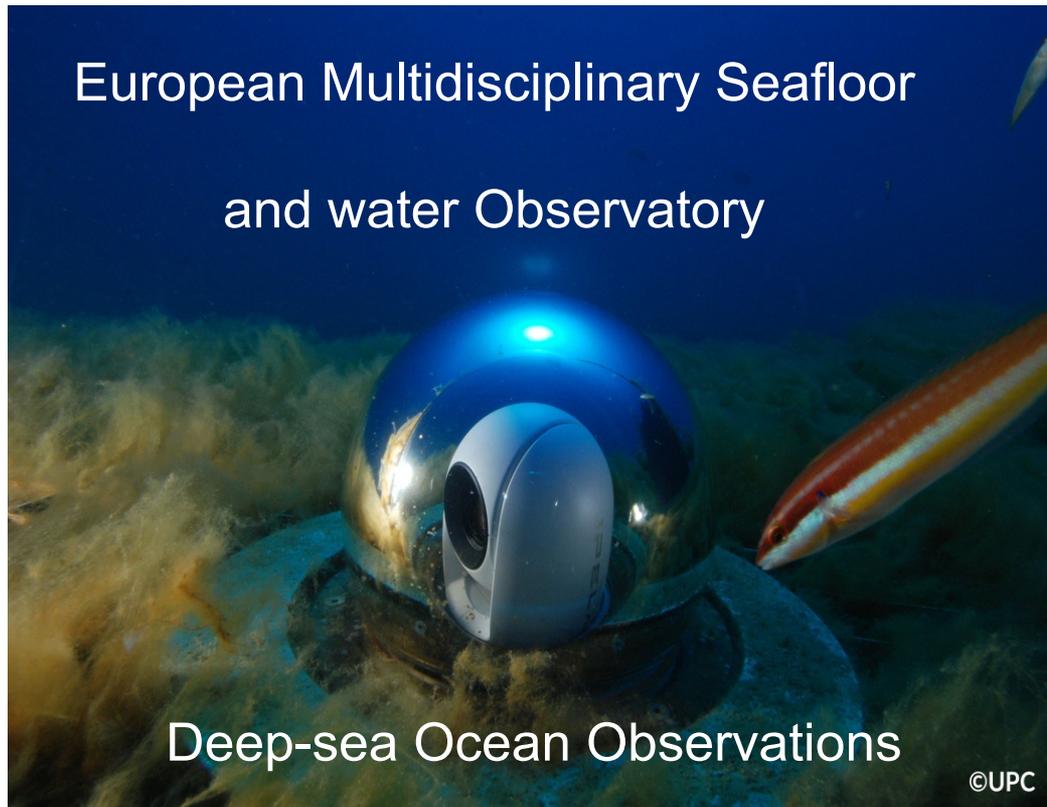


European Multidisciplinary Seafloor and water Observatory



Deep-sea Ocean Observations

©UPC

Why EMSO Ocean Observations are crucial to understand
global environmental changes?

