

# Argo-España

Parte de la estrategia global de observación del océano



## Argo – Spain Annual Report 2021

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ARGO ESPAÑA – IEO - SOCIB / 22 – 72

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INSTITUTO  
ESPAÑOL DE  
OCEANOGRAFÍA



Balearic Islands  
Coastal Observing  
and Forecasting  
System

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# Argo - Spain Annual Report 2021

## Present status and future plans

### 1. Introduction.

#### a. Organization.

Argo-Spain ([www.argoespana.es](http://www.argoespana.es)) is a joint initiative between the *Instituto Español de Oceanografía* (Spanish Oceanographic Institute, IEO) and the *Sistema de Observación Costero y de Predicción of the Balearic Islands* (Coastal Ocean Observing and Forecasting System, SOCIB) to development and consolidation of the Spanish contribution to Argo. Its activities are mainly focused on the international core Argo program and its extension toward the deep ocean.

Thus, the following team, detailed below, coordinates all the activities of Argo – Spain:

- **IEO:** National and scientific coordinator of deployments in the Atlantic Ocean (P. Vélez) and head of quality control activities (A. González).
- **SOCIB:** Scientific coordination of deployments in the Mediterranean Sea (J. Tintoré, L. Díaz and I. Lizarán).

#### b. Funding.

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 a total of 100 Argo profilers have been deployed in the North Atlantic and the Mediterranean Sea since then.

The Argo Spain program does not have proper long-term funding for deployments of Argo floats. However, the minimum contribution to the Euro-Argo ERIC is secured and sustained, based on IEO's access to infrastructures calls from the Spanish Ministry of Science, Innovation, and Universities and from the SOCIB's contribution, which has ensured deployments of at least 3 floats per year since 2015. 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. The IEO funds the scientific and the transmission costs.

#### c. Long-term evolution of Argo – Spain.

This has been Argo's proposal at the Spanish national level:

- 2021: Core Argo mission, temperature, and salinity (0 to 2000 m).

- 2015 – 2021: Participation in the pilot array for the extension of the Argo network to the deep ocean with Australia, China, France, Japan, New Zealand, Norway, the UK, and the USA.
- 2021-2023: Participation in the Core mission, and the pilot array for extension to the deep Ocean.

Core T/S floats are fully funded by IEO and SOCIB, while deep floats have been funded by the Ministry of Science. Argo Spain strategy will be set according to national interests and guidelines, as is shown in the Euro – Argo's long-term road map for the implementation of a new sustained phase for Argo in Europe.

#### **d. Float development.**

All the developments during 2021 with the participation of Argo Spain have been made under the frame of the EA - RISE Project (<https://www.euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022>). The IEO has participated in the development of 2 Deep Arvor floats with three heads, consisting of 3 mounted sensors (SBE41, SBE61, and RBR), especially in the deployment phase and in the comparative study phase to assess the accuracy of the sensor measurements. Under the same project, SOCIB has participated in terms of float development by improving floats sampling in shallow waters and boundary currents, optimizing configuration and life expectancy's floats, and improving technical floats' aspects in marginal seas.

## 2. The status of implementation.

Since the beginning of Argo Spain, 100 floats have been deployed so far, of which 24 were active at the end of 2021. All deployments are chosen based on Spanish research criteria, as well as the operational activities of each of the institutions, mainly in the Atlantic Ocean and the Mediterranean Sea.

