

USACE Post-Matthew Survey Operations, Mapping Products and Services

Charlene Sylvester

Physical Scientist

Mobile District / JALBTCX Operations

NC GICC Federal Interagency Committee Meeting

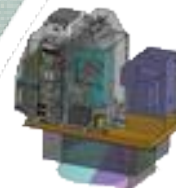
Wilmington, NC

26 January 2017

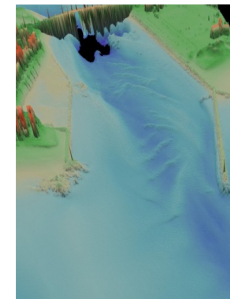
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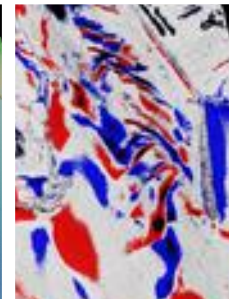
Joint Airborne Lidar Bathymetry Technical Center of Expertise



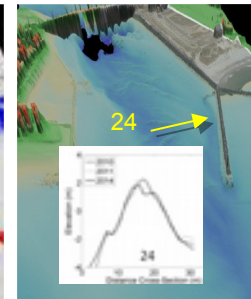
RESEARCH &
DEVELOPMENT



OPERATIONS &
MAINTENANCE



REGIONAL SEDIMENT
MANAGEMENT



ASSET MANAGEMENT





Agenda



BUILDING STRONG

- JALBTCX and the USACE National Coastal Mapping Program (NCMP)
- Post-Matthew operations overview
- Rapid response lidar products
- Data products for emergency response
- 2017 NCMP planning and coordination

Joint Airborne Lidar Bathymetry Technical Center of Expertise

Director: Jennifer Wozencraft



Annual Technical Workshop, June or July 2017
Myrtle Beach, Charleston or Wilmington - TBD



Logos include: Optech, Spatial Data, US Army Corps of Engineers, ONR, CBI, Kona Beach Air Ltd., Dynamic Aviation, USGS, NOAA, Virginia Tech, FUGRO, AHAB, University of Notre Dame, Magnolia Flyer, Texas A&M University, University of New Hampshire, Geomatics Data Solutions, and others.

National Coastal Mapping Program Goals

- Develop regional, repetitive, high-resolution, high-accuracy elevation and imagery data
- Build an understanding of how the coastal zone is changing
- Facilitate management of sediment and projects at a regional, or watershed scale

NAVD83 Elevation (m)



Topo (500 m)



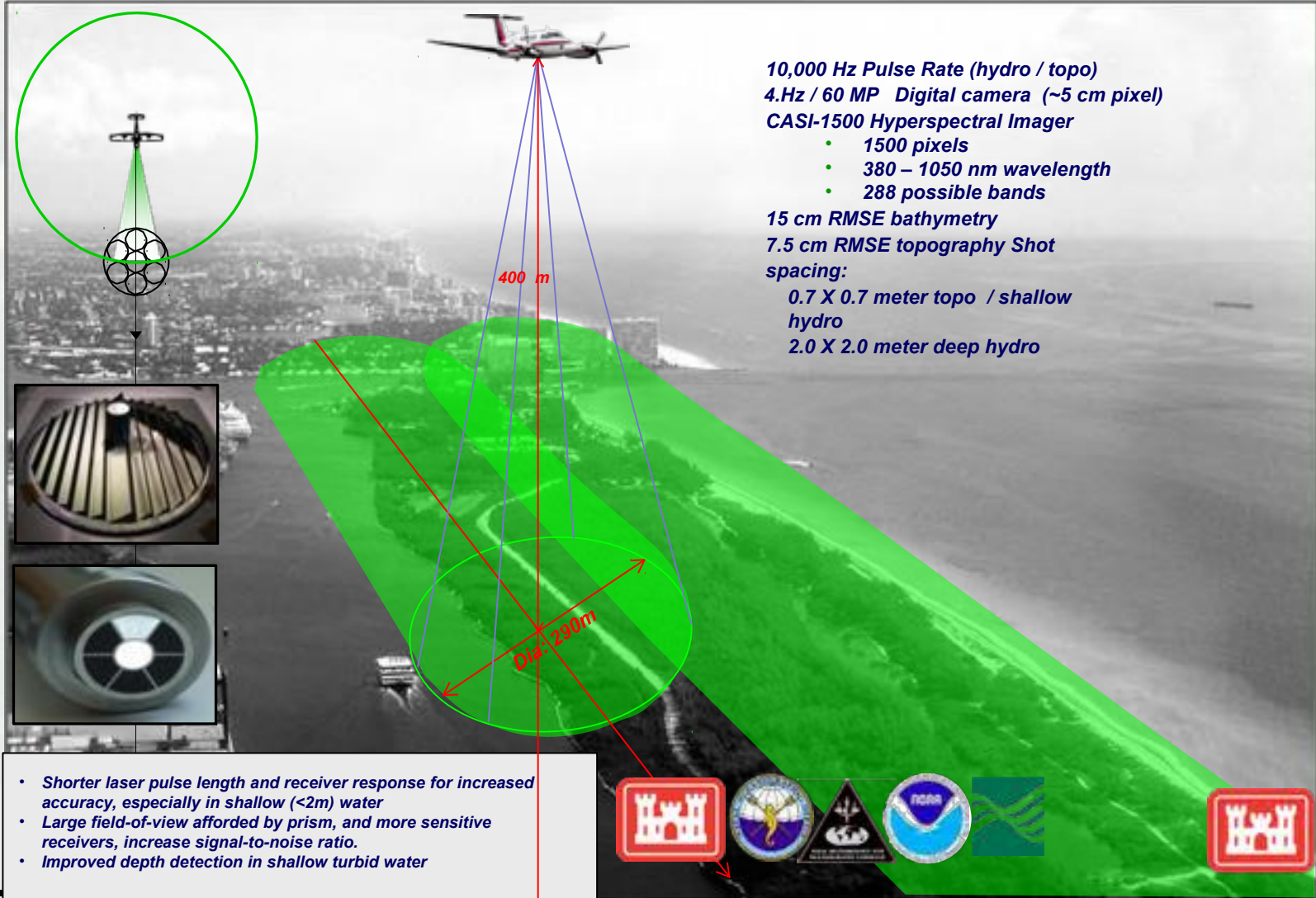


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Coastal Zone Mapping and Imaging Lidar



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- 10,000 Hz Pulse Rate (hydro / topo)
- 4.Hz / 60 MP Digital camera (~5 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

