A High resolution coastal model of northern France

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Key words: hydrography, coastal monitoring, geoid model, Airborne LiDAR Bathymetry (ALB), Mean Sea Surface (MSS)

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Accra, Ghana

Your World, Our World: Resilient Environment and Sustainable Resource Management for All

Global developments… are driving key challenges.

Population growth

World population projected to reach 9.8 billion by 2050[1]

Growing inequality

Unequal distribution of wealth and resources

Global warming

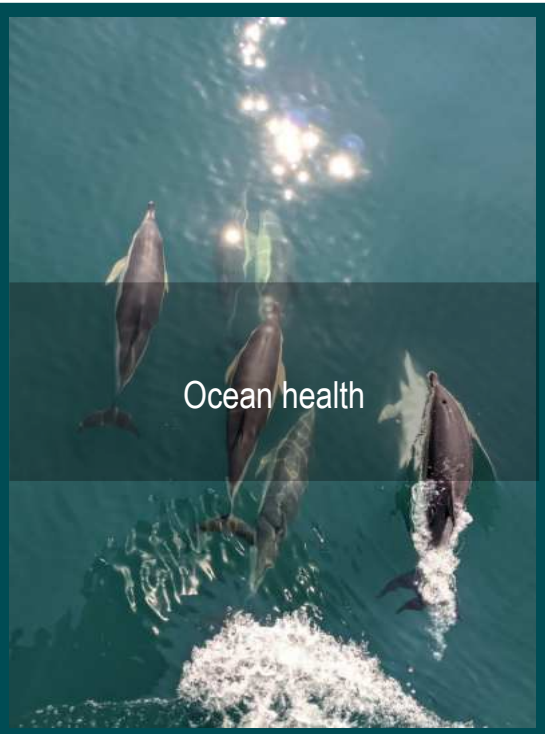
By 2050, climate change could drive 216 million people to migrate[1]

Biodiversity and populations under threat

From Extreme weather, sea level rise, and mega-trends

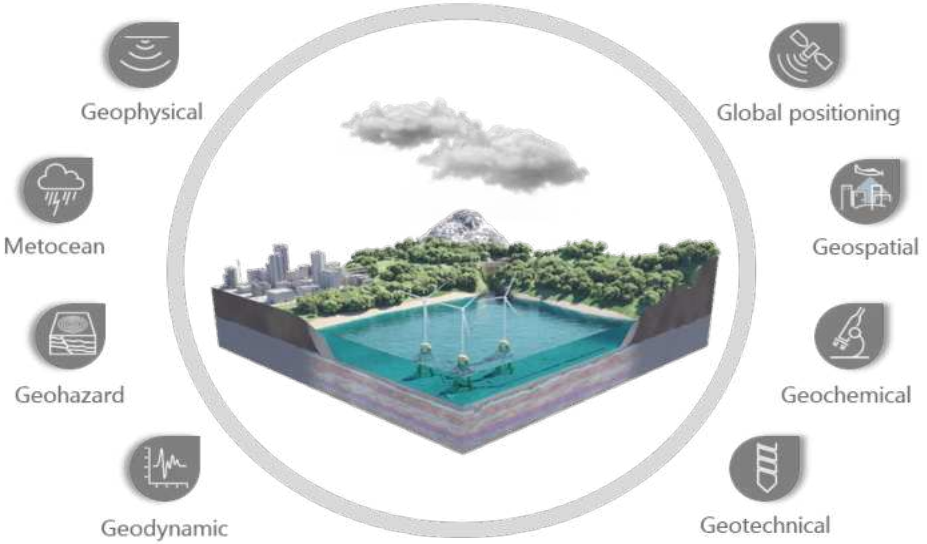

Our ambition is to support the transition in our markets
Energy
Infrastructure
Water
Energy transition
Resilient infrastructure
Climate change adaptation
SUSTAINABLE DEVELOPMENT GOALS
3
Hamza MAZIH - EAtHC18, Casablanca, 1-3 mai 2024

Investing in our oceans and freshwater systems is vital to keep the planet safe and liveable



The world's leading Geo-data specialist

Fugro portfolio



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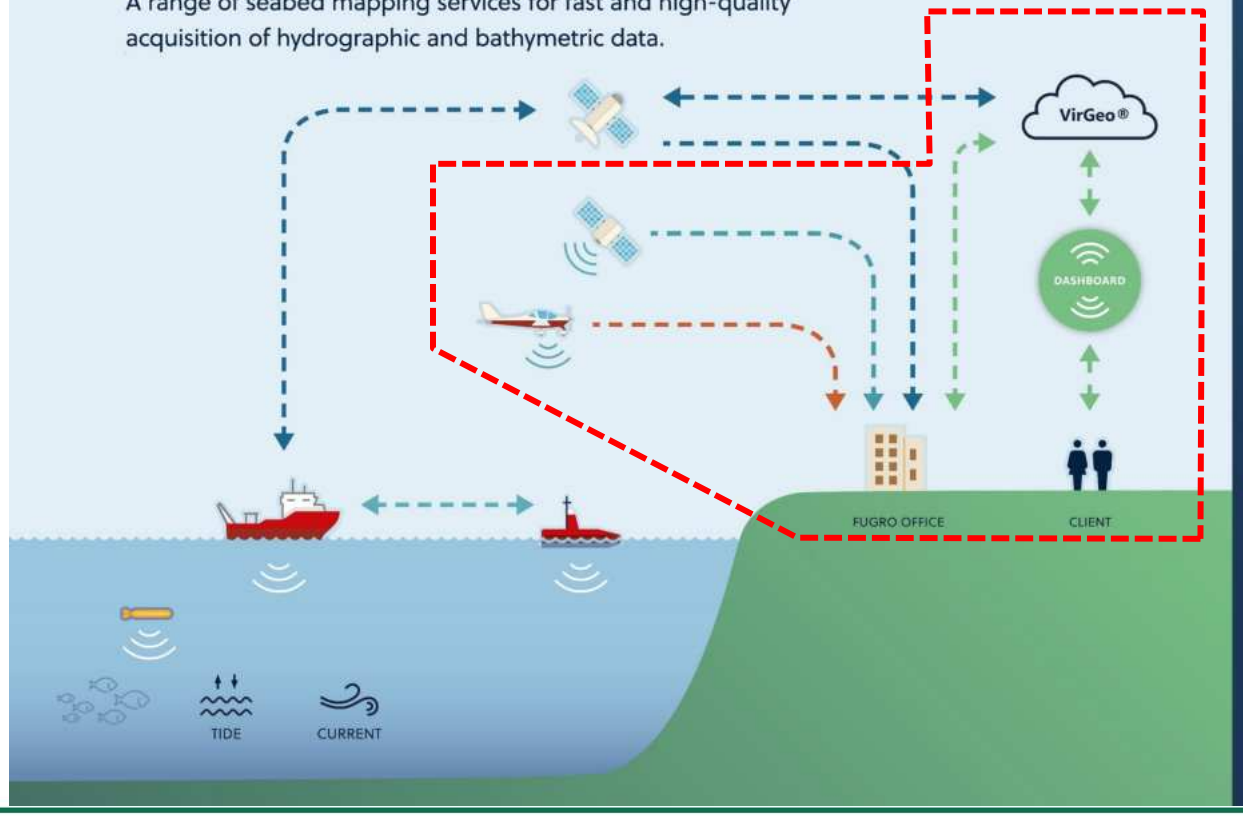
Some of our market-agnostic assets
easily deployable across global markets
8
uncrewed surface vessels (USVs)
26
specialised service vessels (+8 LT charters)
64
remotely operated vehicles (ROVs)
4
autonomous underwater vehicles (AUVs)
Global network of remote operations centres
FUGRO
8


