SUBMERSE FINAL EVENT
Oceanographic Use cases: Training session

Aggeliki Barberopoulou (HCMR, trainer)
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15 April 2026

www.submerse.eu

Co-funded by
the European Union

SUBMarine Cables for ReSearch and Exploration

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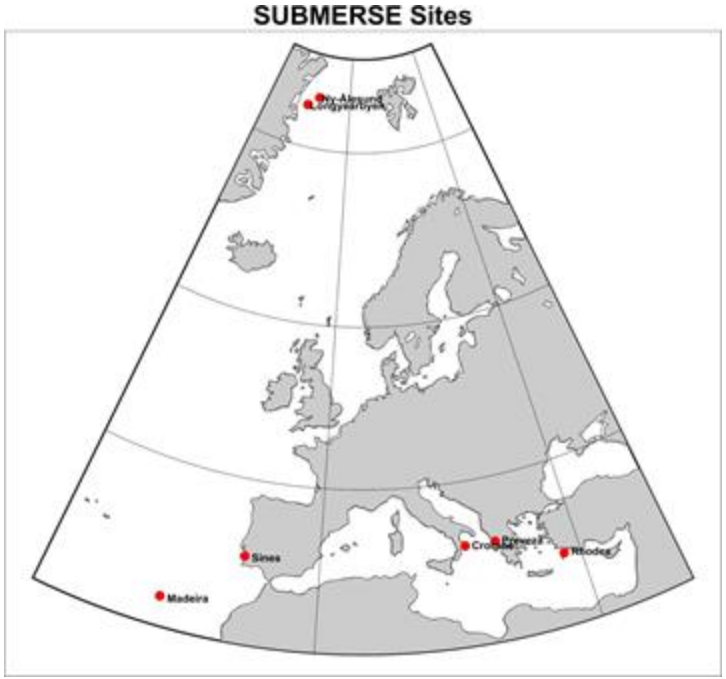
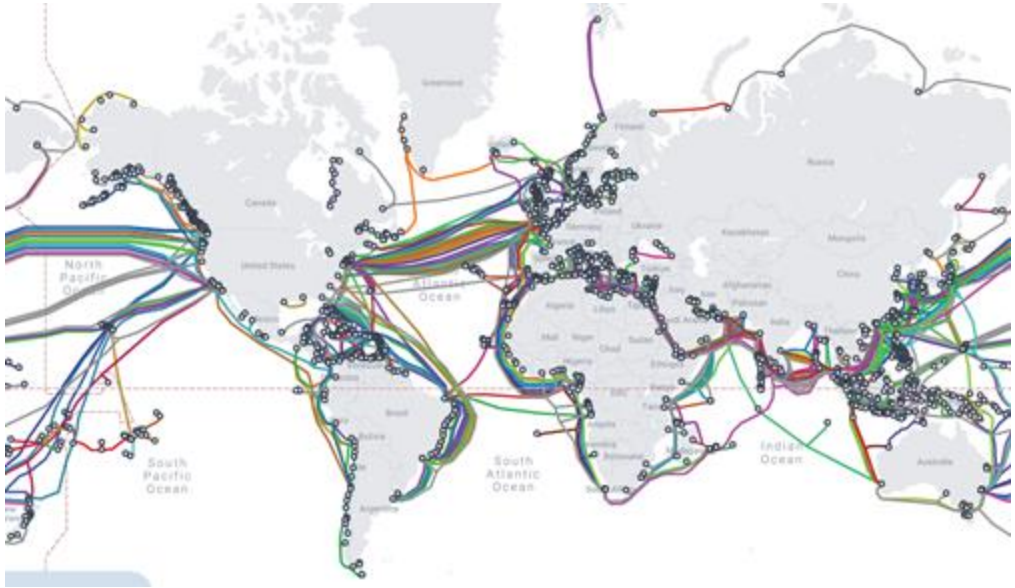
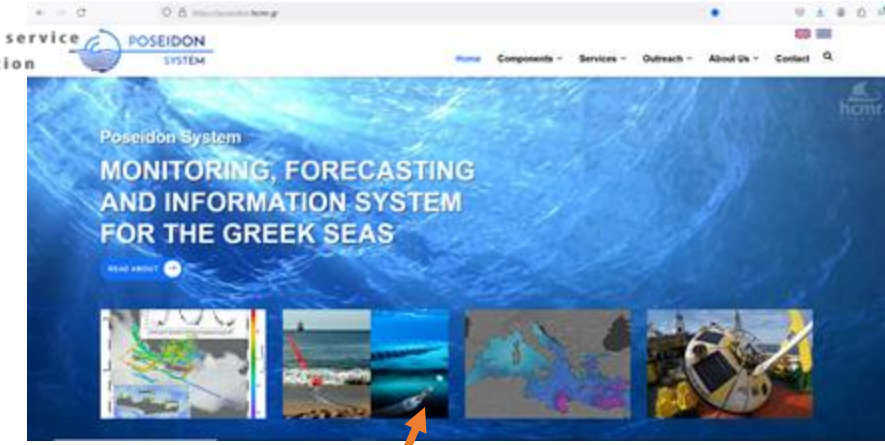
a new way to observe and monitor the ocean—using the cables already in place





