ARGO

part of the integrated global observation strategy

21st ADMT Meeting

Virtual Meeting

29th November - 5th December, 2020

Link to schedule: Argo: ADMT 21 (virtual): Schedule

Link to ADMT-21 Action items

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1. Introduction

The ADMT-21 meeting was a virtual meeting due to the COVID-19 pandemic. Despite the difficult time zone for many, there were over a hundred participants each day: 116 on day one, 118 on day two and 113 on day three. A Google Drive Folder was set up to share the presentations, documents and action items for the meeting. Speakers were invited to upload longer versions of their talks in addition to shorter versions to provide background information as needed.

The Agenda is in Annex I, The Action list status for ADM20 and new Action list for ADM21 are available in Annex II and III

2. Status and updates

2.1. Feedback from AST (S. Wijffels, T. Suga)

Toshio Suga provided feedback from the AST meeting that was org-anized as a virtual meeting last April. The Argo network has not suffered too much from COVID19 even if fewer deployments were possible. A new governance structure was endorsed to facilitate steering between Core, Deep and BGC Argo into one network.

Argo's environmental impact statement was written under the leadership of Steve Riser and Susan Wijffels. It was an important step and could help proper communication on the environmental impact especially as public awareness of ocean observing increases due to the UN Ocean Decade. It is important for the Argo community to respond to this issue in a consistent manner. Euro-Argo is preparing a leaflet for wider outreach and it was suggested that an infographic and/or slides are created to help with the public.

Argo's first data paper was published thanks to Annie Wong's leadership, covering the first ~20 years/2M profiles of core Argo. It is a significant milestone, providing a comprehensive description of the data set and its evolution with assessments of parameter accuracies.

A framework has been set up to introduce new sensors and parameters in Argo and to request endorsement from the IOC for new parameters and sensors. It consists of the three stages: "Experimental" as MSR under UNCLOS, "Global Argo Pilot" with notification through AIC and "Global Implementation." While "Experimental" could be either within 'Argo' or outside 'Argo,' the key is that any data collected on 'Argo' float will be shared in real time, for any stage. M. Belbeoch noted that there are floats with experimental sensors in the ocean which are interested in potentially becoming part of Argo, so this is something that the AST and ADMT should be aware of.

Toshio is leading the "One Argo" proposal to be a UN Decade Program, emphasizing its multidisciplinary, global and transformative nature. He said this could help Argo gain a higher profile with international gov'ts and possibly lead to widespread outreach and more funding. Deadline is Jan 15th for the UN Program Decade submission.

Some immediate challenges were presented regarding filling gaps, especially during recovery from COVID19, excessive cost and low availability of sensors, more precise deployment planning, especially for Deep and BGC floats, requiring a tighter partnership with the RV and other ship operators and across Argo deploying groups. We also need to promote "Argo Beyond 2020" globally to gain the support required, so that we can better serve the broader community. M. Belbeoch offered organizing more basin scale planning meetings to help with effective Argo float coverage.

Argo is growing in complexity; BGC and Deep Argo drive a significant increase in complexity in the data system, which is a big challenge as are trajectory files. The further success of the evolving Argo depends on the data system and our data teams. AST is grateful for the ADMT's continued efforts.

Action item 52: Find ways to effectively share the environmental impact statement. Euro-Argo is developing a leaflet on this which can be shared. Other ideas include creating an infographic and slides. M Bollard/Euro-Argo ERIC, WHOI and AST+ADMT Chairs.

2.2. Feedback from BGC-ADMT (C. Schmechtig)

The BGC-Argo workshop took place virtually on the 30th November and 1st December, 2020 with over a hundred people attending each day. As an introduction, Ken Johnson reports that the BGC-Argo array is constantly growing and the NSF-funding of the Global Ocean Biogeochemical (GO-BGC) array will result in the deployment of 500 more BGC floats over the next five years. The amount of quality controlled data is increasing rapidly at the GDACs making BGC-Argo data much more useful for global analyses.

During the meeting, a working group was established to continue the discussion of the development of a unified BGC-Argo Reference dataset. A working group was also set up to define a flag propagation scheme from core parameter QC to BGC parameter QC that balances traceability, workload and getting the best data to the users.

The BGC-Argo Website will be enhanced with additional information including the status of the BGC files (R,A,D), links to codes for RT and DM processing, the audit for BBP, and the audit for DOXY. These pieces will be added to a "tools and resources" section.

Regarding DOXY, a standardized adjustment equation was agreed upon. Some encouraging SBE83 oxygen sensor testing was also reported. This is the new oxygen sensor under development at SeaBird that is capable of performing in-air measurements. Additionally, research is ongoing related to the implementation of the DOXY time-response correction.

Regarding pH, it was suggested that VK_PH parameter should be added as an i-parameter. This is an additional diagnostic variable for the pH sensor. The pH "pump-offset" issue was also presented; research on this topic is ongoing.

Regarding NITRATE, the use of the new temperature correction algorithm was presented; it is recommended that this update be added to the documentation and adopted by all DACs.
_ACCURACY and _ERROR recommended updates for pH, DOXY and NITRATE are presented; without objection these will be added to the documentation.

A DMQC method is presented to correct the radiometry profiles. Without objection this method will be added to the documentation.

Two Surveys will be set up in the coming weeks to finalize discussions on improvement on RTQC for BBP and CHLA parameters that have been presented, a meeting is planned for January/February to finalize the decisions and move forward.

2.3. Action item status (M. Scanderbeg)

M. Scanderbeg presented on the status of the Action Items from ADMT-20. Given the pandemic, the status of the Action items was quite good: 31 were completed, 27 were in progress and 5 were not started. Overall, the ADMT co-chairs received positive feedback for the use of a Google Spreadsheet for the Action Items and this will be continued next year. Additionally, it looked like DACs and DMQC operators were using the priorities in the spreadsheet to help them decide the order in which to tackle the Action items.

Feedback from the DACs was a bit mixed and it is clear that many DACs are working hard to keep up with the ADMT requirements, but that it is quite difficult. The first DAC Workshop highlighted these challenges and we hope that improved collaboration between DACs can help reduce the burden, especially with the ramping up of the BGC and Deep Argo missions.

The User Manual was published promptly after ADMT-20 - thank you!

DMQC operators reported very positive comments on the tables in the monthly Coriolis report to help prioritize which floats to DMQC as a high priority.

John Gilson released an updated Argo ref DB, but was unable to explore a more sophisticated way of thinning out data by region. This Action can be continued to ADMT-22.

The proposed joint Argo - OceanPredict workshop did not happen last March due to COVID. It is important for Argo to interact with the operational community so that we can understand their needs and they can better understand Argo data availability, accessibility, and format. We support planning another workshop.
No work was done to collect best practices information and make it available on Argo websites. This action should remain for ADMT-21.

Action item 41: Keep using Google Sheet for action items and post link on ADMT-21 meeting website.

Action item 42: Review incomplete actions from ADMT-20 to see which actions need to be kept for ADMT-21.

Action item 7: ADMT co-chairs will continue to try and prioritize DAC actions from meetings to provide clear guidance on which ones to accomplish first. Co-chairs will consider a mid-year virtual meeting with DACs to check on progress.

Action item 39: Ask John Gilson to apply suggested filters except the one to thin out the Argo ref db and release that version of Argo ref db. Afterwards, ask John to explore thinning data by region.

Action item 53: Work on collecting Best Practices information for core Argo on float deployment, float storage, data practices, etc. and first step make it available on WWW page.

Action item 30: The ADMT suggests a working group, led by Peter Oke, to organize a joint Argo-OceanPredict workshop that will feature both science and data talks to encourage better communication and engagement between Argo and the operational community.

3. Real Time Data Management

3.1. DAC RT Status including timeliness on GTS and DACs, anomalies (A. Tran, C. Coatanoan, N. Verbrugge, M. Belbeoch)

Anh Tran reported on the timeliness of Argo data on the Global Telecommunication System (GTS). From October 2019 to October 2020, on average MEDS received 13,453 unique BUFR messages transmitted on the GTS, of which 10,662, 2785 and 20 messages from floats transmitted using Iridium, Argos and Beidou satellites, respectively. On the entire Argo network, approximately 90% of the BUFR messages are transmitted within a 12 hours target for floats using Iridium satellites and a 24 hours target for floats using the Argos satellite. About 90% of BUFR messages meet the 12 hours target for floats transmitted on Iridium and 89% of BUFR messages meet the 24 hours target for floats transmitted on Argos. For floats using Beidou satellite, 91% of the BUFR messages were transmitted within 12 hours of data collections. MEDS only started to receive messages transmitted on the Beidou satellite in July 2020. CLS and the Korean DACs don’t have any floats using Iridium satellites during this period. If Argo changes the timeliness target from 12 to 6 hours, only 80% of the current Argo data will meet the target.

Christine Coatanoan reported on the anomalies detected on the GDAC. First, the report from Coriolis has been reorganized to highlight the suspicious floats that exhibit drifting salinity in the table reporting the floats that have doubtful behavior. New floats with anomalies that have been detected during the last month are listed at the top of the table. These floats have been detected using the MinMax test, but may have started to drift for more than one month. The other floats notified in previous reports are still listed if not yet on the grey list and still trigger a warning from the MinMax method. To finish the table, floats are sorted in two parts: one to indicate the floats for which the DAC operators do not agree although these floats still appear in the anomalies, and a second one to indicate the floats present in the table the previous month but which have been grey-listed.

At the last ADMT, all DACs were asked to grey list floats that fail the MinMax drift test. Many floats have been drifting for several months and should be automatically grey listed when they have been in the table for some time. Some DAC operators or PIs have informed of the greylisting but there are still too many of them. If these floats were put in the grey list, it would mean less anomalies detected and less messages to send to the DAC operators.

This report highlighting anomalies, combined with other reports such as the altimetry one, provide guidance on how to prioritize DMQC processing.

Periodically, an unusually large number of anomalies has been observed and it is due regular events like the feedback from CORA (the Coriolis ReAnalysis product updated every 6 months for the Copernicus Marine Service) or the new spike test implemented in the Coriolis quality procedure. Some examples have been shown with drifting floats and also others anomalies that continue to exist at the GDAC. All the information regarding the anomalies can be found in the report sent monthly to mailing lists: argo-dm & argo-dm-dm. This report is also available on the Coriolis GDAC ftp site.

Nathalie Verbrugge (CLS, France) presented the status of the anomalies detected with altimetry. The synthesis of the quarterly analyses for 2020 shows that about 20% of the floats put in alert by the comparison of altimetry and dynamic height anomalies are checked and corrected if necessary. 172 floats are on the alert list in November 2020, and we recommend a transfer to the greylist for 43 of them. It also seems that some floats with a greylist tag have cycles corrected with a QC at 4, up to the last cycle that remains false and uncorrected. The float is not on the greylist and false profiles are still delivered. It is strongly recommended to put the floats with the greylist tag on the greylist when the drift is confirmed to avoid the delivery of bad profiles to users. Comparison of the entire Argo database with QC=1 and altimetry indicates a slight degradation this year for R-mode profiles, but the statistics improve significantly by removing the data from the floats on alert from the November 2020 quarterly analysis.

The values of the salinity and pressure adjustments made in delayed mode are stable, with low amplitudes for a large majority of the floats: 85% of the profiles were adjusted less than 0.01 psu in salinity and less than 1 dbar in pressure. These 85% also show differences of less than 1 cm between adjusted and unadjusted dynamic heights. Finally, the differences with the co-located altimetry data are also small and stable over time and less than 5 cm for 84.4% of the profiles showing a good coherence between these two types of observation throughout the life of the floats.

In discussion, S. Wijffles thanked the teams that are performing the global tests and quality assessments that are very important. She seconded the recommendation to DACs to actively manage those reports and put floats that are detected as drifting on greylist rapidly. In particular it was requested that AOML work to find a solution for NAVO floats when the data should also be greylisted and stopped from distribution on the GTS.

For NAVO floats, AOML mentioned that they greylist those data when appropriate before GDAC submission. Only very few are still active on the GDAC as NAVO floats do not enter AOML data stream since 2016.

Action item 9: Ask AOML to work with NAVO to find a solution for drifting floats that should be greylisted and not distributed on the GTS.

M. Belbéoch (OceanOPS) reported on some of real-time issues for Argo data flow. The daily data flow is on slow decrease (10%) since early 2020, within a longer-term slowly decreasing trend. This decrease might be partially explained by COVID impact but the longer trend is due to flat funded Argo national contributions. The data availability indicator, which is the difference between floats operating vs floats distributing data is higher than ever: 97.5% showing DACs did substantial efforts to optimize real-time distribution and process the float backlog which is generally due to new float and sensor types.

97% of Argo data reaches the GTS (french node) in 24h, 92% for US GDAC and 93% for FR GDAC. As the Iridium share of floats is now close to 85%, better latency is expected (difference between observation time vs availability to users time). 75% of data reaches the GDACs within 6h. BGC float data meet the 24h target, except for BODC. Deep float data meet this target as well, except US deep floats profiling on descent, and present an incompressible delay of 10 to 15 days. Beyond this technical limitation, 5h are required to process and distribute the US deep float data (median). He remarked that the GDACs were sometimes adding an extra 5 to 7 hours to the overall processing chain, in particular for ISDM, INCOIS and CSIRO, while it is generally around 1-2 hours for other DACs.

In discussion, Matt Donnelly (BODC) mentioned that setting up the APF11 processing took some time which can explain delays as they were new platforms managed by the centre. CSIRO mentioned that there was a bug in code related to the new decade that has been fixed but could explain the INCOIS delay as they share the same code, so it should be easy to fix at INCOIS. In general, the delay computed from the GDACs shows differences in terms of the delay that could probably be improved by sharing expertise between different DACs. This could be an item for further discussion at the next DAC workshop. S. Wijffles welcomed the improvements in timely delivery onto the GTS and noted that it should be more widely communicated to the operational community and the joint Argo - OceanPredict meeting planned that should be organised early 2021 could be one place to do so. The issue of delay from floats profiling upon descent could also be brought.

Action 50: Ask M. Donnelly and C. Schmid to consider adding a topic to the next DAC workshop on improving data delivery strategies. It could be that some DACs could improve their timeliness based on suggestions from other DACs. Also consider adding the results of an audit of metadata consistency between DACs and OceanOPS.

M. Belbéoch remarked that the grey list was increasing and represented 15% of operational floats. He suggested reviewing the density maps calculation to exclude these floats. He finally mentioned that new performance indicators will be developed and added to the Metrics part of OceanOPS website to better monitor delays to 3, 6, 12, 24h targets, for different Networks (Core, BGC, Deep) and telemetry systems.

DAC	ALL average / median delays, hours		BGC		DEEP		ARGOS		IRIDIUM		BEIDOU	
BODC	48	5	493	493	-	-	14	5	80	5	-	-
KMA	14	14	-	-	-	-	15	15	-	-	-	-
INCOIS	34	24	4	3			36	24	13	13	-	-
JMA	10	5	7	7	6	5	16	7	5	5	-	-
CSIRO	10	6	16	11	-	-	22	22	8	5	-	-
SIO/SOA-2	4	3	2	2	-	-	5	6	3	3	3	2
ISDM	11	11	118	15	-	-	-	-	11	11	-	-
NOAA/AOML	20	3	4	4	308	245	14	16	20	3	-	-
CORIOLIS	25	2	9	2	2	2	9	5	29	2	-	-

October 2020 delays for DACs - Orange and red show margin for progress
Find all these delays, on any float sample, time window at ocean-ops.org/argo section Data flow

DAC actions #9, 10, 11, 12, 13, 15, 16, 19, 20, 22, 23

#9 GTS delivery target to 12 hours or less:
The objective is to check if DAC delivers Argo data on GTS within a 12 and 6 hours target.
Four DACs answered positively: BODC, JMA, MEDS and Coriolis

The action #9 remains opened for the 7 DACs: AOML, CSIO, CSIRO, INCOIS, KMA, KORDI, NMDIS
#10 Coriolis monthly anomaly report: DAC feedback
Check that DACs properly manage the monthly anomaly reports sent by Christine.
Each DAC has a procedure to manage the monthly report.
#11 Altimetry anomaly report: DAC feedback
Each DAC has a procedure to manage the quarterly anomaly report.
However, some anomalous floats remain on altimetry alerts, without acknowledgement or action.
#12 Replace RTQC gradient test T&S with the new MEDD test.
Only Coriolis DAC implemented the MEDD test.
The action #12 remains opened for the 10 other DACs
#13 MinMax drift test: feedback from DACs
Each DAC has a procedure to manage the MinMax chapter of the monthly report.
#15 Real-time adjustment
DACs should apply real time adjustment to all R files when a D mode adjustment becomes available. This means going back and re-processing R files after last D mode file and current R files coming in.
Coriolis does it for salinity only.
CSIRO does it for oxygen only.
The implementation is in progress in the 9 others DACs
The action #13 remains opened.
#16 BGC trajectory files
Ask that all DACs with BGC floats make sure they produce traj files that include all MCs for all BGC events.
Coriolis responded positively.
The action #16 remains opened for the 10 other DACs
#19 Garmin GPS problem
Ask DACs to make list of APEX and NAVIS floats deployed between April and September 2019 to monitor possible Garmin GPS problem.
The list is online on Argo GDAC : ftp://ftp.ifremer.fr/ifremer/argo/etc/gps-problem/
#20 CARS real-time adjustment
CSIRO and INCOIS stopped adjusting real-time data against CARS climatology.
The action is closed.
#22 Grey list : active floats only
The greylist should not contain entries for floats entirely demoded.
All DACs are aware of that.
The action is closed.
#23 Ask DACs to implement new global range test
Only Coriolis and INCOIS did it.
The action #23 remains opened for the 9 other DACs

Ask all DACS to fill the 2020 action list mentioning if there are real difficulties in progressing on the action or if it's just a matter of time and manpower
Action 7: ADMT co-chairs will continue to try and prioritize DAC actions from meetings to provide clear guidance on which ones to accomplish first. Co-chairs will consider mid-year virtual meeting with DACs to check on progress.

In discussion, BODC reiterated that their focus has been catching up on APF11 floats. After that, they plan to turn to other actions.

S. Wijffels asked DACs to please let her and Toshio Suga know if implementing new missions has been impacting your ability to implement core activities. The AST co-chairs would like to know if the introduction of the BGC and Deep missions have put additional pressure on their workflow, especially if this has come without additional funding. A few DACs commented on this noting that implementing BGC floats is a huge effort and that this will not be stabilizing quickly as DACs are being asked to regularly reprocess BGC floats.

Brian King emphasized that from a scientific point of view, it is crucial to use the identified audits and tests that are designed to quickly identify bad data in near real time and prevent them going through with a good QC flag. Finding and excluding these bad data makes a substantial improvement to the quality and reputation of the dataset, and need to have a high priority. So when deciding what to do first with limited resources, please give strong consideration to things that remove the bad data and improve the quality.

4. Real time qc tests & flagging of data:

4.1. Refined deepest pressure test for shallow profiles (C. Schmid) Action 14

Claudia Schmid presented three options on how to refine the deepest pressure test for shallow profiles:
(1) The approach suggested by Corioils, which is based on interpolating a tolerance as a percentage of the target profile pressure. This percentage is 150% (10%) for a target profile pressure of 10 dbar (>= 1000 dbar). This translates to a tolerance of 15 dbar for a target profile pressure of 10 dbar; 405 dbar for a target profile pressure of 550 dbar; 100 dbar for a target profile pressure of 1000 dbar.

(2) A short table like this:

Target profile pressure	tolerance
Less than 100 dbar	200 dbar
100-200 dbar	300 dbar
200-700 dbar	400 dbar
700-900 dbar	300 dbar
More than 900 dbar	200 dbar

(3) A combination of (1) with a fixed tolerance of 200 dbar for all target profile pressures below 1000 dbar.

An email that contains the presentation has been sent to the argo-dm mailing list on 12/2/2020 to get feedback from all DACs (and others) and elaborate a consensus approach.

Action item 11: Finalize refinement of deepest pressure test for shallow profiles.

5. Collaboration & code-sharing efforts

5.1. Feedback from DAC workshop & ways to improve coordination between DACs

This was the first of two sessions, with the second to be held in early 2021. Attendance at the workshop included representatives from DACs, but also e.g DMQC operators, PIs and manufacturers. Feedback so far is that the session improved understanding of challenges faced by DACs and potential routes for future collaboration, but that we should start with 'small' endeavours.

Shared challenges were apparent in terms of growing data system complexity, managing diverse fleets of floats with exception handling being a particular challenge, and sustaining future development alongside long-term data infrastructure, all in a heavily resource constrained environment. Each DAC has its own infrastructure setup, and allow there are broadly common workflows there are challenges to collaboration such as different implementations, programming languages, approaches to storage and interactions with DMQC operators.

Past code sharing has been limited and brought additional challenges such as creating dependence rather than collaboration, and challenges with code integration. It is clear we need to develop a better approach to collaborating - at least on requirements and approaches - rather than just sharing code once written. Collaboration is also challenging due to different skillsets, stages of development and competing priorities/timelines. It seems clear that collaborating on entire processing chains is too complex and DACs need to work out what to collaborate on in terms of toolboxes/libraries/utilities. An 'infrastructure agnostic' approach to enable plug-and-play code integration is needed, and efforts may be best focused around the development of the BGC data system, e.g. a common real-time QC toolbox.

There is the potential to work more closely with manufacturers on data file decoders/readers, to minimise duplication of effort across DACs. The two key elements to this will be working out where the divisions of responsibilities lay between manufacturers and DACs, and how decoders can be collaboratively developed as e.g. firmware evolves. To ease this process it would be helpful if manufacturers can minimise the variability in firmware and maximise its stability to reduce the need for complex exception handling. There is also potential to introduce 'manufacturer vocabularies' (reference tables) for e.g. configuration and technical metadata to map to Argo terms, capturing a huge wealth of knowledge and store these in the NERC Vocabulary Server.

A poll to select a date for the second session will be sent around, and feedback is welcome on the exact format this session should take, e.g. break-out sessions, etc.. Feedback can be provided directly to the convenors at: lien and *claudia.schmid@noaa.gov* or via the DAC mailing list: argo-dac-operations@listes.ifremer.fr. A survey of the DACs is also underway and will feed-in to the second workshop session.

Action item 49: ADMT endorses continuing the DAC Workshop and finding ways to collaborate more effectively.

5.2. Update on transferring reference tables to NVS server (update by M. Donnelly on behalf of the Argo Vocabulary Task Team)

As part of the EU Horizons 2020 project ENVIR-FAIR, BODC, NOC has been migrating the Argo reference tables to be hosted on the NERC Vocabulary Server (NVS). The presentation included a large amount of background material (slides with white headers) on work done and the progress made in the past year, as well as a number of areas of planned investigation for the coming year. The material presented at the session (slides with blue headers) focused on main developments, including migrating of most of the reference tables, agreement having been reaching on addressing the remaining tables (e.g. configuration, technical and trajectory tables), investigations that have identified further opportunities to constrain the metadata in the Argo NetCDF files, and upcoming release of the new tool known as VocPrez to improve human readability and access to machine-readable services. A new ADMT webpage dedicated to the Argo vocabulary server has been created and (currently) draft content will be populated in the near future as a gateway for Argo users.

Remaining work in the coming year will include finishing the population of the SENSOR* tables, creating links (known as 'mappings') between entries in the vocabularies, completing migration of the outstanding reference tables, starting work on the new reference tables (28-30) introduced at last ADMT. Work on improving the search and editor interfaces will also progress in the coming year. There were 4 proposals put to ADMT for approval in support of upcoming work.

Proposal 1: Change the mode of operation for managing additions and modifications to the reference tables/vocabularies starting from January 2021. This included using GitHub issues for tracking discussions and decisions rather than the mailing lists, a 2-week time-limit for progressing discussions, final approval by the ADMT Executive, and implementation by vocabulary editors. Feedback after the session highlighted that it would be useful to retain the option for mailing list discussions, at least initially.

Proposal 2: Make the NVS the 'master' source for the Argo reference tables starting in April 2021. At this point all other material, such as the user manuals, should be treated as copies of the NVS contents. We would cease to use the Google Documents and spreadsheets at this time. All future updates would be through the mode of operation described in proposal 1. Feedback after the session highlighted the importance of retaining human readable versions of NVS content, and it is critical that the new ADMT webpage dedicated to the Argo vocabulary server include details of this functionality for ease of access.

Proposal 3: Create a new reference table '31' containing the 3 elements of the framework for entering Argo which would enable each SENSOR and PARAMETER to be clearly 'mapped' to each of these terms. Feedback after the session was broadly against this proposal.

Proposal 4: Adopt the ICES platform codes for ships to constrain the DEPLOYMENT_PLATFORM field. The ICES platform codes are already used in the Ocean OPS system. The exact form to be included in the meta-file still needs to be decided to take into account none ship-based deployments (e.g. air deployments) and this proposal only seeks approval to proceed with adopting the ICES platform codes, with implementation decided through option 1. Feedback after the session was broadly in support, with clarity needed regarding the mechanism for generates ICES platform codes. During discussion, it was noted that including deployment ship is useful when trying to find launch CTD casts and when making maps promoting key ships contributing to Argo like the RV Kaharoa. To this end, it would be helpful for DACs to have a list of the ship codes easily available to put into the meta files.

In addition, 8 areas of further investigation were highlighted (details in the background material slides) and input from the community was welcomed, preferably through the NVS GitHub.

5.3. Introduction to the Euro-Argo Collaborative Framework

G. Maze and the EARISE WP2 group (IEO, INOGS, BSH, IFREMER, SOCIB, BODC, FMI, OceanOPS, IPMA, SU, IOPAN)

Within this work package, our goal is to improve the quality of the Argo dataset. Beyond improving quality control methods, EARISE aims to improve how Argo (DM)QC activities are conducted. We organise QC activities in 3 categories:

- Software (eg: development, performance, usage, access)
- Reference dataset (eg: content, access, availability)
- Data & expertise (eg: training, sharing, educating users)

We assume that improved collaboration is the best way toward a long term and robust development of these activities. To foster this collaboration, we have set-up in Dec. 2019, and are still developing today, an online collaborative framework at github.com/euroargodev.

This online framework is organised around “repositories”: a collection of files (possibly) with online collaborative services like discussion threads (“Issues”), wiki pages, project management and a complete set of community development (based on “git”). The content of each repository can be shared through web sites or published with packages (eg “npm”, “docker”, etc …) or a simple zip file release.

The Euro-Argo partners have agreed to use this framework as the primary tool to share, distribute and work together on Argo community tools. More than 45 people have registered and more than 20 repositories are being filled with Argo useful information and tools.

The online collaborative framework is a place where the Argo community:

- distribute softwares, codes, documents
- develop softwares together
- have discussions and share expertise

We now welcome any member of the Argo international community to join and participate in this framework. Contact G. Maze (*gmaze@ifremer.fr*) for further information.

6. GDACs

6.1. Operation status at US GDAC & Coriolis GDAC (M. Ignaszewski, T. Carval) (Actions 1, 2, 3, 4)

#1 Keep grey list on GDACs. Make sure that it contains only active floats.
On December 1st, there were 1350 floats in the greylist (2197 parameters).
There are 429 floats with “start_date” older than year 2015 (core parameters).
A regular yearly check is necessary, in 2020, the situation is correct.
The action is closed.

DAC	NB_FLOAT
aoml	731
coriolis	225
csiro	149
bodc	90
jma	73
csio	26
incois	24
meds	23
kma	6
kordi	3
Total	**1350**

Core argo parameters	
Floats with start_date < 2015	
DAC	NB_FLOAT
aoml	273
csiro	76
bodc	28
coriolis	22
jma	13
csio	7
kma	6
kordi	3
meds	1
Total	**429**

#2 Ask GDACs to keep Mprof files available for one month after SProfs are available at both GDACs. Then the MProf files can be removed
Done on US and Coriolis GDACs: BGC-Argo synthetic profiles have replaced M-profiles.
The action is closed.

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

#3 US GDAC FTP server
Ask US GDAC to explore ftp connection and see if it is possible to have more than one connection at one time: 10 connections allowed to GODAE from NCEI
Study why US GDAC and NCEI ftp synchronization takes 21+ hours: Syncro down to 3 hours
The action is closed.

#4 Stop accepting D-mode files in less than v3.1 in November 2019
Done October 2020: the trajectory files having an older version than V3.1 are rejected by the format checker
The action is closed.

6.2. Format checker updates (M. Ignaszewski) (Actions 5, 6, 7, 8)

The FileChecker is current with the Users Manual v3.3. The new reference tables – 28, 29, 30 – are not currently being validated. This check is expected in February 2021.

Cross-reference checks were added to the meta-data files based on reference tables 23 and 27. These are currently implemented as WARNINGS. It is proposed that these be transitioned to ERRORS (rejections) in January 2021.

The full trajectory checks are now implemented as WARNINGS. There are many errors currently. These will remain as WARNINGS for the foreseeable future while DACs correct the errors. The ongoing upgrades are:

1) Checking of configuration and technical parameter names. Basic checks of the names are currently being performed. This enhancement validates the "template" values against approved settings. The proposal is to add these tests as WARNINGS in January 2021.

2) Checking of the technical parameter values. The values are encoded as strings. This enhancement checks that the setting corresponds to the data type specified for the specified unit. There are currently lots of errors. Mark will collaborate with the DACs to address these errors.

This coming year:
1) Complete the parameter name transition.
2) Add the new reference table checks (ref table 28, 29, 30)
3) Transition to the NERC vocabulary server
4) Move FileChecker software to GitHub(?)

During the discussion on collaborative work through a tool such as Github it was agreed that it could be worth trying but within a small community as it is important to only have certain people modifying the code. M. Ignaszewski noted that the file checker is coded in Java, and he was notsure how many Java programmers are in the Argo program, but AOML stated they have Java programmers. Mark reiterated that the file checker can be downloaded by any DAC or dmode operator to test their own files prior to submission.

Action item 1: Ask M. Ignaszewski to consider ways to transition the File Checker to a more sustainable format to prepare for his retirement in late 2021.

Action item 2: Ask DACs to review warnings on configuration and technical parameters from the File Checker, work with M. Ignasewski and take actions to fix the problems.

Action item 3: Add new reference table checks (ref table 28, 29, 30) to the File Checker.

Action item 4: Transition the File Checker to using the NERC vocabulary server version of the Argo reference tables.

6.3. Short and long term plans for GDACs

Mark Ignaszewski announced he will be retiring within the year 2021 and has been in discussions with the US Argo Program on this transition. Fleet Numerical Meteorology and Oceanography Center (FNMOC) is committed to maintaining the hardware and hosting the US GDAC with the help of Mike Frost. In addition, the US Argo Program is exploring how to maintain the File Checker after Mark's departure.

7. SBE CTDS

7.1. Update on cell thermal lag and alignment (SeaBird)

Sea-Bird provided updates on dynamic corrections to SBE41cp CTD data. The results from the tank work, field data and Greg Johnson's analysis align well, lending confidence to the numbers. There are plans to start testing this at Sea-Bird and then in the field with R&D floats. Sea-Bird also provided an update on the status of understanding and resolving Salty Drift in Sea-Bird Argo CTDs. They have assembled a cross-functional team that has been able to recreate salty drift at the Bellevue site. Alternate materials and construction are currently being tested. Results are pending, but will be shared with the community as soon as they are available.

Can change the temp and conductivity sampling sequence on SBE 41cp to reduce alignment in post-processing. Would reduce work done later by dmoders.
Temp drift looks good over time based on ctds at SBE and ones that had been in the water.

In discussion, Kim mentioned she can find out when alignment error changed and hopefully report back on the Serial Number. She agrees SeaBird needs to document the changes in thermal alignment when it happens again.

S. Wijffels asked about when some of the dynamic corrections suggested may be made on board and how Argo can help with this process. Kim said she wants to get alignment corrections in the firmware, but it is hard to predict a timeline with the COVID-19 pandemic. During the transition, cell thermal mass may need a second salinity channel. It was suggested that a working group be formed to work with SeaBird to best handle this transition.

Action item 32: S Wijffels to lead discussion with AST and ADMT to form a proposal on how to approach testing and validating dynamic corrections for C from on board the floats before S is calculated, binned and transmitted.

7.2. Update on status of high salinity drift CTDs (SeaBird)

J. Klinke noted that it was hard to correlate Fast Salinity Drift (FSD) with manufacturing because it happens years after deployment, but he has been working with diverse teams to investigate FSD. This includes recovering some SBE 61 CTDs from the field to investigate and trying to correlate the FSD issue with changes of cell. SBE can now force salty drift at their lab in Bellevue, WA. They are trying to narrow down reasoning and may have an answer by the end of year.
FSD defined as >0.1 PSU at ~20-40 profiles.

Deep salty drifters are less understood, not linear in drift and not correctable.

Premature Fast Salinity Drift: 6 months of CTD production in 2018. SeaBird hasn't found salty drifters after 2018. Changes in manufacturing were made on 3 Oct 2018 and we are hoping that this is solved.

7.3. Report from working group on how to dmode high salinity drift CTDs and monitor the impact on the fleet (J. Gilson) Action 47

The Fast Salinity Drift (FSD) Working Group has recommended DMQC best practice for the documentation of SBE41(CP)/SBE61 CTDs undergoing anomalous salty drift.

Recommendations:

1) Anomalous PSAL > +0.05psu should be strongly questioned and marked ‘4’ (bad) within DMQC, without solid evidence to the continued validity of the data. The 0.05psu guidance for PSAL correction continues previous guidance. Depth dependence of the PSAL anomaly was not identified by the Working Group for FSD anomalies < abs(+0.05)psu.

2) Amplitude (recommendation #1) is not the only indication of FSD CTD sensor failure, leading to flagging ‘4’ in DMQC. Other characteristics include...

a) PSAL jumps of > +0.01 psu from one cycle to the next
b) Increasing rate of change over several cycles
c) A strong regression back towards valid salinity values (after questionable values)
d) Temporal variability unexplained by the historical data

3) The first two recommendations signal the failure of the CTD. However failure might not exactly coincide with the cycle of #1 & #2) (e.g. exactly when the PSAL anomaly reaches +0.05psu). Other profiles should be carefully analyzed for questionable/failed PSAL data.

4) To track the impact on PSAL of premature CTD failures within the Argo Program, a shared spreadsheet will be maintained listing important information on the affected floats. All DMQC groups are asked to submit their FSD information to Birgit Klein (BSH birgit.klein@bsh.de) or enter the information directly into the FSD spreadsheet.

https://docs.google.com/spreadsheets/d/e/2PACX-1vS041PxmjzJcyYbczT_XbBIG62WYAaMGo7U0F3qz_yxzDQgYIlf-9bKT18lDvaDxV60Dqut4GVJUprG/pubhtml#

For active floats, please update the table at least annually, and certainly when a float is declared dead.Enter floats into the spreadsheet with the following characteristics
a) SBE41(CP) floats with CTD serial numbers > 6000 and all SBE61 floats
b) An estimated salinity adjustment of > +0.01psu within two years of deployment or CTD failure determined by recommendation #1, #2, or #3 above within five years of deployment.

The requested information for the FSD spreadsheet includes…
WMO_ID, Float_type, Argo Program, Country, Float Status (Active or Inactive), Date of addition, Float deployment year, CTD model, CTD serial number, Greylist status (added or not), Number of existing cycles, Severity of drift problem (S=Severe indicating sensor failure, M=Moderate indicating strong drift > +0.01psu within two years but not failure), Cycle where DMQC PSAL adjustment was first applied, Final cycle where DMQC PSAL adjustment was applied, Total of corrected cycles prior to cycle 80, Total of corrected cycles, Cycle of first failed PSAL, Cycle of last failed PSAL, Total of lost (failed) cycles, Notes (if any)

Please read and follow the “Presentation_of_the_sheet” Tab to maintain consistency in the table.