FUGRO
WATER
ENERGY
PEOPLE
MAP
MODEL
MONITOR

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
- Integrated **metocean observations** for accurate vertical datum reduction and charting applications
- Autonomous underwater vehicles capture **precise** and **reliable** data for seabed surveys and environmental studies

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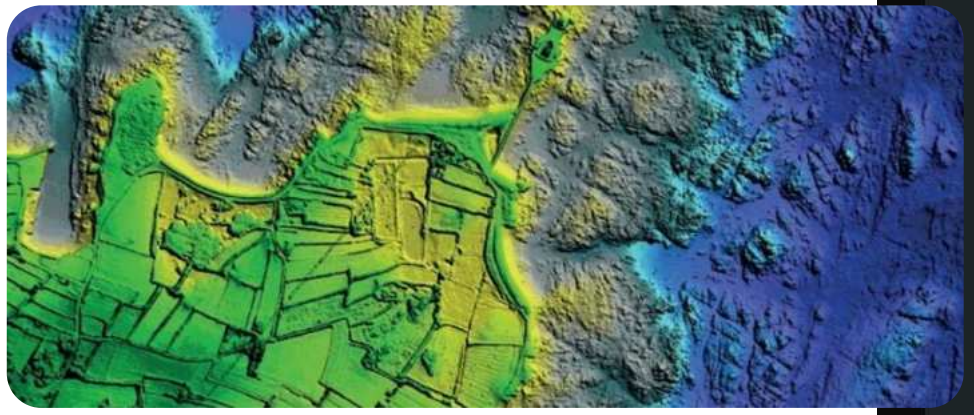
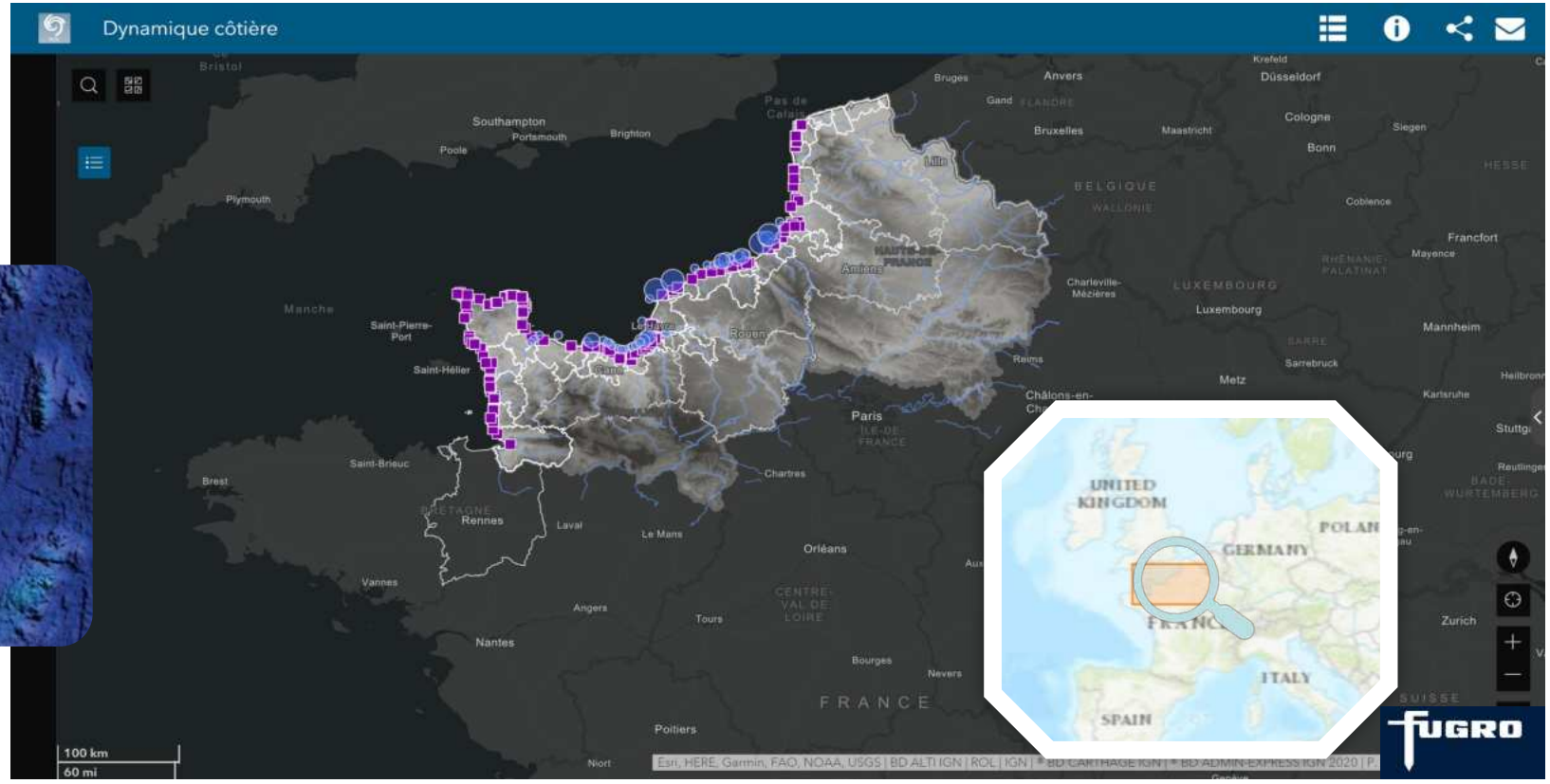
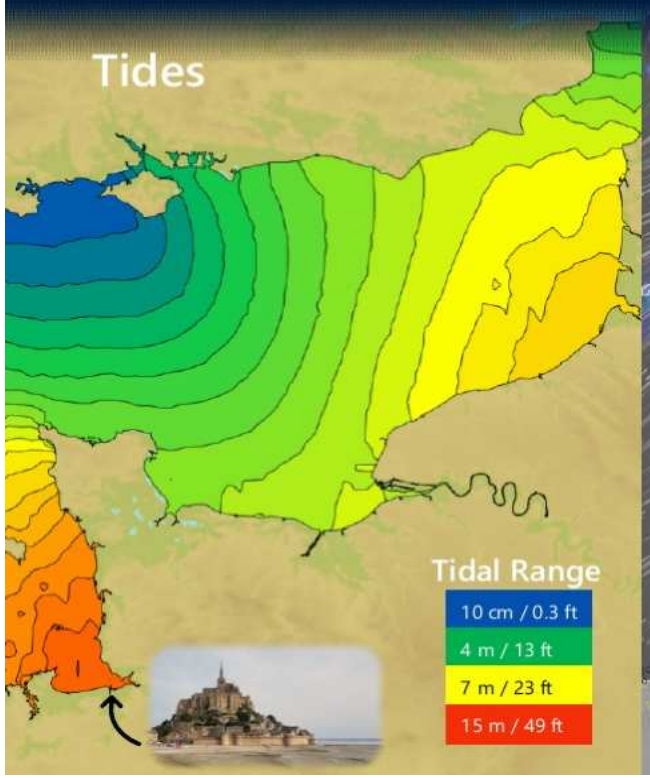
Continuous coastal Topo-Bathymetric model of northern France for ROL

