

FIVE-YEAR

PLAN

2019-2023



pH

Chl a

O<sub>2</sub>

EUROARGO

EUROPEAN RESEARCH  
INFRASTRUCTURE CONSORTIUM  
FOR OBSERVING THE OCEAN



6000m

# Table of contents

<b>1</b>	<b>Where are we now?</b>	<b>2</b>
<b>2</b>	<b>What are the key drivers over the next five years?</b>	<b>8</b>
	Euro-Argo key scientific drivers .....	8
	Euro-Argo ERIC infrastructure drivers.....	9
<b>3</b>	<b>Five-year plan</b>	<b>10</b>
	<b>Objective 1</b> , Sustain the existing Core Argo Mission.....	12
	<b>Objective 2</b> , Extend the Euro-Argo contribution to the “global, full-depth and multidisciplinary Argo” design .....	14
	<b>Objective 3</b> , Contribute to a global ocean observing system.....	18
	<b>Objective 4</b> , Develop engagement with the European Argo user communities & stakeholders and reinforce Euro-Argo visibility.....	20
	<b>Objective 5</b> , Operate the Euro-Argo ERIC Office under good governance .....	24
	<b>Conclusion</b>	<b>26</b>
	<b>List of acronyms and bibliography</b>	<b>28</b>

# WHERE ARE WE NOW?

*Argo is the first global, real-time in situ ocean-observation network and marks a true revolution in global ocean observation. As a major component of the Global Ocean Observing System (GOOS), the Argo programme is actively participating in monitoring and understanding climate change and its impact on ocean health. Argo therefore ultimately contributes to two of the 17 Sustainable Development Goals (SDGs) adopted by all United Nations (UN) Member States in 2015: SDG13 “Take urgent action to combat climate change and its impacts” and SDG14 “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”.*

Argo provides an unprecedented dataset for researchers to study water-mass characteristics and ocean variability. The implementation of a strong European contribution to the Argo ocean observing network hinges on the Euro-Argo European Research Infrastructure Consortia’s (ERIC) ability to procure, deploy, monitor and process all European floats, in close collaboration with Argo International and its monitoring body JCOMMOPS, as well as to provide users with fully qualified data. The activities implemented in the past 5 years are summarised in the → [Table 1 p. 5](#).

To meet its aims successfully, Euro-Argo depends on strong collaboration

between the ERIC Office and the National Members, see → [Table 1 p. 5](#). The ERIC Office, in close cooperation with the international Argo community, coordinates the evolution of the European contribution to Argo while the Members coordinate their own national strategic roadmaps. European deployments are set out to meet both the needs of the international Argo programme in terms of the geographical distribution, and those of the European scientific and operational oceanographic communities in terms of scientific importance. These needs (Argo and national strategies) have nurtured an increase in sampling areas of specific European interest (i.e. Atlantic Ocean, marginal seas such as the Baltic Sea, the Mediterranean and the Black Sea) and at high latitudes (i.e. regions seasonally covered with sea ice, such as the Nordic Seas, Arctic and Southern Oceans). The Euro-Argo ERIC is coordinating deployment plans in order to minimize oversampling in certain areas of the ocean while also maintaining the array at a global scale.





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

Table 1. The different Euro-Argo ERIC activities and the tasks shared between Euro-Argo ERIC Office and National Members.



©Oliver Dugornay/Ifremer

### Float deployment

The Euro-Argo ERIC currently has the means to acquire and deploy about 250 floats per annum and to monitor them appropriately. European deployment is undertaken via the efficient coordination of activities between members: the acquisition of floats is supported either by National Members or by the ERIC Office through floats funded under European projects. The ERIC Office offers the service of centralised float procurement at significant discounted rates, providing substantial value for members buying small numbers of floats per annum. The ERIC Office's technical team also conducts pre-deployment tests on the floats at IFREMER facilities (including a 20m test tank and a hyperbaric chamber), these services are particularly beneficial for Euro-Argo members lacking access to such facilities.

The deployment of floats is carried out by National Members, usually in collaboration with neighbouring countries (Members or non-members) in the case of marginal seas. In the open ocean, Euro-Argo benefits from the support of international scientific collaborations. Deployment can also be carried out by leisure craft as opportunities arise, while some memoranda of understanding have been signed with industrial partners (such as Orange Marine), with both these carrier types generally taking routes not covered by scientific campaigns.

Once floats are deployed, it is essential that critical technical parameters (i.e. energy budget, transmission power, battery voltage or data transmission) can be monitored. The Euro-Argo ERIC Office has developed an at-sea-monitoring system allowing continuous observation of floats' technical parameters. This service allows the performance of instruments to be evaluated, and malfunctions to be detected at an early stage. An alert system has been developed to trigger corrections in delayed mode in the case of

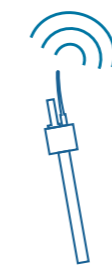
sensor drifts. Euro-Argo ERIC "At-sea monitoring" activities are performed in collaboration with JCOMMOPS and Coriolis. Through the ERIC's collaboration with JCOMMOPS/AIC, it has access to global statistics on the floats (i.e. age distribution, life expectancy, deployment maps) while its collaboration with Coriolis allows for the monitoring of floats' technical parameters and the reporting of early failure of individual floats.

The Euro-Argo ERIC's efforts have contributed to the improvement of float technology and performance. For example, it played a major role in the enhancement of the hydraulic float-pumping system of NKE floats for deep-water cycles and over long periods. France, Spain, Germany and the UK have worked on the new generation of biogeochemical (BGC) and Deep Argo floats, while other member countries (Bulgaria, Finland, Greece, Ireland, Italy, Norway, Poland) collaborate by testing the floats in their own specific environments (such as the marginal seas' shallower waters or at high latitudes).

