

NOAA Update

Mike Aslaksen
Chief, Remote Sensing Division
NOAA's National Geodetic Survey

16th Annual JALBTCX Airborne Coastal Mapping & Charting Technical Workshop



National Oceanic and Atmospheric Administration

Outline

- **FY14/15 metrics**
- **Updates on VDatum, Kd analysis, satellite derived bathy**
- **Sandy Supplemental Project Update**
- **Riegl VQ-880G and DSS camera upgrades**
 - **Oblique imagery capability**
- **FY16 President's Budget and House/Senate marks**
- **New Datums!**



CMP FY14 Metrics

- **10,300** miles* of shoreline compiled (**6.2%** of US)
- Updated shoreline for **>89** nautical charts
- Shoreline updates compiled for **>42** ENCs
- **40** ports updated with new shoreline
- **24** ports analyzed for change (CSCAP)

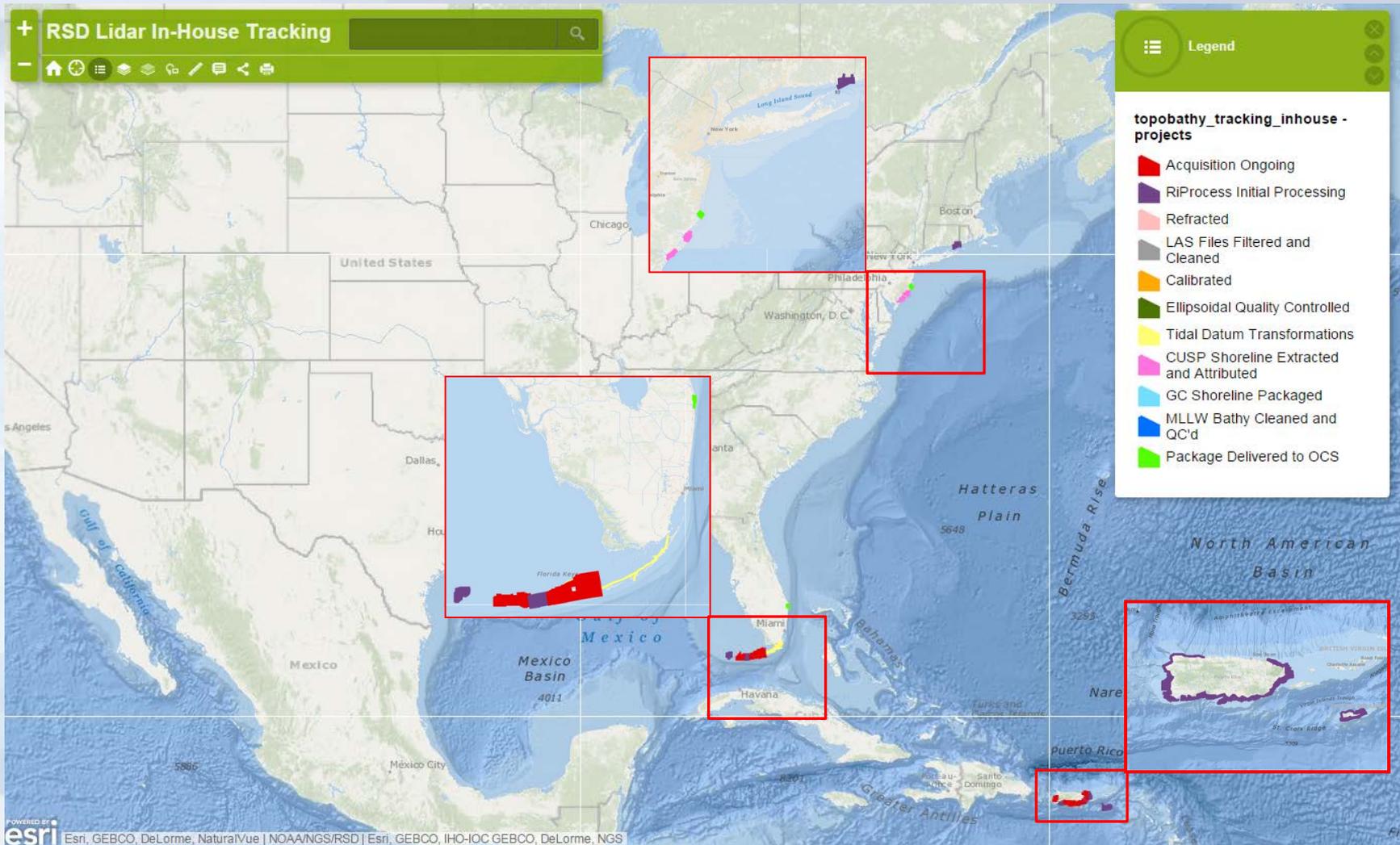
* miles measured at 1:80,000 scale



National Oceanic and Atmospheric Administration

NGS.Shoreline.Request@noaa.gov

FY14/15 NGS Lidar Operations



National Oceanic and Atmospheric Administration

Total: ~1210nm² acquired



NOAA Shoreline Data Explorer

National Geodetic Survey



<http://www.ngs.noaa.gov/NSDE/>



National Oceanic and Atmospheric Administration

1064 layers

Narrow your results

Theme

State/Territory

Offshore Region

Service Type

12NM Territorial Sea

NOAA Office of Coast Survey

Each coastal State may claim a territorial sea that extends seaward up to 12 nautical miles from its baselines. The coastal State exercises sovereignty over its territorial sea, the air space above it, and the seabed and subsoil beneath it.

Data featured in [MarineCadastrre.gov](#)

- Downloads
- Services
- Preview
- More Info

1944 Guam Historical 8 Bit Imagery

NOAA | Guam Government

This dataset consists of scanned aerial photos provided by the Guam Government, and is part of a larger effort to scan historical aerial photos for Hawaii, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands (CNMI).

- Downloads
- Services
- Preview
- More Info

1945 CNMI Saipan High Res Land Cover

NOAA Coastal Services Center

The Coastal Change Analysis Program (C-CAP) produces nationally standardized land cover data from remotely sensed imagery. C-CAP products provide inventories of coastal intertidal areas, wetlands, and adjacent uplands. High-resolution C-CAP provides data relevant for addressing site-specific management decisions.

- Downloads
- Services
- Preview
- More Info

Looking for the Data Access Viewer?

Learn More

Learn how to integrate map services from the Digital Coast in your mashups. [View in Gallery](#)



Additional Resources

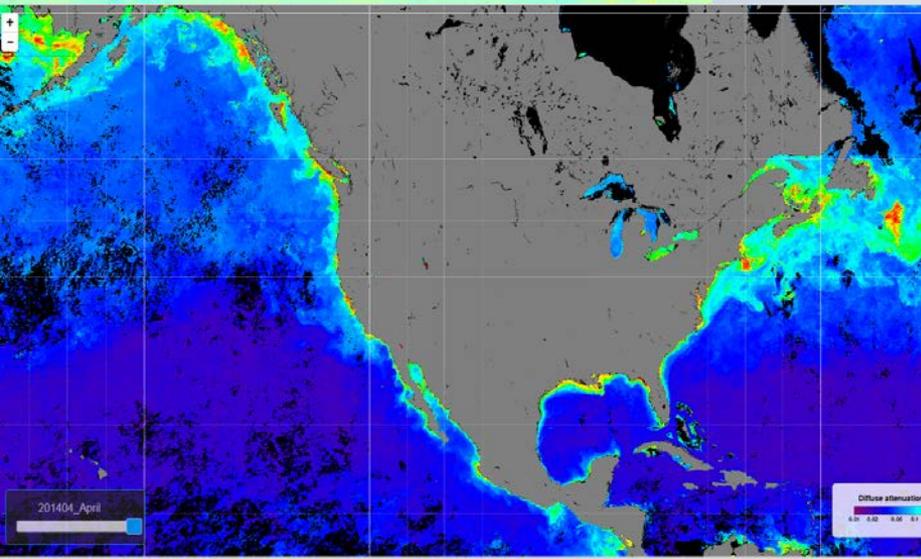
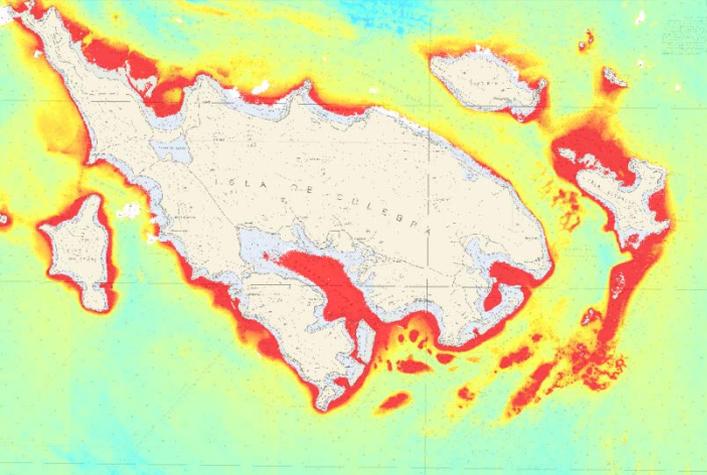
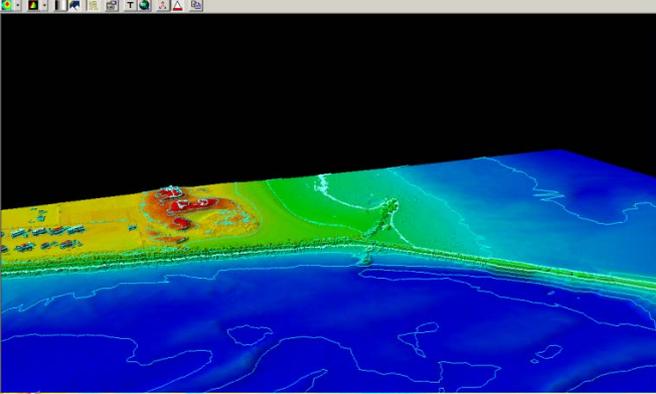
[Hurricane Planning and Response](#)

Data, tools, and additional resources you need to get ready for the next big storm

Connect to [Other Data Resources](#) on state, federal and regional websites



Implementing New Technology



- **Emerging class of topo-bathy lidar system**
 - Narrow beam, low power, small FOV, very high sampling rates
 - Focus is on shallow water and environmental applications
- **VDatum**
- **Providing water clarity to support operations**
 - Leveraging NCCOS capabilities
 - Includes near real time information and climatology
- **Satellite Derived Bathymetry (SDB)**
 - Leveraging data from USG sources at little or no costs
 - Leverage internal and external algorithms and procedures
 - Low cost effective reconnaissance and change analysis tool

VDatum Update



National Oceanic and Atmospheric Administration

<http://vdatum.noaa.gov/>

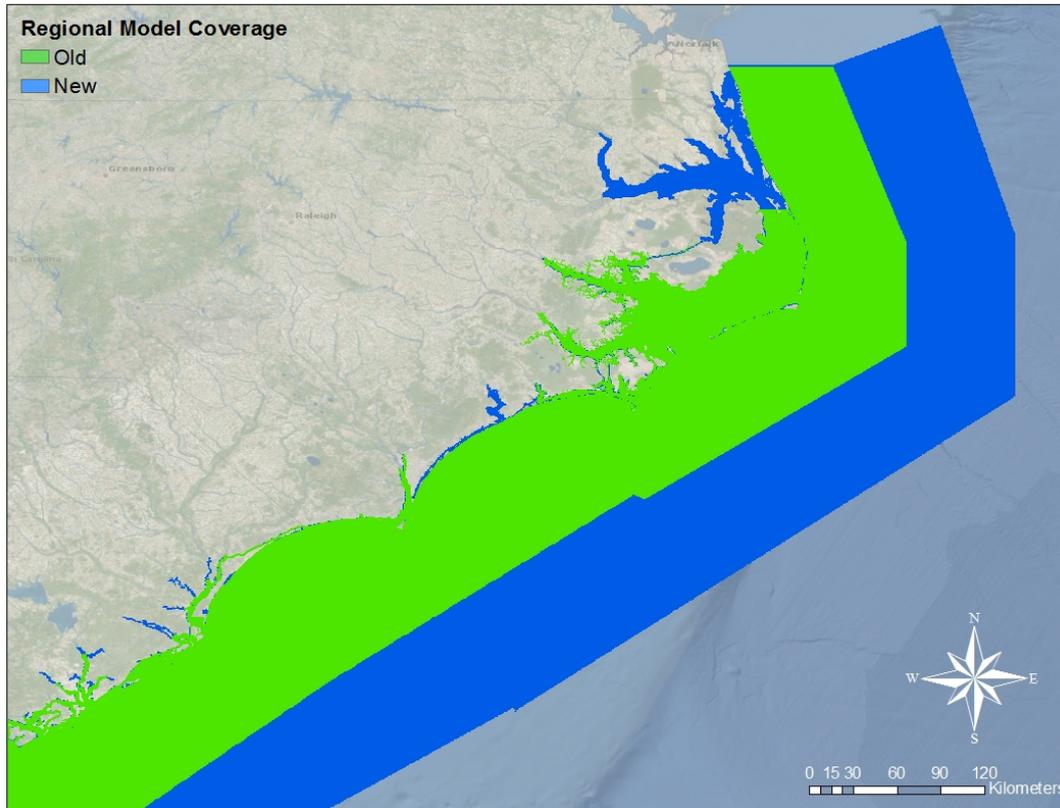
VDatum Software Development

- **Version 3.4 of the software was released on 12/23/2014**
 - Included South Atlantic Bight Update
 - Consistent TSS field for entire East Coast (assist Weather Service)
 - Included several Bug Fixes
 - Added in capability to increase amount of data to read and process, which can greatly increase performance based on the amount of RAM one has available.
- **Next Version will include:**
 - Phase 1 Uncertainty Integration into software
 - GEOID12b, EGM96, EGM2008 support
 - Possibly 3D Shapefile support
- **Future Work:**
 - Updated SF Bay Model (FY16)
 - Updated NY Bight/LIS Model (FY17)

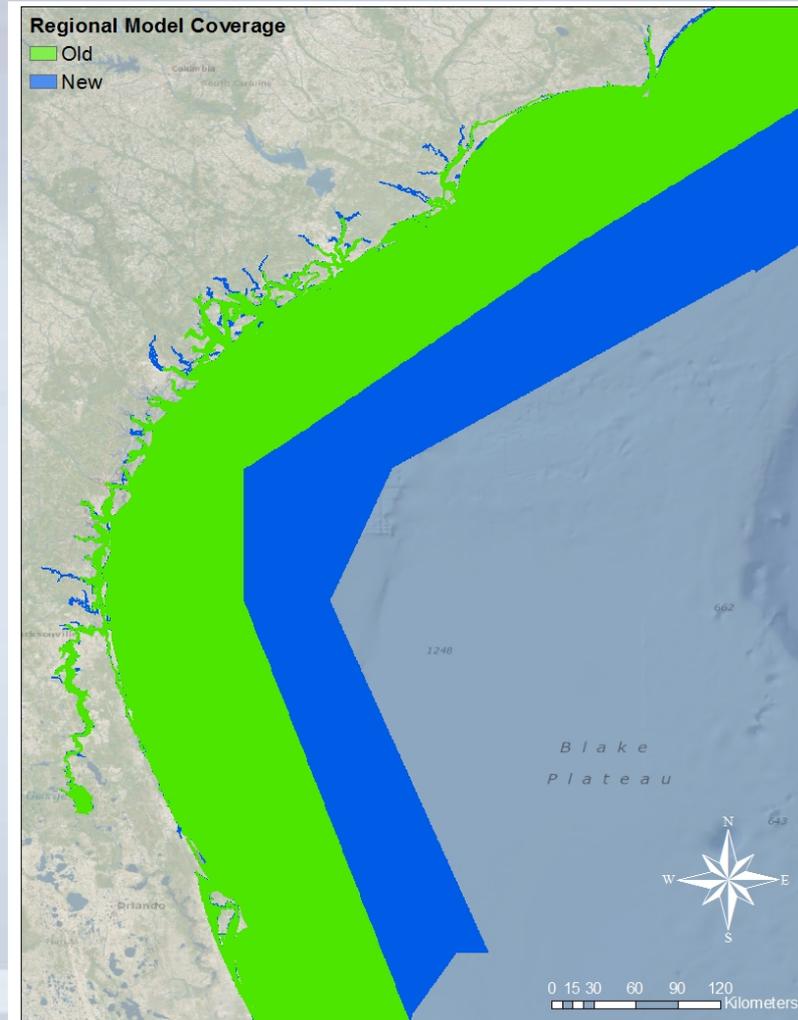
The screenshot shows the NOAA's Vertical Datum Transformation v3.3 software interface. It is divided into several sections: 'Horizontal Information', 'Vertical Information', and 'Point Conversion'. The 'Horizontal Information' section includes fields for Source and Target Datum (both set to NAD83(2011/2007/CORS96HARN) - North Am...), Coord. System (Geographic (Longitude, Latitude)), Unit, and Zone. The 'Vertical Information' section includes fields for Source and Target Datum (Source: NAD83(2011/2007/CORS96HARN) - North Am..., Target: MTL), Unit (both set to meter (m)), and radio buttons for Height and Sounding. There are also checkboxes for GEOID model. The 'Point Conversion' section has tabs for Point Conversion, ASCII File Conversion, and File Conversion. It shows input and output coordinates (Longitude: -97.3096500, Latitude: 26.3897528, Height: 0) and output options like File Report and DMS. A vertical uncertainty of 15.5621cm is displayed. The bottom of the window shows the vertical area: TXlagmat01_8301 [Non_tidal_areas].



South Atlantic Bight Update

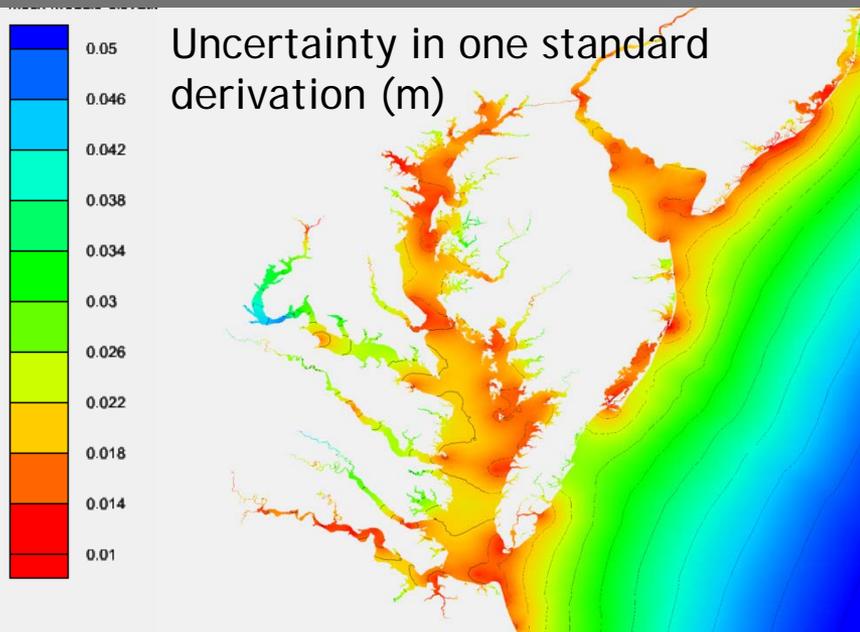


Blue areas denote expanded coverage: offshore, Albemarle Sound, Southern NC Intracoastal waterway, extended upstream regions



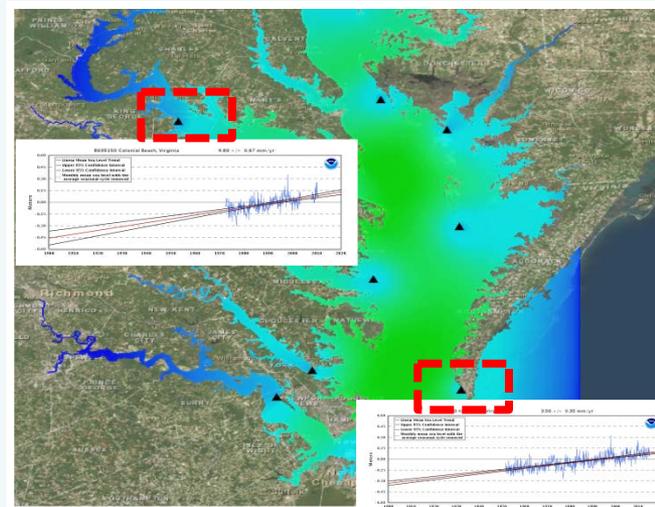
Currently Working on Spatially Varying Uncertainty Estimation: Operationalize FY16/17

- Tidal Datum Grids
 - Statistical data assimilation is used to blend model results and data, also providing the associated uncertainty.
 - Initial results for the Chesapeake Bay are shown below:



- TSS Future work (by October 2015)
 - Incorporating actual uncertainty for tide gauges
 - Establishing a TSS correlation model between tide gauges
 - Considering spatial and tidal aspects
 - e.g. over-water distance
 - Test for West Coast and GoM

$$\Sigma_{TSS} = \begin{pmatrix} \sigma_1^2 & \dots & \sigma_{1,K} \\ \vdots & \ddots & \vdots \\ \sigma_{K,1} & \dots & \sigma_K^2 \end{pmatrix}$$



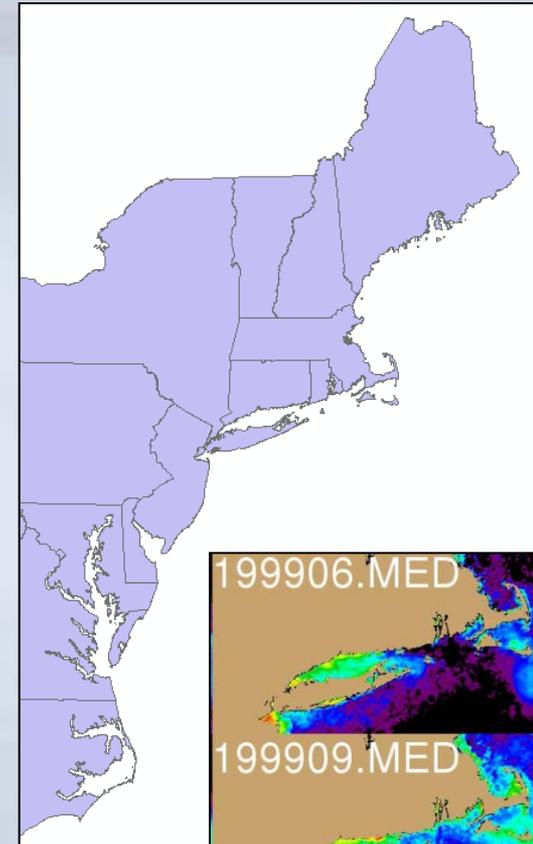
NOAA NGS/NCCOS Kd Climatology Product

Year 1 (2015)

- Prototype with **300 m** climatology for **NE**
- available this fall
- prototype Alaska with key areas (Alaska has different “back end”)
- Design front end strategy for access
- Determine system requirement/production strategy
- Looking for feedback from Navy on priority areas?

