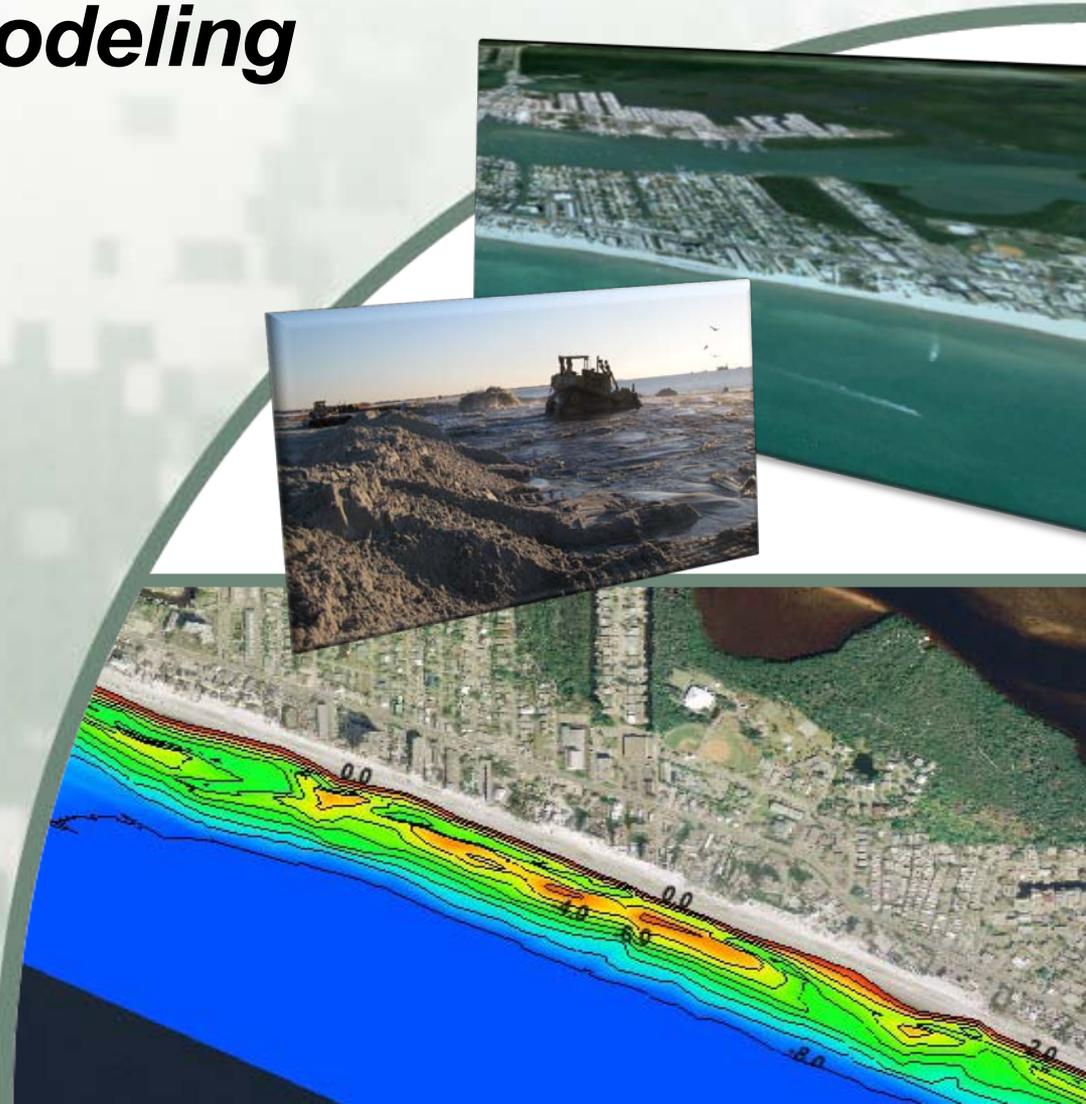


Nearshore Berm Sediment Transport & Migration: *Measurements & Modeling*

Nearshore Berm Workshop
13 February 2013



US Army Corps
of Engineers®



Report Documentation Page

*Form Approved
OMB No. 0704-0188*

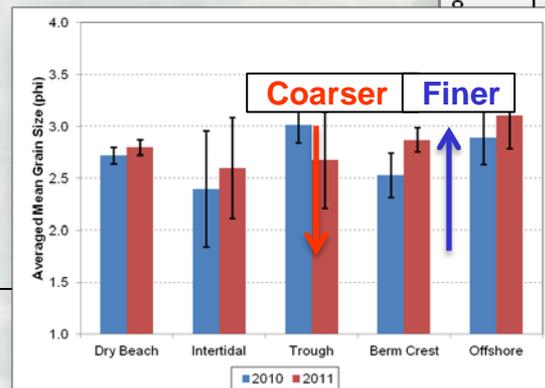
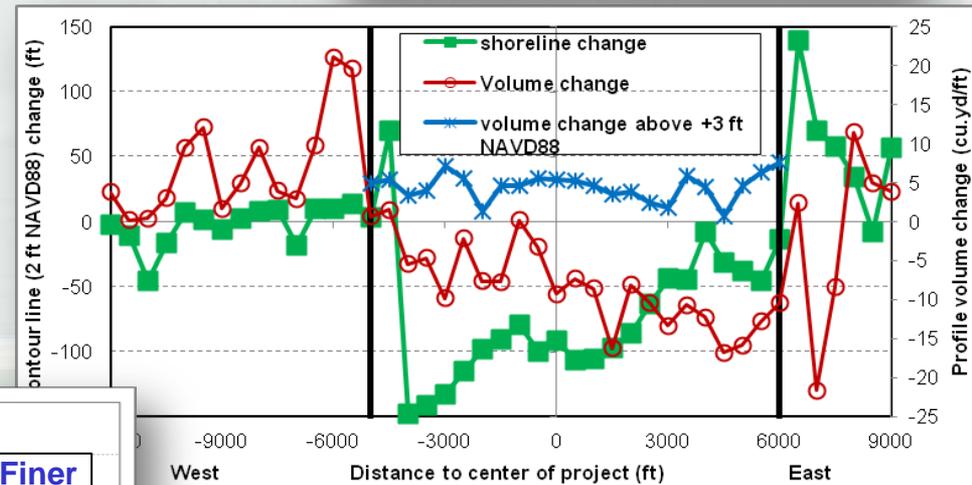
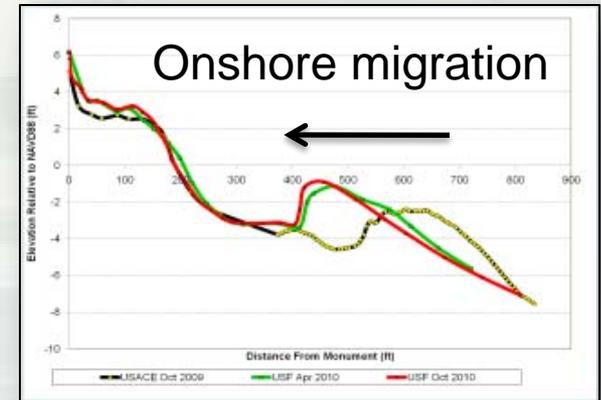
