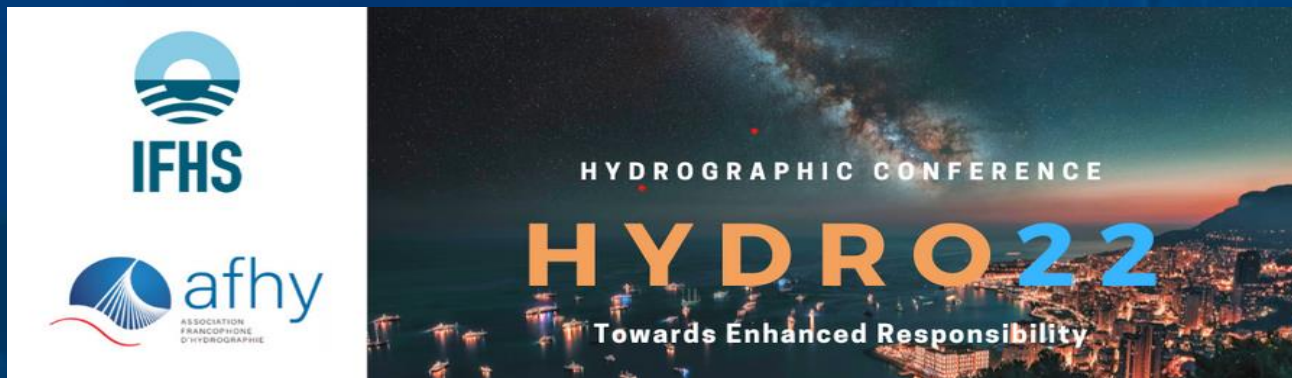


Hydrography in the Blue Economy



Carlos Rubrio Marques



videira.marques@hidrografico.pt

crubrio@hotmail.com

06/12/2022

Agenda

- Introduction
- Blue Economy
- Hydrography
- The IH PT
- Blue Hydrography
- Final Remarks

Introduction

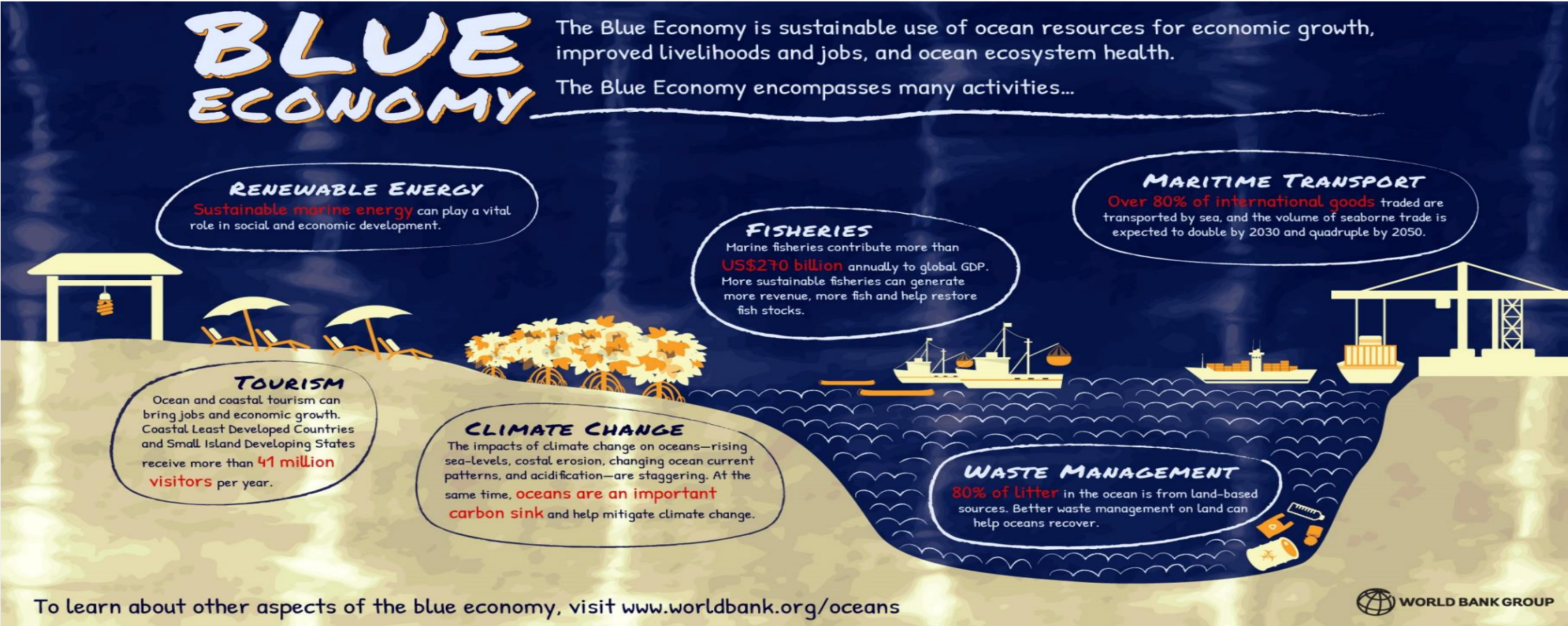
- “The blue economy is transforming our approach to bathymetric surveying ...”

[Andy Waddington](#), Hexagon’s VP of Bathymetric Services

Blue Economy

- According to the **World Bank**, the blue economy is the "sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of ocean ecosystem."
- **European Commission** defines blue economy as "All economic activities related to oceans, seas and coasts. It covers a wide range of interlinked established and emerging sectors."
- A **United Nations representative** recently defined the blue economy as "an economy that comprises a range of economic sectors and related policies that together determine whether the use of ocean resources is sustainable".

Blue Economy



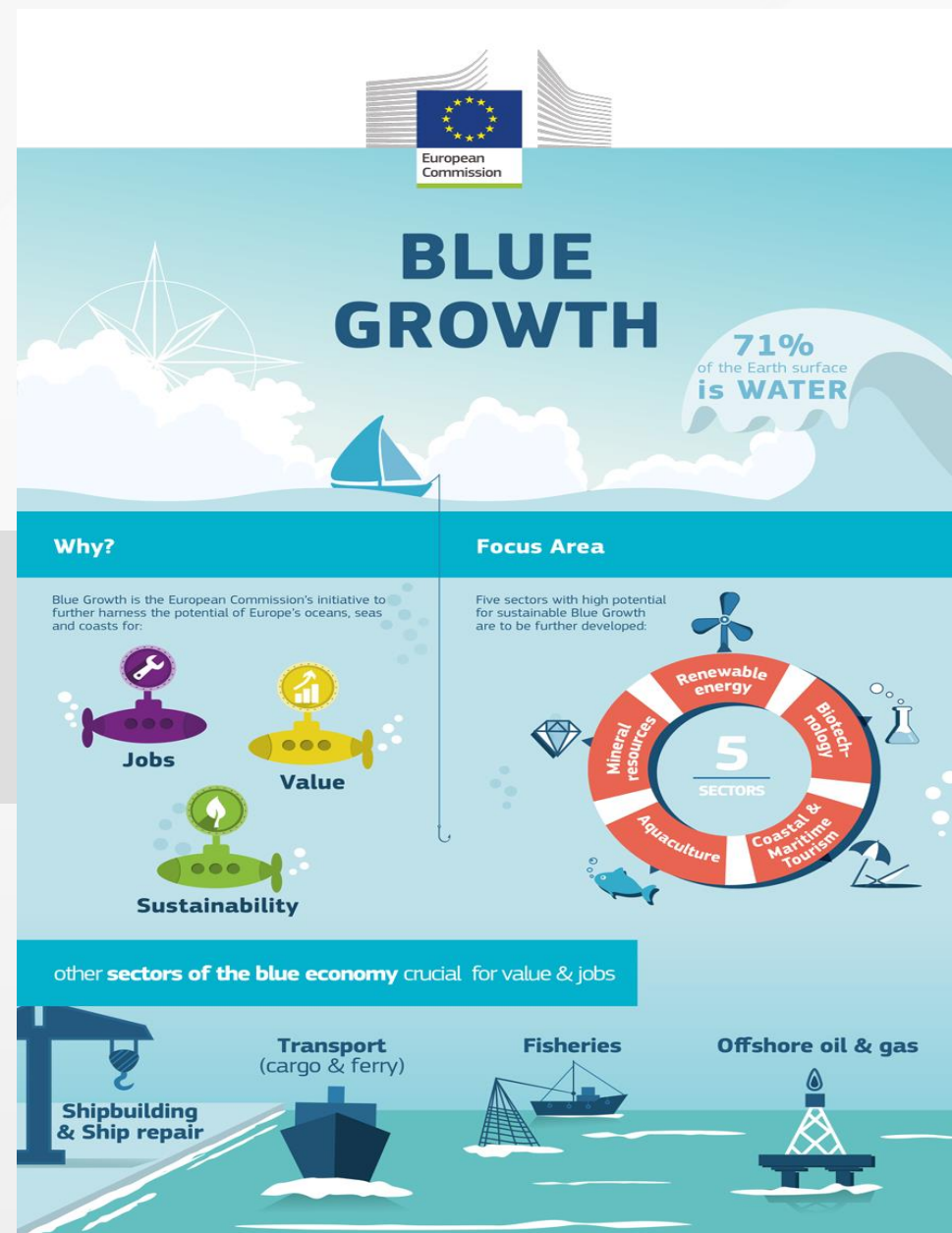
Blue Economy

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Blue Economy

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Blue Economy



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Blue Economy

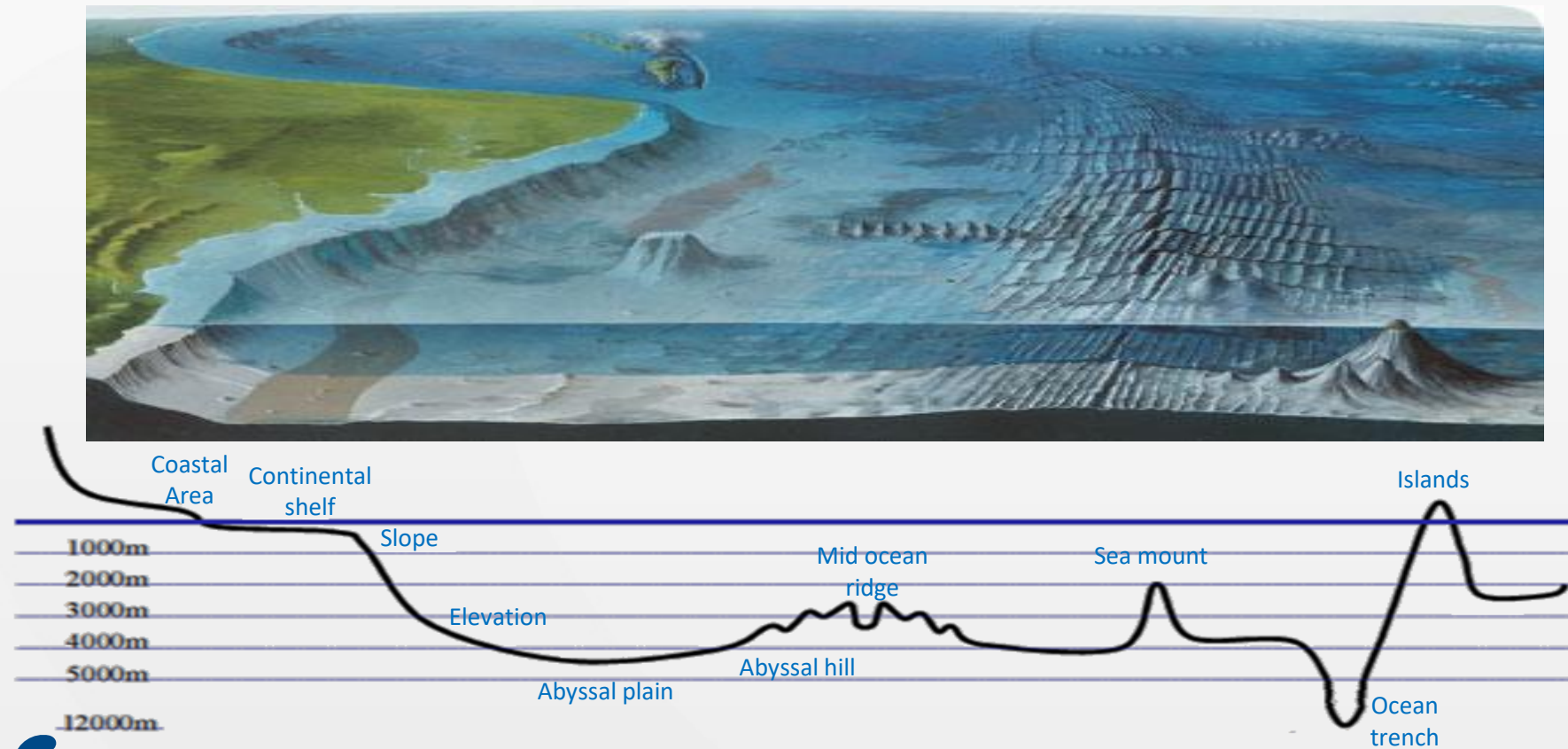
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Hydrography

- The seabed is just submerged land ...



Hydrography

- in **Encyclopedia Britannica**
 - **Hydrography**, the art and science of compiling and producing charts, or maps, of water-covered areas of Earth's surface.



Hydrography

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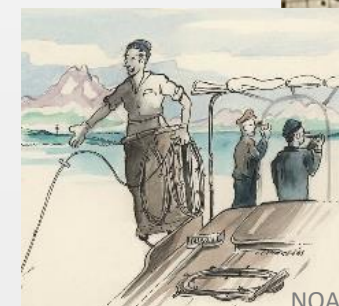
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Hydrography

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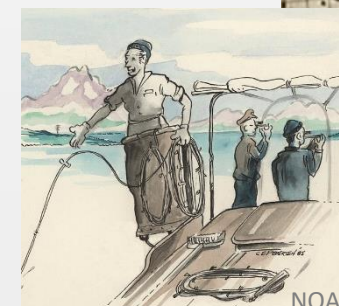
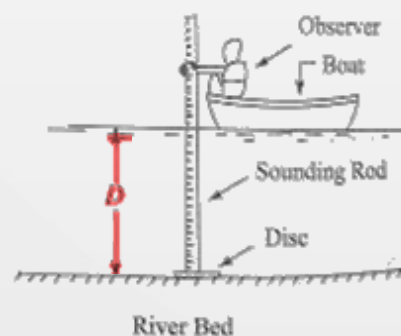
- The terms *hydrography* and *hydrographer* are based on an analogy with *geography* and *geographer* and date from the mid-16th century. Hydrography ordinarily denotes only the study of ocean depths and of the directions and intensities of ocean currents. Other facets—such as temperature profiles or mineral content—are covered by the sciences of hydrology and oceanography.



Hydrography

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Hydrography

- from IHO

- **Hydrography** is the branch of applied sciences which deals with the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defence, scientific research, and environmental protection.



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 - In addition to supporting safe and efficient navigation of ships, hydrography underpins almost every other activity associated with the sea, ...



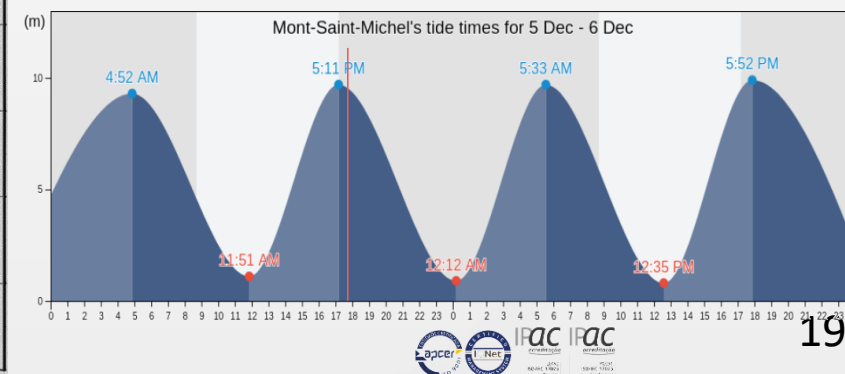
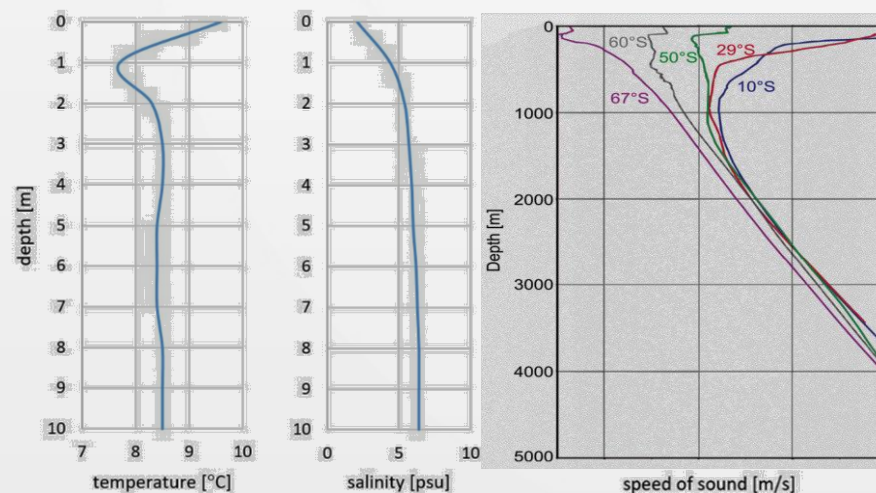
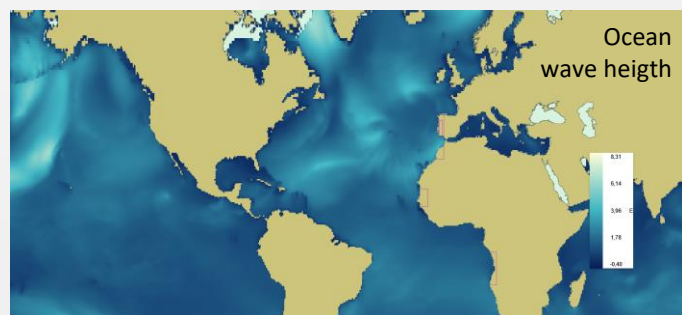
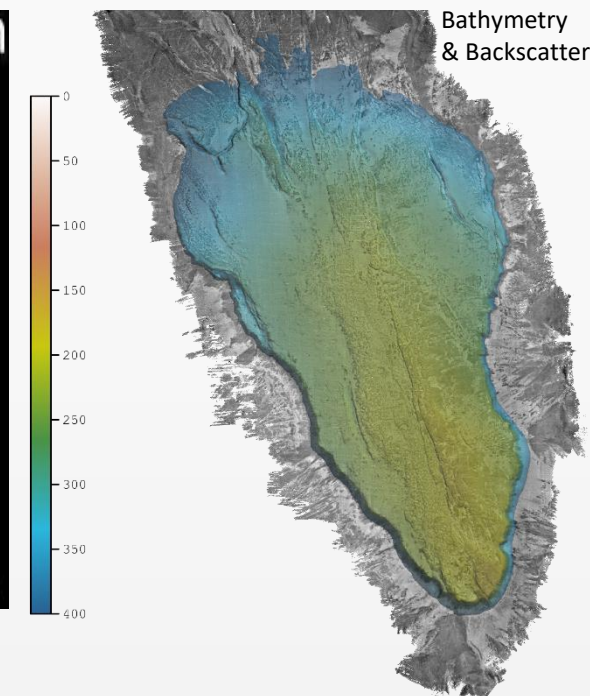
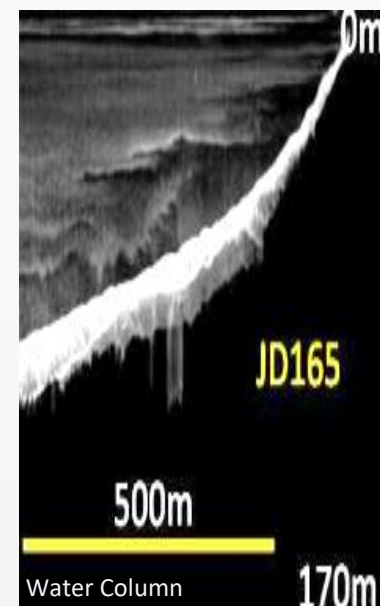
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Hydrography

- *Hydrographic data is a collection of several ocean, sea, ... water covered areas ... physical features.*
 - *depth soundings, backscatter, sediment type, sound speed, water levels and tides, water currents, temperature, salinity and other variables are among the information collected.*

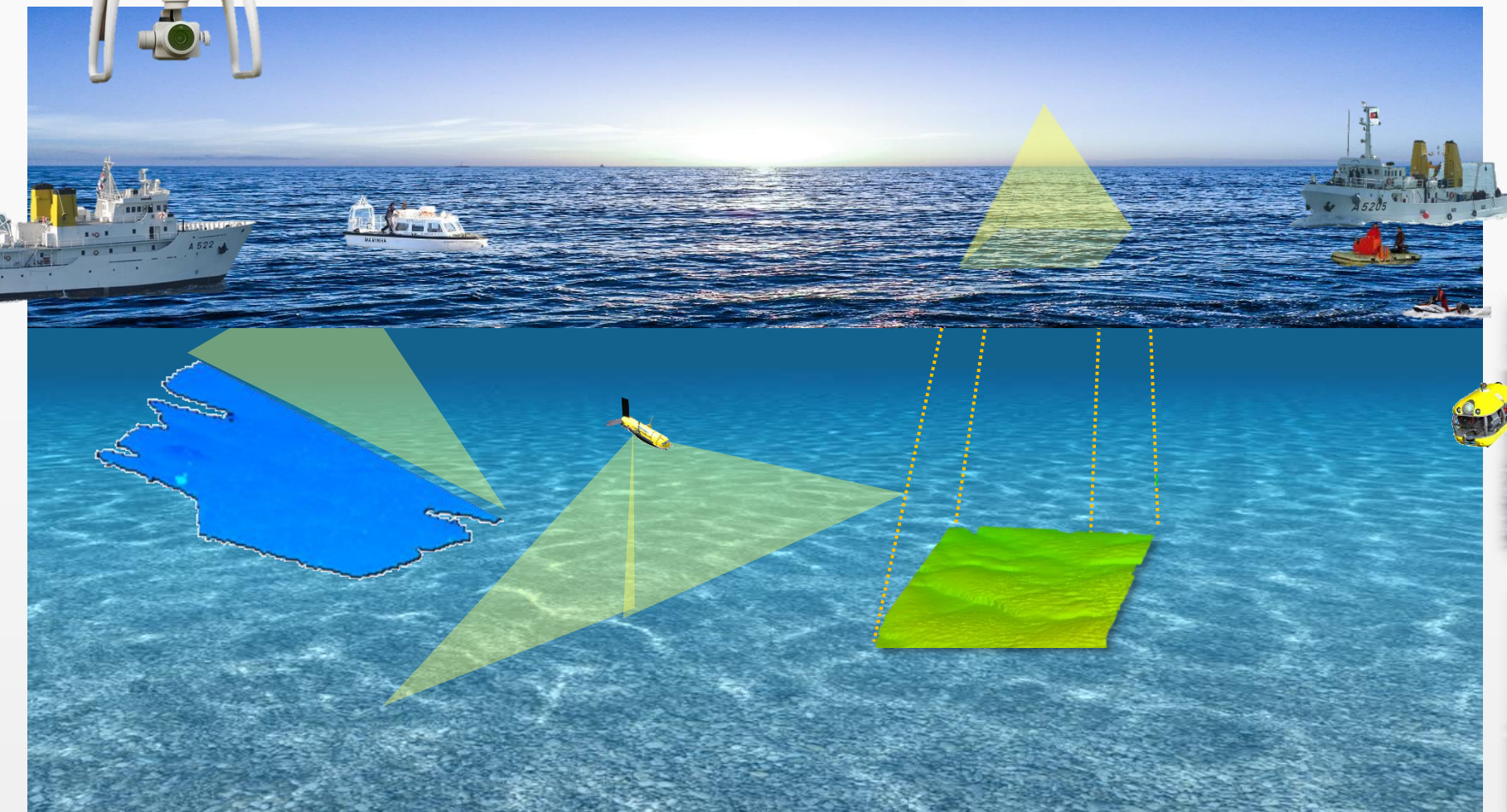


Hydrography

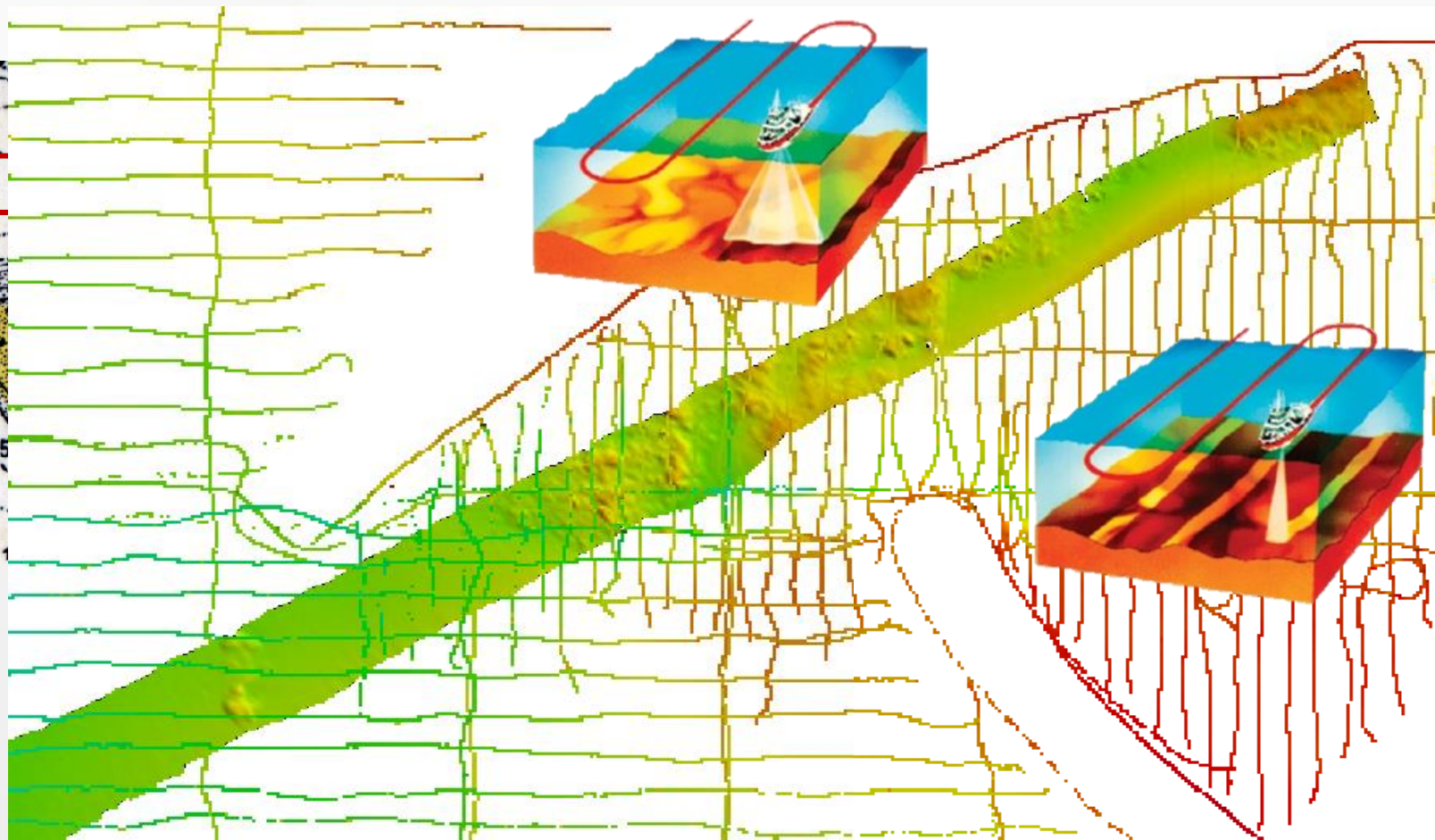
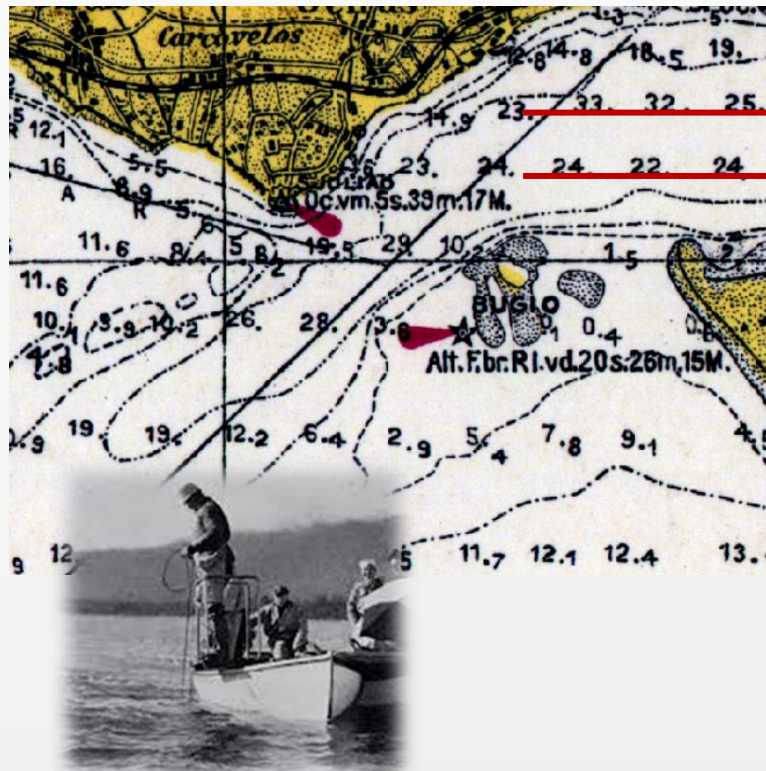
- A long time ago ... hydrography was mostly done manually, using direct measuring



