French National Report on Argo - 2020

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By the Argo-France Management Board

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Background, organization and funding of the French Argo activities

Organization

Argo-France (https://www.argo-france.fr) gathers all the French activities related to Argo and its extension toward deep and biogeochemical measurements. Argo-France is the French contribution to the Euro-Argo European research infrastructure (ERIC) that organizes and federates European contributions to Argo.

All Argo-France activities are led and coordinated by:

- a scientific committee shared with the CNRS/LEFE Group Mission Mercator Coriolis (GMMC),
- a steering team with: a national coordinator (G. Maze), scientific coordinators for the physical and bio-geochemical missions (N. Kolodziejczyk, F. D'Ortenzio, H. Claustre), technical coordinators for the physical and bio-geochemical missions (S. Pouliquen, F. D'Ortenzio), head of the data center (T. Carval), data center officer for BGC (C. Schmechtig) and heads of operational and infrastructure activities (N. Lebreton, N. Poffa, A. Poteau) and heads of quality control activities (C. Cabanes and R. Sauzède).

Argo-France is part of the Ministry of Research national roadmap on large research infrastructure (TGIR). Argo-France operational activities are organized through the Coriolis partnership (IFREMER, SHOM, INSU, IRD, Météo France, CEREMA, CNES and IPEV). Two research laboratories are leading the Argo-France scientific activities: the "Laboratory for Ocean Physics and Satellite remote sensing" (LOPS, Brest, France) and the "Laboratoire d'Océanographie de Villefranche"/"Institut de la Mer de Villefranche" (IMEV/LOV, Villefranche-sur-Mer, France). Coriolis and Argo-France have strong links with Mercator Ocean International (the French operational ocean forecasting center).

Funding

Argo-France is mainly funded by the ministry of Research through Ifremer as part of the national roadmap on large scale infrastructures and contribution to Euro-Argo (TGIR). This is a long term commitment. Argo-France is also funded through Ifremer, SHOM (Ministry of Defense), CNRS/INSU and other French institutes involved in oceanography (CNES, IRD, Météo-France). At regional scale, Argo-France is supported by the IUEM/University of Brest OSU (Observatory) and funded by the Brittany and Provence Alpes-Cote d'Azur regions (CPER projects).

The French contribution to the Argo global array is at the level of 60 to 65 floats per year with funding from Ifremer (50 floats/year) and SHOM (about 10 to 15 floats/year).

Since 2000, around 1450 French floats have been deployed in different geographic areas. Deployments focused on meeting specific French requirements while also contributing to the global array.

To complement Argo-France, the NAOS project (Novel Argo Ocean observing System, 2011-2019) was funded by the Ministry of Research to consolidate and improve the French contribution to Argo and to prepare the next scientific challenges for Argo**.** The project provided an additional funding of 15 to 20 floats per year from 2012 to 2019, which allowed Ifremer to increase its long-term contribution to Argo from 50 to 65-70 floats/year. NAOS also developed the new generation of French Argo floats

and set up pilot experiments for biogeochemical floats (Mediterranean Sea, Arctic), Under Ice BGC floats (baffin bay) and deep floats (North Atlantic).

As follow up of this project:

- the Ifremer PIANO project (2021-2025) will consolidate and improve the French contribution to BGC-Argo (funding of 15 BGC floats) and develop the next generation french of deep-Argo floats (6000m), and BGC-ECO floats (BGC float with ecological sensors).
- the Argo2030 project (2021-2028) has been recently accepted and funded by the Ministry of research to consolidate and improve the French contribution to BGC-Argo (funding of 15 BGC floats), and to test the next generation of french deep-Argo-6000 floats (funding of 22 floats), and of BGC-ECO floats (funding of 14 BGC-ECO float).

The level of support, additional to float purchase, is as indicated in Tableau 1 (man power for coordination activities, float preparation, deployment and data management activities).

Year	Funding	**Man/Year**	***French floats***	***Co-funded EU floats***	***Total***
2000	300k€		*11*		*11*
2001	633k€	3	*12*		*12*
2002	980k€	6	*7*	*4*	*11*
2003	900k€	9	*34*	*20*	*54*
2004	1400k€	15	*85*	*18*	*103*
2005	450k€	15	*89*	*11*	*100*
2006	900k€	12	*51*	*14*	*65*
2007	900k€	12	*36*		*36*
2008	1200k€	12	*90*		*90*
2009	1200k€	12	*35*	*8*	*43*
2010	1400k€	12	*59*		*59*
2011	1400k€	12	*64*		*64*
2012	1400k€	12	*105*		*105*
2013	1400k€	12	*89*		*89*
2014	1400k€	12	*108*		*108*
2015	1400k€	14	*131*		*131*
2016	1400k€	14	57		*57*
2017	1400k€	14	69		69
2018	1400k€	14	86		86
2019	1400k€	14	71		71
2020	1400k€	15	45		45

Total (2000-2020)			*1334*		*1333*
2021	**1400k€**	**15**	80		

Tableau 1: (*Man/year* column) Man power dedicated to Argo for coordination activities, float preparation, deployment and data management activities (GDAC, DAC, NAARC, DMQC) within Argo-France. (*French floats* column) French floats contributing to Argo deployed by year. (*Co-funded EU floats* column) EU floats are the additional floats co-funded by European Union within the Gyroscope, Mersea and MFSTEP projects. Estimated value is given for 2021.

Long term evolution of Argo

At the national level, Argo-France will contribute to the new phase of Argo with about 69 floats/year with the following repartition:

- 30 core Argo floats /year
- 15 core Argo floats with O2 sensor /year
- 15 Deep-Argo-4000 floats /year (+ 22 Deep-Argo-6000 floats)
- 9 BGC-Argo floats /year (+ 14 BGC-ECO floats)

Core T/S, deep floats and oxygen sensors will be funded until 2027 (CPER Brittany region), the biogeochemical mission is funded triugh different projects (CPER PACA and Brittany regions, ERC Refine, Argo-2030 and PIANO projects).

