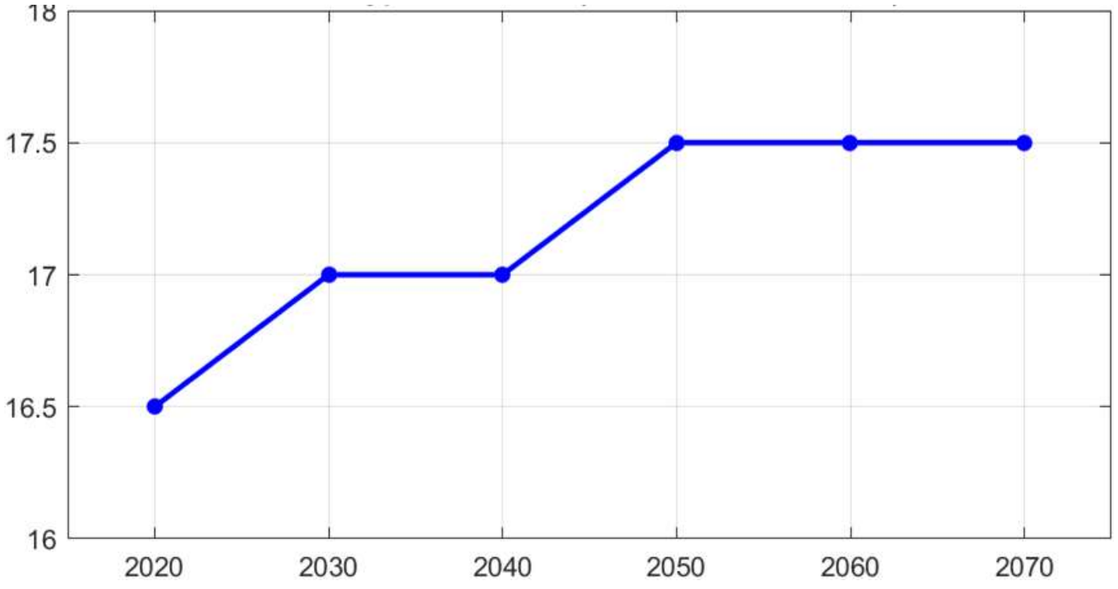
- All Atchafalaya and Mississippi River levees have been surveyed since last Master Plan
- USACE has recommended a linear, upward interpolation of levee elevations rounded upward to nearest 0.5ft rather than toggling to future authorized design at a specific date



USACE Levee Survey colored by survey date. Warmer = newer, Cooler = older

USACE LEVEE UPDATES

STORM SURGE AND WAVES



Levee Elevation between 2020 and 2070 (ft, NAVD88 2009.55)

Locations of USACE Levee survey

MODEL VALIDATION

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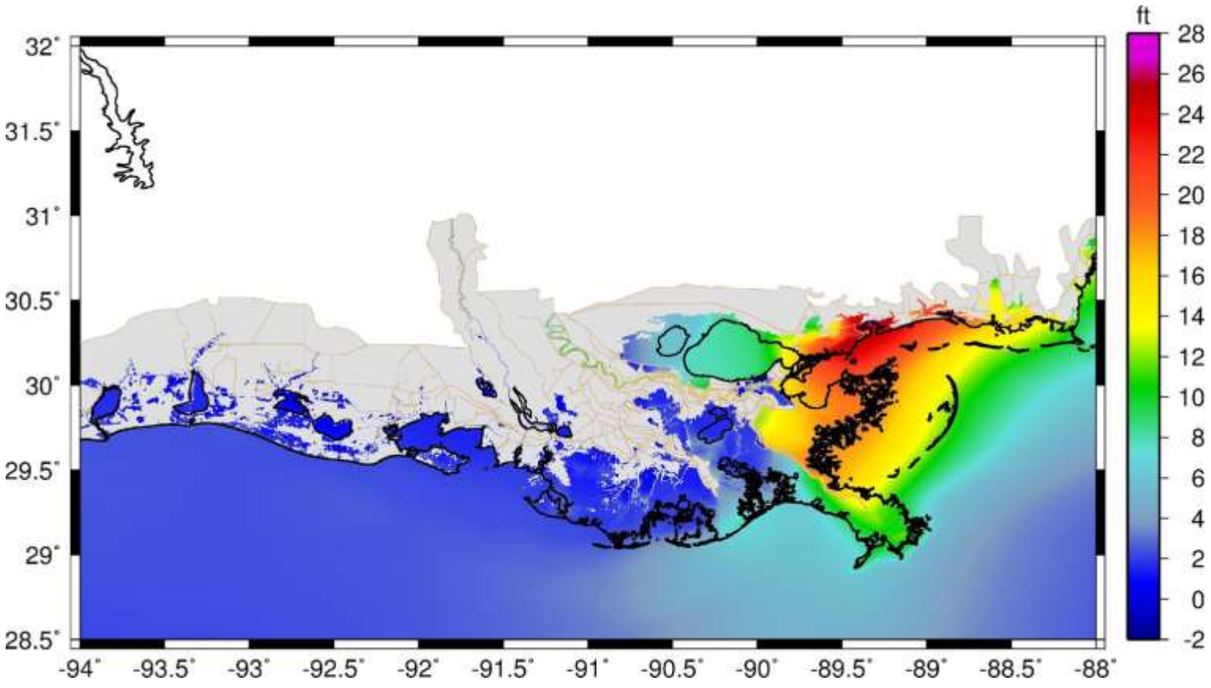
STORM SURGE AND WAVES

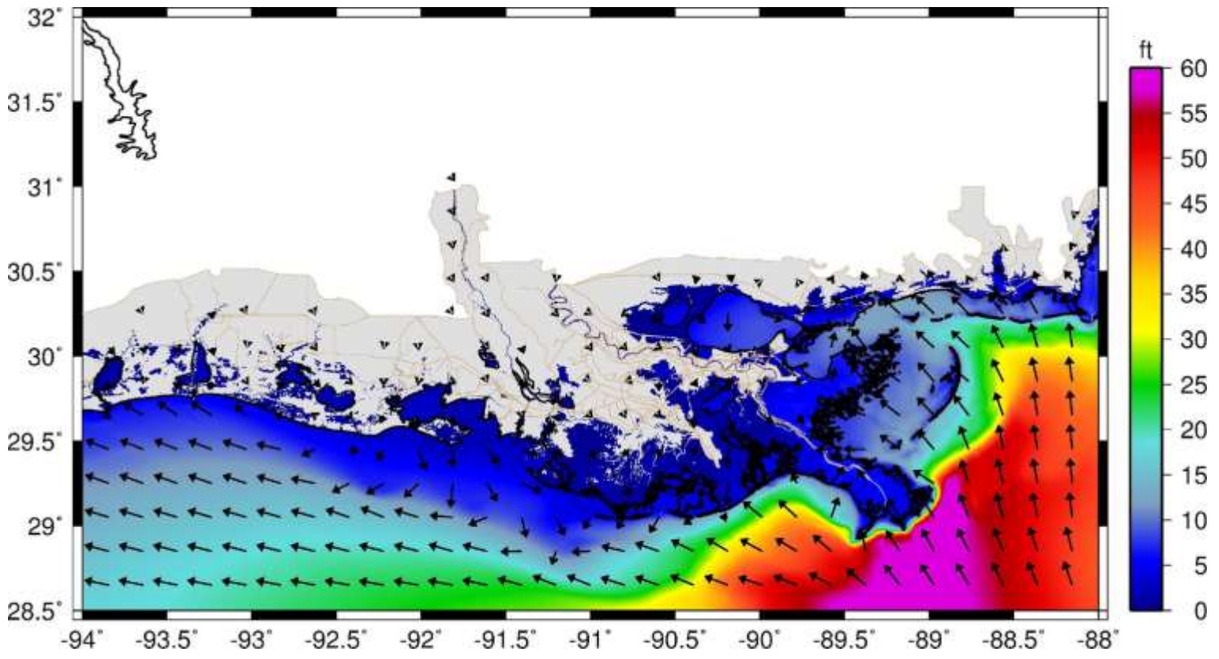
- Final model validation is in progress and results are not final

HURRICANE KATRINA

STORM SURGE AND WAVES



Maximum Water Surface Elevation (ft, NAVD88 2009.55)



Maximum Significant Wave Height (ft) and direction

HURRICANE KATRINA

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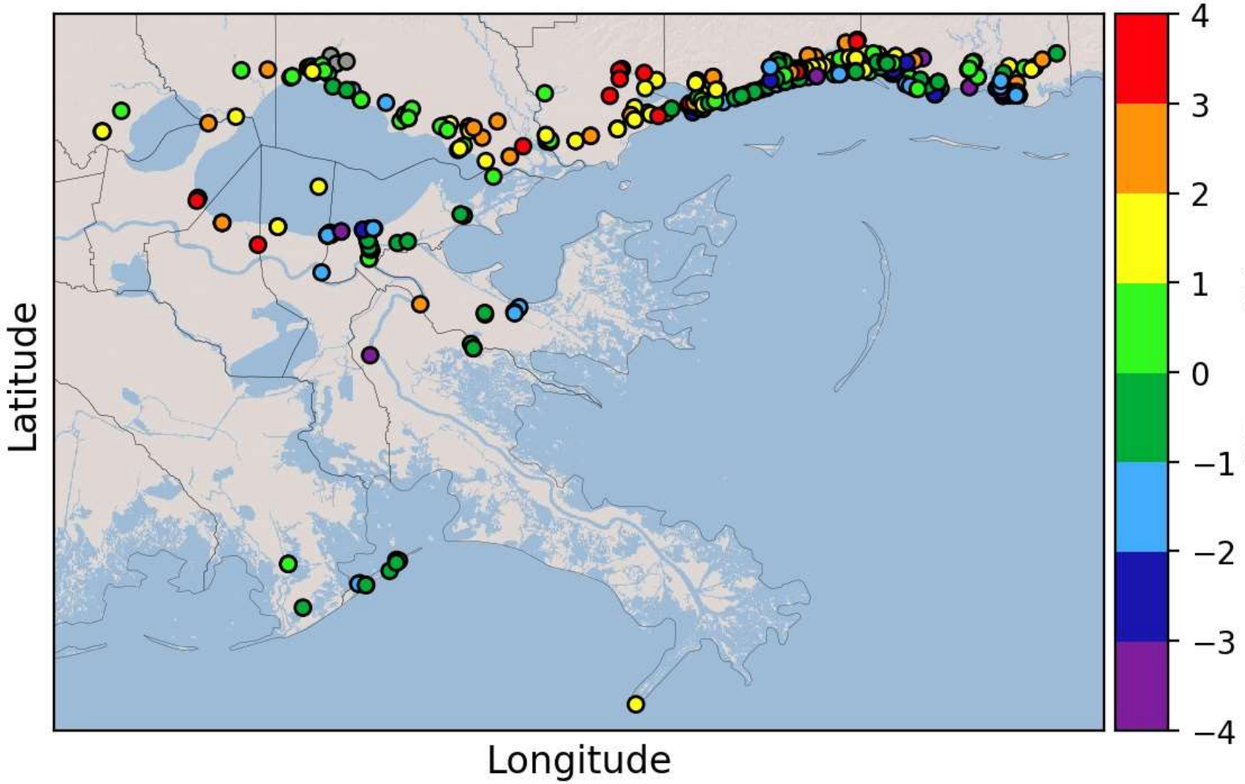
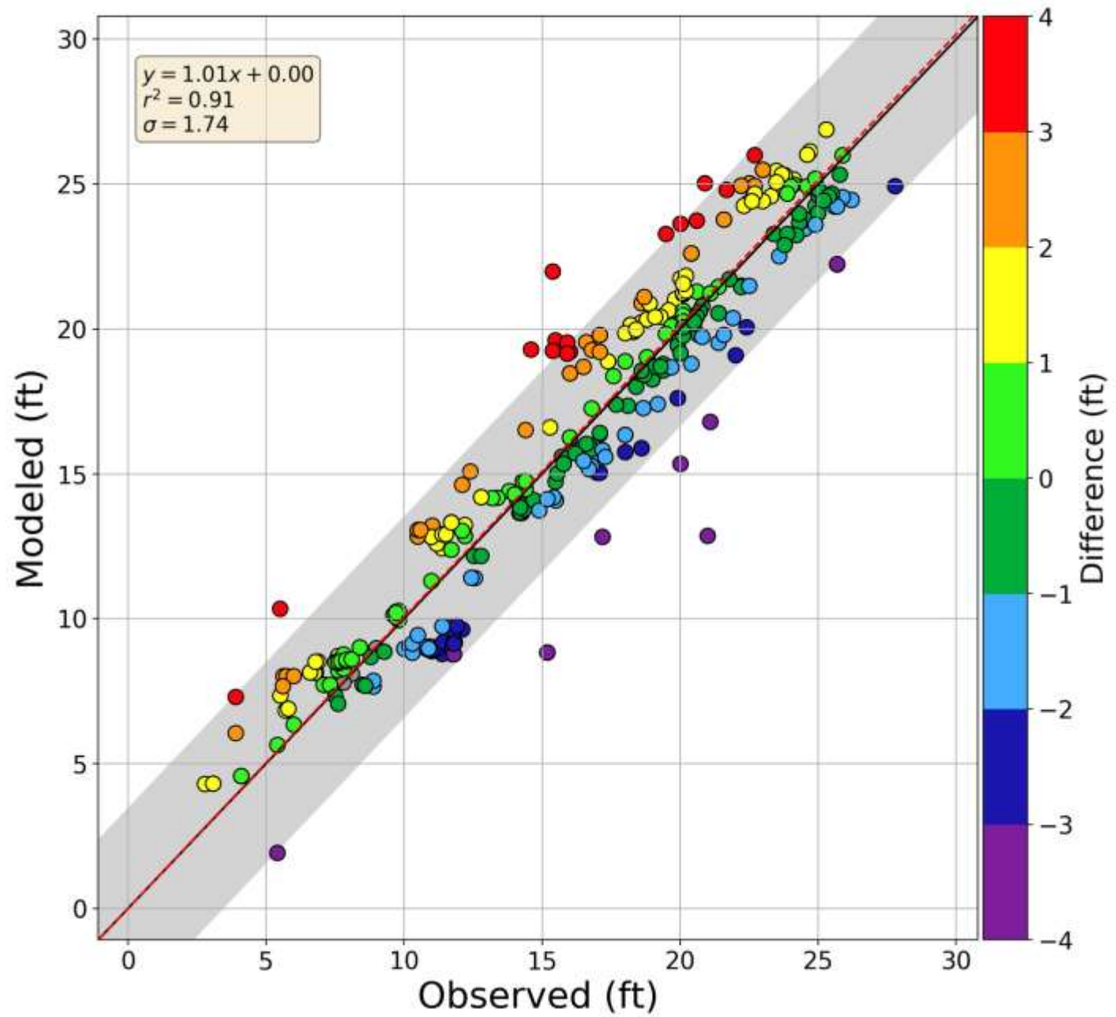


