

A map of the Gulf of Mexico coastline, specifically the area from Louisiana to Florida. The map is overlaid with a color-coded storm surge product. The colors range from blue (low surge) to red (high surge). The highest surge areas are shown in red and orange, extending inland from the coast. Major cities like Baton Rouge, New Orleans, and Mobile are visible. The Atchafalaya National Wildlife Refuge is also labeled.

# How NHC Real-Time Storm Surge Products are Created

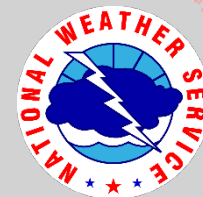
**Robbie Berg**

**National Hurricane Center**

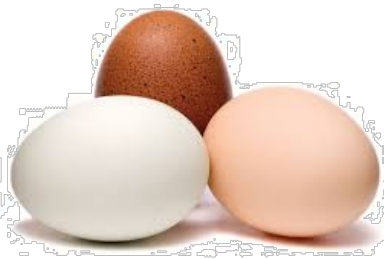
**National Hurricane Conference**

**New Orleans, Louisiana**

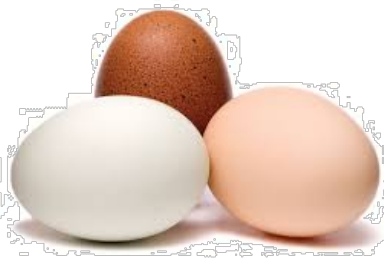
**20 April 2017**



# Baking the Perfect Chocolate Chip Cookie



# Baking the Perfect Chocolate Chip Cookie



**What kind of flour?**

**All Purpose?**

**Whole Wheat?**

**Gluten Free?**

**Cake Flour?**

**Bread Flour?**



# Baking the Perfect Chocolate Chip Cookie

**Do you use butter?**

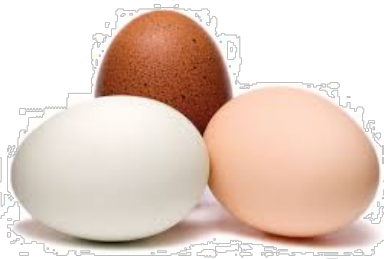
**Or Margerine?**

**Or Shortening?**

**Or Coconut Oil?**



# Baking the Perfect Chocolate Chip Cookie



**What kind of sweetener?**



**White Sugar?**

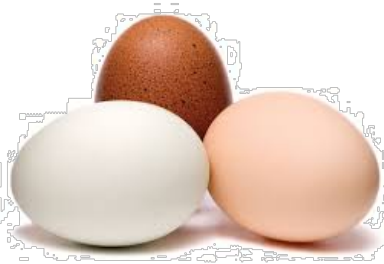
**Brown Sugar?**

**Stevia?**

**Maple Syrup?**



# Baking the Perfect Chocolate Chip Cookie



**What kind of chocolate chips?**

**Milk Chocolate?**

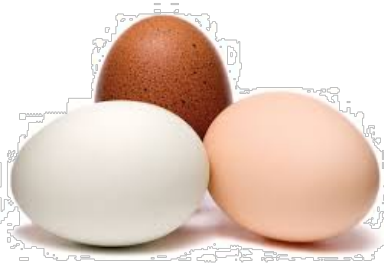
**Dark Chocolate?**

**White Chocolate?**

**Semi-Sweet Chocolate?**



# Baking the Perfect Chocolate Chip Cookie



**Do you ruin the cookies by putting walnuts in them?**



# Baking the Perfect Chocolate Chip Cookie

**Other things to consider:**



**Do you chill the dough for 24 hours before baking?**



**What temperature do you bake them at?  
375°? 325°?**



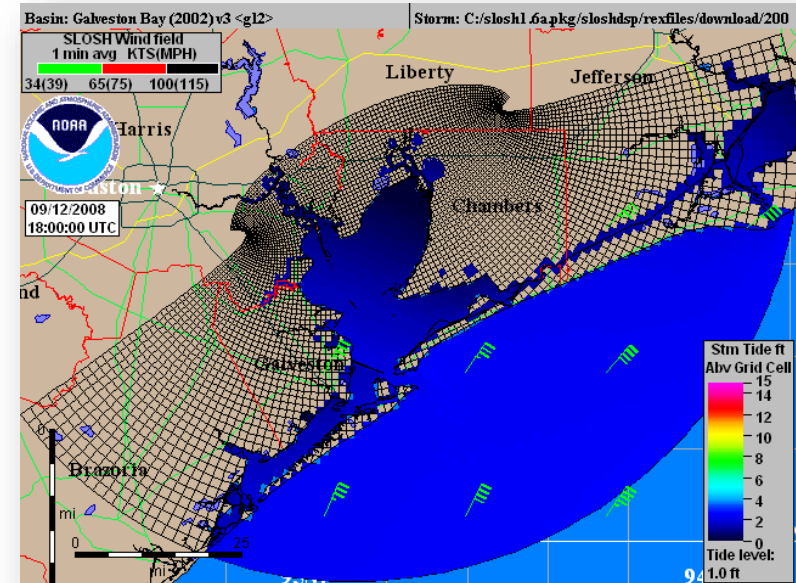
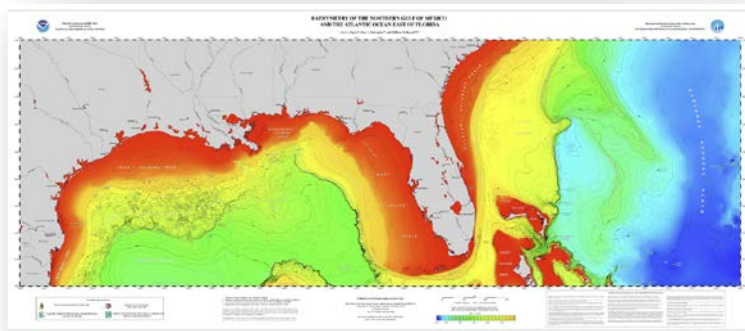
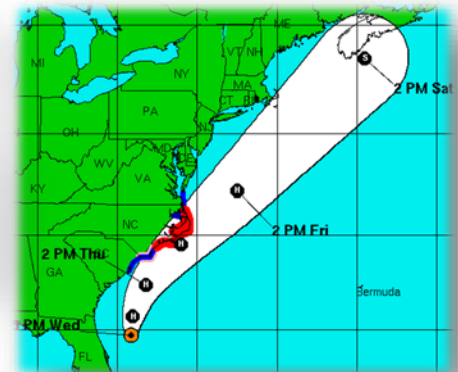
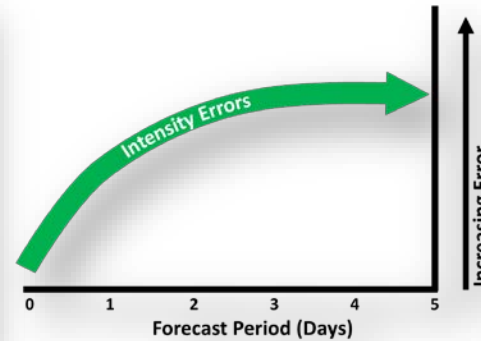
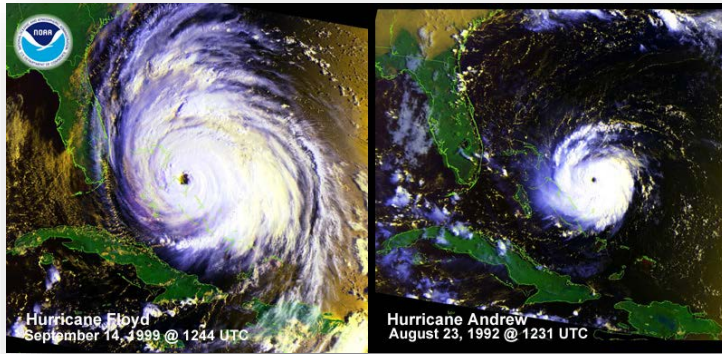
**What kind of pan do you use?  
Air bake?  
Stoneware?  
Silpat mat?**





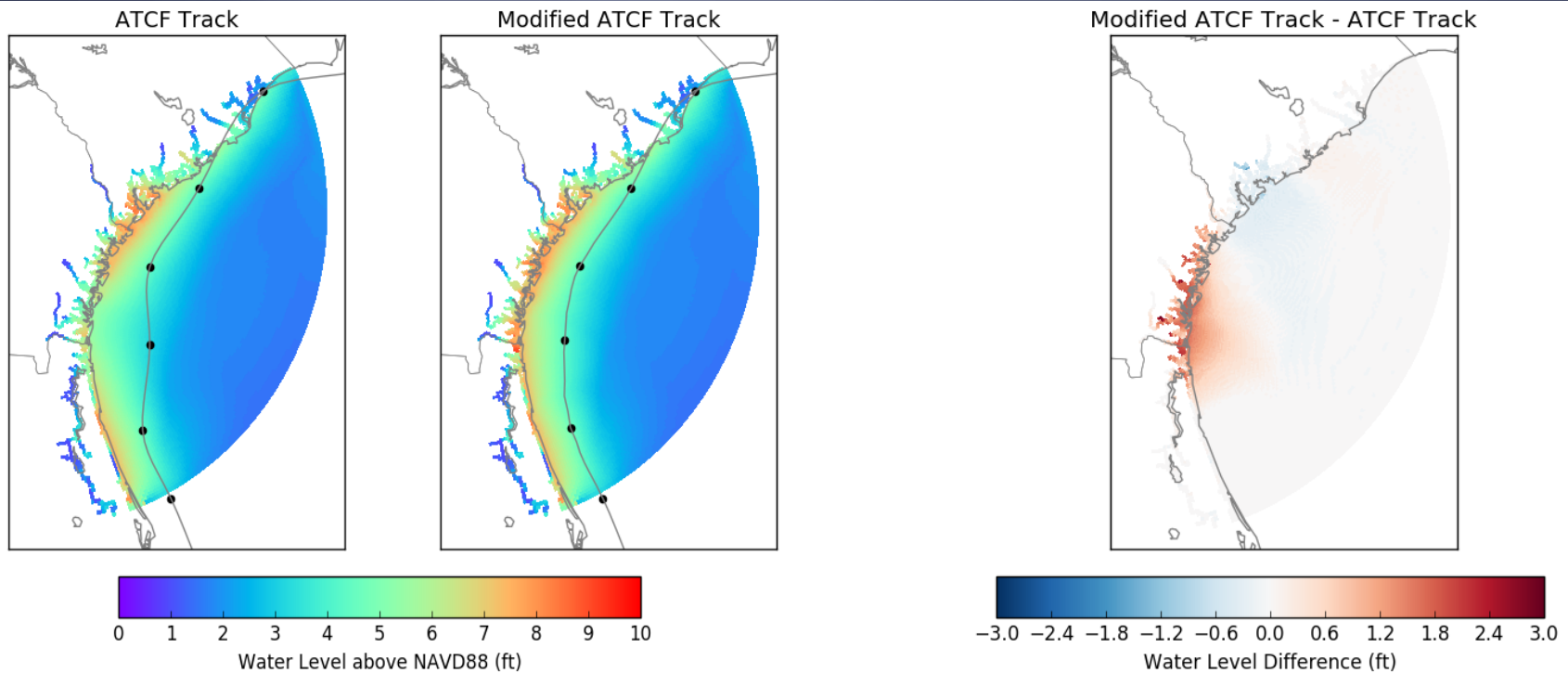
From The Ultimate Guide to Chocolate Chip Cookies, [HandletheHeat.com](http://HandletheHeat.com)

