RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

AN EPA REGION 1 CLIMATE MAPPING EFFORT

BRIEFING FOR THE NORTHEAST REGIONAL OCEAN COUNCIL

MAY 21, 2015

IVY MLSNA, MLSNA.IVY@EPA.GOV

Summary of Presentation

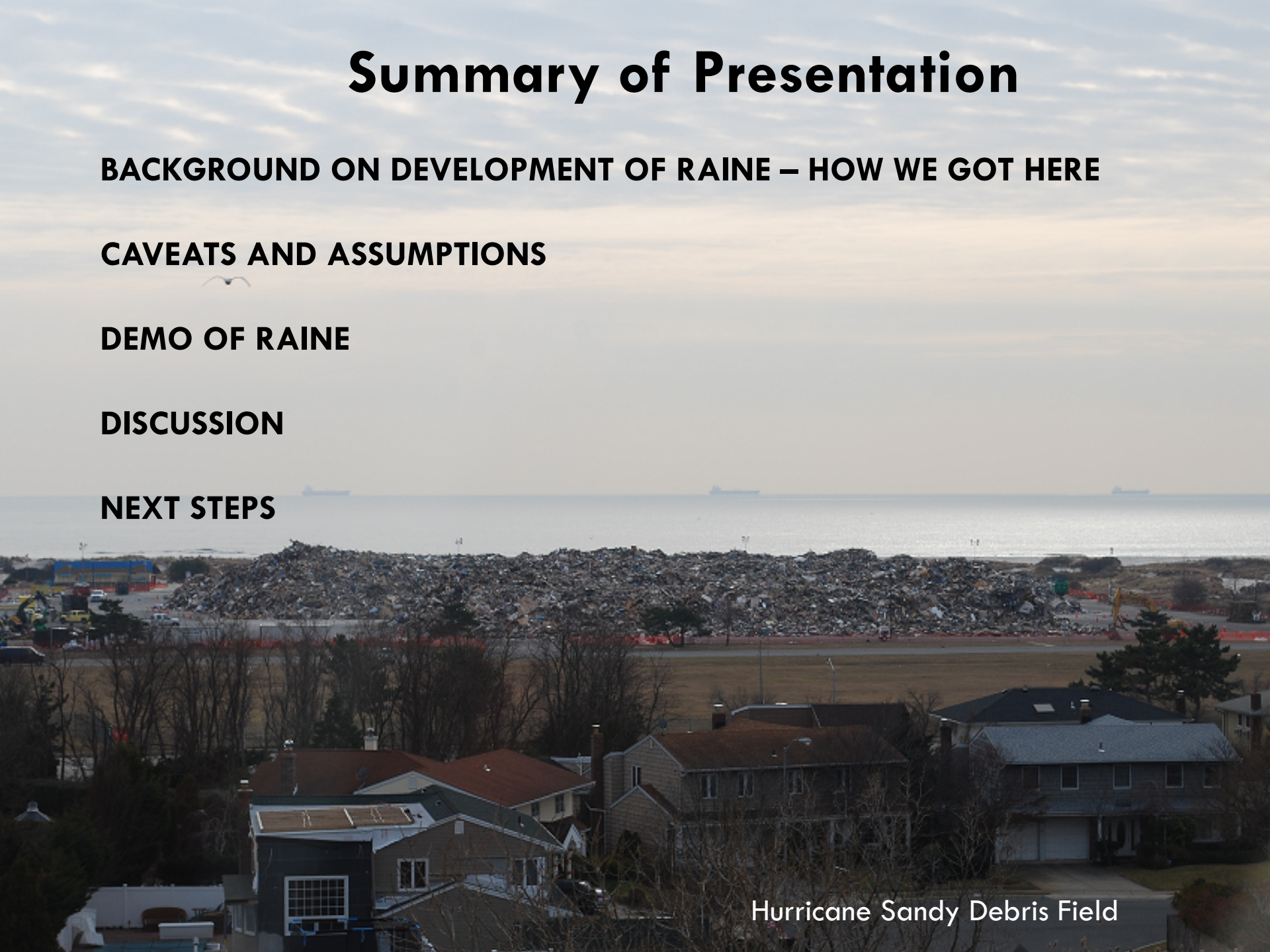
BACKGROUND ON DEVELOPMENT OF RAINE – HOW WE GOT HERE

CAVEATS AND ASSUMPTIONS

DEMO OF RAINE

DISCUSSION

NEXT STEPS



Hurricane Sandy Debris Field


PREPARING FOR
CLIMATE CHANGE
LEADERS SUMMIT
Friday, Nov. 8, 2013
9:00 a.m. – 5:00 p.m.
Johnson & Wales University, Harborside Campus, Providence, RI
WE INVITE YOUR PARTICIPATION
during this invitation-only, Climate Leadership Summit:
Strengthening New England Communities

FOLLOW UP TO THE SUMMIT

6 WORK GROUPS FORMED (FED/STATE/LOCAL/REGIONAL REPS)
WORKGROUPS ARE NO LONGER ACTIVE – NE STATES ARE COLLABORATING

A VULNERABILITY ASSESSMENTS AND PILOTS

B STATE ROUNDTABLES

C INTEGRATING ADAPTATION INTO BUSINESS AS USUAL AT THE MUNICIPAL LEVEL

D DATA

E COMMUNICATION

F RESILIENT INFRASTRUCTURE

CAVEATS

WE CAN'T POSSIBLY CAPTURE EVERYTHING

NOT THE USUAL ROLE FOR EPA – BUT WE HAVE INTERNS

WE NEED KEY PARTNERS – STATES, NEP'S, RPA'S, ACADEMIC

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

HOW MIGHT EPA USE RAINE?

- IDENTIFY VULNERABLE BROWNFIELDS, REMEDIATION SITES, DRINKING WATER OR WASTEWATER PLANTS AND SEE IF ADAPTATION IS TAKING PLACE

- TARGET TECHNICAL ASSISTANCE TO VULNERABLE AREAS WHERE COMMUNITIES ARE LESS ACTIVE

- FIND EXAMPLES TO SHARE WITH SELECTED PILOT COMMUNITIES AND SET UP PEER TO PEER LEARNING OPPORTUNITIES

HOW MIGHT OTHERS USE RAINE?

- COMMUNITIES JUST BEGINNING THEIR CLIMATE CHANGE ADAPTATION PLANNING MAY LOOK TO THE DATABASE FOR EXAMPLES
- LOCAL DECISION MAKERS MAY MODEL ORDINANCES AFTER ONES THAT HAVE ALREADY BEEN COLLECTED IN THE DATABASE
- PEER-TO-PEER LEARNING AND COMMUNICATION – CUT OUT THE MIDDLE MAN

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

DEMOS WITH POTENTIAL USERS

WASHINGTON COUNTY REGIONAL PLANNING (NORTHERN MAINE)

NEW ENGLAND MUNICIPAL SUSTAINABILITY NETWORK (NEMSN)

PARTNERSHIP FOR SUSTAINABLE COMMUNITIES (EPA/DOT/HUD/FEMA/USDA)

NEW ENGLAND FEDERAL PARTNERS (16 FEDERAL AGENCIES)

CLIMATE ADAPTATION KNOWLEDGE EXCHANGE (CAKE)

GEORGETOWN CLIMATE CENTER

EPA REGION 1'S GLOBAL CLIMATE CHANGE NETWORK (GCCN)

EPA'S OFFICE OF ENVIRONMENTAL INFORMATION

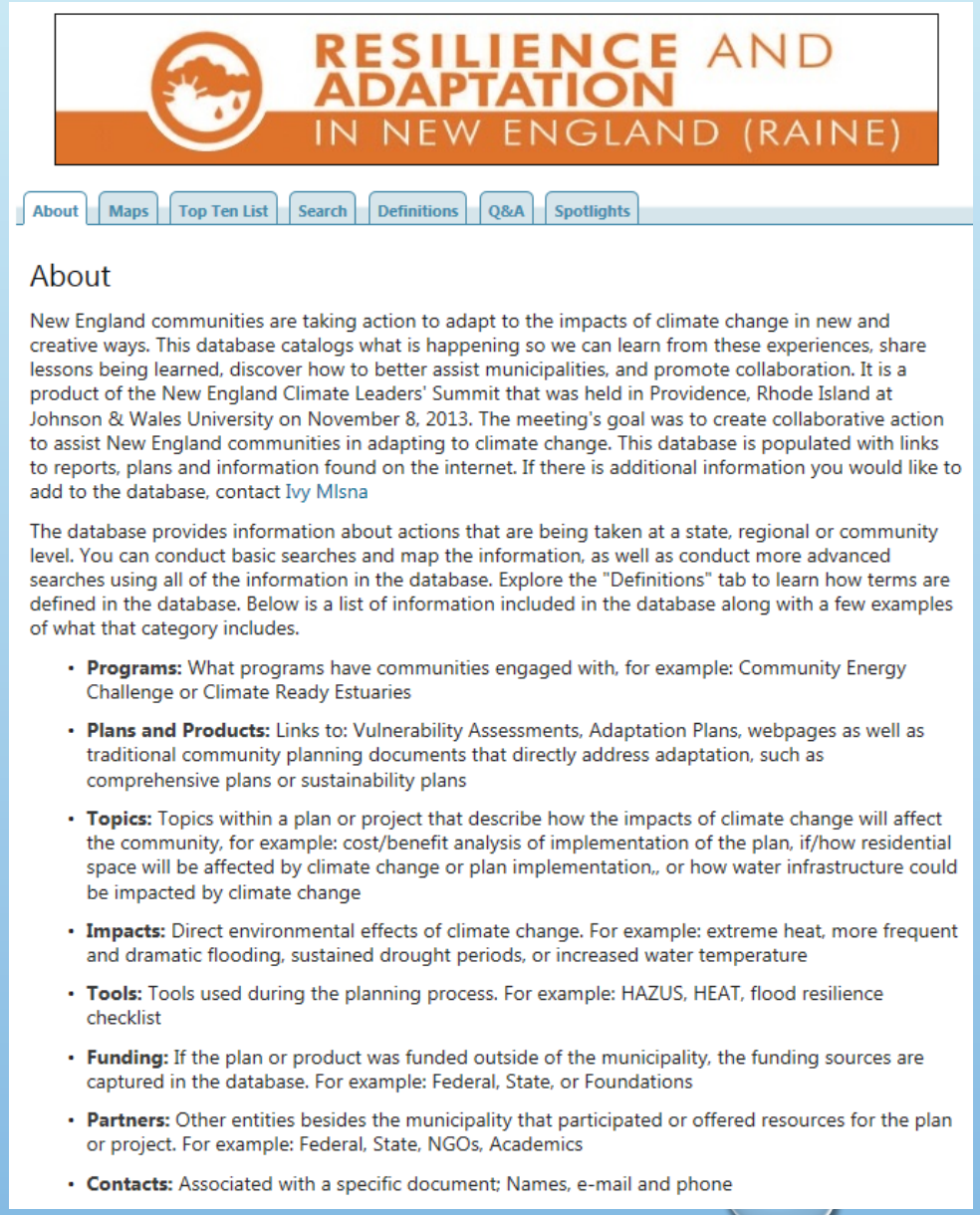
EPA REGIONS 2-10

RHODE ISLAND CZM

NEIWPCC

A BETTER CITY

RAINE INTRANET HOME PAGE



DETAILS ABOUT TOPICS, IMPACTS AND PROGRAMS

Impacts

Direct environmental effects of climate change

Topics

Keyword tags for topics that are included in plans and/or products. Topics are divided into six categories:

- Social
- Economic
- Ecosystems
- Government/Academic Planning
- Infrastructure
- Response

SIMPLE ANALYSIS: MAP

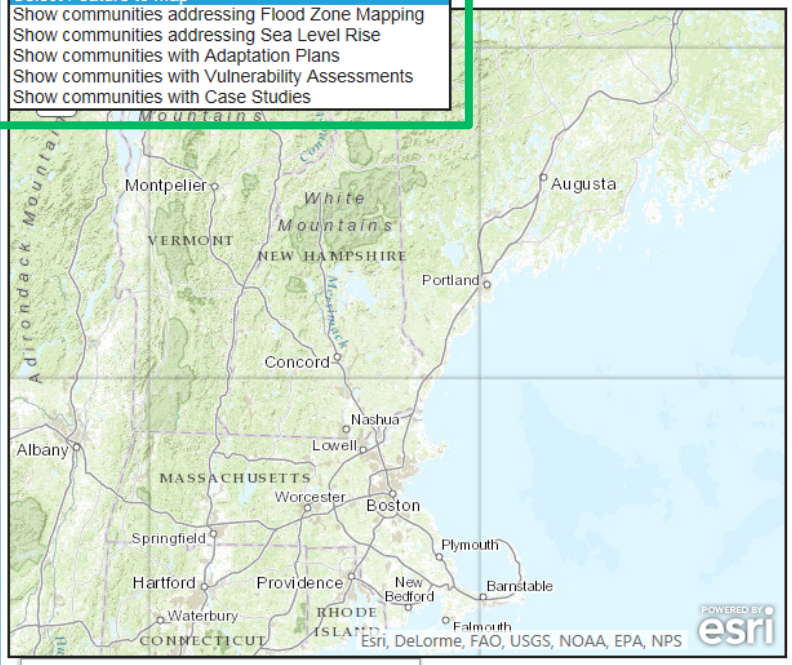
RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

About | Maps | Top Ten List | Search | Definitions | Q&A | Spotlights

Maps

Use the drop down arrow to select a subset of towns, states, or organizations that are being tracked in RAINE to map the following key features. Click on the points to view pop-ups containing links to reports.

Select Feature to Map
Show communities addressing Flood Zone Mapping
Show communities addressing Sea Level Rise
Show communities with Adaptation Plans
Show communities with Vulnerability Assessments
Show communities with Case Studies



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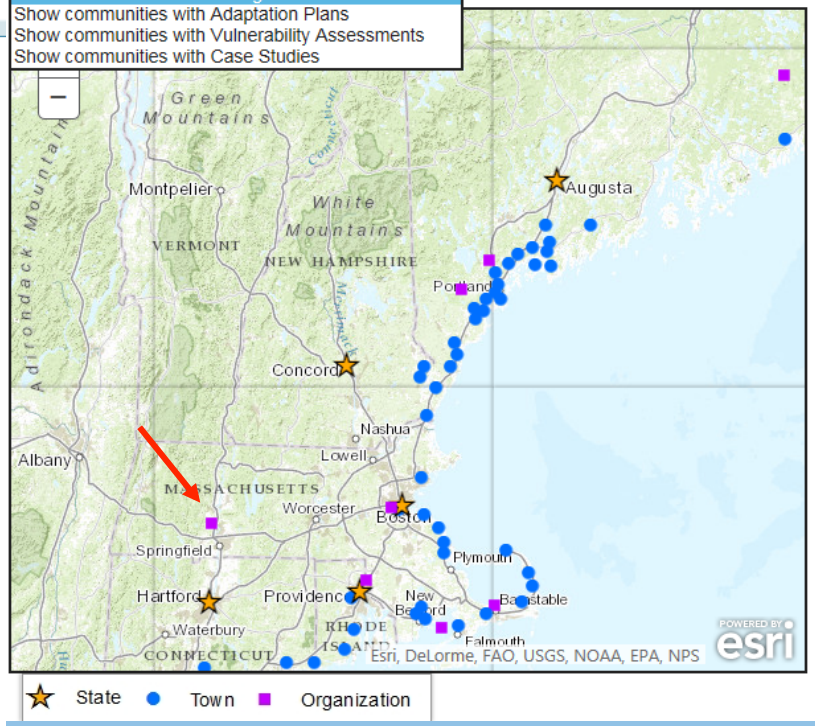
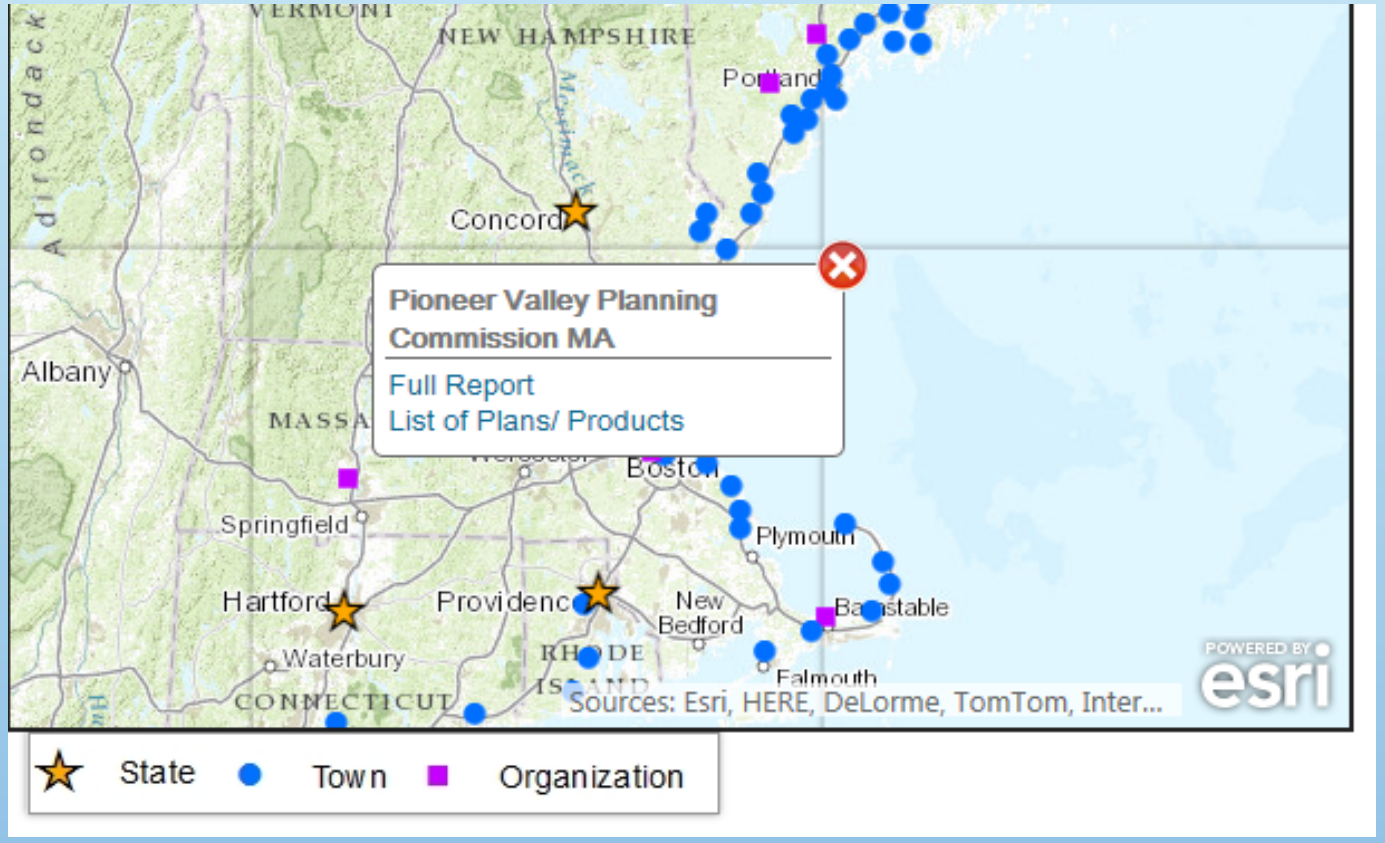


Additional Information from maps



SIMPLE ANALYSIS: "TOP TEN" GRAPHS

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

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Top Ten List

Use the drop down arrow to select a subset of the most common key features to graph. Click on the bar graph for additional information and links to reports.

