

SATELLITE-BASED REMOTE SEABED SURVEYS IN HIGHER LATITUDES – APPLICATIONS AND UNIQUE BENEFITS

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2023-10-26

WHO IS EOMAP?



Private technology company est. 2006 from German Aerospace Centre



Focus on satellite data analytics and software solutions



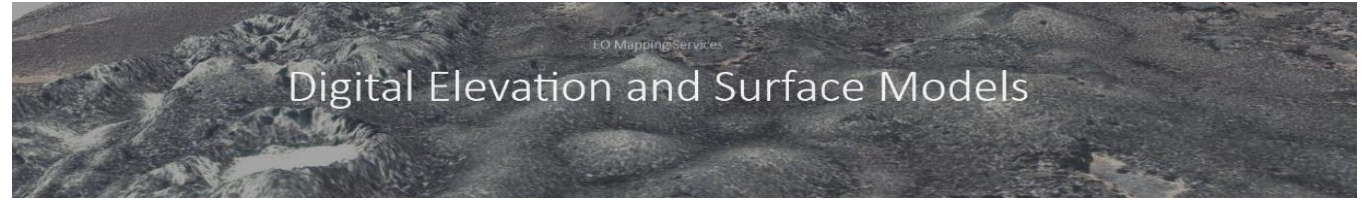
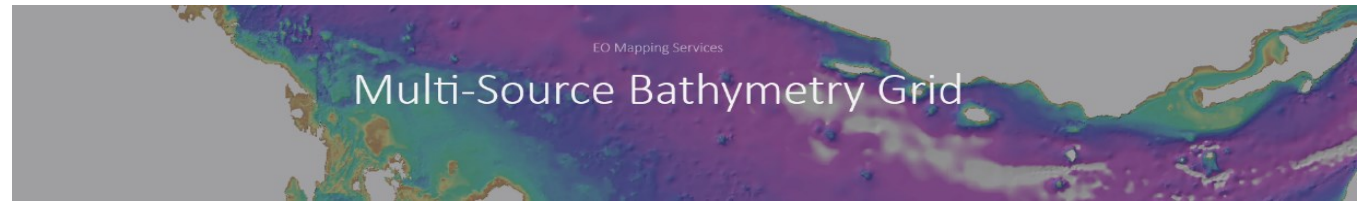
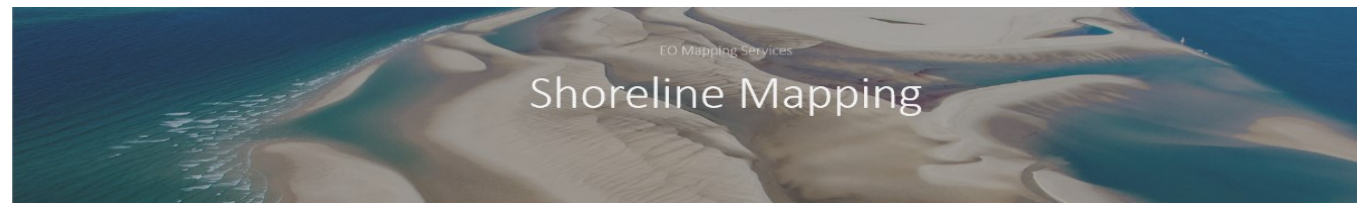
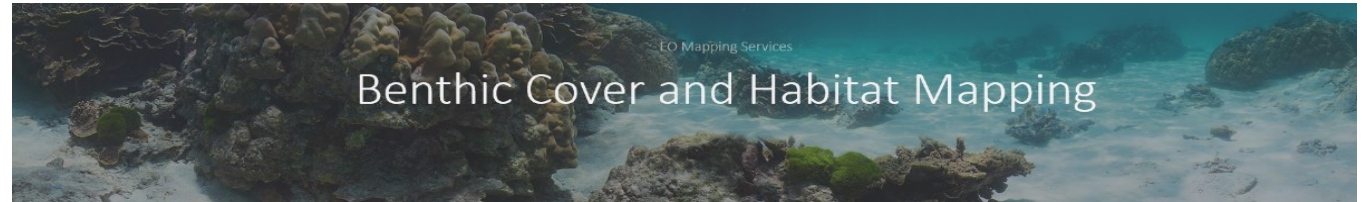
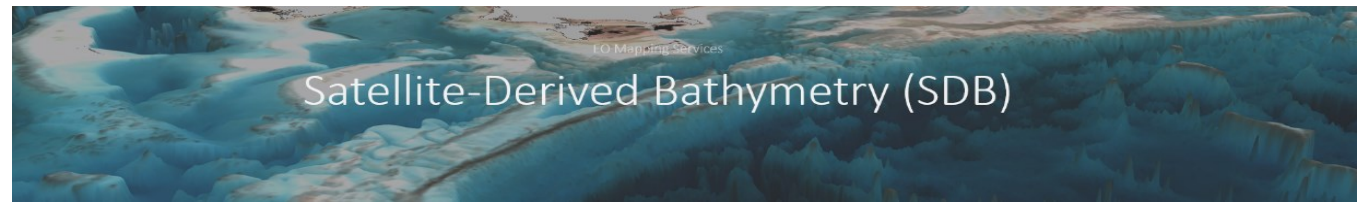
Specialises in coastal and aquatic environments



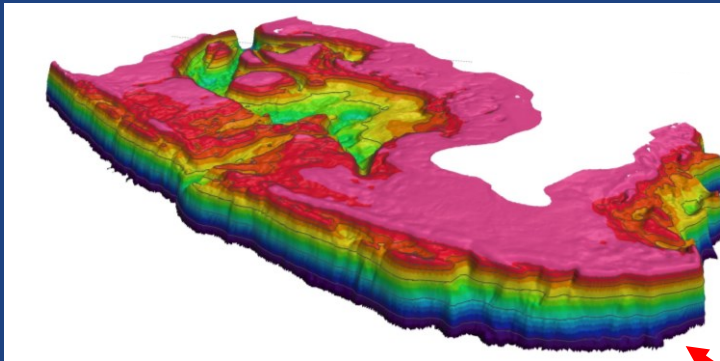
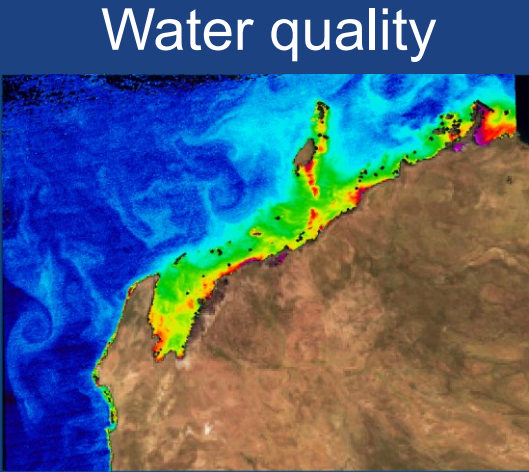
International team of 50 employees



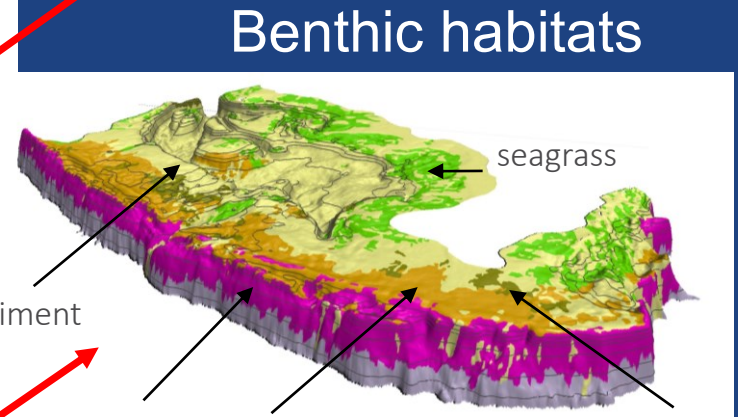
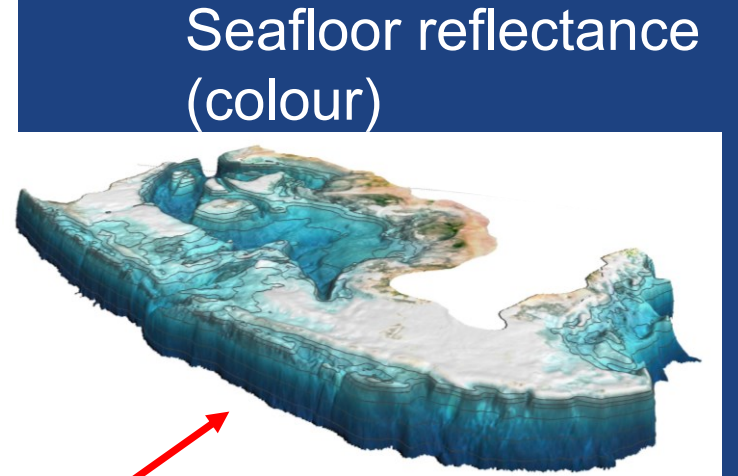
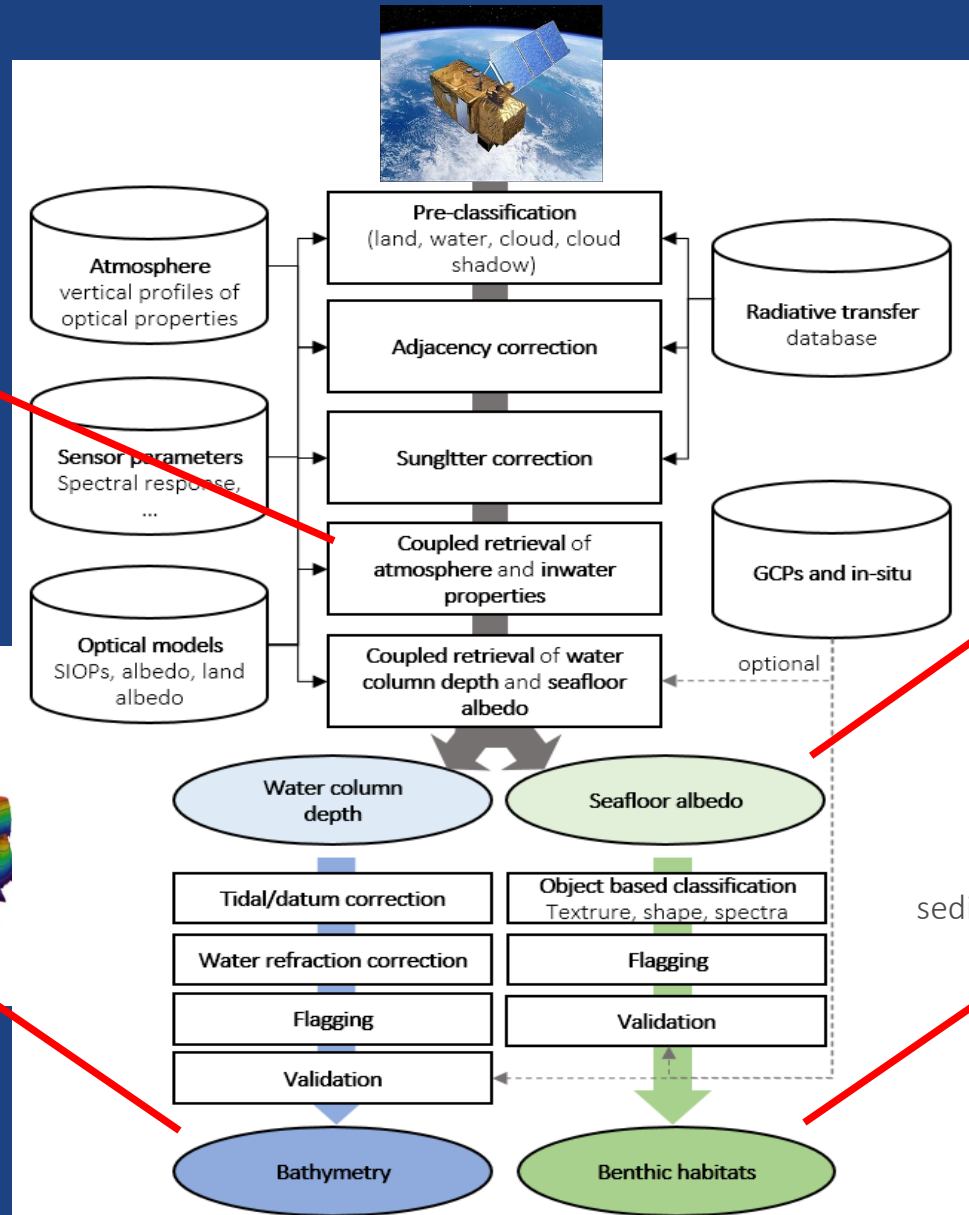
HQ in Germany with offices in USA, Australia, Indonesia, Dubai