*Juanjo Dañobeitia,
on behalf of EMSO ERIC*



Geo-inquire- seminar,
11 May 2023, online



EMSO ERIC RF Components and locations

EMSO ERIC RF Components and locations - 2023

DISTRIBUTED RESEARCH INFRASTRUCTURE

- ✓ 8 Countries
- ✓ 27 Research Institutions

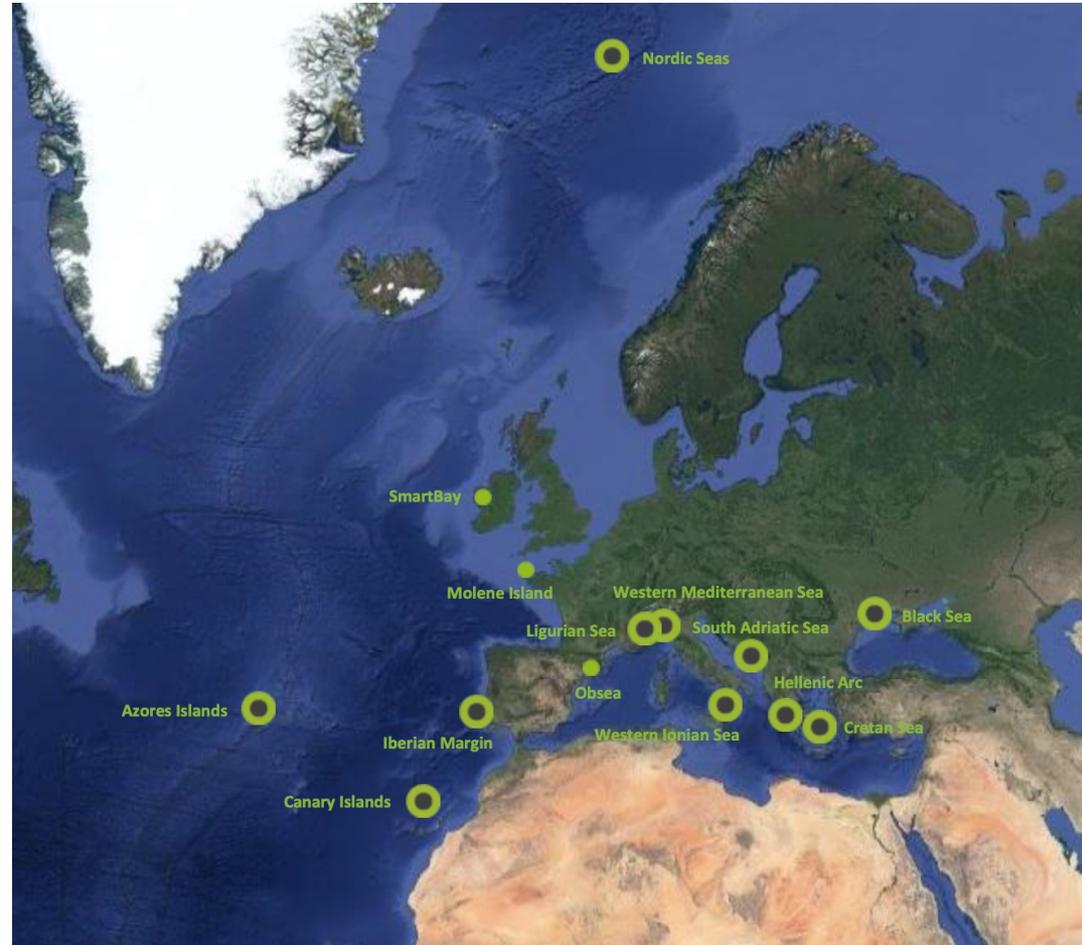
14 FIXED POINT MUTI-SENSORS

PLATFORMS:

- ✓ 11 Deep Sea Observatories
(Cable & Stand-alone)
- ✓ 3 Test Sites, Shallow water

OBSERVING AND MONITORING THE OCEANS

- ✓ **Time-series:** continuous parameters acquisition
- ✓ **Target:** Open Ocean Multidisciplinarity
*Geosphere-Hydrosphere-Biosphere-
Atmosphere interactions*



EMSO RFs Access to High-quality Marine Environmental Information

Geo-inquire- seminar,
11 May 2023, online

EUROPEAN MULTIDISCIPLINARY SEAFLOOR AND WATER COLUMN OBSERVATORY

EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

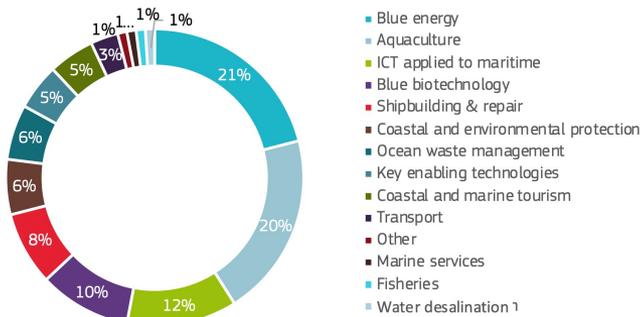
EMSO ERIC is an intergovernmental organisation, with autonomous legal status (ERIC), participated by eight European countries. EMSO is headquarters are located in Rome, Italy

EMSO ERIC aims at promoting excellent science through the coordination of a distributed infrastructure of fourteen observatories serving marine science researchers and technology engineers, policymakers, industry and the general public.

Needs and benefits of multiplatform Ocean Observations

- 5 million jobs in EU
- New jobs related with Blue growth
- The ocean is the new Blue economic frontier

Figure 2.4 Distribution of companies funded by BlueInvest per sector

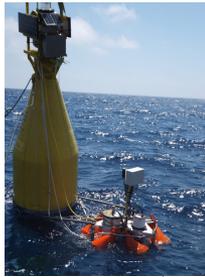


After the EU blue economy report, 2022

- **Grand challenges**
 - Climate change
 - Biodiversity & Ecosystems (Anthropogenic action- loss of diversity, limited resources)
 - Pollution (toxic algal, pesticides, plastic)
 - Geohazards (Earthquakes, Tsunamis, Submarine slides)

