Intensity and Reflectance for Habitat Mapping and Seafloor Characterization using the Superstorm Sandy Lidar Data

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Silver Spring, MD

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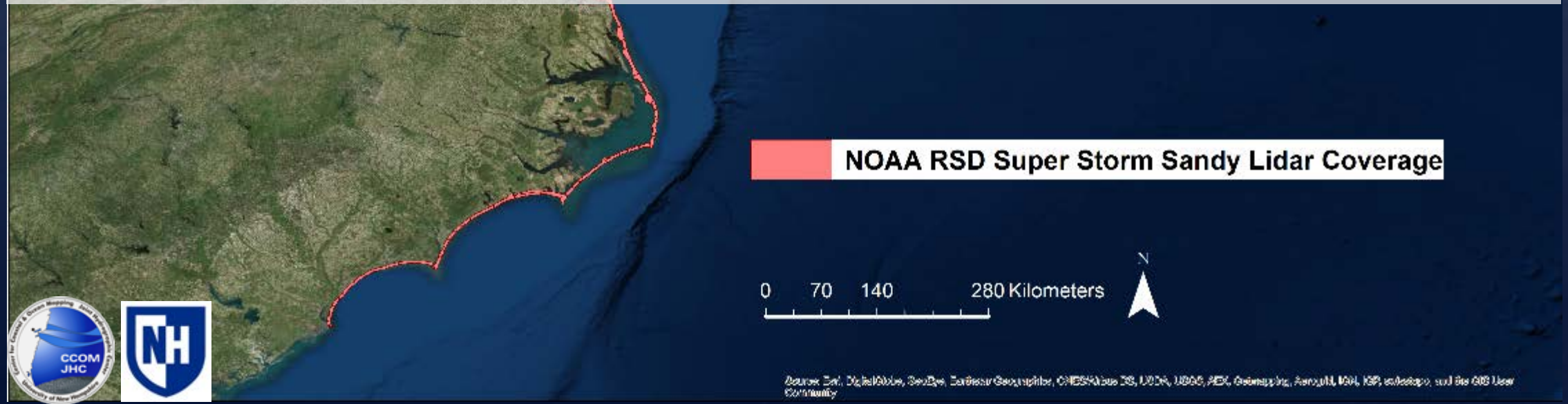
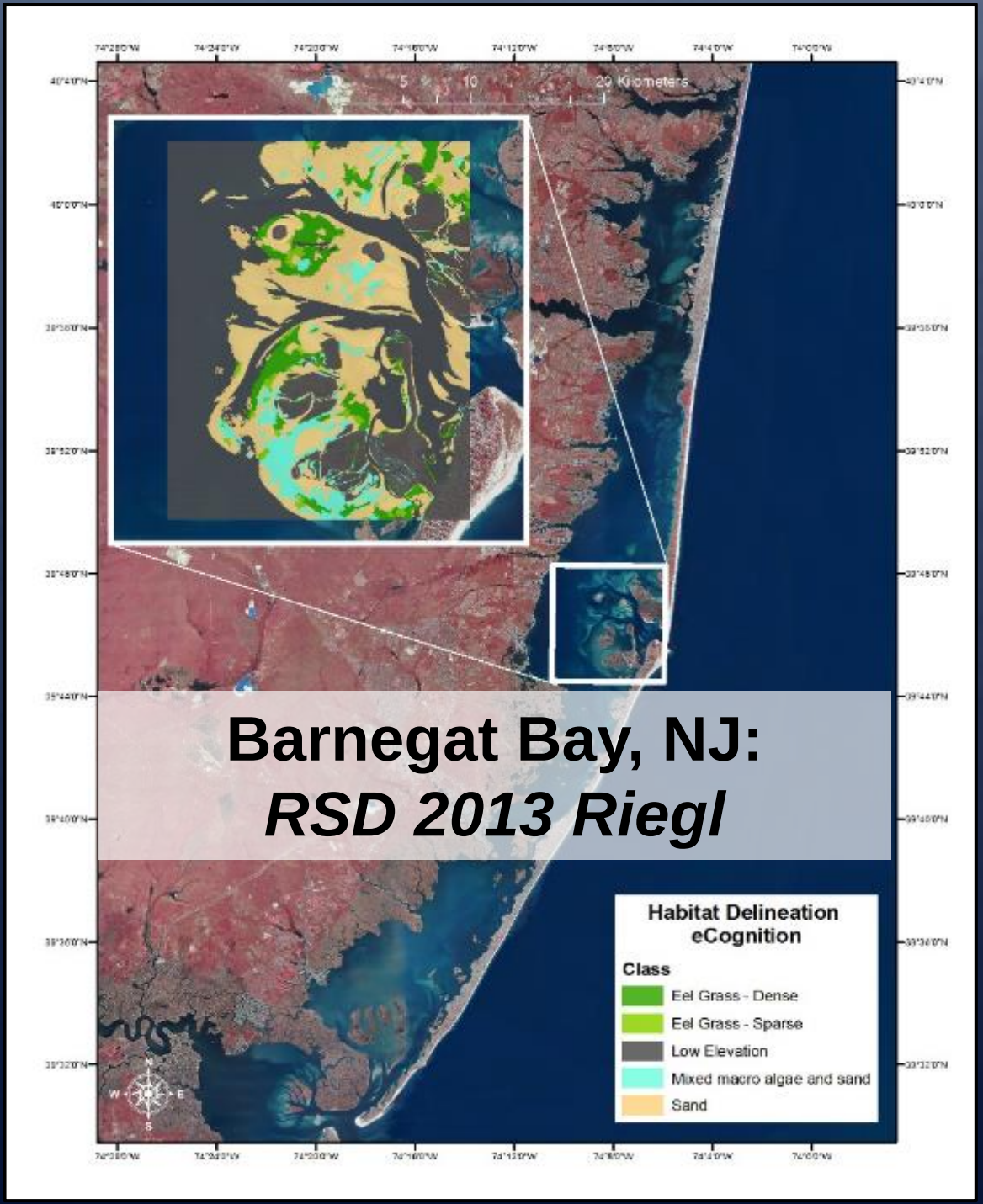
1=ERT, Inc. NOAA Sandy IOCM Team JHC at UNH, 2=NOAA JHC at UNH, 3=JHC/CCOM at UNH, 4=Oregon State University

Background: IOCM Sandy Project
“Map Once Use Many Times”

Builds on UNH CCOM/JHC Sandy Grant research, bring research concepts into production

Sandy affected region:



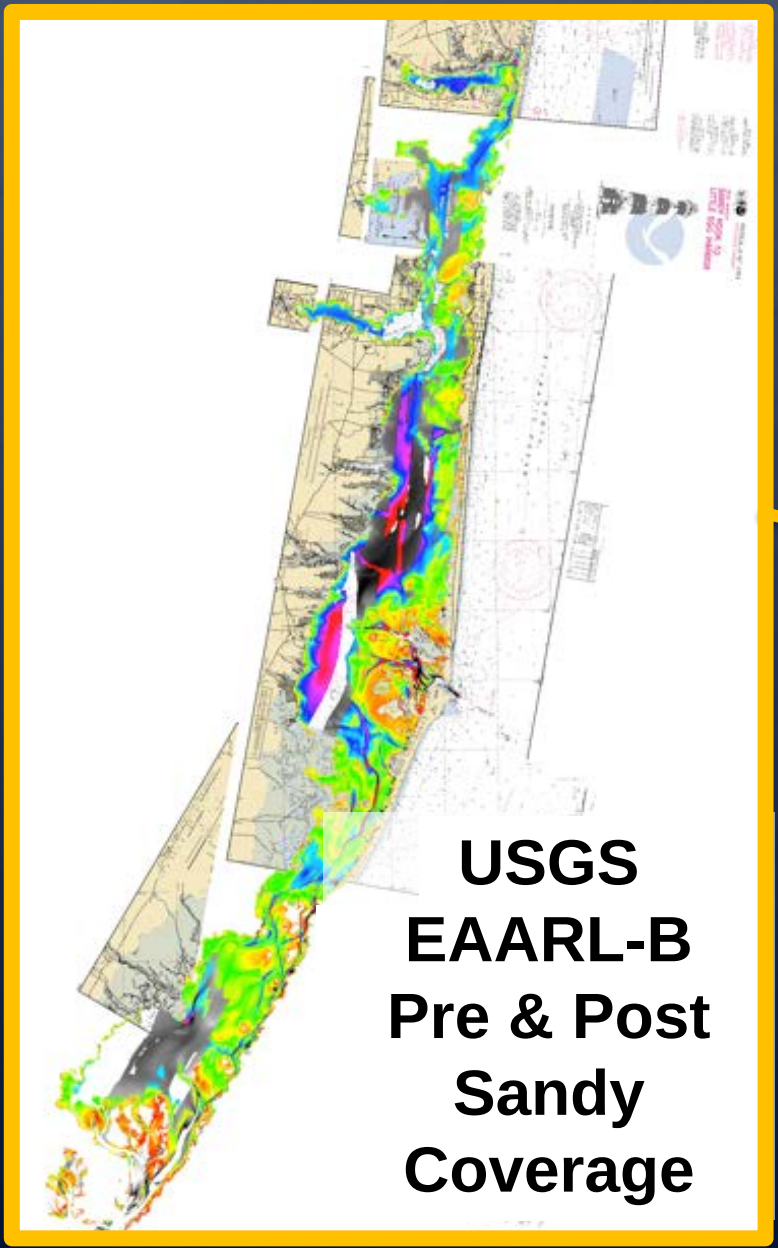


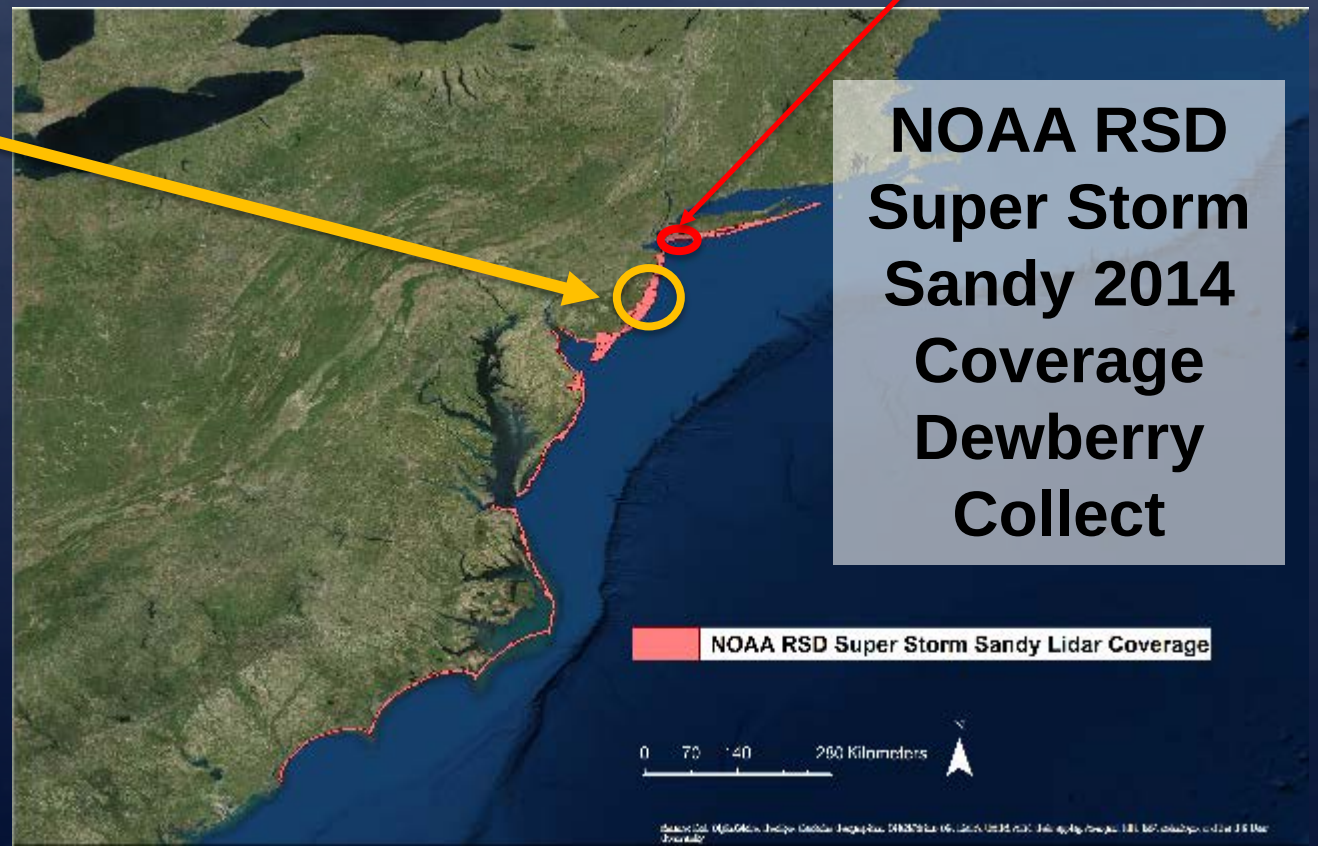
UNH JHC/CCOM Sandy Grant HABITAT MAPPING

Parrish, C.E., J.A. Dijkstra, J.P.M. O'Neil-Dunne, L. McKenna, and S. Pe'eri, In Press. Post-Sandy Benthic Habitat Mapping Using New Topobathymetric Lidar Technology and Object-Based Image Classification. *Journal of Coastal Research*.

