SUBMERSE Project

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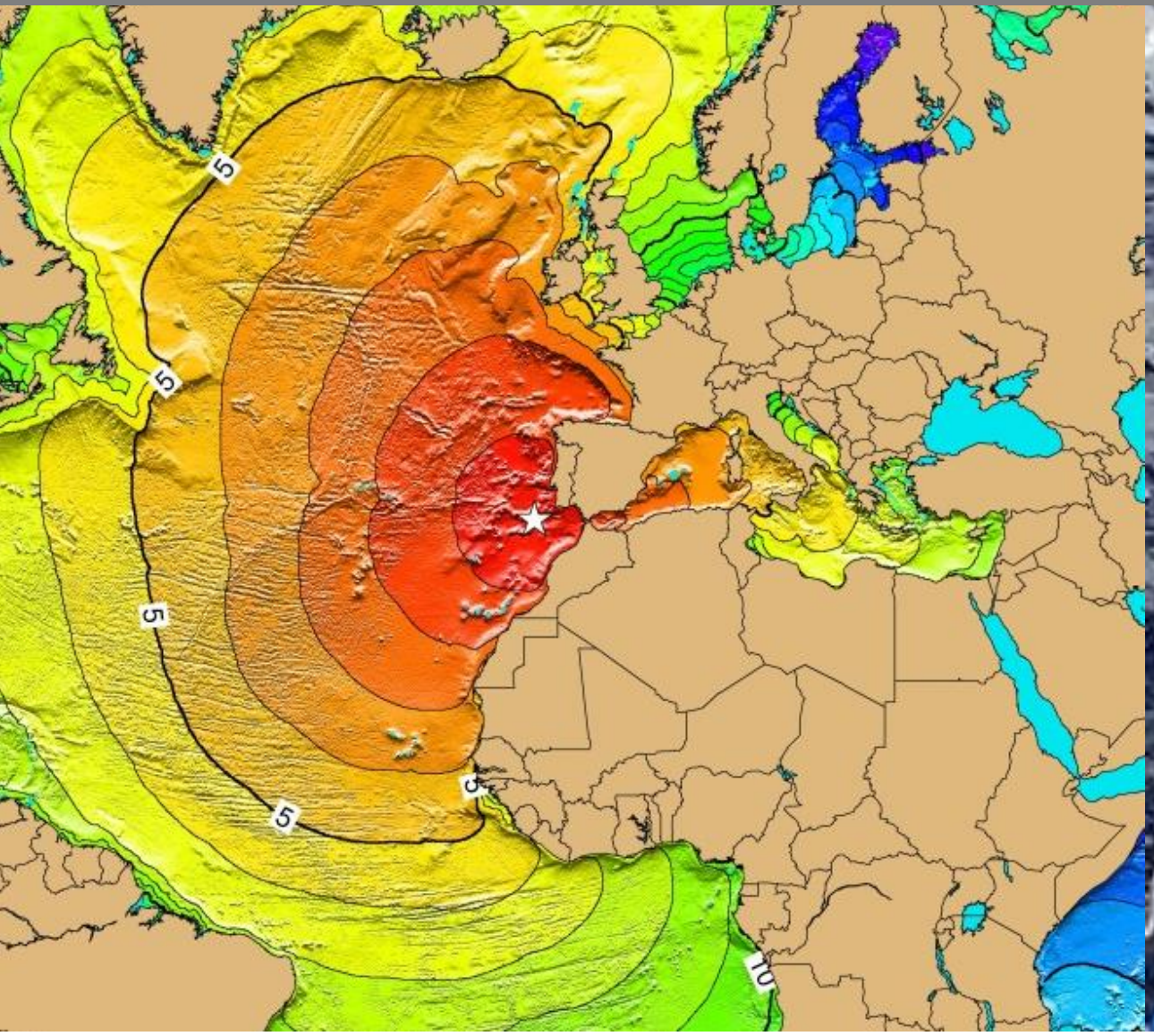
CEF 19 Apr 23

