ERDC
Engineer Research and Development Center

Nearshore Placement as a Regional Sediment Management Practice

Katherine E. Brutsché, Ph.D.
Brian C. McFall, Ph.D., P.E.

Coastal and Hydraulics Laboratory
US Army Engineer R&D Center

ASBPA National Coastal Conference
Long Branch, New Jersey

October 27, 2016

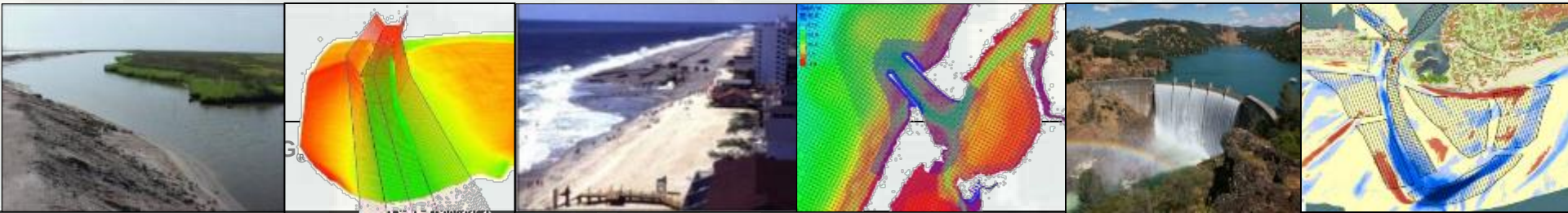
Outline

- Regional Sediment Management
- Nearshore Placement
- Nearshore Berms
- Tools and Technologies
  - SMT
  - CMS
  - RIOS
- Case Study at Vilano Beach, Florida
- Summary and Conclusions

Regional Sediment Management (RSM)

A systems approach to deliberately manage sediments in a manner that maximizes natural and economic efficiencies to contribute to sustainable water resource projects, environments, and communities = Healthy Systems

- O&M, FRM, Ecosystem, Emergency Mgmt:
  - Short and long-term sustainable, resilient solutions
  - Coastal and Inland
- Recognizes sediment as a valuable regional resource
- Work across multiple projects, authorities, business lines
- Tools and technologies for regional approaches
- Relationship building, decision making, implementation



RSM Strategies

Reduce Offshore Placement

Nearshore/Beach Placement

Bypass
Optimize Placement

Reduce Sediments at the Source

Reduce CDF Placement and Improve System

Ecosystem Restoration w/partners

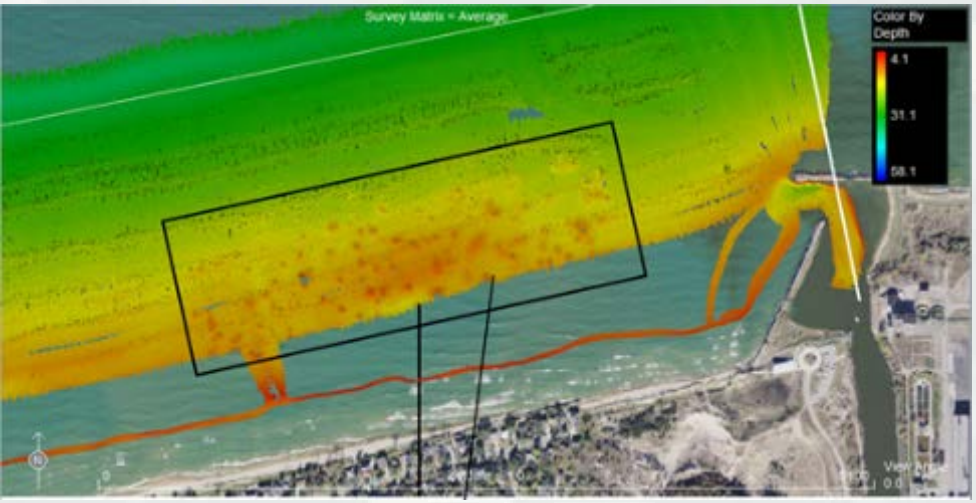
- Keep sediment in the littoral system
- Mimic natural sediment processes
- Reduce sedimentation

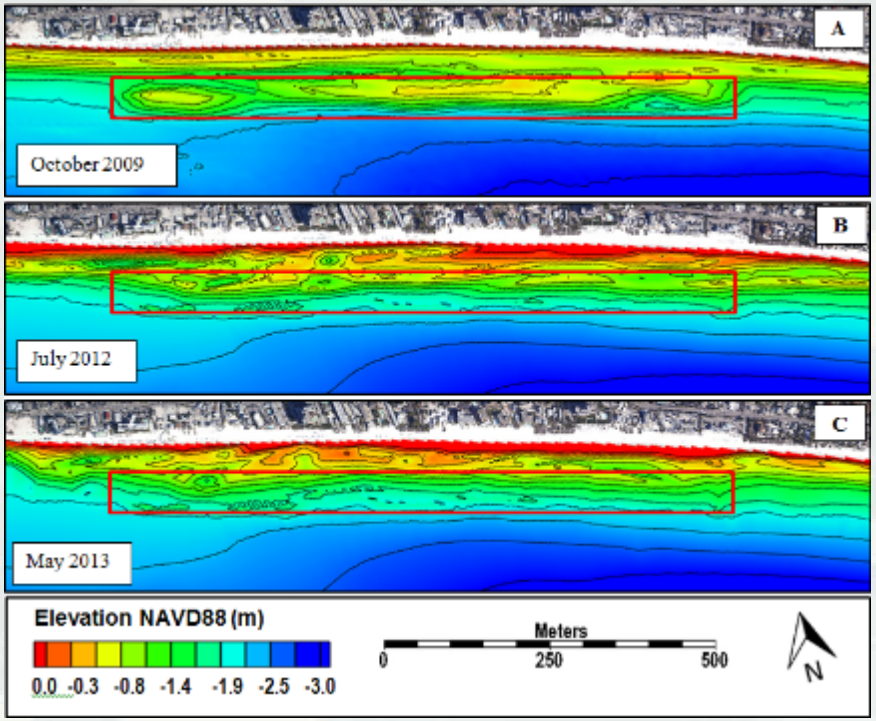
Nearshore Placement

- Dredged material placement in the nearshore in a manner and at locations that permits natural forces to disperse the dredged material toward other locations where it can deliver benefits
  - Maximize benefits
  - Minimize rehandling
  - Minimize negative environmental impacts
  - Reduced cost (vs. direct placement)
  - Increase beneficial use applications
- Typically consist of dredged sediment from navigation projects that is incompatible with natural beach sediment
- Nearshore berms are a specific example of nearshore placement