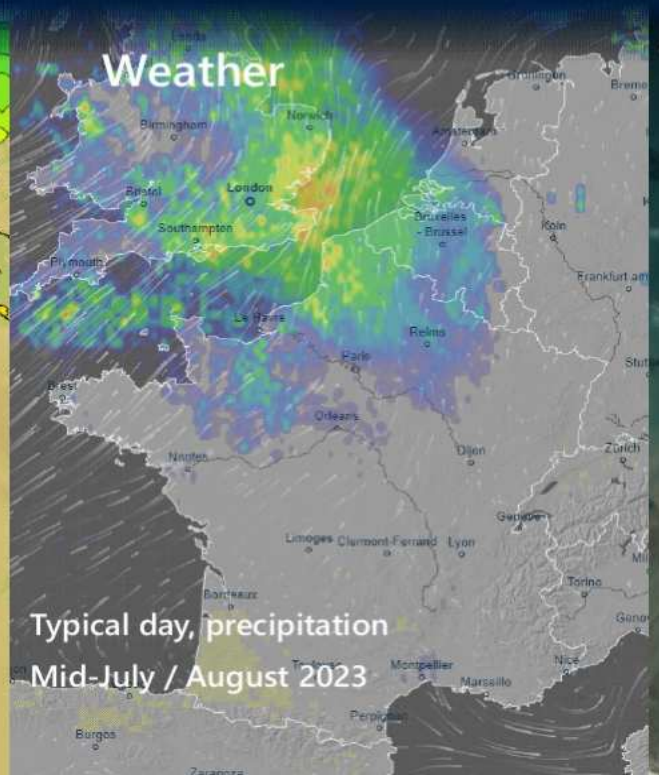
(Reseau d'Observation du Littoral)

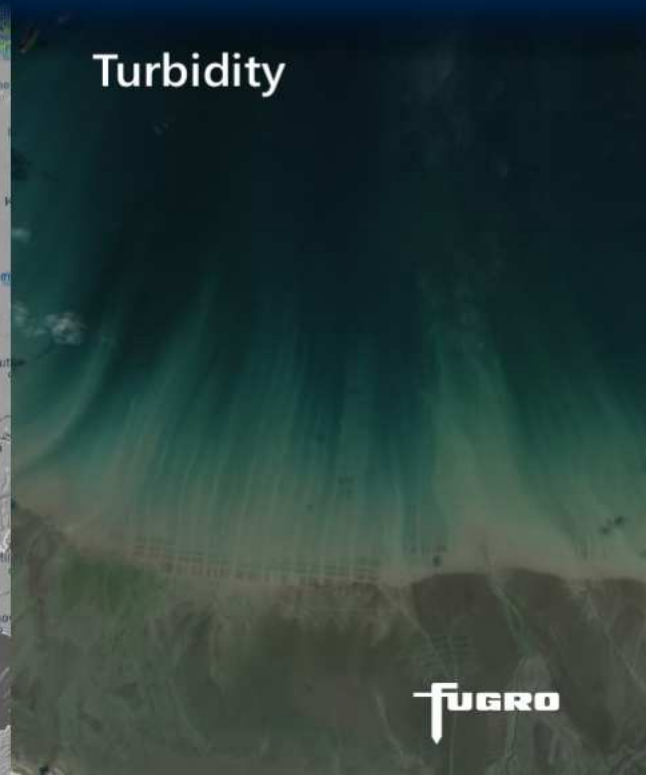




Challenges


Tides
Tidal Range
10 cm / 0.3 ft
4 m / 13 ft
7 m / 23 ft
15 m / 49 ft


Weather
Typical day, precipitation
Mid-July / August 2023


Turbidity
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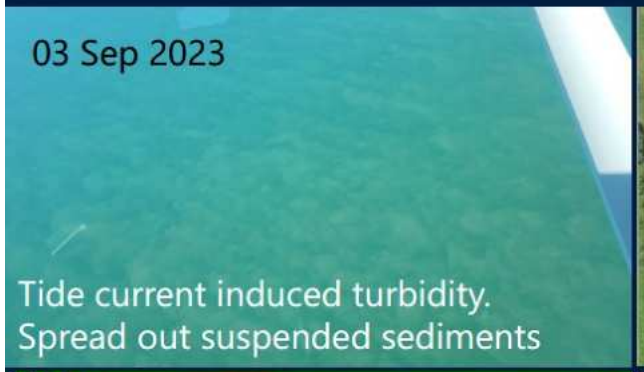
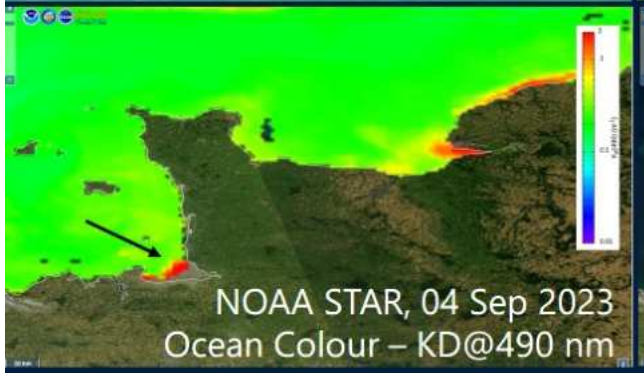
Site Observations





