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Data-driven Sea level rise Web GIS Applications

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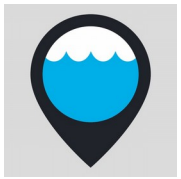

FIU | GIS Center FLORIDA INTERNATIONAL UNIVERSITY

UF | UNIVERSITY of FLORIDA

Outline

Coral Gables Sea Level Rise Impact Planning Tool

- Background
- Scenarios
- Implementation
- Application live demo

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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

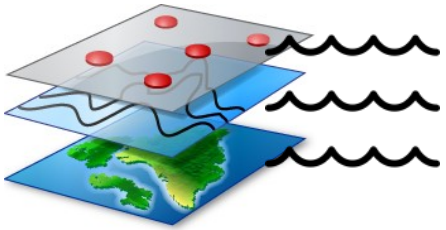
- Time line:
  - 2-year project (October 2017 - September 2019)

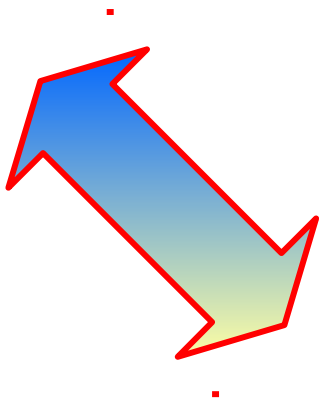
- Funding agency: City of Coral Gables

Project team

- GIS Center, FIU
  - *Zhaohui Jennifer Fu (PI)*
  - *Levente Juhász (technical lead)*
  - *Sheyla Santana, Boyuan Guan, Julian Gottlieb, Jorge Sotolongo*
- Department of Earth and Environment, FIU
  - *Keqi Zhang (SLR modeling)*
- Geomatics Program, UF
  - *Henry Hochmair (SLR modeling, statistics)*
- International Hurricane Research Center, FIU
  - *Yuepeng Li (storm modeling)*

Proposed functionality

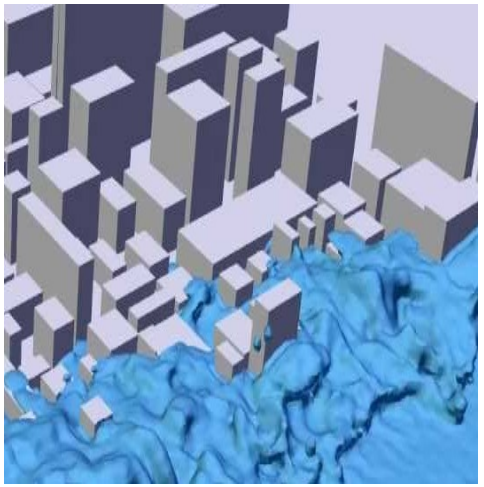




Statistics about affected areas

2D Flood mapping

3D flood visualization



New slide

- …

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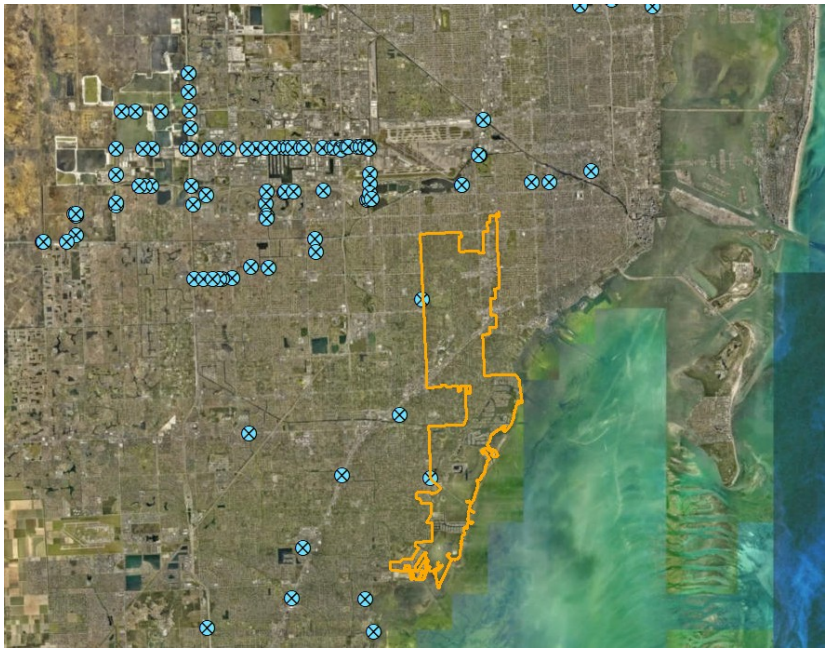
Scenarios