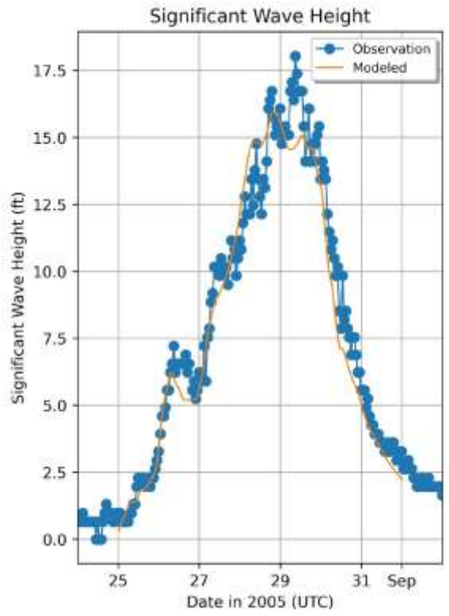
High Water Mark Spatial Plot

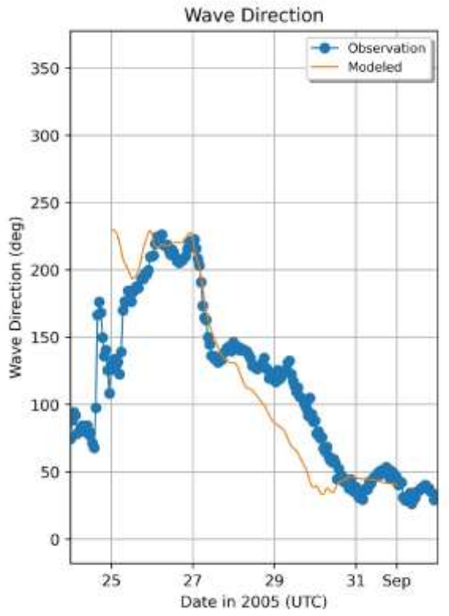


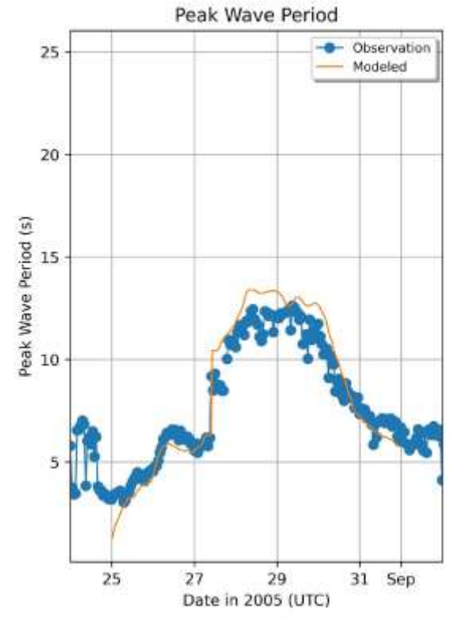
High Water Mark Scatter Plot

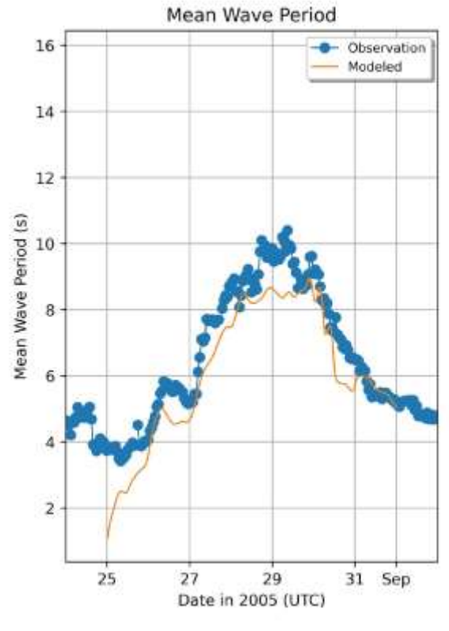
HURRICANE KATRINA WAVE OBSERVATIONS

STORM SURGE AND WAVES









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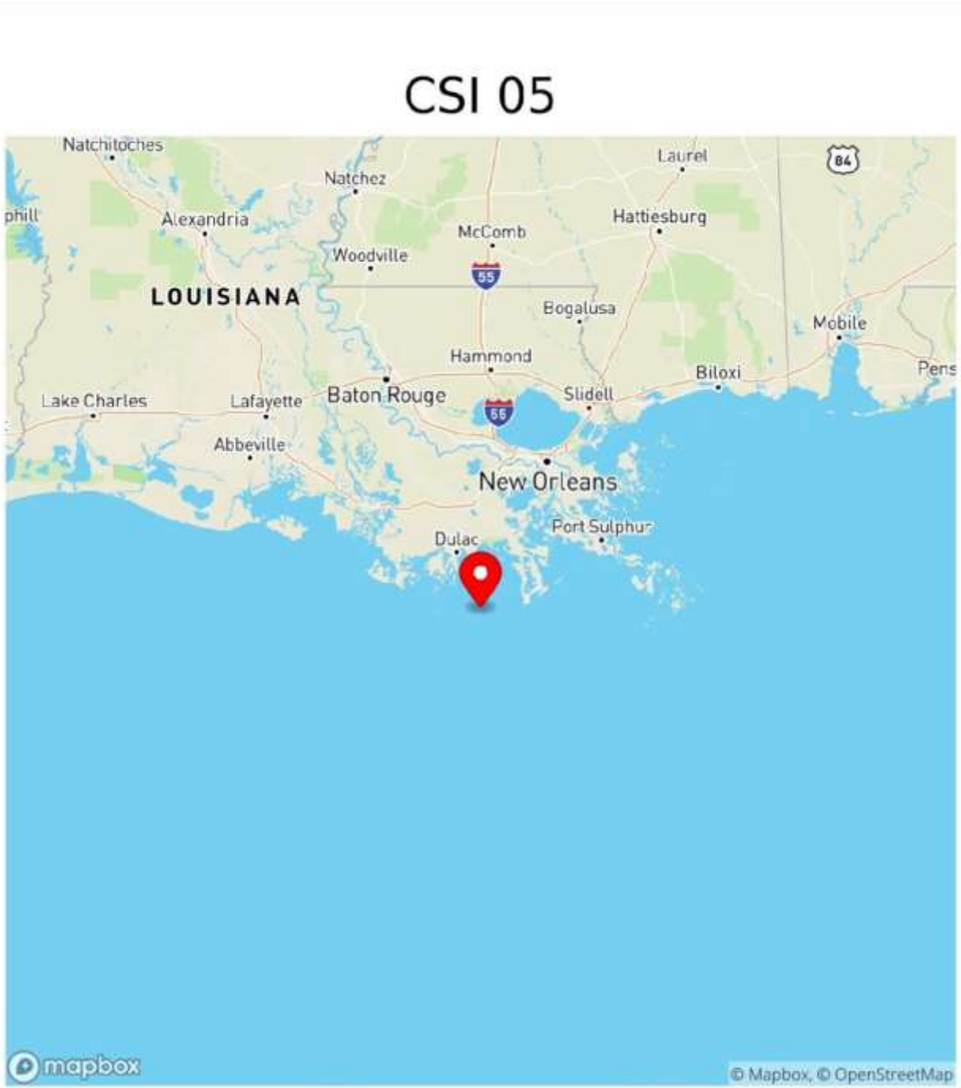
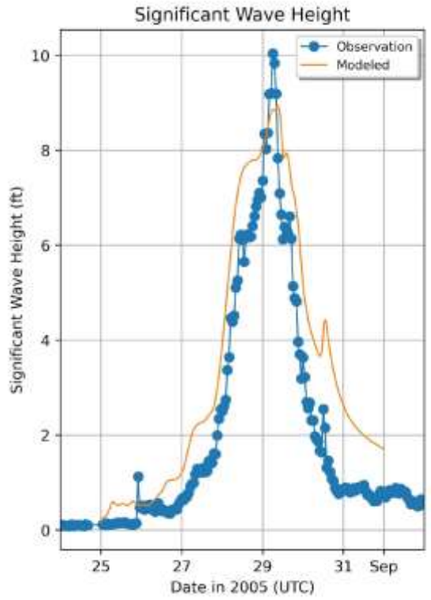
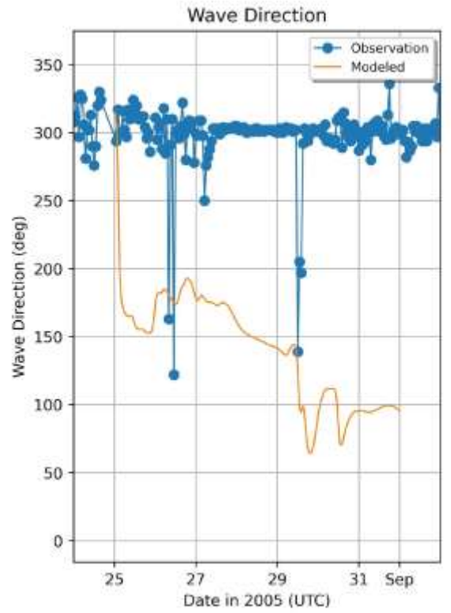
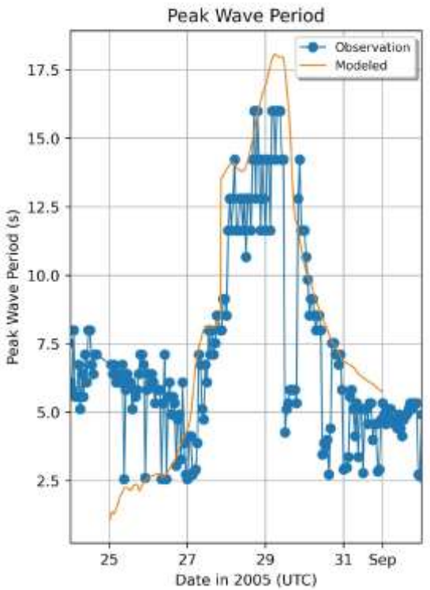
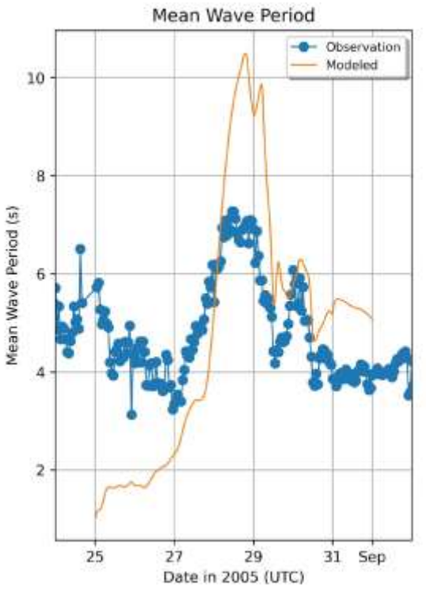
STORM SURGE AND WAVES





