

Hurricane Simulation for Florida Utility Damage Assessment

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Outline

- Quanta Technology
- Introduction
- Hurricane Model
 - Assumptions
 - Components
 - Results
- Damage Model
- Latest and Future Work



Quanta Technology

- Quanta Technology is a subsidiary of Quanta Services
- Founded July 2006
- Headquarters in Raleigh, NC
- Consulting for electric and gas energy delivery & supply
- Customers including more than 60 utilities and regional transmission organizations

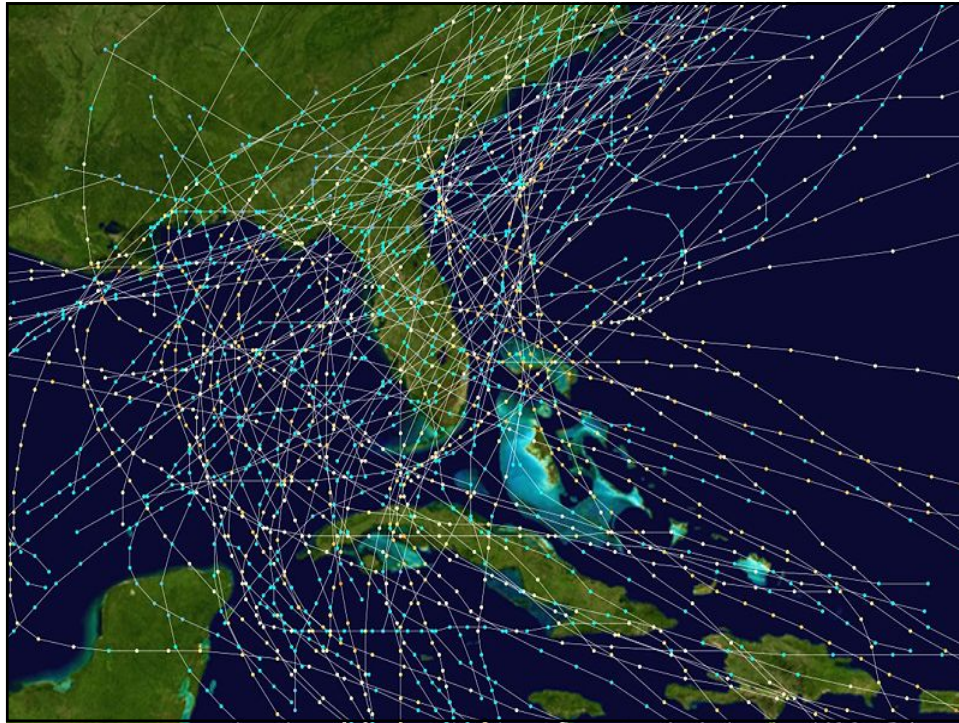
<http://www.quanta-technology.com>



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General Approach

- To assess the hurricane induced damage and risk to utilities in Florida

- Hurricane Model
 - A probabilistic hurricane model
 - To track the average effect of a large group of simulations
 - NOT to reproduce a specific hurricane in the past.
 - Monte Carlo simulation
 - To deal with significant uncertainty in the hurricane characteristics

- Damage Model

Hurricane Model

- Reinventing the wheel?
 - HAZUS-MH by FEMA
- Similarities & Differences
 - Same models for many weather aspects
 - Some models are simplified or modified
 - computational intensity
 - geographic characteristics
 - Customized towards Florida

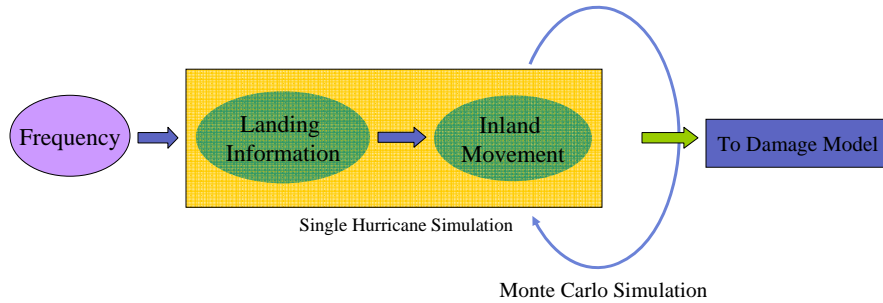


Assumptions

- Constant wind speed until landfall
- Constant translation velocity (forward speed)
- Only the landfall hurricanes are counted, BUT...
- Only one landfall for each hurricane, BUT...
- Straight line hurricane trajectory



