

EUROARGO

EUROPEAN RESEARCH
INFRASTRUCTURE CONSORTIUM
FOR OBSERVING THE OCEAN



WHY STUDY THE OCEAN?

WHY IS THE OCEAN THE PRIMARY REGULATOR OF GLOBAL CLIMATE?

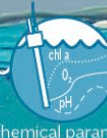
93% OF HEAT EXCESS IS STORED IN THE OCEAN

~25% OF ANTHROPOGENIC CARBON IS STORED IN THE OCEAN

WHAT AND WHERE DO ARGO FLOATS MEASURE?



Core-Argo floats



6 biogeochemical parameters
BGC floats



To deep ocean
DEEP floats



To high latitudes



To Marginal Seas

GEOGRAPHIC EXTENSIONS

WHAT ARE THE CONCLUSIONS REACHED THANKS TO THESE OBSERVATIONS?



Climate change



Global sea level rise



Exchange of energy between atmosphere and ocean



Climate and ocean forecasts



Ocean health, air/sea fluxes of CO₂, primary production, acidification



Deep ocean circulation



Global ocean monitoring

WHO THESE RESULTS ARE USEFUL FOR?

"In terms of platforms, maintenance of Argo Core mission, at the present level is a strong priority at global and regional level".
CMEMS in situ Requirements, p. 9



Operational Oceanography



Scientific Research

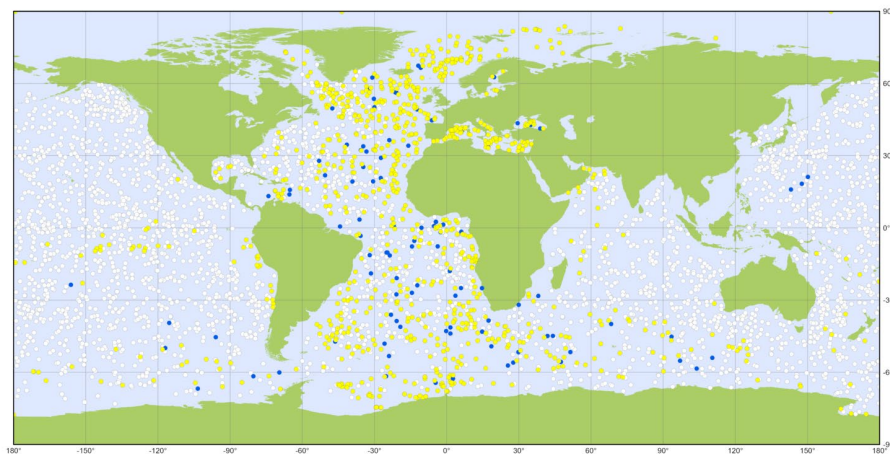
"Since 2006, when the array of Argo profiling floats reached near-global coverage, it has been possible to get an accurate estimate of the ocean thermal expansion (down to 2000 m depth) and test the closure of the sea level budget".
Special report on the Ocean and Cryosphere in a Changing Climate, IPCC, Chapter 4

© Alexandr Koch/Pixabay

WHAT IS ARGO?

Argo is the first global real-time in situ observing network in the history of oceanography.

- Argo represents a fleet of about **4000 autonomous floats**, deployed all over the world ocean, up to **depths of 2000m to the abyss**.
- They carry sensors to report **profiles of ocean properties** (temperature, salinity and possibly up to 6 biogeochemical parameters).



Argo EuroArgo August 2022

Contribution of the EuroArgo European Research Infrastructure Consortium (ERIC) to the Argo observing network
Latest locations of operational profiling floats (data distributed within the last 30 days)

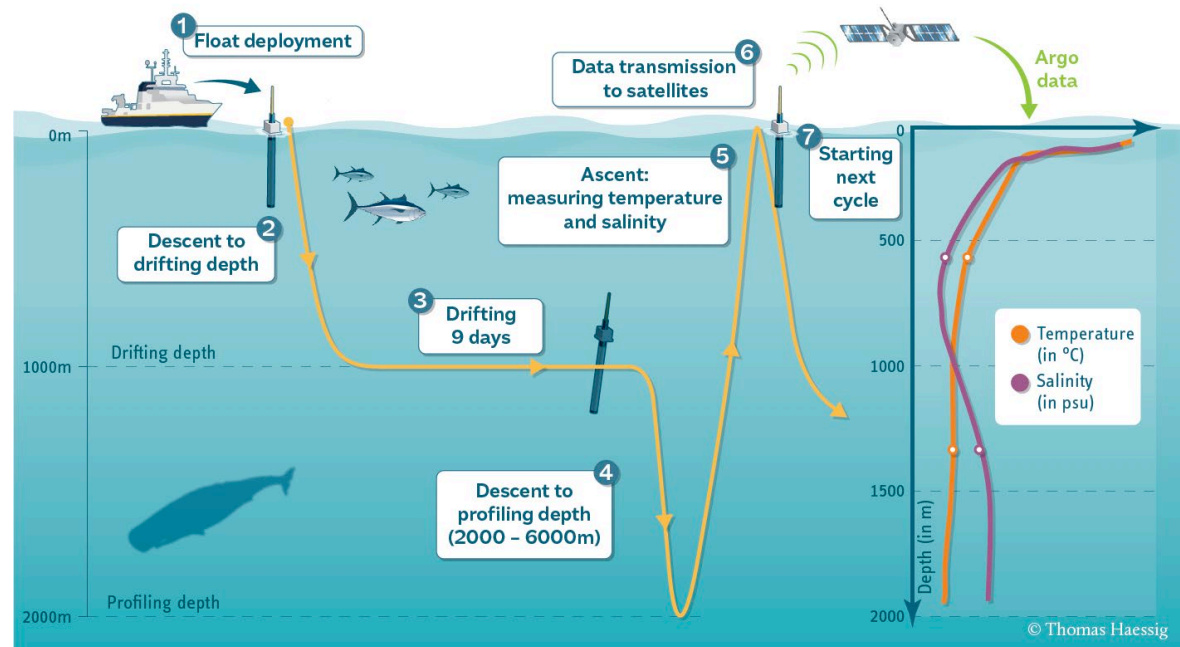
● EuroArgo - national contributions (872) ● EuroArgo - EU funded (101) ● International - non EuroArgo (2948)



WHAT IS ARGO?

- Argo floats perform measurements while actively going up and down the water column.
- They provide an unprecedented free and open quality-controlled dataset to a wide range of users, both for climate change research and for ocean analysis and forecasting systems.

TEN DAYS CYCLING OF AN ARGO FLOAT



4 YEARS
Argo float's life
time expectancy

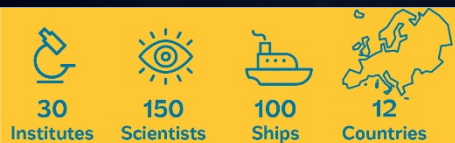
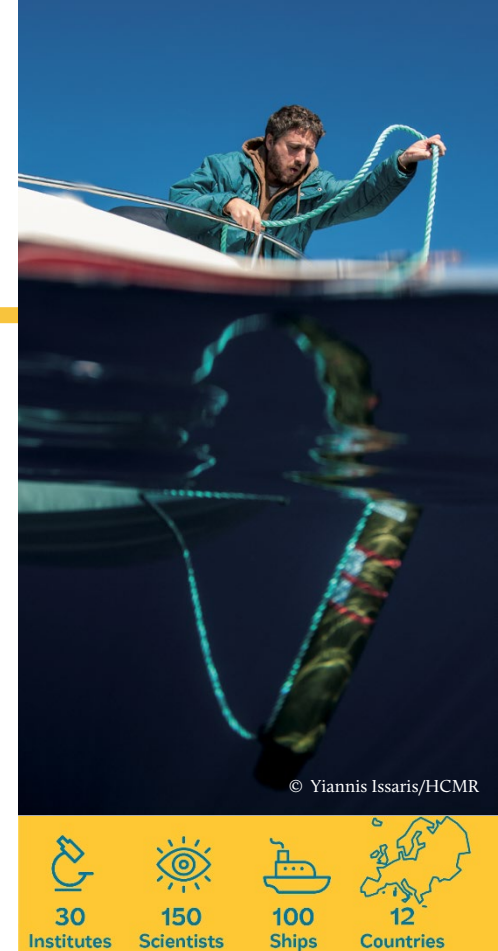
~ 10 DAYS
for a full
cycle

~ 12 HOURS
for transmission
to data centres

WHAT IS EURO-ARGO?

