



## Argo-Spain National Report 2023

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- 1. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2023)**
  - a. floats deployed and their performance**

Argo Spain contributed to extending the international Argo network during 2023 deploying floats in the Atlantic Ocean and Mediterranean Sea. These deployment missions were coordinated by the Spanish Institute of Oceanography (IEO-CSIC) and the Balearic Islands Coastal Observing and Forecasting System (SOCIB). The specifications of the deployments by area are shown below.

### Atlantic Ocean

Within the framework of the biannual oceanographic cruises RAPROCAN2304 and RAPROCAN2312, together with the collaboration of other IEO-CSIC scientific teams, a total of 6 floats were launched in the Atlantic Ocean by IEO-CSIC (Table 1). All of them were deployed in the Canary basin, except the first BGC-Argo float of Argo Spain, deployed in the Cantabrian Sea mid-year during RADPROF2304 cruise. The remaining 5 floats corresponded to 4 core Argo and 1 Deep Argo.

### Western Mediterranean Sea

In November 2023, during the Canales Autumn 2023 oceanographic cruise, Spain launched 2 core Argo floats from the deck of the vessel R/V SOCIB (Table 1). These cruises are part of the SOCIB 'CANALES' endurance line, which aims to further deepen the knowledge of the state and variability of the Balearic Sea, consolidating and further developing scientific research.

WMO	Deployment date	Deployment location	Cruise
4903713	16/04/2023	29°14.772' N, 15°50.508' W	RAPROCAN2304
3902506	02/07/2023	44°19.998' N, 5°40.002' W	RADPROF2304
6990625	12/12/2023	29°9.282' N, 15° 30.258' W	RAPROCAN2312
2903822	14/04/2023	29°10.002' N, 18°10.002' W	RAPROCAN2304
4903712	10/12/2023	29°10.056' N, 18°29.928' W	RAPROCAN2312
2903823	17/04/2023	28°56.472' N, 14°22.542' W	RAPROCAN2304
3902466	07/11/2023	39°15.486' N, 1°58.890' E	Canales Autumn 2023
6990533	08/11/2023	39°00.024' N, 0°44.256' E	Canales Autumn 2023

**Table 1**, Deployment information related to Spanish deployed floats during 2023. The BGC Argo float was registered as 3902506 and the Deep Argo as 4903712.

Different preset configurations were used before each mission. On the one hand, all Core Argo floats and the BCG float were configured to dive up to 2000 dbar and 1000 dbar of parking depth. On the other hand, the Deep Argo float was set to dive up to 4000 dbar and 1000 dbar of parking depth. All floats worked in cycles of 10 days in the Atlantic Ocean and 5 days in the Mediterranean Sea.

### **Active Spanish floats in 2023**

In summary, 19 Spanish floats have been active during 2023 in the Atlantic Ocean and the Western Mediterranean Sea.

#### **b. technical problems encountered and solved**

During 2023, the IEO-CSIC sent to the manufacturer NKE 2 Core Argo floats from previous batches that experienced problems. One of them failed in data transmission in the pre-deployment phase, while the other was stranded on a beach; the sensors needed to be cleaned/checked. A response is still being awaited. Regarding the batch of floats received in 2023, 2 Core Argo floats experienced problems. One of them apparently failed in data transmission in the pre-deployment phase. And the last one did not pass the checklist on land. These 2 floats are planned to be shipped to NKE during 2024 to be repaired.

Although SOCIB initially planned to deploy 3 floats, only 2 were eventually deployed. This decision was made to ensure the deployment scheduled for 2024 by SOCIB in the Mediterranean, as part of their agreement within the Euro-Argo ERIC ([Disposición 14622 del BOE núm. 214 de 2022](#)). The adjustment was needed by considerations related to the budget allocated for future purchases by the center.

**c. status of contributions to Argo data management (including status of high salinity drift floats, decoding difficulties, ramping up to include BGC or Deep floats, etc)**

After each deployment, detailed technical information is provided to the DAC in charge of the floats (Coriolis) and the AIC. The Argo-Spain program is aware of the changes in the technical and metadata data formats and is providing the necessary information.

**d. status of delayed mode quality control (DMQC) process**

Argo-Spain mainly deploys floats in the Atlantic Ocean and the Mediterranean Sea. In terms of DMQC, Argo-Spain, through IEO-CSIC, manages its floats that operate in the Atlantic Ocean, and the *Instituto Nazionale di Oceanografia e di Geofisica Sperimentale* (OGS) manages all the floats that operate in the Mediterranean Sea, including floats of Argo-Spain.

In terms of the floats for which Spain is responsible for the DMQC process, 53 out of the 71 Atlantic floats have been processed, including 2 (WMO 6901262 and 6901264) in the year 2023. There are plans to achieve a processing rate of 12 floats per year in the upcoming year.

**2. Present level of and future 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, Spatial (Polar, equator, WBCs)**

Spain has participated in the international Argo program since its inception and is currently a member of the European Research Infrastructure Consortium Euro-Argo (ERIC). Spanish participation in Argo began in 2002 through a first European project, and since then, a total of 108 Argo floats have been deployed. Among these, 71 floats have been deployed in the Atlantic Ocean, and 37 floats have been deployed in the Mediterranean Sea. Additionally, 4 floats have been donated to other countries: 2 floats to Costa Rica, 1 float to Morocco, and 1 float to Mexico.

