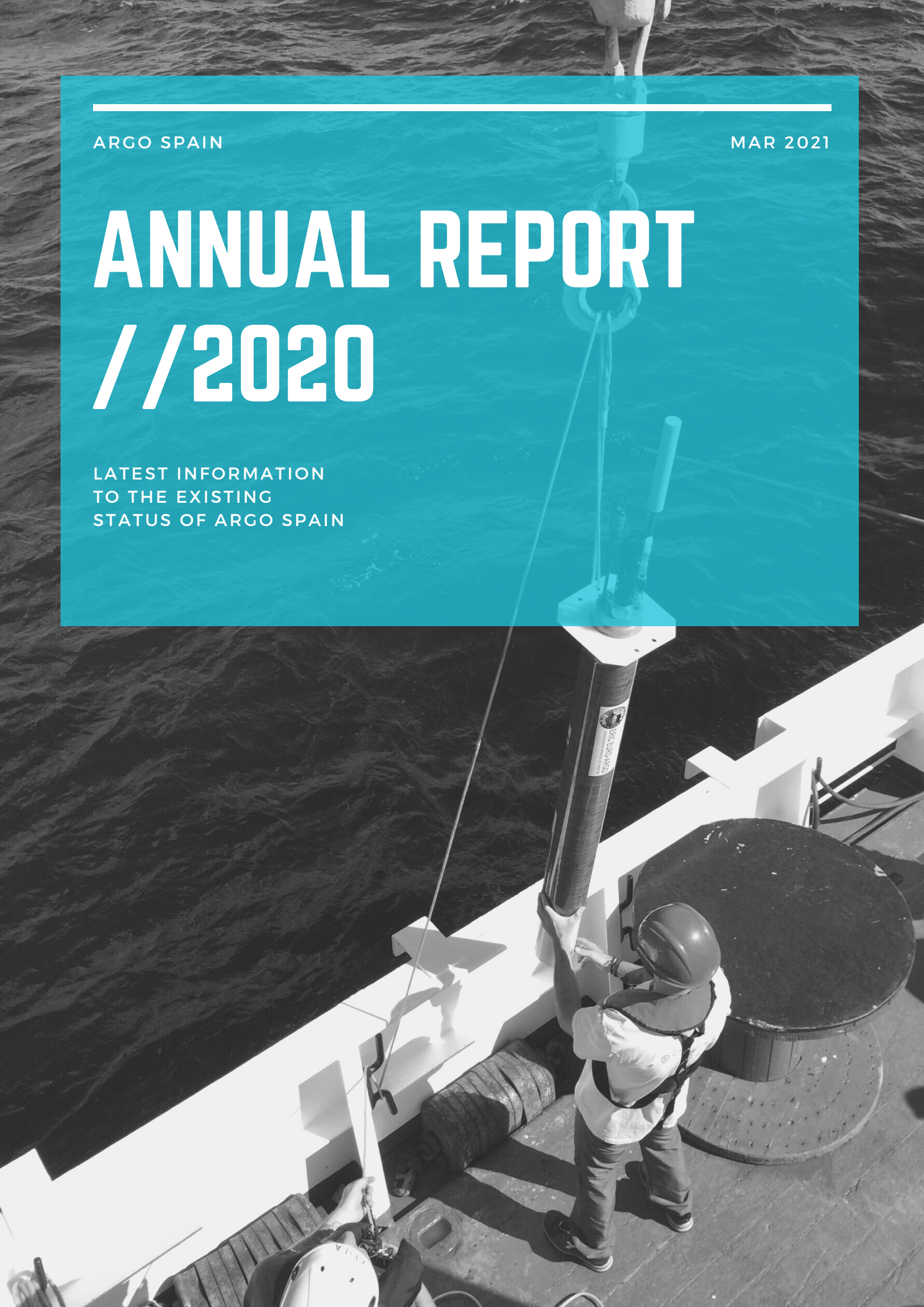

ARGO SPAIN

MAR 2021

ANNUAL REPORT //2020

LATEST INFORMATION
TO THE EXISTING
STATUS OF ARGO SPAIN



Argo-España

Parte de la estrategia global de observación del océano



Argo – Spain Annual Report 2020

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Argo – Spain Annual Report

Feb 15, 2021

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Argo - Spain Annual Report 2020

Present status and future plans

1. Introduction.

a. Organization.

Argo – Spain (www.argoespana.es) takes care of the development and consolidation of the Spanish contribution to Argo. Its activities are mainly focused on the international Argo core 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, I. Ruiz, 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 93 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 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. Both institutions have also assumed 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.