EOMAP'S PHYSICS-BASED PROCESS



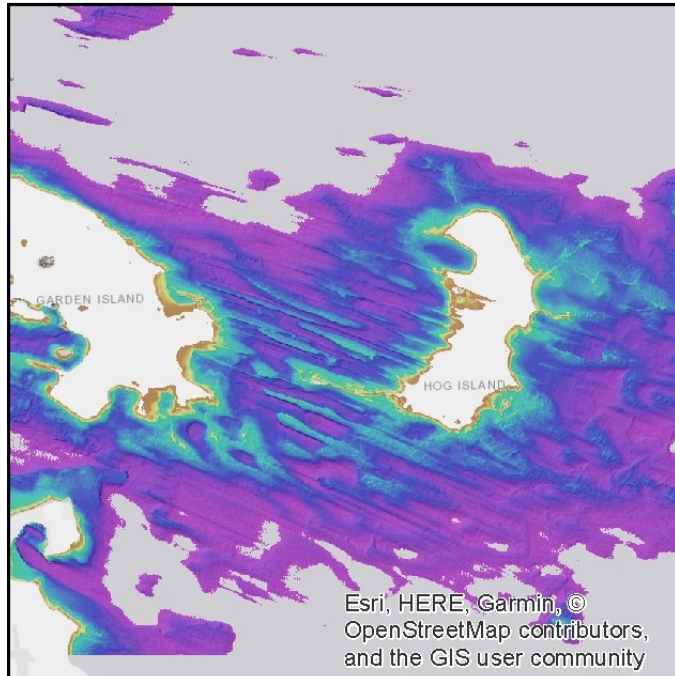
SDB (Satellite-derived bathymetry)



Data Comparison and Quality Check

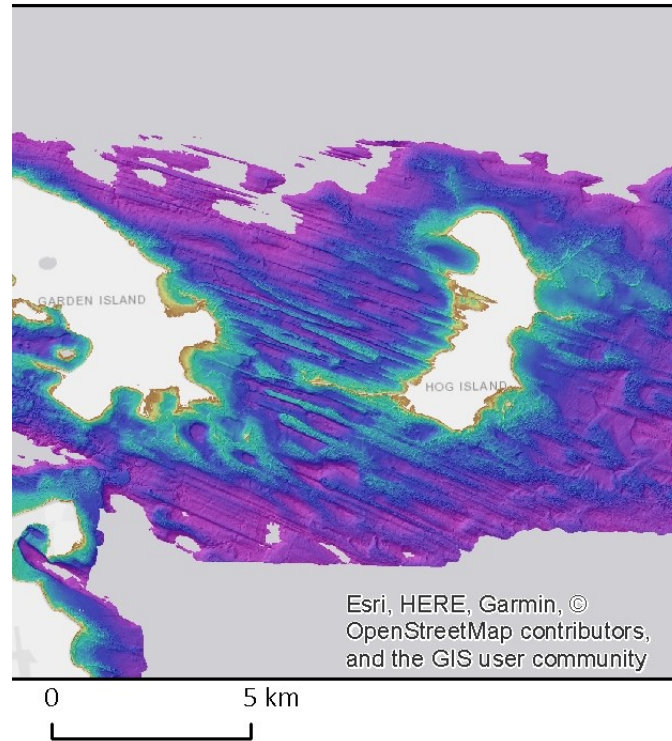
Example: Great Lakes

Satellite-Derived Bathymetry, multi



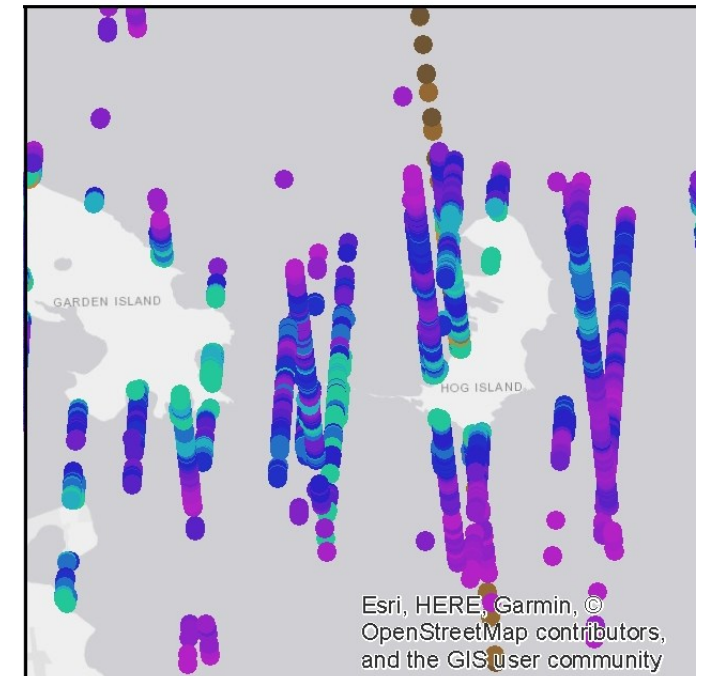
SDB results of SDB-Online webapp
sdb-online.eoapp.de/

Airborne Lidar Bathymetry



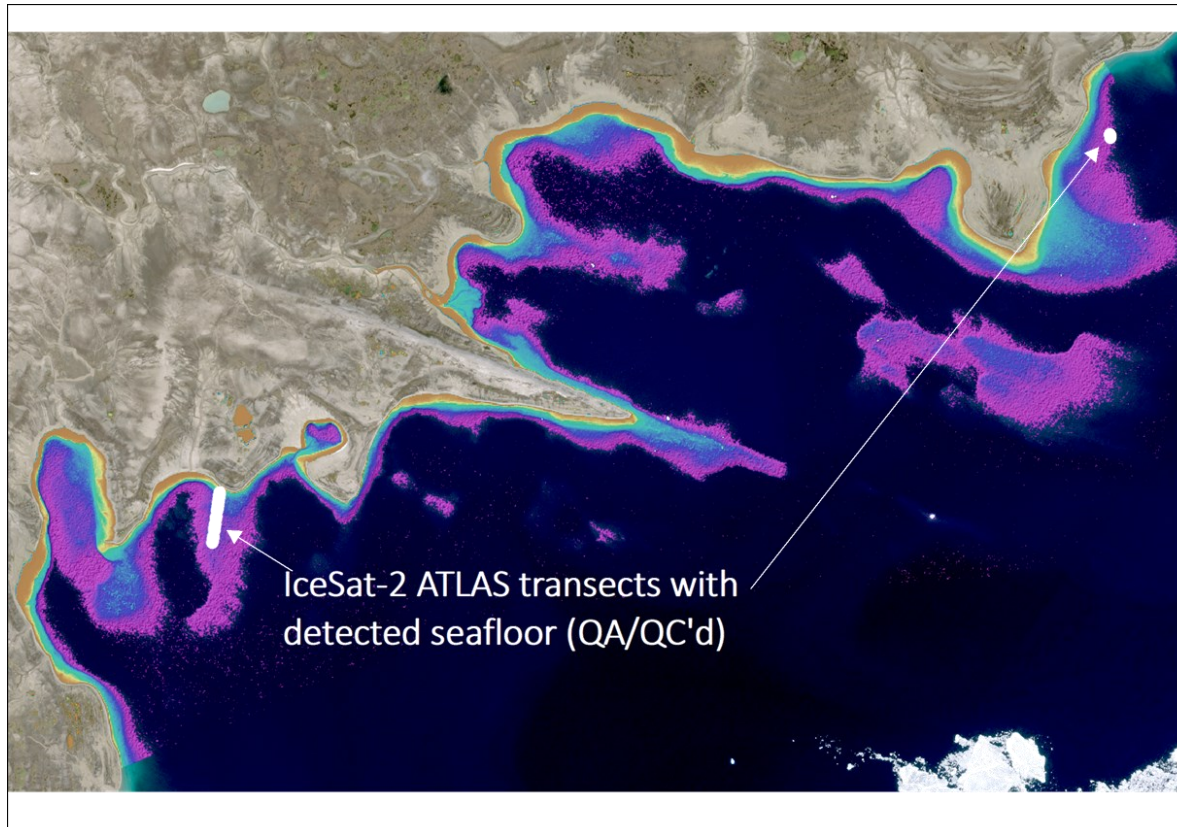
Airborne Lidar
-> Potential source for validation