https://www.submarinecablemap.com/

How do we monitor the oceans?



HISTORY OF OPERATIONAL OCEANOGRAPHY

1999: POSEIDON SYSTEM (>25 years of operation)

From **early human history** (Viking explorations) to **1950s** (WWII technologies i.e sonars)

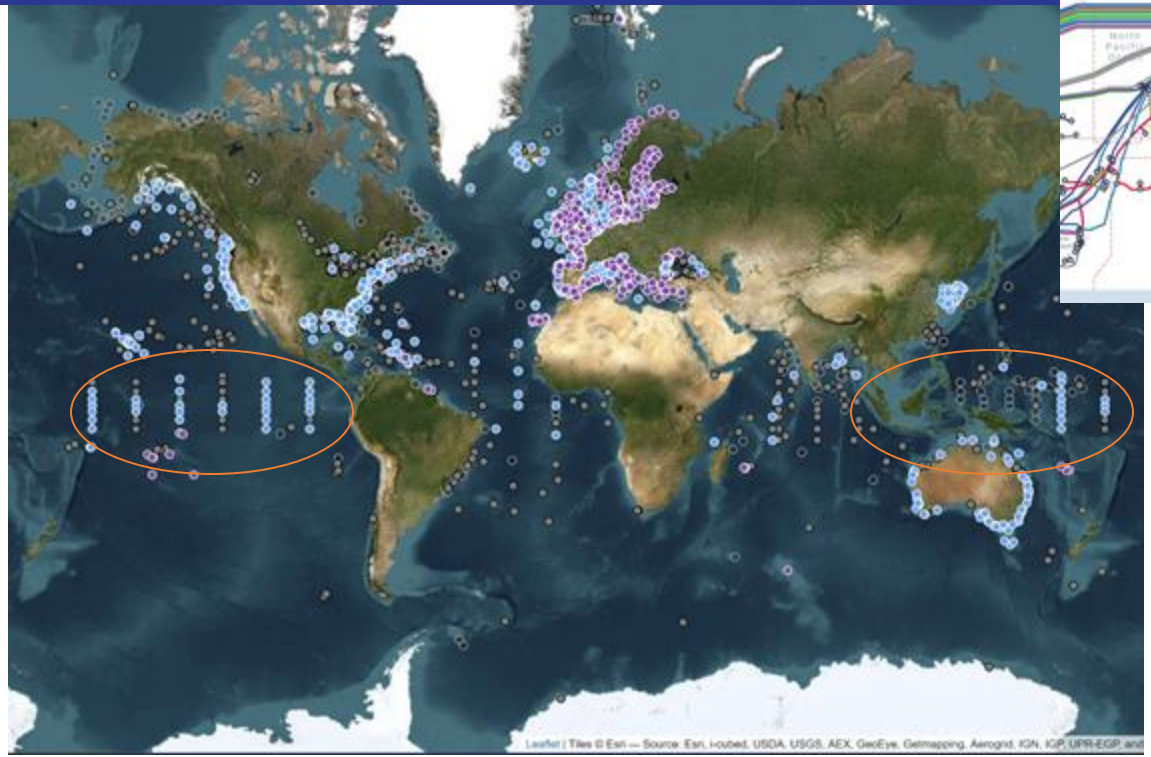
1950s-1990s
Satellites, improved computer capacity, data assimilation let to the beginning

