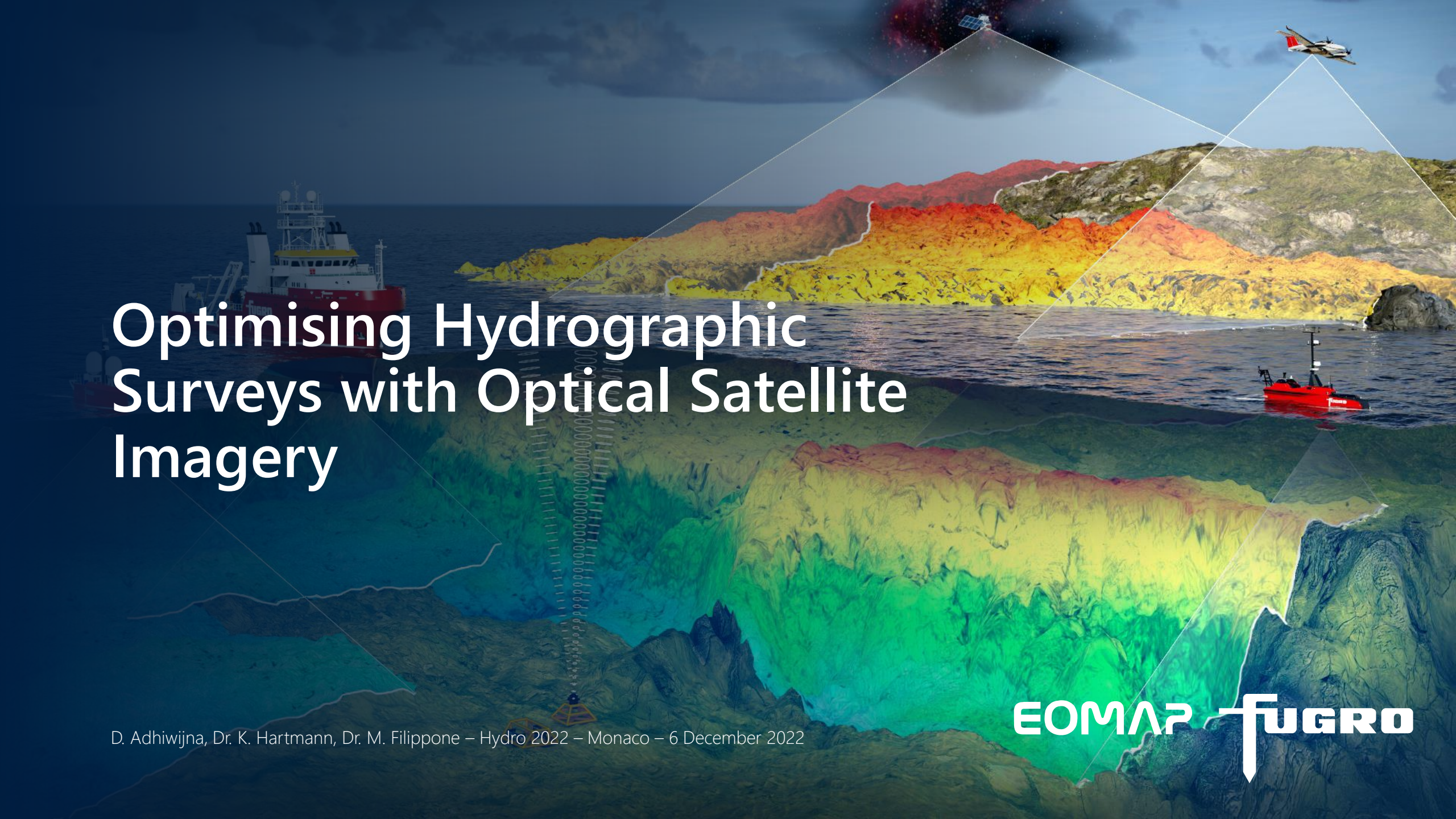


Optimising Hydrographic Surveys with Optical Satellite Imagery

D. Adhiwijna, Dr. K. Hartmann, Dr. M. Filippone – Hydro 2022 – Monaco – 6 December 2022

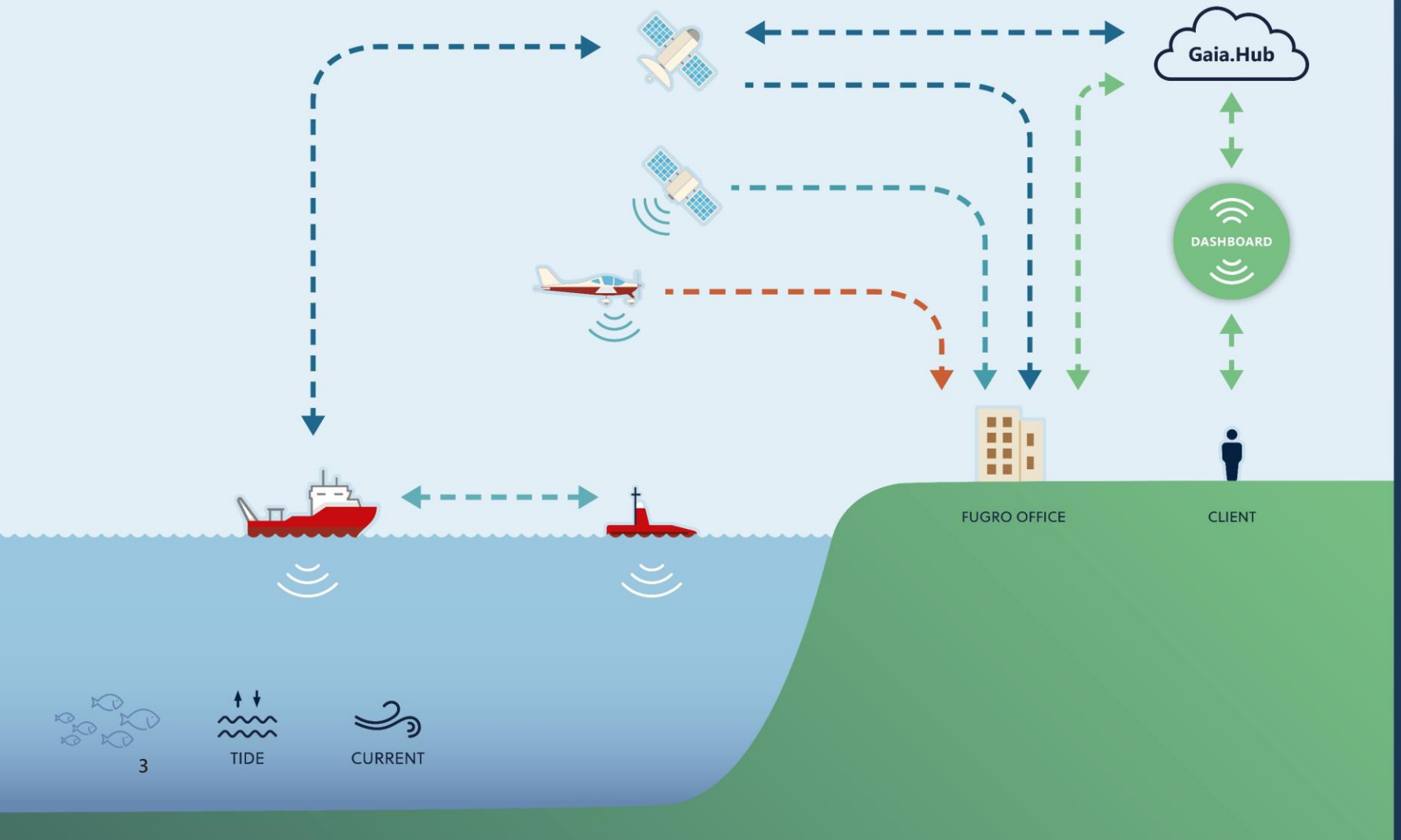
EOMAP FUGRO

“

Understanding Geo-data is key to planning, constructing and operating any structure on earth

Integrated Hydrographic Solutions

A range of seabed mapping services for fast and high-quality acquisition of hydrographic and bathymetric data.



BENEFITS

Satellite imagery analysis supports bathymetry and environmental mapping of nearshore environments

Airborne lidar bathymetry captures **fast and high-quality** shallow water bathymetry over large areas

Vessel based multi beam echo sounder acquires **accurate hydrographic data** reaching all ocean depths