The IEO funds the scientific coordination (1.5 man x month per year) and the transmission costs. Also, in 2020 a technician was incorporated permanently at the IEO, as head of the quality control data and support the scientific coordination. Besides, through the financing of the Euro-Argo EA-RISE project (Euro-Argo Research Infrastructure Sustainability and Enhancement), a technician has been hired full-time at SOCIB for one year.

c. Long-term evolution of Argo – Spain.

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

- 2020: Core Argo mission, temperature, and salinity (0 to 2000m).
- 2015 – 2020: 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.

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 2020 with the participation of Argo Spain have been made under 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, the SOCIB has participated in terms of float development by improving floats sampling in boundary regions, 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, 93 floats have been deployed so far, of which 24 were active at the end of 2020. 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.

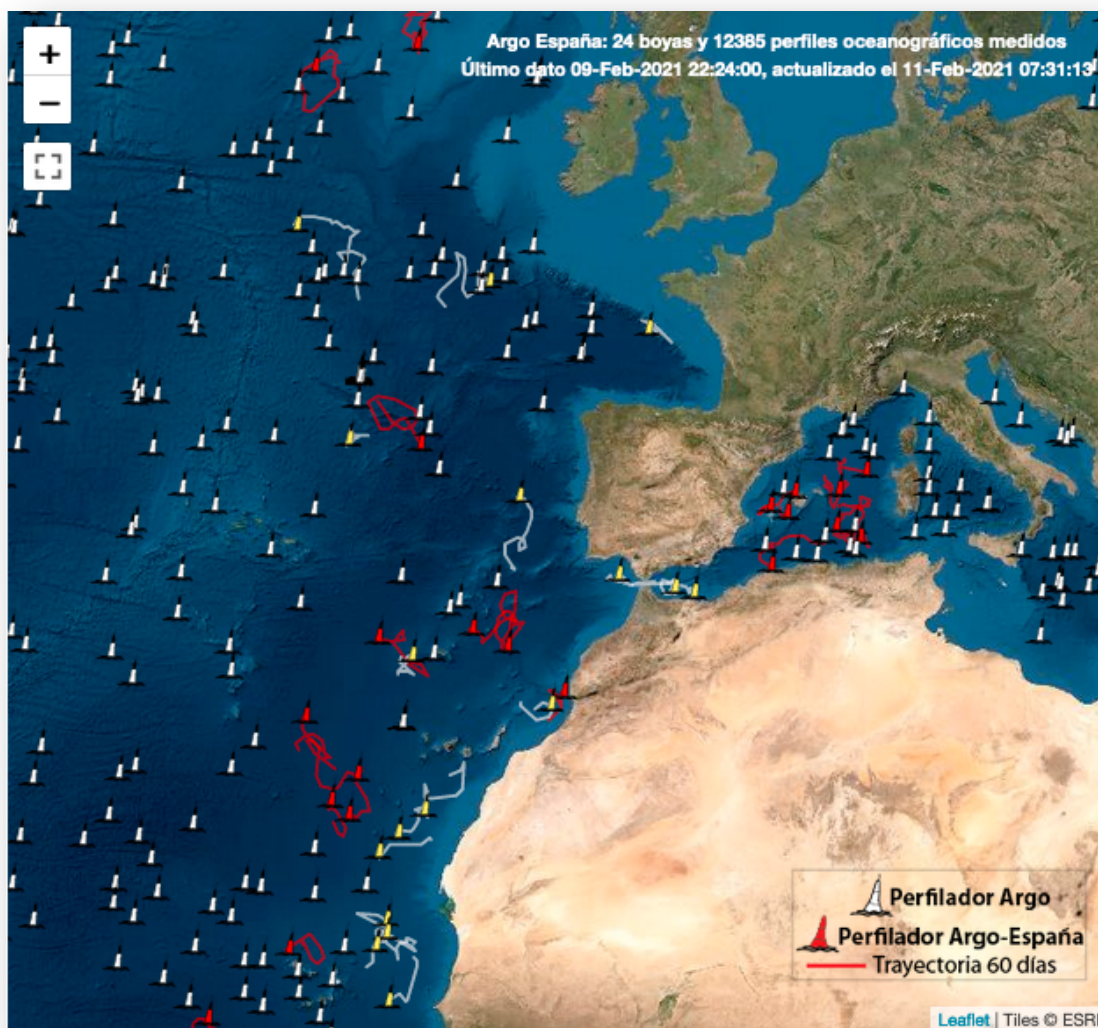


Figure 1. Status of the Argo Spain program on February 15th 2021.