Select One
10 most common Topics
10 most common Impacts
Partners
10 most common Programs
10 most common Tools
Funding Sources
Federal Funding Sources

RAINE Town List - Internet Explorer

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

Communities which have Built Infrastructure as a Feature
Spotlight communities are highlighted in yellow.

Community	View Report
Acushnet MA	
Barnstable MA	
Bath ME	
Biddeford ME	
Boston MA	
Bridgeport CT	
Brunswick ME	
Burlington VT	
Cape Elizabeth ME	
Cranston RI	
Damariscotta ME	
Dover NH	
Durham NH	
Duxbury MA	
Ellsworth ME	
Fairhaven MA	

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

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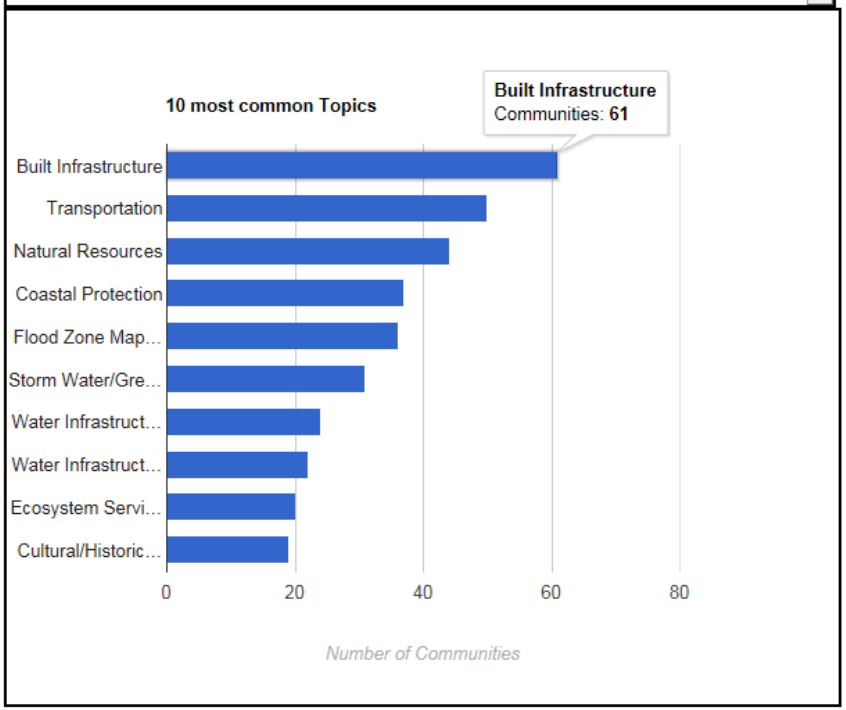
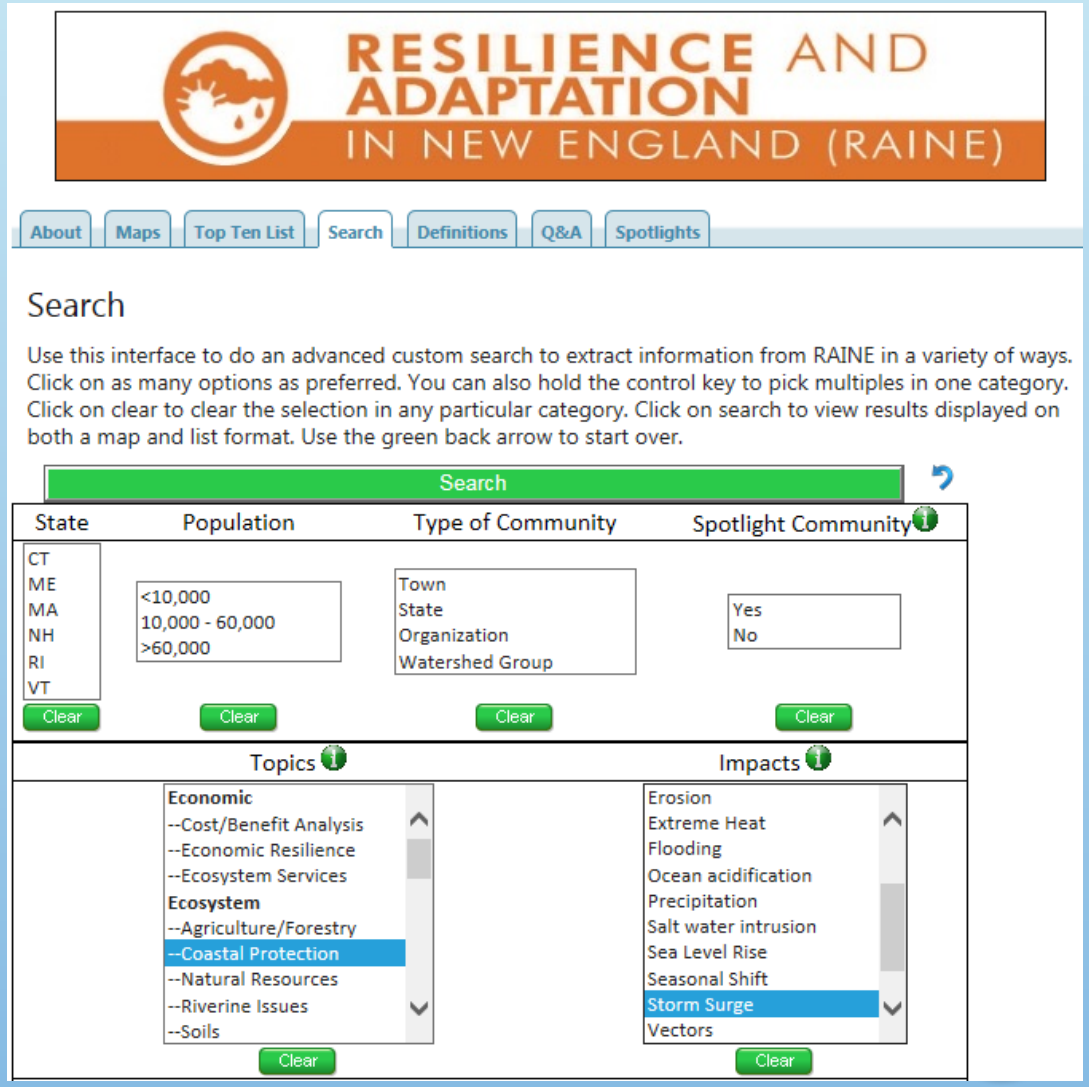


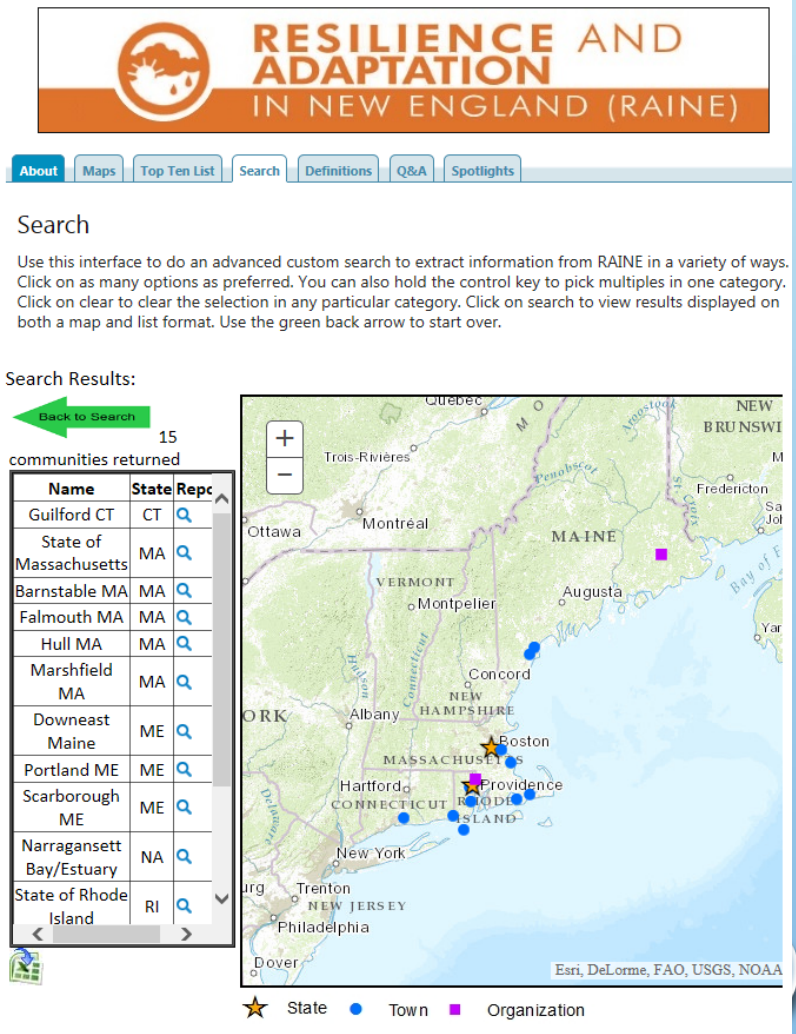
ADVANCED SEARCHES



Customizable searches based on:

State
Population Size
Type of Community
Topic
Impacts
Programs
Partners
Tools
Funding

SEARCH RESULTS: TOWNS ADDRESSING STORM SURGE AND COASTAL PROTECTION IN PLANNING DOCUMENTS



Map

List of towns that can be exported into excel spreadsheet

Links to reports, where more information is available about the town and links to actual documents

REPORTS:

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

North Kingstown, RI: Town Summary

The Town of North Kingstown was selected to participate in a pilot project with the University of Rhode Island Coastal Resources Center and the RI Sea Grant to study climate change and sea level rise. The outcome of this pilot project was maps and on-line data display tools to identify sea level rise vulnerabilities of local assets including public property and infrastructure, as well as community threats in North Kingstown. The town also utilized LiDAR data and sea level rise models to apply the Sea Level Affecting Marshes Model (SLAMM) to project the migration of marshes in the town in response to sea-level rise, in order to help decision makers identify marsh areas most at-risk, and locations where landward migration should be made possible.

Population (US Census 2010): 25,953

Features by category

Economic	Ecosystem	Government/Academic Planning	Infrastructure	Response	Social
Economic Resilience	Coastal Protection	Bylaws/Ordinances/Codes Flood Zone Mapping	Built Infrastructure Transportation	Emergency/Disaster Preparedness/Hazard Mitigation	Cultural/Historical Resources

Impacts

Drought
Flooding
Sea Level Rise
Storm Surge

Programs

Community Rating System

Tools

Sea Level Affecting Marshes Model (SLAMM) :

Plans and Products

Measurement and Evaluation-

Cost Efficient Climate Change in the North Atlantic(Year Unknown)

Vulnerability Assessment-

Mapping Assets Vulnerable to Sea level Rise (2011)

Webpage-

Rhode Island Sea Grant: North Kingstown Coastal Resilience webpage(Year Unknown)

Partners

Foundations- Rhode Island Foundation

State- Rhode Island Sea Grant

State- Rhode Island Statewide Planning Program

Funding

Federal- National Oceanic and Atmospheric Administration (NOAA) (Amount: Unknown) Sea Grant and North Atlantic Regional Team

Foundations- (Amount: Unknown) Rhode Island Foundation

State- (Amount: Unknown) Rhode Island Sea Grant

State- (Amount: Unknown) Rhode Island Statewide Planning Program

Contacts

Teresa Crean (401) 874-6626

Pam Rubinoff Coastal Management Extension Specialist 401-874-6135

Notes

See page 77 of "Cost Efficient Climate Change in the North Atlantic" for information relevant to North Kingstown, RI.

Detailed report on a plan/ product

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

Mapping Assets Vulnerable to Sea level Rise (2011)

Vulnerability Assessment Link
North Kingstown,RI

Features

Economic	Ecosystem	Government/Academic Planning	Infrastructure	Response	Social	Other
None.	None.	Flood Zone Mapping	Built Infrastructure Transportation	None.	Cultural/Historical Resources	None.

Impacts

Flooding Sea Level Rise
Storm Surge

Tools

Funding

Foundations- Rhode Island Foundation (Amount: Unknown)
State- Rhode Island Sea Grant (Amount: Unknown)
State- Rhode Island Statewide Planning Program (Amount: Unknown)

Contacts

Name: Teresa Crean
Email:
Phone Number: (401) 874-6626
Organization:
Expertise:

RESILIENCE AND ADAPTATION IN NEW ENGLAND (RAINE)

Spotlight: Warwick RI

End of Road Retrofits

What they did, and why:

In the summer of 2014, Save the Bay worked with the City of Warwick to remove pavement at the end of five roads that dead end along Narragansett Bay. These roads were vulnerable to erosion and coastal flooding and conveyed untreated stormwater directly to the Bay.

The pavement was removed and stormwater filter strips were installed to slow and filter road runoff. Grasses were planted in the restored coastal area and public access was incorporated at some of the sites to enhance neighborhood access to the shore.

NEXT STEPS

- CONTINUE TO REFINE THE DATABASE AND INTERNET SITE
- NOTIFY MUNICIPALITIES AND GET DATA QC'D
- WORK WITH KEY PARTNERS
- ENTER DATA
- GATHER SPOTLIGHTS
- GET THE WORD OUT – CAN YOU HELP?

DISCUSSION QUESTIONS

- Can you help us to identify federal funding sources for some of these types of projects?
- Are you aware of adaptation/resiliency efforts that should be captured in this database, but may have been overlooked? Do you have a suggestion for a highlight?
- How could this align with your work?
- Is there more state-level information we should be including?
- Who would be the most appropriate person(s) at the State departments to review the data we've captured for your state?

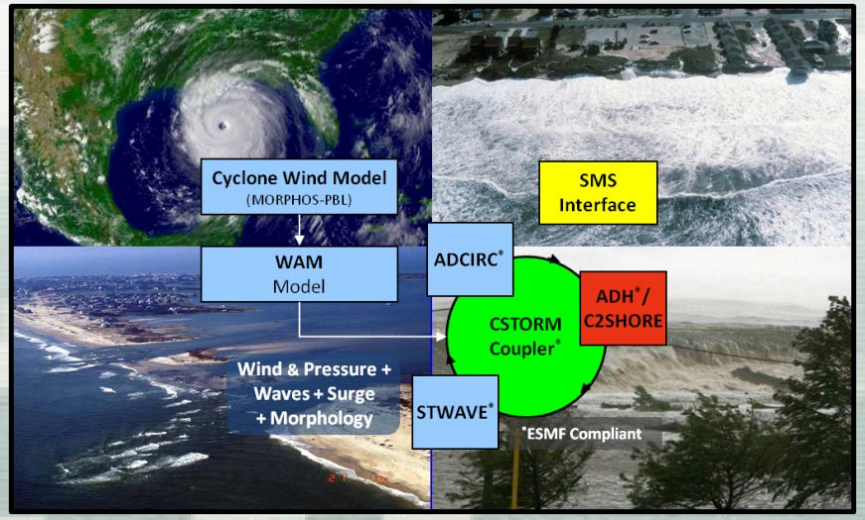
High King Tide, 2014
Boston Harbor

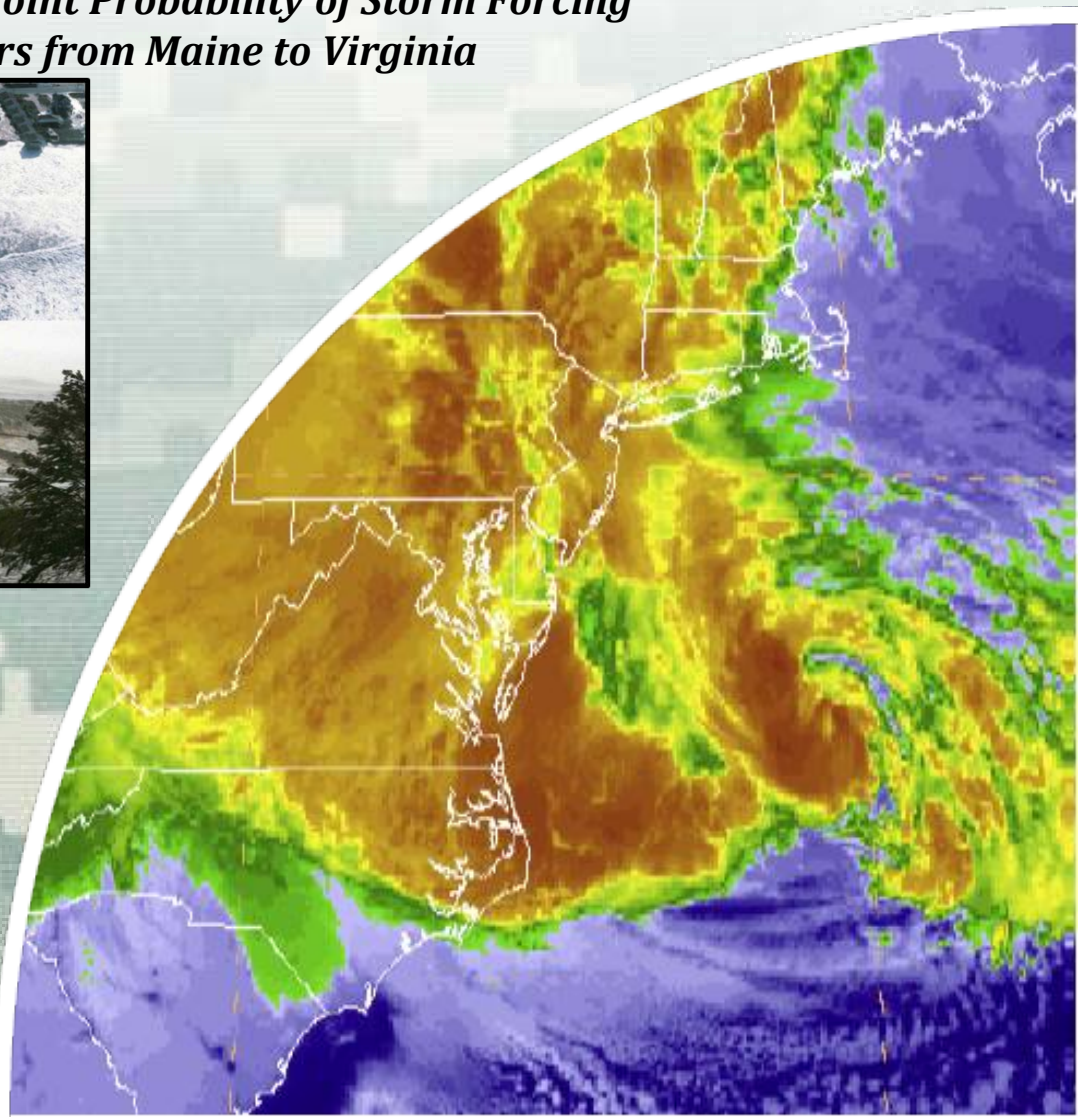
North Atlantic Coast Comprehensive Study