Erin Nagel & Victoria Price*QPS

IOCM Work: RSD Lidar & EAARLB





Objectives:

Process Post Sandy Data to create Intensity/Reflectance Maps
Approach for specific data sets

USGS EAARLB

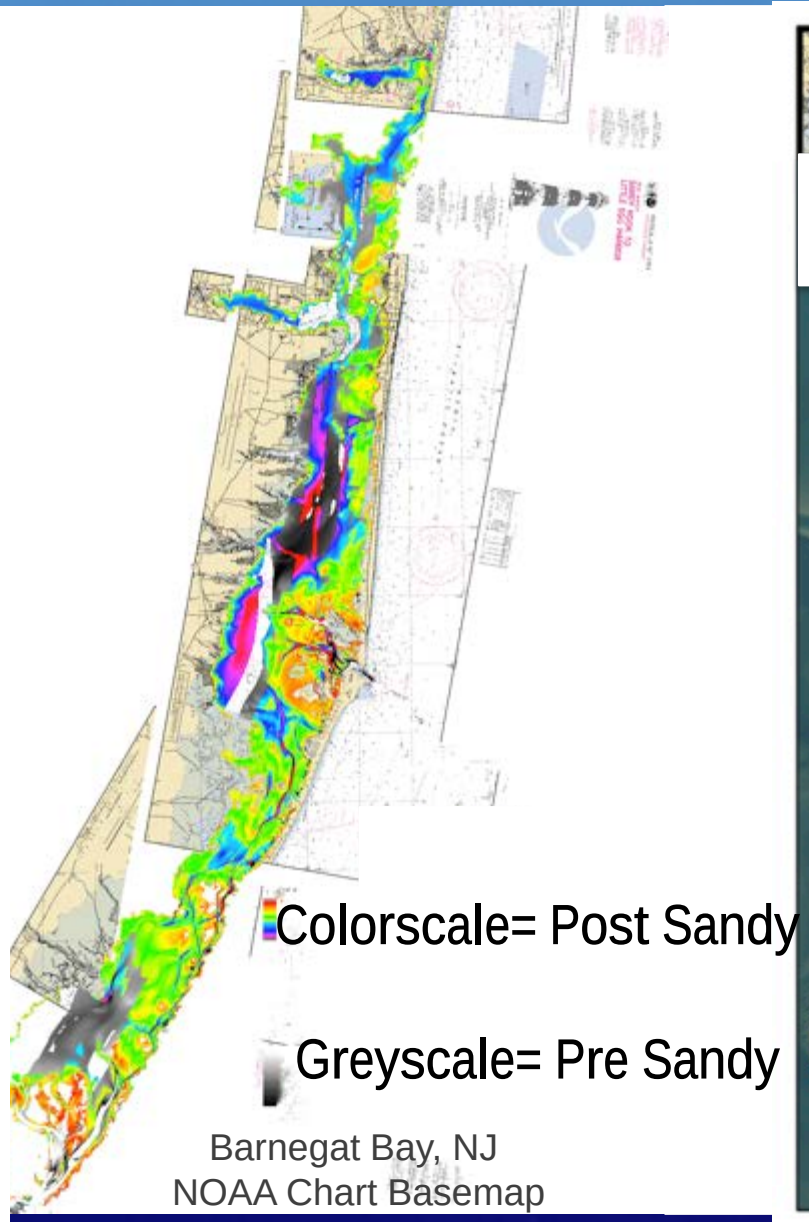
1) Waveform Bathymetry exports for all of Barnegat Bay USGS EAARLB Pre & Post Sandy
2) Reflectance Maps of EAARLB Pre & Post
3) Bottom characterization based on ground truth of select areas
4) Barnegat Bay Pre and Post Sandy Change?
5) Compare Acoustic SS/BS & Lidar Intensity

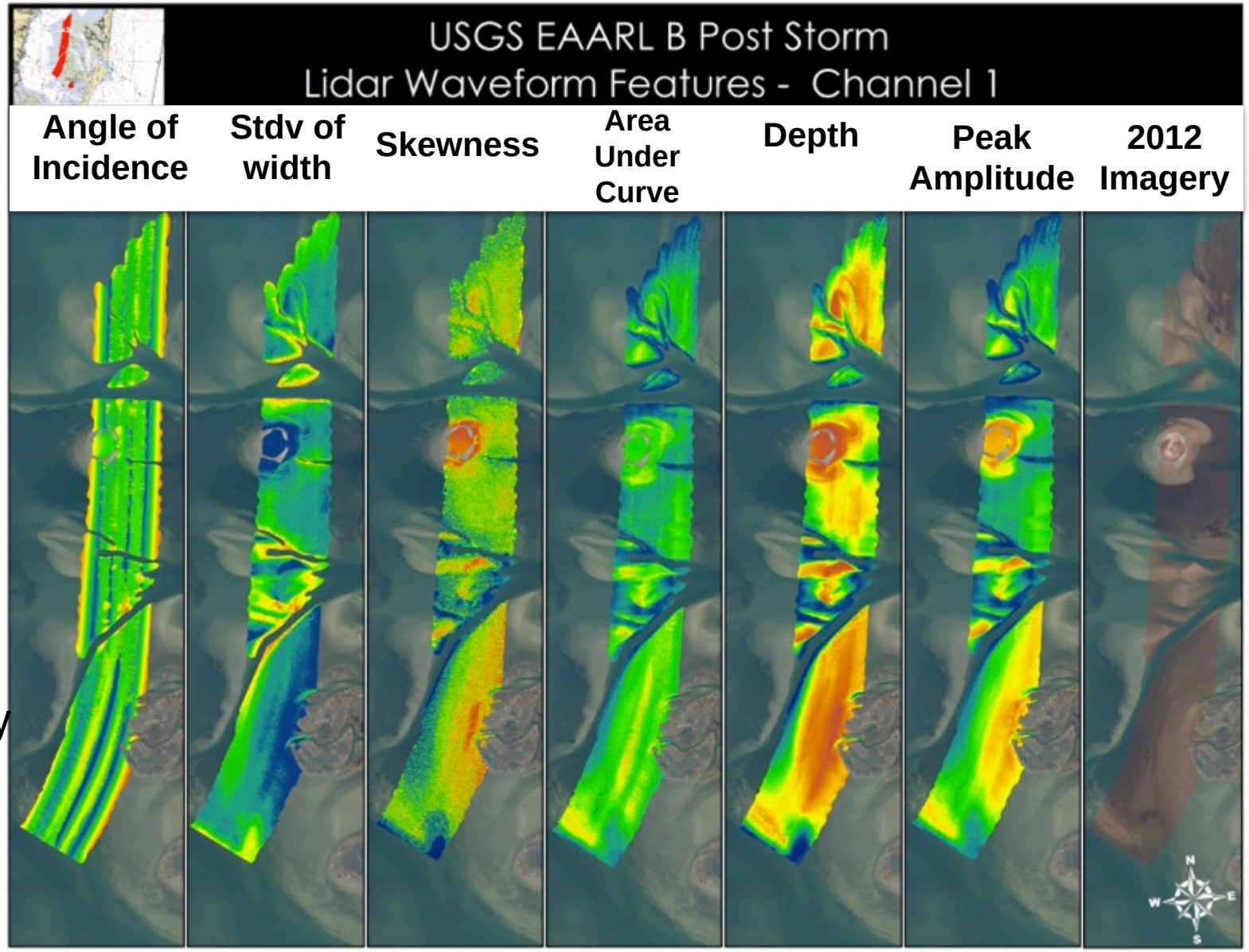
RSD Riegl

1) Intensity Maps for Coverage/ Assessment
2) Reflectance Maps for Characterization
3) Case Studies on Characterization with Groundtruth (Jamaica Bay, NY)

Extraction of Waveform Statistics of USGS EAARLB LIDAR from Barnegat Bay for Pre and Post Sandy

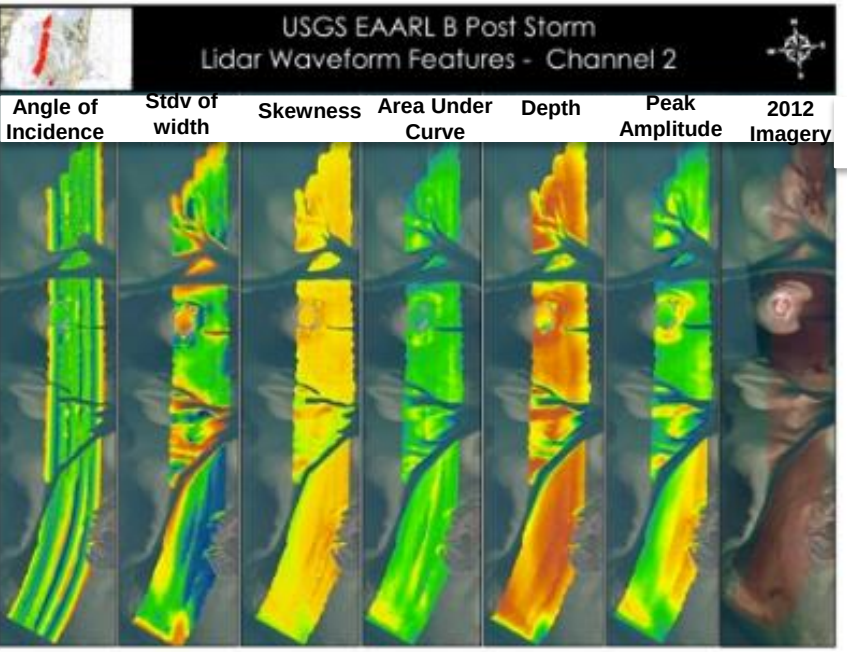
USGS EAARLB Coverage for Barnegat Bay (Bathymetry)



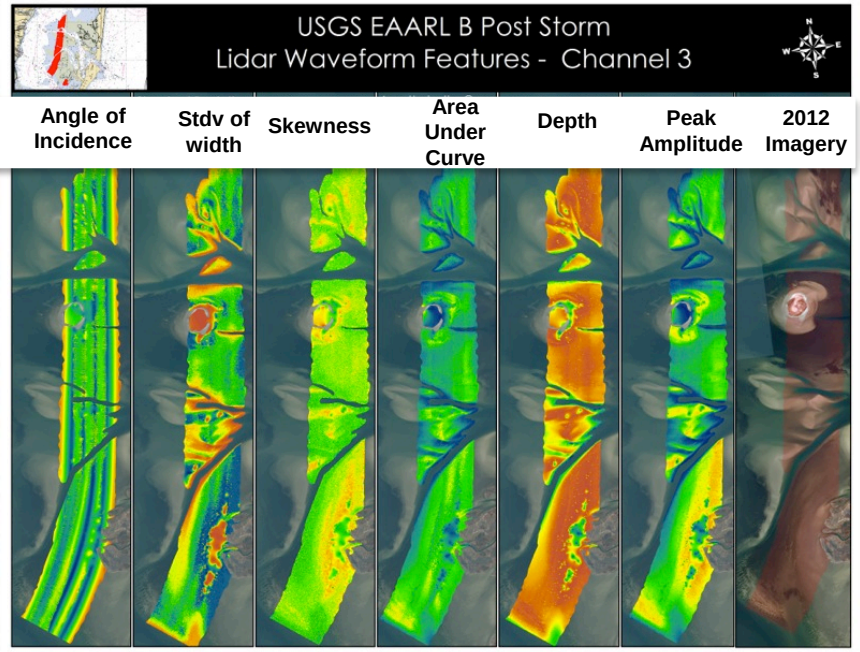


Extraction of Waveform Statistics of USGS EAARLB LIDAR from Barnegat Bay for Pre and Post Sandy

