2018

Sea level rise Web GIS Applications

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FIU Florida International University

UF UNIVERSITY of FLORIDA

Outline

Projects

- Sea Leve Rise App. (2014-2016)
  - Background
  - SLR, Tides, FEMA flood map
  - Flood reports
  - System architecture

- Coral Gables Sea Level Rise Impact Planning Tool (2017-2019)
  - Background
  - Scenarios
  - GIS analysis and statistics

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Project Background

- Initiative among four journalism faculty members at FIU: Susan Jacobson, Robert “Ted” Gutsche, Kate MacMillin and Juliet Pinto

- Project goal:
  - raise public awareness of sea level rise through student and community engagement

- Sea Level Rise App supports the Eyes on the Rise initiative: http://www.eyesontherise.org/

Stakeholders and Partners

- Development:
  - Faculty and students from FIU School of Journalism and Mass Communication
  - FIU GIS Center researchers and developers

- Funding:

Online News Association

Celebration of the Sea Foundation

Florida International University seed funding

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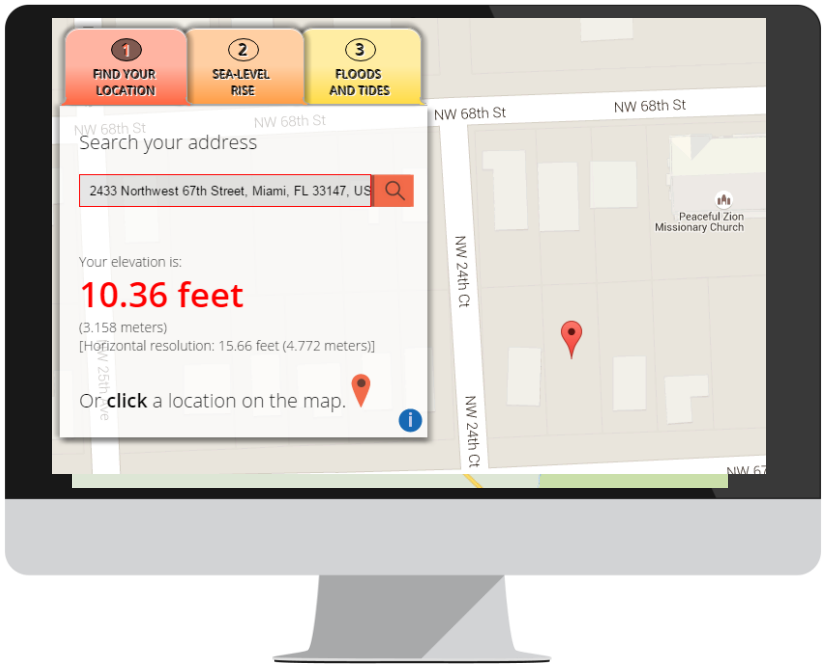
Elevation by Location

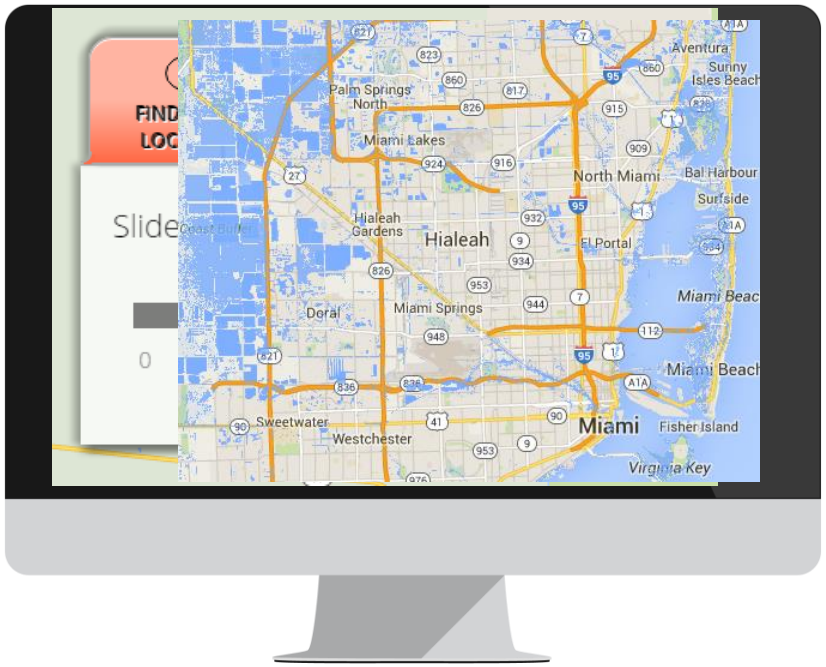


- Location

- Google Map APIs
- Google Elevation Services

- Public URL: http://eyesontherise.org/app/

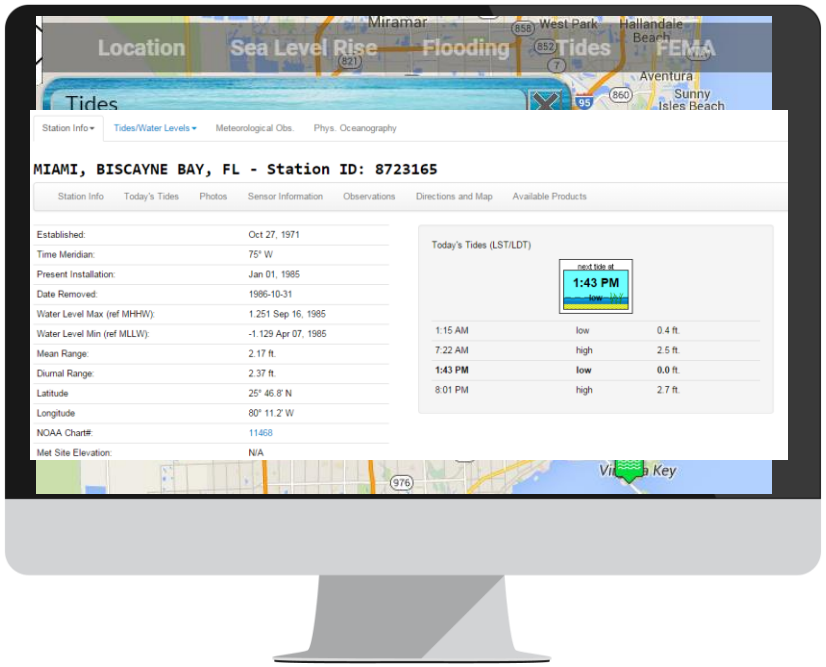
Sea Level Rise Inudation



- Sliding Bar
- Sea Level Visualization

- Peter Harlem's Inudation Model
- State of Florida Division of Emergency Management LiDAR Project LAS Dataset
- 1-6 feet inundation visualization

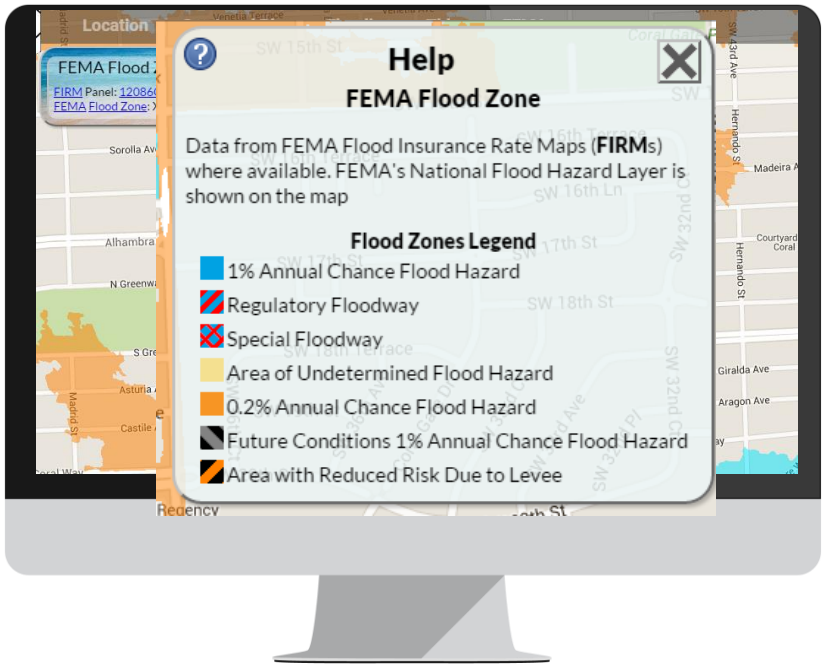
NOAA Tidal Stations



- Tides

- NOAA Tidal Stations

FEMA Flood Insurance Rate Maps



- Location
- Display of FEMA Flood Zones

- Flood Insurance Rate Maps (FIRMs)
- FEMA's National Flood Hazard Layer

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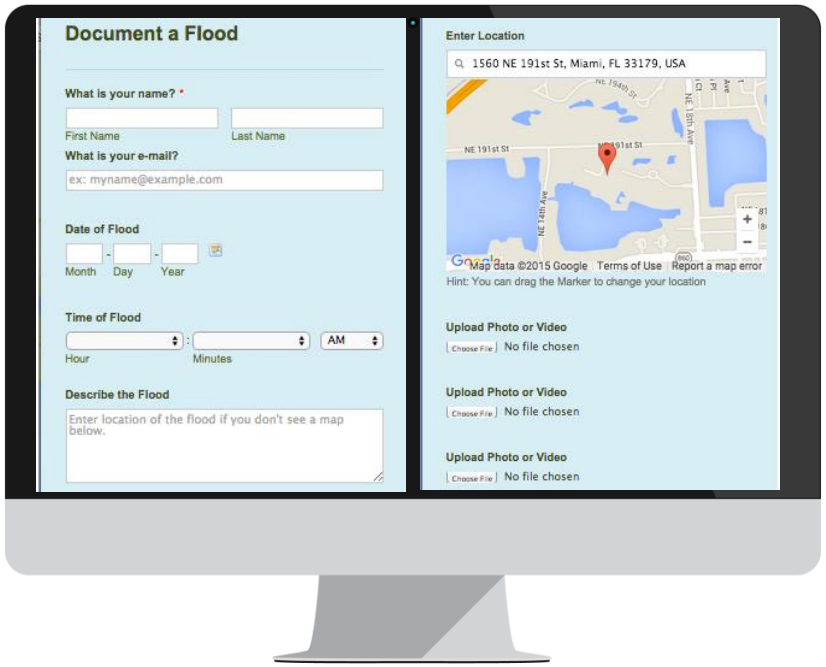
Flood reports

Documenting King Tides

- Highest high tides of the year, usually during Fall and Spring
- Fall of 2015, King Tide was up to 4 feet on Miami Beach
- FIU students and faculty used the app to document King Tides

Document a Flood

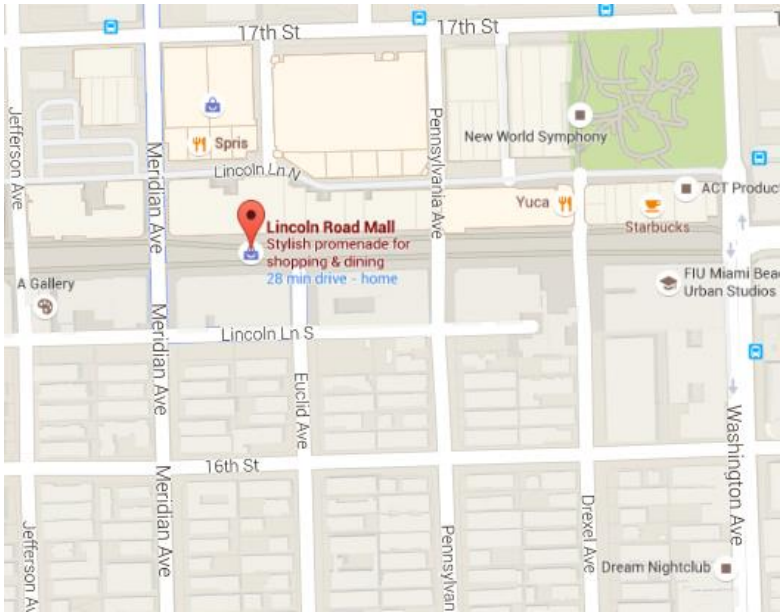


- Document King Tide flooding
- Enter date, time, location
- Upload photos

- Use smartphone in field to upload reports
- May also upload reports later on computer

