NROC Council Meeting
Portsmouth, NH
March 14, 2014

Meeting Materials

This was the Winter NROC meeting, during which Council members and partners provided updates; an update on the Sandy Comprehensive Study was given, along with a presentation on associated modeling efforts; the potential for a regional sand management working group was discussed; as well as an overview and results of the ROP Benefits project.

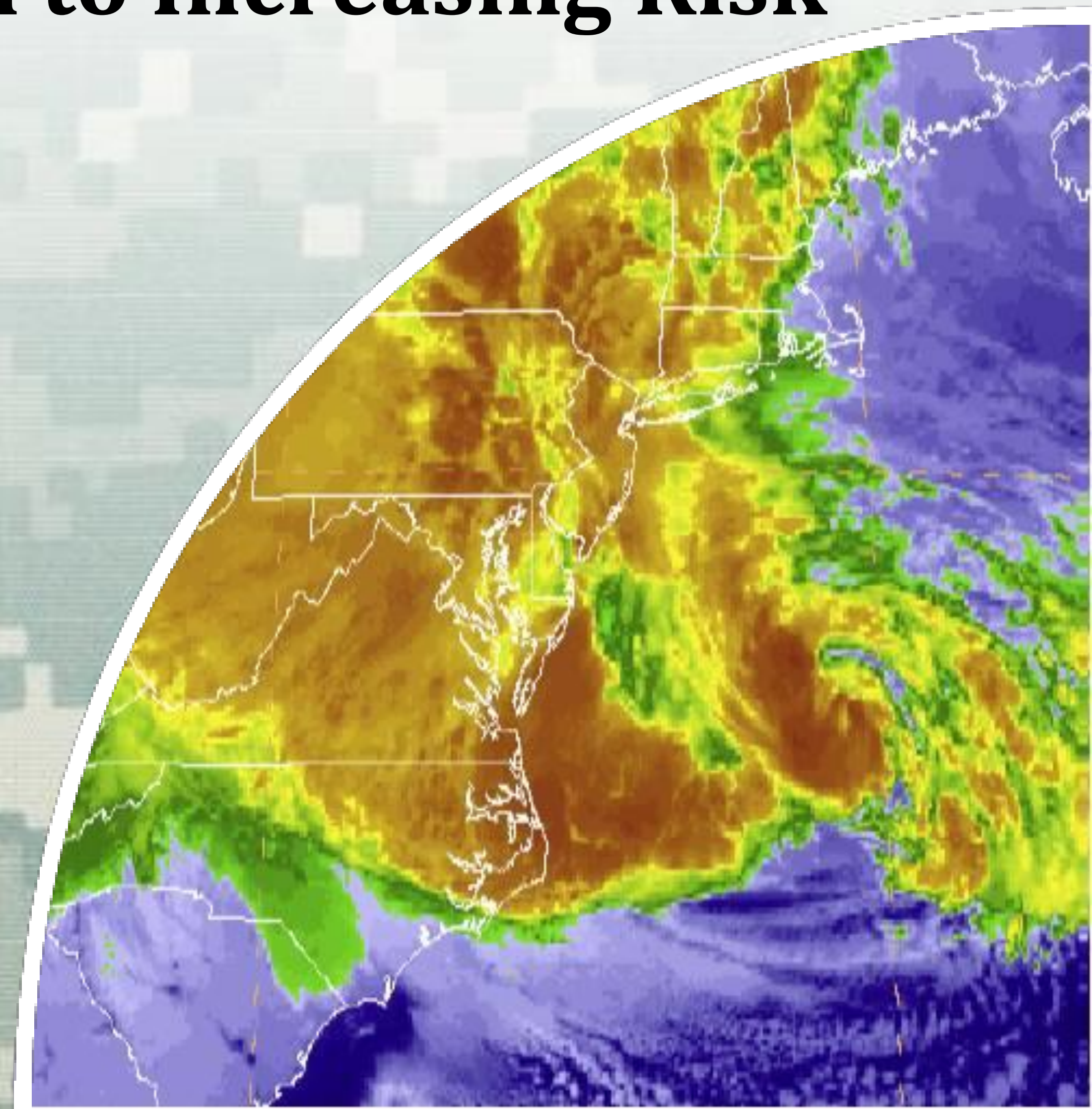
Attached are the following materials and presentations from the meeting:

- North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk *(Lynn Bocamazo, USACE)*
- North Atlantic Coast Comprehensive Study: Overview of Numerical Coastal Storm Modeling *(Lynn Bocamazo, USACE)*
- Marine Minerals Program: Restoring and Protecting Our Nation's Coasts through Stewardship of OCS Resources *(Renee Orr, BOEM)*
- Value of Regional Ocean Partnerships *(Andy Lipski, SeaPlan and Arleen ODonnell, ERG)*

North Atlantic Coast Comprehensive Study: Resilient Adaption to Increasing Risk

U.S. Army Corps of Engineers
Coastal Storm Risk Management
Planning Center of Expertise

13 February 2014



Outline

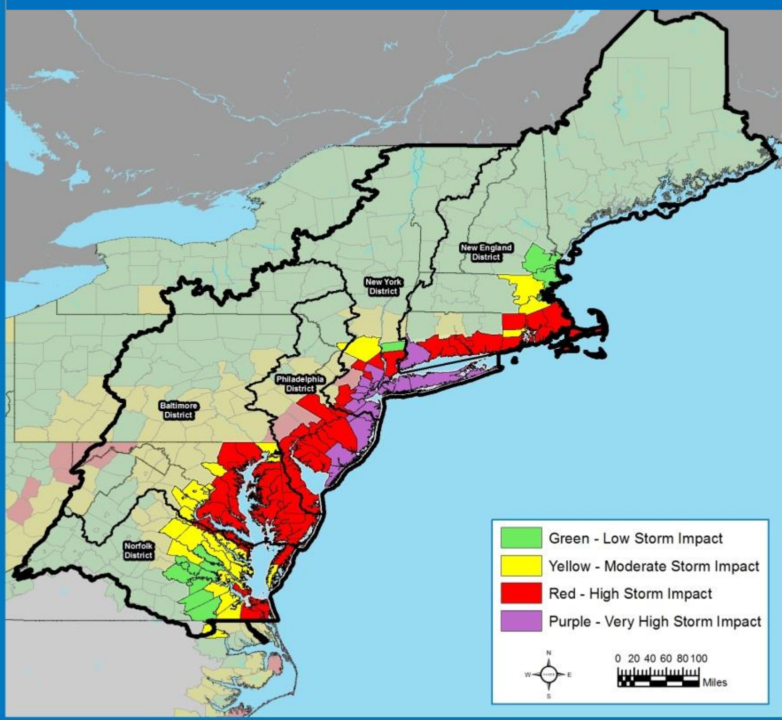
- Background and Sandy's Impact
- North Atlantic Coast Comprehensive Study (NACCS) Study Area and Future Scenarios
- NACCS Framework
  - Flooding Exposure
  - Planning Reaches
  - Risk Reduction Measures and Nature-Based Features
- Collaborative Efforts
- Preliminary Findings, Outcomes and Opportunities
- Schedule
- Way Ahead

Background

"That using up to $20,000,000* of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps..." (*$19M after sequestration)

- Complete by Jan 2015

FEMA H. Sandy storm surge data



Goals

- Provide a **Risk Reduction Framework**, consistent with USACE-NOAA Rebuilding Principles
- Support **Resilient Coastal Communities** and robust, sustainable coastal landscape systems, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure

Background

- Hurricane Sandy impacted the Atlantic coastline in October 2012
- Affected entire east coast from Florida to Maine; and west to Great Lakes
- Greatest areas of impact NJ, NY, CT
- Public Law 113-2, enacted 29 January 2013

Sandy's Impact

- **Human**
  - **286 lives lost** (159 in the US)
  - 500,000 people affected by **mandatory evacuations**
  - 20,000 people required **temporary shelter**
  - Extensive **community dislocations** – continuing today in some areas

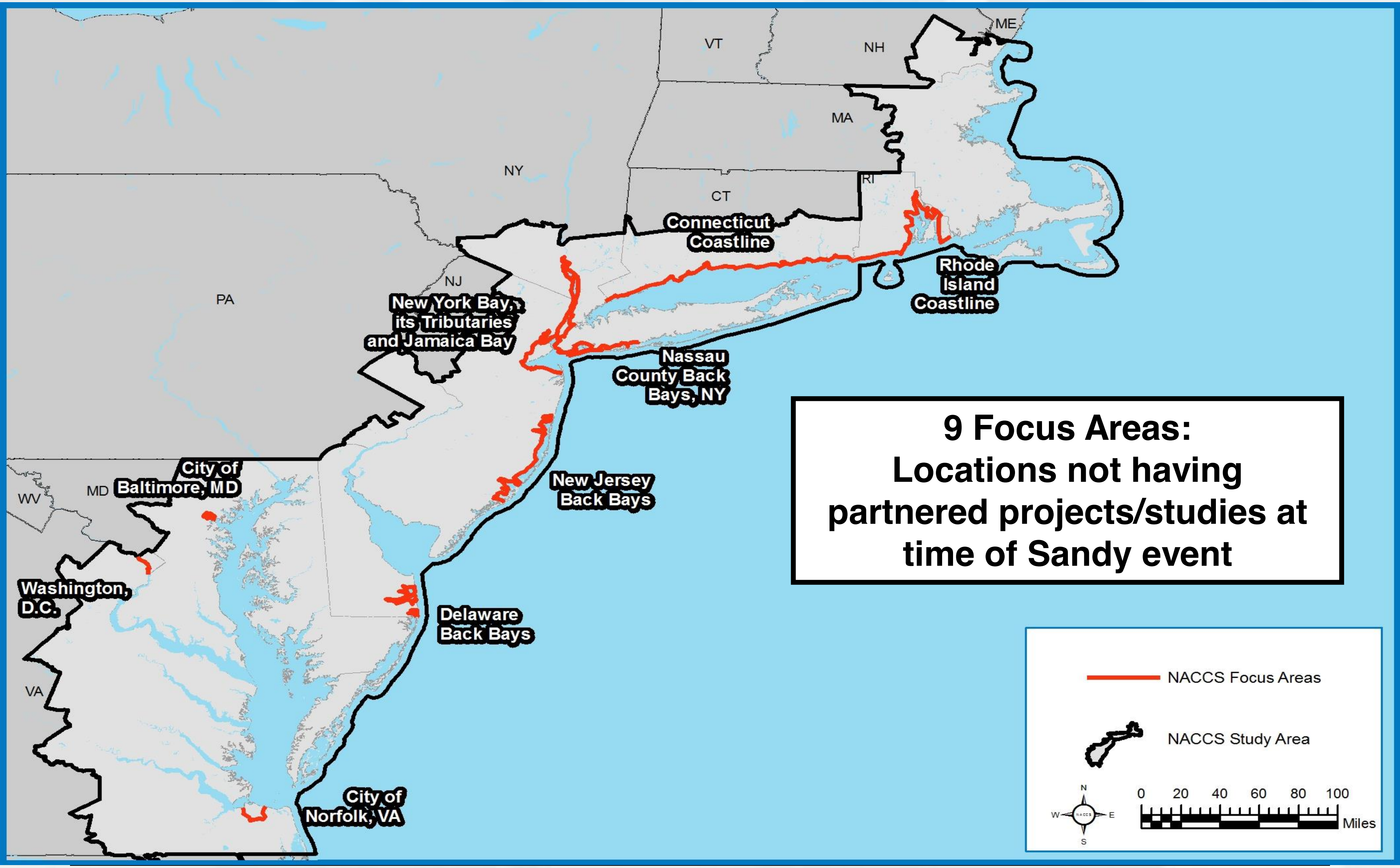
- **Economic**
  - **$65B in damages** in the U.S.
  - **26 states affected** (10 states and D.C are in the study area)
  - **650,000 houses** damaged or destroyed

Sandy's Impact

- **Infrastructure**
  - **Telecommunications** significantly disrupted (25% of cell towers in study area were out of service at one period of time)
  - **Mass transit** shut down (3 weeks for many NYC subway lines)
  - **Bridges, tunnels** damaged
  - **Fuel** shortages (2 refineries shut down, 4 operations reduced)
  - 8.5M people lost **power** (some for several months)
  - **Barrier islands (natural coastal features) breached** in 4 locations

- **Existing Coastal Projects**
  - **Beaches/Dunes**
    - Significant volumes of **sand lost** (~ 3 million cubic yards in NYC alone)
    - Hazards to **Navigation** from sand movement
  - **Walls, Revetments and Levees**
    - **Most not significantly damaged**; some with toe scouring
    - Cliff Walk, RI revetment notable exception, extensive damage

North Atlantic Coast Comprehensive Study Area



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NACCS Future Scenarios

- **Climate Change and Sea Level Rise**
  - **Sea level is increasing** throughout the study area
  - **Increased** populations and infrastructure **exposed** to storm surge and **frequency** of flooding
  - **Shorelines are changing** in response to sea level rise
  - Historic **erosion** patterns will **continue and accelerate**
- **Socioeconomic Factors**
  - **Population is aging** (complicates evacuation/relocation during flooding)
  - **Population is increasing in coastal zone** (greater exposure)
  - **Vulnerability of operating channels and ports** critical to regional and national economy
- **Environmental**
  - **Coastal Habitats** increasingly challenged by expanding built environment
  - **Climate change** and related habitat transitions with potential for altering species distribution and competition

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Future Scenarios

Sea level rise* evaluated for the years 2018, 2068, 2100** and 2118

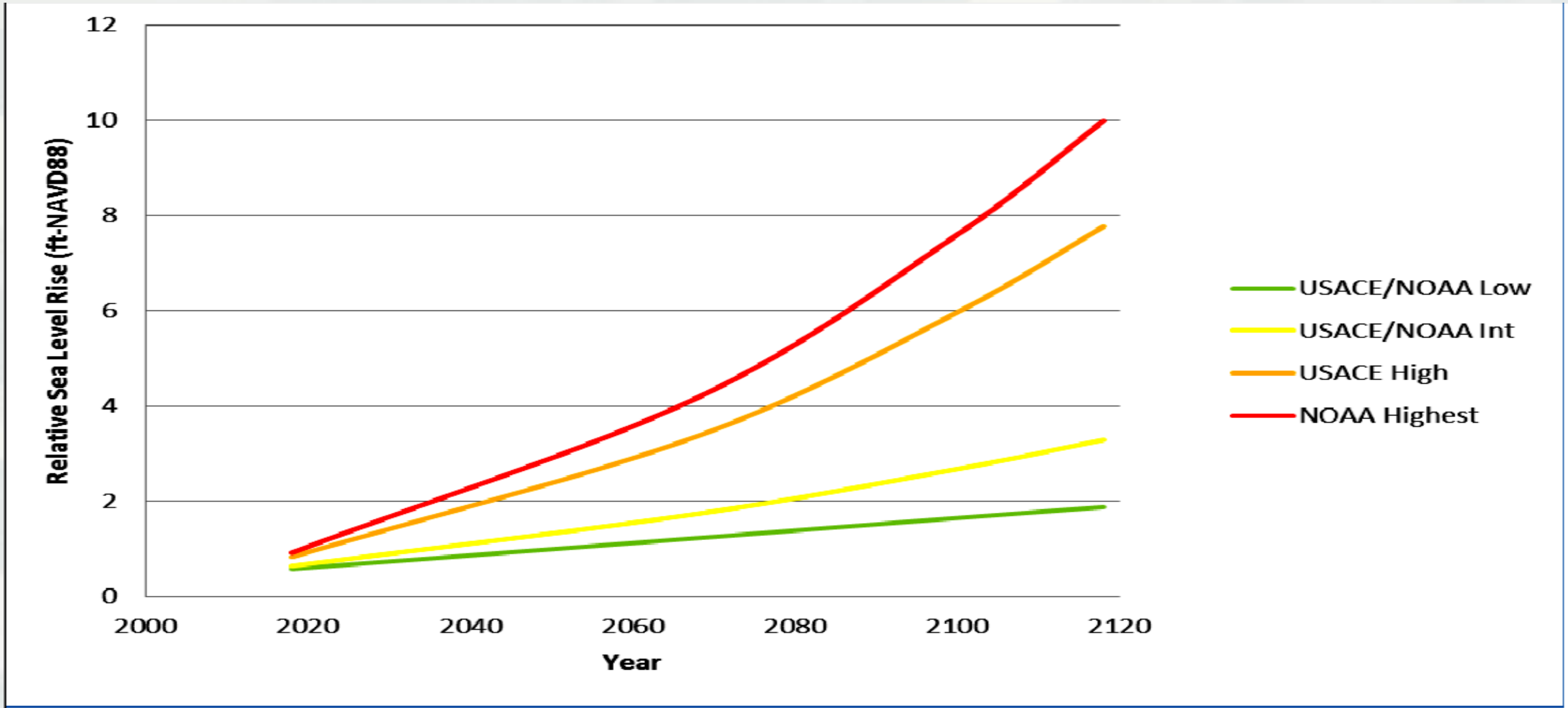
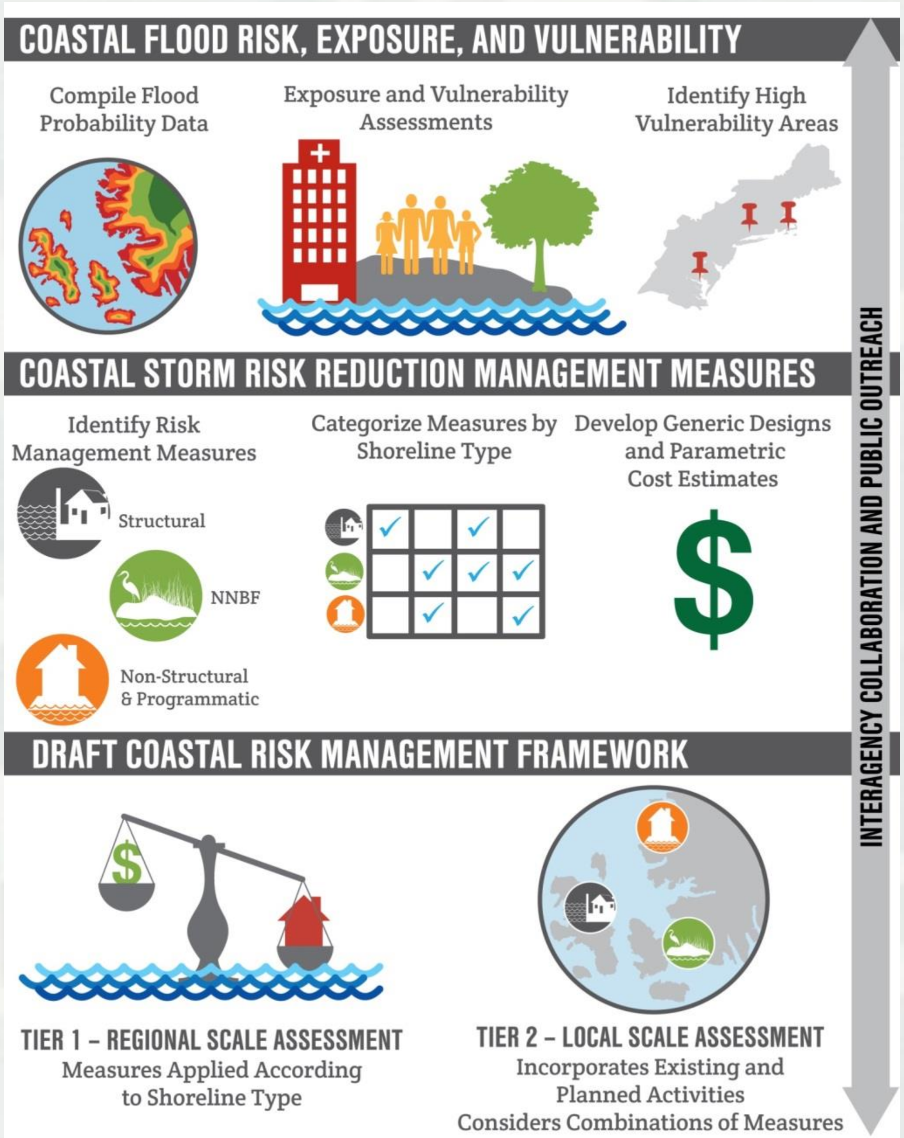


Figure V-1. Relative sea level rise for Sandy Hook, NJ for USACE and NOAA sea level change

* SLR evaluated using both USACE's Engineer Circular (EC) 1165-2-212 (low, intermediate high) and NOAA 's highest SLR scenarios

** Intergovernmental Panel on Climate Change scenario

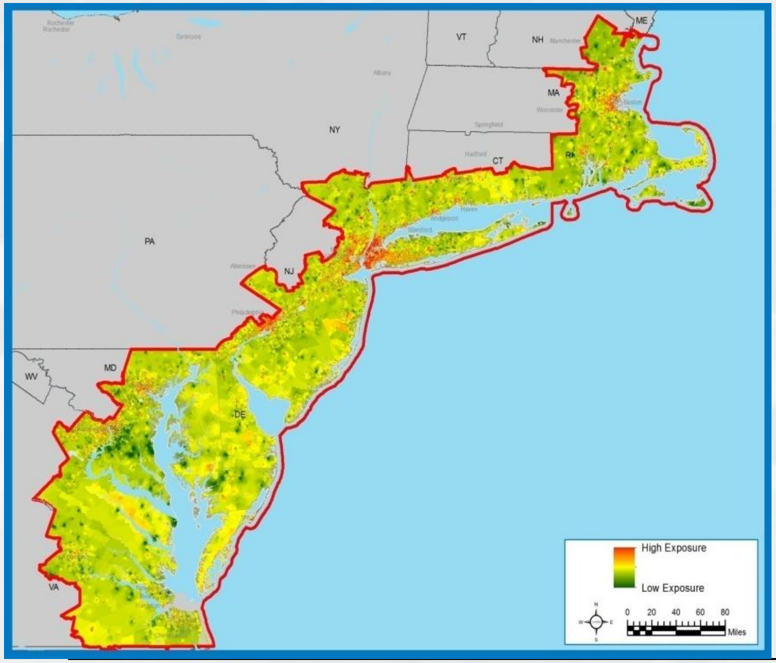
NACCS Framework



- **Who and what** is exposed to flood risk?
- **Where** is the flood risk?
- What are the **appropriate strategies** and measures to reduce flood risk and how do they align with **each other and other regional plans**?
- What is the **relative cost** of a particular strategy compared to the anticipated risk reduction?
- What **data are available** to make a **RISK INFORMED decision**?
- What **data gaps exist/can be closed** through the NACCS?