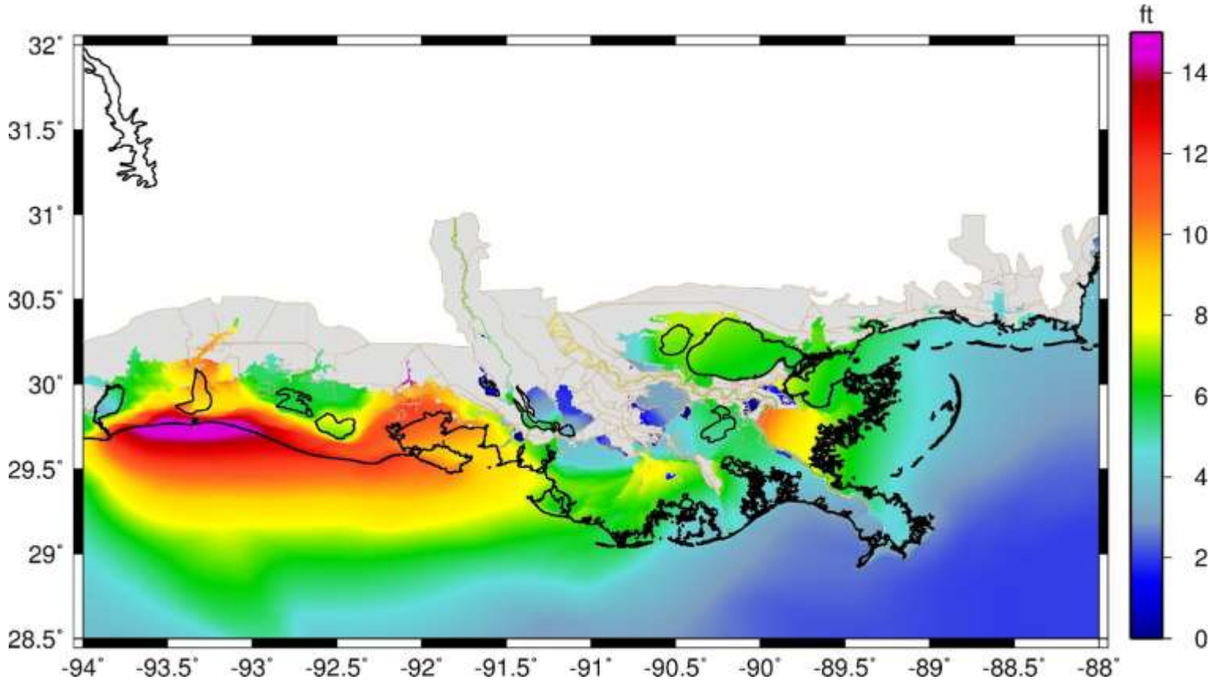




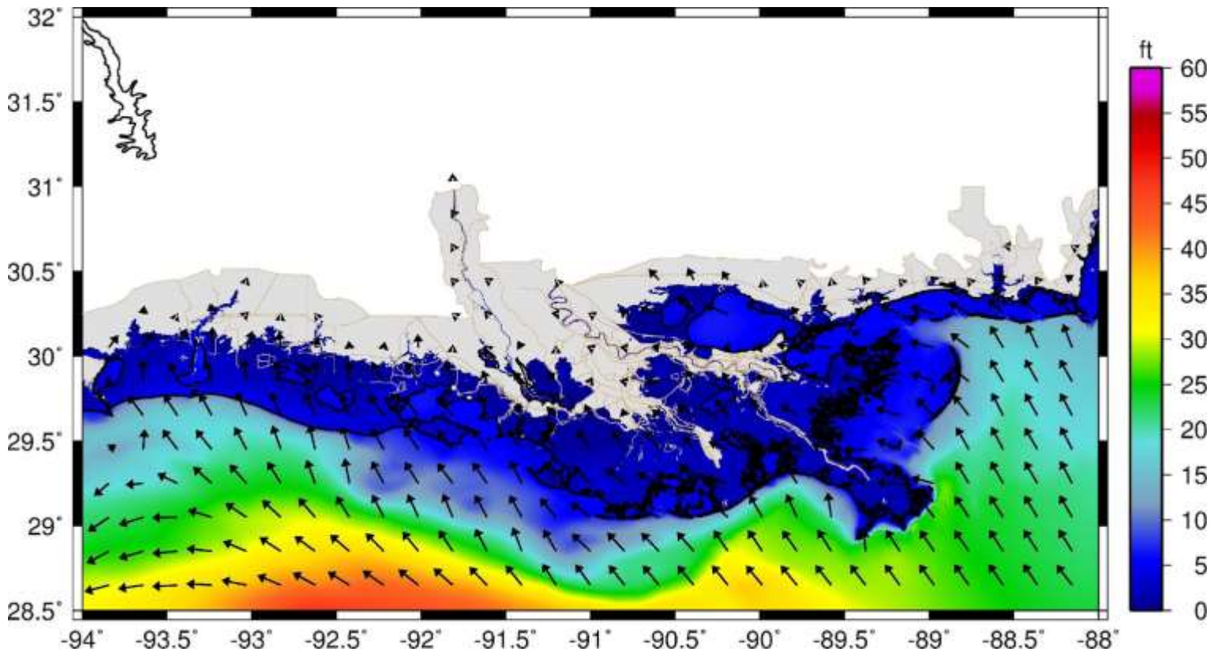


HURRICANE RITA

STORM SURGE AND WAVES



Maximum Water Surface Elevation (ft, NAVD88 2009.55)



Maximum Significant Wave Height (ft) and direction

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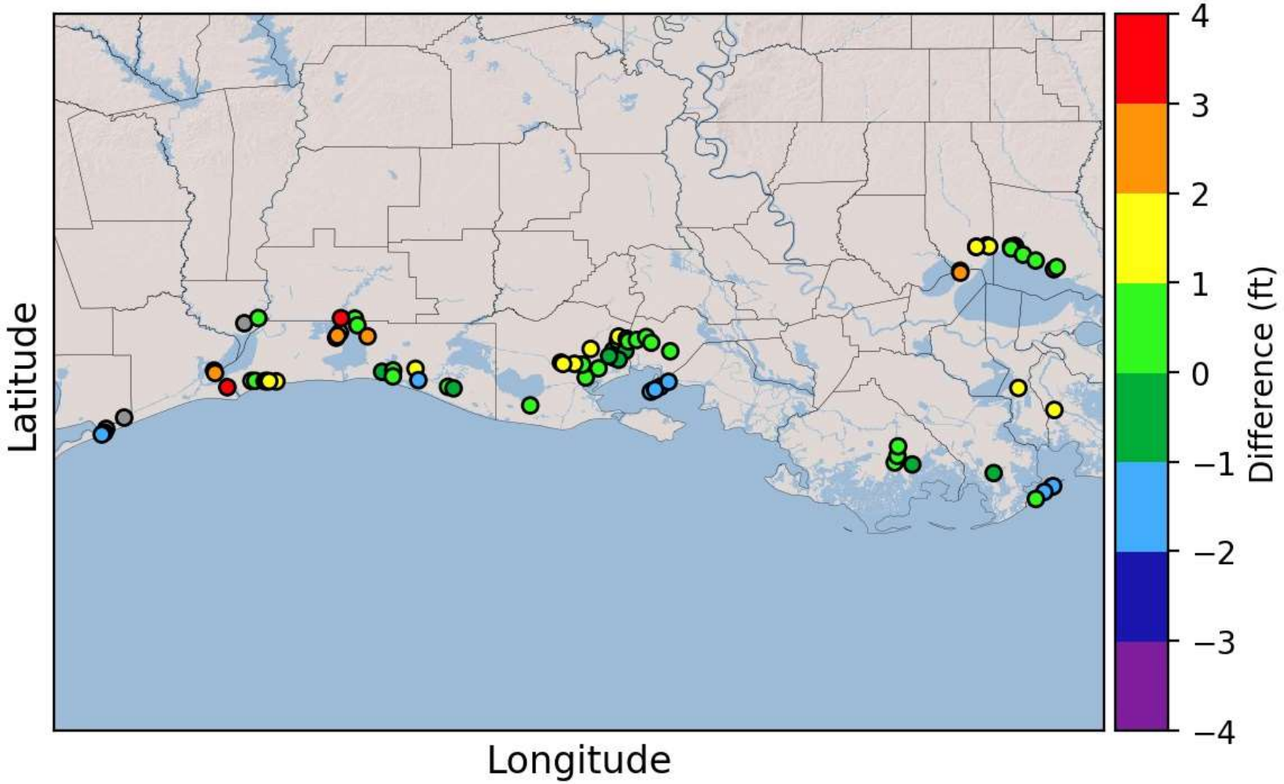
STORM SURGE AND WAVES



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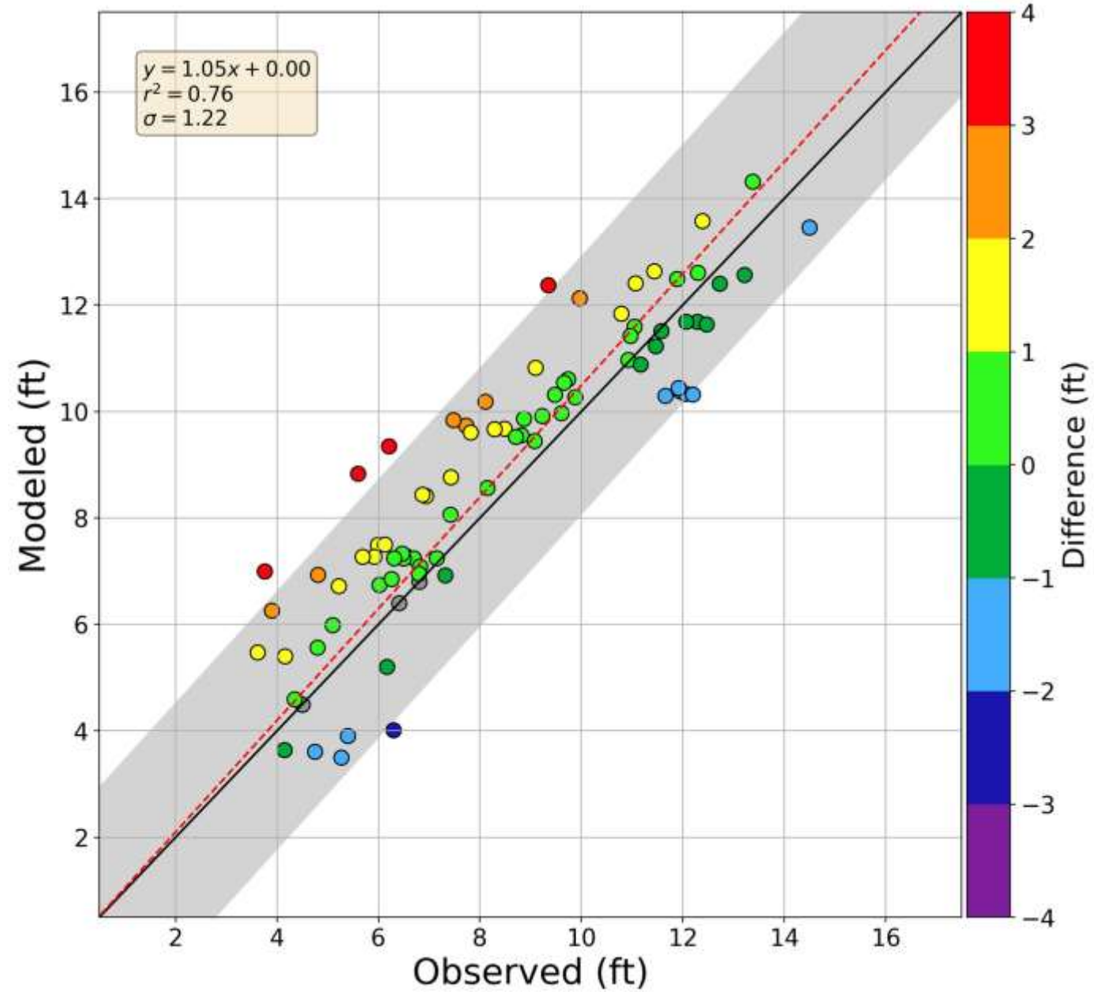
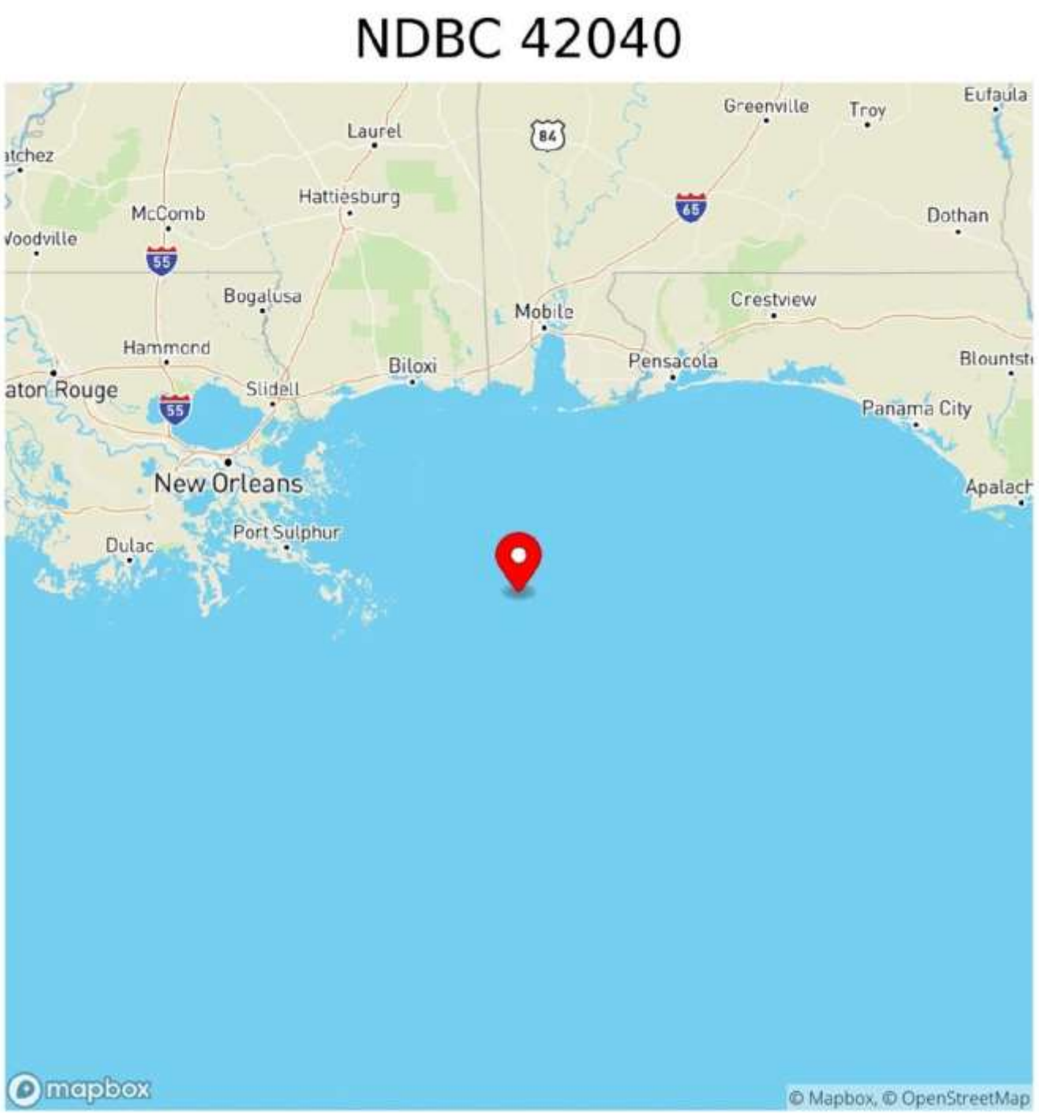
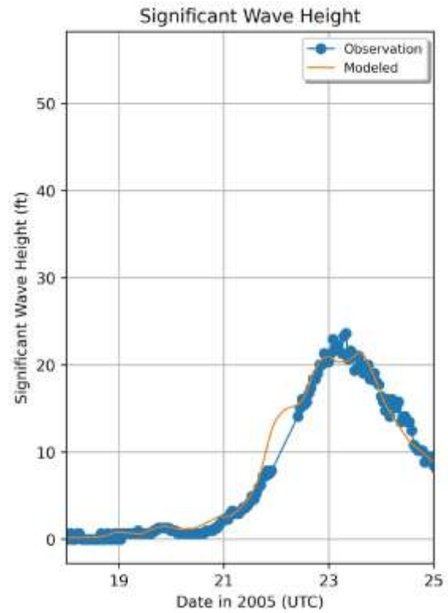


