Overview of SC -BOEM and Other Wind Energy Related Studies and Data Collection and Data Products

Paul Gayes , Director
School of Coastal and Marine Systems Science
Coastal Carolina University

BOEM-SC Task Force Meetings; Litchfield Beach SC Sept 9,2015

- **BOEM – SC Study**
  Atlantic Offshore Wind Energy Development: Geophysical Mapping and Identification of Paleolandscapes and Historic Shipwrecks Offshore South Carolina
  Coastal Carolina, USC-ESRI, SC SCIAA

- **NOAA Thematic Mapper/Habitat Mapping Partnership**
  - Coastal Carolina , NOAA- Beaufort

- **Dept. of Energy**
  - Advanced Technology for Improving the Design Basis of Offshore Wind Energy Systems
  - Coastal Carolina Savannah River National Lab, National Renewable Energy Lab and MMI Engineering Inc

- **US DOE Bureau of Safety & Environmental Enforcement**
  - Establishment of Met-ocean Data and Hazard Curves for Wind Energy Areas (WEAs) off the Atlantic Seaboard
    - Coastal Carolina and MMI Engineering

- **Santee Cooper/Visalia Vertical Wind Experiment**
  - Santee Cooper, Vasialia, Coastal Carolina, Savannah River Nat. Lab

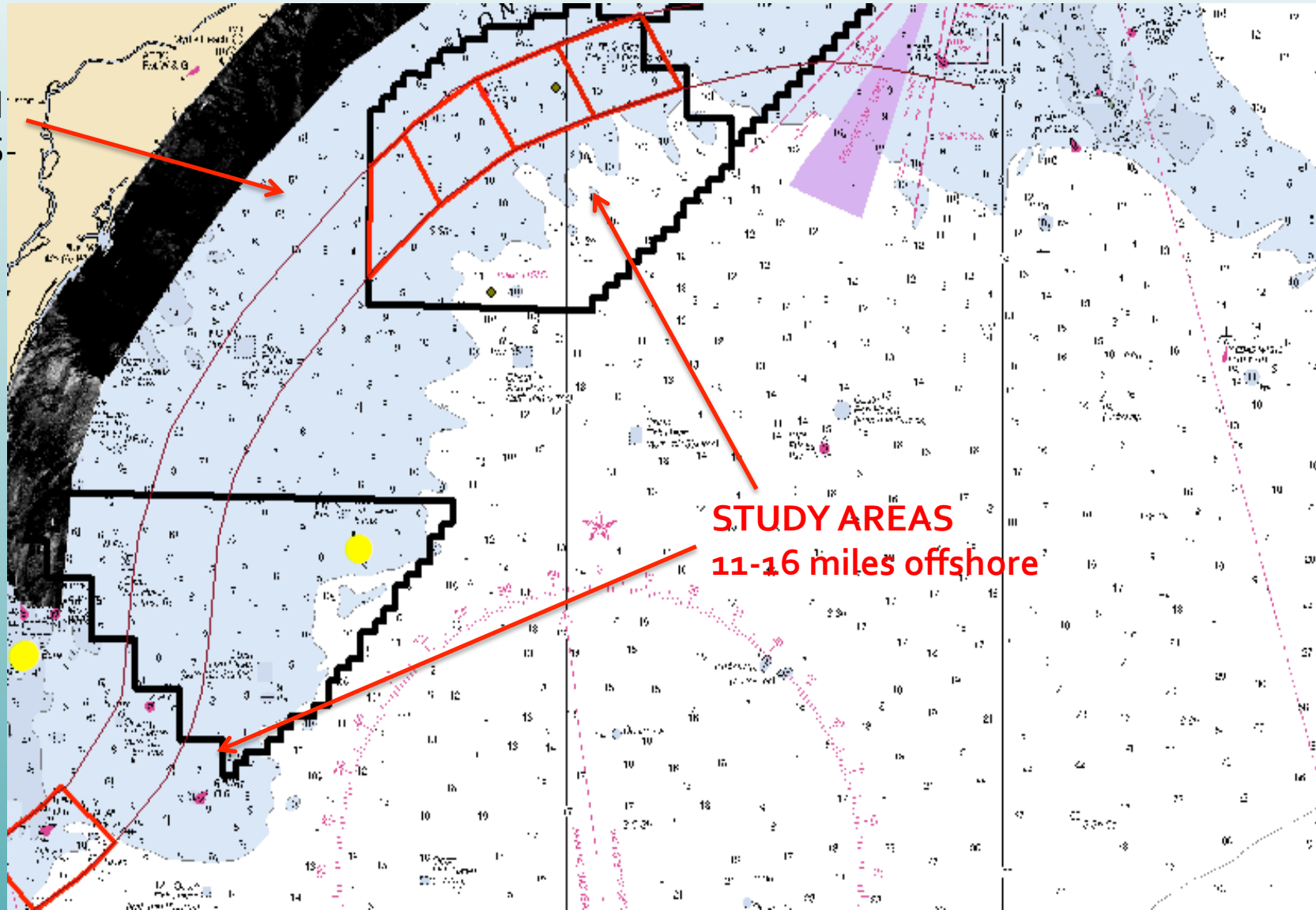
- **DOE Regional Wind Resource Center**
  - SEWC, Coastal Carolina, Clemson, Georgia Tech, James Madison, Florida

All studies oriented towards facilitating BOEM process or reducing uncertainties facing developing industries to drive down exploration, design and operational costs

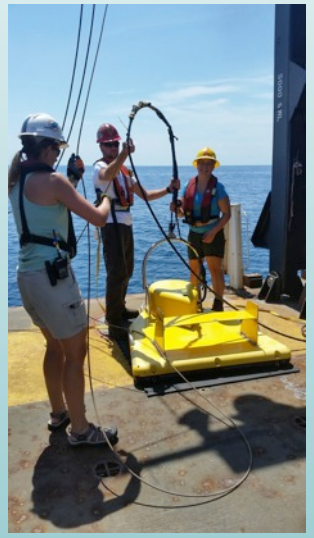
BOEM – SC Study

Atlantic Offshore Wind Energy Development: Geophysical Mapping and Identification of Paleolandscapes and Historic Shipwrecks Offshore South Carolina

Previous extensive geophysical survey USGS-SC Grant partnership

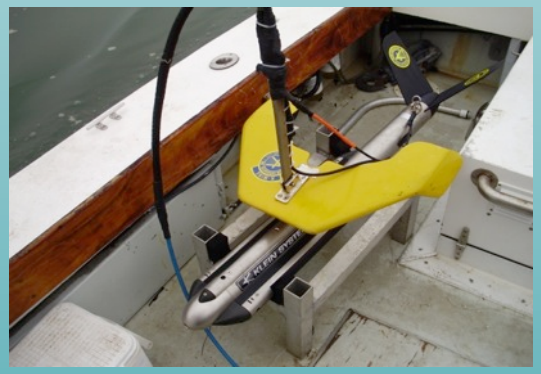


- **Geophysical Mapping**
  - Multibeam Sonar
  - CHIRP Sub-bottom Sonar
  - Side Scan Sonar
  - magnetometer



Coastal Carolina's "Coastal Explorer"

