FEMA

Monroe County Technical Update Meeting

Southeast Florida Coastal Study

March 15, 2016– Marathon

March 15, 2016– Key West

RiskMAP

Increasing Resilience Together

Welcome and Introductions

- **FEMA Region IV**
  - Christina Lindemer – Technical Lead
- **Production and Technical Services (PTS) Contractor**
  - Michael DelCharco – Project Manager

BakerAECOM
An Integrated Production Team

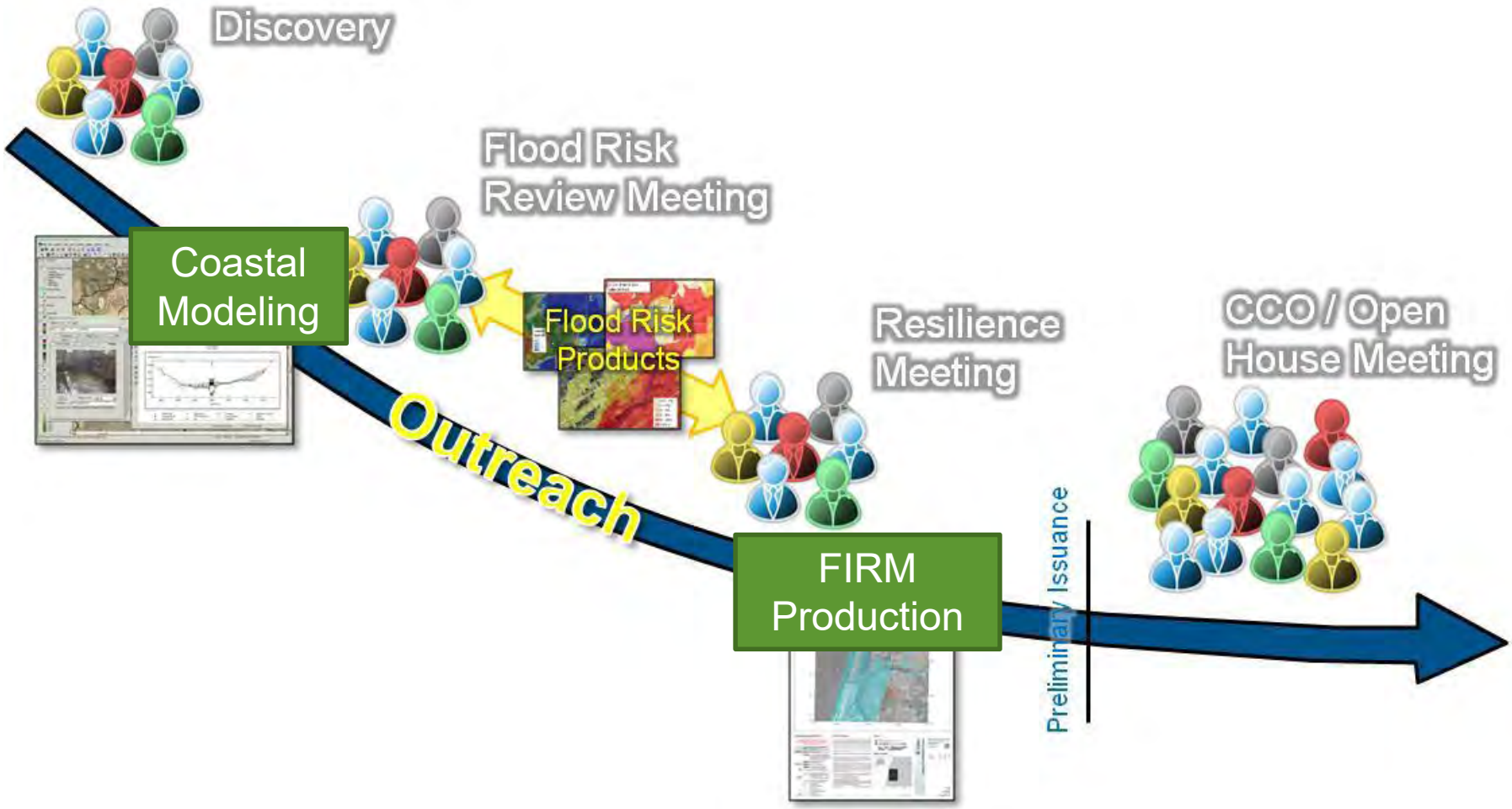
Agenda

- Risk MAP Overview
- Coastal Project Overview
- Status and Update
- Questions and Answers

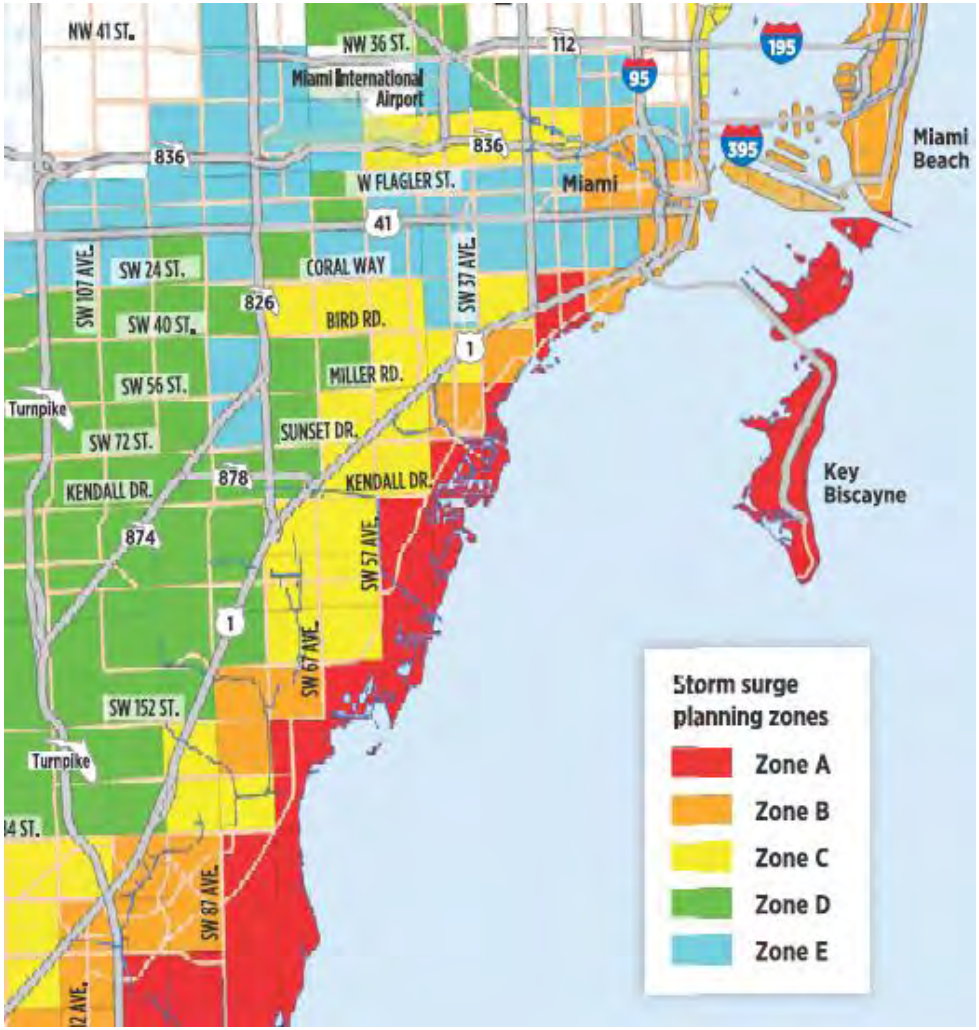
Risk MAP Program Overview

- **Risk MAP Objective (Coastal)**
  - To provide updated flood hazard data for 100% of the populated U.S. coast

Risk MAP Project Timeline

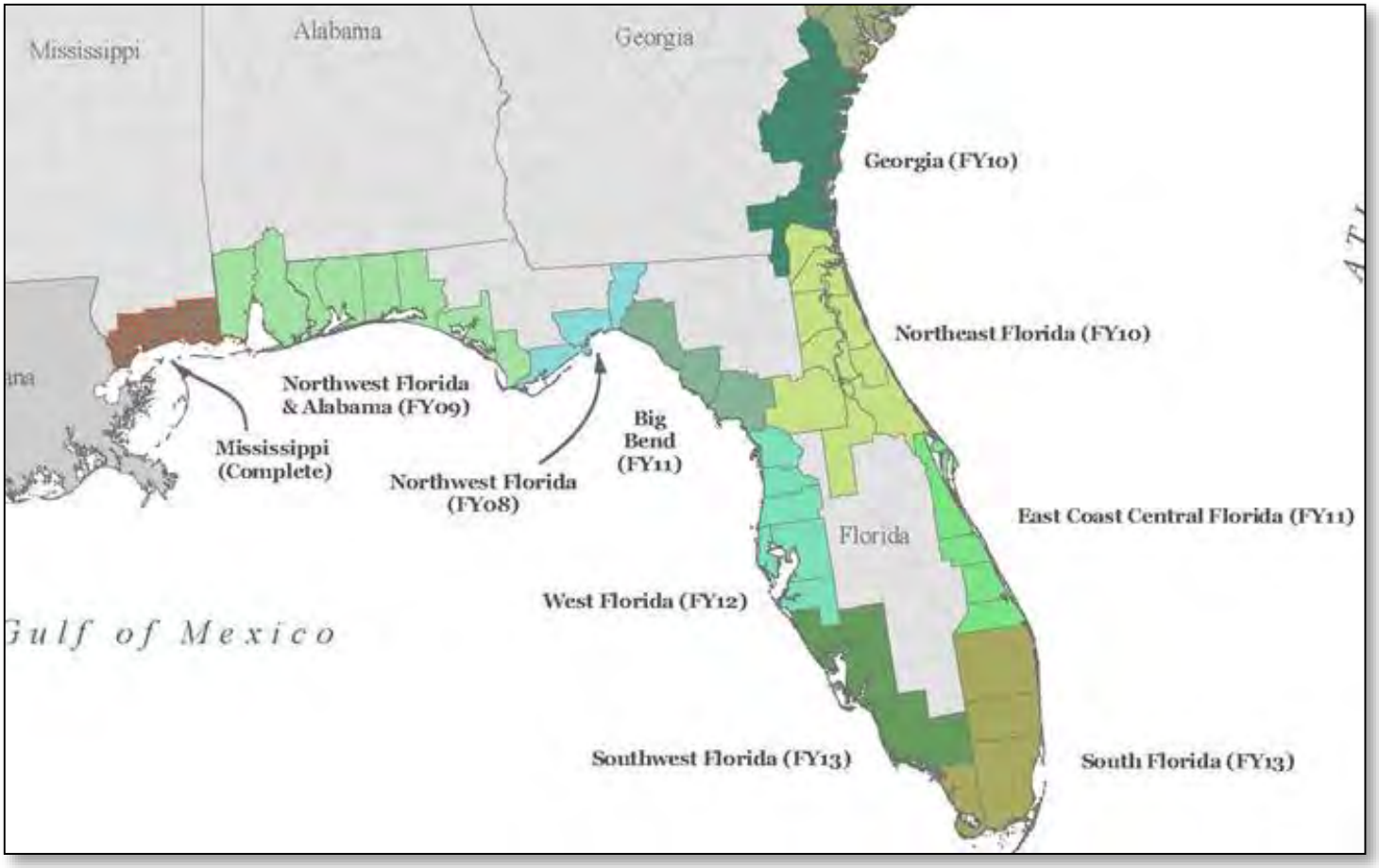


Southeast Florida Coastal Study – What It's Not……

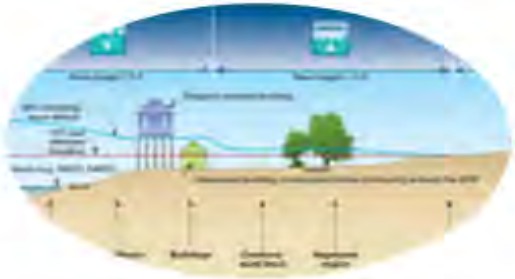


The new FEMA Coastal Study is NOT a Hurricane Evacuation Study and is not meant to replace your current Hurricane Evacuation Study.

Ongoing Coastal Studies



Southeast FL Coastal Study – Project Goals



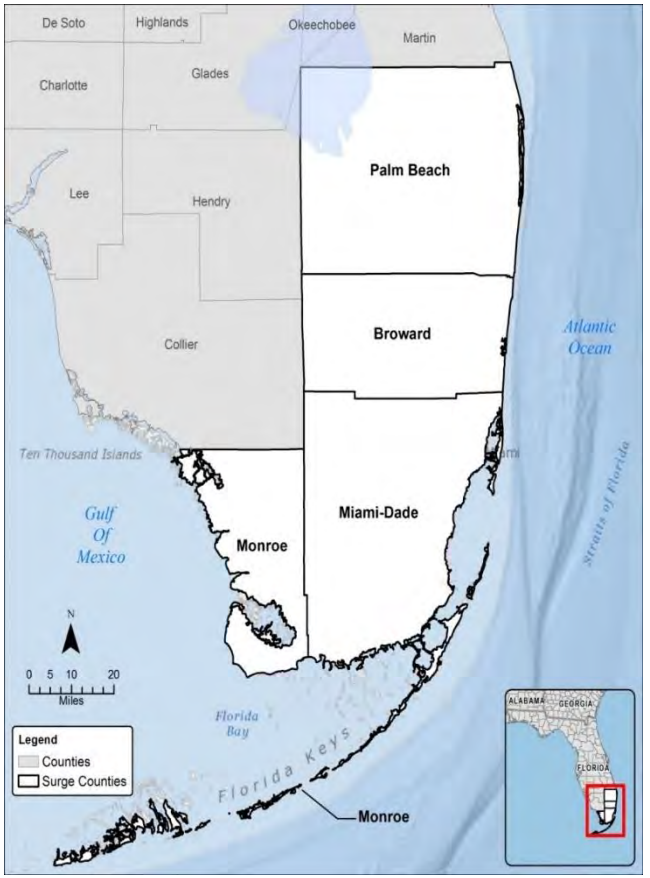
Determine revised Base Flood Elevations (BFEs) and flood inundation boundaries for 1% annual-chance (base) flood total water levels

Update the coastal Flood Insurance Study (FIS) and Flood Insurance Rate Map (FIRM) Panels

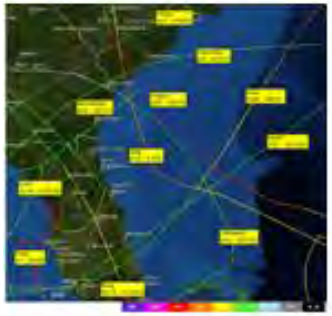
Assist communities with incorporating this information into risk assessment and hazard mitigation planning

Coastal Study – Details

- Study methodology
  - DEM and Mesh development
  - Land Cover Data Analysis
  - Site Reconnaissance
  - JPM-OS
  - Validation
  - Canal sensitivity
- Questions?



