Surface ocean carbon measurements: a case study in Africa

Webinar by the KADI project

16.05.2025

KADI

Agenda & Speakers

- Short presentations by invited speakers
- Open Discussion

Richard Sanders, Director, ICOS Ocean Thematic Centre (ICOS OTC)

Oksana Tarasova, Senior Scientific Officer, Infrastructure Department World Meteorological Organization (WMO)

Maciej Telszewski, Director, International Ocean Carbon Coordination Project (IOCCP)

Tommy Bornman, Manager, Coastal node of the South African Environmental Observation Network (SAEON) and the Shallow Marine and Coastal Research Infrastructure

Abdirahman Omar, Senior researcher in chemical oceanography, Norwegian Research Centre (NORCE); Principal Investigator at the ICOS ocean station, Sea-Cargo Express

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Towards an African continental scale contribution to SOCONET

Richard Sanders,
ICOS Ocean Thematic Centre
Bergen, Norway

The Ocean take up about 20% of the C we release to the atmosphere

Without this 'sink' Climate Change would be happening much faster and our response would need to be faster, larger and more expensive
Where is it happening – observations key to answering this as part of global network

34.4 $GtCO_2$/yr

87%

13%

5.3 $GtCO_2$/yr

17.3 $GtCO_2$/yr

44%

29%

11.6 $GtCO_2$/yr

22%

8.9 $GtCO_2$/yr

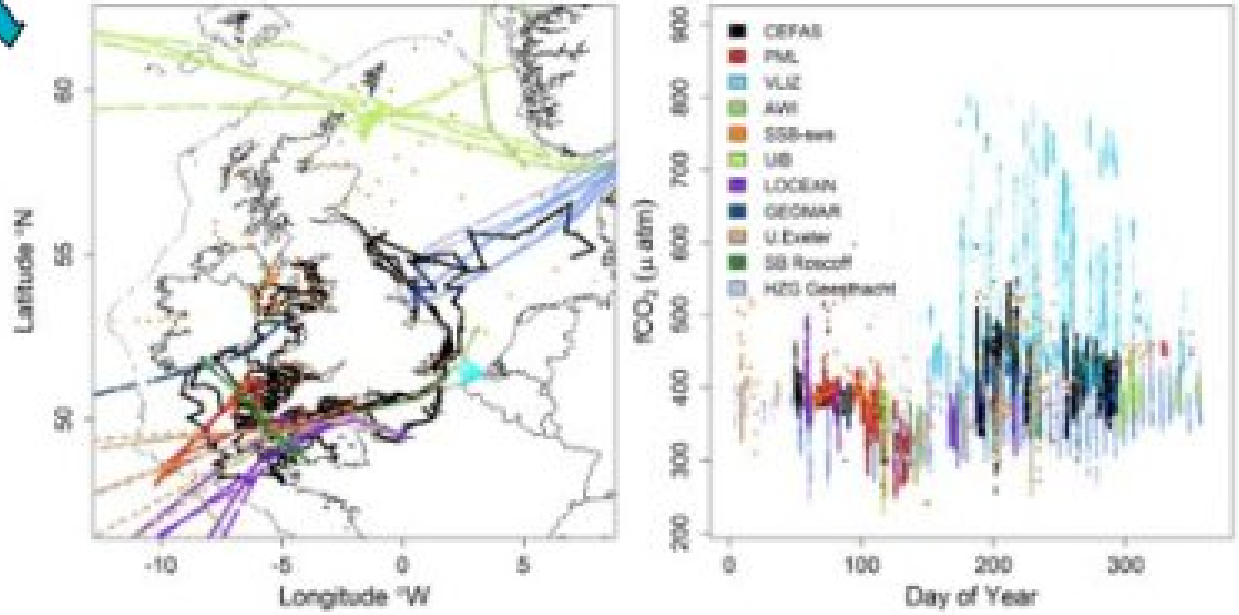
Budget Imbalance:

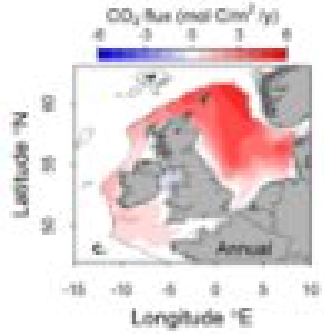
5%

1.9 $GtCO_2$/yr

Source: CDIAC; NOAA-ESRL; Houghton and Nassikas 2017; Hansis et al 2015; Le Quéré et al 2018; Global Carbon Budget 2018

Require system to monitor ocean C uptake and report it to decision makers in support of climate negotiations – both in the open ocean and in coastal waters (Coastal waters are tremendously important.





SCIENTIFIC REPORTS
nature research

Winter weather controls net influx of atmospheric CO_2 on the north-west European shelf

Vassilis Kitidis, Jamie D. Shutler, Ian Ashton, Mark Warren, Ian Brown,

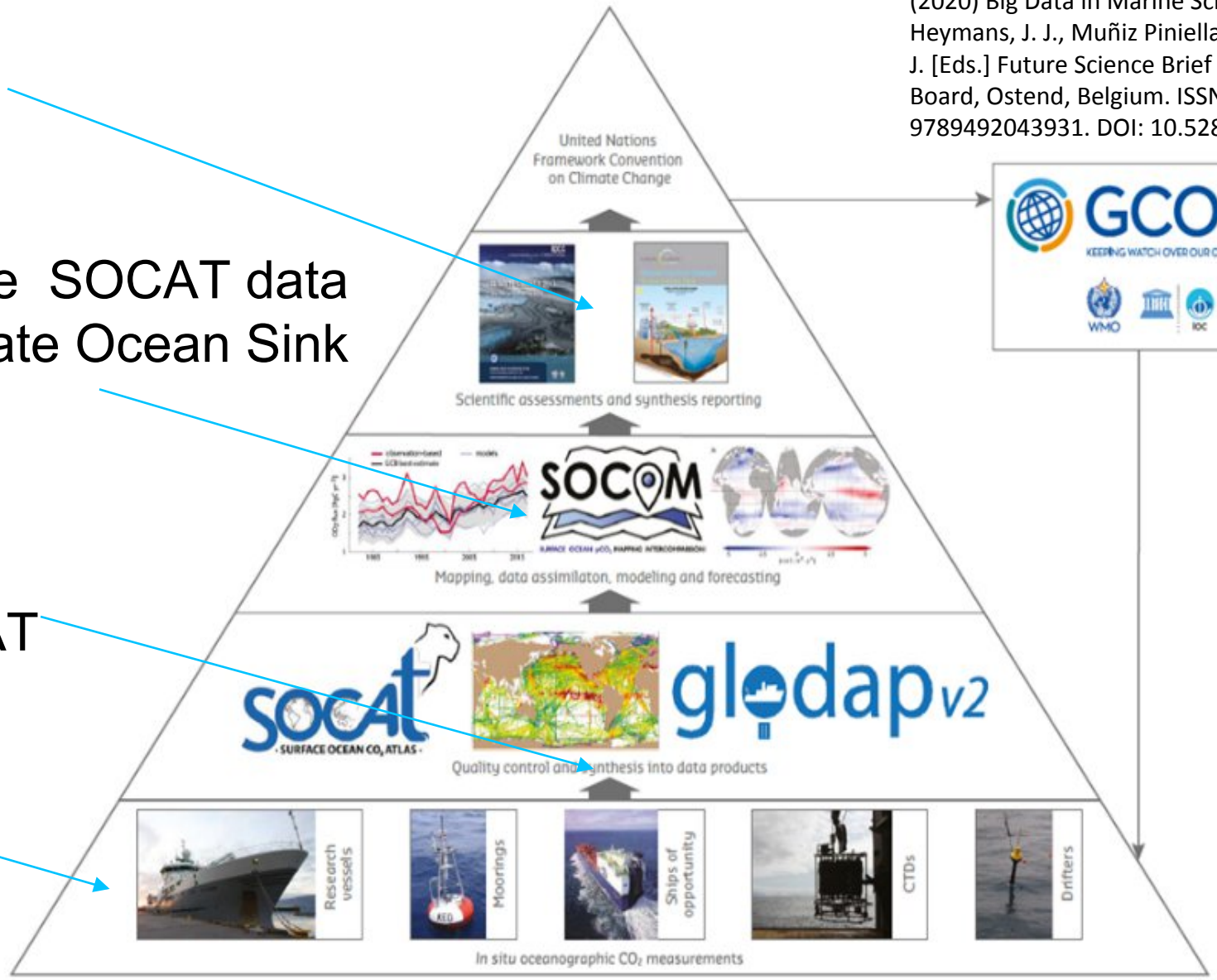
ICOS

Global C Project

Multiple Groups use SOCAT data in SOCAT to estimate Ocean Sink

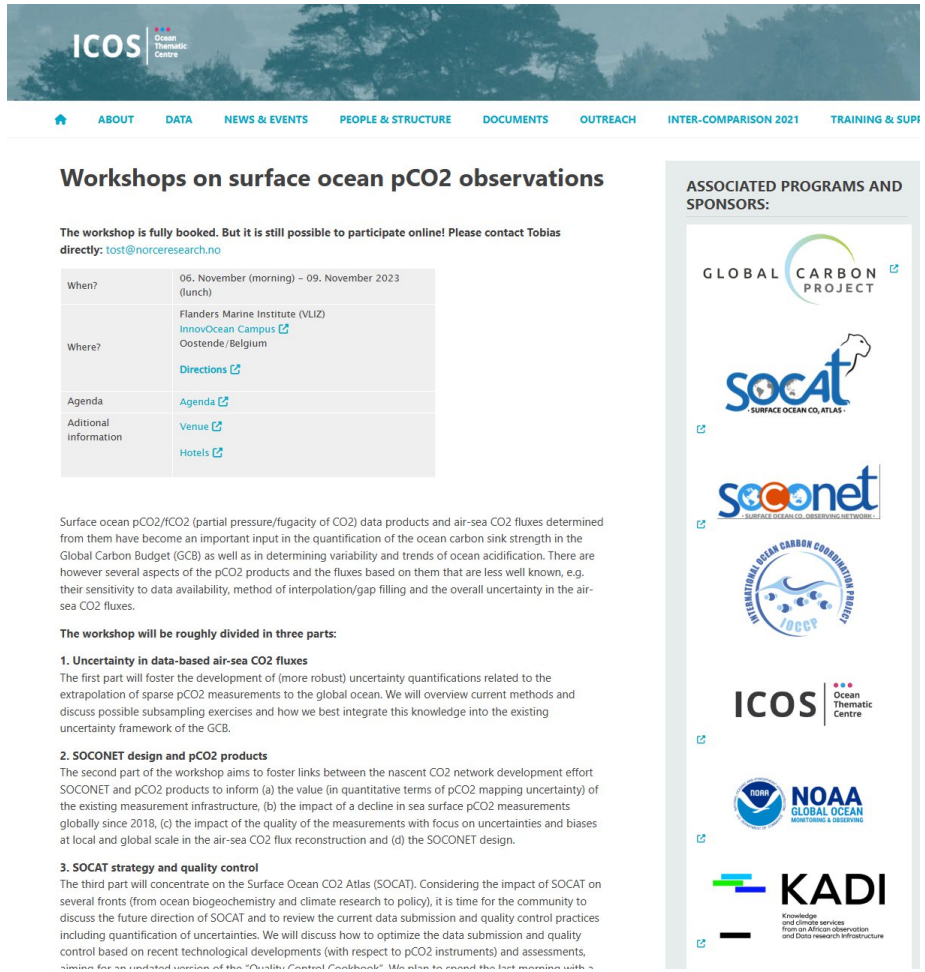
Data reported to NODCs and SOCAT

Multiple Groups Make observations



The Ocean Carbon Value Chain (From Guidi et al., (2020) Big Data in Marine Science. Alexander, B., Heymans, J. J., Muñiz Piniella, A., Kellett, P., Coopman, J. [Eds.] Future Science Brief 6 of the European Marine Board, Ostend, Belgium. ISSN: 2593-5232. ISBN: 9789492043931. DOI: 10.5281/zenodo.375579).

Delivering the Value Chain in support of the Global Carbon Project and the Global Greenhouse Gas watch



ICOS Ocean Thematic Centre

ABOUT | DATA | NEWS & EVENTS | PEOPLE & STRUCTURE | DOCUMENTS | OUTREACH | INTER-COMPARISON 2021 | TRAINING & SUPI

Workshops on surface ocean pCO2 observations

The workshop is fully booked. But it is still possible to participate online! Please contact Tobias directly: tost@norceresearch.no

When?	06. November (morning) – 09. November 2023 (lunch)
Where?	Flanders Marine Institute (VLIZ) InnovOcean Campus Oostende/Belgium Directions
Agenda	Agenda
Aditional information	Venue Hotels

Surface ocean pCO2/fCO2 (partial pressure/fugacity of CO2) data products and air-sea CO2 fluxes determined from them have become an important input in the quantification of the ocean carbon sink strength in the Global Carbon Budget (GCB) as well as in determining variability and trends of ocean acidification. There are however several aspects of the pCO2 products and the fluxes based on them that are less well known, e.g. their sensitivity to data availability, method of interpolation/gap filling and the overall uncertainty in the air-sea CO2 fluxes.

The workshop will be roughly divided in three parts:

1. Uncertainty in data-based air-sea CO2 fluxes
The first part will foster the development of (more robust) uncertainty quantifications related to the extrapolation of sparse pCO2 measurements to the global ocean. We will overview current methods and discuss possible subsampling exercises and how we best integrate this knowledge into the existing uncertainty framework of the GCB.

2. SOCONET design and pCO2 products
The second part of the workshop aims to foster links between the nascent CO2 network development effort SOCONET and pCO2 products to inform (a) the value (in quantitative terms of pCO2 mapping uncertainty) of the existing measurement infrastructure, (b) the impact of a decline in sea surface pCO2 measurements globally since 2018, (c) the impact of the quality of the measurements with focus on uncertainties and biases at local and global scale in the air-sea CO2 flux reconstruction and (d) the SOCONET design.

3. SOCAT strategy and quality control
The third part will concentrate on the Surface Ocean CO2 Atlas (SOCAT). Considering the impact of SOCAT on several fronts (from ocean biogeochemistry and climate research to policy), it is time for the community to discuss the future direction of SOCAT and to review the current data submission and quality control practices including quantification of uncertainties. We will discuss how to optimize the data submission and quality control based on recent technological developments (with respect to pCO2 instruments) and assessments,

ASSOCIATED PROGRAMS AND SPONSORS:

GLOBAL CARBON PROJECT

SOCAT SURFACE OCEAN CO2 ATLAS

SOCONET SURFACE OCEAN CO2 OBSERVING NETWORK

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT IOCCP

ICOS Ocean Thematic Centre

NOAA GLOBAL OCEAN MONITORING & OBSERVING

KADI Knowledge and climate services from an African observation and Data research Infrastructure

INTERNATIONAL OCEAN CARBON COORDINATION PROJECT IOCCP

Declaration on Operationalising the Surface Ocean Carbon Value Chain

OUR COLLECTIVE AMBITION, founded in the GCOS IP, is to completely transform our ability to deliver an integrated global ocean carbon monitoring system, helping countries to better understand and manage the causes of climate change in a timely and efficient manner. In recognition of this ambition, over 100 experts and stakeholders representing Europe, Australia, Asia, North America, South America and Africa gathered in Oostende, Belgium and together committed to:

- ✔ Formalise the structures of SOCONET to create a robust and resilient GOOS network bringing together surface ocean CO_2 observing efforts
- ✔ Develop a clear pathway to securing a robust, resilient and scalable SOCAT data management system for the long term
- ✔ Support and quantitatively underpin the efforts above with observing system experiments using SOCOM methods, satellite observations and models to optimise the current observing design

The Global Ocean Observing System

News

Three emerging observing networks join the Global Ocean Observing System

August 12, 2024

The Fishing Vessel Observing Network (FVON), Surf Network (SOCONET) and Science Monitoring And Re (SMART) Subsea Cables are three new emerging net contribute to the Global Ocean Observing System by interoperable ocean data to fill known gaps.

Description

The ocean is a key component of the Global Carbon Cycle, absorbing about a quarter of our CO2 emissions, slowing climate change, and giving us time to implement mitigation, adaptation and CDR actions. Any reduction in this uptake will reduce the time available for us to adjust, leading to extra costs, hence there is a strong economic imperative to measure ocean uptake in near real time as part of the 'system of systems' needed for the global stocktake. This uptake is measured via the 'Ocean Carbon Value Chain' which links observing, data management and synthesis together to provide annual estimates of ocean uptake to the COP in support of policy making. However, this chain is weakening, with reductions in data availability leading to higher uncertainty in our estimates of ocean C

Action Network

Where we are now:

- The Ocean C sink is large and changing
- We need to measure it in support of setting policy
- We now have a clear international structure to coordinate surface CO2 observing globally
- The intergovernmental process is taking notice of this.
- If we can bring regional networks into being within the UN Decade then we can transform our ability to support policy

Development of a Global GHG Monitoring System

KADI Webinar; 16 May 2025

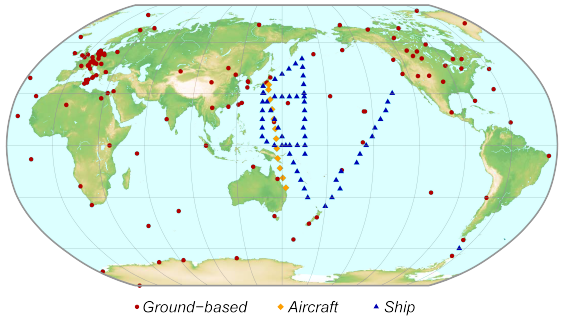
Dr Oksana Tarasova (otarasova@wmo.int)
WMO Infrastructure Department

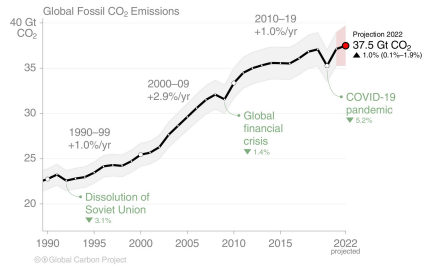
WORLD METEOROLOGICAL ORGANIZATION

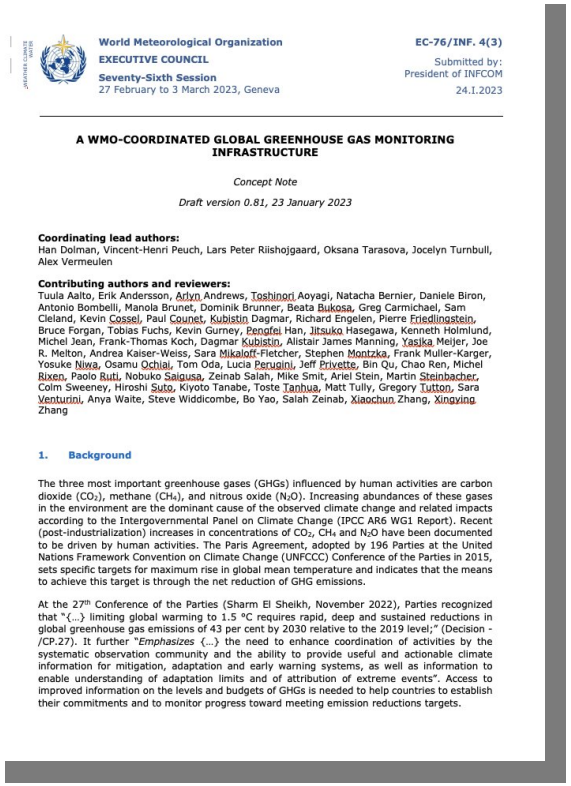
1950-2025 SCIENCE for ACTION

The vision and concept behind Global Greenhouse Gas Watch (G3W)

The concept of G3W was **adopted by the 19th Meteorological Congress**.