1990s-early 2000s
European countries join forces to form European networks of monitoring and forecasting systems (EuroGOOS, My Ocean and Copernicus)

2000s to today
Mature phase in operational oceanography efforts (Copernicus Marine System)

https://eurogoos.eu/
https://www.mercator-ocean.eu/
https://poseidon.hcmr.gr/

Ocean Sensors vs Fibre Infrastructure



Copernicus In situ Thematic Assembly Centre Dashboard

Moored Ocean Buoys

Tide Gauges

Currently decommissioned/not transmitting data

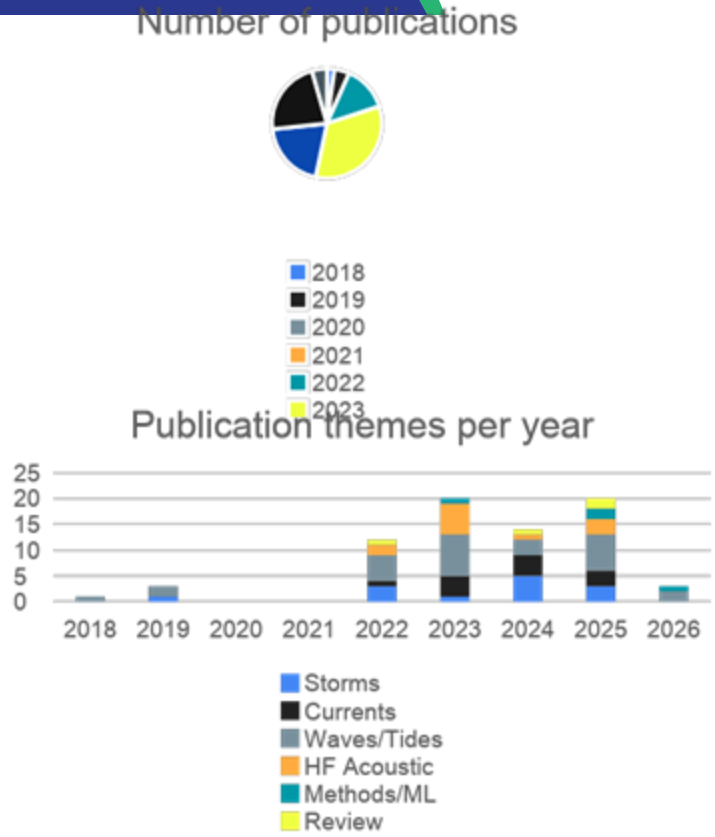
Moored buoy: ~$500k deployment

TAO array: ~$25–30M/year

Research vessel: ~$50k/day

Oceanography related DAS/SOP publications

Publication	Year	DAS	SOP	Storms & Weather	Currents	Waves , Tides & Tsunami	High Frequency Acoustic Signals/ Mammals	Methods / ML	Review
Jousset et al.	2018	✓	–	–	–	✓	–	–	–
Lindsey et al.	2019	✓	–	✓	–	✓	–	–	–
Sladen et al.	2019	✓	–	–	–	✓	–	–	–
Marra et al.	2022	–	✓	✓	–	✓	–	–	–
Landrø et al.	2022	✓	–	✓	–	✓	✓	–	–
Baker & Abbott	2022	✓	–	✓	–	✓	–	–	–
Bouffaut et al.	2022	✓	–	✓	–	✓	✓	–	–
Gorshkov et al.	2022	✓	✓	–	–	–	–	–	✓
Williams et al.	2022	✓	–	–	✓	✓	–	–	–
Xiao et al.	2023	✓	–	–	–	✓	–	–	–
Mata Flores et al.	2023	✓	–	–	✓	–	–	–	–
Wilcock et al.	2023	✓	–	–	–	–	✓	–	–