Storm Simulation and Statistical Analysis

Part I - Overview

Computing of the Joint Probability of Storm Forcing Parameters from Maine to Virginia





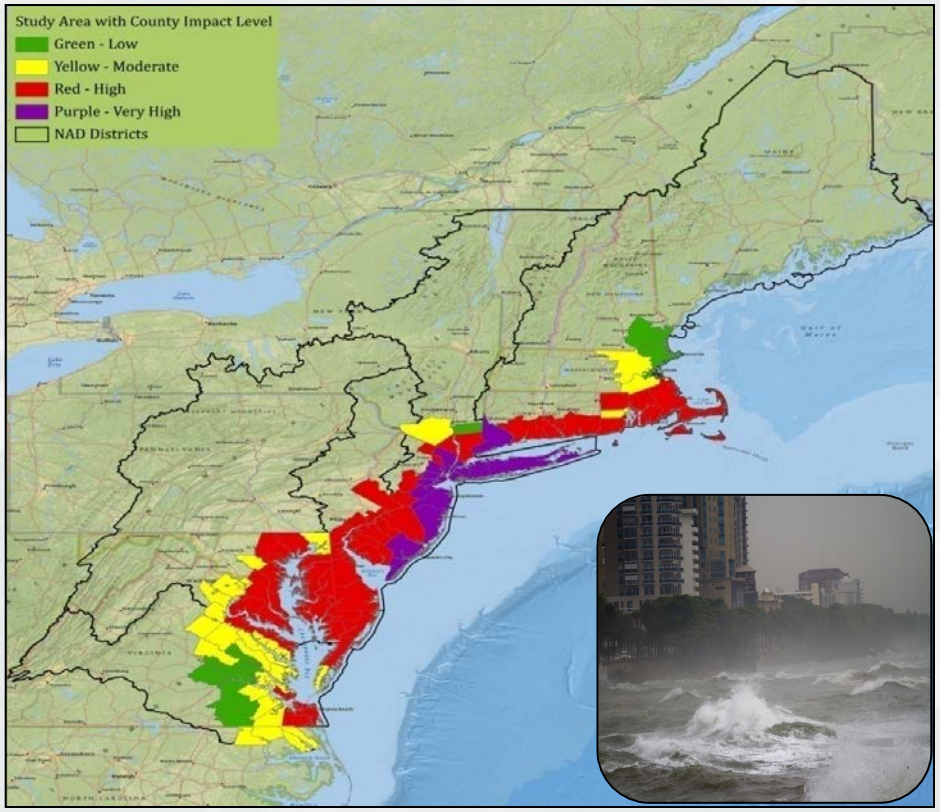
Mary Cialone
Numerical Modeling & Statistics Team Lead for NACCS

U.S. Army Corps of Engineers
Engineer Research & Development Center
Coastal & Hydraulics Laboratory

Northeast Regional Ocean Council
21 May 2015

After Sandy

- Address **flood hazard** of vulnerable coastal populations
- Develop a **risk-reduction** framework consistent with U.S. Government (USACE/NOAA) Rebuilding Principles



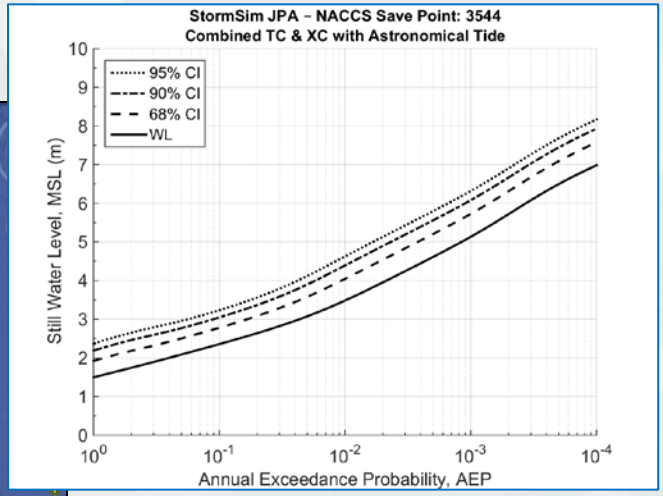
NACCS Goals

- Develop a method to quantify **resilience of coastal communities**

- Promote **coastal resilient communities** with sustainable and robust coastal landscape systems, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure

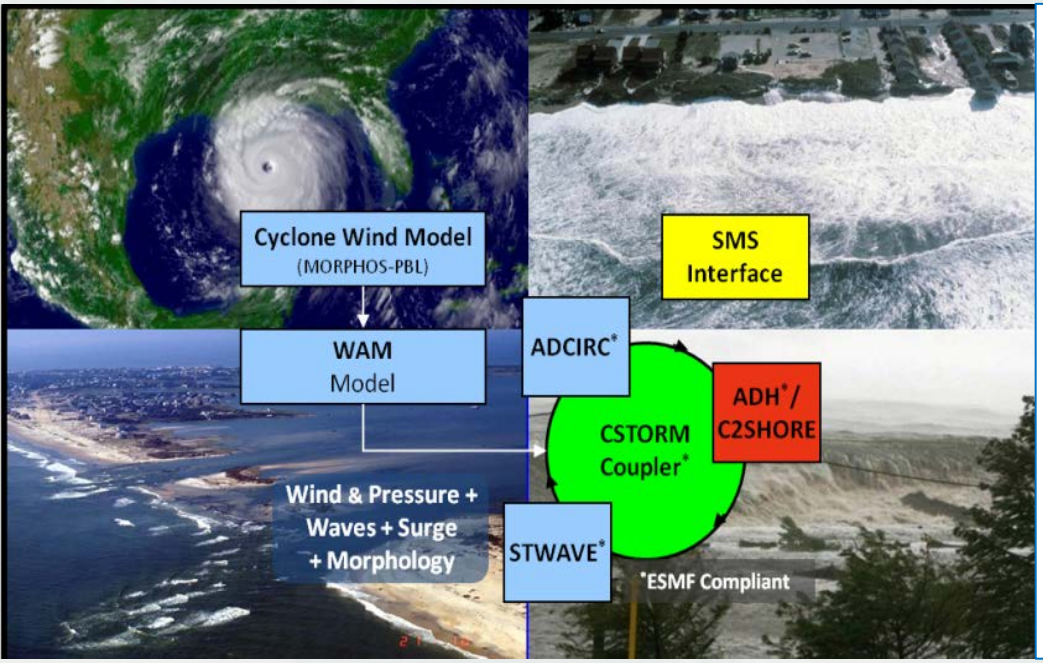
NACCS Numerical Modeling & Statistical Analysis Goal

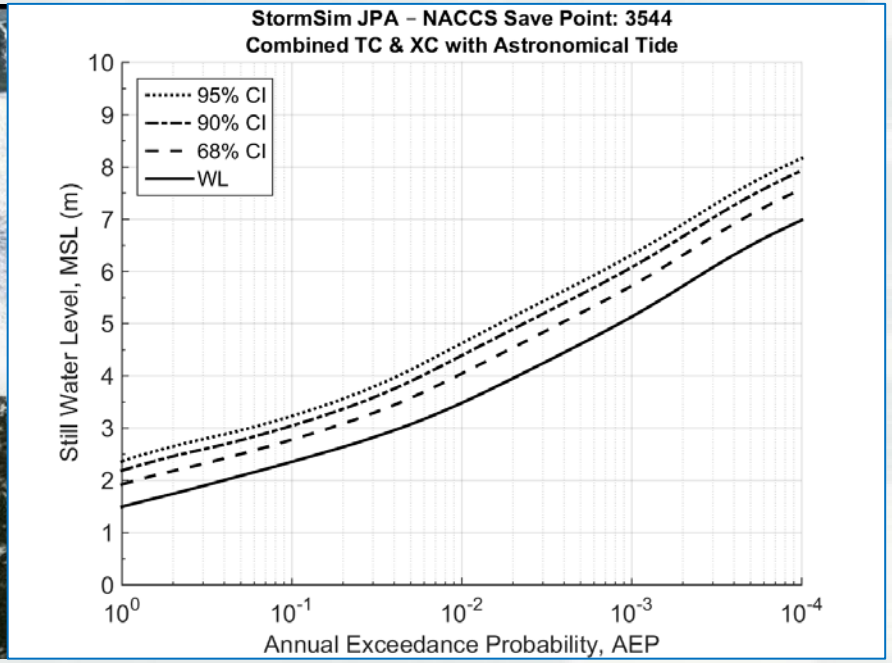
compute statistics of coastal storm forcing parameters for the entire North Atlantic Coast



Presentation Objective

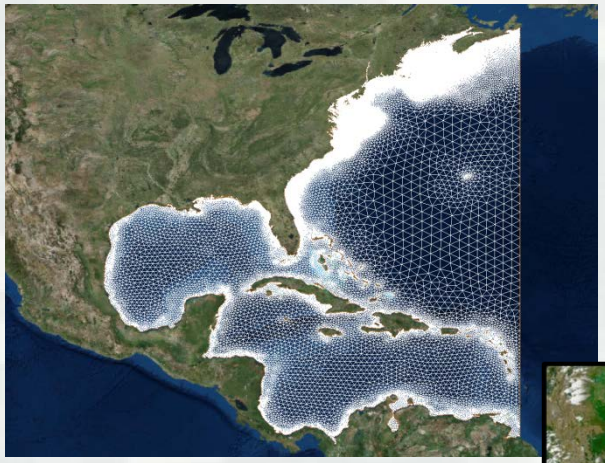
Discuss and inform……about the advancements, outcomes and anticipated benefits of the storm surge modeling and statistics conducted for the NACCS

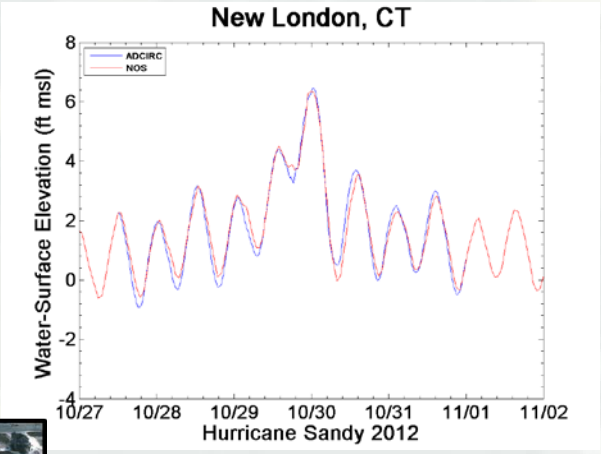


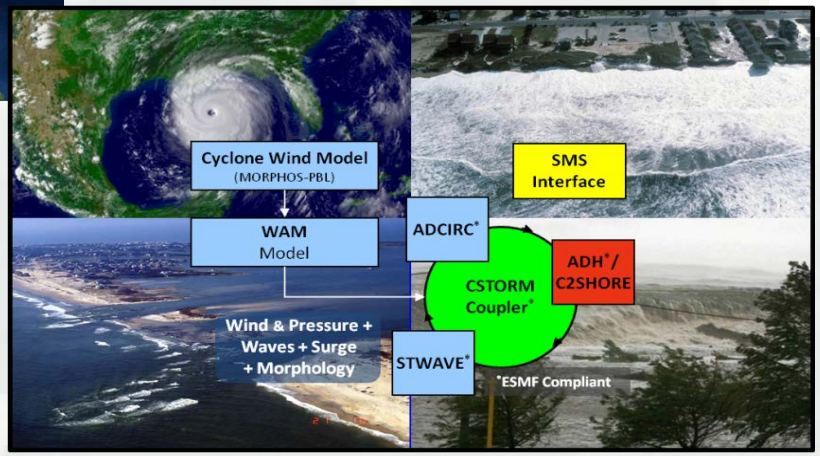


CSTORM-MS
High Fidelity Modeling

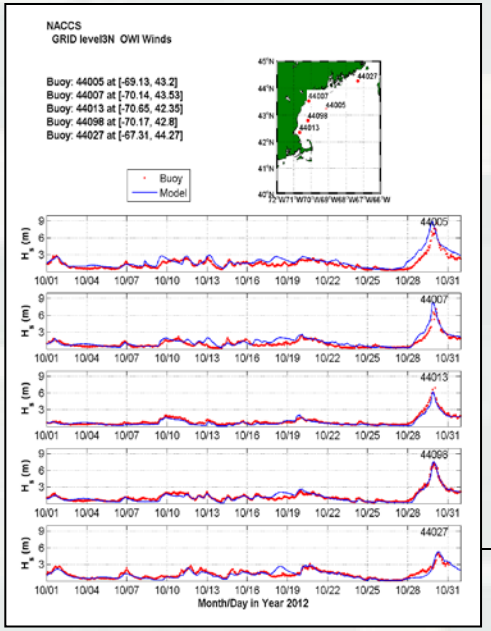
ADCIRC



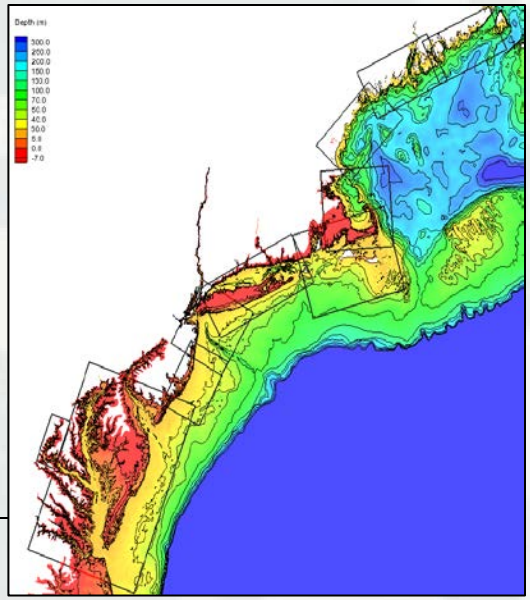




WAM



STWAVE



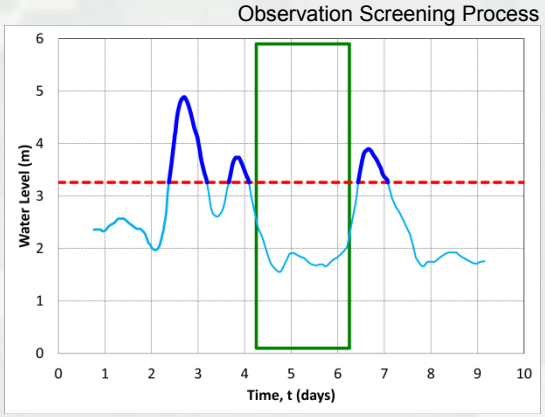
CSTORM-MS: Coastal STORM Modeling System

WAM: WAve Prediction Model
STWAVE: STeady-State Spectral WAVE model
ADCIRC: ADvance CIRCulation Model

Storm Selection

Historical Storms – *applied to extratropical events*

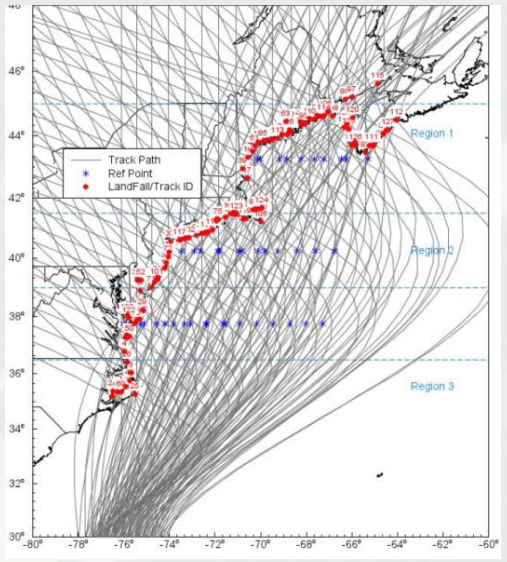
- 23 NOAA water level stations
- 30-yr record or more
- Peak-over-threshold
- 100 storms selected
- Composite Storm Set method (Nadal-Caraballo et al. 2014)



Synthetic Storms – *applied to tropical events*

- Radius to maximum winds
- Central pressure
- Forward speed
- Track
- Landfall location

1050 storms



NACCS Storm Suite

- 100 Historical Extratropical Storms
- 1050 Synthetic Tropical Storms

1150 Total Storm Population

Model Simulations: 1150 Storms x 3 conditions:

- Surge and wave only (base)
- Surge and wave and tide
- Surge and wave and tide and sea level change

Total Storms simulated: 3450

HPC Resources: 3450 Storm Simulations

Department of Defense Supercomputing Resource Centers (DSRCs)

USACE

Garnet: Cray XE6

4,716 compute nodes
32 cores/node
150,912 processors

Air Force

Spirit: SGI Ice X

4,590 compute nodes
16 cores/node
73,440 processors

Navy

Armstrong: Cray XC30

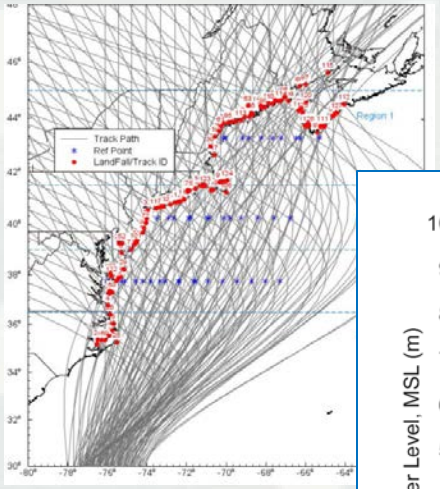
1,347 compute nodes
24 cores/node
32,328 processors

- *100M CPU hours*
- *Largest CW project*
- *40% Garnet and 60% Armstrong*
- *8-month time frame*