Action item 33 : The FSD Working Group will document the above in the relevant Argo Documentation by February 2021.

Sylvie POULIQUEN noted that it is very important to keep track of the impact of FSD on the Argo data stream to evaluate how much data is being lost. This documentation could be done inside the Argo files or in an external spreadsheet. Given the burden of deciding on strings to add and then putting them into the Argo files themselves, the FSD working group chose to track FSD impacts through an external spreadsheet. The ADMT strongly encourages dmode operators to fill in this spreadsheet.

Action item 34: Ask DMQC operators to fill in spreadsheet on FSD floats to help monitor the impact on the Argo data set. If operators prefer to send their information to B. Klein, she will fill in the spreadsheet.

In the discussion, J. Gilson showed that for the SB41CP there are still FSD in SBE CTDs > 10000 (for SIO primarily CTD SN between 10600 and 10900, deployment years 2018-2019). As it seems difficult to immediately link deployment year to CTD SN, Argo would like SeaBird to communicate the SN when they changed their manufacturing process to solve the issue so that Argo can monitor if the issue still remains in the current fleet.

Action item 35: Ask SeaBird to confirm the Serial Numbers after 11250 should be when they changed their manufacturing process to solve the Fast Salty Drift issue so that Argo can monitor if the issue still remains in the current fleet.

8. Deep Argo

8.1. Flagging of Deep Argo data and cpcor correction coefficients in real time and delayed mode (V. Thierry) Action 44

V. Thierry presented recommendations provided by an Ad Hoc working group on the RT and DM implementation of the Cpcor coefficient correction for Deep Argo data. When comparing Deep Argo data with shipboard reference CTD profiles, a fresh salinity bias increasing with depth has been observed in all types of Deep Argo floats (Deep Ninja, Deep Apex, Deep Arvor and Deep Solo). This bias is due to the pressure correction term (e=Cpcor) in the SeaBird conductivity equation :

$$\boldsymbol{Co} = (\boldsymbol{g} + \boldsymbol{h} * \boldsymbol{f}^2 + \boldsymbol{i} * \boldsymbol{f}^3 + \boldsymbol{j} * \boldsymbol{f}^4)/(\mathbf{1} + \boldsymbol{\delta T} + \boldsymbol{\epsilon} * \boldsymbol{P})$$

Comparisons of SBE-61 and SBE-41 (deep) profiles to reference shipboard CTD data show that nominal Cpcor value from SBE (CpcorSBE), -9.57e-8 is too large, resulting in a substantial fresh salinity bias at high pressure. To correct this pressure dependency, the recommendations of the Ad-Hoc WG on Cpcor coefficient correction are the following:

- In the absence of other information, the new recommended value for Cpcor are:
    - CPcor_new = -12.5 (±1.5) e-08 $dbar^{-1}$ for SBE-61 data.
    - CPcor_new = -13.5 (±1.5) e-08 $dbar^{-1}$ for SBE-41 Deep CTD

- If a refined estimate for CPcor for a float or floats is available to the DMQC expert:
  - that refined estimate should be applied in place of the recommended value.
  - This value can differ between groups.
  - -20e-08 dbar^{-1} <= *CPcor_new* <= - 5e-08 dbar^{-1}
  - If *CPcor_new* falls outside those ranges, the DM operator should consider that the salinity data are not correctable and that further investigations are required to demonstrate that such *CPcor_new* values are valid.
- In any event, the Cpcor value used and its uncertainty should be specified in the data files.

Note that those recommendations may be revisited and refined in the future.

It is then proposed to implement RT adjustment with the recommended Cpcor value since float deployment. Once the RT adjustment is done the WG proposes to

- leave PSAL_QC = '3' and to set PSAL_ADJUSTED_QC='1' below 2000 dbar.
- set QC of raw and adjusted data fro PRES and TEMP to '1' below 2000 dbar
- pass the adjusted data through RT QC tests
- distribute full-depth adjusted data onto the GTS

Such implementation by the DACS is of highest priority to allow the Deep Argo data to be used. The implementation procedure will be detailed in a dedicated manual.

Then, the DMQC procedure has to be done in two steps:
- apply the Cpcor coefficient correction in using either the recommended CPcor value or an optimized one
- apply the OWC based correction of sensor offset/drift

Matlab codes to estimate the optimized Cpcor value can be shared. Note that C. Cabanes volunteered to compare the existing procedures (three at the moment) to evaluate whether they differ or not (they are probably very similar). A recommendation on the best way to get the optimized value by comparison with shipbased reference CTD profiles will be provided in the coming weeks.

It is then proposed to apply an improved RT adjustment based on the last valid DMQC adjustment. The procedure of such implementation will be detailed when DM groups will have refined the DM adjustment process.

Note that the Cpcor coefficient correction will be stored in the SCIENTIFIC_CALIB fields with N_CALIB=1. Other adjustments (Thermal mass, OWC, …) will be recorded as N_CALIB=2,3,...
It was highlighted that the highest priority is to make RT correction at DACs with new cpcor values. For DMQC,it's still experimental and there is a need to discuss more about how to run with with OWC and this could be discussed at next DMQC workshop that is planned end June /early July 2021

Action item 31: A. Wong & V. Thierry to draft up documentation for DACs on how to apply the Cpcor correction in real time and send to DACs for feedback on whether this is feasible to implement. Refinement on the delayed-mode procedures for Deep Argo data will continue.

9. RBR CTDs

9.1. Update from RBR Data Task Team

Formed after AST-21, the RBR Data Task Team is focussed on characterizing and quantifying RBR sensor accuracy on Argo floats. Key issues are checking static accuracy, dynamic accuracy, long term drift/stability, formulate DMQC tools and protocols for RBR CTD data. The team is using 3 data sources: ship-based profils where the RBR CTD is mounted on a CTD rosette with an SBE9 system, and ideally Niskin samples; data from the global float pilot; laboratory experiments undertaken by RBR Ottawa.

National programs have responded to the AST request to join the global pilot, with 29 floats deployed and at least another 24 in the pipeline. Changes are being proposed to facilitate the distribution of these pilot float data in the Argo data system. RBR's JM Leconte has been working with the ADMT on standardizing RBR meta data. RBR now provides ascii text files with meta data in standard Argo vocabulary, making it easy for DACs to fill the meta data information. An online tool to look up the metadata associated with an instrument is available. (http://oem-lookup.rbr-global.com). In addition, new WMO_INST_TYPE for floats with RBR CTDs are now available. Lastly the conductivity cell temperature "TEMP_CNDC" is proposed to reside in the core data files (see below under format changes).

Progress has been good. The shipboard data analysed to date confirms T and P accuracy in the field. Both the shipboard and pilot float data results suggest improvements in the conductivity/pressure calibrations are needed, and these are being pursued at RBR.
The three sources of dynamic error in conductivity have draft correction procedures. Mat Dever(RBR) will report on these below. Sensor stability assessments rely on the pilot float data set, which continues to build.

The Task Team will be focussing on delayed mode QC protocols for RBR data and hopes to have tools and procedures before AST-22. Increasing the data set at the GDAC is crucial to help road-test these. A paper is also being prepared on the result.

RBR Data Task Team members at this time are: Susan Wijffels, EsmeeVan Wijk, Annie Wong, Breck Owens, Liu Zenghong, Brian A. King, Shigeki Hosoda, Clarke Richards, Guillaume Maze, Nathalie Zilberman, Travis Miles, Greg Johnson (RBR), Mat Dever and Jean-Michel Leconte

9.2. Update from RBR (M. Dever)

Mathieu Dever, in collaboration with the Argo RBR Data Task Team, provided a review of the validation of both static and dynamic corrections proposed to correct the data collected by argo floats equipped with RBR*argo*^{3} CTDs.

For static corrections, the presentation focused on the correction on conductivity due to pressure using both field data from Argo floats and laboratory experiments. Field data suggested that at 2000 dbar, salinity measured from RBR-equipped floats shows a salinity difference up to +/-0.01 PSU when compared to near-by floats. Recent laboratory developments at RBR provided additional insights on the impact of pressure on conductivity readings thanks to the controlled environment: (1) It confirmed that a cubic correction is most appropriate, as it is currently implemented in the CTDs, and (2) It suggested that the salinity difference at depth is due to unit-specific behavior, and can therefore be corrected if a unit is tested in the calibration lab beforehand. Starting in the spring 2021, every RBRargo3 CTD will go through that additional pressure test to derive customized pressure correction coefficients to ensure the best possible accuracy up to 2000 dbar.

Dynamic corrections were validated using in situ data collected by Argo and Argo-like profiling floats. Mathieu Dever demonstrated that the current recommended dynamic corrections improve water column stability by reducing the number of density inversions seen in a profile. The improvements can be visualized on both binned data and 1 Hz data, from many different floats deployed in different oceans. The three major conclusions are

- Dynamic corrections on conductivity can be applied to binned data, although most of its efficiency is hindered by the averaging of the relevant timescales.
- Dynamic corrections are most efficient on 1 Hz data. Implementation of the corrections on the floats is thus the best way forward and will be achieved by Spring 2021 with most of the float manufacturers.
- 1 Hz data has proven to be very informative on CTD performances, sometimes more than a buddy float, or a ship-based cast at deployment. It is recommended to collect a few initial profiles at 1 Hz if possible. A possible approach would be to complete a few binned profiles to identify regions where dynamic corrections could be easily evaluated (i.e., subsurface mixed layers), and then focus the 1 Hz sampling on these depth intervals.

Additionally, Mathieu Dever mentioned a web-based service to retrieve all metadata for RBR*argo*^{3} CTDs, simplifying database maintenance for the argo community. Feedback on format and information provided through this service is welcome and encouraged to make it most useful to the argo community.

Action item 32: S Wijffels to lead discussion with AST and ADMT to form a proposal on how to approach testing and validating dynamic corrections for C from on board the floats before S is calculated, binned and transmitted.

10. Other delayed mode issues

10.1. DMQC improvements as part of EuroArgo-RISE (C. Cabanes)

Cecile Cabanes presented the work done within Euro-Argo-Rise to enhance expertise and facilitate work of the DMQC operators in order to support the arrival of new persons in these activities. All the software and tools are available at : http://www.github.com/euroargodev, the GitHub organization presented by Guillaume Maze on the first day of the meeting. The shared materials have been described by Cecile and consist of:

- Matlab software to manipulate Argo data and reference databases
- the Python version of OWC
- a DMQC report template for core Argo parameters and Matlab code used to generate plots required in the report
- a DMQC cookbook for core Argo parameters issued from the material gathered for the Euro-argo DMQC workshop in April 2018.

A first draft of this cookbook (available here) was shared with the Argo-dm-dm mailing list.

Comments are welcome and will be taken into account to finalize a first version in the coming weeks. This cookbook is of course intended to evolve and future versions may cover additional ocean areas and include other case studies.

10.2. BODC Python conversion of the Matlab OWC toolbox (K. Walicka)

BODC chose python as the language to convert the Matlab OWC toolbox into in order to save money, keep up with new data scientists, and gui options.
The objective is to mirror the matlab version of OWC and only make changes that would optimize it for python.

It is located in the EuroArgo GitHub repository with the specific link of User-Acceptance-Test-Python-version-of-the-OWC-tool. It is recommended to use the anaconda version of python and pycharm.

It has the same inputs as matlab OWC: historical data, config values, float
The outputs include: map, cal, calseries, plots
She requested that more people test out the code. Prior to widespread distribution, BODC would like to make a few developments to improve performance and enhanced functionality.

In the discussion, there was a request that the inputs to the python version of OWC be xml or JSON instead of mat inputs. When the python software was designed, the reading of inputs and outputs was modularized so it can be adapted to read from other sources in the future.
J. Lovell offered to help test the python OWC toolbox.

10.3. Updates to Matlab OWC (C. Cabanes, A. Wong)

Annie and Cecile have been working on Matlab OWC codes and a third version is now available at https://github.com/ArgoDMQC/matlab_owc/releases. The main changes have been presented. Some legacy issues from the old OW variables have been solved and some bugs in the codes were found and fixed. A new function is used to build the covariance matrix. The covariance matrix now takes into account not only the vertical and horizontal scales but also a time scale (determined by small mapping scales). The default mapping length scales in the configuration files have been changed to be more consistent with the scales given in a recent paper by Ninove et al.(2016). There is also information on how to define map scales for the subpolar North Atlantic and the default value of "max_breaks" is recommended to be set to 3 for the first pass. Finally, the condition related to the low number degree of freedom (NDF) values which forces the fit to be an offset is removed. Instead, a warning is displayed to indicate that the fit may not be the "best one" when the NDF value is low.

Ninove Floriane, Le Traon Pierre-Yves, Remy E., Guinehut S. (2016). Spatial scales of temperature and salinity variability estimated from Argo observations. *Ocean Science*, 12(1), 1-7.https://doi.org/10.5194/os-12-1-2016

In discussion Brian King raised the issue of another DMQC workshop. He noted the need to train up both core and deep Argo dmode operators.

Action item 48: There is a recognized need for more DMQC workshops with different focuses: training core DMQC operators, Deep Argo data and BGC data. The core and Deep workshops could be combined, but the BGC one will be separate. G. Maze, B. King, A. Wong, V. Thierry are thinking of a virtual core & Deep workshop in June or July 2021. T. Maurer and C. Schmectig will keep a BGC workshop in mind.

10.4. Dmode of trajectory files (M. Scanderbeg)

M. Scanderbeg reported on the progress of the DMQC Trajectory working group which was admittedly slow last year due to her work on redoing the AST website. The goal of the working group is to finalize guidelines on how to make DMQC trajectory files and fill estimated positions by AST-22. After that, sections will be drafted for the QC User Manual and DAC Trajectory Cookbook to be circulated by June 2021 with the target of receiving approval at ADMT-22 for adoption.

To create dmode trajectory files, there will likely be two steps: 1) quality control and fill adjusted times, positions and cycle numbers and 2) fill the adjusted parameters based on information in the profile files. Using the trajectory file v3.2 will allow the filling of TRAJECTORY_PARAMETER_DATA_MODE and JULD_DATA_MODE.

The working group suggests that National Programs think about how dmode trajectory files will be created and if this will follow the same path as dmode profile files or not. The working group suggests that dead floats are worked on as a first priority as Argos floats need more quality control than Iridium floats. The work will work on creating float independent tools to qc parts of the trajectory files, taking into account the feedback that smaller pieces of infrastructure agnostic codes are preferable.

Finally, Coriolis is validating a near real time QC tool for trajectory files that will perform the current RT trajectory QC tests as well as some additional ones and creates a log file with information to help DM operators more quickly and efficiently create dmode trajectory files. The hope is that this code can help create more accurate near-real time velocity products such as YoMaHa.

11. Delayed mode monitoring at AIC (M. Belbeoch)

Close to 85% of the eligible floats have been dmoded which is very good. Only 75 floats pending on altimetry checks - much better than 1000 floats at the beginning.

Action item 44: Ask M. Belbeoch to include the alerts from MinMax and OA from Coriolis in addition to altimetry one.

OceanOps was asked to have a DM-operator at float level while it was previously only possible at program level.
Mathieu wondered if the DM-Operator needed to be defined by variables or if having a responsibility for physics, biogeochemistry, and biology would be enough. Ideally, this information would be captured at float registration, but during discussion, it was pointed out that the dmode operators were not always known, especially for non-core parameters.
In addition to monitoring the DM operator at OceanOps, Mathieu reminded everyone that dmqc responsibilities are recorded within the global attribute for each netCDF file via ORCID. So for those groups who have implemented this, the DMQC responsibilities for each <param> is defined. Something similar could be implemented at OceanOps

The OceanOps is willing to help track DM-Operators at the float level and to provide tools that would be helpful.

Action item 45: M. Belbeoch to capture DM operators for each float at OceanOPS for notification purposes. Depending on the float, it could be just one operator, one core and one BGC operator, or several operators for each sensor. M. Belbeoch to coordinate with DM operators for best solution.

12. DMQC ref database

12.1. CTD_for_DMQC - update (Christine, Steve, and Tim) Action 54

Christine Coatanoan reported on the progress of actions defined from the ADMT20 meeting and on behalf Steve Diggs and Tim Boyer for the CCHDO and WOD updates.

At the last ADMT meeting, one action was to incorporate the high QC product profiles selected for the Deep-reference database to the Core Reference database, and to replace the profiles with the higher QC'd version. The GO-SHIP easy ocean product has been retrieved from the reported version. 16,231 stations have been downloaded and after a first check, it appeared that a quality control was necessary on the data. Some anomalies were present, which were detected during a careful check using the TS diagram and the potential density by zooming in on the deep waters. Looking at the statistics of bad measurements, it is not much since only several hundred bad measurements (corresponding to less than 0.005%) have been detected. Feedbacks have been sent to CCHDO for correction.

To complete the reference database merged with the GO-SHIP easy ocean product, 5 new GO-SHIP cruises have been downloaded from the CCHDO website. Some additional CTDs (deployment and cruises) provided by scientists and OCL release will be integrated in the next version. At the same time Ingrid Benavides (BSH) has been working on the improvement of the reference database with a work area throughout the Atlantic Ocean. Bad data and duplicates have been deleted and she is currently in the process of populating these boxes with new data sources. The recommendation is to use only one reference database for all the Argo floats to avoid several versions of data.

The status of current CCHDO data sources has been presented. Since November 2019, 1197 new profiles have been added to CCHDO. 322 CTD observations and 588 bottle observations made before 2019-10-30, and 287 CTD observations made from 2019-10-31 to 2020-11-01. In 2020, due to the pandemic situation, some cruises have been cancelled or delayed, only some have been completed. This is a problem for the upcoming months and year with a reduction in the amount of data made available. CCHDO is also working on making GO-SHIP data interoperable with Argo data with implementing NetCDF-CF compliance in their files to improve format variability problem, the GO-SHIP Easy Ocean product is also an example of this interoperability.

Since the last ADMT meeting, NOAA's National Centers for Environmental Information (NCEI) has added, to the World Ocean Database (WOD), 1469 CTD casts taken for years 2000 to 2020 sourced from the CLIVAR and Carbon Hydrographic Office (CCHDO) and 13 981 cast from other sources as GTSPP, ICES and other non CCHDO sources. As a contribution to Argo CTD reference database, NCEI has added 985 CTD casts, between November 2019 and November 2020, which go to depths deeper than 2000 m to the World Ocean Database (WOD): 416 sourced from CCHDO and 569 from other sources.

From the CCHDO and WOD sides, due to the pandemic situation, a decrease of cruises is observed since early 2020 and consequently in the amount of data for the upcoming months and years.

Action item 38: Ask C. Coatanoan to release an updated version of the CTD ref db with clear flags indicating the GO-SHIP Easy Ocean data that can be easily selected for use in OWC.

12.2. Introduction of cleaned up GO-SHIP database for Deep Argo (Sarah Purkey and Katsumata)

A new GO-SHIP data product is available through CCHDO that includes a total of 16,243 full depth temperature-salinity-oxygen profiles collected along 45 zonal and meridional sections across the global oceans (Katsumata et al. 2020). All salinity and oxygen data have been calibrated to bottle samples and any offset between salinity sample standards have been applied following Kawano et al (2006), with an expected accuracy for salinity of 0.002 or better. The calibrated salinity profiles will replace the older versions of the stations in the Argo data reference data set with a new flag to indicate the higher salinity accuracy. The data can also be downloaded directly at https://cchdo.ucsd.edu/products/goship-easyocean.

13. Revised NVS proposal (M. Donnelly)

The proposals presented two days earlier at the plenary sessions received a variety of useful feedback, and so the proposals along with further context was presented again:

- Proposal 1 regarding changing the mode of operation for managing the content of the reference tables was modified to continue to permit email list discussions for those not using GitHub or wanting passive receipt of discussion points, but these would need to still be tracked in GitHub. Note was also made notes of the GitHub issue 'subscribe' option which might address the issue of passively receiving information rather than actively checking the GitHub repository. This proposal had received general support in email feedback and was approved during this session.
- Proposal 2 regarding the NVS becoming the master copy of the reference tables also received general support. The main issues raised were about human readability, and clarifications about the options to interact and download the NVS contents were outlined. Further information would be made available, and potentially training, to support the Argo community in transitioning to the new setup. This proposal was approved.
- Proposal 3 recommended introducing a new reference table covering the 3 stages of the framework for entering Argo. This proposal did not receive much support during the email feedback as the community did not see the value of the proposal to users. It was decided to withdraw the proposal at this time, but it will be reassessed and consulted upon further once migration of existing vocabularies is complete.
- Proposal 4 recommended adopting the ICES platform codes within the Argo meta file as part of the DEPLOYMENT_PLATFORM field, which are already used within Ocean OPS. There are fine details that still need to be worked out, such as which reference source (there are 3) to use and which form the entries should take. The proposal to adopt the ICES codes was approved, and the remaining fine details will be addressed by the Argo Vocabulary Task Team.

Action item 23: NVS will become the master copy of the Argo references tables as of January 2021

Action item 24: Proposal on how to manage content of NVS version of Argo ref tables was accepted. GitHub will be used to track suggested changes to tables and proposed changes will be advertised for 2 weeks. After that, final approval will be given by ADMT exec and implemented by vocab editors

Action item 25: Adopt ICES platform codes for ships to constrain the DEPLOYMENT_PLATFORM field. Details to be addressed by the Argo Vocab Task Team.

Action item 55: Improve NVS Argo vocab links on ADMT website (including more detailed instruction) . Ask the vocab group & OceanOPS to create and post a list on the ADMT website of ICES platform codes to make it easier for DACs to use in the creation of metafiles.
Here is the link to metadata from OceanOPS:
http://www.ocean-ops.org/share/Argo/Status/argo_all.csv

In the discussion, Andrew Barna indicated he may be interested in working with the Argo NVS team on proposals 3 and 4.

14. Format updates by file type

14.1. Trajectory files: combining c- and b- trajectory files: v3.2 (H. Bittig) Action 24 & update to GROUNDED Ref Table (M. Scanderbeg)

Following discussions at ADMT19 in San Diego about a combination of v3.1 c- and b- trajectory files for BGC-Argo floats, a working group was formed to prepare a proposal for ADMT. The proposal put forward at ADMT20 in Villefranche sur Mer proposed to combine the two v3.1 c- and b- trajectory files into a combined trajectory file and outlined the required modifications for a combined traj file format v3.2. After a transition period, this combined trajectory v3.2 will become mandatory for BGC-Argo floats. Core and Deep Argo floats can stay in format v3.1.

The proposal was approved by ADMT, provided that DACs and D-mode groups give support to this format change (ADMT20 Action items #18, #24, #51). This support was given in Feb. 2020 following a survey, and AST endorsed the combination of core and b-trajectory files and agreed with plans to create a new v3.2 format for the combined trajectory file at AST21 (AST21 Action #15).

To implement the v3.2 traj file format, Henry Bittig presents required modifications from the current v3.1 c- traj file format:

- String dimensions of TRAJECTORY_PARAMETERS(N_PARAM, STRING64) and HISTORY_PARAMETER(N_HISTORY, STRING64) need to be expanded from STRING16 to STRING64 to accommodate BGC b- and i- parameters.
- Additional dimensions N_VALUESxx, STRING256, and N_CALIB need to be added to accommodate spectral BGC data as well as a traj SCIENTIFIC_CALIB section
- TRAJECTORY_PARAMETER_DATA_MODE(N_MEASUREMENT, N_PARAM) is added to indicate the availability of adjustments of each TRAJECTORY_PARAMETER (in analogy to b- and s-profiles).
- JULD_DATA_MODE(N_MEASUREMENT) is added to more clearly indicate the availability of adjustment/estimation of the Julian day of the measurement, which is stored in JULD_ADJUSTED. The raw parameter JULD stores the original telemetered value, or FillValue (if not available). If JULD_DATA_MODE = ‘R’, JULD_ADJUSTED = FillValue. If JULD_DATA_MODE = ‘A’, JULD_ADJUSTED = real-time adjusted/estimated value. If JULD_DATA_MODE = ‘D’, JULD_ADJUSTED = delayed-mode adjusted/estimated value.
- <PARAM>_MED(N_MEASUREMENT) and <PARAM>_STD(N_MEASUREMENT) are added as optional variables used to store statistical information of the set of measurements used to compute the averaged values in <PARAM>. This statistical information is provided by some floats, e.g. PROVOR CTS4 and CTS5.
- A SCIENTIFIC_CALIB section is added for information of parameter calibration during park drift, descend to profile, or surface drift. There is one entry per calibration step per parameter per float. Calibration information that is available elsewhere, e.g., for profile data, is not duplicated.

Mark Ignaszewski commented that implementing the v3.2 format in the FileChecker may take some time due to the effort needed.

Action item 27: Update the User Manual and Trajectory Cookbook with the v3.2 traj format.
Action item 12: Start to implement the v3.2 traj file format at the DACs.
Action item 5: Update the GDAC FileChecker with the v3.2 traj format.
Action item 51: Educate users on the new v3.2 trajectory file format (e.g., via website)..
Action item 19: Decide on end of transition period for BGC floats, during which both v3.1 and v3.2 traj files can exist, at ADMT22.

M. Scanderbeg proposed updating the GROUNDED flag reference table to provide more information on whether the float's grounding affected the drift period. This change is motivated by delayed mode work done to create the ANDRO dataset and was agreed upon by the DMQC trajectory working group. The current two flags that indicate grounding, 'Y', 'B' will be updated to mean that the float grounded during the free drift period. If it is unknown when the float grounded, these flags should be used to be conservative and prevent users from using these cycles in velocity calculations. The new flags 'P' and 'C' indicate grounding outside of the drift period. The 'B' and 'C' flags determine grounding by comparison with an external bathymetry database while other information is used to determine grounding for the 'Y and 'P' flags. This other information could be actual grounding data reported by the float or as determined by the operator based on other technical information. This change will require a re-write of the current dmode trajectory files, but until that can happen, the currently assigned GROUNDED flags will ensure that they are not used in velocity calculations. Re-examination of the files may result in more 'P' or 'C' flags which would increase the number of cycles available for velocity calculations. See the table below with the proposed changes in red. The proposal was accepted and will be incorporated into the next version of the User Manual.

Flag	Meaning
Y	Yes, the float touched the ground and the programmed free-drift period was affected. If it is uncertain what mission phase the grounding took place, use 'Y'.
P	Yes, the float touched the ground during a part of the mission that did not affect the free-drift period.
B	Yes, the float touched the ground as determined by an external bathymetry database and the programmed free-drift period was affected. If it is uncertain what mission phase the grounding took place, use 'B'.
C	Yes, the float touched the ground as determined by an external bathymetric database but during a part of the mission that did not affect the free-drift period.
N	No, the float did not touch the ground
S	Float is known to be drifting at a shallower depth than originally programmed
U	Unknown

In discussion, Peter Oke reminded everyone that some floats reported if they are grounded in the technical information which could be used to apply more precise flag in real time. Currently, the table allows for grounded to be determined by comparison with an external bathymetry database only. The option to indicate grounded as detected by the float should be considered when updating the table again. For now, the best course of action if the float indicates it was grounded is to mark either a 'Y' or a 'P' which indicates the float grounded.

14.2. QC flag table revised comments, NB_SAMPLE_<short_sensor_name>, TEMP_CNDC (A. Wong, H. Bittig)

Improved comments in Argo QC flag table (Ref Table 2)
Annie Wong presented the Argo QC flag table (Ref Table 2) with improved comments. This action was motivated by the fact that the "comments" in Ref Table 2 were somewhat outdated, and were not inclusive of the BGC parameters. Therefore an effort to update the "comments" in the table, so that they were representative of both the Core- and BGC- parameters, as well as the most current QC practices, was undertaken by email via argo-bio, argo-dm, and argo-dm-dm, during October 2020. Many comments were received and all were taken into account - thank you to everyone who contributed. A final improved version, together with a set of footnotes, is now available. It is emphasized that the QC flags have not changed; only their "comments" have changed.

Action item 29: Update the Users Manual and all QC manuals with the improved version of the Argo QC flag table and accompanying footnotes.

TEMP_CNDC and NB_SAMPLE_<short_sensor_name> (Ref Table 3)

Annie Wong put forward proposals to change the usage of two *intermediate* parameters in Ref Table 3: TEMP_CNDC and NB_SAMPLE.

TEMP_CNDC is the internal temperature of the conductivity cell. It was listed as an "inactive" intermediate parameter in the b-files. Email exchanges with the BGC group confirmed that TEMP_CNDC was not used in any BGC adjustment, but TEMP_CNDC was an essential parameter for dynamic correction of salinity from the RBR CTD. Annie proposed to activate TEMP_CNDC as an intermediate parameter, and move it to the core-files, so that DACs could include TEMP_CNDC in the core-files for non-BGC floats.

NB_SAMPLE is the number of samples in each pressure bin. It was listed as an intermediate parameter in the b-files, but with no indication of whether the values came from the CTD, or other BGC sensors. Henry Bittig, Jean-Philippe Rannou and Annie Wong proposed to expand NB_SAMPLE to NB_SAMPLE_<short_sensor_name>, where <short_sensor_name> = 'CTD, OPTODE, OCR, ECO, MCOMS, CROVER, SUNA, ISUS, STM, CYC, DURAFET', as listed in Ref Table 27. It was also proposed to move NB_SAMPLE_CTD to the core-files as an intermediate parameter, so that DACs could include NB_SAMPLE_CTD in the core-files for non-BGC floats. Other NB_SAMPLE_<short_sensor_name> from BGC sensors will remain as intermediate parameters in the b-files.

Note: an *intermediate* parameter is a parameter that has no associated _ADJUSTED, _ADJUSTED_QC, and _ADJUSTED_ERROR variables. In other words, an intermediate parameter is a parameter that does not receive any post-processing or adjustment, and therefore is recorded "as is". It does have an associated set of _QC flags for indication of sensor failures.

Actions:
1. Activate TEMP_CNDC in Ref Table 3, with long_name = "Internal temperature of the conductivity cell".

2. Expand NB_SAMPLE to NB_SAMPLE_<short_sensor_name> in Ref Table 3, with long_name = "Number of samples in each pressure bin". <short_sensor_name> is as listed in Ref Table 27.

3. Move TEMP_CNDC and NB_SAMPLE_CTD from the b-files to the core-files as intermediate parameters in Ref Table 3. The other NB_SAMPLE_<short_sensor_name> from BGC sensors will remain in the b-files as intermediate parameters.

4. Update Ref Table 3 in Users Manual and GDAC file checker.

5. DACs to include TEMP_CNDC and NB_SAMPLE_CTD in the core-files as intermediate parameters, ie. no _ADJUSTED, no _ADJUSTED_QC, no _ADJUSTED_ERROR.

It was noted that NB_SAMPLE_CTD is used in conjunction with the sampling frequency of the CTD to estimate ascent rates of the float, or the sampling time of the measurements. Some DACs specify the CTD frequency as part of the character string in "Vertical_sampling_scheme", but overall, CTD frequency is not easily available in Argo data files, but is a much-needed piece of information for many applications. CTD manufacturers confirm that CTD frequency can change between profiles, as well as within a profile.

Action item 20:
Annie Wong to solicit help from other ADMT members to investigate how to record CTD sampling frequency in Argo data files, either as a technical file parameter or as a meta file config parameter, taking into account the CTD frequency can change between profiles and within a profile.

14.3. Tech files: how to store time series in tech files (T. Carval) Action 26

#26 Provide feedback on proposal for adding time series to the tech file
Coriolis DAC wants to report all transmitted information from floats in NetCDF files.
Some technical data are sent with time stamps.
Example : battery voltage during parking drift (Apex APF11, Arvor)
Some technical data are sent in distinct parts of a cycle.
Example: SOLOII battery voltage on drift, ascent and surface
The existing technical data cannot be reported with a time stamp or a MC (measurement code)
Proposal: add an optional timeseries section in the technical file format
double JULD(N_TECH_MEASUREMENT)
int CYCLE_NUMBER_MEAS(N_TECH_MEASUREMENT)
int MEASUREMENT_CODE(N_TECH_MEASUREMENT)
float <TECH_PARAM>(N_TECH_MEASUREMENT)
The proposal was accepted, the NetCDF manual will be updated accordingly.

Action item: The proposal on how to include an optional time stamp for technical data was approved. Update User Manual with new optional variables for tech file.

#27 replace "sea_water_salinity" by "sea_water_practical_salinity"
The CF standard name for PSAL is “sea_water_practical_salinity”
Argo uses a deprecated “sea_water_salinity”
This change should not be performed in the short term, we shall wait for the next significant format change.

This long-term action is tracked on GitHub: https://github.com/nvs-vocabs/ArgoVocabs/issues/10
On NVS Argo R03 PSAL entry, there is a link to “sea_water_practical_salinity”
The request to implement this change has been recorded using the NVS github.

Action item: The CF standard name for PSAL has been updated from ‘sea_water_salinity’ to ‘sea_water_practical_salinity’ and Argo will need to change to this eventually. Record this change in the NVS GitHub repository to keep track of it for future rewrites.

14.4. Meta files: updates

M. Scanderbeg presented a longer term strategy for updating to a new file format. She noted that the last upgrade to File Format Version 3 was initiated 6 years ago to better accommodate the changing data stream including biogeochemical data and changing missions. While format changes are necessary, they are very taxing on the entire Argo data system and so they should be minimized. Rather than set a hard deadline on the frequency of such changes, the ADMT executive committee’s proposal is to manage a list of proposed changes for each file format and evaluate the status yearly to decide when there are enough updates proposed to warrant a format change. These lists of proposed changes could be managed either by few people, perhaps with one person per file type. These lists could be linked from the ADMT website so everyone can see the suggested changes.

Action item 21: ADMT exec committee work on finding the best way to manage a list of proposed changes by file type and present at ADMT-22.

15. Consistent File contents between AIC and DACs

15.1. Update on NAVIS and ARVOR metadata, WIGOS-ID Action 53 (M. Belbeoch)

M. Belbeoch updated the ADMT on the WIGOS-ID issue by stating that he could provide a list of floats with the WIGOS-ID or he could provide each DAC with a list of their floats with a WIGOS-ID. He also stated that anyone can access this via API or go onto OceanOPS and make a list and export it. He will be investigating whether the WIGOS-ID is required for BUFR.

As to improving the consistency of metadata at OceanOPS vs on the DACs, he proposed doing an audit and presenting it at the DAC workshop. At that point, a proposal can be formed on how to implement changes, perhaps even prior to the next ADMT meeting.

Action item 46: Ask M. Belbeoch to perform an audit of metadata at OceanOPS vs what is at the DACs and present it at the DAC Workshop.

Action item 47: M. Belbeoch to find out if the WIGOS ID is required for BUFR on the GTS.

Action item 22: Add WIGOS-ID to list of things to be added to the next version of the metafile.

16. GADR status (T. Boyer) Actions 59 and 60

The GADR hosted at NOAA National Center for Environmental Information (NCEI) is the long-term archive for the Argo program. Twelve monthly instances of Argo were archived in the last year. Instances are compressed tar balls of the data available on the Global Data Assembly Center (GDAC) as of the first of each month. Data are available at **https://doi.org/10.25921/q97e-d719**. GADR also hosts GADR form of Argo data, which is simply the Argo files with some additional metadata for compliance with standards, updated daily. The GADR form data are accessed by ~2,500 unique users per month. NCEI computer systems are in the process of moving from Maryland to North Carolina. There may be a brief outage of the daily GADR updates on or around December 15, 2020 due to shutdown of Maryland computer systems. The Marine Climate Data System (MCDS), a global access point for ocean data at the World Meteorological Office (WMO,) is moving forward again after the dissolution of JCOMM. The World Ocean Database, data aggregator for ocean profile data including Argo and potential reference CTDs is now in the Amazon Web Services (AWS) cloud and freely available. It may be a venue to host Argo data directly in the cloud as well.