Douglass et al.	2023	✓	–	–	–	–	✓	–	–
Pelaez Quiñones et al.	2023	✓	–	–	✓	–	–	–	–
Williams et al.	2023	✓	–	–	✓	✓	–	–	–
Taweesintananon et al.	2023	✓	–	✓	–	✓	–	–	–
Rørstadbotnen et al.	2023	✓	–	–	–	–	✓	–	–
Currenti et al.	2023	✓	–	–	–	✓	–	–	–
Lior et al.	2023	✓	–	–	–	✓	–	✓	–
Yu et al.	2023	✓	–	–	–	✓	–	–	–
Guo et al.	2023	✓	–	–	–	–	✓	–	–
Lin et al.	2024	✓	–	✓	✓	–	–	–	–
Meulé et al.	2024	✓	–	✓	–	✓	–	–	–
Song et al.	2024	✓	–	✓	✓	–	–	–	–
Spingys et al.	2024	✓	–	✓	✓	–	–	–	–
Spingys et al.	2024	✓	–	✓	✓	–	–	–	–
Glover et al.	2024	✓	–	–	–	✓	–	–	–
Shen et al.	2024	✓	–	–	–	–	✓	–	–
Tonegawa & Araki	2024	✓	–	–	–	✓	–	–	–
Wei et al.	2024	✓	–	–	–	–	–	–	✓
Gou et al.	2025	✓	–	–	–	✓	–	✓	–
Liu et al.	2025	✓	–	–	–	✓	–	–	–
Harmon et al.	2025	✓	–	–	–	✓	–	–	–
Ko et al.	2025	✓	–		✓	✓	✓	–	–
Shi et al.	2025	✓	–	✓	–	✓	✓	✓	–
Saw et al.	2025	✓	–	–	–	–	✓	–	–
Yang et al.	2025	✓	–	✓	✓	✓	–	–	–
Xenaki et al.	2025	✓	–	–	–	–	–	–	✓
Loureiro et al.	2025	✓	–	–	✓	✓	–	–	–
Markom et al.	2025	✓	–	–	–	–	–	–	✓
Glover et al.	2026	✓	–	–	–	✓	–	–	–
Davis et al.	2026	✓	–	–	–	✓	–	✓	–



Fibre-Optic sensing of the ocean: DAS

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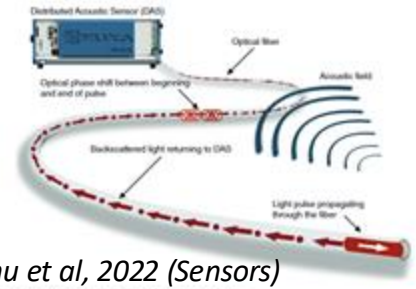
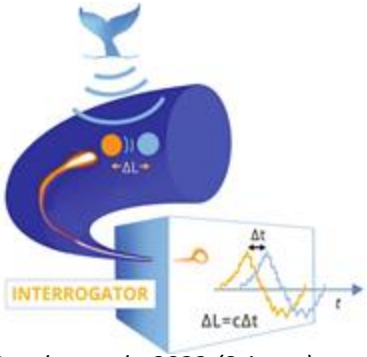
TECHNOLOGY



Zhu et al, 2022 (Sensors)