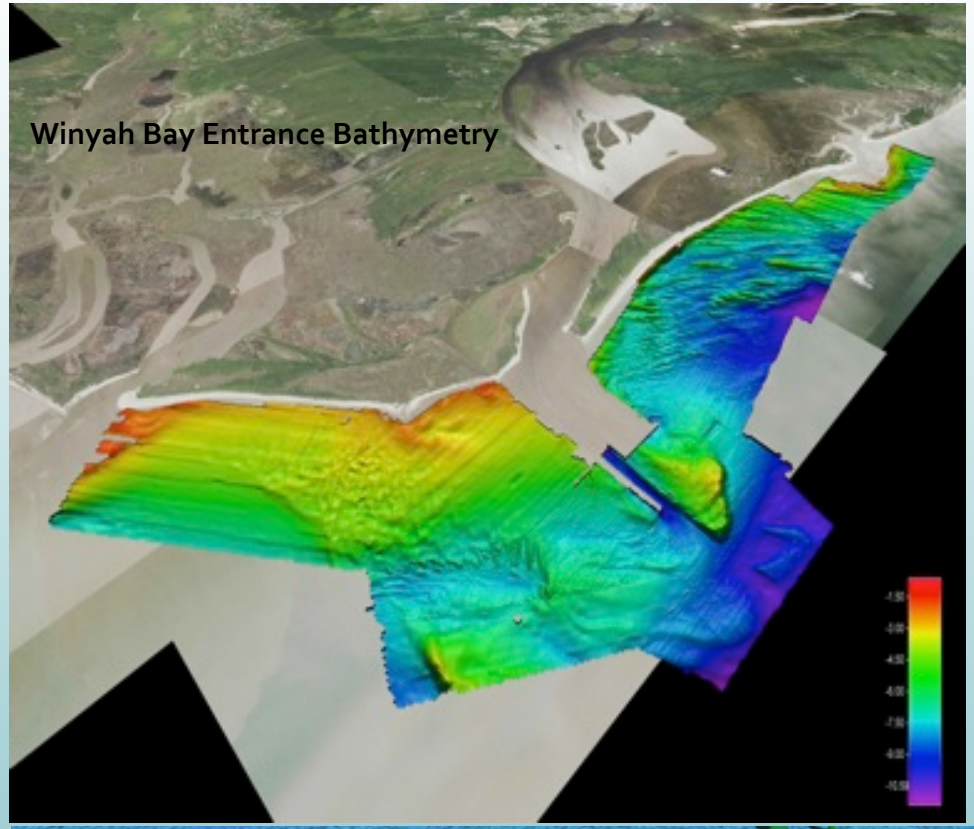
Chirp Sub bottom Profiler

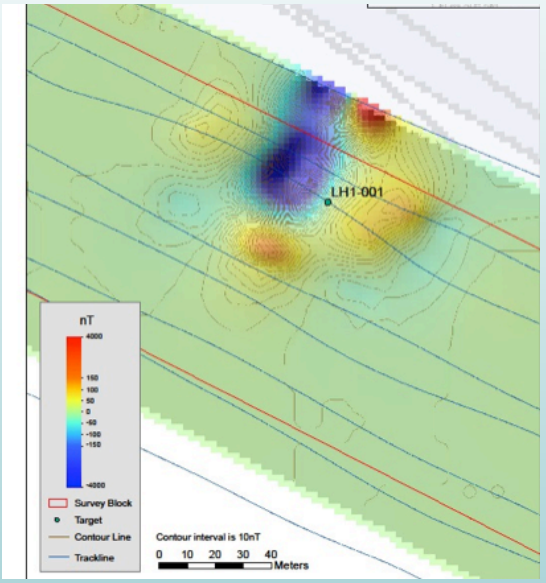


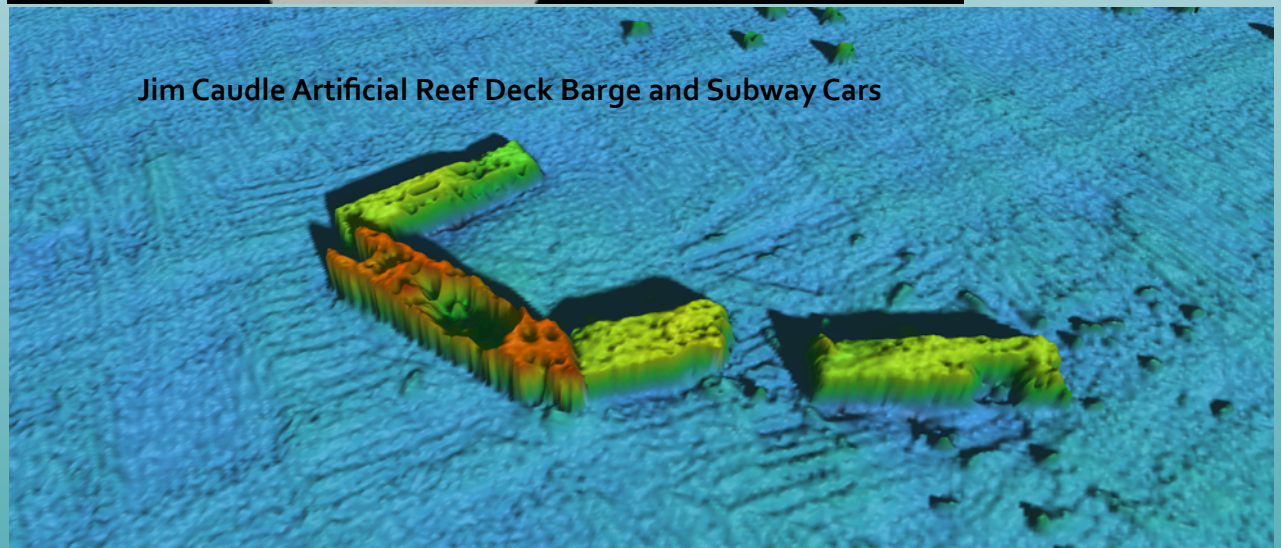
Side Scan Sonar

Cesium Vapor Magnetometer

Multibeam Continuous Depth Imagery

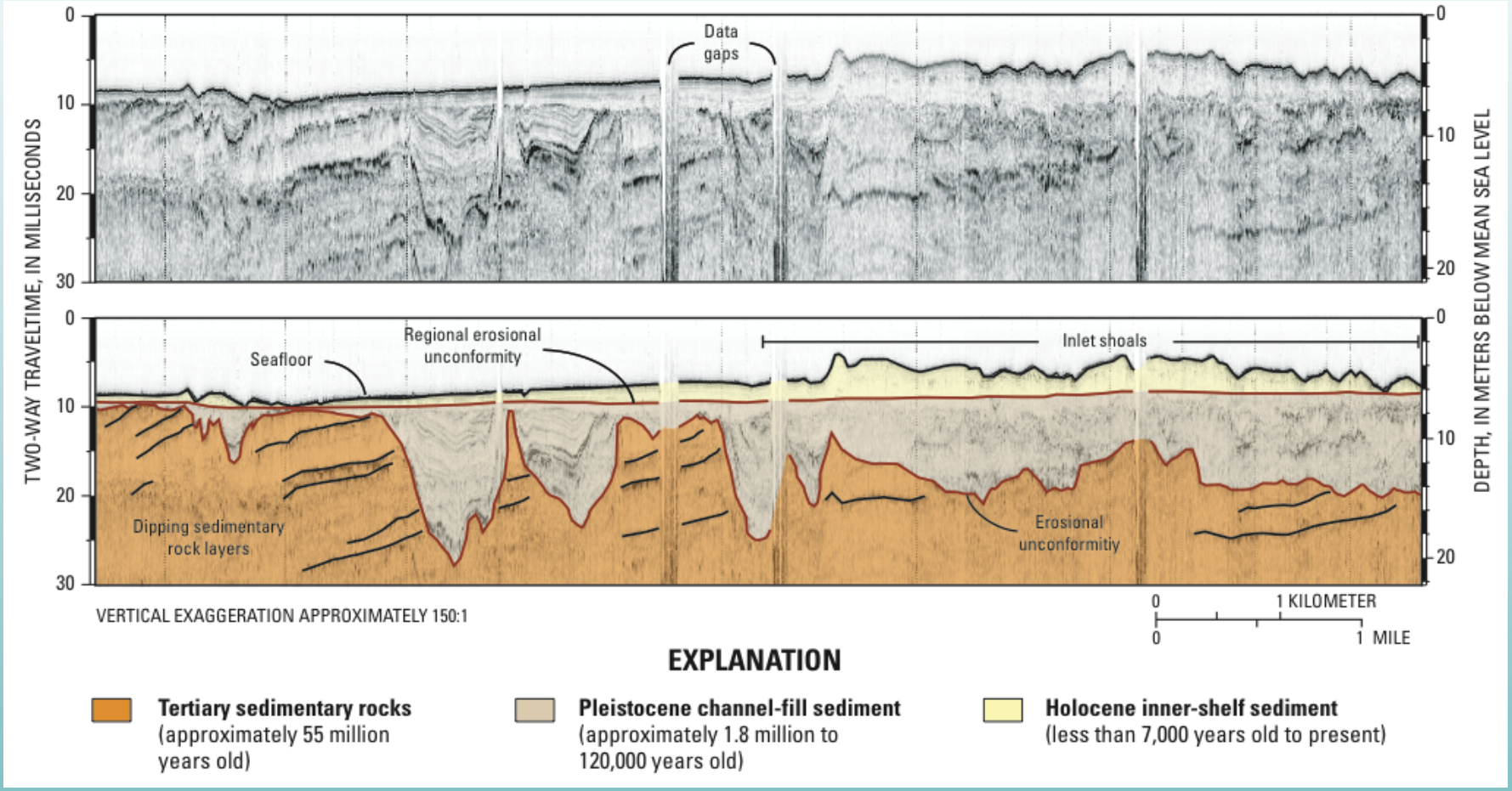




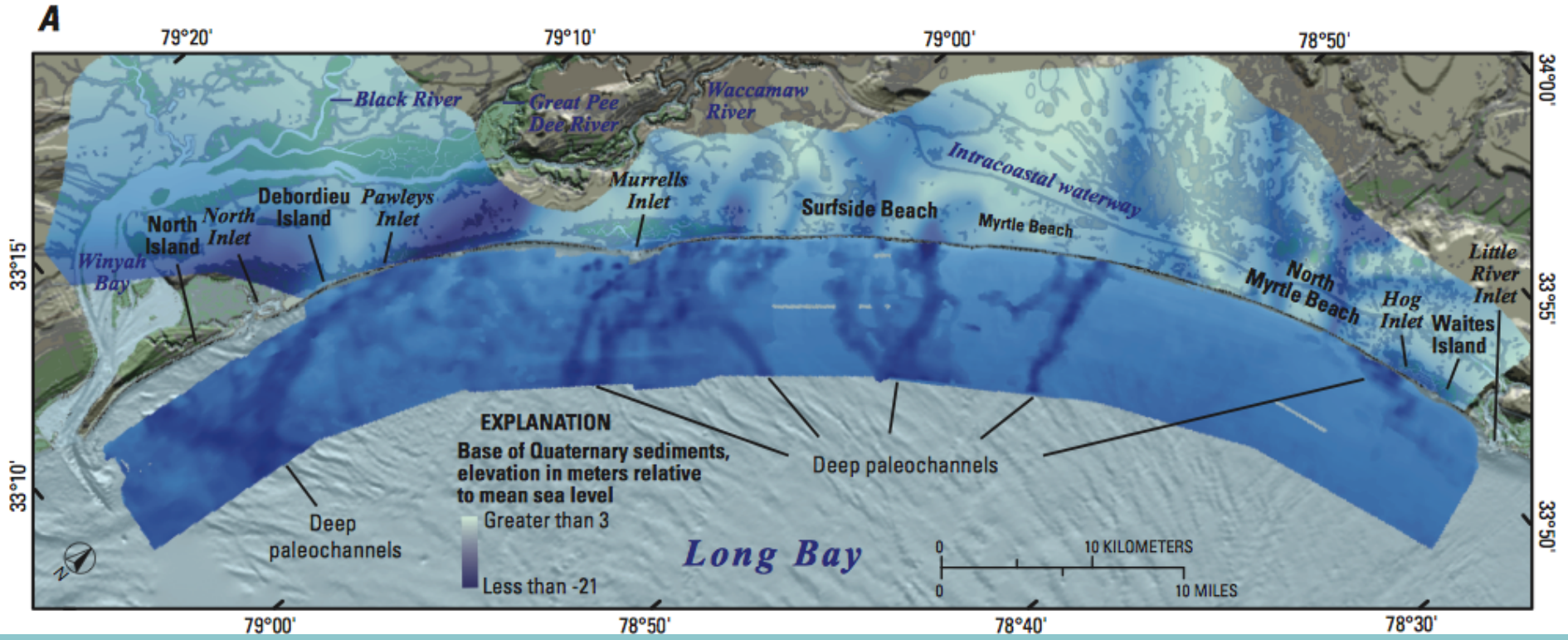


Magnetic signature of metallic objects on or near the sea floor from Charleston Harbor Deepening Study

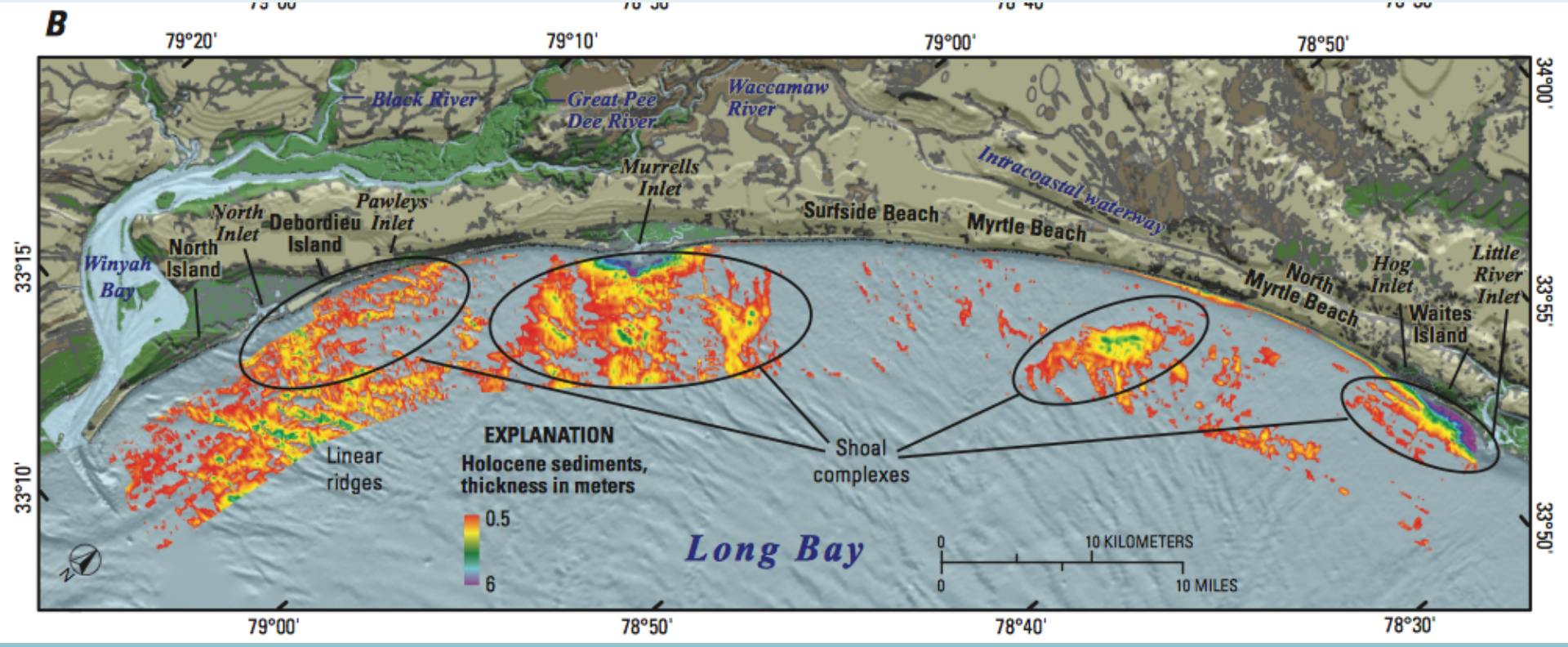
Chirp Example



Identifies where older substrate outcrops (habitat)
Thickness of Sediment Cover
Geologic structure including downed river valleys