Euro-Argo sustains and optimises the European contribution to the international Argo programme, providing, deploying and operating nearly 25% of the floats network.

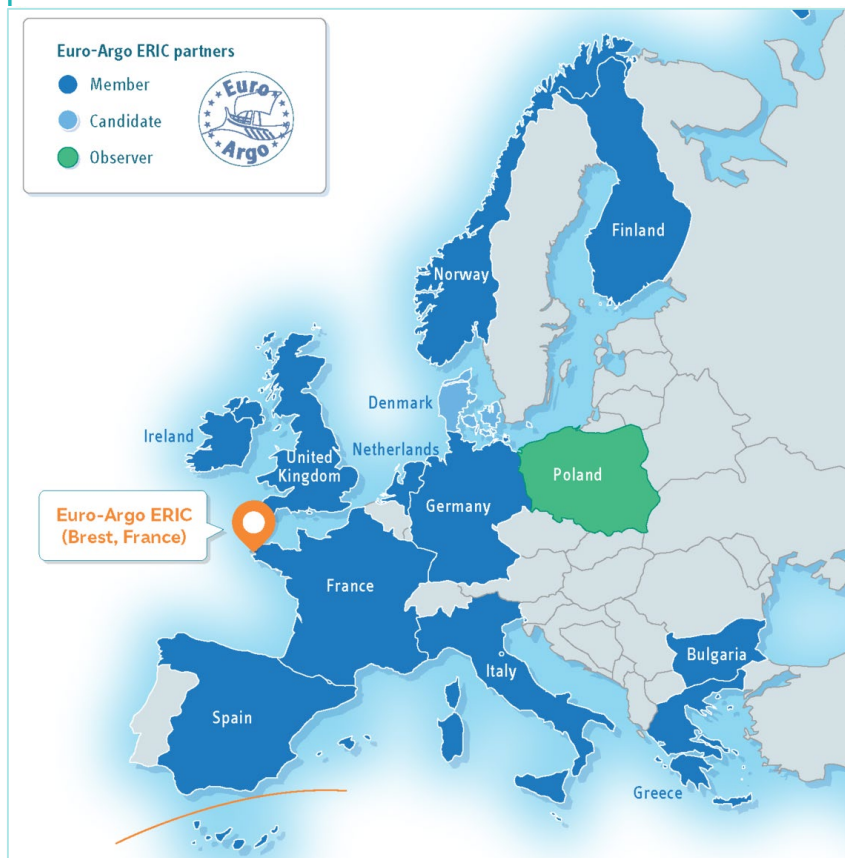
- The Euro-Argo European Research Infrastructure Consortium (ERIC) was created in May 2014, as part of the 2006 [ESFRI Roadmap](#) and engages the countries and their ministries.
- Euro-Argo ERIC has matured to the stage that it is now able to initiate network upgrades in response to **specific European research interests**, especially towards high latitudes, biogeochemistry (BGC) measurements to study ecosystem parameters and greater depths, till the abyss. [See: https://doi.org/10.13155/71937](https://doi.org/10.13155/71937)



WHO ARE EURO-ARGO MEMBERS?

- The Euro-Argo ERIC is composed of 12 countries and 1 Candidate Member and is coordinated by the Euro-Argo ERIC Office, hosted by Ifremer (France).
- Continuously engaging with EU and Pan-EU countries, to strengthen European Argo network.

The Euro-Argo ERIC National Members



12 COUNTRIES

EMODnet

Copernicus

HOPE 2020

3 SUPPORTS

ESFRI

1 LABEL
5

WHO ARE EURO-ARGO MEMBERS?

- Argo's success is mainly due to the high degree of international cooperation behind the initiative and European partners have played a crucial role in the set-up and development of the Argo network.
- Activities implemented at the Euro-Argo ERIC are coordinated and shared between the ERIC Office and the National Members.

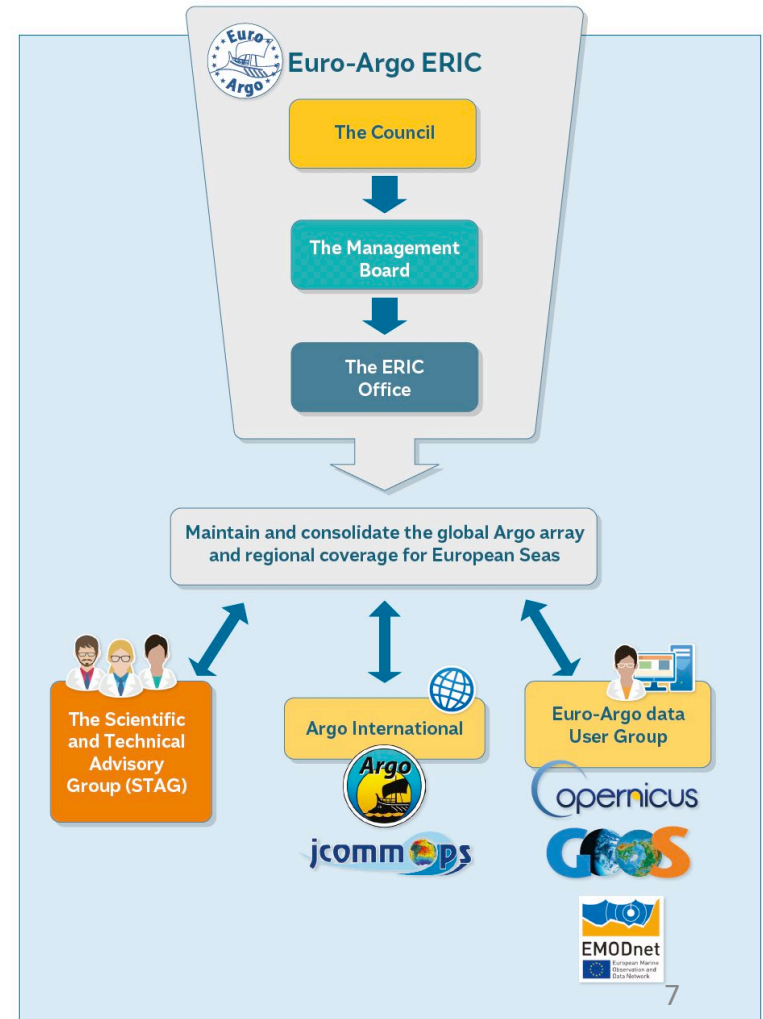
The different Euro-Argo activities and the tasks shared between Euro-Argo ERIC Office and National Members

ERIC Office's tasks	Euro-Argo ERIC activities	National Members' tasks
Ensure coherence with Argo international strategy	<ul style="list-style-type: none"> Implement a strong Euro-Argo programme Define Euro-Argo roadmap 	Ensure coherence with national roadmaps
Organise centralised float procurement and international collaboration for deployments	<ul style="list-style-type: none"> Enhance and optimize European contribution to Argo Support ¼ of the global network 	Organise float procurement & deployments
<ul style="list-style-type: none"> Coordinate European contributions to Argo data management Organise training 	Enhance the Argo system and data quality	Run (Global) Data Assembly Centres and Argo Regional Centres
<ul style="list-style-type: none"> Develop and implement tools for "At-sea monitoring" Test float performance (Ifremer facilities) 	Monitor and improve float behaviour and lifetime	<ul style="list-style-type: none"> Test float performance <i>in situ</i> Enhance float technology
<ul style="list-style-type: none"> Watch on new possibilities and new users needs Organise joint R&D activities 	Develop the Euro-Argo strategic plans, including test and integration of new sensors measuring new parameters	<ul style="list-style-type: none"> Develop innovative sensors Coordinate national R&D activities
Maintain centralised communication tools and activities	Enhance Euro-Argo visibility and awareness	Organise outreach activities and maintain Argo national websites

EURO-ARGO GOVERNANCE

- The Euro-Argo ERIC requires strong coordination embedded in an **effective governance structure**.
- The ERIC's aims are described in the **Euro-Argo Strategy**, which takes into account international, European and national requirements.

The Council	The Management Board	The ERIC Office	The Scientific and Technical Advisory Group (STAG)
Defines the broad strategic direction of the ERIC and its evolution. It is composed of one delegate per member.	Supervises the operation of the Euro-Argo ERIC, ensures that it operates and evolves in accordance with the strategic direction set by the Council.	Responsible for the implementation of decisions & programmes adopted by the Management Board.	Advises on any scientific and technical matters.



