



# Louisiana's 2012 Coastal Master Plan



committed to our coast

## PREDICTIVE MODELING: STORM SURGE AND WAVES

Hugh Roberts, PE  
June 7, 2012



# Overview

- Team Members
- Modeling System Overview
- Validation
- Model Output



# Team Members

- This work was funded by the Coastal Protection and Restoration Authority in support of Louisiana's 2012 Coastal Master Plan
- Dr. Joseph Suhayda
- Zach Cobell, Ryan Clark, Dr. Haihong Zhao, Dr. Anu Acharya, Dr. Shan Zou, Dr. John Atkinson, Jerry Mohnhaupt – ARCADIS

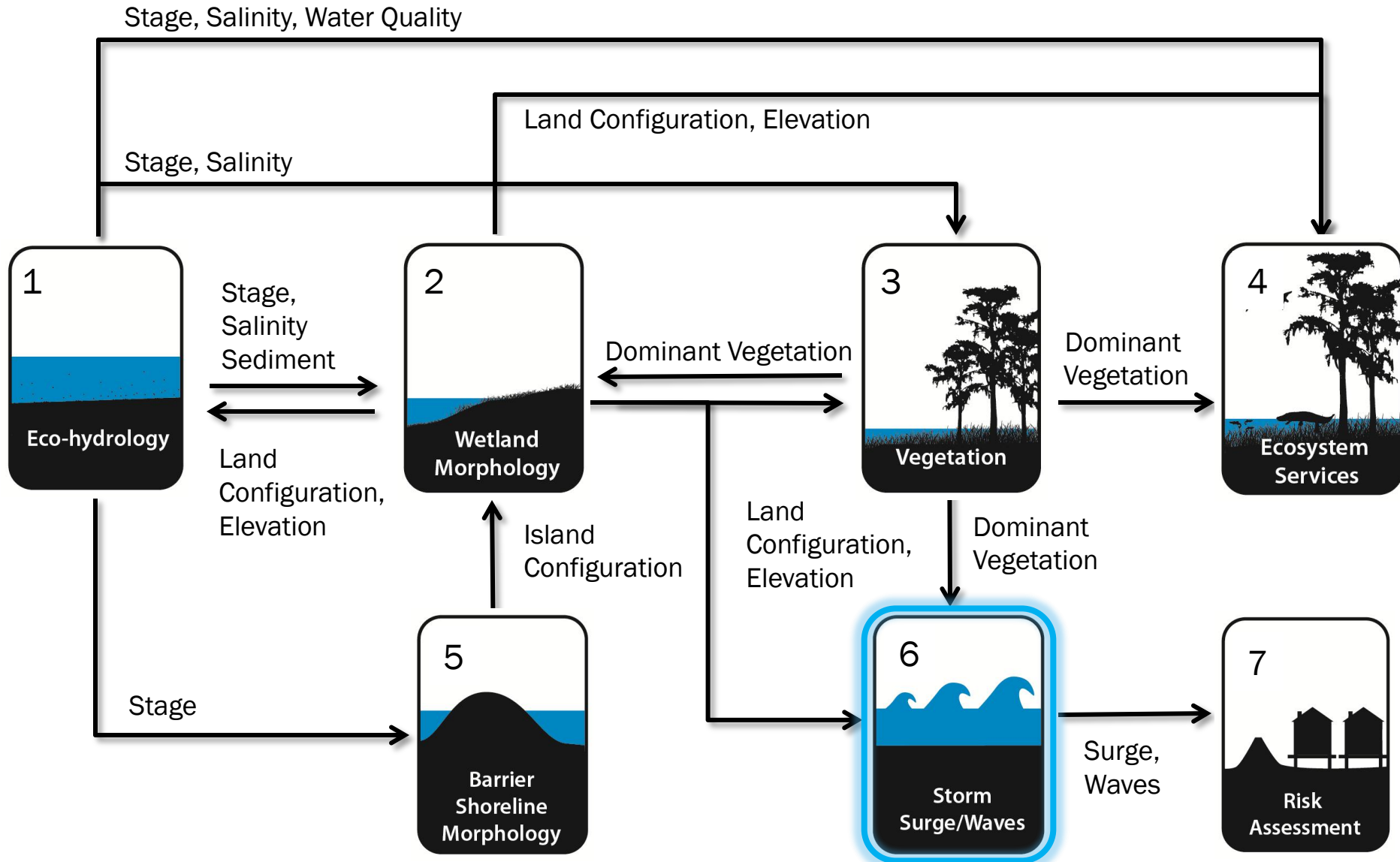


# Team Members

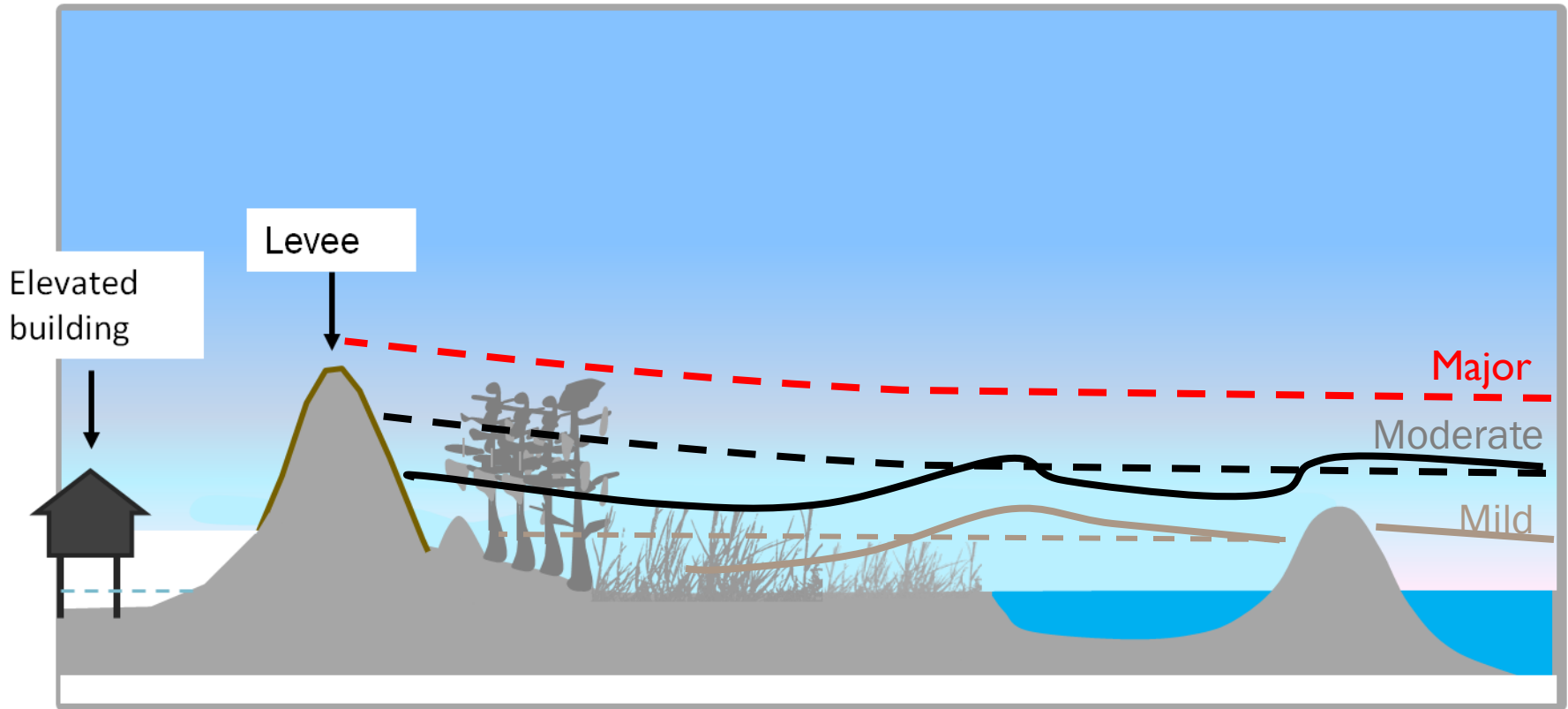
- Dr. Jordan Fischbach, David Johnson, Dr. David Ortiz – RAND Corporation
- Dr. Chris Szpilka – University of Oklahoma
- ADCIRC and UnSWAN Development Teams
- Computational Resources
  - LONI (Louisiana Optical Network Initiative)
  - University of Notre Dame



# Modeling in a Systems Context



# Protection Potential of Coastal Protection and Restoration Features



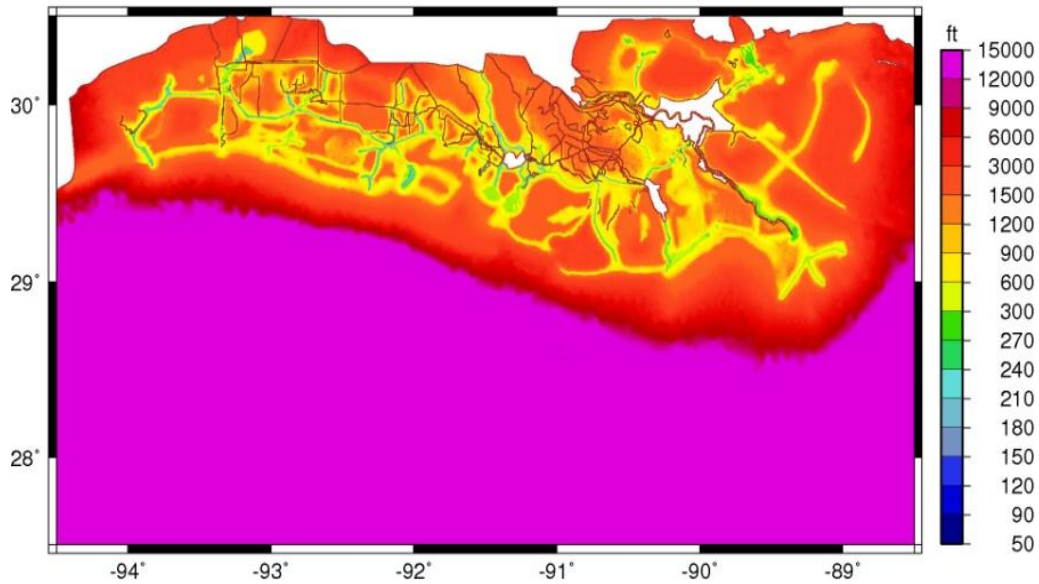
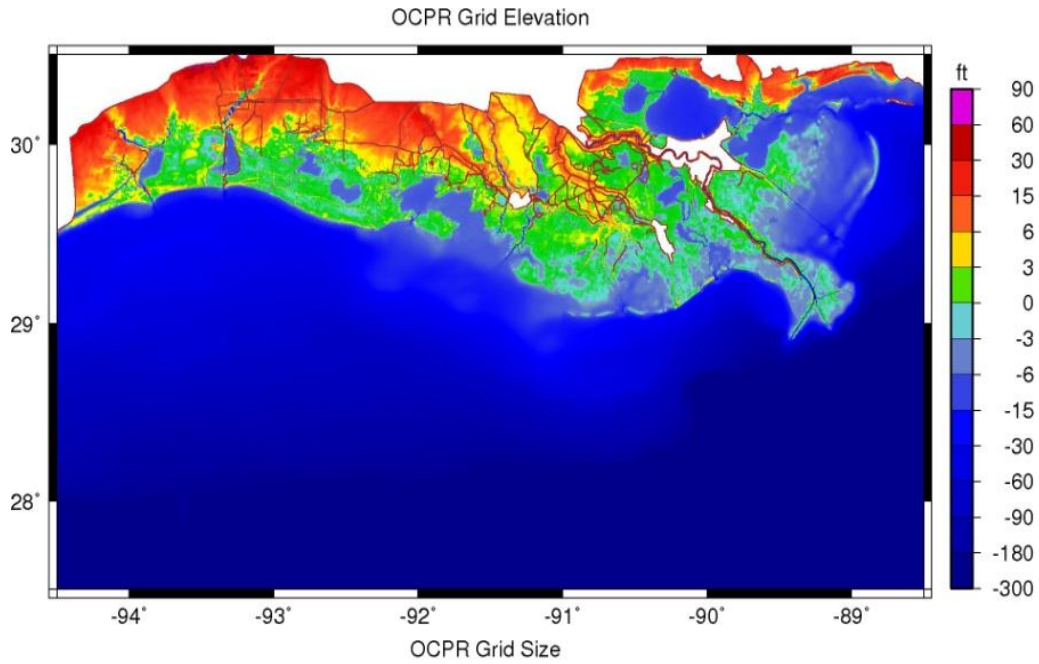
# Model Overview

- Physics Based 2D Finite Element Model
  - Incorporates wind fields, pressure fields, Mississippi and Atchafalaya River inputs, and wave radiation stress
- Models Applied
  - ADvanced CIRCulation (ADCIRC)
  - Unstructured Simulating WAVes Nearshore (SWAN)



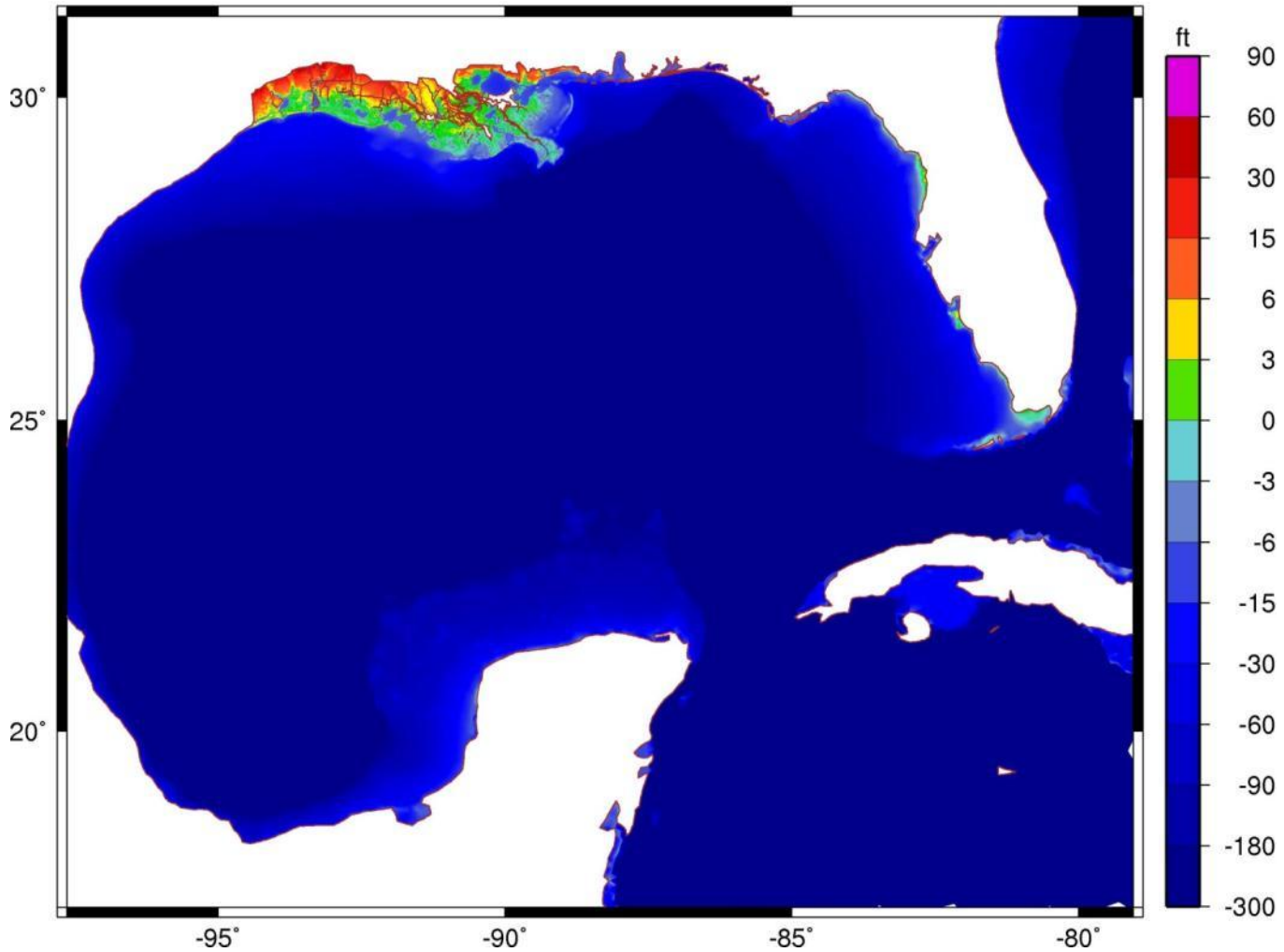
# Mesh Parameters

- CPRA High-Speed Mesh:
  - Min element size: ~23m
  - Nodes: 1,090,351
  - Elements: 2,138,750
- High resolution
  - Channels
  - Other flow pathways
- Wetland and Barrier Shoreline Morphology DEM
  - Mesh elevation
- Vegetation Model output
  - Frictional parameters