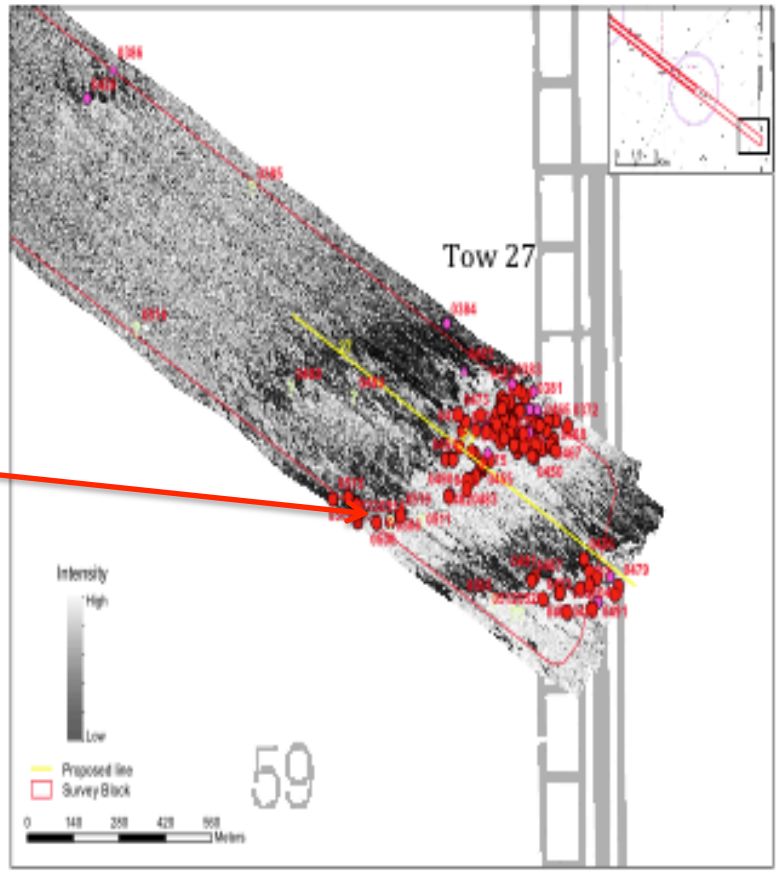


Mapping of drown river valleys Priorities for possible Paleolandscapes for Indigenous Populations

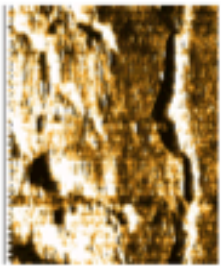


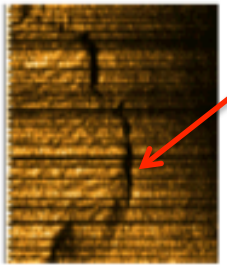
Surficial Sediment Distribution useful for habitat evaluation as well as potential beach nourishment resources assessment

What fish habitat looks like at a given site

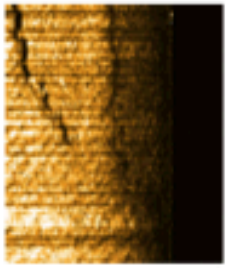


Map view from mosaic



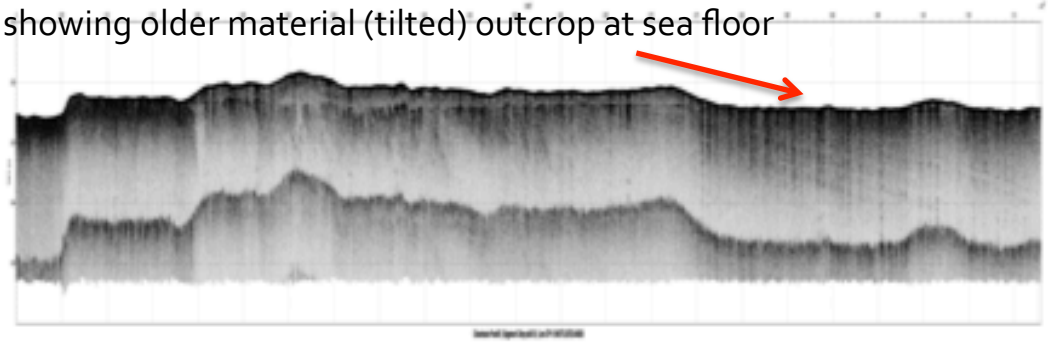


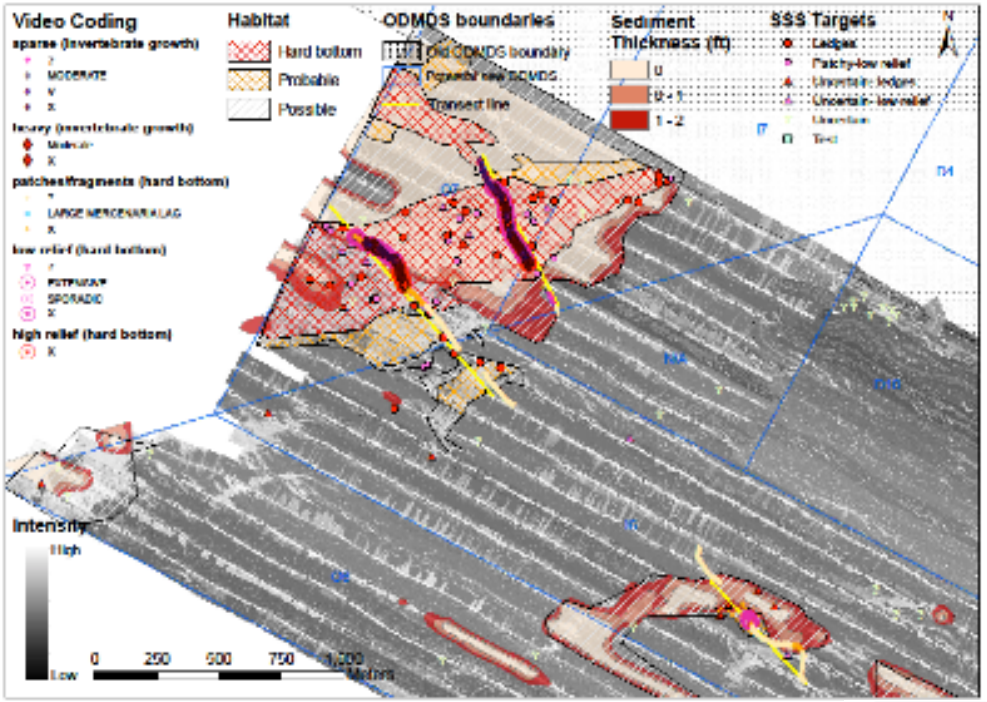
Individual Record



Rocky Ledges in Sonar Backscatter

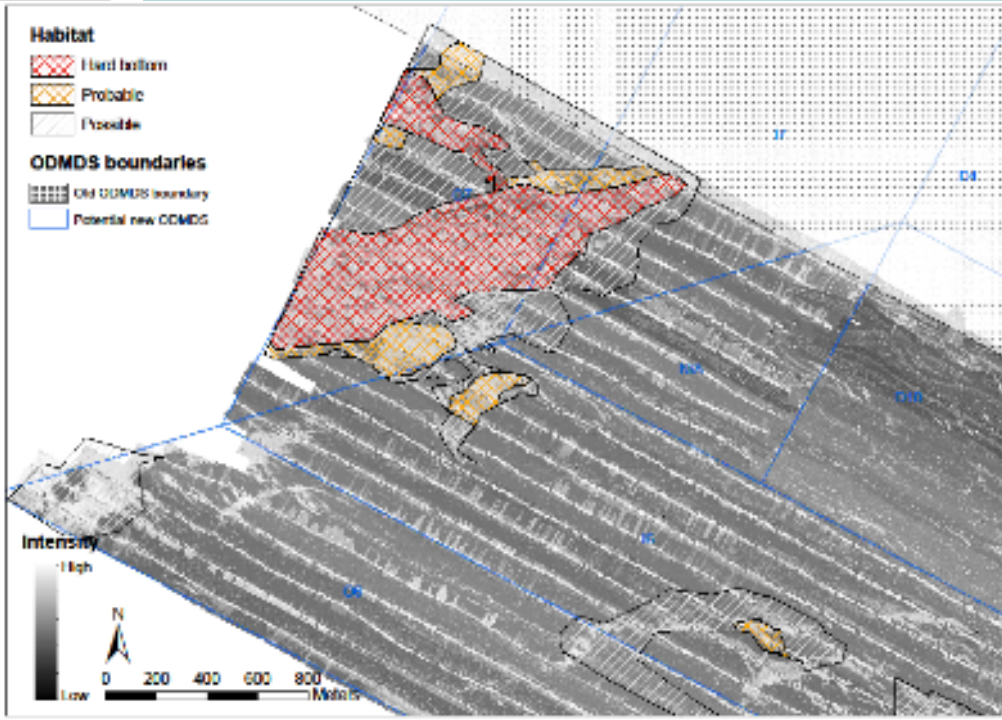
Chirp Data showing older material (tilted) outcrop at sea floor



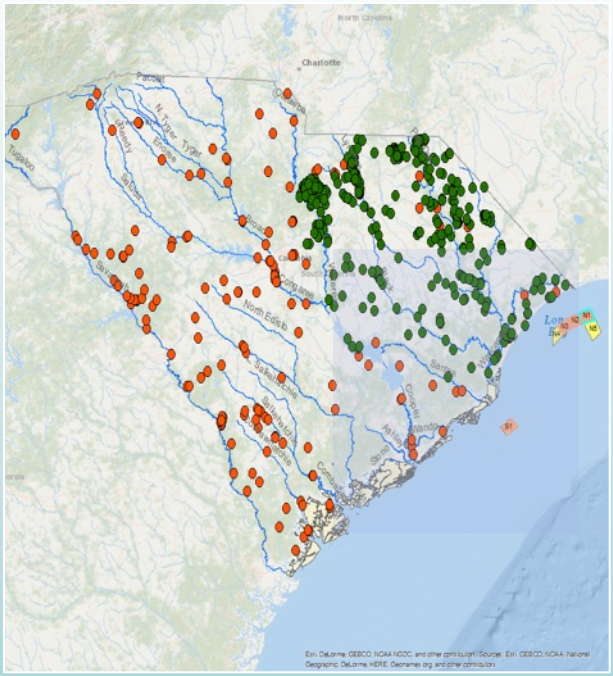


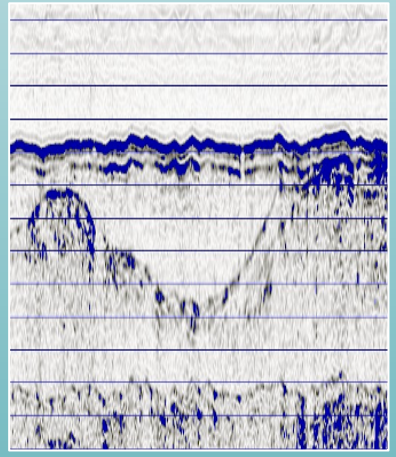
Multiple Data Layers indicating presence of hard ground (fish habitat)

Integrated Habitat Maps (probabilities)



