FEMA Region III Maryland Coastal Flood Hazard Study

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RiskMAP
Increasing Resilience Together

FEMA's Risk MAP Program

- Risk Mapping, Assessment and Planning 2010 -2014
- Builds on Map Mod digitized Flood Insurance Rate Map (FIRM) successes
- Will deliver quality data that increase public awareness and lead to action that reduces risk to life and property.
- Watershed approach
- Regulatory Products: Flood Insurance Study (FIS) and FIRM (Coastal re-mapping)
- New Non-Regulatory Products and Datasets

Why We're Doing This: Hazard Mitigation

- Hazard Mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from hazards
- FEMA encourages local governments to develop Hazard Mitigation Plans
  - To increase public and political support and commitment for mitigation
  - To be eligible for Hazard Mitigation Assistance grants
- Use new Risk MAP information to update your Hazard Mitigation Plan

Non-Regulatory Coastal Flood Risk Products and Datasets

- Flood Risk Products
  - Flood Risk Report
  - Flood Risk Database
  - Flood Risk Map
- Flood Risk Datasets
  - Changes Since Last FIRM
  - Coastal Depth Grids
  - Flood Risk Assessment (refined Hazus analysis)
- Flood Risk Products help communities:
  - Gain a better understanding of flood risk and its potential impact on communities and individuals
  - Take proper mitigation actions to reduce this risk

FEMA

Storm Surge Study and Overland Coastal Hazard Analysis

RiskMAP
Increasing Resilience Together

A JV of Dewberry, URS, and ESP
RAMPP
Risk Assessment, Mapping, and Planning Partners

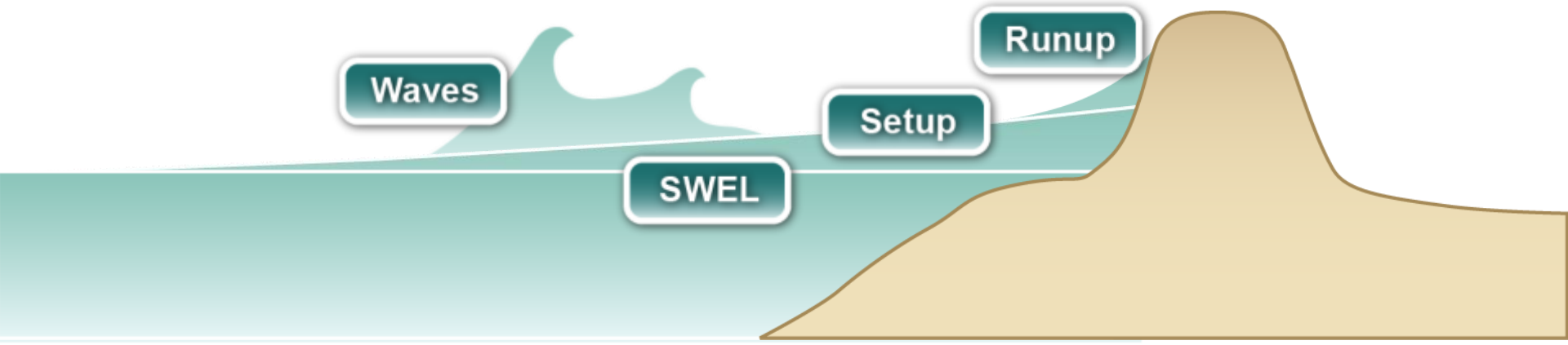
FEMA Coastal Flood Hazards

Base Flood Elevation on FIRM includes 4 components:

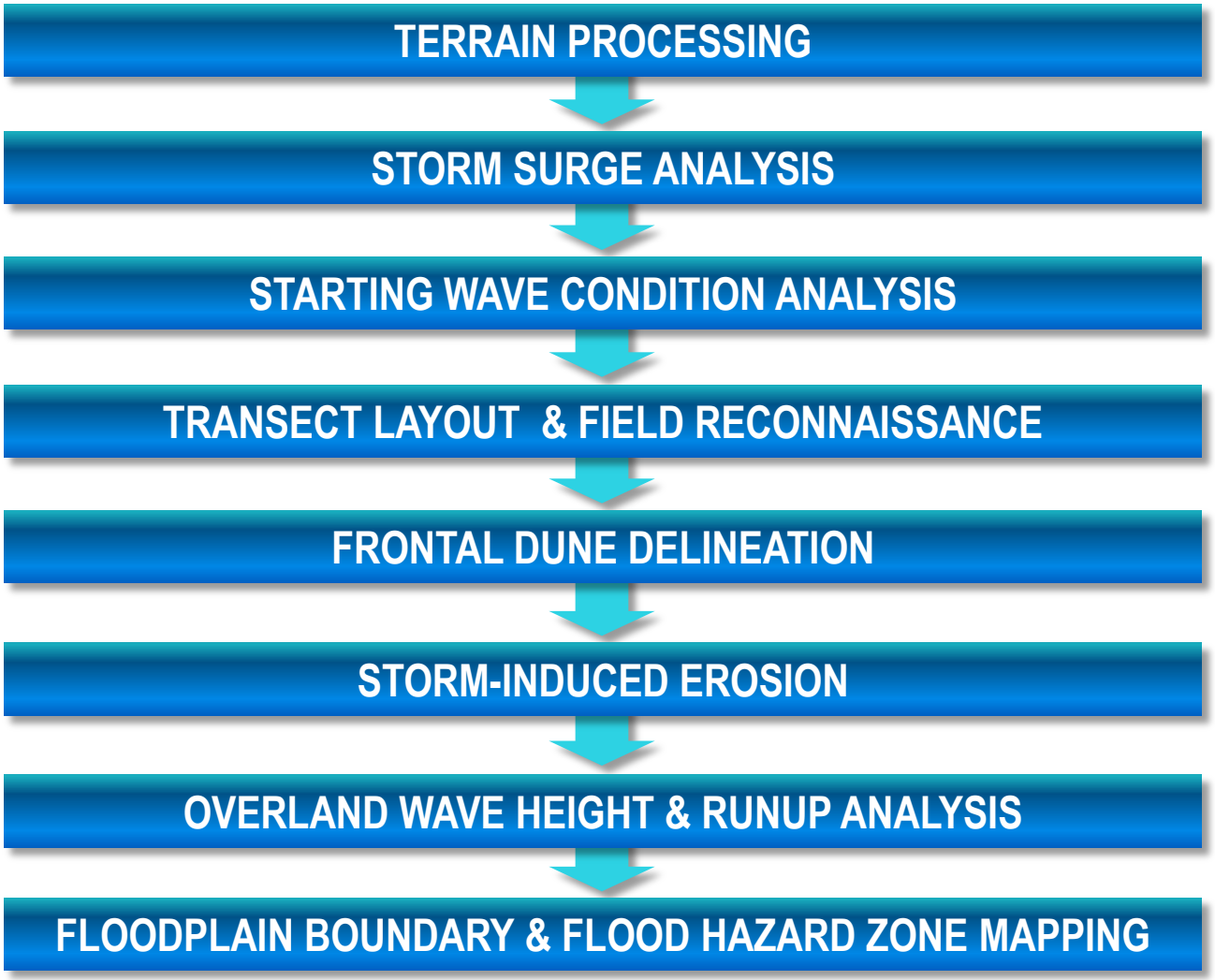
1. Storm surge stillwater elevation (SWEL)
2. Amount of wave setup

