

European Pavilion
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2 - 13 JUNE 2025

SMART Cables for Observing the Ocean and Earth: Present and Future

June 4th 2025



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How to monitor the Ocean?

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SMART cables : Their importance for ocean observation



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How to monitor the Ocean?



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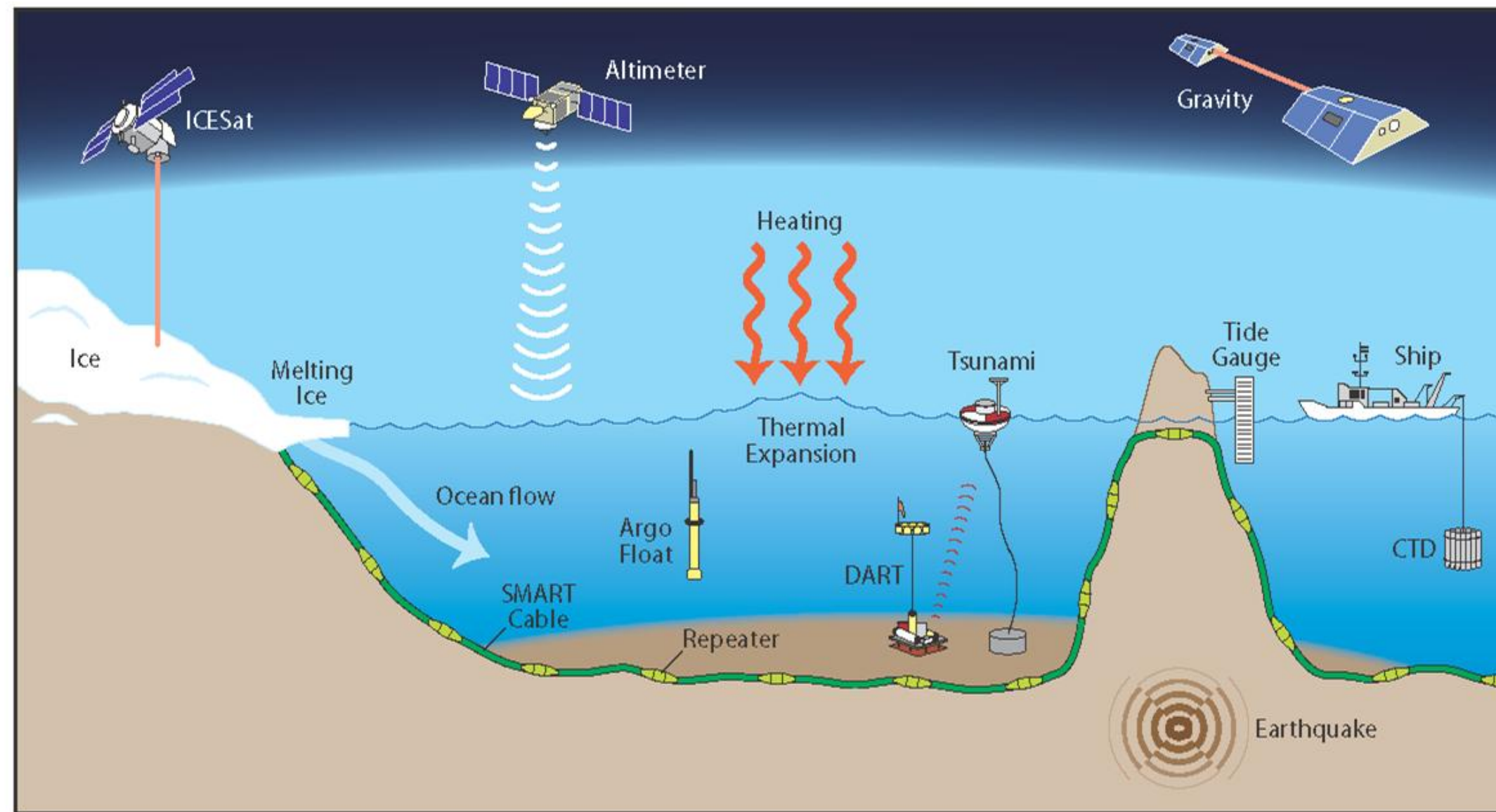
Jerome Aucan

The Pacific Community

**With the Joint Task Force SMART
Cables**



Global Array for Climate, Oceans, Sea Level, Earthquakes, Tsunamis



SMART Cables measure the bottom boundary condition

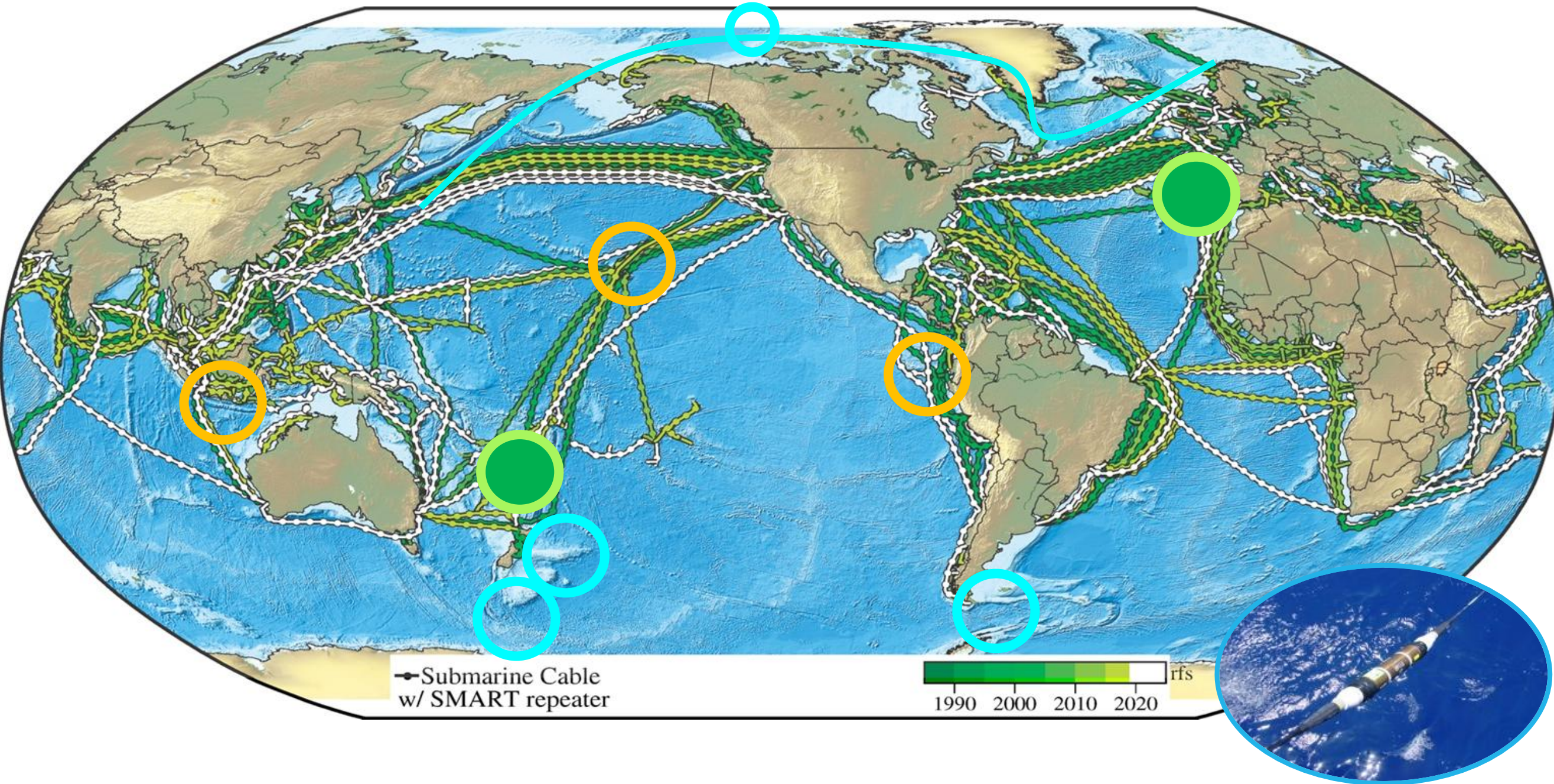
Essential Ocean Variables: Temperature, Pressure; Seismic motion