Year 2

- Process national climatology model
- Evaluate maintenance strategy
- Product review
- Validation



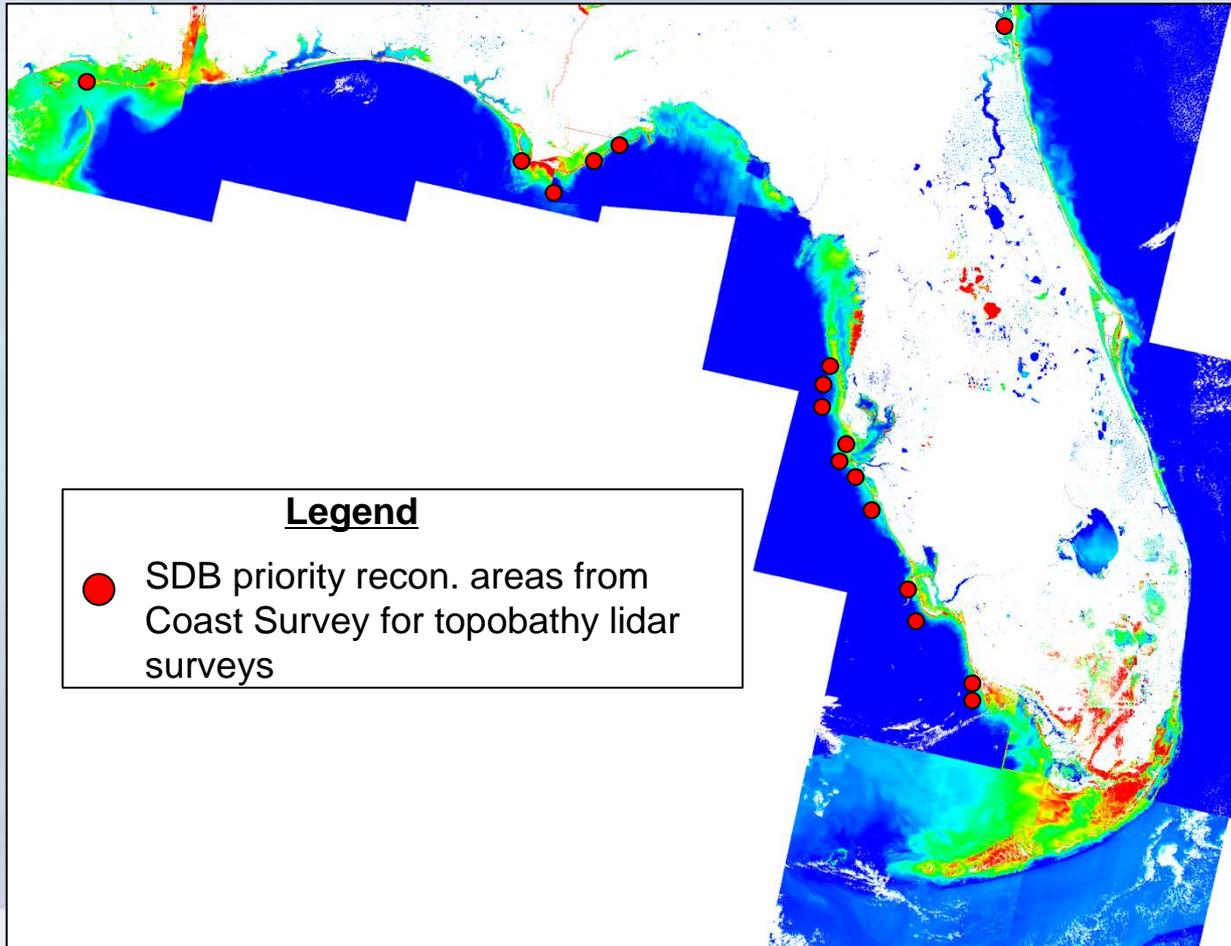
Future outlook: Real-Time data on **Coast Watch**

<http://coastwatch.noaa.gov/>

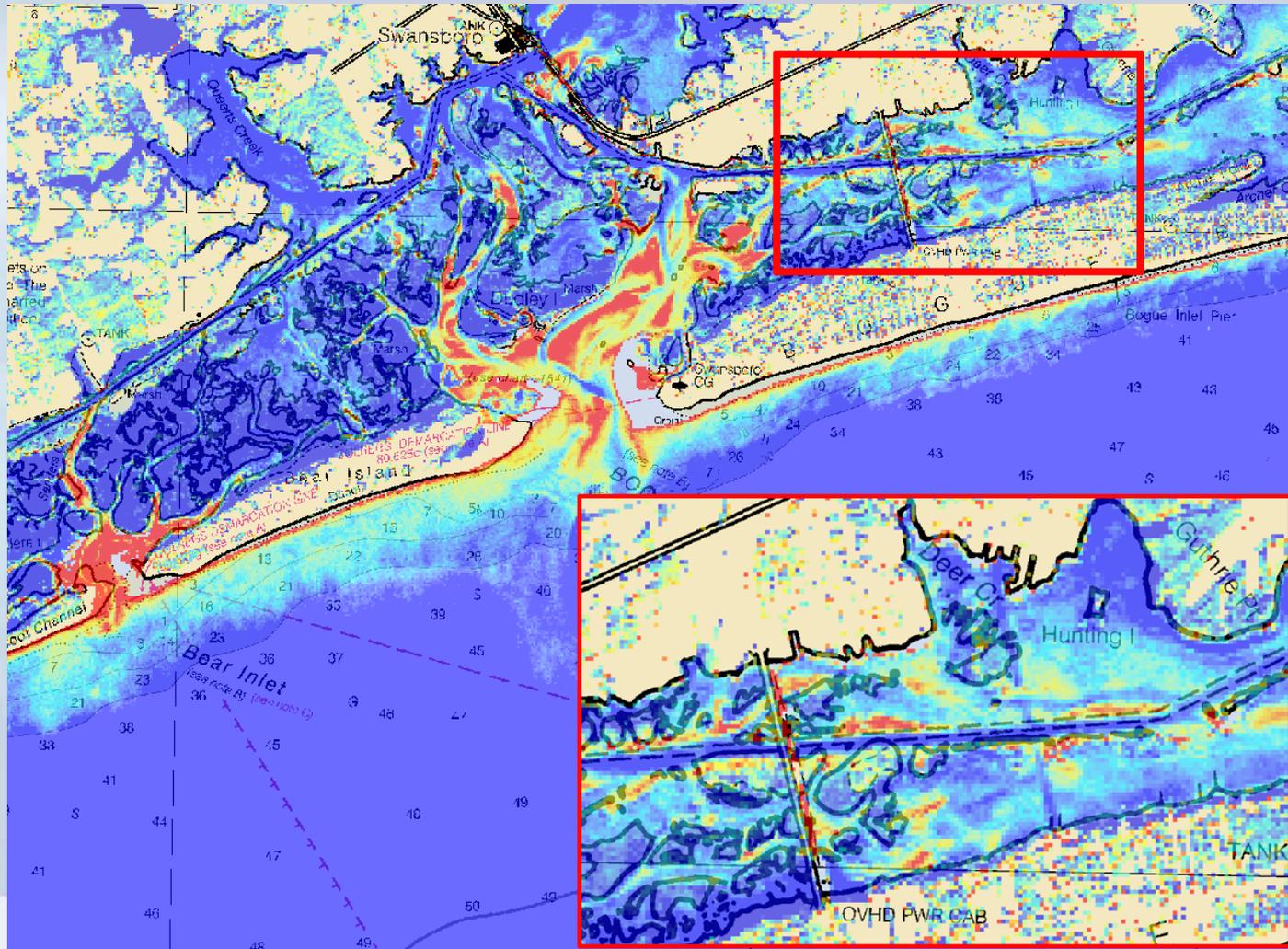


National Oceanic and Atmospheric Administration

Using Satellite Derived Bathymetry for operations



Reconnaissance tool Magenta Line



National Oceanic and Atmospheric Administration

SDB (Landsat 8) over Bogue Inlet, North Carolina.

SDB policy currently in draft form

XX X, 2015

MEMORANDUM FOR: Distribution
FROM: John Nyberg
Chief, Marine Chart Division
SUBJECT: Policy Directive 2015
TITLE: Satellite Derived Bathymetry
EFFECTIVE DATE: XX X, 2015

SECTION 1. PURPOSE

This policy notifies NOAA and the charting and hydrographic community of acceptable use and application of Satellite Derived Bathymetry (SDB) to update NOAA Nautical Charts.

SDB survey refers to depths acquired through analysis of multispectral imagery and is to be used only in shallow-water areas (one Secchi disk depth).

SDB does not meet all of the IHO and Hydrographic Survey Specification and Deliverables (HSSD) requirements however there is charting and/or reconnaissance value until a full hydrographic survey can be obtained.

It is important to note for hydrographic purposes, SDB should be considered as information rather than data. Thus, SDB requires judgment from both the cartographer and the mariner. The bathymetry generated from satellite imagery is based on a set of assumptions on the state of the environment (namely, uniform water column and bottom characteristics). As result, the bathymetry may not be accurately referenced and false shoals may appear due to turbidity. Additionally, any dangers discovered by SDB should be charted but it should be made clear that further dangers may exist.

SECTION 2. ACCEPTABLE USE POLICY

SDB can be used in areas when contemporary authoritative data (e.g. MCD's Nautical Chart Manual specifications, such as NOS hydrographic surveys, USACE surveys, Topographic Bathymetric Lidar surveys, etc.) are non-existent.

SDB shall be used in accordance with Cartographic Order 0XX/15.

SECTION 3. SHOALING POLICY

SDB shall be applied in accordance with Cartographic Order 0XX/15 where multiple satellite images will be used to derive bathymetry to assess major shoal appearance and/or movement. The attached workflow diagram shall be used as guidance for handling SDB at MCD.



Distribution:

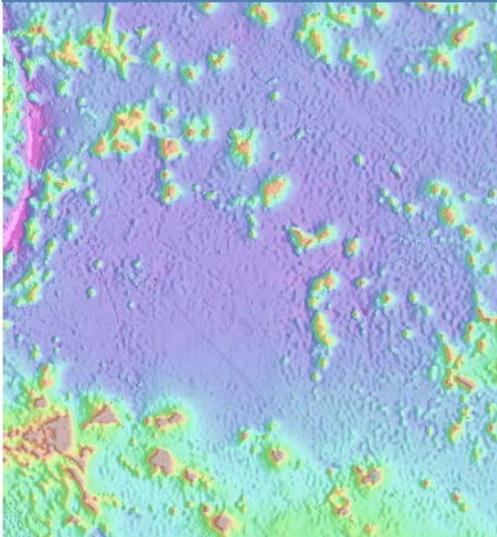
- (1) Chief, Hydrographic Surveys Division
- (2) Chief, Coast Survey Development Laboratory
- (3) Chief, Navigation Services Division
- (4) Program Coordinator, IOCM
- (5) Chief, Remote Sensing Division, NGS

Attachments: Cartographic Order 0XX/15





The IHO-IOC GEBCO Cook Book



September 2014

IHO Publication B-11
IOC Manuals and Guides, 63

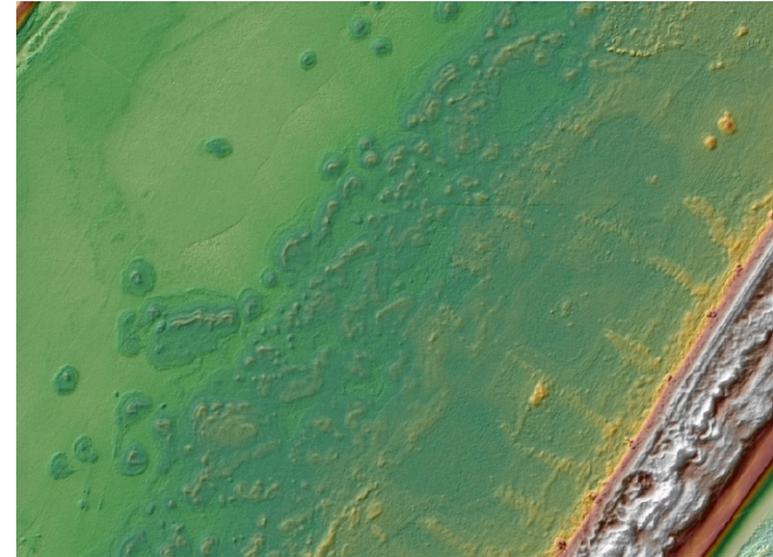
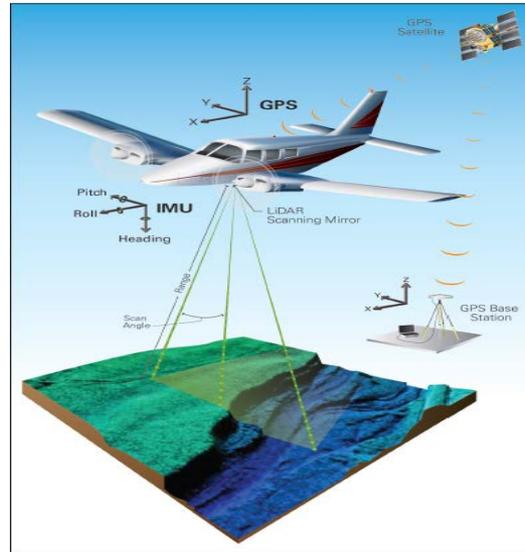
Update of November 2013
using LANDSAT 8 for
Satellite-Derived Bathymetry
that also details how to
access and download
LANDSAT 8 imagery pg 248

http://www.gebco.net/data_and_products/gebco_cook_book/

http://www.star.nesdis.noaa.gov/sod/lsa/GEBCO_Cookbook/documents/CookBook_20140903.pdf



National Oceanic and Atmospheric Administration

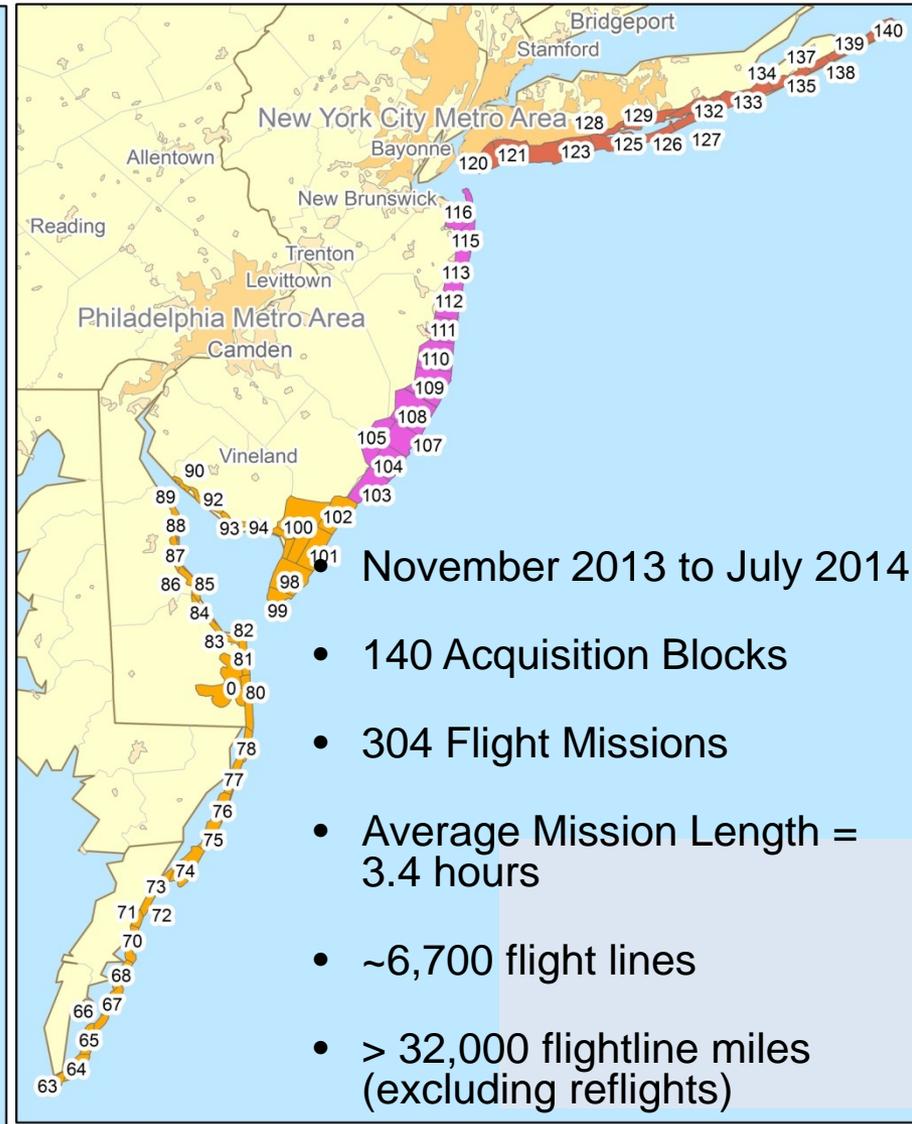
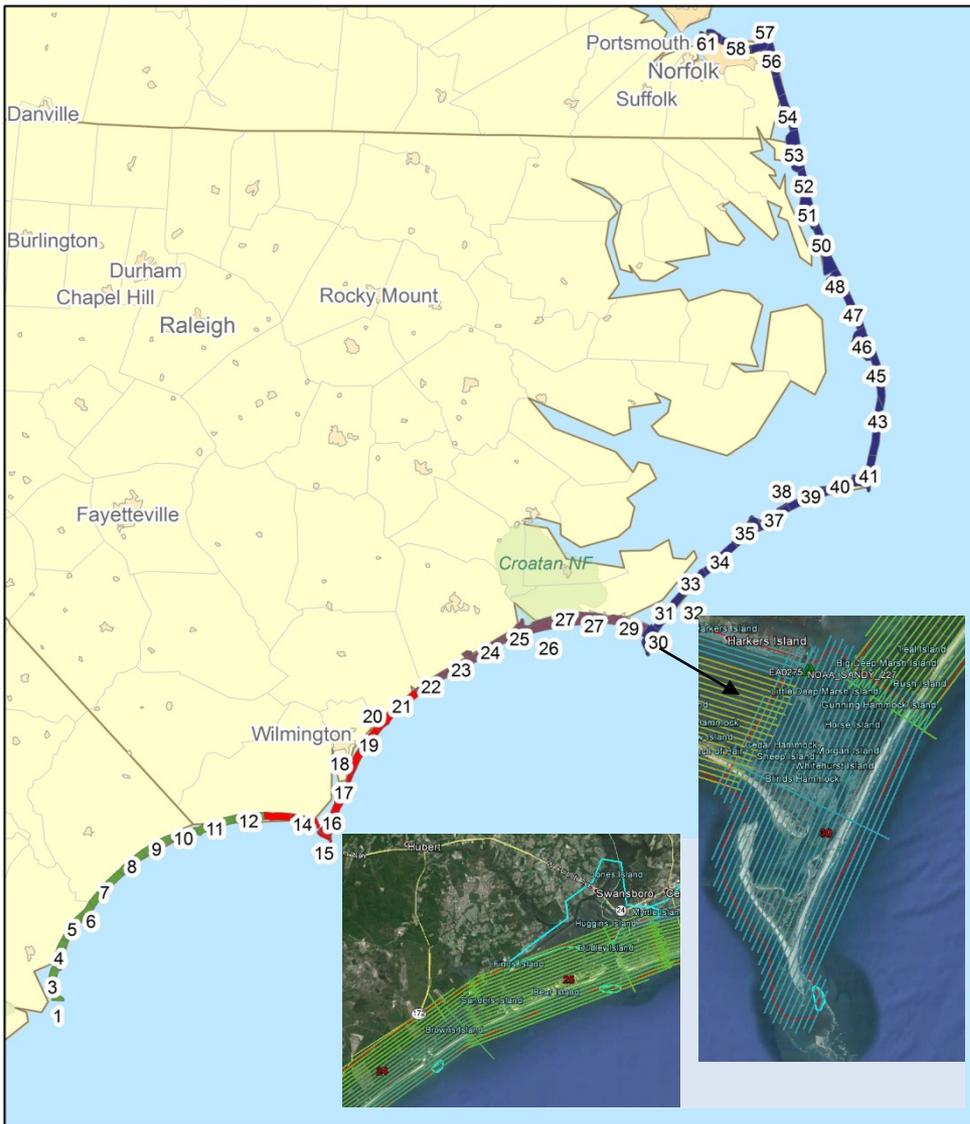