Coastal Study – Details



Storm Forcing
Hurricane Tracks

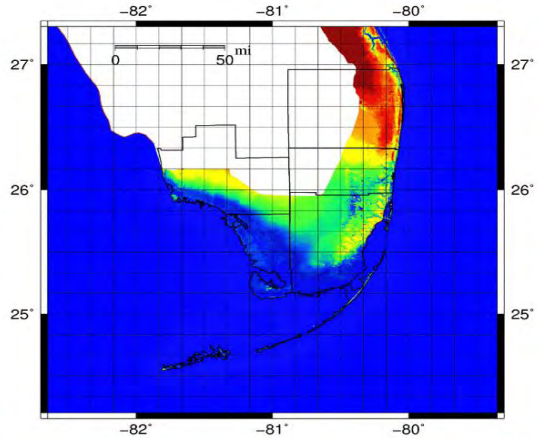
Storm Surge Modeling

Winds

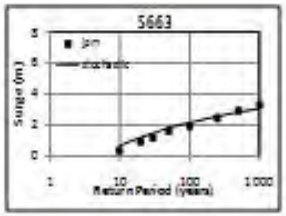
Waves ⟷ **Water Levels**

Return Period Analysis
JPM-OS 2%, 1%, 0.2% Annual Chance
Tide Gage Analysis 50%, 20%, 10% A.C.

SWEL



High-Resolution Bathymetry / Topography Mesh



JPM-OS: Joint Probability Method - Optimum Sampling

Coastal Study – Details
SWAN+ADCIRC

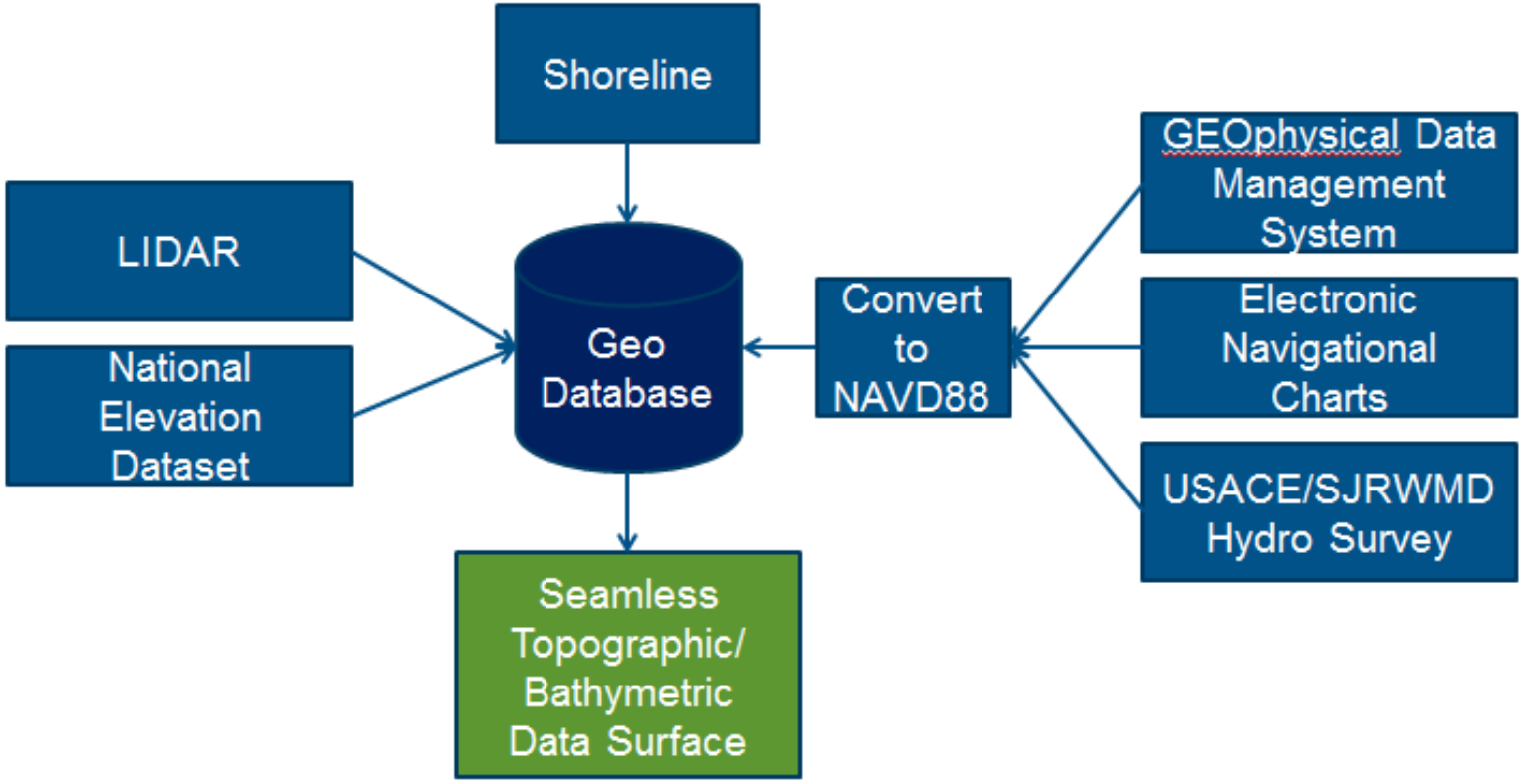
- Water levels + currents + waves
- Parallelized code
- Forcing
  - Wind speed, barometric pressure
  - Tides
  - Riverine flow
- Output
  - Water surface elevation
  - Velocity
  - Wave height, peak period, mean period, direction
  - Radiation stress

Coastal Study – Details

- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- JPM-OS storm suite selection
- Validation
- Canal sensitivity

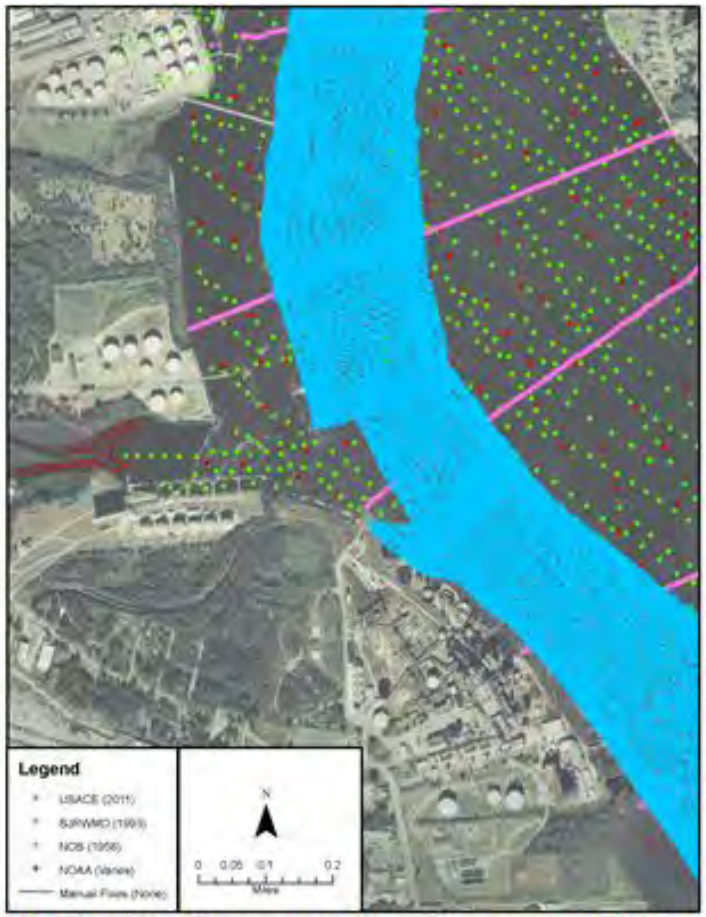
Coastal Study – Details

Seamless Topographic and Bathymetric Data Surface (DEM) Development



NAVD88: North American Vertical Datum of 1988

Coastal Study – Details



Same Area, Different Data Sources, Survey Dates, and Data Extents

Coastal Study – Details

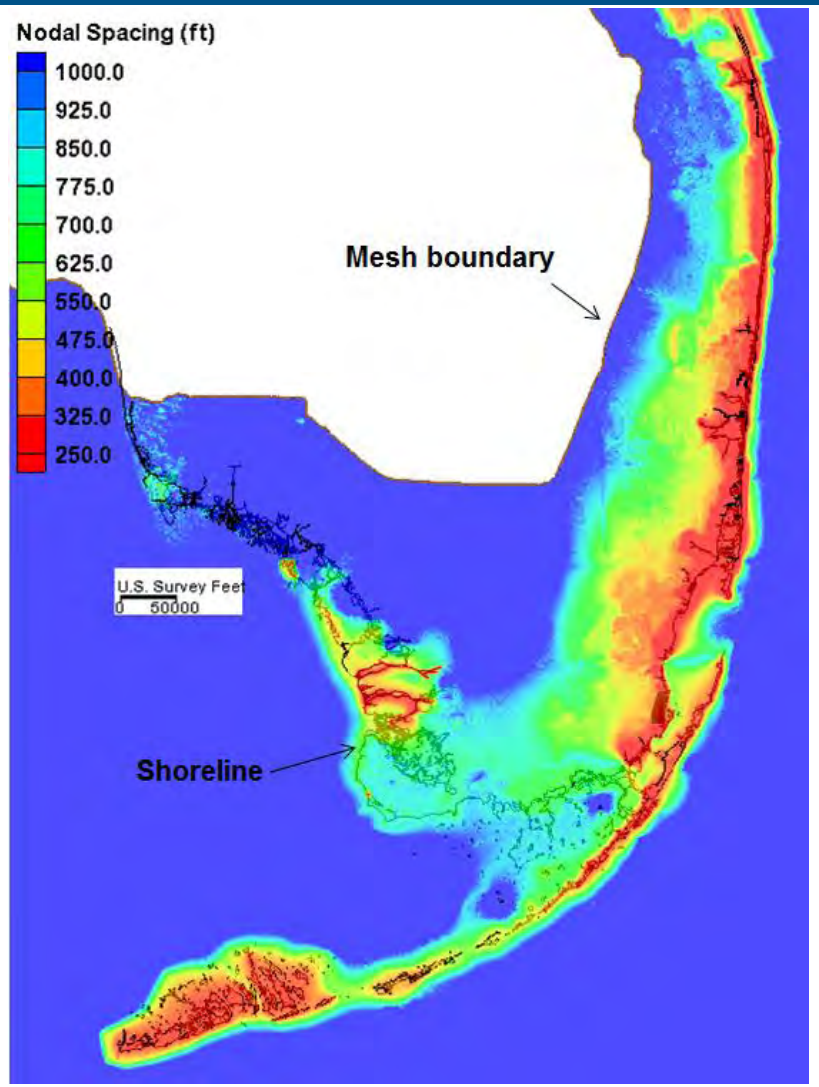
- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- JPM-OS storm suite selection
- Validation
- Canal sensitivity