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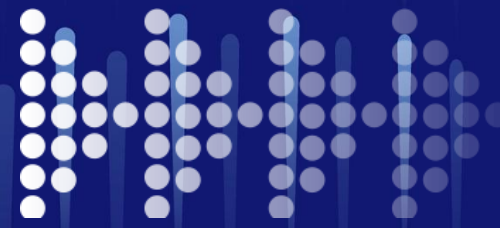


Existing Initiatives and potential

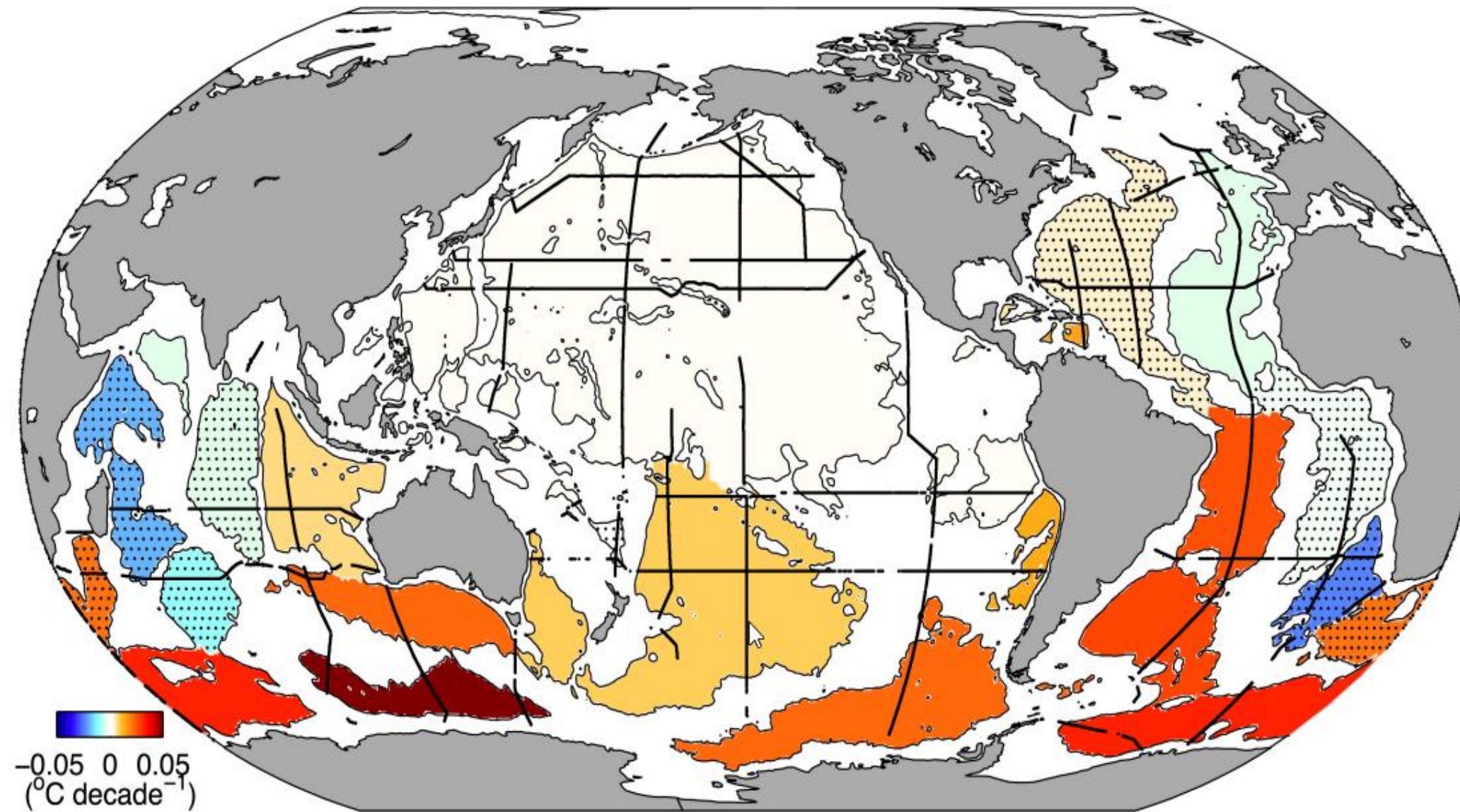


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Bottom temperature



From Purkey and Johnson (2010)

- SMART → Temperature, EOVS
- Deep ocean heat content / thermal expansion → sea level rise
- Δ deep ocean temperature → Δ circulation, Δ climate