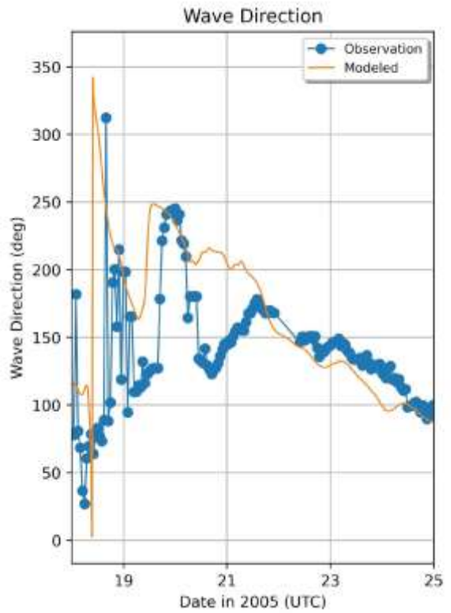
High Water Mark Scatter Plot

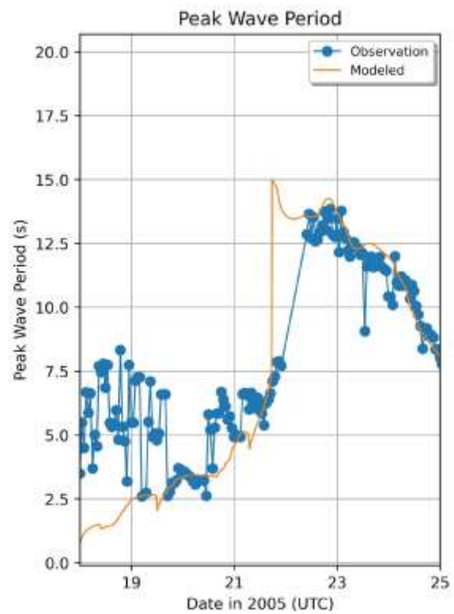
HURRICANE RITA WAVE OBSERVATIONS

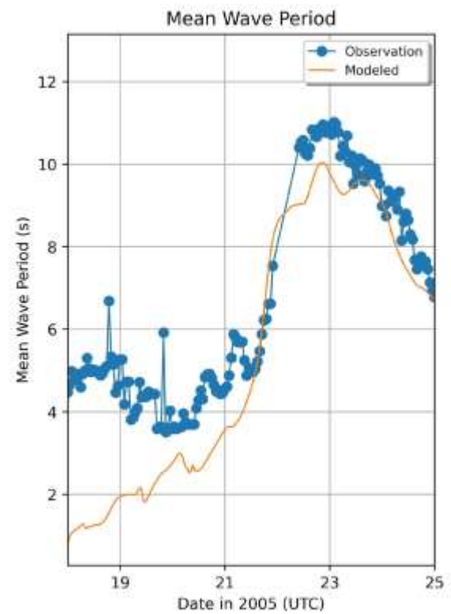
STORM SURGE AND WAVES





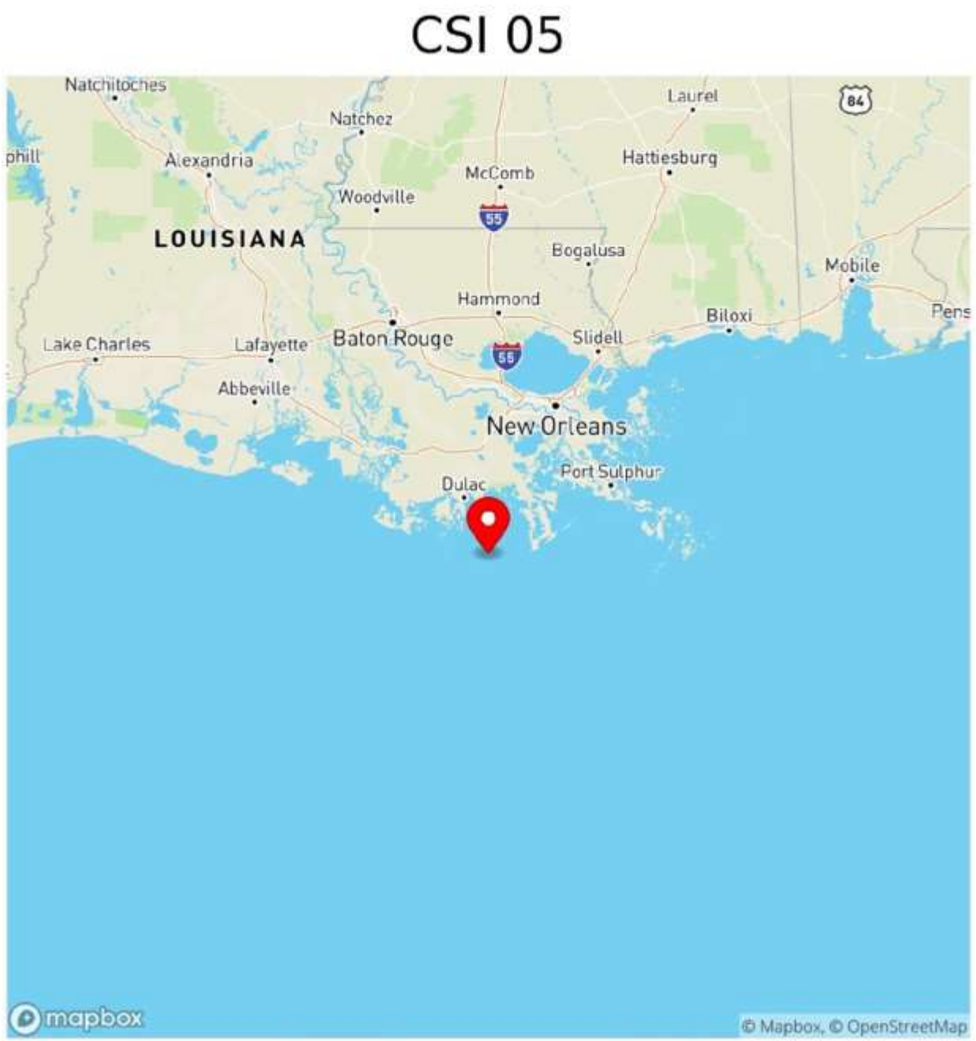


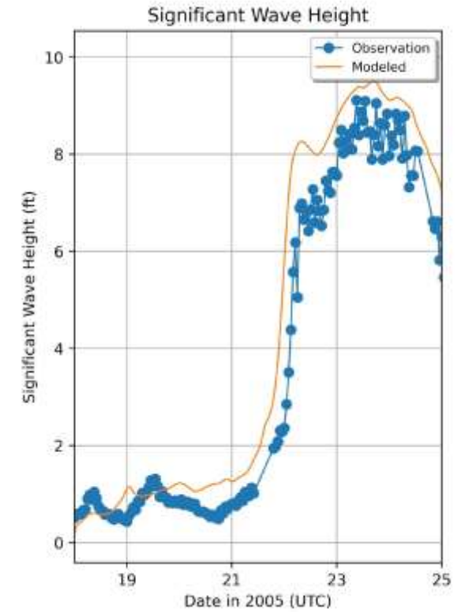


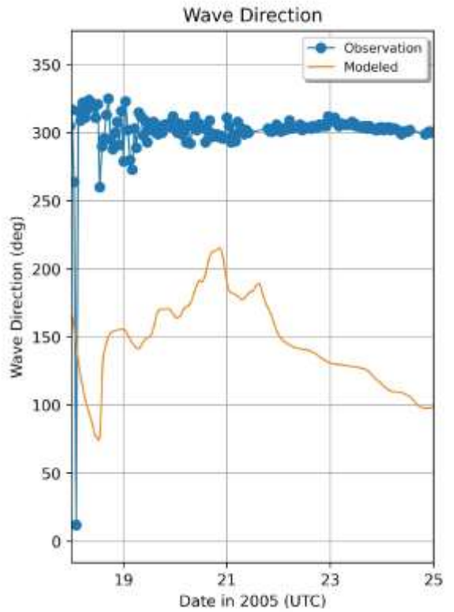


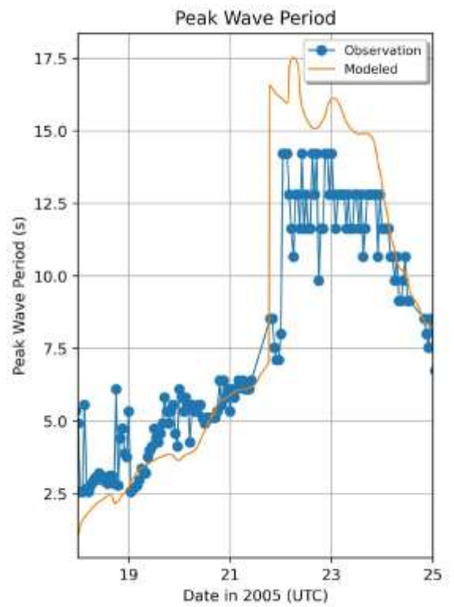
HURRICANE RITA WAVE OBSERVATIONS