# Making the Perfect Storm Surge Forecast



# Even Small Wrinkles Matter

## Hurricane Matthew





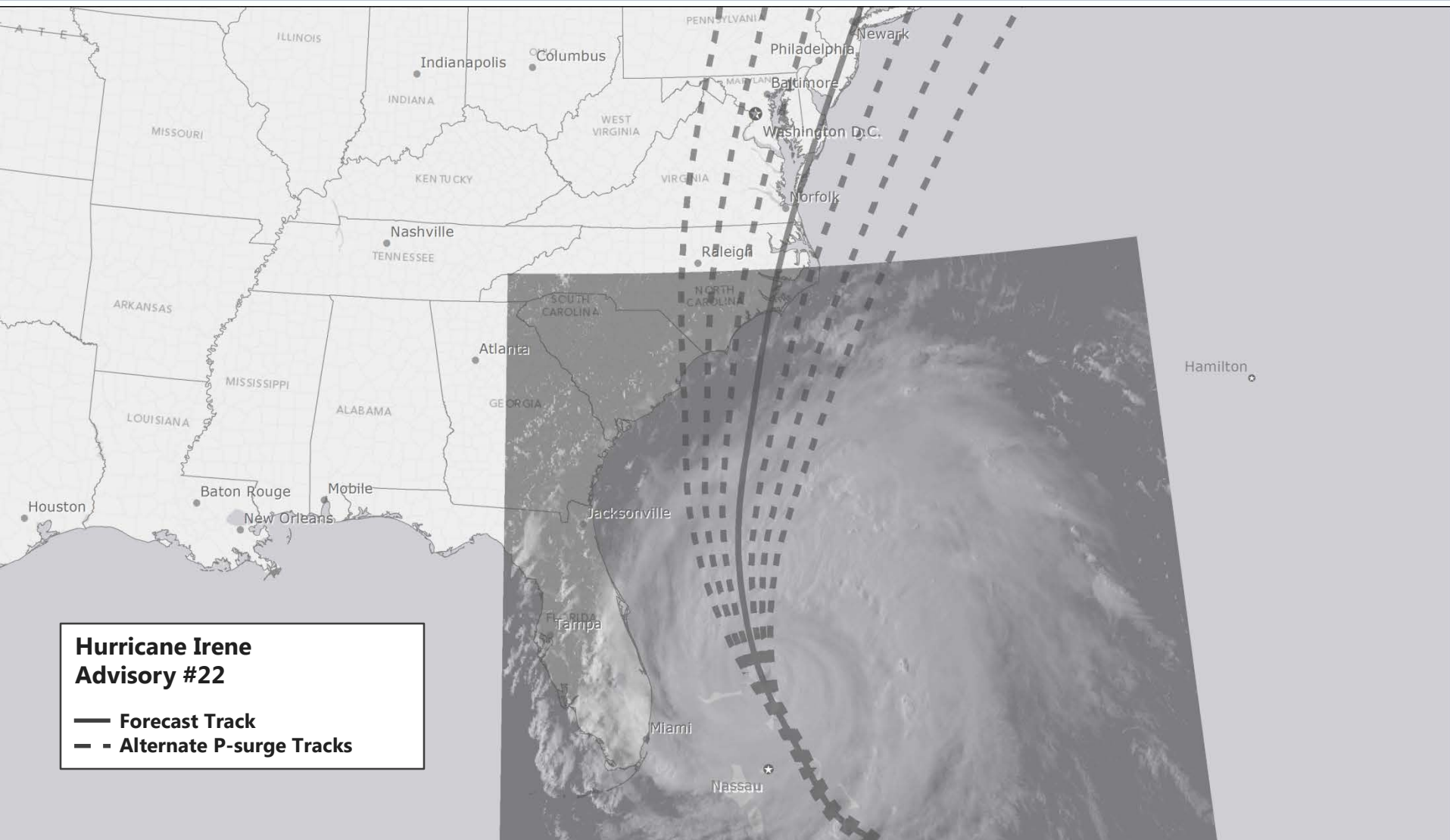
# P-surge Probabilistic Storm Surge



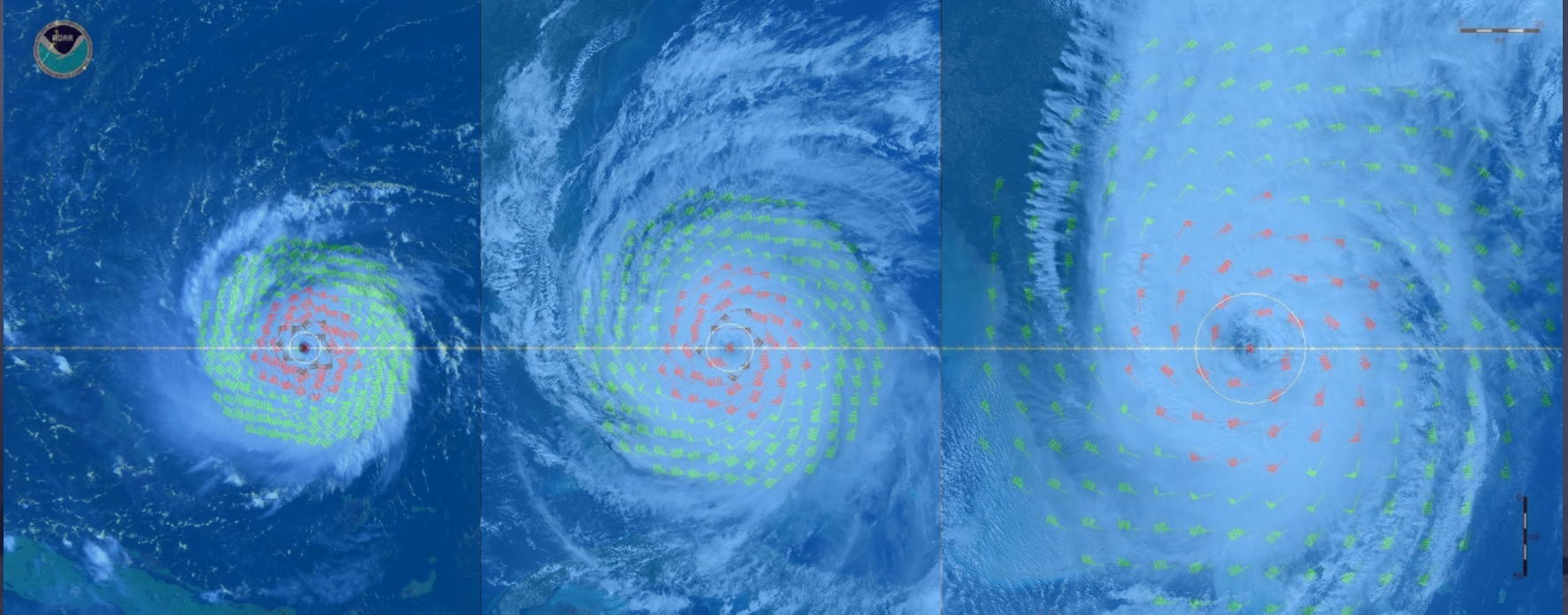
# Probabilistic Storm Surge (P-surge)

- Storm surge probabilities based on NHC official advisory
- Available approximately 48 hours prior to arrival of TS winds
- Accounts for uncertainty in:
  - Track / landfall location
  - Size
  - Forward speed
  - Intensity
- Uncertainties based on historical errors
- Accounts for the tide and is available above NAVD88 and above ground level

# Probabilistic Storm Surge (P-surge) Multiple Tracks and Landfall Locations



# Probabilistic Storm Surge (P-surge) Multiple Tracks and Landfall Locations



**Size: Small, Medium, Large**

**Forward Speed: Fast, Medium, Slow**

**Intensity: Strong, Medium, Weak**



**NHC TRACK ERROR 12 hr. OUT**

**130 mph, 933 mb**

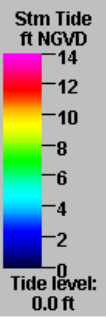
- Hurricane
- ▲ Tropical Storm
- Tropical Depression

**Hurricane Advisory – Approximately 12 hr. before landfall**

0  
100  
mi

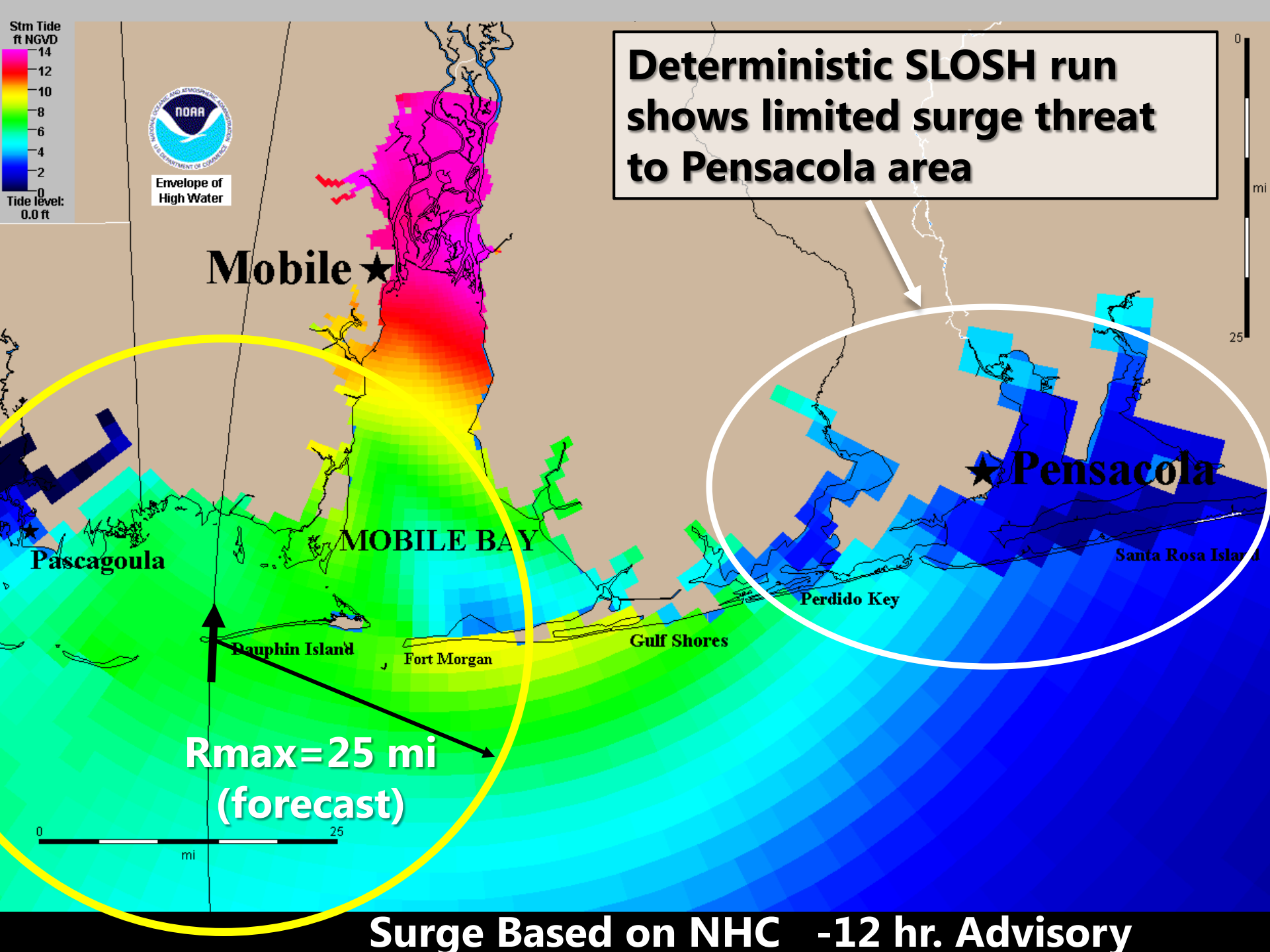
0 100  
mi





Envelope of  
High Water

**Deterministic SLOSH run  
shows limited surge threat  
to Pensacola area**



**Mobile** ★

Pascagoula

MOBILE BAY

★ **Pensacola**

Santa Rosa Island

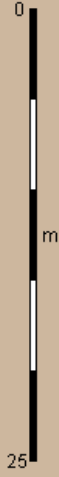
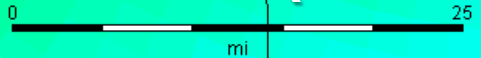
Dauphin Island

Fort Morgan

Gulf Shores

Perdido Key

**Rmax=25 mi  
(forecast)**



**Surge Based on NHC -12 hr. Advisory**

Storm: Ivan2004 Adv54

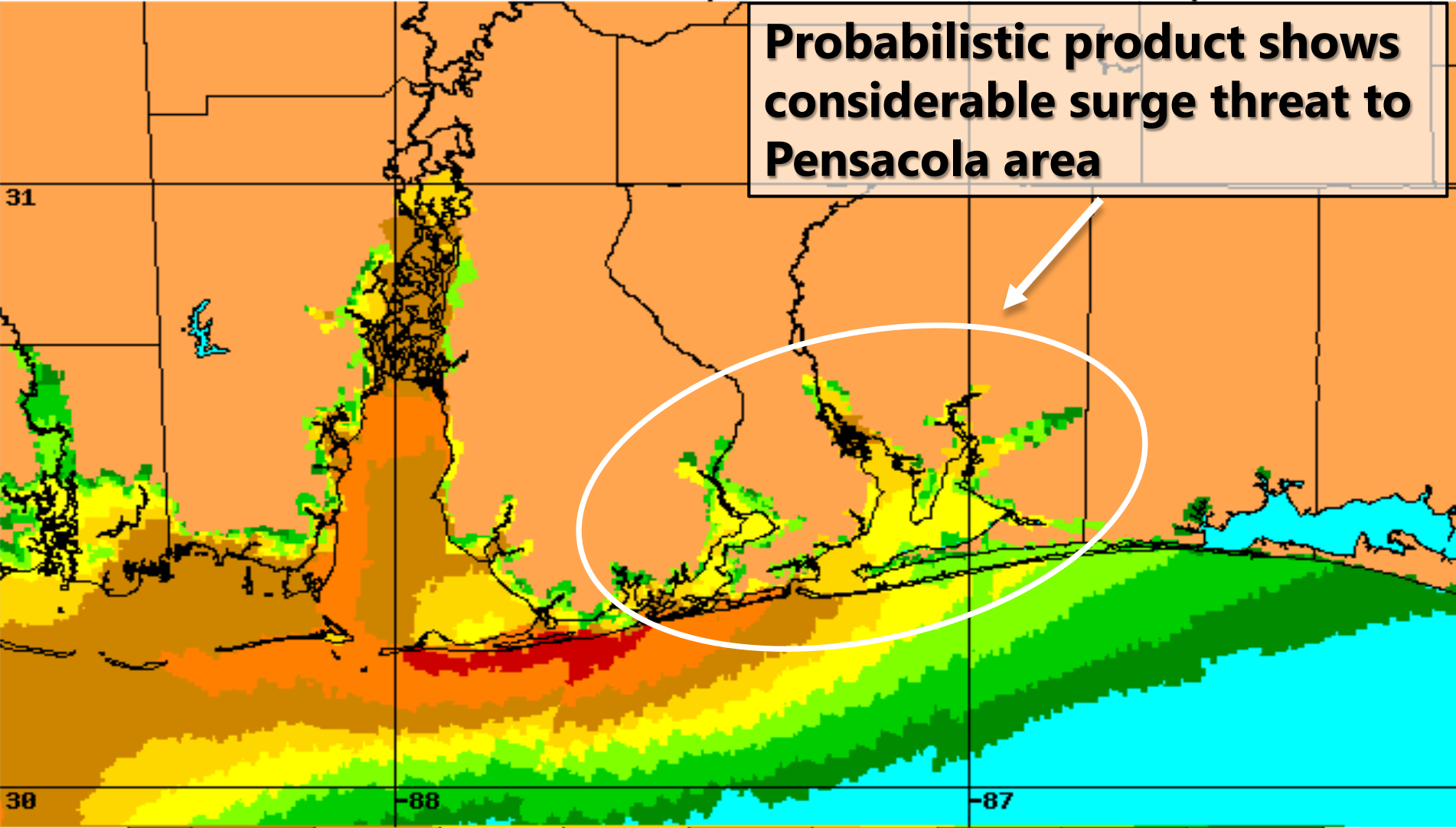
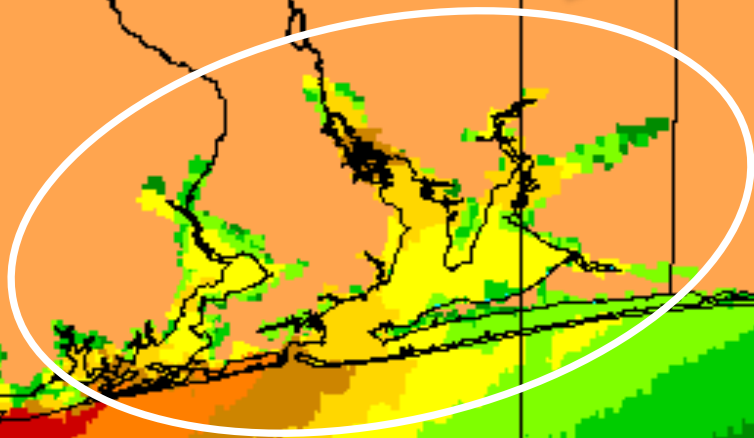
Type: Prob. of surge > 8 feet

