The European landscape on Ocean Observations

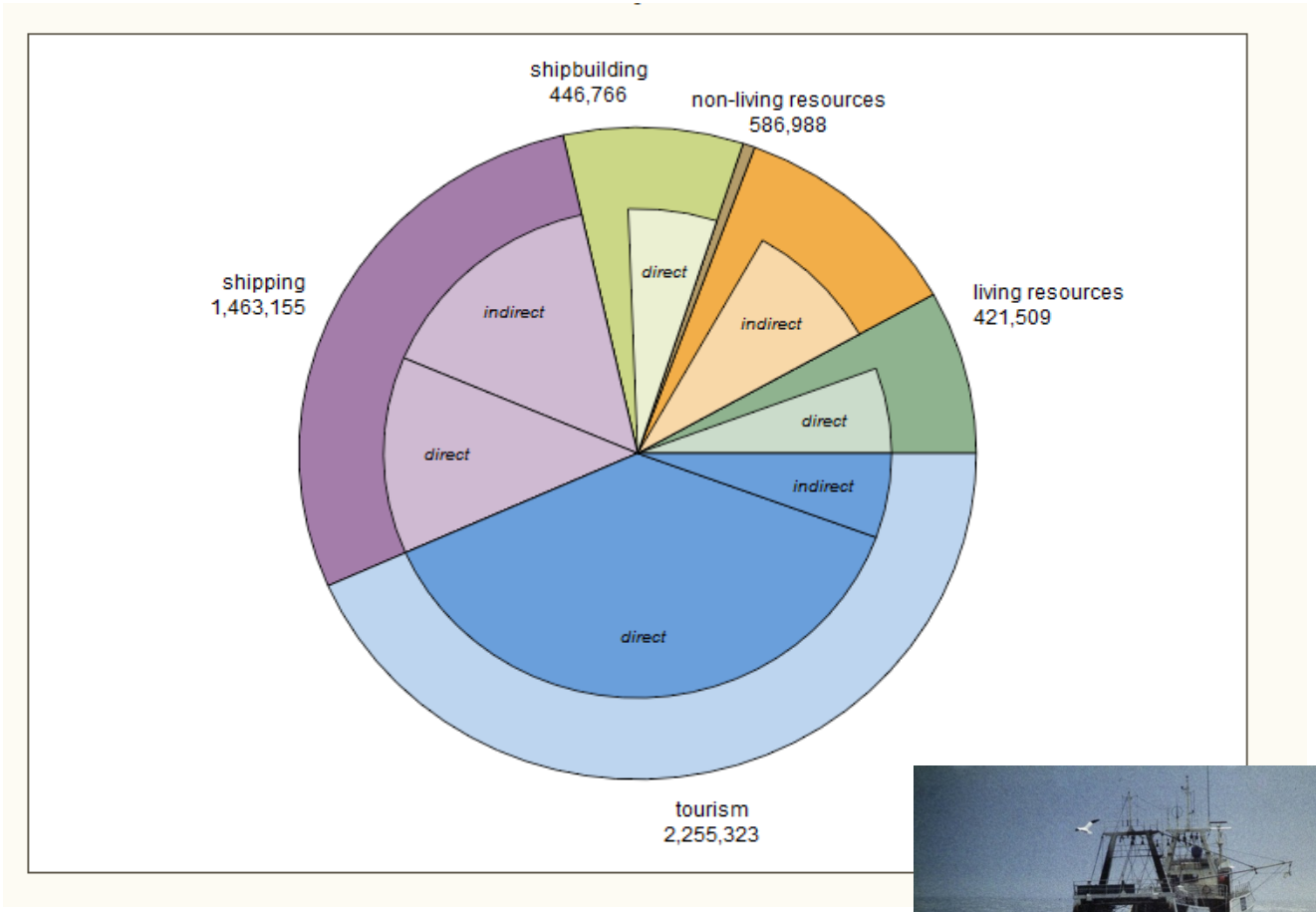
George Petihakis

Hellenic Centre for marine research

15 June 2021

Why do we need ocean observations?

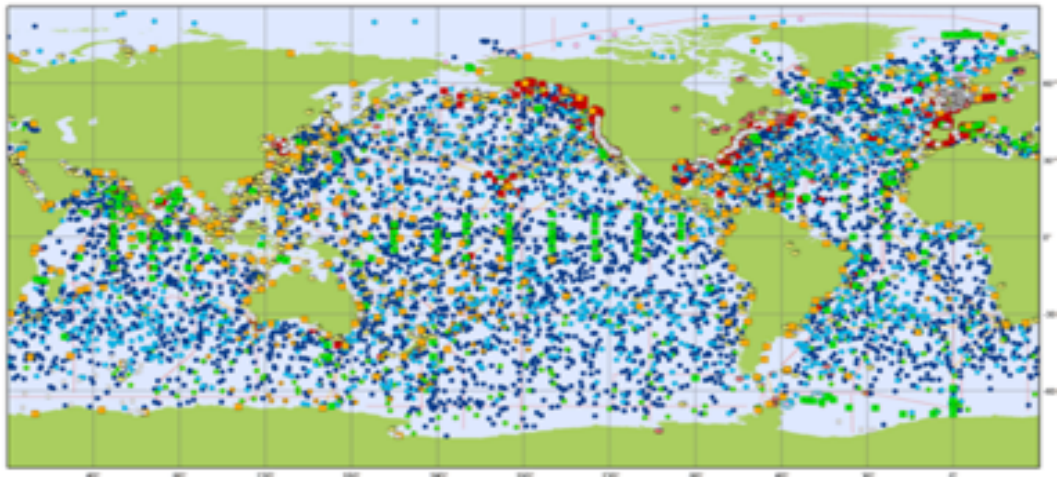
- 5 million jobs in EU
- Offshore wind now employs about half the number as fishing
- Traditional jobs are decreasing
- The ocean is the new economic frontier
- Grand challenges
  - Climate change
  - Human impact (loss of diversity, pollution, limited resources, etc)
- Increased investment risk
- We need effective Management

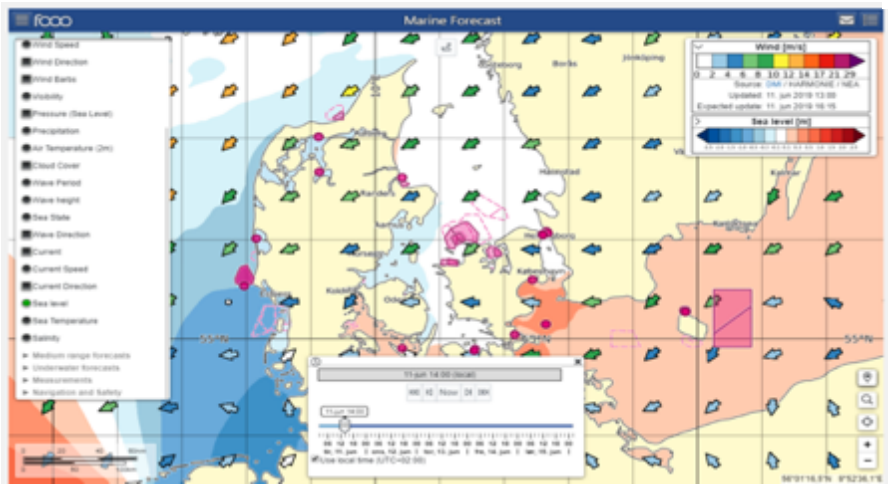


Observing

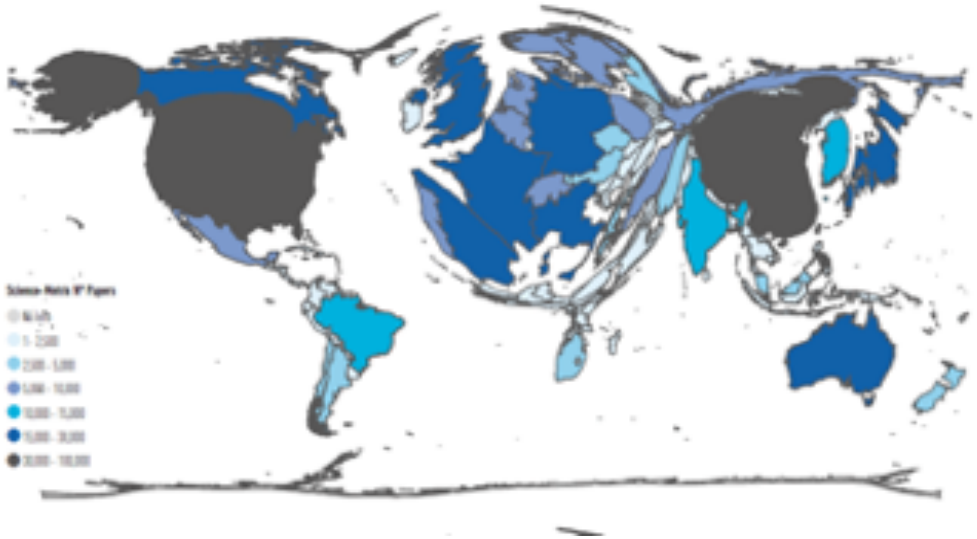
Understanding

Predicting

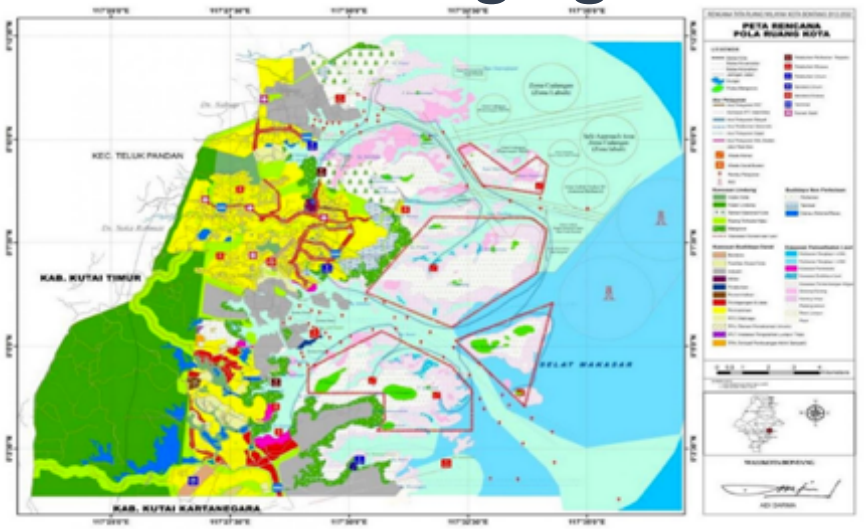




Capacitating



Managing



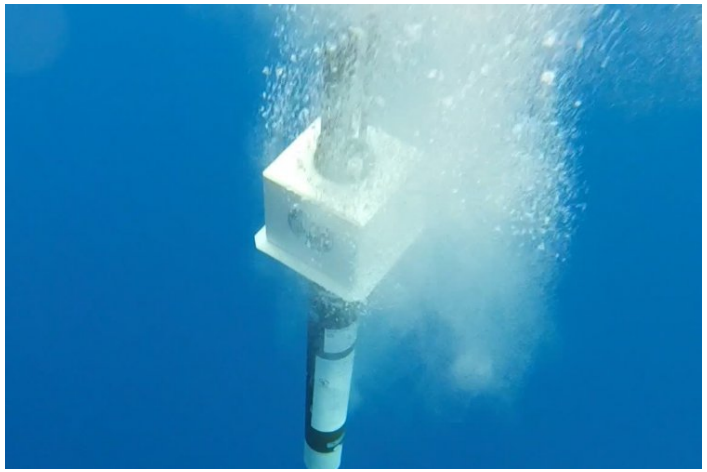
Understanding

Knowledge of the system:

- State
- Functioning
- Underlying Dynamics
- Drivers
- Ocean's role

In order to:

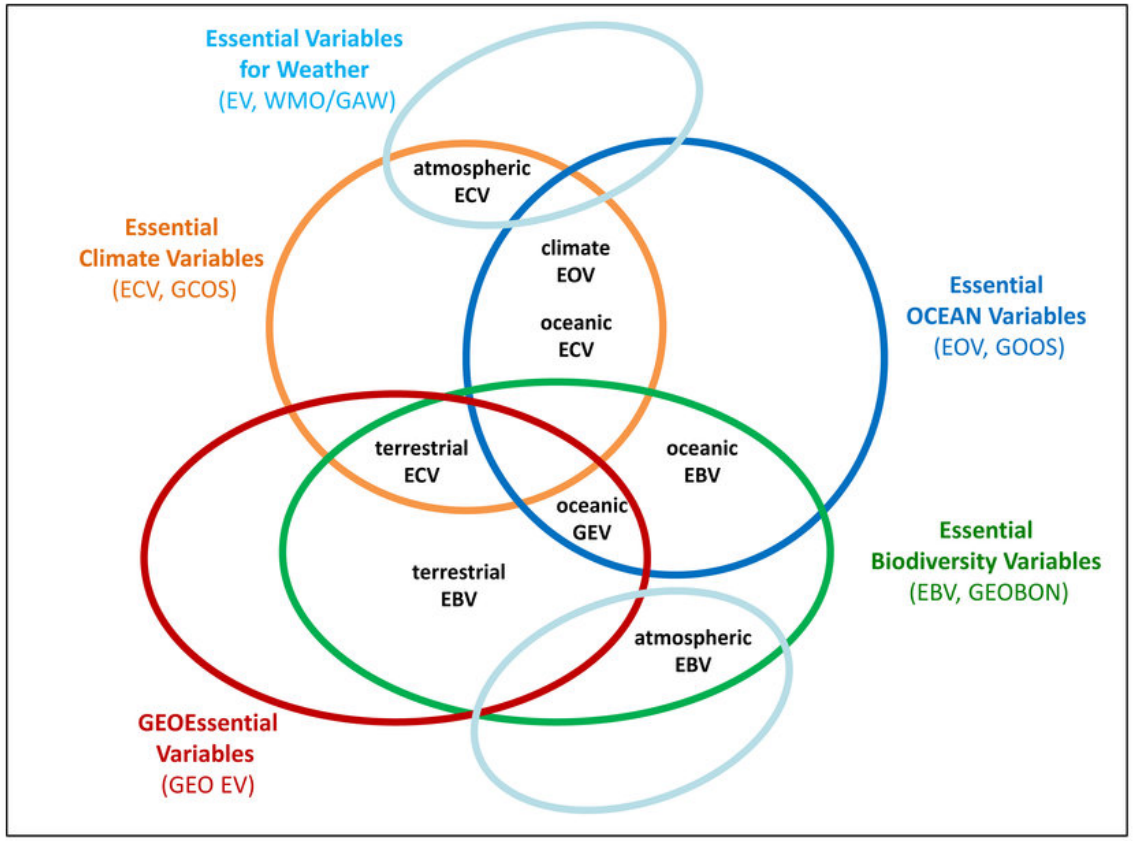
- Manage pressures / impacts
- Apply effective policies
- Raise awareness
- Provide services & products



Questions:

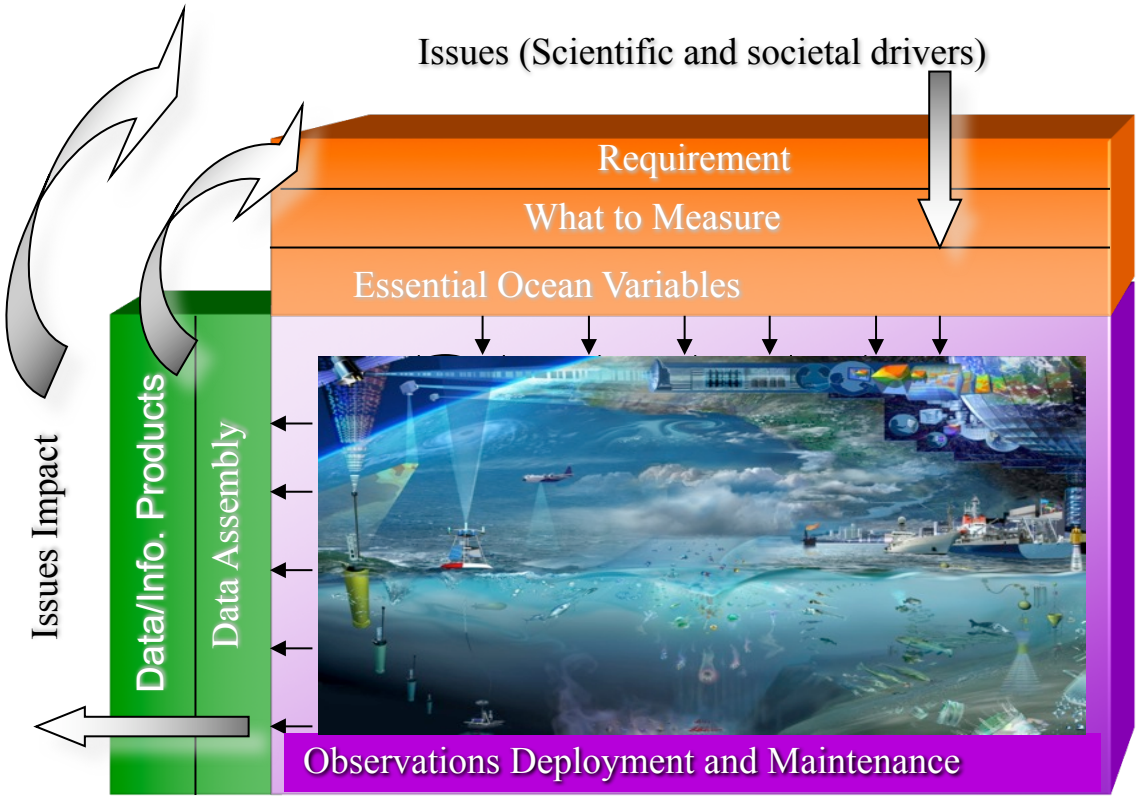
- What to measure?
- Frequency?
- Spatial & Temporal resolution?
- With which platforms?

Observing



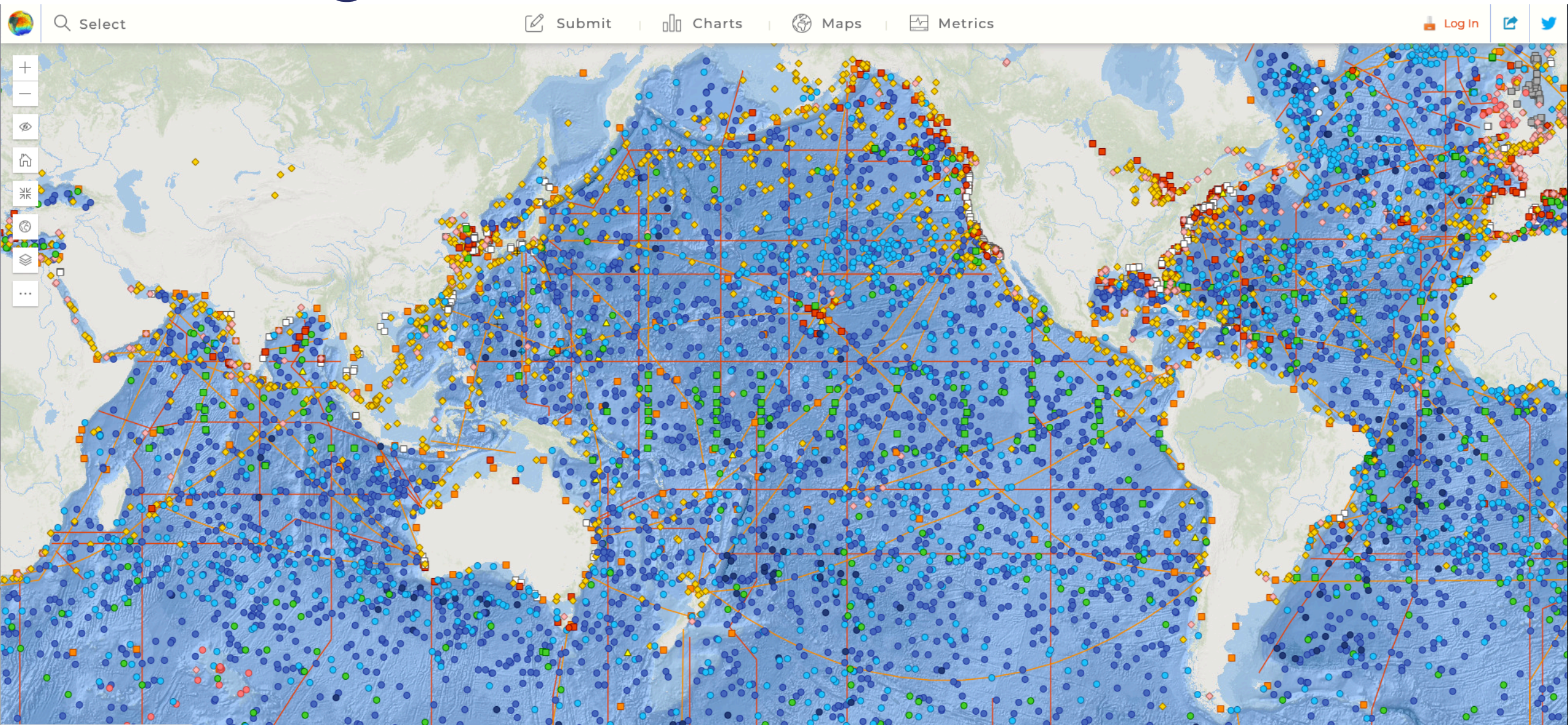
What variables to measure:

- Essential Ocean Variables (EOVs)
- Essential Biodiversity Variables (EBV)
- Essential Climate drivers
- Indicators



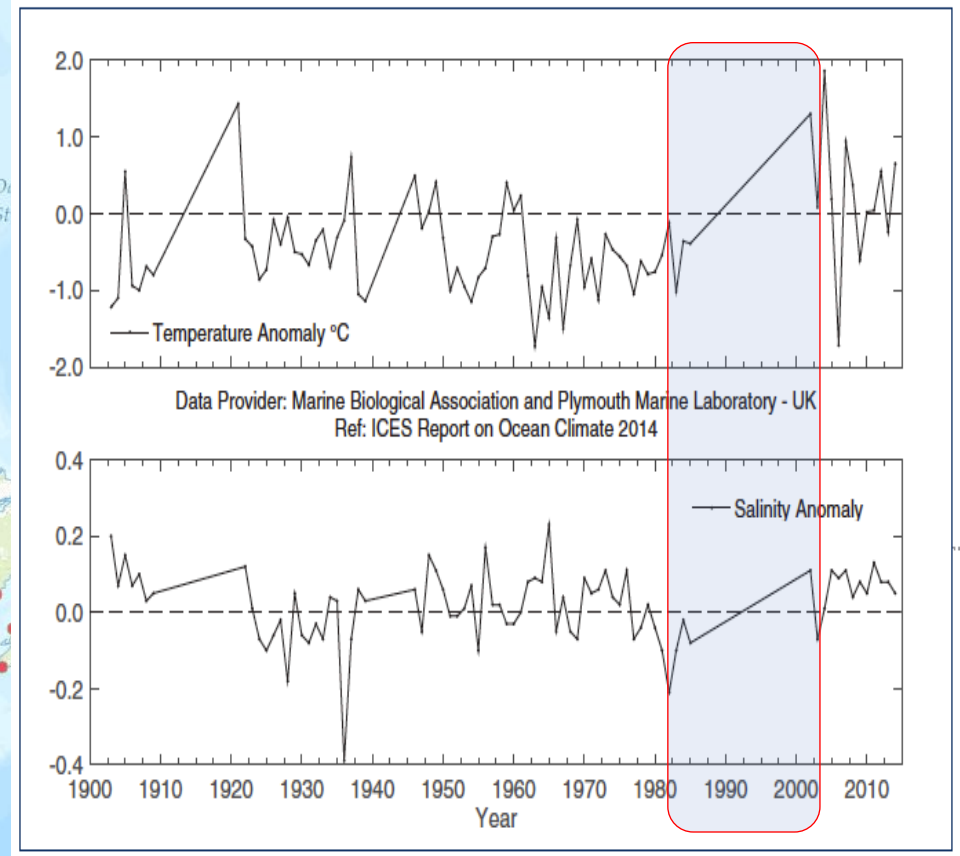
OceanObs 2009 Venice, Framework of Ocean Observations

Observing - effort



OceanOPS (https://www.ocean-ops.org/board#)

Observing - what is missing ?



Spatial gaps

- •horizontal – SE European seas;
- •vertical – deep sea is under-sampled;

Temporal gaps

- •few complete time series;

Parameter gaps

- •biogeochemical; sensors are now available;

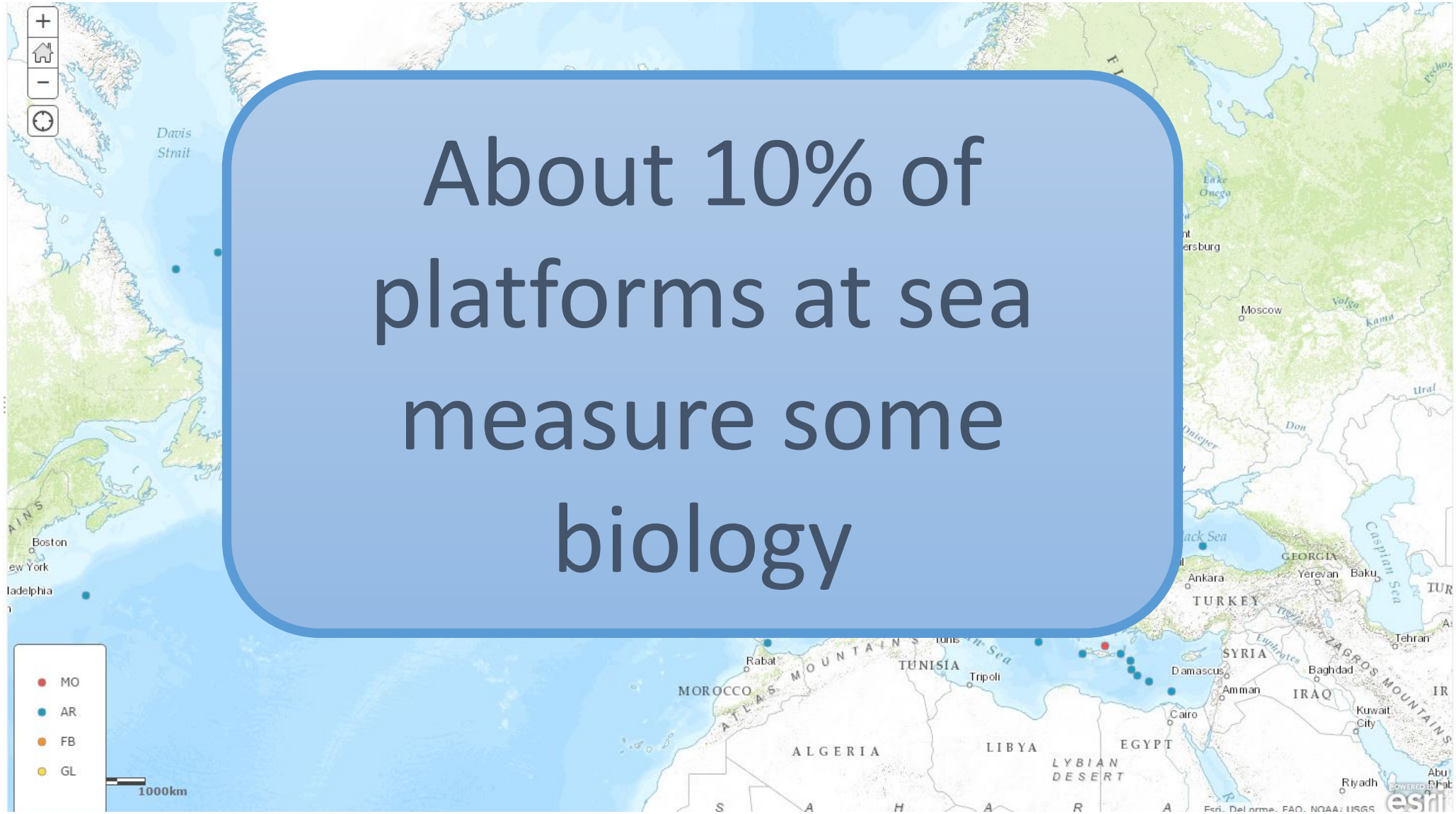
Long term commitments

- •more than 70% based on short term research funding;

Integrated monitoring strategy at European level

- •Reduce overlaps; maximize synergies

Observing - Chlorophyll measurements



Observing - EOVs and Readiness Levels

CONCEPT PILOT MATURE

Physics

- Sea State
- Ocean surface vector stress
- Sea Ice
- Sea level
- SST
- Subsurface temperature
- Surface currents
- Subsurface currents
- SSS
- Subsurface salinity