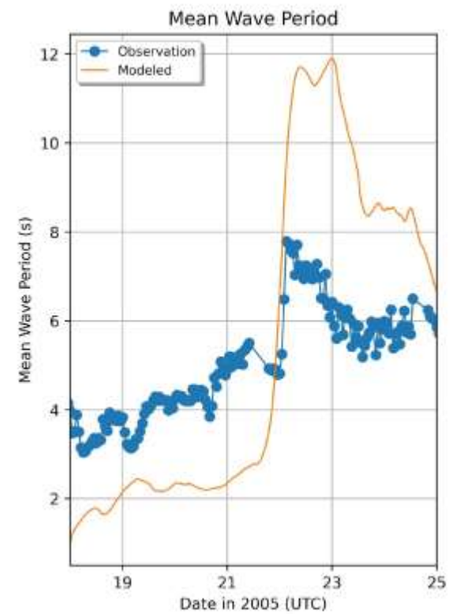
STORM SURGE AND WAVES





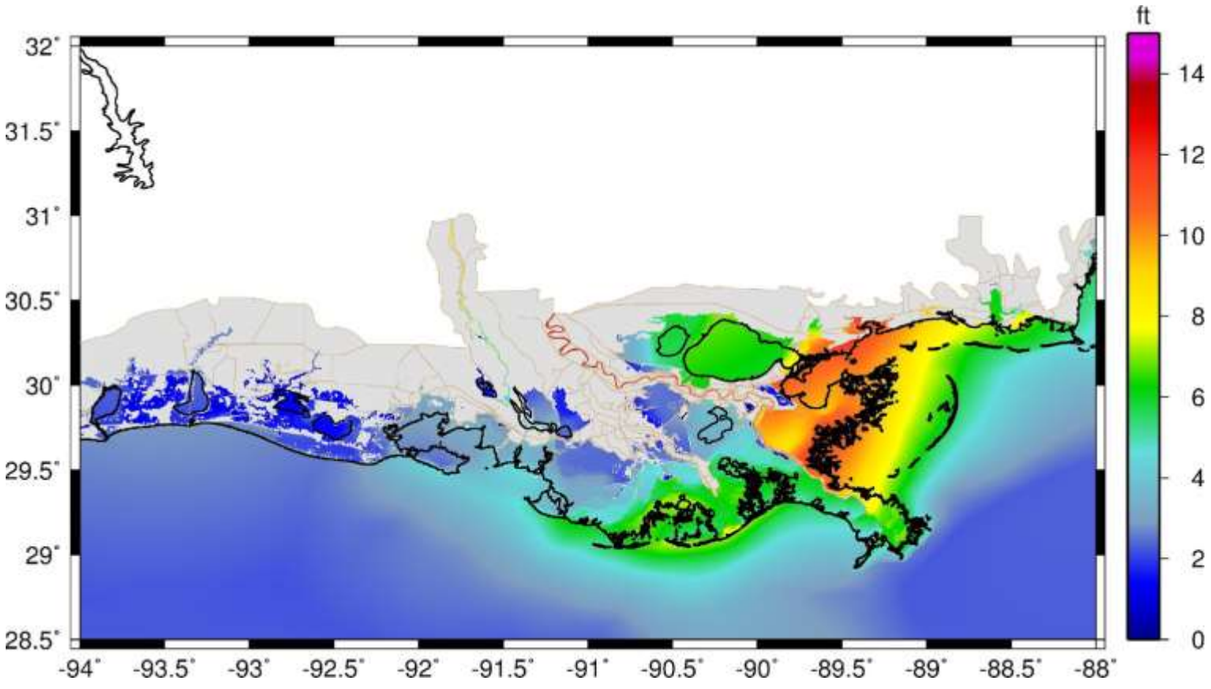




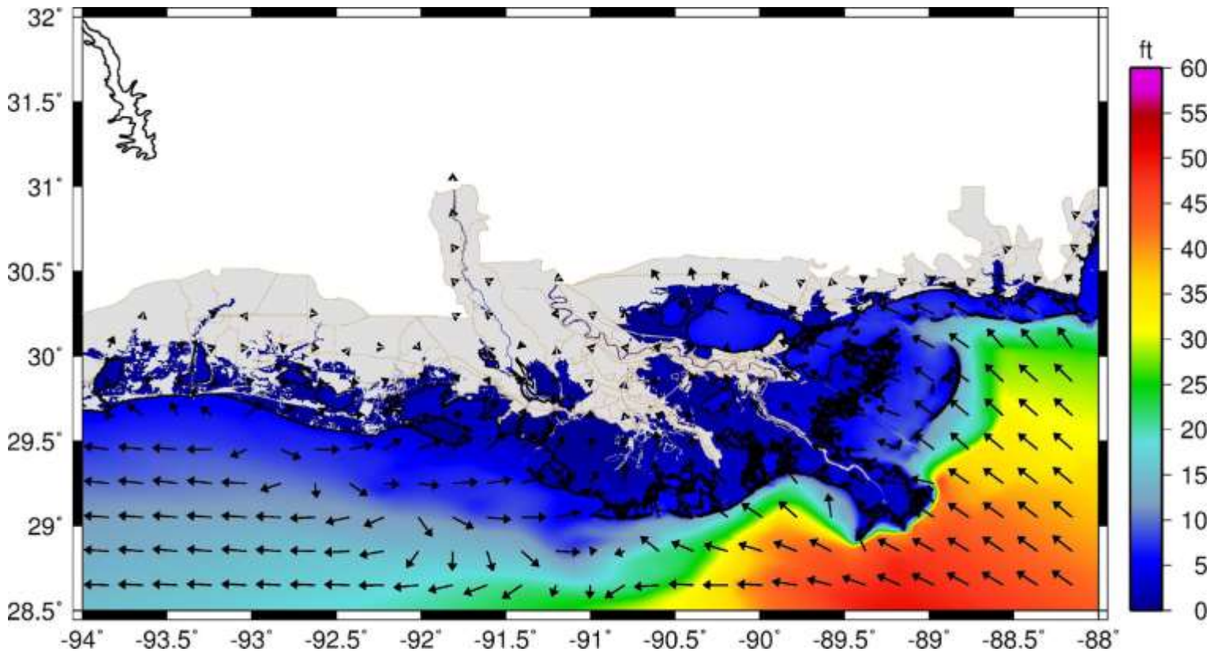


HURRICANE GUSTAV

STORM SURGE AND WAVES



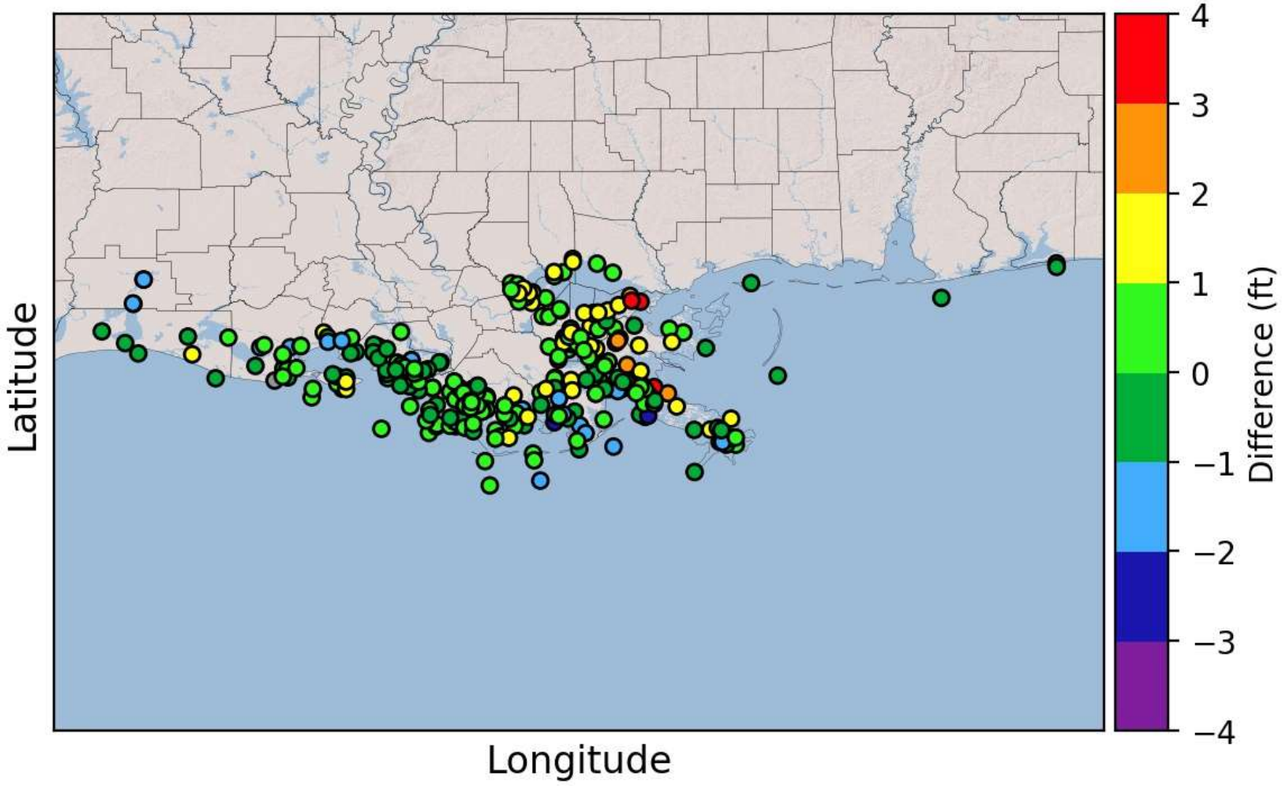
Maximum Water Surface Elevation (ft, NAVD88 2009.55)



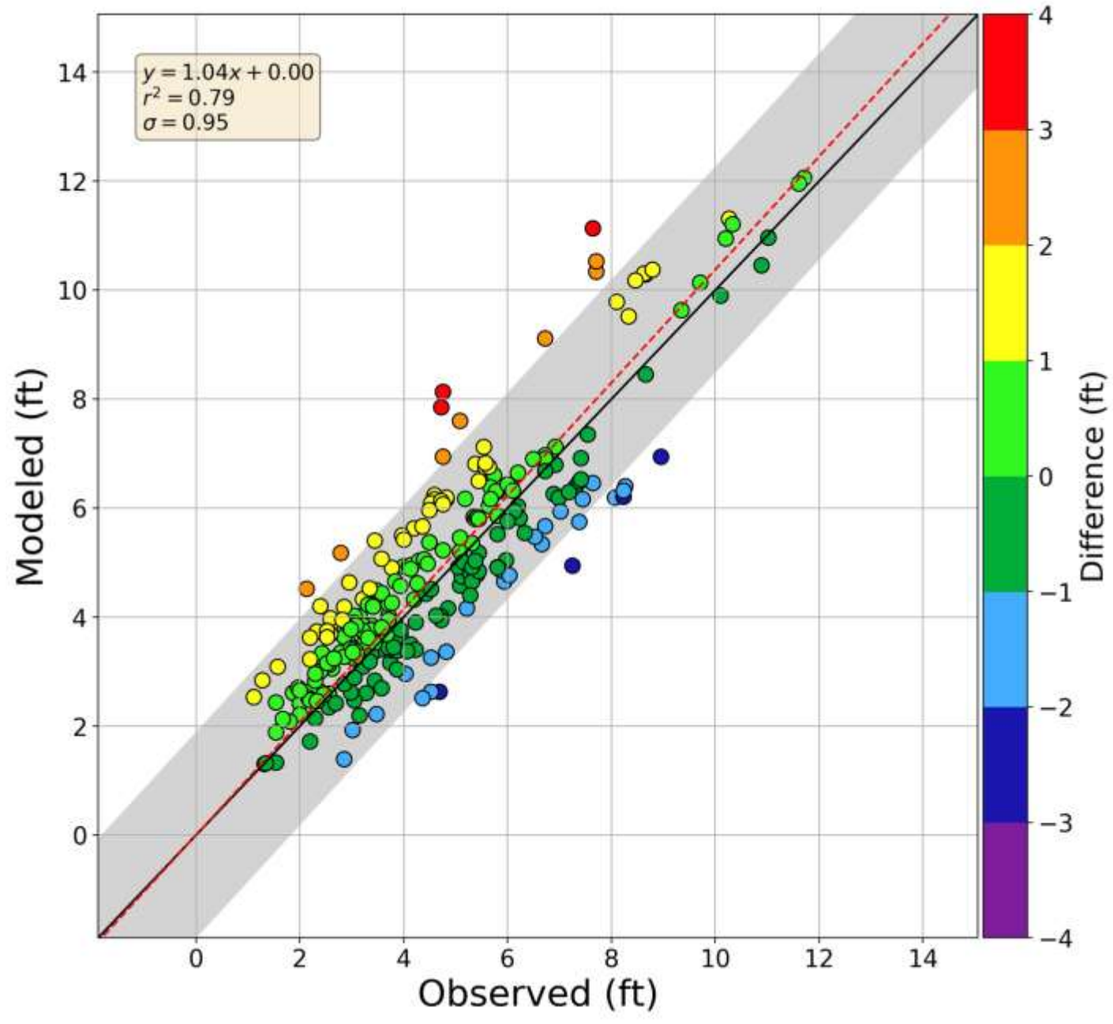
Maximum Significant Wave Height (ft) and direction