Satellite Lidar Bathymetry



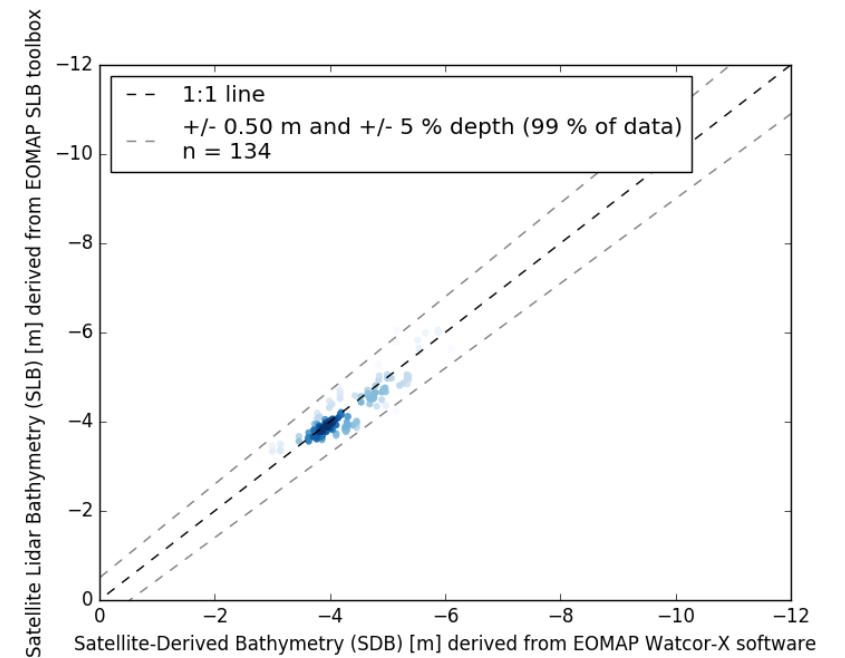
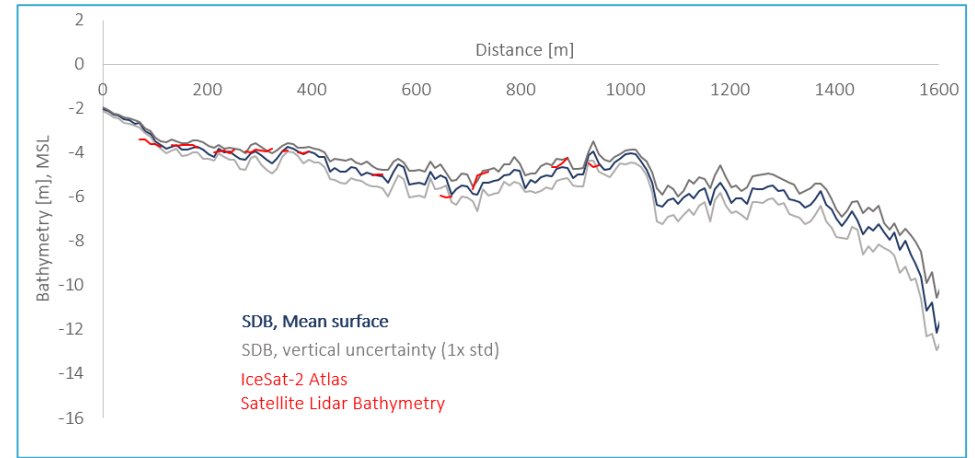
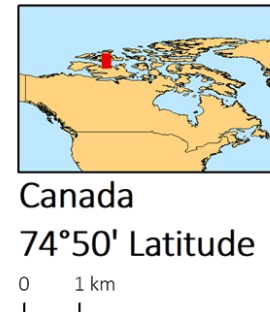
Satellite-Lidar Bathymetry database;
derived from ICESAT-2 archive. Profiling
green laser, depth penetration of 1x
Secchi.

Comparison with ICESAT-2 Atlas data



Data derived with EOMAP's physics based Watcor-X Satellite-Derived Bathymetry software. No calibration, no manual interpretation and no configuration.

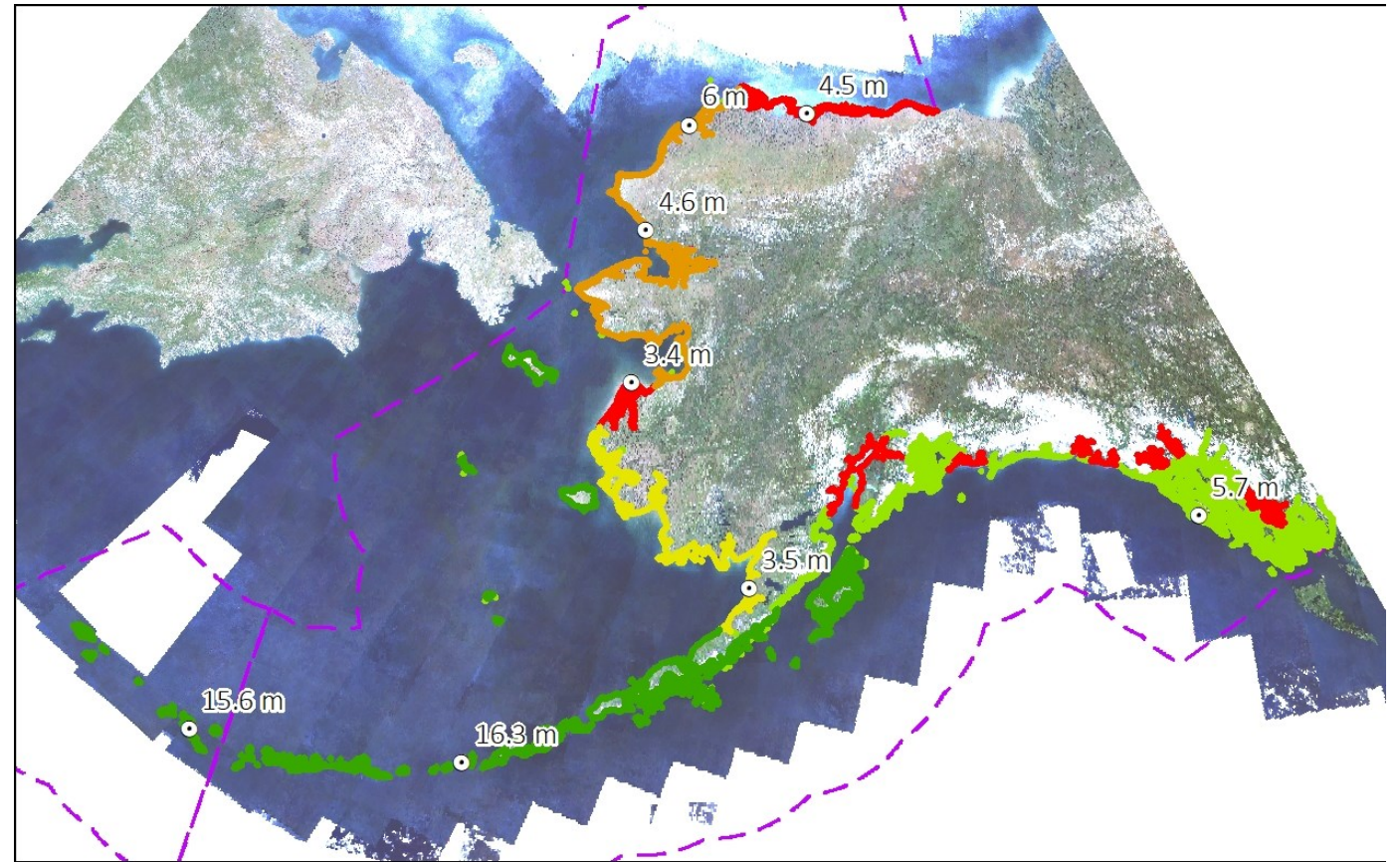
SDB, m (LAT)
+0.5m
-12m



ALASKA SDB FEASIBILITY

Challenges

- Low light intensity at the seafloor
- Dynamic turbidity
- High cloud coverage
- Ice coverage
- Dense kelp forests



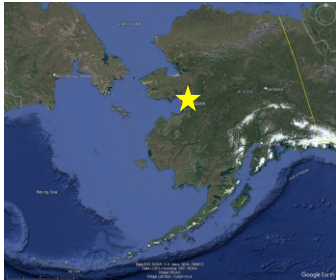
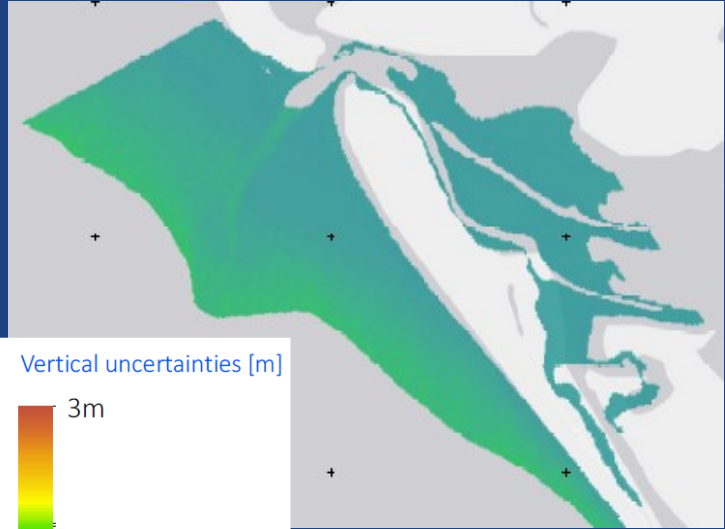
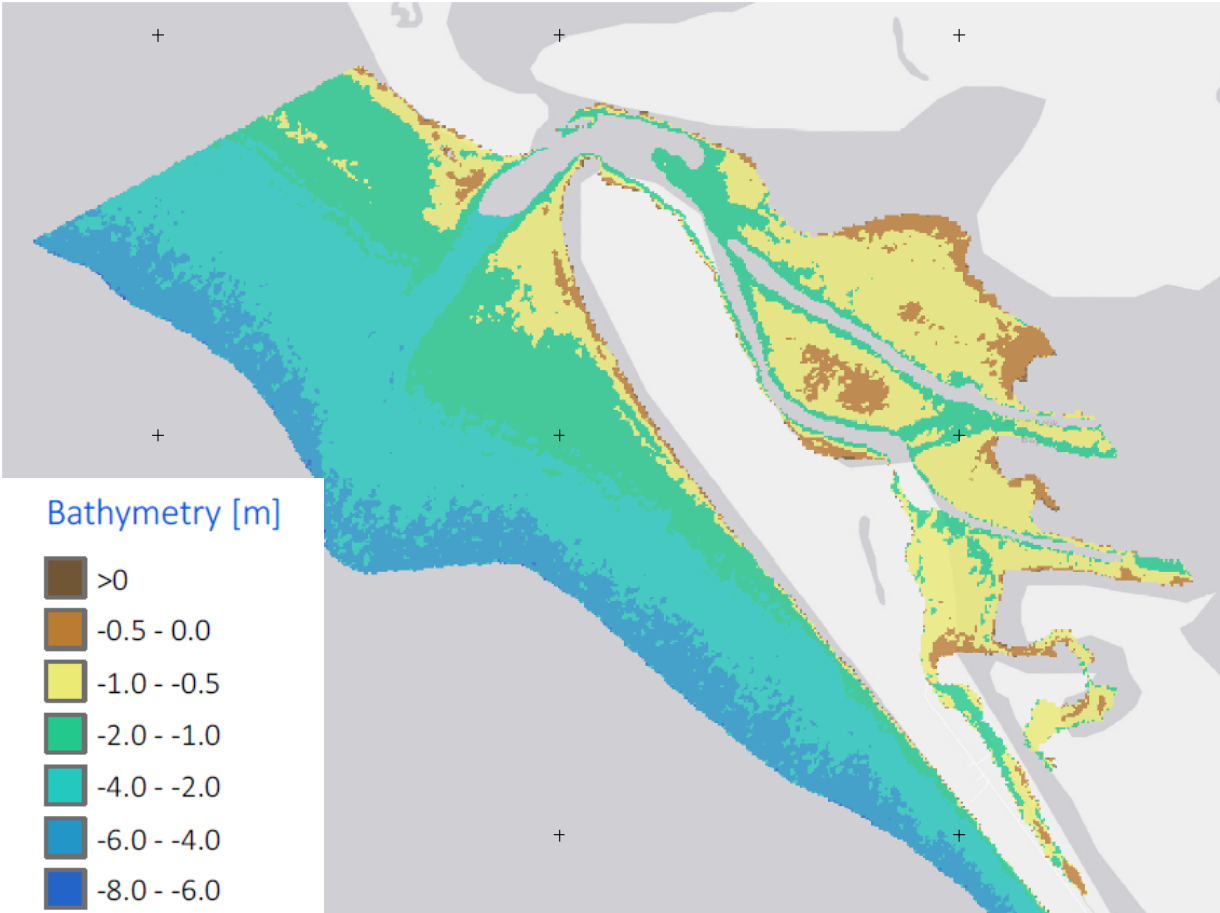
- Average Secchi Depth (satellite)
- Alaska, EEZ
- SDB - most likely not feasible
- SDB - depth down to 4-6m
- SDB - depth down to 5-8m
- SDB - depth down to 5-10m
- SDB - depth down to 10-14m