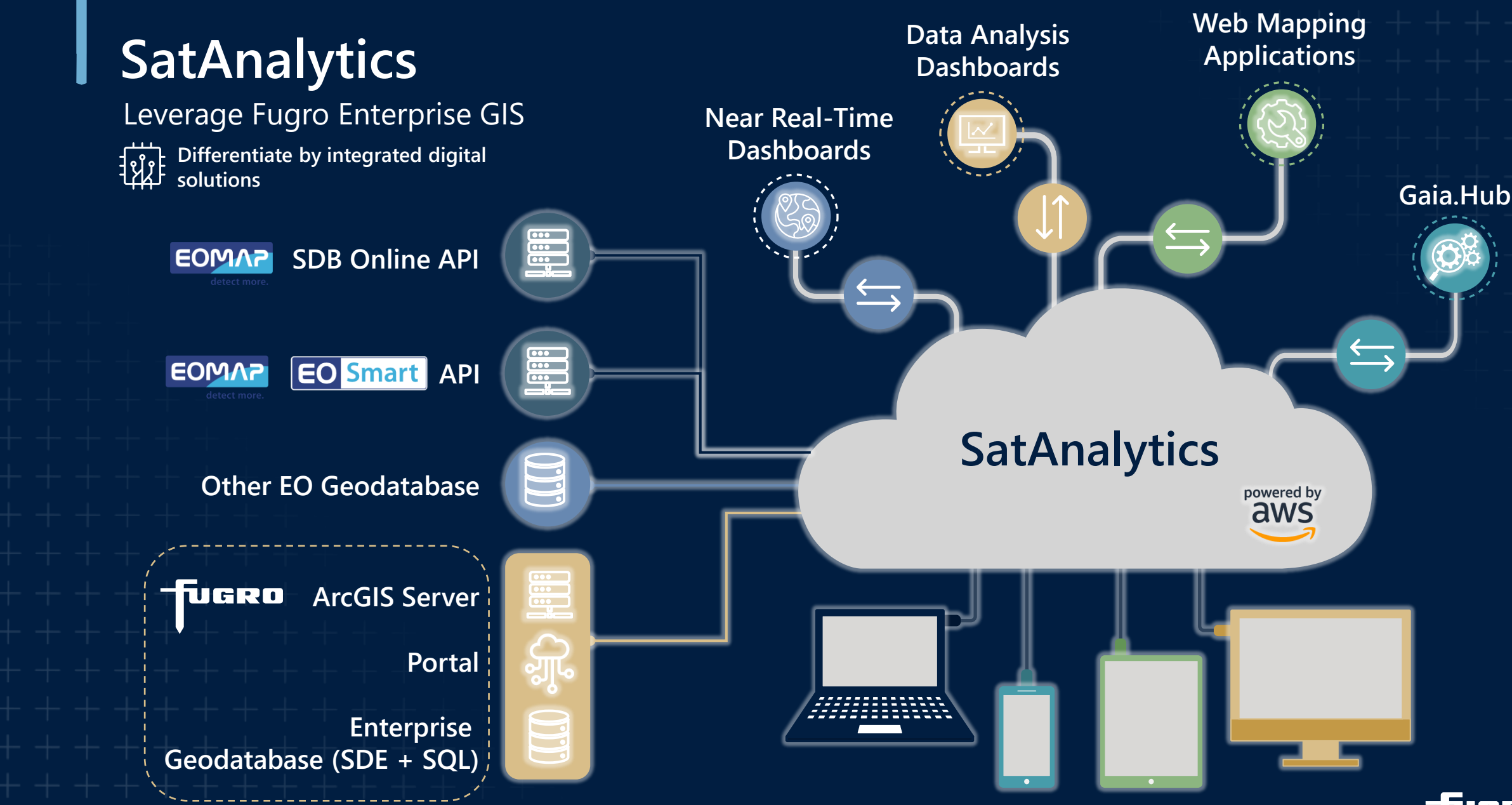
Leverage core expertise in new growth markets

SatAnalytics unlocks Geo-data safely and rapidly in coastal zone without stepping foot on site

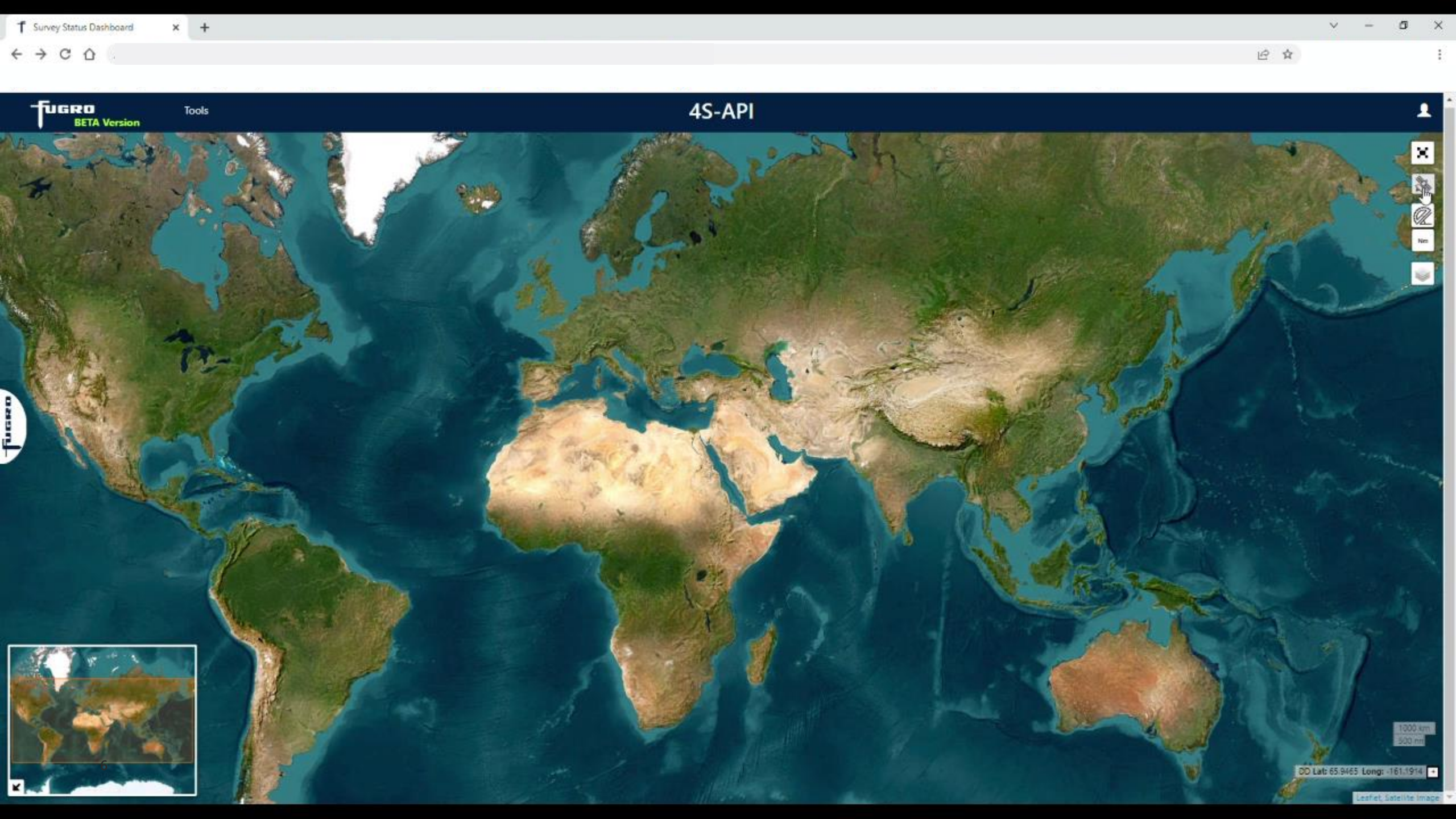
SatAnalytics

Leverage Fugro Enterprise GIS

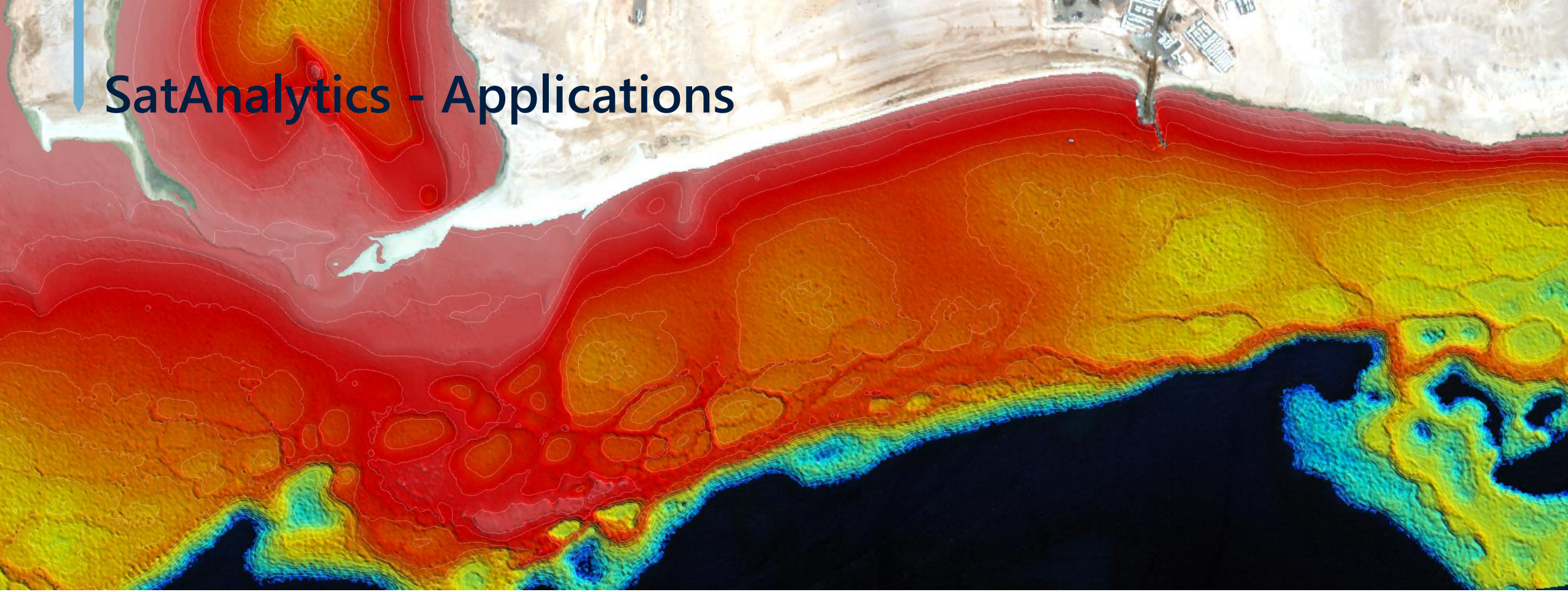
Differentiate by integrated digital solutions



Co-financed by the Connecting Europe Facility of the European Union


Survey Status Dashboard
FUGRO
BETA Version
Tools
4S-API
Nm
1000 km
500 nm
DD Lat: 65.9465 Long: -161.1914
Leaflet, Satellite Image

