SLR, Climate Change, Infrastructure Solutions, Adaption and GIS

Presenter:

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SLR, Climate Change, Infrastructure Solutions, Adaption and GIS

Data Acquisition, Integration and Impact Modeling

- Geographic Information Systems and Survey
- Aerial LIDAR
- Topographic LIDAR
- Aerial Survey and Positioning
- Bathymetric Survey – Sonar
- GPS Tracer / Flow Meter

![Graph](image_url)

**Unified Sea Level Rise Projection**
(Southeast Florida Regional Climate Change Compact, 2015)

<table>
<thead>
<tr>
<th>Year</th>
<th>IPCC AR5 Median (inches)</th>
<th>USACE High (inches)</th>
<th>NOAA High (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2030</td>
<td>6</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>2060</td>
<td>14</td>
<td>26</td>
<td>34</td>
</tr>
<tr>
<td>2100</td>
<td>31</td>
<td>61</td>
<td>81</td>
</tr>
</tbody>
</table>
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Note: All elevations are in NAVD 88.

- Critical Infrastructure (min.) 8.44 ft.
- City Freeboard (min.) 7.44 ft.
- City Base Flood Elev. (min.) 6.44 ft.
- Top of Sea Wall (min.) 5.7 ft.
- SFR Lot Grade (min.) 5.0 ft.
- Crown of Road (min.) 3.7 ft.
- Sept. 2015 Extreme Tidal Event 2.1 ft.

2015 NOAA Low 2015 IPCC Medium 2015 USACE High 2015 NOAA High
Aerial LIDAR Data

1- Existing data allows the extraction of ground elevations, buildings and other features
Aerial LIDAR

1. LIDAR QA – QC. 2007 vs 2015
2. Re-Classification – 2015 / LP360 – HARRIS - ESRI
3. Validation – Accuracy Test - City Benchmarks
4. Feature Extraction – Object Oriented Algorithms
5. Integration
6. Products
Building Base Height
NAVD88 US Feet

- **≤3.2**
- **≤5**
- **>5**

Legend:
- **Biscayne Bay**
- **Biscayne Bay Aquatic Preserve**

Scale:
- 0
- 0.05
- 0.1
- 0.2 Miles
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- 2015 NOAA Low
- 2015 PCC Medium
- 2015 USACE High
- 2013 NOAA High

- Average Sea Wall Elevation: 3.1 ft
- Average Ground Parcel Elevation: 3.48 ft
- Future Sea Walls: 5.7 ft
- Future Finish Floor Elevation: 7.44 ft
- Proposed Crown of Road: 3.7 ft
- Proposed Edge of Pavement: 3.2 ft
- Proposed Edge of Pavement: 2.19 ft
- Existing Edge of Pavement where crown below 3.7: 2.9 ft
- Existing Crown of Road where below 3.7: 2.19 ft

Harmonization

Right of Way
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Mobile LIDAR Survey

1- Urban environment: Roads, buildings, ROW 3D modeling and feature extraction.

Mobile LIDAR unit mounted on SUV for urban infrastructure 3D mapping
Topographic LIDAR survey grade feature extraction capabilities
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Bathymetric and Seawall LIDAR Survey

Seawall Survey – Focus on sea wall from horizontal and vertical perspectives.

Mobile LIDAR unit mounted on boat for coastal infrastructure 3D mapping.
Bathymetric and Seawall LIDAR Survey

Seawall Survey – Focus on sea wall from horizontal and vertical perspectives.

Collins Canal – Bay Road end, 3D Point Cloud capturing seawall conditions and height
Geological Survey of Miami Beach

- AECOM and USGS
- 42 Monitoring Wells
- Characterize Lithology
- Identify Confining Geological Unit

- Confining unit found at the Keys starting at 250 f.
- So far in Miami Beach no confining unit were found at 330 f.
- Future drilling will go to 400.
Geological Survey of Miami Beach

- USGS and the City of Miami Beach
- 42 Monitoring Wells – ground water levels and SLR.
- Characterize Lithology
- Identify Confining Geological Unit

- Confining unit found at the Keys starting at 250 f.
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Storm Surge Modelling

- Existing models are too coarse to represent the effects of storm surge in Miami Beach.
- A high resolution storm surge model could also assist on validating infrastructure changes and future adaptation strategies.
Water Quality and Circulation Patterns in Biscayne Bay

1- Circulation Patterns
2- Seagrass Mapping
3- Chlorophyll Levels
4- Storm Water Discharge Diffusion
Circulation Patterns (Direction and Velocity)

- Flow Meter – Stationary sensor: Current, direction, pressure, temperature, conductivity and turbidity

Midas ECM – Electromagnetic Current Meter

Lagrangian Tracer

Drifter tracks and HF Radar current readings plotted on top of remotely sensed Sea Surface Temperature (SST).
Circulation Patterns (Direction, Velocity and Temperature)

- Flow Meter – Stationary: Current, direction, pressure, temperature, conductivity and turbidity
Unmanned Aircraft System and Hydro Drone Survey

UX5

UX5 HP

SONAR

MikaSense Red Edge Multispectral Sensor

SONY aR7

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GPS Tracer

esri

PIX4D

Dell
Turbidity Mapping

- Aerial Photography: Diffusion and dispersion patterns.

Outfall discharge or dye release

Dispersion patterns
Algae Concentration


- 5 Band Multispectral Sensor

- Seamless mosaic

- e.g. Cyanobacteria in the Baltic Sea
Resiliency Data Management Framework
Overview

Data Acquisition, Integration and SLR Impact Modeling

- Geographic Information Systems
  - Aerial LIDAR
  - Topographic LIDAR
  - Bathymetric Survey – Sonar
  - GPS Tracer / Flow Meter

- Engineering
  - Dynamic Storm Surge and SLR Modelling
  - Hydrologic studies
  - Synthetic modelling solution validation
  - Ground water modeling
  - Water quality studies
  - Wind circulation study

- Emergency Response
  - Post event assessment
  - SLR risk assessment
  - ZIKA prevention

- Environment and Sustainability
  - Green infrastructure
  - Water circulation
  - Beach, reef and coastal vegetation monitoring
  - Water quality monitoring

- Urban Planning
  - Historical districts vulnerability assessment
  - Historical buildings scanning “As Builds”
THANK YOU

QUESTIONS?