World Meteorological Organization
EXECUTIVE COUNCIL
Seventy-Sixth Session
27 February to 3 March 2023, Geneva

EC-76/INF. 4(3)
Submitted by:
President of INFCOM
24.I.2023

A WMO-COORDINATED GLOBAL GREENHOUSE GAS MONITORING INFRASTRUCTURE

Concept Note

Draft version 0.81, 23 January 2023

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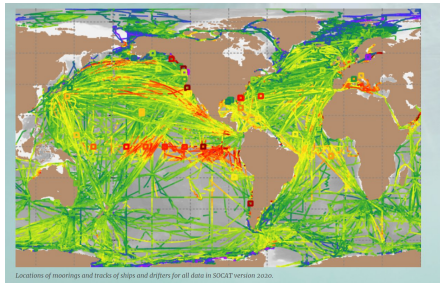
1. Background

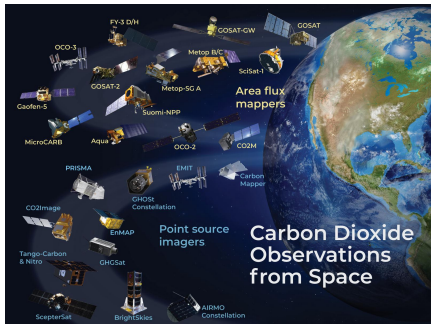
The three most important greenhouse gases (GHGs) influenced by human activities are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Increasing abundances of these gases in the environment are the dominant cause of the observed climate change and related impacts according to the Intergovernmental Panel on Climate Change (IPCC AR6 WG1 Report). Recent (post-industrialization) increases in concentrations of CO_2, CH_4 and N_2O have been documented to be driven by human activities. The Paris Agreement, adopted by 196 Parties at the United Nations Framework Convention on Climate Change (UNFCCC) Conference of the Parties in 2015, sets specific targets for maximum rise in global mean temperature and indicates that the means to achieve this target is through the net reduction of GHG emissions.

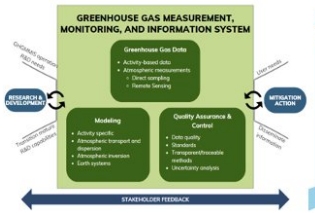
At the 27th Conference of the Parties (Sharm El Sheikh, November 2022), Parties recognized that "{...} limiting global warming to 1.5 °C requires rapid, deep and sustained reductions in global greenhouse gas emissions of 43 per cent by 2030 relative to the 2019 level;" (Decision -/CP.27). It further "*Emphasizes* {...} the need to enhance coordination of activities by the systematic observation community and the ability to provide useful and actionable climate information for mitigation, adaptation and early warning systems, as well as information to enable understanding of adaptation limits and of attribution of extreme events". Access to improved information on the levels and budgets of GHGs is needed to help countries to establish their commitments and to monitor progress toward meeting emission reductions targets.

Substantial **research efforts** have been on-going and will remain **essential**, but **transition to sustained operations** is a necessity in the context of the climate crisis.

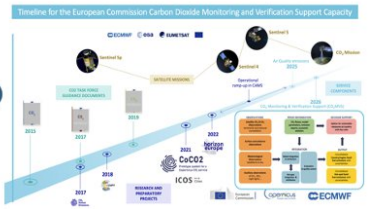


There is good alignment with **fast-track GHGs information efforts**, such as in EU, JAPAN, US… and **large investments in the space sector**.

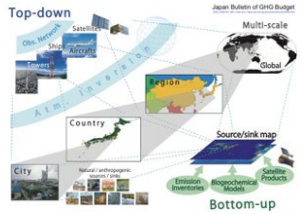




US GGMMIS, 2023



EU COPERNICUS, 2023



JAPAN NIES, 2023

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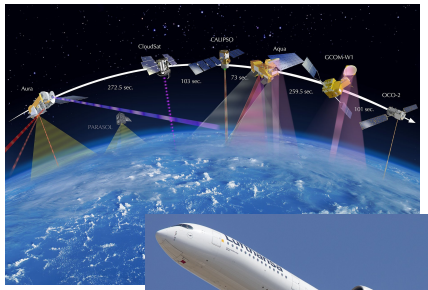
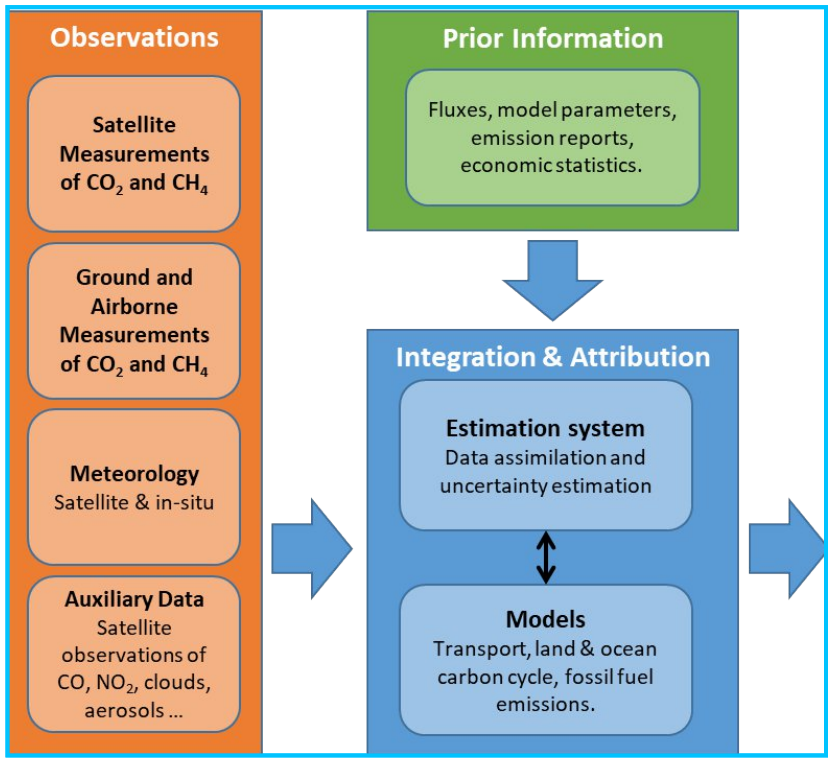
General principles of the observations-based emission estimates

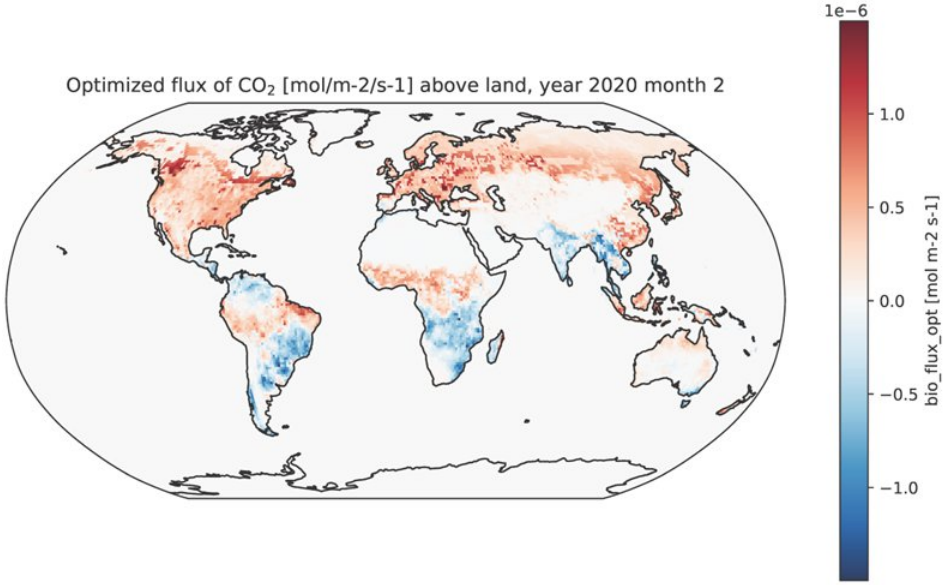


Atmospheric observations

Terrestrial and ocean observations

The system builds on free and unrestricted data exchange





Outputs: Globally gridded monthly net fluxes of CO_2 and CH_4 (and N_2O)

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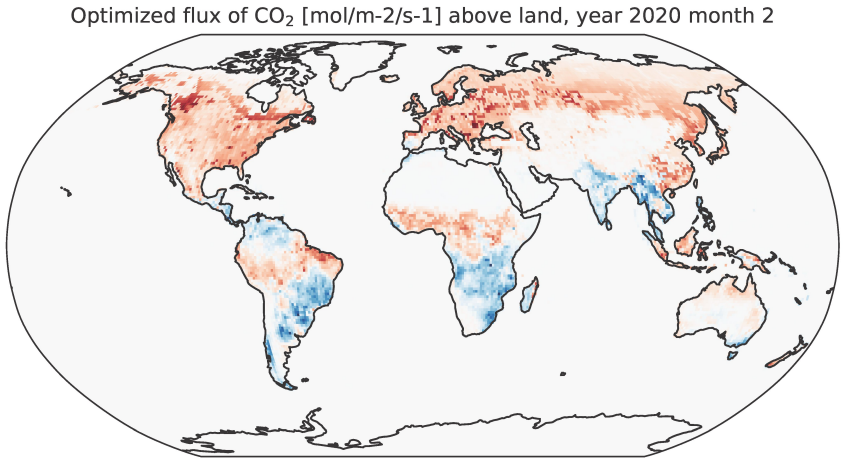
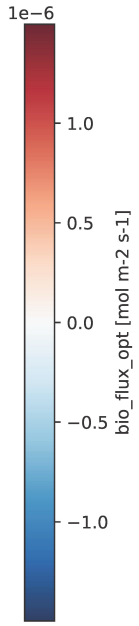
G3W global products could provide boundary conditions to the decision-making scales

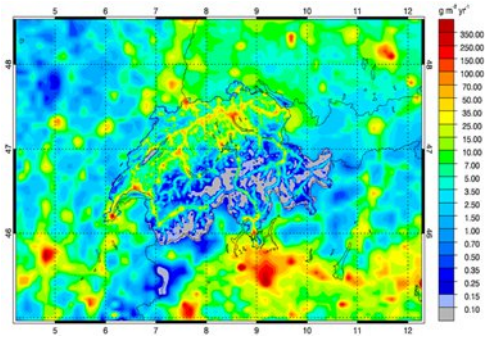


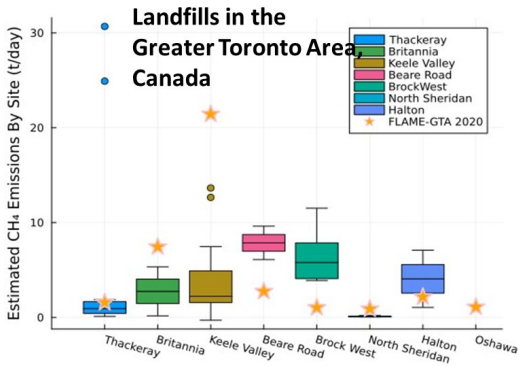


Boundary conditions

IG3IS

- National
- Urban
- Facility



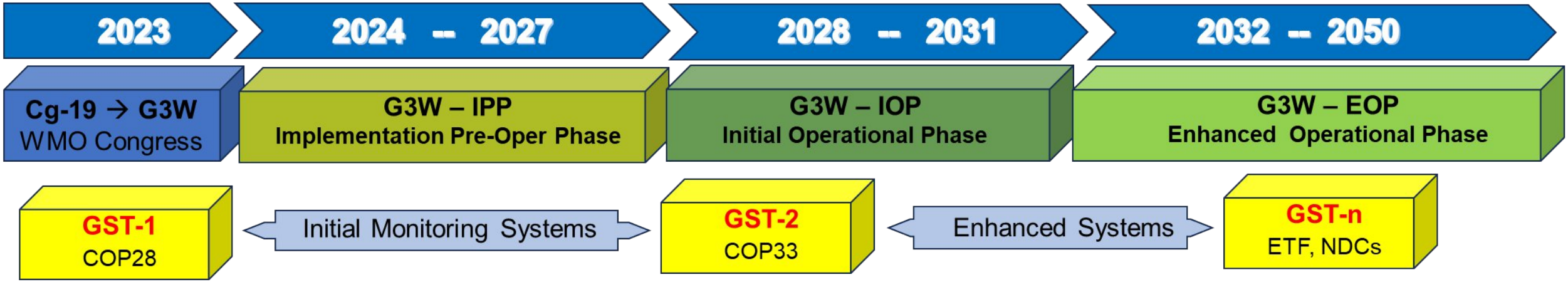


G3W: modelled global GHG concentration fields at 1x1° resolution, and modelled monthly net surface fluxes at 1x1° resolution

External to G3W programme

Space for research, private and national public initiatives

G3W timeline and recent updates



- G3W endorsed by the 78th session of the WMO Executive Council in June 2024.
- G3W Implementation of pre-operational phase officially starts.
- Initial tasks are defined by the WMO Technical Commission on Infrastructure.
- G3W Advisory Group and Task Teams (Modelling, Networks, Data) are formed.
- G3W was presented at Earth Information Day during SBSTA SB61 in COP29.
- Technical workshop to advance implementation was organized on 5-7 March 2025

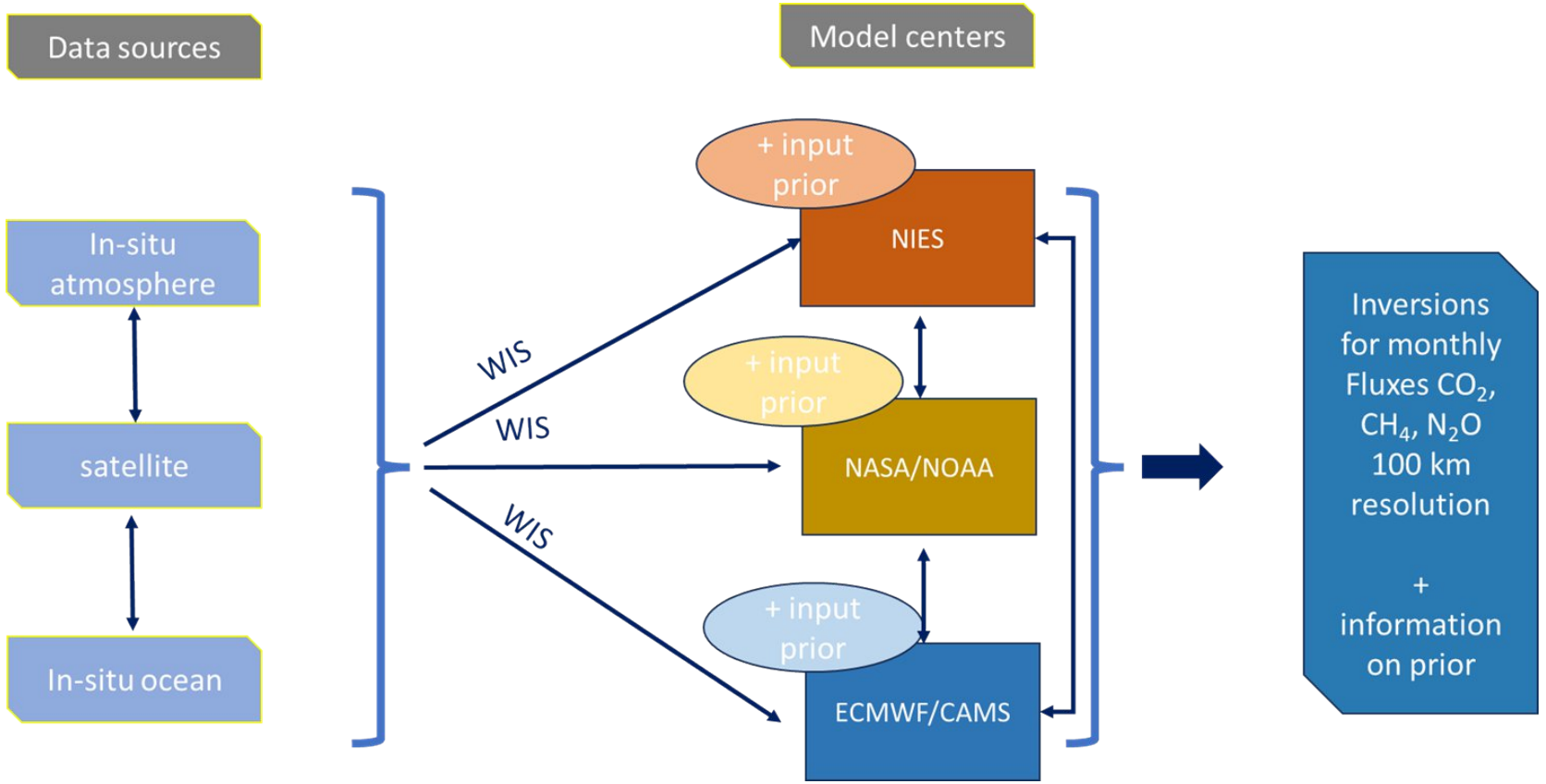
G3W Data Providers Workshop

Geneva, Switzerland and online on 5-7 March 2025

Members of the TT-G3W-Modelling and TT- G3W-Data

Data

- Initial mapping
- Considerations regarding input data
- Data for model verification
- Coordination of satellite, atmospheric non-satellite data and in-situ ocean data
- Role of data aggregators
- Integration of the data flows in WMO Information Systems (WIS)



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Way forward

Development of the global Greenhouse Gas monitoring system critically depends on availability of the different types of measurements:

- The existing GHG observations in different domains should be sustained and existing data should be shared,
- Substantial expansion of GHG observations, particularly in the areas that are highly sensitive to climate change (tropics, polar regions) and data spares regions (like ocean) is required,
- Utilization of the observations-based science driven data needs to be promoted in support of national climate policies and regulations, global stocktake, NDC planning and national reporting,
- Implementation critically relies on the partnerships on national and international scale.