Terminology

Nearshore Placement vs. Nearshore Berm



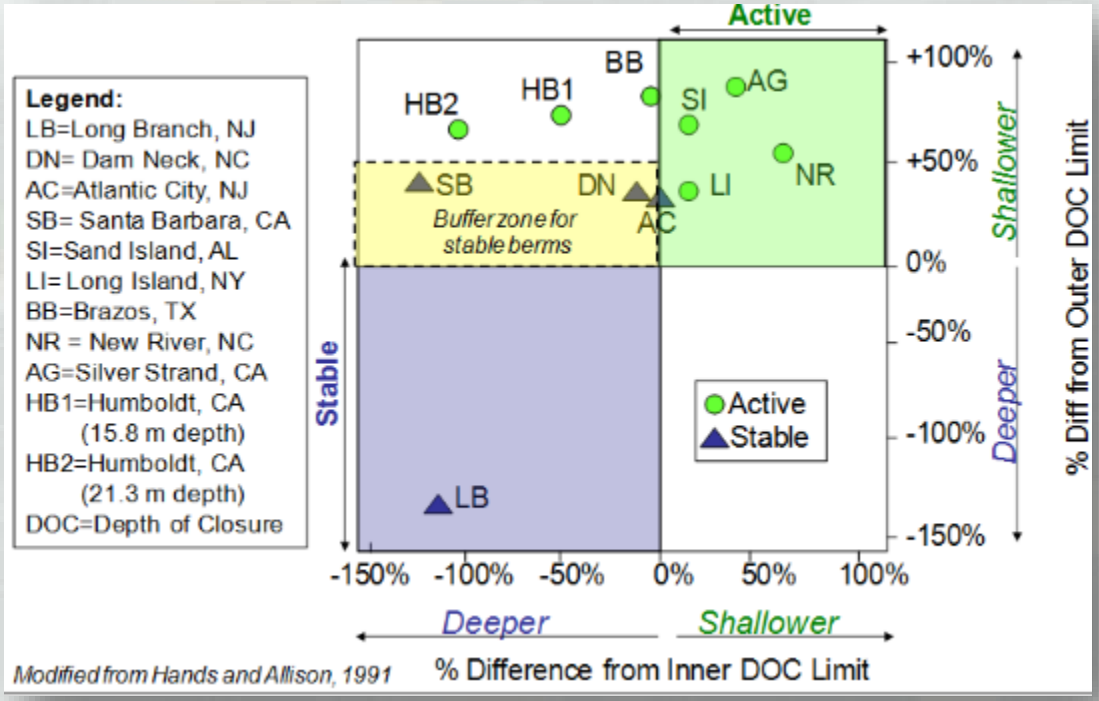


- Discrete mounds placed within a project design template

- Intentional placement of material in an elongate bar or mound feature

Nearshore Berms

- Sediment placed in the nearshore in either an elongate (bar-like) feature or a mound
  - Stable berms- remain stationary for years
  - Active/Feeder berms- sediment dispersed by waves and currents



Nearshore Placement

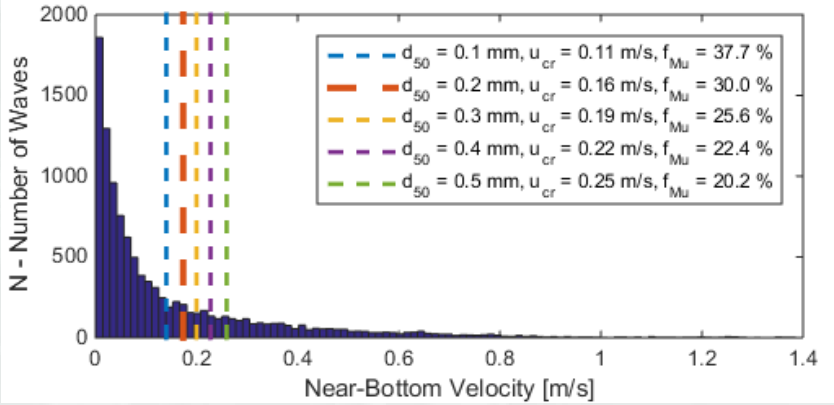
- Nearshore placement is becoming an increasingly utilized method for beneficial use of dredged material
  - Less costly than beach nourishment, fewer restrictions, fewer environmental concerns
- Important to have a better understanding of what happens once the sediment is placed
- Update to current design guidance to answer key regulatory questions

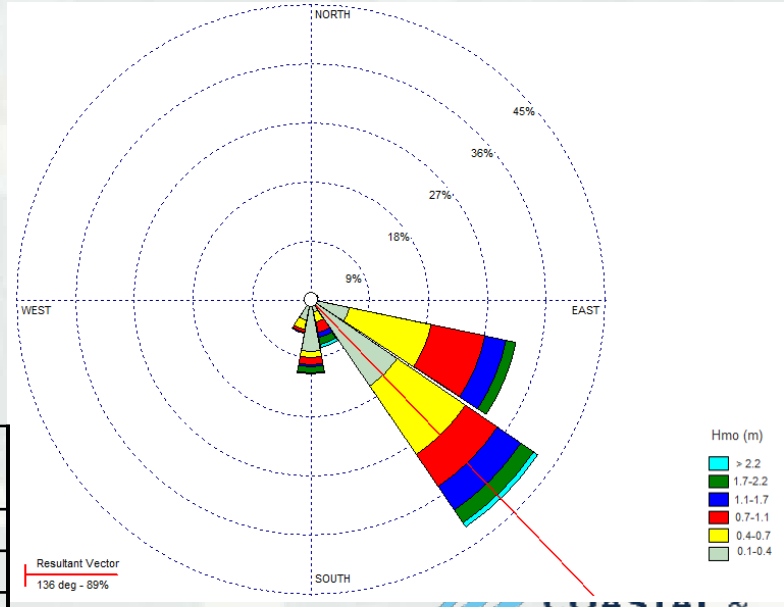
Important Questions

- Will sediment move once it is placed in the nearshore?
- Will sediment move onshore?
- What direction will it move alongshore?
- How much sediment will move?
- How long will it take for the sediment to move?