Argo-France strategy will be adjusted according to international recommendations with regard to the deep and Bio-Argo extensions. Euro-Argo has published a long term roadmap for the next phase of Argo and as part of the ERIC Euro-Argo countries will work on the implementation of a new sustained phase for Argo in Europe.

Float development

As part of the EA-RISE 2019-2022 H2020 project :

- An Arvor model equipped with the RBR CTD has been developed and deployed in December 2020. Analyses are on-going.
- Two Deep-Arvor equipped with 2-CTDs (the RBRargoDeep|OEM and the SBE61) are being developed. Due to delay in sensor provisioning, these floats should be deployed in 2021.
- Two Provor floats with SUNA + OPUS + O2 + EcoTriplet and with OC4 + RAMSES + O2 + EcoTriplet are developed, tested in the Mediterranean Sea and will be deployed in the Baltic.

As part of the new ERC REFINE project (see details in the National research section) technological developments are expected to provide:

- Extended battery packs for longer mission
- New electronic for targeted exploration and adaptative sampling
- New sensors for particles and zooplankton characterization

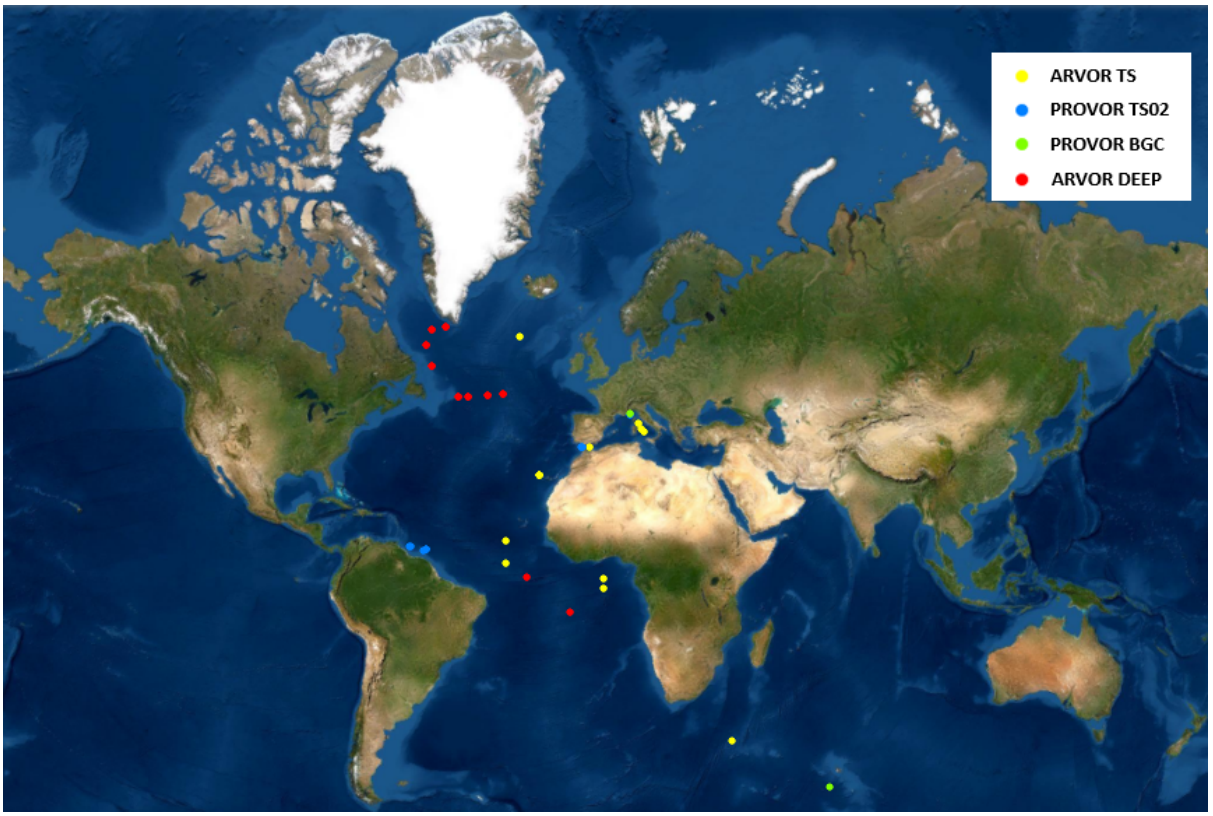
As part of the new Ifremer PIANO project the expected technological developments are :

- New T/S and BGC sensors (optical sensors, sonar, chemical sensor)
- improvment of Deep-Argo 4000 and development of new Deep-Argo 6000 m
- Improve float technology (communications and electronics)

The status of implementation

Floats deployed and their performance

45 floats have been deployed by France in 2020 (15 T/S Core, 8 T/S/O2, 4 BGC, 18 DEEP). We deployed those floats from French RV Pourquoi Pas?, Atalante and Thalassa but also from the German RV Meteor and Maria S. Merian thanks to a fruitful collaboration with BSH and Argo-Germany. A cruise was also conducted from Spain's RV Ramón Margalef and 4 floats were deployed using sailing vessels including 3 on the Vendée Globe race. The deployment areas are chosen to meet French requirements in terms of research and operational activities but also to contribute to establishing the global array (especially in the Southern Ocean) using AIC tools/map. Note that due to COVID19 pandemia ship opportunities from the French Scientific fleet have been postponed to 2021. In 2020, only 57% of the planned deployments have been successfully operated.



