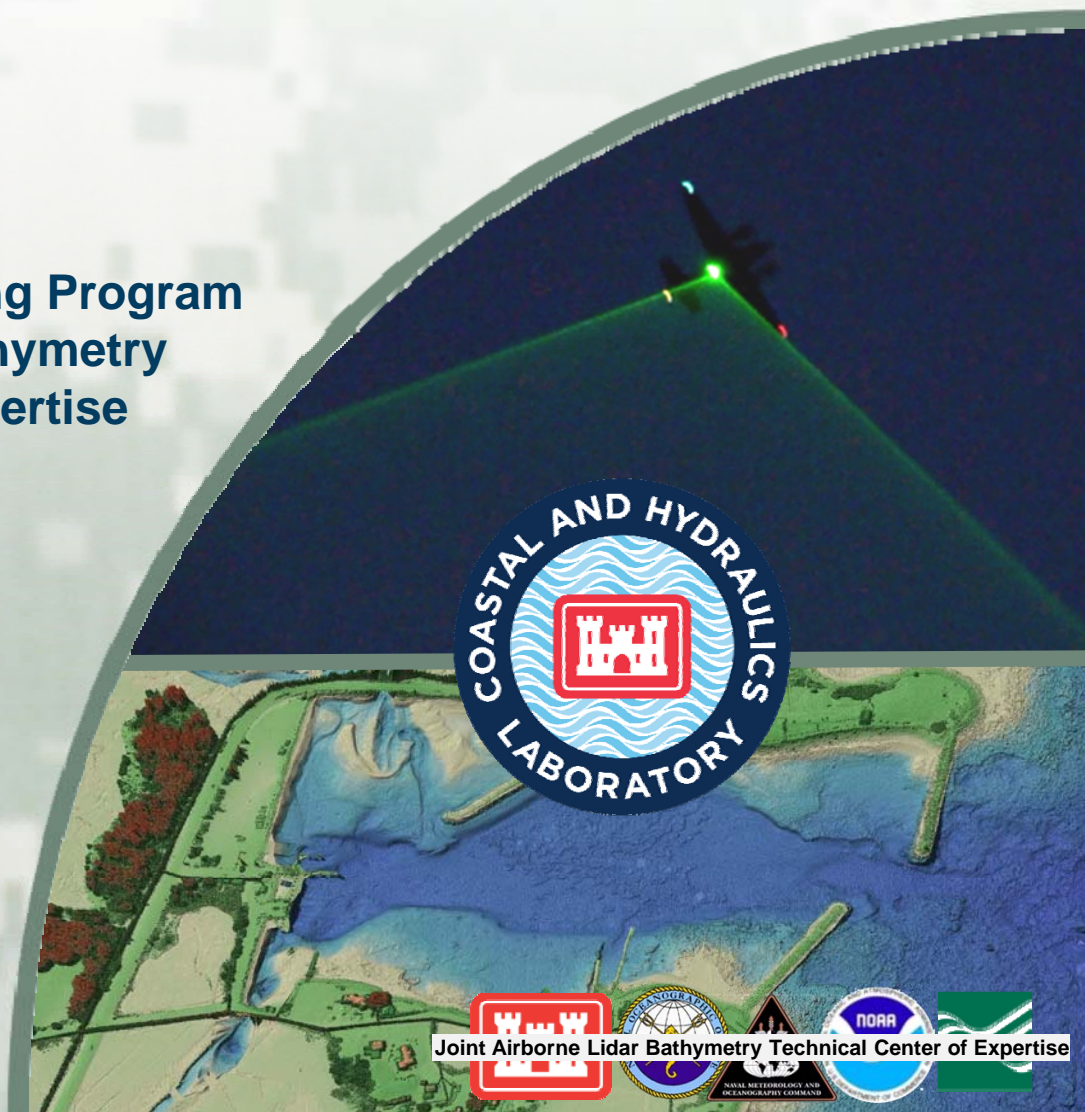


National Coastal Mapping Program Update and Tools

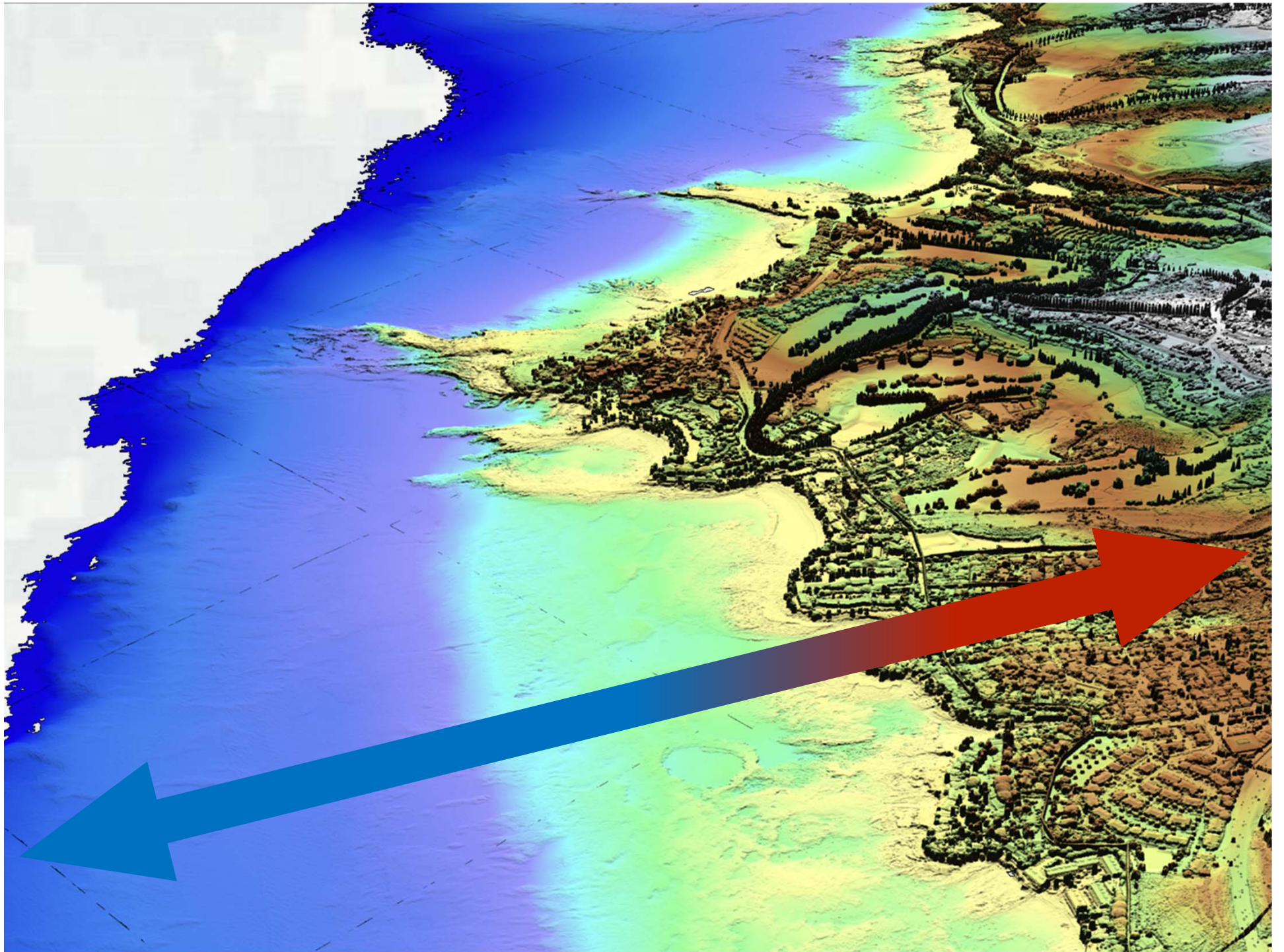
Jennifer M. Wozencraft
Research Physical Scientist
Manager, National Coastal Mapping Program
Director, Joint Airborne Lidar Bathymetry
Technical Center of Expertise

Coastal and Hydraulics Laboratory
US Army Engineer R&D Center

17 May 2016
Regional Sediment Management IPR
Kitty Hawk, NC



Joint Airborne Lidar Bathymetry Technical Center of Expertise





- *Shorter laser pulse length and receiver response for increased accuracy, especially in shallow (<2m) water*
- *Large field-of-view afforded by prism, and more sensitive receivers, increase signal-to-noise ratio.*
- *Improved depth detection in shallow turbid water*



400 m

Dia. 290m

10,000 Hz Pulse Rate (hydro / topo)

0.4 Hz / 25 MP Digital camera (~20 cm pixel)

CASI-1500 Hyperspectral Imager

- 1500 pixels
- 380 – 1050 nm wavelength
- 288 possible bands

15 cm RMSE bathymetry

7.5 cm RMSE topography

Shot spacing:

0.7 X 0.7 meter topo / shallow hydro

2.0 X 2.0 meter deep hydro

300 - 400 m op altitude (hydro)

300 - 1200 m op altitude (topo)



Coastal Zone Mapping and Imaging Lidar



U.S. ARMY

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National Coastal Mapping Program Progress

Number of times surveyed since 2004

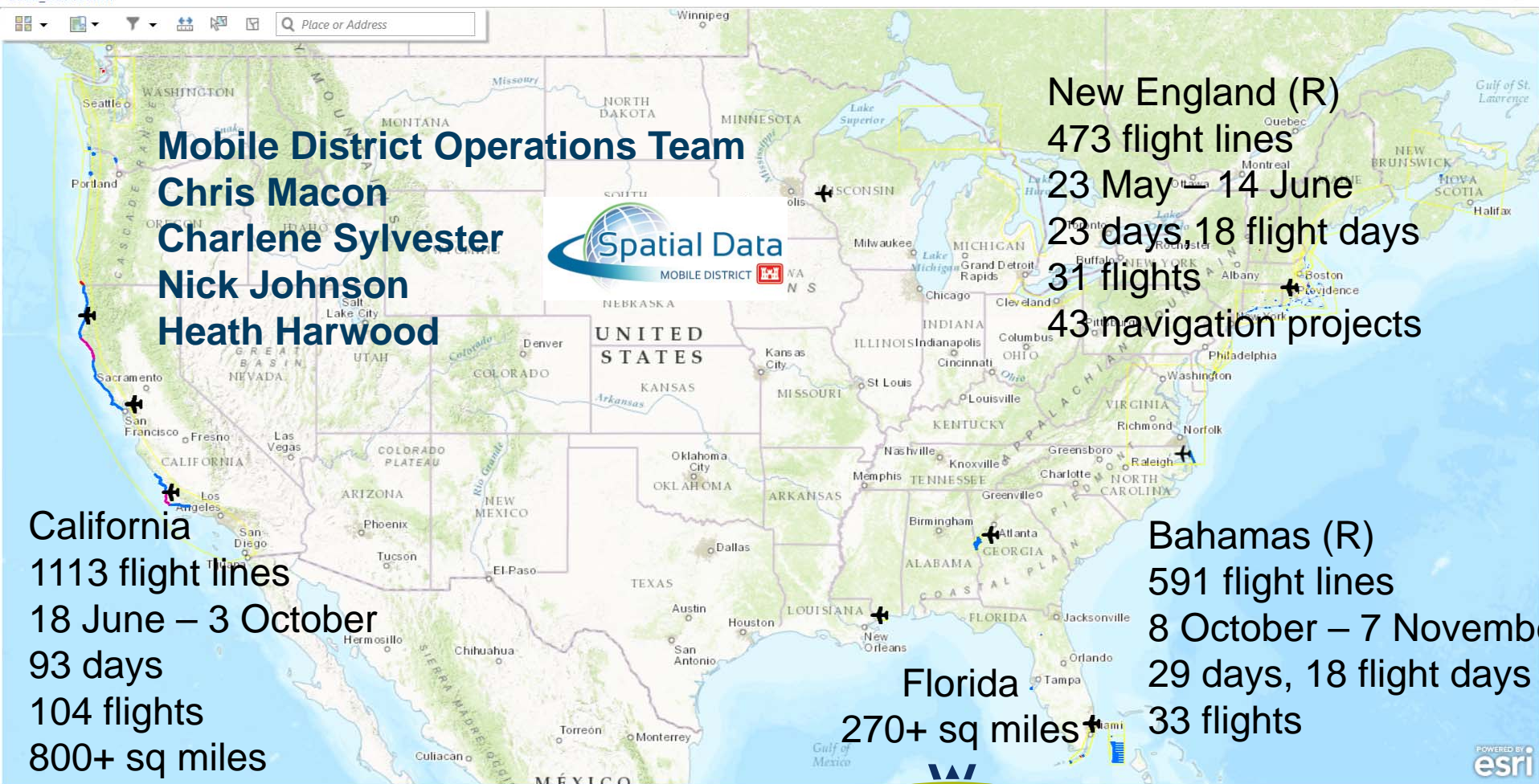
-  One Time
-  Two Times
-  Three Times
-  Four Times
-  Five Times
-  Six Times