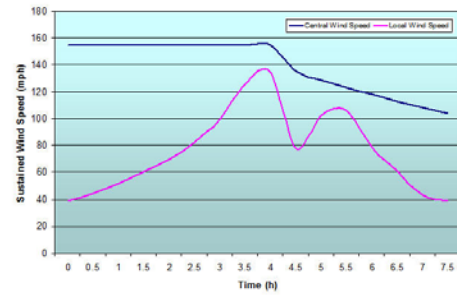
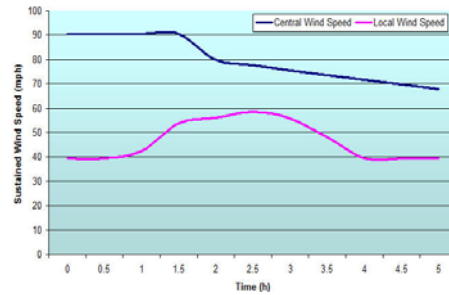
Structure



Hurricane Model

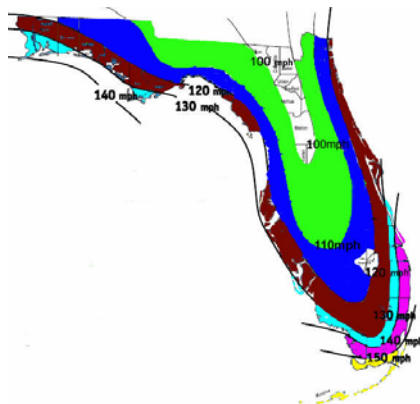
- Frequency
- Landing information
 - Landing Position (latitude and longitude)
 - Approach Angle
 - Translation Velocity (forward speed)
 - Central Pressure
 - Maximum Wind Speed
- Gust Factor
- Radius to Maximum Wind
- Inland movement
 - Maximum Wind Speed Decay Rate
 - Central Pressure Filling Rate
 - Wind Field Profile
 - Duration

Hurricane Simulation

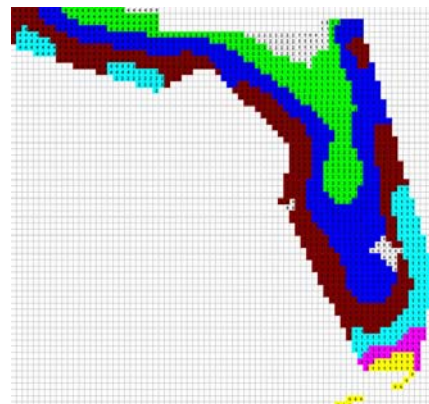


Model Validation

ASCE 7 Wind Map

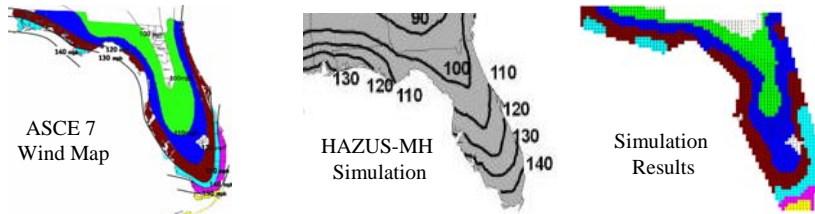


Simulation Results



Comparisons

■ Simulation Performance



■ Computing Resource Requirements

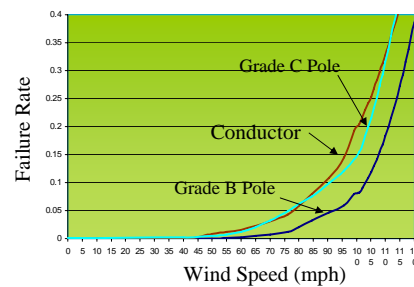
- A few GBs vs. less than 1 MB
- ArcGIS vs. MS Excel



Damage Model

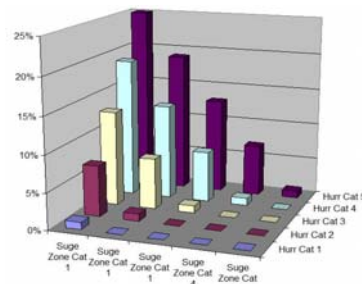
■ Overhead Equipments

- Curve Fitting Approach
 - Poles
 - Spans



■ Underground Equipments

- Data limitation
- Assuming a linear relationship
- Storm surge zone vs. Hurricane category



Latest and Future Work

■ Latest Work

- Restoration Model:
 - To determine the total system restoration time
 - To simulate the restoration process in a particular area.
- Current Application:
 - Underground conversion benefits and costs analysis

■ Future Work

- This framework can be applied to other adverse weather factors such as ice storms, tornados.
- GIS integration will increase the accuracy and provide the feasibility and flexibility of expanding this work to different geographic locations



THANK YOU