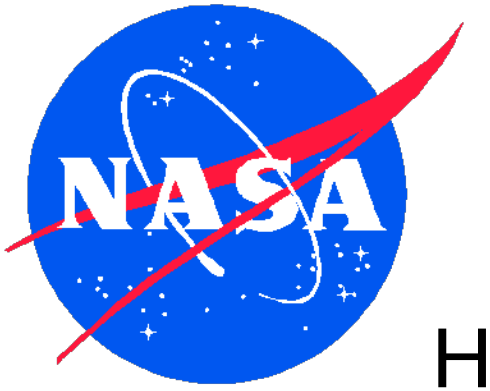

Establishing the Application of High Resolution Satellite Imagery to Improve Coastal and Estuarine Models

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University of Central Florida

Coastal Hydroscience Analysis, Modeling & Predictive Simulations Laboratory

CHAMPS Lab

http://champs.cecs.ucf.edu

What do my wife and I have in common with NASA’s Terra?

The Team

University of Central Florida

- Scott C. Hagen (PI)
- Stephen Medeiros, Ph.D. student
- John Weishampel

NOAA-CREST/The City University of New York

- Naira Chaouch
- Reza Khanbilvardi
- Marouane Temimi

NOAA/NOS/CSDL/Marine Modeling & Analysis Programs

- Jesse Feyen
- Yuji Funakoshi
- Frank Aikman III

NOAA/NWS/Office for Hydrologic Development

- Pedro Restrepo

NOAA/NWS/Lower Mississippi River Forecast Center

- Dave Reed

Overall Goal

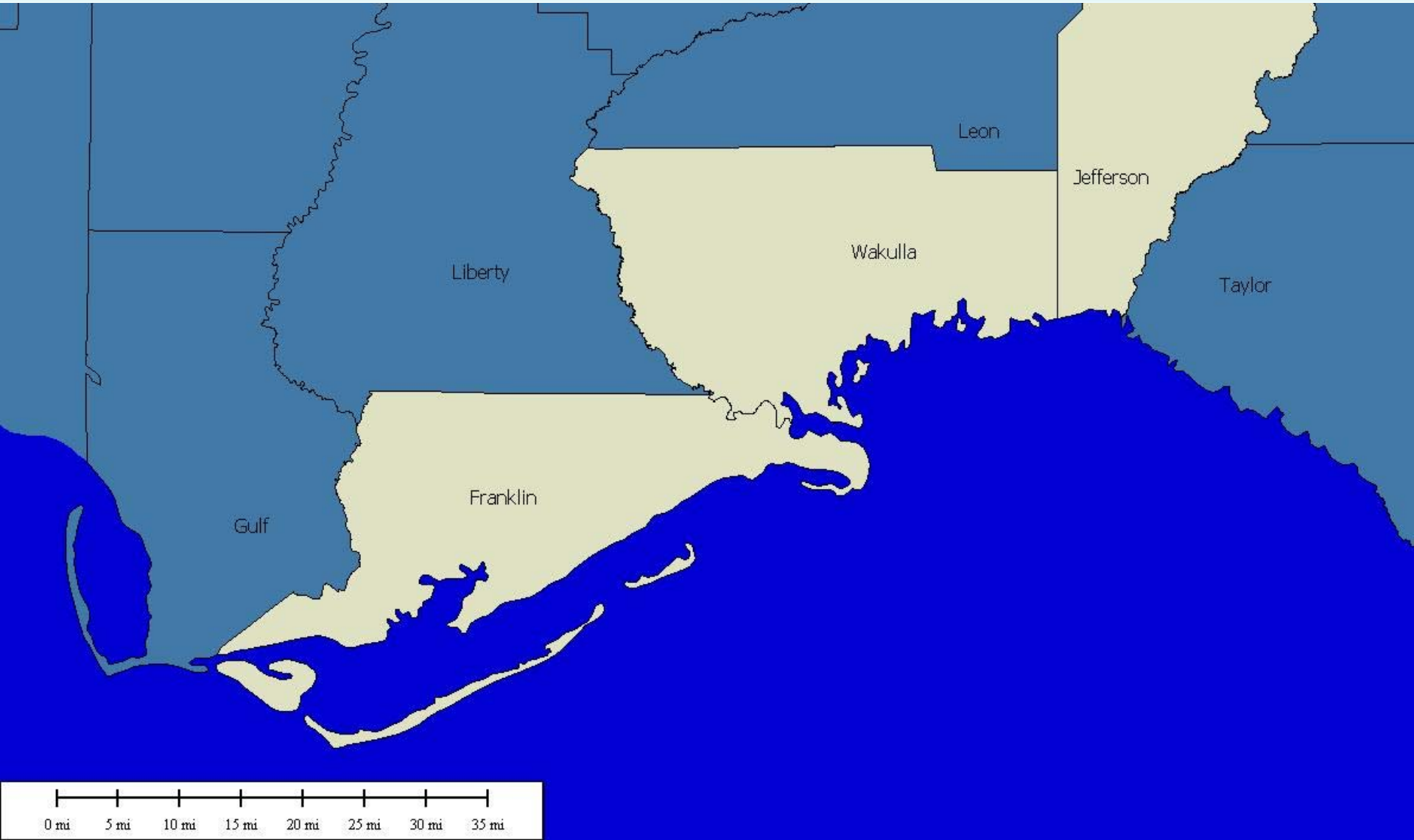
- To demonstrate the efficacy of employing high resolution satellite imagery to improve coastal inundation models.

Background

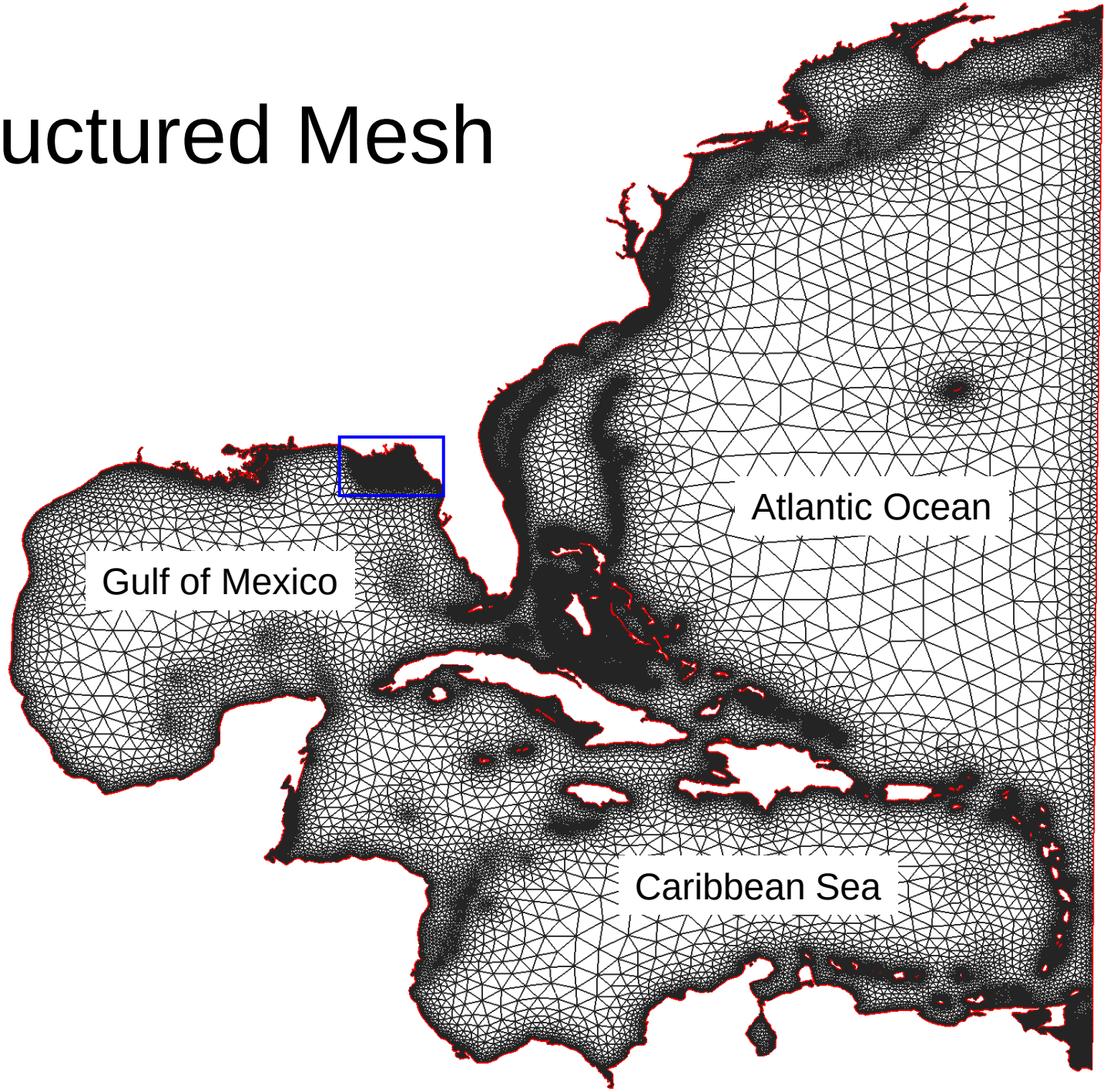
- The Northwest Florida Water Management District (NWFWMD) is taking on the roll of Cooperative Technical Partner for updating FEMA digital flood insurance rate maps
- The goal of this modeling effort is to develop a high resolution storm tide model for coastal areas along Jefferson, Wakulla, and Franklin Counties