- We need knowledge, information and effective Management

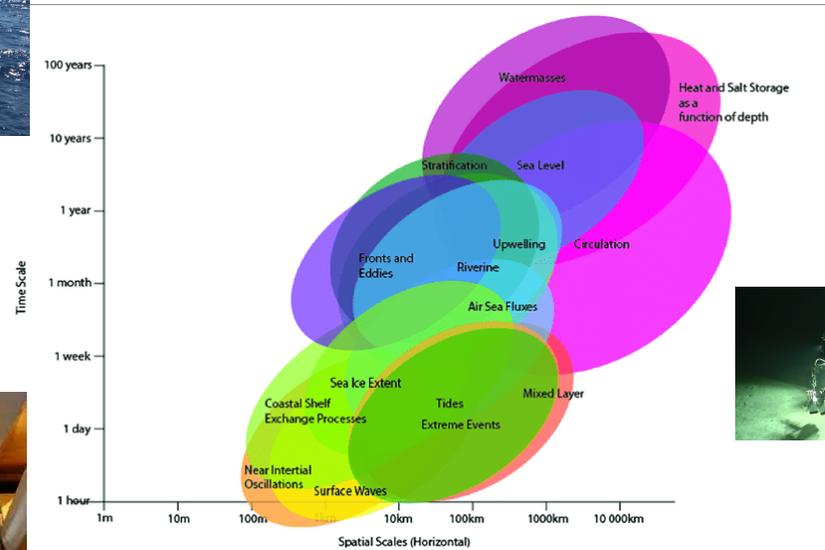
Ocean buoy



Cabled observatories



Gliders



Sloyan BM et al., *Front. Mar. Sci.* 6:449. doi: 10.3389/fmars.2019.00449



Argo Floats



ROVs



Deepsea floor observatories



Research Vessels

Geo-inquire- seminar,
11 May 2023, online

SCIENCE

Oceans play a crucial role in human wellbeing

- Degradation and loss of biodiversity impacts marine resource exploitation
- Ocean circulation affects climate change
- Natural hazards like tsunamis, earthquakes and volcanic eruptions have socioeconomic impacts



Geohazards: slope stability, hydrothermal vents, tsunami, seismic and volcanic real-time monitoring



Climate Change: ocean acidification, dynamics of water masses, deep underwater circulation, sea level rise



Marine Ecosystems: biodiversity, pollution, sustainable fisheries, anthropogenic noise, marine mammal tracking, algal blooms



Continental-scale system of Regional Facilities:

Fixed platforms: moorings and seafloor stations Cabled or autonomous

Time-series: Continuous measurement acquisition

Target: Geosphere-Hydrosphere-Biosphere-Atmosphere interactions

WHY OBSERVE THE DEEP SEA?

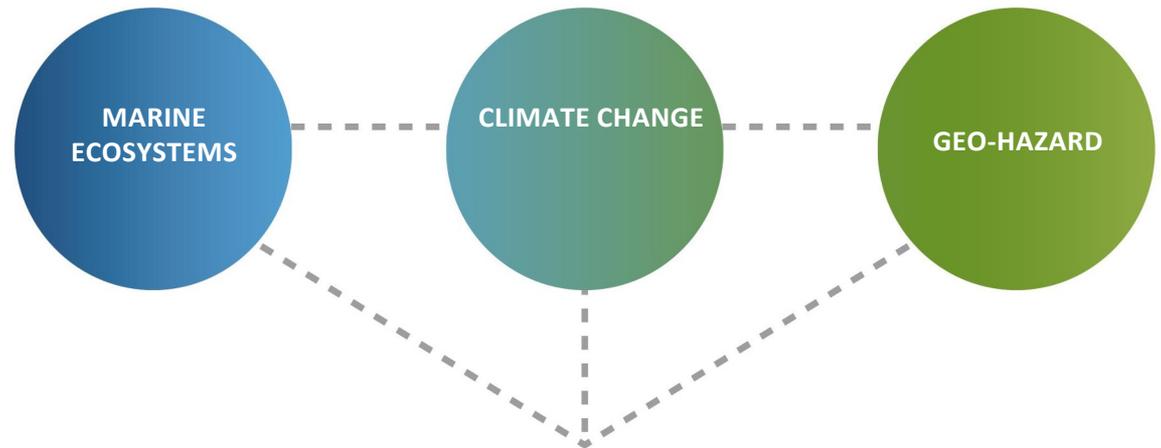
OCEANS PLAY A CRUCIAL ROLE IN HUMAN WELLBEING

Ocean knowledge will certainly help us to better understand processes like:

- Uptakes carbon dioxide from the atmosphere and of anthropogenic origin, critically affecting the climate and life on Earth.
- Degradation and loss of biodiversity reduces or eliminates the food resources and living space for most species.
- Dynamics of Ocean circulation
- Natural hazards such as tsunamis, earthquakes and volcanic eruptions affect human life and has a high socioeconomic impact

EMSO ERIC

supports multidisciplinary research in:



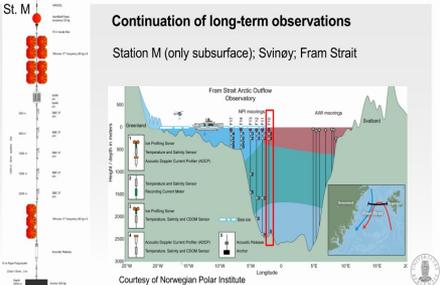
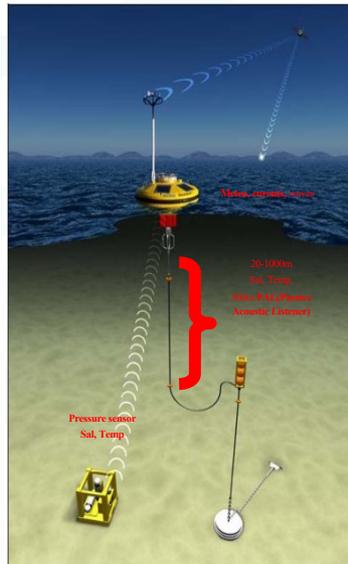
TO ACHIEVE sustainable management and protection of marine resources
TO UNDERSTAND the complex interactions among the geosphere, biosphere, hydrosphere and atmosphere