Sediment Mobility Tool

- Estimates
  - Frequency of sediment mobility
  - On/Offshore migration direction
  - Dominant axis of wave direction to estimate alongshore migration
- Preliminary tool to make educated decisions with little data

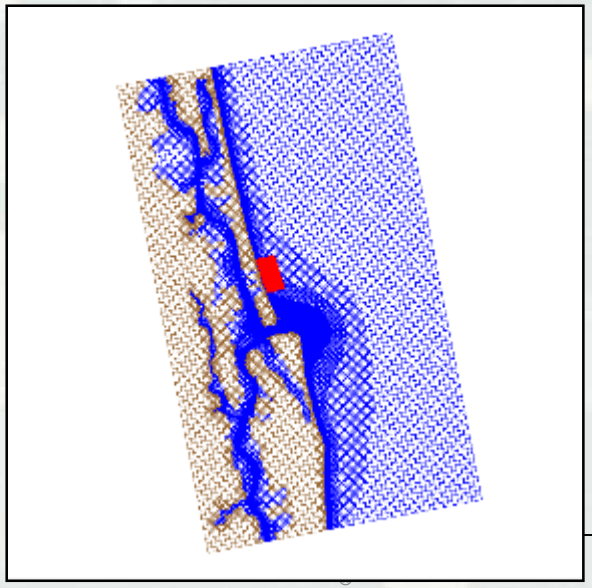


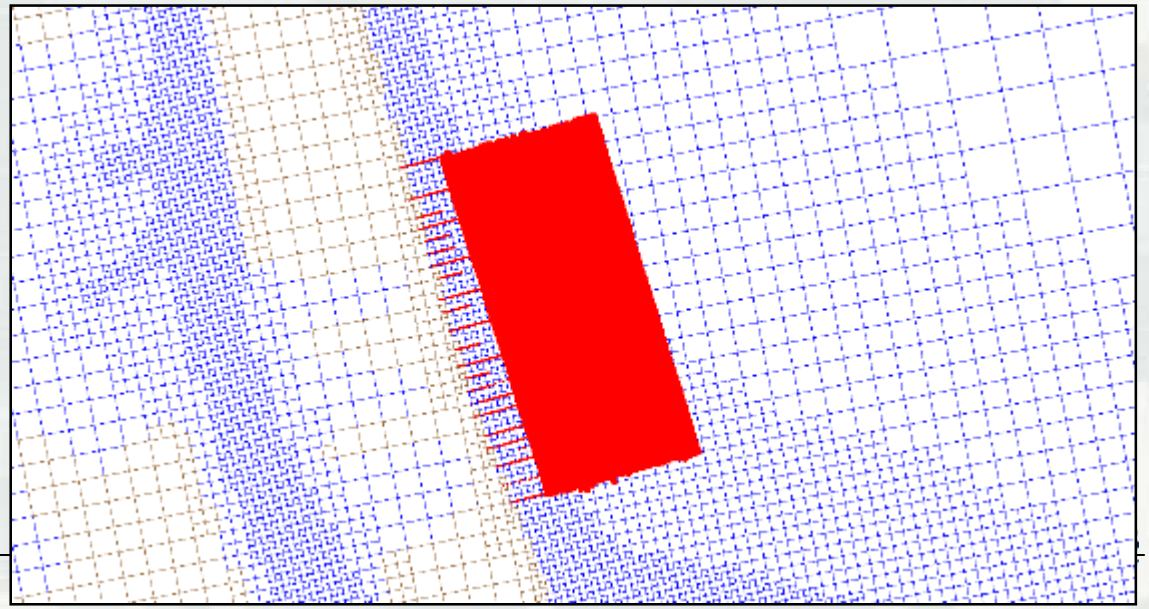


d_{50} (mm)	Frequency of Mobilization	Predicted Sediment Migration
0.1	16 – 38%	83% Offshore
0.2	14 – 30%	60% Onshore
0.3	12 – 26%	84% Onshore

Coastal Modeling System

- The Coastal Modeling System in an integrated 2D numerical modeling system for simulating waves, current, water level, sediment transport, and morphology change at coastal inlets and entrances
- User input: waves, tides, bathymetry, grain size
- CMS output: currents, waves, water levels, morphology, sediment transport



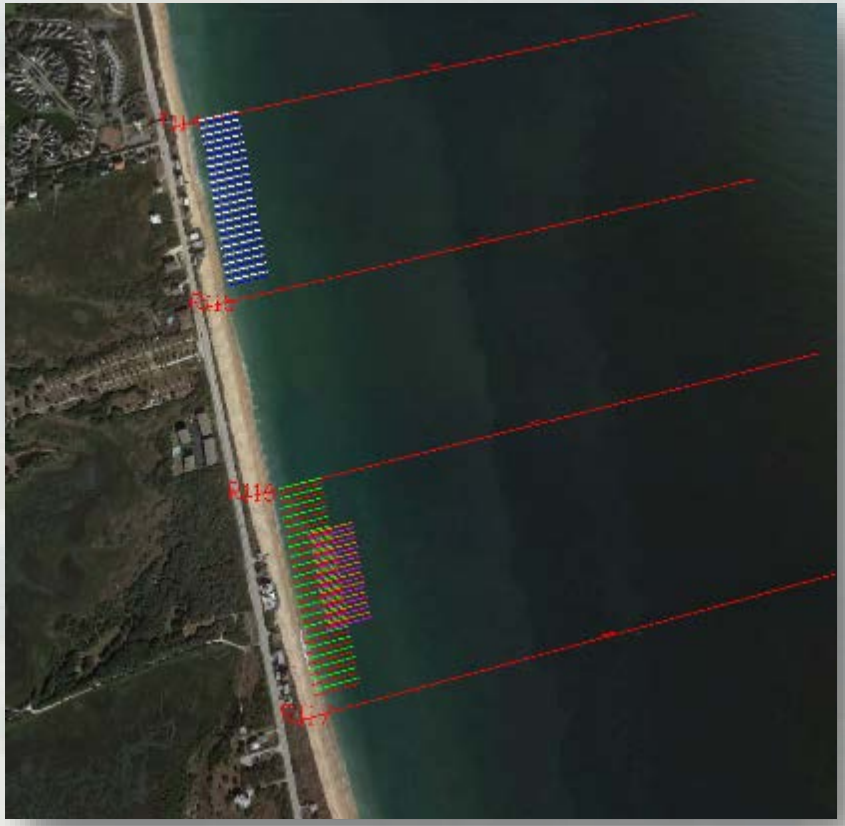


Radar Inlet Observing System: RIOS

- Measures position of inlet channels and shoals continuously to make results available in real time
- Uses X-band radar to measure wave conditions including breaking, speed, period, and angle – from which depths can be determined
- Combination of wave breaking intensity and measured depths from prior surveys and not fully intended to replace traditional bathy survey
- Calculates depth based on linear wave dispersion relationship