5 YEARS OF MAJOR MILESTONES FOR EURO-ARGO

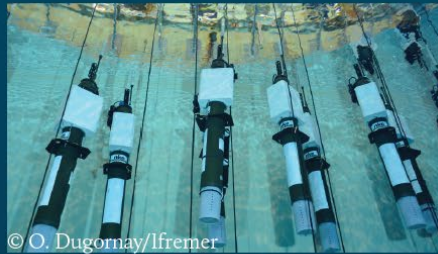
2014



ERIC established



Feasibility demonstration for fleet monitoring



© O. Dugornay/Ifremer

2015



BGC real-time processing implementation at EU DACs and GDAC



- Implementation of the "At-sea monitoring" service
- Deployment and processing of a large fleet of floats
- Contribution to global array and extension to Marginal Seas, polar regions, the deep ocean and to biogeochemical variables



© J.-J. Pangrazi/LOV-CNRS

2016

2016



Publication of the long-term evolution strategy



New services for Members: "central procurement of Core and Deep floats"



Implementation of the Delayed Mode Quality Control (DMQC) for O₂ & chlorophyll a thanks to Euro-Argo



© O. Dugornay/Ifremer

2017



Implementation of Southern Ocean Argo Regional Centre (BODC)



© S. Lesbats/Ifremer

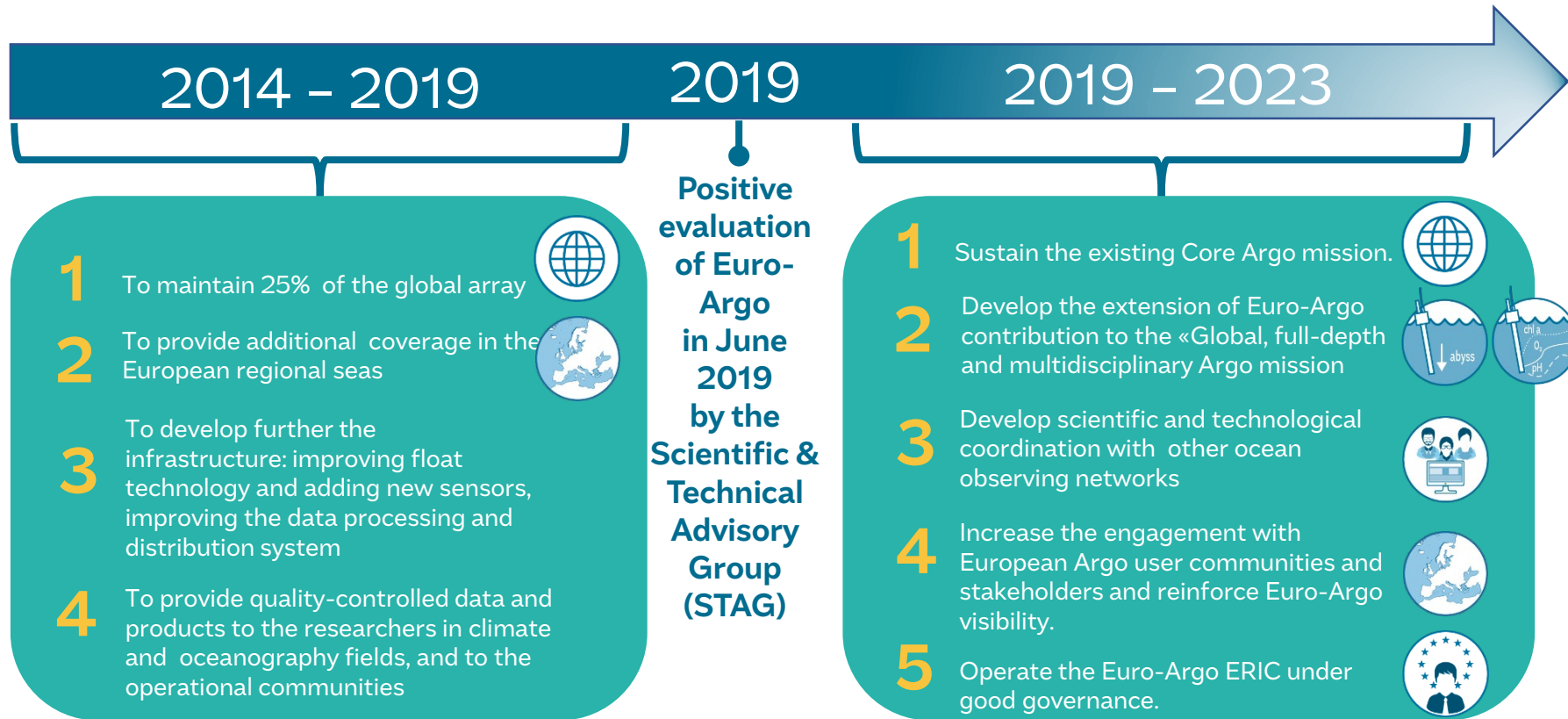
2018

Goal 1: concept and governance development

Goal 2: data management

Goal 3: operational development

EURO-ARGO OBJECTIVES

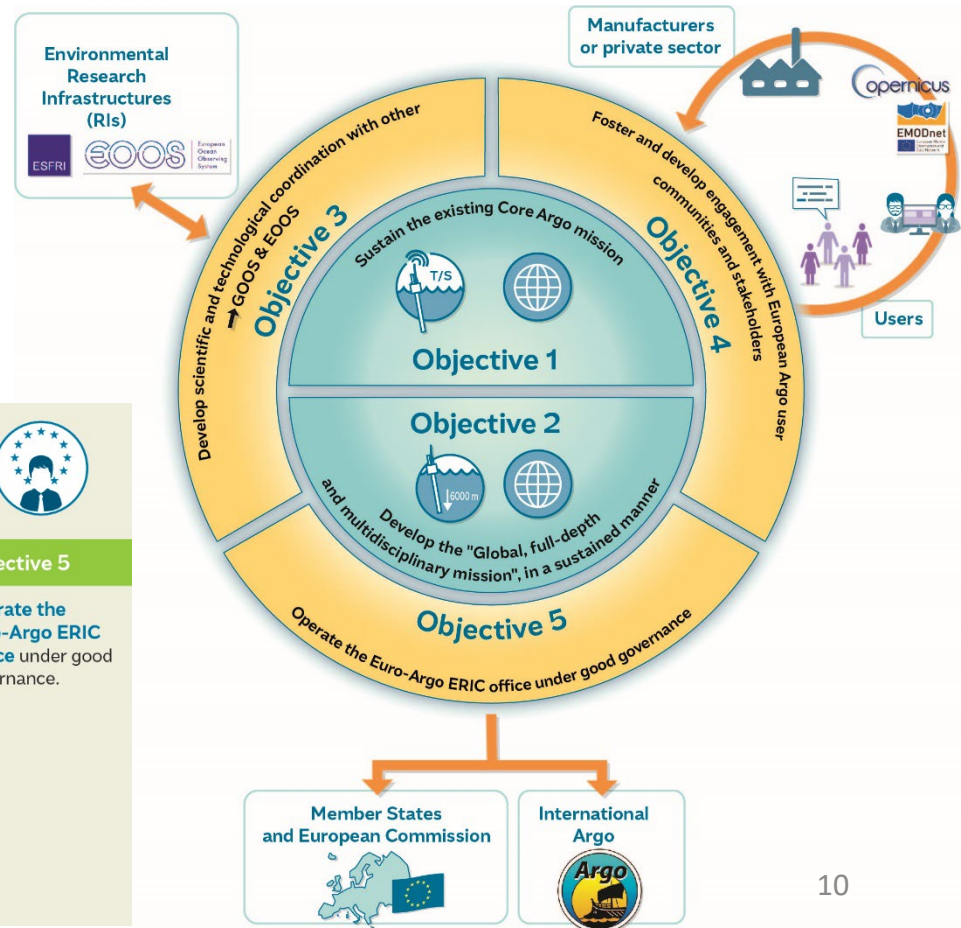


EURO-ARGO OBJECTIVES 2019-2023

As a contribution to extended Argo strategy, Euro-Argo defined its Five-Year plan and its 5 new objectives, as a contribution to the «Global, full-depth and multidisciplinary Argo design».

See: <https://doi.org/10.13155/71936>

THE 5 OBJECTIVES OF THE NEW 5-YEAR PLAN



Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
				
Sustain the existing Core Argo mission.	Develop the extension of Euro-Argo contribution to Argo according to the Euro-Argo strategy as a contribution to the "Global, full-depth and multidisciplinary Argo" design.	Develop scientific and technological coordination with other ocean observing networks and contribute to a Global Ocean Observing System design and its European contribution through European Ocean Observing System (EOOS) initiative.	Develop the engagement with European Argo user communities and stakeholders and reinforce Euro-Argo visibility.	Operate the Euro-Argo ERIC Office under good governance.