EMSO ERIC RFs observing EOVs

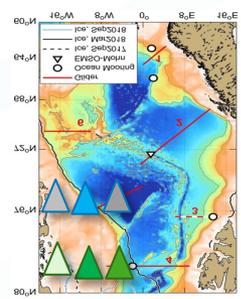


ERIC
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

EMSO Regional facilities Across European Seas

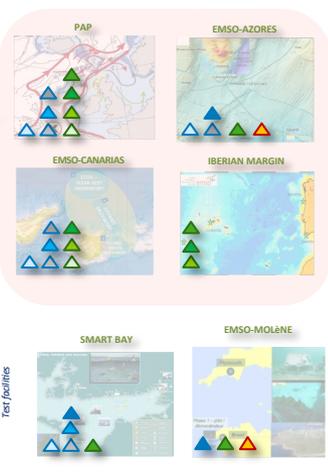


NORDIC SEAS



- ▲ Metrology
- ▲ Geo-hazards
- Physical Oceanography**
- ▲ surface, on buoy
- ▲ surface waters, 0-100m
- ▲ water column, below 100m
- ▲ seabed
- Biogeochemistry**
- ▲ surface, on buoy
- ▲ surface waters, 0-100m
- ▲ water column, below 100m
- ▲ seabed

ATLANTIC OCEAN



MEDITERRANEAN SEA



BLACK SEA

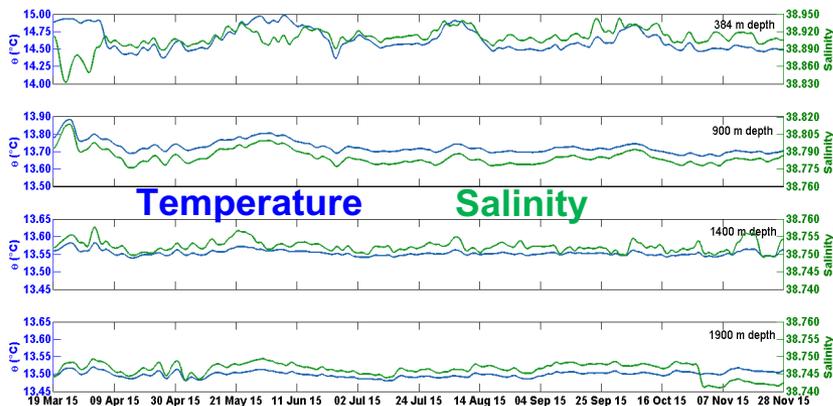
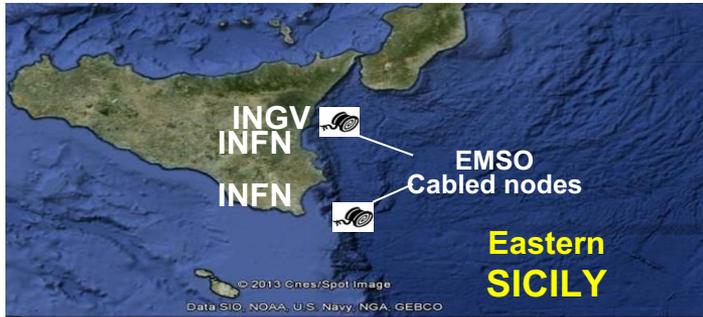


Geo-inquire- seminar,
11 May 2023, online

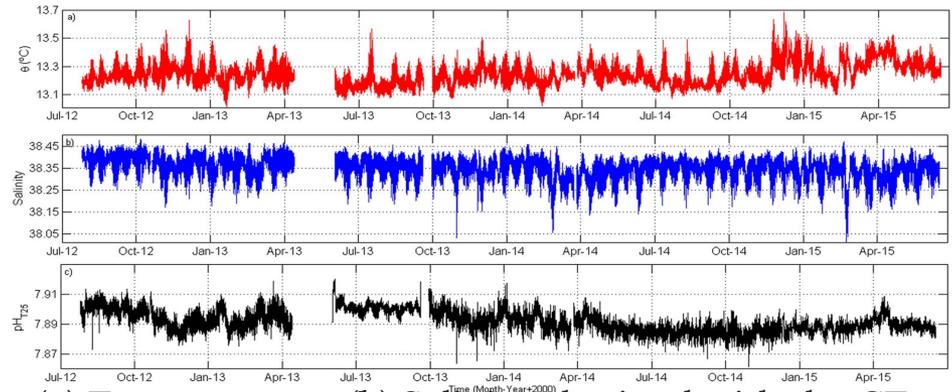
EMSO TIME SERIES CONFERENCE
**OBSERVING
OCEAN
SOUND**