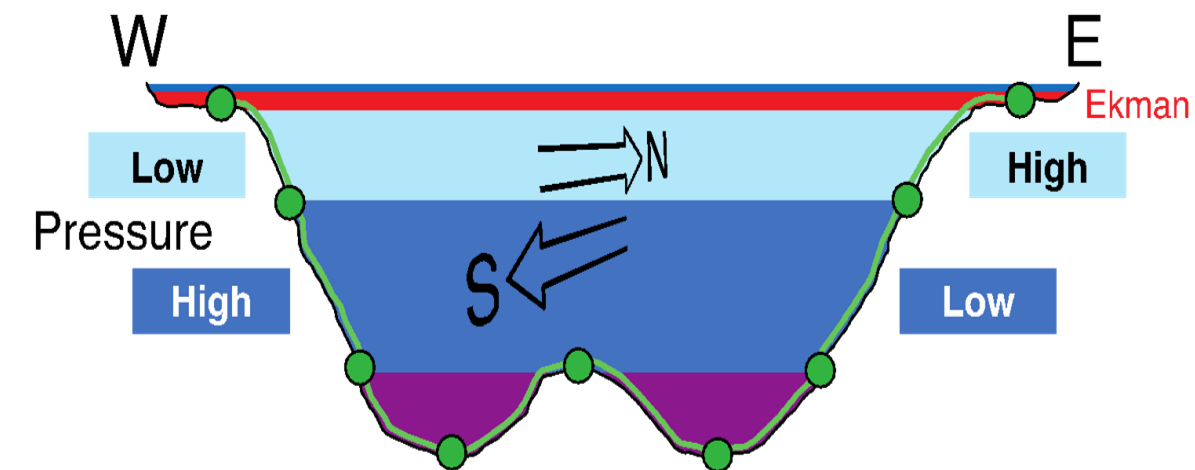
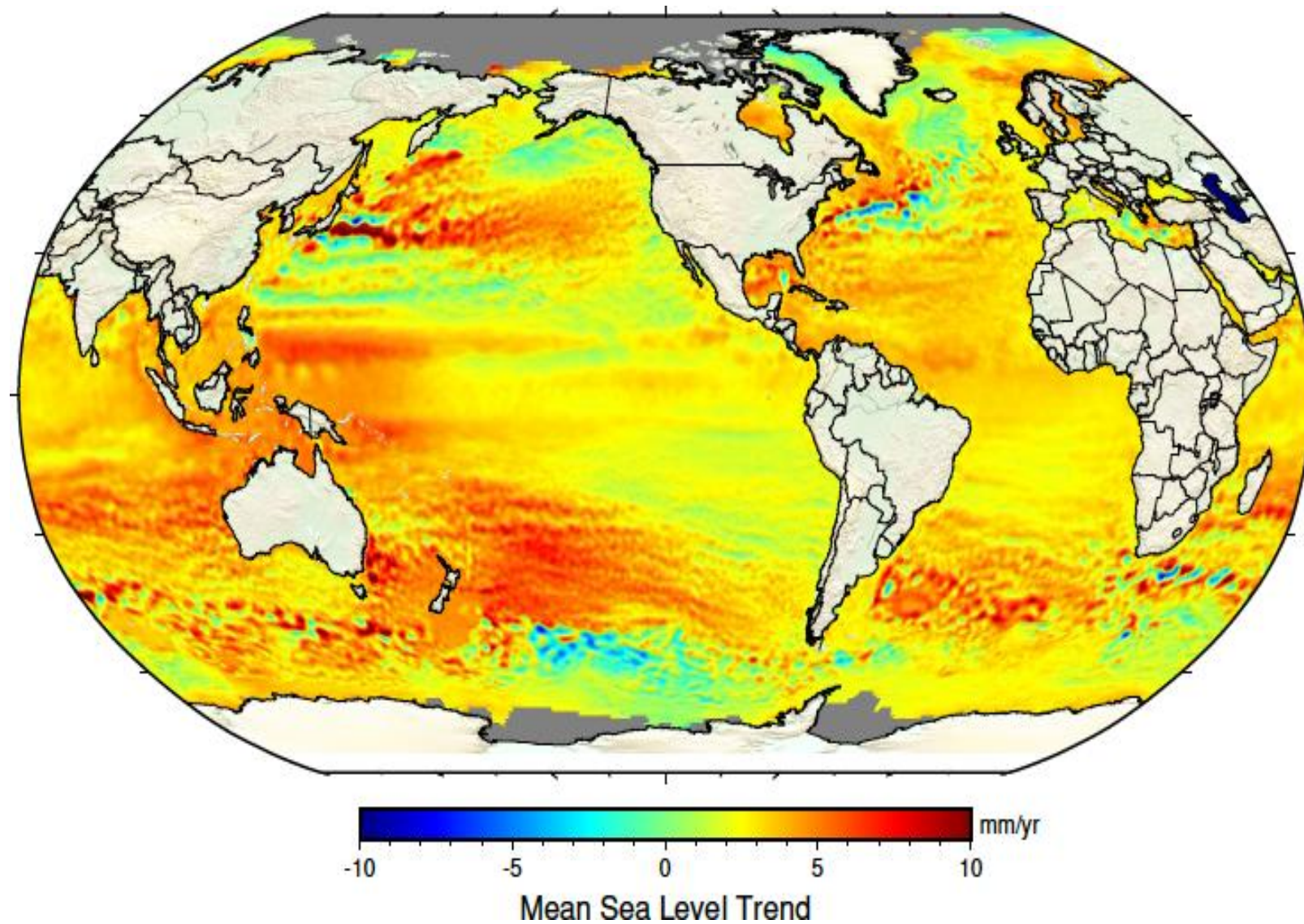


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Bottom pressure

Sea Level mm/yr



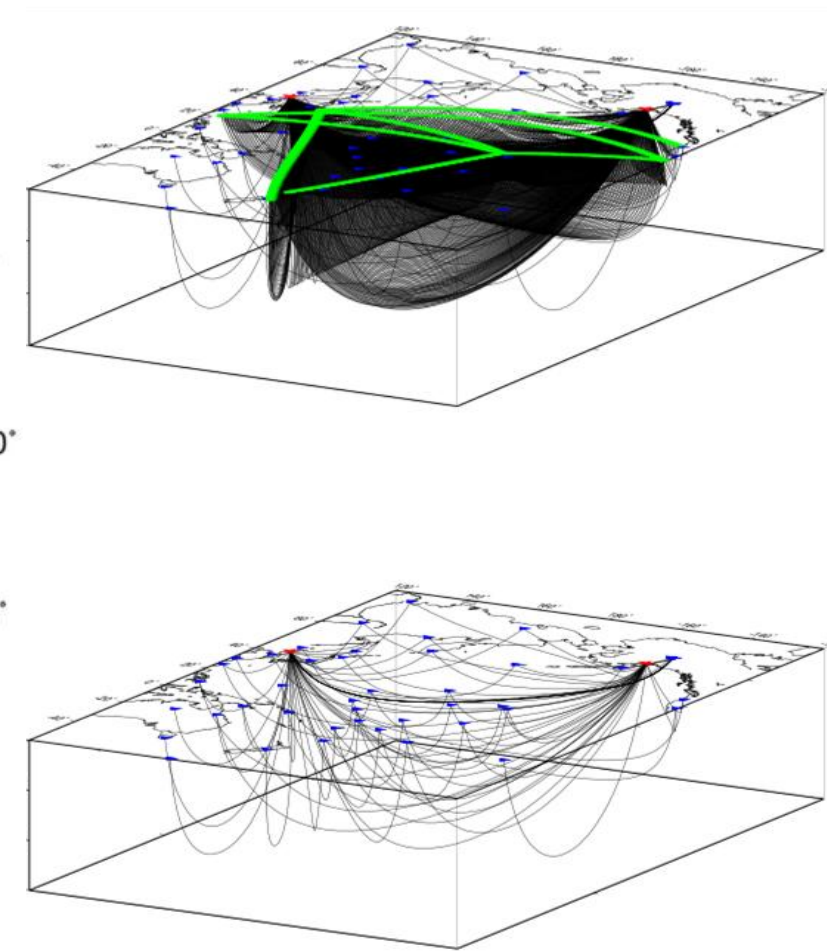
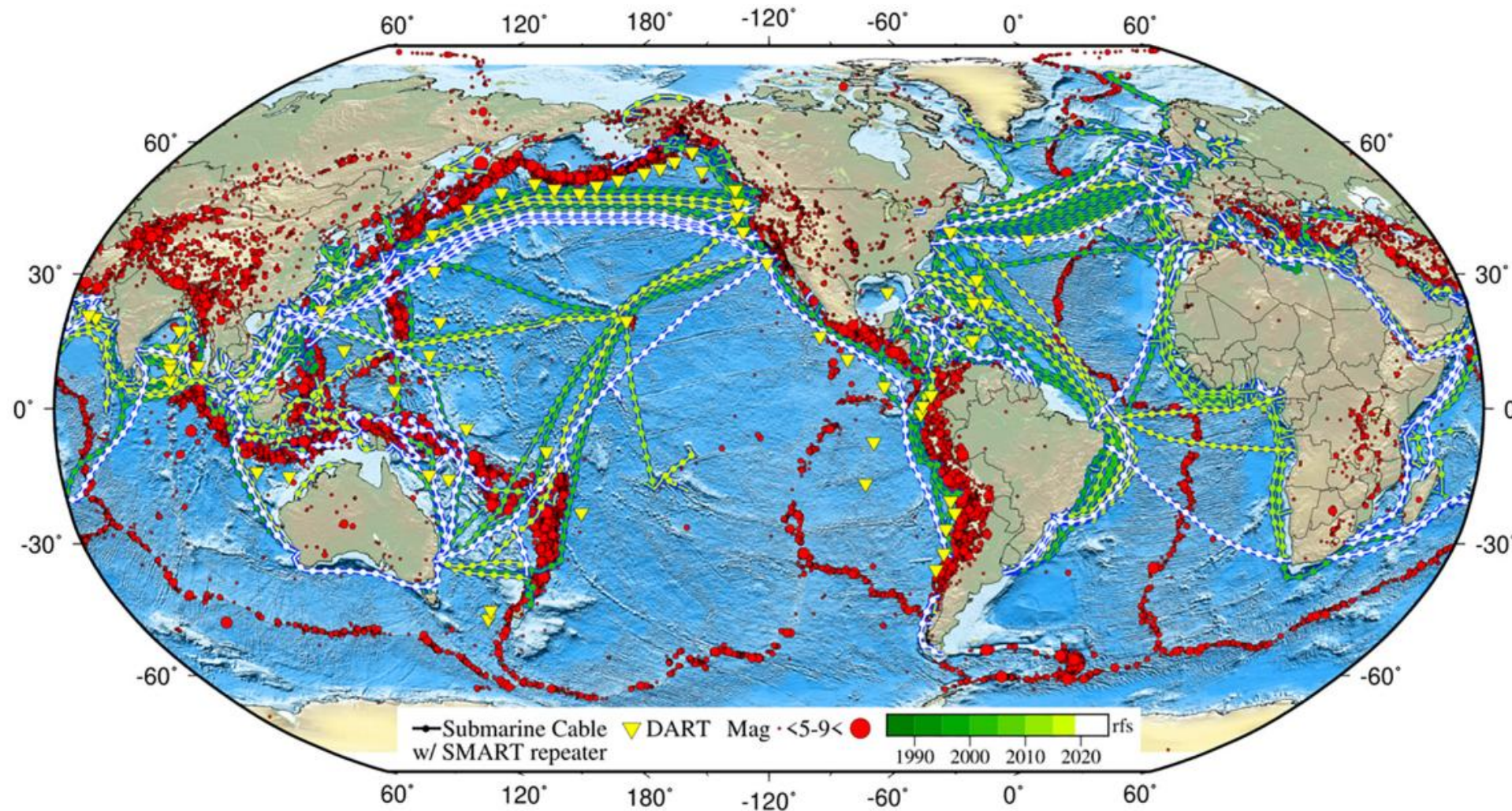
- SMART Ocean bottom pressure (OBP, EOVS) → added mass of melting ice → sea level change
- Δx between OBP → depth-averaged currents and ocean circulation