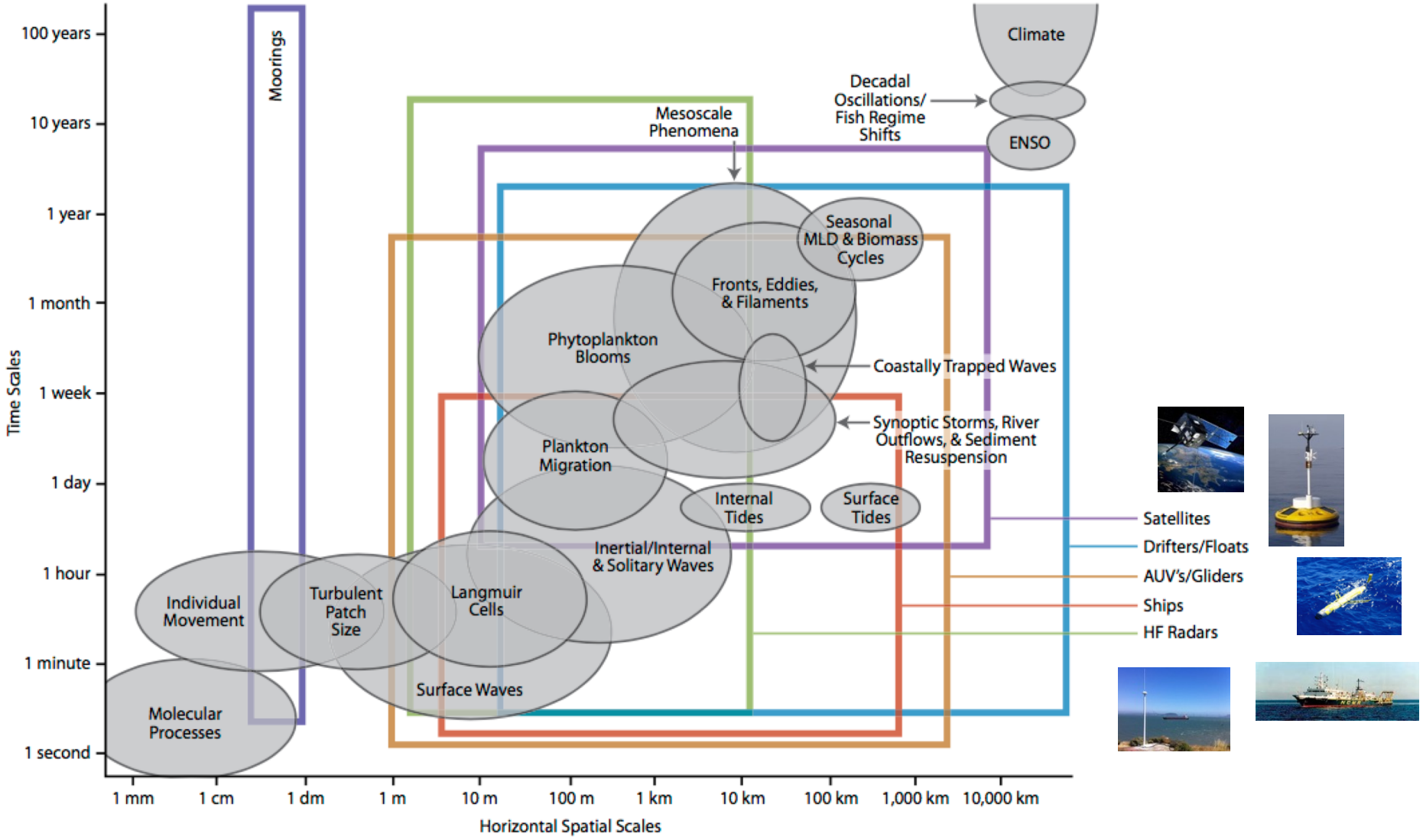
Biogeochemistry

- Oxygen
- Inorganic macro nutrients
- Carbonate system
- Transient tracers
- Suspended particulates
- Nitrous oxide
- Carbon isotope (^{13}C)
- Dissolved organic carbon

Biology and Ecosystems

- Phytoplankton biomass and productivity
- HAB incidence
- Zooplankton diversity
- Fish abundance and distribution
- Apex predator abundance and distribution
- Live coral cover
- Seagrass cover
- Mangrove cover
- Macroalgal canopy cover

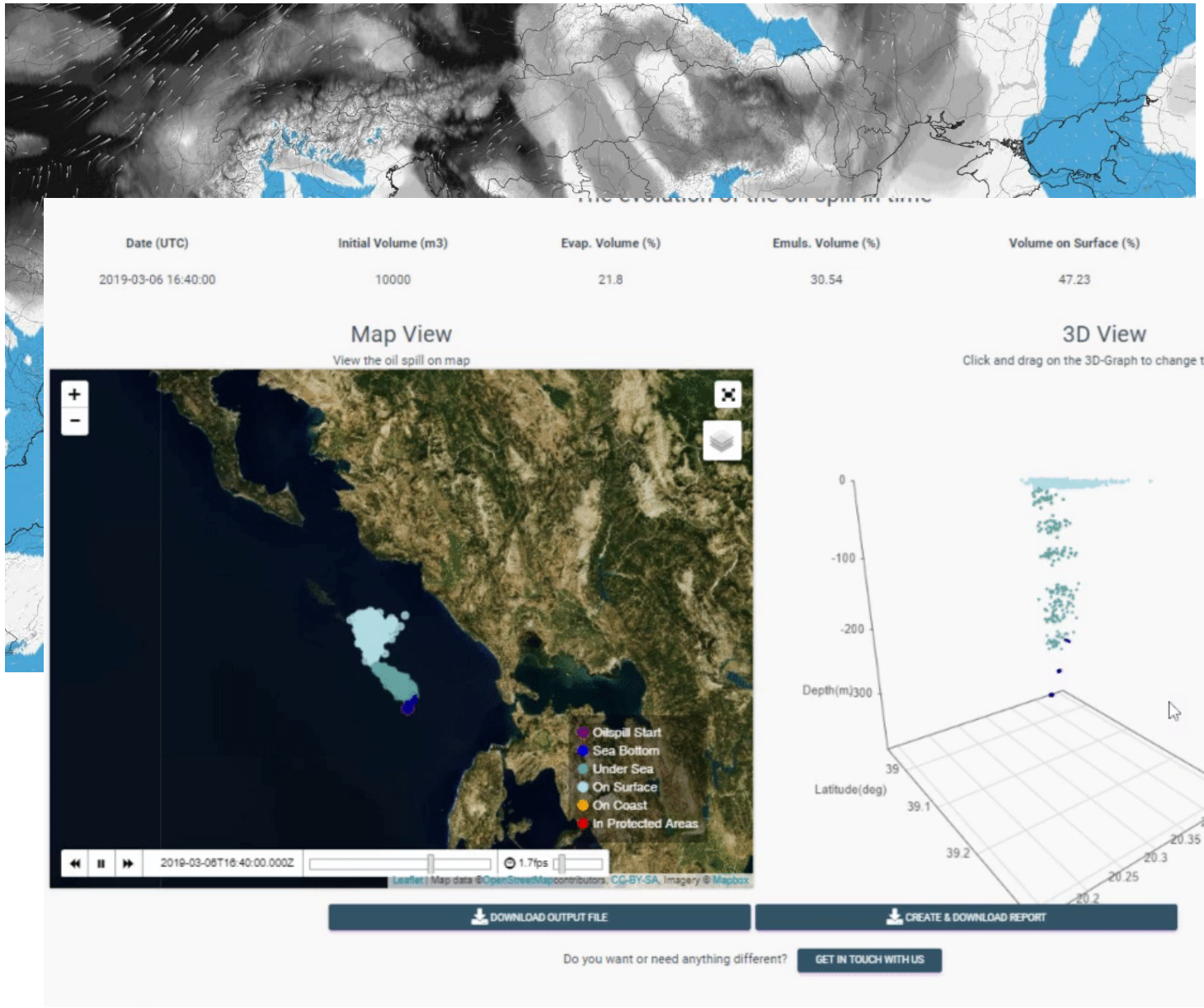
Observing – appropriate scales



Karl et al 2010

Predicting

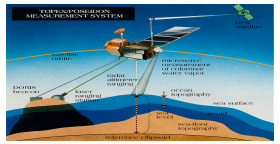
- Information
- Protection
- Early warning
- Risk assessment
- ……



Where we are today ?

Observations

Drifters



Satelilte

Buoys

R/V Vessels

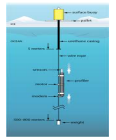
Gliders

FerryBox

Mammals

HF-radar

Fishery & Ocean. Observing System



Profilers

Cabled

AUV's

National Level

NIVA · GEOMAR · HAVFORSKNINGSINSTITUTTET · VLIZ · SYKE · FINNISH METEOROLOGICAL INSTITUTE · National Oceanography Centre · PML Plymouth Marine Laboratory · SMHI · Cefas · EMI Estonian Marine Institute · NIOZ · Marine Institute Foras na Mara · dmi · museum · ILICO · SNO CORAIL · IPAN · Deltares · somlit · AFDELING KUST · Puertos del Estado · MOOSE · Coast-HF · SHOM · SOCIB Balearic Islands Coastal Observing and Forecasting System · euskoos · PLOCAN · SONEL · hidrográfico marinha·portugal · OBSEA · L-Università ta' Malta · INGV · OGS · POSEIDON SYSTEM · Consiglio Nazionale delle Ricerche · INSTITUT ZA OCEANOGRAFIJU I RIBARSTVO SPLIT · ENVIRONMENTAL AGENCY OF THE REPUBLIC OF SLOVENIA · CALYPSO · PO.UNIT Physical Oceanography Unit · COSYNA · NIB NATIONAL INSTITUTE OF BIOLOGY · L-Università ta' Malta

Regional Level

Commissions

HELCOM · UN environment programme · Mediterranean Action Plan Barcelona Convention · OSPAR COMMISSION Protecting and conserving the North-East Atlantic and its resources · Commission on the Protection of the Black Sea Against Pollution

ROOSs

mongoos · Arctic ROOS · Arctic ROOS Secretariat Nansen Environmental & Remote Sensing Center · BOOS Baltic Operational · NOOS North West European Shelf Operational Oceanographic System · IBIROOS

Projects/Programs

AtlantOS · ODYSSEA · INTAROS

European Level

EU Directives/Policy/Strategy

Supporting the Marine Strategy Framework Directive · WHY · WHAT · HOW · MSFD · EU Habitats Directive · The Maritime Spatial Planning directive · BLUE GROWTH · The Common Fisheries Policy · WFD · INSPIRE · Infrastructure for Spatial Information in Europe

Organisations

ICES CIEM · European MARINE BOARD · EuroGOOS European Global Ocean Observing System

ERICs

emso ERIC · EMBRC EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE · Euro-Argo · LifeWatch ERIC · EPOS EUROPEANPLATEOBSERVINGSYSTEM · ICOS · DANUBIUS-RI