Global change and Ocean circulation

Physical and biogeochemical parameters



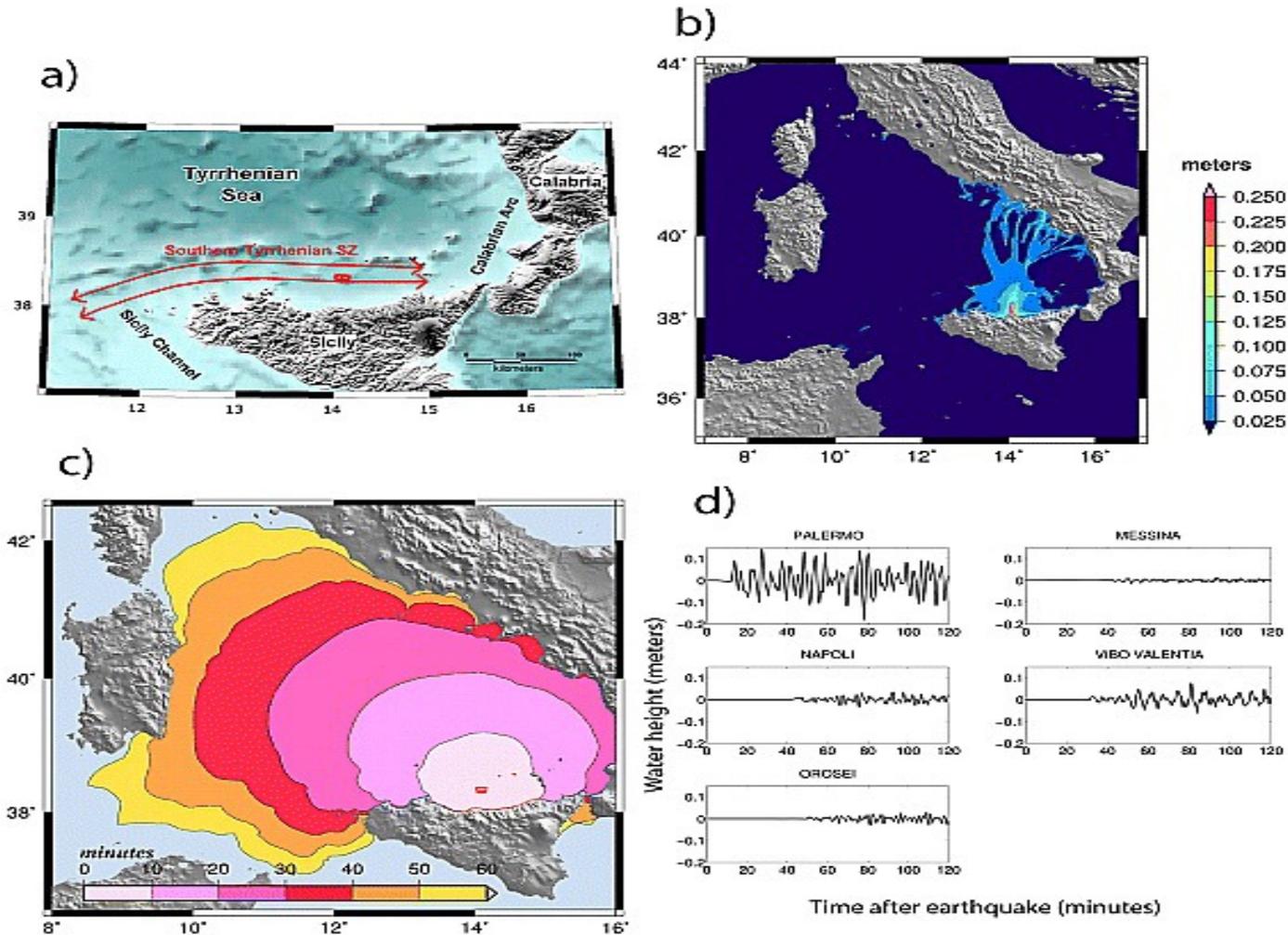
Trends shows an increasing in the Temperature and decrease in the acidity, after Flecha et al, 2015



(a) Temperature , (b) Salinity obtained with the CT and (c) SAMI-pH data from August 2012 to June 2015.

Flecha, S., et al. *Sci Rep* 5, 16770 (2015). <https://doi.org/10.1038/srep16770>

Earthquake-generated tsunamis in the Mediterranean Sea: Scenarios of potential threats to Southern Italy



Earthquake-generated tsunamis in the Mediterranean Sea: Scenarios of potential threats to Southern Italy, Volume: 113, Issue: B1, First published: 09 January 2008, DOI: (10.1029/2007JB004943)