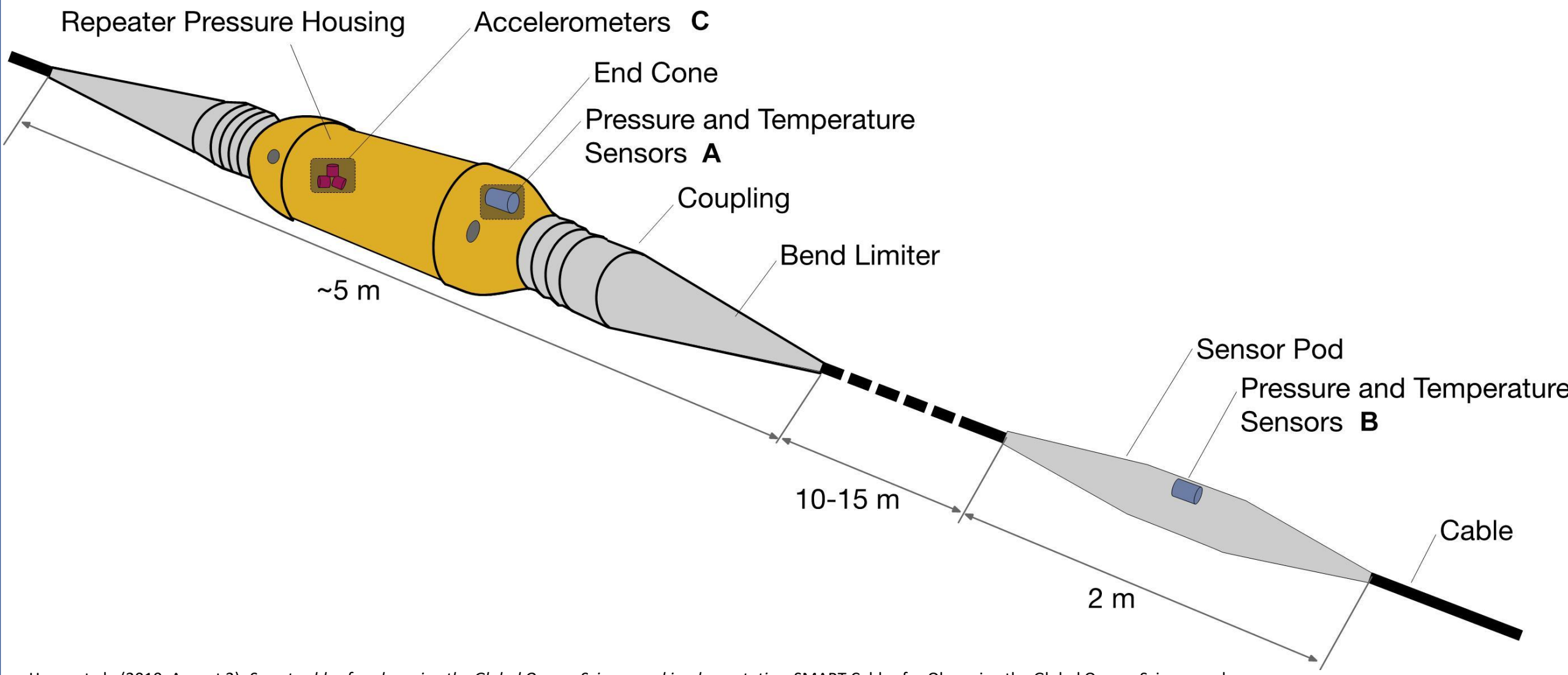
www.submerse.eu

Co-funded by
the European Union

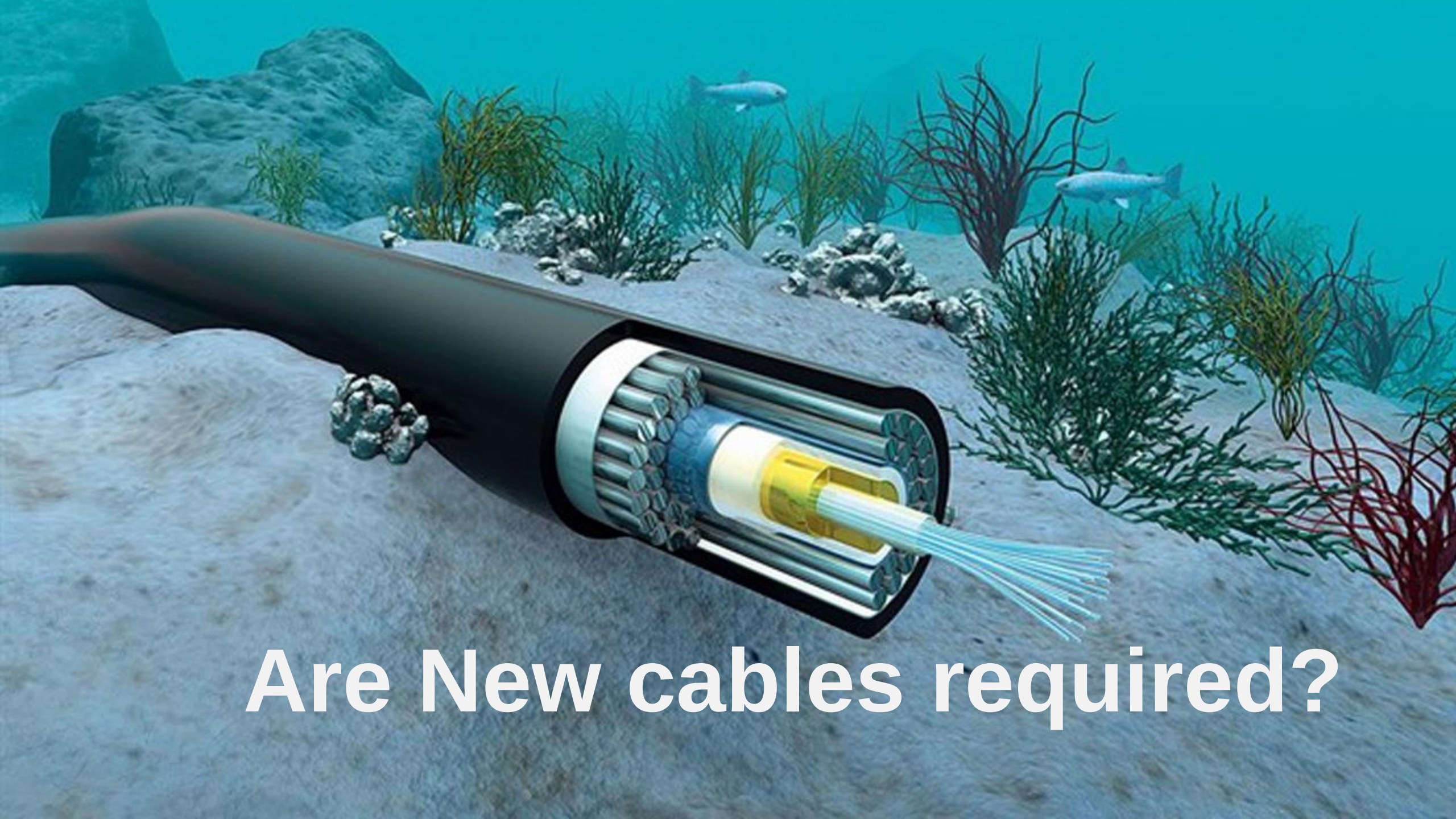
Some of the many global challenges



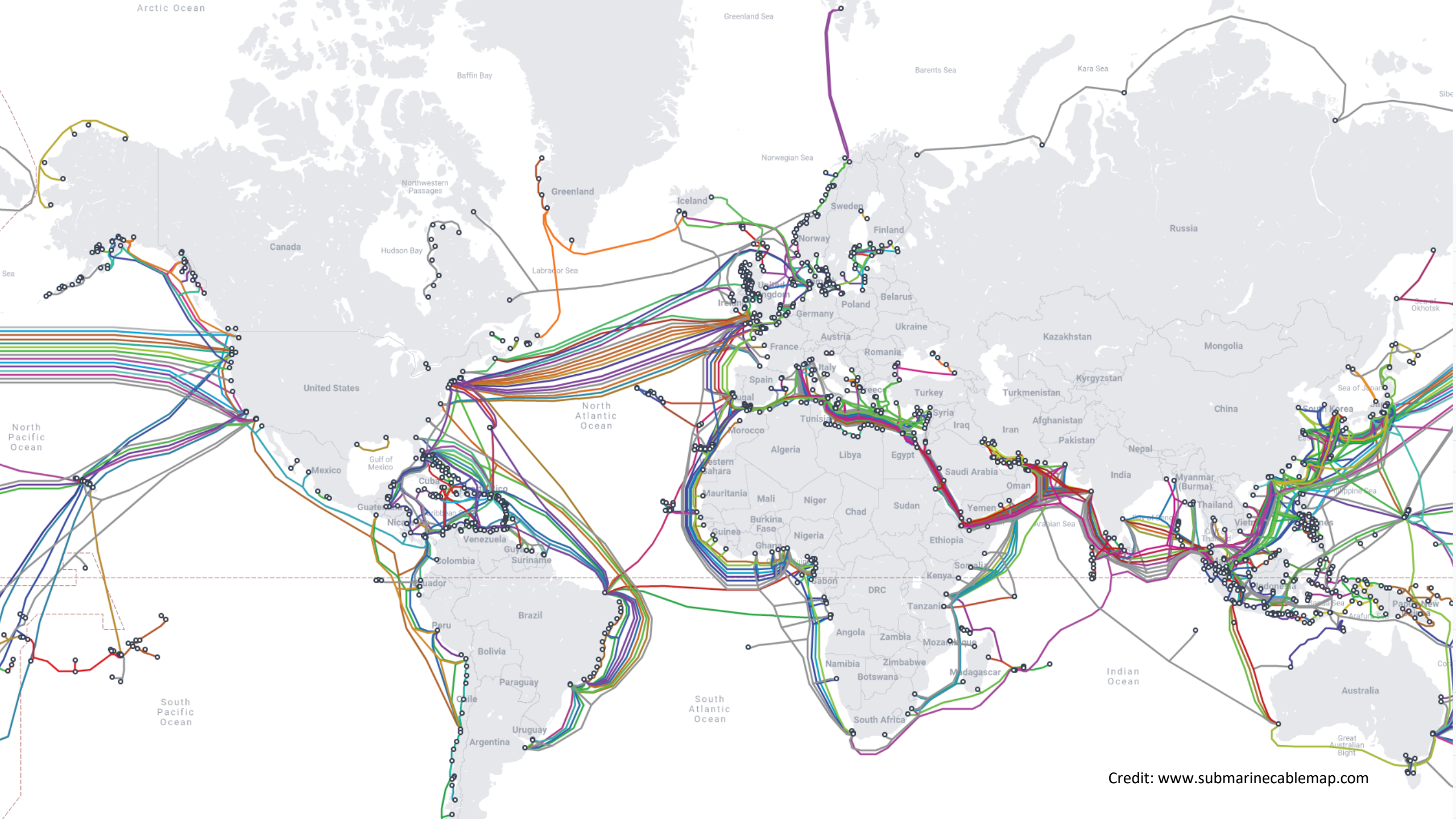
SMART Cable concept



Howe et al., (2019, August 2). *Smart cables for observing the Global Ocean: Science and implementation*. SMART Cables for Observing the Global Ocean: Science and Implementation. Retrieved June 10, 2022, from https://www.frontiersin.org/articles/10.3389/fmars.2019.00424/full



Are New cables required?



Credit: www.submarinecablemap.com

SUBMERSE Project has been funded!

- **Duration:** 36 months
- **State date:** May 2023
- **Total Requested EU contribution:** €9,744,100
- **Total personnel effort:** 652 Person Months
- 24 partner, including GÉANT and 8 NRENs (FCT, GRNET, Sikt, NORDUnet, DeiC, PSNC, GRENA) and EUROPEAN FUTURE INNOVATION SYSTEM CENTRE as Coordinator)
- GÉANT leading WP2 – Set-up and implementation of Proof of Concept (PoC) and providing optical engineering advice.

AIM

Investigate utilising existing telecommunication systems, rather than dedicated submarine fibre, for monitoring the earth and oceans, without disrupting telecoms traffic.

Objectives

Define a standardised concept architecture to integrate sensing technologies (DAS, SOP, SOP OTDR, SOP OFDR) into a single telecoms submarine cable system.

Complement existing infrastructures, datasets, and SMART cable concepts by developing a scalable data dissemination system from the new instruments to existing research infrastructures and communities.

Deploy a standardised prototype research instrument in at least 3 geographically diverse locations.

Scientifically validate and calibrate the instruments deployed

Produce open, machine readable, long-term datasets.

Develop the concept in collaboration with research communities, research infrastructures, Government institutions and industry.

Defining training and capacity building which allows for enhancing the collection, interpretation, processing and reuse of the data generated by the research instruments

Developing a roadmap and strategy to implement a sustainable research instrument and datasets from more countries

