Euro-Argo Report – AST26

The Euro-Argo ERIC (European Research Infrastructure Consortium) organises and federates European contributions to Argo (www.euro-argo.eu). The Euro-Argo ERIC and its governance structure (Council, Management Board and Science and Technological Advisory Group) was set up by the European Commission in May 2014, with 9 funding countries. Currently the Euro-Argo ERIC has twelve members and one candidate member. The Euro-Argo ERIC is made up of a central office based in France (Ifremer, Brest) and distributed national facilities (Figure 1). The distributed national facilities operate with direct national resources. As part of the Euro-Argo Research Infrastructure, they agree to a multi-annual commitment of resources (in particular in terms of floats to be deployed and for the data system), and to coordinate their activities through the Euro-Argo ERIC. The Euro-Argo ERIC delegates some of its activities to the national facilities who have the relevant expertise (e.g., data management and quality control, float deployment), and according to their areas of responsibility.

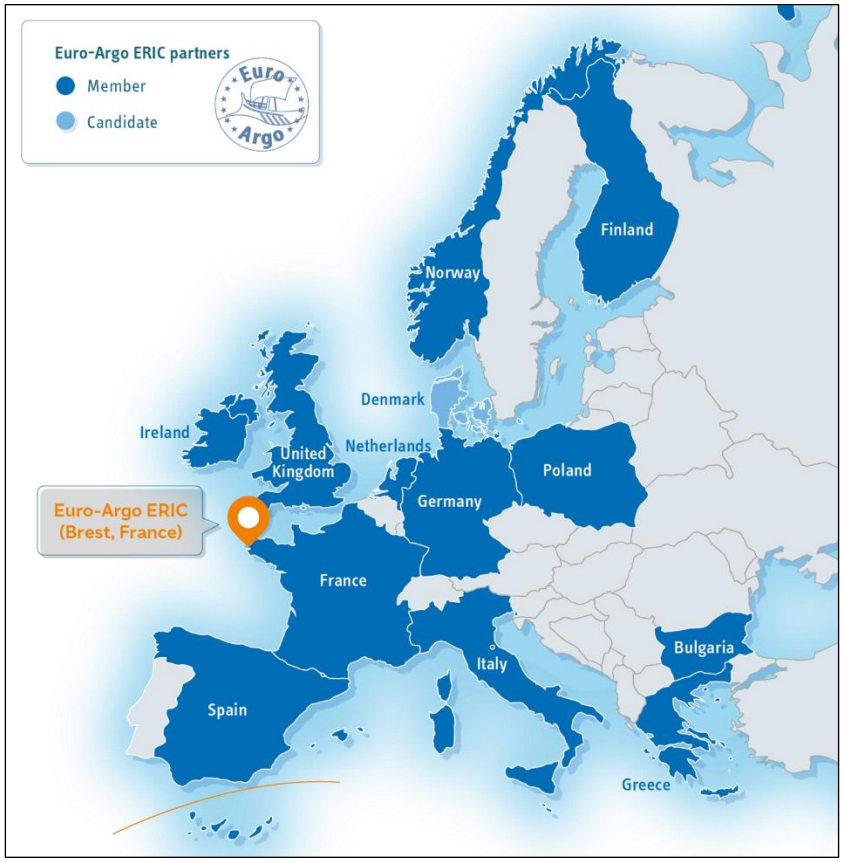


Figure 1. Euro-Argo ERIC membership in 2024

This report presents the contribution of EU funded Argo activities as well as the integrated view of EU plus national European contributions.

1. **The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2024)**

    a. **floats deployed and their performance**

Float deployed

In 2024, according to declarative numbers on OceanOPS, **186 floats were deployed by Euro-Argo** (235 in 2023), including **only 1 EU-funded float** and 185 funded by national members. Table 1 below shows the repartition of floats per variable measured and per type of floats. The EU-funded float is a Deep-O_2 float redeployed in the Greenland Sea after being recovered in the South Atlantic Ocean and sent to nke for refit (float initially funded by the AtlantOS EU project).

Table 1. European floats deployed in 2024, per parameter measured (blue, 7 first columns) and per type of float (green, 7 last columns) following the AST classification.

	Variables							Float types						
	T&S	O2	Chla	BBP	NO3	Irradiance	pH	core	core+ O2	2-3 var BGC	4-6 var BGC	Deep	Deep +O2	**Total (floats)**
EU funded	1	1	0	0	0	0	0	0	0	0	0	0	1	**1**
Member states	185	87	25	25	15	23	19	98	37	5	25	0	20	**186**
total	**186**	**88**	**25**	**25**	**15**	**23**	**19**	**98**	**37**	**5**	**25**	**0**	**21**	**186**

In March 2025, about 80% of the floats deployed in 2024 are still active (148). Most of the inactive ones are presently under ice, and about 10 floats are dead for technical or unexplained reasons.

