STORM SURGE AND WAVE MODEL UPDATE

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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
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

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

\( \sigma = 6.0 \)
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

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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
MODEL VALIDATION
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
STORM SURGE AND WAVES

High Water Mark Spatial Plot

High Water Mark Scatter Plot
HURRICANE KATRINA WAVE OBSERVATIONS
STORM SURGE AND WAVES

NDBC 42036

Significant Wave Height

Wave Direction

Peak Wave Period

Mean Wave Period
HURRICANE KATRINA WAVE OBSERVATIONS
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
HURRICANE RITA
STORM SURGE AND WAVES
HURRICANE RITA WAVE OBSERVATIONS
STORM SURGE AND WAVES

NDBC 42040
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

$y = 1.04x + 0.00$
$r^2 = 0.79$
$\sigma = 0.95$
HURRICANE GUSTAV WAVE OBSERVATIONS
STORM SURGE AND WAVES

NDBC 42040

Significant Wave Height

Peak Wave Period

Mean Wave Period

Unavailable
HURRICANE GUSTAV WAVE OBSERVATIONS
STORM SURGE AND WAVES

UNDKennedy 11

Unavailable

Unavailable
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

CS1 03

![Map of Louisiana with a marker at CSI 03](image)

![Graphs showing wave height, direction, peak period, and mean period](graphs)
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
QUESTIONS