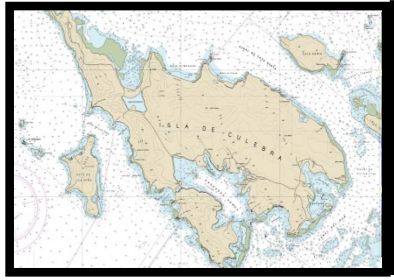
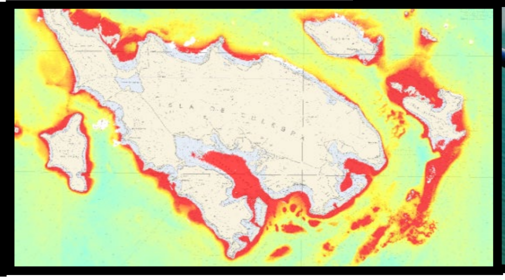
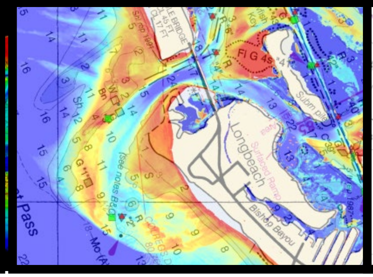
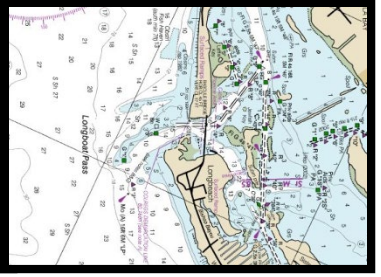



Satellite Derived Bathymetry: What can SDB Offer Coastal Mapping?

Rick Stumpf

National Ocean Service

National Centers for Coastal Ocean Science

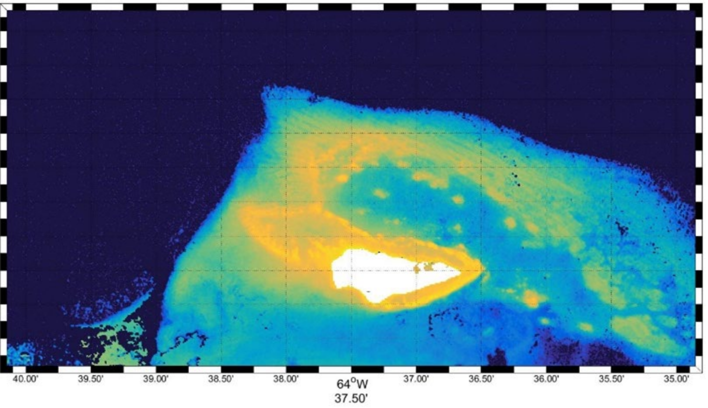
Cross-NOS effort (NGS, OCS)

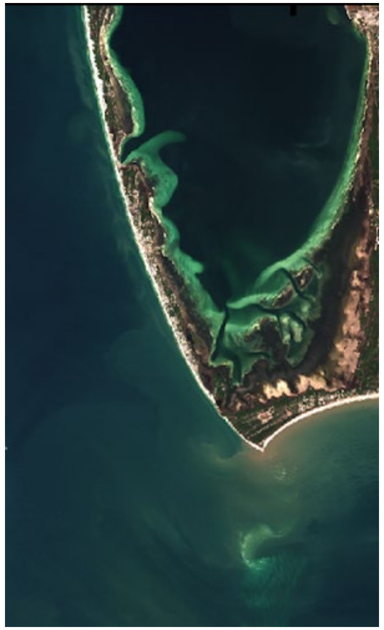
and collaboration with

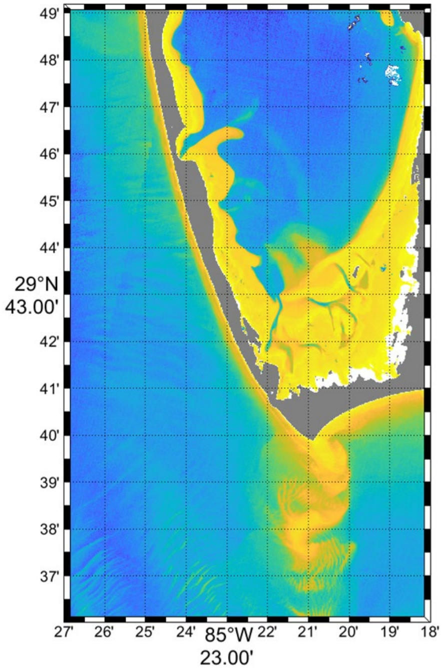
Isabel Caballeros (Spain)

ICMAN

Instituto de Ciencias Marinas de Andalucia







NCCOS

SDB

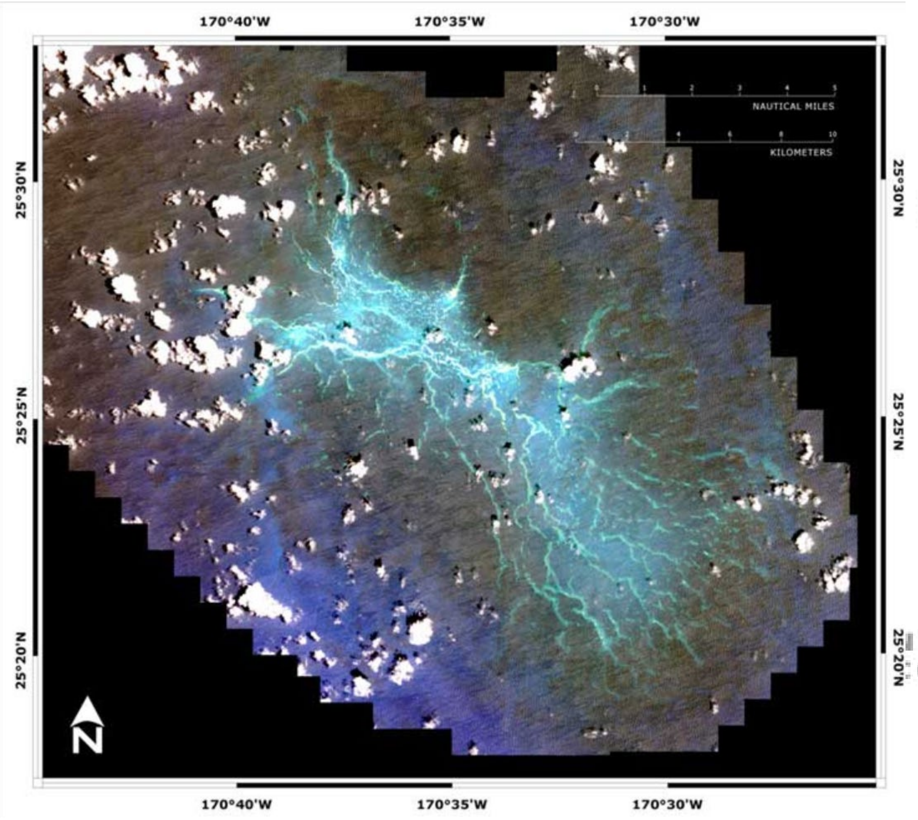
- Background
- What is SDB
  - Methods and effectiveness
  - Limitations and answers
- Uses