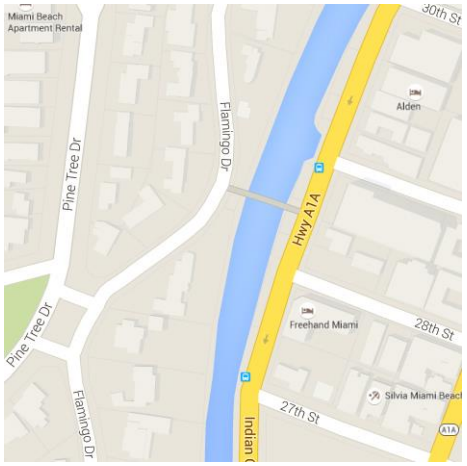
Flood Reports 10/28/2015

Lincoln Rd Mall, Miami Beach, FL



Flood Reports 10/28/2015

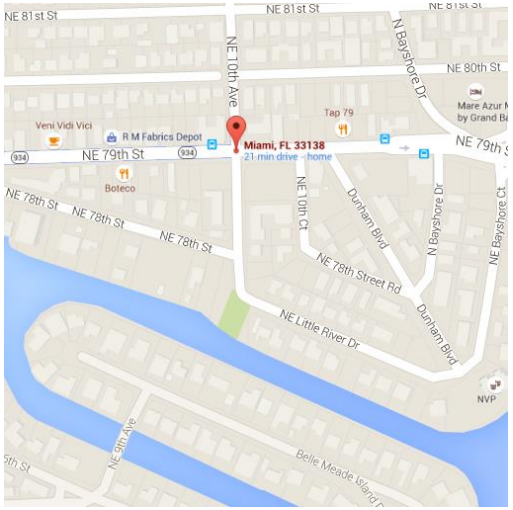
Indian Creek Drive, Miami Beach



https://www.youtube.com/watch?v=sNbu7Iz28uk

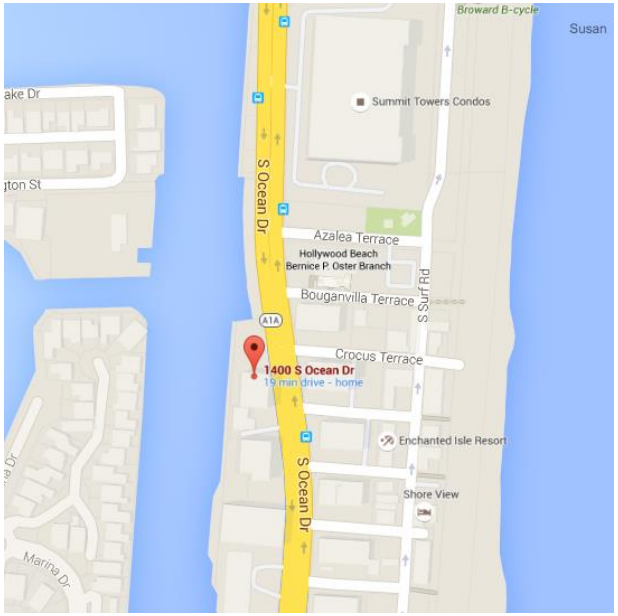
Flood Reports 10/28/2015

Real heavy flooding along NE 10th Ave that reached all the way up to NE 79th St. Could not drive to the base of flood due to depth

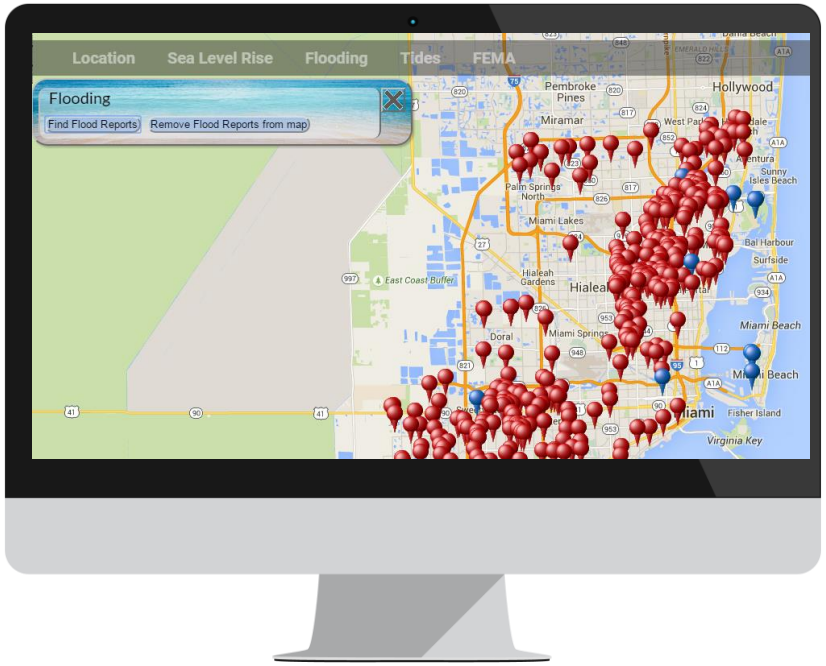


Flood Reports 10/28/2015

1400 S Ocean Dr, Hollywood, FL



Viewing Flood Reports



- Find Flood Reports

- Miami-Dade 311 Flood Reports
- Crowd-Sourced Eye on the Rise Flood Documents

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  - 3D-model

Components and Framework

	Elevation and Rise	Community Sourcing – Report a Flood	FIRMs and Tides
METHODS	•Google Elevation Service, Google Maps API • Using ArcGIS Server to vis LiDAR by FDEM	•Miami-Dade 311 Flood Reports •Documenting Eye on the Rise by Students	• Yearly High Tides and Recent Water Levels (NOAA) •FEMA Flood Insurance Rate Maps (FIRMs)
FUNCTIONALITY	•Locate and identify the elevation of the location •Sliding bar to display sea level rise from 1-6 ft •FEMA flood zones	• Points of 311 flood reports • Mobile interface for students or public to report flooding (King Tide Day)	• Connecting the current NOAA tidal and water level diagrams and reports to the actual point location •Visualizing categories of FIRM zones by location

Key Components

1

Cloud APIs integration

Google APIs, Facebook APIs, Foursquare APIs, Bing Maps APIs, ArcGIS Online

2

ArcGIS Server

Product from ESRI

3

Rich client applications

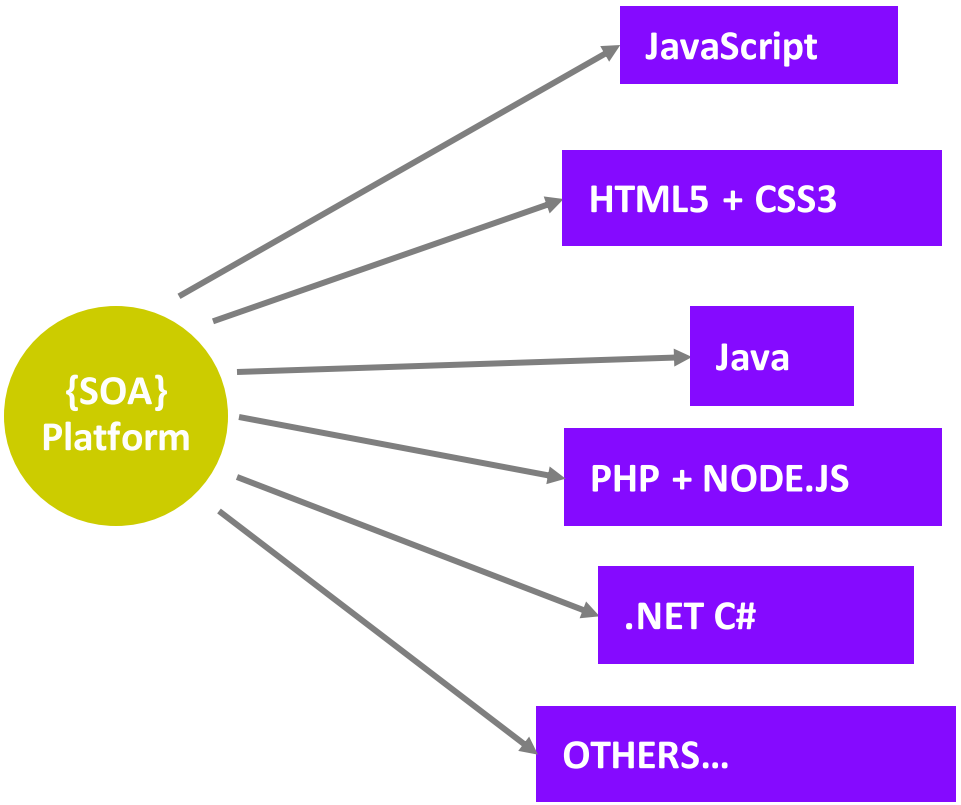
Rich client side logic
AJAX for server side data communication

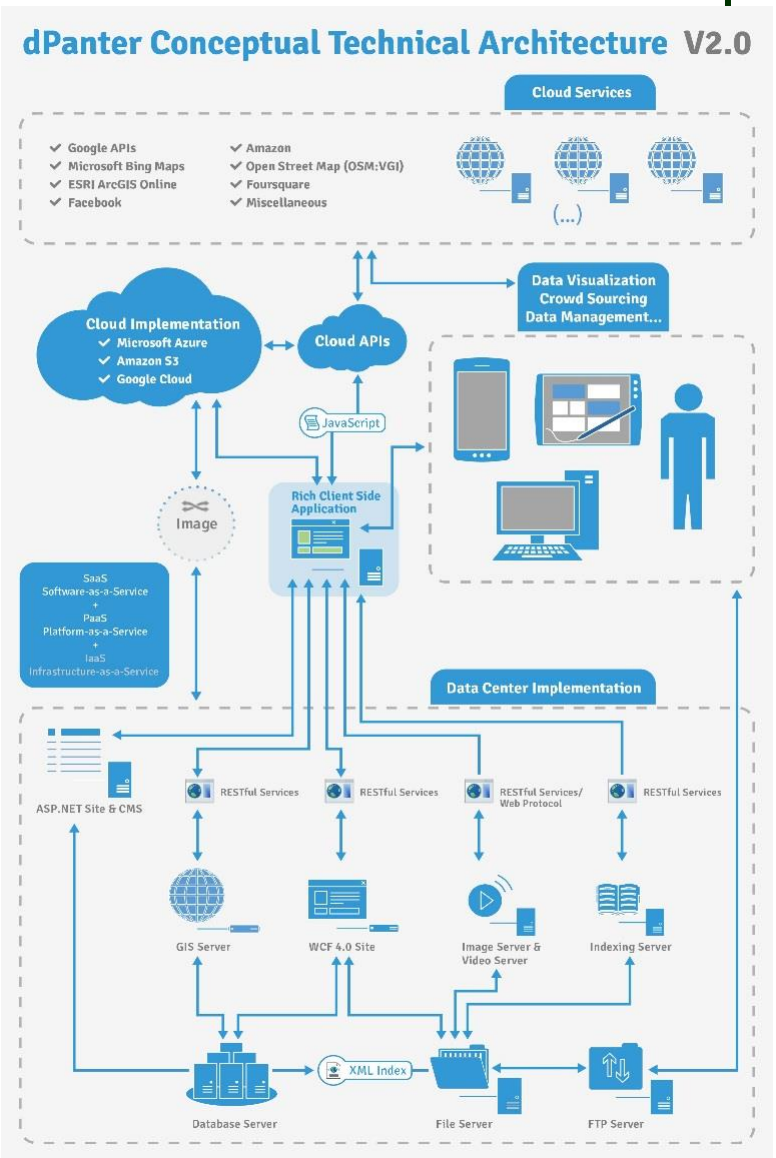
4

Responsive Design

Mobile friendly web interface

System Architecture





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Project Background

- Project goal:
  - develop a high resolution, comprehensive Sea Lever Rise Impact Planning Tool for the City of Coral Gables
  - tool: assist planning and development of a resilient community

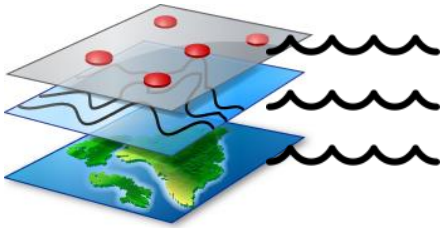
- Time line:
  - 2-year project (October 2017 - September 2019)