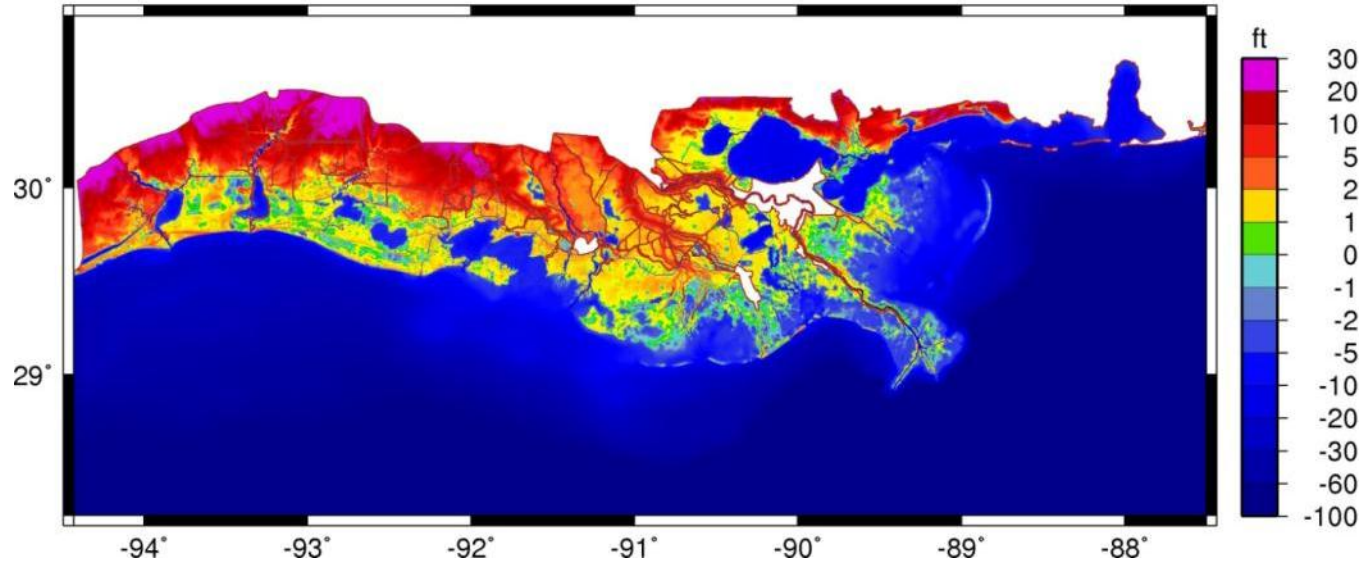


# 2011 Current Conditions

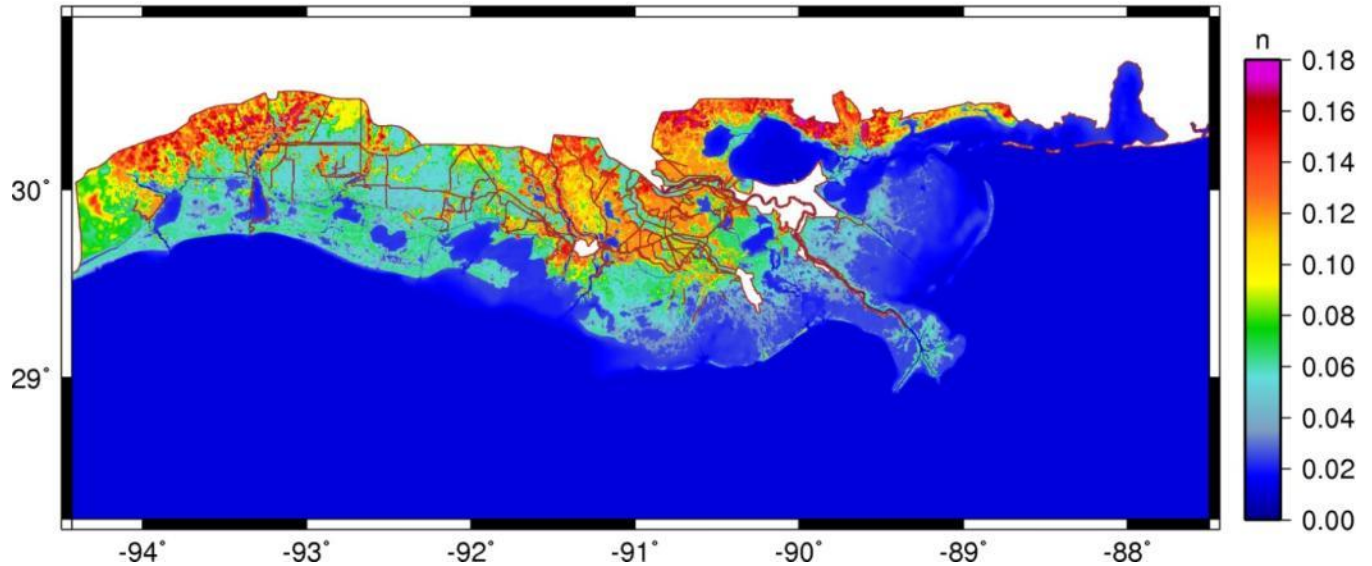


# 2011 Current Conditions

Model Elevation (ft)

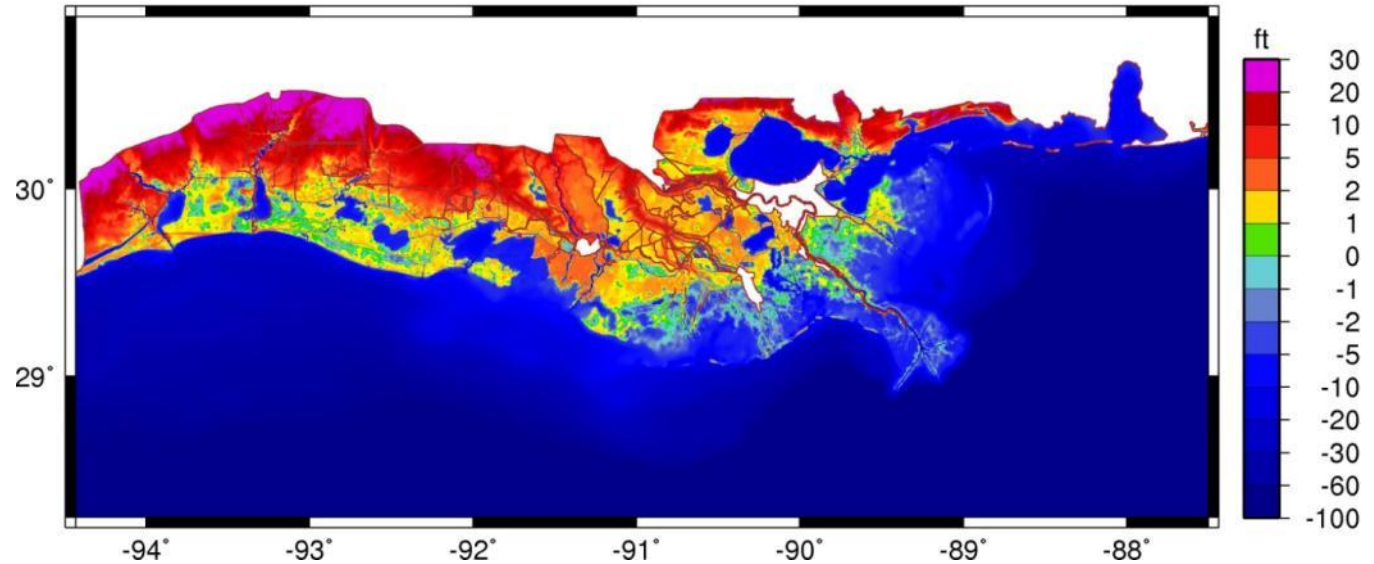


Model Bottom  
Friction Parameter:  
Manning's  $n$

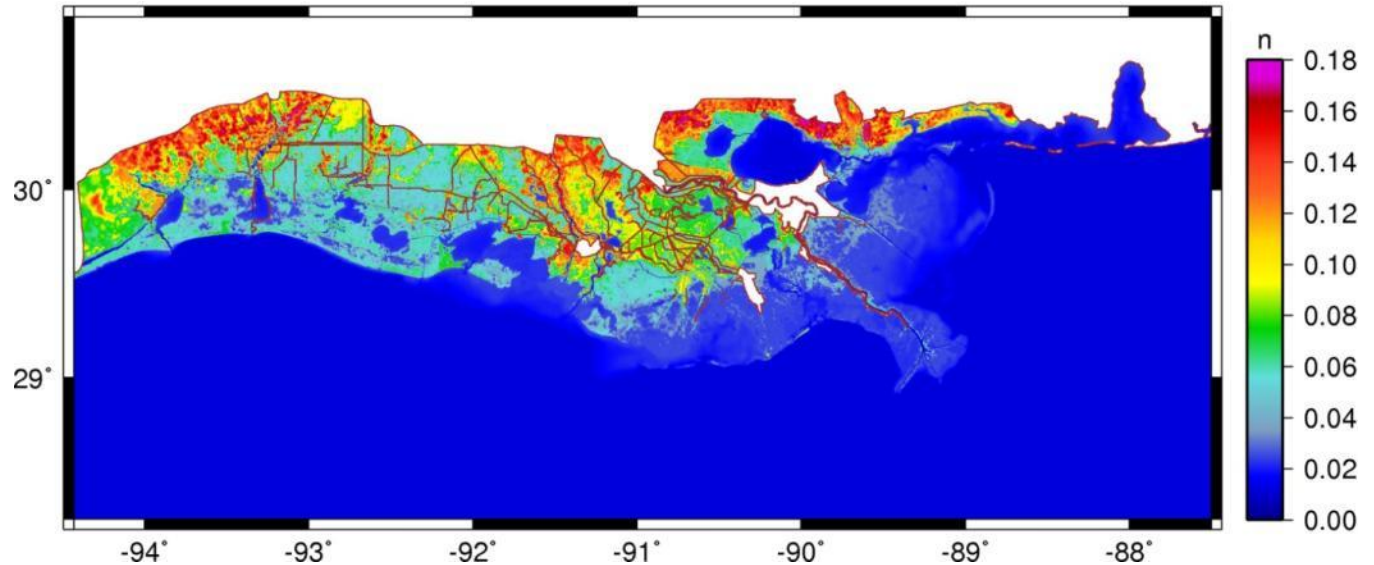


# Moderate Future Conditions

Model Elevation (ft)