Norton Sound

- SDB feasibility areas (red)
- Yukon River turbid, intertidal mapping only

ALASKA SDB FEASIBILITY

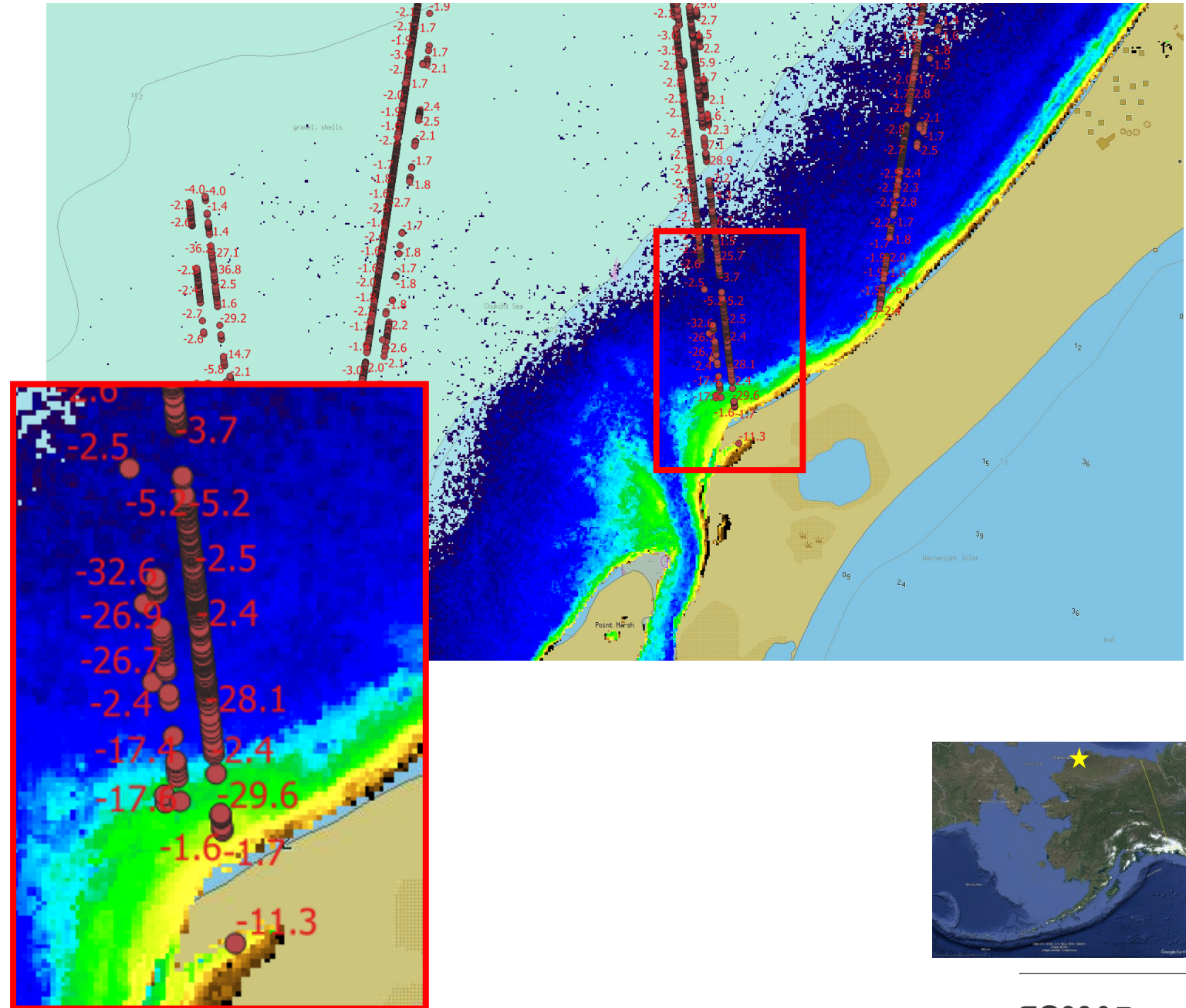
Shaktoolik
Golder Associates (WSP)



ALASKA SDB FEASIBILITY

Wainwright

- Produced by EOMAP's SDB Online
- Cut off 10 m water depth (aligns with NOAA chart)
- ICESAT data erratic (affected by turbidity)

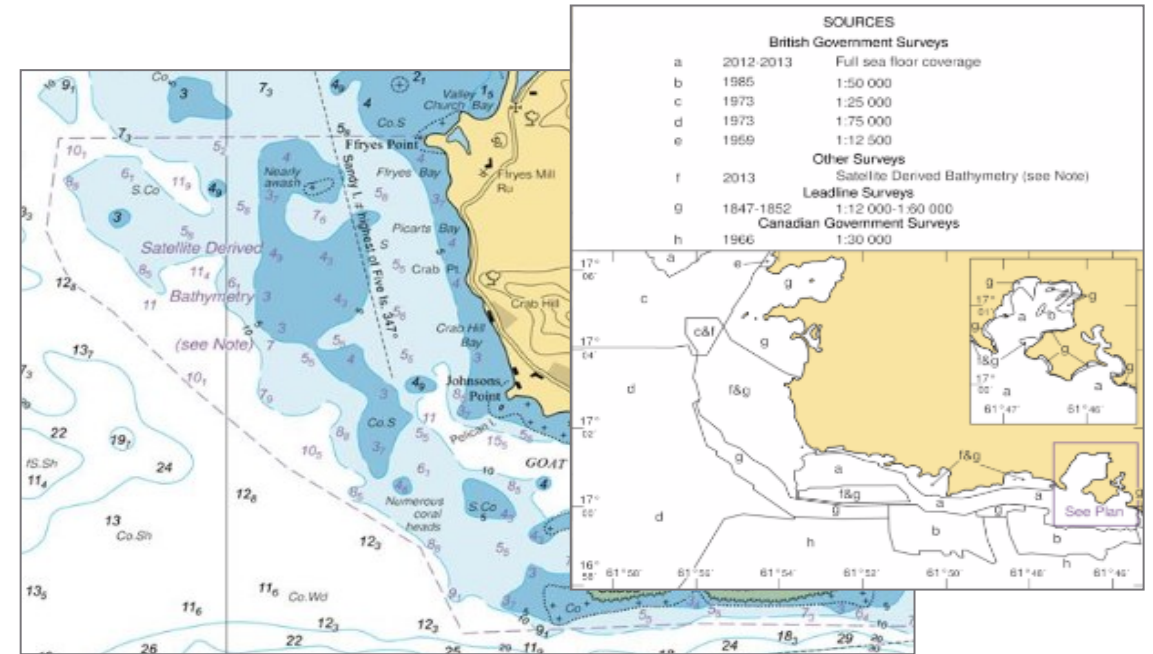


CHARTING

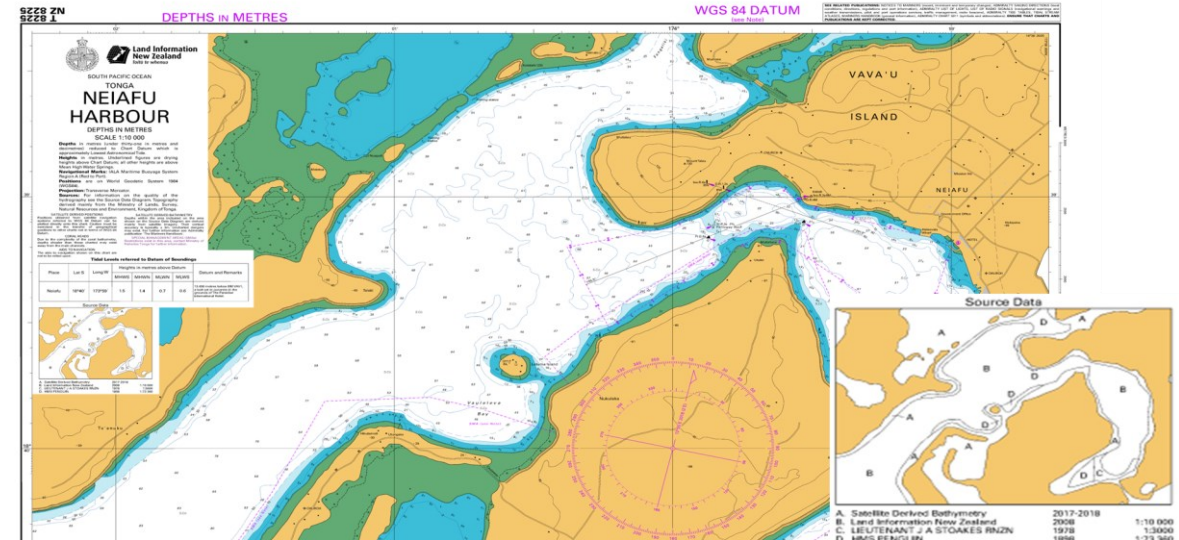
EOMAP's SDB is produced for and integrated in nautical charts of hydrographic offices worldwide:

- UK: UKHO
- Australia: AHO
- New Zealand: LINZ
- Germany: BSH
- Indonesia: Pushidrosal
-