Capes St Blas, St George, Florida

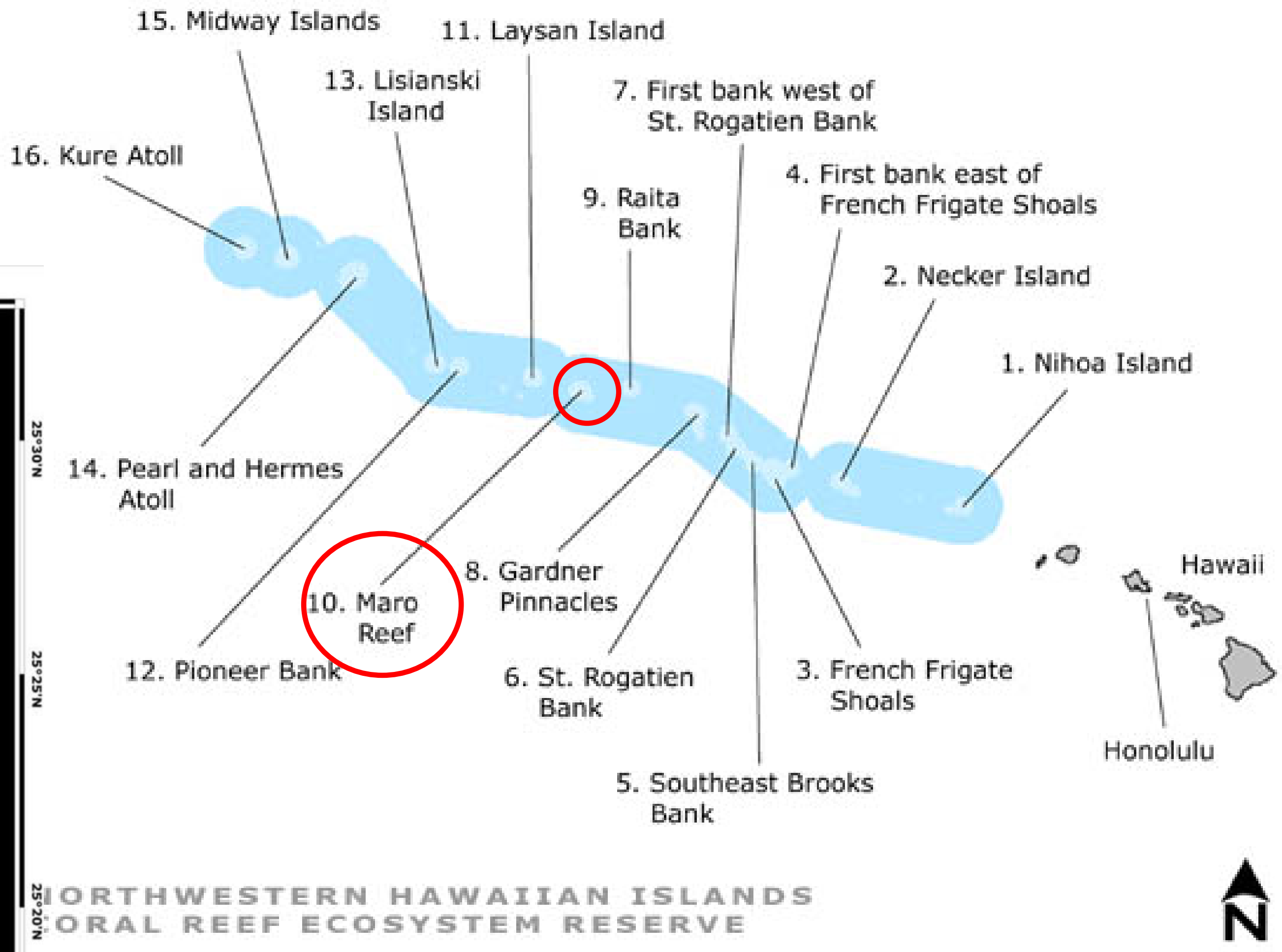
Some Background: Why SDB?

(2001) Where are the NW Hawaiian Islands? Shift Astronomical to GPS datum

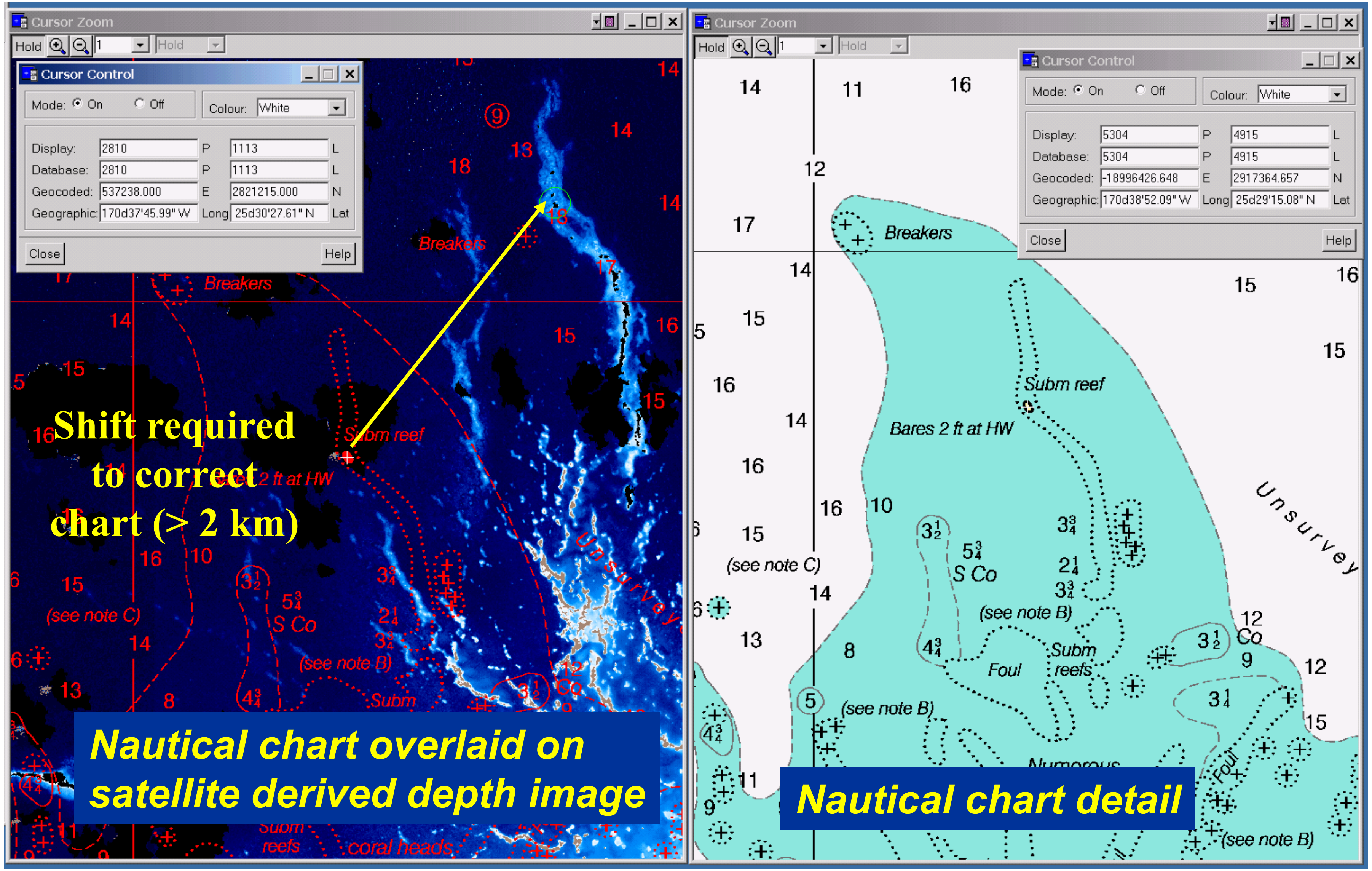
Maro Reef



Papahānaumokuākea Marine National Monument



Nautical Chart Update for Maro Reef, NW Hawaii
- using bathymetry derived by NOS from IKONOS data