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Pressure and seismic sensors



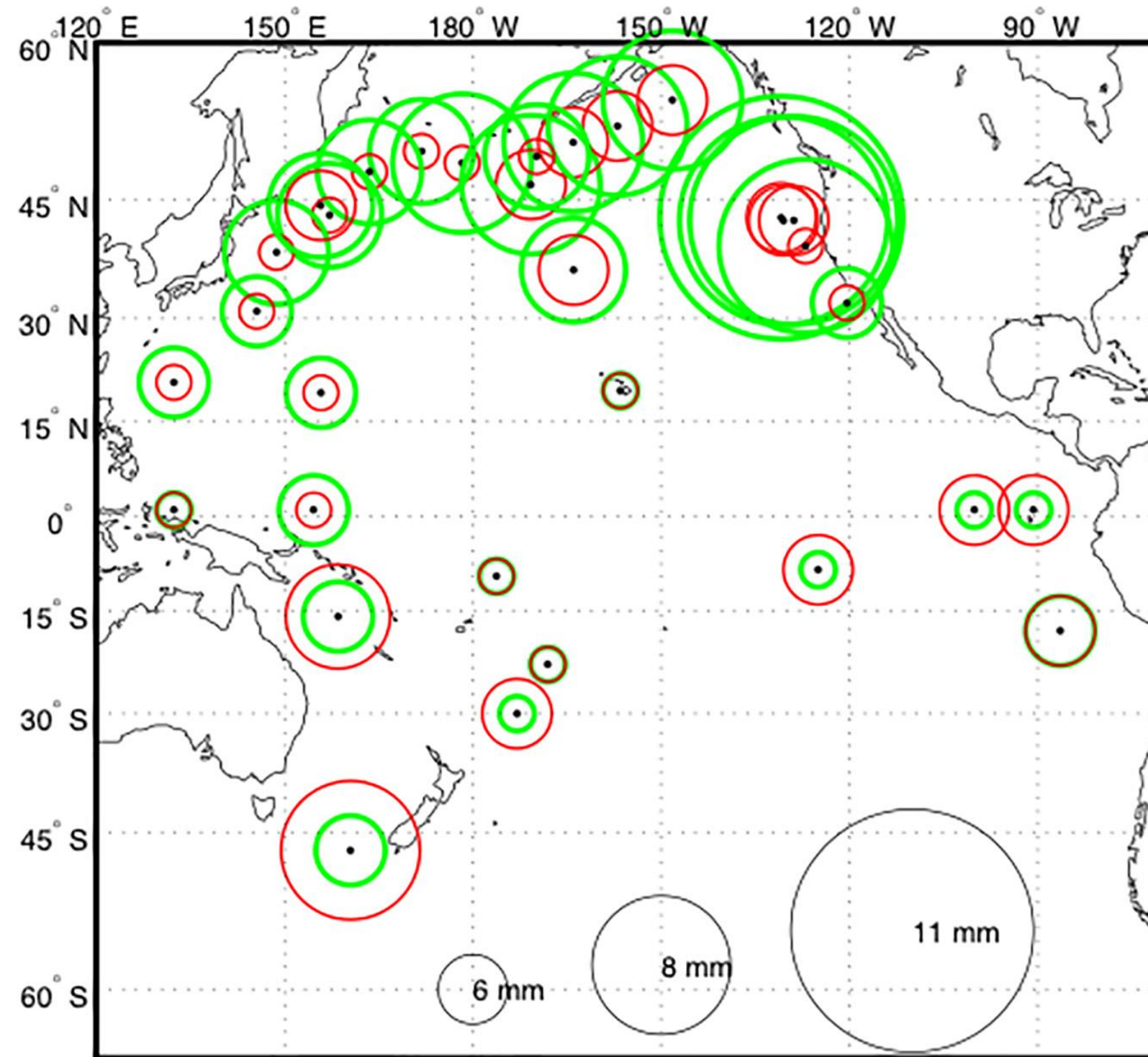
- SMART cables - vastly increase existing ocean pressure/seismic sensors
- Improve tsunami warning precision, reduce unnecessary warning/ evacuations
- SMART Seismic sensors → advance seismology
- Detect, locate small quakes
- Image the Earth's interior



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Pressure sensors



- Indirect information on wind-generated surface waves
- Infragravity waves
- Microseisms