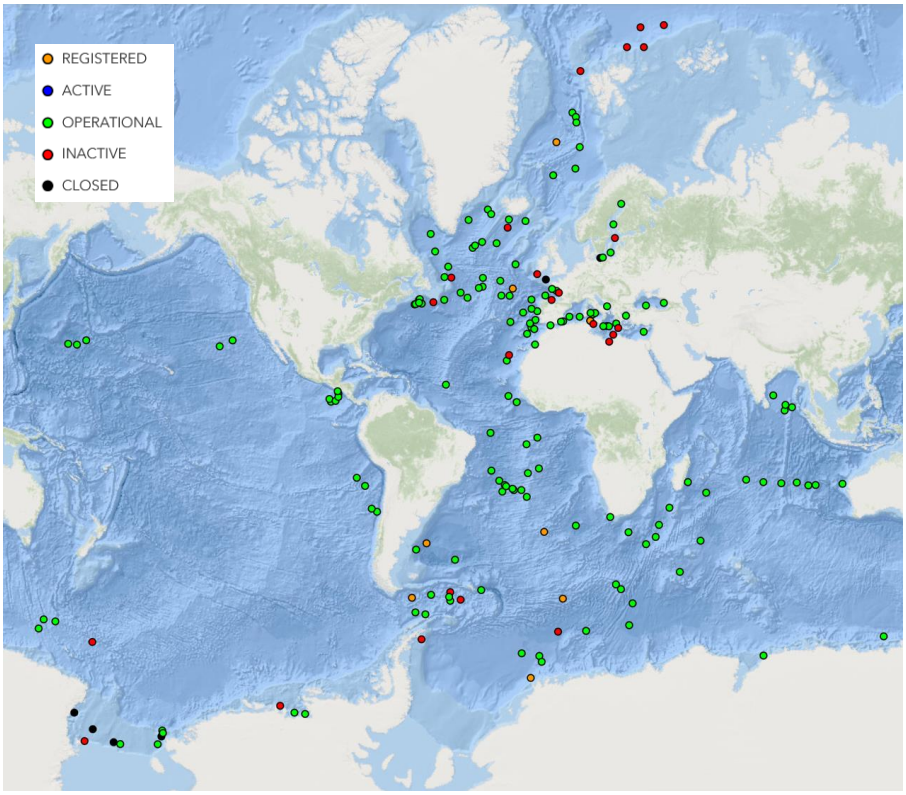


Figure 2. Floats deployed by Euro-Argo in 2024 (latest location as of 28 March 2025). Credit: OceanOPS.

In 2024, Euro-Argo continued the implementation in its usual areas of interest, i.e., Nordic Seas, Atlantic Ocean, European Marginal Seas, Southern Ocean and Arctic Ocean. Floats were also deployed in the Pacific and Indian Ocean as part of the international effort to fill observation gaps (Figure 2).

The European contribution to the Deep-Argo mission was higher than last year: **21 Deep floats** deployed in 2024 versus **8 in 2023** (15 in 2022), accounting for a delay in 2023 deployments. Euro-Argo deployed **14 BGC floats with 6 variables** (17 last year), and almost half of the total number of Euro-Argo floats deployed in 2024 are **equipped with an oxygen sensor (47%).**

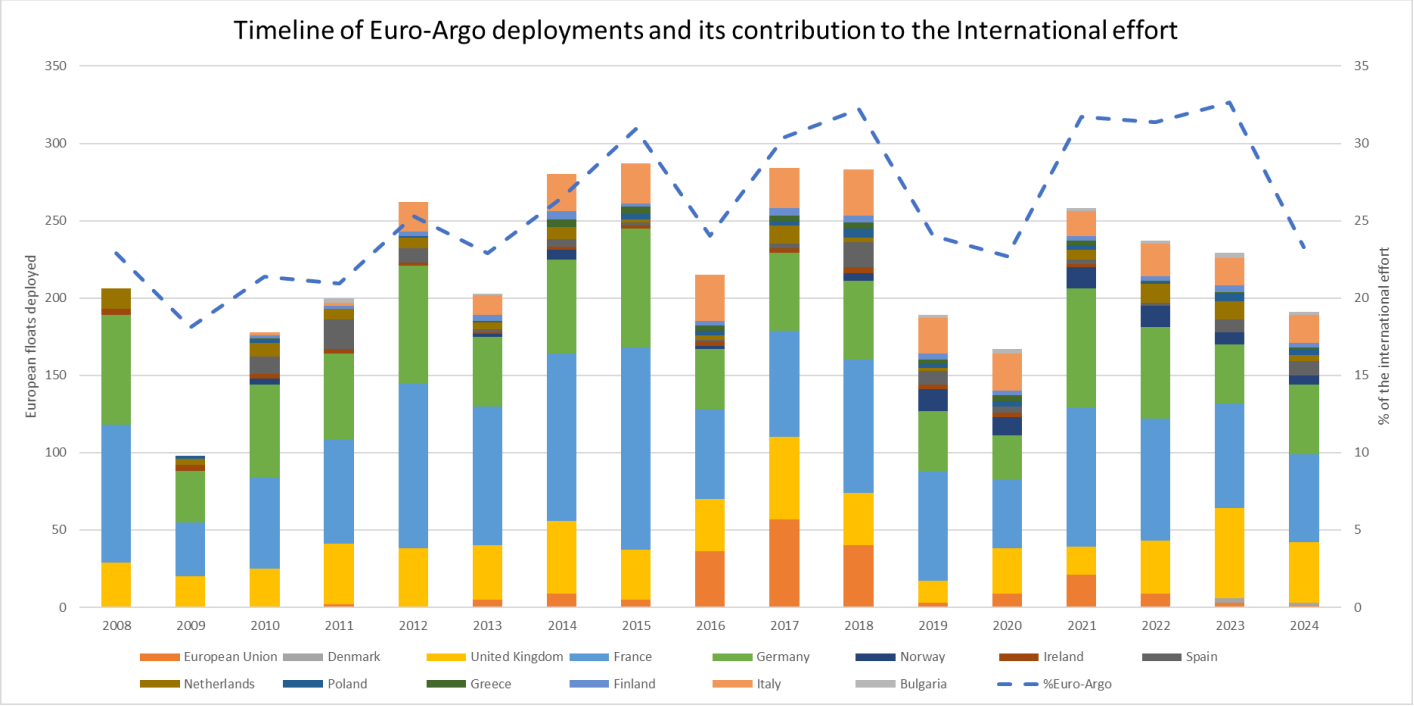


Figure 3. Number of floats deployed per year. Colors show the national programmes.