- 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

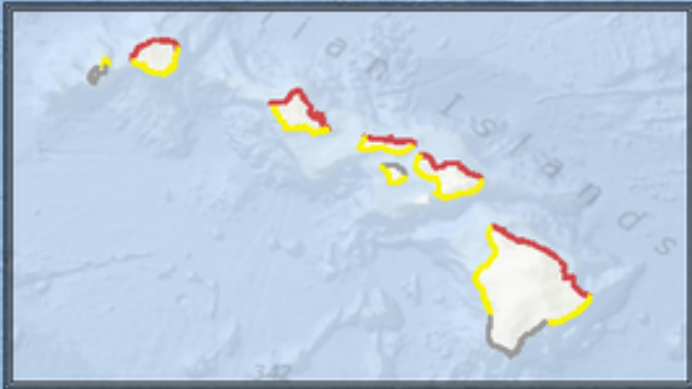


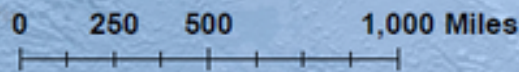
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0 250 500 1,000 Miles

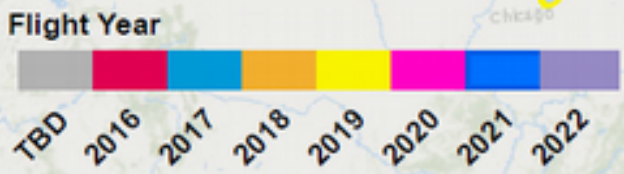


National Coastal Mapping Progress





Future National Coastal Mapping Flights



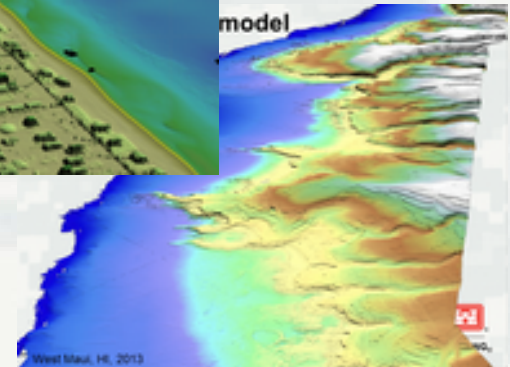
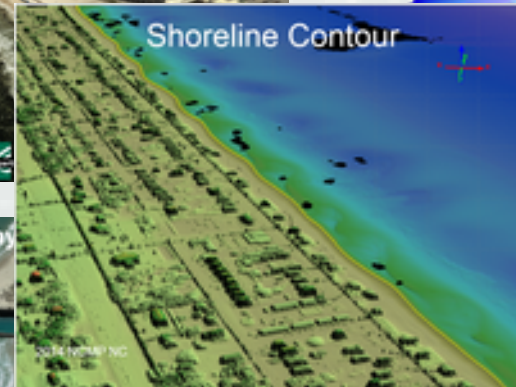
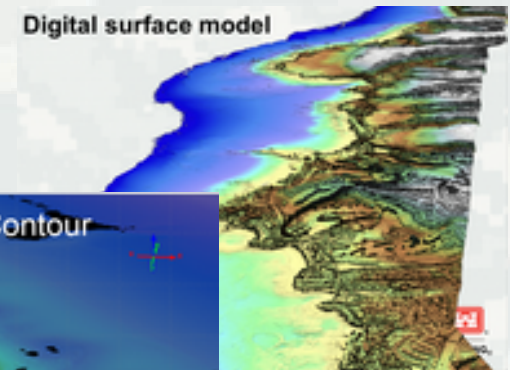
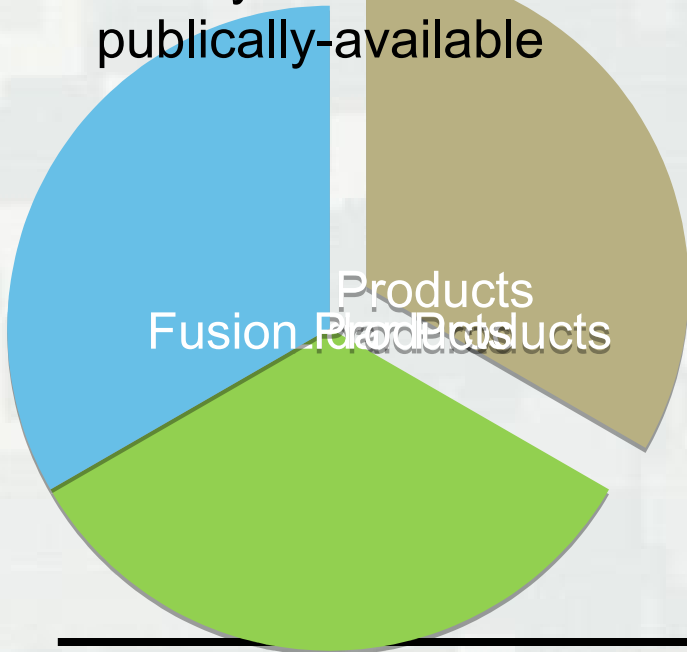


Basic NCMP Data Products



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- Standard product suite
- Born in 2004 and have evolved since
- Workflows promote ease of use and re-use
- Widely disseminated and publically-available





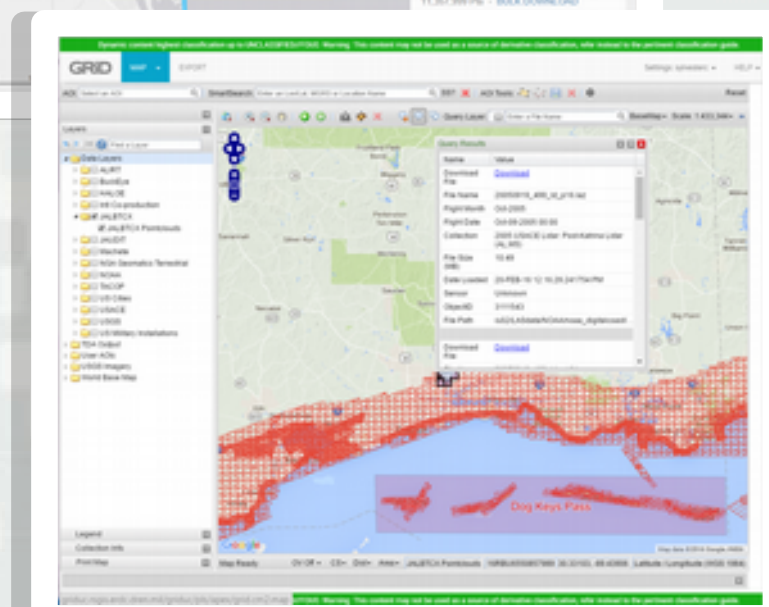
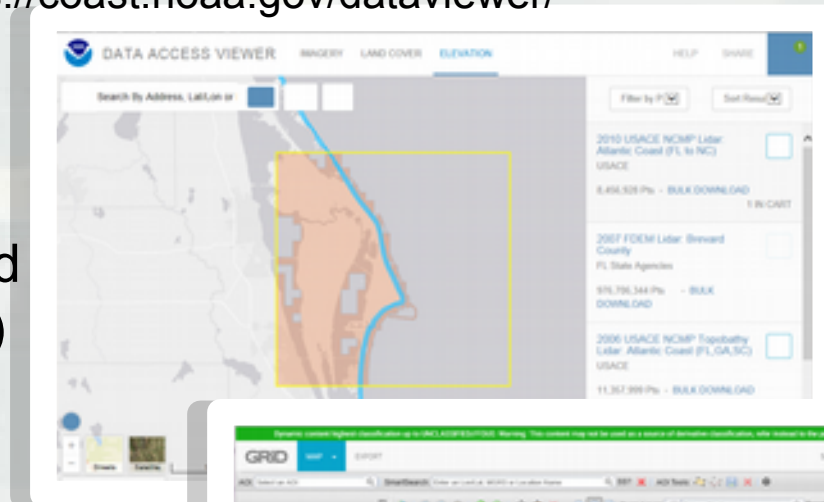
NCMP Data Access