Acoustic Pollution One Ocean Network for Deep Observation

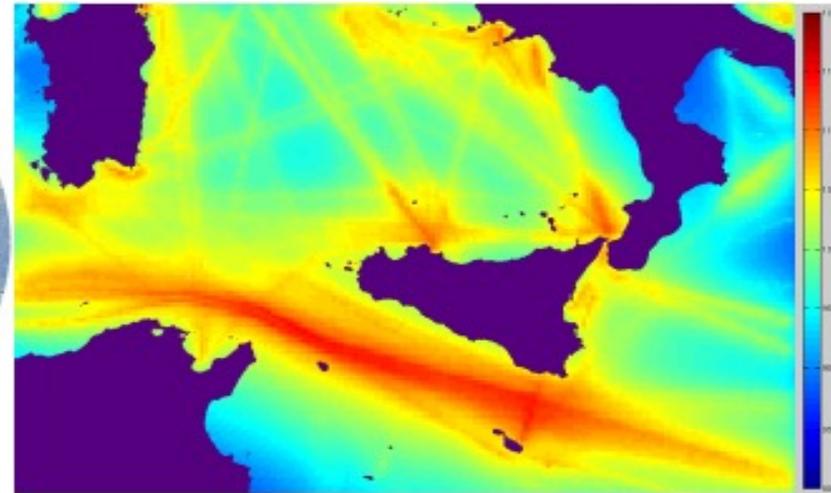
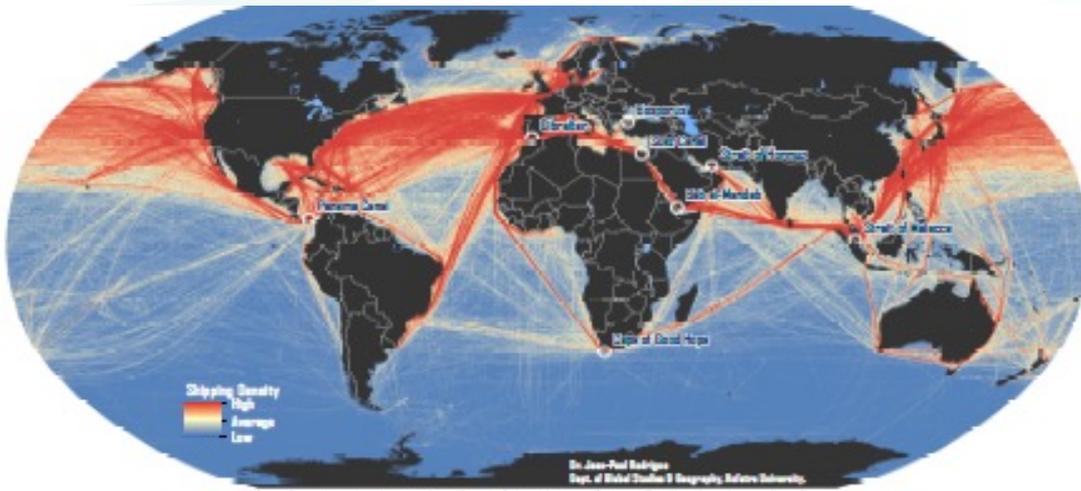


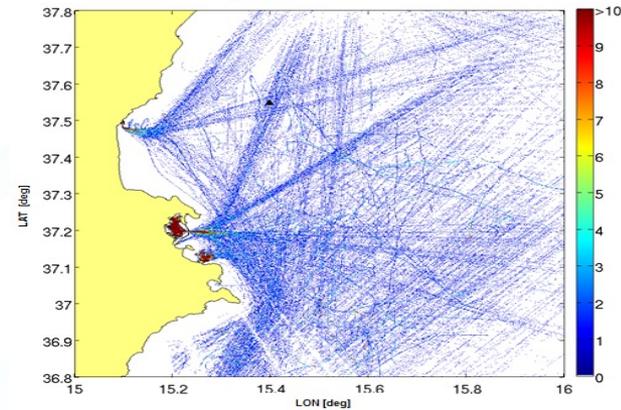
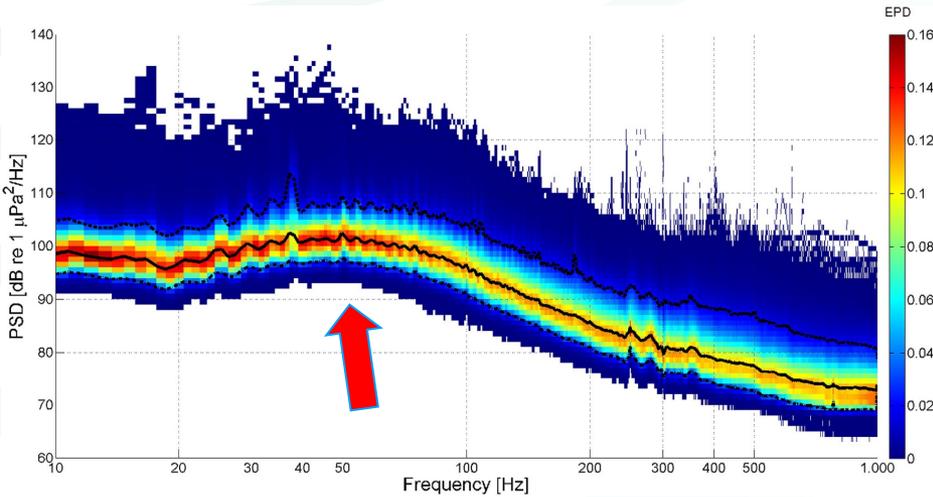
Figure 1. Left: shipping routes density for the global maritime transport system (adapted from National Centre for Ecological Analysis and Synthesis). Right: One year mean Power Spectral Density (dB re $1 \mu\text{Pa}/\text{Hz}$, 100 Hz) in the central Mediterranean Sea obtained from AIS data, period Nov 2012-Oct 2013 (RANDI 3.1 model) (developed by Bioacoustics Groups, preliminary results; colour scale range: 80-120 dB).