British
Admiralty
Chart BA 2066
Southern
Antigua

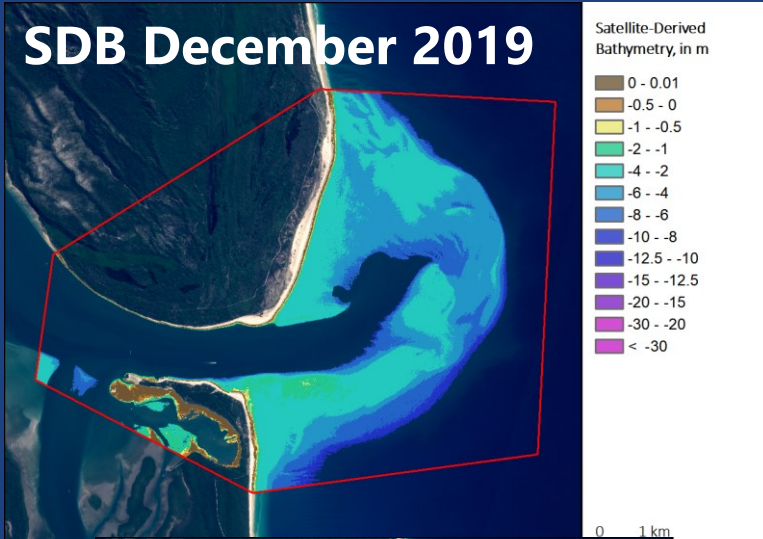


New Zealand
LINZ
NZ8225
Neifu
Harbour,
Tonga

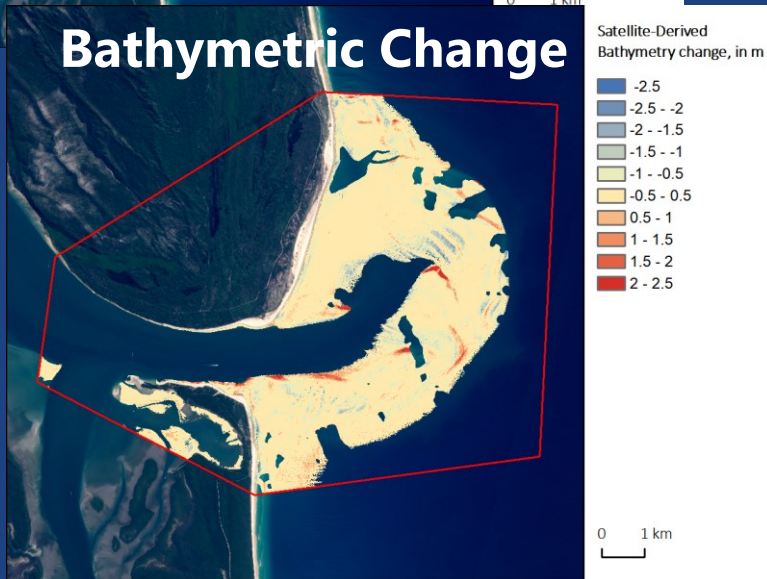


CHANGE DETECTION FOR NAVIGATION

SDB December 2019



Bathymetric Change



Department of Transport and Main Roads - Maritime Safety Queensland

NOTICE TO MARINERS

196 of 2020

Issued by Gladstone Maritime Region on 4 June 2020

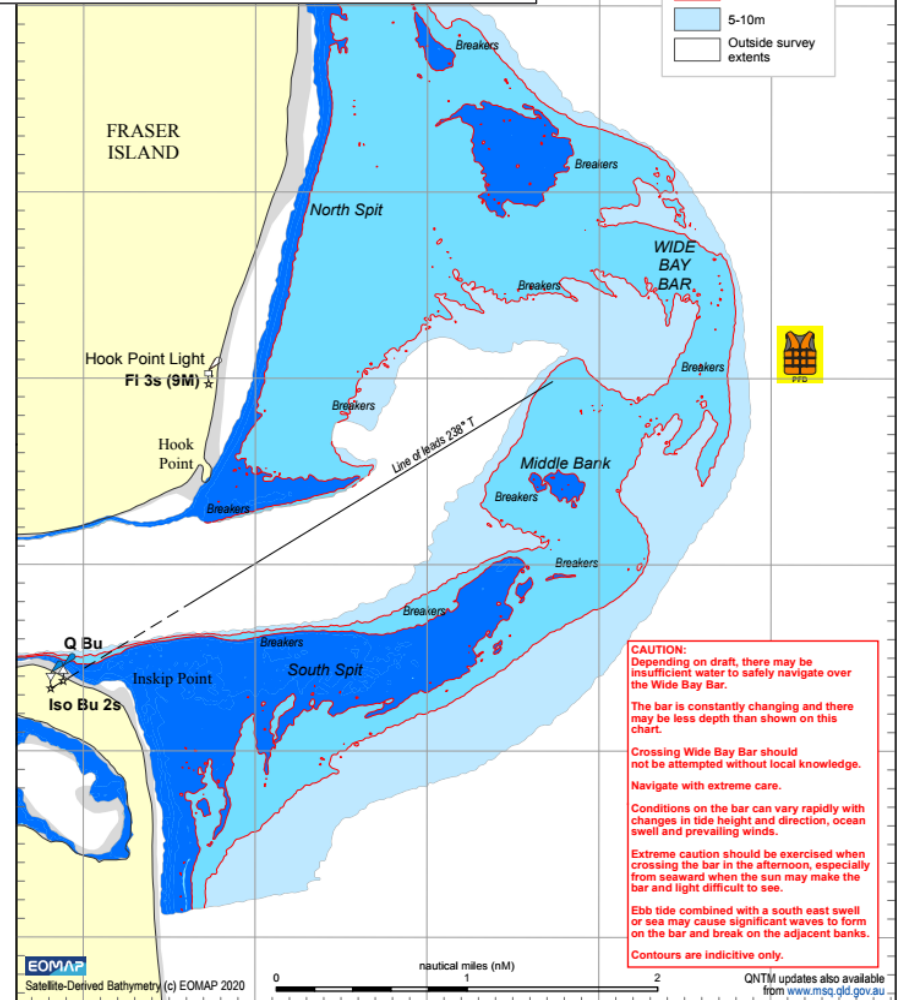


153°7'E

153°8'E

Legend

- Less than 3m
- 3-5m
- 5-10m
- Outside survey extents



© The State of Queensland 2020 (Transport and Main Roads)



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Published by Maritime Safety Queensland
Survey analysis Hydrographic Services
Map by Spatial Services 4 June 2020

QUEENSLAND NOTICE TO MARINERS

Issued by Maritime Safety Queensland

WIDE BAY BAR

Survey by satellite imagery
22 April 2020

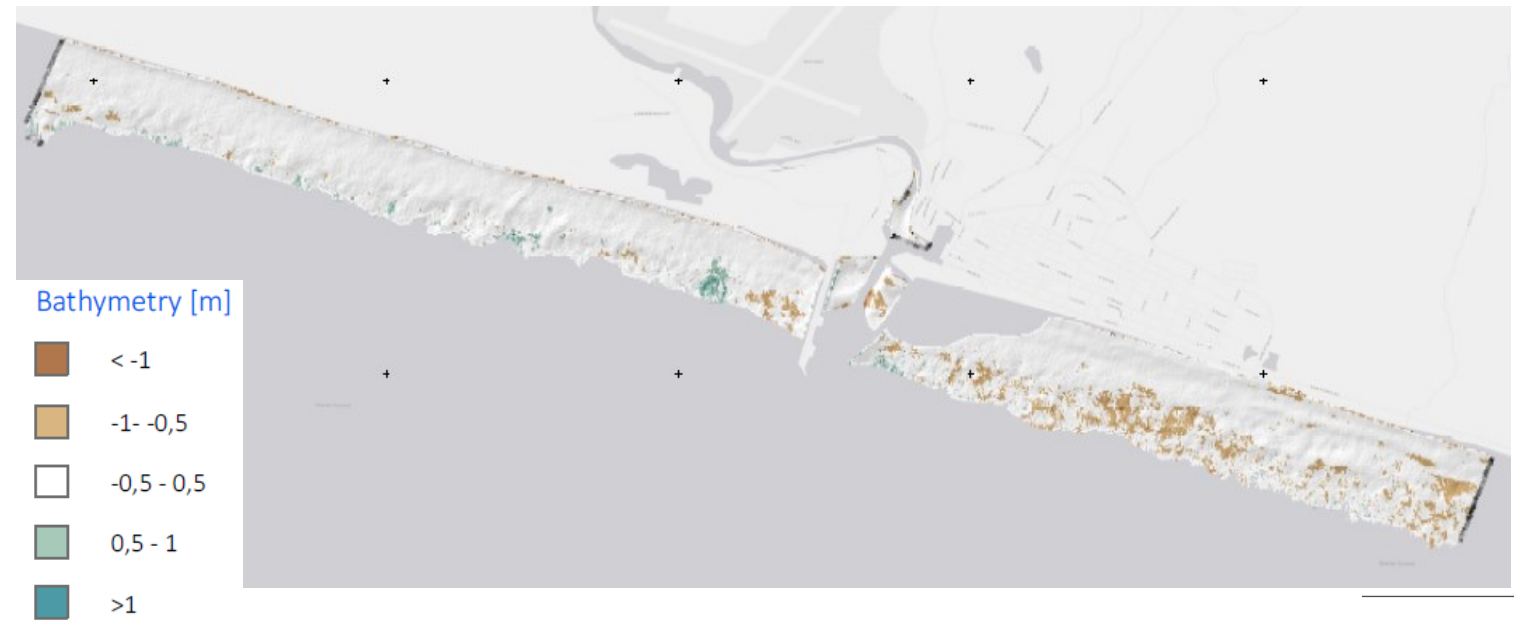
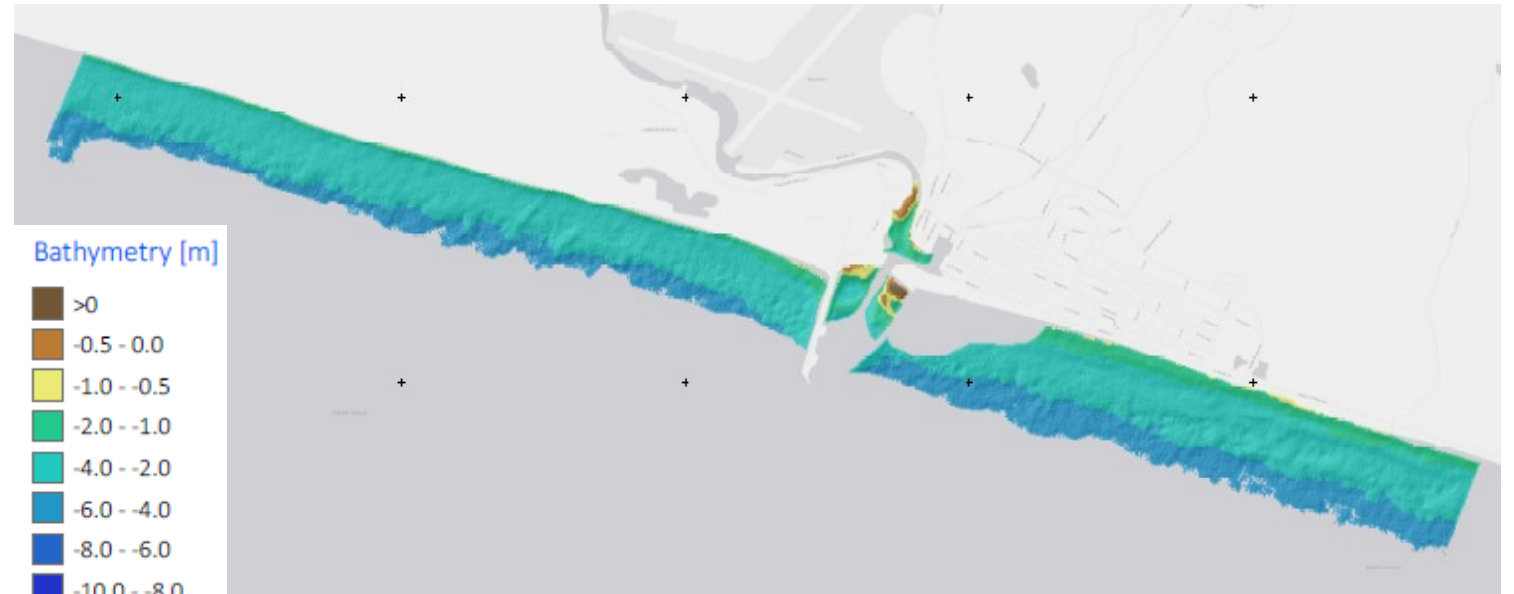
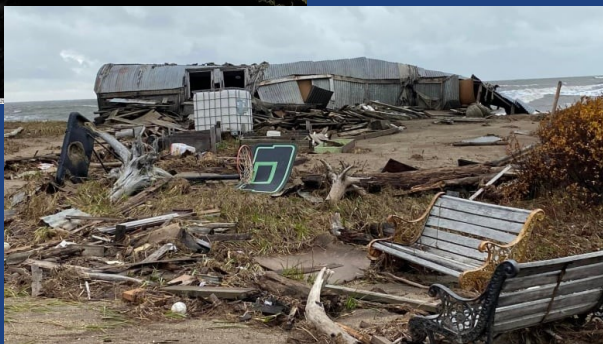
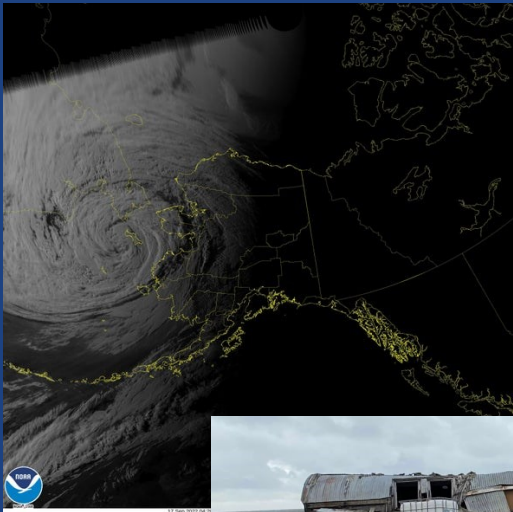
To be used with appropriate NTM
Datum: GDA94 horizontal, LAT vertical
Map projection: UTM (MGA zone 56)