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<https://coast.noaa.gov/dataviewer/>

- USACE District Office
- USACE Geospatial Repository and Data Management System (GRiD)
- NOAA OCM (Digital Coast) and NCEI (Boulder)
- USGS St. Petersburg, FL and Sioux Falls, SD
- By request to jalbtcx@usace.army.mil



<https://griduc.rsgis.ercd.dren.mil/griduc/corpsmap/>



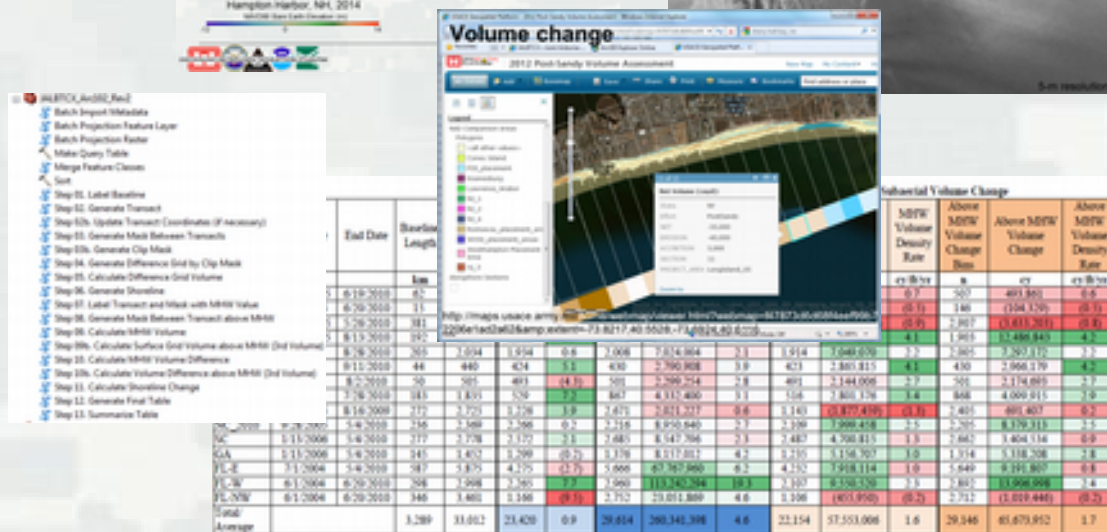
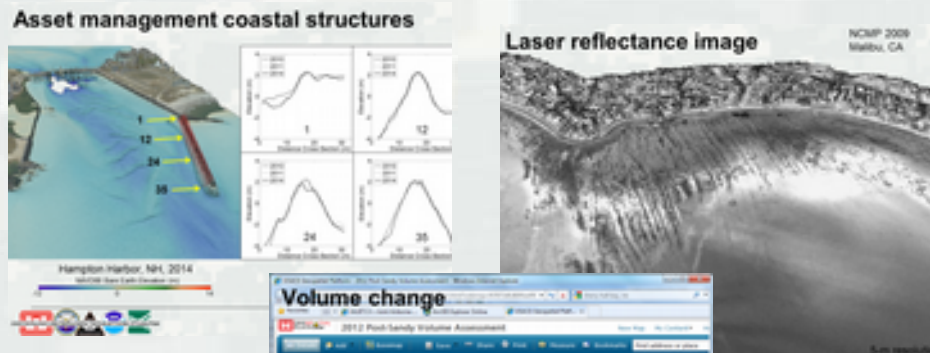
Advanced Lidar Products



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- Extraction of metrics for beach characterization and development of regional coastal engineering indices
- Piloted 2012, 'Beta' release 2016

Leveraging ERDC R&D Expertise



Fusion Products
and Lidar Products

- ❖ Dune height
- ❖ Beach width
- ❖ Shoreline change
- ❖ Volume change



Fusion Data Products



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- Fusion of lidar-derived metrics with spectral information for habitat characterization and monitoring, and critical species detection and modeling

Leveraging ERDC R&D Expertise



Submerged aquatic vegetation

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

Water column attenuation, CWA elements, Active surface, Spectral surface reflectance, SAV species, SAV species

DOER – DIG – DOTS FY16 Mid-Year IPRs

Critical Habitat Modeling of Physical Parameters for Endangered Sea Turtle Nesting Habitat

Lauren Dunkin

- The *C. caretta* nesting habitat suitability model will provide an information tool to better communicate management priorities, evaluate management strategies, and provide decision-support for USACE operations/planning activities.