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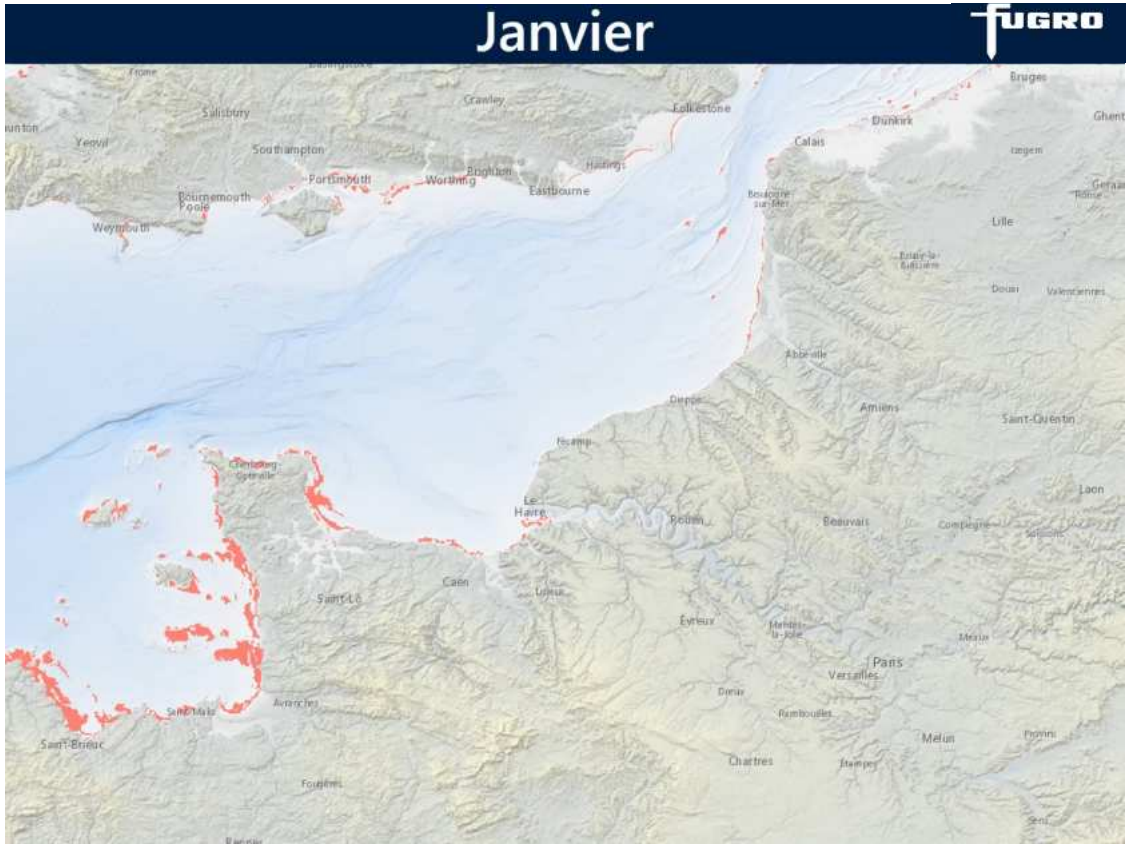
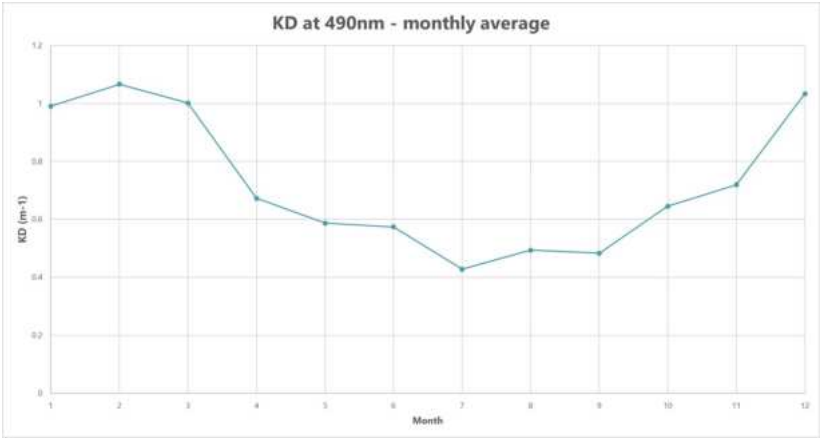
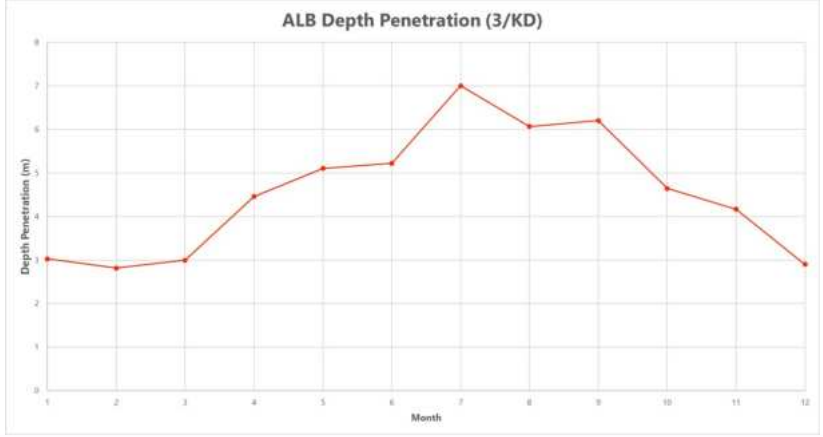
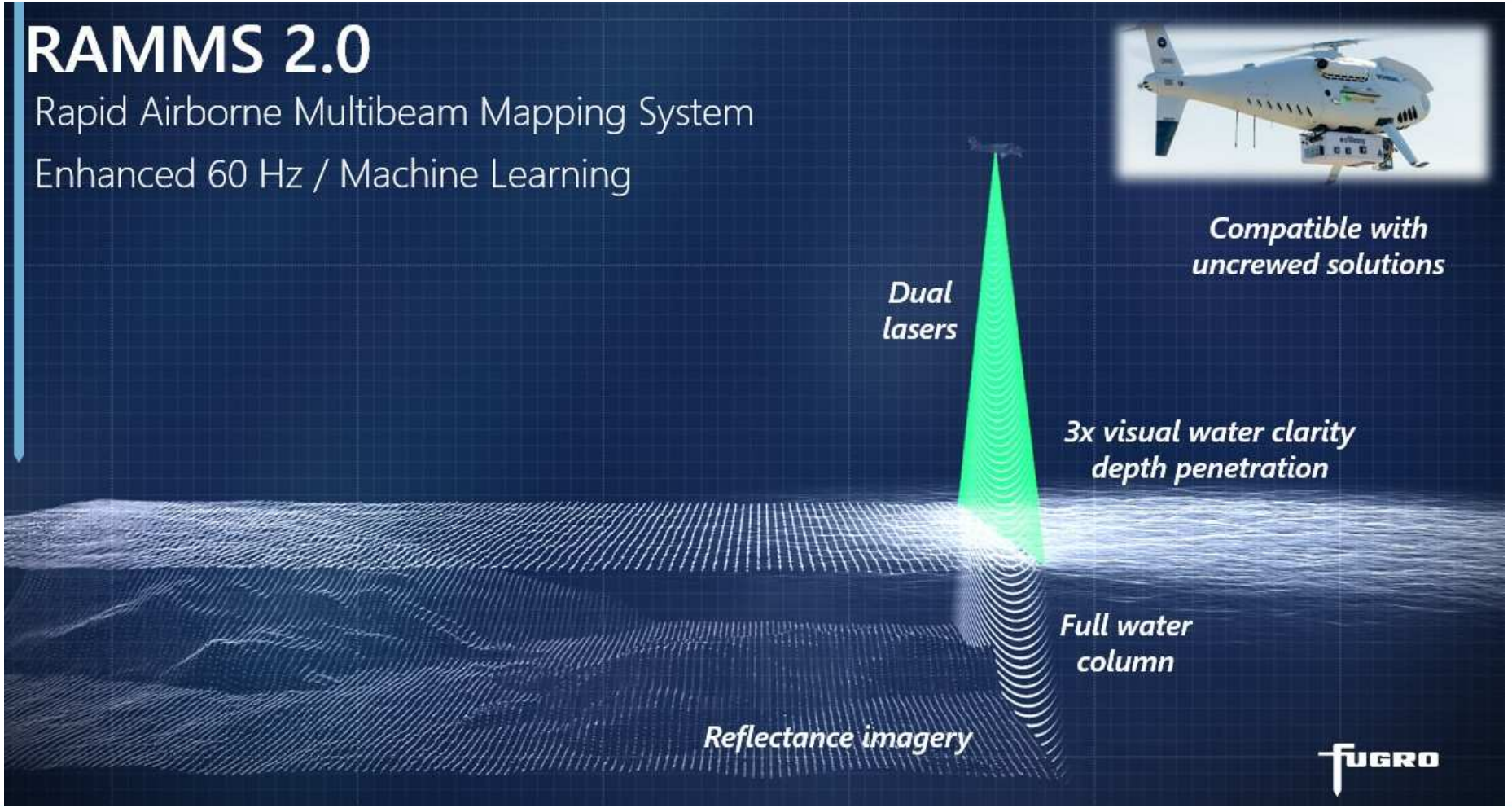
Pre-engagement leveraging from the SatAnalytics tool