Map S11-465
Queensland Government



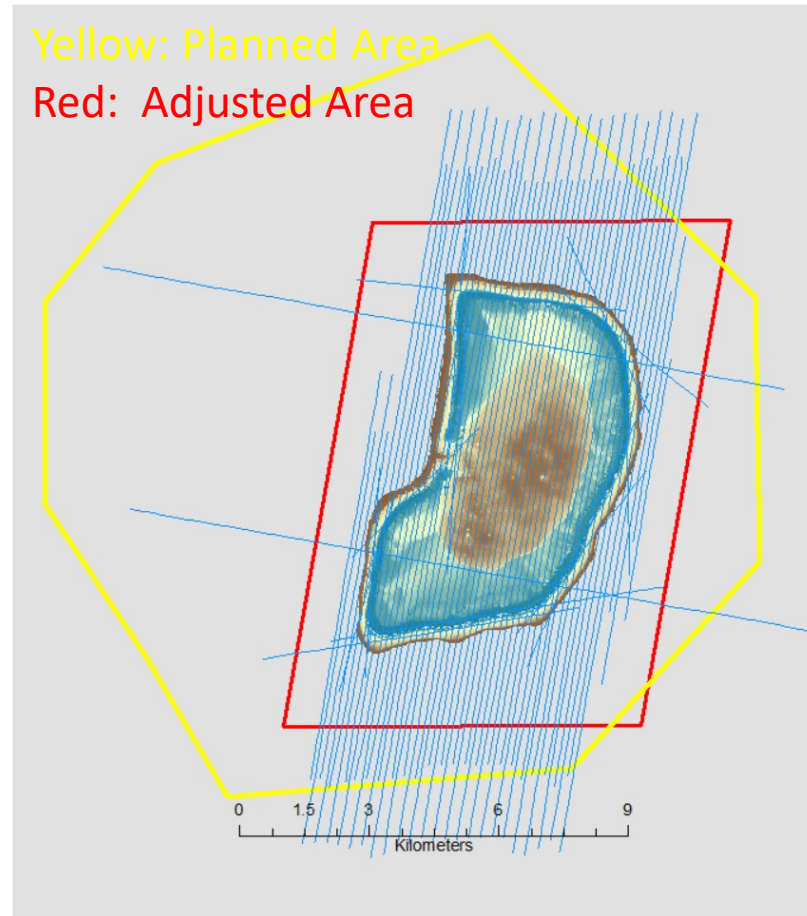
CHANGE DETECTION FROM STORMS

Merbok: Sept. 17, 2022.
Nome
+10.5 feet above low-tide
50-year high
(since November 1974)



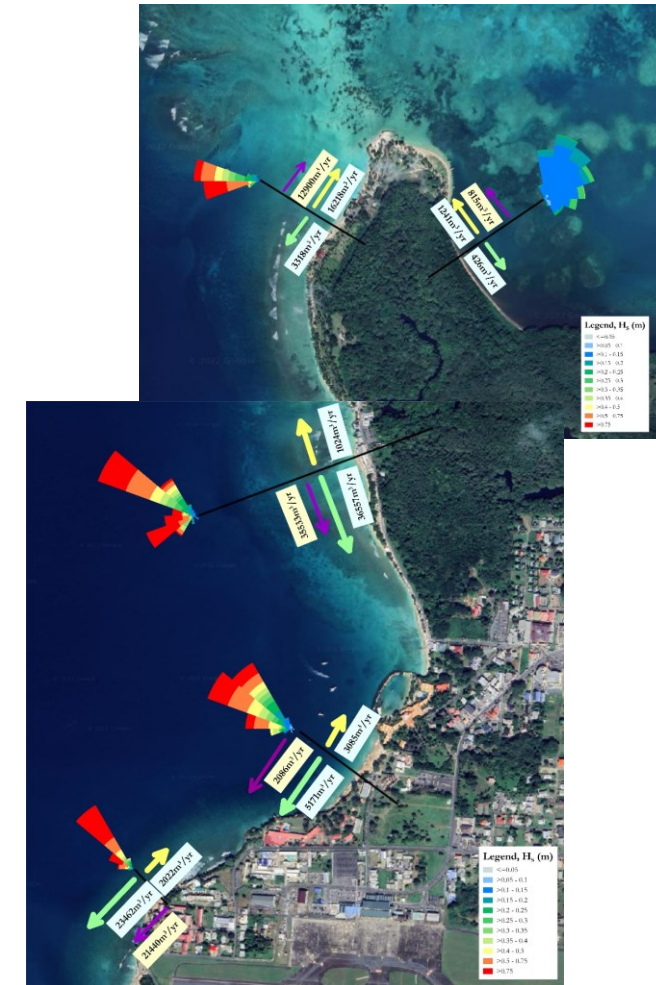
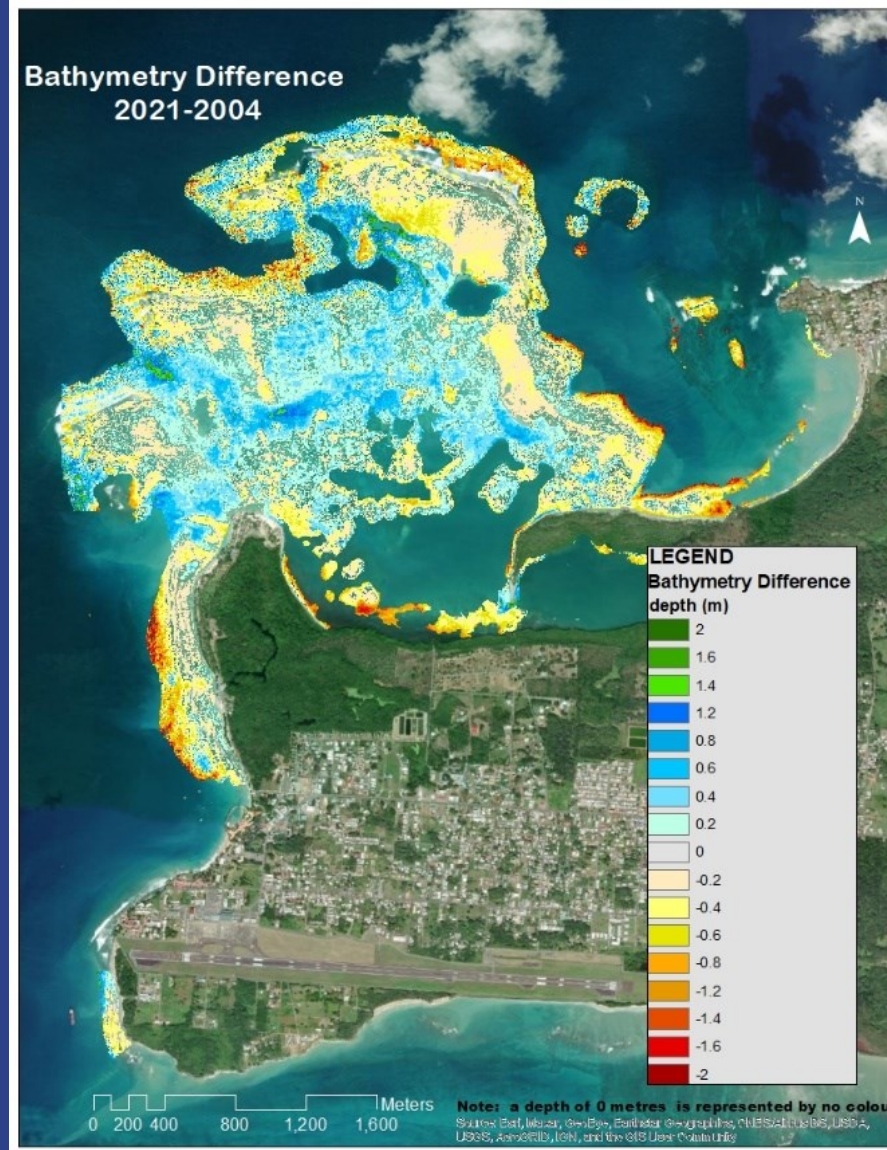
ALB, MLB SURVEY OPTIMIZATION

- Beveridge Reef –
After SDB review
- Reduction in ALB, MLB tracklines
 - Allow technology comparison
 - Add charting confidence