ERDC

2015 JALBTCX Survey Season

2015_DashBoard



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WOOLPERT
DESIGN | GEOSPATIAL | INFRASTRUCTURE



Future NCMP collections

The screenshot shows the SeaSketch web application interface. The main map displays the United States with various data layers overlaid, including a yellow outline of the Great Lakes region and a red outline of the Gulf of Mexico. The interface includes a search bar, a list of data layers, and a sidebar with navigation options.

U.S. Federal Mapping Coordination
A Demonstration Site for Federal Mapping Data Acquisition Coordination

seasketch English take a tour ? help Sign In

Data Layers My Plans Participate

Data Layers Basemap Legend & Ordering

Search layers by name or keyword

Mapping Priorities: Needs, Requirements

- ☐ Topographic Lidar 3DEP Areas of Interest
- ☐ Topobathymetric Lidar Areas of Interest
- ☐ Acoustic/Sonar (bathy, etc.) Areas of Interest
- ☐ Digital Imagery (in conjunction with Topo/topobathy lidar?)

Planned and Ongoing Mapping Projects

- ☐ Topographic Lidar
- ☒ Topobathymetric Lidar
 - ☐ NOAA
 - ☐ USACE
 - ☐ USGS
- ☐ Acoustic/Sonar (Hydro, Bathy, Water Column, etc)
- ☐ Digital Imagery
- ☐ Other (eg. DEM, CSCAP, EPA NCCA)
- ☐ NOAA FY16-17 Fleet Allocation Plans

Alaska/Arctic Priorities, Proposed, Planned, Ongoing

- ☐ Alaska/Arctic

Existing Data

- ☐ Existing Data (not complete; more due diligence necessary)

UAS Pilot NERBS Grand Bay



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<http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4>



National Coastal Mapping Program Products

Products

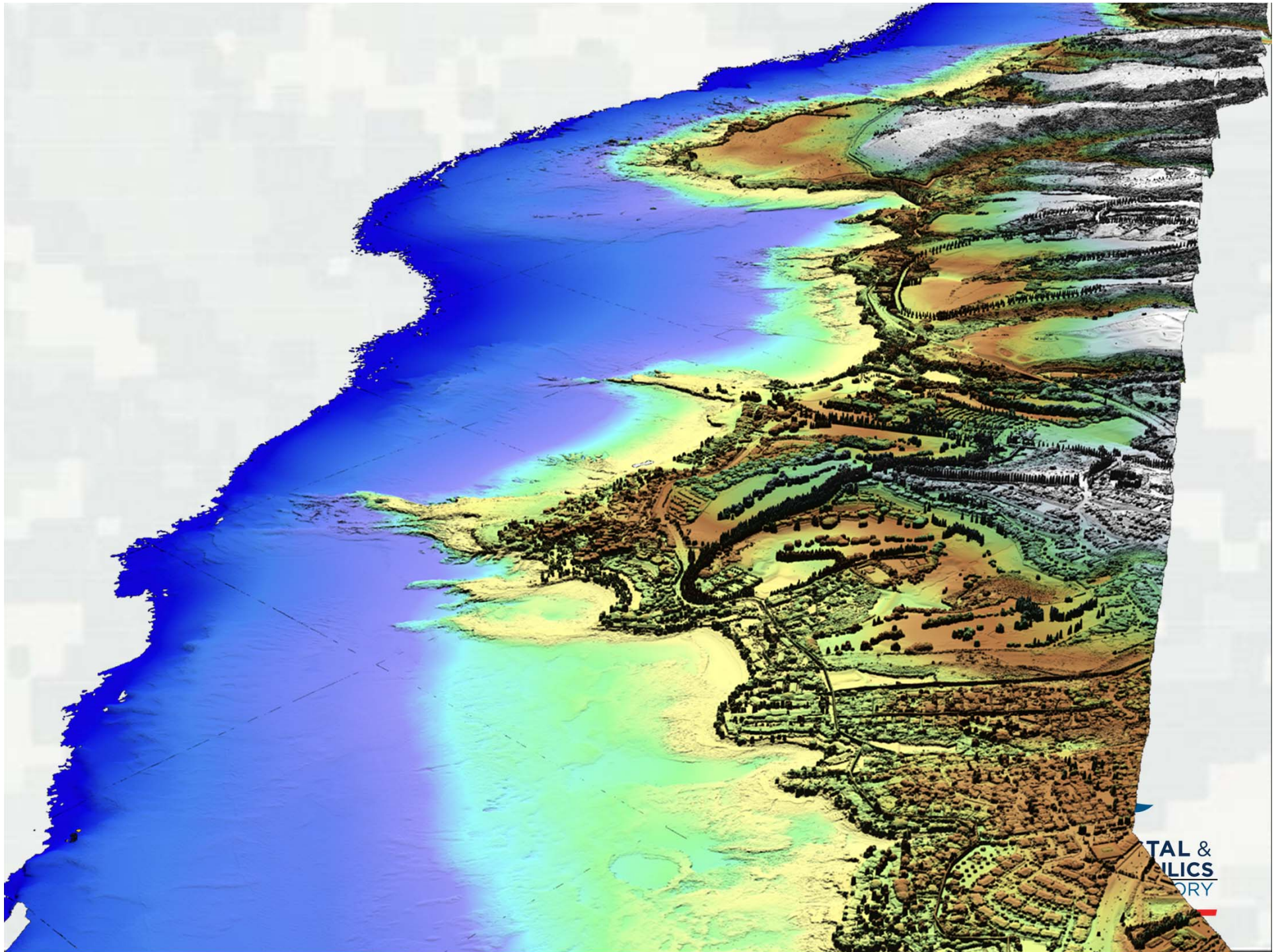
- LAS format bathy/topo
- Aerial photos mosaics
- NAVD88 shoreline
- 1-meter bathy/topo DEM
- 1-meter bathy/topo bare earth DEM
- Hyperspectral image mosaics
- Laser reflectance images
- *Volume change*

