ARGO

part of the integrated global observation strategy

23rd ADMT Meeting

5 - 9 December, 2022

Miami

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1. Status of Argo and link with its users

1.1 Welcome and introduction

Molly Baringer, Deputy Director of AOML, welcomed everyone to Miami and proceeded to introduce John Cortinas, Directory of AOML, who also welcomed Argo and spoke of AOML's historical involvement in the Argo Program as well as their support of collecting observational data in support of operational predictions.

1.2 Feedback from AST-23

Susan Wijffels presented feedback from the AST, starting with the message that in the past year, Argo is making progress towards implementing the OneArgo design, but with the successful pilot arrays, global implementation has stalled. This means that the overall Argo array is in net decline. Even so, Argo coverage remains solid due to longer float lifes compensating for fewer deployments. She noted that as Argo replaces core deployments with Deep and BGC deployments, this decreases the average float lifetime.

Many Argo National Programs have been focused on capacity building for OneArgo and improving the sensors, platforms and their data management systems. However, OneArgo needs 3-4 times current budgets and these resources have not yet been secured. The AST and the AST co-chairs have been reaching out to the global user community through workshops, and more, to help convert the anticipation and enthusiasm for OneArgo into resources for implementation.

Susan noted that despite the ADMT's excellent work, biases in Argo's real time data stream have contaminated ocean data archives and products used for climate analyses. A plan has been formed to reach out directly to some of these operational groups to better communicate how Argo data should be used. She asked whether we should publish an annual update on Argo data which could be read by a wider audience. Finally, she encouraged the ADMT to continue to aggressively find and greylist bad data in R files.

The need remains to diversify CTD sources to reduce risk. Excellent progress has been made on the RBRArgo CTD and the D2 CTD is being tested now at WHOI. There are several prospects for diversity in BGC sensors, but these need further work. She reiterated that new sensors take time and resources to test for use in Argo, but that diversification is important to Argo in the long term.

She pointed out that drift measurements are being used more frequently which is exciting to see and encourages the ADMT to work with the AST to continue defining stronger guidelines for profile time and drift measurements across parameters.

She noted that Basin Deployment Planning meetings are helping to plan deployments for BGC and Deep which need more precise float placement. However, some RV crews are fielding multiple Argo team requests for deployment and notes that this needs to be addressed as Argo relies on the kindness of these vessels for free deployments. She pointed out that the BlueObserver Team, which was a joint US/Euro-Argo charter, was able to deploy 85 floats and fill gaps in the Atlantic.

Susan ended by welcoming Denmark, Indonesia and Portugal to the AST and Victor Turpin as the new Argo Technical Coordinator at OceanOPS and Orens de Fommervault as the BGC Argo Technical Coordinator at OceanOPS. Finally, she thanked the ADMT for their hard work which is necessary to Argo's success.

1.3 Feedback from BGC-ADMT meeting

The data quality has improved dramatically over the last few years as the data quantity continues to grow, and downloading the full dataset is now easier than ever thanks to the implementation of the standalone synthetic profiles DOI in 2022.

An action is taken with the MET Office to specify vocabulary and units for some new parameters to be pushed (e.g. CHLA, NITRATE) in the BUFR format to the GTS.

There are also many upcoming challenges facing BGC Argo data managers. Modified and new sensors and floats will continue to be developed and become operational once approved by IOC. These could be FLBBFL Sea-Bird, RBR BGC sensors, Pyroscience Pico pH optode, LioniX ISFET pH sensor, Trios OPUS nitrate, Trios RAMSES hyperspectral radiometers, New oxygen foils from Aanderaa, SBE83 Sea-Bird and new MRV BGC SOLO II float. Pushing these improvements also requires resources both for development and implementation. There is still a need to foster the support between DACS, by providing codes, outputs and guidance on sensor performance, monitoring and quality control, particularly as data management procedures continue to develop and be refined.

An action is taken to share the documentation (processing and QC) on a drive to foster the collaboration and speed the updates : the BGC QC cover document (Bad PSAL recovery), the pH updates : processing and QC, the nitrate temperature correction in the processing documentation, and the BBP QC document, as examples.

The first BGC DMQC workshop will be organized in Villefranche from the 23 january to the 26 january 2023. The first two days will be focused on DOXY (background, softwares, and use cases), the third day on NITRATE and pH and the last day on biooptics (Radiometry, BBP, CHLA). There is a strong and persistent need for the BGC-Argo community to move toward more standardized and uniform flagging and handling of DMQC methods and protocols. This workshop will provide an opportunity for the community to come together to discuss these issues in detail and frame a better path forward on this front.

We are all fortunate that Orens Pasqueron de Fommervault has recently taken a position heading the BGC Argo project office hosted by Sorbonne University, operated at IMEV-LOV, and sponsored by Explorations of Monaco.

Regarding discussions on specific BGC PARAMETERS, the following list highlights key status points from the recent meeting:

- DOXY : time response implementation in DM has been endorsed
- NITRATE : new temperature correction is now endorsed for processing, paper submitted
- pH : Honeywell will continue the production of ISFET chips
- BBP : paper presenting the RTQC procedure has been submitted (Argo documentation forthcoming)
- CHLA : a single way to provide CHLA scale factor estimates is presented
- Radiometry: working group recommendations include 4 bands – 380, 443, 490, and 555 nm (PAR removed), PRES > 250dbars, vertical sampling < 1m .

1.4 Objectives of the meeting

M. Scanderbeg shared the objectives of the meeting which were:

- To review progress on Action Items from ADMT-22
- To review the quality and timeliness of Argo float data processing in Real Time and Delayed Mode
- To discuss ways to improve the real time, pilot and delayed mode data quality and identification of sensor problems
- To review progress on the Argo Vocabulary Server
- To identify leads to help organize a DAC workshop
- To discuss ways to improve communication with users
- To review the Argo Regional Data Centre progress

1.5 Status of Action items from ADMT-22

M. Scanderbeg went through a brief summary of the non-DAC related Actions from ADMT-22, many of which are now taking more than one year to complete. DAC actions will be discussed later in the Agenda. Overall, 18 actions were completed, 12 were in progress and 3 were not started at all. She suggested that two mini ADMT meetings take place bi-annually to check in on the status of actions related to 1) real time data and 2) delayed mode data. She also suggested that some actions that are difficult to monitor progress on or are statements rather than actions be moved to 'recommendations'.
Next, she went through several actions that either need to be carried over until next year or were moved to recommendations. For the GDACs, Action 1, 3 and 5 are to be carried over to ADMT-23 Actions. These actions ask the File Checker to be updated to accept v3.2 trajectory files, to accept time series data in the technical files and to automatically update when the Argo NVS Ref Tables are updated.

For Format Actions, Action 24 will be carried over which asks the ADMT to decide on the end of the transition period for v3.1 and v3.2 trajectory files for BGC floats. Action 29 has been implemented, but she asked the ADMT to ensure that all appropriate 'float ending causes' have been added to the table in the Google doc. Action 28 will be carried over, but folded into the Argo Vocabulary Task Team (AVTT) GitHub ticket system. Action 26 will move to a recommendation clearly explained in the User Manual.

For DMQC actions, Action 41 will be carried over which asks that the DMQC Trajectory Working Group finalize guidelines on applying PARAM corrections from profile files to trajectory files. Actions 36, 37, 38, 42, 43 and 44 were changed to recommendations and will be included as such in this ADMT-23 Meeting Report.

For pilot data actions, Action 32 will be carried over which asks that DACs with RBR CTDs implement real time salinity adjustments per the QC Manual and flag PSAL_ADJUSTED_QC = '1 in 'A' mode.

For the Argo NVS Ref Tables, Actions 26 and 45 will be carried over. Action 26 asks the AVTT to find a machine to machine solution for identical sensors, even if the name is changed in the Argo vocabulary. Action 45 asks the AVTT to work with OceanOPS to decide which Argo Ref Table vocabularies will be managed by each group and where other solutions need to be found.

For the Workshop Actions, neither the DAC workshop nor the Trajectory Workshop occurred and we are considering how to move these forward during this meeting. Refer to the DAC Workshop and Delayed Mode Trajectory section of the report for more details.

For the Communication actions, Action 50 will be carried over which asks for improved guidelines on the ADMT website for DACs/PIs who wish to add something to the NVS Argo ref tables.

1.6 Feedback from operational centers and altimetry session at 7th Argo Science Workshop

Based on presentation by Peter Oke

What Argo data is being used by the modeling community? The short-range ocean forecasting and reanalysis community, coordinated under OceanPredict, maintains a table of observations used for assimilation and validation. This includes a breakdown of what data from Argo is used by 13 different centers to support 29 different forecast/reanalysis systems. This table is updated annually and can be found here: https://oceanpredict.org/observations-use/#section-argo-profiling-floats. Based on an update in March 2022, all centers assimilate core Argo data (T/S/P), and six centers use Argo trajectory data for validation. One center assimilated DOXY and CHL data, and three others use DOXY and CHL for validation or in research mode (pre-operational).

An example of the negative impact of data with ASD was presented, where negative impact of contaminated analyses was shown to endure for more than 2 years after assimilation. This problem highlights one of the challenges of operational systems that are not easily “repaired”, even after a bad analysis is detected and understood.

Results from many short-range forecast and reanalysis systems, and coupled, seasonal prediction systems were shown to demonstrate the impact of Argo data. The eddy-resolving applications all demonstrate the step-change improvement achieved pre- and post-Argo - with 2005 roughly representing the time when Argo achieved critical mass for constraining these systems. Similarly, all studies show that Argo data is the observational platform that provides the best constraint on subsurface ocean properties.

Results from studies showing the potential impact of assimilating data from a global Deep Argo array was shared, showing the dramatic improvement in constrained temperature and salinity below 2000m depth. Results from a system assimilating BGC Argo data was also presented, showing a mix of improvements to some variables and a degradation to other variables. The mixed results highlight some of the challenges of constraining biogeochemical models at high resolution.

There was also much discussion of the need to help the modeling community understand best practice for using Argo data. Key messages include a clear explanation of the differences between R-mode and D-mode data, the need to regularly update historical datasets, and the risks associated with assimilating data from R-mode data harvested off the GTS. Several approaches to address this were discussed, including approaches to key individuals and key groups - noting that broad announcements and open calls for cooperation have been ineffective. The idea of pursuing joint publications with modelers to demonstrate the value of best practice seemed to be endorsed by the ADMT.

1.7 Preparation for interactions with modeling community to improve communications

Breck Owens reported on efforts he has led to improve communications with analysis centers. He presented some results showing the discrepancy of global maps of steric height from Argo data with satellite data, primarily due to the use of uncorrected Argo salinity data. To redemy this situation, it is proposed to reach out to the global analysis centers so that Argo can suggest improved procedures that use delayed mode, quality controlled Argo data rather than archived real-time data. He proposes to set up a series of meetings with the primary global analysis centers with a group of Argo scientists to discuss how they use our data and to provide guidance on how to take advantage of Argo delayed mode procedures. A group was formed and are reaching out to the various analysis groups.

The message will be delivered in a short presentation explaining the difference between raw data and delayed mode data, showing the impact of using raw data without adjustment and explaining how to use Argo data effectively. He requested feedback on other topics that should be included in the presentation and for an example of the impact of using raw data from a BGC parameter, perhaps DOXY. In the ensuing discussion, it was suggested that two talks be developed, one for CTD data and one for BGC data and that these be recorded and made available on the AST website for further dissemination.

1.8 Core Argo Best Practices document

Tammy Morris

A best practice for core Argo floats has been developed. The document covers how to get involved in the Argo Program, everything a new user or team would need to know about AST, ADMT, EEZ issues, the Argo Program and the various core Argo types, communication systems etc. The objective is to make it as user friendly as possible to join the Argo Program and engage with the larger community. There is also an extensive section on metadata and data, leading users to the next level of information where and when required. The best practice is now ready for community review and the ADMT, AST and the wider Argo national programs are invited to go through the document.

The link to the google form for access is here:

https://docs.google.com/forms/d/e/1FAIpQLSc8fDS2e3afzE-CHHevQGM5I5Fb2_NIN39gyPZwZdeuc_7MuA/viewform?usp=sf_link

Endorsement by GOOS could be asked (as it was done for XBT Best Practices), that would require a letter from ADMT/AST co-chairs.

1.9 Argo Status and real time monitoring

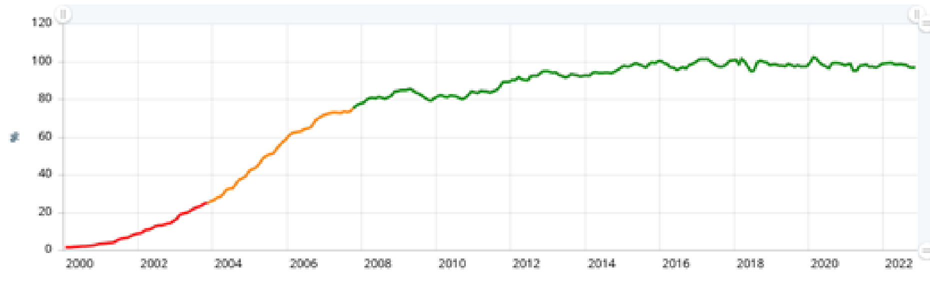
Metadata are essential to assess Argo status and mandatory to comply with international resolutions (IOC resolutions). Sharing metadata is also an OCG criteria to be part of the GOOS and on the implementers responsibility to provide information about any deployed float before or shortly after the deployments. Planning, notifying (IOC resolution), and closing are the three steps any Argo program implementer is engaging to follow to support Argo real time monitoring.

WIth the metadata acquired along those three steps it is possible to provide to the Argo community an accurate view on the situation of Argo with regard to implementation and data flow.

1.9.1 Argo implementation status

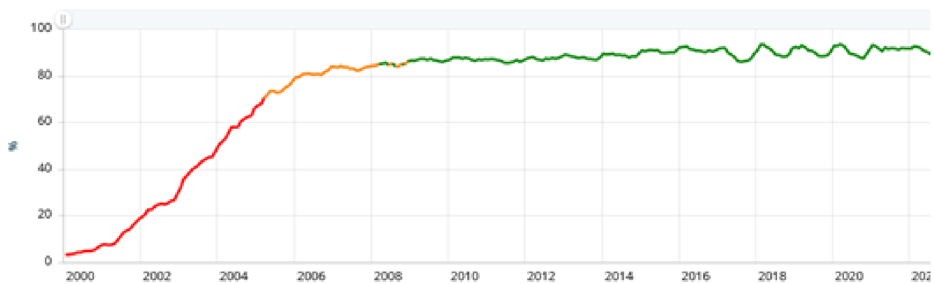
OceanOPS compute indicators to deliver information on the status of the real time Argo program implementation. This indicators can be understood as follow:

The **activity indicator** answers the following question : Is there enough operational Argo floats to implement the Argo array? Answer is yes, Argo is reaching 97% of the target defined by the program.



Activity time serie since the beginning of Argo

The **density indicator** answers the following question: How well are distributed the operational float compared to the target of Argo? The answer is that operational floats are well distributed in the different regions of the global ocean, Argo is reaching 87% of the density target.



Density time serie since the beginning of Argo

The **intensity indicator** answers the following question: Do we deploy enough floats to maintain the Argo array? The answer is not really, 66% of the needs in terms of deployment, as defined initially, is reached.

Intensity time serie since the beginning of Argo

The target on intensity is computed considering the initial requirement on floats performance. This is 150 cycles of 10 days, being 4.1 years. This target is identified in the upper graph by the gray dash line along 100%. Luckily, the performance of the global fleet is much better than 4.1 years. Lowering the need to seed the ocean with floats. The lower gray dash line represents the target when computed from the performance of the fleet that died in the last 4 years. This plot is showing that the decreasing number of floats deployed is compensated by the good performance of the fleet, but we are reaching a dangerous plateau that will take Argo to a decrease in terms of global activity and density.

It is also to be noted that the growing fleet of BGC Argo has lower performance in terms of duration, this may accelerate the decrease of the global indicator described above. More precise monitoring will be provided for the AST in March 2023.

Conclusion with regard to Argo implementation status is that the current good global indicators are hiding some gaps and threats that we must anticipate and react to very shortly unless we will see a decrease in the global coverage of Argo.

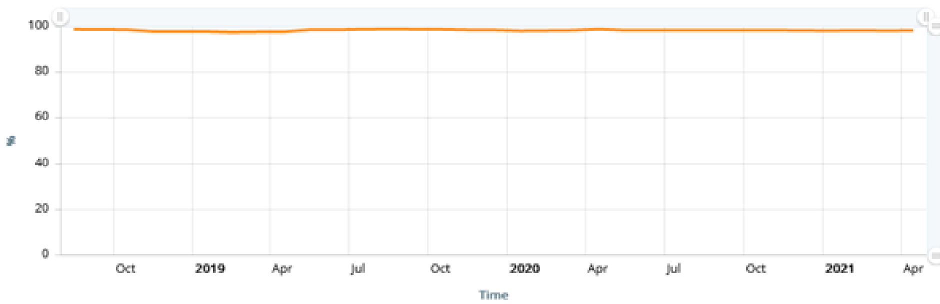
1.9.2 Argo Real time data flow status

OceanOPS monitors the two real time data flows of Argo: GDAC and GTS data flows. GDAC data flow monitoring is based on the production of index files by the Coriolis GDAC. Index files are updated multiple times a day and contain all the information OceanOPS needs to monitor the data flow.
GTS tracking is based on a daily extraction of the GTS flow made by Météo-France for OceanOPS.

1.9.3 GDAC data flow

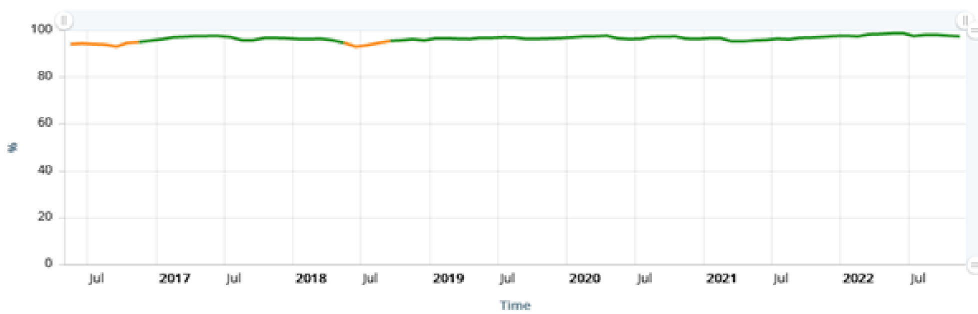
OceanOPS has developed indicators to assess the status of the Argo RT data and metadata flows.

The **metadata quality indicator** answers the following question: Do we access enough metadata to monitor data flow from Argo floats? Answer is yes, 98% of the fleet provide at least metadata for one sensor onboard.



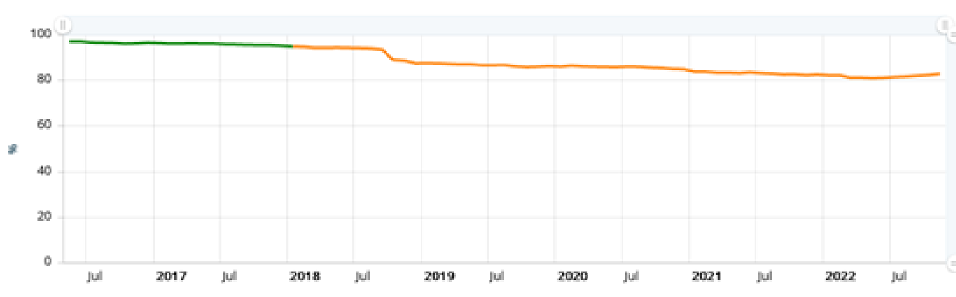
Metadata quality time serie since 2018

The **availability indicator** answers the following question, is Argo data available? The answer is yes, 97% of the Argo fleet provides data to the GDAC.



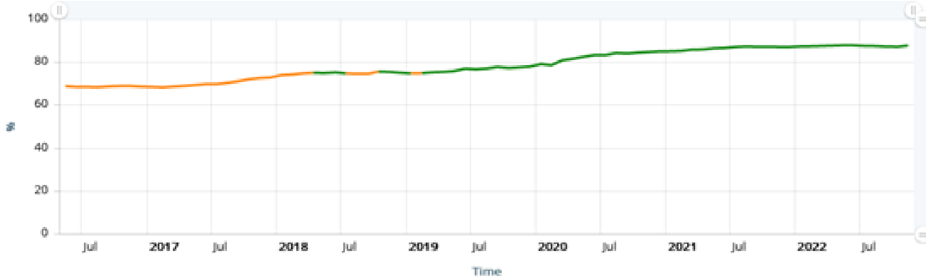
Availability time serie since 2017

The white list indicator is showing the percentage of the fleet providing good data to the GDAC. After a great decrease in the last 4 years, this indicator is growing again, demonstrating the great work made by the ADMT.



White listed float time serie since 2017

The quality (DM processing) indicator answers the question of the general quality of the data provided by Argo. 87% of the non greylisted fleet has been quality controlled.



Quality (DM processing) indicator evolution since the beginning 2017

OceanOPS also monitors the data quality by variable from the GDAC index files since very recently (2022). It is important to note that for core variables, R, D and A mode are taken into account to compute the quality indicator, while only “profil_param_QC”=A is considered as best quality. It has been suggested along the ADMT meeting that A may be too strict. A+B could be considered in the target. This decision is to be taken by ADMT and OceanOPS will implement it on request.

Following ADMT 22, action 48 recommendation, the computation of quality indicator for BGC variables only considers data mode A and D and ““profil_param_QC” = A and B.

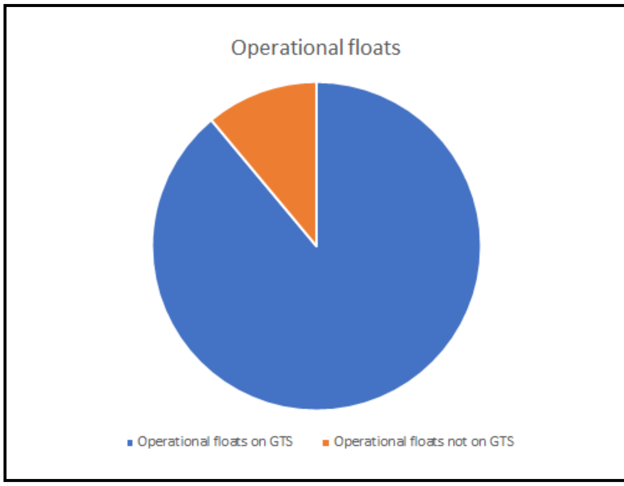
Quality (variable) Argo Global - pH	42.88% 11/2022 ↗	223 Raw count	# of monthly obs of best quality - pH
Quality (variable) Argo Global - Chlorophyll concentration	51.94% 11/2022 ↗	374 Raw count	# of monthly obs of best quality - CHLOROPHYLL
Quality (variable) Argo Global - Oxygen, dissolved	66.32% 11/2022 ↘	955 Raw count	# of monthly obs of best quality - DOXY
Quality (variable) Argo Global - Backscatter	69.17% 11/2022 ↗	498 Raw count	# of monthly obs of best quality - BBP700
Quality (variable) Argo Global - Ocean salinity	73.37% 11/2022 ↗	8817 Raw count	# of monthly obs of best quality - PSAL
Quality (variable) Argo Global - NO3- (nitrate)	79.46% 11/2022 ↗	352 Raw count	# of monthly obs of best quality - NITRATE
Quality (variable) Argo Global - Ocean temperature	90.76% 11/2022 ↗	10907 Raw count	# of monthly obs of best quality - TEMP

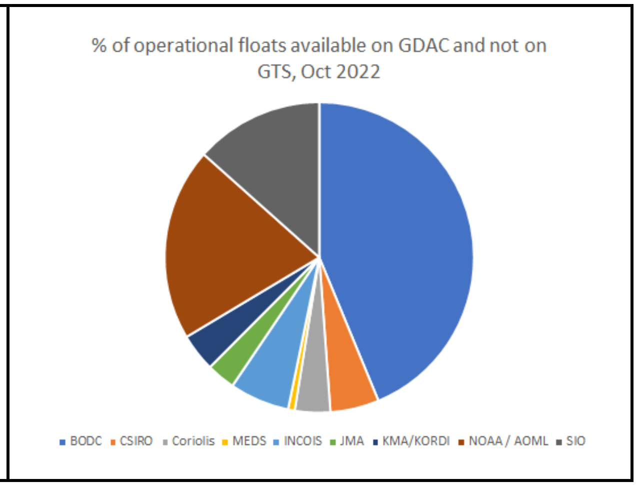
Except for Oxygen, all indicators are progressing. However, this is a pretty new indicator that needs to be monitored in the long term to provide useful and reliable information.

1.9.4 GTS data flow

OceanOPS is monitoring the GTS data flow from an extract of the GTS data provided by MeteoFrance. The study of this extract led to the following conclusion:

- 11% of the Argo fleet is not visible through the monitoring of the GTS made by OceanOPS (left figure below)
- About 45% of the missing data are managed by BODC (right figure below)
- More than 90% of the BODC fleet is not visible on the GTS monitoring made by OceanOPS.





Based on several discussions during the meeting, we understand that Meteo France does not extract BODC Argo data on GTS while existing. This issue is highlighting the difficulty to track GTS data flow in real time and continuously.

Also we realize that it was not yet possible to answer the following question, is temperature data from greylisted floats available on GTS ?

Action: Regularly monitor, from various nodes, the data going onto the GTS including WMO, cycle number, parameter, etc and make this information easily available either through an index file on the GDACs or on OceanOPS

1.10 Update form OceanOPS with regards to ADMT-22 actions and other issues

1.10.1 New mailing list for ADMT

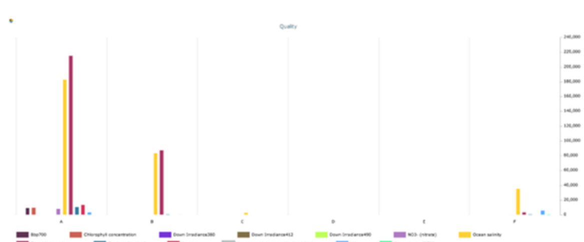
We are moving from old ***@jcommops.org mailing list to new ***@groups.wmo.int mailing list for Argo. So far, both mailing lists are operational. There is still some tuning needed to run the mailing list smoothly but should not be an issue anymore. OceanOPS is ready to turn off the previous mailing list when requested by AST.

1.10.2 ADMT22-Action 48

Action 48 aimed to improve the computation of BGC variables quality indicators. Two features will be implemented this year:

Feature 1: Data quality dynamic graphic mode (i.e., computation based on the selected sample)

"Data mode A-R-D filter should be available to be able to select all the possible combinations (R, A, D, R+A, R+D, A+D, R+A+D). PARAM that does not receive QC should be removed from the computation. The graphic should display "profil_param_qc" distribution" - This feature should be implemented as a filter in the indicator itself.



Distribution of the data quality ranking for each variable

Feature 2: Data processing graphic – dynamic mode

- *“Provide distribution of the sample by data mode.”*
- *“PARAM that does not receive QC should be removed from the computation.”*

1.10.3 BGC metadata

In the past year we tried to benefit from H. Bittig monthly update on BGC Argo (https://biogeochemical-argo.org/cloud/document/implementation-status/BGC_summary_jcommops.pdf) to improve general metadata quality of the BGC fleet, through metadata QC feedback.

This was time consuming and not so efficient. We may continue this again next year with the support of Orens.

Action: Ask BGC volunteers to work with OceanOPS to set up monitoring of BGC sensor behavior to try and identify early on systemic sensor problems

1.10.4 ADMT22 - Action 49 on SPECIAL FEATURE

A review of the content of the “SPECIAL FEATURE” field has been made. Muchinformation is being stored here(aux files, hull performance, Ice avoidance Buoyancy, Depth profil first, Polar Ocean Profiling system, Time of Day profile control, pressure activation…).

OceanOPS and Thierry Carval will work on these issues (https://github.com/nvs-vocabs/ArgoVocabs/issues/32 and https://github.com/nvs-vocabs/ArgoVocabs/discussions/24) with Argo partners to propose a solution for next ADMT.

1.10.5 ADMT22 - Action 45 on reference list management between NVS and OceanOPS

After several meetings organized in the first half of 2022 with EuroArgo and AVTT, we have made progress on some of the vocab that needs to be constrained (SHIPS, Controller Board, Program).

These regular meetings with AVTT and other partners will be revived to finalize the progresses made in 2022.

2. GDAC Data Management

2.1 Operational status of Argo GDACs

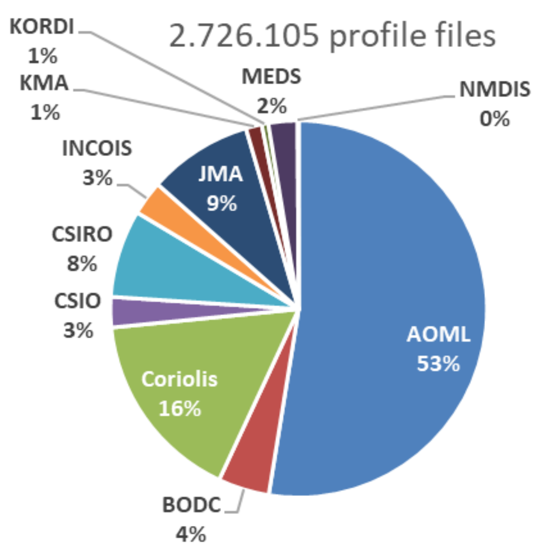
Presentation from Thierry Carval

2.1.1 Coriolis GDAC

There are 11 national DACs that regularly submit data to GDACs. The number of floats increased by 5%, the number of profiles profile files increased by 7% compared to 2021.

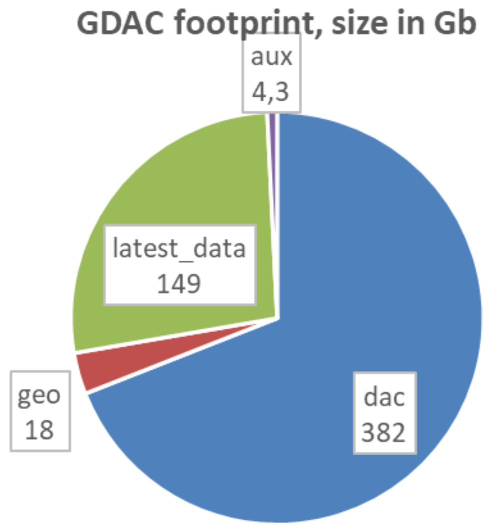
The Argo GDAC dataset consists of 17.700 floats – 2,7 million profiles.

DAC	metadata files 2021	increase	profile files	increase2	delayed mode profile files	increase3	trajectory files
AOML	8 319	5%	1 432 739	6%	1 218 599	8%	10 219
BODC	820	3%	119 843	7%	91 012	4%	519
Coriolis	3 518	7%	449 398	11%	350 321	8%	3 437
CSIO	525	3%	71 015	5%	55 649	9%	523
CSIRO	1 092	6%	205 190	6%	191 023	7%	1 025
INCOIS	491	0%	80 508	2%	36 487	7%	412
JMA	1 887	2%	244 049	5%	200 085	14%	1 616
KMA	259	2%	37 439	3%	33 706	3%	250
KORDI	115	5%	15 423	0%	14 504	0%	107
MEDS	651	8%	68 041	8%	50 113	12%	628
NMDIS	19	0%	2 460	0%	432	-	19
Total	**17 696**	**5%**	**2 726 105**	**7%**	**2 241 931**	**8%**	**18 755**



2.1.2 The GDAC footprint

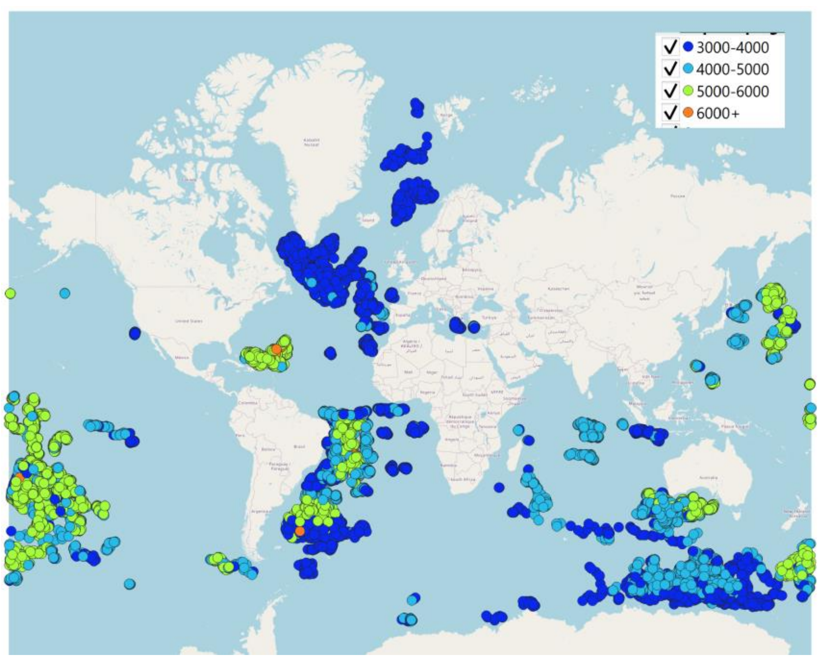
The number of NetCDF files is 3 329 573 (+7%), the size of GDAC/dac directory is 382 Go (+21%) and the size of the GDAC directory is 740 Go (+12% compared to 2021).



2.1.3 Deep-Argo GDAC status

There are 313 deep-Argo floats from 6 DACs; they performed 24561 deep profiles.

dac	nb float	nb deep pro
aoml	139	14 582
coriolis	97	5 190
jma	55	3 579
bodc	15	694
csiro	5	406
csio	2	110
Total	**313**	**24 561**



2.1.4 The Argo greylist

The GDAC hosts a **grey list** of the floats which are flagged before any automatic or visual quality control. The grey list has 1519 core-Argo entries compared to 2100 entries one year ago.

All floats	
DAC	NB_FLOAT
aoml	908
coriolis	177
jma	126
bodc	119
csiro	99
csio	26
incois	24
meds	24
kma	13
kordi	3
Total	**1519**

2.1.5 Operations of the ftp, https and erddap servers

DACs files are collected in parallel every 30 minutes.

Index files of are hourly updated metadata, profiles, trajectories, technical and auxiliary data.

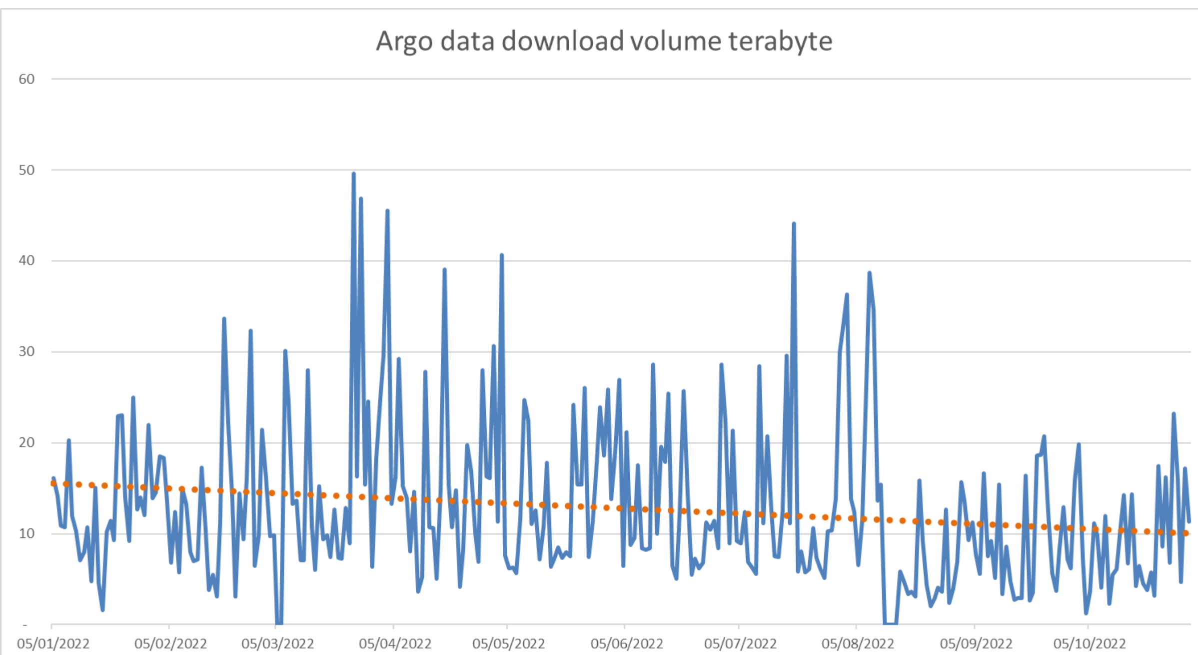
GDAC download services

- ftp ftp://ftp.ifremer.fr/ifremer/argo
- https https://data-argo.ifremer.fr
- erddap https://erddap.ifremer.fr

There is a daily average of 6000 sessions and downloading 20 terabytes of files. There was a huge variability in the number of sessions between May and August 2022.

There were two periods of poor performance, i.e. abnormally low volume of data downloaded by Argo users (less than 0,1 petabyte of data).

- March: 2 days
- August: 4 days



About 6000 sessions and 20 terabytes downloaded every day

2.2 Status of NVS version of Argo Reference Tables & plan for upcoming year

Presentation from Violeta Paba

Update on ADMT-22 action items:
Item 1: Transition the GDAC file checker to reading NVS versions of the Argo reference table. Status: two tables outstanding that are blocking this development: tech and config parameter tables. Meetings have been held throughout the year with the AVTT editors John, Birgit and Catherine, to review the tables and get them ready for NVS load. Given the urgency of the matter, the plan is to move the tables as they are onto the NVS in early January 2023. These tables have also been looked at with Teledyne, as they strive to align their metadata tags to those of Argo and make data ingestion and processing easier for DACs.

Item 16: Update the User manual with NVS version of the Argo ref tables, and include instructions for DACs and users on how to apply the tables. This item was not addressed, but will be in 2023.

Item 26: For R27 (SENSOR_MODEL), move towards using the manufacturer's model name. This item also was not done, and it is high priority for early 2023. New updates will also be loaded to the collection.

Item 27: Ask the NVS team to find a machine to machine solution for identical sensors with different names. We will be using the 'SYN' mapping to link identical R27 sensors. This will be implemented in 2023. Moreover, planned VocPrez upgrades will make NVS mappings more visible to users.

Item 45: NVS task team to finalise the Argo Vocab and identify clearly what is managed at NVS/BODC, what is managed at OceanOps, and what tables need different solutions. A series of productive meetings took place with OceanOps in early 2022, which we plan to resume in the new year. Items discussed were currently unconstrained fields. Moreover, BODC and Euro-Argo discussions have focused on a review of the AVTT GitHub space, and of external NVS editors workflow, which will be progressed in 2023.

Item 46: Clearly identify which sensors are accepted and which are pilot or experimental. The plan was to create a new collection called AST_STATUS with three concepts: Approved, Pilot and Obsolete. However, during the ADMT-23 meeting this plan was scrapped, as it is not ADMT's role to make a public judgment on manufacturer's sensors.

Other NVS items:
Open issues on the AVTT GitHub space were reminded: https://github.com/orgs/nvs-vocabs/projects/2 contains a dashboard of all issues and their status.

The AVTT Editors were reminded, and were asked to confirm their role. Also, it would be great if new people wanted to join the Argo NVS team! We are especially looking for someone to oversee the core configuration parameter names table, formally managed by John Gilson. Please let Violetta know if interested: vpaba@noc.ac.uk.

2.3 Review process to change Argo Ref Tables in NVS

Presentation from Thierry Carval

The publication of the 32 Argo reference tables on NVS is almost complete, the 2 remaining tables should be published within weeks. When complete, a regular export of NVS Argo vocabularies will be provided to the Argo files format checker. The Argo files format checker will be updated to manage NVS vocabularies.

2.3.1 How to add a new term in NVS

Argo vocabularies are negotiated on GitHub: https://github.com/nvs-vocabs/ArgoVocabs

They are managed by the Argo Vocabularies Task Team (AVTT) : https://github.com/orgs/nvs-vocabs/teams/avtt

The format of vocabularies discussions should happen on https://github.com/nvs-vocabs/ArgoVocabs/discussions

The actions are tracked on a kanban board https://github.com/orgs/nvs-vocabs/projects/2

2.3.2 How to add a new term in NVS

If you need a new term in a table you should open an AVTT ticket.

The ticket is affected to the table manager, the discussions are managed in the ticket.

When accepted, the table manager will Upload the term in NVS, open a ticket for a format checker vocabulary revision.

The ticket is closed when the revision of the format checker is active in US and Coriolis GDACs

https://github.com/euroargodev/ArgoNetCDF

2.4 GDAC File Checker status and update

The FileChecker is hosted, managed, and released via the GitHub project:
https://github.com/euroargodev/ArgoNetCDF
All issues, feature requests, code maintenance, and releases are performed here.

The updates for trajectory-v3.2 are ongoing. It is expected that the next release will be the production release and will be available before the end of 2022. Once the traj-v3.2 updates have been deployed, development efforts will return to the updates to support time-series in the technical files; this is a large change for the code.

The transition to the NVS will occur simultaneously and will be a collaborative effort.

Transitioning development and maintenance responsibilities to another group continues to be a priority.

3. Real Time Data Management

3.1 Timeliness of real time data delivery for all parameters on GTS and GDACs

3.1.1 Real time data delivery on GTS (Anh Tran)

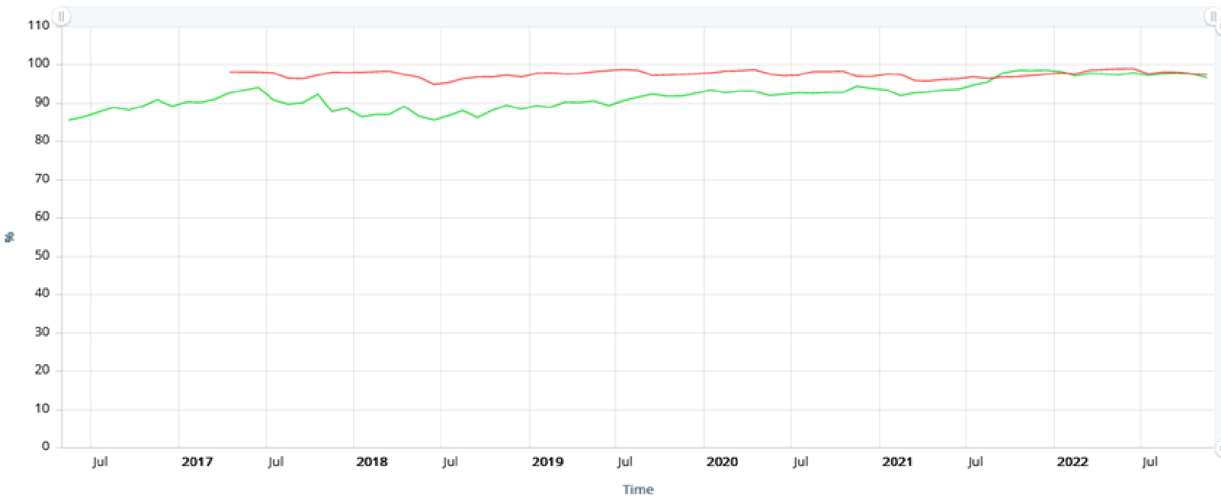
Marine Environmental Data Section (MEDS) routinely collects and processes Argo data transmitted on the Global Telecommunication System (GTS) in BUFR format. Between November 2021 and November 2022, on average 13 479 BUFR messages were transmitted monthly on the GTS, of which 86% of the messages met Argo's timeliness target. 90% of the BUFR messages were transmitted on the Iridium satellite, and 85% of these messages met hte 12 hour timeliness target. Approximately 9% of the BUFR messages were transmitted on the Argos satellite and 93% of these messages met the 24 hour timeliness target. There was no BUFR data received from KMA since April 2022.

For dissolved oxygen data, there were 1175 BUFR messages transmitted on the GTS using BUFR sequence 3 06 037 and 79% of these messages met 24 hours timeliness target. Currently, there was no DOXY data on the GTS for Australia, India and Japan data center even though there was NetCDF files with DOXY data for these DACs on the GDAC.

3.1.2 Real time data delivery on GDAC (Victor Turpin)

Data delivery to the GDAC

This first basic indicator on data delivery shows that 97.5% of the Argo fleet is transmitting data to the GDAC.



Argo data delivery indicator

Argo BGC *Argo Core*

However, we are curious to understand why about 2.5% of the floats registered under the Argo program have not sent data in real time for 4 years. We propose to name them “silent floats”

Action: Ask OceanOPS to investigate why floats are registered as Argo floats and then never send data in real time.

GDAC Timeliness

The timeliness indicators assess the rapidity of the data flow to the GDAC.

Data Flow

		Raw count	Target	
Timeliness (GDAC FR) Argo Global	47.52% 11/2022 ↗	5710 Raw count	3h Target	% of monthly observations distributed within 3h (GDAC FR)
Timeliness (GDAC US) Argo Global	47.55% 11/2022 ↗	5712 Raw count	3h Target	% of monthly observations distributed within 3h (GDAC US)
Timeliness (GDAC FR) Argo Global	79.84% 11/2022 ↗	9594 Raw count	6h Target	% of monthly observations distributed within 6h (GDAC FR)
Timeliness (GDAC US) Argo Global	80.35% 11/2022 ↗	9652 Raw count	6h Target	% of monthly observations distributed within 6h (GDAC US)
Timeliness (GDAC FR) Argo Global	90.46% 11/2022 ↗	10870 Raw count	90% Target	% of monthly observations distributed within 12h (GDAC FR)
Timeliness (GDAC US) Argo Global	91.46% 11/2022 ↗	10986 Raw count	90% Target	% of monthly observations distributed within 12h (GDAC US)
Timeliness (GDAC FR) Argo Global	92.92% 11/2022 ↗	11166 Raw count	90% Target	% of monthly observations distributed within 24h (GDAC FR)
Timeliness (GDAC US) Argo Global	94.02% 11/2022 ↗	11294 Raw count	90% Target	% of monthly observations distributed within 24h (GDAC US)

Indicative values of timeliness

Argo timeliness targets

Timeliness is improving for every target. It is interesting to see that the 6h target (i.e. 90% of the Argo data is available at the GDAC within 6h) is almost achieved. This improvement is due to the increasing use of Iridium from data transmission.

OceanOPS has developed tools to investigate further in the details of data flow. If we want to improve the timeliness of Argo data at the GDAC those tools could be useful.

DAC procedures to collect and push the data to the GDAC will be reviewed to see how we could improve timeliness of Argo data. This will be done through the series of virtual DACs workshops to be organized.

3.2 Anomaly detection at Coriolis GDAC

Presentation from Christine Coatanoan

The types of anomalies that continue to run through the Argo data stream were presented through a number of examples: bad position, interpolated bad position, obvious slight drift in RT and DM profiles, bad DM profile adjustment, and bad data. The 2022 statistics show a decrease in the number of monthly anomalies due in part to the AOML DAC putting a number of floats on the greylist even if there is no feedback from the PI. A message was passed in direction of the PIs and operators to try to motivate them to take into account the results of the various audits. The listing of consequences of taking into account or not the information on the anomalies detected by both minmax and altimetry methods (and audits) is presented in the following table.

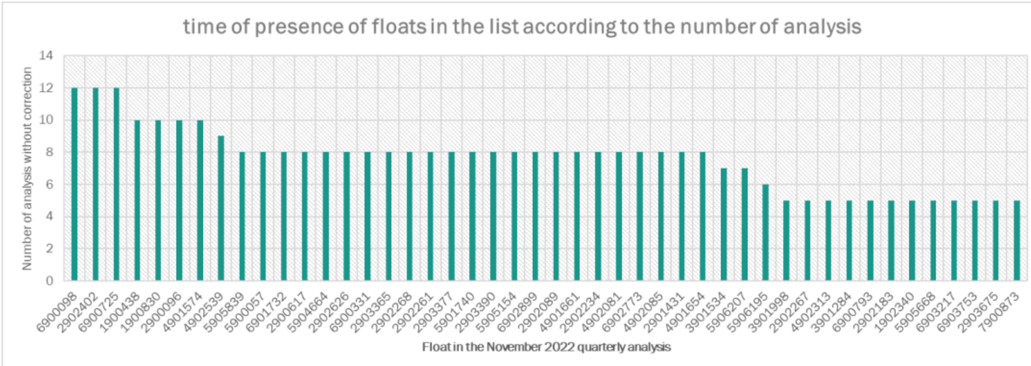
	
Degrade the quality of the dataset	Improve the quality of the dataset
Drifting floats continue to feed models, climatologies, scientific studies	Drift of the floats very quickly put aside with a fast possibility of correction
Slow down the possible update of sensors with problems	Faster detection of sensor anomalies for possible feedback to manufacturers
Waste of time for analysts who rework the same float several times, after multiple submissions	Reduce the time spent processing this data in the QC analysis
Possible misunderstanding of the detected anomalies	Feedback to anomaly managers to improve data analysis

Then the rule and procedure have been reminded to help the operators to take into account these corrections, the rule being to greylist float before going through the data flow (GTS, GDAC, …) and to DMQC float with anomalies in priority. The monthly reports completed with csv files containing information on new, previous and grey list floats are a support to help operators as well as messages generated by OceanOPS.

3.3 Anomaly detection from Altimetry

Presentation from Nathalie Verbrugge

This year, the version of the SLA reprocessed product has been upgraded that led to a better agreement between DHA and SLA. The status of the alerts was described. In 2022, the quality of the Argo Network is steady, except for the 'R' mode for which we observed a decrease of the correlation and an increase of the mean differences between DHA and SLA, Sentinel 6 drift or ASD causes are suggested. A status of the floats that are in alert for a long time was presented. 3 floats are in the list for 3 years, 4 for 2.5 years and 24 for 2 years.



Examples of floats in alert are shown with some profiles that present very bad values and that are not corrected in the database. Matthew Alkire mentions that he didn't receive the list from CLS. Perhaps the distribution method should be revised. This needs to be discussed with OceanOPS.

4. DAC Status

4.1 Discussion of DAC Actions - Megan Scanderbeg

Megan Scanderbeg presented on the status of DAC actions over the past year. Most DACs, except Coriolis and CSIRO, were unable to complete all their assigned actions, so she broke down the actions by category to look for patterns based on type of action. However, when sorted by QC tests, greylisting and format changes, there did not appear to be a clear pattern. After that, the status of each Action Item was shown by DAC and DACs were then given a chance to describe their difficulties. BODC reported that the loss of Matt Donnelly as their lead has been very difficult. In addition, there is a lack of resources along with several new float types which take time to assimilate. Also, when a new QC test is requested, BODC asked for clear documentation as well as possibly code to make the implementation process more manageable. KMA reported that some of the Actions were completed and that not all are applicable to their shallower floats. Canada said that they had some resource challenges recently, but the situation should be improved next year. AOML also noted that some progress had been done on many actions, but more was needed. CSIO did not understand what all the actions were and also did not have access to the User Manuals and QC Manuals for a portion of the year which slowed progress. CSIRO said they were slowed down by new float types, the RBRArgo CTD and the transition of their system from a Matlab to a Python version. The overall consensus was that DACs are having difficulty progressing on actions due to new float types and sensors, a lack of precise descriptions of new QC tests, and a lack of resources. This message of a lack of resources needs to be taken to the AST by the ADMT co-chairs.

4.2 DAC Workshop - Clare Bellingham

At ADMT 20 it was decided to organise the 1st DAC workshop alongside ADMT-21. One of the challenges in improving collaboration between DACs is to understand how each DAC works and so it was decided to do a survey between all DACs as a first step towards discussing challenges and moving forward. The results of the DAC survey were presented and are available in presentation format here DAC survey 2020 with a full report to follow on shortly.

In the discussion, it was suggested that focussed virtual workshops on specific topics such as doxy adjustment in real time, bbp RTQC test, Apf11, the RBRArgo CTD, pH, etc. might be more successful than a large DAC workshop without a clear purpose. This was accepted as an Action Item with Catherine Schmectig, Anh Tran, Clare Bellingham and Annie Wong agreeing to help coordinate the initial virtual workshops.

5. Pilot data management

5.1 Deep Argo data: cpcor correction & DMQC status

Presentation Cecile Cabanes

The work done on deep argo processing was presented. As of December 2022, 329 Deep floats have been processed by 6 dacs. Salinity profiles should be corrected using new Cpcor values (Cpcpor corrects from compressibility of the cell). 48 % of the salinity profiles have been corrected with a new Cpcor value either in A mode or D mode, but only 26% of the profiles in real time have been corrected with a new Cpcor value (some Dacs have not started yet to implement the correction in real time). Last year a spreadsheet was set up to monitor the optimized Cpcor value that can be obtained by comparing the deep Argo salinity profile with a reference CTD cast. Analysing this spreadsheet, the optimized Cpcor values show batch dependencies. The current recommended Cpcor values (-12.5e-8 and -13.5e-8) are no longer representative of the fleet average (~ -11.6e-8 for SBE61 and for recent SBE41 with SN > 11000). Moreover, there is a quite large variability of optimised Cpcor values even in the same batch. Due to the observed CPcor variability between individual CTDs, using the ADMT-recommended Cpcor value of -12.5e-8 for the SBE-61, and -13.5e-8 for the SBE-41 instead of an optimal value, would lead to salinity bias as big as (and potentially larger than) 0.004 PSS-78 outside Deep Argo's target of salinity accuracy. Therefore, the ADMT strongly recommends that SeaBird provides a CPcor value for each CTD. In the meantime, it is needed to clarify the recommendations for the DACs and the DM operators. For the DACs it is recommended to keep the current recommendations: The recommended standard CPcor_new values (-12.5e-8 for SBE61 and -13.5e-8 for SBE41) should be used in A-mode for real-time salinity adjustment . The ADMT recommends the adjustment of real time salinity data with these new CPcor values as high priority. For the DM operators, it is recommended to use an optimised Cpcor value (or a batch average) whenever it is available (reference CTD cast available) and robust. Otherwise, the current recommended Cpcor values should be used. If possible, delayed-mode operators should estimate an optimized Cpcor as soon as possible after deployment, and provide this value to the DAC for better A-mode adjustment. The documentation will be updated according to these new recommendations. A deep Argo DMQC workshop will be held in the next 12 months to help DM operators to acquire expertise.