For the 4th consecutive year, the annual number of Euro-Argo deployments is decreasing (Figure 3), and is now below 200 floats - whereas it is estimated that Euro-Argo should deploy ~300 units annually to achieve its objective to implement 25% of the OneArgo array.

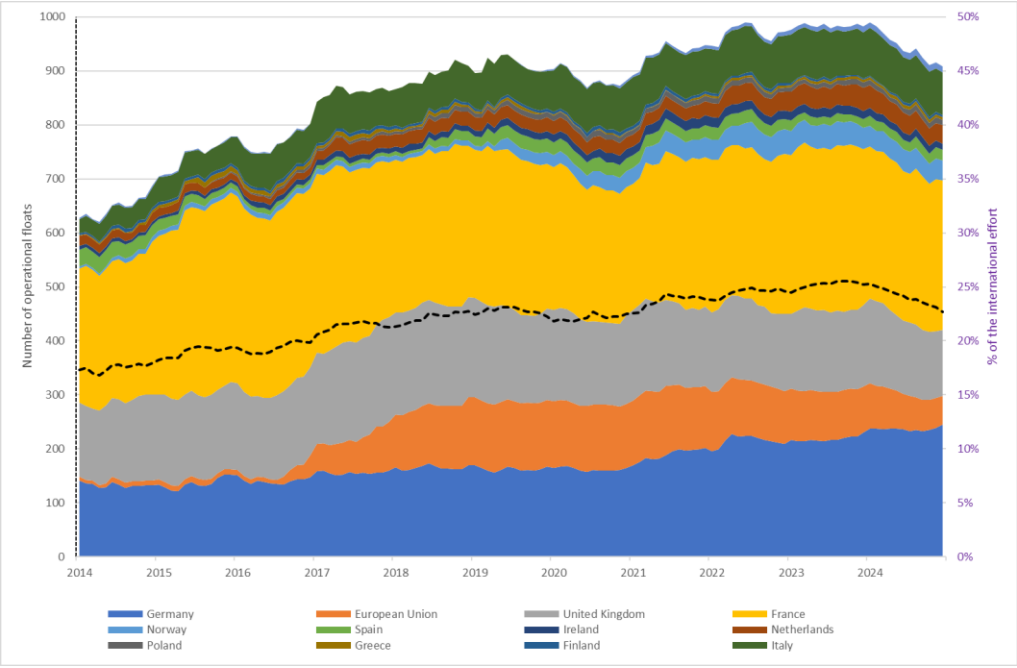


Figure 4. Number of European operational floats as a function of time. Colors show the national programmes.

Similarly, the number of Euro-Argo operational floats (Figure 4) is declining, with ~910 active floats at the end of 2024. This is due to the decrease in number of deployments in the past years, and **now a sharp drop of the European Union contribution is clear since the 2016-2018 MOCCA EU-project fleet is dying and not being replaced** (dark orange in Figures 3 & 4). No new initiative has replaced or pursued this 150-float investment to become a sustained co-funding from the EC.

This decrease is slightly compensated by overall increased float's reliability (not shown), but some missions (Deep, BGC) still show shorter lifetimes.