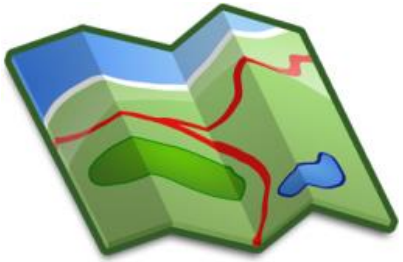
- Funding agency: City of Coral Gables

Project team

- Zhaohui Jennifer Fu, *GIS Center, FIU (PI)*
- Keqi Zhang, *Earth and Environmental Sciences Dept, FIU*
- Shu-Ching Chen, *School of Computing and Information Sciences*
- Henry Hochmair, *Geomatics Program, UF*
- Sheyla Santana, *GIS Center, FIU*
- Boyuan Guan, *GIS Center, FIU*

Proposed functionality

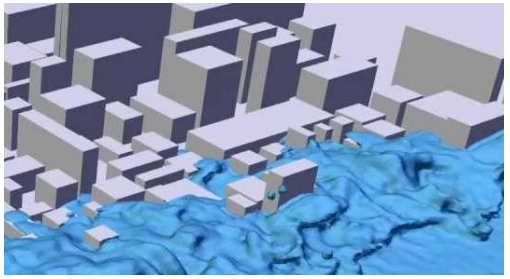




2D Flood mapping

Statistics about affected areas

3D flood visualization



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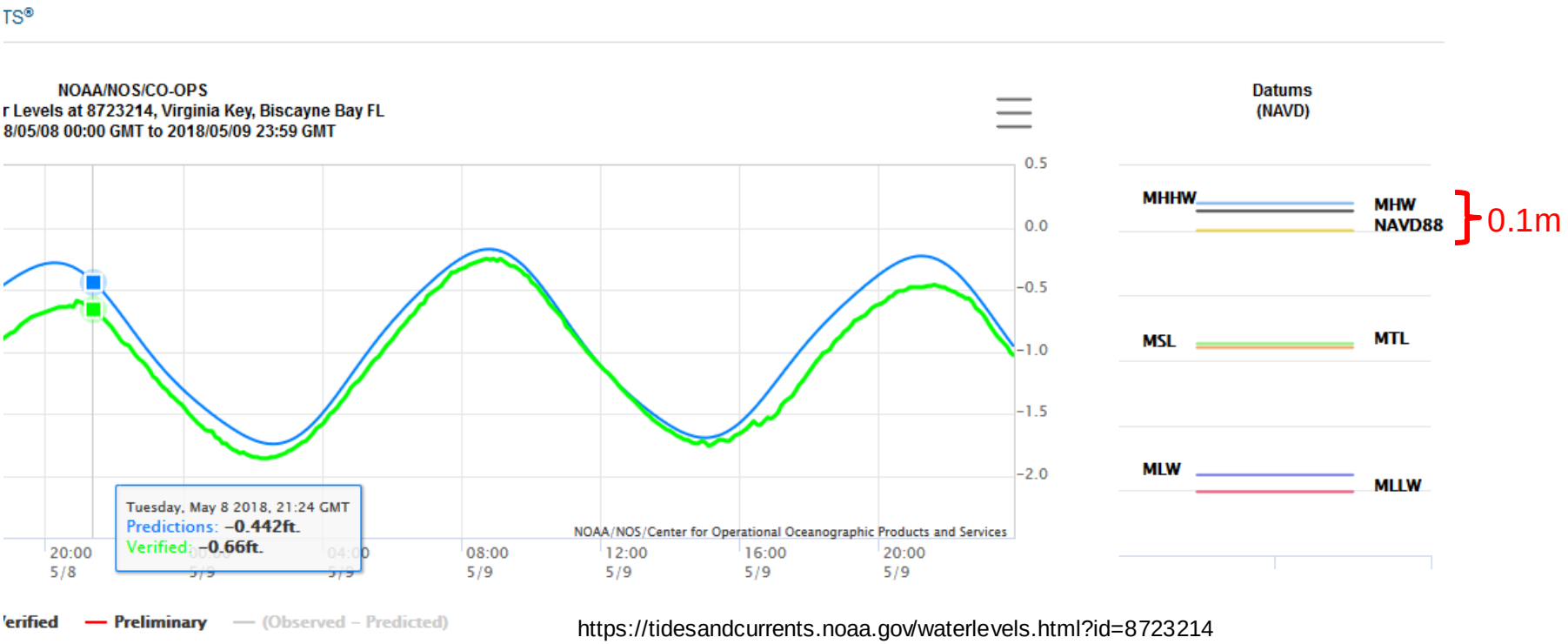
Scenarios

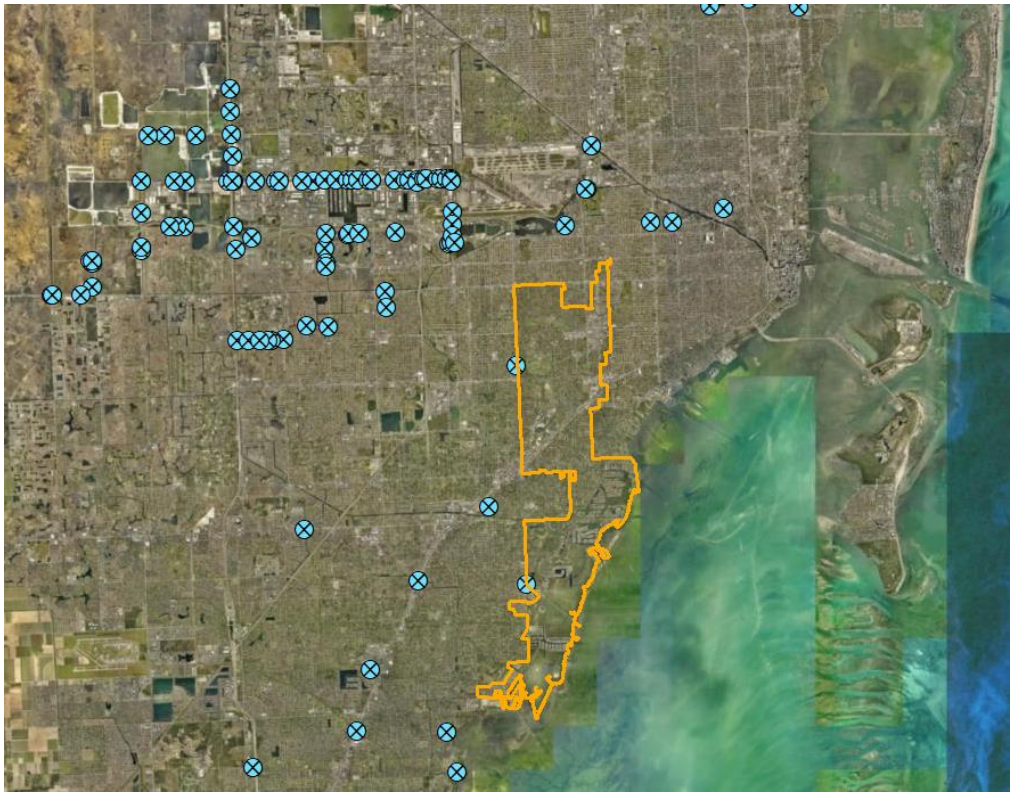
- Sea level rise inundation maps between 0 and 6 ft
  - SLR measured relative to the mean higher high water (MHHW)
  - MHHW ~ 0.1 m (0.3 ft) above NAVD88 datum in south Florida coast



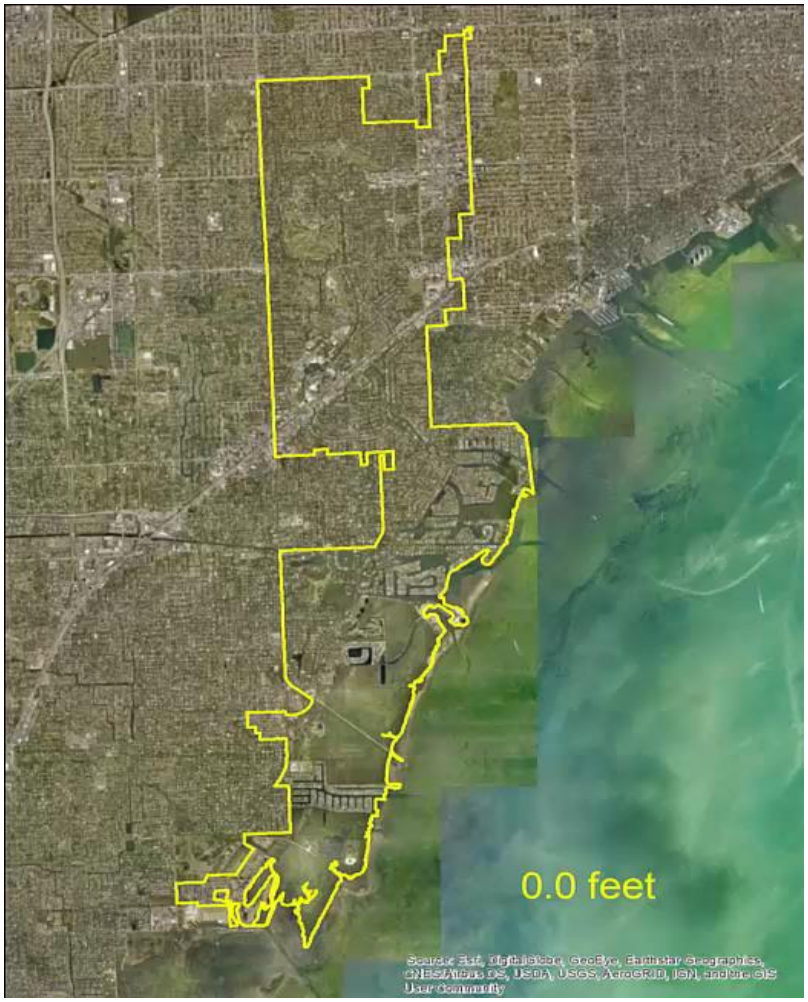
https://tidesandcurrents.noaa.gov/waterlevels.html?id=8723214

Scenarios

- Sea level rise bath tub model (connected to ocean)
- based on 5m DEM (resampled) for South Florida
- consideration of SFWMD structures (weir, levee)



Scenarios

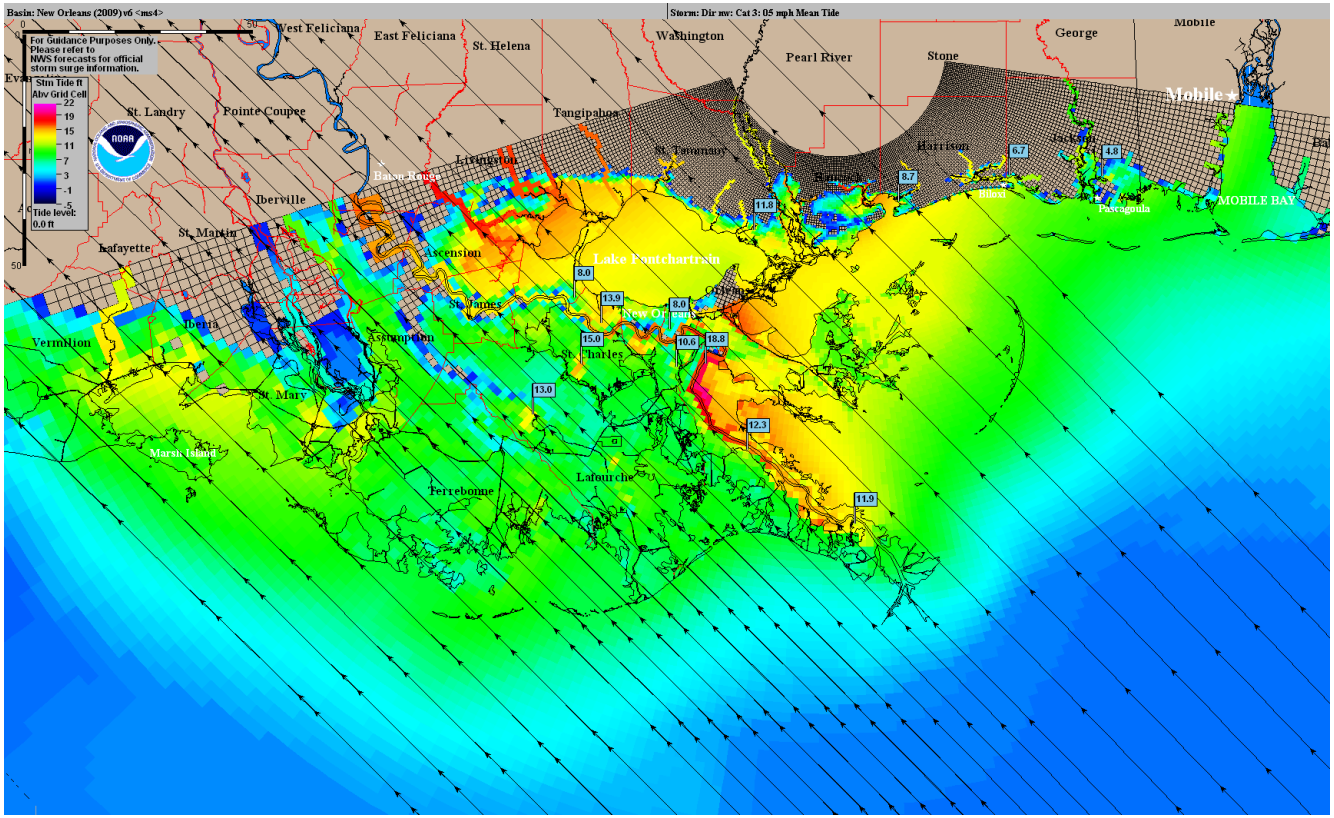


Scenarios (Cont'd)