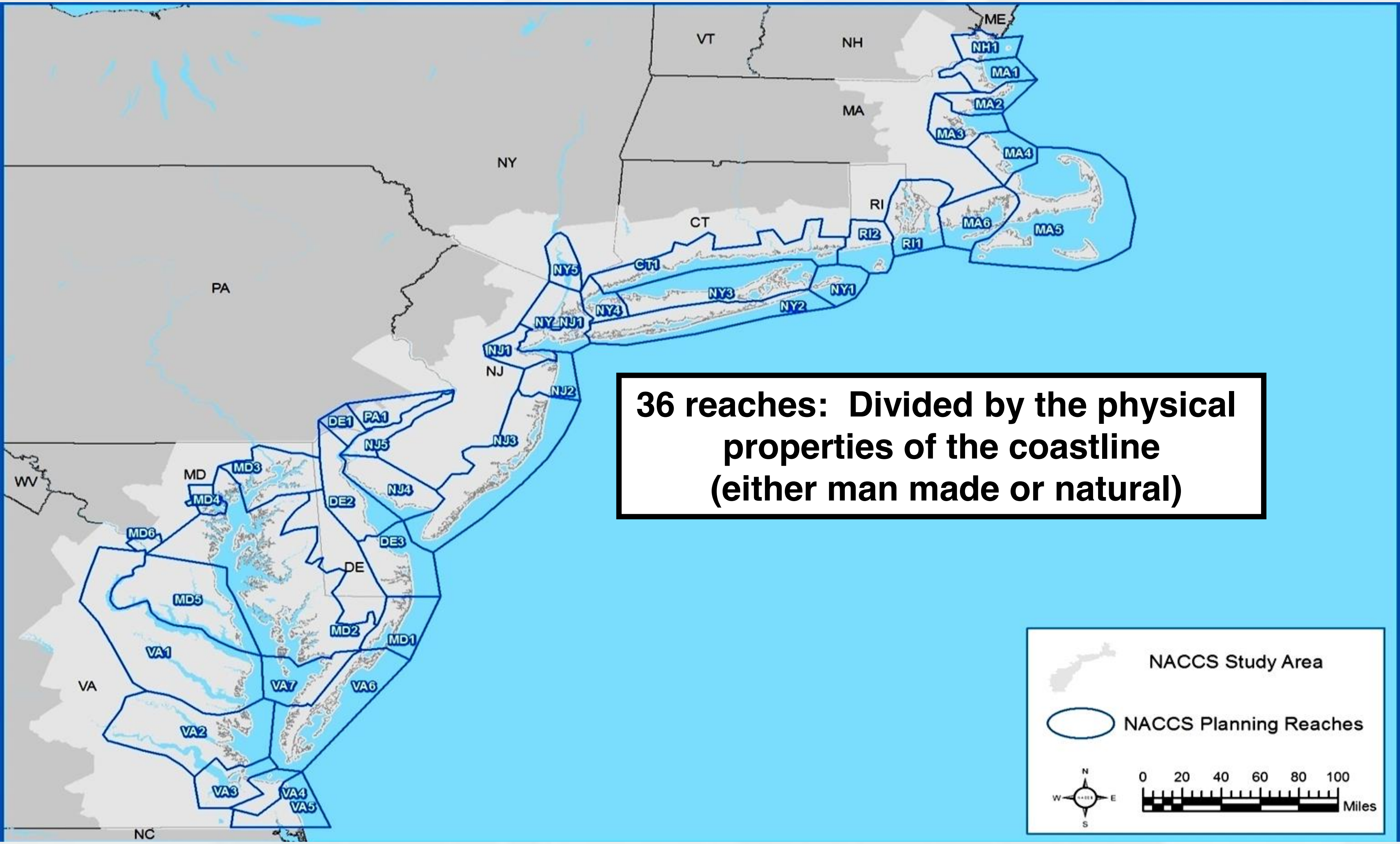
Flooding Exposure

- **Exposure Index**
  - Population **density and infrastructure** (number of people and infrastructure in communities subject to flooding)
  - **Socio-economic groups** (populations that may have more difficulty preparing and responding to flooding)
  - **Environmental** (critical habitat, wetlands and other areas that maintain resiliency of coastal systems)



- **Mapping**
  - Areas of highest exposure during Sandy
  - Majority were highly populated/urban core
    - Boston
    - NY/northern NJ metropolitan region
    - Connecticut shoreline
    - Monmouth and Cape May Counties
    - Upper Delaware Bay portion of NJ

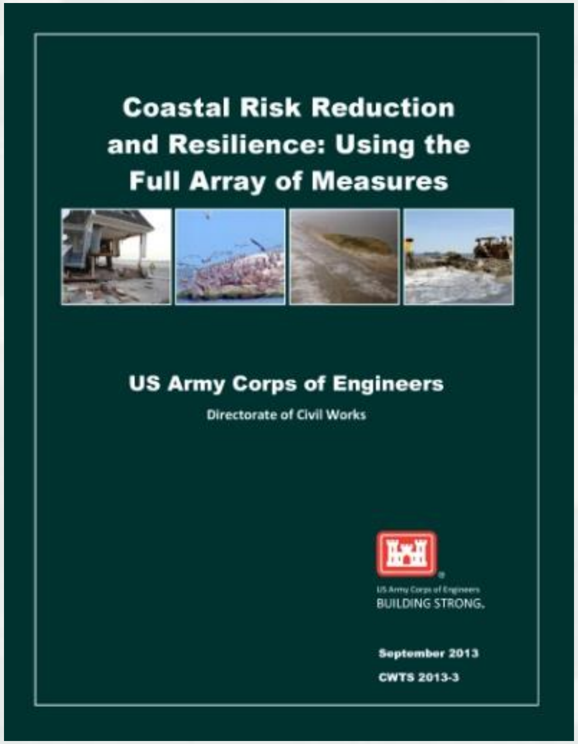
Planning Reaches



36 reaches: Divided by the physical properties of the coastline (either man made or natural)

Risk Reduction Measures

- **Structural**
  - Storm surge barriers, levees, breakwaters, groins, beach fill, dunes
  - **Natural and nature-based features** (e.g. living shorelines, wetlands, oyster reefs, Sub-Aquatic Vegetation restoration)
- **Non-Structural**
  - Floodproofing, elevation, acquisition
  - Evacuation, flood warning systems
- **Policy/Programmatic**
  - Floodplain management, land use planning
  - State/Local Coastal Zone Policies, Flood Insurance Programs
  - Natural resources/surface water management



http://www.corpsclimate.us/ccacrrr.cfm

Nature-Based Features

- **Natural landscapes or engineered ecosystems**, and **blended** solutions
- Intrinsically dynamic, adaptive, and potentially more resilient than built systems

Closing Data Gaps

- **Evaluate performance during Sandy**
- **Identify storm resilient features**
- Provide **tools for benefit evaluation**
- Integrate nature-based features in **coastal risk management systems**
- Work towards building consensus **on nature-based infrastructure, and its coastal storm risk management benefits**

- **State/Local Government Initiatives**
- **Inter-agency Policy Review**
- **International Technical Workshop**
- **HUD Initiative: Rebuild by Design**
- **Rockefeller Initiative: Structures of Coastal Resilience**

Collaborative Efforts

- **Interagency, State, Tribal, and Local Government Input**
  - Formal coordination letters establishing single point of contact
  - Technical working meetings
  - Agency Subject Matter Experts embedded in team and via outreach
  - Federal Register notices and public website with subscribe list and opportunity for input on resilience www.nad.usace.army.mil/compstudy
  - **News releases and media events**
  - **Participation in public events and panel discussions**
- **Interagency Webinar Collaboration Series (archived)**
  - Webinar 1 (30 July 2013) Green/Nature Based Infrastructure
  - Webinar 2 (29 August 2013) Ecosystem Goods and Services
  - Webinar 3 (12 September 2013) Numerical Modeling and Sea Level Rise
  - Webinar 4 (25 September 2013) Vulnerability Assessments
  - Webinar 5 (December 2013) Adaptive Management
  - Webinar 6 (December 2013) Policy Challenges

NACCS Preliminary Findings

- **Shared** responsibility of all levels of Government and partnerships
- Rethink approaches to **adapting to risk**
- Areas of highest (and growing) population density and economically critical urban centers are most **vulnerable**
- Resilience and sustainability must consider a **combination and blend** of measures
- Consider **stormwater and fluvial** aspects of coastal risk management
- **Interior, low-lying** areas highly susceptible to small changes in water level

NACCS Preliminary Outcomes

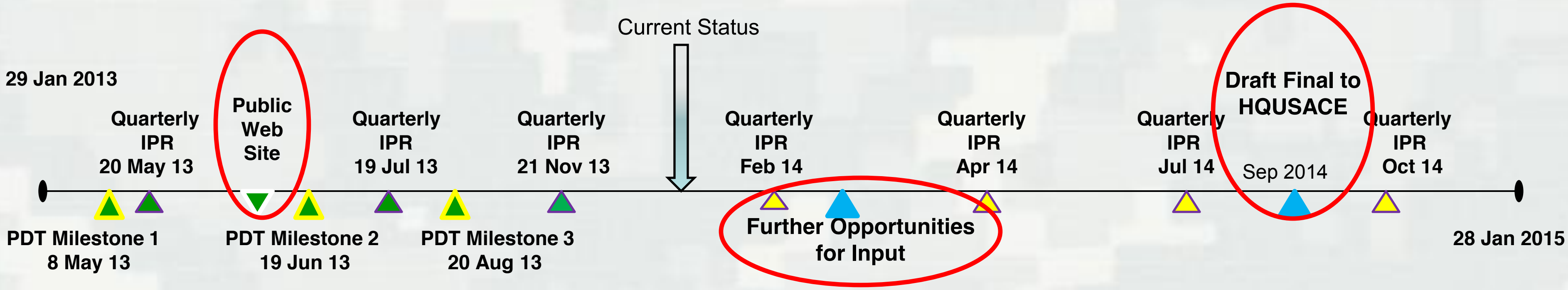
- **State-by-State Risk Reduction Frameworks informing, strengthening and catalyzing the focus on regional** resiliency, redundancy and robustness in ongoing coastal planning and project implementation
- **System-wide framework** and best practices
- **Interagency and Regional alignment**
- **Closed data gaps**
  - Broadened the pool of benefits for benefit-cost-ratio evaluations
  - Developed detailed modeling for future use, including sea level rise scenarios
  - Identified critical habitats and opportunities for using nature-based features (USFWS Planning Aid Report)
  - Developed conceptual regional sediment budget
  - Community Resiliency Survey (NOAA)
  - Collated Technical input

NACCS Preliminary Opportunities

- Identify acceptable **flood risk at a community** and state scale
- **Mitigate** future risk
- **Prioritize** critical infrastructure
- **Rebuild with redundancy**
- Develop **creative incentives** to promote use of resiliency measures
- Utilize a **collaborative regional governance structure**
- Develop **Public-Private Partnerships** for coastal risk management
- Integrate **natural-based features** in coastal risk management systems
- Encourage design **flexibility and adaptive management**
- Advance efforts in the 9 focus areas:

1) Rhode Island Coastline
2) Connecticut Coastline
3) Nassau County Back Bays, NY
4) New York Bay, its Tributaries and Jamaica Bay
5) New Jersey Back Bays
6) Delaware Back Bays
7) City of Baltimore, MD
8) Washington, D.C.
9) City of Norfolk, VA

North Atlantic Coast Comprehensive Study Schedule



Develop draft PMP and SOW (NLT 15 Mar; approved 27 Mar 13)

Phase 1 [Months 1-14]

Interagency & NGO coordination to assemble existing/future conditions. Assessment & formulation of measures

ATR and HQUSACE Review of Draft Analyses

Phase 2 [Months 15-18]

Interagency & international validation & collaboration

Phase 3 [Months 19-24]

Finalize comprehensive report & submit to Congress (January 2015)

PHASE 1 Products

- **Coastal Geographic Information System Geo-database & Analysis**
- **Economic Depth-Damage Estimation Tool**
- **Sea Level Rise and Vulnerability Assessment & Maps**
- **Identification of risk and preliminary approaches for system resilience**

PHASE 2 Products

- **Align with other Regional Plans**
- **Receive interagency, partner and international comments**
- **Institutional Barriers**
- **Additional Analyses that may be warranted.**

PHASE 3 Products

- **Draft Comprehensive Study to HQUSACE (Sep 2014)**
- **Draft comprehensive study to OASA(CW) (Dec 2014)**
- **Submission of final report to Congress**
- **Storm Suite Modeling**

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Way Ahead

- Significant work **completed** ... and **continuing** ...
  - High population and urban areas most vulnerable
  - Primarily **structural** measures anticipated in most vulnerable areas in combination with other measures
  - Other areas of vulnerability; likely to have more opportunities for use of **nature-based features**
  - All vulnerable areas benefit from **redundancy and full use of measures portfolio in a systems approach**
  - Significant **challenges exist in policy alignment** to create implementation incentives at local and regional scale
- Significant interagency and partner **collaboration** and sharing
- Ongoing **review** of analyses
- Identification of **Institutional and Other Barriers** to Comprehensive Storm Risk Management

Policy Challenges and Institutional Barriers

Six themes presented with Policy Challenges, Successes, Opportunities for Actions

- Theme 1: Risk/Resilience Standards
- Theme 2: Risk Communication and Outreach
- Theme 3: Risk Management
- Theme 4: Science, Engineering and Technology
- Theme 5: Leadership and Institutional Coordination
- Theme 6: Economic Stressors and Resources

National Planning Center for Coastal Storm Risk Management US Army Corps of Engineers

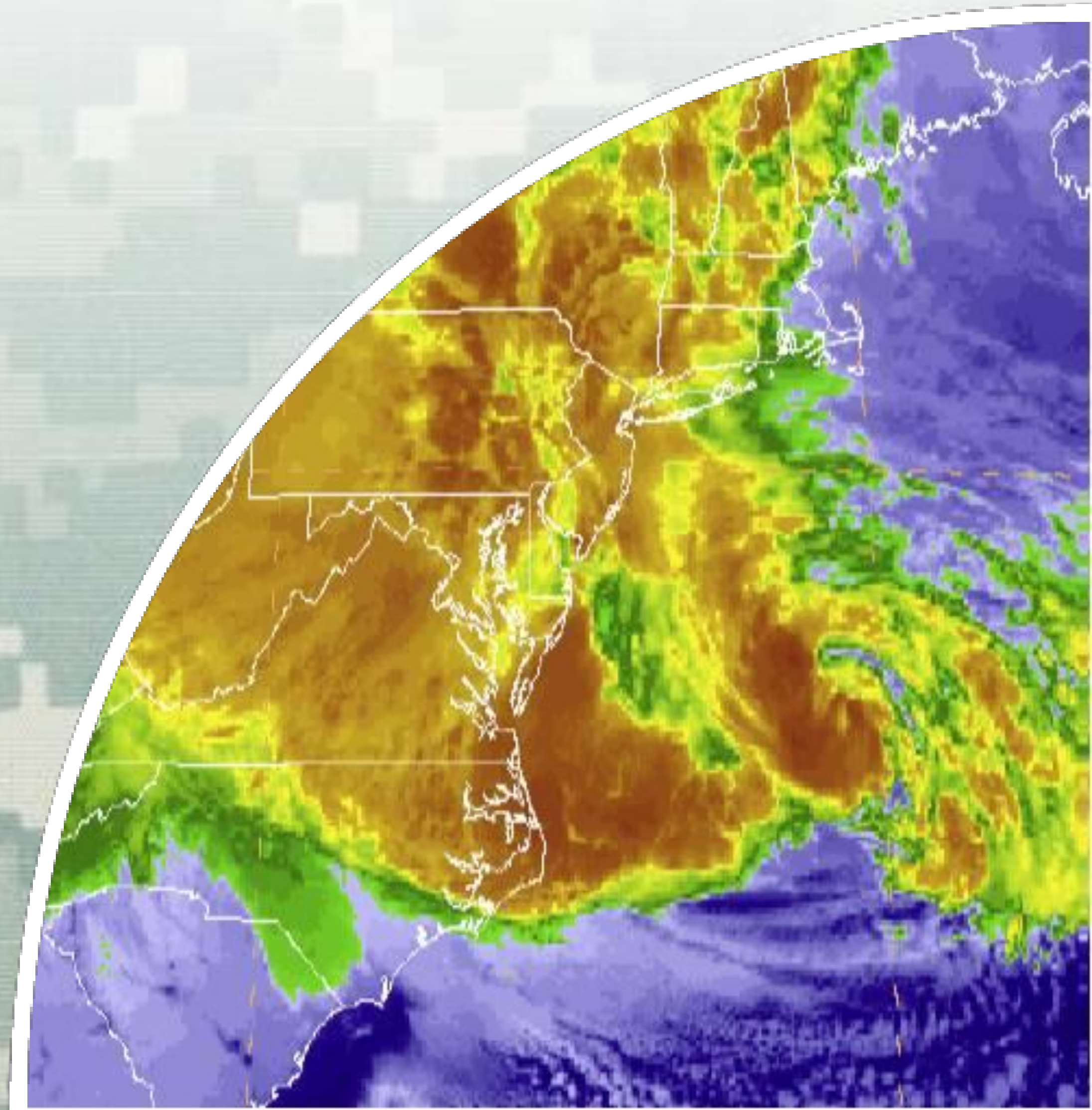
http://www.nad.usace.army.mil/CompStudy.aspx

North Atlantic Coast Comprehensive Study

Overview of Numerical Coastal Storm Modeling

U.S. Army Corps of Engineers
Coastal Storm Risk Management
Planning Center of Expertise

13 February 2014

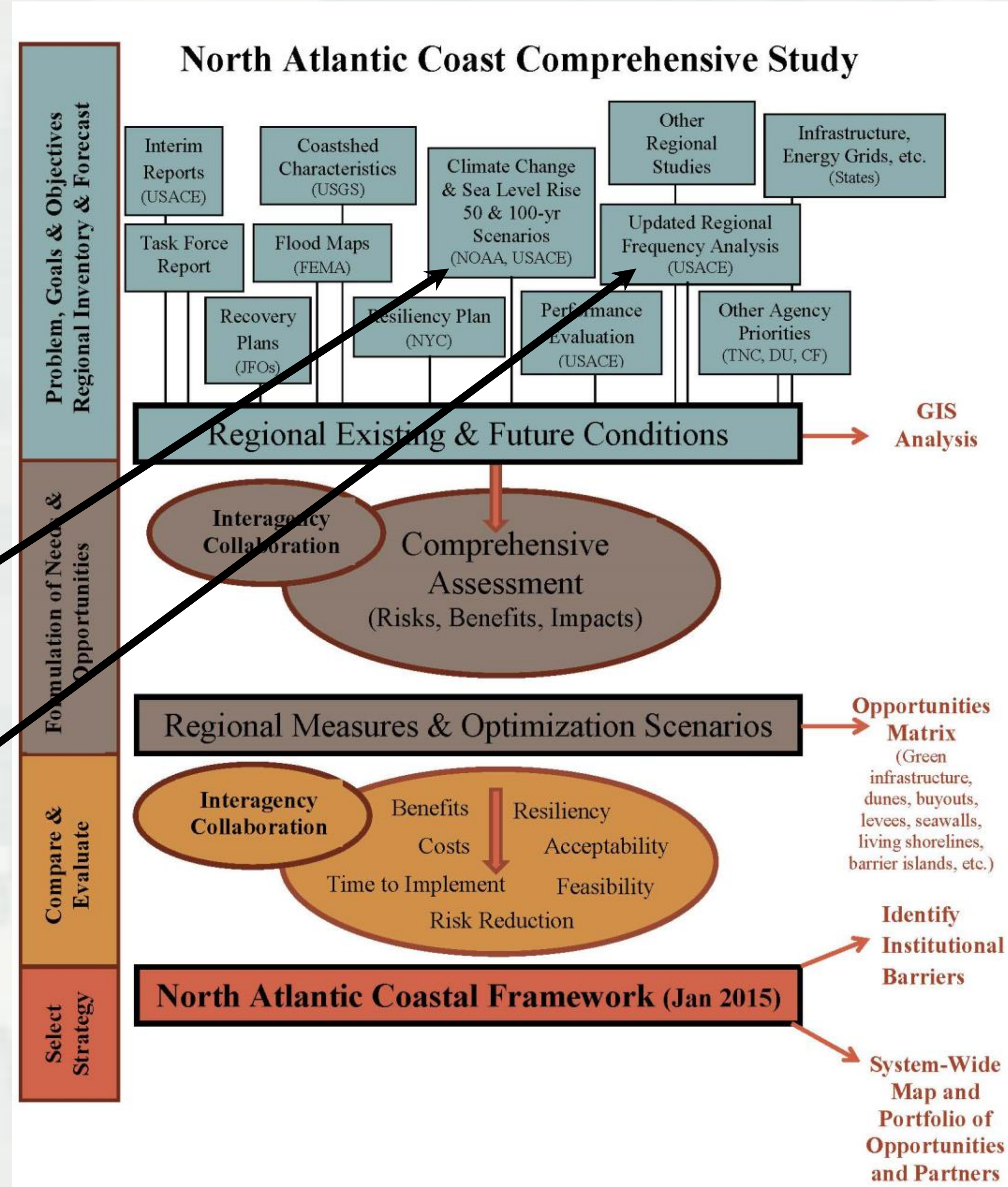


NACCS Scope

- **Coastal Framework**
  - Regional scale
  - Interagency collaboration
  - Opportunities by region/state
  - Identify range of potential solutions and parametric costs by region/state
  - Identify activities warranting additional analysis
- **Technical Teams**