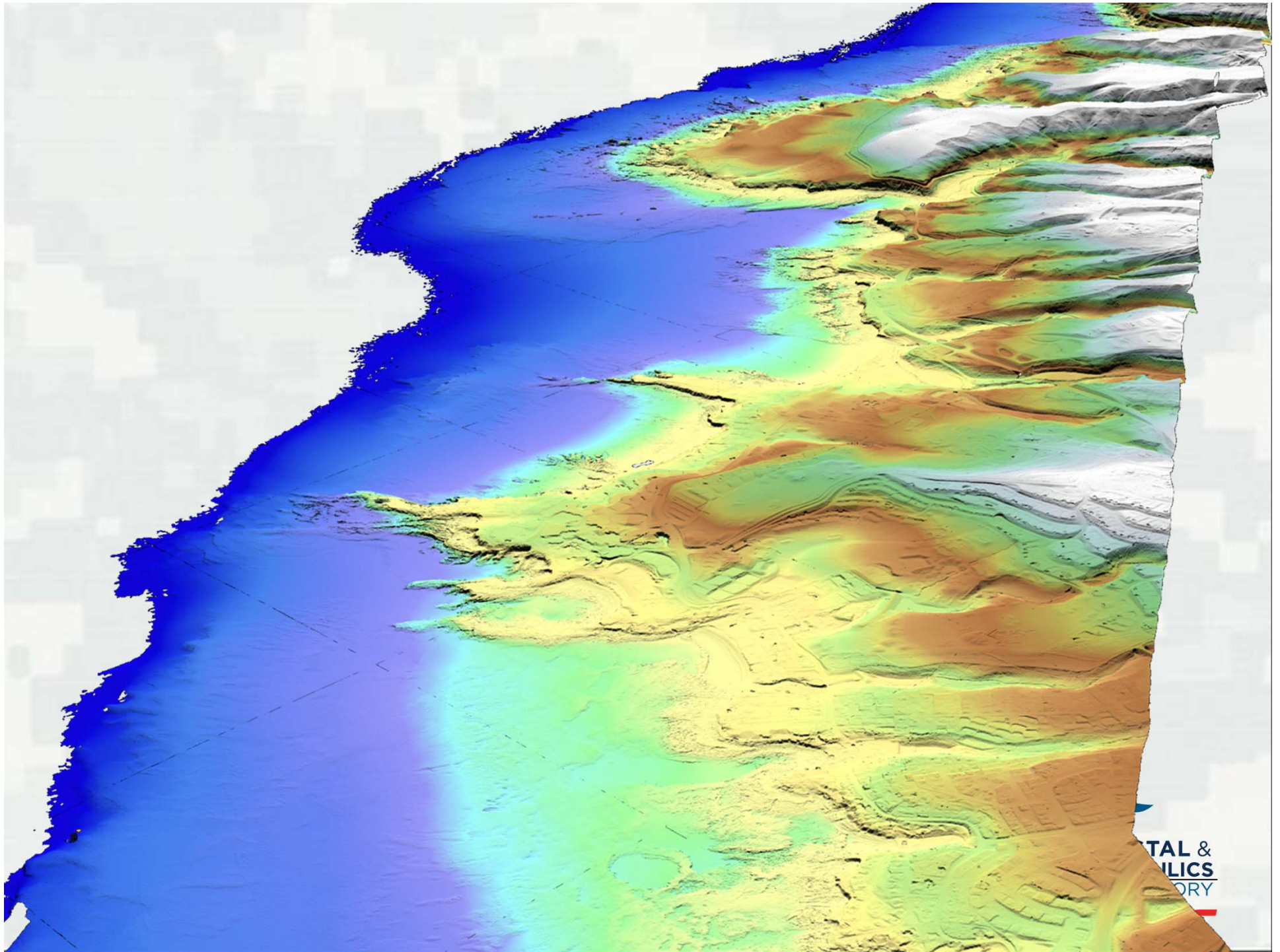
Number of times
surveyed since 2004

- One Time
- Two Times
- Three Times
- Four Times
- Five Times
- Six Times



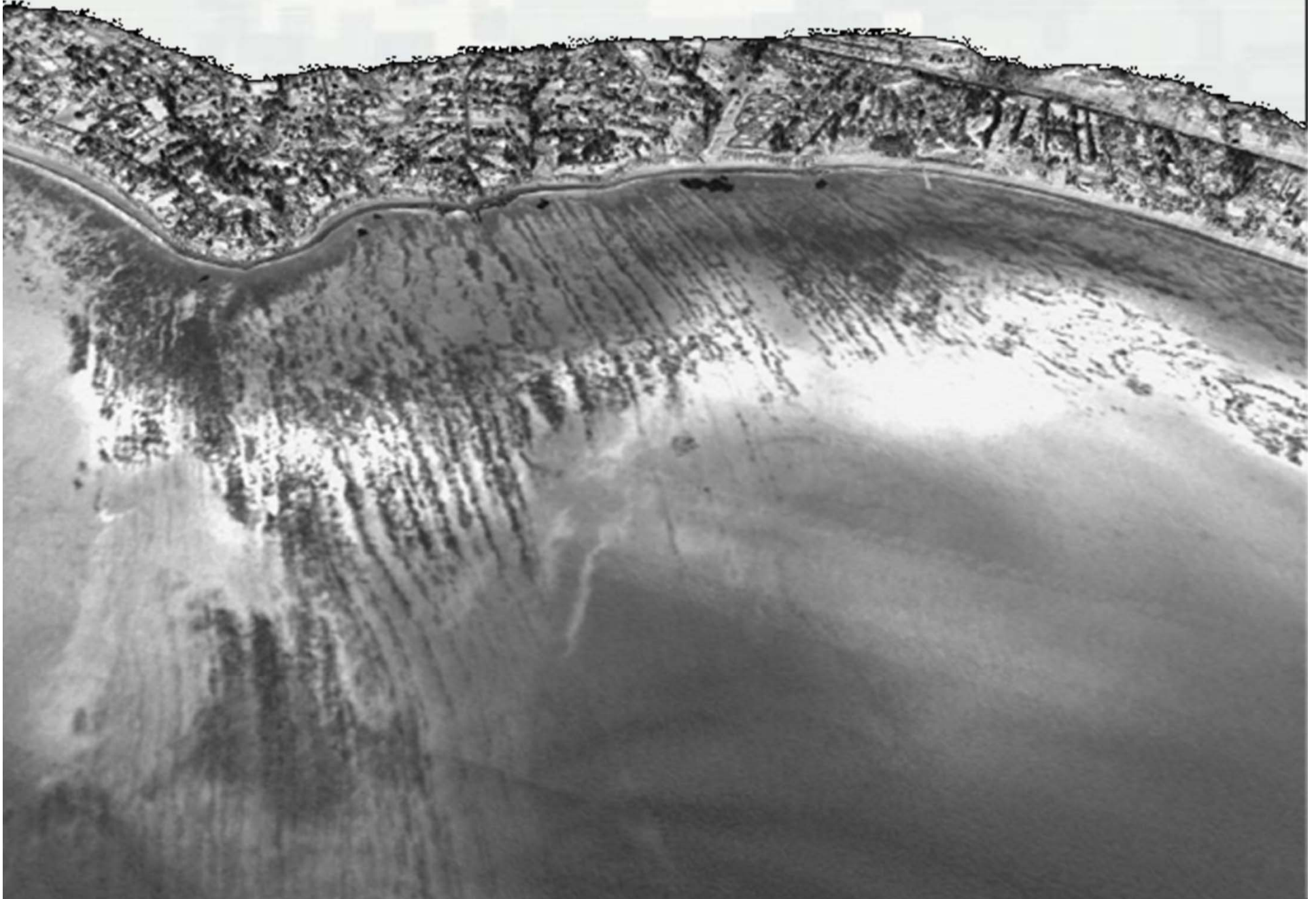
ERDC





Laser reflectance image

NCMP 2009
Malibu, CA



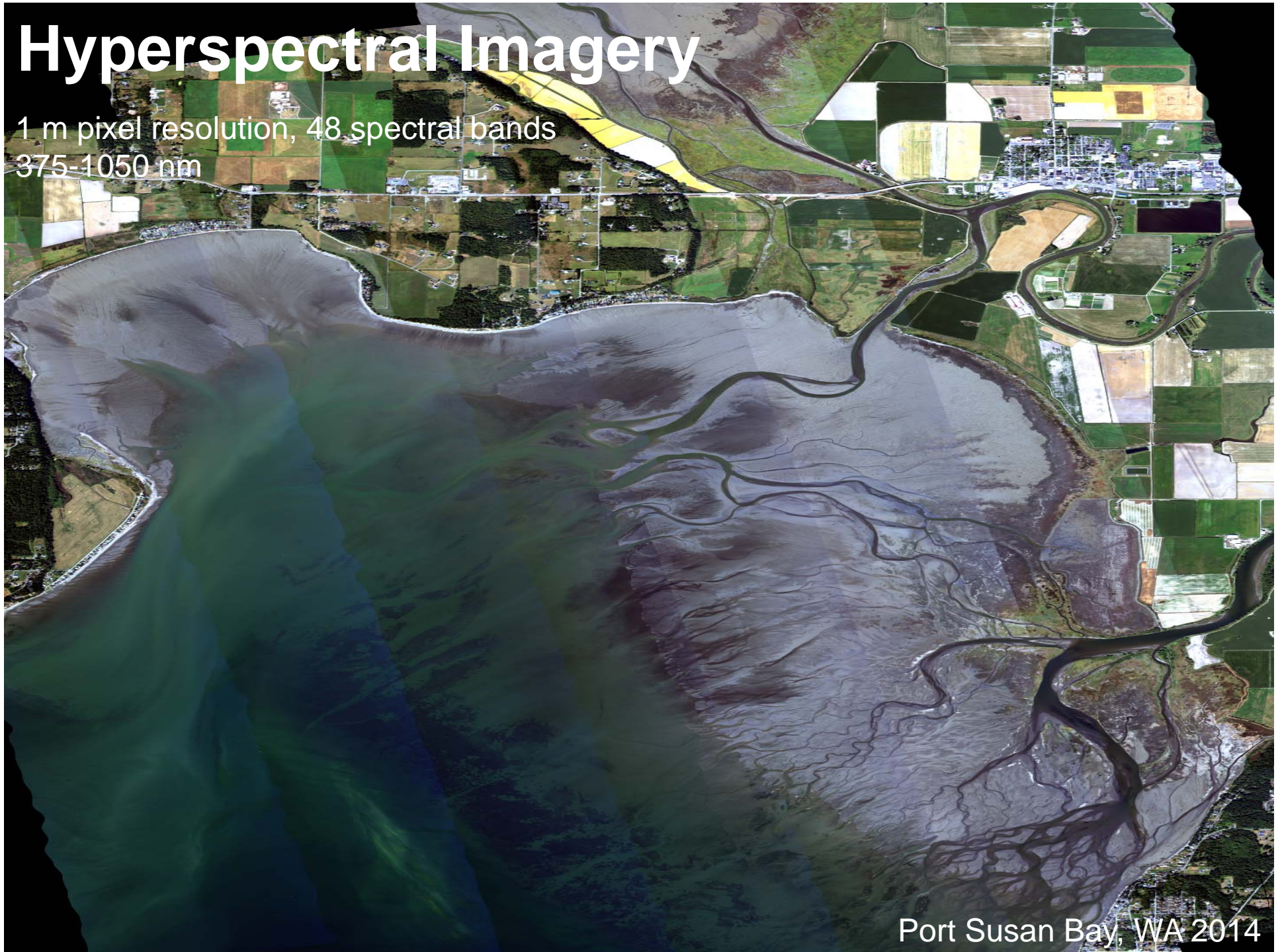
Aerial photography/lidar



Siuslaw River Entrance, OR 2014

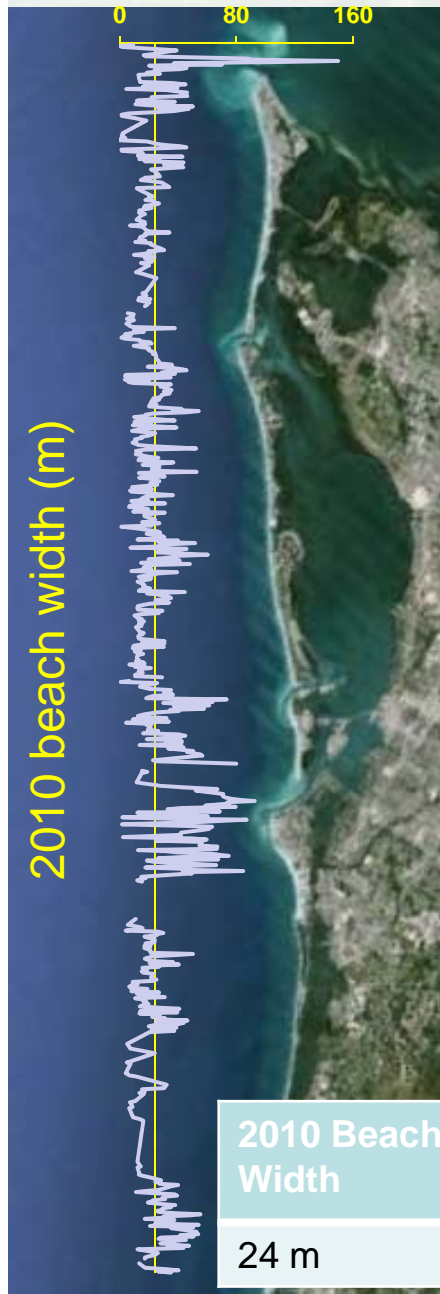
Hyperspectral Imagery

1 m pixel resolution, 48 spectral bands
375-1050 nm



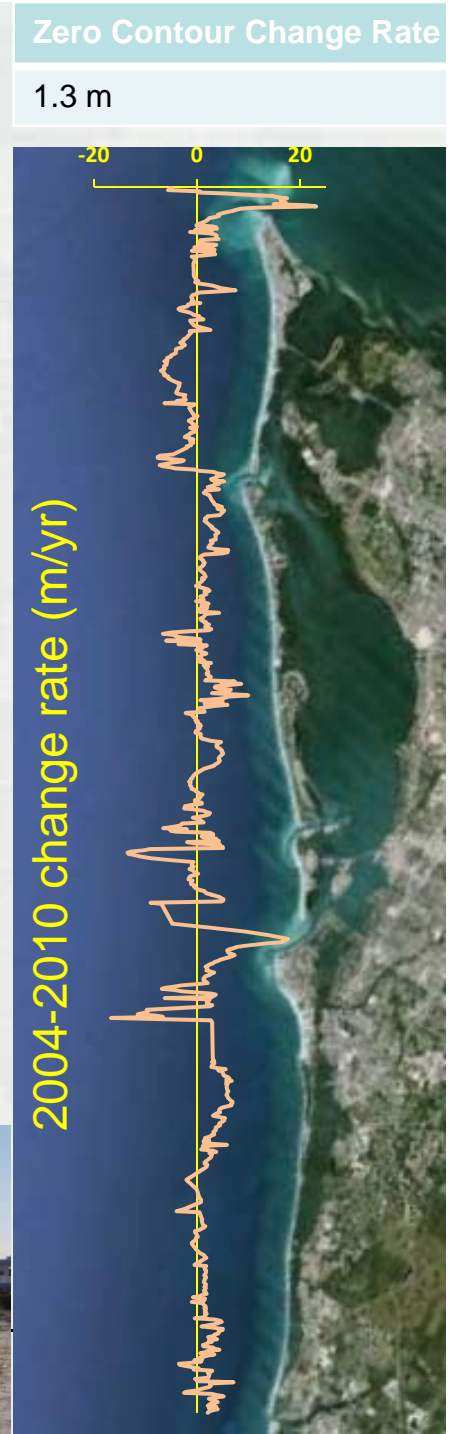
Port Susan Bay, WA 2014

Zero Contour



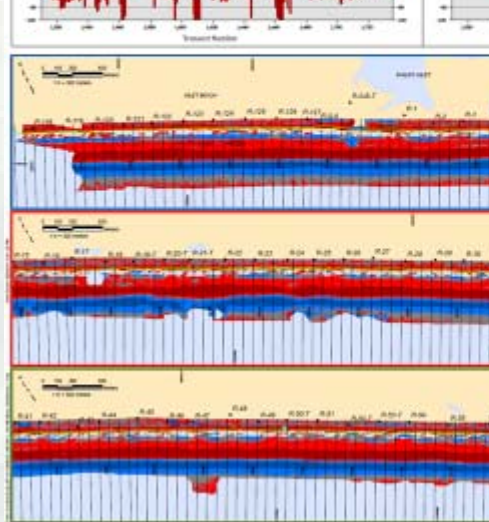
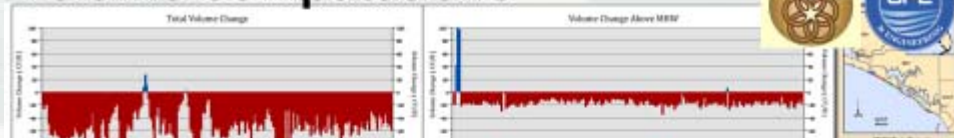
- Beach width provides buffer before the dune as well as recreational benefits
 - Defined as the distance between the zero contour and the dune toe
 - Active portion of the beach
- Contour change rate
 - Used to determine hot spots of erosion and cumulative change can identify extent of inlet influence