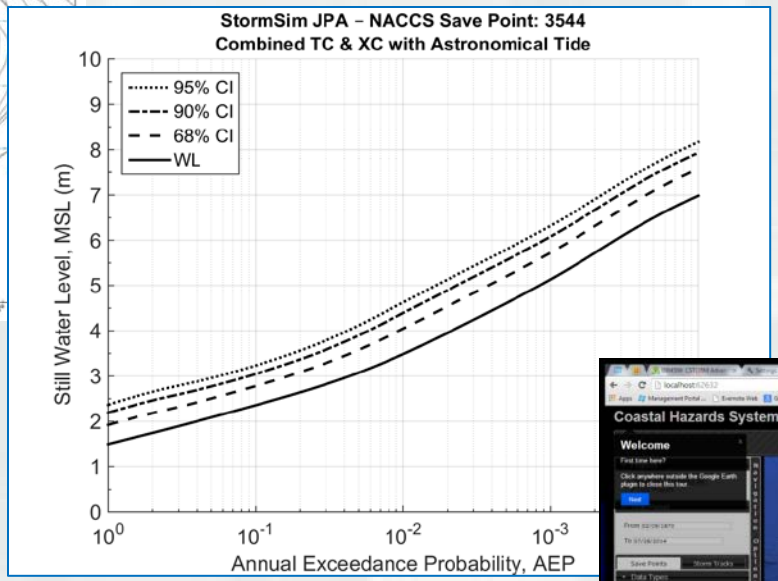
Statistics and Coastal Hazards System

State-of-the-art statistical methodology

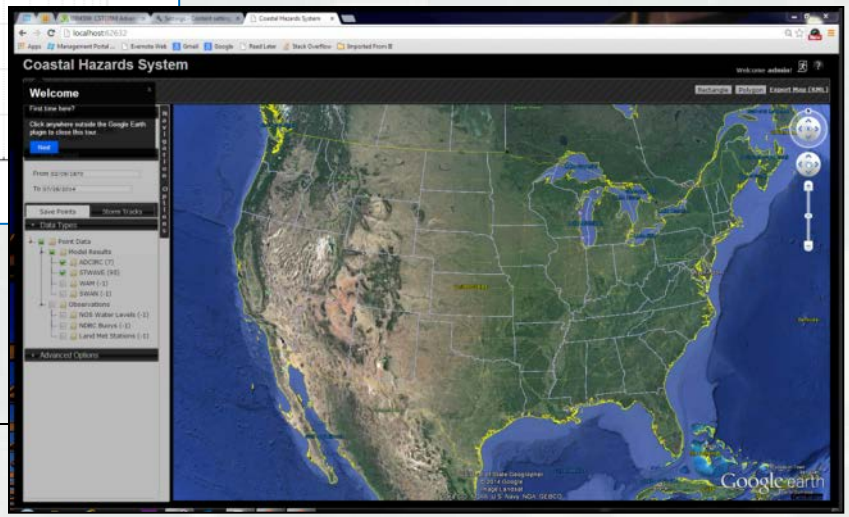
Joint Probability Method with Optimal Sampling (JPM-OS)



- USACE – Guidance documents
- FEMA – Flood mapping
- NRC – Regulatory documents



CHS – Web-Based Tool



Data Products 1/3

serve the coastal engineering and management communities 10+ years

- **Model results – waves, water levels, water velocities, wind and pressures at ~19000 "virtual gage" locations as well as regionally**
- **Statistics**
- **Coastal Hazards System**

Data Products 2/3

serve the coastal engineering and management communities 10+ years

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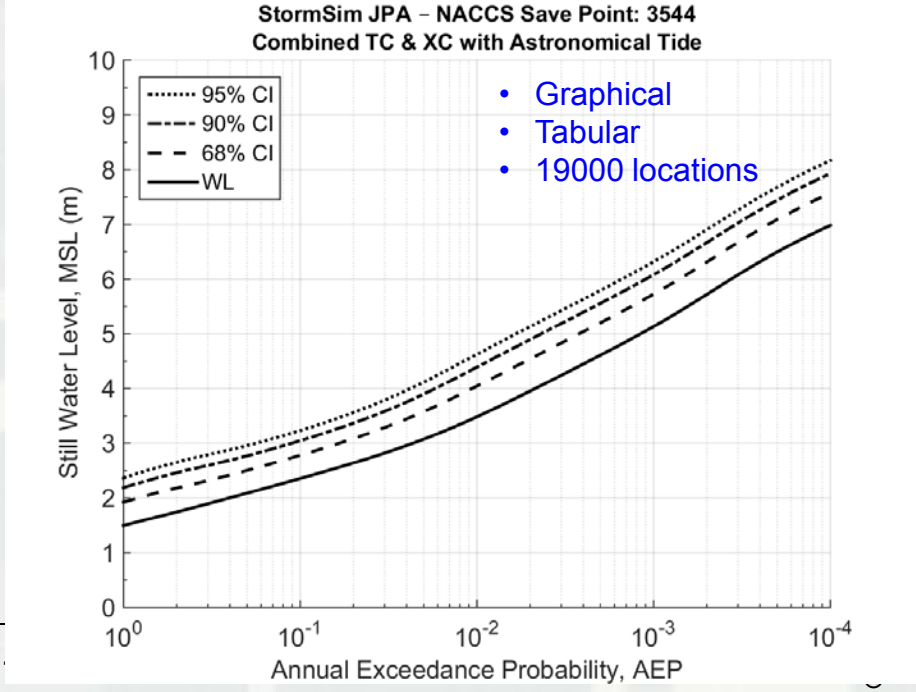
- **Statistics – joint probability of storm response**
- **Coastal Hazards System**

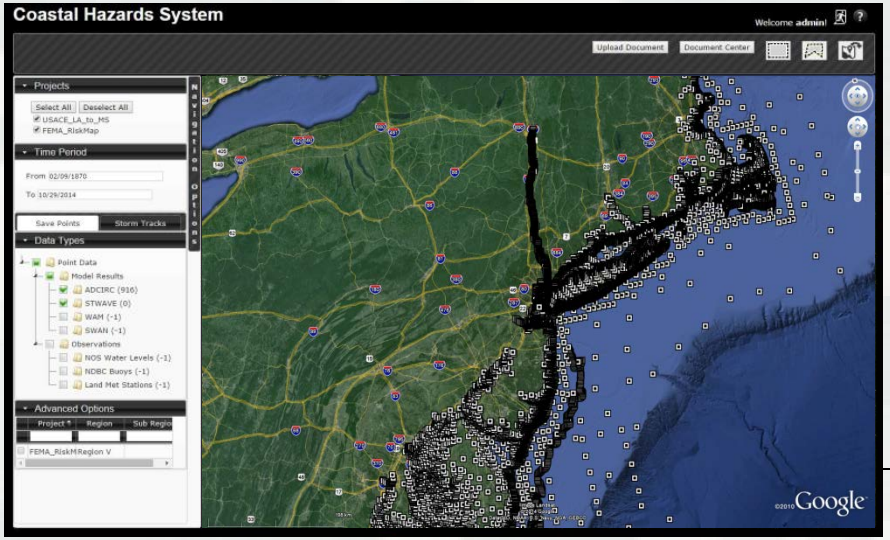


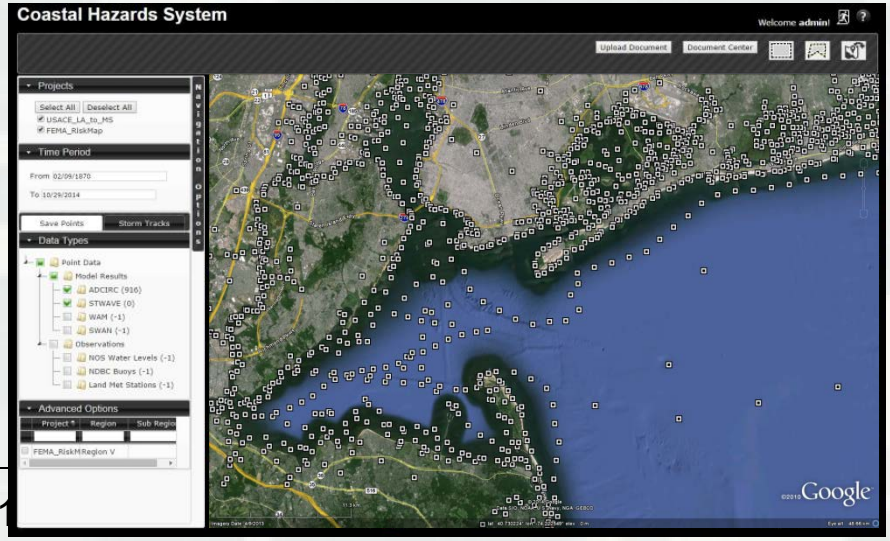
Data Products 3/3

serve the coastal engineering and management communities 10+ years

- **Model results – waves, water levels, water velocities, wind and pressures at ~19000 "virtual gage" locations as well as regionally**
- **Statistics – joint probability of storm response**
- **Coastal Hazards System - web-based software**

  Improved method of delivery of information; well-vetted; QA/QC; available

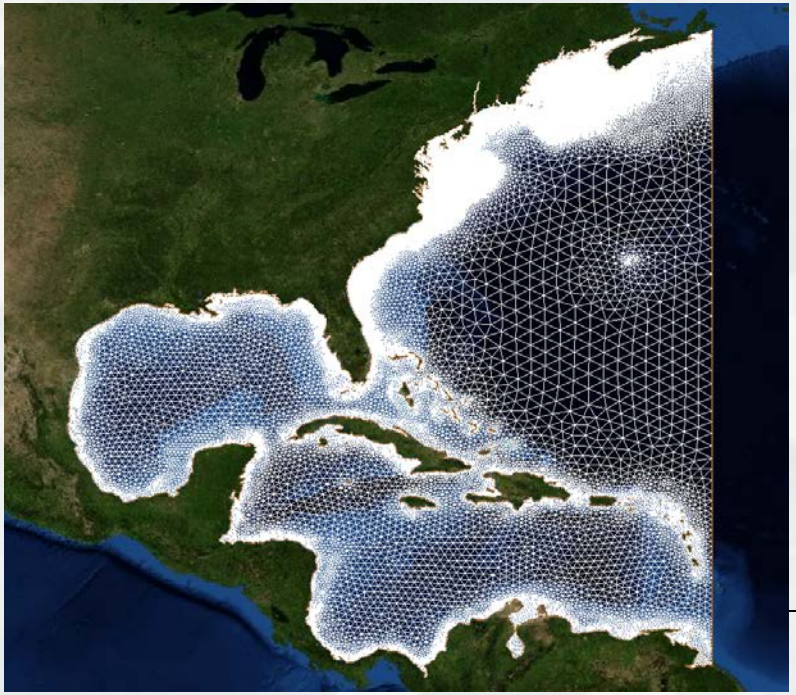




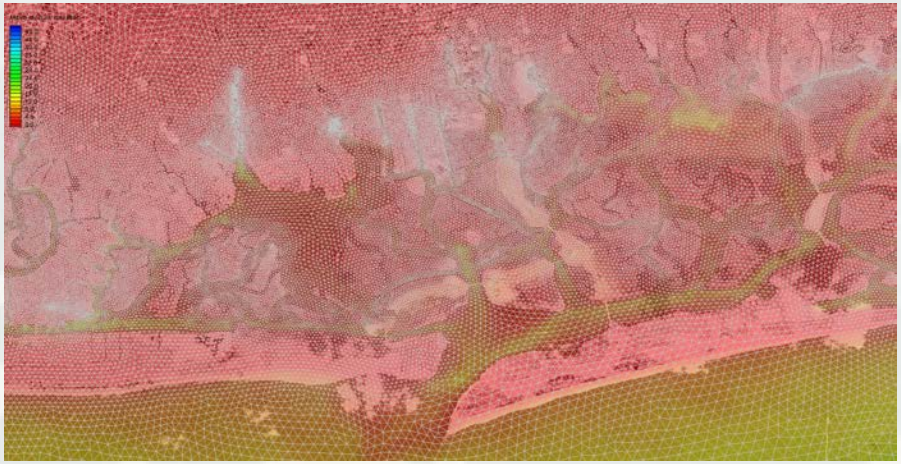
Economies of Scale 1/3

spatial extent/quantity of reusable data from regional model

- **Regional model – detailed resolution from Virginia to Maine;** efficiently perform sims - 5 Districts; consistent transitions/no disjoints/ continuum of data
- **Reusable data**
- **Available to others**



Jones Inlet, NY



Economies of Scale 2/3

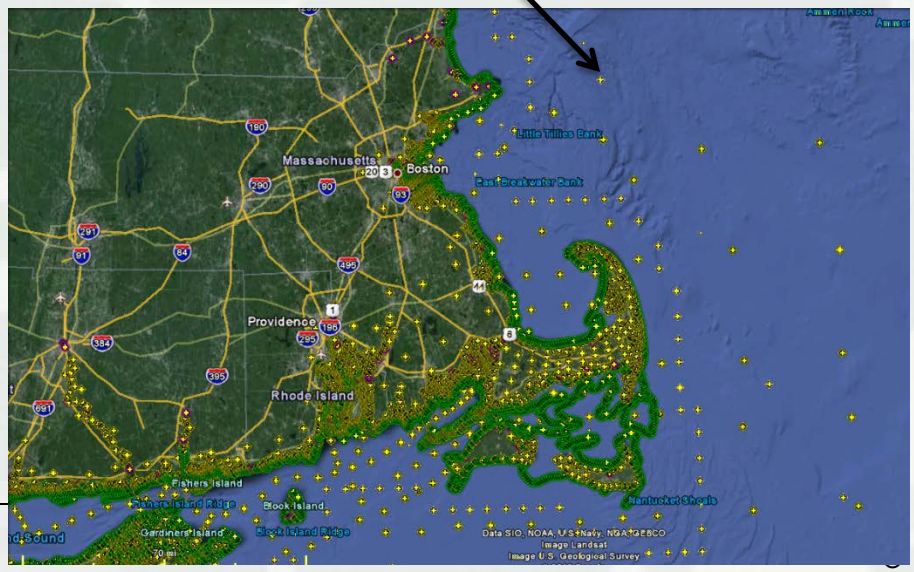
spatial extent/quantity of reusable data from regional model

- Regional model – detailed resolution from Virginia to Maine

- **Reusable data – new project decisions; input conditions for fine scale modeling**

- **Available to others**

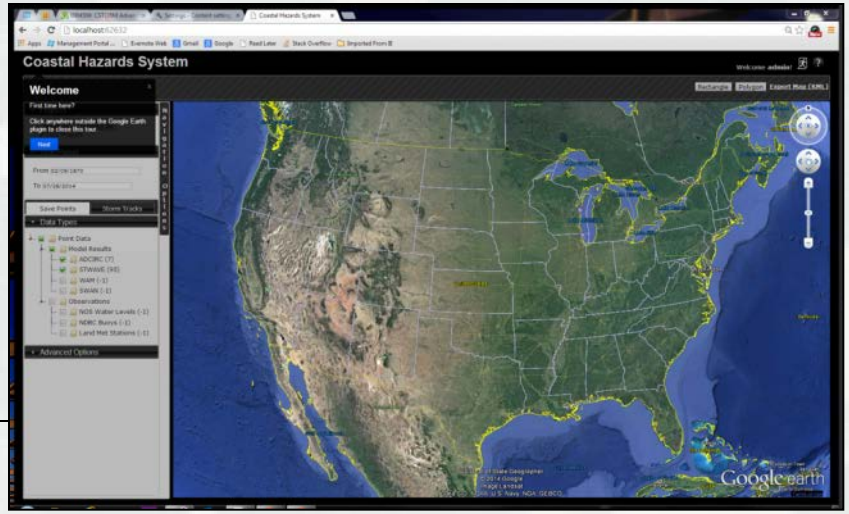
Model Results & Statistics easily accessible



Economies of Scale 3/3

spatial extent/quantity of reusable data from regional model

- Regional model – detailed resolution from Virginia to Maine
- Reusable data – new project decisions; input conditions for fine scale modeling
- **Available to others – Coastal Hazards System accessible to Corps, Federal/State Partners, Coastal Community**
  - **On-line Help**
  - **On-line Tutorials**
  - **Users Guide**

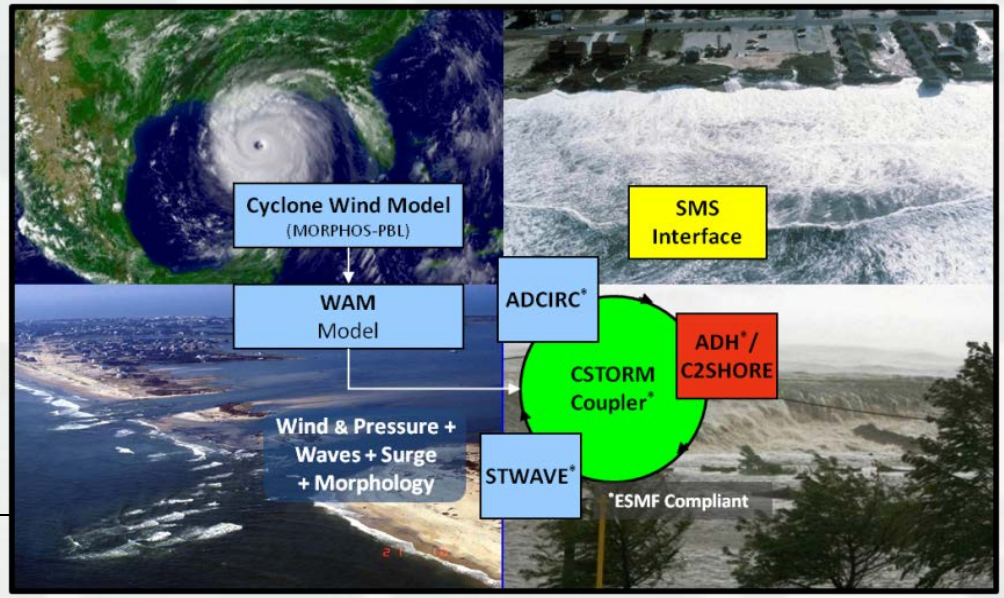


Relevance 1/2

technical advancements post-Katrina; enterprise modeling and analysis methods; USACE engineering guidance update

- **CSTORM-MS – high-resolution, highly-skilled physics-based models in a tightly-integrated modeling system; computational leaps in HPC**
- **Statistical analysis**
- **Incorporated into Corps guidance**

- *Physical representation of land features*
- *Frictional resistance*
- *Wetting/Drying*
- *Coupling*
- *Efficiency*
- *Magnitude*



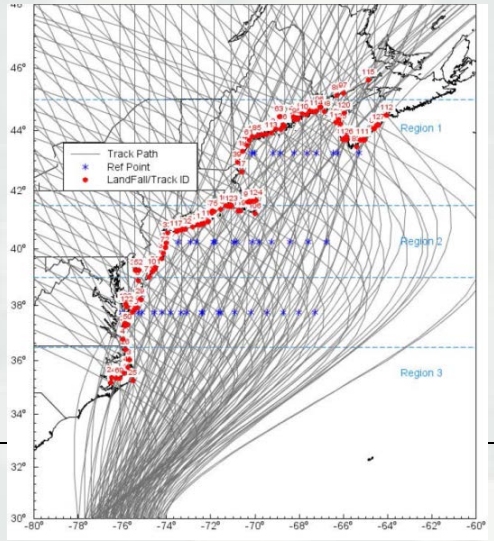
Relevance 2/2

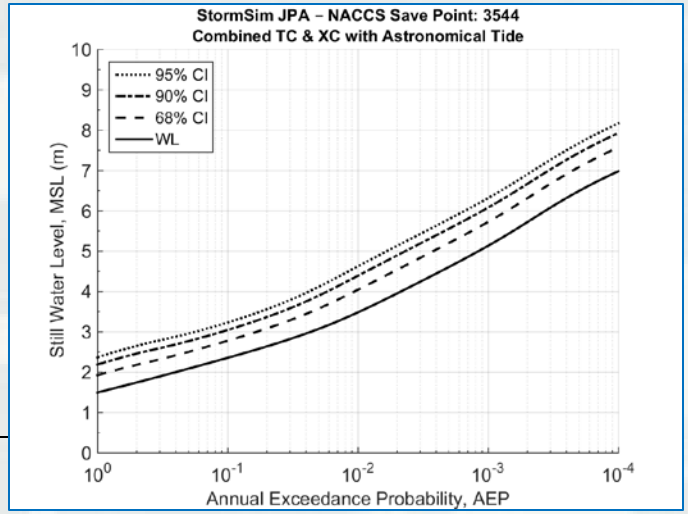
technical advancements post-Katrina; enterprise modeling and analysis methods; USACE engineering guidance update