} Determined from storm surge model

3. Wave height above storm surge (stillwater) elevation
4. Wave runup above storm surge elevation (where present)



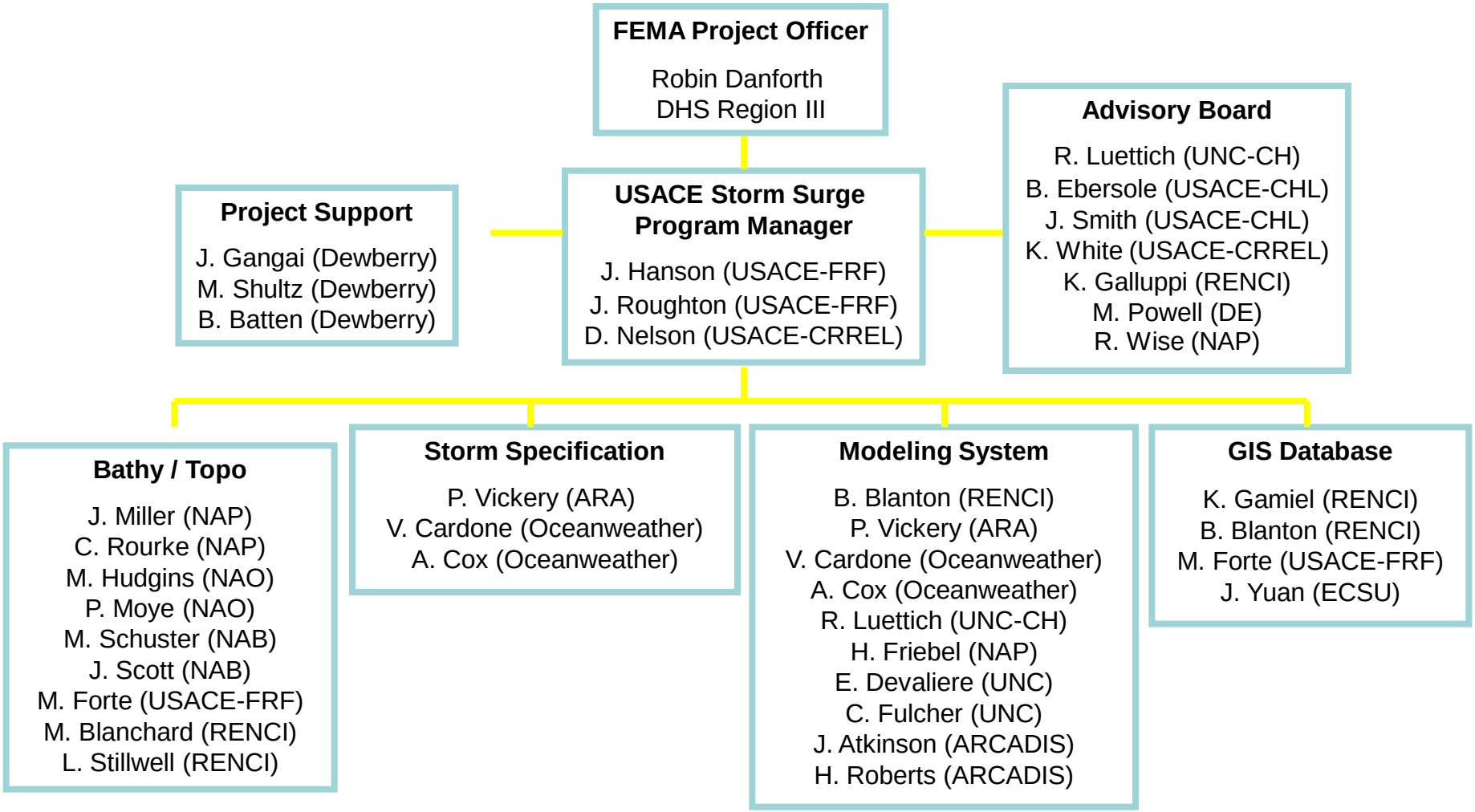
Coastal Study Process



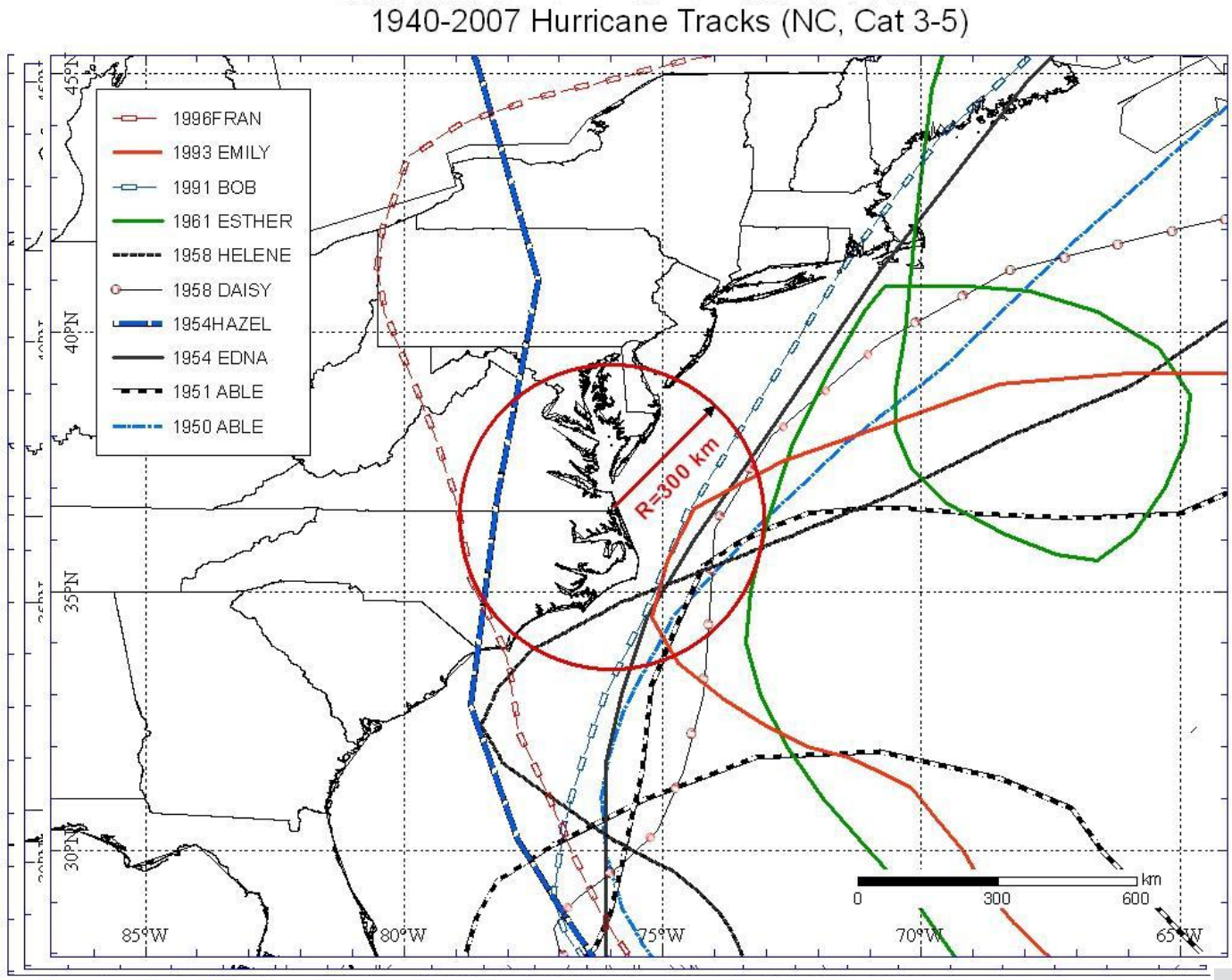
FEMA Region III Study Area

- Four states plus District of Columbia
- Five metropolitan areas
- Complex coastal geomorphology
- Delaware River/Bay system
  - Tidal up to Trenton, NJ
  - 782 square mile bay
  - Strategic shipping and military port
- Chesapeake bay
  - Third largest estuary in world
  - 11,000 miles of tidal shoreline
  - Major shipping, seafood and military ports

FEMA RIII Storm Surge Project Organizational Chart

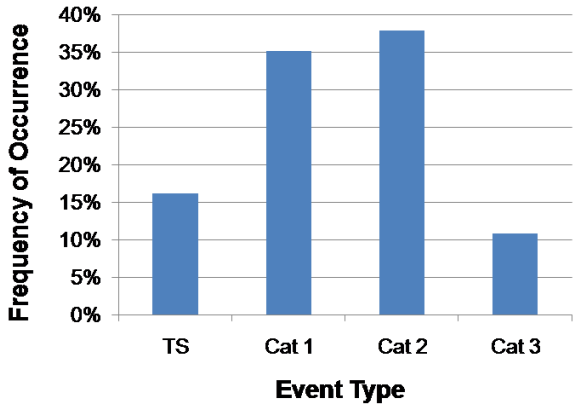


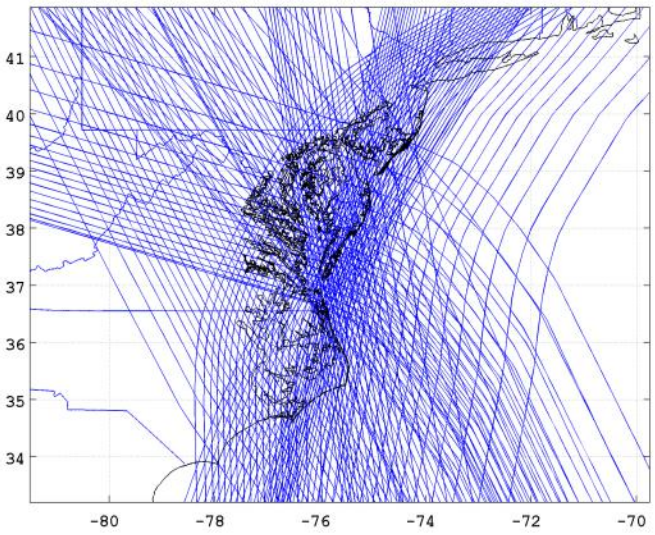
Historic Tropical Storms



Tropical Storm Selection

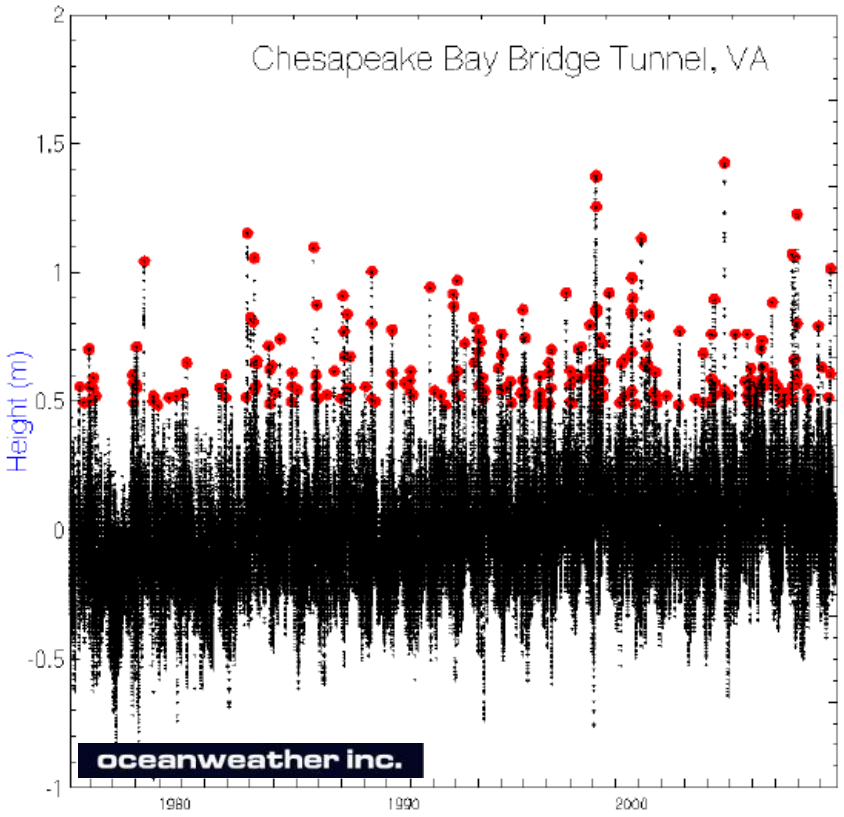
- Critical parameters:
  - Central pressure deficit
  - Radius to max winds
  - Translation speed
  - Heading
  - Holland B (broadening)
- Synthetic tracks are developed based on a combination of the above parameters
- Each storm is weighted by probability of occurrence from parameter distribution/Joint Probability Method
- TC96 and HBL models to simulate tropical storm wind fields