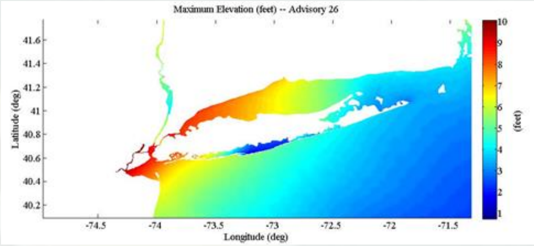
Future Mean Sea Level and Other Climate

Computing the Joint Probability of Hurricane Sandy and Historical Coastal Storm Forcing Parameters from Maine to Virginia

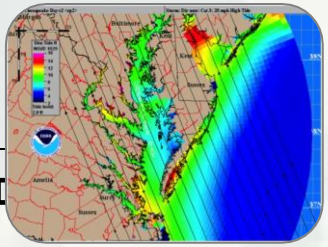


Engineering in NACCS

- **Tasks**
  - Summarize historical data and existing conditions
  - Review and update as warranted engineering design criteria for resiliency, robustness and redundancy
  - Incorporate performance evaluation results
  - **Refine regional storm suites and storm surge, wave forces**
  - Identify range of engineering risk reduction measures for range of regional conditions (berms, levees, floodwalls, nature-based infrastructure, etc.)
  - Hydrodynamics modeling workshop



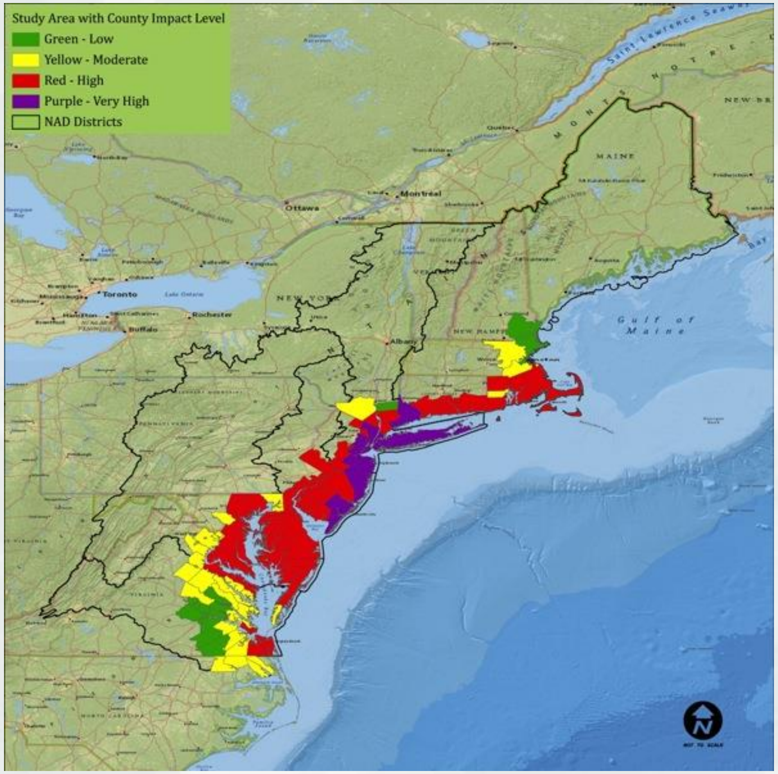
- **Tools**
  - Digital elevation model
  - ADCIRC model, wave model
  - FEMA Region II/III coastal storm modeling
  - National Hurricane Program data/models (SLOSH, etc.)



Coastal Storm Modeling

Compute joint probability of Hurricane Sandy and plausible coastal storm forcing parameters from ME to VA

- Statistical storm population selection using Optimum Sampling Joint Probability Method (*JPM-OS*) for tropical and Empirical Simulation Technique (*EST*) for extra-tropical surge hazards
- Coastal Storm Modeling System (*CSTORM-MS*) simulation
- Data archival, analysis and visualization (*CSTORM-DB*)

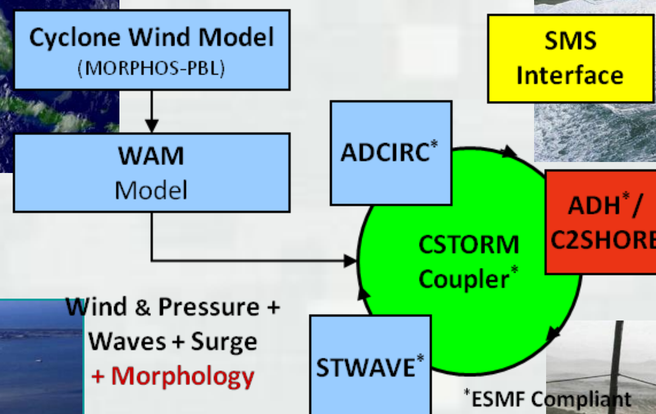


NACCS Area

ERDC's Coastal Storm-Modeling System
(ERDC 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.



Expandable and upgradeable system.

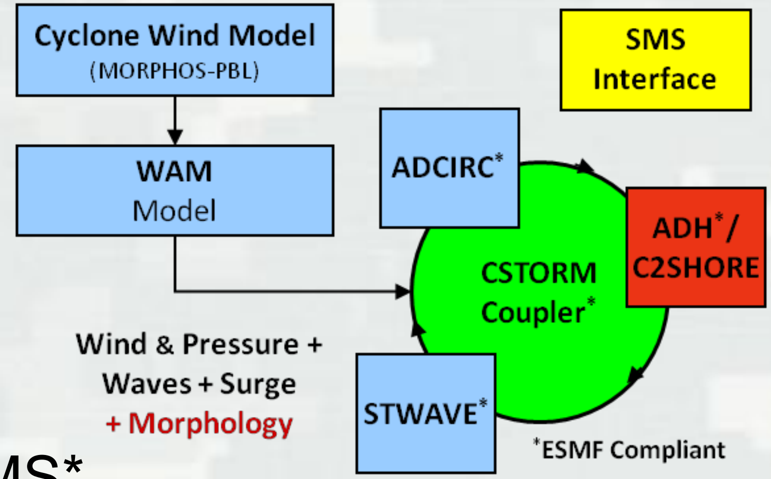
Next Generation Workflow

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

CSTORM-MS COASTAL STORM MODELING SYSTEM

CSTORM System Components 2013

- **Winds/Pressure:** PBL Cyclone Model
- **Waves:**
  - Regional: WAM
  - Nearshore: STWAVE*
- **Circulation/Surge:**
  - ADCIRC*
  - ADH*
- **Morphology:** SEDLIB/C2Shore
- **Coupling Framework:** CSTORM-MS*
- **Graphical User Interface:** SMS



Earth System Modeling Framework (ESMF) Compliance

- Multiple federal agency support ESMF
- ESMF compliant models are readily available to be linked with each other and with other agencies' ESMF compliant models.
- Individual models stay virtually autonomous when coupling.

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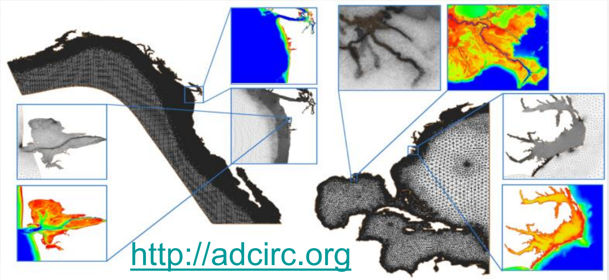
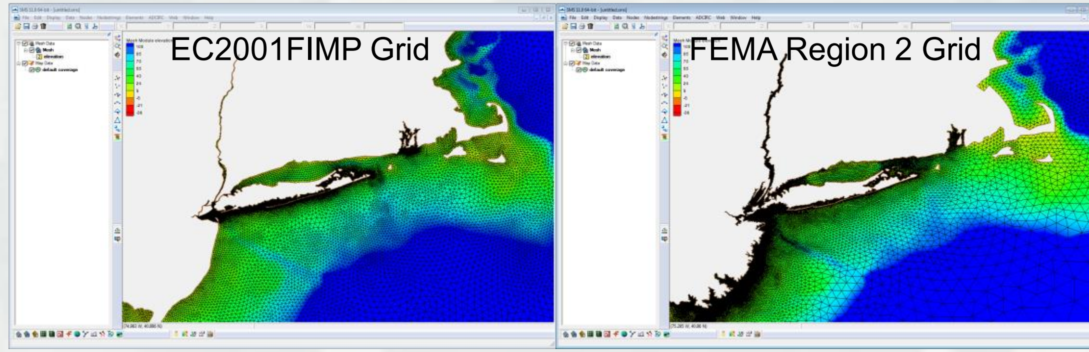
ADCIRC Coastal Circulation and Storm Surge Model



- An unstructured finite element hydrodynamics model
- 2D and 3D simulations
- Wetting/Drying algorithm allows for storm surge inundation over previously dry land
- Highly portable code
- Tides, Rivers, Winds/Pressure, and Waves
- A part of ERDC's Coastal Storm Modeling System

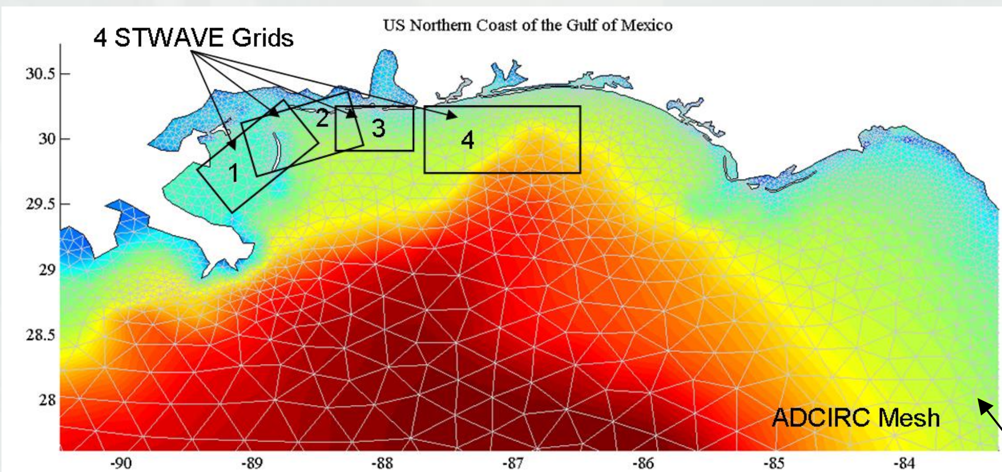


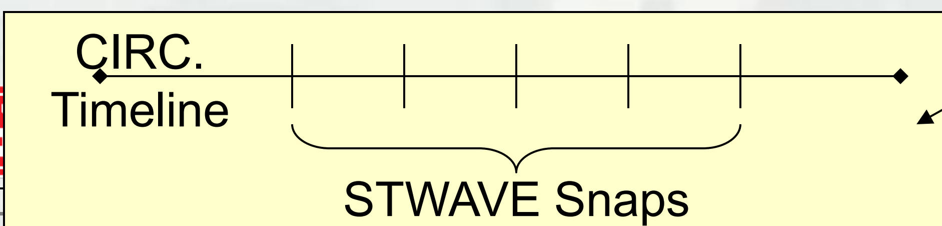
Preliminary Surge Modeling for Sandy

- Used two meshes
    - EC2001FIMP Grid
    - FEMA Region 2 Grid
- Used tidal forcing
- Used an imbedded asymmetric vortex Holland wind/pressure model with inputs derived from the NHC forecast using the ASGS
- Used winds/pressure from NOAA's GFDL models

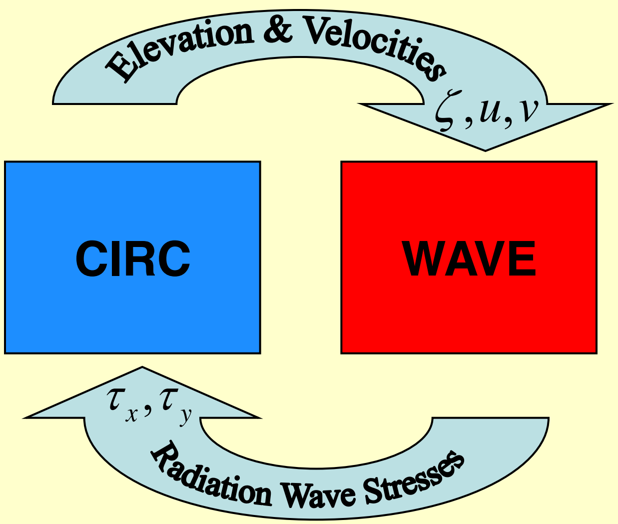
Tight Two-Way Coupling Circulation ←→ Wave

- One unstructured finite element circulation mesh
  - A single instance of ADCIRC/ADH
- One or more structured wave grids
  - Multiple instances of STWAVE
    - Half-Plane
    - Full-Plane





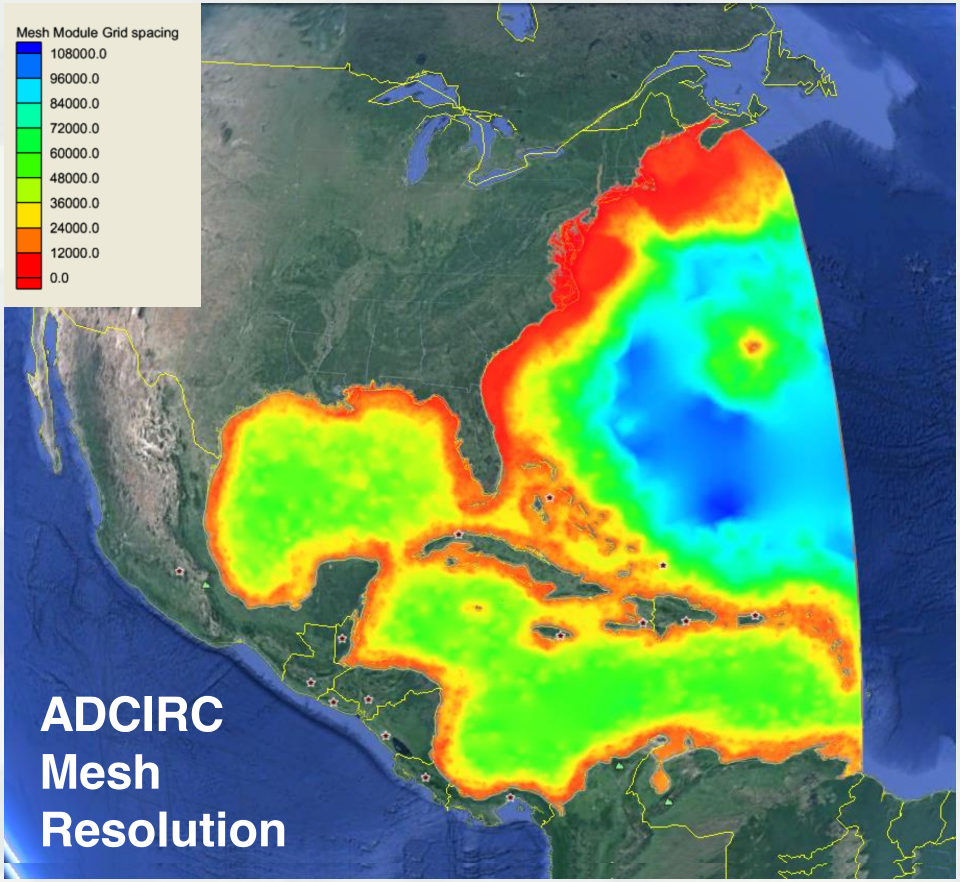
Information to Exchange

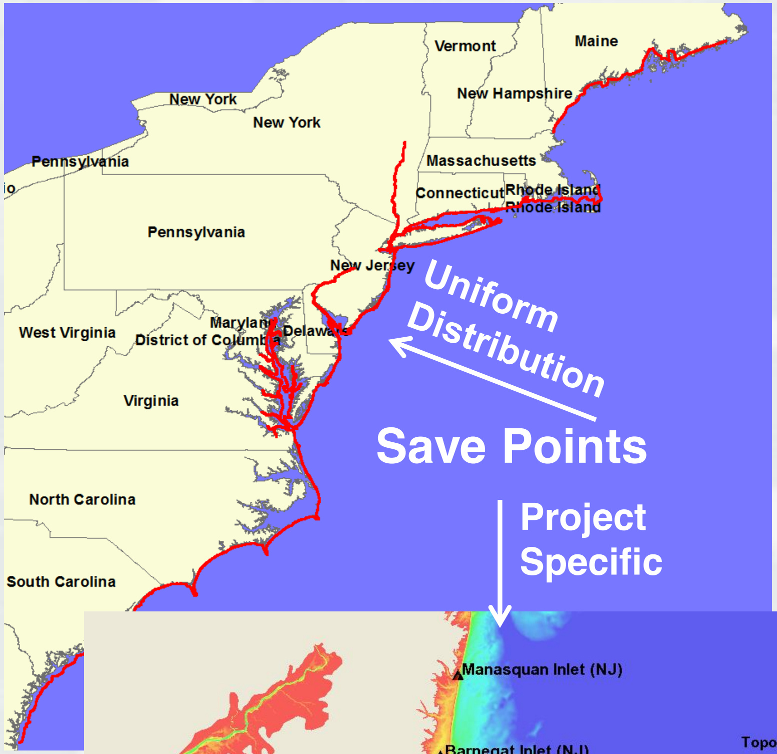


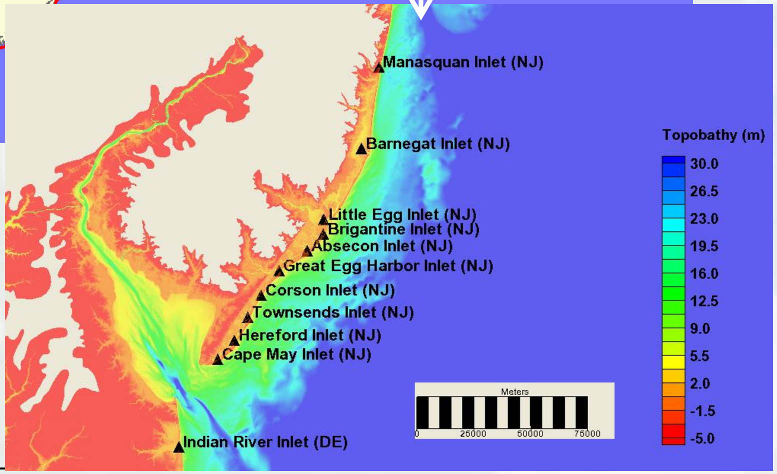
For consistency use the same winds and bathymetry (can be passed also)

Need to be able to synchronize both time and spatial frames of reference.