5.2 RBR data

An update on the status of data management was provided for the RBRargo|2k and RBRargo|6k. The highlights are:

- A peer-reviewed paper was published, detailing the methodology of the necessary corrections to apply to RBRargo|2k CTDs to make the data the best possible quality. Example of field-validation of these methods were provided.
- Internally, RBR is working on helping out the Argo community in the ways they can:
    - Internal monitoring of deployed floats is automated to be able to derive in-situ compressibility correction for pre-April 2021 floats that require it.
    - 2 series of workshops will be organized to help DAC and DM-operators to implement the workflow necessary for RBRargo|2k data
    - CTD firmware was developed to include a profiling speed dependent thermal inertia correction on board. Algorithm was validated and documented.
    - An internal automated monitoring plan is being implemented at RBR to generate alerts if any float from the RBR fleet were to behave anomalously

- An update on the characterization of the RBRargo|6k CTD with respect to its thermal inertia response was provided. Laboratory results provided the necessary coefficients to correct for thermal inertia, which were successfully validated on float data using the tri-tete and bi-tete floats deployed in the eastern Atlantic. The correction method is identical to the one implemented for the RBRargo|2k, caveat with difference coefficients.

6. Delayed Mode Quality Control

6.1 SBE CTDs

6.1.1 Salty drifter spreadsheet update

Presentation Delphine Dobler

The Abrupt salinity Drift issue (ASD), formerly referred to as the Fast Salinity Drift issue (FSD), concerns conductivity sensors that present the following behavior: sensor drift rate accelerates rapidly and abruptly, and/or the sensor drift is erratic with jumps between consecutive profiles. The onset of this issue can take the form of an inflexion point or a jump.
To assess the evolution of the salty drifters issue, three analyses were performed:

- Comparison of all argo data with climatology
- Analyses of ASD confirmed by DM operators and recorded in a manually filled in spreadsheet
- Time evolution of the rate of bad profiles (using profile_QC flags)

The comparison of the raw argo data with climatology was first performed in 2018 by Susan Wijffels et al. The updated analysis uses a new climatology, going from previous CARS to new WHOI climatology and includes one more year of data. Briefly, the analysis assesses for each couple {cycles ; bin of 100 consecutive SN}, the fraction of PSAL profiles that deviates by more than 0.01 psu from the climatology at coldest levels. The updated analysis still shows the 2 batches in the 6000 and in the 8000 with a high fraction of deviating cycles. It also confirms the third 10000-11000 batch that was only emerging in the previous analysis. This comparison was also performed on 'best data' available: real-time or delayed-mode data with QC1 or 2. This comparison shows that the dataset is much improved using 'best' data. However, there remains deviation indicating that not all drifts are flagged or corrected.

To confirm this global analysis, the affected floats and subsequent level of drift must be confirmed by the delayed mode process. To record information from this process, a spreadsheet has been set up since 2018 and is regularly filled in by DM operators for their confirmed ASD floats. This spreadsheet presently has around 790 entries.
The novelty this year is the enhanced sanity checks performed on the spreadsheet and the automatic computation of the C2 (i.e. the cycle after which a profile is uncorrectable). Among the new sanity checks:

- the CTD serial numbers have been checked w.r.t. the information in the metadata file,
- some CTD serial numbers have been checked for duplicates on the entire fleet,
- the difference between PSAL and PSAL_ADJUSTED and the consistency with the comment and the C1 (i.e. cycle after which the drift starts) have been checked,
- the presence of all the active ASD floats have also been checked.

Through this sanity check process, 12 discrepancies have been found and 11 corrected. It also highlighted that 91 active ASD floats (out of the 435 active ASD floats) are not grey-listed.
Thanks to the connection with the GDAC dataset and to ease the DM operator work, it is proposed to simplify the spreadsheet down to five columns: WMO, CTD SN, C1, C2 and Comment.
Histograms of numbers of ASD floats per serial number were plotted: they confirm the 3 peaks observed by the comparison with climatology. The latest most affected range (10482-11252) still has a lower number of affected floats than range 6000 and range 8000. However, this range has increased from 88 to 139 ASD floats in the last 7 months and 75 young floats could still show up as they have less than 80 cycles and are not fully DModed with the presence of RT files. It was also noted that some projects (and subsequent fundings) can be heavily impacted such as the MOCCA project for which 44 % of floats are affected by the ASD issue.
Since the manufacturing change in 2018, the status has improved: only 14 floats with CTD SN above 11252 have been entered in the ASD spreadsheet (+4 in the last 7 months). This is quite encouraging. However, the issue still needs to be monitored after SN 11252 as a fair number is still too young to show or assess a drift (974 floats have less than 80 cycles).

From an end-user point of view, a global analysis of the time evolution of profile_QC='F' (all profile QC is 3 or 4) was performed. It clearly shows the increase in the percentage of lost cycles from 2015 to 2021. Then, the trend changes in 2022 with a stable percentage as compared to 2021. This, together with the fewer entries in the ASD spreadsheet after SN 11252 is very encouraging that the issue is behind us.

It remains important that we keep on these analyses that assess the time evolution of the salinity health status, from a manufacturing point of view (i.e. versus Serial number), from a curated dataset point of view (global comparison with climatology), from a end-user point of view (what period/regions are more impacted ?).

In addition, two requests were discussed:

- First: do the DM operators agree to share OWC plots online for SBS ?

    Most DM operators (Australia, Coriolis, SIO, UW, PMEL, JAMSTEC, KMA) reported that they flag bad data as 4 then rerun OWC, thus the plots showing bad data are not recorded. However, Susan Wijffels proposed to share the comparison done with climatology and that is available at the following link:
    https://argo.whoi.edu/argo/sbedrift_wmo/
    This solution suited Jochen Klinke from SBS.

- Second: Proposition to record ASD floats in the ANOMALY field of the meta file =>

    Comment from Annie Wong: meta files are maintained by the DACs whereas ASD is completely assessed by DM operators. Mechanisms to bridge these two need to be found, not just for ASD, but also for other float_ending_cause.

6.2 Other DMQC items

6.2.1 DMQC python code updates

The key achievements from the development works on the Python version of the OWC software for the DMQC method include providing fully functional pyowc software including all functionality existing in Matlab software which can be used for the DMQC analysis of salinity on a daily basis, ensuring a comparable output to those obtained from Matlab version and improvement the performance of 25 % the pyowc software compared to Matlab version. The developed software is available on argodmqc_owc. The additional functionality implemented to the pyowc software is that code is continuously tested which provides many benefits. The software is using the unit tests which prevents any new implemented features or even the works related with fixing some bugs to break existing functionalities. Another benefit that the code is continuously tested is to ensure compatibility with all platforms and versions of Python. Moreover, another positive aspect of continuously tested software is that the new contributors to the software will not be afraid of breaking the code. What will encourage them to further develop and implement the new functionality.

The pyowc software is additionally enhanced by using automatic documentation of the code. In terms of using the toolbox the standard workflow of the software is very straightforward and is very similar to the Matlab version. The pyowc software is using the argopy package to automatically fetch the profile data from GDAC and generate the file including all profiles. This is further used as an input in the update salinity mapping. The diagnostic plots helping to make the final decision on the salinity data are comparable to those from Matlab.

The actions being still in progress are: packaging the pyowc to be able to install via the pypi and conda Python distributing servers, finalize works with the online documentation using the online readthedocs service, and also all the works related with the publication of the pyowc software in a journal such us Frontiers or Joos. Regarding the upcoming features to the software we plan to prepare some of the Jupyter notebooks with the examples of the DMQC analysis. Our further aspiration is to complete the entire python workflow to include the software to implement the Argo corrections and generate the netcdf files in D-mode. Another aspiration is to create the WebAPI for DMQC analysis. Which is an online URL which will call various software functionalities. This will allow it to: centralize resources locally, possibly share resources with operators with limited resources, build online GUIs and make the software fully interoperable and contribute to Argo data FAIRness.

6.2.2 DMQC in the Baltic Sea

Argo floats have been operated in the Baltic Sea since 2012, currently by Finland, Poland and Germany. As a shallow, brackish, confined and rather small area, the hydrography and thus DMQC challenges are quite different than when operating on oceans.
Water masses are strongly stratified, changing a lot both locally and from season to season, and in ice covered time on the north, even location of the profiles may be uncertain.
The advantages of the area are the constant monitoring programs that provide us with a good reference database, and due to the confined nature of the area, the possibility to recover most of the floats for lab calibrations.
High variability of the water masses is both a challenge for acquiring proper comparisons, and an advantage as the interesting signals are large enough that small drifts matter less than in open oceans.
Quality control work is divided in three parts, real time tests, DMQC on the recovered floats, and DMQC on the floats not recovered. Found suggestions for all there are as follows:

- Real time tests
    - Disable the digit rollover and stuck values tests for the Baltic.
    - Continue to use a threshold of 0.03 kg/m3 for density inversions in the Baltic and apply thermal lag corrections in delayed-mode.
    - Add a regional real time test for Baltic to catch excessively high surface salinities. The proposed test would look at salinities at depth of 10-25 m and assign a QC of 3 to the entire profiles if these are larger than a regionally varying threshold.
    - Explore if the implementation of the min/max near real-time quality control is appropriate for the Baltic.
- DMQC on recovered floats
    - For deployments in the Baltic the best practise to be aimed for is annual or biannual recovery
    - Corrections of the float salinity based on lab calibrations should only be performed if the drift per month is larger than 0.008 S/m/month (conductivity difference of 0.1 over 12 month)
    - Further develop rules on how to correct salinity (if calibration differences are larger 0.1) when such a case appears. Decisions are needed if we should apply a linear drift correction or it can be determined from the data when the drift began. This has to be done float by float by the DMQC operator.
    - The information necessary for the DQMC procedure based on lab calibrations needs to be accessible for the DMQC operators. We recommend that the lists of floats and the calibration sheets are stored at a central accessible directory.
- DMQC when floats are not recovered

- Find the best matches of reference profiles for float profiles using an appropriate search radius (30 km and 30 days). Decide which layer to compare (shallower or deeper) depending on the region. In the southern Baltic only the layer 10-30 m should be taken for comparison.
- Calculate the absolute differences between the float and the reference data
- Check if there is a trend/systematic differences calculated from different profiles/moments in time.
- Assign corresponding flags and errors.

Further details on the work on Euro-argo RISE projects findings on the DMQC on Baltic Sea can be found from D2.7: https://www.euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022/Deliverables

6.2.3 Profile classification methods for DMQC

The DMQC-PCM is a proposed new step in quality control procedures involving reference data selection. It is based on Profile Classification Modeling (PCM), a machine learning method to identify recurrent patterns in a collection of ocean vertical profile measurements. It's been applied in the North Atlantic, Southern Ocean, Indian Ocean, Amundsen Sea and Mediterranean Sea (Maze et al, 2017, Maze et al 2017b, Jones et al, 2019, Rosso et al, 2020, Thomas et al 2021, Boehme et al, 2021, Sambe et al, 2022, Li et al, 2022). The idea of the DMQC-PCM procedure is to use a PCM classifier to organize and select more appropriately reference data for the quality control of Argo float measurements. In practice, a PCM is trained on reference data, then this PCM is used to classify data to validate. Subsequently, only reference data reduced/subsampled to those falling in the same class as the data to validate are used to compute reference statistics.
During the EA-RISE project, a proof of concept has been developed to investigate the performances and characteristics of the procedure. Two notebooks can be executed to train a PCM and to provide results data to be used in the OWC salinity calibration procedure. Augmented versions of the Matlab and Python OWC softwares have been written under the DMQC-PCM repository and are now available to the community for testing. Further developments will take place on the euroargodev DMQC-PCM repository.

BODC was working on improving the quality assessment of the salinity data of the Argo floats in the Southern Ocean (SO). The work has been carried out as a part of the EA RISE project. The improvements are needed because the analysis in this region is very challenging for operators due to strong natural variability of the water masses, frontal regions, complex ocean dynamics, and limited availability of climatology data for comparison with Argo floats. After reviewing and testing the available software for DMQC, BODC decided to implement the PCM method to the DMQC workflow in the SO. The PCM software has been further developed and operationalised by combining it with the currently available software.

The developed SO assessment method is currently available on SO_assesment as an additional branch of the DMQC-PCM repository. The software is available in two versions working with both Python and Matlab OWC software.

The SO assessment method has been used to review the core argo parameters in the SO in delayed mode. BODC set up the automatic procedures to detect the questionable floats. The log file with the list of the problematic floats for the review is automatically generated and the simple comparison plots are created. The suspicious floats from the log file are further carefully reviewed and any floats with the questionable decisions are further shortlisted. Overall BODC reviewed 368 floats in d-mode from the Atlantic and Pacific Ocean, while BODC identified 31 questionable floats requiring additional checks by the DMQC operators responsible for the floats. BODC started sending the feedback to DMQC operators for additional review.

The major issue in the DMQC analysis leading to the discrepancies was no salinity corrections applied to the data by operators, where the corrections were needed.The decision of not applying correction might be various due to the large error bars coming from comparison between the floats and reference data, or due to the reference data from different water masses used for analysis which could bias the OWC output. These issues can be potentially improved by the use of the pre-classified reference data using the PCM method. This can increase the confidence of the operator to apply or reject corrections and help to maintain a better quality of the d-modded data.

Overall, the implementation and further automatisation of the PCM method in the quality assessment in the SO allowed it to quickly check a large number of floats. Moreover, the developed software can be used for every day DMQC operators and also the ARC's. This software. These works showed that there is a need to continue the regular quality assessment checks of d-mode salinity data from Argo floats covering the entire SO; a need to improve the overall consistency of the Argo DMQC procedures and operator skills developed through regular workshop and also a need to secure sustained funding to ensure future maintenance and development of the SO quality assessment tool and to support the SOARC activities.

6.2.4 Near real-time QC procedure using signature-based neural network

Argo profile data undergone real-time QC could contain some error data, and could sometimes be difficult to use directly for analytical researchers. So, an automated QC of Argo core-profiles, based on a path-signature-based neural network to improve the procedure proposed by Sugiura and Hosoda (2020). There are two advantages of using path-signature. One is that it is an efficient feature extraction expressed by a linear equation theoretically. The other is that it can be treated uniquely without concern for profile length or vertical sampling rate. JAMSTEC try to represent the weight function with a neural network for non-linearity, and try to improve with a kind of metric meaning method, which is called ArcFace. This method was applied to the global Argo profile data. The precision becomes quite better than Sugiura and Hosoda (2020). Using this method we can actually detect 80% of the bad profiles with a precision of 0.8. This signature-based neural network has large advantages to end-users to help providing better rQCed data by just applying a simple processing, and also opening up a possibility in offering a quick and automated QC processing of Argo profiles before providing dQCed data.

6.2.5 Leveraging multiparameter eddy tracking and satellite data for Argo QC

- NOAA NCEI and NOAA's Lab for Satellite Altimetry (LSA) have been working on a system of multiparameter eddy tracking for adapted use in Argo QC
- NCEI's experimental monthly OHC product showed a strong cold anomaly in August 2020, which spurred an investigation into the selective removal of anomalously warm Argo temperature profiles (some >4 degrees C at 500 m). Adding flagged profiles back in reduced the cold anomaly, but did not eliminate it completely. We still require QC, but the question remains as to how we better identify floats that are in anomalous features vs. floats that are experiencing other forms of anomalous or erroneous conditions
- Chose one particular Argo float near the Brazil Confluence in the South Atlantic on August 10, 2020 as a case study as it aligns with a strong anticyclonic eddy identified through satellite altimetry
- The multiparameter mesoscale eddy tracking system in development at NOAA's LSA and NOAA CoastWatch was then adapted for use as a potential supplementary Argo QC system with y/n response
- Ran eddy tracking for the South Atlantic and identified the responsible eddy, yielding trajectory/lifespan, contours, horizontal length scale, SST, SSS, ocean color chl-a, amplitude, EKE, relative vorticity, and other calculated characteristics.
- While further testing is required, the proposed supplementary QC method would serve as an additional check on anomalous Argo float data with a y/n algorithmic response, with a thorough description trajectory, contour, and characteristics provided if the anomalous profile is found to be within a mesoscale feature

6.2.6 Under ice position estimation

Presentation of Annie Wong on behalf of Kaihe Yamazaki

The terrain-following interpolation method based on Yamazaki et al. (2020) https://doi.org/10.1029/2019JC015406 was first introduced to the ADMT in the December 2021 meeting, and was presented again in this December 2022 meeting to provide updates. The Python code for this method (available at https://github.com/euroargodev/terrain-following) was updated in July 2022 to improve the output csv files. It now runs smoothly with input from the Argo multi-cycle *_prof.nc files. Error estimates can be obtained from Table A1 in the manuscript.

Delayed-mode operators are reminded that improving under-ice position estimates is an optional activity. If resources allow and an improved estimate is evaluated as acceptable, it can be recorded in the Argo profile files with POSITION_QC='8'. In addition, two optional variables, POSITION_ERROR_ESTIMATED and POSITION_ERROR_ESTIMATED_COMMENT, can be filled to provide information on the method.

Presentation of Catherine Schmechtig,

Based on Kaihe Yamazaki's work, the Coriolis DAC (J-P Rannou) adapts the routine in matlab. The code is available https://github.com/euroargodev/Coriolis-under-ice-positioning, along with a documentation. It allows to perform the algorithm in backward and forward direction and add some constraints on the pressure estimates, like the maximum pressure of the float and the grounded flags. The output of the routines is stored in a csv file that contains the estimated positions and the estimated speed of the float between two profiles. The estimated trajectory should be evaluated by the DM operator.

Based on presentation by Peter Oke

A method for estimating Argo trajectories under ice was described. The method identifies contours of potential vorticity (f/H), mea sea-level, and sigma-1 between known positions for position-gaps, producing up to three estimated trajectories. Using just one constraint, fails for 10-20% of position-gaps. But all constrains fail for the same position-gap for less than 1% of cases. With multiple estimated trajectories in hand, a user can manually select one trajectory to be used for each position-gap. Details of the method are described by Oke et al. (2022https://doi.org/10.1029/2022EA002312), and data are available on Zenedo (Rykova and Oke 2022; https://doi.org/10.5281/zenodo.6571146).

There was discussion about whether this should be included in D-files. It was agreed that there are pros and cons to this, noting that users aren't great at paying attention to QC flags. There was also discussion about sharing code for this system. Peter agreed to tidy up the code, add comments, and share it with those interested. In the mean-time, estimates have been produced for the most recent Austral winter and will soon be published on the Zenedo web-site (probably version 2022.12).

Oke, P. R., T. Rykova, G. S. Pilo, J. L. Lovell, 2022: Estimating Argo trajectories under ice. *Journal of Geophysical Research – Earth and Space Science.* https://doi.org/10.1029/2022EA002312.

Rykova, T., P. R. Oke, 2022: Argo trajectories under ice (Southern Hemisphere, version 2022.05) [Data set]. In Journal of Geophysical Research – Earth and Space Science (2022.05). *Zenodo*. https://doi.org/10.5281/zenodo.6571146.

6.2.7 Trajectory files

Megan Scanderbeg reported on the actions of the Dmode Trajectory Working Group over the past year which resulted in the update of the QC manual with instructions on how to dmode trajectory files and the update of the DAC Trajectory Cookbook to accommodate the v3.2 trajectory file and BGC measurements in general.

Work was not finalized on how to apply PARAM corrections to trajectory files and this remains an action item. In addition, a workshop was not held to familiarize dmqc operators with the trajectory files, but they hope to hold a series of virtual workshops in the next 12-18 months on this topic once v3.2 trajectory files are more widely available and dmqc methods are improved.

6.3 DMQC monitoring

6.3.1 Monitoring of floats through DMQC with highest priority on floats on notification lists

Currently, OceanOPS provide feedback to DMQC operators on:

- GreyList (all variables)
- Coriolis min/max QC test (T&S)
- Coriolis CLS Altimetry comparison (T&S)

Other types of feedback can be sent to DMQC operators such as:

- Date/Time errors
- Location errors
- Metadata errors

OceanOPS has implemented an operational system to provide feedback based on the regular and high quality tests done by Argo and its partners (Coriolis, CLS). This implementation has been made at the request of the ADMT and AST and these automatic alerts are a great tool for the global quality of the Argo data set.

What has been demonstrated is that the way we manage the DMQC alerts feedback should be improved to facilitate the work of DMQC operators that are in charge of answering those alerts. It has also been said that reporting on the OceanOPS system is useful for Argo partners providing the alerts.

Action: Consider improving feedback method from DACs and dmode operators for both objective analysis warnings and altimetry detection to make it easier to provide bulk feedback

6.3.2 Monitoring of DM operator

- Delayed Mode Operators (DMO) role has been added to the list of roles at the level of the program and the float. Multiple DMO is possible.
- When program DMO and float DMO exist, float DMO is kept.
- DMO(s) receive DMQC alerts discussed above.

We strongly encourage national programs to define DMO at the level of the program (at least).
It is technically feasible for OceanOPS to get DMO at the variable level, but it will be even harder to get the information in the system.

6.3.3 Orphan floats: which are they and who will DMQC them?

A consensus on the exact characterization of an orphan float is currently lacking although earlier definitions have been suggested (H. Bittig, S. Wijffels). Several criteria are usually considered, such as:

- Presence of a program DMO or a float DMO filled in the metadata
- Existence of DMQC files (A or D data mode)
- Age of the float

One definition proposed by V. Turpin and O. de Fommervault during the ADMT-23 was to consider that a float deployed more than a year ago without any known DMO at OceanOPS and files in D mode can be considered as orphan. According to this definition the total number of orphan floats is 278 (~1.5 % of the fleet), 84 of them being active (48 Core Argo and 36 BGC Argo). They are managed by the 2 main GDAC (NOAA/AOML, Coriolis) and belong to 9 programs:

- Argo BGC – AOML
- Argo FPAII-GMMC
- Argo GO BGC, UW
- Argo GO BGC, WHOI
- Argo Morocco
- Argo UW
- Coriolis
- Euro Argo RISE
- EuroSea Argo

However, this approach is far from unanimous. S. Wijffels suggested to speak rather of “orphan profiles” than “orphan floats”.

6.4 DMQC ref db

6.4.1 CTD reference database updates

Since the last ADMT22, the version 2021_V02 was made available on the ftp site at the end of 2021. This version takes into account corrections following user feedback, CTDs provided by scientists, CTDs made during float deployments and some GO-SHIP CTDs retrieved from the CCHDO website. Some work has been done in the framework of EA-RISE and the new version in preparation will benefit from this work which was the « clean-up » for V2021 version and local updates done for high latitudes (Arctic and Southern Ocean (Atlantic sector)), the Mediterranean Sea, Baltic Sea and Easy Ocean product dedicated to Deep Argo. For the high latitudes, some updates were made from UDASH and ICES as well as the criterion >700db (boundary current) for the Arctic area and for Southern Ocean clean-up and PANGEA updates were made. For the Mediterranean Sea, data have been collected from research institutes at the regional level and from the main European Marine Services. The work is still in progress. For the Baltic Sea, different criteria are used due to the particular configuration of this area. ICES and Helcom (FMI) data are collected for the reference database as well as for improving the min/max statistics. The preparation of the official reference database is done at BSH. In the next version, data collected from 2 WOD updates in 2022, data from scientists, confidential and public data from CCHDO (new way to exchange confidential data with owncloud) will be added. Over the next two months, work with Ingrid Benavides will be done to recover CTD data boxes on which improvements have been made. The new version should be delivered next spring.

Agreement to get more CTD data with depth<700db for some regions (Caribbean, Arctic).

6.5 GADR

6.5.1 Update on status of GADR

Presentation Tim Boyer

The Global Argo Data Repository (GADR) at the U. S. National Centers for Environmental Information (NCEI) is the official archive for Argo data. It also serves the function of providing Argo profilefiles which meet Attribute Convention for Data Discovery (ACDD) standards. There were 12 monthly compressed tar balls added to the GADR archive in 2022 bringing the total to 211 monthly archivals since May, 2003. The monthly archival packages consist of the contents of the Coriolis Global Data Assembly Center (GDAC) as of the first of each month. It was determined that the digital object identifier (DOI) assigned to the GADR archive (https://doi.org/10.25921/q97e-d719) would no longer be listed on the Argo DOI page so as to avoid confusion with the Coriolis GDAC monthly repository DOI. ACDD compliant files for new float profileswere not added to the repository in 2022. Work continues on a transformation of the GADR archive from a monthly tarball to a system in which each version of each float cycle is preserved sequentially and separately so a user can recall the exact Argo data set they used in their work simply by entering the date on which they initially downloaded their Argo data set. This will allow for better and easier reproducibility of results than the current monthly tarball. This system cannot easily be implemented on the computer system currently available at NCEI so an initial attempt to set up the system in the cloud is proposed.

7. Format issues

7.1 Move CNDC to be an intermediate core parameter

A motion was put forward to move CNDC (electrical conductivity) from a core parameter (c) to an intermediate core (ic) parameter. CNDC by nature is an intermediate parameter, being an input to compute salinity. In the past, the Argo parameters table did not have an “intermediate core” category, but now it does. Being an intermediate parameter means that DACs no longer need to include CNDC_ADJUSTED, CNDC_ADJUSTED_QC and CNDC_ADJUSTED_ERROR in the Argo data files. (These _ADJUSTED_ variables are optional for intermediate parameters, so old files that contained them would still be accepted at the GDACs.)

This motion was accepted and action items were recorded in the Action Item list for ADMT23.

7.2 Argo NetCDF format evolution & proposals for improving consistency of Argo ref tables with controlled vocabularies

The Suggested changes to Argo files document created a few years ago is the list of NetCDF format evolution requests. This document will be obsoleted, replaced by AVTT tickets.

The changes are negotiated in GitHub Argo Voluntary Task Team - AVTT dashboard

When a format change is approved, the « Argo user’s manual work in progress version » is updated

Once a year, if needed, a new version is officially released.

7.2.1 Review of AVTT dashboard tickets

The dashboard was presented to ADMT-23 and a series of tickets were reviewed.

It was decided that the Argo data management web site would have a documentation page on how to use AVTT dashboard.

The major change tickets need ADMT approval.

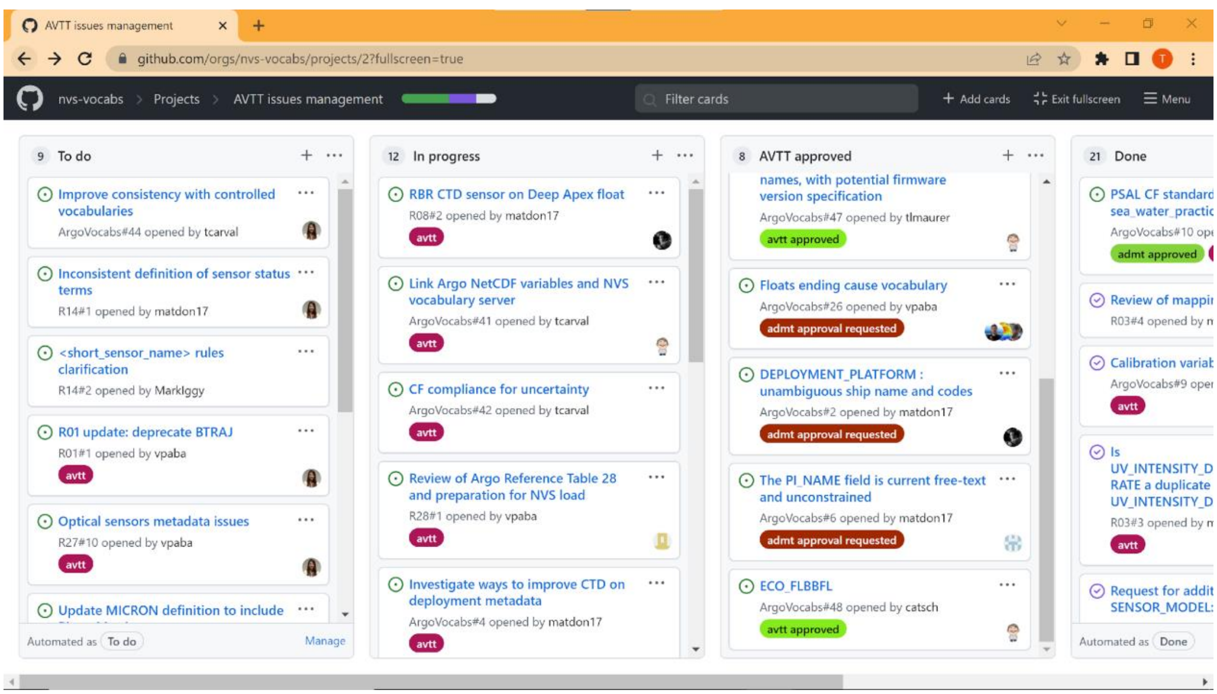
The minor change tickets need an AVTT approval, not a full ADMT approval (example : add a new type of sensor in reference table 27).

Three tickets were marked as “ADMT approved”.

- Add Argo GDAC DOI in global attributes
  https://github.com/orgs/nvs-vocabs/projects/2#card-87158769
- How to record an Argo float ASD - Abrupt Salty Drift
  https://github.com/nvs-vocabs/ArgoVocabs/issues/38
- move CNDC to be an intermediate core parameter
  https://github.com/nvs-vocabs/ArgoVocabs/issues/46

Three tickets have a status “ADMT approval requested”. For each of these tickets, a message will be sent on the ADMT mailing list. If no objection arises within 3 weeks, their status will pass to “ADMT approved”.

For information, two tickets are AVTT approved, not yet closed, waiting for the parameter “upload” in the NVS (Nerc Vocabulary Server).



The AVTT dashboard as of December 10th 2022

8. Demonstrating Argo’s value - Data access and communication

8.1 Results from survey at 7th Argo Science Workshop

Claire Gourcuff briefly presented the results of the short survey proposed at the beginning of the 7th Argo Science Workshop in Brussels in October 2022. The aim of the survey was to get feedback from the Workshop participants about Argo data access. 74 persons answered the questionnaire that contained 3 basic questions.

34% of the respondents find Argo data either difficult to access (7%) or that access should be improved (27%), with some suggestions for improving it (listed in the slides). About two thirds of the respondents would like to have more educational opportunities about Argo, most popular topics for such educational opportunities among the 49 respondents being Argo software tools training, through webinars (67%) and tutorial videos (67%). Last question showed the engagement of the workshop participants in the Argo programme, with 62% of the 74 respondents already involved in Argo, 28% of them not currently involved but would like to be and 10% not involved and do not wish to be (the Argo users).

8.2 Feedback from the GOOS webinar on Argo data

Tammy Morris reported on a GOOS webinar organized in September 2022 on “Argo Data - how to access and use this freely available dataset”. This was a one hour session with a short video on the Argo data management system and a Q&A session with a panel of Argo experts. There were over 200 registrations to the webinar with 128 confirmed participants on the call, from all over the world. It is available on youtube and has been watched 90 times since being loaded. The statistics on participants show that most of the participants are not currently using Argo but but are willing to, and they were mostly ocean researchers and research services providers and students.

8.3 Update on available Data Visualizations and Tools

Megan Scanderbeg showcased the list of data visualizations and access tools, including the new Argo Online School developed in the last year which is a great resource for newcomers to the Argo data system. She pointed out some of the BGC tools that are included and asked for the ADMT to update her on any additional tools that are missing.

8.4 Discussion on user community needs for accessing and using Argo data

A short discussion on how we could improve Argo data access was held. Claire Gourcuff introduced the discussion by sharing some thoughts on why we should improve this access, highlighting for instance the need to educate the Argo user community to avoid wrong use of the data, as shown in previous days by Peter Oke (see above). In the discussion, it was suggested to make a general presentation on the subject that could be shared with everyone, listing all existing datasets and access points. Workshop opportunities prior to AGU and other big workshops were also suggested, including aspirations as to how we plan to serve Argo data to both get feedback and to alert users to possible changes to make things easier. It was also recommended that AST/ADMT co-chairs send out to all centers a one pager with data best practices.

9. Argo Regional Centers

9.1 Atlantic

Cécile Cabanes

Consistency checks in the Atlantic ARC were run and the analysis is underway. So far about 20 floats have questionable adjustments in Delayed Mode. Results have been compared to the suspicious floats catched by Annie and John's audit, and that shows that the two analyses are complementary. The ISAS20 product (T,S monthly field) has been released as well as an update of the ANDRO velocities atlas. The NRTQC tool has been presented. This tool provides automatic QC of the trajectory files, alerts and warnings that could be used in DM and generates a Near Real Time velocities Atlas (same format as ANDRO).The tool is being implemented at Coriolis.

9.2 Med Sea

MedArgo is the Argo Regional Centre for the Mediterranean and the Black Sea and OGS coordinates its activities. More than 86000 profiles were acquired in Mediterranean and Black seas from 2000 to October 2022, about 5500 profiles are collected in 2022. 14 new floats were deployed and Italy and Greece planned to deploy 9 floats before the end of 2022. BGC profiles are decreasing but Italy and France have planned to deploy more floats in the upcoming years. Regarding the performance of the fleet, the mean half-life is about 150 cycles for all floats. In detail, floats with Iridium telemetry system have a mean life much larger than floats with Argos telemetry system. This confirms that less time spent at the surface to transmit data reduces the risk of losing the float. Looking at the vertical distance (only upward profiles) traveled by floats, 50% of floats reach 900 m depth. This is important for DMQC purposes since CTD and ARGO reference profiles have to be shallower than this depth. OGS performed the DMQC activity for the Argo physical data. The DMQC analysis is applied to 76% of the eligible floats deployed between 2003 and 2021 in the Mediterranean and Black Seas. 10% out of this percentage were quality controlled but the D-files were not sent to GDAC yet. This percentage includes analysis that has to be repeated due to problems related to the reference dataset or in the data itself, and to shallow floats. The DMQC report/info of each float can be downloaded by the MedArgo web page. OGS continues to improve and implement the DMQC procedure for Core and Deep Argo floats. The high-quality ship-based CTD reference data from the near-surface to depths more than 2000 m, for QC purposes of Core and Deep-Argo float data in the Mediterranean and Black seas, was reviewed and improved.

The MedArgo web page's new address is: http://argo.ogs.it/medargo/. There are 72 active Argo floats in the Mediterranean Sea and 12 in the Black Sea as of 5 December 2022. The aim is to maintain at least 60 active floats, with ~25% BGC and Bio and 2 deep floats in deep Ionian & Rhodes Gyre area for Mediterranean Sea and 10 active floats, with ~20% Bio & TS DO for Black sea.

9.3 Pacific

PARC has been operated by JAMSTEC since 2019, although it was operated in coordination with IPRC.
PARC web service had been down since March 2021 due to a network security incident that occurred at JAMSTEC. JAMSTEC has developed and released the new version of PARC website, since the functions of the previous version of PARC web site have been mostly built into the new site and JAMSTEC internet connection has been fully restored.
In the new year, JAMSTEC are going to develop the new functions on PARC website as follows: providing information about BGC and Deep floats as well as core floats in the Pacific, sharing statistical results, and sharing the information of the Pacific float deployment coordination working group, which has been established in 2022.

9.4 Indian Ocean

Coordination of float deployments by India and other countries and help provision in processing of Argo floats deployed by NIO, Goa were continued. The float density map was used to identify the region of low float density and a suggestion was made for deployment in those regions which is extensively used by our deployment team.

The ARC worked on estimating gain and offset values for improving the chlorophyll data from Bio-Argo floats deployment by India. Sample data was uploaded to GDAC. The team also continued to use the SAGEO2 tools for generating the BD files using the gain factor given by the software.

Archiving of temperature and salinity profile data from floats deployed by Indian and other countries in the Indian ocean and making them available through Web-GIS was also continued, as well as generation of value added products based on gridded products obtained from Objective and Variational Analysis methods. These value added products are made available on the web and also on the Live Access Server and ERDDAP web sites. The use of Argo data for scientific analysis by students, researchers and scholars was encouraged.

9.5 Southern

The activities undertaken in the SOARC group in the Southern Ocean (SO) are made by the individual members without overall coordination due to a lack of the new SOARC lead. Over the 2022 there were new 73 floats deployed in the SO below 60 deg S. This includes floats from the following programs: 1 EuroArgo, 14 Coriolis, 5 Argo UW-SOCCOM, 4 UK Argo, 2 Argo New Zealand, 7 Argo Italy, 8 Argo GO BGC-UW, 1 Argo BSH, 21 Argo AWI, 10 Argo Australia.

NOC was working on improving the quality assessment of the salinity data of the Argo floats in the Southern Ocean (SO). The work has been carried out as a part of the EA RISE project. NOC reviewed the quality of 368 floats in d-mode from the SO and compiled a list of typical issues in the DMQC analysis. NOC has also started cross-collaboration works with other ARC groups to coordinate the DMQC quality check of d-moded floats.

CSIRO took a lead on activities of running the recurrent DMQC discussion meetings to review more difficult issues and complex floats. One of the sessions has been dedicated to the SO region. Esmee van Wijk et al. published a paper using ice float data to estimate the ocean heat transport that drives high basal melt rates of the Denman Glacier. Peter Oke et al. published a paper with a new technique for estimating Argo trajectories under ice.

BSH is continuing work on updating the reference database using data from Pangea. They also performed the DMQC analysis on 56 old AWI floats in the SO.

MBARI collaboratively worked with Matt Mazloff from SOCCOM on pH climatology data. Matt is working on a model-based product using around 10 years of float data implemented in the B-SOSE model.

The key limitation of the SOARC group is a Loss of the lead of the SOARC group to carry out the key activities. BODC has limited resources in BODC to continue leading the SOARC group. Another issue is that other SOARC group members are under-resourced and over-committed to other existing projects. Moreover, the independent work of SOARC members is often based on limited funding from other national projects.

The major needs for the SOARC group are to restore the collaboration within the SOARC group members, secure sustainable funding and resources for the ARC activities and continue cross-collaboration with all ARC’s.

10. Review action items

Megan Scanderbeg presented the Action Items from ADMT-23 for review and several were edited for accuracy.

11. Other ADMT business

Megan Scanderbeg welcomed Shigeki Hosoda as the new ARC representative on the Argo Data Management Team Executive Committee.

12. Upcoming meetings

AST-24

Canada is hosting the AST-24 meeting in Halifax, Nova Scotia 20 - 24 March, 2023.

ADMT meeting in 2023

Peter Oke has generously offered to host the ADMT-24 meeting in Tasmania Hobart and we wish to hold the meeting earlier in the year - perhaps in September, October or November.

Workshops in 2023-2024

A series of workshops are planned in the 12 - 18 months including:

- Hybrid BGC DMQC Workshop in January in Villefranche
- Virtual RBRArgo CTD workshop in February - April 2023 focused on the real time data stream led by Mat Dever and Annie Wong
- Virtual Deep DMQC workshop in June - August 2023 focused on application of the cpcor correction and led by Nathalie Zilberman and Cecile Cabanes.
- Virtual Trajectory DMQC workshop(s) in November 2023 - February 2024 led by Trajectory working group

13. Annex 1 - Agenda

ADMT-23 DAY 3 SCHEDULE

décembre 9

Link to google doc with ADMT-23 Agenda and Notes

Link to google drive for ADMT-23 with presentations and reports

Link to ADMT-23 draft meeting report

Start time	duration	Presentation	Speaker	Actions from ADMT-22	
Time is EST		**Format issues**			**morning slack monitor**
		Proposed changes recorded in this Google Doc			Breck Owen
9:00 AM	00:15	Adding GDAC DOI to files	Thierry Carval		
9:15 AM	00:15	CF compliance for uncertainty	Thierry Carval		
9:30 AM	00:20	Linking NVS version of Argo ref tables directly to netCDF files	Thierry Carval	28	
9:50 AM	00:10	Move CNDC to be an intermediate core parameter	Annie Wong		
10:00 AM	00:30	Proposoals for improving consistency of Argo ref tables with controlled vocabularies	Thierry Carval		
10:30 AM	00:30	BREAK			
		Demonstrating Argo's value			**afternoon slack moderator**
		Data access and communication			Anh Tran
11:00 AM	00:10	Results from survey at 7th Argo Science Workshop	C. Gourcuff		
11:10 AM	00:10	Update on available Data Visualizations and Tools	M. Scanderbeg	52	
11:20 AM	00:30	Discussion on user community needs for accessing and using Argo data	C. Gourcuff		
11:50 AM	01:30	LUNCH BREAK			
		Argo Regional Centres		(most were closer to 15 min)	
1:20 PM	00:10	Atlantic	Cecile Cabanes		
1:30 PM	00:10	Mediterranean Sea	Antonella Gallo		
1:40 PM	00:10	Pacific Ocean	Kanako Sato		
1:50 PM	00:10	Indian Ocean	Uday Bhaskar		
2:00 PM	00:10	Southern Ocean	BODC		
2:10 PM	00:30	BREAK			
2:40 PM	00:30	**Review Action Items**			
3:10 PM	00:15	Other ADMT business			
		Upcoming Meetings			
3:25 PM	00:05	AST-24	Blair Greenan		
3:30 PM	00:10	ADMT meetings in 2023			
3:40 PM	00:15	Workshops in 2023-2024			
3:55 PM		**END OF MEETING**			

BGC-ADMT Meeting

décembre 6

Start time	duration		
Time is EST			
9:00 AM	00:30	BGC data in trajectory files	Emily Clark
9:30 AM	00:15	When to end acceptance of v3.1 B-traj files for BGC floats	Annie Wong
9:45 AM	00:20	Status of WMO BUFR format for BGC parameters	Jon Turton, Fiona Carse
10:05 AM	00:10	Documentation updates / vocabulary (github repository)	Maurer, Schmechtig
10:15 AM	00:20	PSAL recovering for 'salty drifters' and impacts on BGC	brief working group update, documentation (Alkire, Wong, Maurer)
10:35 AM	00:30	BREAK	
11:05 AM	00:30	Code sharing and tools for the community	Donata Giglio, others
11:35 AM	00:30	Status updates and feedback on BGC Argo data products	Andrea Fassbender, Raphaelle Sauzède, Jon Sharpe
12:05 PM	01:30	LUNCH BREAK	
1:35 PM	00:30	Status update and feedback on parameter audits	Plant, Sauzede
2:05 PM	00:20	Discussion -- how can we work together, DAC assistance, DAC priorities	All
2:25 PM	00:40	pH parameter accuracy and implications to pCO2	Maurer, Johnson, Cathy Wimart Rousseau, H Bittig
3:05 PM	00:30	BREAK	
3:35 PM	00:30	Discussion -- aligning DMQC among DACs	All
4:05 PM	00:30	Discussion and planning - DMQC workshop for BGC	All
4:35 PM	00:25	Final Discussion, Actions Summary	Maurer, Schmechtig
5:00 PM		**END OF MEETING**	

ADMT-23 EXECUTIVE MEETING

décembre 6

	zoom	https://ucsd.zoom.us/j/92150557786?pwd=aTNJMzBFTTFyRjdwaWVnSTVveEVhQT09	
Start time	**duration**	**Presentation**	**Speaker**
Time is EST			
5:00 PM	02:00	ADMT-23 executive meeting	
7:00 PM		END OF MEETING	

ADMT-23 DAY 1 SCHEDULE

décembre 7

Link to google doc with ADMT-23 Agenda and Notes
Link to google drive for ADMT-23 with presentations and reports
admt-23-meeting Slack Channel

blue text means virtual speaker
Link to ADMT-23 draft meeting report

Start time	duration	Presentation	Speaker	Actions from ADMT-22	Moderator for morning Slack
Time is EST		**Status of Argo and link with its users**			
9:00 AM	00:10	Welcome	John Cortinas		Susan Wijffels
9:10 AM	00:20	Feedback from AST-23	S. Wijffels, T. Suga		
9:30 AM	00:20	Feedback from BGC-ADMT Meeting	T. Maurer, C. Schmectig		
9:50 AM	00:10	Objectives of the meeting	ADMT co-chairs		
10:00 AM	00:15	Status of Action Items from ADMT-22	M. Scanderbeg		
10:15 AM	00:15	Preparation for interactions with modeling community to improve communications	B. Owens, A. Wong		
10:30 AM	00:10	Core Argo Best Practices document	Tammy Morris	56	
10:40 AM	00:20	Argo Status and real time monitoring	V. Turpin	48, 49	
11:00 AM	00:30	BREAK			
		GDAC Data Management			
11:30 AM	00:20	Operational status of Argo GDACs	Thierry Carval, Mike Frost		
11:50 AM	00:20	Status of NVS version of Argo Reference Tables & plan for upcoming year	Violetta Paba	1, 16, 26, 27, 45, 46	
12:10 PM	00:15	Review process to change Argo Ref Tables in NVS	Thierry Carval	50	
12:25 PM	00:20	GDAC File Checker status and update	Mark Ignaszewski, Thierry Carval	2-5	
12:45 PM	01:30	LUNCH BREAK			
		Real Time Data Management			**Moderator for afternoon Slack**
2:15 PM	00:25	Timeliness of Real Time Data Delivery for all parameters on GTS and GDACs	Anh Tran, V. Turpin		Cécile Cabanes
2:40 PM	00:20	Anomaly detection at Coriolis GDAC	Christine Coatanoan		
3:00 PM	00:20	Anomaly detection from Altimetry	Nathalie Verbrugge		
3:20 PM	00:30	BREAK			
		DAC Status			
3:50 PM	00:30	Discussion on DAC Actions and needs	ADMT co-chairs to introduce discussion	6 - 15, 30 - 32	
4:20 PM	00:15	DAC Workshop	Clare Bellingham	53	
4:35 PM	00:20	Feedback from operational centre and altimetry session at 7th Argo Science Workshop	P. Oke (prefers afternoon)		
4:55 PM		**END OF MEETING**			

ADMT23 DAY 2 SCHEDULE

décembre 8

Link to google doc with ADMT-23 Agenda and Notes
Link to google drive for ADMT-23 with presentations and reports
Link to YouTube channel

Link to ADMT-23 draft meeting report

Start time	duration	Presentation	Speaker	ADMT-22 Actions	Morning slack moderator
Time is EST		**Pilot data management**			Catherine Schmechtig
9:00 AM	00:20	Deep Argo data: cpcor correction & DMQC status	Cecile Cabanes	35	
9:20 AM	00:30	RBR data	Mat Dever, Annie Wong		
		Delayed mode quality control			
		SBE CTDs			
9:50 AM	00:20	Salty drifter spreadsheet update	B. Klein, D. Dobler	33, 37	
10:10 AM	00:30	BREAK			
		Other DMQC items			
10:40 AM	00:15	DMQC python code updates	Kamila Walicka	36	
10:55 AM	00:15	DMQC in the Baltic Sea	Simo-Matti Siiria		
11:10 AM	00:20	Profile classification methods for DMQC	Guillaume Maze, Kamila Walicka		
11:30 AM	00:15	Near real-time QC procedure using signature-based neural network	Kanako Sato		
11:45 AM	00:15	Leveraging Multiparameter Eddy Tracking and Satellite Data for Argo QC	Heather Roman-Stork		
12:00 PM	01:30	LUNCH BREAK			
1:30 PM	00:30	Under-ice position estimation	Annie, Peter, Tatiana	39, 40	
2:00 PM	00:10	Trajectory Files	M. Scanderberg	18, 20, 41, 42, 54	
		DMQC monitoring			**afternoon slack moderator**
0,5902778	0,0069444	Monitoring of floats through DMQC with highest priority on floats on notification lists	OceanOPS		Tanya Maurer
0,5972222	0,0069444	Monitoring of DM operator	OceanOPS		
0,6041667	0,0069444	Orphan floats: which are they and who will DMQC them?	OceanOPS		
2:40 PM	00:30	BREAK			
		DMQC reference databases			
3:10 PM	00:20	CTD reference database updates	C. Coatanoan, S. Diggs		
		GADR			
3:30 PM	00:15	Update on status of GADR	Tim Boyer	47	
3:45 PM	00:05	**END OF DAY**			
4:30 PM	01:30	Tour of AOML			
6:00 PM	04:00	**Networking event at SALT**			
10:00 PM		End of event			

ADMT-23 DAY 3 SCHEDULE

décembre 9

Link to google doc with ADMT-23 Agenda and Notes
Link to google drive for ADMT-23 with presentations and reports

Link to ADMT-23 draft meeting report

Start time	duration	Presentation	Speaker	Actions from ADMT-22	
Time is EST		**Format issues**			**morning slack monitor**
		Proposed changes recorded in this Google Doc			Breck Owen
9:00 AM	00:15	Adding GDAC DOI to files	Thierry Carval		
9:15 AM	00:15	CF compliance for uncertainty	Thierry Carval		
9:30 AM	00:20	Linking NVS version of Argo ref tables directly to netCDF files	Thierry Carval	28	
9:50 AM	00:10	Move CNDC to be an intermediate core parameter	Annie Wong		
10:00 AM	00:30	Proposoals for improving consistency of Argo ref tables with controlled vocabularies	Thierry Carval		
10:30 AM	00:30	BREAK			
		Demonstrating Argo's value			**afternoon slack moderator**
		Data access and communication			Anh Tran
11:00 AM	00:10	Results from survey at 7th Argo Science Workshop	C. Gourcuff		
11:10 AM	00:10	Update on available Data Visualizations and Tools	M. Scanderbeg	52	
11:20 AM	00:30	Discussion on user community needs for accessing and using Argo data	C. Gourcuff		
11:50 AM	01:30	LUNCH BREAK			
		Argo Regional Centres		(most were closer to 15 min)	
1:20 PM	00:10	Atlantic	Cecile Cabanes		
1:30 PM	00:10	Mediterranean Sea	Antonella Gallo		
1:40 PM	00:10	Pacific Ocean	Kanako Sato		
1:50 PM	00:10	Indian Ocean	Uday Bhaskar		
2:00 PM	00:10	Southern Ocean	BODC		
2:10 PM	00:30	BREAK			
2:40 PM	00:30	**Review Action Items**			
3:10 PM	00:15	Other ADMT business			
		Upcoming Meetings			
3:25 PM	00:05	AST-24	Blair Greenan		
3:30 PM	00:10	ADMT meetings in 2023			
3:40 PM	00:15	Workshops in 2023-2024			
3:55 PM		**END OF MEETING**			

14. Annex 2 - ADMT Actions List

Originating ADMT meeting	Action Number	Opened Actions	Who	When	Priority (High, Low, Regular)
		GDACs			
22	1	Transition the File Checker to reading NVS versions of the Argo ref tables to allow for automatic updates to the FileChecker when NVS tables are updated and to help in constraining the fields appropriately.	NVS team, M. Ignaszewski, T. Carval,	ADMT-24	H
22	2	Update the File Checker to accept v3.2 trajectory files.	M. Ignaszewski, T. Carval	janvier 2023	H
22	3	Update the File Checker to accept time series data in the technical files.	M. Ignaszewski, T. Carval	ADMT-24	L
		DACs			
23	4	Ask DACs who have DOXY data to explore how to get adjusted data only onto the GTS in a timely manner	DACs, BGC-ADMT	ADMT-24	H
22	5	Start to implement the v3.2 traj file format for BGC floats.	DACs	ADMT-24	H
23	6	Ask DACs to use DMQC operator suggestion of CPcor for real-time salinity adjustment in A-mode. If that is not available, ask DACs to use the recommended standard CPcor_new values for deep floats (-12.5e-8 for SBE61 and -13.5e-8 for SBE41) for real-time salinity adjustments in A-Mode.	DACs	ADMT-24	H
22	7	DACs to apply real time adjustment to all subsequent R files when a D mode adjustment becomes available.	BODC, CSIO, INCOIS, JMA	ADMT-24	R
22	8	DACs to go back and re-process R files after new D mode file arrives with an adjustment that needs to be applied.	BODC, CSIO, INCOIS, JMA, MEDS	ADMT-24	R
22	9	DACs to include TEMP_CNDC in the core-files as intermediate parameters, ie. no _ADJUSTED, no _ADJUSTED_QC, no _ADJUSTED_ERROR.	AOML, BODC, INCOIS, JMA, KMA	ADMT-24	R
22	10	DACs to include NB_SAMPLE_CTD in the core-files as intermediate parameters, ie. no _ADJUSTED, no _ADJUSTED_QC, no _ADJUSTED_ERROR.	AOML, BODC, INCOIS, JMA, KMA	ADMT-24	
22	11	DACs to implement new deepest pressure test (19)	AOML, BODC, CSIO	ADMT-24	R
21	12	Ask DACs to create netCDF with N_CALIB = 2 for Deep floats as described in the User Manual	DACs	ADMT-24	R
22	13	DACs to create new depth dependent adjustment for cpcor	DACs	ADMT-24	R
22	14	DACs to change BGC 'count' parameters (RAW_DOWNWELLING_IRRADIANCE* , RAW_DOWNWELLING_PAR, NB_SAMPLE_CTD, NB_SAMPLE_<parameter sensor name>) to the data type specified in the physical parameters xlsx.	AOML, BODC, CSIO, INCOIS, JMA, KMA	ADMT-24	L
		Manuals			
23	15	Update QC manual with instructions on cpcor usage for Deep floats	Annie	ADMT-24	R
23	16	Update Argo Manuals based on accepted tickets from GitHub AVTT	Annie, Thierry	ADMT-24	R
23	17	Update User manual with instructions on using the manufacturers' model name in the SENSOR_MODEL variable. If a sensor is identical, but from a different manufacturer, this is indicated in the NVS Ref Table.	Annie, Thierry	ADMT-24	R