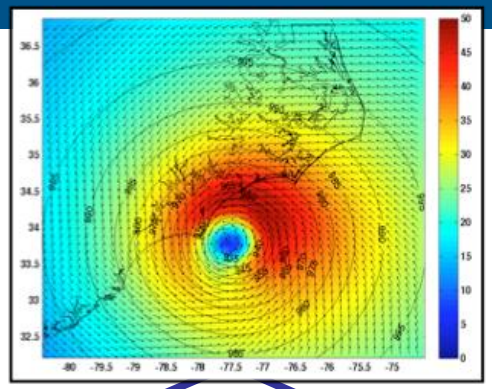


Extratropical Storm Selection

- Storm-ranking of surge events based on NOS measurements
- 7 stations found to have good data coverage between Jan 1975 and Aug 2008
- Water level peaks greater than the 99th percentile residual water (surge) were identified and ranked
- 30 storms were selected based on the above ranking system
- PBL model is used for the generation of wind and pressure fields



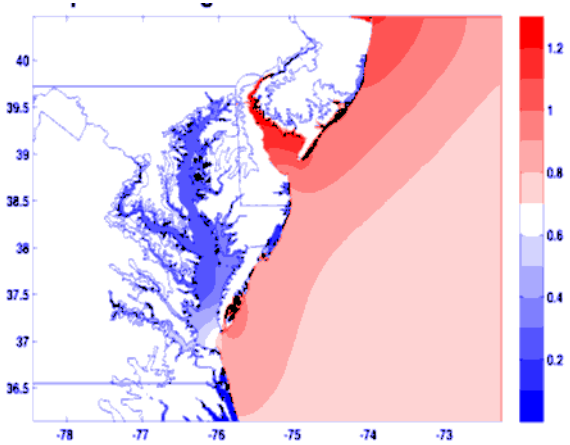
Storm Surge Modeling System



Wind and Pressure Fields

TC96 PBL Hurricane Model
OWI Extratropical Reconstructions

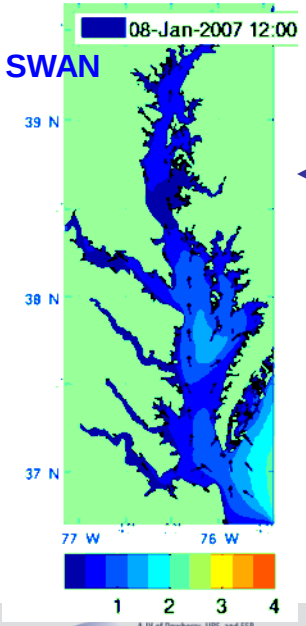
Water Levels

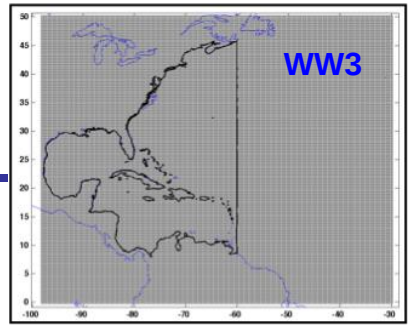


ADCIRC Coastal Circulation and Storm Surge Model

Coupling

Waves/ Radiation Stress

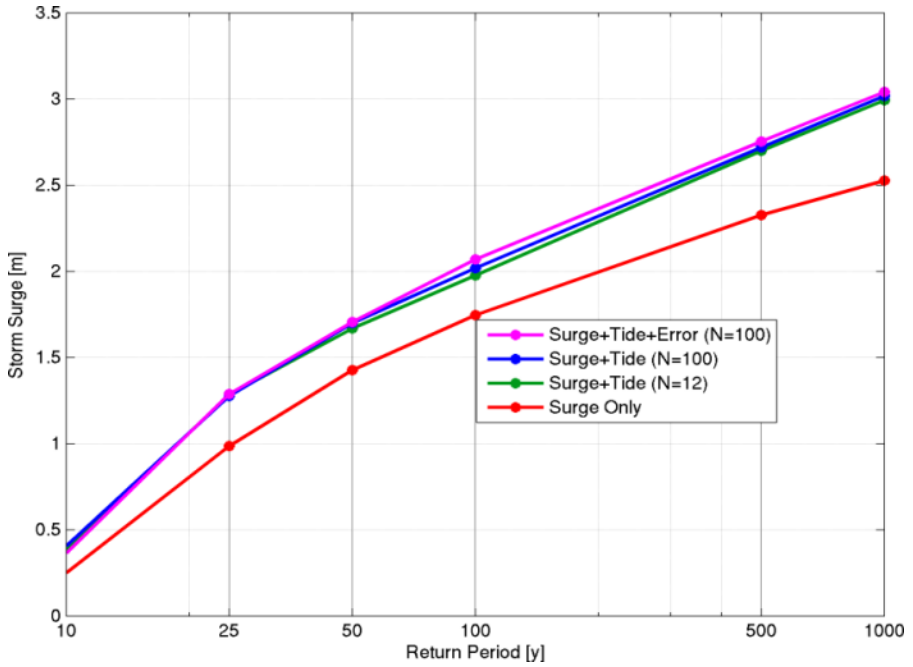




WaveWatch III
Basin Scale Waves
SWAN
Coastal Waves
Radiation Stress

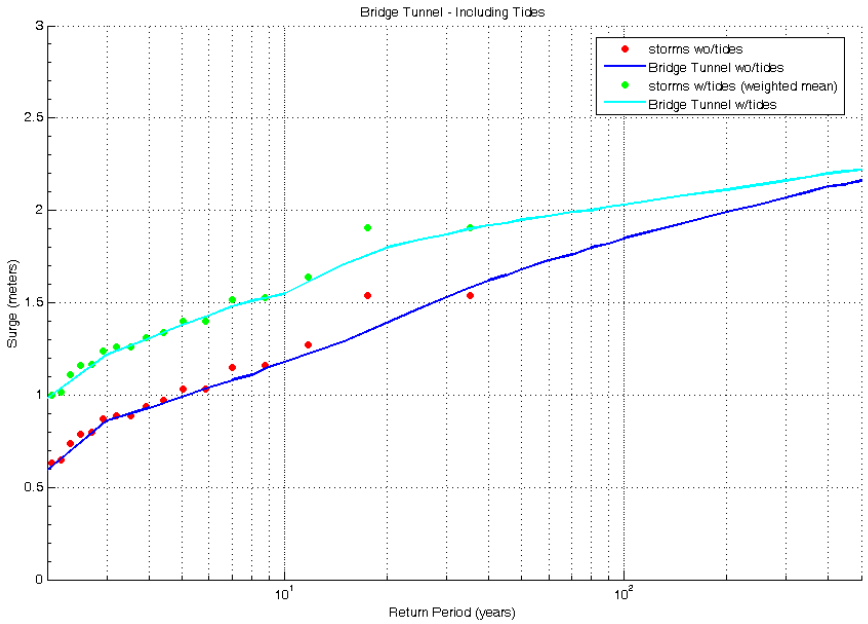
Tropical – Tide Contribution

- Assumes that any storm can occur at any point in the tidal cycle
- 100 Random sampling of tidal cycle for each storm
- Randomly selected tide level added to simulated surge level
- The 156 simulated storms duplicates 100 times per storm giving 156,000 surge responses at each calculation point.