Post-Sandy Topobathymetric LiDAR along the Eastern Atlantic Seaboard

Amar Nayegandhi
Associate Vice President
Director of Remote Sensing
Dewberry

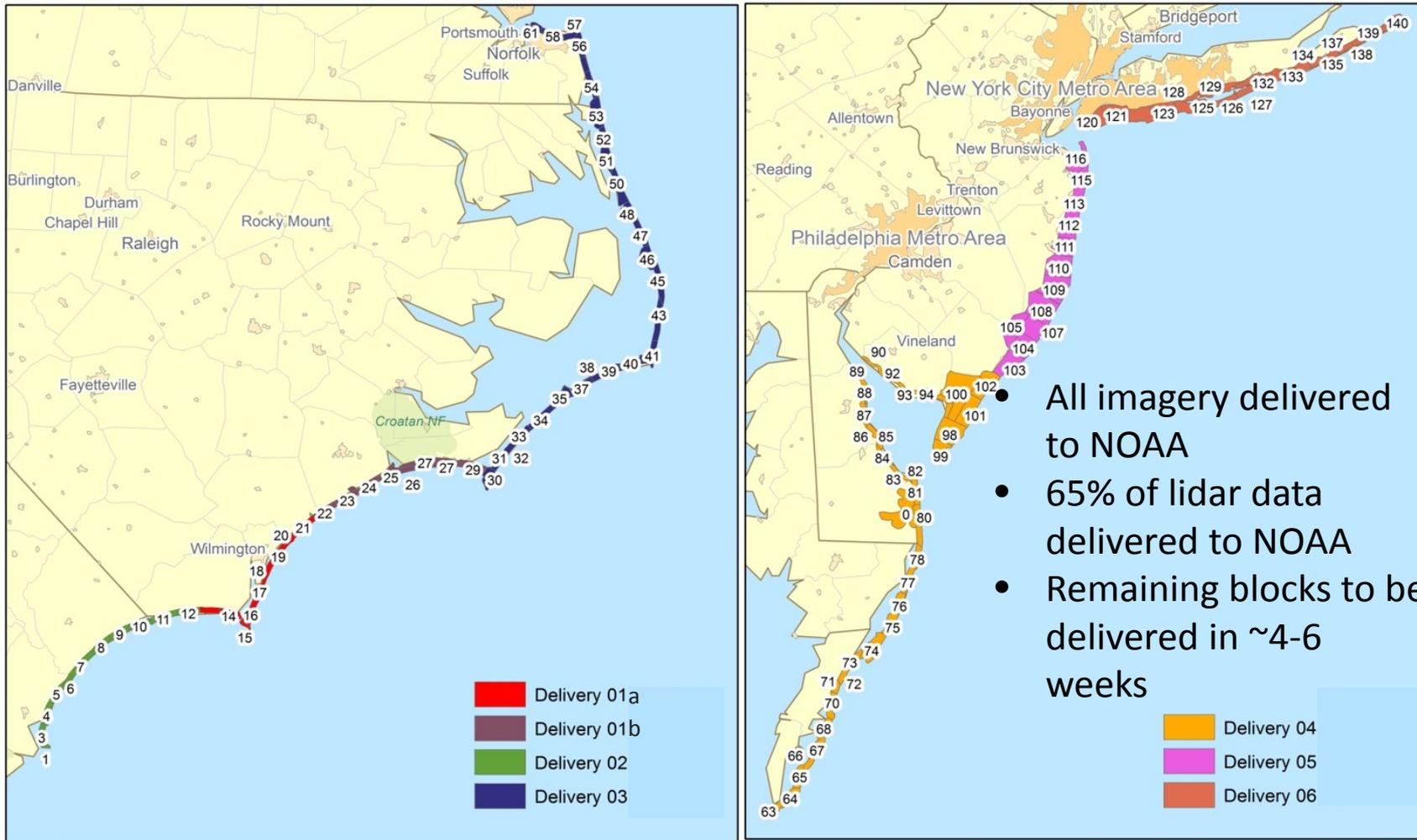
Mike Aslaksen
Chief – Remote Sensing Branch
NOAA National Geodetic Survey

Acquisition Overview



Production Status

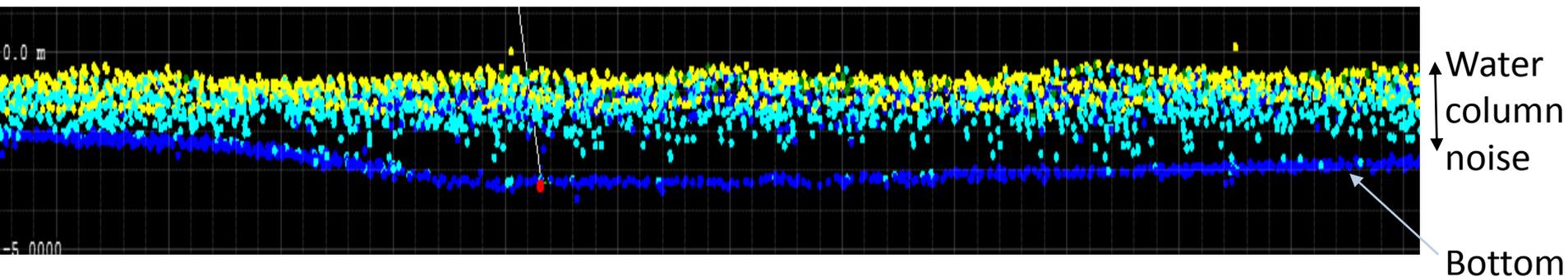
- Six processing delivery blocks defined.



Point Density Statistics

Average* Points per square meter (ppsm)	All returns	Ground and bathy only (classes 2 and 26)
Topo-only	19.1	8.3
Topo-bathy	91.9	5.3
Bathy only	72.0	4.5

* Determined using representative tiles for each category



Final Accuracy Results

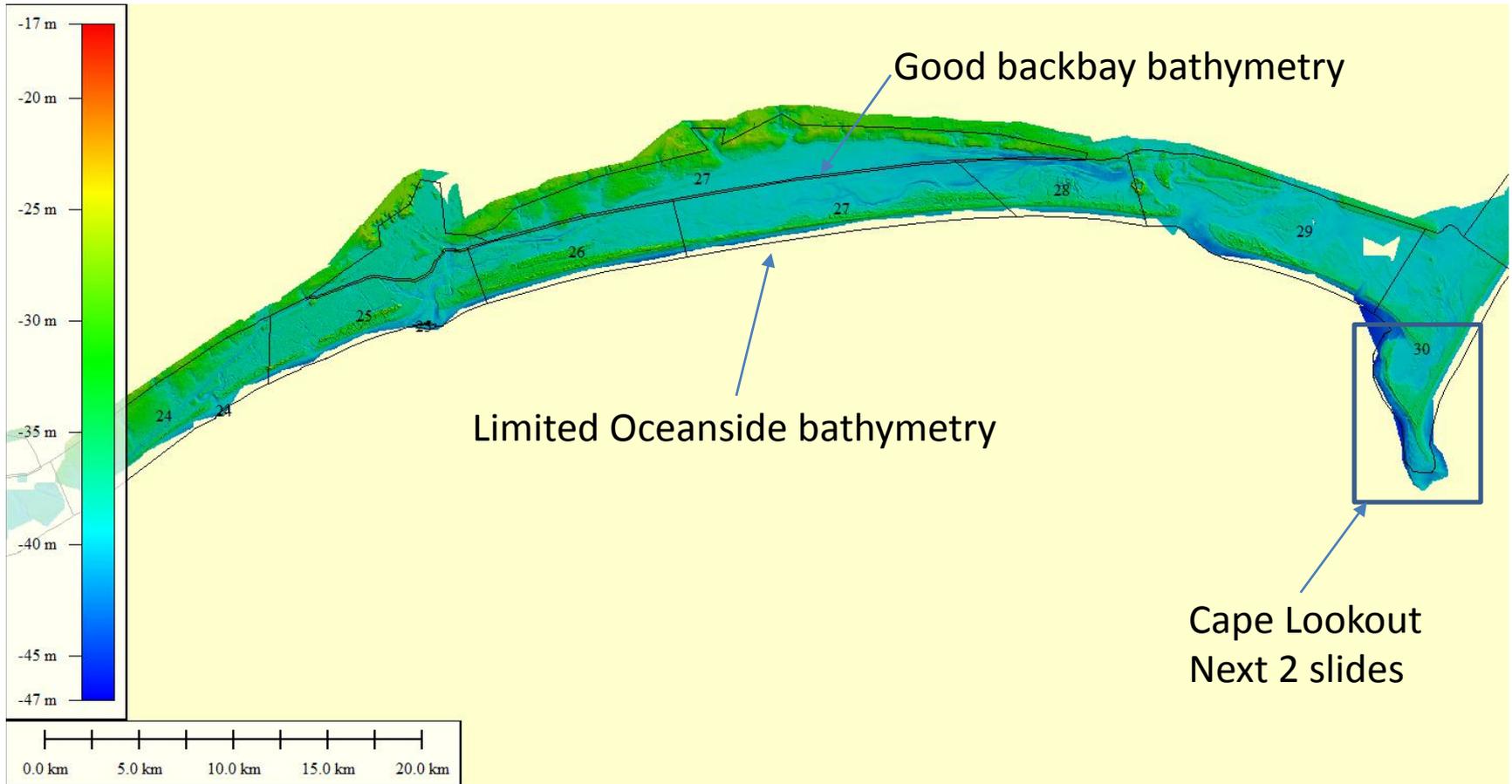
RMSE_z in urban / open terrain is 7.8 cm

RMSE_z in submerged topography is 16.5 cm

Land Cover Category	# of Points	ACCURACY _z (RMSE _z x 1.9600) m	CVA – Consolidated Vertical Accuracy (95th Percentile) m	SVA – Supplemental Vertical Accuracy (95th Percentile) m
Consolidated	261		0.226	
Brush Lands and Trees	63			0.240
Tall Weeds/Crops	68			0.227
Urban/Open Terrain	62	0.153		
Forested	68			0.176
Submerged Topography	52	0.323		

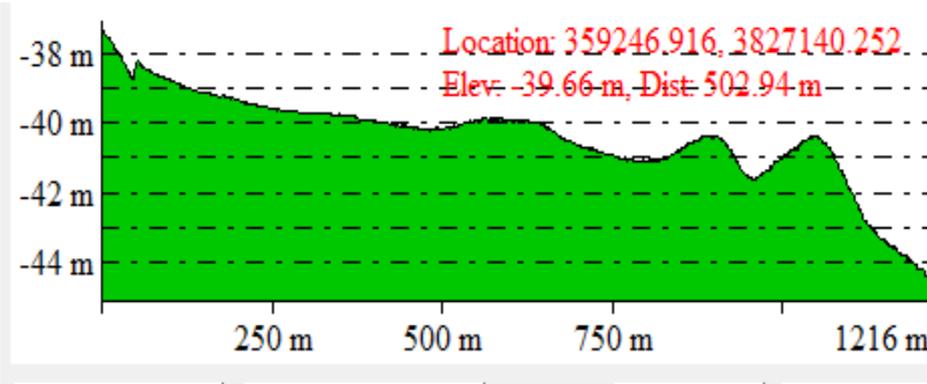
Open Terrain must meet 24.5 cm Accuracy_z while Submerged Topography must meet 49 cm Accuracy_z. CVA and SVA must meet 36 cm based on the 95th percentile.

Oceanside and Backbay Performance

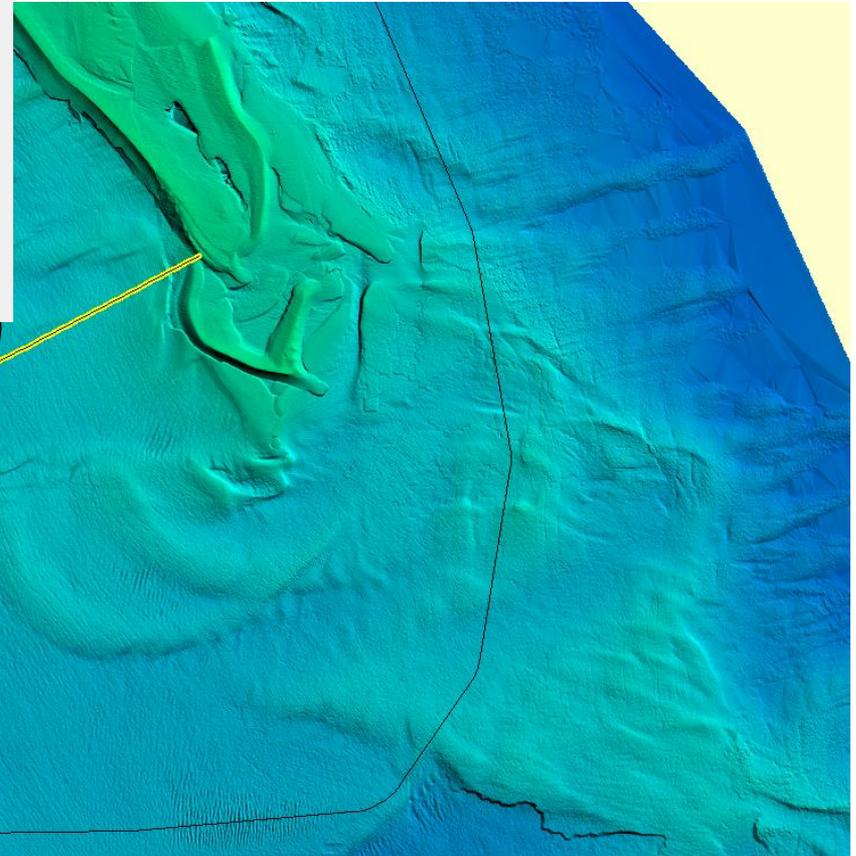
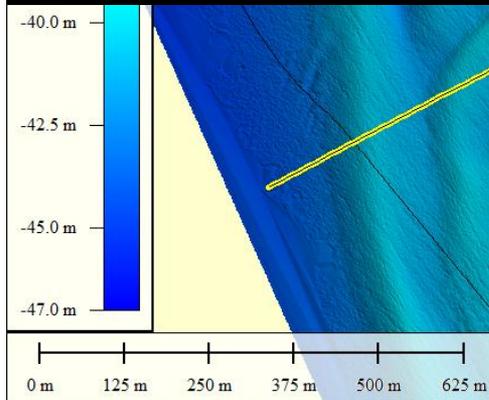


Ocean Side Performance

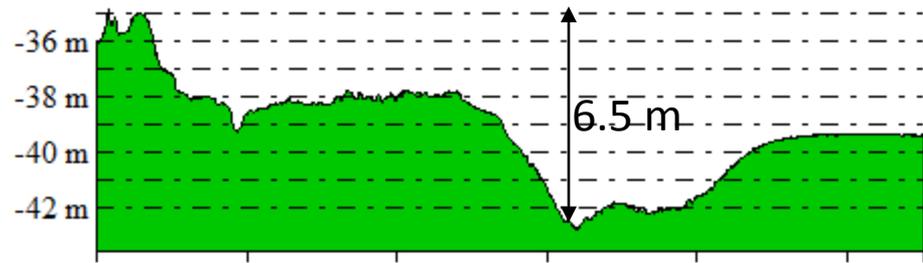
Cape Lookout (NC)



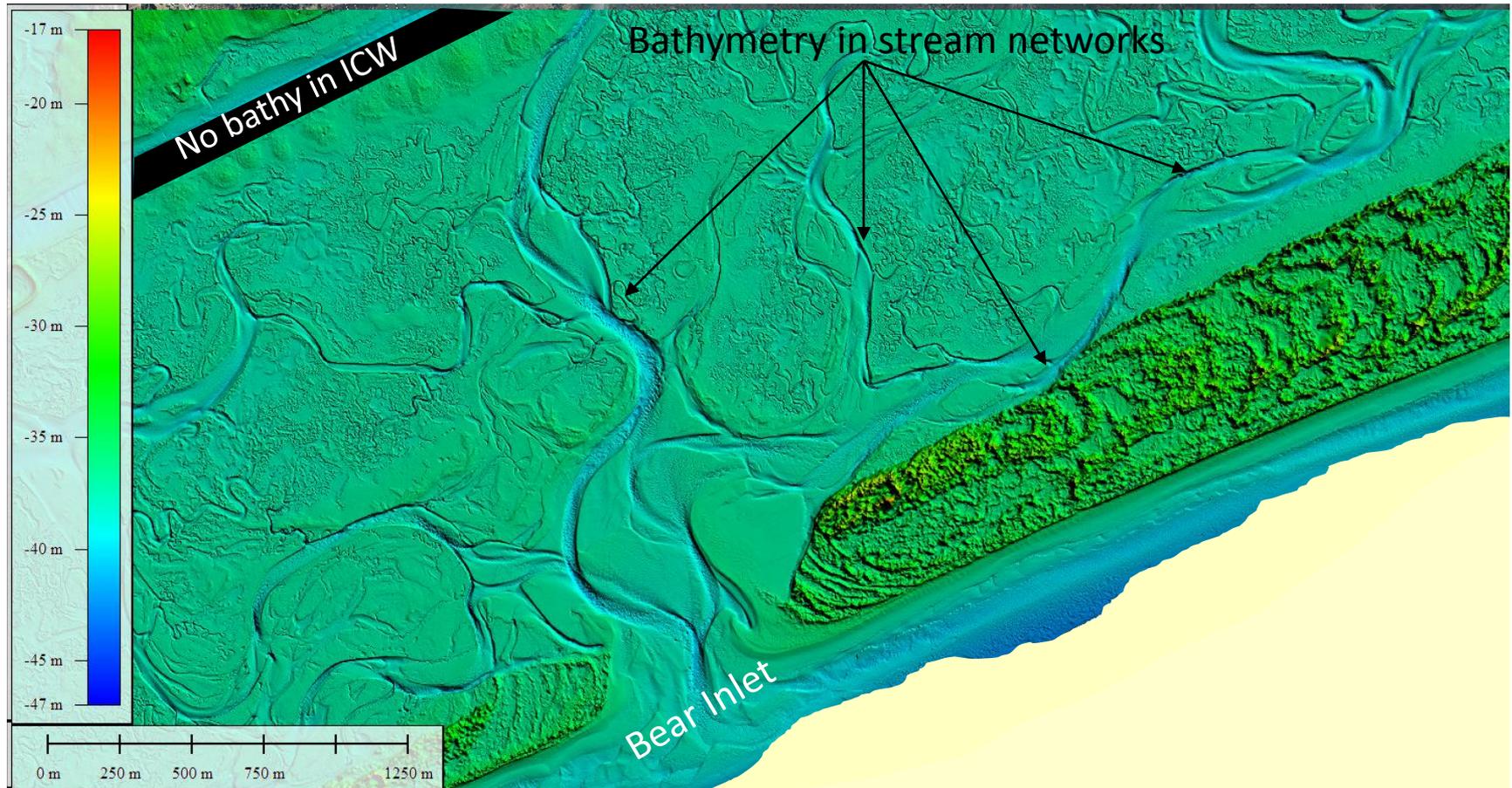
Depth Range: ~7.5 m
Extent: 1.2km offshore