Originating ADMT meeting	Action Number	Opened Actions	Who	When	Priority (High, Low, Regular)
		Format			
22	18	Decide on end of transition period for BGC floats, during which both v3.1 Btraj and v3.2 traj files can exist, at ADMT-24.	DACs	ADMT-24	R
23	19	Transition from list of 'Suggested changes to Argo files' google doc to the GitHub AVTT dashboard	T. Carval, NVS Team	ADMT-24	R
23	20	Add a DAC resource webpage to ADMT website with links to Argo Vocab Task Team GitHub dashboard, information on how to start a ticket, when tickets are accepted, etc.	T. Carval, M. Scanderbeg	ADMT-24	R
23	21	Move CNDC to the "intermediate core" (ic) category in the physical parameters list. GDAC file checker to update accordingly. DACs no longer need to include CNDC_ADJUSTED, CNDC_ADJUSTED_QC and CNDC_ADJUSTED_ERROR in Argo data files	Catherine Schmechtig, Mark Ignaszewski, DACs	ADMT-24	
23	22	Ask BGC ADMT to send the desired units, precision and the minimum and maximum acceptable values for each BGC parameter (except oxygen) to Jon Turton and Fiona Carse at UK Met Office for creation in a BUFR format to send the BGC data onto the GTS	BGC ADMT co-chairs, ?	AST-24	R
23	23	Ask contacts to work with UK Met Office to validate BGC BUFR format to help obtain final approval prior to full release on GTS	Anh Tran, others?	ADMT-24	R
23	24	Ask BGC ADMT for a recommendation on what BGC data should be sent onto the GTS. Should it be only *_ADJUSTED fields or are raw fields with QC flagsacceptable?	BGC ADMT co-chairs, ?	ADMT-24	R
		Pilot data			
22	25	Ask DACs with floats with RBR CTDs to implement real-time salinity adjustment as per QC Manual, and flag PSAL_ADJUSTED_QC = ‘1’ in 'A' mode. Real time adjusted data can be distributed onto GTS.	DACs with RBR floats	ADMT-24	R
		DMQC			
21	26	Ask DM operators to ensure that floats with ASD are on the greylist. If not put on greylist by AST-24, ask DACs to consider putting them on the list	DM operators	AST-24	H
22	27	Ask DMQC Trajectory working group to finalize guidelines on applying PARAM corrections from profile files to trajectory files.	M. Scanderbeg, J-P. Rannou, C. Cabanes, N. Kolodziejczyk, J. Gilson, D. Mack-West, A. Wong	ADMT-24	R
23	28	Consider how best to implement and serve PCM updates to Matlab_OWC. This method could also be generalized for other updates and extensions of OWC.	Annie, Cecile, Guillaume, Kamila	ADMT-24	R
23	29	Refer to updated QC manual for recommendations on cpcor adjustments in DM for deep floats	Deep DM operators	ADMT-23.5	R
23	30	If possible, delayed-mode operators should estimate an optimized Cpcor for Deep floats asap after deployment, and provide this value to the DAC for better A-mode adjustment	Deep DM operators	ADMT-23.5	R

Originating ADMT meeting	Action Number	Opened Actions	Who	When	Priority (High, Low, Regular)
23	31	After orphan list is created, ask DM operators to consider adopting orphan floats with very obviously bad salinity data after comparison with Susan's climatology	DM operators	ADMT-24	R
		NVS version of Argo ref tables			
22	32	NVS task team to finalize the Argo Vocab and identify cleary what is managed at NVS/BODC, what is managed at OceanOPS and what are the tables where another solution needs to be found	NVS Argo TT, V Paba Magali K	ADMT-24	H
22	33	NVS Argo task team to finalize transition of last tables to allow FileChecker update	NVS Argo TT	AST-24	H
23	34	ON HOLD until we confirm with Mark: Find a way to identify sensors as 'current', 'deprecated' and 'obsolete' to aid in FileChecker administration	NVS Argo TT, Mark Ignaszewski	ADMT-24	R
23	35	Ask NVS/AVTT for training for interested DACs/ADMT members on how best to access NVS Argo ref tables via API	NVS Argo TT	ADMT-24	R
22	36	Ask NVS team to find a machine to machine solution to find identical sensors, even if the name has been changed in the Argo vocabulary	NVS Argo TT	ADMT-24	R
		GADR			
		ARCs			
		Monitoring			
23	37	OceanOPS to find way to reconnect aic@jcommops.org and http://argo.jcommops.org that is on the float label through 2032.	OceanOPS	AST-24	H
23	38	Regularly monitor, from various nodes, the data going onto the GTS including WMO, cycle number, parameter, etc and make this information easily available either through an index file on the GDACs or on OceanOPS	OceanOPS, C. Schmechtig, T. Maurer, Thierry, Anh, Molly, ?	ADMT-24	R
23	39	Ask BGC volunteers to work with OceanOPS to set up monitoring of BGC sensor behavior to try and identify early on systemic sensor problems	OceanOPS, Claire Gourcuff	ADMT-24	R
23	40	Consider improving feedback method from DACs and dmode operators for both objective analysis warnings and altimetry detection to make it easier to provide bulk feedback	OceanOPS, Christine, Birgit, Claire Gourcuff	ADMT-24	R
23	41	Ask OceanOPS to share list of 'orphan' floats according to what was shown in order to determine who needs to be added to OceanOPS system as a DM alert contact	OceanOPS, DM operators	ADMT-24	R
23	42	Ask DM operators to ensure that they are listed as 'DM alert' contact with OceanOPS	OceanOPS, DM operators	ADMT-24	R
23	43	Search for orphan floats with no D files for >3 years	OceanOPS	AST-24	R
23	44	Ask OceanOPS to investigate why floats are registered as Argo floats and then never s	OceanOPS	ADMT-24	R
		Communication			

Originating ADMT meeting	Action Number	Opened Actions	Who	When	Priority (High, Low, Regular)
23	45	Identify additional items to be discussed with operational centers during outreach efforts by working group and report them to Annie, Breck, ADMT co-chairs		AST-24	H
23	46	Improve guidelines on ADMT website for DACs/PIs who wish to add something to the Argo ref tables on the NVS. This process will take place on GitHub and each submission will be reviewed by the appropriate team. When accepted, the NVS table will be updated and so will the FileChecker when it is able to read in the NVS tables.	V. Paba, T. Carval	AST-24	R
23	47	Ask operational center comms working group to consider recording two presentations (one focused on CTD data and one on BGC data) covering topics to be discussed for posting on AST website to help introduce others to how to use, access and refresh Argo data	Annie, Breck, Peter, Megan, Claire G	ADMT-24	R
23	48	Ask operational center comms working group to consider how best to update the community yearly on status of Argo data stream	Annie, Breck, Peter, Megan, Claire G	ADMT-24	R
23	49	Add a webpage on the AST website aimed at float deployers with best practices information, links to technical workshops, etc	Megan, Blaire	ADMT-24	R
23	50	Consider a flow chart diagram to help users understand how to navigate Argo data system	Megan, Claire, Henry ??	ADMT-24	R
		Workshops			
23	51	Hold a virtual workshop for DACs focused on how to work with RBR data in real time	Mat Dever, Annie Wong	Feb - Apr 2023	H
23	52	Hold a virtual Deep Argo DMQC workshop focused on cpcor correction application	Nathalie Zilberman, Cecile Cabanes	June - Aug 2023	H
22	53	Consider holding a virtual DMQC Trajectory Workshop to begin familiarizing DM operators with tasks necessary for DMQC of trajectory files.	M. Scanderbeg, J-P. Rannou, C. Cabanes, N. Kolodziejczyk, J. Gilson, D. Mack-West, A. Wong	Oct - Dec 2023	R
22	54	Suggest DACs to hold a series of virtual workshops to discuss specific issues such as doxy adjustment in real time, bbp RTQC test, Apf11, etc. Additional topics to be defined by DACs.	DACs, Catherine, Anh, Clare, Annie	ADMT-24	R
23	55	Consider holding virtual workshops on how to use the GitHub AVTT ticket system	Thierry or Violetta	ADMT-24	R
		Other			
23	56	Send a letter of thanks to the local hosts including Emily Smith, Molly Baringer and AOML	M. Scanderbeg, Claire Gourcuff	AST-24	R
23	57	Ask ADMT commuity to review core Best Practices paper and send comments to Tammy Morris		AST-24	R
23	58	ADMT endorses the request to add CTD and Argo reference data with depth >700m in shallower regions	Christine Coatanoan, CCHDO, John Gilson	ADMT-24	R

Originating ADMT meeting	Action Number	Opened Actions	Who	When	Priority (High, Low, Regular)
23	59	Work with manufacturers to develop a similar machine readable format for sensor metadata	RBR, SBE, TWR, NKE, Victor Turpin, Brian King, Claudia, Roger Scott, Violetta Paba, Catherine, Annie, Cedrick	ADMT-24	R
		Recommendations			
23	1	DM operators are encouraged to use more sophisticated methods such as Kaihe's or Peter's code for under-ice position estimation. Ideally, this method would be documented in the literature. When adding the position to the files, POSITION_QC = '8'. POSITION_ERROR_ESTIMATED and POSITION_ERROR_ESTIMATED_COMMENT can be filled to provide information on the method.			
23	2	ADMT encourages DMQC operators to provide OceanOPS with the core DMQC operator and the BGC DMQC operator for their floats			
23	3	ADMT encourages expanding the PCM to other regions and to consider publishing on the method			
23	4	ADMT agrees to simplifying the ASD spreadsheet to 5 columns and asks that DM operators continue to fill it out			
23	5	ADMT strongly recommends that SBE provide a cpcor value for each SBE61 and SBE41extended CTD			
23	6	Consider asking dm operators to share information on how many floats they DM yearly to help assess program costs			
23	7	Ask ADMT community to begin transition to GitHub ticket based system to initiate changes in Argo ref tables and content updates			

15. Annex 3 - National Reports

Argo National Data Management Report – Australia, November 2022

Peter Oke[1], Joel Cabrie[2], Annie Foppert[3], Lyudmila Koziy[1], Lisa Krummel[2], Jenny Lovell[1], Pat McMahon[1], Gabriela Pilo[1], Tatiana Rykova[1], Christina Schallenberg[1], Peter Strutton[3], Roger Scott[1], Dirk Slawinski[1], Tom Trull[1], Esmee Van Wijk[1]
[1]CSIRO, [2]BoM, [3]UTAS

22 November 2021

1. Real Time Status

Deployments

Between November 2021 and November 2022, we deployed 68 floats. Of these floats, 2 were NIWA (NZ) floats, 2 were deep floats, 4 were BGC floats with six BGC sensors, and 13 core floats were deployed south of 60^{o}S (including the 2 NIWA floats). We deployed 7 buddy pairs (Altos with RBR sensors, buddied up with either an APF11 or Navis with SBE41 sensors). A map of deployment locations, showing float types, is presented in Figure 1.

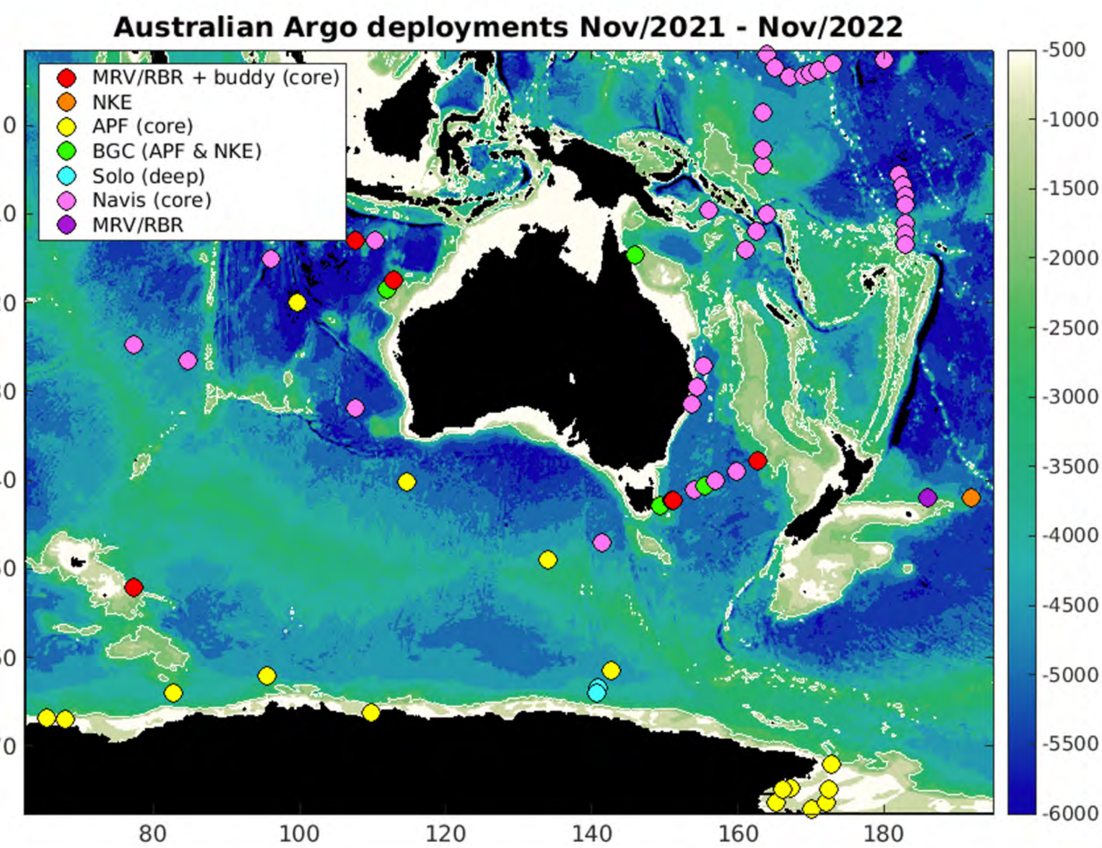


Figure 1: Map of deployment locations for the period November 2021 to November 2022. The colour of each dot denotes the float type.

Real-Time (RT) system developments

We still maintain two RT systems: a Matlab-based RT system and a Python-based RT system. The Matlab-based system has been used for a long time. Our motivation for developing a Python-based system is to deliver a system with more stability, that is more portable, and does not require a paid user license. Both systems are run at CSIRO, and the Matlab system is run at the BoM. In the coming year, we hope to port the Python-based system to BoM, and may be able to retire the Matlab-based system.

All of our operational floats are being processed by the Python-based RT system (including BGC and Deep floats). However, only data from 38% of our operational floats being exported to the GDACs are produced by our Python-based RT system. For the rest, the data uploaded to the GDACs are produced by Matlab-based RT system.

Over the past year, there has been a lot of coordination between the RT and DMQC teams to make sure the new files can be ingested by the DM system. Processing data that reports 2 or more profiles per cycle (i.e., from APF11s and BGC floats) has taken a lot of time and effort.

Data issued to the GTS

Currently, the Australian Fleet has 347 operational floats, including 333 Core, 11 BGC, and 3 Deep floats. Data are processed every 3 hours in the Python system and every 6 hours in the Matlab system. Of the 11 operational BGC floats, all but two have six BGC sensors – however the pH sensor failed on 4 of our BGC floats. We no longer have any operational floats that communicate using Argos.

We run our Matlab-based system every 3 hours, four times a day at CSIRO and four a day at the BoM – with execution staggered by 3 hours; and we run our Python-based system every 3 hours at CSIRO. Real-time data delivery at the BoM, after real-time QC is applied, is summarised in Figure 2**: Summary of the timeliness of real-time data delivery. Not included here are statistics for 31 floats that we think may still be operating (but are under ice), but have not reported in 2022.**. Of all Iridium BUFR bulletins reported during November 2021-October 2022, 97% were submitted within 12 hours of observation time; and 88% were submitted within 6 hours.

Both Matlab and Python RT systems perform real-time adjustment of salinity. After coordination with the DMQC team, we established a workflow were the PSAL drift value is saved by the DMQC operator as they evaluate the float, and then automatically ingested by the RT systems.

Real-time QC and adjustments performed on DOXY, NITRATE, pH and CHLA. We hope to soon apply real-time adjustments for BBP RTQC (waiting for ADMT recommendations).

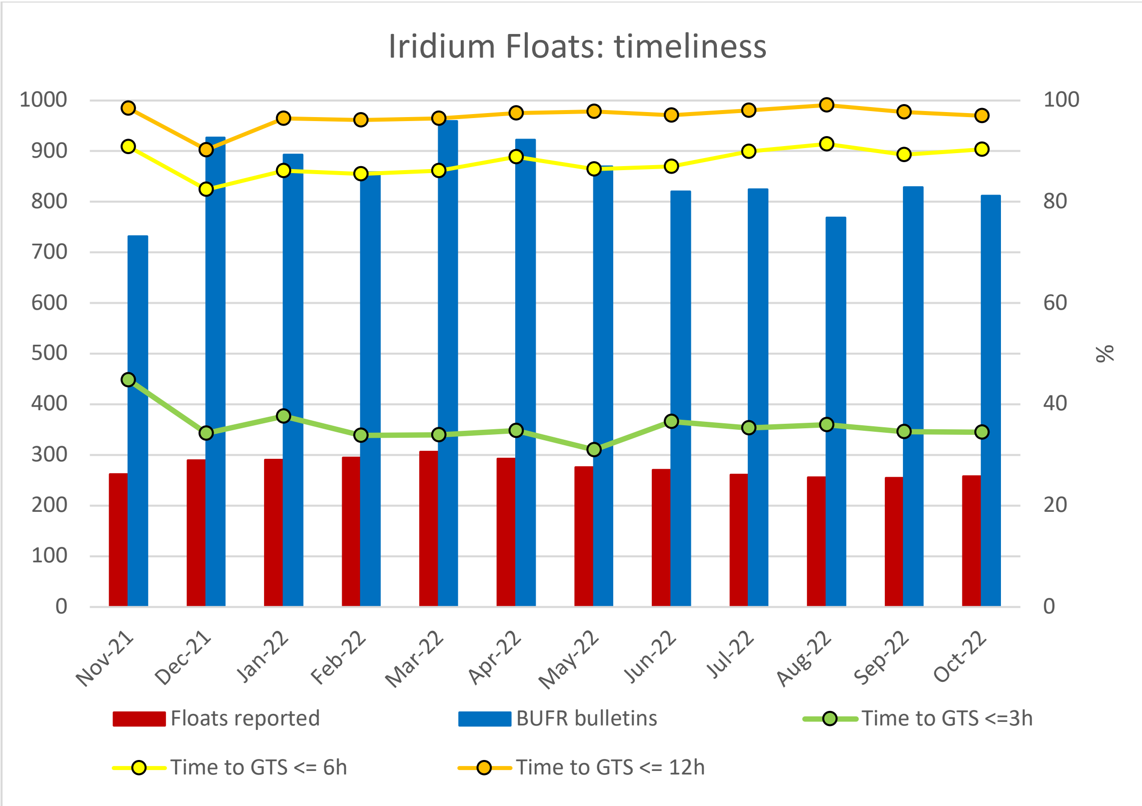


Figure 2: Summary of the timeliness of real-time data delivery. Not included here are statistics for 31 floats that we think may still be operating (but are under ice), but have not reported in 2022.

Delayed Mode data sent to the GDACs

D-files have been submitted to the GDAC for over 97% of eligible files.

As of 14 November 2022 (14:07), in the preceding year, the number of R-files (NR) submitted to the GDACs 13,831; the number of R-files older than 365 days (NN) is 4,637; and the number of D-files (ND) is 190,798. The raw percentage of D-files processed (100*ND/[NR+ND]) is 93.2409%. Considering only data from the eligible floats, we calculate that the percentage of D-files (100-100*NN/[NN+ND]) is 97.6273%. Over the last year, the number of D-files submitted to the GDACs is 54191, from a total of 386 different floats.

No D-mode BGC data are currently being generated for operational floats; our reasoning is that getting to A-mode is 90% of the job done, and that Christina is also still learning and gaining confidence in calculating the adjustment factors (for example for NITRATE and PH). So calling the result A-mode rather than D-mode seems prudent for now. There is also still a backlog of dead floats that haven't received any QC or adjustments at all, so starting DMQC on those is currently considered higher priority by our DAC.

2. Delayed Mode QC status

DMQC-related achievements over the past year include:

- A long-time serving member of our DMQC team, Catriona Johnson, has left CSIRO to pursue other things. Catriona made a fantastic contribution to our Program. We have trained a new DMQC Operator, Lyudmila Koziy, who is now a valued member of our DMQC team.
- Coordination between DMQC and RT systems to pass back DM adjustments to be used in RT – implemented for PSAL drift adjustments.
- Coordinated with the RT system to handle incomplete files from floats experiencing the APF11 bladder issue. RT places a “hold” at the point where R-files are incomplete and DMQC ingests cycles prior to this point. This has been done to avoid spending DM time on incomplete data and having to repeat that work later if more data are received.
- RBR processing code has been completed and can produce correct D-mode files. Including:
    - Applying the re-calculated compressibility coefficient;
    - Thermal lag correction;
    - QC of TEMP_CNDC; and
    - Writing correct SCIENTIFIC_CALIBRATION information in D-files.
- Work is continuing to process data in more complex file structures e.g. N_PROF>2 or where N_PROF=1 is not the deepest profile. This has required some re-writing of routines that compare float data with climatologies and nearby floats and restructuring the local matlab storage of float data (csiromat files).
- The DMQC group has been active in participation in the bi-monthly working group lead by Tatiana Rykova, with presentations from Tatiana, Jenny and Lyuda at recent meetings.
- We have provided prompt feedback to Objective Analysis and Altimetry alerts and updated the ASD spreadsheet. We notified Susan Wijffels of 5/136 sensors with SN>11252 showing signs of ASD.
- Responses have been provided to the DMQC Audit, conducted by Annie Wong and John Gilson. Discussion about one cohort of 3 floats in the Southern Ocean is ongoing, and is waiting on the resolution of a software issue for finalisation. We expect this will be completed by the end of the calendar year.
- Most of our DOXY data on dead floats is in D-mode, and work has begun on doing DMQC for BBP and adjustments for CHLA on dead floats; holding back on DMQC for CHLA on dead floats until consensus has been reached on how the slope factor should be calculated (awaiting ADMT advice on that)
- Overall, the strategy at the moment is to focus on RT adjustments for live floats and DMQC dead floats, with the priorities being 1) FL/BB, 2) DOXY, 3) other BGC sensors, which reflects the frequency of sensors in our fleet of dead floats
- The next step change for BGC QC will be for DOXY – we’re currently still using WOA to adjust DOXY even though all our live floats are capable of in-air measurements; we’re

working in decoding the in-air measurements so that they can be used for DMQC and RTQC adjustments.
- The next step for DMQC team is to update the climatology and to better understand how to optimally configure OWC.

3. Value Added items

Argo Technician Community of Practice

A series of virtual meetings to maintain the Argo Technical Community of Practice was initiated by Pat McMahon in 2021 as a forum for collaboration, knowledge sharing and coordinated action to establish, review and refine best practice procedures for pre-deployment testing of floats to eliminate premature deaths and performance-debilitating failures for core and BGC Argo. The group aims to create an environment where individuals working directly with Argo floats can discuss technical problems, including checkout testing, hardware design ideas, and deployment logistics. One of the primary goals is to identify issues that occur across programs which will then be presented to manufacturers with 'one voice'. To date, this group has met to discuss new developments, and issues that include:

- Deployment techniques and Remote controlled float release;
- Navis BGC and ballasting;
- Development of “coastal” floats.
- UW APEX APF11 Bladder stiction Issues

This group meet quarterly over Zoom, and rotate the chair and responsibility for each meeting. The group is not be open to vendors, and is targeted at technical staff working directly with floats. The group welcome topics for investigation from PI's and we will capture and report our key findings to AST. For more details, contact Pat McMahon (Pat.McMahon@csiro.au). A website has been maintained to communicate with participants and to provide a record of past meetings and topics covered. The website is at: www.cmar.csiro.au/argo/dmqc/html/ArgoCop.html.

DMQC Discussion Series

A series of virtual meetings on ***Argo DMQC Discussions*** was initiated in February 2022. This discussion series is intended to promote collaboration between Argo DMQC Operators and interested members of the Argo Community. The forum is an opportunity for newer Operators to learn from more experienced Operators, to ask questions, and to seek second opinions. This forum is intended to build a greater sense of community, and to promote consistent DMQC practices. This forum may also have a role in training the next generation of DMQC Operators, to address the emerging issue of succession planning in Argo DMQC. The meeting is open to anyone interested. Discussions have been held every two months, with 6 discussions held this calendar year. Topics covered include:

- Difficult floats;

- Floats with RBR sensors;
- Deep floats; and
- Floats showing abrupt salty drift.

Discussions have been led by 11 different members of the Argo DMQC community, and has been attended by 14-20 people at each gathering. Meetings run for 2 hours, and are scheduled with start times that are offset by 8 hours for each consecutive meeting, to allow people in all different time-zones to attend without necessarily having to endure meetings at night. For more details, contact Tatiana Rykova (tatiana.rykova@csiro.au). A basic website has been maintained to communicate with participants and to provide a record of past meetings and topics covered. The website is at: www.marine.csiro.au/argo/dmqc/html/ArgoDM-Disc.html.

Deployment Planning

Gabriela has participated in the deployment planning meetings for the Indian Ocean, organised by Tammy Morris ; and the Pacific Ocean, organised by Sarah Purkey.

Web pages

We maintain several technical web pages that we use to monitor the status of our fleet, and the performance of each component of our operation. Details can be provided if anyone from the Argo community wishes to examine these, but they are intended for internal use.

Statistics of Argo data usage

Australian operational systems that use Argo data include:

- OceanMAPS: www.bom.gov.au/oceanography/forecasts/;
- POAMA/ACCESS-S: poama.bom.gov.au;
- OceanCurrent: oceancurrent.imos.org.au; and
- BoM's SST Analysis: www.bom.gov.au/marine/sst.shtml.

Scientific applications include:

- BRAN2020: research.csiro.au/bluelink/global/reanalysis/
- Blue Maps: research.csiro.au/bluelink/blue-maps-a-new-ocean-analysis/;
- Argo Trajectories under ice: zenodo.org/record/6571146#.Y3thKS0Rptw.

A record of what data types are used by OceanPredict systems are at for initializing forecasts and reanalyses is at: oceanpredict.org/observations-use/#section-argo-profiling-floats. This is not a product produced, or maintained by Argo Australia, but we include it here in case it interests members of the ADMT.

4. GDAC Functions

N/A

5. Regional Centre Functions

N/A

6. Other Issues

Cycles with multiple profiles has caused us some problems, and has required significant resources to resolve (which we haven't completed yet). We understand that some floats report raw, decimated, averaged, and median samples, and that merging these data is not straightforward. But we wonder whether ADMT might consider establishing a protocol for combining multiple profiles into one – to avoid this issue?

Argo Canada Data Management Report

ADMT 23

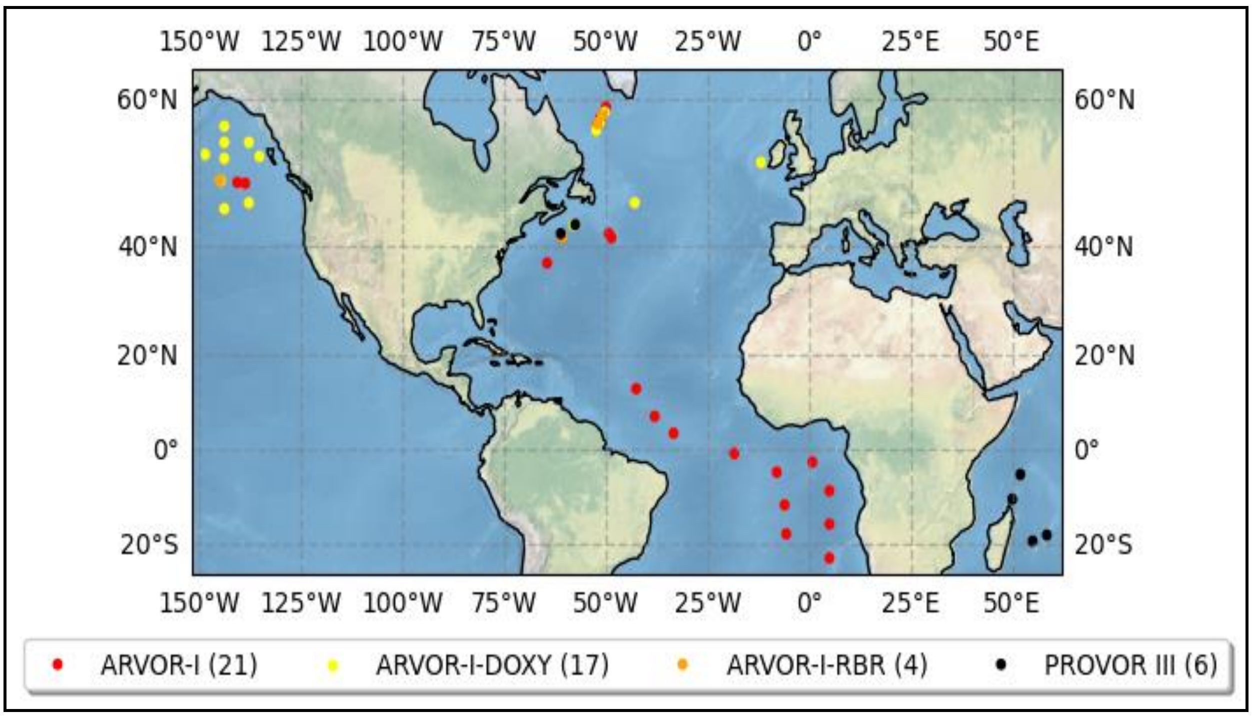
Miami, USA, 5-9 December, 2022

Anh Tran, Trajce Alcinov, Clark Richards, Chris Gordon, Blair Greenan, Tetjana Ross

1. Real Time Status

Deployments

Between December 2021 to November 2022, Argo Canada deployed a total of 48 floats. Of these floats, 21 were Arvor-I, 17 were Arvor -I equipped with additional Aanderaa Optode 4330 sensor, 4 were Arvor-I with RBR sensor, 4 were BGC(Provor III) floats with dissolved oxygen, chlorophyll-A, backscattering sensor, and 2 were BGC (Provor III) with the above BGC sensors plus SBE PH sensor. All floats are manufactured by NKE. Below is the figure showed the deployment location of these floats.



Data acquired from floats

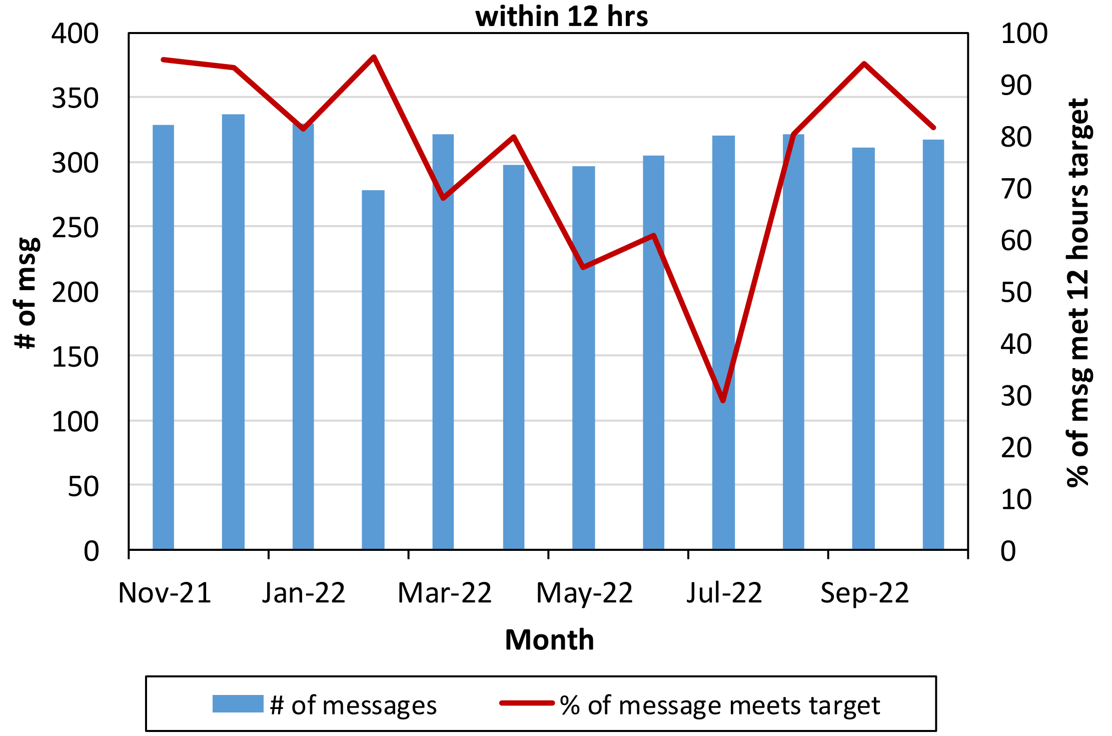
As of the end of November 2022, Argo Canada has 149 active floats, including 12 NOVA, 1 DOVA, 125 NKE Arvor, 5 NKE Arvor with RBR, and 6 BGC floats.

For BGC floats, the data are processed every 6 hours in the system of mixed Java and Python codes. For other floats, the data are processed hourly in the system of mixed Java, and FORTRAN codes. We plan to migrate both processes into one when the BGC processing system is more stable.

Data issued to GTS

All data are issued to the GTS in BUFR format. From November 2021 to October 2022, on average 313 BUFR messages were issued on the GTS monthly, of which 76% of the messages met 12 hours target. During the year, we experienced some significant drops in timeliness because MetOcean Telematics canceled the decoding service from SBD format to CSV for Nova and Dova floats. Hence, we had to developed the software to decode data for Nova and Dova floats.   Figure 1 showed the performances of Argo real-time data delivery on the GTS.

Figure 1: Summary of Argo real-time data deliveries on the GTS within 12 hrs



Data issued to GDACs after real-time QC

The profile, technical, trajectory and meta files are transmitted to the GDACs in NetCDF format version 3.1 on an operational basis for all floats except BGC floats.

For BGC floats, the profile, technical and meta files are available at the GDAC in NetCDF format version 3.1 every 6 hours after the float surfaces. We still have to develop the software to construct the trajectory NetCDF file for these floats. We estimate that the trajectory file for BGC float will be available in early 2023.

2. Delayed Mode QC status

Core Argo DMQC

Due to change in the delayed mode operator, and ongoing updates and validation of the DMQC Matlab toolkit developed by MEDS, delayed mode data submissions have been paused since March 2022. Delayed mode QC and submissions are expected to resume at the end of 2022 or early 2023, including responses to monthly anomaly reports and delayed-mode audits of past data submissions.

BGC-Argo DMQC

Delayed mode quality control of DOXY was not completed this year due to other tasks taking precedence, such as the development of real time quality control processing for CHLA and BBP which are new variables to the MEDS DAC. Development of the python package bgcArgoDMQC continued (see below for more details). As the RTQC processing chain becomes more stable, submission of delayed mode BGC files will restart.

3. Value Added items

Web pages

We maintain Argo Canada web pages, http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/index-eng.html, that show float track and all data collected by Canadian core floats. Links to both real-time and delayed mode data are also available for download directly from GDAC. The pages are updated daily.

Argo Canada data is discoverable from the Government of Canada Open Government Portal, https://open.canada.ca/en.

It provides links to download data in NETCDF and web services to access float positions.

Statistics of National Argo data usage

- Argo data have been used to generate monthly maps and anomaly maps of temperature and salinity along line P in the Gulf of Alaska. Line-P has been sampled for 50 years and has a reliable monthly climatology. For more information on the Line-P products and other uses of Argo to monitor the N.E. Pacific go to: http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/canadian-products/index-eng.html.
- The Canadian Meteorological Centre (Dorval, Québec) of Environment Canada is assimilating real-time Argo data in operational mode.

Software tools and training

Argo Canada continues to maintain and update the R argoFloats package[1], which was developed during the early stages of the Commonwealth Blue Charter program. Since the publication of the package, training material related to reading and analyzing ocean data was organized into a two day tutorial that was delivered to Commonwealth participants (around the globe) in 4 virtual workshops. Day two of the course involved an introduction to Argo, the argoFloats package, and instruction on how to use the package to find, download, and analyze Argo data. The course materials are currently being turned into an online self-guided course, supported by the Commonwealth Secretariat.

The python package bgcArgoDMQC provides code to load in BGC-Argo oxygen data, calculate gain via comparison to WOA climatology data in the water column or NCEP data using in-air measurements, update QC flags and DOXY_ADJUSTED values, and export them to a D-mode netCDF file. The software is under active development, but a stable release is available that has been shown to closely agree with the analogous matlab software, SAGE-O2. This release can be installed via Anaconda or pip, and to code can be found on the ArgoCanada github page. A short paper detailing the software's use is planned for the new year.

[1] https://www.frontiersin.org/articles/10.3389/fmars.2021.635922/full

Additionally, python software for performing RTQC on CHLA and BBP was developed this year (medsrtqc). While the package is currently specific to the MEDS DAC, the code was written in a modular way, and there is strong interest in contributing to a "system-agnostic" python package for RTQC. This code is also publicly available on the ArgoCanada github page.

4. GDAC Functions

Canada has no Argo GDAC function. However, Canada forwards TESAC data to the GDACs in Ifremer (France) and USGODAE (USA) three times a week. Canada also monitors the timeliness of Argo data on the GTS in BUFR format.

5. Regional Centre Functions

Canada has no regional centre function

6. Other Issues

There was no issue reported during the compilation of this report.

Chinese Argo National Data Management Report

5-9 December, 2022 (ADMT-23)

Zenghong Liu[1], Xiaogang Xing[1], Xiaofen Wu[1]

1) Second Institute of Oceanography, Ministry of Natural Resources, Hangzhou, China

- **Status**
  - Data acquired from floats

From last December, China acquired 5,464 temperature and salinity (additionally 821 O2, 532 CHLA/BBP/CDOM, 729 DOWN _IRRADIANCE and 292 NITRATE) profiles from 89 operational floats including 5 APEX, 53 PROVOR, 24 HM2000, 4 ARVOR_D, 1 NAVIS, 1 HM4000 and 1 XUANWU floats (Fig.1). CLS stopped the telnet service for Argos message from this April, unfortunately CSIO didn't receive that notice, which lead to an interruption of the data reception from those floats (4 floats) using Argos satellite until October. At present, CSIO has not installed Argos web service client successfully, and has to export Argos messages from the CLS website. The technician from CLS is now helping us to solve the problem.

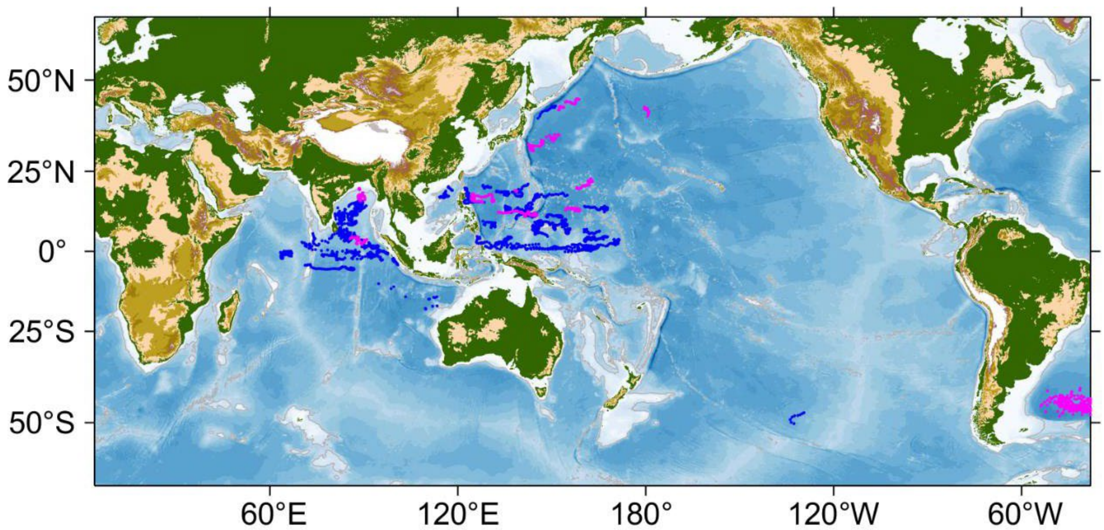


Fig.1 The geographic distributions of Core (blue) and BGC (pink) profiles

- Data issued to GTS

At CSIO, the JMA BUFR generation script is being applied. BUFR bulletin is generated for each Argo profile and transferred to China Meteorological Administration (CMA), who will insert bulletin into the GTS. Besides T/S profiles, O2 profiles are able to be converted into BUFR and inserted into GTS.

- Data issued to GDACs after real-time QC

Meta, technical, trajectory and profile files are submitted to GDAC in netCDF format version 3.1 on an operational basis. The updated deepest pressure test has been added into our RTQC procedure according to the latest QC manual. CSIO also routinely checks feedbacks from Coriolis data center and reflags the doubtful data. As QNLM deployed the first XUANWU (6000 m) float equipped with SBE61 CTD, CSIO added the real-time adjustment for salinity observations based on the new CPcor.

- Data issued for delayed QC

At CSIO, Ms. Xiaofen Wu is still in charge of DMQC for all core profiles. Some difficult floats that she cannot make decision are always sent to Zenghong and other DMQC experts (such as Annie Wong, Jenny Lovell, Cecile Cabanes, etc.) for further inspection. We appreciate their sincere help.

- Delayed data sent to GDACs

About 10187 D-files were sent to GDACs. Totally above 78% of the core profiles have been DMQC'd, and D files of some old floats have received the second DMQC processing.

- Web pages

The website (http://www.argo.org.cn) of the China Argo Real-time Data Centre (Hangzhou) was maintained by CSIO, from which the latest progress on China Argo, the real-time observations from Chinese floats including data file and related plots are provided.

- Statistics of Argo data usage (operational models, scientific applications, number of National Pis…)

  Operational uses: Argo data have been used into most ocean data assimilation systems operated by department or institutions such as NMEFC, NMDIS, IAP, QNLM, etc.

  Scientific applications: The Argo data are mainly used in from seasonal to decadal ocean variations in global and regional scales, air-sea interactions, ocean's role in global climate change.

- Until now, about 21 PIs from 10 organizations have deployed profiling floats and share data with Argo community.

- Products generated from Argo data …

  BOA_Argo: It is a biannually updated gridded Argo product developed by CSIO (ftp://data.argo.org.cn/pub/ARGO/BOA_Argo/). The product is based on the post-QC'd Argo dataset maintained by CSIO.

  GDCSM_Argo: It is a gridded Argo product jointly developed by SHOU (Shanhai Ocean University) and CSIO based on the Gradiente-dependent Correlation Scale Method (ftp://data.argo.org.cn/pub/ARGO/GDCSM/). The data set had been published at the Argo Program website since this September.

  IAP data set: IAP data set is a global ocean gridded data se developed by Lijing Cheng from IAP. In contrast to BOA_Argo, other available profiles from various instruments (e.g. XBT, MBT and shipboard CTD, etc.) are also used while producing the data set. It includes 1°×1° monthly temperature fields since 1940 from the sea surface to 2000 m.

  Post-QC'd global ocean Argo dataset: The dataset is based on a FAST post-QC toolbox developed by CSIO, with which we can make a synchronization with GDAC server four times a day and conduct a post-QC procedure to each profile (ftp://ftp.argo.org.cn/pub/ARGO/global/core/). The daily high-quality Argo data derived from this toolbox are now transferred to several operating departments.

  Global ocean BGC-Argo dataset: The dataset is derived from the B-files on the GDAC, and is separated into various txt files according to BGC parameters. The dataset is also expected to be quarterly updated depending on the CSIO resources (ftp://ftp.argo.org.cn/pub/ARGO/global/bgc/).

- **Delayed Mode QC**

(Please report on the progress made towards providing delayed mode Argo data, how it's organized and the difficulties encountered and estimate when you expect to be pre-operational .)

CSIO is now still using the DMQC system developed by CSIRO to process Chinese floats (mainly Core Argo). This year, we had mainly processed on HM2000 floats and floats on “Argo Delayed-Mode Salinity Audit” list provided by Annie Wong and floats checked by “OceanOPS QC”. In addition, during the processing of DMQC, we also compared the float data with ISAS climatology, so as to confirm whether there is indeed a drift in salinity from multiple channels. Finally, we found that the reference dataset requires more new data to be added, for example, we have 2 floats deployed in the western Indian Ocean (WMO: 2902559 and 2902659, both have died), after talked with Annie Wong, we could not make a conclusion about the sensor drift because the reference data are quite old there.

- **GDAC Functions**

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete)

None.

- **Regional Centre Functions**

(If your centre operates a regional centre, report the functions performed, and in planning)

None.

Argo data management report 2022

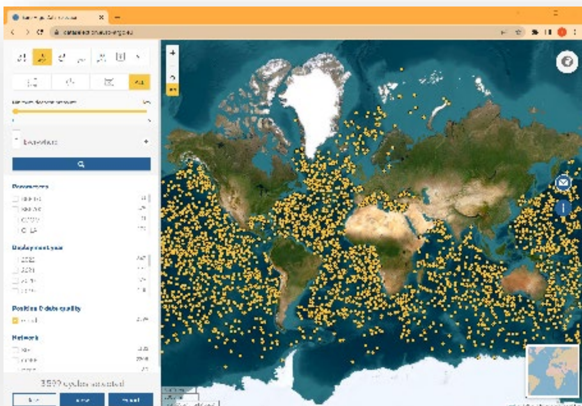
Coriolis DAC & GDAC

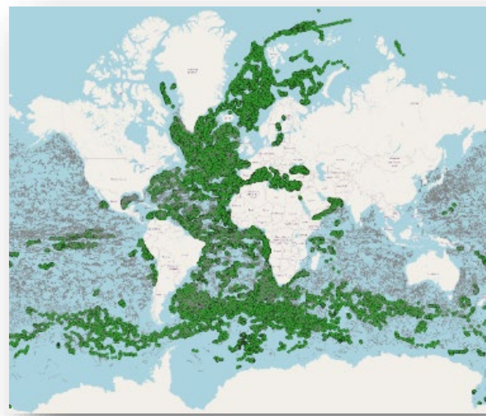
Data Assembly Centre and Global Data Assembly Centre

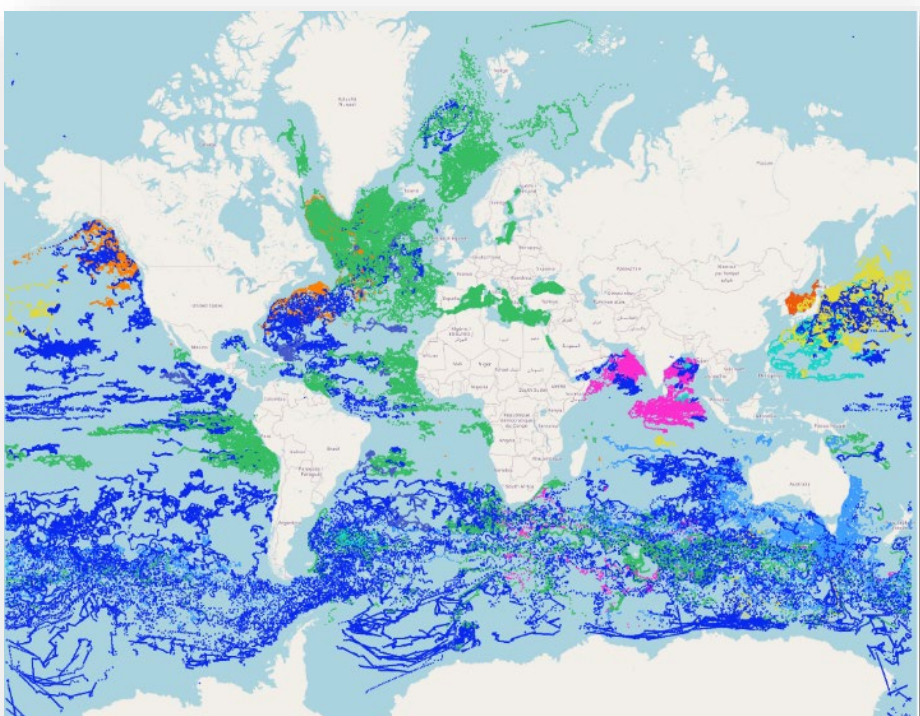
Annual report November 2022

Version 1.0

https://doi.org/10.13155/92009







1 DAC status

This report covers the activity of Coriolis DAC (Data Assembly Centre) for the one-year period from September 1st 2022 to October 30th 2022.

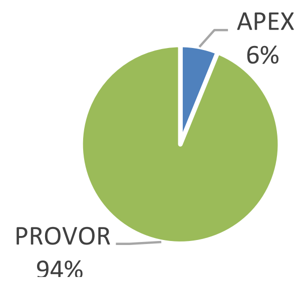
1.1 Data acquired from floats

1.1.1 Active floats for the last 12 months

These last 12 months, **64452profiles from 888 active floats** were collected, controlled and distributed. Compared to 2021, **the number of profiles keeps increasing (+10%), the number of floats increased by 7%.** These figures illustrate a good momentum in Coriolis DAC activity.

The 888 floats managed during that period had 51 versions of data formats.