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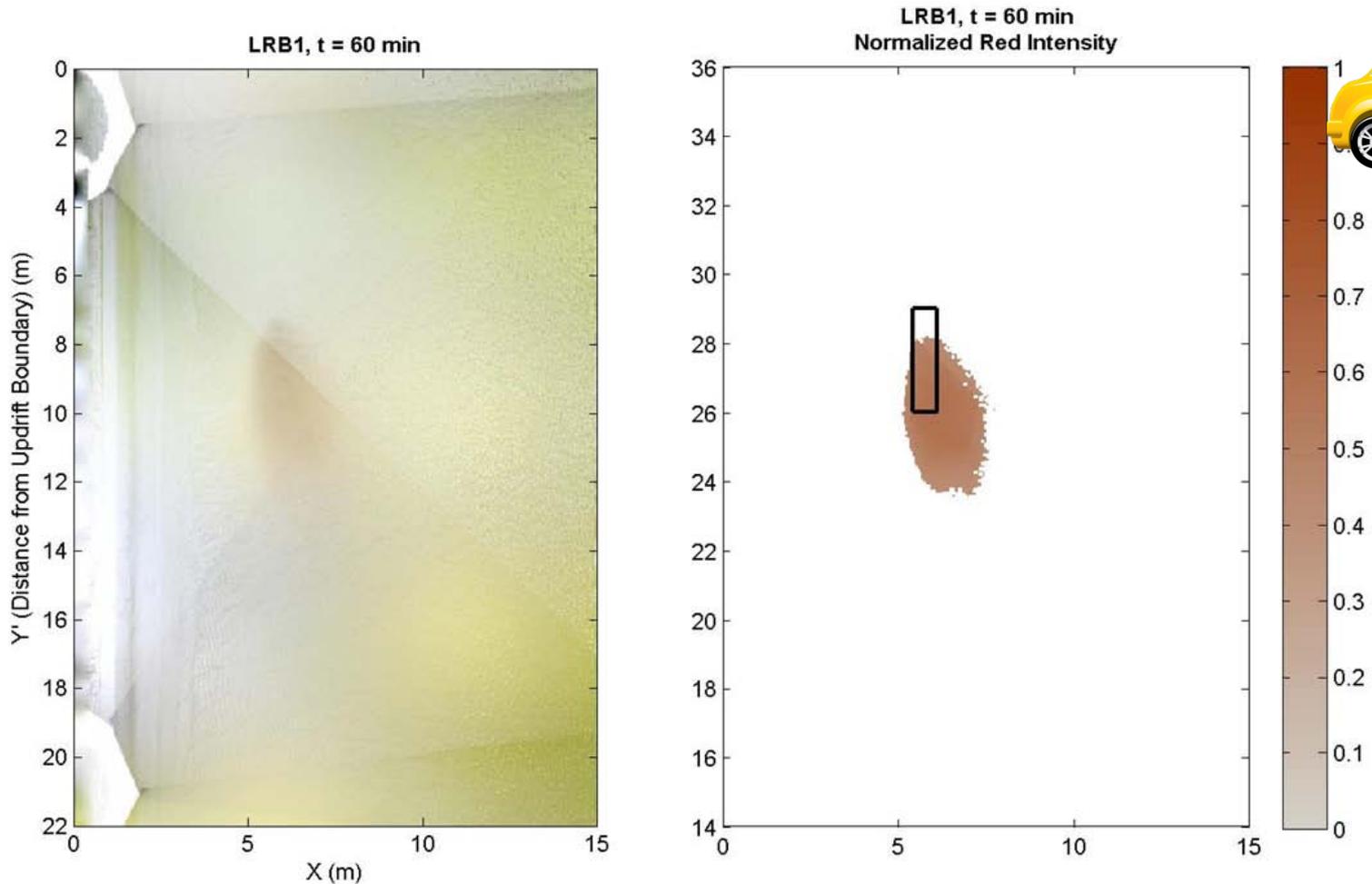
Definitions

- **Cross-shore Transport Vs. Alongshore Transport**

- **Where is the beach accreting?**
 - **Adjacent beach or region of nourishment**
- **How much is it accreting by?**
 - **Shoreline change or profile volume**
- **What is the long-term fate of the material?**