Projects/Programs

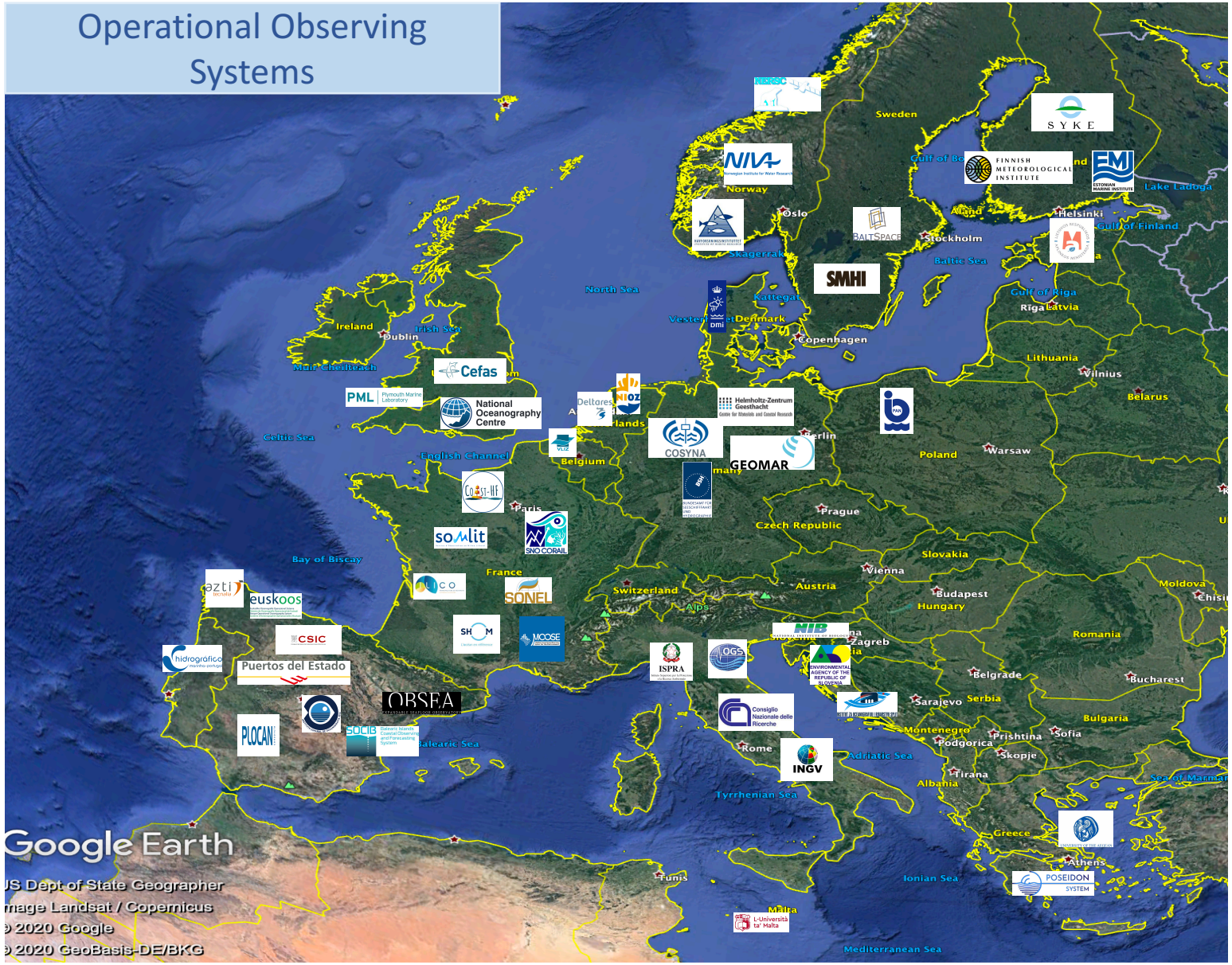
FixO3 FIXED POINT OPEN OCEAN OBSERVATORIES · JERICO-RI SCIENCE – SERVICES – SUSTAINABILITY · GROOM Gliders for Research, Ocean Observation &Management · Eurofleets Towards an alliance of European research fleets · EurSea

Data Aggregators

COPERNICUS MARINE IN SITU TAC · EMODnet · SeaDataNet · ICES CIEM · OBIS OCEAN BIOGEOGRAPHIC INFORMATION SYSTEM · PANGAEA.

Challenges

- Competition
- Fragmentation
- Complexity
- Overlapping
- Waste of resources
- Capacity imbalance



The Marine RIs – an important component

EU Contribution to Global efforts`

Argo

Ocean Gliders

DEEP OCEAN OBSERVING STRATEGY

ERICs

Euro Argo

Eurofleets — Towards an alliance of European research fleets

DANUBIUS-RI

EMBRC — EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE

ICOS — INTEGRATED CARBON OBSERVATION SYSTEM

emso ERIC

LifeWatch ERIC

SIOS

EPOS — EUROPEAN PLATE OBSERVING SYSTEM

Projects/ Programs

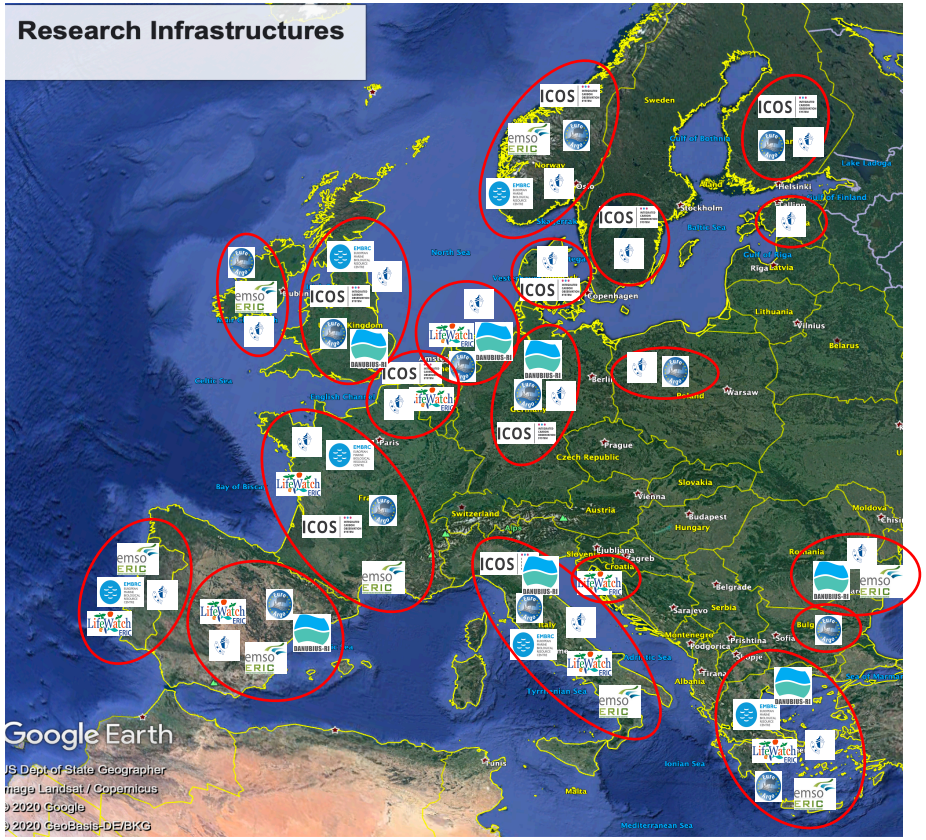
JERICO RI

AtlantOS

GROOM

- Platform Specific
- Environment Specific
- Process Specific
- Discipline Specific
- Area Specific

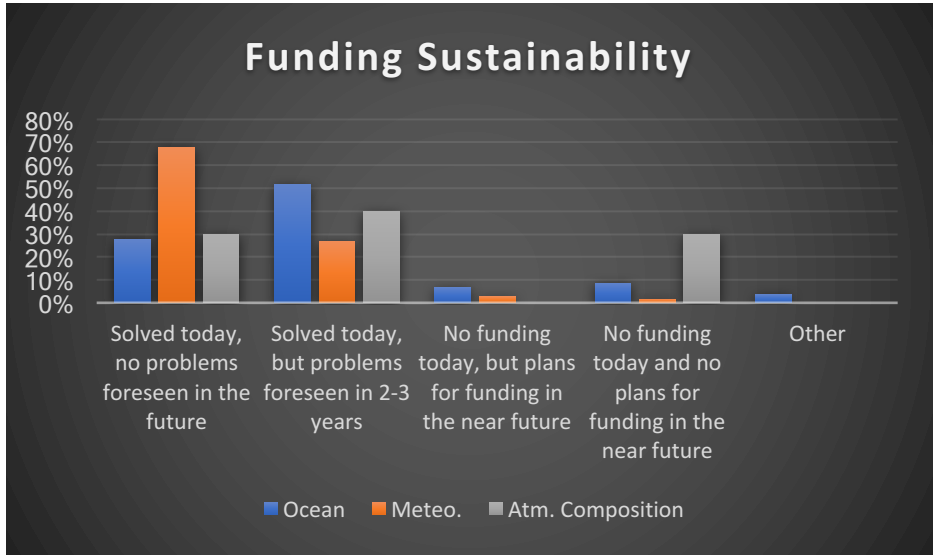
Contribution of National efforts



Sustainability

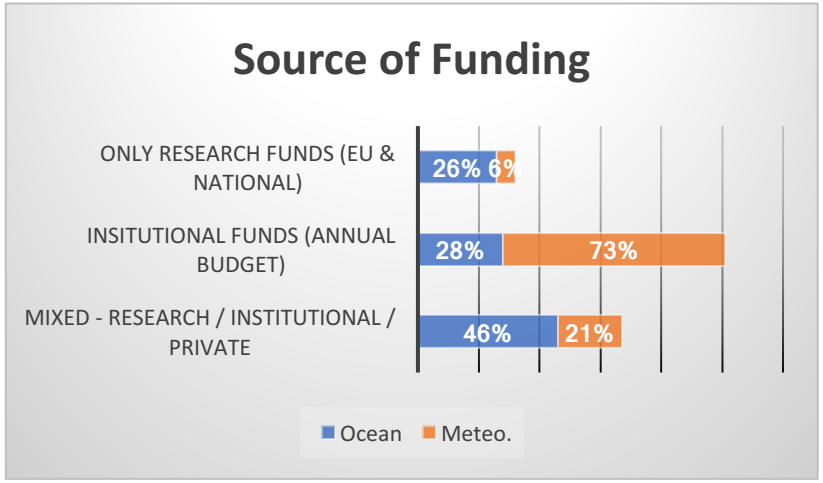
- ☹ Problems at: National Systems ←→ EU RIs.
- ☹ Quite often there are funds to acquire very expensive equipment but there are problems maintaining them.
- ☹ EU RIs → funding from MS and EU but hard to raise funds from services

Funding sustainability	Ocean	Meteo.	Atm. Composition
Solved today, no problems foreseen in the future	28%	68%	30.00%
Solved today, but problems foreseen in 2-3 years	52%	27%	40.00%
No funding today, but plans for funding in the near future is under way	7%	3%	
No funding today and no plans for funding in the near future	9%	2%	30.00%
Other	4%		