RAMMS 2.0
Rapid Airborne Multibeam Mapping System
Enhanced 60 Hz / Machine Learning
Compatible with uncrewed solutions
Dual lasers
3x visual water clarity depth penetration
Full water column
Reflectance imagery
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Implementation: Fugro RAMMS ALB Solution

- Depth Performance: 3x Secchi
- Point cloud: 2.5pts/m2 - IHO Order-1a compliant
- Machine Learning Processing
- Topo-Bathy site investigations
- Significant CO_2 emission reduction

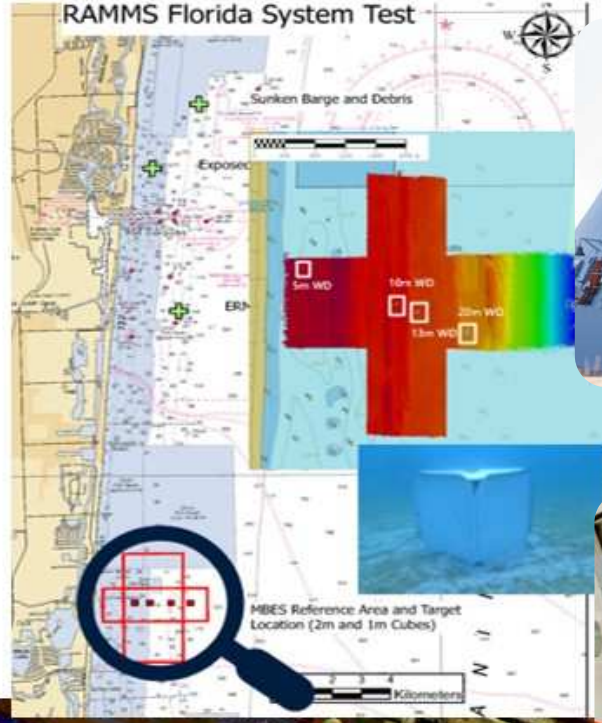
Some applications:

Nautical Charting / Habitat Mapping Coastal zone mapping for coastal resilience (flooding modeling, etc.)