SatAnalytics - Applications



Planning

Mapping

Monitoring

Analysis

Reccee Data for Protecting Assets

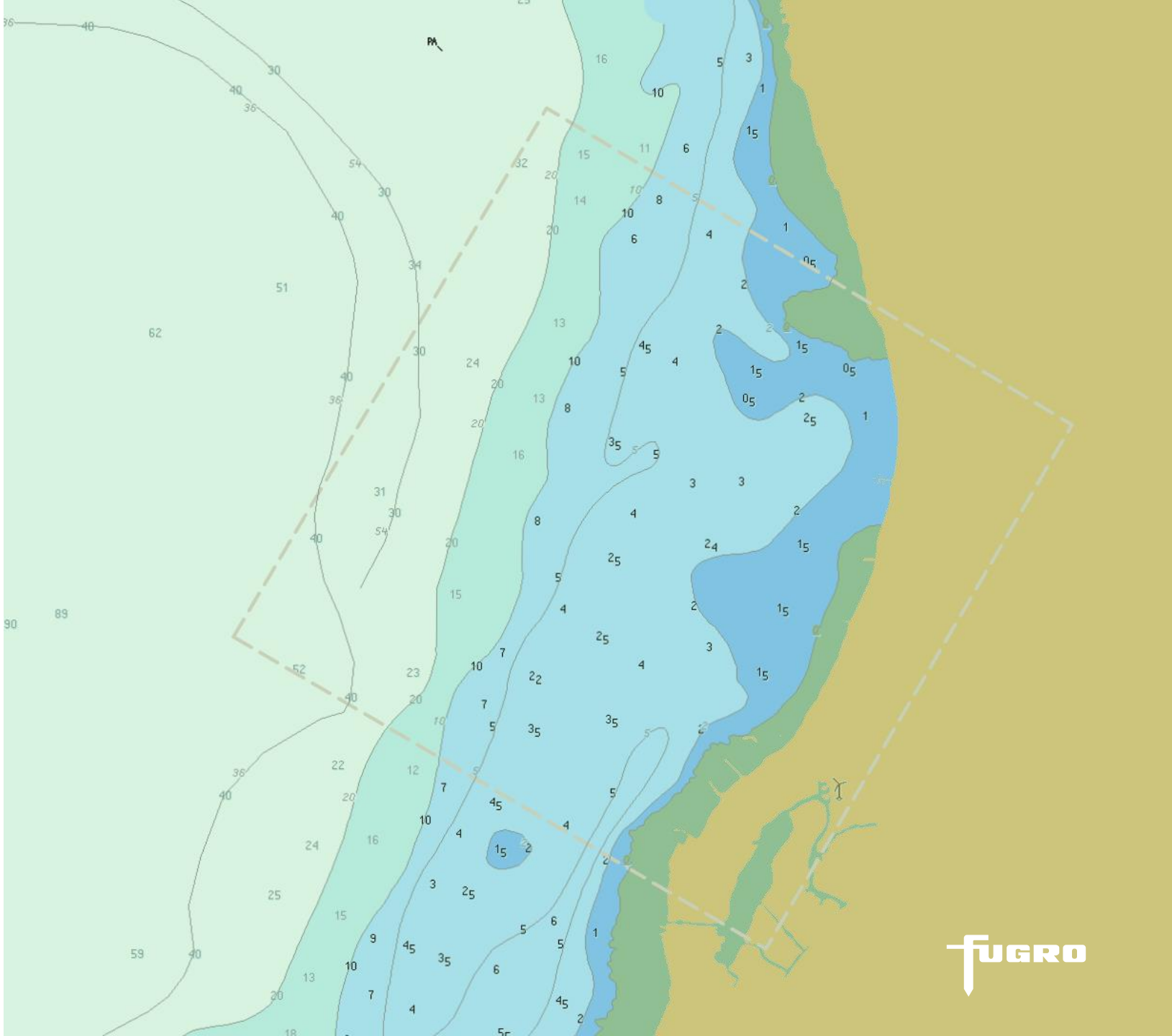
FUGRO BLUE SHADOW™

Hazards detected in un-charted area

Reccee Data for Survey Planner

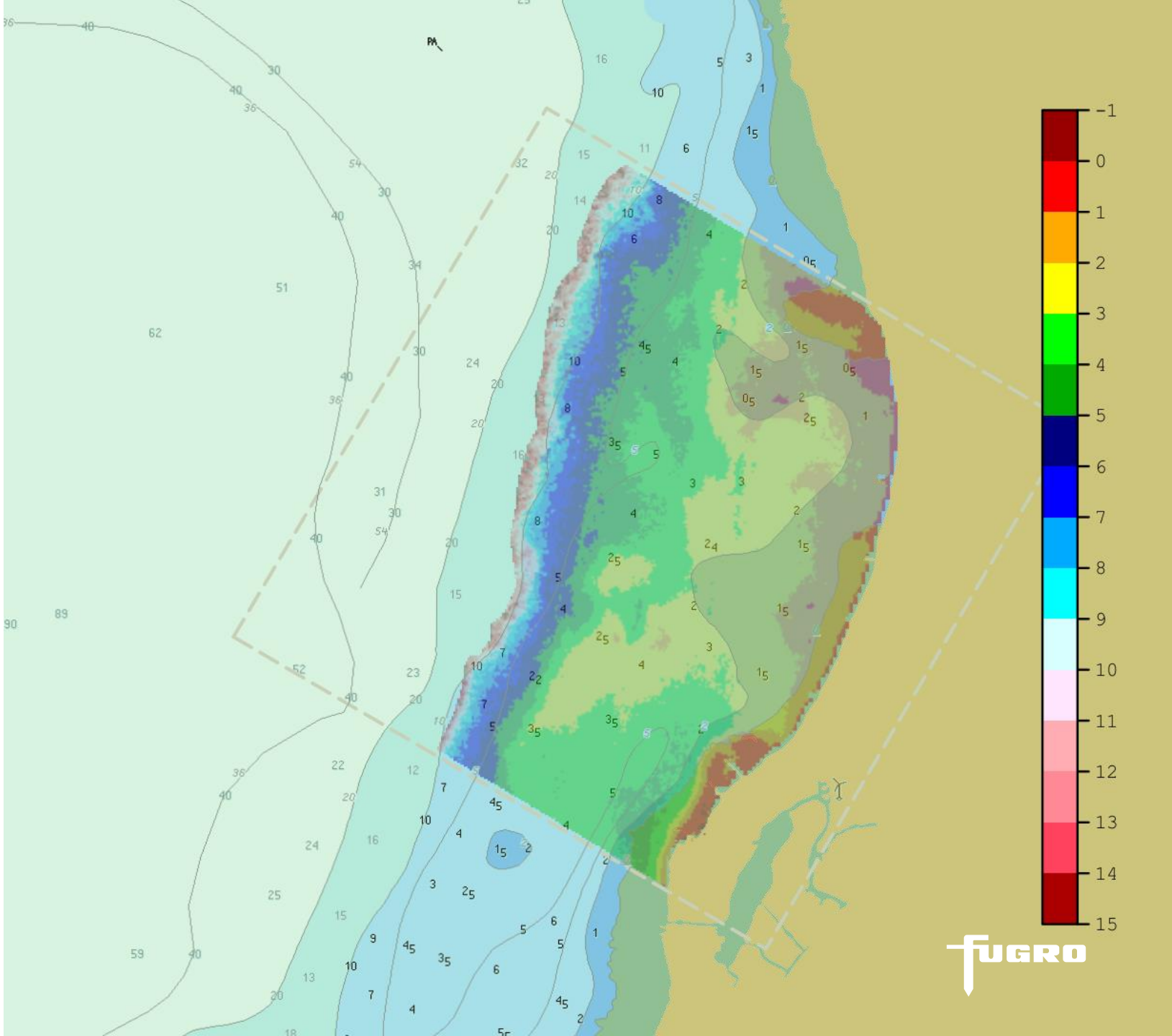
Inputs are:

1. **Pre-known depths**;
2. OPS hours;
3. Survey speed;
4. Transit speed;
5. Turn time between lines;
6. Overlap requirements;
7. Tie or cross lines;
8. Boat draft;
9. SVP time interval and type;
10. MBES technical specifications.



Reccee Data for Survey Planner

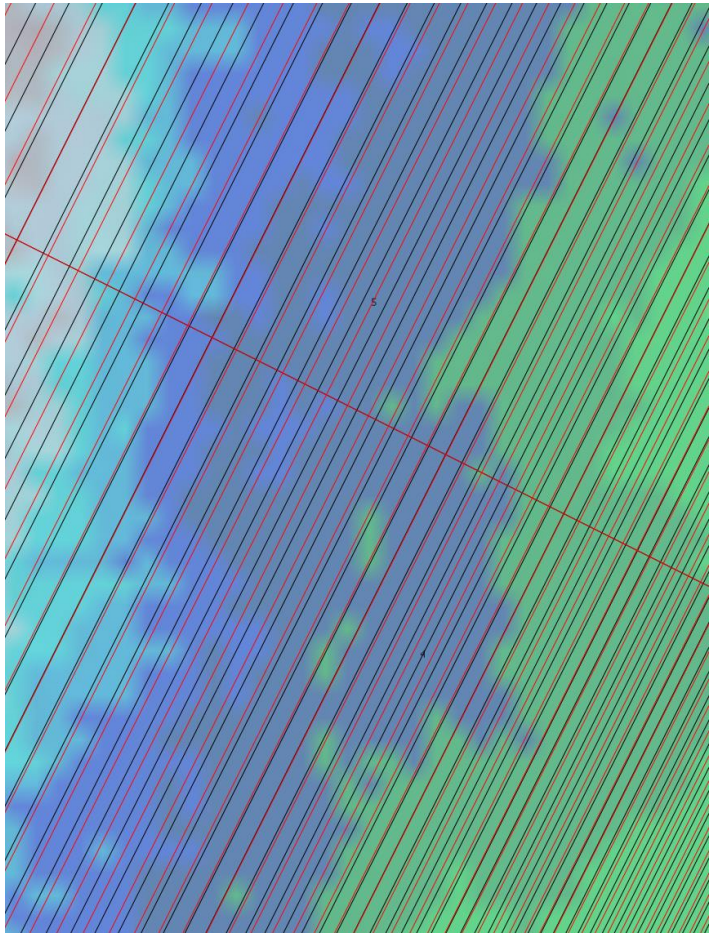
- ENC sounding depths provide low resolution depth input for Fugro Survey Planner
- SDB reccee depths shows differences compared to ENC contour depths