Zoom Level: Full

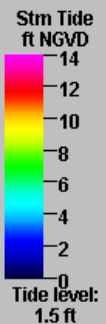


Experimental Tropical Cyclone Storm Surge Probabilities  
Chance of Storm Surge  $\geq$  8 feet at Individual Locations  
Hurricane Ivan (2004) Advisory 54  
Valid from 05 PM EDT Wed Sep 15 to 10 PM EDT Sat Sep 18

**Probabilistic product shows considerable surge threat to Pensacola area**

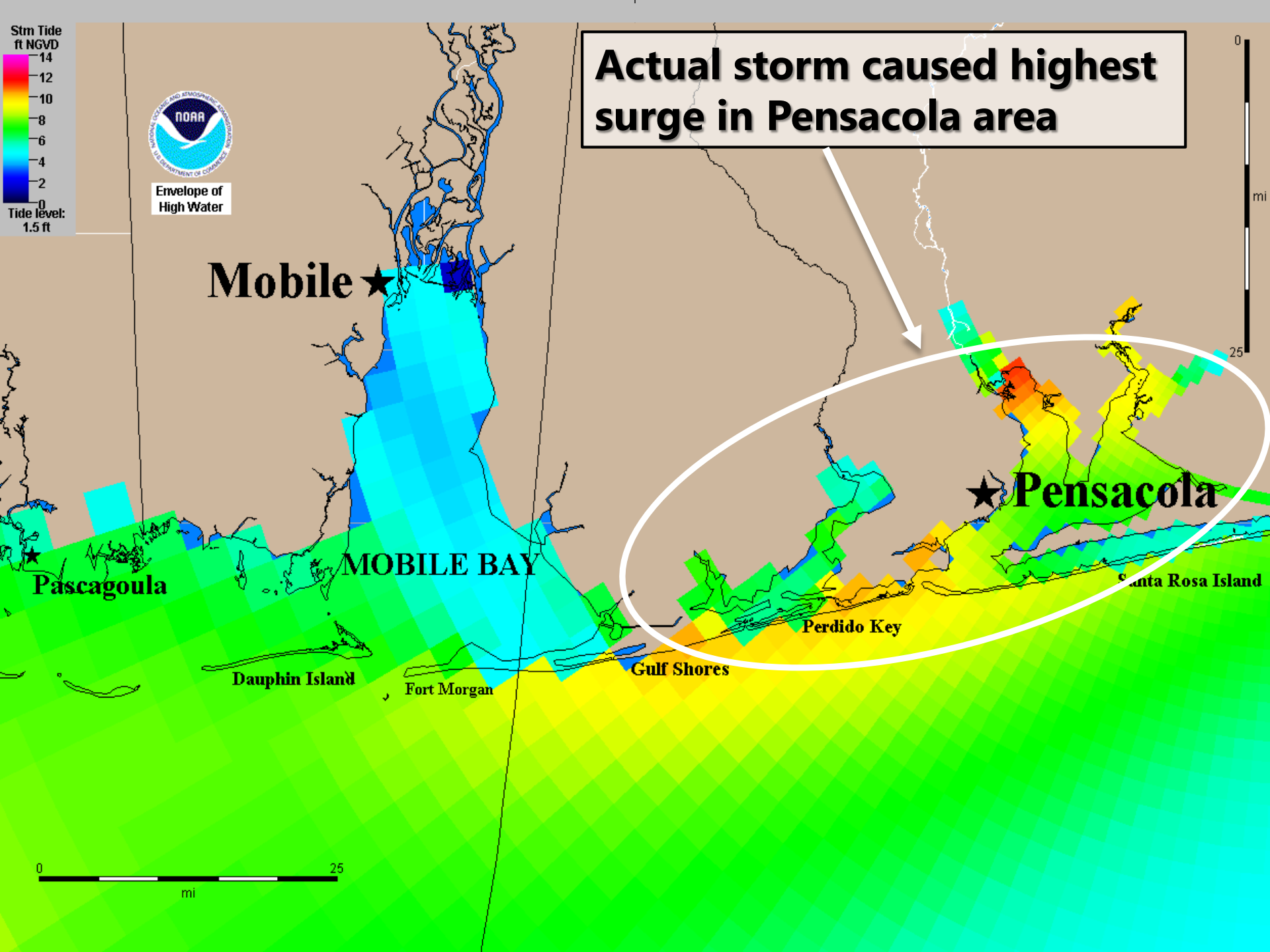


Probability



Envelope of  
High Water

**Actual storm caused highest surge in Pensacola area**



**Mobile** ★

**MOBILE BAY**

**Pascagoula** ★

**Dauphin Island**

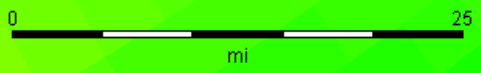
**Fort Morgan**

**Gulf Shores**

**Perdido Key**

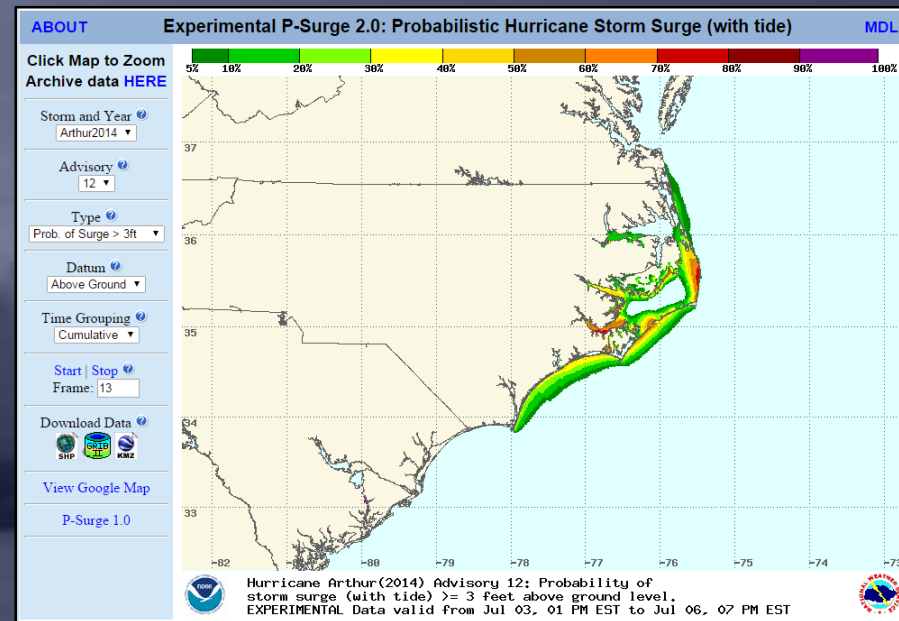
★ **Pensacola**

**Santa Rosa Island**



# When is P-Surge Available? (On the NHC Website)

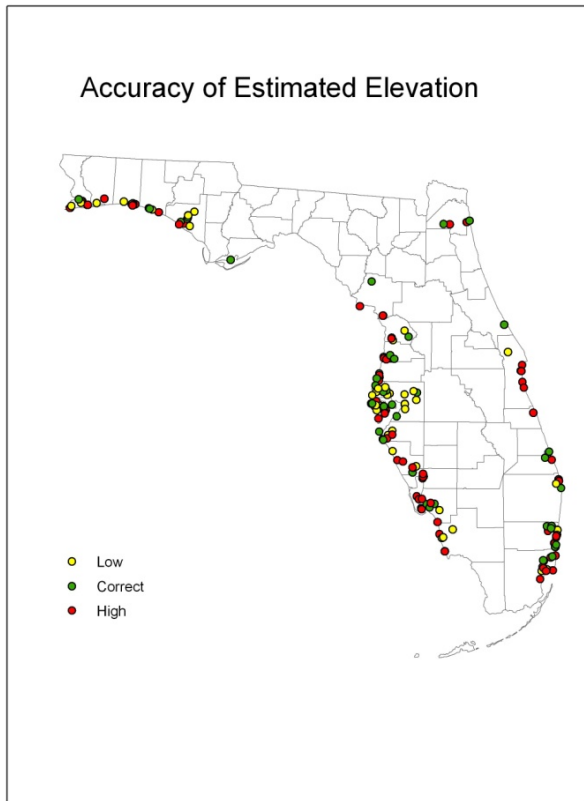
- Whenever a hurricane (and sometimes tropical storm) watch or warning is in effect
  - Approximately 48 hours prior to arrival of TS winds
- Available approximately 30 minutes after full advisory release time
  - 05:30 EDT
  - 11:30 EDT
  - 17:30 EDT
  - 23:30 EDT