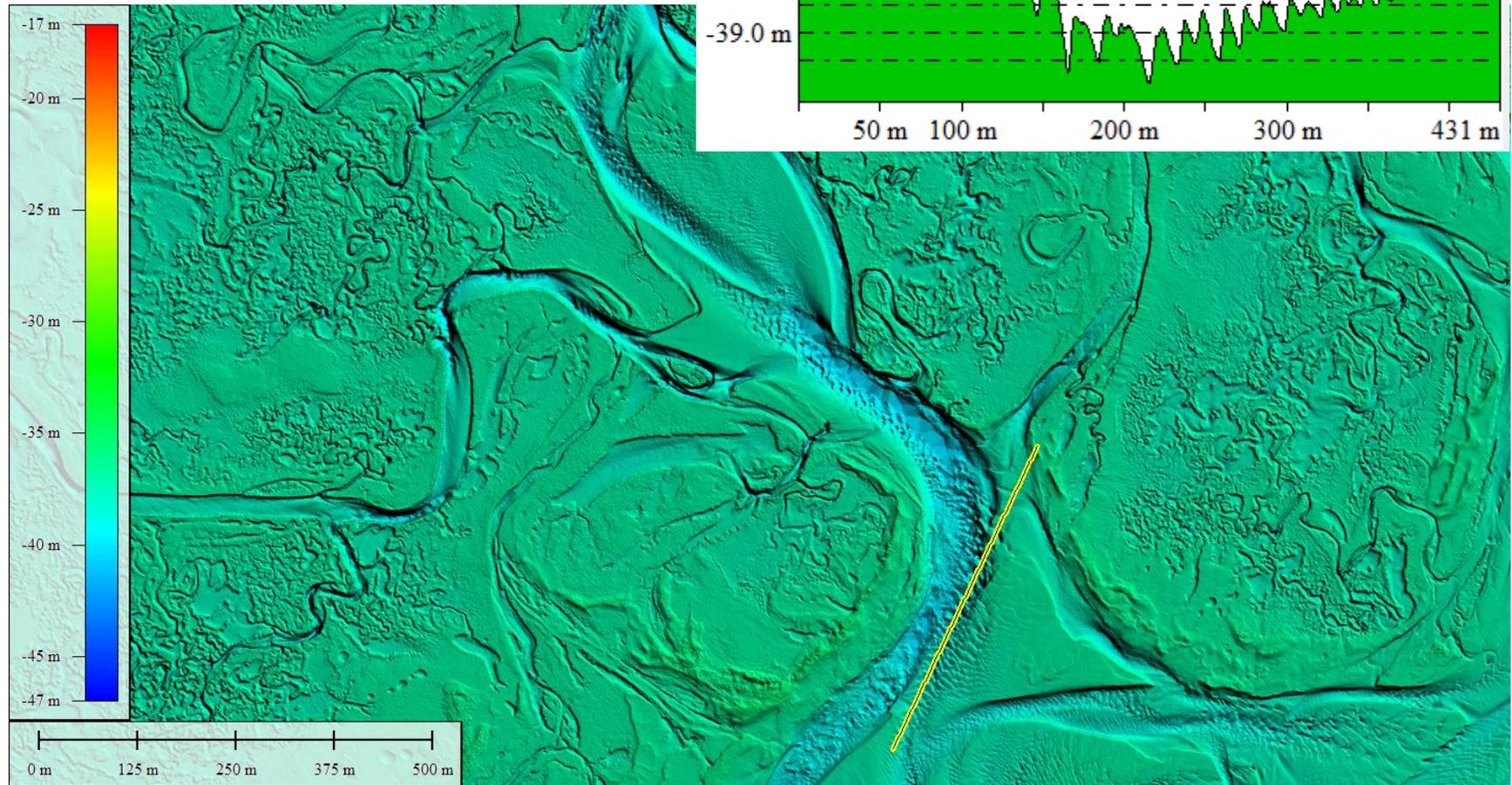
Backbay Performance



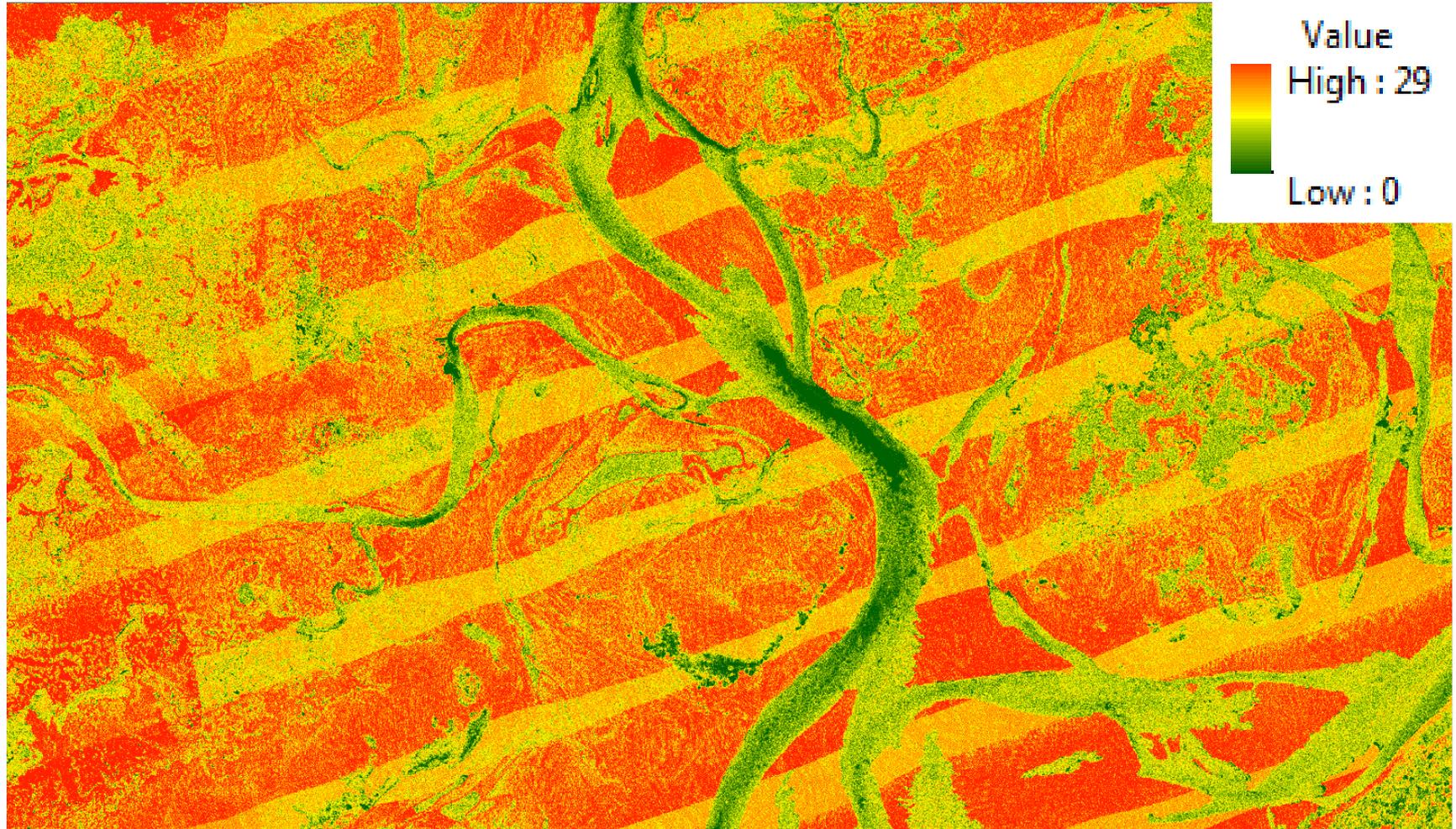
Backbay Marshes



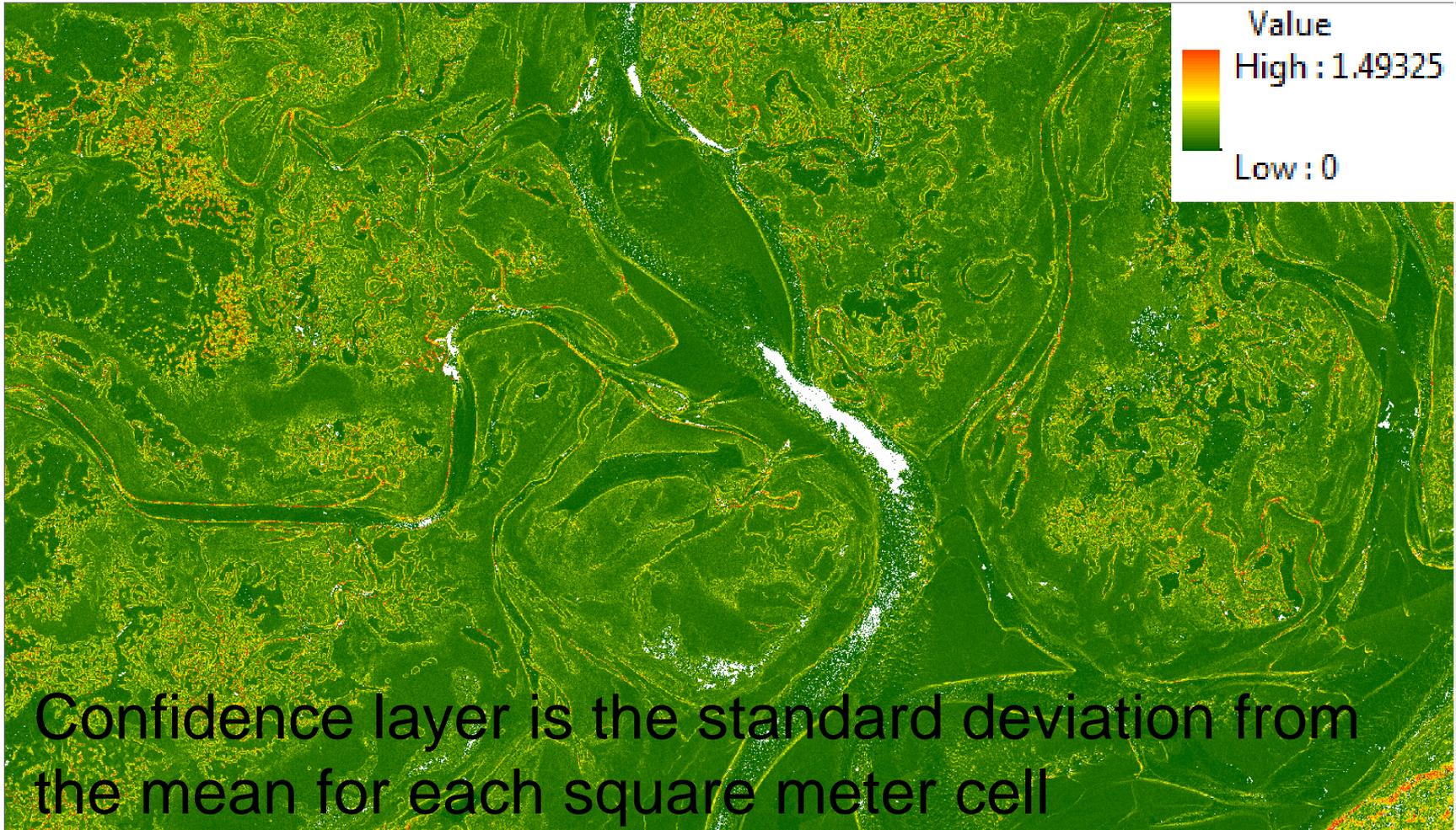
Backbay Marshes



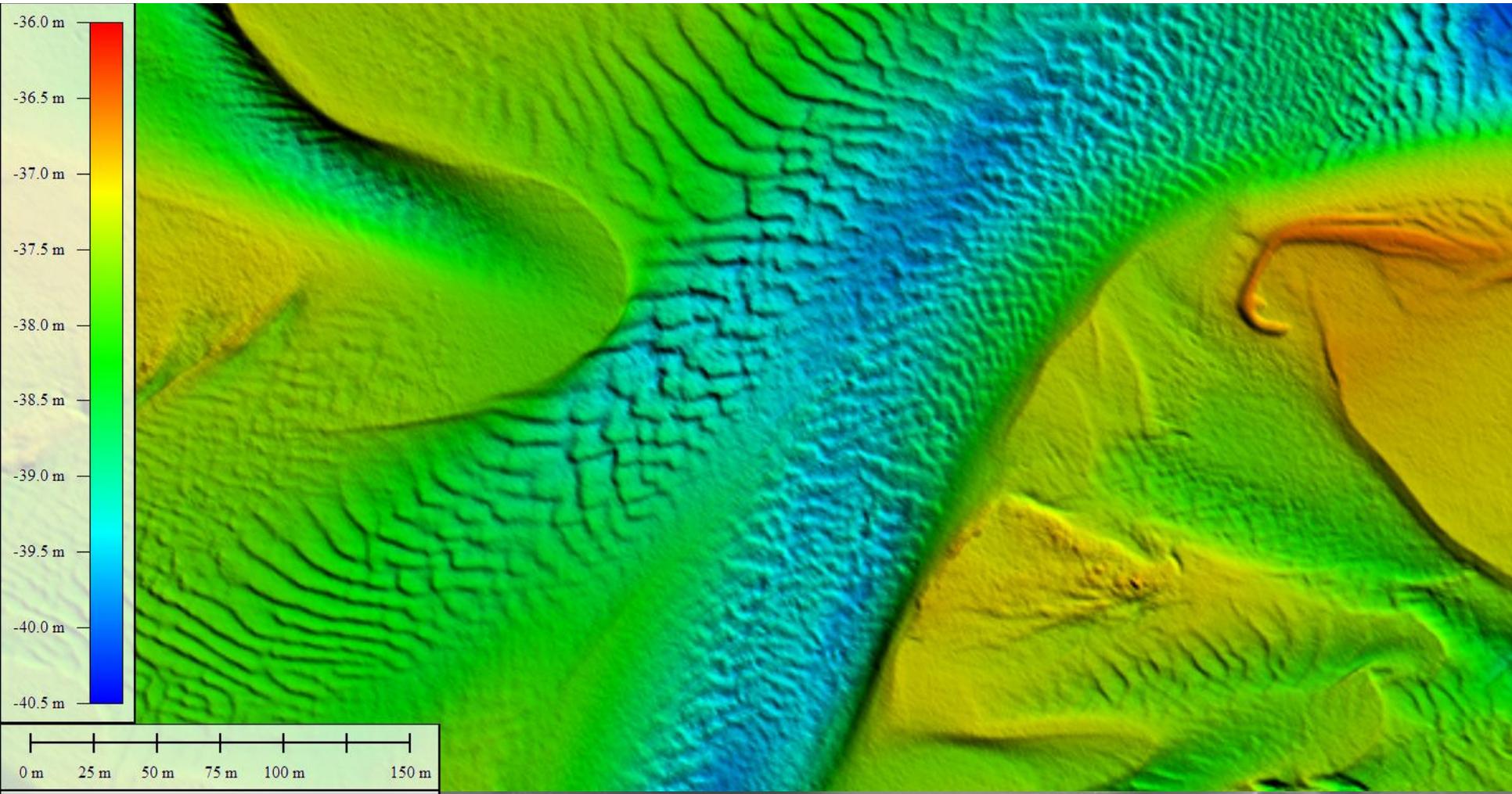
Delivered Products – Density Grid



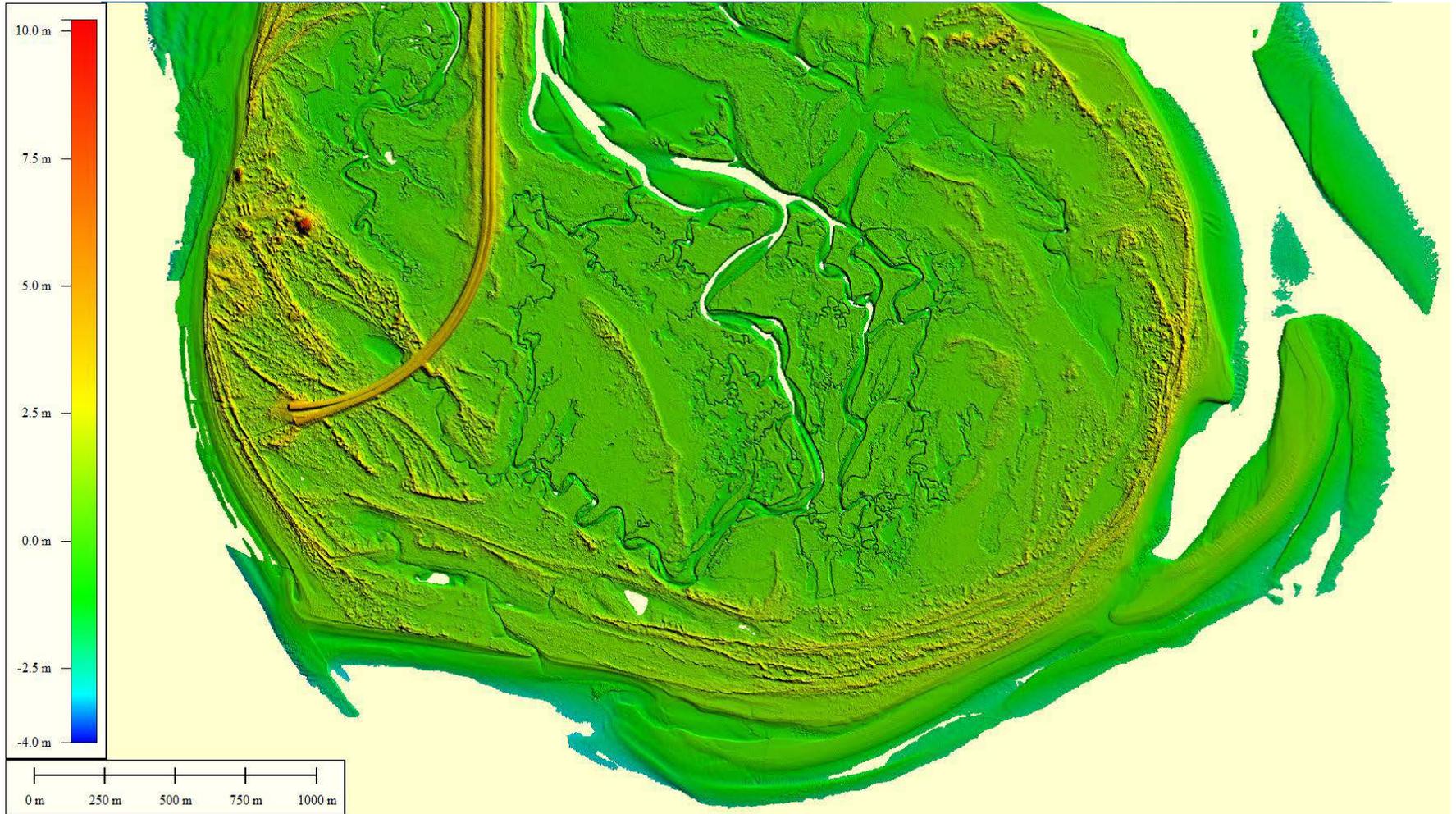
Delivered Products – Confidence Layer



Level of Detail

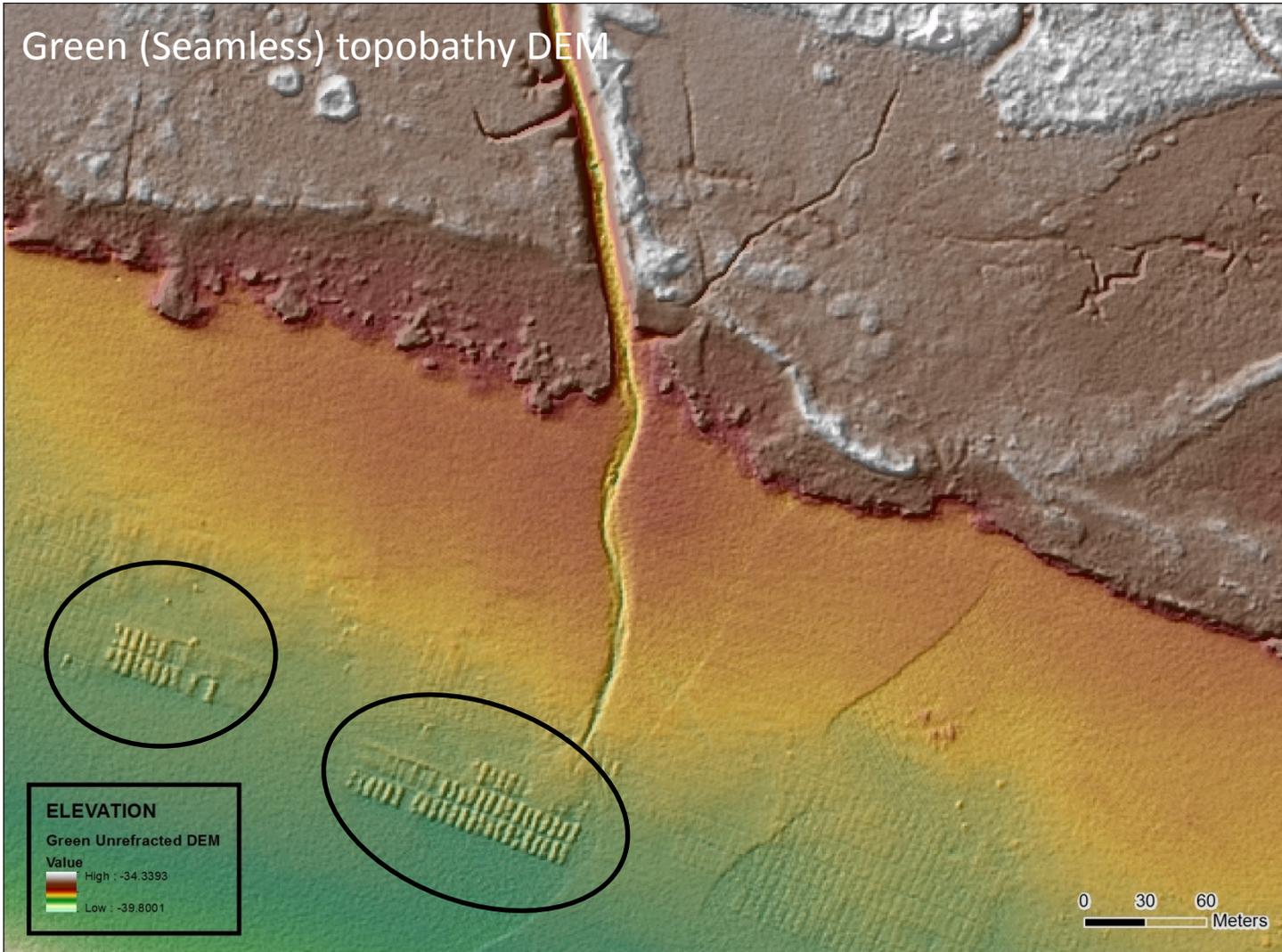


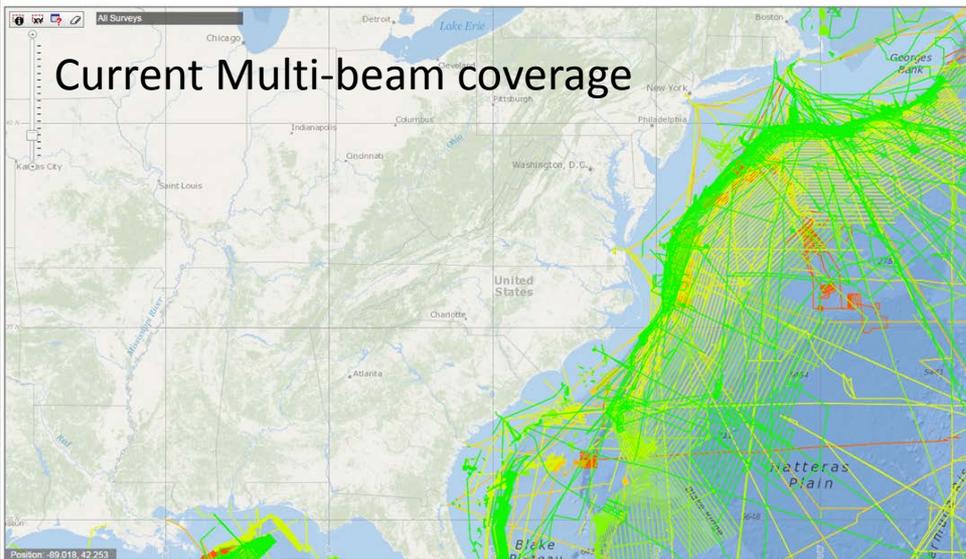
Fisherman Island NWR



Identifying submerged features in topobathy LiDAR – Oyster beds

Green (Seamless) topobathy DEM



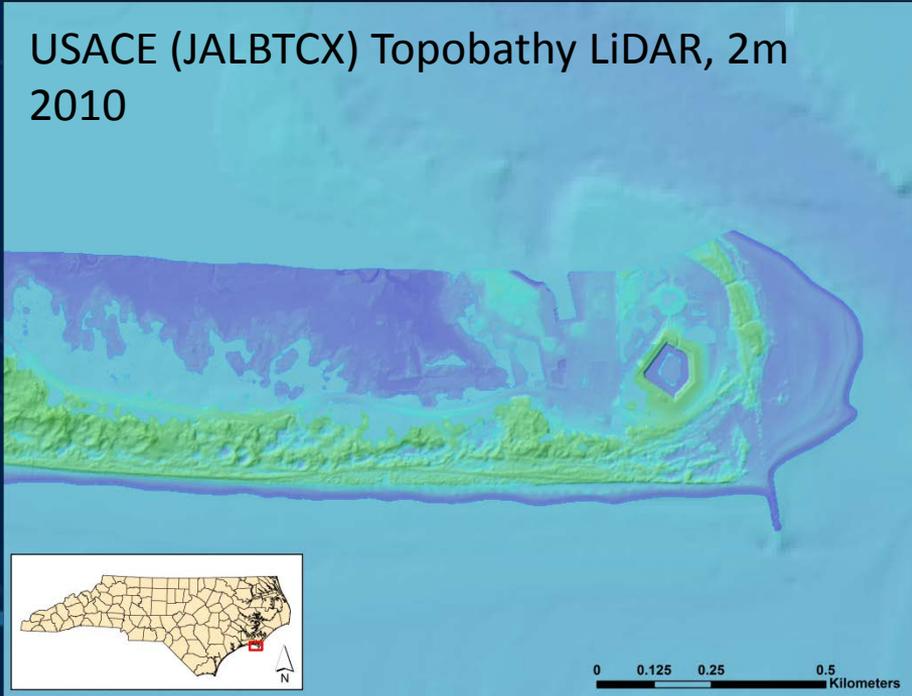


NOAA NGDC integrated dataset, 10m
1869-2010

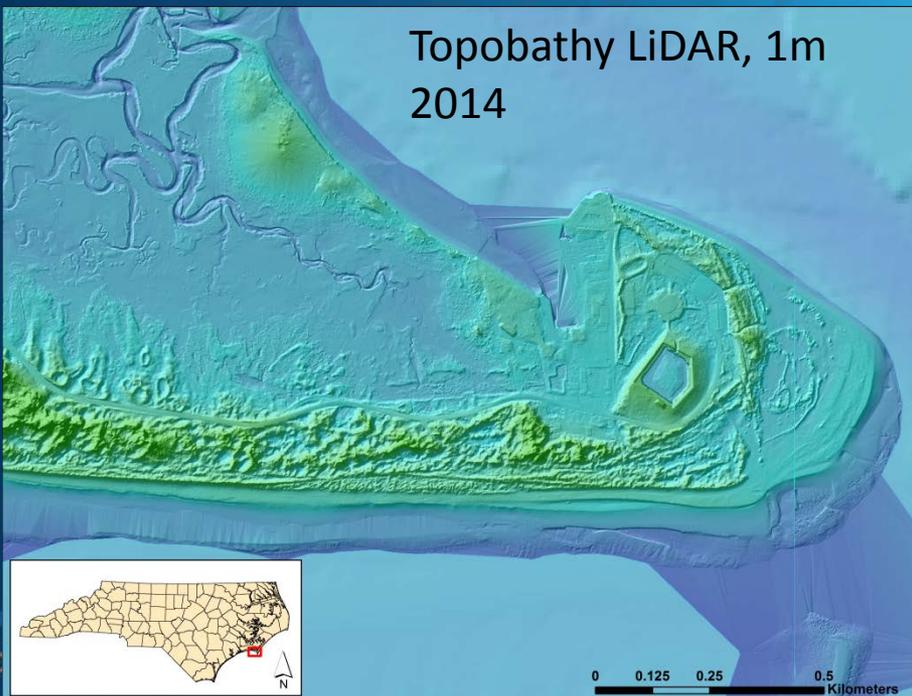


0 0.125 0.25 0.5 Kilometers

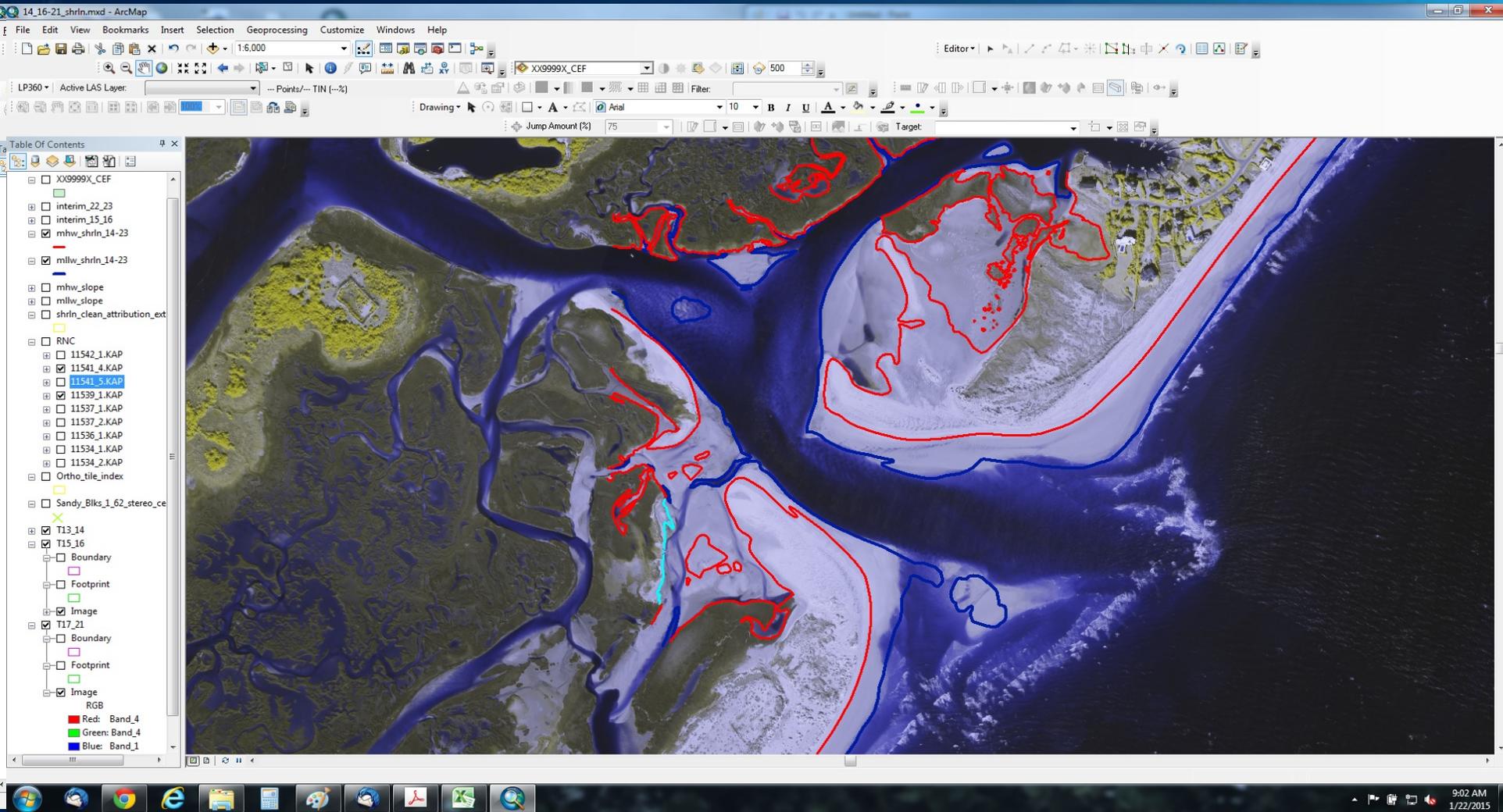
USACE (JALBTCX) Topobathy LiDAR, 2m
2010



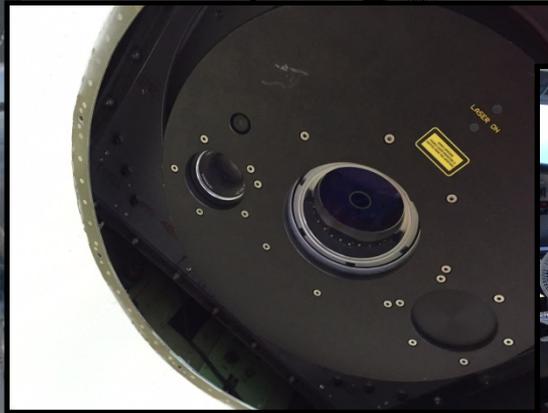
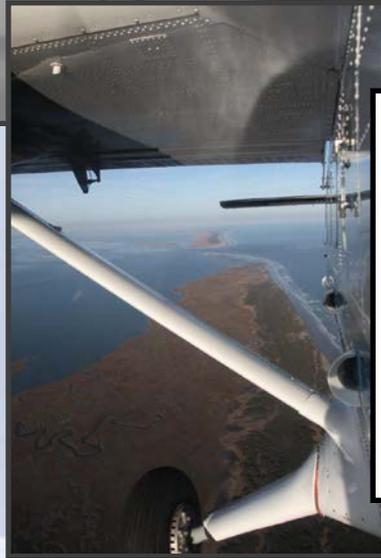
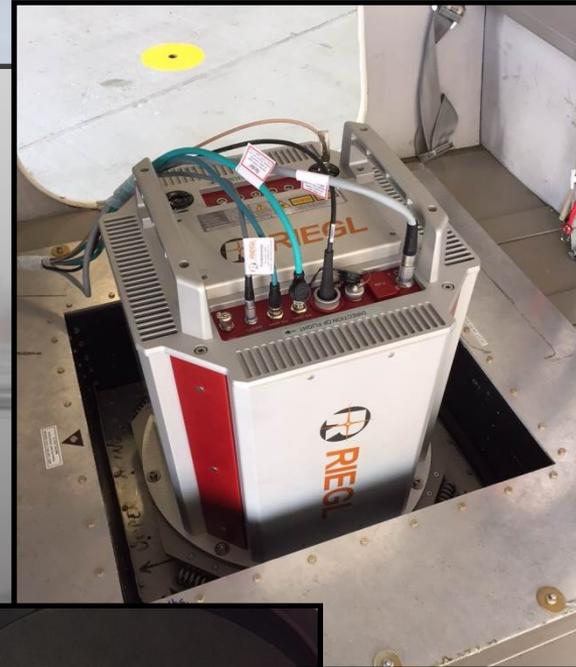
Topobathy LiDAR, 1m
2014



Update NOAA Nautical Charts – new shoreline Mason Inlet, NC



Riegl VQ-880G Upgrade



National Oceanic and Atmospheric Administration

NEW RIEGL VQ-880-G



The new RIEGL VQ-880-G is a fully integrated airborne laser scanning system for combined hydrographic and topographic surveying.

The system is offered with integrated and factory-calibrated high-end GNSS/IMU system and cameras. The design allows flexible adaptation of these components to specific application requirements. Complemented by a RIEGL data recorder, the RIEGL VQ-880-G is a complete LIDAR system to be installed on various platforms in a straightforward way.



Fully Integrated Topo-Hydrographic Airborne Laser Scanning System

Typical Applications

- Coastline and Shallow Water Mapping
- Acquiring Base Data for Flood Prevention
- Habitat Mapping
- Measurement for Aggradation Zones
- Surveying for Hydraulic Engineering
- Hydro-Archaeological-Surveying



www.riegl.com



RIEGL LMS GmbH, Austria

RIEGL USA, Inc.

RIEGL Japan Ltd.

RIEGL China Ltd.

at a glance

RIEGL VQ-880-G

RIEGL VQ-880-G Technical Data



combined topographic
& hydrographic scanning



pulse repetition rate PRR