Thank you.

wmo.int

KADI Webinar: Surface ocean carbon measurements: a case study in Africa
16 May 2025

Development of a Coastal GHG Observing System in southern Africa

Thomas Bornman, Abdirahman Omar, Richard Sanders, Louisa Giannoudi, Matthew Saunders

National Research Foundation | SAEON South African Environmental Observation Network
SMCRI Shallow Marine & Coastal RESEARCH INFRASTRUCTURE
science, technology & innovation
Department: Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA
hcmr ΕΛΚΕΘΕ
NORCE
ICOS Integrated Carbon Observation System
KADI

Designing a coastal GHG observation network

Complex interactions and highly variable environment

- Multiple processes
  - Estuarine Outgassing, The continental Shelf pump, Blue Carbon, Ocean Acidification and “Blue Nitrogen”
- Multiple habitats
  - Rivers, salt marsh, mangroves, seagrass, kelp forests, mudflats, pelagic upwelling zones, benthic diversity, etc.
- Multiple biogeographic provinces and bioregions
- Temporal scales – hourly, diurnal, fortnightly, monthly, seasonal & extreme events

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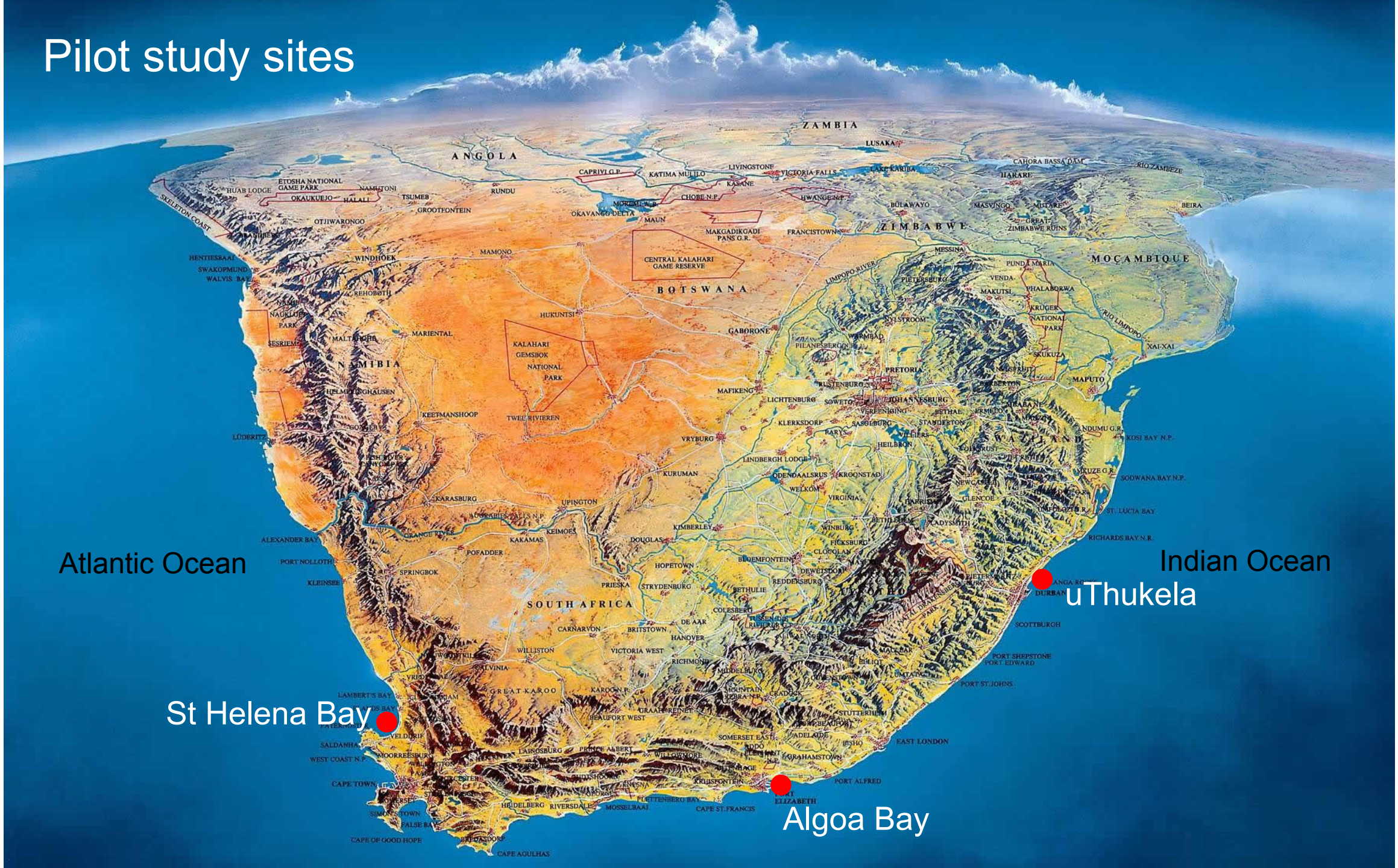
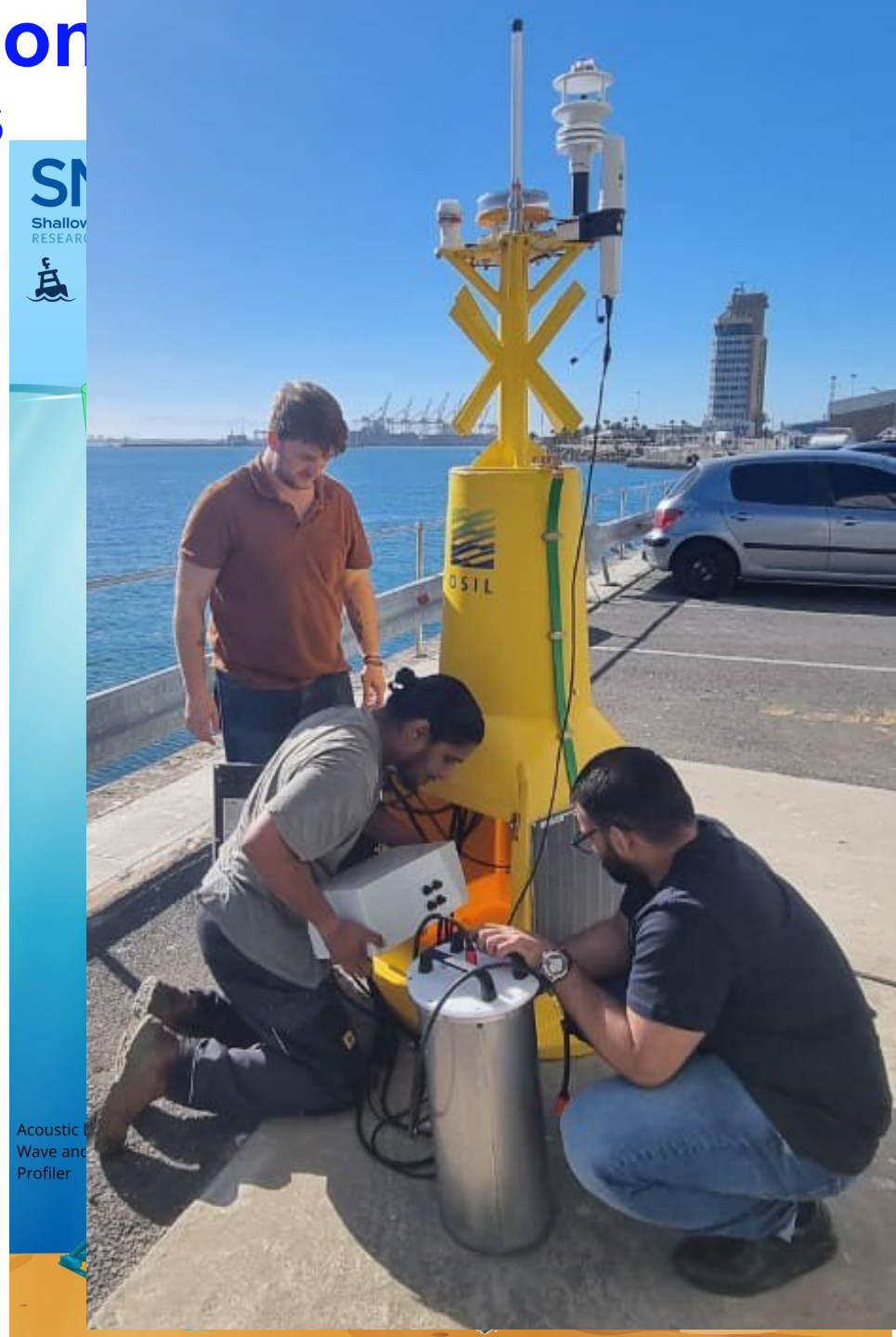
Pilot study sites



Carbon Observatory: Fixed station measurements

Near-real time MetOcean Mooring sensors:

- Sea surface pCO_2 (VeGAS-pCO_2 sensor) & air pCO_2
- SAMI pH sensor (replaced by Seabird pH in 2025)
- Moored Seabird CTD:
  - Temp, salinity, pressure, pH, DO, Chl-a, turbidity
  - SUNA V2 Nitrate Sensor
- Thermistor string (UTR every meter)
- ADCP (currents and waves)
- Surface climate
- Frequency: One reading per hour
- Roll-out planned for 2025 to St Helena Bay and Algoa Bay. uThukela and False Bay in 2026.
- Plan to have moorings labelled as ICOS Marine Stations by 2027

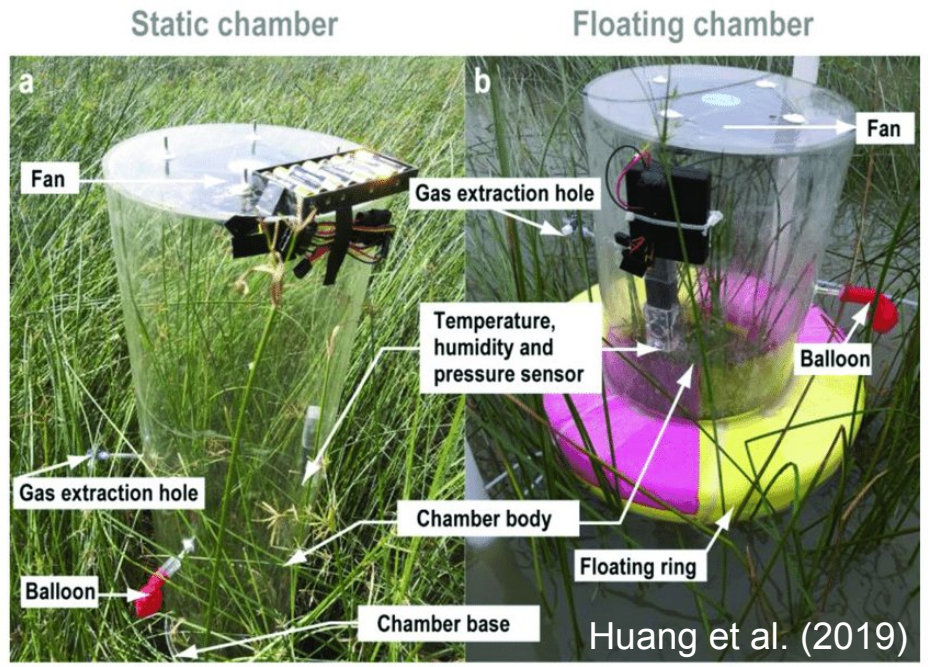


Carbon Observatory: Fixed stations – discreet measurements

- Pelagic Ecosystem LTER sampling
  - Monthly in Algoa Bay (since 2010);
  - Quarterly in St Helena (starting in 2025)
  - Quarterly in KZN-Bight (starting in 2026)
  - Monthly in False Bay (starting in 2026)
- Essential Ocean Variables
  - Temp, salinity, DO, pressure, turbidity, pH
  - 5 nutrients (NO_3, NO_2, PO_4, $Si(OH)_4$, NH_4)
  - TA, pCO_2, pH, DOC, DIC, POC, PIC, CDOM, etc
    - VeGAS pCO_2 underway analyser
- Essential Biodiversity Variables
  - Chl-a, Phytoplankton & zooplankton

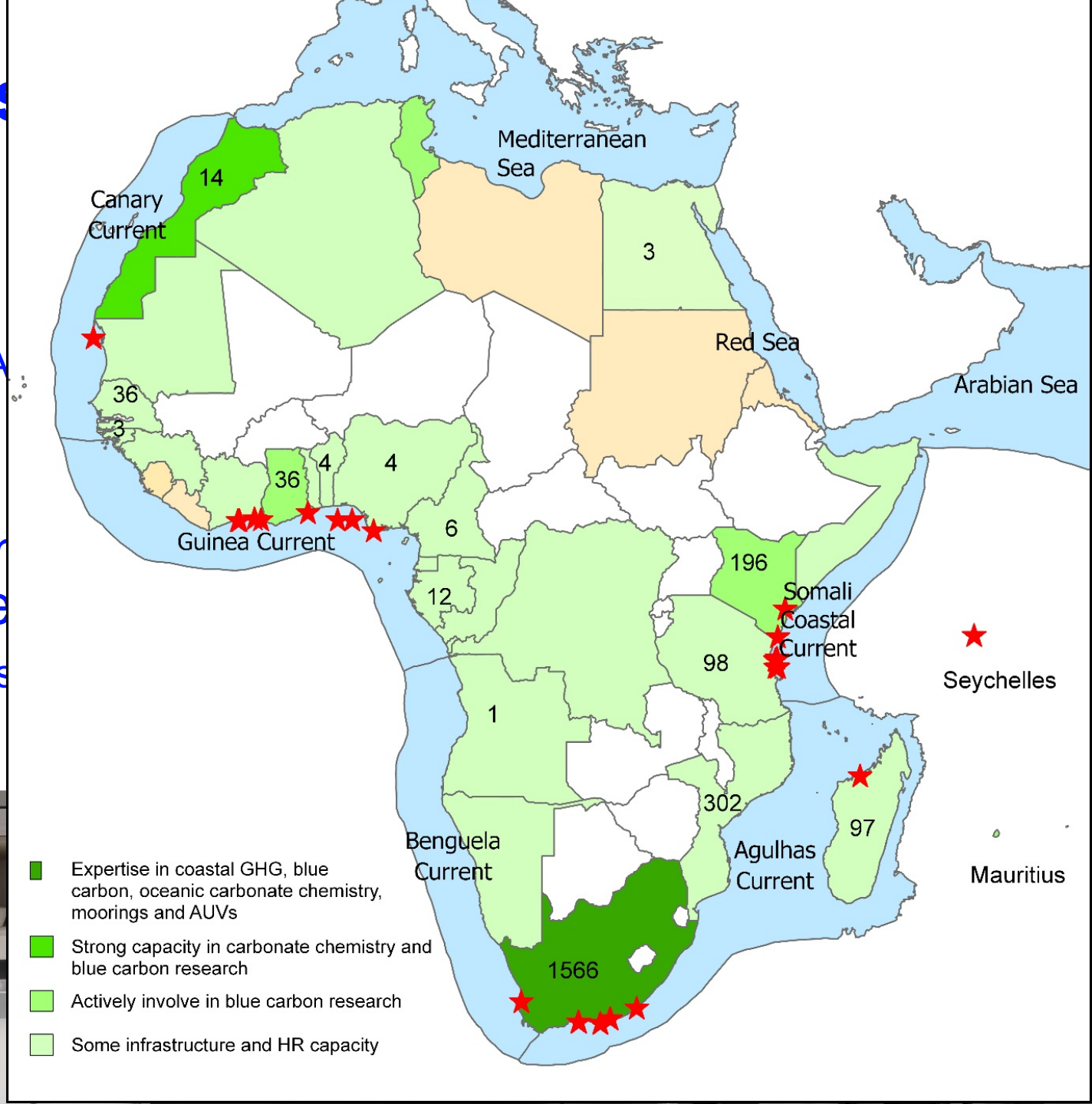
GHG and estuarine carbon observatory

- GHG-flux through chamber measurements
  - Real-time flux calculations connected to Gas Analyzers for CO_2, CH_4, and/or N_2O measurements.
  - Static flux chamber for sediment-atmosphere boundary gas exchange determination.
  - Dark and transparent chamber deployments = respiration & net ecosystem exchange
  - Pore water dissolved concentrations
  - Diffusive flux at water-air interface
- Quantifying the emission pathways & seasonality in trace gas fluxes from coastal habitats:
  - Diffusion, ebullition & plant-mediated transport = net ecosystem GHG flux
- Measurement of water and soil carbon species (DIC, DOC, TOC, PIC, POC, etc.) using CNS elemental analyzers at SAEON/SMCRI
- Started in November 2023



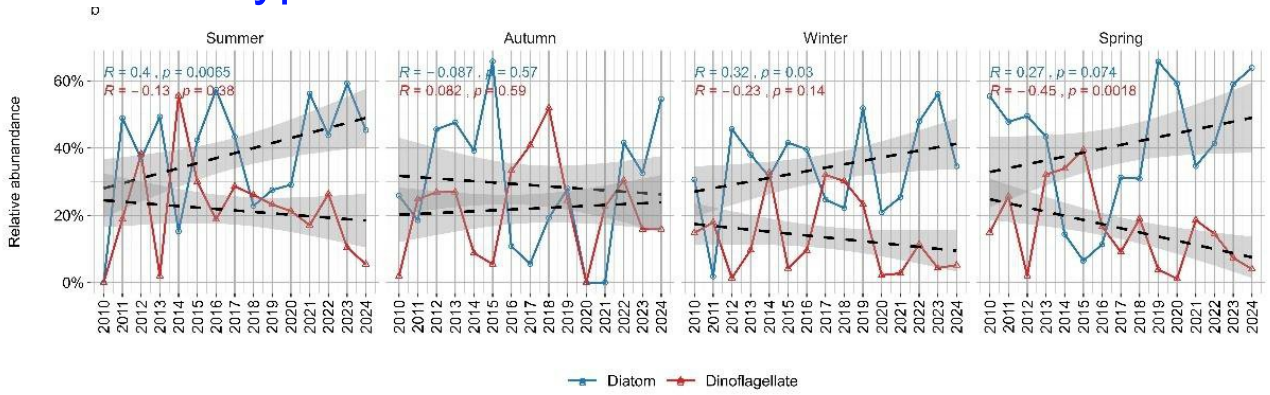
Blue carbon s

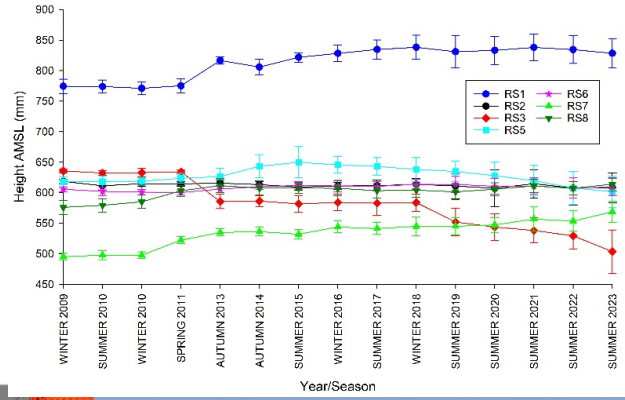
- Sediment carbon pools
  - Drying, ashing, milling (C stock)
  - Laser sediment particle analyser at SA
  - 210Pb dating (iThemba Labs)
  - C/N/S analyses (SAEON) - TOC, TIC
- Vegetative carbon pools (salt r
  sea grasses, kelp, macroalgae
  - Drying, ashing, milling, C/N/S analyses

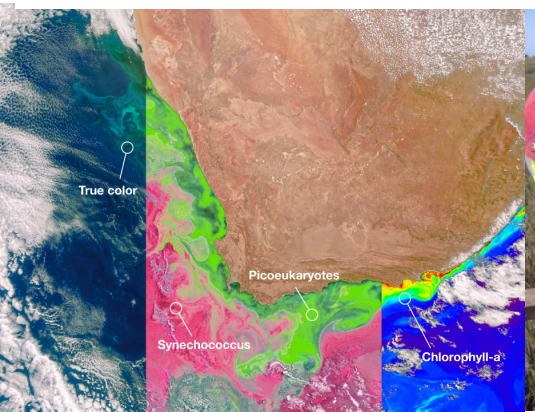


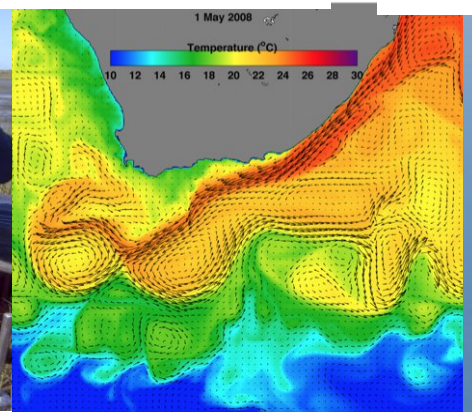
Changes in stocks over time

- Rod-Set-Elevation Tables (sediment elevation change)
  - Stations in Swartkops since 2009 and Berg since 2024.
- Remote sensing (vegetation density, canopy height, etc.)
  - SAEON's Airborne Remote Sensing Platform
  - Ocean Colour satellite products – SST, Chl-a biomass
  - PACE Hyperspectral satellite products – Phytoplankton Functional Types