1) *What shoreline is most meaningful to you?*



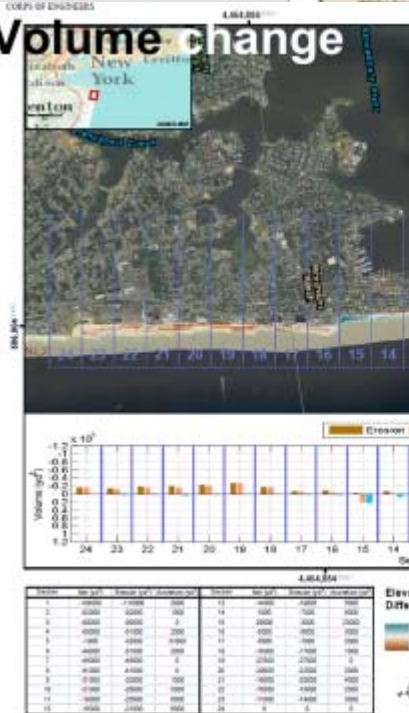
Volumes

Volume computations

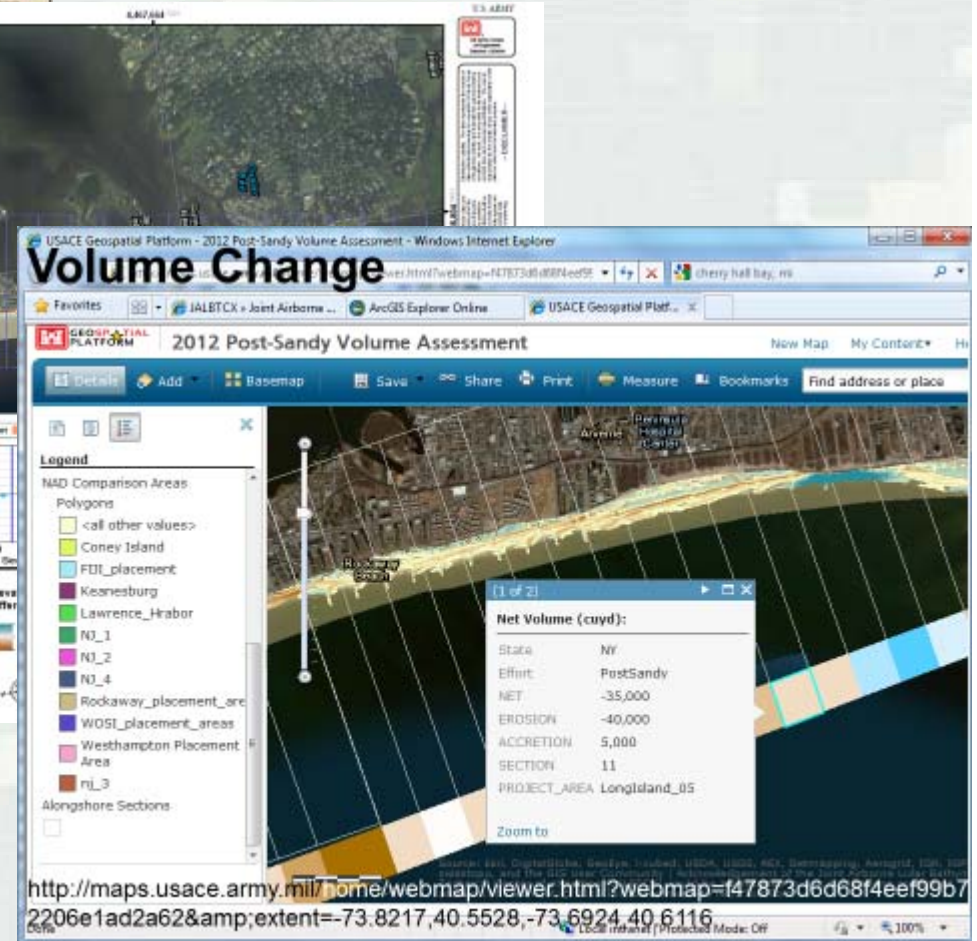


2012 pilot project

Volume change



2012 emergency operations



2013 web services

Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
ME	10/19/2005	6/19/2010	62	633	(0.4)	13.5	0.7	0.6
NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

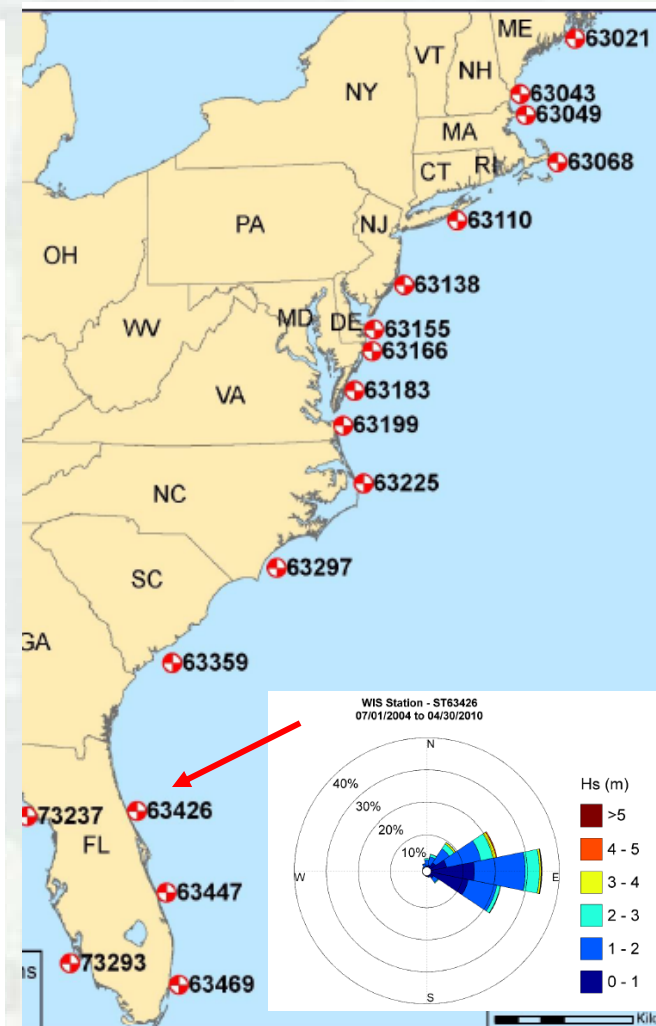


Figure 5. Locations of selected WIS stations.



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Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
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MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
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NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
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FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

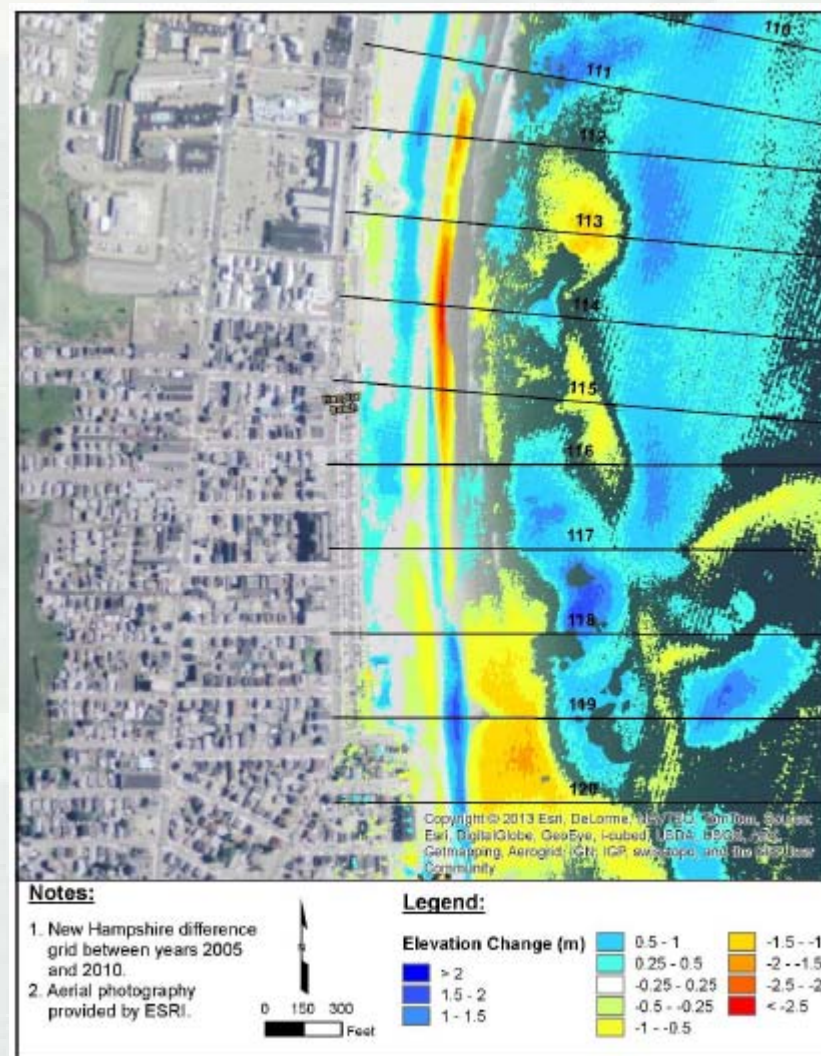


Figure 8. Elevation change near Hampton Beach, NH.



