Storm Surge Approach

Storm Forcing
- Extratropical Wind Fields
- Hurricane Tracks

Storm Surge Modeling
Winds

Waves
Water Levels

Return Period Analysis
JPM-OS 10%, 4%, 2%, 1%, & 0.2% annual chance
Tide Gage Analysis 50% & 20% annual chance

Still Water Elev.

High-Resolution Bathy / Topo Mesh

JPM-OS: Joint Probability Method- Optimum Sampling
Storm Surge Modeling System

Wind and Pressure Fields

Water Levels

Waves/ Radiation Stress

Coupling

ADCIRC: Coastal Circulation and Storm Surge Model

SWAN: Coastal Waves Radiation Stress
Development of ADCIRC Mesh

ADCIRC: ADvanced CIRCulation Model

- Finite element difference model
- Uses unstructured, triangulated mesh
- Node spacing set to accurately represent underlying topography/bathymetry
- Created “feature arcs” to represent elevated features (i.e. roads)
Keaton Beach – Taylor County
Keaton Beach – Taylor County
Suwannee – Dixie County
Suwannee – Dixie County
Cedar Key – Levy County
Cedar Key – Levy County
Storm Climatology

- Reviewed historical storms
- Selected both tropical and extra-tropical storms to validate the hurricane/surge model
- Generated hundreds of synthetic storms
Storm Climatology

Tropical: the “quiet” corner of the Gulf: Typically Category 1 or less at landfall

Tropical Storms: 1850 - 1959

Tropical Storms: 1960 - 2010
Storm Climatology

Extra-Tropical: Intense storms can develop in the Gulf before crossing Florida and racing up the East Coast as a Nor’easter.

52-knot wind speed maxima analyzed during March 1993 “Super Storm”
Tropical Cyclone Tracks and Parameters

Individual storm tracks were plotting and sorted into 4 categories:
1. Inland
2. Land Exit
3. Land Fall
4. Offshore

Offshore systems > 120 Nmi away were dropped

*Nmi: Nautical Mile*
Of the available NOS data in the study area, only Cedar Key provides a historical record that covers a time period long enough for storm selection (1965-2011 searched).

Apalachicola, FL NOS was just to check Cedar Key storms in period of 1996-present.

NOS: National Ocean Service
## Significant Surge Events

<table>
<thead>
<tr>
<th>Event Name</th>
<th>Date</th>
<th>Surge at Cedar Key (NAVD88 feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurricane 1842</td>
<td>10/5/1842</td>
<td>+/-18</td>
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<tr>
<td>Hurricane 1896</td>
<td>9/29/1896</td>
<td>10.5</td>
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<td>Hurricane 1935</td>
<td>9/4/1935</td>
<td>highest tide since 1896</td>
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<td>Hurricane Easy</td>
<td>9/5/1950</td>
<td>3.56</td>
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<td>Hurricane Agnes</td>
<td>6/19/1972</td>
<td>5.69</td>
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<tr>
<td>Extra-Tropical Event</td>
<td>12/25/1975</td>
<td>3.14</td>
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<td>Hurricane Elena</td>
<td>8/31/1985</td>
<td>6.95</td>
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<td>Hurricane Juan</td>
<td>11/1/1985</td>
<td>4.65</td>
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<td>Hurricane Kate</td>
<td>11/21/1985</td>
<td>2.97</td>
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<tr>
<td>Hurricane Opal</td>
<td>10/5/1995</td>
<td>4.94</td>
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<tr>
<td>Tropical Storm Josephine</td>
<td>10/8/1996</td>
<td>2.93</td>
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<tr>
<td>Hurricane Earl</td>
<td>9/3/1998</td>
<td>5.05</td>
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<tr>
<td>Extra-Tropical Event</td>
<td>7/24/2001</td>
<td>4.43</td>
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<tr>
<td>Tropical Storm Bonnie</td>
<td>8/12/2004</td>
<td>2.96</td>
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<tr>
<td>Hurricane Frances</td>
<td>9/6/2004</td>
<td>4.35</td>
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<tr>
<td>Hurricane Ivan</td>
<td>9/15/2004</td>
<td>4.02</td>
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<tr>
<td>Hurricane Dennis</td>
<td>7/10/2005</td>
<td>5.53</td>
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<tr>
<td>Tropical Storm Debby</td>
<td>6/25/2012</td>
<td>4.44</td>
</tr>
</tbody>
</table>
Validation Storm Selection

Validation storms

Tropical Storms
- Hurricane Elena (Aug/Sept 1985)
- Hurricane Frances (Sept 2004)
- Hurricane Dennis (July 2005)

Extra-tropical Storms
- April 1983
- March 1993 (Storm of the Century)
- July 2001
Validation Summary

- Validation completed for tides and six historical storms
- Demonstrated model capability to reproduce water levels and waves in project area
- Comparisons to available data showed reasonable agreement for water levels and waves