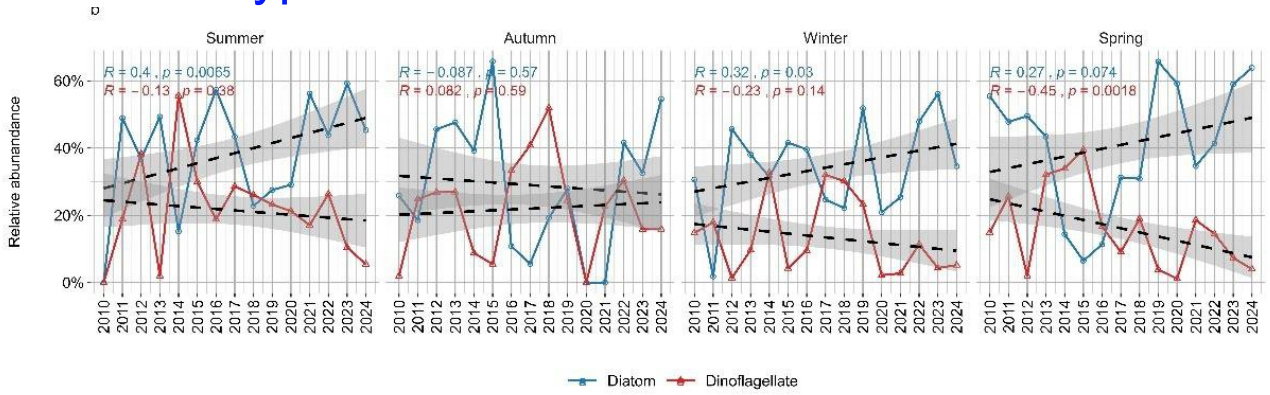


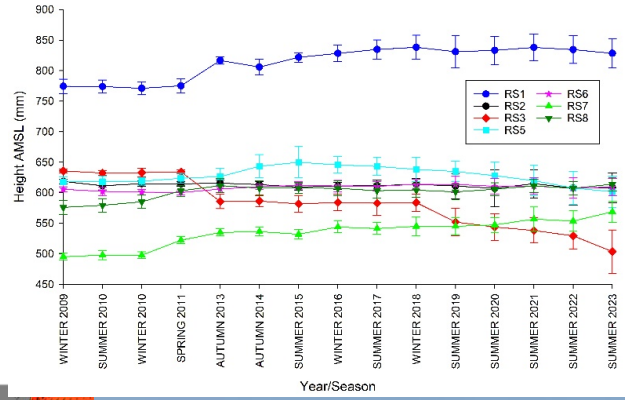


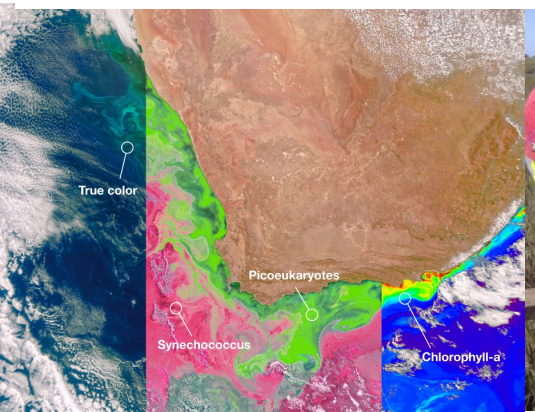


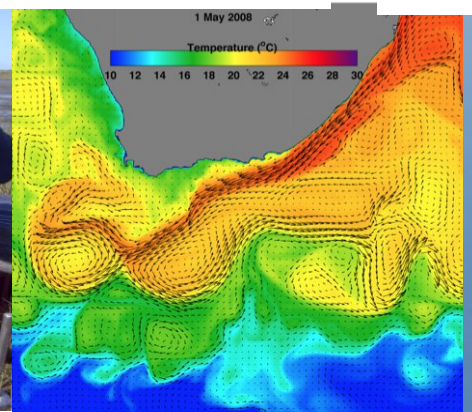
Changes in stocks over time

- Rod-Set-Elevation Tables (sediment elevation change)
  - Stations in Swartkops since 2009 and Berg since 2024.
- Remote sensing (vegetation density, canopy height, etc.)
  - SAEON's Airborne Remote Sensing Platform
  - Ocean Colour satellite products – SST, Chl-a biomass
  - PACE Hyperspectral satellite products – Phytoplankton Functional Types







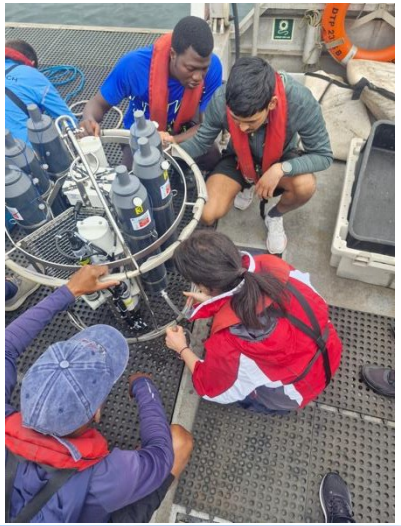


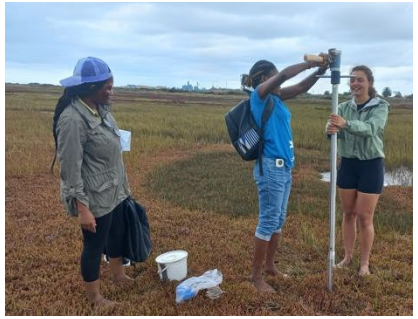
Workshop on surface ocean CO_2, Oostende, Belgium, November 2023.

KADI supported the attendance of six African Scientists from a variety of career stages across the continent.

The workshop activity was divided into three parts:

1) working on the process by which sparse observations are converted into estimates of global ocean uptake of carbon dioxide (CO2)
2) linking the international observing community together to develop a vision for the future structure of SOCONET (the Surface Ocean CO2 Network)
3) training users in the quality control procedures used by large international databases that support our understanding of the oceans role in the global C cycle.





A training course in coastal greenhouse gas measurements held in the Algoa Bay marine environment at the Nelson Mandela University, Gqeberha, South Africa, March 2024.

Focussed on practical hands-on training and 13 African scientists were upskilled to deliver the key elements of SOCONET as detailed in the Ostend Declaration.

The course participants were trained on blue carbon measurements in a tidal estuary, coastal biogeochemistry measurements, analyses of sediment and seawater samples in the laboratory, and analyses and interpretation of the measured results.

Also, discussions were held to explore and elucidate the current needs, resources and limitation for building a community of operators, funders and end-users of ocean carbon cycle science in Africa.

Image source Pexels

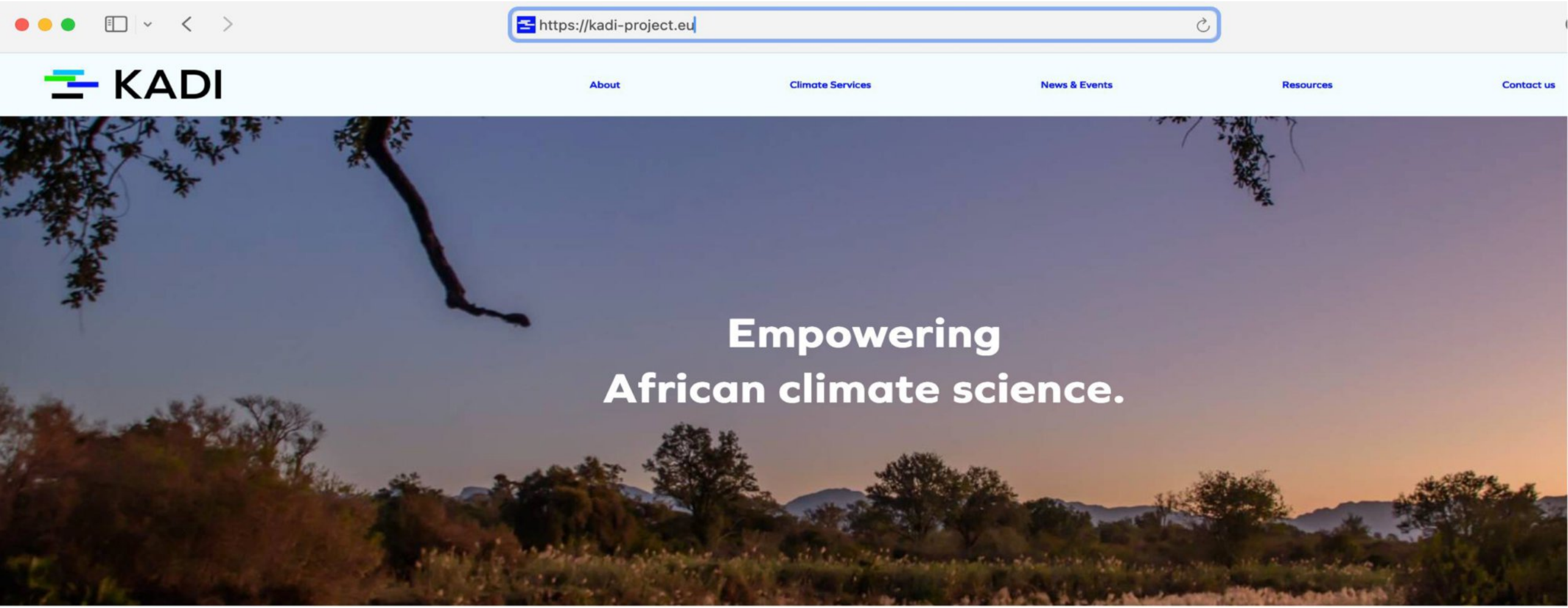
A 2-day hybrid workshop on Opportunities for integrating African coastal carbon measurements into global observational networks, to be held at National Fisheries Research Institute, Casablanca, Morocco, 25 - 26 June (or 2 - 3 July) 2025.

Planned structure and content

The workshop will be hybrid, few *stakeholder champions* and KADI representatives physically together, and online for WMO/GOOS and African/Global participants who are interested in the area. It will be in three parts:

- Present and discuss the status and knowledge gaps identified in the coastal observation space (infrastructure and human capacity) and make recommendations.
- Develop a blueprint for achieving observational requirements for global networks .
- Outline a report summarising the discussions, recommendations, and roadmap for future steps.

Updates to be made available....



For more info contact:

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Thomas Bornman tg.bornman@saeon.nrf.ac.za
Theresia Bilola theresia.bilola@icos-ri.eu

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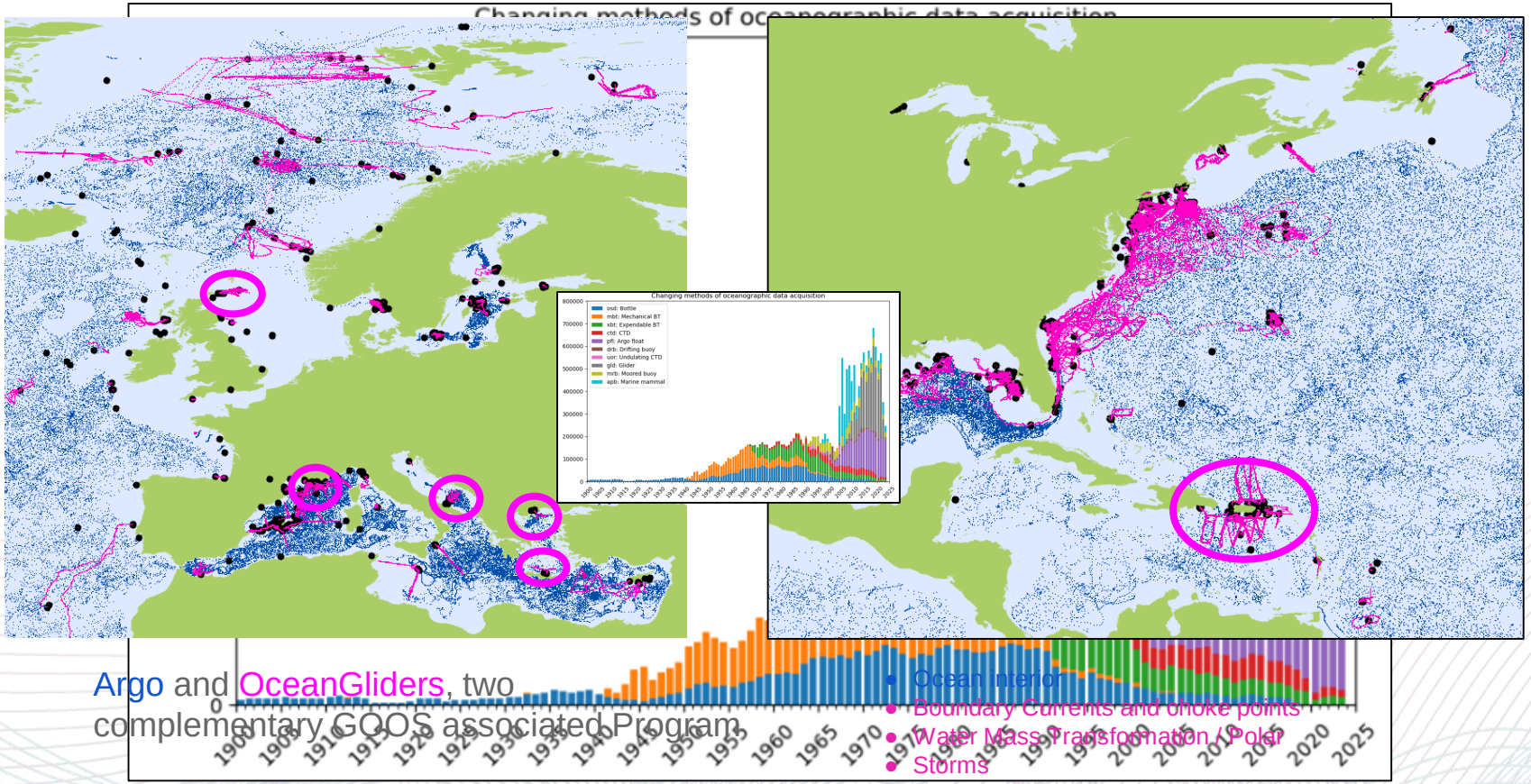
Who

Where?

When

The challenge of massive data flows



Argo and OceanGliders, two complementary GOOS associated Program

World Ocean Database, NCEI/NOAA

Motivations for AMRIT and similar projects

Some of today's Ocean Observing challenges :

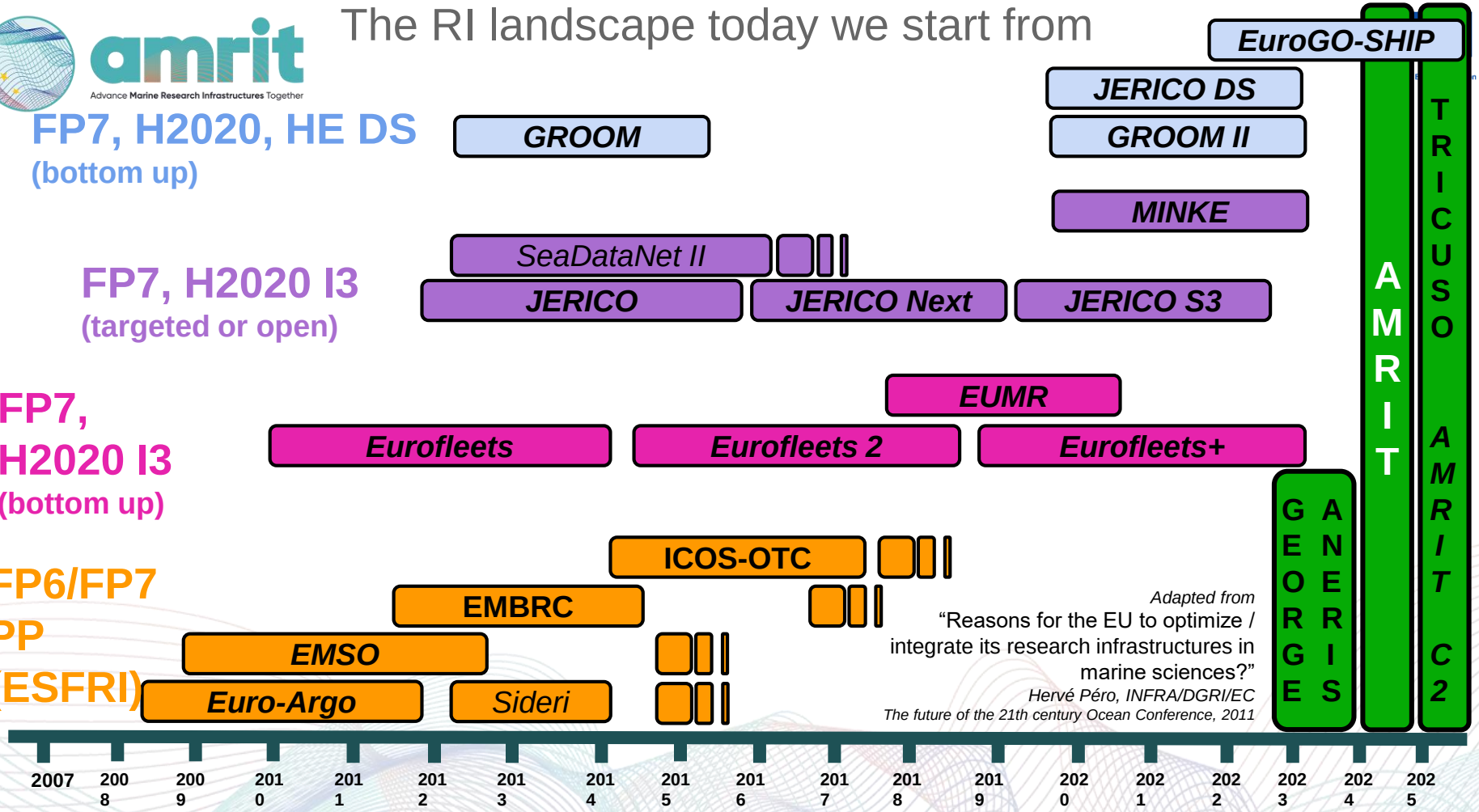
- Massive/expensive data flow from a very large number of differents platforms and operators
- Growing demand from Copernicus, incl. DTs, from Maritime Policies (DGMARE), etc.
- Multiple stakeholders at global, EU and national level
- Operators from multiple organisations from multiple countries
- Data collection for both fundamental research, sustained ocean observing and any others uses
- Not to mention, OO to meet Earth Grand Challenges (climate, biodiversity, etc.)