Shipping noise

Halpern et al., 2008 Science

Pollution acoustic

Marine traffic monitoring



Acoustic noise and correlation with AIS data

Noise distribution showing average PSD (power Spectral Density) Up to about 70 Hz, the median of the average PSD often > 100 dB re 1 $\mu\text{Pa}^2/\text{Hz}$.

European Marine Strategy Framework Directive, MSFD

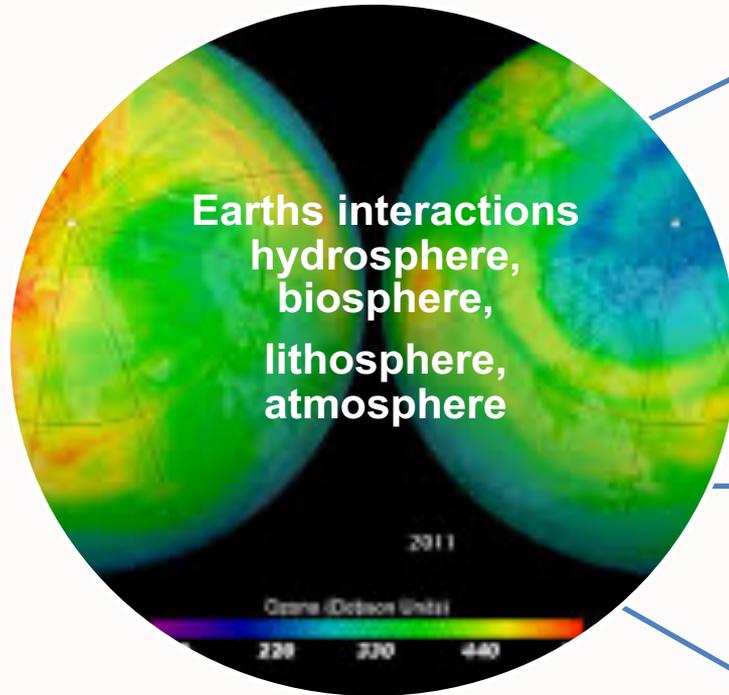
Reduce speed of shipping lines. Affects;

- Emissions of greenhouse gases,
- Underwater noise
- Collision risk for whales

EMSO Western Ionian Sea

Scientific & Societal demand for Environmental Marine Research Infrastructures

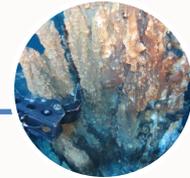
Facilitating the *Blue Economy*



Connecting scientific outcomes
to stake holders and policy makers



Geohazard and
early warning for
earthquakes
, tsunamis, gas-
hydrates
release,



Interactions between
ecosystems , biodiversity,
biogeochemistry physic and
climate for e.g.
understanding present and
past climate changes?



Impact of exploration
and extraction of
natural resources and
living resources



Observation on
how Natural and
Anthropogenic
changes

EGIM deployment

- Publication of the press release “EMSO ERIC has deployed the EGIM offshore La Palma close to the new lava flow”
- Communication campaign on social media
- 2 articles published on Spanish journal:
 - Canary ports
 - EIApuròn
- Next steps: a second press release when the data will be released

EMSO ERIC has deployed the EGIM offshore La Palma close to the new lava flow



Figure 1 - The lava reached the Atlantic Ocean at 1:45 (GMT). Credits: Ministerio Transportes, Movilidad y Agenda Urbana, Gobierno de España.

The Cumbre Vieja volcano erupted on 19 September in La Palma threw jets of lava and ash into the air. Large amounts of volcanic lava, ashes and gas - carbon dioxide (CO₂), sulfur dioxide (SO₂) and water steam (H₂O) - were released during the eruption. The lava flow reached the sea 10 days after the eruption creating a marine delta formed around the shallow platform. On November 10th at 1:45 a.m. local time, a second lava flow reached the sea near the beach of Los Guirres.

EMSO vigila el impacto del volcán de La Palma en el océano con el apoyo de PLOCAN y la Universidad Politécnica de Cataluña

EL APURÓN 12.11.2021 - 13:05 GMT



El Observatorio Europeo Multidisciplinar para el estudio de Fondo Marino y la Columna de Agua (EMSO) ha desplegado en aguas próximas al volcán de La Palma el Módulo de Instrumentos Genéricos (EGIM), con el fin de evaluar y vigilar el impacto de la actividad del volcán en el ecosistema marino, con el apoyo de la Plataforma Oceánica de Canarias (PLOCAN) y la Universidad Politécnica de Cataluña.

El módulo se depositó en el lecho marino a una profundidad de unos 500 metros en una zona con una pendiente relativamente baja y a 2,5 km del punto en el que el flujo de la lava está entrando en el océano Atlántico, en la playa de Los Guirres.