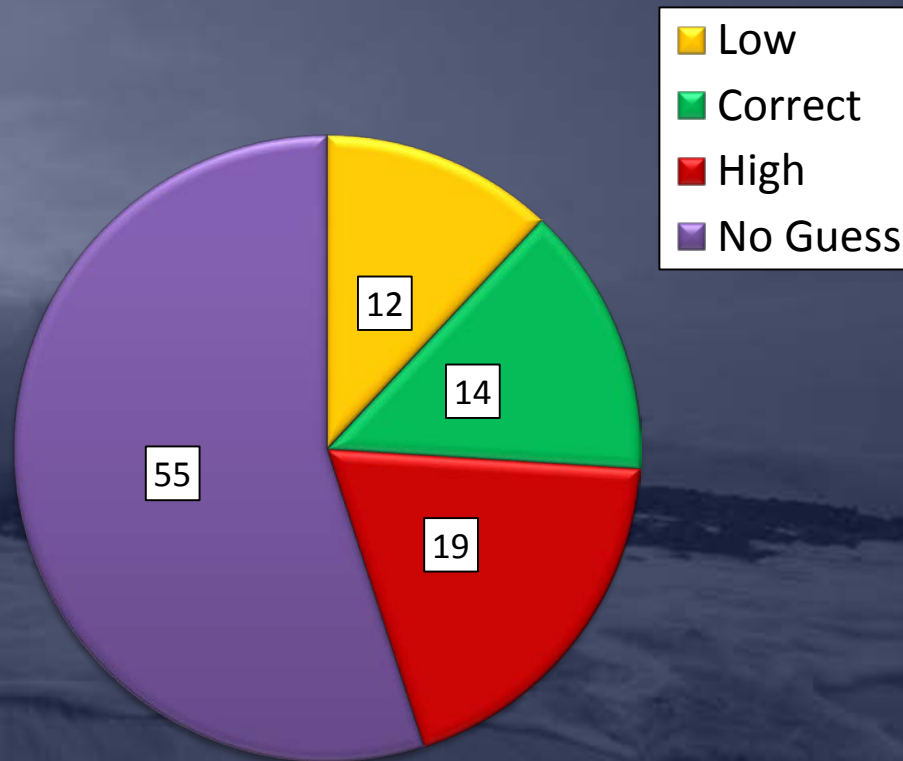
# Potential Storm Surge Flooding Map



# Do People Know Their Elevation? (within a 5-foot interval)

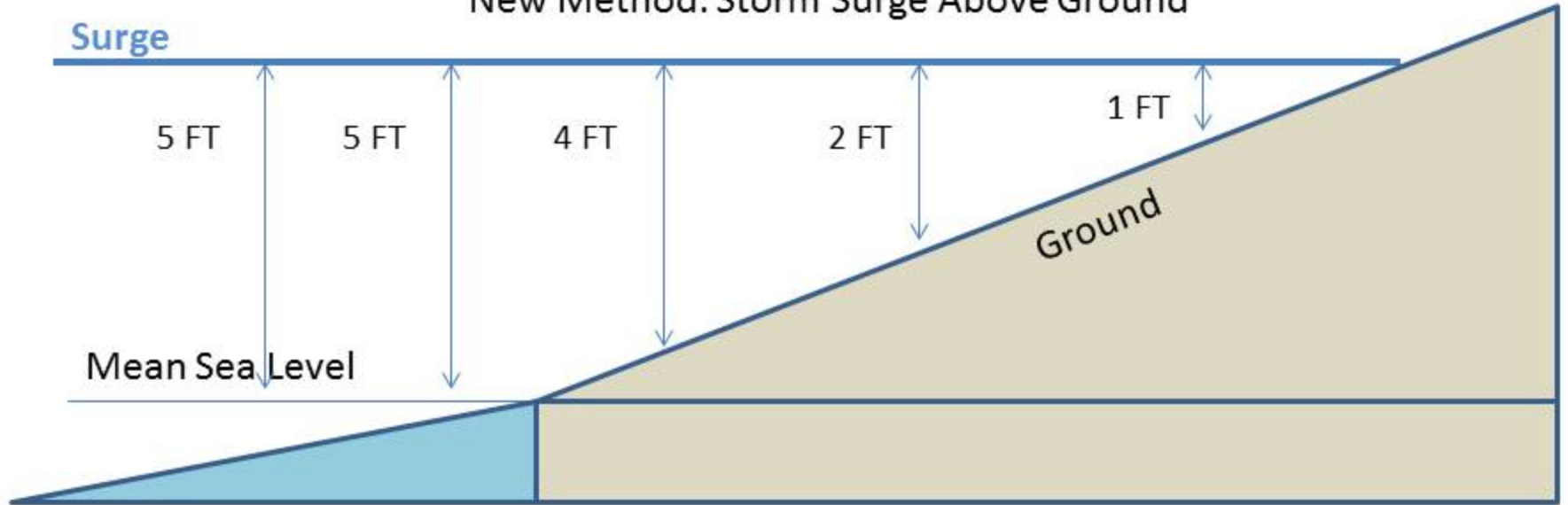


## Accuracy of Perceived Elevation

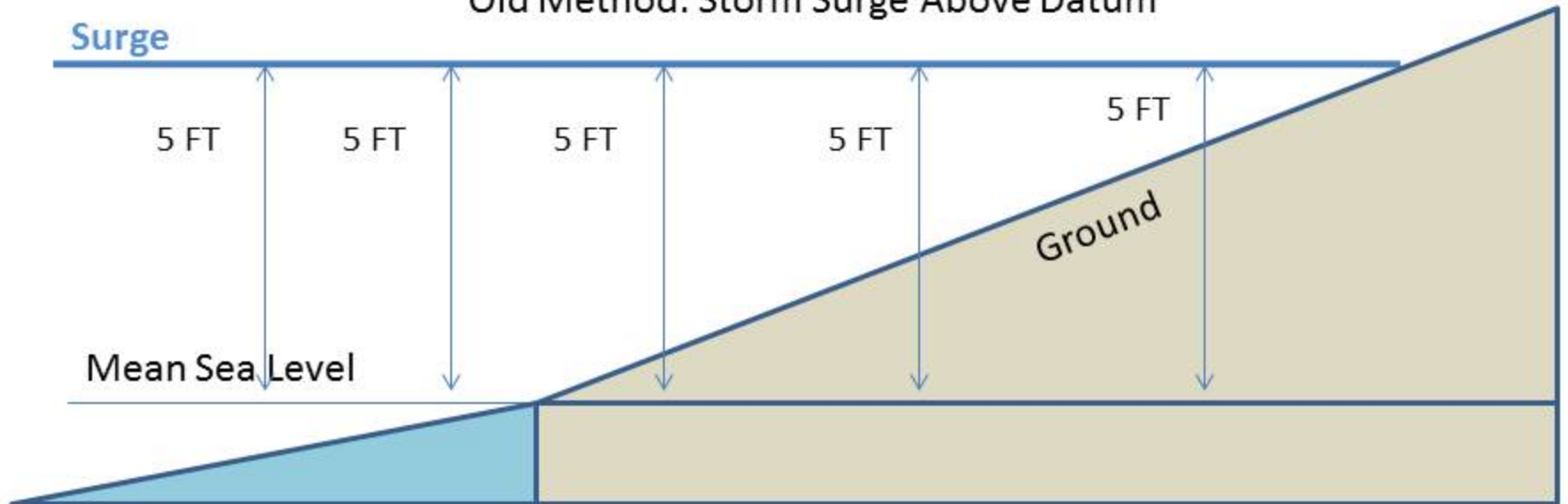


Courtesy Jay Baker, FSU

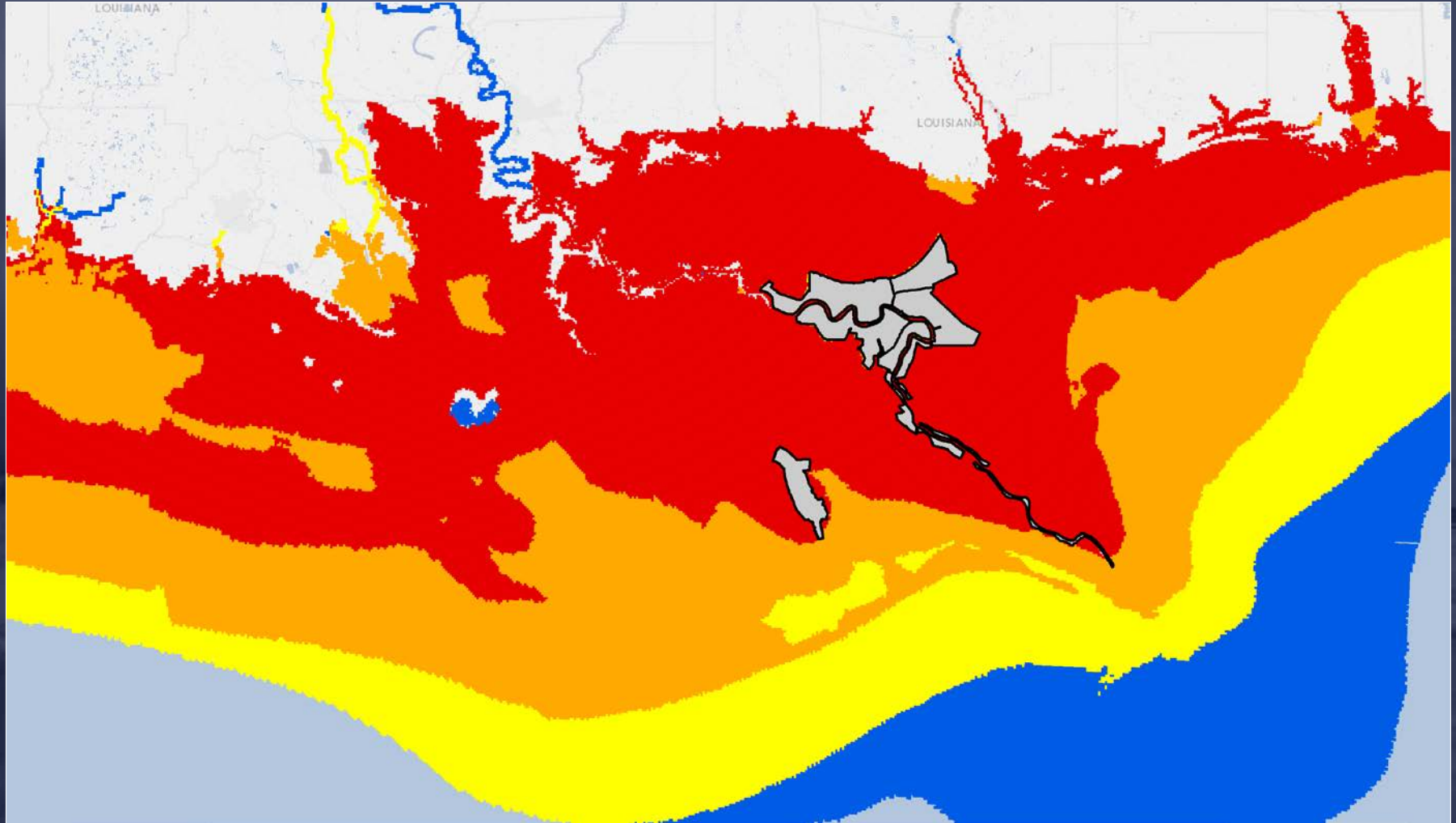
### New Method: Storm Surge Above Ground