Some of the pathways to meet these challenges currently explored:

- Improved national coordination: FrOOS, HIMIOFoTS, ITINERIS, FMRI, etc.
- Europe : EOOS framework, project for a "Ocean observation – sharing responsibility" regulation
- ESFRI : asks for more synergies (research/operational), between RIs, "no new RIs" message
- Horizon Europe : since 2022, a series of INFRA calls for synergies/integration/fusion of RIs
- G7 FSOI : WG on Marine RIs and Sustained Ocean Observation

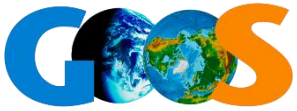
This context & incentives result in a new type of EU INFRA projects such as : GEORGE & ANERIS in 2022; **AMRIT**, AQUARIUS & POLARIN in 2023; *AMRIT-C2* & TRICUSO this year

The RI landscape today we start from



Adapted from
"Reasons for the EU to optimize / integrate its research infrastructures in marine sciences?"
Hervé Péro, INFRA/DGRI/EC
The future of the 21th century Ocean Conference, 2011


WIGOS


GOOS


GCOS


Funded by
the European Union


GEORGE
ANERIS


amrit


EOOS
European
Ocean
Observing
System


AMRIT
C2


Euro
Argo


emso


ICOS
Integrated
Carbon
Observation
System


EMBRC
EUROPEAN
MARINE
BIOLOGICAL
RESOURCE
CENTRE


EuroGO-SHIP


GROOM RI


MINKE


JERICO
RESEARCH
INFRASTRUCTURE


Copernicus
Marine Service


Climate
Change Service
climate.copernicus.eu


EUMETNET
METEO
FRANCE
Met Office
DWD
FMI

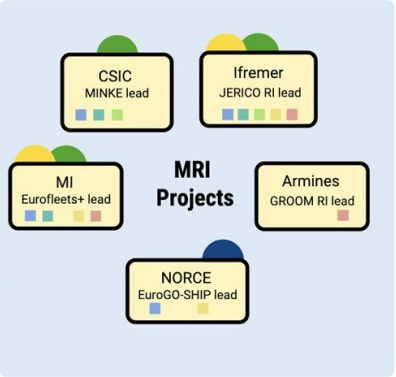

NOAA

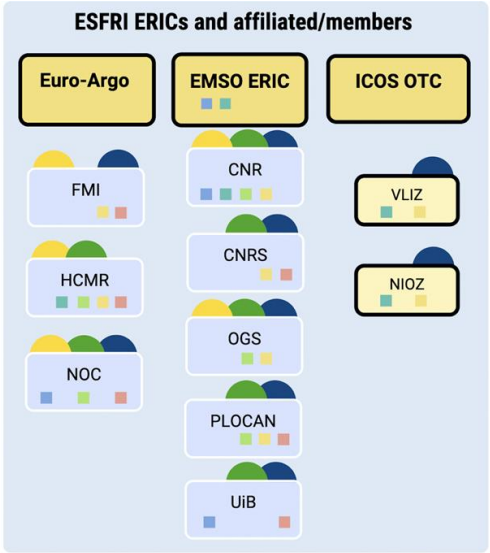

OceanOPS

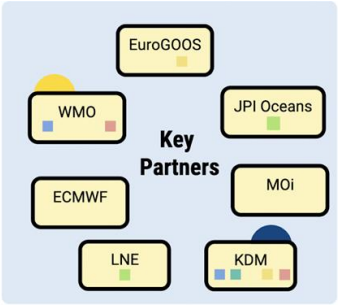

EuroGOOS
European Global Ocean
Observing System

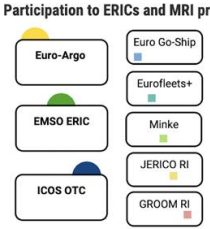

JPI
OCEANS

AMRIT Partnership : ALL TOGETHER







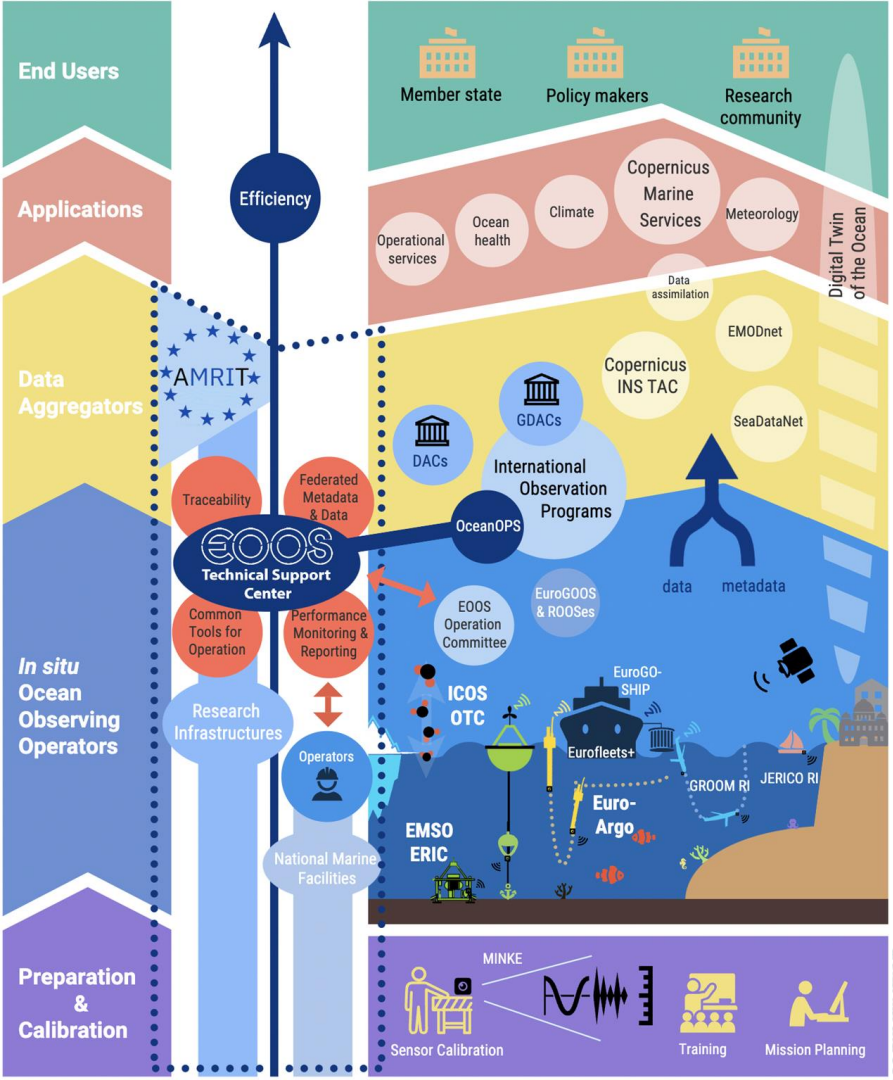


WP3 EuroSea legacy

- Based on the 3 marine ERICs focused on marine observations (engaging EMBRC too)
- Includes the 5 MRI projects, seen by the EC as the ‘national networks’ representing observational capacities for the Members States
- Relies on Copernicus, EOOS and GOOS Key players:
  - MOi and ECMWF (Copernicus Marine and Climate Services)
  - EuroGOOS, WMO and JPIO (Coordination and ‘Policy’ oriented)

AMRIT Overall

Funded by the European Union

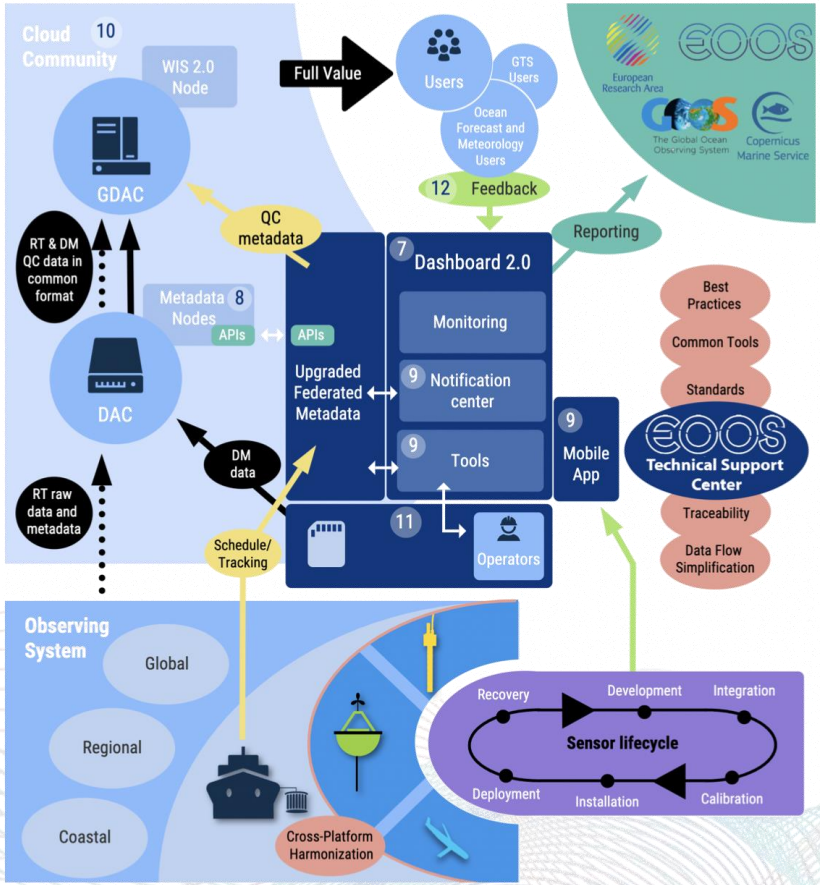


The European Ocean Observing System (EOOS) is the foundation of European ocean knowledge.

AMRIT EOOS Technical Support Centre will be the cornerstone in establishing and maintaining the EOOS.

EOOS TSC integrates the information services needed to operate sensors and platforms at sea and support its users.

AMRIT's digital ecosystem



The AMRIT Integrated Dashboard

- Web based **dashboard**
- Dashboard Mobile application
- Mobile Application to flash, register, track platforms/sensors
- **Dedicated tools** for the platforms
- Helpdesk support centre
- Documentation including tutorial videos

based on

- IT federation of existing and new services
- Controlled vocabulary and ontologies server
- Overarching API for metadata exchange and systematic PID allocation
- Cloud-based community for open source developments

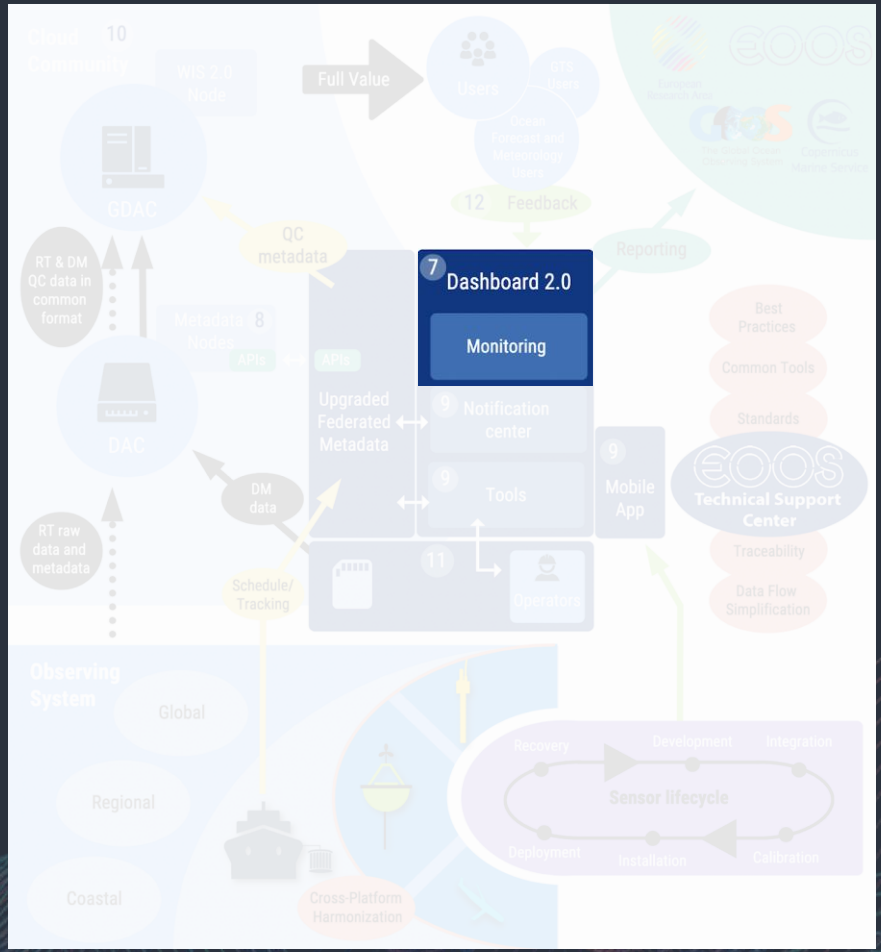
The integrated dashboard will be developed by the AMRIT SCRUM team

Dashboard

A **dashboard** is a visual display of key informations. It aggregates and organizes metrics, statistics, and insights in a concise and easily accessible format, using charts, graphs, and tables.

It aims at tracking performances, monitoring trends, and supporting decision-making by providing overview of important information.

Information Center of the “Observing System”



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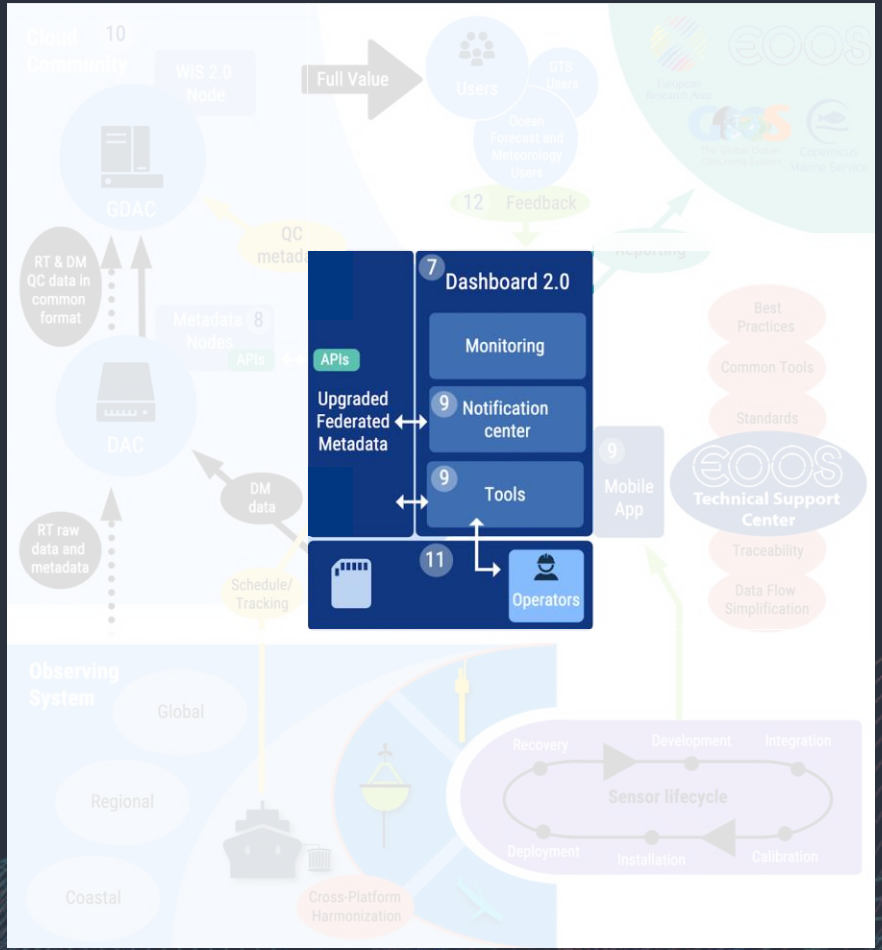
Funded by the European Union

How to feed the information center with information ?



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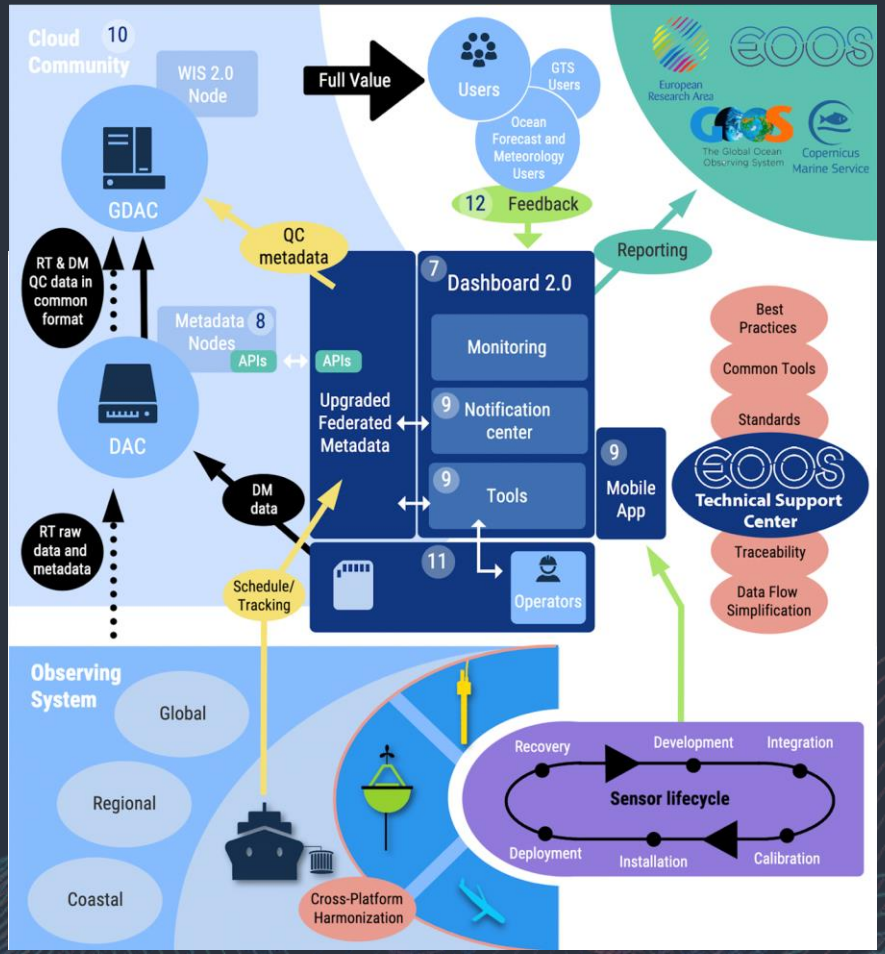
How to feed the information center with information ?