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	Controller Board	Deployment Date
6901253	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	29/05/2018
6901254	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	15/10/2018
6901255	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	16/6/2019
6901256	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	01/06/2018
6901257	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	06/02/2019
6901258	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	04/06/2018
6901259	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	11/03/2019
6901262	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	08/06/2018
6901263	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	06/02/2019
6901265	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	10/06/2018
6901266	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	13/06/2018
6901268	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	18/03/2019
6901269	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	16/06/2018
6901270	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	18/08/2018
6901271	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	30/10/2018
6901272	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	26/03/2019
6901273	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	11/12/2018
6901277	Active	Argo SPAIN	IEO	ARVOR_L	70-10-444	31/07/2019
6901278	Active	Argo SPAIN	EA-RISE SOCIB ICTS	ARVOR_I	I535	12/03/2020
6901280	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	I535	12/08/2020
6901281	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	I535	04/11/2020
6904065	Active	Argo SPAIN	SOCIB ICTS	ARVOR_I	I535	14/08/2020

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 2020).

a. Floats deployed and their performance.

During 2020, a total of 4 Argo floats were deployed by Argo-Spain:

- 4 ARVOR – I floats (Argo Spain in the Mediterranean Sea).
 - 3 of them under the framework of Argo Spain’s minimum annual coverage commitment for the Euro – Argo contribution and purchased by SOCIB.
 - 1 of them under the framework of the EA-RISE project.
 - 1 recovery and next redeployment.

The contribution of Argo Spain to extend the international Argo network during 2020 was focused on the Med sea, deploying a total of 4 ARVOR – I floats. These deployment missions were coordinated by SOCIB ICTS – IEO and developed by SOCIB ICTS in collaboration with partners who cooperated for the success of the missions. One of the floats (WMO 6901278) deployed has been managed under the Euro-Argo Research Infrastructure Sustainability and Enhancement (EA – RISE) project, deployed by SOCIB ICTS. If more information is required about this project, please find the next link: <https://cutt.ly/OIEVIDc>

As an example, the ARVOR – I float WMO 6901280 is currently diving northeast of Mallorca island after 37 profiles developed (Fig. 3). The float was programmed to dive up to 2000m every 5 days measuring temperature and salinity during the ascending phase, developing a profile depth of 2000m within a parking depth of 1000m.



Figure 2. R/V SOCIB operator moments before the deployment of WMO 6901280 float under safety measures at *Canales Summer 2020* survey.