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Hydrography

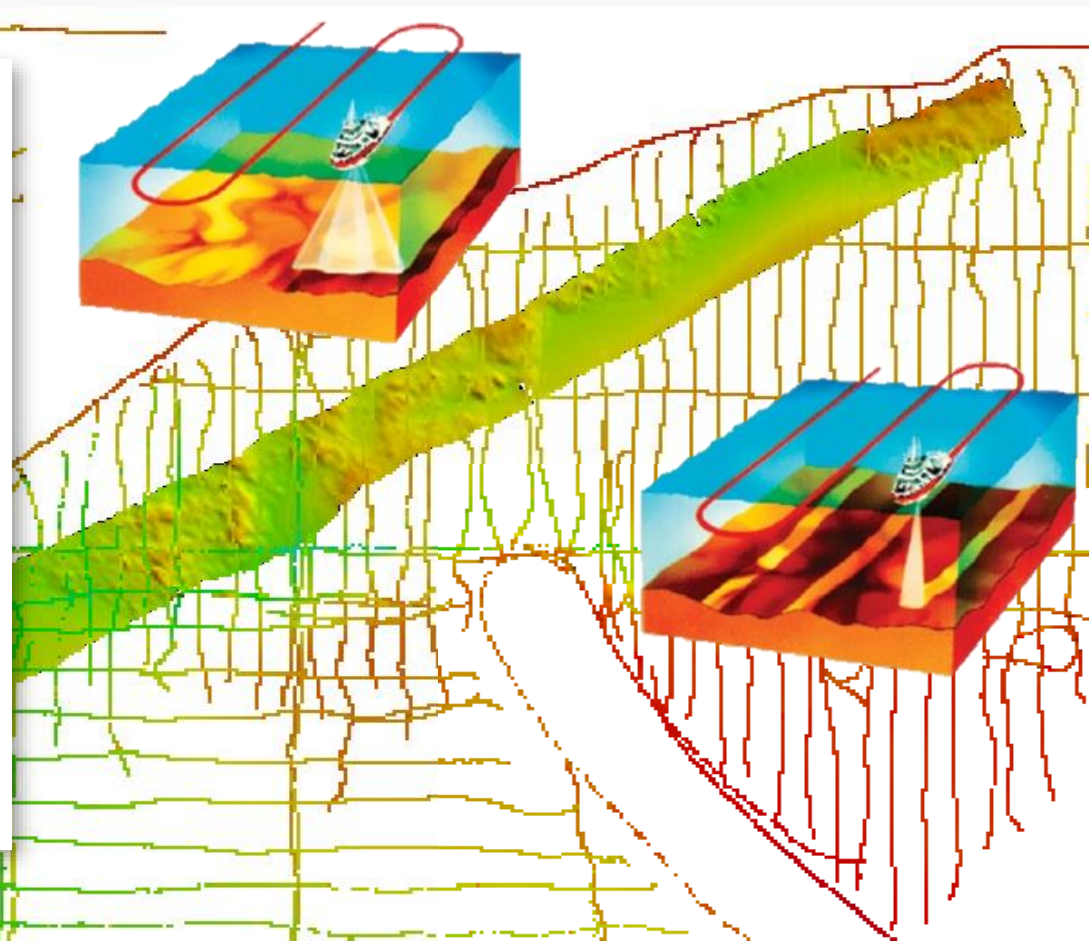
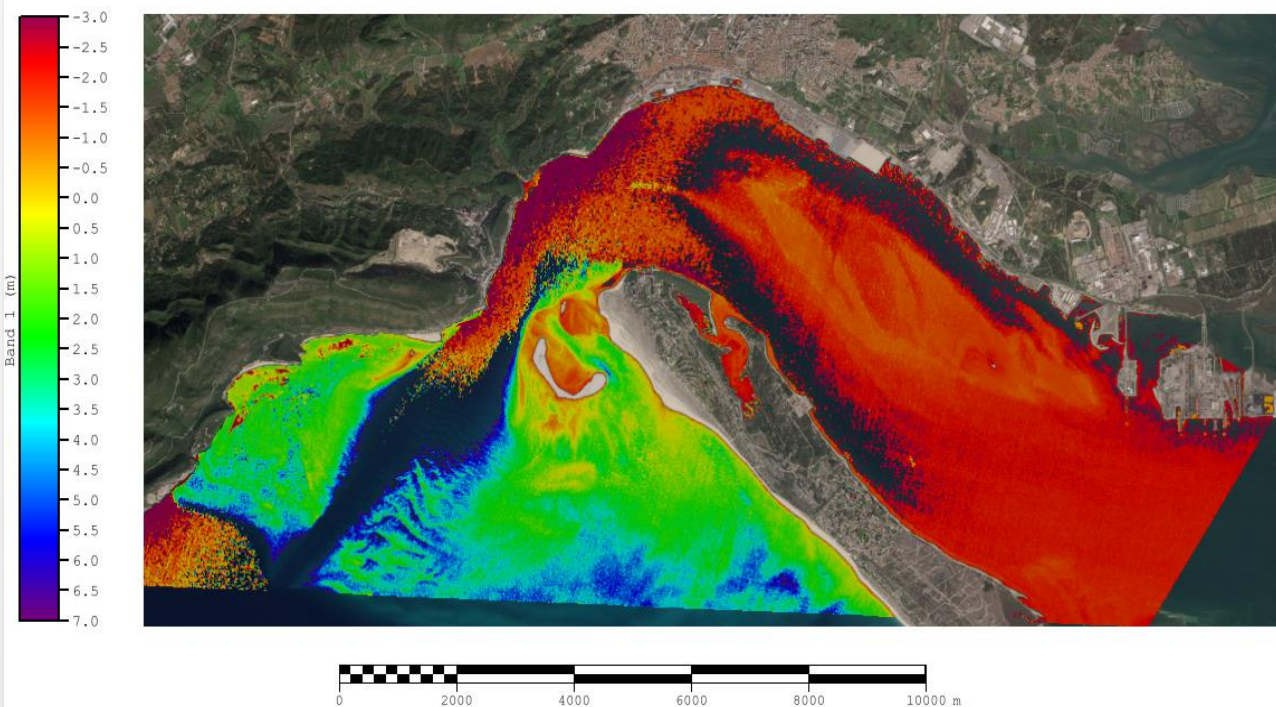


Hydrography

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Tide = -3.054



Hydrography

- Technology has made it easier:
 - topographical surveys
 - positioning instrument
 - depth measuring instrument,
 - motion sensor equipment,
 - tide gauge equipment,
 - Sound velocity measurement equipment,
 - etc ...

GNSS Operational Options

	real-time	post-processed	signal	
no corrections	GNSS		Pseudorange	stand-alone code (< 10m)
base station(s) / SBAS	DGNSS		Pseudorange	code-differential (< 5m)
orbits and clocks	RTG, RTS	PPP	Pseudorange + Carrier	floating-point ambiguities (< 25 cm)
base station(s)	RTK	PPK	Carrier	integer-fixed ambiguities (< 5 cm)
network of base stations	RTN	NPPK	Carrier	improved integer-fixed ambiguities (1-2 cm) 25

November 2022

GNSS Methods

Hydrography

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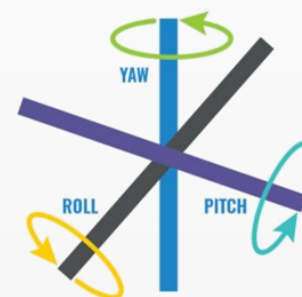
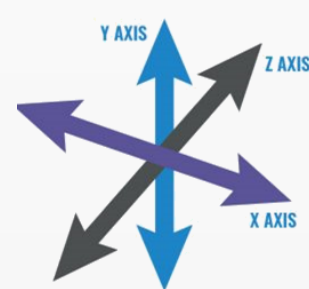


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SIX DEGREES OF FREEDOM

CEVA



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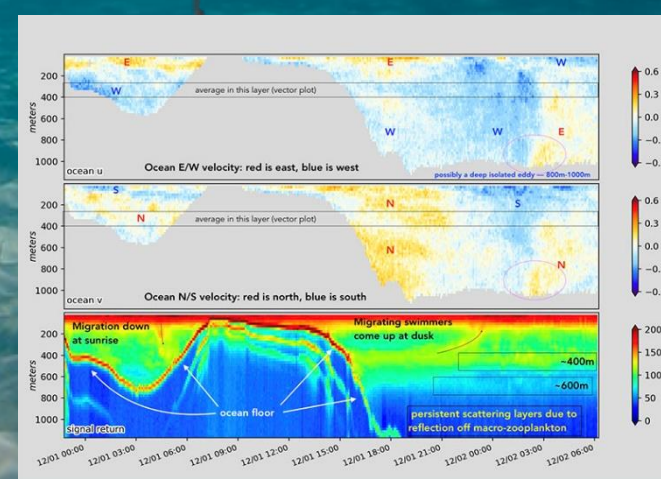
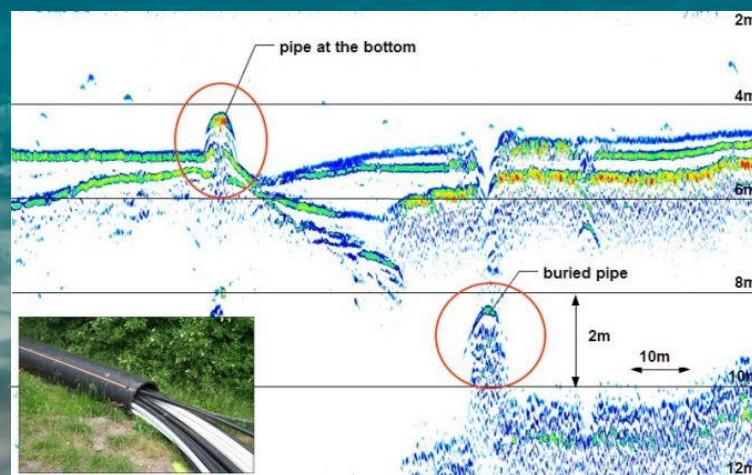
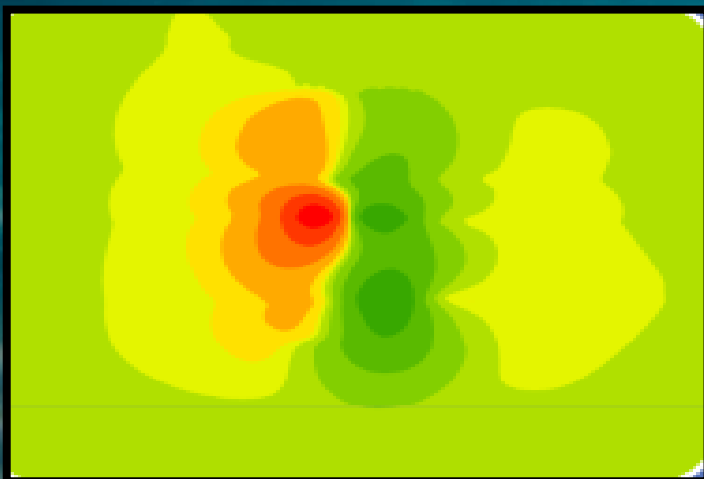
- ... branch of applied sciences which deals with the measurement, description and prediction of the physical features ...
- “ordinarily denotes only the study of ocean depths”



Hydrography

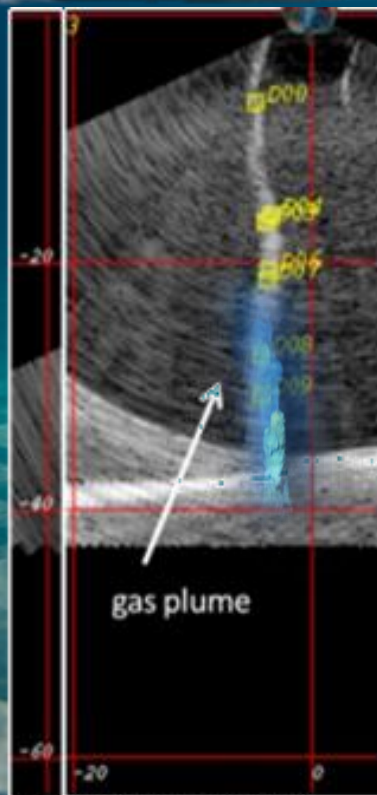
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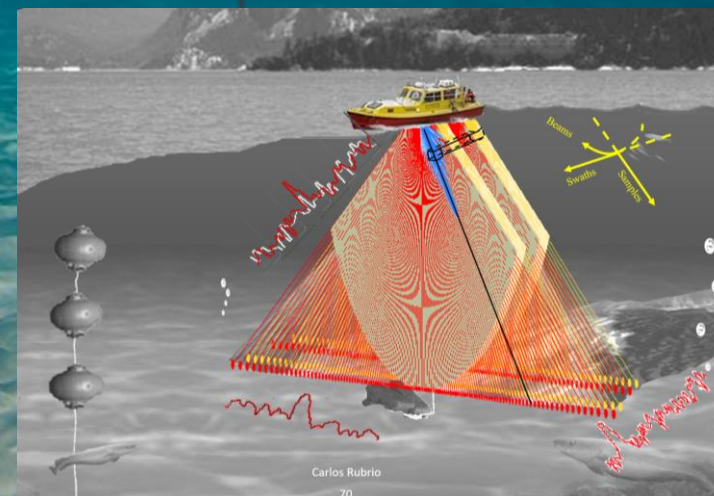
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ramish 2011, with an EM110

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Hydrography



Hydrography

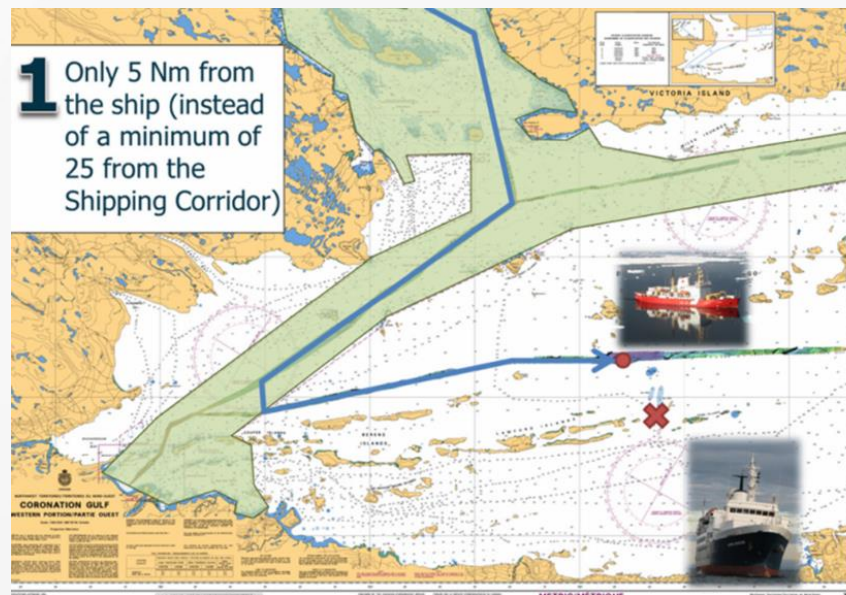
- Identifying the borders of any port is essential, in a 3D fashion, that is why Hydrography is the main source *to build nautical charts and hydrographic models.*
- There is an international obligation to provide hydrographic services. All member countries of the SOLAS (Safety of Life at Sea) Convention are required to provide hydrographic services for the safe navigation of ships



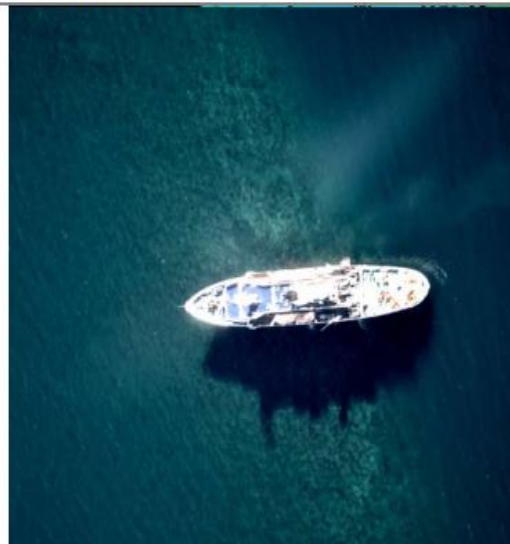
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- Safety of navigation



Overhead View²⁹



Starboard Side View³⁰



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- Safety of navigation



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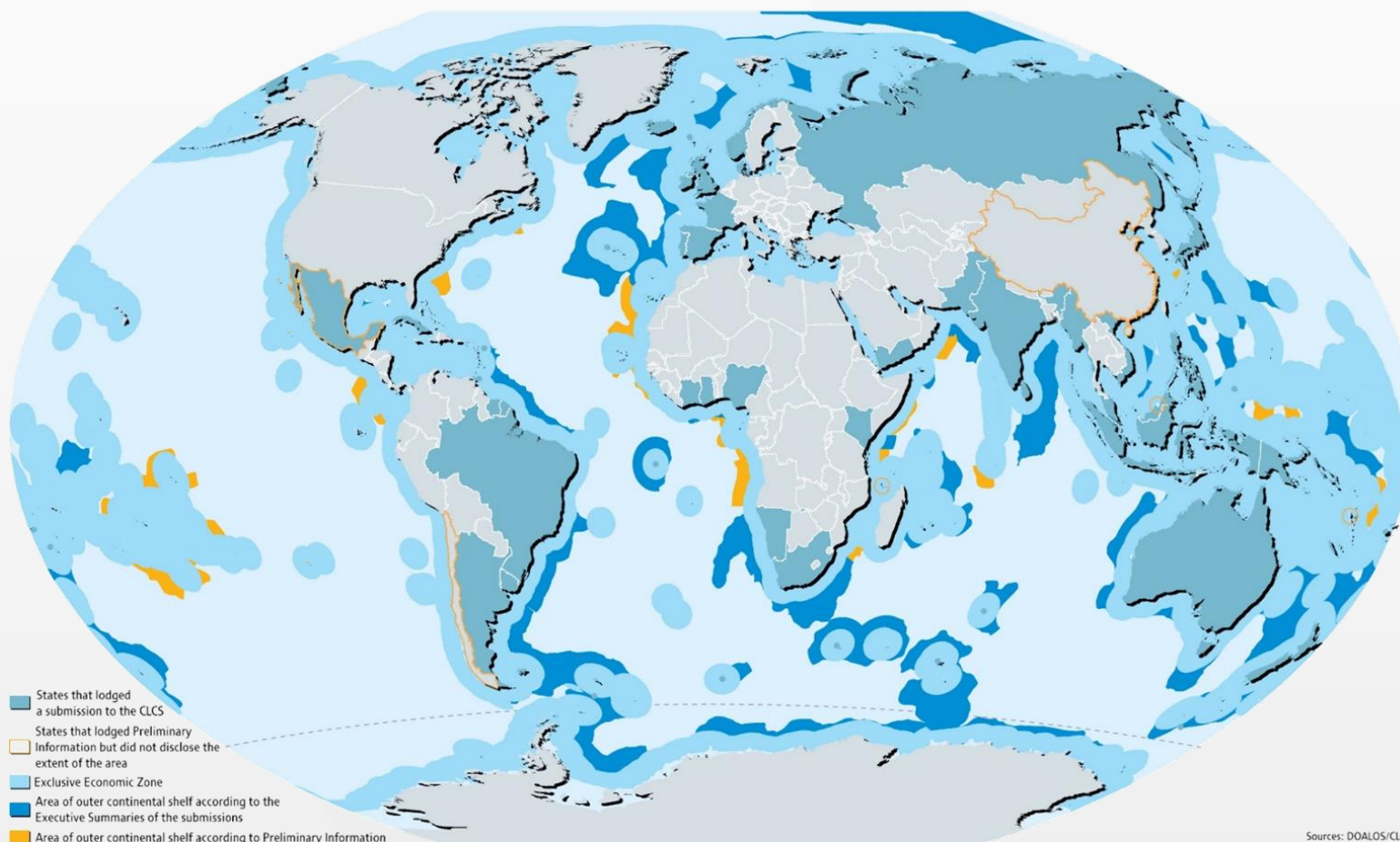
- Safety of navigation
- Marine tourism,



Hydrography

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Global distribution of outer continental shelf



- Safety of navigation
- Marine tourism,
- National Marine spatial data infrastructures,
- Managing, maritime boundaries, Coastal zone

Hydrography

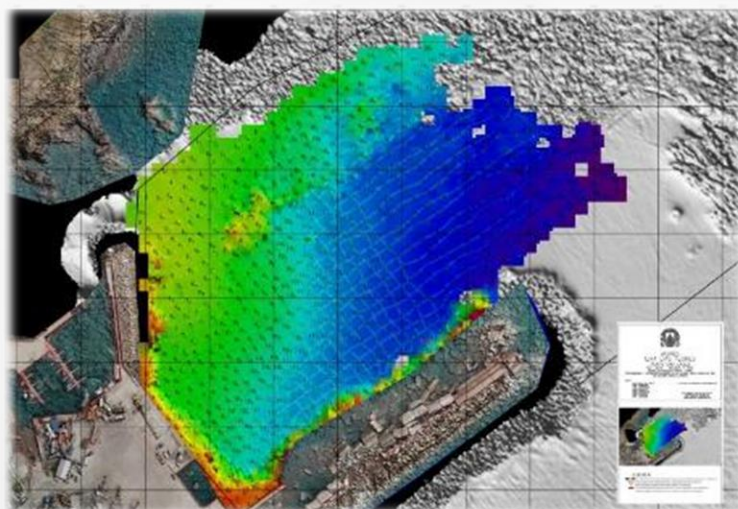


COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

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Insight Report

The Global Risks Report 2019 14th Edition



2017	2018	2019
Extreme weather events	Extreme weather events	Extreme weather events
Large-scale involuntary migration	Natural disasters	Failure of climate-change mitigation and adaptation
Major natural disasters	Cyber-attacks	Natural disasters

- Safety of navigation
- Marine tourism,
- National Marine spatial data infrastructures,
- Managing, maritime boundaries, Coastal zone
- Risk Management

This map illustrates the extensive network of submarine cables in the Atlantic Ocean. Key features include:

- Atlantic Crossing Cables:** GTT Atlantic, GTT Express, TAT-14, Atlantic Crossing-1, AEC-1, and others.
- European Connections:** Pan European Crossing, Celtic, UK-Channel Islands-7, UK-Channel Islands-8, HUGO, and others.
- African Connections:** Canalink, Subcan Link 1, Subcan Link 2, TRANSCAN-3, and others.
- Other Cables:** Columbus-III, CAM-Link, AFOS, and others.

The map shows the geographical distribution of these cables, connecting major hubs in Europe, Africa, and the Americas. The Atlantic Ocean is labeled at the bottom, and the word "Connections" is visible on the left side.

- 

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- Safety of navigation
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- Risk Management
- Communications
- Engineering,



Hydrography

Sustainable blue economy vital for small countries and coastal populations



© Unsplash/Benjamin L. Jones - Seagrass meadows - expanses of green, grass-like shoots and flowers - are a hugely effective nature-based solution to climate change.