Shore, Beach Width, Dune Elevation, Dune Peak

Nesting Suitability

ERDC

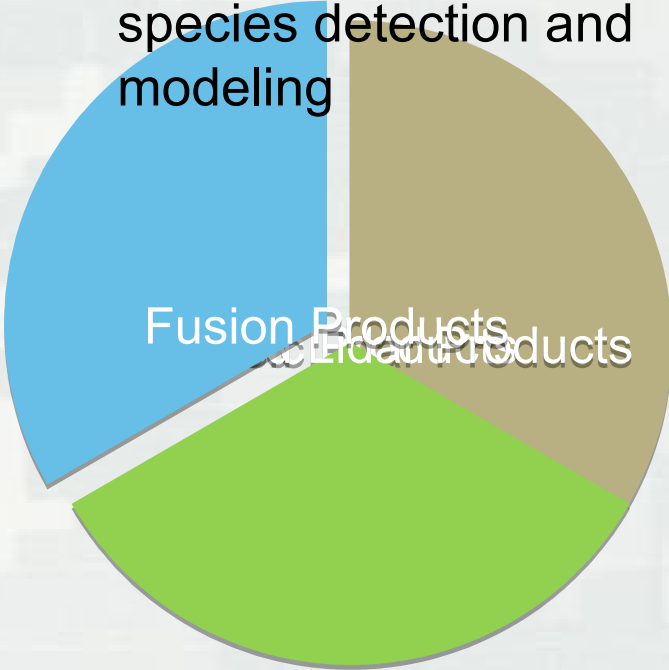
Dune Vegetation Density

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

Dune Vegetation Area tool

Dune Vegetation Density Area:
 Low: 0.75km²
 Medium: 0.28km²
 High: 0.12km²

Extract vegetation within the dune field



- ❖ Dune vegetation
- ❖ Land cover
- ❖ SAV
- ❖ Water quality indicators



2016 NCMP Operations



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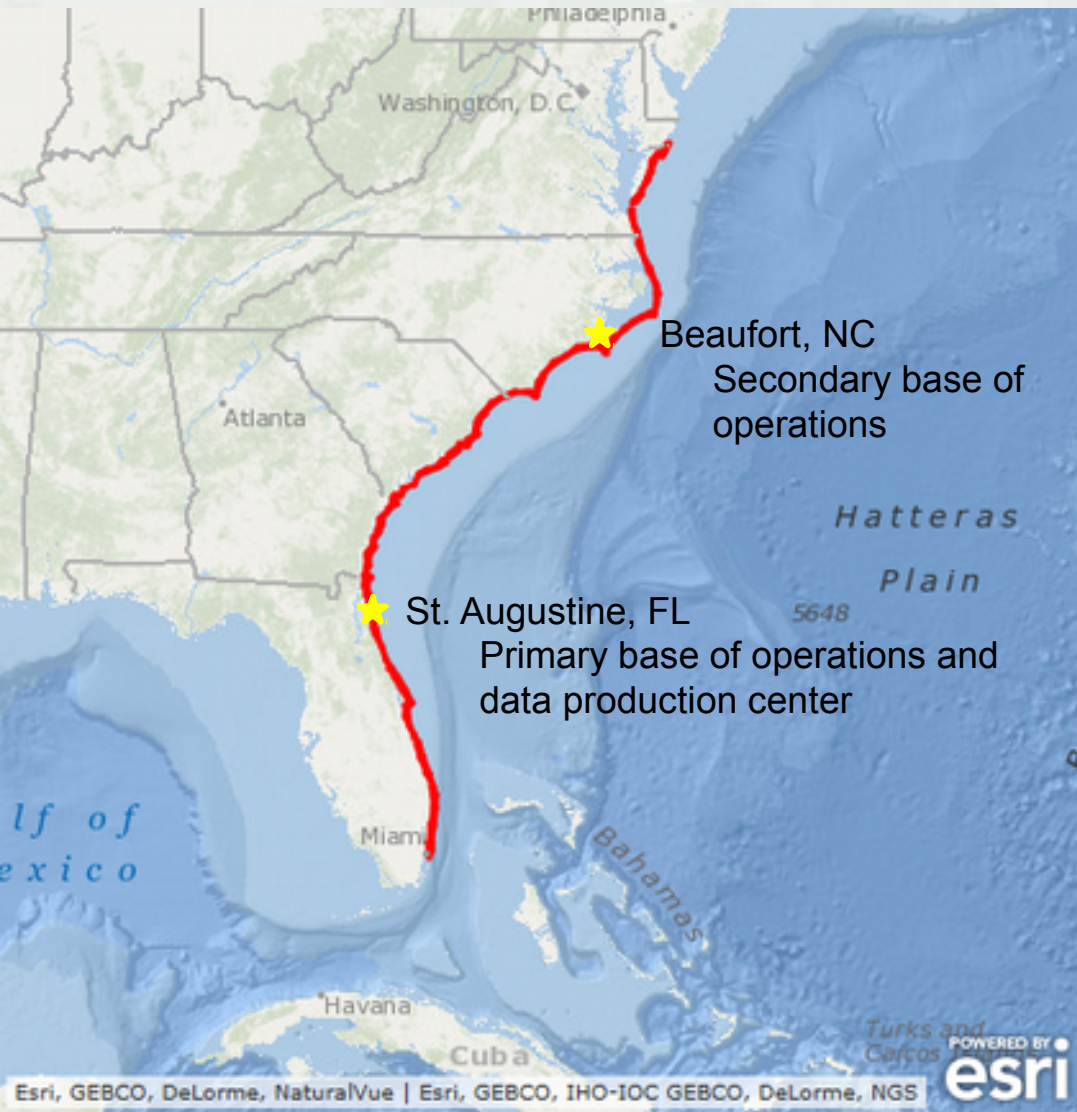




2016 Post-Matthew Operations Overview



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Key Biscayne, FL to VA/MD Border

- Dual aircraft operations
- 991 flight lines
- 27 Oct – 2 Dec
- 36 days
- 76 flights

- 4 ground-truth teams (USGS)

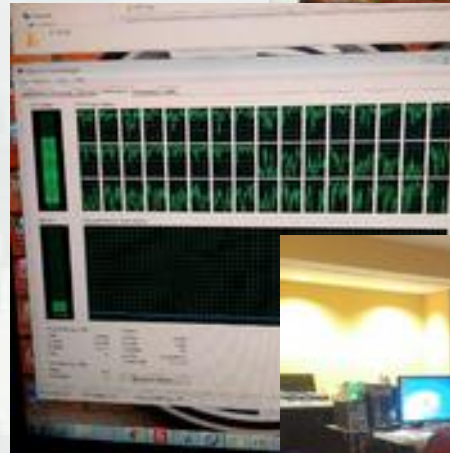
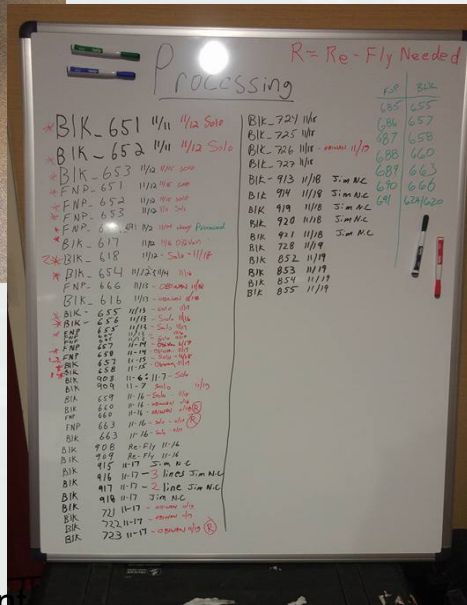
- 24-hr field office
- Rapid-response data product deliveries
- Advanced lidar products for emergency response



Post-Matthew Operations and Production Center – St. Augustine, FL



10-hr equipment mobilization from Kiln, MS



7 – 20 people / 24-hr ops



Mob: 27 Oct
De-mob: 17 Dec

- 12 workstations
- 24 monitors
- 2 field support boxes
- Networking equipment
- 4 GPS base stations

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Post-Matthew Survey Control



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- GNSS base every 30 km
- NGS monuments in the 2011 adjustment
- Secure location (i.e. airport)
- 3 occupations to establish coordinates
- All occupations processed and verified in Opus Projects

OPUS Projects - Manage "2016HurricaneMatthew"
National Geodetic Survey

NGS Home About NGS Data & Imagery Tools Surveys Science & Education Search

Results From ALL OPUS SOLUTIONS

Controls

MARKS: ● meet preferences ● do not meet preferences ● are not included ● have error
CORS: ● meet preferences ● do not meet preferences ● are not included
Baselines: —

Map Satellite

Map showing survey points in North and South Carolina.