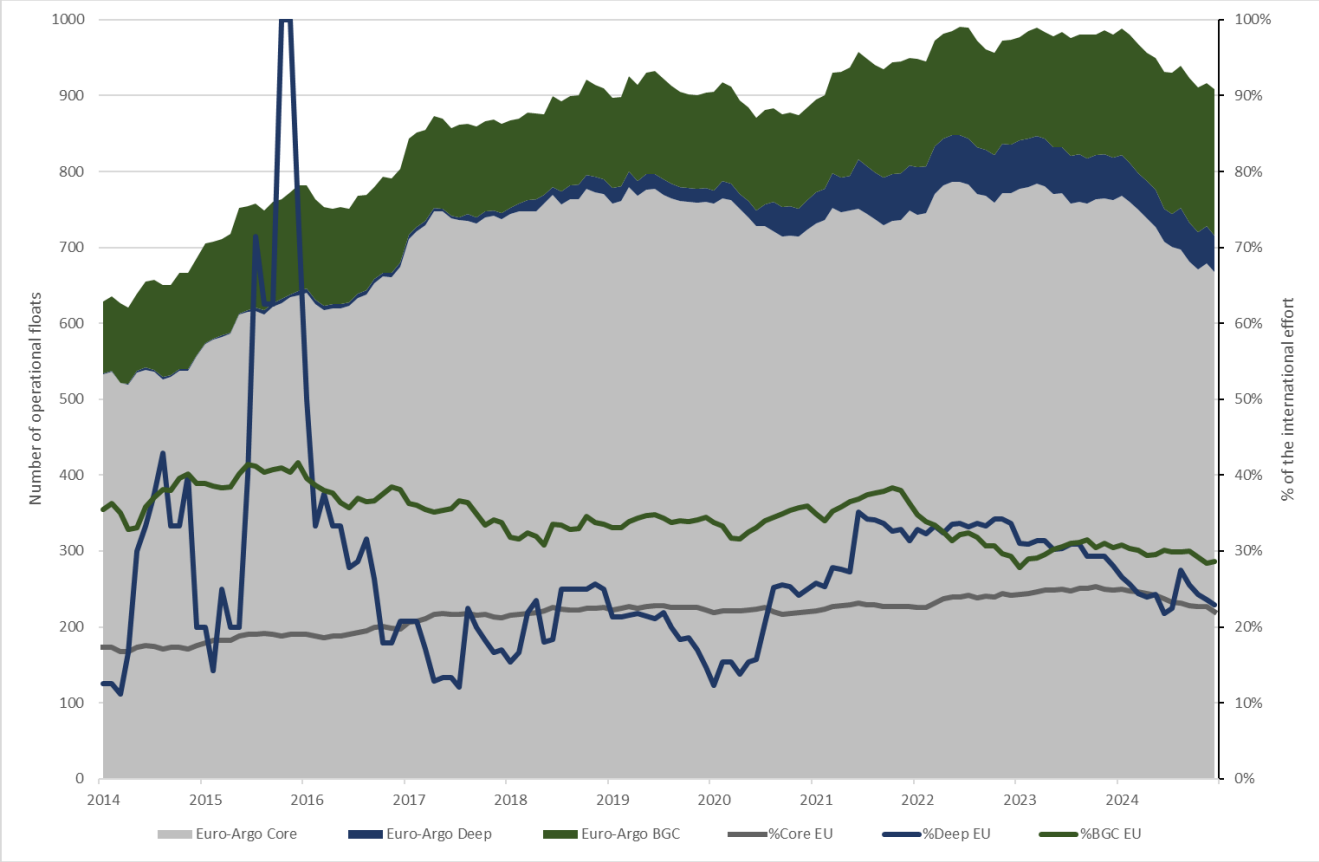


Figure 5. European operational floats as a function of time, for the core-Argo, BGC-Argo and Deep-Argo missions.

Regarding the different missions (Figure 5), our contribution to Core is still predominant but globally decreasing, BGC is increasing and Deep slowly decreasing. Our current implementation with respect to our 2030 strategy (25% of OneArgo) is quite below objectives, especially for the BGC and - above all - Deep missions.

In all cases (number of deployments, number of active floats, share of the international effort), **Euro-Argo contribution is decreasing**.

2024 inactive floats

Table 2 below shows the results of Euro-Argo analysis of ending causes for all Euro-Argo floats that reported a last position in 2024.

Table 2. Ending causes of European floats which died in 2024, grouped by ending causes categories.

Ending causes of the 213 Euro-Argo floats that became inactive in 2024	**Nb floats**
battery_end_of	71
battery_end_of,stuck_on_surface	59
unknown	36
recovered_intentional	13
battery_end_of,recovered_intentional	8
battery_failure,stuck_on_surface	5
battery_end_of,stuck_on_surface,beached	3
recovered_unintentional	2
sensor_ctd,stuck_on_surface	2
sensor_ctd,stuck_on_surface,beached	2
iced	2
unknown,stuck_on_surface	2
sensor_ctd,unknown	1
unknown,recovered_unintentional	1
unknown,location	1
stuck_on_surface,beached	1
unknown,sensor_other,grounded	1
telemetry,unknown	1
internal_vacuum	1
sensor_ctd,recovered_unintentional	1
Total	**213**

On the 213 Euro-Argo floats that became inactive in 2024:

- **141 (66%) worked until battery exhaustion**. A bit less than half of them ended drifting at the surface (known Arvor behaviour)
- **25 (12%) have been recovered** (4 unintentionally, caught by a ship)
- On the 56 remaining floats, below is a description of ending causes (non-disjoint set) status:
    - 6 beached to shore
    - 7 experienced a CTD sensor issue or failure
    - 2 left permanently under ice
    - 7 were Arvor RBR floats, including 5 that had a very rapid battery failure (currently still unexplained reason)
    - About 40 became inactive for unknown or unexplained reasons

- Some technical issues could be determined for 2 floats: internal vacuum or telemetry

Table 3. Performances of 141 Euro-Argo floats that became inactive in 2024 having exhausted their batteries

PLATFORM_ TYPE	Nb floats	Average of AGE (years)	StdDev of AGE (years)	Average of NB_CYCLES	StdDev of NB_CYCLES
APEX	32	6.3	2.1	264	57
ARVOR	81	6.1	1.7	313	122
ARVOR_D	17	3.4	0.3	127	12
NAVIS_EBR	4	6.7	0.8	246	31
NOVA	1	7.3		269	
PROVOR	2	7.2	0.3	284	18
PROVOR_III	3	3.7	2.0	222	55
PROVOR_V	1	3.0		344	
Total	**141**	**5.8**	**1.9**	**275**	**114**

Recoveries

Euro-Argo maintains several KPIs on the number of recovered floats per year:

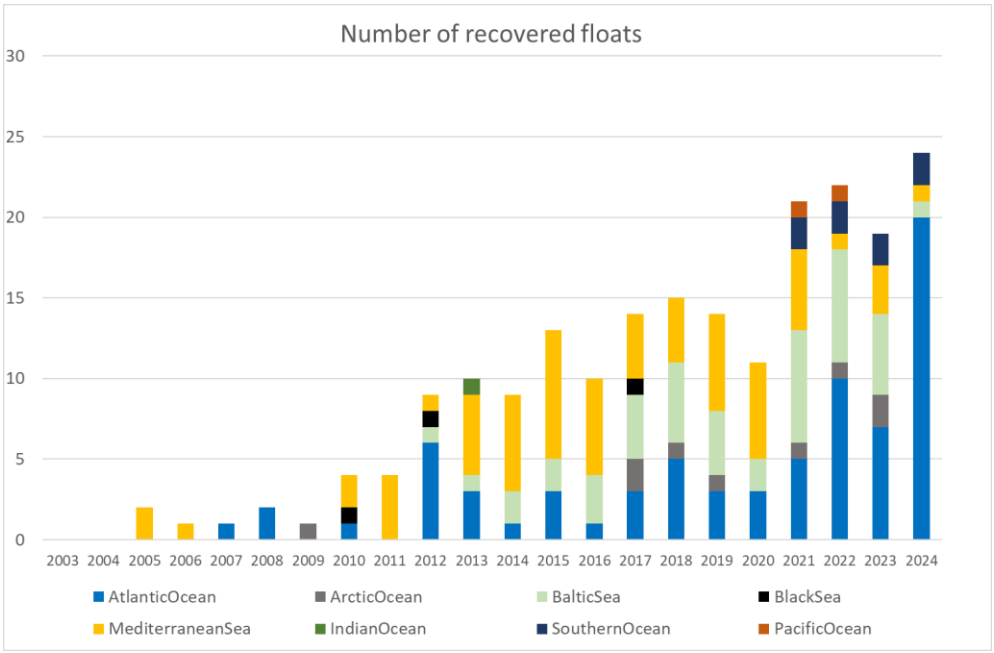


Figure 6. Number of Euro-Argo floats recoveries per year of recovery. Colors show the region of the recovered floats.

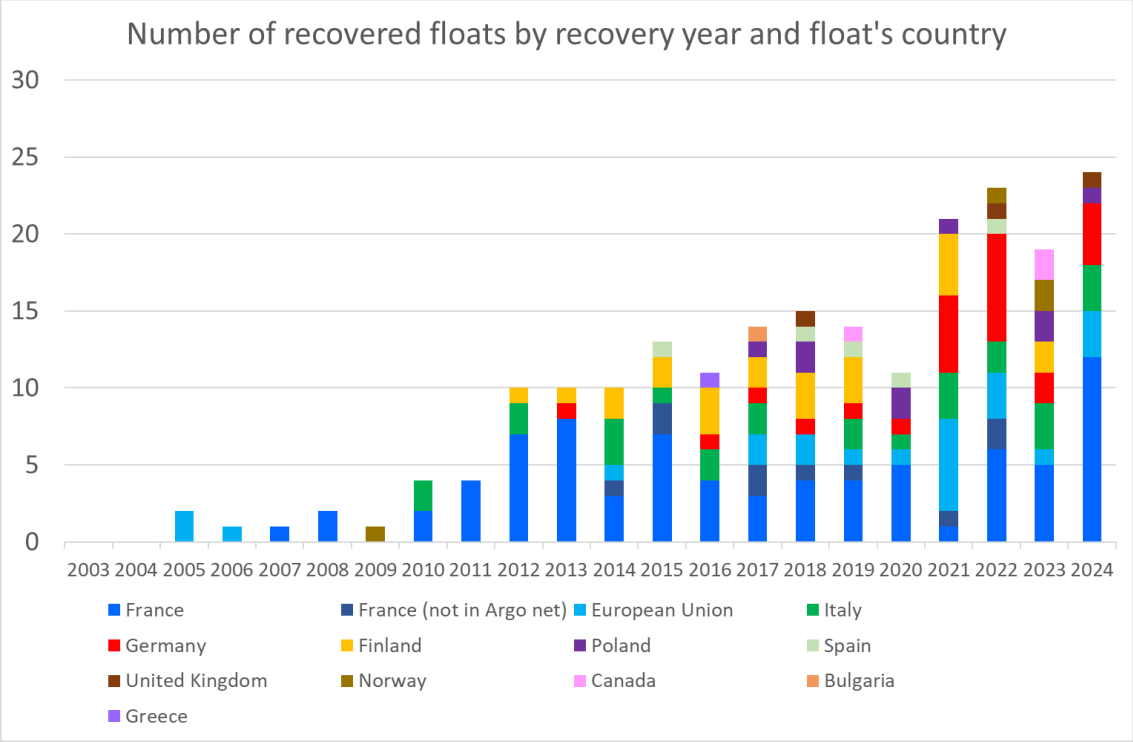


Figure 7. Number of Euro-Argo floats recoveries per year of recovery. Colors show the national program of the recovered floats (may be different from the recovery ship and/or person who organised the recovery).

Euro-Argo is engaged in developing an Argo recovery pilot programme, and aspires to increase the number of recoveries in the coming years. Several European and national projects are and will support these activities (e.g., GEORGE and Euro-Argo ONE EU-projects).

b. technical problems encountered and solved

See national reports of Euro-Argo members.

c. status of contributions to Argo data management including:

i. the status of your DAC, if applicable

All European floats data are decoded and processed in Real Time by Coriolis and BODC DACs (respectively 84% and 16% of the 44427 European profiles in 2024), and DMQC of T and S parameters is currently shared between 7 institutes (BSH, OGS, Ifremer, BODC, IMR, IOPAN and IEO). European partners are also strongly involved in the development of DMQC procedures and their implementation for Deep Argo and BGC Argo (especially for BBP, Chl-A and Irradiance) or for Argo operating in specific areas (e.g., Baltic Sea), as well as in the monitoring of high salinity drifting floats.