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Issues addressed by SDB

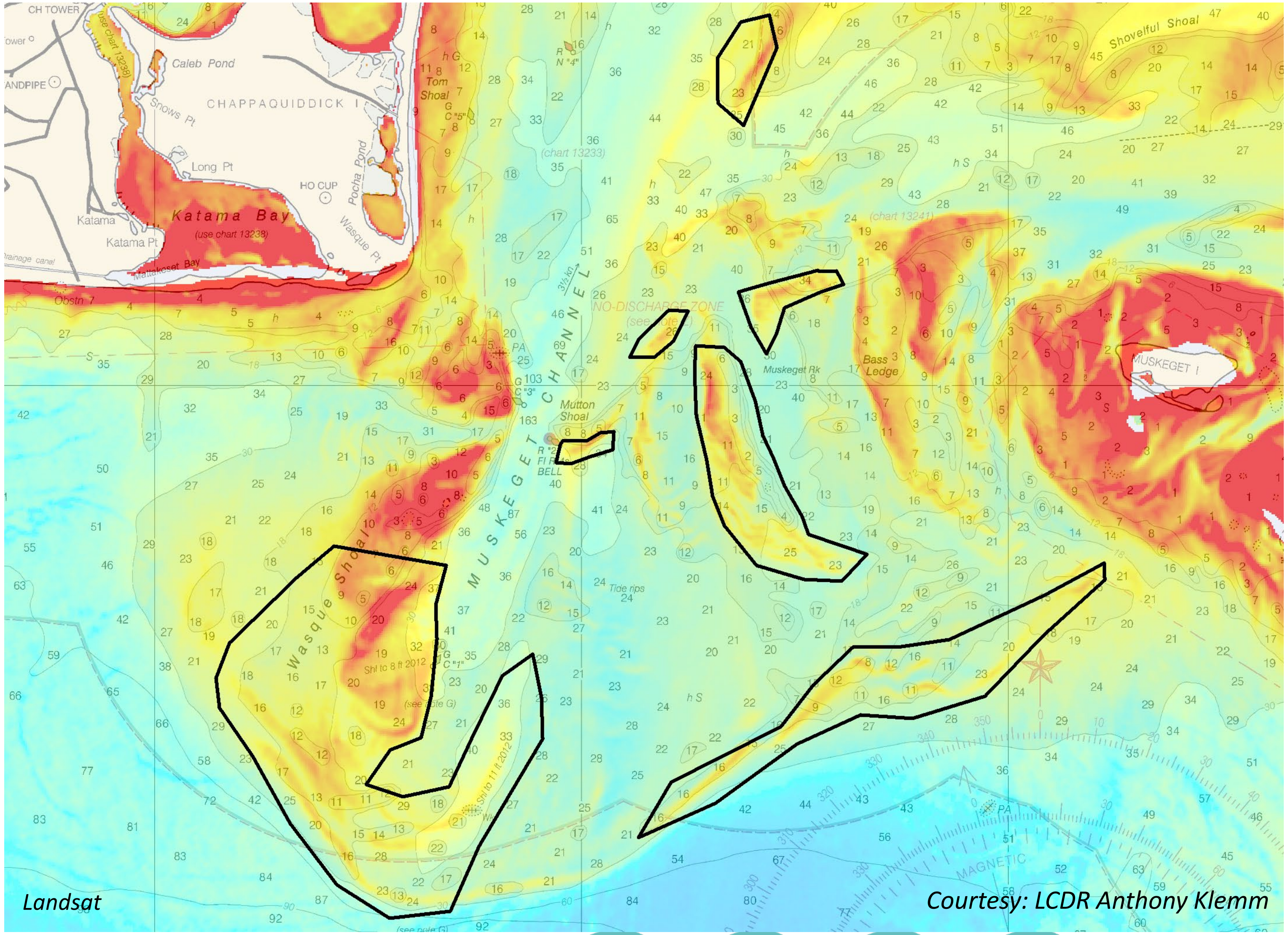
Reconnaissance

Mission planning

Monitoring of shoals

Storm response

Infilling of lidar/multi-beam



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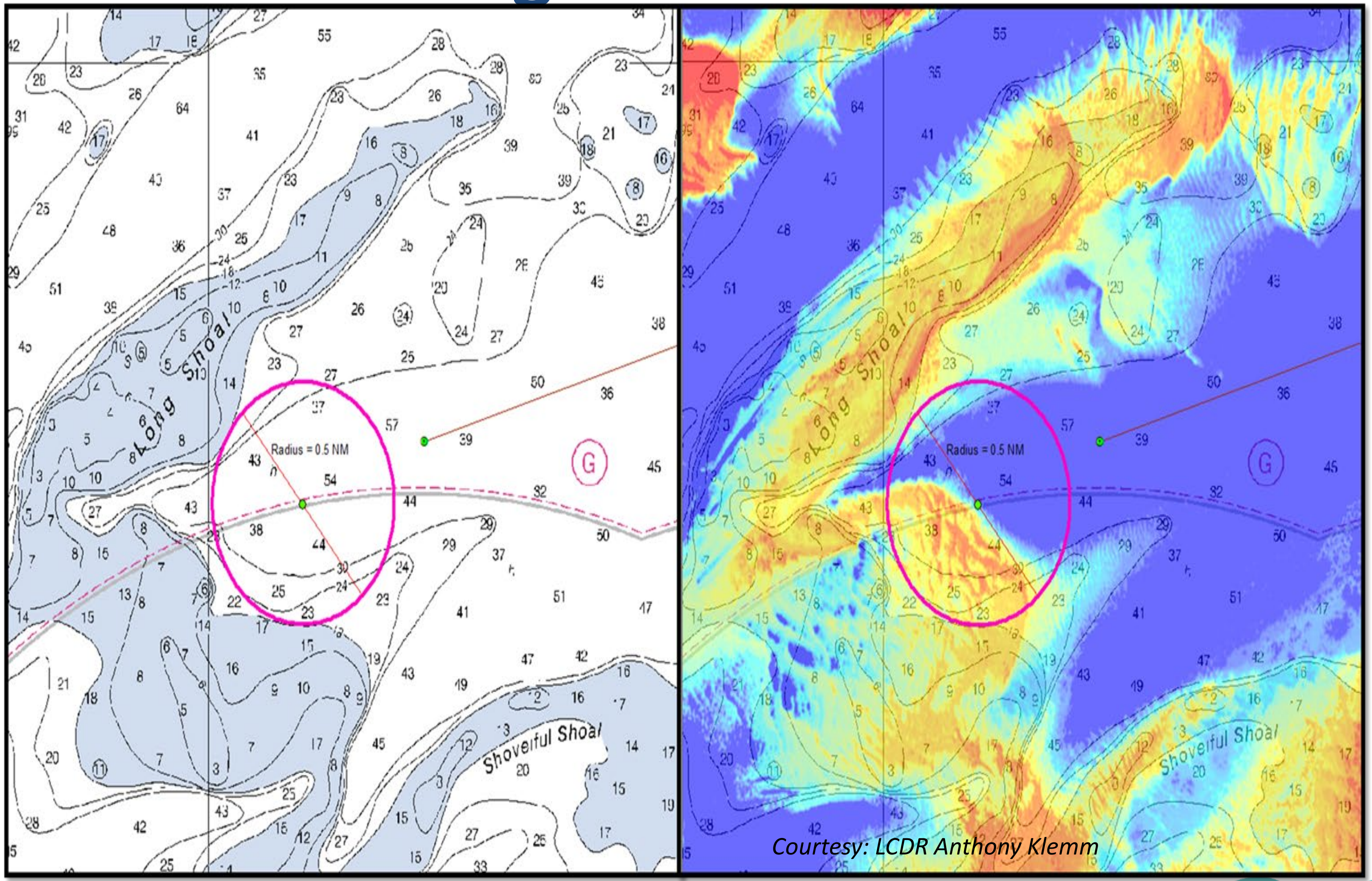
Operational Planning