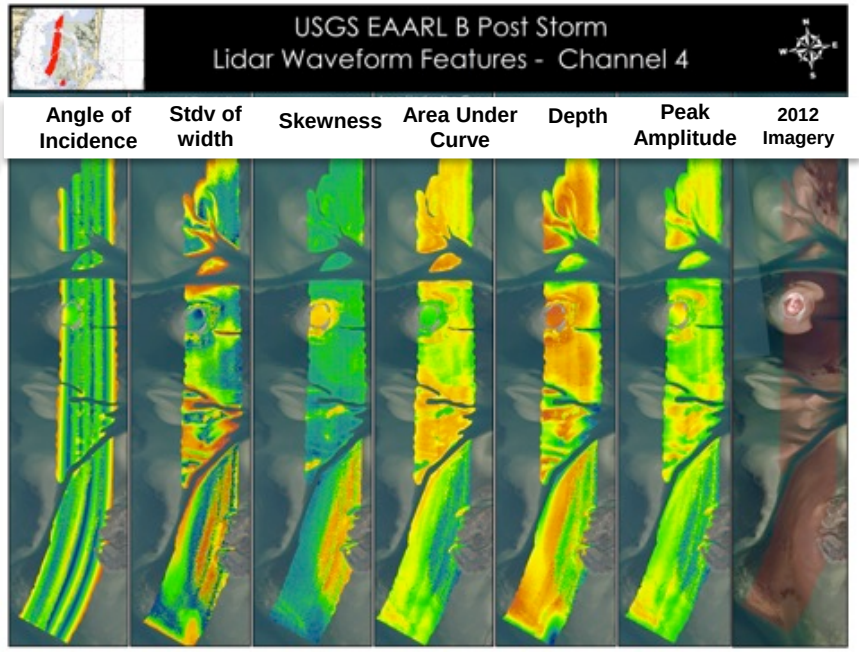
Ch 2



Ch 3



Ch 4



Angle of Incidence | **Stdv of width** | **Skewness** | **Area Under Curve** | **Depth** | **Peak Amplitude**

Calculate Reflectance:

Peak Amplitude, (equivalent of intensity)

Angle of Incidence, Depth important to calculate reflectance

Normalize across flight line

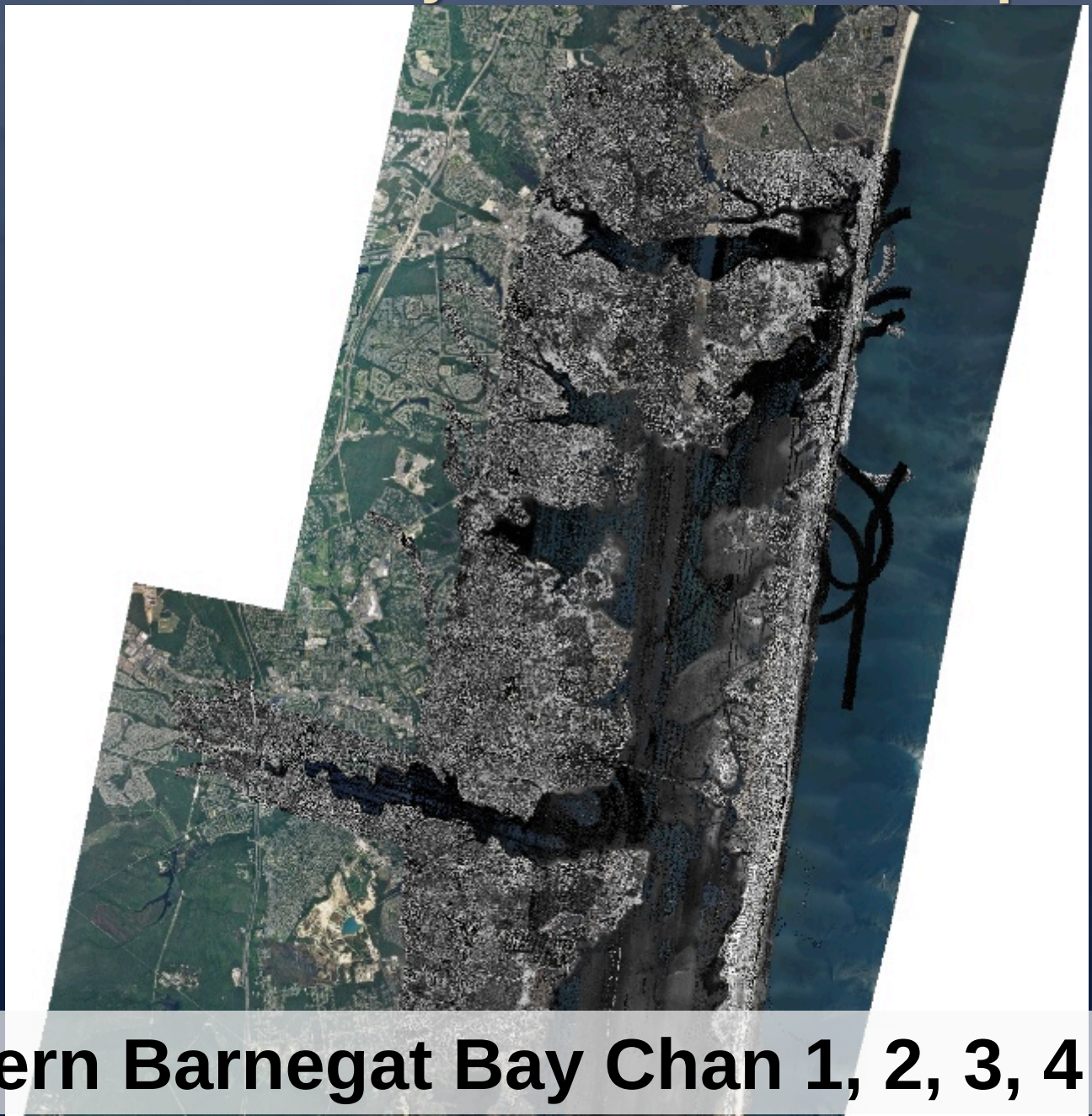
- Using 30% of watercolumn/ waveform above the bottom bathymetry
- Matlab scripts used *(in conjunction with Chris Parrish, Nick W. etc.)*
- Currently Height filter and intensity filter for extreme fliers

In Progress:

- Cropping Land, and additional noise filtering (Convert data using VDatum to NAVD88, MLLW)
- Still experimenting with best filter values for noise keep vegetative height/ morphology, keep habitat areas intact

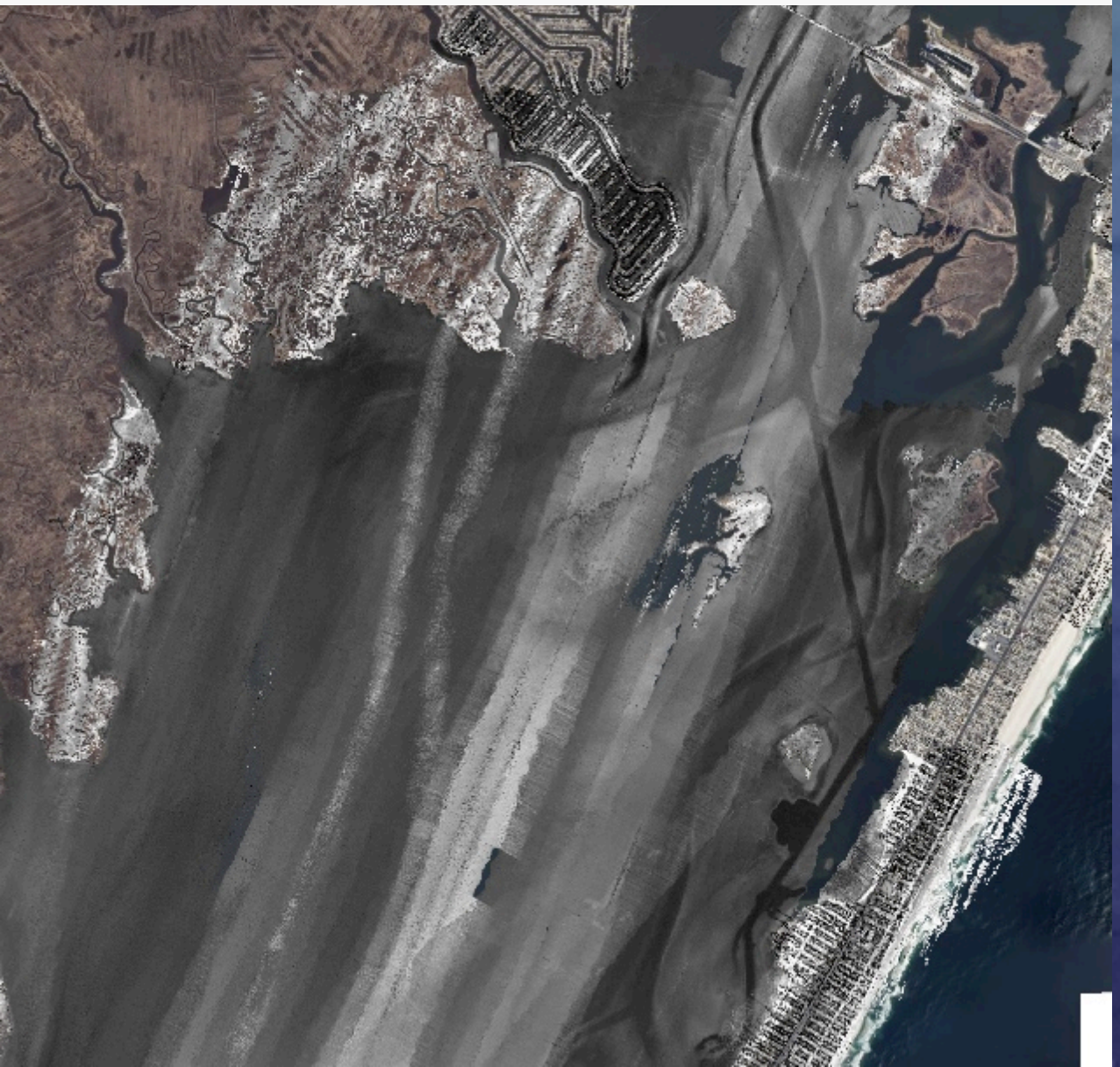
Builds on previous work by Chris Parrish et al., help from USGS EAARLB/ EROS
Parrish Dijkstra etc..