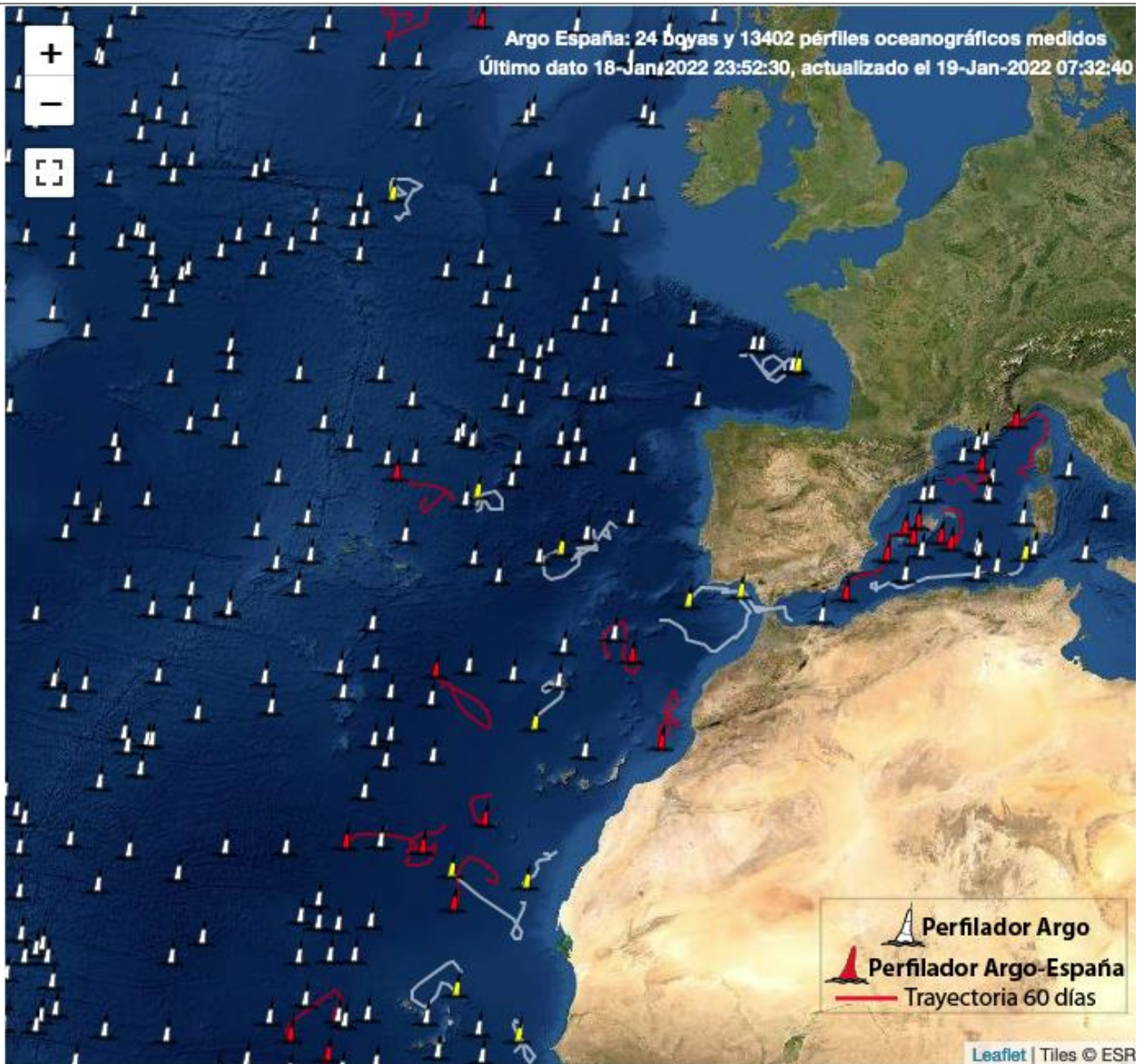


Figure 1. Status of the Argo Spain program on January 18<sup>th</sup>, 2022.

The following table shows relevant information about each Argo-Spain float. It is a database that records information of some features from the deployment until the floats stop completely.