Improved synchronization with IFREMER and working towards switching to US GODAE with rsync type work.
Little effect on ship time yet….

There was quite a bit of discussion around offering Argo data via cloud services. Tim mentioned that with AWS, the WOD data is taken via THREDD servers and they put their own front end on it and control the refresh rate. The main advantage is to make the data more accessible, but it would not replace the Argo GDACs.

Action item 43: Ask for feedback about sharing data via cloud services to consider how to host Argo data on the cloud.

17. ARC status and report on role of ARCs as envisioned by EuroArgo (M Donnelly)

Each ARC has submitted a written report through Google Drive. Matt noted an announcement from the Pacific ARC that they are designing their website during 2021 to provide more functionality.

The main portion of the presentation focused on ideas for evolving the functioning of the Argo Regional Centres. The key points were:

- To reconsider the responsibilities of the Argo Regional Centres as a value cycle starting from supporting coordinator of float deployments through to quality control of the fleet, through to comparison with model data and back to deployment planning in the context of observing system design and optimisation;
- Develop ARCs to go beyond the data management role and include a greater science and float deployment coordination role, including clear representation at both ADMT and AST;

- Review who contributes and how, bringing in new partners who may already be active in areas of ARC responsibilities, but not yet ARC partners;

The aspiration is to sustain and coordinate the increasingly complex Argo array, prepare ourselves to manage the range of core/deep/BGC delayed-mode QC, better position ourselves to interact with various bodies (GOOS, SOOS, AtlantOS, etc.), stimulate future collaborations and perhaps even increase the chance of future funding of collaborative science.

ARC reports submitted to google drive.
Broad idea:

- Evolve role of ARCs beyond data management role (AST and ADMT facing roles)
- View future as key role in obs sys design and optimization
- Review who contributes and how to bring in new people

Ideas shared with other ARCs and response has been positive.
Would need to bring new people in.
ARCs haven't always been well funded and developed with their own priorities. Working together between different ARCs would be valuable.
Invite people to get in touch with us if interested. Reaching out to Indian and Pacific ARCs which aren't led by Europe as well.

18. Data visualizations, APIs & web apps (45 min)

18.1. Argovis (D. Giglio, M. Scanderbeg)

D. Giglio presented on the status of Argovis (www.argovis.colorado.edu) which is a platform for co-locating oceanic and atmospheric data to accelerate climate science workflows. Argovis is a web app and a database containing Argo core profiles with a QC flag of 1, deep Argo data with QC flags up to 2 (for temperature) or 3 (for salinity) deeper than 2000dbar and all BGC profiles, regardless of QC flag. Weather events such as Atmospheric Rivers and Tropical Cyclones are also in Argovis as well as some gridded products such as the Roemmich and Gilson climatology, and SOSE sea ice coverage. More products will be included in time, including GO-SHIP profiles. Argovis serves, for the first time, Argo profile data and metadata globally via API and selections are possible in time and space (in *any* shape), by platform number, variable and mission. Example API scripts are available in python, Matlab and R. Examples were shown on how to draw a shape on the Argovis web app and then, using that URL, query BGC variables in the region (via API) and make plots to quickly identify bad data.

The Argovis APIs are documented here: **https://argovis.colorado.edu/api-docs/.** The Argovis team thanks Guillaume Maze and Kevin Balem at Ifremer for working with them to make Argovis data available via Argopy which is a python service to fetch Argo data.

D. Giglio also gave a quick tour of the web app, including how to search for platforms, change projections, missions, etc. She showed the beta BGC platform page which allows users to choose which BGC variable to plot and to customize the plot (e.g. choosing the colormap and colorbar limits and choosing which kind of plot). She pointed out the metadata table available at the bottom of the line chart pages which can be sorted and downloaded.

Upcoming things to look out for on Argovis are user friendly pages with general information and an improved User Guide and the addition of GO-SHIP data which will allow for co-location with Argo profiles. The GO-SHIP data will be available via API with a date indicating when the data were updated or added to Argovis. There will also be a flag indicating if the profile is part of the GO-SHIP Easy Ocean product.

Finally, people were asked to explore Argovis and let Donata know if they had questions. There is also a survey which people may take to indicate what further development they would like to see on Argovis.

18.2. Ocean-OPS update (M. Belbeoch)

Anthonin Lizé presented on behalf of Mathieu Belbéoch to report on the latest OceanOPS' updates.
They presented the rebranding of JCOMMOPS to OceanOPS and the associated 5 year strategic plan for OceanOPS, available here: www.ocean-ops.org/strategy.
They advertised the latest edition of the Ocean Observing System ReportCard available here: www.ocean-ops.org/reportcard
They gave a status update on the contribution of the Vendée Globe sailing race to the GOOS and especially Argo. They presented the current status of the team working for Argo at OceanOPS, with a focus on direct Argo implications (even if all the team members contribute to all networks).
The second part of the presentation was focused on the updates of the web application ocean-ops.org.
It is stabilised and requires now less update in terms of interface. A lot of work is targeting back end processing and bug fixing.
The 3D GIS interface embedded still carries a lot of new functionalities, like height/depth filtering amongst the observing elements.
The system is now well advanced to offer services to OceanGliders thanks to Victor Turpin, and enhanced metadata for the OceanSITES and moored buoys.
The data tracking tool has been covered during the presentation, a useful tool to track performance of the networks especially during the covd period. https://www.ocean-ops.org/board/wa/DataTrackingModule
The API to access metadata (and at a later stage submit) is in its final stages of development and should be released soon. https://www.ocean-ops.org/api/preview/

OceanOPS gave a quick look at the work plan for Argo in the following month, especially a work on density maps. They called for ideas or suggestions.

18.3. French GDAC web services and new Viewing service (R Cancouët and T. Carval)

In the frame of Euro-Argo RISE (Task 7.2 Promotion and improvement of data access and usage) and ENVRI-FAIR (Implementation of a data API for machine to machine access) projects, a new viewing and subsetting service at the GDAC has been released: a new version of the Argo data selection tool. This is intended to replace the existing tool available from the ADMT website. The technical developments have been led by Ifremer.

The main features of the website and a live demo have been presented at next ADMT. It offers a great way for users to select, visualise and download scientific Argo data (i.e. from the profiles netCDF files). It is available at https://dataselection.euro-argo.eu/

In the ensuing discussion, S. Wijffels mentioned it would be good to encourage users to rely on both QC flags and error estimates to decide on the quality of the data. These visualizations could consider filtering data by error threshold.

Action item 54: Form working group to better document, explain and include data access & visualisation tools on AST and ADMT websites taking into account different user levels. M. Scanderbeg, S. Diggs, C. Gourcuff, C. Gordon, H. Bittig, G. Maze

18.4. R package (C. Richards)

A new R package, based on the existing "oce" package, has been developed to help make Argo/BGCArgo data available to a wider range of scientists/students at a range of different coding levels. The package facilitates data discovery, downloading, reading, and analysis of Argo data through a set of simple functions. It also includes tools for evaluating Argo QC flags, using data that meets specific QC requirements, and investigating beyond the provided Argo QC to allow for user-specific QC. Also includes a simple graphical interface, which can work with a previously downloaded index, to ease float exploration and subsampling for regions/times. Extensive training materials are being prepared, including "vignettes" that are included with the package, youTube tutorials, and a series of training modules to be used for workshops with different groups in the near future. .

Would like to include Argovis and EuroArgo APIs.

18.5. New BlueMap product (P. Oke)

A new gridded product, combining Argo data with satellite altimetry and sea surface temperature data has been developed. The product is called Blue Maps. Blue Maps exploits tools developed for ocean forecasting. The first version is being finalised. Blue Maps is 1/10 degree resolution, and will include weekly maps from 2005 to present. Maps will be updated regularly. Data will soon be made available. The development webpage, including technical details, successes, and failures, is at: www.marine.csiro.au/~oke060/Argo/ArgoMaps.html.

19. ADMT exec committee make up

The ADMT-EXEC committee proposed new Terms of reference for the ADMT exec committee and also a new composition based on the expertise needed to coordinate data management activities for Core Argo and it's Deep and BGC extensions.
The proposal (see Annex IV) was accepted and enter into force in 2021

20. Conclusions

The virtual ADMT-21 meeting ended with the hope that ADMT-22 could meet in person next year at AOML in Miami. The ADMT co-chairs did receive feedback from several participants that keeping a virtual component at future meetings would be beneficial as many countries cannot send as many people as they would like to the meeting.

Annex I – Agenda

Day 1: Status & Real Time Data Management

Status and updates (40 min)
- Feedback from AST (S. Wijffels, T. Suga) (10 min)
- Feedback from BGC-ADMT (C. Schmechtig) (10 min)
- Action item status (M. Scanderbeg) (20 min)

Real Time Data Management (1h00)
- Summary presentation on DAC RT Status including timeliness on GTS and DACs, anomalies (to be prepared by A. Tran, C. Coatanoan, N. Verbrugge, M. Belbeoch) 20mn
- Discussion with DACs on status on action items from ADMT-20. (Actions 9, 10, 11, 12, 13, 15, 16, 19, 20, 22, 23) 30 mn
- Real time qc tests & flagging of data:
    - Refined deepest pressure test for shallow profiles ? (C. Schmid) (5 min) Action 14 Ask Claudia about progress.

Collaboration & code-sharing efforts (50 min)
- Feedback from DAC workshop & ways to improve coordination between DACs (10 min)
- Update on transferring reference tables to NVS server (M. Donnelly) (15 min) Action 39
- GitHub collaborative framework (G Maze) (10min)

GDACs (30 min)
    - Operation status at US GDAC & Coriolis GDAC (M. Ignaszewski, T. Carval) (10 min) Actions 1, 2, 3, 4
    - Format checker updates (M. Ignaszewski) (10 min) Actions 5, 6, 7, 8
    - Short and long term plans for GDACs (10 min)

Day 2: Delayed Mode Data Management

SBE CTDS (50 min)
- Update on cell thermal lag and alignment (SeaBird) (10min)
- Update on status of high salinity drift CTDs (SeaBird) (10min)
- Report from working group on how to dmode high salinity drift CTDs and monitor the impact on the fleet(B. Klein) (10 min) Action 47

Deep Argo (10 min)
- Flagging of Deep Argo data and cpcor correction coefficients in real time and delayed mode (V. Thierry) (10 min) Action 44
- Consider how to refine deepest pressure test (RT test 19) or decide not to apply this test (?) Action 42

RBR CTDs (20 min)
- Update from Argo-RBR working group (S. Wijffels) (10 min)

Other delayed mode issues (30 min)
- DMQC improvements as part of EuroArgo-RISE (C. Cabanes) (10 min)
- BODC Python conversion of the Matlab OWC toolbox (K. Walicka) (10 min)
- Updates to Matlab OWC (C. Cabanes, A. Wong) (5 min)
- Dmode of trajectory files (M. Scanderbeg) (5 min)

Delayed mode monitoring at AIC (M. Belbeoch) (20 min)

- Monitoring percentage of suspicious floats that have been dmoded based on lists of high priority floats including:
    - Floats on altimetry warning lists from N. Verbrugge
    - Floats in fast salinity drift CTD serial number batches
    - Floats on MinMax warning list & OA comparison list from Coriolis
- Monitoring dmode operator(s) for each float in AIC database, including core and BGC variables (Actions 48, 52)
- Orphan float management

DMQC ref database (20 min)
- CTD_for_DMQC - update (to be prepared jointly by Christine, Steve, and Tim) (10 min) Action 54
- Introduction of cleaned up GO-SHIP database for Deep Argo (Sarah Purkey) (10min) Is this data a subset of CTD_for_DMQC? Can it be flagged as such in CTD_for_DMQC?

Day 3: Format Issues, GADR, conclusions

Format updates by file type (1h00)
- Trajectory files: combining c- and b- trajectory files: v3.2 (H. Bittig) (15 min) Action 24 & update to GROUNDED Ref Table (10 min)
- Tech files: how to store time series in tech files (T. Carval) (15 min) Action 26
- QC flag table revised comments, NB_SAMPLE_<short_sensor_name>, TEMP_CNDC (A. Wong, H. Bittig) (5 min)
- Meta files: battery meta data updates (5 min)
- Prof files: there are small changes beginning to be requested for the profile files such as replacing 'sea_water_salinity' by 'sea_water_practical_salinity' (Action 27). Propose a strategy for ADMT to keep track of these items & when enough are present, do a format change

Consistent File contents between AIC and DACs
- Update on NAVIS and ARVOR metadata, WIGOS-ID Action 53 (get group to help work on this) (M. Belbeoch) (10 min)
- GADR status (T. Boyer) (15 min) Actions 59 and 60 – submitted report with short summary
- ARCs – submitted reports from each
- ARC status and report on role of ARCs as envisioned by EuroArgo (M Donnelly) (10mn)

Data visualizations, APIs & web apps (45 min)
    - Ocean-OPS update (M. Belbeoch) (10 min)
    - French GDAC web services and new Viewing service (T. Carval and R Cancouët) (15 min)
    - Argovis (D. Giglio, M. Scanderbeg) (10 min)
    - R package (C. Richards) (10 min)
    - New BlueMap product (P. Oke) (5 min)

ADMT exec committee make up

Conclusions

Annex II - The Action list status for ADM20

	Action	Who	When	Priority	Status
	GDACs			H = high R = regular L = low	
1	Keep grey list on GDACs. Make sure that it contains only active floats. When floats/profiles are dmoded they should be removed.	T. Carval, M. Frost, DACs, dmode operators	AST-21	R	Coriolis : done, regular yearly check needed
2	Ask GDACs to keep Mprof files available for one month after SProfs are available at both GDACs. Then the MProf files can be removed.	T. Carval, M. Frost	prior to AST-21	H	Done USGDAC, Coriolis done
3	Ask US GDAC to explore ftp connection and see if it is possible to have more than one connection at one time. Study why US GDAC and NCEI ftp synchronization takes 21+ hours	M. Frost, T. Boyer	AST-21	R	syncro down to 3 hrs. 10 connections allowed to GODAE from NCEI.
4	Stop accepting D-mode files in less than v3.1 in November 2019	M. Ignaszewski	novembre 2019	R	Done Oct 2020
5	Make full trajectory file checks live in January 2020	M. Ignaszewski	janvier 2020	R	Implemented as a warning on Sept 28
6	Begin additional checks on config and tech parameters in February 2020	M. Ignaszewski	février 2020	R	Implemented as a warning on Sept 28
7	Run all existing v3.1 files through the current FileChecker and report results to ADMT in February 2020	M. Ignaszewski	février 2020	R	Waiting to complete current meta-data and tech PARAMETER checking updates
8	Study if the File Checker needs to be adjusted to accommodate format changes agreed upon in Actions under 'User Manual Updates' section	M. Ignaszewski	ADMT-21	R	Implemented all except Ref Table 28, 29, 30 checks - Oct 2020. New reference table checks for BATTERY variables expected Dec 2020.
	DACS				
9	Change our data delivery target to 12 hours. Ask A. Tran to monitor delivery on GTS in 6 and 12 hours for both Iridium/Beidou and Argos and to monitor O2 data delivery by DAC. Send message to operational users through websites, Argo-OceanPredict Workshop, etc.	A. Tran, DACs, Websites, ADMT co-chairs	ADMT-21	R	AOML: done (for Iridium; not for descending profiles or undr ice profiles). BODC already done. JMA has done. MEDS done Coriolis done
10	Ask DACs to review the list of missing netCDF files from Coriolis monthly anomaly report. Please provide feedback to Christine Coatanoan if there is a reason for the file not appearing so that it will be removed from future reports.	DACs	monthly	H	AOML - we regularly compare what we have with GDAC holdings. Review latest list pending. BODC done. JMA is in progress Coriolis: not applicable (... done)
11	Ask DACs to review floats on satellite altimetry comparison list and provide feedback to Nathalie Verbrugge through the JCOMMOPS website. If suggestion is to add to greylist, please review this quickly as these are large errors that are detected and should be removed from the data system rapidly. It can detect when floats begin to show high salinity drift.	DACs	quarterly	H	AOML - rely on DM operators. BODC on-top of this and handle shortly after receipt. CSIRO address this upon receipt of report. CORIOLIS is in progress JMA is in progress. MEDS address this upon receipt of the email.
12	Replace RTQC gradient test T&S with the new MEDD test. Refer to Action in User Manual update on this topic	DACs	ADMT-21	R	AOML- pending. BODC - no progress. JMA is in progress MEDS no progress Coriolis done
13	Ask DACs to put floats that fail MinMax test for drift on the greylist. Information for this is found in monthly report from Coriolis in first chart. Start cycle and QC flag suggestion are included in the report. DACs should do this automatically without contacting the PI.	DACs	monthly	H	AOML - pending. BODC doing as received. INCOIS done JMA is in progress MEDS done Coriolis done
14	Ask two DACs with shallow profiles to volunteer to test the refined deepest pressure test for shallow profiles and provide feedback at ADMT-21. This is documented in Argo RT QC Coriolis Implementation Manual (https://doi.org/10.13155/49438). Coriolis is already implementing it.	AOML	ADMT-21	R	AOML - presented the options for a more sphisticated deepest pressure test (Coriolis table and a simplified table). See ADMT21 meeting report for more.
15	DACs to apply real time adjustment to all R files when a D mode adjustment becomes available. This means going back and re-processing R files after last D mode file and current R files coming in.	DACs	AST-21	R	AOML - done (for salinity) BODC not yet doing - focus has been on catching up float decoding CSIRO only does this for oxygen JMA is in progress. MEDS is in progress Coriolis done for Core-ARgo

16	Ask that all DACs with BGC floats make sure they produce traj files that include all MCs for all BGC events.	DACs with BGC data	ADMT-21	H	AOML - pending, this is part of our plan after we finished BGC profile processing system. BODC - no progress, focused on catching-up float decoding INCOIS not done JMA is in progress MEDS not done Coriolis done
17	Ask Coriolis to produce combined trajectory file format v3.2 examples for testing prior to AST-21	Coriolis	AST-21	R	done
18	Ask all DACs and dmode groups to reply with YES or NO about the proposed combined traj file format v3.2 by 01 Feb 2020	DACs	févr 2020	H	done
19	Ask DACs to make list of APEX and NAVIS floats deployed between April and September 2019 to monitor possible Garmin GPS problem.	DACs	févr 2020	R	AOML: fixed all GPS times as best we can (by revising the decoders). Do not have a list at this time. INCOIS done JMA has done. Coriolis : no float concerned. MEDS has no floats
20	Ask CSIRO and INCOIS to stop adjusting real time data against CARS climatology. Instead flag it as bad in real time and use it to help identify which floats to DMQC first.	CSIRO, INCOIS	AST-21	L	CSIRO complete. INCOIS also updated.
21	Keep grey list on GDACs. Make sure that it contains only active floats. When floats/profiles are dmoded they should be removed. See QC Manual Update section for more details	T. Carval, M. Frost, DACs, dmode operators	AST-21	R	AOML: done BODC no progress INCOIS done JMA has done. MEDS done Coriolis done
22	Ask DACs to apply the greylist test to trajectory files	DACs	ADMT-21	R	AOML: no progress yet BODC no progress INCOIS not done JMA is in progress. Coriolis done. MEDS done
23	Ask DACs to implement new global range test	DACs	ADMT-21	R	AOML - not yet. BODC - no progress INCOIS done JMA is in progress. MEDS done Coriolis done
	Format				
24	Ask all DACs and dmode groups (Core and Bgc) to reply to email from M. Scanderbeg with YES or NO about proposed combined traj file format v3.2 by 01 Feb 2020.	DACs, M. Scanderbeg	févr 2020	H	**voted yes**
25	Accept proposal for three optional variables related to position error. POSITION_ERROR_REPORTED, POSITION_ERROR_ESTIMATED, POSITION_ERROR_ESTIMATED_COMMENT	DACs, dmode operators Mark	février 2020	R	**accepted**
26	Provide feedback to Thierry on proposal for adding time series to the tech file by AST-21 so finalized proposal can be put forward to AST for approval	ADMT	févr 2020	H	
27	Study how to replace "sea_water_salinity" by "sea_water_practical_salinity" and come to ADMT-21 with a proposal. Maybe GDACs can help with this replacement.	Andrew, Matt,Claudia,Thierry, Mark	ADMT-21	R	Should not be performed in short term, wait for the next significant format change Argo R3 parameters vocabulary table : PSAL standard name is the correct "sea_water-practical_salinity"
	to AST				
28	Suggest ARCs interact with AST on the network implementation aspects and review their Terms of Reference	ARCs	AST-21	R	SOARC in progress JAMSTEC is in progress
29	Encourage deployment planning coordination at AST, especially in areas that seem over-sampled in the AIC report, or are targeted as pilot areas for DEEP or BGC	Argo PIs	ADMT-21	R	Done for Atlantic basin JAMSTEC has done.
30	Communicate that it isn't necessary for operational centers to use greylist since QC flag information is available in BUFR msgs.	ADMT co-chairs, P. Oke, AST	OceanPredict Workshop at AST-21	H	Done : Peter Oke gave "Argo and OceanPredict" seminar at an OceanPredict virtual workshop outlining this, and other related issues.
	QC Manual Update				

31	Make RTQC gradient test for T&S obsolete. Add MEDD test. Can replace grad test with MEDD test in the order. DACs, see Action 11 on this topic	A. Wong	janvier 2020		done
32	Global range test to be updated	A. Wong & Thierry Carval	janvier 2020		done
33	Annie and Catherine to document how to add global attribute for DMQC operator in D and BD files.	A. Wong & C. Schmechtig	janvier 2020		done
34	Ask C. Cabanes to write clear instructions on how to apply real time adjustments and to which files they have to be applied.	C. Cabanes & Annie Wong	janvier 2020		done
35	Ask C. Cabanes to update guidance on use of grey list in the DM procedures for salinity. This includes start date of problem so that DACs can reprocess files accordingly.	C. Cabanes & Annie Wong	janvier 2020		done
36	Ask Annie Wong to update QC Manual to include the greylist test on trajectory file.	A Wong	janvier 2020		done
	User Manual Update				
37	Update wording on grey list to record: when floats/profiles are dmoded, they should be removed from greylist. Make it clear how/where this information can be recovered.	T. Carvel, A. Wong, M. Scanderbeg	janvier 2020		done
38	Release updated User Manual within 1-2 months of ADMT meeting with agreed upon changes. If additional changes are agreed upon later in the year, prior to ADMT, another version can be released.	T. Carval	janvier 2020		done
39	Clearly identify which sensors are accepted and which are pilot in ref table 27. This needs to be in User Manual and NVS tables	T. Carval, M. Scanderbeg, C. Schmechtig, V Pabba, Mark	janvier 2020		in progress
40	Update User Manual to reflect that the ADMT accepts the proposal for three optional variables related to position error: POSITION_ERROR_REPORTED, POSITION_ERROR_ESTIMATED, POSITION_ERROR_ESTIMATED_COMMENT. Filechecker may need to be updated.	T. Carval, M. Scanderbeg, A. Wong, B. Klein, Claudia	janvier 2020		done
41	Define R/A/D for BGC	Catherine, Thierry, Annie	janvier 2020		done
	Deep Argo				
42	Consider how to refine deepest pressure test (RT test 19) or decide not to apply this test	Esmme, John,Claudia Cecile, Kamillia	ADMT-21	R	
43	Develop Deep Argo cookbook	N. Zilberman, Brian, Kamillia, C. Schmid	ADMT-21	R	Not ready yet
44	Ask Deep Argo to present to AST their requests about changing RT flags under 2000 dbar if new Cpcoef is used.	N. Zilberman, Brian	AST-21	H	Done at AST-21 and accepted by AST to implement a fleet wide cpcor in real time with better qc flags. cpcor can be changed in dmode
	John				
45	Ask J. Gilson to compile list of WMO number for APEX and NAVIS floats with Garmin GPS and the cycle number as of 6 April 2019. This will be a way to note which floats have been affected by the Garmin GPS problem. Store simple ASCII file at the GDACs.	J. Gilson	janvier 2020	R	John compiled the list. Sent to GDACs for storage.
	DMQC				
46	Ask DMQC operators to use table at beginning of Coriolis monthly report which contains MinMax test results to prioritize floats to DMQC.	DMQC operators	novembre 2019	H	BODC has cleared a significant DMQC backlog in the past year, and now moving towards routine operations CSIRO does this JAMSTEC use Coriolis monthly report to prioritize floats to DMQC. MEDS does this
47	Form DMQC working group to create document with best practices for DMQC of high salinity drift CTDs. Present work at AST to get scientific feedback.	J. Gilson, B. Klein, C. Cabanes, CSIRO, M. Alkire, K. Wlicka, SeaBird, Uday, Kanako Sato, Annie Wong	AST-21	H	Provided inputs from INCOIS JAMSTEC is in progress

48	Ask all DMQC operators to make an account at argo.jcommops.org	DMQC operators	AST-21	R	BODC done Done for CSIRO JAMSTEC has done.
49	Ask DMQC operators to obtain an ORCID for recording in D and BD prof files. Add this ORCID to AIC system	DMQC operators	février 2020	R	BODC done - not added to AIC system? Coriolis : ORCID for some DM operators; CSIRO: ORCID for all operators JAMSTEC is in progress and will respond by ADMT21.
50	Ask DMQC operators to add global attribute with DMQC operator name. :comment_dmqc_operator agreed syntax: "PRIMARY| https://orcid.org/16-digit-number | operator name, institution". if BD files need more info, syntax should be: PRIMARY line first, then: "B-PARAM | https://orcid.org/16-digit-number | operator name, institution"	DMQC operators	février 2020	R	BODC - no progess Coriolis : ORCID added to new DM files; for CSIRO this is implemented in development system JAMSTEC is in progress and will respond by ADMT21.
51	Ask all DACs and dmode groups to reply with YES or NO about the proposed combined traj file format v3.2 by 01 Feb 2020	DMQC operators	février 2020	H	done
	Mathieu				
52	Ask Mathieu to set up system to capture DMQC operator by parameter with the ability to change operator over a float's lifetime and the possibility of params being grouped in the future. Then, when dmode files come in, Mathieu can pull in dmode operators from the profile files to keep up to date.	JCOMMOPS, DMQC operators	ADMT-21	H	
53	Ask Mathieu to specify what is needed to add the WIGOS-ID in the Argo metafile and BUFR template	Mathieu ,John Turton +DACs	ADMT-21	R	
	ref DB				
54	Ask Christine Coatanoan to incorporate high QC GO-SHIP product profiles selected for DEEP-ref-DB to Core ref db. This will be released yearly. Suggest that if the GO-SHIP profile from CCHDO exists in the ref DB, it should be replaced with higher QC'd version.	C. Coatanoan	ADMT-21	R	Link for Deep-ref-DB recovered on 2th October, not clear which QC done on this dataset, integration should be done or in progress for ADMT-21
55	Ask John Gilson to apply suggested filters except the one to thin out the Argo ref db and release that version of Argo ref db. Afterwards, ask John to explore thinning data by region	J. Gilson	ADMT-21	R	
	Other				
56	Next AST meeting in Southampton has a side Ocean-Predict and Argo meeting. Important to have data people to attend		AST21	R	Likely rescheduled to early Feb
57	Work on collecting Best Practices information for core Argo on float deployment, float storage, data practices, etc. and first step make it available on WWW page	Megan to lead, Deb West	ADMT-21	R	
58	Put ADMT-20 action items on a Google Spreadsheet and share with ADMT community to help coordinate action status throughout the year. China will be sent separate doc so they can contribute too	M. Scanderbeg	ADMT-21	R	done
	GADR				
59	Explore setting up an rsync service at US GDAC to improve archiving at NCEI	M. Ignaszewski, M. Frost, T. Boyer	ADMT-21	R	M. Frost checking with T. Carval on rsync list and possibility of use by GODAE for NCEI mirror
60	Ask T. Boyer and M. Belbeoch to work together on finding a way to include Argo GDACs as part of the Marine Climate Data System.				Marine Climate Data System (MCDS)was esentially on hold pending breakup of JCOMM. New WMO expert team set up and started working on MCDS Nov 3, 2020. Will take some time to spin up.
	ARC				
61	Rename NA-ARC to Atlantic ARC	Websites	févr 2020	R	done
62	Link to Antarctic Treaty float deployment document from SO-ARC on JCOMMOPS and AST website	Matt, M. Scanderberg, M. Belbeoch	AST-21	R	
63	Gather information how it has been done in the past to comply to the Antartic Treaty float deployment	Matt and Brian	ADMT21	R	

Annex III - New Action list for ADM21

	Action	Who	When	Priority	Status
	Yellow highlighting means the action is carried over from ADMT-21				
	GDACs				
1	Ask M. Ignaszewski to consider ways to transition the File Checker to a more sustainable format to prepare for his retirement in late 2021.	M. Ignaszewski	ADMT-22	H	
2	Update GDAC file checker to accommodate changes to Ref Table 3 in Users Manual.	M. Ignaszewski	ADMT-22	H	
3	Ask DACs to review warnings on configuration and technical parameters from the File Checker, work with M. Iganszewski and take actions to fix the problems.	DACs, M. Ignaszewski	AST-22	R	
4	Add new reference table checks (ref table 28, 29, 30) to the File Checker.	M. Ignaszewski	AST-22	R	
5	Transition the File Checker to using the NERC vocabulary server version of the Argo reference tables.	M. Ignaszewski, M. Donnelly, NVS	ADMT-22	R	
6	Update the GDAC FileChecker with the v3.2 traj format	M. Ignaszewski	ADMT-22	R	
7	Run all existing v3.1 files through the current FileChecker and erport results to ADMT	M. Ignaszewski	AST-22	R	
	DACS				
8	ADMT co-chairs will continue to try and prioritize DAC actions from meetings to provide clear guidance on which ones to accomplish first. Co-chairs will consider mid-year virtual meeting with DACs to check on progress.	ADMT co-chairs	juin 2021	H	
9	Ask DACs to review warnings on configuration and technical parameters from the File Checker, work with M. Igansewski and take actions to fix the problems.	DACs, M. Ignaszewski	ADMT-22	H	
10	Ask US Argo to work with NAVO on finding a way to prevent bad data from going onto the GTS.	C. Schmid, M. Scanderbeg, US Argo	AST-22	H	
11	Ask DACs to put floats that fail MinMax test for drift on the greylist. Information for this is found in monthly report from Coriolis in first chart. Start cycle and QC flag suggestion are included in the report. DACs should do this automatically without contacting the PI.	AOML, JMA, CSIO, CSIRO, KMA, KORDI	monthly	H	
12	Finalize refinement of deepest pressure test for shallow profiles.	C. Schmid, DACs	ADMT-22	R	
13	Start to implement the v3.2 traj file format at the DACs.	DACs	ADMT-22	R	
14	Replace RTQC gradient test T&S with the new MEDD test. Refer to Action in User Manual update on this topic	All DACs but Coriolis	ADMT-22	R	
15	Ask DACs to implement new global range test	AOML, BODC, JMA, CSIO, CSIRO, KMA, KORDI,	ADMT-22	R	
16	DACs to apply real time adjustment to all R files when a D mode adjustment becomes available. This means going back and re-processing R files after last D mode file and current R files coming in.	BODC, CSIRO for core, JMA, MEDS, INCOIS, KMA, KORDI, CSIO	ADMT-22	R	
17	DACs to include TEMP_CNDC and NB_SAMPLE_CTD in the core-files as intermediate parameters, ie. no _ADJUSTED, no _ADJUSTED_QC, no _ADJUSTED_ERROR.	DACs	ADMT-22	R	
18	Ask DACs to apply the greylist test to trajectory files	AOML, BODC, JMA, CSIO, CSIRO, KMA, KORDI, INCOIS	ADMT-22	L	
	Format				
19	add way to calculate float energy capacity in battery variables				
20	Decide on end of transition period for BGC floats, during which both v3.1 and v3.2 traj files can exist, at ADMT22.	DACs, BGC Argo	ADMT-22	R	
21	Annie Wong to solicit help from other ADMT members to investigate how to record CTD sampling frequency in Argo data files, either as a technical file parameter or as a meta file config parameter, taking into account the CTD frequency can change between profiles and within a profile.	A. Wong, other ADMT members	ADMT-22	R	
22	ADMT exec committee work on finding best way to manage list of proposed changes by file type and present at ADMT-22.	ADMT exec	ADMT-22	R	
23	Add WIGOS-ID to list of things to be added to next version of the metafile.	ADMT exec	ADMT-22	R	
24	Activate TEMP_CNDC in Ref Table 3, with long_name = "Internal temperature of the conductivity cell".	DACs with RBR floats	ADMT-22	R	
25	Expand NB_SAMPLE to NB_SAMPLE_<short_sensor_name> in Ref Table 3, with long_name = "Number of samples in each pressure bin". <short_sensor_name> is as listed in Ref Table 27	DACs	ADMT-22	R	
26	Move TEMP_CNDC and NB_SAMPLE_CTD from the b-files to the core-files as intermediate parameters in Ref Table 3. The other NB_SAMPLE_<short_sensor_name> from BGC sensors will remain in the b-files as intermediate parameters.	DACs	ADMT-22	R	

	The CF standard name for PSAL has been updated from ‘sea_water_salinity’ to ‘sea_water_practical_salinity’ and Argo will need to change to this eventually. Record this change in the NVS GitHub repository to keep track of it for future rewrites.	T. Carval	ADMT-22	R	
	NVS server ref tables				
27	NVS will become the master copy of the Argo references tables as of January 2021		janvier 2021	R	
28	Proposal on how to manage content of NVS version of Argo ref tables was accepted. GitHub will be used to track suggested changes to tables and proposed changes will be advertised for 2 weeks. After that, final approval will be given by ADMT exec and implemented by vocab editors	NVS vocab editors, ADMT exec	janvier 2021	R	
29	Adopt ICES platform codes for ships to constrain the DEPLOYMENT_PLATFORM field. Details to be addressed by the Argo Vocab Task Team.	DACs, NVS vocab editors	ADMT-22	R	
	User Manual Update				
30	Update the User Manual and Trajectory Cookbook with the v3.2 traj format.	A. Wong, T. Carval	AST-22	H	
31	Update the Users Manual and all QC manuals with the improved version of the Argo QC flag table and accompanying footnotes.	A. Wong, T. Carval	AST-22	H	
32	Update Ref Table 3 in Users Manual.	A. Wong, T. Carval	AST-22	H	
33	Clearly identify which sensors are accepted and which are pilot in ref table 27. This needs to be in User Manual and NVS tables	T. Carval, M. Scanderberg, C. Schmechtig, V Pabba, Mark	AST-22	R	
34	Update ref table 15 to allow MC 100 as part of surface oxygen measurements	T. Carval, M. Scanderbeg	AST-22	R	
	The proposal on how to include an optional time stamp for technical data was approved. Update User Manual with new optional variables for tech file.	T. Carval	AST-22	R	
	to AST				
35	The ADMT suggests a working group, possibly led by Peter Oke, to organize a joint Argo-OceanPredict workshop that will feature both science and data talks to encourage better communication and engagement between Argo and the operational community. Topics to consider include data timeliness, descending profiles, using QC flags in BUFR format, etc.	P. Oke, ADMT co-chairs, others?	first half of 2021?	H	
	Pilot data				
36	A. Wong & V. Thierry to draft up documentation for DACs on how to apply the cpcor correction in real time for Deep Argo data and send to DACs for feedback on whether this is feasible to implement.	A. Wong & V. Thierry	AST-22	R	
37	S Wijffels to lead discussion with AST and ADMT to form a proposal on how to approach testing and validating dynamic corrections for C from on board the floats before S is calculated, binned and transmitted.	S. Wijffels	ADMT-22	R	
	DMQC				
38	The Fast Salty Drift (FSD) Working Group will document the suggested procedures for handling FSD floats in the relevant Argo Documentation by February 2021.	J. Gilson, B. Klein, C. Cabanes, CSIRO, M. Alkire, K. Wlicka, SeaBird, Uday, Kanako Sato, Annie Wong	février 2021	H	
39	Ask DMQC operators to fill in spreadsheet on FSD floats to help monitor the impact on the Argo data set. If operators prefer to send their information to B. Klein, she will fill in the spreadsheet.	DMQC operators	AST 22	R	
40	Ask SeaBird to confirm the Serial Numbers after 11250 should be when they changed their manufacturing process to solve the Fast Salty Drift issue so that Argo can monitor if the issue still remains in the current fleet.	K. Martini, J. Klinke	AST-22	H	
41	Ask DMQC operators to obtain an ORCID for recording in D and BD prof files. Add this ORCID to AIC system		ADMT-22	R	
42	Ask DMQC operators to add their name to the global attributes section of the D- and BD- files, as per the agreed format described in Section 3.7 of the QC Manual.		ADMT-22	R	
	ref DB				
43	Ask C. Coatanoan to release an updated version of the CTD ref db with clear flags indicating the GO-SHIP Easy Ocean data that can be easily selected for use in OWC.	C. Coatanoan	AST-22	R	
44	Ask John Gilson to apply suggested filters except the one to thin out the Argo ref db and release that version of Argo ref db. Afterwards, ask John to explore thinning data by region	J. Gilson	ADMT-22	R	
	GADR				
45	Ask T. Boyer and M. Belbeoch to work together on finding a way to include Argo GDACs as part of the Marine Climate Data System.		ADMT-22	R	

	ARC				
	Other				
46	Keep the format of the action items as a Google Sheet with the link appearing on the ADMT-21 meeting website and ADMT meetings page.	ADMT co-chairs	End of 2020	R	
47	Review incomplete actions from ADMT-20 to see which need to be carried on to ADMT-21	ADMT co-chairs	End of 2020	R	
48	Ask for feedback about sharing data via cloud services to consider how to host Argo data on the cloud.	T. Boyer, T. Carval, other cloud service experts	ADMT-22	R	
	Monitoring				
49	Ask M. Belbeoch to include the alerts from MinMax and OA from Coriolis in addition to altimetry one.	M. Belbeoch	ADMT-22	R	
50	M. Belbeoch to capture DM operators for each float at OceanOPS for notification purposes. Depending on the float, it could be just one operator, one core and one BGC operator, or several operators for each sensor. M. Belbeoch to coordinate with DM operators for best solution.	M. Belbeoch	ADMT-22	R	
51	Ask M. Belbeoch to perform an audit of metadata at OceanOPS vs what is at the DACs and present it at the DAC Workshop.	M. Belbeoch	ADMT-22	R	
52	M. Belbeoch find out if the WIGOS ID is required for BUFR on the GTS.	M. Belbeoch	ADMT-22	R	
	Workshops				
53	There is a recognized need for more DMQC workshops with different focuses: training core DMQC operators, Deep Argo data and BGC data. The core and Deep workshops could be combined, but the BGC one will be separate. G. Maze, B. King, A. Wong, V. Thierry are thinking of a virtual core & Deep workshop in June or July 2021. T. Maurer and C. Schmectig will keep a BGC workshop in mind.	G. Maze, B. King, A. Wong, V. Thierry, T. Maurer, C. Schmectig	ADMT-22	R	
54	ADMT endorses continuing the DAC Workshop and finding ways to collaborate more effectively.	ADMT co-chairs	ADMT-22	R	
55	Ask M. Donnelly and C. Schmid to consider adding a topic to the next DAC workshop on improving data delivery strategies. It could be that some DACs could improve their timeliness based on suggestions from other DACs. Also consider adding the results of an audit of metadata consistency between DACs and OceanOPS.	M. Donnelly, C. Schmid	2nd DAC Workshop	R	
	Communication				
56	Educate users on the new v3.2 trajectory file format (e.g., via website).	M. Scanderbeg	AST-22	H	
57	Find ways to effectively share the environmental impact statement. EuroArgo is developing a leaflet on this which can be shared. Other ideas include creating an infographic and slides.	M Bollard/Euro-Argo ERIC and AST+ADMT Chairs	First Draft for AST22	R	
58	Work on collecting Best Practices information for core Argo on float deployment, float storage, data practices, etc. and first step make it available on WWW page	Megan to lead, Deb West	ADMT-22	R	
59	Form working group to better document, explain and include data access & visualisation tools on AST and ADMT websites taking into account different user levels	M. Scanderbeg, S. Diggs, C. Gourcuff, C. Gordon, H. Bittig, G. Maze	ADMT-22	R	
60	Improve NVS Argo vocab links on ADMT website. Ask the vocab group & OceanOPS to create and post a list on the ADMT website of ICES platform codes to make it easier for DACs to use in the creation of metafiles.	T. Carval, Argo Vocab Task Team	ADMT-22	R	

Annex IV – ADMT Executive Board

Terms of Reference

It supports the ADMT co-chairs in steering ADMT activities to fulfil AST requirements. •It is composed of a Primary and an Alternative representatives for each of the following topics. •The Primary and Alternative representatives coordinate so that at least one will attend the Exec Board meetings. Both representatives can attend the same meetings if both are available. •On each topic the Primary and Alternative representatives are in charge of working with the ADMT members on the actions linked to their topic and monitoring progress. •Identify issues and possible solutions to be discussed at the Exec Board meetings and at the ADMT meetings.

