1.0 TROPICAL STORM CLIMATOLOGY

Recent work in wind hazard assessment has resulted in a number of techniques for generating large storm sets with statistics that match historical observations (e.g., Emanuel et al. 2008; Viderney, 2000). These techniques can be extended to produce storm sets for future climate scenarios that consider, for example, the impact of global warming on storm intensity.

2.0 STORM TROPICAL CLIMATOLOGY PARAMETERIZATION

For risk analyses tropical storms are often characterized by a number of storm related parameters:

- **Track** - The storm's position and timing, landfall location, forward speed, and approach angle.

- **Intensity** - Central pressure deficit and/or maximum wind speed.

- **Size** - Radius to maximum winds, radius to tropical storm force winds.

These parameters can be used to categorize storms using various indices or other metrics (Powell and Rashid, 2007, Kuxheva, 2008).

- **Saffir-Simpson Scale (SS)**
- **Integrated Kinetic Energy (IKE)**
- **Hurricane Intensity Index (HSI)**
- **Hurricane Damage Index (HDI)**
- **Integrated Kinetic Energy (IKE)**
- **CarVi Hurricane Index (CHI)**

Categorization by HSI has physical justification for use in assessing tropical cyclone generated storm surge potential (Jordan and Clayson, 2008).

\[
\text{HSI} = \frac{R}{V} \left( m - 60 \right)^2
\]

Where, \(R\) = radius to maximum winds and \(V\) = maximum wind speed.

3.0 STORM SURGE SET SELECTION

A representative subset of storms is selected from the large set using a Monte Carlo approach. The large synthetic storm set is characterized by HSI and a number of storms are selected at random from each bin. The choice of bin size and the size of the subset in each bin ultimately affects the precision and range of the surge exceedance probability estimates. The surge exceedance probability estimates may be improved incrementally by adding more storms to the sub-set. It may not be unreasonable to utilize the entire large storm set.

4.0 SURGE SIMULATIONS

The Advanced Circulation (ADCIRC) model is used simulate the large scale storm surge inundation processes with a high degree of spatial precision (i.e., down to 30m resolution).

5.0 SURGE STILL WATER LEVEL CDF DEVELOPMENT

The tropical storm surge response at a given Location Of Interest (LOI) can be considered as a multi-dimensional function of a set of independent storm parameters. (Resio et al. 2007, Irish et al. 2009, Irish et al. 2011)

1) Maximum Wind Speed (Intensity)
2) Radius to Maximum Winds (Size)
3) Forward speed (Track)

In this approach the probability of the response is incorporated through the application of the HSI statistics, while the magnitude of the surge is determined by the use of a large statistically robust set of synthetic storm tracks (which may use the Monte Carlo approach to sub-set).

Assumptions:

- The storm surge level at a given location is directly related to the HSI at landfall for a given storm
- The exceedance probability for the surge is directly related to the exceedance probability of the HSI
- The HSI may be adjusted locally using a Track Surge Factor which to LOI and storm specific.

5.0 MAXIMUM SURFACE ELEVATION CDF

The Maximum Water Surface elevation (Hs) for a single node in the ADCIRC grid is considered as a multi-dimensional function of the existing climate and sea-level rise scenarios with 20th and 21st century climates. Hs can be considered as a multi-dimensional function of climate change and sea-level rise. In many coastal areas the adverse impacts of climate change and sea-level rise may be reduced by a careful response to the increasing threat of storm induced flood damage. The identification of appropriate adaptive actions (e.g., sand dune retreat, elevation, protection, and engineering approaches) depends largely on an understanding of the present and future surge induced flood risk. In particular, an accurate and precise assessment of the exceedance probability of tropical cyclone induced storm surge, provided at high spatial resolution, will help decision-makers identify areas of existing vulnerability requiring immediate action, as well as, areas that benefit from present planing for future sustainability. This paper gives an overview of a novel approach to generating this information by combining recent methodology for wind risk damage assessment with state-of-the-practice hydrodynamic modeling of hurricane storm surges.

The storms position and timing, landfall location, forward speed, and approach angle. The storms position and timing, landfall location, forward speed, and approach angle. The storms position and timing, landfall location, forward speed, and approach angle.

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