WMO	Status	Project Name	Float Owner	Platform Type	Deployment Date
6901253	Active	Argo SPAIN	IEO	ARVOR_L	29/05/2018
6901254	Active	Argo SPAIN	IEO	ARVOR_L	15/10/2018
6901255	Active	Argo SPAIN	IEO	ARVOR_L	16/6/2019
6901256	Active	Argo SPAIN	IEO	ARVOR_L	01/06/2018
6901257	Active	Argo SPAIN	IEO	ARVOR_L	06/02/2019
6901258	Active	Argo SPAIN	IEO	ARVOR_L	04/06/2018
6901259	Active	Argo SPAIN	IEO	ARVOR_L	11/03/2019
6901262	Active	Argo SPAIN	IEO	ARVOR_L	08/06/2018
6901263	Active	Argo SPAIN	IEO	ARVOR_L	06/02/2019
6901265	Active	Argo SPAIN	IEO	ARVOR_L	10/06/2018
6901266	Active	Argo SPAIN	IEO	ARVOR_L	13/06/2018
6901268	Active	Argo SPAIN	IEO	ARVOR_L	18/03/2019
6901269	Active	Argo SPAIN	IEO	ARVOR_L	16/06/2018
6901270	Active	Argo SPAIN	IEO	ARVOR_L	18/08/2018
6901271	Active	Argo SPAIN	IEO	ARVOR_L	30/10/2018
6901272	Active	Argo SPAIN	IEO	ARVOR_L	26/03/2019
6901273	Active	Argo SPAIN	IEO	ARVOR_L	11/12/2018
6901277	Active	Argo SPAIN	IEO	ARVOR_L	31/07/2019
6901278	Active	Argo SPAIN	EA-RISE SOCIB ICTS	ARVOR_I	12/03/2020
6901280	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	12/08/2020
6901281	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	04/11/2020
6904065	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	14/08/2020
6901282	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	13/12/2021
6901283	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	14/12/2021
6901284	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	14/12/2021

Table 1. Extract of current Argo Spain floats database.

### 3. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2021).

#### a. Floats deployed and their performance.

During 2021, a total of 3 Argo floats were deployed by Argo-Spain:

- 3 ARVOR – I floats (Argo Spain in the Mediterranean Sea), un under the framework of Argo Spain’s minimum annual coverage commitment for the Euro – Argo contribution and purchased by SOCIB.

The contribution of Argo Spain to extend the international Argo network during 2021 was focused on the Med Sea, deploying a total of 3 ARVOR – I floats. These deployment missions were coordinated by SOCIB – IEO and developed by SOCIB in collaboration with partners who cooperated for the success of the missions <https://bit.ly/3nEONXv>.

As an example, the ARVOR – I float WMO 6901283 is currently diving northeast of Ibiza Island after 8 profiles developed (Fig. 3). The float was programmed to dive up to 2000 m every 5 days measuring temperature and salinity during the ascending phase, within a parking depth of 350 m.

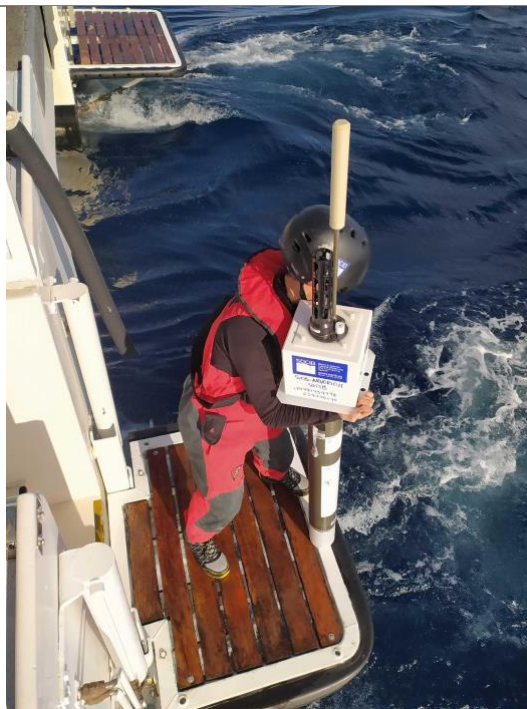


Figure 2. R/V SOCIB operator moments before the deployment of WMO 6901283 float under safety measures at *Canales Autumn 2021* survey.