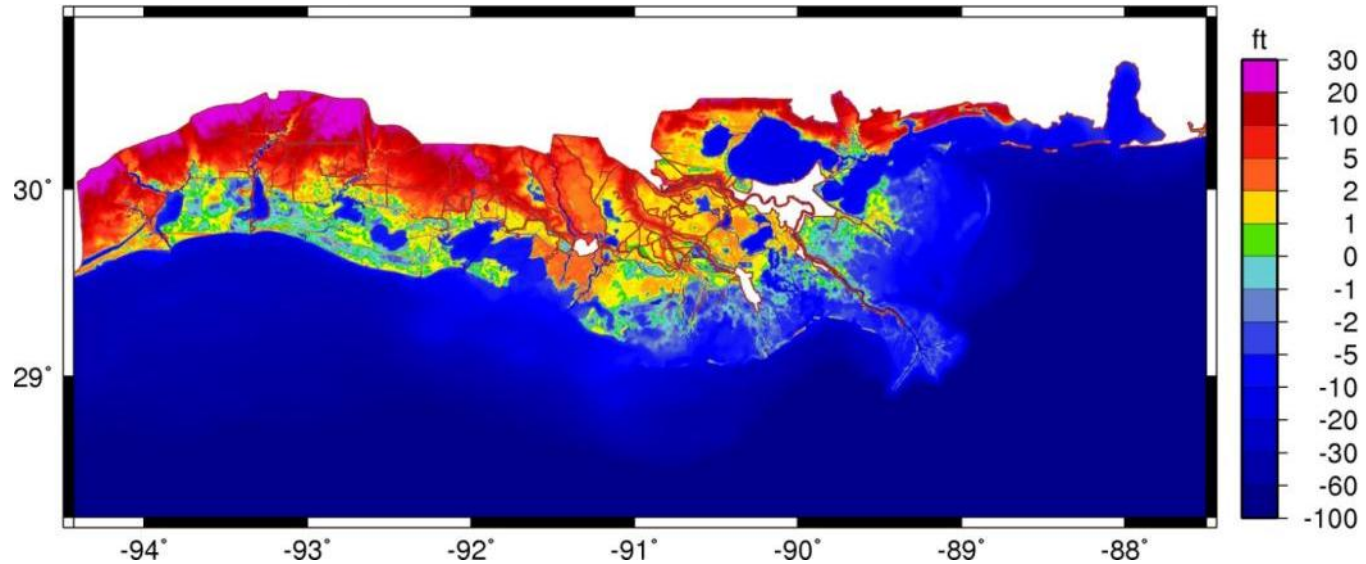


Model Bottom  
Friction Parameter:  
Manning's  $n$

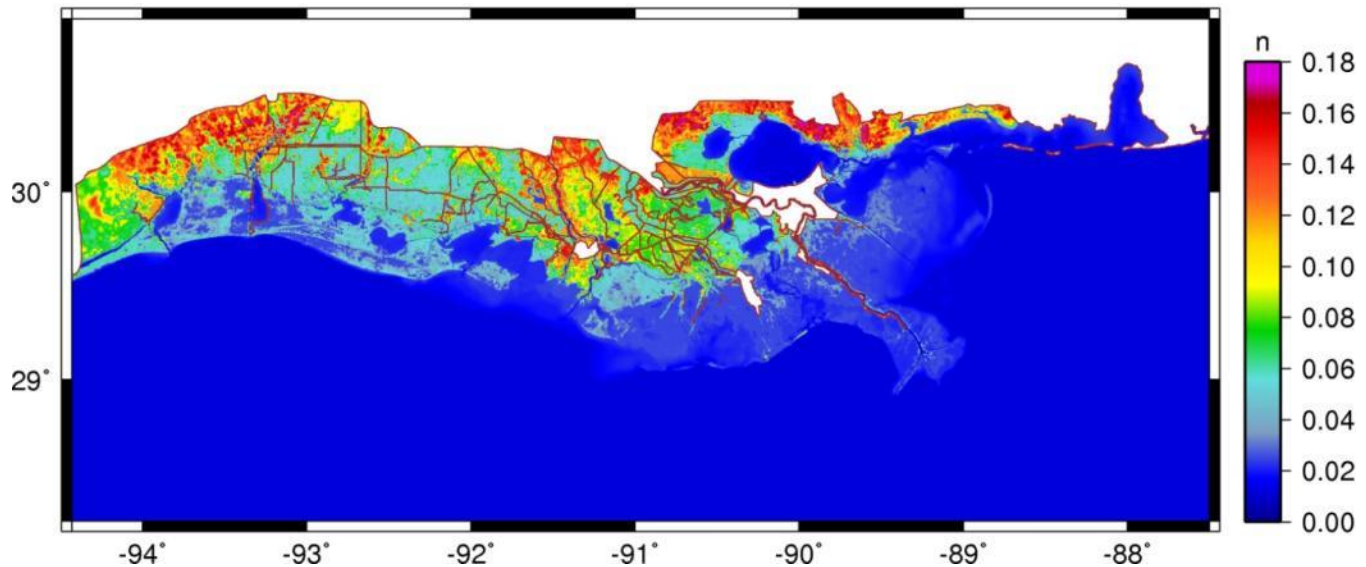


# Less Optimistic Future Conditions

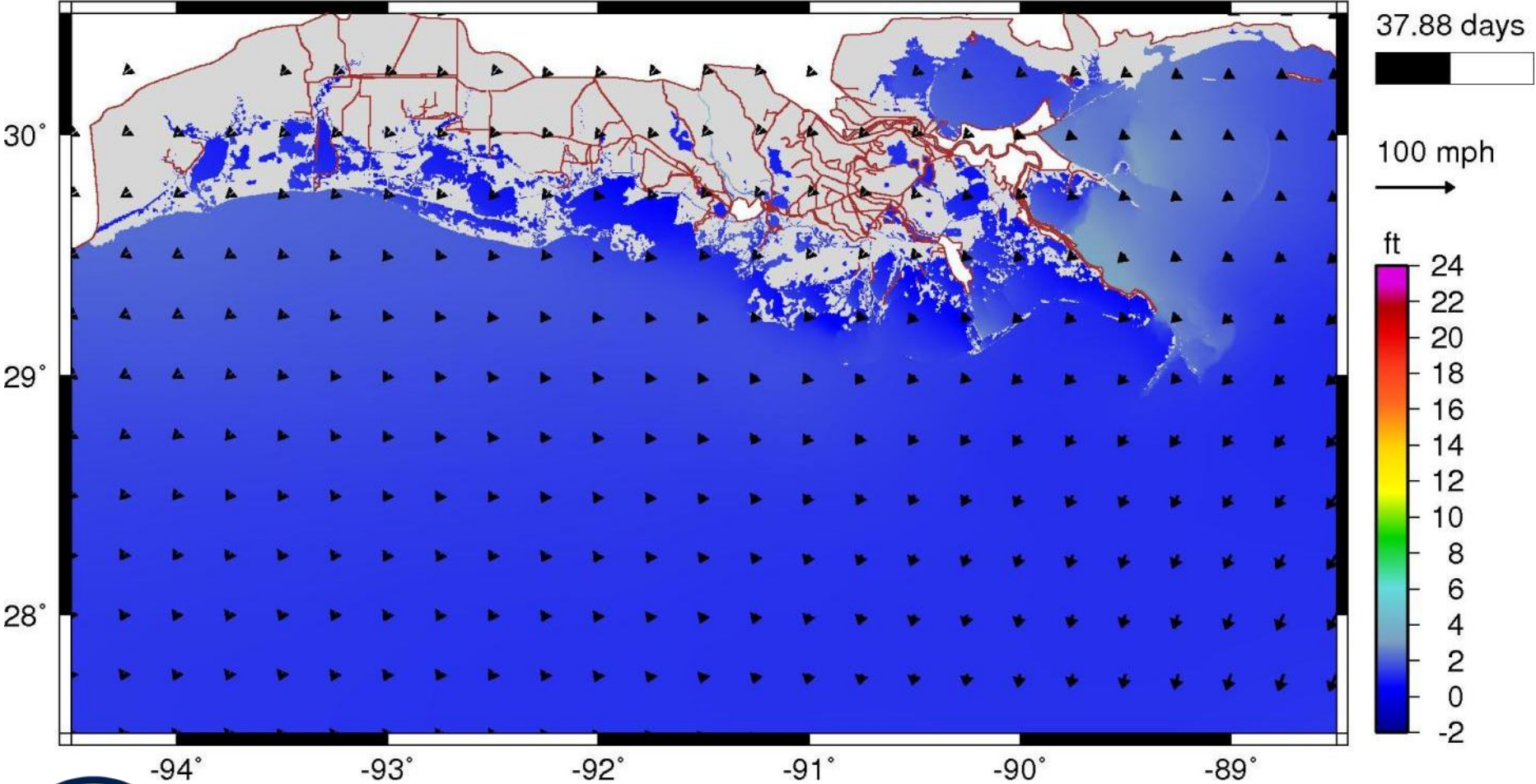
Model Elevation (ft)



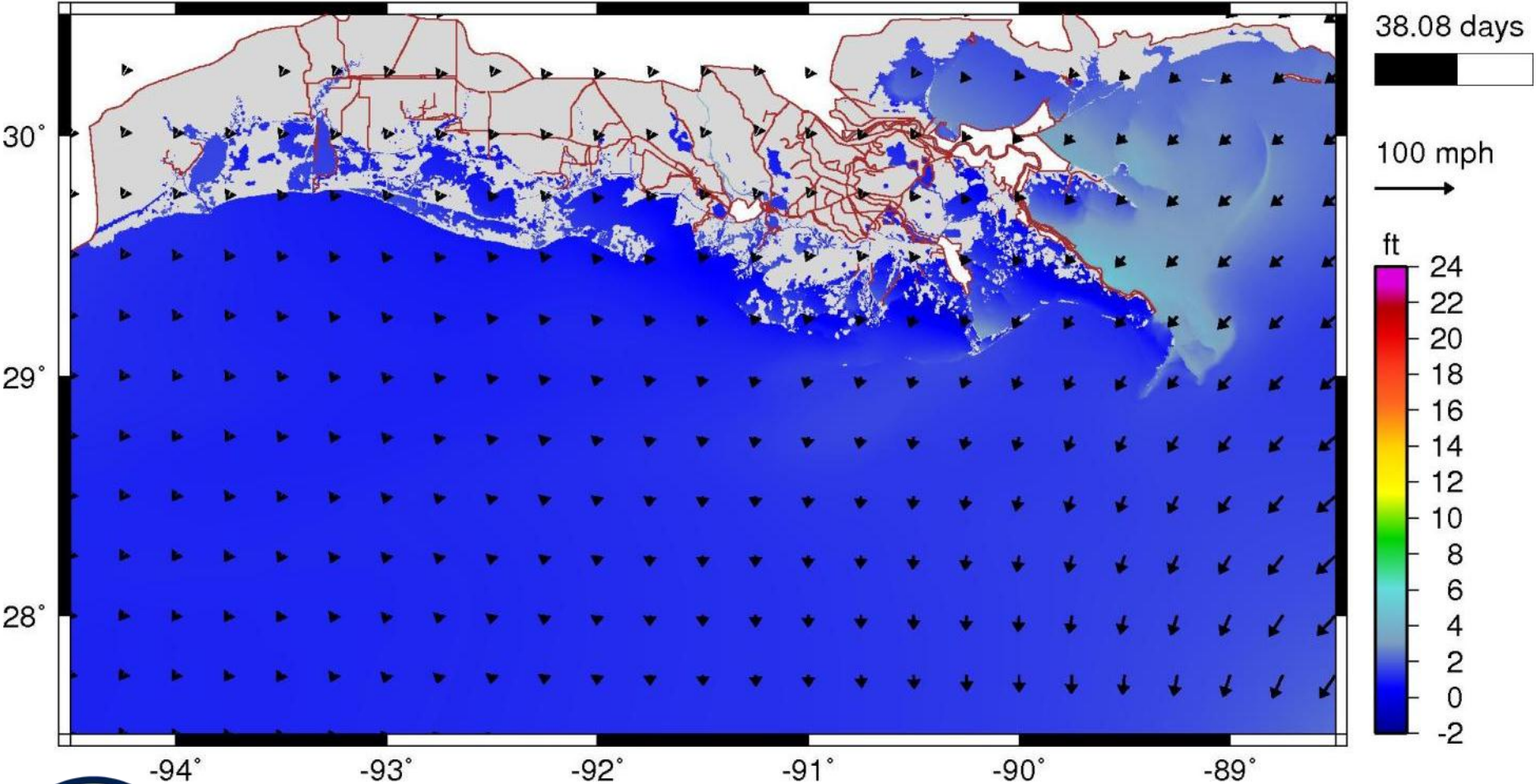
Model Bottom  
Friction Parameter:  
Manning's  $n$