### Old Method: Storm Surge Above Datum

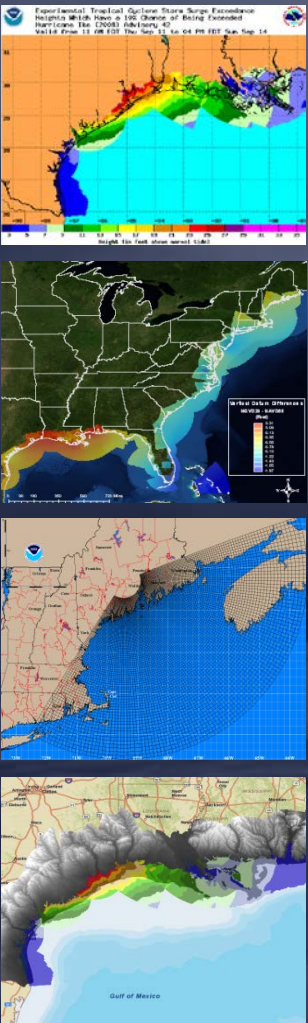


# Storm Surge Inundation



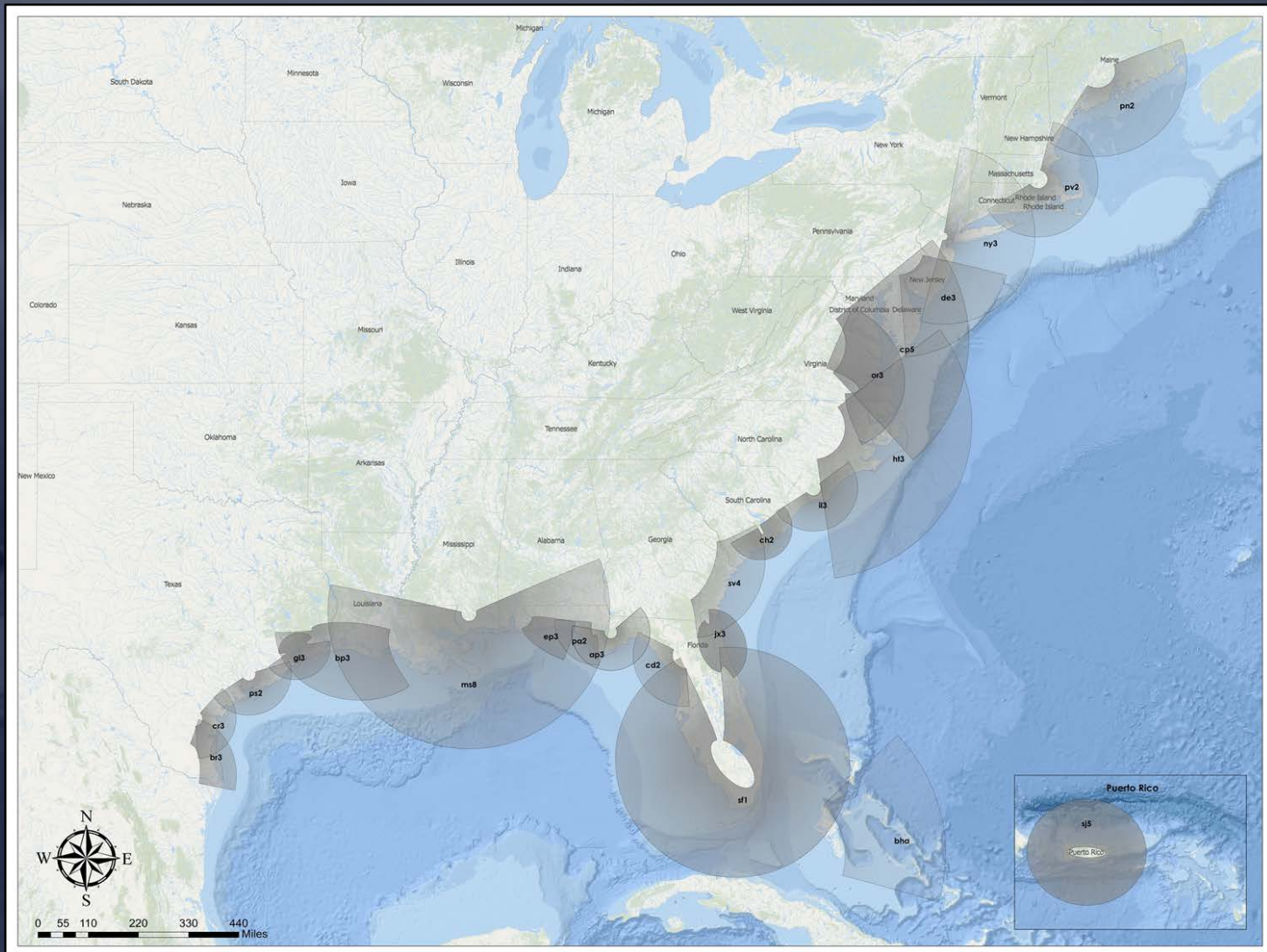


# NHC Potential Storm Surge Flooding Map

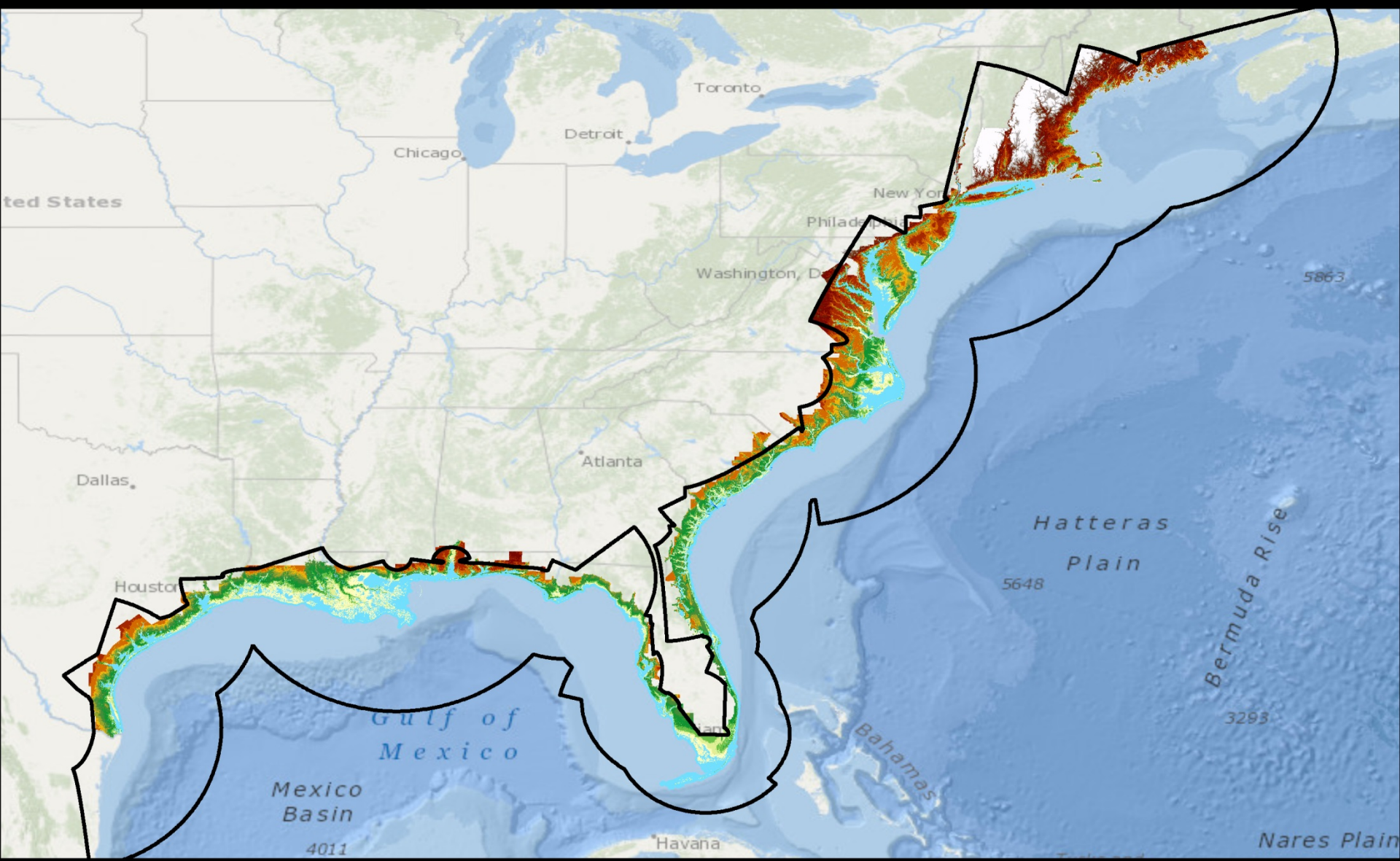


- Which product will drive the flooding map?
  - Psurge 2.x (includes tides)
  - 10% Exceedance (a reasonable worst-case scenario)
- Grids
  - Latest SLOSH basins updated to **NAVD88**
- Topography/Digital Elevation Models (DEMs)
  - NOAA OCM Sea-level rise DEM
    - Resampled to smoother resolution
  - Augmented with USGS NED
- Processing
  - Locally using **ArcGIS** for Server and Desktop
  - Working toward leveraging NWS integrated dissemination program (IDP)