HURRICANE GUSTAV

STORM SURGE AND WAVES



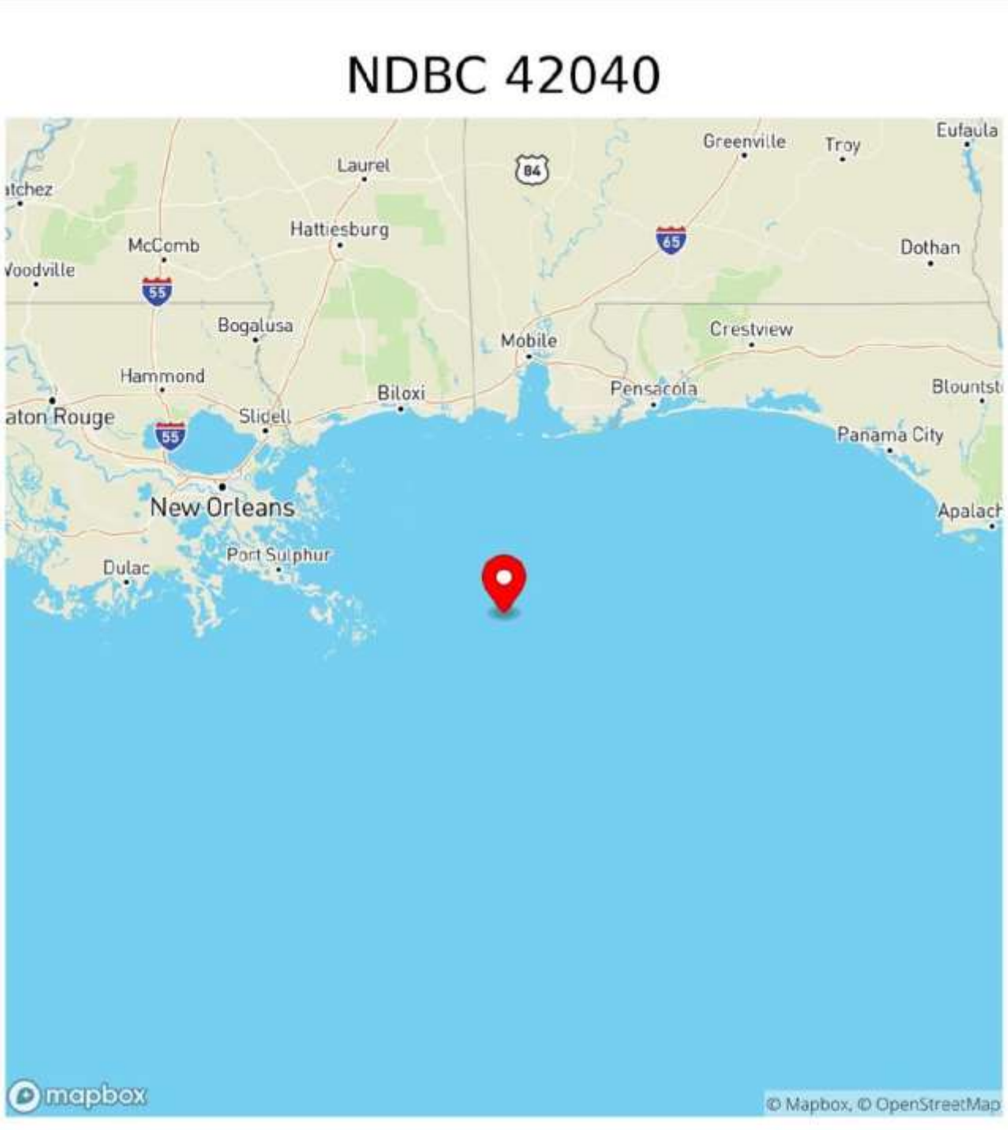
High Water Mark Spatial Plot

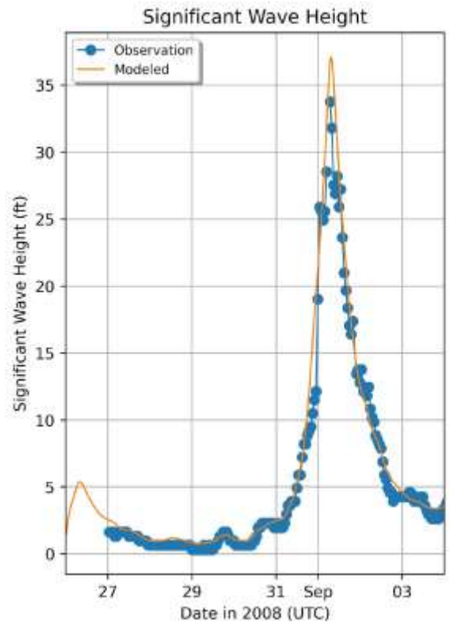


High Water Mark Scatter Plot

HURRICANE GUSTAV WAVE OBSERVATIONS

STORM SURGE AND WAVES





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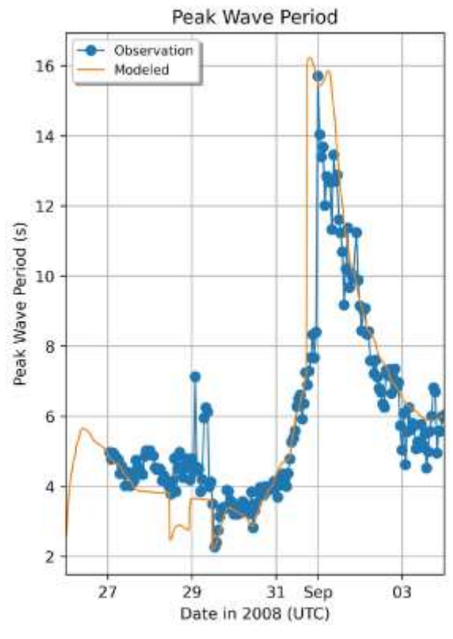
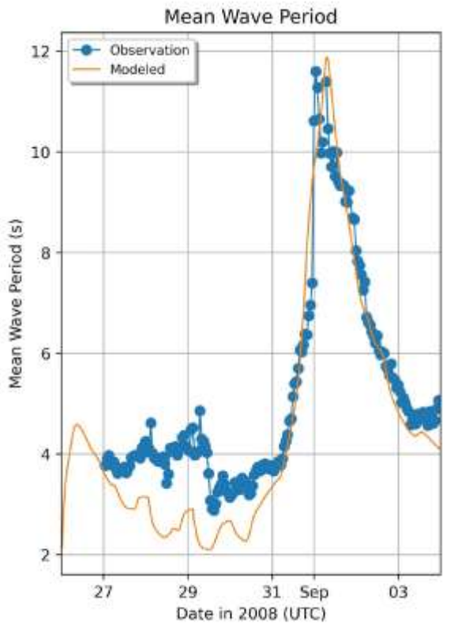
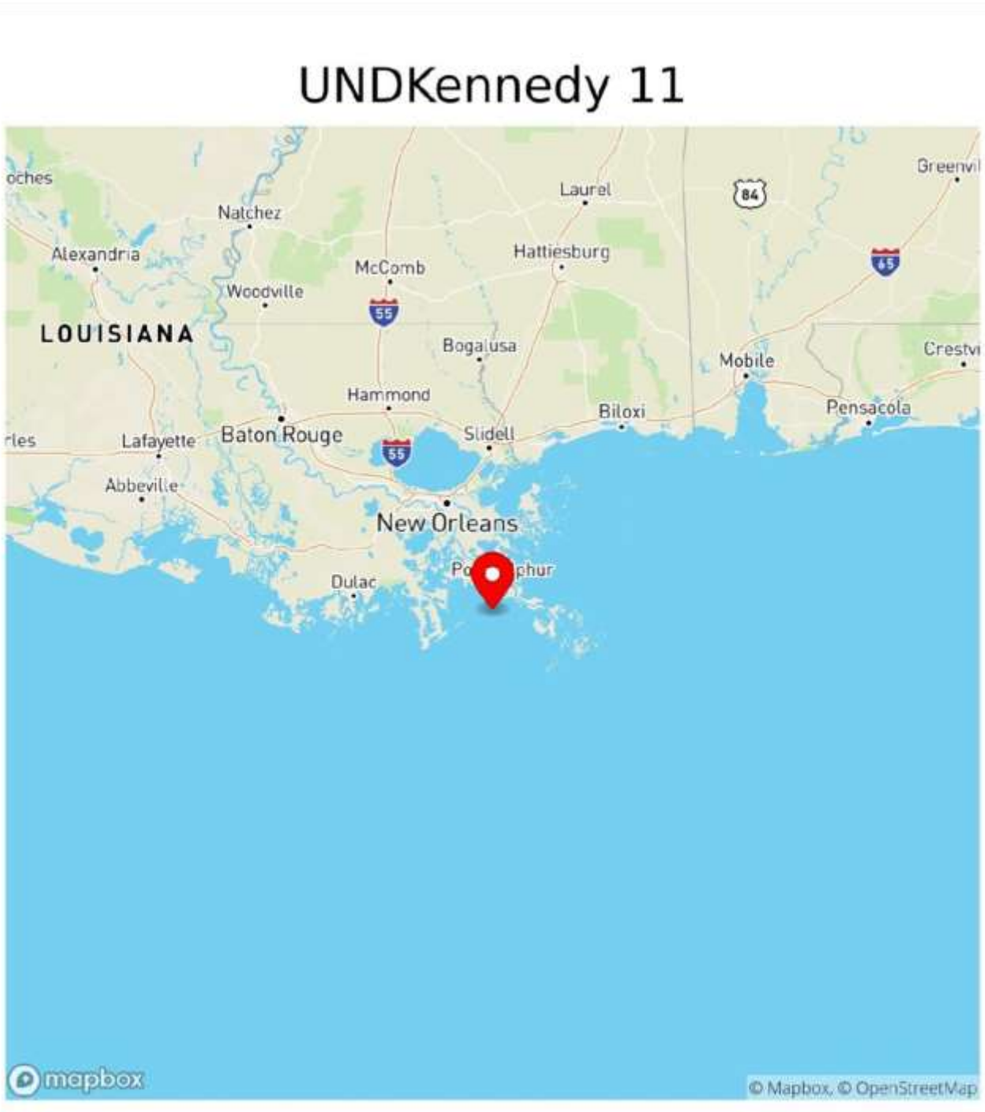
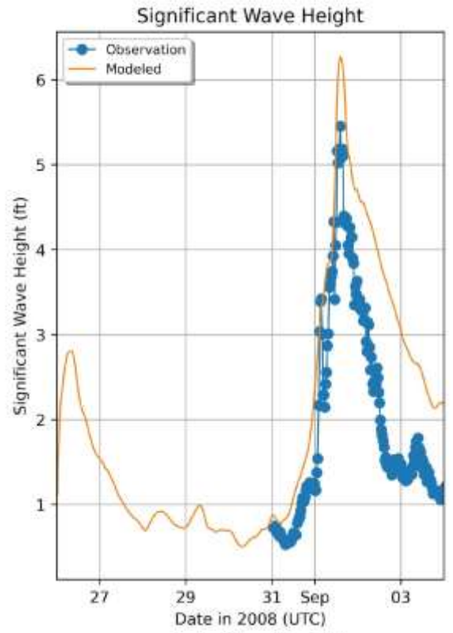




HURRICANE GUSTAV WAVE OBSERVATIONS

STORM SURGE AND WAVES





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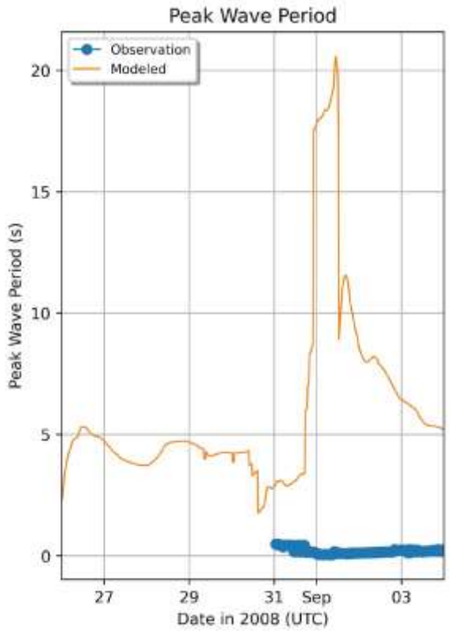

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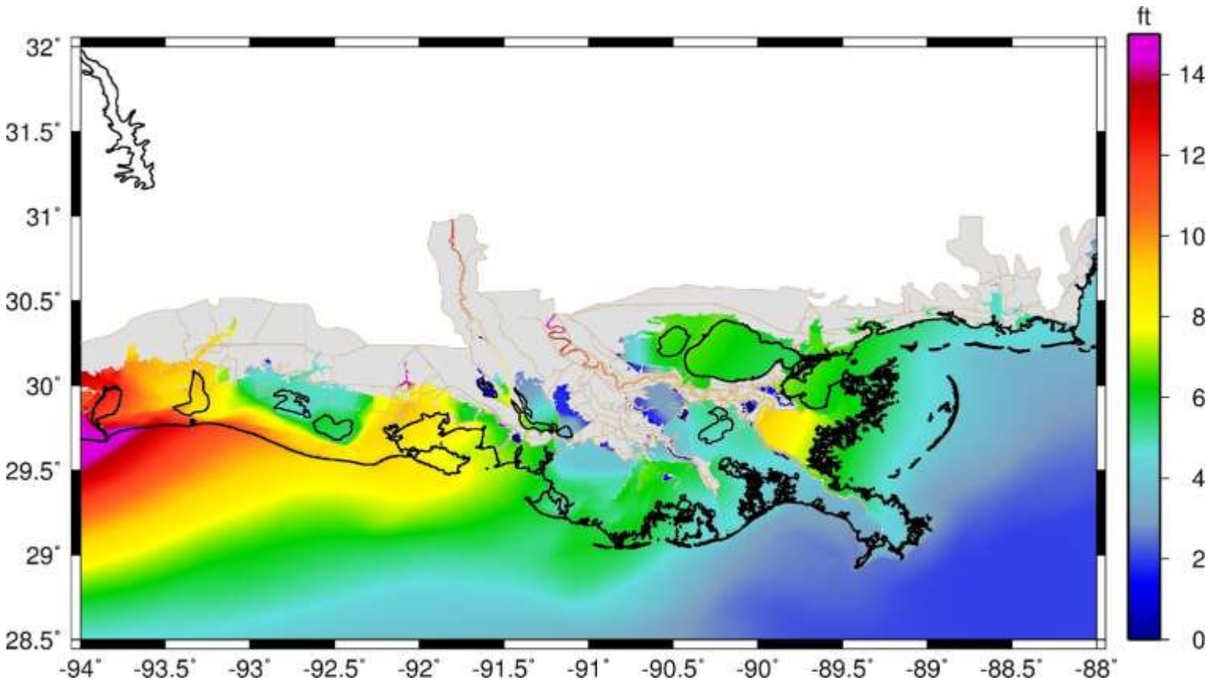
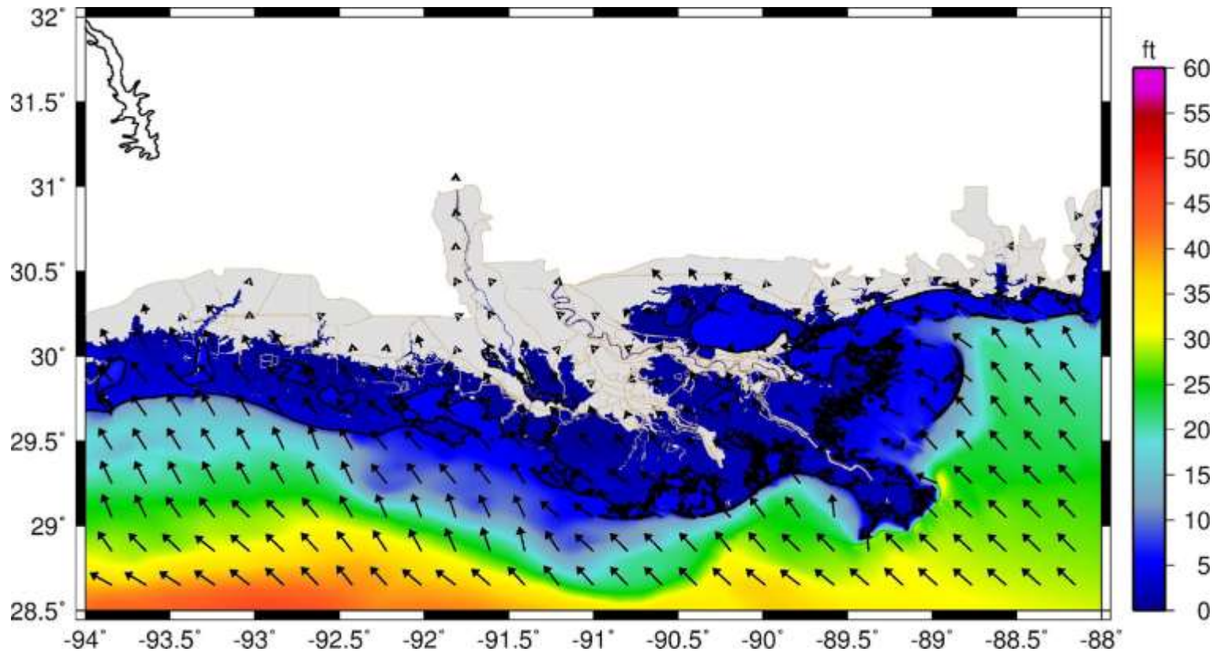
HURRICANE IKE

STORM SURGE AND WAVES



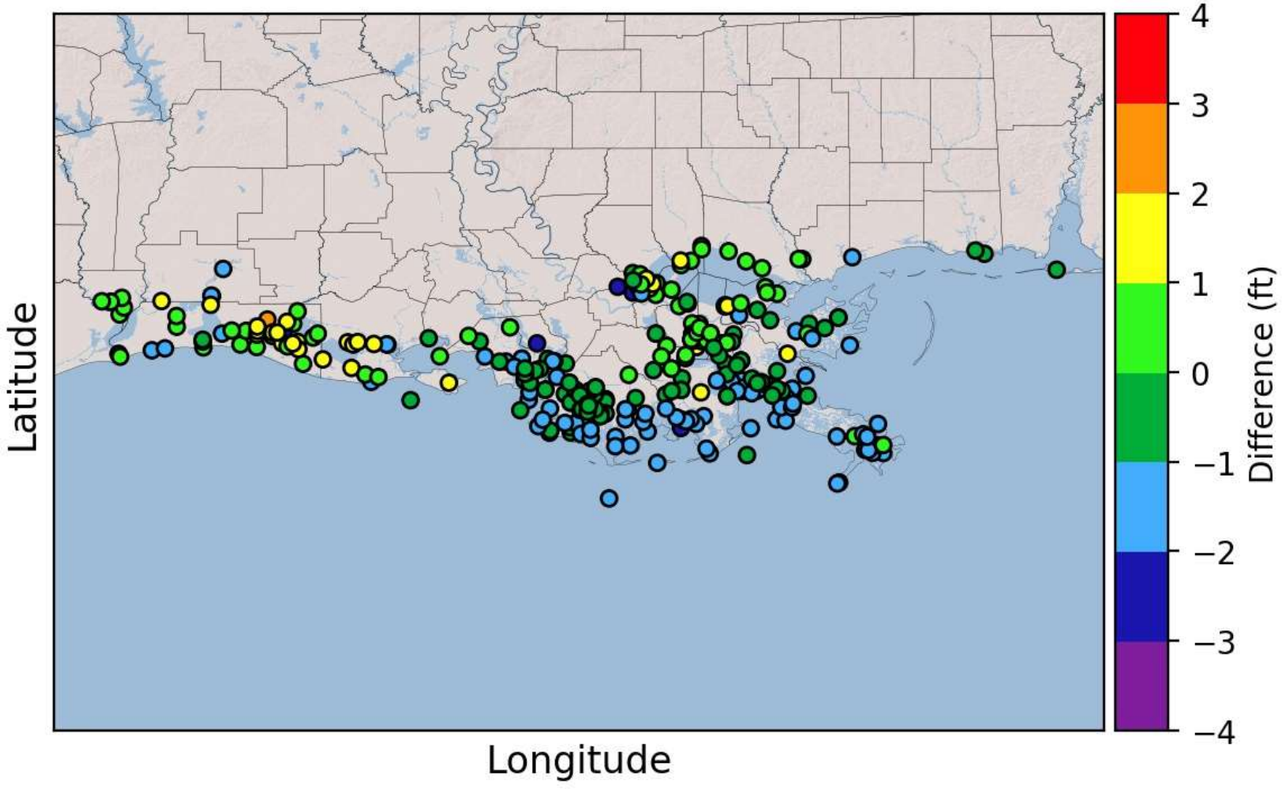
Maximum Water Surface Elevation (ft, NAVD88 2009.55)