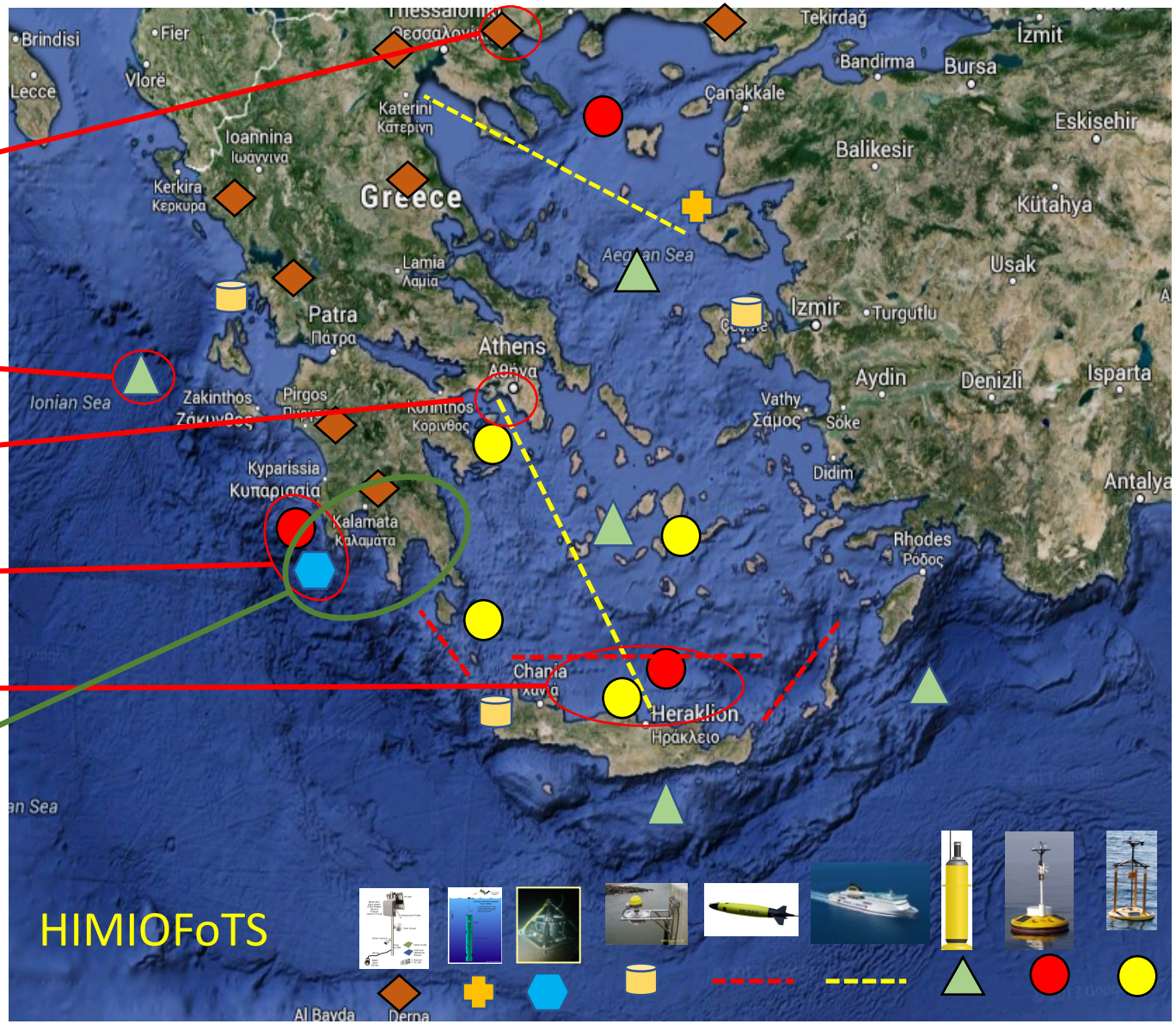



Sustainability Survey
Erik Buch, Vicente Fernández, Ines Sraic, Alex Vermeulen

https://insitu.copernicus.eu/library/reports/Sustainabilitysurveyupdatedreportfinal.pdf



Collaboration at National Level

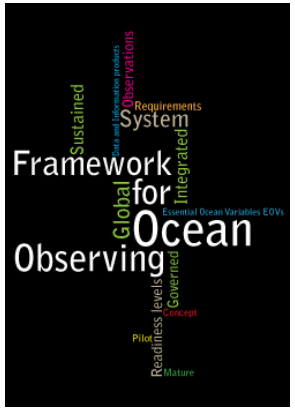


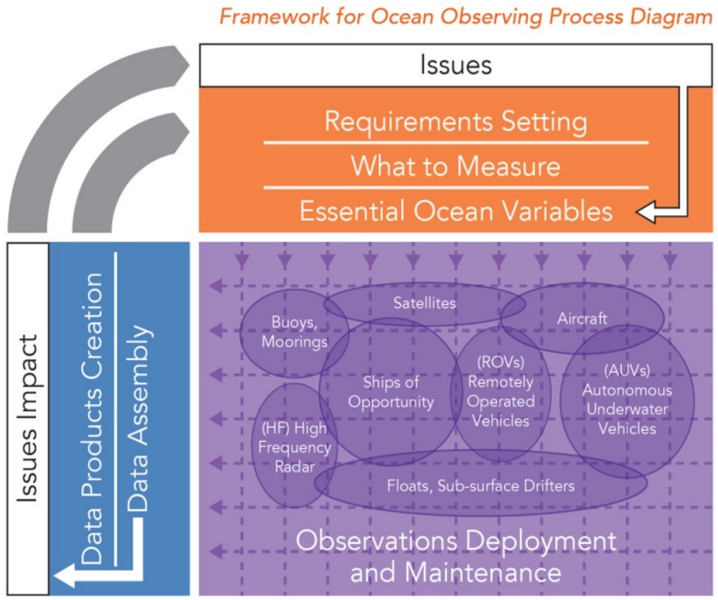
Requirements

Connection with users and stakeholders → Need to know the requirements (not always the case).

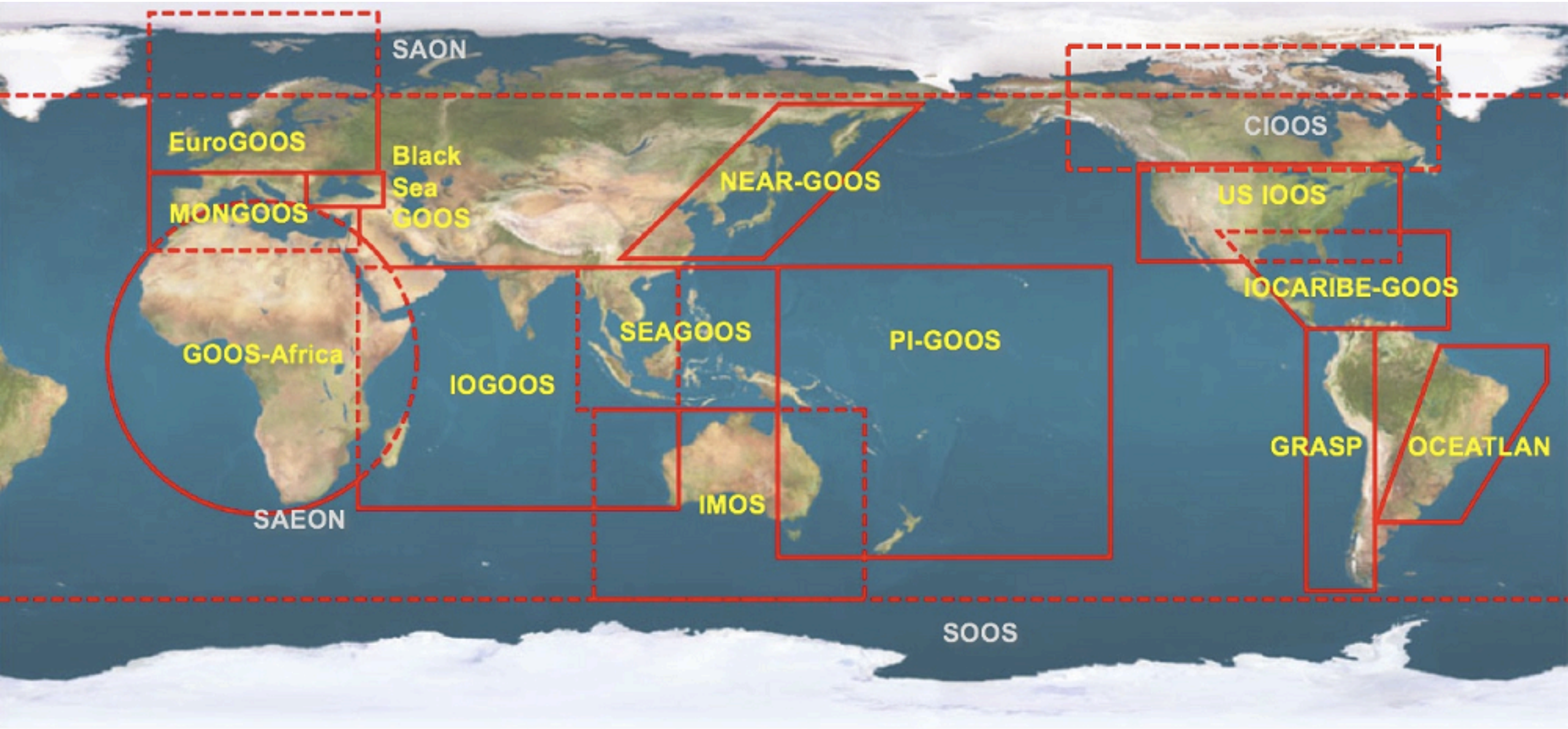
⛔ First set up an RI and then we try to find the users.

✅ Open Access – We need to brake barriers and especially with industry





Structure


SAON
EuroGOOS
Black Sea GOOS
MONGOOS
NEAR-GOOS
CIOOS
US IOOS
IOCARIBE-GOOS
GOOS-Africa
IOGOOS
SEAGOOS
PI-GOOS
GRASP
OCEATLAN
SAEON
IMOS
SOOS

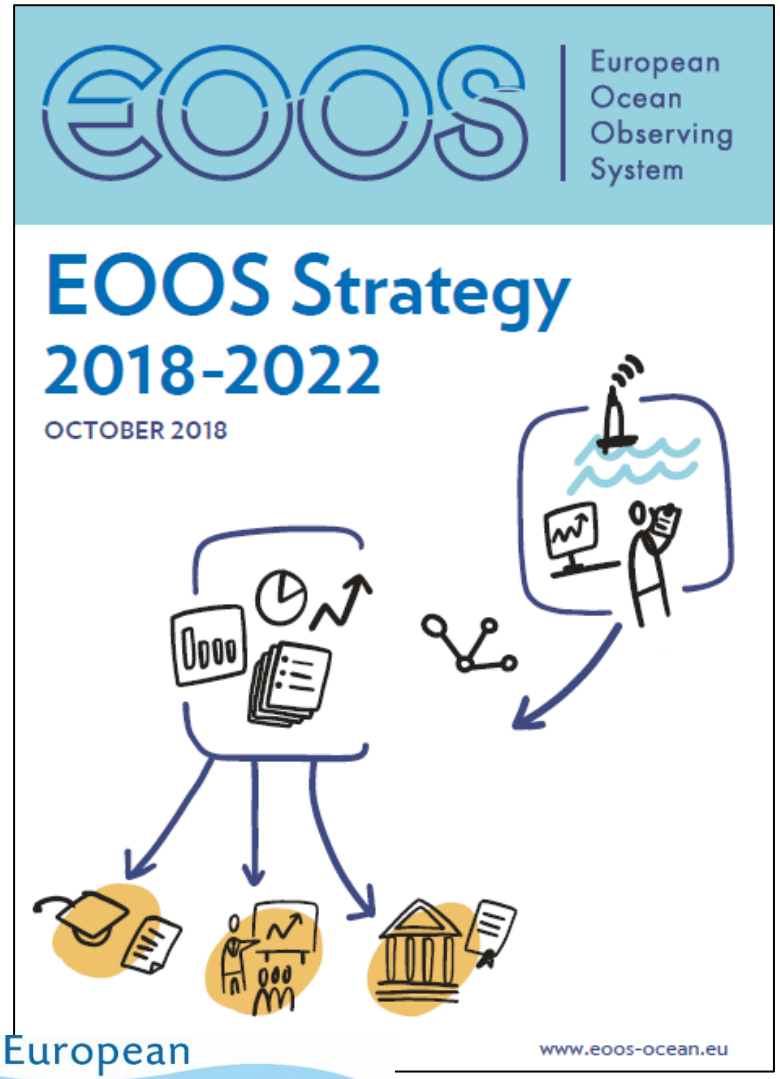
What is EOOS?