In 2022, the agreement was renovated between the Ministry of Science and Innovation, IEO-CSIC and SOCIB ([Disposición 14622 del BOE núm. 214 de 2022](#)), assuming the financial commitment that Spain participates as a full member of the ERIC Euro-Argo. The interest in such participation was demonstrated in the process of prioritizing Spain's participation in European research infrastructures,

as detailed in the document on the Spanish Strategy for participation in scientific infrastructures and international organizations.

However, the Argo-Spain program currently lacks proper long-term funding for the deployment of Argo floats. The contribution to the Euro-Argo ERIC is secured and sustained through membership payments from the Spanish Ministry of Science, Innovation, and Universities, as well as SOCIB. Additionally, the availability of extra funding relies on access to infrastructure calls. Both IEO-CSIC and SOCIB are committed to ensuring deployments of at least 3 floats per year, and its transmission costs. Also, IEO-CSIC funds the scientific coordination (1.5 person/month per year).

At the end of 2021, SOCIB received funding from NextGenerationEU/PRTR to ensure the purchase and deployment of floats in the Mediterranean Sea during the next few years.

The personnel of Argo-Spain during 2023 consisted of the following individuals from IEO-CSIC and SOCIB:

IEO-CSIC:

- 1 technician working 50% of their time.
- 1 Principal Investigator (PI) working 50% of their time.

SOCIB:

- 1 technician working 50% of their time.
- 1 technician working 10% of their time
- 1 PI working 5% of their time

**3. Summary of deployment plans: please see the [separate documents](#) explaining the longer term outlook this year as a response to G7 requests. This spreadsheet is to be returned separately ASAP to help prepare for the meeting. It can be sent to Megan or dropped in the folder link containing the instructions.**

This information is included in the European deployment planning statistics for subsequent years, which is located in the "national\_dpeloyment\_information" folder of the AST25. However, we attach below individually the theoretical contribution of Argo-Spain for the coming years (Table 2).

SPA		2024					
	Total	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O
Nordic Seas	0						
Mediterranean Sea	2	1					
Black Sea	0						
Baltic Sea	0						
Southern Ocean	0						
Arctic Ocean	0						
Global Ocean	4	2		1		1	
<b>Total</b>	<b>5</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>
SPA		2025					
	Total	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O
Nordic Seas	0						
Mediterranean Sea	0	3					
Black Sea	0						
Baltic Sea	0						
Southern Ocean	0						
Arctic Ocean	0						
Global Ocean	10	7	1			2	
<b>Total</b>	<b>13</b>	<b>10</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>
SPA		2026					
	Total	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O
Nordic Seas	0						
Mediterranean Sea	0	3					
Black Sea	0						
Baltic Sea	0						
Southern Ocean	0						
Arctic Ocean	0						
Global Ocean	10	8	2				
<b>Total</b>	<b>13</b>	<b>11</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

**Table 2**, Potential deployments of Spanish floats (float types and corresponding quantities) projected for the coming years as part of Euro-Argo ERIC

- 4. 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 the AST and AIC websites.**

Argo is used by many Spanish researchers to improve the understanding of climate and ocean variability. Operational ocean forecast models also use Argo data for model assessments and model improvement through data assimilation (e.g. The Western Mediterranean Operational forecasting system - [WMOP](#) -, the Atlantic-Iberian Biscay Irish-Ocean Physics Analysis and Forecast - [IBI-MFC](#) - and Mediterranean Sea Physics Reanalysis - [Med MFC](#) -). The web page of the Argo Spain program is: <http://www.argoespana.es>

- 5. 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-25 plenary, each national program will be asked to mention a single highlight or issue via a very brief oral report.**

No issues.

- 6. 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.**

A CTD cast is performed after most of the Argo-Spain deployments.

- 7. 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.**

González-Santana, A., Oosterbaan, M., Clavelle, T., Maze, G., Notarstefano, G., Poffa, N., et al. (2023). Analysis of the global shipping traffic for the feasibility of a structural recovery program of Argo floats. *Front. Mar. Sci.* 10, 1161580. doi: [10.3389/fmars.2023.1161580](https://doi.org/10.3389/fmars.2023.1161580)

Olivé Abelló, A., Pelegrí, J. L., and Machín, F. (2023). A Simple Method for Estimating Horizontal Diffusivity. *Journal of Atmospheric and Oceanic Technology* 40, 739–752. doi: [10.1175/JTECH-D-22-0097.1](https://doi.org/10.1175/JTECH-D-22-0097.1)

Jiménez-Rincón, J.A., Cianca, A., Ferrero-Martín, C., Izquierdo, A. (2023) A Glider View of the Spreading and Mixing Processes of Antarctic Intermediate Water in the Northeastern Subtropical Atlantic. *J. Mar. Sci. Eng.* 11, 576. <https://doi.org/10.3390/jmse11030576>

Olivé Abelló, A. (2023). Transformations and pathways of Southern Ocean waters into the South Atlantic Ocean. **Thesis:** <http://hdl.handle.net/2445/204661>

Chevillard, C. (2023). Assessment of the ocean state, variability and changes in the northwestern Mediterranean Sea from multi-platform observations in the context of climate change. **Msc Thesis**

**8. How has COVID-19 impacted your National Program's ability to implement Argo in the past year? This can include impacts on deployments, procurements, data processing, budgets, etc.**

No problems with float's deployment and recovery.

**9. Does your National Program have any deployment plans for RBR floats in the next couple years? If so, please indicate how many floats you will be buying in 2024 and 2025 (if known) and where they might be deployed.**

At the moment, this option is not contemplated in the short term.