IOCM Work: Initial Intensity & Reflectance Maps Ch1, 2, 3, 4

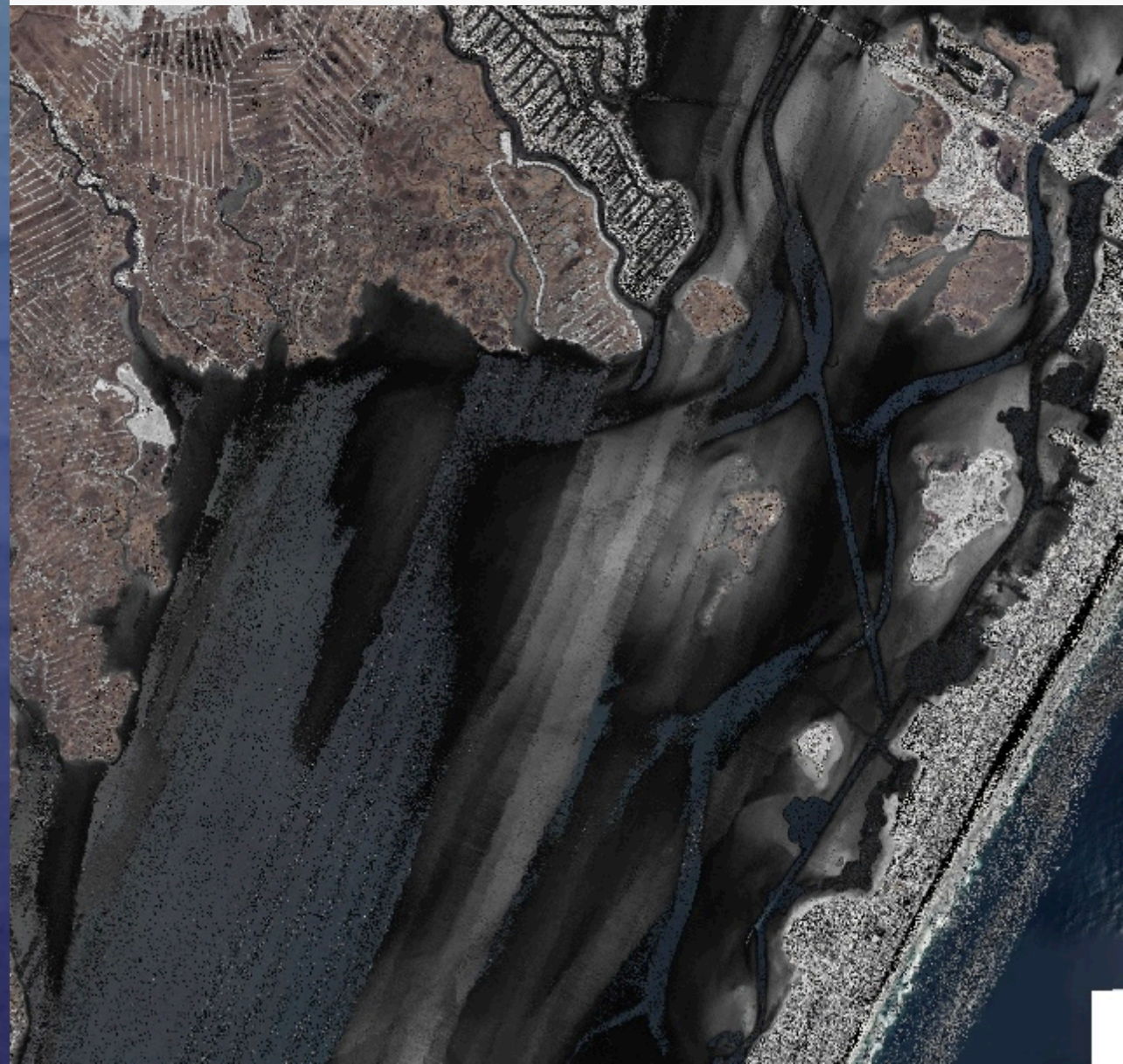


Northern Barnegat Bay Chan 1, 2, 3, 4

South Middle Barnegat Bay Channel 4 Reflectance

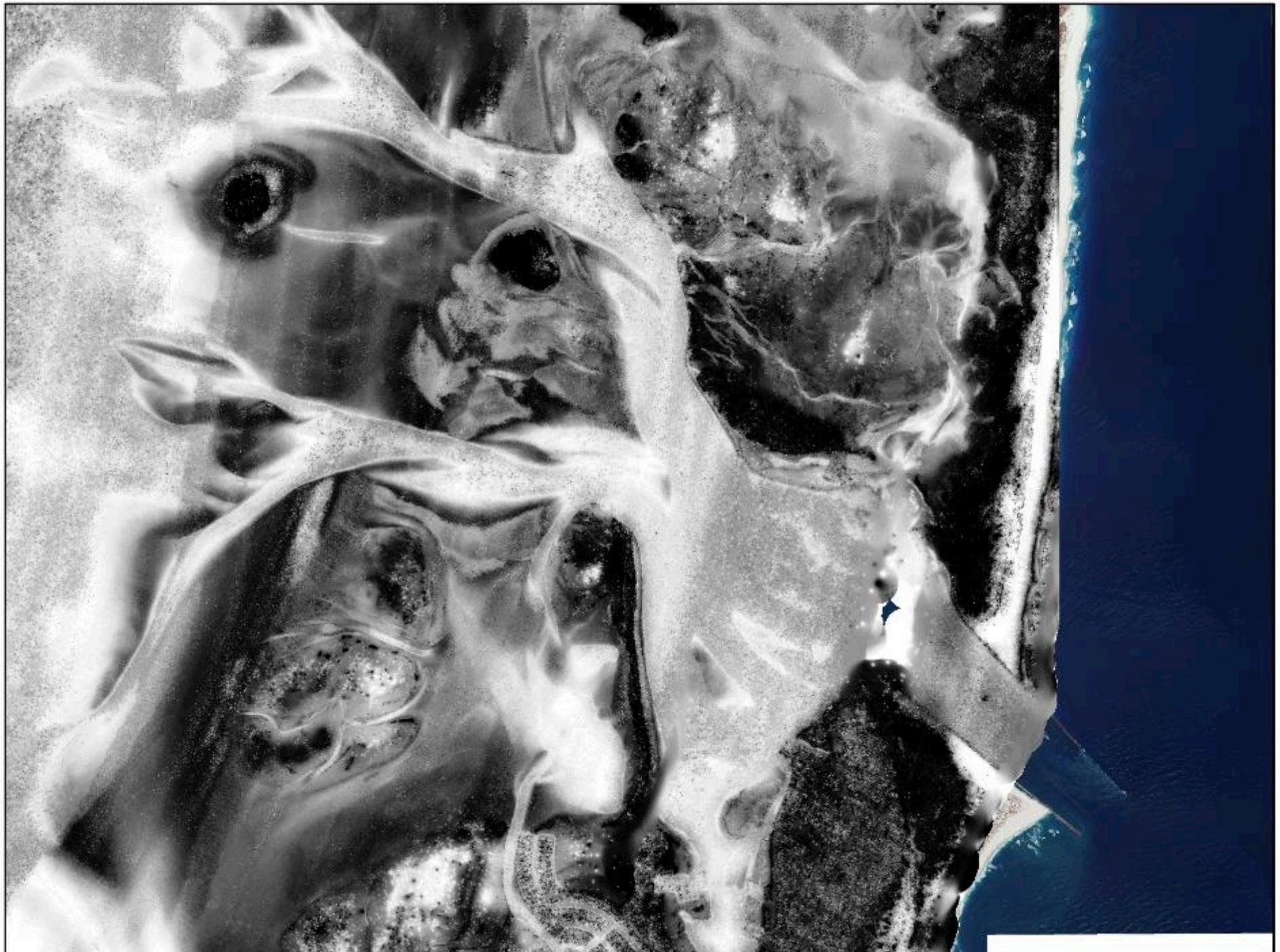


South Middle Barnegat Bay Channel 2 Reflectance



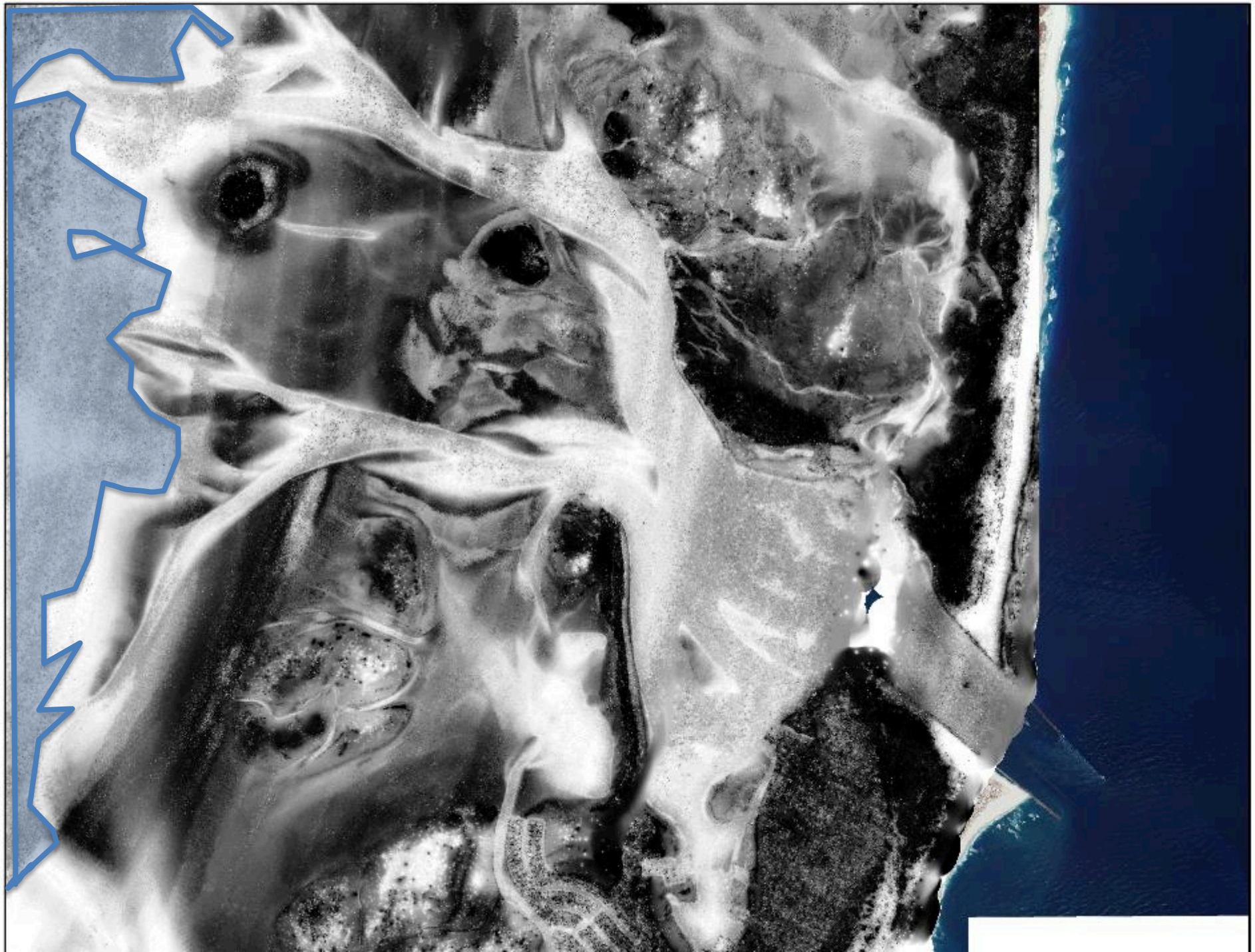
IOCM Work: Initial Intensity & Reflectance Maps

IOCM in Progress: Challenge Histogram equalize different days to create mosaics for interpretation for large area (Example Channel 4 Barnegat Inlet single grid)



Channel 1 Reflectance EAARLB Barnegat Inlet (Middle Barnegat Bay)

Manual Digitization of Bottom types by drawing polygons.
Ex: Channel 1 Reflectance