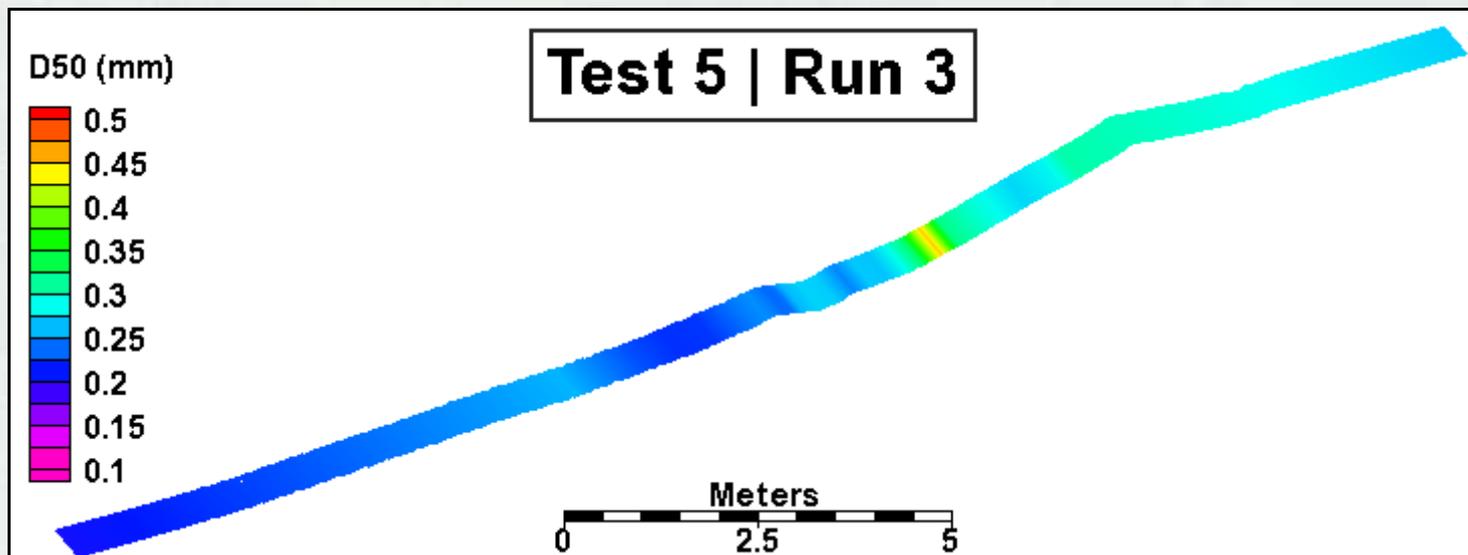
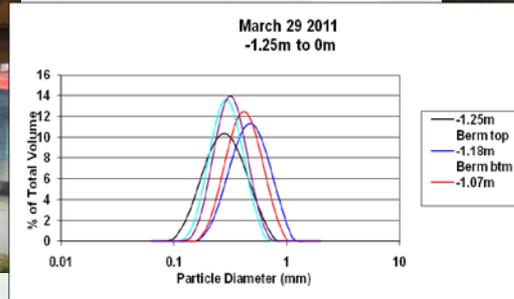
Large-scale Sediment Transport Facility



Dr. Ernest
Smith, CHL
(Funded by
LRB)

- **Alongshore Processes: Longshore current-driven advection**
- **Cross-shore Processes: Wave-driven diffusion across the surf zone**

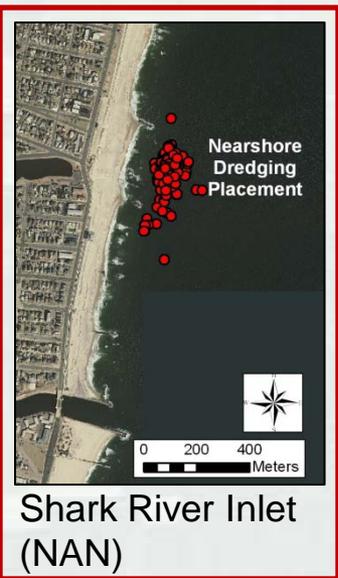
3-ft Wave Flume: Cross-shore Sediment Transport



Tanya Beck,
CHL
(Funded by
CHL-IRIP)

- Alongshore Processes: Longshore current-driven advection
- **Cross-shore Processes: Wave-driven diffusion across the surf zone**

The Variation of Placement Types



Shark River Inlet (NAN)



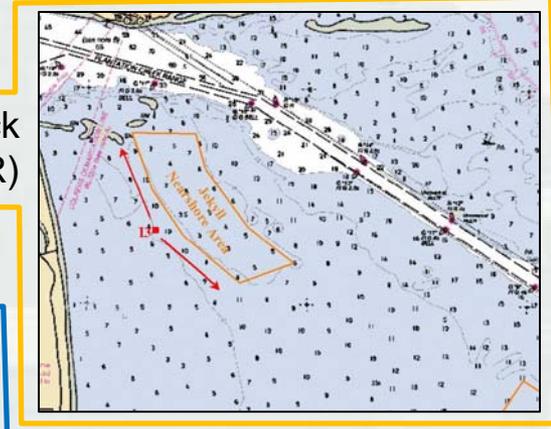
Assateague Island, MD (NAB)



Perdido Key (SAM)

Large, Designed Migrational Placements

Brunswick (SAS; DOER)



Benson Beach Beneficial Use Placement; North and South Jetty Placements at MCR (NWP)



Small Dispersive Placements





Research Supported Monitoring Projects in Collaboration with SAJ & SAM

- BERM VOLUME (CY): 140,000
- BERM RELIEF (FT): 7
- BERM WIDTH (FT): 600
- BERM LENGTH (FT): 1200
- WIS STATION/NOAA BUOY #:
- SEDIMENT SIZE D50 (MM): 0.25
- % FINES OF FILL: 6