NOAA Ship *Thomas Jefferson*
SDB in Nantucket Sound

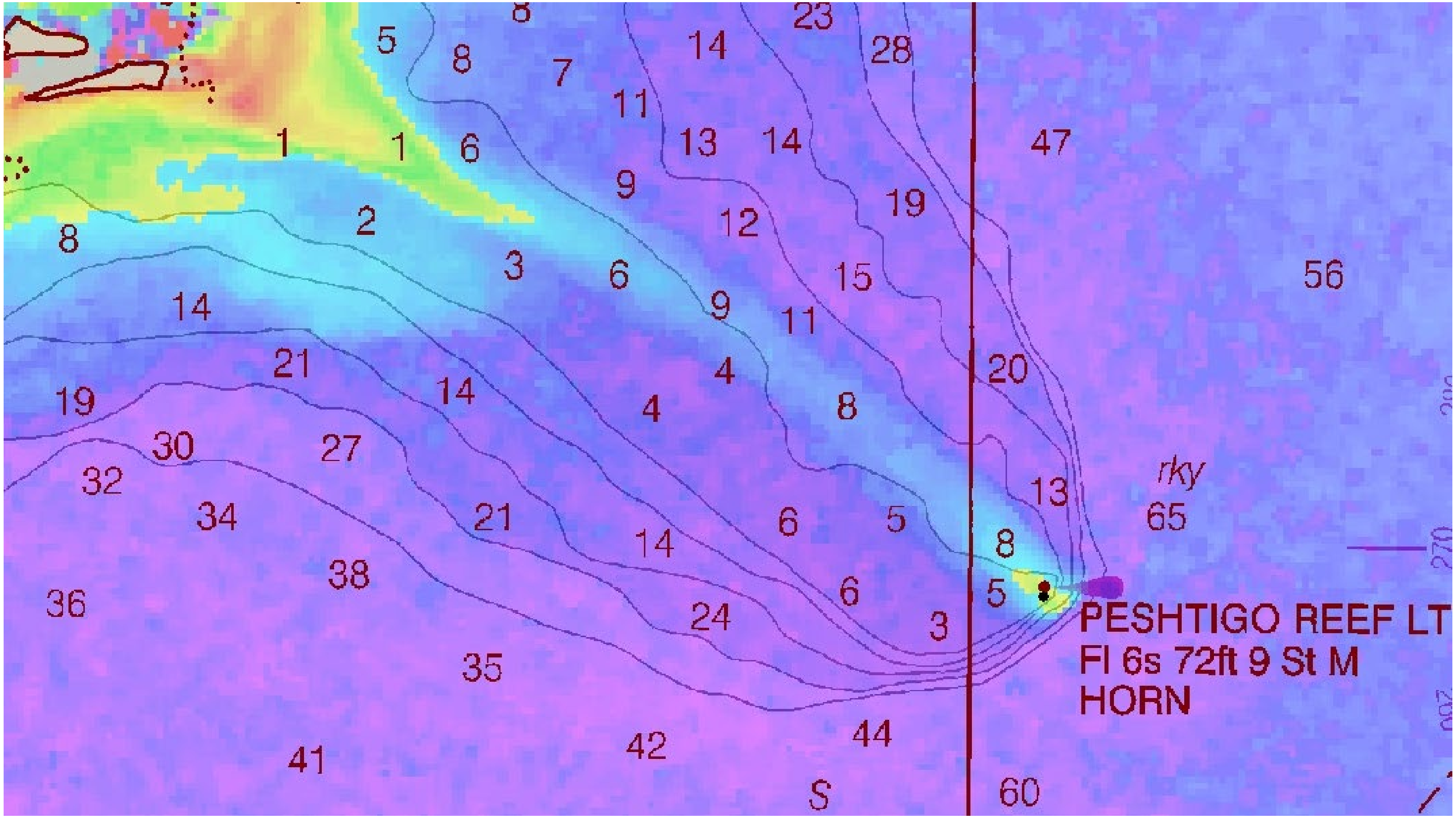


Courtesy: LCDR Anthony Klemm

WV2

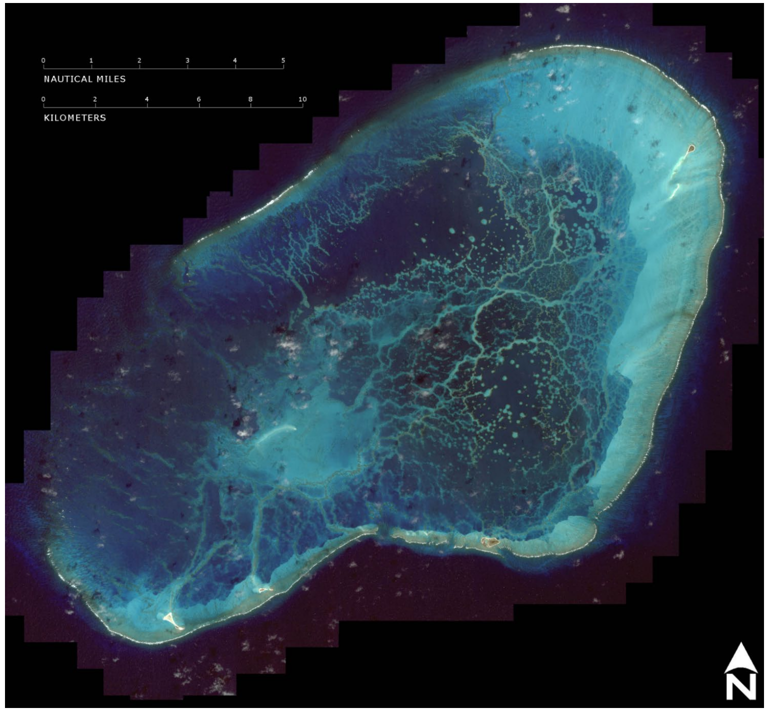
NCCOS

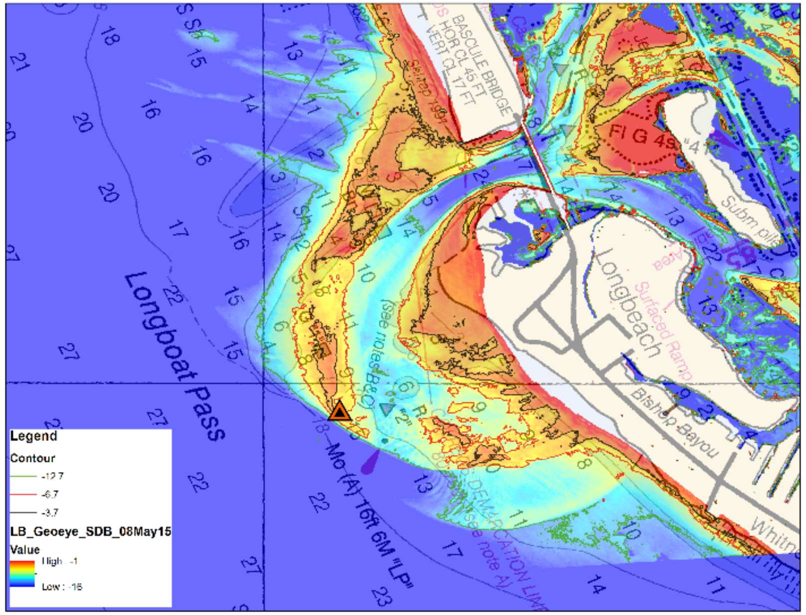
Peshtigo Reef Lighthouse, Green Bay WI, evaluate shoaling