Survey lines estimation
ENC vs SDB (Carribean Study Case)

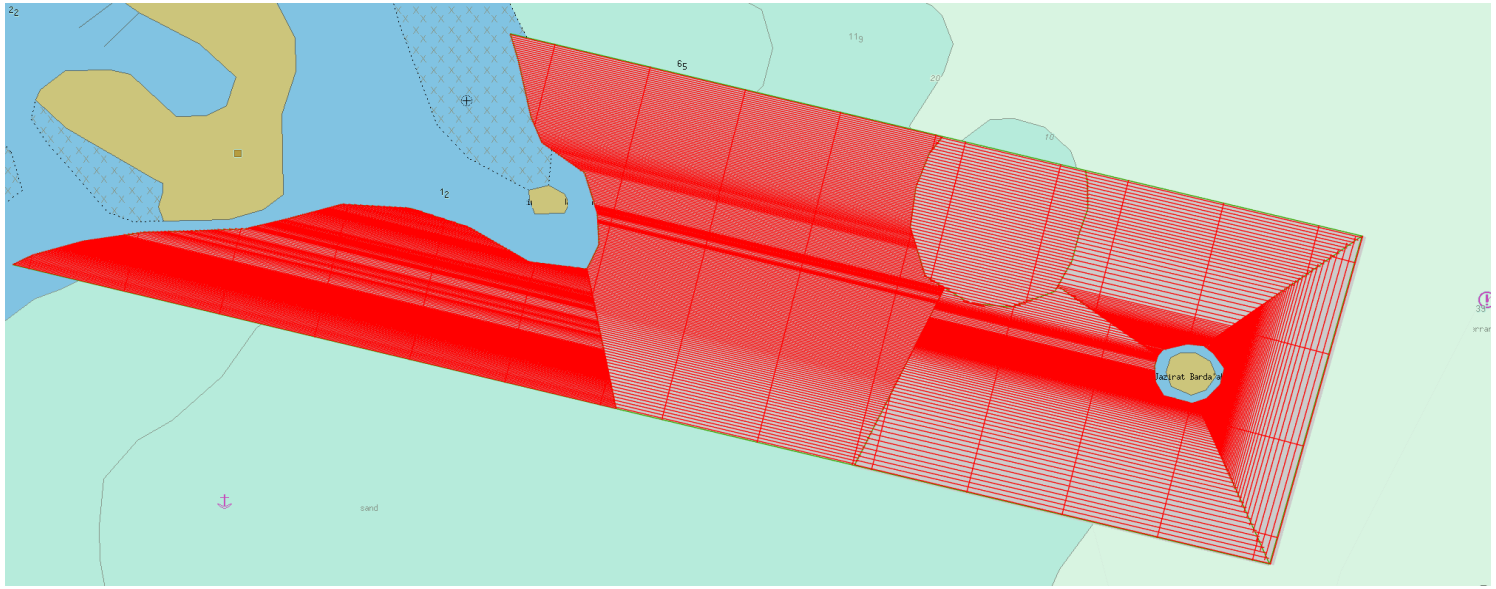
Depth Input	No. of lines	Survey Hours	OPS Days (12 hrs OPS)
ENC	102	107	9
SDB	619	148	12

- Low resolution depth input can provide under-estimation in operationals days
- Under-estimation can cause delays and leakage in project



Survey lines estimation
ENC vs SDB (North Africa Study Case)

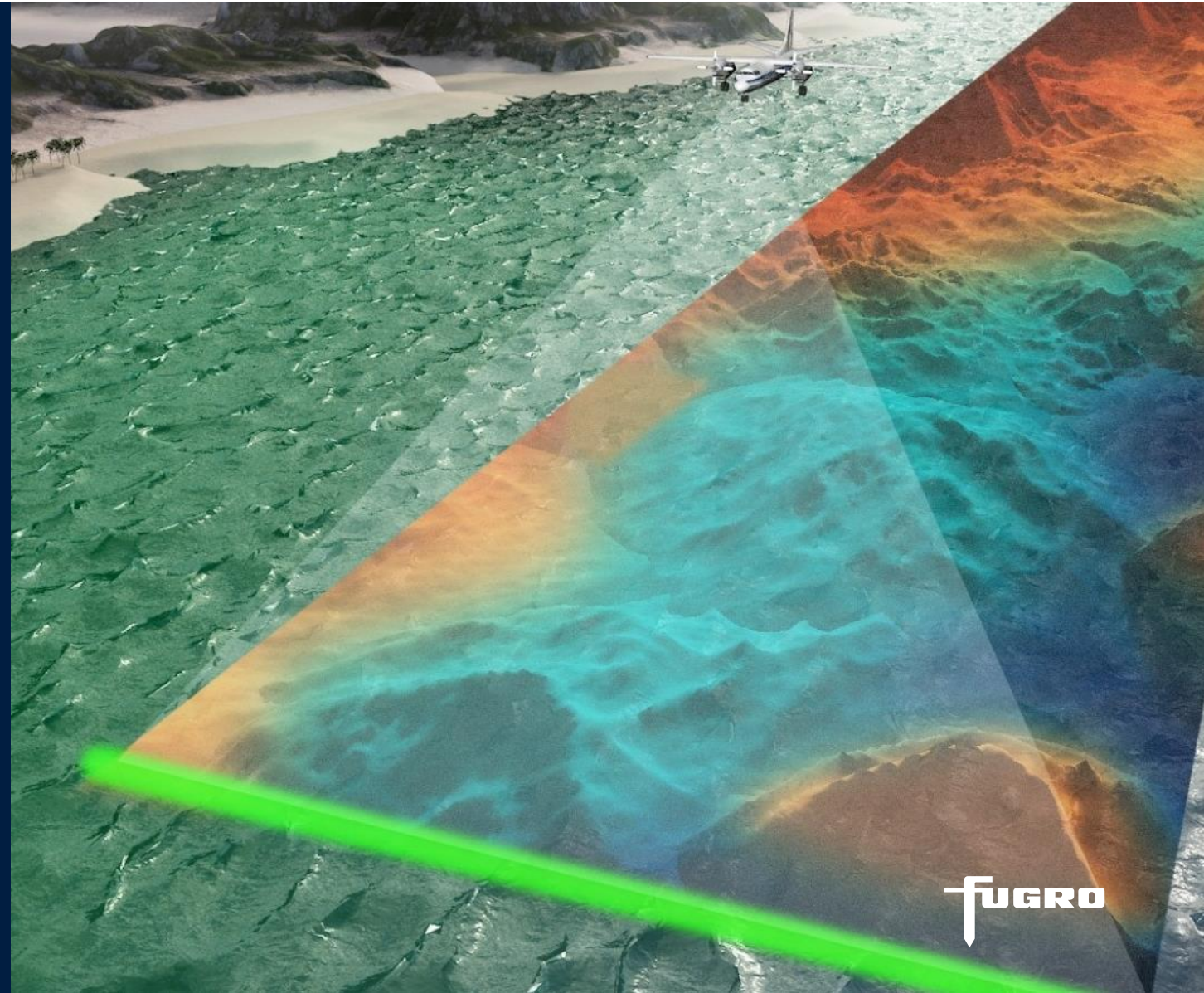
Depth Input	No. of lines	Survey Hours	OPS Days (12 hrs OPS)
ENC	189	194	16
SDB	230	237	20



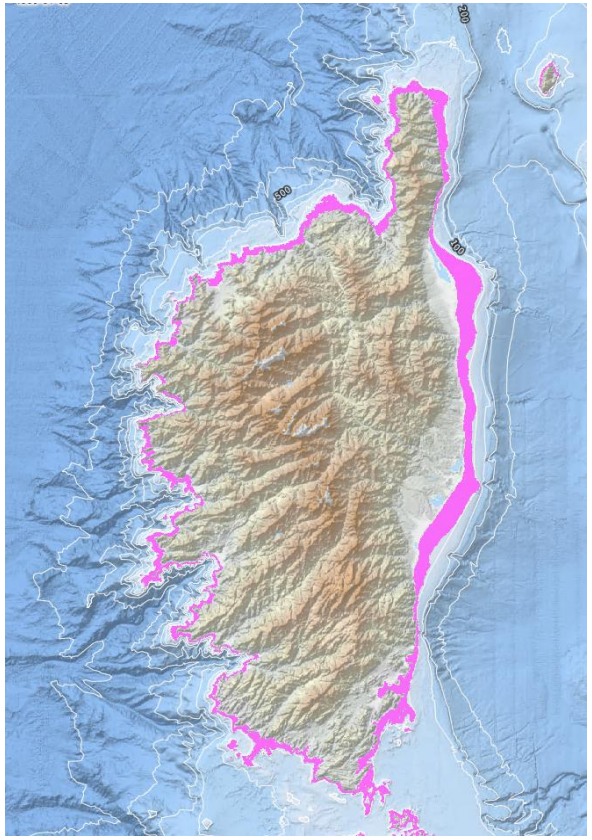
- Low resolution depth input can provide under-estimation in operationals days
- Under-estimation can cause delays and leakage in project

ALB Coverage Estimation for ALB Survey Planning

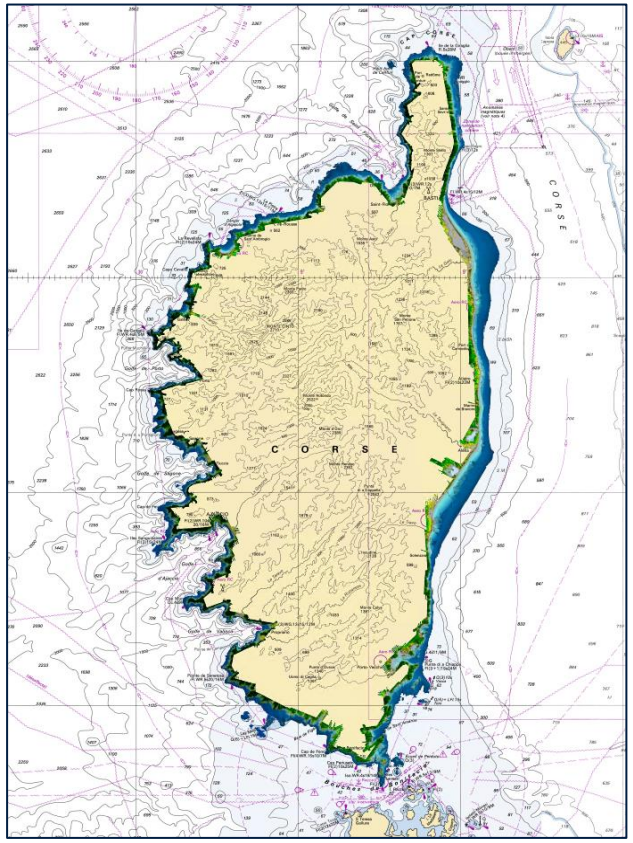
- Using passive ocean color satellite observations (e.g. MERIS, MODIS & VIIRS) to understand light attenuation at sea (Kd490);
- Kd490 obtained from ESA Ocean Colour Climate Change Initiative (OC-CCI);
- Kd490 is then processed with low resolution bathymetry (GEBCO / EMODnet) to calculate ALB penetration depth estimation.