- Sea level rise inundation maps between 0 and 8 ft
  - SLR measured relative to the mean higher high water (MHHW)
- Sea level rise bath tub model (connected to ocean)
- based on 5m DEM (resampled) for South Florida
- consideration of SFWMD structures (weir, levee)



Scenarios (Cont'd)

- Worst case basin snapshot of storm surge inundations for hurricanes of categories 1-5
- 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

- 8 SLR scenarios + 5 Storm Surge
- No compound effect but simple addition of the two

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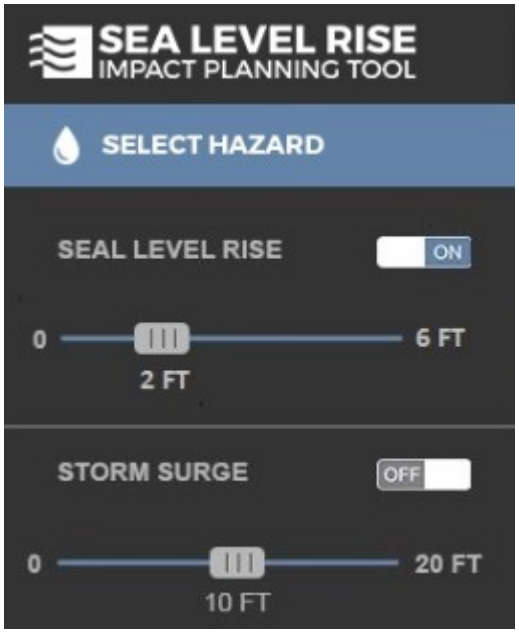
Application workflow

- User selects a scenario and area at census block level



Application workflow

- User selects a scenario and area at census block level
- 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

Web implementation

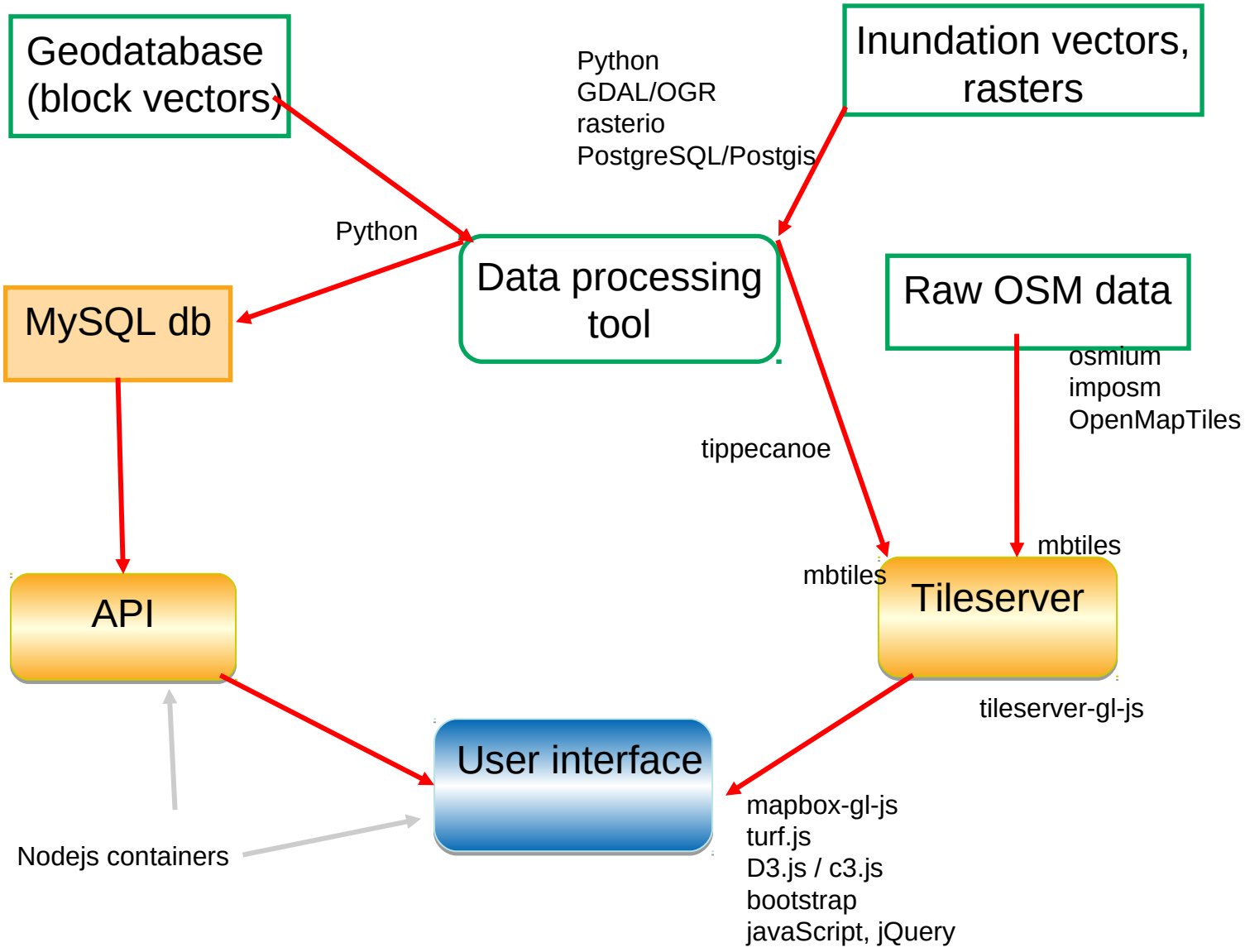
- Design principles
  - Simple interface focused on functionality and presentation
  - Lightweight application
  - Contemporary technologies
  - Responsiveness
  - Flexible architecture