RIOS information from J. Waters and J. McNinch

Case Study: Vilano Beach, Florida

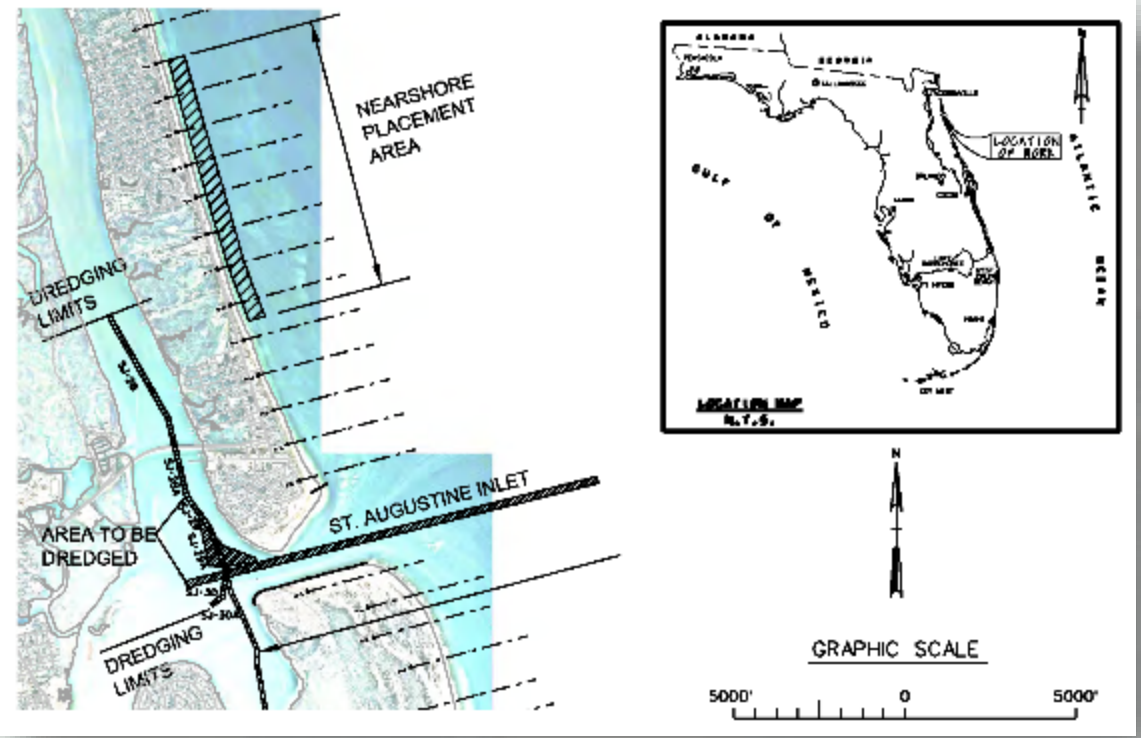


- 150,000 cy
- St. Augustine Inlet ebb shoal, flood shoal and part of the IWW
- *Murden* 500cy hopper, light loaded for NS access ~350-400cy
- Between T-114 and R-115 and R-116 and R-117
- In front of the two property clusters
- Two berm methods to see if there is a differing outcome

Project and Objectives

Can we observe, document and make conclusions about beneficial placement of dredged materials in the nearshore?

- Concentrate the placement area
  - Two berms
- Understand the sediments
- Predict sediment mobility using SMT
- Visually document changes to the shoreline and nearshore (photogrammetry/RIOS)
- CMS model



Data Collection

Camera array set up at R-114

Morgan & Eklund survey the nearshore for the county prior to placement

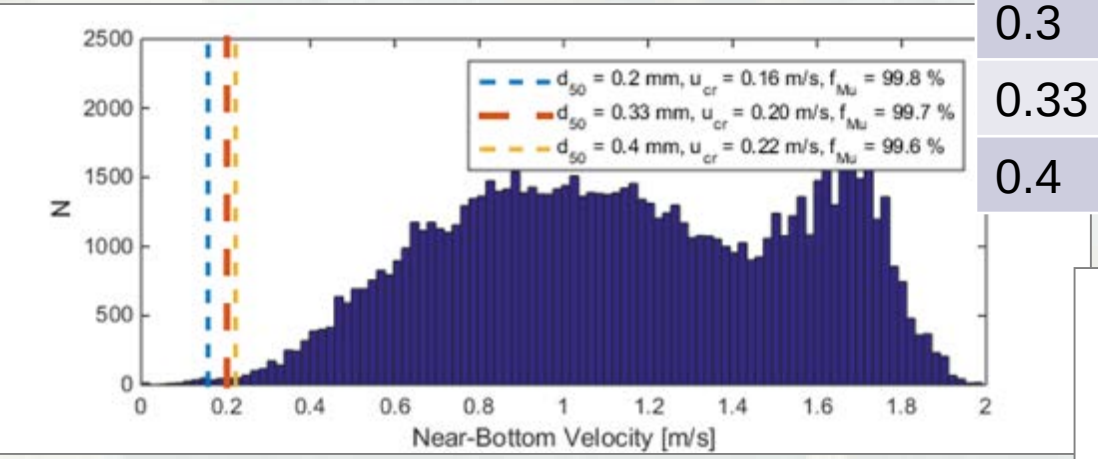
- Set up two camera arrays, T-114.5 and R-116.5
- 180 view of the coastline
- Cross shore topo and multi-beam bathy
- Collected cross shore profile sediment samples
- RIOS

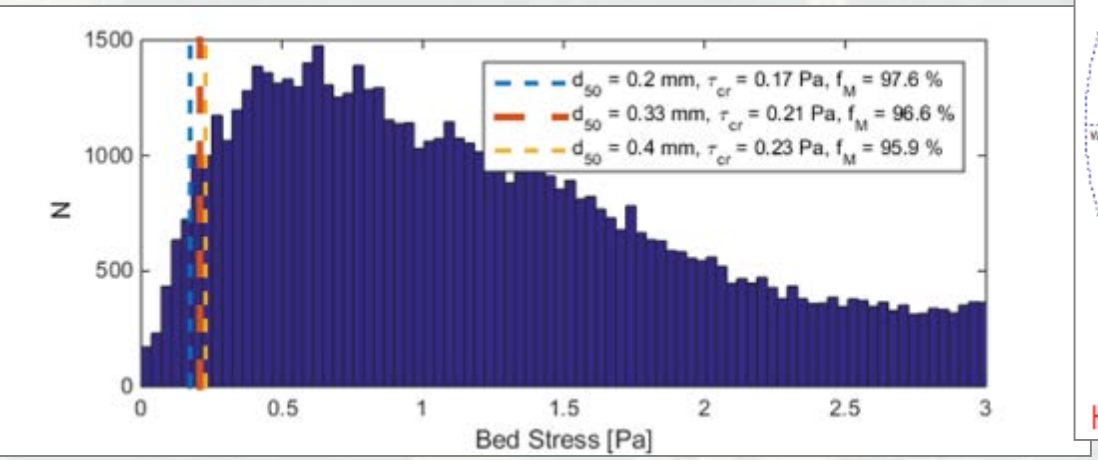
ST
ALM ST
SHEET NO. 002
R113
T114
Vilano Beach
R115
R116
R117
R118
SHEET NO. 003
urths
sland