- CSTORM-MS – high-resolution, highly-skilled physics-based models in a tightly-integrated modeling system; computational leaps in HPC

- **Statistical analysis – JPM-OS state-of-the-art scientific tools**

- **Incorporated into Corps guidance**

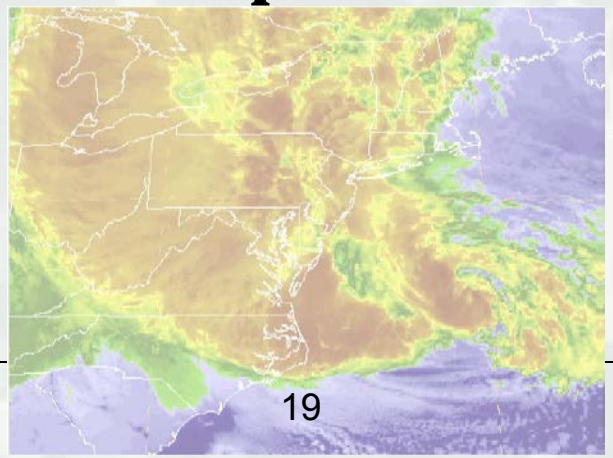




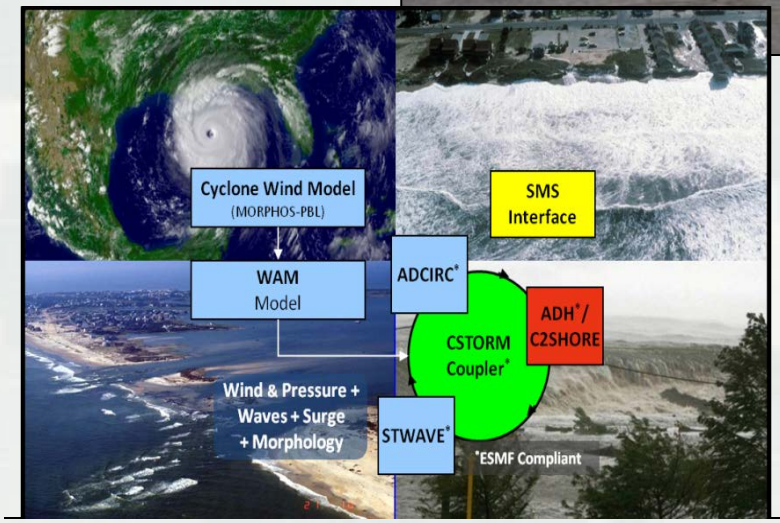
Summary Outcomes of NACCS

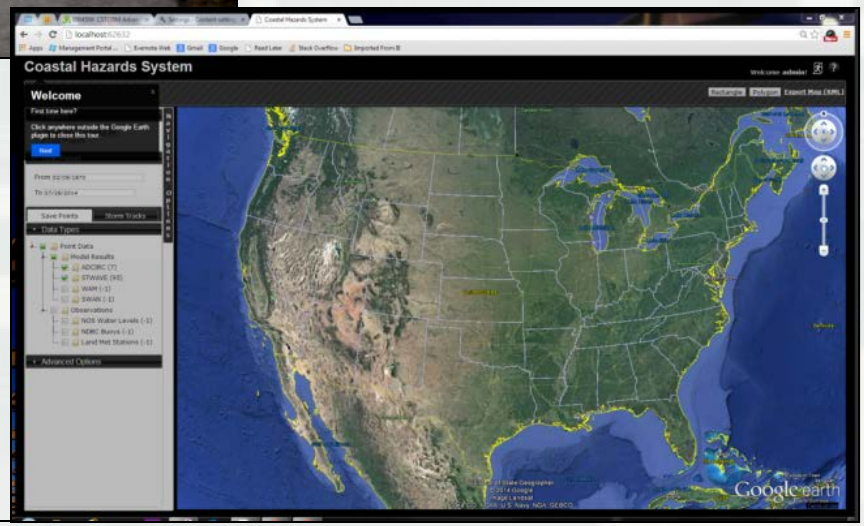
Numerical Modeling and Statistical Analysis

- ***Data Products***: **serve the coastal engineering and management communities 10+ years**
- ***Economies of Scale***: **spatial extent/quantity of reusable data from regional model**
- ***Relevance***: **technical advancements post-Katrina; enterprise modeling and analysis methods; USACE engineering guidance update**



Questions?


Cyclone Wind Model
(MORPHOS-PBL)
WAM
Model
Wind & Pressure +
Waves + Surge
+ Morphology
SMS
Interface
ADCIRC*
CSTORM
Coupler*
ADH*/
C2SHORE
STWAVE*
*ESMF Compliant


Coastal Hazards System
Welcome
Google earth

Composite Storm Set

Extratropical Cyclones

- Based on peaks-over-threshold (POT) sampling of storm surge (NTR) from 23 NOAA water level stations.
- Generalized Pareto distribution fitted to POT events.
- *Compare*
  - Composite storm set (CSS) ("global" set – 1 per study)

    vs.
  - Full storm sets (FSS) ("local" set – 1 per gage)
- *Objective*
  - Determine minimum number of storms in CSS required to match the FSS' probability distributions.

CSTORM-MS COASTAL STORM MODELING SYSTEM

ERDC Engineer Research and Development Center

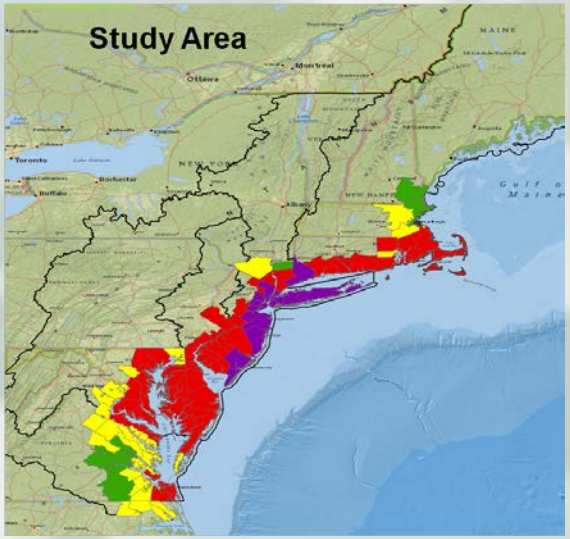
North Atlantic Coast Comprehensive Study

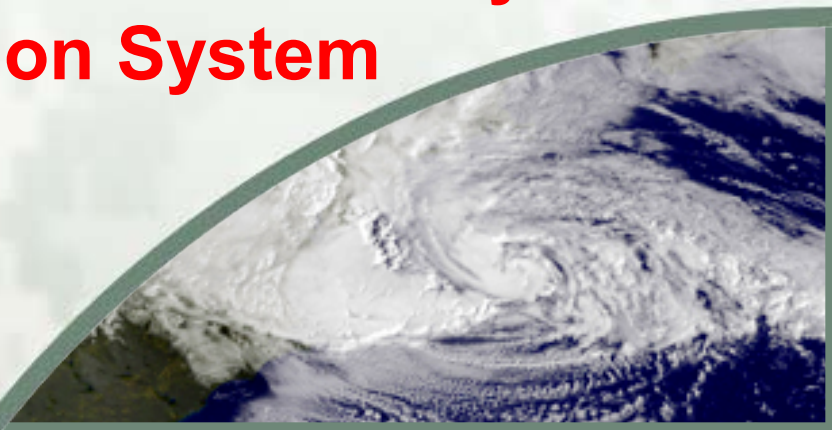
Storm Simulation and Statistical Analysis

Part II – Production System

Chris Massey, Jay Ratcliff, and Mary Cialone

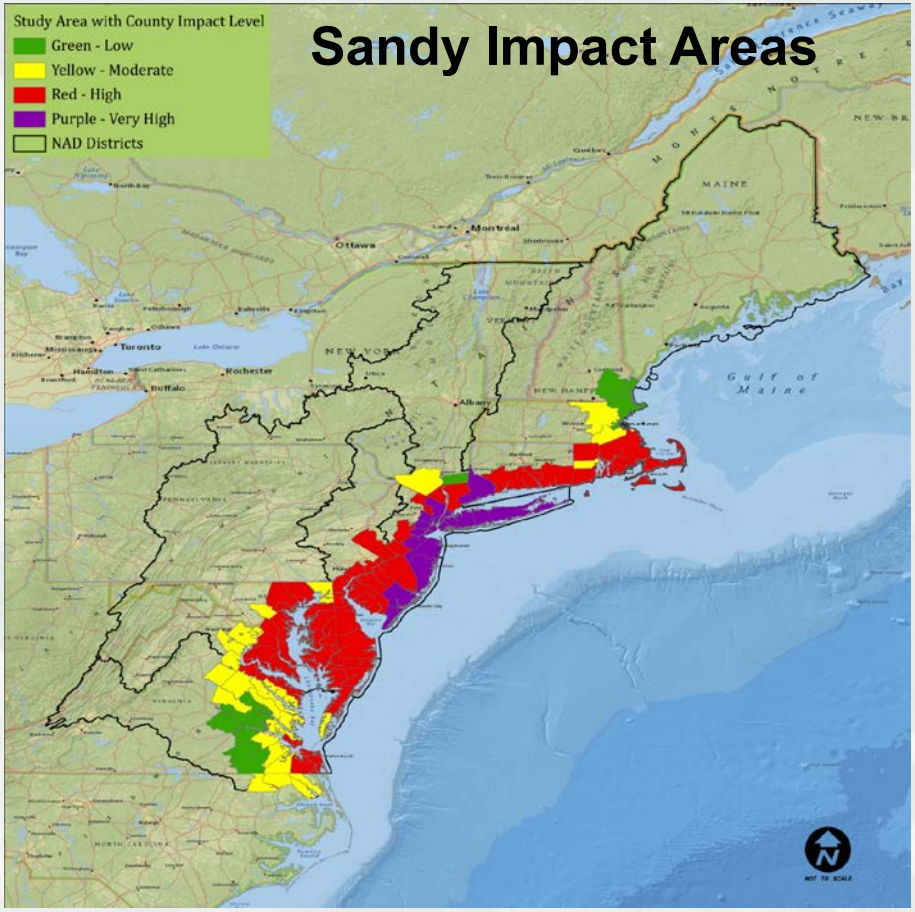
USACE-ERDC
Coastal & Hydraulics Lab
Chris.Massey@usace.army.mil





Northeast Regional Ocean Council
21 May 2015

North Atlantic Coast Comprehensive Study



This study will compute the joint probability of Hurricane Sandy and historical coastal storm forcing parameters for the east coast region from Maine to Virginia as a primary requirement for project performance evaluation. The primary focus is on **storm winds**, **waves** and **water levels** along the coast for both tropical and extra-tropical storm events.

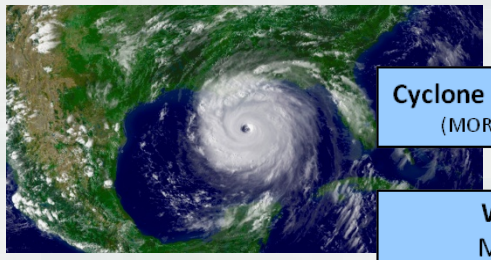
Modeling Team Lead and POC:
Mary Cialone, USACE-ERDC-CHL

Coastal Storm Modeling System

CSTORM-MS

Application of high resolution, highly-skilled numerical models in a tightly-integrated modeling system with user friendly interfaces

Not just hurricanes and not just in the Gulf of Mexico.



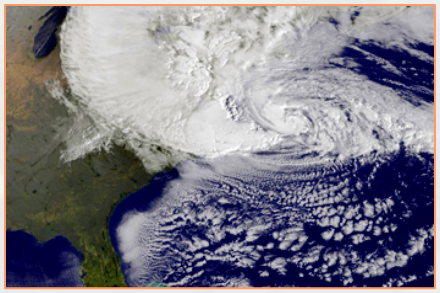
Next Generation Workflow

Expandable and upgradeable system.

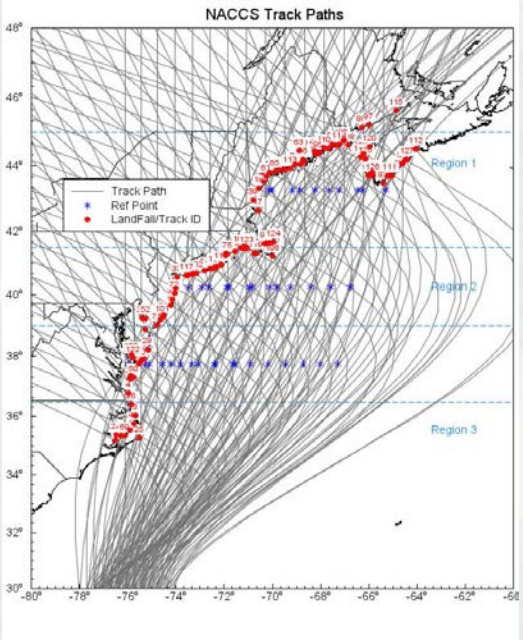
Provides for a robust, standardized approach to establishing the risk of coastal communities to future occurrences of storm events.

Combined Joint Probability of Coastal Storm Hazards

- ***Forcing***
  - Tropical cyclones
  - Extratropical cyclones
- ***Response***
  - Water level (storm surge, astronomical tide, SLC)
  - Currents
  - Wave height, peak period, direction
  - Wind speed, direction



NACCS Storm Suite



- 100 Historical Extratropical Storms
- 1050 Synthetic Tropical Storms

1150 Total Storms

1150 Storms simulated for 3 conditions:

- Surge and wave only (base)
- Surge and wave and tide
- Surge and wave and tide and sea level change

Total Storms simulated: 3450 **(Challenge #1 – many storms)**

HPC Resources: 3450 Storm Simulations

Department of Defense Supercomputing Resource Centers (DSRCs)

USACE

Garnet: Cray XE6

4,716 compute nodes
32 cores/node
150,912 processors

Air Force

Spirit: SGI Ice X

4,590 compute nodes
16 cores/node
73,440 processors

Navy

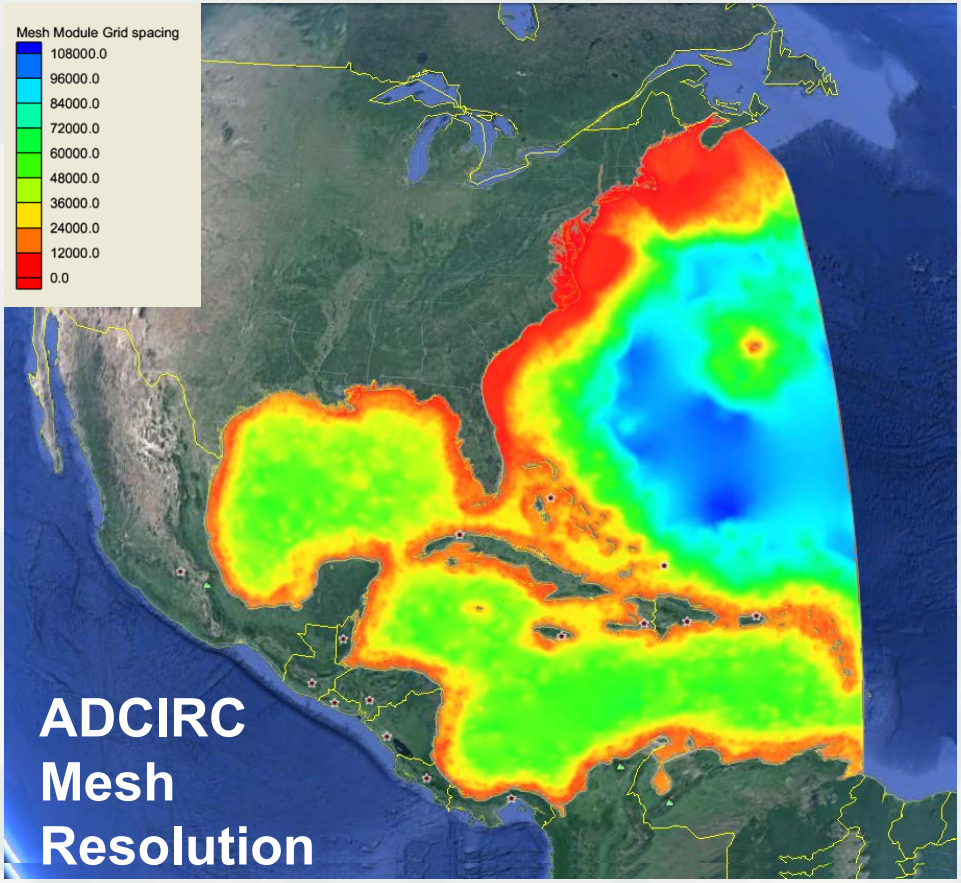
Armstrong: Cray XC30

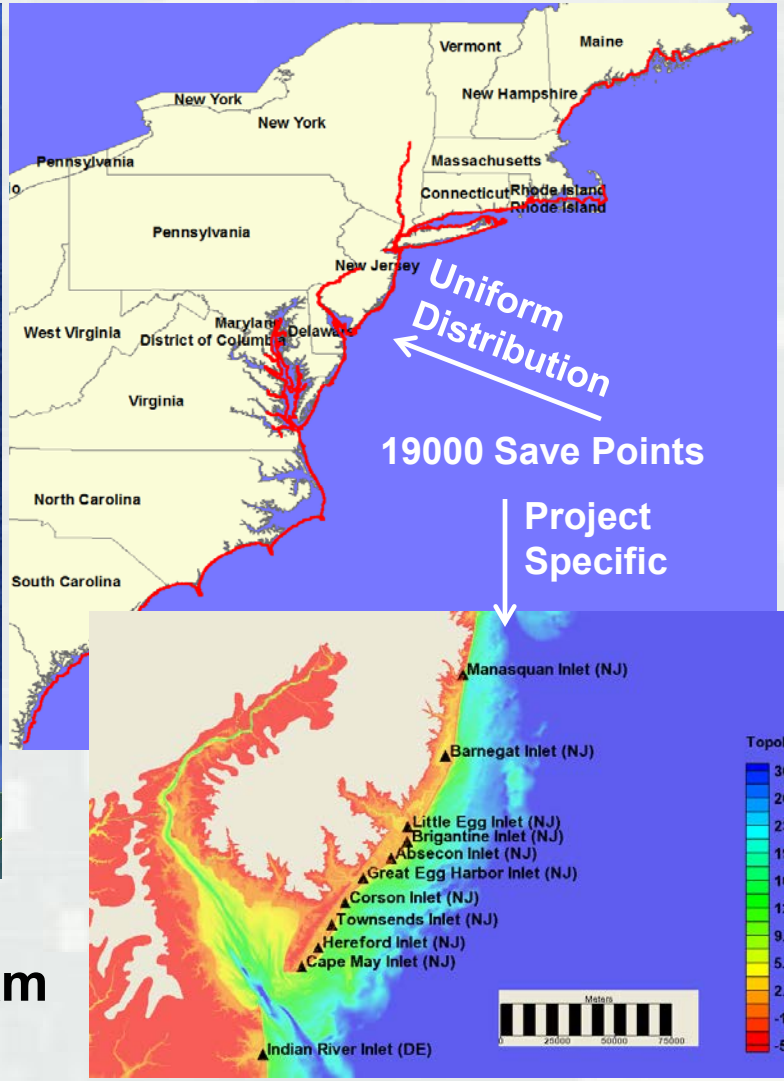
1,347 compute nodes
24 cores/node
32,328 processors