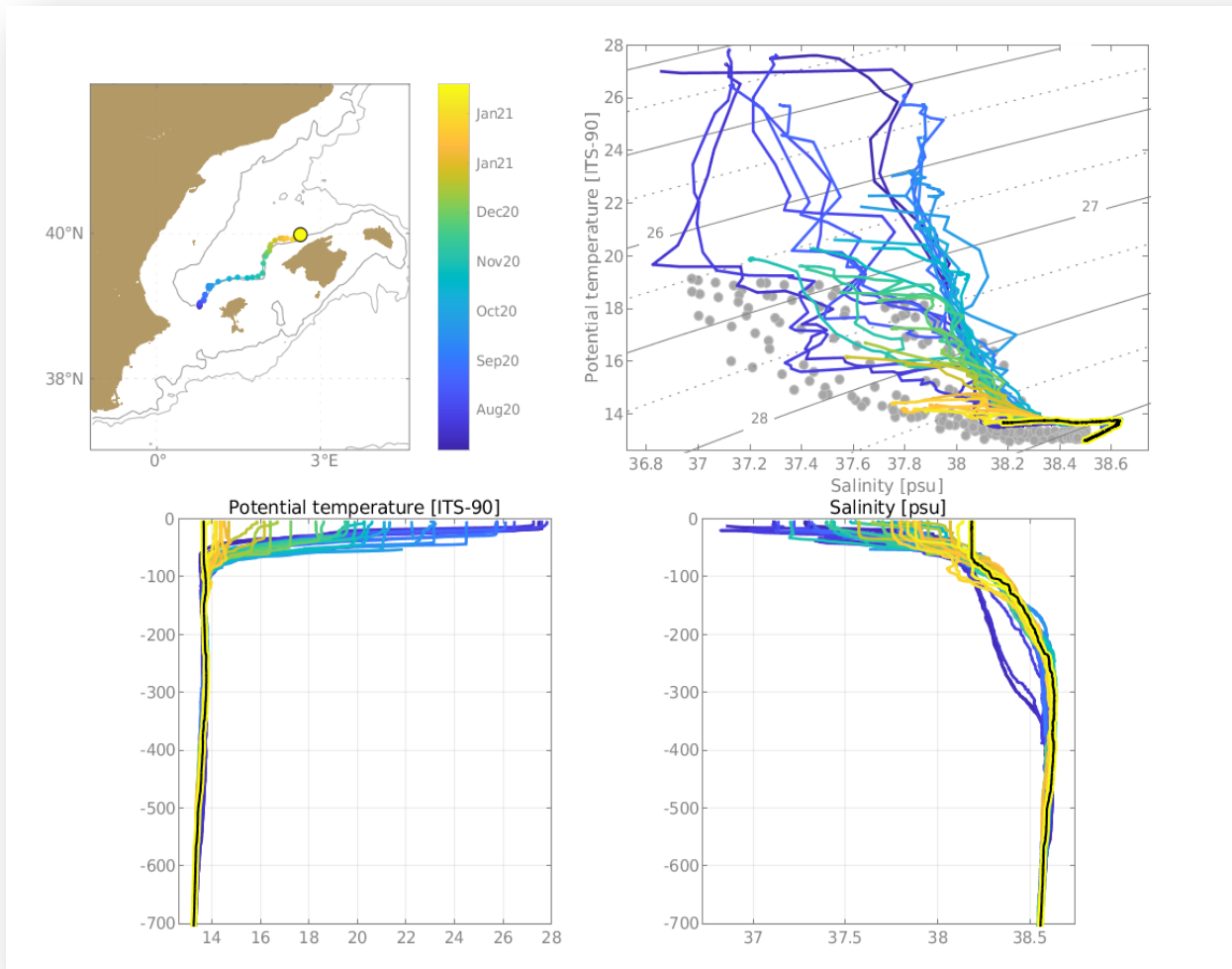


Figure 3. The trajectory of the float since the deployment is shown in the upper left side of the picture. T-S diagram of the data collected by WMO 6901280 is shown on the upper right side of the picture. The grey points are the climatology of the area. The black line is the first profile carried out by the float. Potential Temperature and Salinity profiles are also shown on the lower side of the picture.

The ARVOR – I float WMO 6901279 also as an example, which was deployed between Mallorca and Ibiza islands, performed a northwest trajectory until it was captured by a local boat (fig. 4). The float was delivered to SOCIB ICTS and it was redeployed on Aug 14th, 2020 under a new WMO 6904065. The float was programmed to dive up to 2000m every 5 days measuring temperature and salinity during the ascending phase, developing a profile depth of 2000m within a parking depth of 1000m (fig. 5).

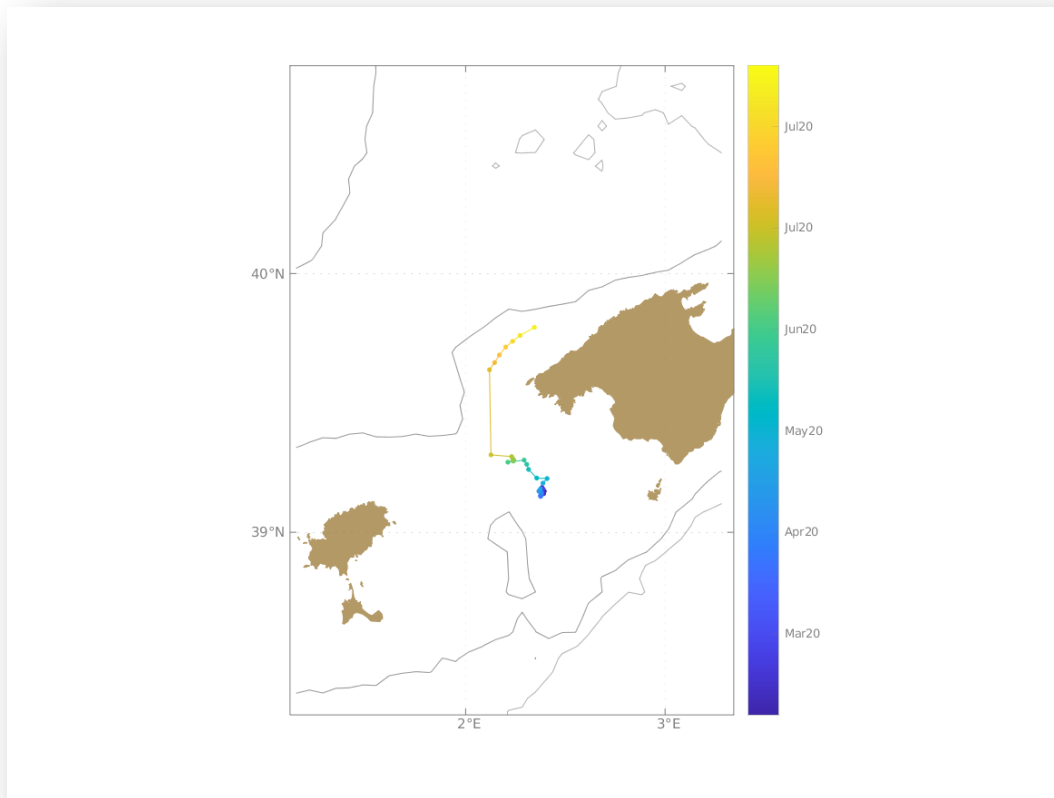


Figure 4. The trajectory of the float WMO 6901279 from the deployment until its capture.