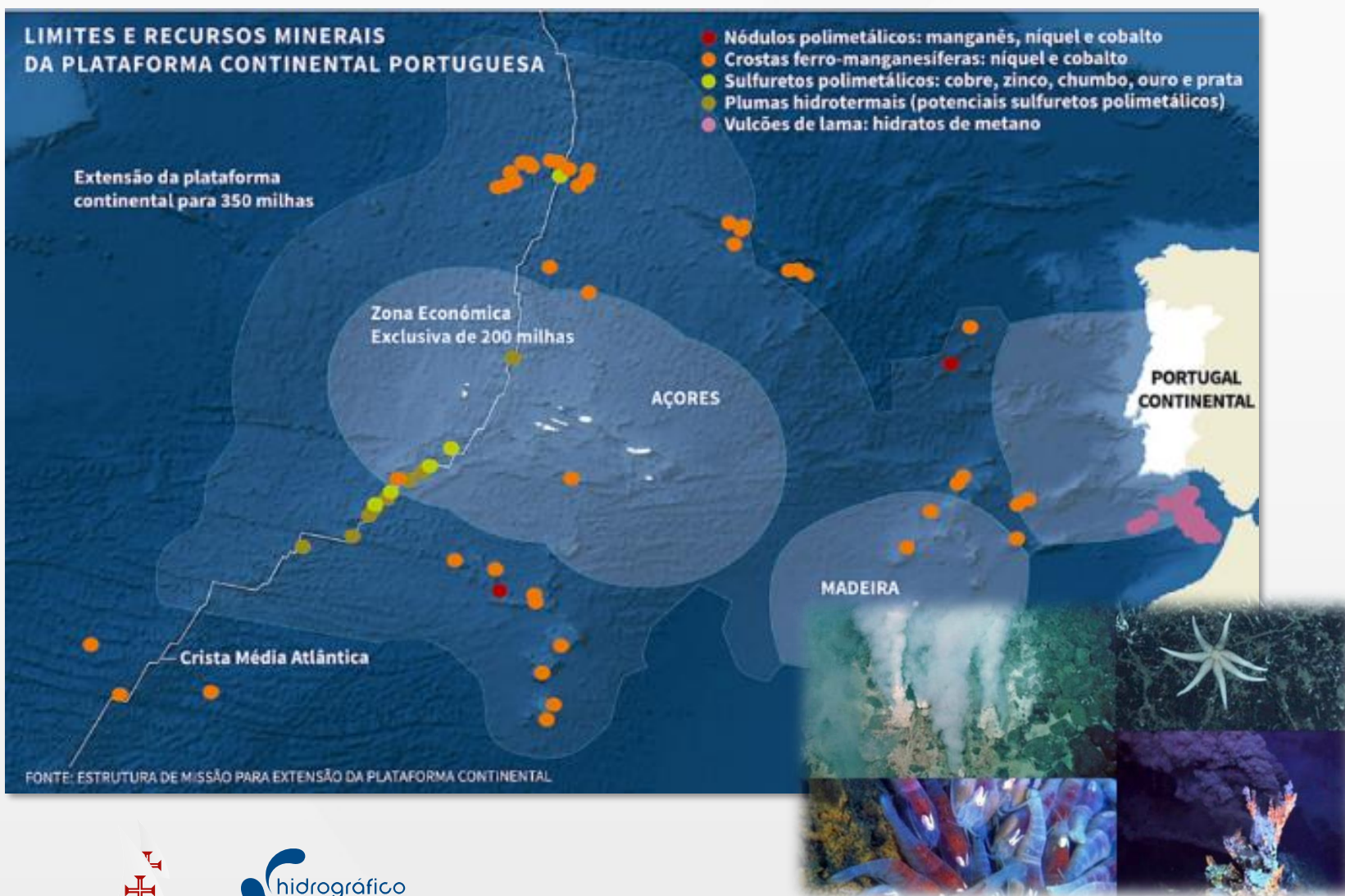
With the livelihoods of about 40 per cent of the world's population living at or near a coast, the second day of the **UN Ocean Conference** under way in Lisbon focused on **strengthening sustainable ocean-based economies, managing coastal ecosystems**.



- Safety of navigation
- Marine tourism,
- National Marine spatial data infrastructures,
- Managing, maritime boundaries, Coastal zone
- Risk Management
- Communications
- Engineering,
- Marine science,

Hydrography

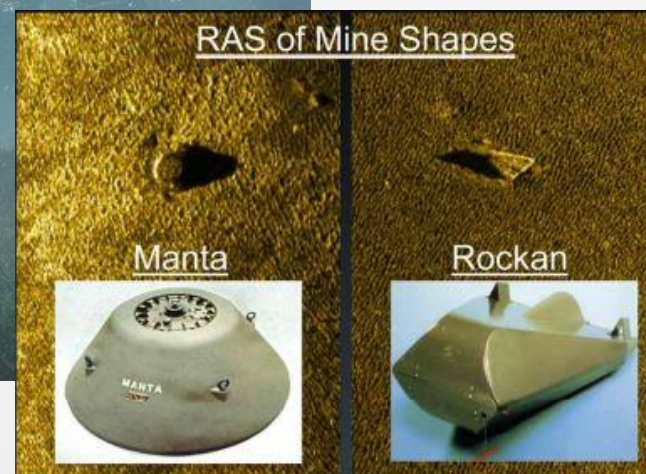
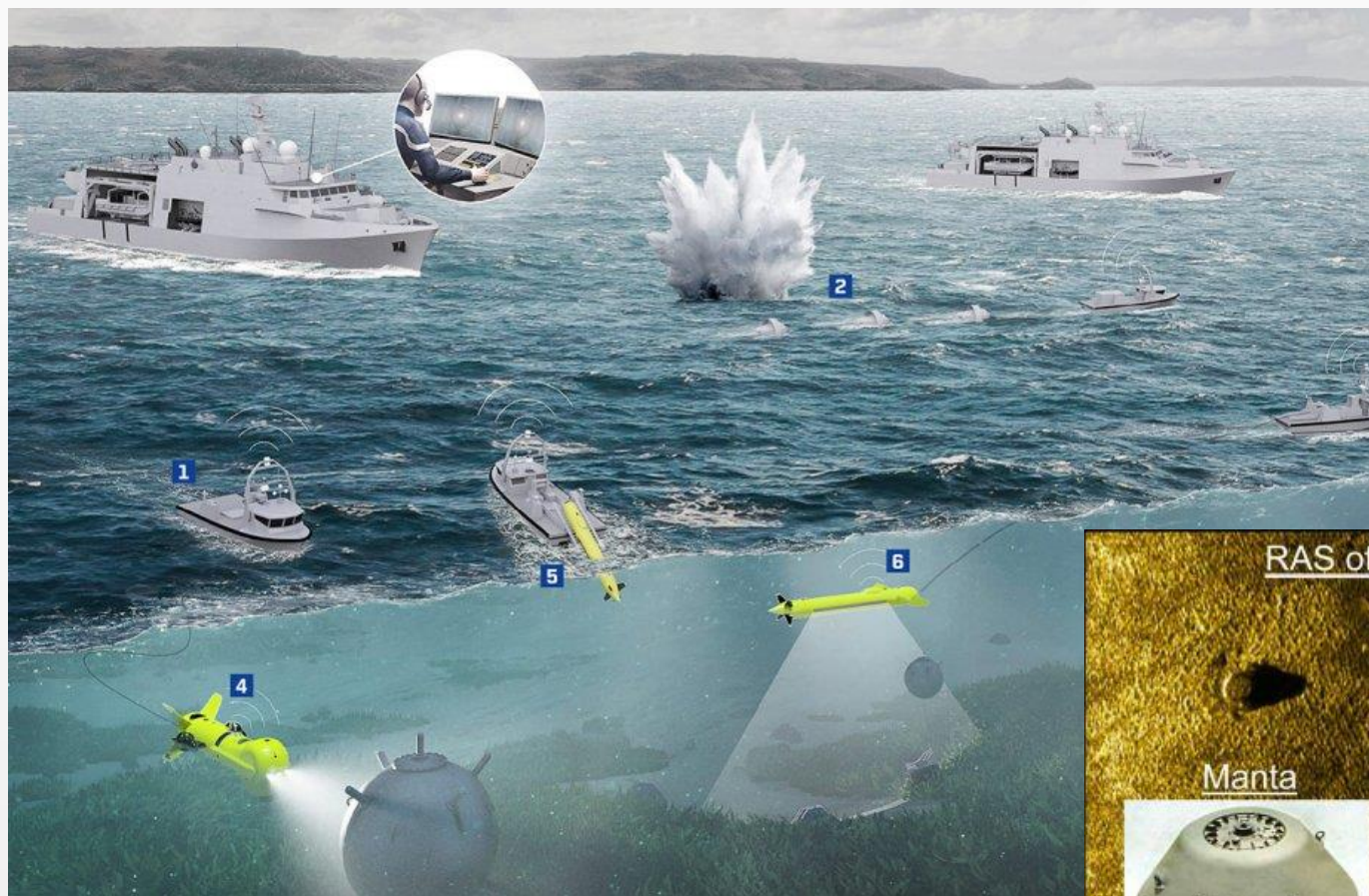
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- Safety of navigation
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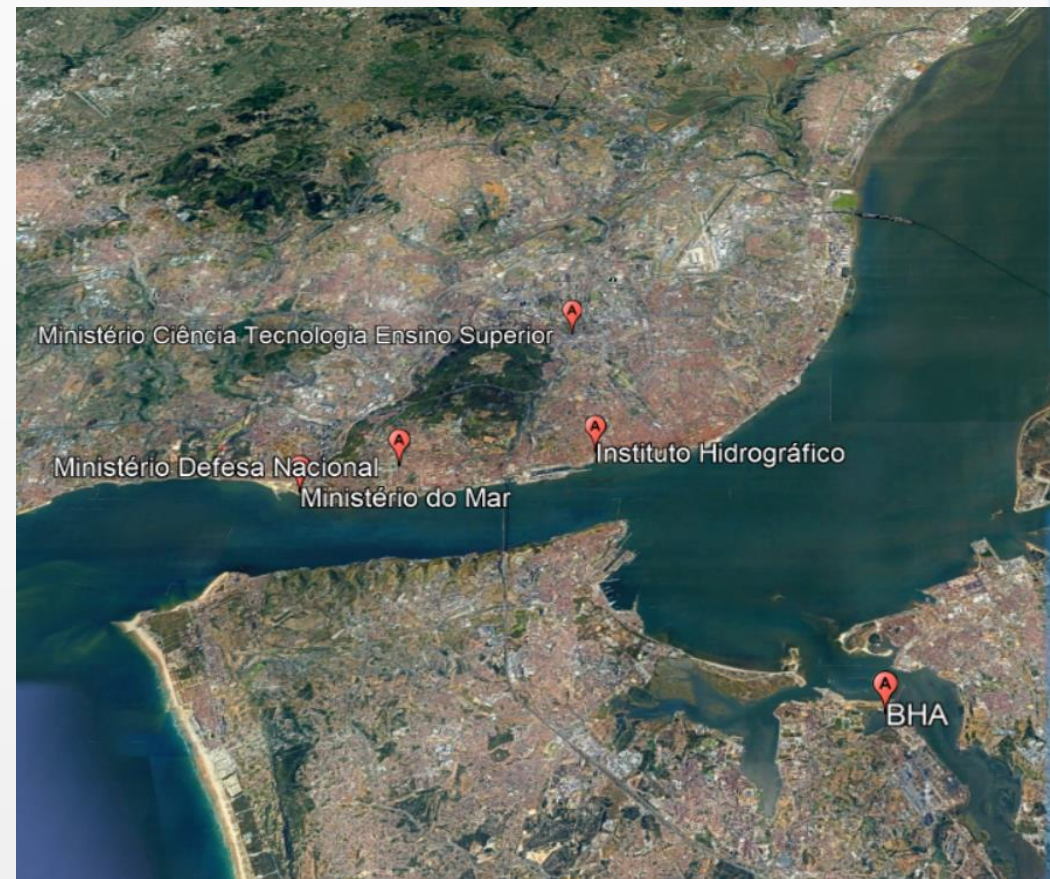
Hydrography

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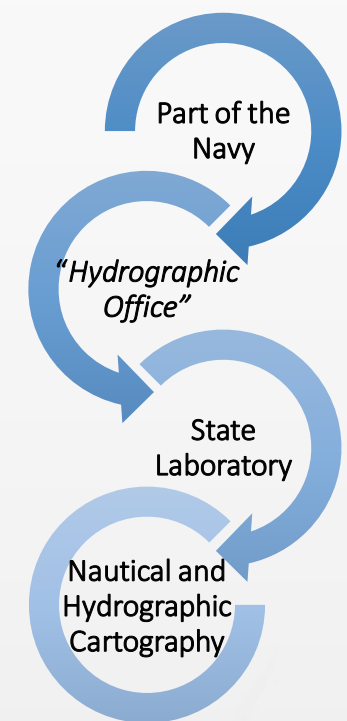


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- Tsunami and tidal modelling,
- Maritime defence and security

Hydrographic Base Seixal



Legal Review

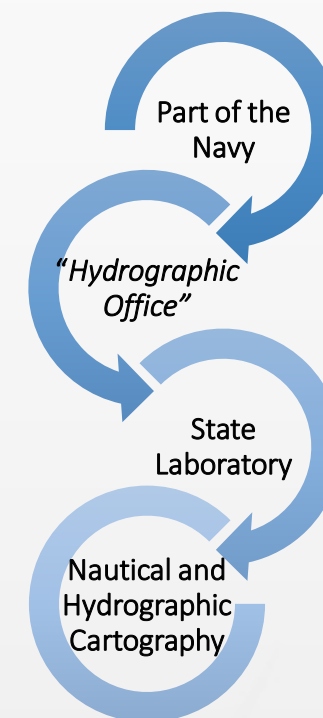


IH PT

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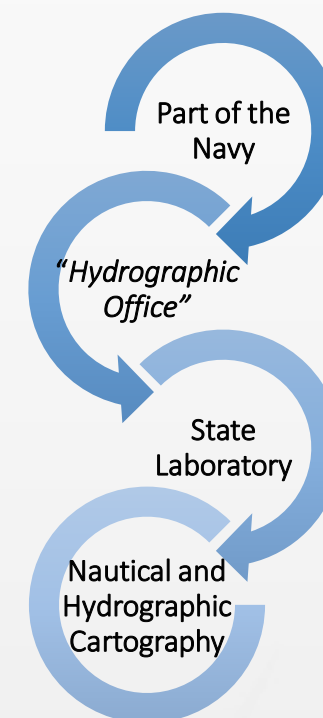


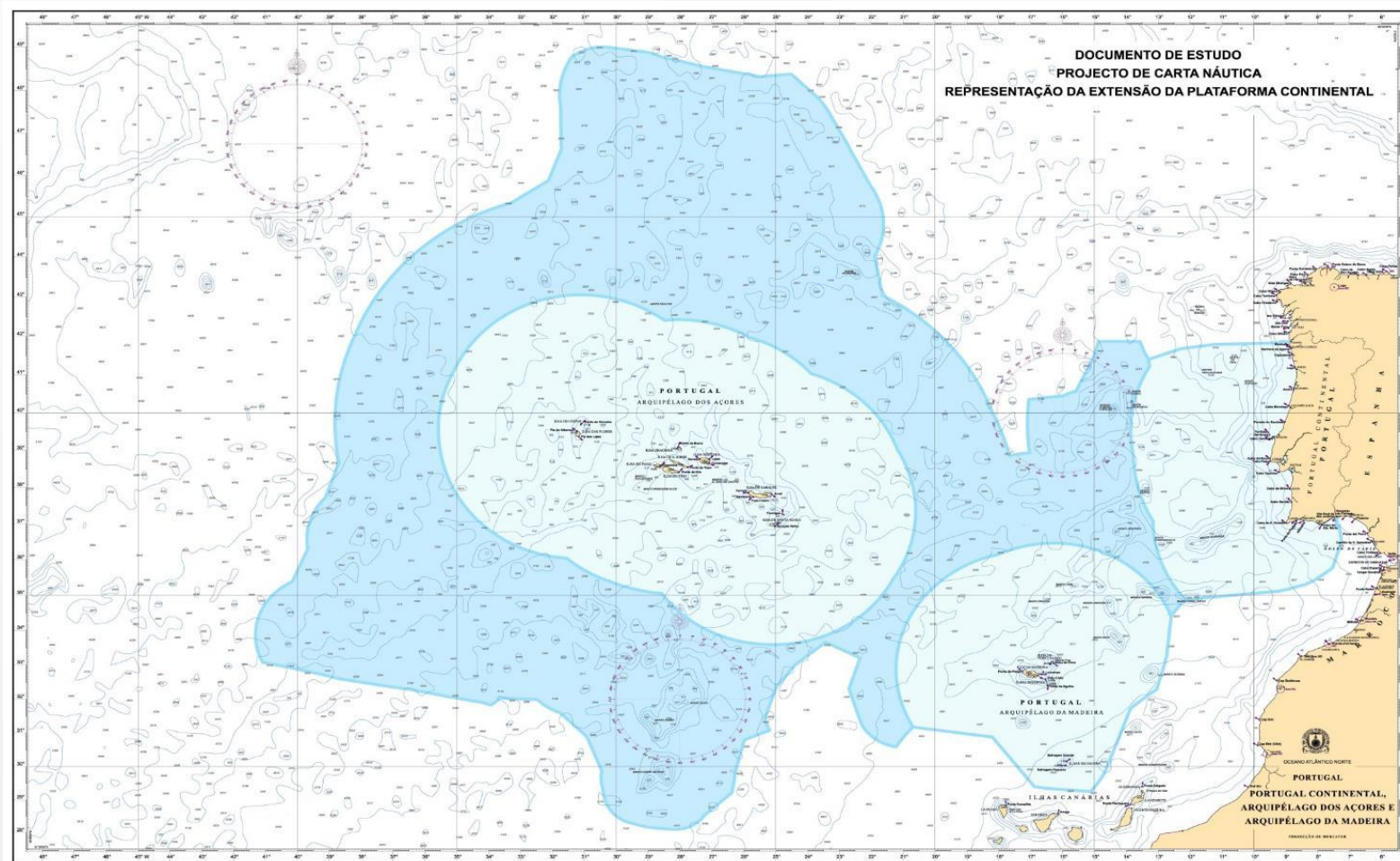
IH PT

- **Portuguese Navy body** with administrative and financial autonomy;
- **Hydrographic Office** and **Research Lab** integrated in the **Portuguese Research Laboratories Network**;
- Regulates **Hydrographic cartography** and responsible for **Nautical cartography**;
- Under strategic supervision of the :
 - **Ministry of Defense**, together with,
 - **Ministry of Science, Technology and Higher education**,
 - **Ministry of the Economics and Sea.**



Legal Review

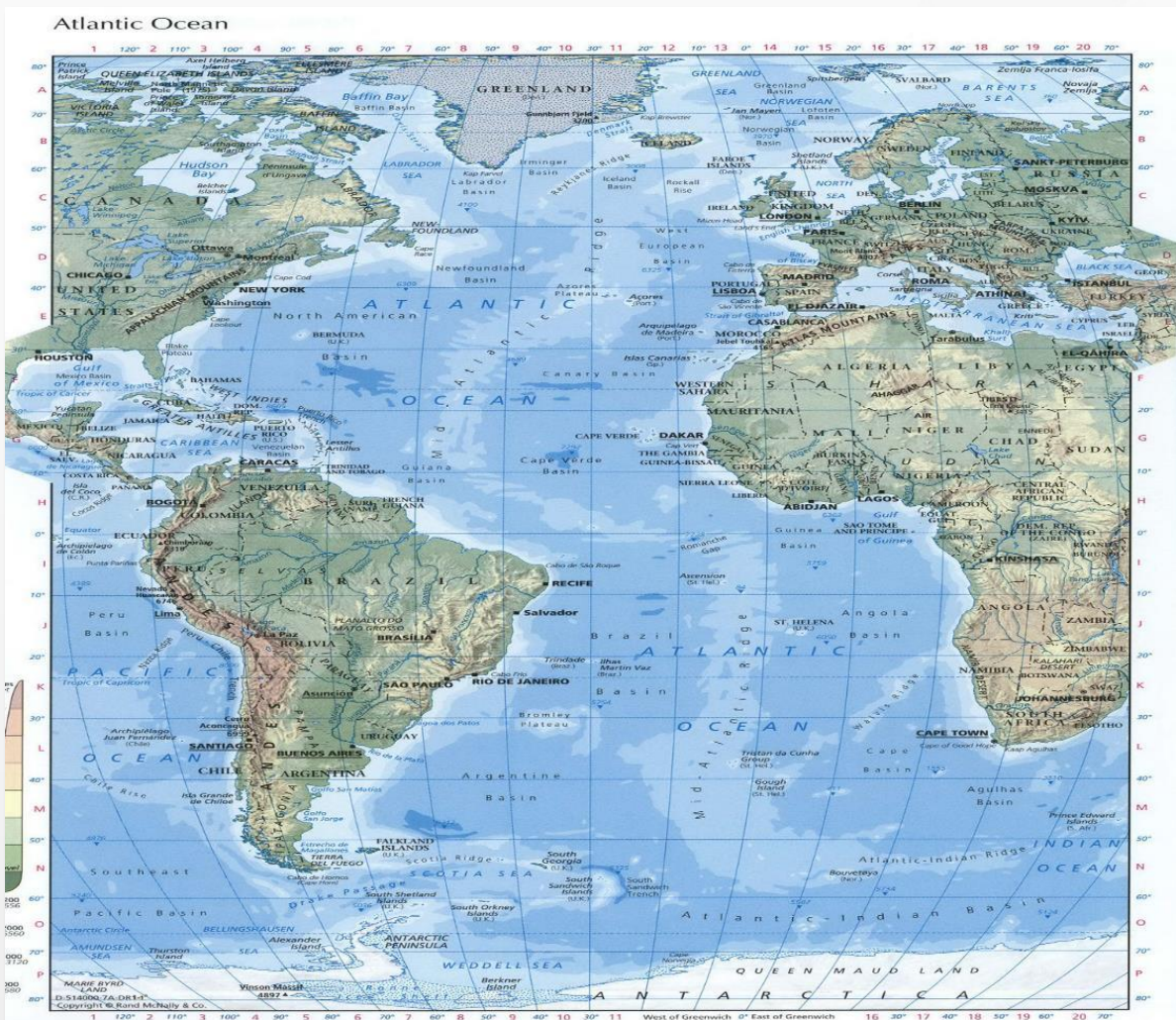




Maritime Areas of Interest

IH PT

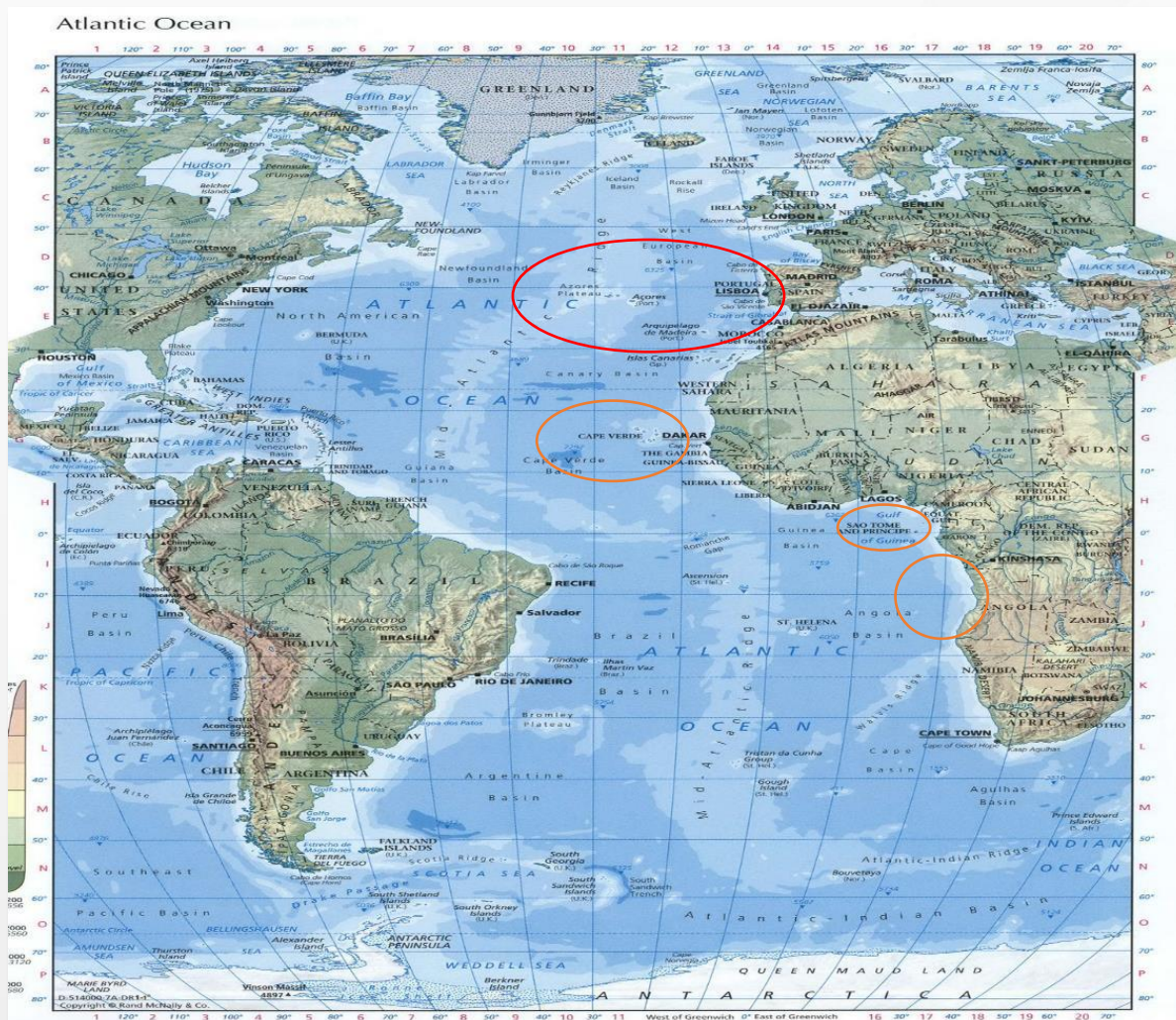
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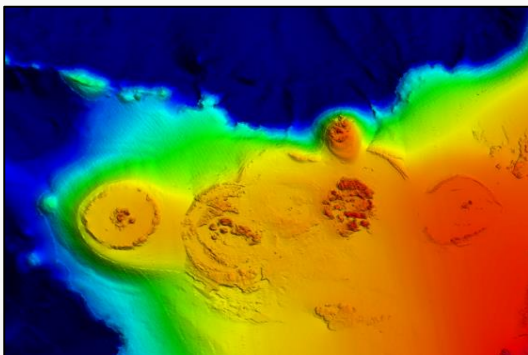
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Maritime Areas of Interest