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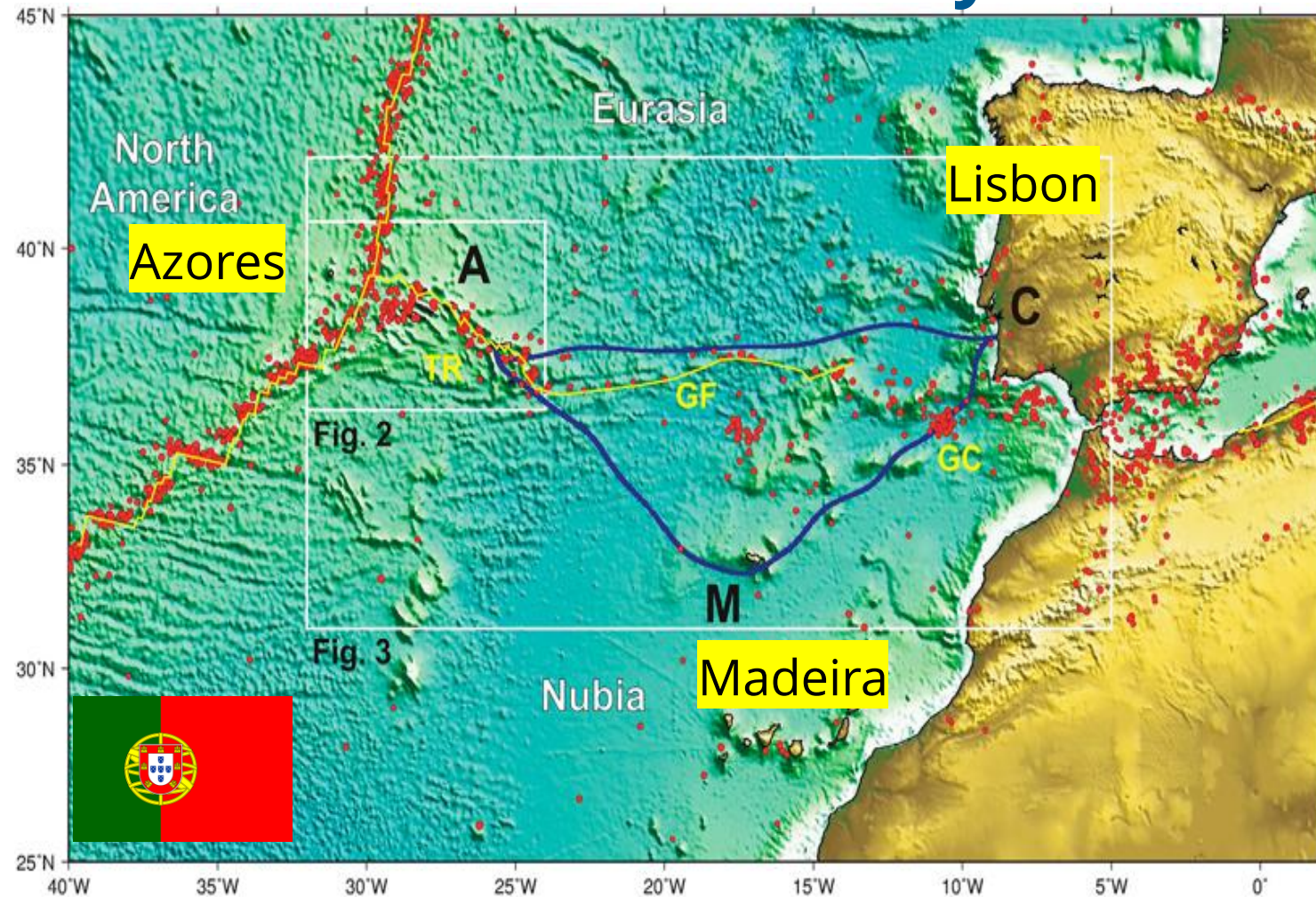


Inspire Funded SMART Cable Systems

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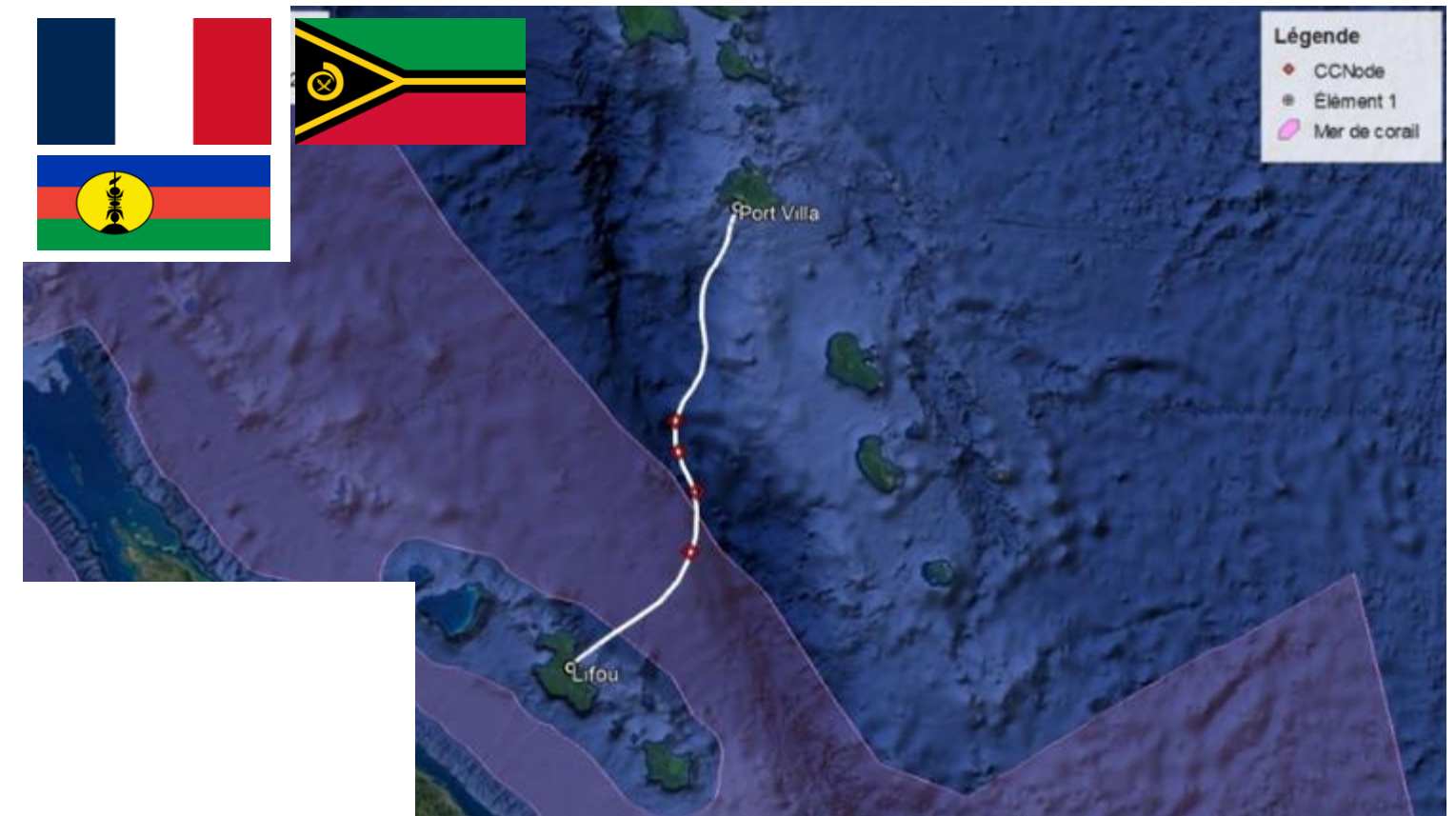
Atlantic CAM SMART System



- 3700 km, ~20 SMART modules
- Gov't €154M. EU support €56M
- SMART 15% → €22M ~ €2/citizen/25 y
- ~ = 2 Tsunami buoys, 25 year (unreliable, no seismic, not real time)

Contracts
signed
ASN
RFS 2026

TAMTAM SMART Cable System



- 450 km long, 4 SMART modules
- France funding SMART

- 25+ year life, reliable, low lifetime cost
- Leverage \$5B/y industry, 175 y

Optical Fiber Sensing in both

GORDON AND BETTY
MOORE
FOUNDATION





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THANK YOU

SMART Cables for Observing the Global Ocean: Science and Implementation
Howe et al. 2019, Frontiers in Marine Science





2. Smart cables a reality

ASN Climate Change Solution

S.M.A.R.T. option for subsea cables



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***ASN Climate Change Solution
S.M.A.R.T. option for subsea
cables***

AUDE Jean

Alcatel Submarine Networks



Climate Change solution (SMART* market)