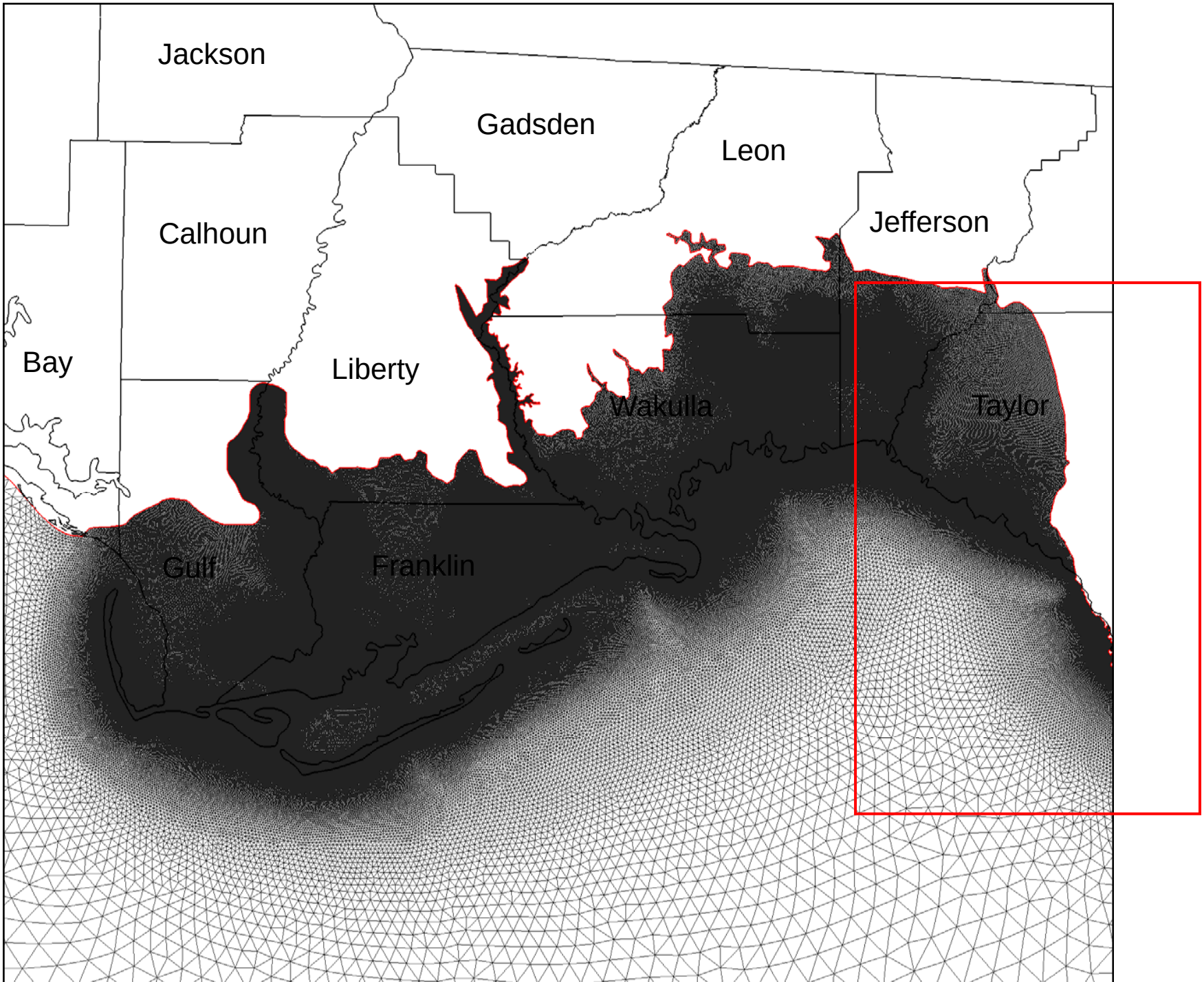
Image NASA
Image © 2008 TerraMetrics
Image © 2008 DigitalGlobe
©2008 Google™
30°03'57.24" N 69°50'18.01" W
Eye alt 7678.35 km