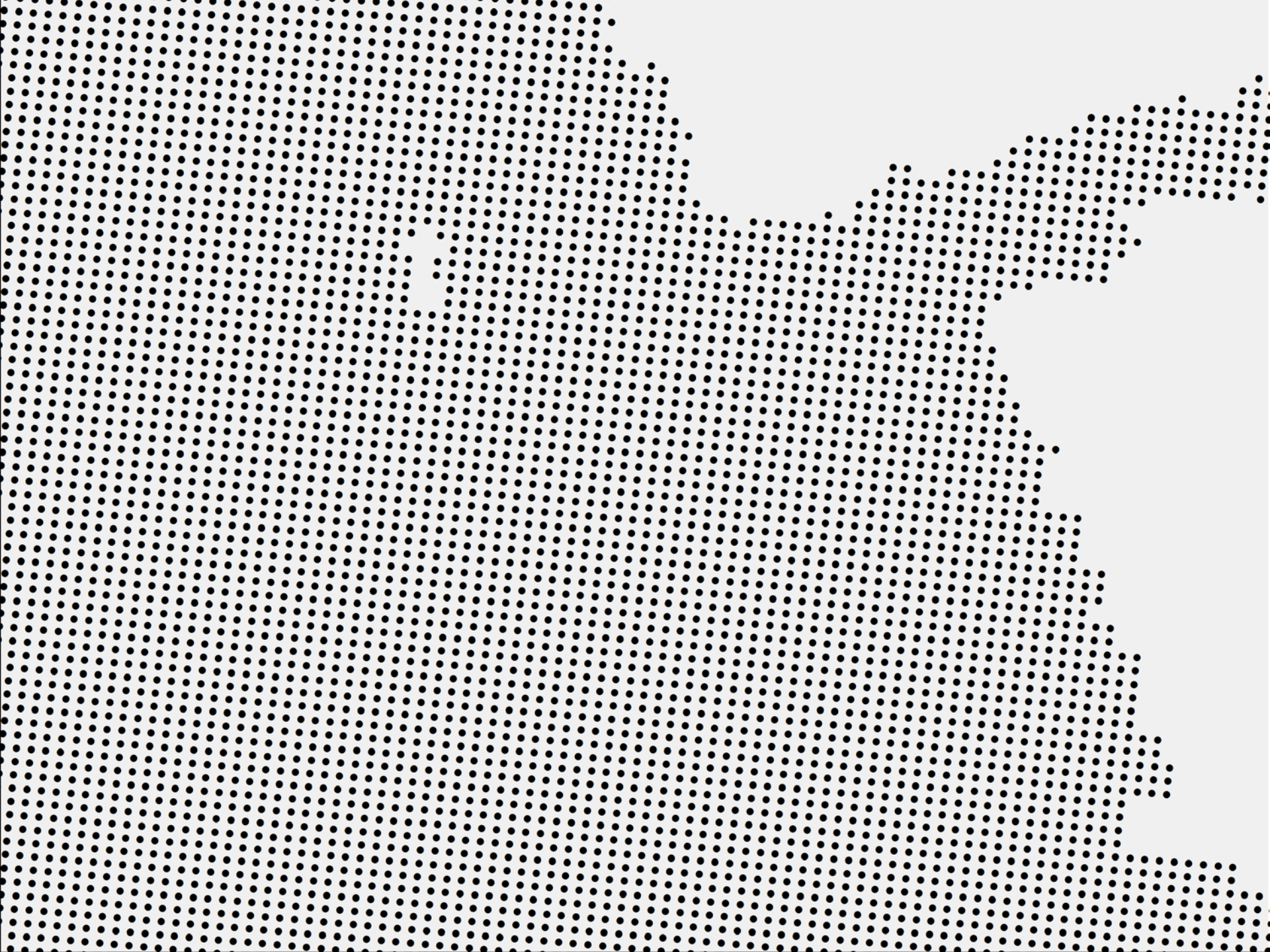
# SLOSH Grids



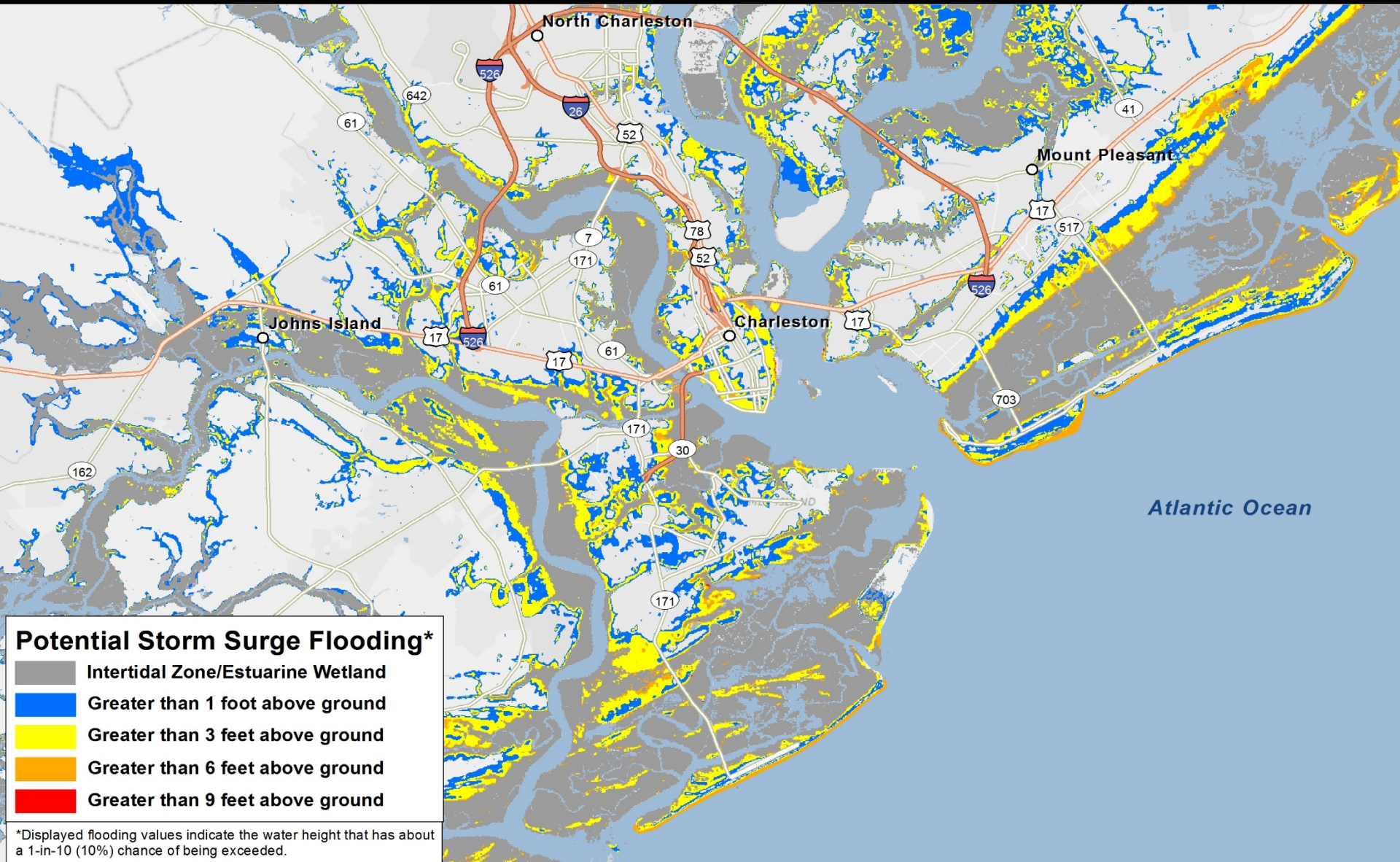
# SLOSH Basins and DEMs



National Hurricane Center  
Storm Surge Unit



# Hurricane X

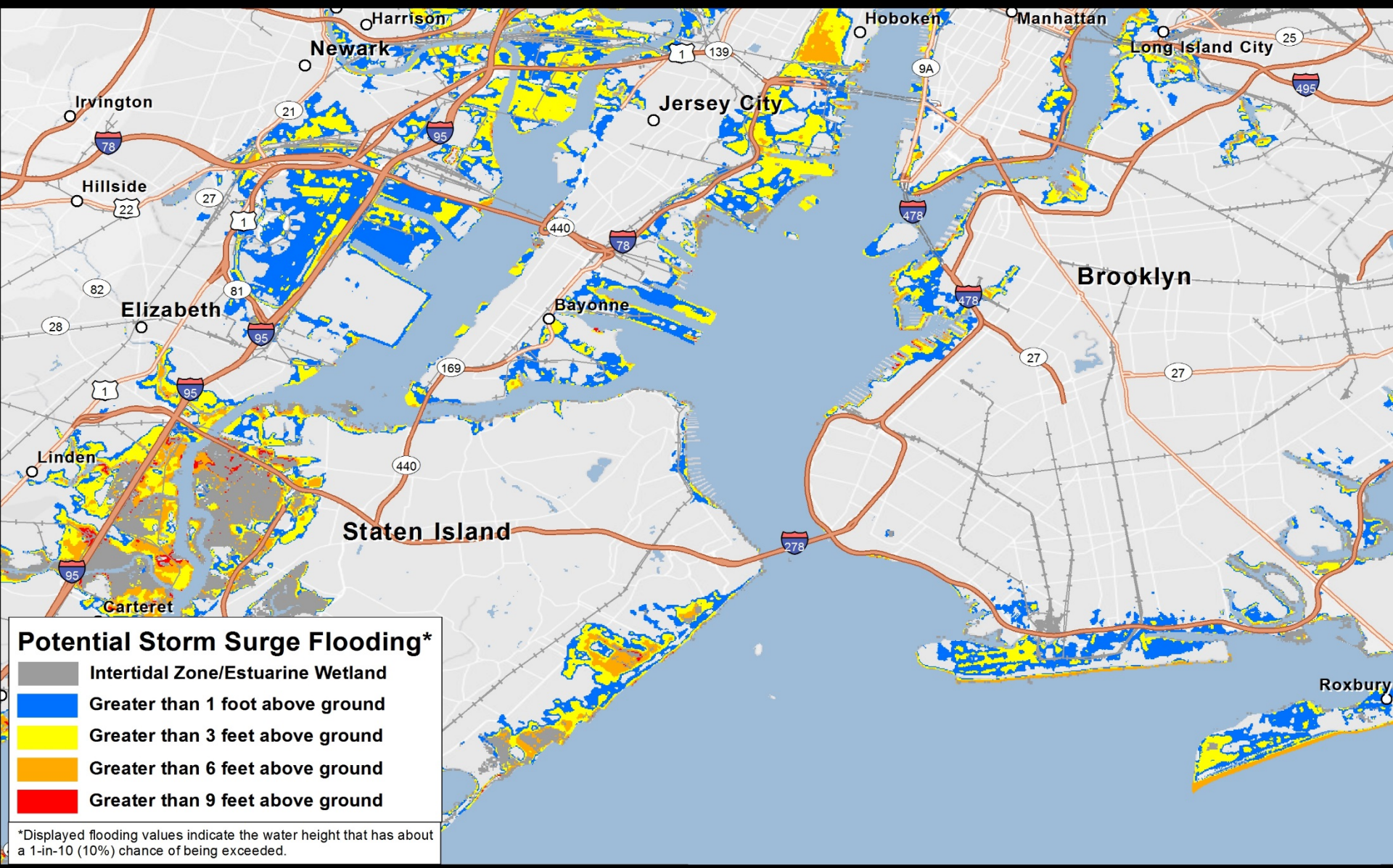


**Potential Storm Surge Flooding\***

- Intertidal Zone/Estuarine Wetland
- Greater than 1 foot above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

\*Displayed flooding values indicate the water height that has about a 1-in-10 (10%) chance of being exceeded.

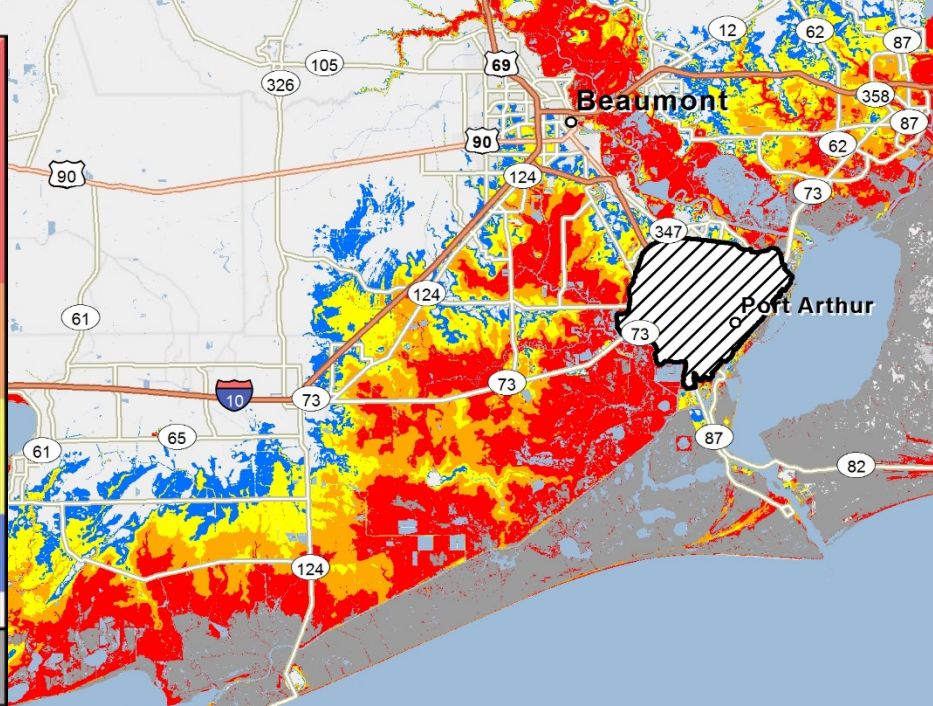
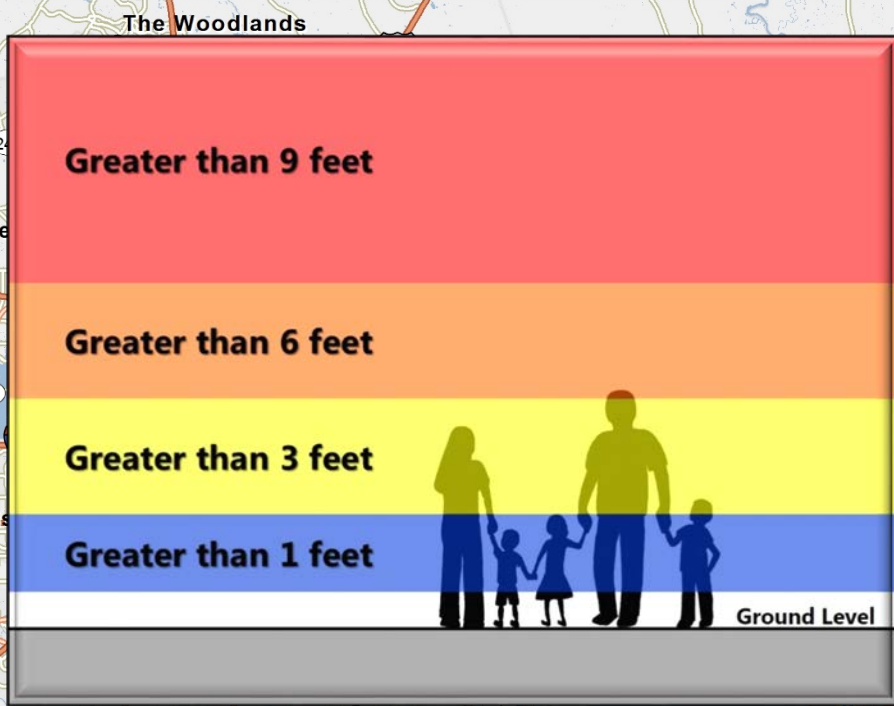
# Hurricane X



- Potential Storm Surge Flooding\***
- Intertidal Zone/Estuarine Wetland
  - Greater than 1 foot above ground
  - Greater than 3 feet above ground
  - Greater than 6 feet above ground
  - Greater than 9 feet above ground

\*Displayed flooding values indicate the water height that has about a 1-in-10 (10%) chance of being exceeded.

# Hurricane X



## Potential Storm Surge Flooding\*

- Intertidal Zone/Estuarine Wetland
- Greater than 1 foot above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground
- Leveed area  
Consult local officials for flood risk

\*Displayed flooding values indicate the water height that has about a 1-in-10 (10%) chance of being exceeded.



National Hurricane Center  
Storm Surge Unit

# Intertidal Zone/Estuarine Wetlands

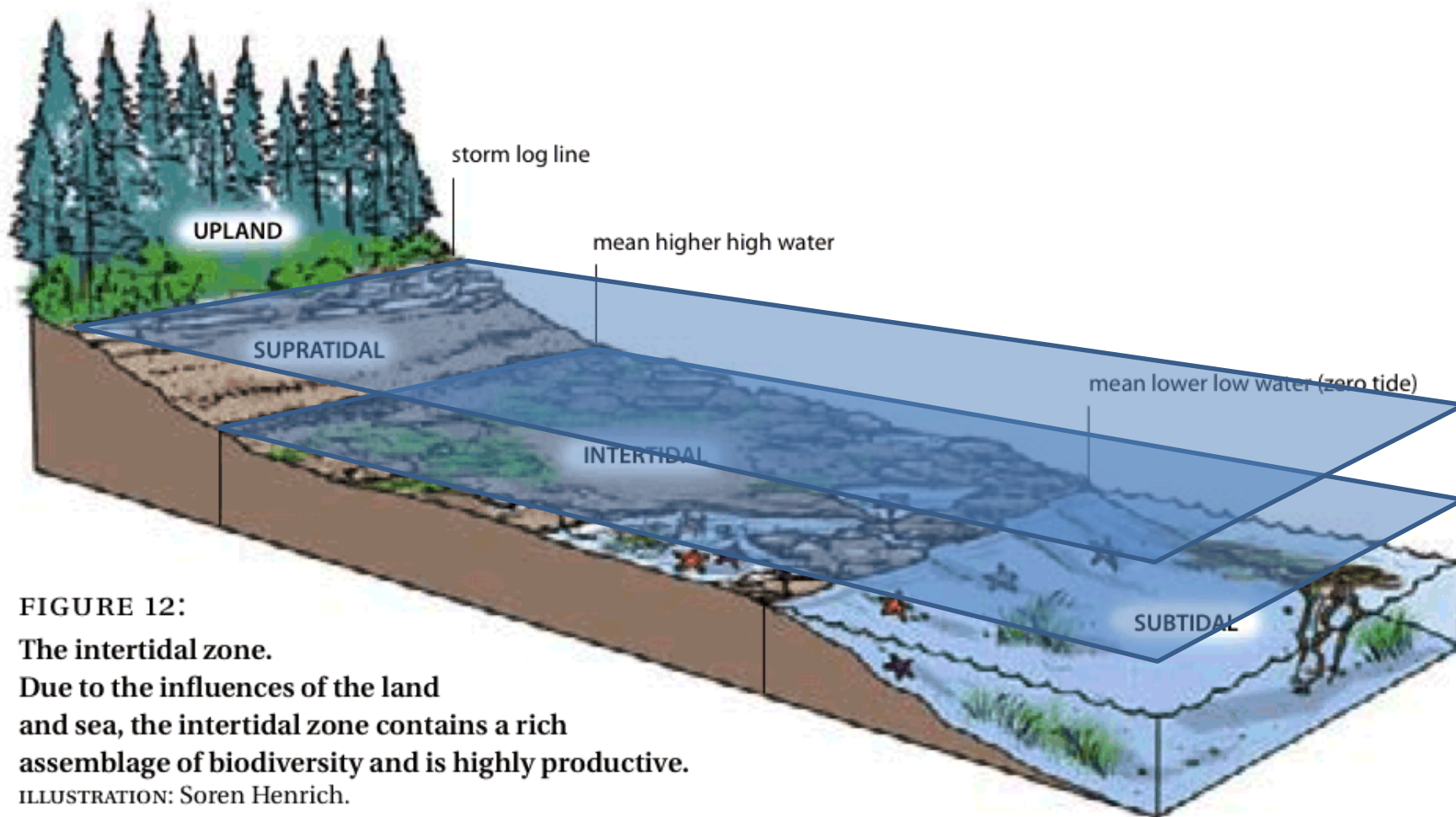


FIGURE 12:

The intertidal zone.