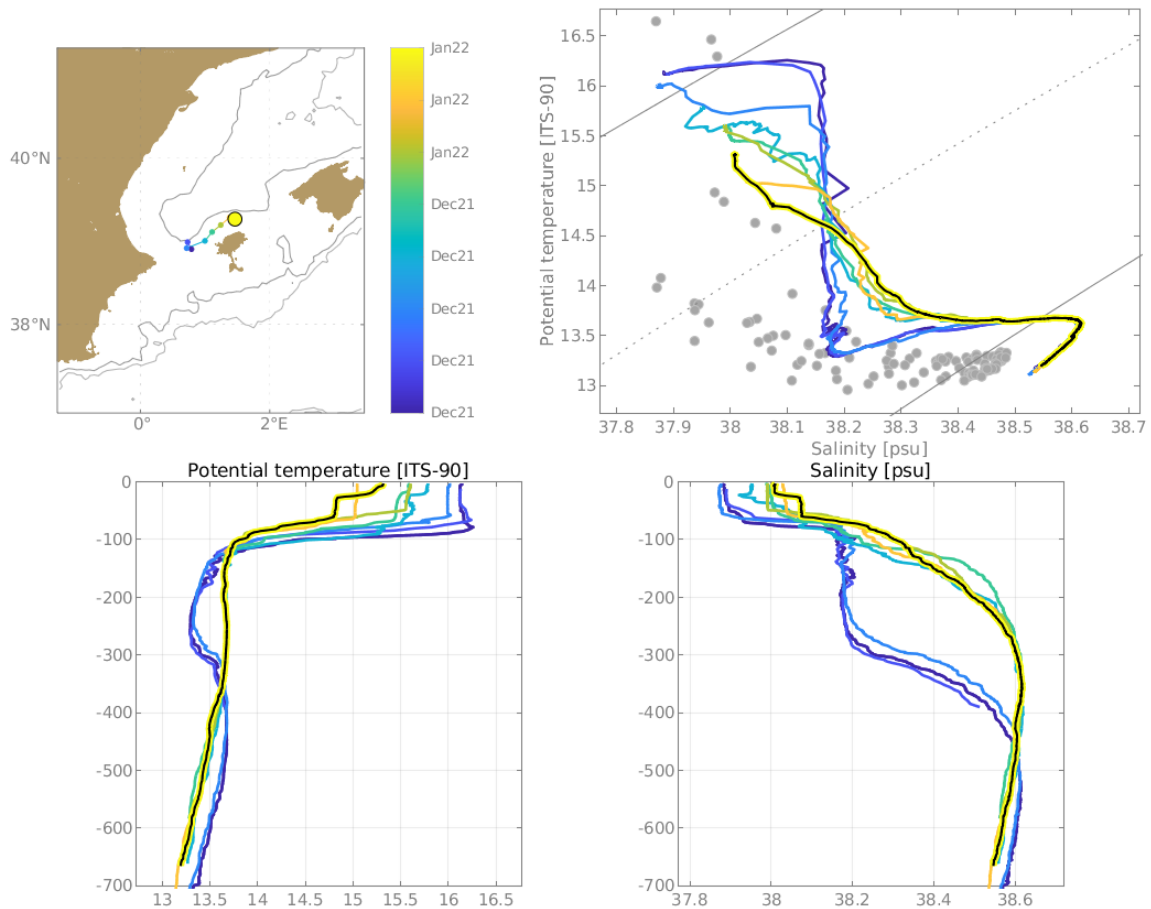


Figure 3. The trajectory of the float since the deployment is shown in the upper left side of the picture. The T-S diagram of the data collected by WMO 6901283 is shown on the upper right side of the picture. The gray points are the climatology of the area. The black line is the first profile carried out by the float. Potential Temperature and Salinity profiles are also shown on the lower side of the picture.