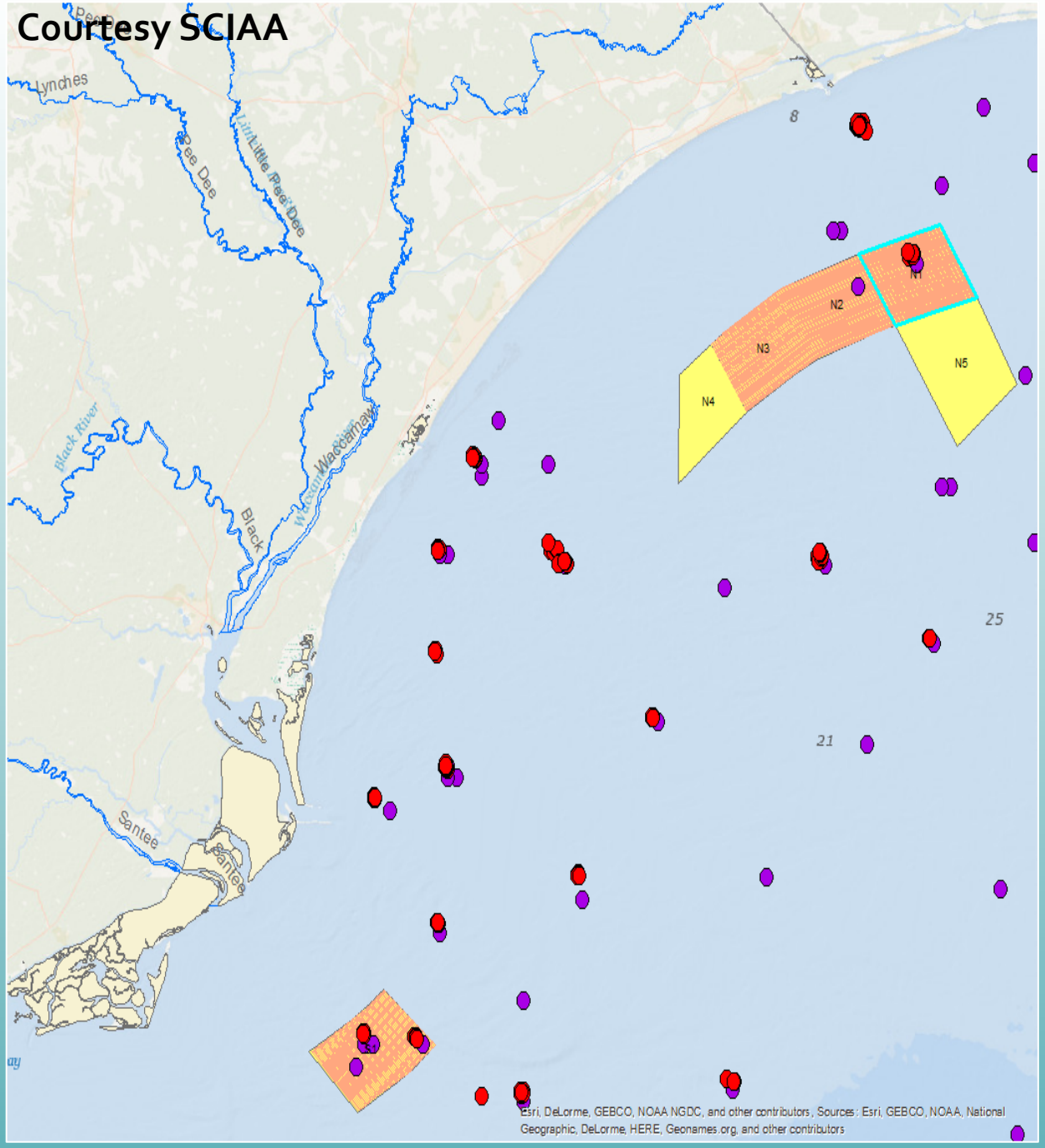
Courtesy SCIAA



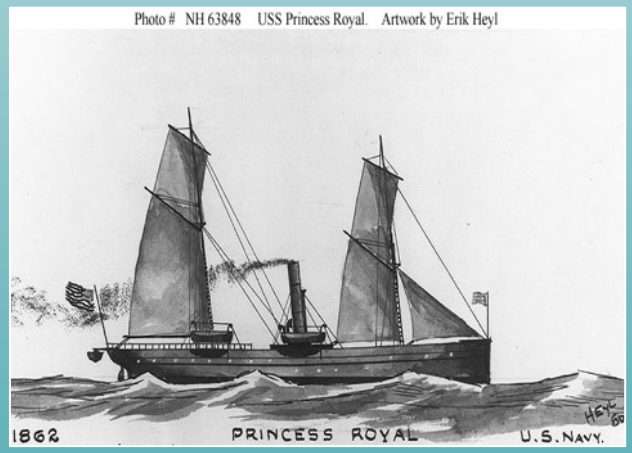


- Paleo-Archaic sites inventoried by project underwater archaeologist from state site files (Paleo in orange, Archaic in green); submerged paleo landform; Clovis lithic .

Courtesy SCIAA

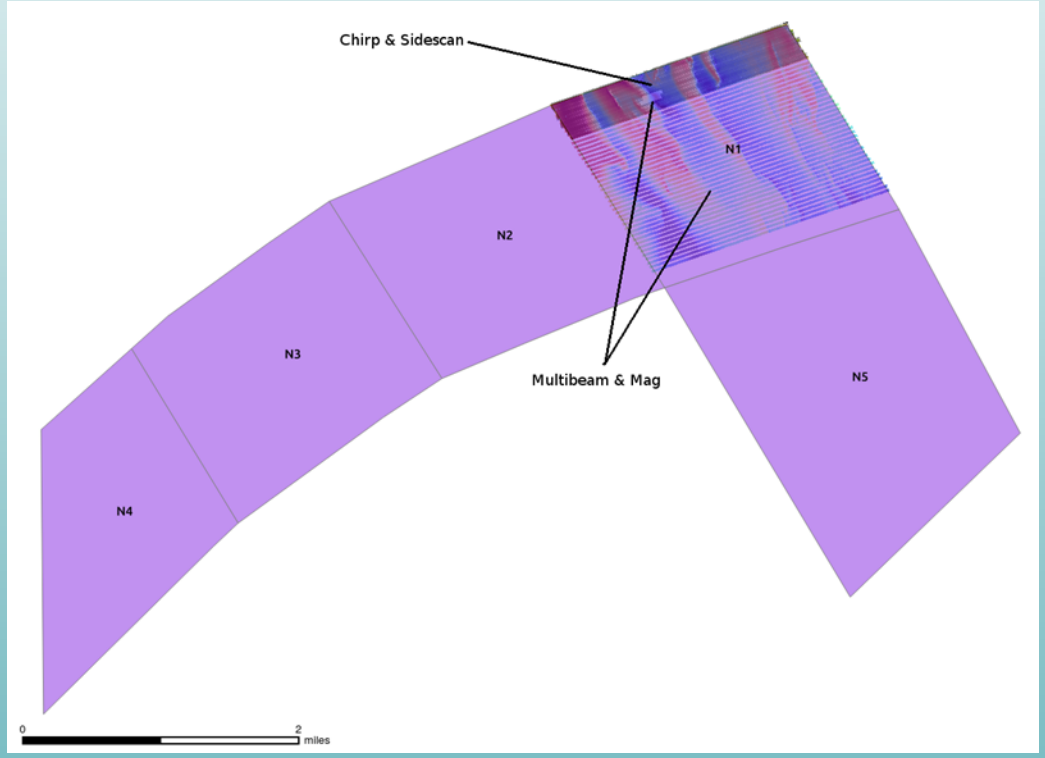


- Artificial reefs (red) and shipwrecks (purple) located within and around SC-BOEM research blocks.



Courtesy USC-ERSI

Coverage



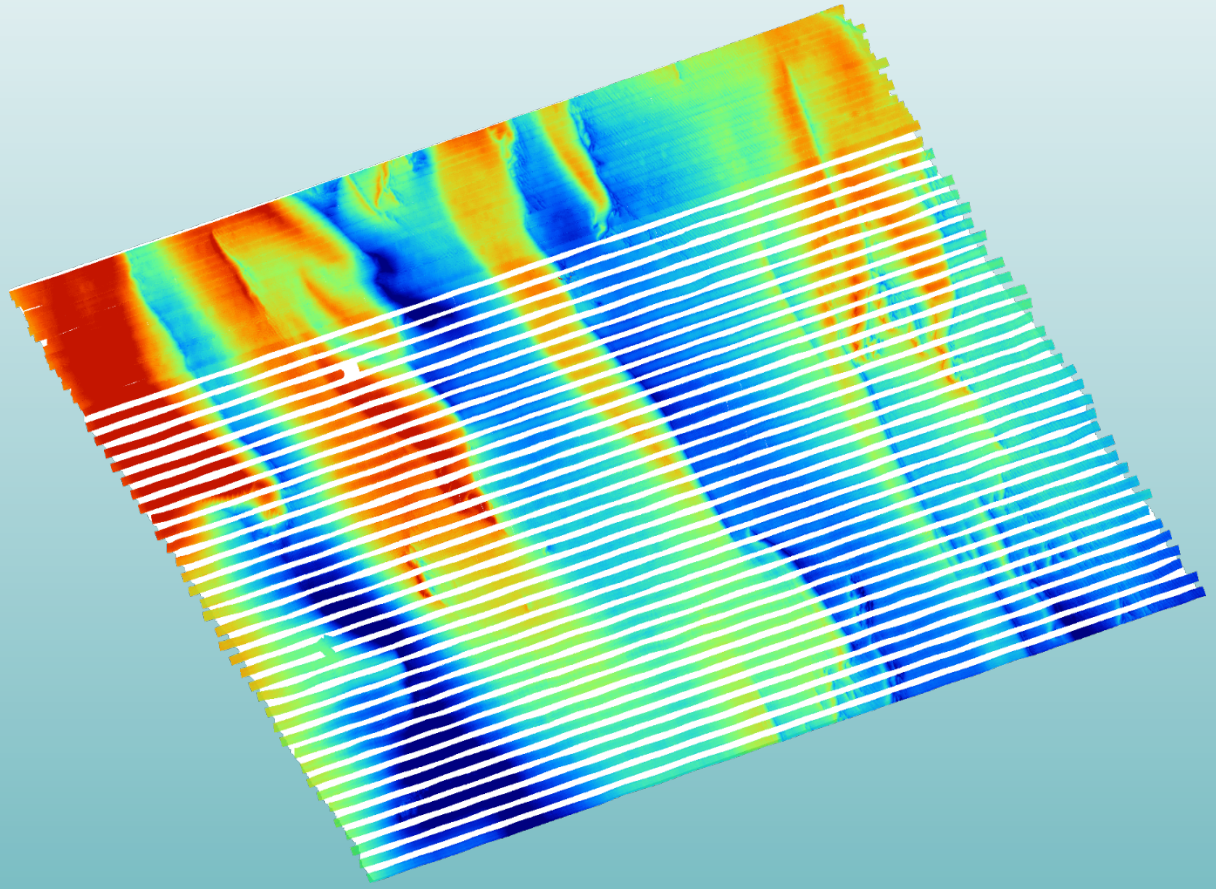
Courtesy USC-ERSI

Multibeam Bathymetry

Provide surface analysis and bottom-type classification

Provide surface structure for identifying areas of interest

Source of backscatter data



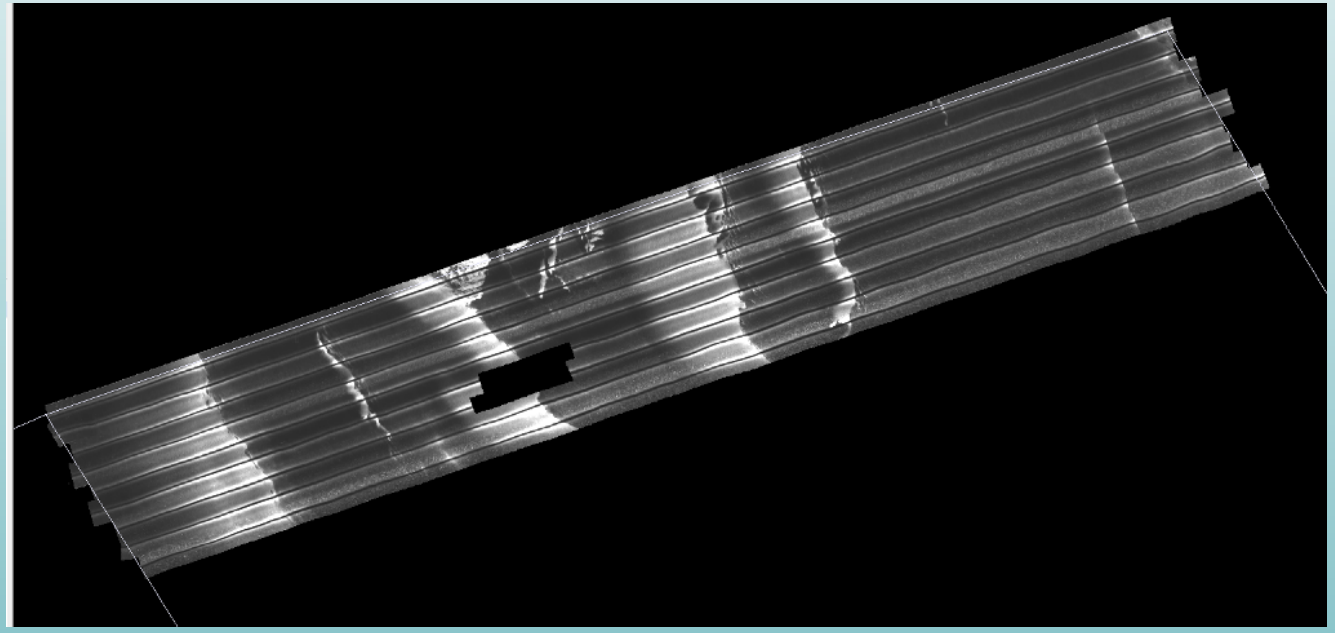
Courtesy USC-ERSI

Sidescan Sonar

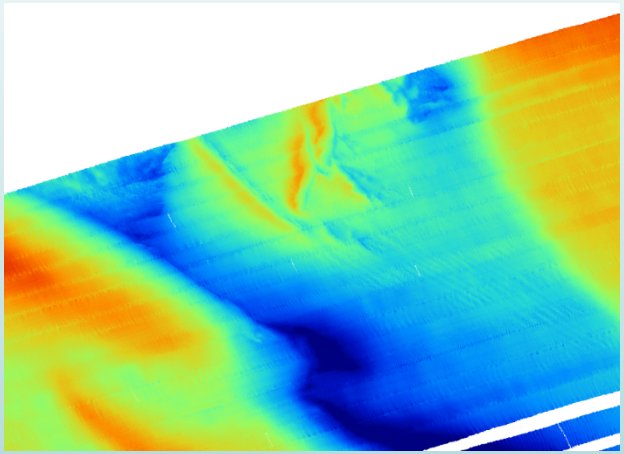
Provide surface analysis and bottom-type classification