Hydrography



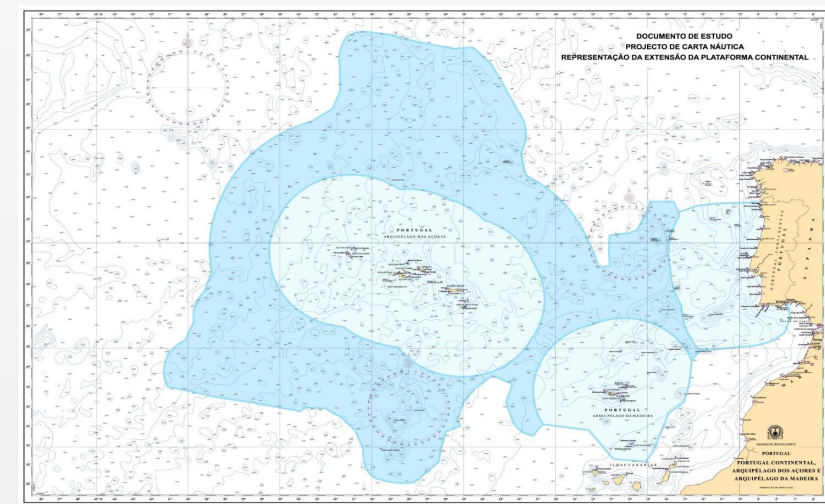
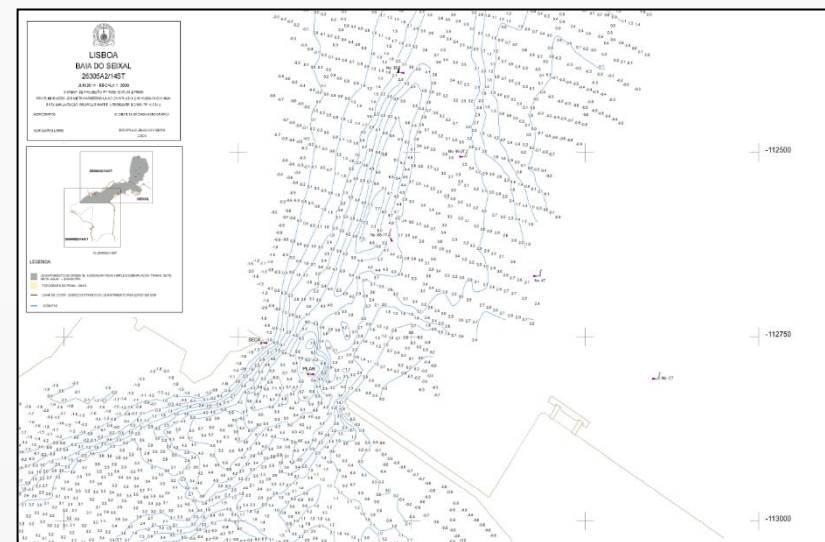
Geology



Oceanography



Marine Chemistry



Nautical Cartography

Scope Marine Information

Hydrography

HI



QP

Marine Chemistry



Oceanography

OC



NV

Navigation



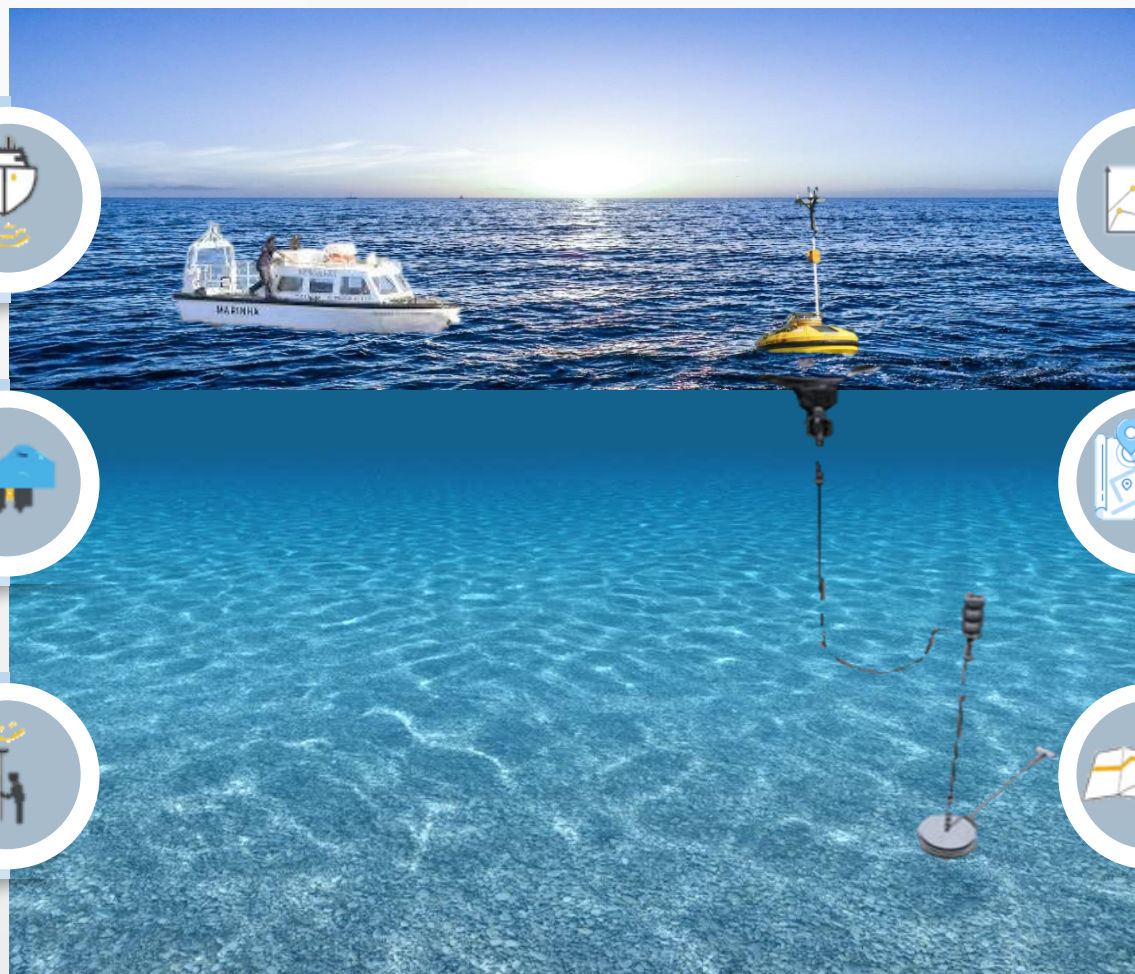
Marine Geology

GM



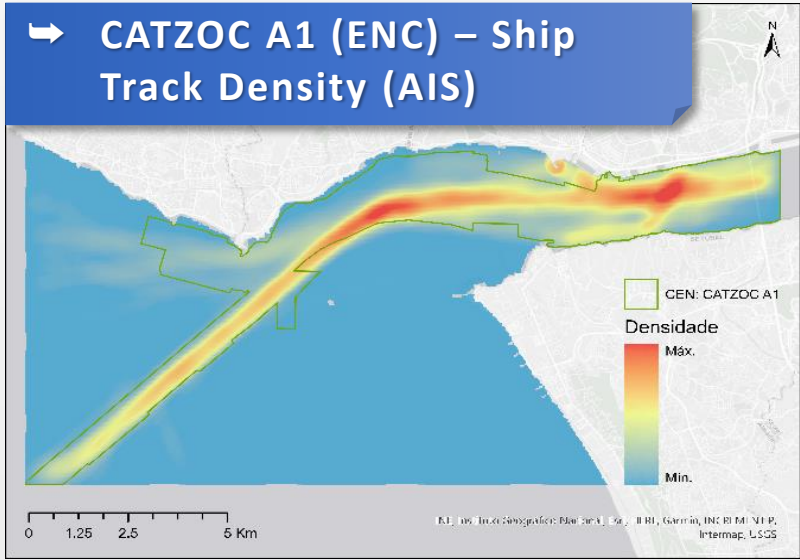
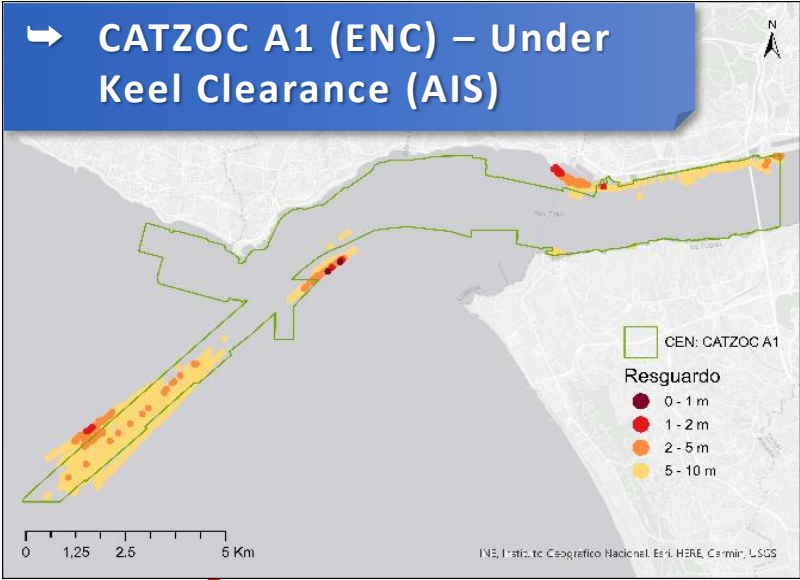
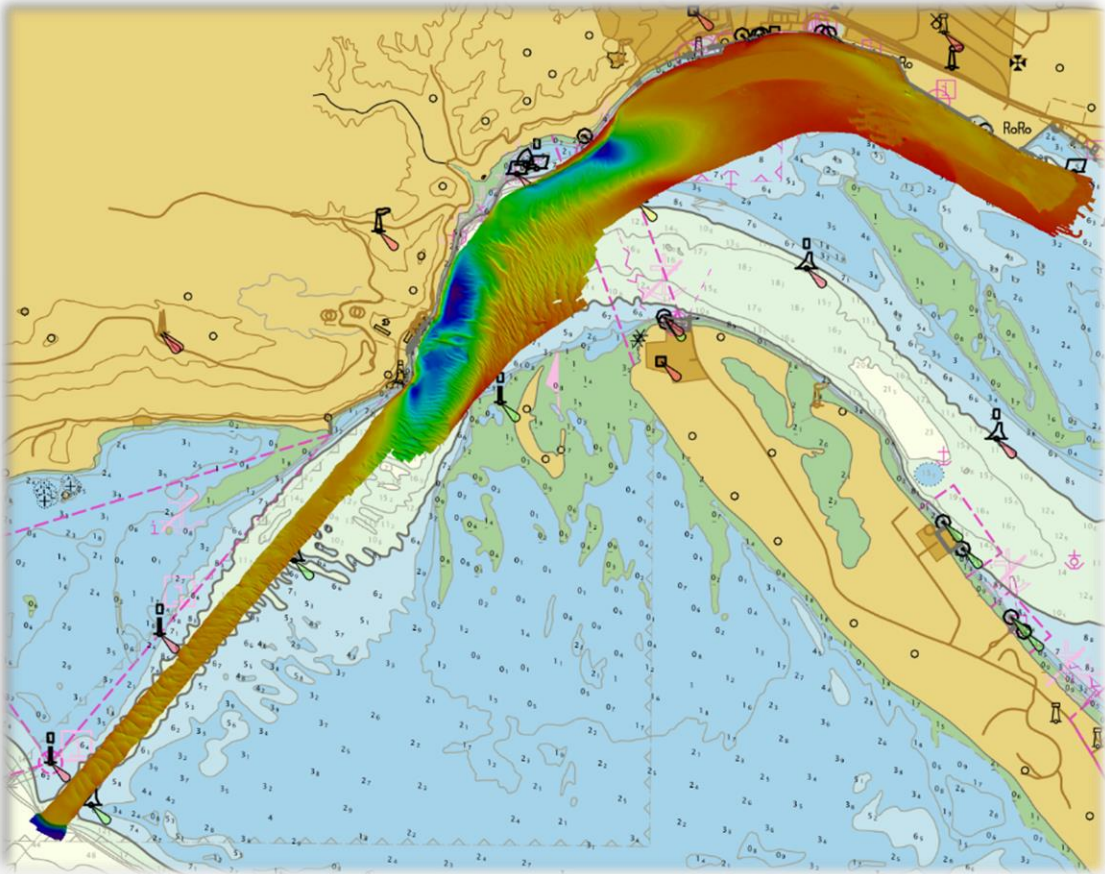
CN

Cartography



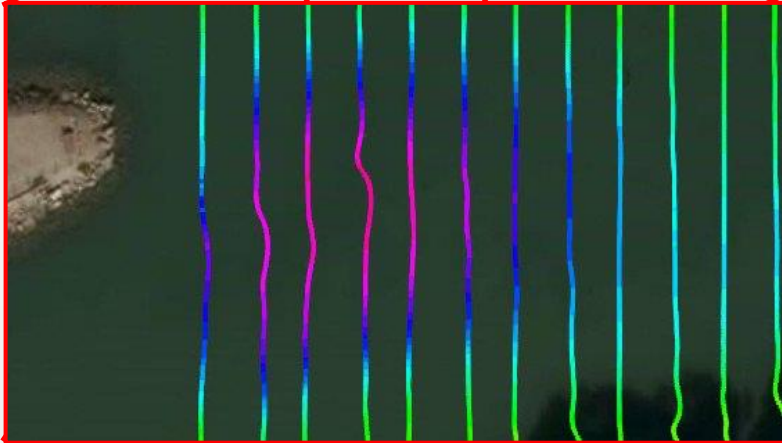
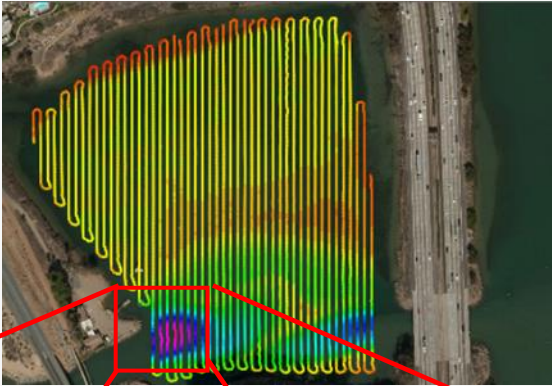
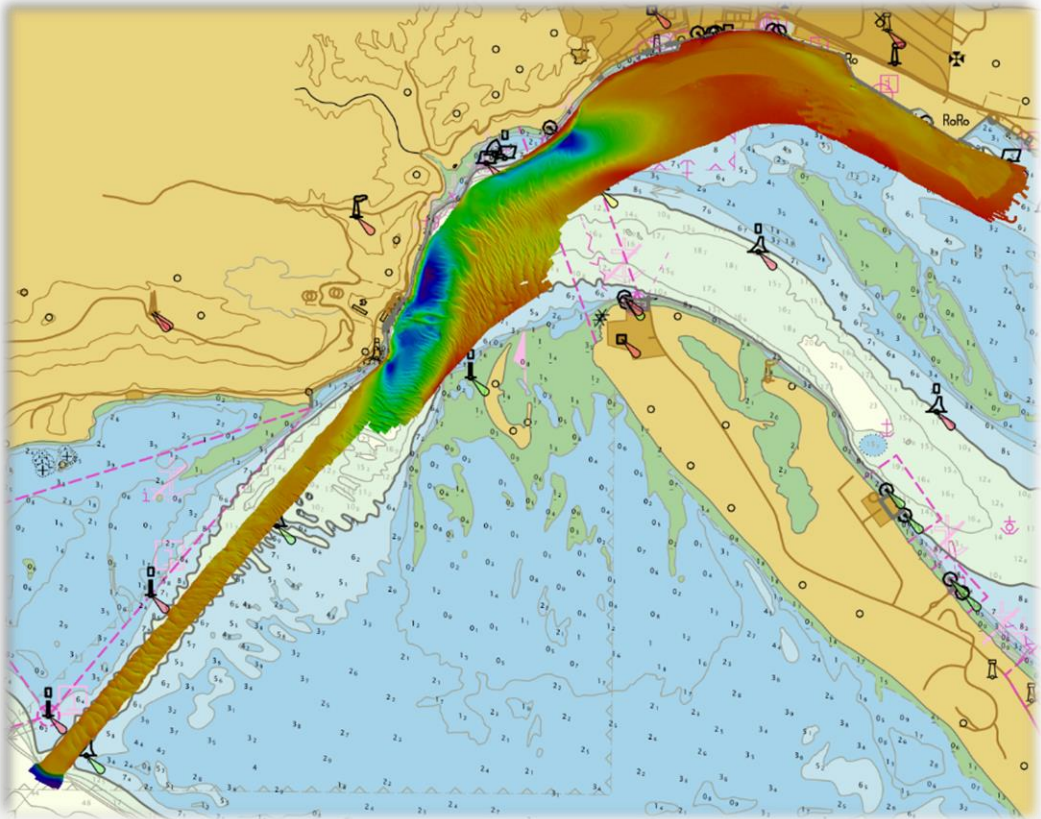
Blue Hydrography

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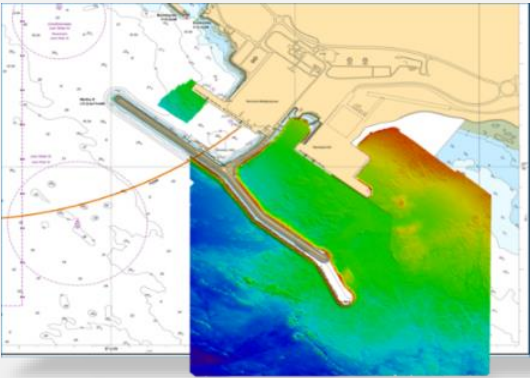
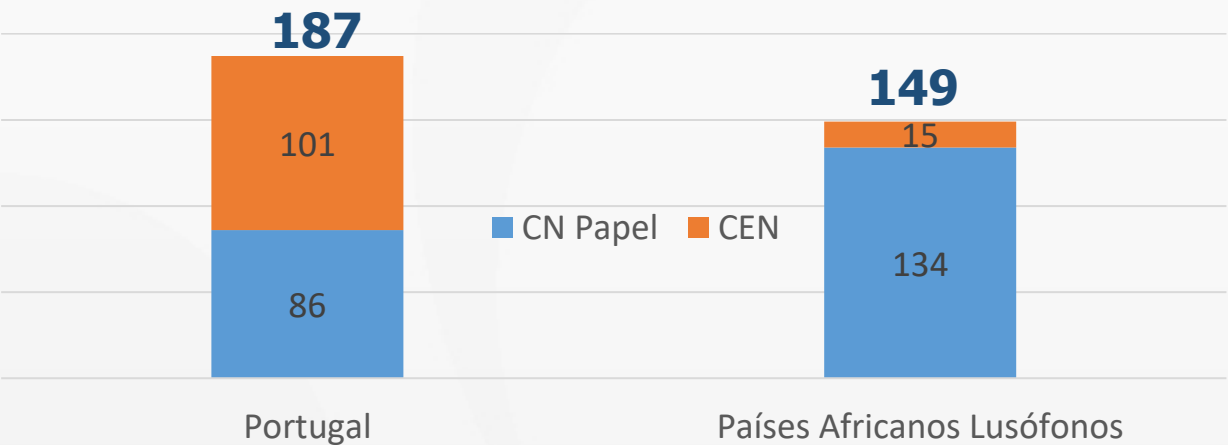


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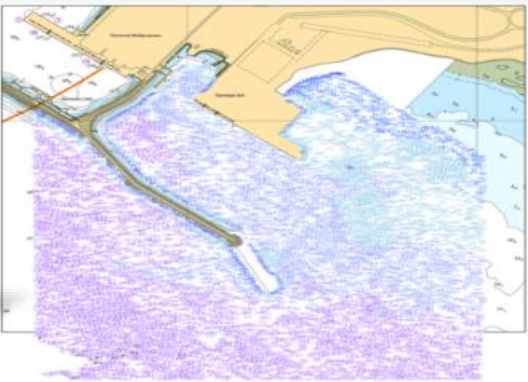
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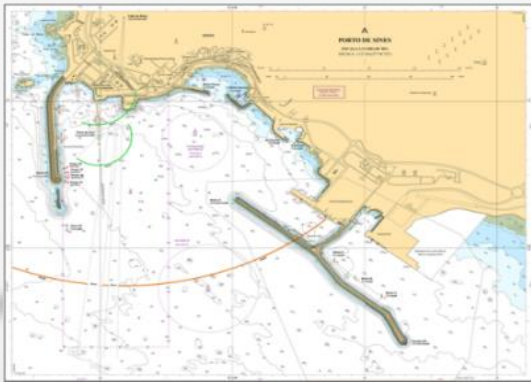
Blue Hydrography



Bathymetric Model
31 330 335 soundings

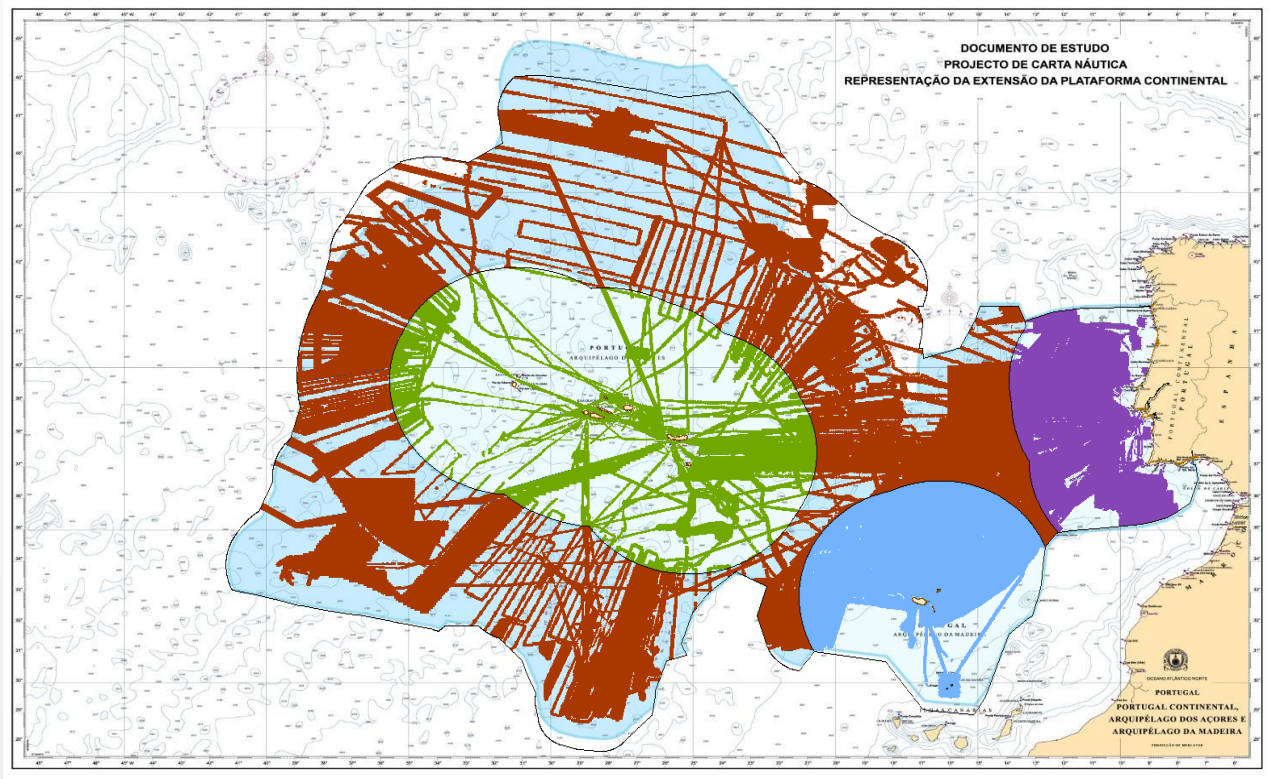


Sounding selection
331 286 sondas



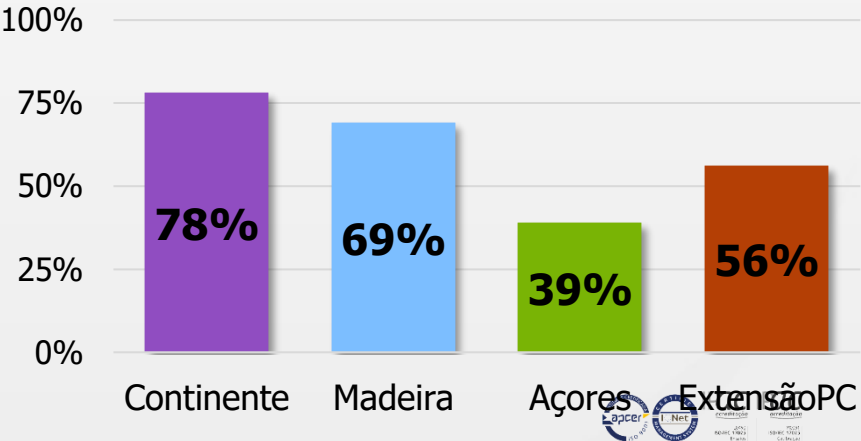
Nautical Chart
89 sondas

Blue Hydrography



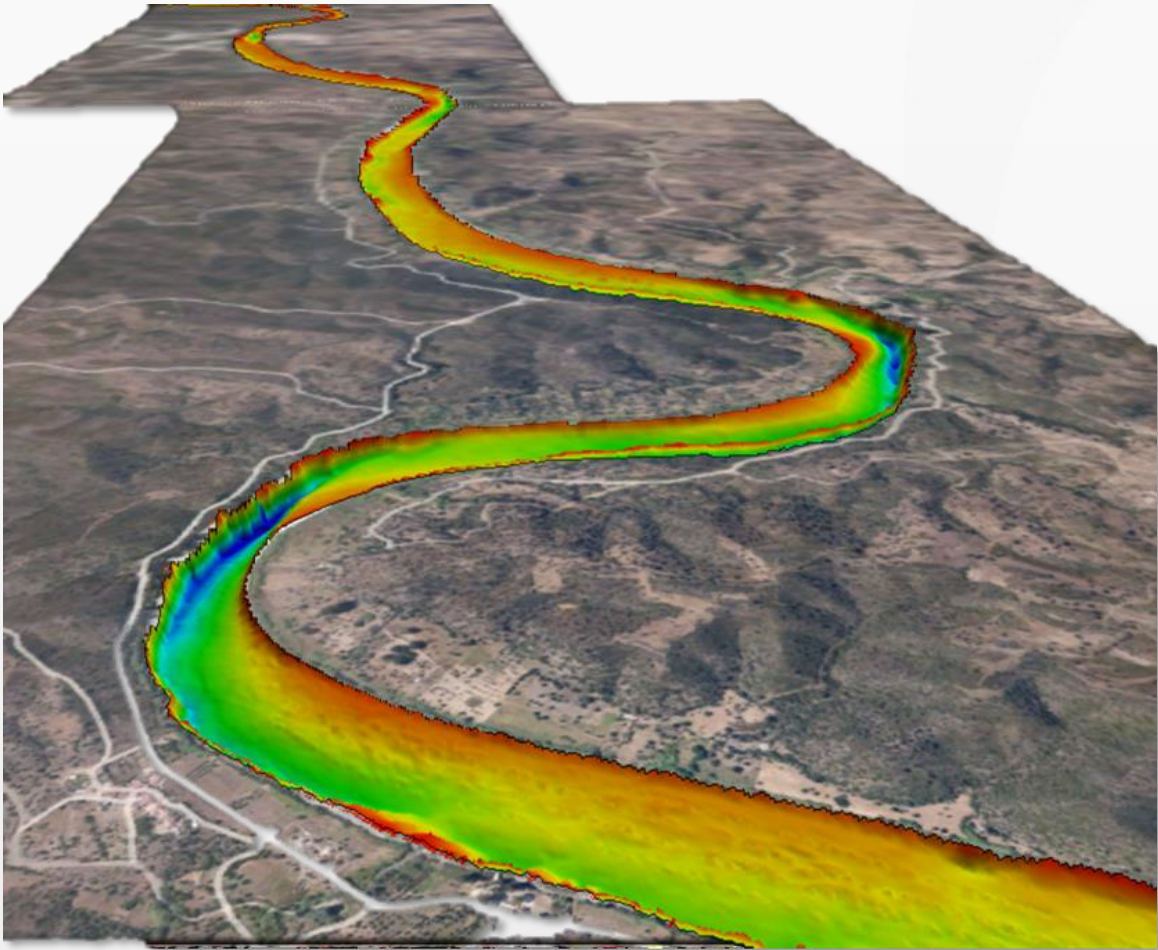
Sovereignty
Knowledge
Environment
Economy
Sustainability