- Worst case basin snapshot of storm surge inundations for hurricanes of categories 1-5 at mean and high tide level (5 x 2 = 10 combinations)
- using output from SLOSH model developed by NWS (National Weather Service)
- SLOSH stands for **S**ea, **L**ake, and **O**verland **S**urge from **H**urricanes

SLOSH

- MEOW: Sturm Surge Maximum Envelope of Water

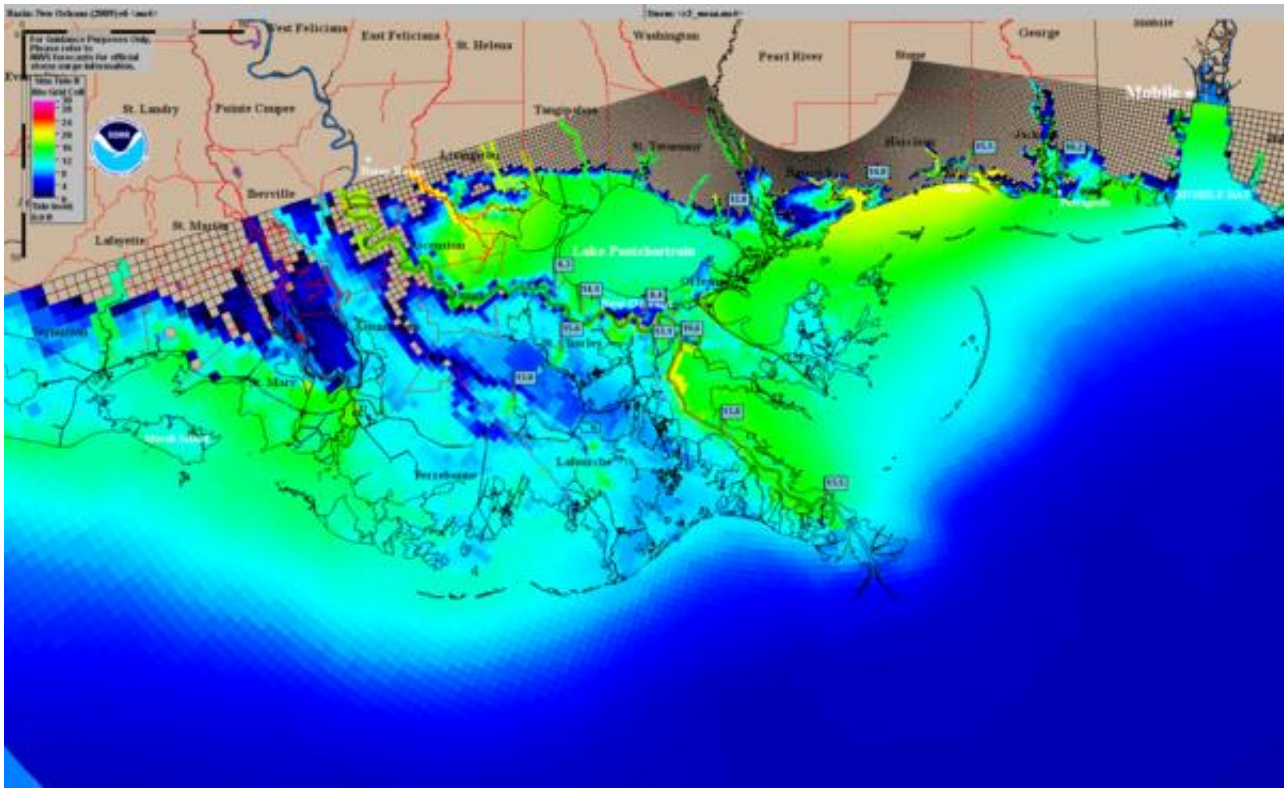


https://www.nhc.noaa.gov/surge/meowExample.php

Example for New Orleans basin, Hurricane Category 3, NW 5 mph

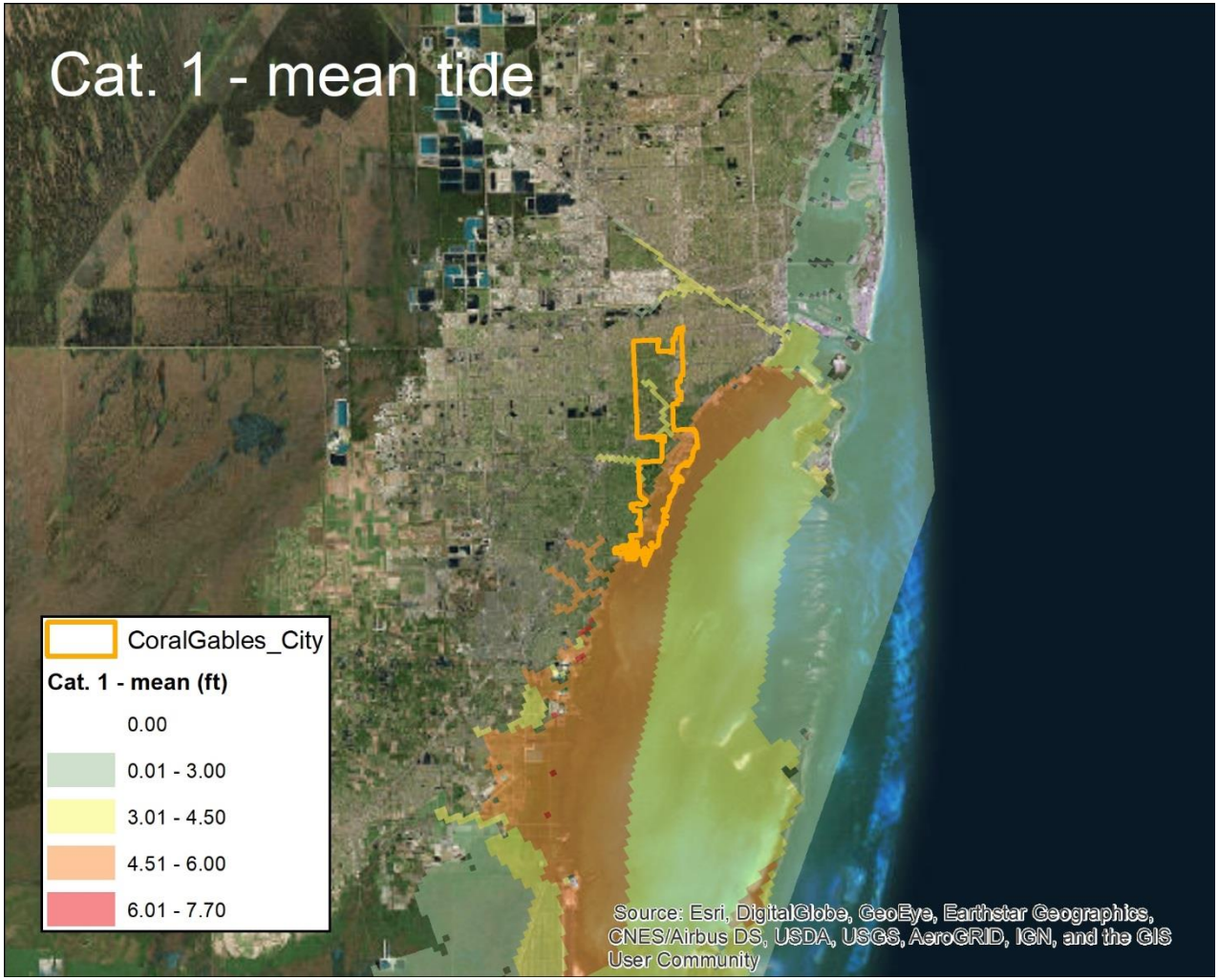
SLOSH

- A MOM is the Maximum of MEOWs (layers used in project).