ii. **status of high salinity drift floats**

iii. **decoding difficulties**

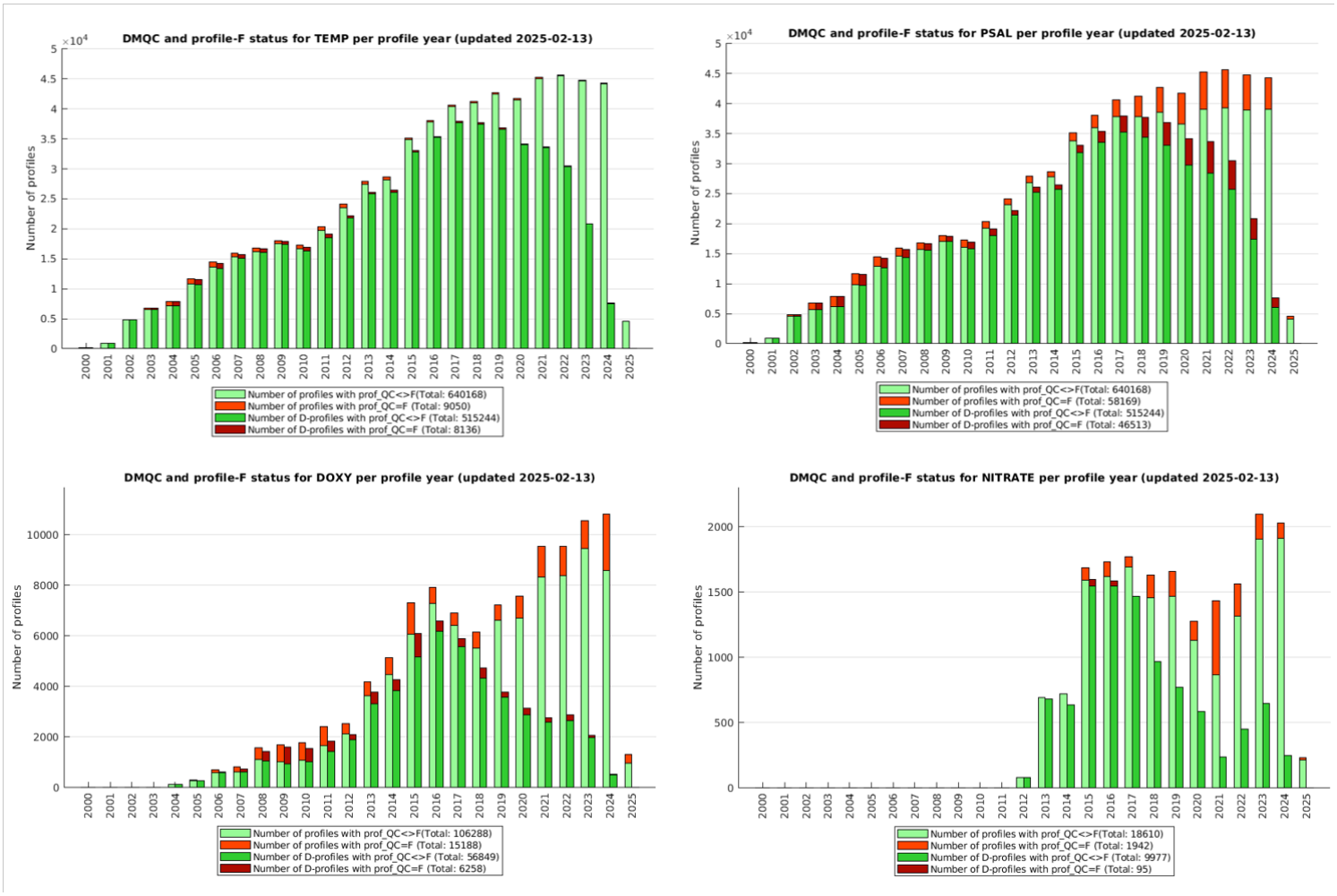
iv. **real time BGC implementation**

v. **real time Deep implementation**

See UK and French national reports.

d. status of delayed mode quality control process

Figure 8 shows the status of DMQC of European profiles (Coriolis and BODC DACs) and their quality, for each of the 8 OneArgo parameters.