Deployment locations of Argo-France floats in 2020 by float types.

Technical problems encountered and solved

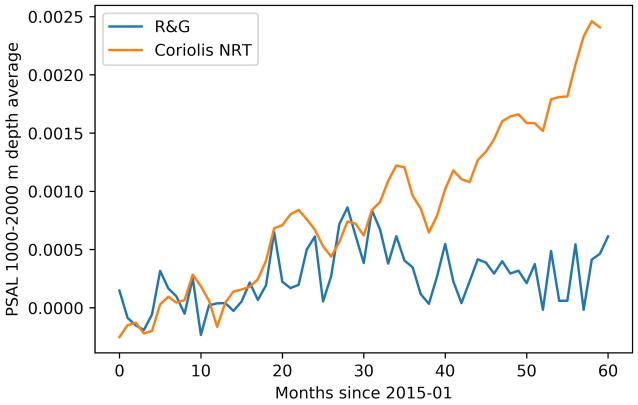
Technical problems on Deep Arvor.

- 2 Deep Arvor have been lost due to suspected water leak after less than 15 cycles.

Seabird batch of drifting CTDs is being assessed and monitored.

- 16 Floats QCed by LOPS and affected by the issue are documented here: https://docs.google.com/spreadsheets/d/1qzuJgw8yAZhiWTSL9j3AMatbBWaD6ZsapTsfFofkDXA/edit#gid=0
- The SBE CTD drift is likely to impact near real time (NRT) Argo analysis products at Coriolis using both DM and RT profiles (for recent years). Since 2015, global averaged salinity issued

from Coriolis NRT analysis is suspectly increasing over the whole water column (+0.001 to 0.0025 pss below 1000 m depth). This could be explained by the large amount of RT profile suffering from SBE salinity drift (still in late 2020). The potential impact of SBE salinity drift on global salinity and halosteric height analysis is an ongoing work.



Global (60°N-60°S) averaged salinity anomaly (referred to the period 2006-2015) between 1000-2000 m depth from Roemmich and Gilson Argo analysis (blue; with corrected salinity) and from NRT Coriolis analysis (yellow; including RT profiles).

- A more complete assessment of the impact on the national fleet is in preparation and QC analysis is available on this issue of the public Argo QC forum.
- The DMQC analyis of French floats is updated and concatenated at European level :https://docs.google.com/spreadsheets/d/e/2PACX-1vS041PxmjzJcyYbczT_XbBIG62WYAaMGo7U0F3qz_yxzDQgYIlf-9bKT18lDvaDxV60Dqut4GVJUprG/pubhtml?urp=gmail_link&gxids=7628#

Status of contributions to Argo data management

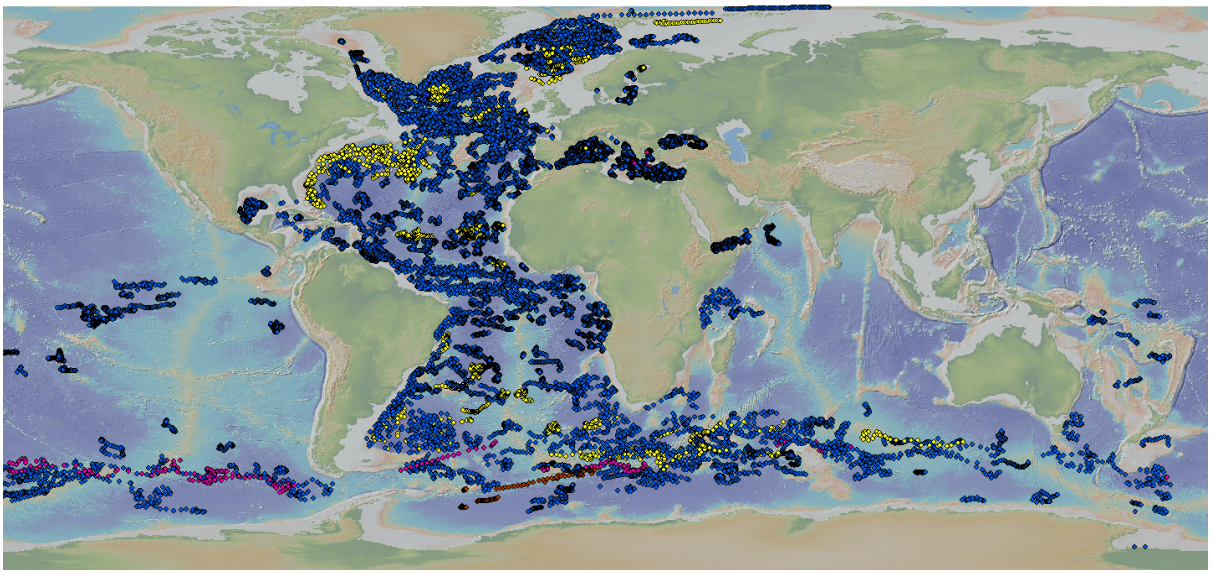
Within Argo-France, data management is undertaken by Coriolis, which play three roles: Data Assembly Centre, Global Data Centre, and leader of the North Atlantic Argo Regional Centre. Coriolis is located within Ifremer-Brest and is operated by Ifremer with support of SHOM. Since 2016, the BGC floats processing chain have been fully operational and integrated within the Coriolis data management stream.

All Argo data management details are in the Coriolis DAC and GDAC 2020 annual report (english) : https://doi.org/10.13155/77033

Data Assembly Center

Coriolis processes in Real Time and Delayed Mode float data deployed by France and 7 European countries (Germany, Spain, Netherlands, Norway, Italy, Greece, Bulgaria).