SDB: Areas of interest

- Coral reefs, infrequent turbidity
- Inlets, turbidity issues
- Capes, shoals, turbidity issues





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SDB methods

- Passive optical (based on physics of light in water), most common

Other methods being examined and researched:

- Empirical (machine learning) methods, extensive calibration.
- Wave refraction (potential for turbid water), many images, coarser resolution.
- Photogrammetry (less water influence, also intertidal); limited acquisition, requires high resolution, not suitable for featureless bottom.
- IceSat (Lidar from space) fixed limited swath and frequency. May help cal/val in remote areas. Not ready for routine use.

Check out this story map on methods: "Satellite derived bathymetry 101"
https://storymaps.arcgis.com/stories/f8728c724d6d4c28ad48fe43aff2c48b

Commonest SDB

Passive optical based on physics of light in water (most common)

- Empirically tuned (based on how light changes with water depth)
    - NOAA method needs no more than 10-12 (**existing**) calibration depths
    - Calibration can work in more than one location (being evaluated)
    - Can readily support automation (semi-automation being tried now)
- Optimization tuned (sometimes called "physics-based")
    - – Coefficients have physical meaning (light attenuation, etc.)
        - Allows adaptability, customization

SDB acquisition

Sentinel-2 (open access)

10 m pixel,

5 day routine repeat.

300 km swath

Worldview-2/3 etc. (commercial)