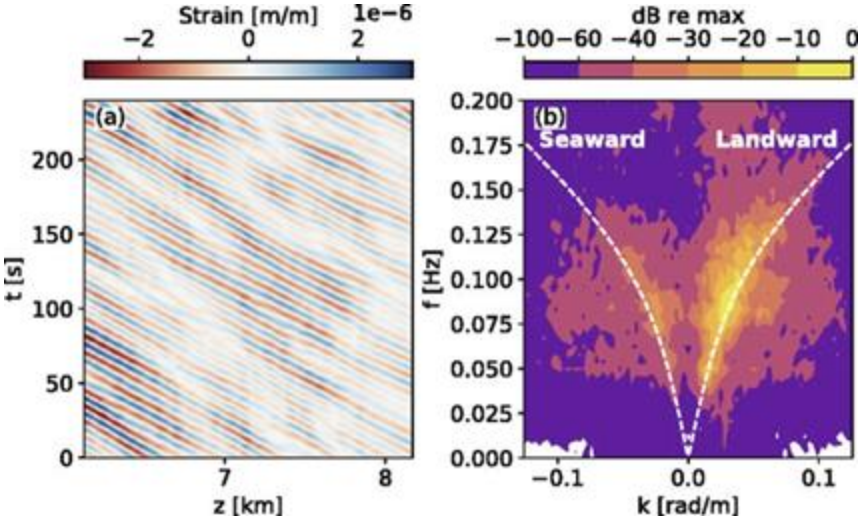


Landrø et al., 2022 (Science)

phase of backscattered light ⇒
dynamic strain ⇒ ocean signals

OBSERVED OCEAN SIGNALS

Ocean Surface Gravity Waves (OSGW)



Xenaki et al., 2025 (JASA)

From DAS signals to ocean parameters

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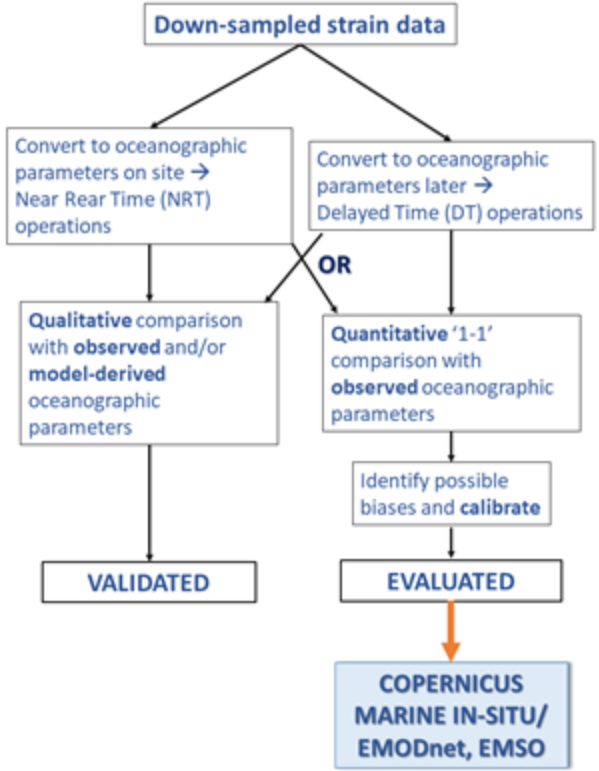
From strain to ocean parameters workflow

