CATALOGING ALL AVAILABLE STORM SURGE MEASUREMENTS FOR THE STATE OF NORTH CAROLINA: THE NATIONAL STORM SURGE DATABASE

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PROJECT DESCRIPTION

The Program for the Study of Developed Shorelines (PSDS) at Western Carolina University (WCU) is using relational tools and geographic information systems (GIS) to build a national storm surge database, beginning with a North Carolina prototype. This project will provide one central location for coastal scientists and engineers to access storm surge and high water mark data (HWM).

This queriable database is being built in Microsoft Access and ArcGIS at WCU, but will ultimately be maintained and archived at NOAA’s National Climatic Data Center (NCDC). Storm surge data are being obtained from multiple sources including federal agencies, state agencies, academic-studies, and the private sector.

SIGNIFICANCE

During a hurricane, storm surge is often the greatest factor contributing to loss of life and property along the coast. Therefore, predicting the height of storm surge for an approaching storm is vital for coastal communities.

The Program for the Study of Developed Shorelines at Western Carolina University (PSDS) has been working to improve the understanding of storm surge. Prior to this project, most water level data has been stored within storm specific reports and documents.

Different types of measurements are part of the database, including hurricane tracks, characteristics and water level data. Much of the hurricane track and characteristic data was imported directly from NOAA’s IBTrACS database. Additional data was imported from federal agencies, state agencies, academic-studies, and the private sector.

DATABASE FIELDS

Water Level Characteristics

- Measurement Type (storm surge, HWM, storm tide)
- Elevation of Water Level
- Latitude/Longitude
- Vertical Datum
- Collector
- Reported Quality

Hurricane Landfall Characteristics

- State/City
- Time
- Winds
- Pressure
- Diameter

Imported directly from IBTrACS database

- Track Speed
- Storm Impact Angle
- Track Straightness
- Nearshore Slope

Calculated by PSDS using data from IBTrACS and ArcGIS

PROJECT SIGNIFICANCE

What is Storm Surge?

Storm surge is an abnormal rise of water generated by a storm, most commonly hurricanes, moving cyclonically around the hurricane eye. As the hurricane moves, wind associated with the actual storm high pressure system pushes the ocean water in the direction of the wind. This causes the water to rise above normal sea level, forming a slope or ‘knee’ on the shoreline.

Possible Database Uses

- Understanding the factors that lead to higher storm surge values
- More accurate storm surge prediction
- Storm surge model verification and calibration
- Locating surge data gaps
- Understanding the role of barrier islands/wetlands as storm buffers

DATABASE FIELDS:

- Top ten HWM measurements:
  - Hurricane Name (year)
  - Hurricane ID
  - Highest HWM measured (feet)
  - Source
  - Date

- Top ten storm surge events:
  - Hurricane Name (year)
  - Hurricane ID
  - Highest storm surge height (feet)
  - Source
  - Date

Top ten highest wind speeds:

- Hurricane Name (year)
- Wind speed (12 hrs prior to landfall)
- Source
- Date

Top ten lowest wind speeds:

- Hurricane Name (year)
- Wind speed (12 hrs prior to landfall)
- Source
- Date

Top ten highest wind pressures:

- Hurricane Name (year)
- Pressure
- Source
- Date

Top ten lowest wind pressures:

- Hurricane Name (year)
- Pressure
- Source
- Date

Top ten highest storm impact angles:

- Hurricane Name (year)
- Storm Impact Angle
- Source
- Date

Top ten most dangerous counties:

- County
- Percent of population in surge > 8 ft
- Most dangerous counties based on hurricanes in NC, Carteret and New Hanover

Current & Future Work

The database has recently been updated to include the states of South Carolina and Florida. This brings the number of hurricanes in the database to 26, with over 1,700 water marks.

Storm Surge Viewer

One of the most important features utilizing the database is the user-interactive web site, the storm surge viewer. This site uses a Google Maps interface to search, filter, and view storm surge and hurricane path data using a simple location search.

Additionally, a storm surge viewer prototypewas built during the NSF-funded project. This prototype was developed using Microsoft Access and ArcGIS spatial database engines.

ACKNOWLEDGMENTS

This project is funded by the National Science Foundation, CC$	extsuperscript{2}$H2O (Coastal Change, Hazards, and Other Oceanic Processes) under Grant No. OCE-0754761. Additional support was provided by the Western Carolina University Research Development Corporation (WCU-REDC) and the Western Carolina University Board of Governors.

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HWM from Bonnie (1998) in Dare County, NC:

<table>
<thead>
<tr>
<th>Hurricane Name</th>
<th>Date</th>
<th>Location</th>
<th>HWM (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonnie (1998)</td>
<td>1998</td>
<td>Dare County, NC</td>
<td>7.5 ft</td>
</tr>
</tbody>
</table>

**Fun Facts are based on 16 hurricanes from 1954-2008**

- **Hurricane with the straightest track**:
  - Hurricane Isabel (2003) : 145 knots/167 mph

- **Hurricane with the most storm surge**:
  - Hurricane Isabel (2003) : 87°

- **Hurricane with the most dangerous counties**:
  - Carteret County, NC : Percent of population in surge > 8 ft

- **Hurricane with the straightest track (72 hrs prior to landfall)**:
  - Hurricane Isabel (2003) : 145 knots/167 mph

- **Hurricane with the most dangerous counties (1998)**:
  - Carteret County, NC : Percent of population in surge > 8 ft

- **Hurricane with the most dangerous counties (2003)**:
  - Carteret County, NC : Percent of population in surge > 8 ft