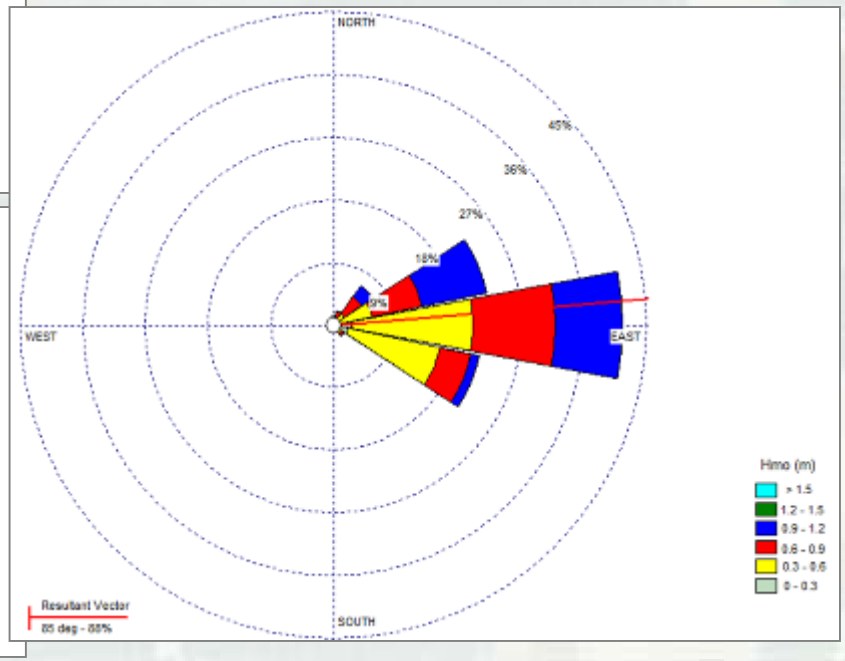
Sediment Mobility Tool

- d_{50} = 0.33 mm
- h = 10 ft
- WIS Station 63416

Grain Size (mm)	Predicted Sediment Migration
0.1	88% Offshore
0.2	93% Onshore
0.3	100% Onshore
0.33	100% Onshore
0.4	100% Onshore