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Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
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NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
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FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

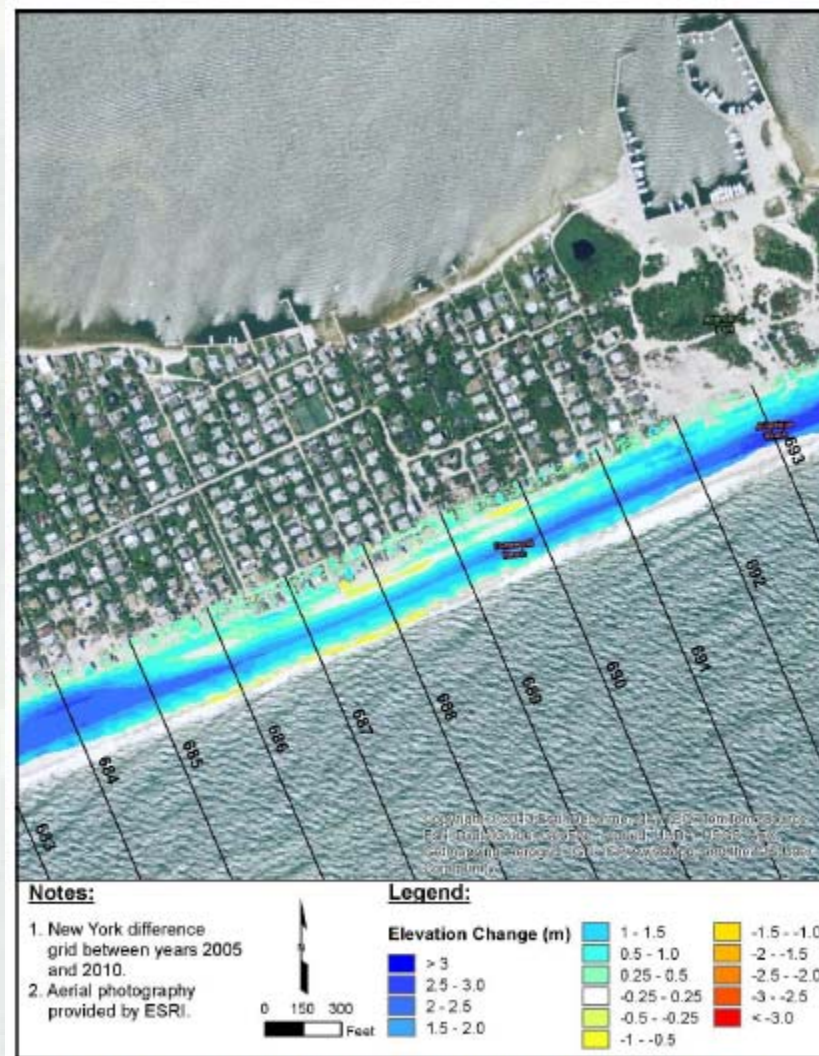


Figure 10. Elevation change near Dunewood, Fire Island, NY.



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Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
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NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
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FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
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FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

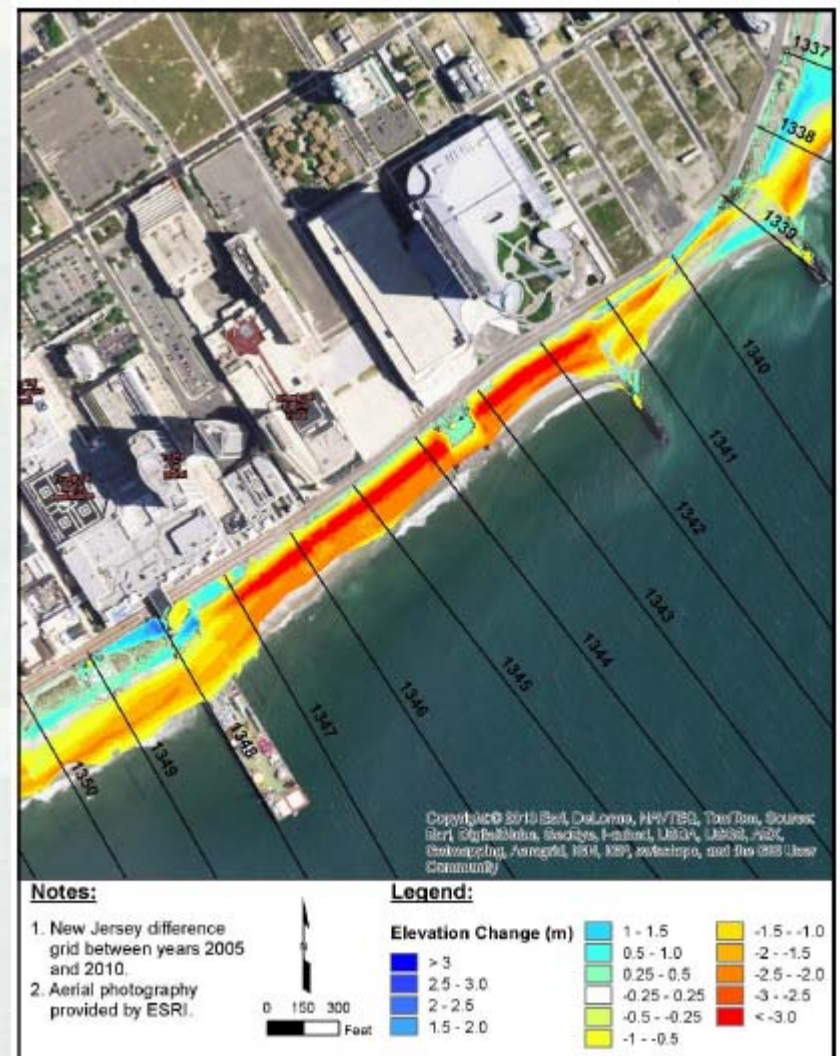


Figure 12. Elevation change near Atlantic City, NJ.



Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
ME	10/19/2005	6/19/2010	62	633	(0.4)	13.5	0.7	0.6
NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

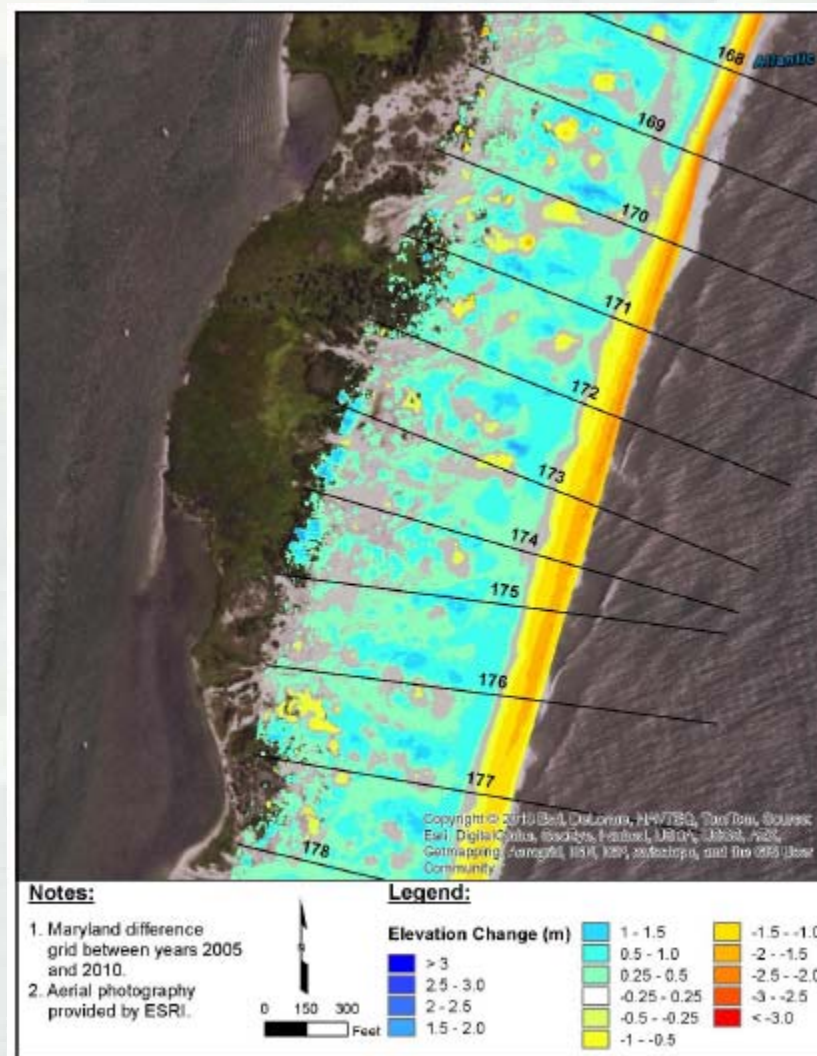


Figure 13. Elevation change on Assateague Island, MD.



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Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
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NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/Average			3,289	33,012	0.9	4.6	1.6	1.7

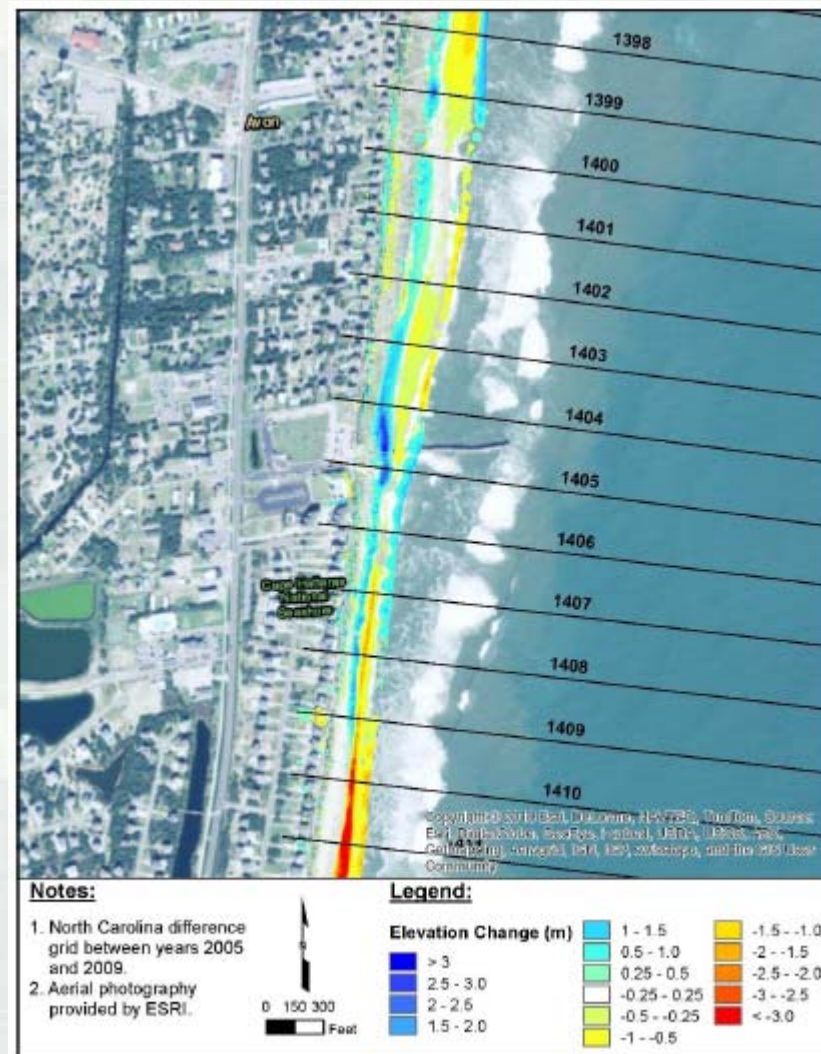


Figure 15. Elevation change near Avon, NC.