Seamap 2030 Coverage

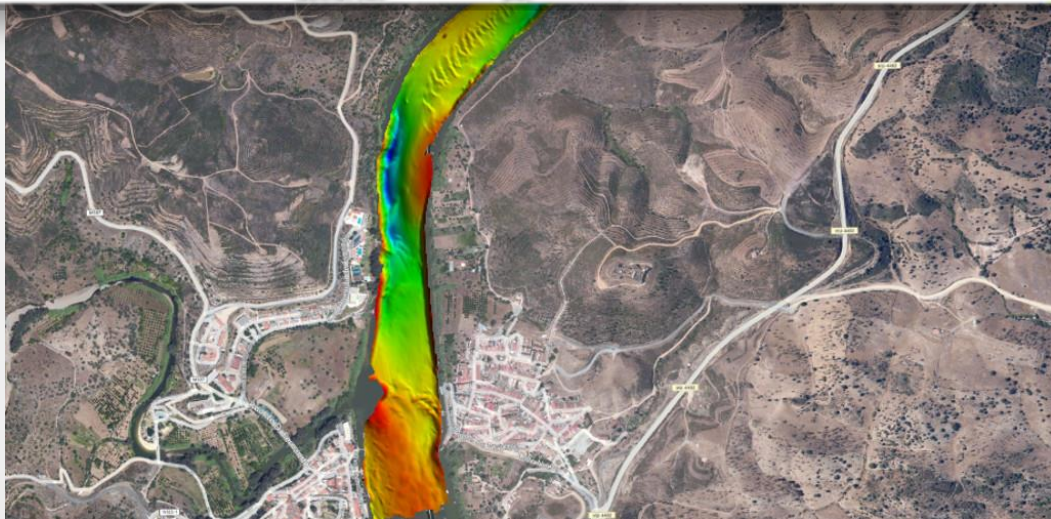
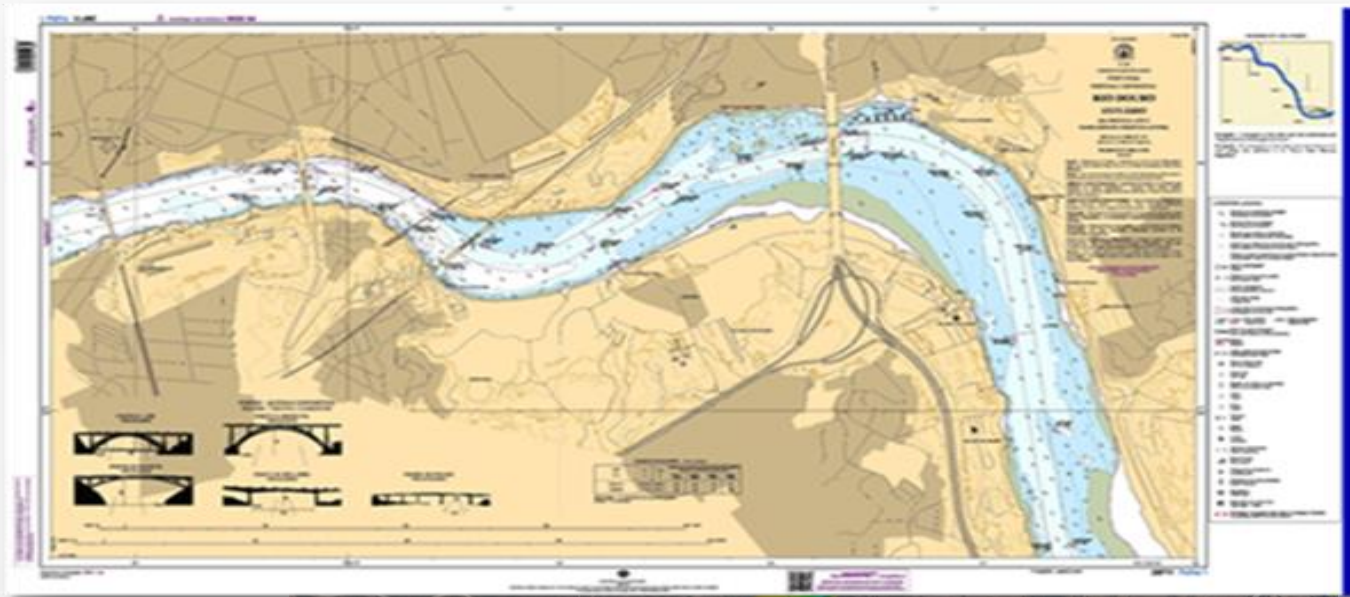
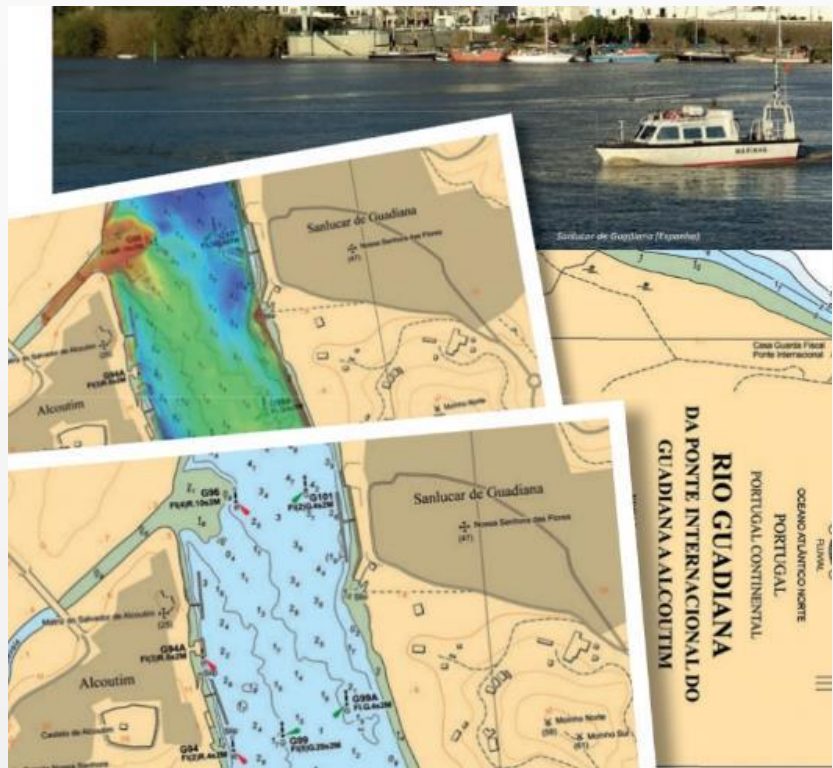


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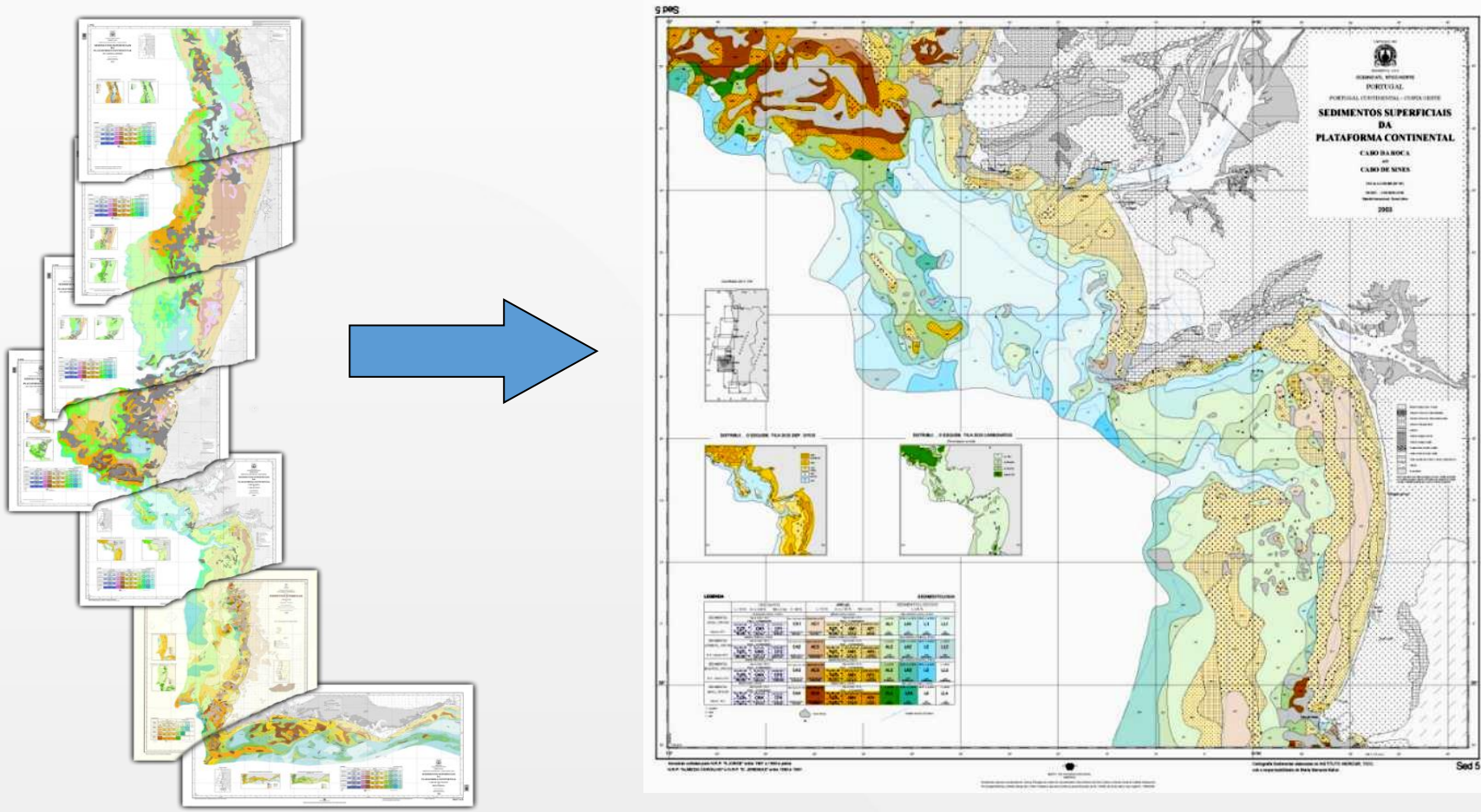
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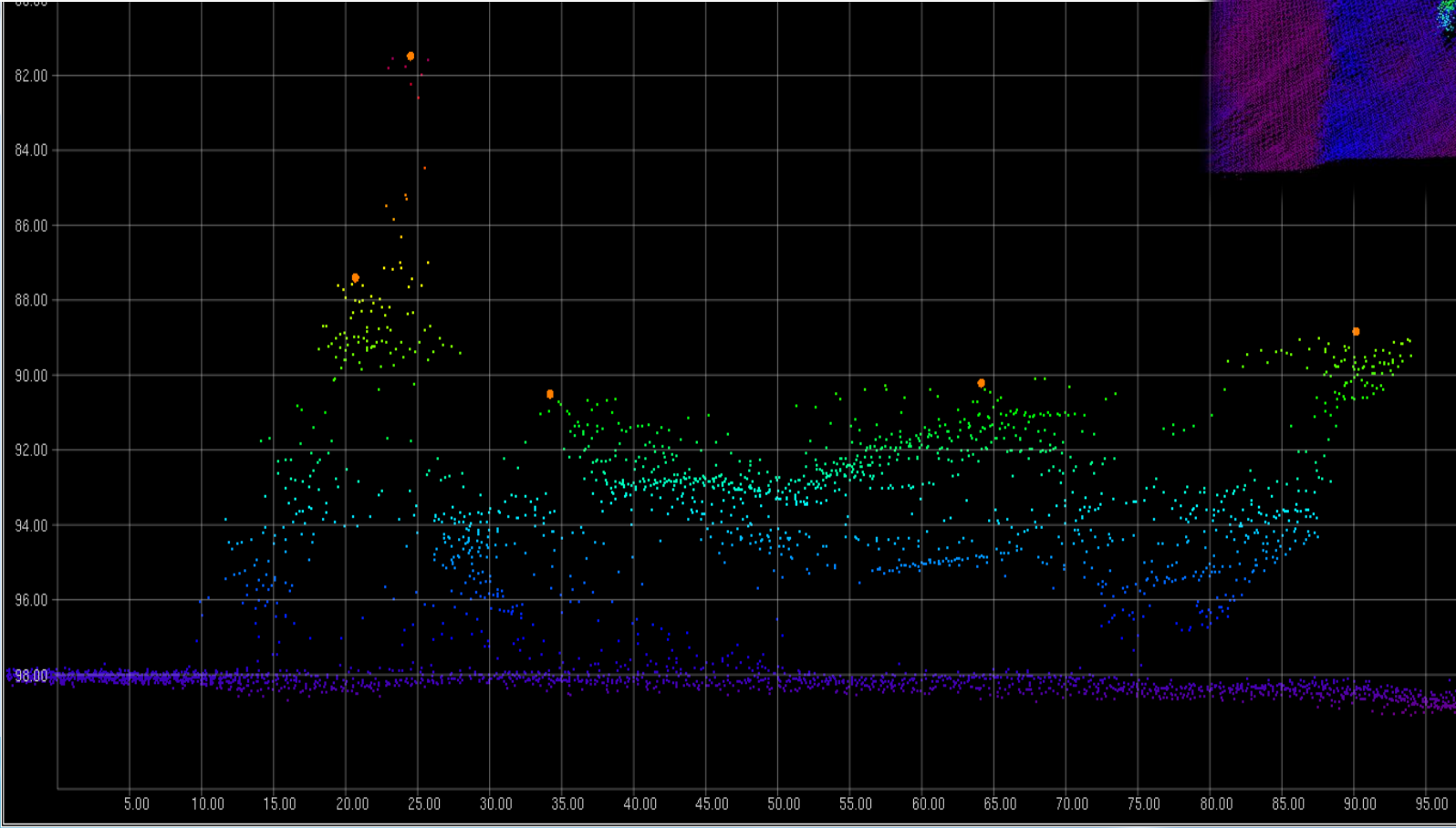
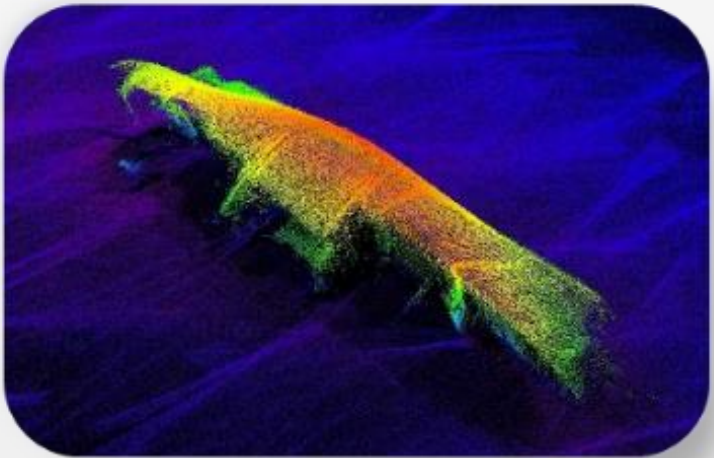
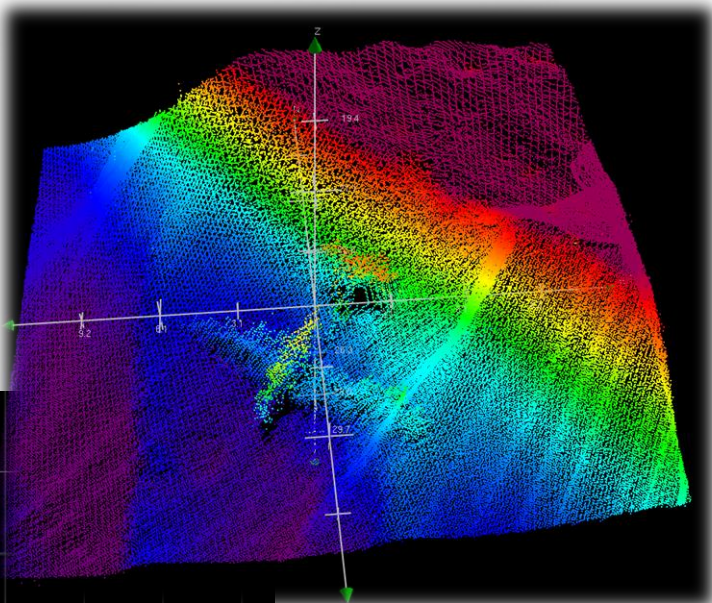


Blue Hydrography



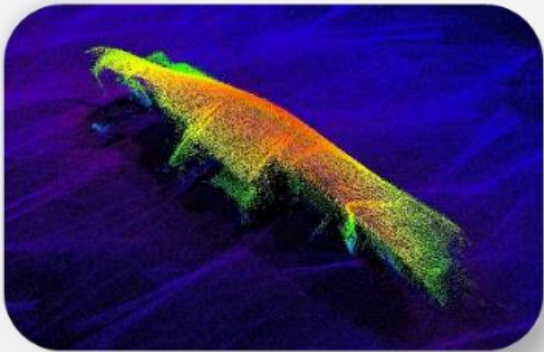
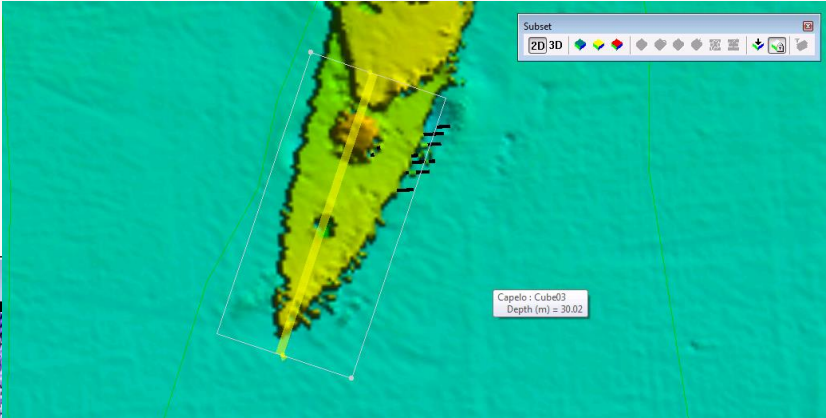
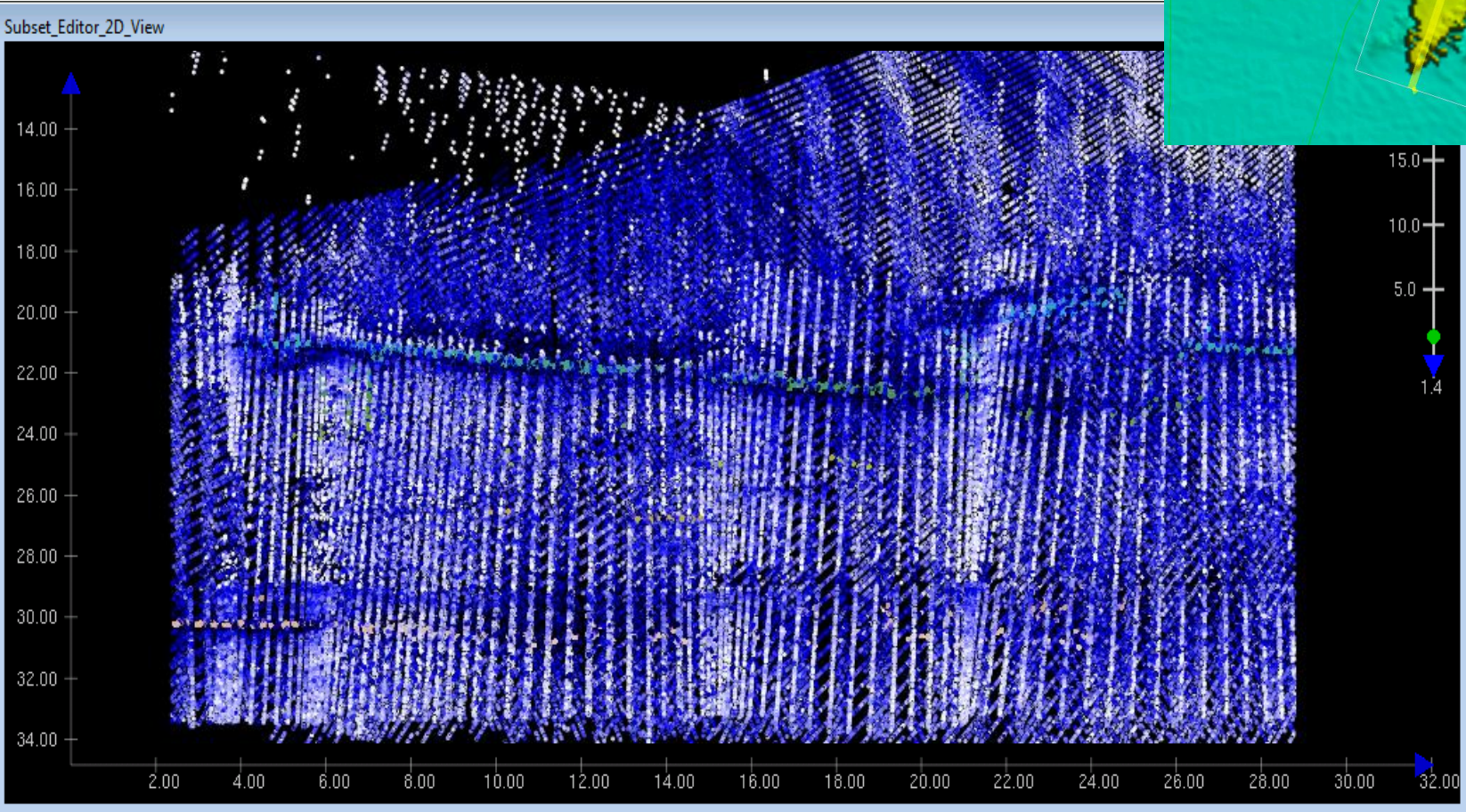
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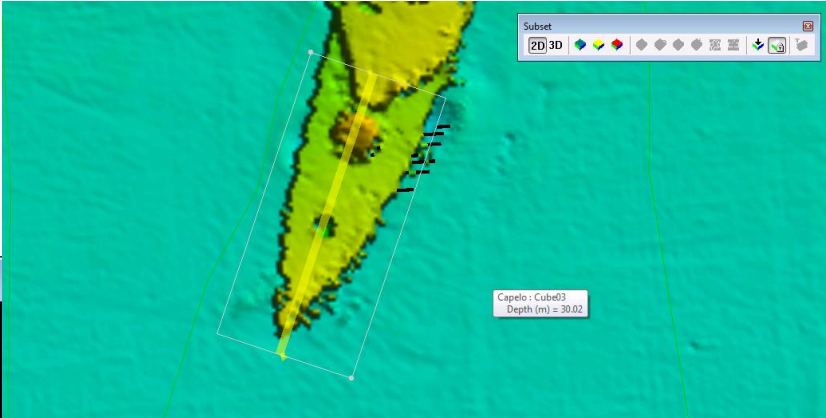
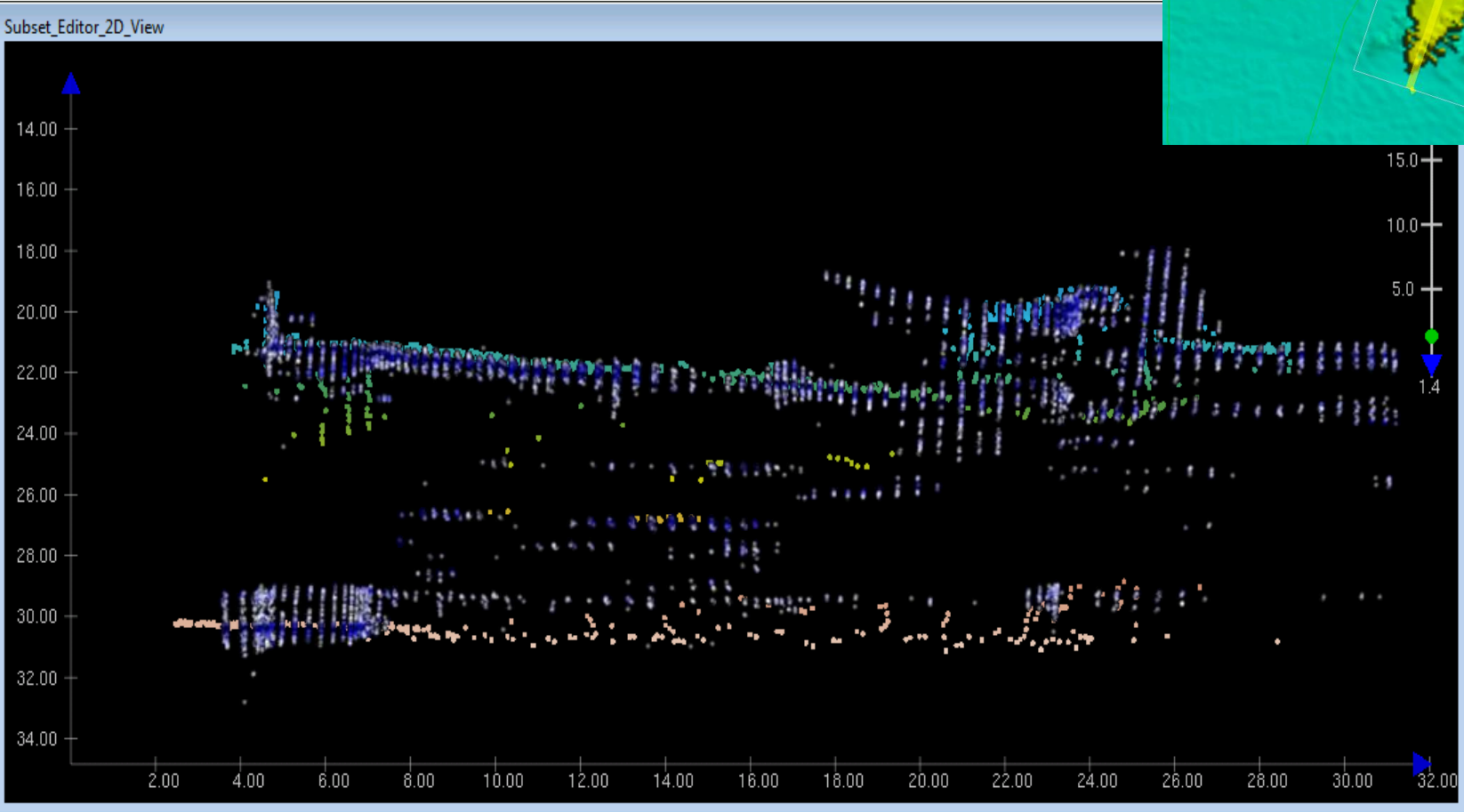
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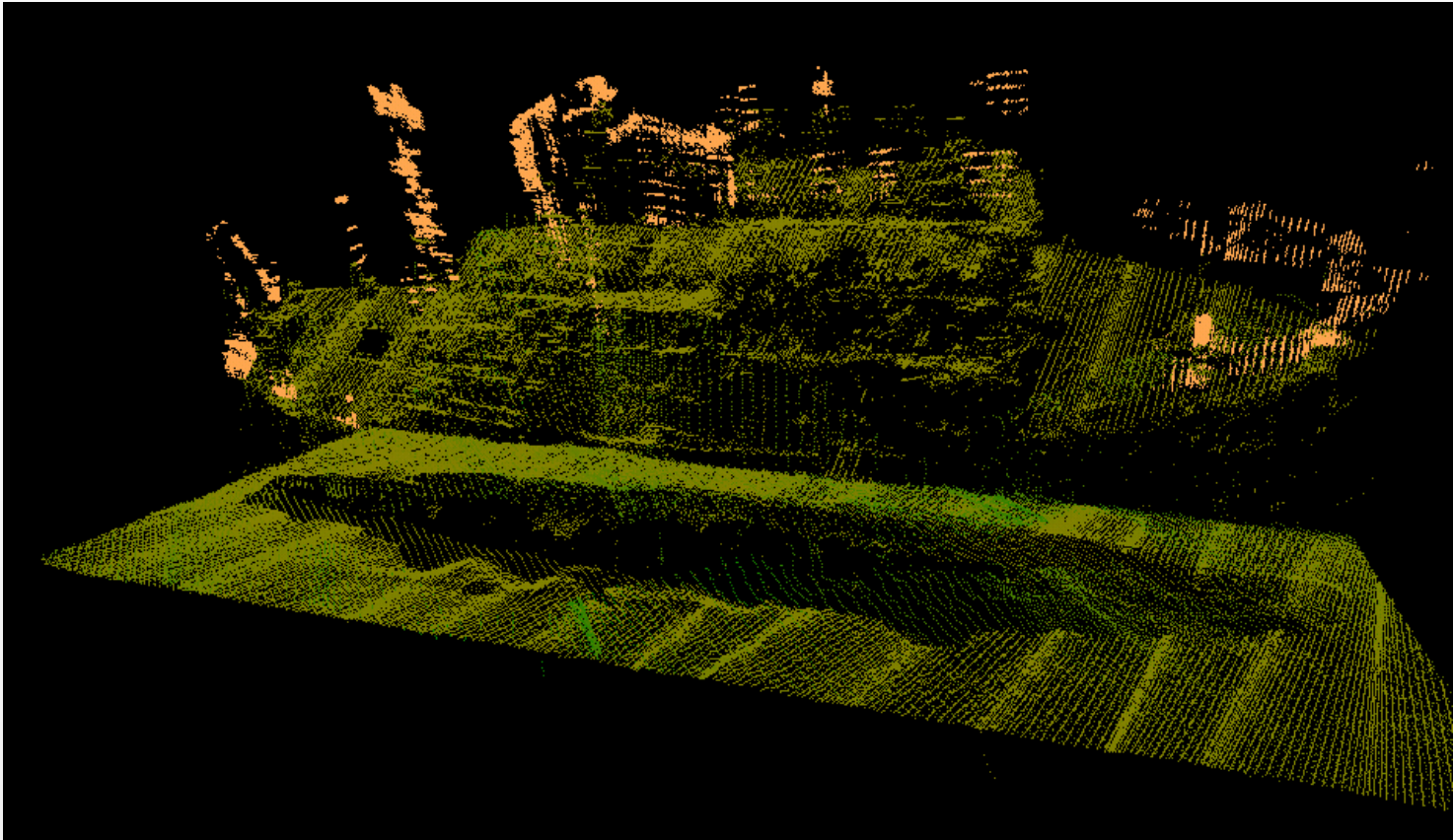
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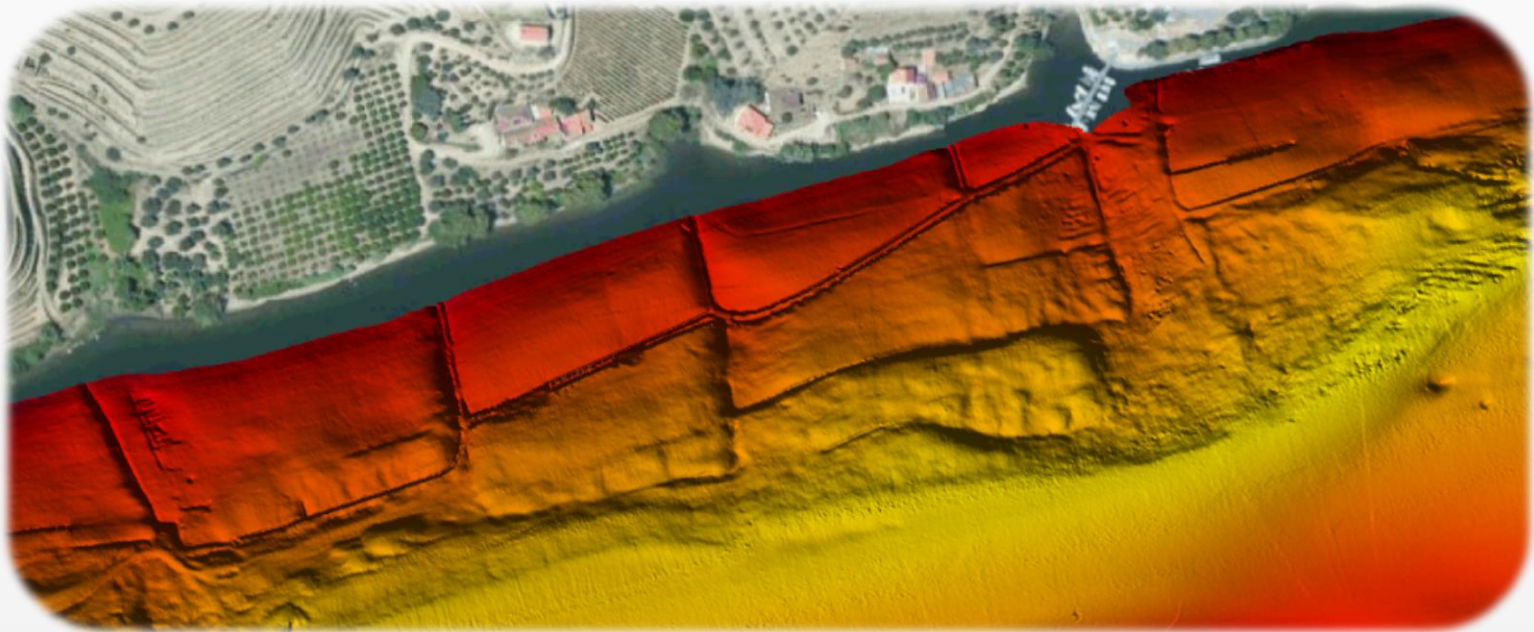