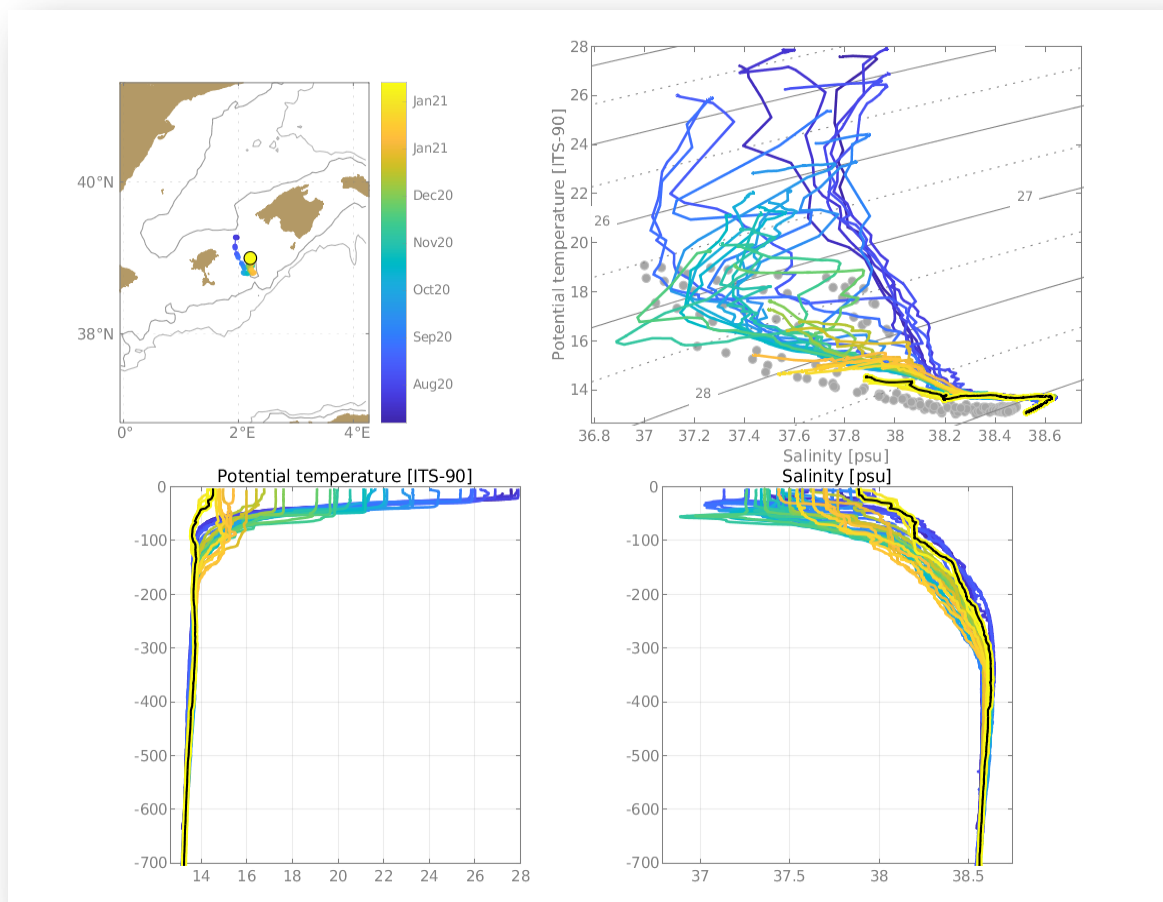


Figure 5. The trajectory of the float since the deployment is shown in the upper left side of the picture. T-S diagram of the data collected by WMO 6904065 is shown on the upper right side of the picture. The grey points are the climatology of the area. The black line is the first profile carried out by the float. Potential Temperature and Salinity profiles are also shown on the lower side of the picture.

b. Technical problems encountered and solved.

- The ARVOR – I float WMO 6901279 was deployed on March 13th, 2020 at the Mediterranean Sea. The float worked as expected, developing a total of 31 profiles in total until it was captured by a local boat. The float was delivered and, after inspection, redeployed on Aug 14th, 2020 under a new WMO 6904065.
- According to SOCIB ICTS, the ARVOR – I float WMO 6901278 had performed some emergency ascents during its last cycles (fig. 6). This issue was reported to NKE.

NKE identified the issue: The float had reached for 5 cycles pressure slightly higher than 2100 dBar [2102, 2123, 2109, 2125 & 2105] and entered into emergency ascent mode. A solution was provided by NKE and the float hasn't performed any emergency ascent so far.