Hurricane Model Mesh

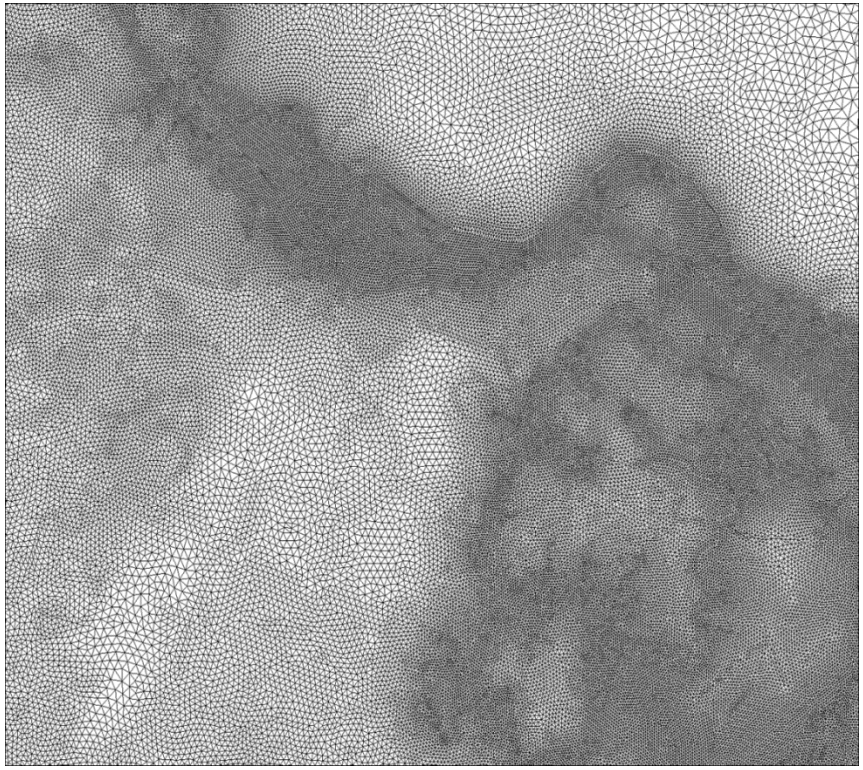
Coastal Study – Details

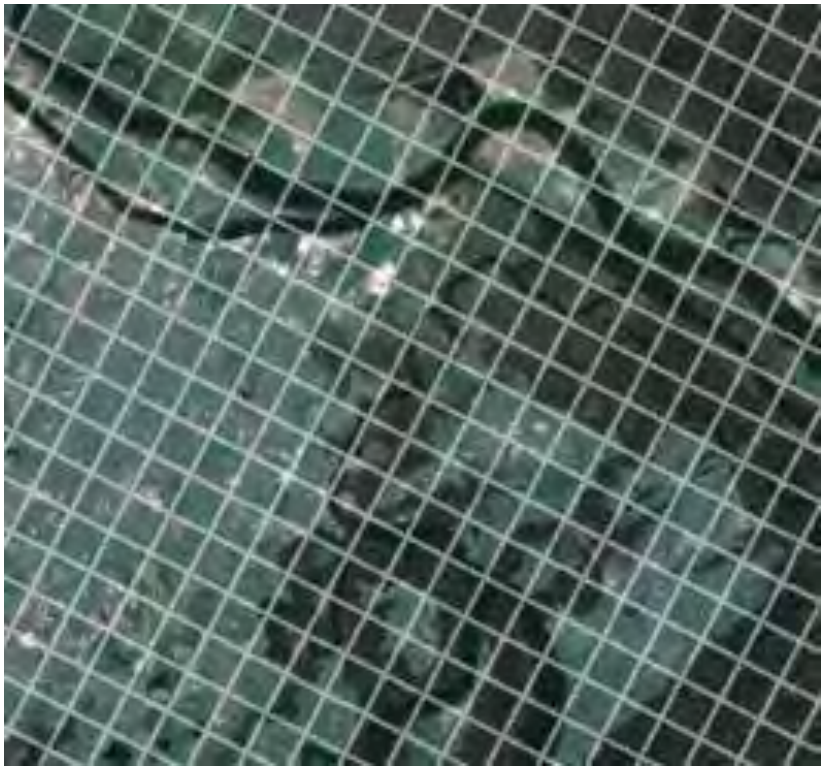
SFL Mesh Grid Resolution

- Resolution down to 50 ft in some areas
- High population density leads to complex road networks to capture
- Extensive canal systems



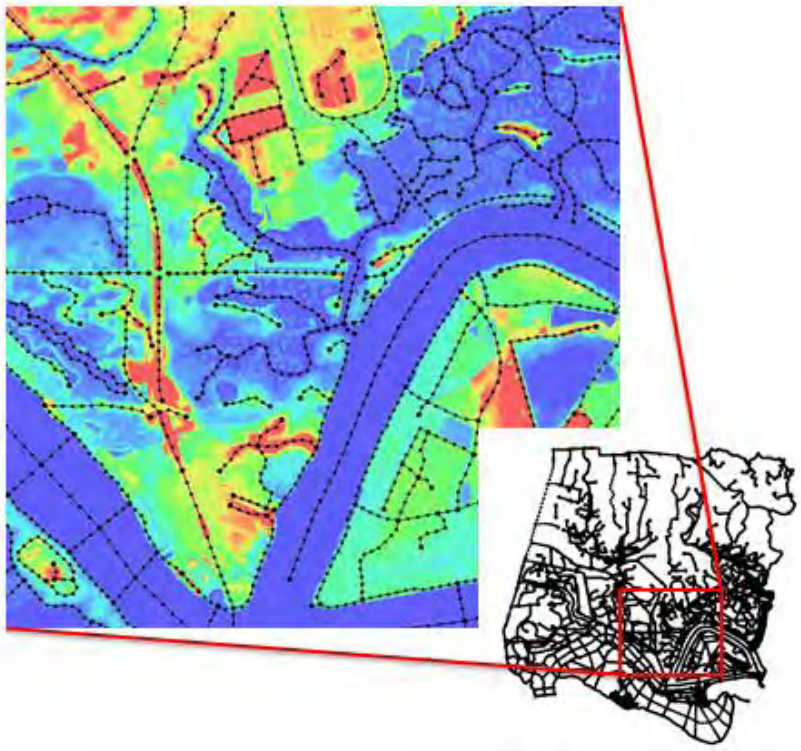
Coastal Study – Details

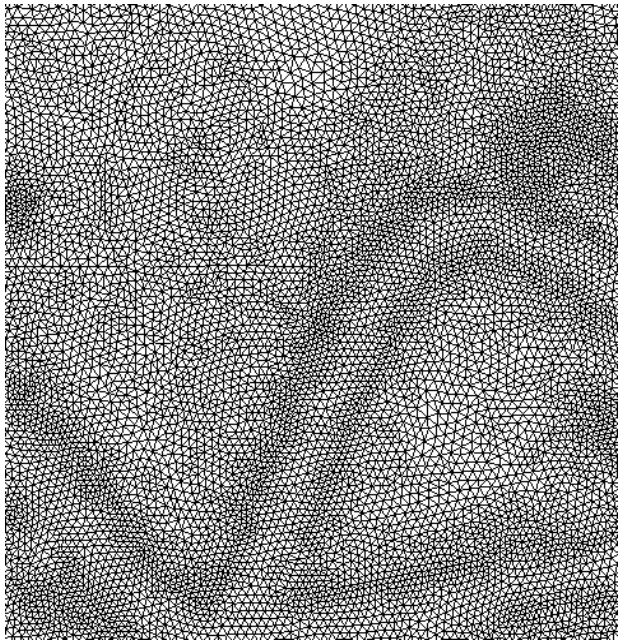




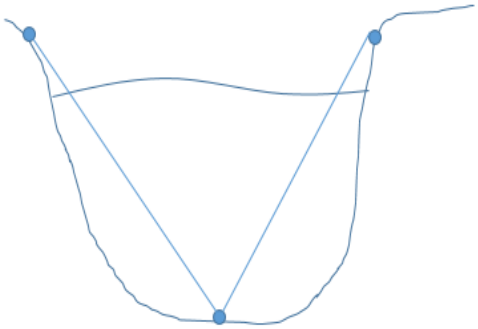
Coastal Study – Details

- Node spacing set to accurately represent topography/bathymetry
- Applies “feature arcs” to represent elevated or depressed features (e.g., roads or channels)

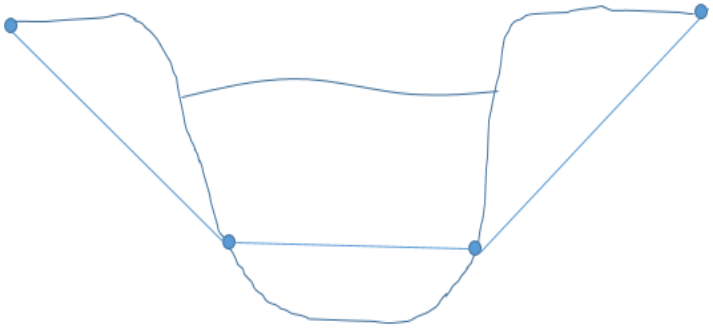




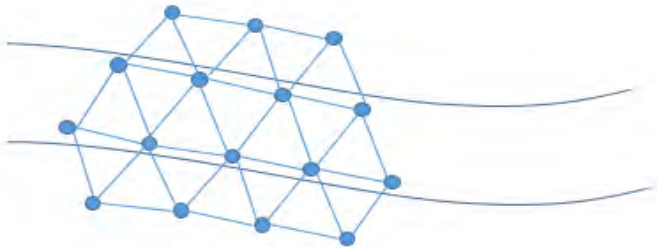
Coastal Study – Details



v-notch

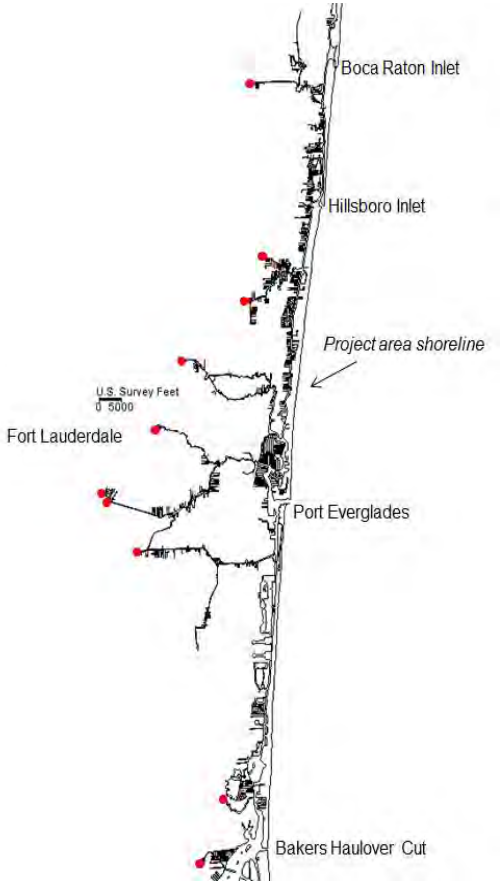


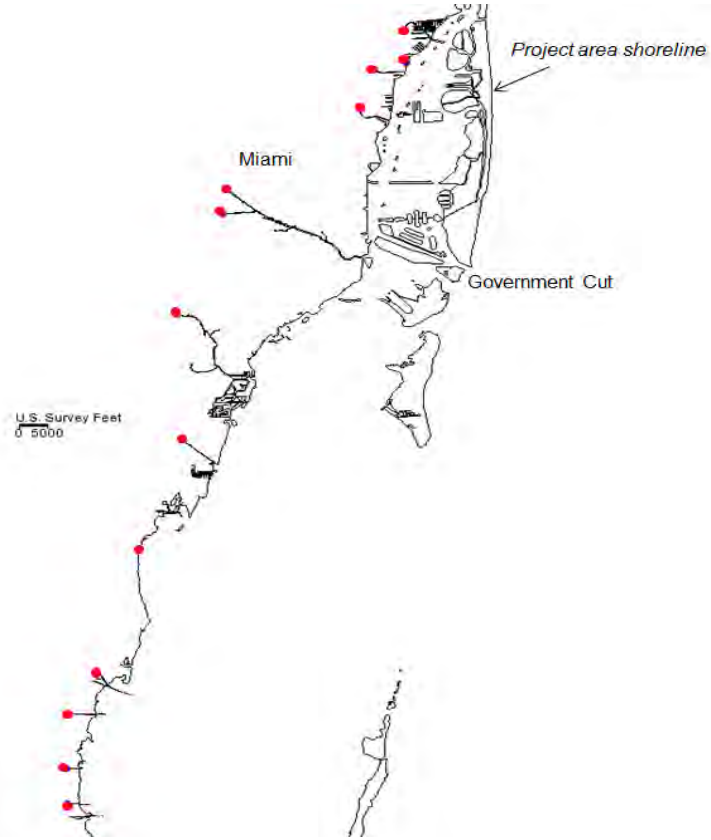
one element across channel



Coastal Study – Details

Bathymetric mesh – SFWMD control structures





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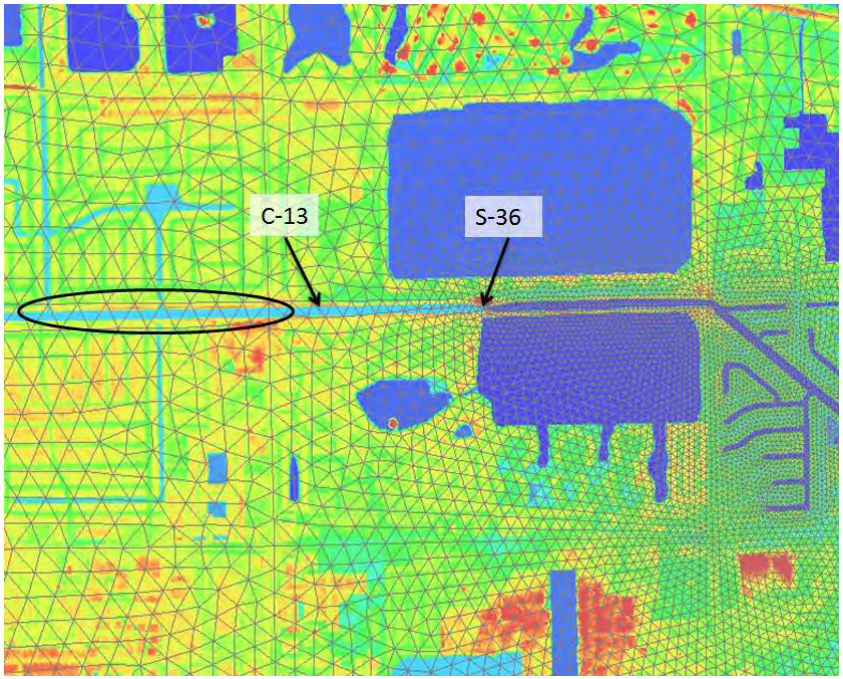