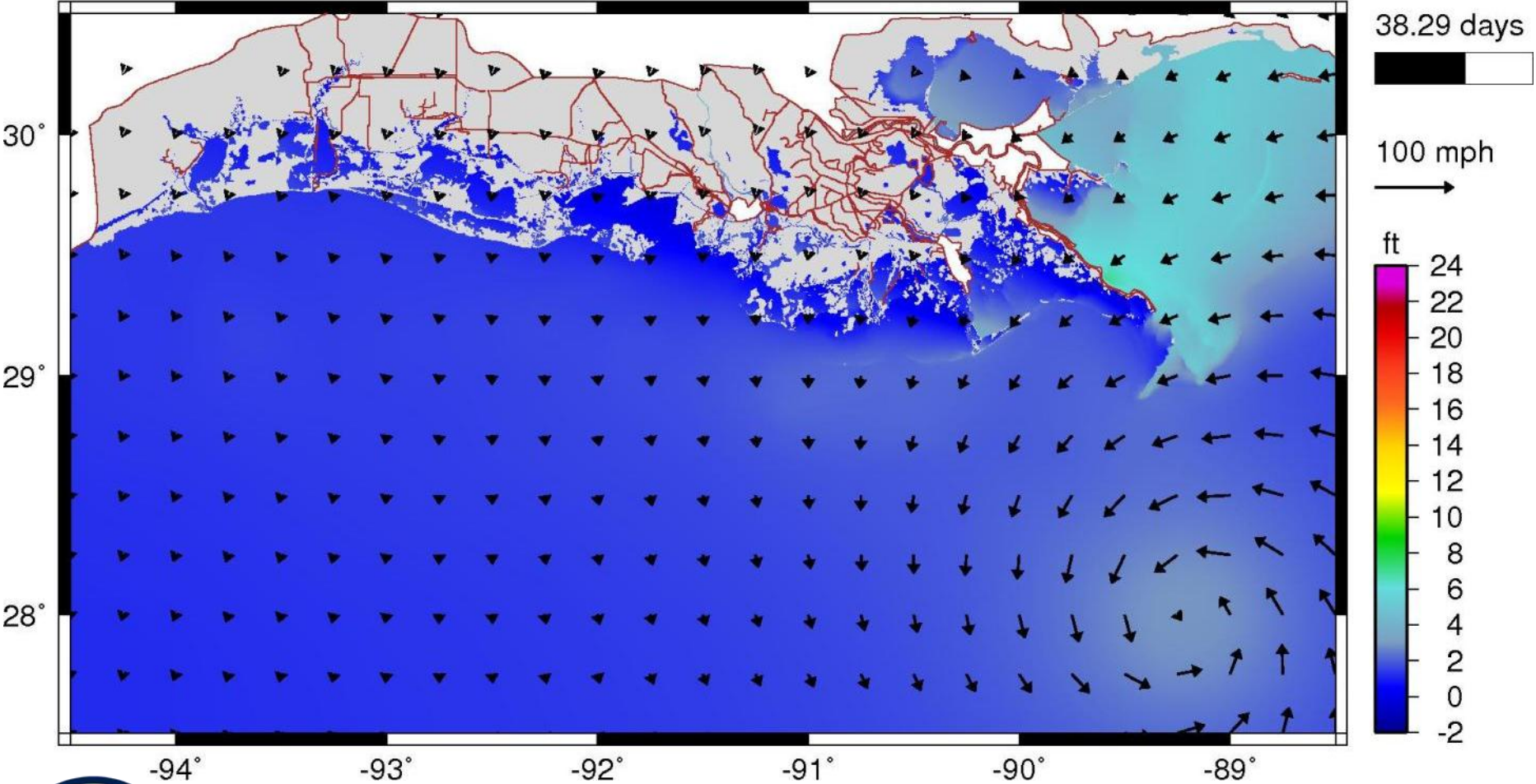
# Hurricane Gustav



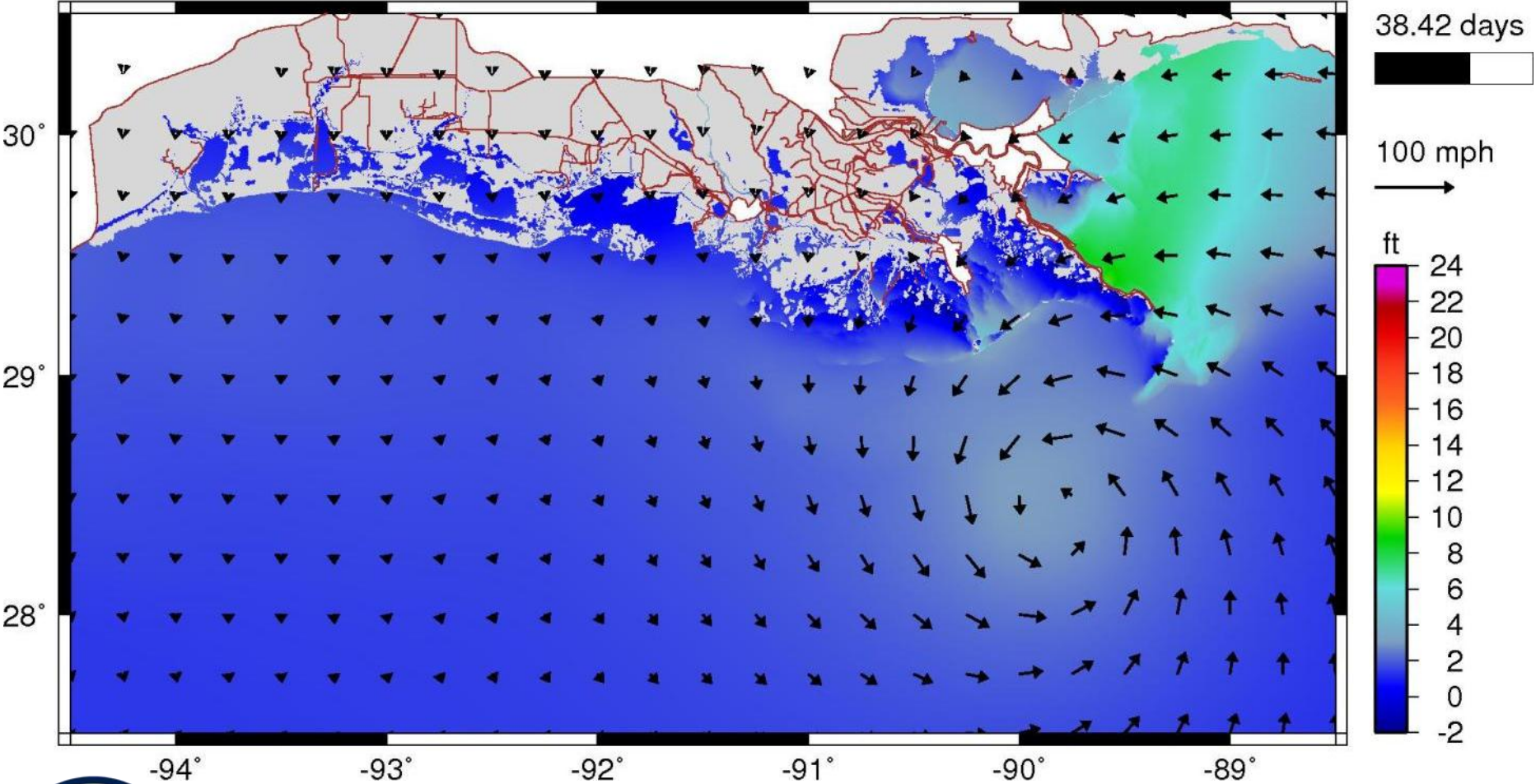
# Hurricane Gustav



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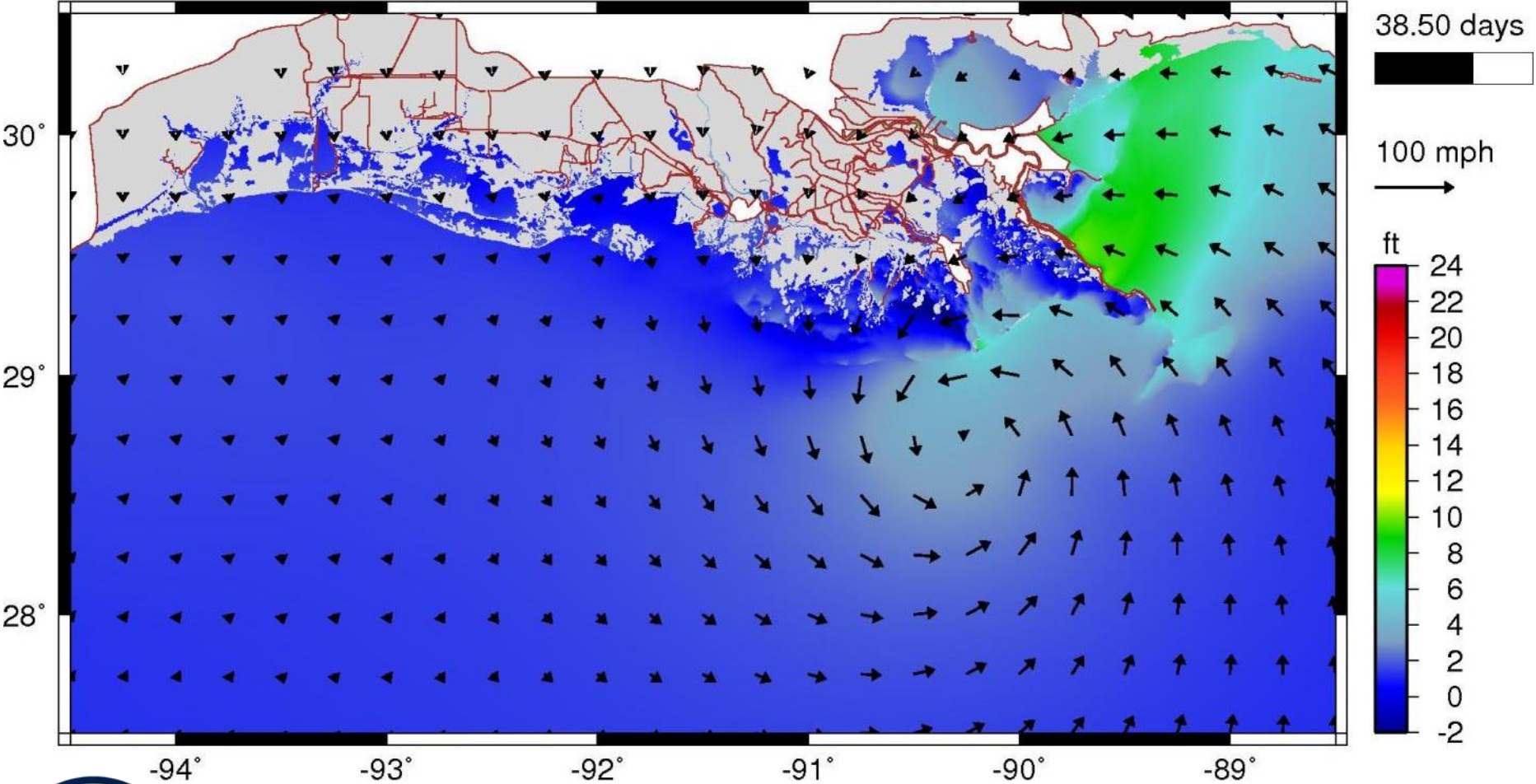


# Hurricane Gustav

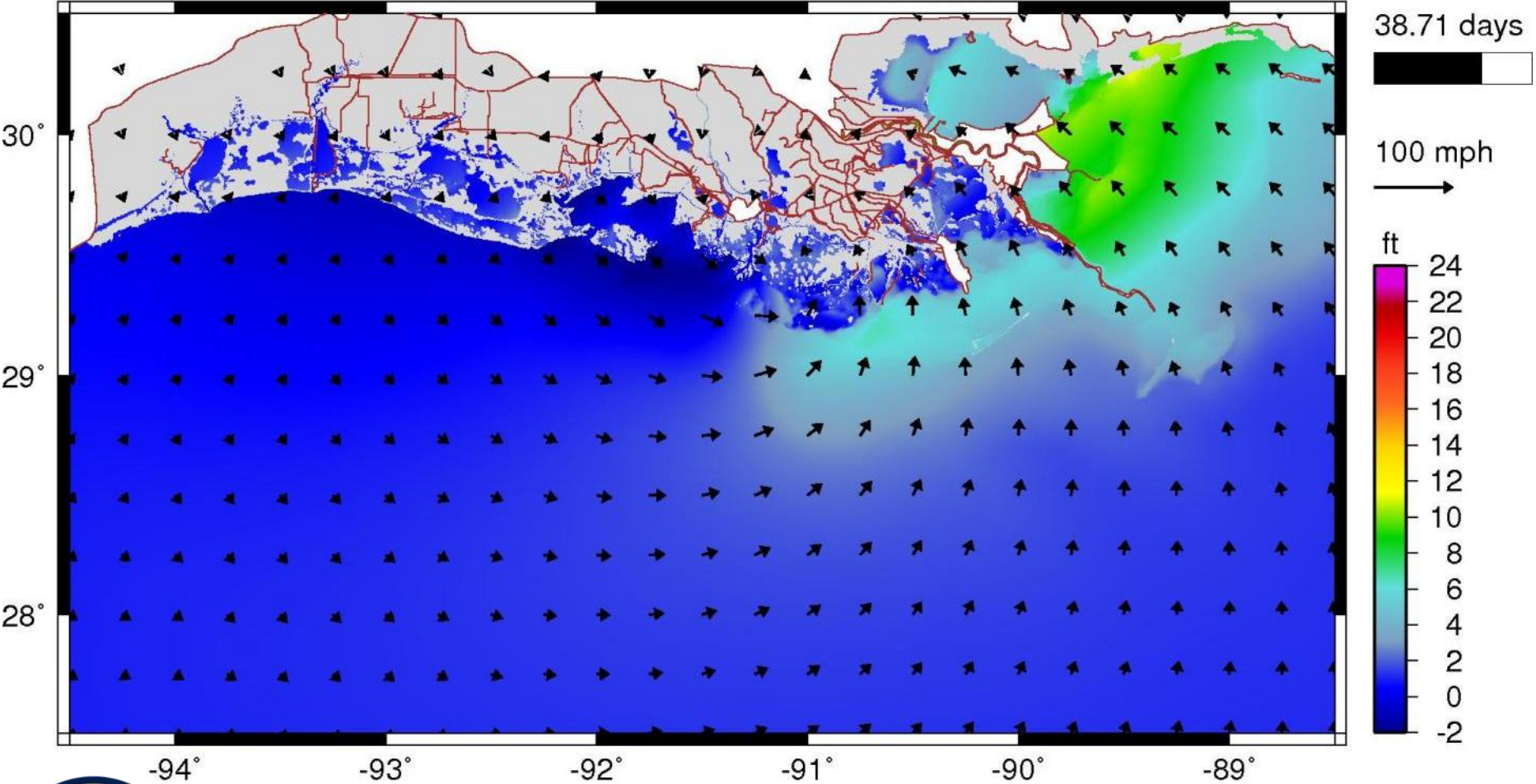




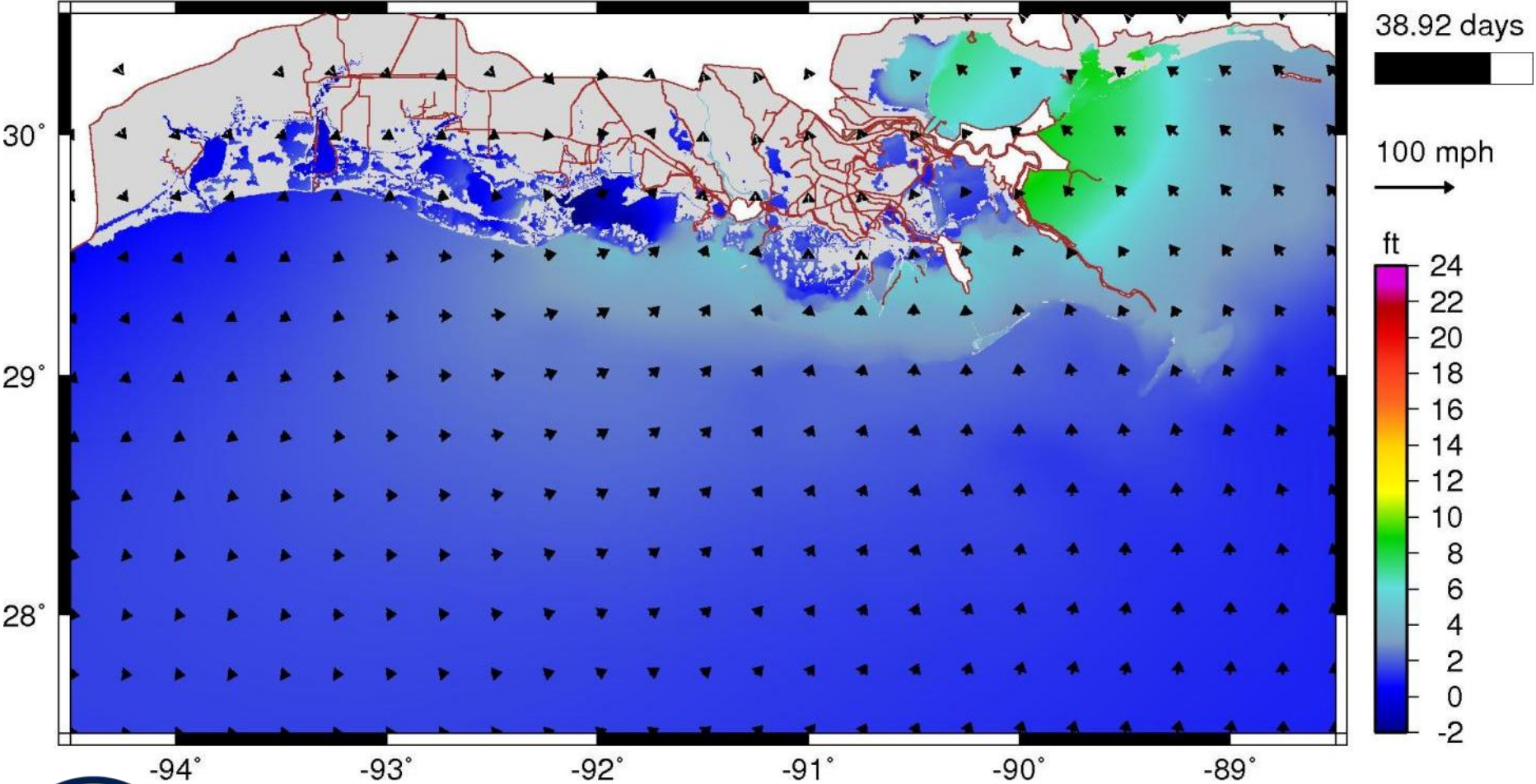
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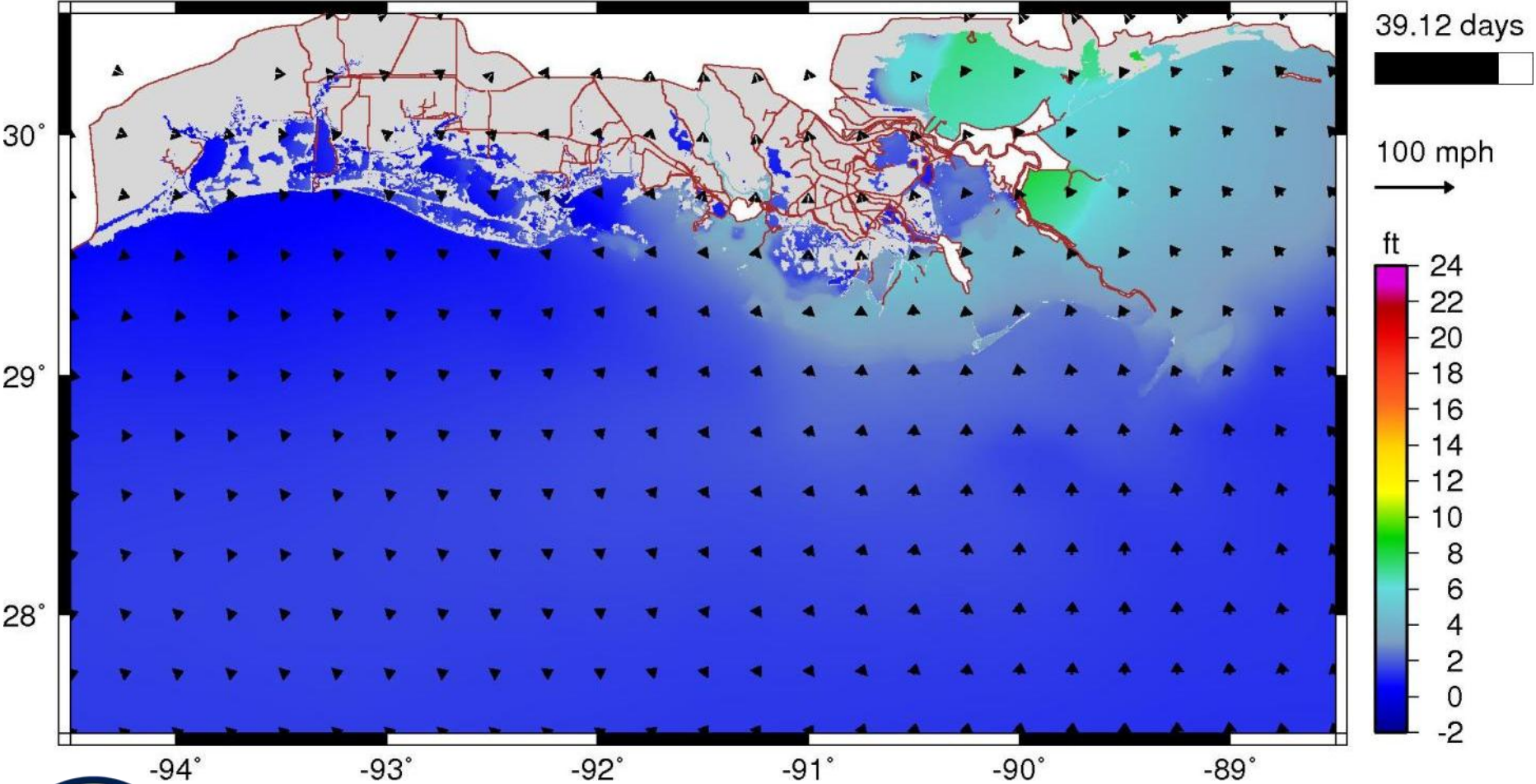
# Hurricane Gustav