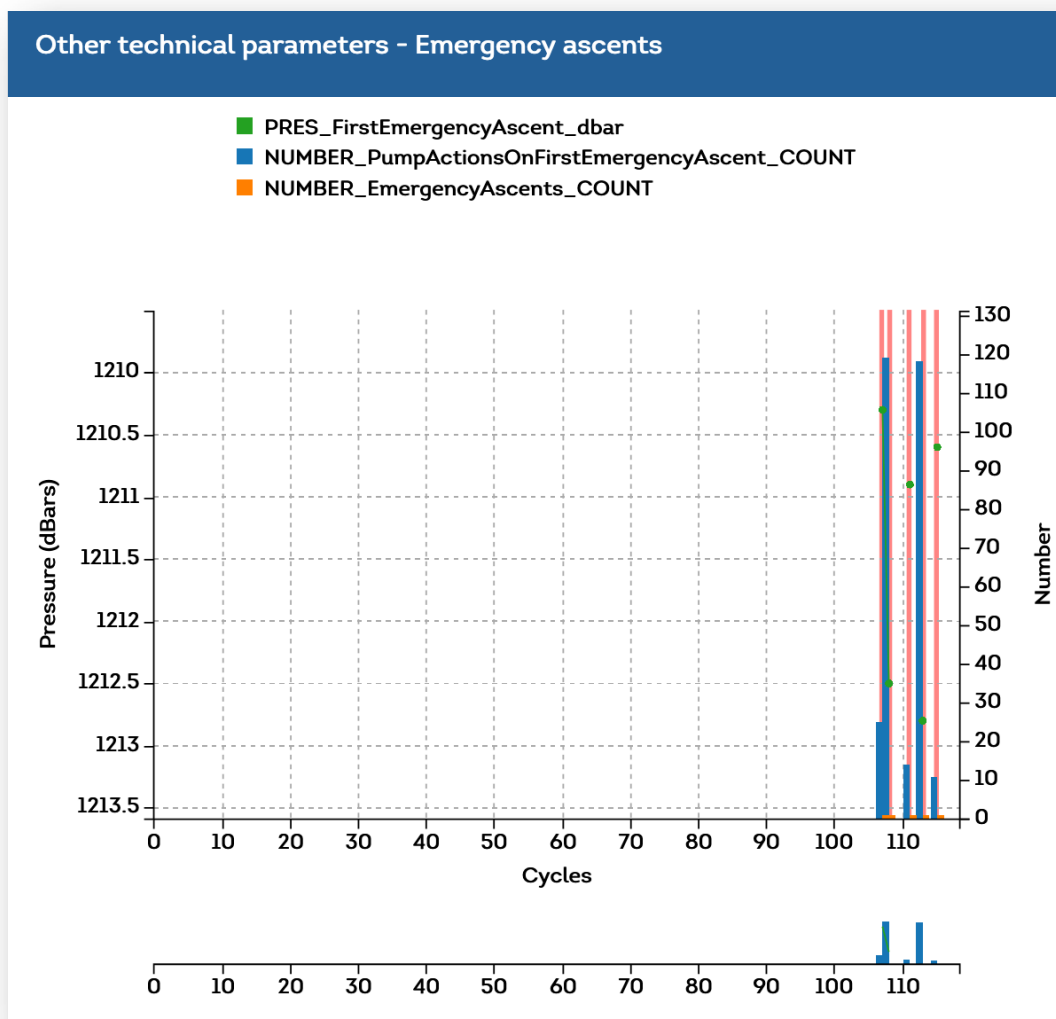


Figure 6. The ARVOR – I WMO 6901278 has been experiencing emergency ascents in the last cycles.

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 SOCIB ICTS will be scheduled so that SOCIB ICTS is in charge of the DMQC of the Argo Spain profilers deployed in the Mediterranean.

Argo-Spain fleet is comprised of 92 floats deployed so far. A total of 63 floats have been deployed in the Atlantic Ocean and 29 floats deployed in the Mediterranean Sea (fig. 7).