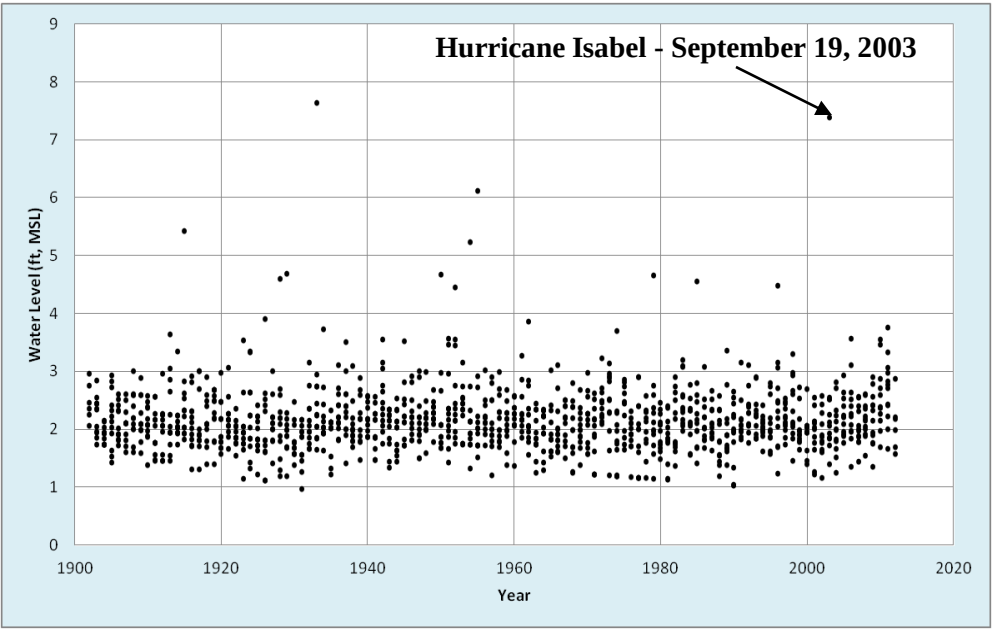
ExtraTropical – Tide Contribution

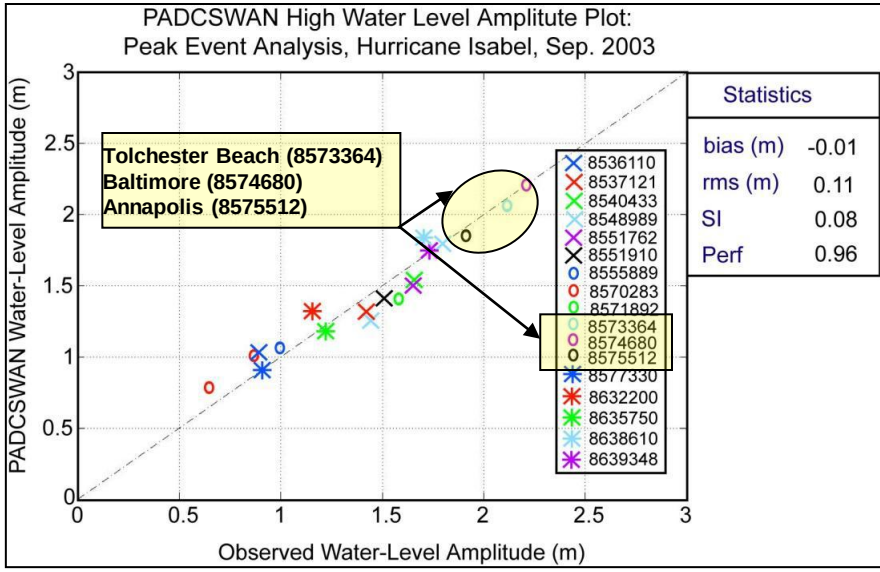
- The tide contribution to total water surface elevations was accounted for by expanding each storm to four realizations with tides.
- Assumes extratropical storms are of sufficient duration that high tide will occur during the event.
- Peak storm surge was increased by the high tide amplitude corresponding to mean, neap, and spring tidal ranges.
- Introduced relative weighting of 2 for storms associated with mean high tides, storms associated with neap and spring high tide were given a weight of 1.



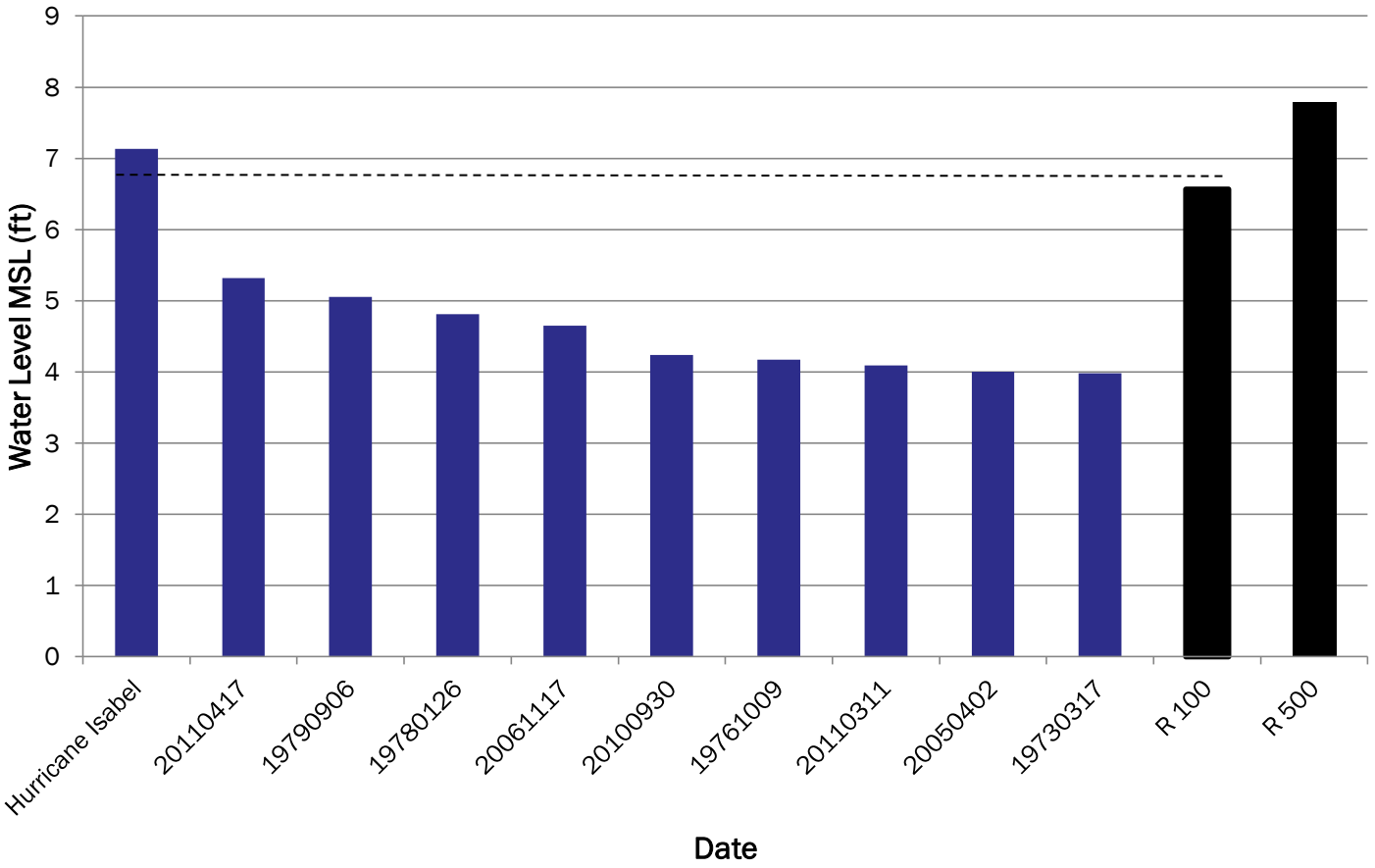
Gage Data – Hurricane Isabel, 2003

NOAA Station	Hurricane Isabel Peak WL, measured (ft MSL)	Hurricane Isabel Peak WL, modeled (ft MSL)	Difference, modeled - measured (ft MSL)	Updated 1%-annual-chance SWEL (ft, MSL)	Updated 0.2%-annual-chance SWEL (ft, MSL)
Baltimore, MD (8574680)	7.4	7.0	-0.4	5.2	7.3
Tolchester Beach, MD (8573364)	7.1	6.5	-0.6	5.2	6.6
Annapolis, MD (8575512)	6.4	6.0	-0.4	4.5	6