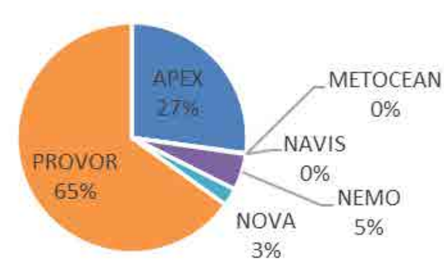
Coriolis DAC, active floats in 2021			
Float family	nb versions	nb floats	nb core p
APEX	17	54	4 870
NOVA	2	8	328
PROVOR	32	826	59 254
Total	51	888	64 452

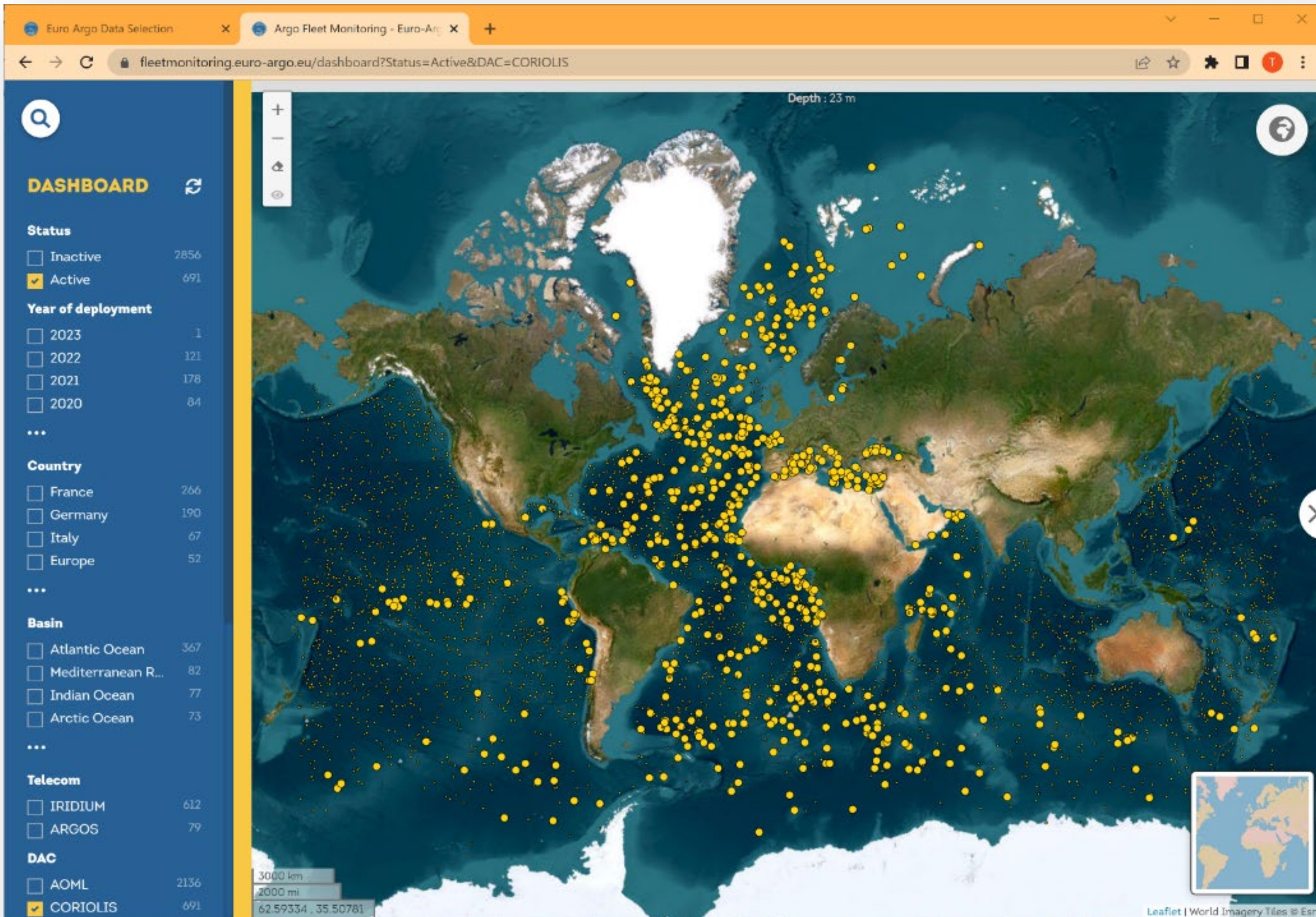


1.1.2 All floats managed by Coriolis DAC

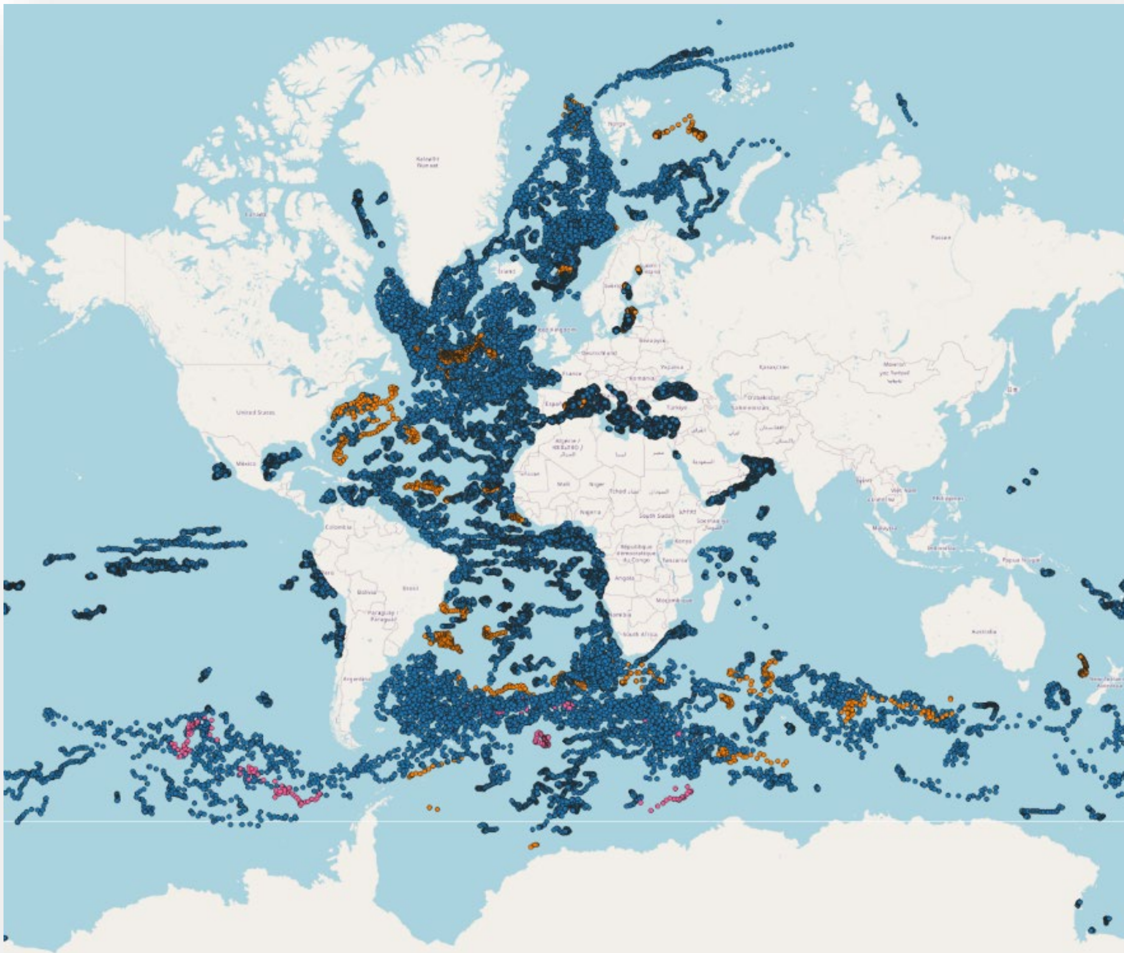
Coriolis DAC manages a total of 3.409 floats with 172 versions, from 6 families.
These floats reported 643.357 core Argo vertical profiles.

Coriolis DAC, all floats			
Float family	nb versions	nb floats	nb core p
APEX	79	926	145 680
METOCEAN	1	1	52
NAVIS	1	3	1 932
NEMO	8	174	10 185
NOVA	3	85	9 629
PROVOR	80	2 220	475 879
Total	172	3 409	643 357

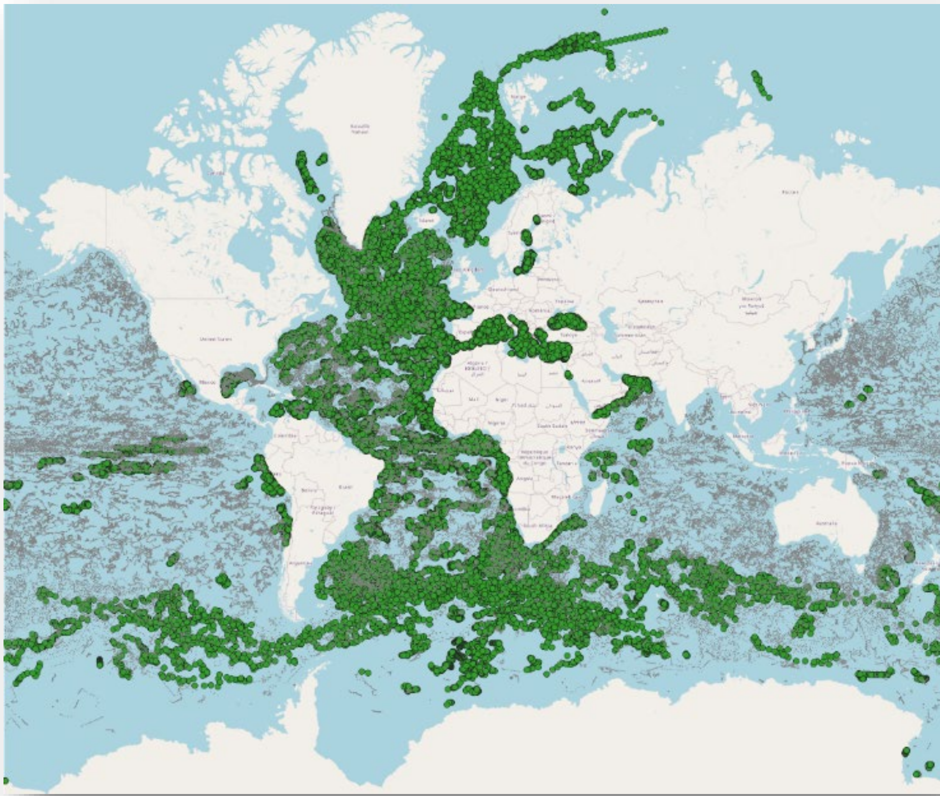




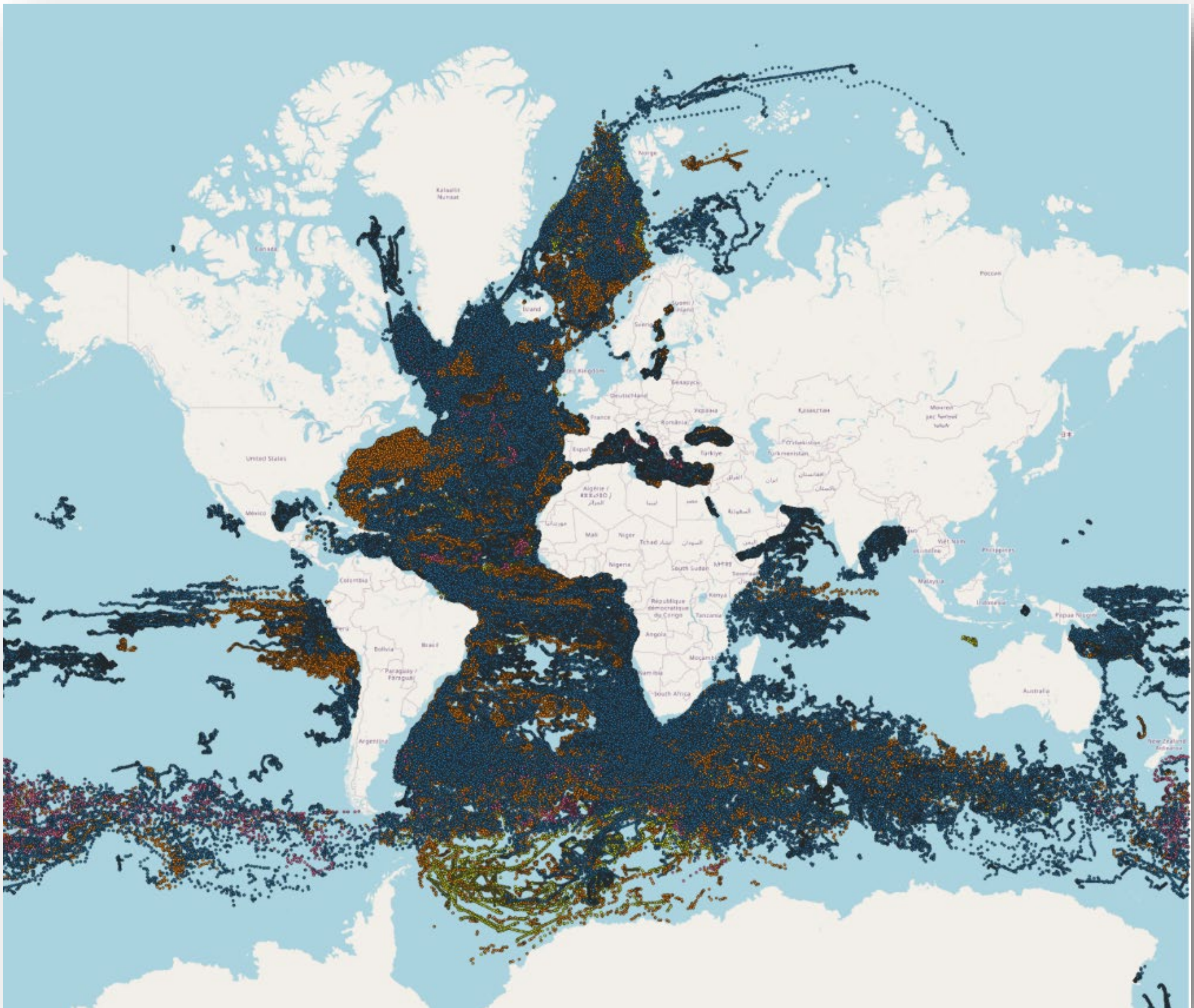
Map of the active floats on November 27th 2022 decoded by Coriolis DAC, among others DACs (small dots) as displayed on Euro-Argo floats dashboard https://fleetmonitoring.euro-argo.eu/dashboard



Map of the 64 452 profiles from 888 active floats decoded by Coriolis DAC this current year
Apex Nova Provor

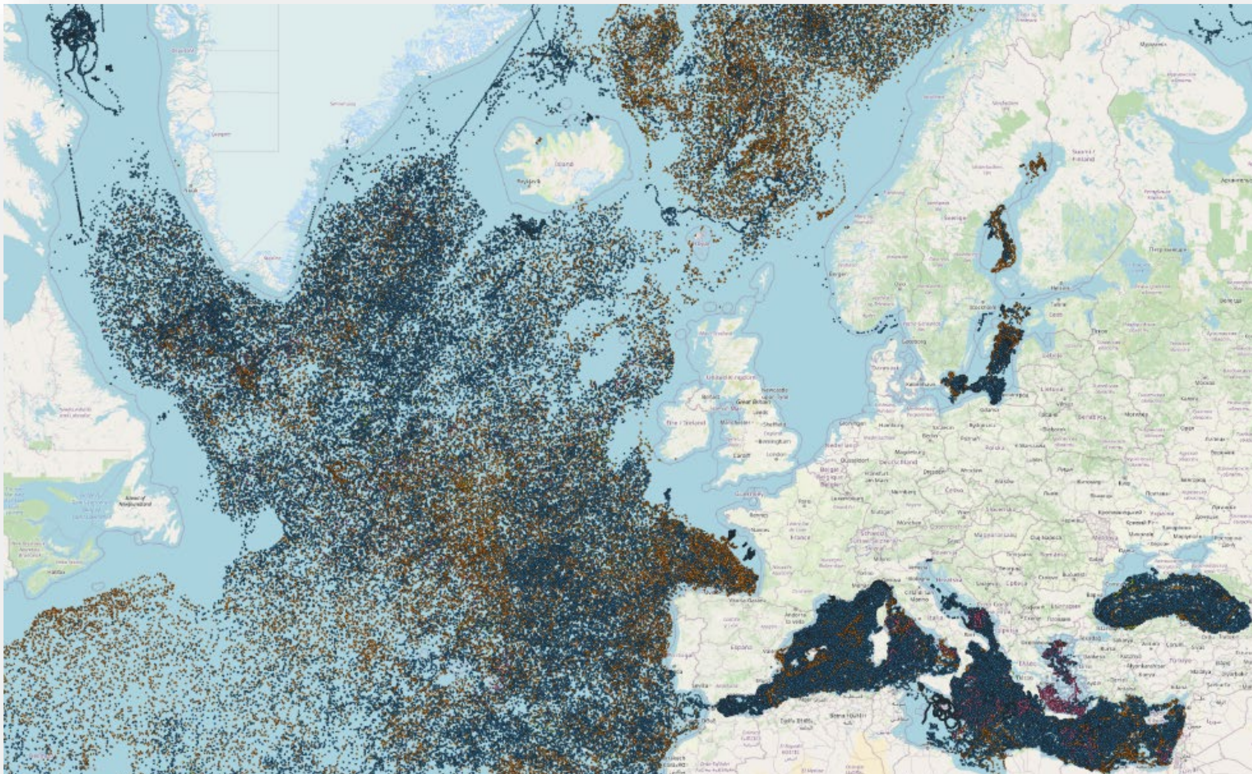


Map of the profiles from active floats decoded by Coriolis DAC this current year, among the other DAC's profiles (Coriolis: green, other DACs: grey)



Map of the 450.000 profiles from 3.500 floats managed by Coriolis DAC

Apex **Metocean** **Navis** **Nemo** **Nova** **Provor**



Map of the profiles floats managed by Coriolis DAC , focus on North Atlantic
Apex **Metocean** **Navis** **Nemo** **Nova** **Provor**

1.1.3 BGC-Argo sensors on Coriolis floats

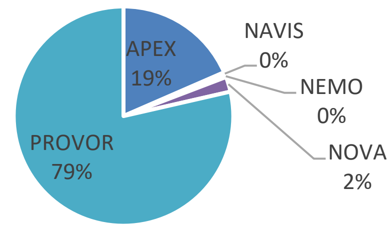
The data processing chain for data and metadata from Coriolis BGC-Argo floats is continuously improved. These are advanced types of floats performing bio-geo-chemical (BGC) measurements.

Coriolis DAC manages 677 BGC-Argo floats from 5 families. They performed 90.115 cycles.

The data processing chain is freely available:

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

BGC-Argo floats processed by Coriolis DAC				
Float familly	nb versions	nb floats	nb profile	nb cycles
APEX	33	125	22 489	16 456
NAVIS	1	3	644	644
NEMO	1	2	297	297
NOVA	1	15	1 236	1 210
PROVOR	46	532	198 417	71 508
Total	**82**	**677**	**223 083**	**90 115**



General characteristics

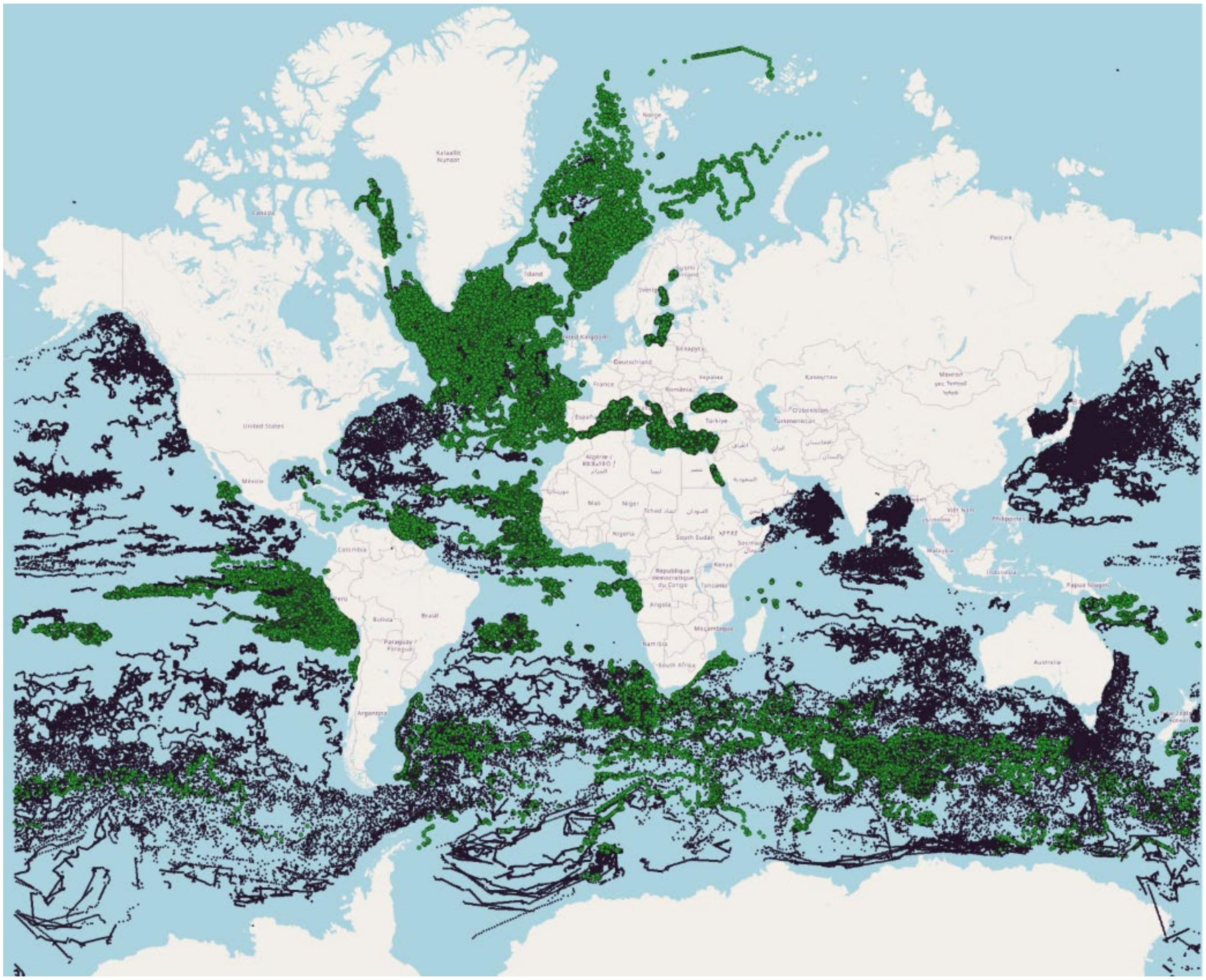
- Iridium sbd or rudics bi-directional communication or Argos
- Fourteen sensors are fitted on the floats
- Eleven BGC parameters reported

Coriolis BGC-Argo floats s	nb floats	nb profiles
AANDERAA_OPTODE	599	85 539
SATLANTIC_OCR504_ICSW	228	180 440
SUNA_V2	95	17 874
SEAFET	45	4 907
C_ROVER	25	5 045
UVP6-LP	13	773
RAMSES_ACC	8	868
ECO_FLBB	4	888
CYCLOPS-7_FLUOROMETER	2	106
OPUS_DS	2	792
SEAPOINT_TURBIDITY_METEI	2	106
HYDROC	1	120
9AXIS_IMU	1	24

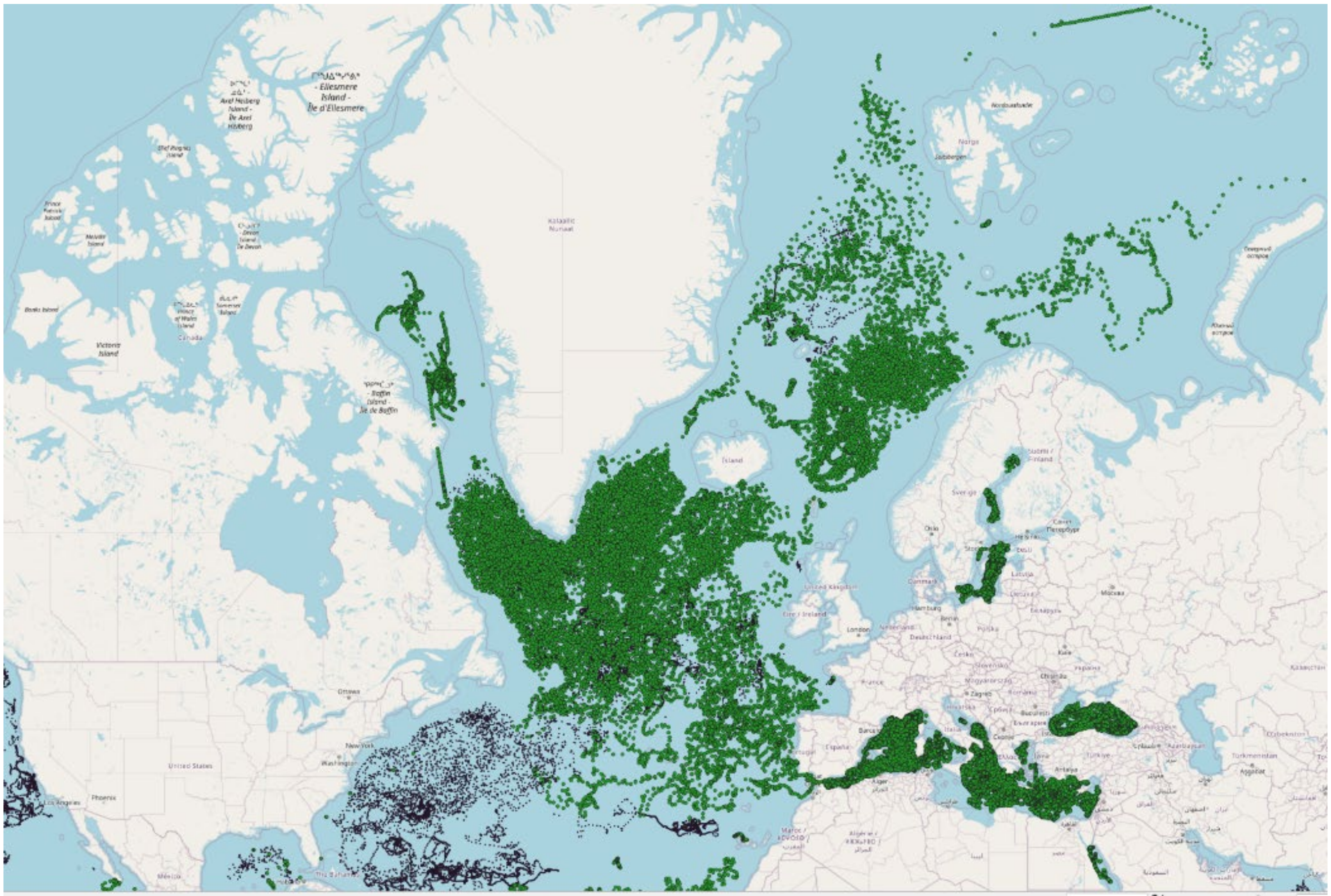
The 13 types of sensors mounted on Coriolis BGC-Argo floats

BGC parameter	nb files
DOXY	258 079
CHLA	108 988
BBP700	106 473
NITRATE	59 180
CDOM	50 144
DOWN_IRRADIANCE490	48 344
DOWNWELLING_PAR	47 117
PH_IN_SITU_TOTAL	37 968
TURBIDITY	2 514
BISULFIDE	1 352

The 10 main BGC parameters reported by Coriolis BGC-Argo floats



Map of the 677 BGC-Argo floats managed by Coriolis DAC (grey dots: the others DACs bio-Argo floats). They measure parameters such as oxygen, chlorophyll, turbidity, CDOM, back-scattering, UV, nitrate, bisulfide, pH, radiance, irradiance, PAR.



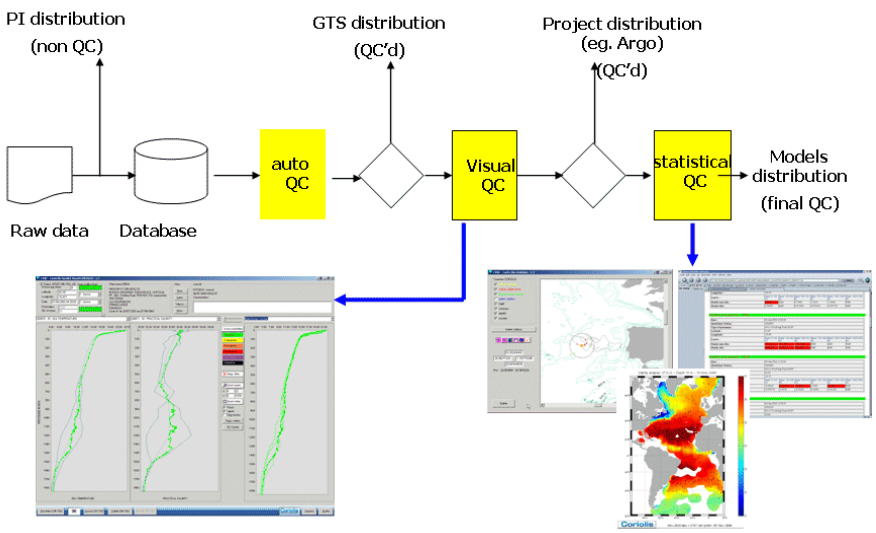
A zoom on North Atlantic of the BGC-Argo floats managed by Coriolis DAC (grey dots: the others DACs bio-Argo floats)

1.2 Data issued to GTS

Vertical profiles processed by Coriolis are distributed on the GTS by way of Meteo-France. This operation is fully automated. After applying the automatic Argo QC procedure, the Argo profiles are inserted on the GTS every hour. The profile files are sent as BUFR messages.

Vertical profiles are distributed on GTS if they are less than 30 days old. Once a day, floats data are checked with ISAS objective analysis that triggers alerts and visual inspection for suspicious observations.
The corrected data are not redistributed on GTS.

In July 2019, Coriolis stopped the TESAC messages distribution; only BUFR messages are now distributed.

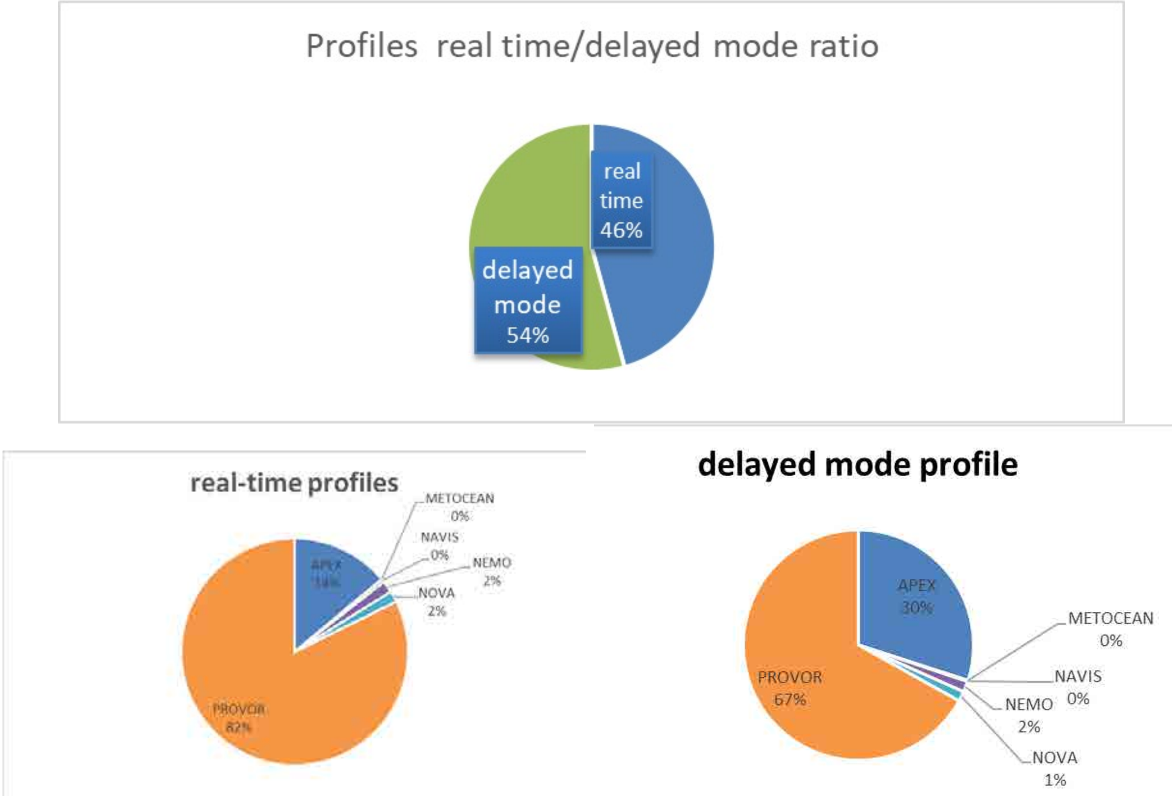


Coriolis DAC Argo data flow

1.3 Data issued to GDACs after real-time QC

All meta-data, profiles, trajectory and technical data files are sent to Coriolis and US-GODAE GDACs. This distribution is automated.

All Coriolis floats, number of profile files on GDAC				
Family	nb floats	nb profile	RT profile	DM profiles
APEX	926	145 680	41 015	104 665
METOCEAN	1	52	-	52
NAVIS	3	1 932	1 411	521
NEMO	174	10 185	4 941	5 244
NOVA	85	9 629	4 705	4 924
PROVOR	2221	475 903	242 168	233 735
Total	**3 410**	**643 381**	**294 240**	**349 141**



Distribution of Coriolis DAC real-time and delayed mode profiles

1.4 Data issued for delayed mode QC

Delayed mode profiles

All profile files are sent to PIs for delayed QC.

1.5 Delayed mode data sent to GDACs

An Argo delayed mode profile contains a calibrated salinity profile (psal_adjusted parameter).

- A total of **107.747 new or updated delayed mode profiles** was sent to GDACs this year.
- **A total of 350.000 delayed mode profiles** where sent to GDACs since 2005.

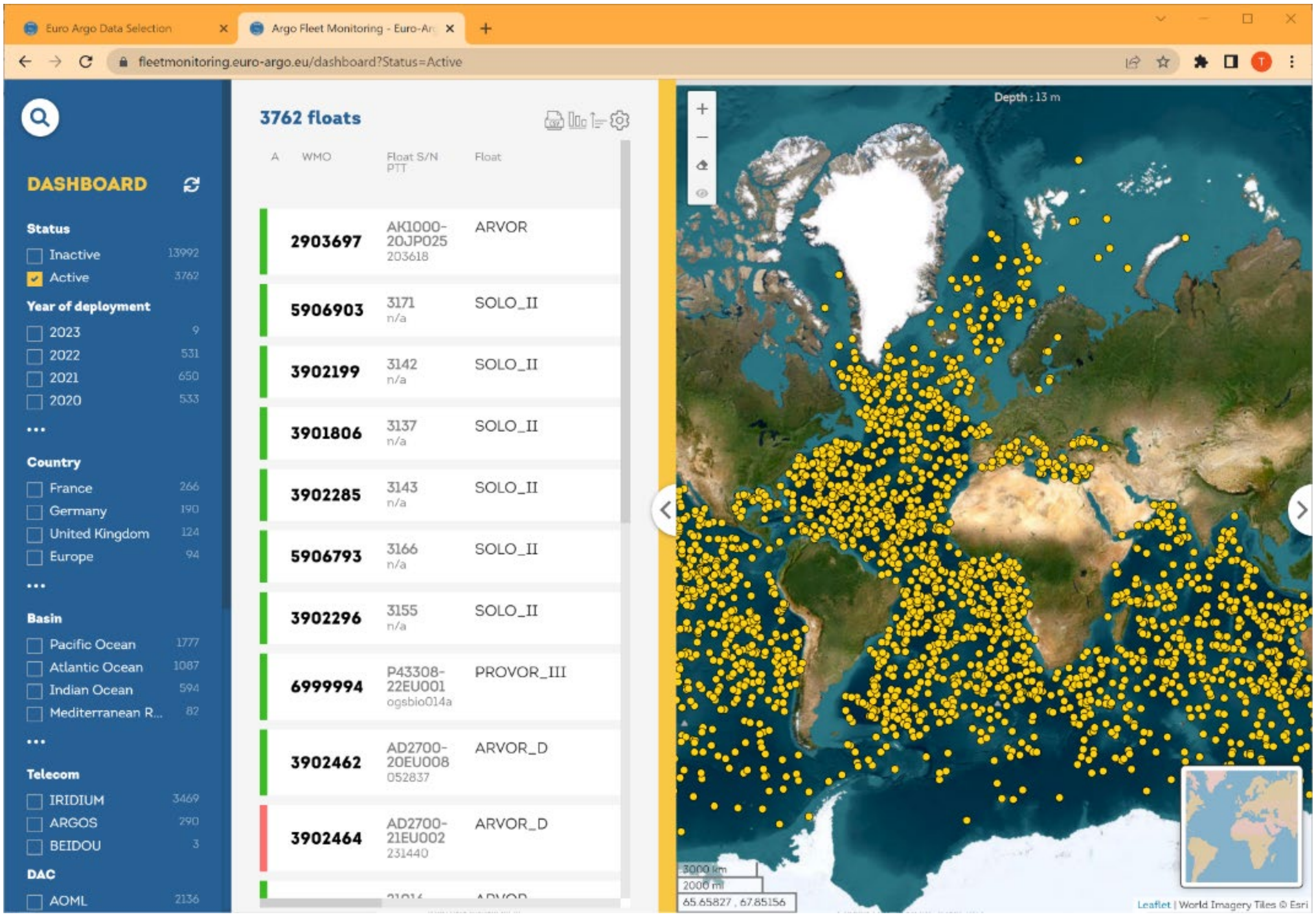
  The number of delayed mode profiles increased by 8% this year compared to 2021.

1.6 Web pages

1.6.1 Argo dashboard

The Argo floats dashboard developed in 2019 by Coriolis team is available at:

- https://fleetmonitoring.euro-argo.eu/dashboard

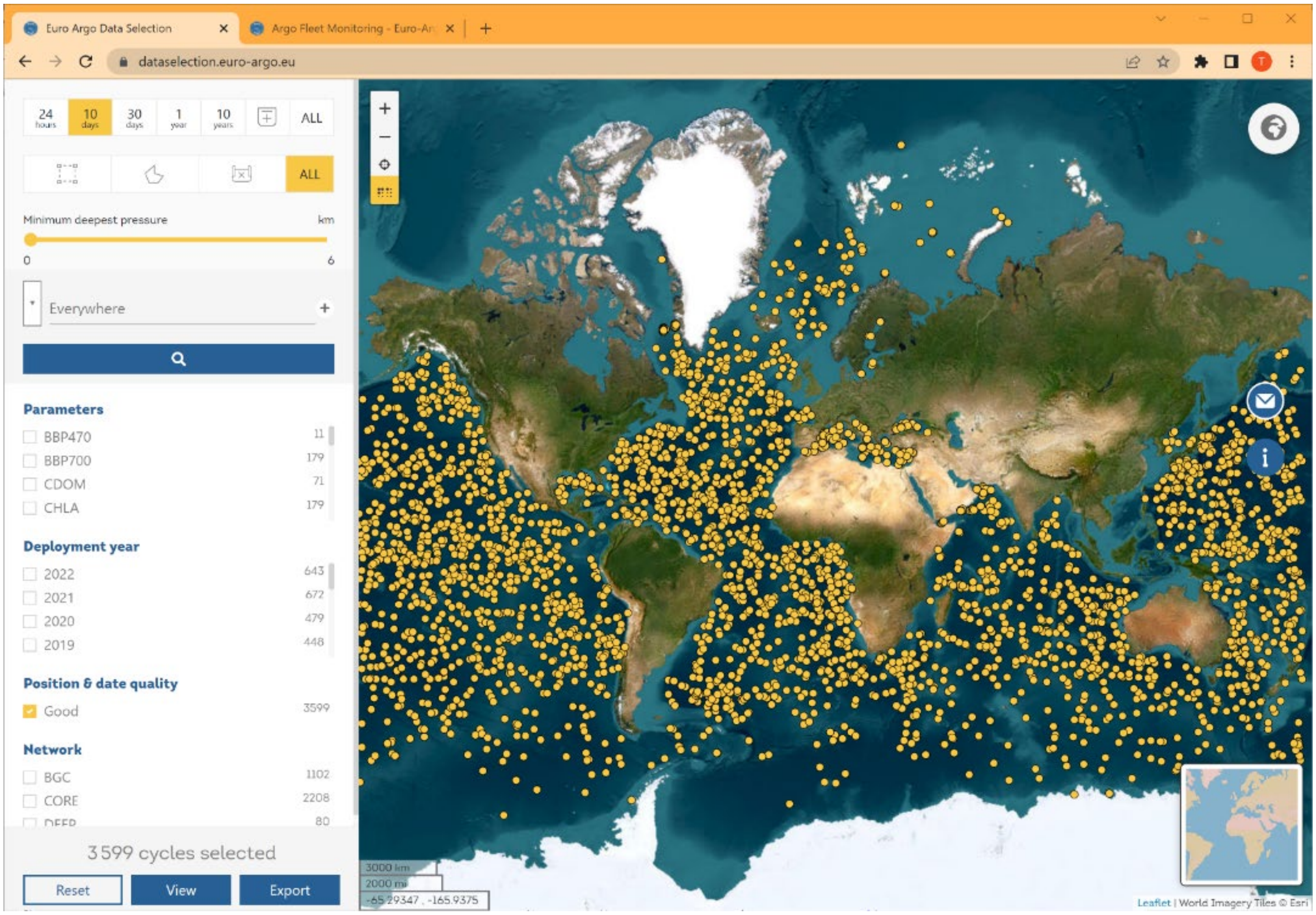


It displays all Argo floats, with facetted interrogations and instantaneous answers. The dashboard is developed on cloud and big-data techniques.

- Cloud techniques: a metadata and a data APIs, opened to internet machine to machine queries
- Big-data techniques: Argo metadata are hourly indexed in an Elasticsearch index, Argo data are hourly indexed in a Cassandra data base. Elasticsearch and Cassandra allows instant answers on dataset having billions of observations.

The Argo data selection was developed in 2020. The initial version is online at https://dataselection.euro-argo.eu/

It proposes data discovery with facetted search on temporal and spatial coverage, parameters, deployment years or quality codes. The selected data are downloadable in NetCDF and CSV formats.



Argo data selection https://dataselection.euro-argo.eu

1.6.2 European Open Science Cloud BlueCloud

A collaboration is underway with NASA-JPL and the European Blue Cloud to use the CMC (Common Mapping Client) client as the front office of Argo dashboard to provide in situ – satellite – model integration.

- http://bluecloud.odatis-ocean.fr

1.6.3 Interoperability services (ERDDAP API,…)

The APIs used by Argo dashboard and Argo data selection web portals are open and publicly available to interested users at the following endpoints OpenAPI (swagger):

- https://fleetmonitoring.euro-argo.eu/swagger-ui.html
- https://dataselection.euro-argo.eu/swagger-ui.html

More information available on https://www.euro-argo.eu/Argo-Data-access

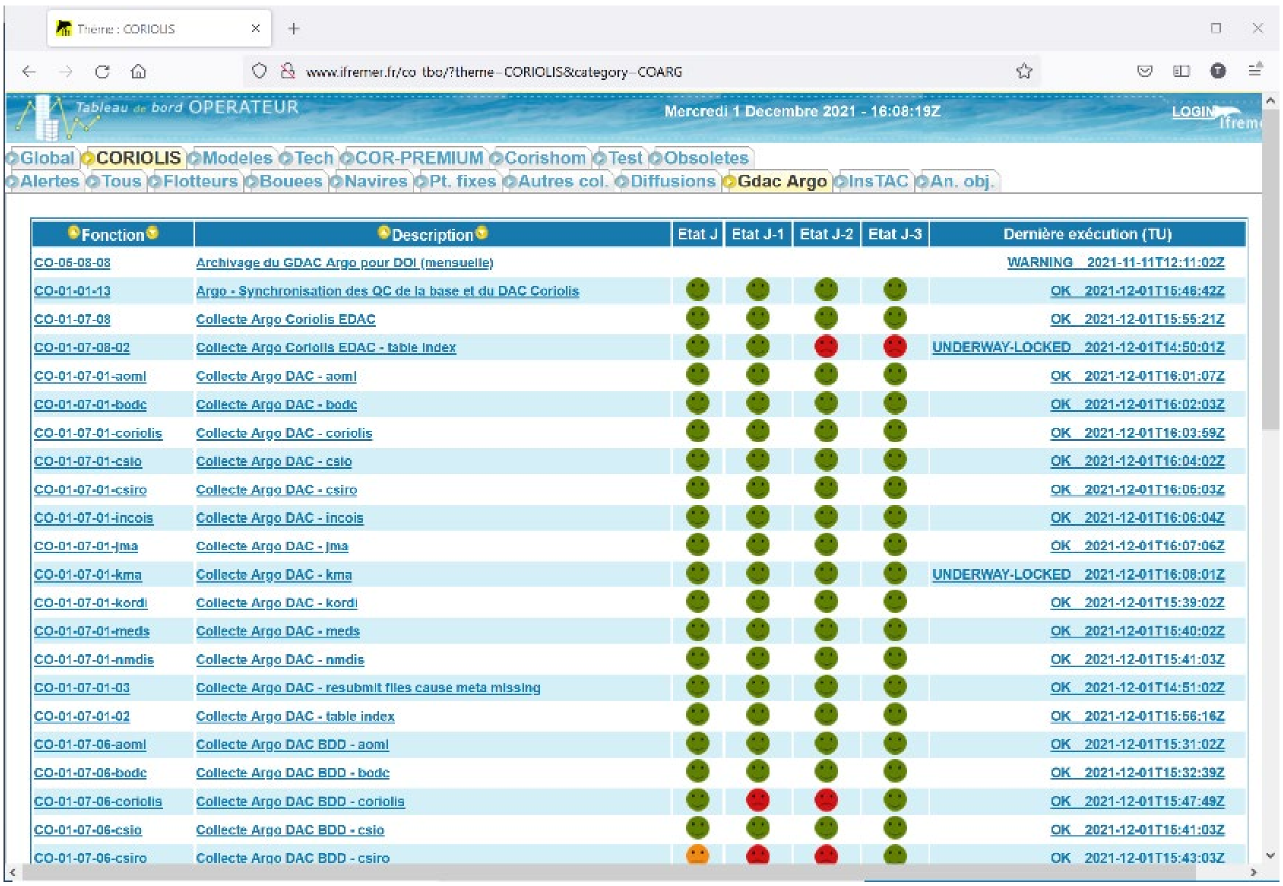
This web page describes all Argo floats interoperability services from Coriolis:

- http://www.coriolis.eu.org/Data-Products/Data-Delivery/Argo-floats-interoperability-services2
    - Argo data through ERDDAP data server (www.ifremer.fr/erddap)
    - Display an individual float's data and metadata in HTML or XML format

- Display all Argo floats, display a group of floats
- Argo profiles and trajectories data selection (HTML or XML)
- All individual float's metadata, profile data, trajectory data and technical data
- Argo profiles data on OpenDAP, OGC-WCS and http
- Argo data through Oceanotron data server
- Argo profiles data through GCMD-DIF protocol
- Argo data through RDF and OpenSearch protocols
- Display Argo profiles and trajectories with GoogleEarth

1.6.4 Data centre activity monitoring

Coriolis operators perform an activity monitoring with an online control board.



Fonction	Description	Etat J	Etat J-1	Etat J-2	Etat J-3	Dernière exécution (TU)
CO-06-08-08	Archivage du GDAC Argo pour DOI (mensuelle)					WARNING 2021-11-11T12:11:02Z
CO-01-01-13	Argo - Synchronisation des QC de la base et du DAC Coriolis					OK 2021-12-01T15:46:42Z
CO-01-07-08	Collecte Argo Coriolis EDAC					OK 2021-12-01T15:55:21Z
CO-01-07-08-02	Collecte Argo Coriolis EDAC - table index					UNDERWAY-LOCKED 2021-12-01T14:50:01Z
CO-01-07-01-aoml	Collecte Argo DAC - aoml					OK 2021-12-01T16:01:07Z
CO-01-07-01-bodc	Collecte Argo DAC - bodc					OK 2021-12-01T16:02:03Z
CO-01-07-01-coriolis	Collecte Argo DAC - coriolis					OK 2021-12-01T16:03:59Z
CO-01-07-01-csio	Collecte Argo DAC - csio					OK 2021-12-01T16:04:02Z
CO-01-07-01-csiro	Collecte Argo DAC - csiro					OK 2021-12-01T16:05:03Z
CO-01-07-01-incois	Collecte Argo DAC - incois					OK 2021-12-01T16:06:04Z
CO-01-07-01-jma	Collecte Argo DAC - jma					OK 2021-12-01T16:07:06Z
CO-01-07-01-kma	Collecte Argo DAC - kma					UNDERWAY-LOCKED 2021-12-01T16:08:01Z
CO-01-07-01-kordi	Collecte Argo DAC - kordi					OK 2021-12-01T15:39:02Z
CO-01-07-01-meds	Collecte Argo DAC - meds					OK 2021-12-01T15:40:02Z
CO-01-07-01-nmdis	Collecte Argo DAC - nmdis					OK 2021-12-01T15:41:03Z
CO-01-07-01-03	Collecte Argo DAC - resubmit files cause meta missing					OK 2021-12-01T14:51:02Z
CO-01-07-01-02	Collecte Argo DAC - table index					OK 2021-12-01T15:56:16Z
CO-01-07-06-aoml	Collecte Argo DAC BDD - aoml					OK 2021-12-01T15:31:02Z
CO-01-07-06-bodc	Collecte Argo DAC BDD - bodc					OK 2021-12-01T15:32:39Z
CO-01-07-06-coriolis	Collecte Argo DAC BDD - coriolis					OK 2021-12-01T15:47:49Z
CO-01-07-06-csio	Collecte Argo DAC BDD - csio					OK 2021-12-01T15:41:03Z
CO-01-07-06-csiro	Collecte Argo DAC BDD - csiro					OK 2021-12-01T15:43:03Z

Argo GDAC operations monitoring: every working day, an operator performs diagnostics and take actions on anomalies (red or orange smileys)

1.7 Statistics of Argo data usage (operational models, scientific applications, number of National Pis…)

Operational oceanography models; all floats data are distributed to:

- EU Copernicus Marine service models (Mercator, Foam, Topaz, Moon, Noos, Boos)
- French model Soap (navy operational model)

Argo projects: this year, Coriolis data centre performed float data management for **72 Argo scientific projects and 60 PIs (Principal Investigators).**

List of Coriolis scientific PIs and project names

project	nb floats
argo-bsh	126
coriolis	108
argo italy	80
argo germany	57
mocca	45
mocca-eu	39
euro-argo	34
ovide	31
naos wp1	30
norargo2	28

Top 10 of Coriolis DAC projects having active floats

pi name	nb active flo
birgit klein	215
pierre-marie poulain	82
kjell arne mork	51
christine coatanoan	41
damien desbruyeres	39
virginie thierry	33
andreas sterl	31
romain cancouet	28
bernard bourles	21
sophie cravatte	20

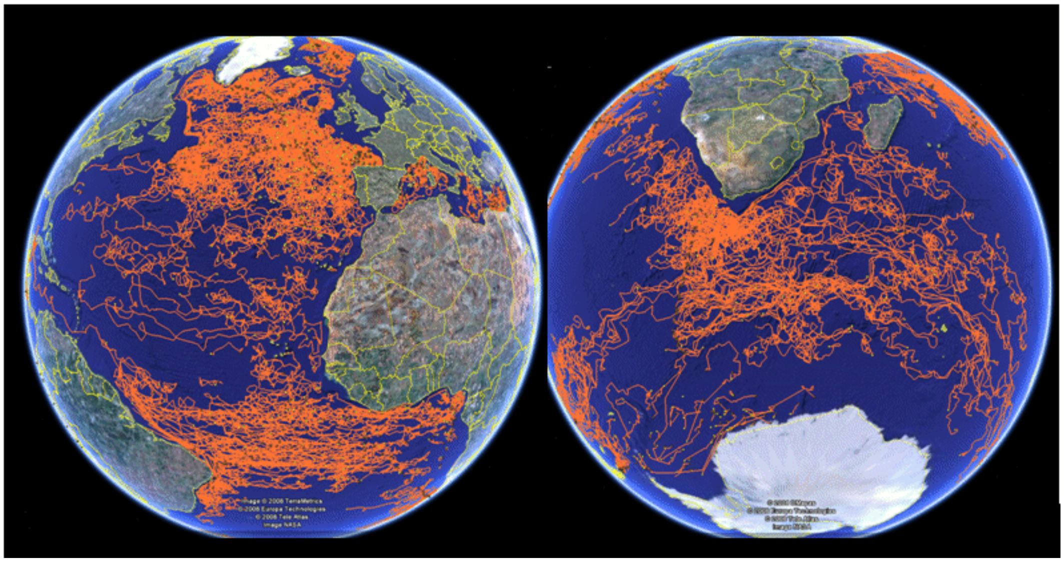
Top 10 of Principal Investigators (PI) in charge of active floats

1.8 Products generated from Argo data

Sub-surface currents ANDRO Atlas

Based on Argo trajectory data, Ifremer and CNRS team are regularly improving the "Andro" atlas of deep ocean currents. The ANDRO project provides a world sub-surface displacement data set based on Argo floats data. The description of each processing step applied on float data can be found in:

- Ollitrault Michel, Rannou Philippe, Brion Emilie, Cabanes Cecile, Piron Anne, Reverdin Gilles, Kolodziejczyk Nicolas (2022). **ANDRO: An Argo-based deep displacement dataset**. SEANOE. https://doi.org/10.17882/47077



Argo trajectories from Coriolis DAC are carefully scrutinized to produce the "Andro" atlas of deep ocean currents.

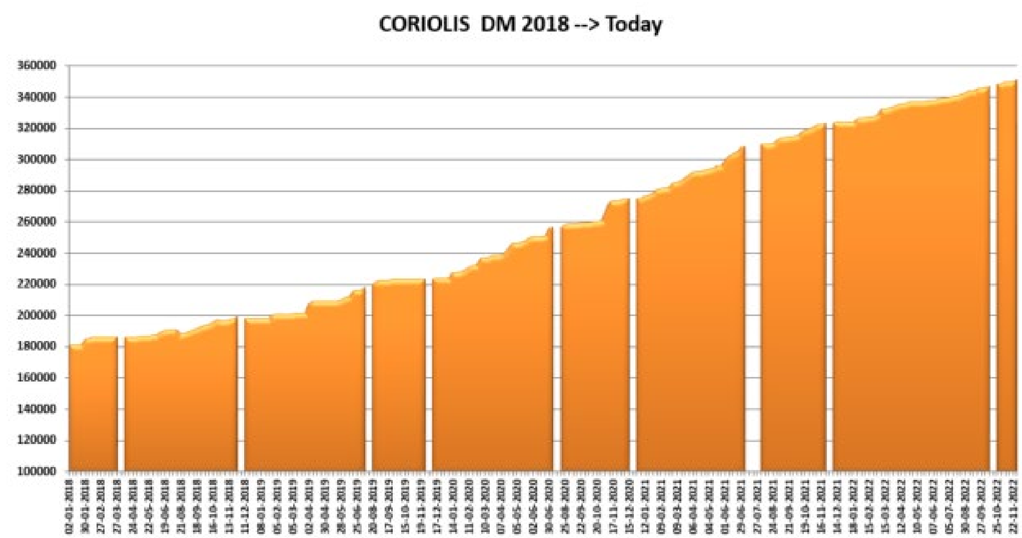
2 Delayed Mode QC

At the Coriolis data centre, we process the delayed mode quality control following four steps. Before running the OW method, we check carefully the metadata files, the pressure offset, the quality control done in real time and we compare with neighbor profiles to check if a drift or offset could be easily detected. By working on this way with PIs, the delayed mode quality control is strengthen.