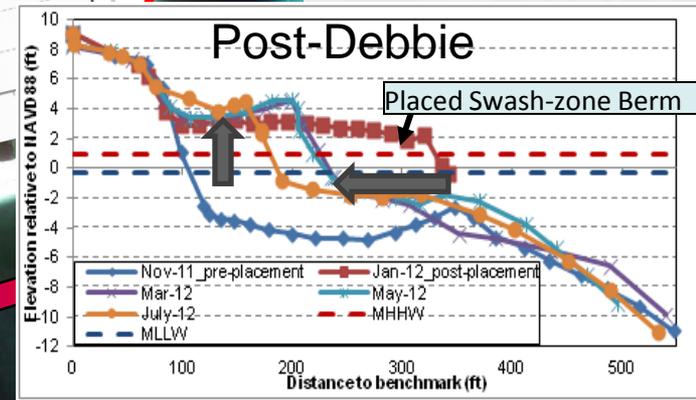
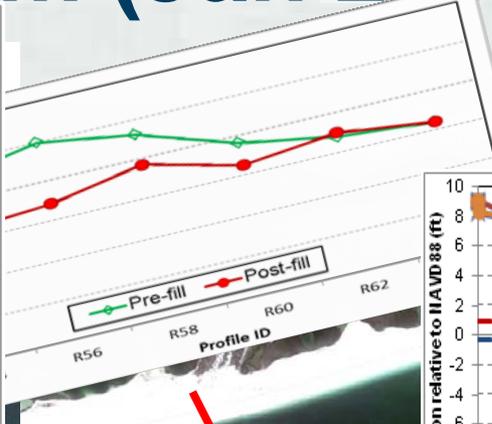
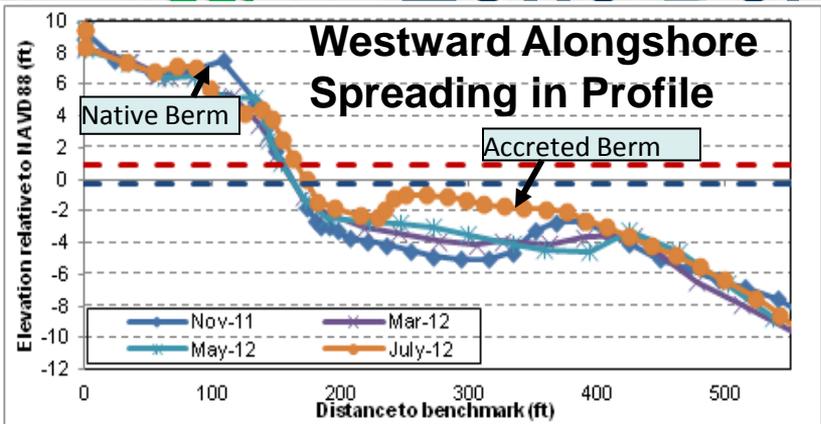
• TIDE RANGE (FT):
 • APPROX. WATER DEPTH (FT): 15 TO 28
 • CONSTRUCTION DATE: DECEMBER 1988 TO JANUARY 1989
 • MONITORING: YES

[RELATED RESEARCH ARTICLES](#)

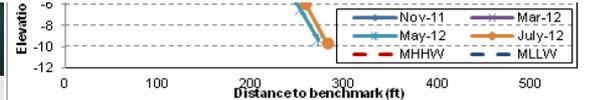
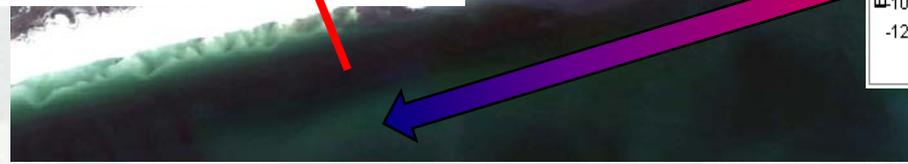
- Perdido Key: Monitored since Jan 2012
- Egmont: Startin Jan 2013
- New Smyrna Beach: Started Aug 2012
Complete
- Ft. Myers Beach: Monitored since May 2010
(Complete; Starting Oct 2012)



Perdido Key Swash Zone Berm (Jan 2012)