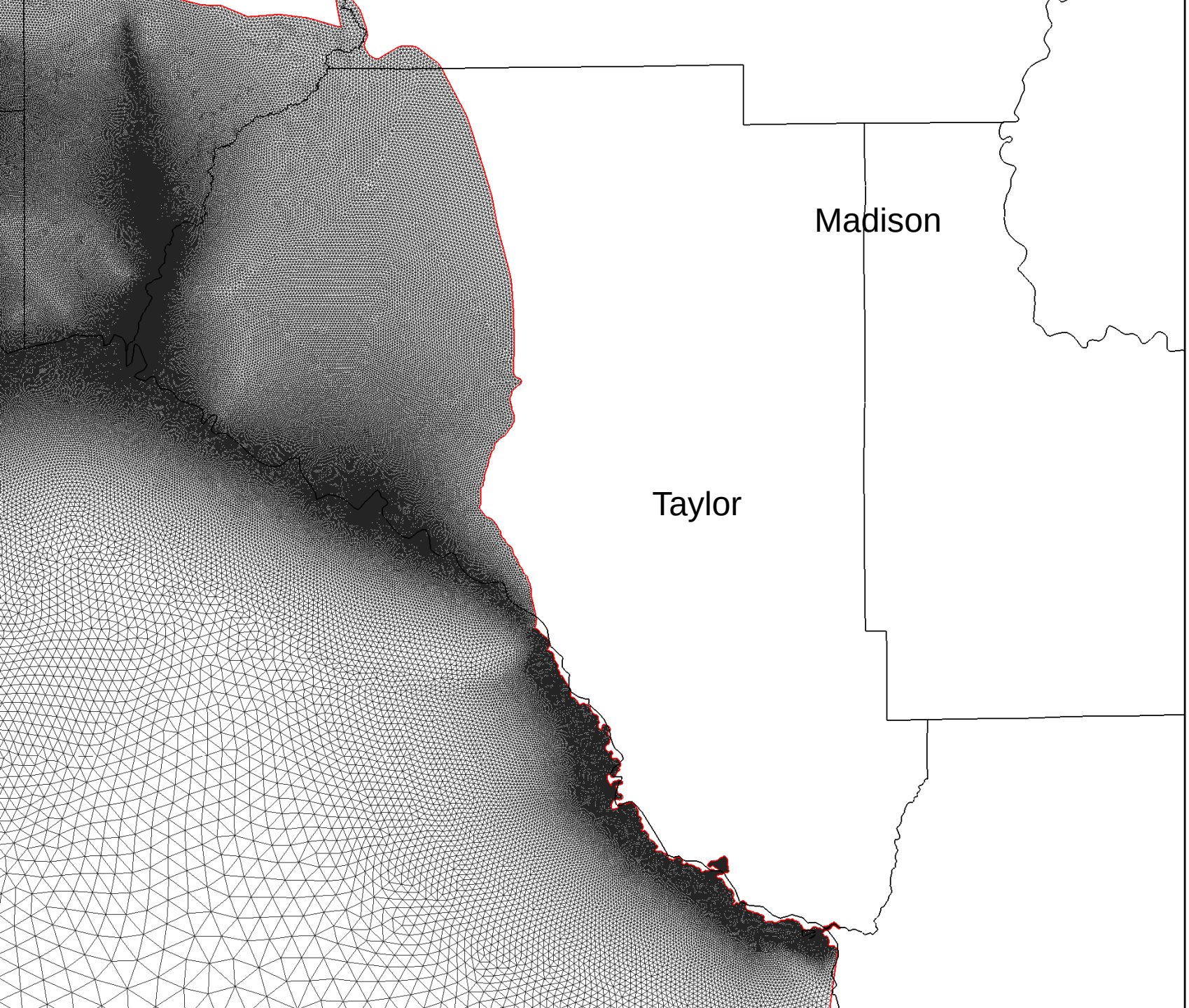
Study Domain

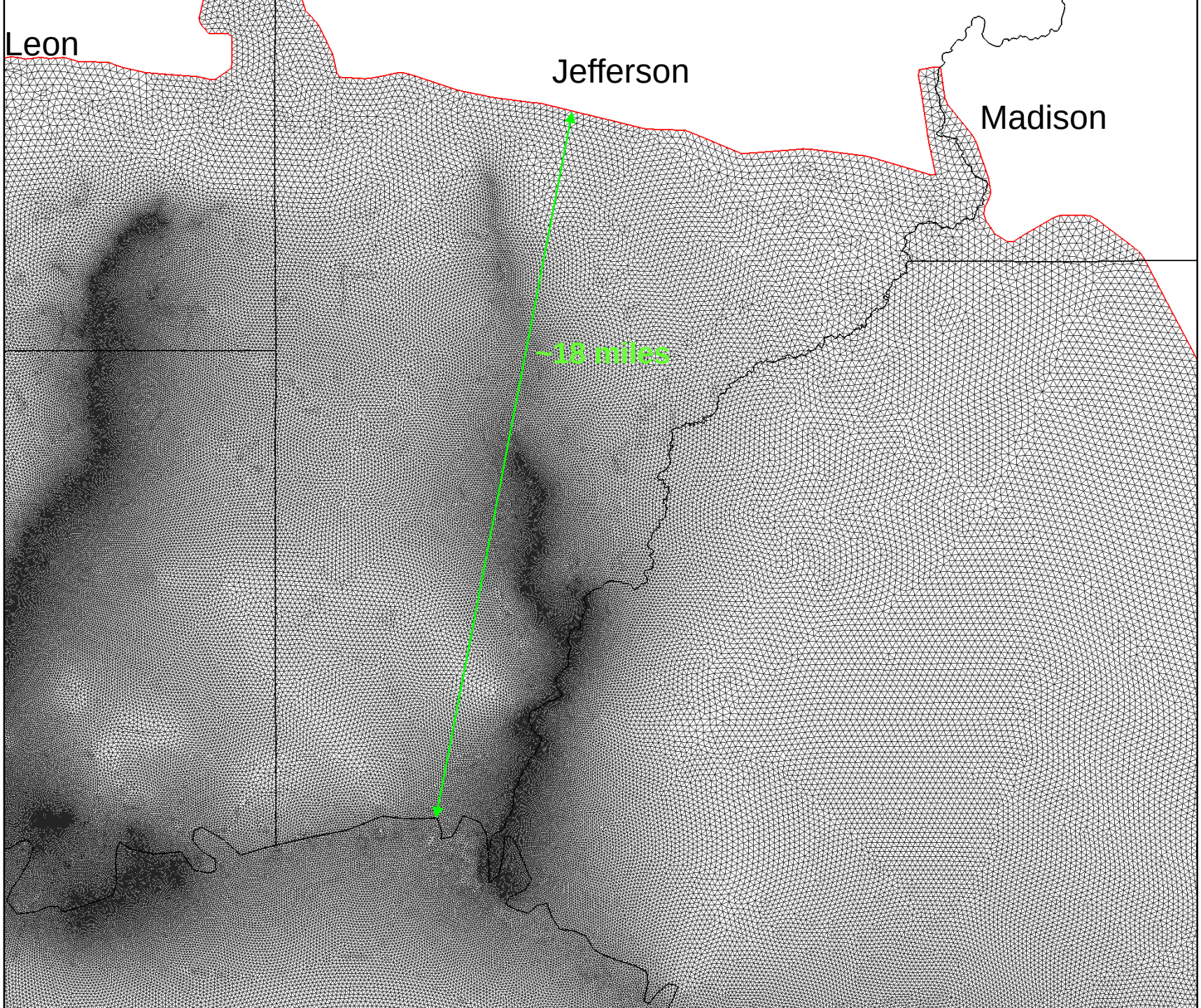


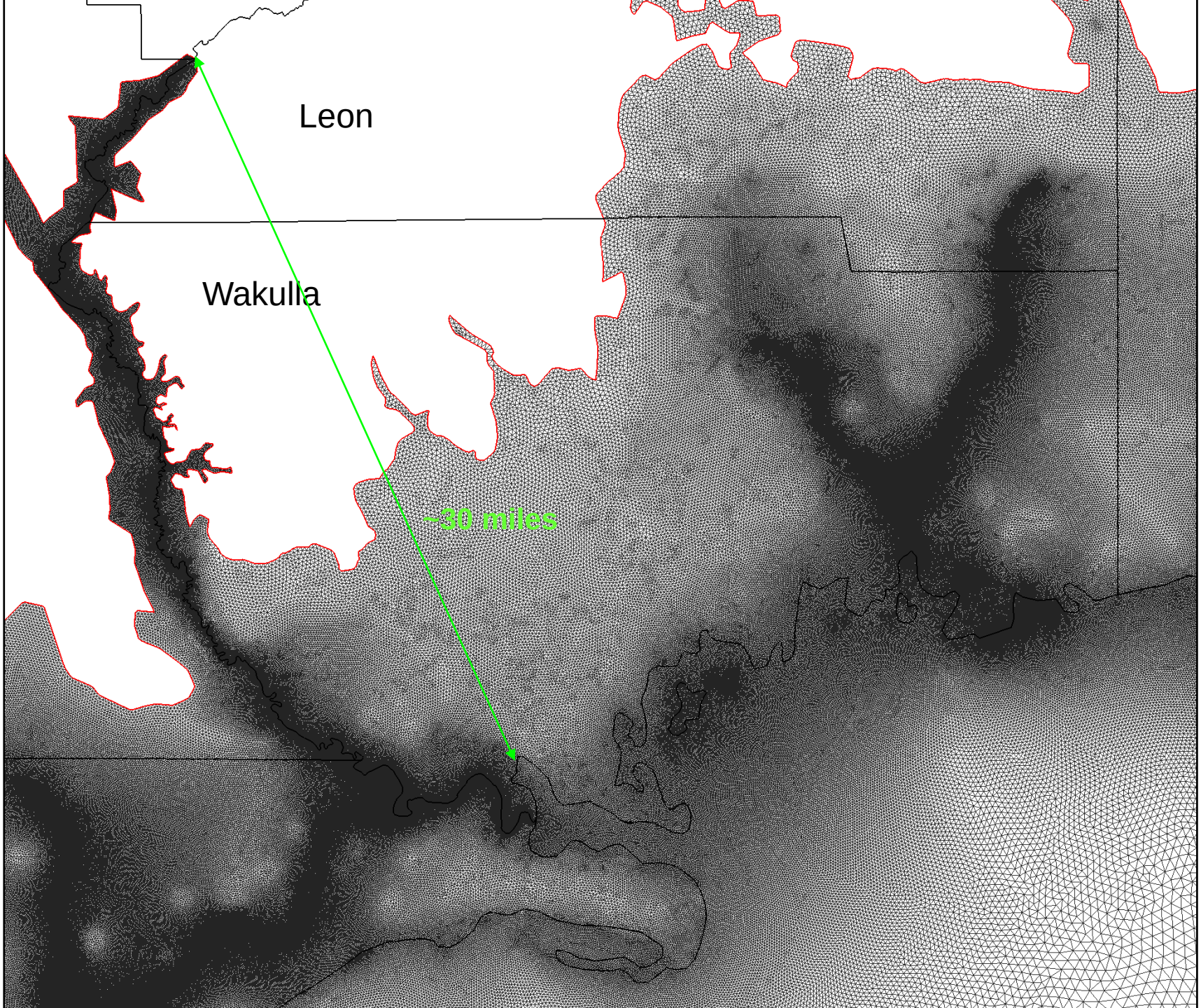
Unstructured Mesh

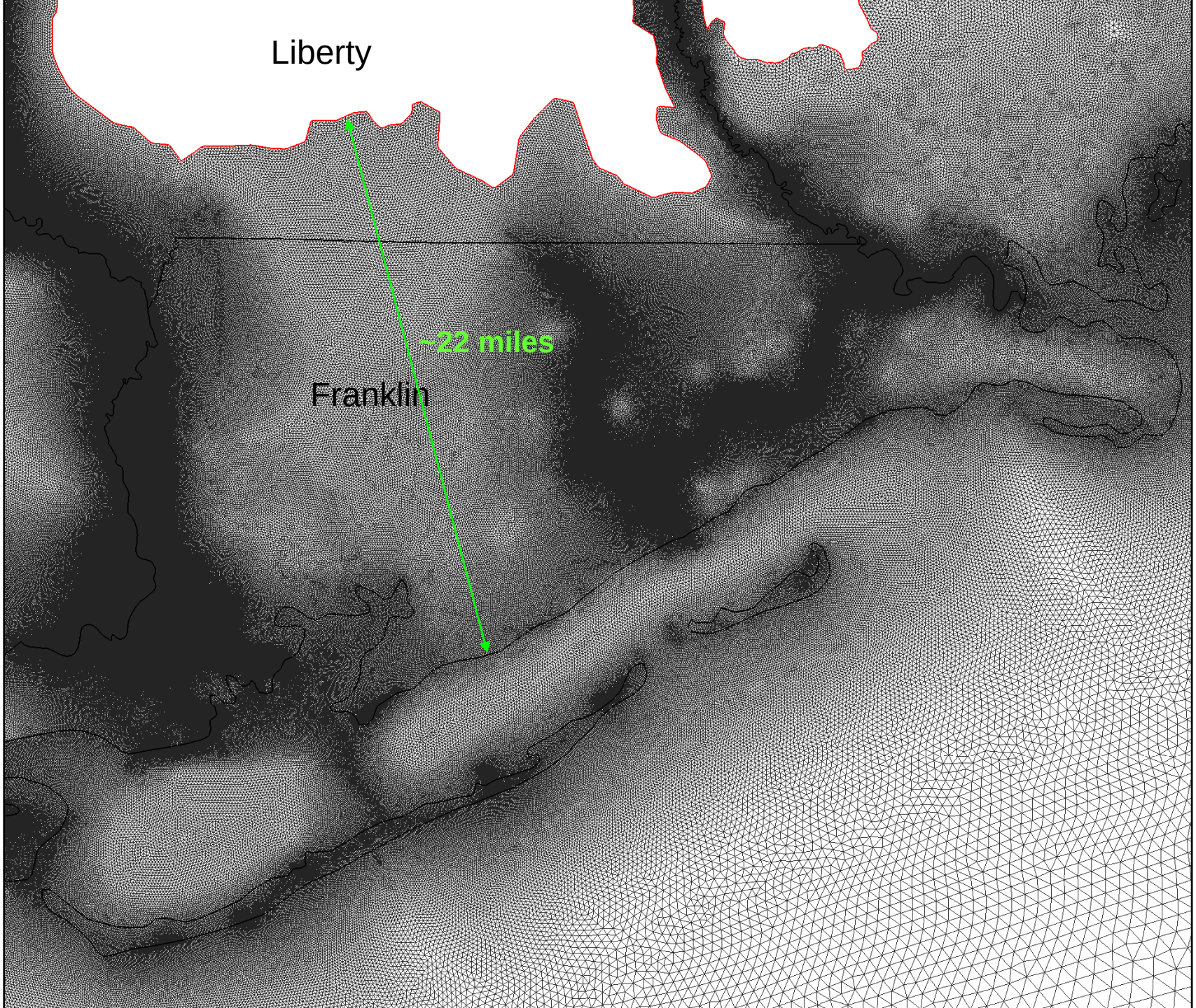


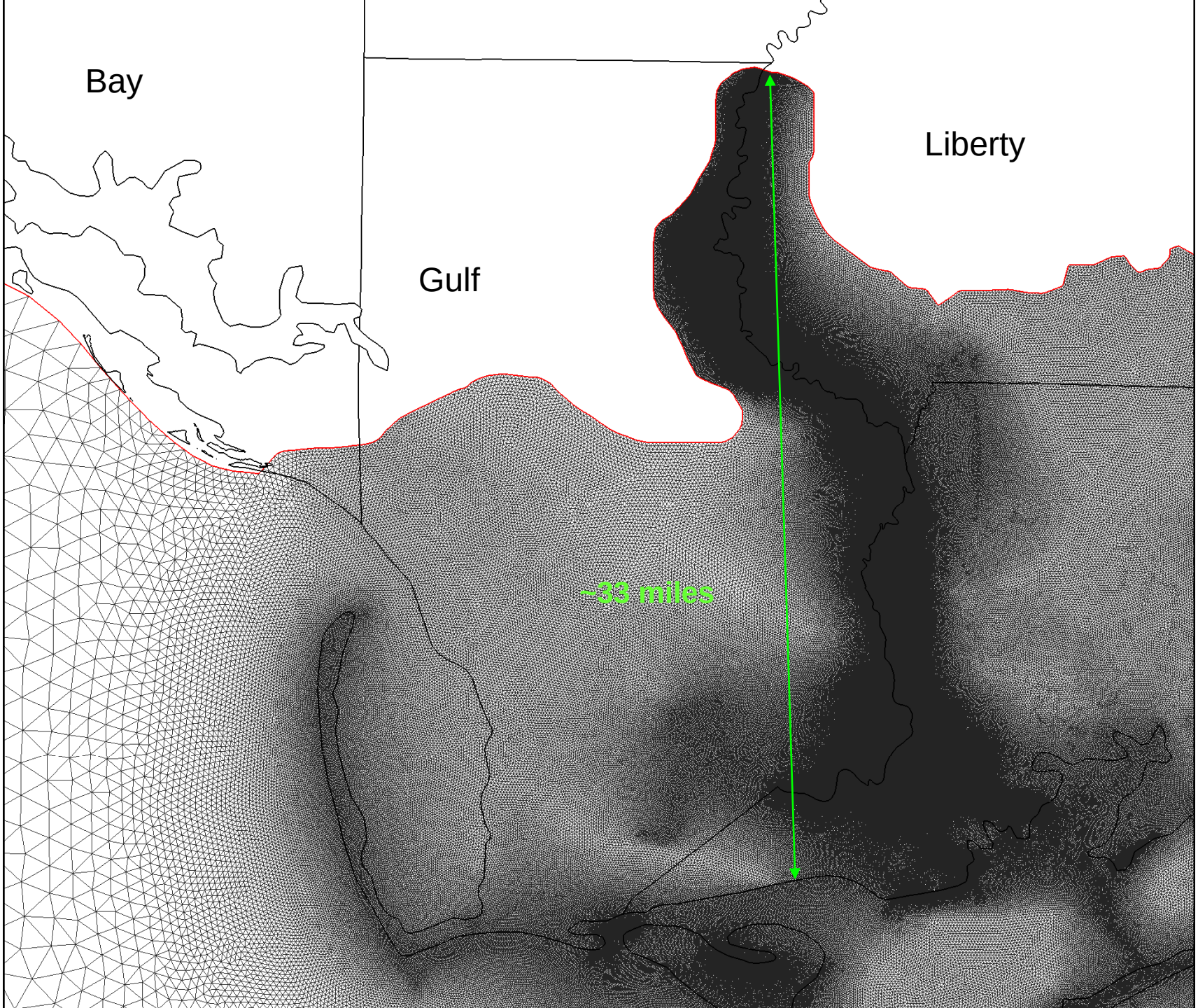

Jackson
Gadsden
Leon
Calhoun
Jefferson
Bay
Liberty
Wakulla
Taylor
Gulf
Franklin