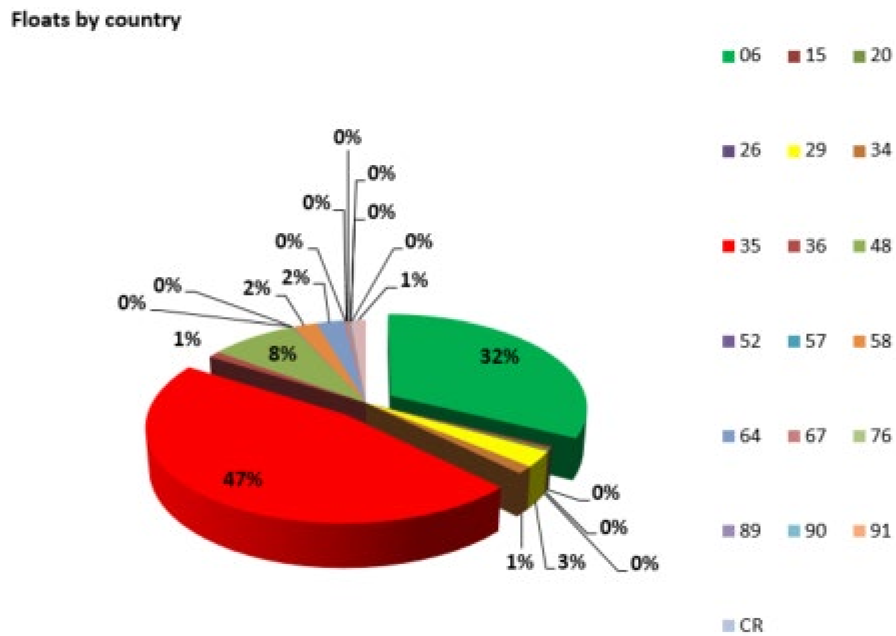
Some floats have been deployed from some projects, meaning a lot of PIs and a lot of time for explaining the DM procedure to all of them. A few PIs are totally able to work on DMQC following the four steps but this is not the case for most of them. Since the unavailability of the PIs leads to work by intermittence and then extend the period of work on the floats, we did the work with a private organism (Glazeo) to improve the realization of the DMQC, exchanging only with the PIs to validate results and discuss about physical oceanography in studied area. Working in this way, we largely improve the amount of delayed mode profiles

A lot of work is always done from BSH (Birgit Klein) taking into account also floats from other German institutes and OGS (Antonella Gallo/Massimo Pacciaroni/Giulio Notarstefano) for the MedSea as well as Alberto Gonzalez Santana for IEO.

Over the past 5 years, a major effort has been made to steadily improve the quality control status of the delayed mode.

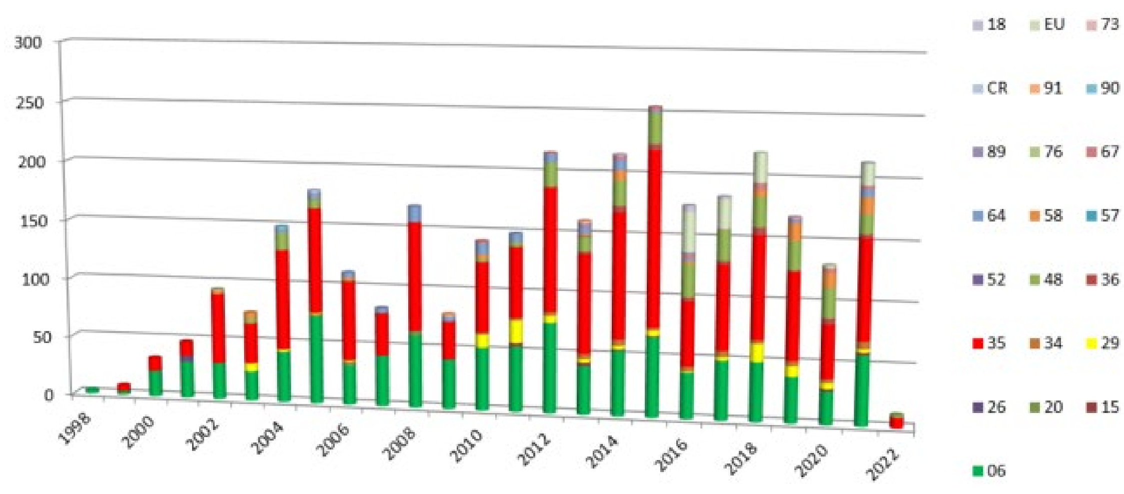


Evolution of the DM profiles' submission versus dates in last 5 years



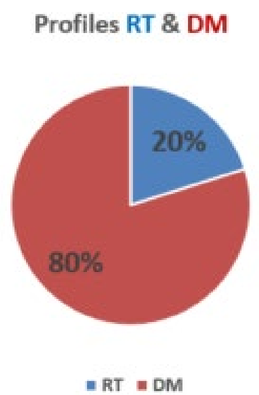
Percentage of floats by country in the Coriolis DAC.

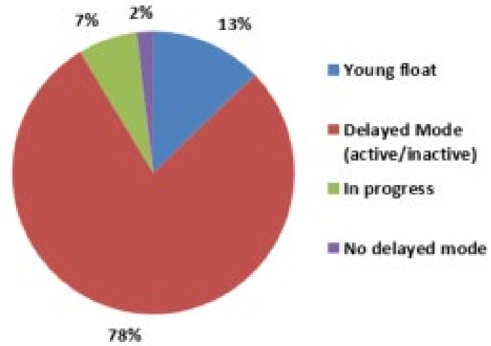
Codes for the countries: 06 : Germany - 15 : Bulgaria - 20 : Chili – 26 : Denmark – 29 : Spain – 34 : Finland - 35 : France – 36 : Greece - 48 : Italy – 52 : Lebanon - 57 : Mexico - 58 : Norway – 64 : Netherlands – 67 : Poland – 76 : China – 89: Turkey - 90 : Russia – 91 : - South Africa - CR : Costa Rica



Number of floats by country and by launch’s year in the Coriolis DAC

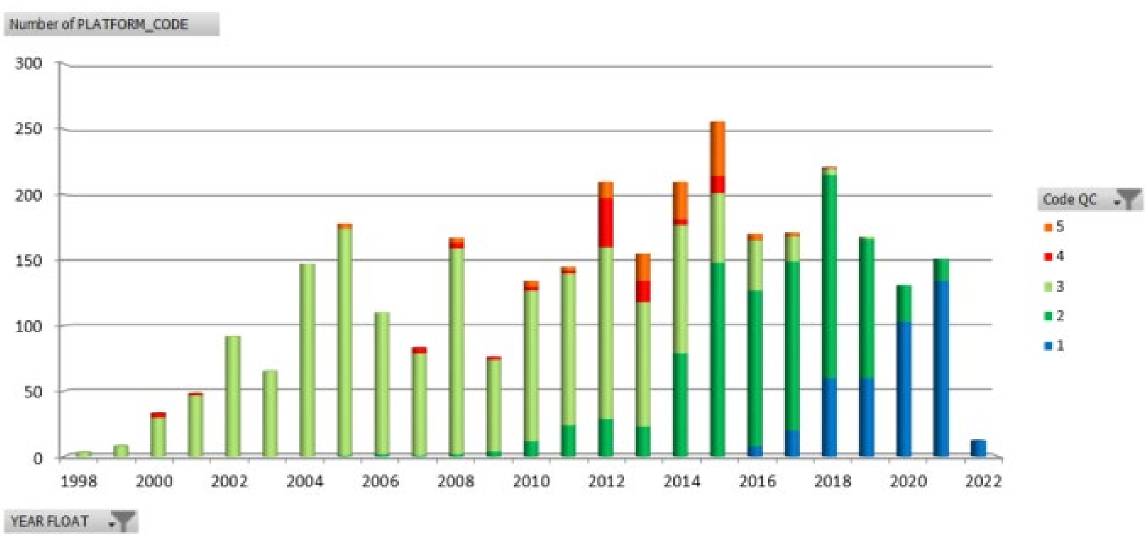
During the last year (from November 2021 to November 2022), 27386 new delayed mode profiles where produced and validated by PIs. A total of 350836 delayed mode profiles where produced and validated since 2005.





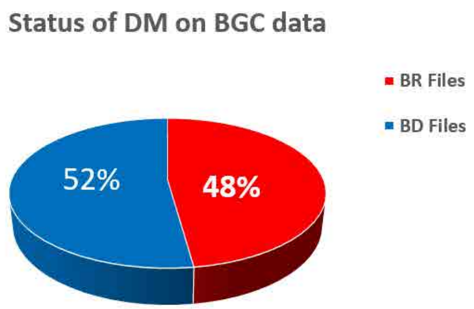
Status of the floats processed by Coriolis DAC.
Left: in terms of profile percent (DM available) and right: in terms of float percent (DM : delayed mode – RT : real time).

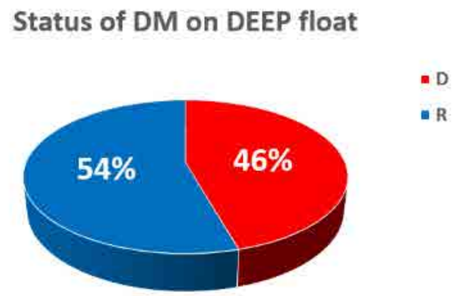
The status of the quality control done on the Coriolis floats is presented in the following plot. For the three last years (2020-2022), most of the floats are still too young (code 1) to be performed in delayed mode. For the years 2012 to 2016, we are still working on the DMQC of some floats. The codes 2 and 3 show the delayed mode profiles for respectively active and dead floats.



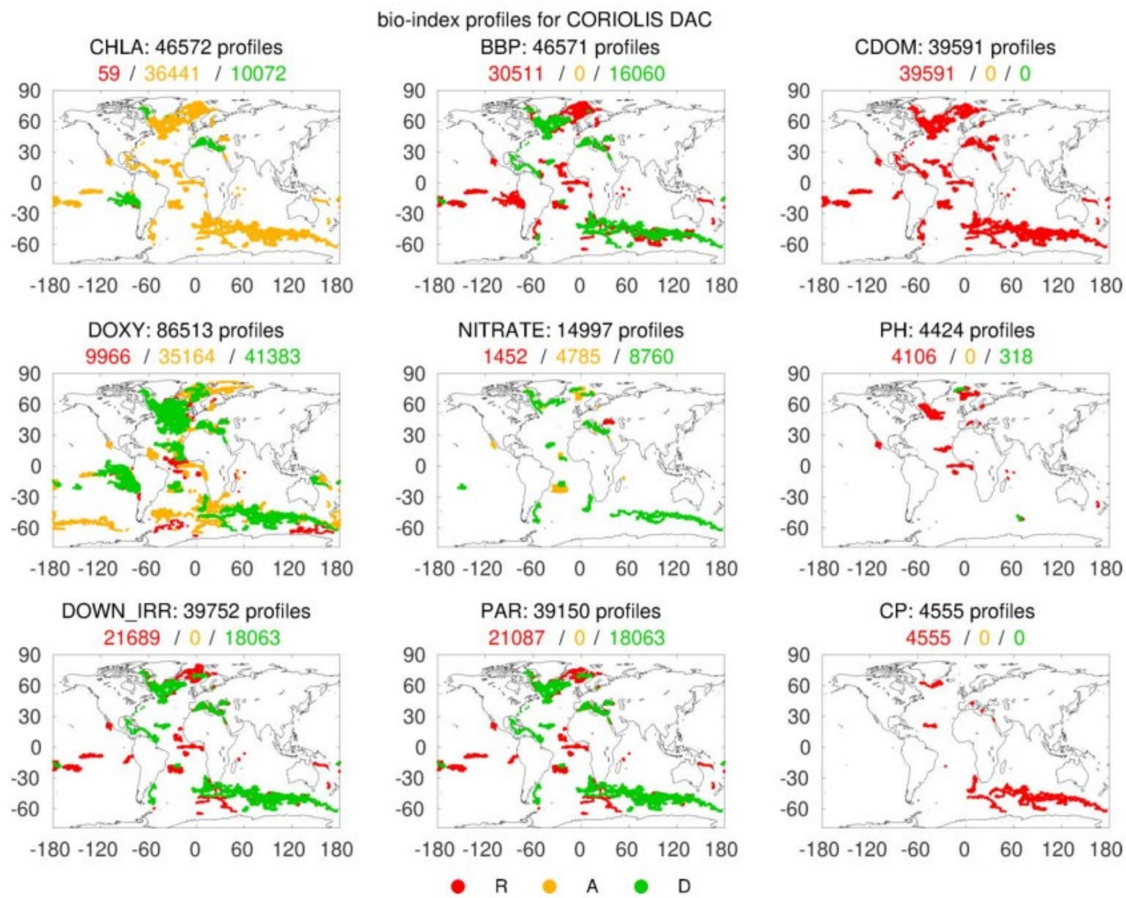
Status of the quality control done on profiles sorted by launch's year, code 1: young float, code 2: active float, DM done, code 3 : dead float, DM done; code 4 : DM in progress, code 5 : waiting for DM, code 6 : problems with float.

Looking in more detail to focus on BGC or Deep Argo data, a great effort has also been made to increase the count of delayed mode profiles: at least 52% of float have one parameter in D mode for BGC profiles when 46% of Deep Argo floats have been processed in delayed mode.



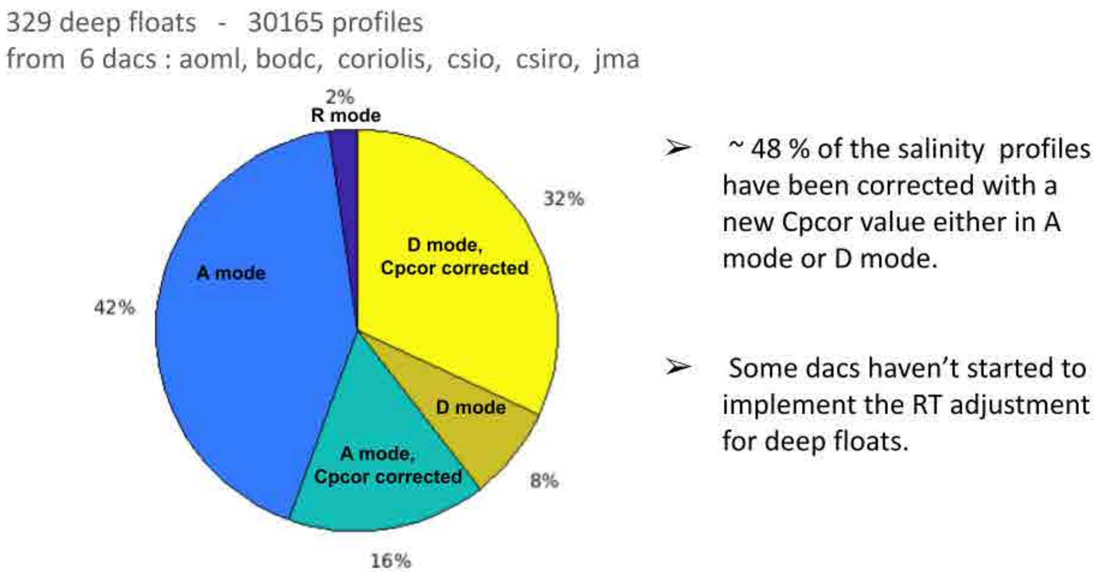


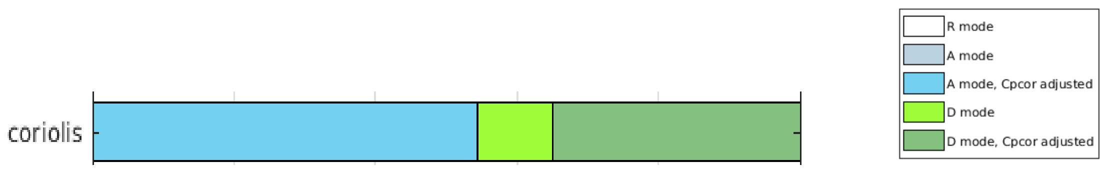
Regarding the BGC data, some information can be found on the document provided by the audit of Henry Bittig (https://biogeochemical-argo.org/cloud/document/implementation-status/BGC_summary_coriolis.pdf).



Location and number of R,A,D profiles per parameters.

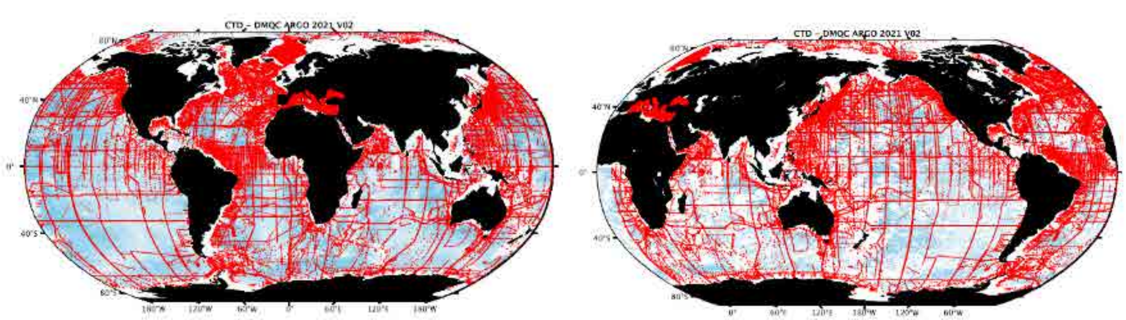
For the Deep Argo data, current status of RT and DM adjustments has presented in the pie-chart for 6 DACs and details for Coriolis are presented in the histogram bar.





CTD Reference database

The version 2021V02 including some new CTDs (deployment CTDs, scientists' CTDs, GO-SHIP CTDs retrieved from the CCHDO website) as well as some corrections from the US-Audit DM feedback, has been provided at the end of the year 2021.



Like the others, the last version is available on the Ifremer ftp site (ask login/password at codac@ifremer.fr) and is divided in smaller tar balls, one by wmo box area (1-3-5-7): for instance, CTD_for_DMQC_2021V02_1.tar.gz for all boxes starting with wmo 1, then we will have 4 tar files.

A new version is in preparation and will include updates from ocean climate library, CTD from CCHDO (confidential and GO-SHIP data), CTD from deployment, data from PANGEA and CTD provided by scientist (Arctic area).

3. Value Added items

- List of current national Argo web pages, especially data specific ones
- Statistics of National Argo data usage (operational models, scientific applications, number of National PIs…)
- Products generated from Argo data that can be shared
- Publicly available software tools to access or qc Argo data

4. GDAC Functions

If your centre operates a GDAC, report the progress made on the following tasks:

- Operations of the ftp server
- Operations of the www server
- Operations of a user friendly interface to access data
- Data synchronization
- Statistics of Argo data usage : Ftp and WWW access, characterization of users (countries, field of interest : operational models, scientific applications) …

5. Regional Centre Functions

If your centre operates a regional centre, report the functions performed and any future plans.

6. Other Issues

Please include any specific comments on issues you wish to be considered by the Argo Data Management Team. These might include tasks performed by OceanOPS, the coordination of activities at an international level and the performance of the Argo data system.

3 GDAC Functions

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete)

- National centres reporting to you
- Operations of the ftp server
- Operations of the www server
- Data synchronization
- Statistics of Argo data usage : Ftp and WWW access, characterization of users (countries, field of interest : operational models, scientific applications) …

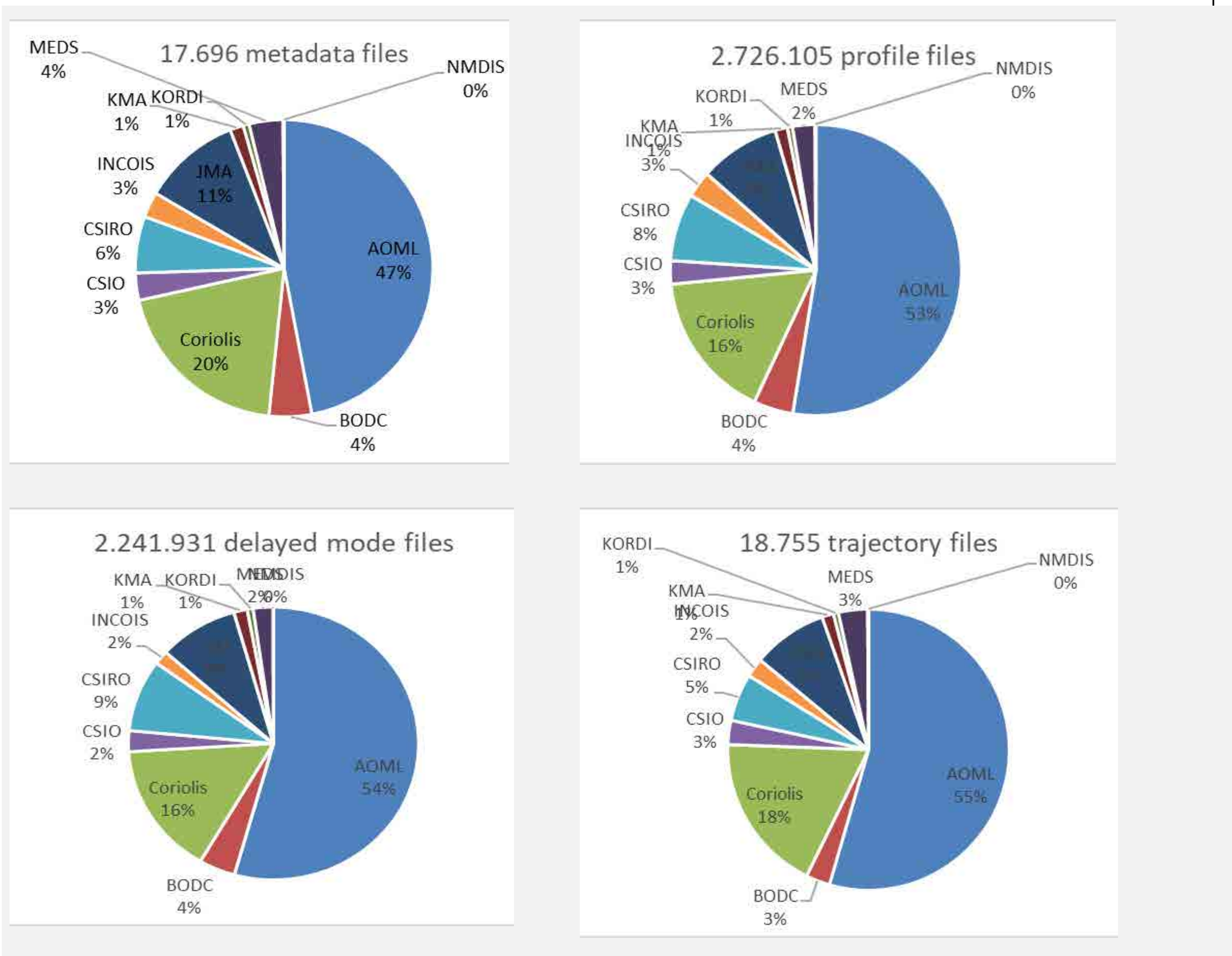
3.1 National centres reporting to you

Currently, 11 national DACs submit regularly data to Coriolis GDAC. On November 2022, the following files were available from the GDAC FTP site.

Compared to 2021, the number of floats (metadata) increased by 5%, the number of profile files increased by 7%.

3.1.1 GDAC files distribution

DAC	metadata files 2021	increase	profile files	increase2	delayed mode profile files	increase3	trajectory files
AOML	8 319	5%	1 432 739	6%	1 218 599	8%	10 219
BODC	820	3%	119 843	7%	91 012	4%	519
Coriolis	3 518	7%	449 398	11%	350 321	8%	3 437
CSIO	525	3%	71 015	5%	55 649	9%	523
CSIRO	1 092	6%	205 190	6%	191 023	7%	1 025
INCOIS	491	0%	80 508	2%	36 487	7%	412
JMA	1 887	2%	244 049	5%	200 085	14%	1 616
KMA	259	2%	37 439	3%	33 706	3%	250
KORDI	115	5%	15 423	0%	14 504	0%	107
MEDS	651	8%	68 041	8%	50 113	12%	628
NMDIS	19	0%	2 460	0%	432	-	19
Total	**17 696**	**5%**	**2 726 105**	**7%**	**2 241 931**	**8%**	**18 755**



Number of files available on GDAC, November 2022

3.1.2 Argo Semaphore dashboard: give credit to data providers

Ifremer manage a dashboard (Semaphore) to monitor data distribution and give credit to data providers such as Argo floats.

- https://audience-argo.ifremer.fr

FTP, HTTPS and ERDDAP 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.

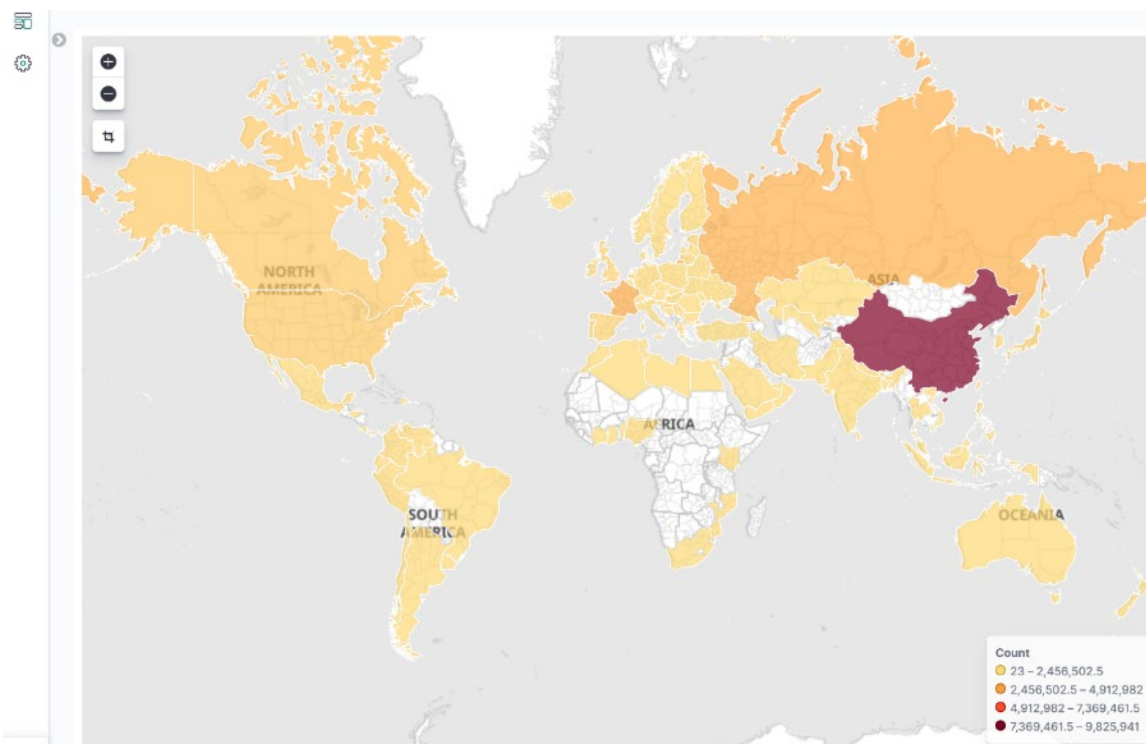
This dashboard offers the possibility to give credit to Floats owner institutions such as how many data from one particular institution was downloaded, by whose data users.

Semaphore key figures for 2022:

- **2 million sessions for Argo data downloads**
- **655 million of files downloaded**
- **80% of ftp downloads, 20% of https downloads**
- **20 terabytes daily downloads**

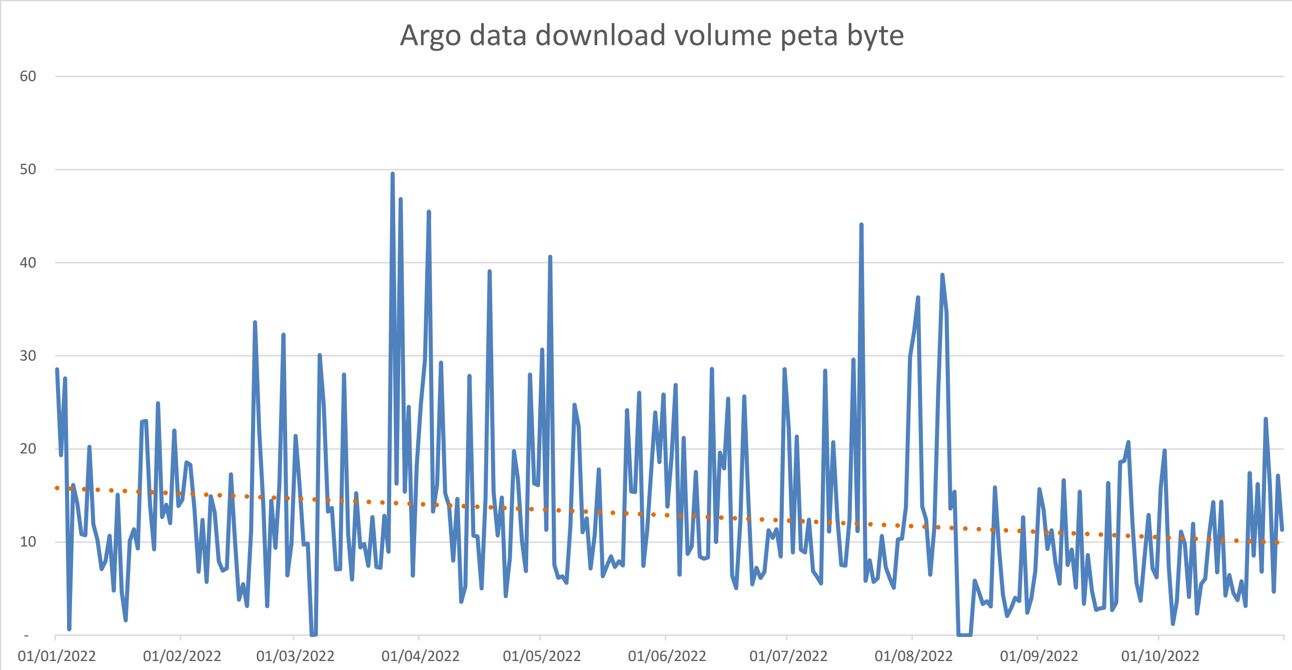
Download service	Nb hits	percent
ftp	525 899 105	80%
https	127 977 145	20%
thredds	816 041	0,12%
cms-ezpublish	536 706	0,08%
erddap	72 709	0,01%
Total	655 301 706	

The vast majority of downloads is with ftp (80%), followed by https (20%) and a tiny fraction with Thredds or ERDDAP data services.



Distribution by countries of GDAC ftp, https erddap downloads in 2022

The majority of downloads are from China, Russia, Europe and North America.



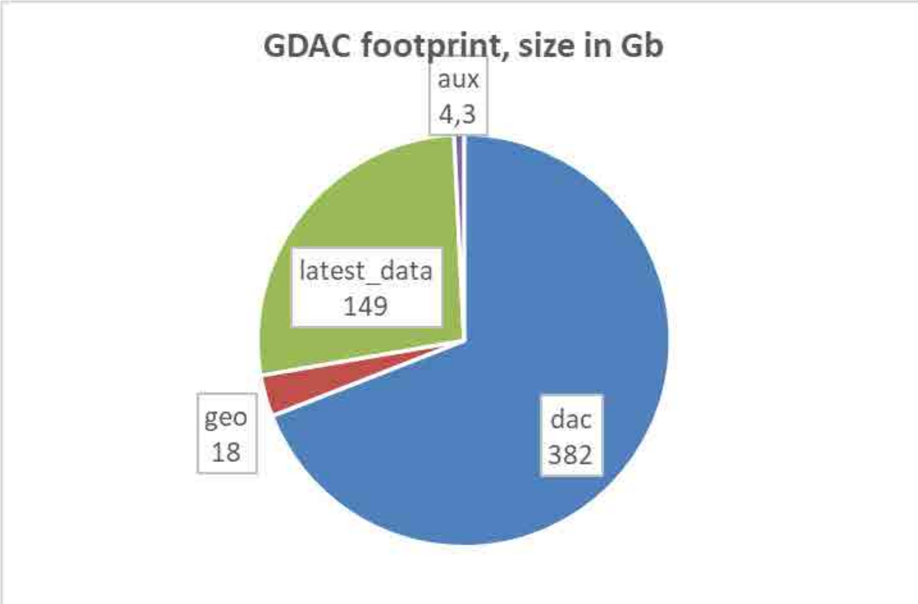
Argo FTP, HTTPS and ERDDAP downloads in 2022, an average of 20 terabytes per day with spikes up to 50 terabytes a day

GDAC files size

- The total number of NetCDF files on the GDAC/dac directory was 3 329 573 (+7% in one year)
- The size of GDAC/dac directory was 382 Go (+21%)
- The size of the GDAC directory was 740 Go (+12%)

More on: http://www.argodatamgt.org/Data-Mgt-Team/News/BGC-Argo-M-prof-files-no-more-distributed-on-GDAC

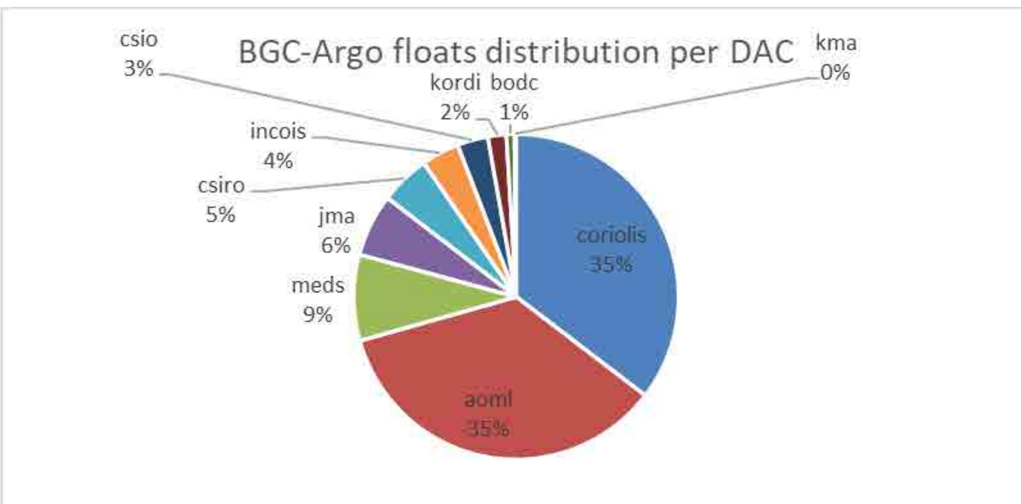
branch	GDAC size in Gb	yearly increase	N-1
dac	382	21%	316
geo	18	-87%	135
latest_data	149	831%	16
aux	4,3	48%	2,9
gdac total	740	12%	661

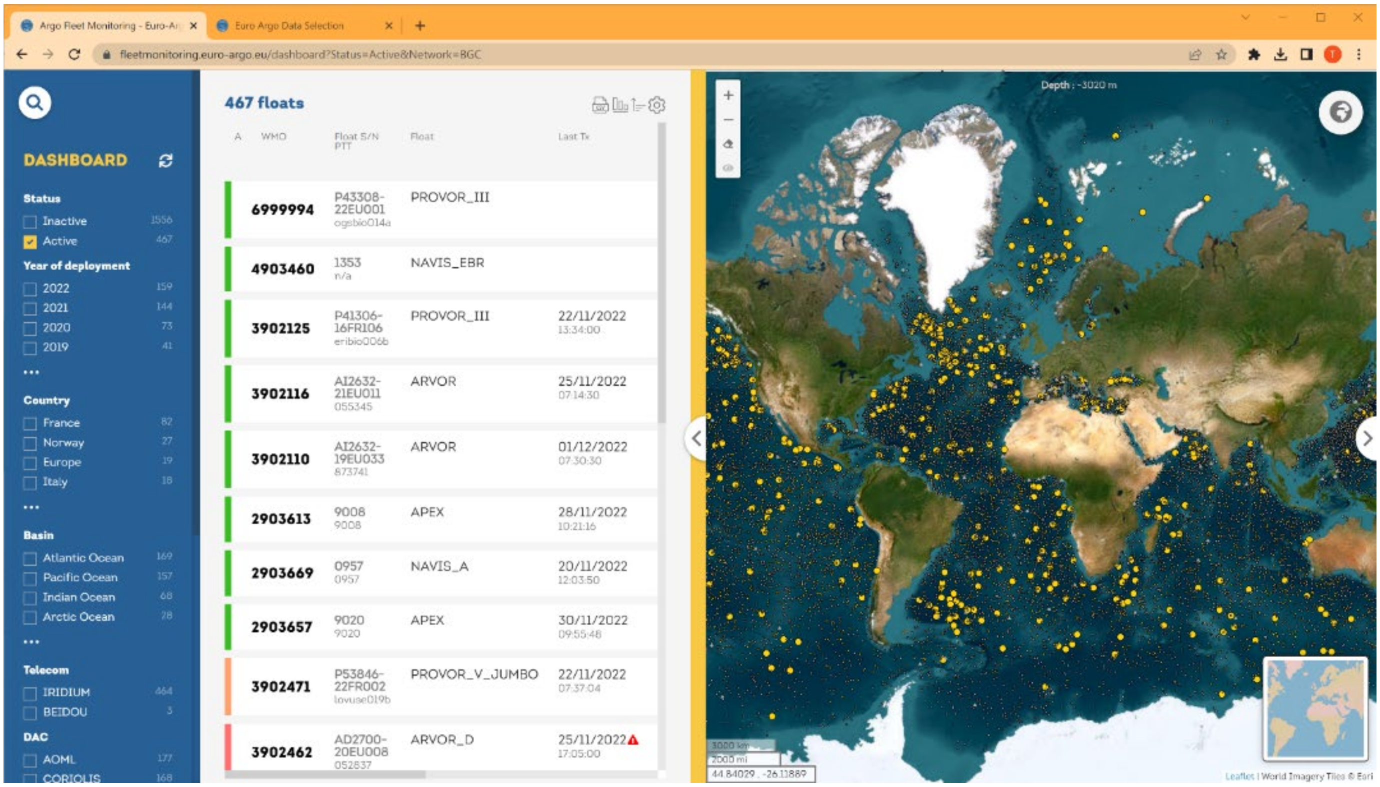

GDAC footprint, size in Gb
aux
4,3
latest_data
149
geo
18
dac
382

3.1.3 BGC-Argo floats

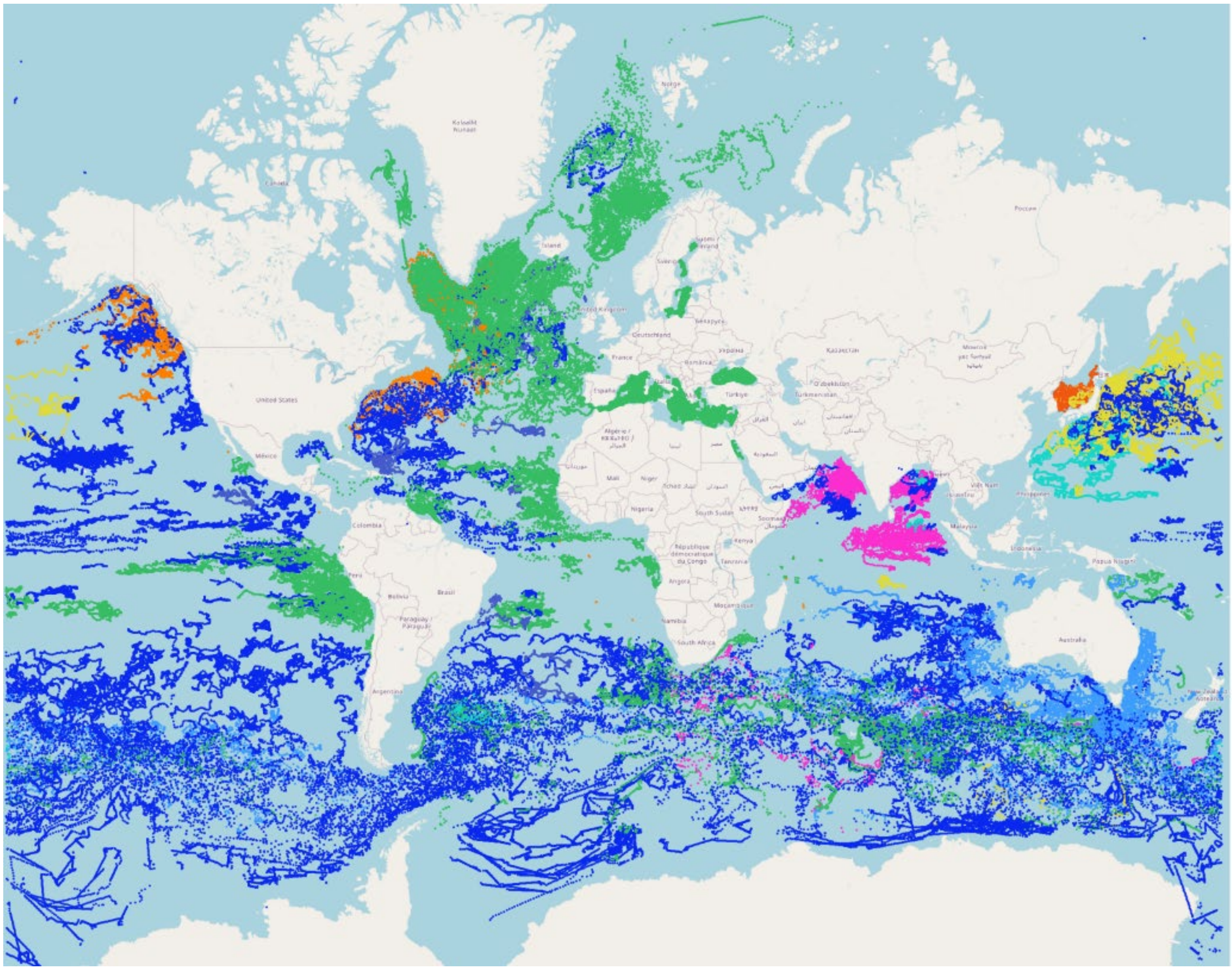
In November 2022, 270.819 BGC-Argo profiles from 1860 floats were available on Argo GDAC. This is a fair increase compared to 2021: +12% more floats and +8% more profiles.

DAC	nb bgc float	nb bgc file
coriolis	658	97 307
aoml	656	93 989
meds	159	5 692
jma	116	19 836
csiro	92	22 832
incois	70	12 167
csio	57	10 267
kordi	34	3 426
bodc	15	4 835
kma	3	468
Total	**1860**	**270 819**



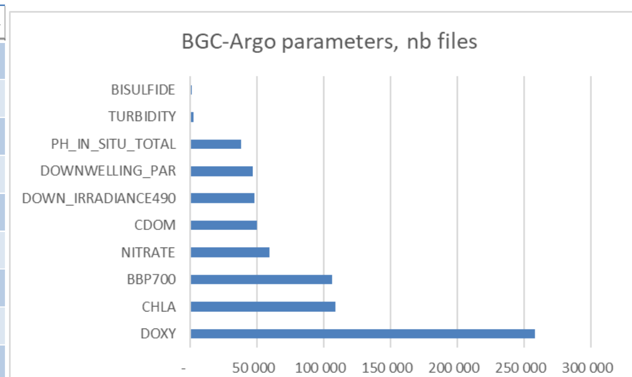


Map of 467 BGC-Argo active floats (yellow) among 2023 BGC-Argo floats (other: grey dots) from https://fleetmonitoring.euro-argo.eu/dashboard



BGC-Argo profiles, colored by DACs

BGC parameter	nb files
DOXY	258 079
CHLA	108 988
BBP700	106 473
NITRATE	59 180
CDOM	50 144
DOWN_IRRADIANCE490	48 344
DOWNWELLING_PAR	47 117
PH_IN_SITU_TOTAL	37 968
TURBIDITY	2 514
BISULFIDE	1 352

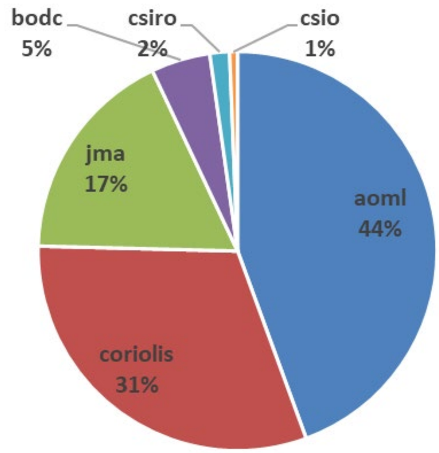


Main BGC-Argo physical parameters, number of s-profiles

3.1.4 Deep-Argo floats

The deep-Argo component of the One-Argo program is under development. A deep Argo float performs high precision observations from ocean surface to bottom, at up to 6000 meters deep.

dac	nb float	nb deep pro
aoml	139	14 582
coriolis	97	5 190
jma	55	3 579
bodc	15	694
csiro	5	406
csio	2	110
Total	**313**	**24 561**



3.2 Operations of the ftp, https and erddap servers

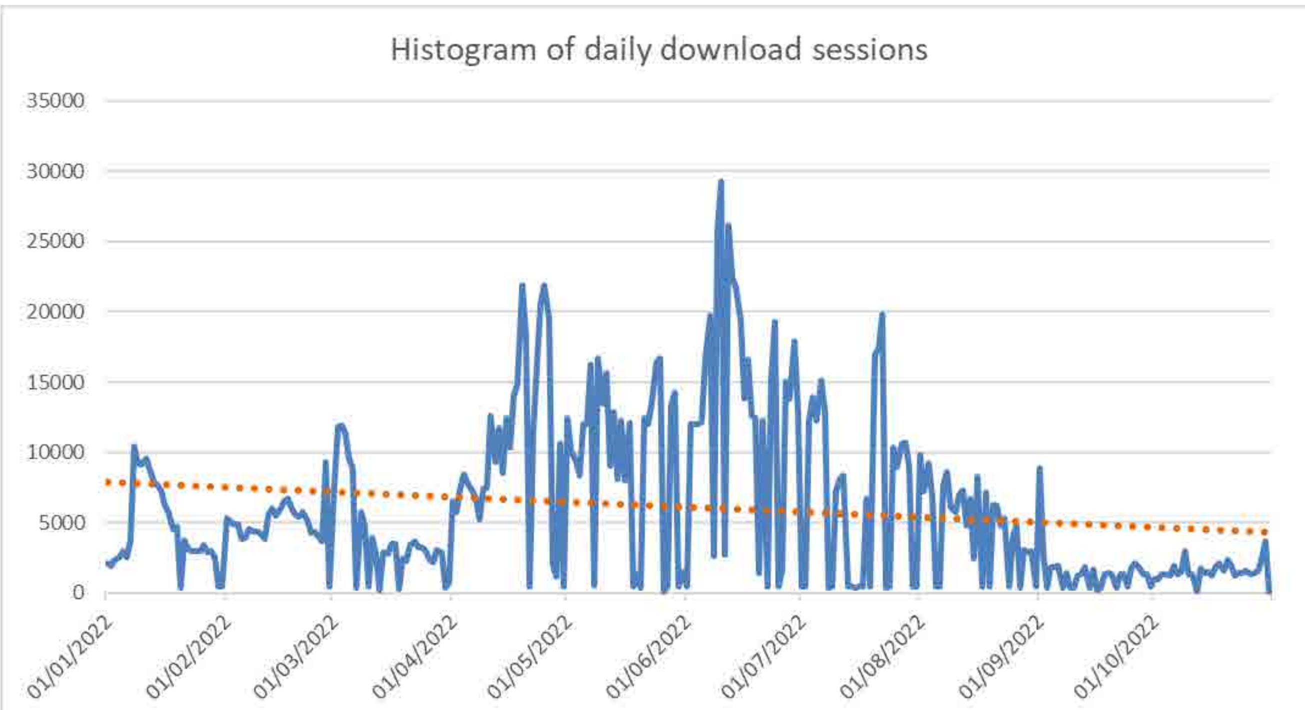
For each individual DAC, every 30 minutes, meta-data, profile, trajectory and technical data files are automatically collected from the national DACs. The 11 DACs are processed in parallel (one process launched every 3 minutes).

Index files of metadata, profiles, trajectories, technical and auxiliary data are hourly updated.

GDAC download services

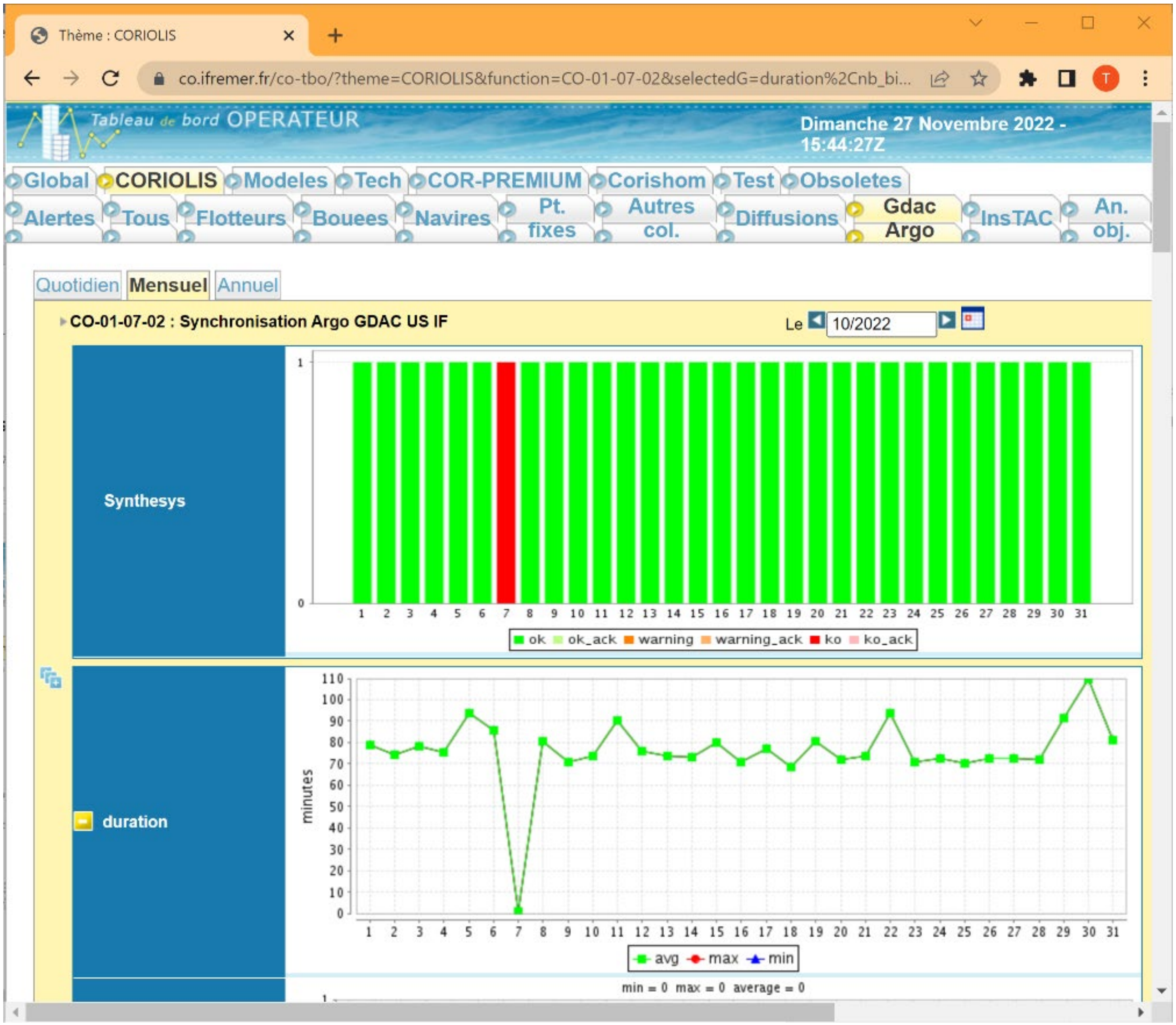
- ftp ftp://ftp.ifremer.fr/ifremer/argo
- https https://data-argo.ifremer.fr
- erddap https://erddap.ifremer.fr

There is a daily average of 6000 sessions and downloading 20 terabytes of data files. There was a huge variability in number of sessions between May and August 2022.



3.3 GDAC files synchronization

The synchronization with US-GODAE server is performed once a day at 03:55Z



Synchronization dashboard in October 2022: the daily sync. time takes on average 80 minutes, with a failure on October 7th.