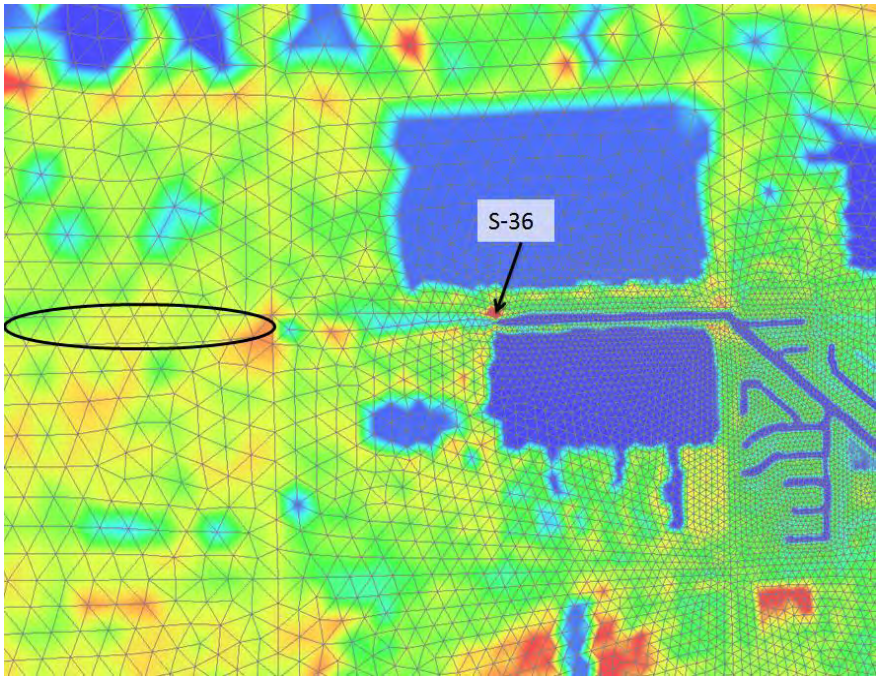

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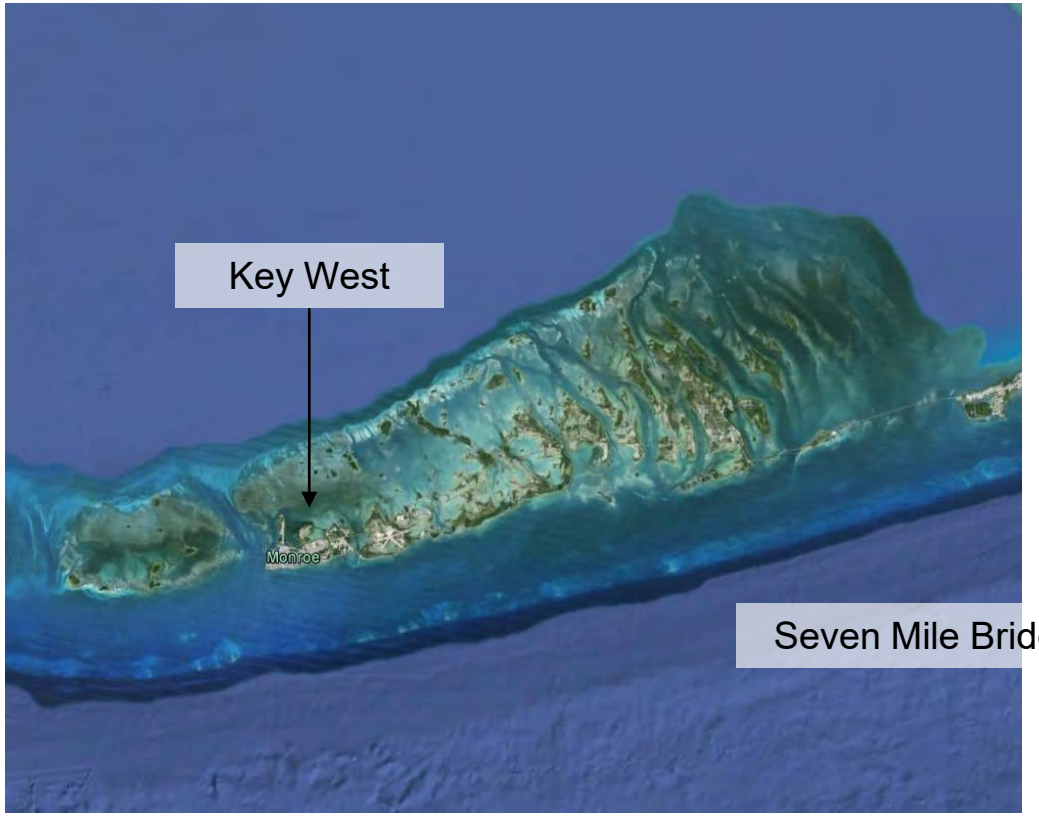
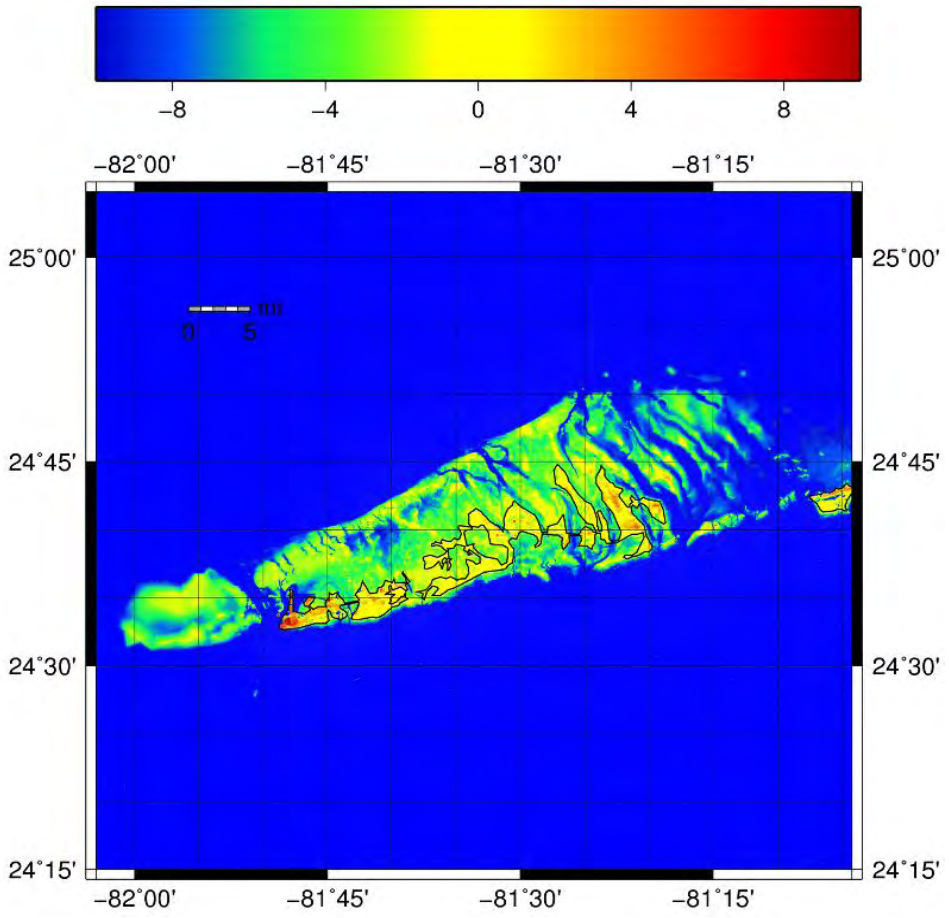


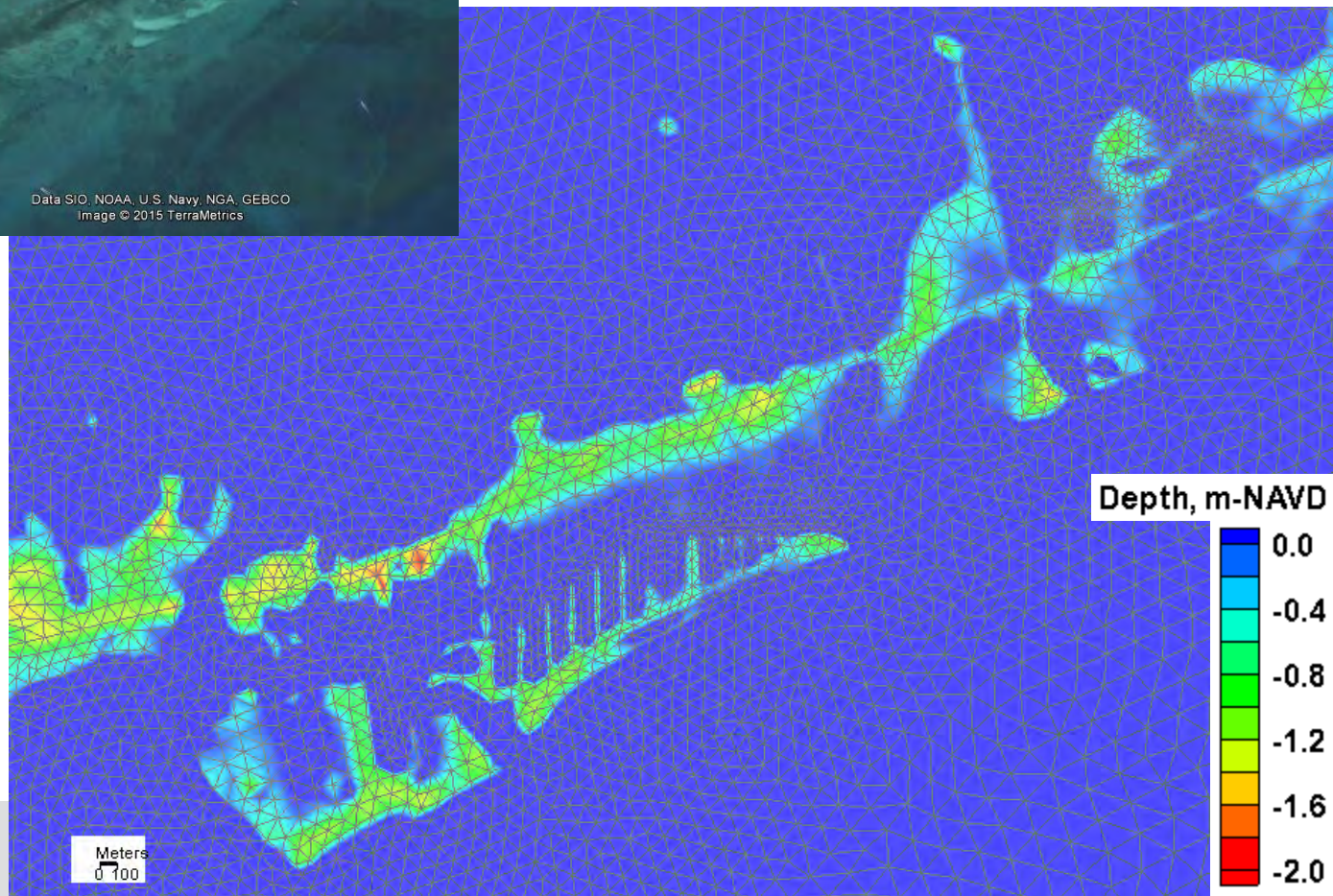
Coastal Study – Details

SWAN+ADCIRC Mesh – Lower Keys



Elevation, ft-NAVD

Marathon

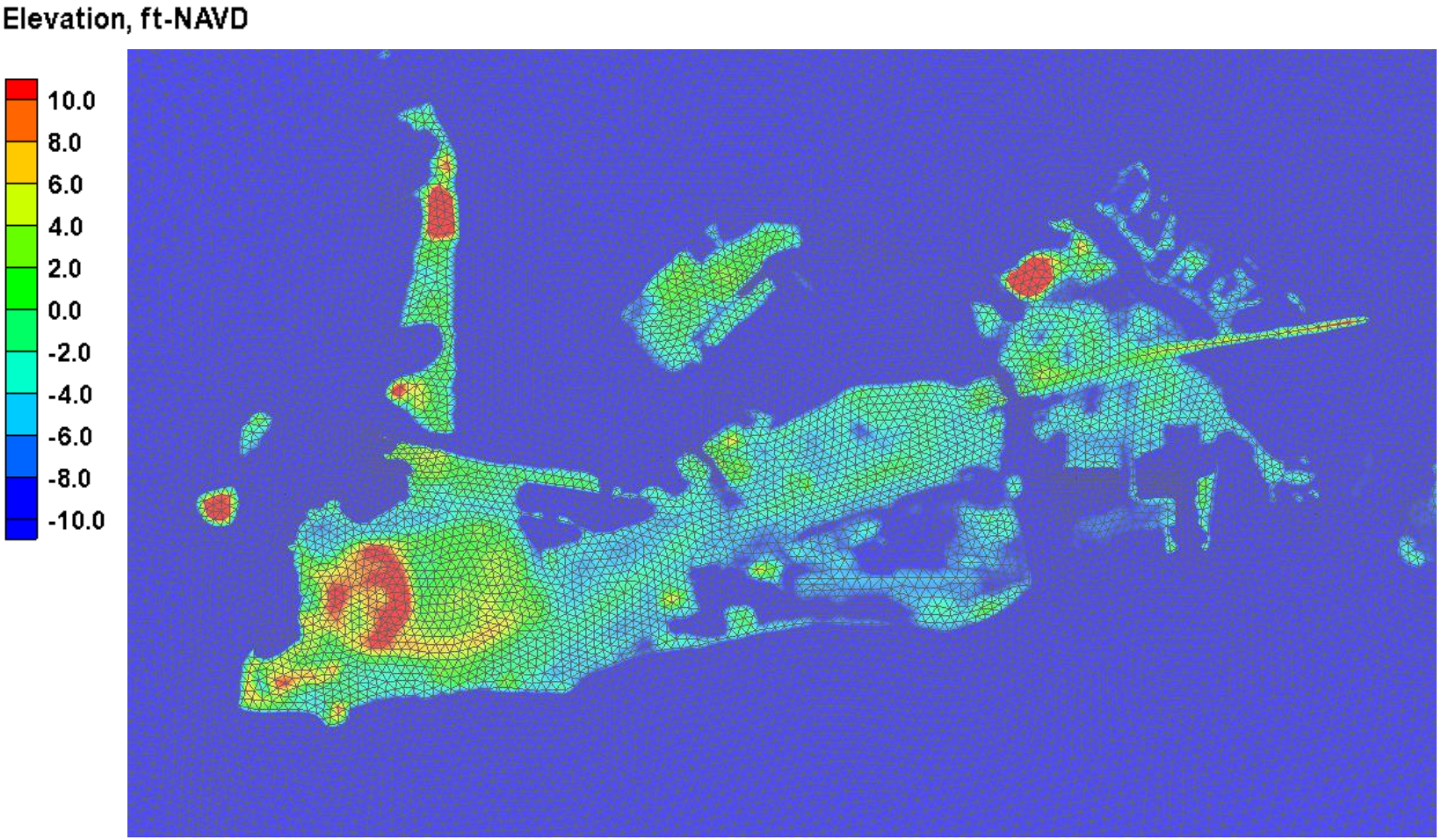


FEMA

Coastal Study – Details

Key West, FL

Coastal Study – Details



SWAN+ADCIRC Mesh – Key West, FL

Coastal Study – Details

- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- JPM-OS storm suite selection
- Validation
- Canal sensitivity