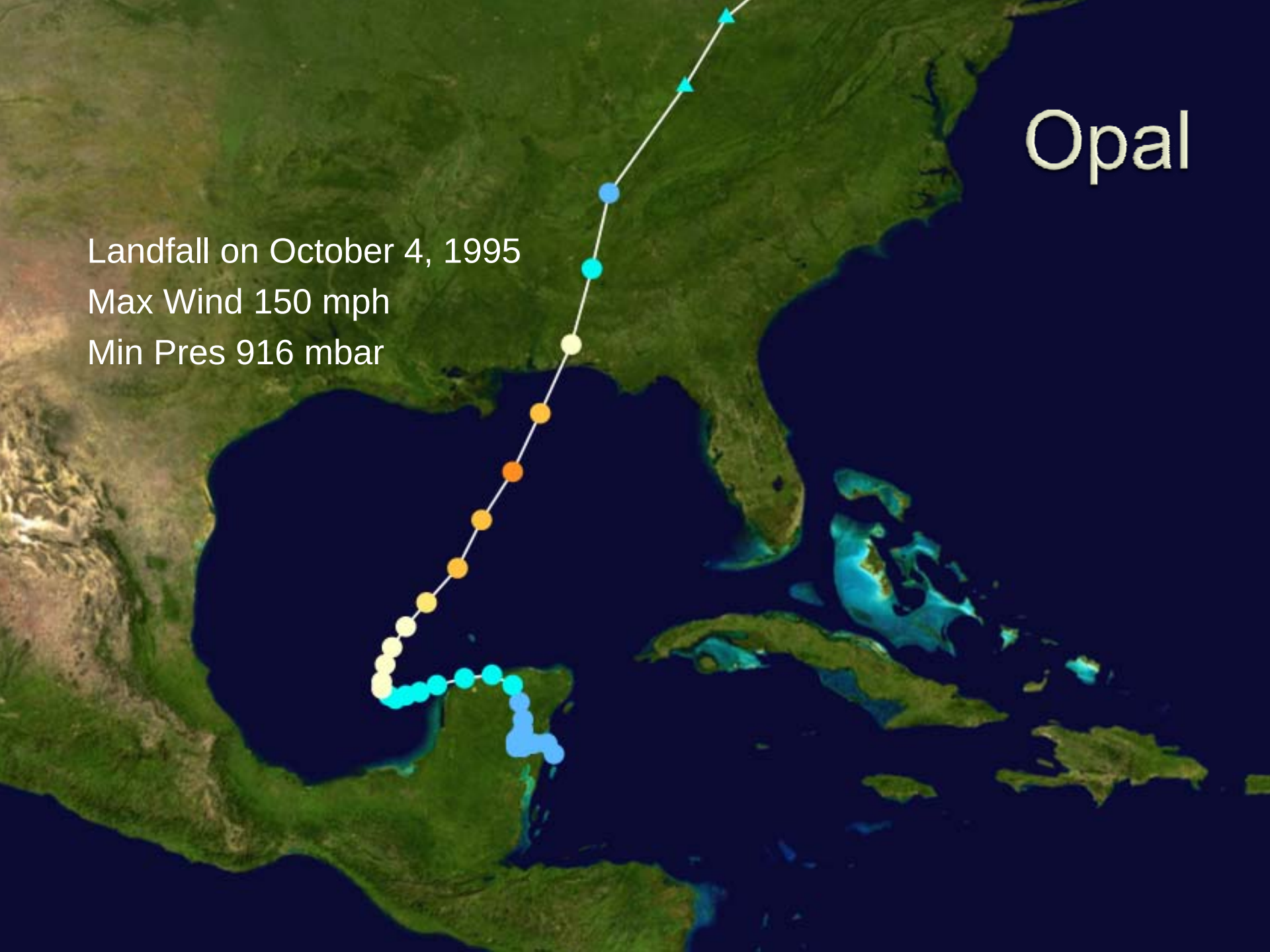

Madison
Taylor


Leon
Jefferson
Madison
~18 miles


Leon
Wakulla
~30 miles


Liberty
~22 miles
Franklin

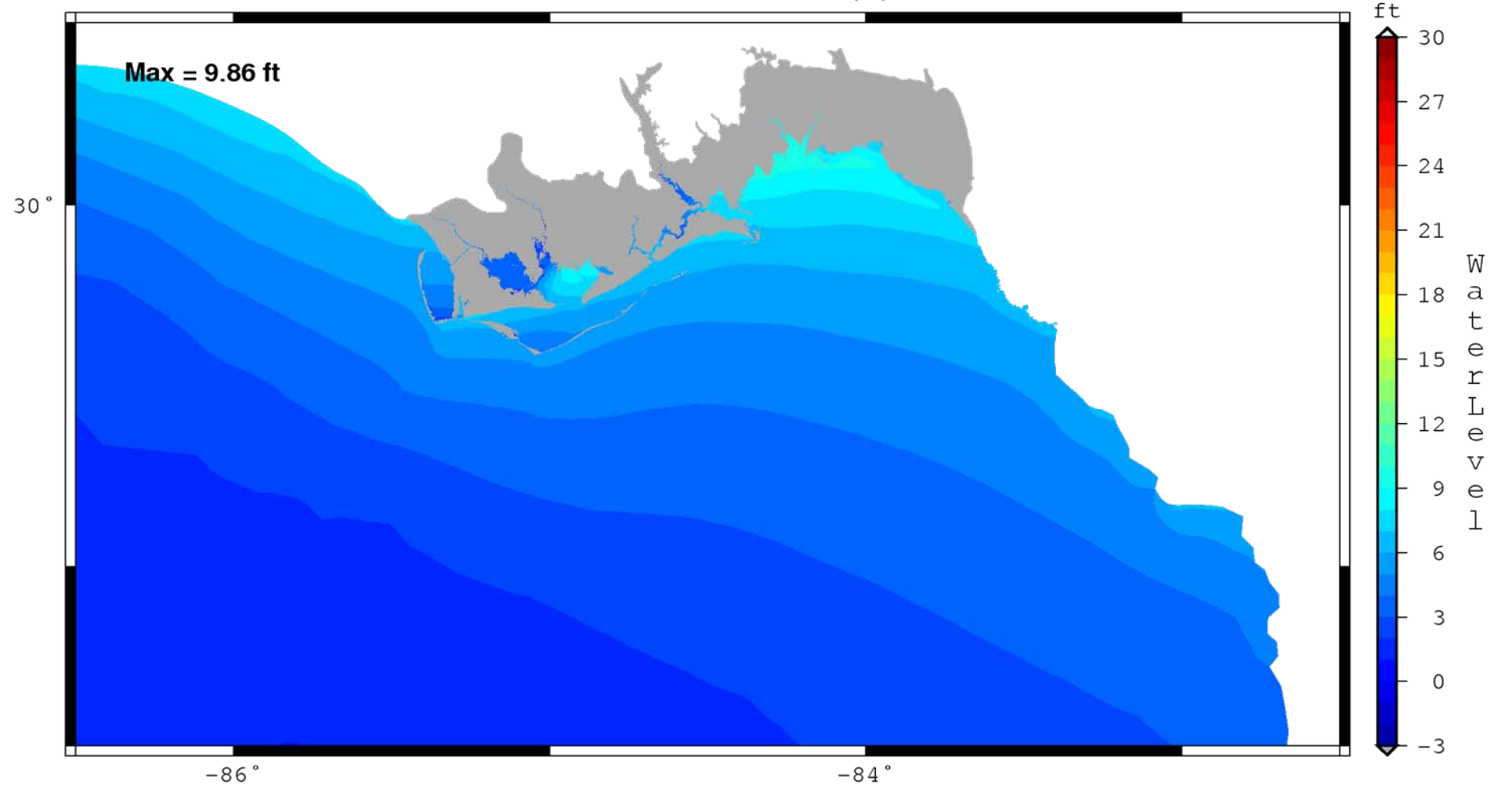

Bay
Liberty
Gulf
~33 miles

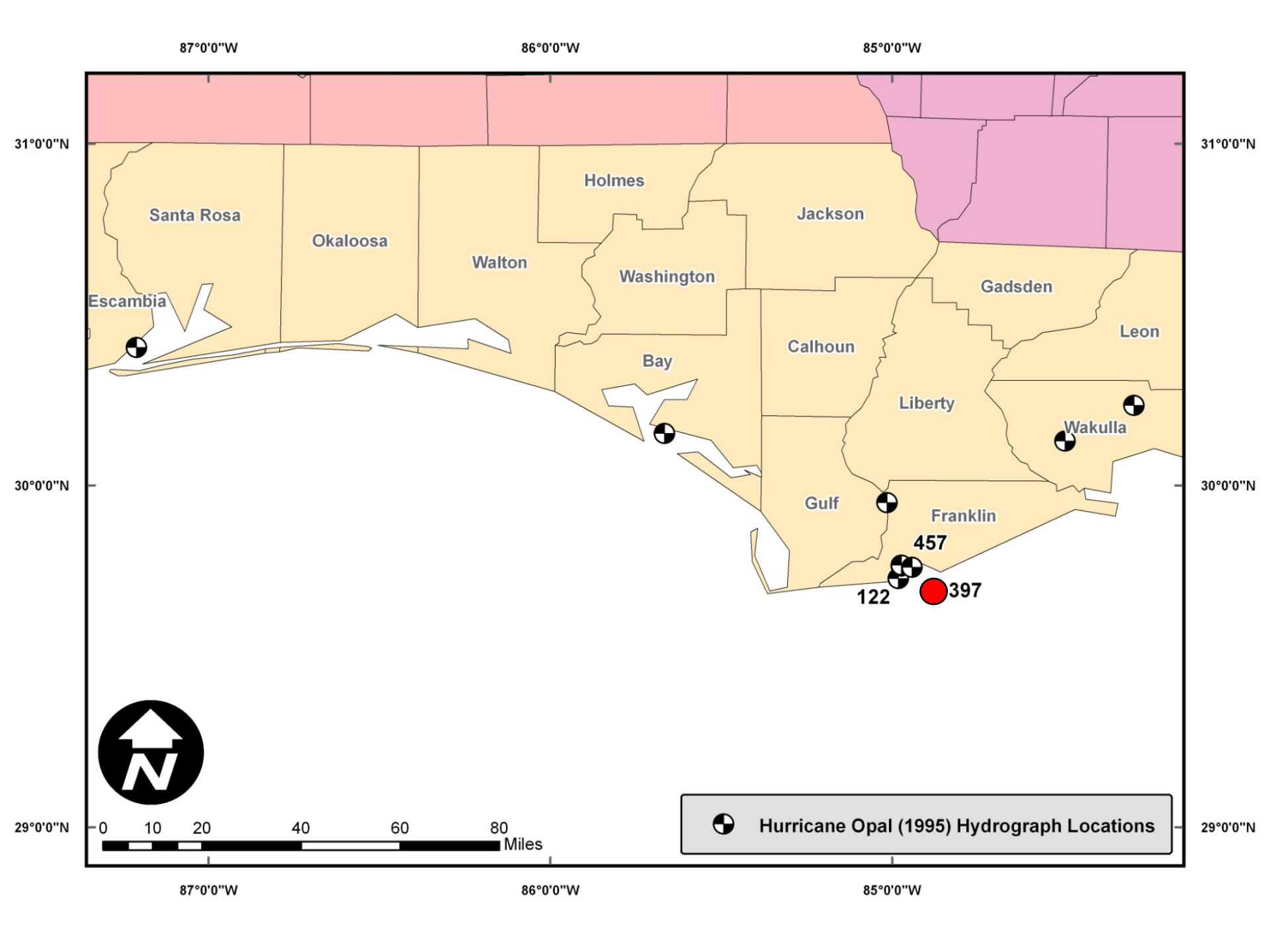

Opal
Landfall on October 4, 1995
Max Wind 150 mph
Min Pres 916 mbar