EMSO vigila el impacto del volcán de La Palma en el océano con el apoyo de PLOCAN y la Universidad Politécnica de Cataluña

Archivado en: Marino - Observatorio Europeo Multidisciplinar para el estudio de Fondo Marino y la Columna de Agua - EMSO - Volcán de La Palma - EGIM - Universidad Politécnica de Cataluña - PLOCAN

Reseccion | LUNES, 15 DE NOVIEMBRE DE 2021, 17:54



El módulo se depositó en el lecho marino a una profundidad de unos 500 metros en una zona con una pendiente relativamente baja y a 2,5 km del punto en el que el flujo de la lava está entrando en el océano Atlántico (Playa de los Guirres)

EMSO ERIC STRENGTHS

- **Continuous recording of long measurements time series in the deep ocean as baseline** for improving our understanding of the state of the deep ocean
- **Interactions among environmental domains** (sub-seafloor-seafloor- water column)
- **Landmark** in the ESFRI roadmap (assessment in 2022)
- **International cooperation** with the world's leading ocean observatories
- Great potential for **multi-node service** operation

value of EMSO ERIC larger than the value of $RF_1+RF_2+\dots+RF_n$

SUSTAINABLE DEVELOPMENT GOALS



UN Decade of Ocean Science for
Sustainable Development (2021-2030)

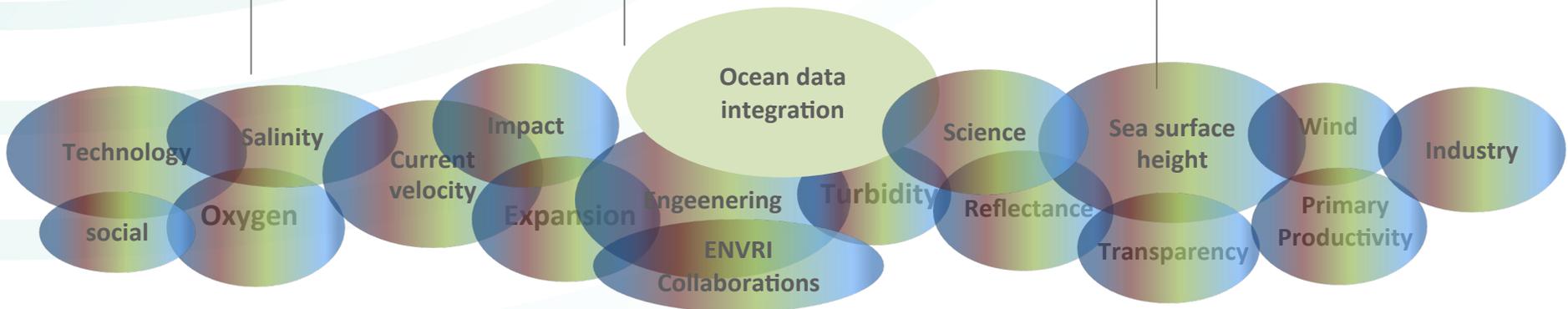
INTEGRATING DATA & KNOWLEDGE

Harmonising Information

FOCUSSING ON QUALITY
OCEAN OBSERVATIONS

PROMOTING
COLLABORATIVE
RESEARCH

PROMOTE THE USE OF *DIGITAL OCEAN* OUTSTANDING
SCIENCE



DELIVERING SERVICES:

- Science
- Data and products
- Communication
- Engineering and Logistics (testing)
- Innovation & Industry
- External Relations

MEETING the DEMANDS of SOCIETY

UN Decade of the Ocean Science for Sustainable Development
Common Fisheries Policy
Habitats Directive
Water Framework Directive
Maritime Strategy Framework Directive
EU Civil protection and Aid and Civil Protection

EMSO Ocean Observations are critical to understand complex interactions among the geosphere, biosphere, hydrosphere and atmosphere

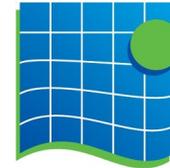
- ❑ **14 Regional Facilities/Test sites** operational in European seas
- ❑ **Continuous recording of long measurements time series in the deep ocean as baseline** for improving our understanding of the state of the deep ocean
- ❑ **Multidisciplinary harmonized Data delivery** from a multimode perspectives from the facilities
- ❑ **Interactions among environmental domains** (sub-seafloor-seafloor- water column)
- ❑ Wide range of **environments**, strategically distributed
- ❑ Wide range of **observations/instruments**
- ❑ Wide range of **expertise** across the Members
- ❑ Great potential for **multi-node service** operation
- ❑ Enhancing collaboration between **Marine and environmental RIs**
- ❑ **International cooperation** with the world's leading ocean observatories
- ❑ Strong Member **engagement**, EMSO Conference in Athens, February 2020, EMSO TSC, Las Palmas 2021, Planning next EMSO Conference by 2024



EMSO ERIC involvement in projects



EMSO ERIC Research Organisations



*Foras na Mara
Marine Institute*



ISTITUTO NAZIONALE
DI GEOFISICA E VULCANOLOGIA



OGS
Istituto Nazionale
di Oceanografia
e di Geofisica
Sperimentale



Thank you



emso

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EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

Observing the ocean to save the earth

www.emso-eu

