

Argo France National Reports Argo Steering Team Meetings 26

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

Deployments (59)

59 floats were deployed in 2024:

- 30 T/S Core (including 4 Arvor-C),
- 2 T/S/O2,
- 6 BGC ,
- 19 Deep.

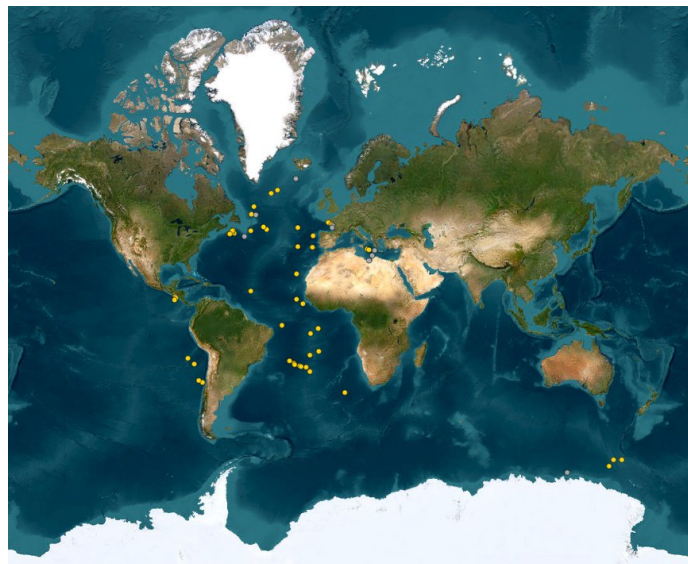


Figure 1 : Argo France 2024 deployments

The majority of 2024 deployments took place in the North Atlantic (CROSSROAD campaign) and South Atlantic (PIRATA and Vendée Globe). Two GMMC campaigns enabled deployments in the Pacific (SEPI-CAF & ARGO-DOME). One campaign took place in the Southern Ocean with the CSIRO Investigator. Finally, 5 TS floats were deployed in the Mediterranean during a SHOM campaign (Fig. 1).

Fleet monitoring

To date (January 2025), of the **59 floats deployed in 2024** :

- 52 are active (6 under ice)
- 2 ARVOR have reached the end of their battery life (SHOM high-frequency sampling),
- 2 ARVOR RBR have disappeared due to a problem identified but not resolved by nke/RBR,
- 1 Deep has disappeared without explanation,
- 1 Arvor-C has been trawled.
- 1 BGC (CTS Jumbo) disappeared probably due to sensor flooding issues,

The French fleet operational at the beginning of 2025 is made up of **67% ARVOR T/S, 11% DEEP, 6% T/S/O2 and 16% BGC.**

54 French floats disappeared in 2024, mainly due to battery depletion (>67%). **13** (~25%) of these floats were recovered at sea before disappearance (NAARCO and Arvor-C campaigns).

The **average age of the disappearances is 3.6 years**, mainly due to the low life expectancy of Deep Arvor.

b. technical problems encountered and solved

Deployments of Arvor-RBR floats were interrupted last year due to premature failure of few units. After investigation by RBR and NKE, no problems were detected. The deployments resumed, but we carefully monitor Arvor-RBR floats currently at sea.

c. status of contributions to Argo data management including:

i. the status of your DAC, if applicable

A detailed report on Coriolis DAC/GDAC data management activity for ADMT25 is available:

Carval, T., Coatanoan C., Schmechtig C., Racape V., Rannou J.- P., Dobler D. (2024). Argo data management report 2024, Coriolis DAC & GDAC & A-ARC. Ref. Ifremer/irsi/isi-dti/rap-24-024. Ifremer.
<https://doi.org/10.13155/102566>

ii. status of high salinity drift floats

- 10 warranty SBE41 CTD replacement credit provide by SBE were used in 2024.
- 7 floats are on Euro-Argo's list for a second request to SBE

iii. decoding difficulties

N/A

iv. real time BGC implementation

A new Real Time (RT) correction for the physiological ratio, incorporating geographical variations, was proposed in 2023 and accepted at AST25 in March 2024. This correction is based on SOCA products from the BGC-Argo database. It has been thoroughly evaluated, notably by comparison with DM-qualified data, and the results presented to ADMT25 .Operational implementation of this correction in RT is scheduled for 2025. A paper will present this correction in detail. This new HLC correction in RT will pave the way for the qualification of HLC data in DM, minimizing the gap between the two and improving the quality of HLC datasets.

v. real time Deep implementation

RT and DM data management of Deep-Argo float data is implemented at Coriolis.