Grids and Save Points

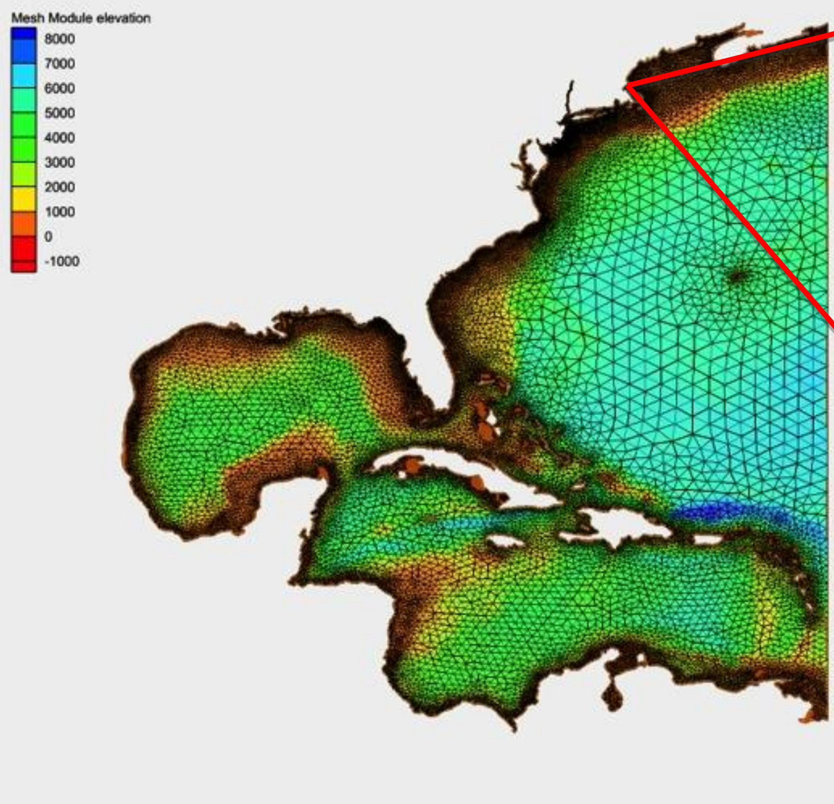


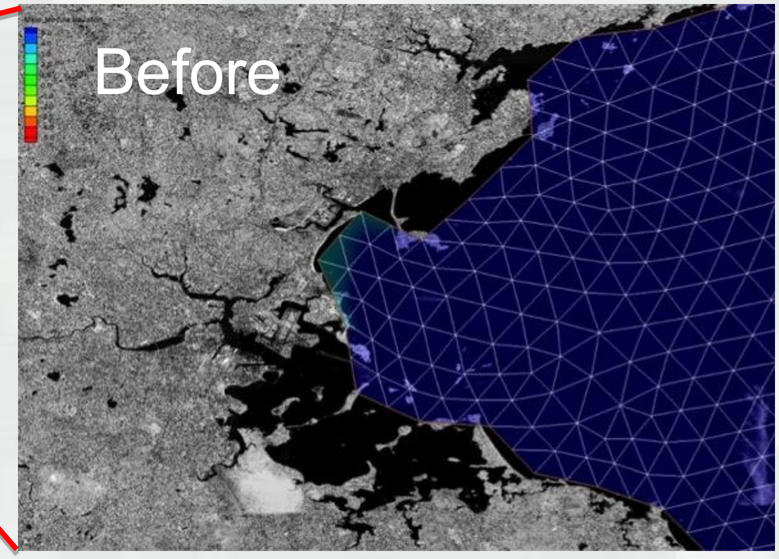




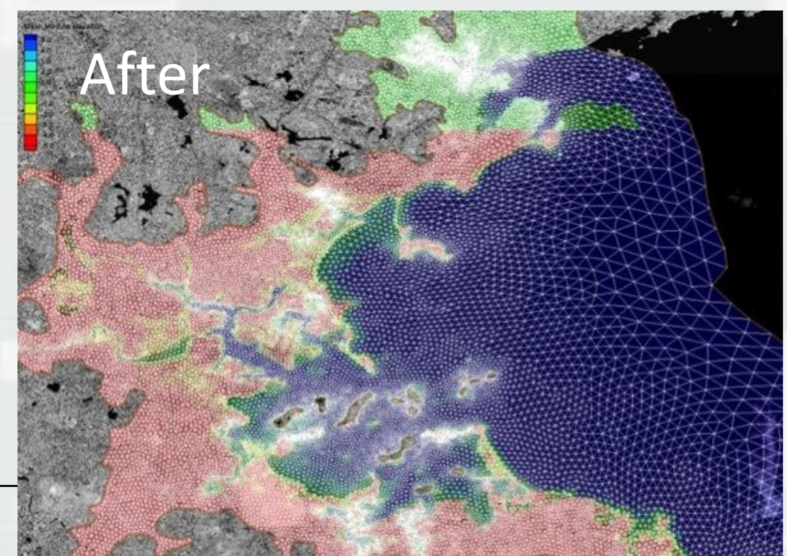
~ 6.2 million nodes
Resolution from 10 m to 100 km

ADCIRC Mesh Development



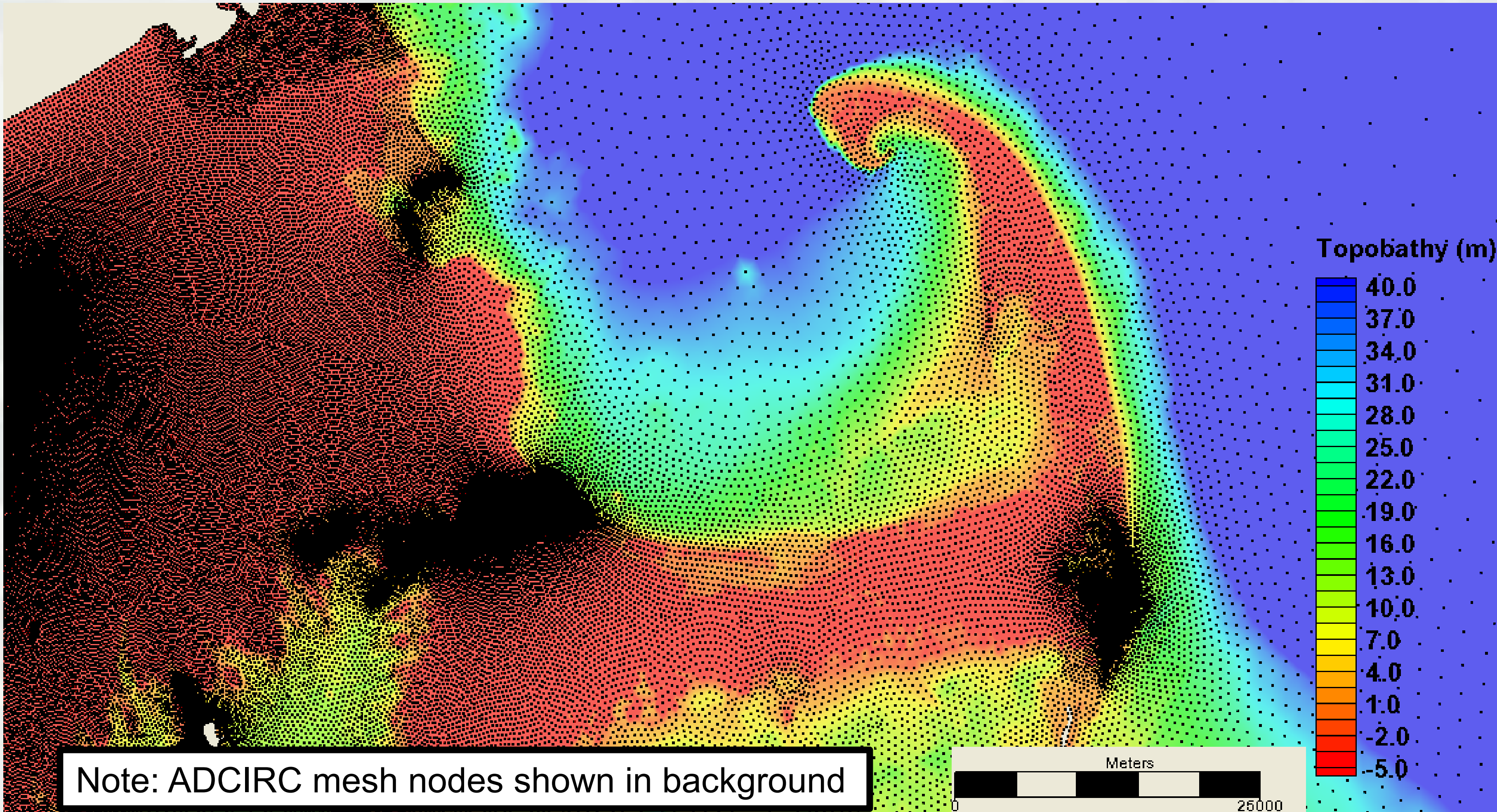


Example Location: Boston Harbor



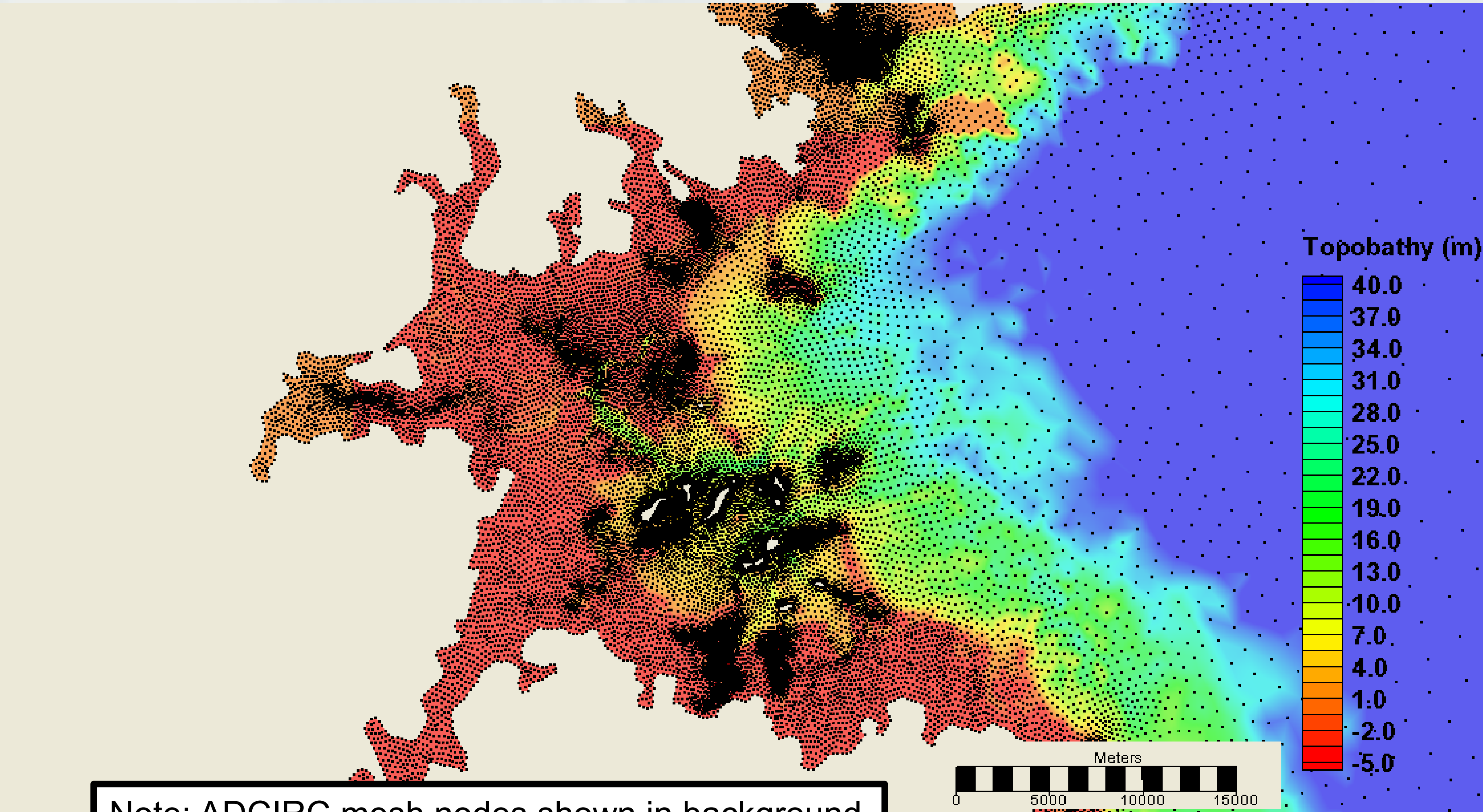
Bathymetry – NGIA DNC/NOAA ENC
Topography – USGS 10-m DEM

Cape Cod Mesh Resolution



Note: ADCIRC mesh nodes shown in background

Boston Harbor Mesh Resolution



Note: ADCIRC mesh nodes shown in background

High Frequency Collocation Points

(Formerly Known as “Save Points”)

- Global solution files will still be available; however, “save points” (ADCIRC and STWAVE model results; i.e. WSE, water and wind velocity, and wave conditions) will be saved more often.
- These time-series results can provide useful information at District project sites and/or can be applied as boundary forcing conditions for local refined numerical models.

USACE District Feedback

- ADCIRC mesh elevation and resolution for each save point location has been examined.
- ERDC provided each District with a section of the mesh and XY output locations to ensure that previously identified projects are included and adequately resolved within the mesh.
- Enhancements/updates made to the mesh, as necessary.

Status of Collocation Points

NAD District	Date ERDC-CHL Sent Files to District Personnel	Feedback Received from District?	Approximate* Number of Save Points
NAP	05 Sept 2013	Yes	750
NAE	13 Sept 2013	Yes	4050
NAO	19 Sept 2013	Yes	500
NAN	26 Sept 2013	Yes	2600
NAB	30 Sept 2013	Yes	1100

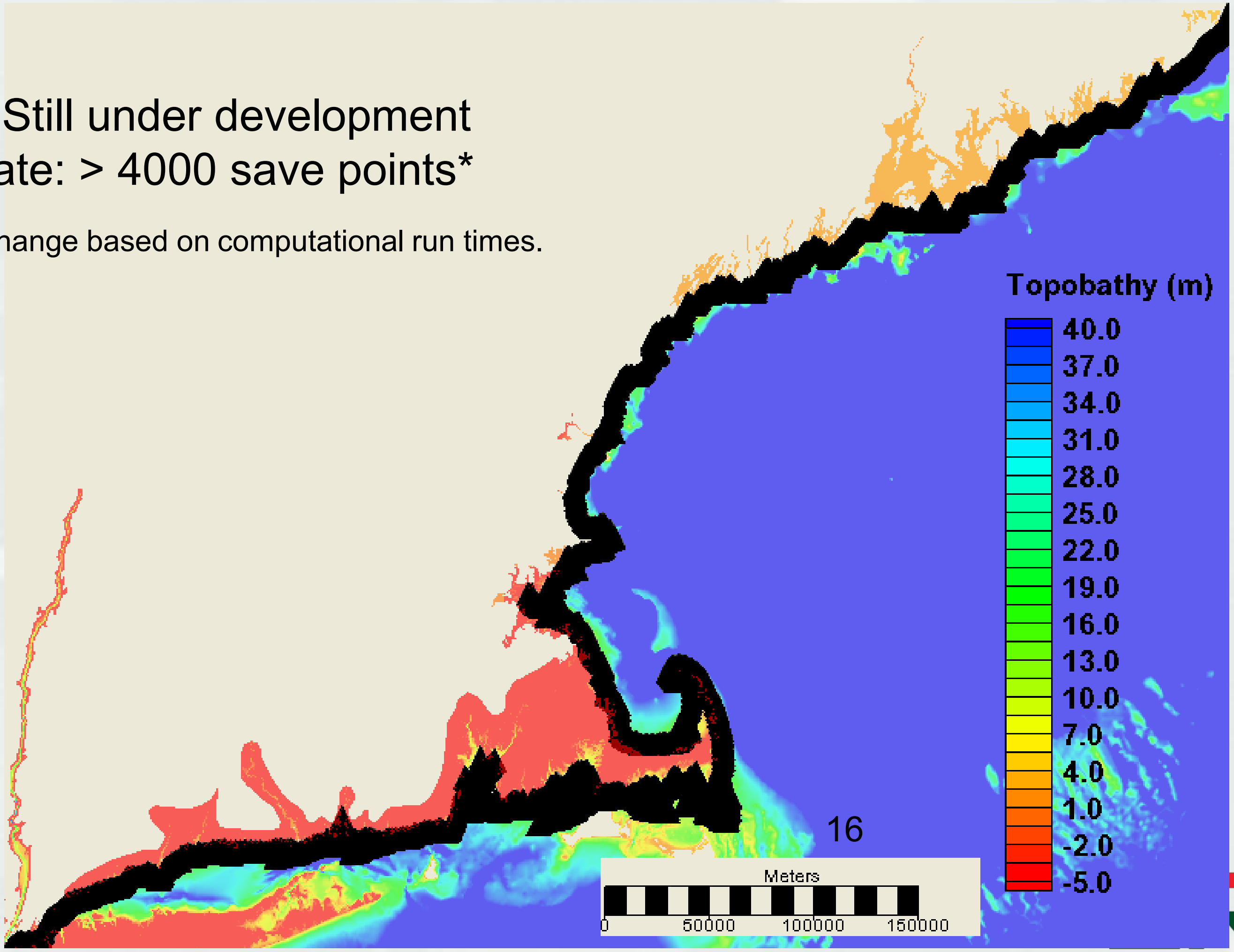
Total # High Frequency Collocation Points: 9000*

***Subject to change based on computational run-times for simulations.**

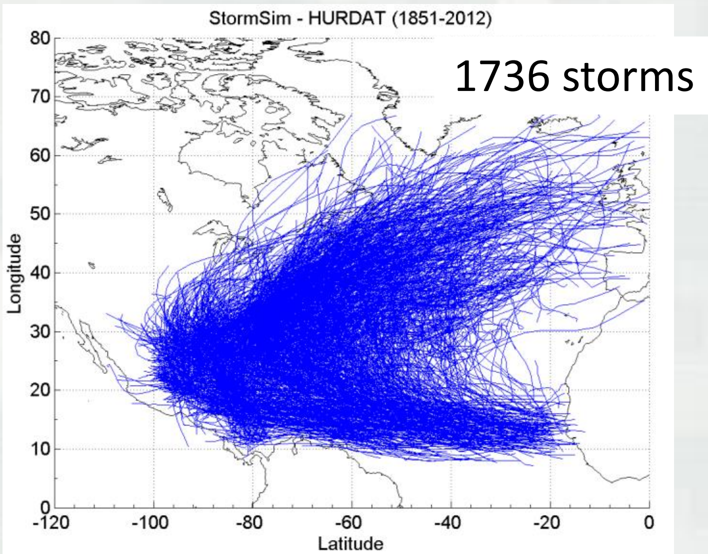
New England District (NAE)
Save Points along Depth Contours

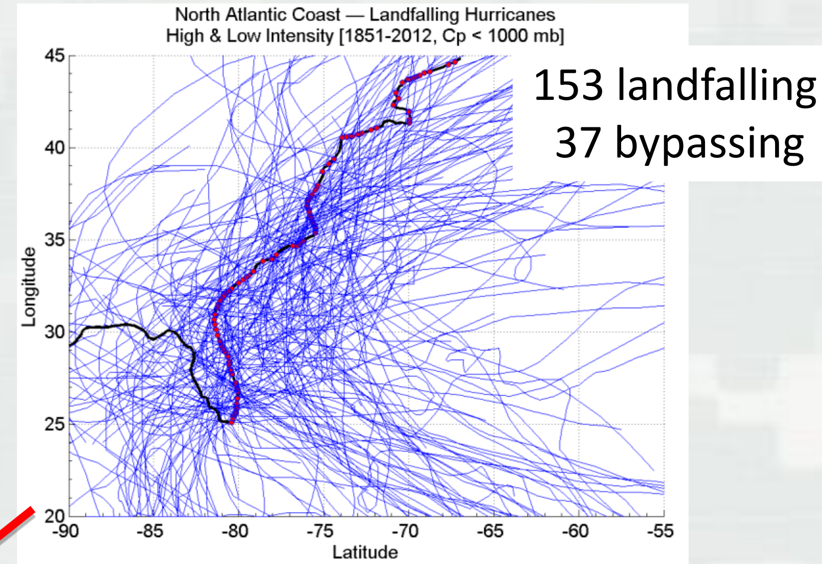
Note: Still under development
Estimate: > 4000 save points*

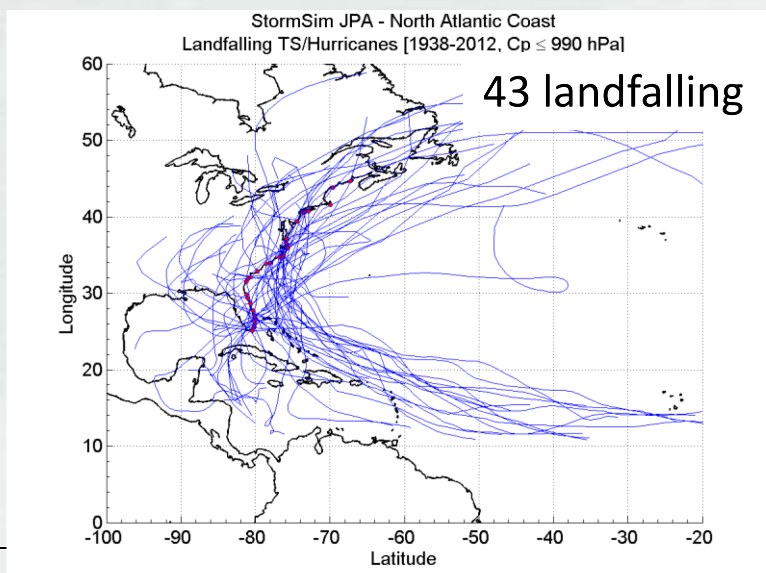
*Subject to change based on computational run times.