EURO-ARGO A MAJOR CONTRIBUTOR TO ARGO



WORLDWIDE
DISTRIBUTION OF
EURO-ARGO
(YELLOW DOTS)
AND ARGO FLEET
(BLUE DOTS)

EUROPEAN CONTRIBUTION TO ARGO

EVOLUTION OF THE EUROPEAN CONTRIBUTION TO THE ARGO NETWORK IN NUMBER OF OPERATIONAL FLOATS AND IN PERCENTAGE OF THE INTERNATIONAL EFFORT

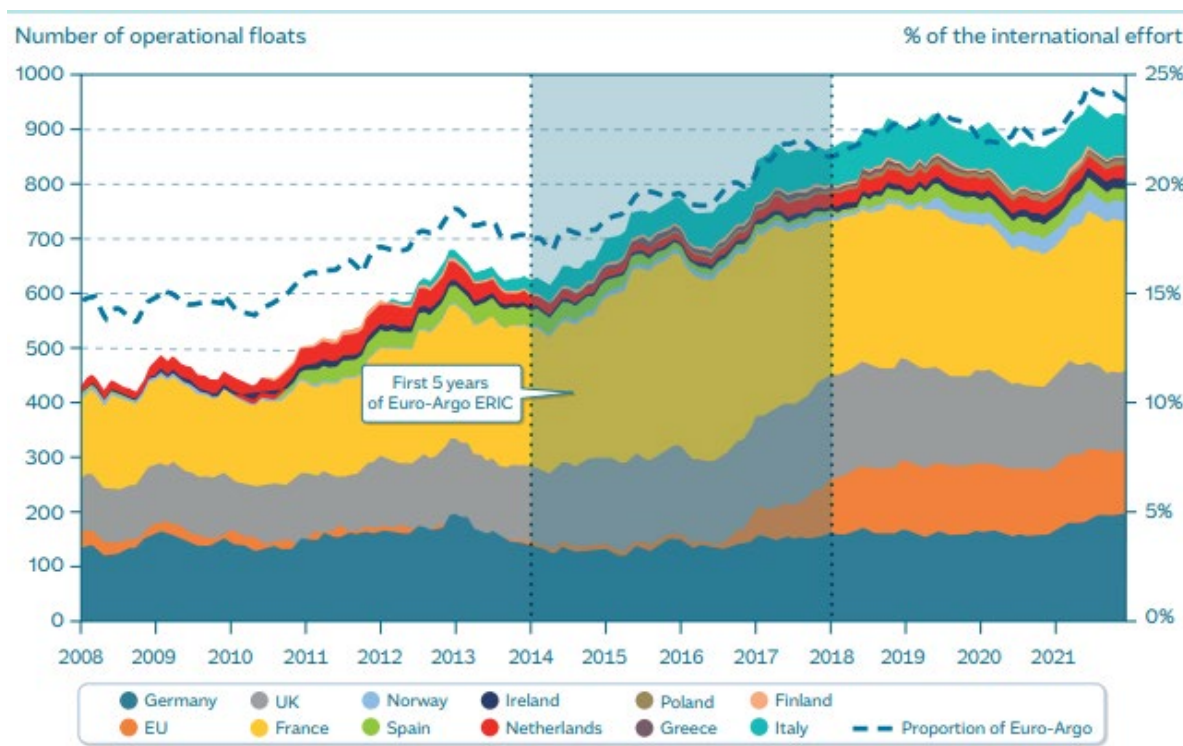
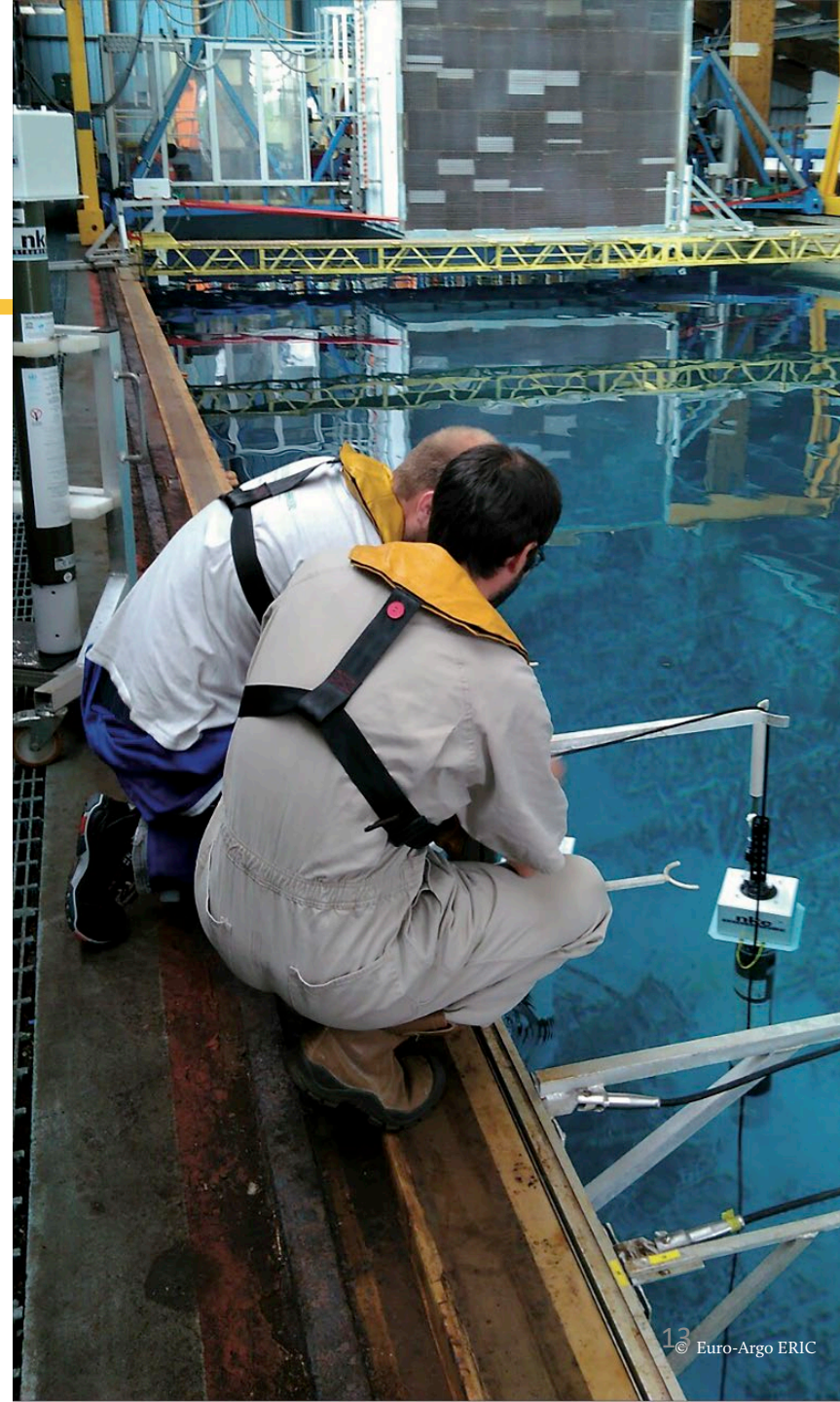


Figure 9: Evolution of the European contribution to the Argo network in number of operational floats (colour, left axis) and in percentage of the international effort (blue dashed line, right axis). © OceanOPS/AIC

EURO-ARGO BENEFITS FOR ITS MEMBERS

- To achieve its objectives, the Euro-Argo ERIC has established a **high level of cooperation** between the 12 National Members and the ERIC Office.
- Euro-Argo ERIC ensures **coherence with Argo international strategy**, enlarging its community of data users and **responding to their needs**.