Coastal Study – Details

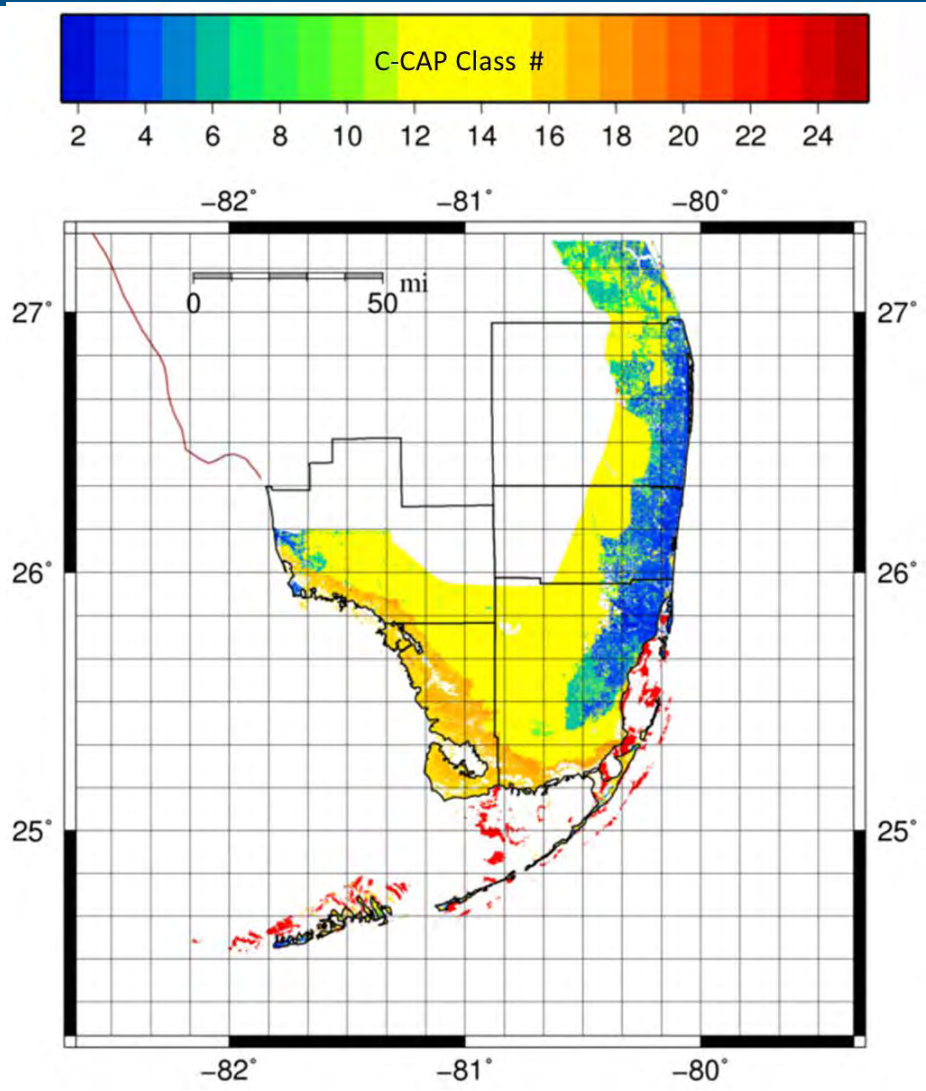
Land Classification Data

- Need large-coverage data sets to provide consistent and comprehensive land cover data
- NOAA, EPA, USGS work together to develop Coastal Change Analysis Program (C-CAP) data
  - 25 categories of land cover
  - emphasis given to more detailed, up-to-date wetland information than currently available in other national land cover products

Coastal Study – Details

Land Classification Data

Class No.	Land Cover	% Land Class in Study Area
0	Background	-
1	Unclassified	-
2	High Intensity Developed	1.8
3	Medium Intensity Developed	5.6
4	Low Intensity Developed	8.6
5	Open Spaces Developed	3.9
6	Cultivated Land	4.1
7	Pasture/Hay	1.3
8	Grassland	0.5
9	Deciduous Forest	0.0
10	Evergreen Forest	0.9
11	Mixed Forest	0.1
12	Scrub/Shrub	0.6
13	Palustrine Forested Wetland	10.6
14	Palustrine Scrub/Shrub Wetland	4.4
15	Palustrine Emergent Wetland	33.9
16	Estuarine Forested Wetland	9.1
17	Estuarine Scrub/Shrub Wetland	4.3
18	Estuarine Emergent Wetland	3.7
19	Unconsolidated Shore	0.0
20	Bare Land	0.4
21	Water	0.0
22	Palustrine Aquatic Bed	6.1
23	Estuarine Aquatic Bed	0.0



Coastal Study – Details

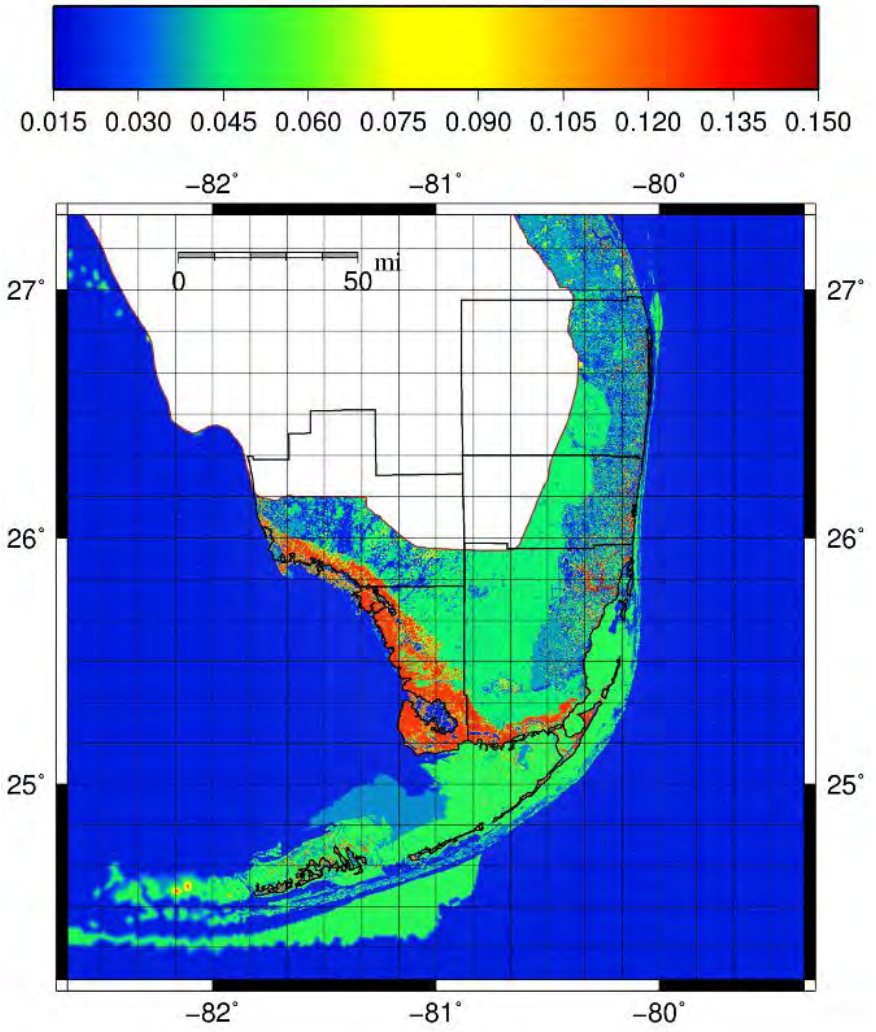
Land Classification Data

- Working to improve methods to quantify land cover effects on storm surge
- Team member UCF
  - Lidar-based assessment of vegetation
  - Field-based measurement of vegetation features
  - Provide sensitivity study for validation models

Coastal Study – Details

Land Classification Data

- Seagrass and hardbottom in Biscayne Bay and the keys



Manning's n

Coastal Study – Details

- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- JPM-OS storm suite selection
- Validation
- Canal sensitivity

Coastal Study – Details

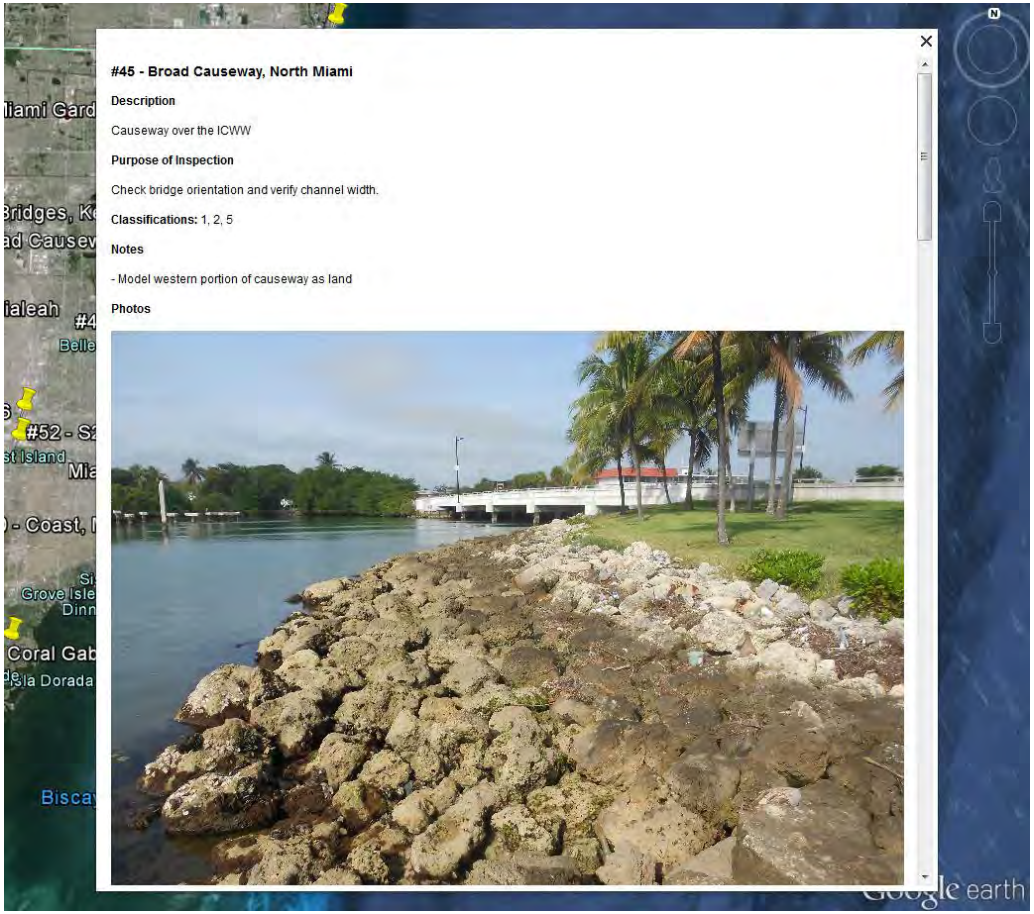
Site Reconnaissance Effort

- Field reconnaissance completed at 89 locations
- Sites categorized into five classes:
  1. surge conveyance pathways and four classes of raised features;
  2. other man-made embankments (roads, railroads, and bridge approaches);
  3. flood protection and other hydraulic control structures;
  4. natural topographic features (including dunes);
  5. shoreline features (shoals, breakwaters, jetties, groins, beach nourishments)

Coastal Study – Details

Site Reconnaissance Effort

- Create Google Earth dataset to catalog locations, notes, and photos
- Apply this data during mesh refinement stage



Coastal Study – Details

- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- **JPM-OS storm suite selection**
- Validation
- Canal sensitivity