- A community-driven initiative
- Steering Group: co-Chaired by EuroGOOS and EMB

Vision: Connect Europe's diverse ocean observing stakeholders and make ocean observation a public utility in Europe, by strengthening coordination, strategy and sustainability in ocean observation.

www.eoos-ocean.eu

EOOS Strategy & Implementation Plan



EOOS is a coordinating framework designed

- To **align and integrate** Europe's ocean observing capacity for the long term;
- To **promote** a systematic and collaborative approach to collecting information on the state and variability of our seas and oceans;
- To **underpin** sustainable development, protection and conservation of the marine environment and its resources.

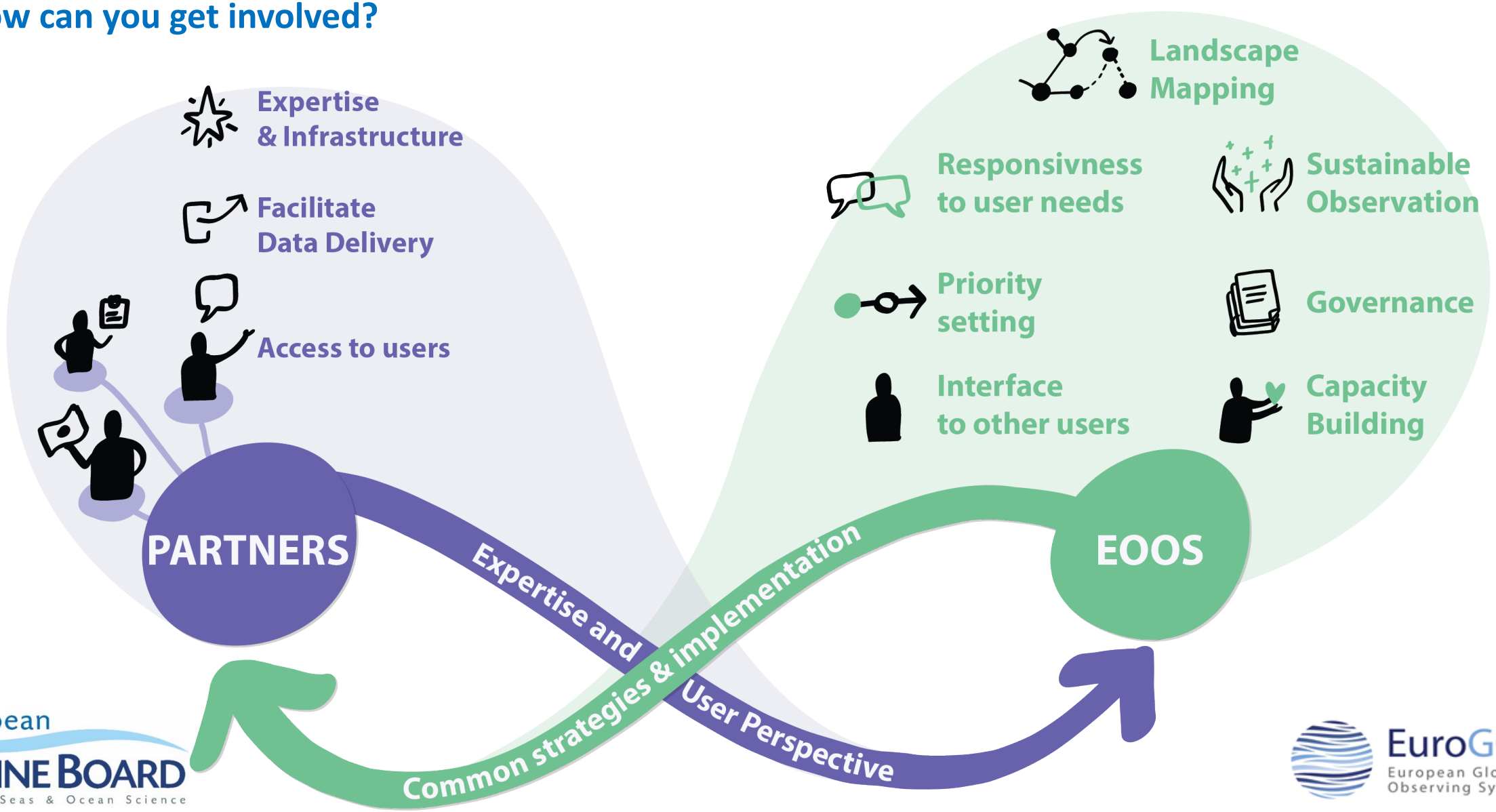
www.eoos-ocean.eu

European MARINE BOARD
Advancing Seas & Ocean Science

EuroGOOS
European Global Ocean Observing System

Partnership

How can you get involved?

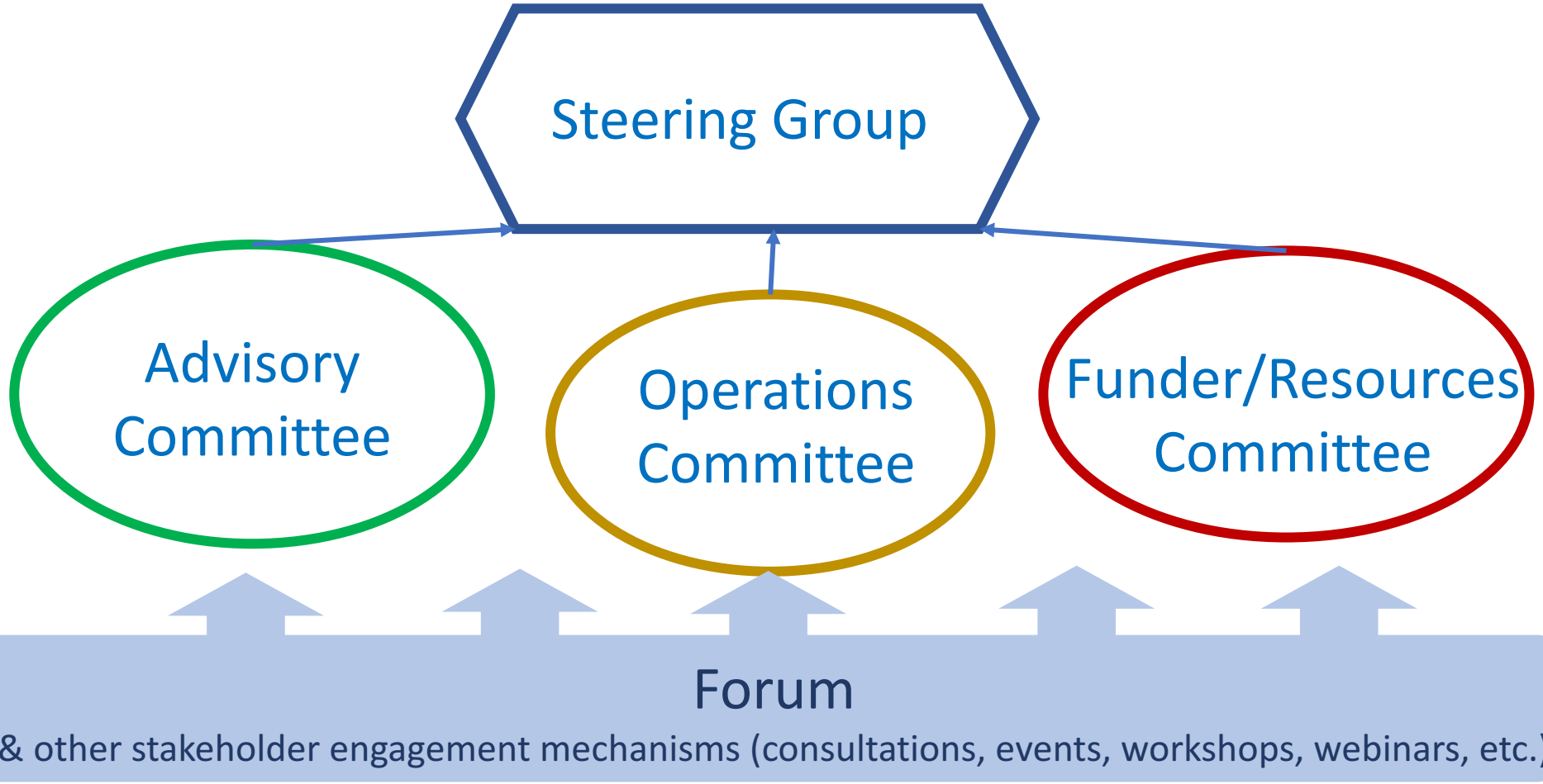


European Ocean Observing System

European Marine Board
Advancing Seas & Ocean Science

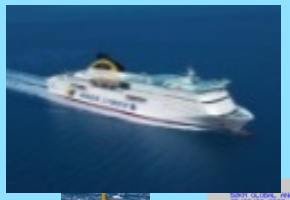
EuroGOOS
European Global Ocean Observing System