These last 12 months, 52,160 profiles from 787 active floats were collected, controlled and distributed. Compared to 2019, the number of profiles has significantly increased (+49%), the number of floats increased by 5%. These figures show a fair stability in Coriolis DAC activity. The 787 floats managed during that period had 48 versions of data formats.

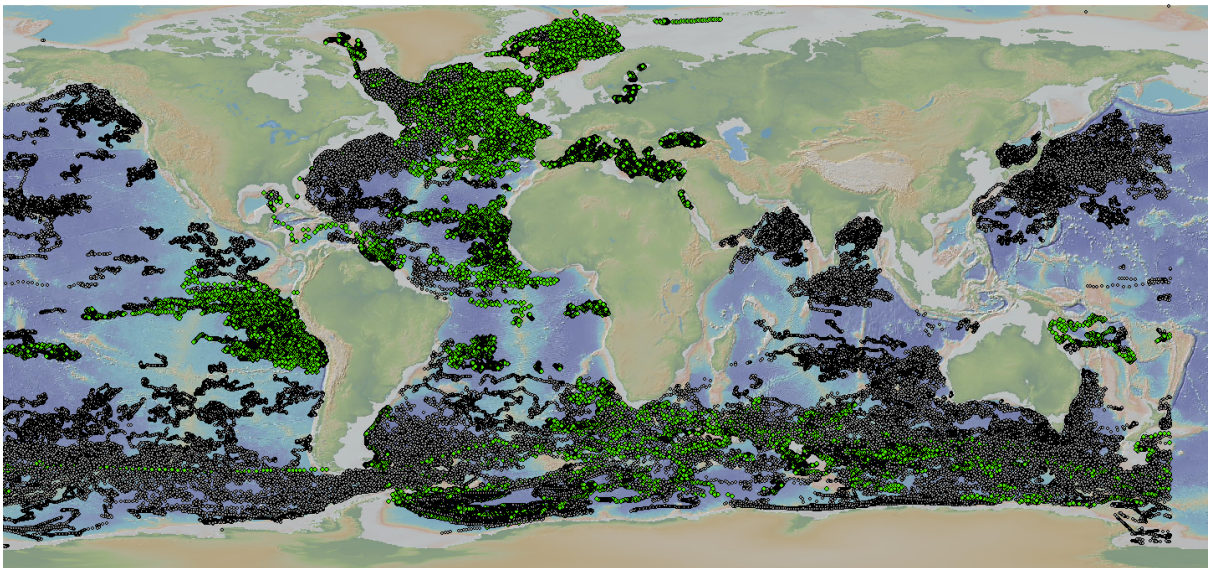


Map showing the 52,160 profiles from 787 active float décoded by Coriolis DAC in 2020
Apex Nova Provor Nemo

The data processing chain based on Matlab to manage data and metadata from Coriolis BGC-floats is continuously improved. These are advanced types of floats performing bio-geo-chemical (BGC) measurements.

Coriolis DAC manages 513 BGC-Argo floats from 5 families and 57 instrument versions. They performed 68,978 cycles. The data processing chain is freely available:

- Coriolis Argo floats data processing chain, http://doi.org/10.17882/45589



Map of 513 flotteurs BGC-Argo managed by Coriolis DAC (gray: BGC floats from other DACs). Measurements are dissolved oxygen, chlorophyll, turbidity, CDOM, backscattering, UV, nitrates, le bisulfit, pH, irradiance, PAR.

Global Argo Data Centre

Coriolis hosts one of the two global data assembly centres (GDAC) for Argo that contains the whole official Argo dataset. The Argo GDAC ftp server is actively monitored by a Nagios agent (see http://en.wikipedia.org/wiki/Nagios). Every 5 minutes, a download test is performed. The success/failure of the test and the response time are recorded. There is a monthly average of 560 unique visitors, performing 4300 sessions and downloading 5.9 terabytes of data files.

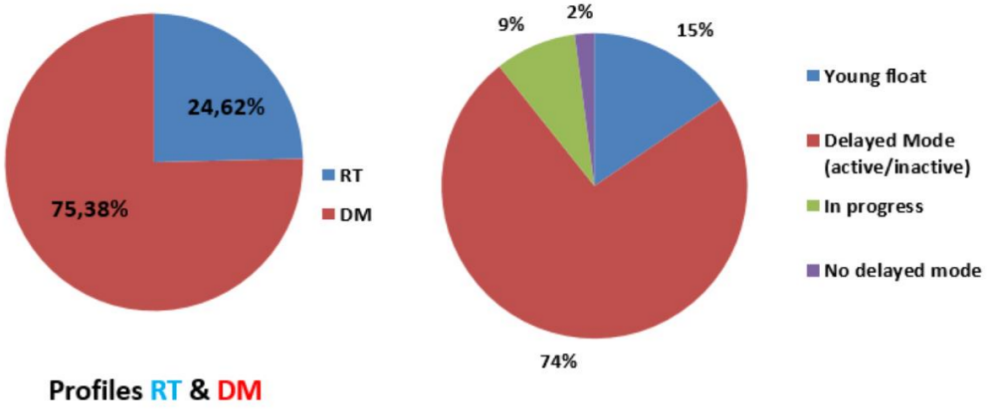
Within the EMODnet and CMEMS-INSTAC projects , in continuity of the prototype developed in the EU AtlantOS project, Ifremer is setting up a dashboard (Semaphore) to monitor data distribution and give credit to data providers such as Argo floats partner institutes. FTP downloads log files are ingested in an Elasticsearch index. A link between downloaded files, download originators, floats included in the downloaded files and institution owners of the floats is performed. These links are displayed in a Kibana dashboard.This dashboard will offer the possibility to give credit to Floats owner institutions such as how many data from one particular institution was downloaded, by whose data users