Consortium Members

SUBMERSE

EFISCENTRE

FCiências.ID
ASSOCIAÇÃO PARA A INVESTIGAÇÃO E DESENVOLVIMENTO DE CIÊNCIAS

Universidad de Alcalá

NTNU
Norwegian University of Science and Technology

ΕΘΝΙΚΟΝ ΑΣΤΕΡΟΣΚΟΠΕΙΟΝ ΑΘΗΝΩΝ
NATIONAL OBSERVATORY ATHENS

INESCTEC

U LISBOA
UNIVERSIDADE DE LISBOA

GFZ
Helmholtz-Zentrum
POTSDAM

hcmr
ΕΛΚΕΘΕ

LifeWatch ERIC

UNIVERSITAS BERGENSIS

Research Organisations

NORDUnet
Nordic Gateway for Research & Education

grnet

DeiC
DANISH E-INFRASTRUCTURE COOPERATION

CESNET

Sikt

GÉANT
Networks · Services · People

GRENA
GEORGIAN RESEARCH AND EDUCATIONAL NETWORKING ASSOCIATION

Red CLARA

FCT
Fundação para a Ciência e a Tecnologia

FCCN
Computação Científica Nacional

PSNC

NRENs

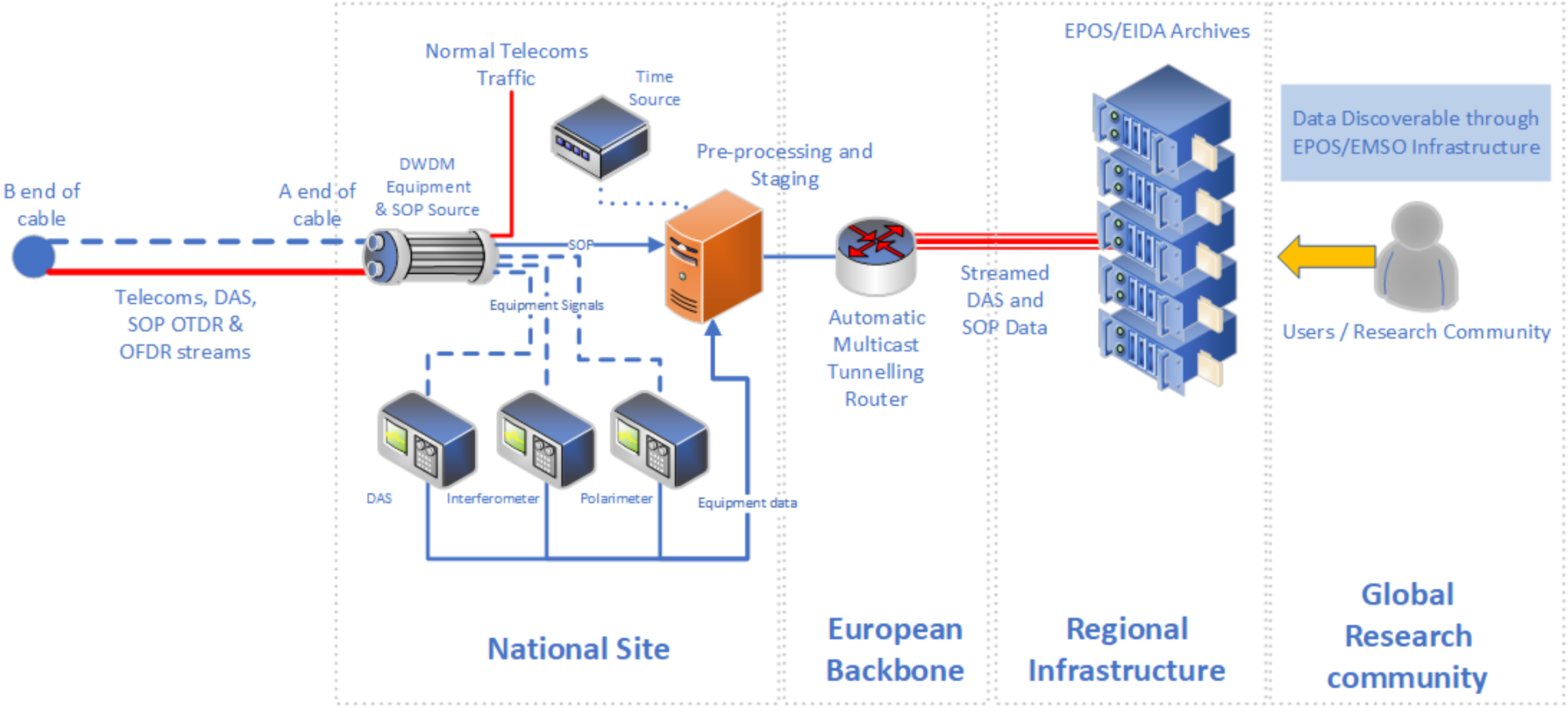
ALCATEL SUBMARINE NETWORKS

EllaLink

Coriant

Commercial organisations

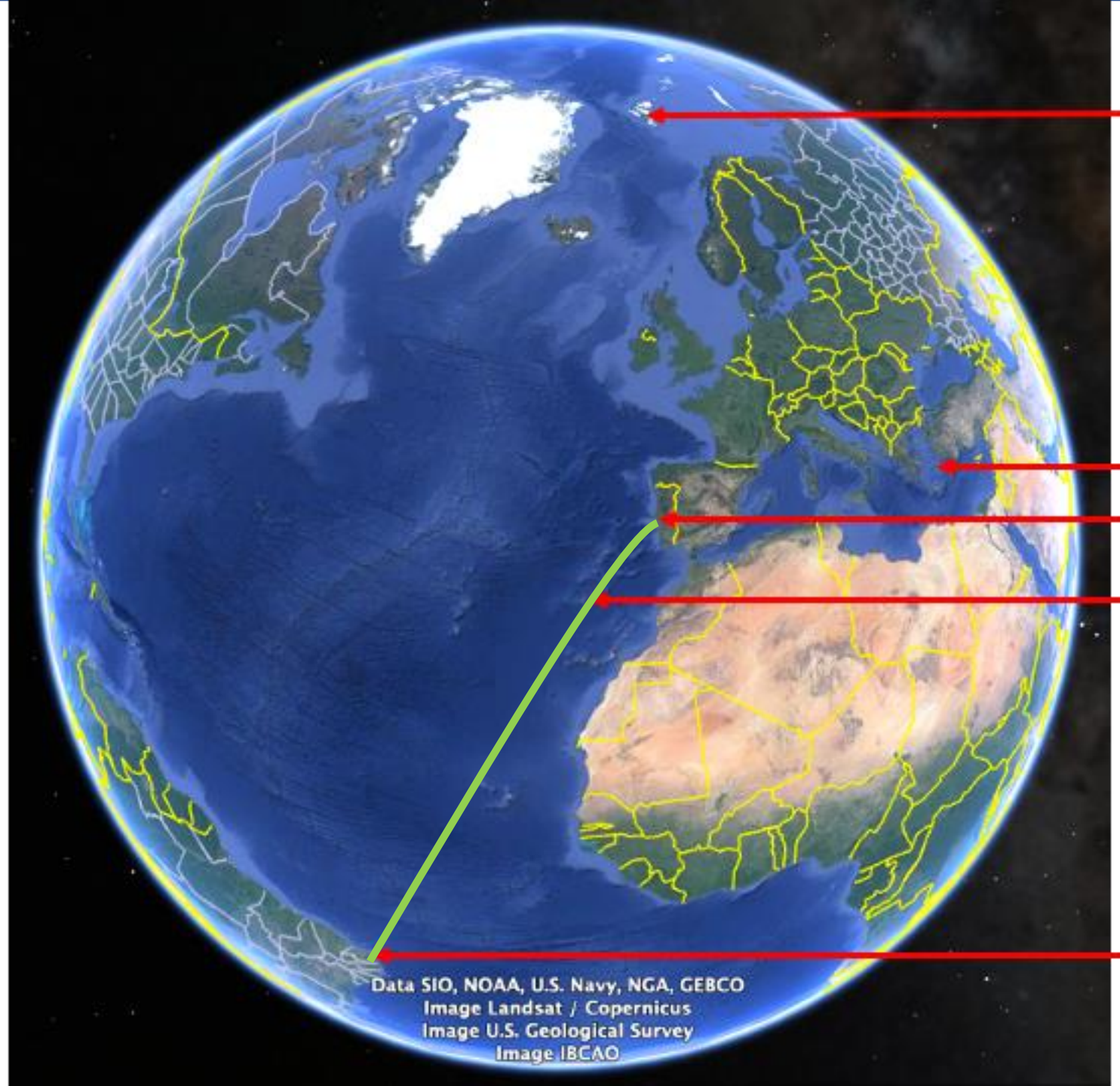
SUBMERSE Project concept



Indicative Site Locations

Primary sites would have both DAS, SOP and SOP OTDR

Secondary sites would not have all experiments



Svalbard, Norway
(DAS, SOP, SOP OTDR)

Rhodes, Greece
(DAS, SOP, SOP OTDR)

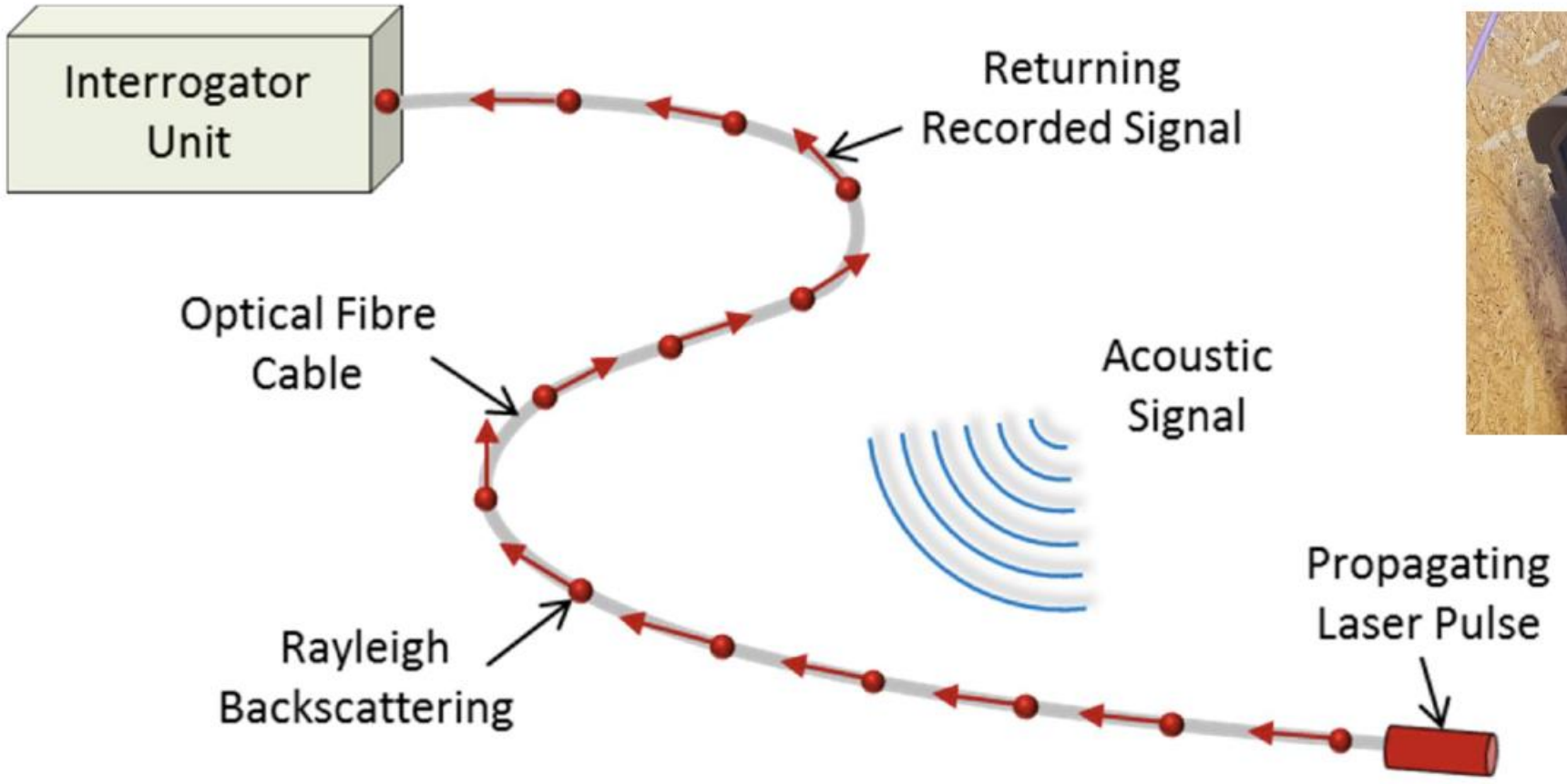
Sines, Portugal
(DAS, SOP, SOP OTDR)

Madeira, Portugal
(DAS)

Fortaleza, Brazil
(SOP, SOP OTDR)