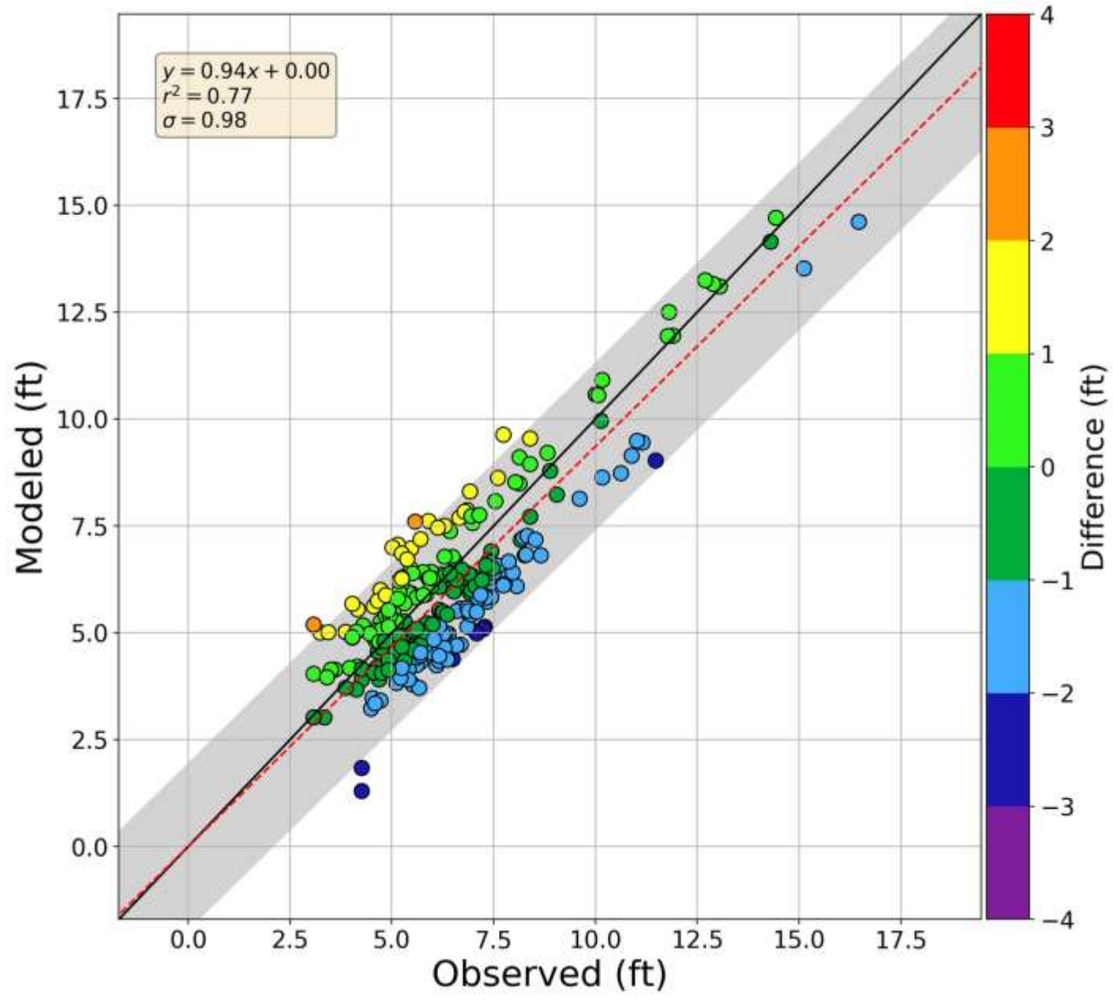
Maximum Significant Wave Height (ft) and direction

HURRICANE IKE

STORM SURGE AND WAVES



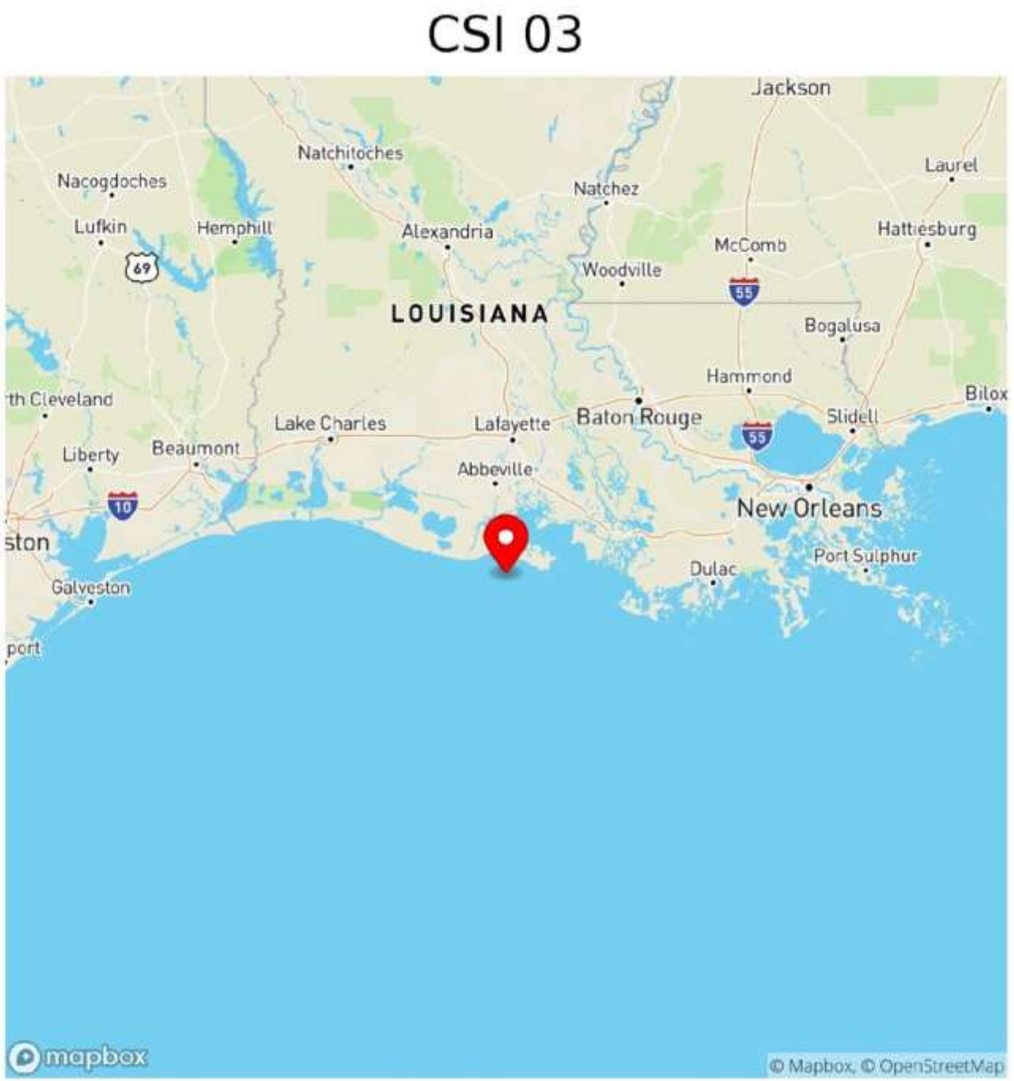
High Water Mark Spatial Plot

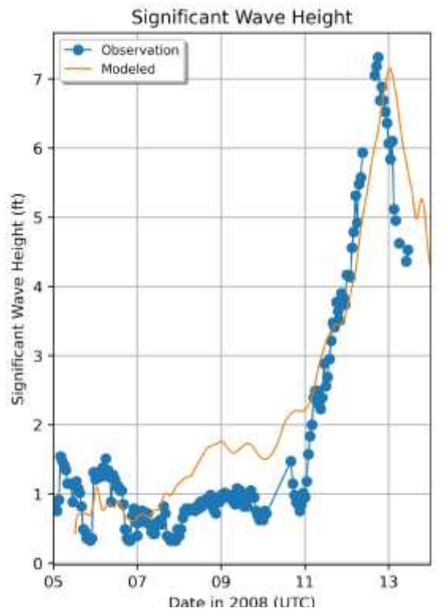


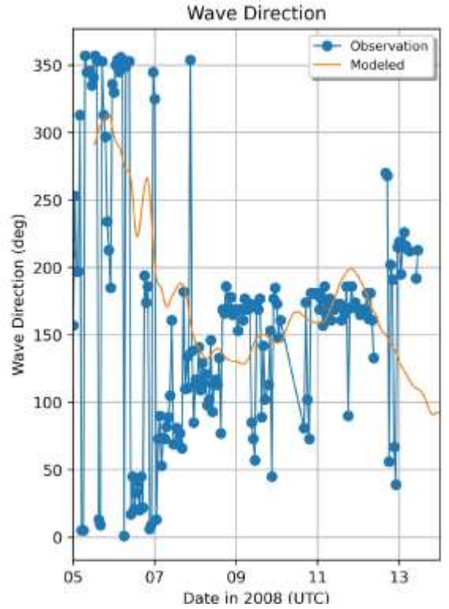
High Water Mark Scatter Plot

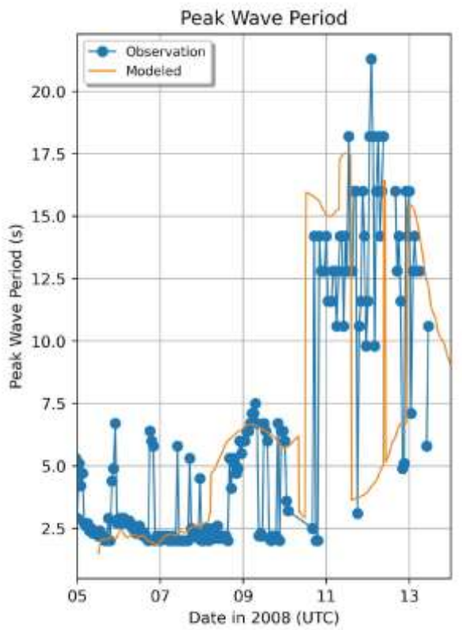
HURRICANE IKE WAVE OBSERVATIONS

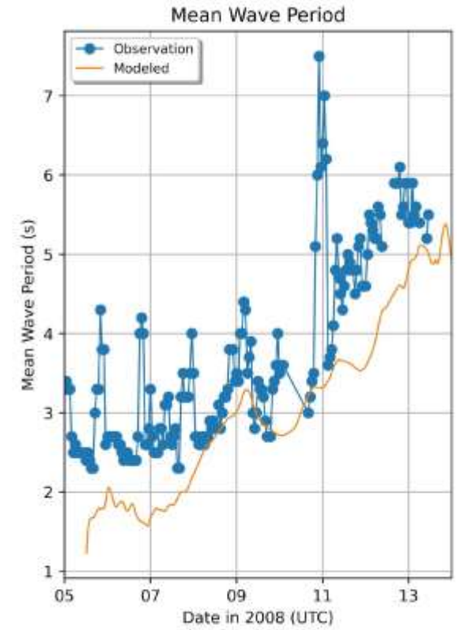
STORM SURGE AND WAVES





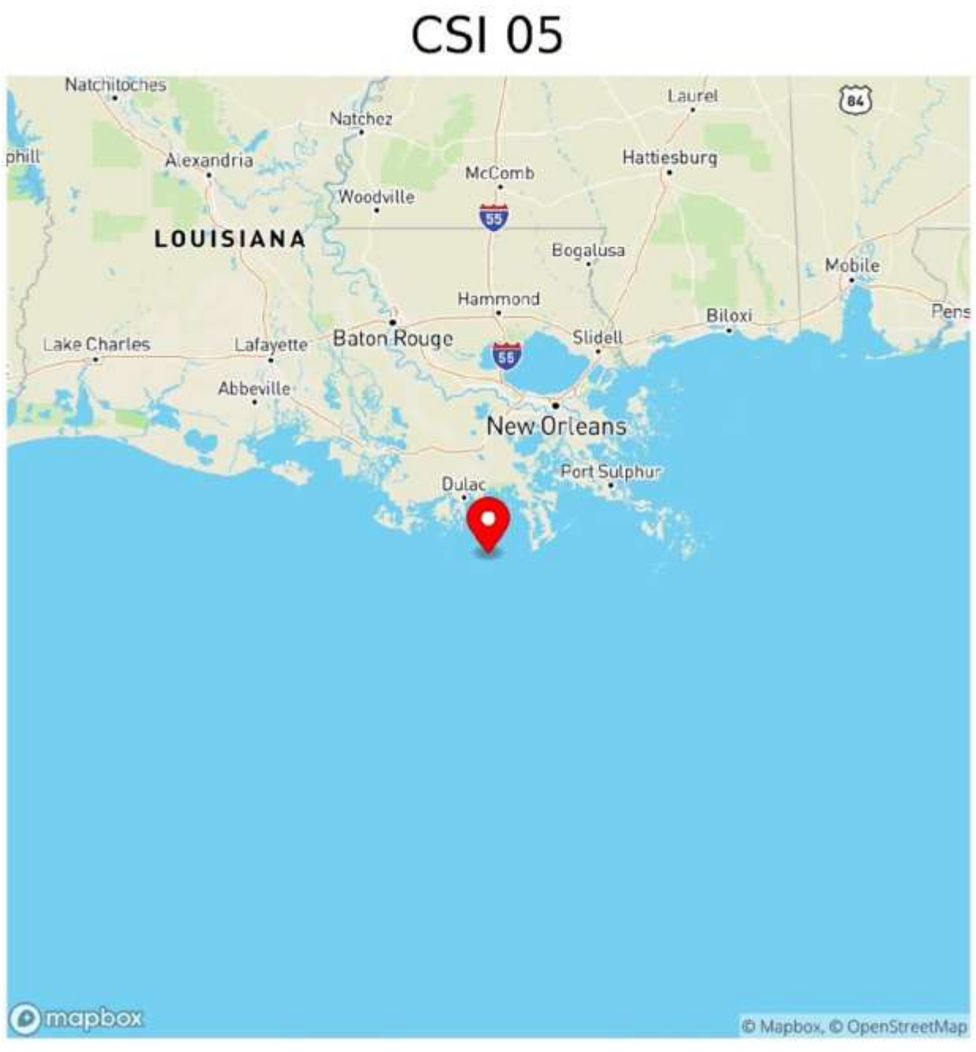


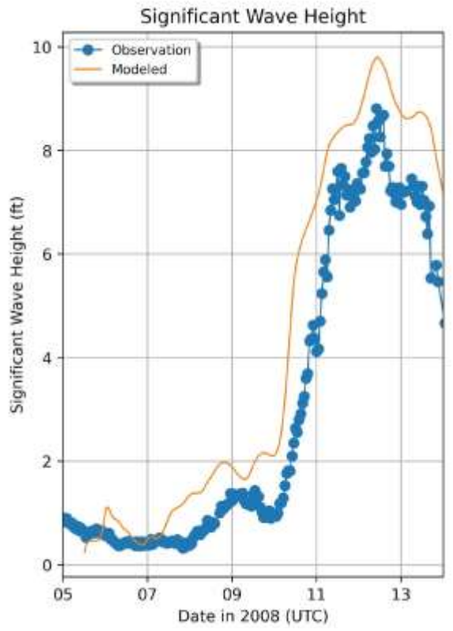




HURRICANE IKE WAVE OBSERVATIONS

STORM SURGE AND WAVES





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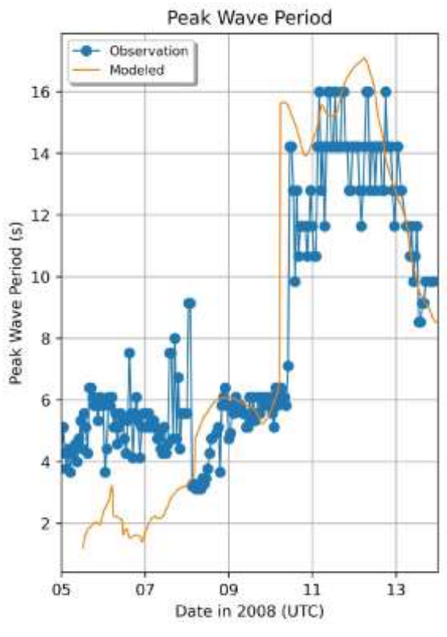
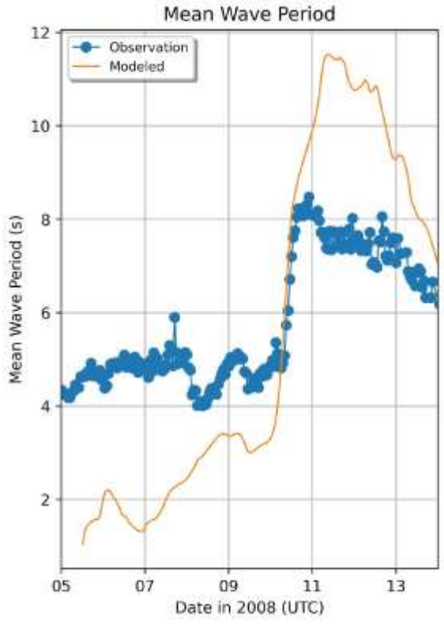