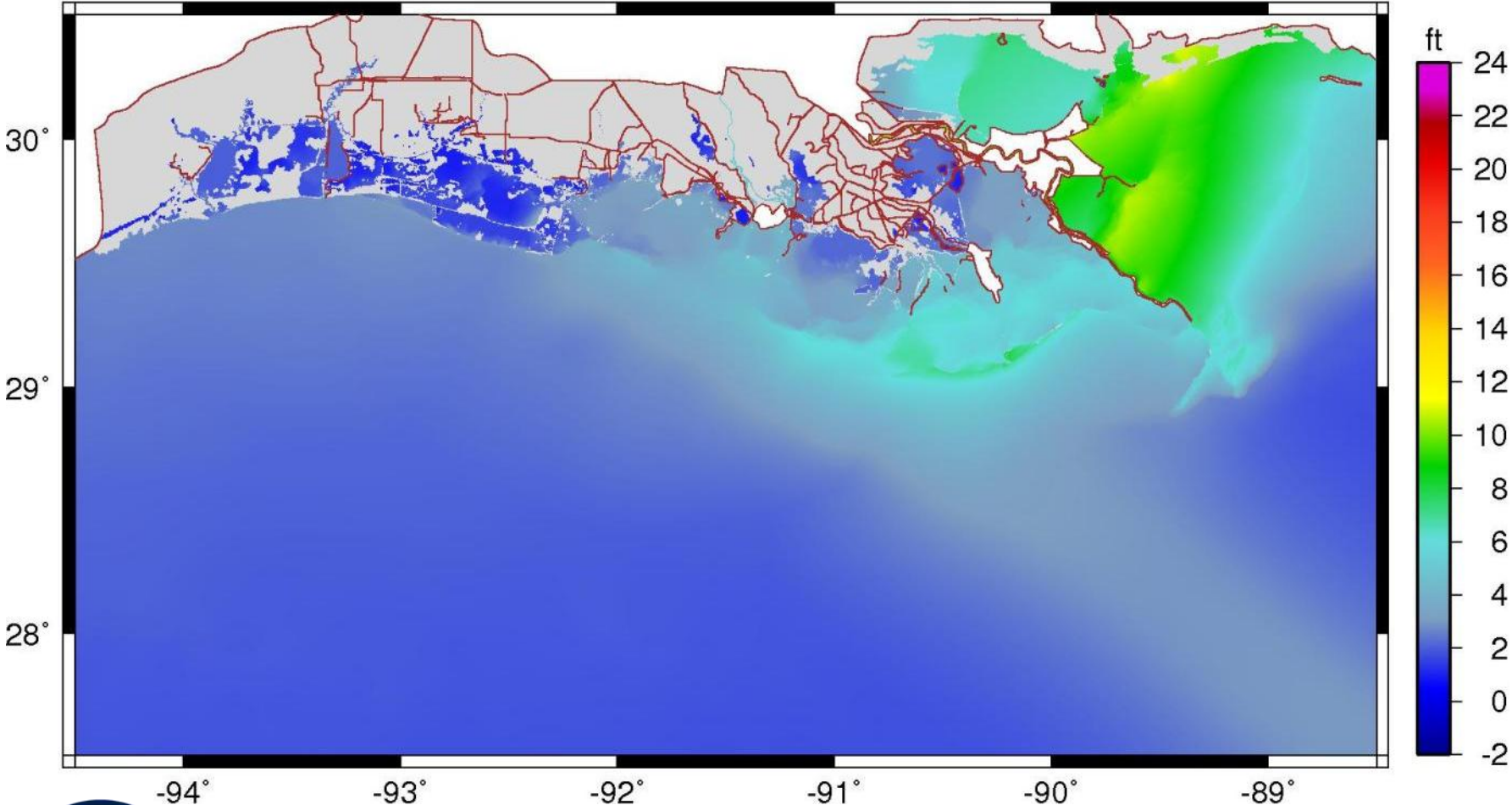
# Hurricane Gustav



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# Hurricane Gustav

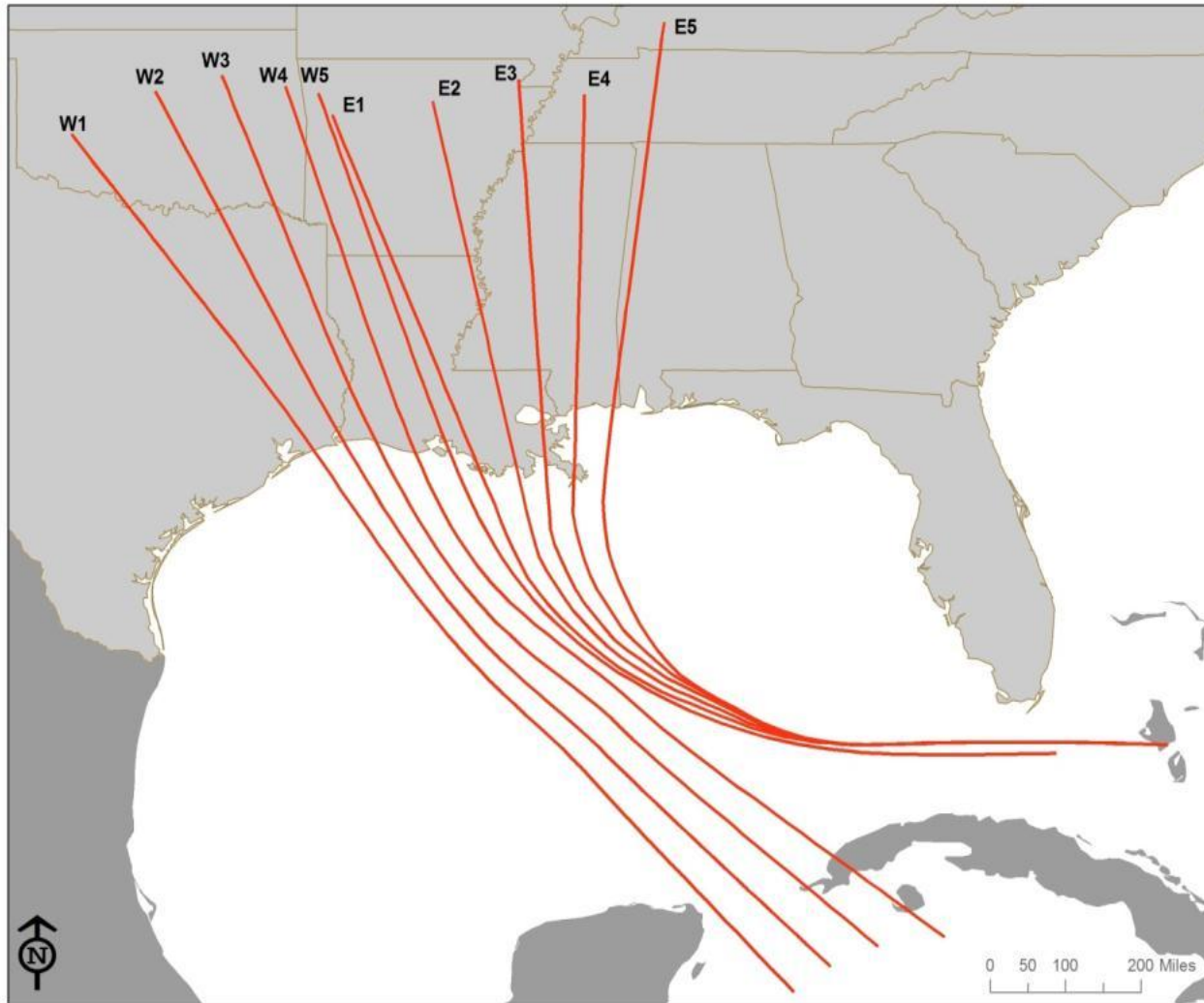


# Model Output

- Output for Each Potential Storm
  - Maximum surge
  - Peak wave heights and periods
  - Surge time series
- Multiple Conditions
  - Current Conditions
  - Moderate Future Conditions
  - Less Optimistic Future Conditions
- With and Without Project Analysis