The technologies

DAS: Distributed Acoustic Sensing



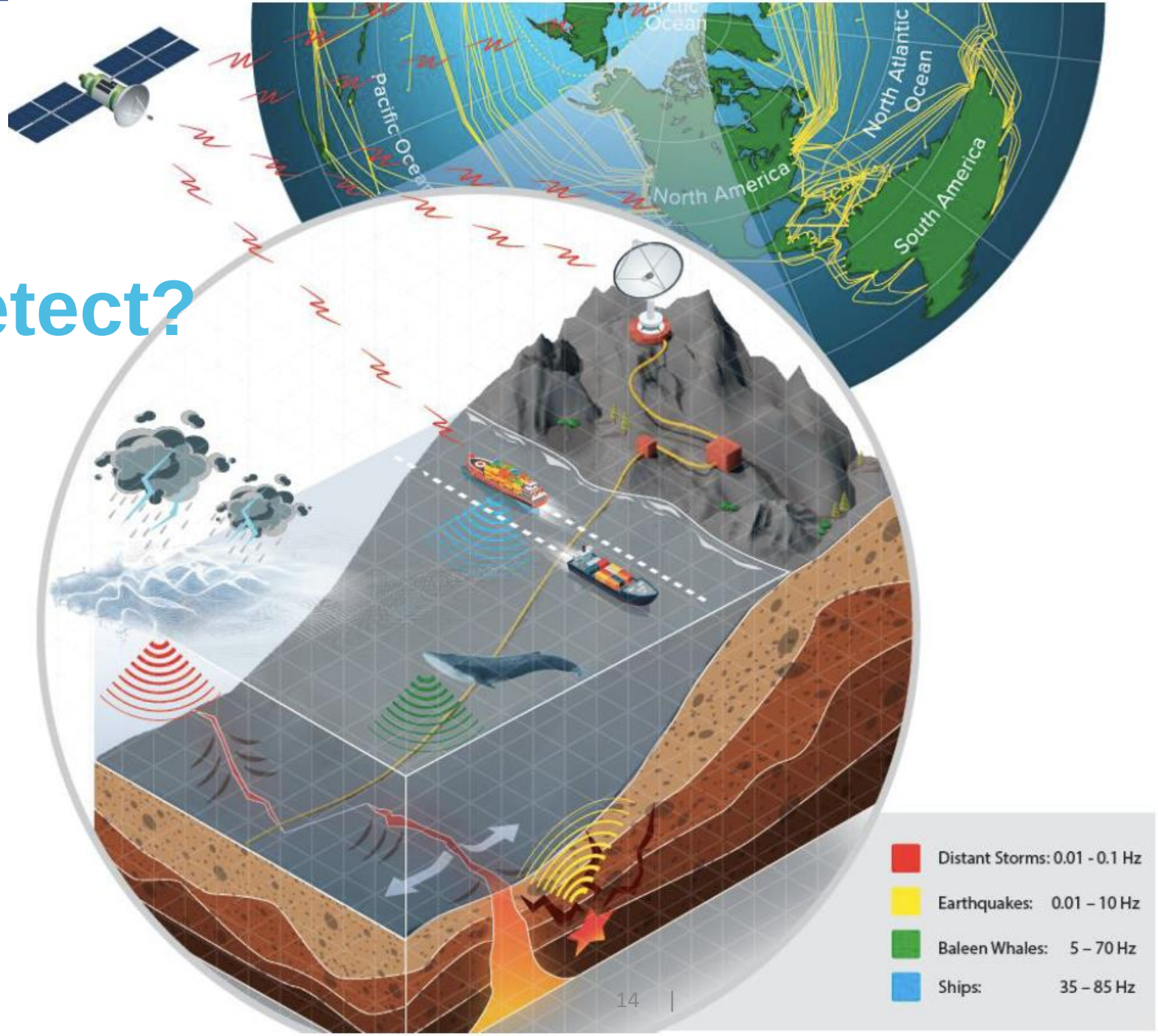
Can also measure transmitted signal or perform polarization analysis at the end of the fibre: SOP

Figure adapted from Wilks et al. , CLIMIT poster 2016

With thanks to Prof Martin Landrø, NTNU

What can DAS detect?

- Wales
- Storms
- Ships
- Earthquakes
- And more



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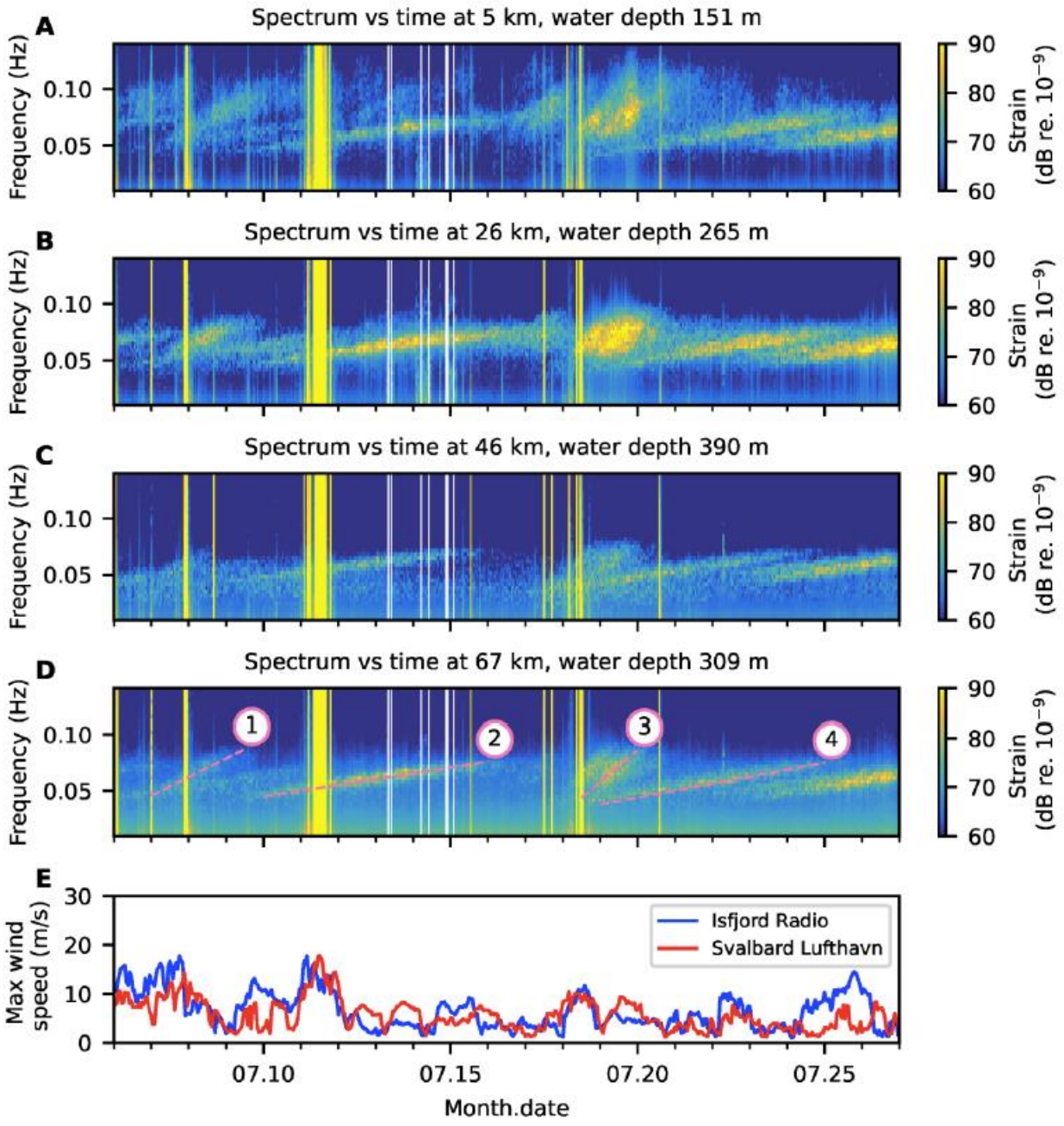
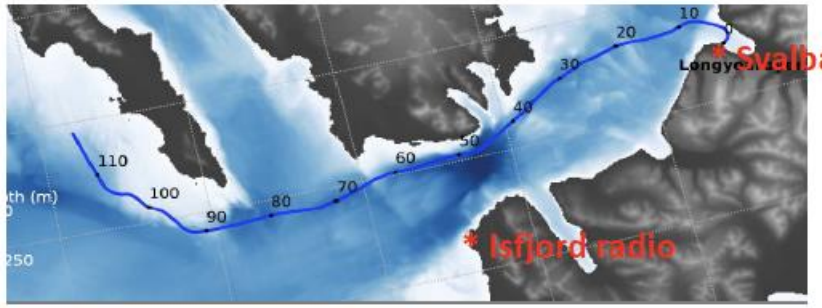