MARKS

- aa18
- ab39
- ad78
- ad91
- ai09
- aj45
- aj52
- ak06
- ak30
- aq09
- aq26
- br12
- ck27
- cs99

CORS

- al20
- brtw
- ccv5
- ccv6
- ded2
- demi
- dind

Map data ©2017 Google, INEGI 50 km Terms of Use



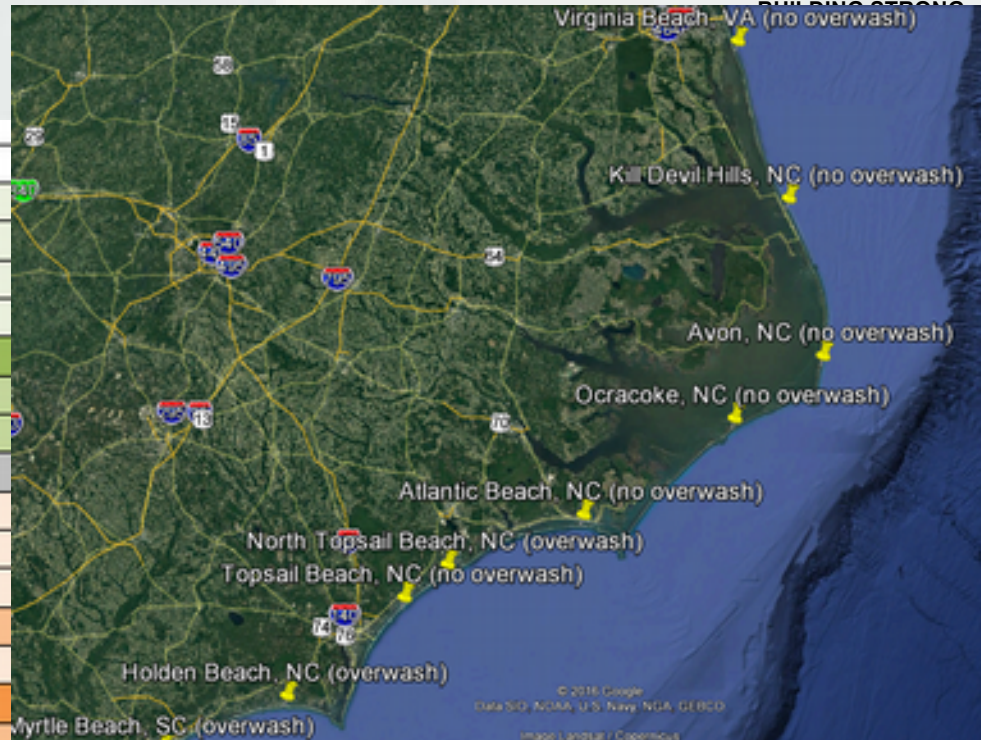
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Post-Matthew Ground Truth Locations



Ground-truth data acquired by USGS, a JALBTCX partner

Longitude	Latitude	Location	State
-80.07566773060	26.31310308590	Deerfield Beach	FL
-80.09284778300	27.01430013400	Jupiter Isl	FL
-80.36767394000	27.69254016400	Indian River Shores	FL
-80.60569005000	28.27613202000	Cocoa Beach	FL
-80.74604795100	28.81063976670	Canaveral	FL
-81.13955668210	29.50628632610	Flagler Beach	FL
-81.35589437440	30.16215084960	Ponte Vedra Beach	FL
-81.43145400000	31.01100300000	Jekyll Island***	GA
-81.34169300000	31.18519800000	Sea Isl	GA
-80.84668300000	31.99078700000	Tybee Isl	GA
-80.67970500000	32.20760600000	Hilton Head Island	SC
-80.31385343800	32.49082791500	Edisto Beach	SC
-79.71812565000	32.81674940000	Isle of Palms	SC
-79.15621900000	33.34343600000	Debidue Isl	SC
-78.90458631200	33.66921707900	Myrtle Beach	SC
-78.25914619190	33.91407399730	Holden Beach	NC
-77.65895144000	34.34171256000	Topsail Beach	NC
-77.43809852380	34.48360742470	North Topsail Beach	NC
-76.73935686000	34.69733911000	Atlantic Beach	NC
-75.95963460000	35.10261714000	Ocracoke	NC
-75.49778956990	35.36327878790	Avon	NC
-75.66751730080	36.03039443430	Kill Devil Hills	NC
-75.92661182240	36.70070609310	Virginia Beach	VA
-75.77991902330	37.29622988970	Cobb Island	VA
-75.37830423000	37.85356672000	Sthrn Assateague Isl	VA



yes			District 8	13
yes			Brunswick	14
no			Pender	15
yes			Onslow	16
no			Carteret	17
no		Ferry?	Carteret	18
no	Cape Hatteras NS		Dare	19
no			Dare	20
no			Virginia Dare	21
no		Checking: VIMS	Eastern Shore	22
no			Eastern Shore	23

Cell Phones These locations are approximate; adjust to be within 500m of waterline for use as control for lidar survey.