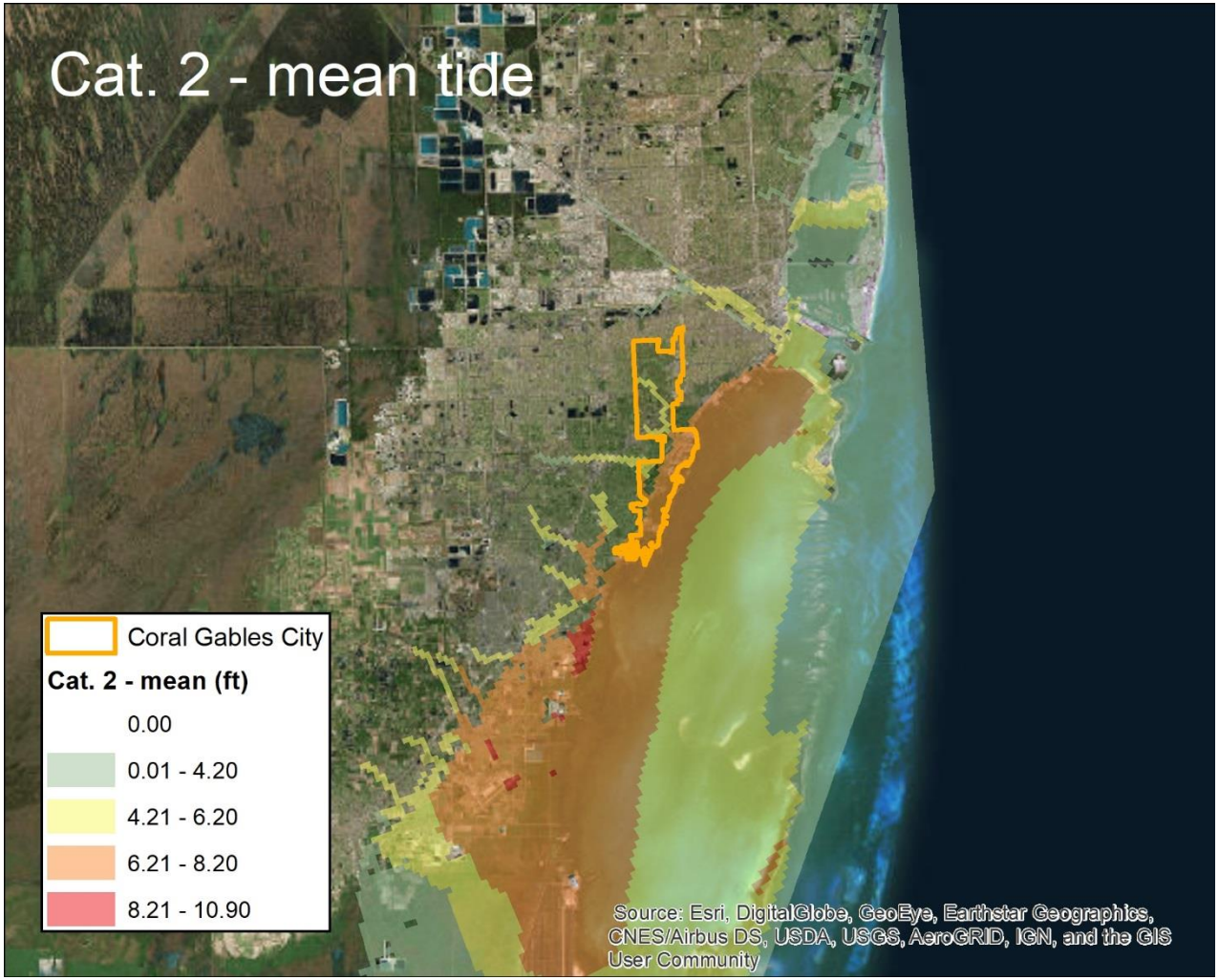


MOM for a Category 3 hurricane at mean tide across the New Orleans basin

SLOSH – Miami-Dade basin



SLOSH – Miami-Dade basin



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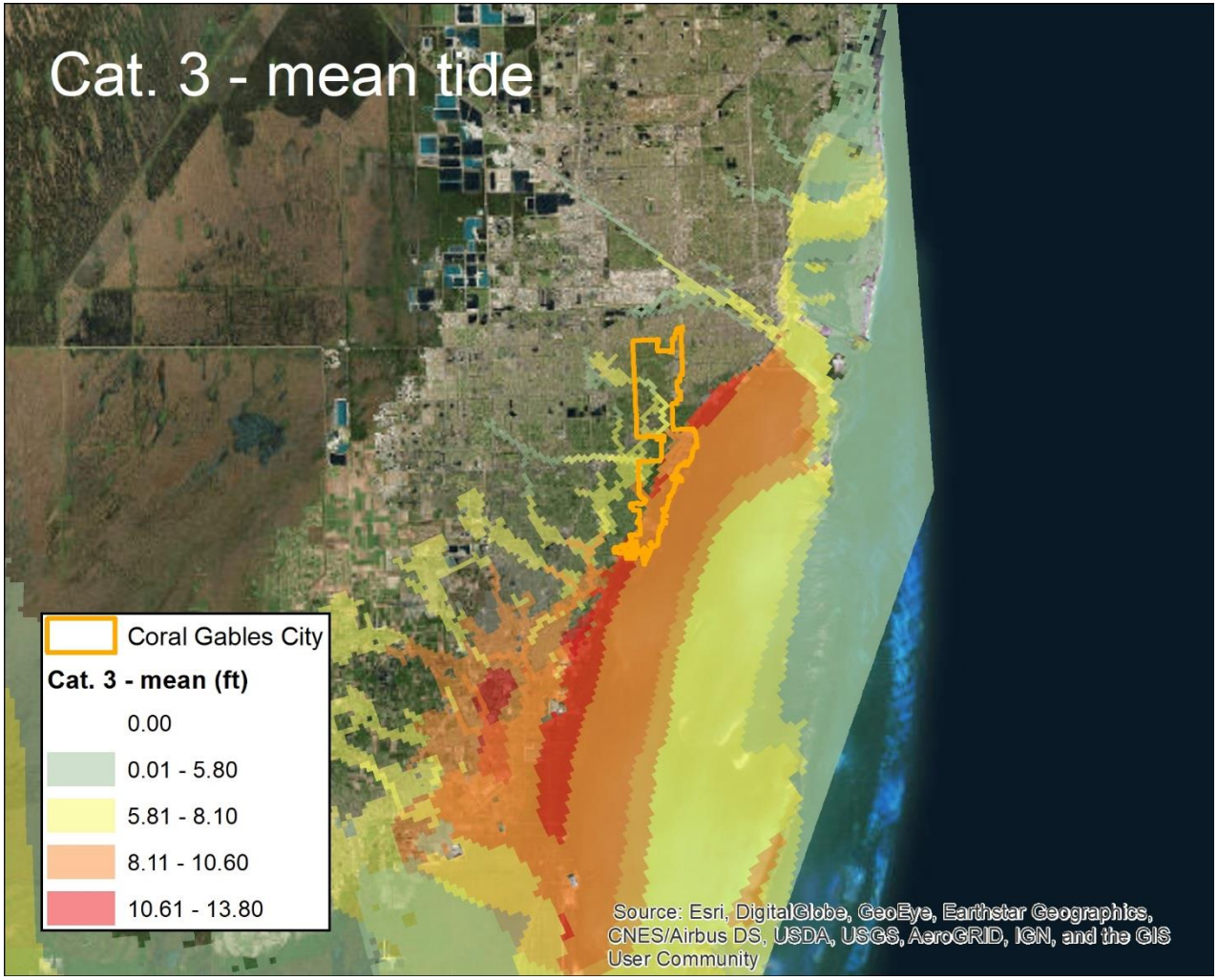

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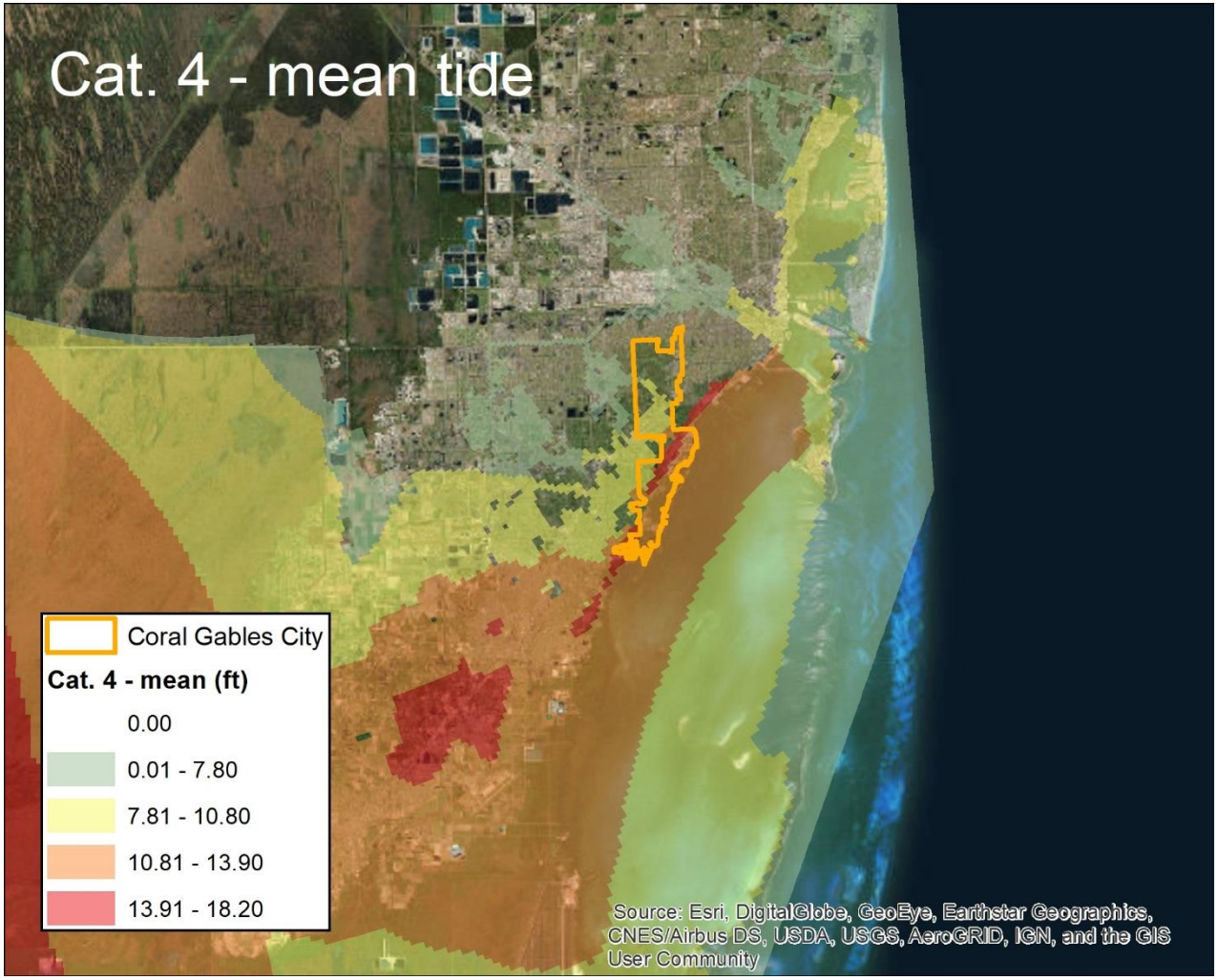

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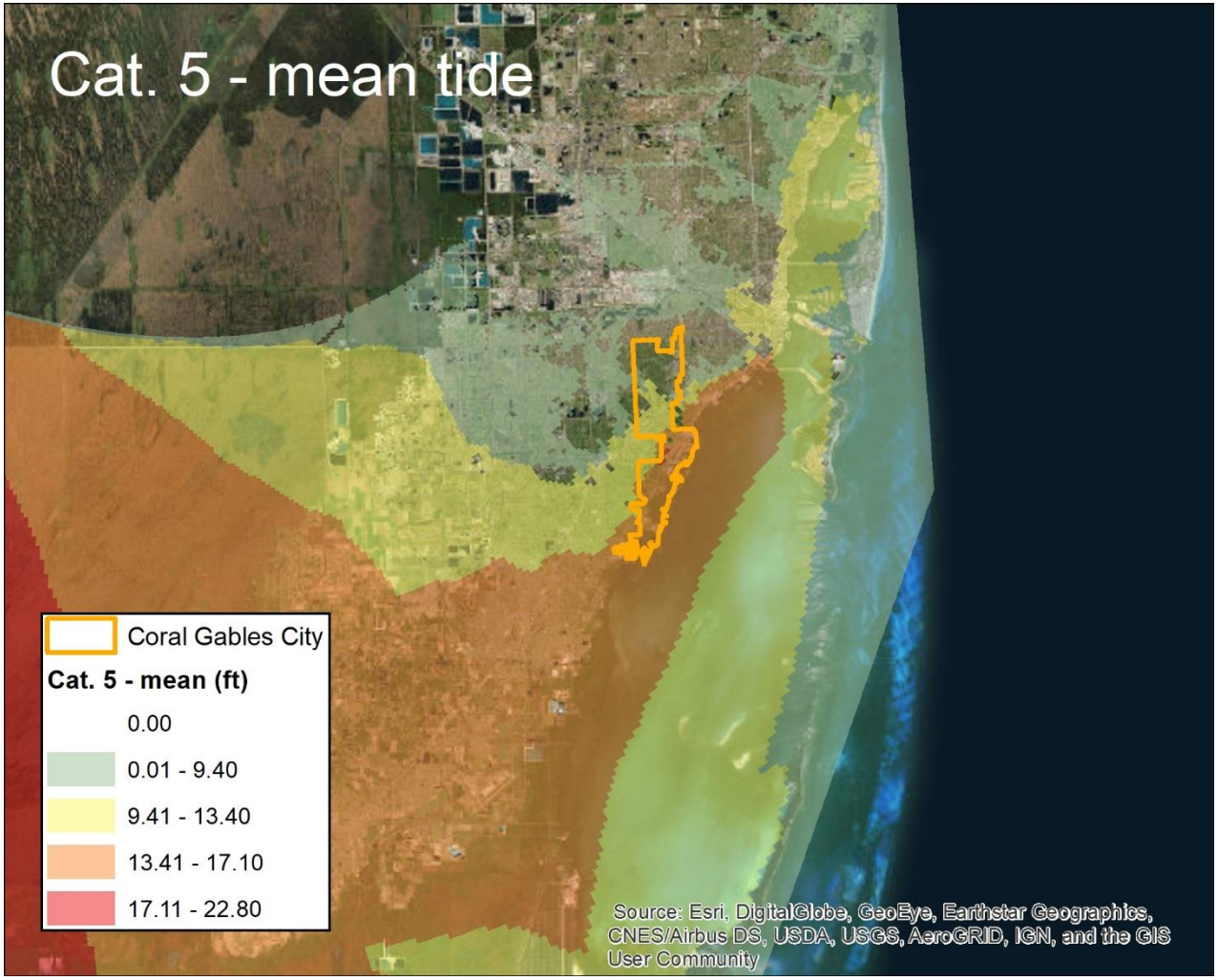

