Overland Wave Modeling & Mapping: Notable Challenges

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Modeling and Mapping Challenges

• Building a seamless SWEL surface from a point dataset
• A case for including reverse/backside transects for wave analysis
• Delineation of the Primary Frontal Dune line in atypical dune ridge environments
• Engineering judgement and the LIMWA line
• Coastal Structures
Building a seamless SWEL surface from a point dataset
Storm Surge Surface Creation

- Data gaps
Storm Surge Surface Creation – Edisto Island
Storm Surge Surface Creation – Horry County
A case for including reverse/backside transects for wave analysis
Reverse Transects for Wave Analysis

~12,500 ft
Reverse Transects for Wave Analysis

Section D.2.7.2

Transects should be located along any shoreline across which damaging waves may propagate during the base flood. This certainly includes all open-coast shorelines and other shorelines along large sheltered bodies of water subject to storm surge flooding (bays, sounds, and estuaries). However, damaging waves are not likely to accompany storm surge flooding along portions of small tributaries leading into large coastal bodies of water, particularly where those tributaries are narrow and winding and fetches are short. WHAFIS transects will not be required in these instances.

The Mapping Partner shall also consider multiple flooding sources when specifying transects. For example, different transects may be required along different sides of a barrier island, if both the open coast and the back side of the island are subject to waves during a severe storm (high winds and waves may approach the island from different directions). This situation may require multiple specifications for water level and wave height, and multiple overland wave height analyses, with the flood map based on the more severe water level and wave conditions on land. Ultimately, transect specification requires a balance between representing coastal flood and
Reverse Transects for Wave Analysis
Reverse Transects for Wave Analysis
Reverse Transects for Wave Analysis

Storm Surge
Reverse Transects for Wave Analysis

Review Wave data for specific node
Reverse Transects for Wave Analysis

- Hydrographs of storm events

**Storm Hydrographs for ADCIRC Node XYZ**

- Storm Surge (Storm A)
- Storm Surge (Storm B)
- Storm Surge (Storm C)

**1 PCT SWEL**

- Time (hours)
- Storm Surge Height
Reverse Transects for Wave Analysis
Reverse Transects for Wave Analysis

AE 7 Gutter

AE Zone
VE Zone
Reverse Transects for Wave Analysis
Delineation of the Primary Frontal Dune line in atypical dune ridge environments
Primary Frontal Dunes

- Primary Frontal Dunes (44 CFR, Section 59.1):
  - “a continuous or nearly continuous mound or ridge of sand with relatively steep seaward and landward slopes immediately landward of and adjacent to the beach and subject to erosion and overtopping from high tides and waves during major coastal storms.”
Primary Frontal Dune – St Johns County, FL
Primary Frontal Dune – St Johns

Large Dune Ridge:
- 300 – 600 ft wide
- 1-2 rows w/commercial

Narrower Frontal Ridge
- Merges and diverges
- Consistent and vegetated
Primary Frontal Dune – St Johns
Primary Frontal Dune – St Johns
Primary Frontal Dune – Beaufort, SC

- Large developed ridge
- Smaller frontal ridge
Primary Frontal Dune – Beaufort, SC
Primary Frontal Dune – Coastal Structure Case

• Section D.2.11.2.1 (FEMA, 2007):

It is possible the a PFD maybe identified landward of a shore protection structure. If the structure can be certified……the VE zone should be delineated based on wave analysis…. …If the structure cannot be certified and the structure will partially or completely fail….the VE zone should be mapped to the PFD landward heel.
Primary Frontal Dune – St Johns
Primary Frontal Dune – St Johns
Primary Frontal Dune – St Johns
Engineering judgement and the LIMWA line
LiMWA – Operating Guidance 13-13

• Delineated only in conjunction with a VE Zone
• Only one LiMWA line per flooding source
• Where possible LiMWA should not cross flood zone boundaries and gutters
• LiMWA should not be depicted within VE zones, X zones, AE zones where the BFE approximately matches the SWEL
PFD Limits the V-Zone

Limit of 1.5 ft Wave Height
LiMWA – Operating Guidance 13-13
LiMWA – Edisto Island
LiMWA – Edisto Island
Coastal Structures
Coastal Structures - References


• FEMA, 1990, Criteria for Evaluating Coastal Flood Protection Structures for the NFIP.
  – Design Criteria
  – Certification Requirements
If the available information does not clearly point to survival or failure of a coastal structure, the Mapping Partner may either:

1. **Conduct a detailed evaluation based on the FEMA criteria (April 23, 1990)** (see the previous subsection).

2. **Perform the erosion and wave analyses for both the intact and failed structure cases** and map the flood hazards associated with the more hazardous case.
Coastal Structures

Partial failure of a sloping revetment.

Revetment failure geometry.

Failed soil slope.

Previous beach.

Storm water level.

Eroded beach.

Depth of scour.

Failed vertical structure.

Rough, porous slope.

Existing grade.

Presentation Title
Coastal Structures - Revetments

Transect 7
Coastal Structures - Revetments
Coastal Structures - Seawall
Coastal Structures - Seawall

Intact

SWEL

Erode to wall

Failed Profile

Adjusted Intact Profile

Intact_Profile

Toe

Peak

SWEL

Failed Structure Profile

Station, FT

Elevation (NAVD88, FT)

1 on 50
Thank You