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Volumes

Table 6. Condensed Results by State

State	Start Date	End Date	Baseline Length	Number of Transects	Average Shoreline Change Rate	Volume Density Rate	MHW Volume Density Rate	Above MHW Volume Density Rate
			km	n	ft/yr	cy/ft/yr	cy/ft/yr	cy/ft/yr
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NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
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NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
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NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

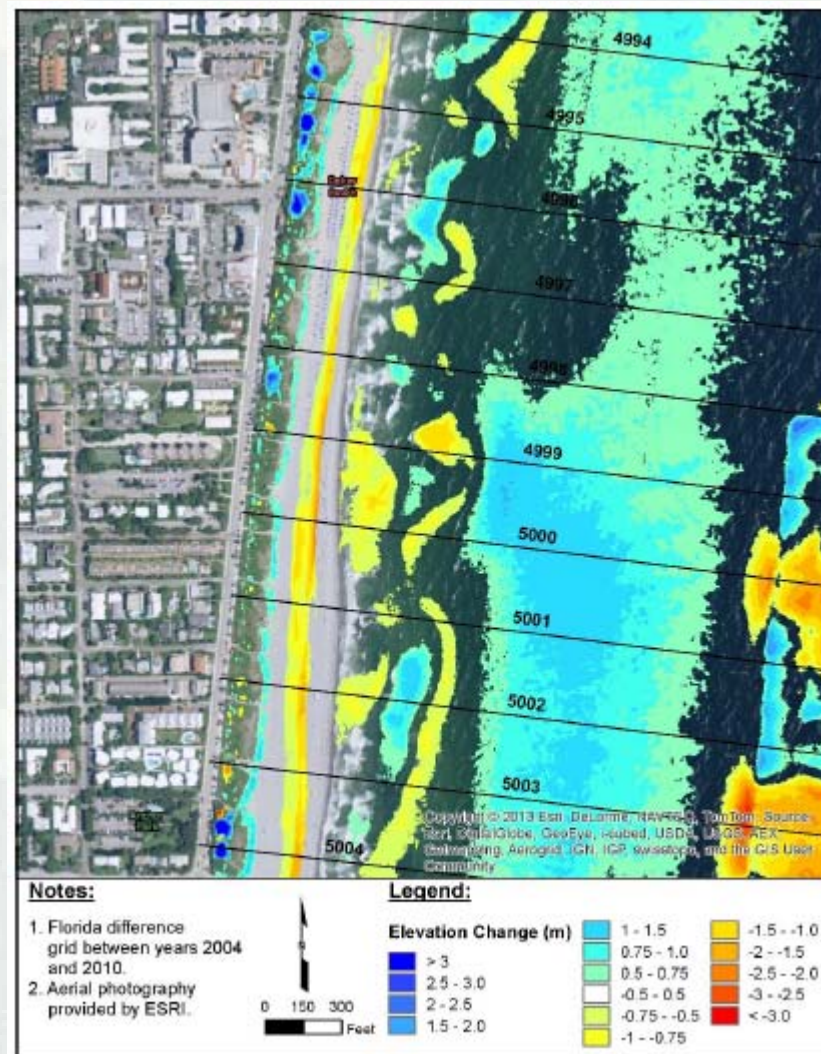


Figure 18. Elevation change at Delray Beach, FL.



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1) Does selection of MHW for volumes matter?

Asset management coastal structures

ArcGIS Explorer Online - Windows Internet Explorer

NCMP Structures Mapping Presentation Sign In Help

Home Details Share Find Places

San Pedro Long Beach Harbor Los Angeles Harbor

Query Results

LA-LB Harbors Middle... 66 of 73

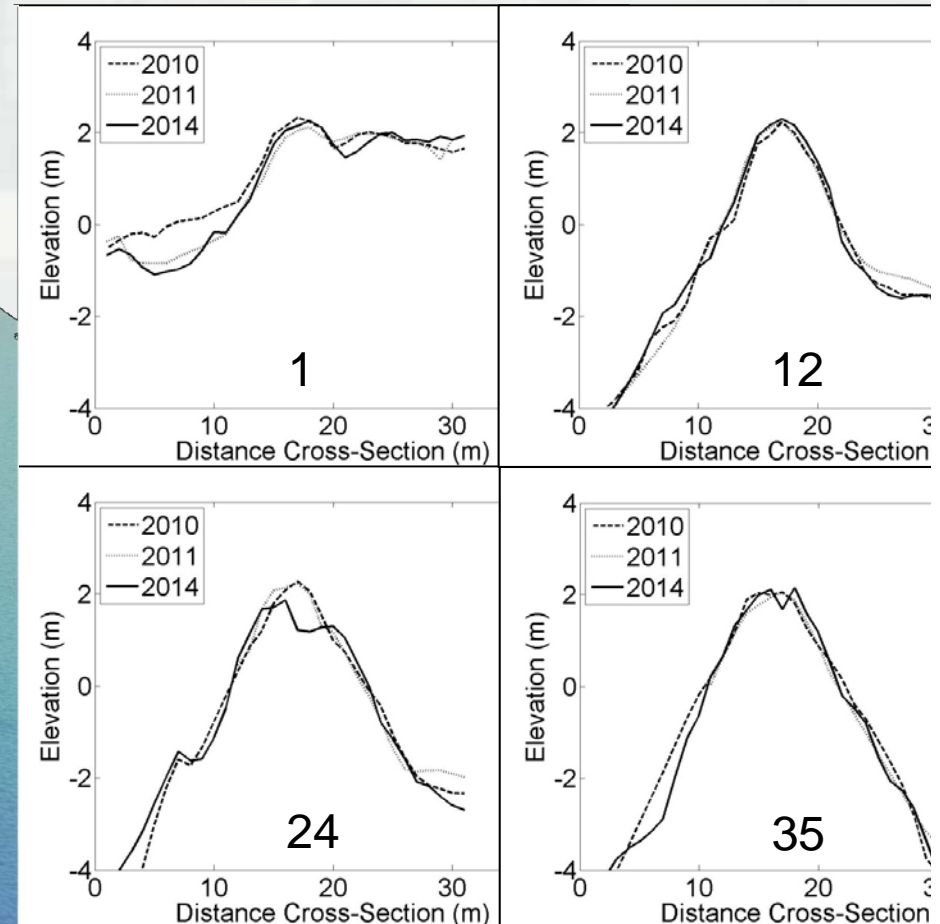
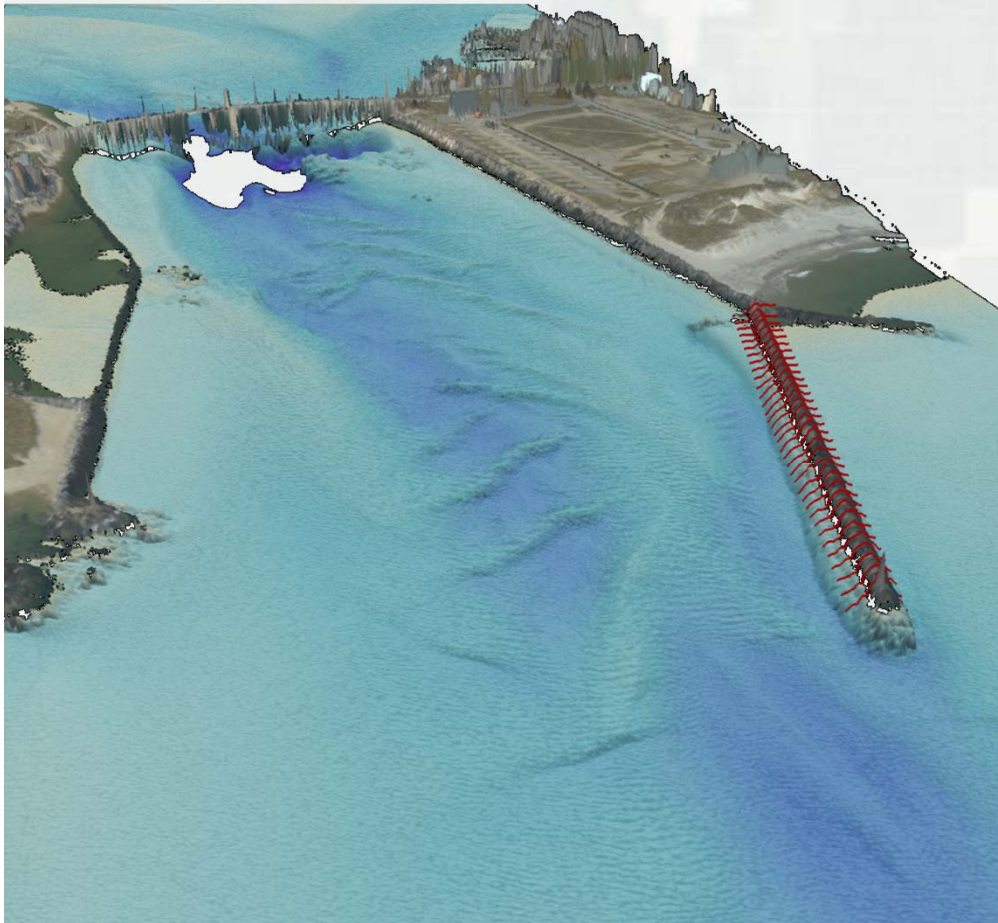
Azimuth	77.9018
jetty_id	SPL_JET_116
meta_id	SPL_jetty_area_1010.xml
coord_id	
feat_name	LA-LB Harbors Middle Breakwater
perim	37936.8875399
perim_u_d	FT
user_flag	
instln_id	SPL
facil_id	
op_stat_d	UNSPECIFIED
feat_len	18500
length_u_d	FT
crest_hght	14

Zoom To Zoom All More Re-execute

http://www.arcgis.com/home/webmap/viewer.html?url=http%3A%2F%2Fgis.sam.usace.army.mil%2Fserver%2Frest%2Fservices%2FJALBTCX%2FJALBTCX_Structures%2FMapServer&source=sd

Done Local intranet | Protected Mode: Off 100%

Asset management coastal structures



Hampton Harbor, NH, 2014



U.S. ARMY

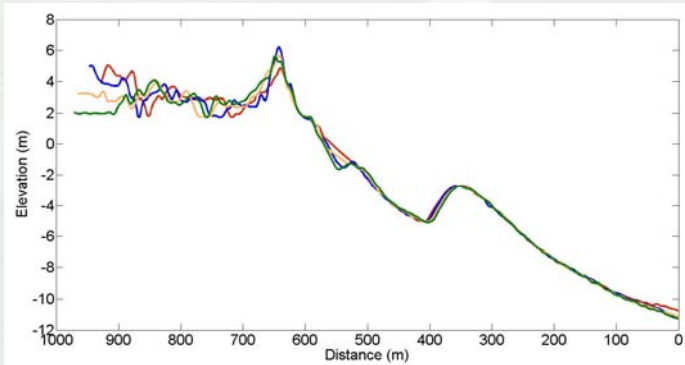
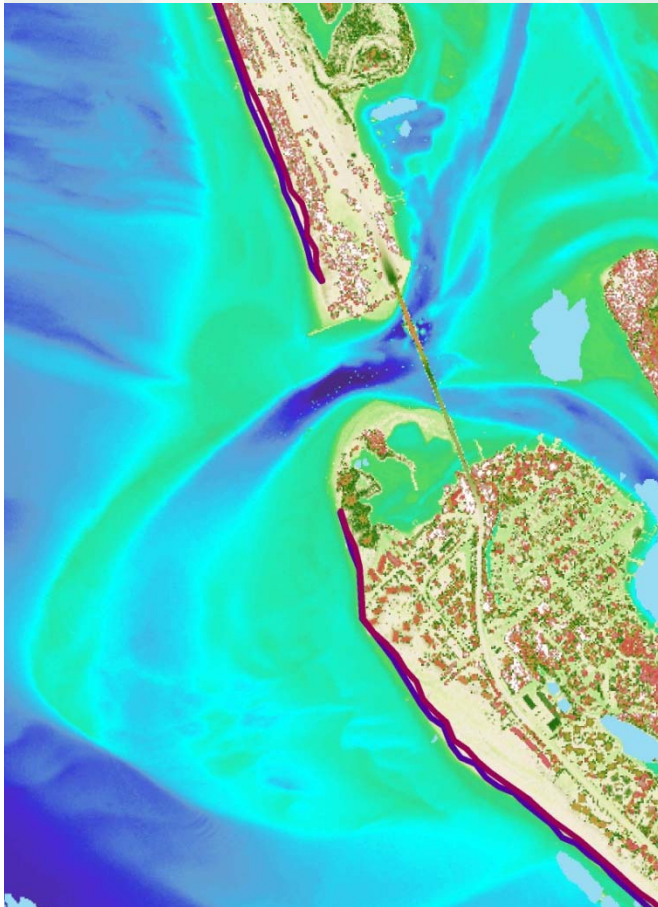
BUILDING STRONG®