North Atlantic Argo Regional Centre

See section 5.4

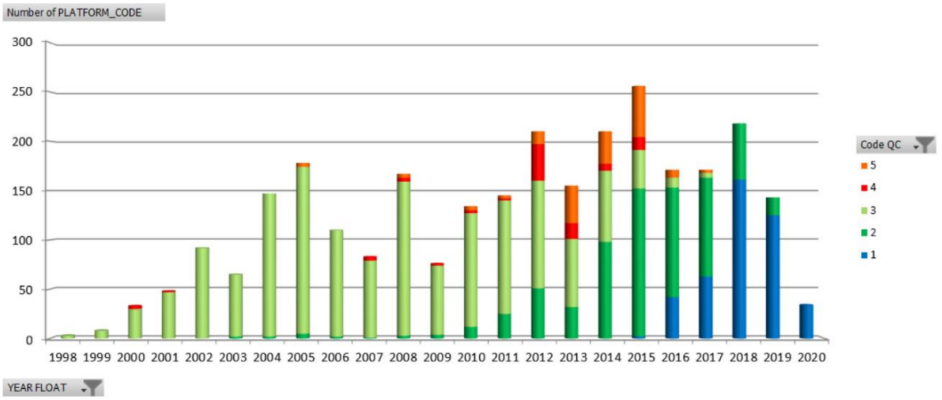
Status of delayed mode quality control process

Last year (october 2019-November 2020), 50,641 new delayed mode profiles were produced, validated by PIs and sent to GDACs. A total of 273779 delayed mode profiles were produced and validated since 2005. In February 2021, 75.38% (74%) of the profiles (floats) processed by the Coriolis DAC were in delayed mode (see Figure below).



Status of the floats processed by Coriolis DAC.
Left: in terms of profile percent and right: in terms of float percent (DM : delayed mode – RT : real time).

The status of the quality control done on the Coriolis floats is presented in the following plot. For the two last years (2019- 2020), most of the floats are still too young (code 1) to be performed in delayed mode. For the years 2012-2013-2014, we are still working on the DMQC of some floats. The codes 2 and 3 show the delayed mode profiles for respectively active and dead floats.



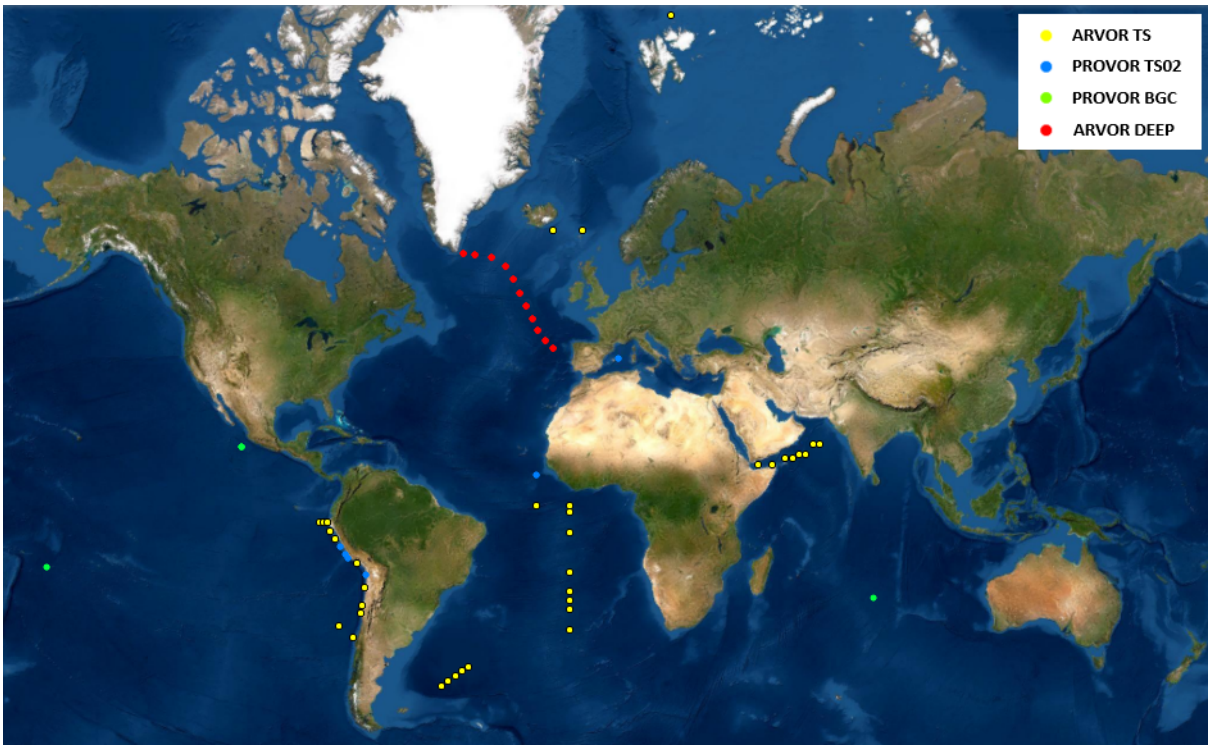
Status of the quality control done on profiles sorted by launch's year, code 1: young float, code 2: active float, DM done, code 3 : dead float, DM done; code 4 : DM in progress, code 5 : waiting for DM, code 6 : problems with float.

Summary of deployment plans and other commitments to Argo for the upcoming year and beyond where possible

According to the current deployment plan, 80 floats are scheduled to be deployed in 2021 (75 are confirmed with 43 T/S, 10 BGC, 22 DEEP), see map below.