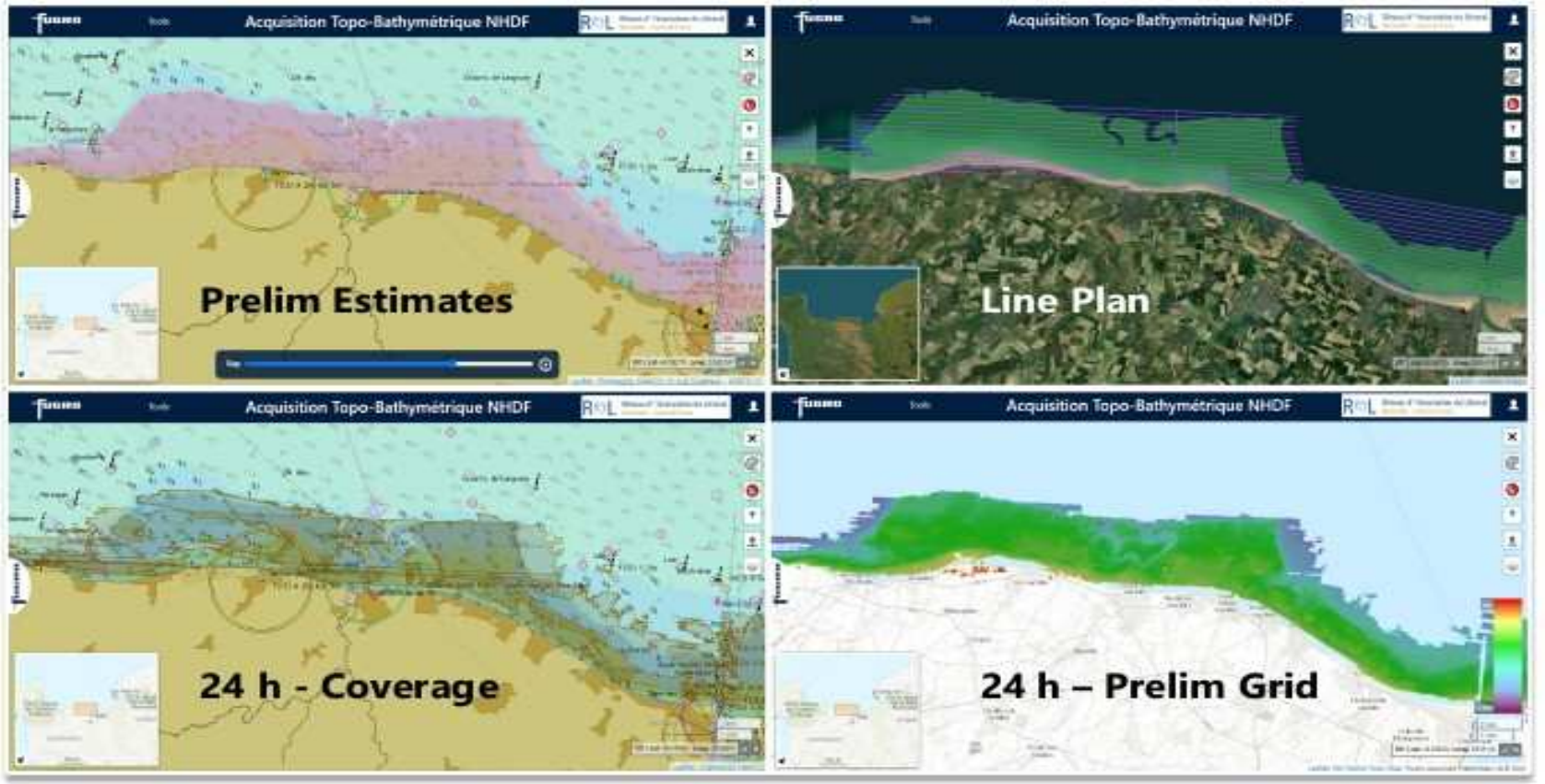
Feature automatic detection results

- Survey speed: varying 110-140kts
- Survey altitude: 325 AGL
- ext. depth @ 25 m

Target size	Line #	Water depth	Feature detection (pass/fail)
Cube 1 m	10001	5.8 m	✓
	10019	5.8 m	✓
	10020	5.8 m	✓
Cube 1 m	10003	9.3 m	✓
	10008	9.3 m	✓
	10009	9.3 m	✓
	10019	9.3 m	✓
Cube 2 m	10002	9.3 m	✓
	10003	9.3 m	✓
	10008	9.3 m	✓
	10009	9.3 m	✓
	10019	9.3 m	✓
	10020	9.3 m	✓
Cube 1 m	10003	13.8 m	✓
	10007	13.8 m	✓
	10019	13.8 m	✓
Cube 2 m	10003	13.8 m	✓
	10007	13.8 m	✓
	10019	13.8 m	✓
	10020	13.8 m	✓
Cube 2 m	10019	19.8 m	✓
	10020	19.8 m	✓



Implementation: VirGeo® WebGIS platform



Machine Learning Data Classification

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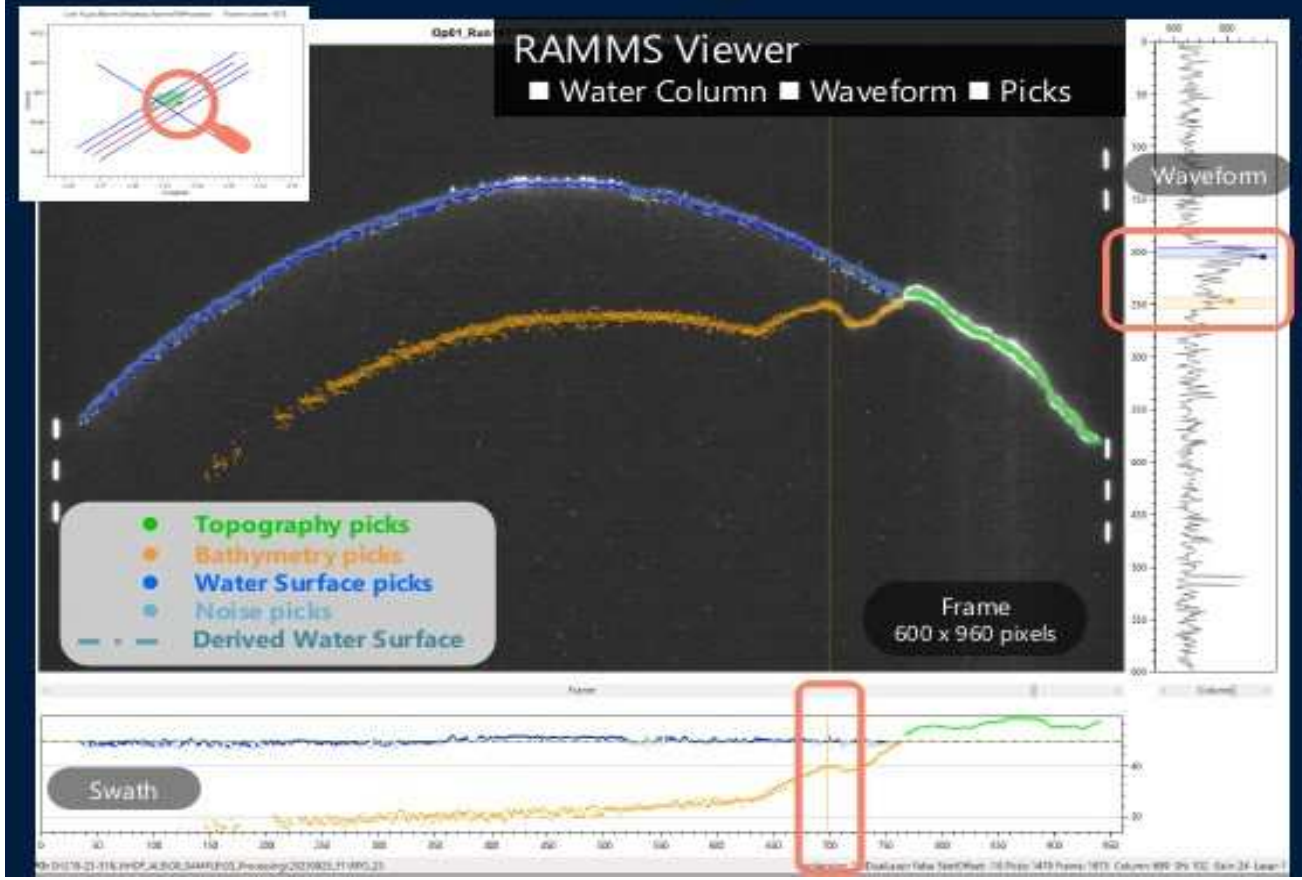