(burst)



waveform data output



online waveform
processing



multiple target capability



not intrinsically eye safe

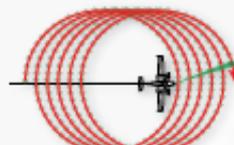
Eye Safety Class	Class Class 4*
Hydrographic: Typ. Measurement Range	1.5 Seachi depth
Typ. Operating Flight Altitude AGL	800 m (1,970 ft)
Topographic: Max. Range @ Target Reflectivity 20% / 60%	2,500 m / 3,600 m
Typ. Operating Flight Altitude AGL	2,200 m (7,200 ft)
Minimum Range	10 m
Accuracy / Precision	25 mm
Effective Measurement Rate	up to 550,000 mpts./sec
Field of View / Scan Angle	± 20° = 40°

*Class 4 Laser Product according to IEC 60825-1:2007

RIEGL VQ-880-G Circular Scan Pattern



forward & backward look for
collecting data of vertical structures



circular scan pattern

Mechanical Drawings



Main Features

- designed for combined topographic and hydrographic airborne survey
- high accuracy ranging based on echo digitization and online waveform processing with multiple-target capability
- multiple-time-around processing for straightforward mission planning and operation
- concurrent full waveform output for all measurements for subsequent full waveform analysis
- high spatial resolution due to measurement rate of up to 550 kHz and high scanning speed of up to 160 scans/sec
- integrated inertial navigation system
- integrated digital cameras
- compact and robust housing compliant with typical hatches in aircrafts and with stabilized platforms

RIEGL LMS Measurement Systems GmbH assumes no responsibility or liability whatsoever for the use of the RIEGL products, especially for applications, modifications, or alterations, and quality warranty and for the accuracy of the digital data, especially, if they are derived.

© Copyright RIEGL LMS Measurement Systems GmbH, Wien, Austria

www.riegl.com

RIEGL VQ-880-G Installation Examples



RIEGL VQ-880-G installed in the nose pod
of fixed-wing aircraft DIAMOND D840 MP

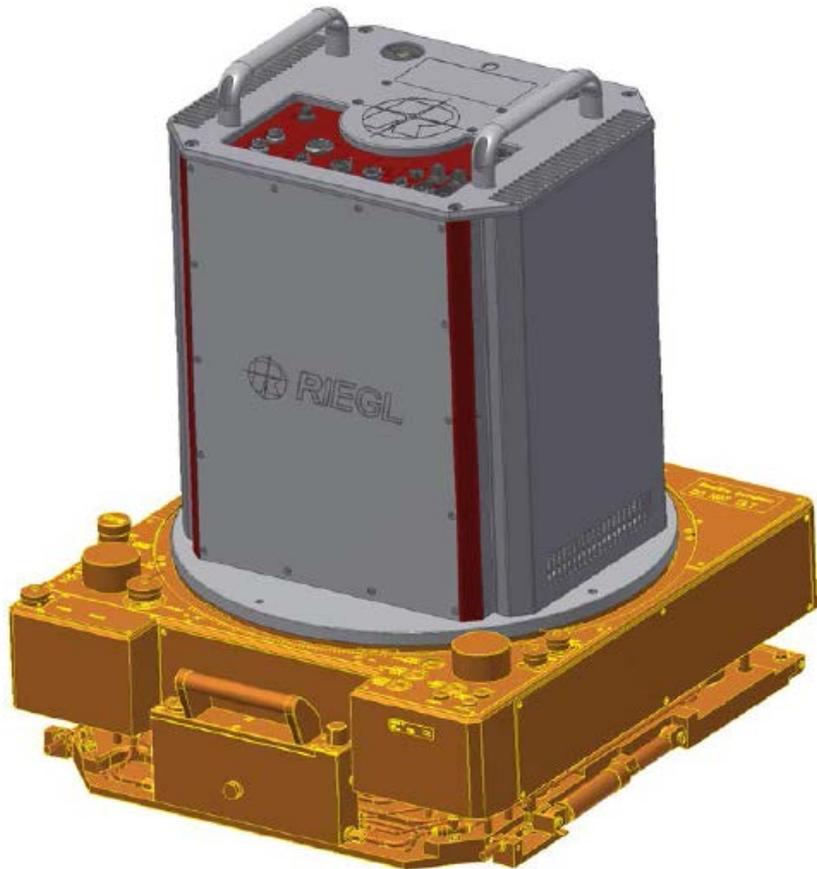


RIEGL VQ-880-G
installed on G9A-1000
stabilized platform

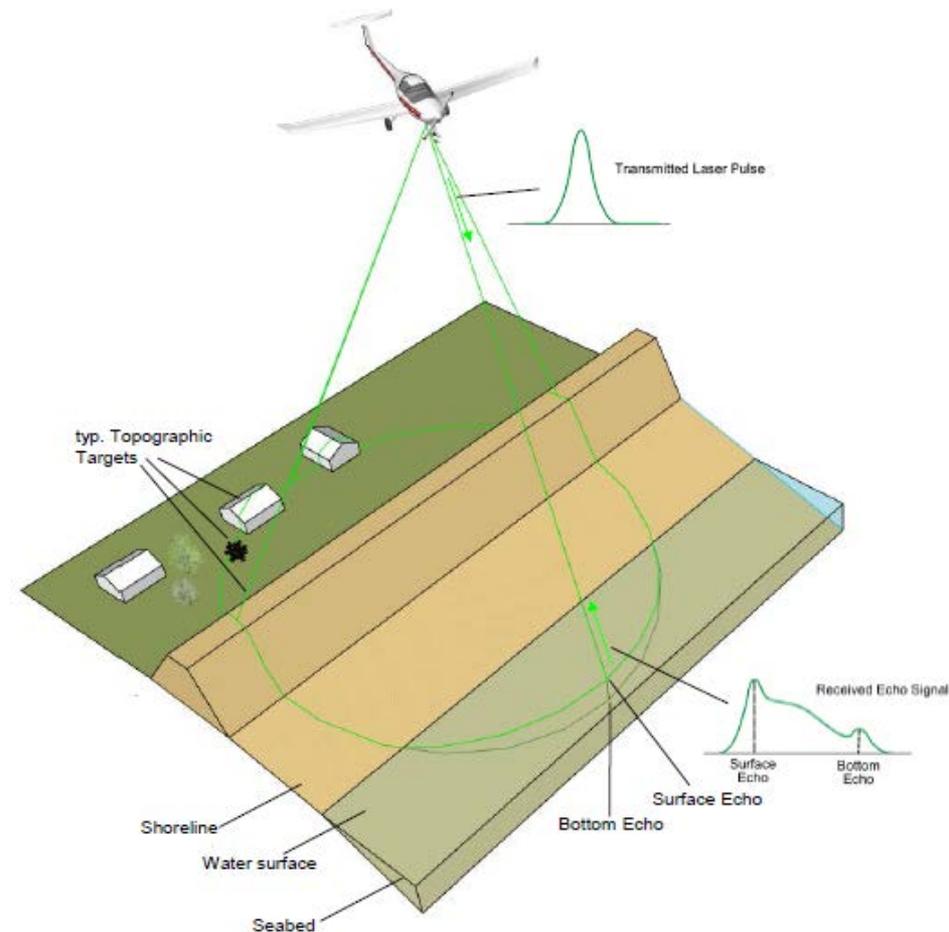


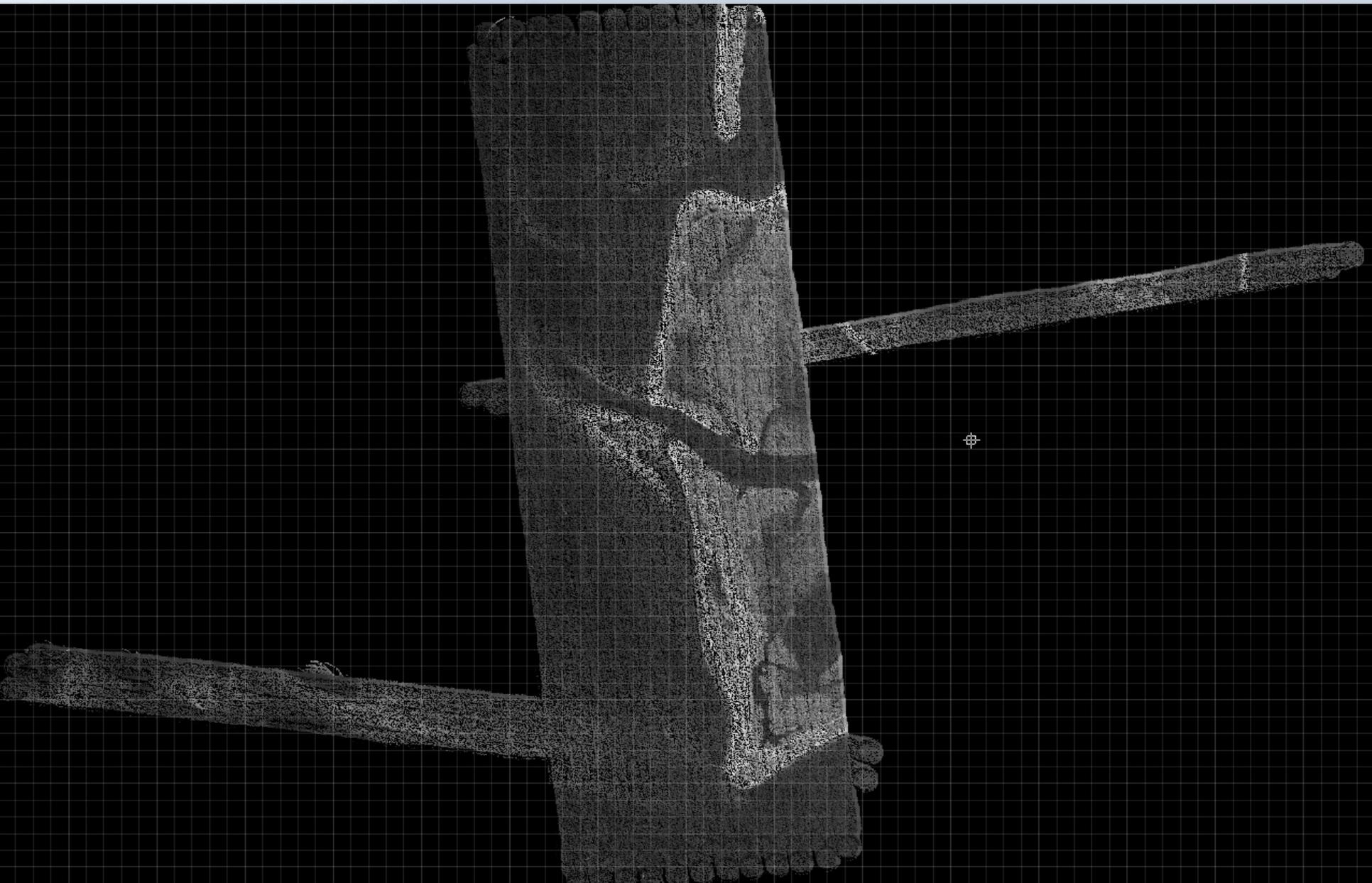
July 2014 VQ880-G (2014-10-01)