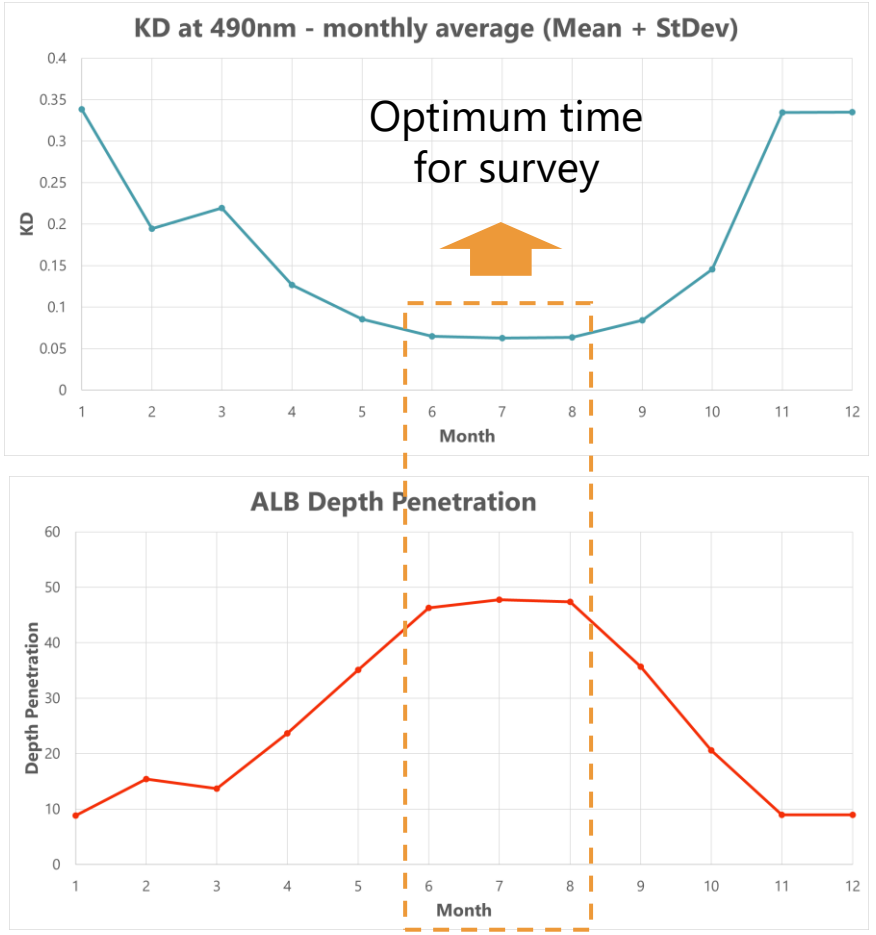
ALB Coverage Estimation for ALB Survey Planning Case Study Corsica



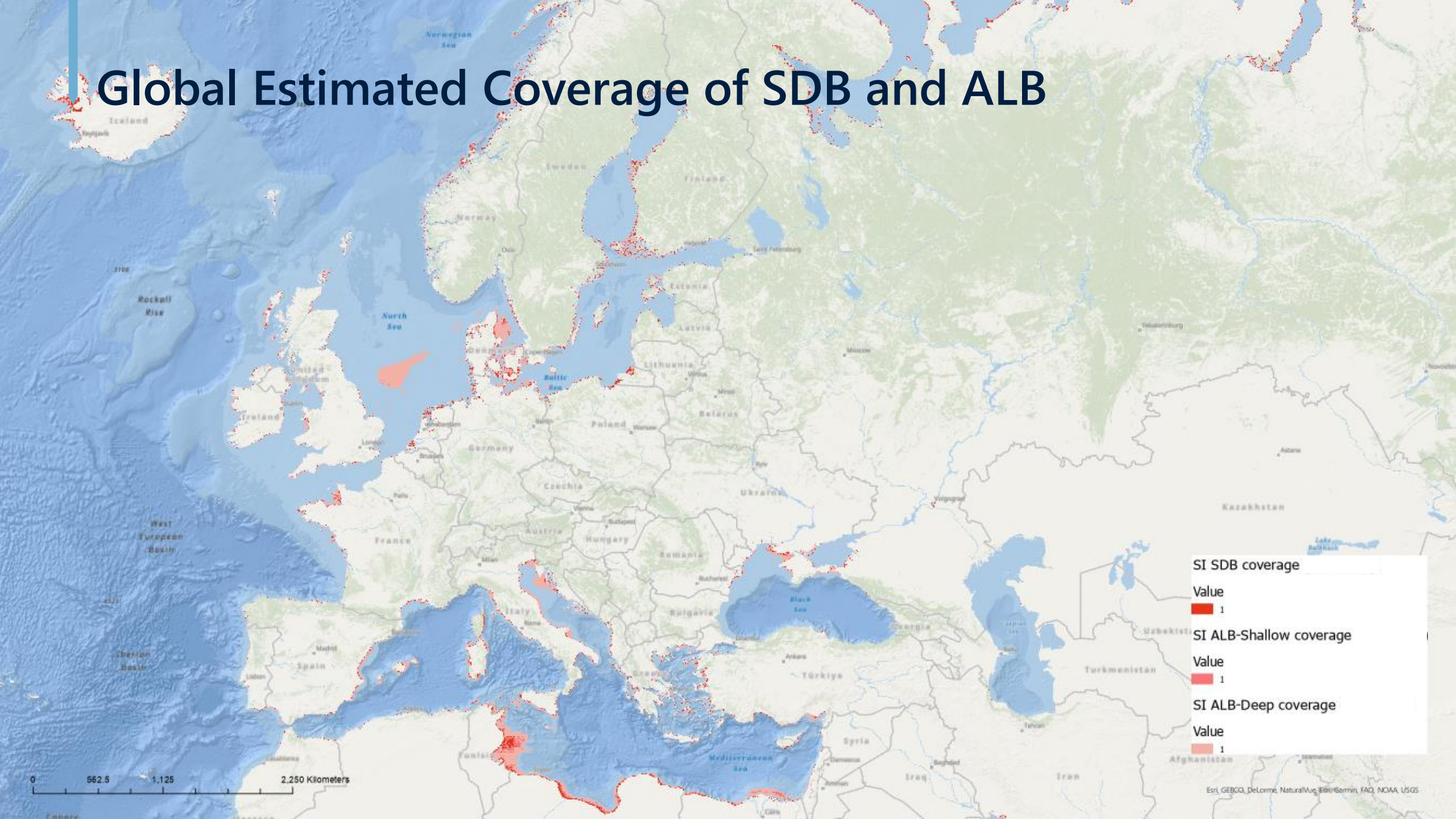
Coverage (pink) and EMODnet Bathymetry Consortium (2020): EMODnet Digital Bathymetry (DTM)



LiDAR 2017-2018
Shom - Collectivité de Corse - Dreal Corse, 2020.
https://dx.doi.org/10.17183/L3D_MAR_CORSE_2017_2018