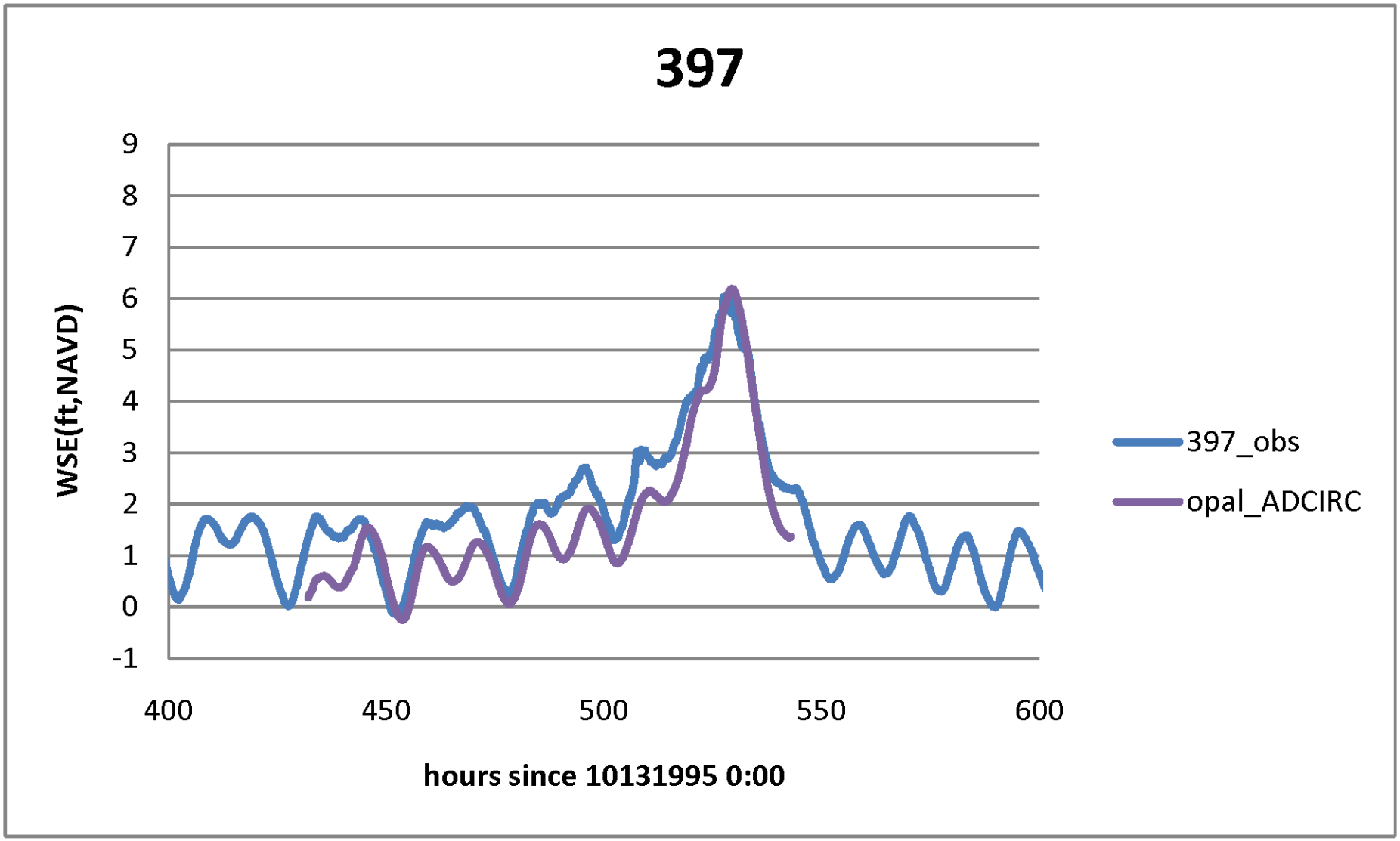
FWJ_v1.02b

Storm 8030

Max. Water Level (Ft)




87°0'0"W
86°0'0"W
85°0'0"W
31°0'0"N
30°0'0"N
29°0'0"N
Santa Rosa
Okaloosa
Walton
Holmes
Washington
Jackson
Escambia
Bay
Calhoun
Gadsden
Leon
Liberty
Wakulla
Gulf
Franklin
457
122
397
0 10 20 40 60 80
Miles
Hurricane Opal (1995) Hydrograph Locations