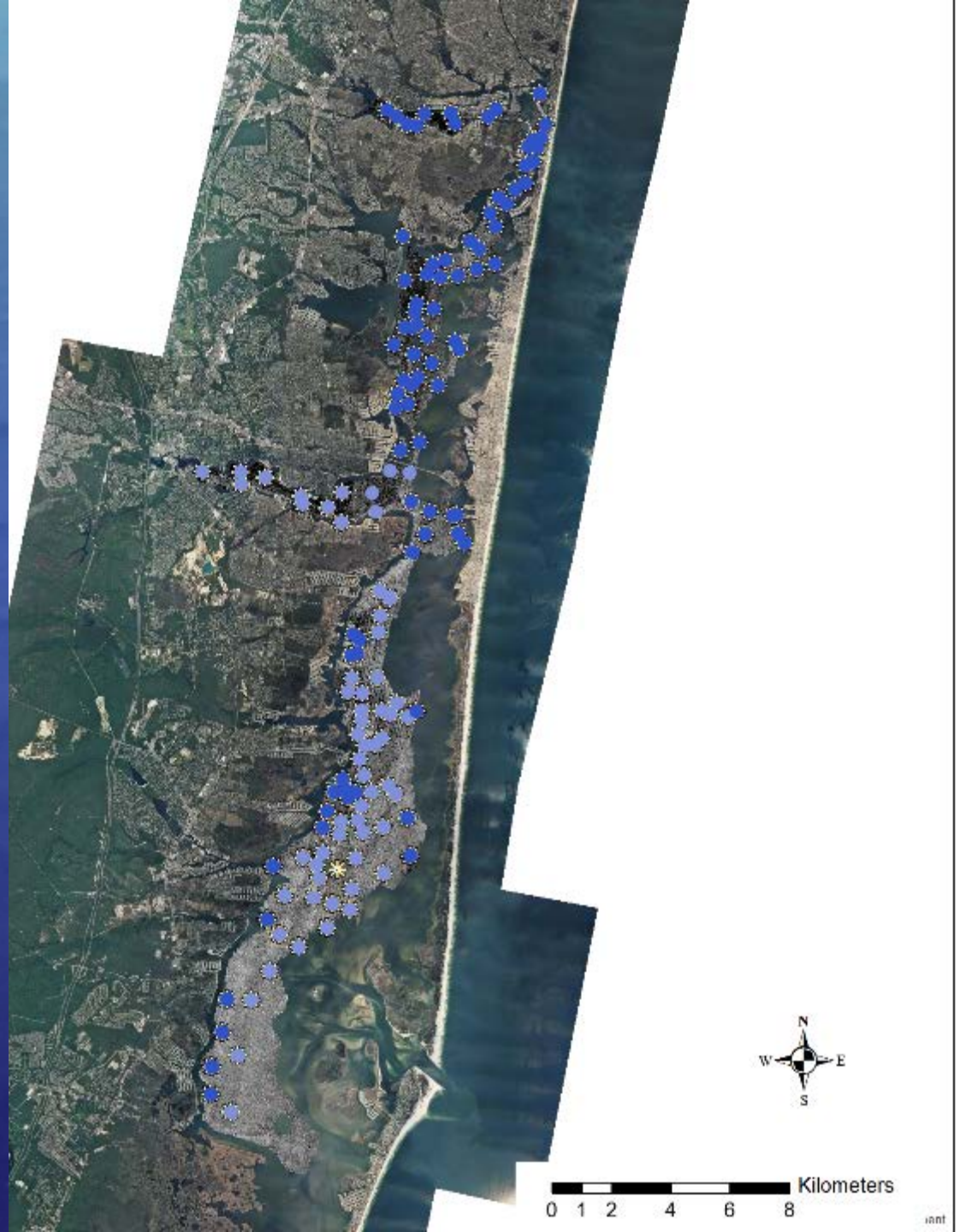


Map of USGS Sediment Sample And Bottom Photo Distribution for Barnegat Bay

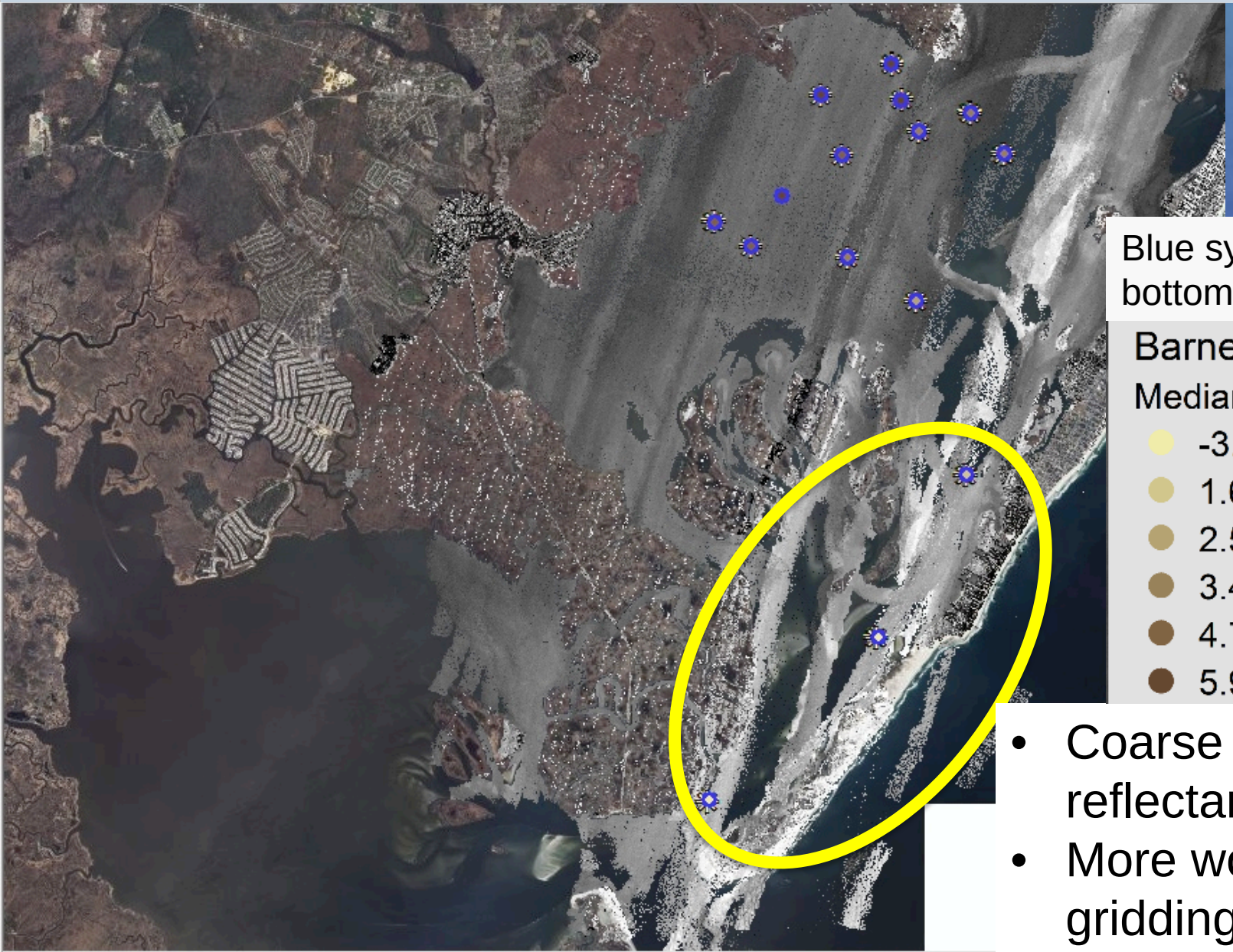
Light Blue = 2012 Pre Sandy

Dark Blue = 2013 Post Sandy

Sidescan Acoustic Coverage over 2014 RSD imagery



EAARLB Post Sandy intensity with USGS Bottom Samples: Southern Barnegat Bay



Blue symbol show bottom photos taken with bottom samples

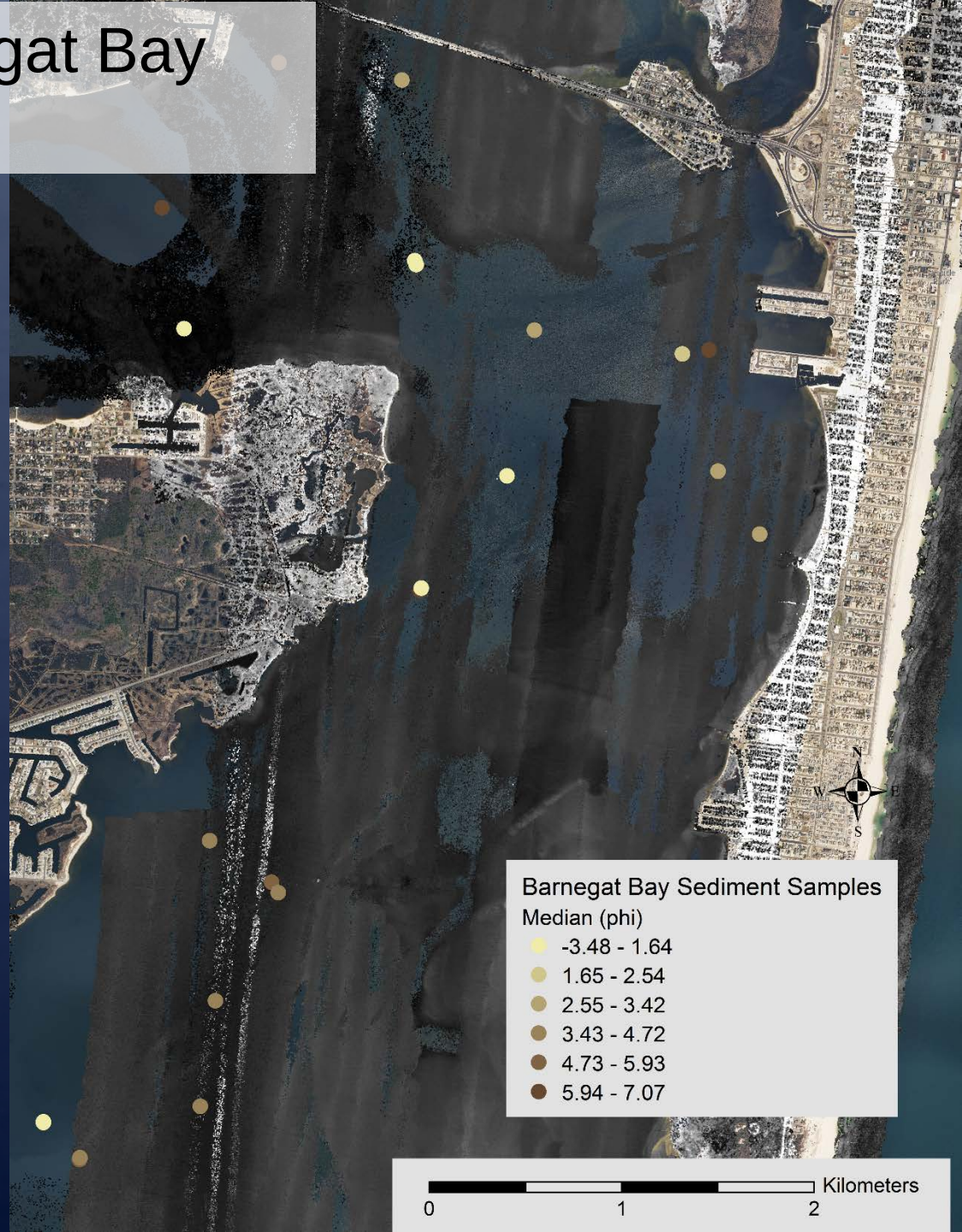