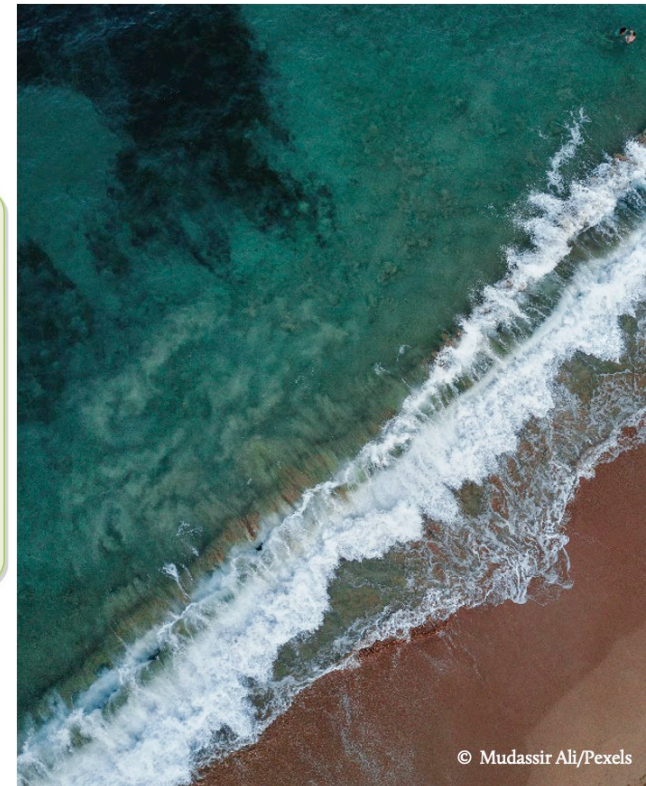
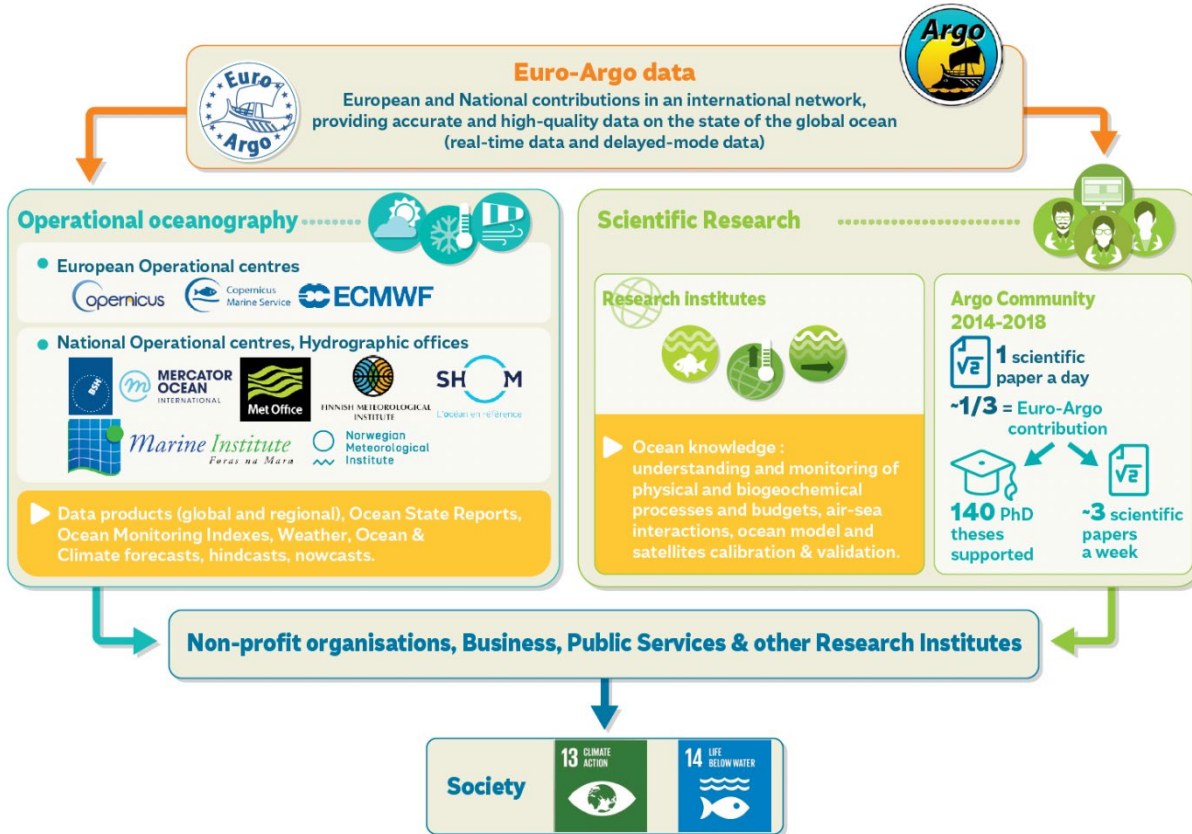
EURO-ARGO BENEFITS FOR ITS MEMBERS

The past 5 years have seen consolidation of:

- Centralised float procurement and deployment.
- Coordinated “At-sea operations”, floats testing and monitoring activities, maximising float life expectancy to increase cost-effectiveness of the Argo programme.
- Strengthened integrated data processing and services.
- Joint outreach and training efforts. Euro-Argo organised the 1st European Argo Delayed Mode Quality Control (DMQC) data workshop in 2018.



EURO-ARGO BENEFITS FOR SCIENCE AND OPERATIONAL OCEANOGRAPHY

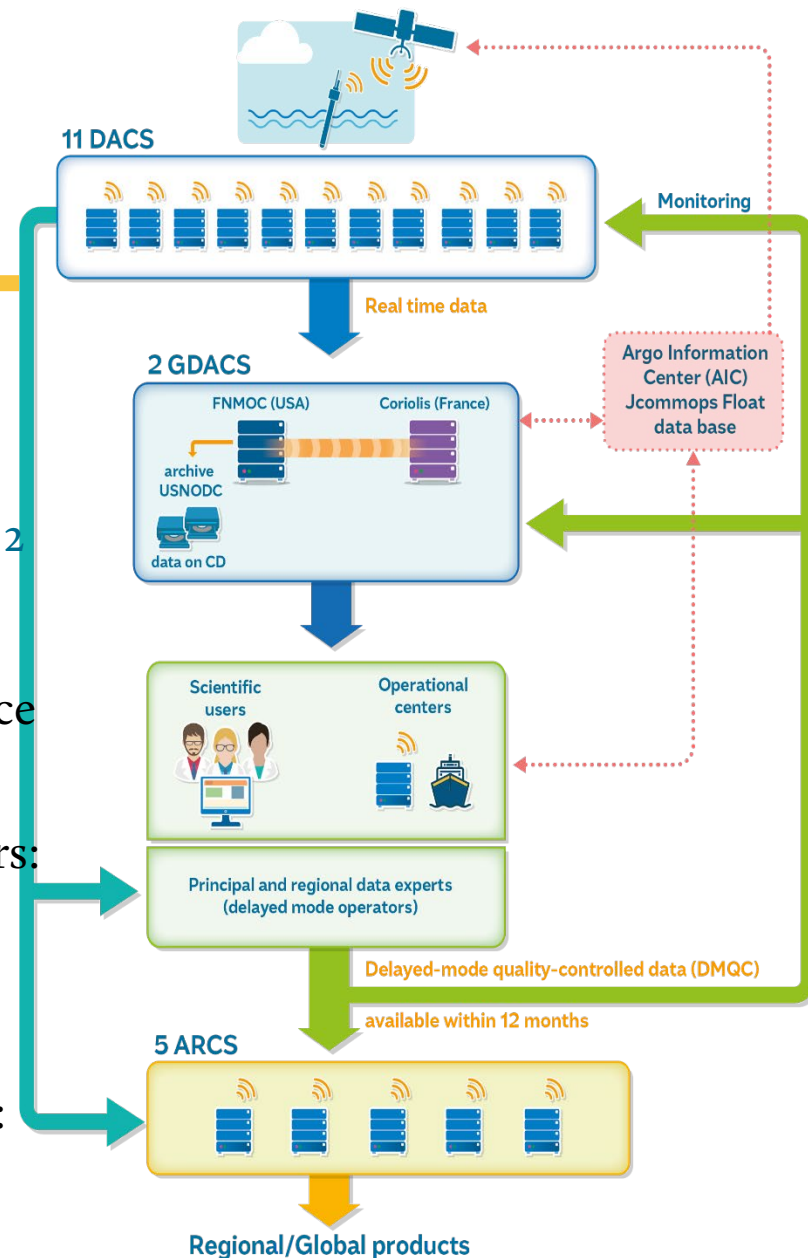


© Mudassir Ali/Pexels

ARGO DATA SYSTEM

Data are managed at international level:

- Floats send their measurements to **DACs***, where raw data are processed and sent to the **2 GDACs***:
 - ✓ 1 GDAC in Europe (Coriolis/Ifremer)
 - ✓ 2 DACs in Europe (Coriolis/Ifremer, France and BODC, UK)
- **3 ARCs*** are coordinated by European partners:
 - ✓ Atlantic ARC (Ifremer, France)
 - ✓ Southern Ocean ARC (BODC, UK)
 - ✓ Med & Black Seas ARC (OGS, Italy)
- **Argo Information Centre (AIC)** at OceanOPS:
 - ✓ Registration of floats
 - ✓ Information on data (“metadata”)