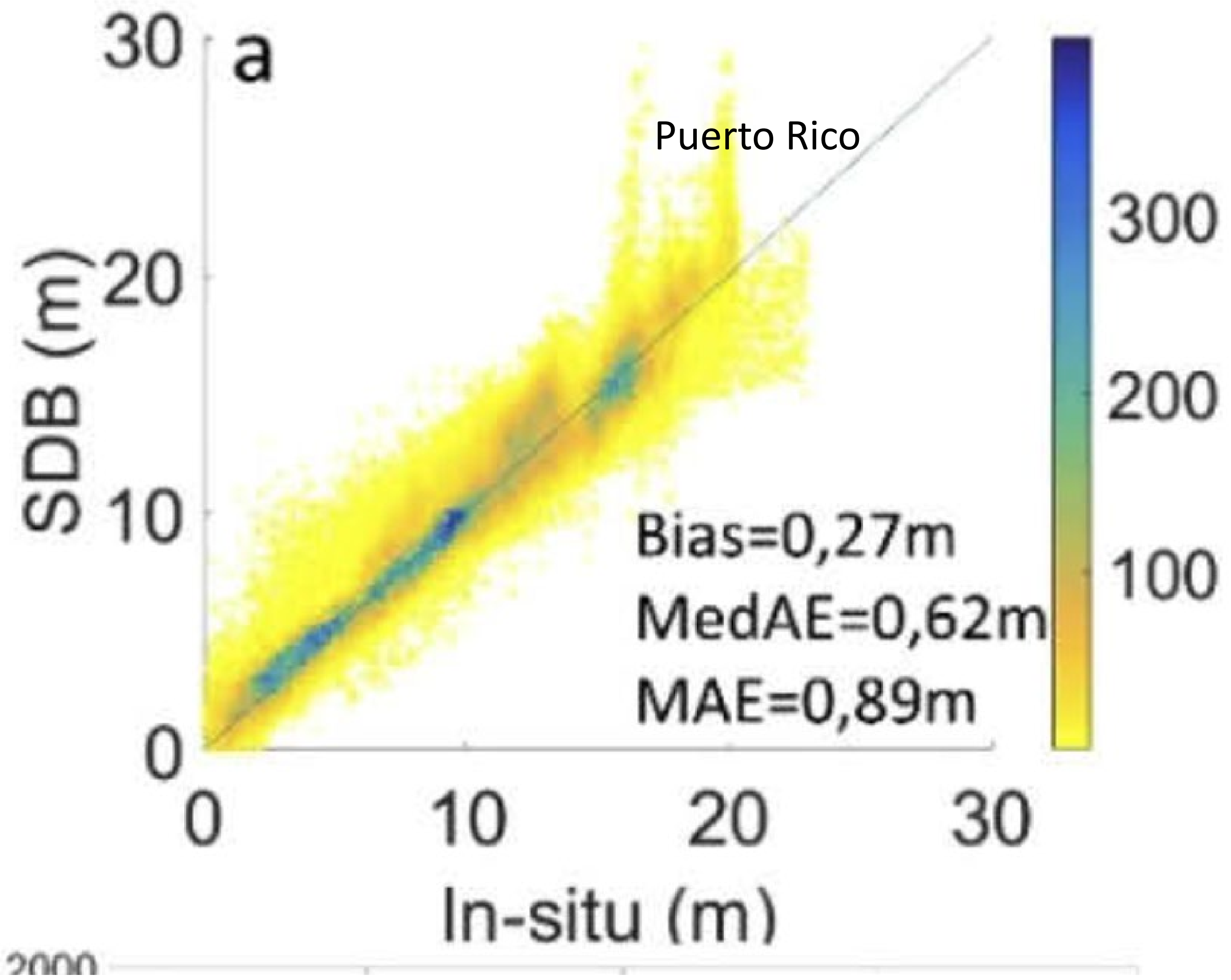
2 m pixel

1-4 day possible revisit

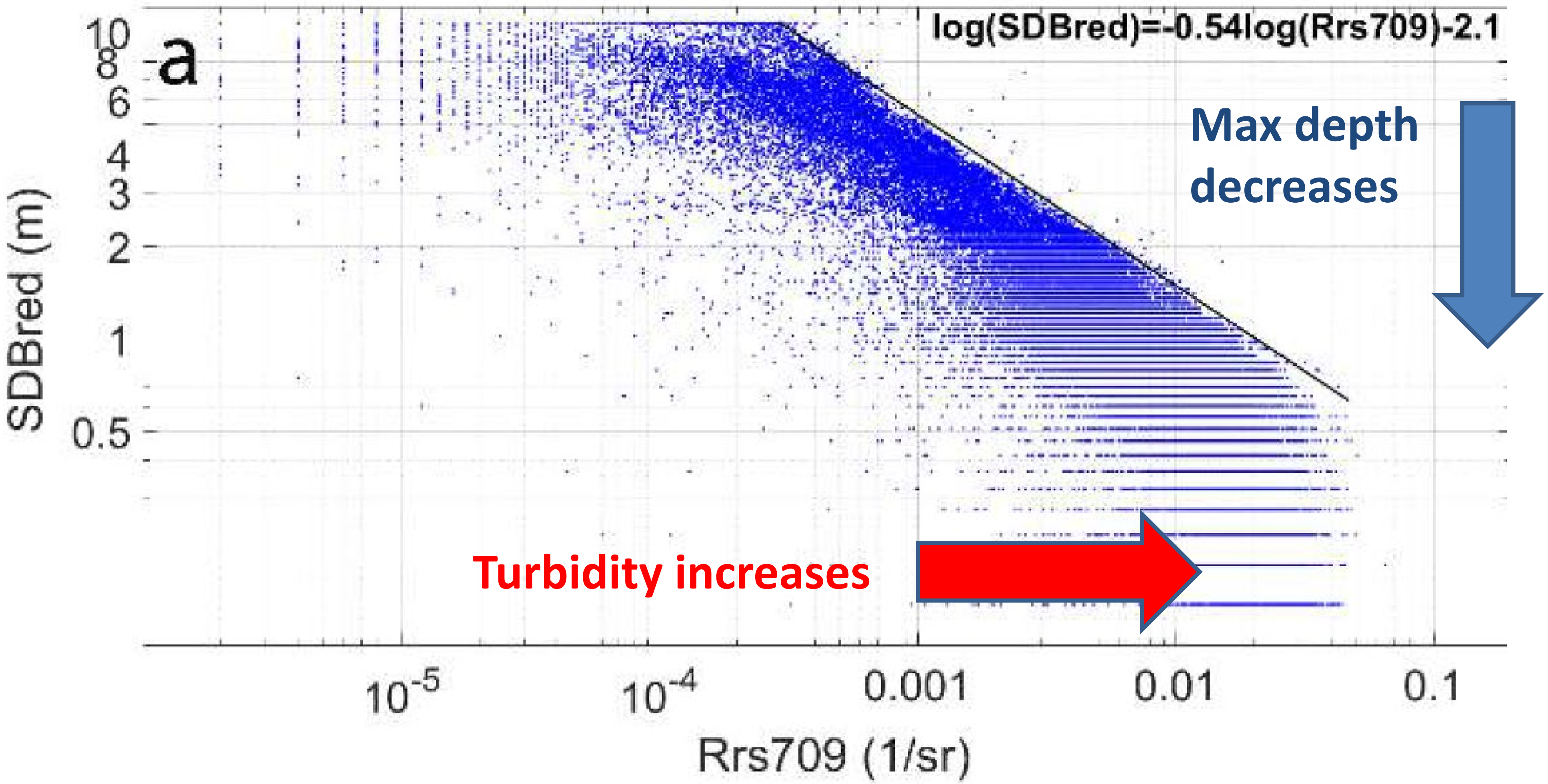
16 km swath (repointable)

Other sensors with blue green red near-IR (quality depends on calibration and sensitivity)

20 m in clear water (e.g., Florida, Puerto Rico)