- *100M CPU hours*
- *Largest CW project*
- *40% Garnet and 60% Armstrong*
- *8-month time frame*
- *(Challenge #2 – managing resources)*

NACCS Model Domains and Save Points

scale and magnitude of modeling

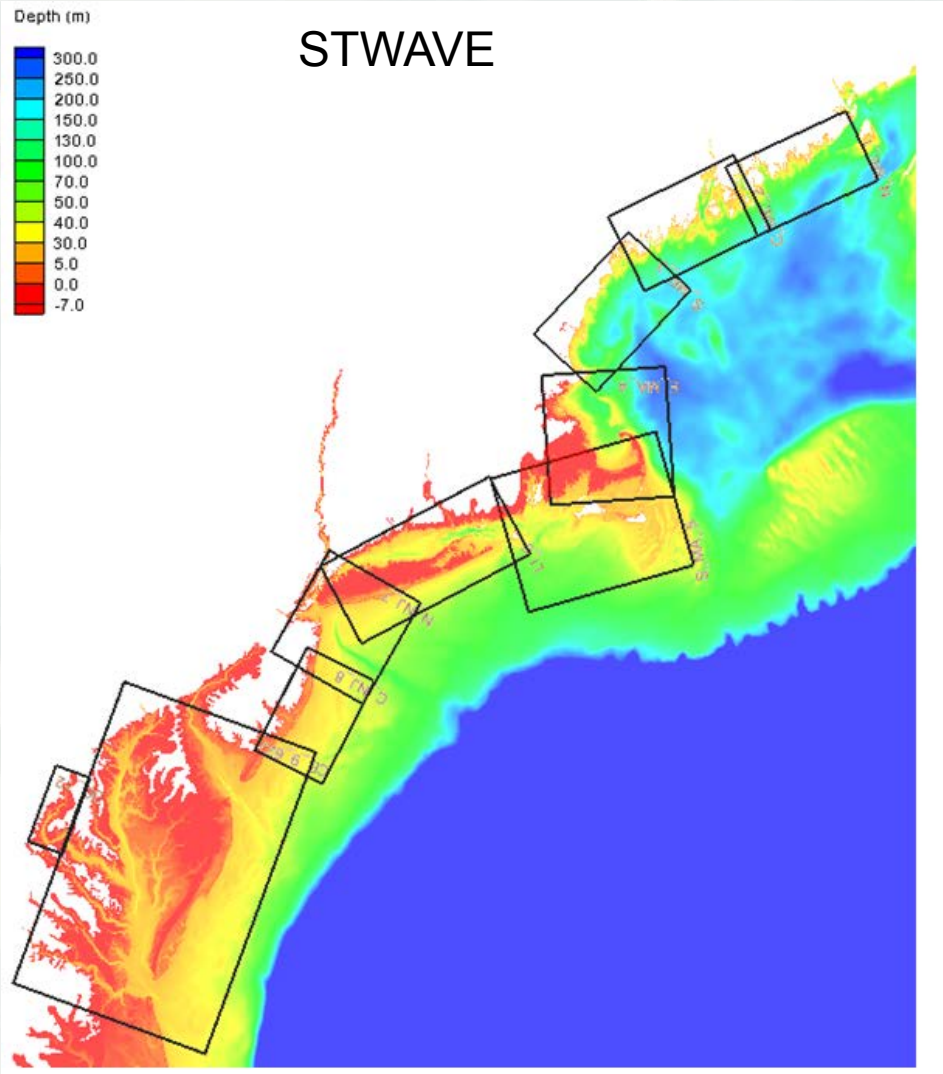


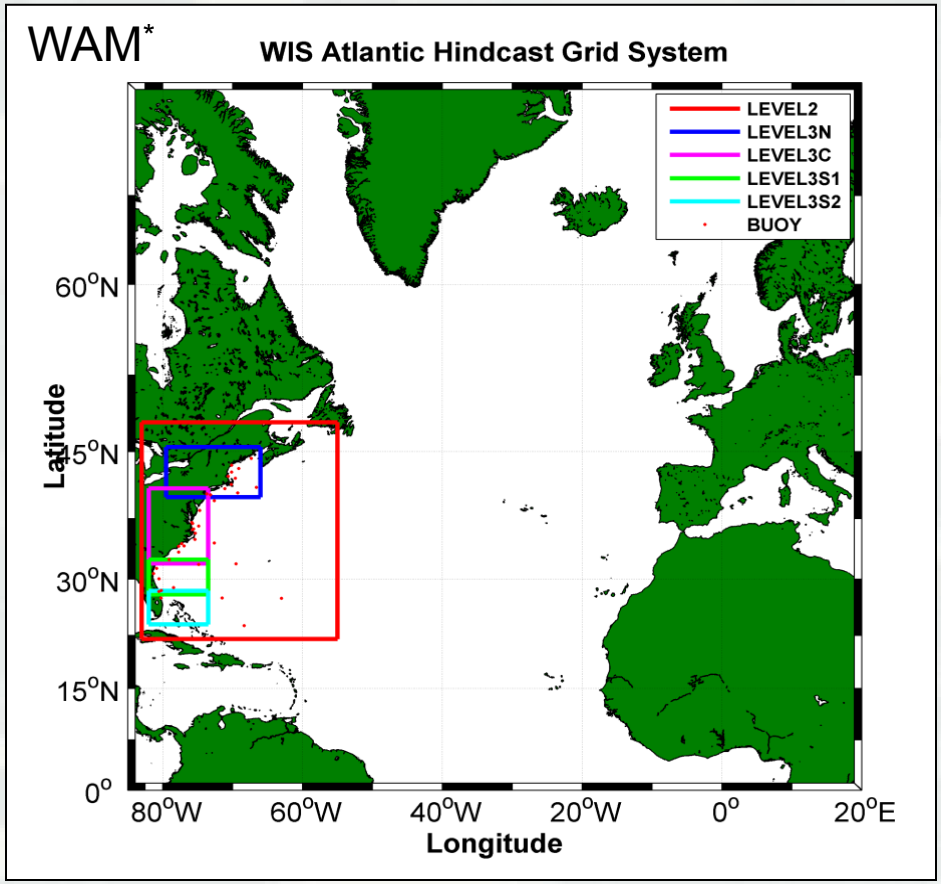


~ 3.1 million nodes (Challenge #3)

Resolution from 10 m to 100 km

Wave Grids





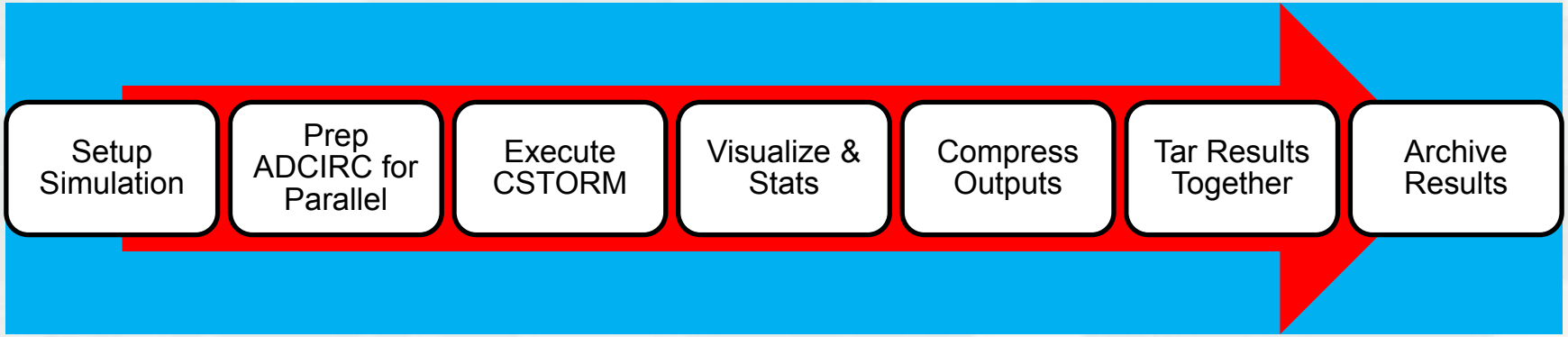
Challenge #4 – Many grids

CSTORM Production System

Challenge #5 – Staying Organized!
Many storms, resources, computational nodes, grids

- The **CSTORM Production System** (CSTORM-PS) makes use of standard Linux/Unix tools (bash scripting) and readily available open source software (Python)

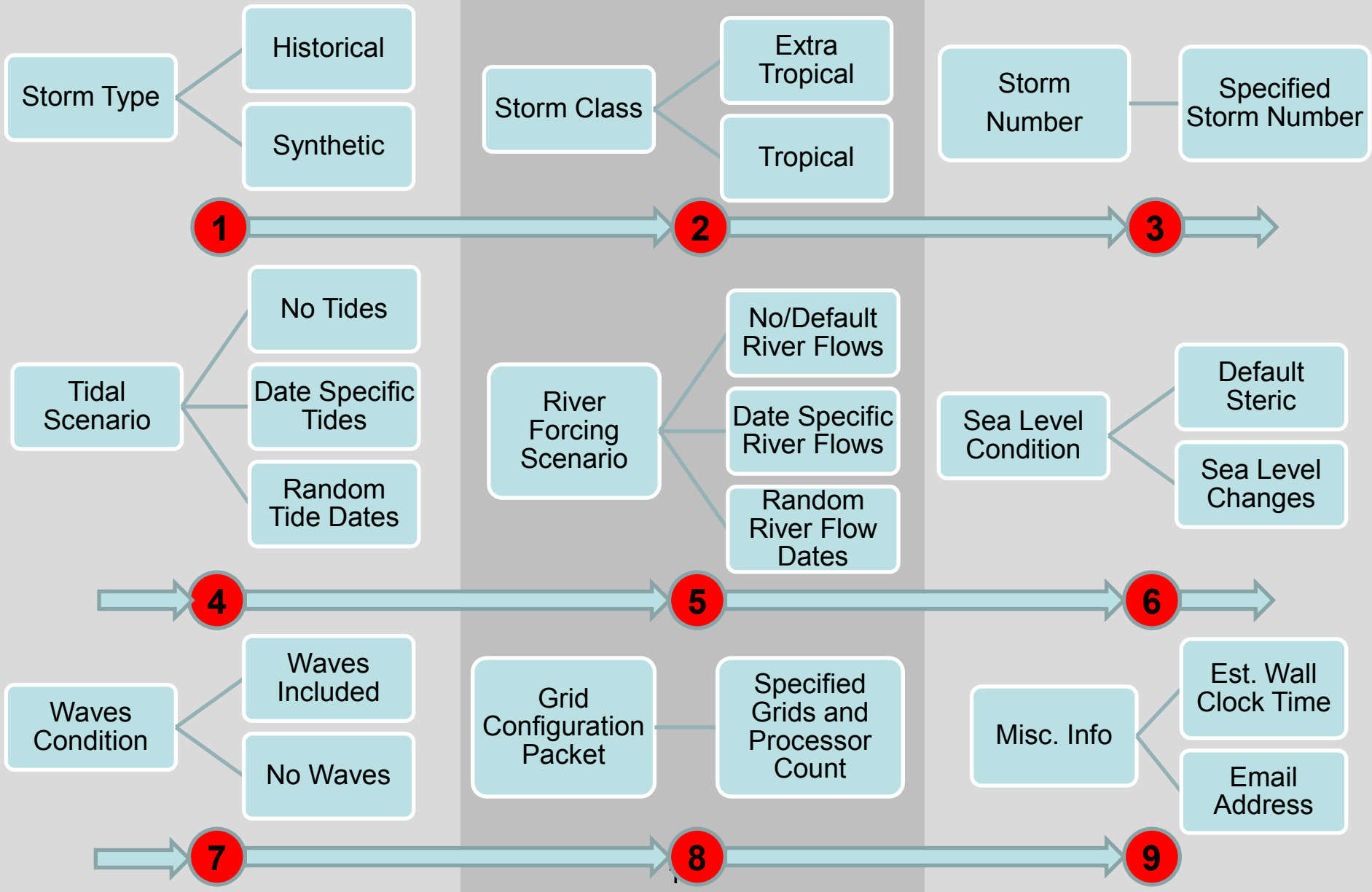
- The production system allows for
  - Rapid preparation of necessary input files for individual CSTORM-MS production runs (Reduces chances for human error)
  - Execution of the simulation
  - Execution of the CSTORM Visualization and Report tool
  - Efficient file storage and archival
- The production system is general enough for use in future projects



CSTORM-MS COASTAL STORM MODELING SYSTEM

CSTORM-PS: Decision Tree

simulation classification



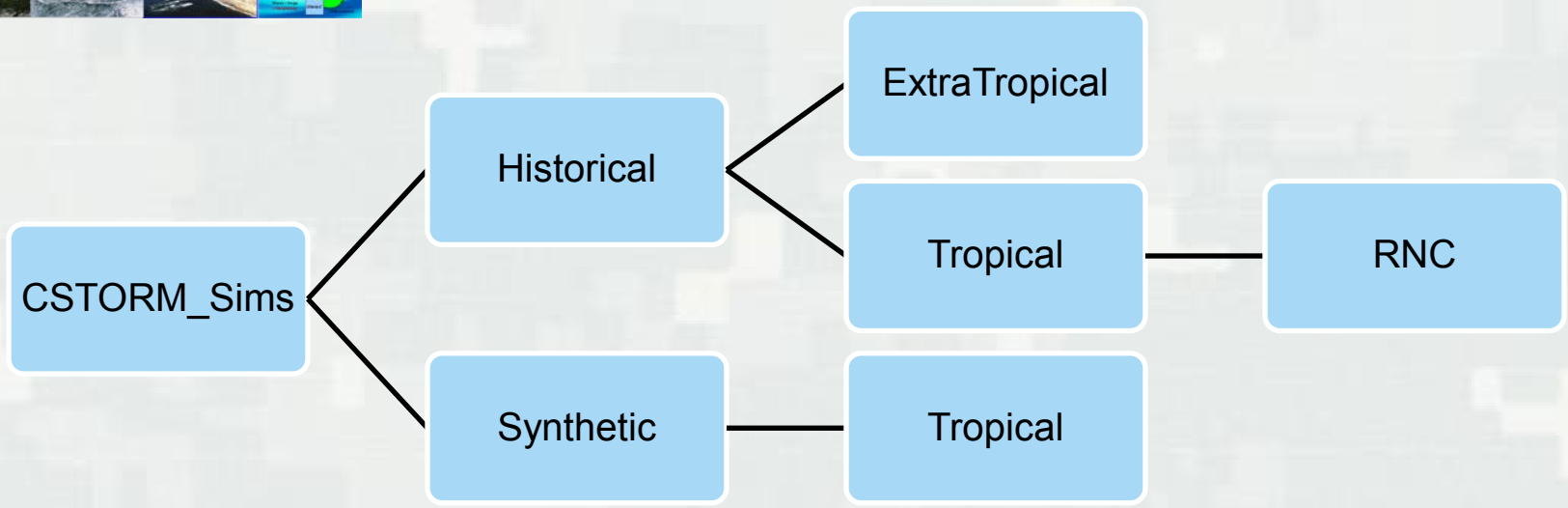
CSTORM-PS
Main Project Directory

- Codes
- Met_Inputs
- CSTORM_Sims
- RIVER_Data
- Grids
- WAM
- Documents
- Tides_Only_Data

For organizing and classifying simulations

Basic Directory Hierarchy

Naming convention: group/label storms; improved metadata; cataloging of events



RNC = Run_NM_Tides_TN_SLC_SN_RFC_RN_WAV_WN_GCP_PN_UID_IDV

- Run_NM = Storm Number, NM = 0001 to 1050
- Tides_TN = Tidal Scenario, TN = 0 to 5
- SLC_SN = Sea Level Change/Steric Adjustment Scenario, SN = 0 to 2
- RFC_RN = River Forcing Conditions, RN = 0 to 2
- WAV_WN= Waves Off/On, WN = 0 or 1
- GCP_PN = Grid Configuration Packet
- UID_IDV = User Identification, IDV = person performing simulation

CSTORM-PS Grids Directory

ADCIRC

STWAVE

WAM

WAM2STWAVE

GridConf_Packets

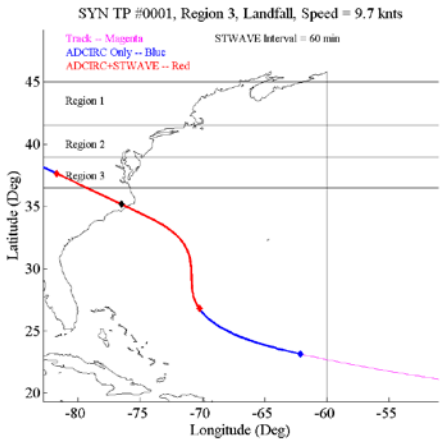
Documents

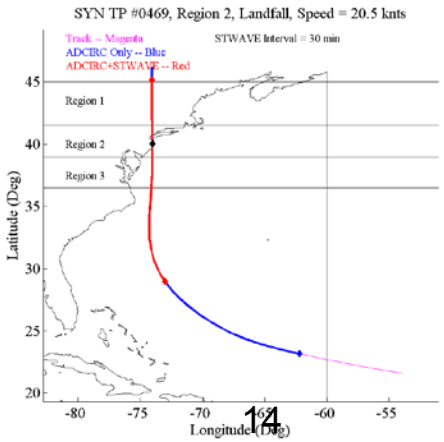
To define different project level grids .compare project designs; with and without project

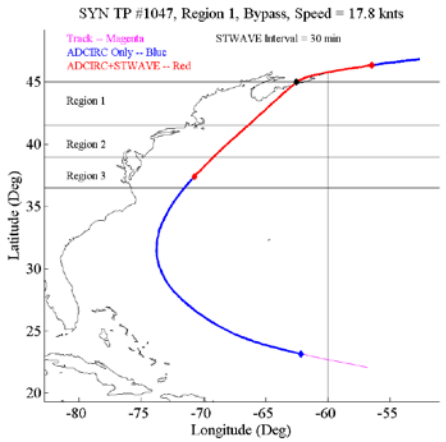
Run Parameter Table (Synthetic Tropical)