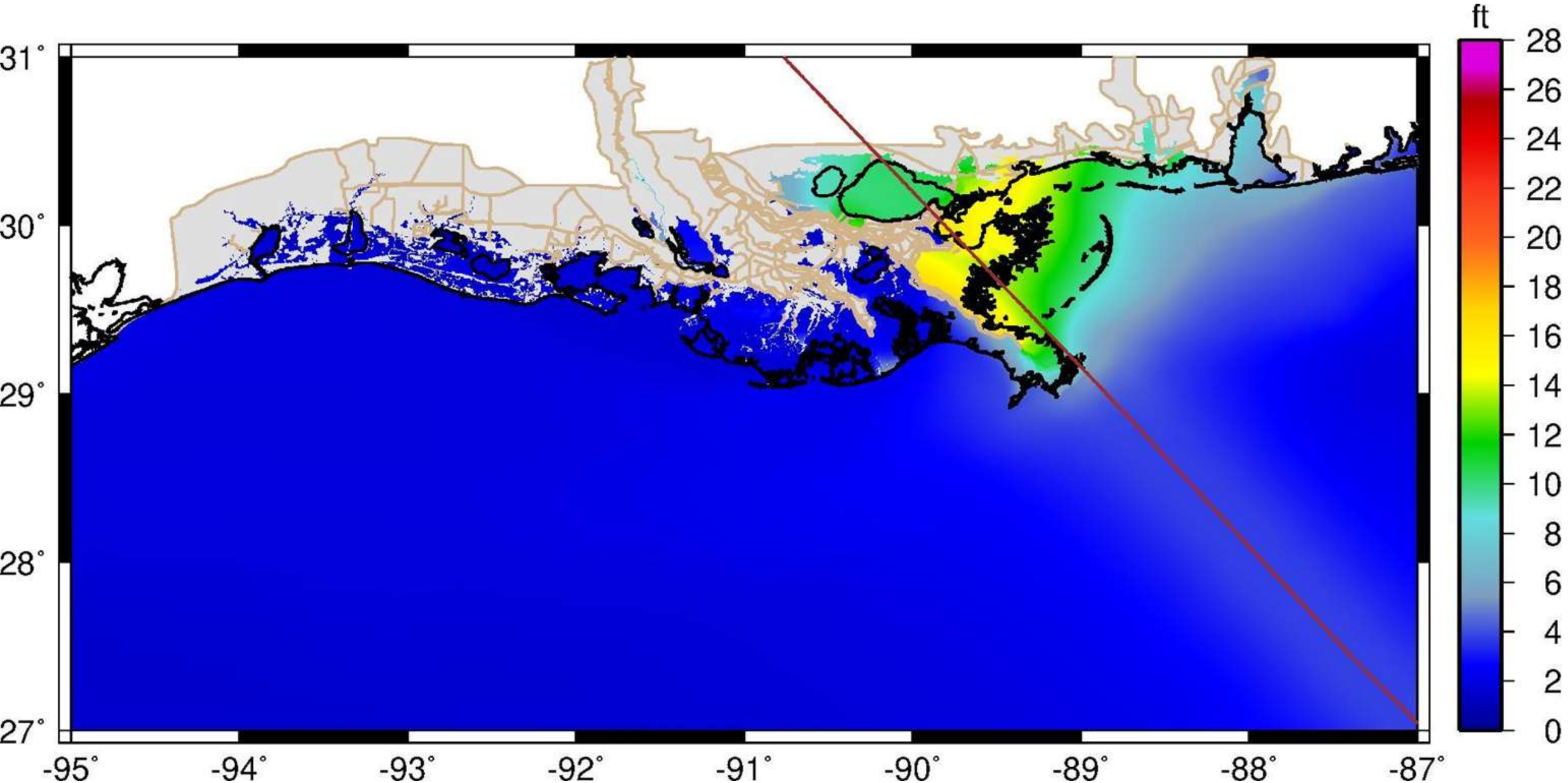


STORM SUITE RUNS

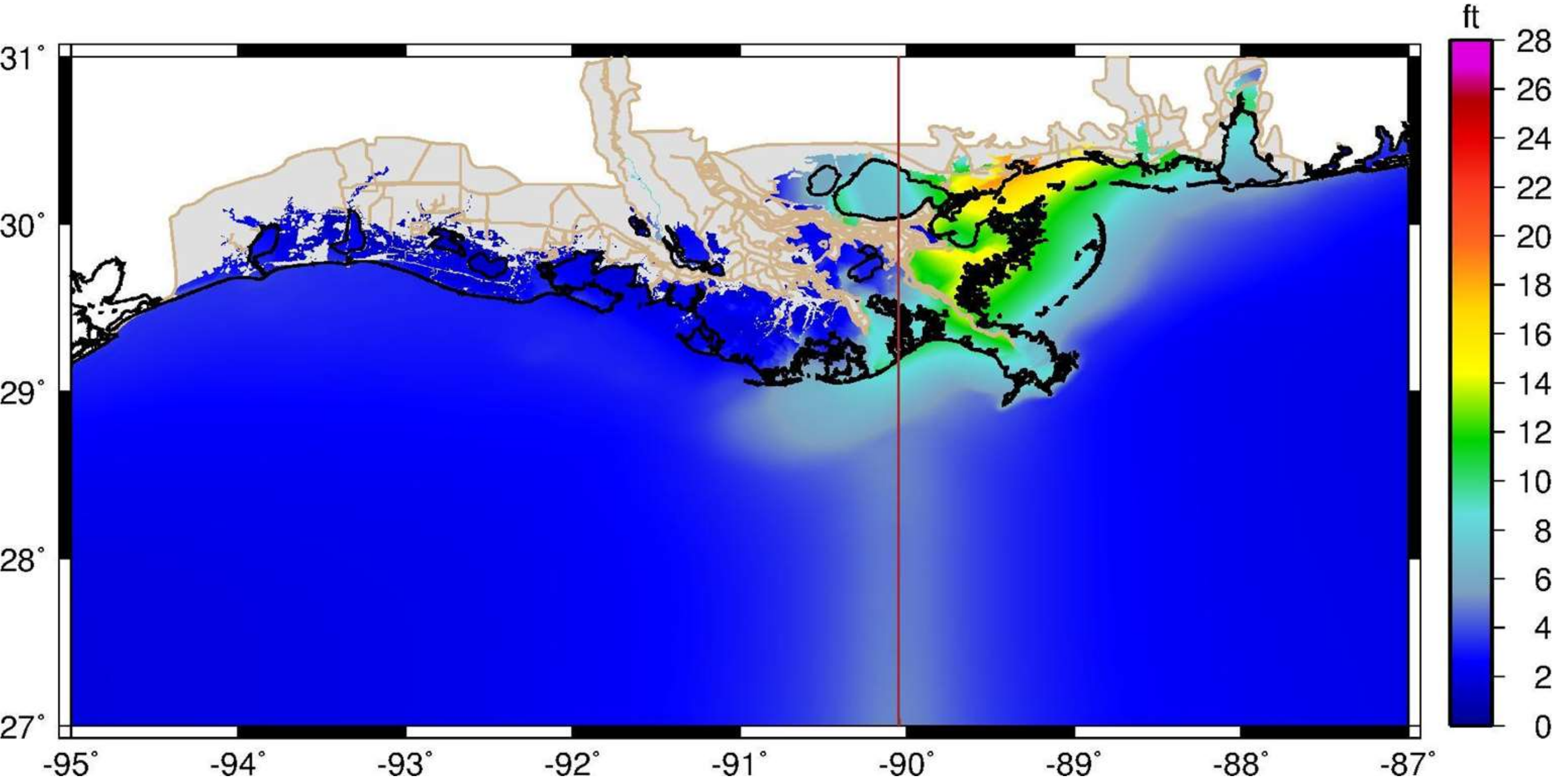
SYNTHETIC STORM SUITE RUNS

STORM SURGE AND WAVES

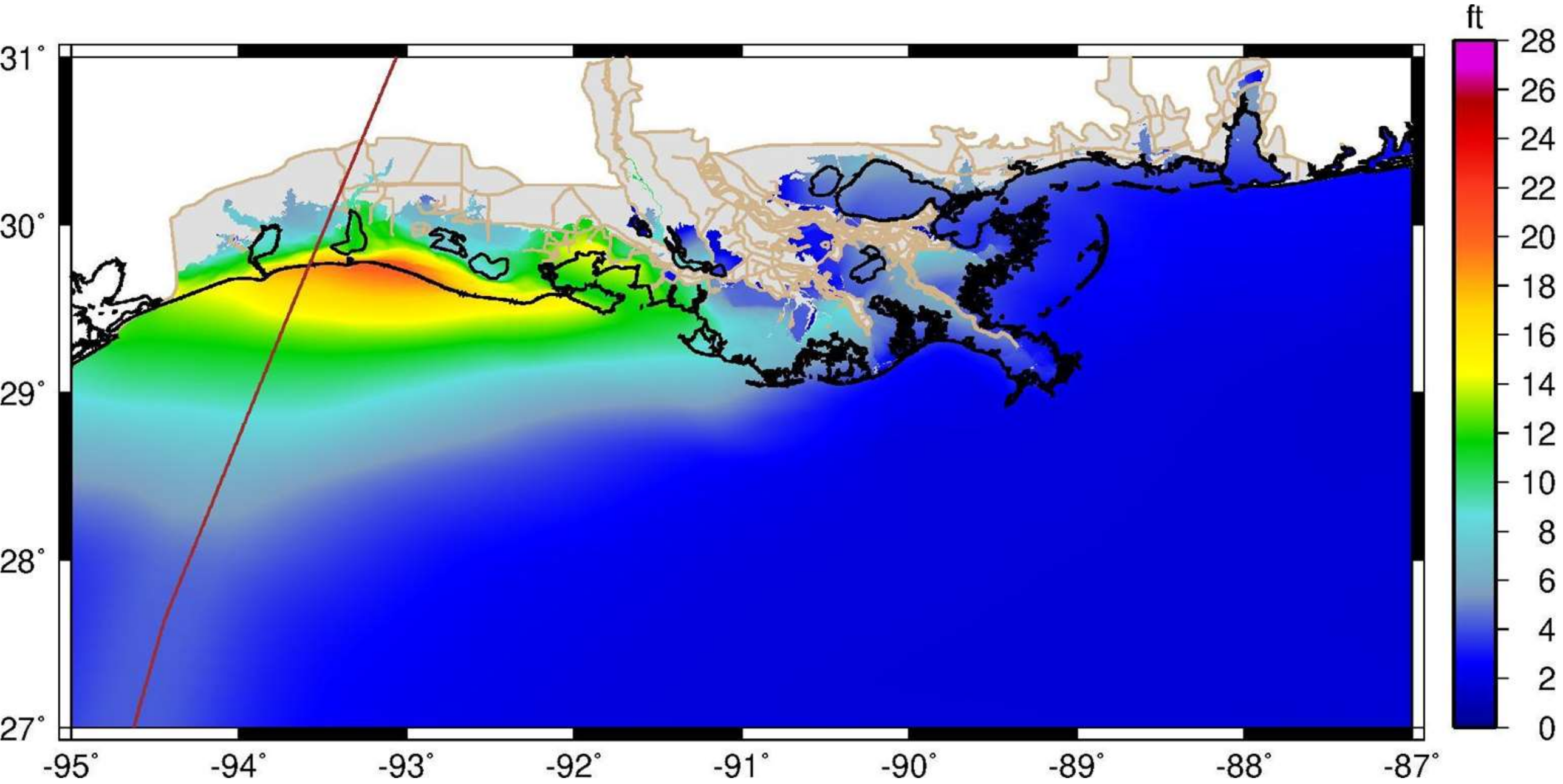
- Storms simulated in prior phase using 2017 model
  - Reduced suite will be simulated with updated model
- Recomputed Gulf seasonal initial water level using CRMS
  - 1.188ft NAVD88 2009.55
  - +0.158ft (1.8in) from 2017 Plan
- Updated Mississippi and Atchafalaya flows based on USACE study
  - Mississippi: 400,000cfs
  - Atchafalaya: 171,500cfs
- Uses updated wind drag/bottom friction parameters from prior phase
  - Garratt drag law, 0.0025 limit
  - Quadratic bottom friction lower limit: 0.001



STORM 0186 MAXIMUM ELEVATION



STORM 0402 MAXIMUM ELEVATION



STORM 0471 MAXIMUM ELEVATION

QUESTIONS