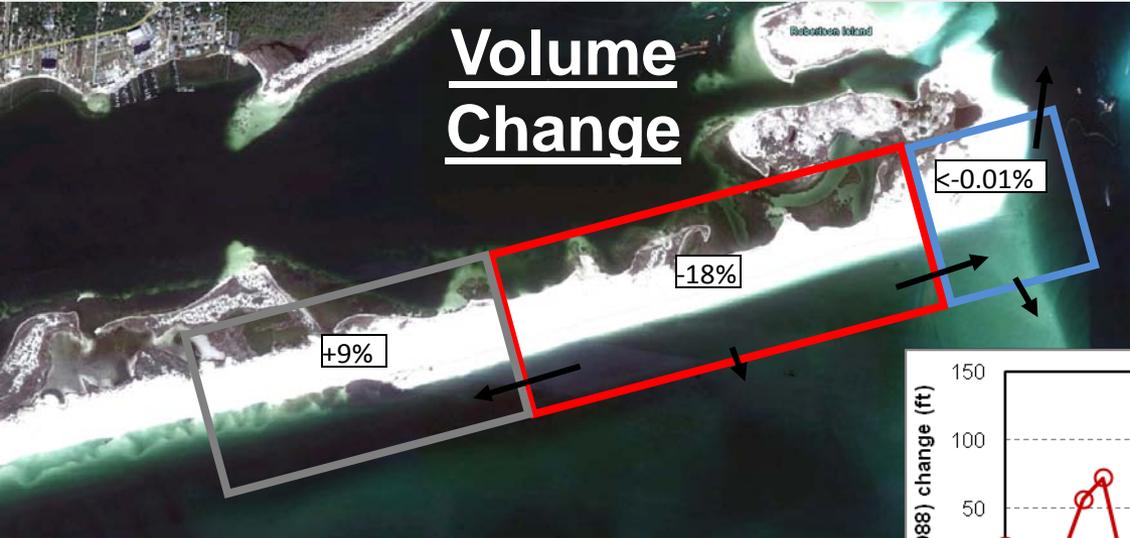


0 0.2 0.4 0.8 1.2 1.6 Miles
State Plane Florida North, NAD83



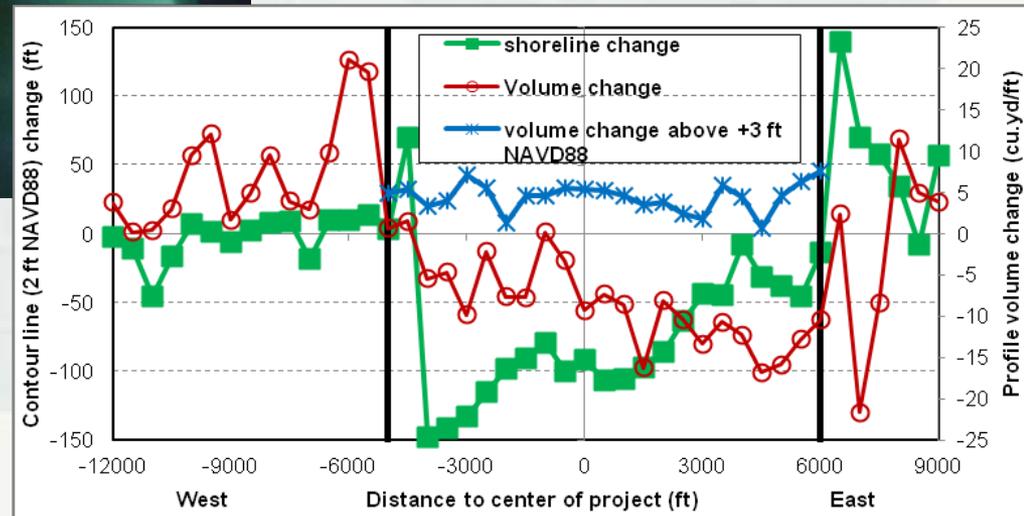
- Sediment grades coarser away from inlet; fill is uniform inlet material
- Following placement, shoreline erodes landward and shoreface accretes
- Rapid migration furthest from the inlet; lowest erosion rates near the ebb shoal
- Alongshore spreading through the nearshore profile
- Inlet shoreline changes not substantial; limited bayside monitoring

Perdido Key Swash Zone Berm (Jan 2012)



6 Month Volume Calculation

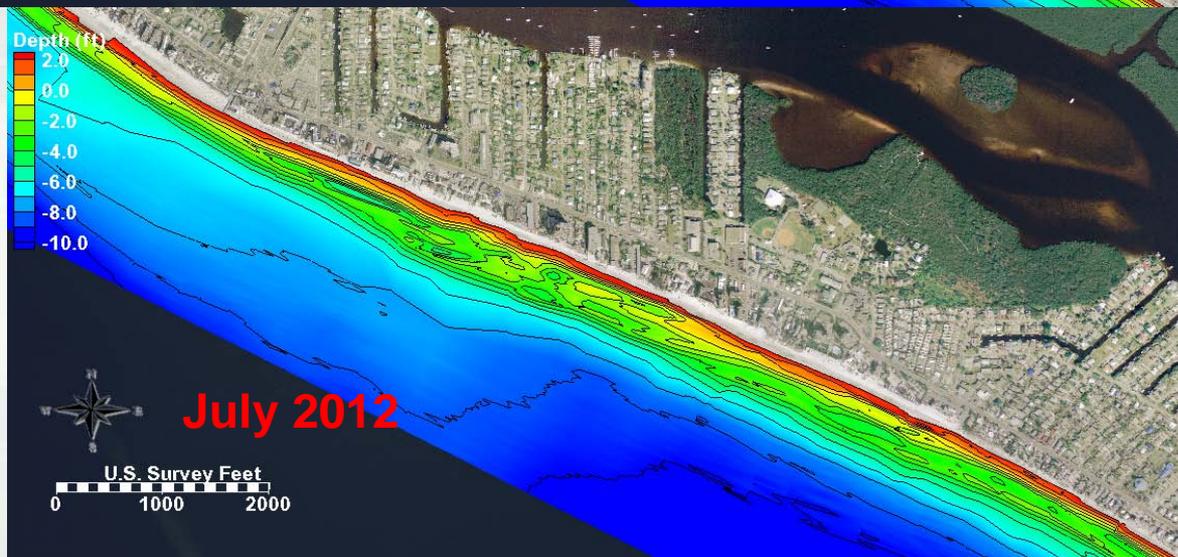
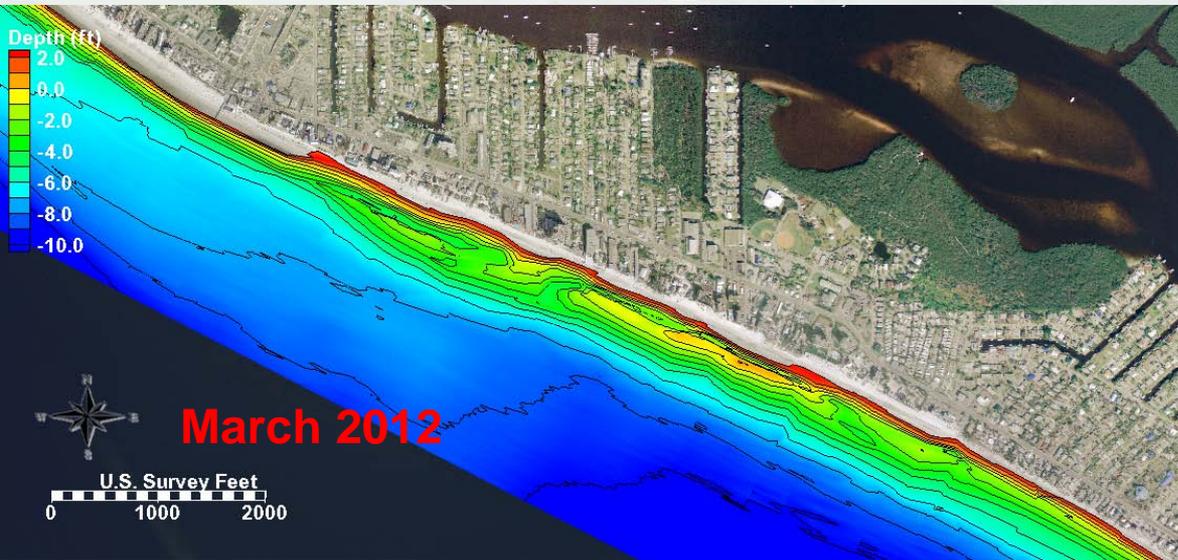
- Accurate means of determining sand volume within and adjacent to the nourished area
- Quantitative method to describe the movement of material





