

Optimizing the Design of Unstructured Meshes Describing North Carolina Coastal Regions to Improve Accuracy of Flood Predictions



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1. Background & Motivation

- ADCIRC Surge Guidance System (ASGS)
 provides forecast guidance for winds, waves and storm surge during a hurricane
- For NC Coast, ADCIRC is run twice daily, and four times daily during severe storms
- The NC-CERA website is shown on the right
- The high-resolution mesh for North Carolina region is the NC9 mesh
- In other regions, meshes with much higher levels of resolution are used
- Similar increase in resolution in targeted locations should improve the predictive accuracy of coastal flooding

Mesh	Elements
NC6b	575,512
NC9	1,230,430
NC9 X 4	4,921,720
SL 16	9,945,623



- Computationally expensive and hence used only during storm events
- For daily forecasts, NC6b mesh is used

Source: http://nc-cera.renci.org/

2. How to Construct an Unstructured Mesh

• NC9 mesh was used in the generation of flood risk maps for FEMA



A hole representing the region to be is cut out from the original mesh

3. Searching for Accuracy Errors

- A mesh having four times the resolution of NC9 was created using SMS – NC9 X 4
- Water levels obtained from ADCIRC runs for Hurricane Irene on this mesh is taken as the "true" solution and was compared against water levels from ADCIRC runs on the NC9 mesh
- This was done by mapping the global water levels file (fort.63) of NC9 mesh on to the NC9 X 4 mesh by linear interpolation







- Morehead City (2011) and NC v2.6 (2008) are 10m resolution DEMs available for the NC region
- Node strings are then drawn representing different features







- The final hole-coverage is then converted to a mesh
- Bathy-Topo values are then interpolated from the DEM onto the meshed hole using Half-element ADCIRC Cell Averaging and it is then merged on to the original mesh



4. Results & Future Work

- The comparison plots shows areas where there are difference in water levels between the NC9 Mesh and the NC9 X 4 mesh
- These are regions where resolution of NC9 Mesh could be increased
- Errors in mass conservation based on a simple mass balance (accumulation minus flux) will be calculated for each element of the NC6b mesh
- Vertices will then be moved from regions with small mass residual errors to regions with large errors
- Thus, the result will be an optimized mesh with improved accuracy in predictions