Modeling Coastal Flood Risk Using GIS-Based Automated Tool
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Information Needed to Create DFIRMs

Diagram showing:
- BFE including wave effects
- 100-year stillwater elevation
- Datum (NAVD 88)
- Properly elevated building
- Un Elevated building constructed before community entered the NFIP
- Shoreline
- Sand Beach
- Buildings
- Overland wind fetch
- Vegetated region
- Limit of 100-year flooding and waves

Wave height ≥ 3 ft
Wave height < 3 ft
Data Entry

Storm surge elevation

(-5, -55) -> (0, 0) -> (3.5, 30) -> (4.5, 38) -> (7.5, 25) -> (12.5, 40)
Conventional vs. Fully Digital Process

- Human errors
- Data size limitations
- Time needed to process and complete
- Lack of geo-referencing
- Difficult to QA/QC
- Limitation to visualize results
- I/O Software format (Fortran77)

- Increase efficiency
- Improve analysis and predictions
- Ability to visualize every details
- Ease of performing QA/QC
- Capability to use the output data for so many applications
**Process Steps**

1. **Step 1&2**
   - Transect Layout
   - LiDAR
   - Bathymetry
   - Storm Surge
   - Survey (Dune)

2. **Step 3**
   - Dune Erosions (Remove or Retreat)

3. **Step 4**
   - Vegetation
   - Building footprint

4. **Step 5**
   - Populate Starting Wave Conditions

5. **Step 6**
   - Generate WHFIS files (I/O)

6. **Step 7**
   - Compute RUNUP2.0 (I/O)

7. **Step 8: Output**
<table>
<thead>
<tr>
<th>Steps</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Create Transect Databases</td>
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<tr>
<td>Step 2</td>
<td>Integrate Survey</td>
</tr>
<tr>
<td>Step 3</td>
<td>Dune Erosions</td>
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<td>Generate WHAFIS</td>
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<td>Step 7</td>
<td>Generate RUNUP2.0</td>
</tr>
<tr>
<td>Step 8</td>
<td>Summary Transects</td>
</tr>
</tbody>
</table>

**QA/QC**
Data Setup – Transect & Terrain

- Storm Surge
- Transects Layouts
- Bathymetry
- Ground LiDAR
Data Setup (Cont.) – Hydraulic Connectivity
Step 1: Create Transect Databases

- Generate 3-D Transect profile

- P1 (Profile 1): RAW Data

- P2 (Profile 2): Filtered Data
Step 2: Integrate Survey

- Survey will override profile P2
- P1 (Profile 1): RAW Data
- P2 (Profile 2): Filtered Data
- P3 (Profile 3): Survey Profile
Step 1&2: Create DB + Integrate Survey (Cont.)
Step 3: Dune Erosions

- **PFD Reservoir < 540 square feet**
  - Dune removal
  - SWEL 100
  - Dune toe
  - 1:50 slope

- **PFD Reservoir > 540 square feet**
  - Dune face retreat
  - SWEL 100
  - 1:12.5 slope
  - 1:40 slope
  - 1:1 slope

- 1:12.5 slope
- 1:40 slope
- 1:1 slope
Step 3: Dune Erosions (Cont.)
Step 4: Populate Node Data

» Vegetation:
  » GAP Land Cover and Forest Inventory and Analysis Data
  » Imagery and field recon
Step 4: Populate Node Data (Cont.)

▶ Buildings:

Building footprints, Imagery and Google Pro, field recon

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Step 5: Populate SWC

- Extracting the values of significant wave height and wave period for each transect
Step 4&5: Populate Node Data and SWC (Cont.)
Step 6: Generate WHAFIS

WHAFIS – Wave Height Analysis for Flood Insurance Studies is used to compute Wave Heights at each transect.
Step 6: Generate WHAFIS (Cont.)
Step 7: Generate RUNUP2.0

- Uses RUNUP 2.0 through an interactive window and then connects input data with the software via DOSBox
Step 7: Generate RUNUP2.0 (Cont.)
Step 8: Summary Transects

- At every node, this table provides all needed information (i.e., station, ground elevation, SWEL, wave height and elevation, mean and 2% RUNUP, and BFE)
Step 8: Summary Transects (Cont.)
QA/QC

- Simplicity and Accuracy of performing QA/QC
QA/QC (Cont.)
What Next?