CGF SFI Centre for Geophysical Forecasting

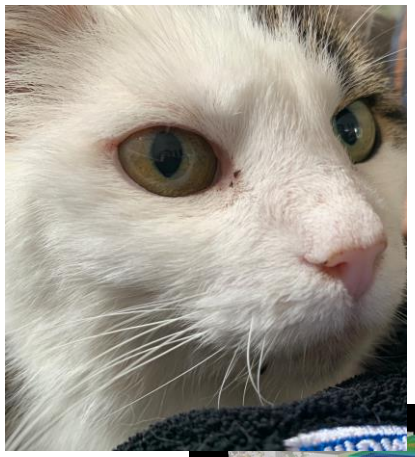


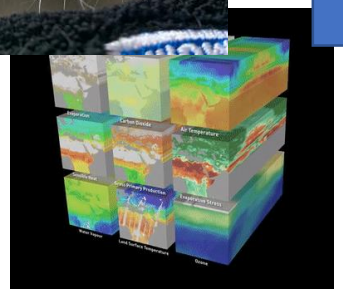
Munk, 1963: $$x = \frac{g}{4\pi\left(\frac{df}{dt}\right)}$$

1: Edouard 4100 km
2: Offshore Brazil, 13000 km
3: Storm between Iceland and Greenland 2400 km
4: Offshore Brazil, 11 000 km

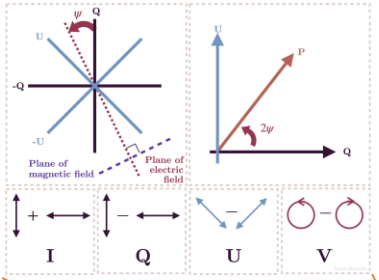
With thanks to Prof Martin Landrø, NTNU

The other technique – State of Polarisation (SoP)