  - Use of open source software and open data as much as possible

Architecture (overview)

- Backend
  - Processing stack
    - Transforms, processes raw data to digestible formats
  - MySQL database
  - Custom-built API
    - Acts as middleware between the application and database
  - Tileserver
    - Provides geospatial data
- Frontend
  - User interface
    - Interacts with the API and Tileserver

Architecture (overview)



Data processing

- Statistics
  - Vector polygons (block)
  - ~1000 Census blocks in Coral Gables
  - SLR scenarios (0ft .. 8ft)
  - Storm scenarios (Category 1 .. Category 5 Hurricane)
  - 5 thematic groups, 27 variables

  - 6 x 9 x 27 ~ 1,500 attributes
  - Not suitable for the web

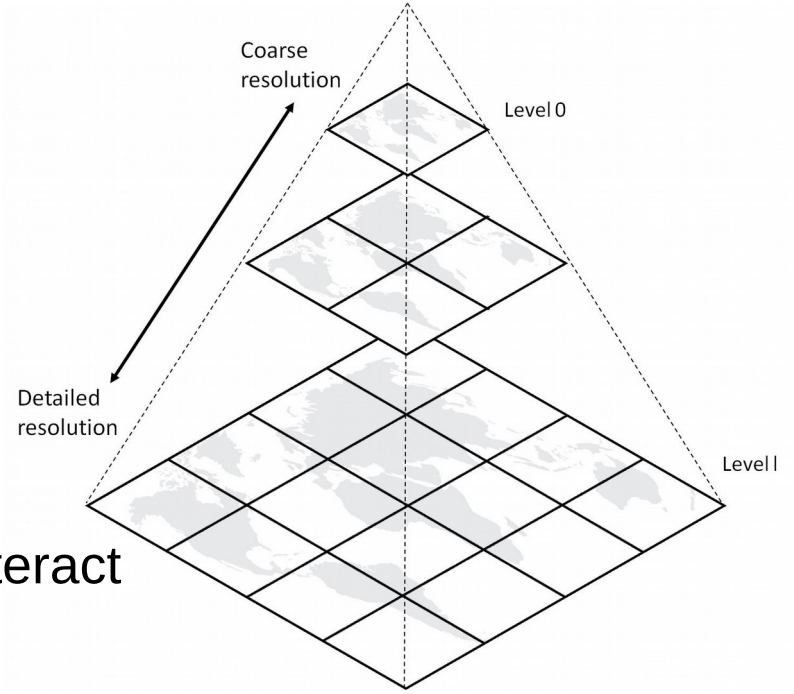
  - Database **normalization**.
  - 4 tables, multi-column indexes, multiple joins
  - Responses in milliseconds

Vector tiles

- Tiled map with vector geometries

- Advantages
  - Smooth transitions
  - Flexible rendering (real time)
  - On-the-fly data processing
  - All in the browser

  - Opens up a lot of possibilities in terms of how we present and interact with geodata on the web