Storm Num.	Met Start Date	Met End Date	Met Int. (min)	STW Start Date	STW End Date	STW Int. (min)	ADC Wind Start Date	ADC Wind End Date
0469	2000071106	2000071518	5	2000071315	2000071515	30	2000071205	2000071518
0470	2000071212	2000071512	5	2000071407	2000071507	15	2000071316	2000071512
0471	2000070500	2000071700	5	2000071206	2000071606	60	2000070709	2000071700

(cont)	Tidal Spin-Up (days)	Random Tide IHOT Val 1	Random Tide IHOT Val 2	Random Tide IHOT Val 3	Random Tide IHOT Val 4	Random Tide IHOT Val 5	SLC / Steric 0 (m)	SLC / Steric 1 (m)	SLC / Steric 2 (m)
	14.00	2862000	2329200	1825200	1602000	2012400	0.109	1.109	0.609
	14.00	1684800	2289600	2296800	1404000	3614400	0.109	1.109	0.609
	14.00	1882800	2444400	3081600	3204000	1933200	0.109	1.109	0.609





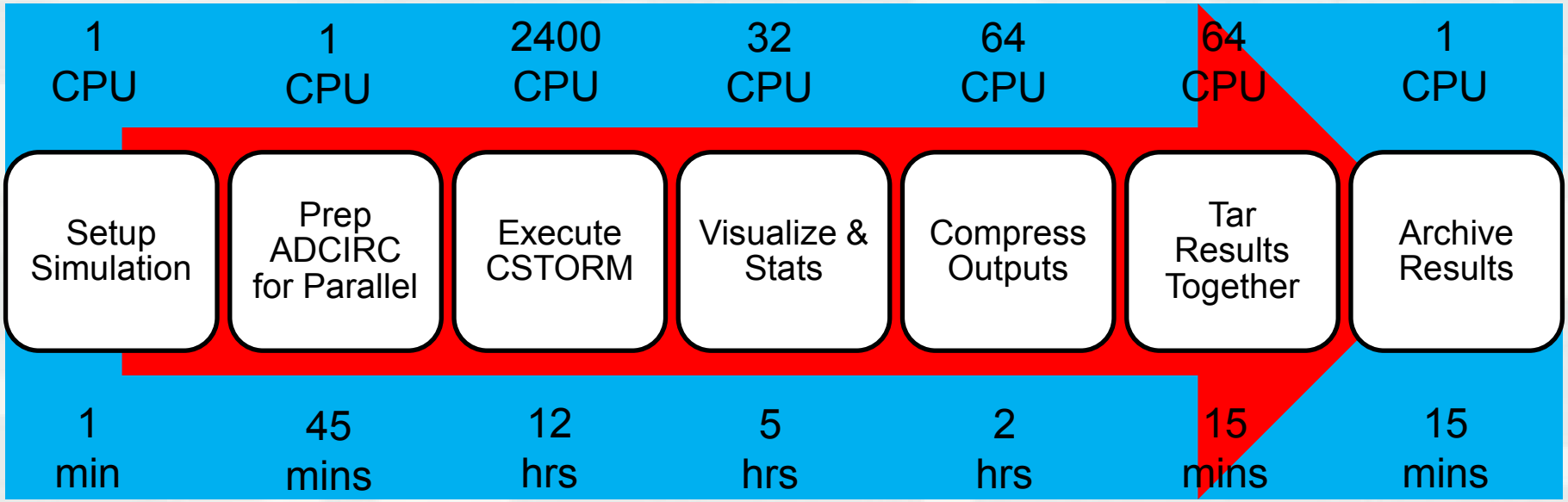


CSTORM Properties Log
(Inclusion of Metadata)

NACCS CSTORM-MS Production Script Log

Setup Performed by User ID: brittany
Setup Date Time (MM-DD-YYYY HH:MM:SS) : 10-17-2014 13:48:49
Storm Type : Synthetic
Storm Class : Tropical
Storm Number : 0468
Tidal Scenario Num. : 2
Sea Level Condition Num. : 1
River Flux Condition Num. : 0
Geoid Offset : 1.109 meters
Grid Configuration Packet : GCP_NAC13
CSTORM Executable : cpadcirc_v1.1.16_adc_v51.32_stw_v6.2.24_20140716
Number of STWAVE Grids : 10
Number of Wind/Pre Files : 2

Production Simulation Sequence and Processors

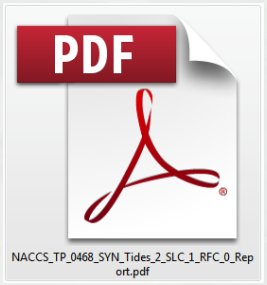


(Average Run Time on Garnet)

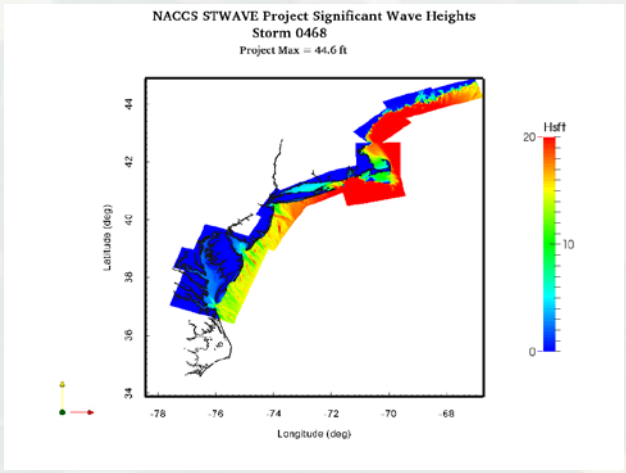
For the entirety of the NACCS Numerical Modeling Study, approximately 100 million CPU hours were used on DoD HPC systems to simulate over 3450 combinations of storms and water level conditions.

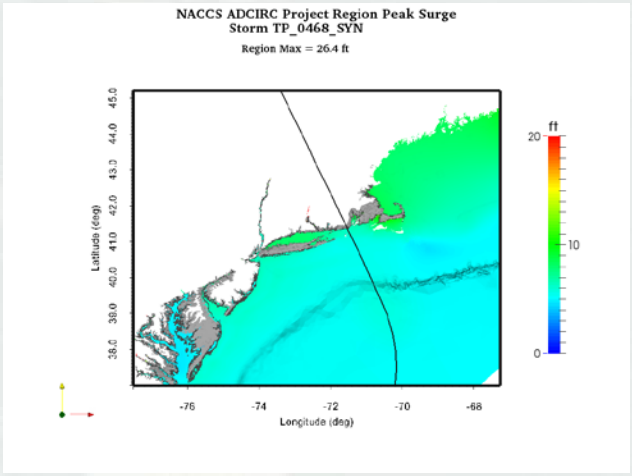
CSTORM-Viz & Report

POC: Dr. Jay Ratcliff



A 57 page auto generated report with 55 pages of images: maximums for surge, waves heights and periods and a 2 page summary of run statics.





The report quality graphics and run statics are generated via a combination of Python scripts and Paraview, which is a multiplatform visualization software package capable of rendering graphics using multiple processors.

Archived Results

ADCIRC:

NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_ADCIRC_GBL_Hydro.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_ADCIRC_GBL_Met.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_ADCIRC_MaxMins.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_ADCIRC_Stations.tar

STWAVE:

NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_STWAVE_NME_Outputs.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_STWAVE_NME_SurgeWind.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_STWAVE_All_Stations.tar

} **Repeated for each STWAVE Grid**

CSTORM:

NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_CSTORM_Data.tar

Viz:

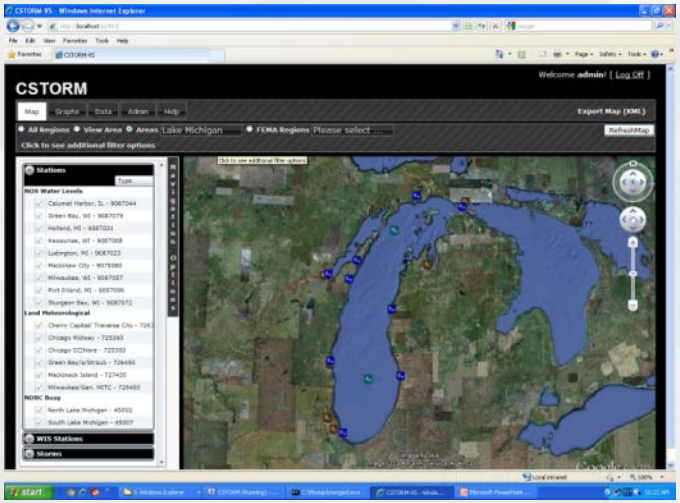
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Report.pdf
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Viz_ADCIRC_pngs.tar.gz
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Viz_STWAVE_MaxMins.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Viz_STWAVE_pngs.tar.gz
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Viz_Data.tar
NACCS_TP_0468_SYN_Tides_2_SLC_1_RFC_0_Viz_VTK.tar

Typically: 31 tar files with compressed results plus a copy of the PDF report.

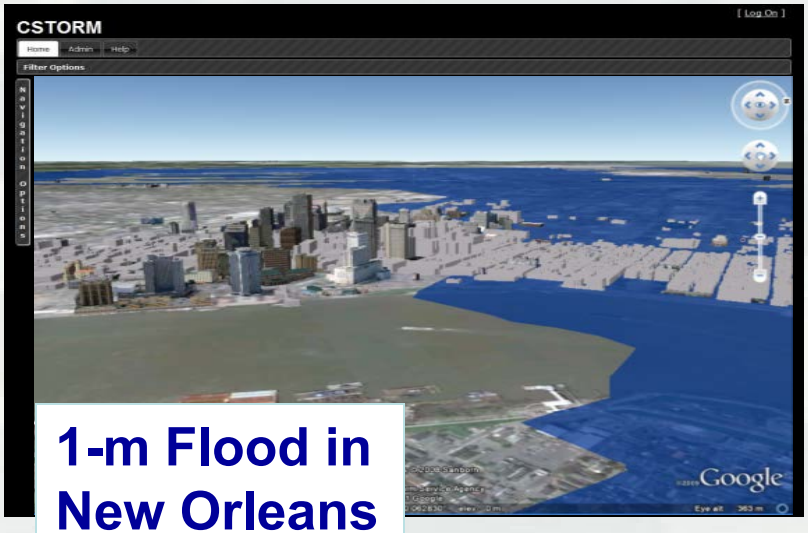
Run properties log included within each tar file.

Coastal Hazards System (CHS)

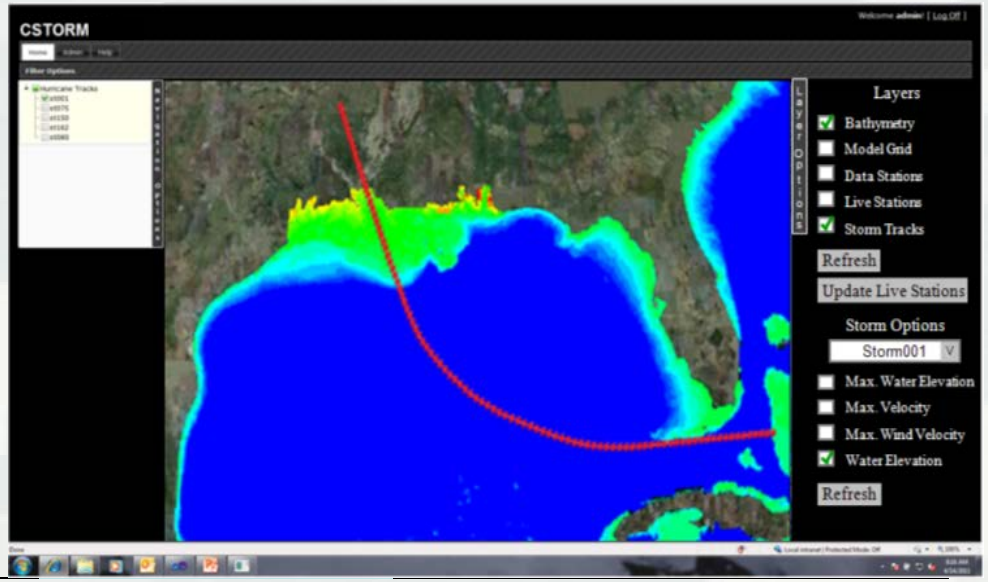
POC: Jeff Melby, USACE-ERDC-CHL



- Leveraging USACE regional coastal studies
- Gathering historical measurements and high-fidelity climate, surge, and wave modeling results
- Creating national storm database
- Web tool with Google Earth map interface
- Data mining and analysis tools (plotting, extremal analysis)
- Surrogate modeling from database (high-fidelity surge prediction layer)

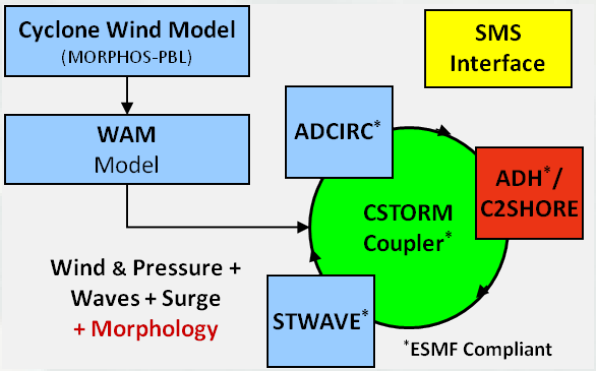


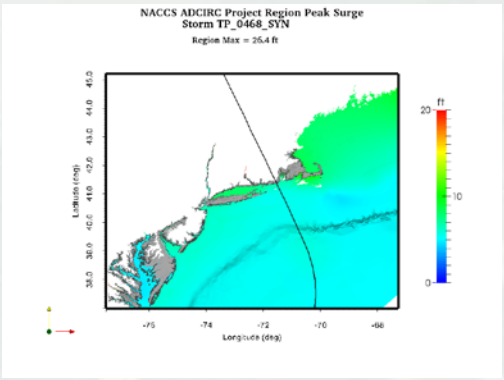
1-m Flood in New Orleans

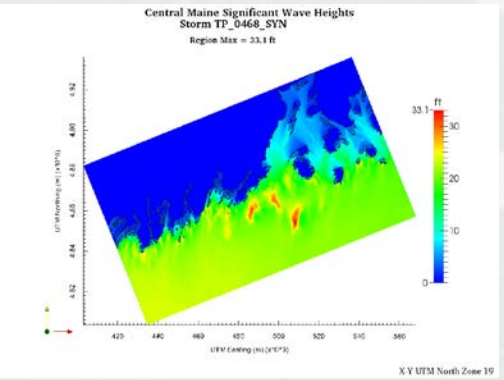


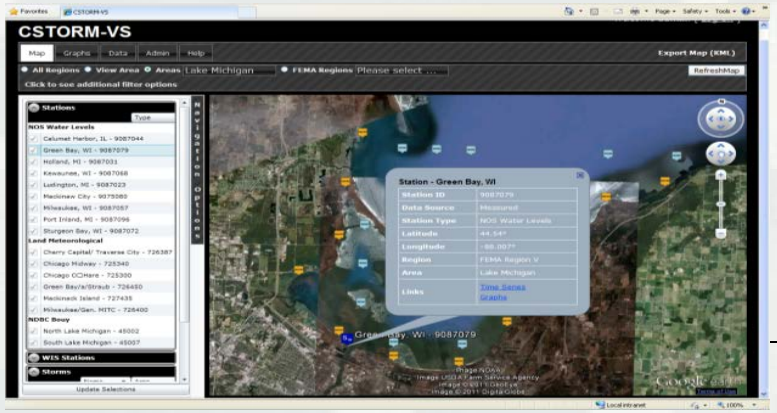
Summary

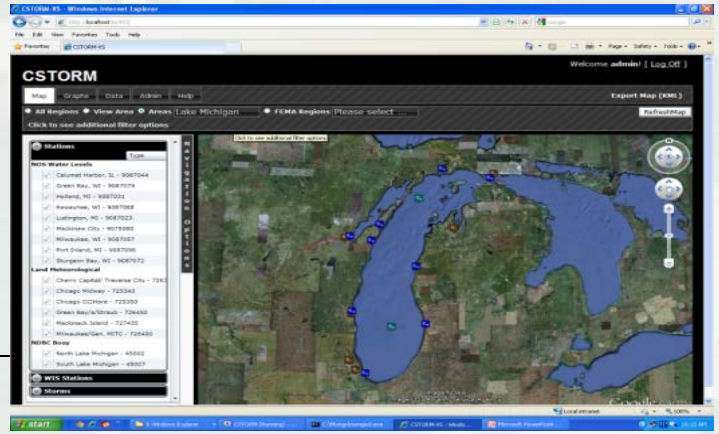
- CSTORM-MS is an efficient, robust, extensible modeling system for quantifying the risk of coastal communities to storm events
- Streamlined workflow saves time and reduces both computational and personnel cost
- Model data feeds into the Coastal Hazards System for easy access and reuse purposes