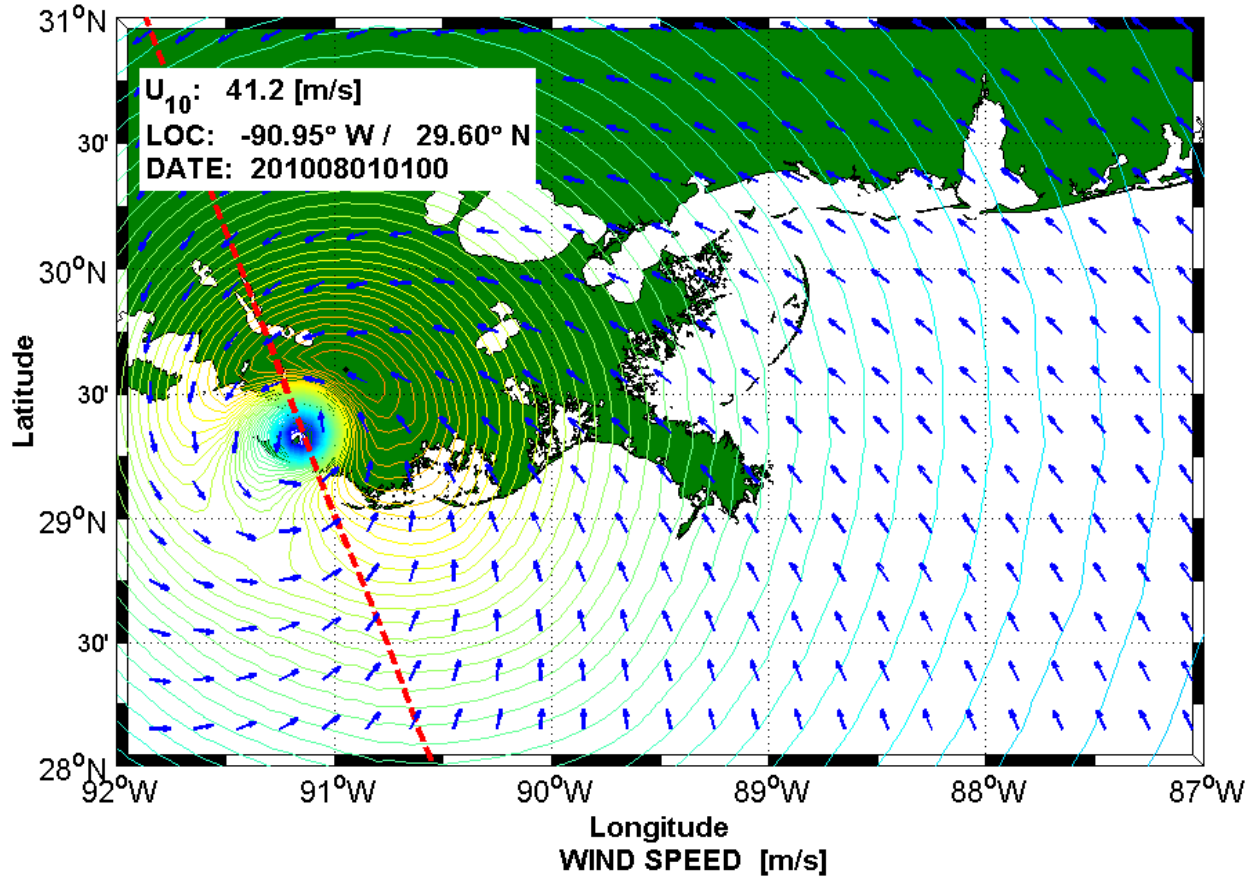


# Synthetic Storm Suite



# Sample Storm Track E1

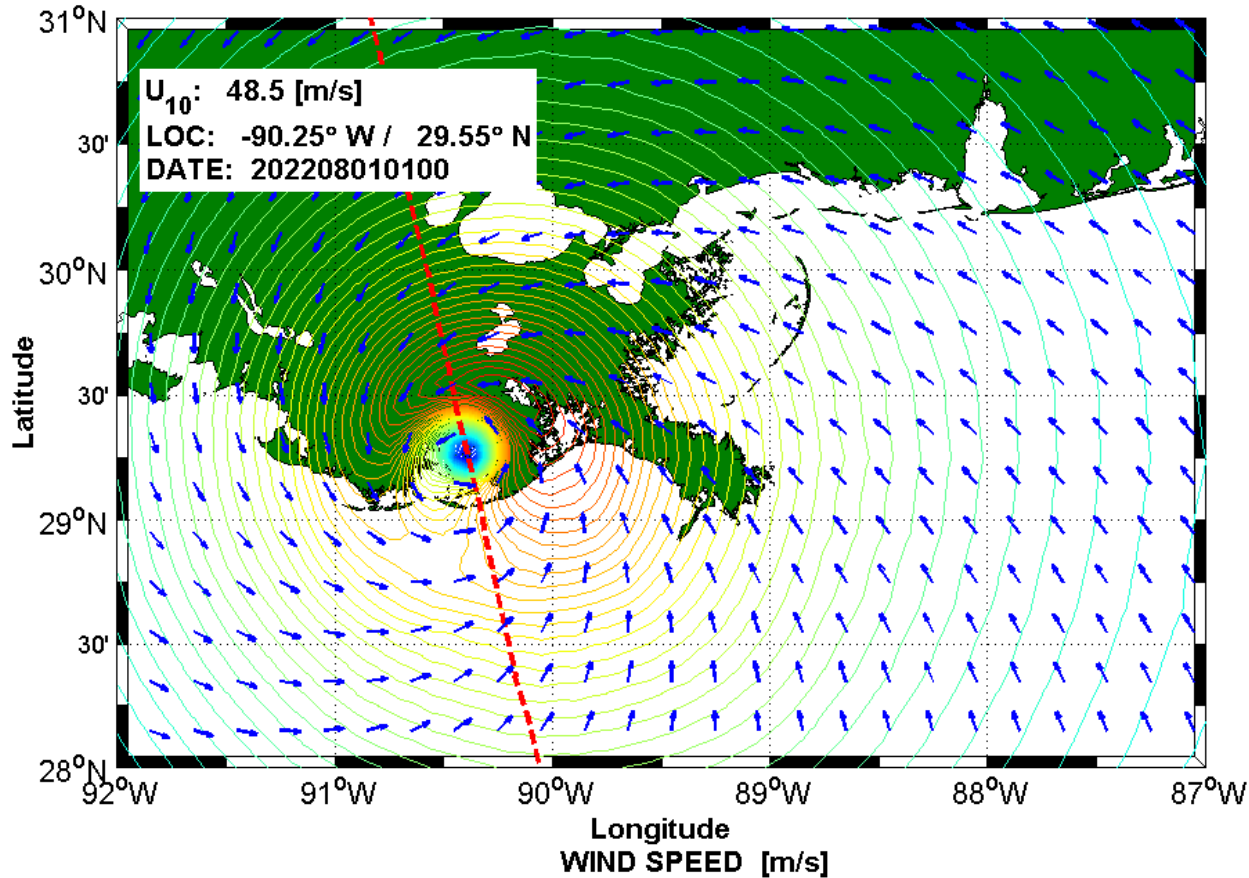
WIND SPEED RESULTS: RUN005





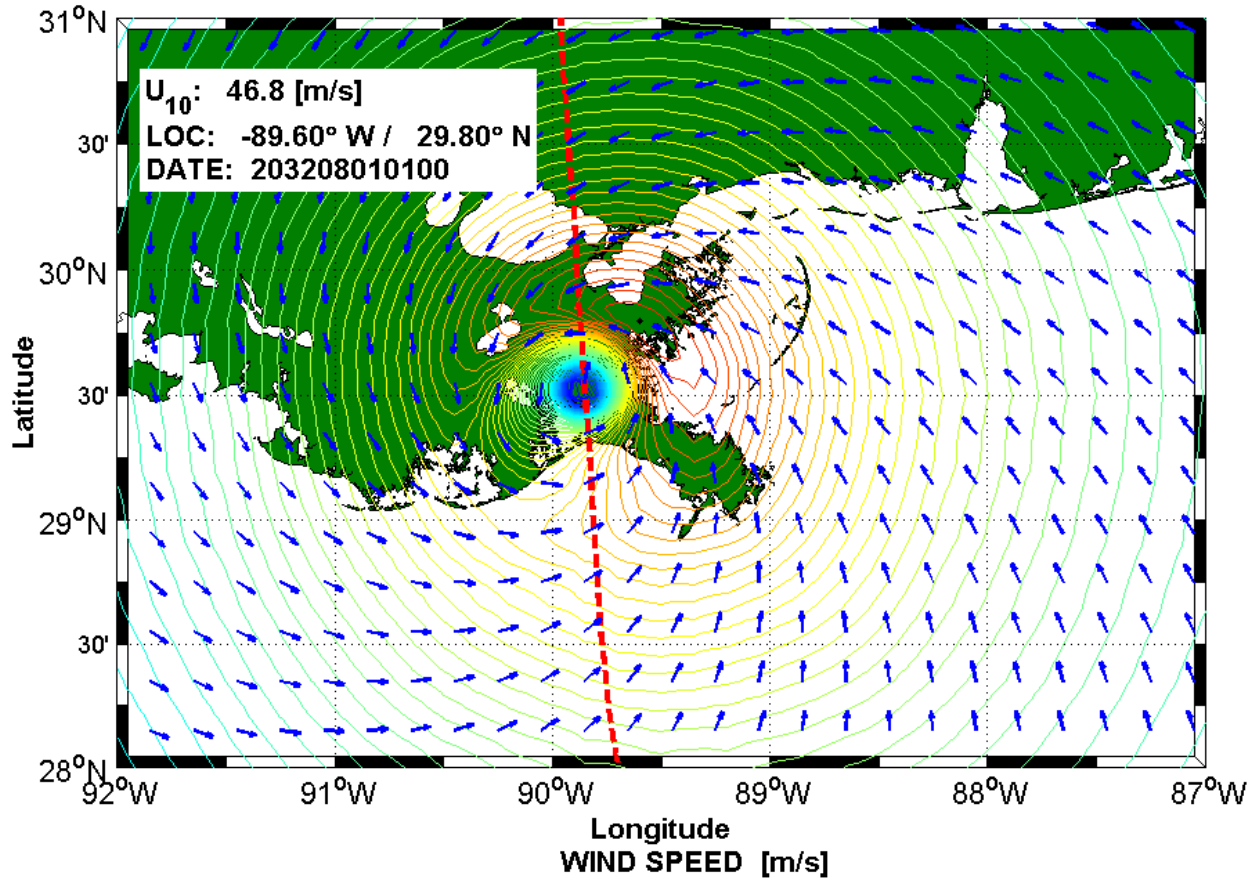
# Sample Storm Track E2

WIND SPEED RESULTS: RUN017



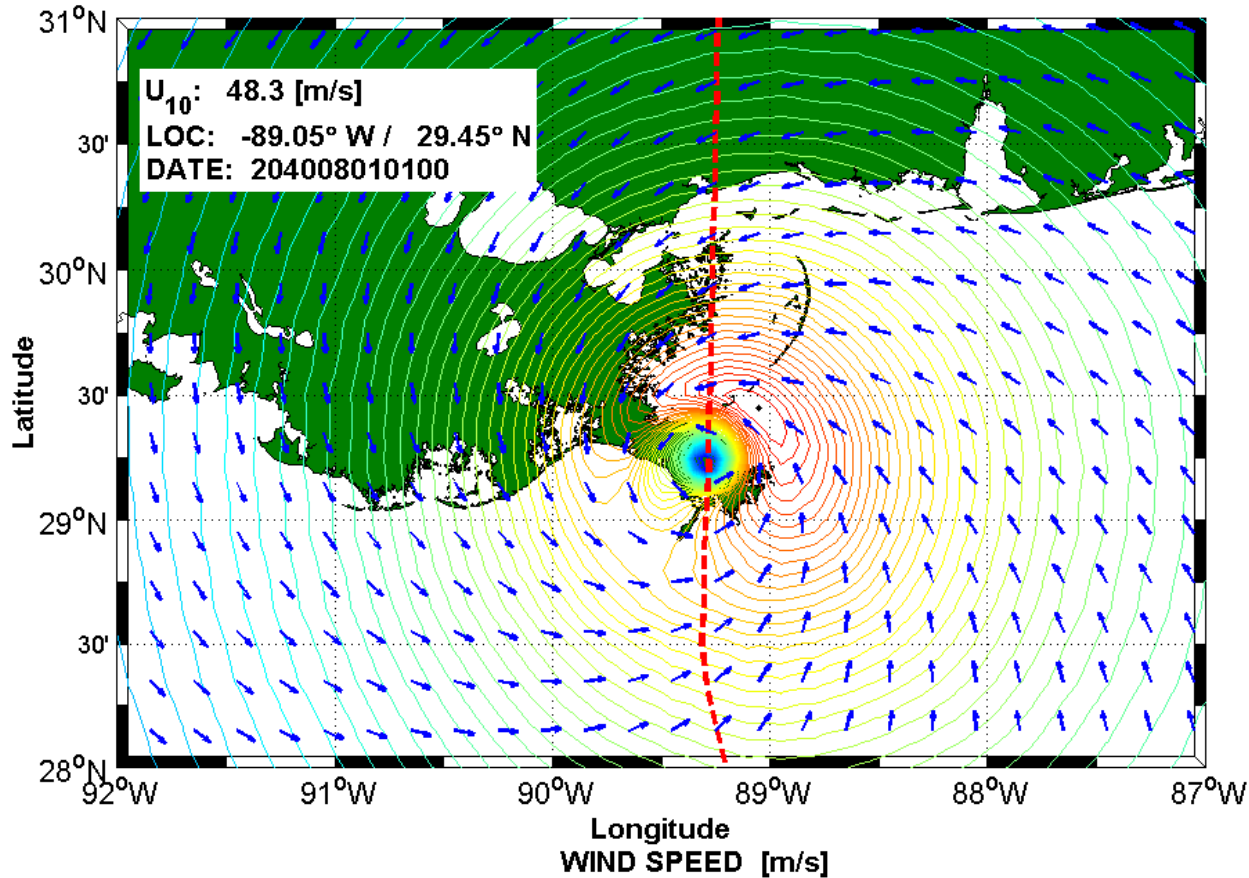
# Sample Storm Track E3

WIND SPEED RESULTS: RUN027



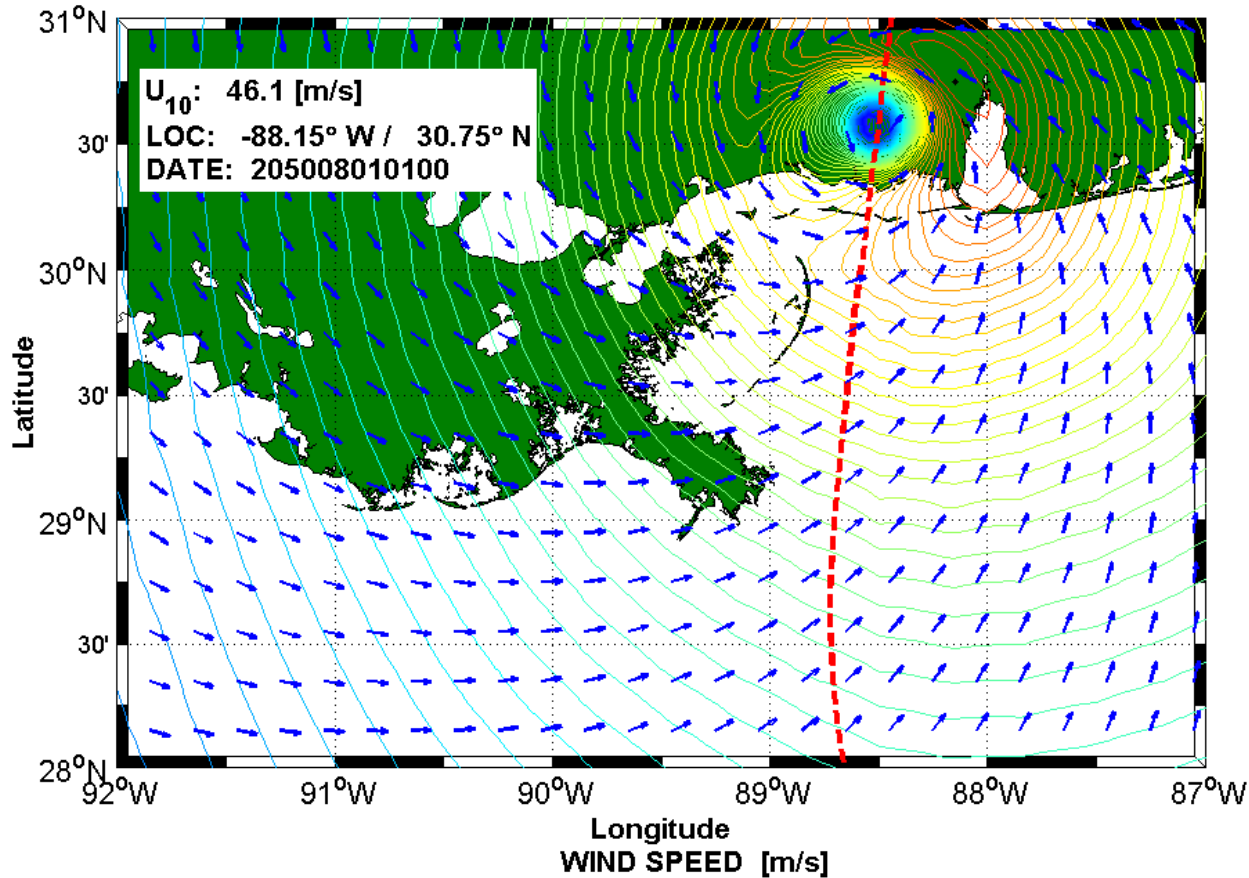
# Sample Storm Track E4

WIND SPEED RESULTS: RUN035



# Sample Storm Track E5

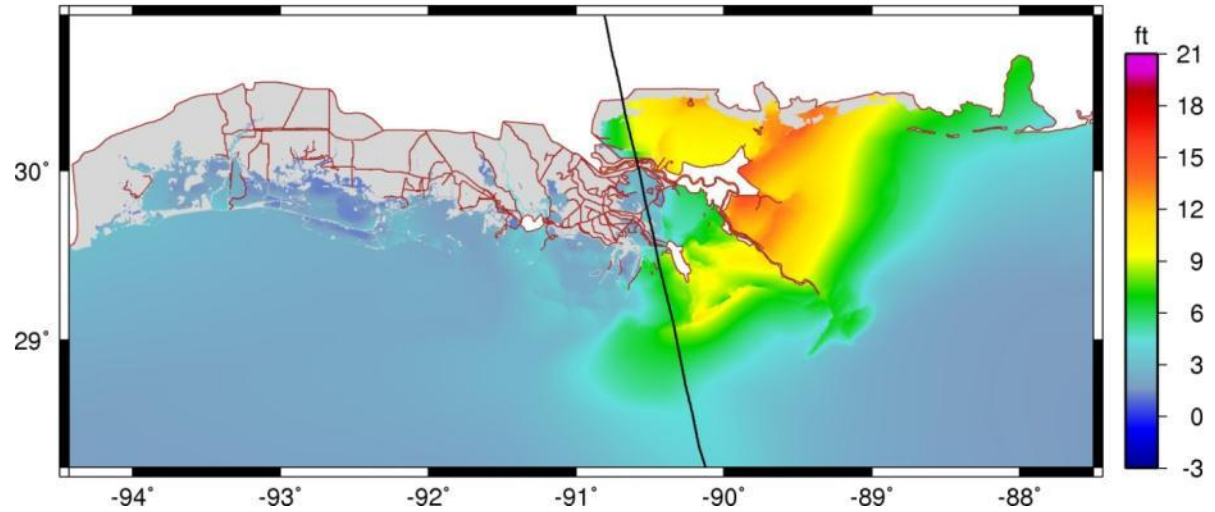
WIND SPEED RESULTS: RUN045



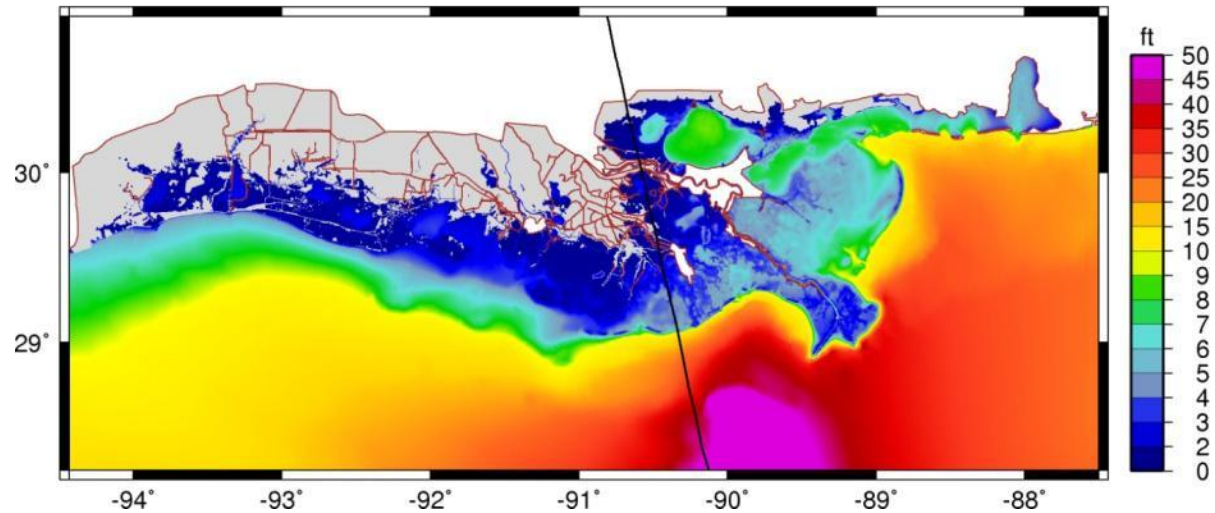
# Synthetic Storms: 2011 Current Conditions

Storm 15 (East)

Storm 15 Maximum Water Elevation



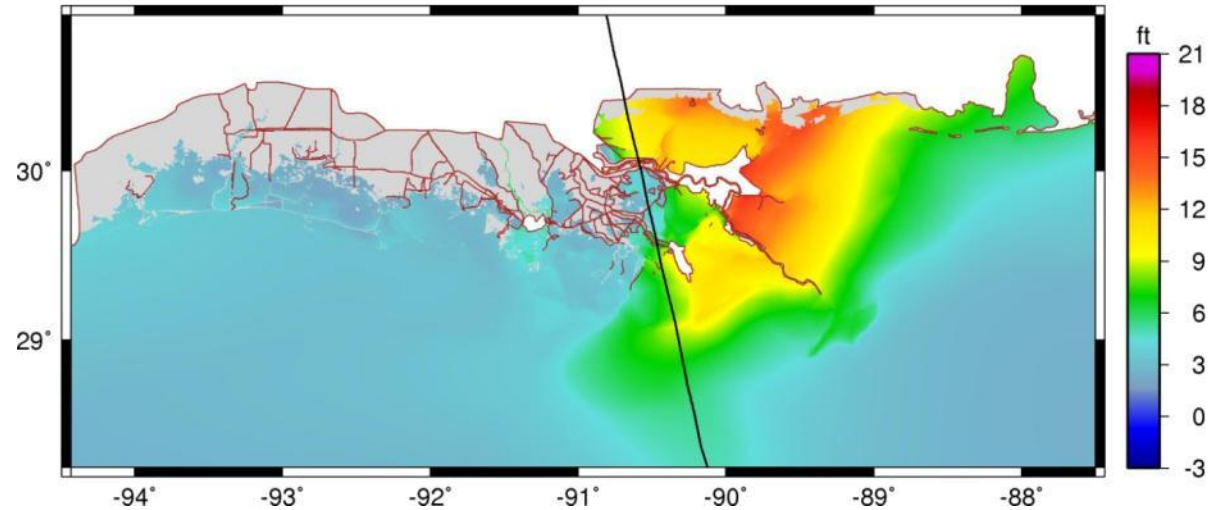
Storm 15 Maximum Significant Wave Height



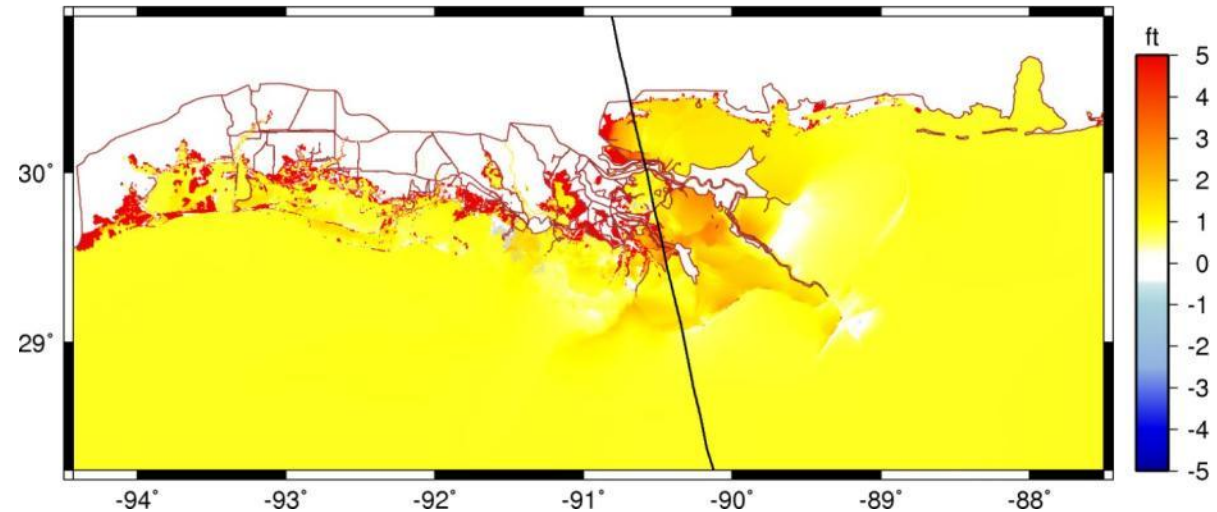
# Synthetic Storms: Moderate Future Conditions