Photos © Ocean Revival



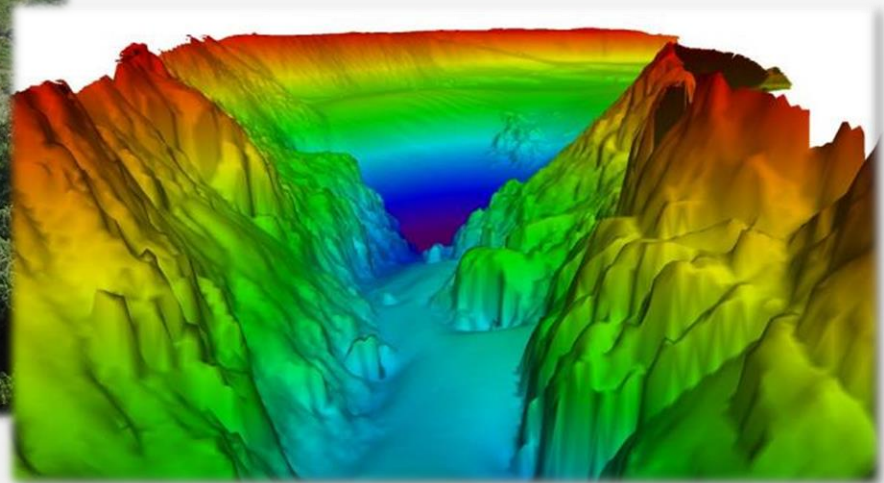
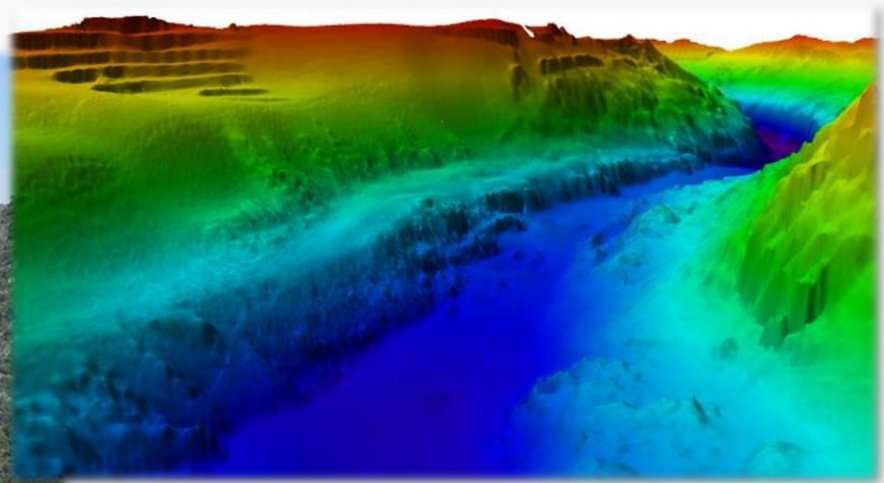
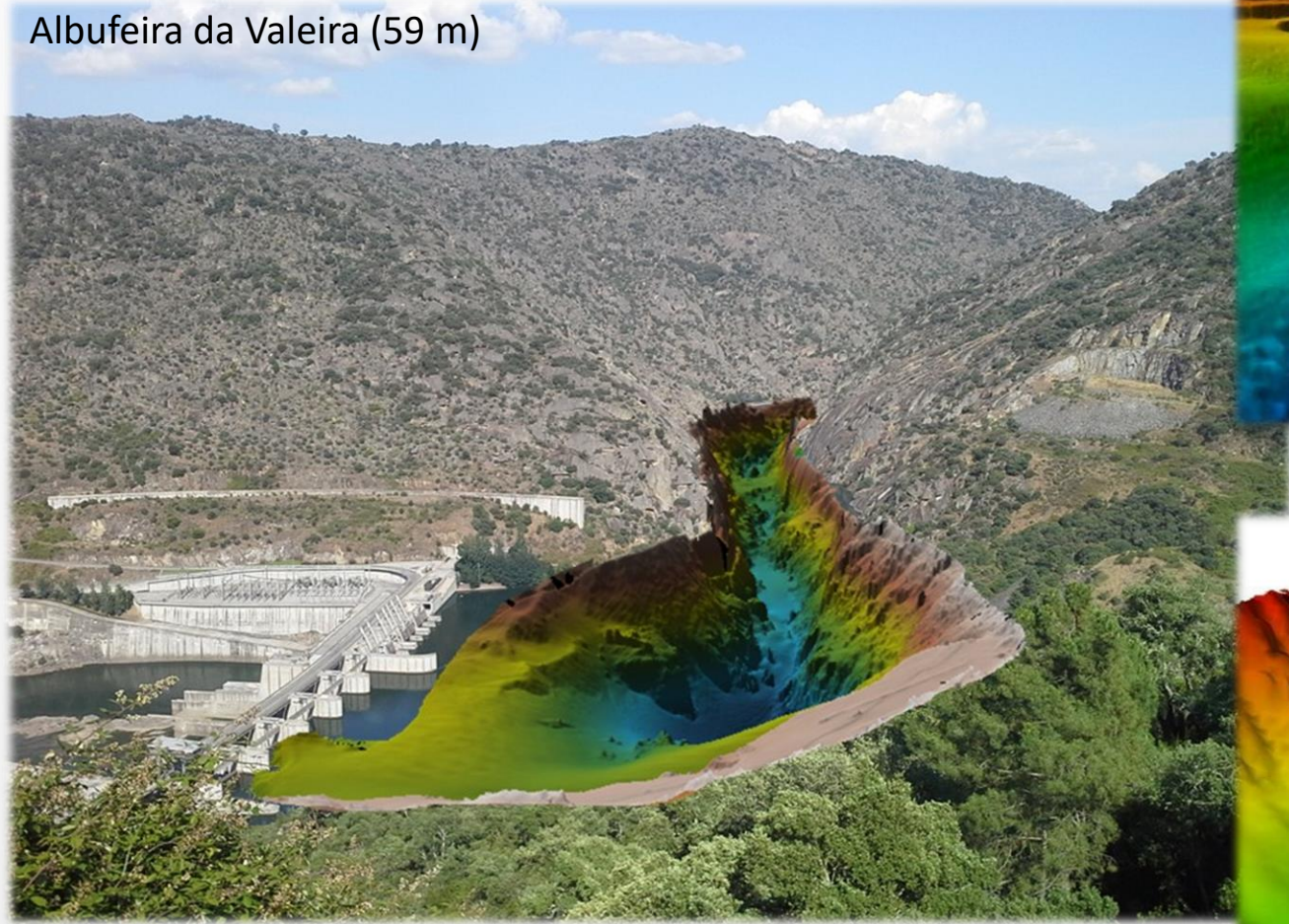
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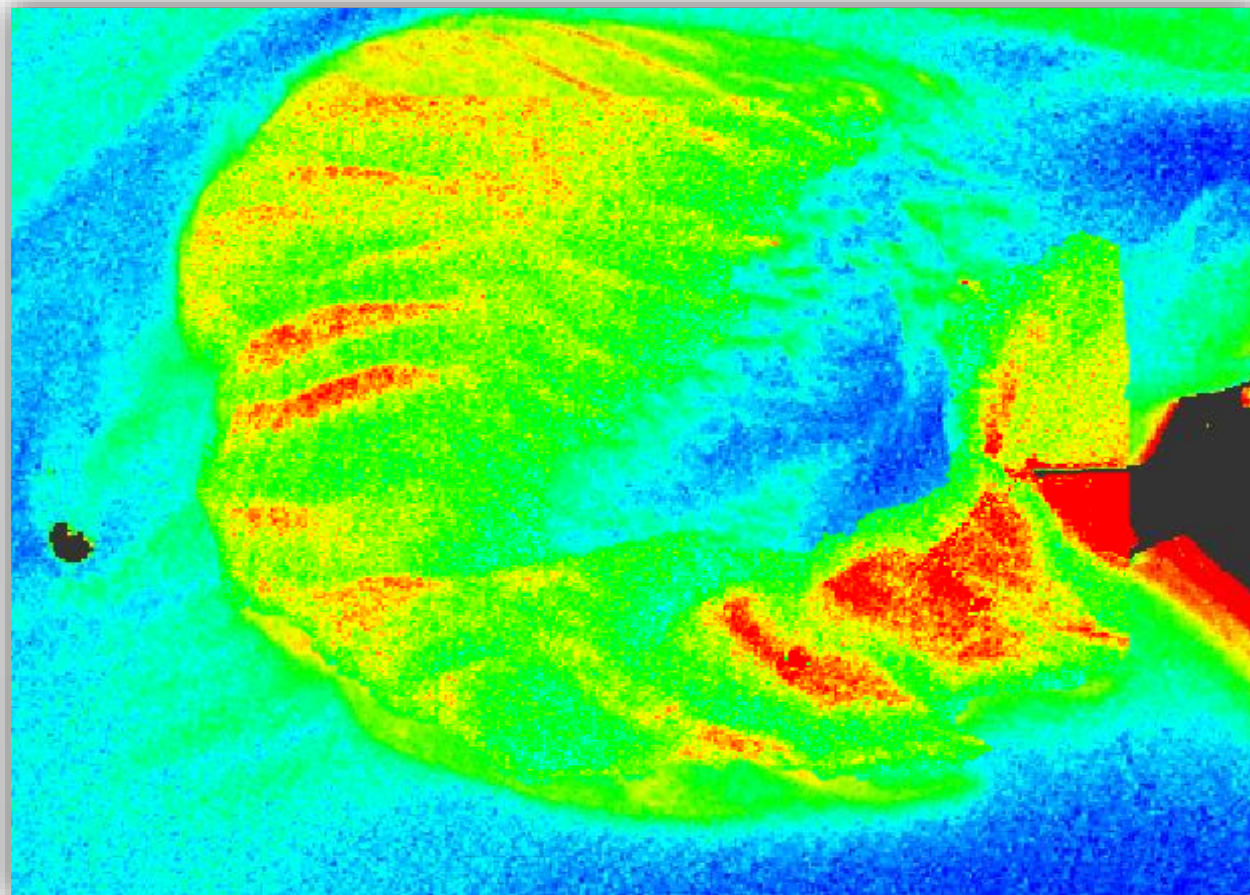
Blue Hydrography

Albufeira da Valeira (59 m)

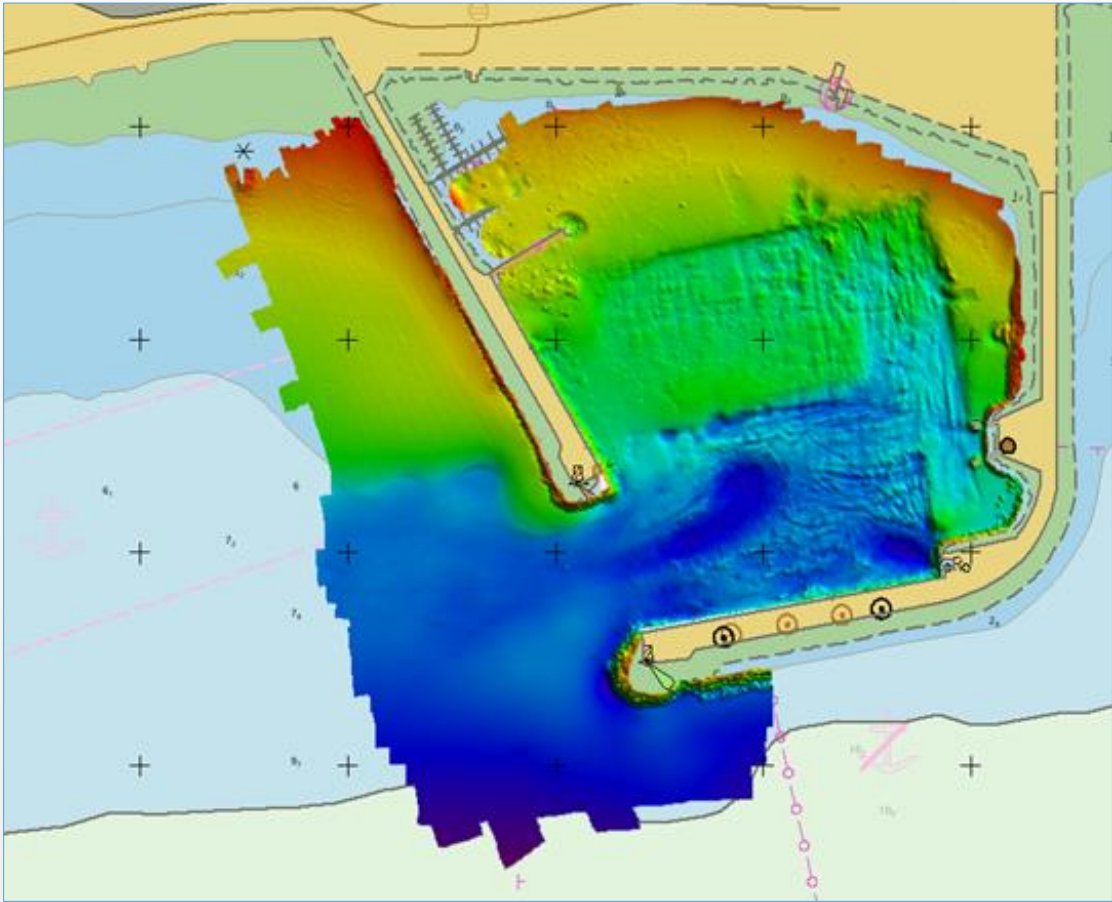


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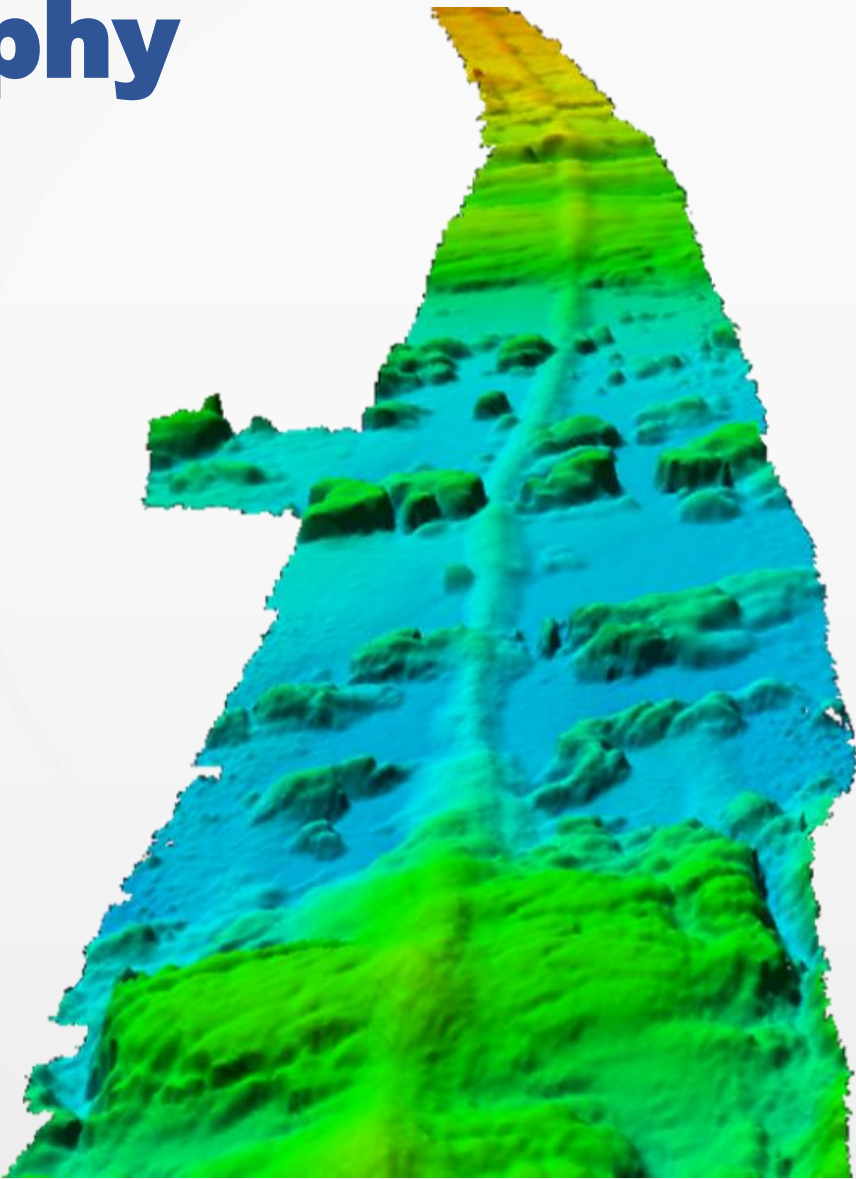
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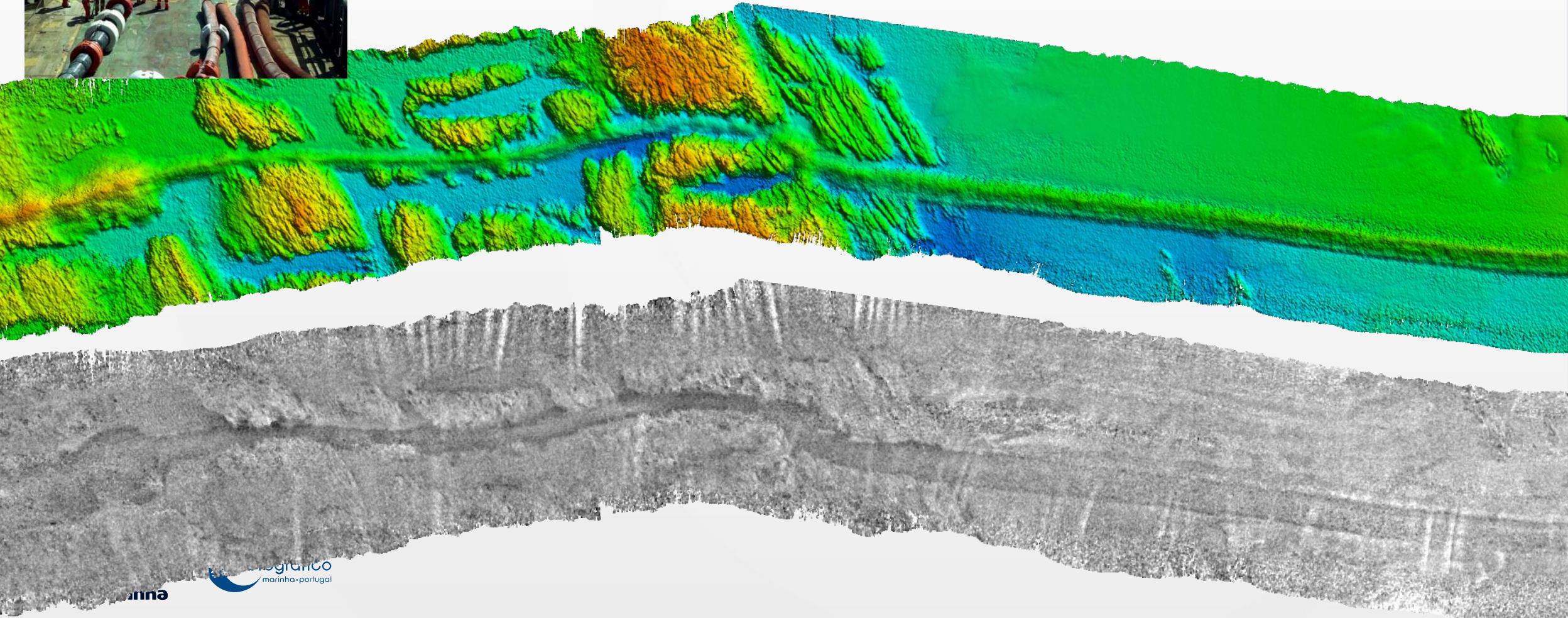
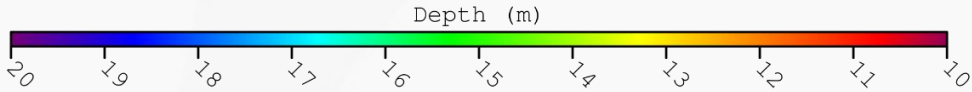
Blue Hydrography