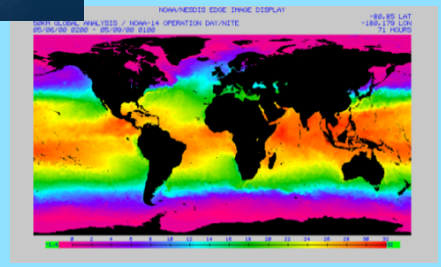
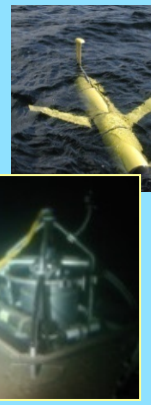
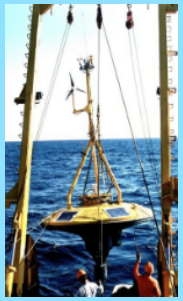
EOOS Governance



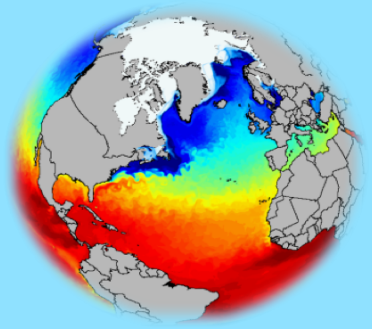
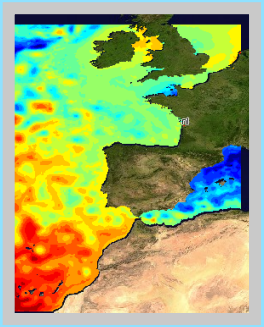
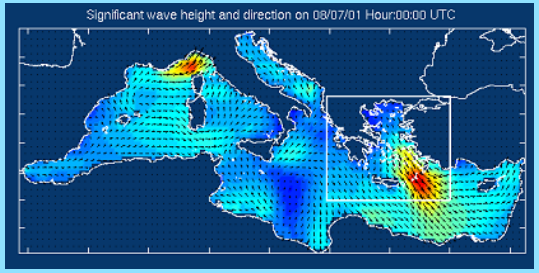
The Value Chain

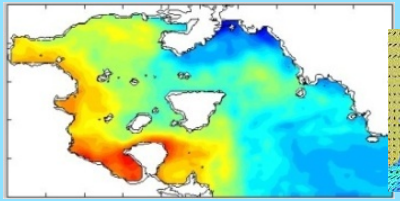
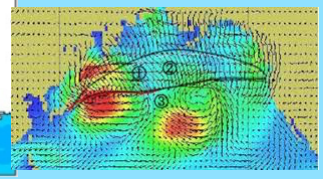
Observations



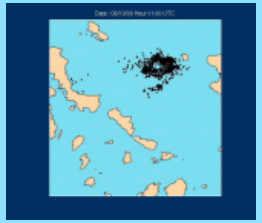
Processing & Modeling

Services



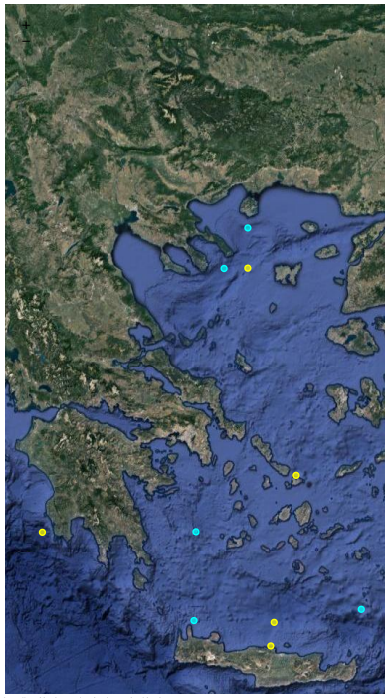




Open Data

Open Access

Data

15/06/2021 in situ map | Poseidon System



https://poseidon.hcmr.gr/services/ocean-data/situ-data

POSEIDON SYSTEM

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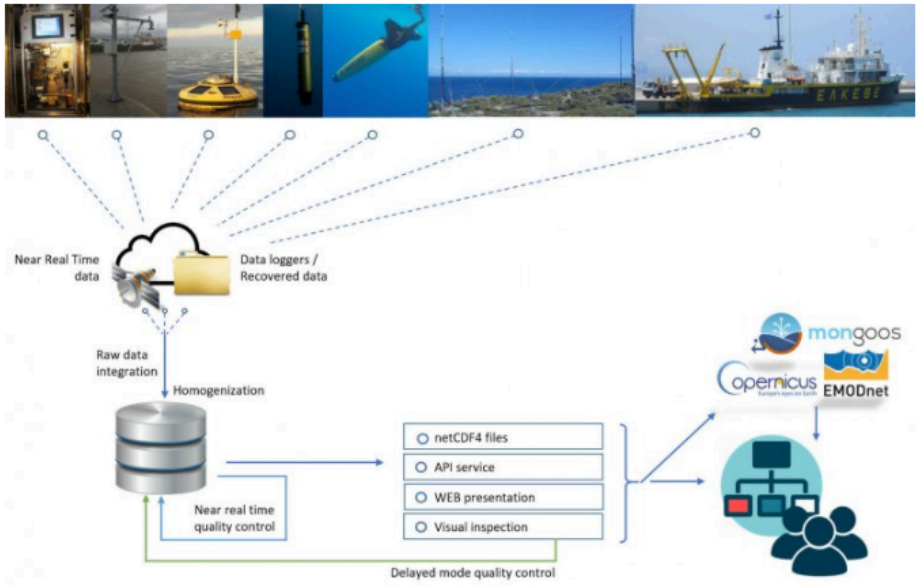
Data Center

Operational Center

The operational center of POSEIDON is located at HCMR's facilities in Anavyssos, Attica. It consists by a cluster of servers and storage media which provides cloud services of high availability and load distribution with the use of a series of virtual machines together with High Performance Computers capable to support the timely provision of the...

Data Flow



The POSEIDON monitoring network consists of a series of different platform types recording in situ data in the vicinity of the Greek seas:

Fixed mooring stations, Tide gauges, Argo floats, Gliders, CTDs, Sampling bottles, Ferrybox, HF radar system and Cabled seabed observatory

Each platform hosts a number of different sensors recording a...

Information and services

iOS OR ANDROID

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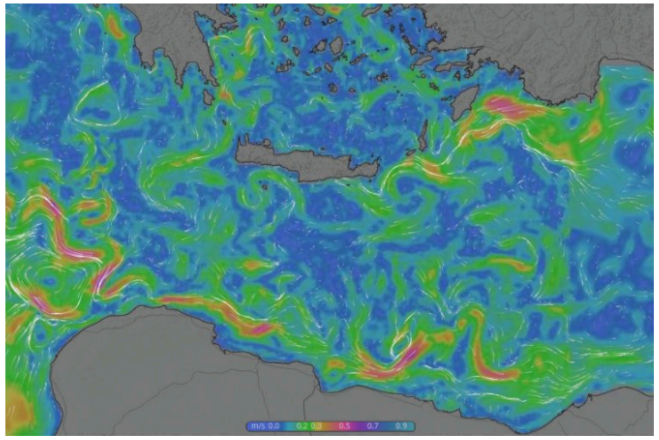
Hydrodynamics

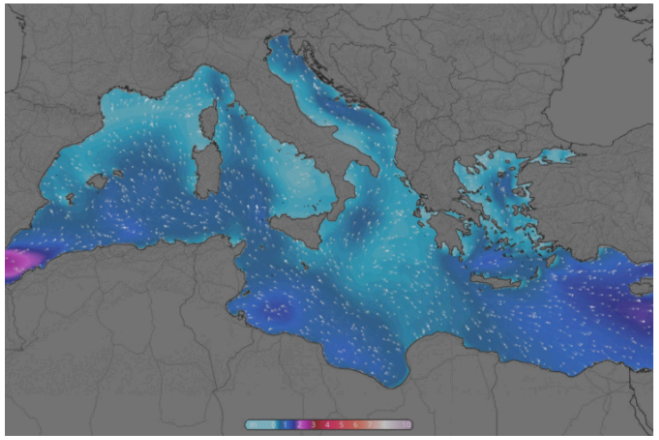


The Mediterranean ocean circulation forecasting system

Development and implemenation: HCMR Chief Scientist: Dr. Gerasimos Korres

The Mediterranean Sea ocean forecasting system is composed of a 1/10° resolution – 24 sigma layers Mediterranean implementation of POM model (Korres et al., 2008) and a data assimilation scheme based on the Singular...

Waves



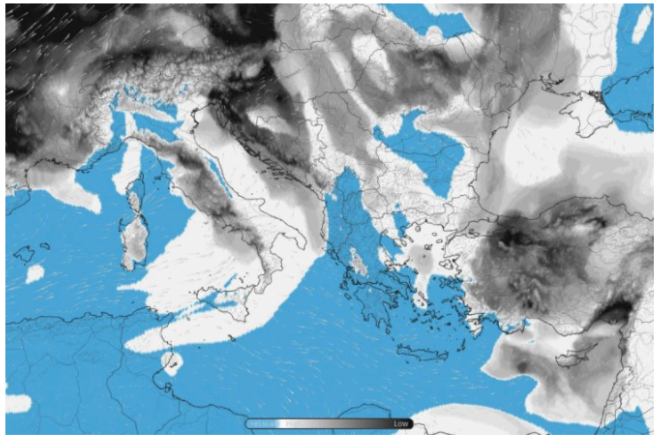
POSEIDON's wave forecasting system

Development and Implementation: HCMR Chief Scientist: Dr. Gerasimos Korres

A. WAM model

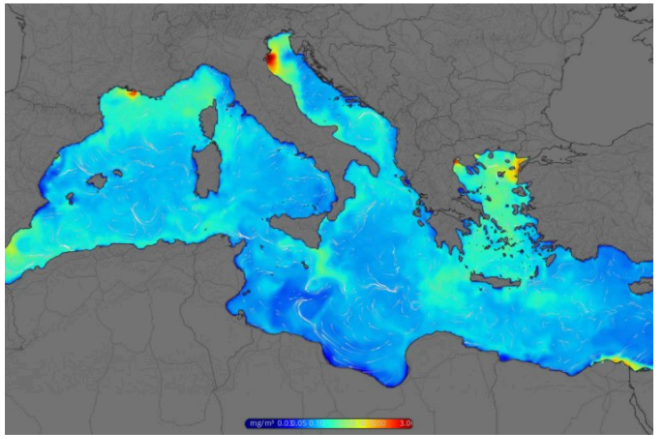
The wave forecasting system was set-up as a nested configuration with a coarse grid covering the entire Mediterranean Sea at a spatial resolution of 0.1o×0.1o and a fine grid nested within the coarse grid. The domain of...

Meteo



The POSEIDON weather forecasting system

Ecosystem



Ecosystem model

Thank you for your attention

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