*(G)DAC= (Global) Data Assembly Centre
 *ARC= Argo Regional Centre

ARGO DATA SYSTEM

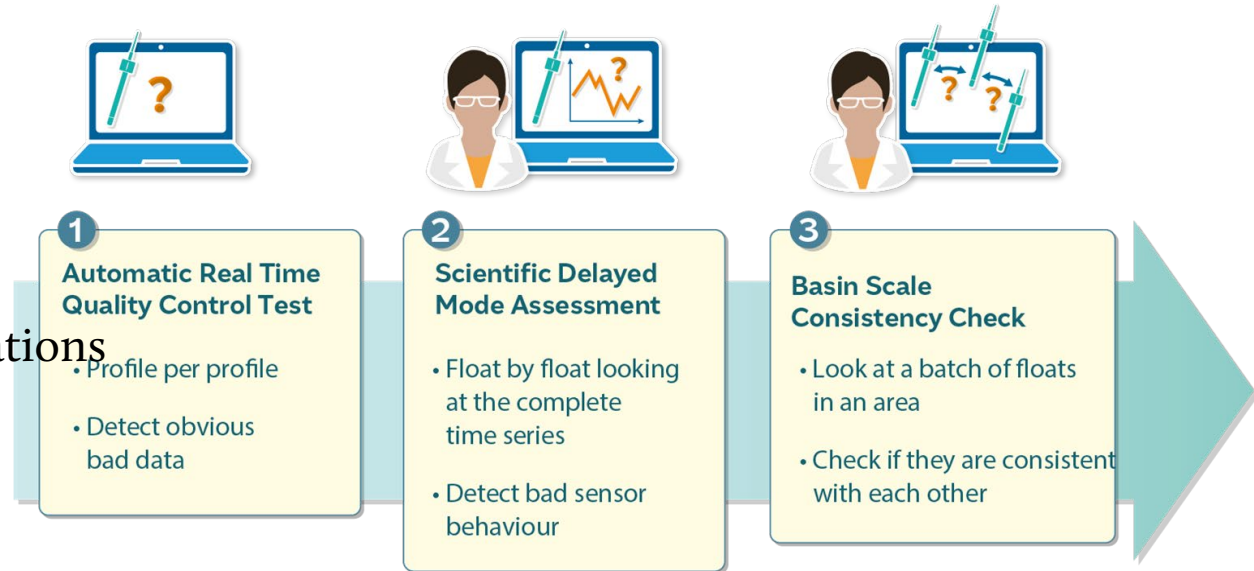
There are two data flows:

- **Real Time**

- ✓ 12 hours max
- ✓ Automatic Quality Control tests
- ✓ Operational applications

- **Delayed Mode**

- ✓ 12 months
- ✓ Detailed time series analysis and corrections
- ✓ Ocean & climate science applications



Additional analysis are then completed at basin scales ([Argo Regional Centres](#))

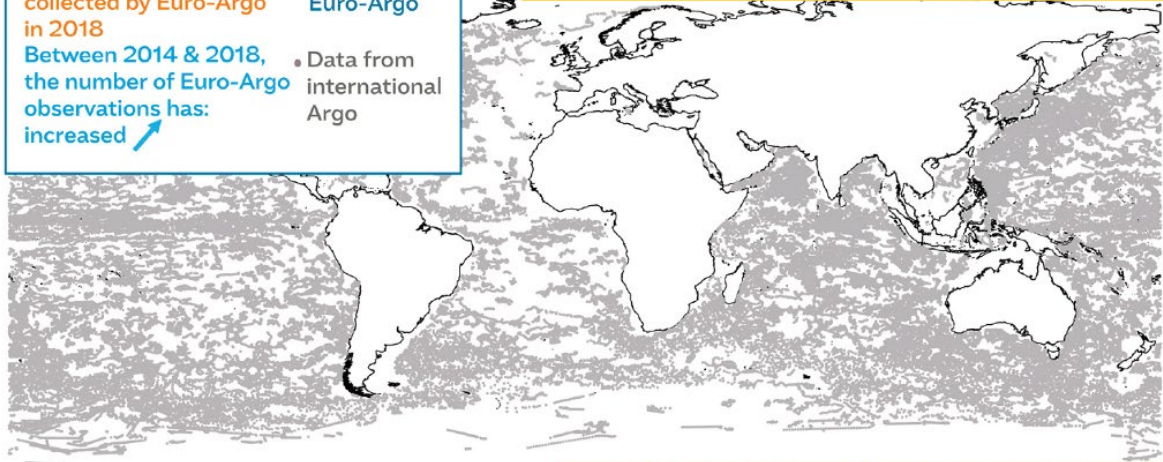
EURO-ARGO ACHIEVEMENTS

A significant contribution to geographic extensions.

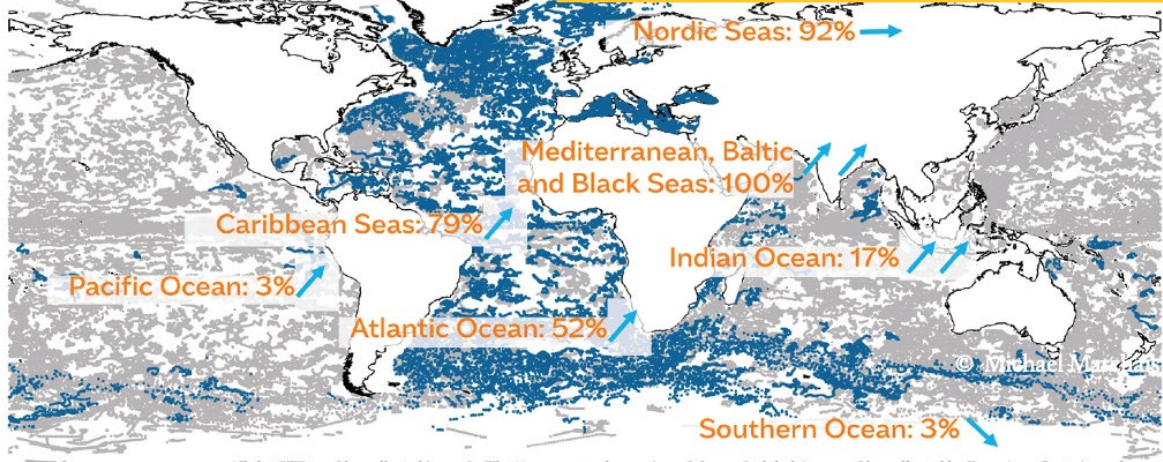
% of all observations collected by Euro-Argo in 2018
 Between 2014 & 2018, the number of Euro-Argo observations has: **increased** ↗

- Data from Euro-Argo
- Data from international Argo

ARGO NETWORK WITHOUT EURO-ARGO CONTRIBUTION



ARGO NETWORK WITH EURO-ARGO CONTRIBUTION

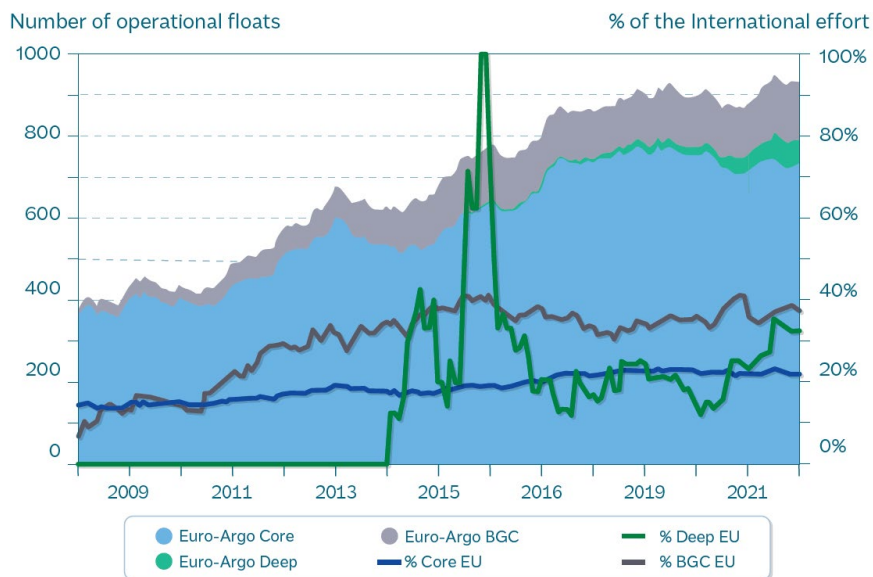


© Claudie Marec

All the CTD profiles collected in 2018. The % represents the portion of the 2018 global Argo profiles collected by Euro-Argo floats in each area.