It is also desirable that new parameters can be measured to meet scientific demands from the user community (identified through close collaboration between the Euro-Argo ERIC and partners such as Copernicus or EuroGOOS) and that these parameters are available within the Argo data stream in a timely manner and provided quality control. National Members are instrumental in sensor innovation as they develop accurate and stable sensors whose performance is then evaluated by other Members. The improvement of floats is also boosted by the ERIC's close collaboration with SME manufacturers (NKE). The Argo network presently relies heavily on sensors developed and produced by a small number of companies, and improving commercial competition is a challenge, which will be undertaken by engaging with SMEs in the development of next generation sensors.



12 COUNTRIES



MAINTAINING 25 % OF THE GLOBAL ARRAY

### Data processing

The Euro-Argo ERIC has the ability to process all European floats and to provide data to users through the implementation of a powerful European Argo data system, developed in the past 20 years, capable of evolving to match the new generation of floats. As coordinator of the European contribution to Argo data management, the Euro-Argo ERIC has improved Europe's ability to meet its data-processing commitments under the Argo international Programme. The ERIC ensures that accurate data can be processed and transmitted to users in a timely manner (delivery within less than 24 hours). It offers quality-control services to new members and provides training on data processing and use.

### Visibility

The visibility of the Euro-Argo ERIC is promoted by the ERIC Office, which provides access to outreach material, as well as by National Members who participate in awareness-raising activities and educational programmes both nationally and at European level. The Euro-Argo ERIC has initiated the organisation of scientific workshops and training courses on data processing for end-users. Euro-Argo's visibility is further boosted by the ERIC participation in European research projects, some of them coordinated by the Euro-Argo ERIC itself. The ERIC reinforces European integration into the Argo network, and provides necessary support for activities, including deployment, innovation, communication and links with end-users such as Copernicus, or climate communities and hydrographic offices. Scientific dissemination is ensured by the large number of publications based on Argo and Euro-Argo data, with an average of more than one publication per day at International level, 1/3 involving European partners.

### Strategy

The original Euro-Argo strategic plan for float deployments was defined in 2016 and identified scientific gaps and needs. This plan was developed in conjunction with National Members, who are responsible for bringing Argo community together within their respective countries as well as coordinating national scientific needs. In the past 5 years, the implementation of the Euro-Argo strategic plan progressed with strong European leadership in the consolidation of the biogeochemical (BGC) Argo group, the involvement of European partners in the concept proofs for Deep Argo, the deployment of floats in the high latitudes and sustainability of the marginal seas monitoring. This strategic plan anticipated the new Argo mission endorsed by Argo International: a vision for a "global, full-depth and multidisciplinary Argo".

The Euro-Argo ERIC is also a driving force in reaching out to the European scientific community, and its coordination capacity places the ERIC in a strategic position with regard to submitting proposals in response to H2020 calls. The Euro-Argo ERIC also plays a key role in stimulating national implementation (such as Argo-Italy) and in promoting coordination at the regional level with neighbouring countries (Mediterranean Sea, Black Sea, Baltic Sea).



OPERATIONAL SERVICES



CLIMATE



OCEAN HEALTH

Main targeted applications of Euro-Argo.

## WHAT ARE THE KEY DRIVERS OVER THE NEXT FIVE YEARS?

*The Euro-Argo ERIC is now at a turning point of its history: the ERIC Office and National Members set up a reliable infrastructure, that both manages to strengthen the European Contribution to Argo and start implementing the new missions.*

### EURO-ARGO KEY SCIENTIFIC DRIVERS

The overarching scientific objective of Euro-Argo in the next five years is to make use of the technological advances in order to observe unknown regions and properties of the ocean that play key roles in ocean ecosystems and Earth climate, particularly those that are of interest to the European research community and wider society. The development of European contributions which extend Argo into the deep ocean will provide essential data to better estimate heat and freshwater budgets and sea level variations in the ocean. The exten-

sion of Argo measurements towards high latitudes will also allow for a better understanding of ocean variability in these key regions of the globe. Strengthening the biogeochemical component will enable us to define variability and trends in biogeochemistry and to investigate effects of acidification and deoxygenation of marine ecosystems, as well as monitoring various elements of ocean health.

Nearly half of the ocean's volume has yet to be observed by Argo. The ocean below 2000m remains largely unknown apart from sparse ship-based hydrographic sections and mooring sites. However, this abyssal part of the ocean plays a fundamental role in climate because it can store heat and anthropogenic carbon for decades to centuries. A significant part of deep-water masses of the global ocean originates from the North Atlantic (Johnson, G.C., 2008). In Europe, our objective is first to focus on observing the deep North Atlantic Ocean: it is a very complex region that exerts a major control on European climate with dynamics not yet fully understood. The European objective is to better constrain the inter-annual variability of these deep layers in order to better understand multi-decadal climate change signals.



© Claudie Marrec

The amount of anthropogenic carbon emission in the atmosphere that is currently taken up in the ocean is approximately 26%. The North Atlantic is thought to represent the largest ocean sink for atmospheric carbon dioxide in the Northern Hemisphere, yet little is known about its temporal variability. This is happening at a time where there is only a rudimentary understanding of the ocean biological carbon cycle. In Europe, the objective is to provide an observing network on regional to global scale for these presently under-sampled ecosystem properties of the ocean (i.e. nitrates, oxygen, chlorophyll-a, irradiance and pH) in order to better understand ocean biogeochemical dynamics. This will enable examination of the impact of an increase in ocean carbon content on the marine environment (e.g. deoxygenation, acidification) and on ecosystems functioning (e.g. phytoplankton blooms).

**Changes in Ocean dynamics that are not observed or well understood can result in significant economic costs to society and societal impacts.**

Europe will contribute to the new international Argo sampling strategy through a scientifically driven balance of global scale contributions and regional scale focus points, such as the North Atlantic, European marginal seas and high latitudes regions.