Global Estimated Coverage of SDB and ALB



Mapping Remote Coastal Environment

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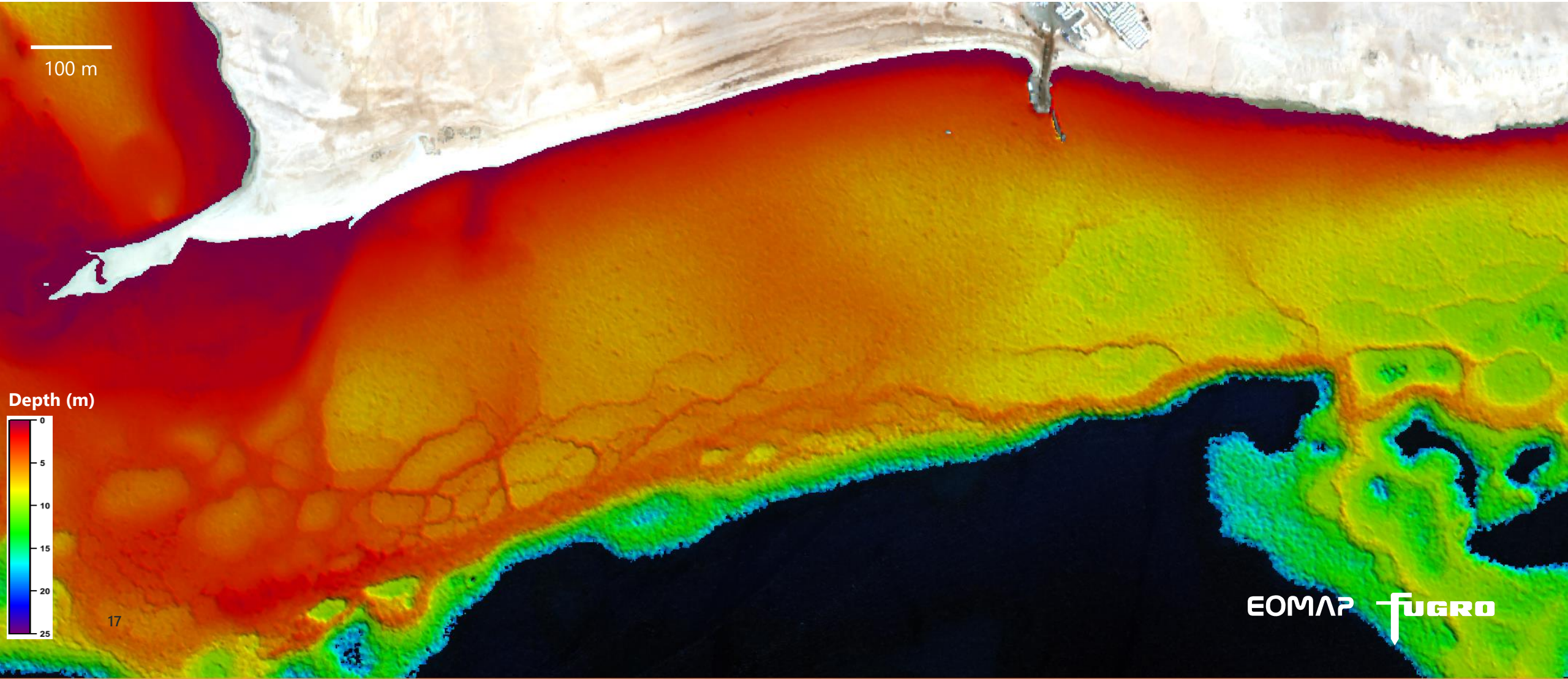
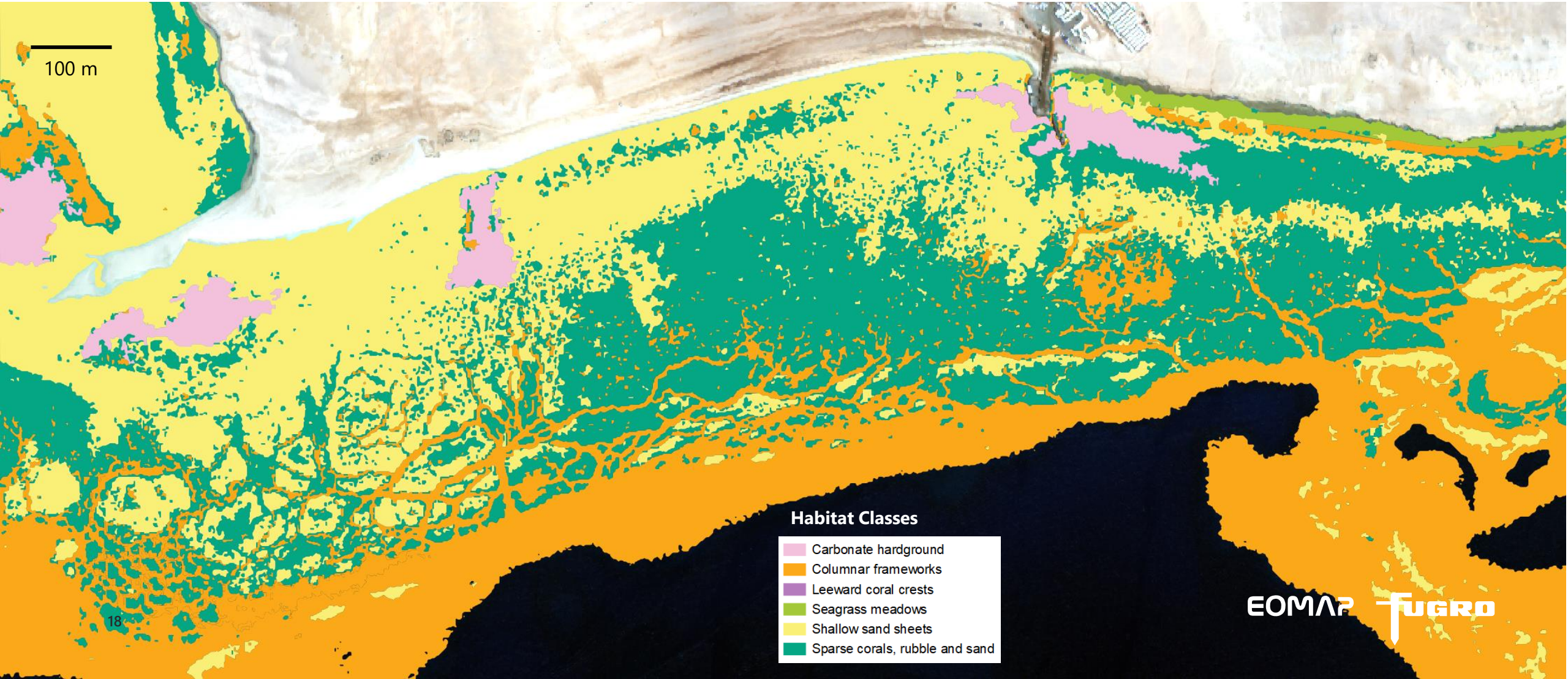
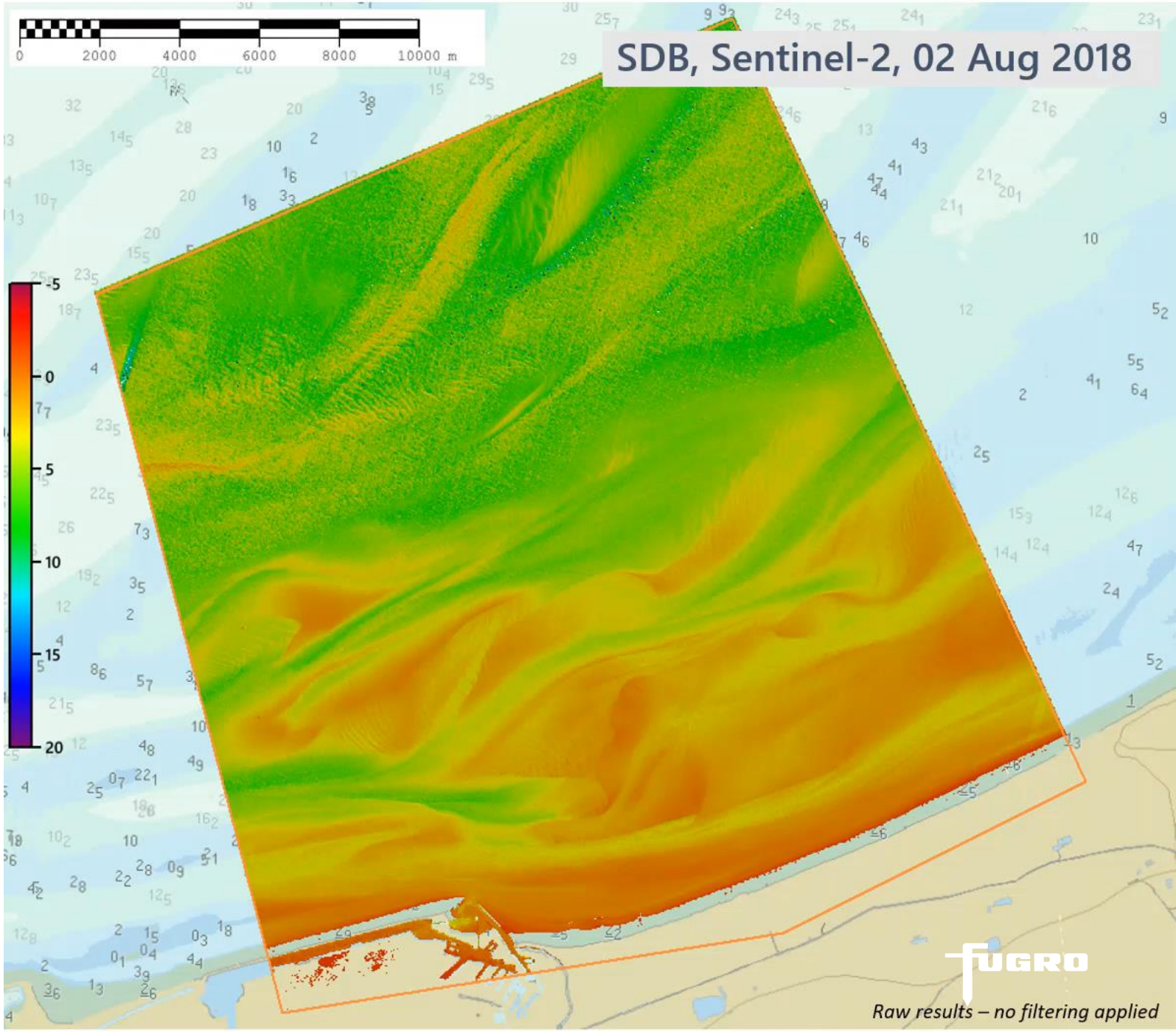
Mapping Remote Coastal Environment



Mapping Remote Coastal Environment



Monitor Changes



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Fugro and EOMAP
Current Innovation and Development

EOMAP FUGRO

Drone-Derived Bathymetry

Using the similar concept and processing workflow like SDB but bringing it closer to ground

- DJI 1000S
- Positioning and Motion
- Sony a5000 camera
- MAIA Multispectral Camera

Co-financed by the Connecting Europe Facility of the European Union

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Test flight track plan

Co-financed by the Connecting Europe Facility of the European Union

All lines with DSLR and multi spectral camera @80m flight height

Two flights @ approx. 12min each

Total about 5,5km of lines and >1200 images each camera system

Flown week 34/22, data evaluation still in progress, e.g. MS camera under the EU 4S project scope

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Sentinel-2 Real Color Image – 10 m resolution