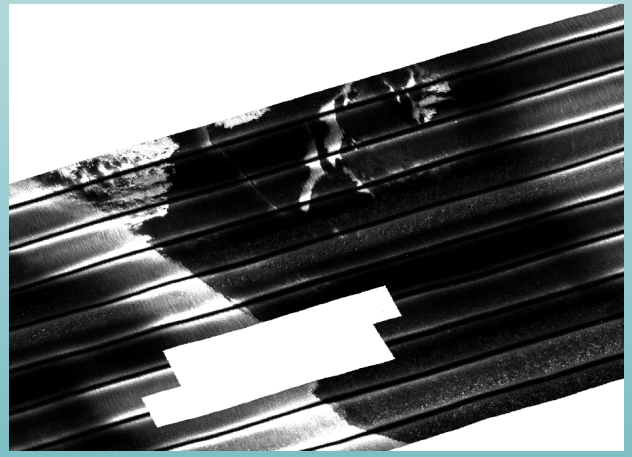
Provide surface structure for identifying areas of interest

Source of backscatter data

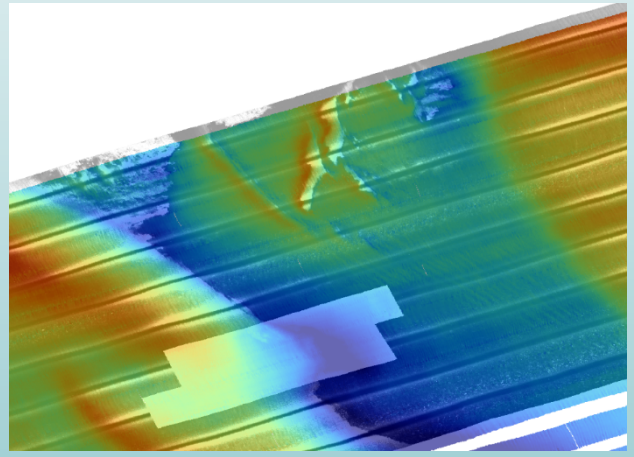


Courtesy USC-ERSI





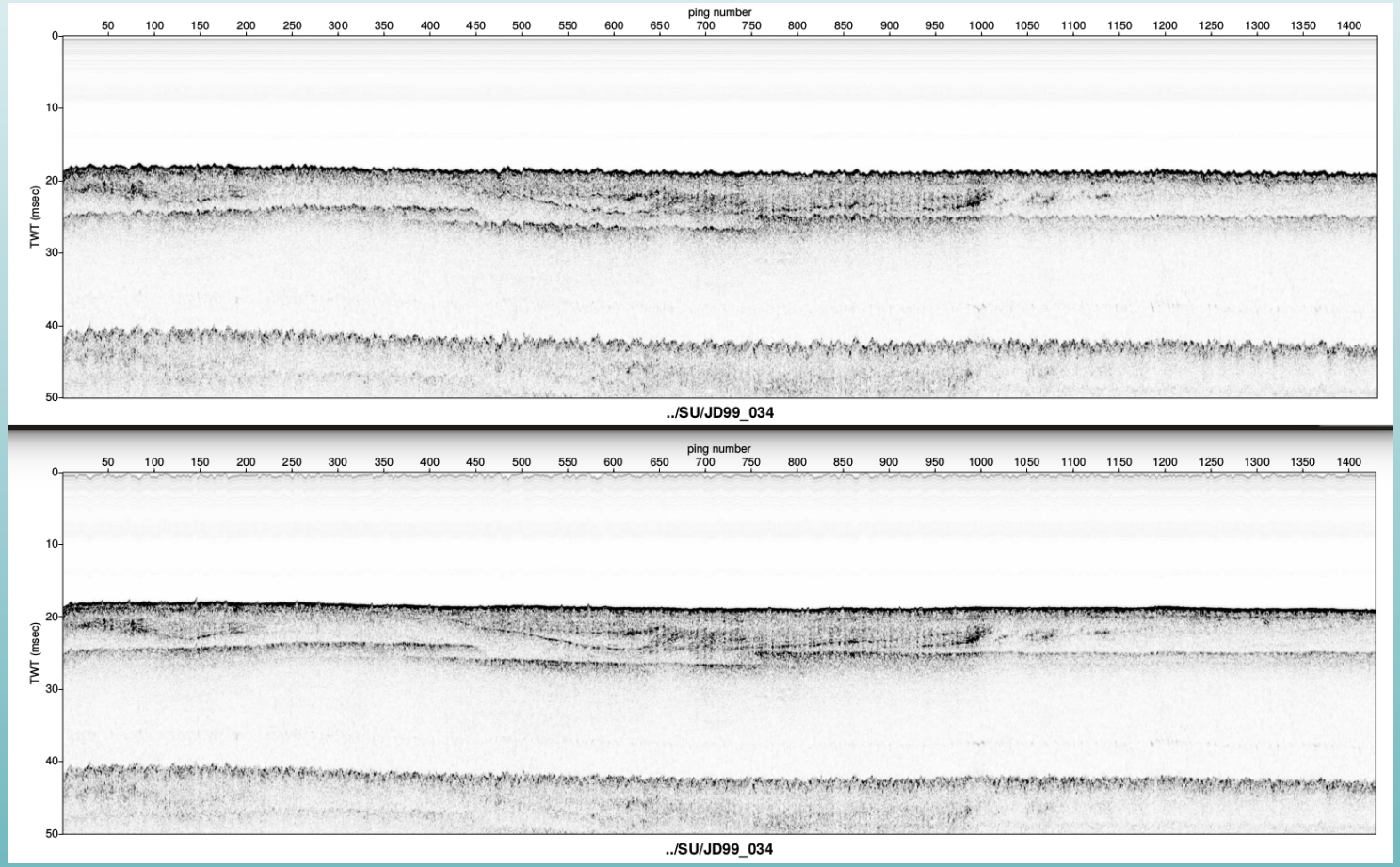
Multibeam and Sidescan are overlain to aid backscatter co-location.



Backscatter from both datasets may be compared to improve bottom classification.