- Ensure effective communications with various user groups via outreach activities.
- Ensure Argo data adhere to the FAIR data principles.

Thematics Roles

- Argo Data Management Chairs
- Argo Director
- Argo Steering Team Chairs
- BGC Mission
- Monitoring
- GDACs
- Delay Mode Operators
- DACs
- ARCs
- GADR
- Format / User Manual

ADMT Executive Board members

Role	**Primary**	Alternative
Argo Data Management Chairs	Megan Scanderbeg Sylvie Pouliquen	
Argo Director	Breck Owens	
Argo Steering Team Chairs	Susan Wijffels Toshio Suga	
BGC Mission	Catherine Schmechtig	Tanya Maurer
Technical Coordination/Monitoring	Mathieu Belbeoch	Victor Turpin

GDACs	Thierry Carval	Michael Frost
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NATIONAL REPORTS

Australian Argo National Data Management Report prepared for ADMT21, November 2020

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Deployments in 2019/20

Australia has deployed 85 floats between 1 October 2019 and 1 October 2020, including 36 manufactured by Teledyne-Webb, 40 by Seabird, and 9 by MRV. Two Teledyne-Webb floats include BGC sensors to measure pH, oxygen, nitrate, chlorophyll fluorescence and backscatter. The MRV floats include RBR CTDs; the rest are core floats with SBE41 CP CTDs. From the core SBE41 floats, four were deployed in the ice zone over the Antarctic shelf and are parking on the sea floor, and sampling to the bottom. Figure 1 shows a map of deployment locations.

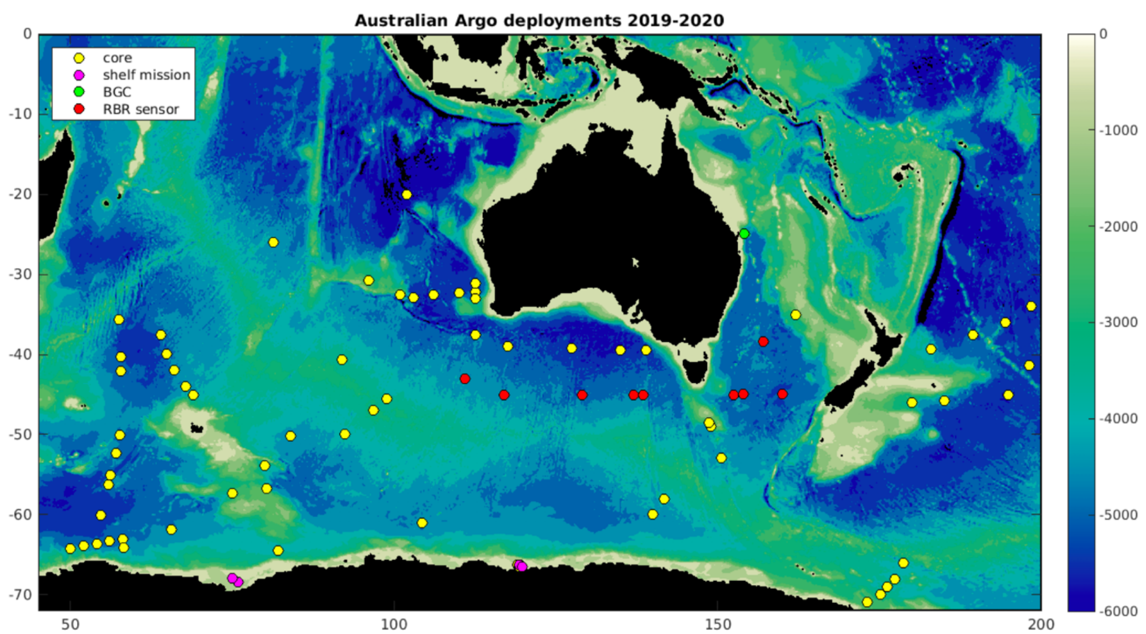

Figure 1: Map of Argo Australia deployments between 1 October 2019 and 30 September 2020; coloured dots indicate deployment location of two Argo-BGC floats (green), four floats in a mission sampling shelf waters off Antarctica (magenta), and nine MRV floats with RBR CTD sensors (red); remaining floats are Argo-Core.

Organization and resourcing

Australian Argo partners include CSIRO, BoM, IMOS, UTAS (Australian Antarctic Program Partnership - AAPP), and the Department of Defence (DoD). Argo Australia is organized as a Facility under IMOS, with the Facility led by Peter Oke (CSIRO), and two sub-Facilities: Deep, led by Steve Rintoul (CSIRO); and BGC, led by Peter Strutton (UTAS). The Facility shares resources for real-time data processing, float testing, float deployment, and software support for real-time operations.

Argo Australia operates with a total of ~5.4 Full-Time Equivalents (FTEs), with ~1.5 FTEs dedicated to DMQC, ~1.0 FTEs dedicated to RT support, ~1.5 FTEs dedicated to technical float support, ~0.9 FTEs dedicated to BGC Argo, and ~0.5 FTEs dedicated to science and leadership.

Status of RT Operations

Argo Australia has a team of eight people with fractional allocations to RT operations. In total, we dedicate about 1.0 FTE to RT support. Those individuals involved, and their roles, are:

- Gabriela Pilo: management and trouble-shooting of real-time data streams at CSIRO (with support from Rebecca Cowley)
- Lisa Krummel and Joel Cabrie: management of real-time data streams at the BoM
- Pat McMahon: float procurement and logistics
- Craig Hanstein: technical deployment planning
- Beatriz Pena-Molino: scientific deployment planning
- Craig Hanstein and Pat McMahon: telecommunications
- Roger Scott: Code Support

In October 2019, Argo Australia appointed a new RT operator (Gabriela Pilo). Gabriela was trained and supported by Rebecca Cowley. Since mid-2020, we have maintained two RT systems: a legacy Matlab-based system (operated by Gabriela Pilo), and a new Python-based RT system (developed and operated by Roger Scott). The Matlab-based RT system is still the primary system for floats with Iridium-RUDICS and Argos communications (currently 397 floats). The Python-based system is the primary system for floats with Iridium-SBD communications (currently 33 floats). However, the Python-based system also processes all other floats, as a secondary, backup service. We plan to transition our primary system from Matlab to Python by the end of 2021, and discontinue operation of the Matlab-based system some time thereafter.

Following a denial of service attack on one of our servers in 2019, we installed a secondary, backup RUDICS-server at CSIRO's offices in Perth, Western Australia. This secondary server provides some redundancy, in case of hardware fail, or in case of another malicious attack.

Float data are decoded, processed, and disseminated at CSIRO and BoM every 6 hours – staggered, so that data from the Australian array are processed every 3 hours. The Python RT processing only happens at CSIRO for now, and runs every 3 hours.

At the time of writing (24 November 2020), 98% of eligible data are being uploaded to the GDACs within 24 hours of measurement. The data are issued to the GTS in BUFR bulletins via the Bureau of Meteorology (AMMC). These messages are generated every hour, as data become available. RT performance is summarised in Figure 2. The dip in data delivery between December 2019 and January 2020 was caused by two incidents. First, over this period, we deployed 57 floats and couldn't quite keep up with the attribution of WMO IDs to all floats within 24 hours of deployment. Second, there was a bug in the code when the year changed from 2019 to 2020. As a result, the CLS files from floats with Argos comms weren't processed. Once we fixed the issue, we processed the backlog of CLS files to restore the complete archive of profiles.

Since 1999, Argo Australia has deployed 977 floats. We currently have 430 floats on our database that we consider to be "alive". This includes floats that are under ice, floats that haven't reported for some time, and 23 floats that are sending suspect data. On 24 November, 2020, 342 floats have reported profiles within the last 90 days. Figure 3 shows a map of the current location of operational floats.

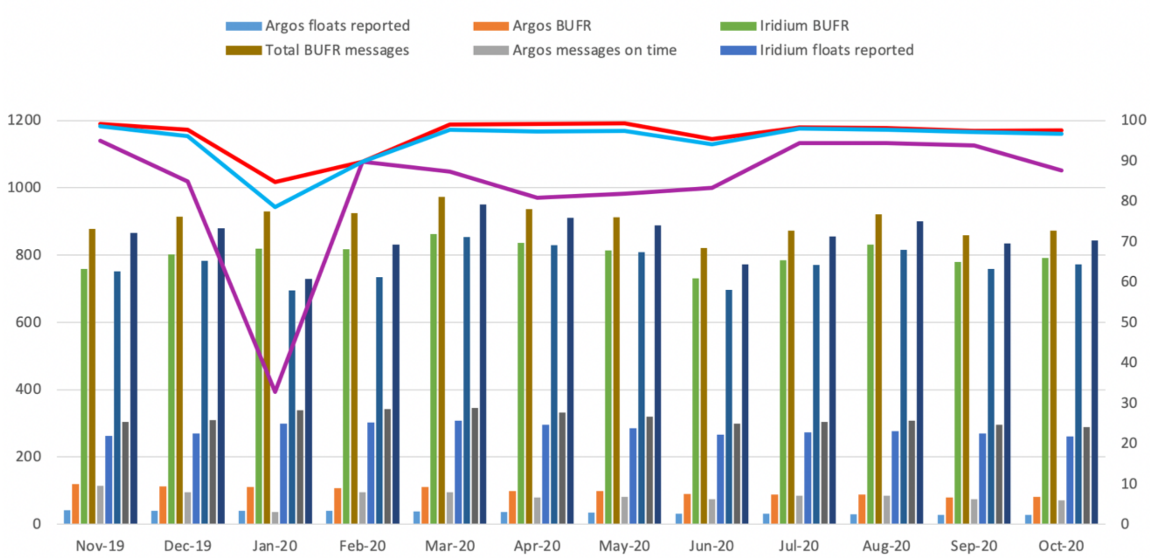

Figure 2: Summary of RT metrics for the Argo Australia operation. The lines at the top indicate the percentage of files delivered to the GDAC within 24 hours for floats with Iridium-RUDICS comms (red), Argos comms (purple) and both (light blue), with percentage axis on the right. The vertical bars indicate the number of floats reported and number of BUFR files sent to the GDAC per month, with axis on the left.

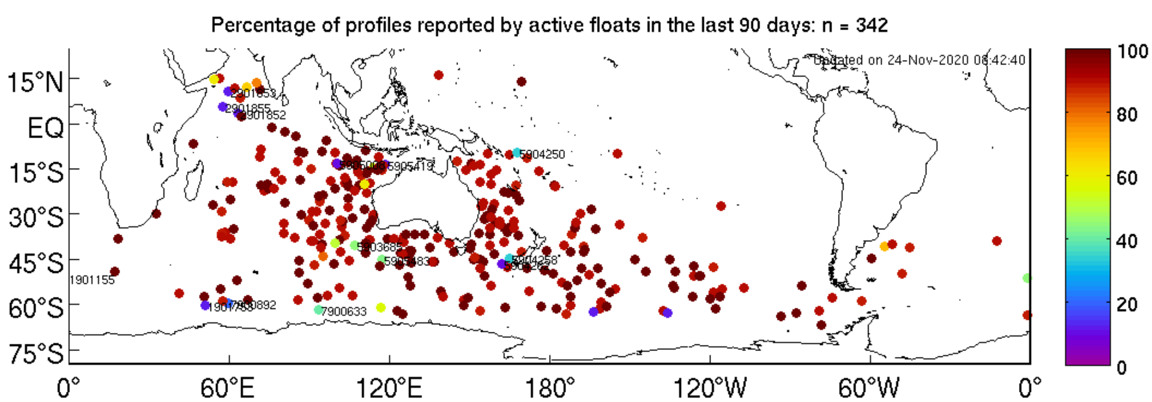

Figure 3: Map of the current locations of operational floats managed by Argo Australia. The colour of each dot indicates the percentage of data return over the last 90 days; with 100 indicating that 9 out of 9 profiles have been returned. Floats that have reported profiles fewer than 5 times in the last 90 days are labelled with their WMO ID (used by the Argo Australia team to identify floats that may be dead and that need to be checked and monitored).

Status of DMQC Operations

Argo Australia has a team of six people with fractional allocations to DMQC operations (with only five active for most of the past year). In total, we dedicate about 1.5 FTEs to core DMQC and about 0.5 FTEs to BGC DMQC. Those individuals involved, and their roles, are:

- Core DM Operators: Catriona Johnson, Jenny Lovell, Tatiana Rykova (on maternity leave)
- BGC DM Operator/Specialist: Christina Schallenberg
- DM Consultant: Esmee Van Wijk
- Software support: Dirk Slawinski

At the time of writing (19 November 2020), 95.8% of eligible core profiles have been DMQC-ed with D-files uploaded to the GDACs.

We are using OWC-V2 to make salinity adjustments for floats with PSAL drift and plan to soon upgrade to OWC-V3. Out of the whole fleet (both active and dead), we find that close to 20% of floats require PSAL adjustment for some profiles. For floats with CTD serial numbers (SN) in the range 6000-7100 this percentage is 50%. There are 71 floats with CTDs in this SN range; two have not been assessed for drift due to RT data issues, and these have RTQC of 2 applied to PSAL in recognition of the higher likelihood for PSAL drift.

CSIRO hosted a DMQC Operator from China (Xiaofen Wu) during Aug-Oct, 2019 and delivered the CSIRO DMQC system to her. During this time some improvements were made to the structure of the system to make it more easily portable to external users. We maintain a collaborative relationship with Xiaofen, providing some code-support to accommodate different float characteristics, although our capacity to provide full code-support is limited.

In the past, our core DMQC operators performed DMQC on DOXY parameters. This is now handled separately by our BGC DMQC specialist. Some changes are underway to ensure accurate documentation and delivery of DMQC information and meta-data between the two efforts, as well as some changes to the software to facilitate the independent export of D-files and BD-files. At the time of writing, 90.9% of eligible DOXY profiles have been DMQC-ed with BD-files uploaded to the GDACs.

There is currently 0.9 FTE available for BGC-related tasks, with about 0.5 FTE to BGC DMQC. Other BGC tasks include sensor selection, pre-deployment decisions, and RTQC (including the “adjusted” mode for several BGC variables). To date, only the DOXY variable has received DMQC, as indicated above. However, several issues related to QC of the DOXY_ADJUSTED variable have been solved in the past year, and all our DOXY data are now in “adjusted” mode. We have responded to float issues that have come up in the DOXY audits and after the most recent improvements have been completed, we should have no more than ~15 DOXY profiles outside of the expected bounds.

None of the other BGC variables have received DMQC, but the CSIRO BGC operator has led the effort to update the CHLA RTQC documentation, with final decisions on crucial aspects of the QC process to be decided at ADMT-21. The BGC operator will subsequently incorporate the decisions into an updated CHLA RTQC document for the BGC Argo community, and DMQC of CHLA will commence shortly thereafter. The next variables to receive DMQC will be BBP and IRRADIANCE/RADIANCE/PAR, which are the most common variables present in our data set (after DOXY). It is expected that these variables will be up to date with DMQC by mid 2021. The remaining variables (PH and NITRATE) are expected to follow in the second half of 2021.

Analysis of PSAL drifts

We aim to perform the first DMQC on floats six months after deployment, with a 3-month lag; and we then aim to perform DMQC every year, with a 6-month lag. We assess PSAL against CARS09 and nearby-Argo at multiple theta levels. If after assessment, it is decided that the PSAL drift or offset is real, we run OWC and apply piece-wise, linear adjustments where necessary. If the required adjustment in DMQC is large, we greylist the float for PSAL in RT QC (QC3 if PSAL is well-behaved and we expected we can correct the data with DMQC, QC4 if un-correctable). We have performed an assessment on our fleet to assess the percentage of floats showing a salty drift. At the time of this analysis – of our entire fleet (846 floats), 77 have not yet been assessed, 658 (78%) showed no drift; 177 (21%) showed a salty offset or drift; 12 (1.4%) showed a fresh offset or drift; and 38 returned bad PSAL data (these were not included in the percentages reported here). These results are summarized in Table 1. Based on experience, we expected to find the percentage of salty drifters to be closer to 10-12%. We repeated this analysis for floats with SBE41 CTDs with SN6000-7100, and SN8000-8999. The results are in Table 2 and 3. We find that there is a much higher percentage of salty drifters with SN6000-7100 (Table 2). But we find no evidence (in our small sample) for more than usual salty drifters with SN8000-8999 (Table 3).

Table 1: Analysis of PSAL drifts in SBE41 CTDs for all floats deployed by Argo Australia.

Code	Meaning	Frequency	Percentage
0	Not assessed	77	
1	No drift	658	78%
2	Salty drift	177	21%
3	Fresh drift	12	1.4%
4	Bad PSAL	38	
		Total assessed: 846	

Table 2: Analysis of PSAL drifts for SBE41 CTDs with SN6000-7100. Of those not assessed, two have problems being processed through our DMQC system (software issues) and six are from floats in the high latitudes with sparse reference data that need further analysis.

Code	Meaning	Frequency	Percentage
0	Not assessed	8	
1	No drift	35	50%
2	Salty drift	34	49%
3	Fresh drift	1	1%
4	Bad PSAL	3	
		Total assessed: 69	

Table 3: Analysis of PSAL drifts for SBE41 CTDs with SN8000-8999.

Code	Meaning	Frequency	Percentage
0	Not assessed	0	
1	No drift	29	78%
2	Salty drift	5	14%
3	Fresh drift	3	8%
4	Bad PSAL	0	
		Total assessed: 37	

Web pages, products, and papers

Argo Australia have developed a new product, called Blue Maps. Blue Maps is a gridded product of temperature, salinity, and sea-level, constructed by mapping observations from Argo, satellite altimetry, and satellite sea surface temperature. The mapping method is based on the ensemble-based data assimilation system routinely used under Bluelink – an ocean forecasting effort in Australia. Results from a prototype of Blue Maps is at: www.marine.csiro.au/~oke060/Argo/ArgoMaps.html.

Once the system configuration is finalized and documented, data will be made available to the community via OPeNDAP. This is expected in early 2021.

Other products generated in Australia using Argo data include:

- OceanMAPS: operational, short-range ocean forecasts produced by the BoM (summarised by Schiller et al. 2019);
- BRAN: Bluelink ReANnalyses produced by CSIRO (summarised by Schiller et al. 2019). The latest version – BRAN2020 – was completed in October 2020. Once assessed and documented, data will be made available to the community via OPeNDAP; and
- OceanCurrent (http://oceancurrent.imos.org.au): a product based mostly on satellite data, but includes Argo data in graphics.

Argo data in Australia continues to be used to underpin many different scientific studies. These are captured on the Argo Bibliography webpage. Some studies coming out of the Australian Argo team include a couple of papers on the oceanography of the East Australian Current region (Oke et al. 2019a,b), a study of Antarctic Bottom Water (Silvano et al. 2020); a study of biomass in the Arabian Sea (Wojtasiewicz et al., 20210), an analysis of ocean warming in the Indian Ocean (Beal et al. 2020), a study of changes in Antarctic ice sheets (Noble et al. 2020), and others. The Argo Australia team are also working on a paper to analyse the fail modes of all of our floats. This study is led by Jenny Lovell, and aims to identify why some floats fail early (before their power is exhausted), with a view to eliminating avoidable failures in our future fleet.

Assessment of Impact

One of our funders (IMOS) recently undertook an assessment of impact of each of their facilities. This may be of interest to the International Argo Community. For the Argo facility, this focussed on the impacts of Argo Australia, rather than the International Argo effort. Some results are summarised below. It is estimated that between 2006 and 2019, data collected and disseminated by Argo Australia:

- Informed 430 publications, delivering societal benefit to four main areas (with roughly equal distribution), including food security; coastal populations; maritime safety, security and sovereignty; and biodiversity conservation and management;
- Informed 103 publications that were related to Sustainable Development Goals (mostly to SDG 13: Climate Action);
- Informed 42 publications taken up into policy documents;
- Informed 601 uses/applications, including application to publications (430); Reports (59); Products (35); Projects (55); and Postgraduate projects (22); from Australian Institutions or Australian Industry.

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Argo Canada National Data Management Report

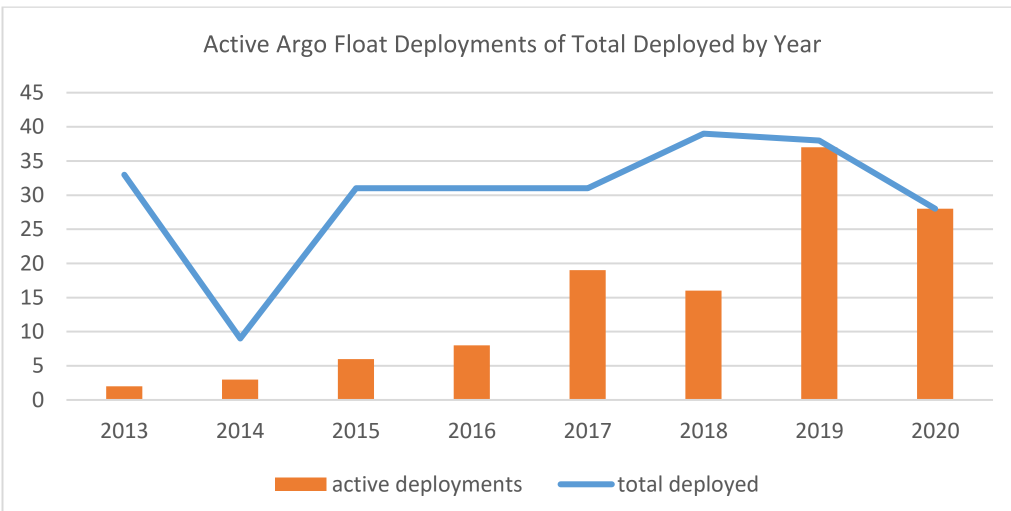
ADMT21 - Virtual Meeting

November 29 – December 4, 2020

1. Status

- Data acquired from floats

  As of the end of October 2020, we are tracking 119 floats of which 14 floats may have failed to report within the last 6 months. The plot below shows the total number of floats deployed per year and the number of floats which are still active since 2013.



  Since October 2019, we deployed 32 new ARVOR-I floats of which 2 floats are equipped with dissolved oxygen sensors. All floats were acquired from NKE and are reporting on the Iridium satellite system.

- Data issued to GTS

  All data are issued to the GTS in BUFR formats. Since October 2019, on average, 85% of data were issued on the GTS within the 12 hour target in BUFR formats. A monthly average of 283 BUFR messages were transmitted on the Argo network between October 2019 and October

2020. As of October 2020, we have experienced some difficulties with the server and has caused a drop in the transmission time on the GTS.

- 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 with some additional delay, compared to the data sent on the GTS, because the two processes run on different servers. There are still a number of trajectory NetCDF files of dead floats that are not in format version 3.1 at the GDACs.

- Data issued for delayed QC
  Data are available for delayed mode QC as soon as they are sent to the GDACs, but only floats deployed for at least 6 months are qualified for DMQC

- Delayed data sent to GDACs
  About 1300 profiles have been DMQCed within the last year. Specifically, the eligible files deployed for at least 6 months are quality-controlled in full cycle including pressure, visual QC and salinity OWC process and the QCed profiles converted to D-files are transmitted to GDACs. The profiles lasting under 6 months are quality-controlled in partial cycle with pressure and visual QC and the QCed profiles converted to D-files are sent to GDACs. All the delayed data files are gradually converted from the previous V3.1 to V3.3 based on the latest Argo quality control manual, including supplementary comments on DMQC institutions and operators.

- Web pages
  http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/index-eng.html

We maintain web pages that show float tracks and all data collected by Canadian 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 Argo data usage (operational models, scientific applications, number of National Pis…)
    a. 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.
    b. The Canadian Meteorological Centre (Dorval, Québec) of Environment Canada is assimilating real-time Argo data in operational mode.

2. Delayed Mode QC

As of November 2, 2020, 67% of all eligible floats, active and inactive, had their profiles DMQCed visually and adjusted for pressure according to the latest delayed-mode procedures at least once, significantly greater than the last year's percentage of 50%.

- Of eligible floats, 66% have been DMQCed at least once with salinity QC, obtaining the higher percentage of 68% for the last year. The relatively lower percentages of eligible salinity QCed floats for the current year are mainly due to the fact that some of the recent DMQCed floats initially deployed within 6 months are visually QCed only and these floats are not counted into the percentage. In addition, the new floats deployed within the last year increase the total numbers of floats and consequently decrease the percentage of eligible floats.

- Of eligible B-profiles, 14% have been visually DMQCed at least once. There are similar percentage of eligible B-profiles floats that have been fully DMQCed at least once with 14% in the current year and 12% for the last year. It should be noted that the current DMQC of B-profiles in Canada refers to the quality control of DOXY.

The DMQC tool in Canada for core Argo floats has been updated to the most recent climatology references for salinity and visual QC. In addition, functions have been added to the tool, advancing the reading capability of both ascending and descending profiles within the same cycle and extending the visualization QC to include the floats locations on a geographic map. The DMQC tool for BGC Argo float focusing on DOXY is under development with notable improvements.

A near-future plan for the Canadian core Argo DMQC is to bring in the satellite sea surface temperature (SST) such as AVHRR to better validate the floats deployed in the Gulf Stream region under complex oceanographic conditions.

3. GDAC Functions

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.

4. Regional Centre Functions

Canada has no regional centre function.

5. References

Chinese Argo National Data Management Report

ADMT-21

Virtual meeting, 29 November-4 December, 2020

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

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

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

This year China acquired 3,906 temperature and salinity (additionally 389 O2, 357 CHLA, 357 BBP, 295 CDOM, 741 DOWN _IRRADIANCE, 275 NITRATE, and 121 pH) profiles from 112 operational floats including 26 APEX, 53 PROVOR, 26 HM2000, 5 ARVOR_D and 2 NAVIS floats (Fig.1).

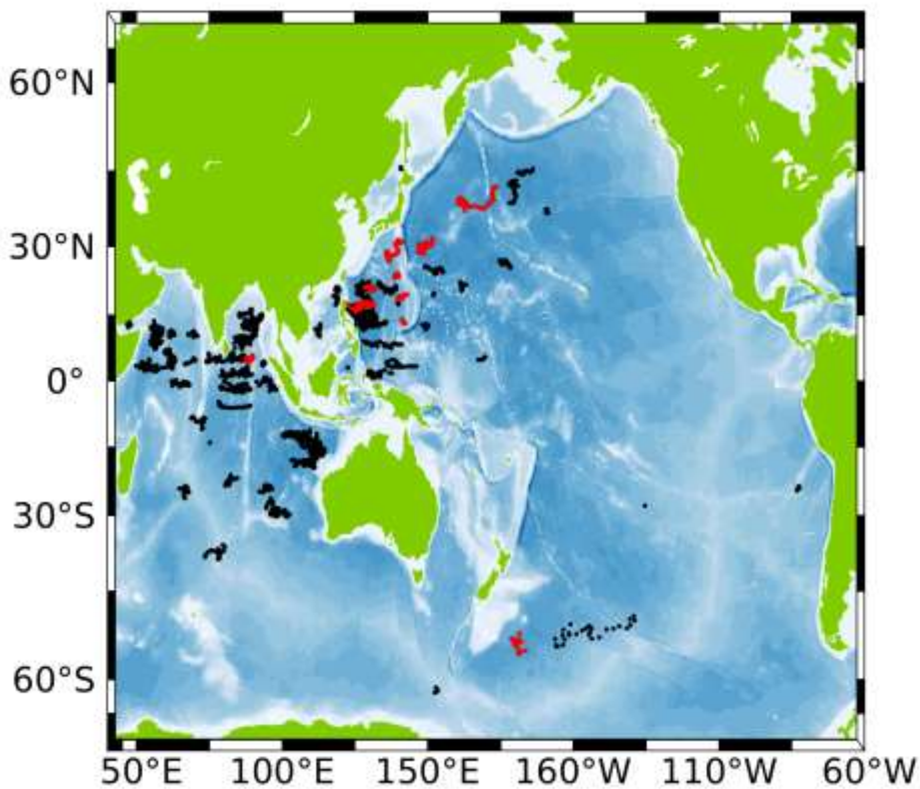


Fig.1 The geographic distributions of Core (black) and BGC (red) profiles

- Data issued to GTS

BUFR bulletins for Argo profile are generated by JMA perl script. Every day CSIO sends BUFR bulletins to GTS through Beijing node (038) from China Meteorological Administration (CMA). 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 MEDD test was added into our RTQC procedure according to the latest QC manual. According to the decision from the BGC-Argo data management team, a real-time adjustment has been applied with a gain derived from the WOA climatology.

- Data issued for delayed QC

At CSIO, as a newcomer, Ms. Xiaofen Wu is in charge of DMQC for core profiles after she received a technical training at CSIRO last year. Zenghong and Jianping will help her handle decision-making. Moreover, DMQC team members at CSIRO (Dirk,Catriona, Jenny, etc.) keep helping her to be more familiar with the DMQC system, including codes update, troubling-shooting, etc. Xiaofen also gets help from professor Annie Wong on OWC applications. We are here to extend our warm gratitude to each of them.

- Delayed data sent to GDACs

About 10,250 D-files from 66 floats were sent to GDACs. Totally about 71.6% of the core profiles have been DMQC'd, and D files of some old floats have received the second DMQC processing.

- Web pages

The new website (http://www.argo.org.cn) of the China Argo Real-time Data Centre (Hangzhou) was released on 2 November, from which the latest progress on China Argo, the real-time observations from Chinese floats including data file and related plots are provided. Both the core Argo and BGC Argo data visualization website based on Web-GIS have been developed(http://www.argo.org.cn/index.php?m=content&c=index&a=lists&catid=103).

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

  Operational uses: NMEFC and NMDIS from MNR, IAP/Chinese Academy of Sciences have applied Argo data into their operational models.

  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 12 PIs from 8 institutions and universities have deployed profiling floats and share data with Argo community.

- Products generated from Argo data …

  BOA_Argo: It is now 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.

  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 twice 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/).

2. 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 using the DMQC system developed by CSIRO to process Chinese floats (mainly Core Argo and Deep Argo). By now, this system could not be used for HM2000 float. We therefore need to consider how to solve this problem because in the near future over 400 HM2000 floats will be deployed into the oceans.

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)

None.

4. Regional Centre Functions

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

None.