Turbidity (measured from satellite) decreases extinction depth



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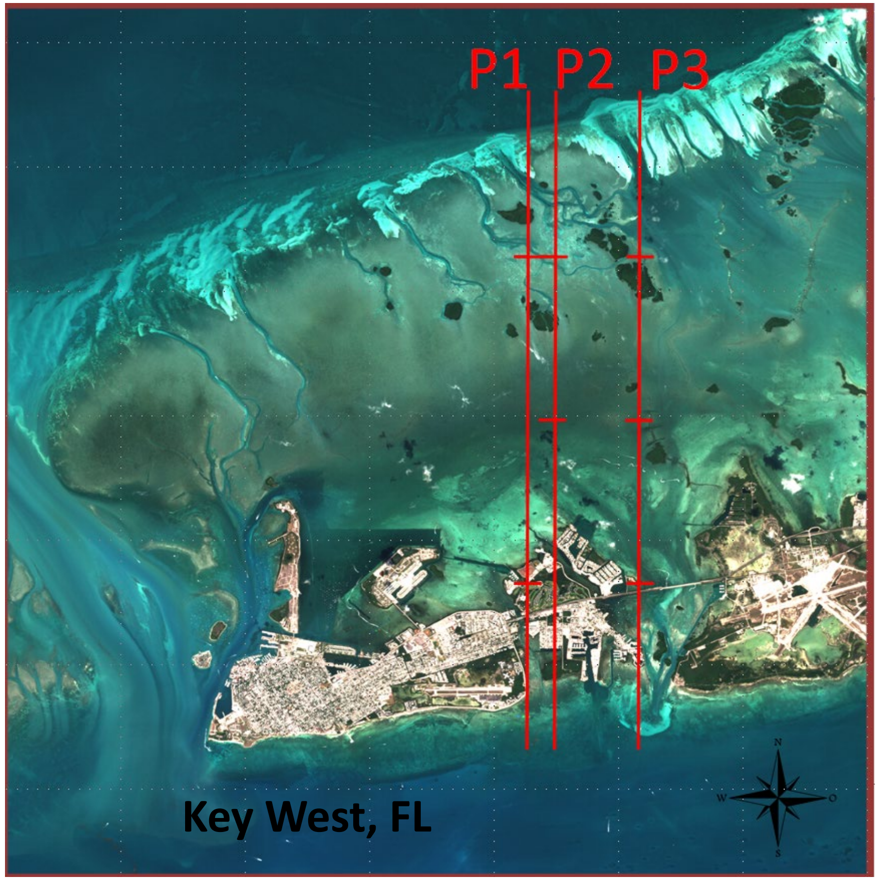
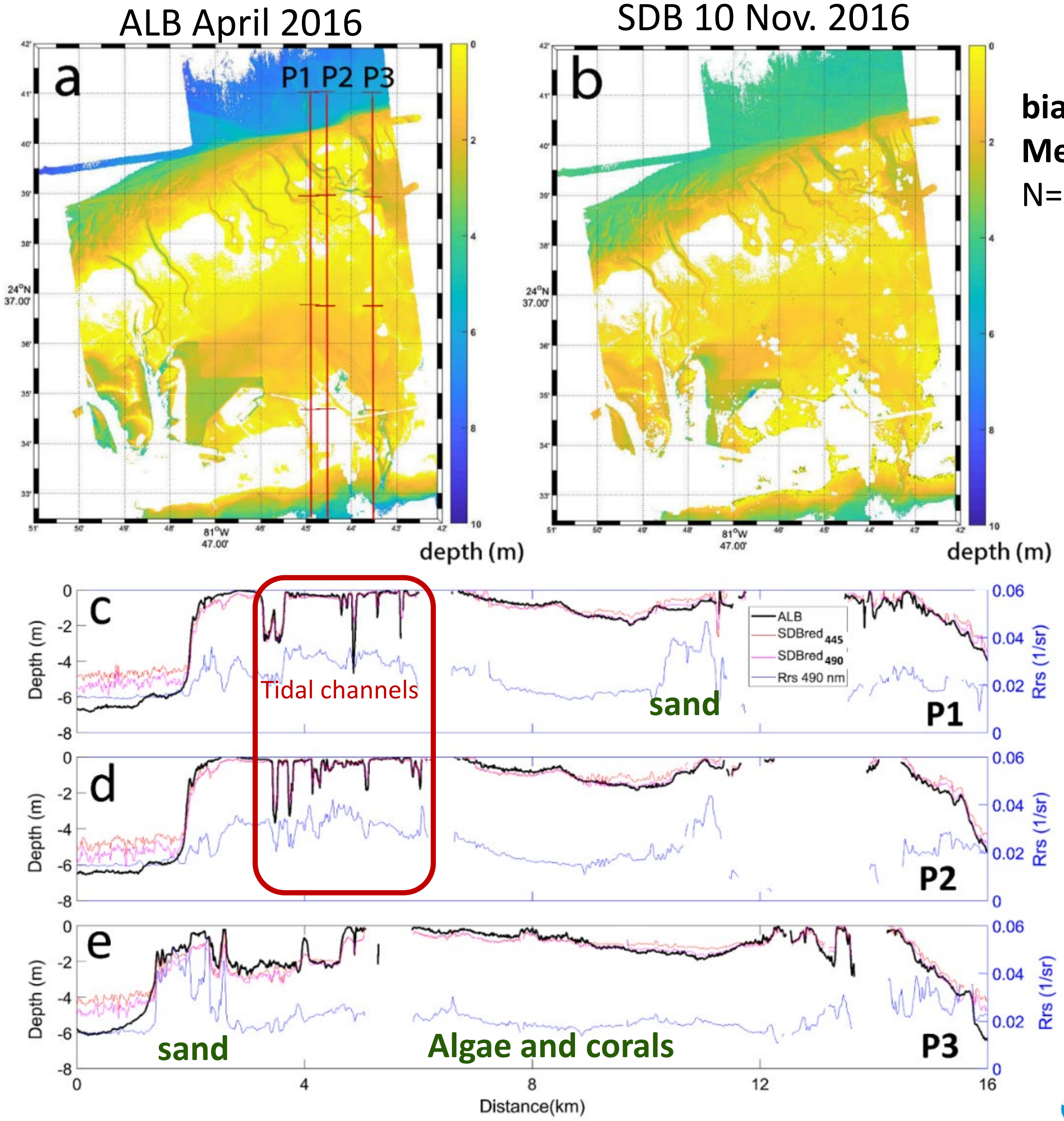
Pick up fine-scale features.
Works on different bottom.