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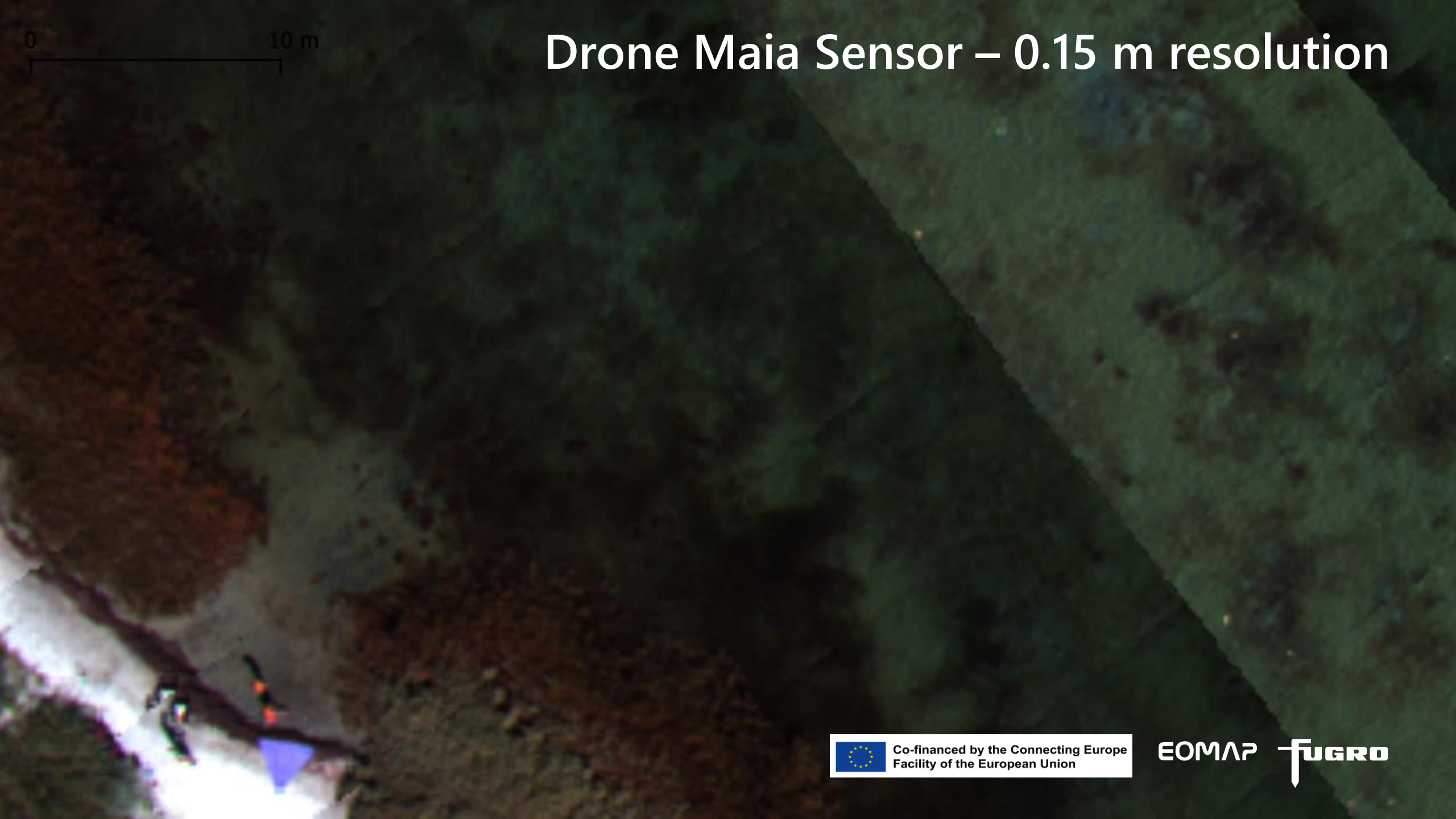

Drone Maia Sensor – 0.15 m resolution

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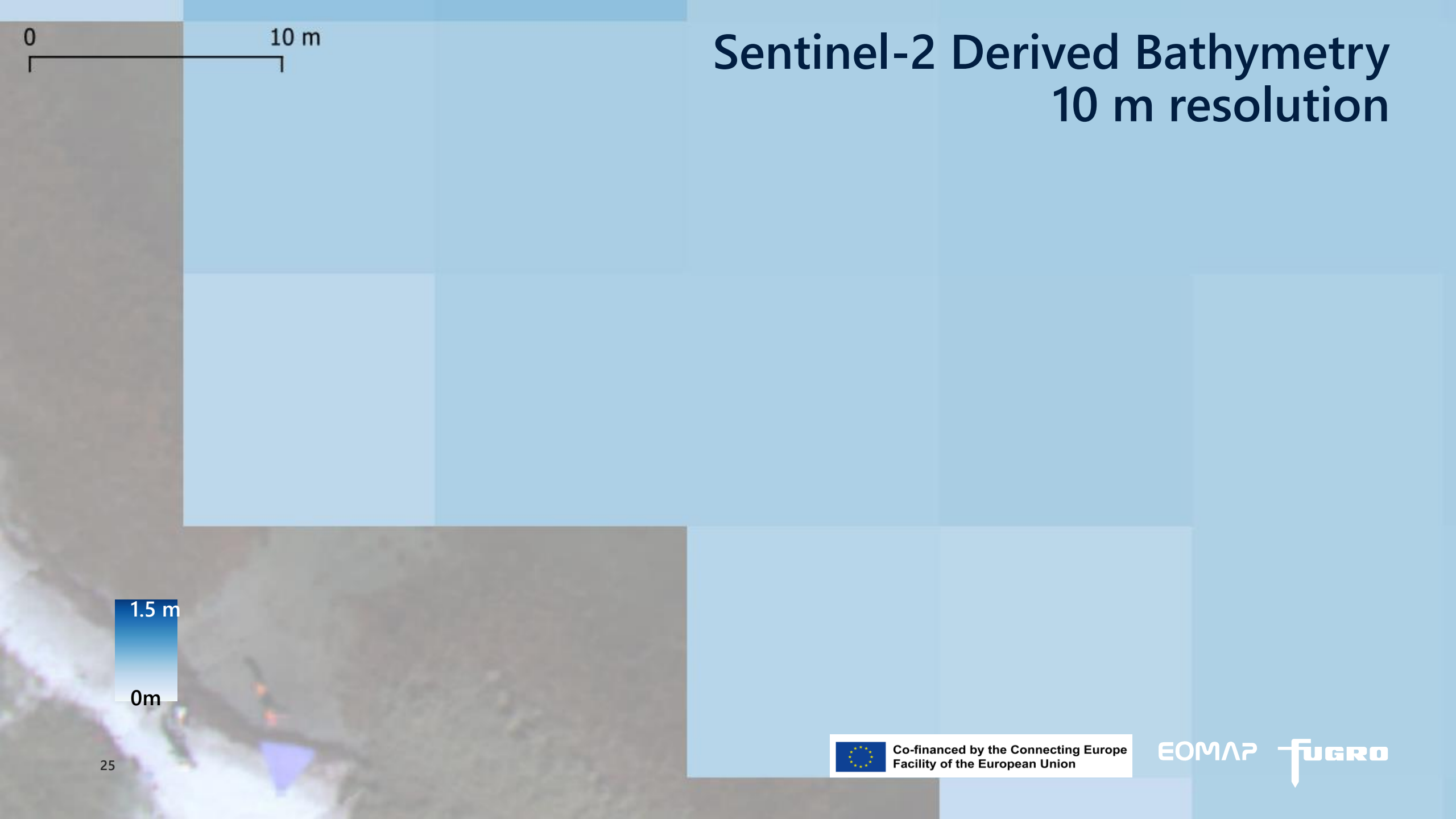
Sentinel-2 Derived Bathymetry
10 m resolution



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Drone Derived Bathymetry
0.15 m resolution