* Scientific Monitoring And Reliable Telecommunication



Discover the CC Node

Specific sensors integrated in a submarine telecom repeater



Key applications

Resilience
Improving

Climate
Change
Monitoring

Tsunami
Warning

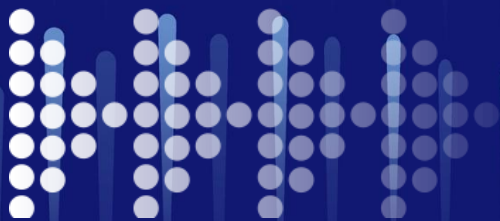
Earthquake
Seismic
Activity

ASN SMART PROJECTS

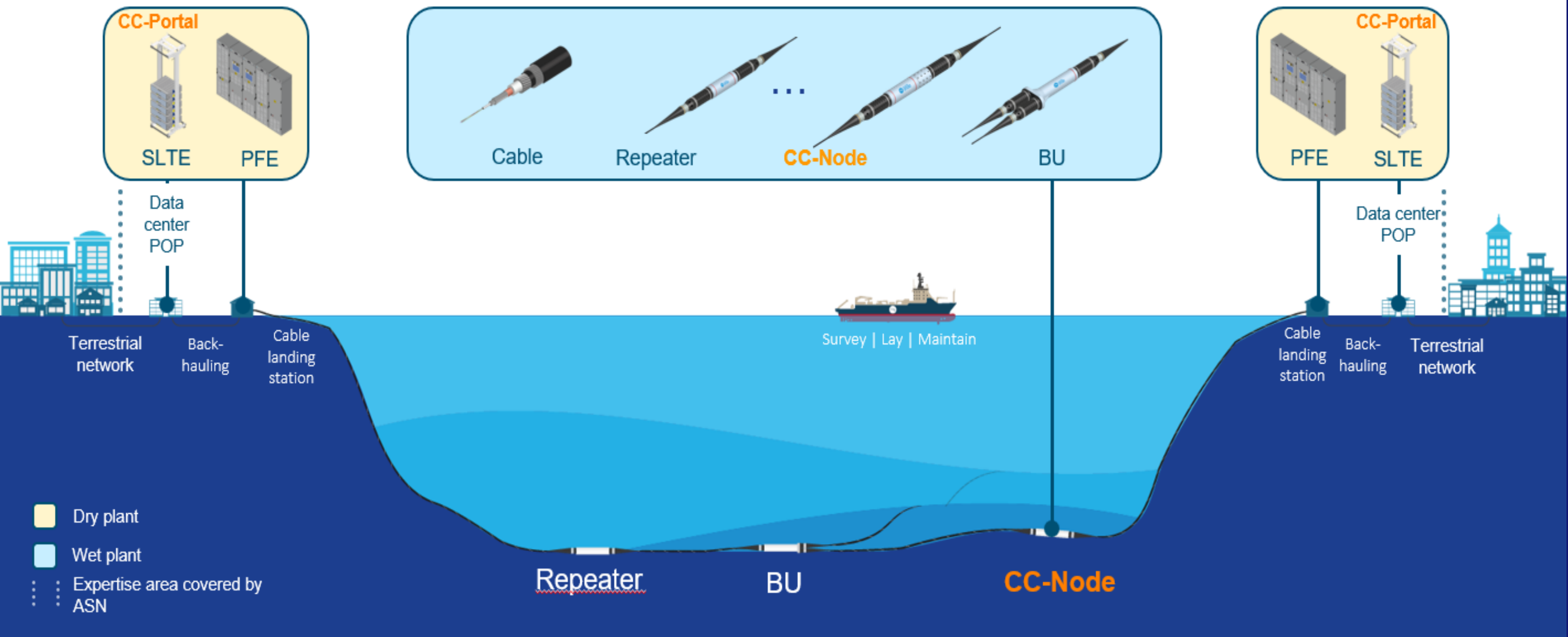


SMART Selected by GOOS:
sustainable, interoperable
data to close critical gaps.

End-to-end SMART subsea network



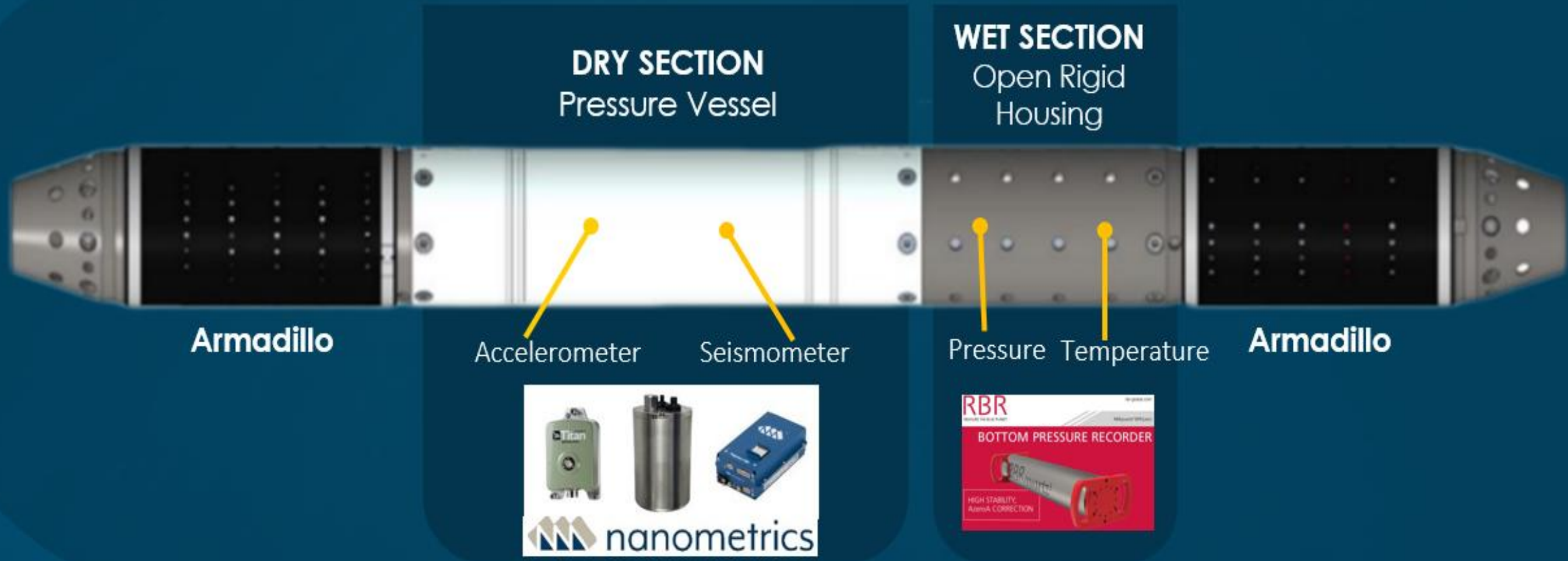
Wet ASN Product Portfolio



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Our innovation : Integrated CC-Nodes in ASN Submarine Cable