Observing inadequately understood regions and properties of the ocean (Polar Regions, deep-ocean and marine ecosystems) is of paramount importance for the European community. Changes in Ocean dynamics that are not observed or well understood can result in significant economic costs to society and societal impacts.

### EURO-ARGO ERIC INFRASTRUCTURE DRIVERS

Euro-Argo must evolve within a landscape of complementary Research Infrastructures (RIs). An integrated ocean observing system approach has been developed by GOOS at global scale, SOOS at Southern Ocean scale, AtlantOS programme at Atlantic level and EOOS at European scale, in their respective strategies as a contribution to the UN Decade of Ocean Science for Sustainable Development (2021-2030). Within this context, closer interactions and cooperation with the other European environmental marine Research Infrastructures (RIs) will be beneficial at many levels including sensor developments, data interoperability and integrated ocean observing design.

Key beneficiaries of the Argo Programme along with the scientific community, include indirectly climate-sensitive industries (i.e. agriculture, aquaculture, tourism, and fisheries) and industries with a significant maritime presence (i.e. oil and gas, shipping and emergency response). In most cases, the Argo community's end user engagement is maintained indirectly through the forecasting community (i.e. Copernicus Marine Service and ECMWF in Europe) or through the scientific community. BGC Argo is currently supporting a growing community of scientific end-users with significant potential to contribute to societal engagement (such as "climate variability and change" and "ocean ecosystem health") through a variety of stakeholders. These stakeholders include end-users of ocean observation, modelling products and services that utilise BGC-Argo data. It is important that Euro-Argo engage with these stakeholders at European scale to understand their specific needs.

# 3

## FIVE-YEAR PLAN

Many activities and services have been implemented over the past five years. However, this needs to be continued through the next phase of Argo. There are multiple challenges including the maintenance of Core Argo activities, the extension towards a global, full depth and multidisciplinary Argo mission that needs to be further developed in a sustained way.

Better engagement with end-users is required to contribute to an integrated Global Ocean Observing System (GOOS) in a multiplatform perspective. It aims at contributing to basin scale observing systems, like AtlantOS in the Atlantic

and Southern Ocean Observing System (SOOS), in the Southern Ocean, or to regional alliances such as EuroGOOS. To reach programme sustainability, five objectives have been identified, see → Figure 1 p. 11.

### THE FIVE OBJECTIVES OF THE NEW FIVE-YEAR PLAN

Objective 1	Objective 2	Objective 3	Objective 4	Objective 5
				
<b>Sustain the existing Core Argo mission.</b>	<b>Develop the extension of Euro-Argo contribution to Argo</b> according to the Euro-Argo strategy as a contribution to the "Global, full-depth and multidisciplinary Argo" design.	<b>Develop scientific and technological coordination</b> 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.	<b>Develop the engagement with European Argo user communities and reinforce Euro-Argo visibility.</b>	<b>Operate the Euro-Argo ERIC Office</b> under good governance.