Fibre strain →

Transfer function/ML →

Ocean variable

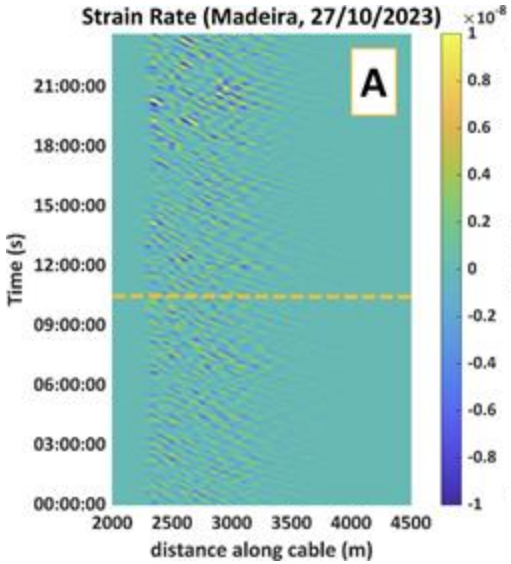


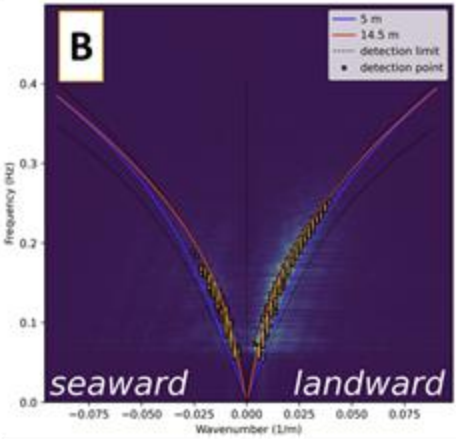
Ocean signals detected

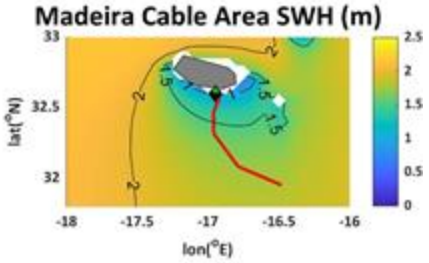
Ocean signals observed Distributed Acoustic Sensing (DAS)	Frequency	Publications	Comparison to in-situ observations
Ocean surface gravity waves (OSGW)	~0.05–0.5 Hz	Lindsey et al., 2019 Sladen et al., 2019 Landrø et al., 2022 Williams et al., 2022 Taweesintananon et al., 2023 Glover et al., 2024 Lin et al., 2024 Meulé et al., 2024 Song et al., 2024 Yang et al., 2025 Shi et al., 2025 Loureiro et al., (in press)	Yes Yes Yes Yes
Internal waves (IW)	~0.001–0.1 Hz	Pelaez Quiñones et al., 2023 Williams et al., 2023	Yes
Ocean bottom currents	<0.01 Hz	Williams et al., 2022 Mata Flores et al., 2023 Lin et al., 2024 Song et al, 2024 Spingys et al., 2024 a, b Ko et al., 2025	Yes Yes Yes
Marine mammal vocalizations	10 Hz–20 kHz (depending on the species)	Landrø et al., 2022 Bouffaut et al., 2022 Rørstadbotnen et al., 2023 Wilcock et al., 2023 Saw et al., 2025 Loureiro et al., (in press)	

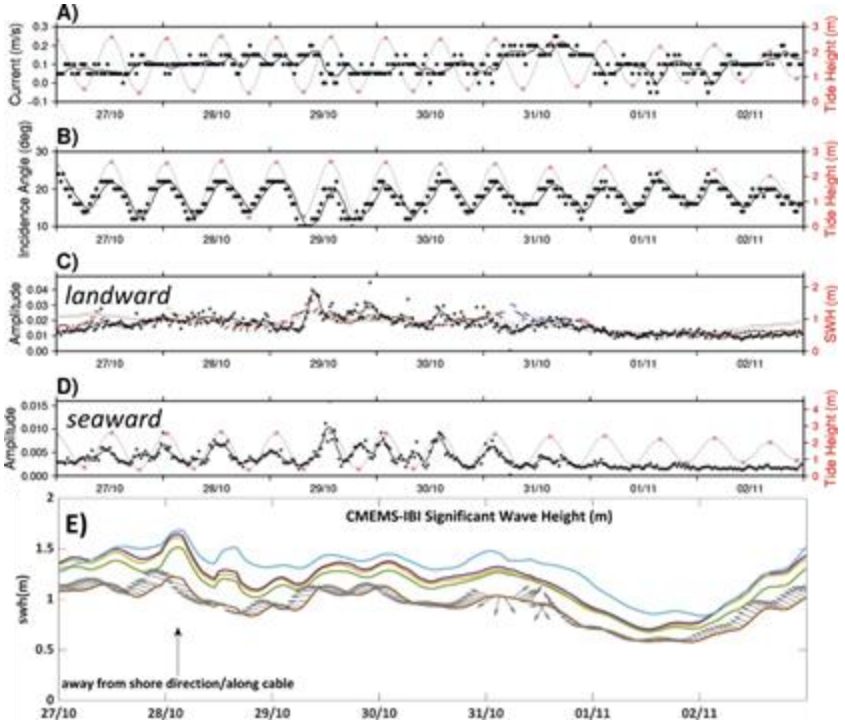
# of studies including ocean observations = 8

Ocean variable proxies observed with DAS: Madeira Site









Schlaphorst et al.(under review)
Papapostolou et al. (OSM 2026, AGU)