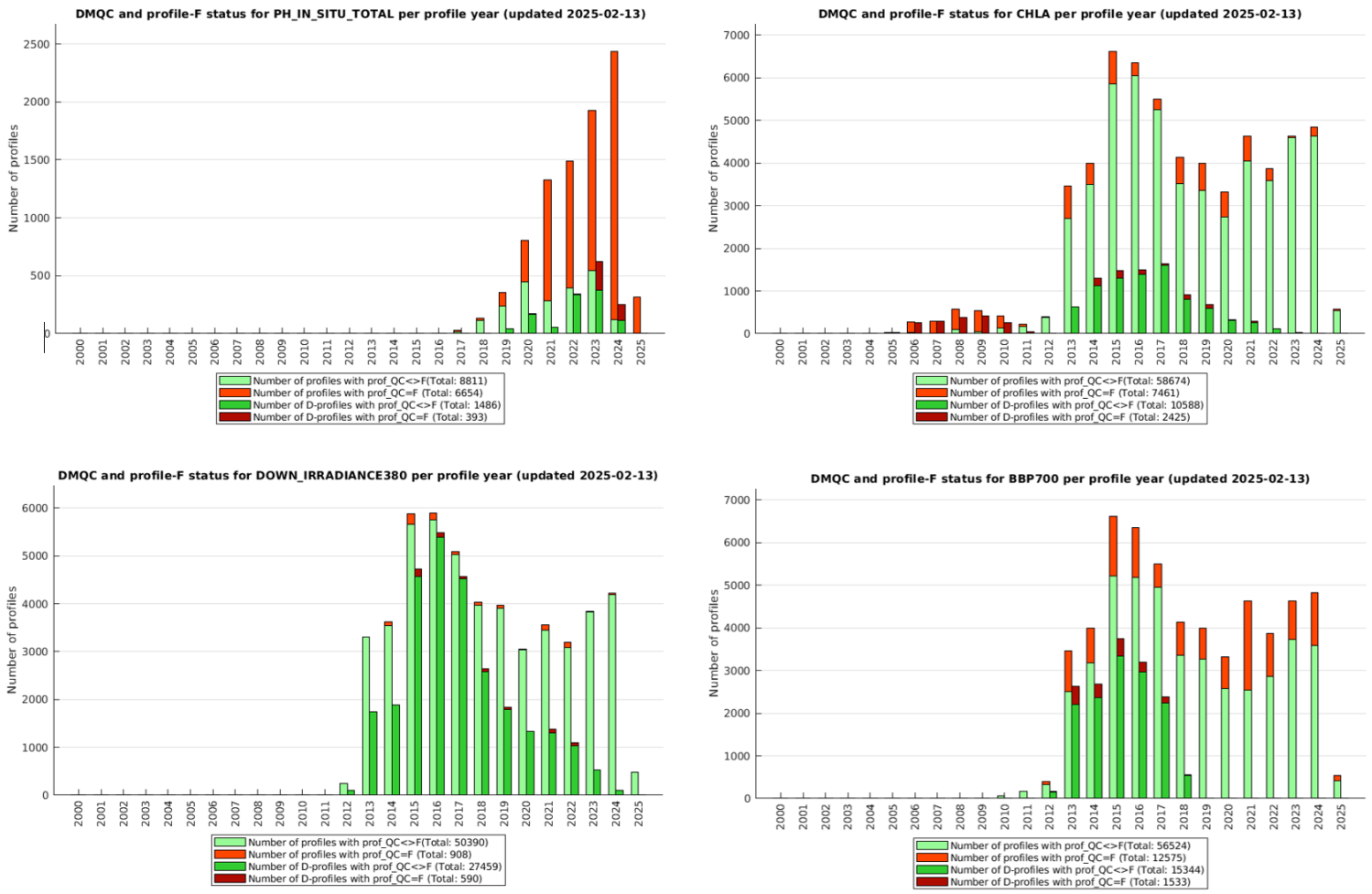


Figure 8. European DMQC status and data quality, in number of profiles, as a function of the year of observation, for each of the OneArgo variables. Light red/green is for RT profiles and dark red/green is for DM profiles.

2. Present level of, and prospects for, national funding for Argo including a summary of the level of human resources devoted to Argo, and funding for sustaining the OneArgo mission: Core, BGC, Deep, Polar, Spatial (equator, WBCs)

In 2024, the Euro-Argo ERIC office was a team of ~8 FTE (5.9 permanent, 1 project-funded and 0.75 consultant). This team supports European countries to sustain and optimise the European contribution to the Argo International programme, and comes in addition to the national members' personnel. The office team salaries are funded thanks to money coming from both Euro-Argo membership fees paid by the countries (long term commitments) and EU-funded project grants.

Apart from 10 floats funded through Horizon Europe TRICUSO project (other projects only fund Argo related activities / salaries) there is currently no secured plan to get resources from the EU to buy and operate floats.

However, the office team, together with the Euro-Argo members, are putting a lot of efforts in advocacy activities towards the European Commission and its various components, and in particular in the context of the Copernicus Programme, one of the main European users of Argo data. Contacts have been made with key people within the European Commission instances and a Working Group including Euro-Argo representatives of Euro-Argo Management Board and Council has been set-up to pursue this long-term effort collaboratively at the political level.

Activities are also undertaken with Copernicus Entrusted Entities (e.g., Mercator Ocean International, EUMETSAT, ECMWF, etc.). Some discussions occurred in 2023 between Euro-Argo (office) and both the satellite agencies (ESA and EUMETSAT) and modelers in charge of the Monitoring Forecasting Centres of the Copernicus Marine Service (COINS project). Euro-Argo organised, in collaboration with the European Environmental Agency (EEA) which is in charge of the *in situ* component of Copernicus, a fruitful workshop at Mercator Ocean International in March 2024 in order to (i) better assess the needs of these key Argo data users and (ii) discuss leads to co-advocate for increased European fundings for the OneArgo implementation in Europe. A report summarizing the discussions and providing recommendations is available here. These activities will be continued in the framework of the newly awarded Euro-Argo ONE EU project, in collaboration with Euro-Argo members and through the EEA-funded project IDEA, one objective of which is to define the new Copernicus strategy in terms of in situ data from 2028 onwards.

3. **Summary of deployment plans: as was done last year, please fill out this spreadsheet to help us understand the progress towards implementation of OneArgo. There is one new column this year for floats being deployed with experimental sensors such as UVP, C-sensor, etc. This spreadsheet is to be returned separately by 17 March to help prepare for the meeting. It can be sent to Megan or dropped in this folder link.**

See this table for EU-funded floats.