Argo data management report 2020

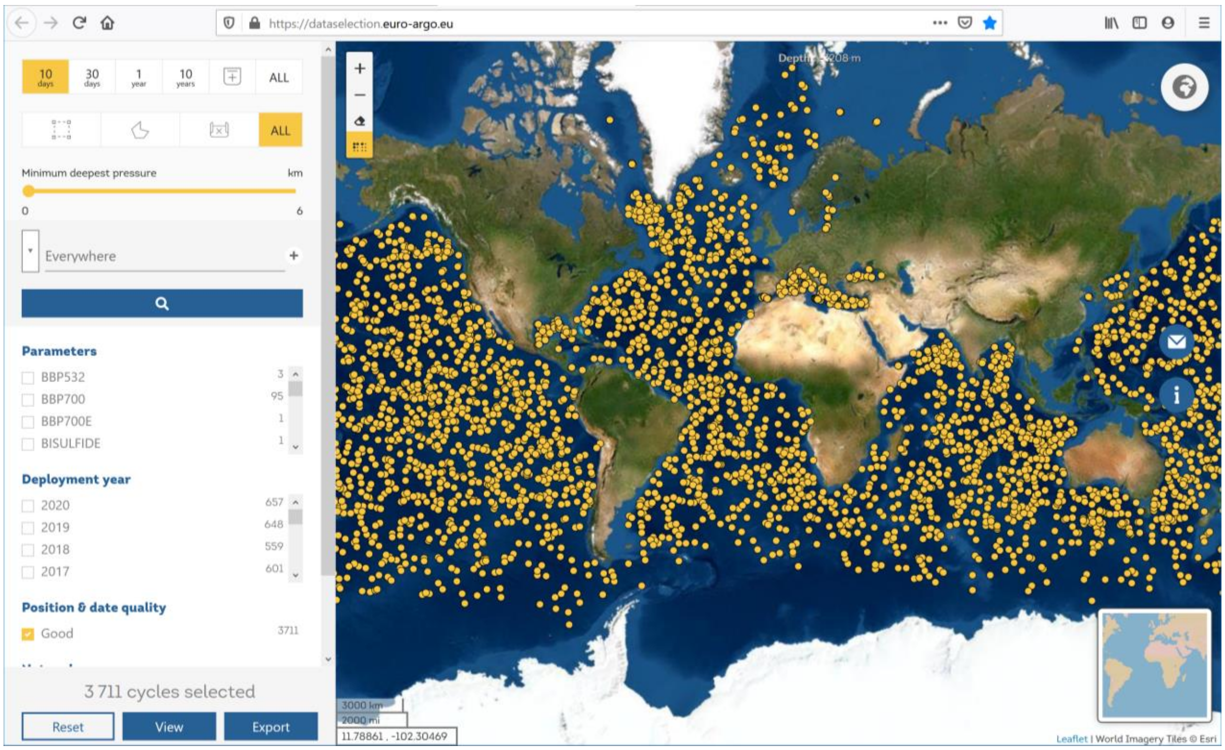
Coriolis DAC & GDAC

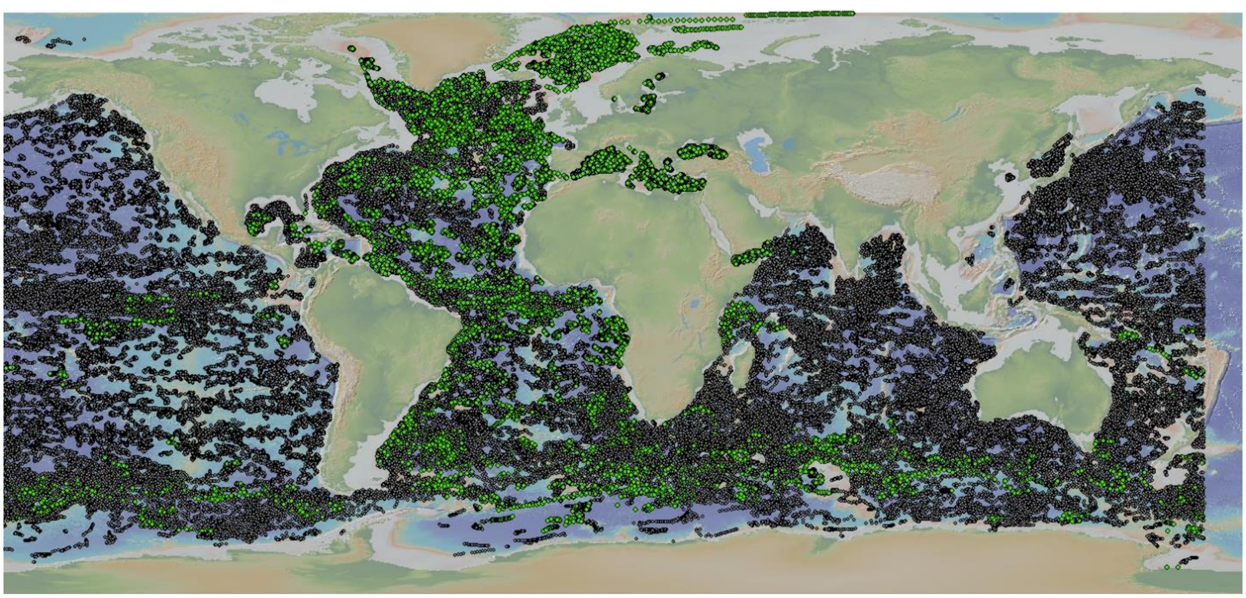
Data Assembly Centre and Global Data Assembly Centre

Annual report November 2020

Version 1.0

https://doi.org/10.13155/77033





1 DAC status

This report covers the activity of Coriolis DAC (Data Assembly Centre) for the one-year period from September 1st 2019 to October 30th 2020.

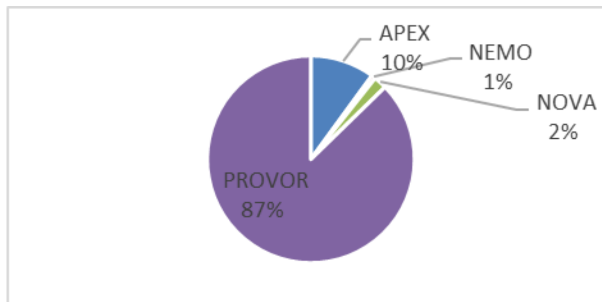
1.1 Data acquired from floats

1.1.1 Active floats for the last 12 months

These last 12 months, **52.160 profiles from 787 active floats** were collected, controlled and distributed.
Compared to 2019, **the number of profiles is significantly increasing (+49%), the number of floats decreased by 5%.** These figures illustrate a good momentum in Coriolis DAC activity, although the floats small decrease may be related to delayed deployments (maybe related to COVID-19).

The 787 floats managed during that period had 48 versions of data formats.

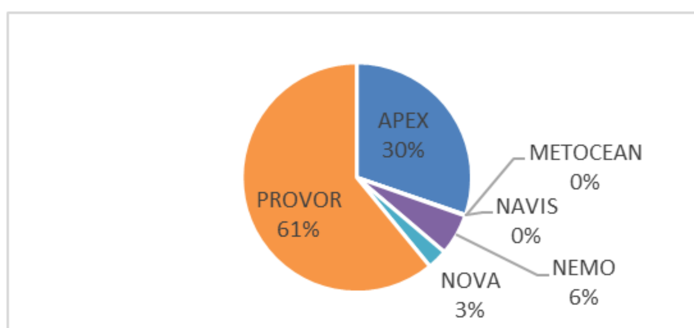
Coriolis DAC, active floats in 2020			
Float family	nb versions	nb floats	nb core p
APEX	16	79	5 221
NEMO	1	5	354
NOVA	2	16	564
PROVOR	29	687	46 021
Total	**48**	**787**	**52 160**

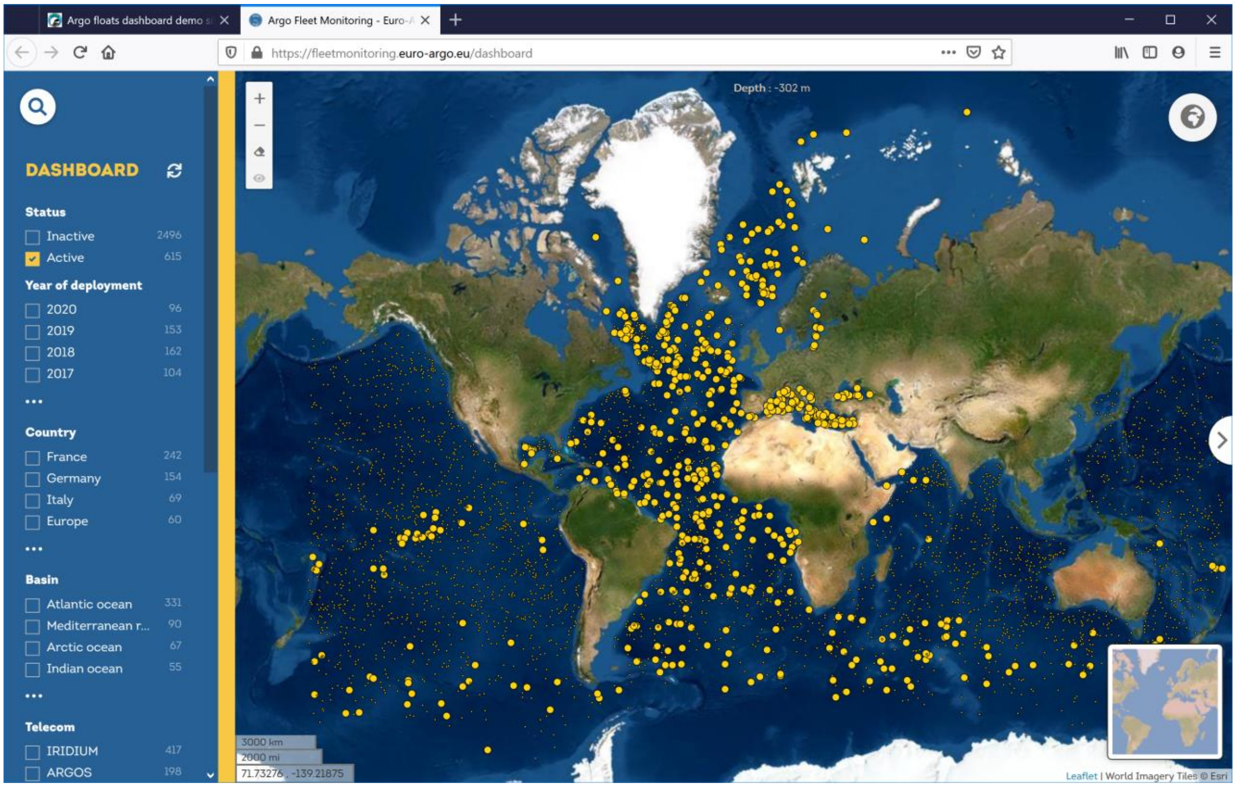


1.1.2 All floats managed by Coriolis DAC

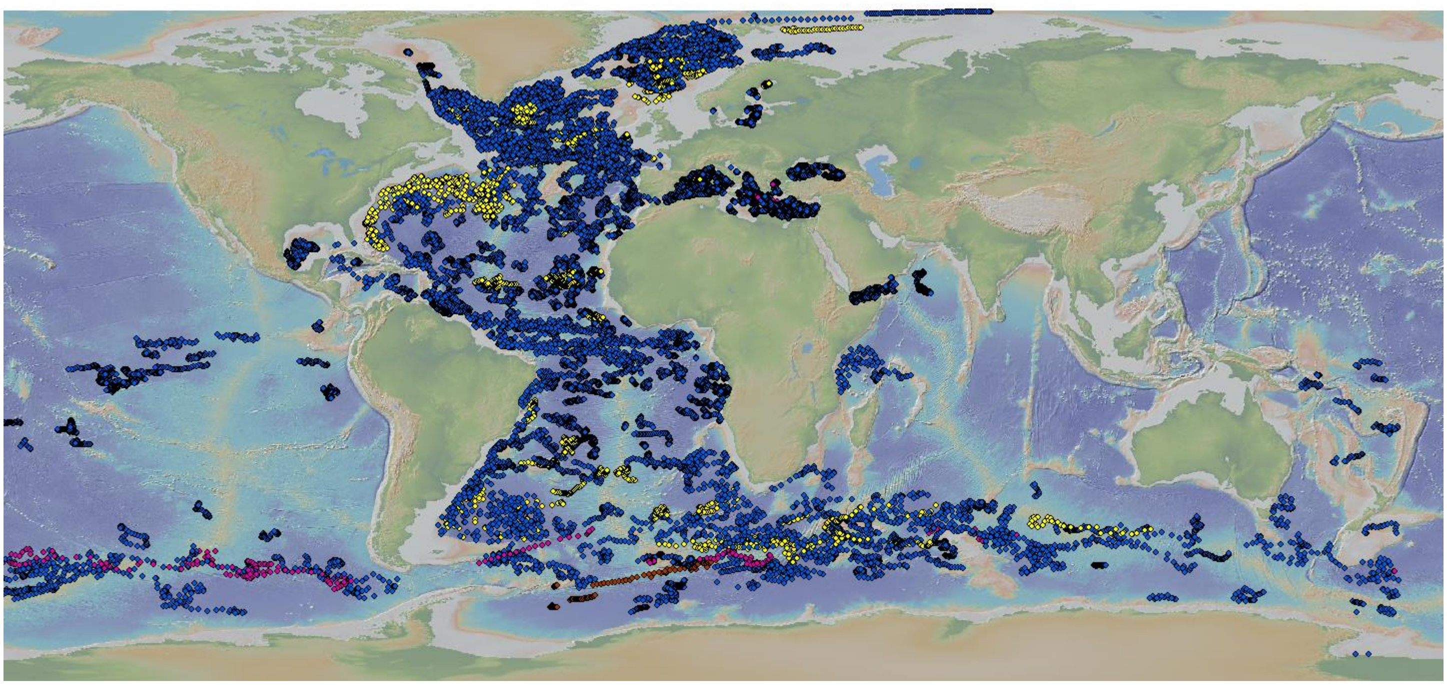
Coriolis DAC manages a total of 2.976 floats with 153 versions, from 6 families.
These floats reported 521.184core Argo vertical profiles.

Coriolis DAC, all floats, 2020			
Float family	nb versions	nb floats	nb core p
APEX	72	901	135 899
METOCEAN	1	1	52
NAVIS	1	3	1 932
NEMO	8	173	18 825
NOVA	3	84	8 863
PROVOR	68	1 814	355 613
Total	**153**	**2 976**	**521 184**

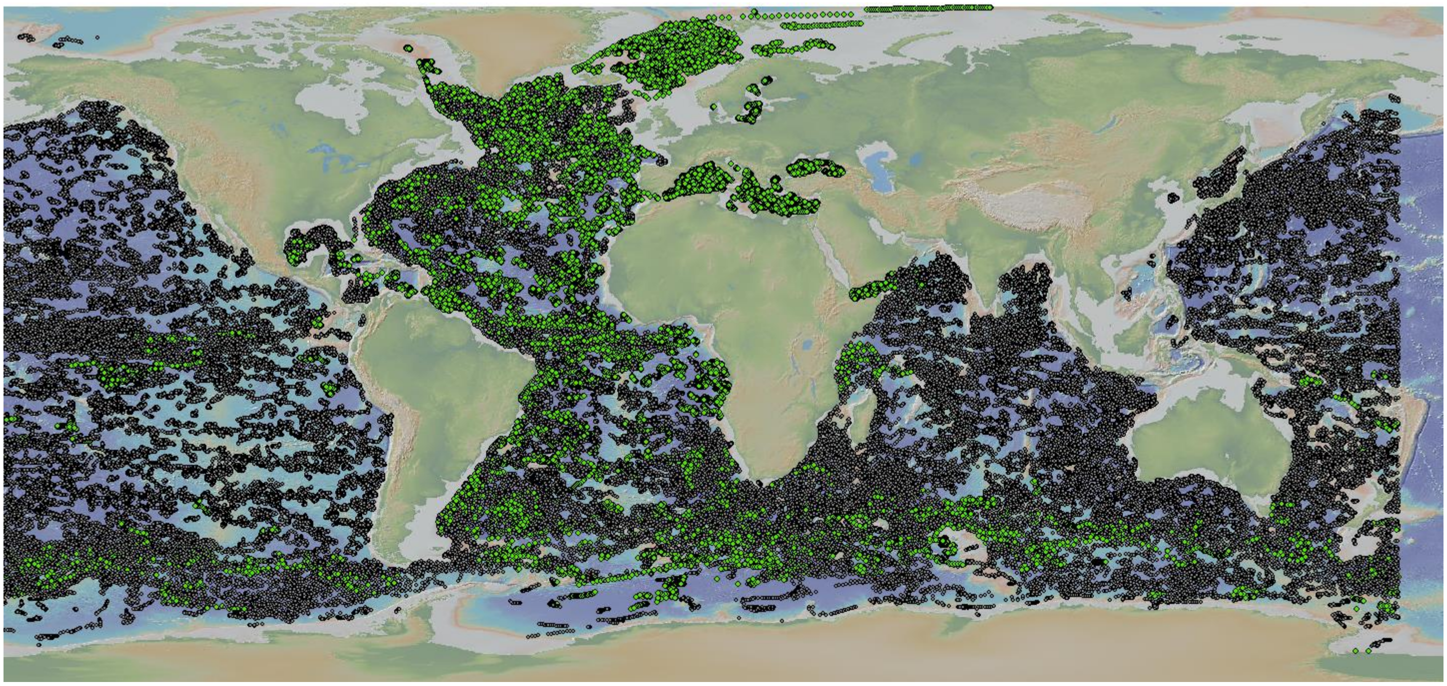




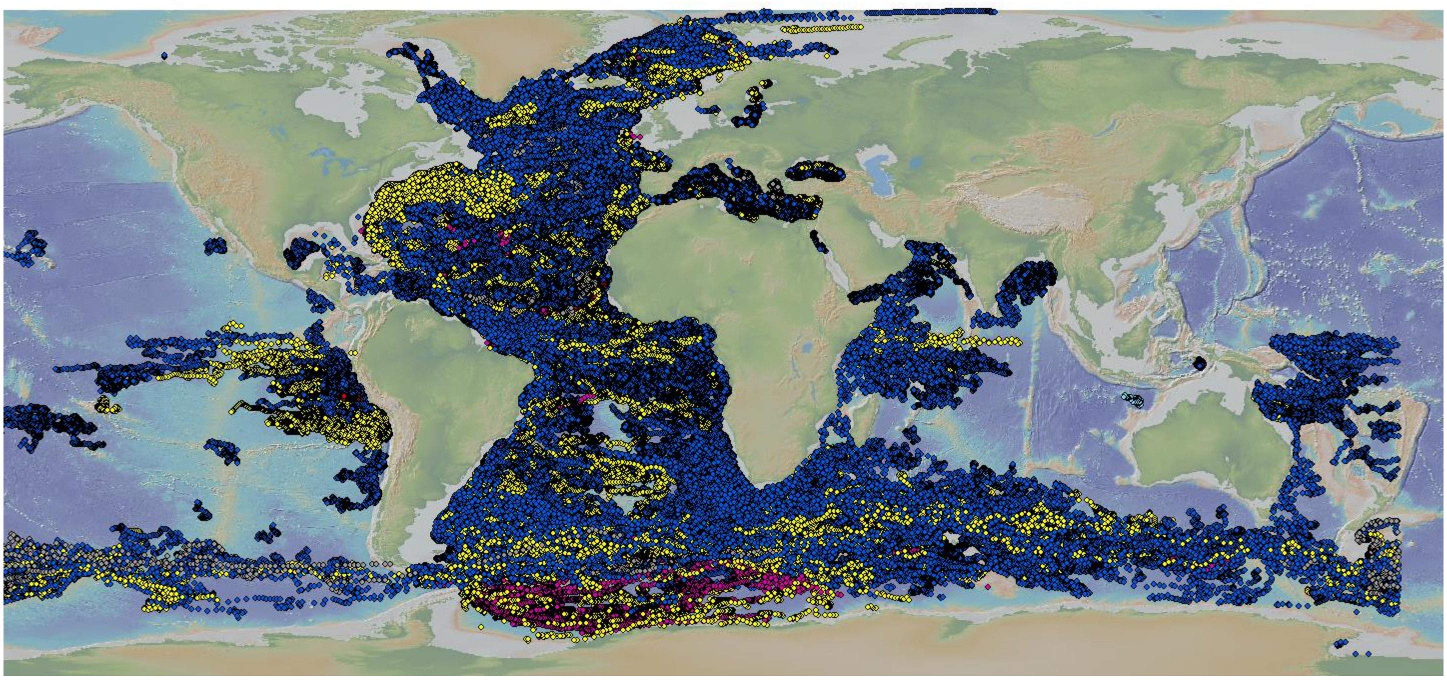
Map of the active floats on November 11th decoded by Coriolis DAC, among others DACs (small dots) as displayed on Euro-Argo floats dashboard https://fleetmonitoring.euro-argo.eu/dashboard



Map of the 52 160 profiles from 787 active floats decoded by Coriolis DAC this current year
Apex Nova Provor Nemo



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 521.184profiles from 2.976 floats managed by Coriolis DAC

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 513 BGC-Argo floats from 5 families. They performed 68.978 cycles.

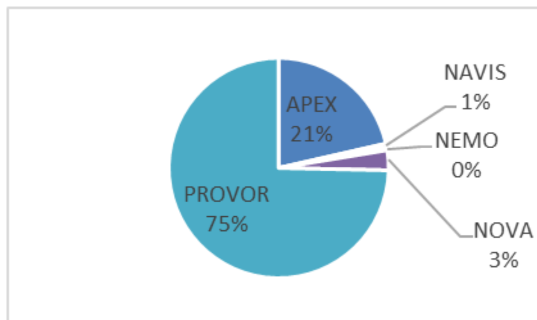
The data processing chain is freely available:

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

Oxygen data reprocessing

In 2020, the Oxygen manual was updated: "Processing Argo oxygen data at the DAC level cookbook" http://doi.org/10.13155/39795

BGC-Argo floats processed by Coriolis DAC				
Float familly	nb versions	nb floats	nb profile	nb cycles
APEX	27	110	15 442	13 703
NAVIS	1	3	551	551
NEMO	1	2	297	297
NOVA	1	15	1 130	1 105
PROVOR	38	383	148 246	53 322
Total	68	513	165 666	68 978



General characteristics

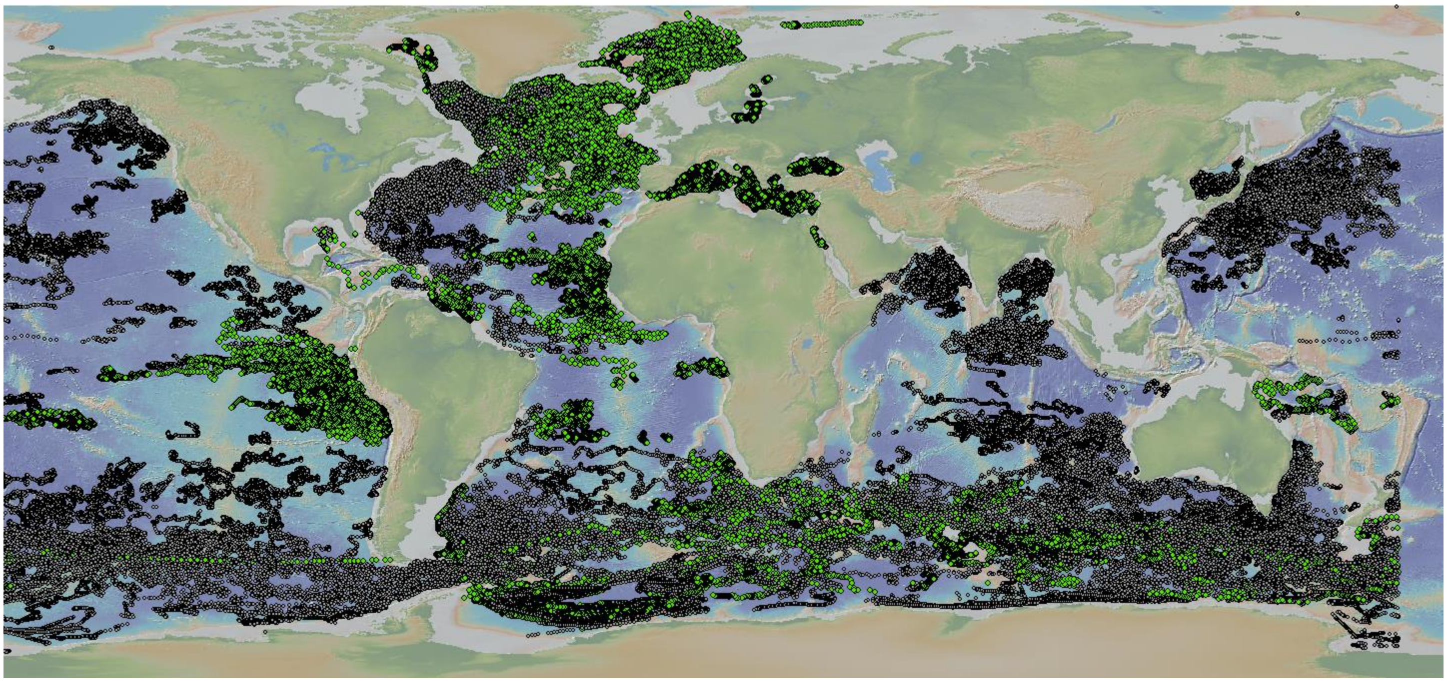
- Iridium sbd or rudics bi-directional communication or Argos
- Fourteen sensors are fitted on the floats
- Eleven BGC parameters reported

Coriolis BGC-Argo floats sensor	nb floats	nb profiles
AANDERAA_OPTODE_4330	298	39997
SATLANTIC_OCR504_ICSW	166	120504
ECO_FLBBCD	163	89820
AANDERAA_OPTODE_3830	77	10801
SUNA_V2	73	10933
SBE63_OPTODE	20	1885
ECO_FLBB_AP2	19	4982
C_ROVER	15	4449
SBE43F_IDO	13	1596
ECO_FLNTU	10	5366
SEAFET	8	409
ECO_FLBB2	4	2112
FLBB	2	616
UVP6-LP	1	30

The 14 types of sensors mounted on Coriolis BGC-Argo floats

BGC parameter	nb files
DOXY	177791
CHLA	71315
BBP700	69206
NITRATE	35052
DOWN_IRRADIANCE412	33999
CDOM	32427
PH_IN_SITU_TOTAL	13555
CP660	4849
TURBIDITY	2109
UP_RADIANCE555	619
TRANSMITTANCE_PARTICLE_BEAM_	426

The 11 main BGC parameters reported by Coriolis BGC-Argo floats



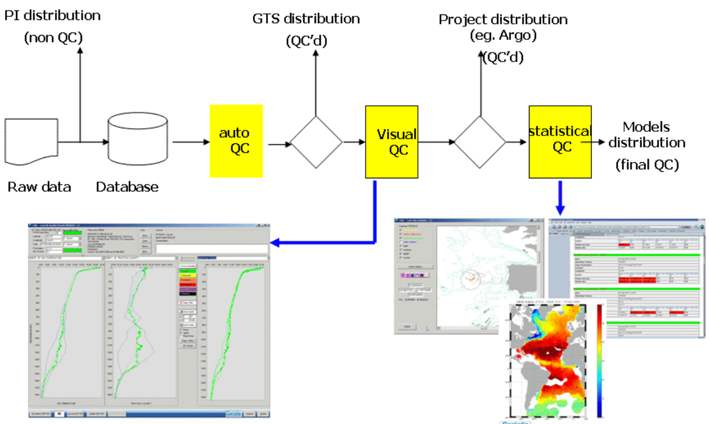
Map of the 513 BGC-Argo floats managed by Coriolis DAC (grey dots: the others DACs bio-Argo floats). They measure parameters such as oxygen, chlorophyll, turbidity, CDOM, back-scattering, UV, nitrate, bisulfide, pH, radiance, irradiance, PAR.

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.

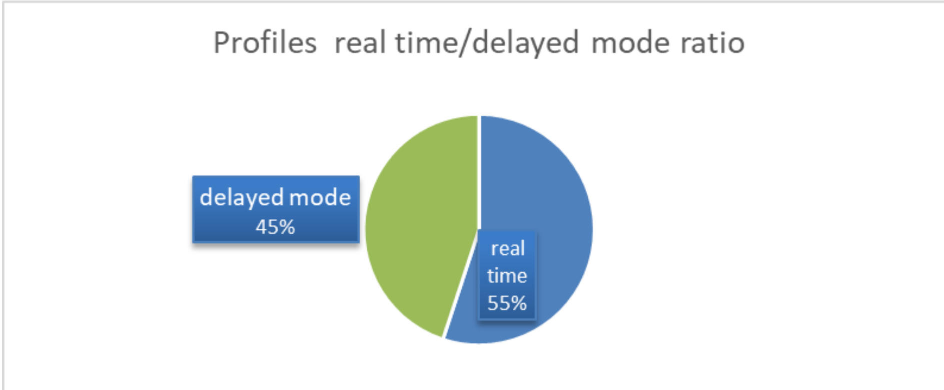


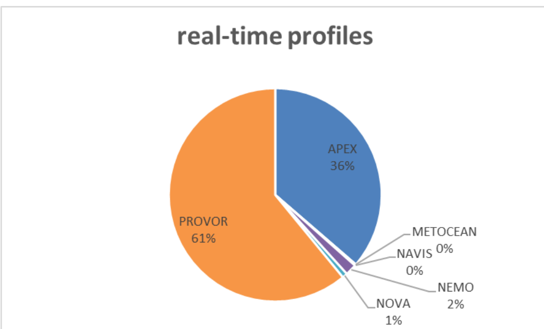
Coriolis DAC Argo data flow

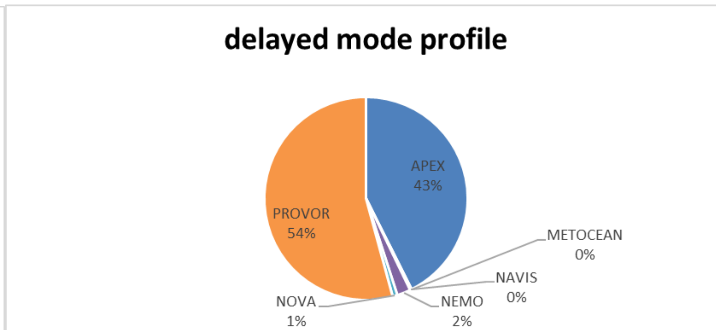
1.3 Data issued to GDACs after real-time QC

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 profil
APEX	841	36 742	99157	94879
METOCEAN	1	-	52	52
NAVIS	2	1 411	521	521
NEMO	102	14 084	4741	4774
NOVA	38	6 721	2142	1694
PROVOR	1337	189 212	166418	120721
Total	**2 321**	**248 170**	**273 031**	**222 641**







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. Most of the Atlantic data handled by Coriolis are checked by the European project Euro-Argo.

1.5 Delayed mode data sent to GDACs

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

- A total of **84.272 new or updated delayed mode profiles** was sent to GDACs this year.
- ***A total of 222.641 delayed mode profiles*** *where sent to GDACs since 2005.*

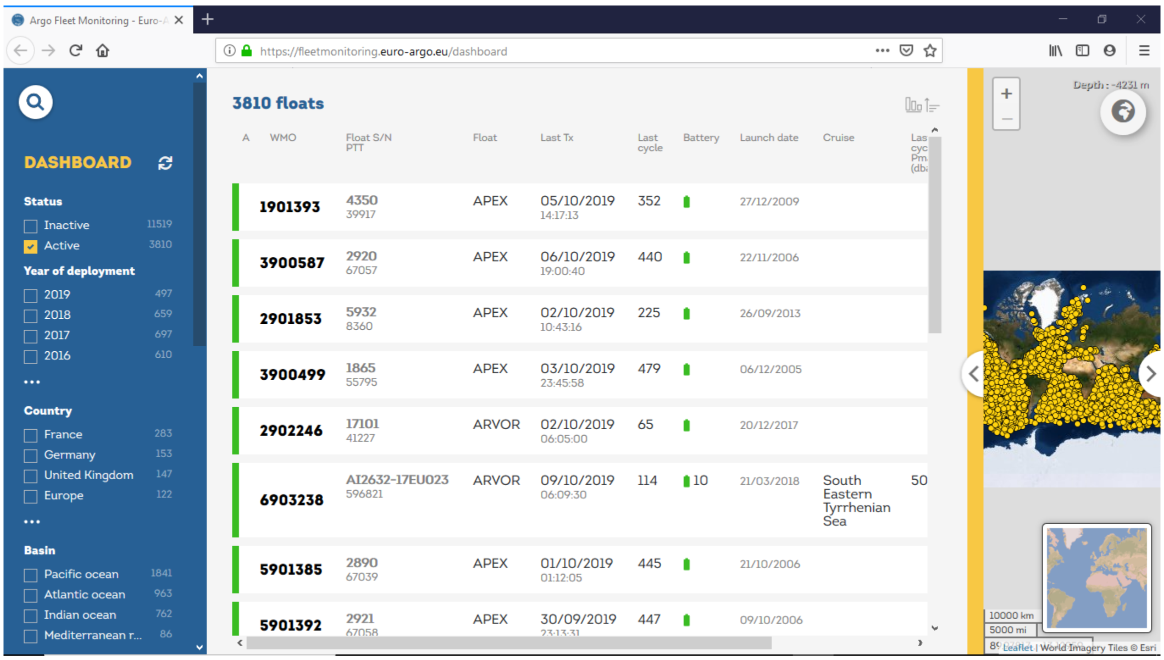
  The number of delayed mode profiles decreased by 27% this year compared to 2019.

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

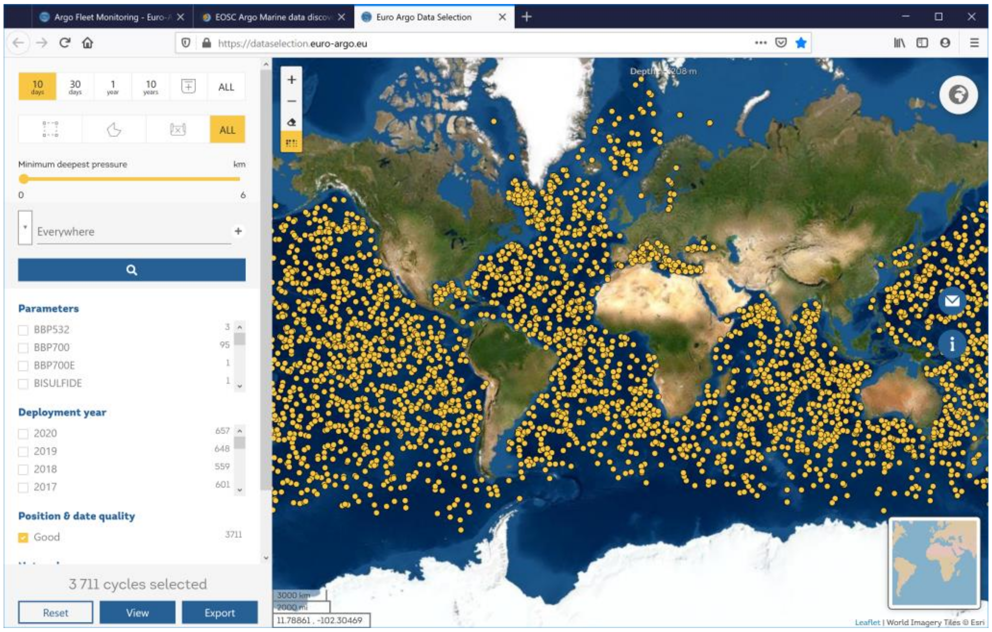


It displays all Argo floats, with facetted interrogations and instantaneous answers. The dashboard is developed on cloud and big-data techniques.