CESAJ
USF

Ft. Myers Nearshore Berm (Jun 2009)



- Fine sediment found in trough and offshore for 1st year; 2nd year none in trough, and coarsening of berm/trough to native grain size as migrating
- Berm migrated 150 ft/yr; characteristic of an asymmetric onshore migrating bar
- Gaps in berm migrated alongshore, but there was little alongshore spreading
- Little effect on shoreline response (low-wave energy)
- Overall, predominantly mobile in the cross-shore, with moderate alongshore spreading



New Smyrna Nearshore Placement (Aug 2012)



www.offshoreswell.com

CESAJ



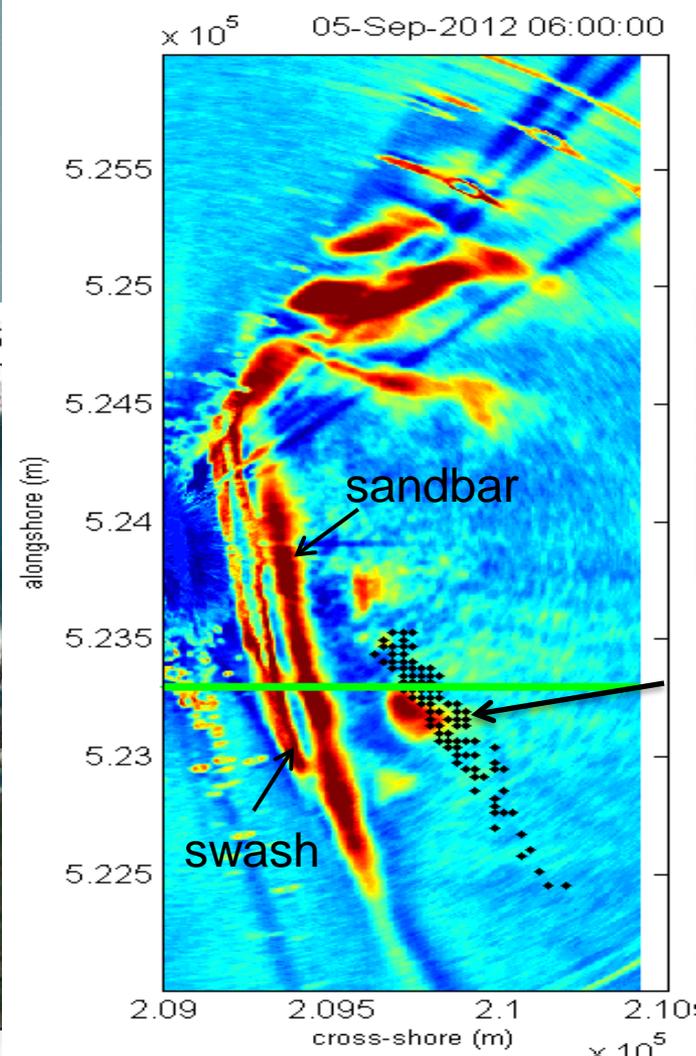
US ARMY CORPS OF ENGINEERS: ENGINEER RESEARCH & DEVELOPMENT CENTER
Field Research Facility

RADAR INLET OBSERVING SYSTEM:



RIOS

25



Placement locations

	WQC PLATES	FILE NAME:	OWN BY:	GENERAL NOTES:
	NOT FOR CONSTRUCTION		CMK	
	DEPARTMENT OF THE ARMY	DATE: FEBRUARY 2012	BSW RYI	CMK/SR
	JACKSONVILLE DISTRICT, CORPS OF ENGINEERS	SCALE: AS SHOWN	CRS RYI	SR