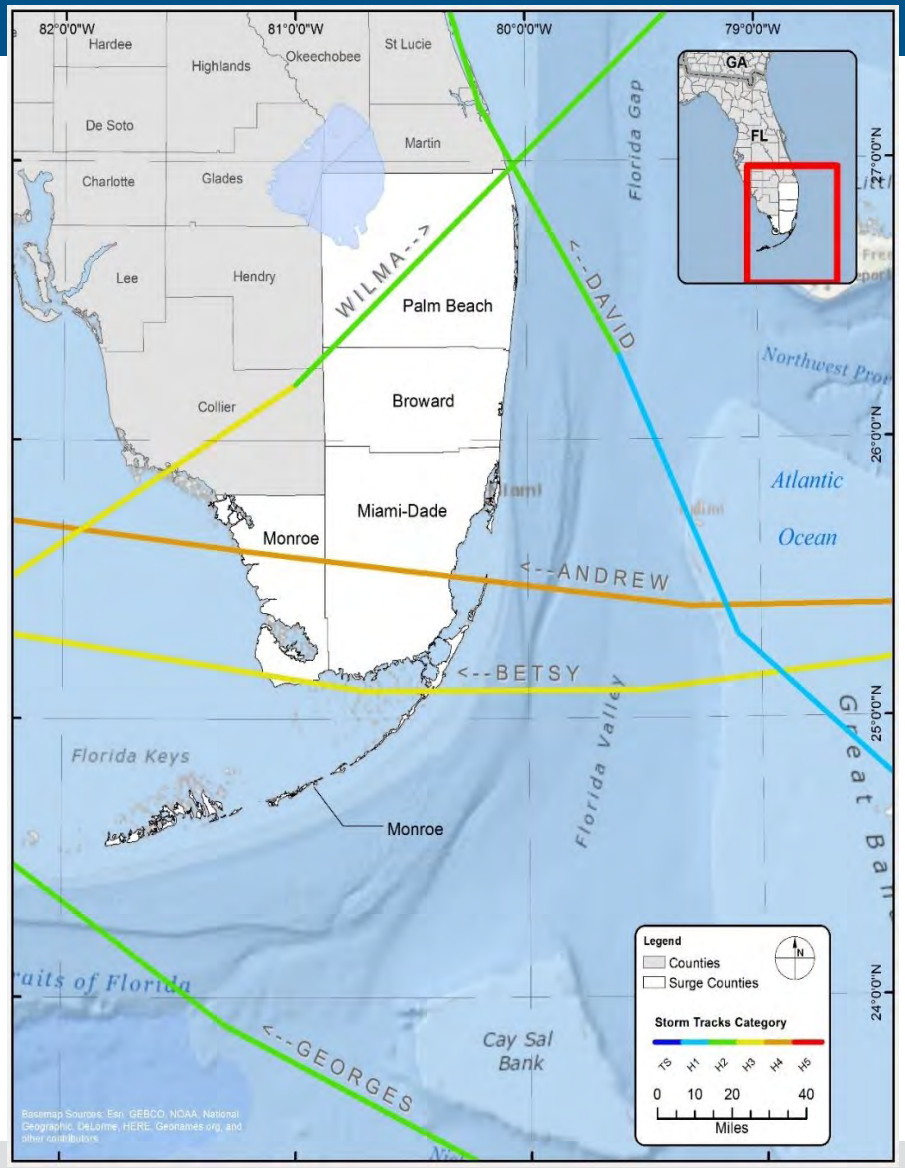
Coastal Study – Details

- JPM - reasonable method to statistically represent storm parameters consistent with local climatology
- Use a coarse ADCIRC mesh (60,000 nodes) to run large number of storms
- USACE method of Optimal Sampling minimizes number of storms represented in final storm suite while maintaining sufficient accuracy

Coastal Study – Details

- Digital Elevation Model (DEM)
- Mesh development
- Land cover data analysis
- Site reconnaissance
- JPM-OS storm suite selection
- **Validation**
- Canal sensitivity

Coastal Study – Details



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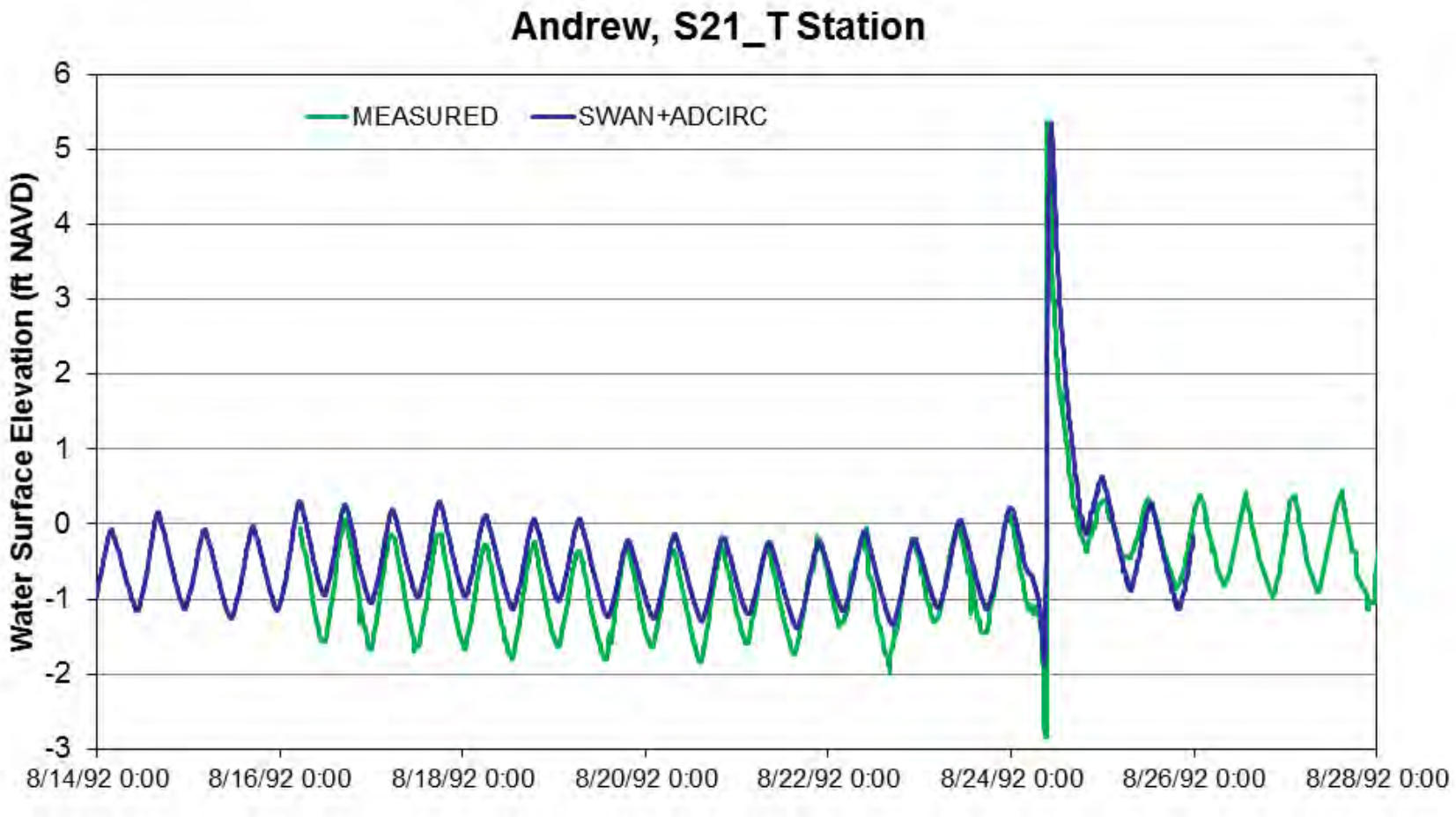

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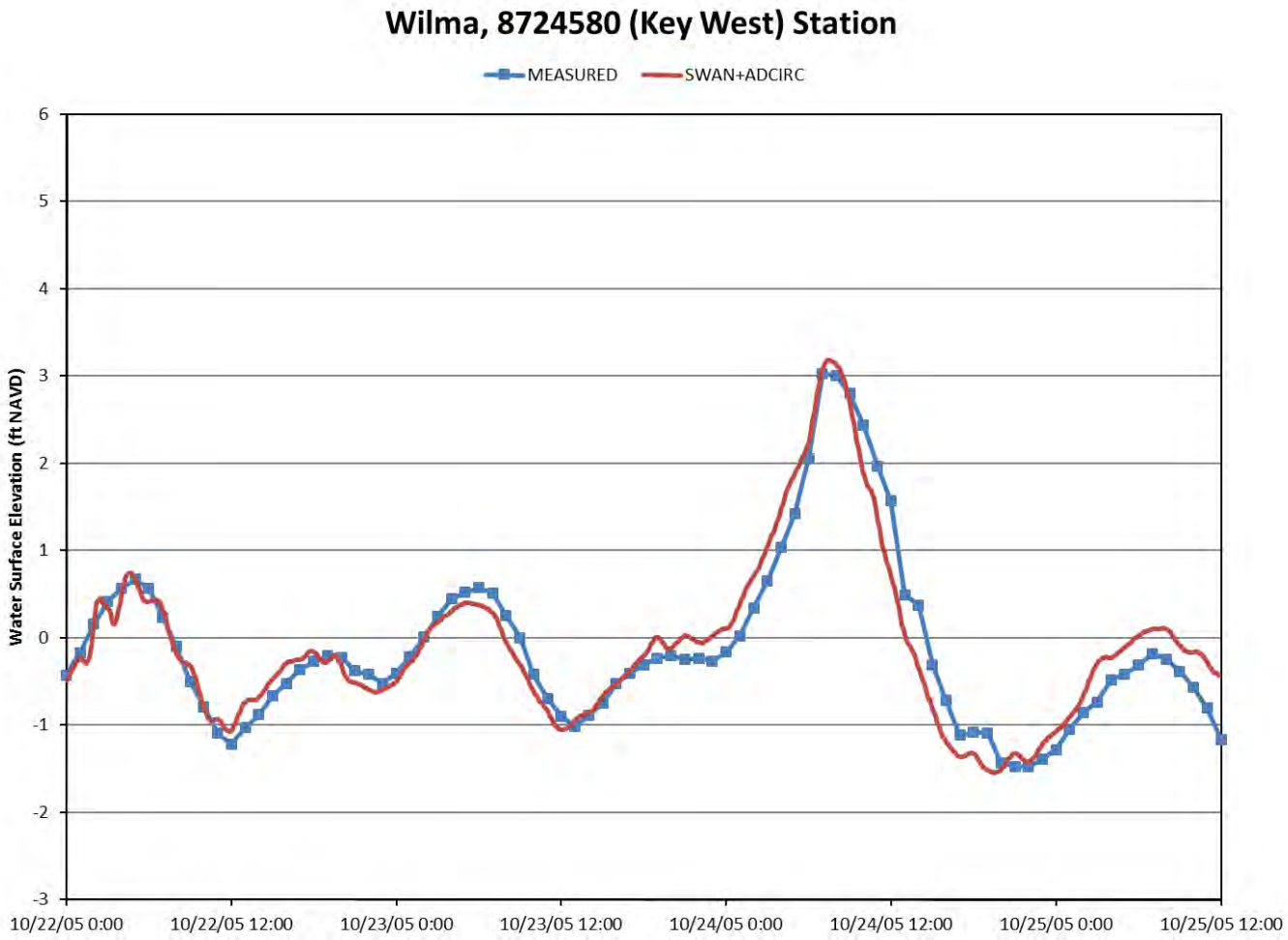

Coastal Study – Details

- Digital Elevation Model (DEM)
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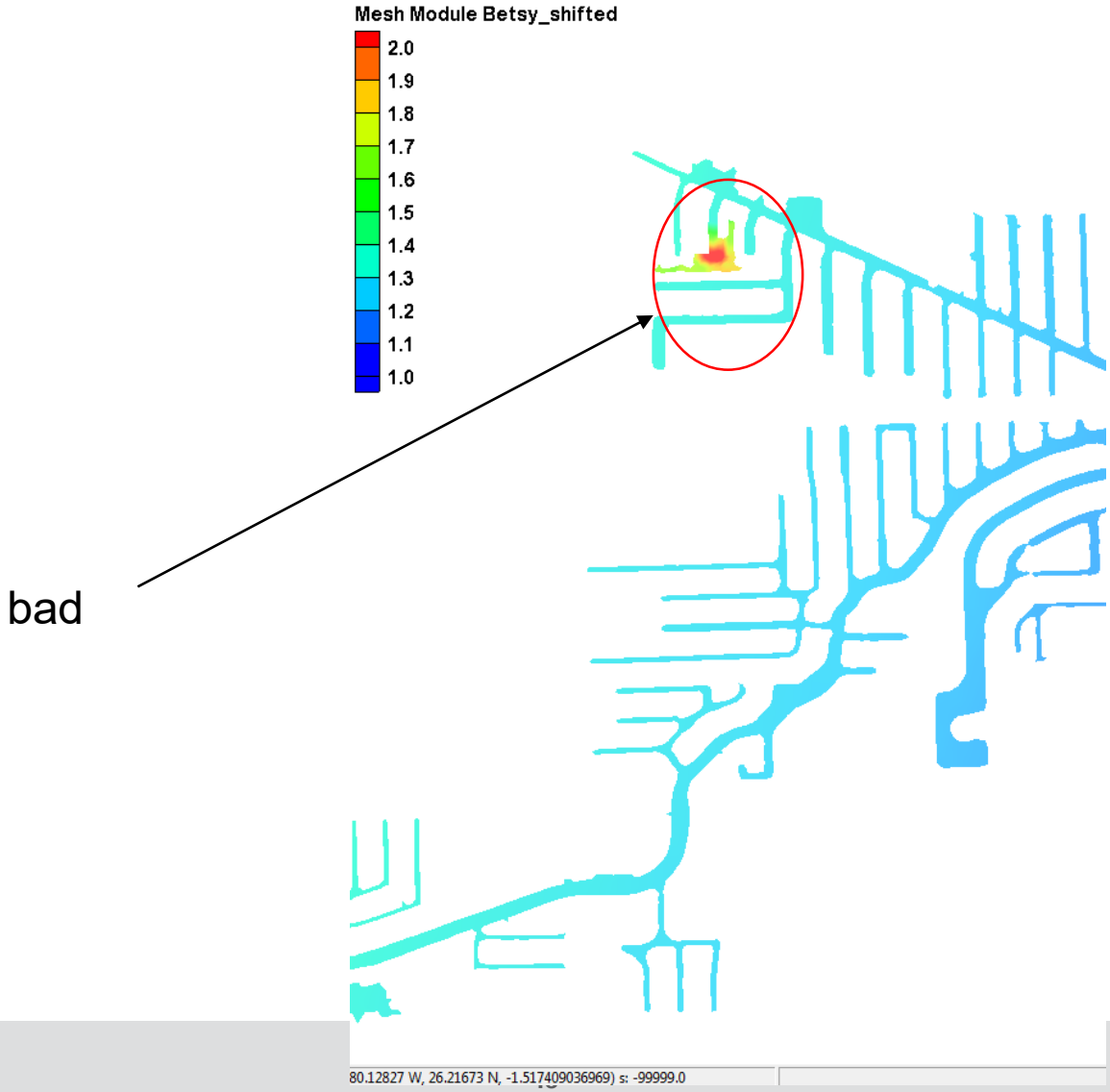
Coastal Study – Details