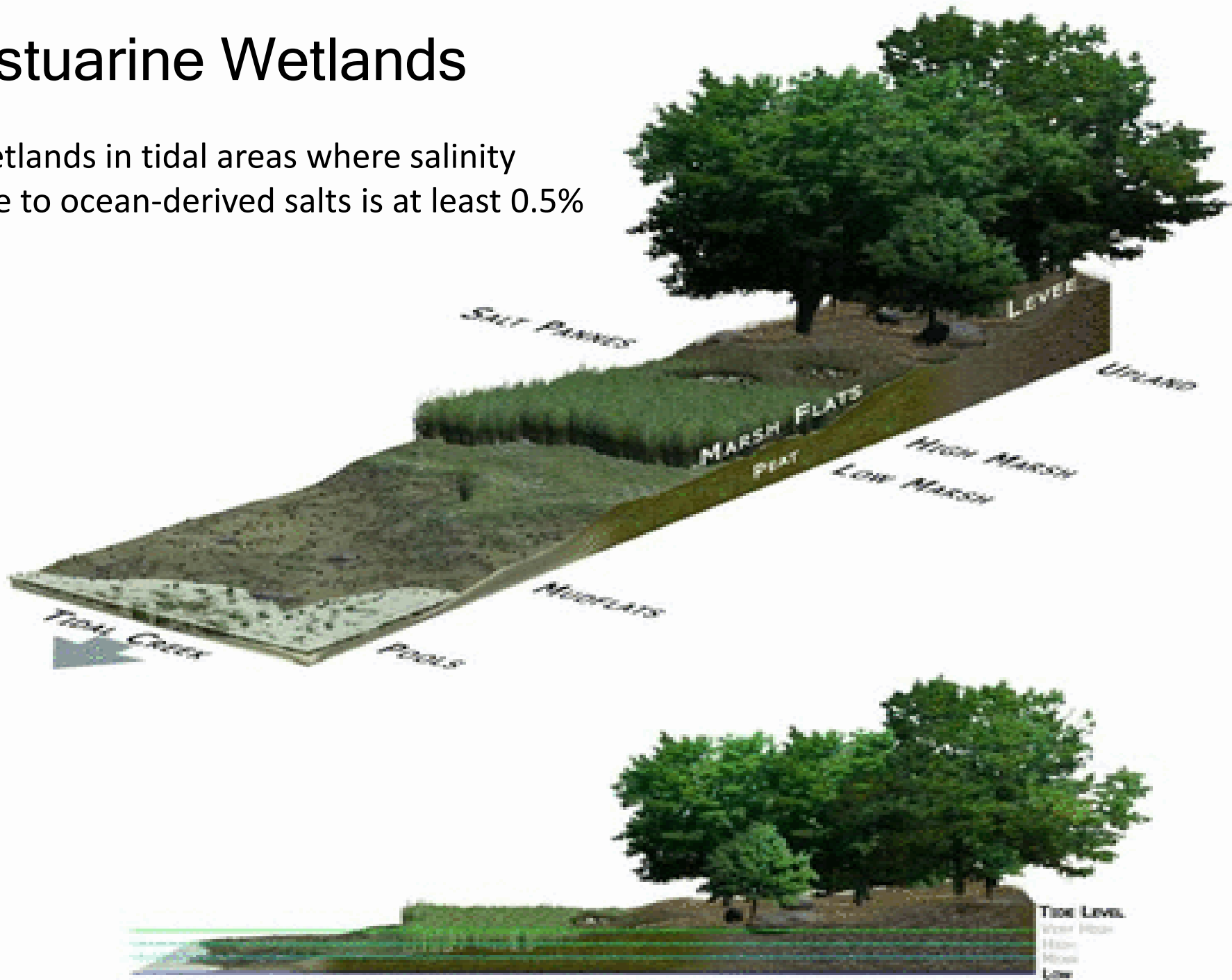
Due to the influences of the land and sea, the intertidal zone contains a rich assemblage of biodiversity and is highly productive.

ILLUSTRATION: Soren Henrich.



# Estuarine Wetlands

Wetlands in tidal areas where salinity due to ocean-derived salts is at least 0.5%



# Salt Marshes



Sapelo Marsh, Georgia

# Mangroves



Southwest Florida

# Estuarine Forests (including Louisiana Bayous!)



Shell Bank Bayou, Louisiana

# Potential Storm Surge Flooding Map

- Provides a quantitative risk assessment for decision makers.

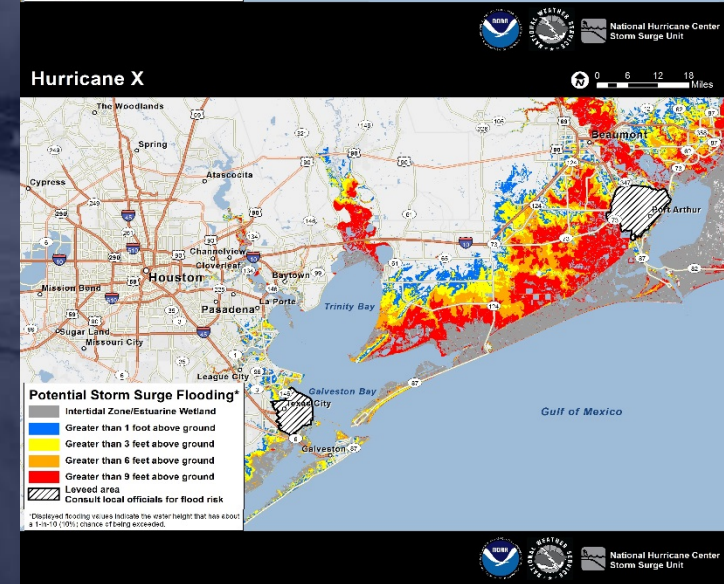
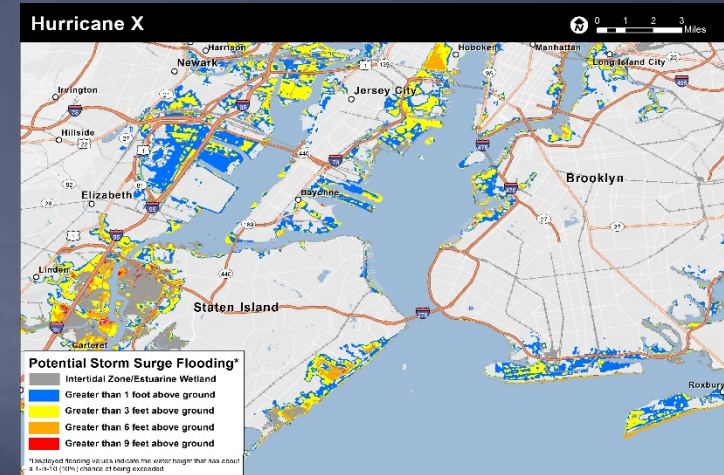
- Shows height above ground that the water **could** reach.

- Depicts the reasonable worst-case scenario at any individual location.

- Shows inundation levels that have a **10%** chance of being exceeded.

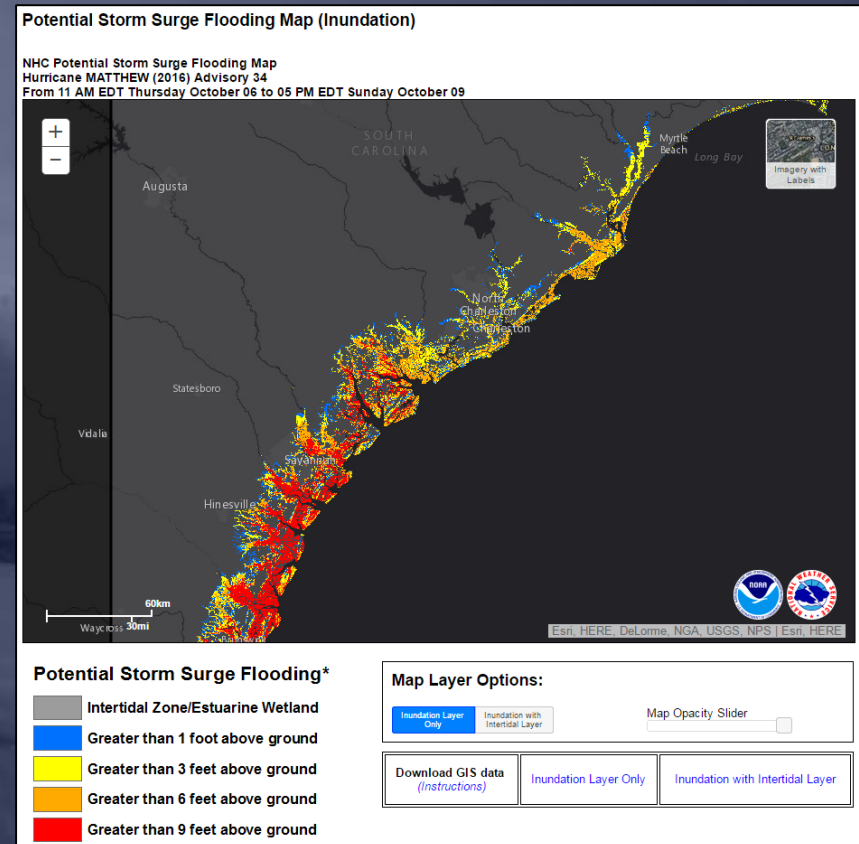
- First map issued at the same time as the initial hurricane watch or in some cases, with a tropical storm watch.

- Available about **60 to 90 minutes** following the advisory release.

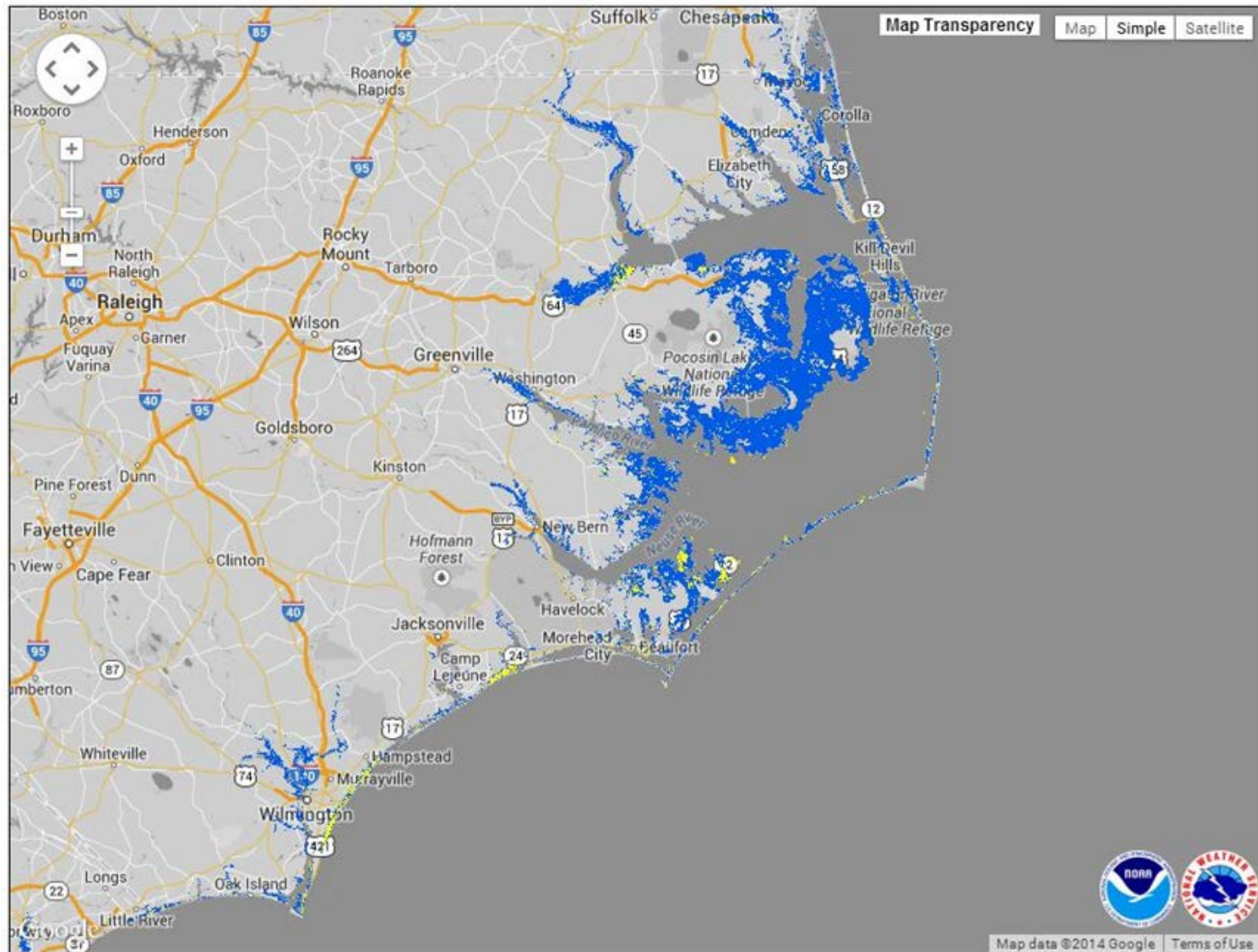


# Interactive Interface and Data Access

- Interactive viewer available on [hurricanes.gov](https://hurricanes.gov)
- Intertidal layer can be turned on/off (NHC recommends leaving it on)
- GIS data available for download
- Available on NOAA's nowCOAST
  - <https://nowcoast.noaa.gov/>
  - Map Services (REST and WMS)



NHC Experimental Potential Storm Surge Flooding Map  
 Hurricane ARTHUR (2014) Advisory 10  
 From 05 AM EDT Thursday July 03 to 10 AM EDT Sunday July 06