CC Solution – Fully Integrated, End-to-End, Turnkey Delivery



Terminal Equipment CC-Portal

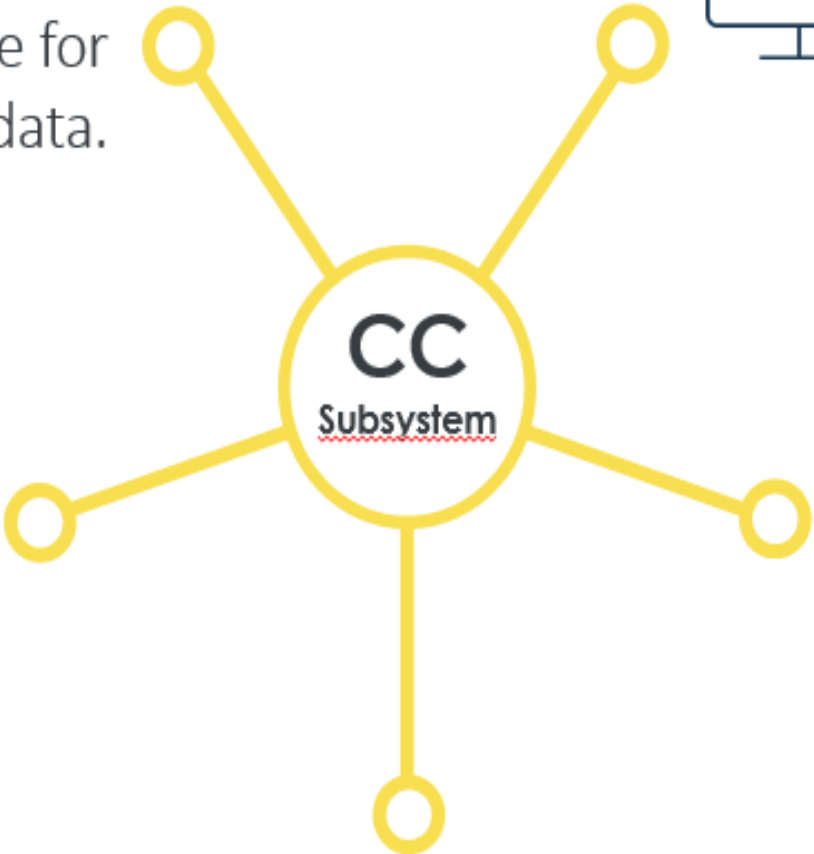
at the Cable Station: The interface for retrieving data.



Dedicated Fiber Pair in the Cable: Ensures reliable data transmission.



CC-Node: The primary sensor deployment unit, on new systems for repeated and unrepeated system.



CC SN module to manage the components of the network,

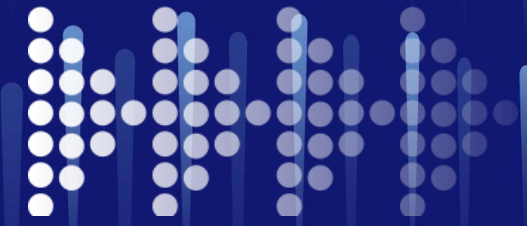


Regeneration Module in the Repeater: Enhances signal strength when required.



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CC-Node are installed like repeaters, with the same lay and recovery rules.



Location accuracy of CC-Node at the sea bed

Location Accuracy:

- **Standard Accuracy:** 5% of the water depth, with a minimum uncertainty of 100 meters.
- **Enhanced Accuracy:** Improved accuracy is possible if vessel speed is reduced during deployment (additional cost applies).

Flexible CC-Node Placement:

- **Water Depth:** Up to 6000 m
 - **In-Line Distance:** Minimum 500 m from any other body
- Final positioning must be determined in coordination with scientists and marine experts following the marine survey.



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Scientific Monitoring And Reliable Telecommunication
→ SMART Submarine Cables

Thank You !



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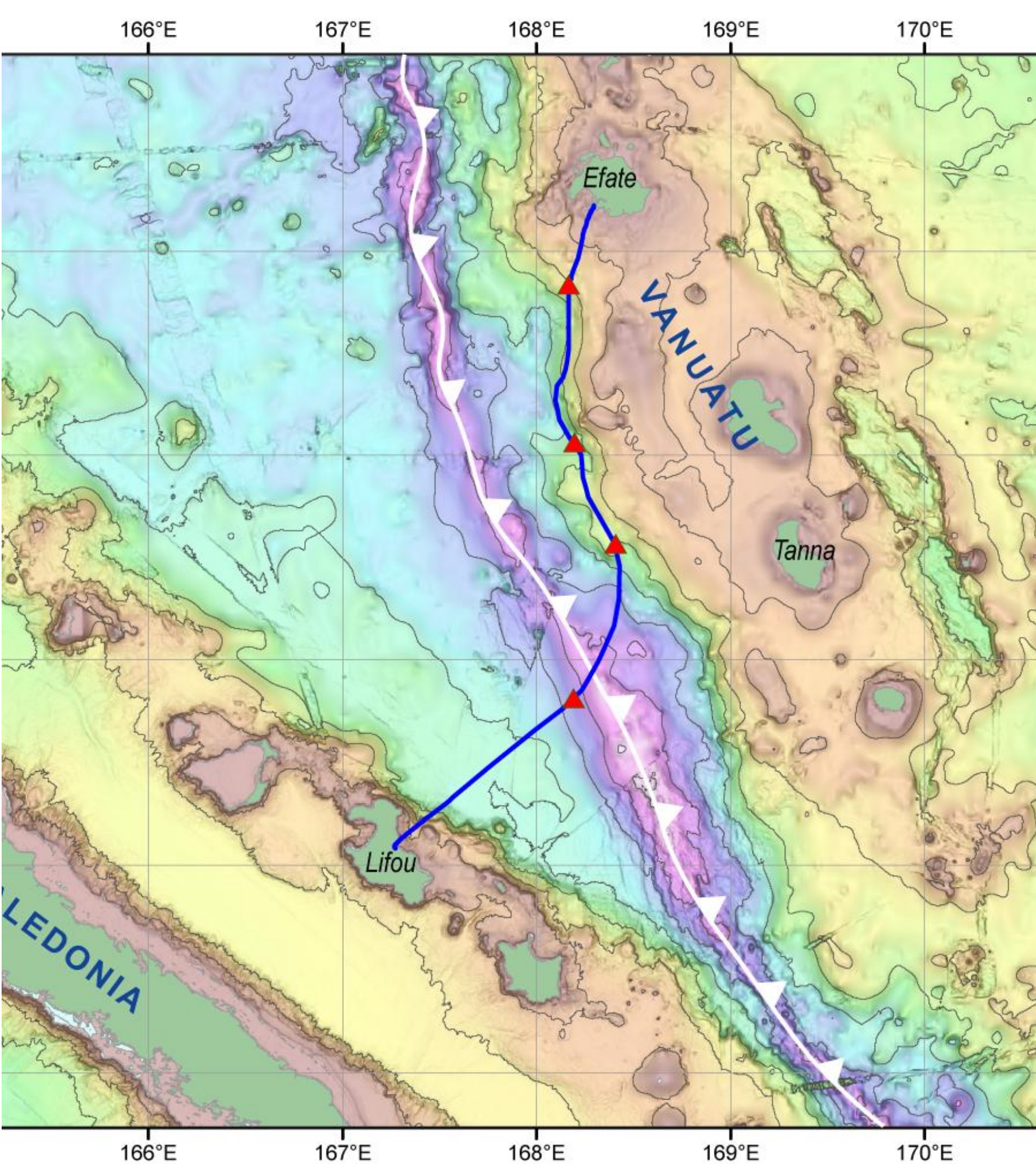
A practical experiment
TAMTAM project