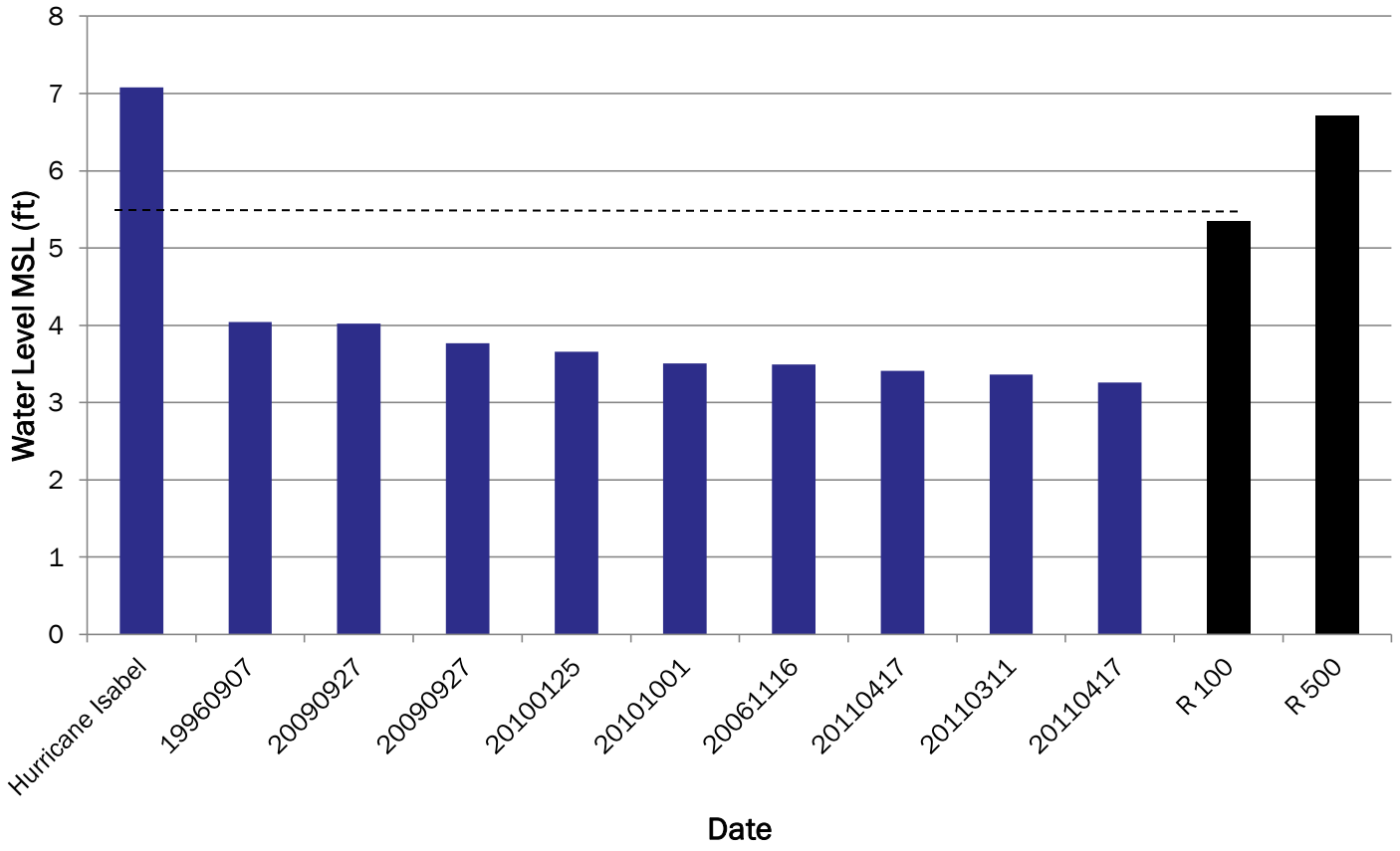




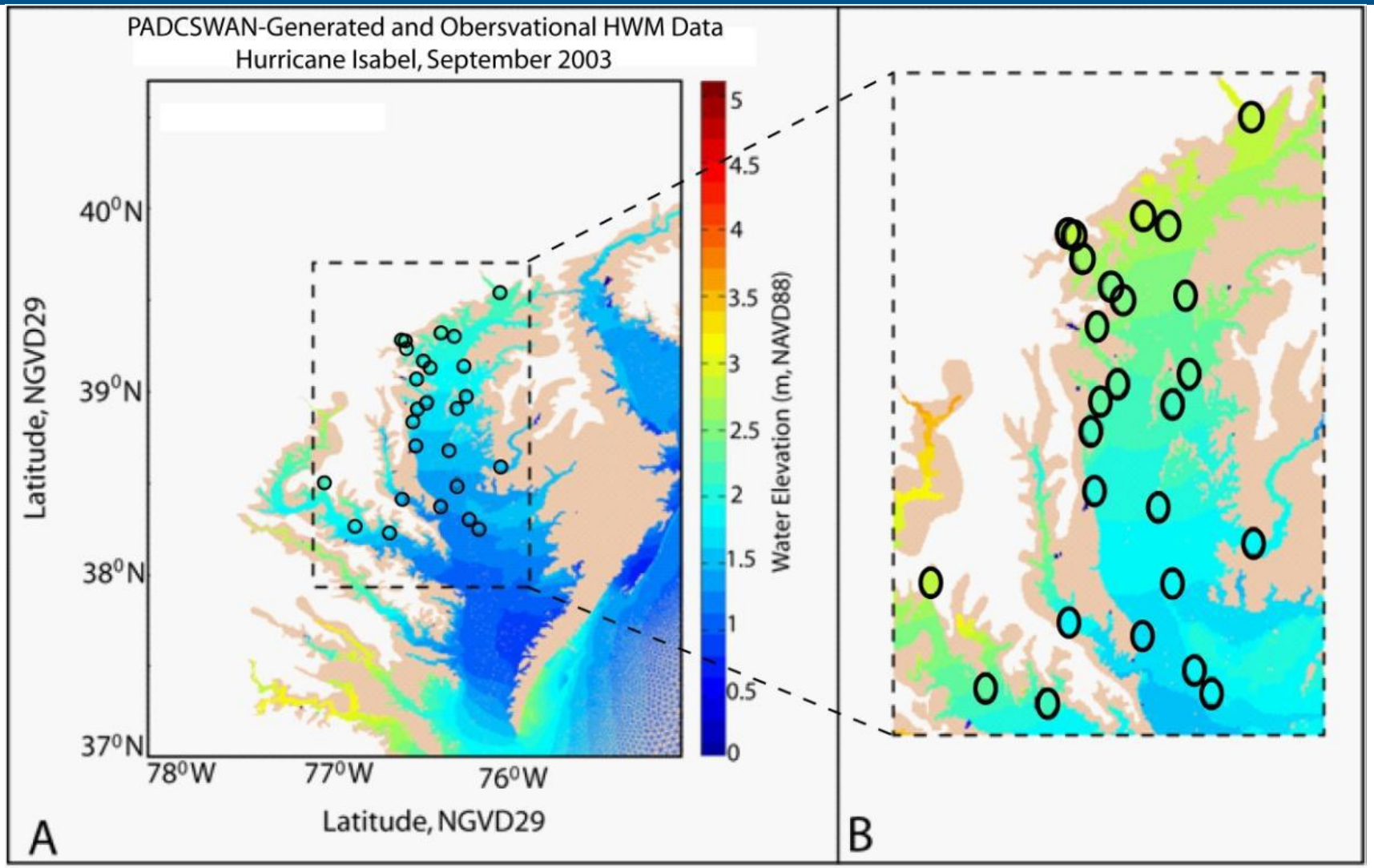
Gage Data - Chesapeake City



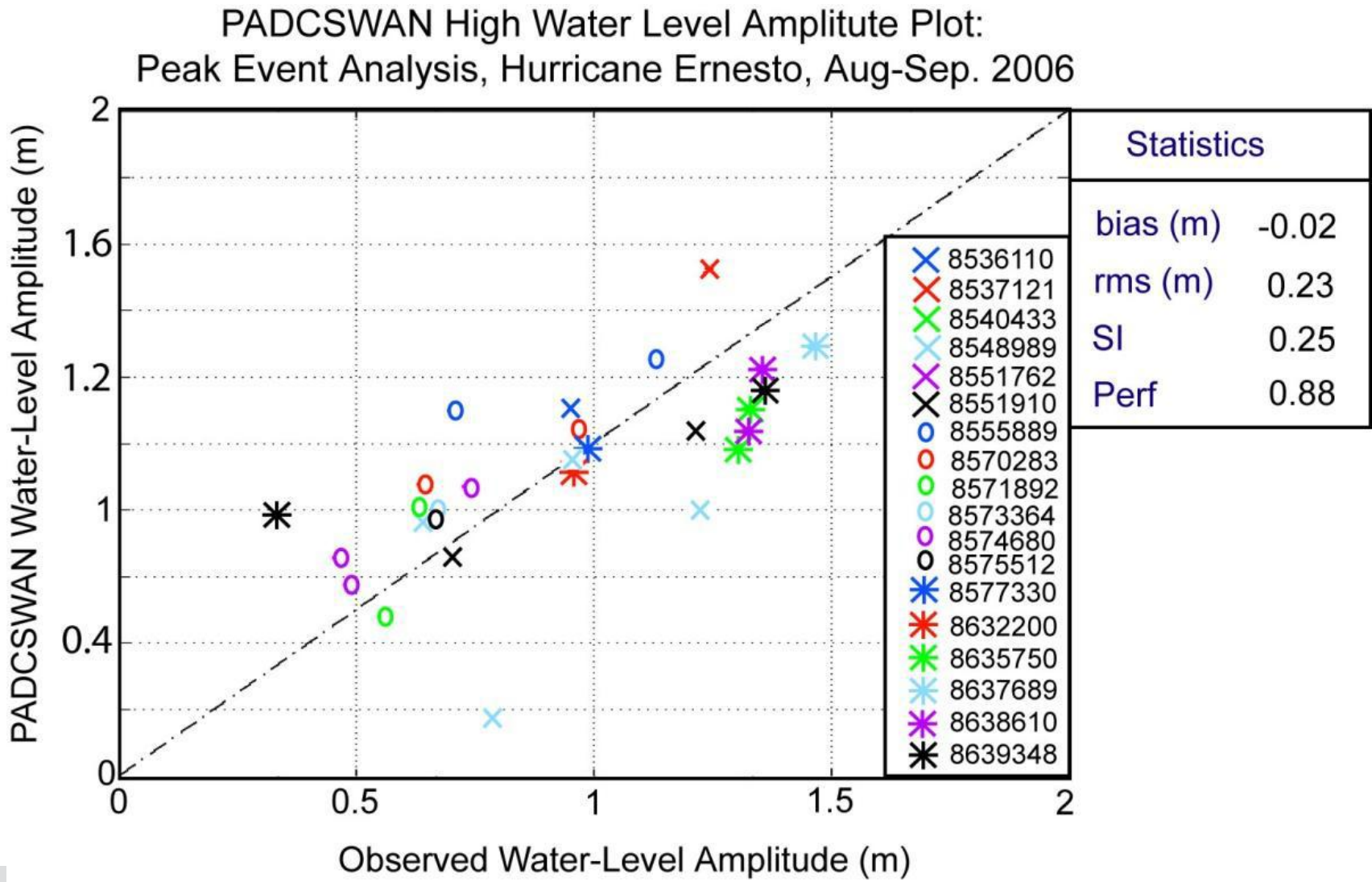
Gage Data – Tolchester Beach



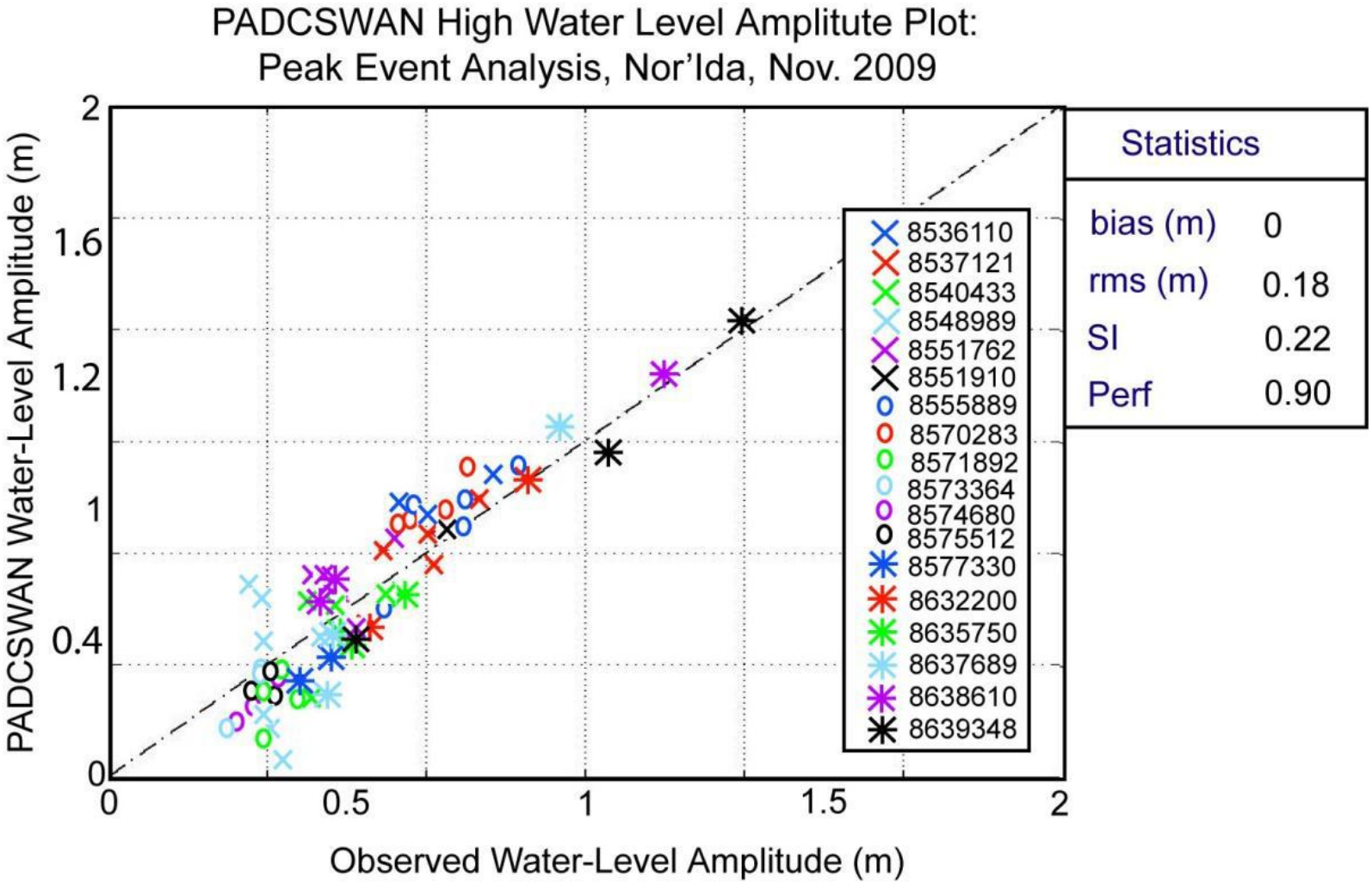
Isabel HWM


PADCSWAN-Generated and Obersvational HWM Data
Hurricane Isabel, September 2003
40⁰N
39⁰N
38⁰N
37⁰N
78⁰W
77⁰W
76⁰W
Latitude, NGVD29
Latitude, NGVD29
Water Elevation (m, NAVD88)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
A
B