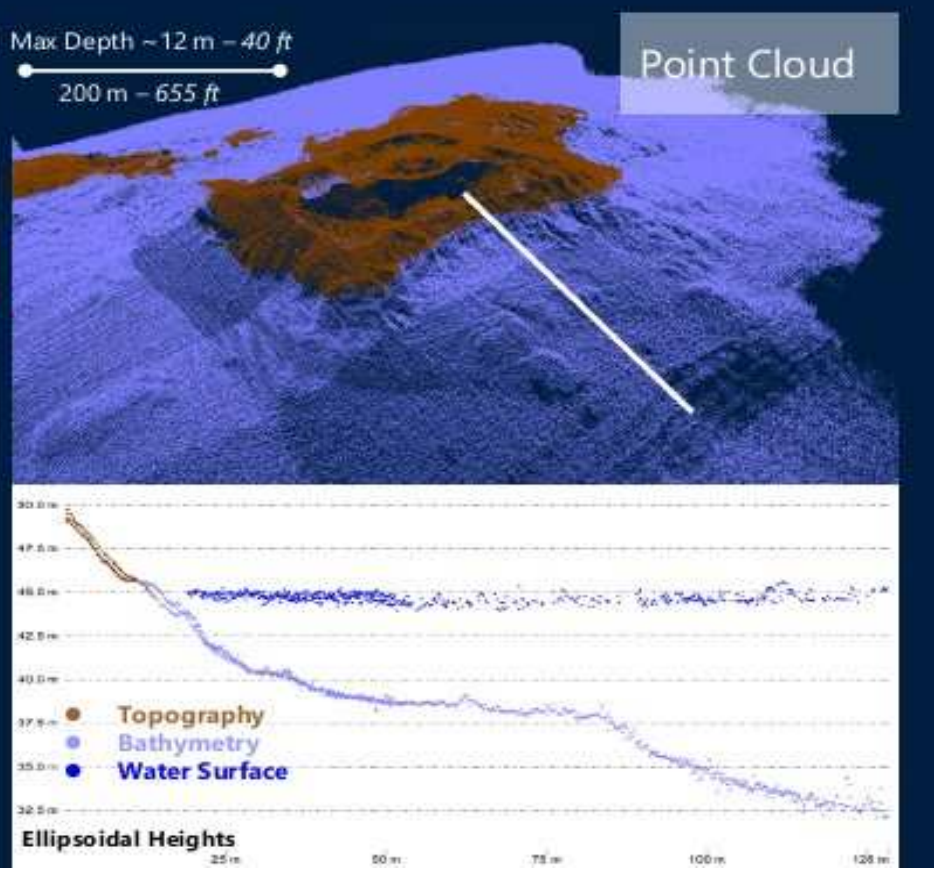

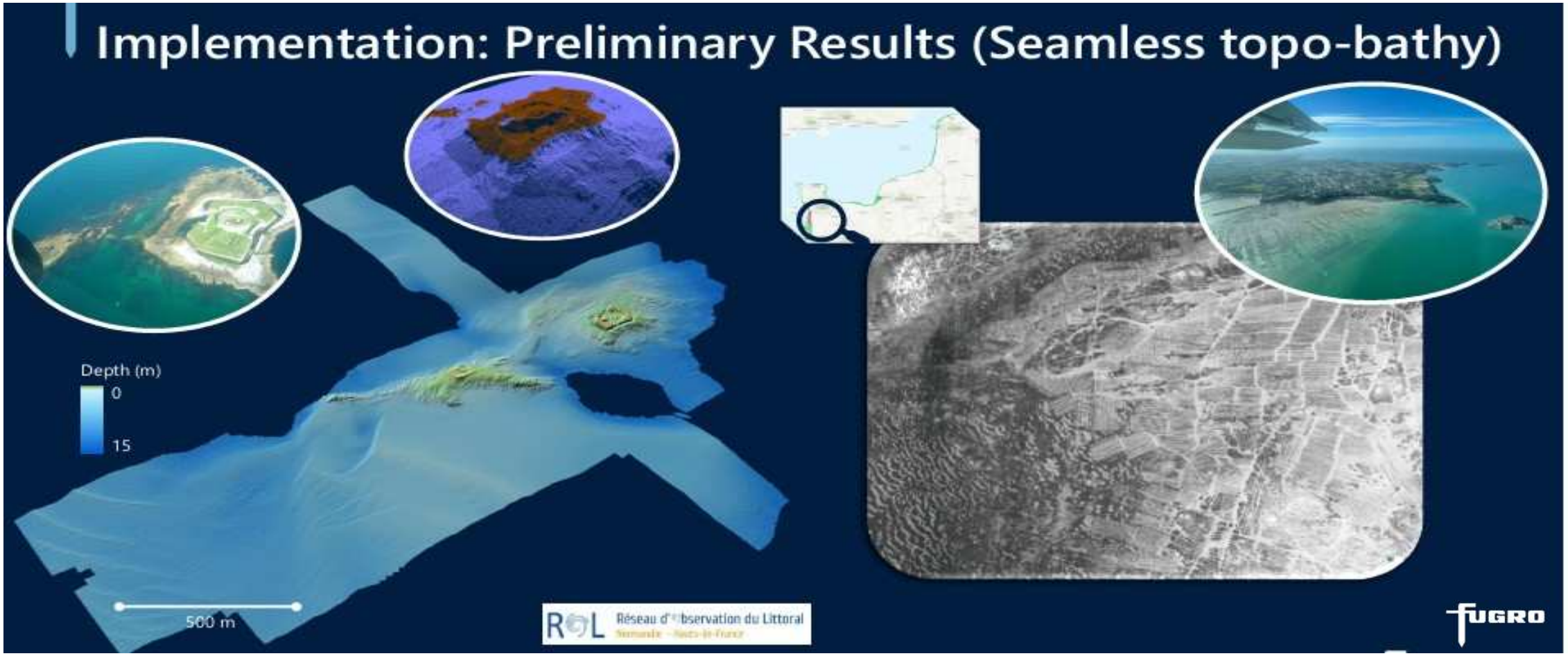
Implementation: Preliminary Results (Seamless topo-bathy)
Depth (m)
0
15
500 m
Réseau d'observation du Littoral
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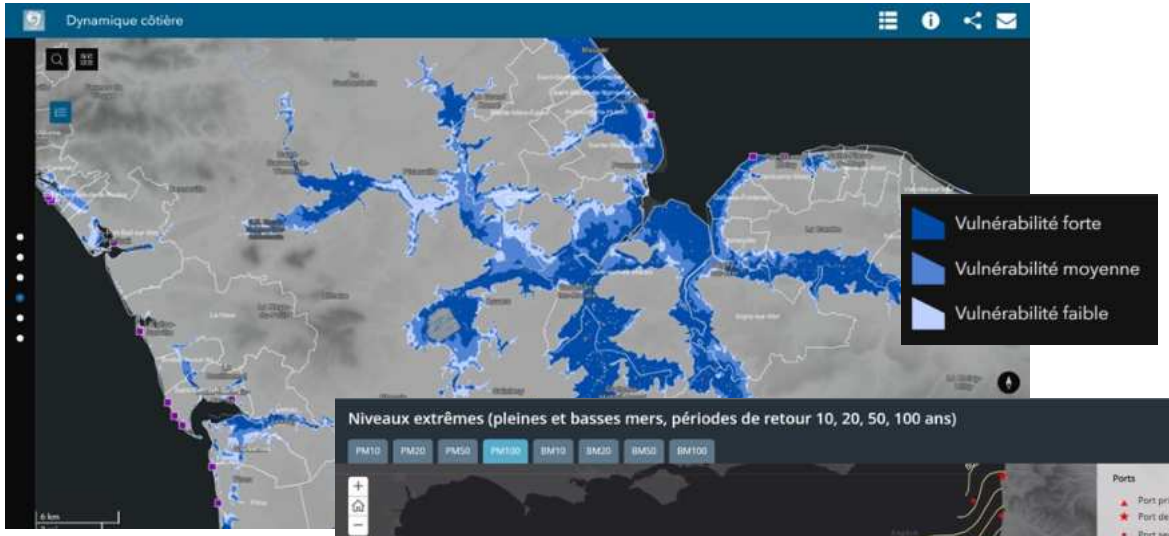
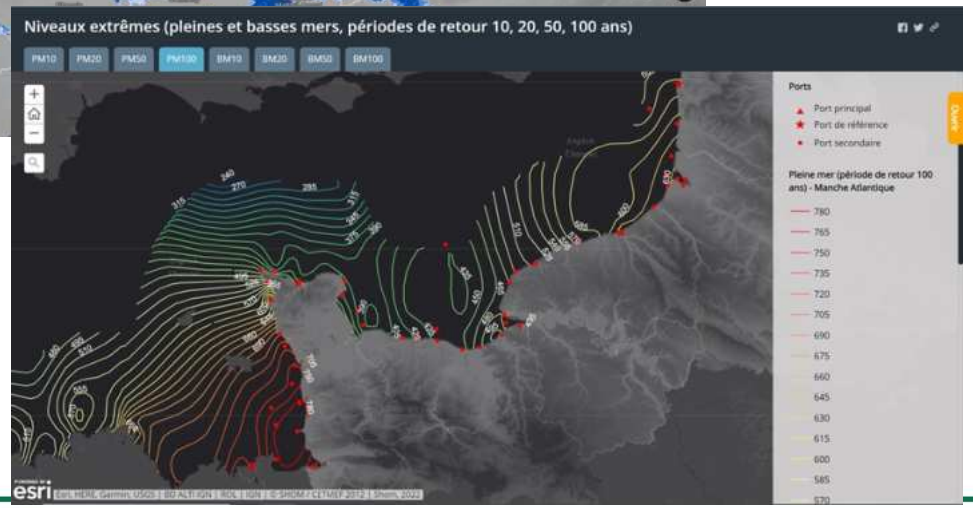
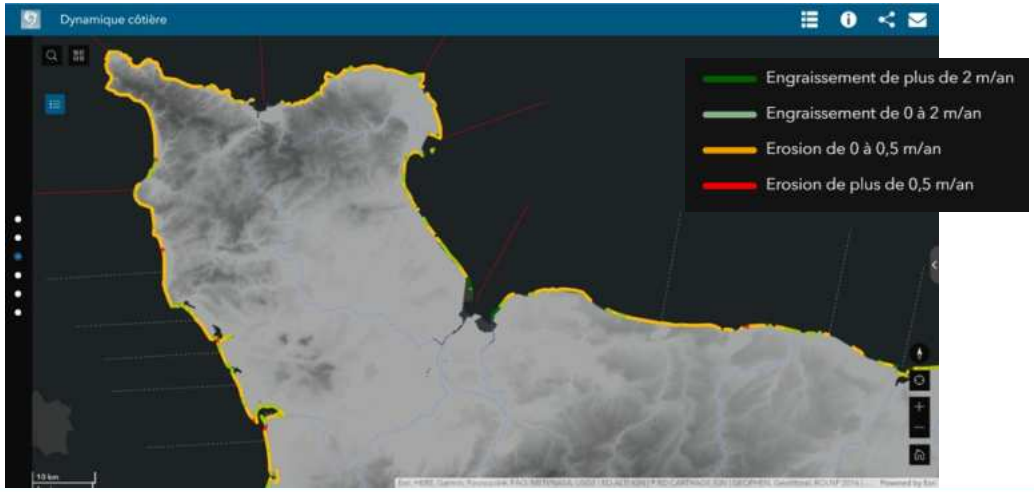
What are Fugro data enabling?







SUSTAINABLE DEVELOPMENT GOALS | International Federation of Surveyors supports the Sustainable Development Goals

Commission 4

Facing the Changing Climate & Environmental Degradation: Hydrospatial Solutions

Serving Society for the Benefit of People and Planet

Vessel carbon reduction towards net zero 2035

All vessels

Efficiency measures

- Route optimisation
- Hull performance monitoring
- Reflective deck paint
- Economic speed
- Shore power
- Propulsion system modification

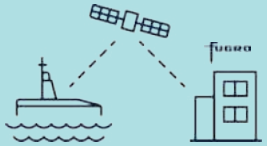
Owned crewed vessels

Battery hybrid conversions

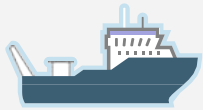
Methanol conversions

Uncrewed surface vessels

USV programme



Third-party chartered vessels



Third-party vessel owners' engagement programme