Courtesy USC-ERSI

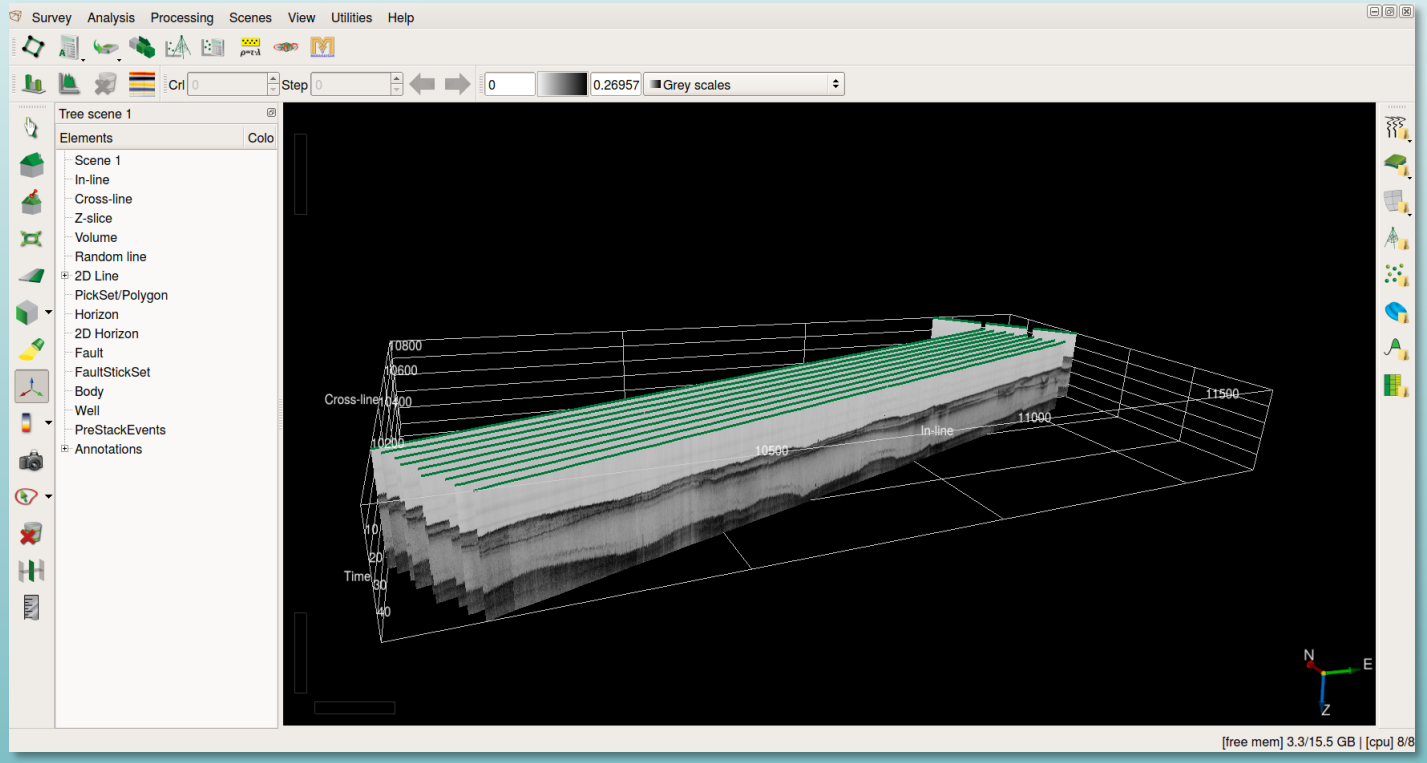
CHIRP – before and after filtering

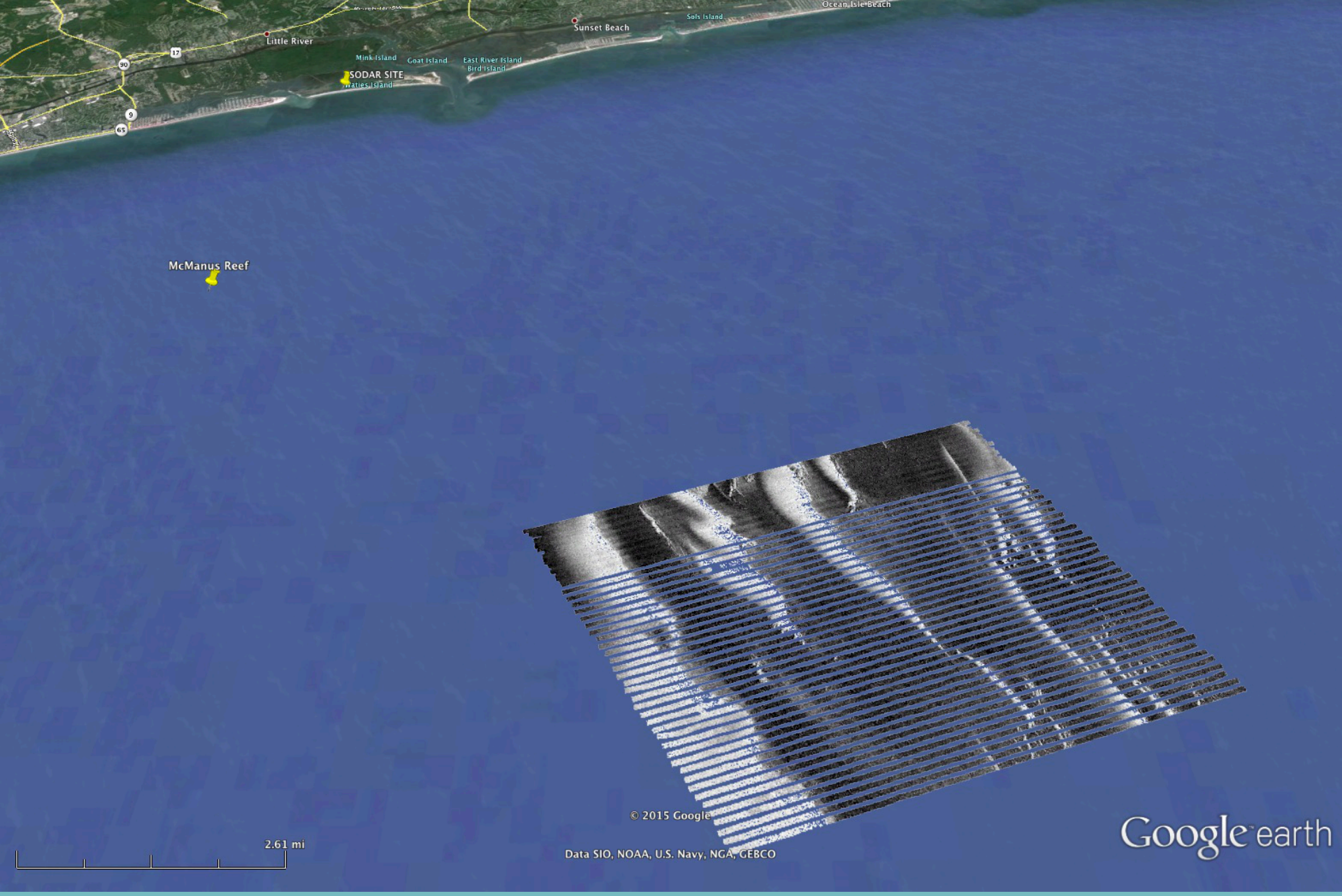


Courtesy USC-ERSI

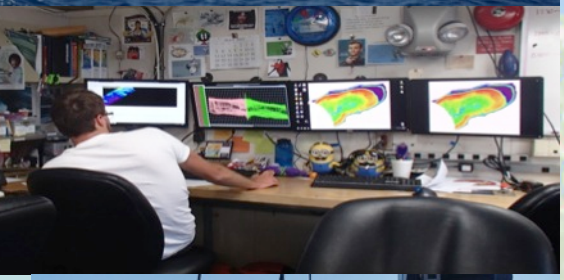
Chirp – fence diagram

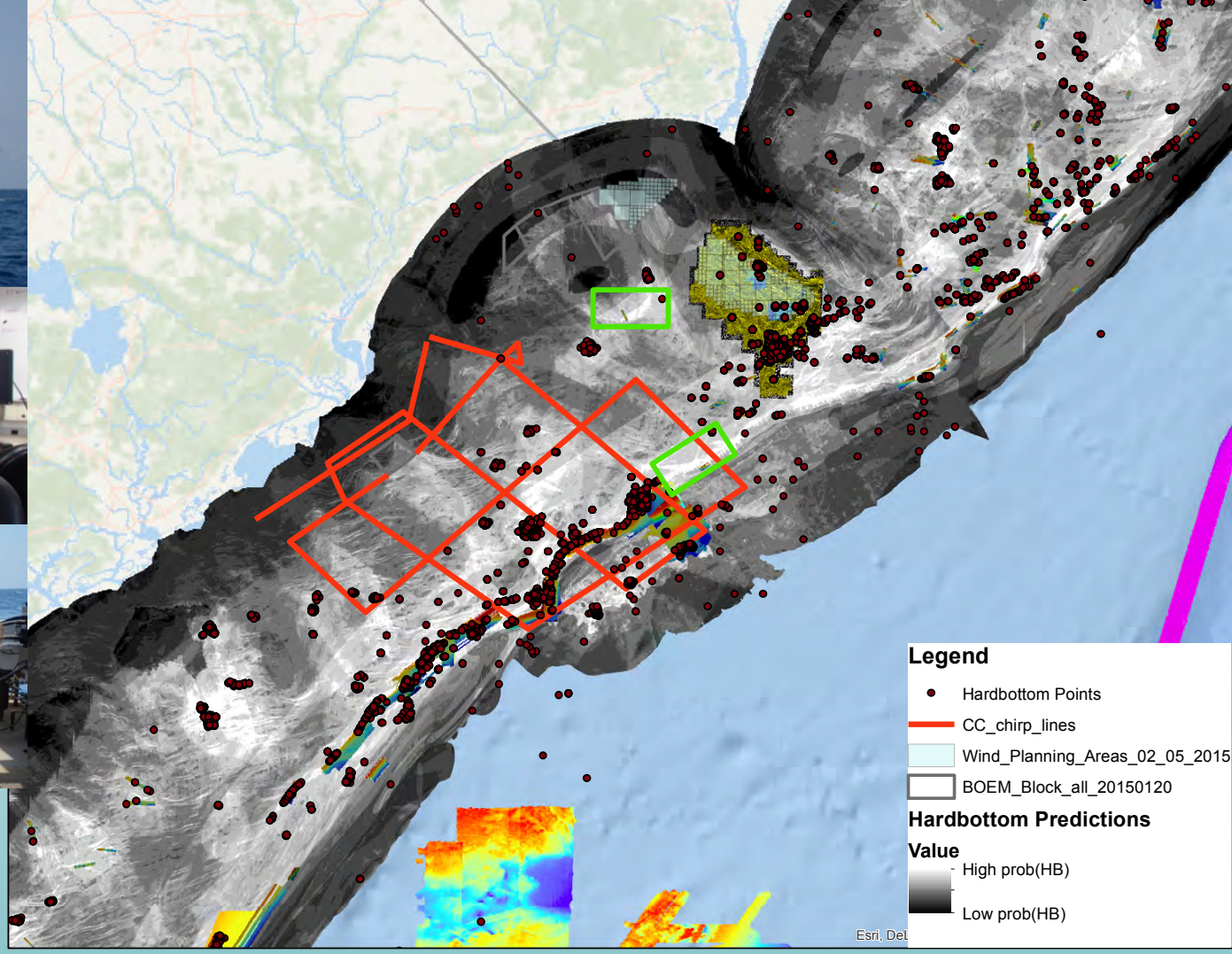
Sub-bottom horizons may be used to identify paleo-channels that may contain anthropogenic deposits





Early Sonar Backscatter Mosaic From Study Area- Ongoing Work

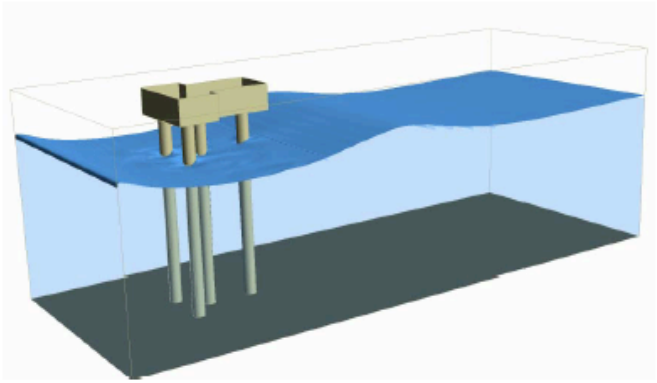




Cooperative with NOAA Fisheries to test their Habitat mapping Model Added regionally to BOEM Effort

SRNL
SAVANNAH RIVER NATIONAL LABORATORY

Advanced Technology for Improving the Design Basis of Offshore Wind Energy Systems



Applicant Information	
Applicant Name	Savannah River National Laboratory
Type of Organization	FFRDC
Topic Area	6.0 Resource Characterization and Design Conditions
Subtopic Area	6.2 Advanced Research Topics

Technical Point of Contact

Ralph Nichols
Fellow Engineer
SRNL
Bldg. 773-42A, Rm. 249
Aiken, SC 29808
803.725.5228
ralph.nichols@srnl.doe.gov

Business Contact

Steve Wach
Mgr. SRNL Technology Transfer
Bldg. 773-41A, Rm. 249
Aiken, SC 29808
803.725.3020
steve.wach@srnl.doe.gov

Participants (Funded)

National Renewable Energy Laboratory
Coastal Carolina University
MMI Engineering

Participants (Cost Sharing)

Coastal Carolina University

U. S. Offshore Wind: Removing Market Barriers
Funding Opportunity Announcement No.: DE-FOA-0000414
CFDA No.: 81.087

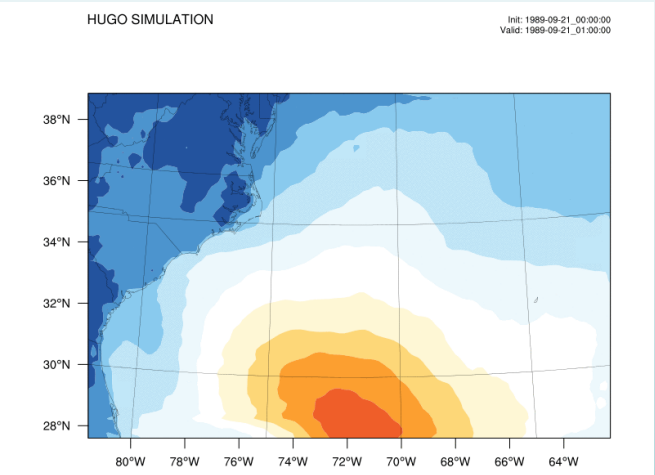
Advanced Modeling & Observations Of Wave Forcing; High Energy Events

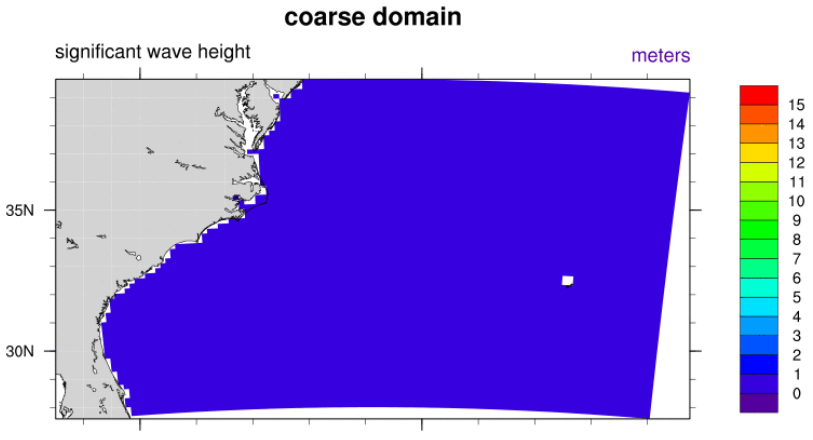
Define Forces To Reduce Uncertainty in Design Of Offshore Structures

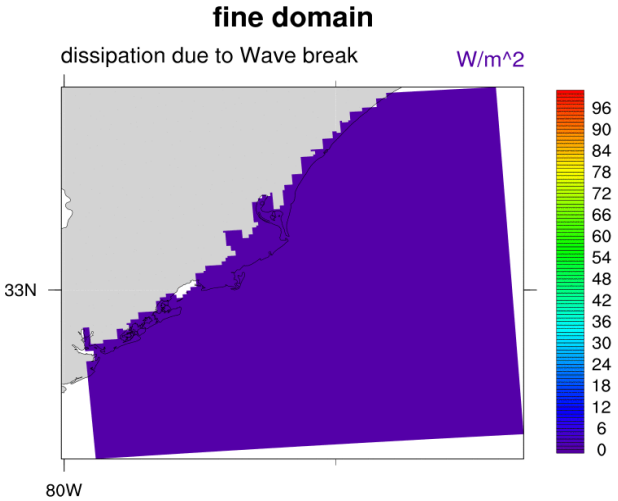
Efforts to Drive Down Construction / Financing Costs