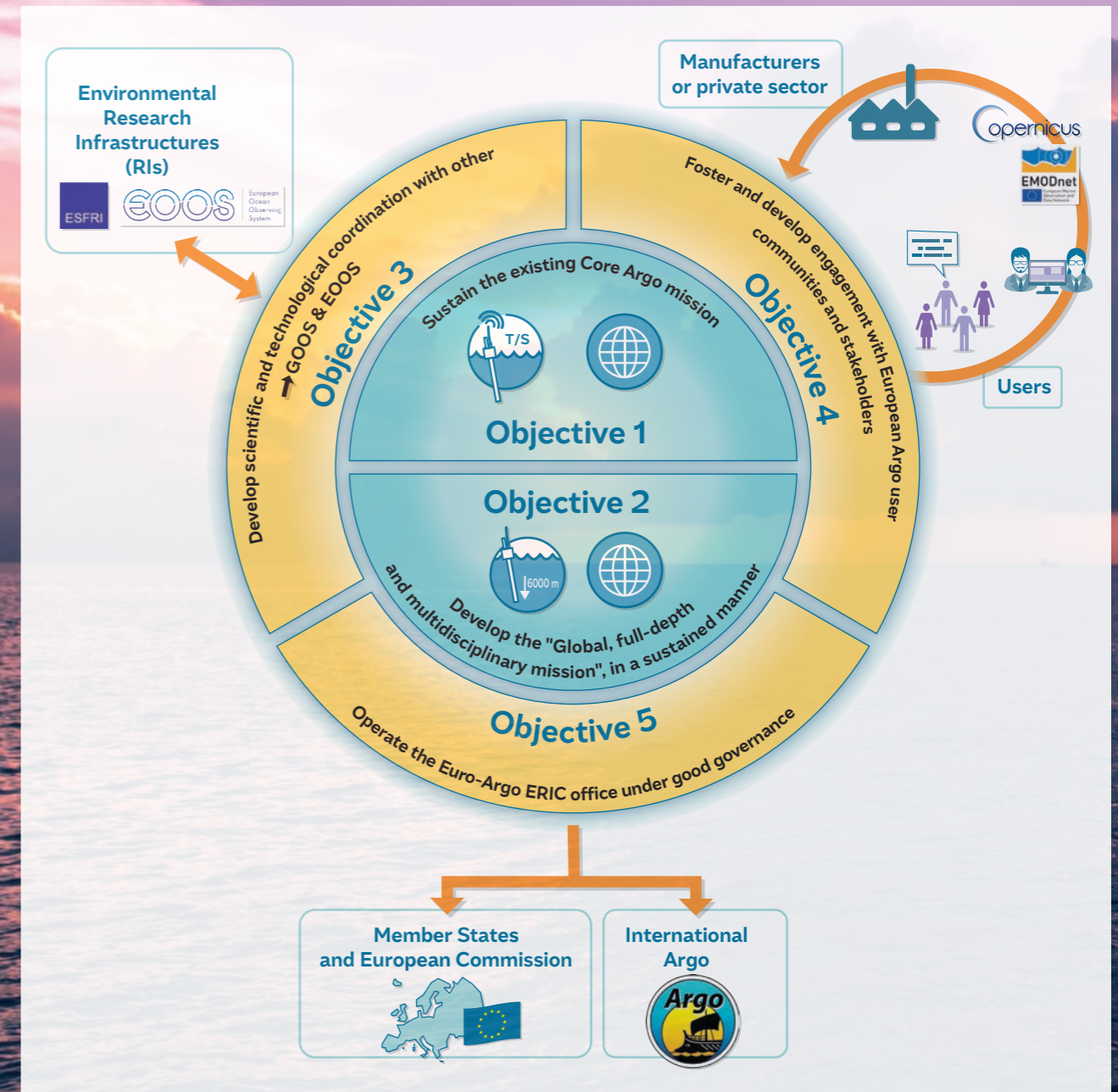


Figure 1: The five objectives of the new five-year plan and the involved partners.



© Tarron Lamont & Gavin Turt

MOCCA float deployed in the Agulhas current, August 2017.



**Objective 1**

**SUSTAIN THE EXISTING CORE ARGO MISSION**

The sustainability of the existing European contribution to the Core Argo mission and activities linked with the objectives described above (→ see p. 10) requires moving towards a sustained contribution from the European Union, complementing national funding programmes.

Sustaining the Core Argo mission requires a reduction in its cost without any degradation of the quality of the Argo data. To achieve this objective, four main activities have been identified:

1. Improvement of float life expectancy so that fewer floats are needed for the same amount of profiles.

2. Strengthen of the Argo mission by diversifying pressure, temperature and salinity sensors (presently the sensor market is anticompetitive).

3. Optimisation of the network implementation, deploying floats where they have increased impact on targeted applications.

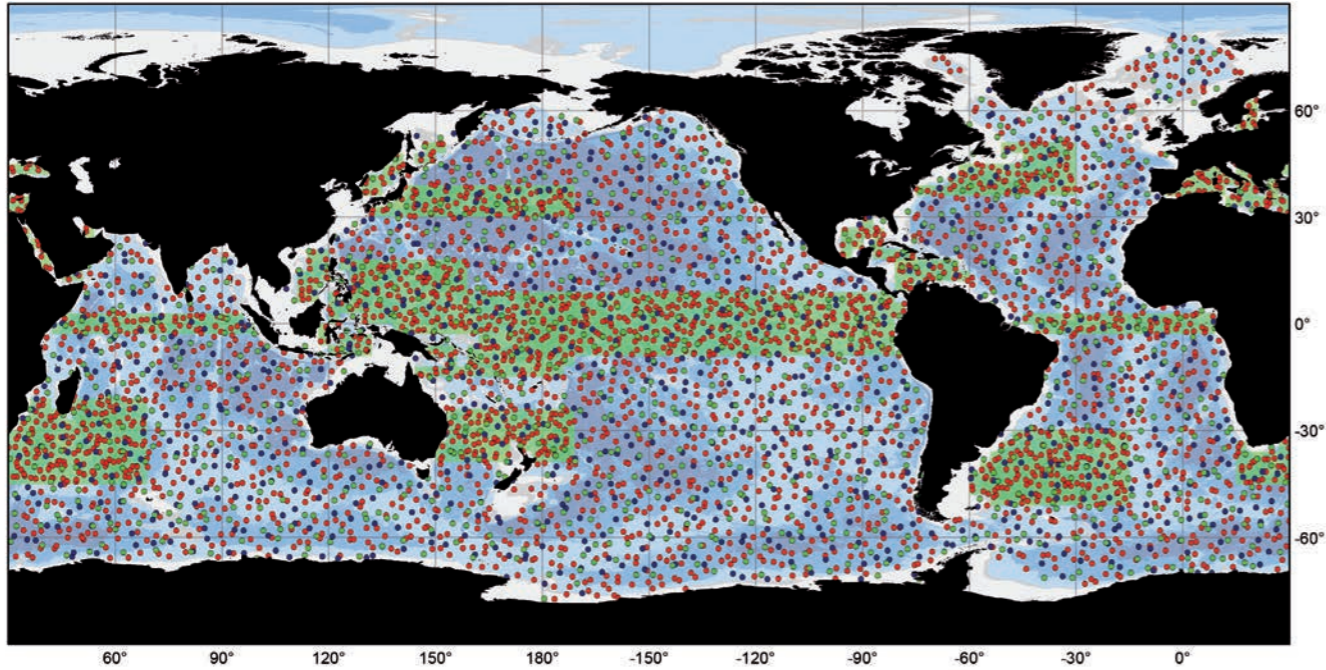
4. Improve the efficiency of data management by revisiting quality control procedures and reduce the additional resources required to accommodate new missions.

The collaboration between the ERIC Office and members needed to organise these activities is outlined in → Table 1 p. 13.

TABLE 1: TASKS TO SUSTAIN THE EXISTING CORE ARGO MISSION

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Sustain European contribution to Core Argo</b>	Sustain/increase national contributions including services	Sustain and enhance the current services (centralised float procurement, at sea monitoring, training)	Continuous
		Design a strategic plan (source of funding) to move towards a sustained contribution from EU (EU funding programmes)	Final version of new strategy in EA RISE due 2022
		Develop a Euro-Argo ERIC business plan	Final version of business plan in EA RISE due 2022
<b>Contribute to the global array and fill the gaps in under sampled areas</b>	Extend deployments on ships/vessels of opportunity	Coordinate deployment opportunities and develop monitoring tools together with JCOMMOPS	Continuous
		Assess the impact of the European contribution on the global array by dedicated studies	Impact assessment in EA RISE due 2022
		Study use of dedicated ship time (in conjunction with Argo international)	Analysis for 2021
<b>Maintain and enhance the European data management system</b>	Maintain and enhance Quality Control (QC) procedures of the Argo data using more advanced methodologies such as machine learning	Coordinate the implementation of the enhanced data quality methods developed at National level by Euro-Argo ERIC members at European scale and with Argo international	First version of Machine Learning tools developed in EA RISE available in 2022 Continuous for Data Quality enhancement
<b>Improve technology performances</b>	Improve and enhance pre-deployment procedures (float and CTD tests) to improve float's lifetime and reduce early failure rate	Coordinate and improve training of deployment groups, foster manufacturer's competition to raise floats and sensors quality	Continuous