Argo-France is taking part in the international working group tasked with establishing and documenting the procedure for time-delay processing of Deep Argo floats. In particular, a procedure for correcting a pressure-dependent bias linked to the compressibility term (CpCor) has been established, and a code has been made available: https://github.com/ArgoDMQC/DM_Cpcor. This year, a follow-up to these corrections was presented at ADMT25 and led to an update of the data management document with a new value of the Cpcor used to correct salinity data in real time and new flag assignment 1 below 2000db (QC= 1).

vi. real time and delayed mode Trajectory implementation

An automated processing chain to operate real-time QC on trajectories, to be able to distribute qualified "RTraj" Argo files in a systematic way that can be used for real-time current products. It is daily updated and available from <https://doi.org/10.48670/moi-00041>

This work is a first step towards setting up the delayed-time QC protocol for Argo trajectory measurements, so as to be able to distribute qualified Argo "Dtraj" files to the community. Finally, in collaboration with the Coriolis data center, Argo France has initiated the implementation of a procedure for transferring ANDRO trajectory history files controlled in delayed mode Argo 'Dtraj' format to the Coriolis data center, enabling the distribution of trajectory data in Real Time with Real Time QC. This will be embedded in the UE project Euro-Argo One (2025-2028).

d. status of delayed mode quality control process

Core and Deep

This year, consistency checks were carried out for the AARC region, enabling analysis of DM salinity data from 3,814 floats. For each float, we used the OWC method with a standard set of configuration parameters. We then checked a float's DM salinity correction only if the results obtained differed significantly from those obtained by the float's PI. We were then able to isolate a small number of floats for which the salinity profiles were subject to additional checks: sections along the float's trajectory, comparison of certain profiles with the closest reference data or with the closest real-time Argo data available, if necessary. Finally, where necessary, we suggested that the float's DM or PI operator modify the salinity corrections. The AARC web page lists the floats for which the PI or DM operator has been notified (<https://www.umn-ops.fr/en/SNO-Argo/Activities/A-ARC/Consistency-checks-of-DM-salinity-corrections>).

This year, we processed around **72 floats (including 38 deep floats)**. Within this framework, Argo-france maintains the OWC code, which is the one recommended for calibrating salinity data from Argo

floats. We develop and maintain the DM_FLOATS processing chain, used by LOPS operators, subcontractors and various European operators.

BGC

In 2024, a significant effort was devoted to the qualification of Delayed Mode (DM) radiometric data. **32 floats** were processed, representing **5226 profiles**, by applying the correction method described by *Ju-tard et al.* (2021). However, some data could not be qualified, notably from floats without drift data or night-time measurements, making the method inapplicable. Alternative approaches are currently being developed to find suitable solutions for correcting these particular floats.

In 2024, the method was applied to a majority of floats (of all nationalities) to demonstrate its applicability on a global scale, irrespective of the presence of radiometers on the floats. This development was made possible by the development of SOCA-light, a neural network-based method for generating synthetic radiometric profiles for floats without radiometers (*Renosh et al.*, 2023). A qualified global CHL dataset has been published on SEANOE, detailing delayed-mode CHL processing (<https://doi.org/10.17882/102324>).

The BBP audit accessible online (ftp://ftp.mbari.org/pub/BGC_argo_audits/BBP700) since June 2021 was updated at the end of 2024. The anomaly report was presented at ADMT25 at the end of 2024. The audit is proposed thanks to the comparison of BBP measurements with reference data corresponding to BBP weekly climatological fields (SOCA product). The updated audit enabled a total of ~140,000 BBP profiles to be inspected in 2024, of which ~500 profiles were flagged as abnormal (~0.5% of data compared with 1% last year). This improvement in the quality of the BBP database is due in particular to the application of real-time QC proposed by *Dall'Olmo et al.*, 2023 to BBP data from coriolis during 2023.