Coriolis will continue to run the Coriolis DAC and the European GDAC as well as coordinating the Atlantic ARC (A-ARC) activities. Within Euro-Argo, development will be carried out to improve anomalies detection at GDAC both in RT and DM, to monitor in real time the behaviour of the European fleet and to improve data consistency check within A-ARC.

France also will continue to contribute to the funding of the AIC.



Deployment locations of Argo-France floats planned in 2021 by float types.

COVID19: Because of the global pandemic outbreak in early 2020, Argo-France has reported a significant impact on its operations for 2020 (57% of scheduled deployments). Argo-France foresees possible perturbations in 2021. This impact is still being assessed and will be reported at the OceanOPS and Euro-Argo level for possible coordinations to sustain the array (https://docs.google.com/spreadsheets/d/1ofo5ipeBLFRpNVKpcbTZuiKjpCmWwVU2TPI3-bBO0BM/edit#gid=0). Contribution of France to the Atlantic charter that is organised jointly between USA,Euro-Argo and Canada is a possibility that may allow to deploy core floats according to plans.

Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers

Operational ocean forecasting

All Argo data (alongside with other in-situ and remotely sensed ocean data) are routinely assimilated into the MERCATOR operational ocean forecasting system run by the MERCATOR-Ocean structure. MERCATOR also operates the Global component of the European Copernicus Marine Environment Monitoring Service (CMEMS).

Support to the Mercator and Coriolis scientific activities

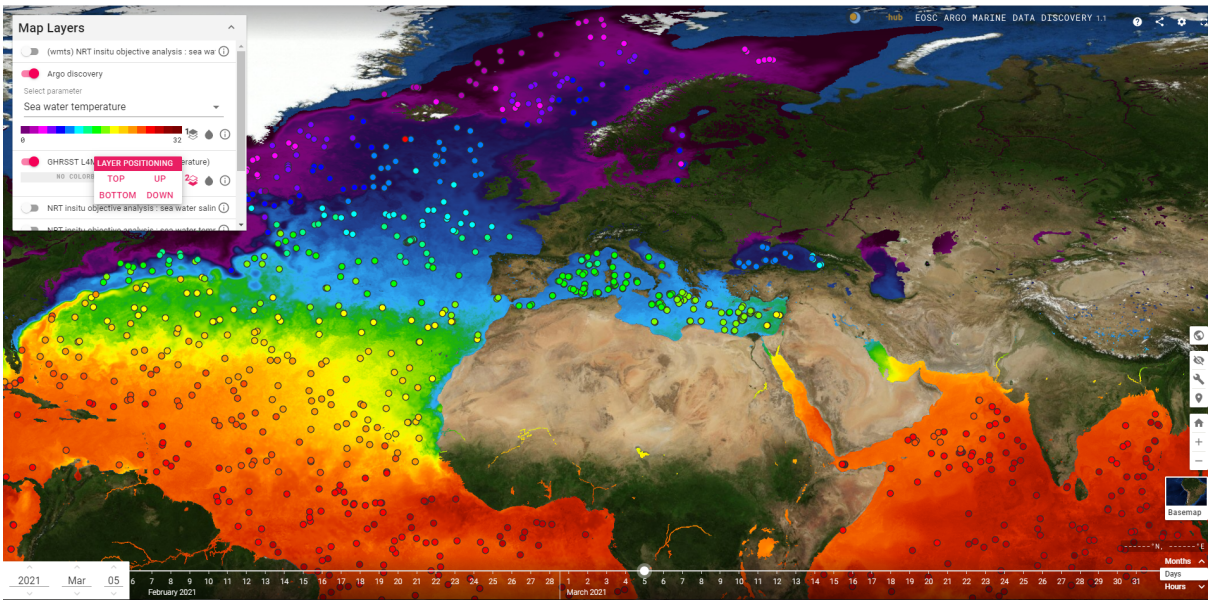
Coriolis has developed together with MERCATOR (The French operational oceanography forecast center) a strong connection with the French research community via the Mercator-Coriolis Mission Group (GMMC). It consists of about one hundred researchers (with some turnover each year) following a scientific announcement of opportunities and a call for scientific proposals. Its task is to support the Mercator and Coriolis scientific activities and to participate in product validation. The call for scientific proposals proposes to the community "standard" Argo floats as well as floats equipped with oxygen and biogeochemical sensors. These new opportunities strengthen the link between the French scientific community and Coriolis with regard to the development of qualification procedures for "Argo extensions" floats.

European Argo-data project involving French Argo community

- Argo MOCCA (2017-2020):
    - Machine learning to help DMQC operator
- Euro-Argo RISE (2019-2022): https://www.euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022/News/Euro-Argo-RISE-progress-already-halfway-there
    - Development & Implementation of DMQC machine learning methods
    - Improvement of data access
    - Sensors: addressing SBE61 accuracy and stability & testing RBR on core and deep floats
    - DMQC method for Argo extended missions (Deep, BGC)
    - Viewing service : https://dataselection.euro-argo.eu/
    - Outreach
- ENVRI-FAIR: connecting ERICs (Euro-Argo) to EOSC Blue Cloud:

- Improving data access to European data base including Argo dataset through new API on Coriolis GDAC

- EOSC-Blue cloud
  - Improving visualization tools for Argo data combined with satellite information (http://bluecloud.odatis-ocean.fr/)



Map of Argo-Float surface temperature overloaded with satellite SST

National Research

Argo data are being used by many researchers in France to improve the understanding of ocean properties (e.g. circulation, heat and freshwater storage and budget, and mixing), climate monitoring and on how they are applied in ocean models (e.g. improved salinity assimilation, …).

A list of France bibliography is available at the end of this report.