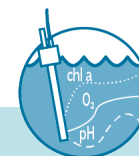
EURO-ARGO ACHIEVEMENTS

A boost for extension to biogeochemical (BGC) and DEEP Argo.



OPERATIONAL EURO-ARGO FLOATS

23% of the network in 2021



→ Number of operational Euro-Argo floats measuring BGC variables

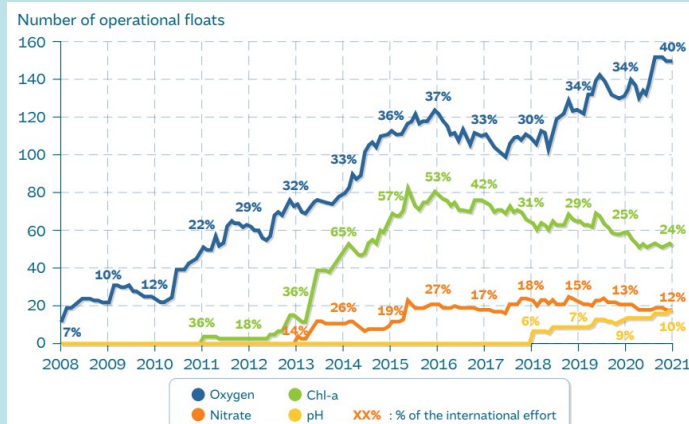


Figure 10: Evolution of the European contribution to four of the six biogeochemical parameters, in number of active Euro-Argo floats measuring that variable (left axis, solid curve), and percentage of active Euro-Argo floats measuring that variable in the global array (percentage of each year on the curves).
© OceanOPS/AIC

EURO-ARGO supporting research

→ Data access in average



633
VISITORS PER MONTH
(AVERAGE)



5218
SESSIONS



4,53
TERABYTES OF DATA
FILES DOWNLOADED

© Coriolis/ADMT21 <https://doi.org/10.13155/77033>

→ Number of publications

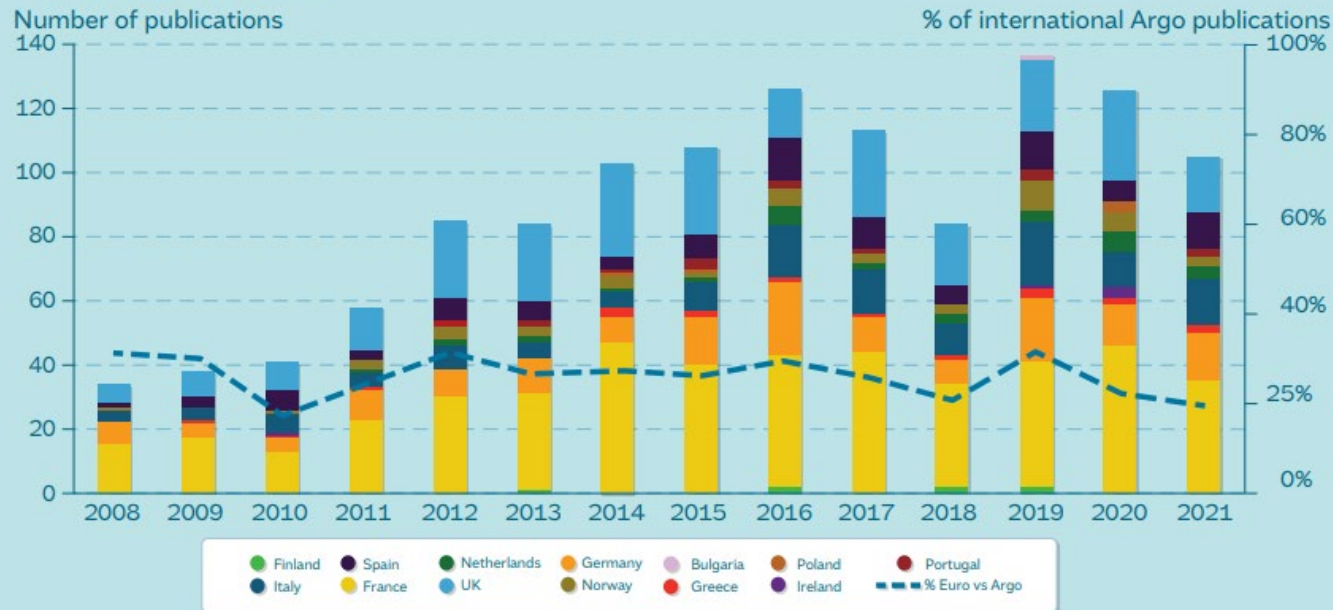
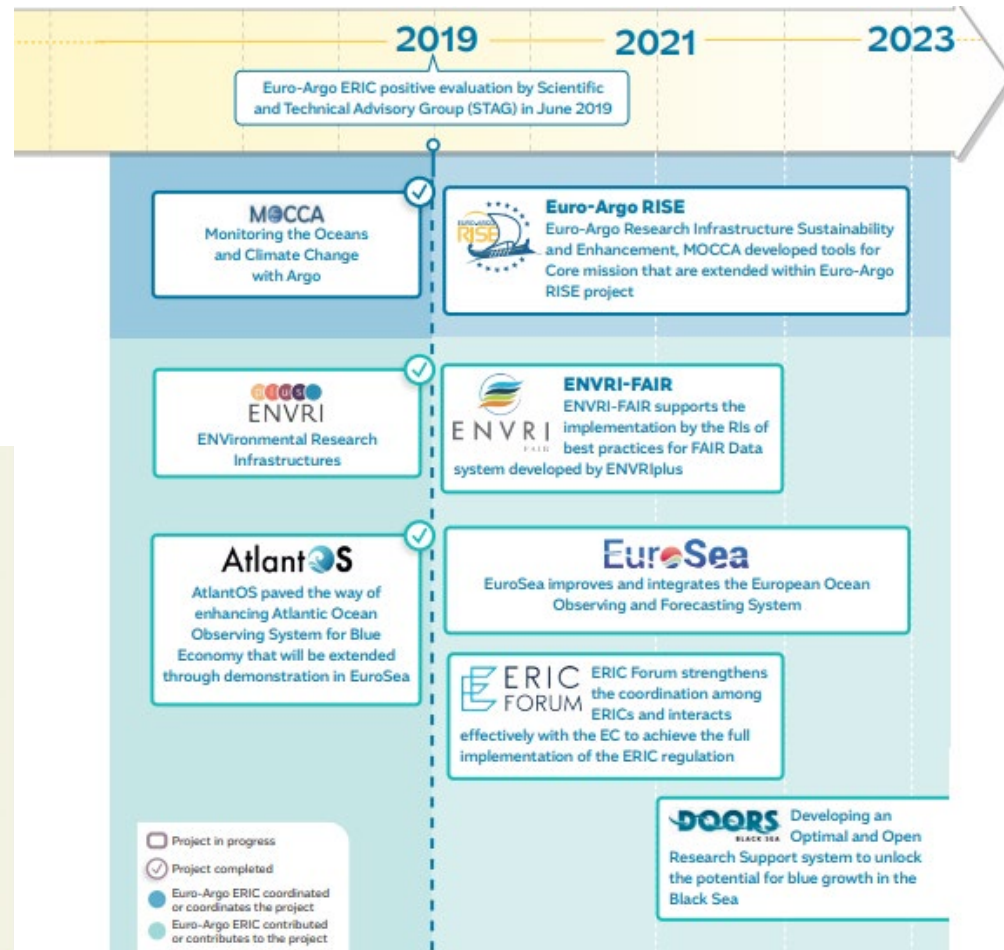
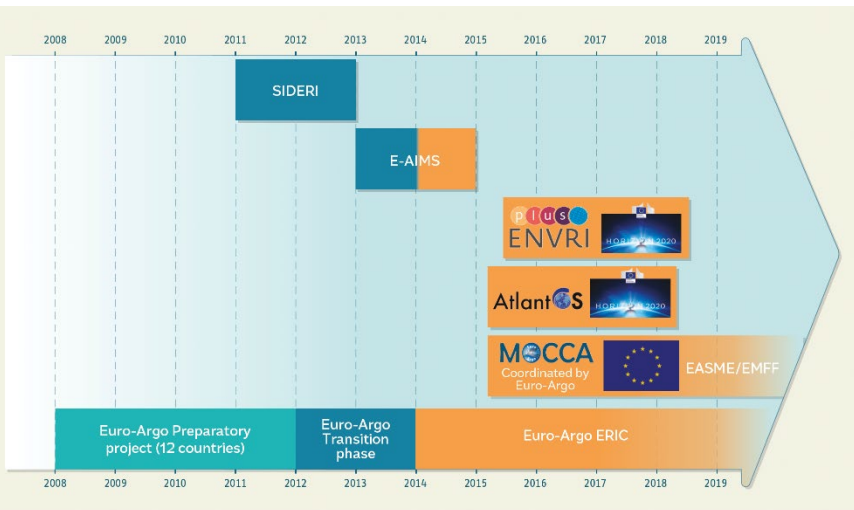


Figure 16: Euro-Argo publications per year (defined as publications using Argo data with first author's affiliation in a European country) in number of publications (left axis) and in percentage of the international Argo publications (right axis).