Argo

Argo 2020 Design: 4700 floats

- Core Floats, 2500
- Deep Floats, 1200
- BGC Floats, 1000

Target density doubled



Generated by www.jcommops.org, 13/11/2018



## Objective 2

### EXTEND THE EURO-ARGO CONTRIBUTION TO THE “GLOBAL, FULL-DEPTH AND MULTIDISCIPLINARY ARG0” DESIGN

The development of the European contribution to the “Global, full-depth and multidisciplinary Argo” design started in Europe mainly on R&D funds, in particular for the deep and BGC extensions.

Fostering the development of the new design will require Euro-Argo to:

1. Develop, both at national and at EU level, sustained funding to cover the cost of the new design, which is three times more expensive than the initial Core Argo mission.

2. Continue the extension in seas of European interest (Marginal Seas, high latitudes, boundary currents) in collaboration with other marine RIs.

3. Enlarge the European contribution to Deep and BGC-Argo and monitor the progress.

4. Propose an organisation for the BGC data management system, that will require the involvement of new teams.

5. Develop more services as well as facilitate additional training to support Members in the implementation of this new design including centralised procurement, training for new platforms/sensors and DMQC training.

These activities are outlined in → [Table 2 p. 16](#).

© Pierre Branellec/Ifremer, LOPS



TABLE 2: TASKS TO DEVELOP THE EXTENSION OF EURO-ARGO CONTRIBUTION TO ARGO

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Expand European Argo programme to move towards 25% contribution of the global, full-depth and multidisciplinary Argo design (150 T&amp;S, 50 deep and 50 BGC floats to be deployed per year)</b>	Approach national funding agencies for additional contributions to fund the global, full-depth and multidisciplinary Argo design	Coordinate actions to join/lead EU projects, to complement national funding programmes	Continuous
		Define a strategy to approach private sector and philanthropists to boost the funding of the global, full-depth and multidisciplinary Argo design	Monitoring of the progress at each annual report
<b>Continue the extension in seas of European interest (Marginal Seas, high latitudes, near-surface layer and boundary currents) in close cooperation with existing observation systems</b>	Continue the extension of Argo according to the European and national strategies	Coordination of Euro-Argo ERIC Members/ Observers with the Euro-Argo strategy and its implementation	Monitoring of the progress at each annual report
	Collaborate with the groups maintaining and developing Ice-Tethered Platforms (ITP's) in the Arctic in order to achieve complete coverage of real-time Argo-type measurements in the Arctic Ocean	Join EU projects to support funding of innovation and implementation	Join the INTAROS 2 proposal of the NEXTGEOSS call (end 2020)
	Collaborate with the Glider community to improve and better coordinate observation of boundary currents	Organise joint meetings with other European Marine RIs	Progress within EA RISE (end 2022) and EuroSEA (end 2023)

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Continue the extensions toward deeper measurements, more BGC parameters and move towards additional biological measurements</b>	Continue collaboration with SMEs to innovate and design new sensors/new floats	Lead/join EU projects to support funding of innovation	Progress within EA RISE (2022) and EuroSEA (2023) projects
		Coordinate with Integrated Carbon Observing System (ICOS) in terms of implementation of the BGC-Argo array and inter comparison of data	
		Development of new services in support of Euro-Argo ERIC members (organise centralised float procurement for the extensions, extend at sea monitoring tools for the complete European fleet)	2020 for the Contract Framework agreement with Sea Bird (SBE) 2022 for the update version of the at sea monitoring tool
		Continue/start working on sensor quality assessment (e.g. pressure, fast salinity drift, etc.) to be able to detect failure at Euro-Argo level	First version in EA RISE due 2022
		Provide enhanced best practices for pre-deployment activities critical for the Argo extension (Deep, BGC)	First version in EA RISE due 2022
<b>Organise the BGC data management system</b>	Develop the European contribution to BGC-Argo and organise the BGC data management system with the ERIC	Develop training for new platforms and sensors as well as DMQC training for BGC variables	2022 for demonstration of training material
<b>Development of a long-term strategy for recovery of floats</b>	Provide information on ships cruises and costs Ease recoveries in marginal seas	Communicate on environmental impact	2020
		Study various options for recovery and cost-benefit analysis	2021
		Link with JCOMMOPS and other ocean observing network	Final version of Long-Term Strategy Plan in EA-RISE due 2022



© International Space Station



**Objective 3**

**CONTRIBUTE TO A GLOBAL OCEAN OBSERVING SYSTEM**

The previous two objectives describe the activities related to the enhancement of Argo (design, technology and data system). As Argo is only one element of the global ocean observing system, collaboration with other RIs (i.e. EMSO, EMBRC, JERICO and ICOS) and networks (i.e. DBCP and Gliders) is valuable to fulfil the needs and requirements of the operational and research communities targeted by Euro-Argo. This coordination is undertaken at various levels:

1. Development/improvement of sensors and platforms: the same technology (i.e. new sensors, communication systems and power supply units) is shared across observing networks.

- 2. Engagement with manufacturers: Identify promising technical advancements and improve lifetime.
- 3. Network implementation: share deployment and recovery opportunities in collaboration with JCOMMOPS.
- 4. System design: improve the space/time coverage of the global ocean monitoring from different observing platforms in link with GOOS and its European component EOOS.
- 5. Data interoperability: facilitate products development for end-users.
- 6. Joint research activities between National RIs regarding research synergies, funding schemes and in support of pilot projects.