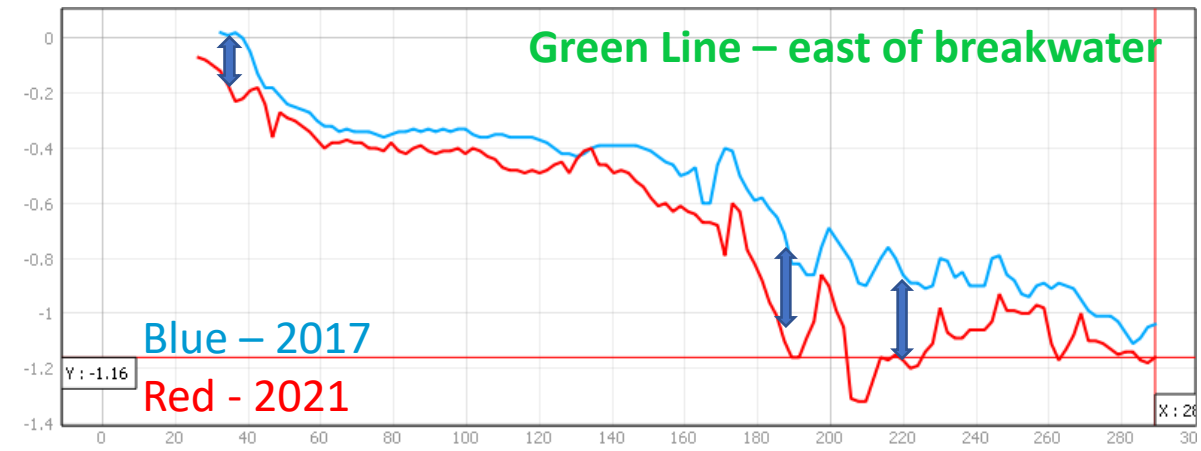
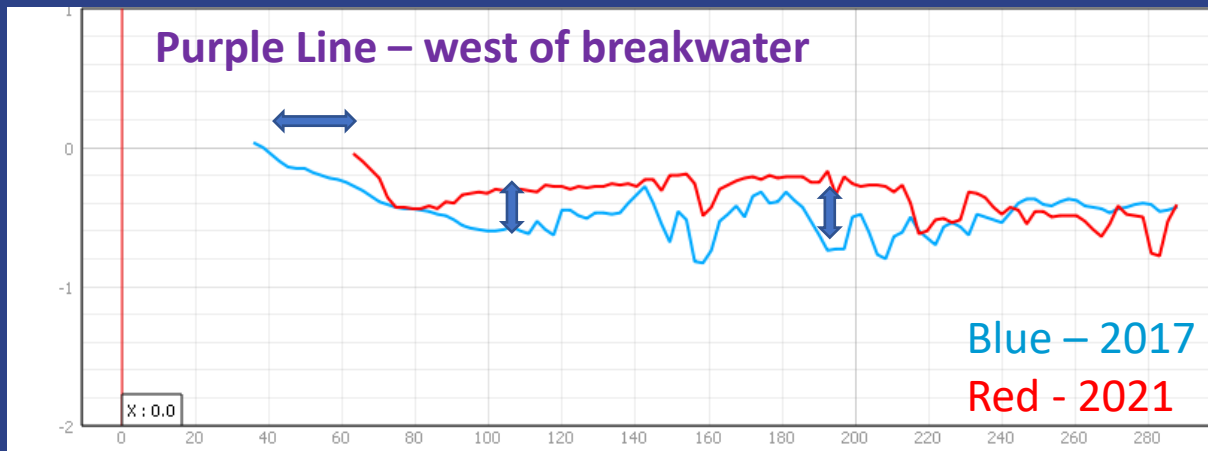
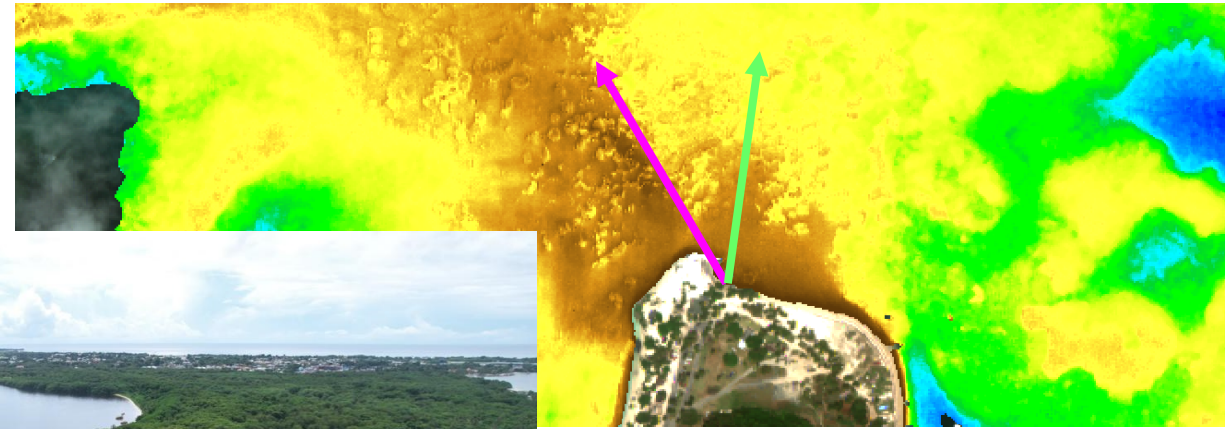
UNDERSTANDING OF NEARSHORE PROCESSES

- Better understanding of spatial & temporal movement of sandbeds
- Volumetric analysis
- Sediment budget



Understand littoral structure impacts

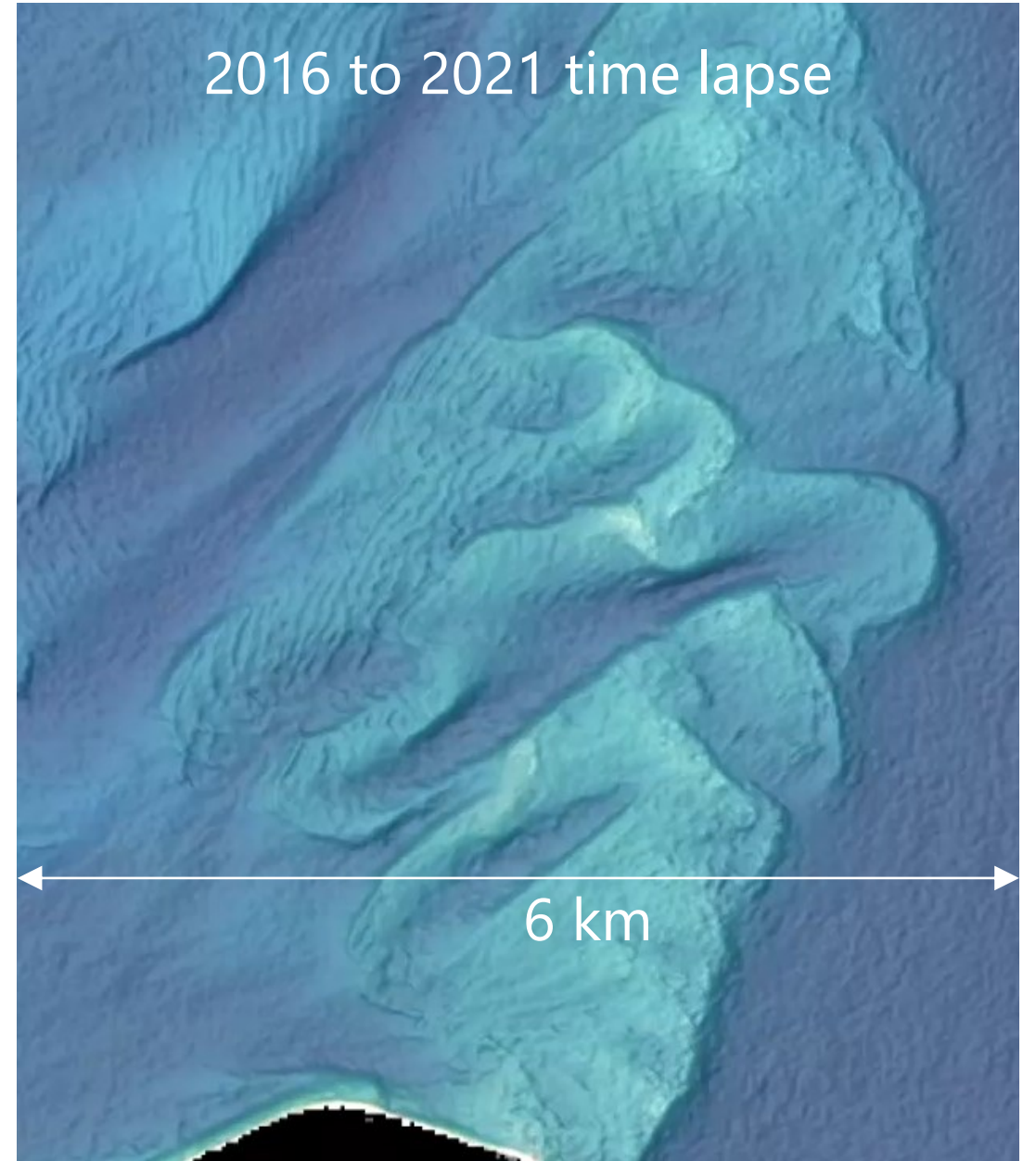
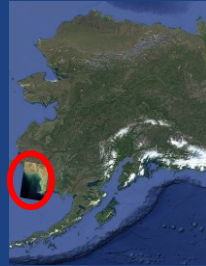
- Demonstration of effects of structure
 - Accretion on updrift side
 - Erosion on downdrift side
- Justification for sound decision making