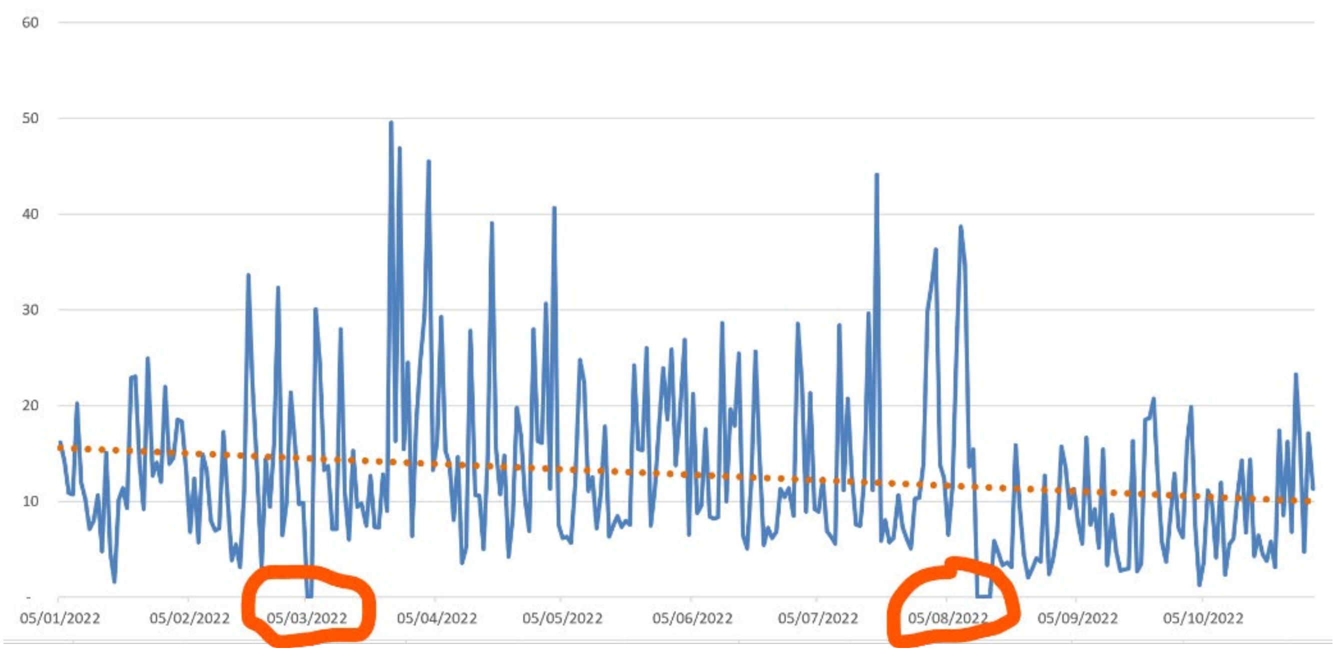
3.4 Download services monitoring

Semaphore is used to monitor the data distribution activity.

In 2022, according to the daily data download volume statistics, there were two period of poor performances: 2 days in March 2022 and 4 days in August 2022.

A poor performance is an abnormally low volume of data downloaded by Argo users (less than 0,1 terabyte of data).

Day	Volume terabyte
05/03/2022	0,013
06/03/2022	0,069
12/08/2022	0,007
13/08/2022	0,005
14/08/2022	0,003
15/08/2022	0,010



Six days of poor data download service in year 2022, less than 0,1 terabyte of data

3.5 Grey list

According to the project requirements Coriolis GDAC hosts a grey list of the floats which are automatically flagged before any automatic or visual quality control. **The greylist has 1519 core-Argo entries** (November 2022), compared to 2100 entries one year ago.

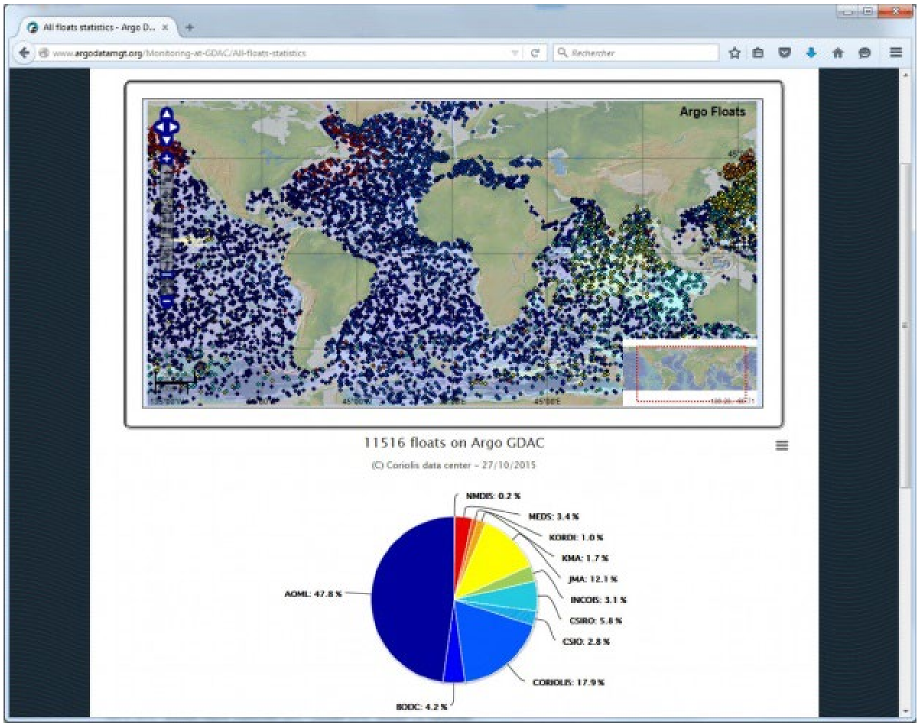
All floats	
DAC	NB_FLOAT
aoml	908
coriolis	177
jma	126
bodc	119
csiro	99
csio	26
incois	24
meds	24
kma	13
kordi	3
Total	**1519**

Distribution of greylist entries per DAC and per parameter

Parameter	nb entries
PSAL	1518
TEMP	185
PRES	147
DOXY	71
BBP700	51
CHLA	35
CDOM	25
BBP532	11
NITRATE	5
DOWN_IRRADIANCE412	4
DOWNWELLING_PAR	4
DOWN_IRRADIANCE490	4
DOWN_IRRADIANCE380	4
CP660	4
PH_IN_SITU_TOTAL	3
PH_IN_SITU_FREE	1

3.6 Statistics on GDAC content

The following graphics display the distribution of data available from GDAC, per float or DACs. These statistics are daily updated on: http://www.argodatamgt.org/Monitoring-at-GDAC



3.7 Mirroring data from GDAC: rsync service

In July 2014, we installed a dedicated rsync server called vdmzrs.ifremer.fr described on:

- http://www.argodatamgt.org/Access-to-data/Argo-GDAC-synchronization-service

This server provides a synchronization service between the "dac" directory of the GDAC with a user mirror. From the user side, the rysnc service:

- Downloads the new files
- Downloads the updated files
- Removes the files that have been removed from the GDAC
- Compresses/uncompresses the files during the transfer
- Preserves the files creation/update dates
- Lists all the files that have been transferred (easy to use for a user side post-processing)

Examples

Synchronization of a particular float

- rsync -avzh --delete vdmzrs.ifremer.fr::argo/coriolis/69001 /home/mydirectory/...

Synchronization of the whole dac directory of Argo GDAC

- rsync -avzh --delete vdmzrs.ifremer.fr::argo/ /home/mydirectory/...

3.8 Argo DOI, Digital Object Identifier on monthly snapshots

A digital object identifier (DOI) is a unique identifier for an electronic document or a dataset. Argo data-management assigns DOIs to its documents and datasets for two main objectives:

- Citation: in a publication the DOI is efficiently tracked by bibliographic surveys
- Traceability: the DOI is a direct and permanent link to the document or data set used in a publication
- More on: http://www.argodatamgt.org/Access-to-data/Argo-DOI-Digital-Object-Identifier

Since July 2019, the DOI monthly snapshot of Argo data is a compressed archive (.gz) that contains distinct core-Argo tar files and BGC-Argo tar files. A core-Argo user can now ignore the voluminous BGC-Argo files.

Argo documents DOIs

- Argo User's manual: http://dx.doi.org/10.13155/29825

Argo GDAC DOI

- Argo floats data and metadata from Global Data Assembly Centre (Argo GDAC) http://doi.org/10.17882/42182

Argo National Data Management Report 2022 - Germany

BSH (Federal Maritime and Hydrographic Agency)

1. Status
(Please report the progress made towards completing the following tasks and if not yet complete, estimate when you expect them to be complete)

- Data acquired from floats
  Presently there are 223 active/operational German floats which belong to BSH except for 28 associated to AWI, 2 to ICBM and 1 to GEOMAR. 55 floats have been deployed in 2022 to date. 13 more are on their way to deployments in the South Atlantic in early 2023. 5 of these are send to storage in South Africa with the Weather Service to be used on the SANAE/Goodhope/Crossroads cruises by South African colleagues in the following month. Data from all presently active floats are available from the GDACS.
- Data issued to GTS
  All German floats are processed in real-time by Coriolis and immediately inserted into the GTS.
- Data issued to GDACs after real-time QC
  All profiles from German floats are processed by Coriolis following the regular quality checks and are routinely exchanged with the GDACs.
- Data issued for delayed QC
  At present (05.12.2022) the German Argo fleet comprises 1107 floats which have sampled 100950 profiles. 87590 profiles of all eligible files are already available as D-files and 8223 are still pending. The total rate of eligible D-files provided to the GDACs is 96%.
- Delayed data sent to GDACs
  The D-files are submitted by email to Coriolis together with the diagnostic figures and a short summary of the DMQC decision taken and are inserted into the GDAC after format testing.
- Web pages
  BSH is maintaining the new Argo Germany Web site at https://www.bsh.de/DE/THEMEN/Beobachtungssysteme/ARGO/.
  It provides information about the international Argo Program, the German contribution to Argo, Argo array status, data access and deployment plans. It also provides links to the original sources of information.
- Statistics of Argo data usage
  Currently no statistics of Argo data usage are available. The German Navy uses Argo data on a regular basis for the operational support of the fleet and uses their liaison officer at BSH to communicate their needs. The SeaDataNet portal uses German Argo data operationally for the Northwest European Shelf. Based on the feedback from the national user workshop (Argo data are routinely assimilated in the GECCO reanalysis, which is used for the initialisation the decadal prediction system MiKlip. They are also routinely assimilated into the Earth-System-model of the Max-Planck

Society in various applications reaching from short term to decadal predictions and are used for model validation. At BSH the data are used within several applications such as EArise and Expertennetzwerk BMVI. Data are also used in various research groups at universities.

- Products generated from Argo data
  A quality screened subset of float data in the Atlantic has been created on the yearly basis and has been exchanged with the universities.

2. Delayed Mode QC
(Please report on the progress made towards providing delayed mode Argo data, how it is organized and the difficulties encountered and estimate when you expect to be pre-operational).
The overall percentage of D-files from all German programs is remaining at a quota of above 90%. BSH had adopted floats from all German universities and agreed last year to perform similar services for the AWI floats. DMQC for the subset of re-processed AWI floats (56 now in V3.1) has now been performed after the reference database was updated with more recent reference data from Pangea. The associated d-files will be submitted as soon as permission has been received from the PI. A meeting with AWI colleagues after summer had to be postponed and needs to be hold at the beginning ot 2023. Remaining issues with the AWI floats are handling of small constant offsets in the order of ± 0.005 psu and the cut-off for TBT issues in early cycles. Therefore at the moment 8721 profiles are available from the 216 AWI floats and but only 48% are available as D-files. For all other floats (891 floats) the DMQC quota is at 96%. Some older floats were reprocessed due to audit requests during the year and new d-files were submitted-

German Floats/ Program Name	Number of profiles	Number of D-files	D-files pending	Comments
Argo BSH	75410	67001	3288	Overall 95%
Argo AWI	8721	3926	4781	Overall 48%, DMQC for 56 reprocessed Nemo float files has been carried out after the update to the reference database and wait for approval of PI.
Argo GEOMAR (129 floats)	13474	13407	67	Reprocessing nearly finished Overall 99 %
Argo U. HH (28 floats)	3347	3258	89	Reprocessing nearly finished Overall 98 %
Argo Denmark (5 floats)	371	360	11	Old floats associated with U. HH, reprocessing nearly finished Overall 97%

BSH has also adopted some floats from Finland (10 non Baltic floats), the Netherlands (121 floats), Norway (30 floats) and Poland (15 floats) for DMQC and is performing DMQC on parts of the MOCCA fleet (44 floats) from the European Union. The progress in these programs providing D-files is generally good, but redecoding of older file-formats and pending DMQCs for floats in the Baltic until endorsement from ADMT are resulting in lower numbers in some programs. Since Argo-Norway has received fundings from the national research council to increase the number of Norwegian floats deployed per year, the program has gotten more involved in the dmqc activities. Floats deployed from 2019 onward have been covered by Norwegian DMQC operators. The same is true for Argo-Poland which also has performed DMQC on their own floats from 2019 onward. The statistics shown below are already a mixture of dmqc performed by BSH and the national DMQC-operators.

Germany has recently started to deploy BGC floats and dmqc of the BGC parameters has been organized within the research project DArgo2025. The host of BGC parameters is divided between research institutes based on their expertise: GEOMAR will oversee pH and O2, IOW will care for nitrate and ICBM will oversee the bio-optical sensors from the radiometers. Starting in 2023 a full term position for dmqc of BGC parameters is established at BSH and will revisit the issues of dmqcs and collaboration with the institutes on their floats. We hope to make swift progress in 2023 and integrate well in the European struchtures.

There are remaining issue with floats from Finland, Poland and MOCCA which are operating in the Baltic and will receive their DMQC decisions from regular laboratory calibrations performed when floats are recovered annually or from nearby calibration stations. The system for the DMQC is set-up within the EuroArgo ERIC in research projects as MOCCA and EArise. These floats had been assigned by their association to the country, but since there are dm-pathways established in these countries, their dmqc should be carried out by the national dmqc operators.

Adopted floats/ Program Name	Number of profiles (all)	Number of D-files (all)	D-files pending (all)	Comments
Argo Poland (15 floats out of 29)	5608	1878	2818	Mostly Baltic floats pending Overall 40%
Argo Finland (10 floats out of 43)	4446	795	3343	Mostly Baltic and Barent Sea floats pending Overall 21%
Argo Netherlands (121 floats)	13731	12218	632	Overall 95%
Argo Norway (30 floats out of 85)	11068	8027	925	Mostly Barent Sea floats pending Overall 91%
MOCCA (44 floats out of 119)	25095	16265	6708	Baltic floats pending Overall 70 %

US Navy (10 floats)	1940	1790	150	Overall 93% Overlooked new cycles from one float
NAAMES/US (E. Boss) (13 floats)	2743	2641	102	Overall 96%

Investigations of fast salty drifters were continued and consolidated with the entire European fleet. Information is now available in a shared in a spreadsheet. Efforts have been undertaken this year to make sanity checks on the manually entered entries into the table and afterwards to perform statistical analysis from the data holdings at the GDACs. Delphine Dobler from Ifremer has undertaken most of this work.

https://docs.google.com/spreadsheets/d/1TA7SAnTiUvCK7AyGtSTUq3gu9QFbVdONj9M9zAq8CJU/edit#gid=974650348

3. GDAC Functions

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete)

- National centres reporting to you
- Operations of the ftp server
- Operations of the www server
- Data synchronization
- Statistics of Argo data usage : Ftp and WWW access, characterization of users (countries, field of interest : operational models, scientific applications) …

4. Regional Centre Functions

(If your centre operates a regional centre, report the functions performed, and in planning)

BSH is part of the SOARC consortium and is working in EArise to updating the CTD Reference data base for the Weddell gyre. Since 2021 all available data from the PANGEA data base have been downloaded and these will be added to the upcoming release of the data base.

As part of work performed in the European projects MOCCA and EArise we are presently working on reference data for the Nordic Seas and Arctic proper. The reference data base for these areas will be updated/established. The main data sources are data from the Norwegian and Polish monitoring cruises and from NABOS for the Arctic. A meeting was held with the Norwegian program to discuss dmqc applications and an audit for the data set from the Norwegian Sea. A follow-up meeting was proposed for early next year with the active dmqc-operators in the area.

Argo National Data Management Report (2022) – India

1. Status

- **Data acquired from floats**
  India has not deployed any new floats between December 2021 and December 2022 in the Indian Ocean. Overall the contribution from India is 494 from the beginning. Out of these 57 floats are active. Data from all these active floats are processed and sent to GDAC.
- **Data issued to GTS**
  All the 57 active floats data is being distributed via RTH New Delhi.

- **Data issued to GDACs after real-time QC**
  All the active floats (57) data are subject to real time quality control and are being successfully uploaded to GDAC. Few old floats with old version (Ver 2.3) are being converted to Ver 3.1 and uploaded to GDAC. Few profiles which are being rejected with the version change are being reprocess and submitted again to GDAC.

- **Data issued for delayed QC**
  In total ~45% of the eligible profiles for DMQC are generated and uploaded to GDAC. Few old DMQCed floats with old version 2.3 are converted to V 3.1 and uploaded to GDAC. Few floats identified and notified through the ocean-ops are passed through DMQC and submitted to GDAC. Few of the are grey listed and the status of them is updated on GDAC.

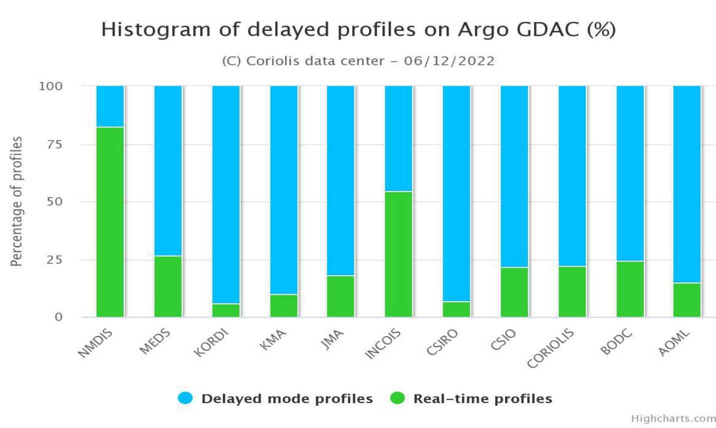
- **Web pages**
  - INCOIS continued maintaining Web-GIS based site for Indian Argo Program. It contains entire Indian Ocean floats data along with trajectories. Further details can be obtained by following the link h ttp://www.incois.gov.in/Incois/argo/argo_home.jsp. Apart from the floats deployed by India, data from floats deployed by other nations in the Indian Ocean are received from the Argo Mirror and made available in the INCOIS website. User can download the data based on his requirement.
  - Statistics of Indian and Indian Ocean floats are generated and maintained in INCOIS web site. The density maps for aiding people for new deployments are made available on a monthly basis. For full details visit h ttp://www.incois.gov.in/Incois/argo/argostats_index.jsp.
- **Trajectory**
  INCOIS continued generating Ver 3.1 trajectory files for all APEX Argo and Iridium floats and uploading them to GDAC. Provor, Arvor floats data could not be generated yet and will be uploaded once ready.
- **Statistics of Argo data usage**
  INCOIS is engaged in enhancing the Argo data outreach program specifically targeting students, researchers and research scholars. Argo data is being widely put to use by various Organisations/ Universities/ Departments. Scientists, Students and Researchers from INCOIS, NIO, SAC, C-MMACS, NRSA, IITM, NCMRWF, IISc etc are using Argo data in various analysis. Many paper based on Argo data were also published in reputed journals. See the references below.

The demand for Bio-Argo data is high and the data is continued to be supplied to researchers interested in using it.
This data is continued to be used for validation of Biogeochemical model outputs like ROMS with Fennel module.

- **Products generated from Argo data**
    1. INCOIS continued to generate value added products using all Argo data (both national and international). Continued to use variational analysis method (DIVA) while generating value added products. Many products are generated using Argo temperature and salinity data. The Argo T/S data are first objectively analysed and this gridded output is used in deriving value added products.
    2. Updation to Version 2.2 of DVD on “Argo data and products for the Indian Ocean” is discontinued which is being made available via INCOIS and UCSD web sites. However the older version of the same is still available for download.
    3. Argo valued products are continued to be made available through INCOIS LAS. For further details visit http://las.incois.gov.in.
    4. Continued to provide the Argo and value added products derived from Argo data through ERDDAP. Here the provision for individual data and the derived products is also enabled for users.

2. Delayed Mode QC

- INCOIS started generating and uploading D files to GDAC form July 2006, and as of today, profiles belonging to all eligible floats have been subjected to DMQC.
- Modified DMQC S/W obtained from Cecil, IFREMER is also being used. Using this s/w all the eligible floats are reprocessed to tackle pressure sensor offset problems, salinity hooks, thermal lag corrections, salinity drifts. COW S/w is mainly used for performing DMQC of Provor/Arovor floats.
- Data obtained from sister concerns and archived is continued to be used in the delayed mode processing.
- About 45% of the eligible profiles are subjected to DMQC and the delayed mode profiles are uploaded on to GDAC. Majority of the old dead float which are passed through DMQC are converted to Ver 3.1 and uploaded to GDAC.



3. GDAC Functions

INCOIS is not operating as a GDAC.

4. Regional Centre Functions

- Continued acquisition of Argo data from GDAC corresponding to floats other than deployed by India and made them available on INCOIS web site.
- Delayed Mode Quality Control (Refer 2.0 above)
- Data from the Indian Ocean regions are gridded into 1x1 box for monthly and 10 days and monthly intervals using Variational Analysis (DIVA) and Objective Analysis. These gridded data sets are made available through INCOIS Live Access Server (ILAS). Users can view and download data/images in their desired format.
- ERDDAP site was set up for the data and data products derived from Argo floats.
- Data Sets (CTD, XBT, Subsurface Moorings) are being acquired from many principle investigators. The CTD data are being utilized for quality control of Argo profiles.
- Value added products:

  Products are currently being made available to various user from INCOIS web site. They are:

  (i) Time series plots corresponding to each float (only for Indian floats).

  (ii) Spatial plots using the objectively analysed from all the Argo floats data deployed in the Indian Ocean.

  These valued added products can be obtained from the following link http://www.incois.gov.in/Incois/argo/products/argo_frames.html

- Regional Co-ordination for Argo floats deployment plan for Indian Ocean. Coordinating the deployment of floats based on the density maps. These maps are generated before cruise beginning and possible regions with low density are targeted for deployment provided they are with in the regions of planned cruises.

Publications:

INCOIS is actively involved in utilization of Argo data in various studies pertaining to Indian Ocean. Also INCOIS is encouraging utilization of Argo data by various universities by funding them. Some of the publications resulted from Argo data which includes scientists from INCOIS are given below:

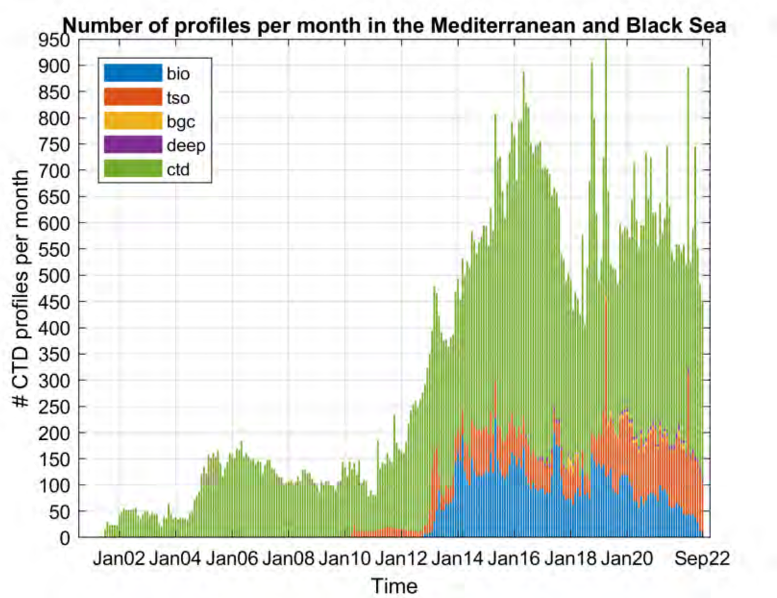
1. Aparna, A. R., and M. S. Girishkumar (2022), Mixed layer heat budget in the eastern equatorial Indian Ocean during the two consecutive positive Indian Ocean dipole events in 2018 and 2019, Climate Dynamics, 58(11), 3297-3315, doi: https://doi.org/10.1007/s00382-021-06099-8.
2. Chacko, N., and C. Jayaram (2022), Response of the Bay of Bengal to super cyclone Amphan examined using synergistic satellite and in-situ observations, Oceanologia, 64(1), 131-144, doi: https://doi.org/10.1016/j.oceano.2021.09.006.
3. Cheriyan, E., A. R. Rao, and K. V. Sanilkumar (2022), Response of sea surface temperature, chlorophyll and particulate organic carbon to a tropical cyclonic storm over the Arabian Sea, Southwest India, Dynamics of Atmospheres and Oceans, 97, 101287, doi: https://doi.org/10.1016/j.dynatmoce.2022.101287.

4. Girishkumar, M. S. (2022), Surface chlorophyll blooms in the Southern Bay of Bengal during the extreme positive Indian Ocean dipole, Climate Dynamics, 59(5), 1505-1519, doi: https://doi.org/10.1007/s00382-021-06050-x.
5. Jyothi, L., S. Joseph, S. P, M. Huber, and L. A. Joseph (2022), Distinct Oceanic Responses at Rapidly Intensified and Weakened Regimes of Tropical Cyclone Ockhi (2017), Journal of Geophysical Research: Oceans, 127(6), e2021JC018212, doi: https://doi.org/10.1029/2021JC018212.
6. Mandal, S., R. D. Susanto, and B. Ramakrishnan (2022), On Investigating the Dynamical Factors Modulating Surface Chlorophyll-a Variability along the South Java Coast, Remote Sensing, 14(7), 1745, doi: https://doi.org/10.3390/rs14071745.
7. Panda, S. K., A. K. Mandal, B. P. Shukla, N. Jaiswal, C. M. Kishtawal, and A. K. Varma (2022), A study of rapid intensification of tropical cyclone Ockhi using C-band polarimetric radar, Meteorology and Atmospheric Physics, 134(5), 86, doi: https://doi.org/10.1007/s00703-022-00921-6.
8. Patel, S., M. Vithalpura, S. K. Mallick, and S. Ratheesh (2022), Impact of Initial and Boundary Conditions on Coupled Model Simulations for Bay of Bengal, Mar. Geod., 45(2), 166-193, doi: https://doi.org/10.1080/01490419.2021.2006376.
9. Prakash, P., S. Prakash, M. Ravichandran, N. A. Kumar, and T. V. S. U. Bhaskar (2022), On anomalously high sub-surface dissolved oxygen in the Indian sector of the Southern Ocean, J. Oceanogr., 78(5), 369-380, doi: https://doi.org/10.1007/s10872- 022-00644-7.
10. Prasad, S. J., T. M. B. Nair, S. Joseph, and P. C. Mohanty (2022), Simulating the spatial and temporal distribution of oil spill over the coral reef environs along the southeast coast of Mauritius: A case study on MV Wakashio vessel wreckage, August 2020, Journal of Earth System Science, 131(1), 42, doi: https://doi.org/10.1007/s12040-021-01791-z.
11. Pravallika, M. S., S. Vasavi, and S. P. Vighneshwar (2022), Prediction of temperature anomaly in Indian Ocean based on autoregressive long short-term memory neural network, Neural Computing and Applications, 34(10), 7537-7545, doi: https://doi.org/10.1007/s00521-021-06878-8.
12. Seelanki, V., T. Nigam, and V. Pant (2022), Inconsistent response of biophysical characteristics in the western Bay of Bengal associated with positive Indian Ocean dipole, Oceanologia, 64(4), 595-614, doi: https://doi.org/10.1016/j.oceano.2022.04.003.
13. Sen, R., S. Pandey, S. Dandapat, P. A. Francis, and A. Chakraborty (2022), A numerical study on seasonal transport variability of the North Indian Ocean boundary currents using Regional Ocean Modeling System (ROMS), J. Oper. Oceanogr., 15(1), 32-51, doi: https://doi.org/10.1080/1755876X.2020.1846266.
14. Singh, V. K., and M. K. Roxy (2022), A review of ocean-atmosphere interactions during tropical cyclones in the north Indian Ocean, Earth-Science Reviews, 226, 103967, doi: https://doi.org/10.1016/j.earscirev.2022.103967.
15. Sridevi, B., and V. V. S. S. Sarma (2022), Enhanced Atmospheric Pollutants Strengthened Winter Convective Mixing and Phytoplankton Blooms in the Northern Arabian Sea, Journal of Geophysical Research: Biogeosciences, 127(10), e2021JG006527, doi: h ttps://doi.org/10.1029/2021JG006527.
16. Valsala, V., A. G. Prajeesh, and S. Singh (2022), Numerical Investigation of Tropical Indian Ocean Barrier Layer Variability, Journal of Geophysical Research: Oceans, 127(10), e2022JC018637, doi: https://doi.org/10.1029/2022JC018637.

1. Real Time Status

- Data acquired from floats

More than 86400 Argo profiles were acquired in the Mediterranean and in Black Seas between 2000 and October 2022. The temporal and spatial distribution of these profiles is depicted in Figure 1, sorted by the different float types used (Core-Argo, Core-Argo with DO, Bio-Argo, Deep-Argo and BGC-Argo [equipped with sensors to measure the 6 EOVs]); the monthly and yearly distribution is shown in Figure 2. More than 70 floats per month have been operated simultaneously in the basins in 2022 and more than 5500 profiles have been acquired (up to October 2022) by different float models (Figure 3).



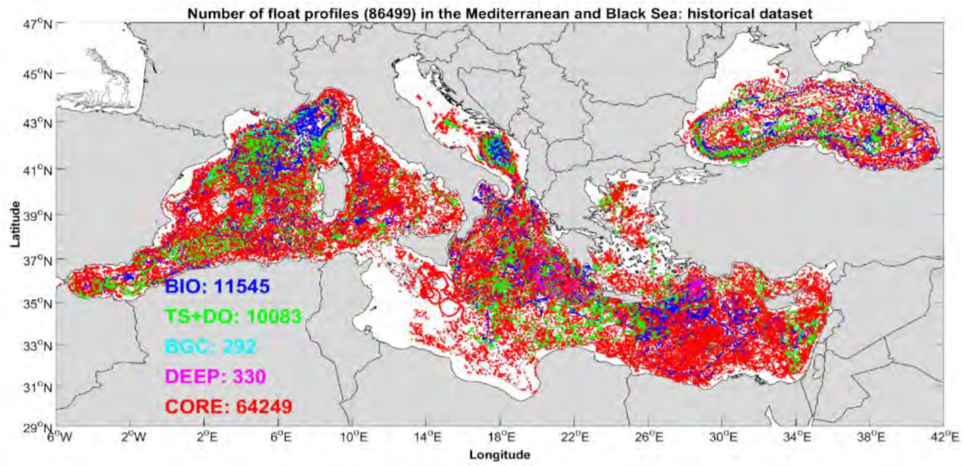


Figure 1. Temporal (upper panel) and spatial (bottom panel) distribution of float profiles in the Mediterranean and Black Sea between 2000 and October 2022.

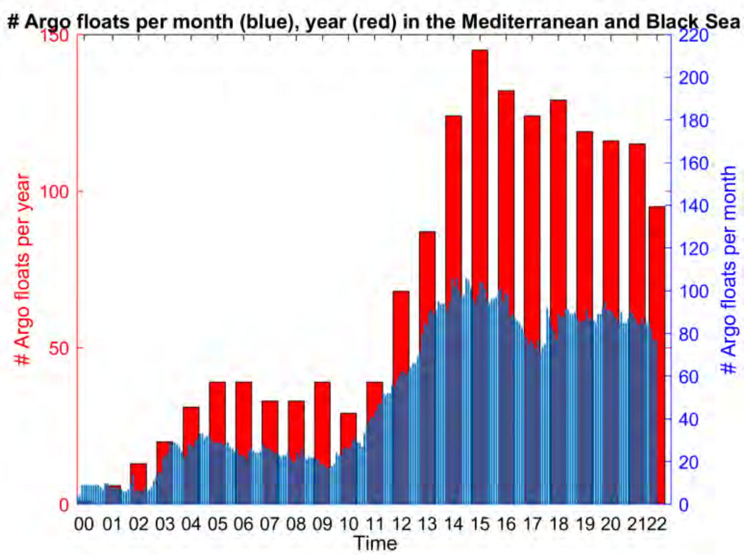


Figure 2. Monthly (blue bars) and yearly (red bars) distribution of Argo floats in the Mediterranean and Black Sea between 2000 and October 2022.

The number of profiles acquired by Argo-extension floats in 2022 is about 1600 whilst the ones collected by the core-Argo floats are about 4000 (Figure 3). EU, Spain, Greece, France, Bulgaria and Italy contributed to maintain/increase the Argo population in 2022: a total of 14 new floats have been deployed both in the Mediterranean and in the Black Seas; 10 out of 14 platforms are core-Argo, 4 are core-Argo with DO. In addition, Greece plans to deploy 3 TS and Italy 6 floats (3 core, 2 Bio, 1 Deep) in the Mediterranean Sea at the end of 2022. The deployment strategy was chosen according to the project's targets and to replace dead floats or under-sampled areas.

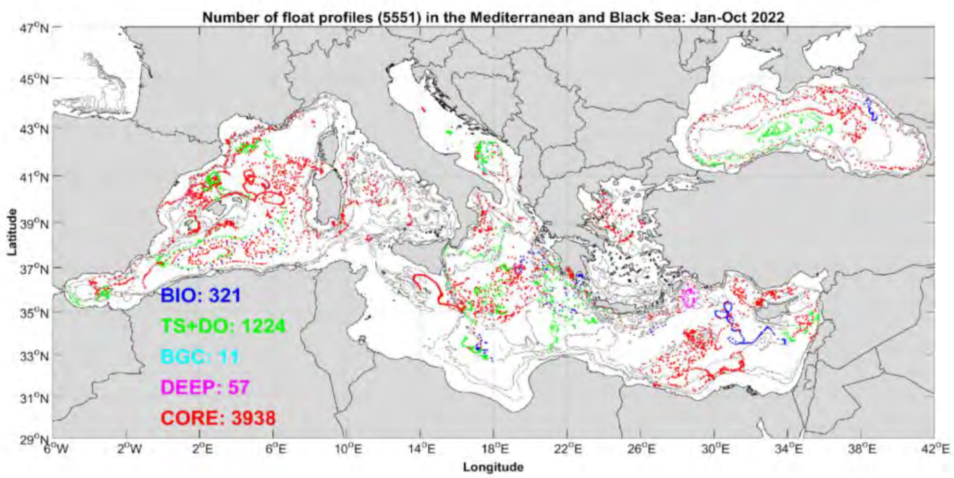


Figure 3. Spatial distribution of profiles collected by Argo floats in 2022 (January-October) in the Mediterranean and Black Sea: locations are color-coded per float type.

Statistics have been computed to assess the fleet performance. The survival rate diagrams produced are separated by transmission mode (figure 4). The maximum operating life is more than 500 cycles, whilst the mean half-life is about 150 cycles (figure 4a). In this computation, active floats with life lower than the mean half-life and recovered floats were excluded (about 20). The vertical distance (upward profiles) traveled by floats is computed and used as an indicator of the profiler performance (figure 4b). The maximal distance observed is about 550 km, whilst the mean distance traveled is about 125 km. The balance of the population is in figure 5a and the annual death rate in figure 5b.

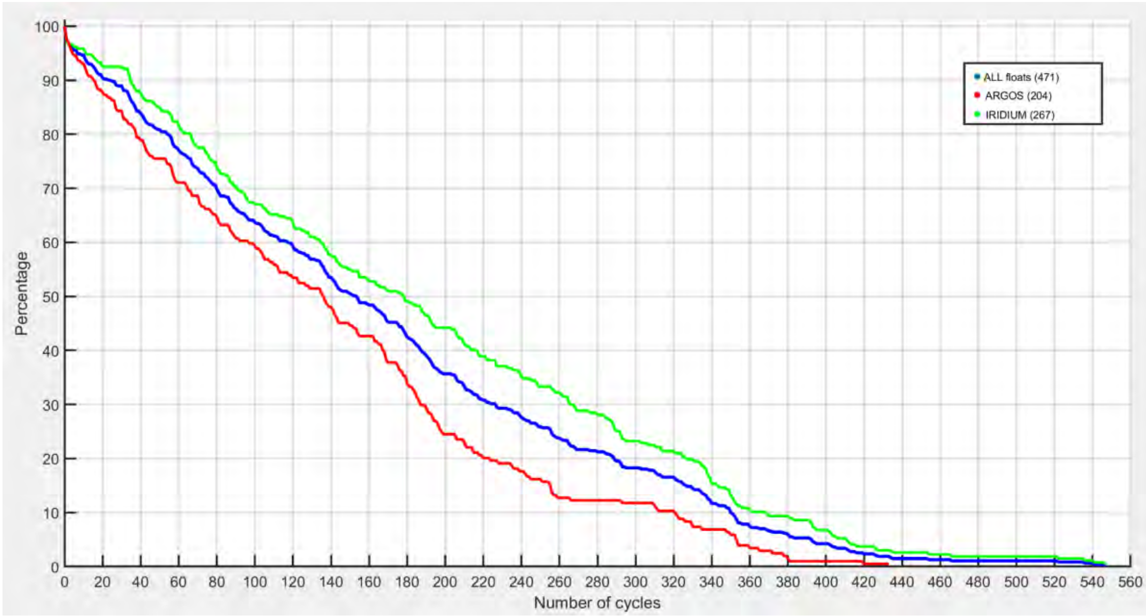


Figure 4a. Survival rate diagrams separated by telemetry system.

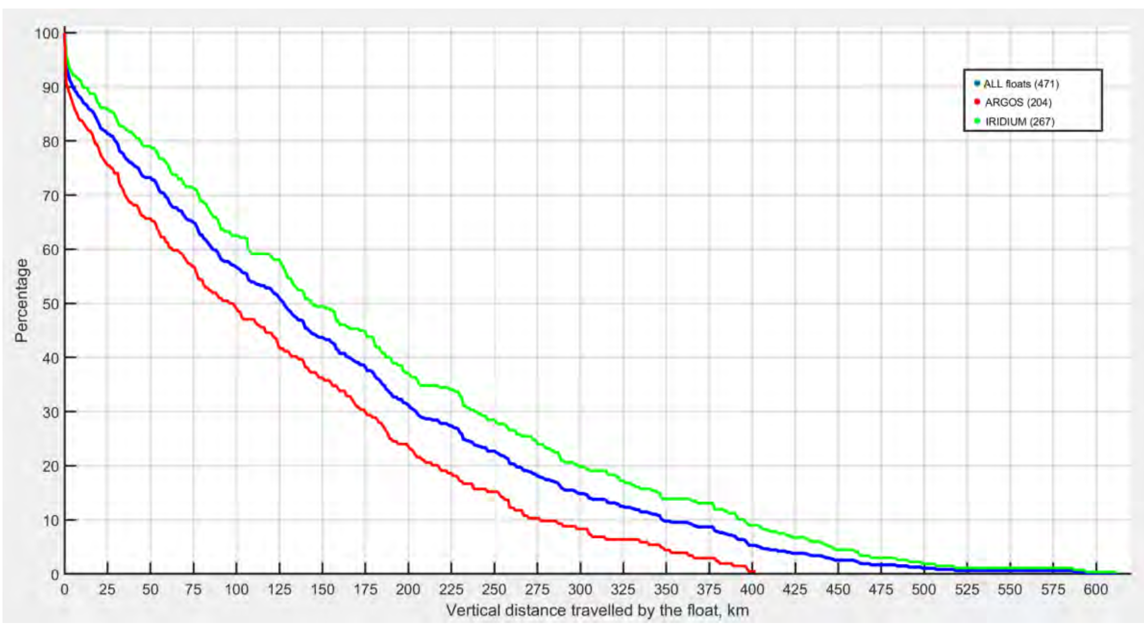


Figure 4b. Diagram of the vertical distance traveled floats, separated by telemetry system.

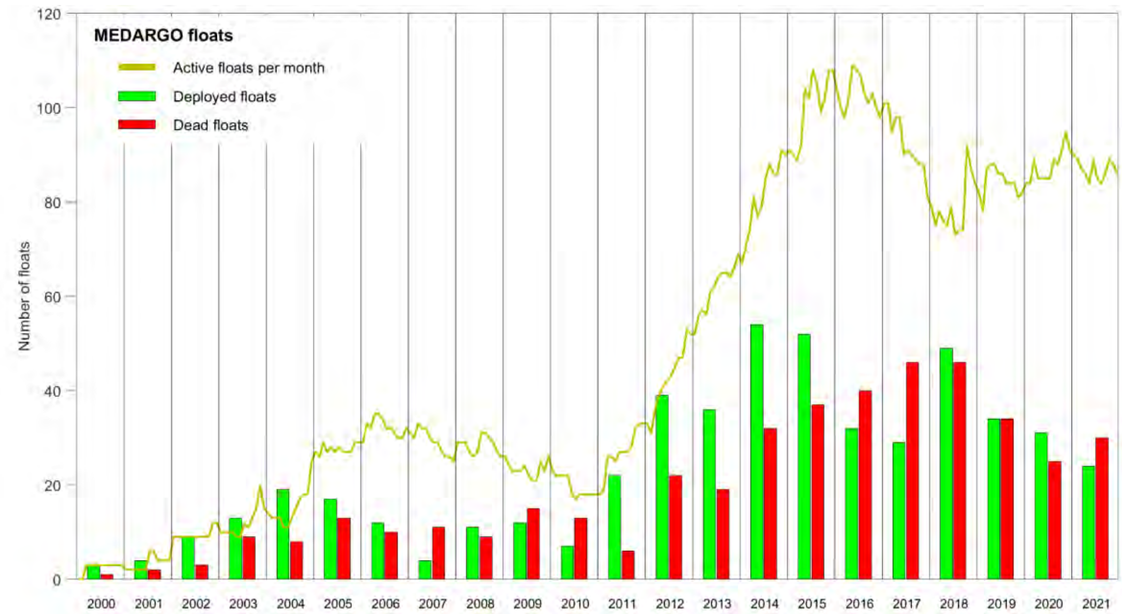


Figure 5a. Balance of the population (rate of population change related to the number of yearly deployments and dead floats).

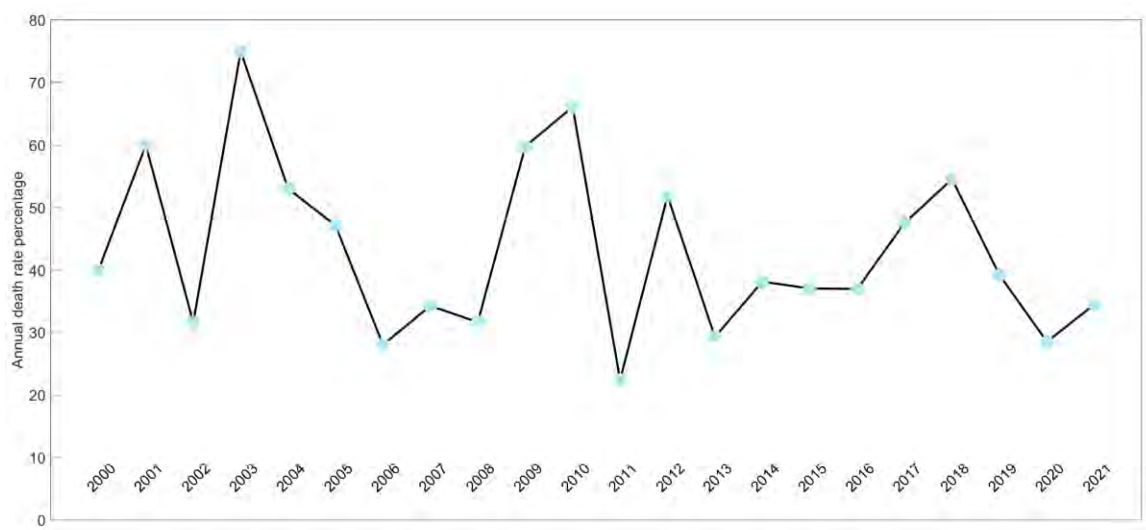


Figure 5b. Annual death rate (ration between yearly failure and yearly average population).

- Delayed mode data sent to GDACs

Most of the eligible floats were quality controlled in delayed-mode for salinity, temperature and surface pressure and the respective D-files were gradually sent to GDAC. The DMQC method was applied to approximately 76% of eligible floats deployed between 2003 and 2021 in the Mediterranean and Black Seas (figures 6 and 7). 10% out of this percentage were quality controlled but the D-files were not sent to GDAC yet. This percentage includes analysis that has to be repeated due to problems related to the reference dataset or in the data itself, shallow floats. The DMQC report/info of each float can be downloaded by the MedArgo web page (http://argo.ogs.it/medargo/table_out.php).

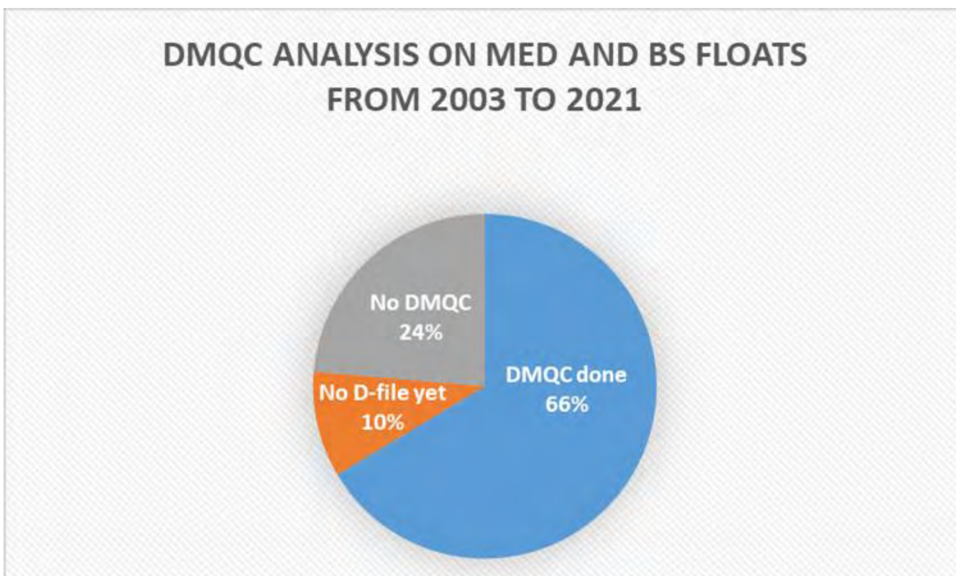


Figure 6. DMQC status.

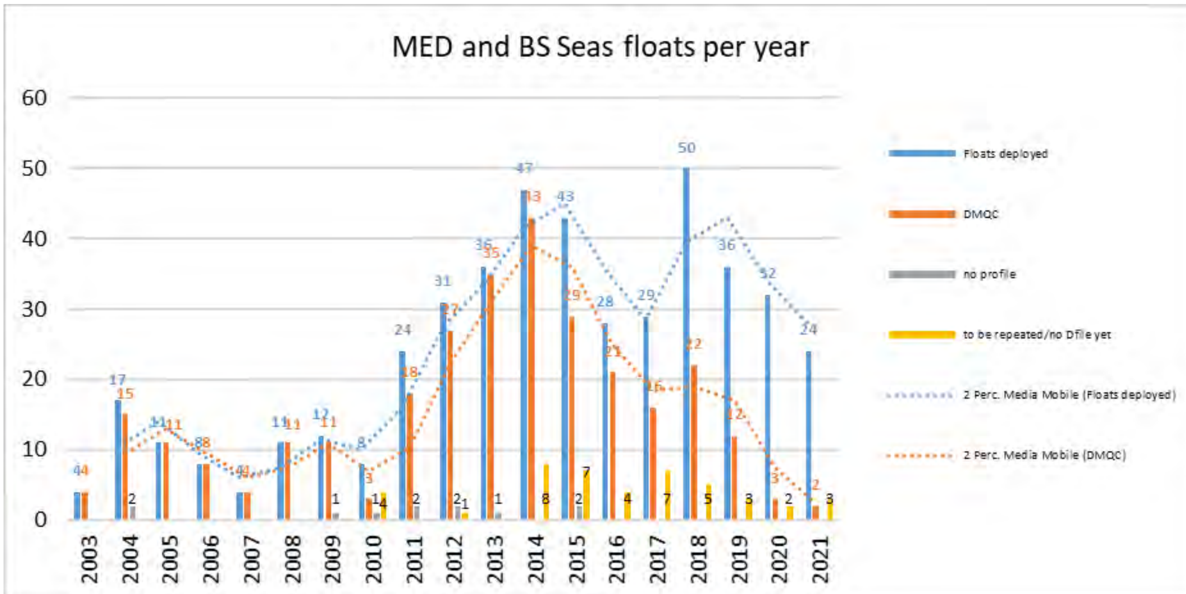


Figure 7. DMQC status per year.

2. Delayed Mode QC status

OGS performed the DMQC activity for the Argo data in the Mediterranean and Black Seas. The OW method in conjunction with other procedures is adopted to conduct the quality control analysis for the salinity data.

- To solve the problem that occurs when different vertical sampling is used, the procedure that creates OWC source has been improved. The modified procedure has been published on github: https://github.com/euroargodev/dm_floats/tree/master/src.
- A new OWC plot is under construction: it is a map in which the float trajectory and all possible climatological data inside the fixed spatial and temporal scales are shown (figure 8). The OWC method can lead to misleading results in the Med and BS when the reference dataset is very old. This new plot wants to give an idea of the age of the climatological dataset when compared to the float profiles and see if the time difference between the two datasets is within the temporal scale set for OWC.

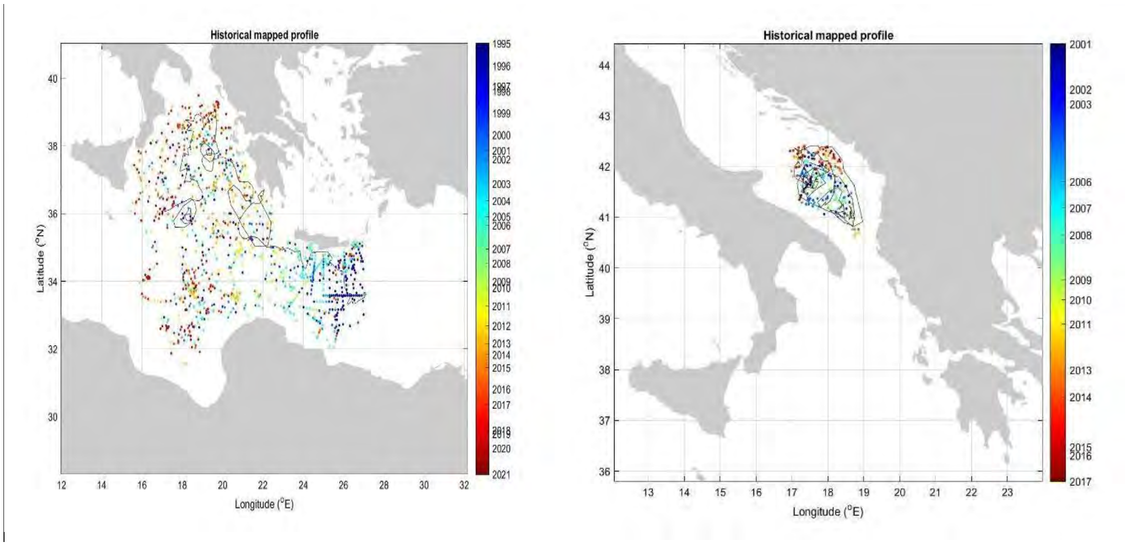


Figure 8. Two examples of a new OWC plot. On the left WMO 6903765 float deployed on 25/10/2019, on the right WMO 6903799 float deployed on 25/04/2021.

- The DMQC analysis has been conducted also on the deep floats deployed in the Mediterranean Sea. CPcor corrections have been applied and compared. The optimal CPcor value obtained has been reported in a shared spreadsheet (https://docs.google.com/spreadsheets/d/1ai1I0gzyHHRv_n6t2M3BMWVBp1F9XO4L2XB1YhBni9U/edit?usp=sharing). OWC and additional qualitative analysis were applied to evaluate any potential sensor drift. An example of DMQC analysis of deep floats was published on github: (https://github.com/euroargodev/dmqc_deep_examples/tree/main/Mediterranean Sea). OGS will continue to implement delayed mode procedures for adjusting salinity data from Deep-Argo floats with the SBE CTDs in MED Sea, selecting the CPcor correction that provides the best result.

- The high-quality ship-based CTD reference data from the near-surface to depths more than 2000 m, for QC purposes of Core and Deep-Argo float data in the Mediterranean and Black seas, was reviewed and improved (figures 9 and 10). Data was collected from several research institutes at regional level and the main European Marine Services. Data was converted in mat format to be used in OWC procedure. A quality control was applied such as an additional visual check to avoid spike or duplication. Data was merged and divided in subsets of WMO boxes according to the climatological areas of the Mediterranean Sea. The updated reference dataset consists of about 66800 CTD profiles. Due to a more detailed quality control and the exclusion of profiles in the first 80 dbar (especially in the Adriatic sub basin), there are less CTD profiles compared to the previous one. This resulted in a good spatial distribution with more recent/contemporaneous data. In order to obtain an even more accurate reference dataset, the procedure developed at BSH is being adapted to marginal seas to find errors, suspicious data, large time gaps, etc.

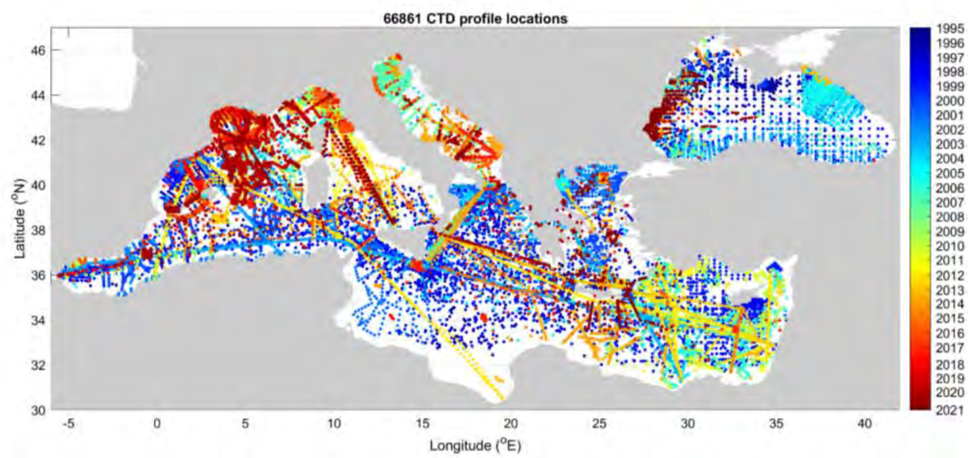


Figure 9. Spatial distribution, color-coded for time, of the CTD profiles in the final version of the CTD reference dataset of the Mediterranean and Black Seas.