Key project activities

ANDRO Trajectory dataset

Argo-France contributes to the DMQC on Argo float trajectories and provides updates to the ANDRO product (Atlas of Argo trajectories). An update for the period 2010-2020 including the floats of the AOML and Coriolis DACs was published in 2020. The delayed-time QCs of the Argo float trajectory data have been updated, as well as the Andro Atlas of float travel velocities at DOI:
Ollitrault Michel, Rannou Philippe, Brion Emilie, Cabanes Cecile, Reverdin Gilles, Kolodziejczyk Nicolas (2019). ANDRO: An Argo-based deep displacement dataset. SEANOE. doi:https://doi.org/10.17882/47077

ICES North Atlantic OCean State Report (IROC)

As every year, in 2020, Argo-France contributed and assembled the French contribution to the ICES report on the state of the North Atlantic Ocean in 2019. The ISAS temperature and salinity fields are used in its "Ocean State Report" (www.ices.dk): Desbruyeres Damien, Kolodziejczyk Nicolas (2020). Contribution to the ICES Report on Ocean Climate : North Atlantic Ocean in 2019. National report: France, May 2020. LOPS-WGOH-2020-05. https://doi.org/10.13155/77447.

H2020 EARISE (Euro-Argo Research Infrastructure Sustainability and Enhancement, 2019-2022)

The H2020 EARISE project has seen its first year of activities show initial results:

- design of the integration of the new RBR probes on the Arvor and Arvor-Deep
- start of the implementation of a DAC for the BGC extension (Coriolis)
- integration design of new bio-optical sensors on PROVOR
- Implementation of a collaborative framework for the Argo community. Collaborative tools are available on github.com/euroargodev. All these tools are free and available for the European Argo community, among others:
    - A public forum on Argo QC to be used by the Argo-France community: github.com/euroargodev/publicQCforum
    - Hosting of digital codes for distribution and development (repositories),
    - Tools for team organization and discussion
    - Project management tools.

ERC REFINE (Robots Explore plankton-driven Fluxes in the marine twIlight zoNE, 2019-2022)

After obtaining a first ERC in 2011 (remOcean), Hervé Claustre obtained in 2019 a second ERC (Advanced Grant) for the REFINE project . The scientific objective of REFINE is to understand and quantify the physical, biological and biogeochemical processes that control the biological carbon pump, a key element in CO2 sequestration. It is in the mesopelagic zone (or twilight zone), between 200 m and 1000 m, that most of the key processes occur. Yet this zone represents one of the least well known ecosystems on our planet. The REFINE project will therefore focus on exploring the meso-pelagic zone and will be implemented through four major coordinated actions:

1. Development of a new generation of multidisciplinary profiling floats, focusing in particular on the composition of phyto- and zooplankton communities.
2. Realization of ~4 years of robotic studies in five ocean areas, representative of the diversity of biogeochemical conditions and responses to climate change in the world ocean, on a continuum of time scales from diurnal to interannual.
3. In-depth analysis of the REFINE dataset, enabling carbon flux budgets to be established for each of the five areas, and understanding the physical and biogeochemical mechanisms involved in the transfer of organic carbon to the deep ocean.
4. "Upscaling" regional processes to the global ocean, notably through the use of artificial intelligence that takes advantage of multi-source observations from REFINE robots and Earth observation satellites.

PIE Ifremer PIANO (Argo Novel Observations Investment Plan ; 2021-2025)

The objective of the PIE PIANO project (Argo New Observations Investment Plan) is to carry out innovative technological developments on Argo floats, on sensors (for T/S and BGC-Argo) and to implement the French contribution to the new Argo phase over 2021-2027. This will involve:

- procurement of BGC-Argo floats (3 floats/year over 5 years)
- to test a new version of the NOSS optical salinity sensor
- to develop a French offer of BGC sensors (active optics, passive optics, micro sonar and pH chemini)
- to develop a Deep-Argo 6000 m float
- to improve float technology (electronics, communication)
- finally to ensure the processing of project data including the development of innovative methods

Equipex+ Argo-2030 (3td Investment Plan of French Research Ministry; 2021-2028)

The objective of the Equipex PIA3 Argo-2030 project is to acquire BGC floats to consolidate the French contribution to the BGC component of the Argo network (20 floats, i.e. 2-3 floats/year over 8 years). Argo-2030 also plans scientific experiments to test and validate the new generations of BGC and Deep floats developed in complementary projects (ERC Refine for the platform, PIE Ifremer PIANO for “Made in France” sensors) :

- The new generation of French BGC-Argo floats (referred to as "BGC-ECO" Argo) will add unique imagery and active acoustics capabilities. These floats will allow the exploration of the mesopelagic zone (100-1000 m)including its biological/fishering dimension (it is believed that the protein resources of this zone are underestimated by at least an order of magnitude) assuming the it is the main site of the remineralization of CO2, and therefore it is decisive for CO2 sequestration.
- The new generation of French Deep-Argo floats (the Deep-Arvor “6000”) will target 6000 m depth (the floats developed and successfully tested in the NAOS Equipex are designed to target 4000 m depth). It will offer a high capacity for carrying additional sensors (oxygen in particular), allowing the Deep-Arvor “6000” to be positioned as the first Deep + BGC mixed float. These floats will help estimate the role of the deep ocean on the planet's energy balance, sea level rise, deoxygenation, acidification in key regions (Atlantic, Southern Ocean). Their deployment will be combined with Deep-Argo 4000 floats to best resolve geographic structures and seasonal to interannual variations in heat and freshwater content, steric height and circulation at the basin scale within deep (> 2000 dbar) and abyssal (> 4000 dbar) oceanic layers.