BUILDING STRONG®

New Smyrna Nearshore Placement (Aug 2012)



www.offshoreswell.com

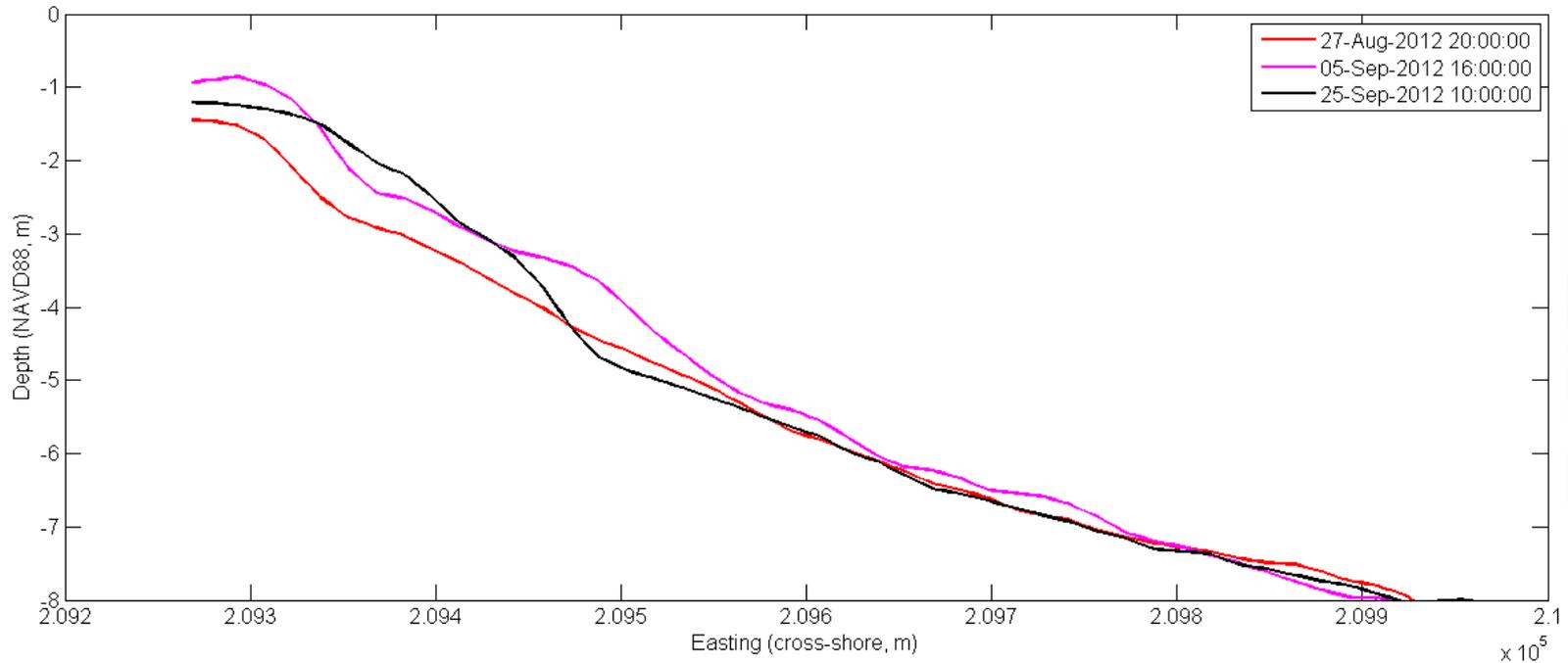
CESAJ



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Field Research Facility

25-Sep-201



- **Nearshore placement (depth and height above bottom) rarely influences local wave field**
- **Little to no measurable increase in the bed elevation due to placement activities**
- **No measurable indication of shoreline or sandbar response (accretion or erosion) in proximity of placement**

Desktop Planning Tool: Nearshore Berm Calculator (NBC)



- **Planning-Scoping Tool**
- **Estimates placement depth (based on wave-limited cross-shore transport)**
- **Calculates position and design from user-defined parameters and coastal engineering design practices**
- **Automated wave parameter extraction; user-defined beach profile; draft depth and placement limitations based on dredge**

st:3141/Berms/Calculate

Nearshore Berm Calculator

Home Calculator Background Definitions References Contact Login

Nearshore Berm Calculator

Dredging & Placement Type Placement Depth Placement Location

General Beach Waves

US

Estimate of Width ft

Estimate of Area ft²

Predicted Length of Given Crest Height ft

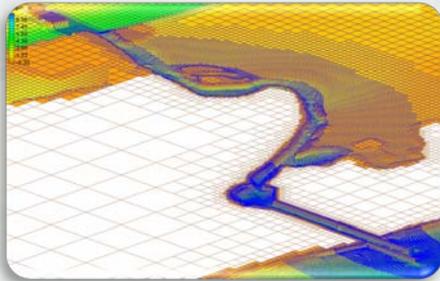
Suggested Length ft

Segmented Count

Segmented Length (each) ft

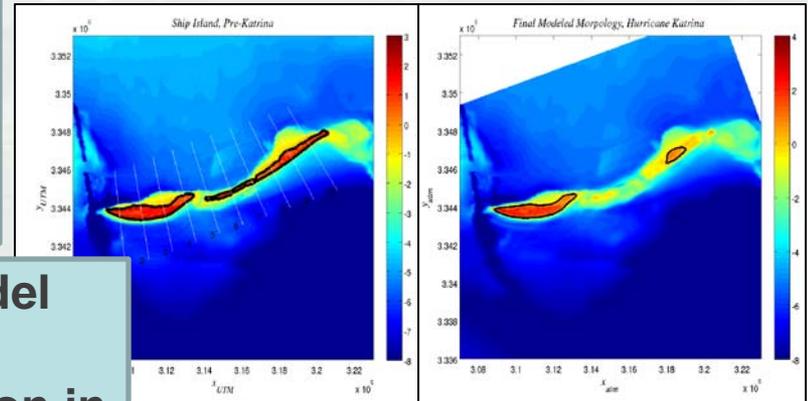
Modeling

CMS

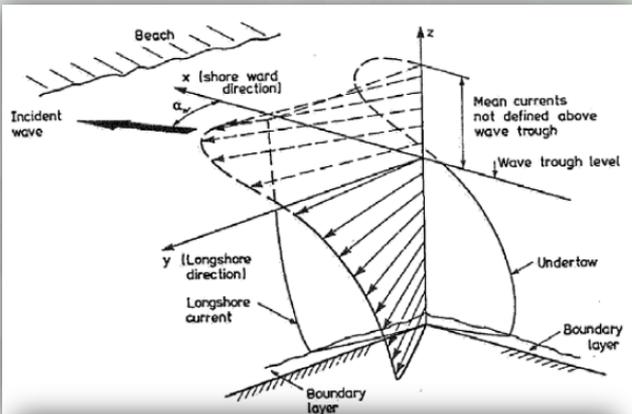


← Validated 2DH Coastal Model that simulates vertical variation of horizontal velocities and includes mixed sands