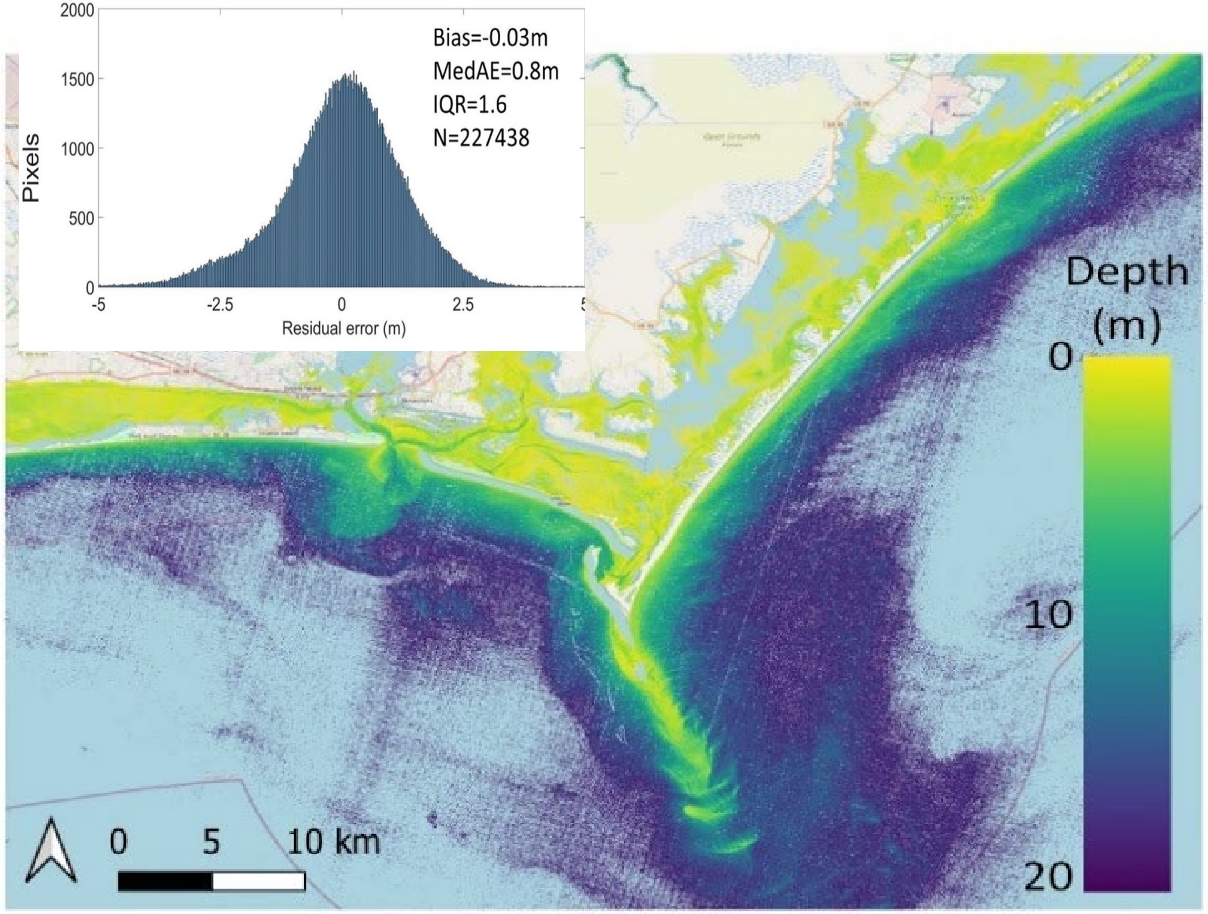


bias=0.1m
MedAE=0.22m
N=1203174

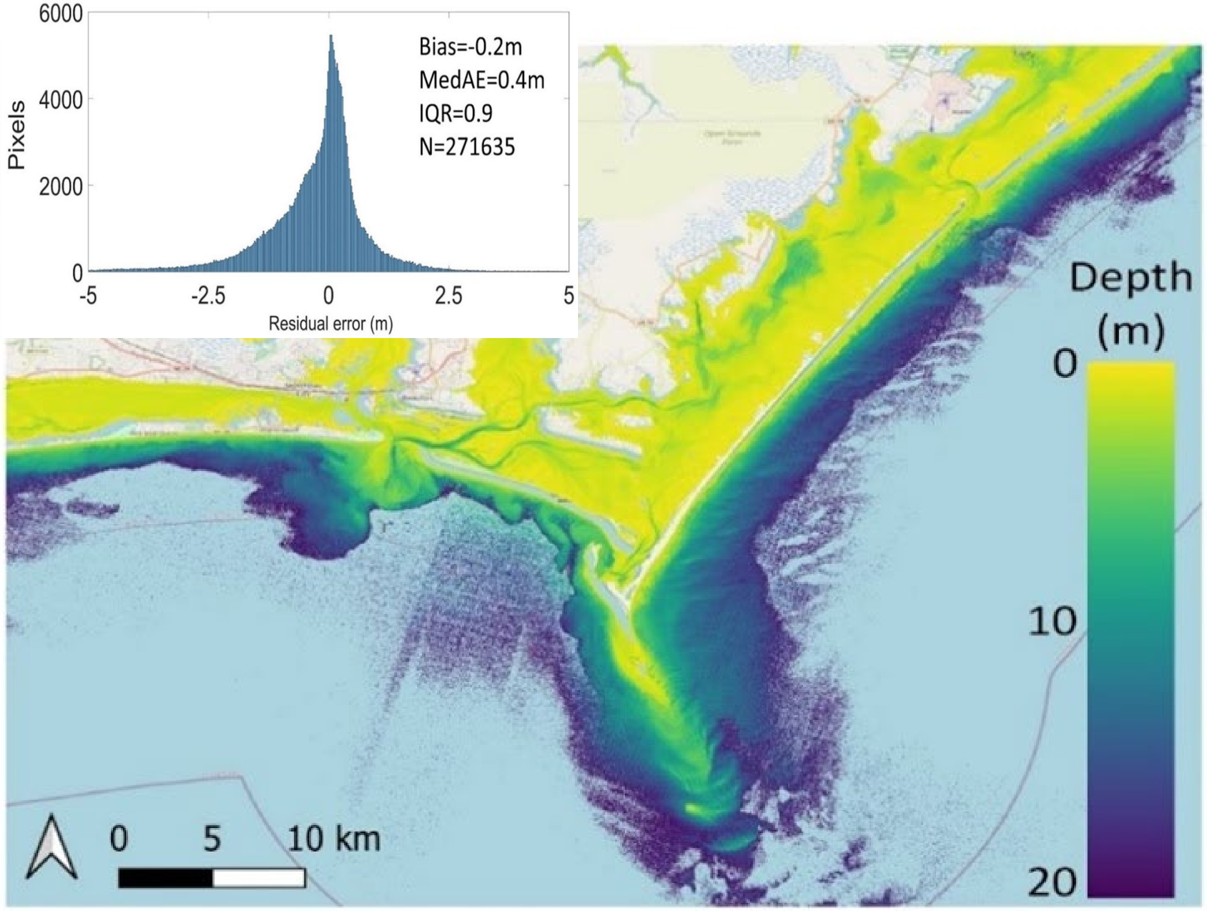
NCCOS

Multi-scene method improves results with turbidity. Potential automation

27 Nov 2017 Clearest scene

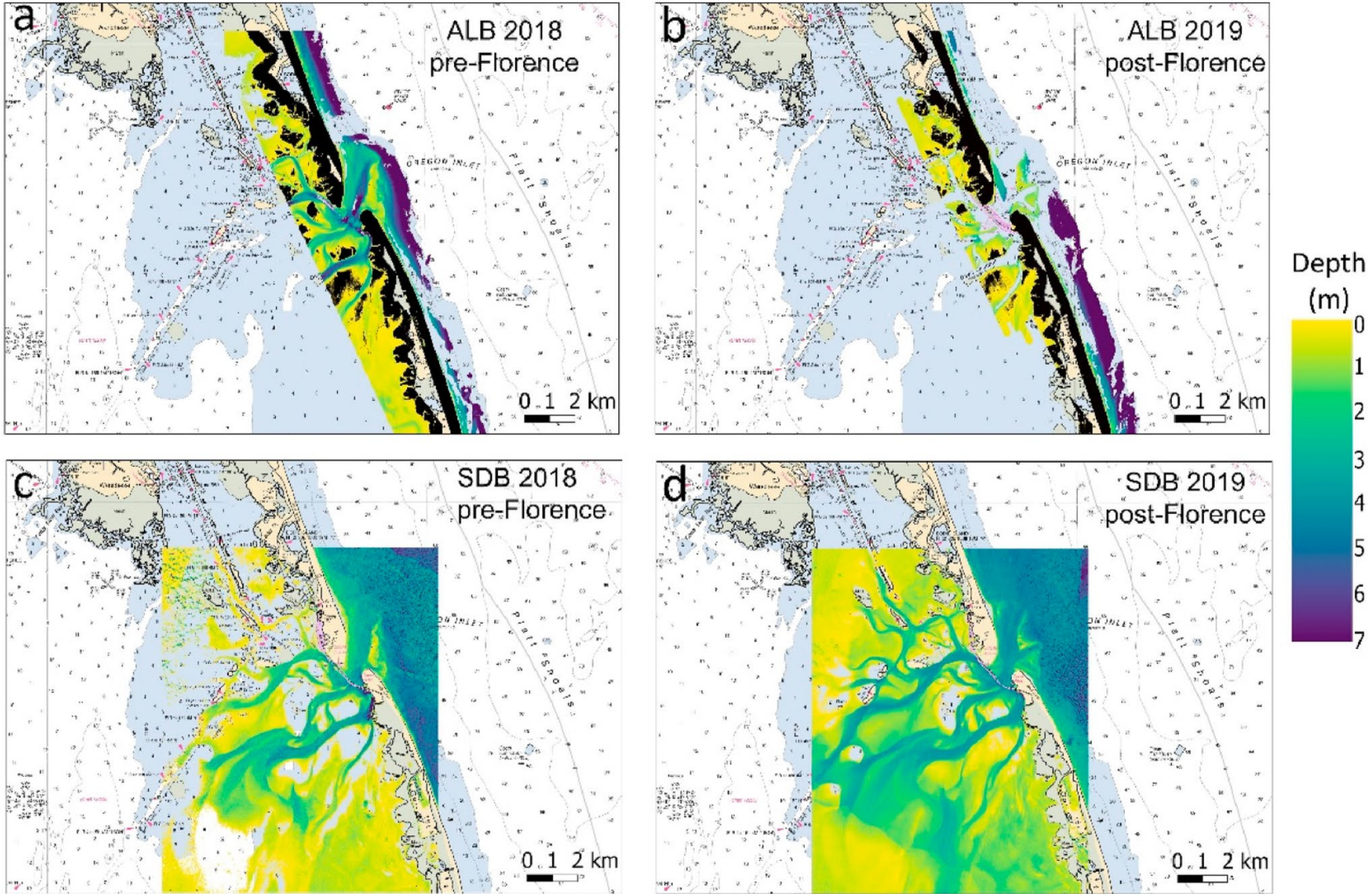


Summer 2017 Multi-scene composite
Reduces turbidity, noise, etc.



North Carolina, evaluate change after hurricane.

Fill in Lidar



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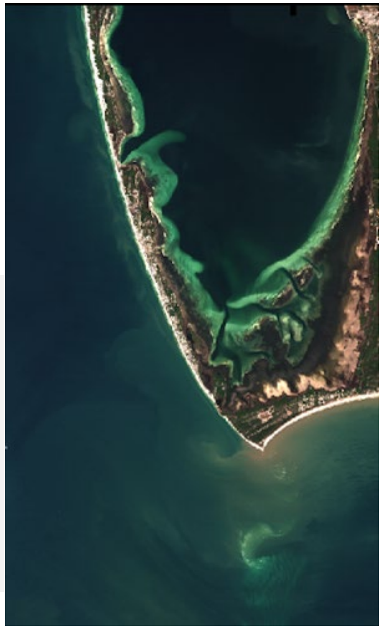
Our goal, to mostly automate SDB at 10 m resolution, with national and global application

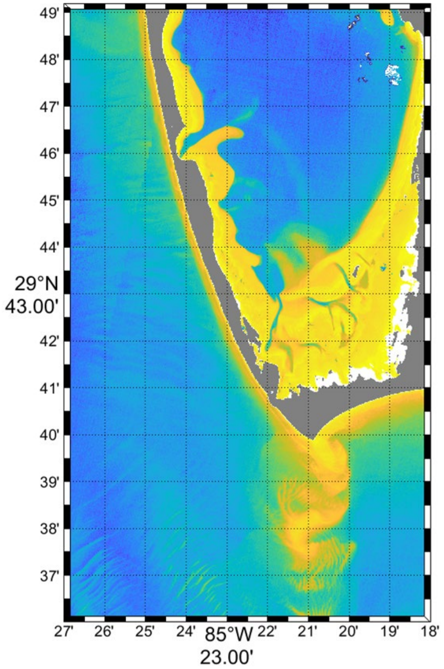
New capabilities coming onboard in NOAA

- Apply to Sentinel-2 (routine 10 m)
- Address mapping concerns (max depth, etc)
- More automation
- Improve calibration, reduce uncertainty, etc.

Rick Stumpf:

Richard.Stumpf@noaa.gov





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