- Collect information along the life of the platform (from planning to end of mission)
- Collect information along the life of the data set (availability, processing, real time, delayed time, timeliness, usage)
- Collect information along the life of the sensor (calibrations)



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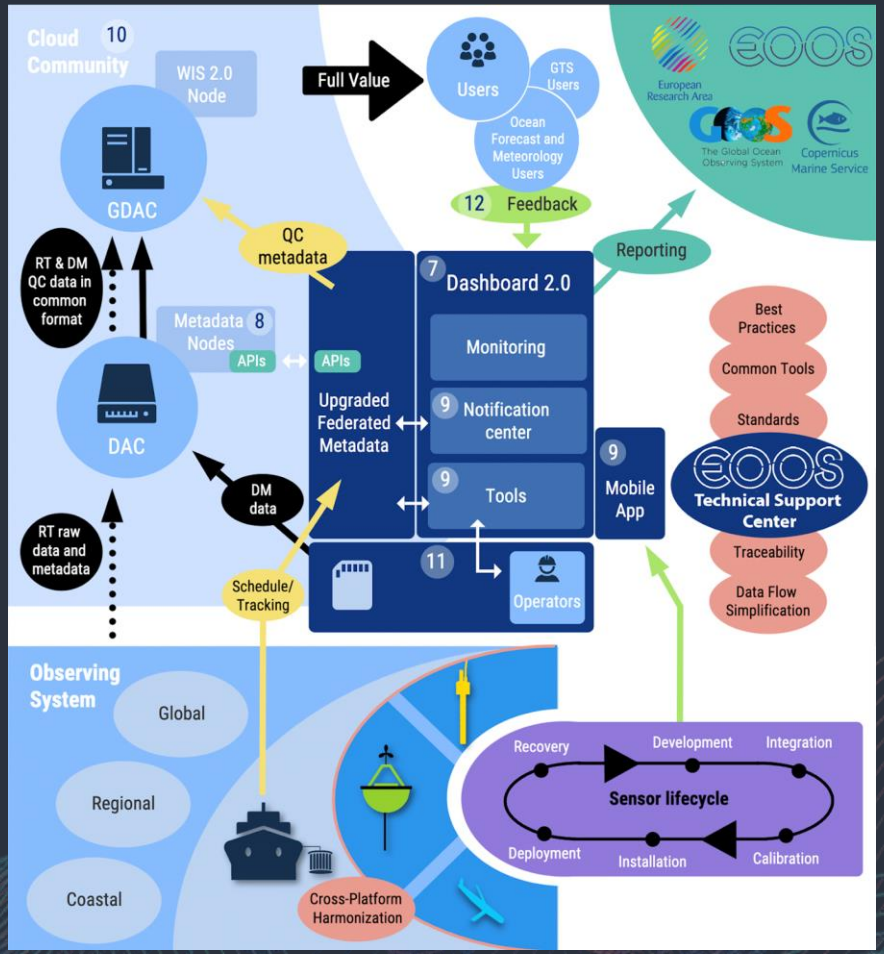
- Ambitious
- Open
- Game changer



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AMRIT SCRUM Team

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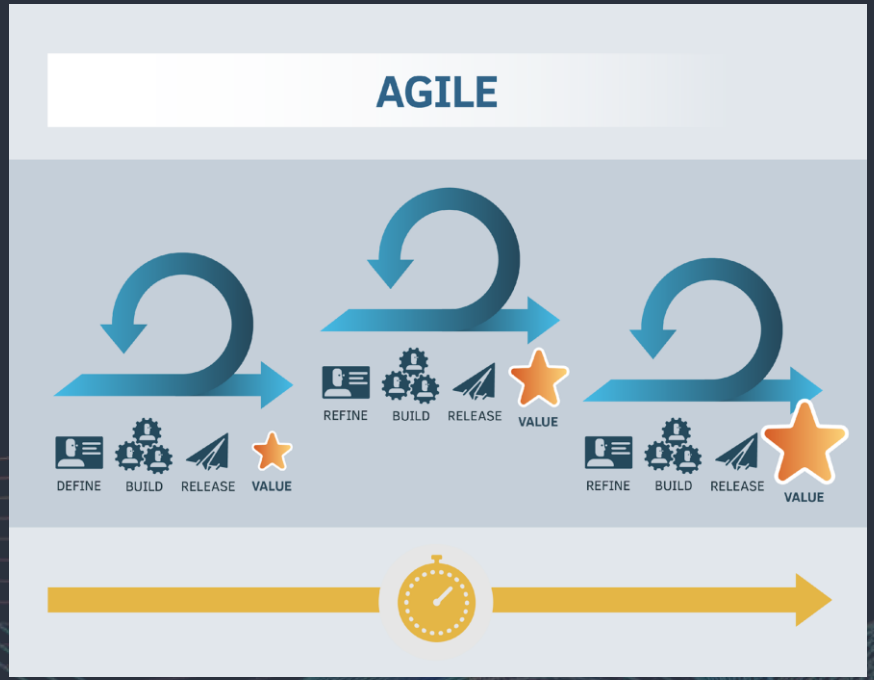
Goals of AMRIT technical support centre software development

Developing software **"together"**

1. Share software development across RIs
2. Common solutions to software approaches across RIs
3. Rapid iterations of software with regular stakeholder input

13 products/features to be developed

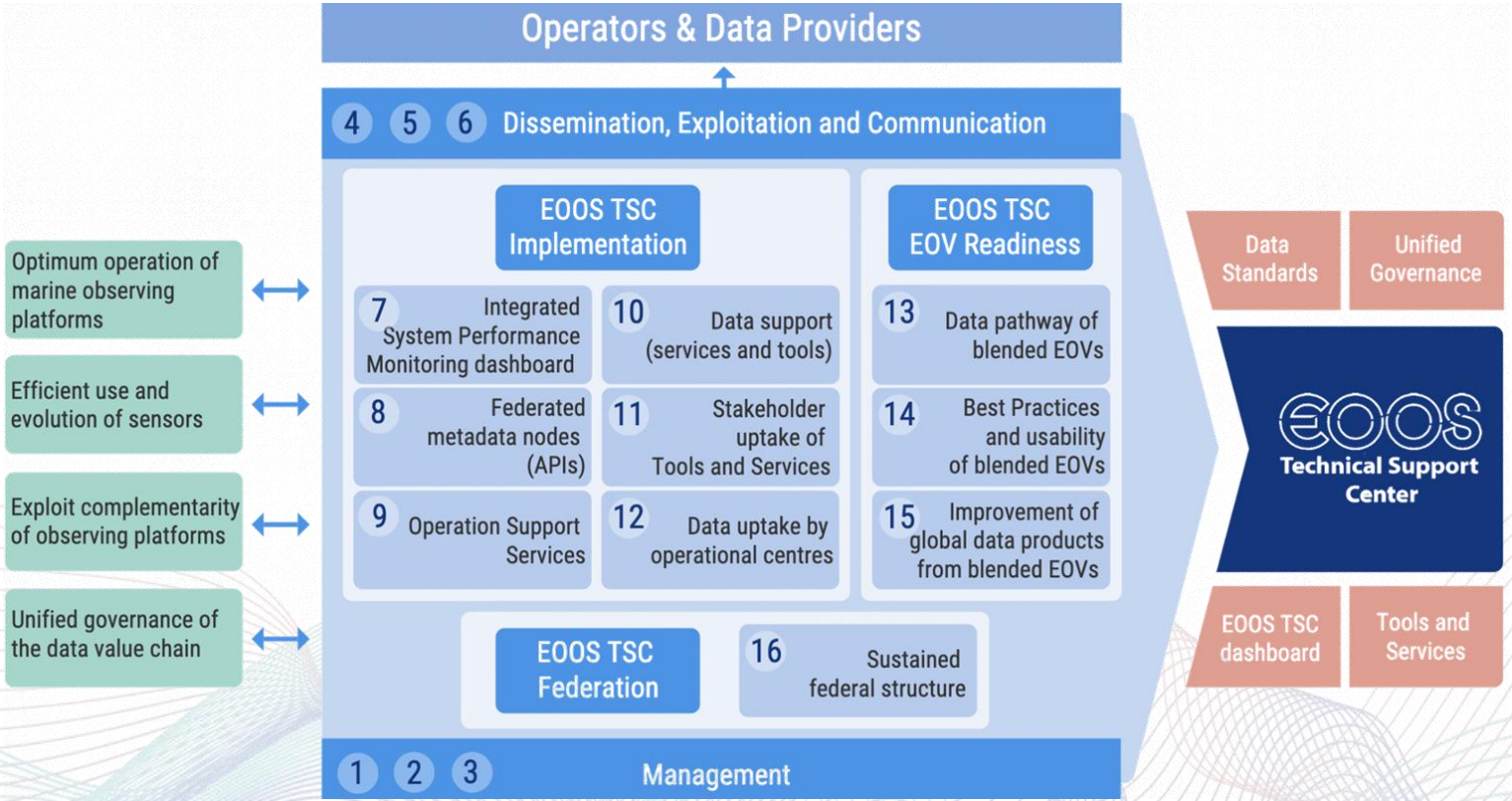
Resources & approach



Shared software development pool:

- Based on widely used "SCRUM" and "agile" software development cultures.
- 300 person months in 24 organisations

AMRIT, a project toward the sustained EOOS Technical Support Center



Funded by the European Union

All NOOS members are invited to contribute !

amrit

Advance **Marine Research Infrastructures** Together

Funded by the European Union's Horizon Europe INFRA-2023-DEV-01 programme under Grant Agreement No 101132013.

Euro-Argo ONE Project

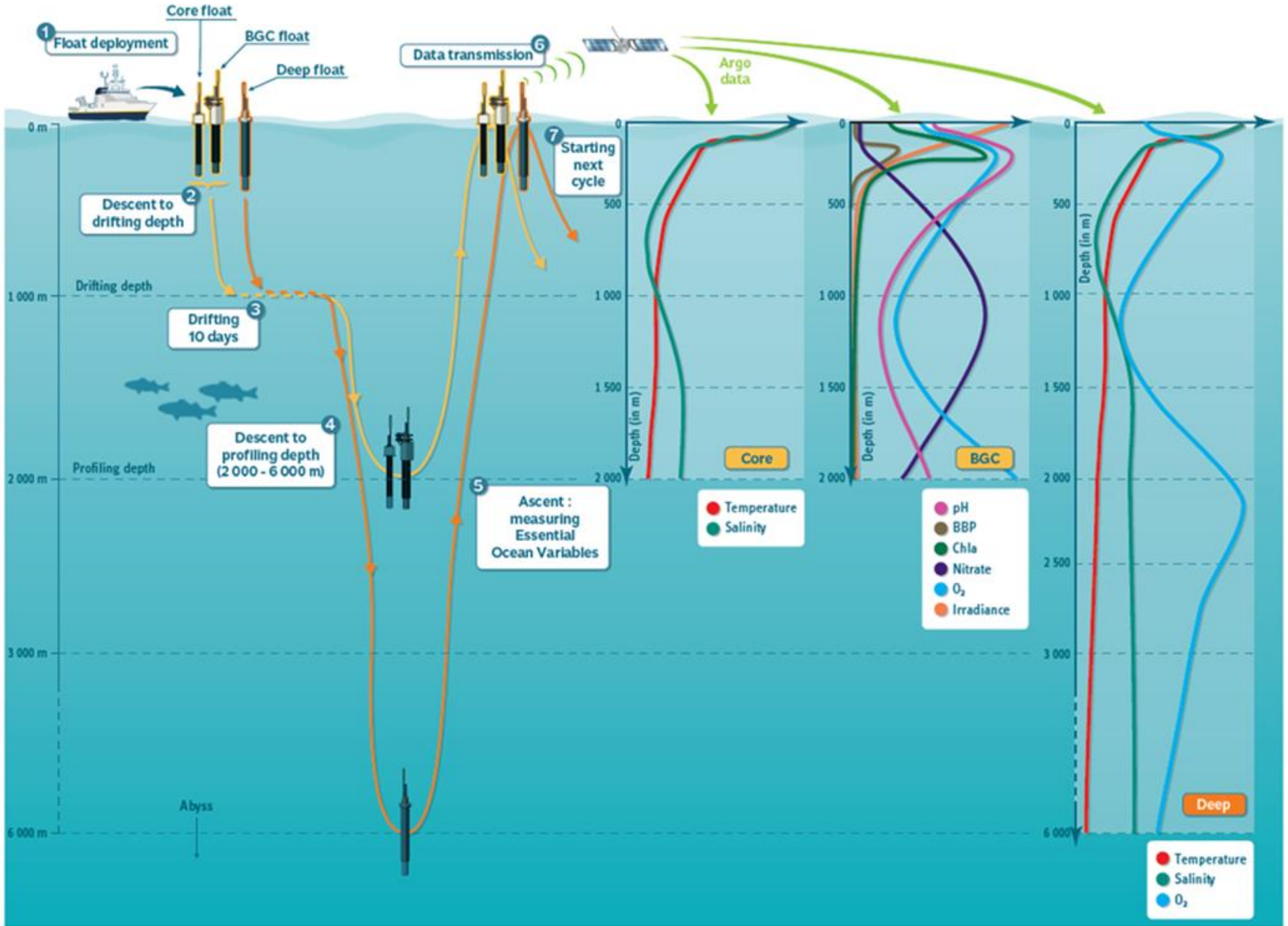
Project coordinator

Yann-Hervé De Roeck

This project has received funding from the European Union's Horizon Europe research and innovation programme under project ID: 101188133

Euro-Argo ONE, why?

A FULLY AUTONOMOUS PLATFORM



12 HOURS max
transmission to data centres & Real Time Quality control

~ 10 DAYS
full cycle

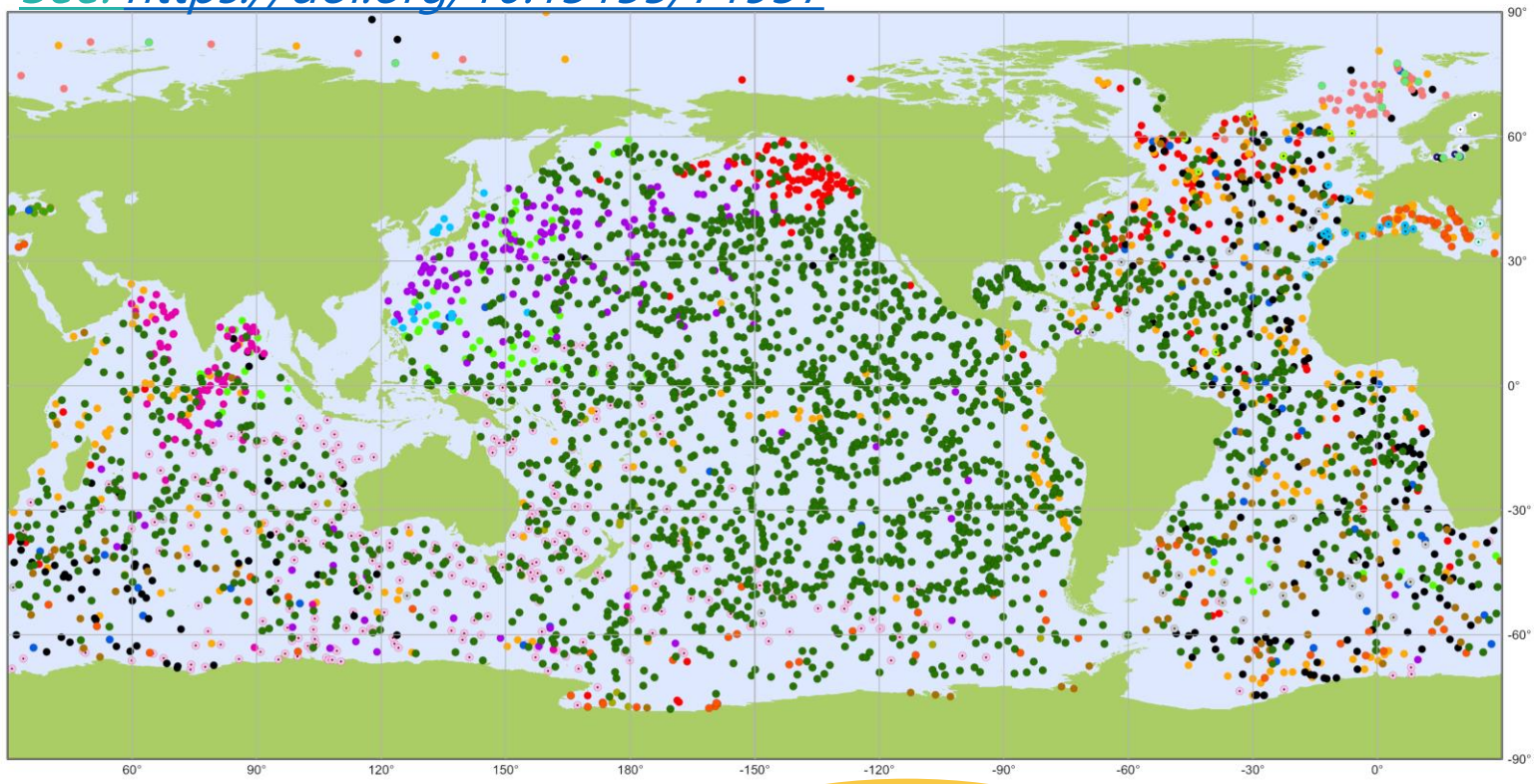
> 4 YEARS
float's life time expectancy

Euro-Argo ONE, why?

AN UNPRECEDENTED GLOBAL NETWORK

Free and open quality-controlled dataset

See: https://doi.org/10.13155/71937



Argo — National contributions- 4139 operational floats — January 2025

Latest location of operational floats (data distributed within the last 30 days)

AUSTRALIA (308)	DENMARK (3)	GREECE (6)	NETHERLANDS (35)	SPAIN (19)
BULGARIA (10)	EUROPE (53)	INDIA (76)	NEW ZEALAND (17)	UK (134)
CANADA (197)	FINLAND (3)	IRELAND (9)	NORWAY (38)	USA (2334)
CHINA (70)	FRANCE (287)	ITALY (84)	POLAND (10)	
COLOMBIA (1)	GERMANY (262)	JAPAN (165)	KOREA, REPUBLIC OF (18)	

Generated by ocean-ops.org, 2025-02-06
Projection: Plate Carree (-150.0000)

BEGINING 1999

30 COUNTRIES

~1000 new floats/year

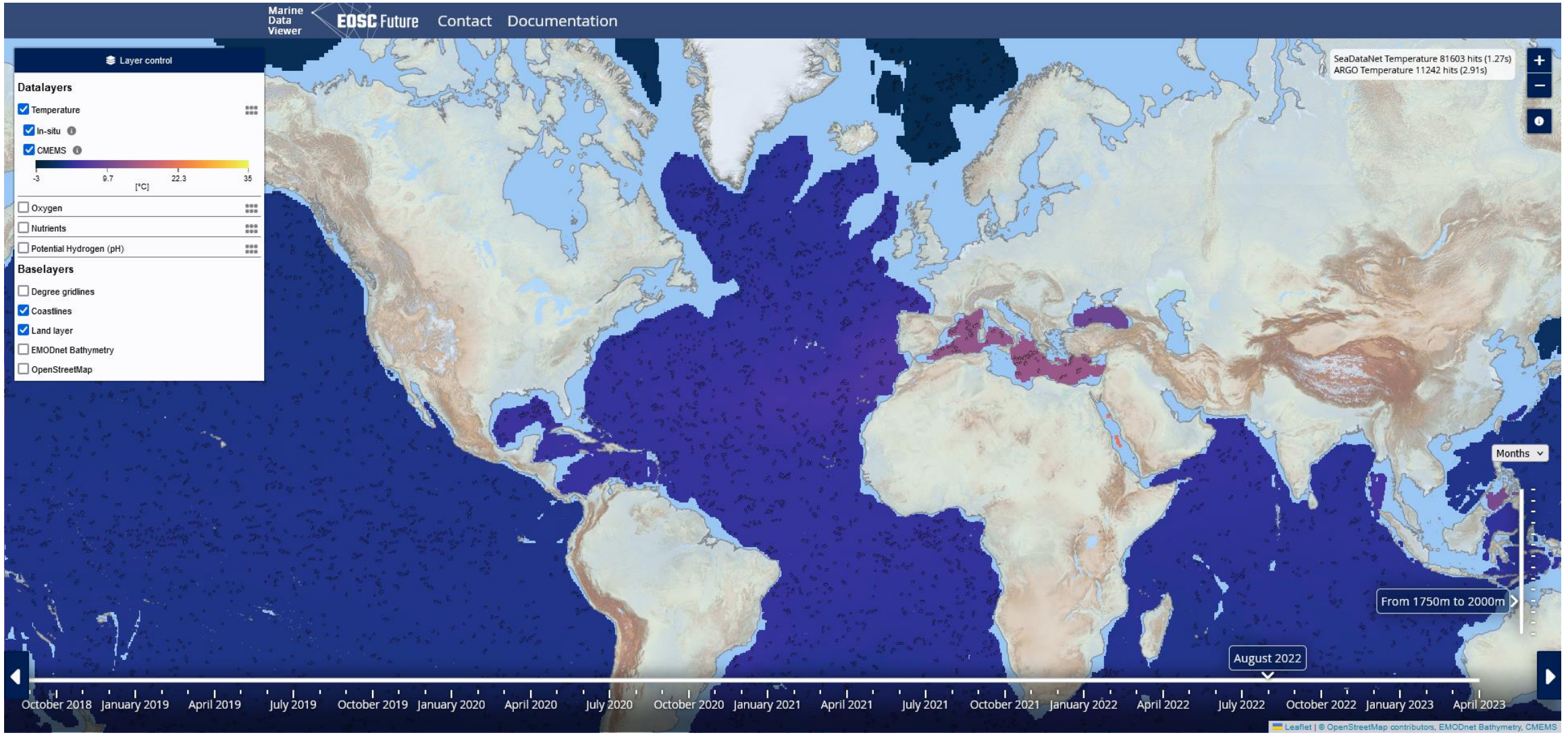
United Nations Educational, Scientific and Cultural Organization

Intergovernmental Oceanographic Commission

WORLD METEOROLOGICAL ORGANIZATION

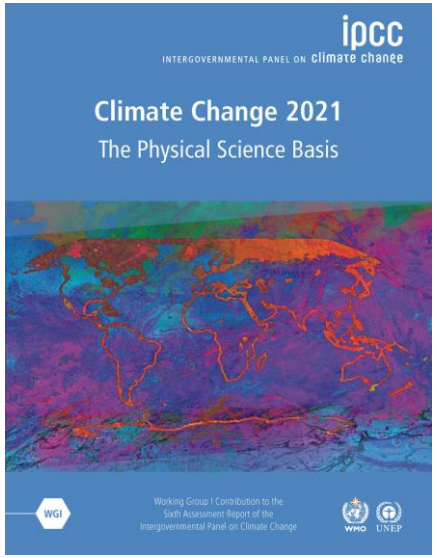
Euro-Argo ONE, why?