Argo-Regional Center: Atlantic

France leads the NA-ARC, which is a collaborative effort between Germany (IFM-HH, BSH), Spain (IEO), Italy (OGS), Netherlands (KNMI), UK (NOCS, UKHO), Ireland (IMR), Norway (IMR), Canada (DFO), and USA (AOML), Greece (HCMR) and Bulgaria (IOBAS). Coriolis coordinates the Atlantic ARC activities and in particular the float deployment in Atlantic.

1903 floats that have been processed in delayed time in the Atlantic ARC, north of 35°S, with a check made using a modified OW method that has been published by Cabanes et al (http://dx.doi.org/10.1016/j.dsr.2016.05.007). Floats for which it may be necessary to revise the original DM correction are reported to PIs. The list is available online at:
http://www.umr-lops.fr/en/SNO-Argo/Activities/NAARC/Consistency-checks-of-DM-salinity-corrections

Issues that your country wishes to be considered and resolved by the Argo

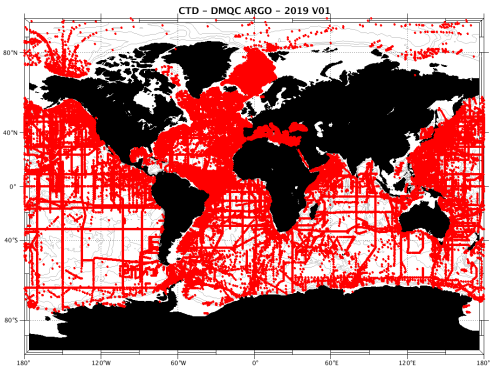
Steering Team regarding the international operation of Argo.

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.

CTD cruise data in the reference database

To continue improving the number of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include the number and location of CTD cruise data uploaded by PIs within your country to the CCHDO website in the past year. These cruises could be used for Argo calibration purposes only or could be cruises that are open to the public as well.

The version 2019V01 including CCHDO, OCL and ICES updates, CTD from PI, correction from feedback have been provided on the ftp site in the middle of October 2019. This new version includes 12 new cruises from the GO-SHIP program (downloaded from the CCHDO website), updates from OCL, ICES and MSM cruise provided by a scientist. A work has alsobeen done for the boxes in the North Sea, with Ingrid Angel from BSH. Expertise on data has been realized to improve the quality and new data has been added (from UDASH and ICES). In March 2020, a new version will be available, including CTD for deep Argo PIs.



Coriolis manages the Argo reference databases for the DMQC (CTD boat casts and Argo floats). In order to facilitate access by QC software, Ifremer undertakes to serve these databases via the ERDDAP API: https://www.ifremer.fr/erddap/info/ArgoFloats-ref/index.html. For the moment, only Argo reference data is available (because it is freely accessible). Ship data will also be provided via a simple authentication system. The new Argo simplified data access library (such as Argopy library) also provides access to reference data.

Bibliography

List of publications in which a scientist from a french laboratory is involved

In 2020, at least 65 articles with a scientist affiliated in France as a coauthor have been published in peer reviewed journals. Note that the list of all publications in which a scientist from a French laboratory is involved is available on the Argo France website and on the Argo Bibliography webpage. To date, more than 400 articles have been listed. http://www.argo-france.fr/references

How has COVID-19 impacted your National Program's ability to implement Argo in the past year?

Argo France program

The Argo France program has been impacted by the Covid-19 pandemic. The steering meetings could be carried out remotely. This mainly concerns the deployment activity, dependent on the activity of the French Oceanographic Fleet, which has been reduced by around 43%. The campaigns providing for deployments of Argo floats are mostly postponed to 2021.

Purchases and tests

The activity was nominal, with no postponed deliveries, the usual tests (pressure tests, basin tests) were not impacted. The teams remained mobilized and Ifremer's test resources adapted with great responsiveness. The slots were shared with the Euro-Argo ERIC team, with an optimization of the weeks in terms of the quantity of instruments tested.

Deployments at sea

About forty floats were deployed in 2020 against around 70 initially planned. This is mainly linked to two postponement of french campaigns due to COVID pandemic (~30 floats). These two projects are confirmed for early 2021.
So far , due to the lifespan of the floats, the impact on the network will take time to be visible and is likely to be small if the deployments are not canceled but only postponed.
Monitoring of GAP formation in Atlantic will be carried on with Euro-Argo and USA partners and mitigating some of the gaps through the Atlantic charter is planned

DAC/GDAC and data management

Data management activities (DAC, GDAC, DMQC, A-ARC)) have been carried on as planned despite the fact that most people were working from home thanks to the services set up by the IT departments of Ifremer and CNRS.).

Meeting/outreach

AST 21 in visio conference March 2020
ADMT 21 in visio conference December 2020
Most of meeting and outreach events were postponed to 2021

Does your National Program have any deployment plans for RBR floats in the next couple years?

Two “three-head” deep floats equipped with an SBE41CP, an SBE61 and an RBR sensor were deployed during the Spanish RAPROCAN2020 campaign off the Canary Islands in December 2020. The data are under processing and analysis at LOPS.
As part of the H2020 Euro-Argo-RISE project, Ifremer has developed the Arvor-I / RBR which is therefore a standard Arvor-I float equipped with the CTD RBR. 2 floats of this type were deployed during the Spanish RAPROCAN2020 campaign off the Canary Islands in December 2020. The data are under processing and analysis at LOPS.
Two Arvor-RBR remained to be deployed. This should be done in 2021.
We also plan to buy 10% of the core-Argo floats with RBR sensors in the coming years.

New RBR CTD mounted on the head of the Arvor float (left) and deep-Arvor prototype equipped with 3 CTDS: RBR, SBE41 and SBE61 (right).

Argo-France: http://www.argo-france.fr
French bibliography: *http://www.argo-france.fr/publications*
Argo PhD list: http://www.argo.ucsd.edu/argo_thesis.html
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