The ARVOR – I float WMO 6901282 also as an example, which was deployed between Mallorca and Ibiza islands, performed a southern trajectory up to the date of writing this report (fig. 4). The float was programmed following the same configuration set-up.

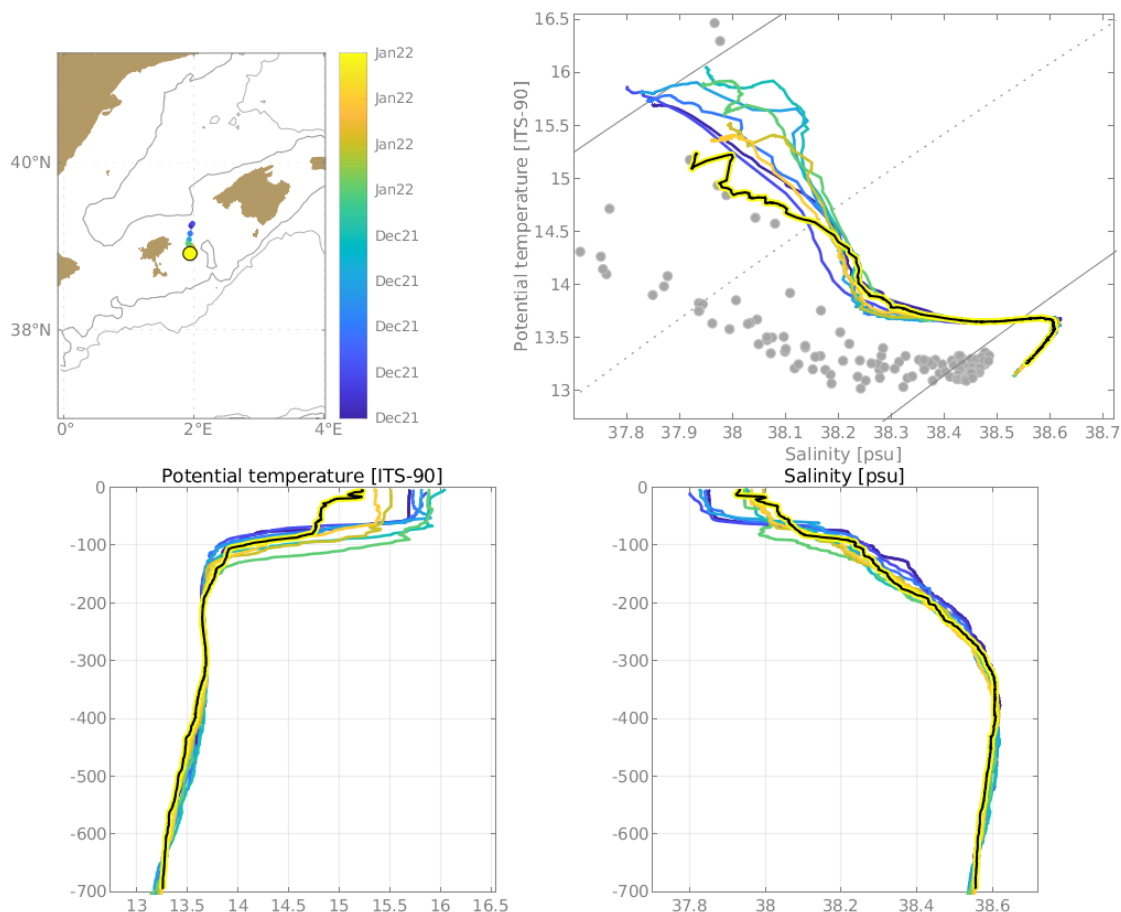


Figure 4. The trajectory of the float since the deployment is shown in the upper left side of the picture. The T-S diagram of the data collected by WMO 6901282 is shown on the upper right side of the picture. The gray points are the climatology of the area. The black line is the first profile carried out by the float. Potential Temperature and Salinity profiles are also shown on the lower side of the picture.