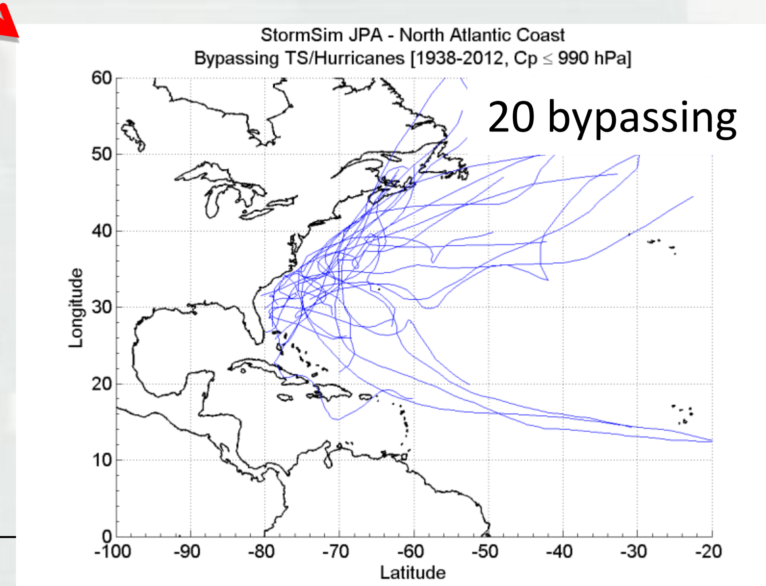


CSTORM-DB: Tropical Storm Censoring Module



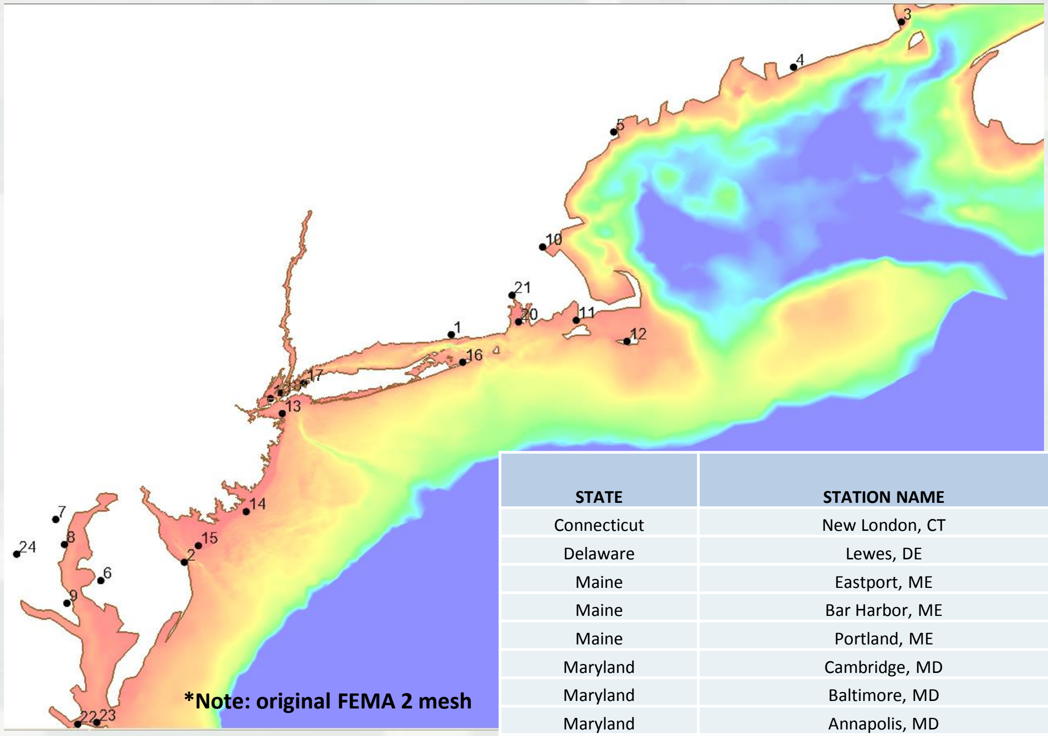






For validation, SLR analysis, and for synthetic storm development

CSTORM-DB: ET Storm Censoring Module



24 water levels gages
30-yr record length
250 storms identified

↓

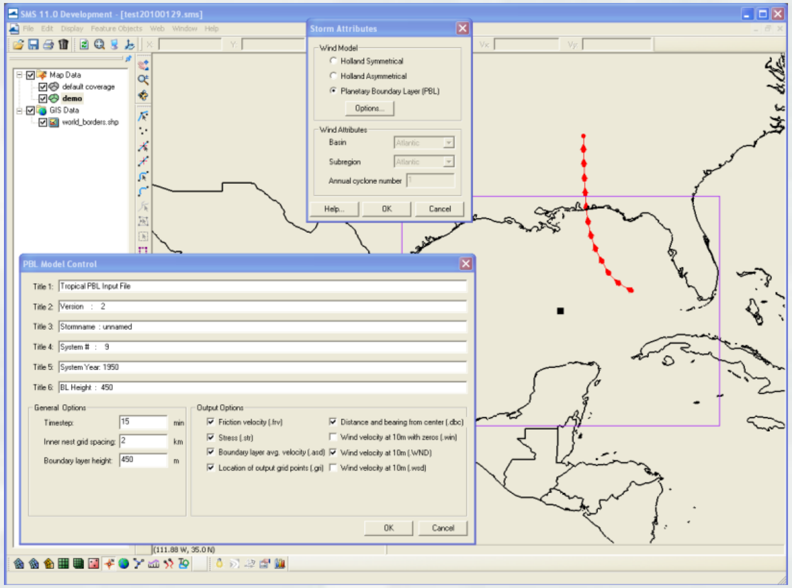
100 storms

STATE	STATION NAME	LATITUDE	LONGITUDE	START YEAR	END YEAR	LENGTH
Connecticut	New London, CT	41° 21.6 N	72° 5.4 W	1938	2013	**76**
Delaware	Lewes, DE	38° 46.9 N	75° 7.2 W	1957	2013	**57**
Maine	Eastport, ME	44° 54.2 N	66° 58.9 W	1958	2013	**56**
Maine	Bar Harbor, ME	44° 23.5 N	68° 12.3 W	1950	2013	**64**
Maine	Portland, ME	43° 39.4 N	70° 14.8 W	1910	2013	**104**
Maryland	Cambridge, MD	38° 34.4 N	76° 4.1 W	1979	2013	35
Maryland	Baltimore, MD	39° 16 N	76° 34.7 W	1902	2013	**112**
Maryland	Annapolis, MD	38° 59 N	76° 28.8 W	1928	2013	**86**
Maryland	Solomons Island, MD	38° 19 N	76° 27.1 W	1979	2013	35
Massachusetts	Boston, MA	42° 21.2 N	71° 3.2 W	1921	2013	**93**
Massachusetts	Woods Hole, MA	41° 31.4 N	70° 40.3 W	1958	2013	**56**
Massachusetts	Nantucket Island, MA	41° 17.1 N	70° 5.8 W	1965	2013	49
New Jersey	Sandy Hook, NJ	40° 28.0 N	74° 0.5 W	1910	2013	**104**
New Jersey	Atlantic City, NJ	39° 21.3 N	74° 25.1 W	1911	2013	**103**
New Jersey	Cape May, NJ	38° 58.1 N	74° 57.6 W	1965	2013	49
New York	Montauk, NY	41° 2.9 N	71° 57.6 W	1959	2013	**55**
New York	Kings Point, NY	40° 48.6 N	73° 45.8 W	1957	2013	**57**
New York	The Battery, NY	40° 42.0 N	74° 0.8 W	1920	2013	**94**
New York	Bergen Point West Reach, NY	40° 38.2 N	74° 8.5 W	1981	2011	31
Rhode Island	Newport, RI	41° 30.3 N	71° 19.6 W	1930	2013	**84**
Rhode Island	Providence, RI	41° 48.4 N	71° 24.0 W	1979	2013	35
Virginia	Sewells Point, VA	36° 56.8 N	76° 19.8 W	1927	2013	**87**
Virginia	Chesapeake Bay Bridge Tunnel, VA	36° 58 N	76° 6.8 W	1975	2013	3[illegible]
Washington DC	Washington, DC	38° 52.4 N	77° 1.3 W	1931	2013	**83**

100+
75+
50+

STRONG®

SMS GUI for Cyclone Models

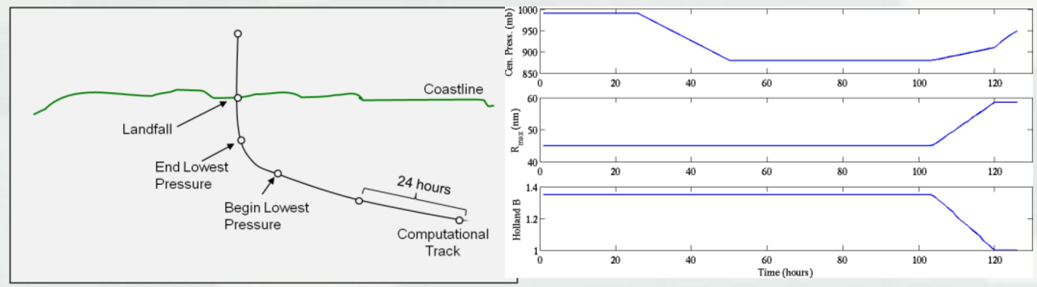


- Setup and run the MORPHOS-PBL Cyclone Wind Model*

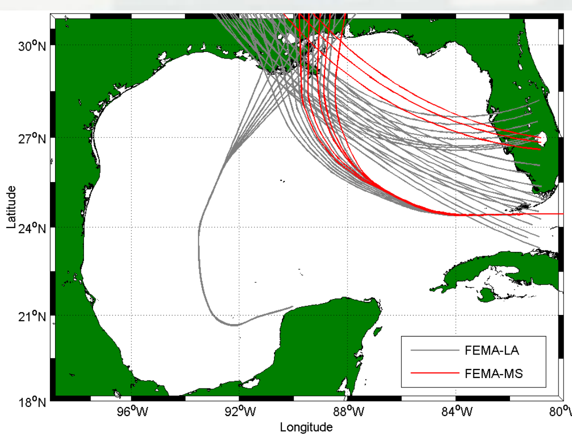
*Updated version of TC96

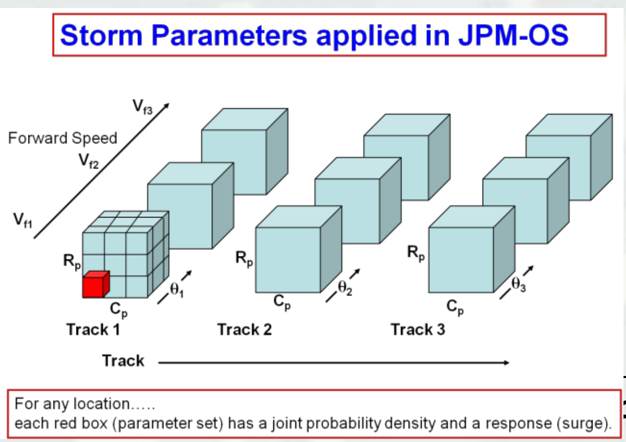
- Import storms from HURDAT

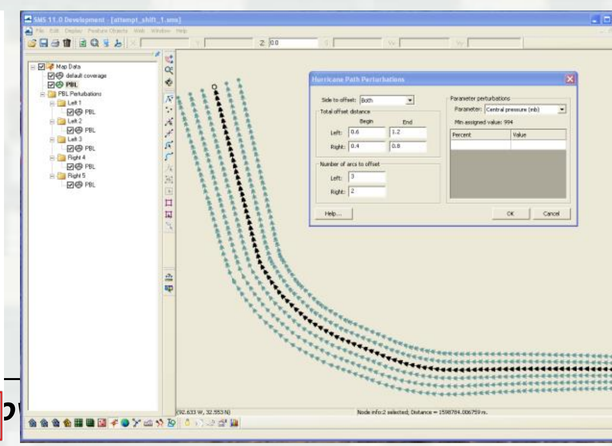
Synthetic storm profile generation routine



Easily create perturbations for storm track/characteristic





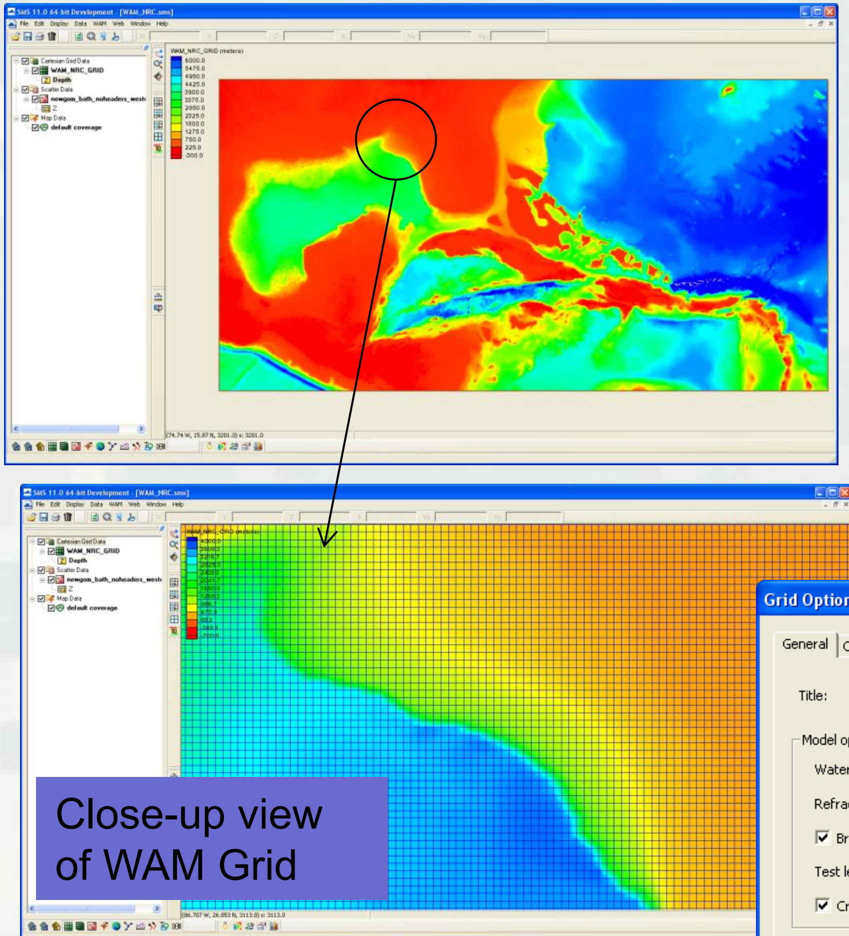


WAM

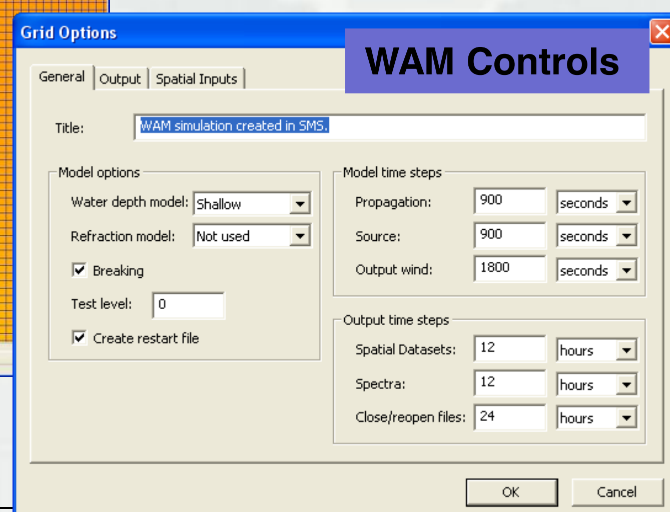
WAM is a third generation global ocean wave prediction model.

Model Assumptions

- Time dependent wave action balance equation.
- Wave growth based on sea surface roughness and wind characteristics.
- Nonlinear wave and wave interaction by Discrete Interaction Approximation (DIA).
- Free form of spectral shape.
- High dissipation rate to short waves.



Close-up view of WAM Grid



WAM Controls

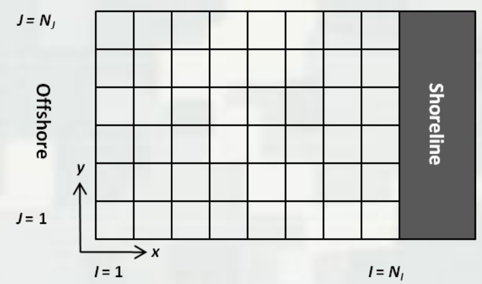
SMS GUI for WAM

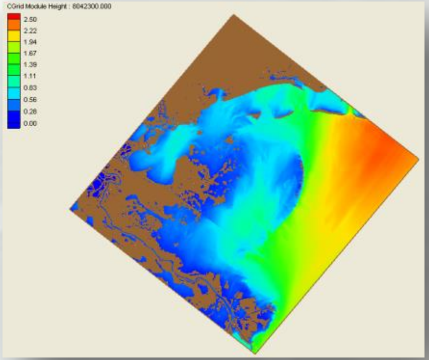
- Create and visualize WAM grids and model results
- Setup input/control files
- Execute WAM

STWAVE Version 6.0

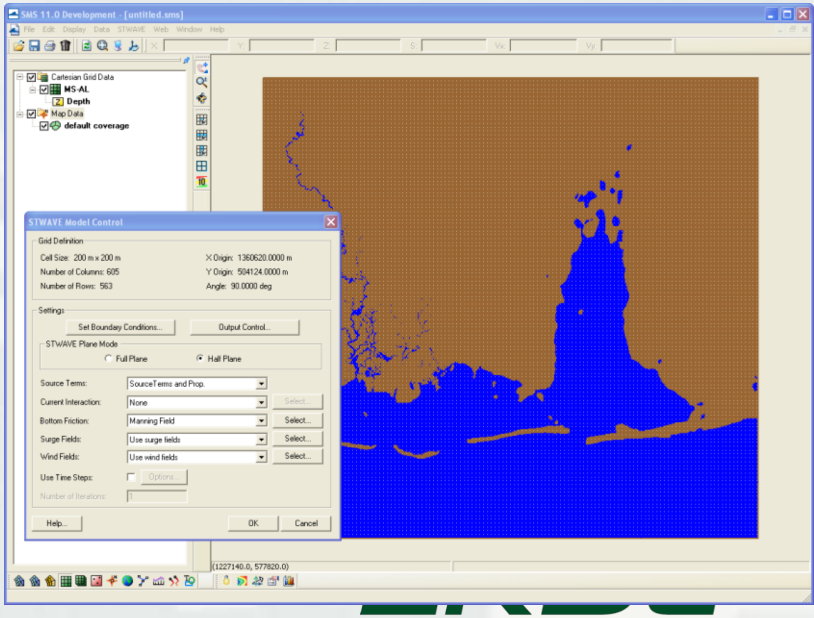
- STWAVE is a steady-state finite difference model based on the wave action balance equation.

- The model is used to compute wave transformation (refraction, shoaling, and breaking) and wind-wave generation.





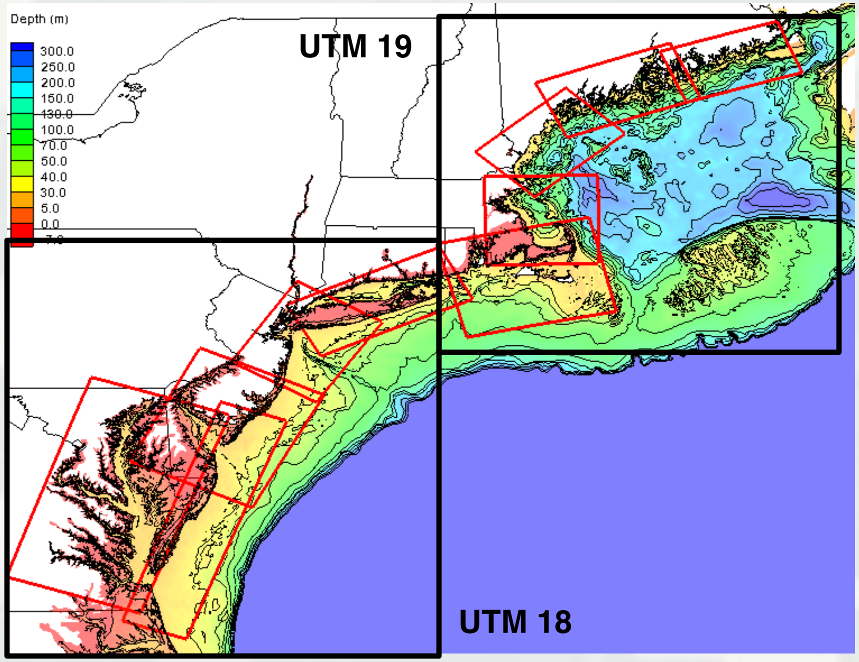
SMS GUI for STWAVE



Some features of the full-plane model include:

- Wave transformation and generation on the full 360-deg plane.
- Option for spatially variable winds and surge.
- Option for spatially constant or spatially variable bottom friction.
- Option for one-dimensional wave transformation on lateral boundaries.

STWAVE Grid Overview



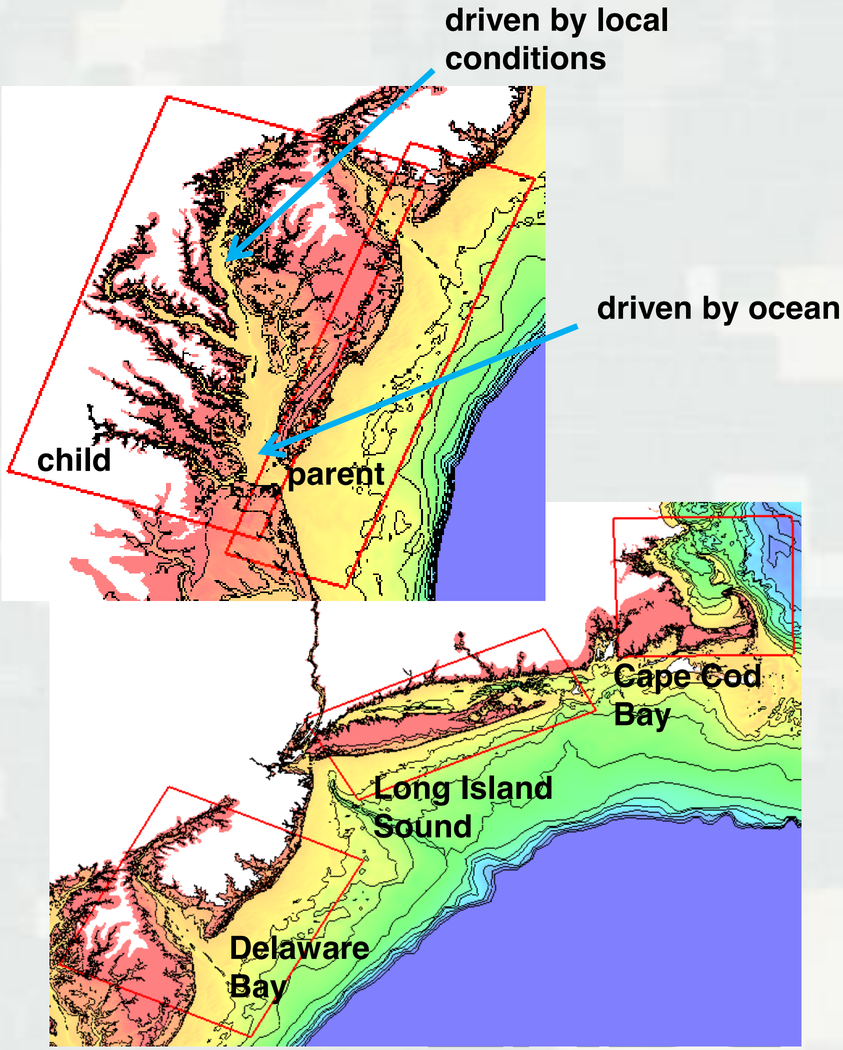
- 10 STWAVE grids
  - UTM Zones 18 and 19
- offshore boundaries at depths of at-least 130 ft (40 m)
- proposed resolution of 656 ft (200 m) for all grids except Chesapeake Bay (328 ft or 100 m)
- offshore wave forcing provided by WAM
- local winds interpolated from ADCIRC

STWAVE Modes

- half-plane allows for wave energy to propagate from offshore to nearshore
  - neglects all waves traveling in the negative x-direction
  - generally appropriate for most nearshore applications
- full-plane allows for wave transformation and generation of wind-waves in all directions
  - mostly used in semi-enclosed bays and lakes
  - considerably higher memory requirements and slower execution compared to half-plane
  - iterative solution