1) What are the meaningful structure parameters? Ex.
Side slopes, rock size

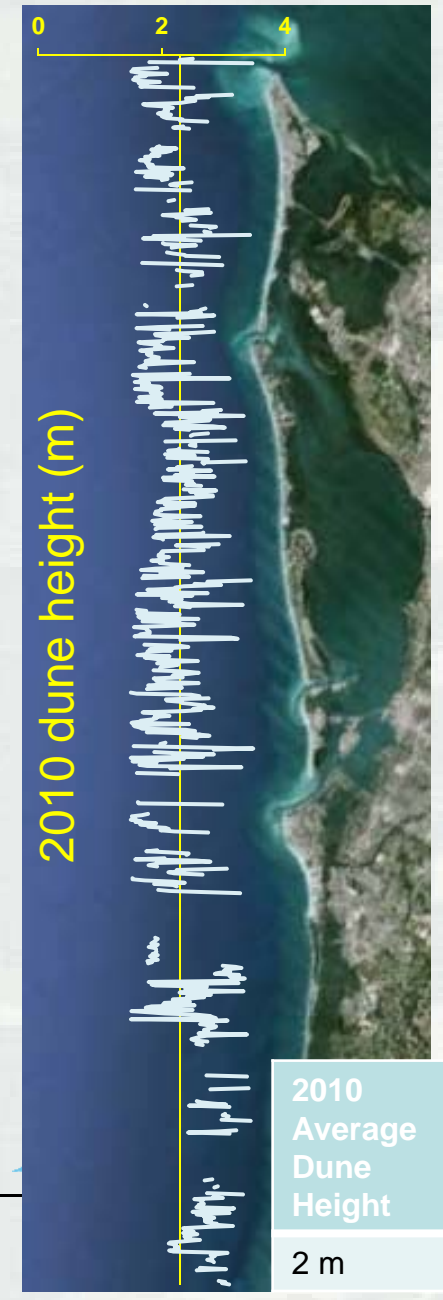


Dunes

- Provide natural buffer from waves/runup to upland areas
- Volume of sediment available for beach recovery
- Included as part of beach nourishment projects



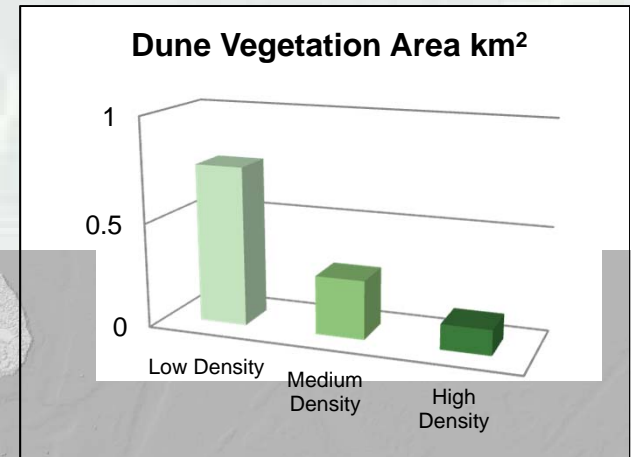
- Dune height – crest of the first dune
 - Dune toe – slope change in dune
- 1) *Dune footprints, or areal extent.*
 - 2) *Dune volume and change.*
 - 3) *Elevation/slope/curvature distributions within dune footprints*



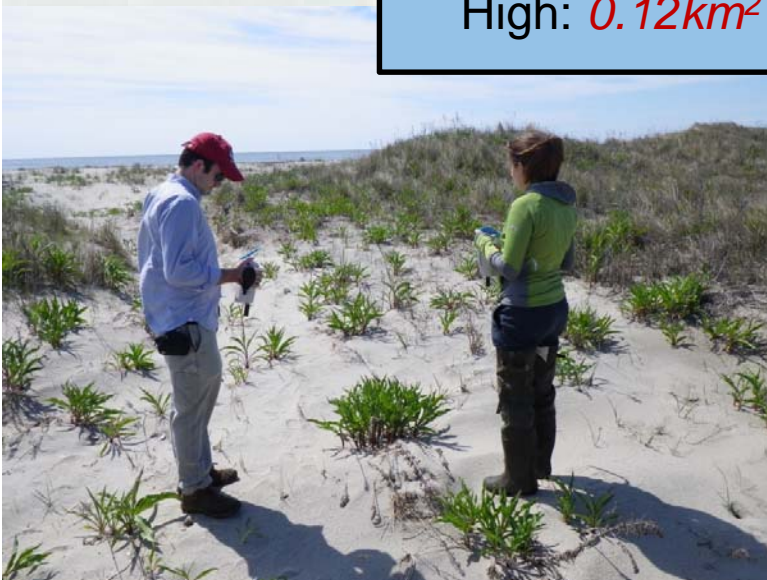
Dune Vegetation Density

- Helps stabilize dunes and reduces erosion by trapping sand
- Provide habitat for critical species, including TE species

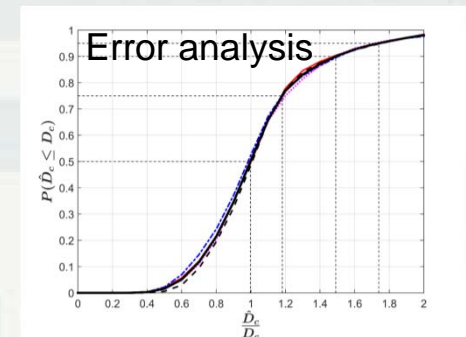
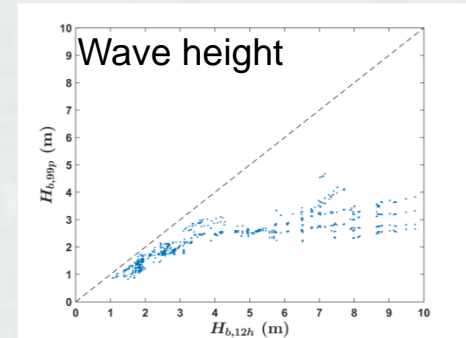
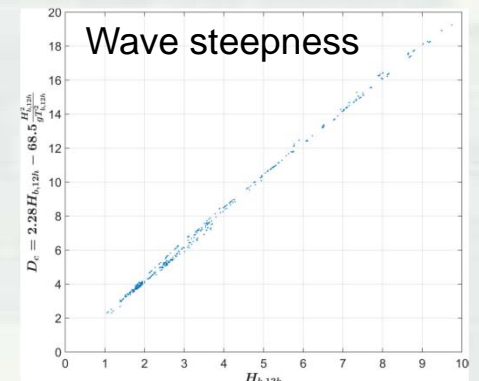
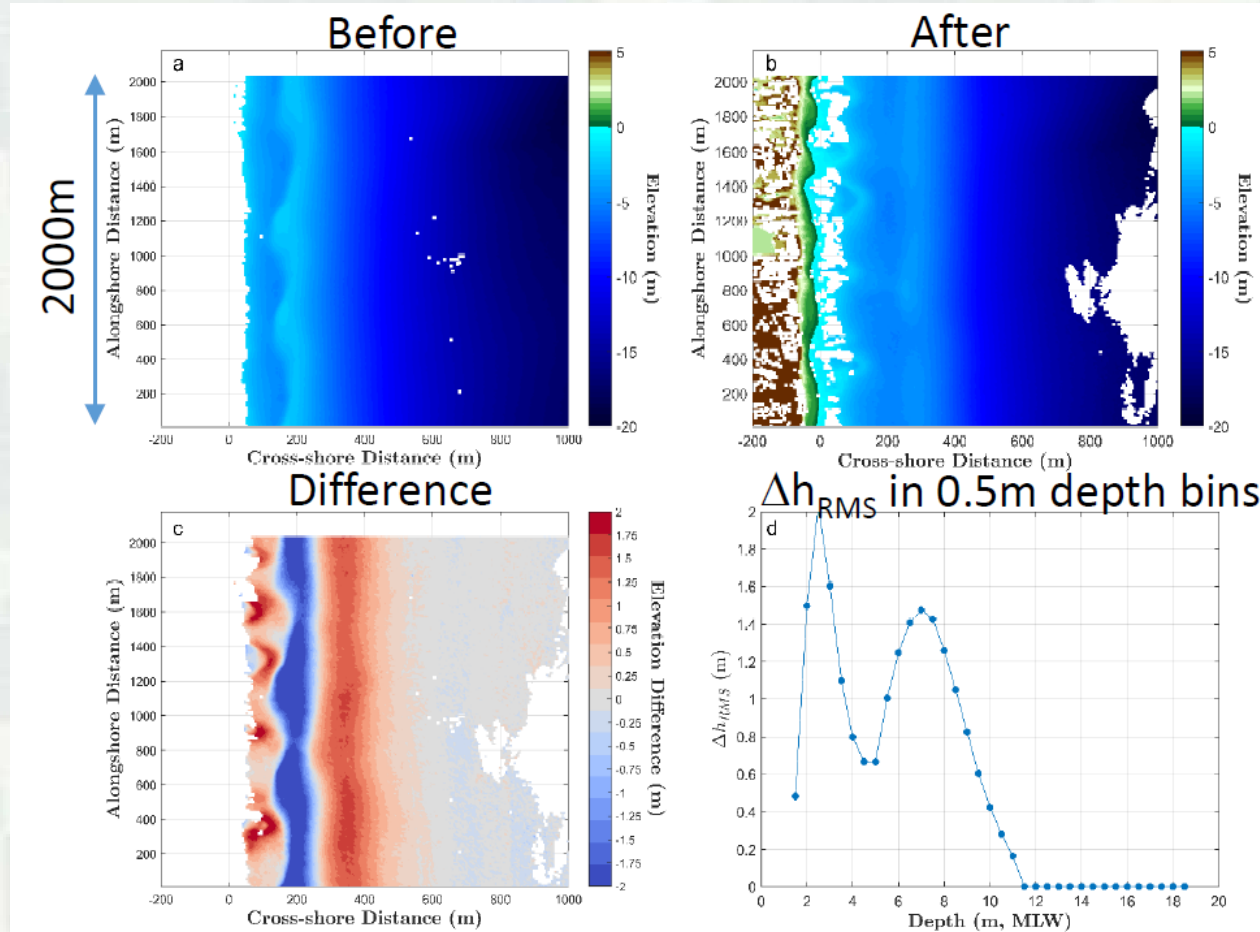
Dune Vegetation Density Area:
Low: 0.75km^2
Medium: 0.28km^2
High: 0.12km^2