397
WSE(ft,NAVD)
9
8
7
6
5
4
3
2
1
0
-1
400
450
500
550
600
hours since 10131995 0:00
397_obs
opal_ADCIRC

Multi Satellite Approach

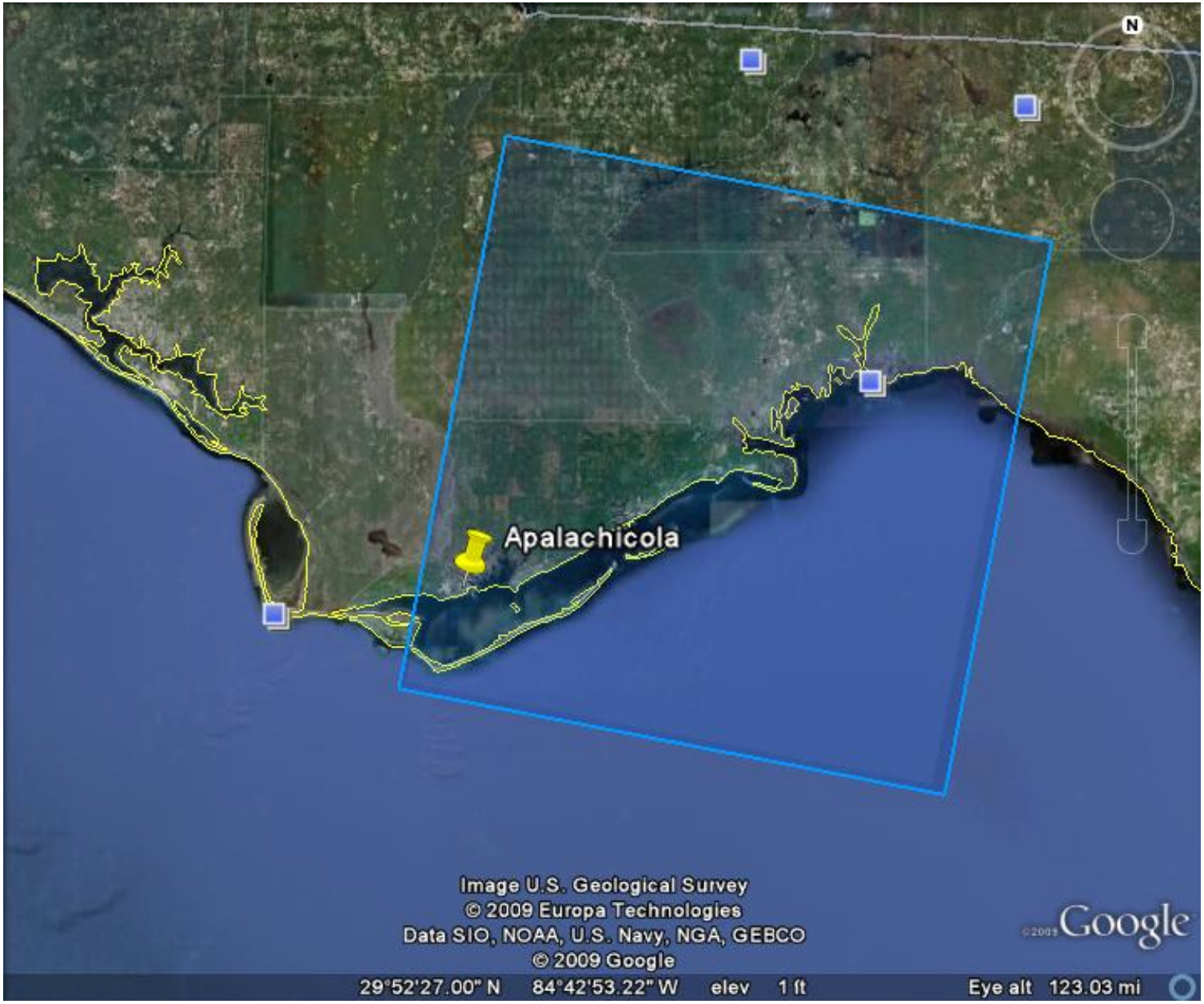
SAR images

Mode	Scene extent	Spatial resolution
Standard Mode	100 km x 100 km	25 m
Fine Mode	50 km x 50 km	9 m

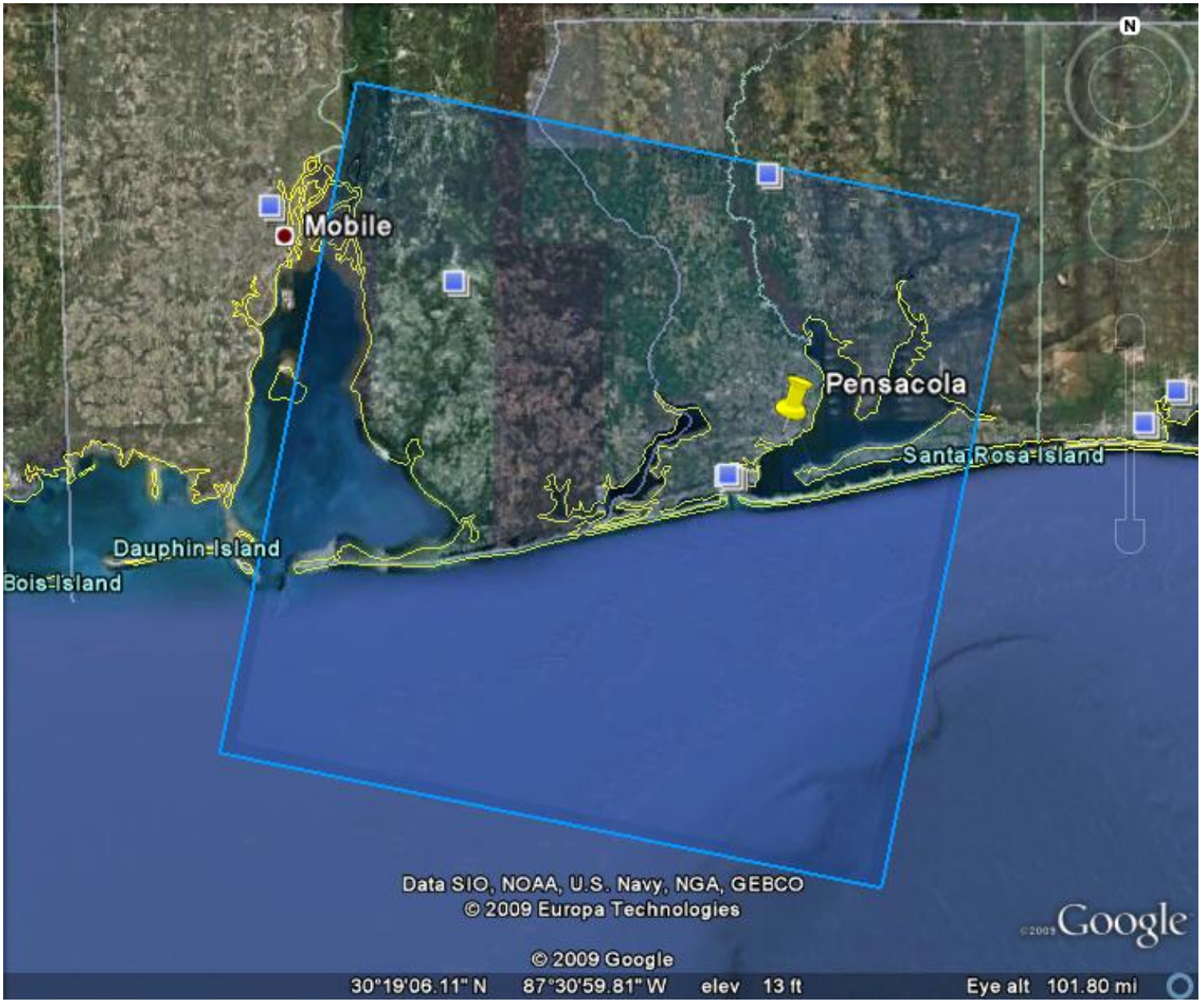
Visible and Infrared Images

Sensor	Bandwidth	Spatial resolution
MODIS	620 - 670 nm 1628 - 1652 nm	250 m 500 m
ASTER	Visible and Near Infrared	15 m
Landsat	Visible and Near Infrared	30 m