SHALLOW WATER MONITORING

Monitoring
bathymetry over time
allows to understand
dynamics and future
trends

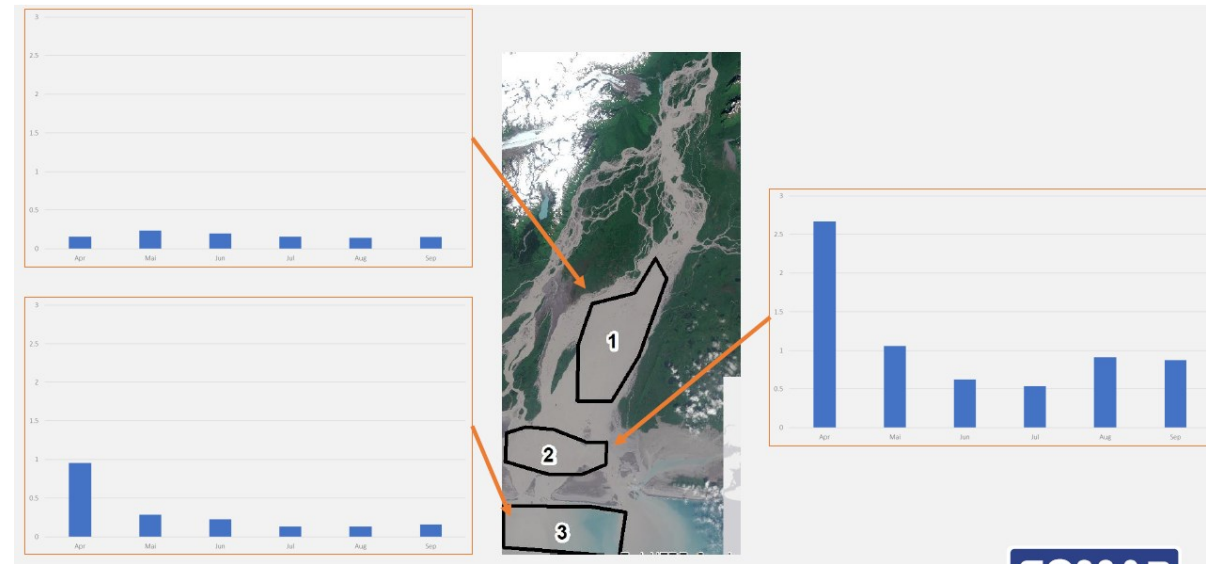
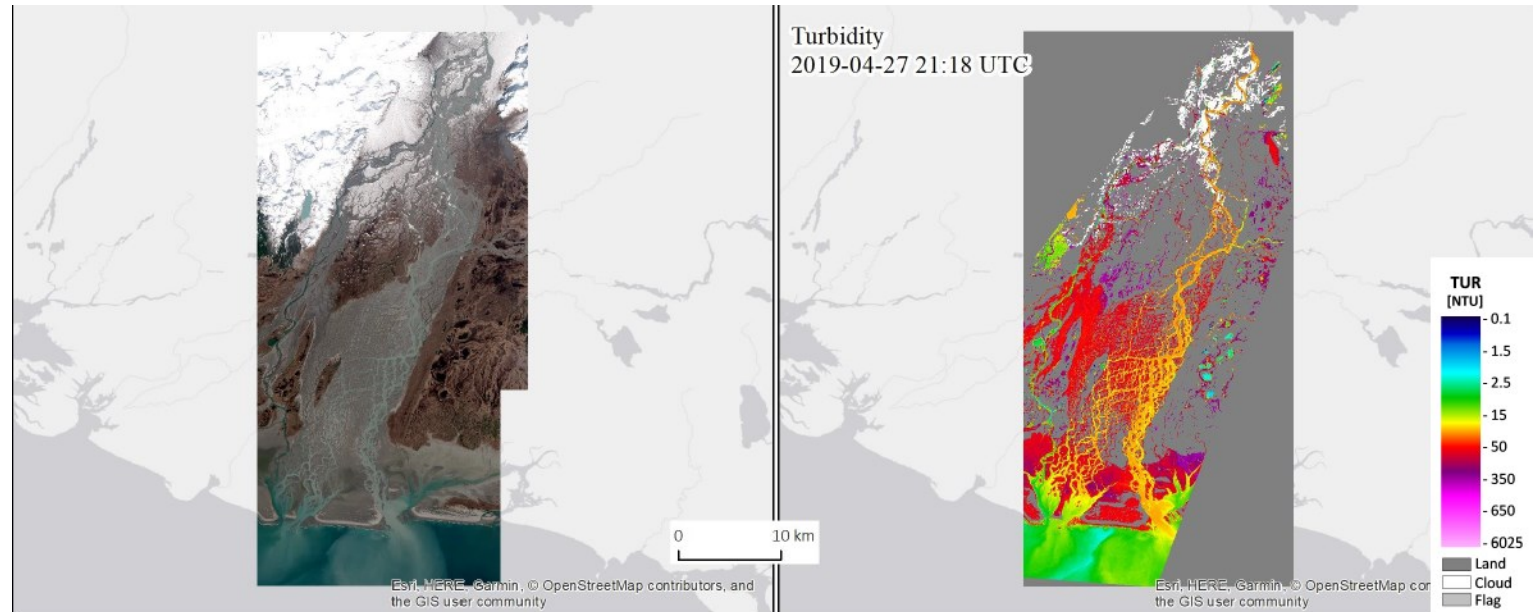
Satellite-Derived
Bathymetry allows a
unique access to past
(almost 30 years) and
ongoing seabed
changes.



WATER QUALITY FOR SURVEY CAMPAIGNS

Copper River

- 2018 – 2020
- 59 cloud free images
- Statistical analysis produced for 3 polygons between April to September for:
 - Turbidity
 - KD90
 - Z90
 - Secchi Disk Depth

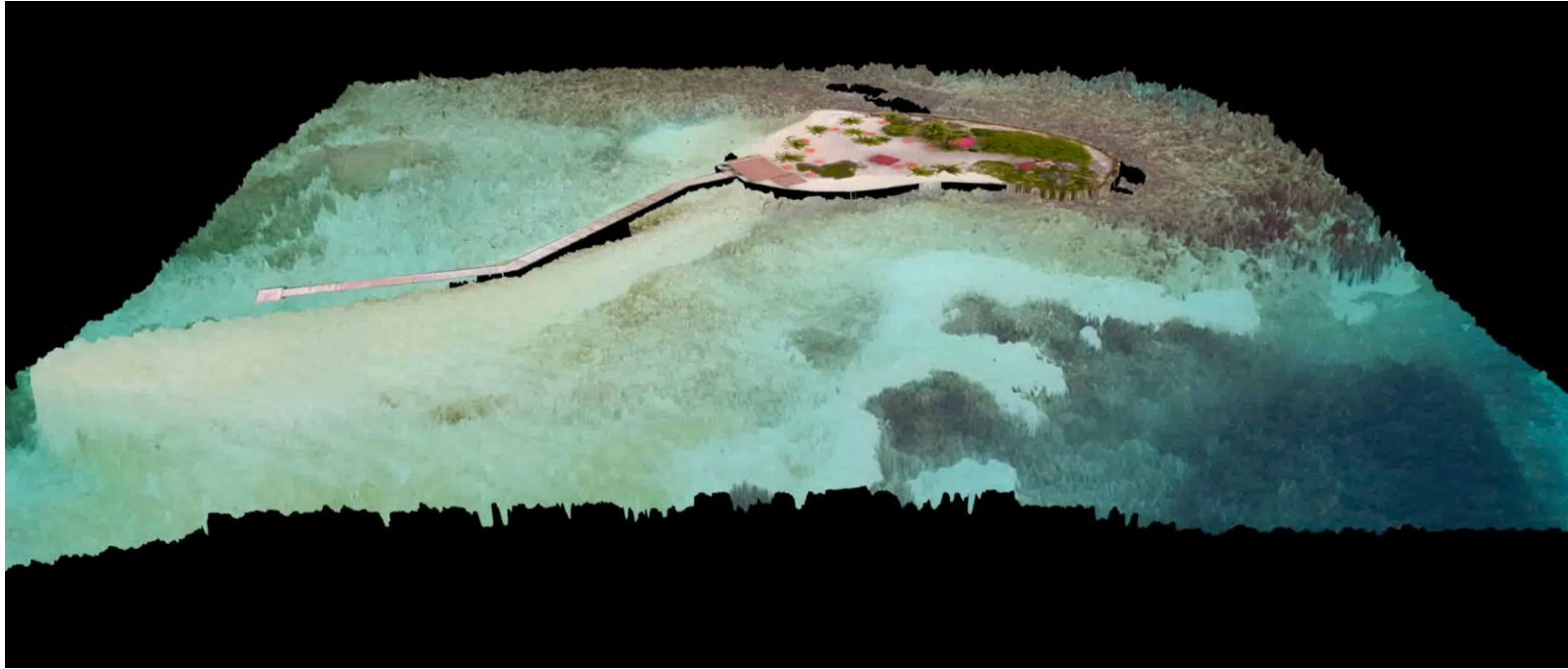


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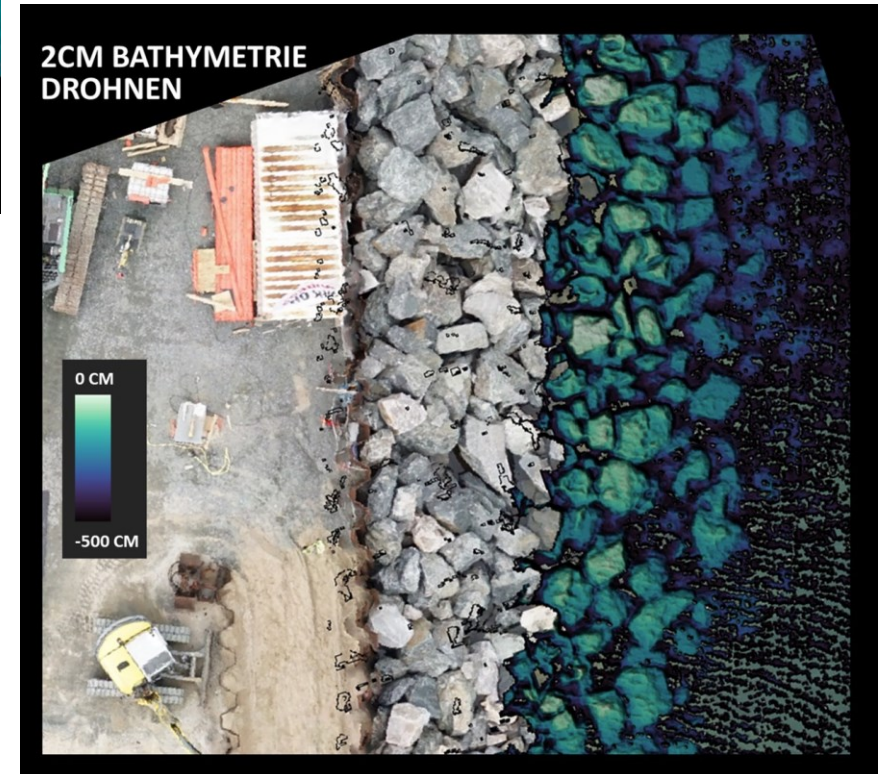
EOMAP
detect more.

EOMAP

Extreme high-resolution SDB data fusion with drones

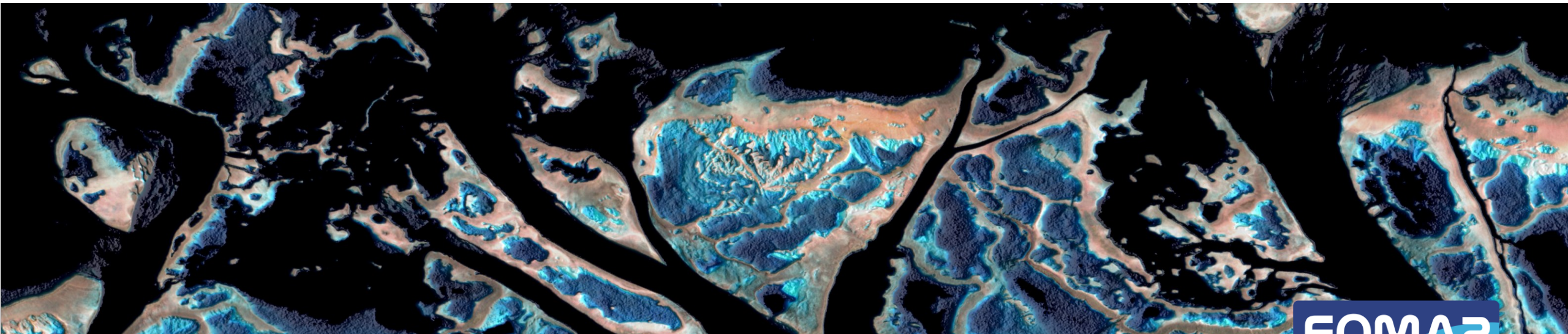


- Multispectral camera mounted on drone
- EOMAP physics-based bathymetric processing



Closing remarks

- EO is non-intrusive mapping for SDB, habitats, water quality, elevation, multisource bathymetry models and land cover
- Remote/inaccessible locations, global coverage, low cost, rapid, complementary (or stand alone), fit-for-purpose
- Advances in sensor technology (satellites and drones), processing algorithms and machine learning will drive forward capabilities, accuracy and speed of EO mapping
- Invaluable data in historical archives



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