Barnegat Bay Sediment Samples

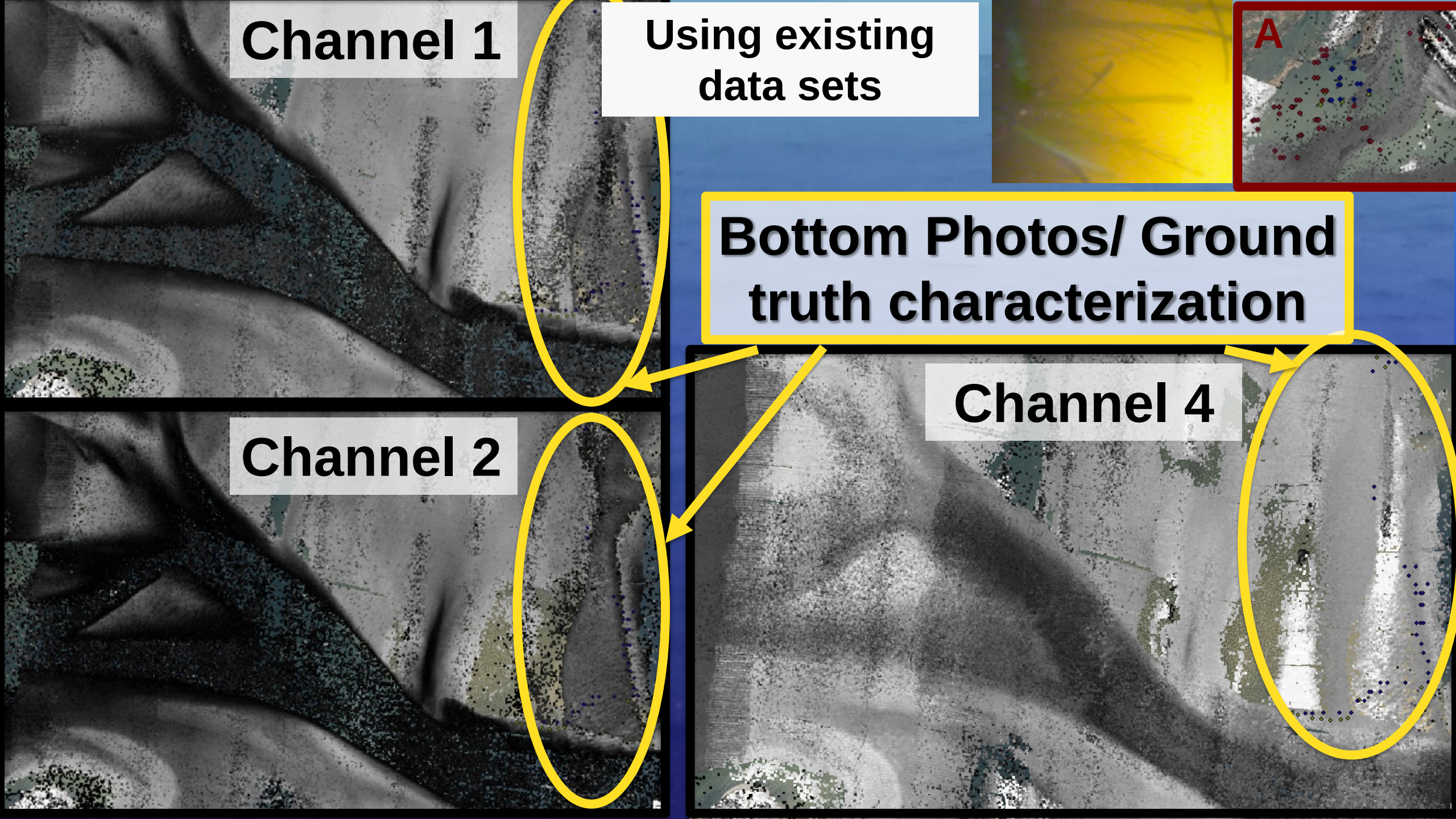
Median (phi)

- -3.48 - 1.64 Very Coarse
- 1.65 - 2.54
- 2.55 - 3.42
- 3.43 - 4.72
- 4.73 - 5.93
- 5.94 - 7.07 Fine

- Coarse Sediment/ Light reflectance seem to correlate
- More work needed on reflectance gridding

North Middle Barnegat Bay
Channel 4

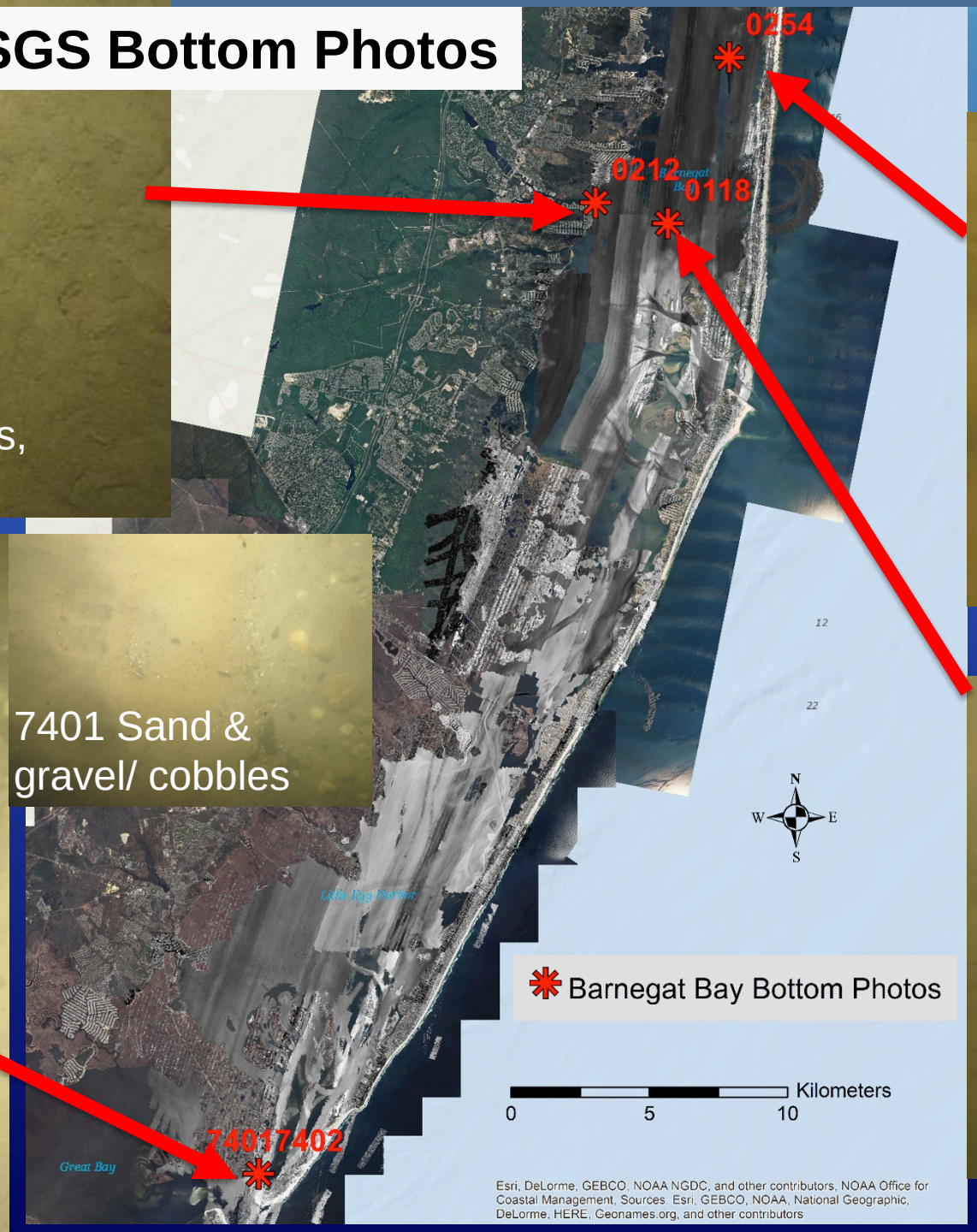



Channel 1
Using existing data sets
A
Bottom Photos/ Ground truth characterization
Channel 2
Channel 4