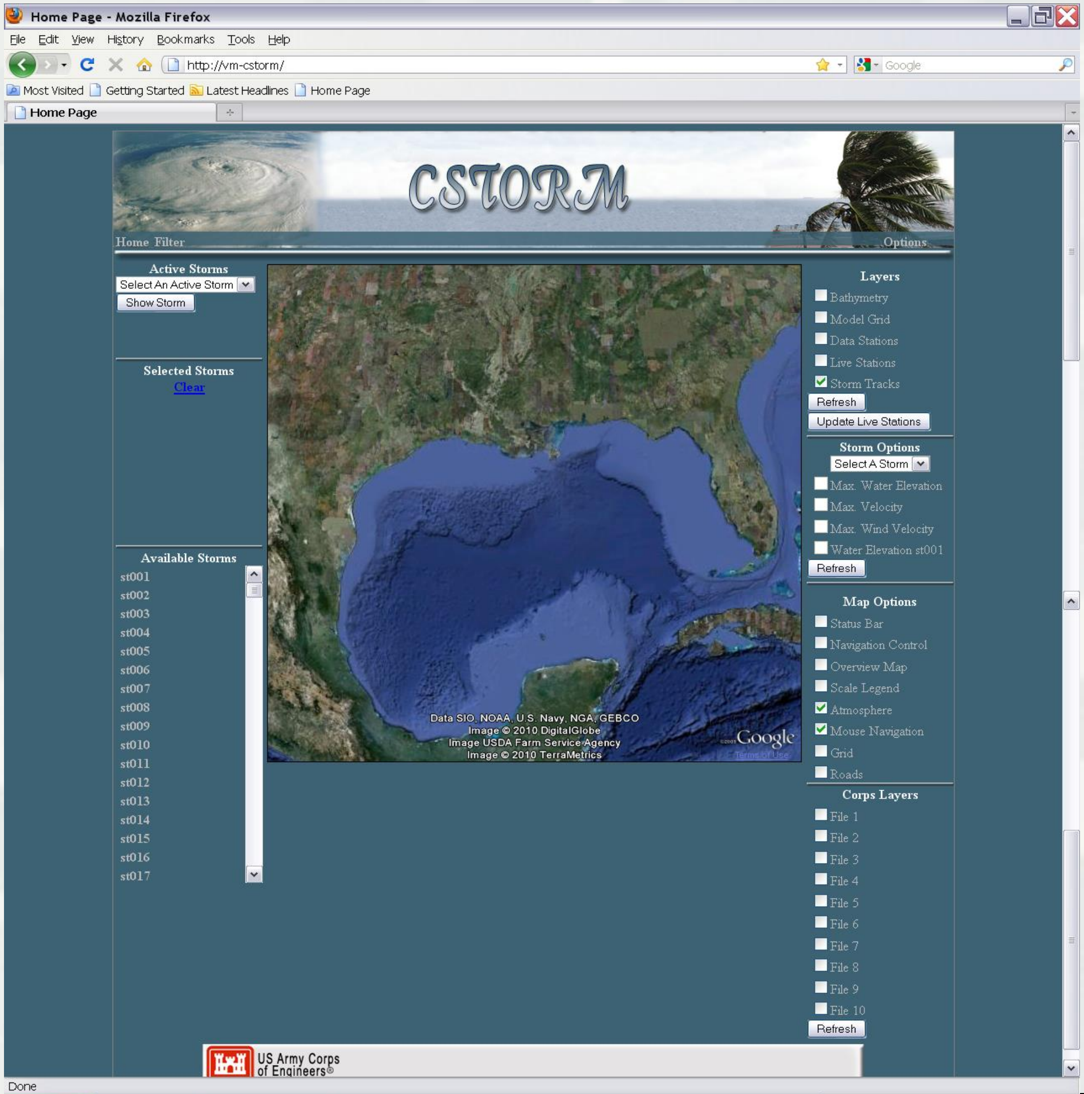
Half-plane vs Full-plane

- majority of grids in HP
- Chesapeake Bay will be a nested FP ‘child’ grid, with spectra provided by a HP ‘parent’ grid
- testing required to determine mode for some grids
  - Delaware Bay, Long Island Sound, Cape Cod Bay



CSTORM-MS COASTAL STORM MODELING SYSTEM

Coastal Storm - Database and Data Mining Tool



Goals

- Develop long-term archive/database of measured and modeled coastal storm data
- Make data easily accessible and understandable to team members
- Integrate contextual data products and tools that support federal decision making
  - Emergency management
  - Risk management/assessment/communication
  - Project design and evaluation

https://cstormdb.erdc.dren.mil/userlogon.aspx

POC: Jeffrey A. Melby, PhD

USACE ERDC Coastal and Hydraulics Lab

Jeffrey.A.Melby@usace.army.mil

ERDC

Innovative solutions for a safer, better world

CSTORM-DB Initial Screen

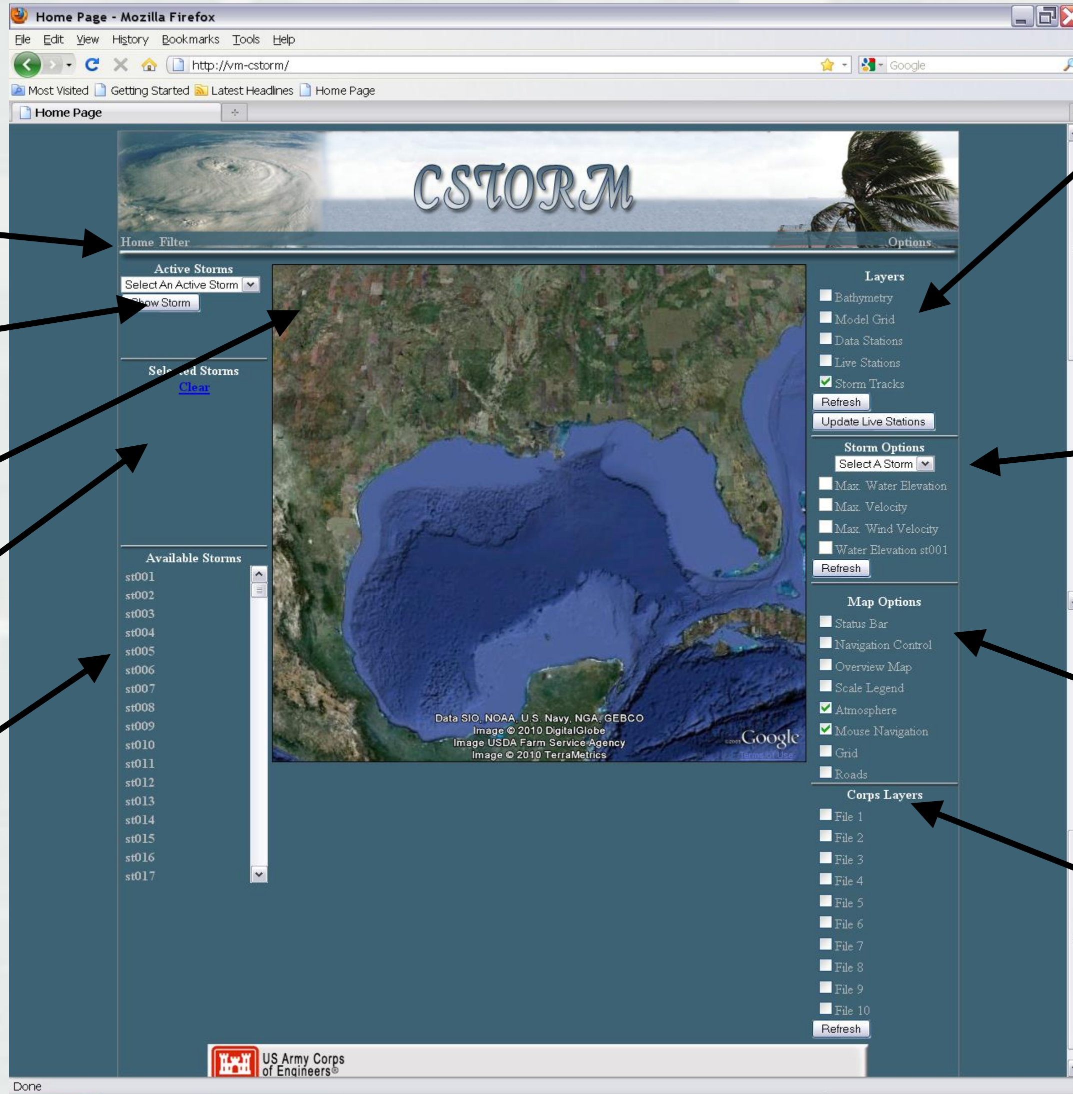
Home
Storm query tool

Add existing storm to map

Google Earth client map

List of selected storms

List of storms available for that region



Turn on and off various layers such as bathymetry, model grid, model save stations, and live gages

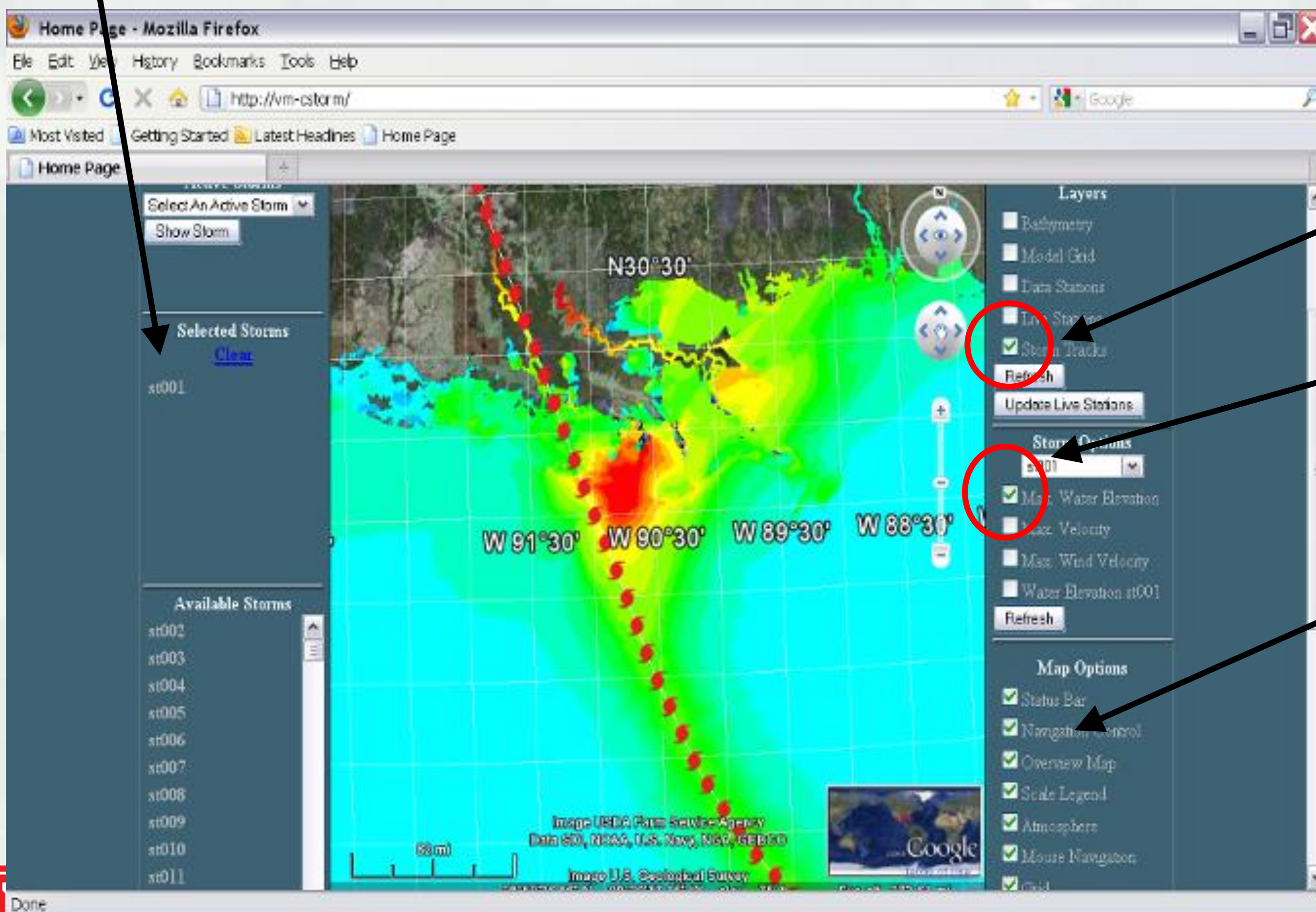
For a select storm, turn on and off maximum contour plots: water level, wind speed, wave height, animations

Turn on and off standard Google Earth map tools

Add any user-defined layer to map

Maximum Water Level Elevation in CSTORM-DB

Select Storm 1



Turn on track

Turn on maximum water elevation contour plot

Turn on standard Google Earth map tools

HPC Resources

For this project two separate DSRC systems will be used, ERDC's Garnet and AFRL's Spirit

Garnet's is a Cray XE6

4716 compute nodes with 32 cores/node = 150,912 processors

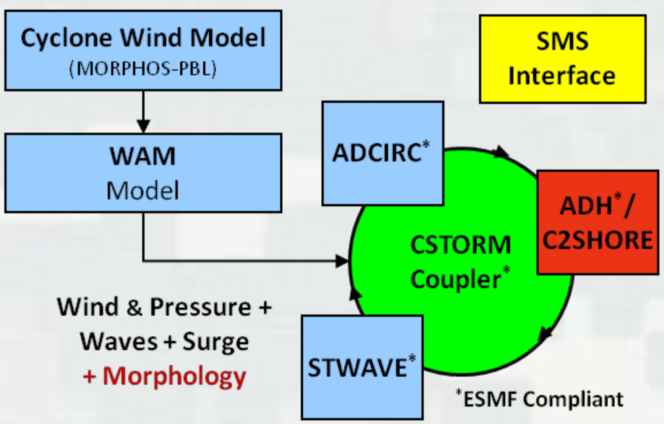
Spirit is an SGI Ice X

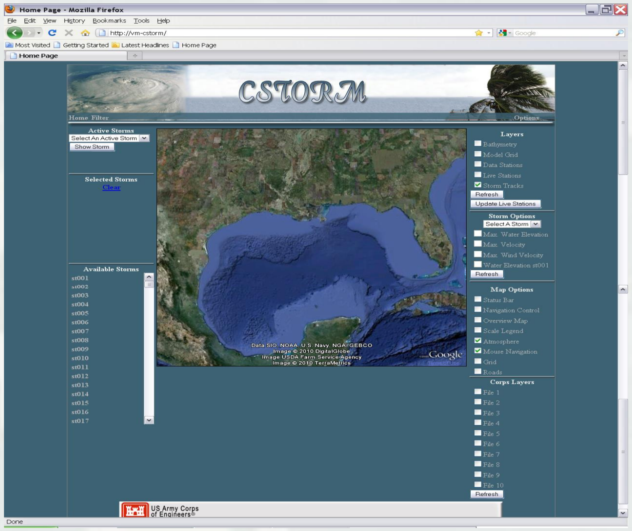
4590 compute nodes with 16 cores/node = 73,440 processors

CSTORM-MS COASTAL STORM MODELING SYSTEM

Summary

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

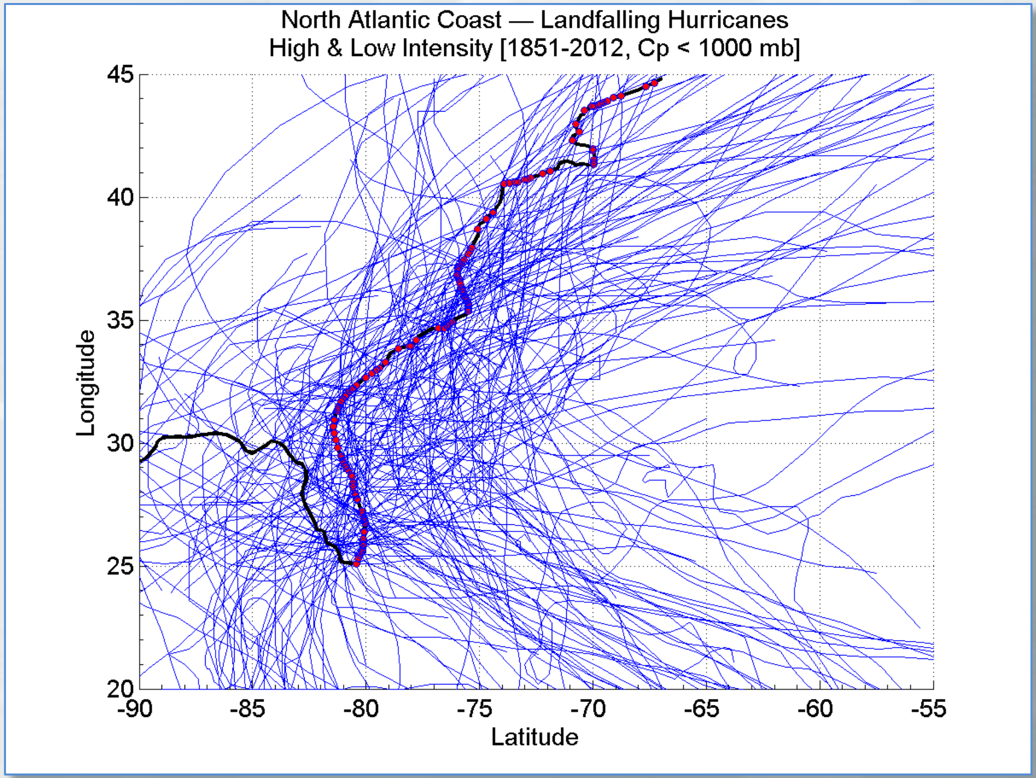




Utilization of Modeling Products: CSTORM

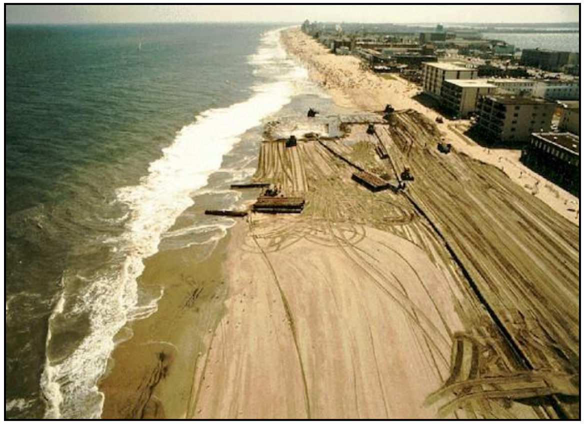
- Summary: An expanded suite of storm simulation and statistical analysis tools is being applied in support of the North Atlantic Comprehensive Coastal Study. Specifically, the CSTORM-MS and CSTORM–DB are being used to define the coastal storm probability space for the study area to for coastal risk assessment and project design.
- CSTORM data will develop water levels and other storm parameters for future, more detailed studies by the completion of the NACCS study (Jan 2015).
- The product of this simulation work will serve the coastal engineering and management communities of practice from VA to ME for years to come

Thank you…



North Atlantic Coast — Landfalling Hurricanes
High & Low Intensity [1851-2012, Cp < 1000 mb]
45
40
35
30
25
20
Longitude
-90
-85
-80
-75
-70
-65
-60
-55
Latitude

Marine Minerals Program



Restoring and Protecting Our Nation's Coasts through Stewardship of OCS Resources

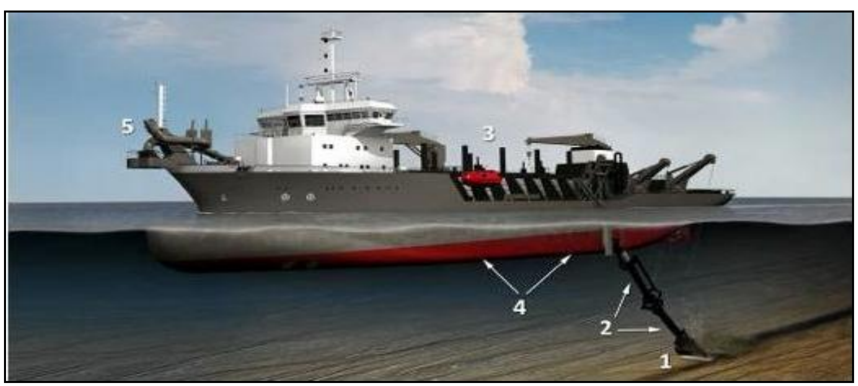
BOEM
BUREAU OF OCEAN ENERGY MANAGEMENT

Submerged Lands Act Boundary (3 nautical miles)

Marine Minerals Program's Purpose

Responsible for managing development of OCS marine mineral resources in an environmentally and economically responsible way.