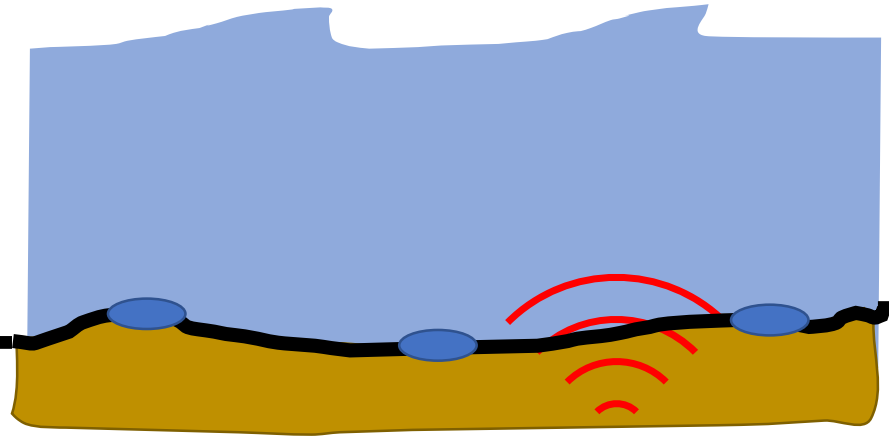
Normal telecoms traffic

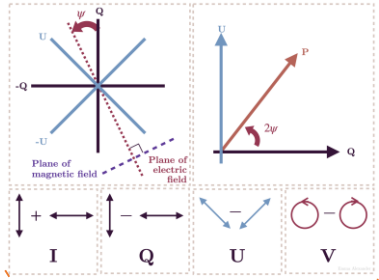


Stokes Parameter

DWDM Optical Transponder

Fibre optic Submarine telecom cable





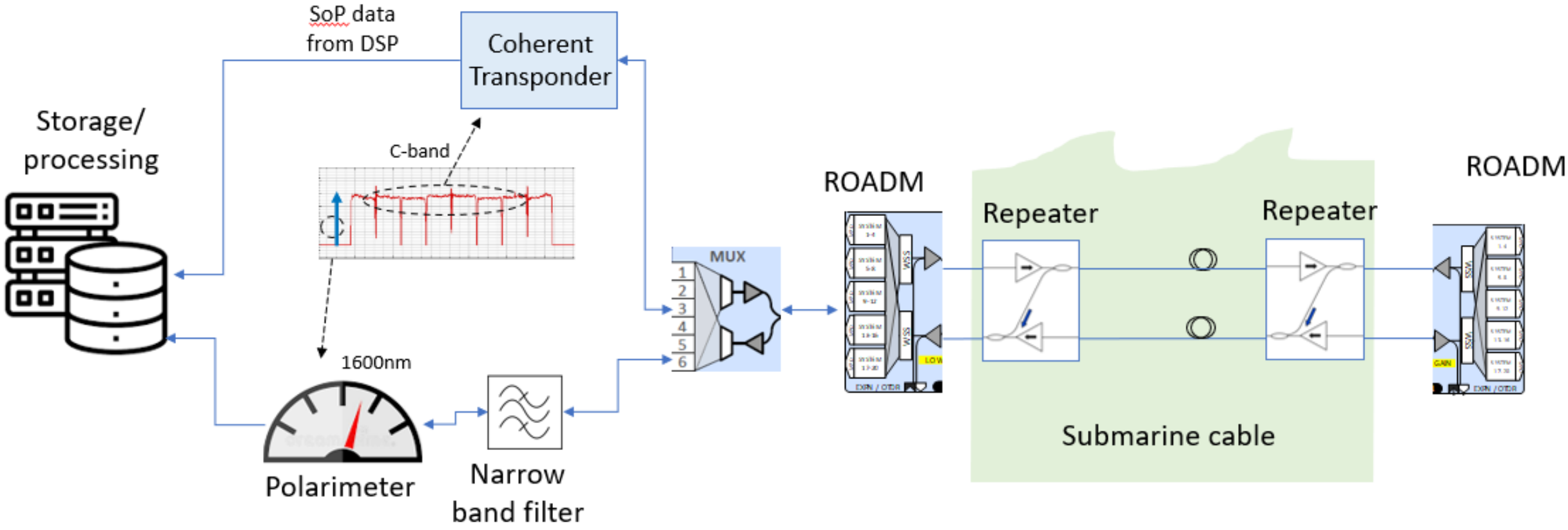
Stokes Parameter

DWDM Optical Transponder

Carrier phase and polarization can be recovered from the DSP outputs.

SOP OTDR

Sate of Polarization testing



SOP OFDR

Optical phase and polarization changes can be recorded across individual cable spans (the cable spans between repeaters) based on the frequency difference between the laser source and repeater units.

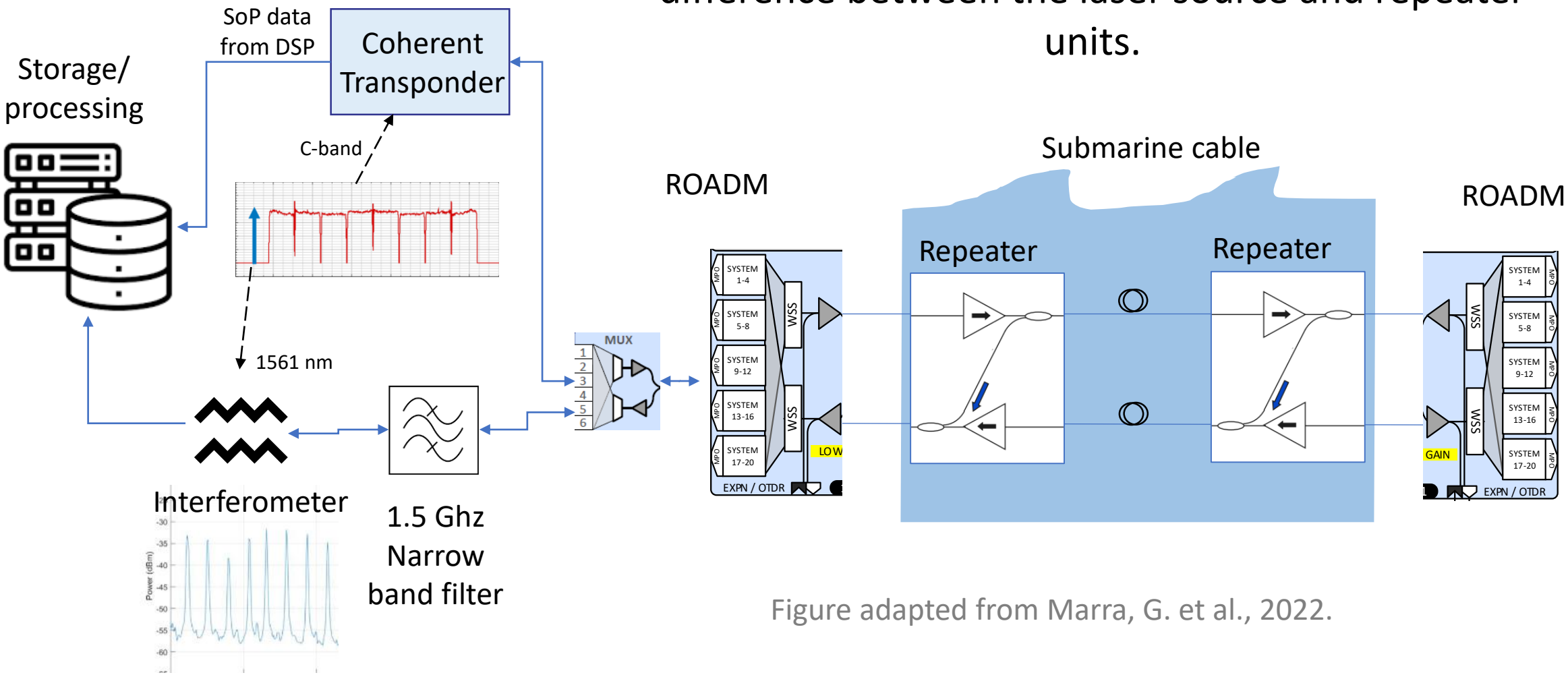


Figure adapted from Marra, G. et al., 2022.

CONCLUSION

- SUBMERSE has been funded and will launch in May
- Strong consortium of equipment vendors, NRENs and research institutes
- Initial infrastructure will include three submarine fibre systems, likely more fibre in the future
- Building a repository of seismic data for science will be a big asset for researchers
- The GEANT community’s dark fibre assets will move from being a commodity internet to a scientific instrument

SUBMERSE

Thank you

Any questions

www.submerse.eu

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