- 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, the initial version is online https://dataselection.euro-argo.eu

1.6.2 Argo data on EU 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

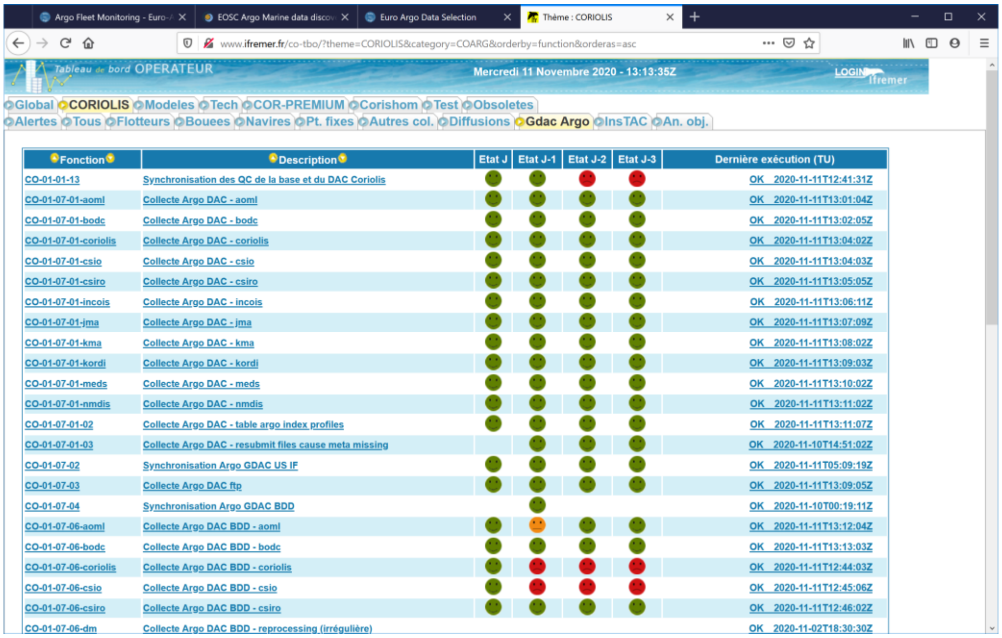
1.6.3 Interoperability services (ERDDAP API,…)

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.



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 52 PIs (Principal Investigators).**

List of Coriolis scientific PIs and project names

project	nb floats
coriolis	210
argo-bsh	166
euro-argo	155
argo italy	71
mocca	61
naos wp1	56
mocca-eu	55
naos	53
pirata	30
argo spain	28

Top 10 of Coriolis DAC projects having active floats

pi	nb active flo
birgit klein	172
pierre-marie poulain	92
christine coatanoan	73
virginie thierry	52
sabrina speich	35
kjell arne mork	33
bernard bourles	33
romain cancouet	26
pedro velez	26
damien desbruyeres	20
fabrizio d'ortenzio	16
waldemar walczowski	16

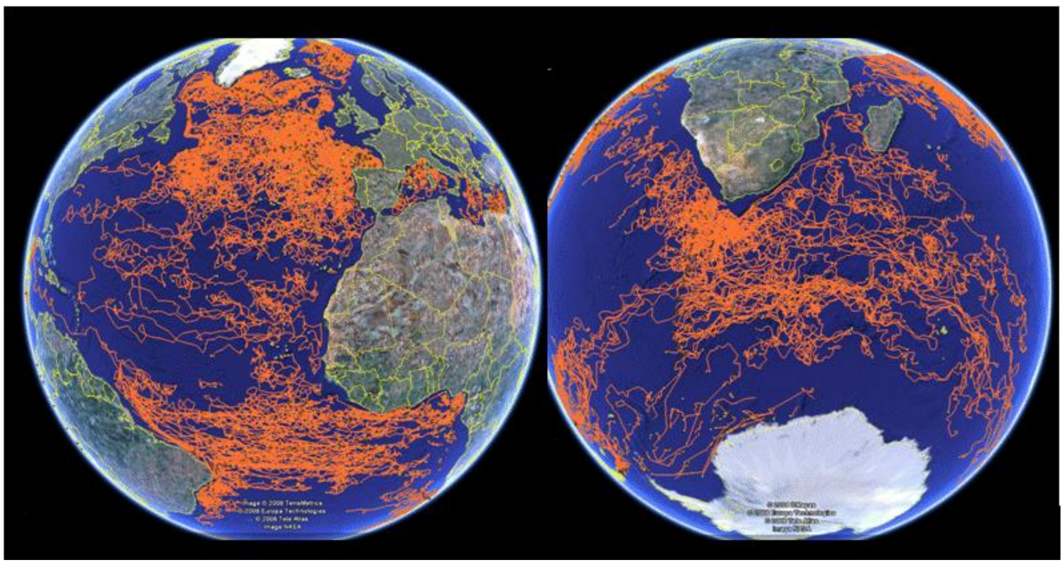
Top 10 of Principal Investigators (PI) in charge of active floats

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 (2019). **ANDRO: An Argo-based deep displacement dataset**. SEANOE. http://doi.org/10.17882/47077



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

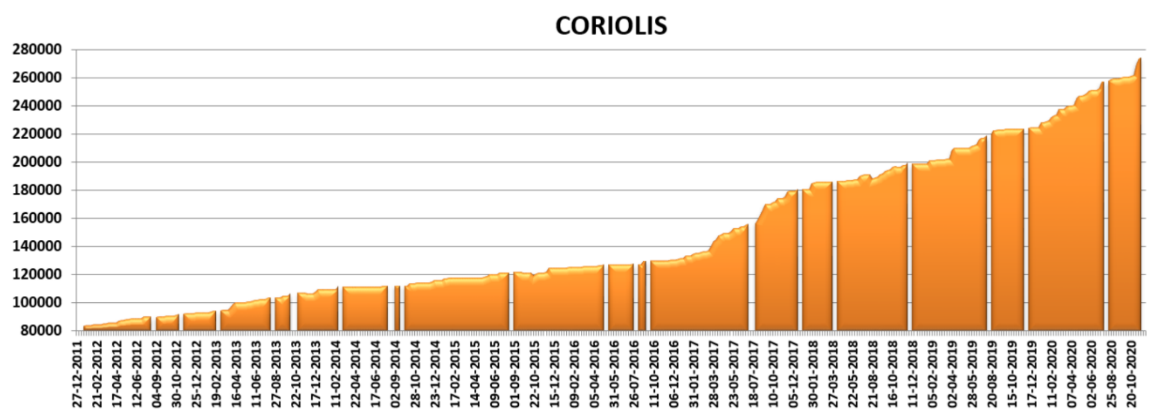
2 Delayed Mode QC

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. As each year, we have worked on this way with PIs to strengthen the delayed mode quality control.

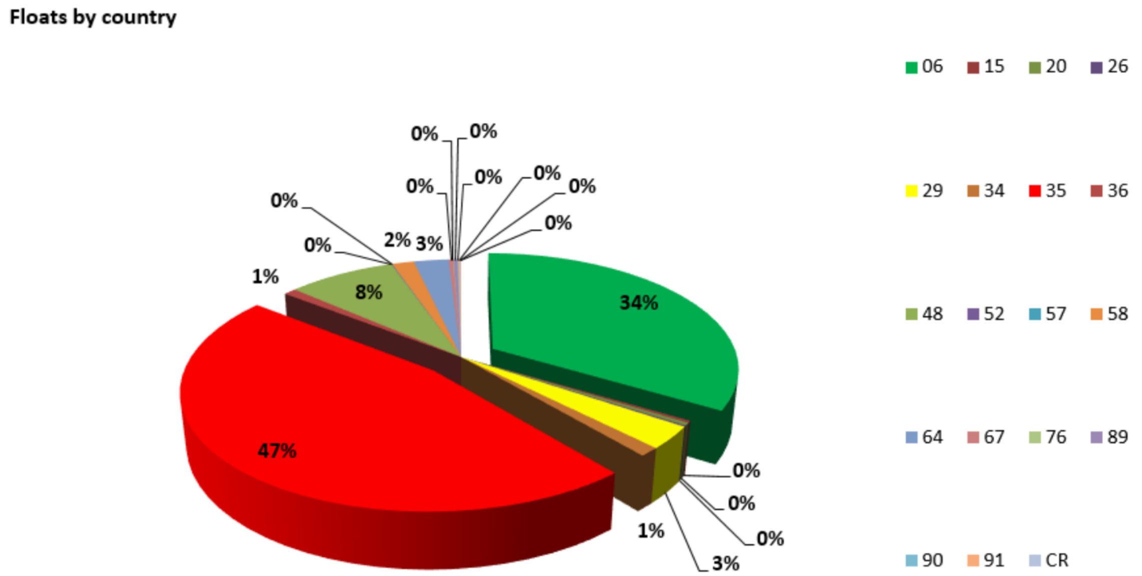
Some floats have been deployed from some projects, meaning a lot of PIs and a lot of time for explaining the DM procedure to all of them. A few PIs are totally able to work on DMQC following the four steps but this is not the case for most of them. Since the unavailability of the PIs leads to work by 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 (Giulio Notarstefano) for the MedSea.

In the last 3 years, an important effort has been dedicated to improve the delayed mode quality control status.

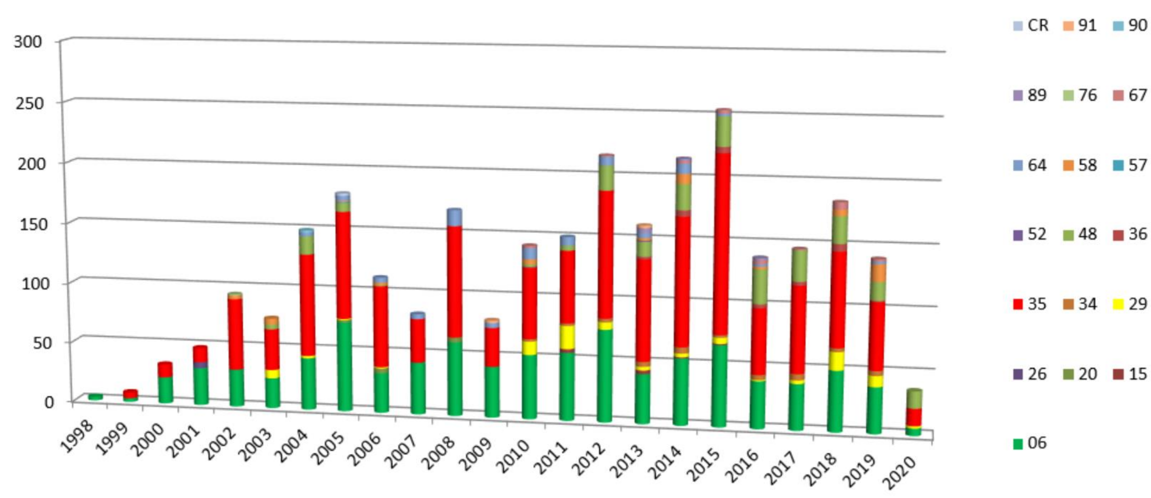


Evolution of the DM profiles' submission versus dates



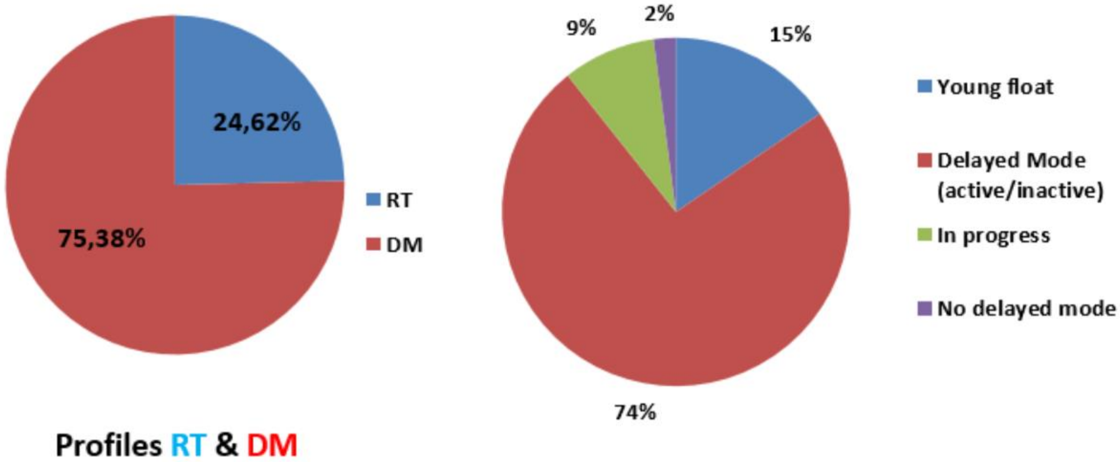
Percentage of floats by country in the Coriolis DAC.

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



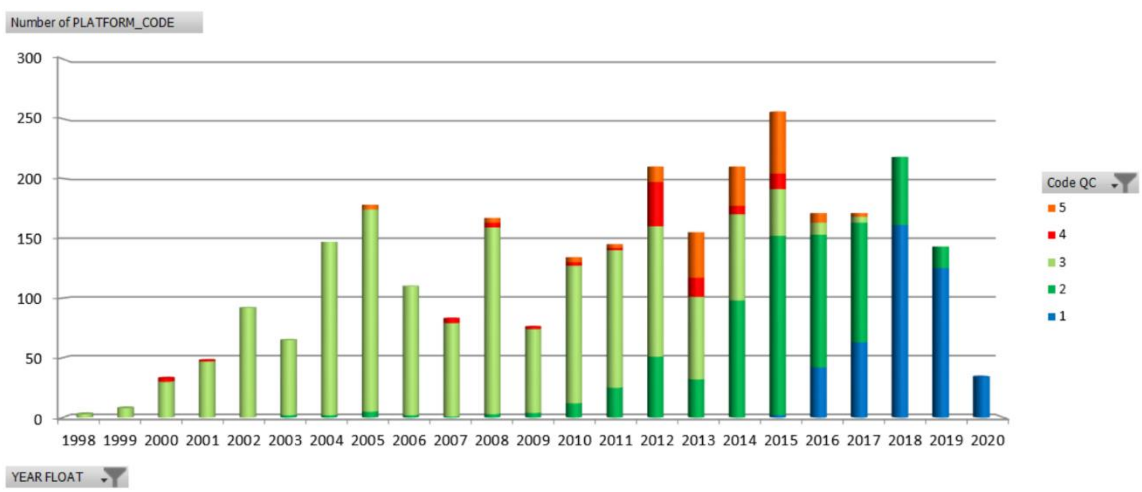
Number of floats by country and by launch's year in the Coriolis DAC

During the last year (from October 2019 to November 2020), 50641 new delayed mode profiles where produced and validated by PIs. A total of 273779 delayed mode profiles where produced and validated since 2005.



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

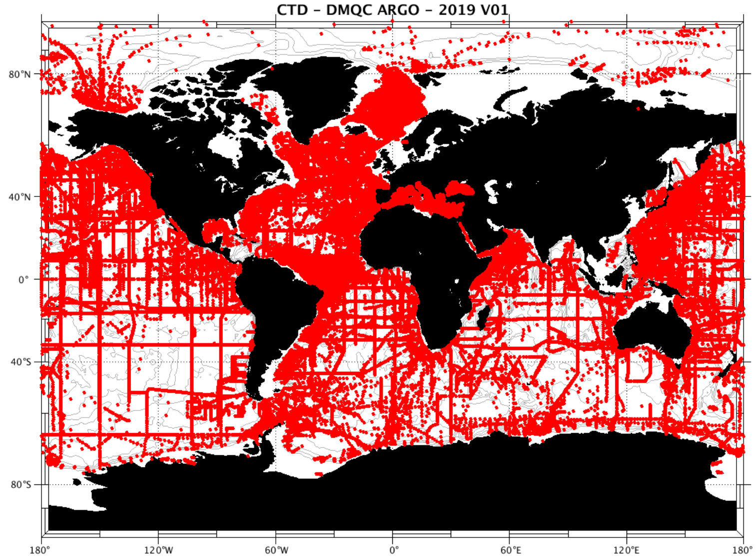
The status of the quality control done on the Coriolis floats is presented in the following plot. For the two last years (2019-2020), most of the floats are still too young (code 1) to be performed in delayed mode. For the years 2012-2013-2014, we are still working on the DMQC of some floats. The codes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



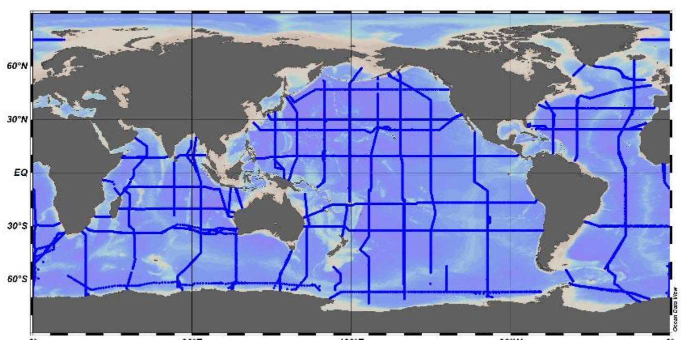
Status of the quality control done on profiles sorted by launch's year, code 1: young float, code 2: active float, DM done, code 3 : dead float, DM done; code 4 : DM in progress, code 5 : waiting for DM, code 6 : problems with float.

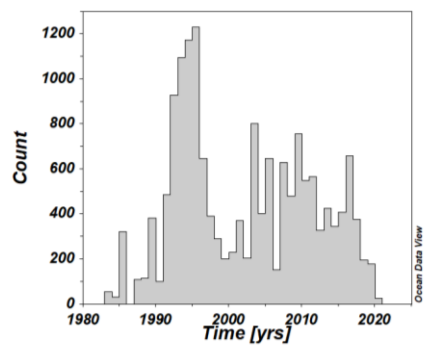
Reference database

At the end of 2019, an updated version 2019V01 has been provided with some updates on a few boxes and including including CCHDO, OCL and ICES updates, CTD from PI, correction from feedbacks.

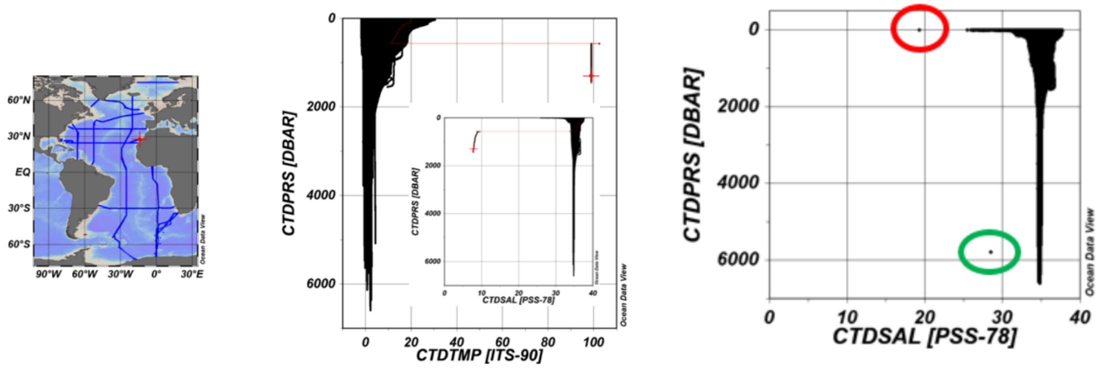


For the next version 2020V01, an action was to incorporate high QC GO-SHIP product profiles selected for DEEP-ref-DB to Core ref db. This product was made available in mid-September (16231).





A first check has shown some anomalies in the dataset that could not be integrated as is in the dataset and needed thorough quality control. Some anomalies were easy to detect and others needed more scrutinized analysis.



After the quality control, the next step that is in progress is to replace the profiles, which already exist in the Core Ref DB with the data from DEEP-ref-DB and add the new ones.

In addition, Ingrid Angel Benavides (BSH) worked on the clean-up of the CTD reference database in the Atlantic Ocean, Arctic and nordic seas, removal of out of range or incomplete samples, and duplicate checks. New mat files must be sent to Coriolis to update the reference database.

The last version is divided in smaller tar balls, one by wmo box area (1-3-5-7): for instance, CTD_for_DMQC_2019V01_1.tar.gz for all boxes starting with wmo 1, then we will have 4 tar files.

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)

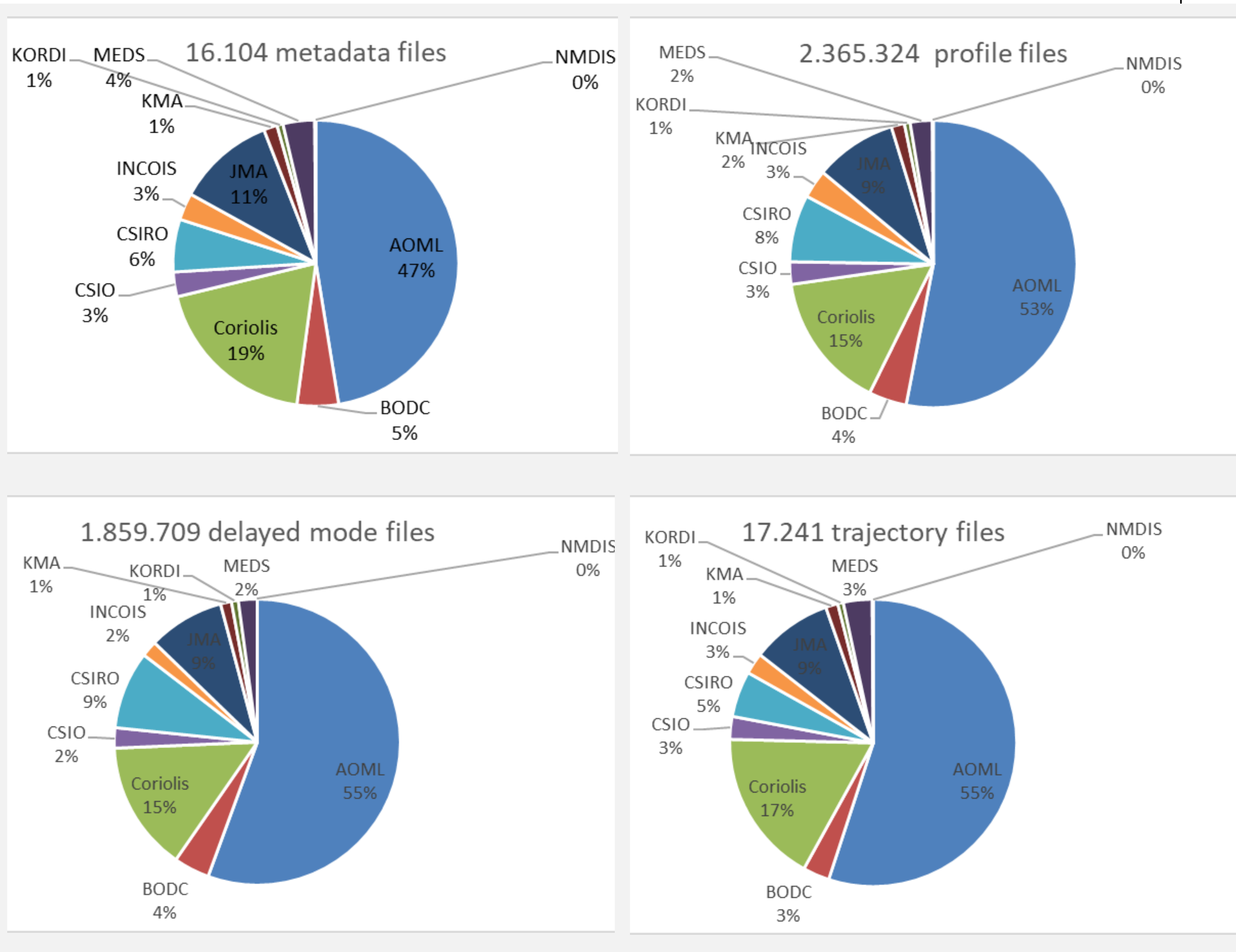
- *National centres reporting to you*
- *Operations of the ftp server*
- *Operations of the www server*
- *Data synchronization*
- *Statistics of Argo data usage : Ftp and WWW access, characterization of users (countries, field of interest : operational models, scientific applications) …*

3.1 National centres reporting to you

Currently, 11 national DACs submit regularly data to Coriolis GDAC. On November 2020, the following files were available from the GDAC FTP site.

3.1.1 GDAC files distribution

DAC	metadata files 2020	increase	profile files	increase2	delayed mode profile files	increase3	trajectory files 2019	increase4
AOML	7 640	6%	1 254 815	9%	1 033 917	17%	9 488	6%
BODC	756	6%	100 951	12%	75 251	65%	516	1%
Coriolis	3 073	5%	364 708	12%	273 031	23%	2 994	6%
CSIO	449	10%	59 538	8%	42 805	181%	443	10%
CSIRO	958	10%	179 229	9%	163 731	11%	891	8%
INCOIS	491	3%	75 564	9%	33 712	10%	413	0%
JMA	1 784	4%	218 511	6%	160 237	8%	1 571	2%
KMA	247	2%	35 325	5%	23 094	0%	238	3%
KORDI	109	0%	15 330	-3%	14 505	0%	107	0%
MEDS	578	6%	58 893	7%	39 381	3%	561	6%
NMDIS	19	0%	2 460	0%	45	-	19	0%
Total	**16 104**	**6%**	**2 365 324**	**9%**	**1 859 709**	**18%**	**17 241**	**5%**



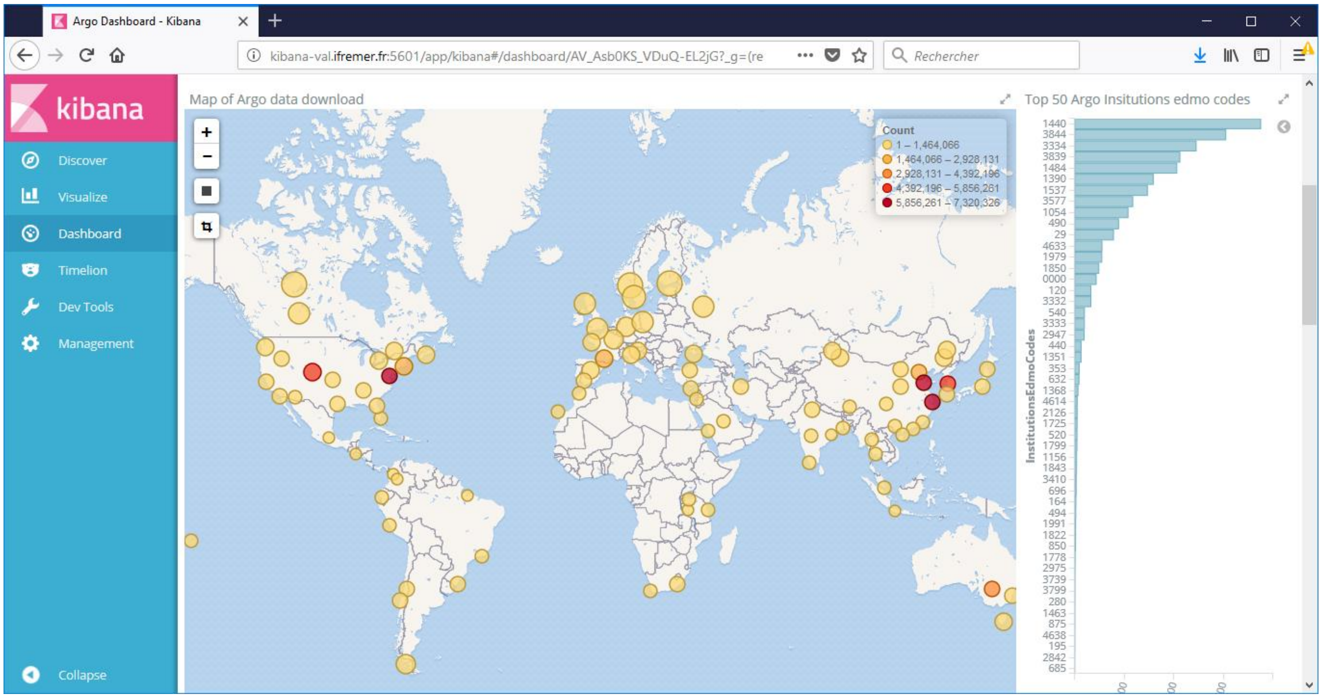
Number of files available on GDAC, November 2020

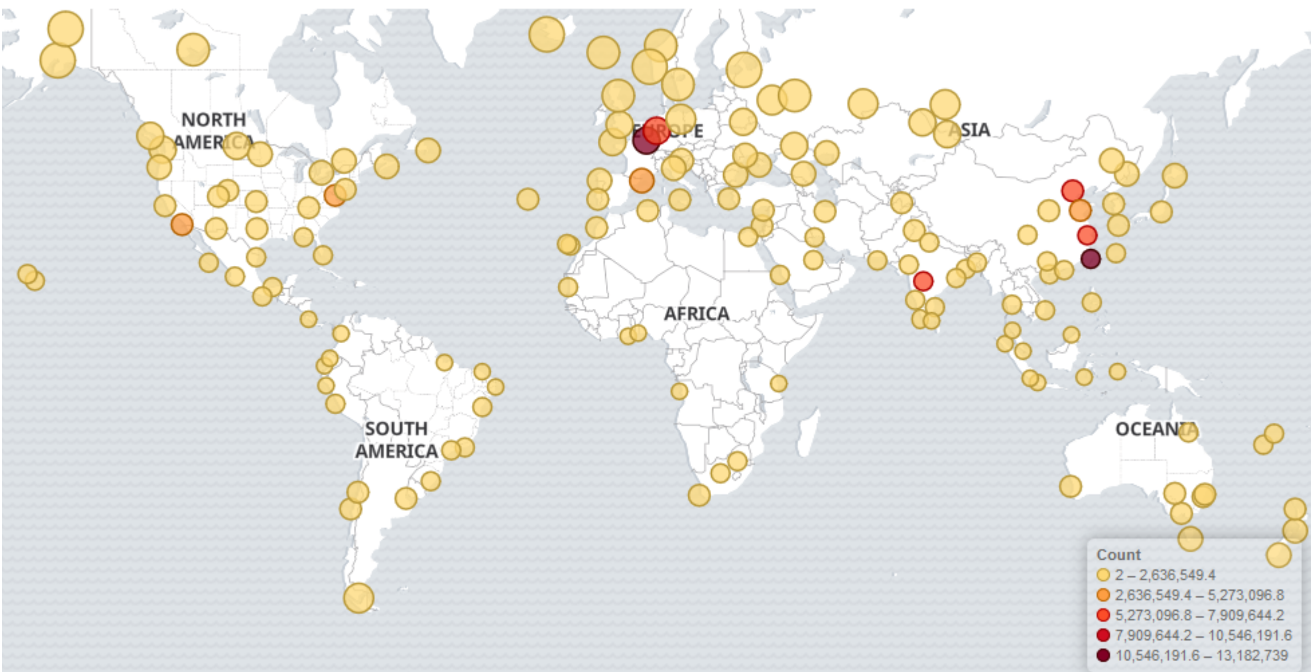
3.1.2 Argo Semaphore dashboard: give credit to data providers

Within EU AtlantOS project, Ifremer is setting up a dashboard (Semaphore) to monitor data distribution and give credit to data providers such as Argo floats.

FTP downloads log files are ingested in an Elsaticsearch index. A link between downloaded files, download originators, floats included in the downloaded files and institution owners of the floats is performed. These links are displayed in a Kibana dashboard.

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





Geographical distribution of GDAC ftp downloads in 2018 - 2019

The majority of users (red dots) are located in USA, China, Australia and of course Europe. The right side histogram sorts the floats institution code (1440: PMEL, 3844: WHOI, 3334: INCOIS, 3839: UWA, 1484: CSIRO, …).

The top 50 of floats institutions downloads and the top 50 of data user's

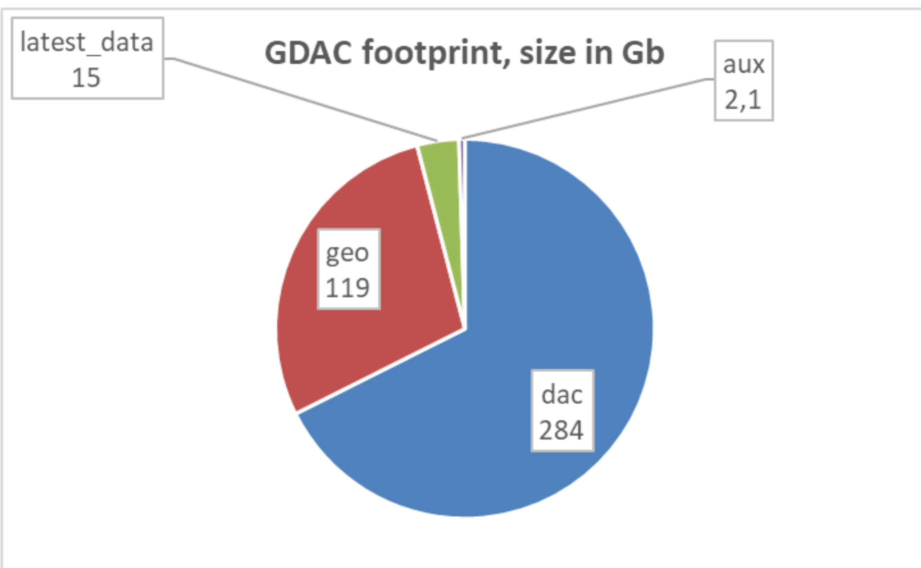
3.1.3 GDAC files size

- The total number of NetCDF files on the GDAC/dac directory was 2 867 119 (+18% in one year)
- The size of GDAC/dac directory was 284Gb (- 163%)
- The size of the GDAC directory was 572Gb (- 4%)

The decrease in size of the GDAC is related to the removal of BGC-Argo M-files, replaced by much more compact S-files. The S-files (and former M-files) are synthetic files merging core-Argo and BGC-Argo profiles.