- Outer Continental Lands Act (OCSLA)
- Public Law 103-426
  - Authorizes BOEM to negotiate, on a noncompetitive basis the rights to OCS sand gravel or shell resources for shore protection, beach or wetlands restoration projects, or for use in construction projects funded in whole or part or authorized by the Federal Government
  - A 1999 amendment prohibits BOEM from charging federal, state and local government agencies a fee for OCS sand



Program Statistics

20
Years of Marine Minerals Management

130
Research Projects

22
Offshore Borrow Areas Used

77
Million Yd^3 of Offshore Sand Conveyed

230
Miles of Coastline Constructed

42
Projects Completed

Completed and Active Projects/Leases

http://www.boem.gov/Non-Energy-Minerals/Marine-Minerals-Program.aspx

BUREAU OF OCEAN ENERGY MANAGEMENT

Equipment Deployment
Upland vs. Marine

Sand truck route for Collier beach project irks Lee County leaders

By ERIC STAATS

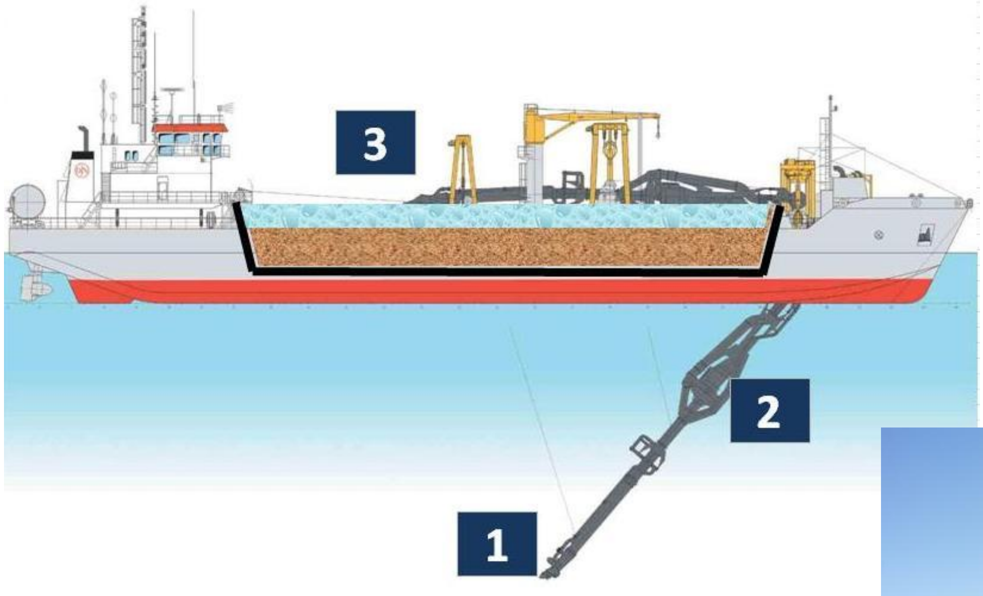
Posted September 17, 2013 at 9:13 p.m.

PHOTO BY DAVID ALBERS, STAFF

Hopper dredge used at the NASA Wallop's Flight Facility on Wallop's Island, VA. *Photo by Charlie Broadwater, BOEM.*

BOEM
Bureau of Ocean Energy Management

Offshore Dredging and Transport to Shore



Trailer Suction Hopper Dredge

Wallops Island, VA

Agreement/Lease Stipulations

- Borrow Site Boundaries
- Dredge Positioning
- Dredge Operating Requirements
- Extraction Volume
- Notice to other Users
- Marine Pollution Control and Contingency Plan
- Discovery of Munitions of Explosive Concern (MEC) Procedures
- Bathymetric Surveys
- Protection of Archaeological Resources
- Project Completion Reporting
- Environmental Compliance Monitoring & Reporting

OCS Example Project NASA Wallops Island , VA Shoreline Stabilization Project

SLA Boundary

OCS Shoal A Borrow Area (~ 17 nm from project)

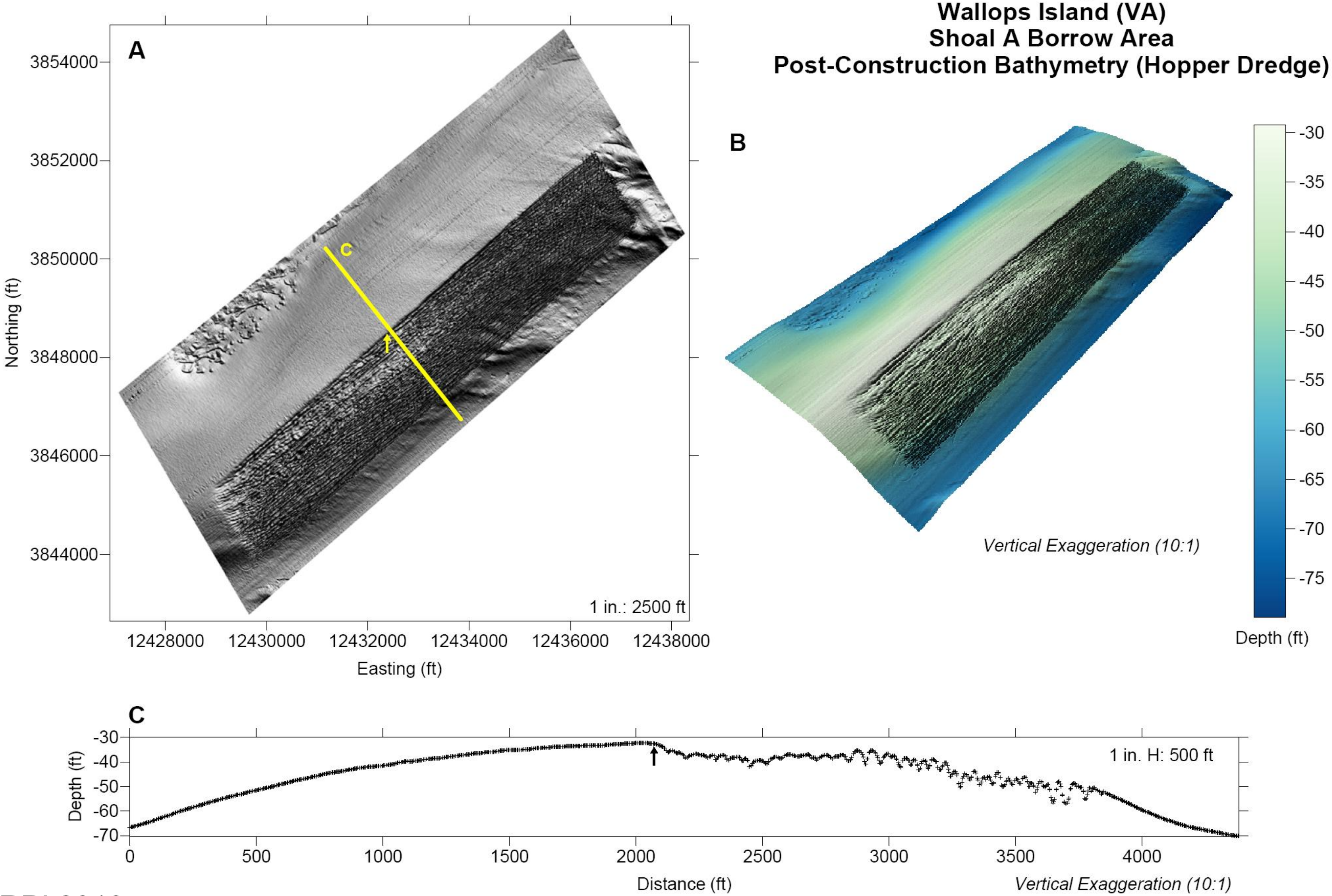
NASA Wallops Island, VA

- 800,000 yd^3 of OCS Sand
- **Resources Evaluated**:
  - Coastal Processes
  - Water and Air Quality
  - Noise
  - Benthos
  - Finfish and Habitat
  - Marine Mammals
  - Threatened and Endangered Species
  - Cultural Resources

Hurricane Sandy Beach Damage on South Wallops Island, Looking South

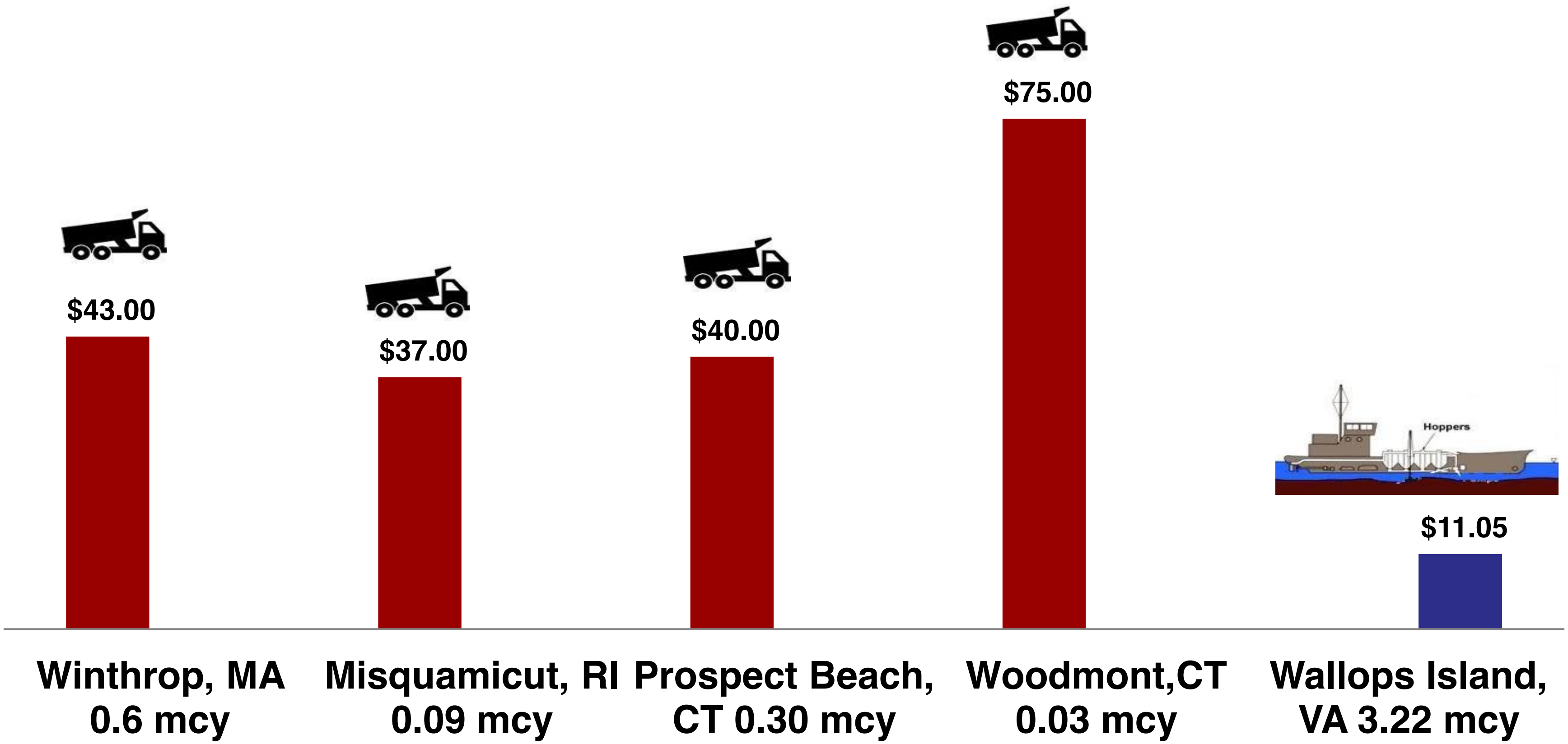
NASA Wallops Island, VA

Sand Ridge - Wallops Island (VA) Shoal A Borrow Area Post-Construction Bathymetry (Hopper Dredge)



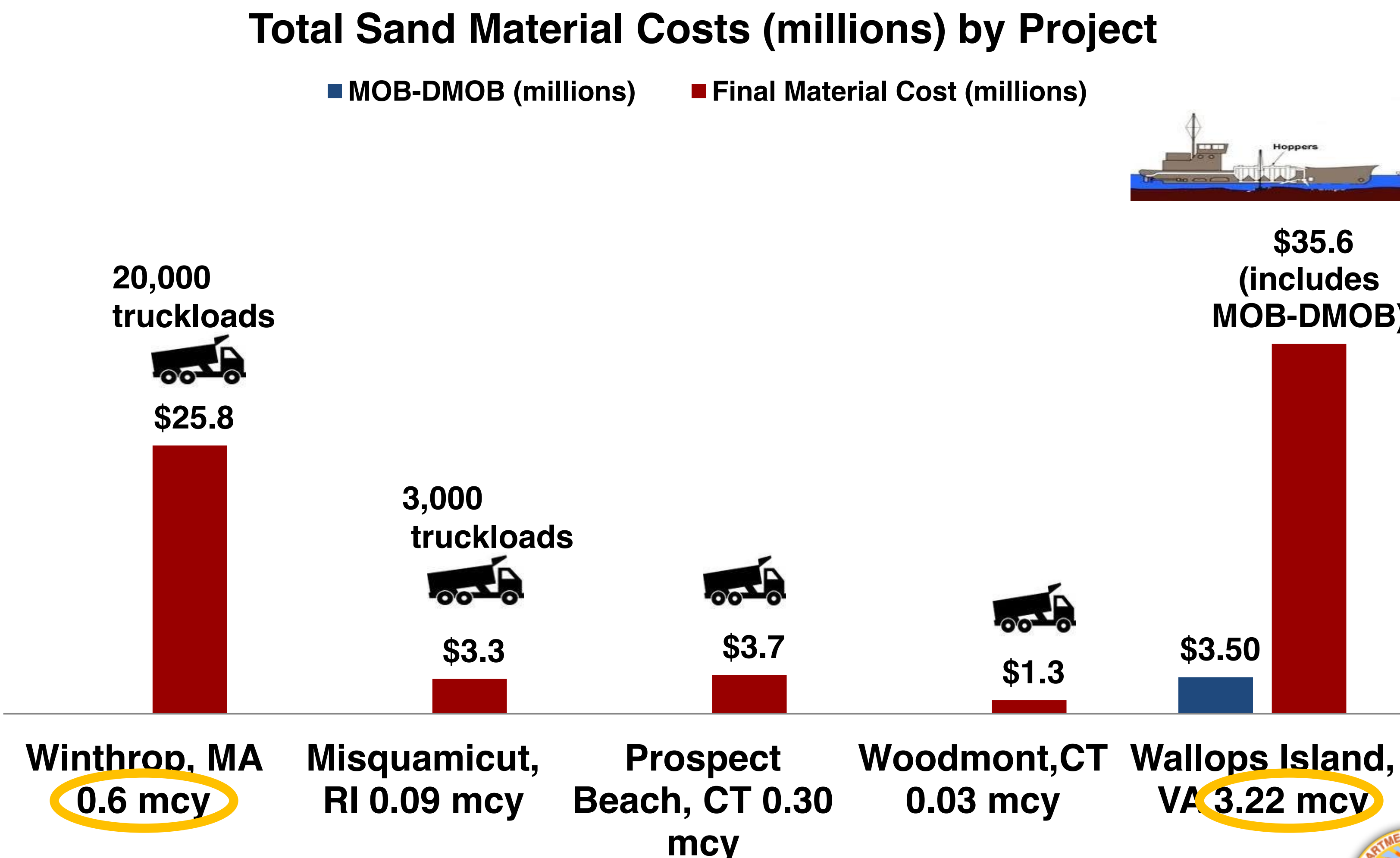
Sand Material Costs
Upland vs. Marine

Sand Material Cost ($ per cubic yard)



Cost figures courtesy USACE New England District and USACE Norfolk District

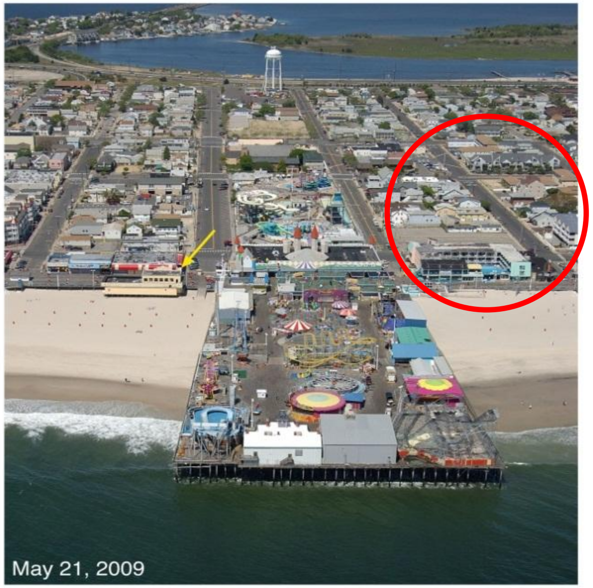
Marine Material Project Cost = Economies of Scale

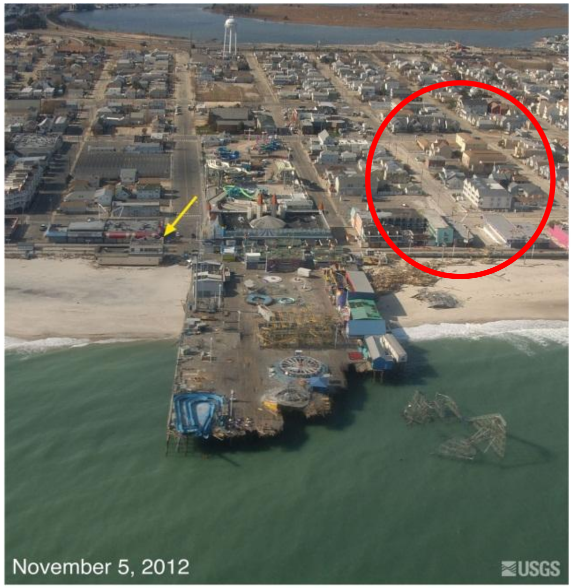


Cost figures courtesy USACE New England District and USACE Norfolk District

Hurricane Sandy Response

- **Identification of OCS Sand Resources**
  - Cooperative Agreements w/ States (rec'd & reviewing proposals from 13 East Coast states)
  - Upcoming Broad Agency Announcement (BAA) for OCS Data Acquisition
- **Current Sandy Related Projects/Leases**
- **Environmental Studies**

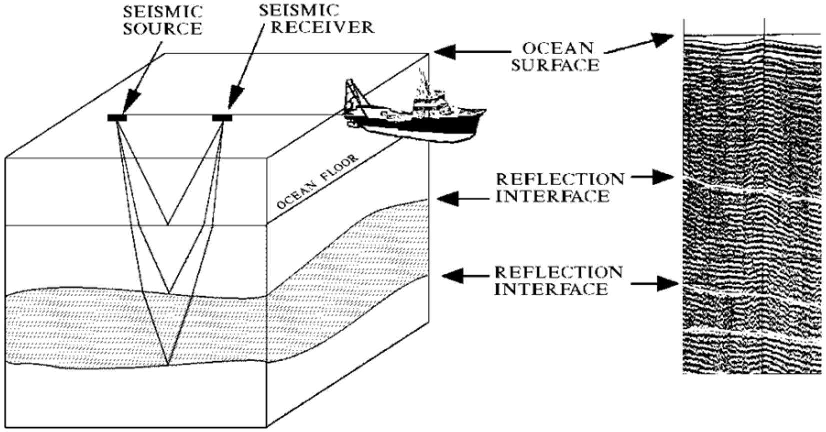


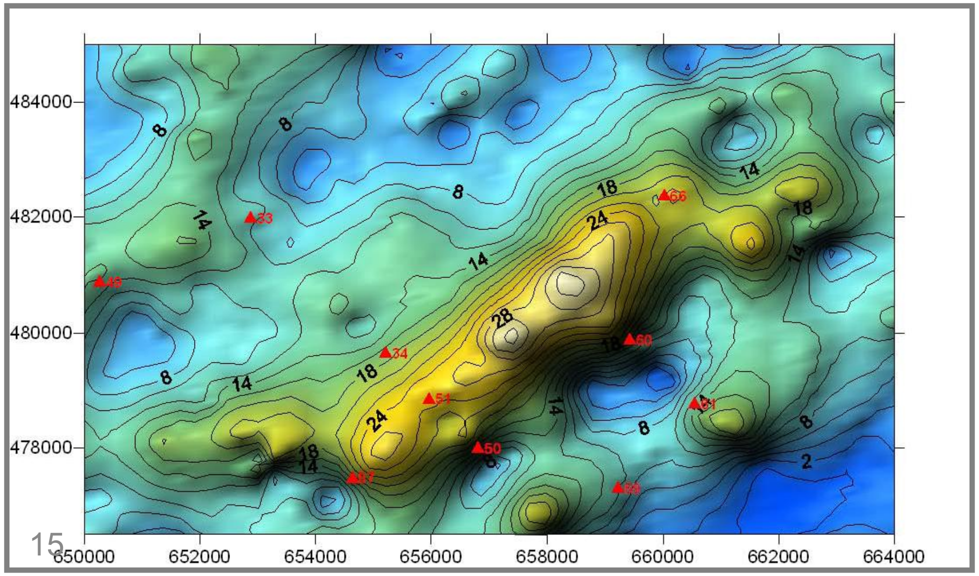


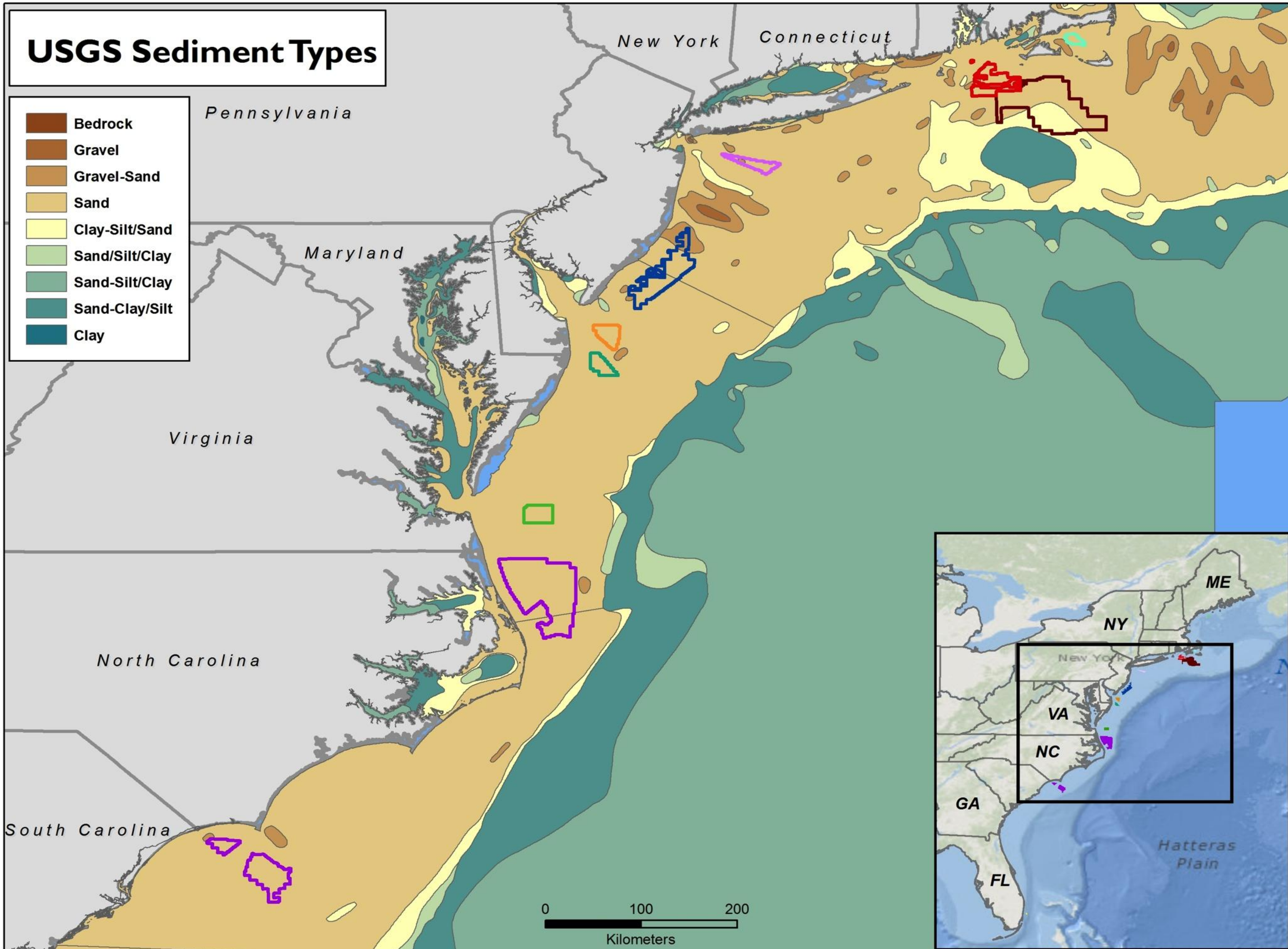
Identification of OCS Sand Resources

Sand Resource Delineation

- Geophysical & Geological Data Collection
- Location
- Quantity
- Grain Size Distribution

