



Detailed Coastal Modeling Approaches

Detailed coastal analyses involve hurricane storm surge studies, flood hazard modeling and coastal floodplain mapping. If budgets allow, new coastal analyses should be performed with updated topographic data. Ideally, LiDAR and detailed transect ground surveys would be available allowing for more accurate elevation datasets.

Storm Surge Analysis

Hurricane storm surge analyses are conducted to determine coastal stillwater elevations to be used in coastal flood hazard modeling. The following models and/or techniques are commonly used in surge analyses:

- ADvanced CIRCulation model (ADCIRC), a 2-dimensional hydrodynamic model for storm surge generation;
- Surface Modeling System (SMS) software to develop and refine the ADCIRC model (or similar) grid scheme for wide geographic application;
- Planetary Boundary Layer Model for hurricane wind and pressure field data; and
- Empirical Simulation Technique (EST) for statistical assessments and return period flood elevation determinations.

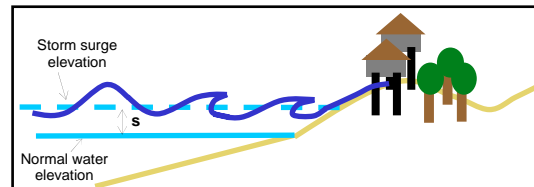
The steps involved in the development of revised stillwater elevations include research, field reconnaissance, model calibration, validation and storm simulations.

Research

An information search is conducted to: identify existing coastal flood hazard data (including available bathymetric and topographic data); document recent tide gage data; acquire historical hurricane wind field datasets specific to the area of study; and, identify specific problem areas to be resolved by the new storm surge model study.

Field Reconnaissance

The study team familiarizes themselves with the varying coastal conditions along the immediate shoreline, including coastal structural development (residential and commercial), infrastructure (roads) and vegetation.



Model Calibration, Validation, and Simulations

Modeling begins by merging the available digital elevation datasets – bathymetric data and topographic data. Storm surge calibrations are then performed to the tidal constituent database. Following calibration, hurricane hindcast/validation simulations are conducted for at least three recently documented coastal flood events in the area of study. Then, using the detailed grid scheme along with wind field modeling data and the National Weather Service HURDAT hurricane database, a detailed set of simulations is performed for use in the statistical analysis of return period flood levels with EST.





Coastal Flood Hazard Analysis

Updated detailed coastal flood hazard analyses for the area of study begin with data research and field reconnaissance. The FEMA Coastal Hazard Analysis Modeling Program (CHAMP) is then utilized for all modeling analyses.

Data Research and Project Setup

Research is needed to assess the availability of recent aerial imagery to be used for overall site assessments, as well as the availability of data on coastal structures and levees (both certified and failed), beach and dune erosion, and hurricane high water mark information. A GIS project is then setup utilizing all collected digital data (aerial imagery, topographic data, etc.). Once the GIS project is established, coastal transect locations are selected with priority given to the location of effective transects and areas of complex topography and/or development.

Field Reconnaissance

During the coastal restudy process, site inspections of each transect (and the coastal reach that each transect represents) are required to: determine if additional wave transects are needed; identify the type and nature of the vegetation and building obstructions along the coastal reach; identify primary frontal dune areas; and document unique coastal features which need to be considered in the modeling (seawalls, cliffs, and alluvial river confluences).



Detailed Coastal Hazard Assessments

Detailed assessments of the deepwater storm wave characteristics and wave transformation to the shorelines of the area of study are addressed, as necessary. These coastal processes may have

a significant impact on subsequent analyses of wave setup, wave heights, and wave runup and should be incorporated into the coastal study process as appropriate. The wave setup depth is computed and added to the 100-year stillwater elevations for each specific coastal reach. CHAMP is then utilized for all detailed coastal assessments and modeling analyses, including storm-induced erosion profile adjustments (based on the 540-square foot criteria), wave height analyses using WHAFIS 3.0, and wave runup analyses using RUNUP 2.0. The resulting mean runup value is subsequently converted to a 2% value in accordance with guidance presented in FEMA Procedure Memorandum No. 37, dated August 1, 2005. The location of the inland limit of the primary frontal dune is also assessed to aid in VE Zone mapping.



Coastal Flood Hazard Mapping

Utilizing an agreed upon base map for the area of study, topographic data source, and results of the coastal hazard assessments for each transect, distinct special flood hazard boundaries for the Zone VE, Zone AE, Zone AO, Zone AH, and Zone X (shaded) hazard areas and respective base flood elevations (BFEs) or depth of flooding for each zone are identified. Flood hazard zone and BFE mapping between each transect are interpolated based upon detailed topographic information, cultural features (vegetation and floodplain development), and effects of coastal flood protection structures.