USGS Bottom Photos

0212 Sand dollars, tunicates, anemones,other seaweed

7402 – Coarse gravel, small cobbles, shells



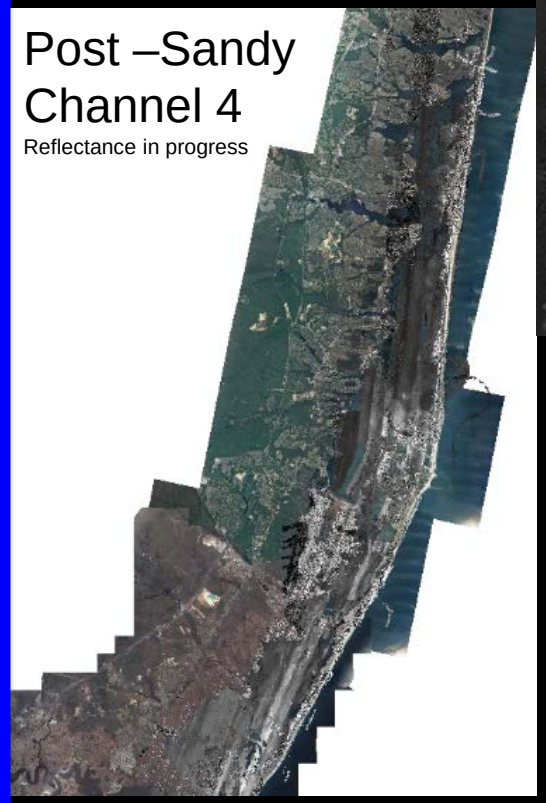
7401 Sand & gravel/ cobbles

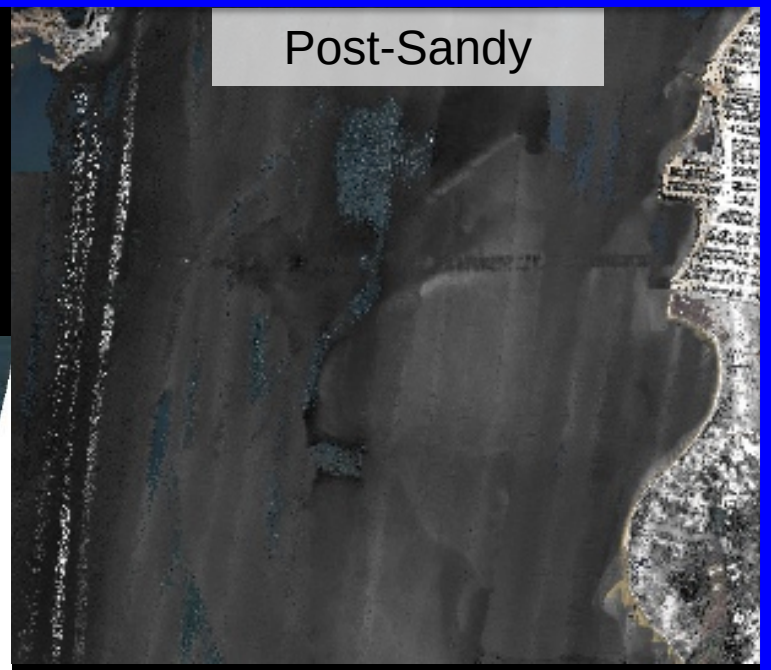
0254 Sea grass

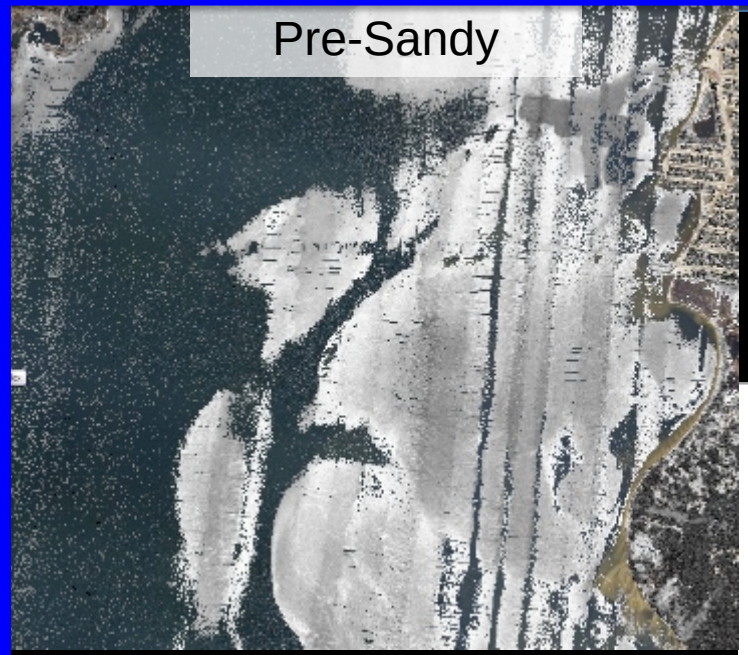
0118 Bedforms and Ulva

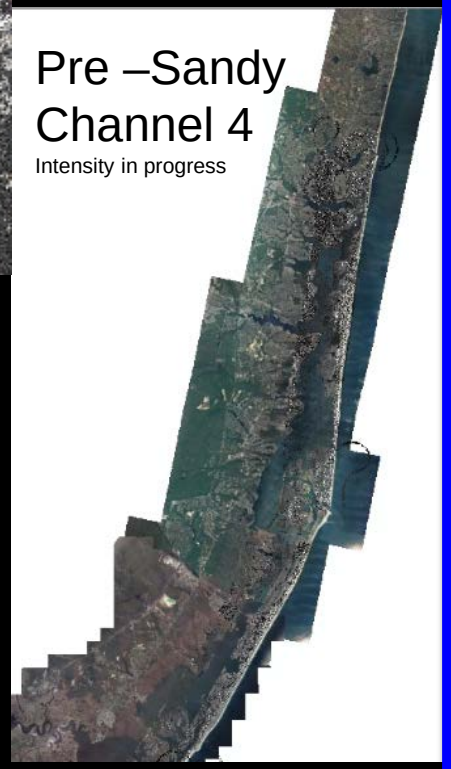
Pre & Post Sandy EAARLB Coverage

IOCM Work: Waveform Statistics Exporting/ Initial Intensity Reflectance Map

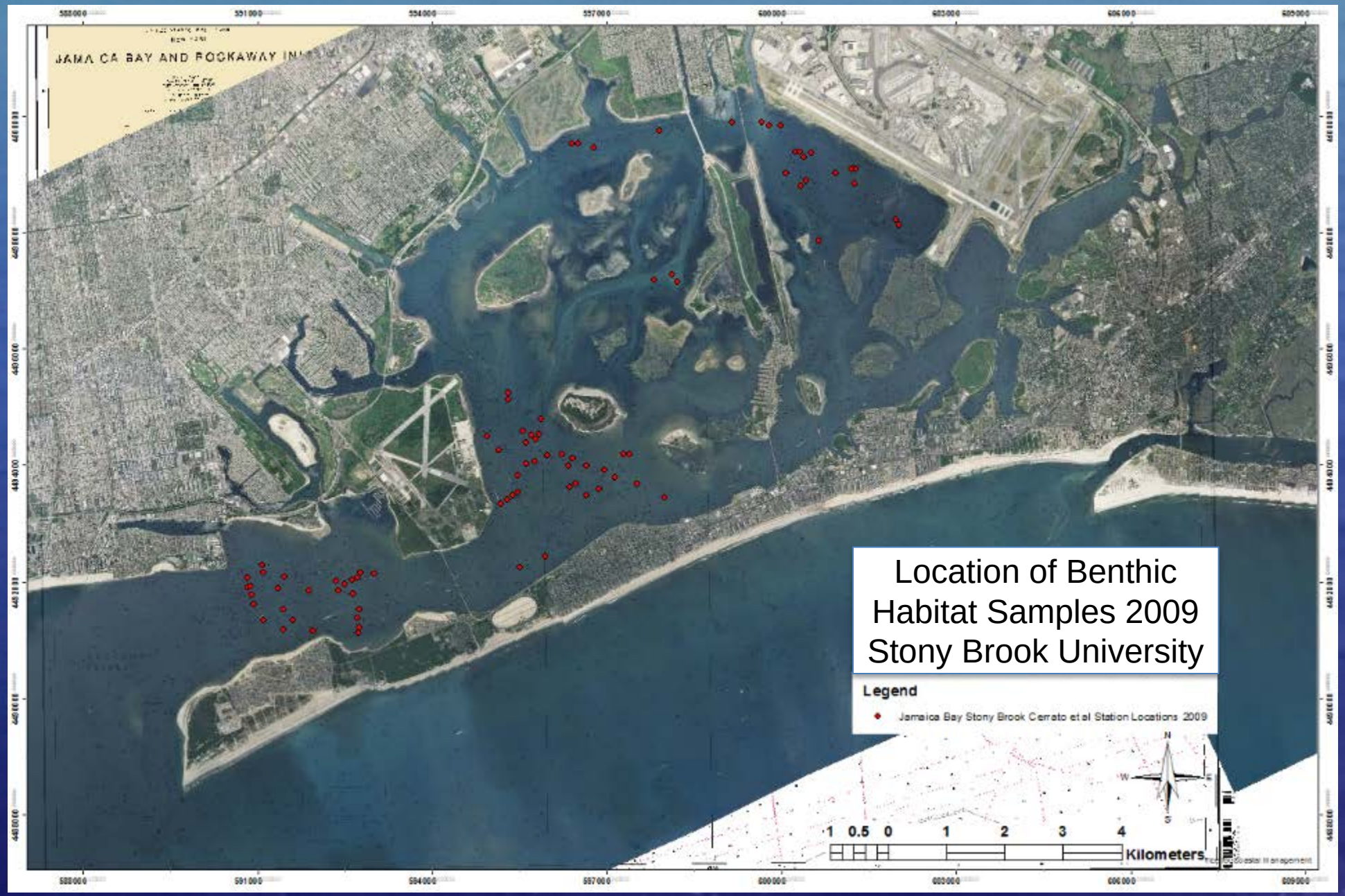




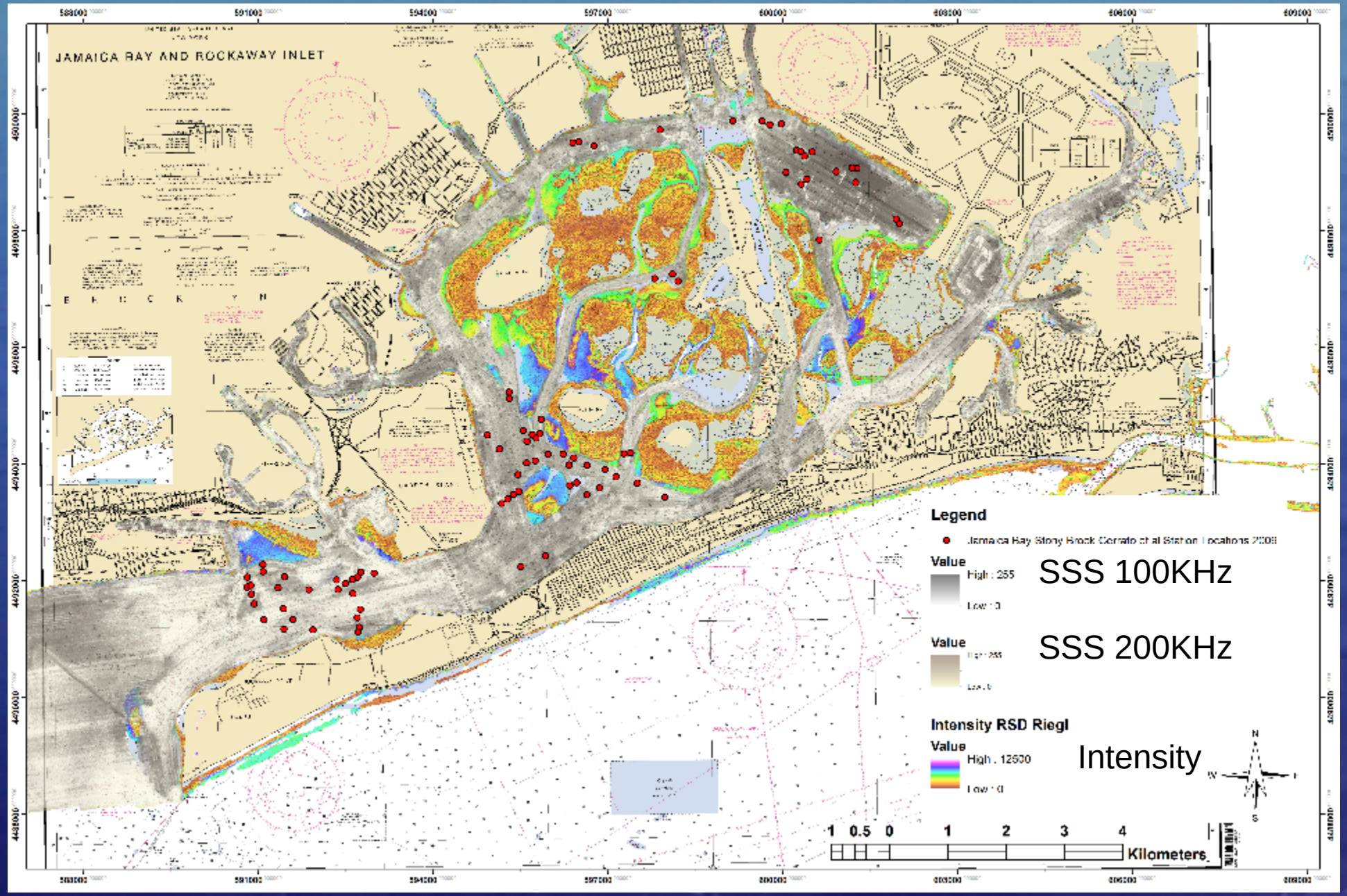




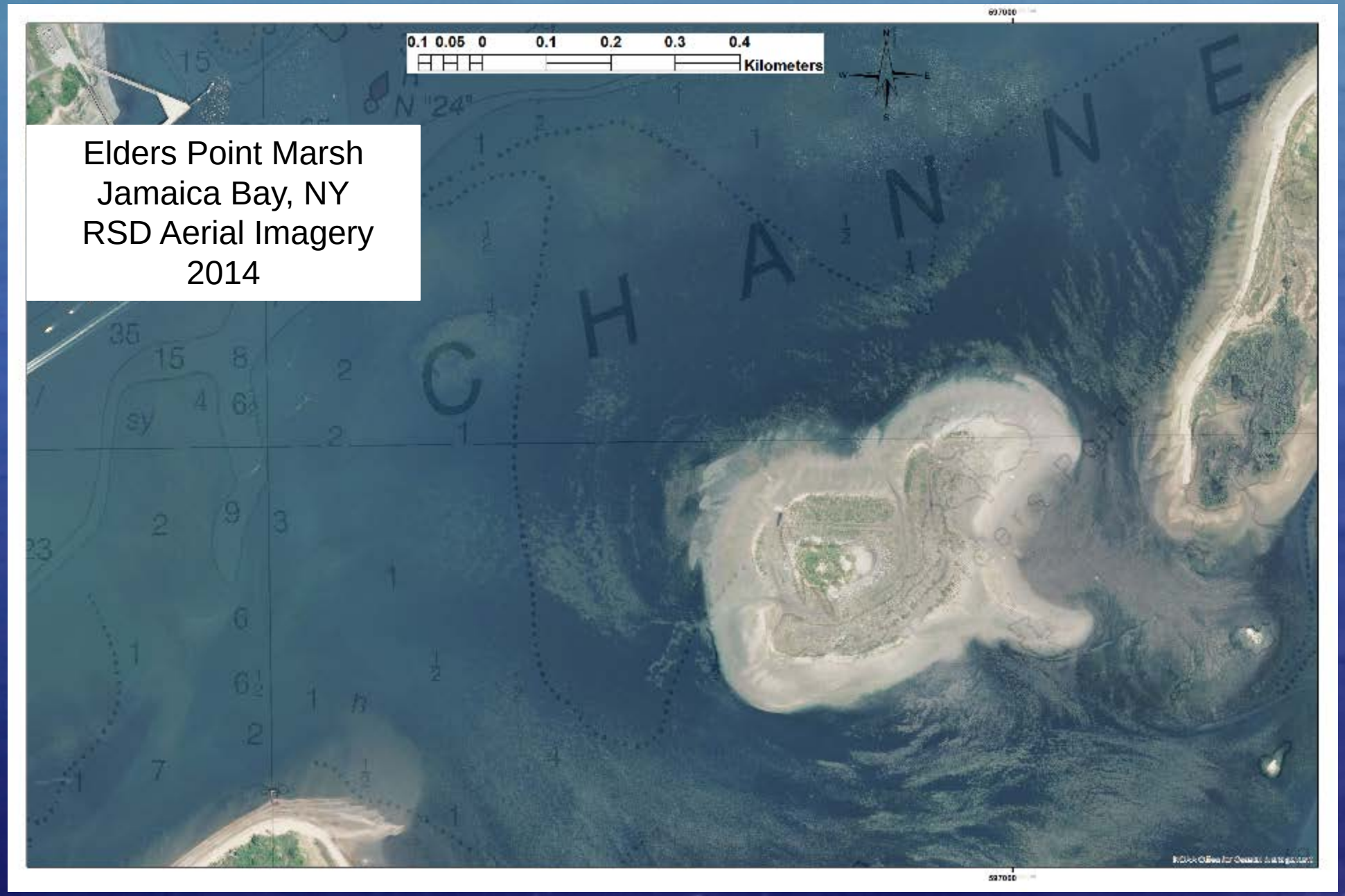
Jamaica Bay, NY RSD Imagery 2014



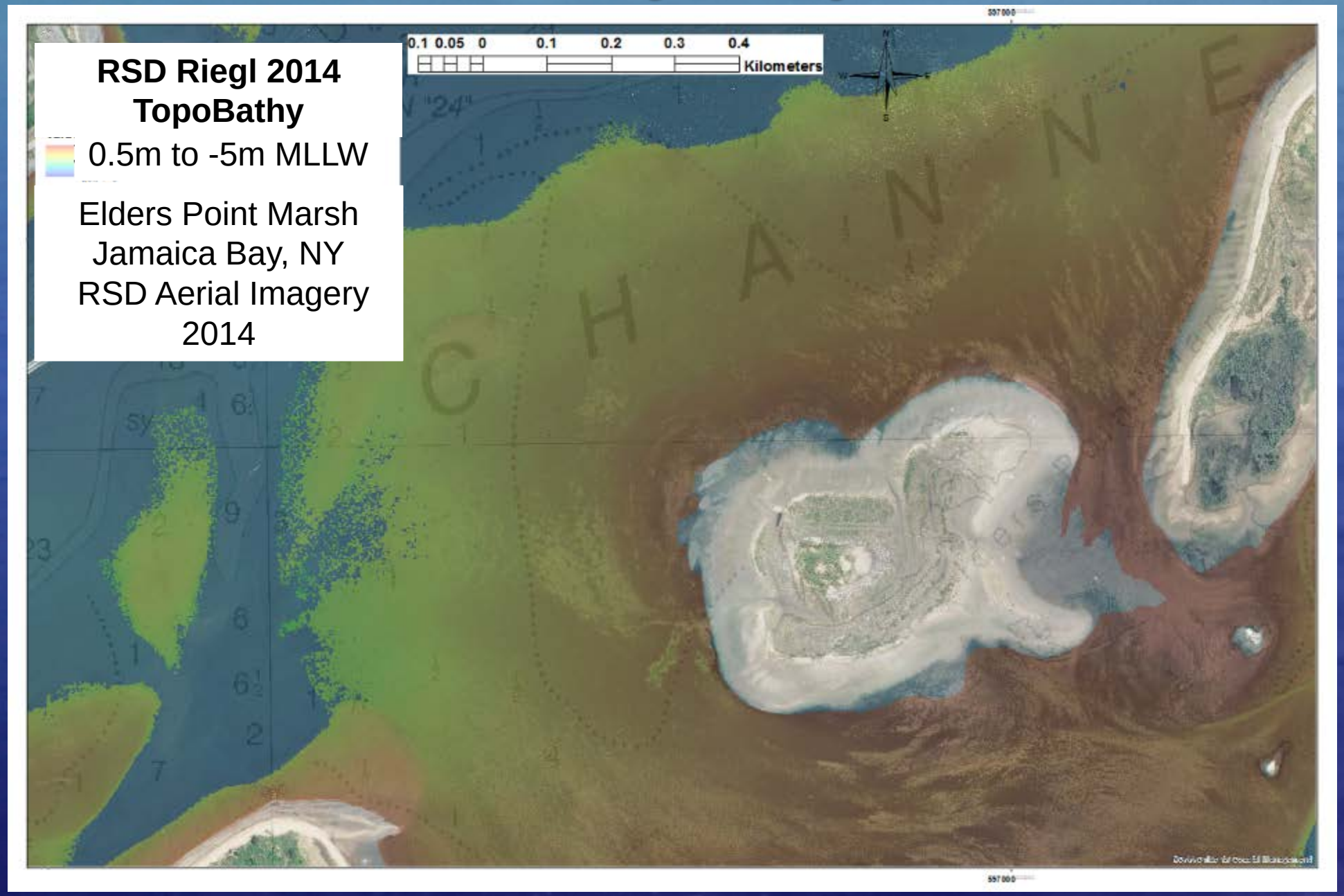
Jamaica Bay, NY NOAA Sidescan & Intensity



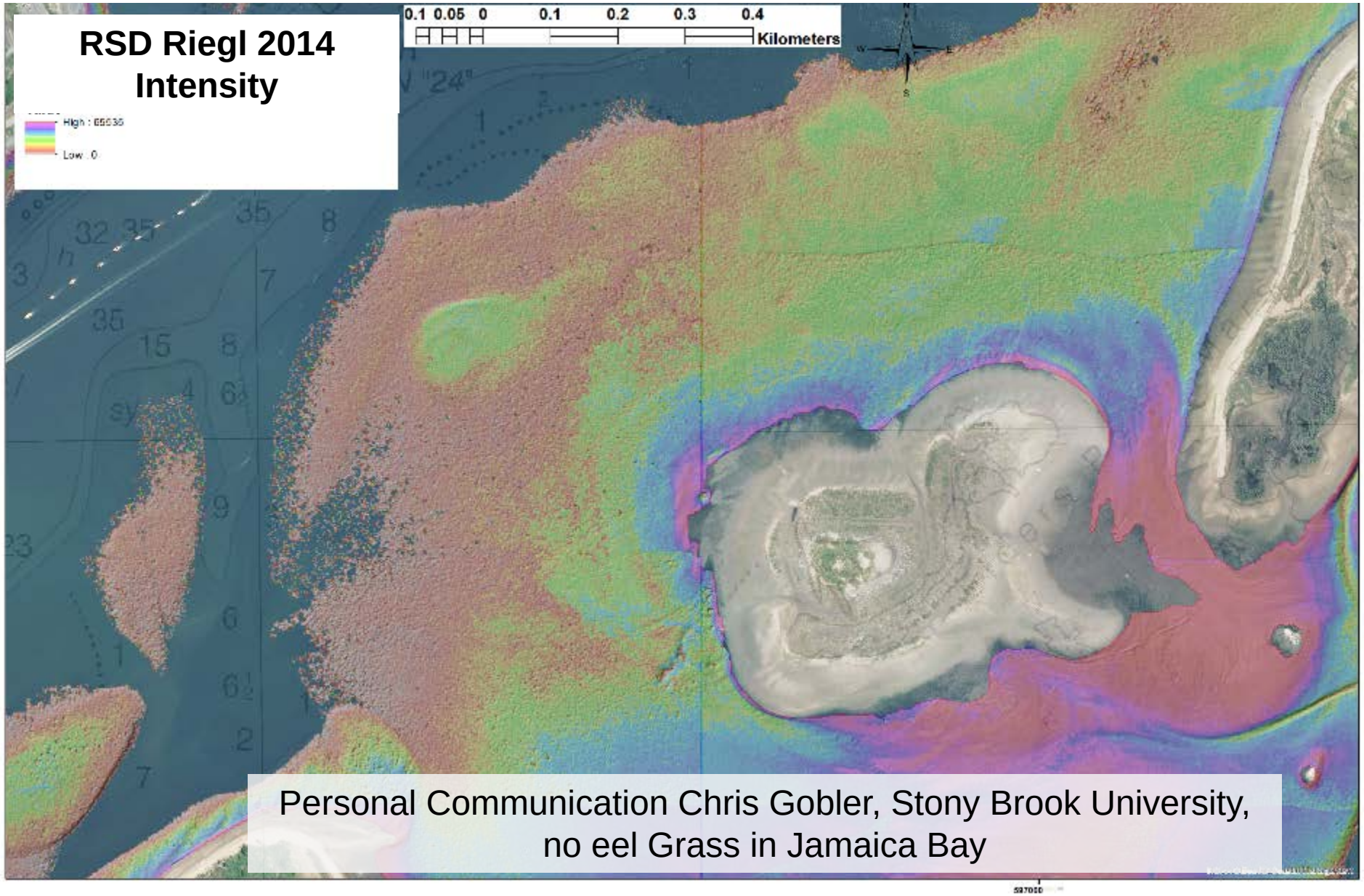
NY RSD example



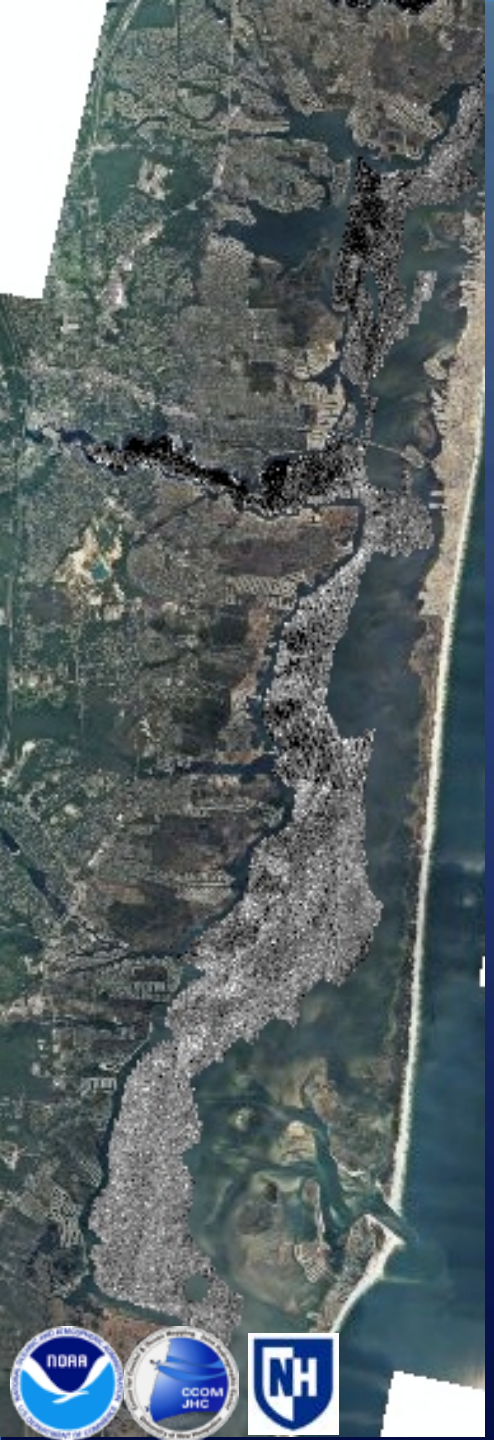
Bathymetry


RSD Riegl 2014
TopoBathy
0.5m to -5m MLLW
Elders Point Marsh
Jamaica Bay, NY
RSD Aerial Imagery
2014
0.1 0.05 0 0.1 0.2 0.3 0.4
Kilometers

RSD Intensity with Shaded Relief/ Hillshade (10X) from bathymetry superimposed semi-transparent



Personal Communication Chris Gobler, Stony Brook University, no eel Grass in Jamaica Bay



Future Work:

Complete Reflectance Maps

Compare Acoustic USGS sidescan/backscatter values against EAARLB Reflectance & similar work for RSD in Jamaica Bay

Delineation of bottom types .. Next step: OBIA? PCA? Using Matlab/ ESRI ArcMap

Compare Barnegat Inlet Lidar Analyzed by CCOM/UNH with IOCM analysis of different lidar collections ?

Acknowledgements:

USGS EROS data center esp. Gayla Evans
USGS EAARLB (Coastal & Marine Program) (Wayne Wright, David Nagle, Christine Kranenburg, David Zawada)

Collaborators at **CCOM/UNH** (Jenn Dijkstra, Erin Nagel, Shachak Pe'eri, Chris Parrish, Nick Wilson, Victoria Price*now at QPS)

NOAA RSD: Stephen White, Mike Aslaksen
NOAA NCCOS
and so many more..

Links:

JHC/ CCOM UNH Sandy Research
http://sandy.ccom.unh.edu/

Chris Parrish
http://cce.oregonstate.edu/node/336