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

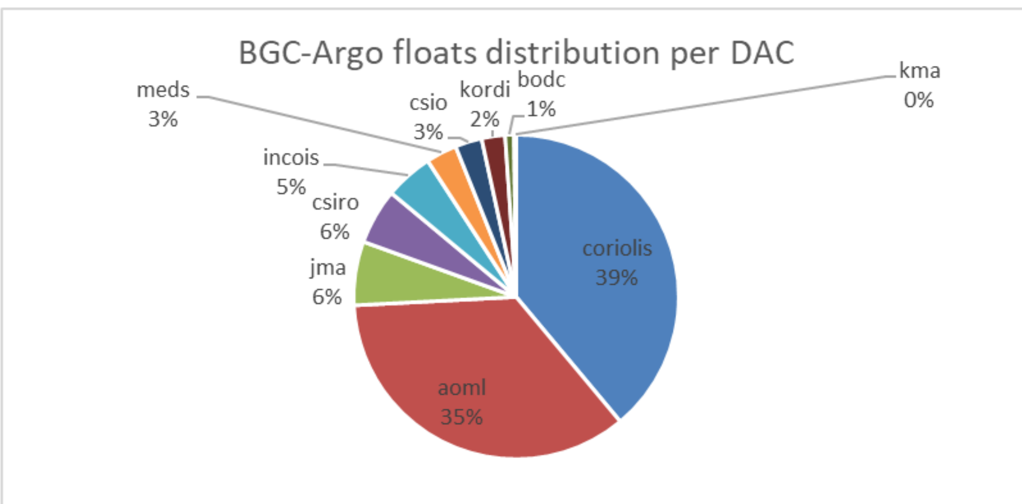
branch	GDAC size in	yearly
dac	284	-16%
geo	119	16%
latest_data	15	-29%
aux	2,1	5%
gdac total	572	-4%

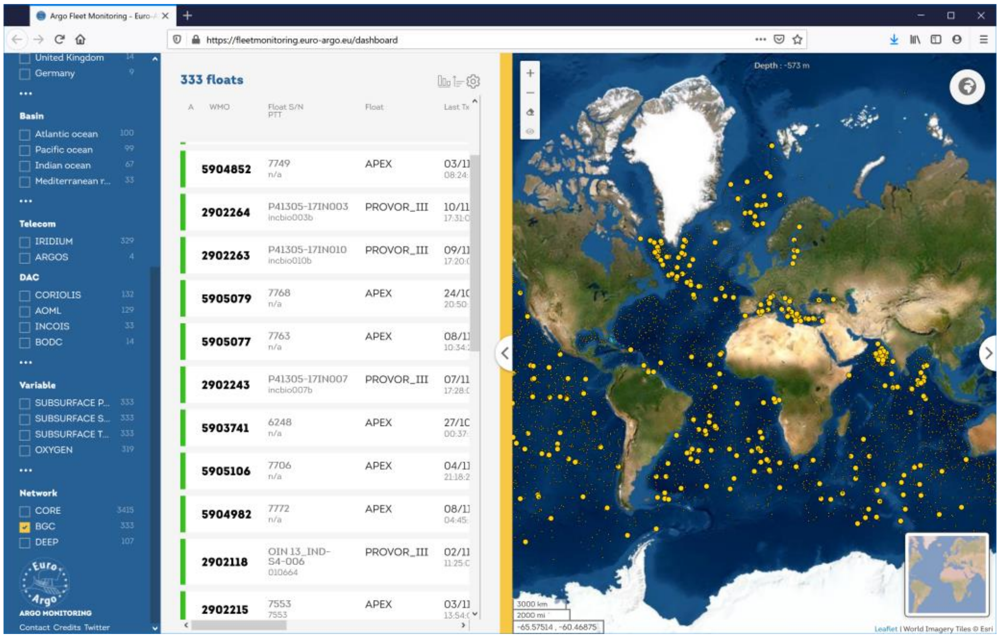


3.1.4 BGC-Argo floats

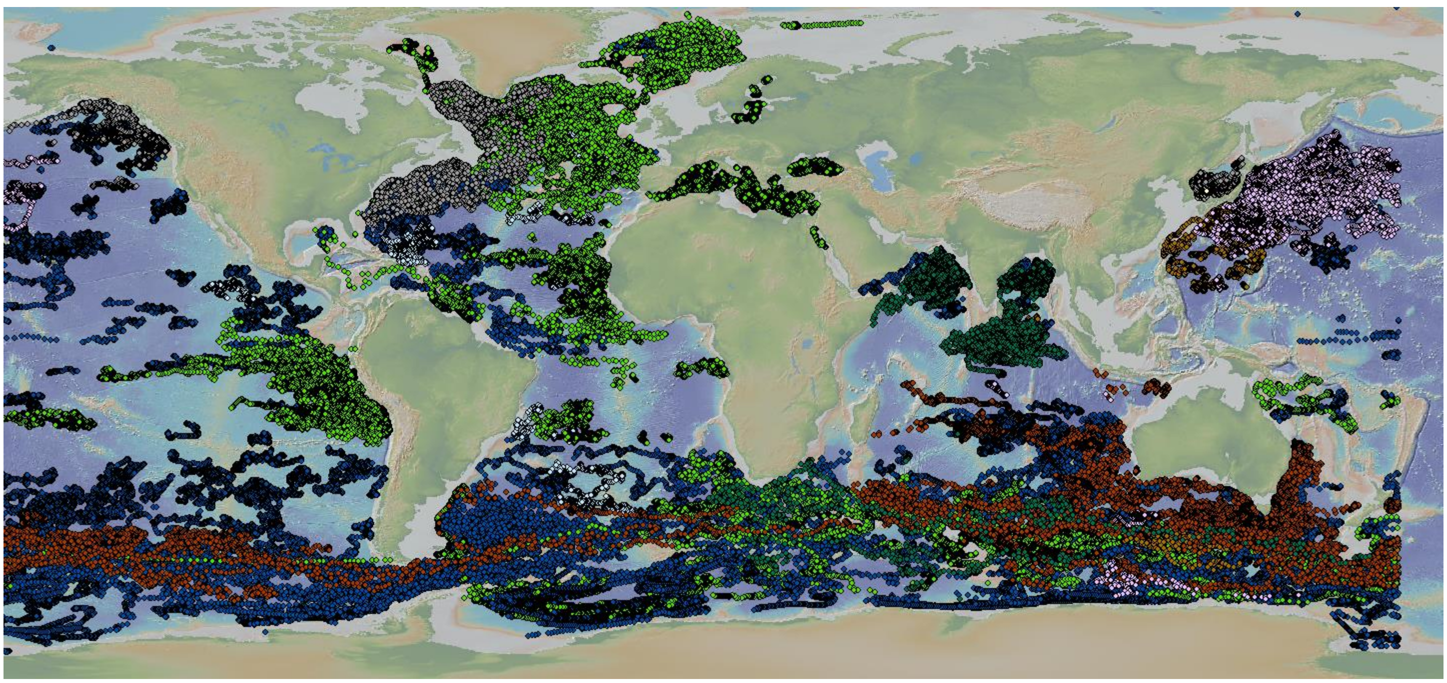
In November 2020, 225.135 BGC-Argo profiles from 1664 floats were available on Argo GDAC. This is a strong increase compared to 2019: +19% more floats and +19% more profiles.

DAC	nb bgc floats	nb bgc files
coriolis	570	78 364
aoml	516	77 298
jma	93	16 193
csiro	81	21 726
incois	70	10 360
meds	45	4 537
csio	39	8 330
kordi	34	3 426
bodc	13	4 433
kma	3	468
Total	**1464**	**225 135**

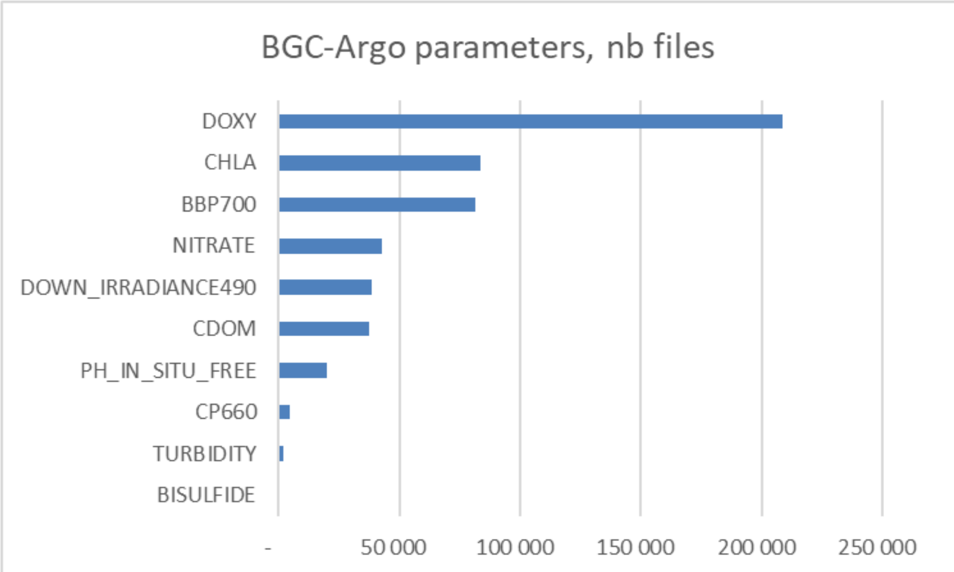




Map of 333 BGC-Argo floats (active: yellow, other: grey) from https://fleetmonitoring.euro-argo.eu/dashboard



BGC-Argo profiles, colored by DACs



Main BGC-Argo physical parameters, number of profiles

BGC parameter	nb files
DOXY	208 627
CHLA	83 398
BBP700	81 289
NITRATE	42 983
DOWN_IRRADIANCE490	38 412
CDOM	37 468
PH_IN_SITU_FREE	20 208
CP660	4 853
TURBIDITY	2 109
BISULFIDE	705

3.2 Operations of the ftp and web server

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).

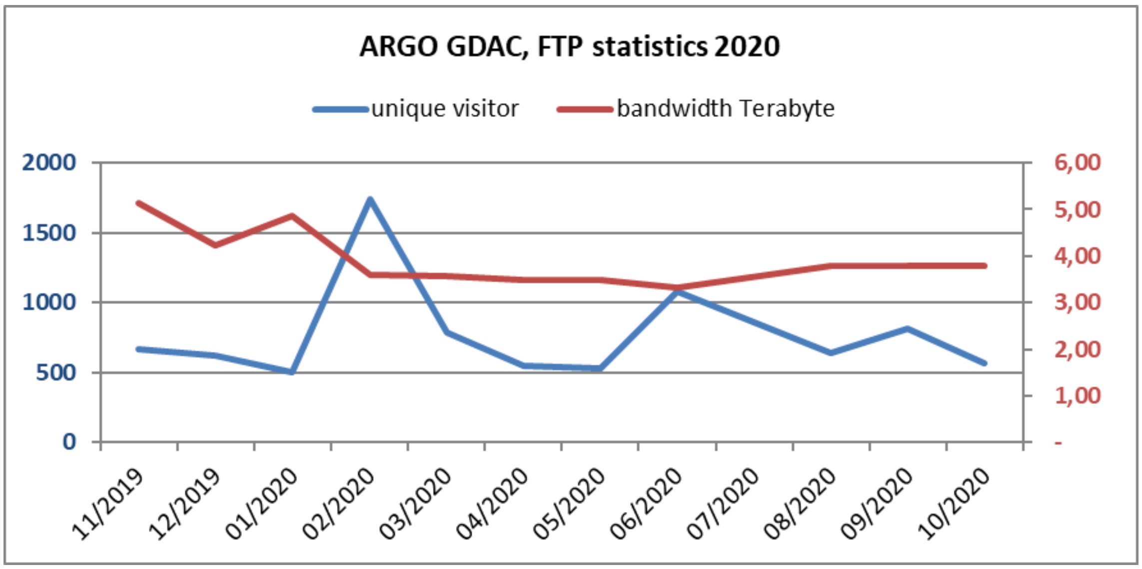
Index files of metadata, profiles, trajectories, technical and auxiliary data are hourly updated.

GDAC ftp address: ftp://ftp.ifremer.fr/ifremer/argo

Statistics on the Argo GDAC FTP server: ftp://ftp.ifremer.fr/ifremer/argo

There is a monthly average of 848 unique visitors, performing 5322 sessions and downloading 3.88 terabytes of data files.

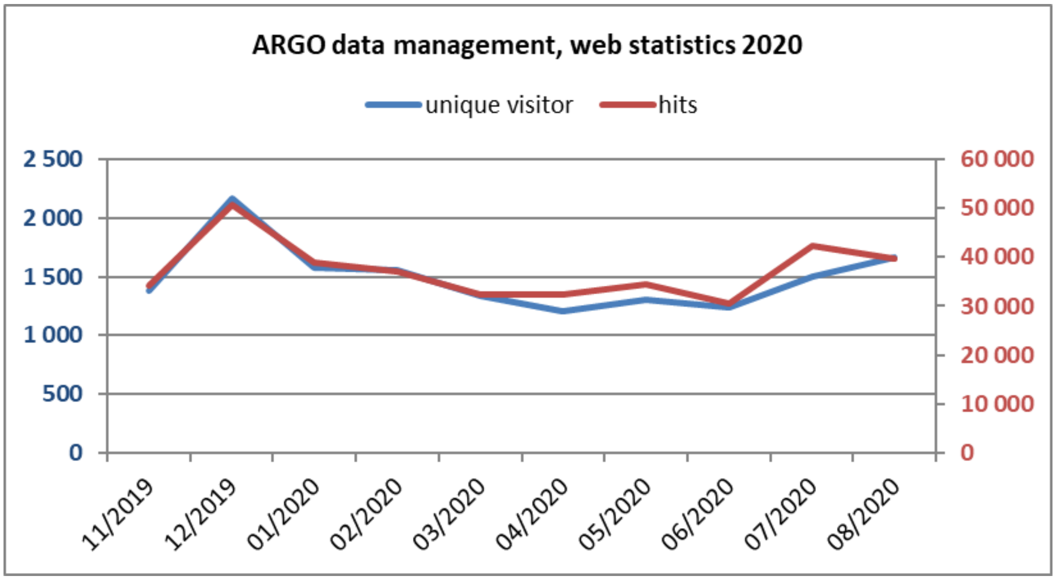
The table below shows an unusual increase of visitors in February on GDAC FTP; we do not have a specific explanation.



ARGO GDAC FTP statistics				
month	unique visitor	number o	hits	bandwidt
11/2019	667	6 133	9 342 106	5,13
12/2019	617	5 717	6 615 380	4,24
01/2020	505	4 805	8 235 915	4,87
02/2020	1739	6 560	8 738 395	3,59
03/2020	783	3 504	10 521 897	3,56
04/2020	551	3 610	10 022 383	3,50
05/2020	529	3 506	13 380 715	3,49
06/2020	1082	4 774	13 938 410	3,32
07/2020	1685	7 538	4 723 588	3,51
08/2020	640	6 560	2 852 686	3,80
09/2020	811	6 172	10 189 287	3,79
10/2020	570	4 988	8 164 053	3,80
Average	**848**	**5 322**	**8 893 735**	**3,88**

Statistics on the Argo data management web site: http://www.argodatamgt.org

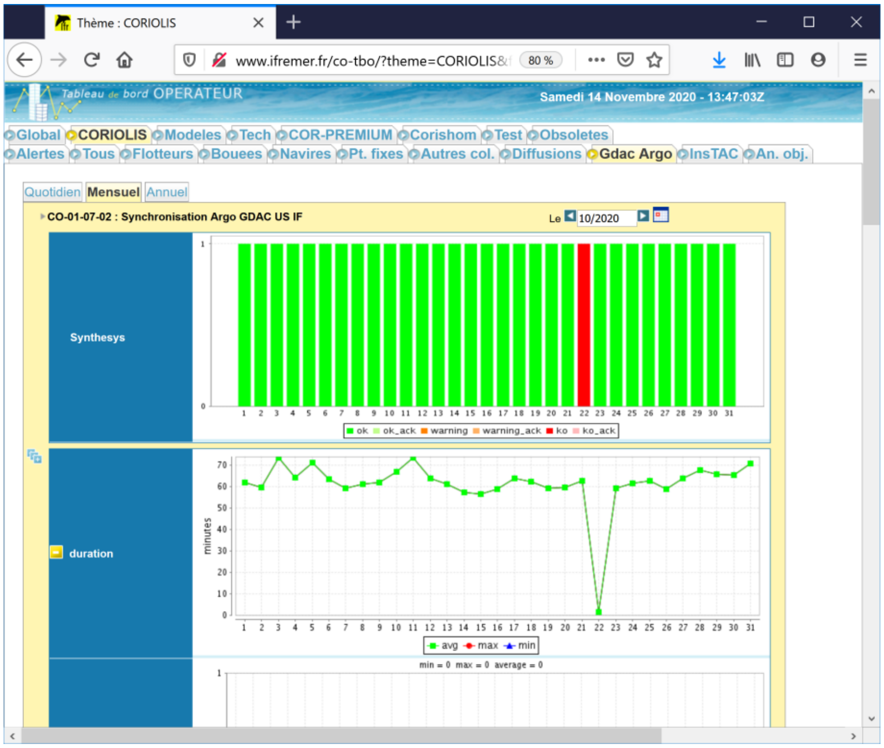
There is a monthly average of 1400 unique visitors, performing 2200 visits and 37000 hits. The graphics shows a slightly stable number of unique visitors.



ARGO GDAC web statistics					
month	unique vi	visits	pages	hits	bandwidt
nov-19	1 689	2 488	5 171	41 499	1,1
déc-19	1 624	2 405	4 669	36 519	1,1
janv-20	1 385	2 070	4 186	34 275	1,6
févr-20	2 164	3 168	6 628	50 696	1,7
mars-20	1 572	2 729	5 664	38 943	1,5
avr-20	1 550	2 337	4 479	37 017	1,1
mai-20	1 336	2 081	4 298	32 350	1,0
juin-20	1 210	1 848	4 355	32 283	0,8
juil-20	1 304	1 919	4 084	34 536	1,3
août-20	1 239	1 742	3 794	30 537	1,7
09/2020	1 503	2 329	4 969	42 220	1,8
10/2020	1 663	2 313	4 748	39 695	1,5
Average	**1 493**	**2 254**	**4 721**	**37 255**	**1,4**

3.3 GDAC files synchronization

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



Synchronization dashboard in October 2020: the daily sync. time takes on average 1 hour, with a failure on October 22nd.

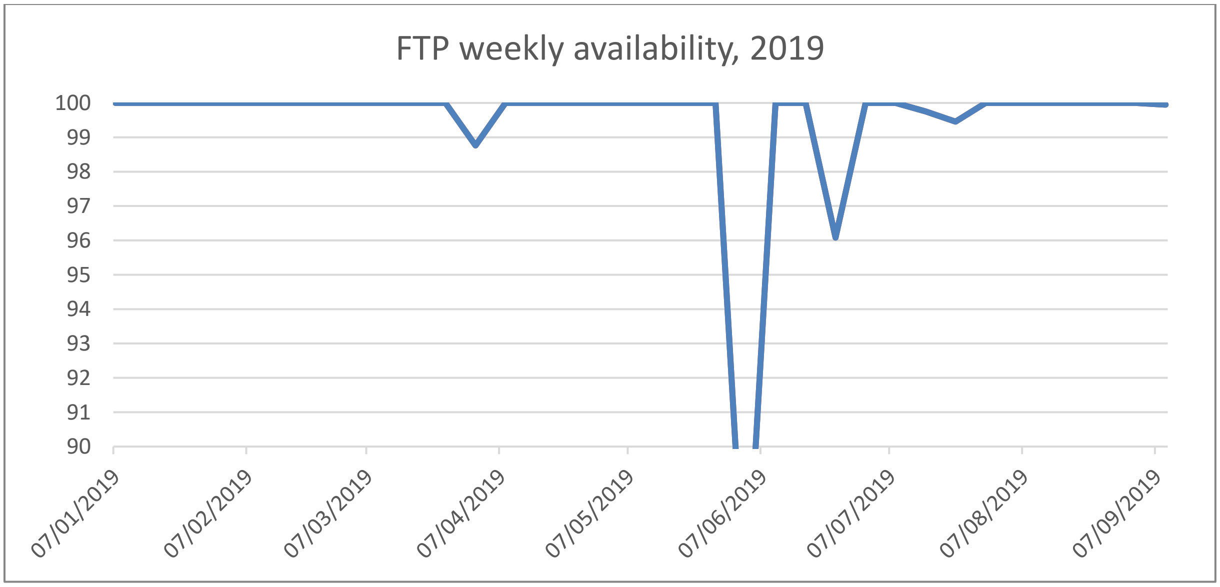
3.4 FTP server monitoring

The Argo GDAC ftp server is actively monitored by a Nagios agent (http://en.wikipedia.org/wiki/Nagios).

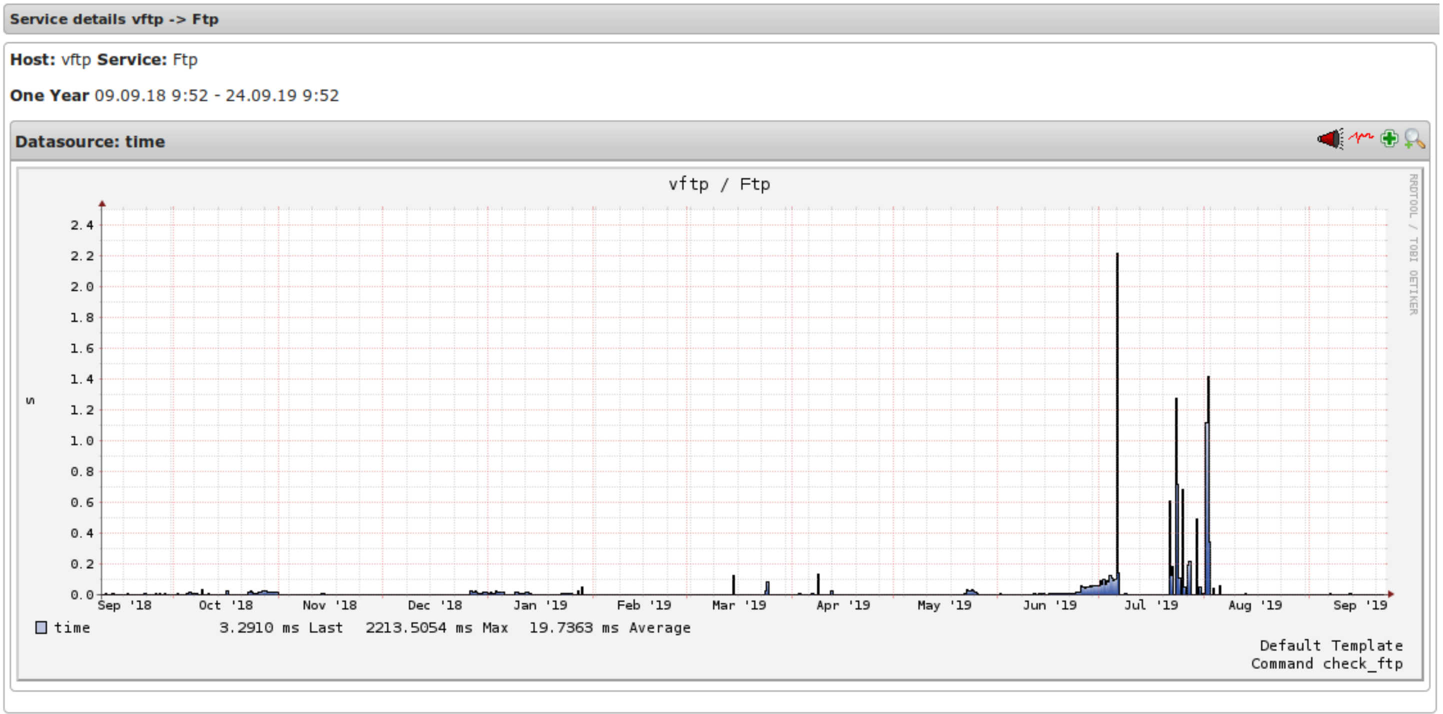
Every 5 minutes, an ftp download test and an Internet Google query are performed. The success/failure of the test and the response time are recorded. The FTP server is a virtual server on a linux cluster.

On the last 9 months, the FTP server was operational on 99.540% of time, non-operational during 1 day and 2 hours (0.421%). This is a very poor performance compared to last year (only 14 minutes non-operational in 2018). The main explanation is electricity maintenance work, which will hopefully improve the future FTP availability. The graphics below shows that the major FTP outages occurred on June 7th and then in July 6th 2019.

FTP server monitoring 01/01/2019 - 24/09/2019			
Status	***percentage***	***duration***	***comment***
OK	*99,540%*	*256d 3h 7m 20s*	*operational*
Warning	*0,039%*	*0d 2h 10m 10s*	*poor performance*
Unknown	*0,000%*	*0d 0h 0m 0s*	
Critical	*0,421%*	*1d 2h 56m 22s*	*non operational*

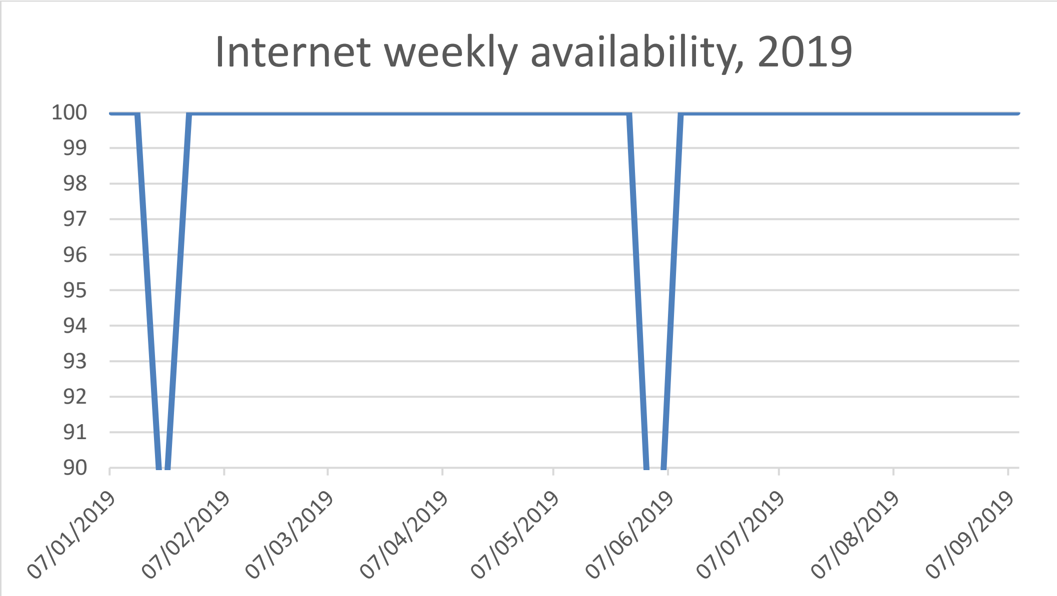


Nagios ftp monitoring: between January and September 2019



FTP server response time monitoring, poor performances end of June and in July

Internet access monitoring 01/01/2019 - 16/09/2019			
Status	***percentage***	***duration***	***comment***
OK	*99,816%*	*265d 20h 33s*	*operational*
Warning	*0,000%*	*0d 0h 0m 0s*	*poor performance*
Unknown	*0,000%*	*0d 0h 0m 0s*	
Critical	*0,184%*	*0d 11h 46m 12s*	*non operational*



Nagios Internet monitoring: between January and September 2019, poor performances in January and June.

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 2210 entries** (November 2020), compared to 2271 entries one year ago.

DAC	Nb greylist entry
aoml	966
coriolis	685
csiro	215
bodc	132
jma	103
csio	32
meds	26
incois	24
kma	18
kordi	9
Total	**2210**

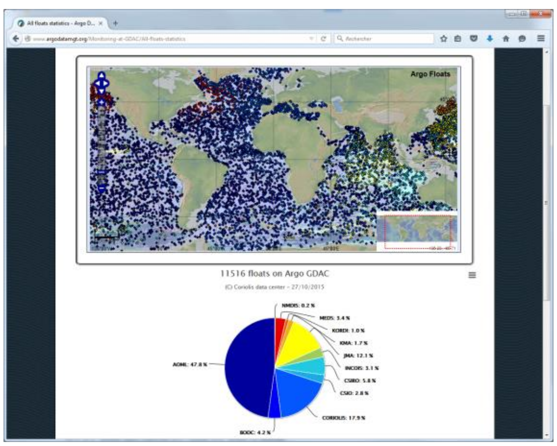
Distribution of greylist entries per DAC and per parameter

Coriolis reports many BGC greylist entries.

Parameter name	number of entri
PSAL	1274
TEMP	221
PRES	211
CDOM	140
BBP700	112
DOXY	93
CHLA	83
DOWN_IRRADIANCE380	15
DOWN_IRRADIANCE412	15
DOWN_IRRADIANCE490	15
DOWNWELLING_PAR	15
CP660	10
NITRATE	2
PH_IN_SITU_TOTAL	2
BBP532	1
PH_IN_SITU_FREE	1
Total	**2210**

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 GDAC monthly snapshots DOIs

- Snapshot of 2018 November 8th http://doi.org/10.17882/42182#59903
- Snapshot of 2014 October 8th http://doi.org/10.17882/42182#42280
- Snapshot of 2012 December 1st http://doi.org/10.17882/42182#42250

Argo National Data Management Report 2020

- BSH (Federal Maritime and Hydrographic Agency), Germany

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 163 active/operational German floats which belong to BSH except for 5 associated to AWI. Only 22 floats have been deployed in 2020 to date because of cancelled cruises due to covid. 11 more floats are going to be deployed by South African colleagues in December. 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 (24.11.2020) the German Argo fleet comprises 1014 floats which have sampled 81813 profiles. 73081 profiles of all eligible files are already available as D-files and 6185 are still pending. The total rate of eligible D-files provided to the GDACs is 89 % and has continued to be at high levels from last year's value of 92%.
- 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 projects such as KLIWAS, RACE, MiKlip, ICDC 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's 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 89%. BSH had adopted floats from all German universities and agreed last year to perform similar services for the AWI floats. A preliminary DMQC for the subset of re-processed AWI floats (now in V3.1) has now been performed, but the submission of D-files has been postponed to increase the reference data base in the Weddell gyre which is outdated. At the moment 8586 profiles are available from the 187 AWI floats and only 42% are available as D-files. For all other floats (741 floats) the DMQC quota is at 95%. Additional time was spend to check files updated to format V3.1 and repeat DMQCs (if necessary), particular for old floats from the universities with BGC sensors with format inconsistencies in the older formats. Occasionally new R-files would be created during reprocessing which were not created before.

German Floats/ Program Name	Number of profiles	Number of D-files	D-files pending	Comments
Argo BSH	56406	52875	1062	Overall 94%
Argo AWI	8586	3548	4960	Are waiting for updates to reference data Overall 42%
Argo GEOMAR (129 floats)	13474	13400	74	Reprocessing nearly finished Overall 99 %
Argo U. HH (187 floats)	3346	3258	88	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 floats from Finland (37 floats), the Netherlands (92 floats), Norway (58 floats) and Poland (26 floats) for DMQC and is performing DMQC on parts of the MOCCA fleet (56 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 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 will get more involved in the dmqc activities. Floats deployed from 2019 onward will be covered by Norwegian DMQC operators. The same is true for Argo-Poland which also will perform 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.

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.

Adopted floats/ Program Name	Number of profiles	Number of D-files	D-files pending	Comments
Argo Poland (26 floats)	3644	1051	1699	Baltic floats pending Overall 34%
Argo Finland (37 floats)	3563	795	2301	Only baltic floats pending Overall 22%
Argo Netherlands (92 floats)	11714	11015	216	Overall 94%
Argo Norway (58 floats)	6059	4417	499	New dm-operators involved Overall 72%
MOCCA (56 floats)	9452	6095	2590	5 Baltic floats pending Overall 65 %
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% Have to check why files have not been uploaded

Investigations of fast salty drifters were continued and consolidated with the entire European fleet. Information is now available in a shared in a spreadsheet

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

Out of the 106 floats presently listed on the spreadsheet 40 floats are associated to Argo-Germany.

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.

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 is updated/established and once done the dmqc results for all floats in this area will be checked to test for data set homogeneity.

5. References

Argo National Data Management Report – Italy (2020) - MedArgo

1. Status

- **<u>Data acquired from floats</u>:** more than 71000 Argo profiles were acquired in the Mediterranean and in Black Seas between 2001 and September 2020. 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); the monthly and yearly distribution is shown in Figure 2. More than 80 floats per months have been operated simultaneously in the basins in 2020 and more than 5500 profiles have been acquired (up to September 2020) by different float models (Figure 3).

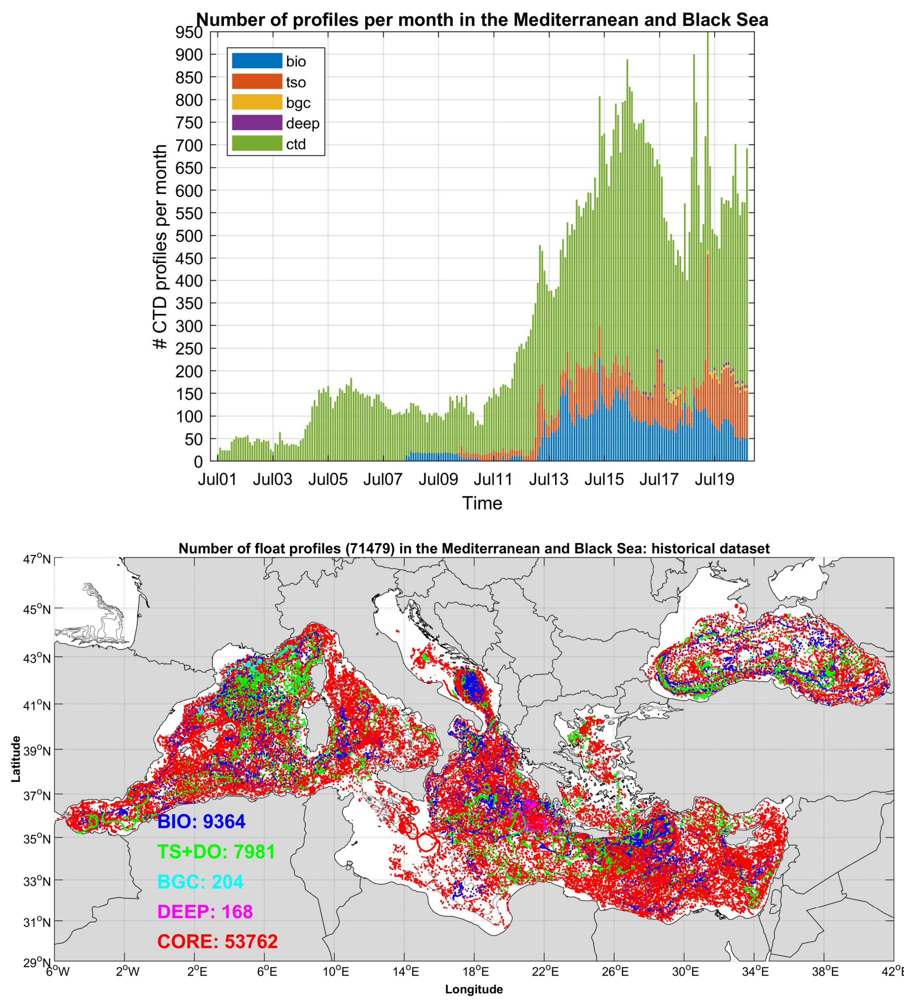


Figure 1. Temporal (upper panel) and spatial (bottom panel) distribution of float profiles in the Mediterranean and Black Sea between 2001 and 2020.

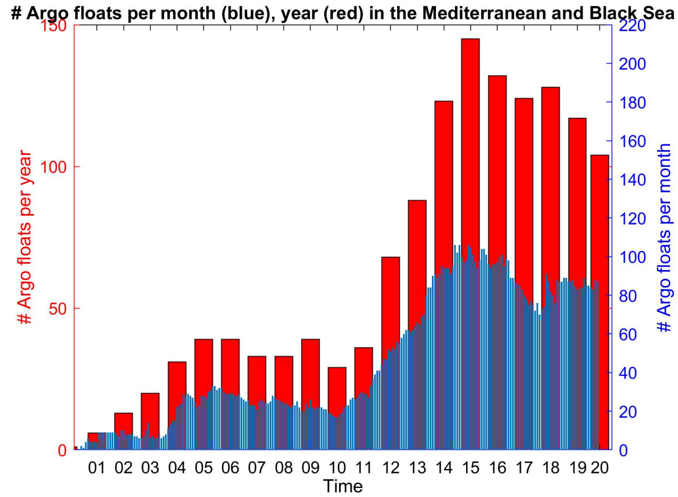


Figure 2. Monthly (blue bars) and yearly (red bars) distribution of Argo floats in the Mediterranean and Black Sea between 2001 and 2020.

The number of profiles acquired by Argo-extension floats in 2020 is about 1700 whilst the ones collected by the core Argo floats are about 3800. EU, Spain, Greece, France and Italy contributed to maintain/increase the Argo population in 2020: a total of 29 new floats have been deployed both in the Mediterranean and in the Black Seas (Figure 3); 26 out of 29 platforms are core-Argo, 2 are core-Argo with DO and 1 is a Bio-Argo. The deployment strategy was chosen according to project's targets and to replace dead floats or under-sampled areas.