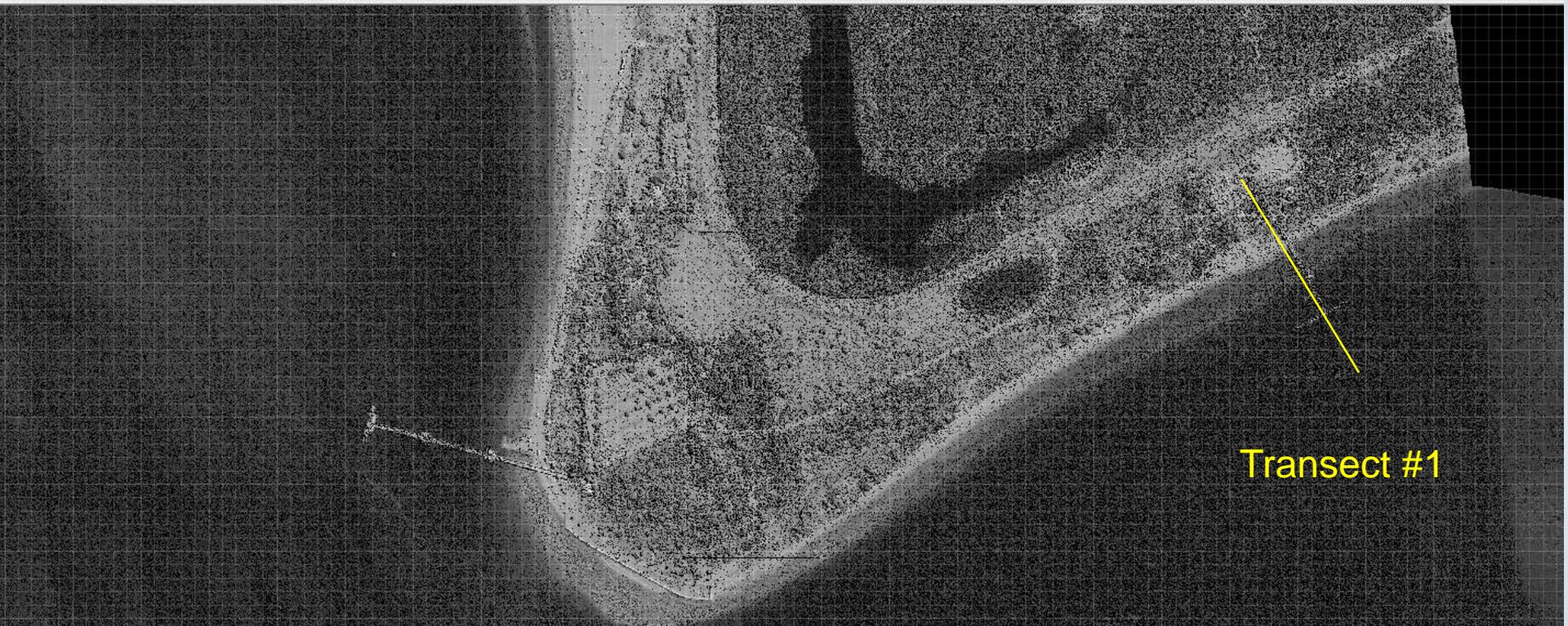
Upgrade to VQ-880G



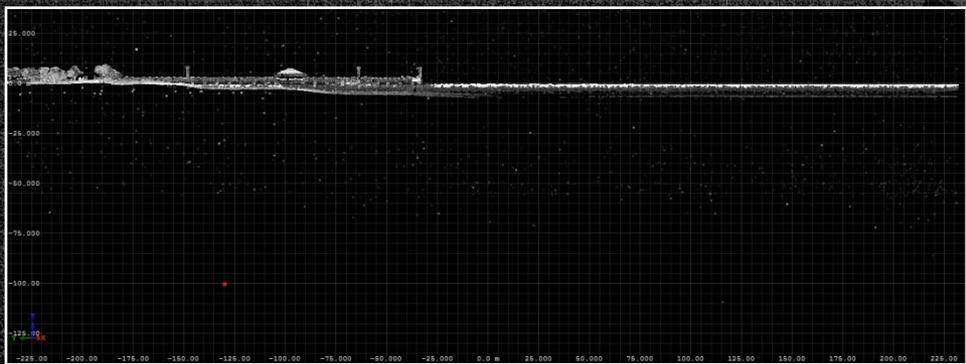
VQ-880G Scan Pattern



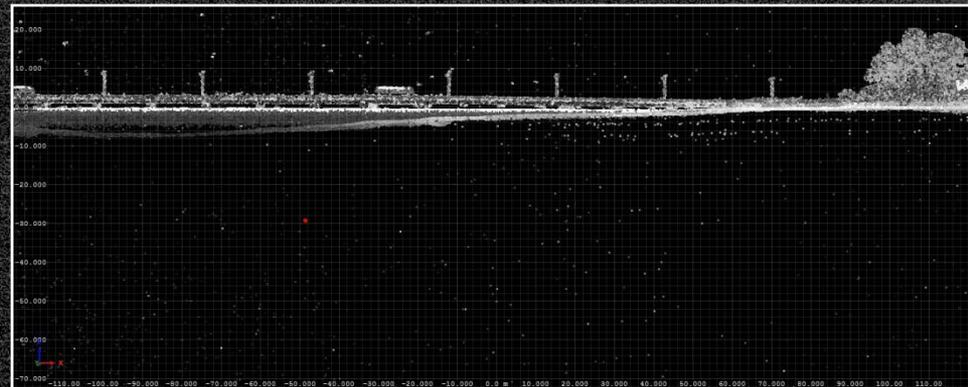




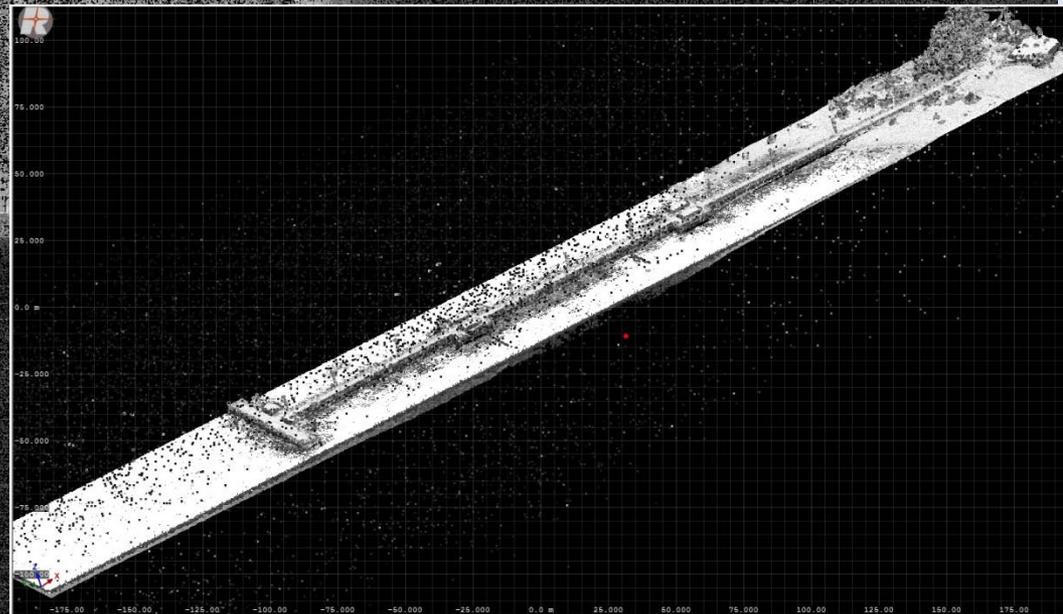
Transect #1

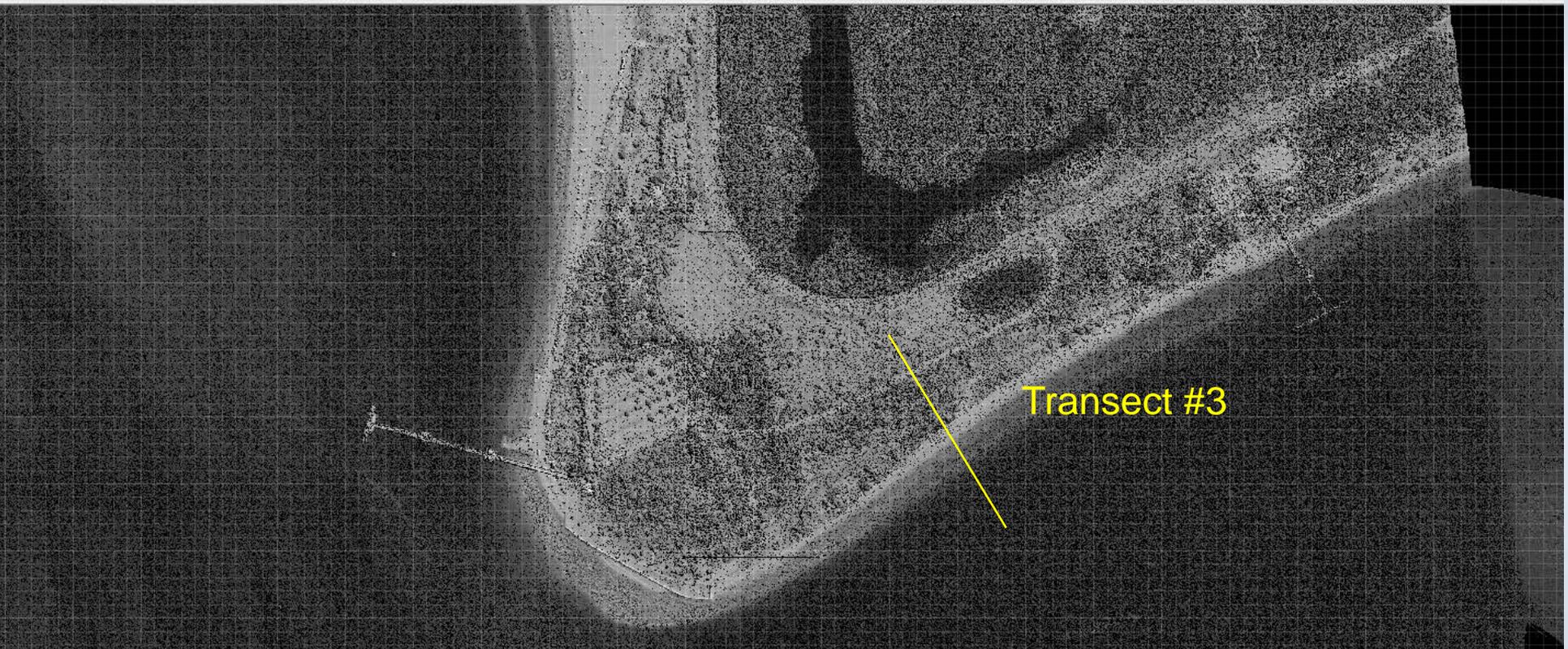


Transect #2

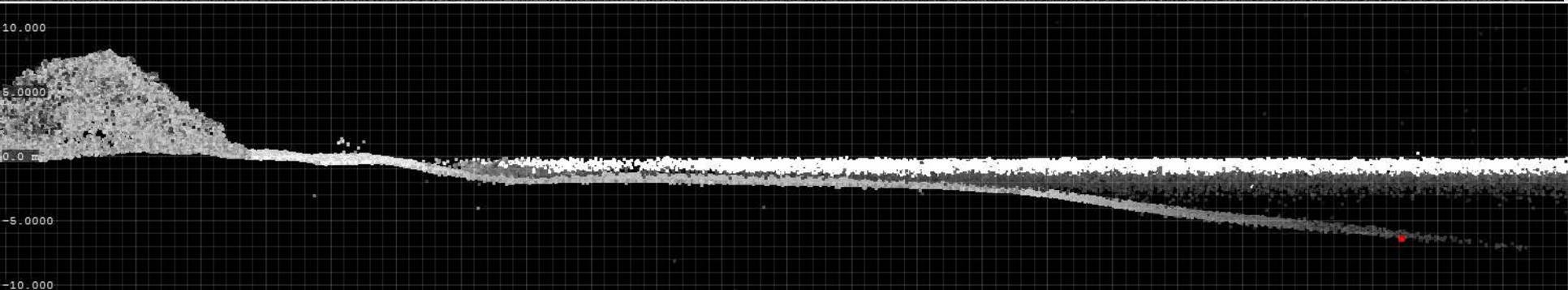


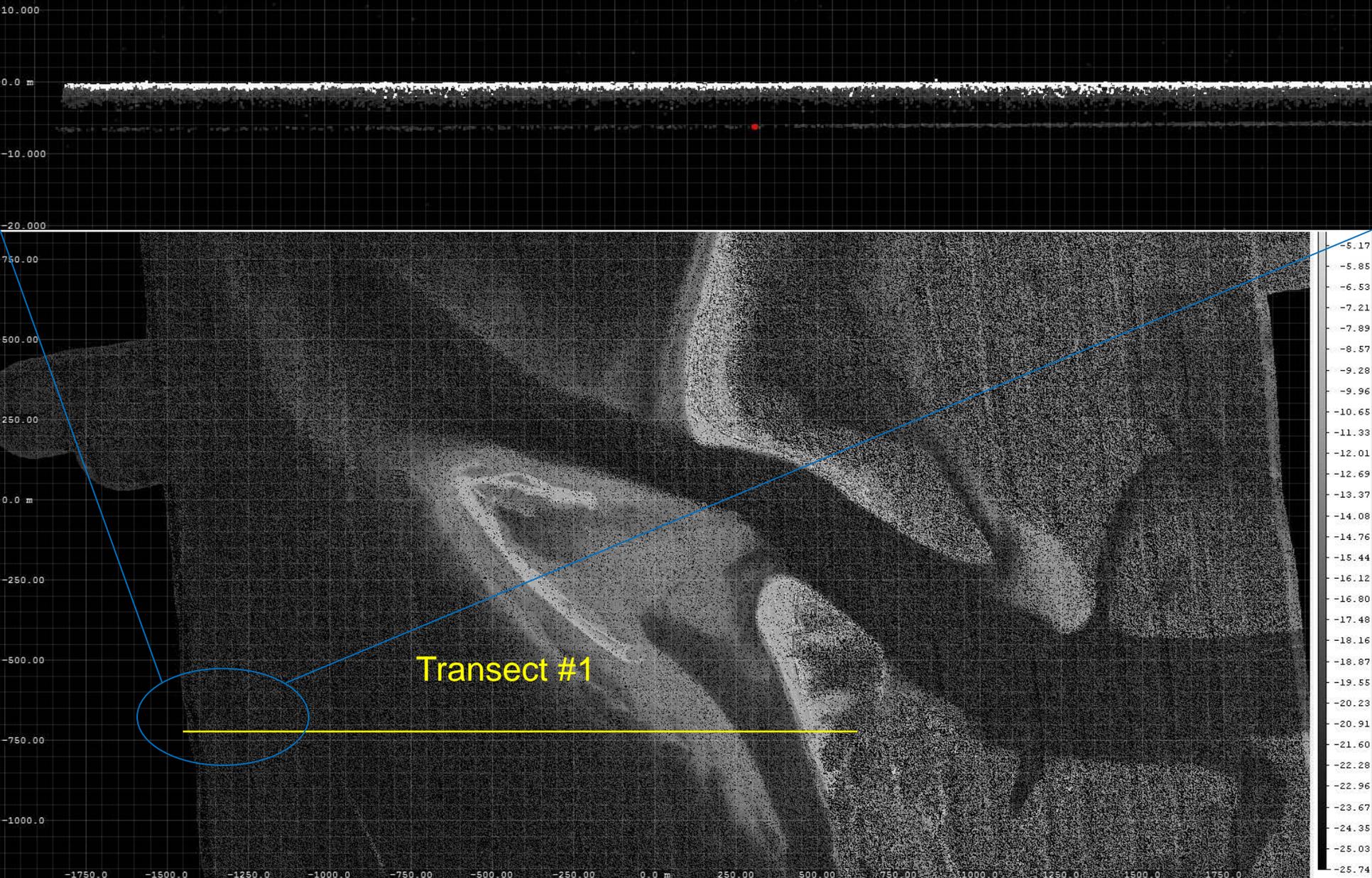
Transect #2

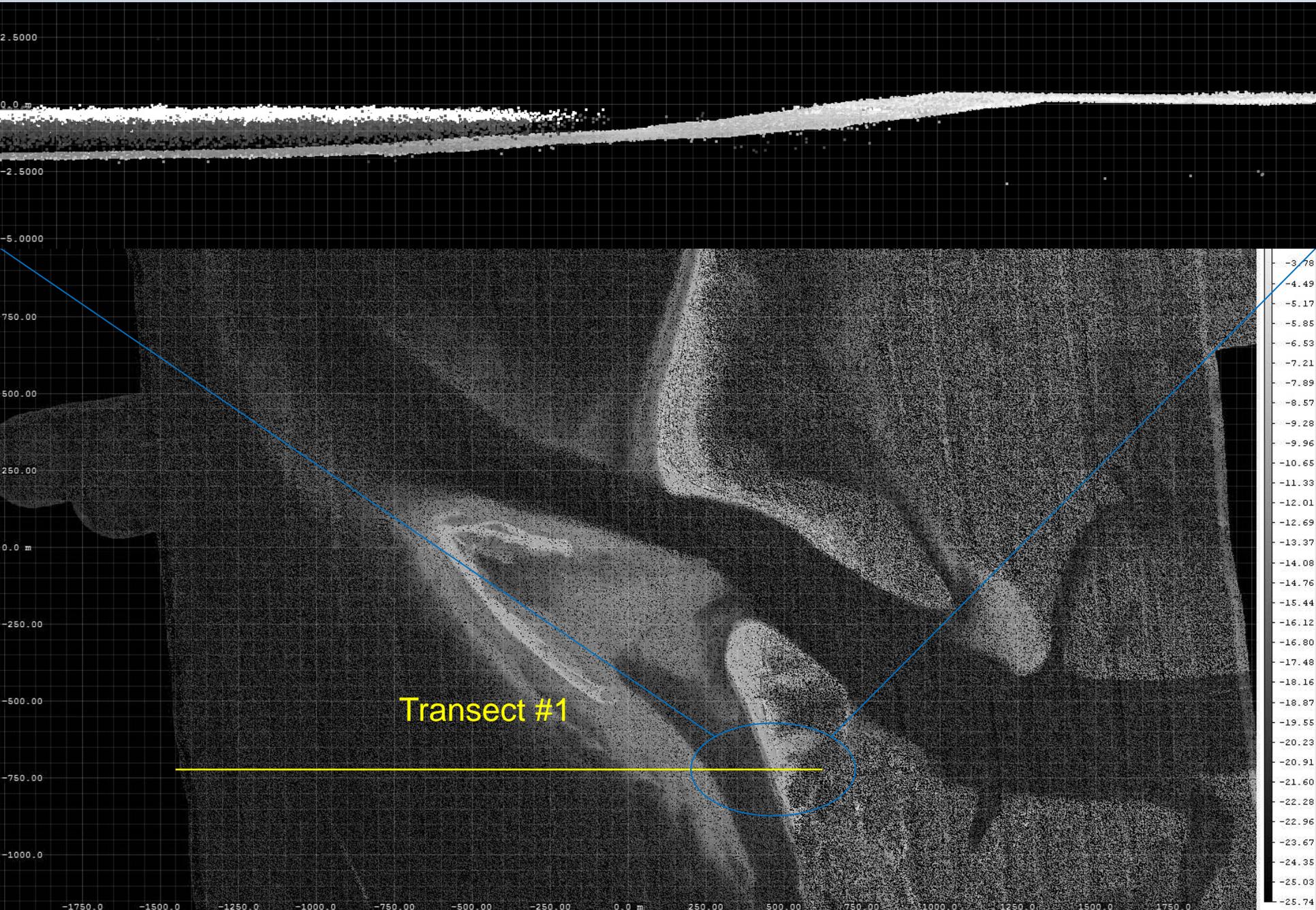




Transect #3







25.000

0.0 m

-25.000

750.00

500.00

250.00

0.0 m

-250.00

-500.00

-750.00

-1000.00

-1750.0 -1500.0 -1250.0 -1000.0 -750.0 -500.0 -250.0 0.0 m 250.00 500.00 750.00 1000.0 1250.0 1500.0 1750.0