The table below presents the aggregated deployment plans for 2025 and 2026 for all Euro-Argo national + European contributions, per float types and deployment basin:

Euro-Argo consolidated plans	2025	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O	Total (any float type)
Nordic Seas (Norwegian, Iceland, Greenland Sea)		9	2		3			14
Mediterranean Sea		7	8		17		5	37
Black Sea		1	2					3
Baltic Sea			4	2				6
Southern Ocean (< 60°S)		55	10	1			5	71
Arctic Ocean		2	1					3
Global Ocean		100	35	7	13	3	6	164
Total		**174**	**62**	**10**	**33**	**3**	**16**	**298**

Euro-Argo consolidated plans	2026	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O	Total (any float type)
Nordic Seas		2	6		4	2	3	17
Mediterranean Sea		2	6	4	7		3	22
Black Sea		1	2					3
Baltic Sea			3	2				5
Southern Ocean		10	7		12			29
Arctic Ocean		12						12
Global Ocean		74	33		14		10	131
Total		**101**	**57**	**6**	**37**	**2**	**16**	**219**

4. **Summary of any research and development efforts over the past year to try new sensors or improve float technology. This could include new collaborations with vendors or other partners.**

See national reports of Euro-Argo members.

As part of the EU-funded GEORGE project, a recovery cruise (NAARCO) was jointly organized by Ifremer/Argo-France and Euro-Argo. It took place in the North Atlantic on board Skravik's catamaran MORSKOUL. The goal of NAARCO was to act as a proof of concept, demonstrating that a dedicated Argo recovery cruise using a low-carbon footprint vessel can provide an effective solution. The MORSKOUL vessel is at 47.5-foot catamaran, operated by the local company Skravik which provides support services for low-carbon scientific operations at sea aboard sailboats. During the cruise, 10 Argo floats were successfully recovered: 5 Deep Arvor (equipped with O2 sensor) and 5 Arvor (core-Argo). They were either reaching the end of their life (around 10 cycles worth of remaining battery) or had deficient sensors (high salty drifts). To prove the efficiency of such a project, NAARCO needed to:

- Collect a significant number of floats either in end of life or somehow deficient;
- Operate in a high-sea area representative of the Argo network on a consistent scale;
- Have a low-carbon footprint;
- Be cost-effective in terms of the value of the collected floats.

All goals were met, although the cost-effectiveness still needs to be quantified by considering the cost of refitting the recovered floats.

5. **Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers. Please also include any links to national program Argo web pages to update links on Argo websites.**

At the European level, the main operational users of Argo data are Copernicus, ESA, EUMETSAT and ECMWF.

6. **Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo. These might include tasks performed by OceanOPS, the coordination of activities at an international level and the performance of the Argo data system. If you have specific comments, please include them in your national report. Also, during the AST-26 plenary, each national program will be asked to mention a single highlight or issue via a very brief oral report.**

Euro-Argo partners (floats under the Argo-France, Argo-Italy and NorArgo programmes) are still waiting for **10 certificates** in the framework of Seabird Abrupt Salinity Drift (ASD) warranty. The certificates were first requested mid-2024, but despite several interactions, including the provision of additional material showing evidence of ASD (late 2024), nothing has been received up to now. The last email to enquire about the certificate status was sent to Seabird in January 2025.

European partners are experiencing lead time and delays for receiving floats after maintenance that affect their planning. In addition, we are also facing increasing logistics and customs issues.

7. **Outreach and communication: please describe, in brief, outreach efforts within your national program over the past year. Also, if you've issued any communications, press releases, participated in articles, etc, please send the links. We are considering our social media strategy, so please let us know which social media you engage with and the corresponding handles.**

An analysis of the importance of Argo as a source of information for the last IPCC report was carried out, that led to the publication of an Infography, available here: https://infogram.com/argos-contribution-to-ipcc-reports-1h9j6q7pkj5954g

The Euro-Argo office team was also involved in the development of the international OneArgo brochure and co-authored the Greenan et al. (2024) paper published in Frontier for Young Mind.

The Euro-Argo office participated in the Adopt A Float programme, in collaboration with Argo-France, speaking in several classrooms in the Brest region and in other regions in France (remotely). The initiative is also being developed in various other European countries.

In early 2025, Euro-Argo left the X social media and opened an account on Bluesky: https://bsky.app/profile/euro-argo.eu. In parallel, it was also decided to enhance Euro-Argo's presence on Linkedin.

8. **To continue improving the quality and quantity of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include any CTD station data that was taken at the time of float deployments this year. Additionally, please list CTD data (calibrated with bottle data) taken by your country in the past year that may be added to the reference database. These cruises could be ones designated for Argo calibration purposes only or could be cruises that are open to the public. To help CCHDO track down this data, please list the dates of the cruise and the PI to contact about the data.**

See national reports of Euro-Argo members.

9. **Keeping the Argo bibliography (Bibliography | Argo (ucsd.edu)) up to date and accurate is an important part of the Argo website. This document helps demonstrate the value of Argo and can possibly help countries when applying for continued Argo funding. To help me with this effort, please include a list of all papers published by scientists within your country in the past year using Argo data, including non-English publications.**
There is also the thesis citation list (Thesis Citations | Argo (ucsd.edu)). If you know of any doctorate theses published in your country that are missing from the list, please let me know. Finally, if you haven't already sent me a list of Argo PIs in your country, please do so to help improve the statistics on how many papers are published including an Argo PI vs no Argo PIs.

See national reports of Euro-Argo members.

10. **Does your National Program have any deployment plans for RBR floats in the next couple years? If so, please indicate how many floats will you be buying in 2025 and 2026 (if known) and where they might be deployed.**

None of the few European floats (EU-funded) to be deployed in the coming years are equipped with RBR sensors. However, in the event of additional substantial grants from the European Union, Euro-Argo would follow the AST recommendations on the proportion of RBR-equipped floats.