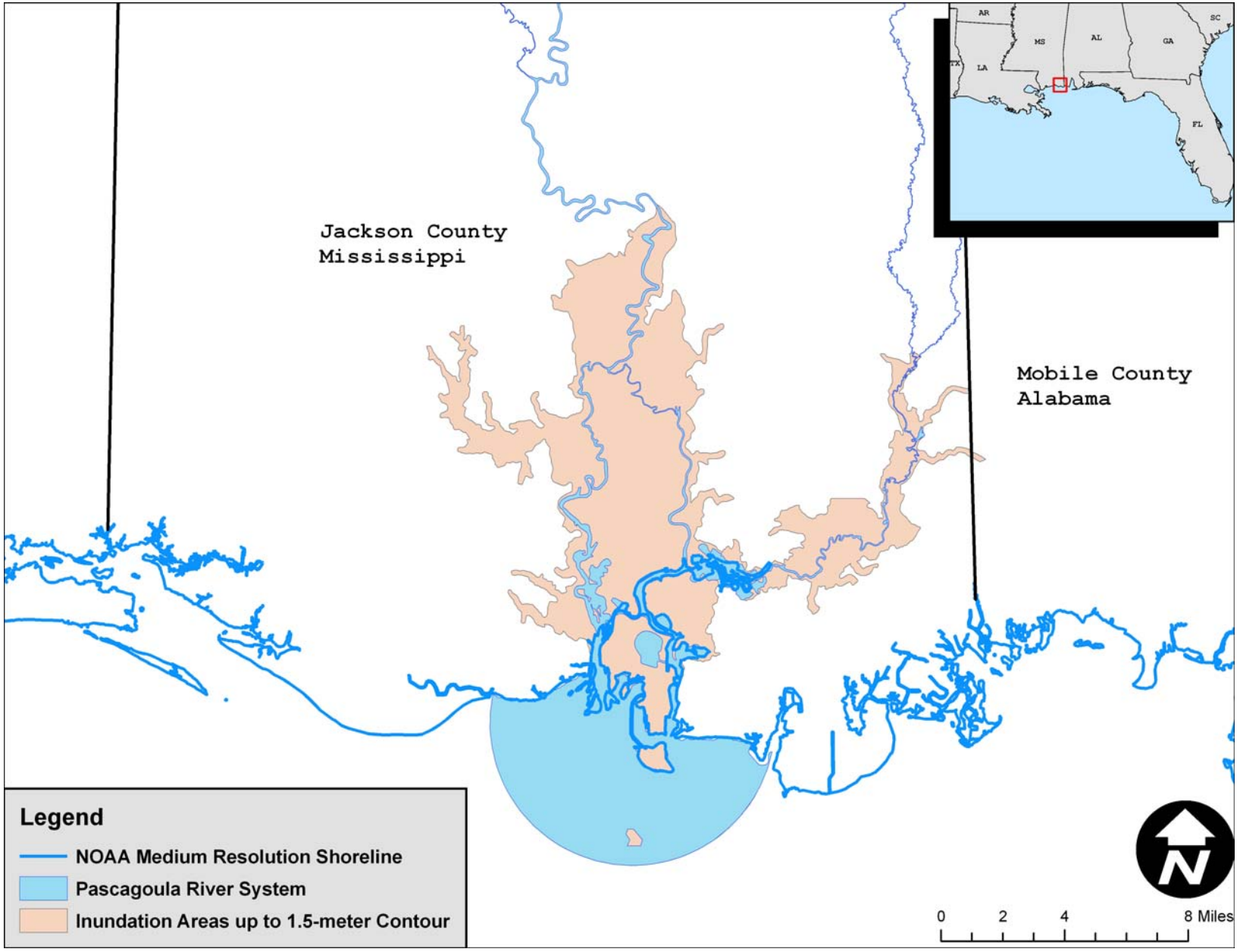
Study Area 1: Apalachicola Region



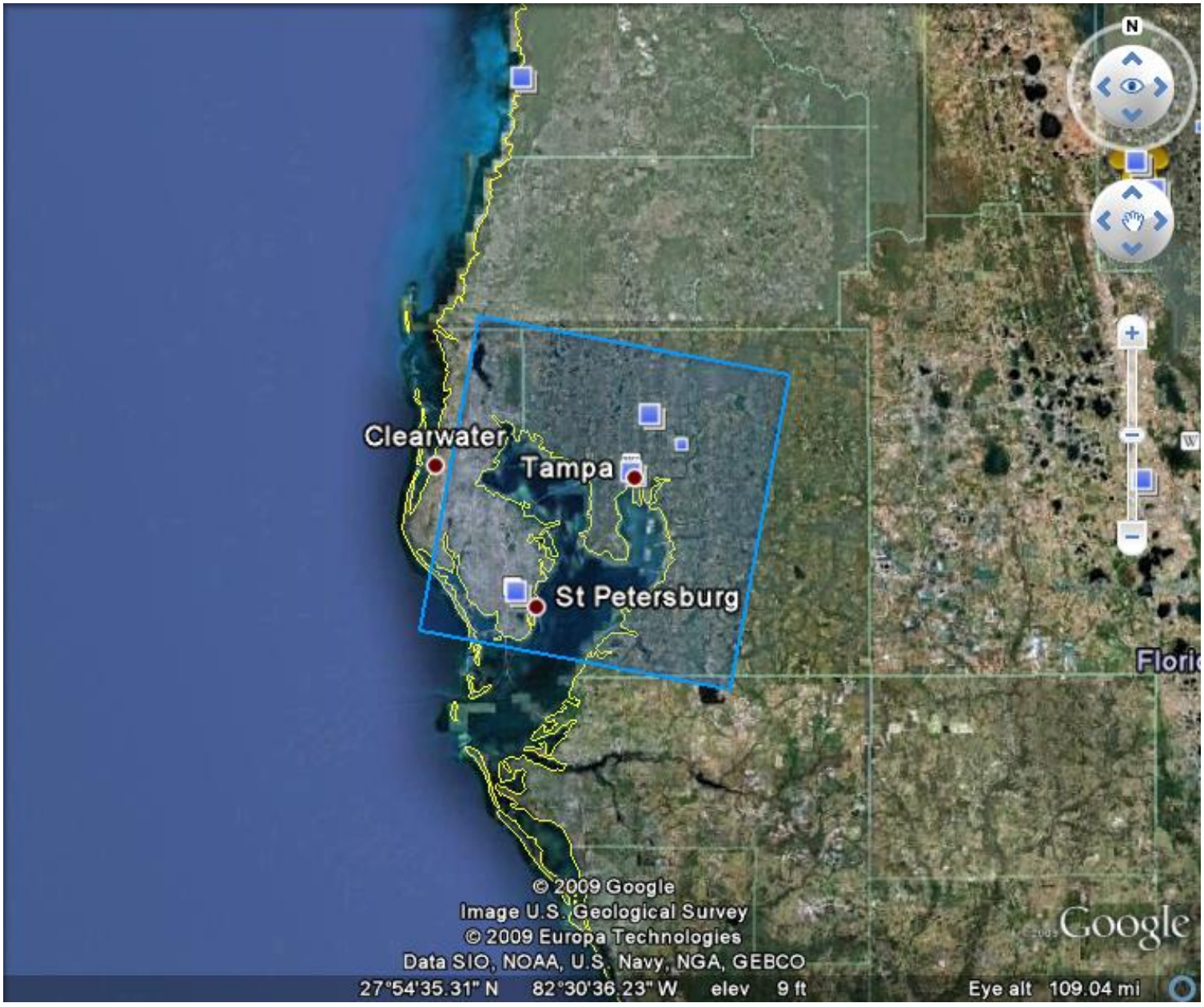
Study Area 2: Pensacola Region



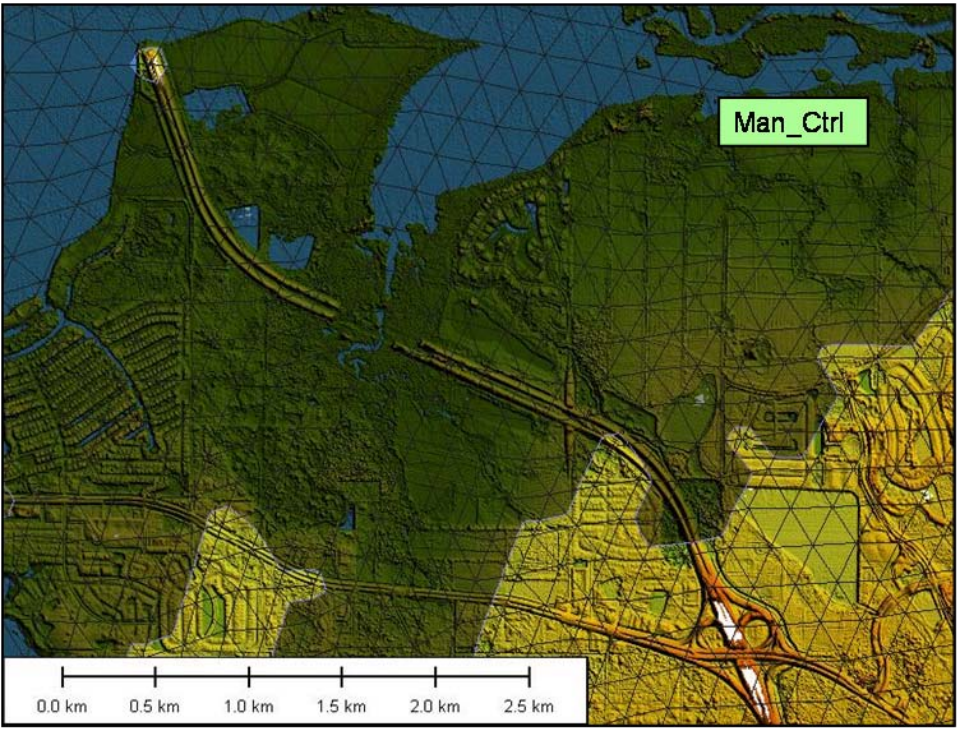
Study Area 3: Pascagoula Region

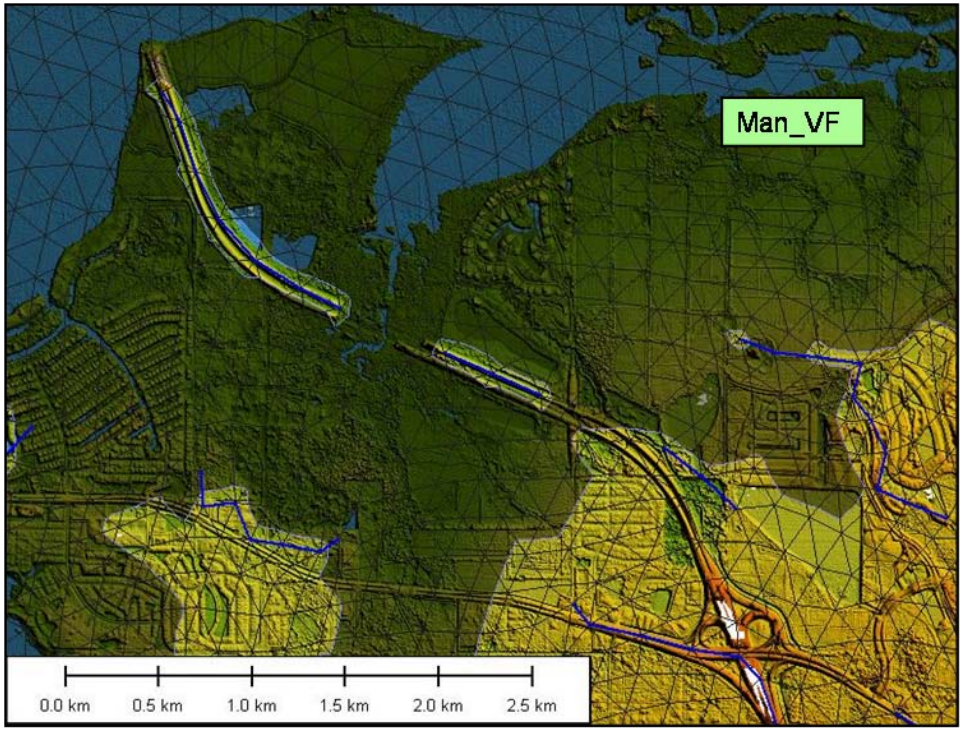


Study Area 4: Tampa Bay Region



Interstate-75 on the Southern Bank of the Manatee River



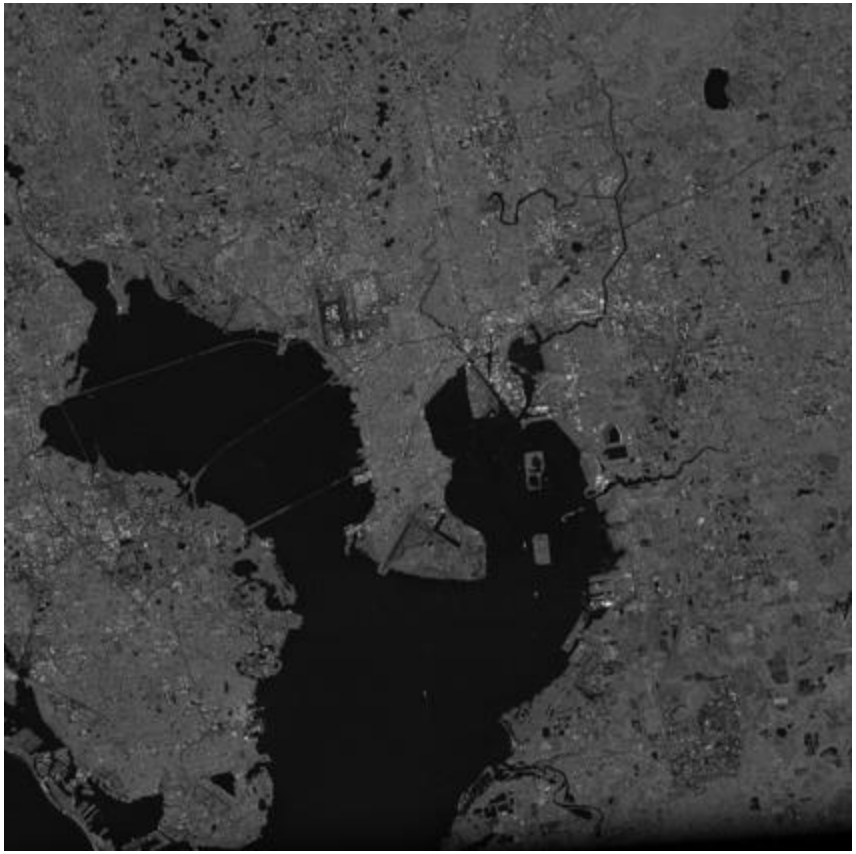


Preliminary Methodology

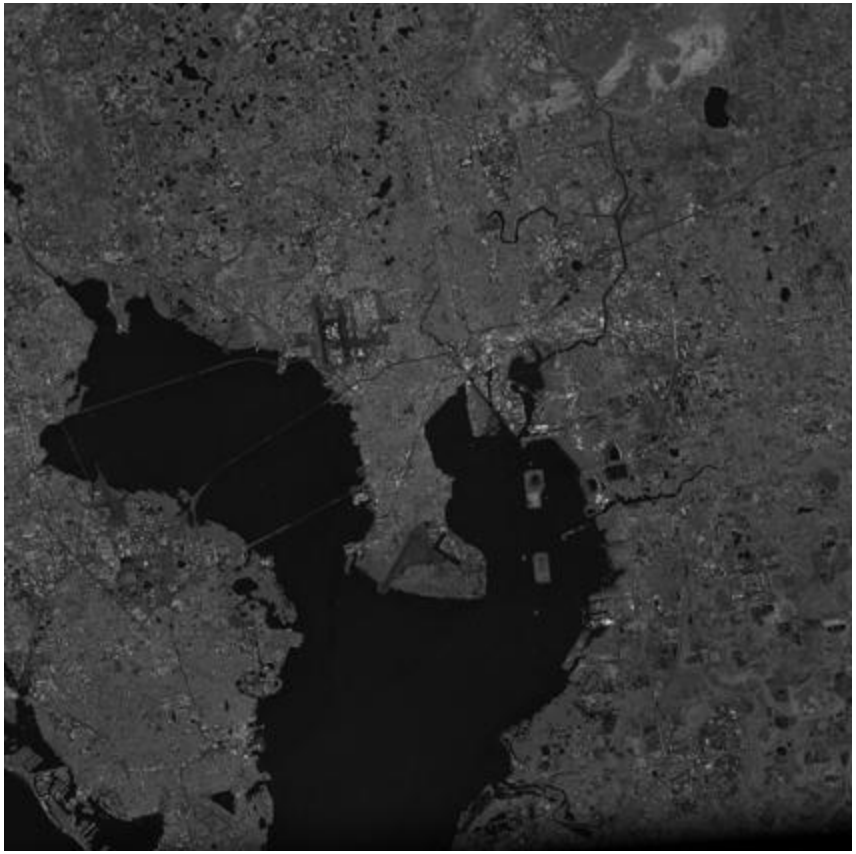
- Only Radarsat images have been used.
- Change detection technique:
  - Multi-temporal images analysis
  - Assign red color to one image, blue and green colors to the other image
- The product corresponds to a multi-temporal false color composite image:
  - Red color correspond to flooded area.
  - Cyan color correspond to non flooded area.
  - Color intensity represents the degree of the change between the two times (severity of the flood)

Radarsat 1 Images