**b. Technical problems encountered and solved.**

No technical issues have been found regarding the deployments and floats monitoring.

**c. Status of contributions to Argo data management (including the status of pressure corrections, technical files, 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 process.**

Argo-Spain mainly deploys floats in the Atlantic Ocean and the Mediterranean Sea. In terms of DMQC, Argo-Spain 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. The DMQC of the Argo-Spain floats that operate in the Mediterranean Sea will be assumed by Argo-Spain itself at some point, subject to personnel availability. In successive meetings, a transfer of DMQC knowledge from the IEO to the SOCIBis planned, so that SOCIBis in charge of the DMQC of the Argo Spain profilers deployed in the Mediterranean.

Currently, SOCIB is working to upload the CTD data to the Argo DataBase from 2014 to nowadays, with a 0.5 m resolution.

The Argo-Spain fleet consists of 96 floats deployed so far. A total of 63 floats have been deployed in the Atlantic Ocean and 32 floats deployed in the Mediterranean Sea (fig. 5).

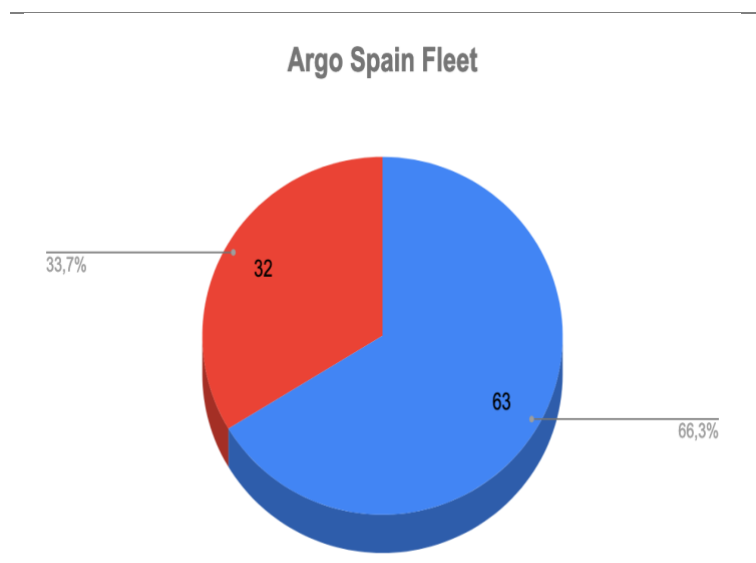


Figure 5. Argo-Spain fleet.

DMQC has been carried out for 16 floats in 2016, for 19 floats in 2017, for 4 floats in 2018, no DMQC has been developed during 2019 and 2020 and for 9 floats in 2021 (fig. 6).

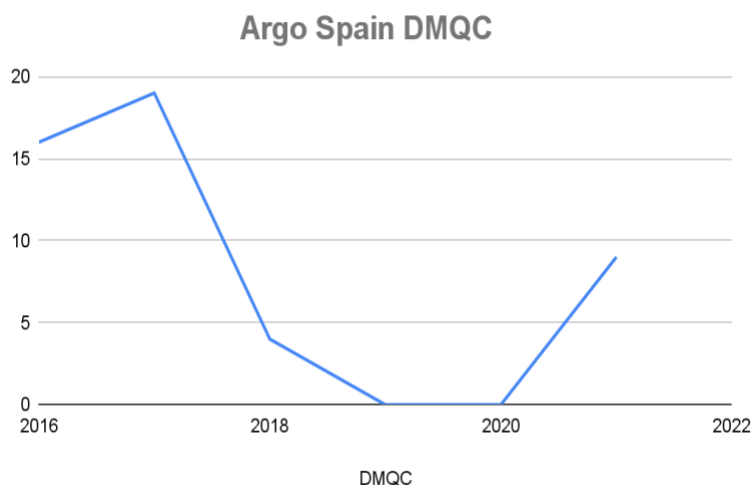


Figure 6. Number of floats that have been inspected by DMQC.