Storm 15 (East)  
SLR = 0.9 feet

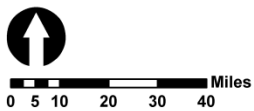
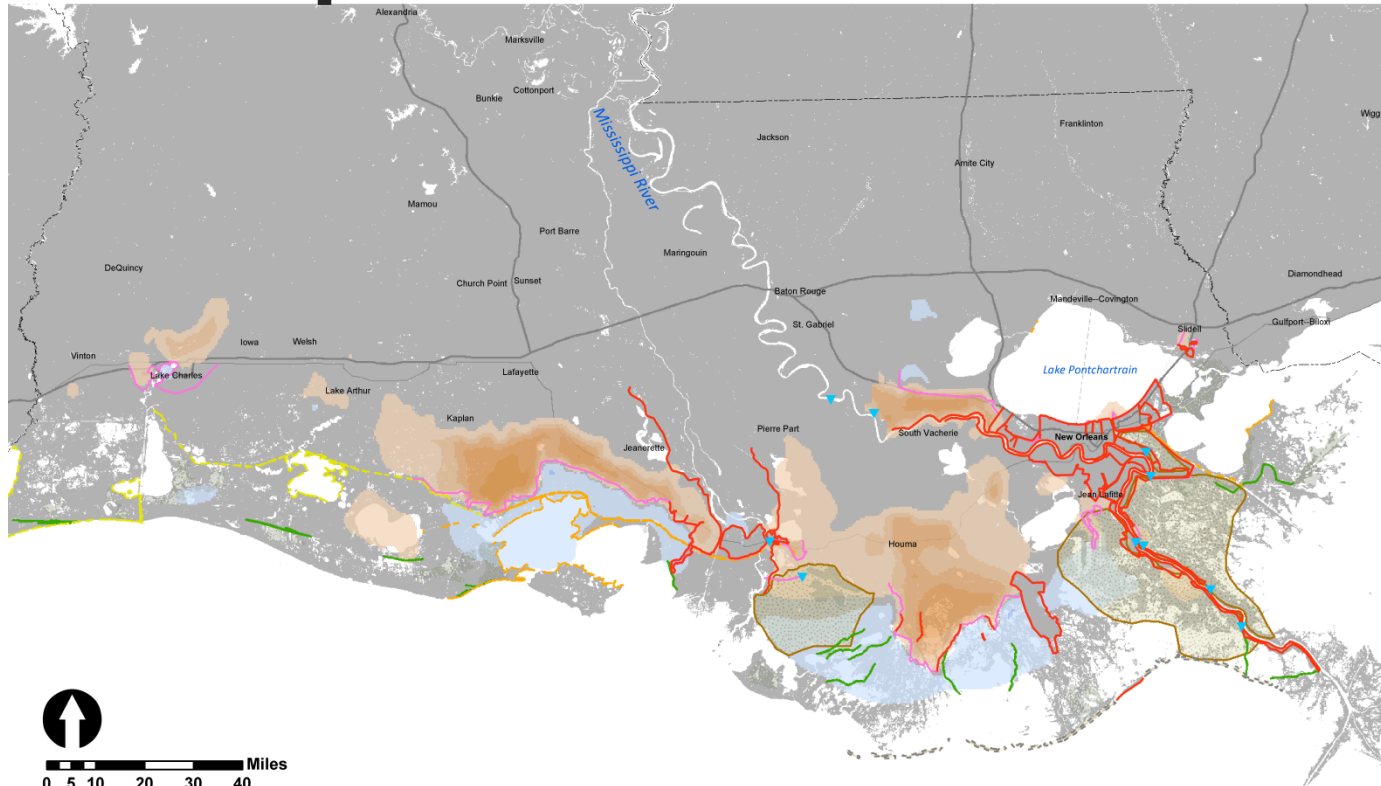
Storm 15 Maximum Water Elevation



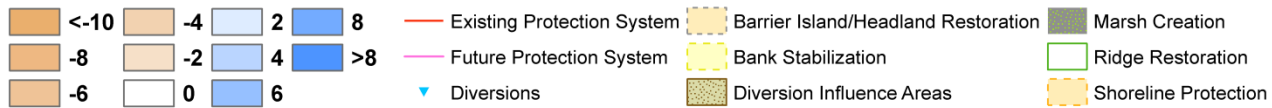
Storm 15 WSE S12 less S50



# Sample Statistical Returns



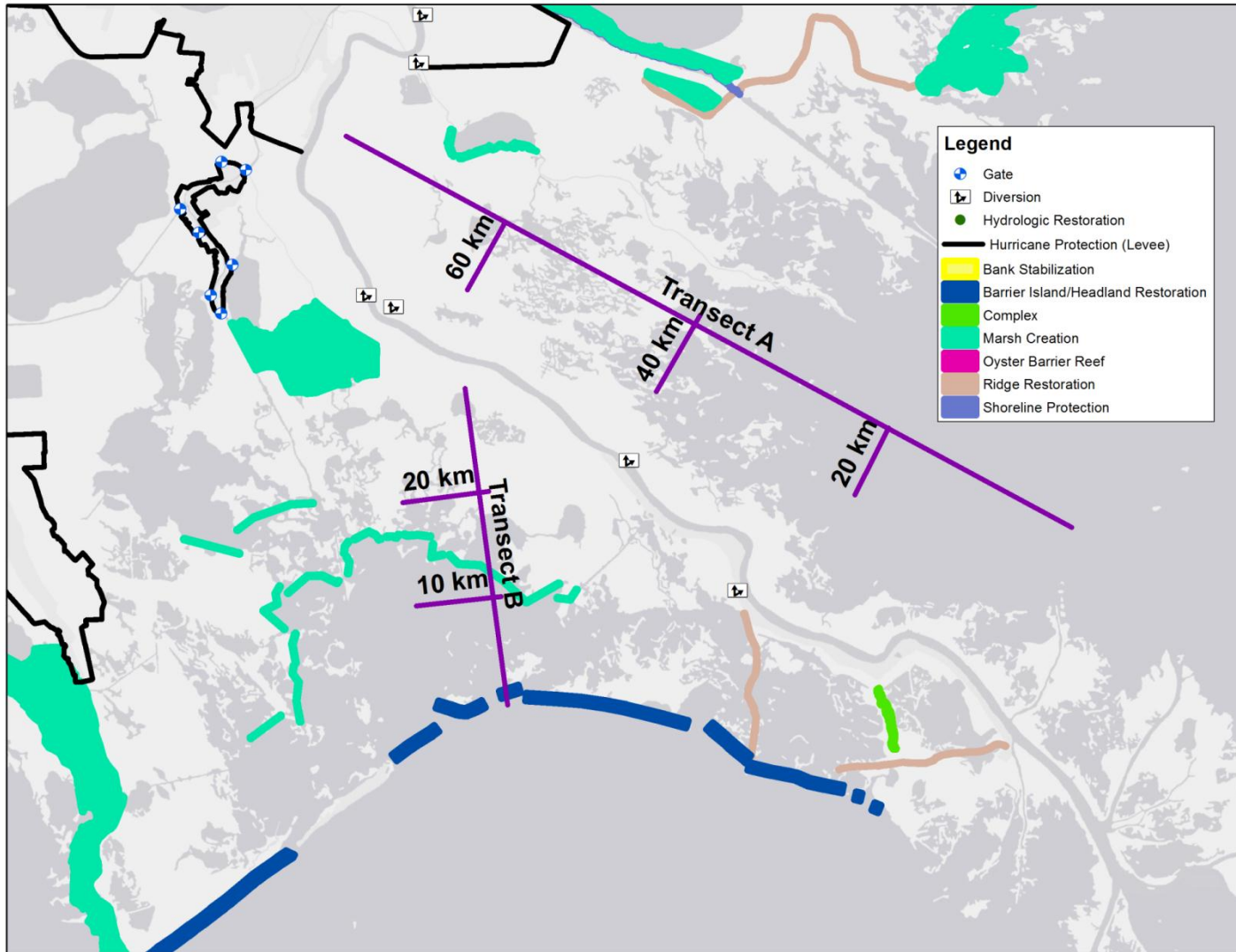
Difference in 100-year Surge Height in Feet  
(NAVD88), 2061 Conditions



3/8/2012



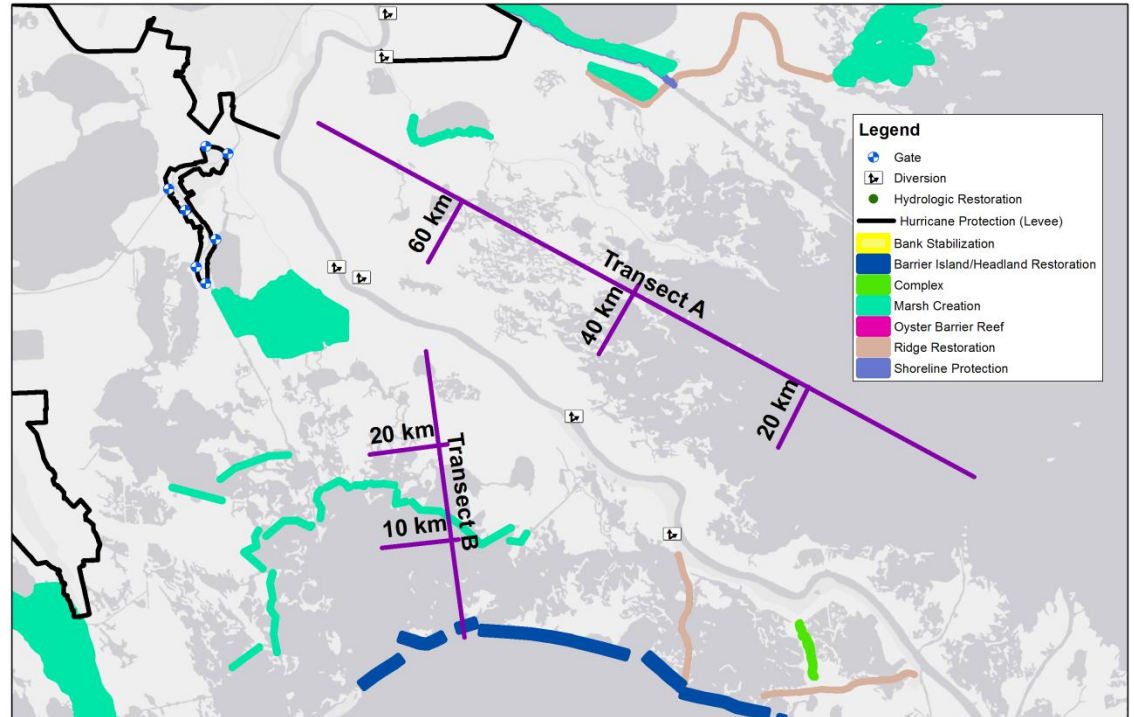
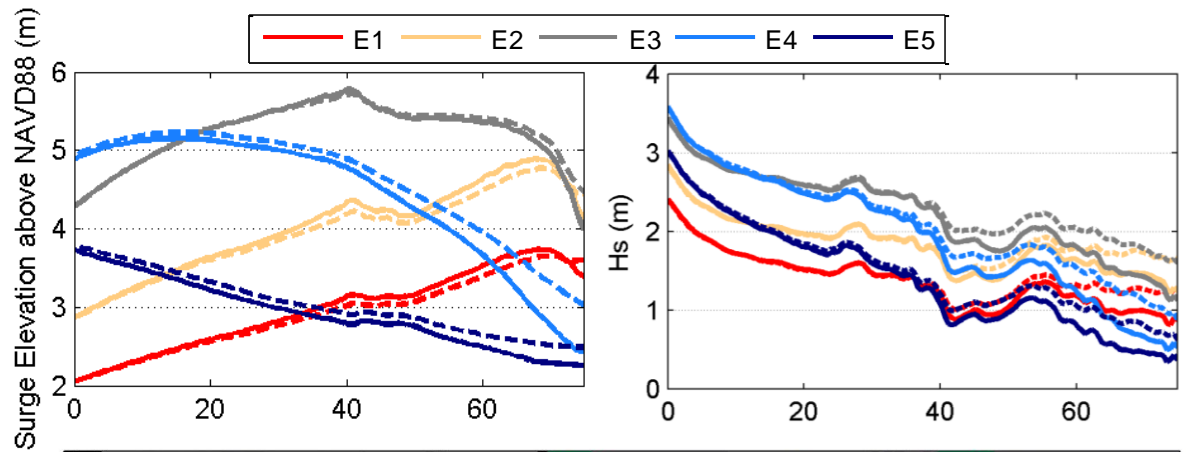
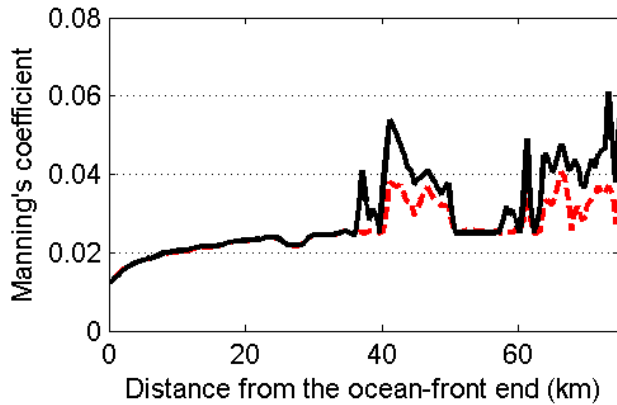
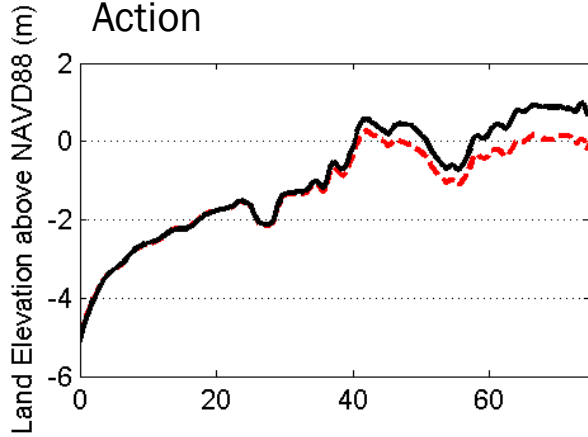
# Project Implementation