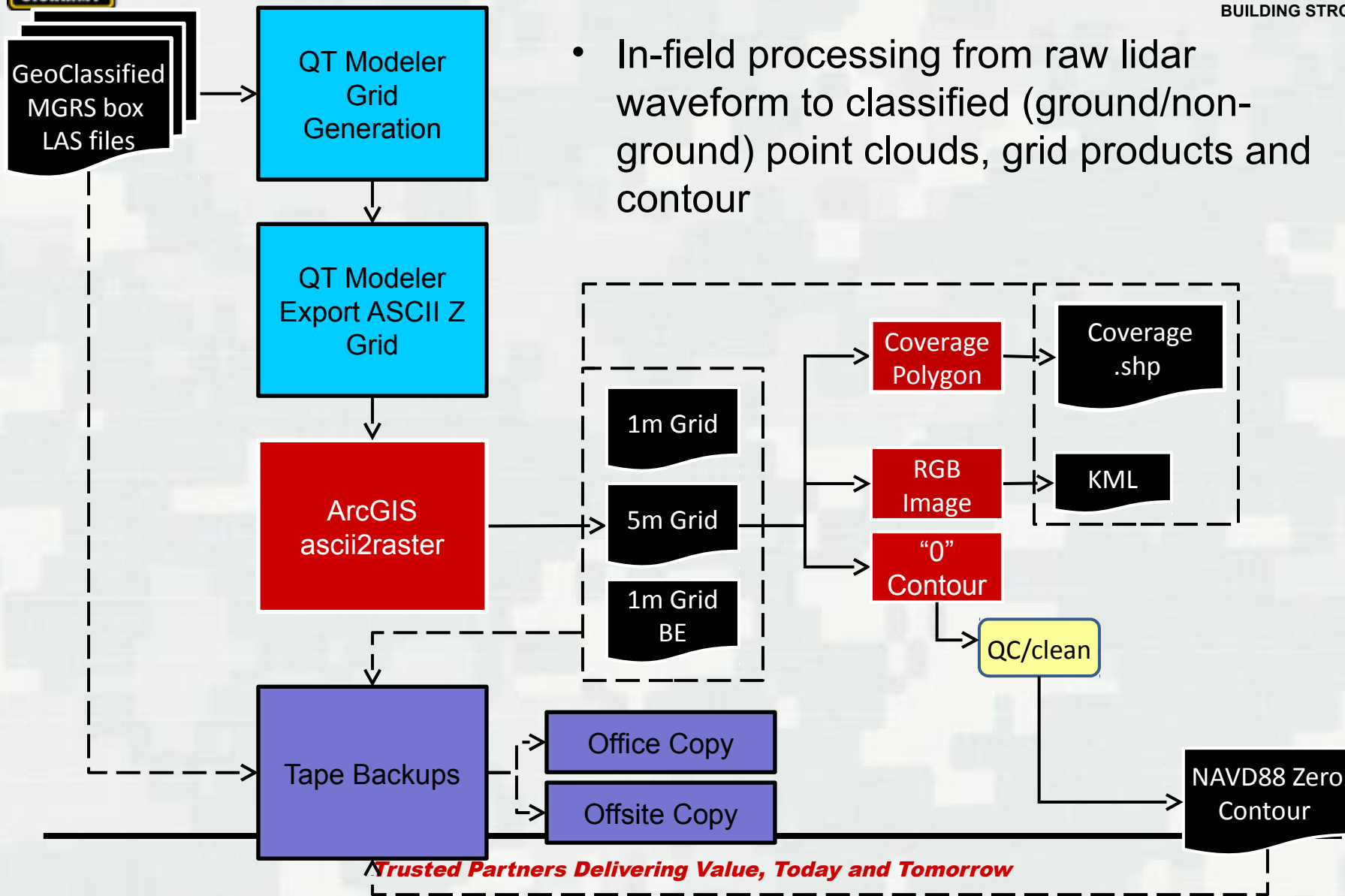


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Workflow for Rapid Response Lidar Products

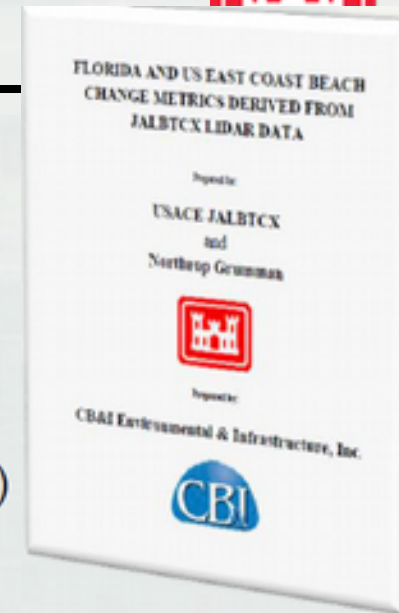


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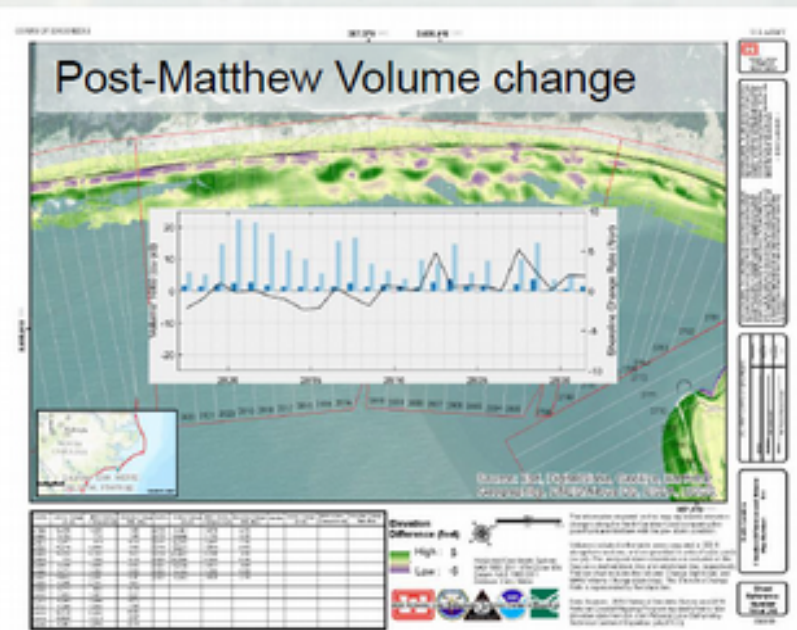




Advanced Lidar Products for Emergency Response



- **Operations:** provide streamlined method to generate volume/shoreline change datasets on a regional scale
- **Planning:** generate map products that can be used to communicate between agency partners to identify priority areas that would benefit from beneficially using sediment
- **R&D:** provide input for SBAS (Sediment Budget Analysis System)
- **Post-Storm:** Hurricane Matthew emergency response – volume change analysis for FL, GA, SC, NC, & VA



East Coast Volume Change (2005 – 2010)

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





Post-Matthew Data Production Status Map



JG STRONG

Home ▾ JALBTCX 2016 Post Matthew Production Status - Viewer New Map ▾ Create Presentation Charlene ▾

Details Add ▾ Basemap Analysis Share Directions Find address or place

Legend

2016_PostMatthew_Status

- Processed
- Edited
- Classified
- Products Delivered
- Volumes Delivered
- Other

Strength of predominance

- > 8
- < 4

<http://arcg.is/2kqc0h9>

- DEM and shoreline deliveries completed for FL, GA, SC and VA
- NC completion end February
- Imagery and volume change work on-going

Flight Block Status

STATE	NC
COUNTY	New Hanover County
Flight Block Name	nc_blk_905
Date Flown	20161030
Processed	20161103
Edited	20161106
Classified	20161108
Products Developed	20161112
Volumes Delivered	20161201

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Post Matthew

with Web AppBuilder for ArcGIS

Esri World Geocoder

Legend

JALBTCX_NCMP_Post_Matthew_Volumes - PostMatthewVolumes

- Complete
- In Progress

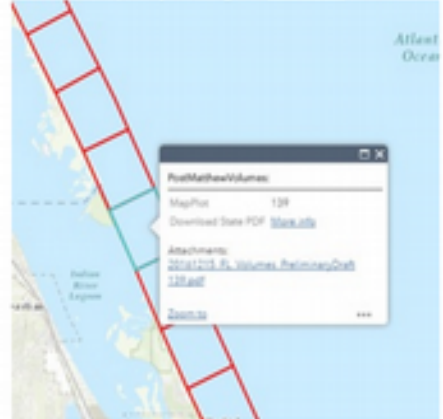
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If you wish download multiple boxes, click the select arrow, then on the Select pulldown choose either Rectangle or Polygon.