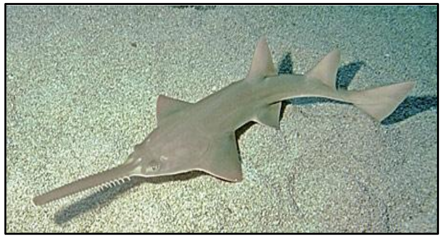






Map ID: ERB-2013-1017

Integrating Environmental Requirements



E.O. 12898: Environmental Justice

Magnuson Stevens Fishery Conservation and Management Act

Federal Water Pollution Control Act

Clean Air Act

Coastal Zone Management Act

Marine Mammal Protection Act

National Historic Preservation Act

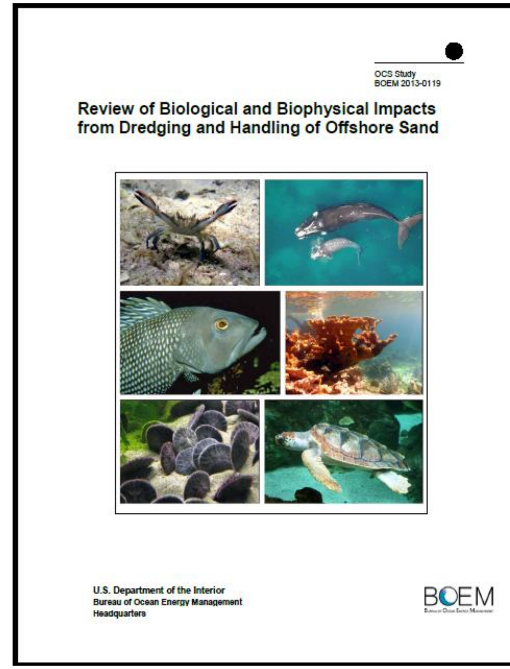
Endangered Species Act

NEPA

BOEM
Bureau of Ocean Energy Management

Environmental Studies

- $15 million spent on MMP Studies since 1994
- More than 40 site specific and programmatic studies
- Mitigation and minimization measures derived from research findings such as improved borrow area design and management
- Identify critical data gaps to guide future research needs


OCS Study
BOEM 2013-0119

Review of Biological and Biophysical Impacts from Dredging and Handling of Offshore Sand

U.S. Department of the Interior
Bureau of Ocean Energy Management
Headquarters

BOEM

Questions/Further Information

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Jeff Waldner, Physical Scientist/Oceanographer MMB
jeffrey.waldner@boem.gov
703-787-1779

- End of presentation

Extra slides follow:

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Active Project Dashboard

Marine Minerals Program: Active Project Dashboard

Updated	Project Details							Completed MMP Milestones								Notes
	Project	Volume (cy³)	ADC[1]	LD Lead	Env Lead	Date of First Contact	Type of Project	Response Ltr Sent	Kick Off Mtg Held	EA / EIS	ROD/FONSI	MOA Execution	Construction Status	Deliverables Received	File Closed Out	
	Martin County, FL	800,000	Sep-12	CRF	GW		3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun	In progress		
	Sandbridge Beach, VA	2,000,000		CRF	GW		3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun	In progress		
	Sandbridge Beach, VA	138,850		CRF	GW	May-13	Modification (not to include extension)	Yes	Yes	Yes	Yes	Yes	Begun	In progress		
	Little Egg Harbor, NJ			JW			3-Party MOA/EA/FONSI	No	No	In progress						
	Bogue Banks (EHS), NC	1,000,000	Dec-12	JW	JC		2-Party Lease/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Completed	In progress		Almost done
	Kitty Hawk, NC			JW	JC	May-13	2-Party MOA/EA/FONSI	No	No	In progress						Follow on PDT meetings?
	Folly Beach, SC	850,000	Aug-13	JW	JC	Apr-13	3-Party MOA/EA/FONSI	Yes	Yes	In progress						Follow on what their continengency plan is
	Manasquan, NJ			JW			3-Party MOA/EA/FONSI	No	No	In progress						
	Patrick Air Force Base, FL	350,000		CB	JC		2-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Not Begun			More likely will not be dreding in the next year
	Pinellas County, FL	1,800,000		CB	GW		3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Completed	In progress		Almost done
	South Carolina Ports Authority, SC	6,000,000	Mar-13	CB	GW		Extension	Yes	Yes	Yes	Yes	Yes	Not Begun			More than likely will not be dredging in the next 2 years
	Dam Neck (Navy), VA	700,000	Apr-13	CB	JC		3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Not Begun			Waiting for Navy to sign MOA, sent in February.
	Brevard County (North Reach), FL	1,055,000	Jul-13	JR	JC	Mar-13	3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun	In progress		DEA is one week behind schedule due to SAJ non-responsiveness regarding
	Brevard County (South Reach), FL	585,000	Jul-13	JR	JC	Mar-13	3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun	In progress		
	Brevard County (Mid-Reach), FL	900,000		JR	JC		3-Party MOA/EIS/ROD	No	No	In progress	In progress					
	Collier County, FL	1,000,000		JR	JC		2-Party Lease/EA/FONSI	Yes	Yes	Yes	Yes	In progress				
	Flagler County, FL			JR	JC			No	No	In progress						
	Longboat Key, FL	466,500		JR	JC		2-Party Lease/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Not Begun			Only one bid received, in negotiations to get cost down - unsure of how mo
	Long Beach Island, NJ	9,000,000		JR	JC		3-Party MOA/EA/FONSI	Yes	Yes	In progress	In progress	In progress				
	Wallops Island Flight Facility, VA	1,000,000		JR	GW	Feb-13	2-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Not Begun			
	Brenton Island (NRDA), LA	3,000,000		GOMR												
	Cameron Parish Restoration, LA	8,600,000		GOMR			2-Party Lease/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun			
	Caminada Headland, LA (phase 1)	5,000,000		GOMR		Nov-09	2-Party Lease/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Begun			
	Caminada Headland, LA (phase 2)	6,100,000		GOMR		Aug-12	2-Party Lease/EA/FONSI	Yes	Yes	In progress						
	Pelican Island, LA	5,500,000		GOMR			3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Completed	In progress		
	Racoon Island, LA	1,100,000		GOMR		Jan-08	3-Party MOA/EA/FONSI	Yes	Yes	Yes	Yes	Yes	Completed	In progress		
	Whisky Island, LA	10,000,000		GOMR			2-Party Lease/EA/FONSI	Yes	Yes	In progress						
	MsCIP, MS	16,000,000?		GOMR			2-Party MOA/EIS/ROD	Yes	Yes	In progress						

1 - Anticipated Date of MOA/Lease Completion

Hurricane Sandy Response Project

If a milestone is denoted Issue there is a strong likelihood that a critical date may be missed and/or upper management may be looped in to help resolve issues.

Value of Regional Ocean Partnerships

Arleen O'Donnell, ERG and Andy Lipsky, SeaPlan

Valuation of Regional Ocean Partnerships

- **Making the Business Case for Regional Ocean Partnerships**

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Project Purpose

- Assess the economic benefits
- Examine Results of Three ROPs -- NROC, GOMA, and WCGA
- Demonstrate how ROPs provide benefit
- Inform future expenditures

Approach

- Hundreds of activities reviewed
- Categorized by type of activity, date completed, role of the ROP, location, and type(s) of benefits
- Narrowed list to select one major effort for each ROP

Selection Criteria

- ROP significantly contributed towards achieving objectives*
- Activity is completed or ongoing and has generated some (at least preliminary) results
- Benefits are measurable
- Represent a good cross-section of ROP work
- Available supporting info to conduct an assessment

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*did not attempt cause and effect attribution

West Coast Governors Alliance - Marine Debris

- Marine debris strategy & implementation plan
- Marine debris database
- Convener and coordinator - Individual states very active

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WGCA – Marine Debris Benefits

- Over 1,600 tons of benthic marine debris
- Reduction of up to $2.4 million in incurred cleanup costs
- Potential gain of up to $210 million in tourism revenues

Gulf of Mexico Alliance - Beneficial Re-use of Sediment

- 70% of dredged sediment is disposed of
- Sediment is needed to stem the loss of over 70K acres of coastal wetlands each year
- Sediment has value and wetlands have value

GOMA – Benefits of Regional Sediment Management Plan

- Based on Mississippi, calculated for Gulf:
- $600 million and $1.2 billion annually
- Over ten years - $12.5 billion (including ESV)

Northeast Regional Ocean Council

Northeast Ocean Data Portal

- Publicly accessible online spatial data server

- Provides access to data, interactive maps, tools, and other information needed for decision-making.

Approximate Costs for MORIS

Funding Source	2008	2009	2010	2011	Real cost/yr	
Partner Contributions	$170,000.00	$170,000.00	$228,500.00	$228,500.00	$797,000.00	
Producer Price Index	175.8	167.1	175.4	189.1		
Real cost (2011$)	$182,861.21	$192,381.81	$246,347.49	$228,500.00	$850,090.50	$212,523/year
				Projected cost for 5 states		$1,062,613.13

Estimated Costs to Establish, Maintain, and Create Data Products for NE Ocean Data Portal

Funding Source	2008-2009*	2010	2011	2012	2013	Total
Data Portal Working Group Member Funding	87,000	$ 345,000	$ 323,000	$ 335,000	$ 410,000	$ 1,500,000

** Does not include all coastal and ocean data products that have been developed and integrated into the portal as many of these products may have been funded as separate products. In addition, much data served through the portal are developed and maintained by third parties

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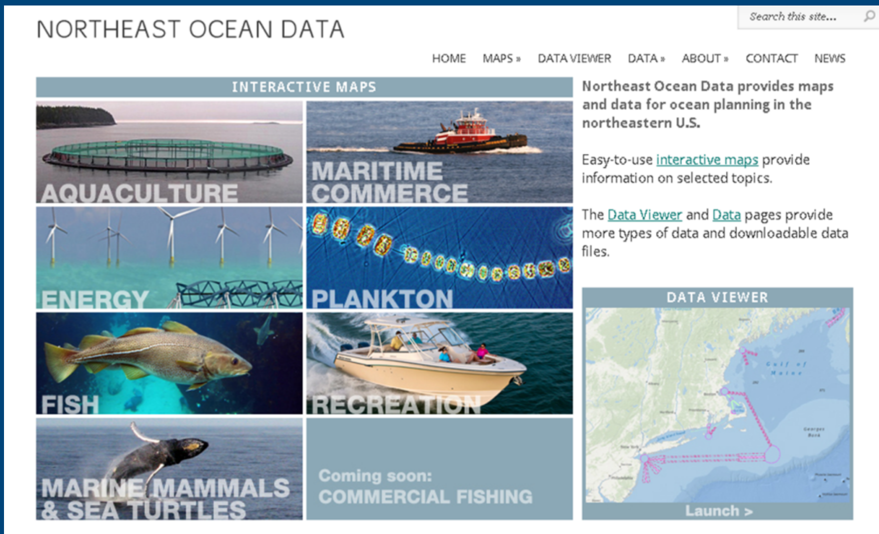
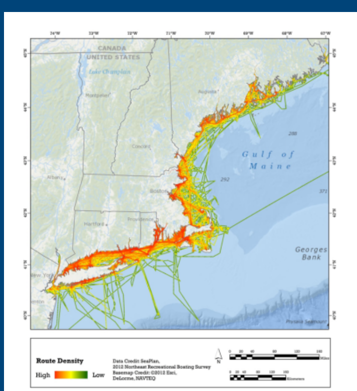
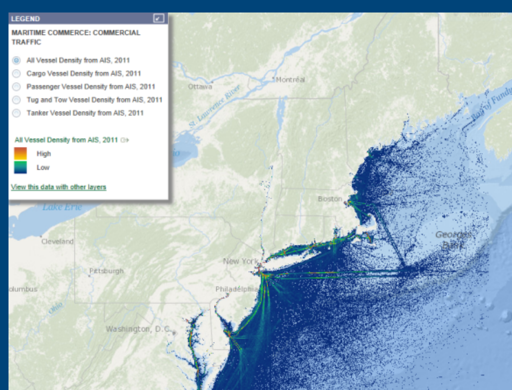
NROC - Value

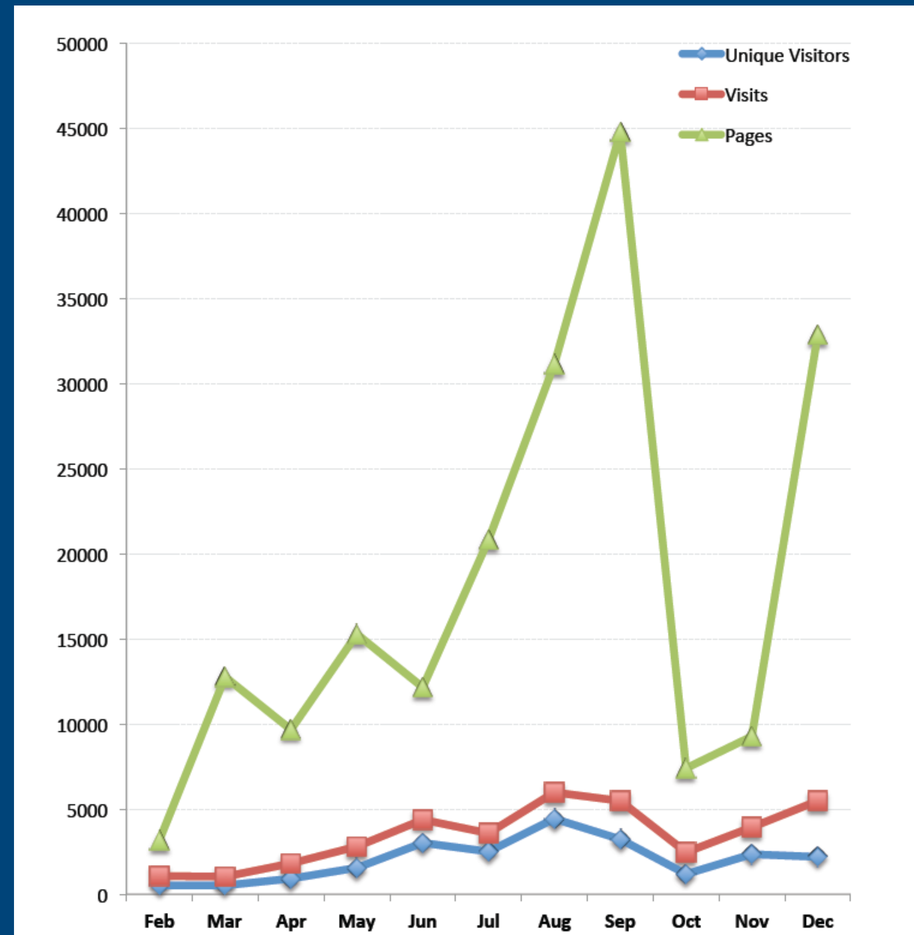
- $3.8 million (based Massachusetts cost)
- $13.5 million (based on ROI study showing 6 or 9 times ROI)

Snapshot of Data Portal Usage









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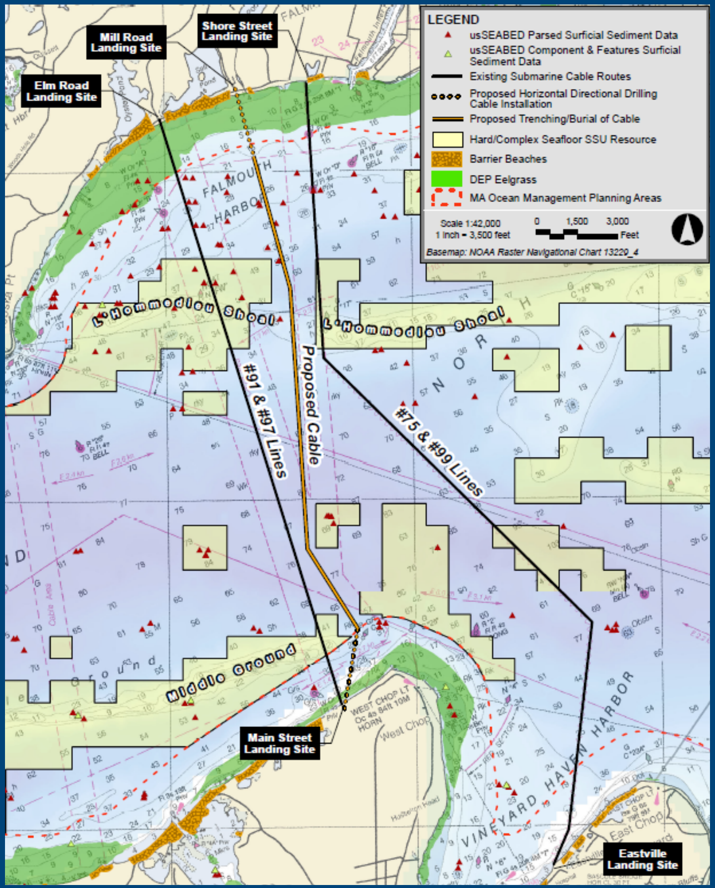
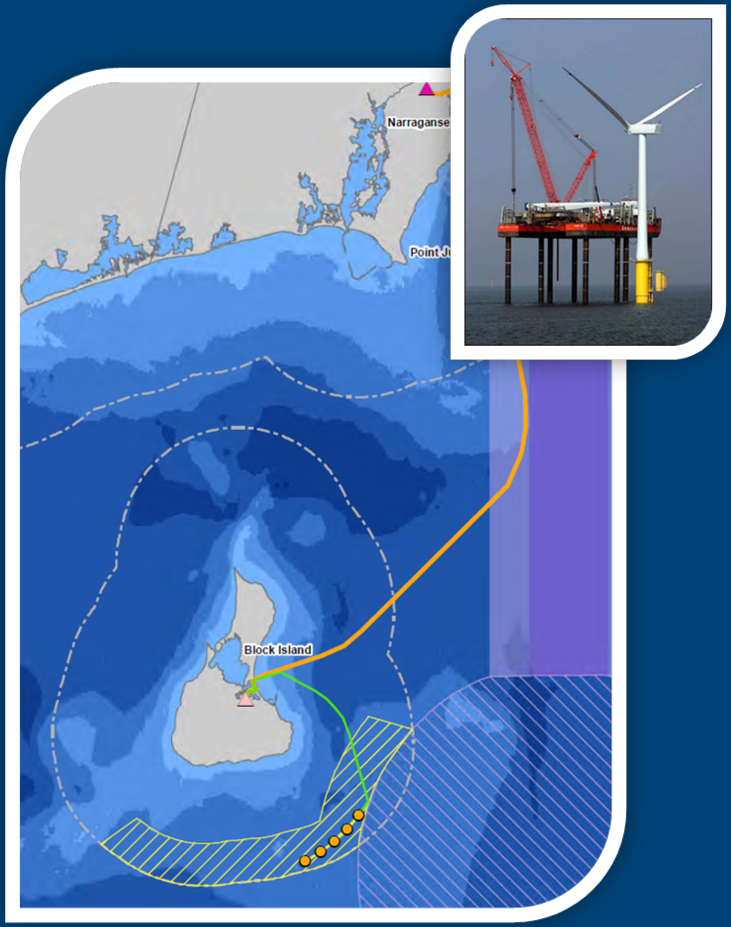
Case Examples of Integrated Data for Ocean Planning Benefitting Local Projects





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Anticipated Benefits Being Realized

Time and cost savings due to:

- Enhanced agency & organizational coordination for project review
- Better access to important data, including stakeholder info
- Agreement on data, protocols, and planning information
- Avoiding upfront data collection efforts
- Avoiding need for developing alternative plans/subsequent reviews
- *Increased Predictability & Transparency*
- *Identification of Data Gaps and Narrowing data acquisition*

Many Indirect Benefits

Challenges

- No new data or research
- Cooperative nature of ROPs makes causal attribution next to impossible
- Difficulty in reasonable and appropriate counterfactuals

Discussion Questions

- How can NROC use or supplement this information?
- Is expressing value in $$$ an abstraction?
- What activity do you think would be most important to value to make the business case for NROC?
- How can NROC plan now to collect the data needed for future economic benefits assessment?