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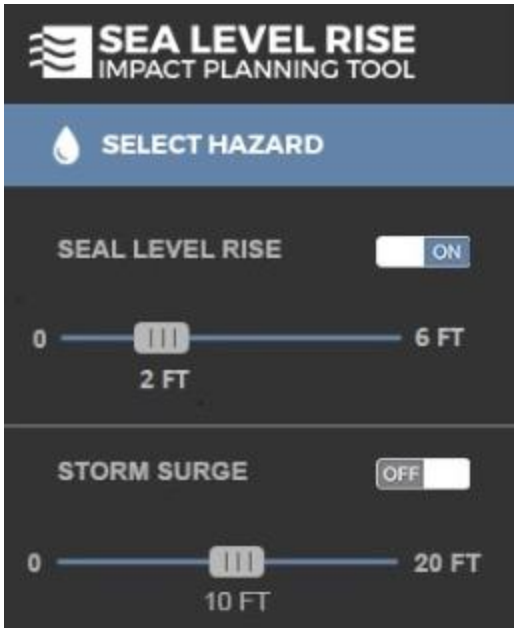
Statistics about Flood Effects

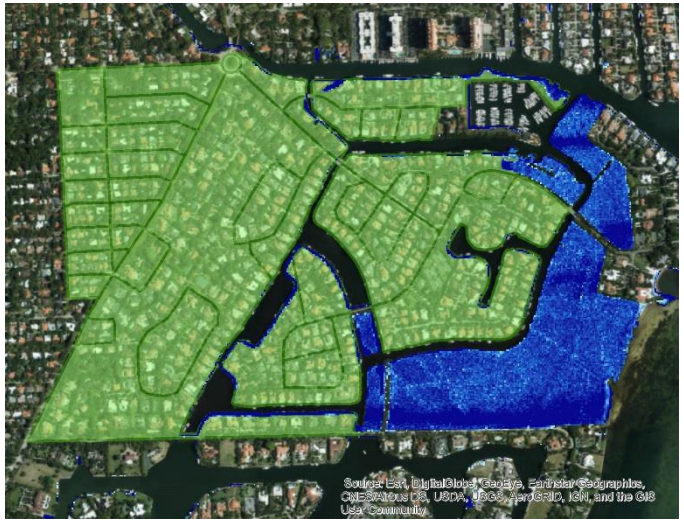
- User selects a scenario and area at census block level

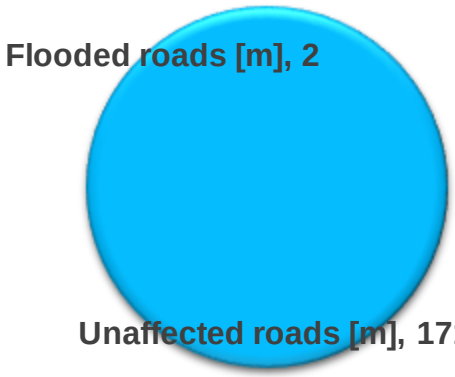


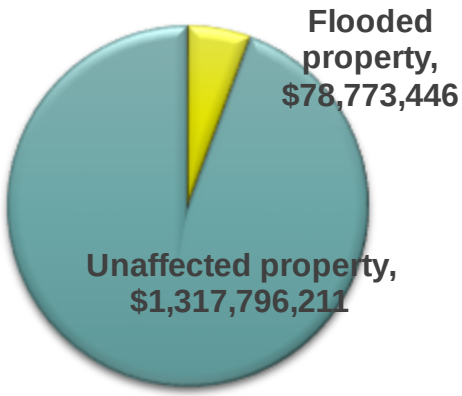
Statistics about Flood Effects

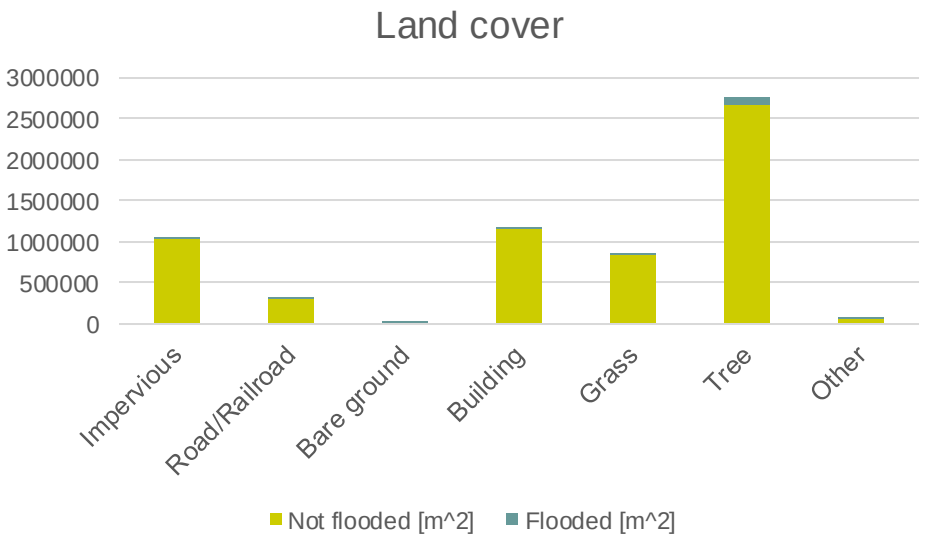
- User selects area at census block level and scenario
- Statistics reported for affected vs. unaffected area:
  - demographics (population, age and ethnicity distribution)
  - property value
  - infrastructure (e.g. roads, schools, bridges)
  - land cover and land use

Scenario: 2 ft Sea Level Rise









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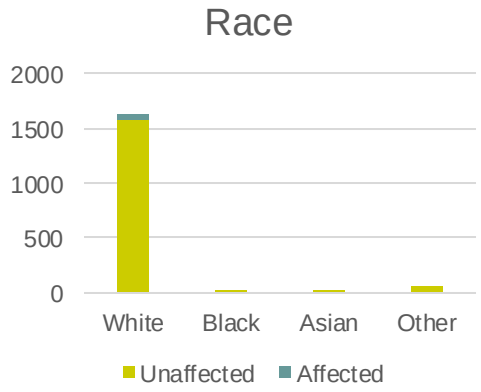
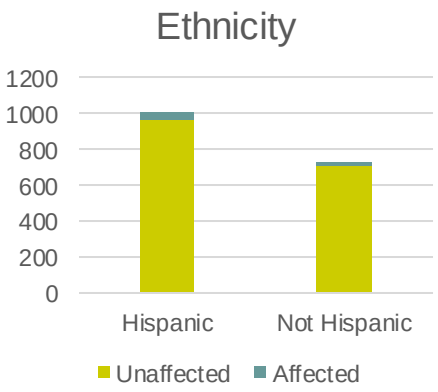
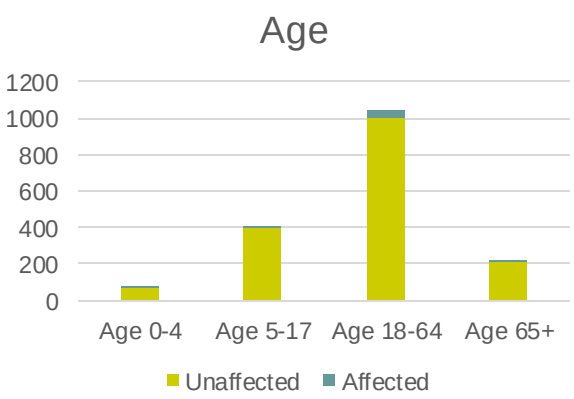
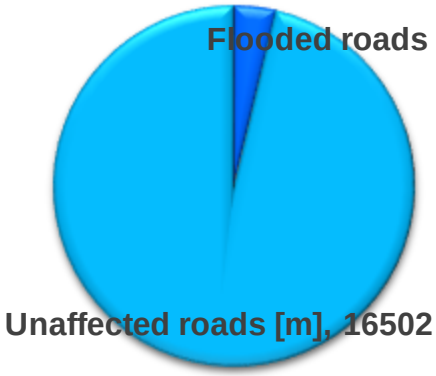
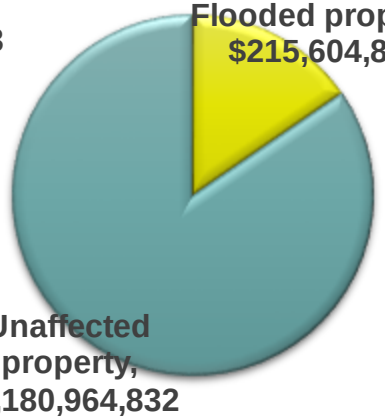


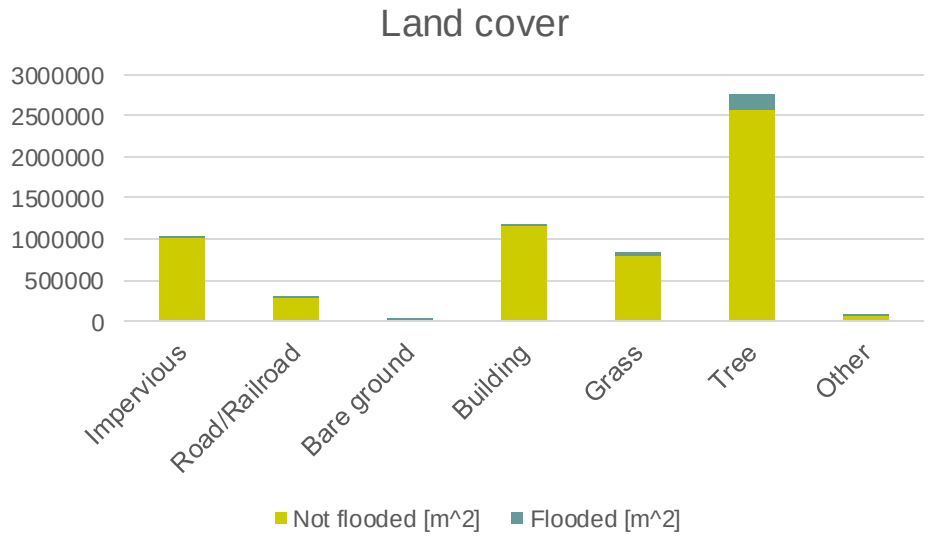




Scenario: 4 ft Sea Level Rise







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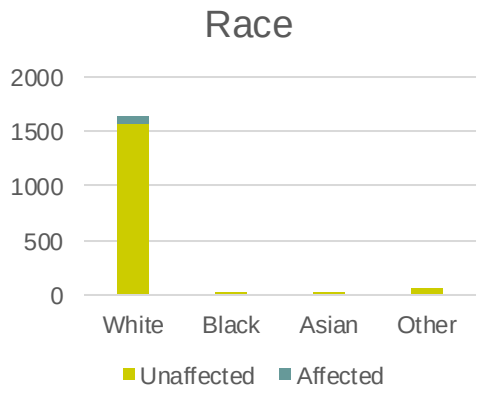
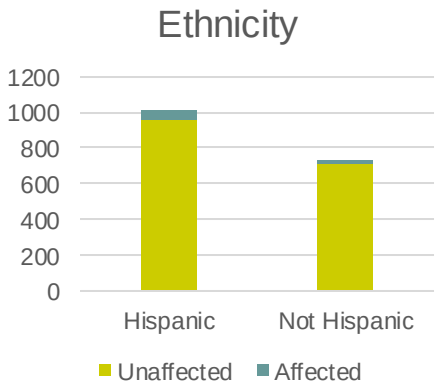
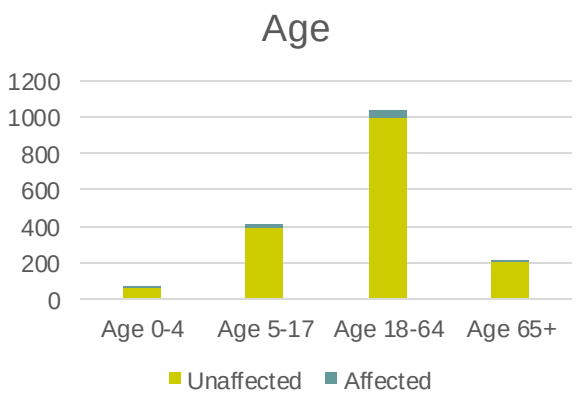
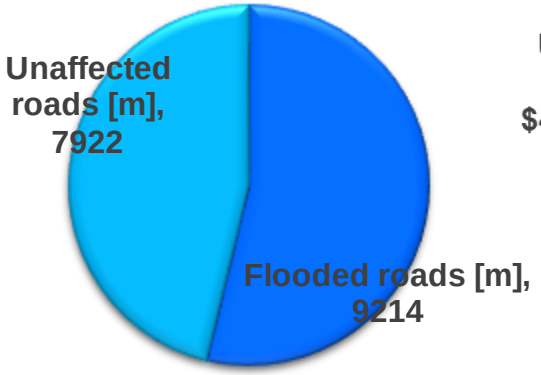
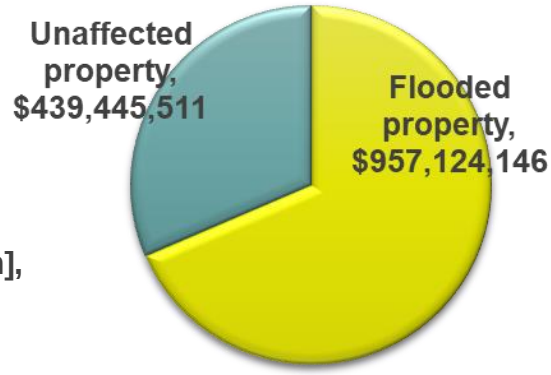