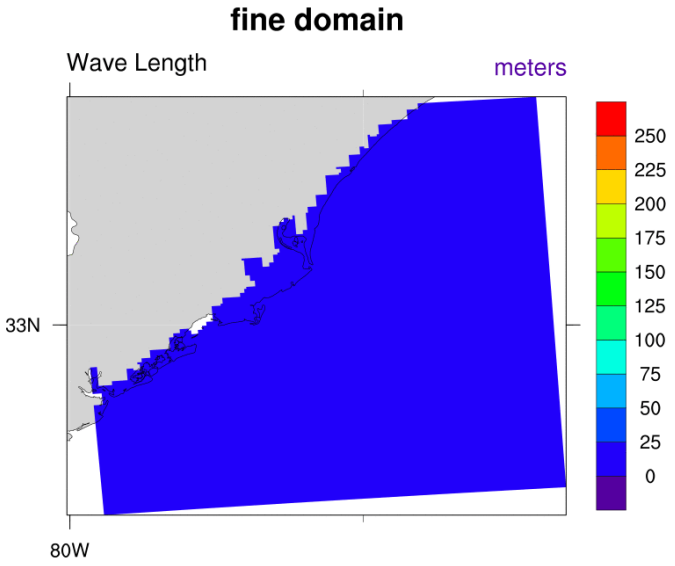
Simulation of Coastal Wave Brea

Hurricane Hugo 1989

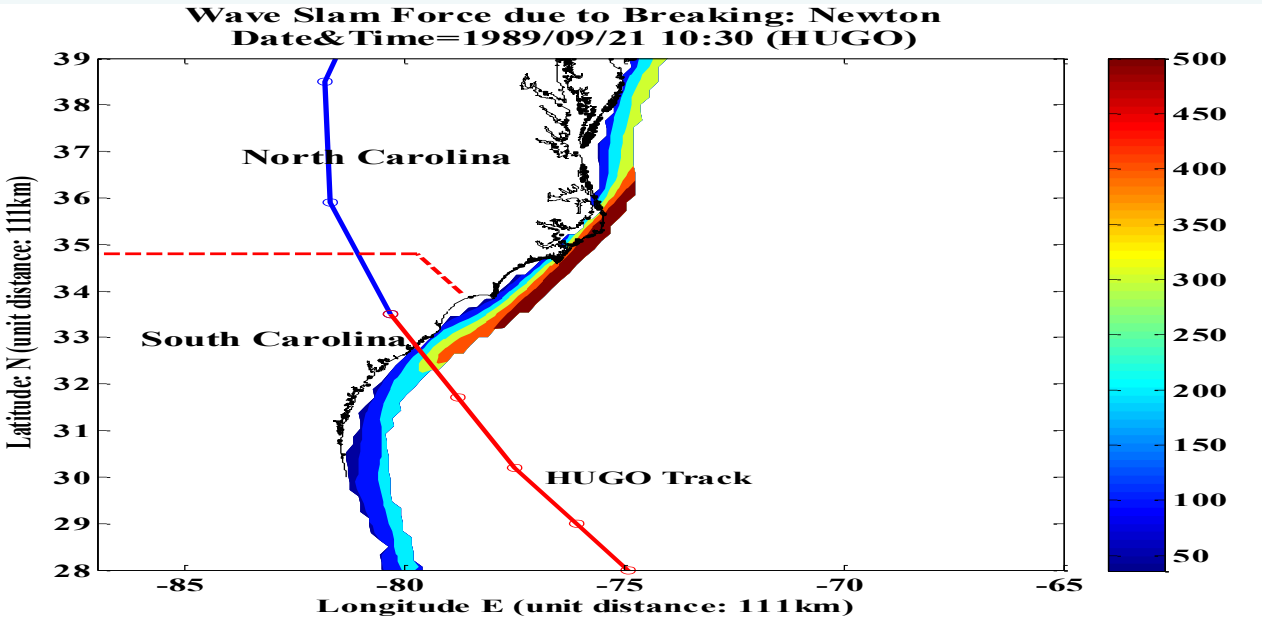


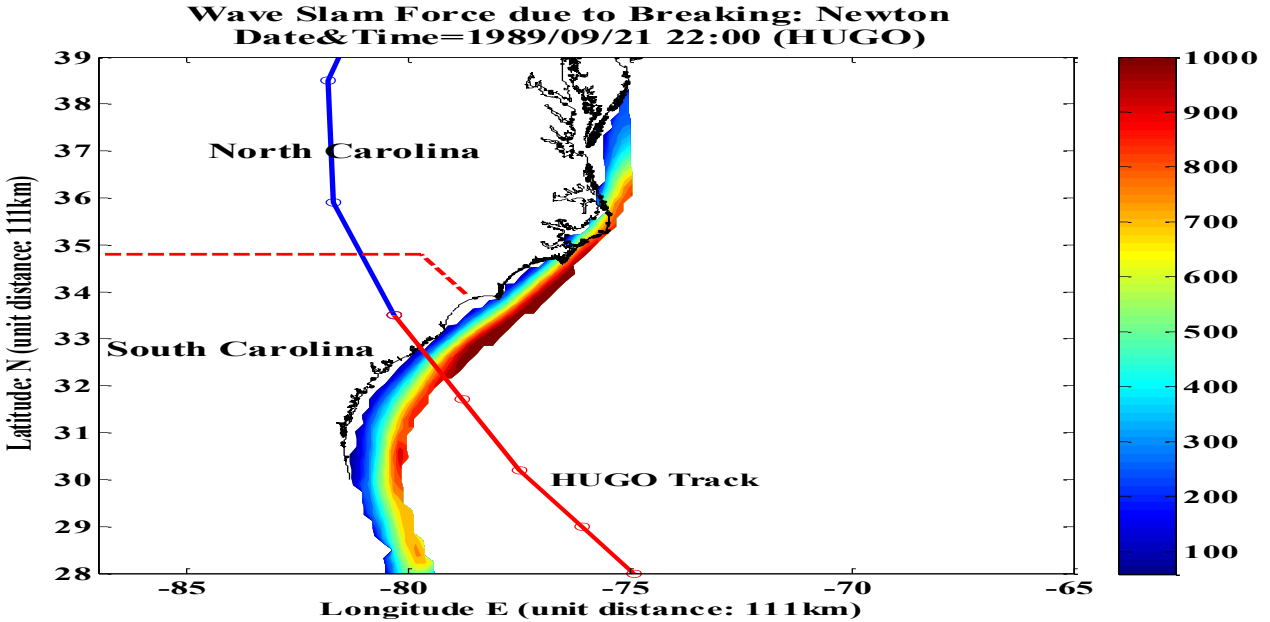






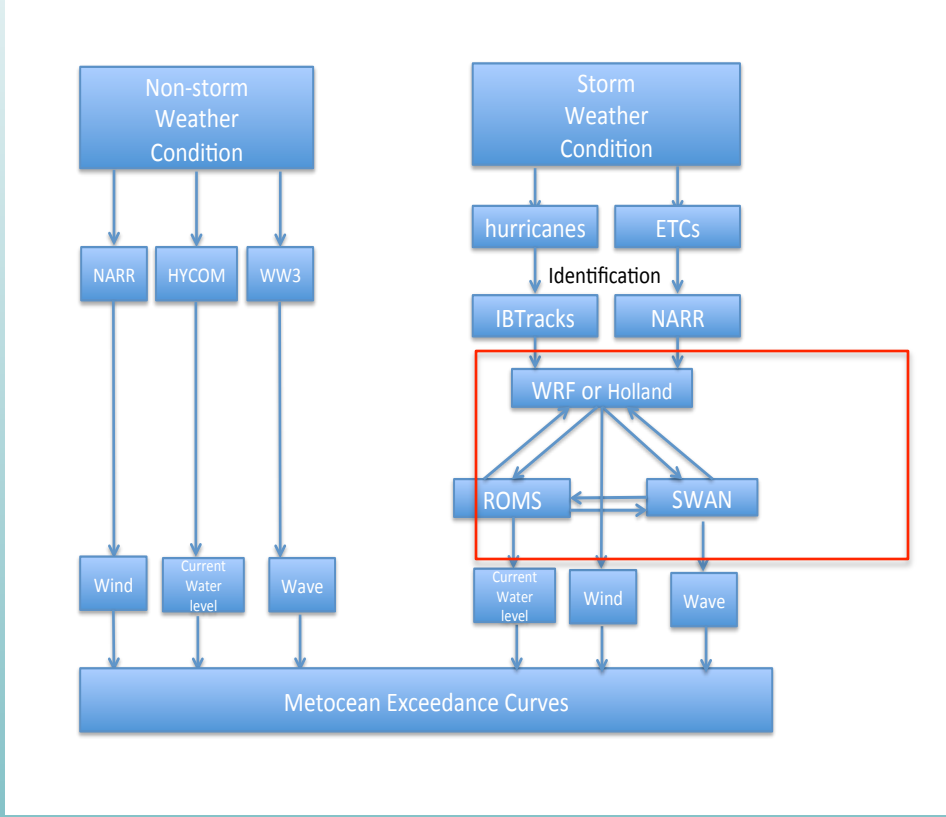
Slam Force – coarse domain

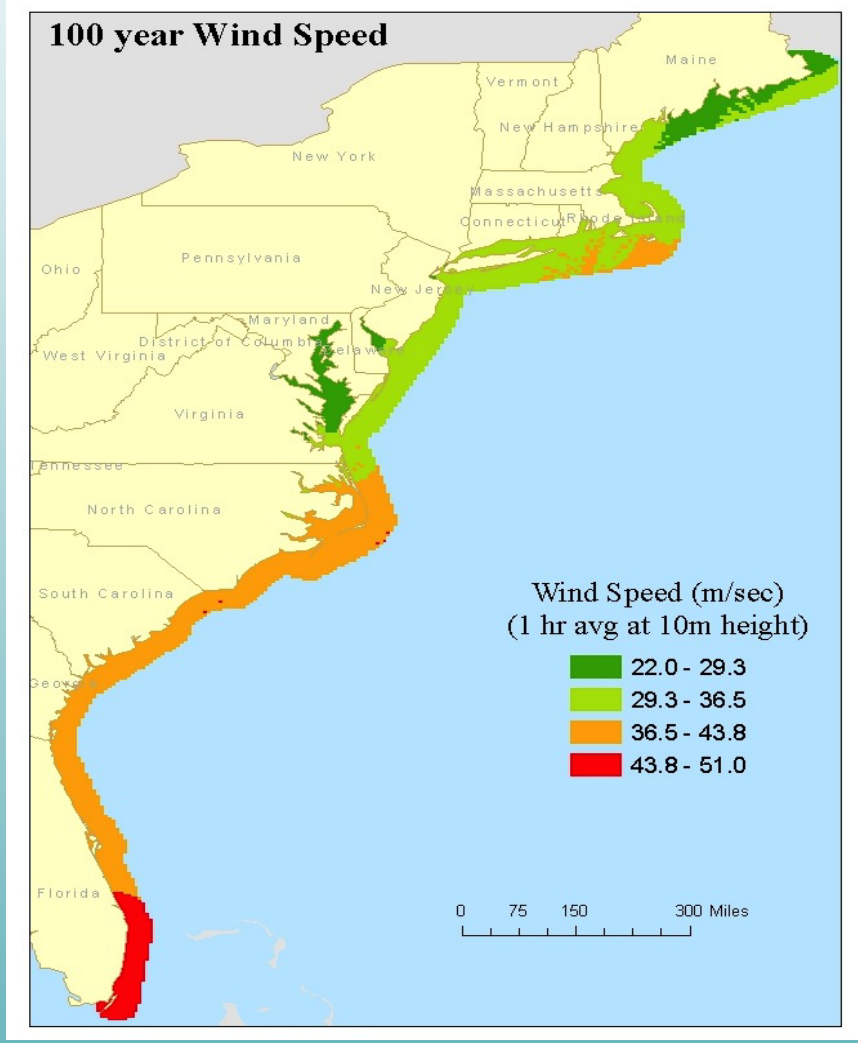




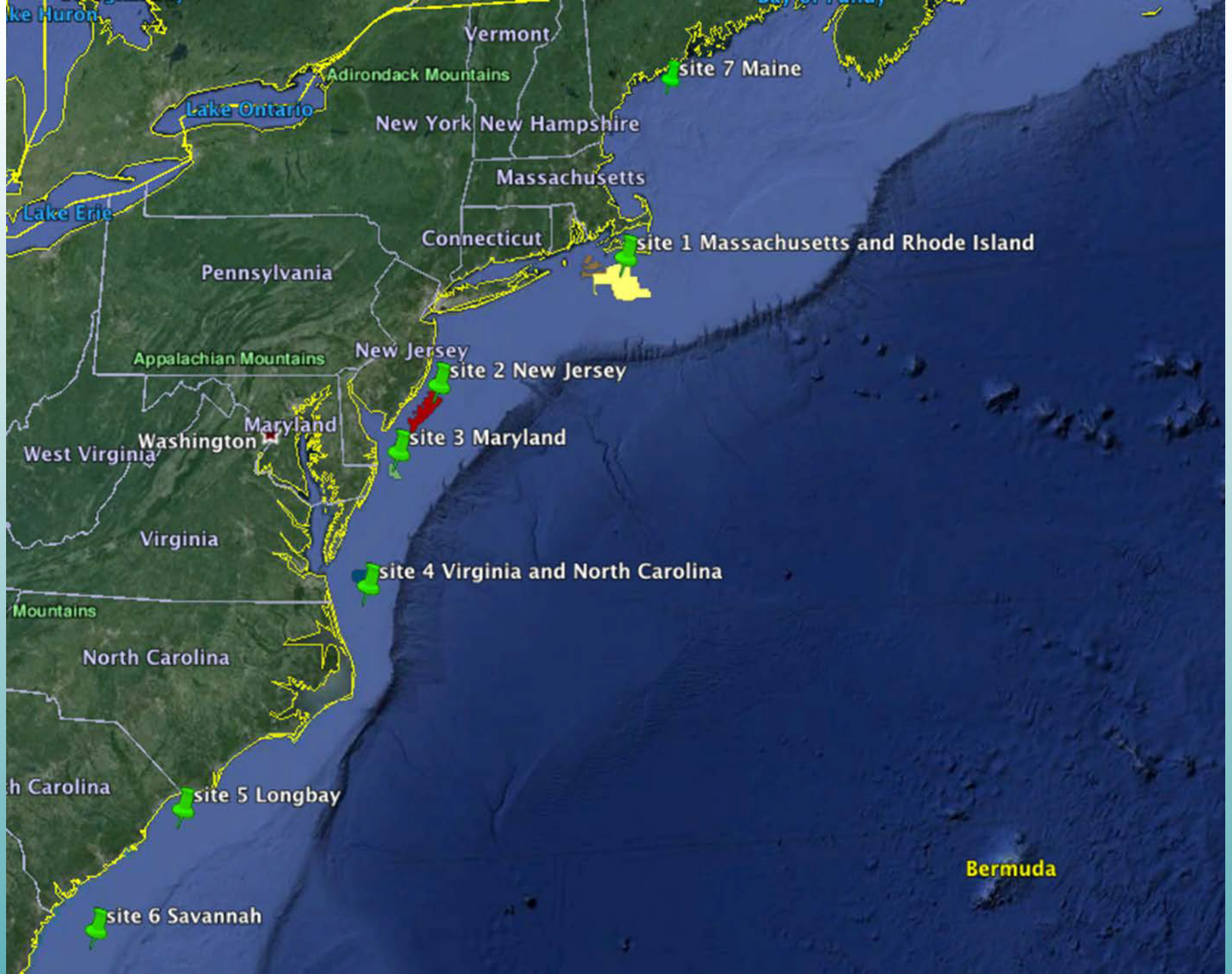
Establishment of Met-ocean Data and Hazard Curves for Wind Energy Areas (WEAs) Off the Atlantic Seaboard

DOI-BSEE BAA Number: E14PS00003

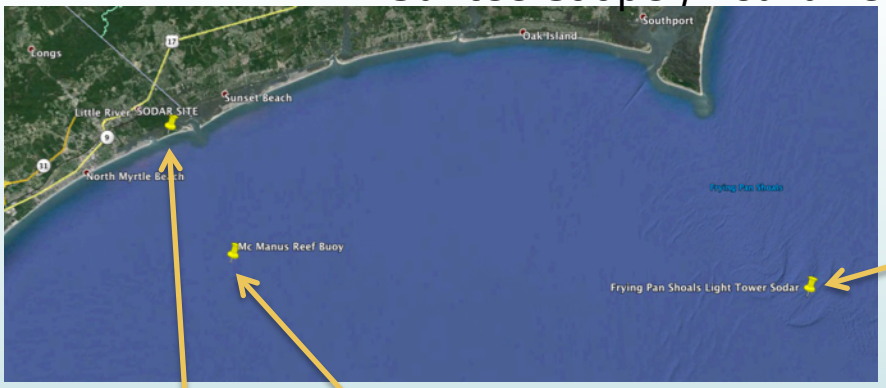


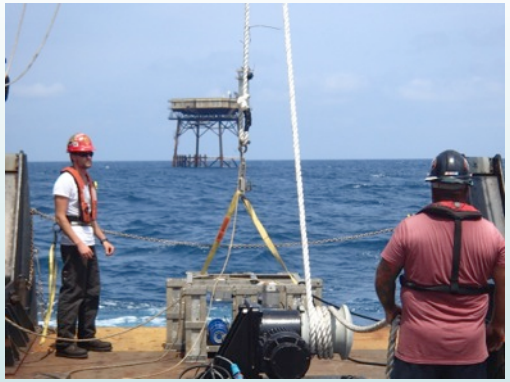


SCHOOL OF COASTAL AND MARINE SYSTEMS SCIENCE
COASTAL CAROLINA UNIVERSITY


Vermont
Adirondack Mountains
site 7 Maine
Lake Ontario
New York
New Hampshire
Massachusetts
Lake Erie
Connecticut
site 1 Massachusetts and Rhode Island
Pennsylvania
New Jersey
Appalachian Mountains
site 2 New Jersey
Maryland
Washington
site 3 Maryland
West Virginia
Virginia
site 4 Virginia and North Carolina
Mountains
North Carolina
site 5 Longbay
Bermuda
site 6 Savannah

Santee Cooper/Visalia Vertical Wind Profile Experiment





SODAR on Frying Pan Shoals Light Tower

CCU Met Ocean Buoy at McManus Reef

SODAR on Waties Island

Triton 142-14 Lat: **33.84515** | Lon: **-78.58710** | Elev: **8m**

Latest 10-minute data: 9/2/2015 18:40:00 UTC

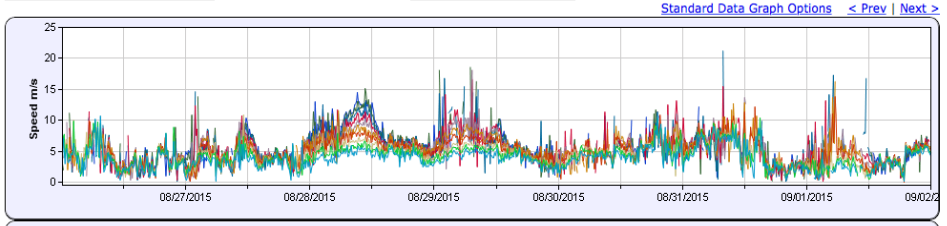
Height	Speed	Direction
200m	---	---
180m	---	---
160m	---	---
140m	5.3 m/s	195°[S]
120m	5.4 m/s	197°[S]
100m	6 m/s	209°[SSW]
80m	5.9 m/s	206°[SSW]
60m	5.8 m/s	201°[S]
50m	5.6 m/s	204°[SSW]
40m	4.9 m/s	204°[SSW]