Blue Hydrography

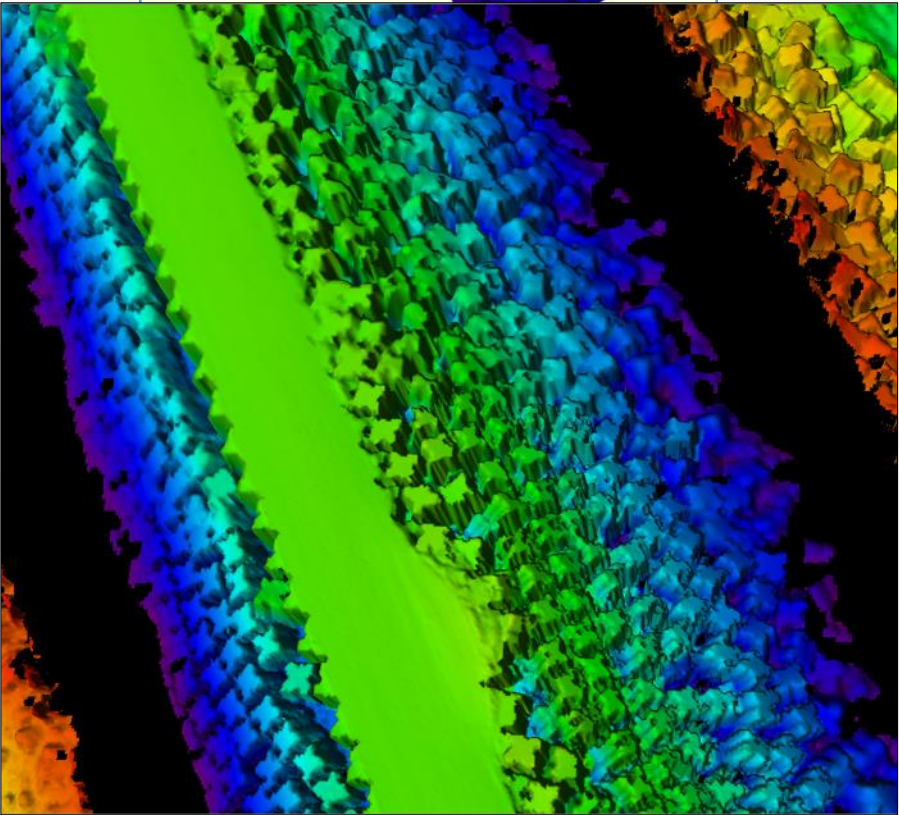
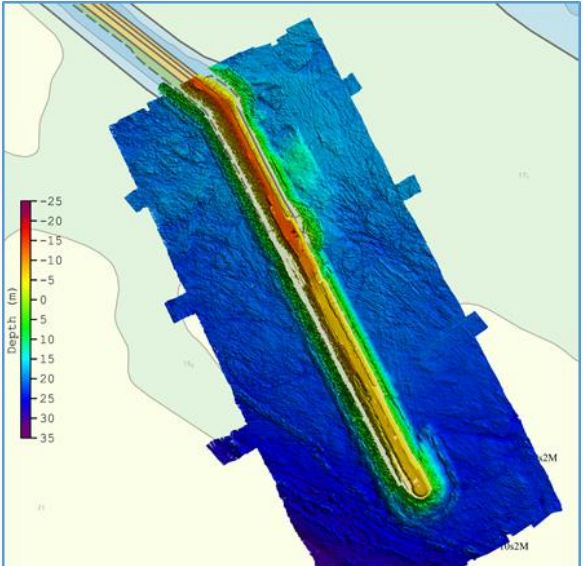
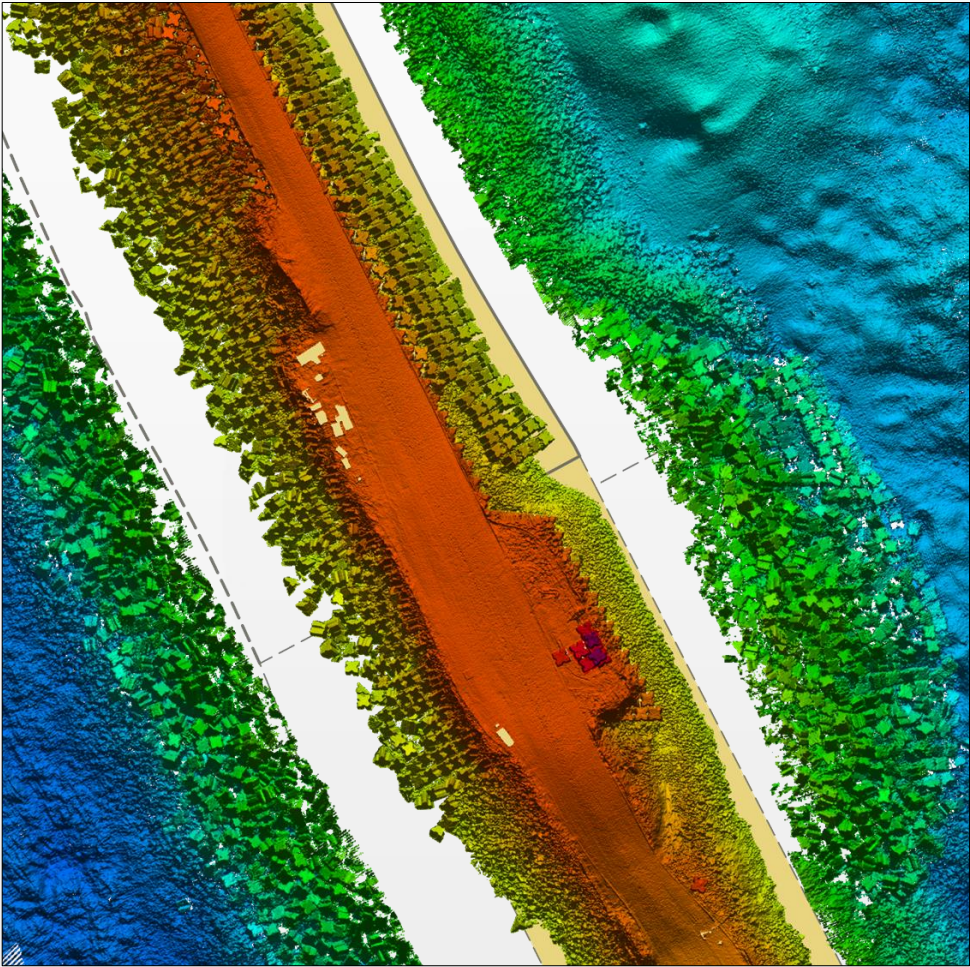


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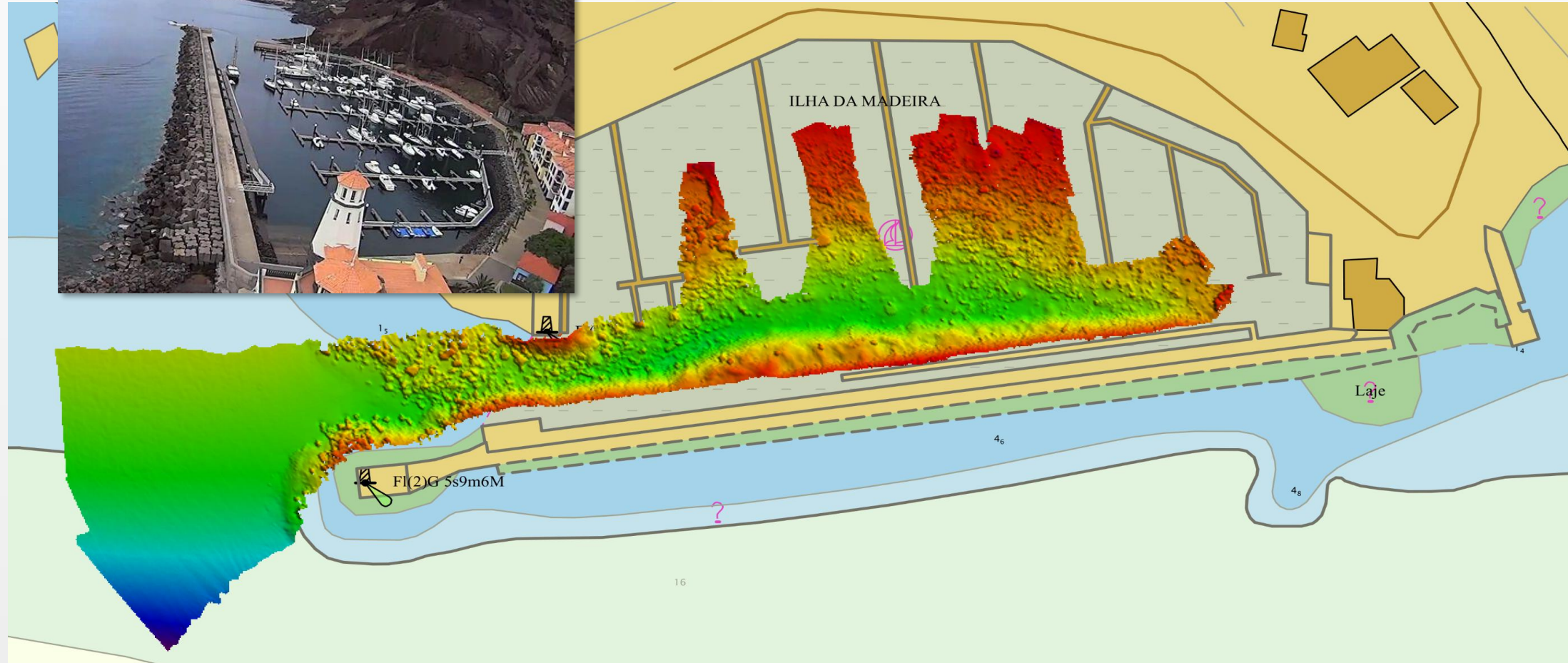
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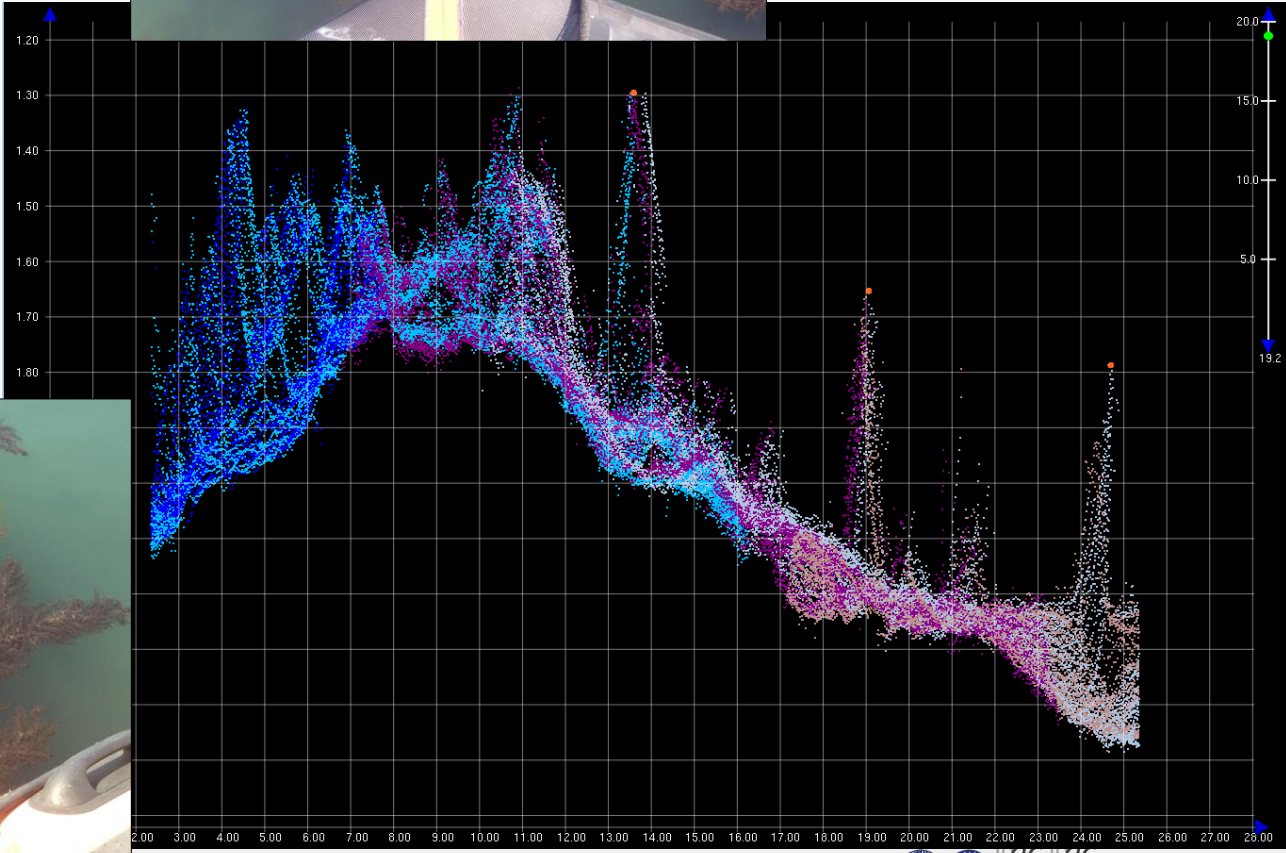
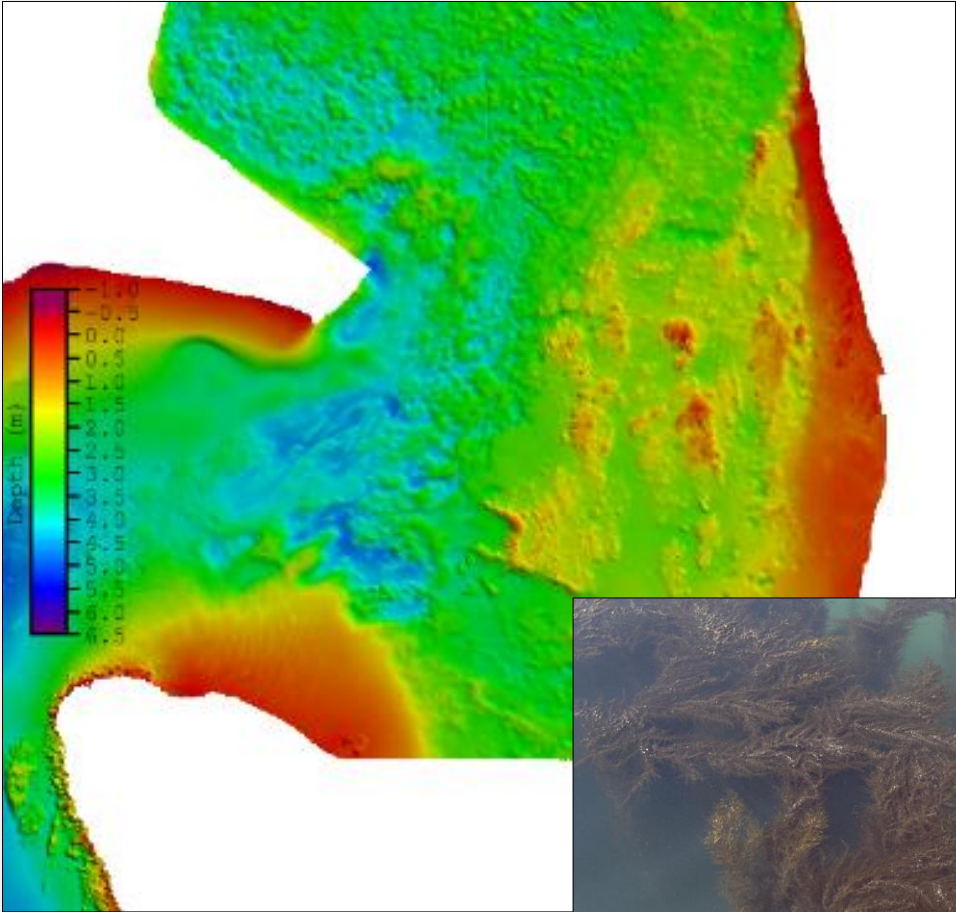
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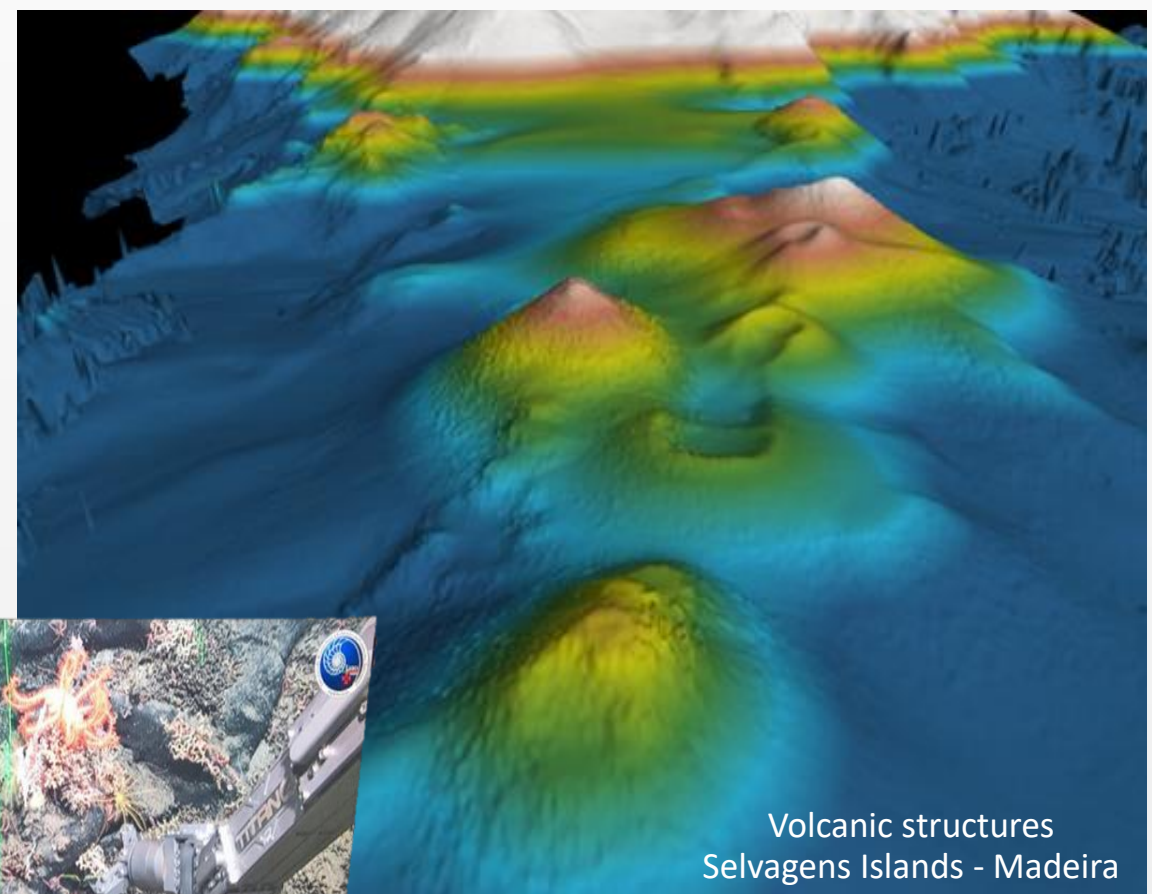
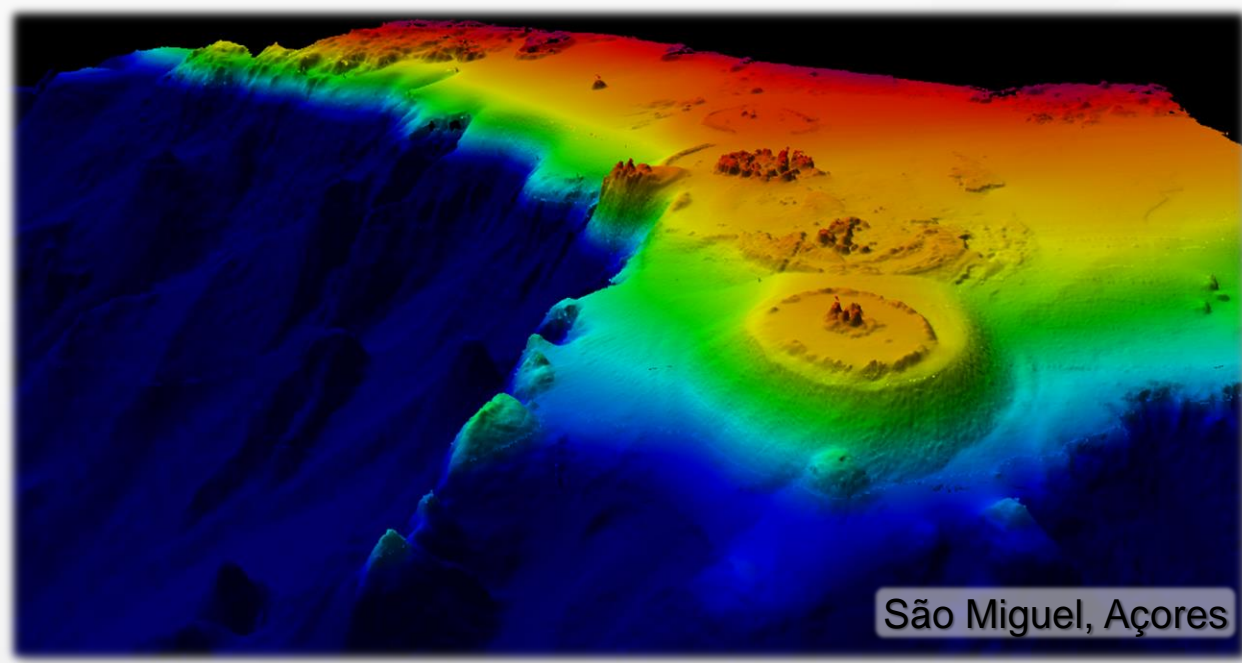


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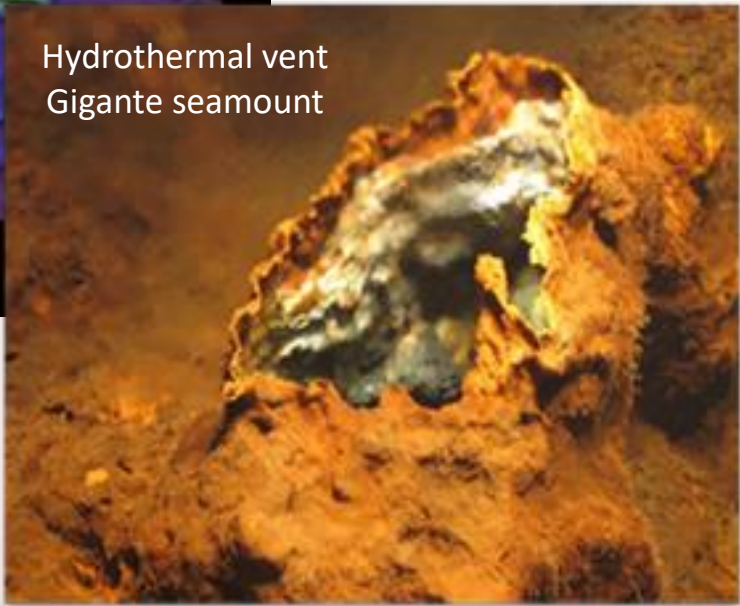
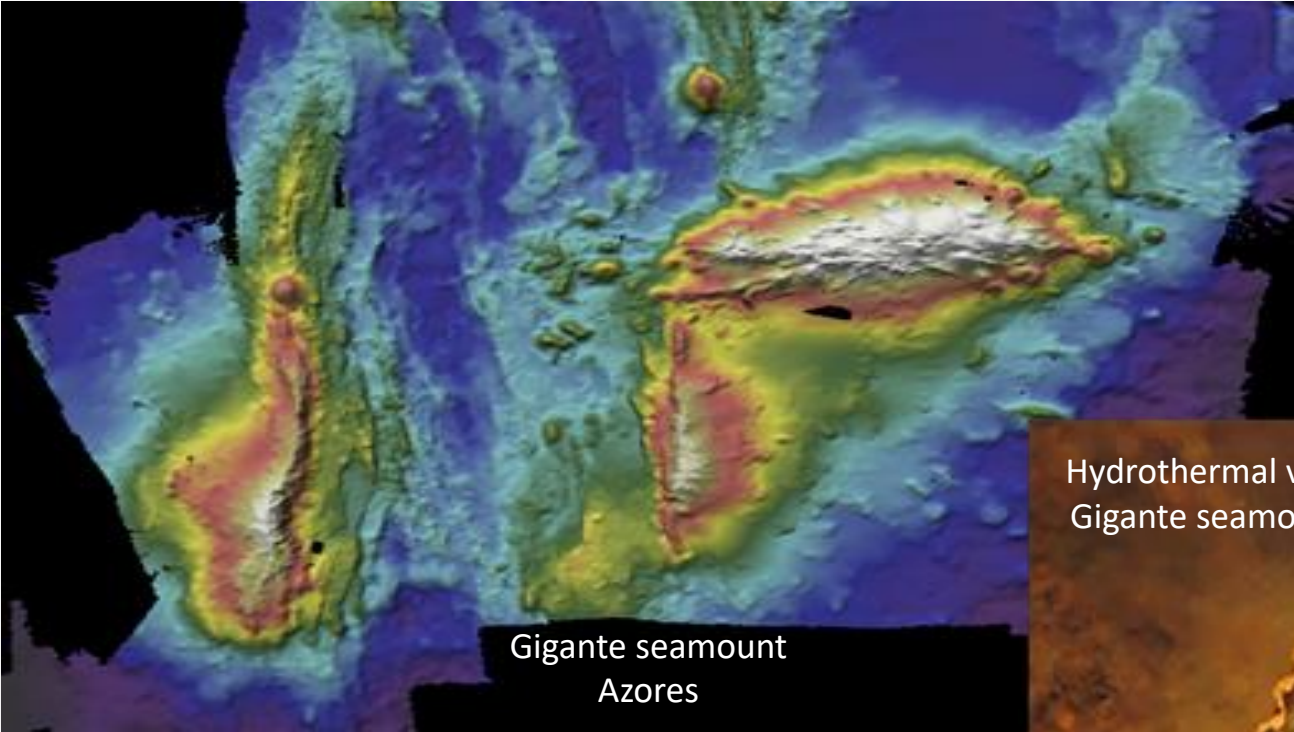