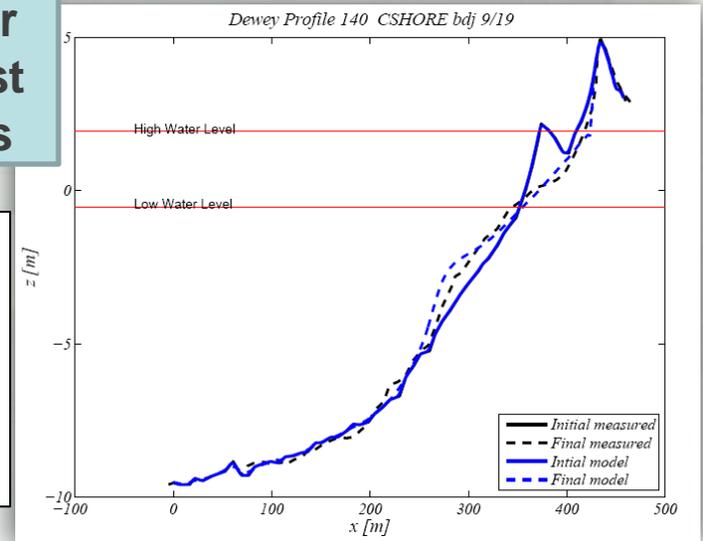
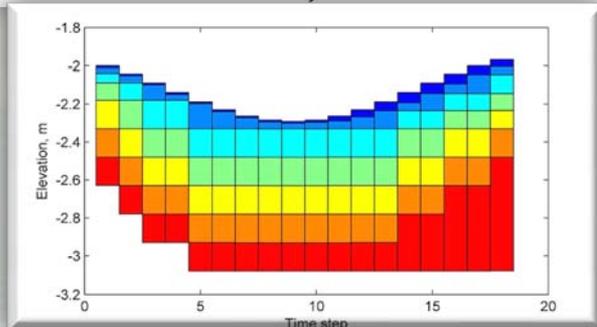
CShore



1D Coastal Model
→ validated for erosion/accretion in the cross-shore for both East and West Coast Applications



Surf Zone Processes:
Undertow
Stokes Drift
Wave Asymmetry
Separated Bed and Suspended Load



Goals for Nearshore Berm R&D

What are we going to get out of our monitoring efforts?

Characterized
Environments
for Prediction

Input for
Empirical
Models

Numerical
Modeling
Datasets



What do these tools provide ?

Mobile
Tools

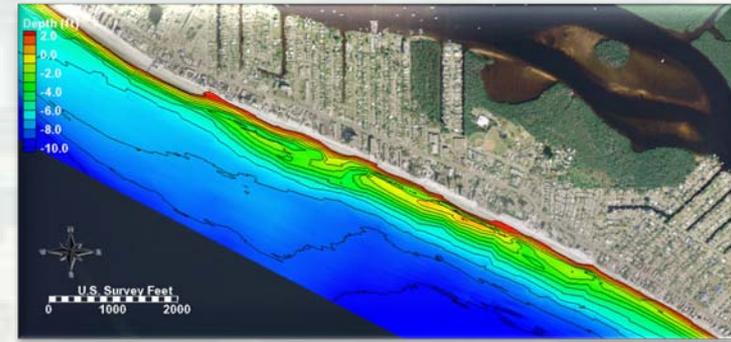
Documentation
of Results

Numerical
Modeling
Methodology





Summary



- **A need exists for improved prediction of nearshore placement behavior, and a more comprehensive understanding for guidance on placement types and the various environmental factors influencing long-term performance**
 - **Basic design parameters exist [depth limits, gap spacing, end slopes], but are insufficient in predicting performance**
 - **Documentation is very limited**
- **Laboratory experiments isolate various parameters and analyze that part of sediment transport and morphology change**
- **Various nearshore placement activities have been monitored for necessary documentation, and to better define performance metrics. Key Factors include:**
 - **Cross-shore transport rates for a given wave climate and ambient sediment transport**
 - **Alongshore spreading of placement material under various environmental forcings**
 - **Temporal incorporation into natural coastal morphology (beach profile)**
 - **Displacement/migration of concentrated fines**

Thank You

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Questions to Discuss

- **Are there studies with the performance of material with different % fines in similar placement areas and wave climate, to determine what % fines works and what doesn't?**
- **How do we know what will happen if we place material along a stretch of beach that has not be modeled or analyzed?**
- **How do we know that what worked in one area (e.g. new Smyrna) will work in another (e.g. Melbourne)? How can we correlate these?**



Questions to Discuss

- **How many O&M projects in FL actually have viable quantities of exclusively nearshore compatible material per state standards? (ie beach quality, except fines between 10 & 20 %)**
- **If the majority of material is beach quality, in order to justify nearshore placement using small equipment such as the Currituck, quantify the economic and ecologic benefit of utilizing small scale "strategic" dredging to hit just critical shoals and expanding the interval between large scale dredging events at the project (maybe go from 3 to 5 years between large scale, traditional dredging events with beach placement). How does this correspond to the funding environment the Corps currently faces, especially for shallow draft nav projects.**