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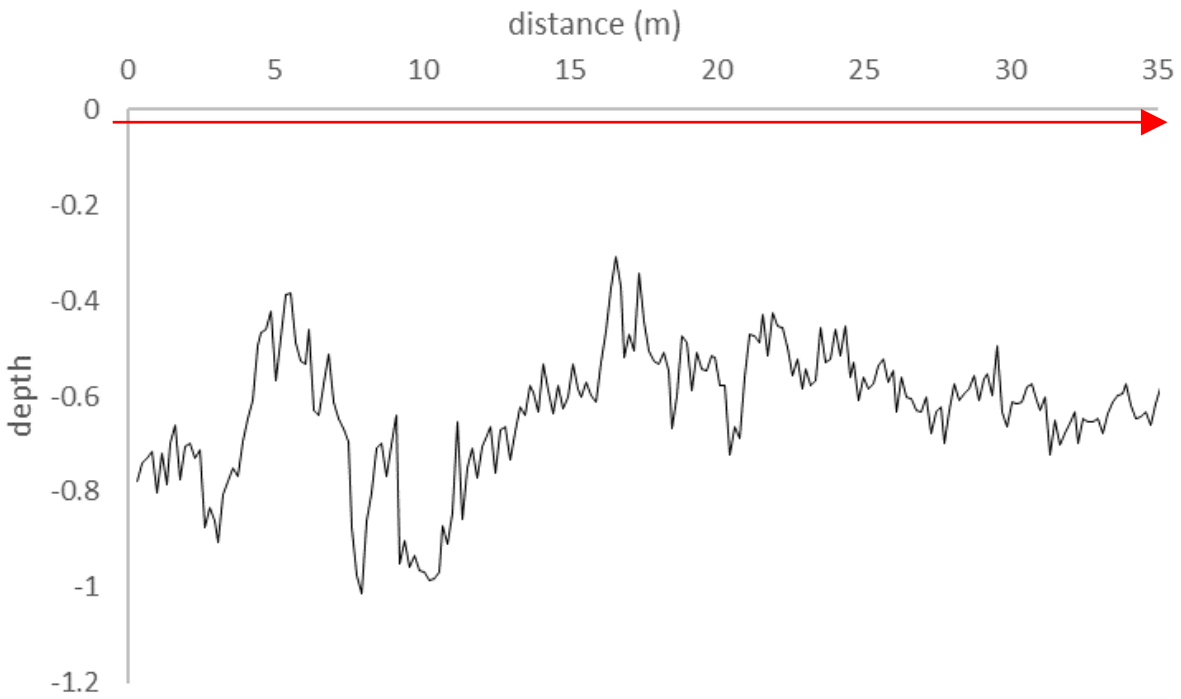
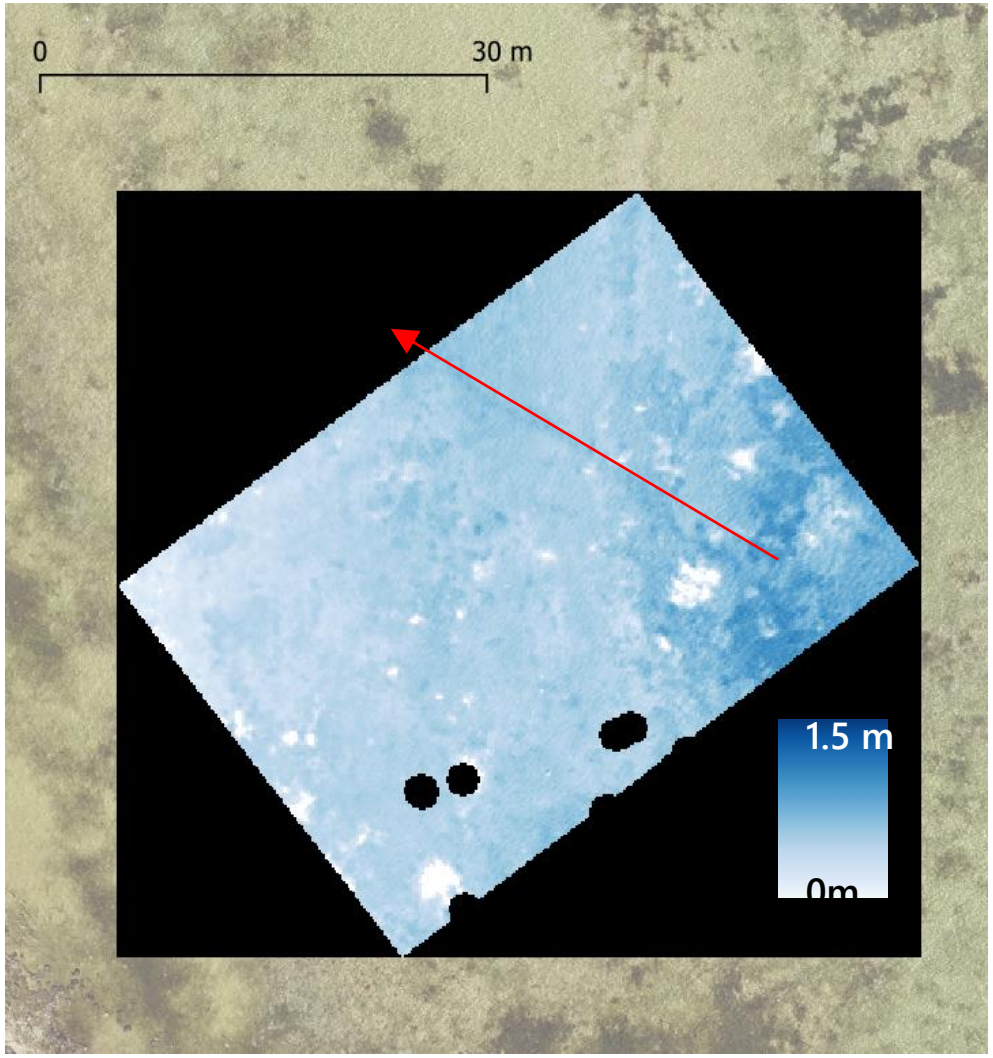
Drone Derived Bathymetry First Results





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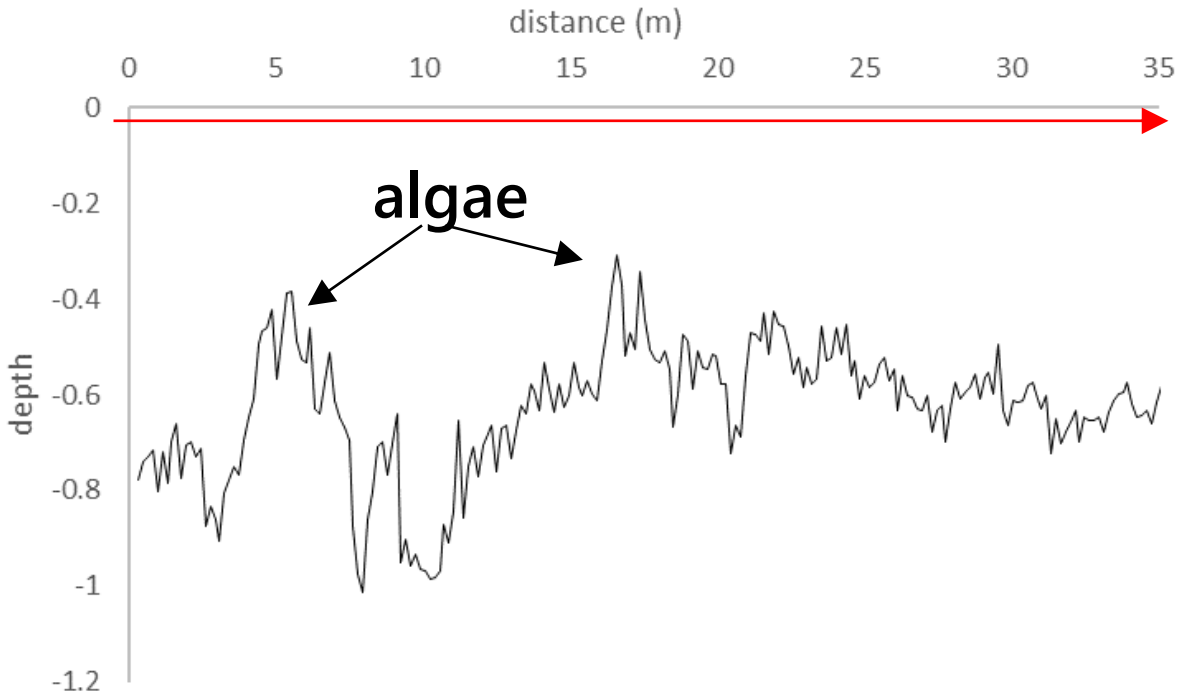
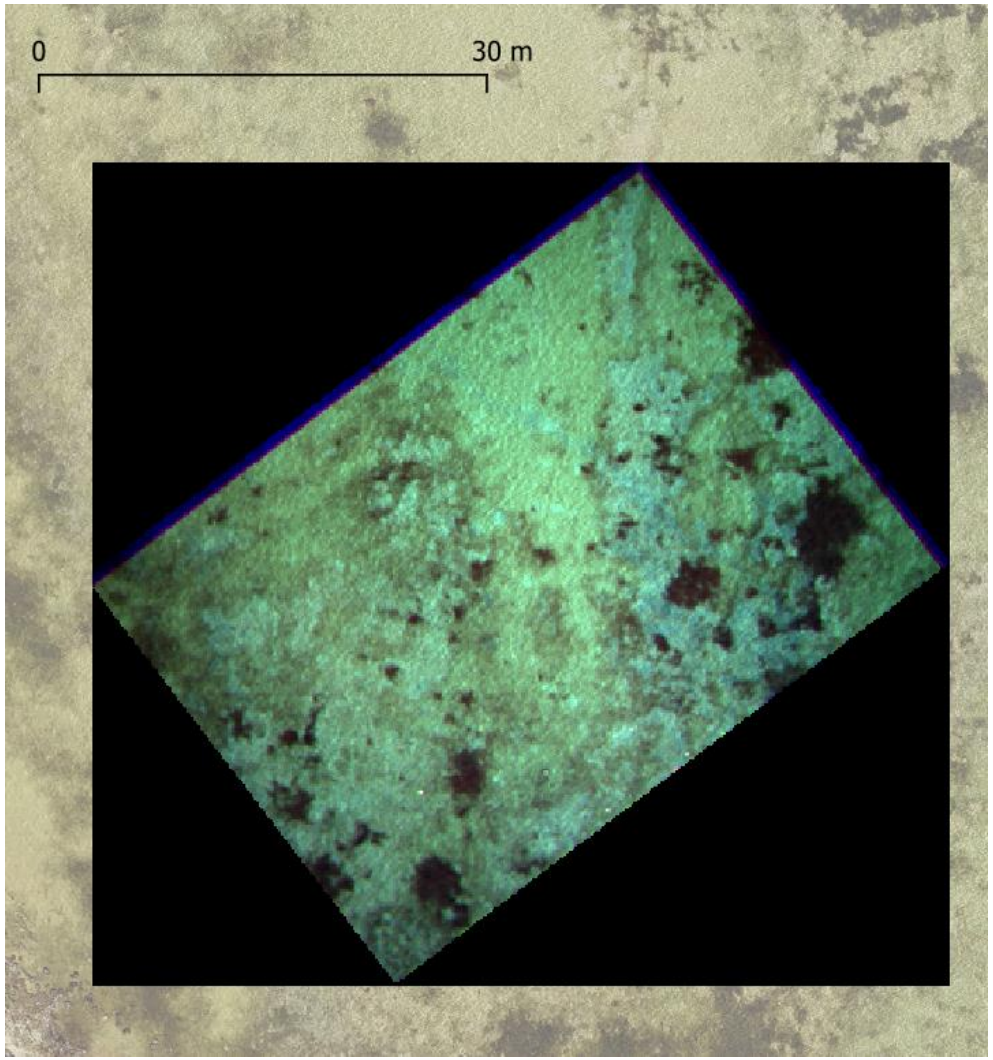
Drone Derived Bathymetry First Results





EOMAP FUGRO

Conclusion

Optical Satellite Imagery optimises Hydrographic surveys by providing:

1. Reconnaissance data for detecting un-charted hazards to protect assets
2. Reconnaissance bathymetry to optimise vessel survey line plans and reduce project leakage
3. Light penetration estimation to plan ALB survey or conduct ALB feasibility studies
4. As alternative cost-effective bathymetric and benthic classification acquisition method
5. Monitoring and analysis capability at low cost

FUGRO

Unlocking **Insights**
from **Geo-data**