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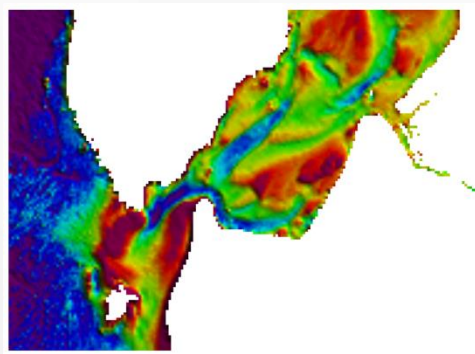
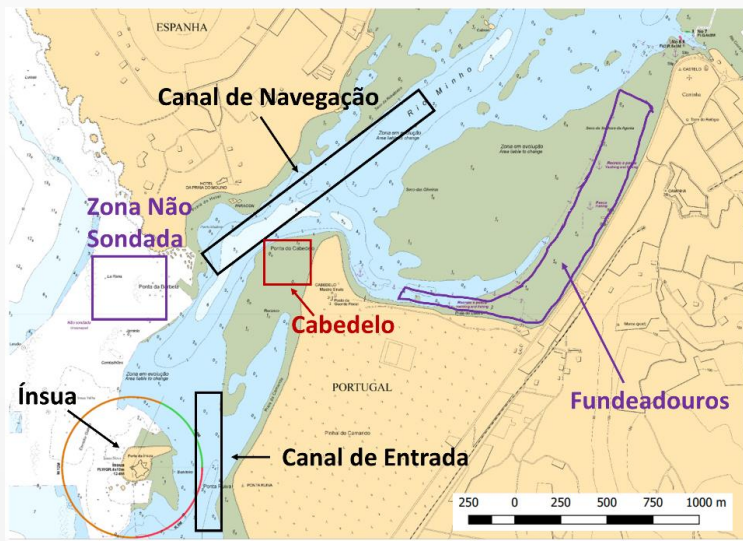


Deep water corals
Madeira Island

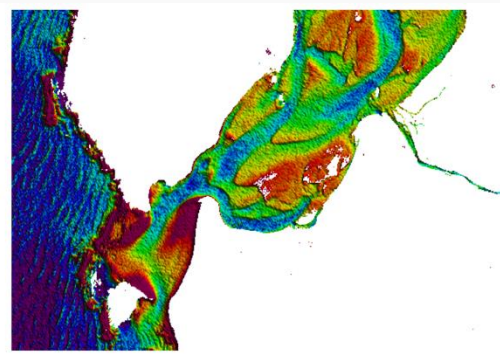
Blue Hydrography



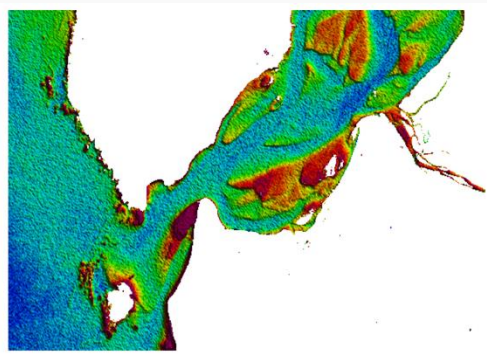
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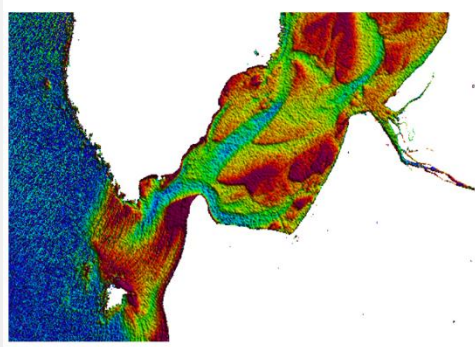
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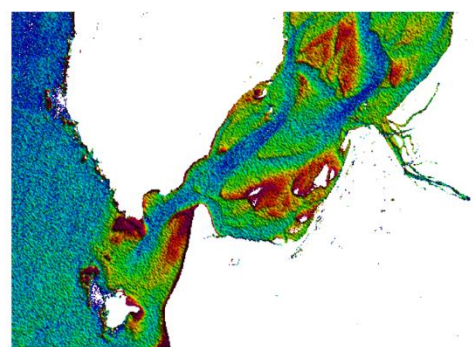
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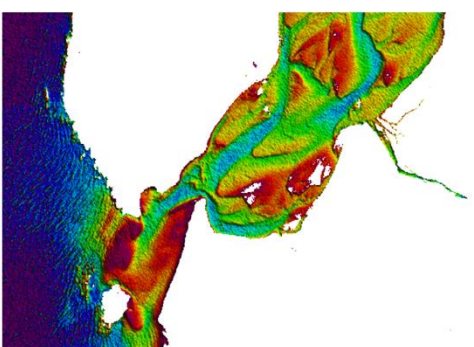
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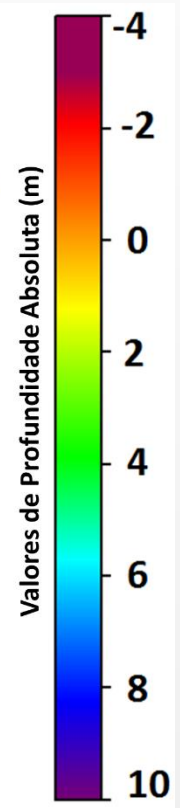
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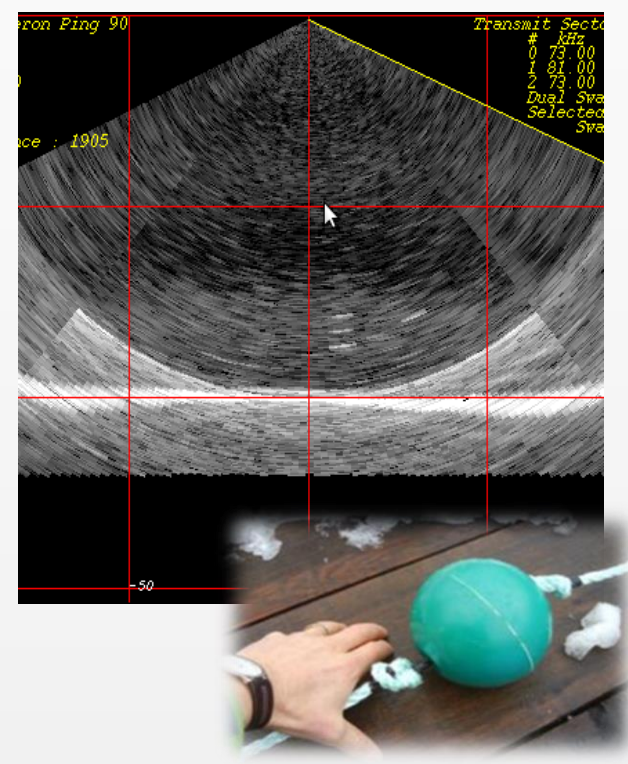
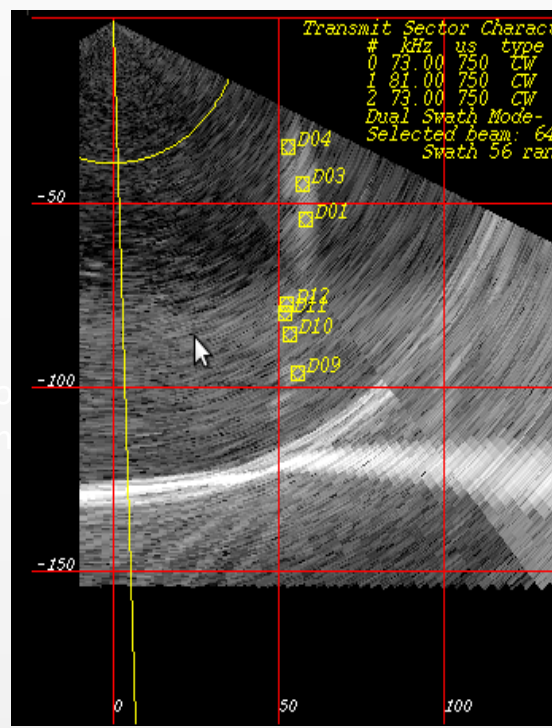
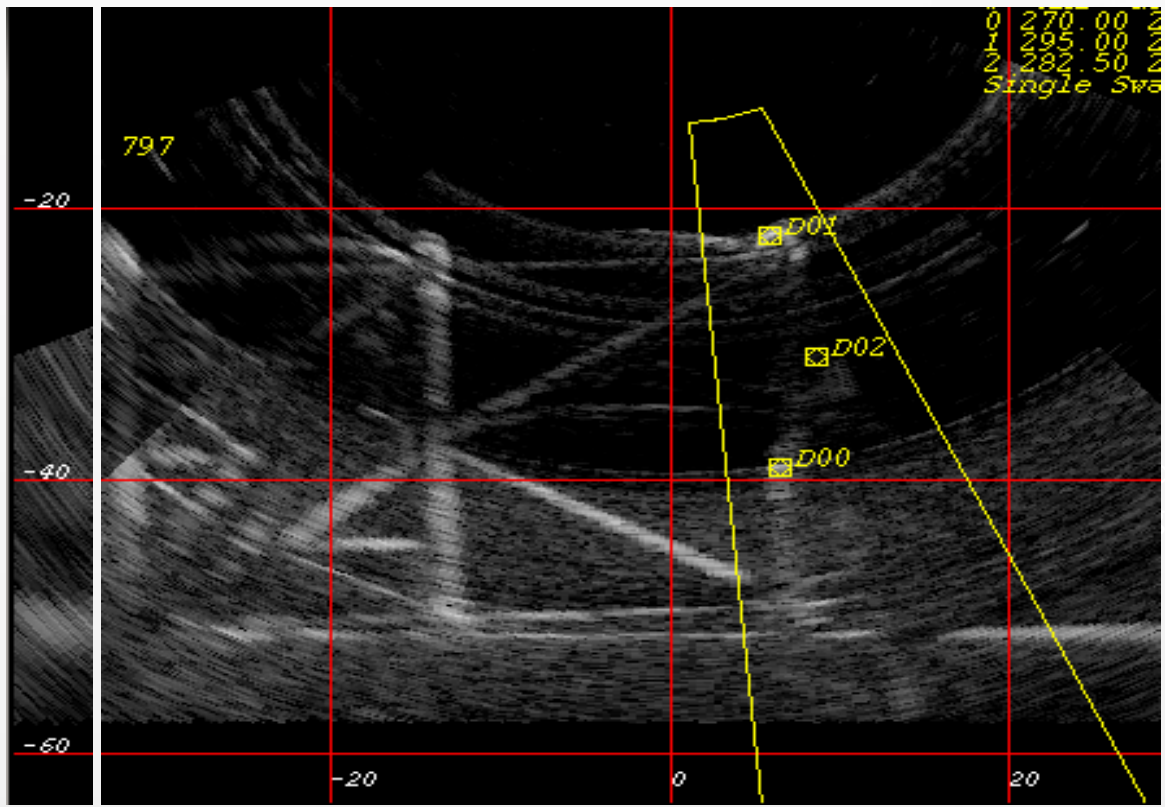


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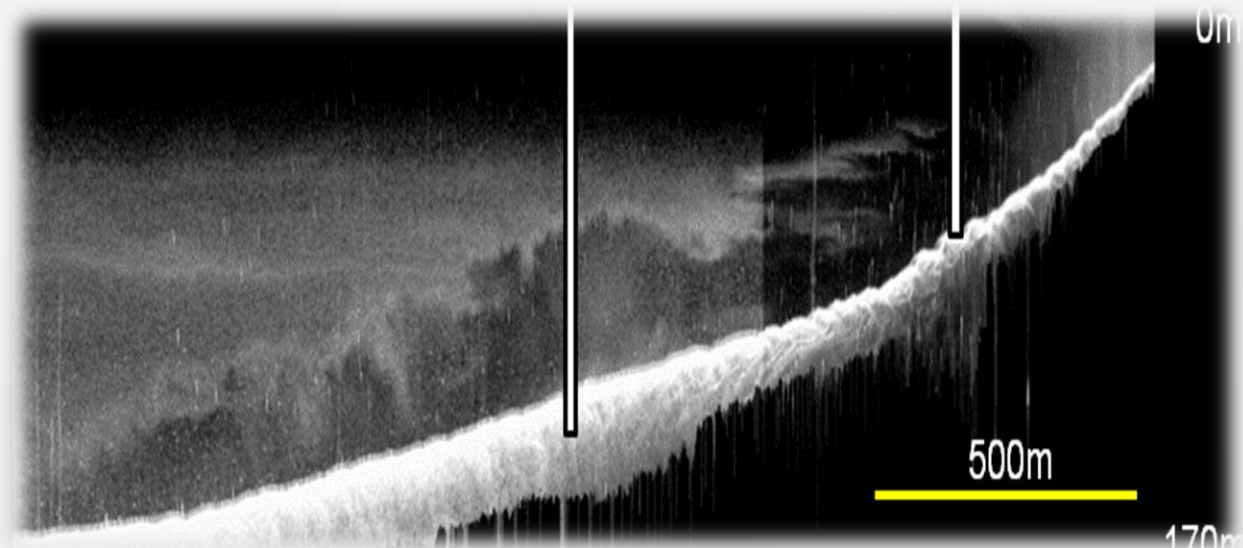
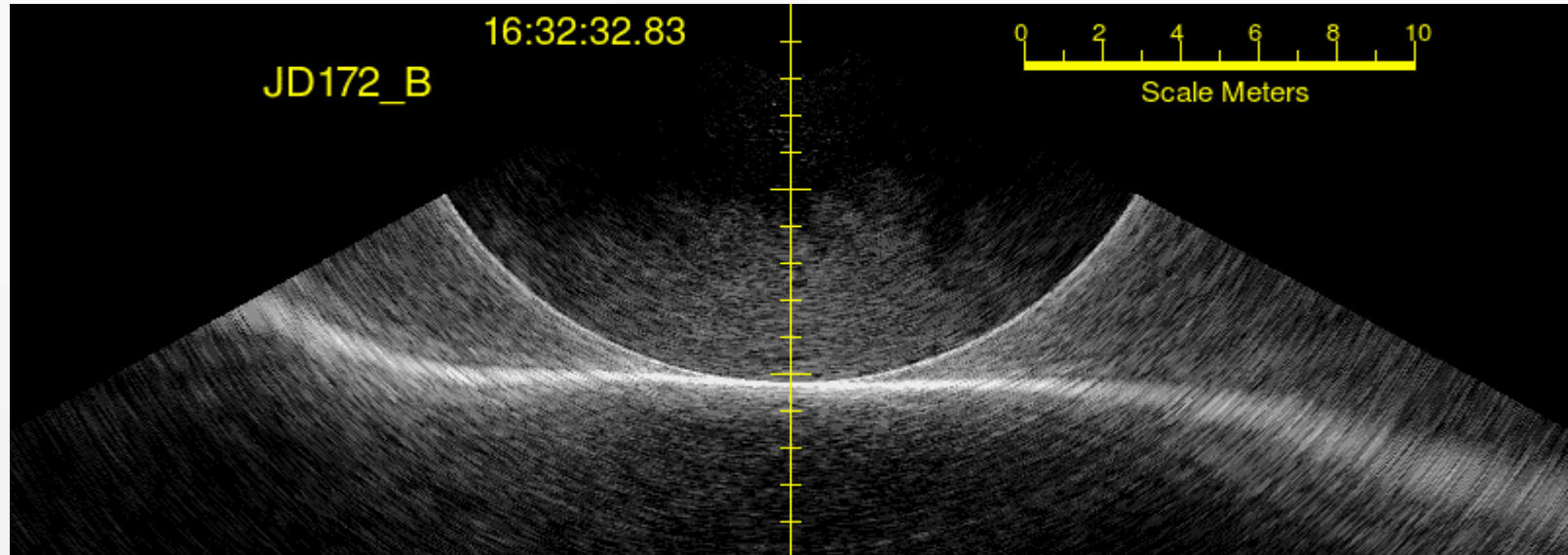


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Blue Hydrography

Squamish: John H. Clarke

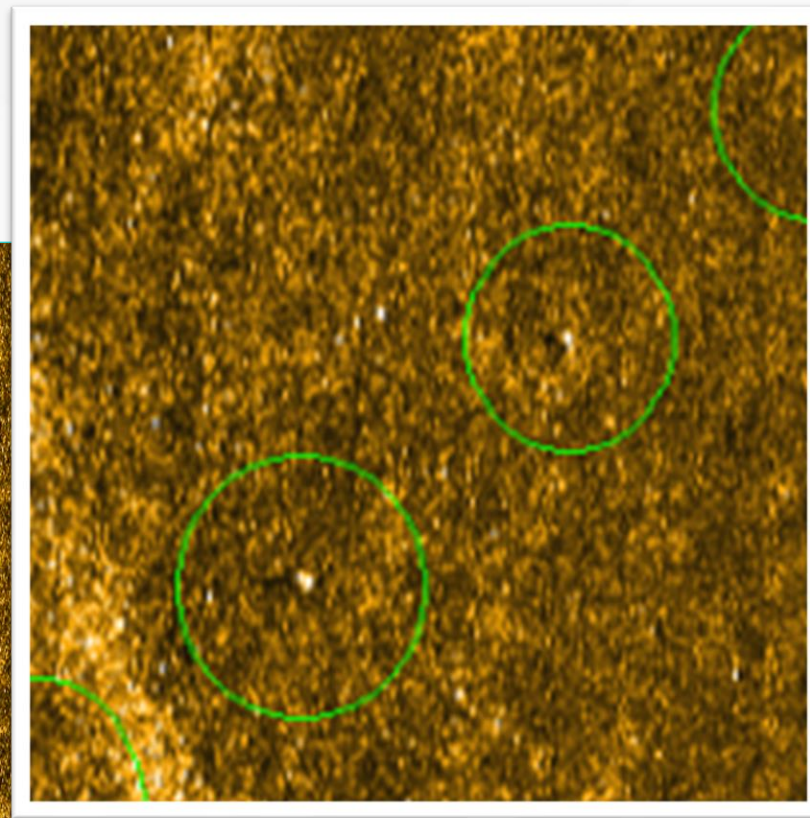
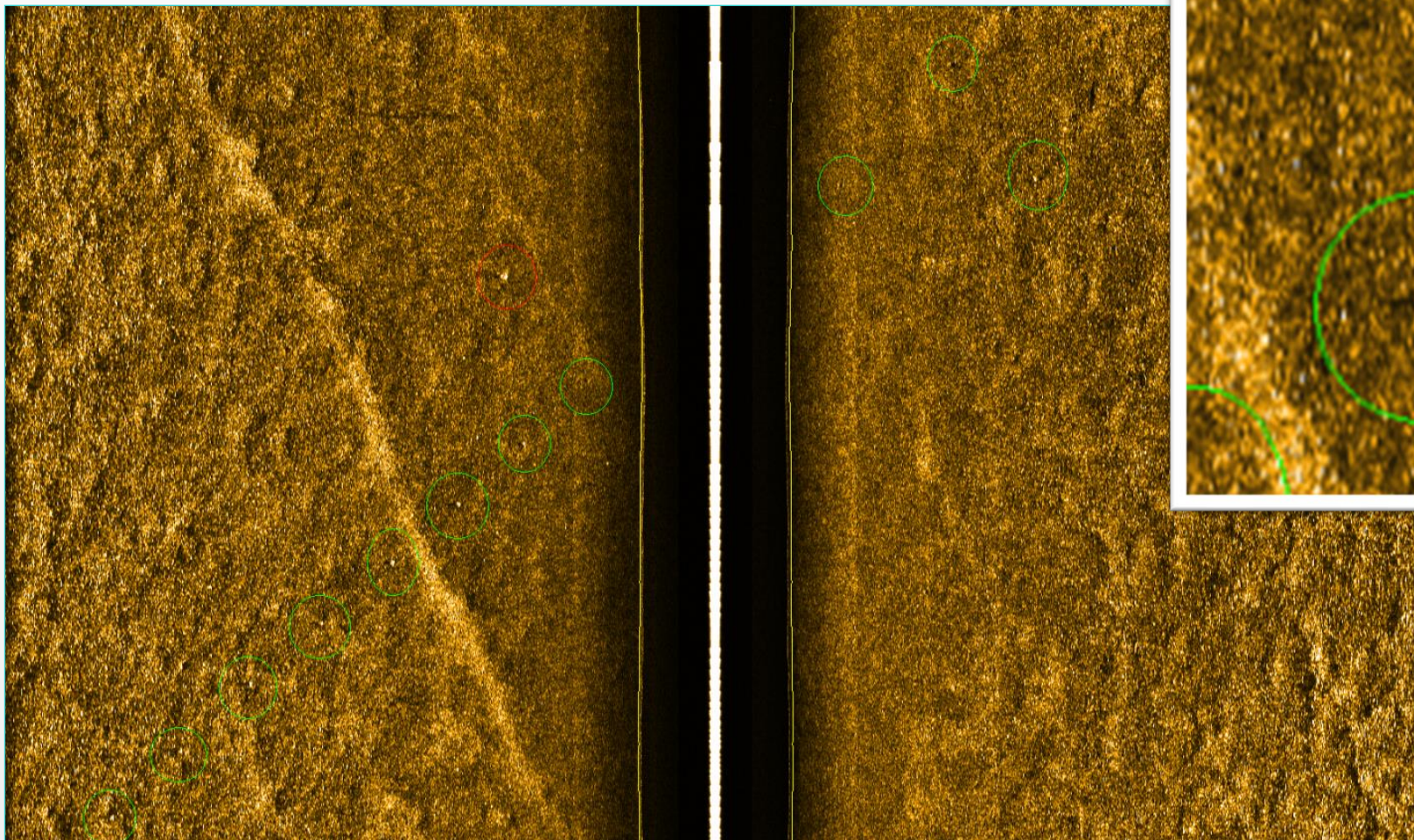


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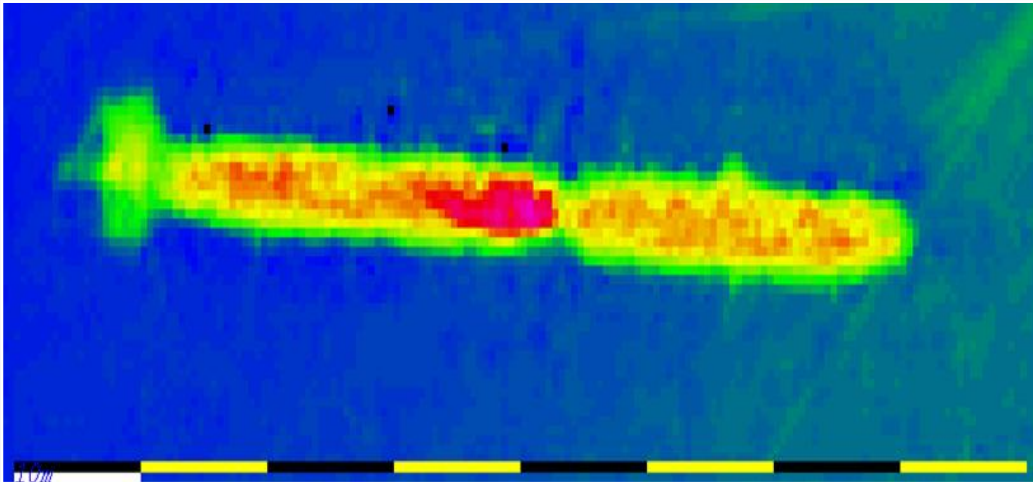
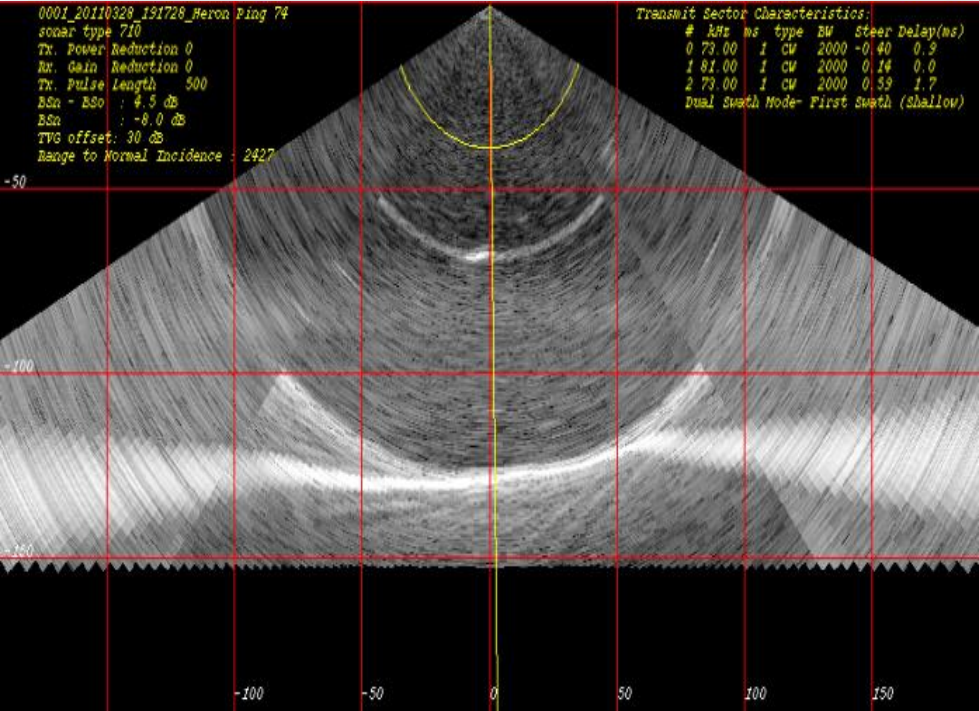


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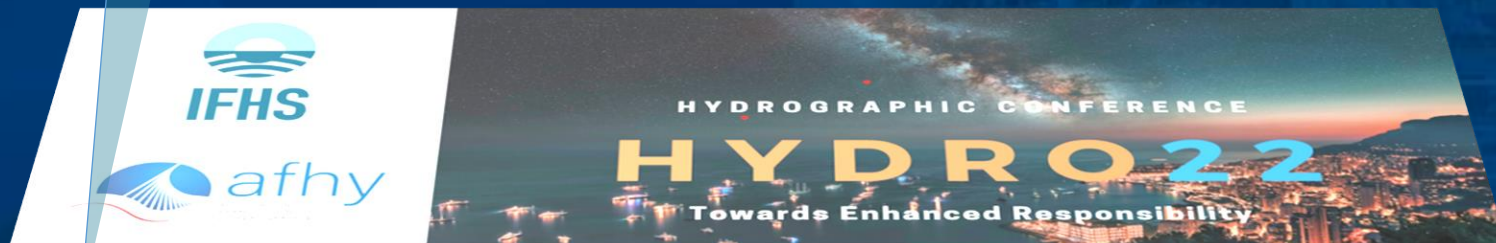


Final Remarks

- “The blue economy is transforming our approach to bathymetric surveying” ...
- Bathymetric surveying is transforming blue economy.
- There is much more than depths in Hydrography
- Hydrography is one of the major keys for unlocking the development of blue economy



Hydrography in the Blue Economy



Thank You

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crubrio@hotmail.com