#### 4. The present level of and future prospects for national funding for Argo including a summary of the level of human resources devoted to Argo.

No changes in Argo-Spain's manpower so far: (1) PI and (1) full-time technician (1) at IEO, another (1) technician and (2) part-time scientists at SOCIB . The knowledge transfer on the DMQC between SOCIB and IEO scheduled for 2021 is postponed until further notice. The IEO and SOCIB's funding covers float procurement in the period 2021-2022 and transmission costs. Moreover, IEO's funding covers part-time personnel support. The IEO funds the scientific coordination and delayed mode in the Atlantic (1 FTE). Besides the long-term support from the IEO, SOCIB will deploy 3 Argo floats per year in the Western Mediterranean.

Also, through competitive calls in Spain, IEO and the SOCIB have obtained funding for 10 floats/year in the Atlantic, including Deep and Bio Argo floats for the years 2022-2024, and 12 floats (CORE) in the Western Mediterranean for the years 2022-2025.

#### 5. Summary of deployment plans and other commitments to Argo for the upcoming year and beyond where possible. Here is a link to the commitments table at OceanOPS. If you cannot edit the online table, please send a list of deployment plans for each of the columns in the table as needed.

Although the potential deployments may change following feedback from the Spanish research community, the current plan for the upcoming year is:

- 3 standard floats (ARVOR - I) to be deployed in the Mediterranean Sea during 2022 (SOCIB).
- 10 standard floats (ARVOR - I) to be deployed in the Atlantic Ocean during 2022 (IEO).

- 5 Deep Argo floats (DEEP ARVOR) to be deployed in the Atlantic Ocean during 2022 (IEO).
- 2 BGC floats to be deployed in the Atlantic Ocean during 2022 (IEO).

**6. 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. Ocean and weather forecast operational models also use Argo data. The web page of the Argo Spain program is: <http://www.argoespana.es>

**7. 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 the AIC, 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.**

None.

**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.**

A CTD cast is performed after most of the Argo-Spain deployments. However, the data have not been submitted to the CCHDO yet.

**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.**

- Vélez-Belchí, P., Caínzos, V., Romero, E., Casanova-Masjoan, M., Arumí-Planas, C., Santana-Toscano, D., González-Santana, A., Pérez-Hernández, M. D., & Hernández-Guerra, A. (2021). The Canary Intermediate Poleward Undercurrent: Not Another Poleward Undercurrent in an Eastern Boundary Upwelling System, *Journal of Physical Oceanography*, 51(9), 2973-2990. DOI: <https://doi.org/10.1175/JPO-D-20-0130.1>
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- García-Sánchez G, Mancho AM, Ramos AG, Coca J, Pérez-Gómez B, Álvarez-Fanjul E, Sotillo MG, García-León M, García-Garrido VJ and Wiggins S (2021) Very High Resolution Tools for the Monitoring and Assessment of Environmental Hazards in Coastal Areas. *Front. Mar. Sci.* 7:605804. <https://doi.org/10.3389/fmars.2020.605804>

**10. 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.**

Yes, it has been a delay in the purchasing process of the floats to be deployed during 2021 and 2022. This has caused the proposed launch plan for 2021 to be postponed to 2022. SOCIB purchased 3 profilers which were deployed on time in 2021.

**11. Argo is still interested in piloting the RBR CTD. 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 2022 and 2023 (if known) and where they might be deployed.**

IFREMER, EURO-Argo, and the IEO will deploy in March 2022 two '2-Headed' a one '3-Headed' Deep Argo floats (range 4000 m depth) in the Canary basin under the framework of the EA-RISE project. Both floats are equipped with an RBR argo3 sensor.