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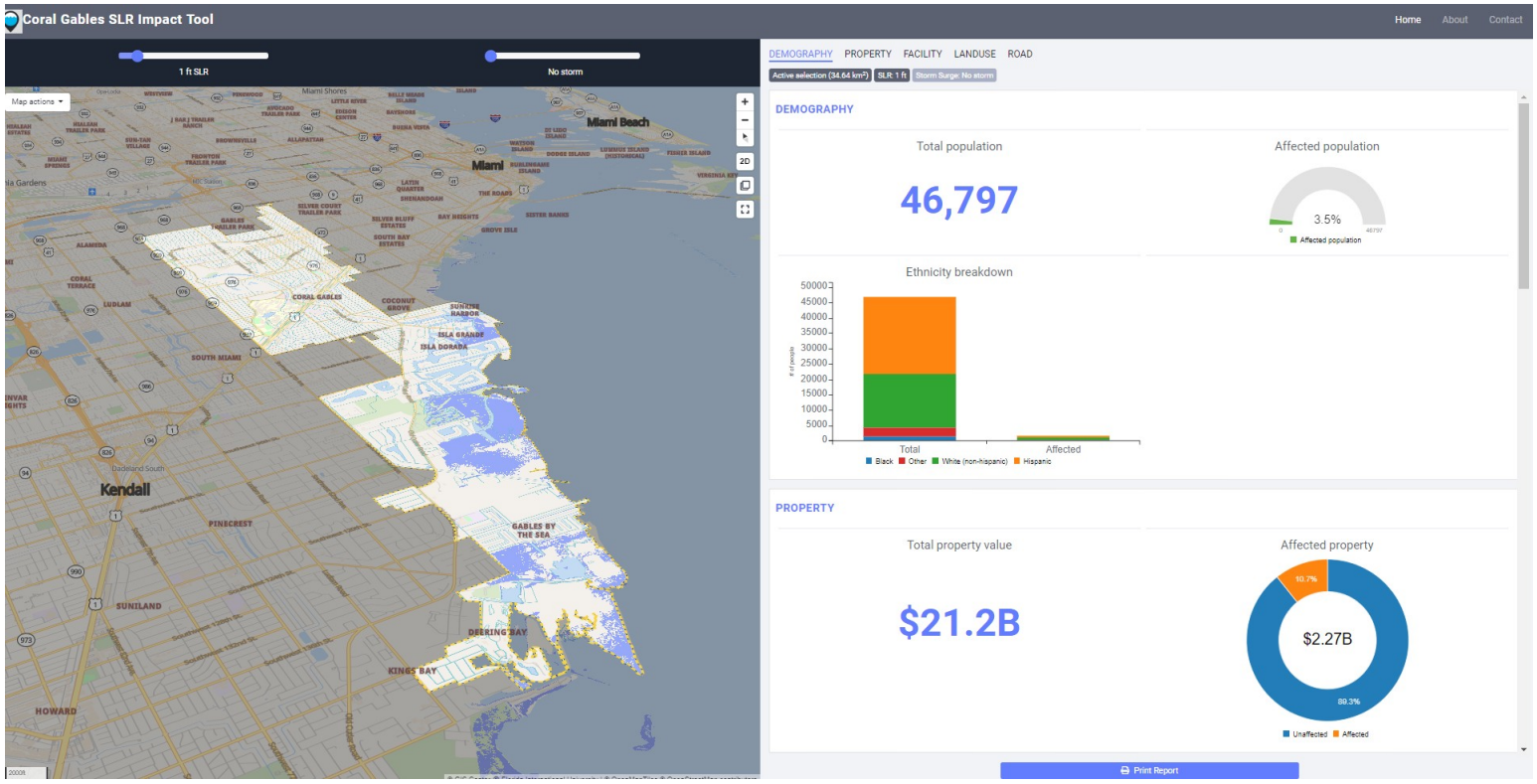
Live demo


Coral Gables SLR Impact Tool
Home
About
Contact
1 ft SLR
No storm
Map actions
DEMOGRAPHY
PROPERTY
FACILITY
LANDUSE
ROAD
Active selection (34.64 km²)
SLR: 1 ft
Storm Surge: No storm
DEMOGRAPHY
Total population
46,797
Affected population
3.5%
Affected population
Ethnicity breakdown
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
# of people
Total
Affected
Black
Other
White (non-hispanic)
Hispanic
PROPERTY
Total property value
$21.2B
Affected property
10.7%
$2.27B
89.3%
Unaffected
Affected
Print Report
Miami Beach
Miami
Kendall
PINECREST
SUNILAND
HOWARD
KINGS BAY
DEERING BAY
GABLES BY THE SEA
CORAL GABLES
COCONUT GROVE
SOUTH MIAMI