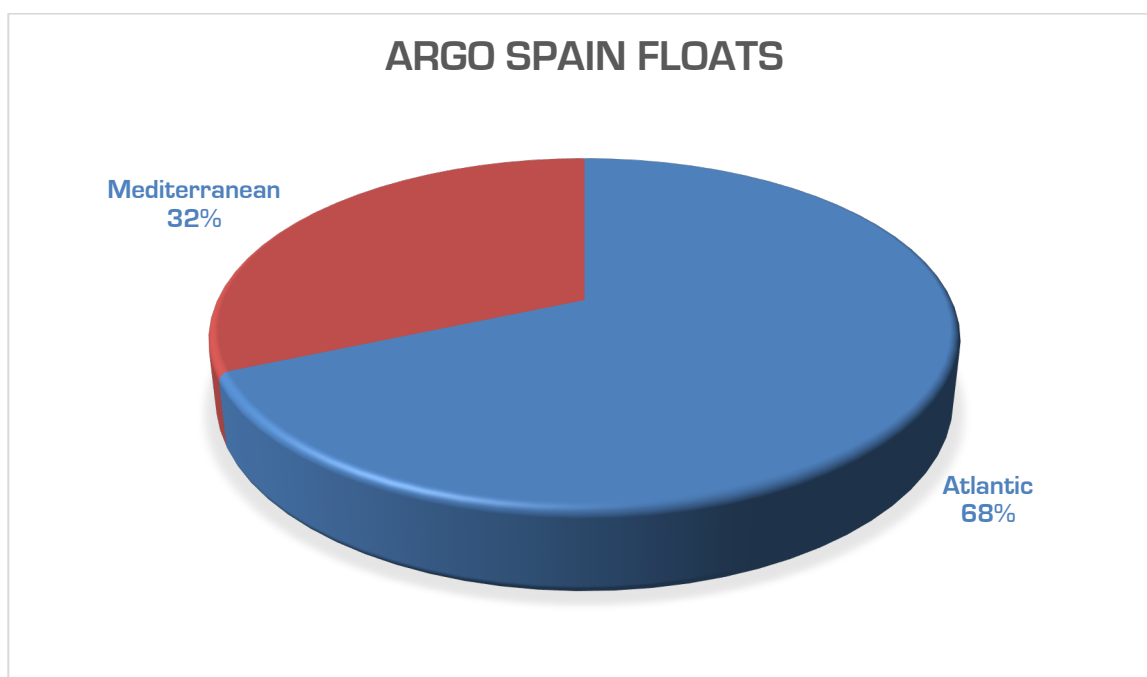


Figure 7. Argo-Spain floats fleet.

DMQC has been carried out for 16 floats in 2016 (35,5%), for 19 floats (42,2%) in 2017, for 4 floats in 2018 (8'8%), and no DMQC has been developed during 2019 and 2020 (fig. 8).

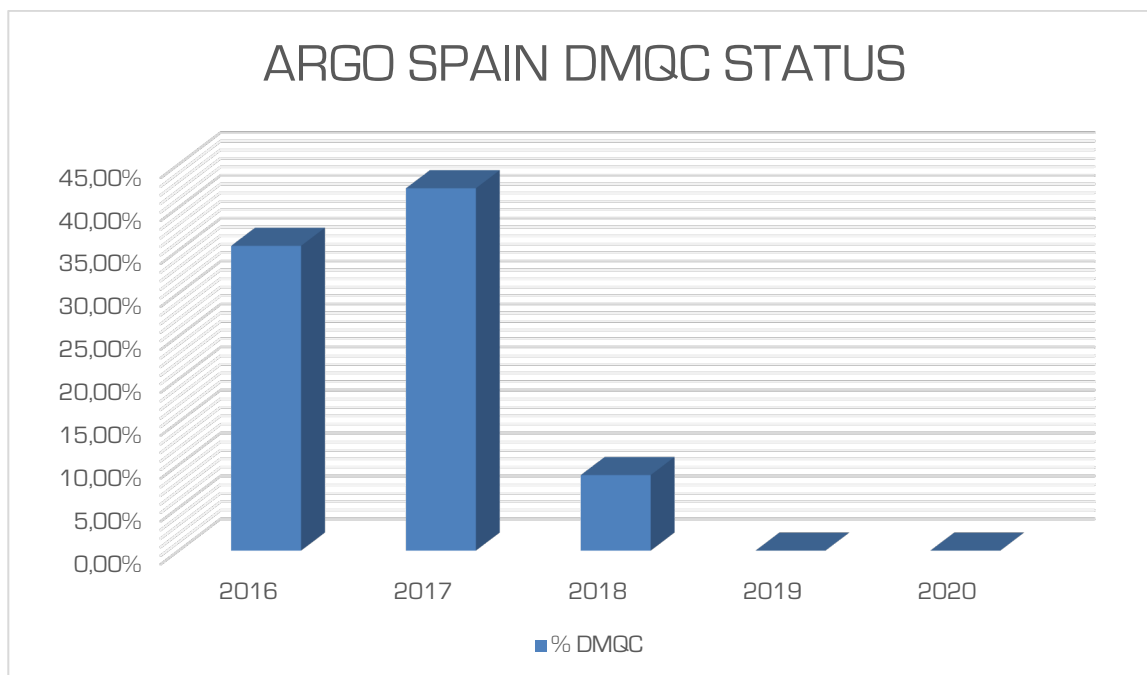


Figure 8. Argo-Spain floats fleet.