4D INSITU VIEW OF THE OCEAN



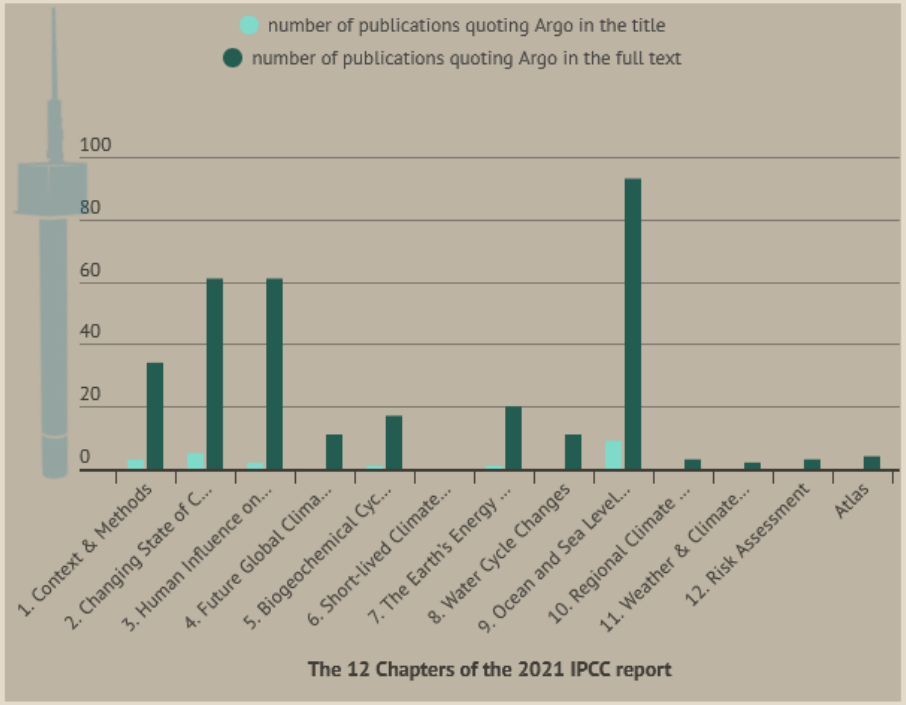
Temperature model validation & assimilation: 80% from Argo data

Euro-Argo ONE, why? ARGO's CONTRIBUTION TO THE IPPC 6th REPORT



https://infogram.com/argos-contribution-to-ipcc-reports-1h9j6q7pkj5954g?live

Argo publications: many direct & indirect references in 2021 IPCC report



Argo people: pivotal contributors to the 2021 IPCC report

more than 80

members of the Argo community are mentioned in IPCC report as **first authors of cited publications**

8 of them

are **contributing authors** of at least 1 of the 12 chapters of the 2021 IPCC report

6 of them

are **expert reviewers** of at least 1 of the 12 chapters of the 2021 IPCC report

651

publications cited in the report have a first author belonging to the Argo community

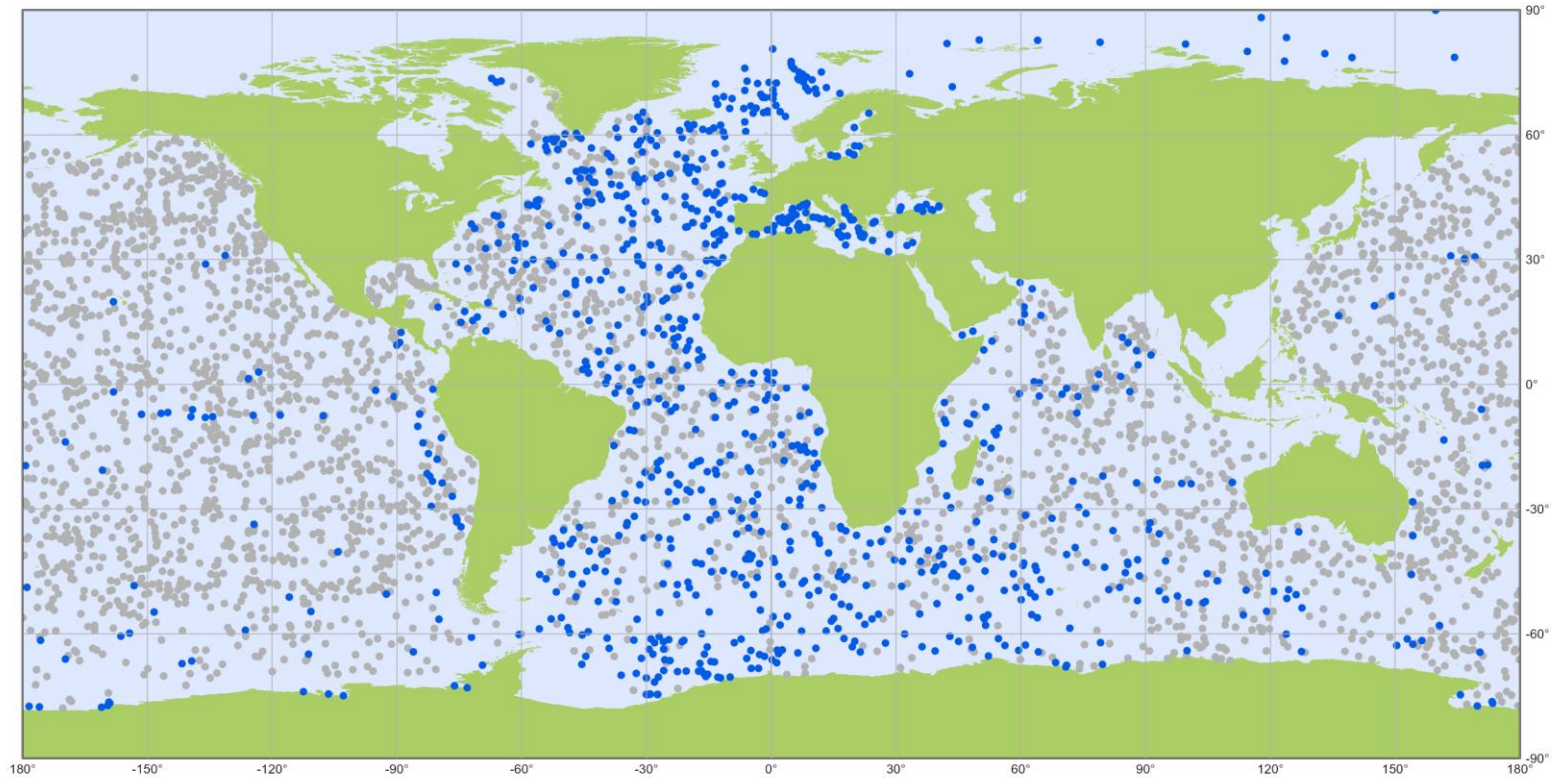
32%

of **Argo Principal Investigators** are cited as **first authors**

Transforming global ocean observation and advancing IPCC's assessments

Euro-Argo ONE, why?

COORDINATION OF THE EUROPEAN CONTRIBUTION TO ARGO



25% of the global fleet

An ERIC since 2014

A data provider for EU services

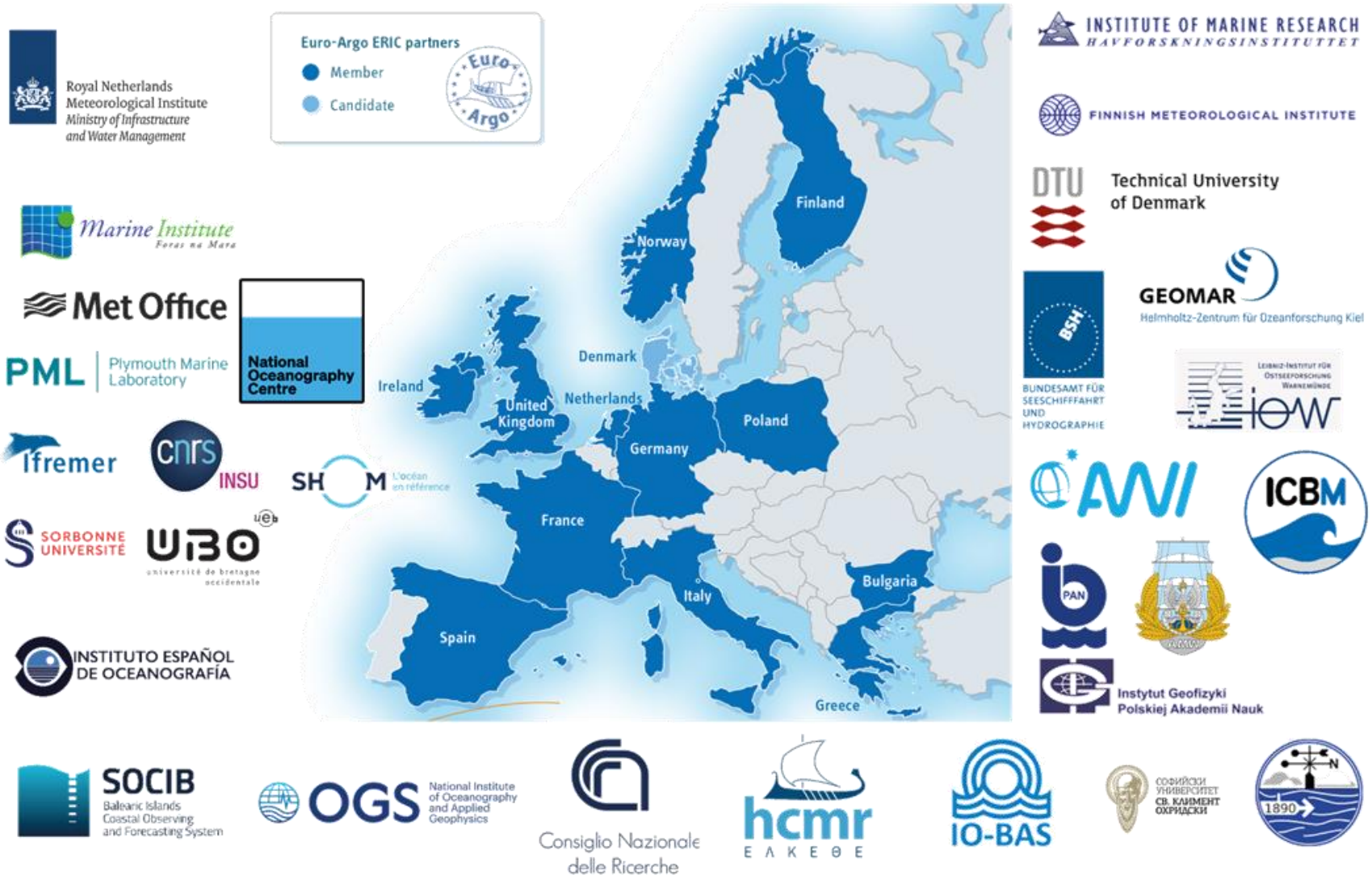
Copernicus

EMODnet

SeaDataNet

Euro-Argo ONE, why?

A DISTRIBUTED ERIC



Composed of 12 countries and 1 candidate

Office hosted by Ifremer (France)

30 entities

ERIC FORUM

ENVRI Community

The Euro-Argo ERIC National Members and Institutes

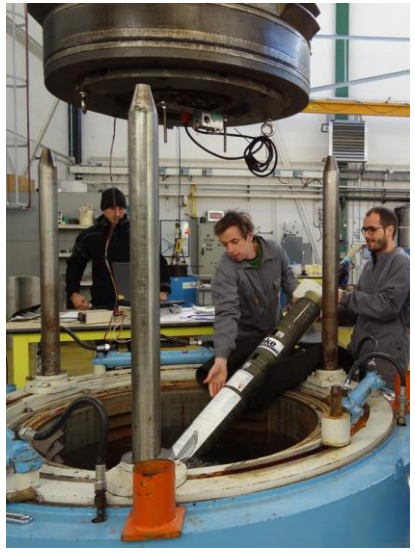
Euro-Argo ONE, why?

OneArgo, NEW DESIGN OF THE GLOBAL PROGRAMME

Geographical extent:
- ✓ Beyond 60 N et 60 S
- ✓ Marginal seas
- ✓ Doubled density in:
  - equatorial zones
  - western boundary currents

Biogeochemical variables:
- ✓ Oxygen
- ✓ Chlorophyl-A
- ✓ pH
- ✓ Nitrate
- ✓ Particules (back scattering)
- ✓ Light (irradiance)

Deep ocean and abysses:
- ✓ 4000 m (90% of the ocean)
- ✓ 6000 m

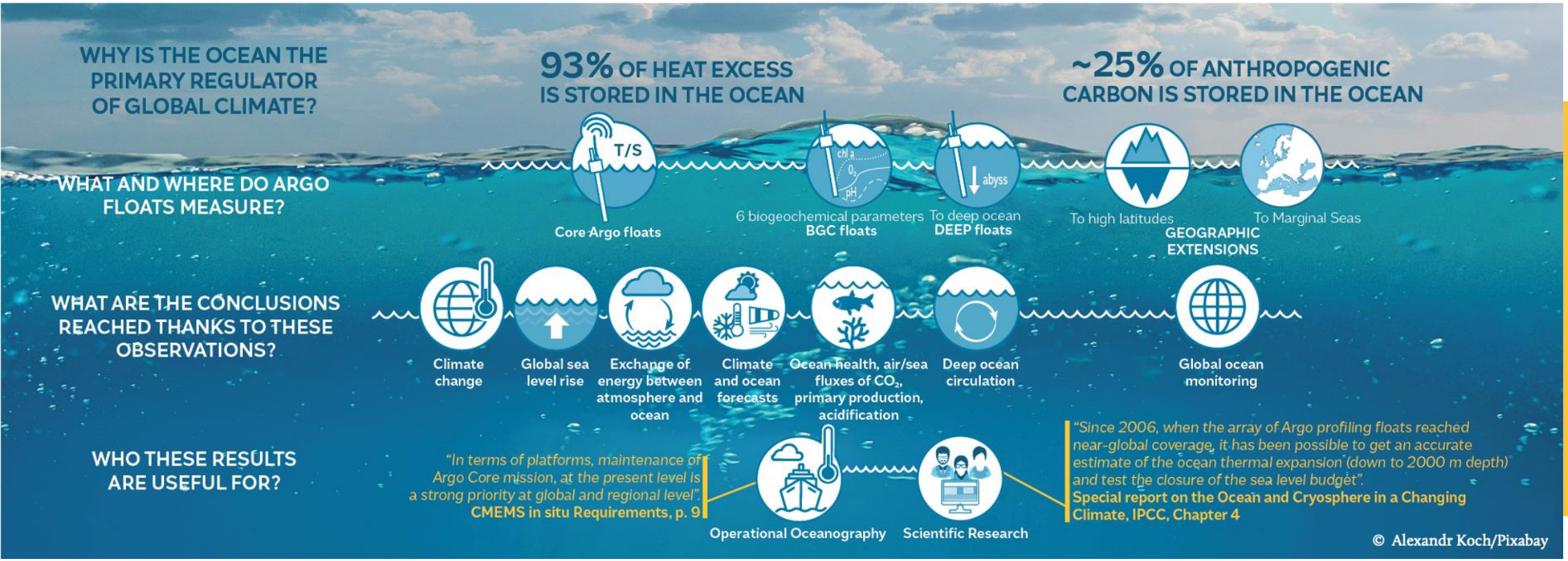


Design established in 2019

4700 floats by 2033

Euro-Argo ONE, why?

OneArgo, ADDRESSING THE GLOBAL CHALLENGES OF THE OCEAN



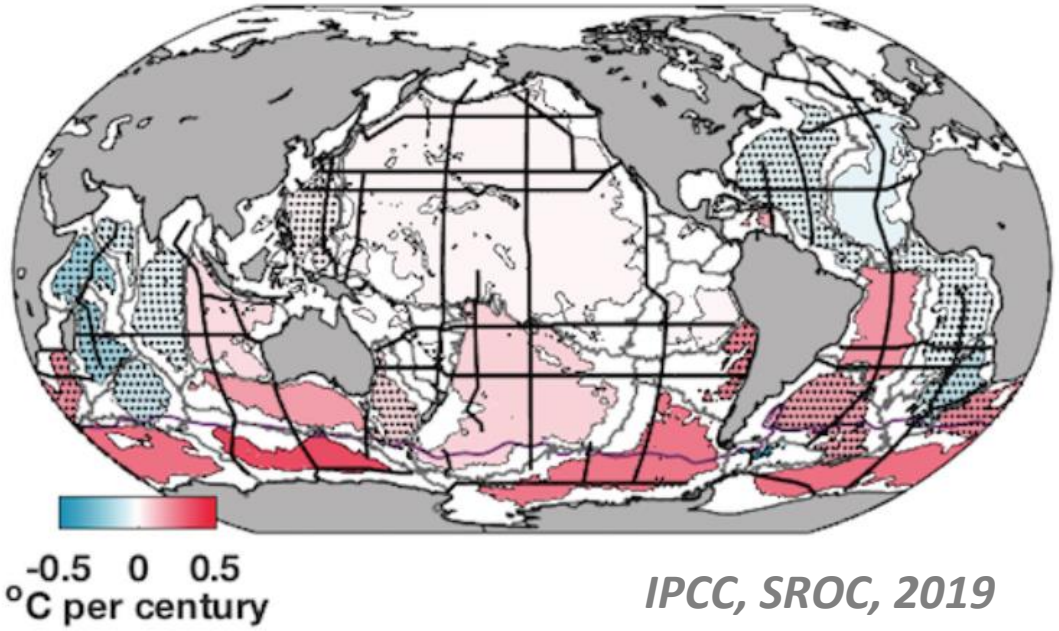
Global interacting processes

Ocean health monitoring

Blue Economy Operational services

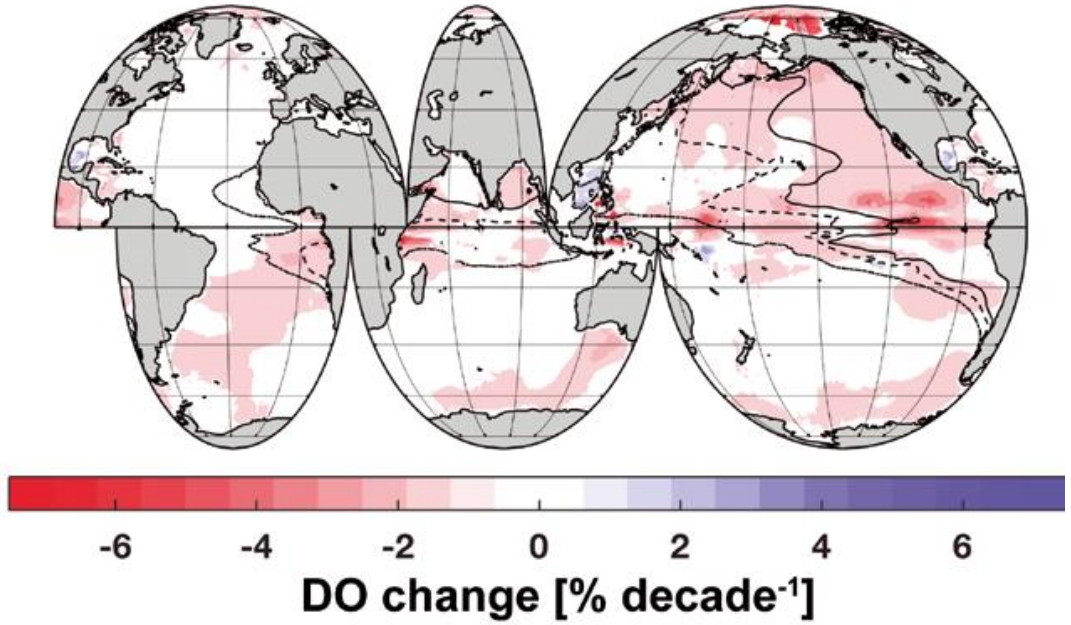
Euro-Argo ONE, why?