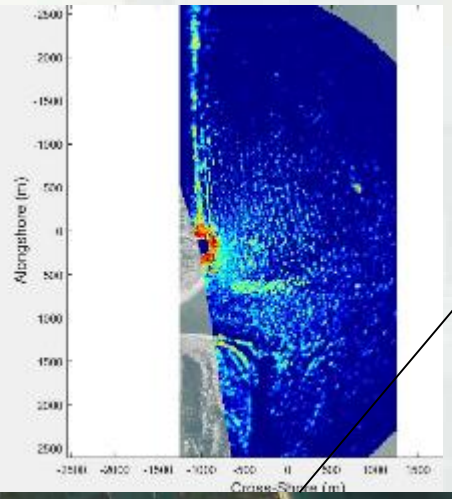


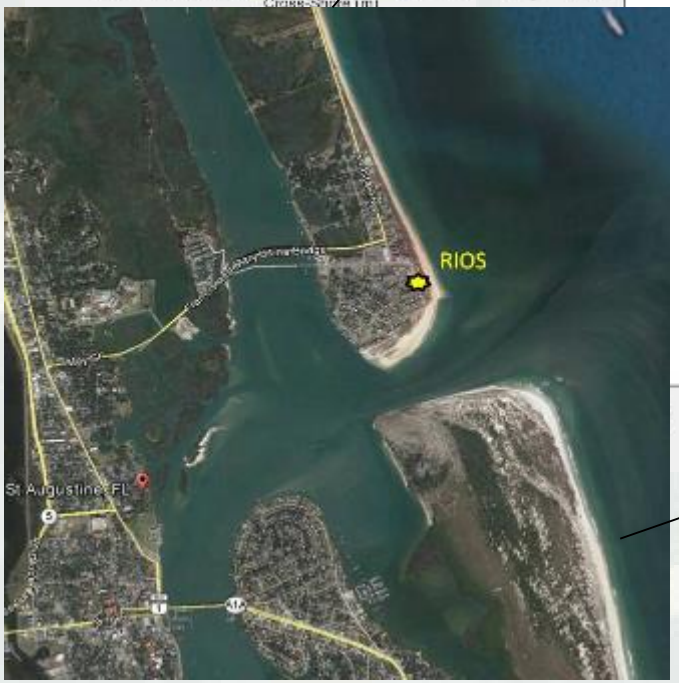


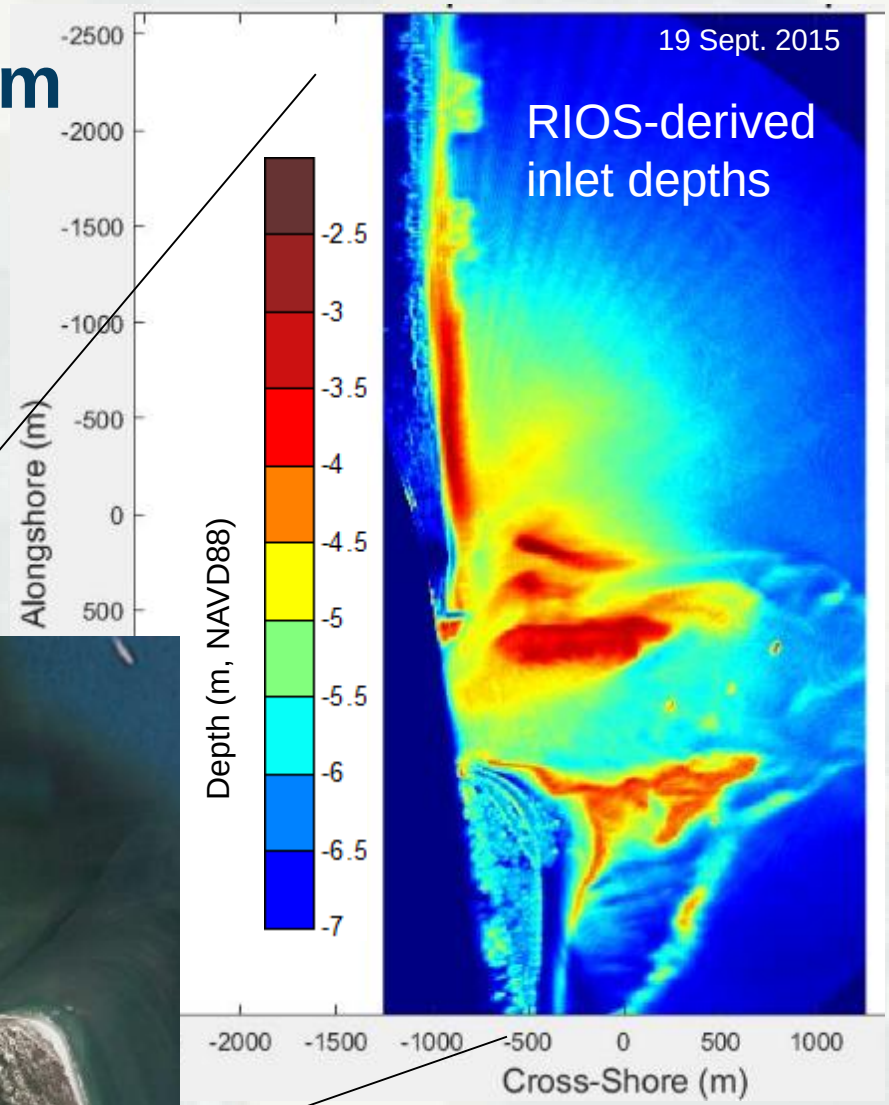
Camera Array

Radar Inlet Observing System

- continuous, hourly measurements of inlet channel and shoals
- autonomous power and internet data upload (xyz depth files and geo-images)
- minimal bi-monthly service