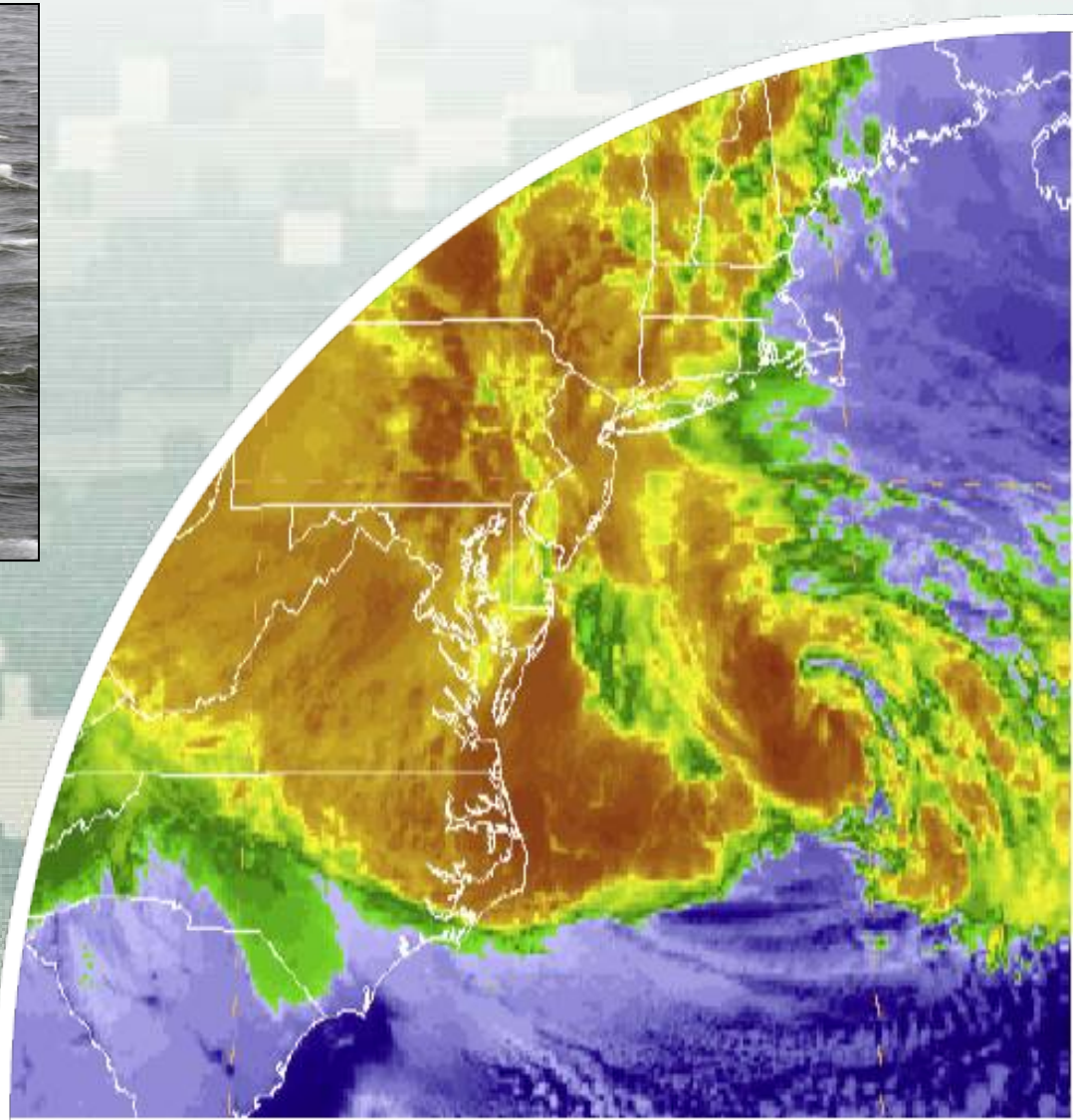






North Atlantic Coast Comprehensive Study

Coastal Storm Risk Management Framework



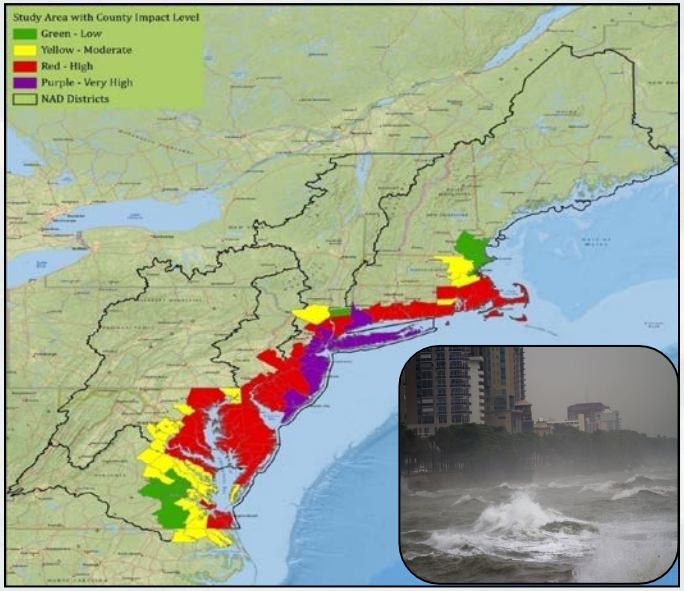
Dave Robbins
NACCS Lead

U.S. Army Corps of Engineers
Baltimore District

Northeast Regional Ocean Council
21 May 2015

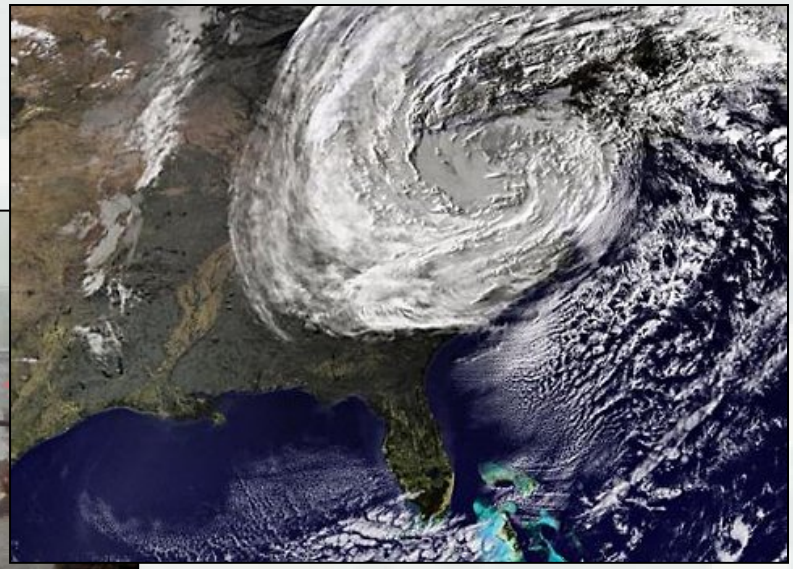
9-Step Process

- Address **flood hazard** of vulnerable coastal populations
- Develop using information/processes related to:
  - USACE 6-step planning process
  - FEMAs National Framework
    - prevention
    - protection
    - mitigation
    - response
    - disaster recover



Provides

- Consistent approach – across governments, communities, scales
- Address coastal flood risk



NACCS Goal

- Customizable to coastal communities
- Implemented to smaller watershed scales
  - Incorporating state and local priorities
  - Refining datasets
  - Performing site-specific analysis

Multi-Tiered Approach

Tier 1 – applied NACCS Framework to entire NACCS study area (Appendix D)

Tier 2 – State scale to address coastal flood risk by applying the NACCS Frameowrk as part of a systems approach using more refined, local datasets, goals, objectives, and constraints

Tier 3 – Community scale

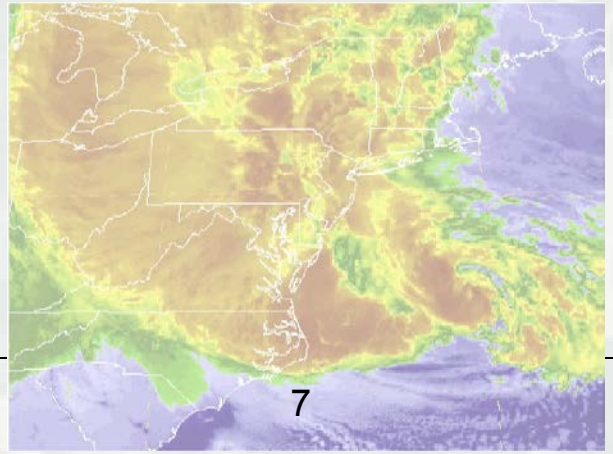
Appendix C – Planning Analysis

- **Methodology of using geographic info datasets associated with…**
- **Exposure indices**
  - **Population density and infrastructure**
  - **Social vulnerability characterization**
  - **Environmental and cultural resources**

Exposure Index

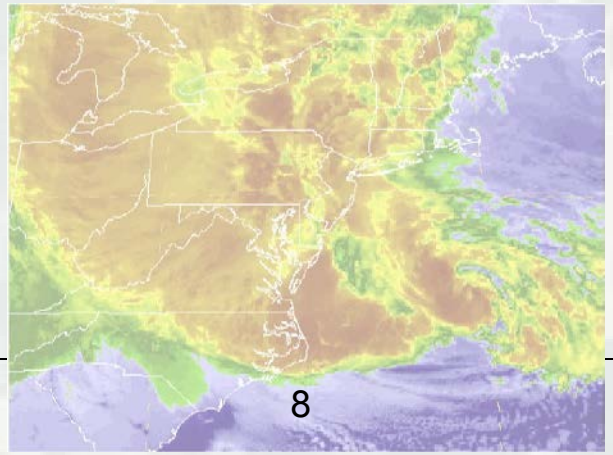
Coastal Storm Risk Management Framework

- Data layers – create an index for comparison
- Weights
  - Assigned to data layers
  - Can be adjusted by coastal manager



To Be Done

- Tier 2 – vulnerability assessment (measuring exposure, sensitivity, adaptive capacity)
- Tier 3 – incorporating benefit-cost analysis, evaluation, and ultimately leading to plan selection



Questions?

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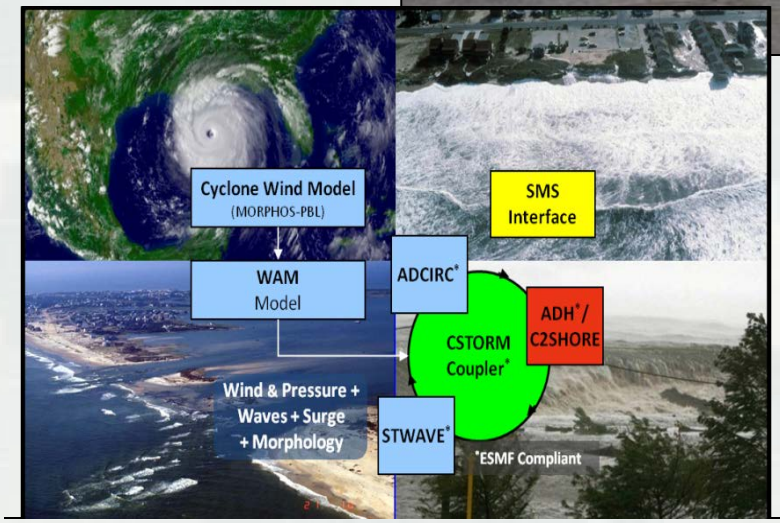
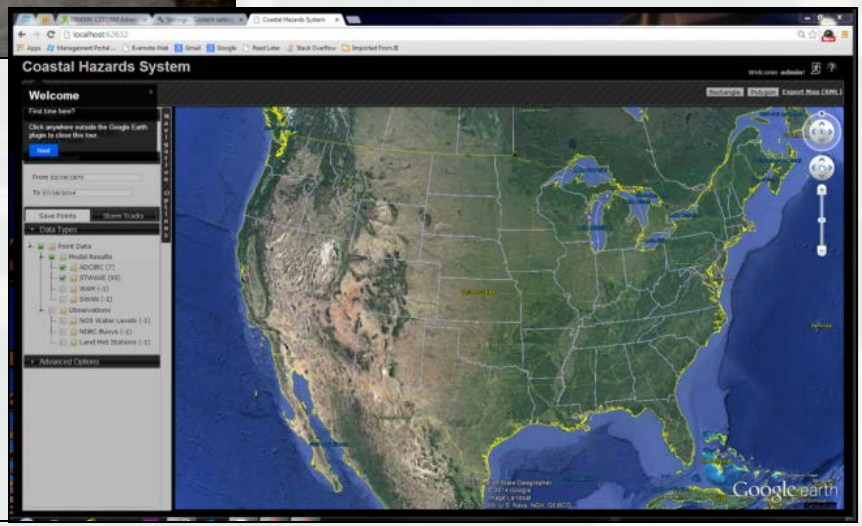




New Approaches to Planning, Implementing & Managing Coastal Measures

Responding to Waves of Change

Howard Marlowe

Alden Street Consulting

Overview

- Challenges
- Opportunities

The Cupboard is (almost) Bare

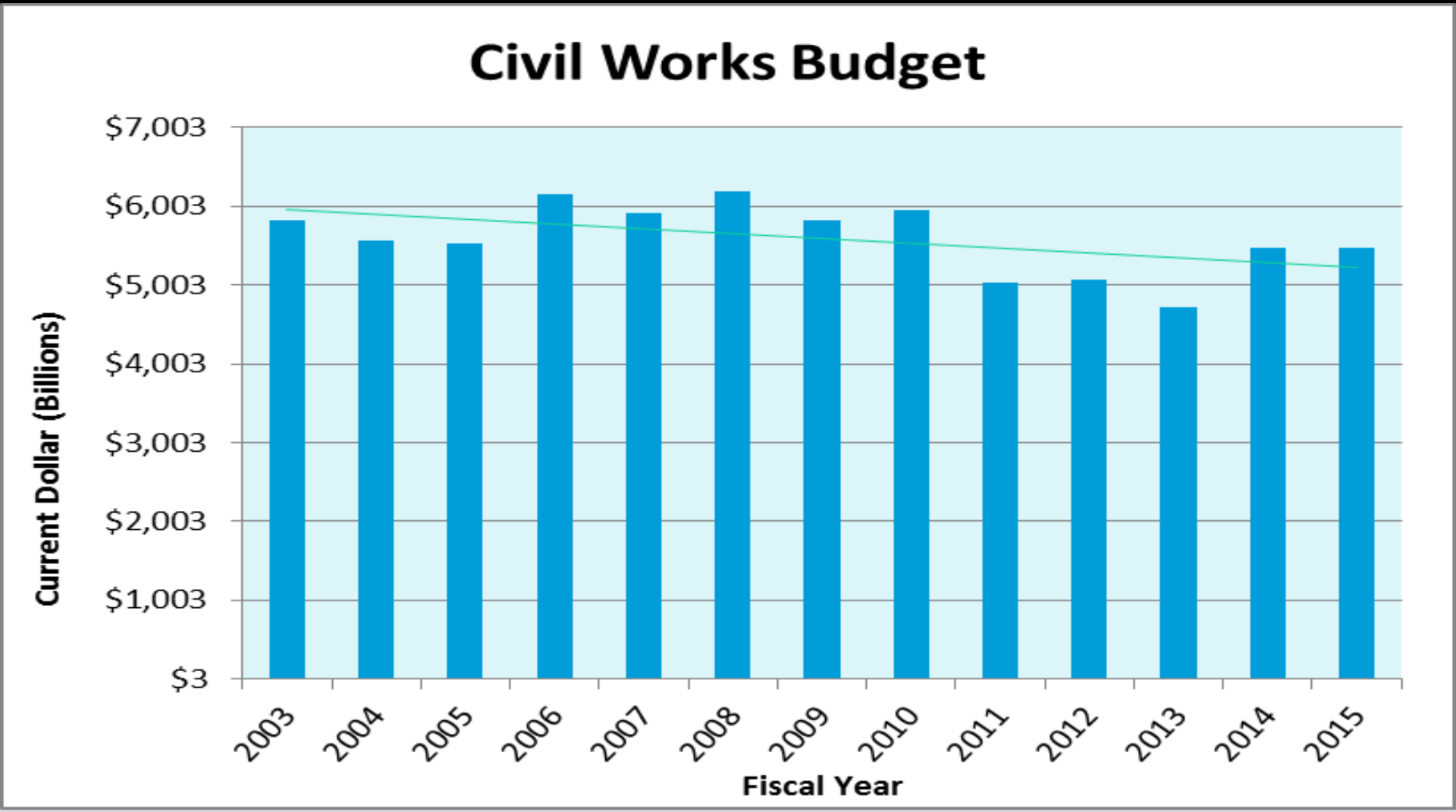
- Corps budget is not adequate to meet needs
- $5 - 6 billion – we fall behind
- Add $1 to $2 billion more, we're still far behind
- State & Local Government wallets are empty

Water Resources – 'Silent Infrastructure'

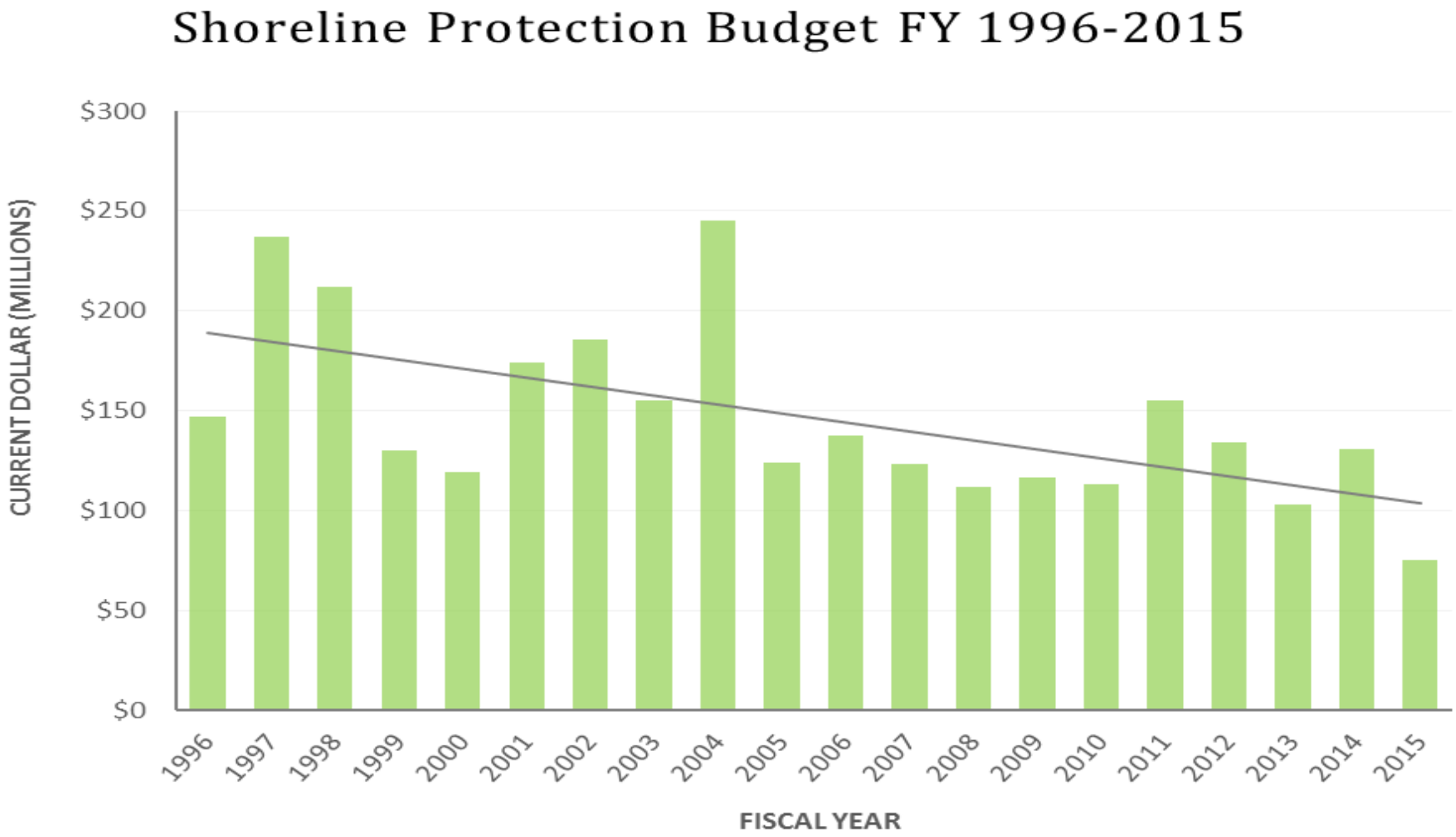
- Neglected; not a public or congressional priority
- Project-by project approach is 'so yesterday' - We know how to do it better
- Feds don't have the money; neither do states
- Alternative Financing is Necessary
- Other Changes Needed

  Corps – Congress – States – Businesses – Etc.

Corps' CW Budget is Flat



CSDR Funding is Declining



Challenges

- Sea Level Rise
- Storms
- New methods to plan, implement and manage coastal water resources needs

Regionality

- Goal
- Impediments
- Existing Authorities
- What's Missing?

Solutions – Systems Approach

- Coastalshed planning, budgeting, and managing
- Regional Alliances of States

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