Emission reduction — per operational day

All vessels	Owned crewed vessels		Uncrewed surface vessels	Third-party chartered vessels
10–25%	15%	< 95%	90–95%	25–75%
Efficiency improvement	Renewable electricity	Green methanol	Smaller size vessels	Efficiency, green fuels, etc.

Introduce remote and digitalised workflows to enable a reduced carbon footprint

5 Fugro's vision and strategy

Fugro USV Classes – Now and in the future

NOW - **Blue Shadow®** 9m	NOW - **Blue Essence®** 12m	2024 - **Blue Eclipse®** 18m	2025 - **Blue Prism®** 16m
			
➢ ***Now converted for Over Horizon operations*** 8 day duration, 2.5m Sig seakeeping, 6 kt survey speeds • KB 2040 MBES	➢ ***MCA CAT0, track record in 3 regions*** 10 day duration, 2.5m Sig seakeeping, 3-4kt survey speeds • Norbit (Dual) MBES systems • SBP and ROV Capability	***> Endurance, Speed, Workability*** 21 day duration, 5m Sig seakeeping, 6 kts survey speeds • Full MBES Options available • SBP and ROV Capability	**Full Hydrography and Geophysics** **21 day duration, 8kts speeds** • 712 or 2042 KB MBES Options • SBP, Mag, SSS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Thank you
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