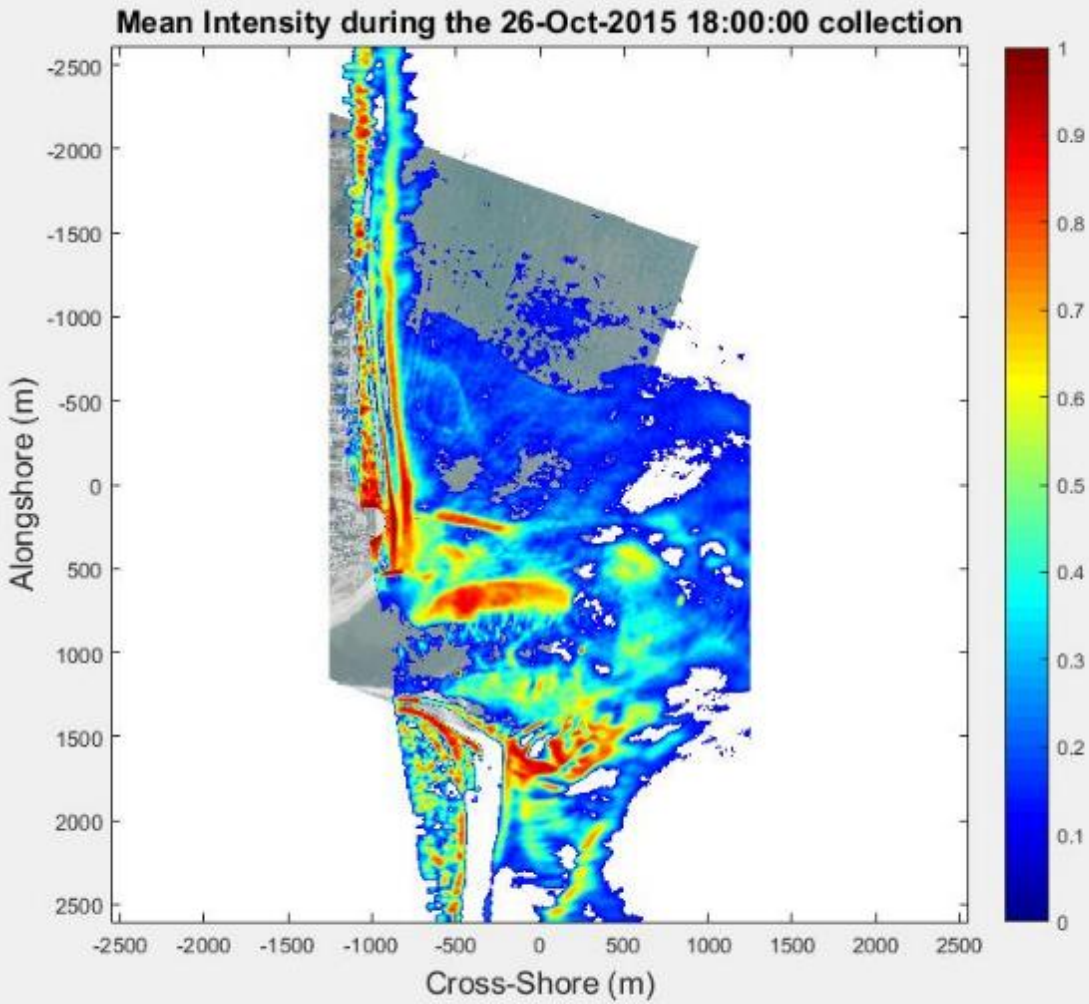


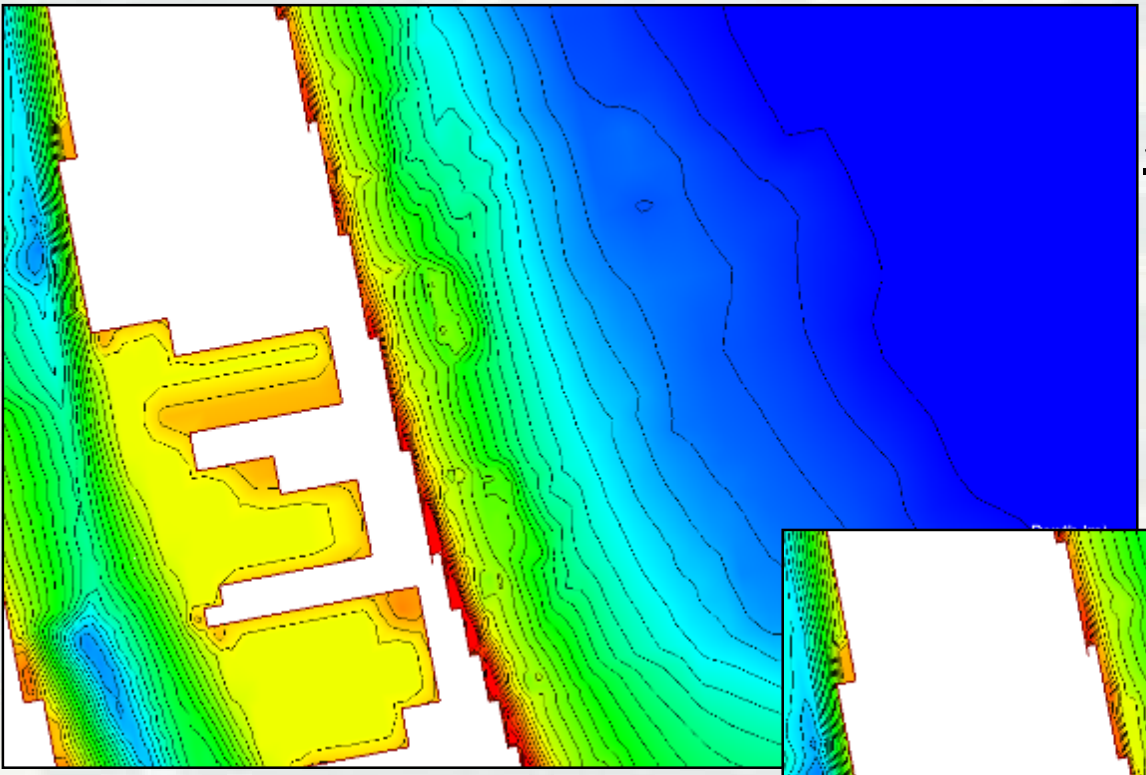
Present deployment:
St. Augustine Inlet

COASTAL & HYDRAULICS LABORATORY

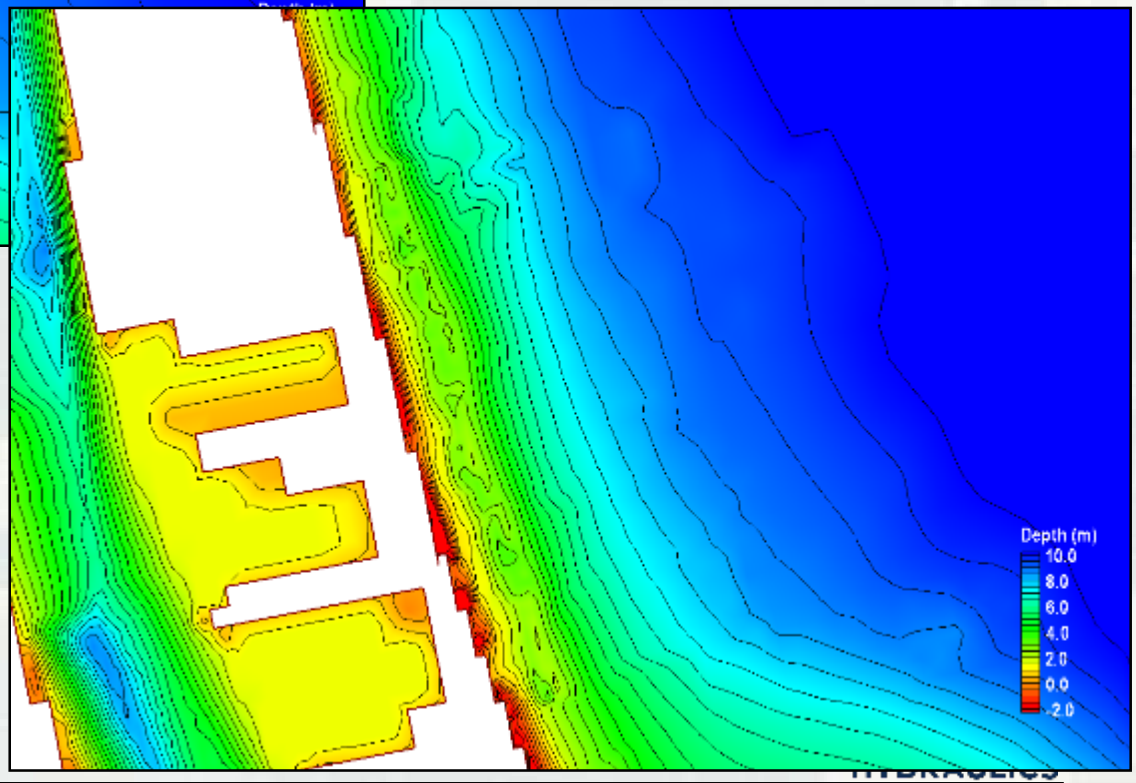
Logistics and ground support provided by USACE-SAJ