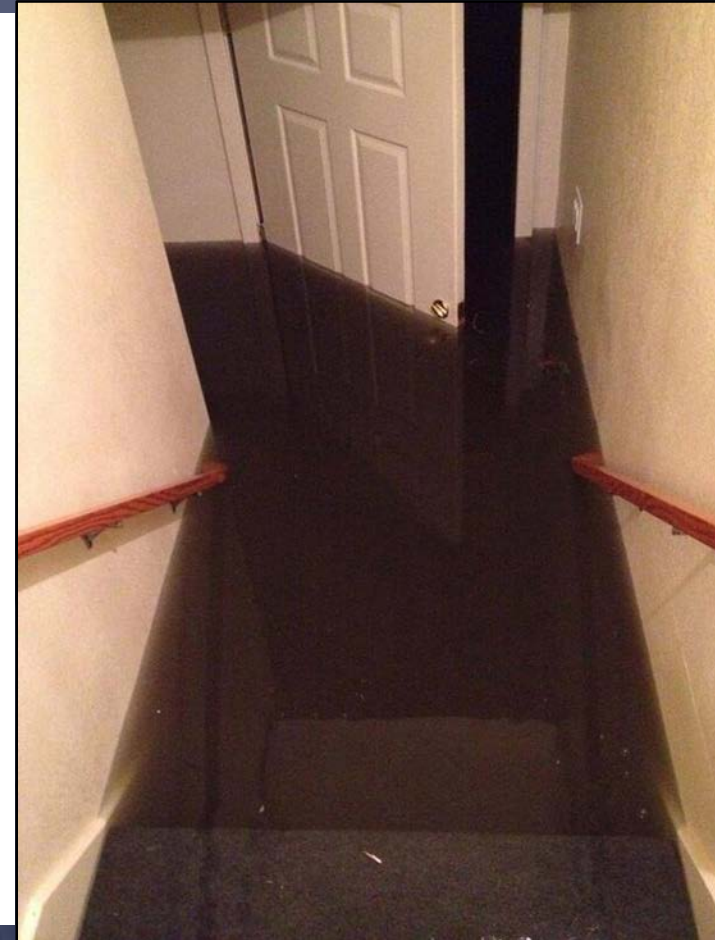
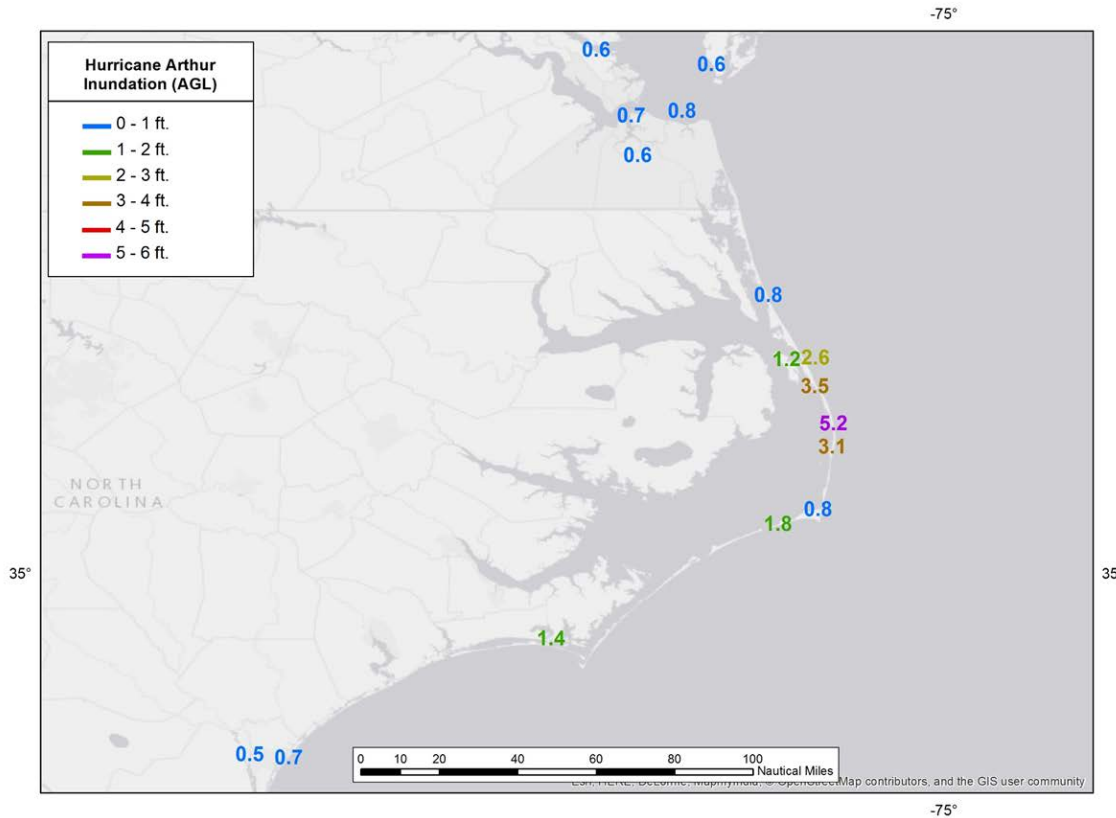
**Potential Storm Surge Flooding\***

- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground

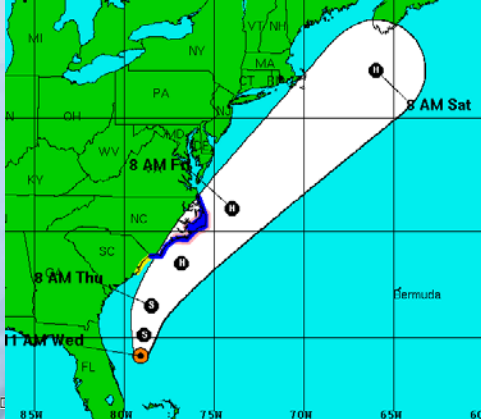
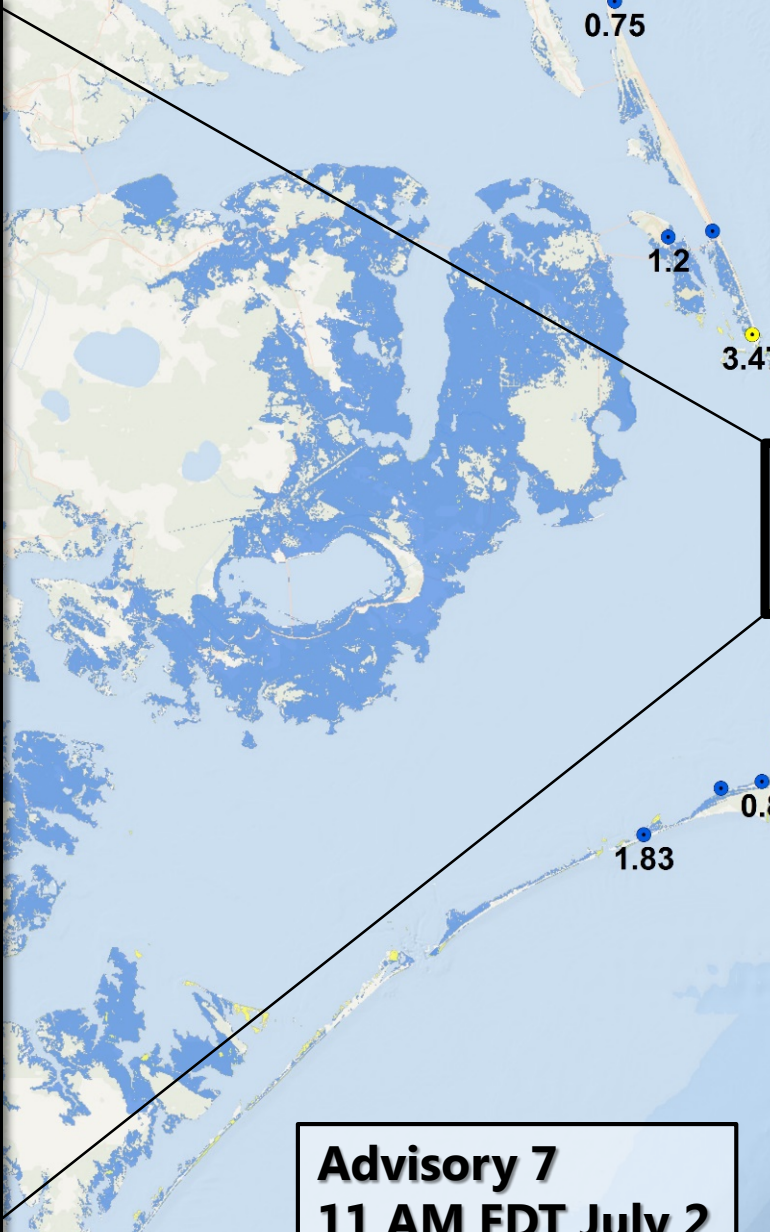
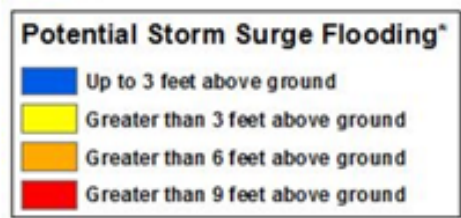
\*Displayed flooding values indicate the water depth that has about a 1-in-10 (10%) chance of being exceeded.

Experimental Potential Storm Surge Inundation GIS datasets will not be disseminated during the 2014 Atlantic Hurricane Season.

# Hurricane Arthur Storm Surge Inundation

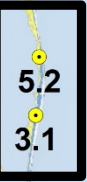
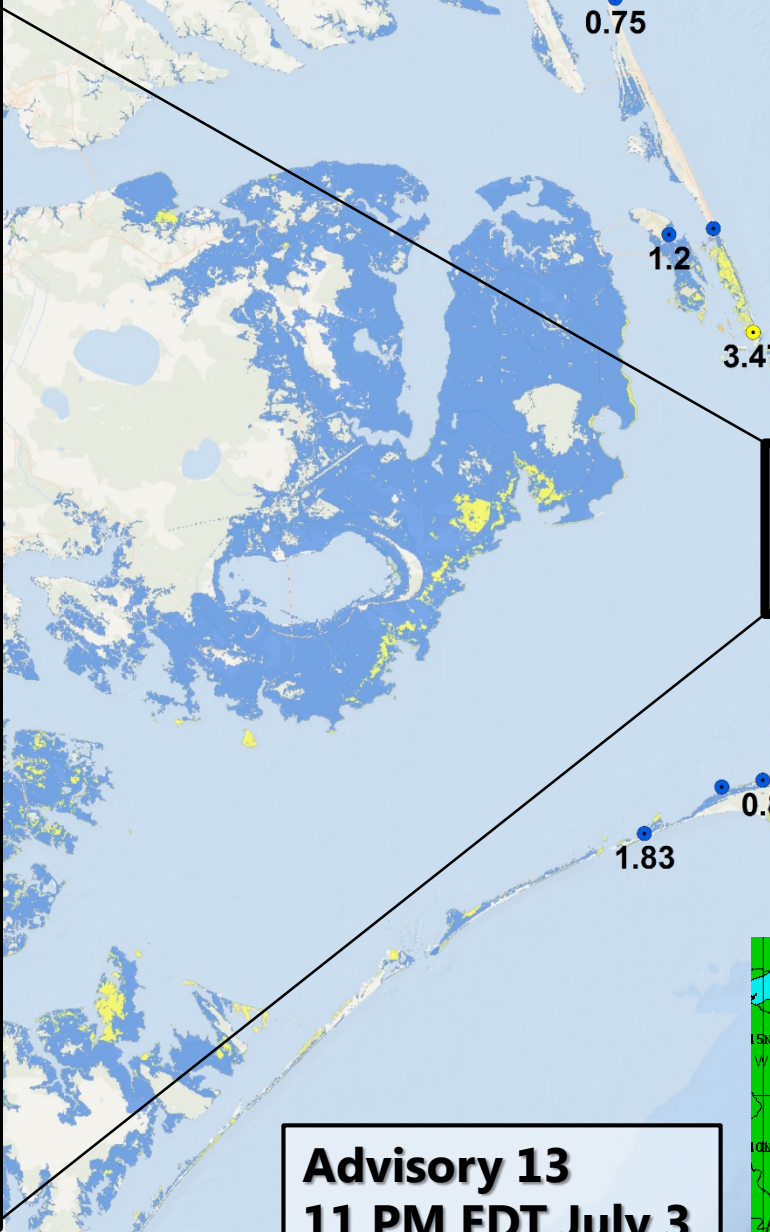
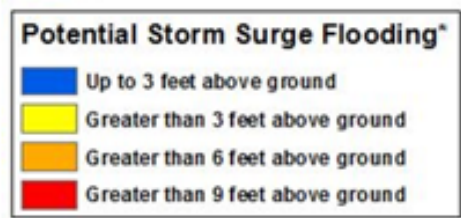




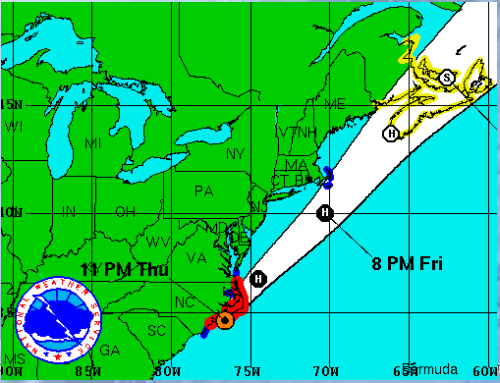


**Advisory 7  
11 AM EDT July 2**

Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors. Esri, HERE, DeLorme, NOAA/NWS/National Hurricane Center/Storm Surge Unit



**Advisory 13  
11 PM EDT July 3**



Esri, DeLorme, GEBCO, NOAA NGDC, and NOAA/NWS/National Hurricane Center/Storm Surge Unit

Esri, DeLorme, GEBCO, NOAA NGDC, and other contributors. Esri, HER NOAA/NWS/National Hurricane Center/Storm Surge Unit

# Questions?