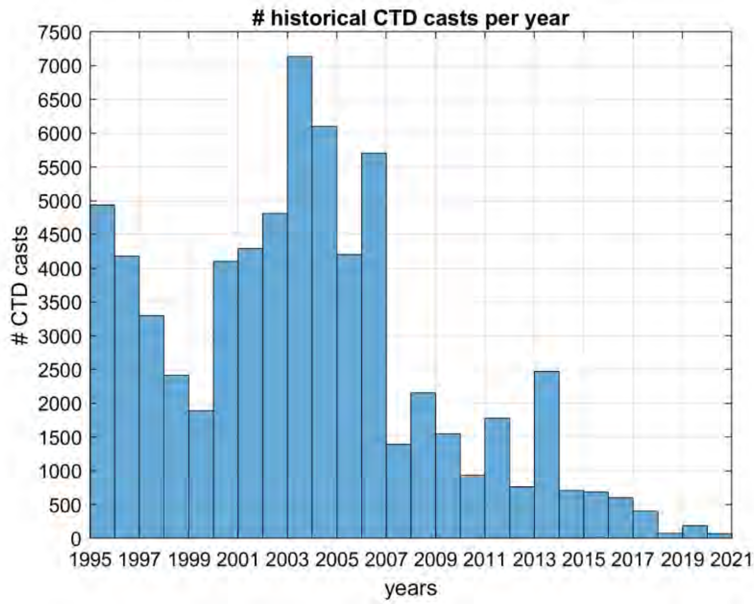


Figure 10. Temporal distribution of the CTD profiles in the final version of the CTD reference dataset of the Mediterranean and Black Seas.

3. Value Added items

- List of current national Argo web pages, especially data specific ones

The MedArgo web page new address is http://argo.ogs.it/medargo/). Tables and graphics are updated in near real time. The floats deployed during 2022 have been added to the web page as soon as the technical information is available. The float positions are plotted daily (Figure 11); the monthly and the whole trajectories are also provided. Links with the Euro-Argo data selection tools and GDAC center (Coriolis) are also available for downloading both the real-time and delayed-mode float profiles.

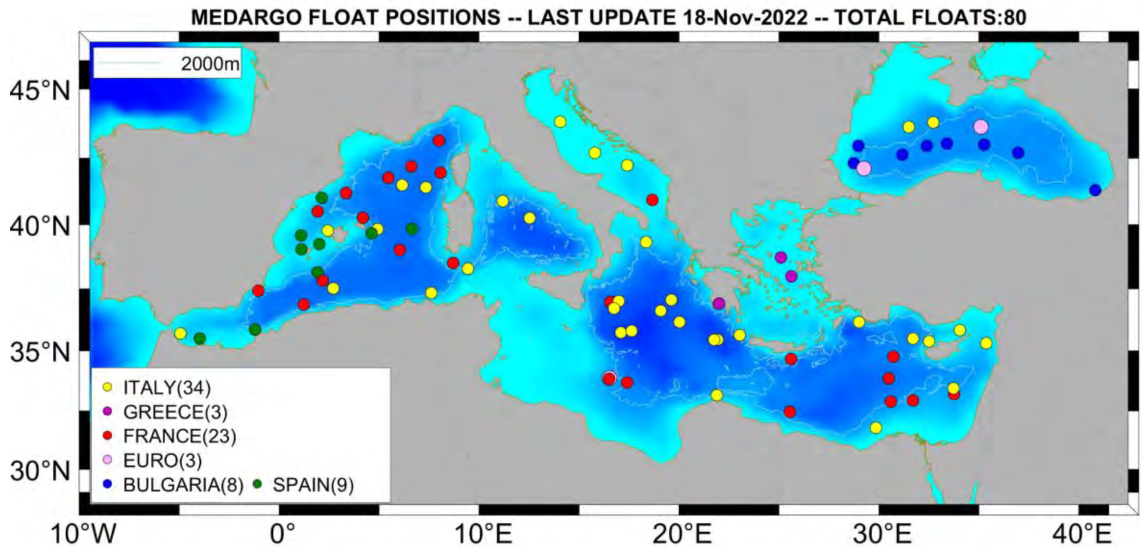


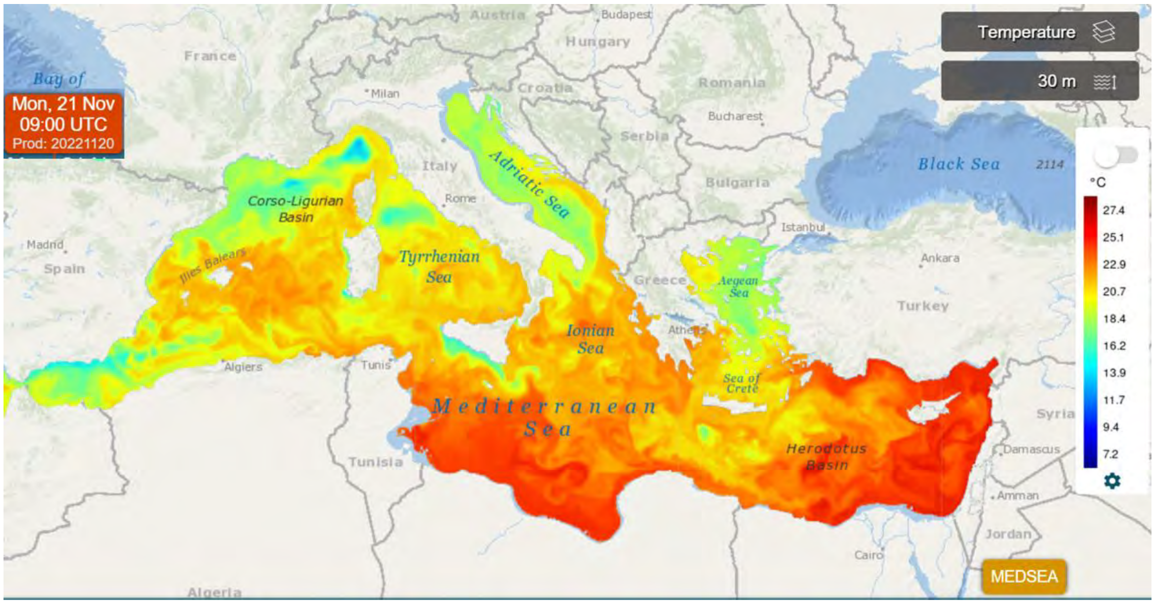
Figure 11. MedArgo float positions as of 18 November 2022 (updated daily).

- Products generated from Argo data that can be shared

a. Daily maps of float positions (Figure 11)

b. Monthly maps of float positions and track

c. Physical and Biogeochemical Argo float data are assimilated in numerical forecasting models by CMCC and OGS; 3D daily maps of Mediterranean ocean forecasting systems are produced and available on CMEMS (Figure 12).



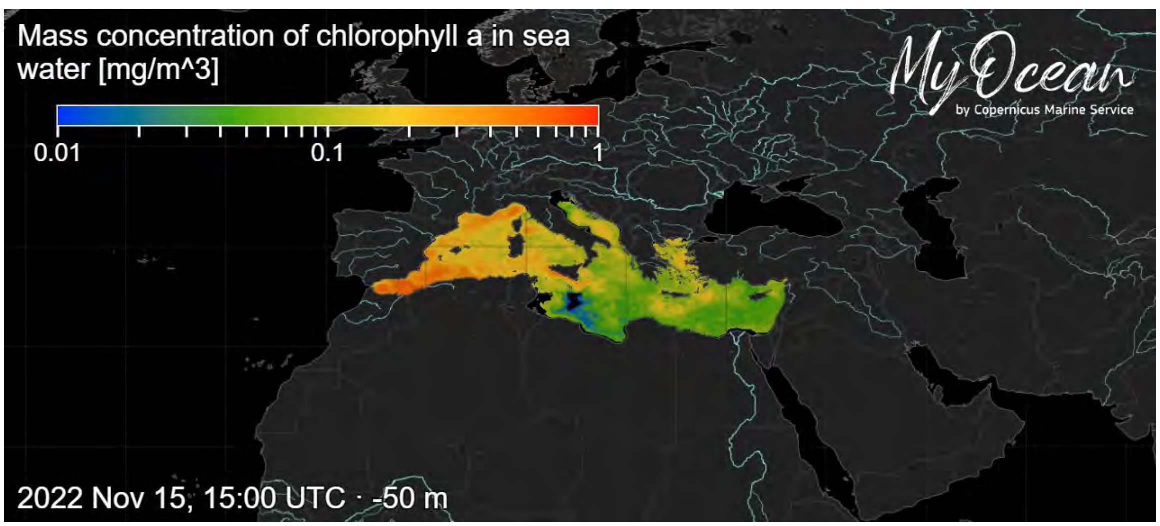


Figure 12. Forecasting models' products available on CMEMS. Physical (top) and biogeochemical (bottom) products.

d. An operational validation system has been developed by SOCIB to systematically assess the model outputs at daily, monthly and seasonal time scales. Multi-platform observations including in-situ measurements (Argo floats included) are used for this systematic validation (figure 13).

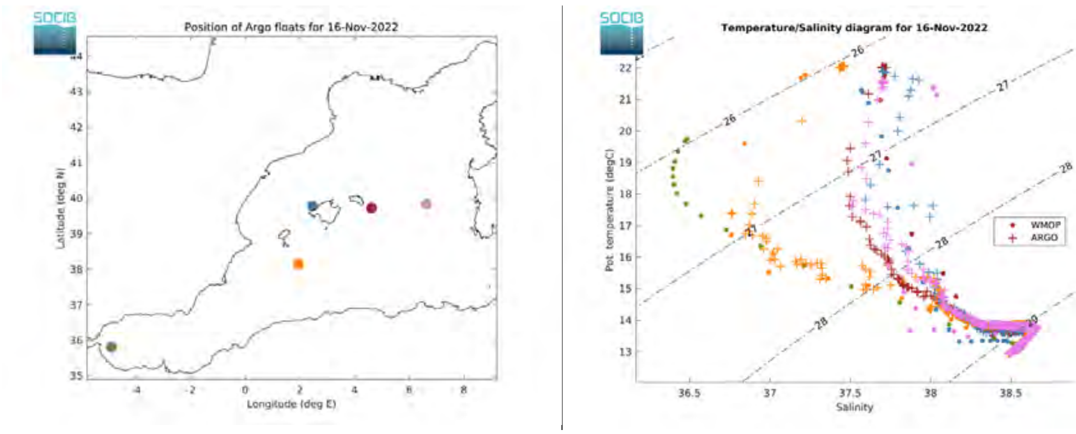


Figure 13. The WMOP temperature and salinity vertical profiles are compared to the last available vertical profiles from Argo floats.

4. Regional Centre Functions

✓ MedArgo is the Argo Regional Centre for the Mediterranean and the Black Sea. OGS, who coordinates the MedArgo activities, established several collaborations with European and non-European countries in order to set the planning and the deployment coordination of floats. Hence, a good coverage is maintained throughout the years. As part of these cooperations, the float data are transferred in near real time to MedArgo and 14 new floats have been deployed in the Mediterranean and Black Sea during 2022, through a coordinated activity of deployment opportunities and thanks to scientific projects. More floats (3 core, 3 TS+DO, 2 Bio, 1 Deep) will be deployed before the end of 2022.

✓ There are 68 active Argo floats in the Mediterranean Sea and 12 in the Black Sea as of 18 November 2022.

✓ The main MedArgo partners (Italy, Greece, Spain, France and Bulgaria) strengthened collaborations with the riparian countries through the H2020 Euro-Argo RISE project, to improve the Argo activities (deployment plans and opportunities, sharing reference datasets for QC, sharing expertise, joint activities). Furthermore, in the framework of this project, extension of Argo operations in shallow/coastal waters is ongoing.

✓ The high-quality CTD reference dataset for DMQC has been improved and updated.

✓ The D-files of 66% of the eligible profiles (core variables) have been submitted to the GDAC.

Future plans:

- ➢ Maintain > 60 active floats, with ~25% BGC and Bio
- ➢ Maintain 2 deep floats in deep Ionian & Rhodes Gyre area
- ➢ Maintain > 10 active floats, with ~20% Bio & TS DO

6. Other Issues

- ➢ Bio/BGC profiles are decreasing
- ➢ In the Black Sea deployments are delayed due to the war in the area

Argo National Data Management Report - Japan

1. Real Time Status

The Japan DAC, the Japan Meteorological Agency (JMA), has processed data from 1884 Japanese Argo and Argo-equivalent floats including 116 BGC floats, 58 Deep floats and 9 RBR CTD floats, of which 201 are active floats (red dots in Fig. 1) including 16 BGC floats, 15 Deep floats and 9 RBR CTD floats, as of November 25th, 2022. There are 11 Japanese PIs who agreed to provide data to the international Argo data management. The DAC is acquiring ARGOS messages from CLS and getting IRIDIUM messages via e-mail and WebDAV server in real-time, thanks to the understanding and the cooperation of PIs. Almost all profiles from those floats are transmitted to GDACs in the netCDF format and issued to GTS using BUFR codes after real-time QC on an operational basis.

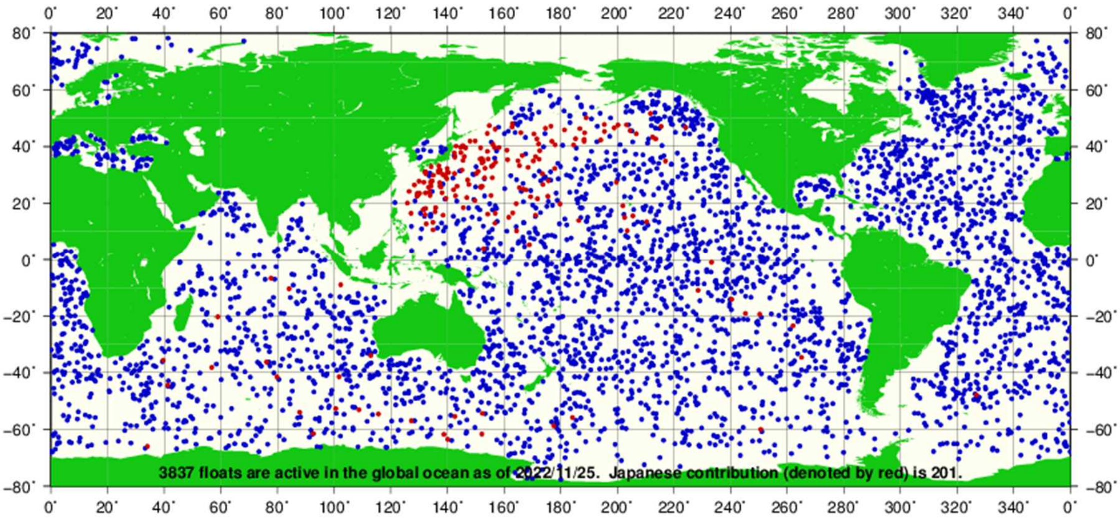


Fig. 1 Active floats (blue and red dots) on November 25th, 2022. Red dots denote floats released by Japanese PIs.

JMA and JAMSTEC have converted the meta-, prof-, tech-, and traj-files of Japanese floats, including APEX, DeepAPEX, PROVOR, ARVOR, NEMO, NOVA, Navis, NINJA, DeepNINJA and S2A. JMA and JAMSTEC have converted most all of Japanese meta-files from v2 to v3.1 and submitted them to GDAC. JMA has converted almost all of Japanese tech-files and submitted them to GDAC. Accordingly, JMA has converted the Rprof-files of Japanese ARGOS floats, except floats with NST sampling scheme and Iridium floats. JAMSTEC has converted all v2 Dprof-files of Japanese floats to v3.1 and submitted them to GDAC. JMA has converted about 30% of Japanese traj-files from v2 to v3.1 and submitted them to GDAC.
JMA has made meta-, tech-, traj-, and Rprof-files v3.1 of the almost all of floats newly deployed since March 2016 and JAMSTEC has made meta-files in v3.1 of JAMSTEC's floats newly deployed since October 2015. JAMSTEC has made Dprof-files in v3.1 since January 2016.

JMA decodes all the variables of active BGC floats of Japan. Now, JMA has been developing RTQC for each BGC parameter and implemented RTQC for DOXY and DOXY adjustments using WOA in August 2022. We plan to introduce RTQC and adjustments for other BGC parameters as well.

Due to a network security incident occurred at JAMSTEC in mid-March 2021, JAMSTEC's servers could not connect to the internet, and JAMSTEC was temporarily unable to send the raw data files of its Iridium communication floats to JMA. The internet connection of JAMSTEC has been completely restored, so that JAMSTEC has restarted sending the raw data files of the target floats to JMA in real time since August 2022. Therefore, JMA has recovered the Rprof-/BRprof-files and traj-files of JAMSTEC's floats within 24 hours of delivery to GDAC.

2. Delayed Mode QC Status

JAMSTEC has done the DMQC for all Japanese floats. JAMSTEC has submitted the delayed mode files of 200,085 profiles to GDACs as of November 25th, 2022. JAMSTEC has submitted 18,517 core delayed mode files (Core-D files) to GDACs through the Japan DAC, JMA, from November 20th, 2021, to November 25th, 2022. JAMSTEC is also re-checking the contents of the D-files and resubmitting 7,300 Core-D files during the period, based on the results of our check and the results of Dr. Annie Wong's audit of the Core-D files.
The procedure of DMQC in JAMSTEC is as follows.

(JAMSTEC floats and the most of Argo-equivalent floats)

5. (within 10days) data re-acquisition from CLS, bit-error repair (if possible), real-time processing, position QC, visual QC
2. (within 180days) surface pressure offset correction, cell TM correction (Apex only)
3. (after 180days) WJO and OW salinity correction, the definitive judgement by experts, D-netCDF file making

(Argo-equivalent floats that had ceased by 2007)

JMA executes real-time processing again by using the latest procedure. The procedure after real-time processing is executed by JAMSTEC according to the procedure describe above.

The OW software is mainly operated instead of WJO. The calculation result of OW has been used at the definitive judgment. The result OW has been used just for reference.

JAMSTEC has adjusted salinity data of Deep floats by using optimal Cpcor for each Deep float. When our Deep float is launched, shipboard-CTD observation is often performed. Therefore, for the optimal Cpcor for each Deep float is estimated by comparing its first profile with shipboard-CTD data at its deployment.

And, JAMSTEC has started performing delayed mode QC for our BGC floats. We are now preparing to processing programs for DOXY-DMQC. We are also testing whether Nitrate and pH observed by our BGC floats in the North Pacific are corrected well by SAGE. We aim to start to release D-mode DOXY Adjusted of our BGC floats to GDAC in next spring.

3. Value Added items

・List of current national Argo web pages:

Japan Argo

https://www.jamstec.go.jp/J-ARGO/?lang=en

This site is the portal of Japan Argo program. The outline of Japanese approach on the Argo program, the list of the publication, and the link to the database site and PIs, etc. are being offered. The website restarted its service in August 2022, although it has been currently unavailable since mid-March 2021 due to a network security incident at JAMSTEC as described in the previous subsection.

Real-time Database (JMA)

https://www.data.jma.go.jp/argo/data/index.html

This site shows global float coverage, global profiles based on GTS BUFR messages, and status of the Japanese floats.

・Statistics of National Argo data usage:

Operational models of JMA

MOVE/MRI.COM-G3 (Multivariate Ocean Variation Estimation System/ Meteorological Research Institute Community Ocean Model – Global 3)

JMA operates the Ocean Data Assimilation System for the monitoring of El Niño Southern Oscillation (ENSO) and for initialization of the seasonal prediction model. The latest version (MOVE/MRI.COM-G3) has been started since February 2022.

For details please visit:
https://www.data.jma.go.jp/tcc/tcc/products/elnino/move_mricom-g3_doc.html

JMA/MRI-CPS3 (JMA/MRI – Coupled Prediction System 3)

JMA operates JMA/MRI-CPS3, which replaced the previous version (JMA/MRI-CGCM2) in February 2022, as a seasonal prediction model and an ENSO prediction model. The oceanic part of this model is identical to the OGCM used for the MOVE/MRI.COM-G3.

For details please visit:
https://www.data.jma.go.jp/tcc/tcc/products/model/outline/cps3_description.html

MOVE/MRI.COM-JPN (Multivariate Ocean Variation Estimation System/ Meteorological Research Institute Community Ocean Model - an operational system for monitoring and forecasting coastal and open ocean states around Japan)

JMA operates MOVE/MRI.COM-JPN, which replaced the previous version (MOVE/MRI.COM-WNP) in October 2020. MOVE/MRI.COM-JPN provides daily, 10day-mean and monthly products of subsurface temperatures and currents for the seas around Japan and North Pacific Ocean.

Other operational models

FRA-ROMSII

FRA-ROMS is the nowcast and forecast system for the Western North Pacific Ocean developed by Japan Fisheries Research and Education Agency (FRA) based on the Regional Ocean Modeling System (ROMS). FRA-ROMS was operated from May 2012 to March 2022. From March 2022, FRA began operating FRA-ROMSII, a new system based on FRA-ROMS with improved model performance in the Japan Sea. The outputs of FRA-ROMS/FRA-ROMSII are used primarily for fisheries resource surveys and are provided every week through the website: https://fra-roms.fra.go.jp/fra-roms/index.html.

・Products generated from Argo data:

Products of JMA

El Niño Monitoring and Outlook / Indian Ocean Dipole Monitoring

JMA issues on a monthly basis an ENSO diagnosis and six-month outlook as well as an IOD analysis on the following website. The outputs (ex. Fig. 2) of the MOVE/MRI.COM-G3 and the JMA/MRI-CPS3 can be found here on the Tokyo Climate Center website;.
https://www.data.jma.go.jp/tcc/tcc/products/elnino/index.html
These products serve as an indispensable basis for the operational seasonal prediction disseminated by JMA and inform National Meteorological Hydrological Services for the purpose of helping them produce their own predictions.

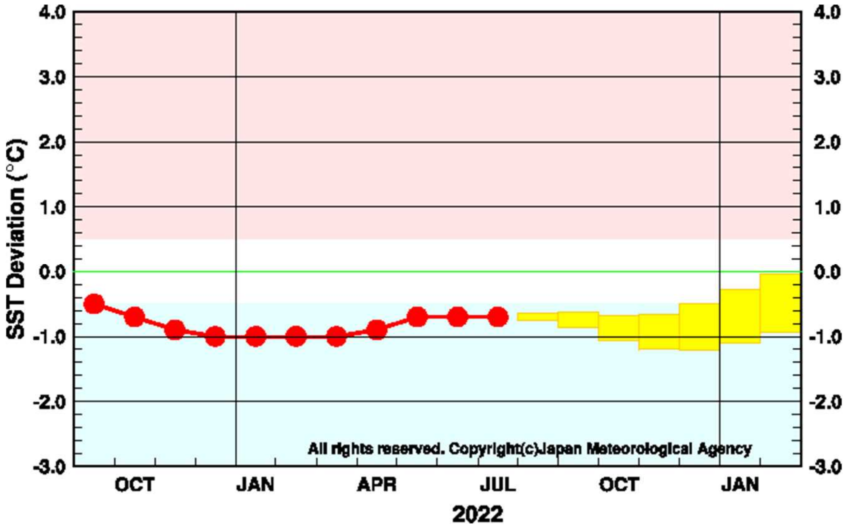


Fig. 2 Five-month running mean of the SST deviation for NINO.3 predicted by JMA's seasonal ensemble prediction system (JMA/MRI-CPS3).
Red dots indicate observed values, and yellow boxes indicate predictions. Each box denotes the range where the value will be included with the probability of 70%.

Subsurface Temperatures and Surface Currents in the seas around Japan

The following parameter outputs of MOVE/MRI.COM-JPN was released in December 2021 and can be found on https://www.data.jma.go.jp/goos/data/database.html. They replace the conventional outputs of MOVE/MRI.COM-WNP, the release of which was stopped in March 2022.

- Daily, 10day-mean and Monthly mean subsurface temperatures at the depths of 50m, 100m, 200m and 400m analyzed for approximately 0.1 x 0.1 degree grid points (ex. Fig. 3).
- Daily and 10day-mean Surface Currents for approximately 0.1 x 0.1 degree grid points.

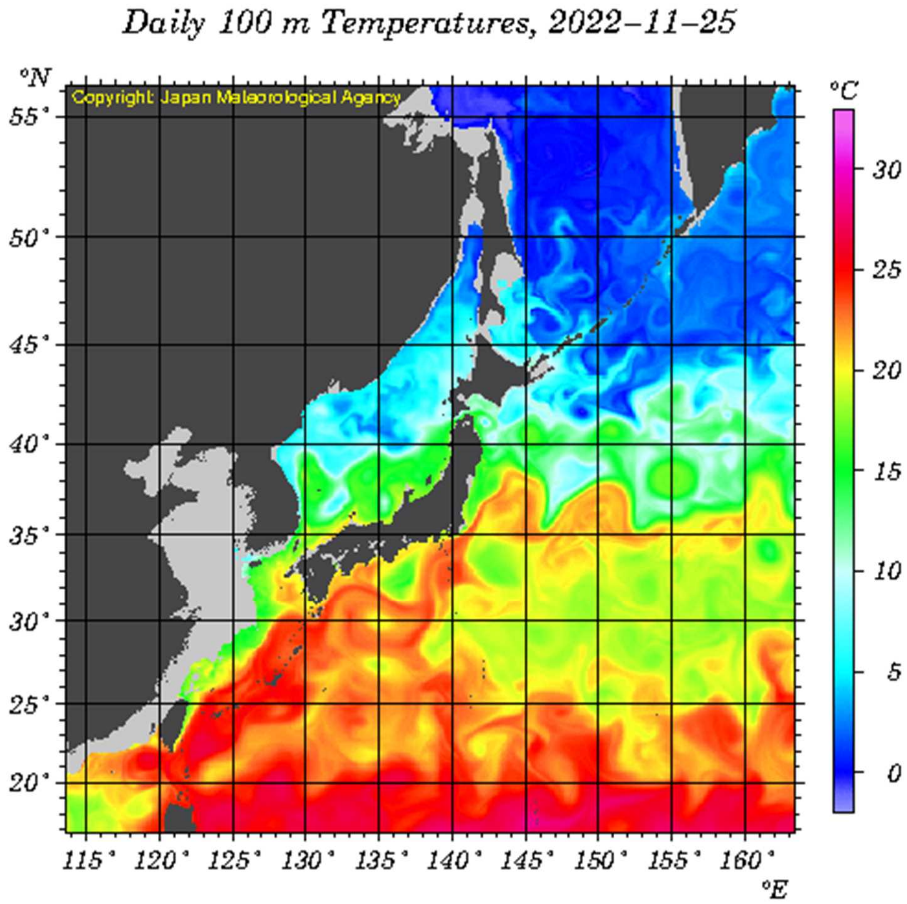


Fig. 3 Daily 100m Sea Temperature around Japan on November 25th, 2022.

Products of JAMSTEC

MOAA GPV (Grid Point Value of the Monthly Objective Analysis using the Argo data)

MOAA GPV is the global GPV data set which was made by monthly OI objective analysis using Argo and TRITON mooring data.
According to abrupt salty drift of CTD sensors on Argo floats that occur more frequently than usual because of a manufacturing problem, JAMSTEC recalculated using the Argo profile data on the latest quality control status at September 17th 2021.
Furthermore, JAMSTEC has released the new dataset mainly delayed mode Argo profile data (hereinafter referred to as Delayed Mode (DM)), in addition to the MOAA GPV mainly using real time QC Argo profile (this version is hereinafter referred to as Near Real Time (NRT)). DM is updated once a year and JAMSTEC will recalculate the dataset for the entire period, using all Argo profile data in GDAC at that time. Therefore, DM uses more delayed mode Argo profile data than NRT.
These data set are released on the following website:
https://www.jamstec.go.jp/argo_research/dataset/moaagpv/moaa_en.html

G-YoMaHa (Objectively mapped velocity data at 1000 dbar derived from trajectories of Argo floats)

JAMSTEC mapped the drift data from Argo floats, YoMaHa'07, at the depth of 1000 dbar on a 1 degree grid, using optimal interpolation analysis. The mapped velocity field satisfies the geostrophic balance and the horizontal boundary condition of no flow through the boundary. The dataset is released on the following website:
https://www.jamstec.go.jp/argo_research/dataset/gyomaha/gyomaha_en.html

MILA GPV (Mixed Layer data set of Argo, Grid Point Value)

JAMSTEC has produced a data set of gridded mixed layer depth with its related parameters, named MILA GPV. This consists of 10-day and monthly average data and monthly climatology data in the global ocean using Argo temperature and salinity profiles.
According to abrupt salty drift of CTD sensors on Argo floats that occur more frequently than usual because of a manufacturing problem, JAMSTEC recalculated using the Argo profile data on the latest quality control status at September 17th 2021.
Furthermore, JAMSTEC has released the new dataset mainly delayed mode Argo profile data (hereinafter referred to as Delayed Mode (DM)), in addition to the MILA GPV mainly using real time QC Argo profile (this version is hereinafter referred to as Near Real Time (NRT)). DM is updated once a year and JAMSTEC will recalculate the dataset for the entire period, using all Argo profile data in GDAC at that time. Therefore, DM uses more delayed mode Argo profile data than NRT.
These data set are released on the following website:
https://www.jamstec.go.jp/argo_research/dataset/milagpv/mila_en.html

AQC Argo Data version 1.2

JAMSTEC has produced the Argo temperature and salinity profile data put through more advanced automatic checks than real-time quality controls every month. This data set has been provided in the ascii formation as well as the netcdf format, because it is useful for analyses using various software. This dataset are released on the following website:
https://www.jamstec.go.jp/argo_research/dataset/aqc/aqc_en.html

Scientifically quality-controlled profile data of Deep NINJA observations

JAMSTEC has released a product of a quality-controlled data set of Deep NINJA observations for convenient use on scientific/educational purposes. The quality-control was led by JAMSTEC on the basis of mainly comparisons with highly accurate shipboard CTD observations at float deployments. Its detailed information has been provided on the following website:

https://www.jamstec.go.jp/argo_research/dataset/deepninja/dn_en.html

ESTOC

This product is an integrated dataset of ocean observations including Argo data by using a for dimensional variational (4D-VAR) data assimilation approach. ESTOC is the open data that consists of not only physical but also biogeochemical parameters for 60 years during 1957-2016 (See the website in JAMSTEC, https://www.godac.jamstec.go.jp/estoc/e/).

JCOPE (Japan Coastal Ocean Predictability Experiment)

JCOPE is a research project for prediction of the oceanic variation using ocean models with assimilation of remote-sensing and in-situ data, which is managed by JAMSTEC. In 2019, JCOPE2M, which is updated version of JCOPE2/FRA-JCOPE2 reanalysis covering the Northwestern Pacific, was released. The Argo data are used by way of GTSPP. The hindcast data 6 months back and the forecast data 3 months ahead are disclosed on the following website: https://www.jamstec.go.jp/jcope/htdocs/home.html.
More information is shown in
https://www.jamstec.go.jp/jcope/htdocs/e/distribution/index.html.
In 2022, JCOPE-FGO, a reanalysis product covering a quasi-global ocean, was released:
https://www.jamstec.go.jp/jcope/htdocs/e/distribution/fgo.html.

・Publicly available software tools to access or qc Argo data:

Decoding Program Creation Support Tool (DPCST)

JAMSTEC has developed the decoding program creation support tool for APEX and Navis, by making use of our experience in creating decoding programs for various types of floats. It often happens that the data format of the same type of float is slightly different developing on the year of purchase. If you are not familiar with the data format of the float, it takes some time to find a different place between those data formats. Then, this tool can help you find differences by comparing the data formats of previously purchased same type floats with newly purchased same type floats. It outputs a list of them names in the transmission data file of the newly purchased float, with information whether or not each item name exists in the transmission data file of same type floats where were already launched. Furthermore, for the items that do not exist, this tool searches for items that are close to the item names in the transmission data file of same type floats that were already launched, by using Jaro-Winkle Distance method. Jaro-Winkler Distance method can quantify the similarity of character strings. Therefore, this tool helps DACs and PIs to find parts of our decoding program which should be modified and it contributes to shortening the time required to build a decoding program. This tool is released at GitHub: https://github.com/argojamstec/ArgofloatChecker.

4. Regional Centre Functions

JAMSTEC has operated PARC since 2019, although PARC was operated in cooperation with IPRC due to limited resources in IPRC. However, IPRC (APDRC) actively provides various products. Users can easily and freely download products from http://apdrc.soest.hawaii.edu/.
JAMSTEC has released the new version of PARC website in November 2022 (https://www.jamstec.go.jp/PARC). JAMSTEC is providing the float monitoring information in the Pacific region (e.g., float activity watch, QC status, anomaly from objective analysis, diagnosis plot for sensor correction, etc.), reference data set for DMQC (SeHyD and IOHB), the link to the CTD data disclosure site of Japanese PIs, some documents, and some QC tools.
We also plan to develop a few new functions; to share information of technical problems and quality control of data including Core, BGC, and Deep Argo floats among PIs, and DMQC operators and users in the next year. We are going to share the result of deployment plan working group in Pacific on the PARC website.

5. Other Issues

・Status of Abrupt Salty Drift for Japanese floats:

Japan has 83 floats, including BGC and Deep floats, suffering from Abrupt Salty Drift (ASD). They were deployed from 2013 to 2021. The most serial numbers of SBE41 and SBE41CP affected by ASD are 10501~11000 (Fig. 4). One of the floats are equipped with SBE41CP whose SN is larger than 11252. Five Deep floats equipped with SBE61 suffered from ASD, whose SNs are smaller than 5724.

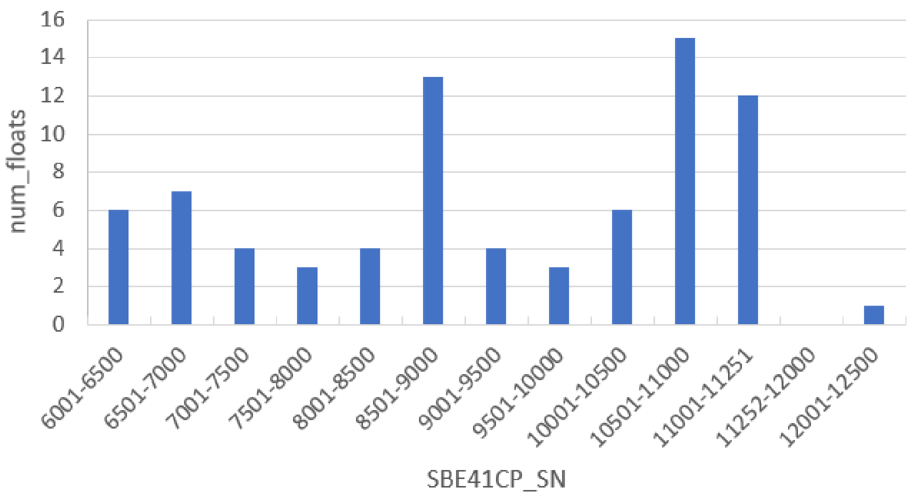


Fig. 4 Number of Japanese floats suffering from ASD by serial number range for SBE41 and SBE41CP.

Japan lost about 4,500 salinity profiles because of ASD from 2015, and they are mainly in the northwestern Pacific (Fig. 5) at a rate of about 800~900 profiles every year (Fig. 6). This number of profiles is equivalent to 5~10% of the number of profiles measured by Japanese floats (Fig. 6).

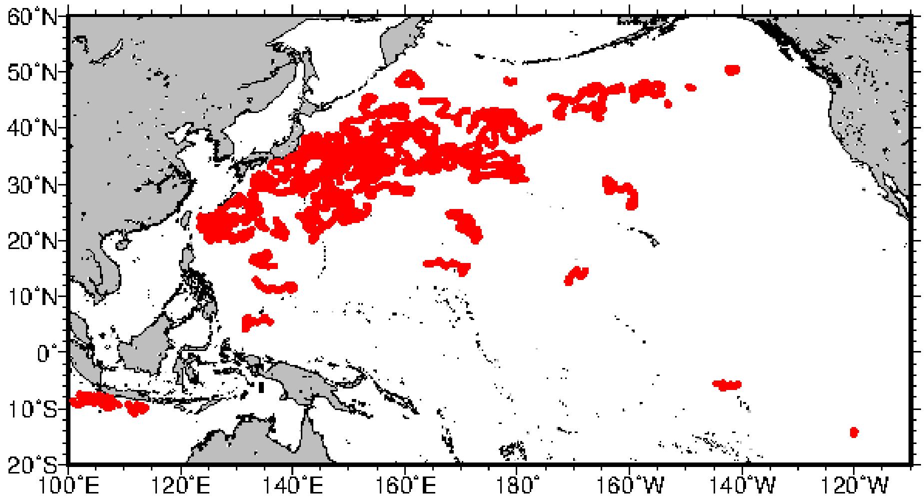


Fig. 5 Distribution of Japanese floats' PSAL profiles with PSAL_QC=4 due to ASD

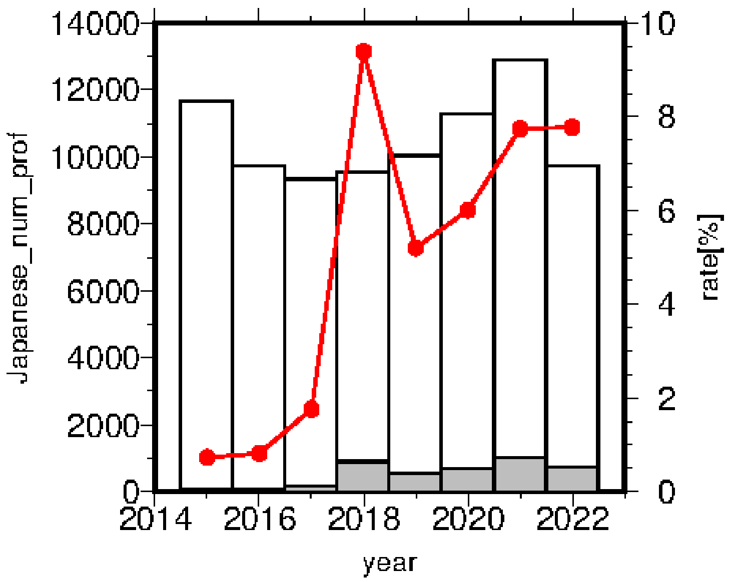


Fig. 6 (Bar) Time series of Japanese PSAL profile: (grey) those with PSAL_QC=4 due to ASD, (white) those with PSAL_QC=1,2,3,or 8. (Red line) Temporal change of the ratio of the number of Japanese PSAL profiles with PSAL_QC=4 due to ASD to the number of all Japanese PSAL profiles.

- **Development Argo real-time QC procedure using path-signature-based neural network:**

  Argo profile data undergone the real-time quality control (rQC), which are automatically processed by DACs, could contain some error data, and could sometimes be difficult to use directly for analytical researches. In this study, we propose an automated QC of Argo profiles, based on a path-signature-based neural network (NN) to improve the procedure proposed by Sugiura and Hosoda (2020). The weights of the NN were determined by learning the existing pairs of the signature of raw profile and its delayed-mode QC (dQC) flag across global Argo observation. By using the NN, nonlinear features in discriminant function for error data can be considered. Furthermore, we introduced metric learning methods for more efficient learning the QC flags. We applied the method to the global Argo profile data, and examine the advantages for the current procedures. One of the main results is that the score of precision/recall is approaching to an acceptable level of practical use, clearly improved from the previous version of the signature method. The other implication is that the precision/recall score seems to be dependent on observed area of ocean. The signature-based NN has large advantages to end-users to help providing better rQCed data by just applying a simple processing, and also opening up a possibility in offering a quick and automated QC processing of Argo profiles prior to providing dQC data.

KOREA Argo National Data Management Report
ADMT-23

Miami, USA, Dec 5 – Dec 9, 2022

1. Status

1.1. Data acquired from floats

In 2022, the National Institute of Meteorological Sciences of Korea Meteorological Administration (NIMS/KMA) could not deployment Argo floats due to COVID-19 and rapid exchange rate increase. The NIMS/KMA has deployed 259 Argo floats around Korea such as the East Sea, Yellow Sea, and the North Pacific Ocean since 2001, and 11 floats are in active as of November 24, 2022. As one of regional DACs, the NIMS/KMA is acquiring ARGOS messages and Iridium messages via web service from CLS in real-time, and all profile data obtained are transmitted to GDAC with the NetCDF format using BUFR data after the real-time quality-control process on operational system.

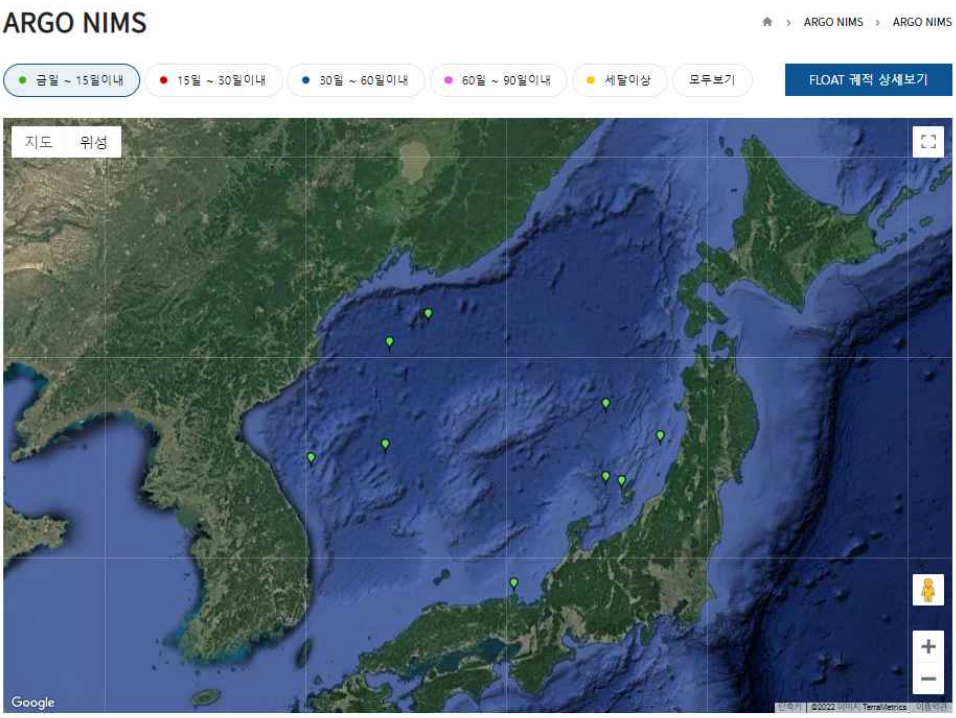


Fig. 1. Active Argo floats location deployed by NIMS (November 24)

1.2. Data issued to GDAC

Total **995** profiles were acquired during January through November in 2022 and sent to the GDAC after the real-time QC processes.

・Data reproduction and resubmission to GDAC by applying Warning Objective Analysis report.
・Implementing the Argo data format check program (New version).
・Updating the RTQC procedure with adding the grey-list test to the trajectory file, and MEDD test for the Pacific and Yellow Sea data, and global range test (Argo QC manual Ver. 3.6.1).
・Real-time quality control development and application to 1,517 profiles obtained from September 2017 to December 2022.
・Romoving the duplicated profile in the data quality-control system.

1.3. Web pages

The NIMS operates the Argo web page (http://argo.nims.go.kr) as regional data assembling center and provides profile data, temporal and spatial distribution of T and S, and status of Argo float activities to the public. It has shown 74,928 hits by visitors in monthly average.

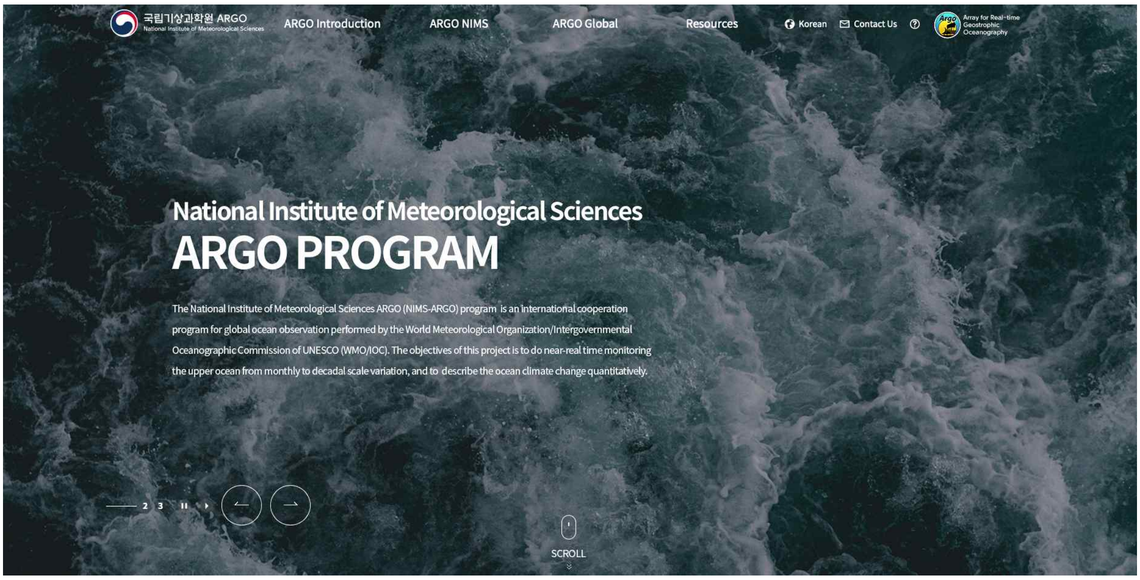


Fig. 2. Argo homepage of NIMS/KMA (http://argo.nims.go.kr)

1.4. Deployment plan for 2023

In 2023, total 14 Argo floats will be deployed around the Korea peninsula in July and November (see Fig. 3). The red squares show the potential deployment area next year aiming at covering the regional seas of Korea.

2. Delayed Mode QC

We completed the DMQC operation on 3,492 profiles (1,905 profiles from the East Sea, 1,587 from the Yellow Sea), which had been observed from early September 2021 to

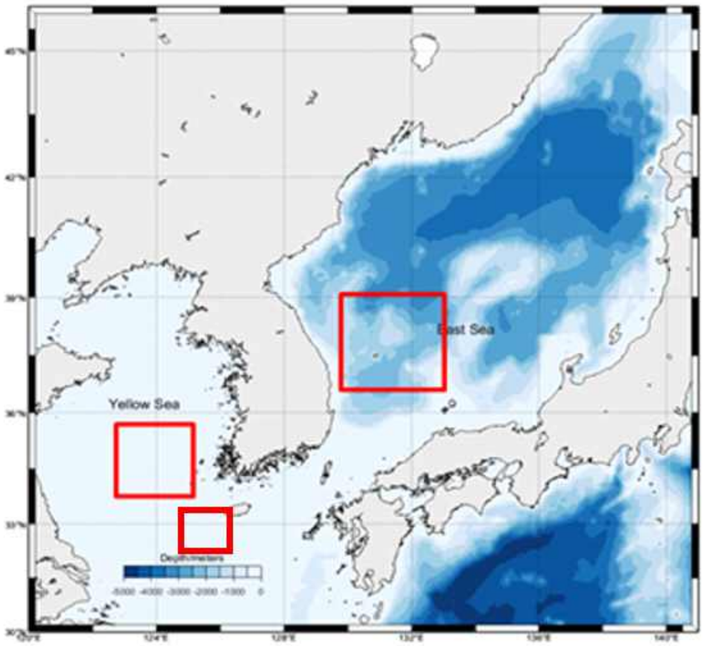


Fig. 3. NIMS/KMA's deployment area in 2023

early September 2022. The OW (Ver. 3.0.0) was used for profile data from the East Sea with new parameters (spatial-temporal correlation scales etc). All QCed profiles had been sent to the Ifremer GDAC on June 29 & October 21, 2022 in NetCDF format. The D-files were updated successfully as checked.

Constant salinity offsets were identified in the several shallow Argo floats right after deployments in the Yellow Sea by using shipboard CTD data. Since the floats in the Yellow Sea observed for relatively short period of time (due to shallow parking depths of less than 100m and short cycle times for about a day), they usually have initial salinity offsets rather than salinity drift. Additionally, since the Yellow Sea is a wide continental shelf area, its temporal and spatial scale of salinity variability are much smaller than those of the open ocean. So, the only shipboard CTD data collected at the similar time and location as Argo floats were utilized as a reference for OW. The identified offset for PSAL evaluated based on the shipboard CTD data is adjusted by using LAUNCH_OFFSET in "MAIN_write_dmqc_files"(matlab code). We will be able to improve this DMQC prototype for the shallow Argo floats with collecting more accurate CTD data.

-The End-

Argo National Data Management Report – Norway 2021

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1. Real Time Status

- **Data acquired from floats**

In 2022, Norway deployed 14 Argo floats (4 BGC@6var, 4 BGC@1-4var, 3 Deep+DO, 3 core). The location and drift of the floats are shown in Figure 1.

Presently there are 47 operative Norwegian floats (Figure 2).

In total 5289 profiles are acquired, and 2402 DM and 854 DM-pending. The right figure below shows the number of deployments in the Nordic Seas/Barents Sea/Arctic Ocean (north of Svalbard).

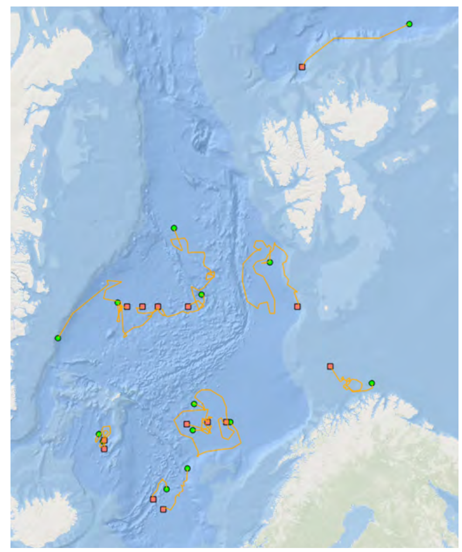


Figure 1. *Deployment locations (red squares) in 2022 and drift of the floats (green dots are last registered positions).*

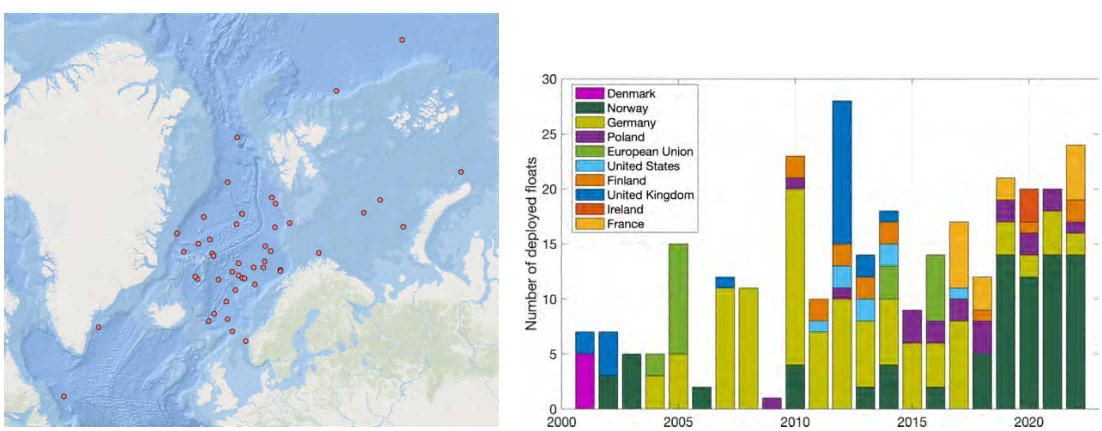


Figure 2. *Left: Last registered position of the active floats in Argo Norway. Right: Number of deployed floats in the Nordic Seas and Barents Sea for each year country.*

Data from all operational floats are available from the GDACs.

The 47 operative floats consist of:

- 6 BGC floats (all 6 variables)
- 12 Bio floats (1-4 BGC variables: DO, chla, bbp, irradiance)
- 10 Deep floats with DO.
- 19 core floats

- **Data issued to GTS**

All Norwegian floats are processed in real-time by Coriolis and delivered to GTS.

- **Data issued to GDACs after real-time QC**

All profiles from Norwegian floats are processed in real-time by Coriolis and exchanged with GDACs.

- **Data issued for delayed QC**

At present (23. Nov. 2022) the Norwegian Argo fleet comprises 84 floats. According to Argo Information Center the floats have so far sampled 10968 profiles with 8027 DM-profiles and 894 DM-pending profiles. In 2022 (1. Jan - 6. Dec), **4158 profiles** were acquired (DM: 2015; DM-pending: 771).