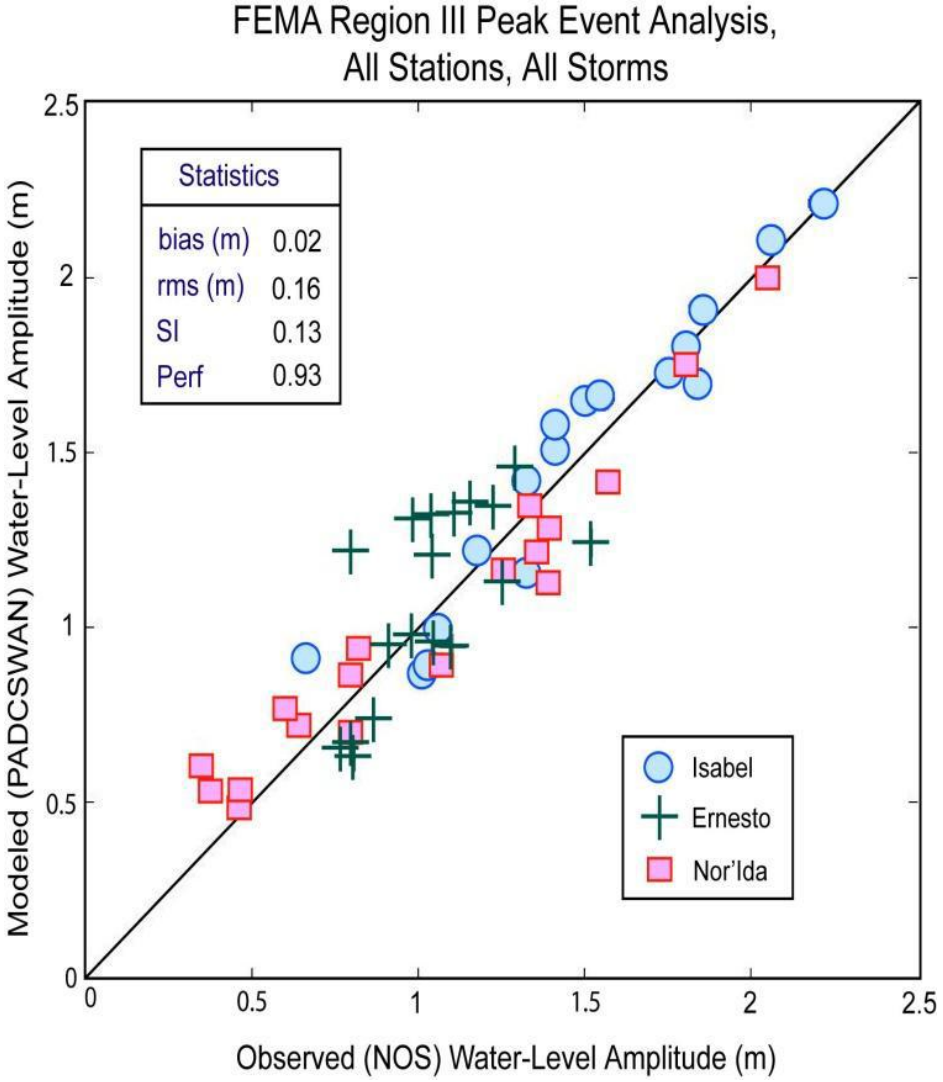
Ernesto Validation



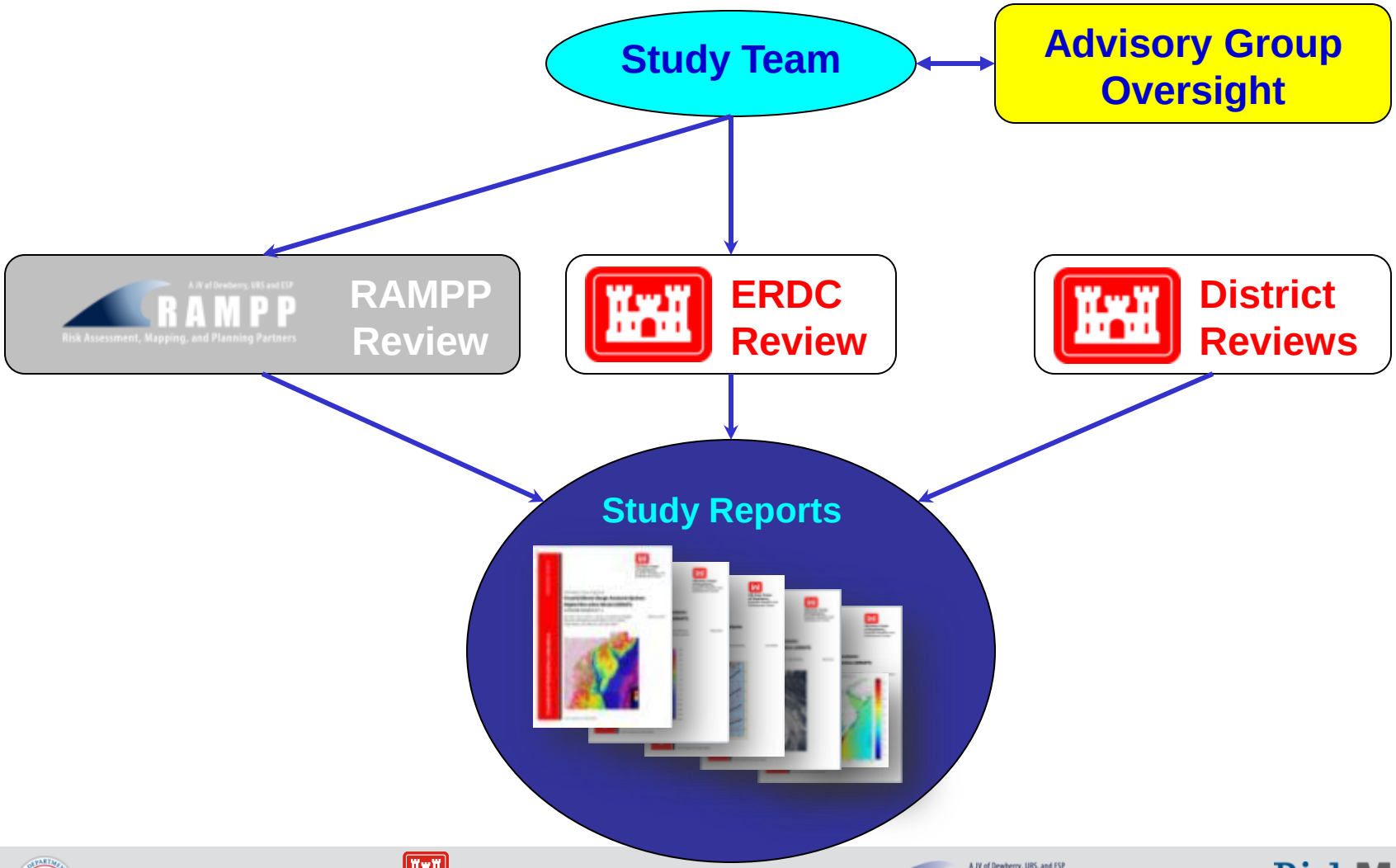
Nor'Ida Validation



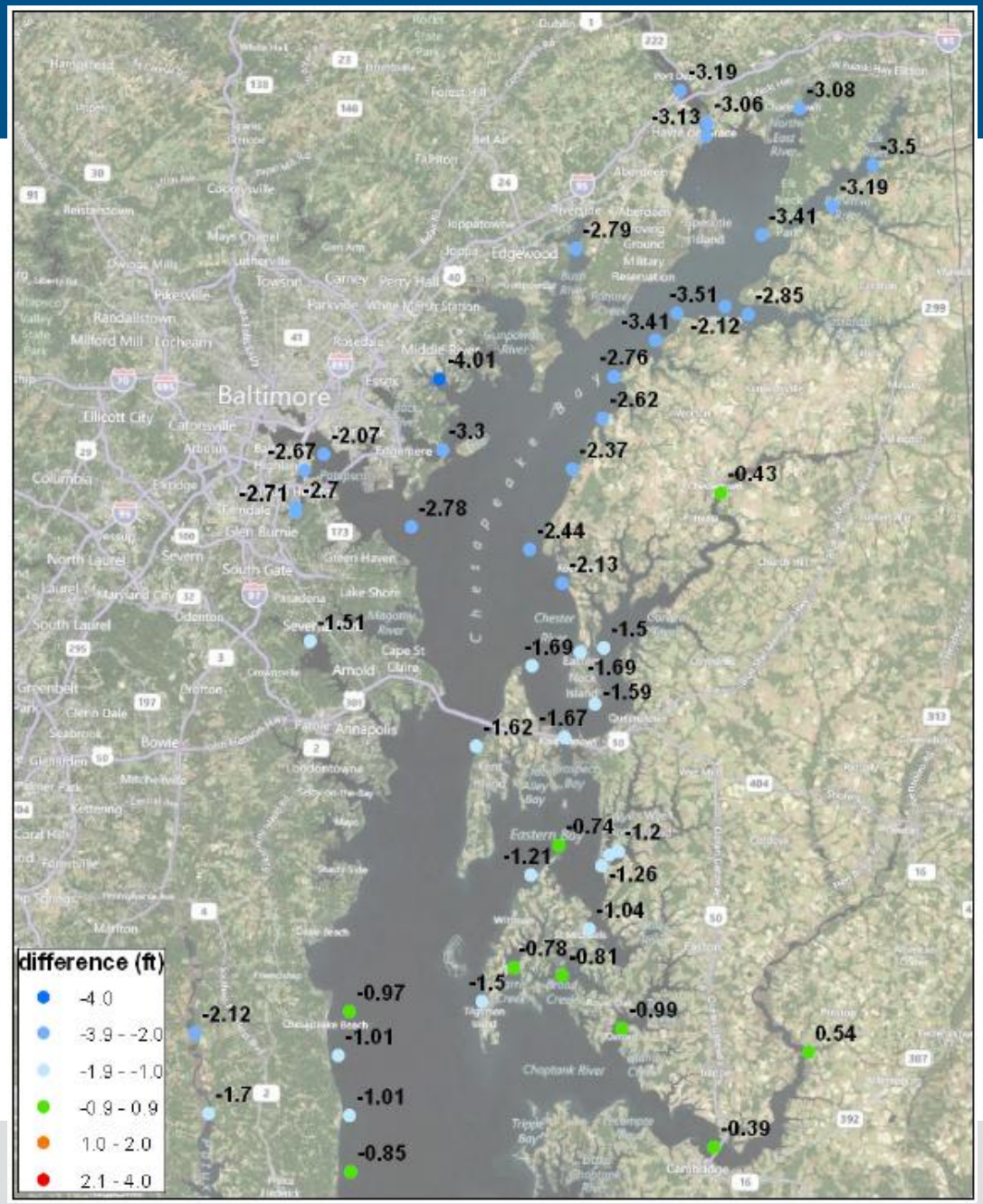
Combined Validation



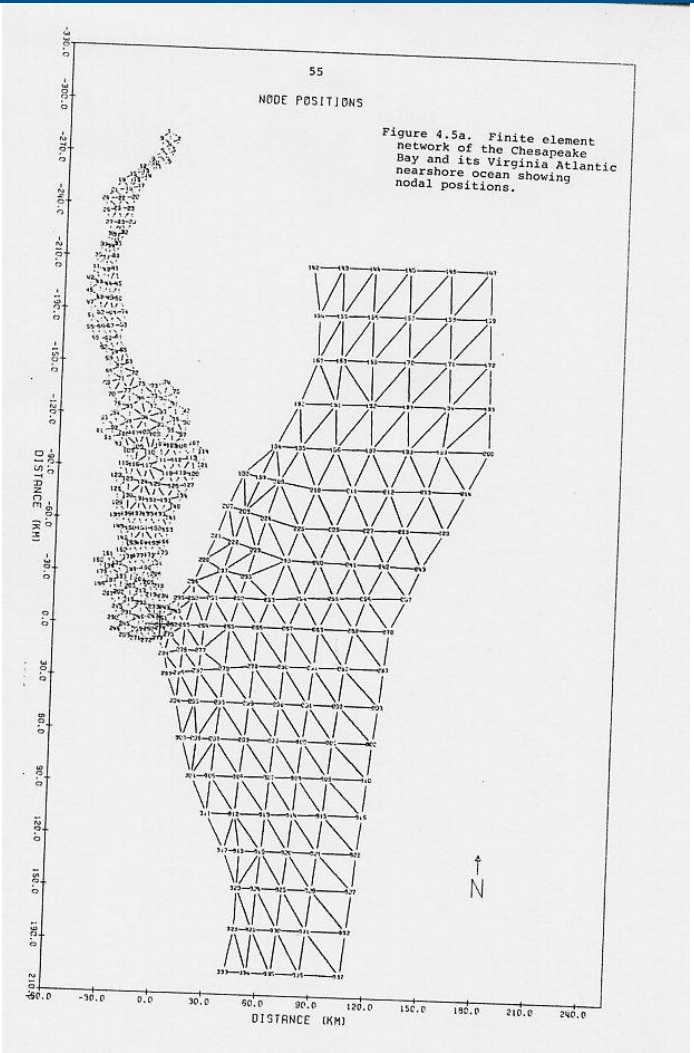
National and Regional Expert Review of Study Results