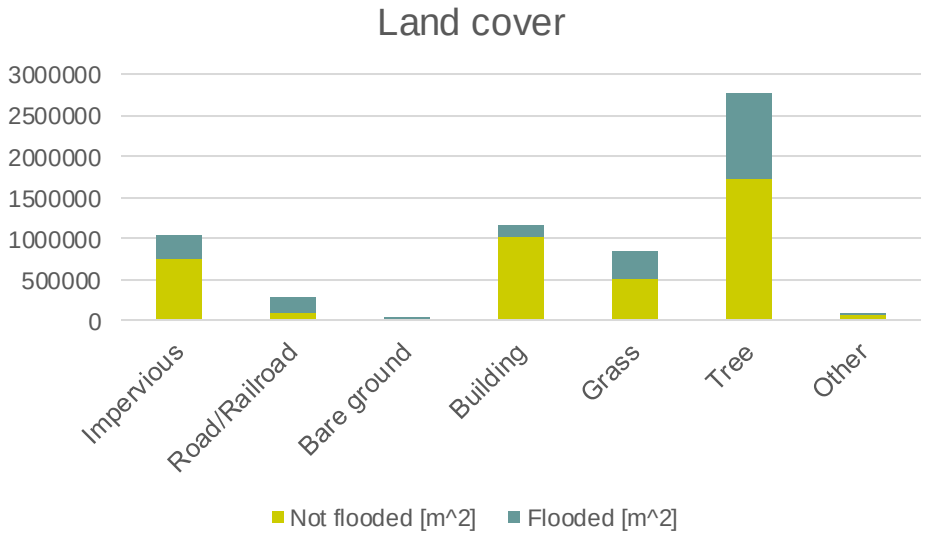




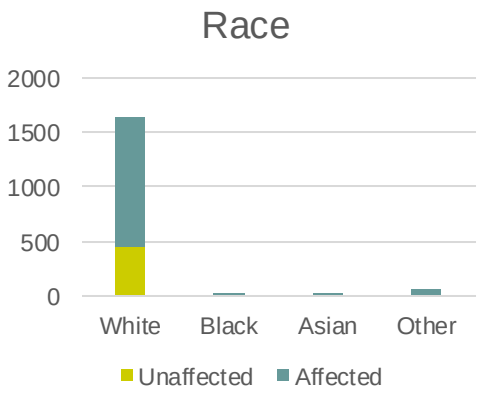
Scenario: 6 ft Sea Level Rise

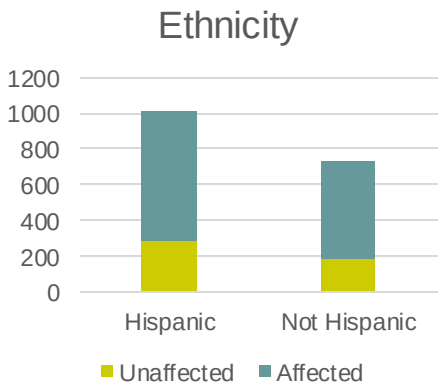


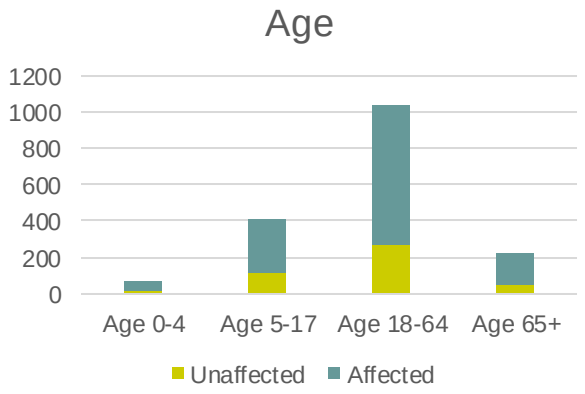




Scenario: 6 ft Sea Level Rise







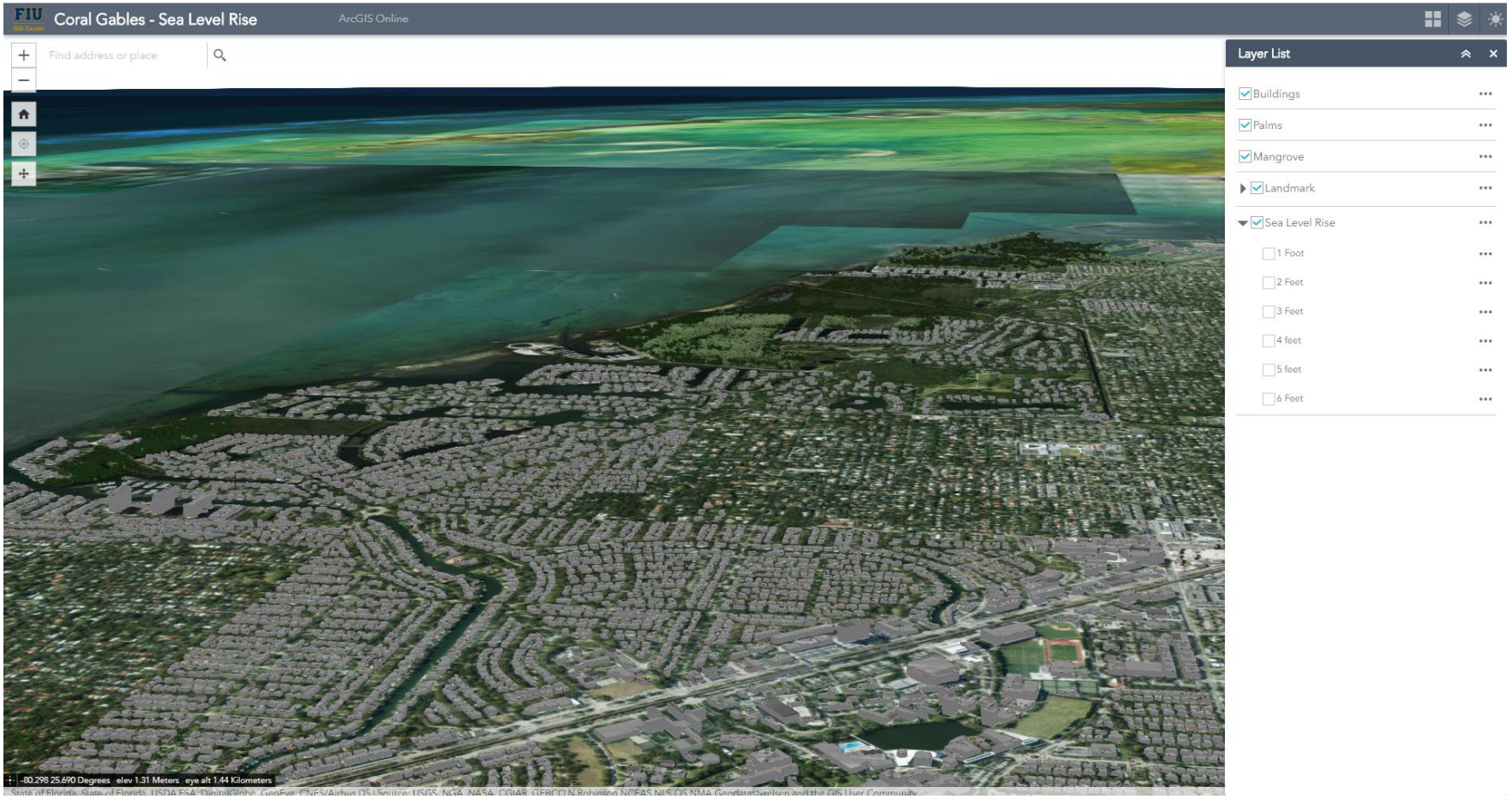
Outline

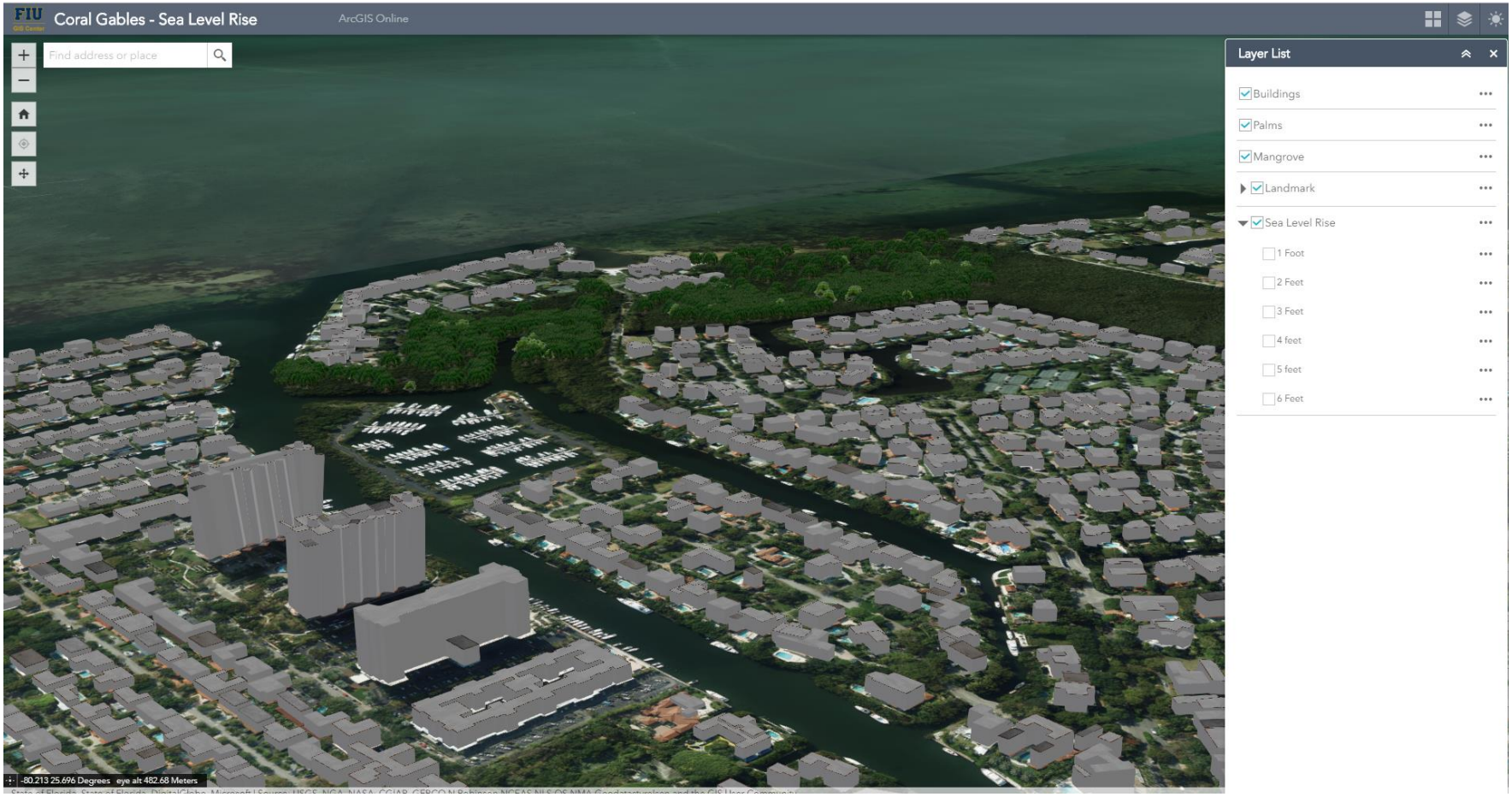
Projects

- Sea Level Rise App
  - Background
  - SLR, Flood, Tides
  - Flood reports
  - System architecture