Jean-Marc DANIEL



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The TamTam Experiment

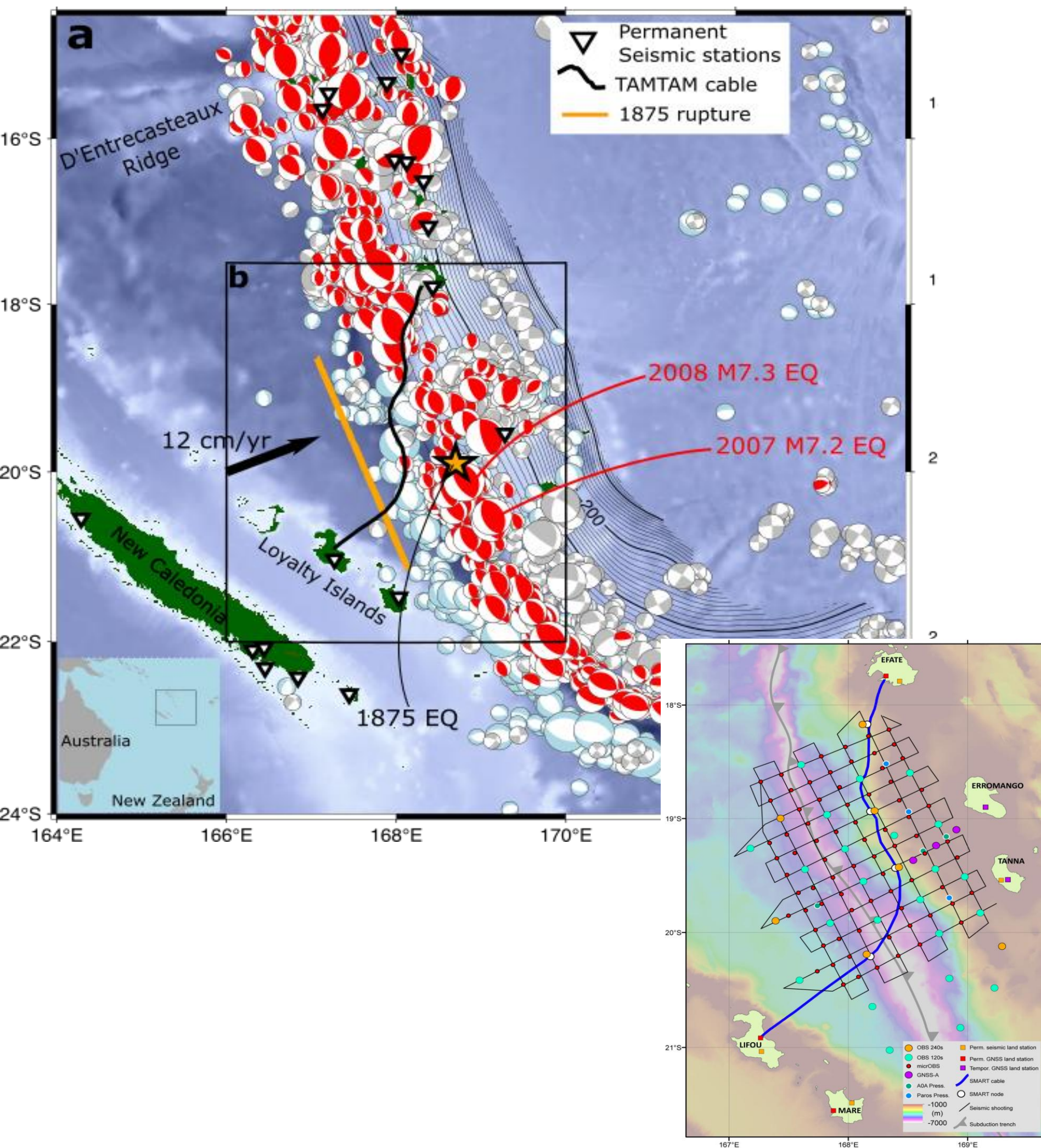
- A major subduction zone
- 4 smart nodes
- Two fibers dedicated to fibersensing

Societal value

- Tsunami warning
- Operational oceanography
- Sea level change

A Public/Private partnership





A dedicated scientific cruise to validate what is measured and more...

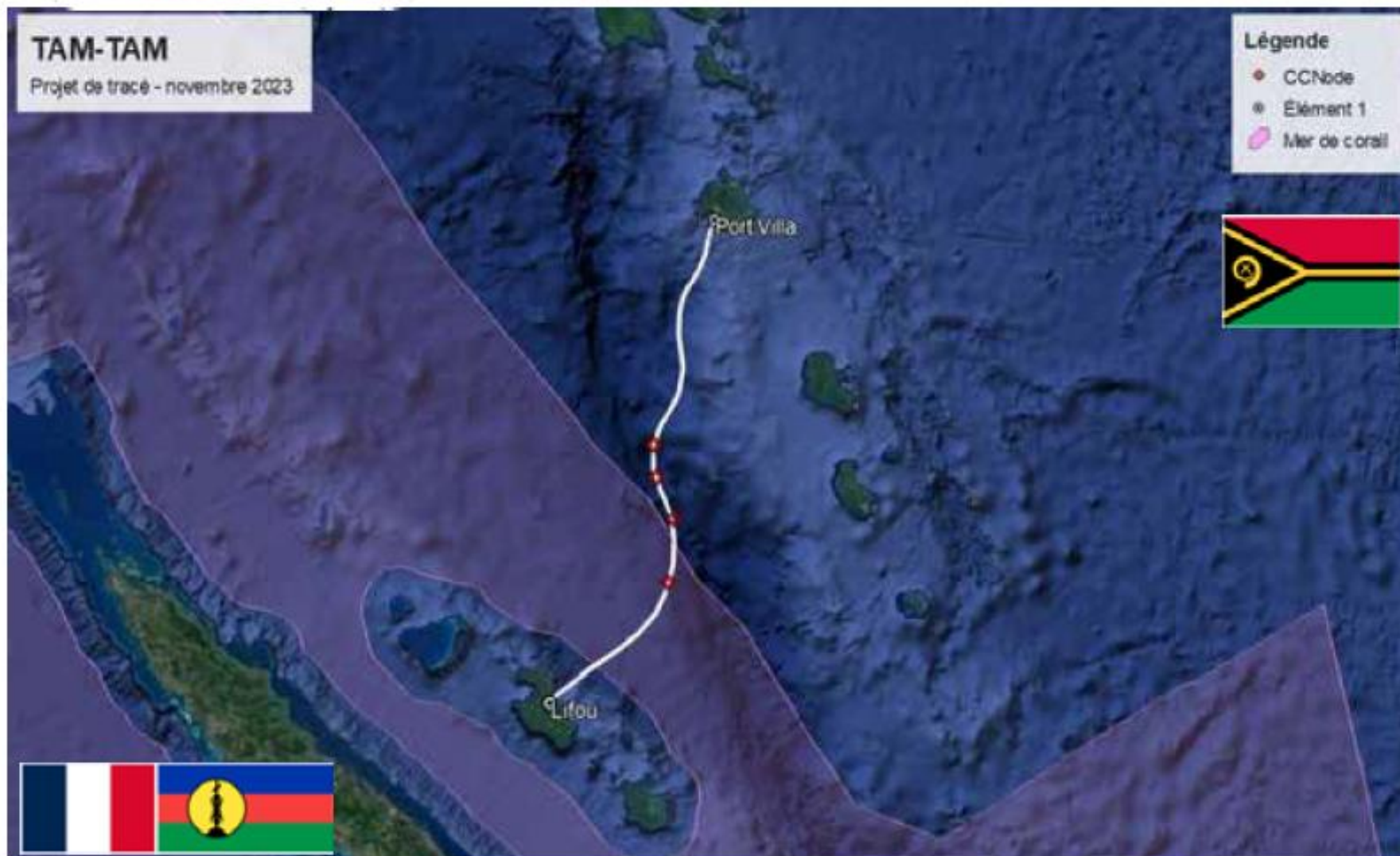
PIs: M. Patriat (Ifremer/Geo-Ocean)

V. Durand (IRD/GéoAzur),

Interseismic Deformation

- Active and Passive OBS array
- Geodesy (GNSS-A + Pressure A0A)

Comparison between fibersensing and Smart nodes



A unique experiment

Smart data in practice

Fibersensing together with
CCnode

How the Law of the Sea
performs?
(UNCLOS art. 248 et 249)

Business model?



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Take home message

Smart Cable – it's a reality!