(Fine mode; 9 m spatial resolution)



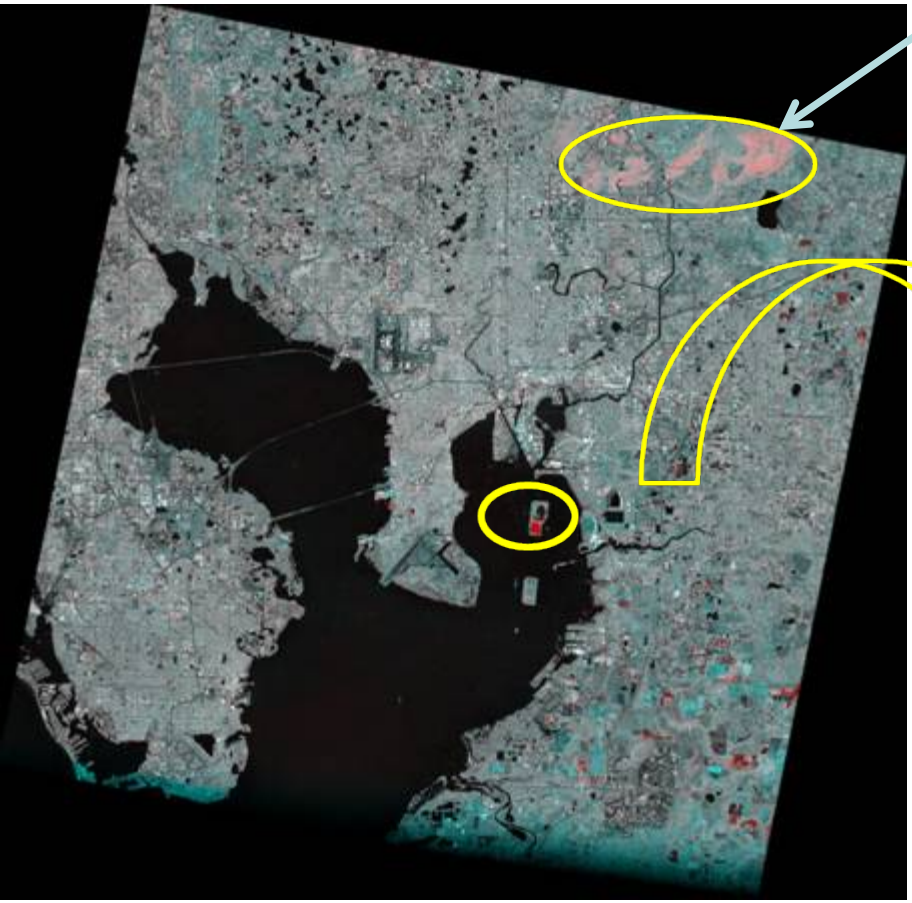
8/15/2004
(Post-Hurricane Charley 2004)

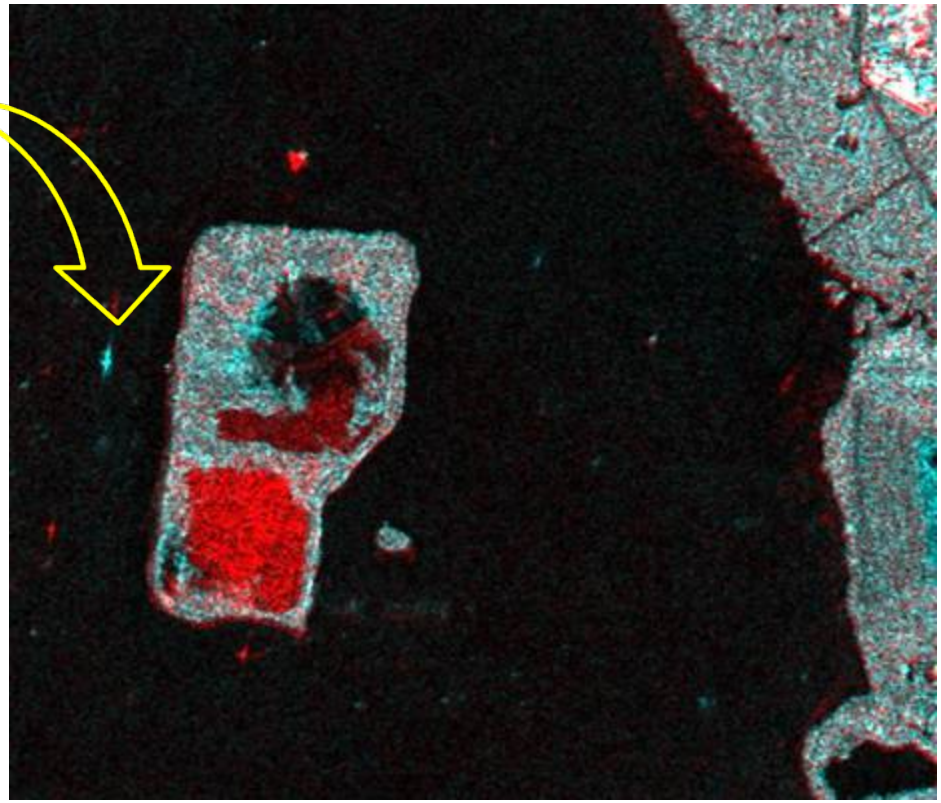


11/14/2005
(Low water level)

Obtained image

Example of inland flooded area



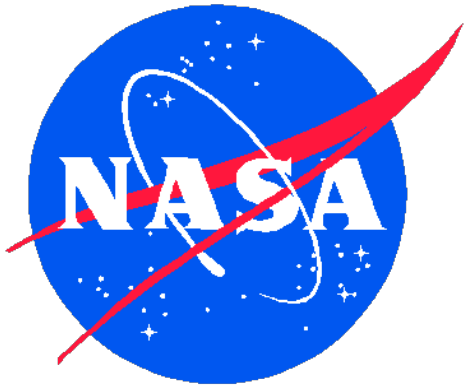


Additional flooded area (in red) can be seen inland and along the coast.

Overall Goal with Objectives

- To demonstrate the efficacy of employing high resolution satellite imagery to improve coastal inundation models.
  - Break new ground for wetting/drying algorithm verification and overall model validation.
  - Provide a key community resource for improving and assessing coastal and estuarine models
  - “Train up” coarse imagery (e.g., MODIS) with high resolution imagery (SAR).
  - Assess the morphology of and characterize frictional properties for barrier islands.

End Users



FEMA

What do my wife and I have in common with NASA's Terra?

10th Anniversary:
December 18, 1999