- Coral Gables Sea Level Rise Impact Planning Tool
  - Background
  - Scenarios
  - GIS analysis and statistics
  - 3D-model

3-D Model


FIU
Coral Gables - Sea Level Rise
ArcGIS Online
Find address or place
Layer List
Buildings
Palms
Mangrove
Landmark
Sea Level Rise
1 Foot
2 Feet
3 Feet
4 feet
5 feet
6 Feet
-80.298 25.690 Degrees elev 1.31 Meters eye alt 1.44 Kilometers


FIU
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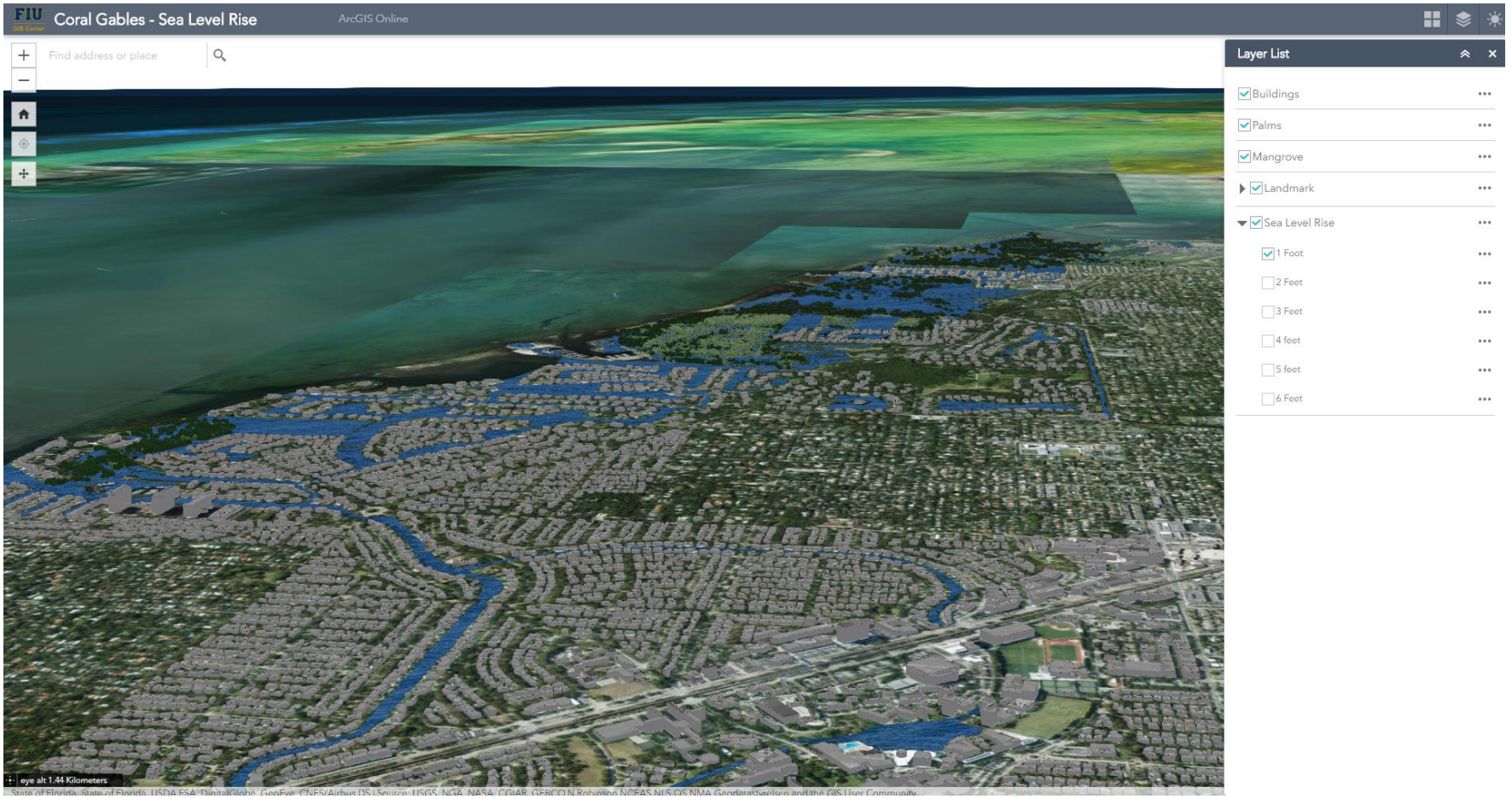
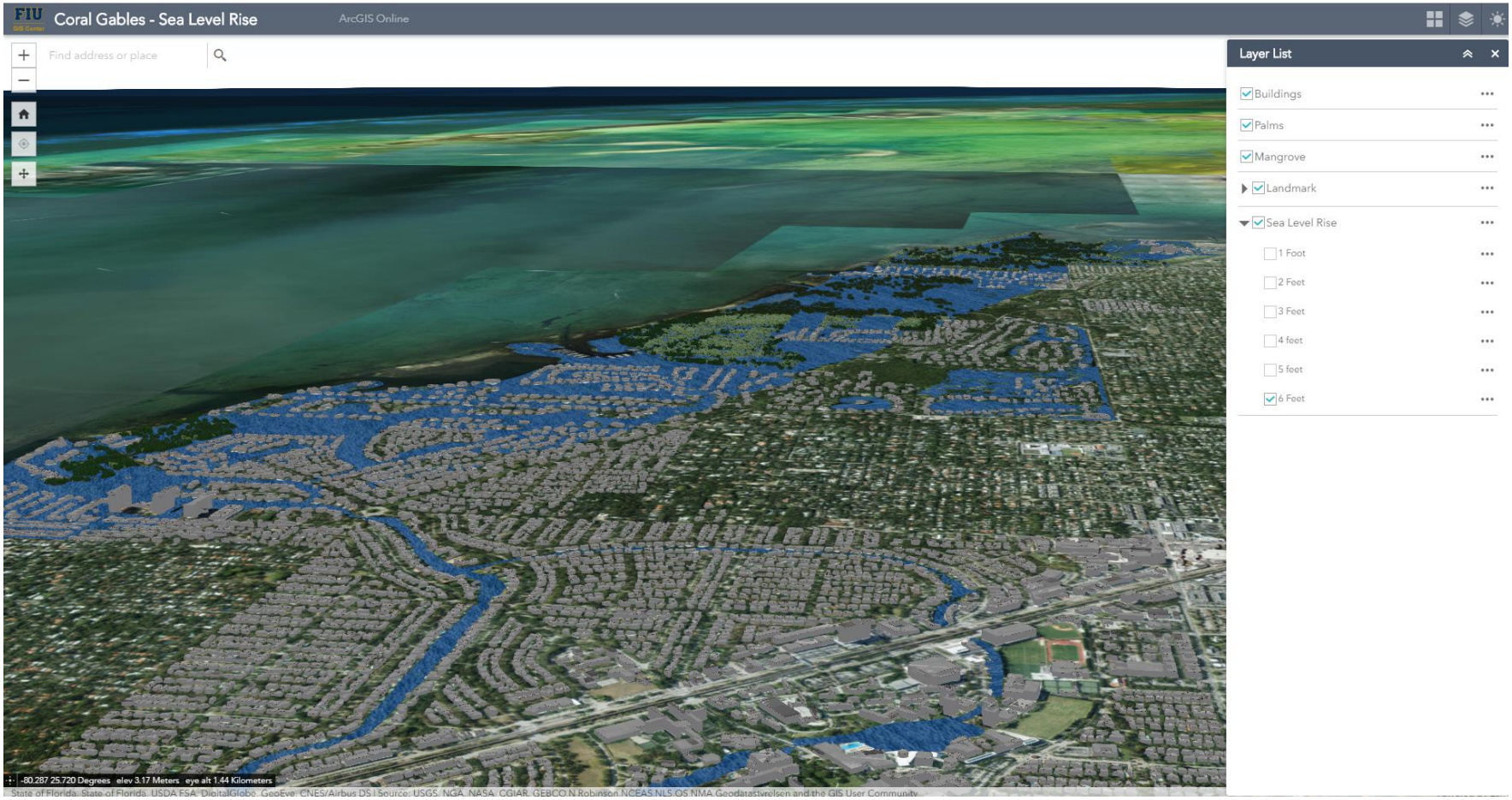
Sea Level Rise
1 Foot
2 Feet
3 Feet
4 feet
5 feet
6 Feet
-80.213 25.696 Degrees eye alt 482.68 Meters

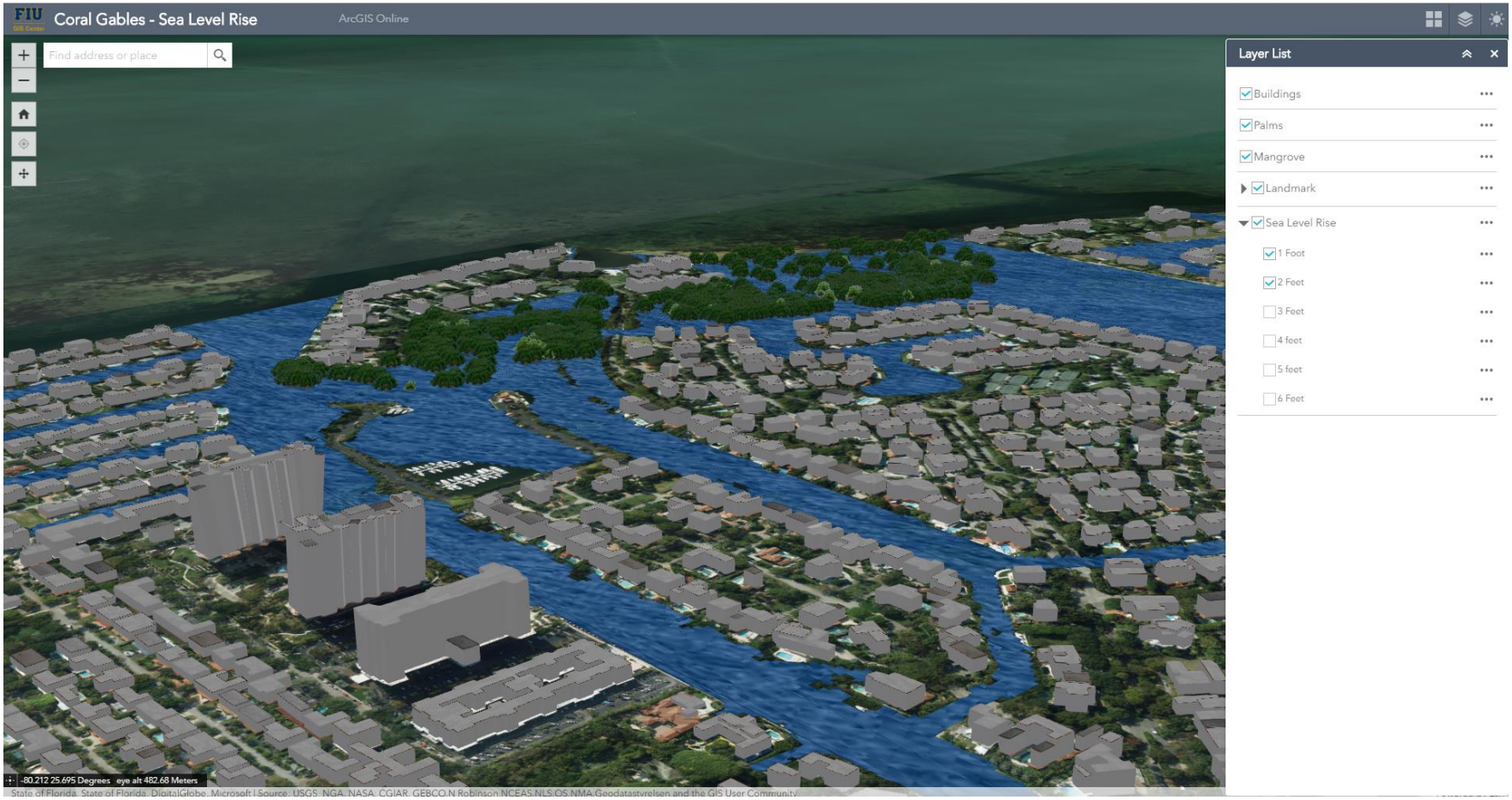
3-D Model and SLR 1-6 Feet Inundation



3-D Model and SLR 1-6 Feet Inundation



3-D Model and SLR 1-6 Feet Inundation



3-D Model and SLR 1-6 Feet Inundation

THANK YOU!

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