AN *ADCIRC* MODEL FOR VOLUSIA AND FLAGLER COUNTIES

REFINING MESH RESOLUTION OF A MAJOR URBAN WATERSHED USING VERTICAL FEATURE DELINEATION

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Historic storm surge damage to Volusia and Flagler counties and the area's growing economic value necessitate a refined surge model to bolster local resiliency.

Figure 1 *This photograph was taken on an RTK-GNSS survey of Volusia County and evinces the extensive damage caused by hurricanes Ian and Nicole (2022).*

Contemporary surge models represent large swaths of coast but often suffer from the following deficiencies:

- Coarse resolution meshes are employed for computational efficiency.
- Significant features pertinent to inundation are often not considered in the placing of mesh nodes.
- Elevation is derived from lidar digital elevation models (DEM's), which are prone to error due to light refraction.

The above factors result in underrepresentation of coastal *topography and bottom friction* within the ADCIRC (ADvanced CIRculation) model environment.

The Hurricane Surge On-Demand Forecast System (HSOFS) mesh of average coastal resolution 500m is the finest mesh available for this area. HSOFS is acceptable for emergency management but cannot produce reliable output on a sub-local level.

Figure 2 *The coarse resolution (100m – 500m) of the HSOFS mesh (left) is to be refined to a resolution of 30m using vertical-feature delineation and RTK-GNSS corrected DEM elevation input.*

This research proposes the following:

- For more accurate sub-local output (inundation elevation, velocity, and extent), the HSOFS mesh will be refined to a local resolution of 30m.
- Significant vertical features, namely seawalls and coastal road A1A, will be delineated as feature lines in Surface-water Modeling System (SMS).
- RTK-GNSS field data will supplement the USGS 1m Florida Peninsular DEM along the coastline, focusing on seawalls, beach transects, jetties, and coastal road A1A.

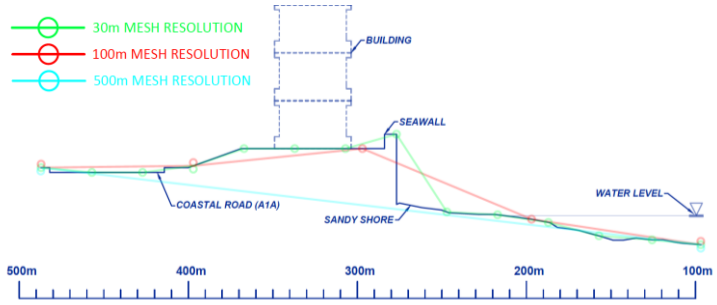

Figure 3 *Profile view of surge path from ocean (right) to inland (left) overlaid with 3 degrees of mesh resolution illustrates substantial differences in coastal representation. Note that 30m mesh resolution would represent the steep gradient between beach and seawall.*

At present, the majority of Volusia County's coast has been RTK-GNSS surveyed. An ArcMap Focal Statistics analysis reveals that RTK-GNSS elevations (regarded as of superior accuracy) differ from DEM elevations at an average of 20cm. Significant discrepancies occur at locations of steep elevation gradient, and the inclusion of seawall feature lines in the revised mesh will mitigate these discrepancies within the model.

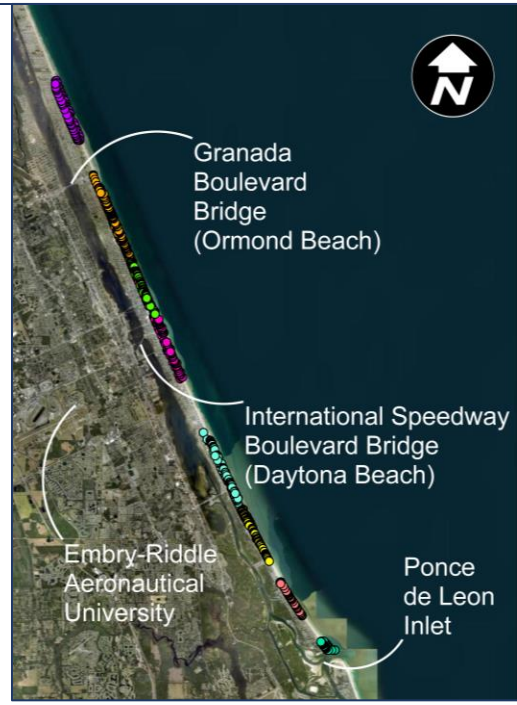

Figure 4 *GIS output of 8 RTK-GNSS surveys along Volusia County's coast. Displayed from south to north, roughly 800 points were collected in Ponce Inlet, Daytona Beach Shores, South Daytona, Daytona Beach, and Ormond Beach.*

To finalize mesh refinement, the following steps will be carried out:

1. Perform tidal analysis of standard HSOFS mesh as baseline data.
2. Synthesize RTK-GNSS data with USGS 1m DEM within ArcMap.
3. Import supplemented DEM into SMS and create feature lines representative of seawalls and coastal road A1A.
4. Pave revised mesh of base resolution 30m.
5. Perform tidal analysis of refined local mesh.
6. Validate new mesh using historic NOAA tide station data.

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Thank you!