PARTICIPATION OF EURO-ARGO IN RESEARCH PROJECTS

Since 2015, the Euro-Argo ERIC made significant progress in operational monitoring of the Argo fleet thanks to its participation in European research projects.



EURO-ARGO RISE PROJECT



Euro-Argo **R**esearch **I**nfrastructure **S**ustainability and **E**nhancement (Euro-Argo RISE) project:

- Will enhance and extend the European capacity of the Argo network to provide essential ocean observations to better answer societal and scientific challenges.
- Will allow Europe to:
 - ✓ Develop its contribution to Argo in the long-term.
 - ✓ Engage with new teams.
 - ✓ Develop a sustainability plan with the National Members and the funding agencies.

<https://www.euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022>



2019-2022

Coordination by Euro-Argo ERIC

- Funding: 3.95M€, 536K€ for Euro-Argo
- European Union's Horizon 2020 research and innovation programme
- Grant agreement ID: 824131
- Call for proposal: H2020-INFRADEV-2018-1



WP1
Project Management



WP2
Improvement of the Core Argo mission



WP3
Extension to deep ocean



WP4
Extension to biogeochemical parameters



WP5
Extension to high latitudes regions



WP6
Extension to Marginal Seas



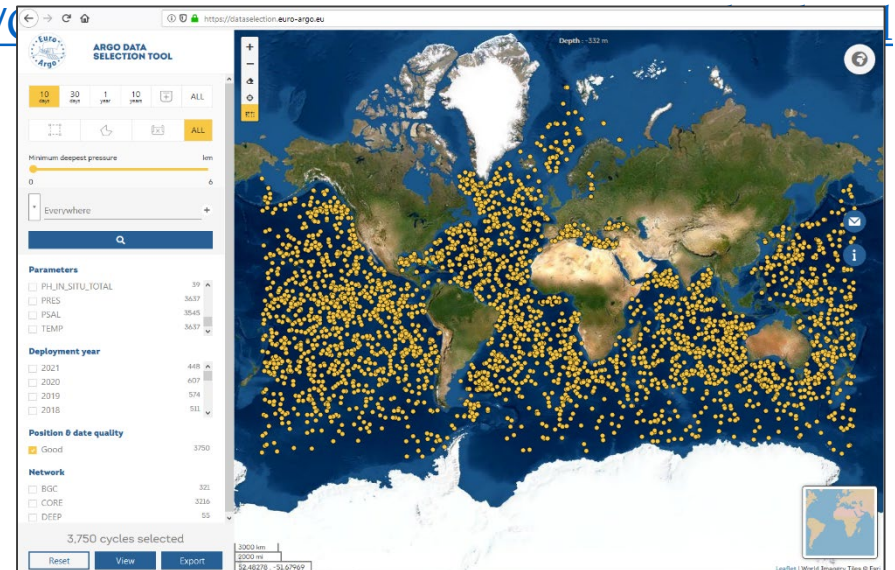
WP7
Euro-Argo RISE visibility: communication and dissemination towards user's community

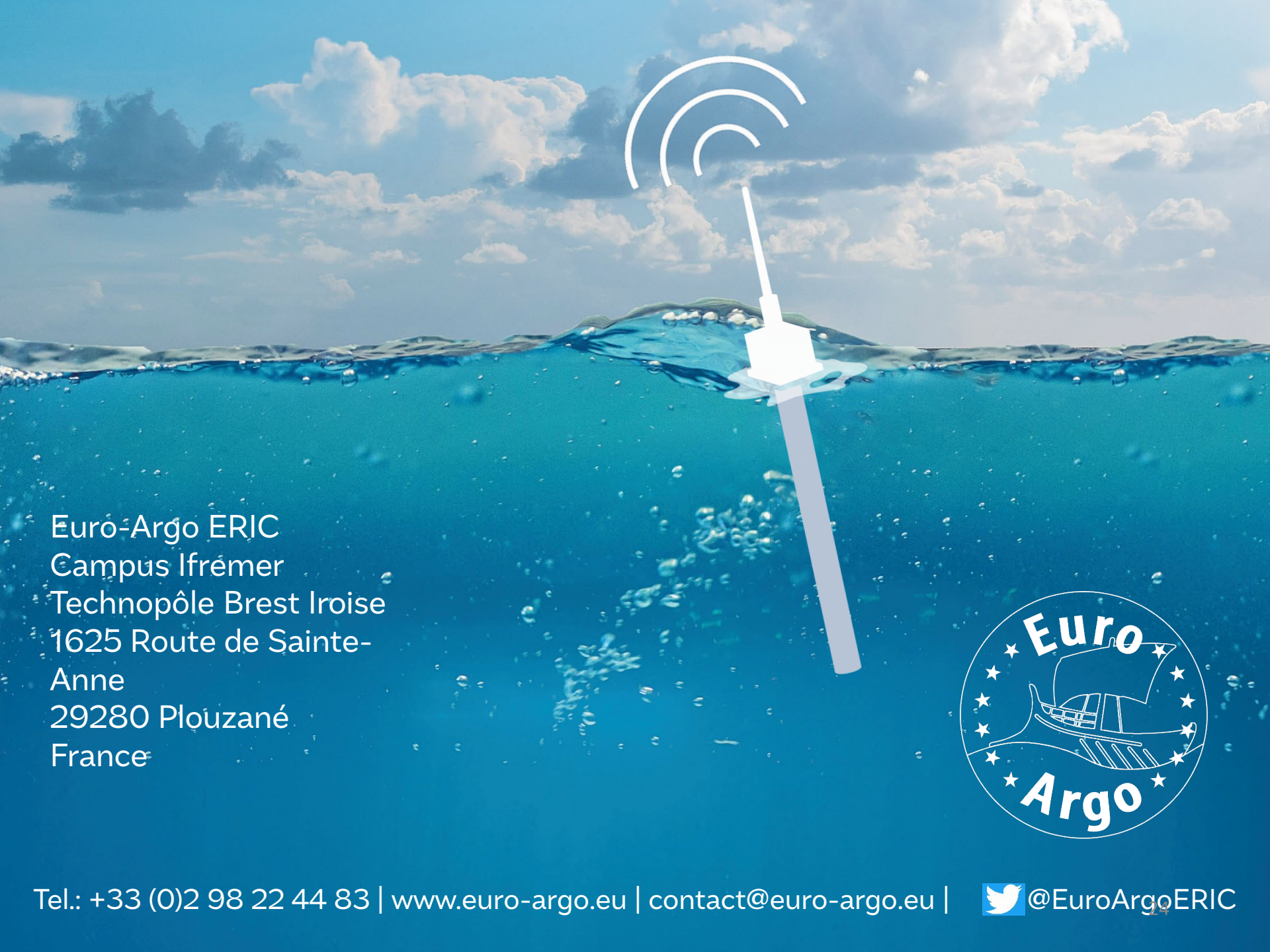


WP8
Integration of Euro-Argo activities in the general context of global ocean observations

ANNEX: ARGO DATA ACCESS & SERVICES

- GDAC ftp server
<ftp://ftp.ifremer.fr/ifremer/argo>
- GDAC DOIs (Data Object Identifiers)
<http://www.argodatamgt.org/Access-to-data/Argo-DOI-Digital-Object-Identifier>
- GDAC synchronization service (rsync)
<http://www.argodatamgt.org/Access-to-data/Argo-GDAC-synchronization-service>
- GDAC Thredds servers
<http://tdso.ifremer.fr/thredds/catalog/>
- GDAC ERDDAP data server
<http://www.ifremer.fr/erddap>
- GDAC interactive data selection
<https://dataselection.euro-argo.eu/>





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