-3.10

-3.78

-4.49

-5.17

-5.85

-6.53

-7.21

-7.89

-8.57

-9.28

-9.96

-10.65

-11.33

-12.01

-12.69

-13.37

-14.08

-14.76

-15.44

-16.12

-16.80

-17.48

-18.16

-18.87

-19.55

-20.23

-20.91

-21.60

-22.28

-22.96

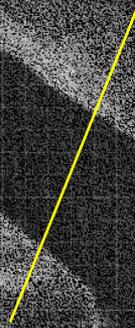
-23.67

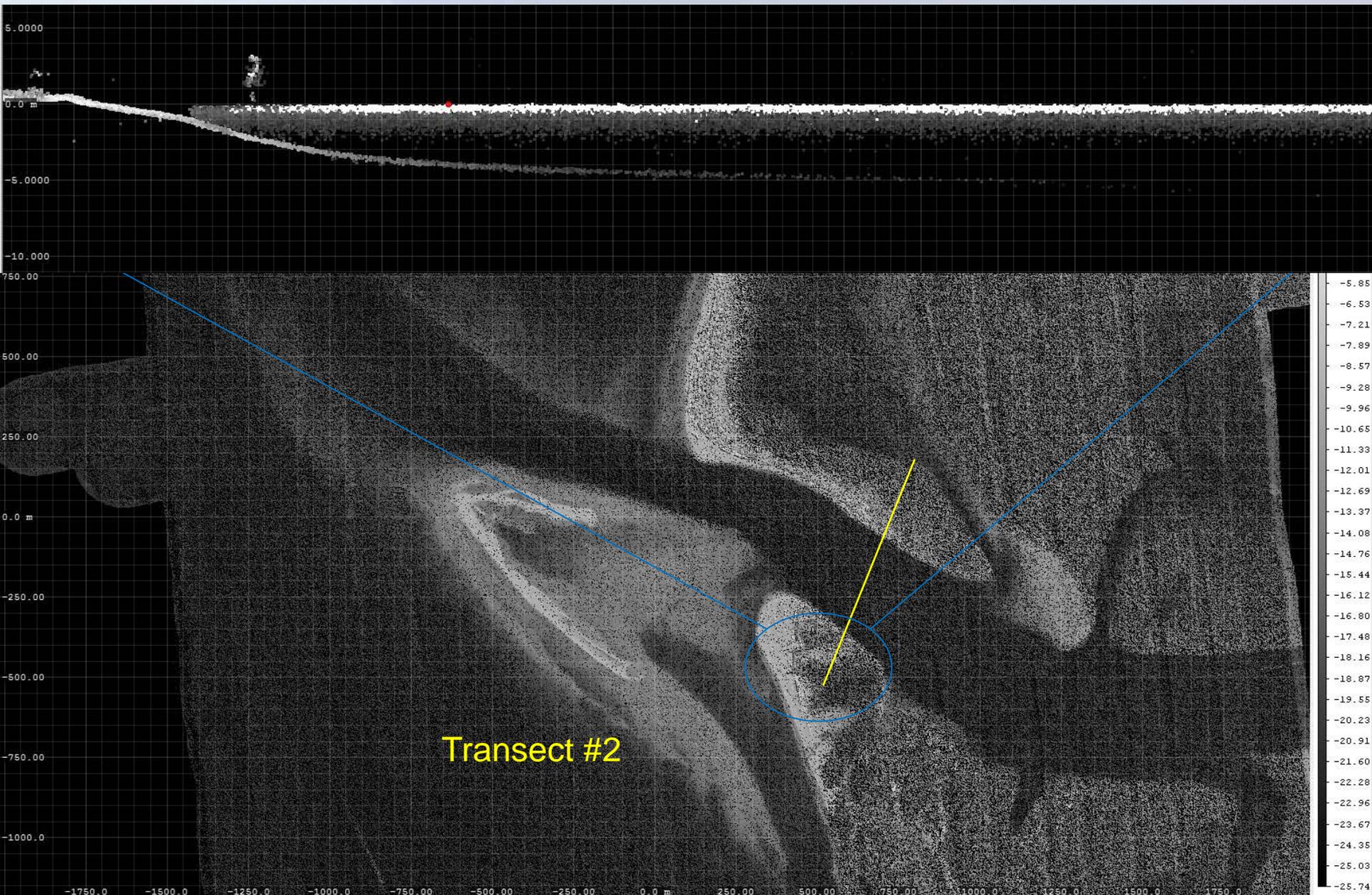
-24.35

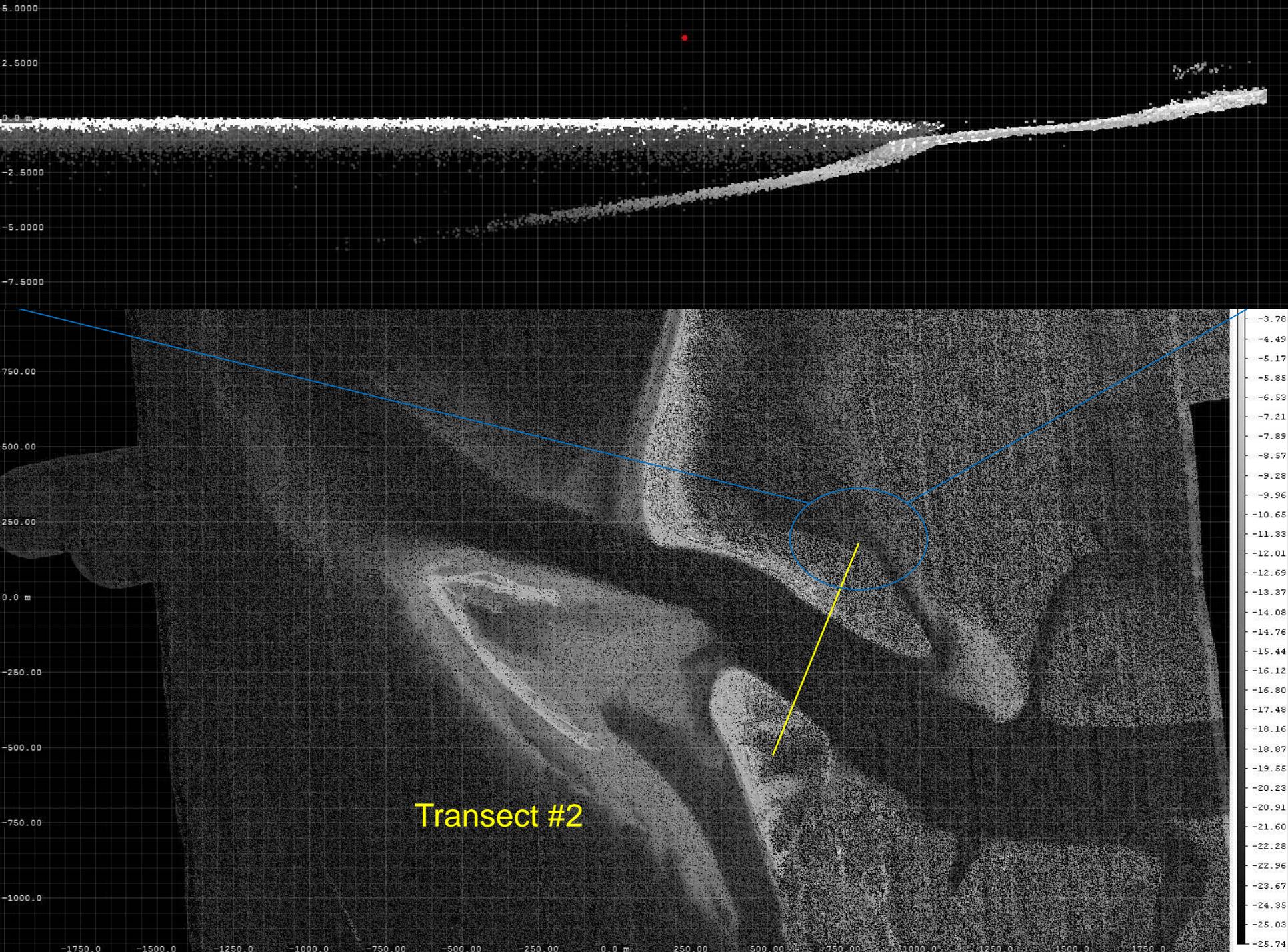
-25.03

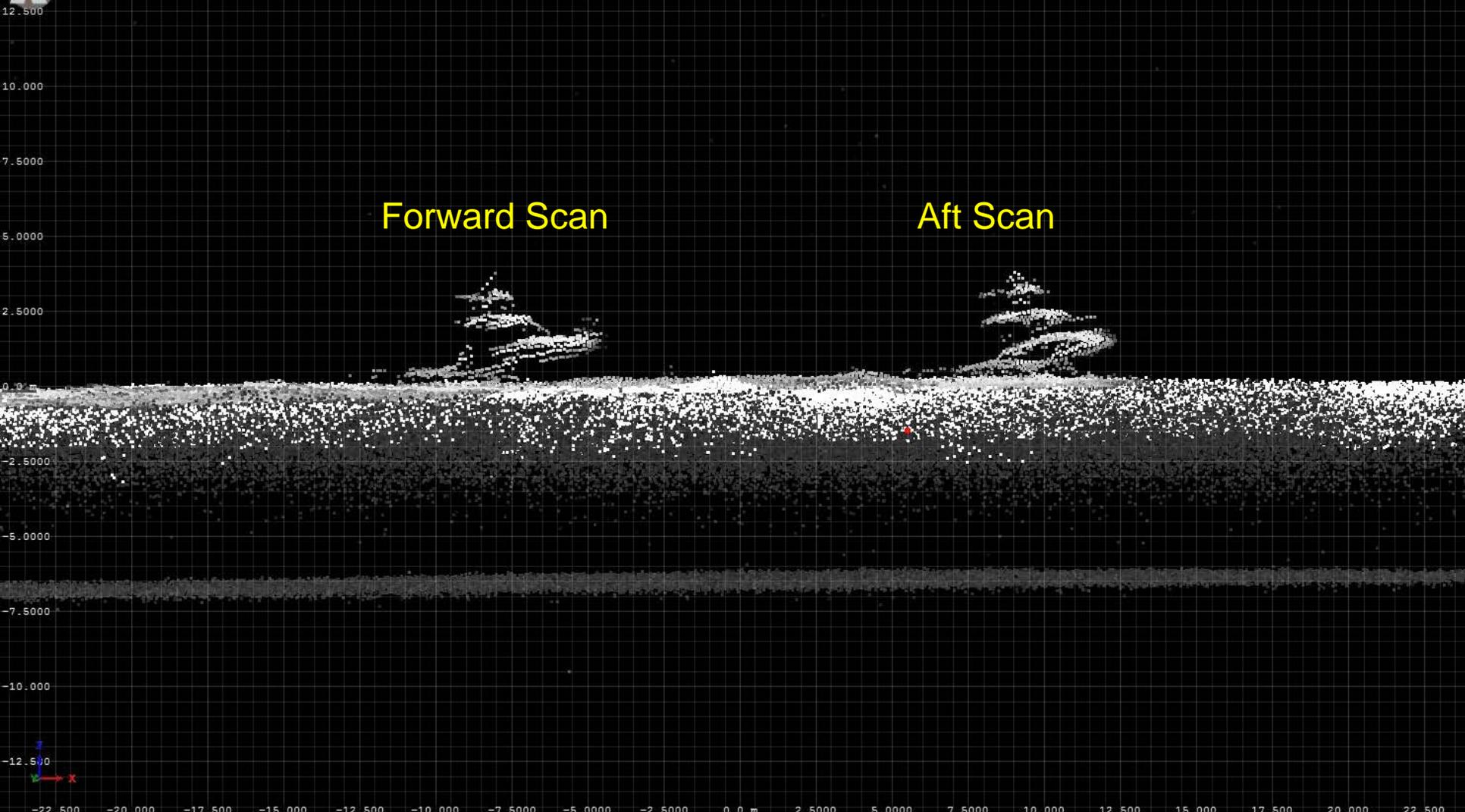
-25.74

Transect #2











Day 1 of 3 at Marathon

5000.0

2500.0

0.0 m

-2500.0

-5000.0

-7500.0

-5000.0

-2500.0

0.0 m

2500.0

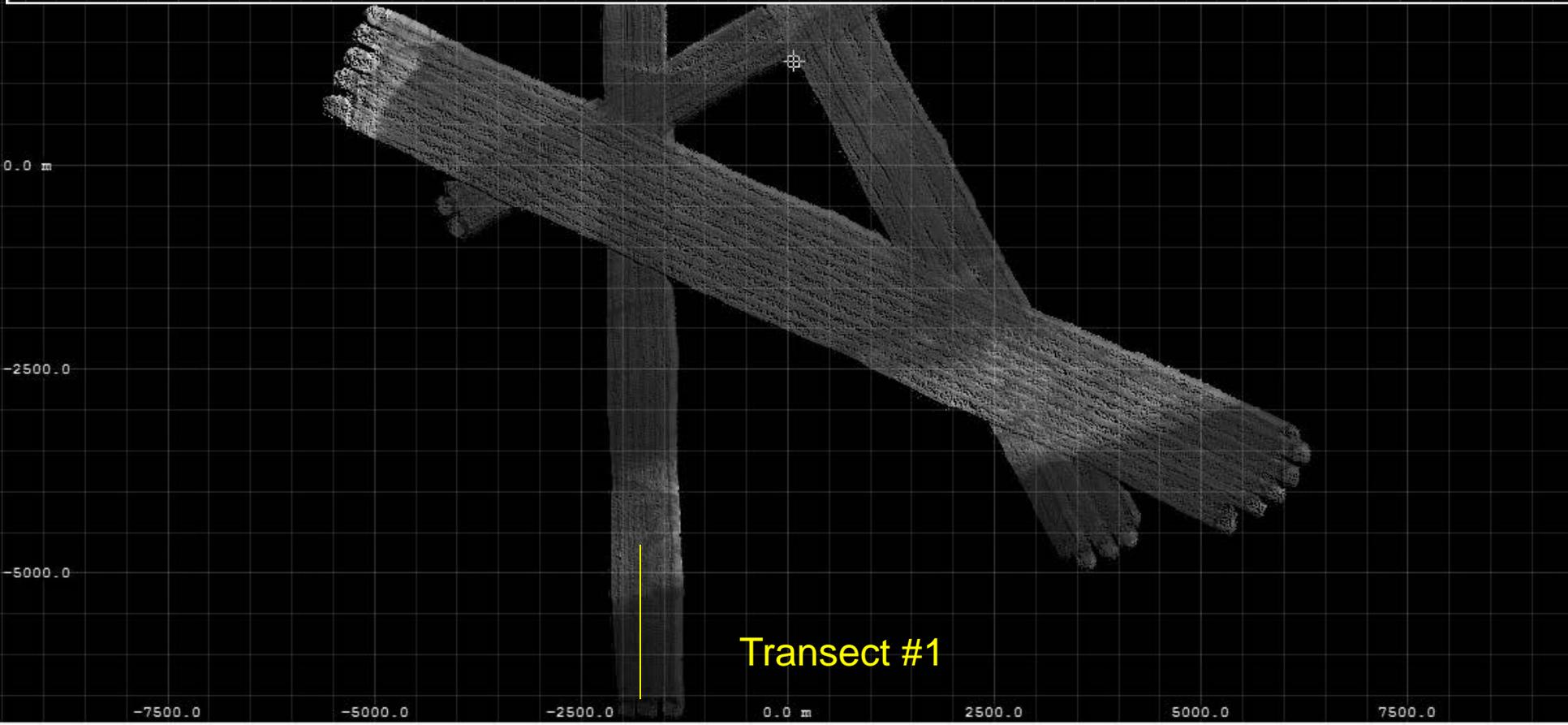
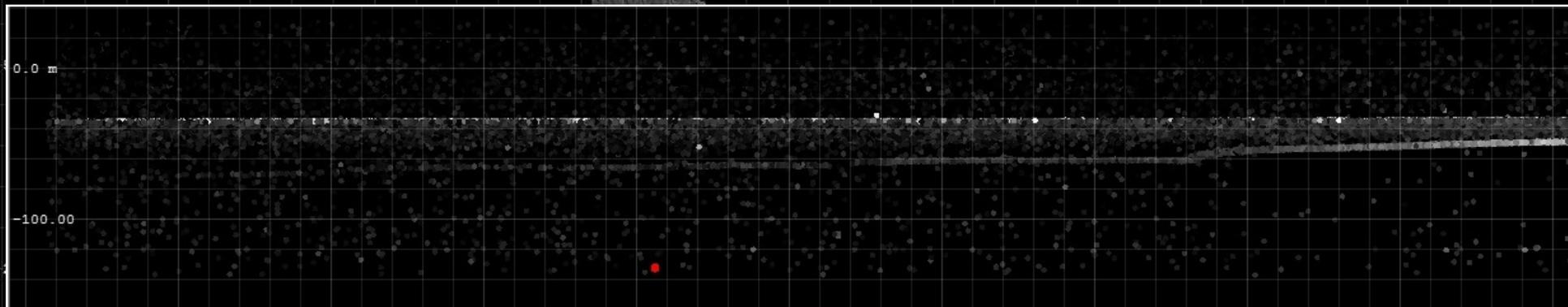
5000.0

7500.0





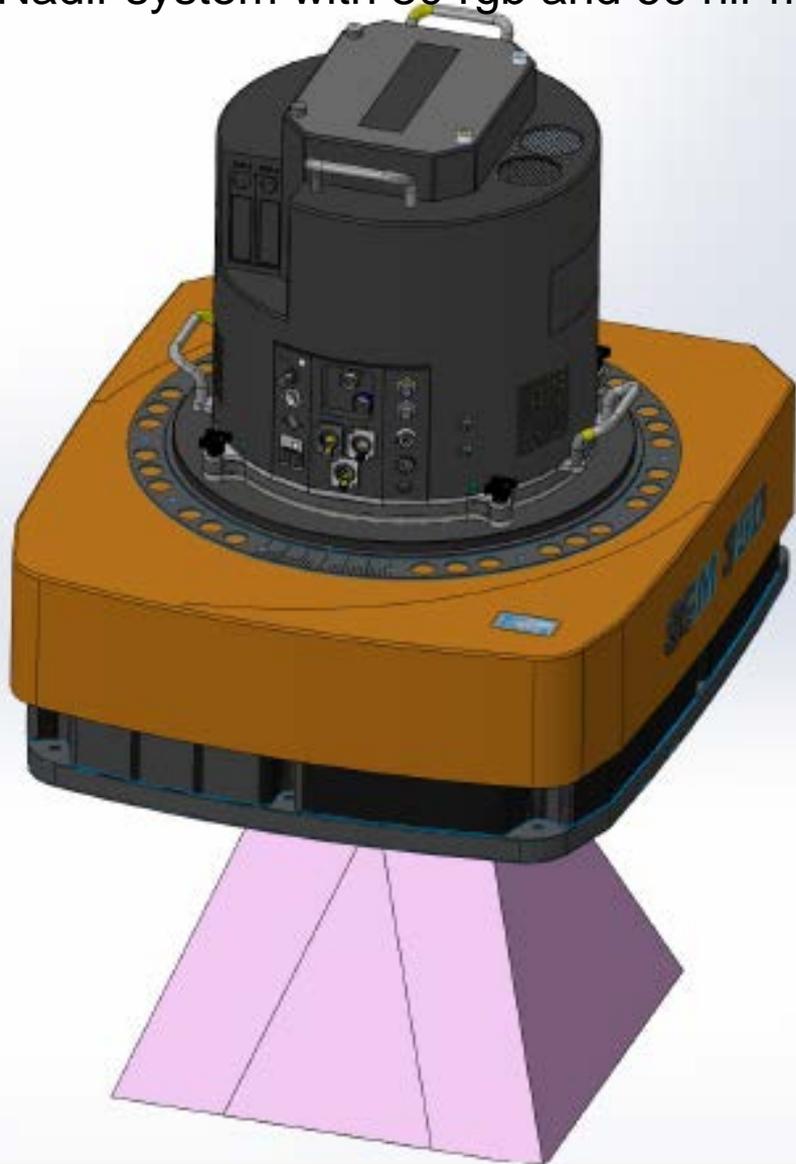
Day 1 of 3 at Marathon



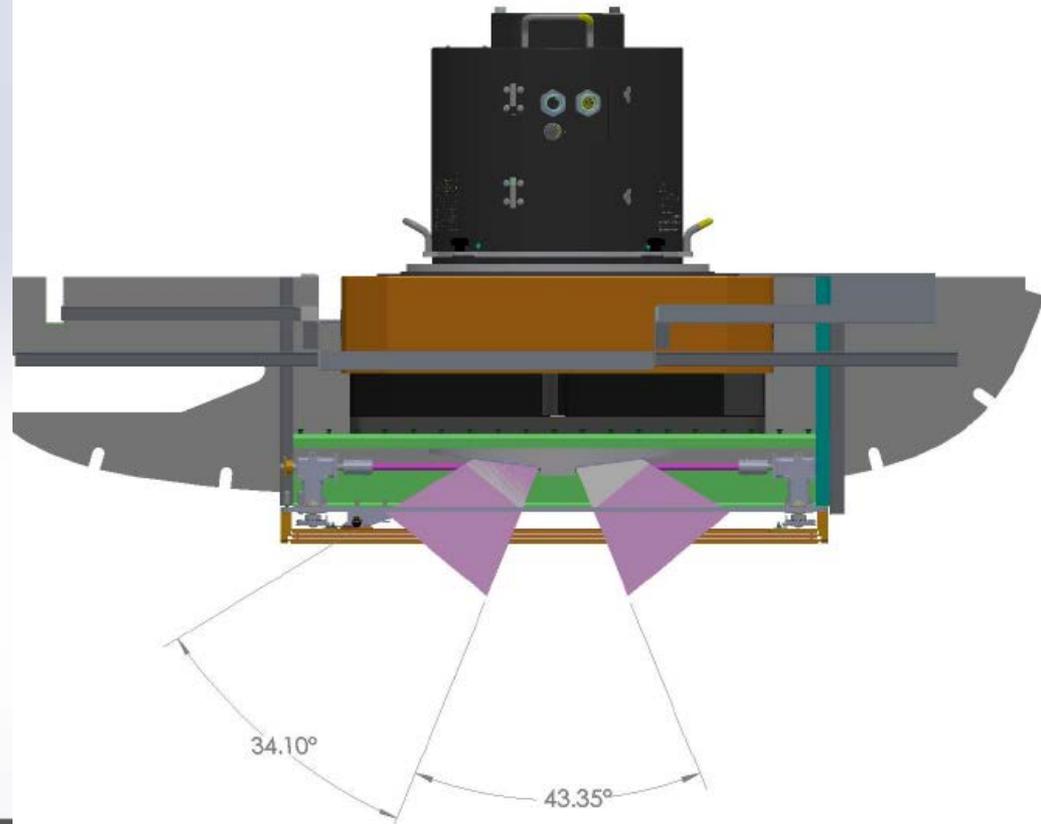
Transect #1

Upgrade to DSS cameras

Nadir system with 80 rgb and 60 nir mp



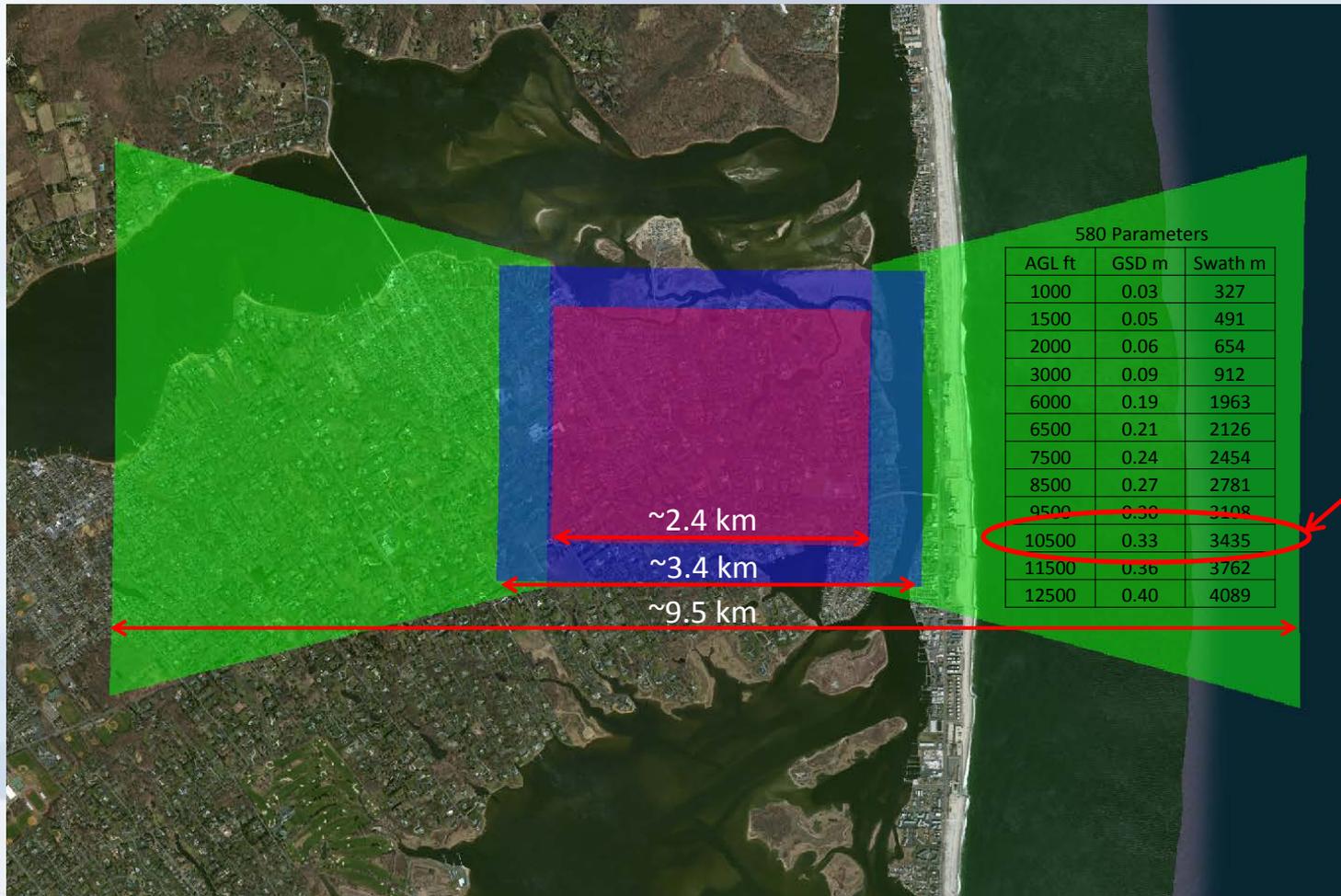
Oblique system with two 39 rgb mp





National Oceanic and Atmospheric Administration

Camera Resolution and GSD



King Air typical flying height

Coverage at 10,500 ft for 439 (Old System) (Red), 580 (Blue) and 539 Oblique (Green)

Example image of nadir and oblique imagery



Hx Arthur Response

← → ↻ 🏠

Hurricane Arthur Imagery ? About 📧 Contact 📄 Download

🔍

Get Started:
Search an address within the acquisition area or zoom in and select a polygon in the left side map pane.
Example address: 2169 Ocean Pearl Rd, Corolla, NC
Mouseover the image in the right side pane to display coordinates in NAD83 (2011) Geographic Latitude / Longitude and U.S. National Grid.