OneArgo SCIENTIFC CHALENGES, EXAMPLES



IPCC, SROC, 2019

Temperature change below 4000m
(8% excess heat stored below 2000m)



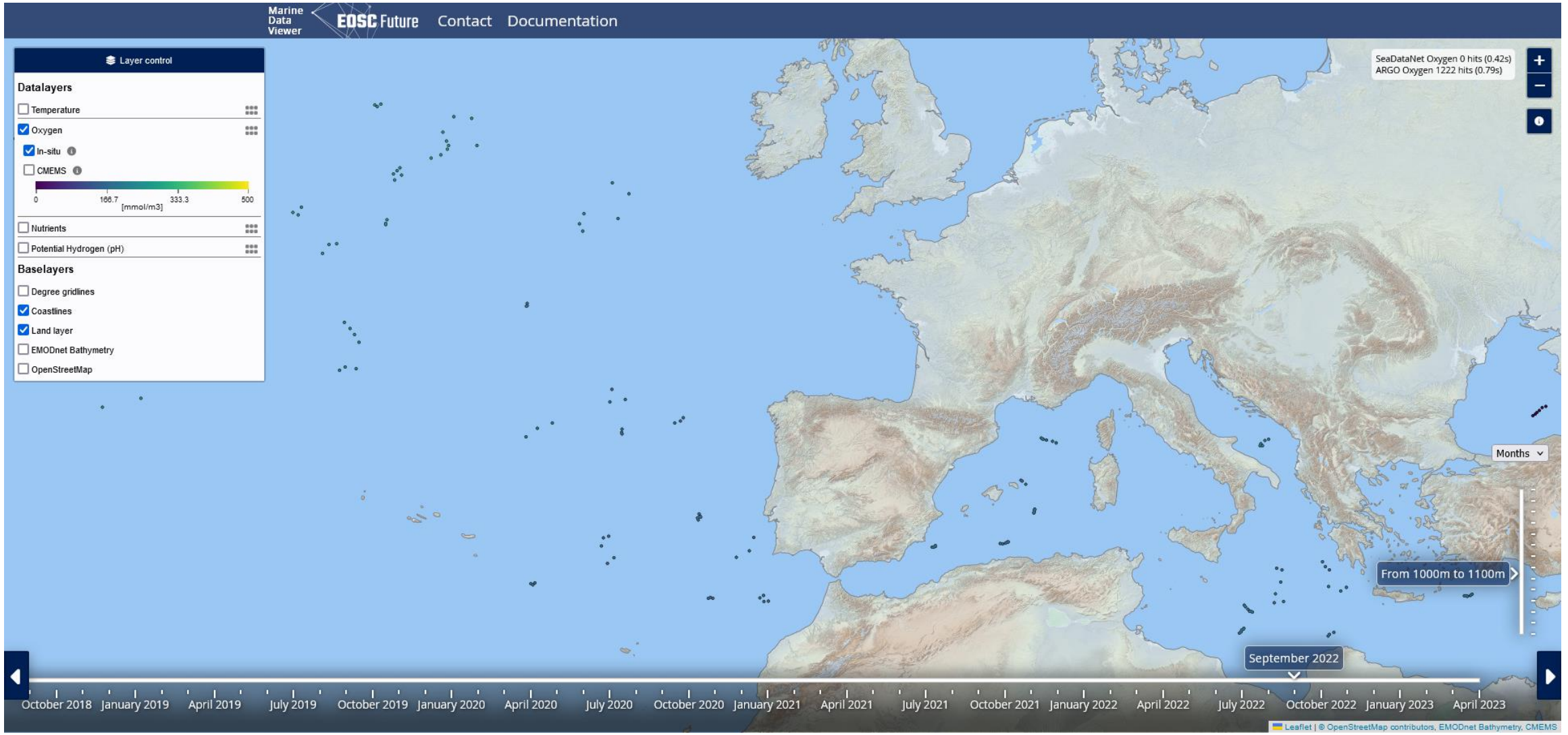
Schmidtko et al., 2017

Oxygen content change in the water-column
(most EU floats carry oxygen optode sensor)

Going deeper and extending the set of observed variables is critical

Euro-Argo ONE, why?

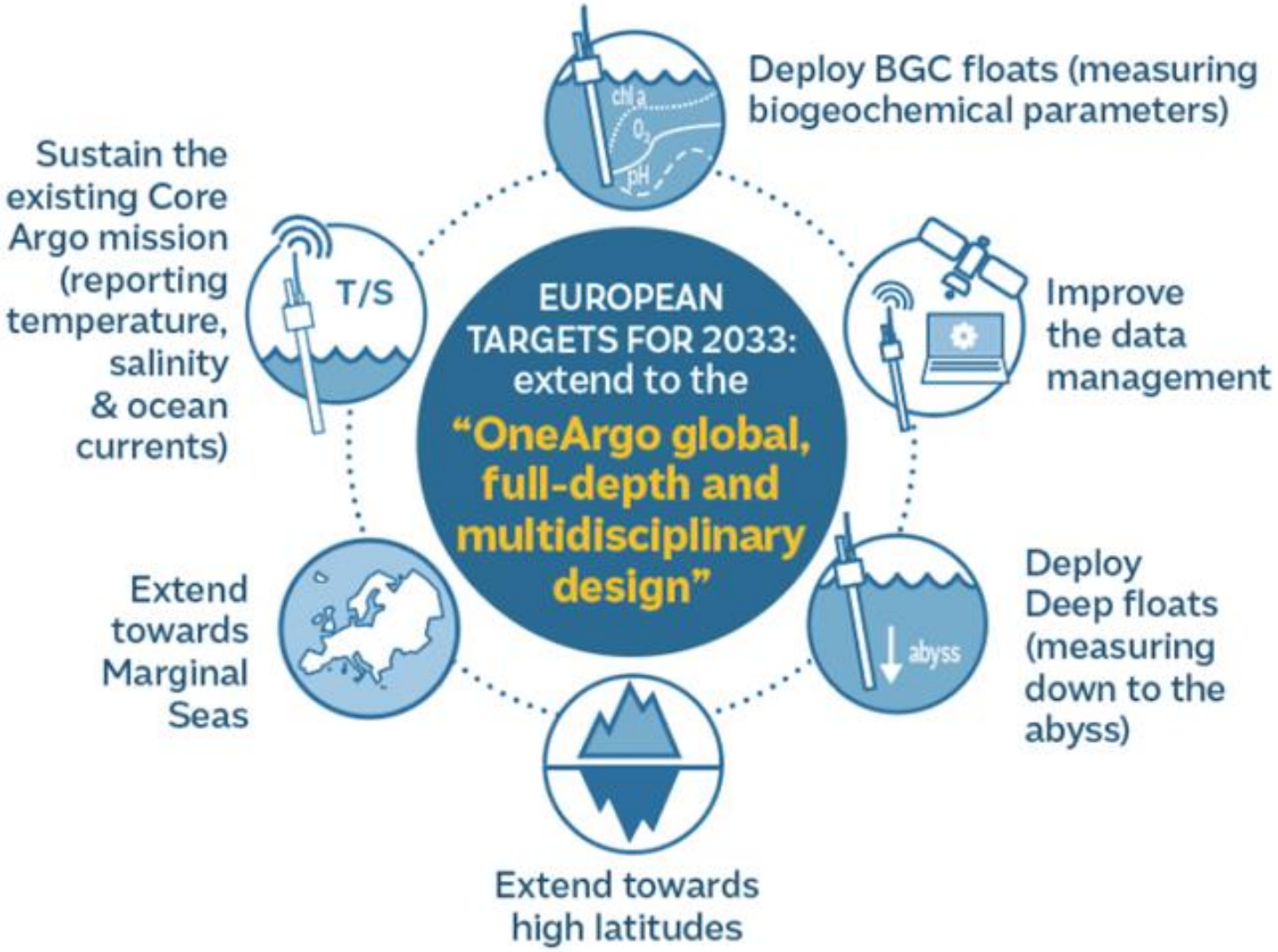
4D INSITU VIEW OF THE OCEAN, OXYGEN



Sparse in situ data: surface sampling, gliders, then Argo only

Euro-Argo ONE, why?

EUROPEAN TARGET CONTRIBUTION TO OneArgo BY 2033



Euro-Argo Strategy 2023

Initiated during EuroSea project

Euro-Argo ONE, when?

BE READY BY 2028 FOR A DECISIVE STEP

Each step of the **structuration of Euro-Argo ERIC** has benefitted from support of EU projects

- **E-AIMS** for its **inception** and initial **Deep** and **BGC** developments (2013)
- **MOCCA** to widen its **deployment capacity** (2015)
- **Euro-Argo RISE** to design complementary **features** for **OneArgo** (2019)

Other EU projects have contributed (Atlantos, EuroSEA, ENVRI-FAIR, GEORGE, AMRIT,…)
but huge national efforts have supported the majority of the costs
(to buy floats, to push technological developments, for data management, etc.).
Complementary **direct support from the EU** has always been expected/promised. ***Not in this MFF.***

It **has to be in the next MFF** (**2028**-2032+), to enable full European contribution to OneArgo.

Now (2024-2027), it is timely to overcome 2 challenges

- **Consolidate and optimize our distributed ERIC**
- **Further develop in view of the implementation of the OneArgo design**

Euro-Argo ONE, when?

HORIZON INFRA-2024-DEV-01-03 call

Destination: Developing, consolidating and optimising the EU RI landscape, maintaining global leadership

Target: Support, **together with member countries**, to the **strengthening, long-term sustainability, reorientation or evolution of [..] ERICs**

EC requirements:

- Reducing fragmentation at European, national and regional level,
- Ensuring coordination of efforts and fostering alignment of priorities among Member States and Associated Countries,
- Connection to the European Open Science Cloud (EOSC),
- Prominent role of the RI in international cooperation

Euro-Argo ONE overarching goal

Scale-up Euro-Argo ERIC's capabilities, sustainability and resilience to ensure Europe's ability to take its share of the global OneArgo array implementation

Euro-Argo ONE, what?

TWO MAIN THREADS ARISE FROM BRAINSTORMING in 2023

Ensure readiness of Euro-Argo for the implementation of OneArgo to cope with its complexity

- diversity of variables measured
- broader scientific and operational usages ⇨ additional expertise required
- improve organisation (workload and skills streamlining)
- procedures (enhancement of quality processes for all missions to the level of the core mission)
- skills (share / improve and sustain them)

Scientific & technical challenges

Ensure confidence in OneArgo outputs to monitor ocean health and track climate change

- highest data quality, as in core Argo (reliability in Argo sensors and platforms)
- improved data stream to users (completion, further development, automation of procedures)
- streamlining the organisation of the Euro-Argo partnership
- rationalisation and greening of the OneArgo design implementation in Europe
- facilitate new operational services based upon high quality data
- contribute to building users' confidence.

Societal challenges

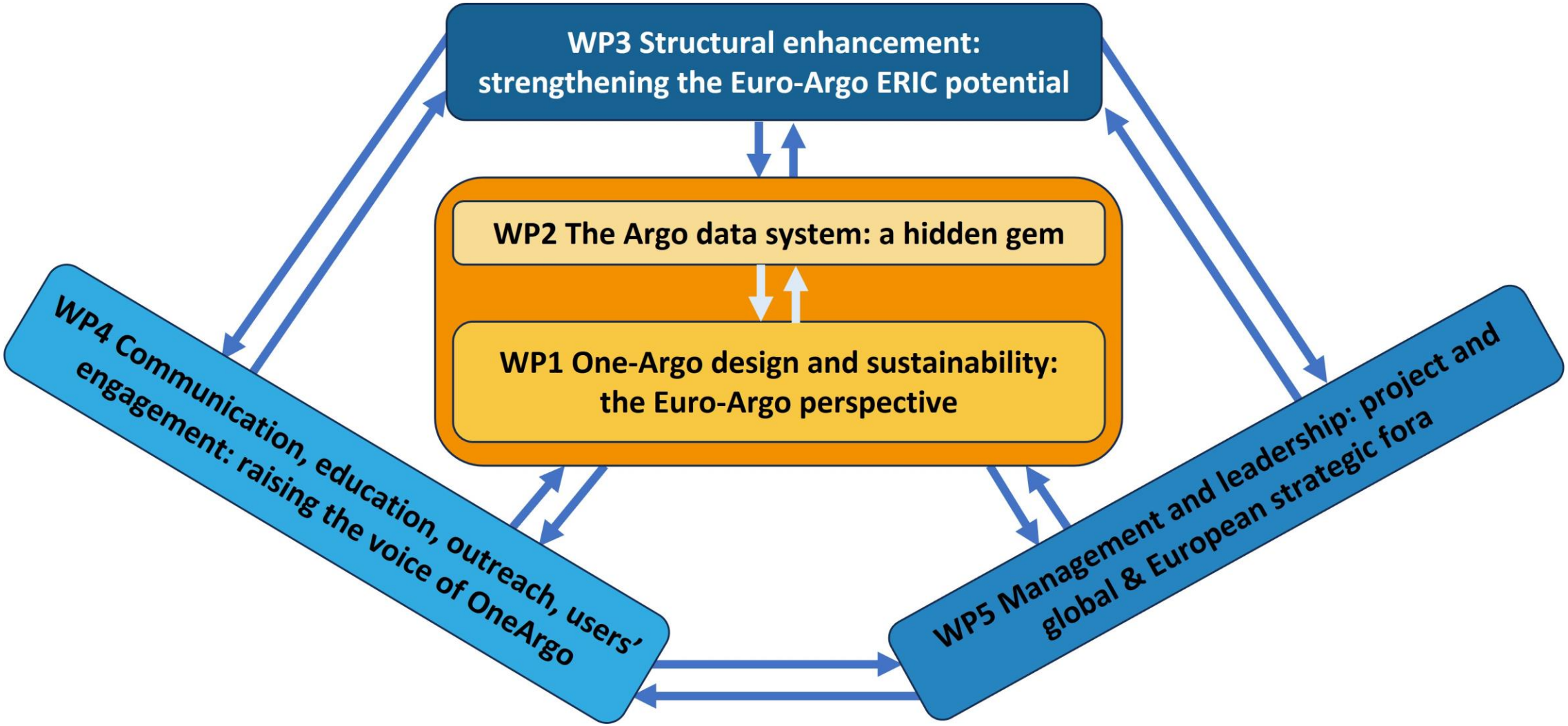
A project with 6 Specific objectives

- **SO1:** Tailor a comprehensive **design** of OneArgo for its **European** implementation
- **SO2:** Escalate Euro-Argo ERIC's **efficacy** in delivering OneArgo **data** and **services**
- **SO3:** Address the **environmental challenges** of OneArgo operations and engage with the **supplier industry**
- **SO4:** Improve OneArgo **products** and **services** and maximise their impact for **operational users** and **broader scientific communities**
- **SO5:** Consolidate Euro-Argo ERIC **leadership** and **collaborations** within the **international** and **European** ocean observation landscape
- **SO6:** Demonstrate and promote the **value** of OneArgo for **societal challenges**

23 partners to scale-up Euro-Argo ERIC for OneArgo Network Extension

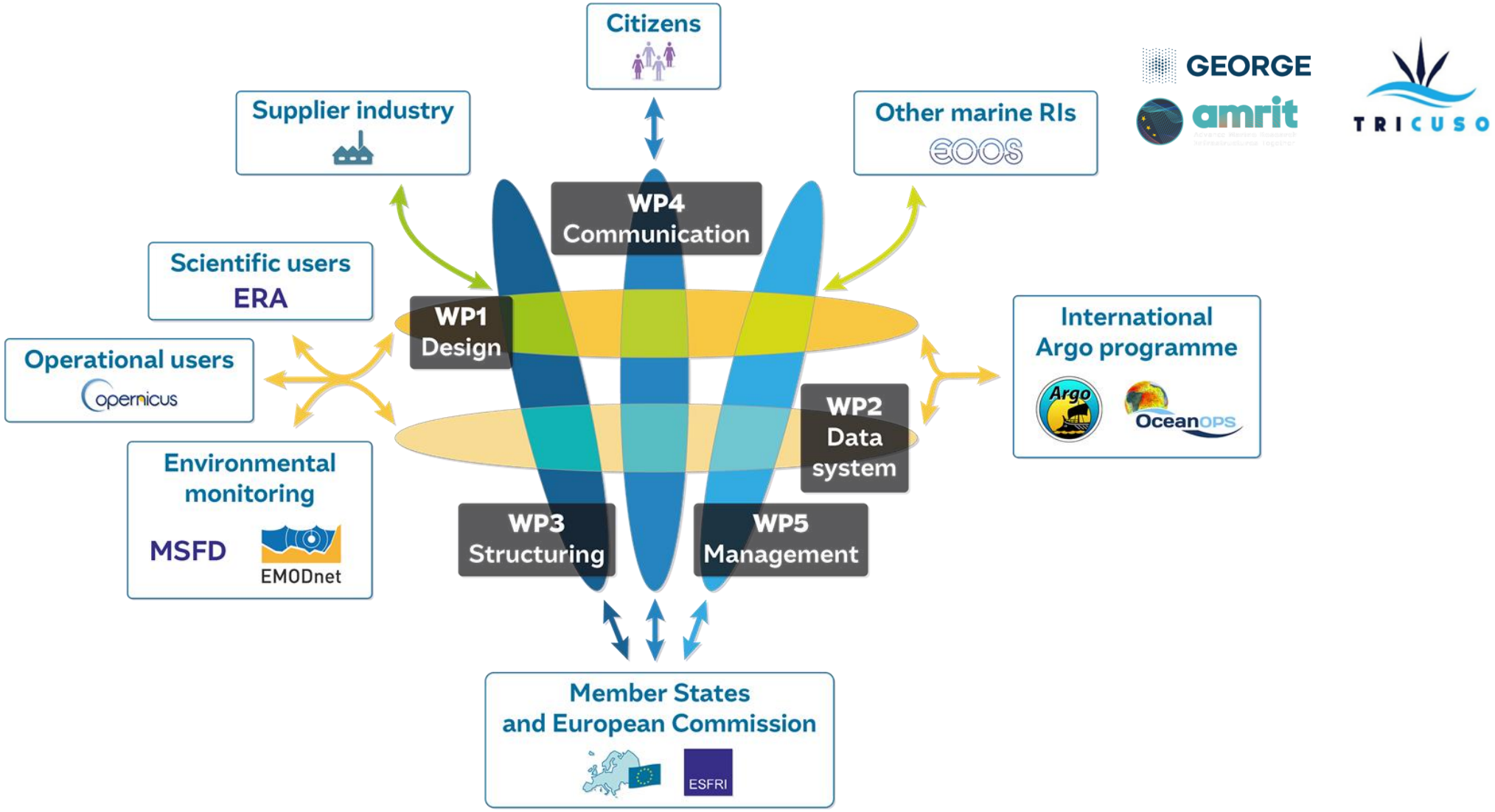
Euro-Argo ONE, how?

STRAIGHTFORWARD & INTERLINKED 5 WP



Design / Data / Structuration / Communication / Management

Euro-Argo ONE, with whom? INTERLINK WITH MANY TYPES OF STAKEHOLDERS



7 Target Groups for Communication, Dissemination and Exploitation

Euro-Argo ONE

3 YEARS TO WORK TOGETHER!

The Euro-Argo ONE consortium

Not all entities/members but 4 new partners (entities not in the ERIC)