- **Delayed mode data sent to GDACs**

BSH (Germany) has done the Quality Control of core data from Norwegian floats deployed in 2018 and earlier, and the D-files are submitted to Coriolis with a short summary and diagnosis figures. Norway do now DMQC of floats deployed in 2019 and later, both core and BGC-floats. According to Argo Information Center the floats have so far sampled **10968 profiles with 8027 DM-profiles and 894 DM-pending profiles.**

2. Delayed Mode QC

BSH has adopted older floats from Norway for DMQC (see report for Germany). Norway do now DMQC of 54 floats deployed in 2019-2022. There exist **6047 profiles for these 54 floats with 3267 DM and 828 DM-pending.**

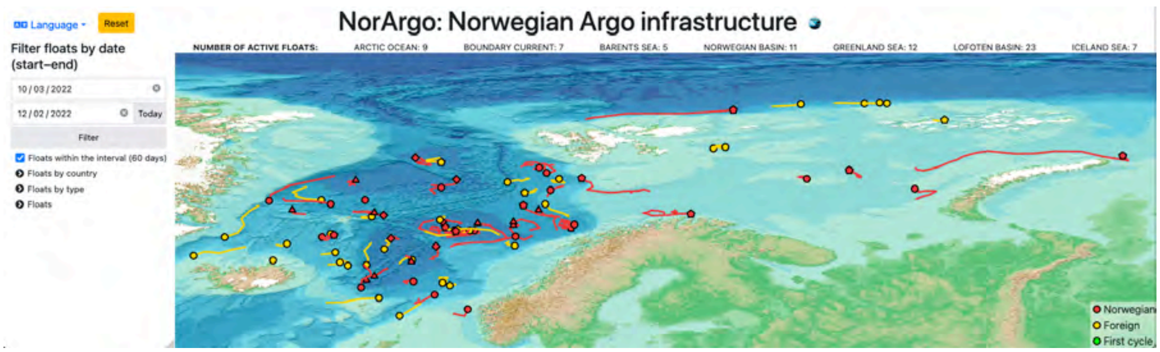
BGC-variables:

DMQC has been performed on the oxygen (NORCE) for 16 Argo floats (in total 1182 profiles), on the pH (NORCE) for one float (125 profile) and on nitrate (IMR) for 4 BGC-floats (398 profiles).
DMQC of nitrate needs to be redone with the new temperature correction of the sensor. We plan to do DMQC on the other BGC-variables (IMR) in near future; CHLA at the end of this year, and BBP and Irradiance in 2023.

3. Value Added items

- **Web pages**

A web page for NorArgo (https://norargo.hi.no) has been developed that IMR updates. A web page for the operational Argo floats in the Nordic Seas have been developed that IMR updates : https://norargo-map.hi.no/ (see below).



- **Statistics of Argo data**

Norway uses the data in research, operational services and monitoring.

IMR uses the data as part of the monitoring program for the marine environment in Norwegian waters.

The NERSC routinely assimilates the data into their TOPAZ4 model and assimilation system for operational monitoring and forecast of the ocean climate. MET.NO also assimilates the Argo data into their operational models.

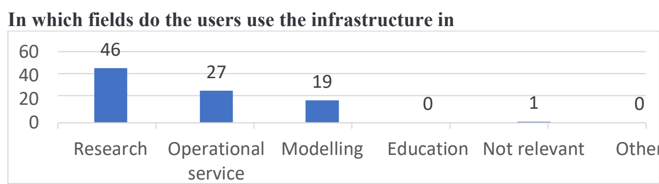


Table 3. Number of users for different fields (several choices can be ticked).

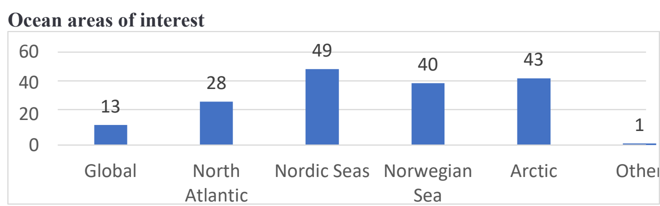


Table 4. Number of users in which the infrastructure are used for in different ocean areas (several choices can be ticked).

The data are used in many research projects and in master and Dr. thesis.

We perfomed a user survey in Norway, and some of the results are shown in the table.

- **Products generated from Argo data …**

The ocean heat and fresh water contents of the Norwegian Sea are regularly updated using Argo data and used for monitoring (see figure below).

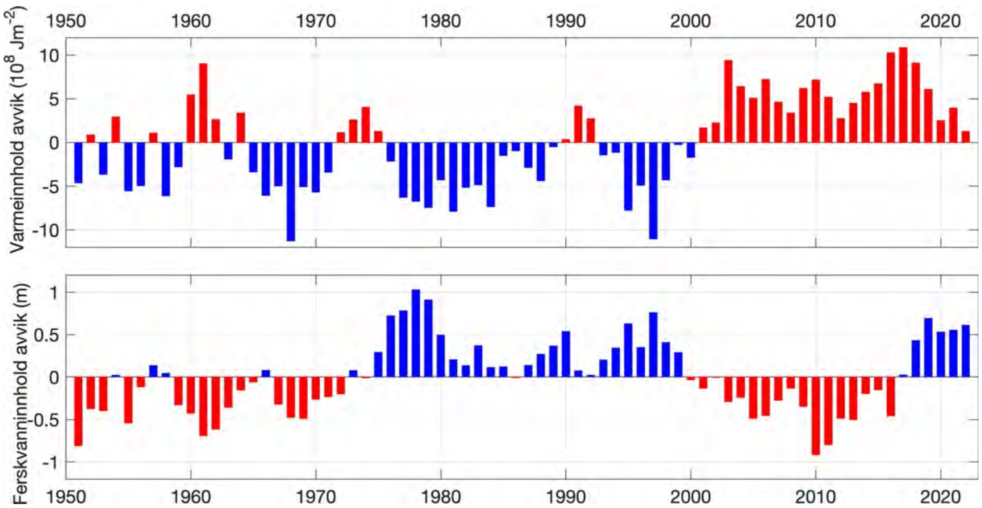


Figure 3. Yearly relative ocean heat (upper) and fresh water (lower) content in the Norwegian Sea. Updated from Mork et al., 2014, GRL.

4. GDAC Functions

5. Regional Centre Functions

6. Other issues

UK Argo National Data Management Report for the 23rd Argo Data Management Team meeting

Authors

UK Argo data team at the British Oceanographic Data Centre, part of the National Oceanography Centre:

- Contributing authors: Kamila Walicka, Clare Bellingham, Violetta Paba, Ian Moores, Helen Snaith
- Other team members: Roseanna Wright, Juliane Wihsgot, Justin Buck

With contributions from the wider UK Argo team by:

- Jon Turton and Fiona Carse (Met Office)
- Brian King, Nathan Briggs, Clive Neil (National Oceanography Centre)

1. Data Management Team

The British Oceanographic Data Centre (BODC), part of the National Oceanography Centre (NOC), is the data assembly center for UK Argo. It is funded primarily by the UK Natural Environment Research Council (NERC) and is responsible for data management of UK, Irish and donated Mauritian floats. In addition, UK Argo is a member of Euro-Argo and is continuing to manage some European Union floats as part of the now-ended MOCCA project. As part of the EU H2020 project ENVRI-FAIR, BODC is working towards hosting the Argo reference tables on the NERC Vocabulary Server (NVS). BODC is also a member of the Southern Ocean Argo Regional Centre (SOARC).

The previous Argo lead left BODC in May 2022 following an extended period of sickness absence. The team now shares the responsibility of maintaining and managing the Argo project. BODC plans to recruit autonomous platforms lead to taking on some of the management responsibilities within Argo and other autonomous platform groups (e.g., glider, Argo, autosub). The post is expected to be recruited in 2023. Additional resources were provided to support the core Argo team in developing new QC systems and tools.

BODC Argo Team member	Contributions	Estimated contribution in past year as Full Time Equivalent (FTE)
Ian Moores	Management oversight	-
Clare Bellingham	DAC lead	0.85 FTE
Kamila Walicka	DMQC core and Deep lead BGC DMQC contributor BODC Euro-Argo Rise Lead	1 FTE

Clive Neil	Support in the Southern Ocean assessment method (EA RISE- WP5)	0.21 FTE
Violetta Paba	Argo vocabularies lead BGC QC lead DAC operator (RT monitoring)	0.9 FTE
Juliane Wihsgott	RTQC toolbox designer	0.33 FTE
Roseanna Wright	Metadata investigations DAC contributor (visual inspection)	0.08 FTE
BODC developer team	Software development (4 sprints)	~0.74FTE
TOTAL		**~4.11 FTE**

2. General Outlook

Core BODC Argo national capability funding from NERC remains static for 2022-23 and is therefore still decreasing in real terms. There is additional funding from NERC associated with research projects and the floats they have procured, such as PICCOLO. NOC/BODC secured funding to develop data infrastructure for NKE BGC floats (the ASBAN UK project) purchased by NOC through NERC Capital funding. Efforts have continued to establish a clear plan for future funding to develop a more sustainable model of UK funding to support the UK contribution to the full-depth multi-disciplinary Argo array, but the funding situation remains challenging. The Euro-Argo Research Infrastructure Sustainability and Enhancement (Euro-Argo RISE) project has provided funding for developing core and deep DMQC (Delayed Mode Quality Control), management of BGC (biogeochemical) extensions and regional data quality assessments in the Southern Ocean up to December 2022. Additionally, BODC is funded under the EU H2020 project ENVRI-FAIR to introduce the NVS vocabulary server to support Argo vocabulary management. BODC has been unable to source sustainable funding to support SOARC functions, so the ARC remains unfunded in the UK to date.

3. Real Time Status

Data acquired from floats

BODC retrieves data for all UK, Irish and assigned EU MOCCA floats from a number of sources and archives these for further processing. BODC currently processes data from floats with Argos communications, Iridium Rudics and Iridium Short Burst Data (SBD) from a diverse fleet of floats manufactured by TWR, SeaBird, NKE and (soon to be) SOLO.

Near real-time data delivery

Processing and delivery of incoming data is normally set up within one week of deployment where the capability already exists for a given float type. We have found that development work for new float types can be significant and manufacturer's data decoders and discussions with other DACs have been important.

BODC continue to operate two parallel processing chains where the BODC-developed chain processes and delivers all UK Navis and Apex floats, and a version of the Coriolis processing chain sitting in the BODC software stack processes and delivers UK NKE, the EU MOCCA NKE that BODC have responsibility for, and Irish NKE floats. During 2022 BODC DAC has developed its deployment and use of the Coriolis processing chain. This work has enabled us to resume delivery of all live MOCCA floats and was necessary due to the expansion of the number of NKE float types that BODC will be processing in the next few years (CTS4 and CTS5).

Data issued to GTS

BODC delivers core data and oxygen (from NKE floats only) in NetCDF format to the UK Met Office four times a day, where it is subsequently issued to the GTS in BUFR format. Over 95% of the NetCDF files are delivered within 24 hours of the data being available to BODC.

Data issued to GDACS after real-time QC

BODC delivers updated meta and tech files for all floats it processes alongside new core profile files to the GDACs as part of every processing run. Delivery of BGC profile data for most floats and many trajectory files are still pending.
BODC endeavors to address any RTQC from Objective Analysis reports and Altimetry QC when it is sent.

We have undertaken a review of the automated RTQC toolbox for core and BGC Argo variables (pH, DOXY, Nitrate, CHL-A, suspended particles and downwelling irradiance) including currently available RTQC tests, highlighted limitations and suggested future recommendations, in order to better understand how the RTQC works for BGC parameters and how they would need to be implemented in BODC. We also undertook the works on re-designing of the implementation plan and procedures of adopting software to the BODC processing chain. The developed toolbox is aimed to need minimal oversite and intervention from the DAC operator, it will consist of the independent tests/QC routines, it will use the internal .qxf format in BODC to store data and flags before their export to NetCDF.

Delayed mode data sent to GDACs

The BODC DAC function currently interacts with DMQC operators through two different modes of operation. The first is internal BODC DMQC operators who directly submit DMQC decisions to the BODC Argo System, and for which updated D-mode NetCDFs are automatically generated and submitted. For floats managed through the Coriolis processing chain at BODC, both internal and DMQC operators from Ifremer, OGS and BSH submit updated NetCDFs which are archived within BODC and submitted to the GDACs.

All delayed-mode QC on BODC hosted floats is submitted to the GDACs the same day that delayed mode QC is complete for a profile when completed by BODC, or as soon as the data has been accepted following submission by external DMQC partners. Submissions from external partners are issued with accession numbers for tracking purposes within BODC archives.

From January 2022 until the time of writing this report, BODC has analysed and submitted around 3676 profiles to the GDAC. This includes profiles from 23 core Argo floats. The most recent statistics provided by Ifremer from October 2022, show that currently BODC delivered around 76.21 % of delayed-mode data from all available data at the DAC.
This is a slight reduction of submitted D-mode data compared to other years due to reduced availability of BODC Argo DMQC operators due to other commitments.

DMQC support was offered to any national program requiring assistance, where BODC has significant physical oceanography expertise. BODC focused on supporting the UK and Irish Argo programs, data for which are managed by the BODC Argo Data Assembly Centre (DAC) function. We have analysed and delivered D-mode data for 8 core Irish Argo floats (633 profiles).

BGC

Real time data delivery

Since ADMT-22, the BODC Argo team has joined efforts with the BODC software developers' team to upgrade the two processing chains used to process and deliver data from the UK Argo fleet.

The work focused on:

- Updating our system with the latest Coriolis processing chain, and start delivering data from the newest batch of 6-parameters NKE floats;
- Upgrade our internal BODC processing chain in order to start delivering BR files from non-NKE BGC floats, starting from an older batch of I9 FLB floats. This work involved writing derivation equations code for DOXY for all the cases relevant to the UK fleet.

This work is significant as it is the first successful attempt to deliver BGC data through our internal processing chain, and the first successful upgrade to deliver live core and BGC data from UK floats using the Coriolis processing chain.

Deep

BODC is currently processing the temperature and salinity coming from the Deep Argo floats using the SBE61 sensor in real time. BODC has 22 deep Argo floats in their fleet, where all of them are currently inactive. NOC plans to deploy a SOLO deep float this year which will be the first float of this type in the UK Argo fleet.

RBR

BODC is currently processing the temperature and salinity coming from the RBR sensor in real time. BODC has 13 RBR Argo floats in their fleet, where 3 of them are currently still active. The UK Argo is planning to deploy another 2 RBR in spring 2023.

BODC is currently not delivering the D-mode data for deep, BGC and RBR floats to the GDACs due to lack of developed infrastructure for DMQC processing of these floats in the BODC processing chain.

4. Data use and data products

Met Office

At the Met Office Argo data are used operationally:

- They are routinely assimilated into its FOAM (Forecasting Ocean Assimilation Model) suite which is run daily and produces 2 analysis days and a 7-day forecast.

- A coupled ocean/atmosphere/sea-ice/land global prediction system is now operational for producing the main Met Office weather forecasts. This coupled NWP system assimilates data in all components of the coupled model, including Argo data in the ocean component. These data therefore affect both weather forecasts and short-range ocean forecasts. An assessment of the impact of Argo in a lower atmospheric resolution version of that coupled system was detailed in King et al., 2019.
- Initial conditions for coupled monthly-to-seasonal forecasts are taken from the global coupled NWP system so the Argo data are used to initialize these forecasts and are used in ocean reanalyzes.
- Argo data are also used in the initialization of ocean conditions in climate models run to make decadal predictions;
- Near-surface Argo data are used to validate the output from the Met Office's OSTIA (Operational Sea Surface Temperature and Sea Ice Analysis).

Met Office research & development applications (non-operational) which have made significant use of Argo data:

- A paper was published on OSSEs to investigate the potential impact of expanding the Argo array (Mao et al., 2020);
- David Ford has done some OSSEs looking at the impact of the planned BGC-Argo array of floats in a global physical-biogeochemical model where he assimilates synthetic versions of the BGC Argo profiles in conjunction with satellite ocean color data (Ford, 2021);
- A PhD project is currently looking at the impact of real BGC Argo data in a global physical-biogeochemical model. The BGC Argo data are assimilated into the model and the impact on air-sea CO2 fluxes is being investigated.
- A paper was published jointly with the University of Reading on the application of a simple smoother algorithm to make better use of Argo data in ocean reanalysis (Dong et al., 2021).
- A project where we made good use of Argo data was in the assimilation of satellite sea surface salinity data from SMOS, Aquarius and SMAP. The near-surface salinity data from Argo was used to bias correct the satellite salinity data and was crucial for the performance of the assimilation of SSS data. That work is written up in Martin et al., 2019. Another paper was published investigating impact in FOAM and the Mercator system of satellite SSS assimilation which used Argo for assessment (Martin et al., 2020).

In the Hadley Centre for Climate Science and Services, Argo data is used in the following products:

- EN4 contains in-situ ocean temperature and salinity profiles and objective analyses. It is updated monthly using real-time Argo profiles and GTSPP data, and annually using delayed-mode Argo profiles (and WOD, GTSPP and ASBO data). EN4 is freely available for scientific research use (see http://www.metoffice.gov.uk/hadobs/en4/). The latest version is EN.4.2.2, which includes a fresh download of all the source data and a substantial update to the XBT/MBT correction schemes. EN.4.2.2 contains four ensemble members where previously there was only two. There is also a new product user guide (based on both the Argo Users' Manual and the HadIOD user guide), including FAQs and example code. EN4 is also forming part of a GEWEX EEI project -

comparing Ocean Heat Content calculated from reanalyses, in situ data and satellite products (the project website is https://sites.google.com/magellium.fr/eeiassessment/dissemination/documents?authuser=0).
- HadIOD (Hadley Centre Integrated Ocean Database) is a database of in situ surface and subsurface ocean temperature and salinity observations supplemented with additional metadata including bias corrections, uncertainties and quality flags. The dataset is global from 1850-present with monthly updates. The current version is HadIOD.1.2.0.0, the chief sources of data are ICOADS.2.5.1, EN4 and CMEMS drifting buoy data. This product has been available to the public since mid-2020 via https://www.metoffice.gov.uk/hadobs/.

Met Office science uses of the EN4 product include OHC analysis, seasonal forecasting, decadal forecasting, climate model initialization and evaluation.

National Oceanography Centre (Brian, Nathan)

At NOC we produce a 4-D global map of Argo T and S data at 2 degree lat and long resolution from 60S to 60N. The data are gridded in 10-day windows using objective mapping on sigma-1 or neutral density levels and then interpolated back to 20 dbar vertical resolution. This is generally updated towards the end of each calendar year. A time series of global heat content is calculated and reduced to annual averages and then incorporated into the synthesis of global heat content calculations led by K von Schuckmann. The full 4-D gridded fields can be made available by contacting Brian King at NOC.

A new two-year NOC-led project called GLOBESINK started in August 2022 to generate a global dataset of particle size and downward particulate organic carbon flux from BGC Argo measurements of optical backscattering. This dataset will contribute to the wider NERC BIO-CARBON programme, which aims to improve our ability to predict changes in biological carbon update by the oceans. This project will develop its own backscattering data QC procedures tailored towards distinguishing “good” data spikes (from large particles) from “bad” data spikes (from fouling, sensor malfunction, or zooplankton attracted to the sensor). One output of the project will be a publicly available particle dataset using BGC Argo data through 2022 (to be delivered in 2024). We will then be looking for ways to keep this product up to date in the future.

Currently, three NOC-led PhD projects have a large component utilizing BGC Argo data. One focuses on net community production in the Weddell Gyre, another is exploring methods to optimally interpolate subsurface chlorophyll data, and a third is looking into the drivers of variability in the remineralization depth of sinking organic carbon in the ocean. A fourth NOC-based project led by the University of Southampton will develop methods to QC and correct pH data from BGC Argo.

5. Delayed Mode QC status

Core DMQC

The strategy adopted to deliver the support to national programs focused on ensuring a high-quality approach and the progressive enhancement of expertise. This includes progress with the developed software, improvements to the submitted data, contribution to the working groups, and giving and getting the relevant training.

Data and Software

BODC has regularly adopted the latest reference databases for DMQC analysis of core and deep Argo floats (CTD_for_DMQC_2021V02 and ARGO_for_DMQC_2021V03). After implementing these within our DMQC procedures we have identified technical issues with some data profiles in the WMO boxes in the Southern Ocean from the CTD reference data. These were immediately reported to Coriolis and will be corrected in the next release of the reference data.

The development works related to the conversion of the DMQC software for core Argo (OWC package) from Matlab to Python has been resource constrained. However, the converted OWC Python *pyowc* software is currently fully functional and is available from the GitHub Euro-Argo repository argodmqc_owc. The next stage to finalize the project is work related to the publication of the software. This includes cleaning up the remaining issues in the repository, documentation and packaging the software. This work has been scheduled for spring 2023. BODC has been closely collaborating with Guillaume Maze from Ifremer/LOPS to publish the software (Frontiers or JOOS journals) and to draw up future recommendations and directions for development of the software. The crucial element needed for the future works is to secure the relevant funding for these works.

Improvements to the quality of the UK Argo fleet data

The UK core Argo fleet data went through the international DMQC audit run by external partners from the DMQC core Argo group. The audit was motivated by the fact that a higher percentage of SBE CTDs are now experiencing sensor drifts, which may not be easily identifiable by only examining individual time series. All identified BODC profiles with some issues were reviewed. Any additional revisions or corrections have been completed and re-submitted to the GDACs. BODC was not able to resubmit the few remaining profiles from very old floats from the beginning of Argo project from early 2000s due to technical issues with the float data.

Moreover, during the work undertaken within the SOARC data review in the Southern Ocean region there were some old UK Argo floats identified with incorrectly corrected d-mode core data. These have been corrected and re-submitted to the GDAC.

Workshops and training

BODC and NOC as the experts in the DMQC analysis of core Argo parameters participated at the series of the International DMQC discussion meeting led by CSIRO. These virtual discussions helped to promote collaboration between DMQC operators and interested members of the Argo community. This forum gives an opportunity for newer operators to improve their skills and get advice on concerning and difficult floats, promote a sense of community, and contribute to the adoption of more consistent DMQC practices.

Working groups

BODC actively contributed to activities related to the Abrupt Salty Drift (ASD) group, focusing on estimating the best practices, guidance and examples on how to treat salinity data that are affected by sensor drift to produce optimal adjustment in d-mode. This involved actively contributing to updating the shared list of floats affected by the salty drift and reviewing best practices and procedures for DMQC operators of core Argo floats.

Deep DMQC

BODC have greatly improved their understanding of the current procedures and guidelines for RT and DMQC of deep Argo data. As a part of the Euro Argo Rise WP3 project BODC and NOC have been actively involved in leading, coordination and organization of work related with deep Argo. This involved organization and coordination of the intermediate meeting with other European partners within the task and provided a regular update of progress to the reporting body. BODC, with collaboration of European partners, compiled a report on the outcome of the comparative study for the deep Argo quality control processing including the most appropriate methods and tools for the quality control of deep Argo floats. As a part of these works BODC performed initial DMQC analysis for one deep Argo float following the most recent recommendations from the Argo manual. However, these data have not been submitted to the GDACs because the BODC processing chain and BODC database is not yet adapted to new deep Argo procedures.
Moreover, BODC have also compiled a report of the sustainability of the actual reference dataset for deep Argo DMQC including assessment of the availability and quality of the CTD reference data for Argo for the regions of deployments of the deep European Argo fleet.

Furthermore, BODC contributed to the research article with the collaboration of the international Deep Argo community on “*The implementation plan of the global Deep Argo array to measure the full ocean volume”*. The article is going to be published in Nature or in Frontiers journal.

Software

BODC has started development work on automatically applying the CpCor correction for pressure effects on conductivity data of deep Argo floats (>2000 dbar) in the real-time QC process, which was recommended by the Deep Argo team in 2021. These corrections are needed in salinity data to remove the pressure-dependent salinity bias. Similar calibrations are required in analyses in delayed mode. Unfortunately, due to limited resources in BODC for the development work, we could not implement the RTQC and DMQC procedures allowing us to deliver rt-adjusted and d-mode data to GDAC.

BGC DMQC

The BODC Argo team has greatly expanded their knowledge of the DMQC analysis of BGC Argo floats.
Kamila and Violetta (BODC) were collaboratively working with the European BGC expert from Villefranche (Catherine Schmechtig) to analyze Argo floats BGC parameters. This collaborative work was focused on knowledge exchange about the procedures for DOXY, CHLA, Nitrate, Radiometry, BBP, review and testing and implementing the available software e.g. Sage02, Sage, and sharing the codes.
BODC has started implementing the workflow of the DMQC BGC procedures of the DOXY parameter for the BGC Argo floats. The initial output from the analysis has been generated and we are planning to submit it to the BGC expert for review and approval before it is submitted to GDAC. However, due to limited resource, and lack of developed infrastructure for DMQC

processing of these floats in the BODC processing chain, BODC is currently not delivering the d-mode data of BGC data to the GDACs.

Within the BGC Argo program, there was also a collaboration with the European partners as a part of the Euro Argo RISE (WP4) project. These activities included reviewing and providing recommendations and enhancements to the QC methods of pH, BBP, and recommendations for the data management structure for BGC extension within the Argo system at the EU level.

RBR
BODC is currently not delivering the d-mode RBR data to GDAC due to lack of developed infrastructure for DMQC processing of these floats in the BODC processing chain.

6. Value Added items

Webpages

- NOC continues to maintain the UK Argo website (www.ukargo.net)
- Facebook page (www.facebook.com/UKArgofloats/)
- Twitter account (twitter.com/ukargo)
- NOC maintains the SOARC website (www.soarc.aq)
- NVS VocPrez website (http://vocab.nerc.ac.uk/)
- Argo Vocabulary Task Team (AVTT) GitHub space: https://github.com/orgs/nvs-vocabs/teams/avtt

Software tools

- A Python implementation of the "OWC" salinity calibration method traditionally available for Matlab used in Argo floats Delayed Mode Quality Control https://github.com/euroargodev/argodmqc_owc
- A software for an infrastructure agnostic set of common BGC parameter derivation equation functions https://github.com/euroargodev/bgc_derivation
- Real time QC automated tests for Argo data. https://github.com/euroargodev/argortqcpy
- The quality assessment method in the Southern Ocean (SO) uses the pre-classified core Argo float and climatological data belonging to similar water mass regimes using the Profile Characterization Model (PCM). https://github.com/euroargodev/DMQC-PCM/tree/SO_assesment
- This repository includes the report template and Matlab codes used to generate plots required in the DMQC report for core Argo parameters. https://github.com/euroargodev/dm-report-template
- BODC has provided the material to update the ‘Argo vocabulary server’ web page on the Argo data management website: http://www.argodatamgt.org/Documentation/Argo-vocabulary-server

Manufacturer engagement
NOC (Brian King) and BODC Argo team have led activities stimulating stronger links between the teams responsible for implementing Argo (the ‘users’), and the commercial suppliers who provide most of the platforms and sensors used by Argo. The initial works started at the end of

December 2021 and have been carried in 2022. These works were undertaken as a part of the Euro Argo RISE project (WP8). These activities recognize the importance of these links and have explored different ways of facilitating networking, feedback and contacts with the industry and identifying the best means to develop stronger relationships. One of the collaborations that ensued and persists is with float manufacturer Teledyne, in a common effort to standardize technical metadata tags. For more information, see session 7 below (Argo NVS: Collaboration with Teledyne).

Training and workshops

The BODC Argo team participated in the professional Product Owner training to improve the efficiency of development sprints in the BODC Argo system. A product owner has a role on a Scrum team that is responsible for the project's outcome. The product owner seeks to maximize a product's value by managing and optimizing the product backlog. Scrum is an Agile software development framework that enables a team to communicate and self-organize.

7. GDAC Functions: Argo NERC Vocabulary Server (NVS) activities

Argo Vocabulary Task Team (AVTT) work

Activity:

- 4th AVTT meeting held in March 2022.
- GitHub repositories live with new issues being created and discussed.
- Presented progress and planned work at the Argo Steering Team (AST) meeting in March 2022

Output:

- AVTT gave approval to create a new NVS collection to include the AST-approval stages of PILOT and APPROVED
- AVTT team approve of using opaque (i.e. deprived of meaning) IDs in all new Argo collections going forward.

Planned work:

- Review membership: are current members happy? Would anyone else like to join?
- Review Editor roles: are current Editors happy with their role? Would anyone else like to become one for a specific collection or group of collections?
- Workflow: BODC to review this with team - including scope of the ArgoVocabs repositories and all the collection-specific AVTT repositories
- Review open GitHub issues and plan to progress and create approved new concepts and collections
- Set more regular meetings from 2023
- AVTT-22 remaining action items

Argo NVS: Internal BODC NVS teamwork

Output:

Represented the Argo community as a stakeholder in NVS development sprints that took place throughout the year. These sprints resulted in:

- Making the NVS more resilient and robust, ensuring fast and uninterrupted service for its users (humans and machines).
- Completing the first phase of the Vocabulary Editor tool upgrade.

Planned work:

- Create NVS collections for reference tables 14, 18, 28, 29, 30 (respectively technical parameter names, configuration parameter names, controller board type, battery type and battery packs).
- Replace deletion with deprecation in mappings;
- Increase visibility of mappings on VocPrez;
- Phase two of the Vocabulary Editor tool upgrade, which will focus on facilitating the role of external editors. During this sprint, the Vocabulary Editor API will be migrated from the BODC website to VocPrez; moreover, the universal web login Auth0 will replace the BODC login, and the Open Policy Agent (OPA) authorization system will be introduced.
- Organize and provide NVS training to AVTT Editors and any interested AVTT/ADMT members to start moving the governance away from BODC

Argo NVS: Collaboration with the OceanOps

Activity:

A series of meetings between BODC and OceanOps took place in early 2022, where the following Argo metadata fields were discussed: CONTROLLER_BOARD_TYPE, PI_NAME, DEPLOYMENT_PLATFORM and PROJECT_NAME.

Output:

- CONTROLLER_BOARD_TYPE: BODC is reviewing this vocabulary
- PI_NAME: This vocabulary is nearly read for NVS upload (see https://github.com/nvs-vocabs/ArgoVocabs/issues/6)
- ~~DEPLOYMENT_PLATFORM: W~~e propose adopting C17 to constrain this metadata fields (see https://github.com/nvs-vocabs/ArgoVocabs/issues/2)
- PROJECT_NAME: solutions are being discussed on GitHub (https://github.com/nvs-vocabs/ArgoVocabs/issues/5); latest proposal is to constrain "PROGRAM" with https://www.ocean-ops.org/api/1/help/?param=program, and for "PROJECT" to remain free text.

Planned work:

- Revive series of meetings
- Present output to ADMT and implement decisions.
- Discuss ways in which the following metadata fields could be constrained: NETWORK, DEPLOYEMENT_REFERENCE_STATION_ID, DEPLOYMENT_CRUISE_ID, SENSOR_MODEL, FLOAT_OWNER and INSTITUTION.

Argo NVS: Collaboration with Euro-Argo

Activity:

- Meeting held on the 8th of November, as a new person (Delphine) joined the NVS Ifremer team.
- Drafting strategic goals as groundwork for funding proposals to support Argo NVS work beyond ENVRI-FAIR

Output:

Agenda, minutes and actions can be found on the AVTT GitHub space: https://github.com/nvs-vocabs/ArgoVocabs_Meetings/tree/main/telecons

Planned work:

Continue collaboration. Next meeting planned for the 13th of December 2022.

Argo NVS: Collaboration with Teledyne

Activity:

A series of meetings between BODC, the config & tech AVTT sub-team and engineers from Teledyne, aimed at reviewing the mappings between the Argo technical and configuration parameter names and the corresponding tags used by the manufacturer.

Output:

Teledyne is keen to help DACs with automating the ingestion of tech and config information sent by the float. They are proposing to produce a CSV file containing a list of all the tech and config parameters using the Argo names and values in the units expected.

Planned work:

Feed back to AVTT/ADMT and continue collaboration with Teledyne - also to answer specific community questions.

Argo NVS: Collaboration with Catherine, Birgit and John on technical and configuration parameter names tables (R14 and R18)

Activity:

Reviewed technical and configuration parameter name tables, and discussed strategy and planned work, also in the context of collaboration with Teledyne.

Planned work:

- Move technical and configuration parameter names tables onto the NVS.
- Map tech and config collections to CONTROLLER_BOARD_TYPE (R28) or PLATFORM_TYPE (R23)
- Create a firmware version collection, and map tech config parameter tables to it;
- Continue collaboration.

Argo NVS: Collaboration with BODC OceanGliders team

Output:

Submitted an abstract to the IODE-II entitled: 'Controlled vocabularies for Ocean Observing Systems: the Argo and OceanGliders case studies'. The conference will take place in March 2023.

Planned work:

Sharing of knowledge and resources with the OceanGliders team as they also create and adopt NVS vocabularies for their data system.

Argo NVS: Collaboration with Mark and Thierry on GDAC file checker upgrade

Planned work:

Support the GDAC file checker upgrade work to implement the Argo NVS vocabularies.

8. Regional Centre Functions

The Southern Ocean assessment method

As part of the Euro-Argo RISE project WP5, Task 5.3, BODC (Kamila Walicka) and NOC (Brian King and Clive Neil have been working to establish a method to improve the quality control analysis of the core Argo floats deployed in the Southern Ocean. The need for the method to improve the quality control analysis is due to relatively limited hydrographic data from climatology in the SO compared to many other ocean regions. Limited availability of the reference data makes the quality control analysis of the core Argo float data in the SO often very challenging for the operators and the analysis needs to be performed with very high care.

The developed quality assessment method in the SO uses the pre-classified core Argo float and climatological data belonging to similar water mass regimes using the Profile Characterization Model (PCM) (Maze et al., 2017). The SO assessment software has been developed based on the code created within the Euro-Argo RISE WP2.4 project at Ifremer/LOPS. The output of this software, which is the pre-classified reference data, is further used in the DMQC software - OWC analysis. This method allows the DMQC operator to reduce noise from other water masses leading to a more robust quality control analysis of salinity data in delayed mode.

The SO assessment software is fully operational and is currently available on GitHub as an additional branch to the currently available DMQC-PCM repository (SO_assesment). This branch of the repository includes the two versions of the SO assessment software (1) *DMQC-PCM-main* - which includes the DMQC-PCM and OWC Matlab software and (2) *DMQC-PCM-Python* -which includes the DMQC-PCM and OWC Python software. We have performed a series of developments to these software's to combine and improve functionality and automatization of the quality assessment process.

The functionality of the SO quality assessment method was tested by comparing the results from our method with d-mode data already submitted to GDAC. The tested floats were mostly coming from the Atlantic sector, with a small subsample of floats from the Pacific Ocean. The analysed floats came from a wide range of DMQC operators and DACs.

Our comparison analysis between the output from the traditional OWC and the SO quality assessment tool in many cases showed very similar results. The key improvement that this method brought was a significant reduction of the variability in the reference data used for analysis and a reduction of the error bars of suggested corrections by the software. The SO quality assessment method allows the DMQC operators to improve their confidence in decision-making during performing the DMQC analysis. This will lead to more robust estimations of corrections which need to be applied to the salinity data of Argo profiles and thereby higher-quality science-ready data.

Review of the floats in the Southern Ocean

During testing, we found some instances where the suggested salinity corrections from the SO assessment method were substantially different from those already present in d-mode data. From about 368 reviewed floats, we have found 31 questionable decisions of salinity data in d-mode. The inconsistencies in results could be related to working with difficult floats, the use of different setups, different versions of reference data or procedures used at the time the d-mode analysis was made and different level of experience of the DMQC operator.

This contributed to compiling the list of the typical problematic cases in the DMQC analysis which might be further addressed during the DMQC workshops to improve the best practices in assessing the quality analysis on the core Argo floats. The review of the subsample of floats from the SO shows that the major issue in the DMQC analysis leading to the discrepancies was no salinity corrections applied to the data by operators, when the corrections were needed. The results from the review are pointing out also to some other issues such as difficulties in identifying the beginning of faulty drift, applying too large or too small salinity correction, overcorrecting the float due to the use of setting up too many breaking points in the time series during the estimates of the salinity corrections by OWC software. However, these are only found in a few very sporadic cases.

Besides having the full functionality of the code, there is a further need to continue its maintenance and propose future developments and wider implementation of the code.

9. Other Issues

Please include any specific comments on issues you wish to be considered by the Argo Data Management Team. These might include tasks performed by OceanOPS, the coordination of activities at an international level and the performance of the Argo data system.

10. References

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US NATIONAL DATA MANAGEMENT REPORT

21st ADMT

December 2, 2021 - December 1, 2022

1. Real Time Status

US Argo Data Assembly Center at AOML statistics

The US Argo Data Assembly Center (DAC) at AOML is responsible for processing of Argo data obtained from all US floats. During the reporting period the DAC has received real-time data from 2,092 floats and sent more than 84,200 profiles to the GDACs. In addition to this, the US Argo DAC distributed meta, technical and trajectory files in the Argo NetCDF files to the GDACs as part of the real-time processing.

The DAC distributed over 83,400 Argo profiles to GTS in the BUFR format. Both for GDACs and GTS 86% of the profiles reached the system within 24 hours. If floats with large delays are excluded (e.g. new deployments and floats under ice), then 96% of the profiles are available in 12 hours and 97% of the profiles are available in 24 hours.

The DAC also passes the files on to the GDACs that come from delayed-mode processing, BGC float processing and auxiliary files. For this purpose, the DAC maintains an ftp server for file exchanges, both for providing reprocessed R-mode and meta files as well as for receiving D-mode files, real-time submission of data from Iridium floats and the submission of deployment information.

Overall, the US Argo DAC has 1,433,744 R-files, 1,219,128 D-files, 94,192 BR-files, and 87,389 BD-files. The corresponding numbers for non-profile files are 8,320 meta, 8,114 tech, 8,105 Rtraj and 2,129 Dtraj files.

The US Argo DAC added 323 new floats to the processing system, 44 of them were deployed in collaboration between AOML and WHOI . As part of this collaboration, the US Argo DAC is finding ships of opportunity and provides ship riders for selected cruises. Recent maps showing their positions with link to graphics of the data collected by the floats can be found at:

https://www.aoml.noaa.gov/phod/argo/opr/php_forms/deployment_maps.php

The US Argo DAC is maintaining a website that provides documentation and information about the operations: http://www.aoml.noaa.gov/phod/argo/index.php

Developments at the US Argo DAC

During the current reporting period, two Argo team members moved on to a new career and we added two team members.

As in the past, changes in float technology or core Argo floats, sensor configuration on BGC floats as well as decisions by the IADMT, of which AOML is a major contributing partner, will be the main reasons for changes to existing software and the development of new software. The trajectory NetCDF file format version 3.2 has been defined in user manual 3.41 (July 2021). Adaptations for writing trajectory files in format 3.2 (in this format core and BGC data are in the same file) were completed in September 2022 and will be activated. This upgrade will go operational once the GDACs accept that format. In January 2022 we finished a decoder for radiometer data from APEX Iridium floats. In March 2022 we implemented revision of quality control procedures because the pilot phase or RBR CTD ended. In April 2022 we completed adaptations for the processing of TEMP_CNDC. Quality control and netcdf software capabilities were expended in May 2022 to process radiometer data from two APEX Iridium floats and made it operational for two floats in test mode (without distribution of our BR netcdf files to the GDACs), because MBARI is producing the BR files for these floats. This will allow comparison of our files with the files produced by MBARI. Finished core data decoding for a NAVIS Iridium BGC float type in September 2022 and started distributing the BR netcdf files to the GDACs. We also finalized implementation of real-time quality control procedures for BGC data in November 2022 (tests are applied for chlorophyll A, CDOM, BBP, nitrate, pH, irradiance) .

AOML continued to collaborate closely with the US Argo partners on the expansion of our BGC capabilities and provide feedback related to the new SOLO BGC float data processing. Revisions o the quality control and netcdf software to process these floats was made operational in February 2022. Four such floats were deployed in March-April 2022. Their core data are quality controlled and the netcdf files are created at AOML. MBARI creates the BR files. Because of the number of profiles collected in each cycle, and how they relate to the BGC profiles, changes were made to the quality control and the netcdf file writing software.

For all floats, AOML continues to create and distribute the bufr files, including oxygen when available.

To date 120+ BGC profiles have been collected by three APEX floats in the AOML-led Gulf of Mexico pilot array. Two 5-sensor APEX operating in the basin (one with a failed pH and one with a failed FLBB sensor). One APEX float was recovered upstream of the Florida Straits region in June of 2022 by small boat. Testing of this float at AOML in October 2022 suggested a vacuum failure and it has been sent back to the University of Washington for testing and refurbishment. One Navis BGC was received in June 2022 and sent to the University of

Washington for hull testing at pressure in light of recent float implosions before and after production of this float. Two additional APEX floats have been ordered (FY22) and are expected to arrive in summer of 2023.

The AOML DAC and AOML BGC D-mode operators are working together to develop a system to apply Sage and Sage-O2 determined adjustments in real-time to produce A-mode data.

2. Delayed Mode QC status

The US Argo DAC receives the Delay mode Argo profiles from US delayed-mode operators and verifies their contents to ensure soundness of the files if requested.

Each US Argo institution has provided information on their delayed-mode processing which was added to this report.

NOAA/AOML

AOML has conducted DMQC for the BGC parameters using Sage-O2 and Sage but continue to refine DMQC for the Gulf of Mexico array, specifically by testing the application of a Gulf of Mexico pH and nitrate reference layers and correction of pH profile offsets that occur around 1000 dbars when the CTD pump turns on in continuous mode. DMQC for core parameters is also underway, including an AOML effort to build out available high quality CTD data in reference databases for the Gulf of Mexico.

NOAA/PMEL

As of 28 November 2022, PMEL had 214,113 D-files at the GDAC that were more than one year old, comprising 82% of the total of 260,138 PMEL profiles that were older than one year at that time. Last year, on 28 November 2021, PMEL had 206,593 D-files at the GDAC that were more than one year old, comprising 86% of the total of 241,040 PMEL profiles that were older than one year at that time. So, Kristene McTaggart's DMQC efforts over the past year resulted in a net increase of 7,975 DMQC profiles for profiles older than one year, about 42% the 19,098 profiles that became older than one year during that time. This reduction in the DMQC rate was largely owing to the continued challenges of COVID-19, teleworking, and John Lyman working on another project last year that took much of his time. A focus on difficult cases identified by automated checking has also slowed progress. Next year McTaggart will continue her DMQC work, rejoined by Lyman.

The PMEL float DMQC procedure currently consists of the following steps: We perform an automated correction, with visual check, of reported pressure drifts and correction for the effect of these pressure drifts on salinity, as well as an automated correction of conductivity cell thermal lag errors following Johnson et al. (2007). We do visual inspection and modification of quality control flags for adjusted pressure, temperature, and salinity using the SIO GUI and the Lyman GUI. We overwrite the raw Param_QC flags during this step as required. We use OWC Version1.1, currently with CTD (CTD_2021v1) and Argo (2020v03) reference databases, and adjust run parameters to get appropriate recommended salinity adjustments. Errors in OWC are computed directly from the least squares fit. We accept or reject the OWC recommendations on the basis of comparison with nearly historical profiles using a PMEL GUI written for this step.

Scripps Institution of Oceanography

Scripps Institution of Oceanography (SIO) has evaluated, as part of delayed-mode quality control (DMQC), a total of 335,000 Argo stations (profiles). This is an increase of 39,372 stations (1079 nominal float years) since the previous Argo Data Management Team (ADMT) Report (December 2021). This count represents 98.3% of the SIO DMQC-eligible stations (older than 12 months). The above numbers include SIO Core and Deep Argo floats and all Argo New Zealand floats for which SIO does DMQC.

SIO expects to maintain a high DMQC completion percentage during the coming year and will continue with a 7-9 month revisit schedule. In the past year, resources were allotted to allow the group to reduce the DMQC backlog that built over the past few COVID-impacted years. The DMQC backlog of SIO's Deep SOLO floats, following the Argo best practice CPcorr estimation, was reduced by about half. The SW Pacific and Indian Ocean Pilot-arrays were the initial Deep floats to be DMQC'd during 2022. The Southern Ocean and Atlantic arrays will follow in 2023. The consensus standard DMQC procedures for SOLO/SOLOII/Deep profile data were continued in 2021.

The timeliness of SIO real time data arrival at the GDAC this year has been uneven. SIO profile data collected between 1 Jan 2022 and 28 Nov 2022 reached the GDAC within 24 hours 95.1% of the time, and 86.9% of the time within 6 hours. Several hardware failures at SIO were the primary cause of the lower percentages as compared to previous years. During June 2022 the percent arrival was only 82.3%/70.5% within 24hrs/6hrs, due to the loss of SIO's primary Argo processing computer. The above timeliness calculation used the float surfacing time, so the temporal span includes the time of transmission, SIO SBD/directIP processing, and AOML DAC netCDF creation.

In 2022 the first IDG developed prototype 6-sensor BGC SOLO was deployed. The software development necessary to parse the transmitted data and distribute the result to AOML/MBARI DACs for netCDF creation was a significant endeavor.

SIO has actively participated in moving forward the priorities of the Argo Program during the year. A non-exhaustive list follows. Megan Scanderbeg's continued work to improve data access descriptions for users and to communicate more often with operational users. SIO continues to update the Argo Climatological Dataset for OW salinity calibration. John Gilson has worked with Annie Wong to provide an Argo-wide audit on the profile netCDF salinity adjustments. Nathalie Zilbermann and Dean Roemmich have worked with Seabird to improve the calibration of the SBE61 CTD (0-6000dbar capability). Sarah Purkey and Jeff Sherman (IDG lab) have led the development of the SIO BGC SOLO.

University of Washington

Over the course of the present reporting period (January 1 through November 15, 2022), it was estimated that 559 floats were "active" in the University of Washington fleet and reported a total of 17,236 profiles. Active floats are defined as having recorded and sent at least one profile during the reporting period. A total of 31,691 profiles were processed in delayed mode during the reporting period, including 28,256 (89 %) from active floats and 3,435 from floats that are no longer active and presumed dead. Delayed mode profiles written during the reporting period included both newly-recorded profiles, profiles that required re-processing (e.g., change in calibration), and profiles that were accidentally or intentionally skipped during previous reporting periods.

Floats associated with the SOCCOM program recorded 2,837 new profiles and a total of 2,701 profiles were processed in delayed mode (includes both new and reprocessed files).

Floats associated with the GO-BGC program recorded 1,120 new profiles and a total of 628 profiles were processed in delayed mode (includes both new and reprocessed files).

Three RBR floats were deployed during the present reporting period. A total of 632 profiles from these floats have been processed in delayed mode, including 257 that were determined to have good salinity that required no adjustment (40 %), 36 that were determined to have good salinity after an adjustment (6 %), and 339 that were determined to have bad and unadjustable salinity (54 %).

In addition, a total of 4,664 dissolved oxygen profiles were written during the reporting period; these profiles were recorded by floats equipped with Aanderaa 4330 optodes and are not processed by the Monterey Bay Aquarium Research Institute. These floats are separate from the SOCCOM and GO-BGC programs. Approximately 3,390 (73 %) of these profiles were newly recorded during the reported period and 1,274 of the profiles were re-processed from older files that required new calibrations.

MBARI (Monterey Bay Aquarium Research Institute)

Biogeochemical data from 237 operational five- or six-sensor BGC-Argo floats are currently being processed and subjected to real-time and delayed-mode quality control by MBARI. This includes 119 active SOCCOM floats in the Southern Ocean, 77 active floats deployed as part of the Global Ocean Biogeochemistry (GO-BGC) array, and 41 active "SOCCOM-equivalent" partner floats in various locations. All float data is managed by Tanya Maurer, Josh Plant and Emily Clark.

A total of 92 BGC-floats managed at MBARI have been deployed throughout 2022 across all programs. 53 of these were GO-BGC floats deployed across 12 different cruises, and 29 SOCCOM across six cruises. These deployments included 57 five-sensor APEX, 21 five-sensor Navis, and four six-sensor BGC-SOLOII. Additionally, MBARI continues to assist with data processing and management for floats outside of these programs, including four APEX oxygen-only BGC-Argo floats deployed in the low-oxygen zone of the Eastern Tropical Pacific and two Navis five-sensor floats deployed near the Bermuda Atlantic Time-series Study (BATS) site. MBARI has also been involved in processing and management of data from various test-floats within the past year, including two dual-optode APEX test floats in the Eastern Pacific and two triple-optode Navis test floats in the North Pacific (dual- and triple-optode data are not yet available at the GDAC).

BR- files are being generated and transferred to the Argo GDACs for all five- and six- sensor operational floats at a frequency of twice per day. Delayed-mode quality control assessment of oxygen, pH and nitrate data is performed multiple times per year. BD-designated files generated at MBARI signify that at least a preliminary DM assessment has been performed, although BD* files are subject to updates periodically throughout a float's life. MBARI-developed MATLAB software used to perform BGC DM assessment is publically available through the SOCCOM github at https://github.com/SOCCOM-BGCArgo/ARGO_PROCESSING and methods are described in Maurer et al (2021), https://doi.org/10.3389/fmars.2021.683207.

In addition to the processing and dissemination of float profile data, over the past year the data team at MBARI has begun processing biogeochemical data from park phase on floats for which it is available. This includes bio-optical data from 279 APEX floats as well as pH and oxygen data on select Navis floats. Both APEX and Navis floats sample temperature, salinity, and pressure data at park depth. These data are being subject to real-time quality control and are being stored internally at MBARI. Integration into combined v3.2 trajectory files will begin in 2023 in collaboration with AOML.

The data team at MBARI is also working closely with sensor developers to prepare for modified and new biogeochemical sensor models. Deployment of Sea-Bird FLBBFL sensors which excite chlorophyll fluorescence at two wavelengths (standard 470 nm, and new 435 nm) will begin shortly. Preparations are also underway to process data from floats carrying the Pyroscience Pico pH sensor. Data from these new sensors will initially go in the auxiliary directories at the Argo GDAC until approved.

MBARI continues to generate a semi-annual audit on DOXY profiles to assist DACs with furthering the amount of adjusted DOXY data at the GDAC. Work is ongoing and international response to this audit has been successful thus far (information on the audit can be found on the MBARI ftp: ftp://ftp.mbari.org/pub/BGC_argo_audits/DOXY/). In addition, the team has been involved in further testing the application of the Bittig et al (2014; https://doi.org/10.4319/lom.2014.12.617) oxygen response-time correction on Argo floats with oxygen sensors and plans to endorse the use of this method in delayed mode or as an external product, depending on community feedback.

An updated temperature correction for NITRATE was recently developed at MBARI and represents an improvement to nitrate accuracy from the Sakamoto et al (2009) correction currently referenced in Argo documentation (doi 10.13155/46121). A manuscript for this method is in preparation, to be submitted to L&O methods within the first quarter, 2023. Additionally, documentation outlining processing and quality control methods for PH_IN_SITU_TOTAL were enhanced this year by the MBARI team and should be available publicly within the first quarter 2023.

MBARI continually supports the ADMT; Tanya Maurer serves as co-chair of the BGC-ADMT task team and MBARI data team members remain active in ADMT working groups focused on various BGC parameter topics.

Wood Hole Oceanographic Institution

WHOI Argo data management report covering the time period Oct 1, 2021 thru Sep 30, 2022. During this time, the WHOI Argo group deployed 123 floats. Of these there were 104 MRV S2A, 2 MRV Alto, 2 MRV Deep Solo, and 15 Navis-BGC. The size of the standing fleet averaged about 425 platforms. There are currently 258510 profiles reported to the GDAC, of which 239611 are eligible for DMQC. Of the eligible profiles, 95.8% have completed DMQC.

WHOI maintains two instances of our real-time telemetry decoder. The first operates on a server in Woods Hole while the second backup server operates in the cloud. Both of these servers are configured to submit data to the primary AOML DAC as well as the DAC's backup server. This system provides redundancy which has been exercised several times in past year with good success as we have managed to maintain data flow despite numerous downtime events of the primary servers at WHOI and AOML.

WHOI continues to contribute to the RBR Data Task Team, and the paper documenting recommended corrections. We are just beginning to work on applying these to our RBR float data. We have acquired 8 RBR ALTO's with onboard dynamic correction capability, which will be deployed in the coming year.

Work continues to identify Fast Salty Drifters. Of the 69 WHOI floats carrying SBE CTDs in the suspect serial number range, we have identified 21 CTDs suffering fast salty drift. New and improved software has been developed to deal with increasing diversity of operating float types including Deep and BGC. Additionally Deb West-Mack has made significant progress in development of protocols and software for performing DMQC on trajectory files. Salinity calibration in the Gulf of Mexico has been aided by development of a carefully screened set of bottle reference data. Other contributions to Argo data management include Global audits of salinity drift of each individual CTD (https//argo.whoi.edu/argo/sbedrift_wmo/) and global maps of fleet coverage (https://argo.whoi.edu/argo/maps/sparse).

3. Value Added items

University of Washington

A manuscript is currently being prepared that summarizes physical and biogeochemical data recorded from floats deployed in the Argentine Basin. It is intended that this manuscript will be submitted to a peer-reviewed journal in early 2023. Another manuscript that described the bias in Argo salinity was submitted to Earth System Science Data in September 2022. UW also contributed to a manuscript about the $RBRargo^3$ CTD, which was published in July 2022 (DOI 10.1175/JTECH-D-21-0186).

In ADMT activities, UW and SIO collaborated on an Argo salinity audit. This activity is expected to continue in future years.

4. GDAC Functions

US GDAC is up and running. Details will presented during ADMT23

5. Regional Centre Functions

Not applicable

6. Other Issues

Nothing to report