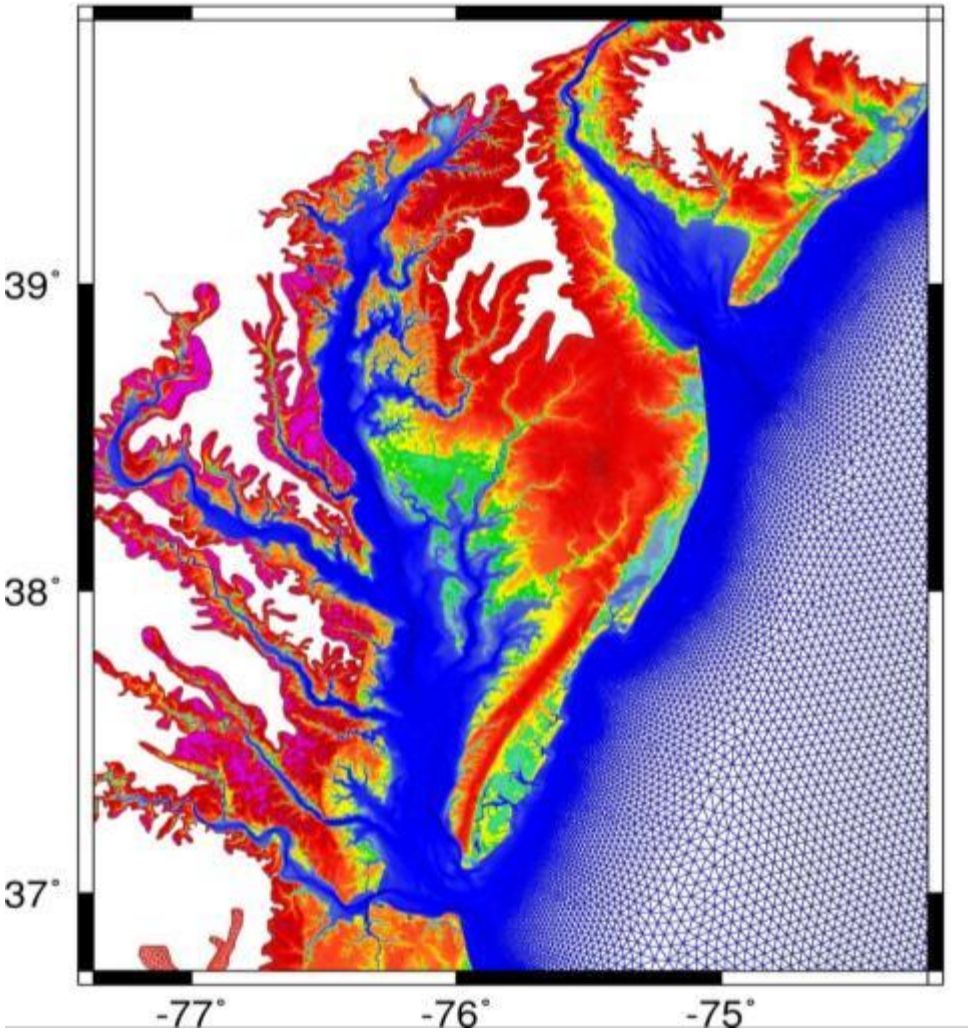
Effective vs. Revised SWEL Differences



1978 Mesh
3-6 mile resolution



2011 Mesh
100 ft Minimum Resolution



Coastal Hazard Analyses Components

Transect layout

Field Reconnaissance (land use, obstructions, shoreline conditions, structures)