The different activities are outlined in → Table 3 p. 19.

**TABLE 3: TASKS TO DEVELOP SCIENTIFIC AND TECHNOLOGICAL COORDINATION WITH OTHER OCEAN OBSERVING NETWORKS**

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Innovative sensors for new measurements in agreement with the integrated observing system (towards biological parameters)</b>	Develop the platform and sensor technology needed for the implementation of the Euro-Argo strategy in partnership with other Research Infrastructures and networks	Collaborate with other Research Infrastructures through the ENVRI-FAIR BEERI and the EuroSEA projects	Continuous
<b>Improve services to allow development of integrated services for end-users</b>	Engage with end-user communities to better define their needs in terms of machine to machine access to Argo data together with other European Research Infrastructures data	Design new back-end services from GDAC to allow such integrated service development	Enhancement of Euro-Argo GDAC fairness in ENVRI-FAIR project 2021
<b>Integration with other Research Infrastructures</b>	Enhance the Argo contribution to the operational monitoring of national waters and the description of the environmental status (e.g. MSFD)	Strengthen relationships with other Environmental ERICs (i.e. EMSO, ICOS, EMBRC, JERICO, etc.) and research communities (i.e. Eurofleets+)	Continuous
<b>Integration with other observing platforms (networks as part of GOOS and EuroGOOS)</b>	Close collaboration with other networks (e.g. gliders, etc.)	Contribution to EOOS / GOOS strategic plan development as well as the UN Ocean Decade for Sustainable Development	Continuous Some activities within ENVRI-FAIR BEERI and EUROSEA projects



© Martin Maupas/IRD



**Objective 4**

**DEVELOP ENGAGEMENT WITH THE EUROPEAN ARGO USER COMMUNITIES & STAKEHOLDERS AND REINFORCE EURO-ARGO VISIBILITY**

To efficiently engage with a growing European Argo user community, the Euro-Argo ERIC will need to:

1. Better assess the user requirements from both operational and scientific communities in order to provide improved fit-for-purpose services.
2. Continue engagement through dedicated events and services such as science or training workshops, enhance data viewing and access services and development of best practice guides.

3. Engage with new users through co-organised events targeting new communities in collaboration with other networks/RIs, approaching new countries and strengthening links with the private sector.

4. Enhance Euro-Argo visibility with the general public through outreach activities such as education (e.g. Ocean Observer initiative), and the scientific community through scientific publication monitoring, use cases and scientific highlights.

The list of activities is outlined in → Table 4 p. 21.

**TABLE 4: TASKS TO DEVELOP THE ENGAGEMENT WITH THE EUROPEAN ARGO USER COMMUNITIES & STAKEHOLDERS AND REINFORCE EURO-ARGO VISIBILITY**

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Consolidate user community</b>	Approach the users of Argo data and strengthen links amongst operational communities, private companies and research communities at national level	Monitor/update/consolidate from national analyses, user requirements and provide user defined services, etc. whenever possible	2020 within EA RISE Such analyses should be periodically updated (process to be defined 2022)
		<ul style="list-style-type: none"> <li>• Gather more feedback from the operational community and strengthen the links with Copernicus (CMEMS and C3S) and ECMWF</li> <li>• Results from OSE/OSSE should also contribute to refine the network implementation to better answer operational needs</li> </ul>	MoU CMEMS 2020 MoU C3S/ECMWF 2021 Continuous interaction
		Increase awareness while showing value of Euro-Argo membership	Continuous
		Continue engagement through dedicated events & services: <ul style="list-style-type: none"> <li>• Science meetings</li> <li>• Training workshops (data, technology)</li> <li>• Data access &amp; visualisation</li> <li>• Best Practices</li> </ul>	Continuous

TABLE 4: TASKS TO DEVELOP THE ENGAGEMENT WITH THE EUROPEAN ARGO USER COMMUNITIES & STAKEHOLDERS AND REINFORCE EURO-ARGO VISIBILITY

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
Engage new end users	Enlarge end-user communities in other research disciplines than physics and biogeochemistry	Organise European science workshops or conferences to attract new end-users/organise scientific session on Argo in international marine conferences gathering potential new end-users	<ul style="list-style-type: none"> <li>• Every 2 years for science workshop</li> <li>• When appropriate for joint events</li> </ul>
		Develop links with the marine resources and fisheries management communities possibly through the Copernicus Marine Environment Monitoring Service (CMEMS)	Deliverable within EA RISE 2021
		Approach new countries developing new scientific partnerships (e.g. around Marginal Seas and high latitudes)	Progress report within EA RISE 2021
Strengthen the links with the private sector		Engage with sensors & floats manufacturers (organisation, participation & invitation in dedicated events)	Progress report within EA RISE 2021
Approach EU monitoring programmes (e.g. MSFD)	Highlight the Argo contribution towards implementing national monitoring programmes (describe Argo in national MSFD monitoring requirements)		Deliverable Within EA RISE 2021

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
Educational and outreach initiatives	Develop at national level educational and outreach activities related to Argo for public awareness	Organise with European and International community outreach and educational initiatives to promote and enhance Argo visibility and promote its impacts (Ocean Observers, summer schools, Argo-online school, etc.)	2020 within EA RISE
		Rebuild the educational website	2022
General communication		<ul style="list-style-type: none"> <li>• Maintain up-to-date communication material &amp; write new documents (policy briefs, environmental impact leaflet, etc.)</li> <li>• Continue outreach activities (News Briefs, twitter, participation in events, etc.)</li> </ul>	Continuous
Scientific dissemination	Establish collaboration with universities (MSc, PhD programmes)	<ul style="list-style-type: none"> <li>• Systematic collection of publications based on Argo data by European scientists</li> <li>• Highlight through use cases</li> </ul>	Continuous
Integrate Euro-Argo in national roadmaps	Approach ministries at national level to develop a communication strategy	Design policy briefs to help	Continuous



**Objective 5**

**OPERATE THE EURO-ARGO ERIC OFFICE UNDER GOOD GOVERNANCE**

The primary aim is to operate the Euro-Argo ERIC within the defined governance and to continue to fulfil commitments within on-going European projects (i.e. submission of delive-

rables, completion of tasks to MOCCA, Euro-Argo RISE, ENVRI-FAIR and ERIC Forum). An essential objective is to develop Key Performance Indicators (KPIs) for the Euro-Argo impact assessment. Euro-Argo ERIC intends to expand its network and approach new countries to extend the membership of the ERIC, see → Table 5 p. 24.