- Extract vegetation within the dune field

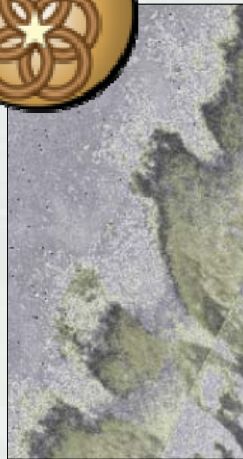


Depth of closure

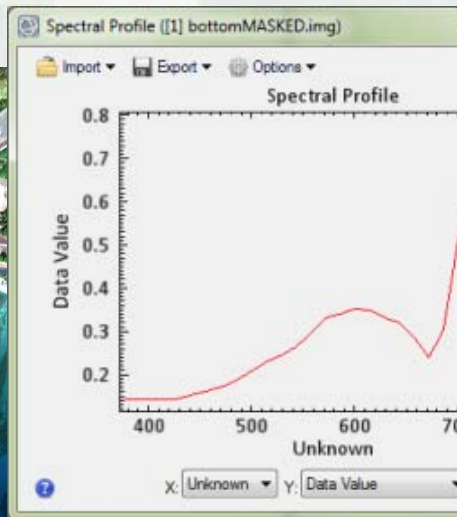
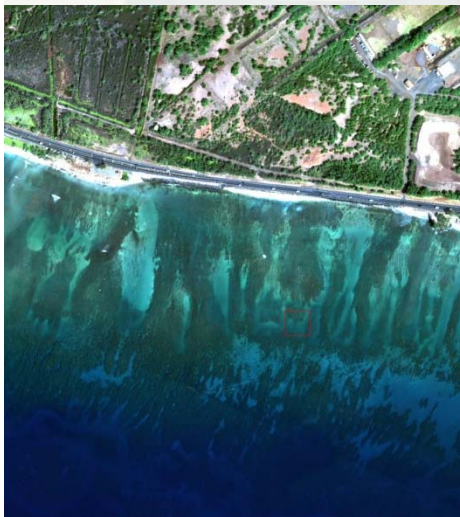
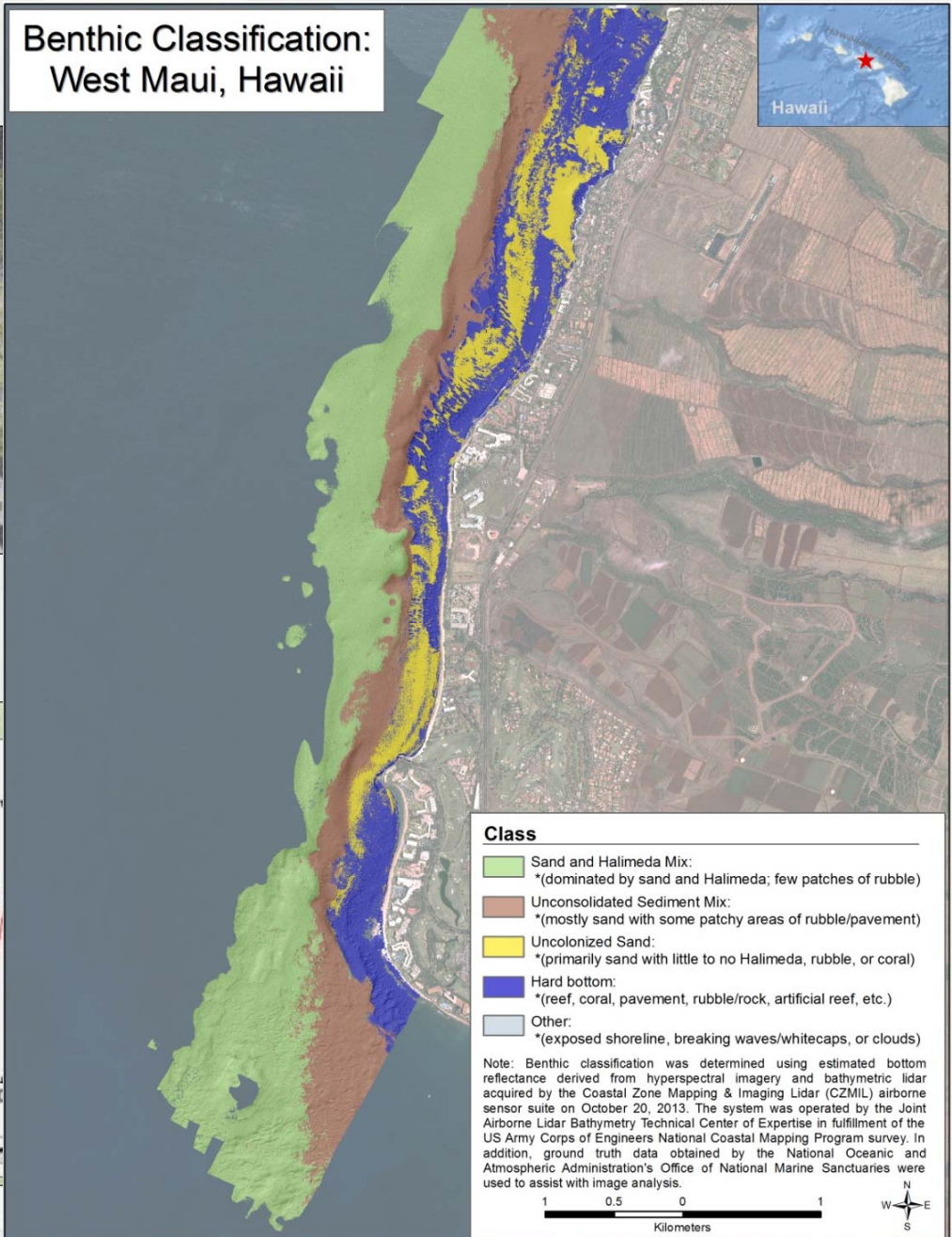


Benthic Habitat Mapping – West Maui, HI

- Estimate bottom reflectance from hyperspectral imagery and depth
- Apply NOAA's ground truth data to create regions of interest in a supervised classification approach to identify major bottom types



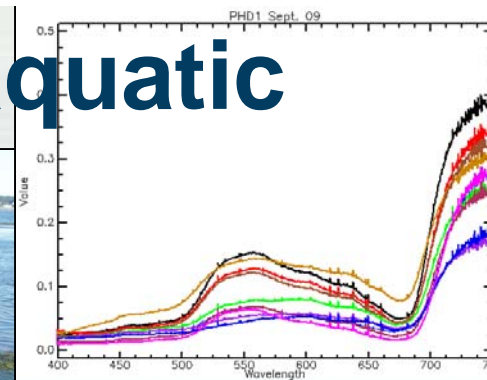
Benthic Classification:
West Maui, Hawaii



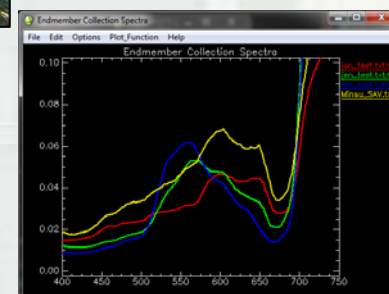
Discrimination of submerged aquatic vegetation species

Background: Dredging impacts to SAV vary by species; CWA lists SAV as a Special Aquatic Site. Mapping species is important for:

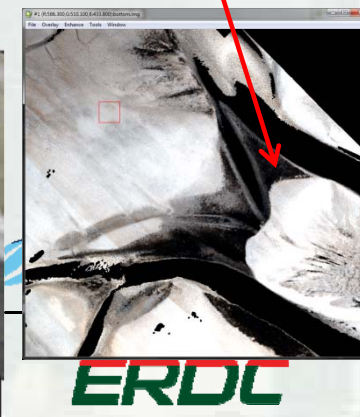
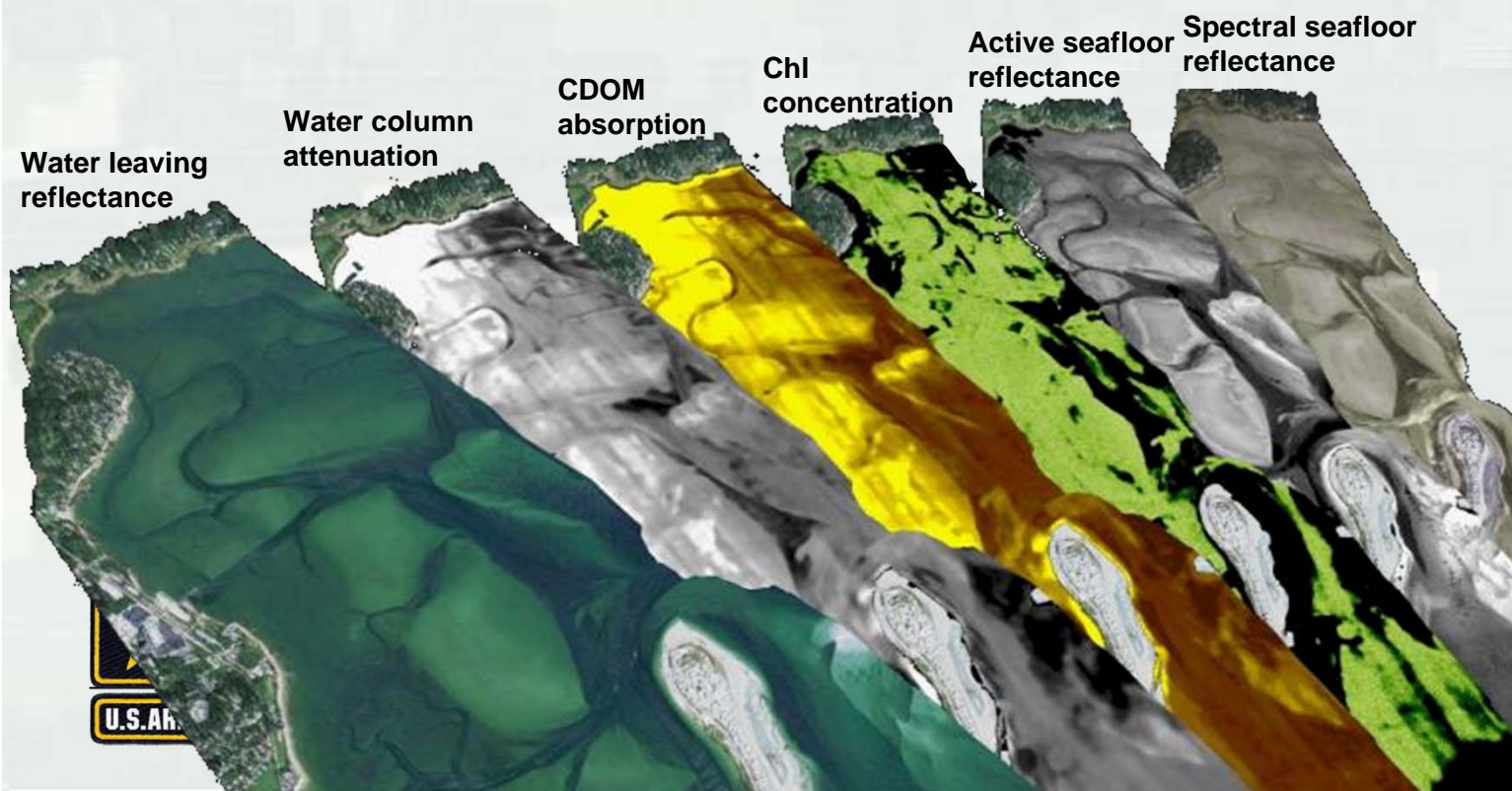
- Planning dredging operations
- Mitigating ecological damage
- Monitoring SAV



Submersed Eelgrass spectra,
Plymouth Harbor, MA



Seagrass



Questions?

- 1) *What shoreline is most meaningful?*
- 2) *Does selection of MHW for volumes matter?*
- 3) *What are the meaningful structure parameters? Ex. Side slopes, rock size*
- 4) *Potential new products:*
 - *Dune footprints, or areal extent.*
 - *Dune volume and change.*
 - *Elevation/slope/curvature distributions within dune footprints.*
 - *Benthic classification: sand, seagrass, hardbottom.*
 - *Depth of closure*

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