Starting wave conditions (wave height and period) from 2D wave modeling eliminating the need for limited fetch analysis

Wave setup from 2D wave modeling

Primary Frontal Dune (PFD)

Dune and Bluff erosion

WHAFIS modeling for overland wave height computation

2% Wave Runup

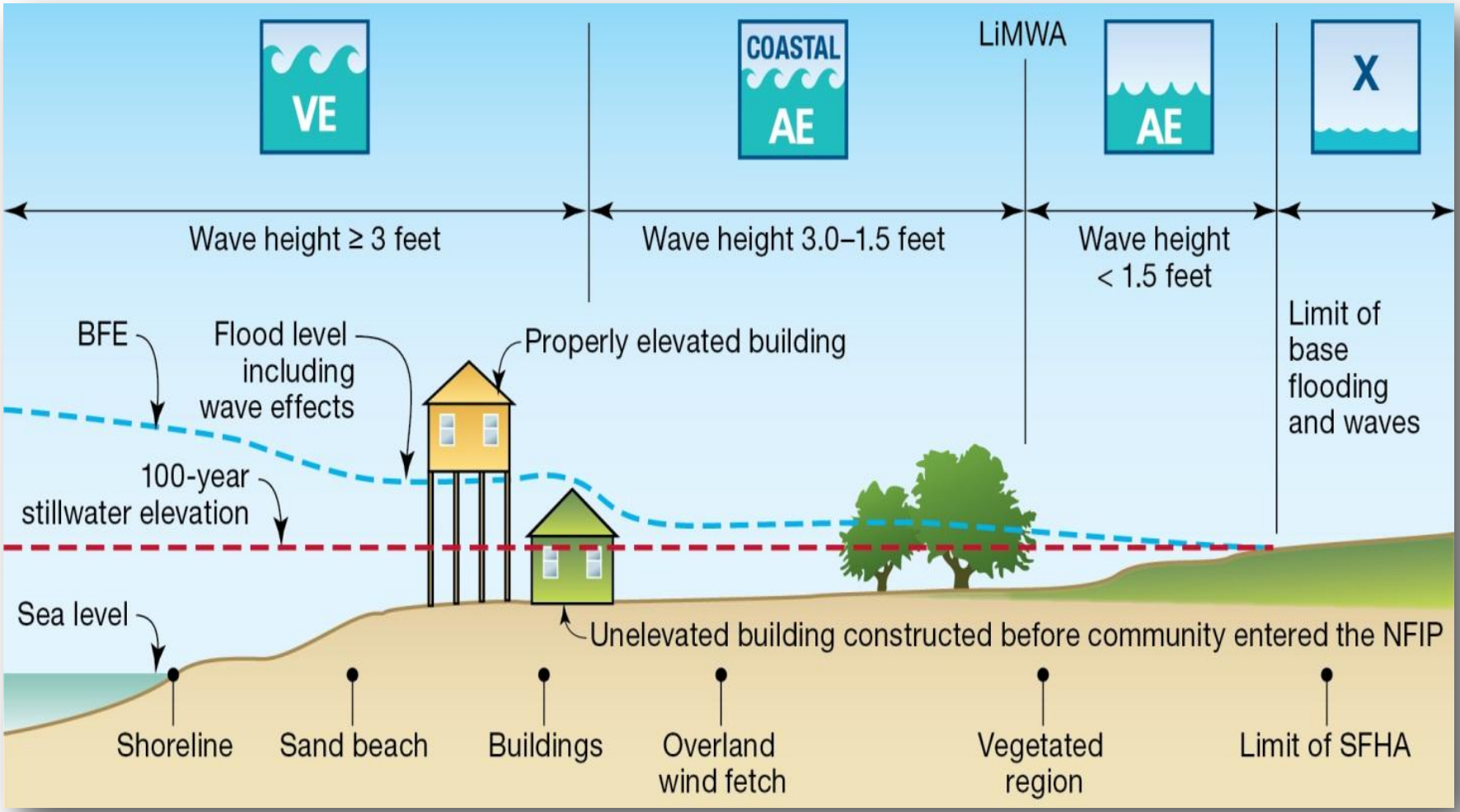
Mapping

- Base Flood Elevation (BFE): The height in feet above a certain datum, in this case North American Vertical Datum of 1988 (NAVD 88), that flood waters have a 1 percent annual chance of reaching or exceeding in any given year

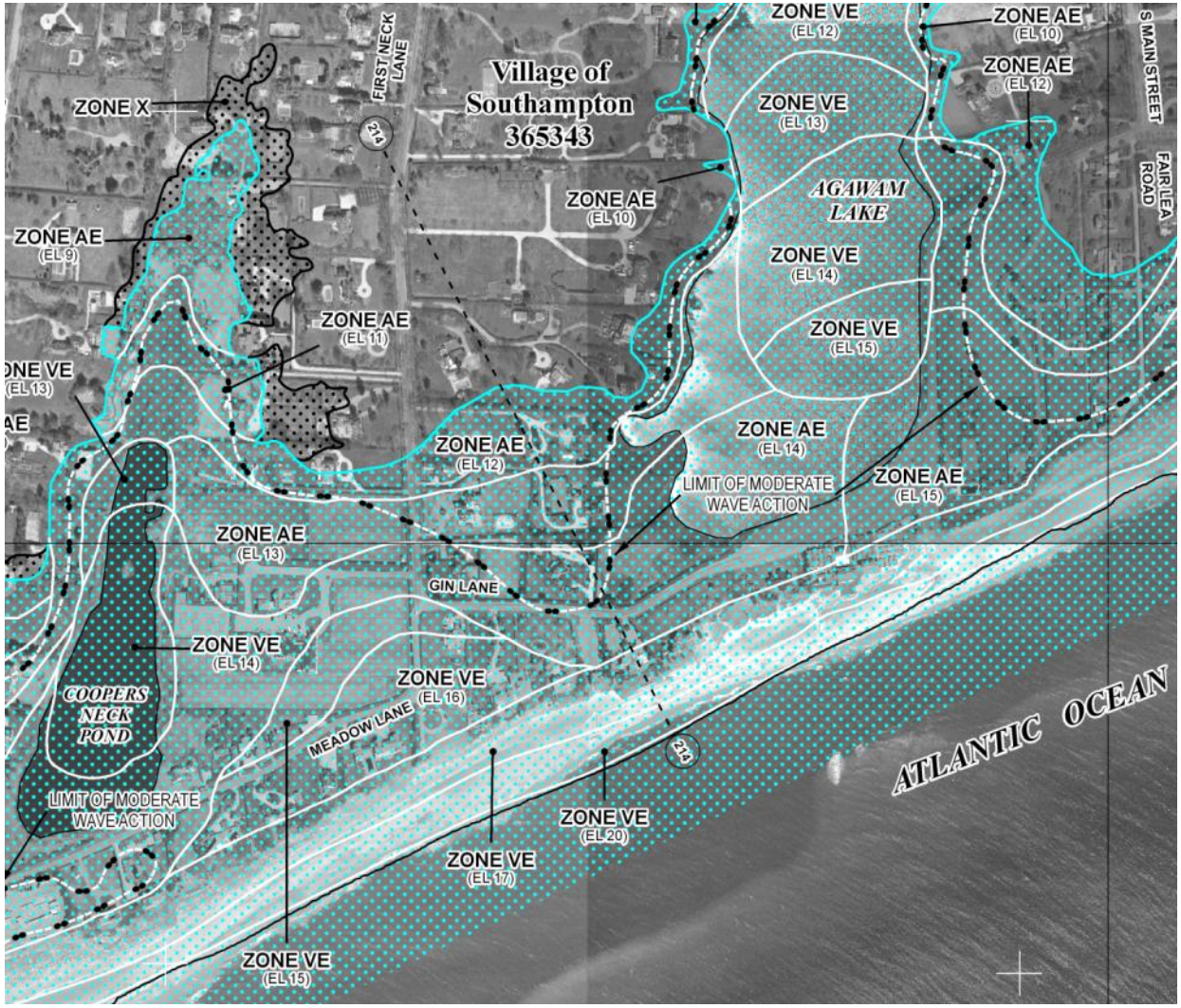
Mapping *(continued)*

- Zone VE: Defined by wave heights of 3 ft. or greater
- Zone AE: Defined by wave heights ranging from 0-3 ft.
- Limit of Moderate Wave Action (LiMWA): Defined by the area subject to wave action with waves greater than 1.5 ft. in height

Mapping *(continued)*



Revised FIRMs



Anticipated Coastal Preliminary FIRM Dates

PROJECT	PRELIMINARY DATE
Kent County, MD, Coastal Countywide	9/30/2012
Queen Anne's County, MD, Coastal Countywide	9/30/2012
Baltimore City (Ind), MD, Coastal PMR	11/30/2012
Baltimore County (Uninc Areas), MD, Coastal PMR	11/30/2012
Prince George's County, MD, Coastal PMR	11/30/2012
Caroline County, MD, Coastal Countywide	1/2/2013
St. Mary's County, MD, Coastal PMR	2/28/2013
Dorchester County, MD, Coastal PMR	3/21/2013

Anticipated Coastal Preliminary FIRM Dates

Somerset County, MD, Coastal PMR	3/21/2013
Calvert County, MD, Coastal PMR	3/21/2013
Worcester County, MD, Coastal Countywide	4/1/2013
Anne Arundel Co., MD, Coastal PMR	4/30/2013
Harford County, MD, Coastal PMR	10/31/2013
Cecil County, MD, Coastal PMR	8/1/2013
Talbot County, MD, Coastal PMR	9/1/2013
Charles County, MD, Coastal PMR	9/1/2013
Wicomico County, MD, Coastal PMR	11/1/2013

FEMA