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)

Argo France secured funding for Core-Argo, which is about **1,1M€/year** with stable man power implication of **13 pers./year**. Project-based fundings support Argo-France for the Deep and BGC missions, for data management (about 2,7M€/an). Some of those projects contribute as well to R&D on floats (Deep6000) and BGC sensors.

Expected floats funding by Argo France for 2025-2029:

	Core	Core + O2	BGC (4-6 EOVS)	Deep + O2	Expended sensors	Total
2025	45	13	11	11		80

(funded)						
2026 (funded)	30	10	10	10		60
2027 (funded)	20	7	18	21	10	76
2028 (funded)	30	7	9	21	4	71
2029 (not yet funded)	26	10	20	24		80

- 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](#).

It is planned to deploy over **70 floats in 2025** over 13 regular or specific campaigns (Fig. 2).

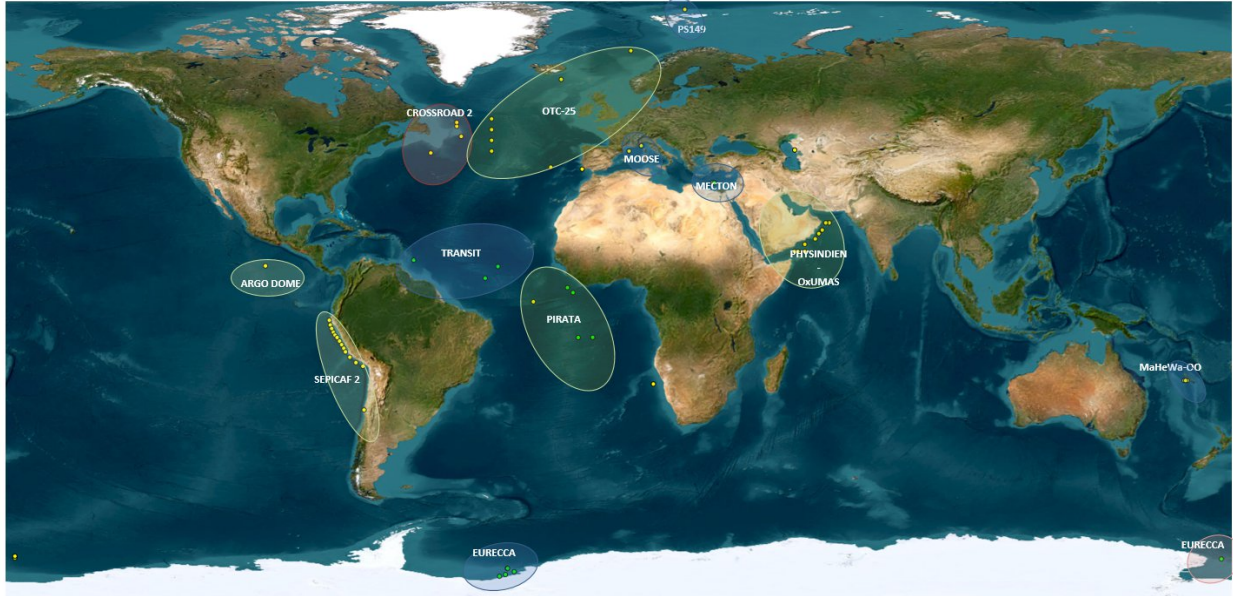


Figure 2 : Region of Argo France floats deployments for 2025

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.**
 - New NKE PFV2 card on Arvor has been implemented. 4 prototypes deployed at sea by NKE, 8 floats already acquired by Argo-France, first two deployments planned this summer in the Med and in Nansen Basin (New version of the Ice Algorithm to be tested) .
 - Development of a new Deep 6000 ?float model is ongoing. Prototypes should be tested at sea in 2025.
 - BGC sensors ?
 - Two Deep-Arvor equipped with an Aanderaa and an AROD-FT optodes have been deployed in 2024. First results will be presented at next ADMT meeting.
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.**

Argo France web page : <https://www.argo-france.fr/>

Argo France products :