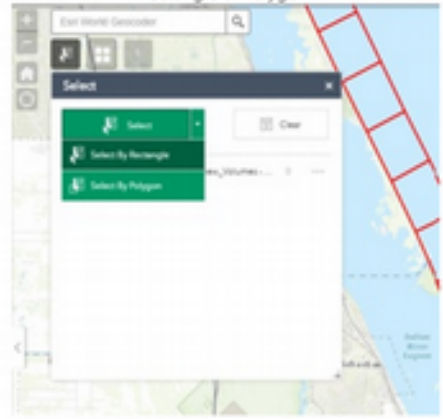
Draw your area of interest on the map to select multiple boxes. This will open a results window that lists the

Post-Matthew Volume Change Viewer

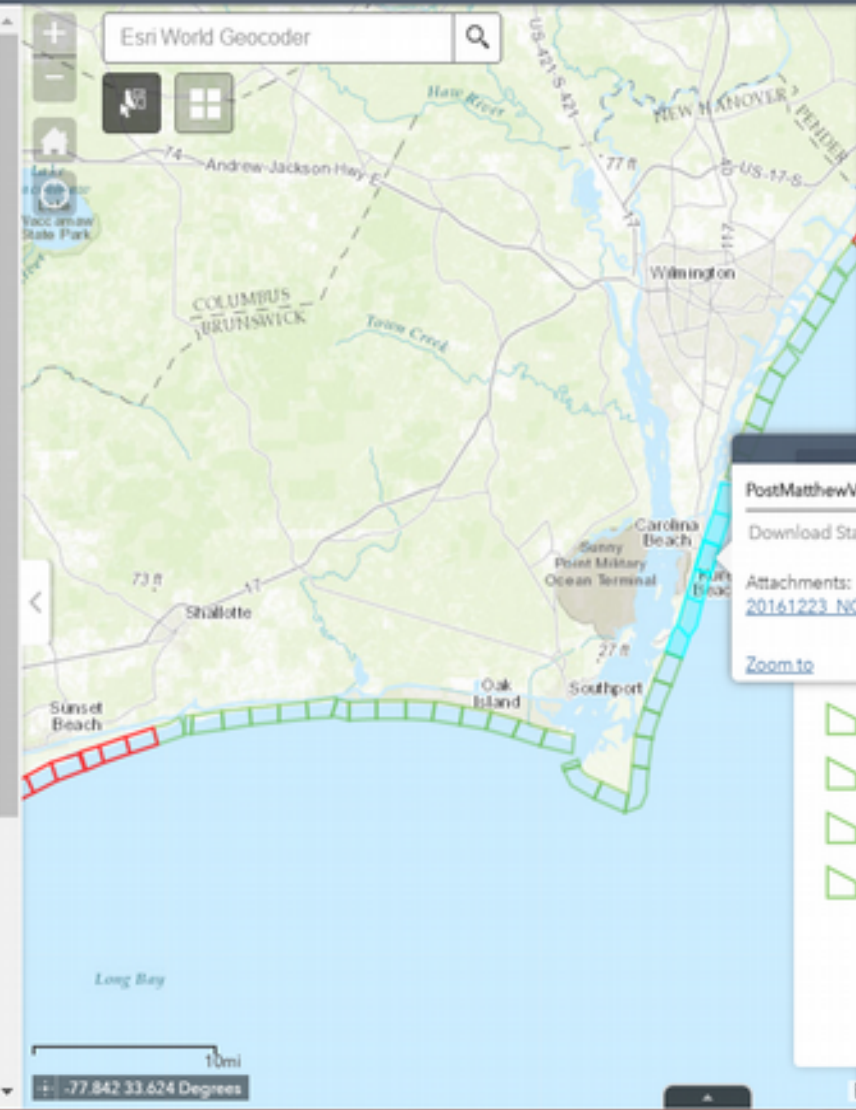
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Draw your area of interest on the map to select multiple boxes. This will open a results window that lists the



Legend

- JALBTCX_NCMP_Post_Matthew_Volumes - PostMatthewVolumes
- ▭ Complete
 - ▭ In Progress

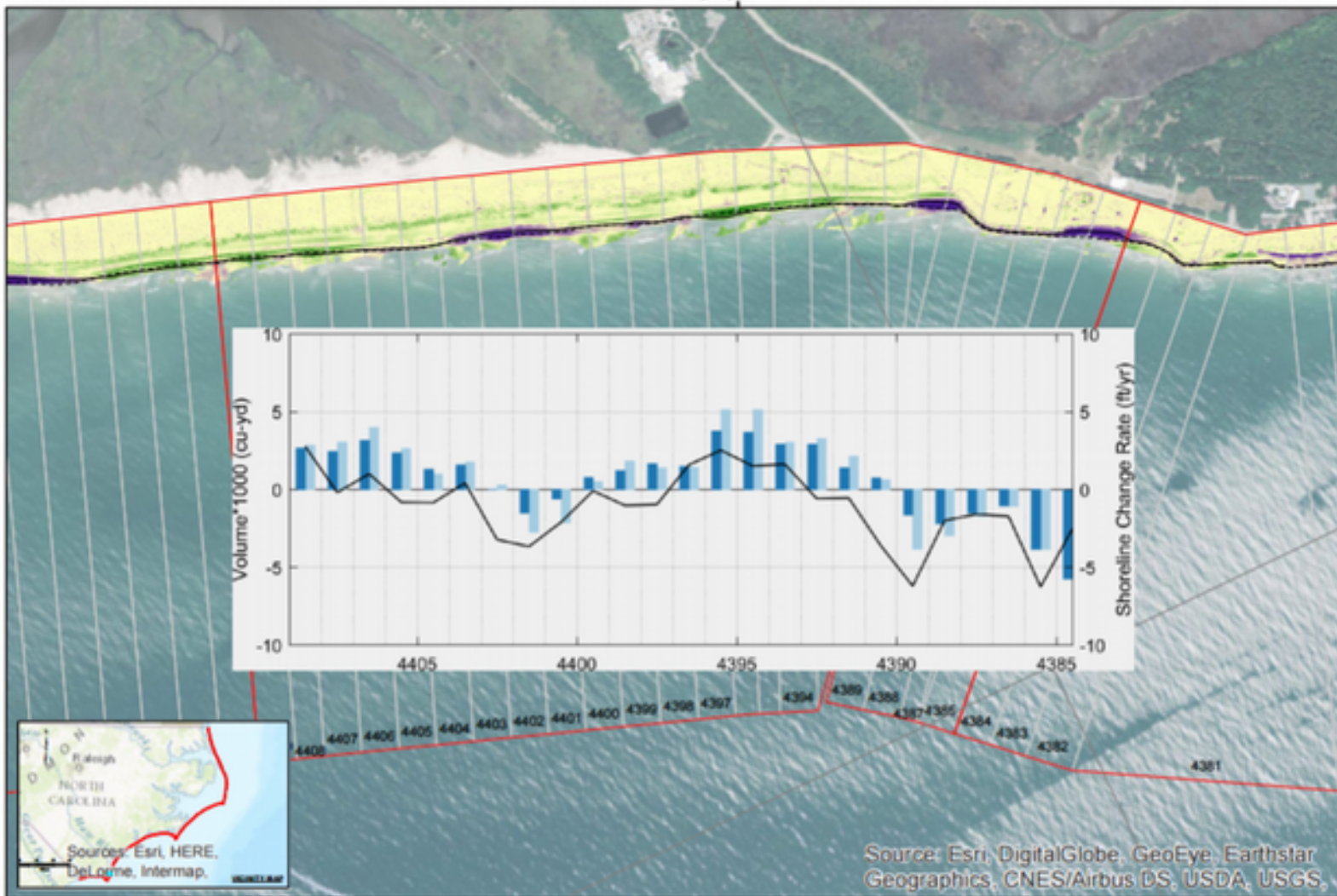
PostMatthewVolumes: NC_177

Download State PDF [More info](#)

Attachments:
[20161223_NC_Volumes_Draft177.pdf](#)

[Zoom to](#)

- ▭ NC_177
- ▭ NC_178
- ▭ NC_179
- ▭ NC_180



DISCLAIMER: The data presented on this map represents the results of a data analysis performed by the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX) for the U.S. Army Corps of Engineers. The data was collected by the U.S. Army Corps of Engineers and is provided for informational purposes only. The data is not intended for use in any other manner. The data is not a warranty, representation, or endorsement of any product or service. The data is provided as is and the user assumes all liability for its use. © 2014 U.S. Army Corps of Engineers. All rights reserved.