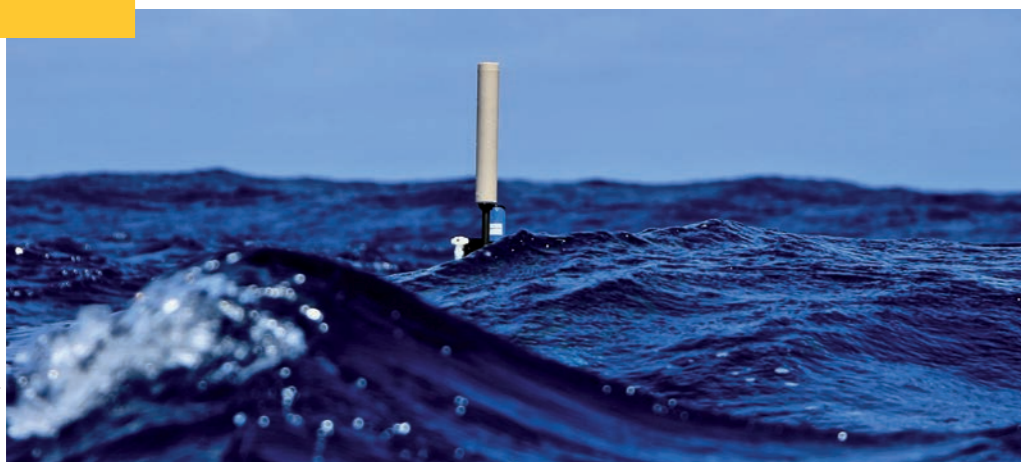
© A. Gonzalez Santana/EO

**TABLE 5: TASKS TO OPERATE THE EURO-ARGO ERIC**

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Optimise the management</b>	Contribute to Euro-Argo ERIC Management Board and Council, ensuring continuity with national and international contributions	Continue Euro-Argo ERIC management with the governance bodies including risks Management and Human Resources	Continuous
<b>Connect with European initiatives</b>	Prepare National Long-Term Sustainability Plans as a contribution to the Euro-Argo ERIC Long-Term Sustainability Plan	Develop new KPIs to better monitor the socio-economic impact of the Euro-Argo ERIC	First version 2021
		Prepare ESFRI 2021 evaluation	2021
		Prepare Long-Term Sustainability Plan and update of the Strategy for next decade	Deliverable within EA RISE 2022
		Ensure efficient networking activities within the ESFRI context	Continuous Will be strengthened within ENVRI-FAIR and ERIC Forum until 2022
		EU tender, watch for new proposal elaboration	Continuous

Activities to be carried out to achieve the objective	Tasks to be performed by		Deadline for task completion
	National members	ERIC Office	
<b>Coordinate/ Supervise EU funded projects</b>	Contribute to successfully funded EU projects (MOCCA, EA RISE, ENVRI-FAIR, ERIC Forum, EuroSEA)	Ensure coordination and continued submission of EU project deliverables (MOCCA, EA RISE) as well as contribute to successful EU funded project (ENVRI-FAIR, ERIC Forum and EuroSEA)	2020 MOCCA 2022 EA RISE and ENVRI-FAIR and ERIC Forum 2023 for EuroSEA
<b>Enlarge Euro-Argo ERIC membership</b>	Develop national Argo programmes with their ministries and institutes to enlarge the national Argo community	Approach new countries to extend Euro-Argo ERIC membership	Continuous
<b>Develop collaboration to deploy floats in poorly sampled areas</b>	Approach international research programmes/campaigns to target specific areas	Approach new private vessels or industry vessels, sign agreement if necessary	2022 for first evaluation
<b>Prepare or contribute to EU proposals in line with the Euro-Argo strategy</b>	Prepare National Long-Term Sustainability Plans as a contribution to the Euro-Argo ERIC Long-Term Sustainability one	Develop new KPIs to better monitor the socio-economic impact of the Euro-Argo ERIC	Continuous

# CONCLUSION



© M. Maupas / GENAVIR

Over the past five years, the Euro-Argo ERIC has demonstrated its ability to implement, develop and manage the European contribution to the international Argo programme. Many activities and services have been implemented, but momentum must continue throughout the next phase of Argo. The challenges are multiple:

1. Core Argo activities need to be maintained.
2. Extensions towards the **“global, full-depth and multidisciplinary Argo missions”** need to be further developed in a sustainable way.
3. Engagement with existing and new end users is necessary to meet societal needs. Euro-Argo is not alone and must evolve within a landscape of complementary RIs. An integrated ocean observing system approach has been defined by several observation networks (GOOS at global scale, SOOS and AtlantOS at basins level and EOOS at European scale) in their respective strategies as a contribution to the UN Decade of Ocean Science for Sustainable Development. Euro-Argo must contribute to this landscape to complement the other networks as efficiently as possible.

To sustain and develop the Euro-Argo ERIC over the next five years, five main objectives have been identified and translated into specific tasks and activities as detailed above. Some of these objectives will be achieved through the existing DG-MARE MOCCA project and new European H2020 projects (Euro-Argo RISE, ENVRI-FAIR, ERIC Forum and EuroSea) that started in 2019. Sustainability of the RIs will be a key issue to solve in the coming years.