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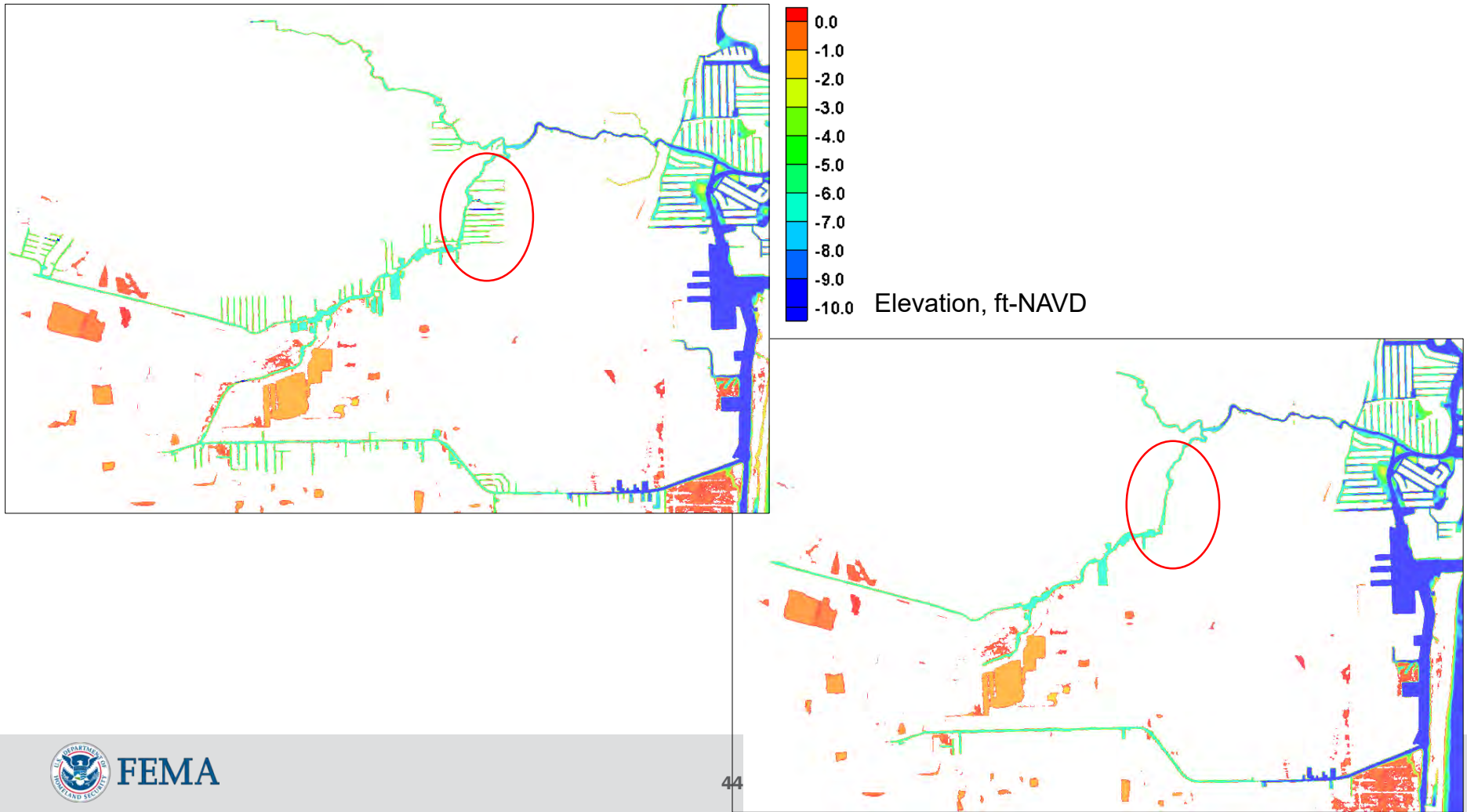

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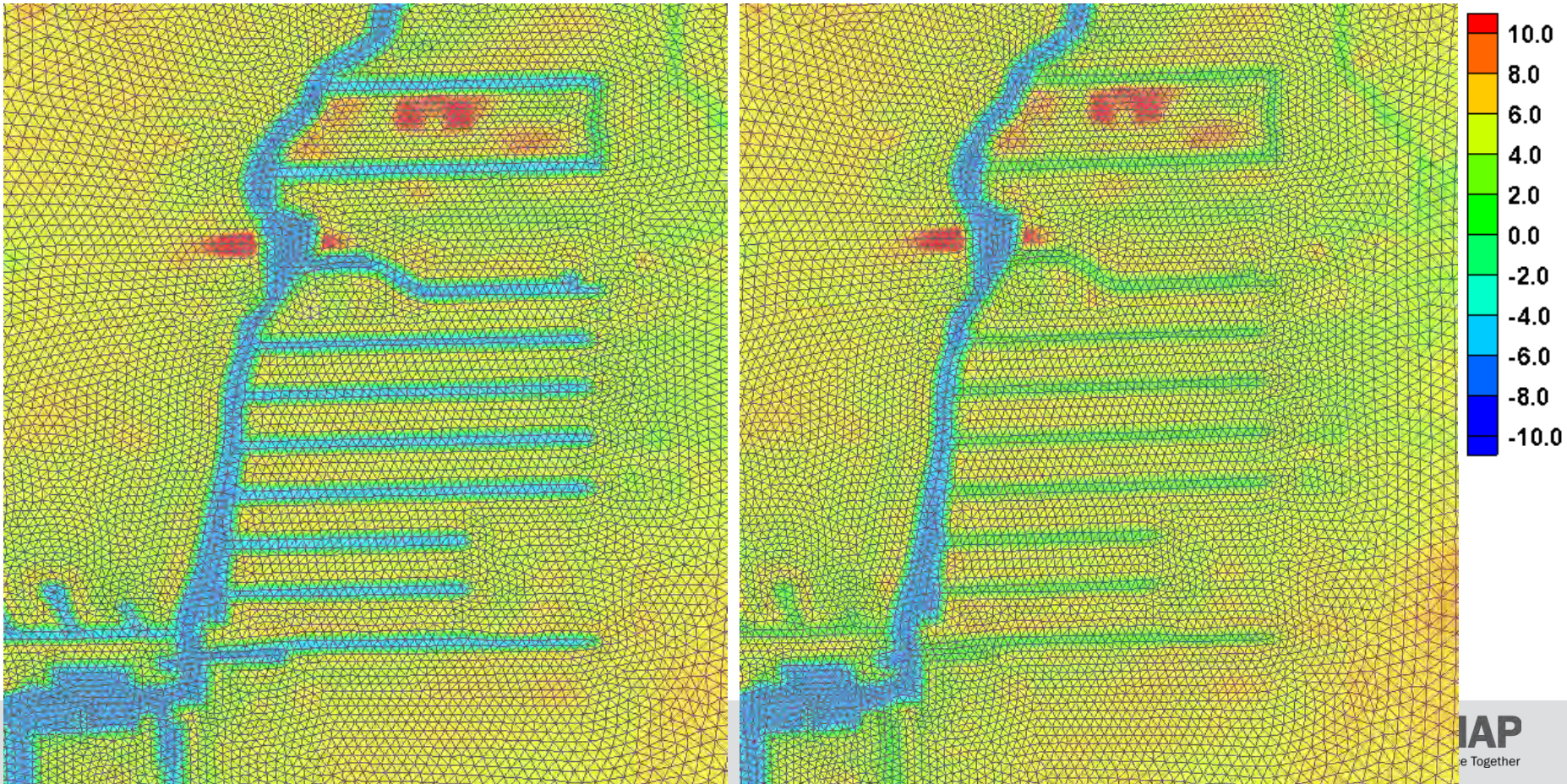
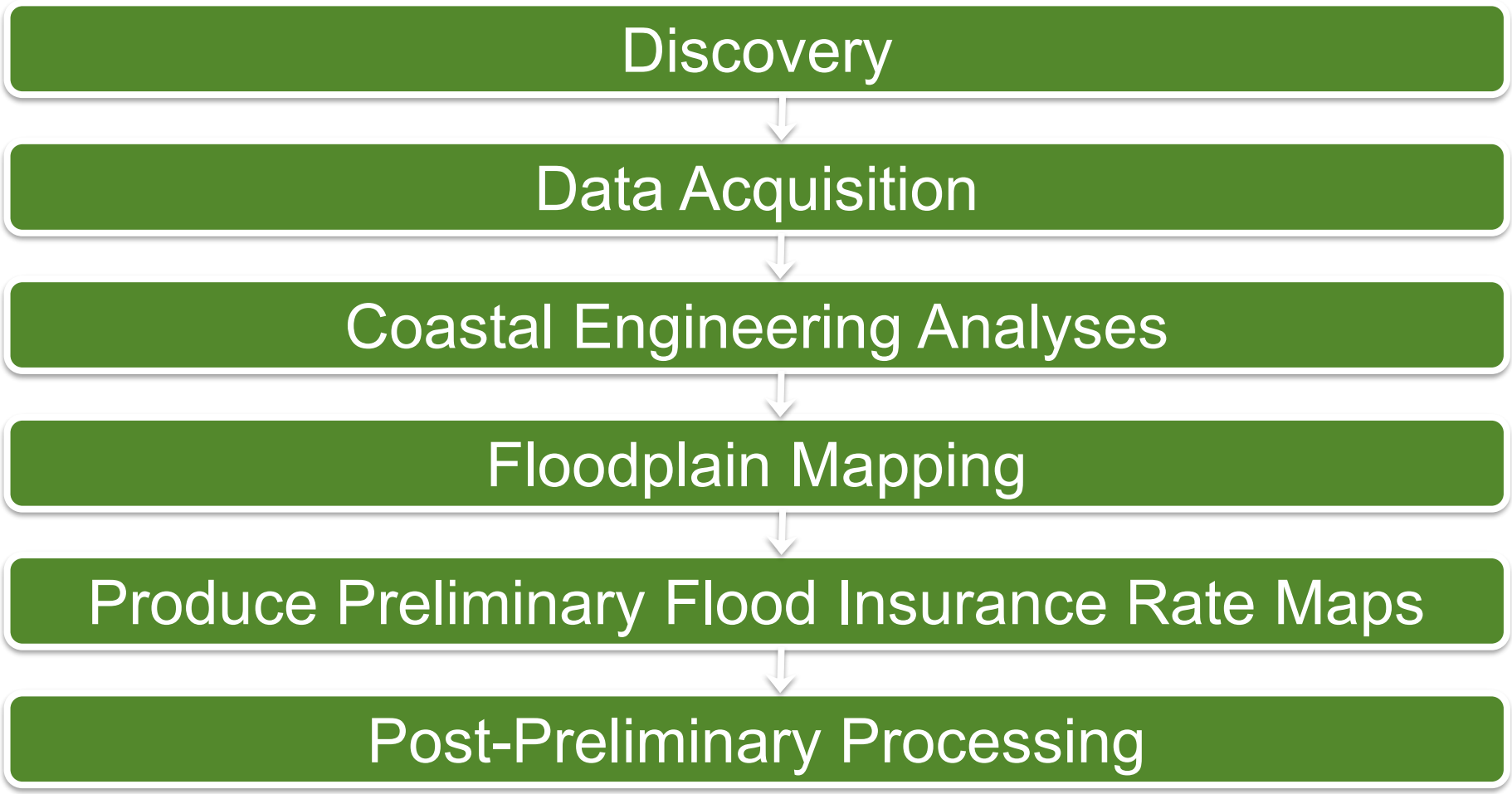