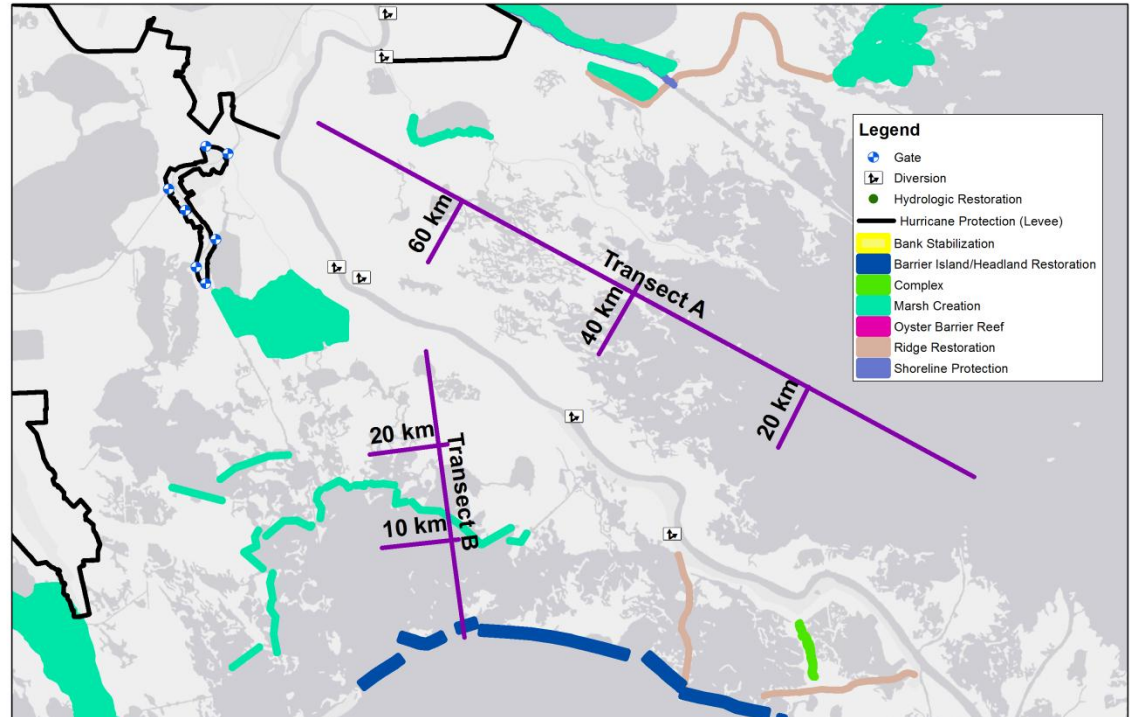
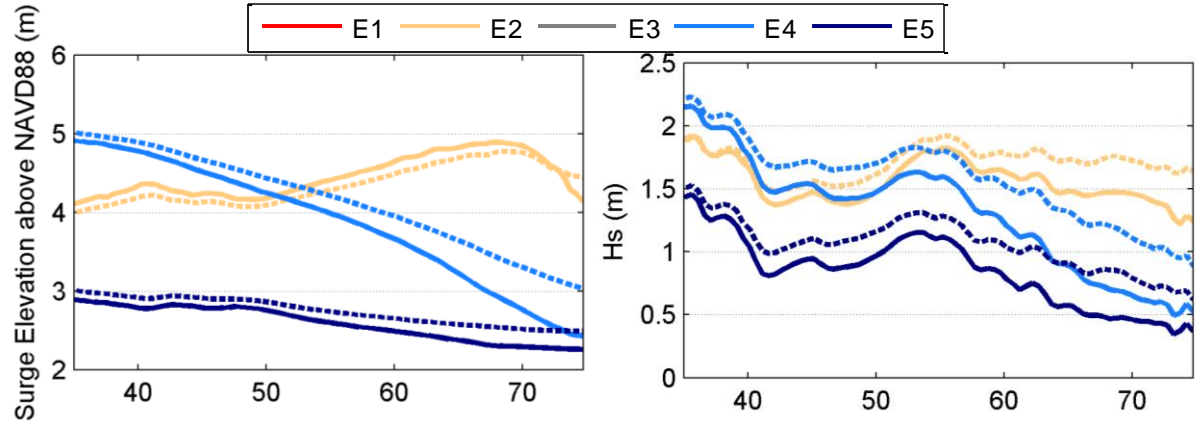
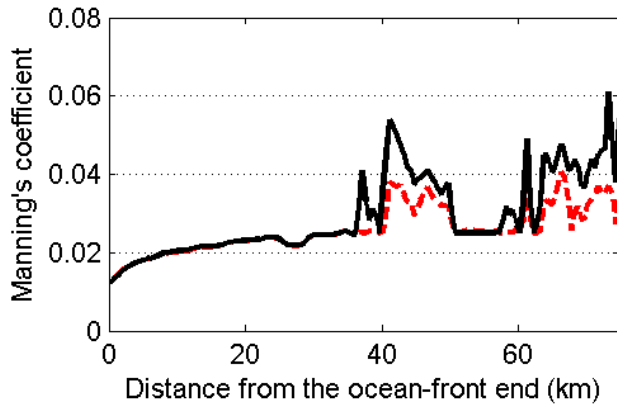
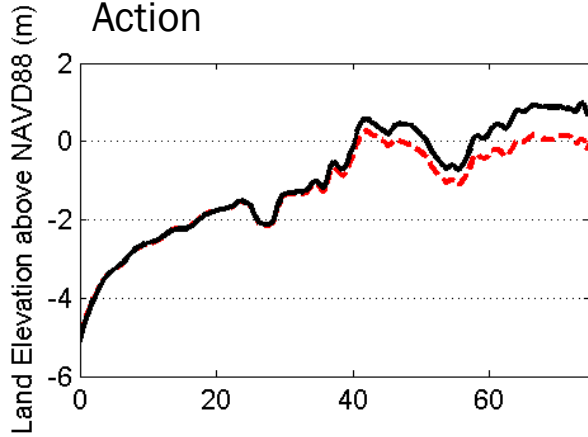
# Transect A

Dash lines: Future Without Action  
 Solid lines: Future With Action



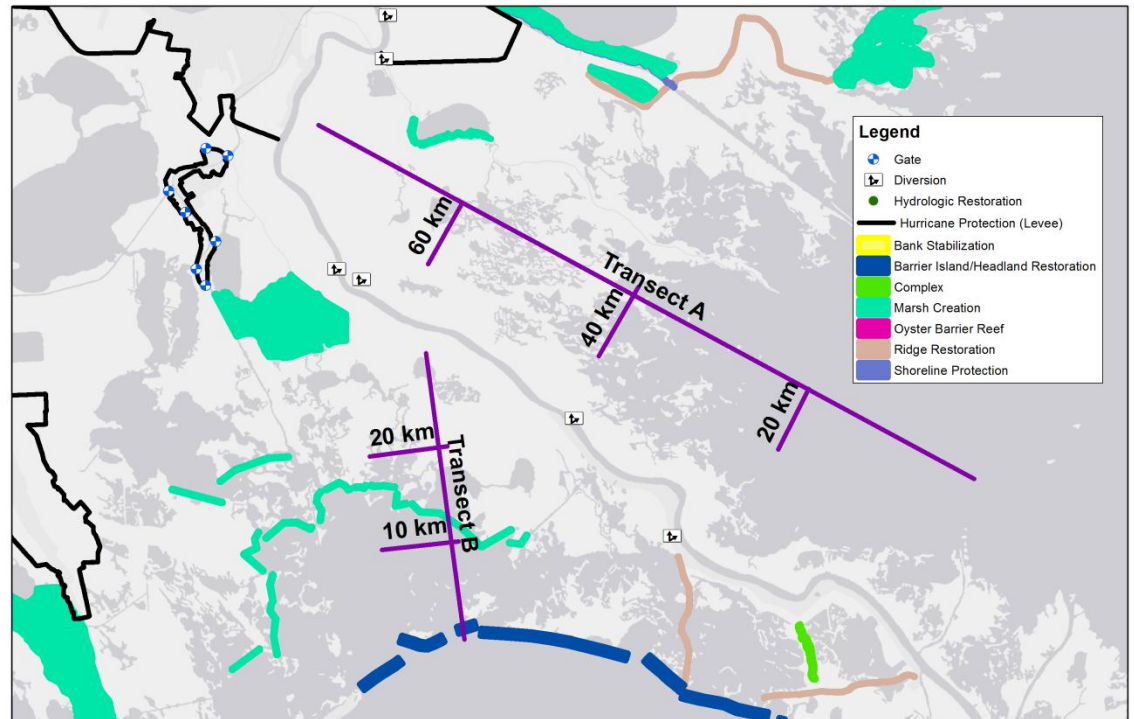
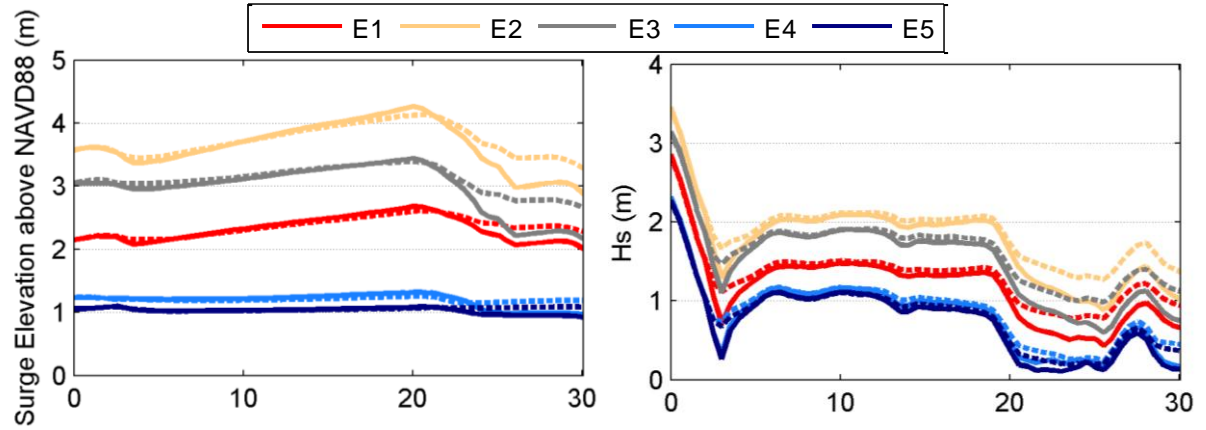
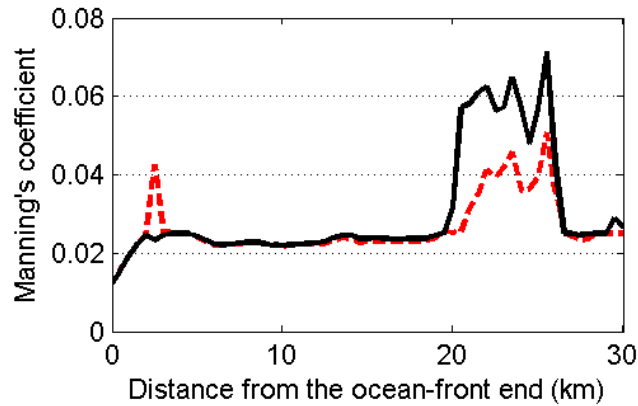
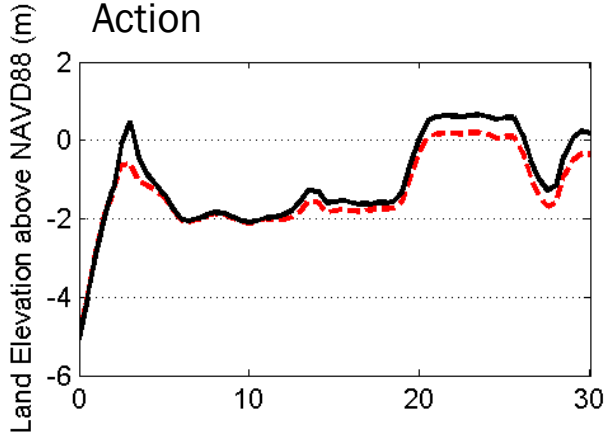
# Transect A

Dash lines: Future Without Action  
 Solid lines: Future With Action



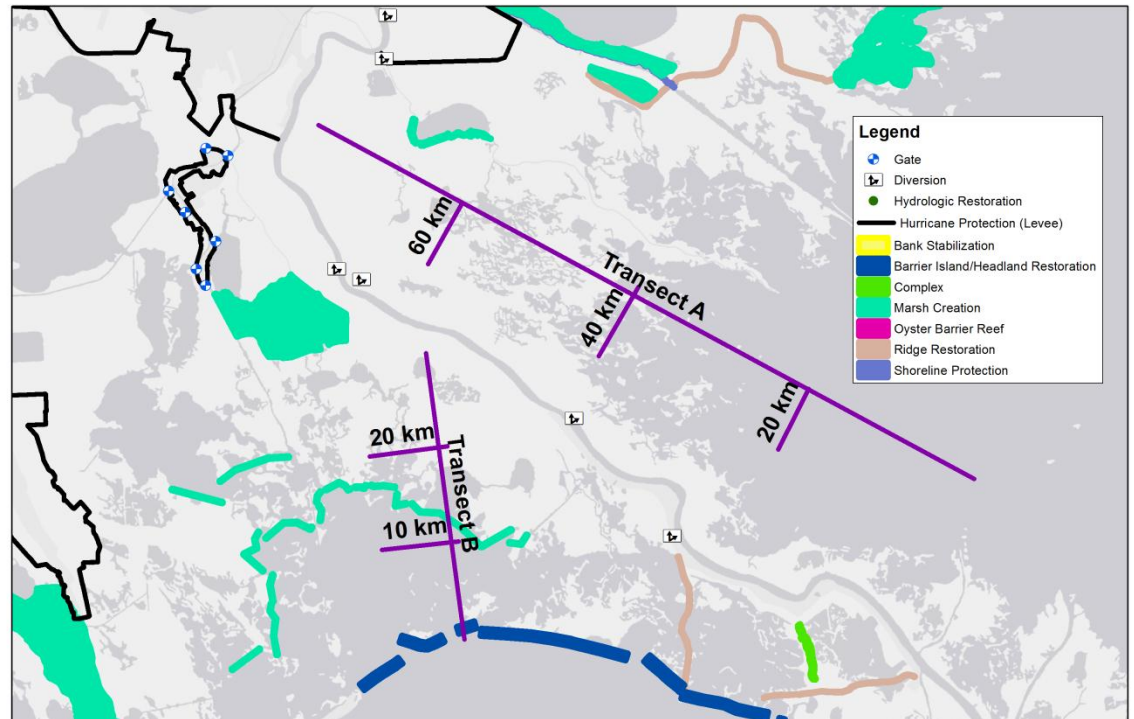
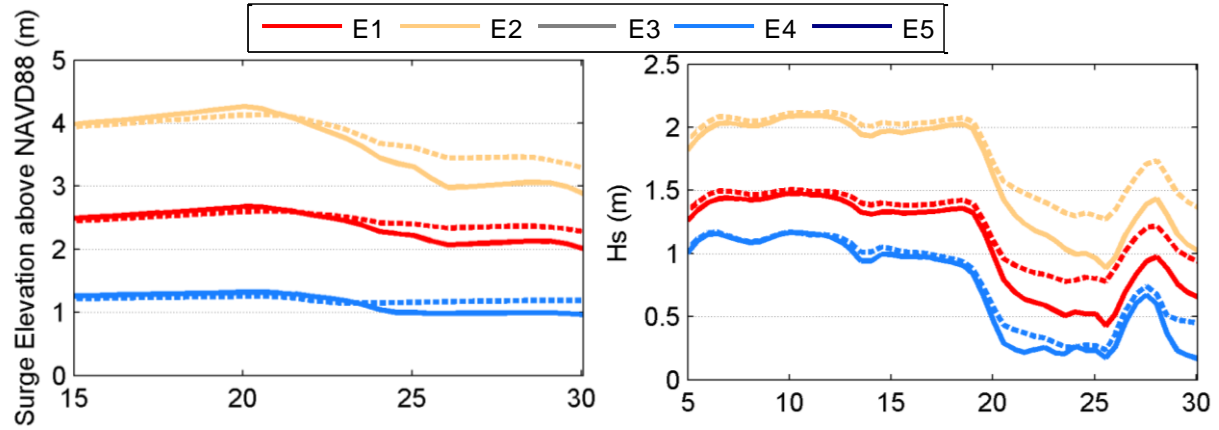
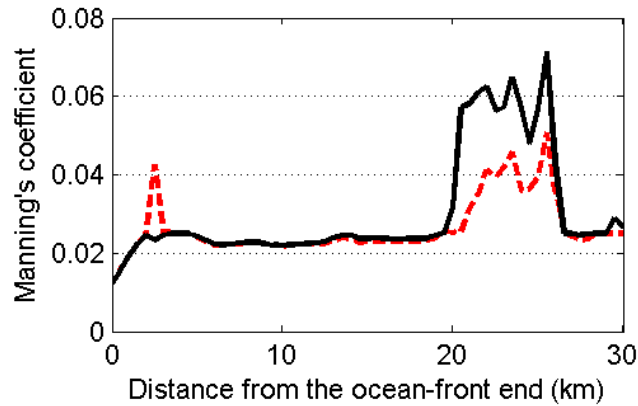
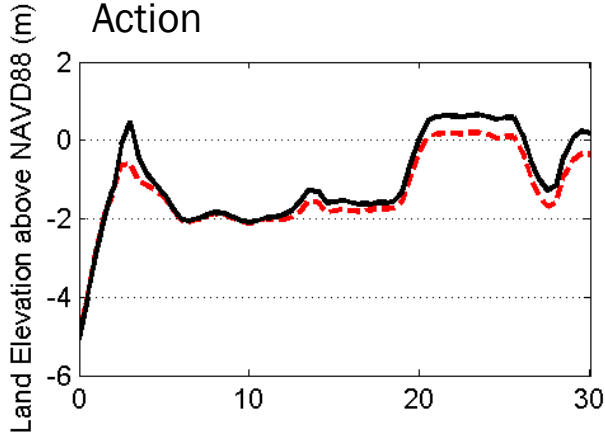
# Transect B

Dash lines: Future Without Action  
 Solid lines: Future With Action



# Transect B

Dash lines: Future Without Action  
 Solid lines: Future With Action





*Questions?*

Imagine the result