Detecting Berm Evolution



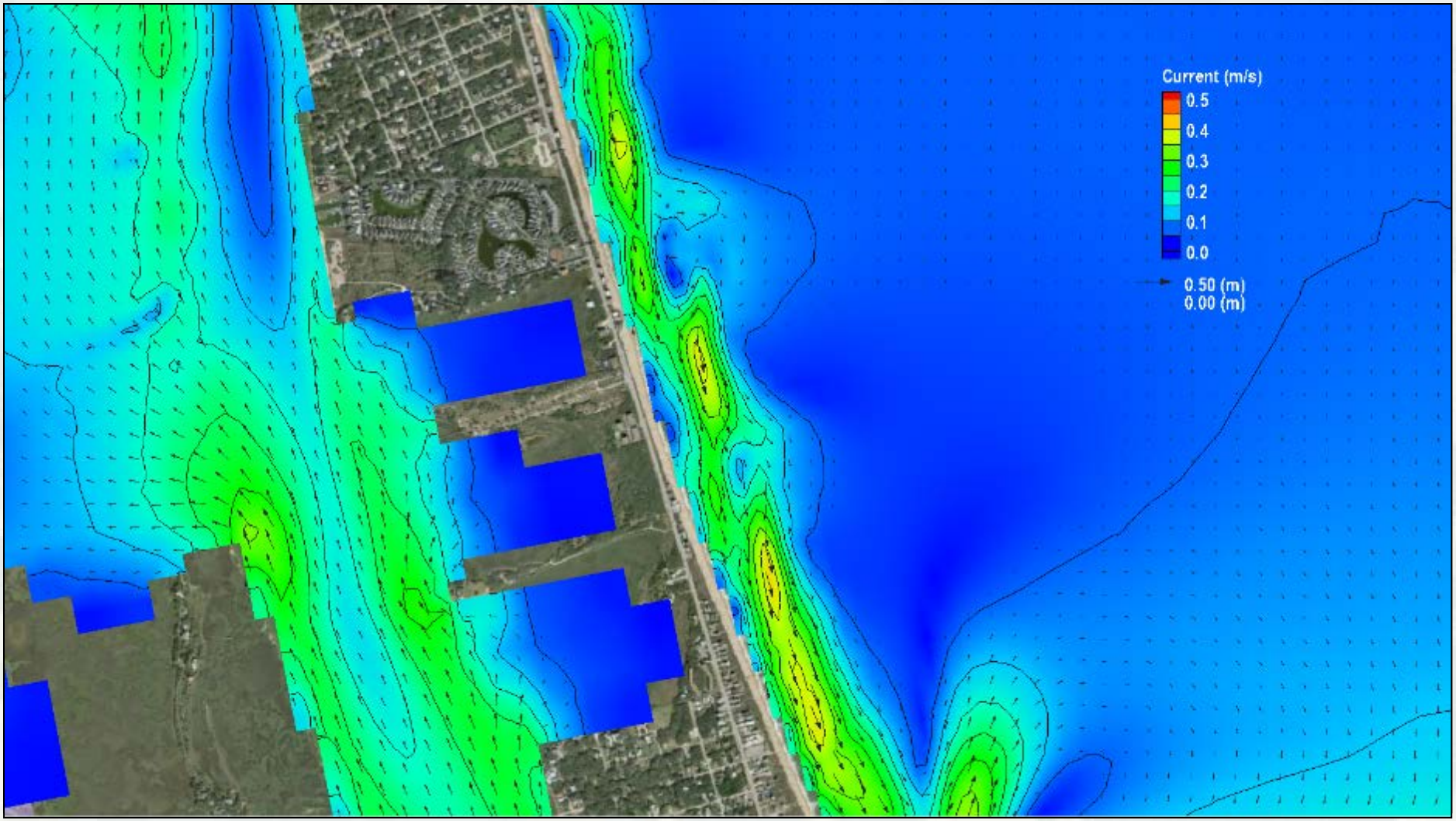


September-October 2015



December 2015

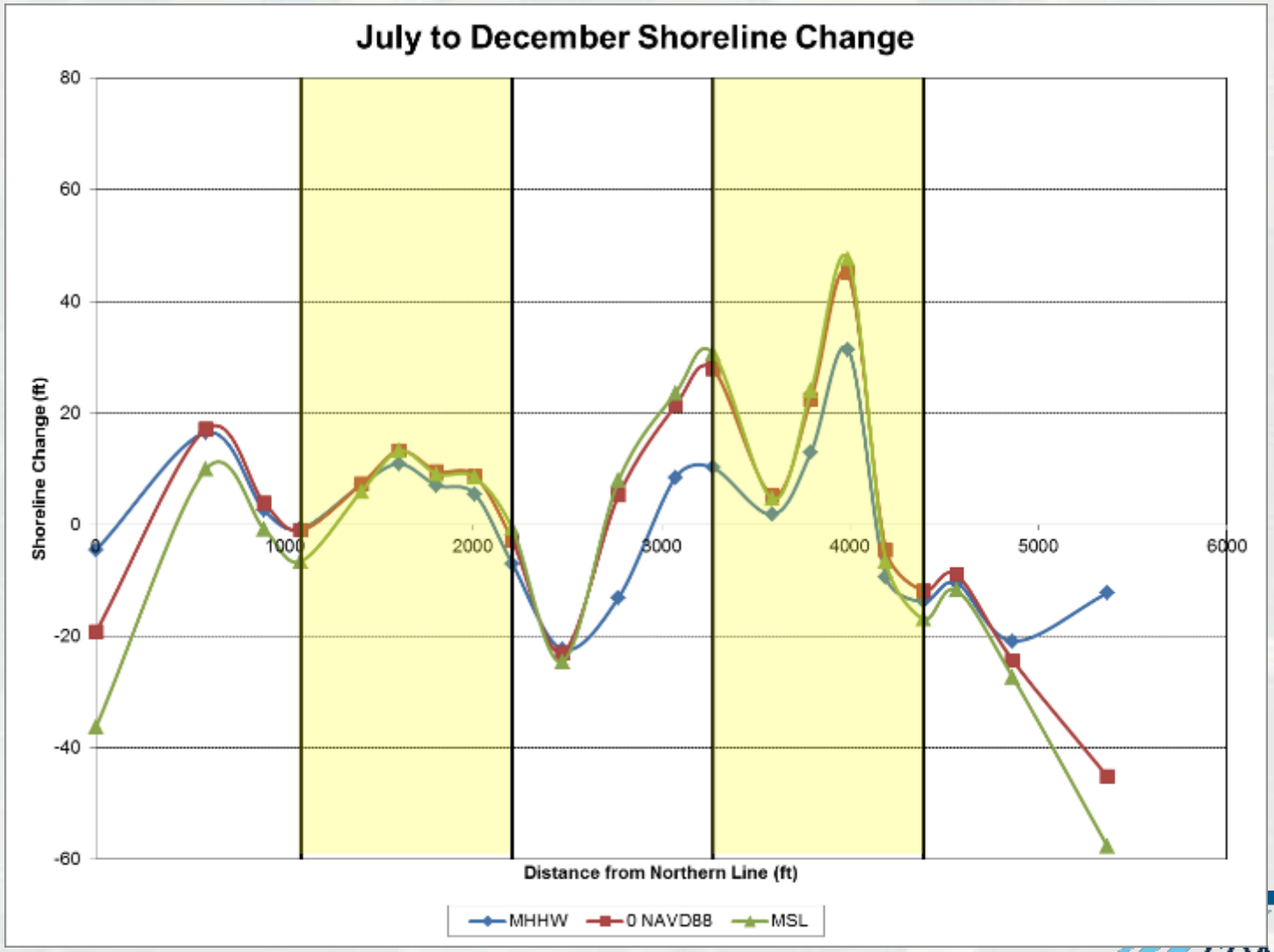
September 25 2015 06:00



BUILDING STRONG®

COASTAL & HYDRAULICS LABORATORY

Shoreline Changes



Summary and Conclusions

- Nearshore placement is a common RSM strategy to beneficially use dredged material
- Nearshore berms are a specific type of nearshore placement
  - Sediment placed in an elongate bar or mound
- Several tools available to determine whether sediment in the nearshore will mobilize and to visualize nearshore placement evolution
  - SMT
  - CMS
  - RIOS

Summary and Conclusions

- Vilano Beach project is an example case study showcasing nearshore berm tools and technologies
  - Validation for SMT
    - Correctly predicted that material would mobilize
    - Gain of sediment in the nearshore may indicate onshore movement of the berms
    - Salients formed in the lee of the berms
  - RIOS captured continuous changes in berms
  - CMS is being used to help validate tool and help visualize berm evolution