- **ISAS**, temperature, salinity and oxygen gridded fields : <https://doi.org/10.17882/52367>. The new ISASO2 fields (decadal and pentadal mean field) from available DMQC DO Argo data have been released in 2024 (<https://doi.org/10.17882/52367>), along with Kolodziejczyk et al. (2024) describing the dataset on : <https://doi.org/10.5194/essd-2024-106>.
 - **ANDRO** product (Atlas of Argo Trajectories) is updated each year. The Andro atlas and the Finnish climatology on an ISAS grid (0.5°x 0.5°) of float speeds at DOI: <https://doi.org/10.17882/47077>.
 - Globally interpolated product of **Chlorophyll-a and particulate backscatter coefficient, transformed into particulate organic carbon**: <https://doi.org/10.48670/moi-00046>. This product provides quarter-degree fields with weekly resolution over the period 1998-2022, as well as monthly resolution for climatological products. This product is derived from the machine learning method SOCA (Sauzède et al. 2016; Sauzède et al. in prep.).
 - **Vertical profiles of nutrient concentration (nitrates, phosphates and silicates) and carbonate system variables (total alkalinity, dissolved inorganic carbon, pH and partial pressure of carbon dioxide)** is distributed and updated annually in Copernicus Marine Services: <https://doi.org/10.48670/moi-00048>. It is derived from Carbonate system and Nutrients concentration from hYdrological properties and Oxygen using a Neural-network (CANYON, Sauzède et al., 2017; Bittig et al. 2018).
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.
- Difficulties to get answers from Seabird to our questions
 - Highlight : NAARCO recovery cruise : In Spring 2024 a 1-month recovery cruise was conducted in cooperation with Euro-Argo in the North Atlantic. It allowed to recover 10 Argo floats (5 Arvor and 5 Deep Arvor) using a small sailing vessel. This low cost / low carbon cruise acted as a proof of concept that together with opportunistic float recoveries there is probably a way to reduce Argo environmental impact (i.e lost floats) without any increase in fuel consumption due to standard vessel operations. Most of the recovered floats have been fully refitted at low cost (compared to cost of acquiring new floats) and will be re-deployed this summer in order to validate float recovery and refit options. Our target is to continue recovering 25% of our floats in the coming years
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.

- In 2024, Argo France was present at the Mer&Education summer school (interdisciplinary training for secondary school teachers; <https://nouveau.univ-brest.fr/mer-education/>)
 - Vendée Globe: The UNESCO/IFREMER/IMOCA/Vendée Globe collaboration will have enabled the deployment of 10 Argo-France floats during the 2024 Vendée Globe, generating exceptional media coverage for the Argo program (<https://www.vendeeglobe.org/article/tout-ce-qu'il-faut-savoir-sur-le-materiel-scientifique-embarque>).
 - Adopt A Float program: During the 2023-2024 school year, nearly 2,000 “Ocean Voyagers” pupils, from the 1st section of kindergarten (3 years old) to the 2nd year of BTS (20 years old), took part in the Adopt A Float educational adventure. Students from mainland France, the French overseas departments and territories (Mayotte, Martinique), Belgium, Italy, Spain, England and the United States adopted a profiling float. In all, no fewer than 55 Argo floats were adopted from the world's oceans. For the new school year 2024-2025, adopt a float continues to expand, with almost 90 classes in France (metropolitan France + French Polynesia) and abroad (Belgium, Italy, Spain and Costa Rica). In particular, the program is strengthening its European dimension as part of the Euro-Argo ONE project, with an Italian initiative being rolled out this year. This new impetus aims to involve a wider community of educators - particularly teachers and students - in learning about ocean sciences.
 - Argo presentation at Ministry level (Education and Fisheries)
 - Argo mentioned in various media reports (TV, radio)
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.**

Argo France is responsible for the CTD reference database. A new release has been issued in February 2024 (see <https://doi.org/10.13155/102566>).

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.**

A total of 44 research articles were co-authored by authors affiliated to a French laboratory, and 3 theses using Argo data were defended at a French university. The list of publications and theses provided on the Argo France website: <https://www.argo-france.fr/Bibliographie>.

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.

Argo France aim to deploy about 50% of its core floats with RBR CTD.