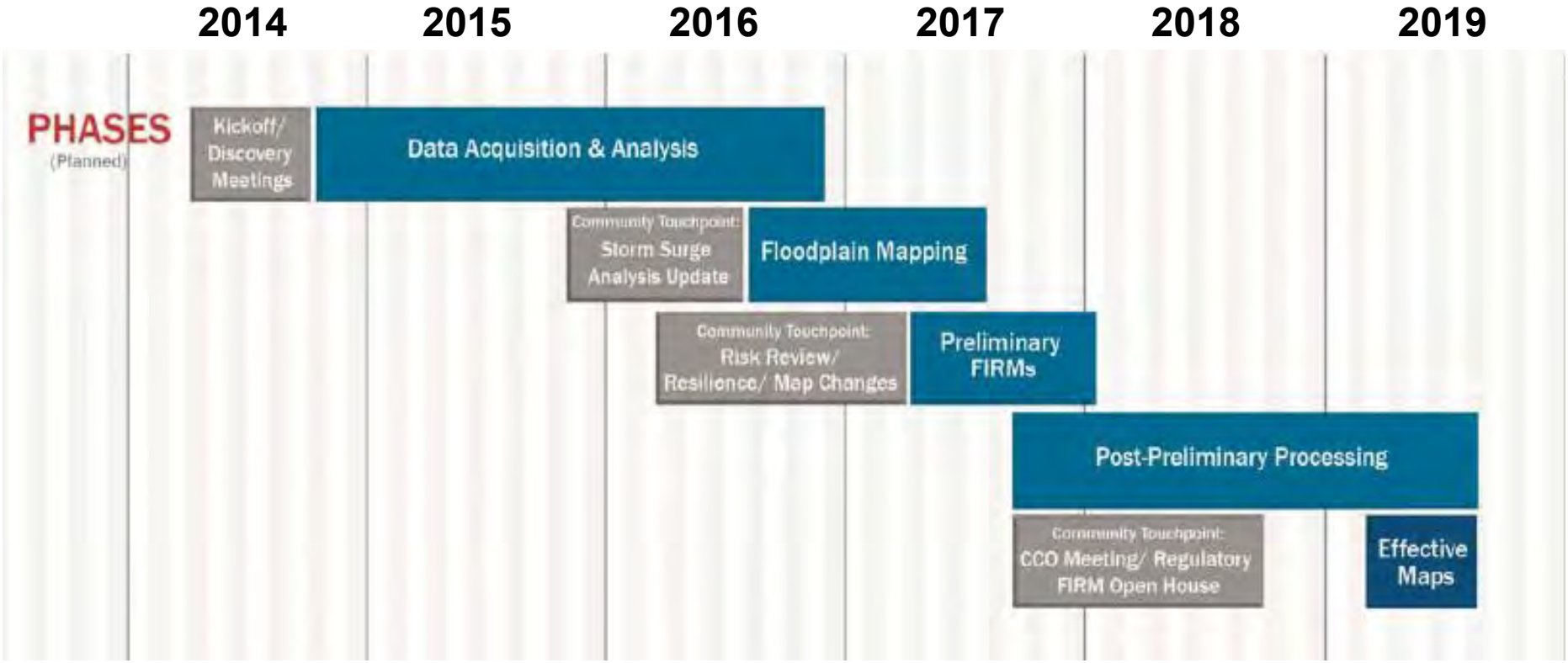
Coastal Study – Details

- FEMA coastal study of South Florida underway
- SWAN+ADCIRC model with 2.3 million nodes uses seamless bathy-topo DEM
- Land cover data, field reconnaissance data incorporated into model mesh development
- Current work
  - JPM-OS production storm suite
  - Validation
  - Canal sensitivity

Southeast FL Coastal Study – Process



Southeast FL Coastal Study – Project Schedule

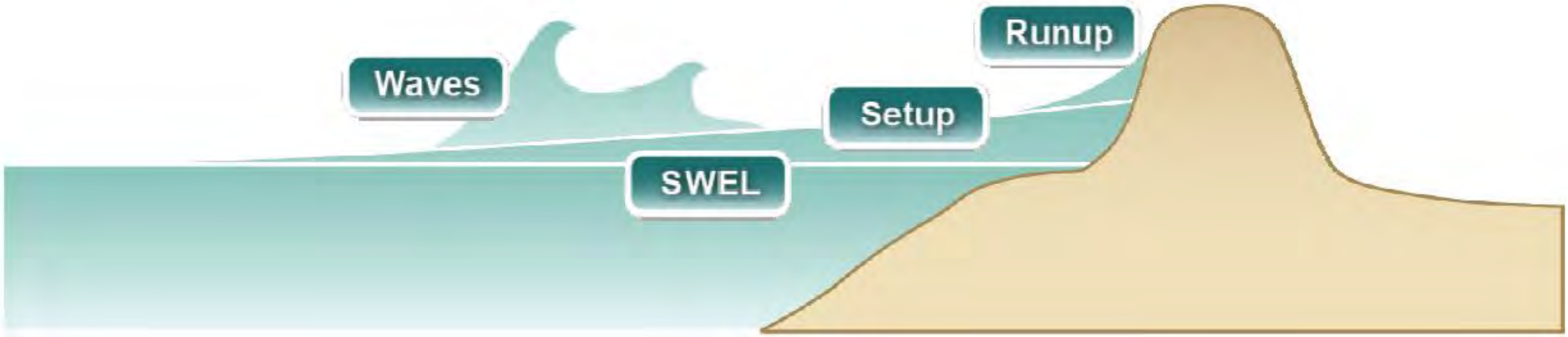


Basic Elements of a Coastal Flood Risk Study

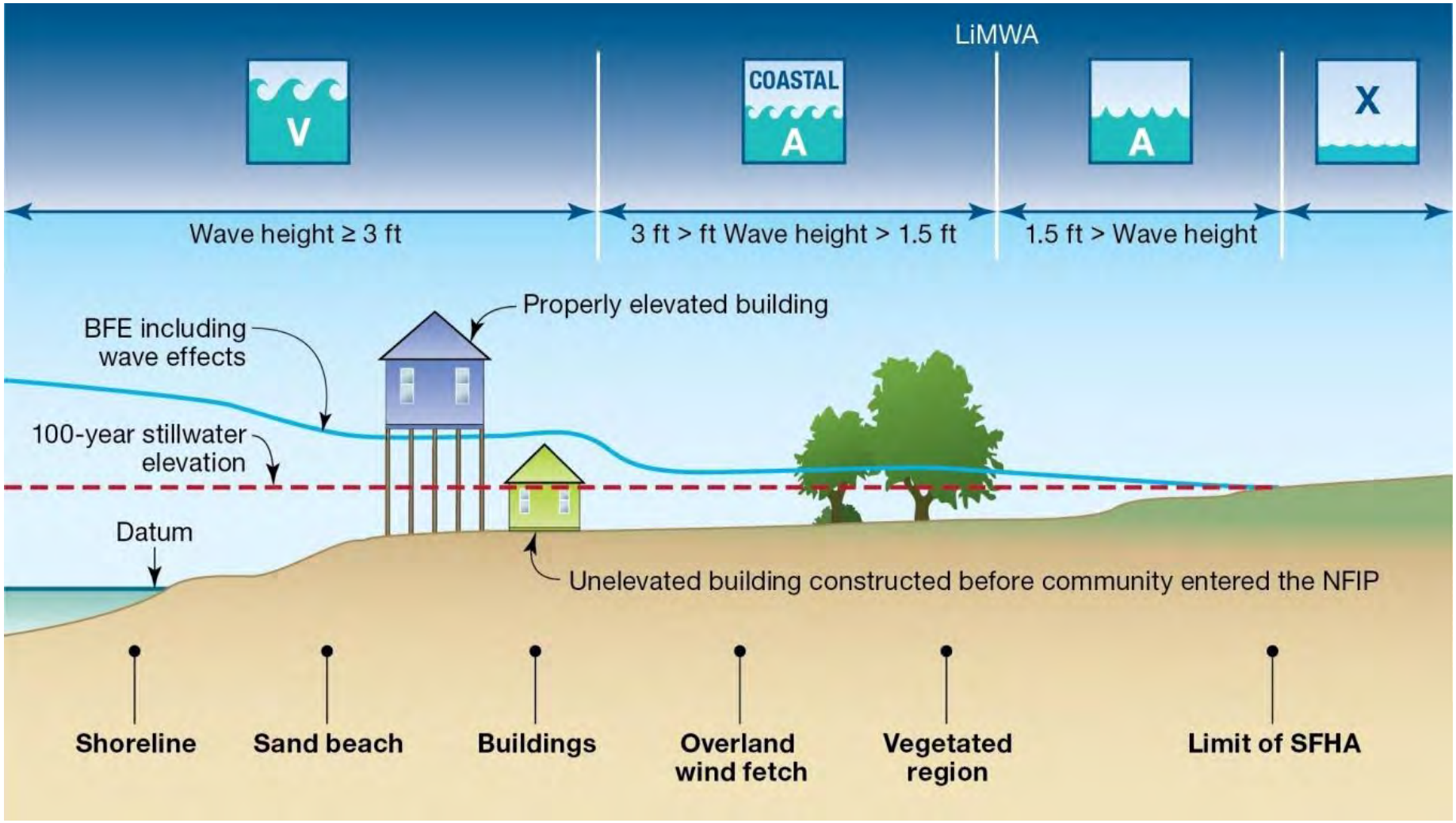
Base Flood Elevation (BFE) on FIRM includes 4 components:

1. Storm surge stillwater elevation (SWEL)
2. Amount of wave setup
3. Wave height above storm surge (SWEL) elevation
4. Wave runup above storm surge elevation (where present)

Determined from storm surge model

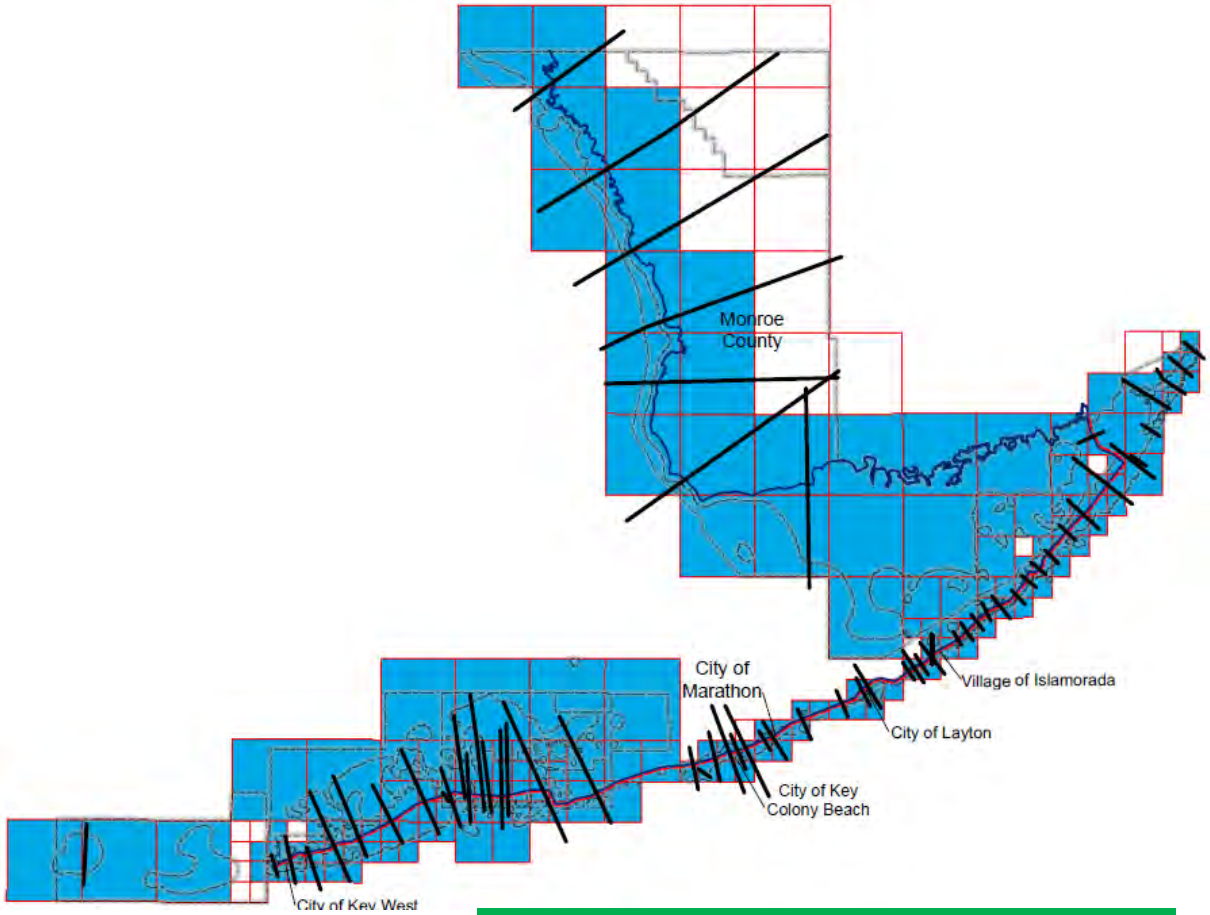


Southeast Florida Coastal Study – Floodplain Mapping



Southeast FL Coastal Study – Monroe of Work

Shoreline Miles	**120**
Estimated WHAFIS Transects	**360**
Transects Per Mile	**3**
Estimated Panels	**160**
Communities	**6**



Effective transects shown

Southeast Florida Coastal Study – Community Meetings

Community Meetings
Discovery Kick-Off Meeting
Discovery Meeting
Technical Update Meeting
Storm Surge Analysis Update Meeting
Flood Risk Review Meeting
Resilience Meeting
Preliminary DFIRM Community Coordination Meeting
Public Open Houses

Southeast FL Coastal Study – Points of Contact

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