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.

Argo-Spain has increased its manpower since a new technician (1) got a permanent position at the IEO and another technician (1) has been hired full-time at SOCIB under the framework of the EA-RISE project. Also, there is a knowledge transfer on the DMQC between SOCIB and IEO scheduled for this year 2021. The IEO’s funding covers float procurement in the period 2021-2022, transmission costs, and 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 until 2021.

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 2021 (SOCIB).
- 10 standard floats [ARVOR - I] to be deployed in the Atlantic Ocean during 2021 and 2022 (IEO).
- 5 Deep Argo floats [DEEP ARVOR] to be deployed in the Atlantic Ocean during 2021 and 2022 (IEO).

- 1 BGC float to be deployed in the Atlantic Ocean during 2021 or 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., it will be done during 2021.

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.

Agulles, M., Jordà, G., Jones, B., Agustí, S., Duarte, C.M., 2020. Temporal evolution of temperatures in the Red Sea and the Gulf of Aden based on in situ observations (1958–2017). *Ocean Science* 16, 149–166. <https://doi.org/10.5194/os-16-149-2020>

Álvarez, M., Fajar, N.M., Carter, B.R., Guallart, E.F., Pérez, F.F., Woosley, R.J., Murata, A., 2020. Global Ocean Spectrophotometric pH Assessment: Consistent Inconsistencies. *Environ. Sci. Technol.* 54, 10977–10988. <https://doi.org/10.1021/acs.est.9b06932>

Caballero, A., Mulet, S., Ayoub, N., Manso-Narvarde, I., Davila, X., Boone, C., Toubanc, F., Rubio, A., 2020. Integration of HF Radar Observations for an Enhanced Coastal Mean Dynamic Topography. *Front. Mar. Sci.* 7. <https://doi.org/10.3389/fmars.2020.588713>

Dañobeitia, J.J., Pouliquen, S., Johannessen, T., Basset, A., Cannat, M., Pfeil, B.G., Fredella, M.I., Materia, P., Gourcuff, C., Magnifico, G., Delory, E., del Rio Fernandez, J., Rodero, I., Beranzoli, L., Nardello, I., Iudicone, D., Carval, T., Gonzalez Aranda, J.M., Petihakis, G., Blandin, J., Kutsch, W.L., Rintala, J.-M., Gates, A.R., Favali, P., 2020. Toward a Comprehensive and Integrated Strategy of the European Marine Research Infrastructures for Ocean Observations. *Front. Mar. Sci.* 7. <https://doi.org/10.3389/fmars.2020.00180>

Olivé, A., Pelegrí, J.L., Machín, F., 2020. Property balances in the Scotia Sea as deduced from inverse modeling. <https://doi.org/10.13039/501100006368>

Olmedo, E., González-Haro, C., Hoareau, N., Umberto, M., González-Gambau, V., Martínez, J., Gabarró, C., Turiel, A., 2020. Nine years of SMOS Sea Surface Salinity global maps at the Barcelona Expert Center. *Earth System Science Data Discussions* 1–49. <https://doi.org/10.5194/essd-2020-232>

Sergi, S., Baudena, A., Cotté, C., Ardyna, M., Blain, S., d'Ovidio, F., 2020. Interaction of the Antarctic Circumpolar Current With Seamounts Fuels Moderate Blooms but Vast Foraging Grounds for Multiple Marine Predators. *Front. Mar. Sci.* 7. <https://doi.org/10.3389/fmars.2020.00416>

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.

The IEO has funding secured in 2020 to purchase floats for two years. Despite problems related to the COVID-19 in 2020, it was possible to begin the purchasing processes that will be done in 2021.

SOCIB tried to purchase 3 profilers but the procedure was canceled because of the pandemic. However, it was also possible to begin the purchasing processes for 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 2021 and 2022 (if known) and where they might be deployed.

- IFREMER, EURO-Argo, and the IEO deployed on December 2020 two '3-Headed' Deep Argo floats (range 4000 m depth) in the Canary basin under the framework of the EA-RISE and NAOS projects. Both floats are equipped with an RBR Concerto sensor. If more information is required, please find the next link: <https://cutt.ly/ykOmOhV>
- Two ARVOR – I floats equipped with RBRargo sensor were also deployed by IFREMER, EURO-Argo, and the IEO on December 2020 under the EA-RISE project.
- It is also planned for the end of 2021 that IFREMER, EURO-Argo, and the IEO will deploy two '2-Headed' floats equipped with RBRargo under the EA-RISE project.