Notes: The information depicted on this map represents elevation changes along the North Carolina Coast comparing the post-Hurricane Matthew with the pre-storm condition. Volumes included in the table were computed in 300-ft alongshore sections, and are provided in units of cubic yards (cu-yd). Pre- and post-storm shorelines are indicated on the map as a dashed black line and solid black line, respectively. The bar chart includes the Volume Change (light blue) and MBW Volume Change (dark blue). The Shoreline Change Rate is represented by the black line.

DATE	PROJECT	SCALE	STATUS

North Carolina
Elevation Difference and Volume MBW
Map Number:

Sheet Reference Number 180 of 210



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, ...

Section	Volume Change (cu-yd)	MBW Volume Change (cu-yd)	Shoreline Change Rate (ft/yr)	Section	Volume Change (cu-yd)	MBW Volume Change (cu-yd)	Shoreline Change Rate (ft/yr)
4,385	-0.980	-0.755	-2.31	4,401	-2.116	-505	-2.15
4,386	-3.843	-3.851	-6.27	4,402	-2.750	-1,494	-3.57
4,387	-1.085	-1,046	-1.73	4,403	288	4	-3.23
4,388	-1.735	-1,493	-1.80	4,404	1,773	1,568	0.41
4,389	-2,961	-2,579	-2.50	4,405	1,565	1,207	2.36
4,390	-3,827	-1,842	-5.71	4,406	2,836	1,708	-0.52
4,391	415	701	-3.61	4,407	4,003	3,163	1.50
4,392	2,145	1,361	-0.55	4,408	3,010	2,450	-0.20
4,393	3,281	2,905	-2.80	4,409	2,863	2,071	2.76
4,394	3,038	2,909	1.62				
4,395	5,127	3,084	1.82				
4,396	6,124	3,799	2.52				
4,397	1,216	1,024	1.08				
4,398	1,379	1,056	-0.97				
4,399	1,354	1,217	-1.33				
4,400	490	782	-6.10				
4,401	-2,116	-326	-0.11				

Elevation Difference (feet)
High : 5
Low : -5

Horizontal Coordinate System:
NAD 1983 2011 UTM Zone 18N
Datum: NAD 1983 2011
Distance Units: Meter



The information depicted on this map represents elevation changes along the North Carolina Coast comparing the post-Hurricane Matthew with the pre-storm condition. Volumes included in the table were computed in 300-ft alongshore sections, and are provided in units of cubic yards (cu-yd). Pre- and post-storm shorelines are indicated on the map as a dashed black line and solid black line, respectively. The bar chart includes the Volume Change (light blue) and MBW Volume Change (dark blue). The Shoreline Change Rate is represented by the black line.

Data Sources: 2014 National Geodetic Survey and 2016 National Coastal Mapping Program Topobathymetric Lidar elevation data from the Joint Airborne Lidar Bathymetry Technical Center of Expertise (JALBTCX).



- May – Oct
- GA through Long Island
- Seeking opportunities for coordination

2017 NCMP Planning

Data Layers My Plans Participate

Data Layers Basemap Legend & Ordering

Search layers by name or keyword

Planned (Funded) and Ongoing Mapping Projects

- Topographic Lidar
- Topobathymetric Lidar
 - NOAA
 - USACE
 - Great Lakes
 - JALBTCX Planned and Ongoing Topobathymetric Lidar
 - The USACE National Coastal Mapping Program (NCMP) acquires high-resolution topographic/bathymetric lidar elevation and imagery on a recurring basis along the sandy shorelines of the US. The typical survey footprint includes an approximately 1-mile wide swath of topography, bathymetry, and imagery 500 m onshore and 1000 m offshore. Planned survey areas and timelines provided in this service are based on the 5-year NCMP update cycle, which follows counter-clockwise along the US West Coast, Gulf Coast, East Coast and Great Lakes. Surveys to support USACE project-specific missions and external partners beyond the standard NCMP footprint are included constituent to requests from project managers. This survey work is coordinated with Federal mapping partners through the Interagency Working Group on Ocean and Coastal Mapping and the 3D Elevation Program.
 - JALBTCX/JALBTCX_NCMP_Acquisition_Status
 - USACE In Progress Lidar
 - USACE Planned Lidar



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Thank you!

charlene.s.sylvester@usace.army.mil

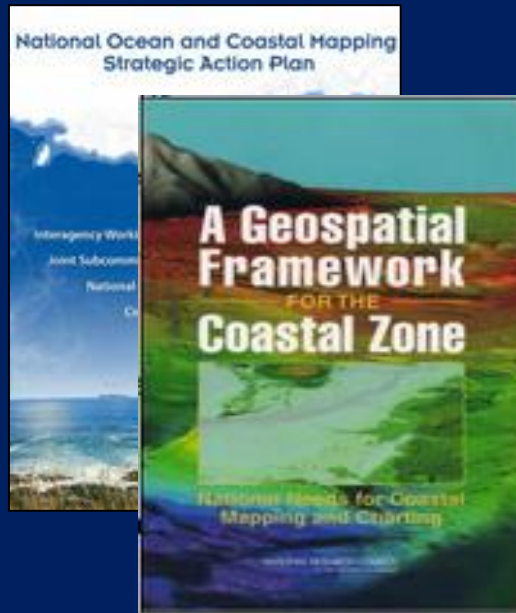
The Interagency Working Group on Ocean and Coastal Mapping (IWG-

OCM)

WHO:

- NOAA
- USGS
- USACE
- NAVO
- BOEM
- NSF
- NGA
- USCG
- EPA
- FEMA
- NASA

▪ *and other appropriate
Federal agencies
involved in ocean and
coastal mapping.*



- Co-chaired by NOAA, USGS, and USACE
- Charged with facilitating “the coordination of ocean and coastal mapping activities and avoid[ing] duplicating mapping activities...”
- Ocean and Coastal Mapping Integration Act of 2009: develop an “Ocean and Coastal Mapping Plan”
- National Ocean Policy: develop a topobathy lidar plan, National Coastal Mapping Plan