GIS Users:
The image that you download (link in polygon popup) is a GeoTiff and will load as an orthorectified product in a GIS. Some users with a GDAL based viewer (QGIS) may need the associated .vrt (Virtual Raster) file. It can be downloaded from the same location by changing the .tif to .vrt. Both the tif and vrt file are included in the bulk download tar file.

© Mapbox © OpenStreetMap Improve this map

noaa.doc Elvidge_boats_2014....docx VQ-880-G_at_a_glan....pdf

Show all downloads...



National Oceanic and Atmospheric Administration

<http://ngs.woc.noaa.gov/storms/arthur/oblique/>





FY16 President Budget

Navigation, Observations and Positioning: Shoreline TopoBathy LIDAR Data: NOAA requests an increase of \$4,000,000 to build upon its coastal LIDAR survey efforts. Working with interagency partners, NOAA will expand the national dataset to enhance navigation safety, coastal storm preparedness, and stewardship of ecological resources.

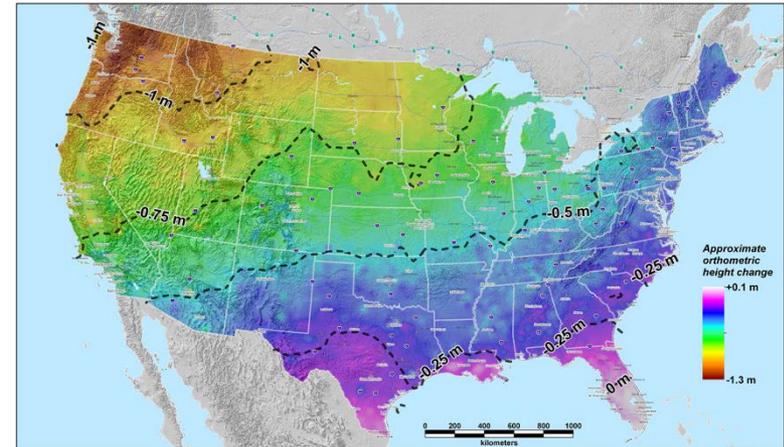
***Supported in the Senate FY16 mark up**



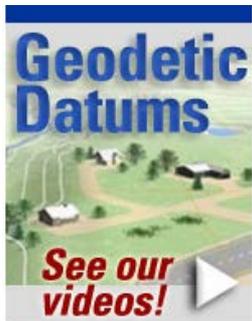
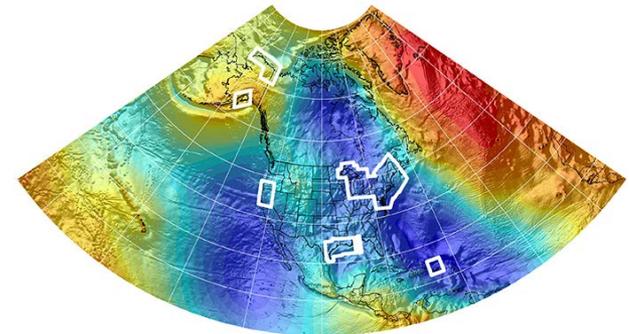
New Datums Are Coming in 2022!

- NOAA's National Geodetic Survey will release new geometric (horizontal) and geopotential (vertical) datums in 2022
- The realization of the new datums will be through GPS/GNSS receivers and will replace the current datums:
NAD 83 (geometric) and NAVD 88 (geopotential)
- Target: 2-centimeter accuracy relative to sea level (orthometric heights) using GPS/GNSS and a geoid (gravity) model from NGS' GRAV-D project.
- NGS will provide the tools to easily transform between the new and old datums.

Approximate predicted change from NAVD88 to new vertical (geopotential) datum



Predicted change estimated as NAVD88 "zero" (datum) surface minus NGS gravimetric geoid



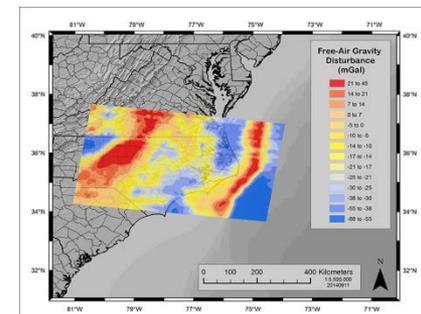
MORE INFO:

April 13-14 DC Area Geospatial Summit:

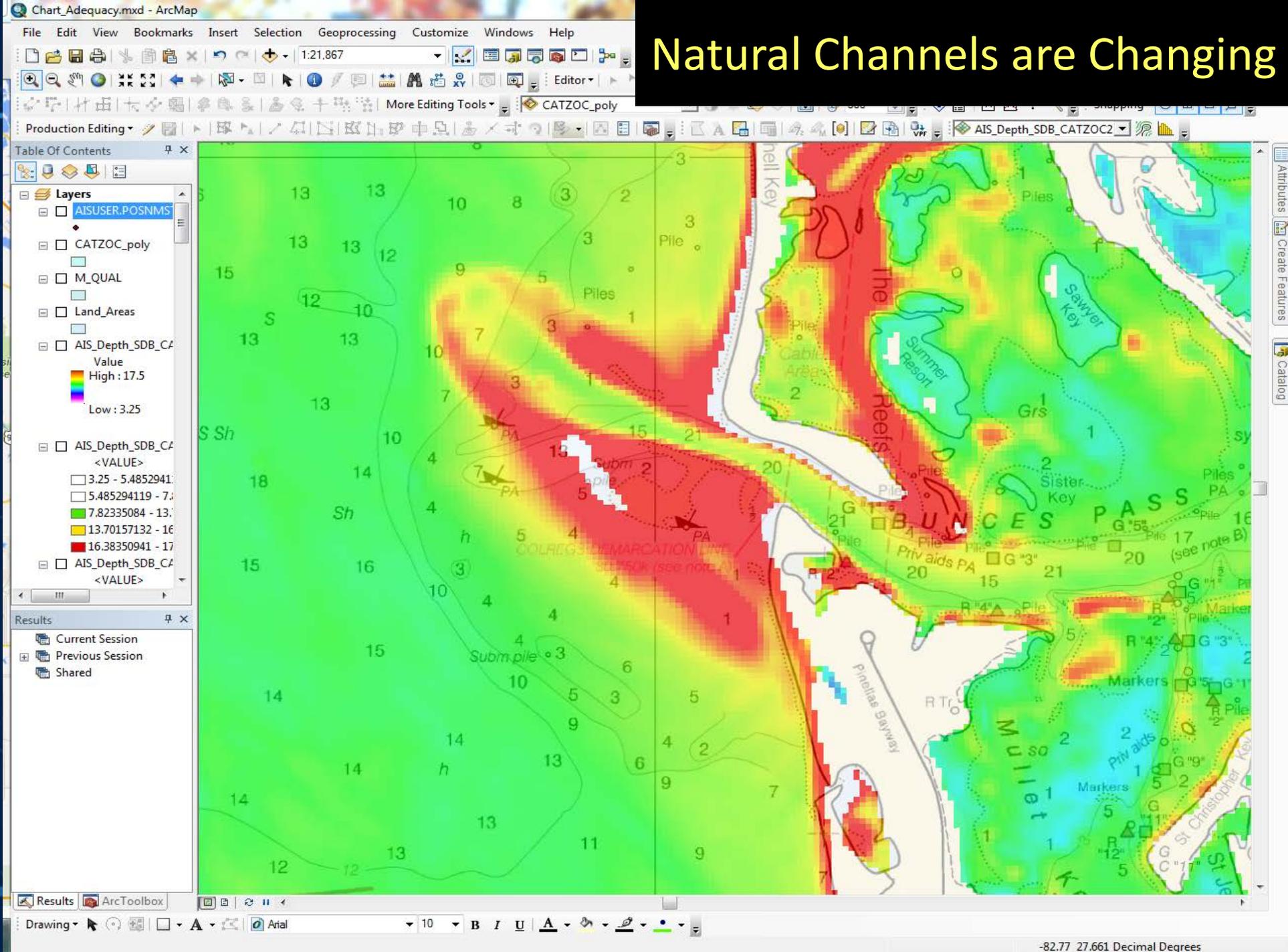
<http://www.geodesy.noaa.gov/2015GeospatialSummit/>

New Datums Webpage and Videos:

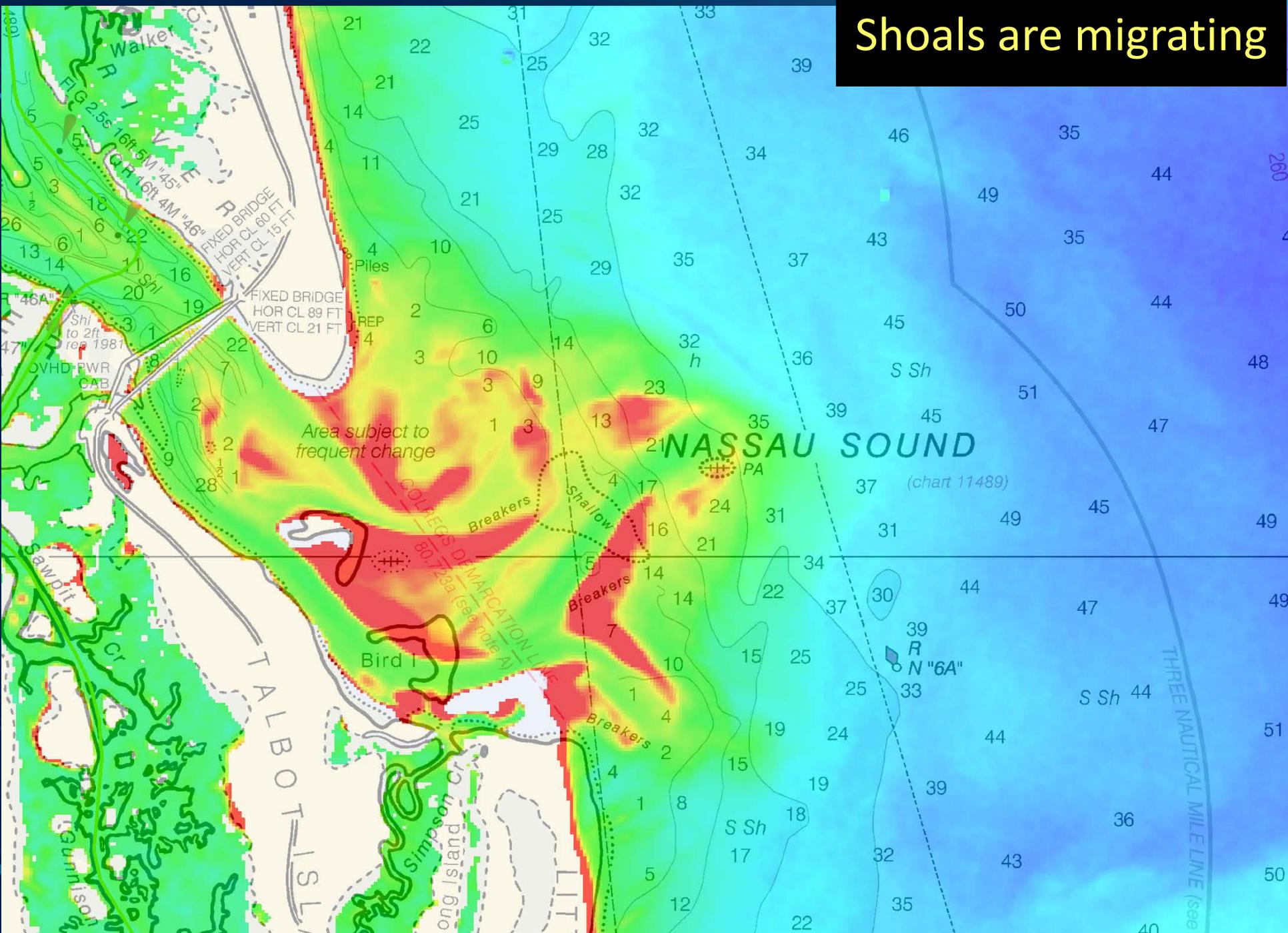
<http://www.geodesy.noaa.gov/datums/newdatums/NewDatums.shtml>



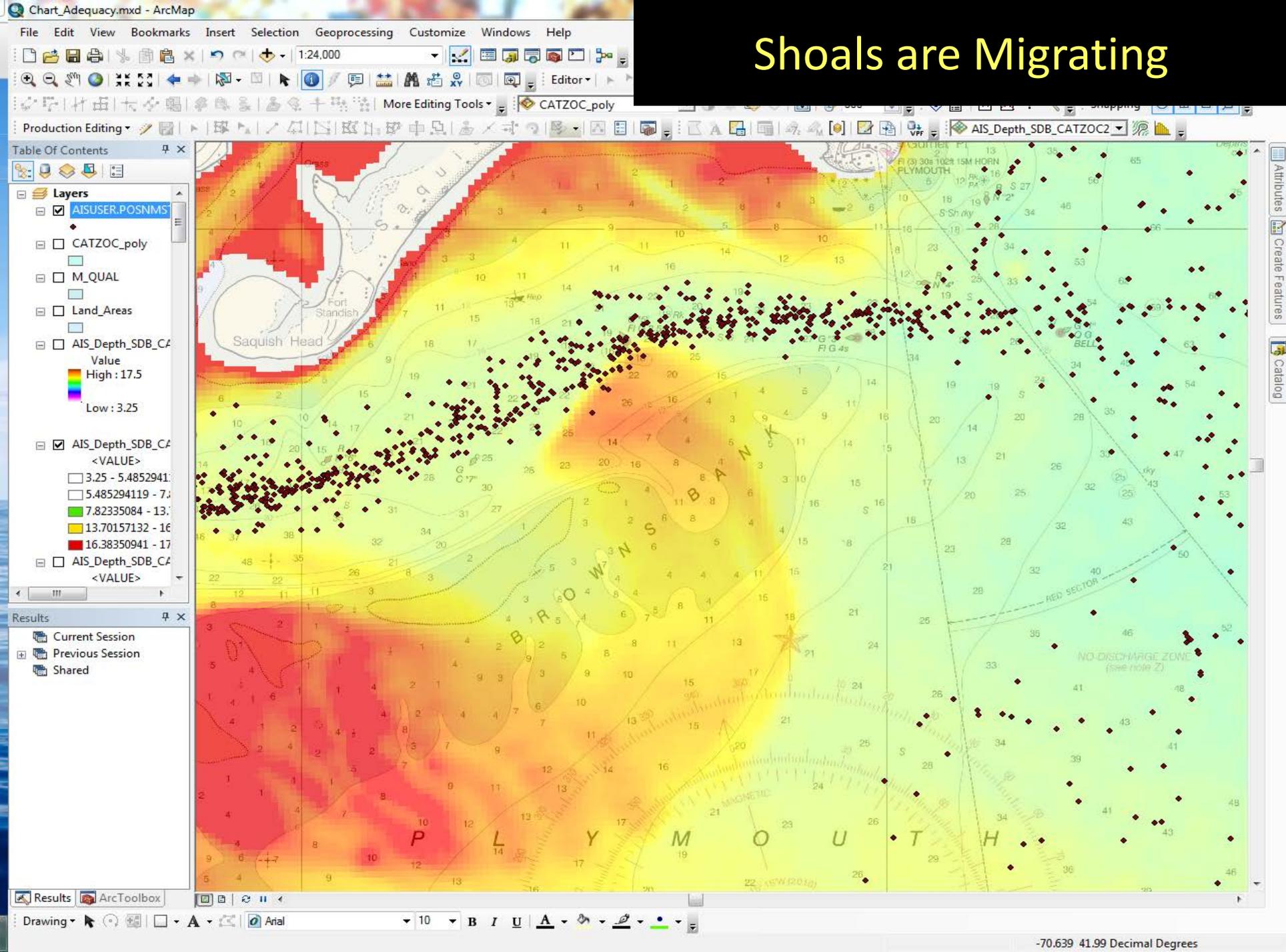
Natural Channels are Changing



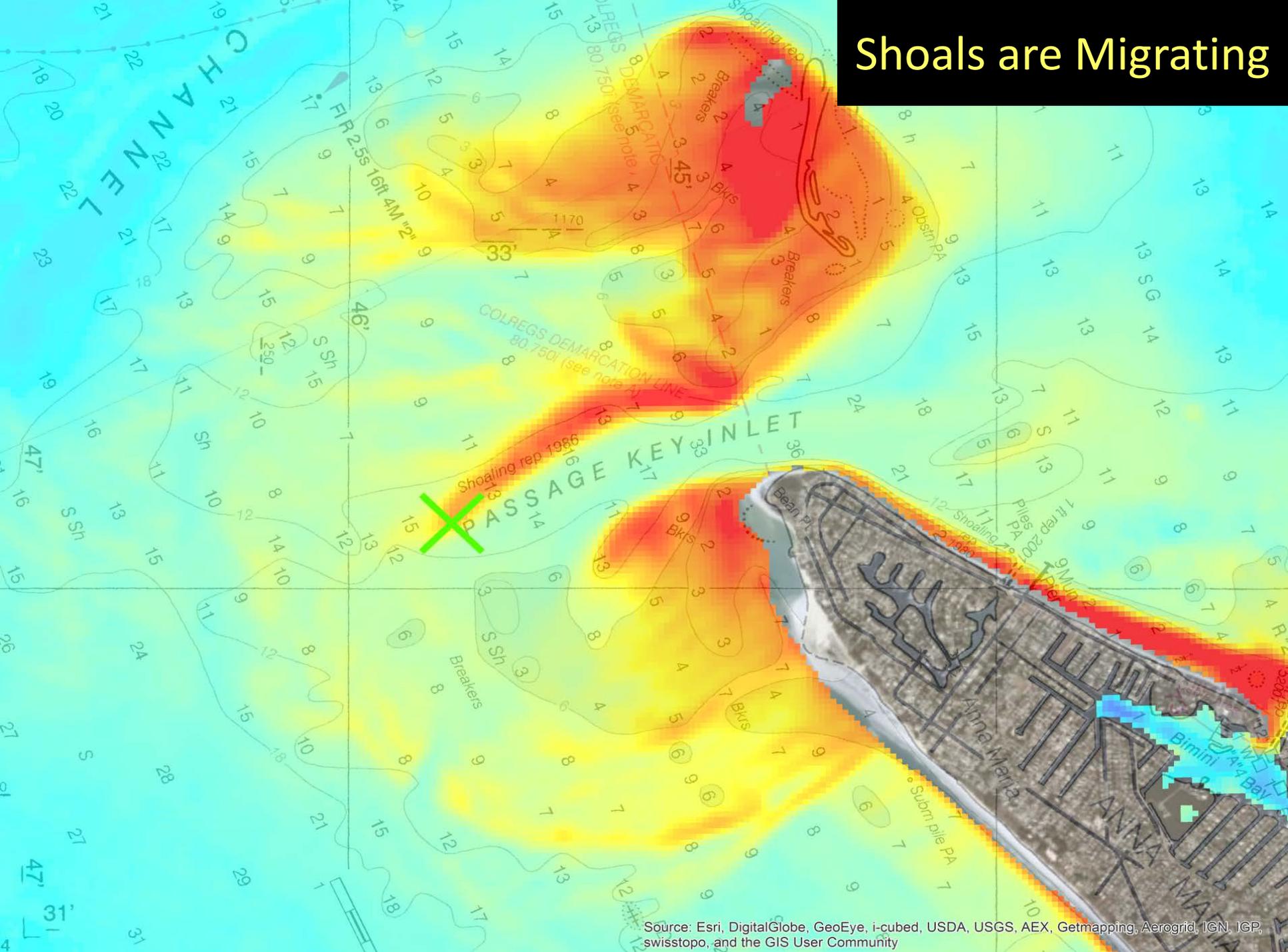
Shoals are migrating



Shoals are Migrating



Shoals are Migrating



Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community