The Euro-Argo ERIC will pursue its primary objective of enhancing and extending capabilities of the European contribution to the Argo network, focusing on the following objectives:



► **Objective 1: Sustain the existing Core Argo mission** through the optimisation of the network implementation, extension of float lifetime, diversification of sensors for temperature/salinity measurements and optimisation of data management procedures.



► **Objective 2: 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.** Euro-Argo ERIC will develop and sustain the Deep and BGC-Argo extensions from platform procurement to data delivery, including quality control and product development for users. The Euro-Argo ERIC will contribute to the improvement of the quality control procedures of parameters measured by Argo (i.e. pressure, temperature, salinity, oxygen, chlorophyll-a, suspended particles, downwelling irradiance, nitrate and pH) in support of observing Essential Ocean Variables (EOVs) by developing a reliable end-to-end value chain from observation to products.



► **Objective 3: 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).** Euro-Argo will guarantee the long-term technological sustainability of the European contribution to Argo by qualifying new sensors and providing opportunities for new SMEs to enter the Argo float market, in collaboration with other RIs and networks. The integration of Euro-Argo within the EOOS shall be achieved through links with other ESFRI Marine Research Infrastructures and basin-scale ocean observing systems (e.g. AtlantOS and SOOS).



► **Objective 4: Foster and develop engagement with the European Argo user communities and reinforce Euro-Argo visibility.** The engagement of new end-users is an important phase, as it will improve services (research, regulatory and operational systems). The visibility of the ERIC is important and the impact of the Argo data in all its applications will be promoted to different types of stakeholders, including the general public to raise awareness, in particular among new Argo data users.



► **Objective 5: Operate the Euro-Argo ERIC Office under good governance, improving the Euro-Argo ERIC coordination, securing the ERIC contribution to EU funded projects, extending membership.** The technological and financial sustainability of Argo implementation will also depend on developing Argo's innovation potential and promoting collaboration between researchers and the private sector (SMEs and industry) as well as with stakeholders.

**Euro-Argo is ready for this next step.**



© Piotr Kuklinski/Arntlab

# LIST OF ACRONYMS

<b>AIC</b> Argo Information Centre	<b>DBCP</b> Data Buoy Cooperation Panel	<b>EUROFleet</b> An alliance of European marine research infrastructure to meet the evolving needs of the research and industrial communities	<b>EOV</b> Essential Ocean Variable	<b>Med-ARC</b> Mediterranean and Black Seas ARC
<b>ARC</b> Argo Regional Centre	<b>DMQC</b> Delayed-Mode Quality Control	<b>EMBRC</b> European Marine Biological Resources Centre	<b>EuroGOOS</b> European regional alliance of GOOS	<b>MOCCA</b> Monitoring the Oceans and Climate Change with Argo
<b>AtlantOS</b> Atlantic Observing System	<b>ECMWF</b> European Centre for Medium-Range Weather Forecasts	<b>EMSO</b> European Multidisciplinary Seafloor and water column Observatory	<b>ESFRI</b> European Strategy Forum on Research Infrastructures	<b>MoU</b> Memorandum of Understanding
<b>BEERI</b> Board of European Environmental Research Infrastructures	<b>ERIC</b> European Research Infrastructure Consortium	<b>ENVRI FAIR</b> ENVIRONMENTAL Research Infrastructures building FAIR services accessible for society	<b>GDAC</b> Global Data Assembly Centre	<b>MSFD</b> Marine Strategy Framework Directive
<b>BGC</b> BioGeoChemical	<b>EA RISE</b> Euro-Argo RISE, Euro-Argo Research Infrastructure Sustainability and Enhancement	<b>ENVRIplus</b> Environmental Research Infrastructures Providing Shared Solutions for Science and Society	<b>GOOS</b> Global Ocean Observing System	<b>NA-ARC</b> North Atlantic ARC
<b>C3S</b> Copernicus Climate Change Service	<b>EuroSea</b> Improving and Integrating European Ocean Observing and Forecasting Systems for Sustainable use of the Oceans	<b>EOOS</b> European Ocean Observing System	<b>ICOS</b> Integrated Carbon Observation System	<b>RI</b> Research Infrastructure
<b>CMEMS</b> Copernicus Marine Environment Monitoring Service			<b>JCOMMOPS</b> Joint technical Commission for Oceanography and Marine Meteorology <i>in situ</i> Observing Platform Support	<b>SME</b> Small and Medium Enterprises
<b>CTD</b> Conductivity, Temperature, Depth			<b>JERICO</b> Joint European Infrastructure Network for Coastal Observatory	<b>SOARC</b> Southern Ocean ARC
<b>DAC</b> Data Assembly Centres				<b>SOOS</b> Southern Ocean Observing System

# BIBLIOGRAPHY

**Johnson, G. C. (2008).**  
Quantifying Antarctic Bottom Water and North Atlantic.  
► *Deep Water volumes. Journal of Geophysical Research*, 113, C05027.  
<https://doi.org/10.1029/2007JC004477>



Conception of the graphic design: Marie-Astrid Bailly-Maitre  
Graphic design: Marie-Astrid Bailly-Maitre and Klara Corvaisier  
Illustration: Thomas Haessig  
Printing: Cloître Imprimeurs



Euro-Argo ERIC  
Campus Ifremer  
Technopôle Brest Iroise  
1625 Route de Sainte-Anne  
29280 Plouzané  
France



See also Activity Report 2014-2018

Tel.: +33 (0)2 98 22 44 83 | [www.euro-argo.eu](http://www.euro-argo.eu) | [euroargo@ifremer.fr](mailto:euroargo@ifremer.fr) | [@EuroArgoERIC](https://twitter.com/EuroArgoERIC)