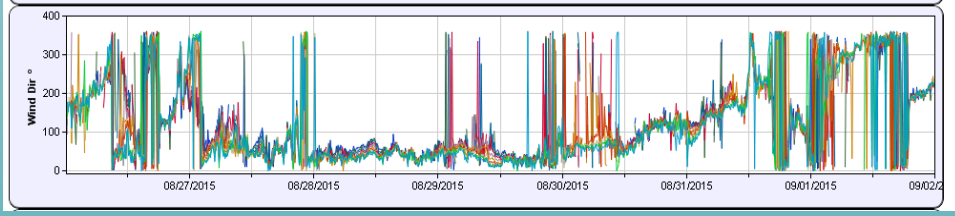
Site Conditions	
Humidity:	75%
Temperature:	32.5 °C
Pressure:	1,017.2 mBar

Interval Averages

Height	Speed
200m	5.5m/s
180m	5.6m/s
160m	5.6m/s
140m	5.5m/s
120m	5.3m/s
100m	5.2m/s
80m	4.9m/s
60m	4.5m/s
50m	4.2m/s
40m	3.8m/s

Standard Data Graph Options < Prev | Next >

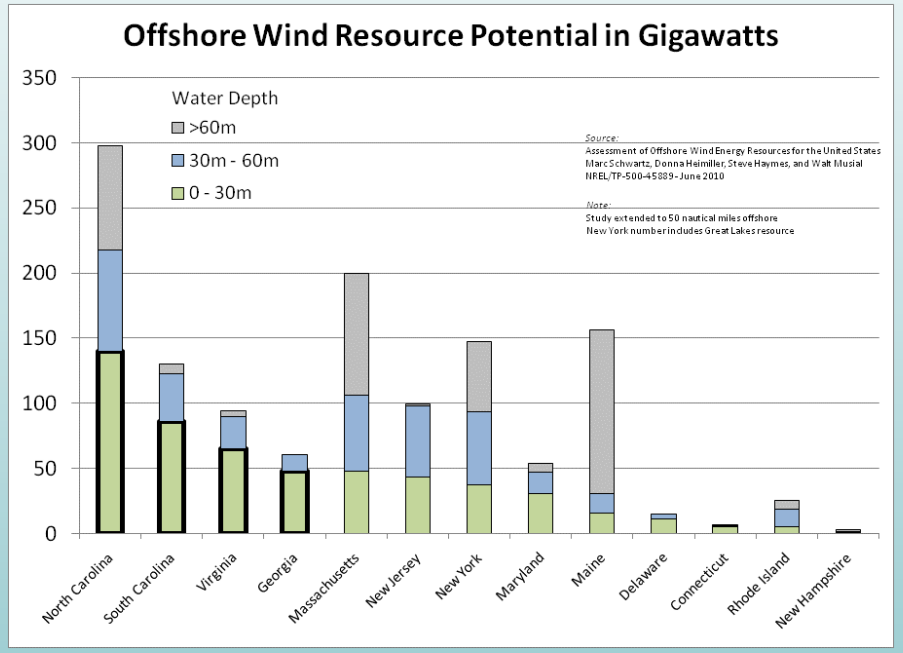


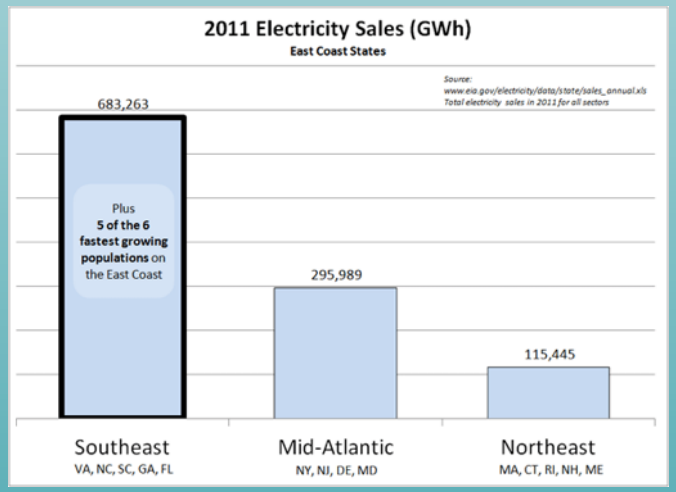


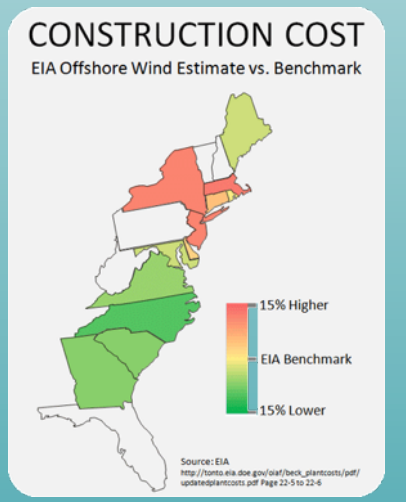
Hub Height Data validate Resource, Production, Economic Models

DOE- Regional Wind Resource Center

Objective broker/source of wind related data







SEWC Leading DOE Resource Center

The Southeastern Wind Coalition has been selected to lead the new U.S. Department of Energy's Southeast Wind Energy Resource Center, covering an 11-state region. The Center will be focused on providing fact-based, unbiased information about wind energy's costs and benefits to stakeholders and decision makers. Key management partners in the Center include James Madison University, NC State University, Clemson University, Coastal Carolina University, Georgia Tech, the Florida Energy Systems Consortium, and Navigant Consulting.

A Great Deal of Activity Focused in the Southeast and Long Bay in Particular

Efforts to facilitate evaluation of resource, identify impediments and opportunities

Provide objective factual information to facilitate societal (environmental, economic, permitting, engineering, operational concerns)

Considerable Investment by Government Agencies, Utilities, Industry, Research Institutions, Municipalities.