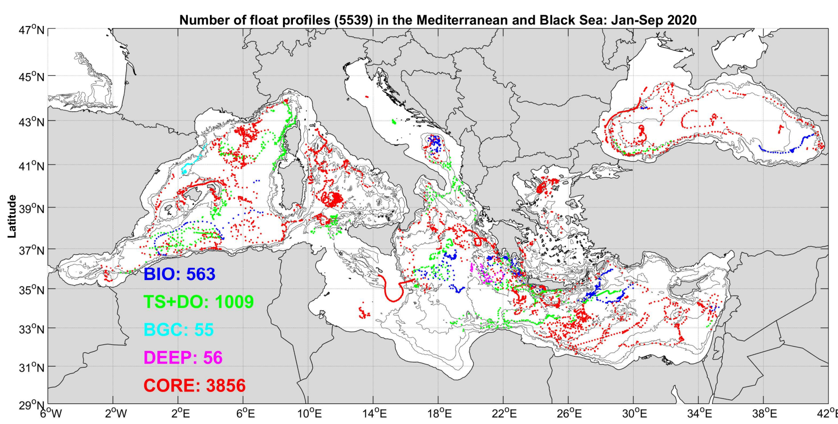


Figure 3. Spatial distribution of profiles collected by Argo floats in 2020 in the Mediterranean and Black Sea: locations are color-coded per float type.

Statistics have been computed to assess the fleet performance. The survival rate diagram produced are separated by transmission mode (figure 4). The maximum operating life is more than 500 cycles, whilst the mean half life is about 140 cycles (figure 4a). The vertical distance travelled by floats is computed and used as an indicator of the profiler performance (figure 4b). The maximal distance observed is about 500 km, whilst the mean distance travelled is about 125 km. The balance of the population is in figure 5a and the annual dead rate in figure 5b.

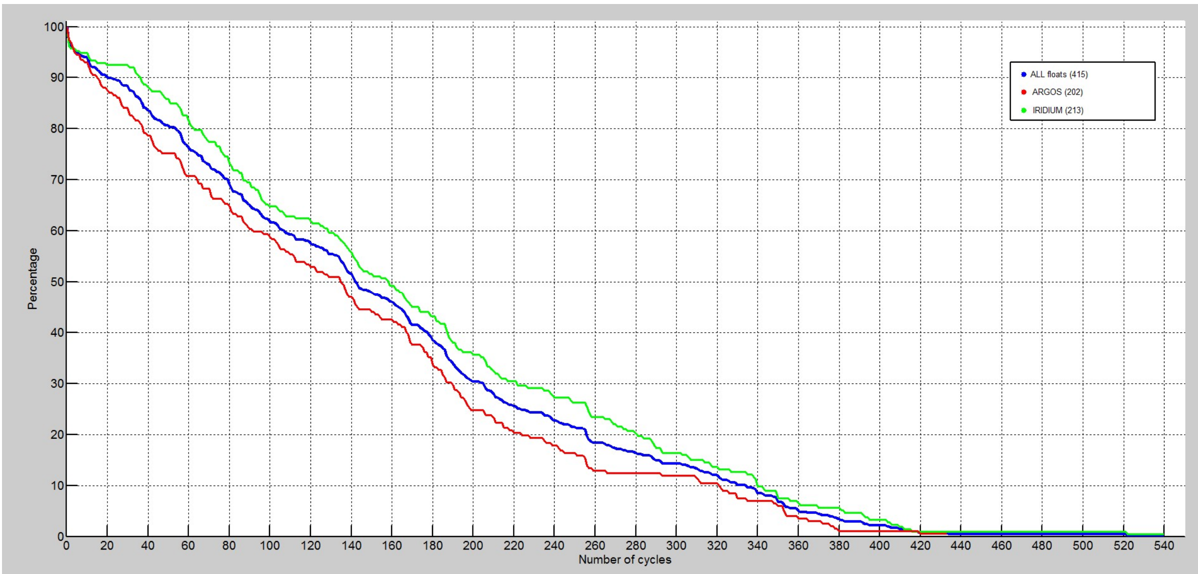


Figure 4a. Survival rate diagrams separated by telemetry system.

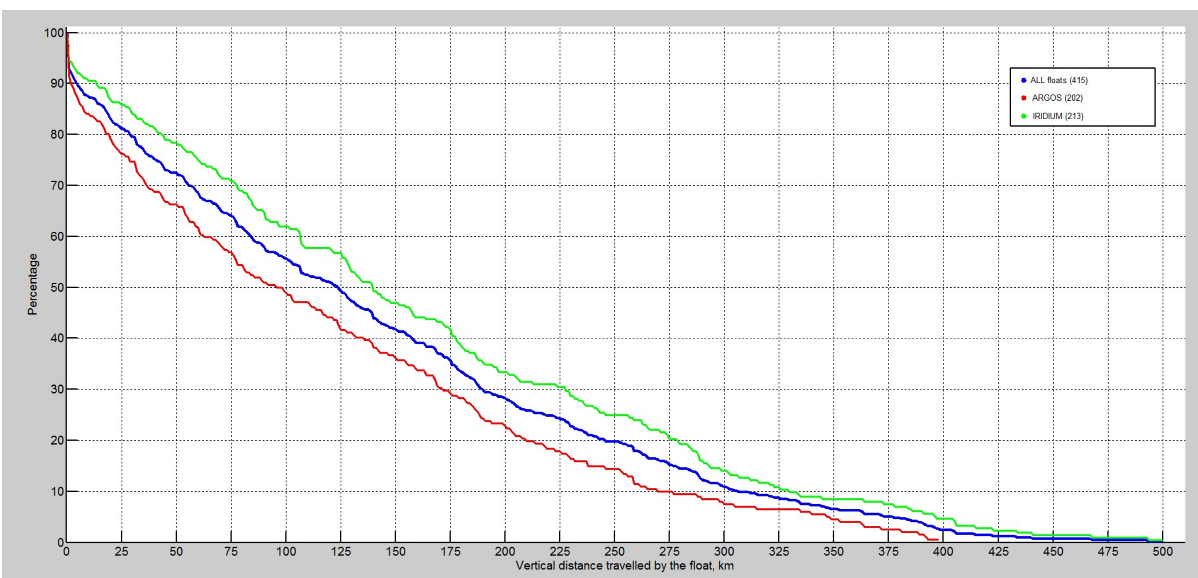


Figure 4b. Diagram of the vertical distance travelled floats, separated by telemetry system.

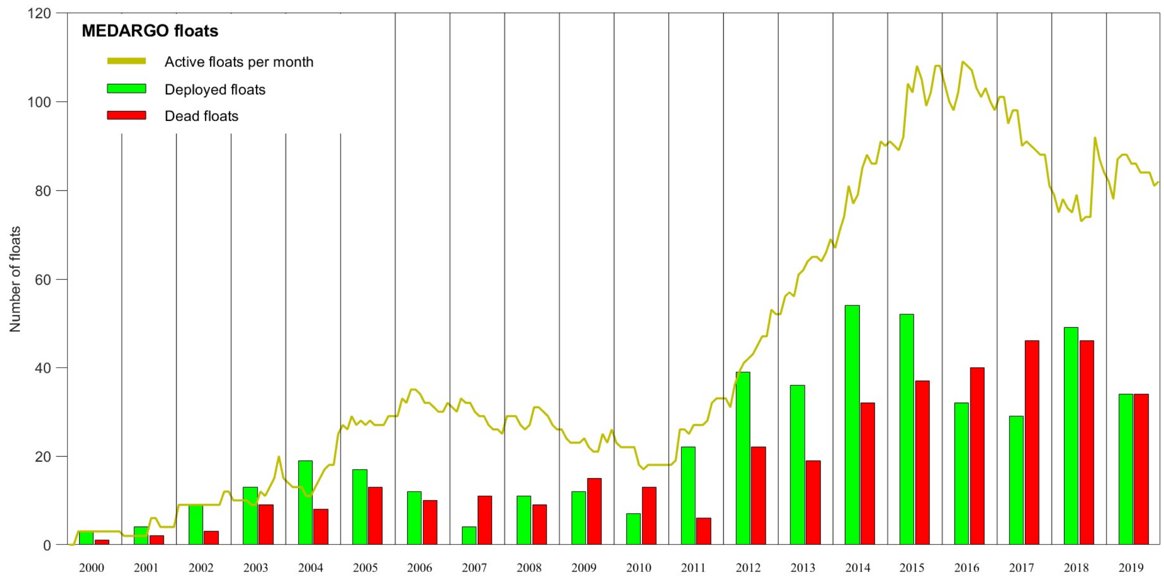


Figure 5a. Balance of the population (rate of population change related to the number of yearly deployments and dead floats).

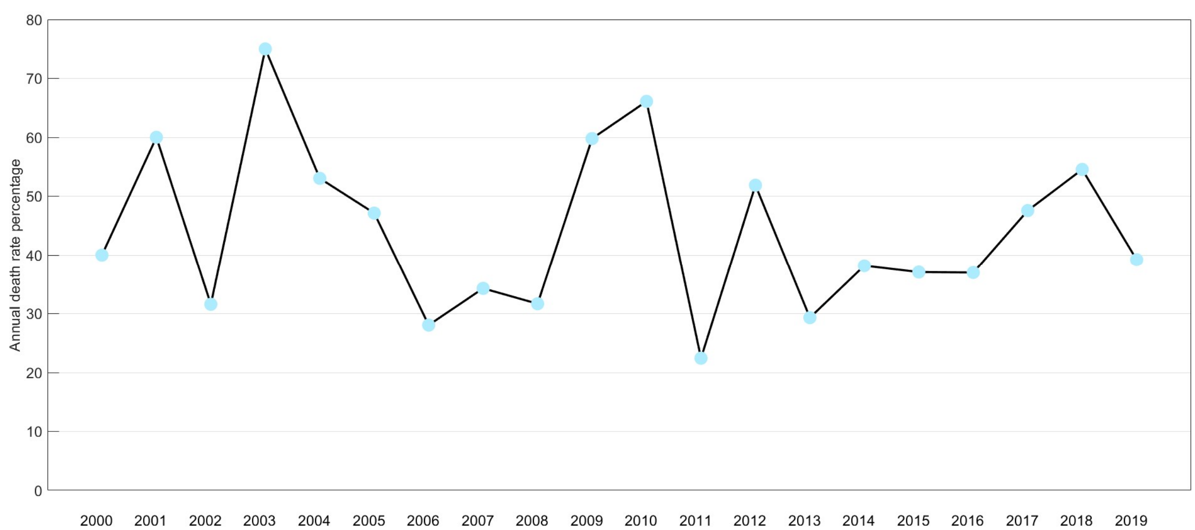


Figure 5b. Annual dead rate (ration between yearly failure and yearly average population).

- **Web pages**:

In the MedArgo web page (http://nettuno.ogs.trieste.it/sire/medargo/active/index.php) tables and graphics are updated in near real time. The floats deployed during 2020 have been added to the web page as soon as the technical information are available. The float positions are plotted daily (Figure 6); the monthly and the whole trajectories are also provided. Links with the GDAC center (Coriolis) are also available for downloading both the real-time and delayed-mode float profiles.

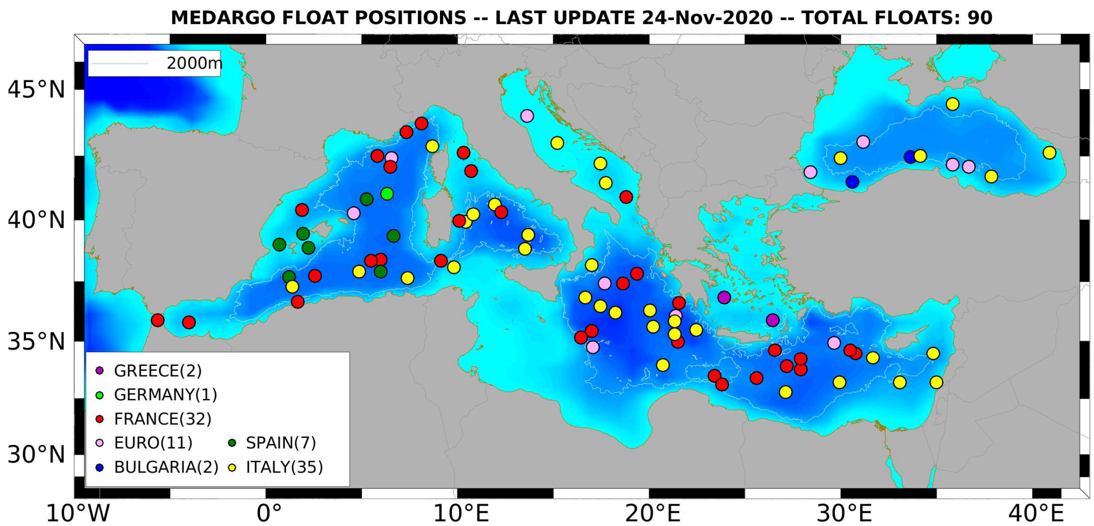


Figure 6. MedArgo float positions as of 24 November 2020 (updated daily).

- **<u>Statistics of Argo data usage</u>:** (operational models, scientific applications, number of National Pis…):
- **<u>Products generated from Argo data</u>:**
    a. Daily maps of float positions (Figure 6)
    b. Monthly maps of float positions and track
    c. Float data are assimilated in numerical forecasting models by INGV (MFS); daily and weekly maps of Mediterranean ocean forecasting system are produced (Figure 7).

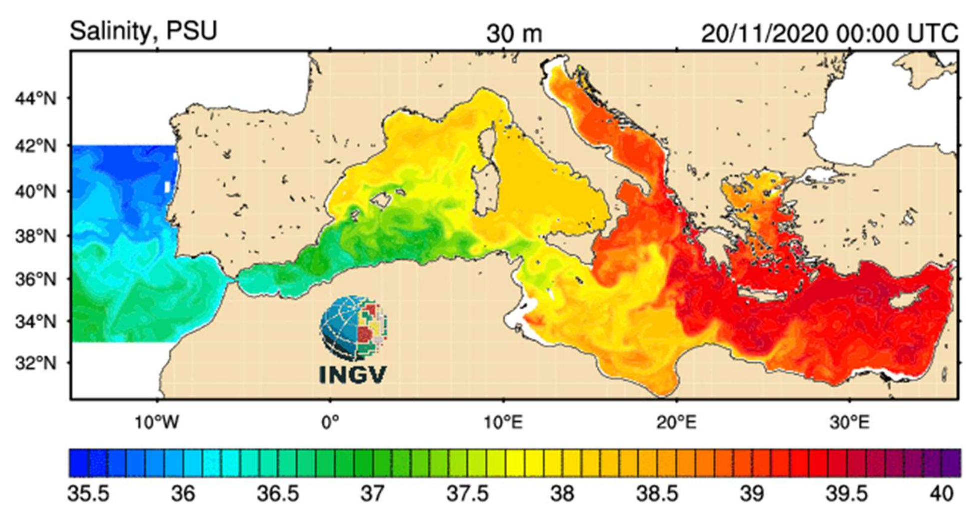


Figure 7. Forecasting model of salinity at 30 meters.

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 8).

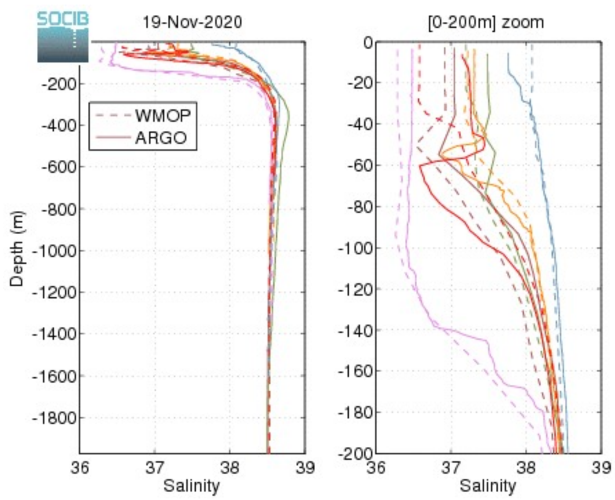


Figure 8. Operational validation system run at SOCIB.

2. Delayed Mode QC

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.

- Impact of the fast salty drift issue at EU level: analysis of affected floats have been conducted and results/comments are reported at: https://docs.google.com/spreadsheets/d/1TA7SAnTiUvCK7AyGtSTUq3gu9QFbVdONj9M9zAq8CJU/edit#gid=1096144849.
- The DMQC method has been applied to about 50% (as of October 2020) of the eligible floats deployed between 2001 and mid 2019 in the Mediterranean and Black Seas: they were quality controlled in delayed-mode for salinity, temperature and surface pressure and the respective D-files are gradually sent to GDAC. The DMQC report/info of each float can be downloaded by the MedArgo web page (http://nettuno.ogs.trieste.it/sire/medargo/all/table_out_all.php). The DMQC work has been proceeding slowly since two years due to a lack of personnel. A new

scientist has been hired in October 2020 and she is currently on training. We expect to be fully operational during next year.

3. 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 29 new floats have been deployed in the Mediterranean and Black Sea during 2020, through a coordinated activity of deployment opportunities and thanks to scientific projects.
- There are 79 active Argo floats in the Mediterranean Sea and 11 in the Black Sea as of 24 November 2020.
- The main MedArgo partners (Greece, Spain, France and Bulgaria) have been contacted by OGS (Italy) to strengthen the collaboration to improve the Argo activities (deployment plans and opportunities, sharing reference datasets for QC, sharing expertise, Argo products preparation). A virtual meeting will follow next year.

Argo National Data Management Report

1. Status

The Japan DAC, the Japan Meteorological Agency (JMA), has processed data from 1802 Japanese Argo and Argo-equivalent floats including 213 active floats as of November 19th, 2020. There are ten 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.

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) has done the Delayed Mode QC for all Japanese floats. The delayed mode QC for the 13,080 profiles observed by Japanese floats from October 2nd 2019 to November 19th 2020 are in progress. JAMSTEC decoded 10,017 profiles of these, which were acquired as ARGOS messages and Iridium messages from October 2nd 2019 to November 19th 2020. JAMSTEC sent 12,105 delayed profile files (D-files) to GDACs through the Japan DAC, JMA, during the period.

JMA and JAMSTEC have been converting 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 the almost all of Japanese meta-files, except a few Iridium floats, 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.

Web pages:

Japan Argo

http://www.jamstec.go.jp/J-ARGO/index_e.html

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.

Real-time Database (JMA)

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

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

Delayed mode Database (Argo JAMSTEC)

http://www.jamstec.go.jp/ARGO/argo_web/argo/?lang=en

JAMSTEC's website shows mainly Japanese float list, trajectory map, profile chart, and QCed float data. Brief profile figures of the selected floats are also shown. This site also shows global maps based on objective analysis (temperature, salinity, potential density, dynamic height, geostrophic current, mixed layer depth, etc.).

Statistics of Argo data usage:

Operational models of JMA

MOVE/MRI.COM-G2 (Multivariate Ocean Variation Estimation System/ Meteorological Research Institute Community Ocean Model – Global 2)

JMA operates the MOVE/MRI.COM-G2, which replaced the previous version (MOVE/MRI.COM) in June 2015, for the monitoring of El Niño and the Southern Oscillation (ENSO) and for initialization of the seasonal prediction model (JMA/MRI-CGCM2). The MOVE/MRI.COM-G2 consists of an ocean general circulation model (OGCM) and an objective analysis scheme.

For details please visit:

http://ds.data.jma.go.jp/tcc/tcc/products/elnino/move_mricom-g2_doc.html

JMA/MRI-CGCM2 (JMA/MRI - Coupled ocean-atmosphere General Circulation Model 2)

JMA operates JMA/MRI-CGCM2, which replaced the previous version (JMA/MRI-CGCM) in June 2015, 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-G2.

For details please visit:

http://ds.data.jma.go.jp/tcc/tcc/products/model/outline/cps2_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

JCOPE2 (Japan Coastal Ocean Predictability Experiment)

JCOPE2 is the model for prediction of the oceanic variation around Japan which is operated by JAMSTEC. JCOPE2 is the second version of JCOPE, developed with enhanced model and data assimilation schemes. In 2019, JCOPE2M, which is updated version of JCOPE2 reanalysis, 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 web site: http://www.jamstec.go.jp/frcgc/jcope/. More information is shown in http://www.jamstec.go.jp/frcgc/jcope/htdocs/e/home.html

FRA-JCOPE2

FRA-JCOPE2 is the reanalysis data created by assimilating most of available observation data into the JCOPE2 ocean forecast system. The high horizontal resolution of 1/12 deg. is used in order to describe the oceanic variability associated with the Kuroshio-Kuroshio Extension, the Oyashio, and the mesoscale eddies from January 1993 to December 2009. Collaboration with Japan Fisheries Research and Education Agency (FRA) has allowed us to assimilated huge amount of in-situ data around Japan. FRA-JCOPE2 reanalysis data are openly available. The website, http://www.jamstec.go.jp/frcgc/jcope/vwp/, provides information about downloading and interactively visualizing the reanalysis data for users.

FRA-ROMS

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 started the operation in May 2012. The forecast oceanographic fields are provided every week on the website http://fm.dc.affrc.go.jp/fra-roms/index.html/.

Products generated from Argo data:

Products of JMA

El Niño Monitoring and Outlook

JMA issues the current diagnosis and the outlook for six months of ENSO on the following web site. The outputs of the MOVE/MRI.COM-G2 and the JMA/MRI-CGCM2 can be found here.
http://ds.data.jma.go.jp/tcc/tcc/products/elnino/index.html

Subsurface Temperatures and Surface Currents in the seas around Japan

The following parameter outputs of the MOVE/MRI.COM-WNP can be found on https://www.data.jma.go.jp/gmd/goos/data/database.html. The outputs of the MOVE/MRI.COM-WNP will be replaced by those of MOVE/MRI.COM-JPN.

- Daily, 10day-mean and Monthly mean subsurface temperatures at the depths of 50m, 100m, 200m and 400m analyzed for 0.1 x 0.1 degree grid points.

- Daily and 10day-mean Surface Currents for 0.1 x 0.1 degree grid points.

Products of JAMSTEC

MOAA (Monthly Objective Analysis using the Argo data)

MOAA is the global GPV data set which was made by monthly OI objective analysis using Argo and TRITON mooring data. Various maps have been made using MOAA, and opened to the public on the Argo JAMSTEC web site, http://www.jamstec.go.jp/ARGO/argo_web/argo/?page_id=83&lang=en

Objectively mapped velocity data at 1000 dbar derived from trajectories of Argo floats

The gridded velocity data at 1000 dbar is made by optimal interpolation analysis using YoMaHa'07. This dataset has been disclosed since October 2009. This dataset are updated every 6 months. This data is opened to the public on the Argo JAMSTEC web site, http://www.jamstec.go.jp/ARGO/argo_web/argo/?page_id=86&lang=en

MILA GPV (Mixed layer data set from Argo floats in the global ocean)

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. The updated data set is released on the Argo JAMSTEC web site, http://www.jamstec.go.jp/ARGO/argo_web/argo/?page_id=223&lang=en.

Scientifically quality-controlled profile data of Deep NINJA observations

We have 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 conducted at float deployments. Its detailed information has been provided on the Argo JAMSTEC web site: http://www.jamstec.go.jp/ARGO/deepninja/

ESTOC (Estimated state of global ocean for climate research)

This product is an integrated dataset of ocean observations including Argo data by using a four dimensional variational (4D-VAR) data assimilation approach. ESTOC is the open data that consists of not only physical but also biogeochemical parameters for 55 years during 1957-2014 (See the web site in JAMSTEC, http://www.godac.jamstec.go.jp/estoc/e/).

AQC Argo Data (Advanced automatic QC 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. JAMSTEC improved this data set and has released it as AQC version 1.2. This data set has been provided in the ascii format as well as netcdf format, because it is useful for analyses using various software (see the web site in JAMSTEC, http://www.jamstec.go.jp/ARGO/argo_web/argo/?page_id=100&lang=en)

Products of JAMSTEC/JMA·MRI

FORA-WNP30 (Four-dimensional Variational Ocean ReAnalysis for the Western North Pacific)

FORA-WNP30 is the first-ever dataset covering the western North Pacific over the last three decades (1982-2014) at eddy-resolving resolution. This is the cooperative work of Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and Meteorological Research Institute, Japan Meteorological Agency (JMA/MRI) using the Earth Simulator. (see the web site http://synthesis.jamstec.go.jp/FORA/e/index.html)

Tools

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.

2. Delayed Mode QC

JAMSTEC has done the DMQC for all Japanese floats. JAMSTEC has submitted the delayed mode files of 160,247 profiles to GDACs as of November 19th, 2020.

The procedure of DMQC in JAMSTEC is as follows.

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

1. (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 testing whether Nitrate and pH observed by our BGC floats in the North Pacific are corrected well by SAGE.

3. GDAC Functions

The JAMSTEC ftp server has been providing the mirror site of GDACs since 2003.

ftp://ftp2.jamstec.go.jp/pub/argo/ifremer/
ftp://ftp2.jmastec.go.jp/pub/argo/fnmoc/

4. Regional Centre Functions

JAMSTEC operates PARC in cooperation with IPRC and CSIRO and has extended the responsible region into the whole Pacific.
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 on the following web pages (http://www.jamstec.go.jp/ARGORC/).
JAMSTEC is now building the new PARC websites. We 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, DMQC operators and users, and to coordinate float development opportunities. The site is going to be more user-friendly than its current version. We will release the new version of PARC websites in 2021.

KOREA Argo National Data Management Report
ADMT-21
Virtual Meeting, Nov 29 – Dec 4, 2020

1. Status

1.1. Data acquired from floats

In 2020, the National Institute of Meteorological Sciences of Korea Meteorological Administration (NIMS/KMA) deployed 6 floats around Korea: 4 for the East Sea, 2 for the Yellow Sea (Fig. 1). The NIMS/KMA has deployed 253 Argo floats in the North Pacific Ocean and East Sea since 2001, and 19 floats are in active as of November 25, 2020. 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 profiles obtained from the floats are transmitted to GDAC in the NetCDF format using BUFR data after the real-time quality-control process on operational system.

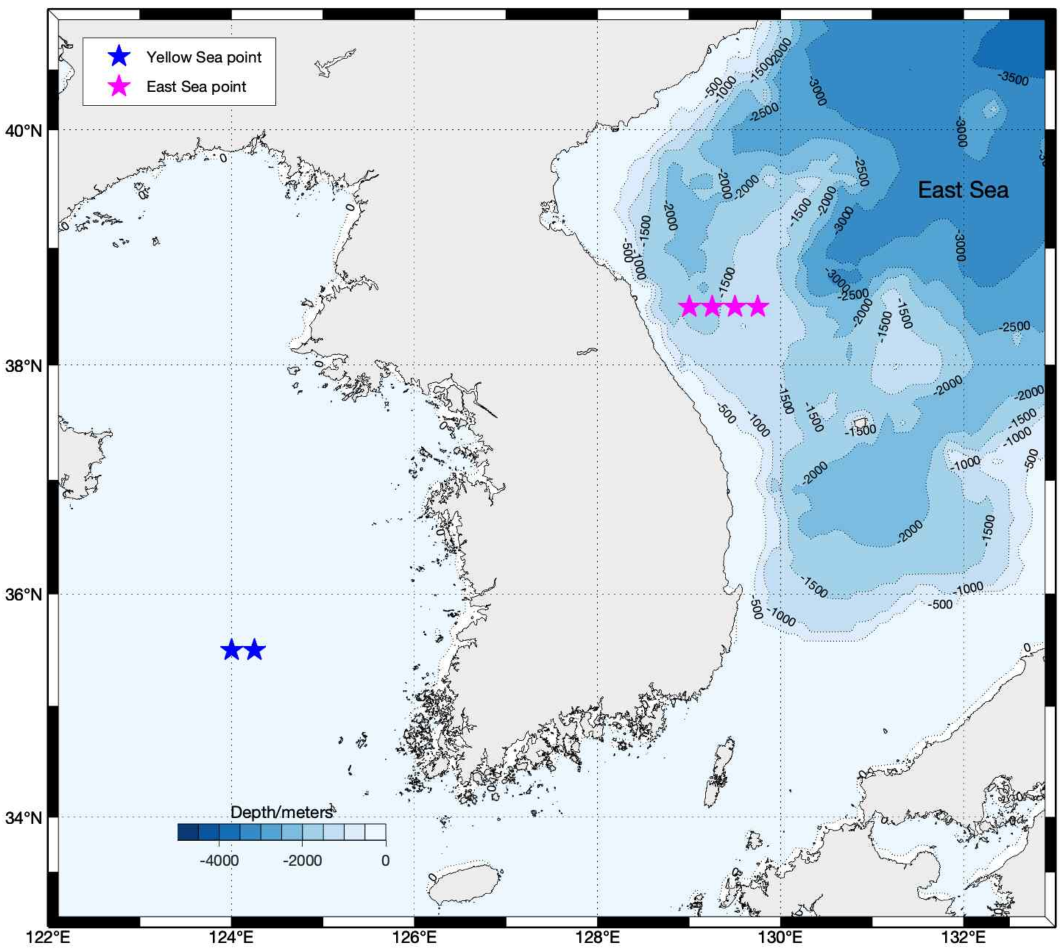


Fig. 1. Deployment position of Argo floats around Korea in 2020

1.2. Data issued to GDAC

Total **1,169 profiles** were acquired during January through November in 2020 and sent to the GDAC by real-time after the RTQC processes.

・Data reproduction and resubmission to GDAC by applying Warning Objective Analysis report.

・Implementing the Argo data format check program (new version).

・The RTQC procedure has been updated for KMA floats in the East Sea.

・Real-time and delayed-mode shallow sea quality control development.

1.3 Shallow Argo

This year, it was successfully observed through Argo deployed in the Yellow Sea. In November 8, 2019, two floats were deployed. In particular, The float (ID: 2901797) achieved 190 profiles (> 380 days) observation from November 8, 2019 to November 23, 2020. It is surprising result from a 2-day cycle of shallow sea observation. The NIMS/KMA will try to keep this kind of shallow Argo observation network in around Korean peninsular area. In addition, a research paper using shallow Argo data was published on the subject of "Ocean responses to typhoon Soulik(1819) around Korea" (Kang, K., Jo, H. J. & Kim, Y., Ocean Sci. J. 55, 445-457).

1.4. Web pages

The NIMS/KMA operates the Korea Argo web page (http://argo.nims.go.kr). This year, the NIMS Argo website has been extensively renewed. In particular, the trajectory data was expressed using the Google dynamic map, and provides profile data and status of Argo floats to the public. It has shown **39,903 hits** by visitors in monthly average, and provides figures of vertical profile, spatial distribution and T-S diagram.

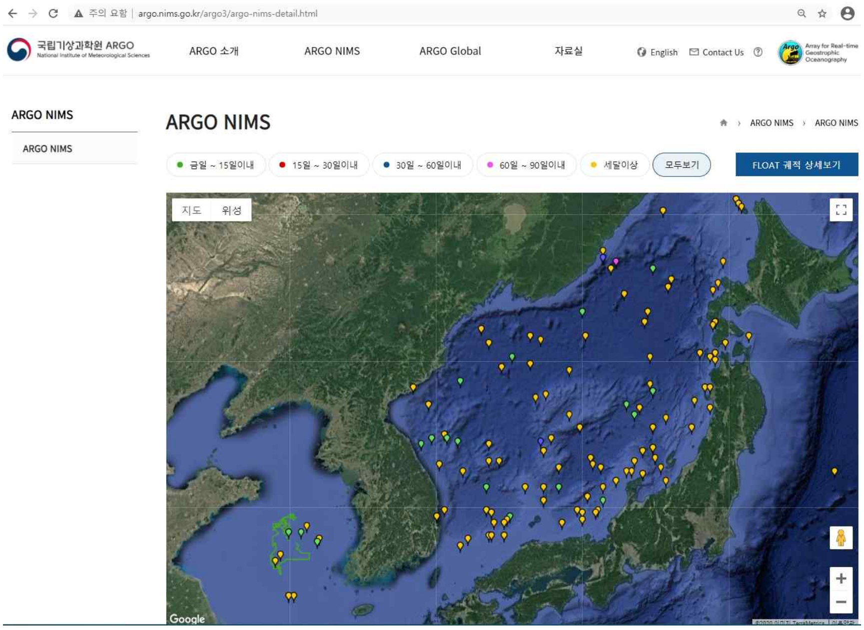


Fig. 2. Argo homepage of NIMS/KMA (http://argo.nims.go.kr)

1.5. Deployment plan 2021

The NIMS/KMA will continue to deploy the 6 Argo floats around Korea such as Yellow Sea and East Sea (see Fig. 4). The red square shows a possible area for the floats to be deploy in 2021 aiming at covering the regional seas of Korea.

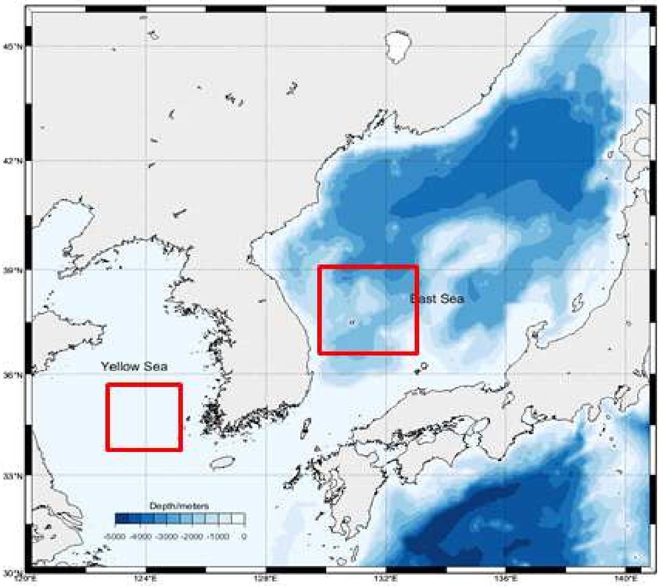


Fig. 3. NIMS/KMA's deployment area in 2021

2. Delayed Mode QC

We completed DMQC operation on 1,875 profiles (1,524 from the East Sea and 351 profiles from the western North Pacific), which had been observed until early July 2020. The profiles had been sent to the ifremer GDAC on November 19, 2020 in NetCDF format. However, we noticed 22,477 D-files submitted to the Ifremer GDAC in 2018 and 2019 had not been updated successfully. We contacted Ifremer in October, and they found our submitted files in their internal eftp directory. We are keeping closely in touch with ifremer, and will fix this issue as soon as possible.

We also developed DMQC prototype for the shallow sea near the Korean peninsula, and tested it on 793 profiles observed from September 2017 to July 2020. We used OW version 1.1.2 (the same OW version used in the East Sea and the Northwestern Pacific), with new reference data-base and new parameters (spatio-temporal correlation scales etc). Since the shallow sea is prone to change its distinctive salinity characteristic every season, only shipboard CTD data collected at the similar time and location were used for OW. We will be improving this DMQC prototype and sending the completed shallow sea D-files to the GDAC by next year.

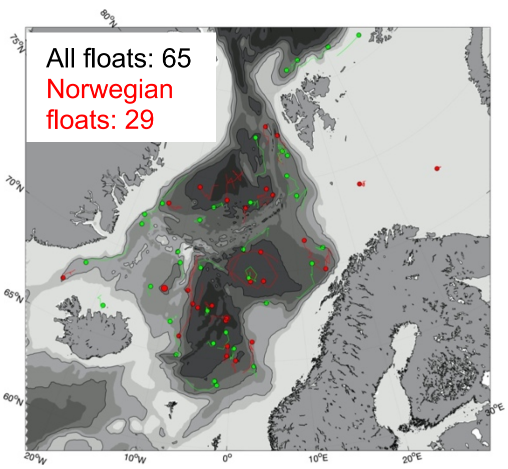
Argo National Data Management Report – Norway 2020

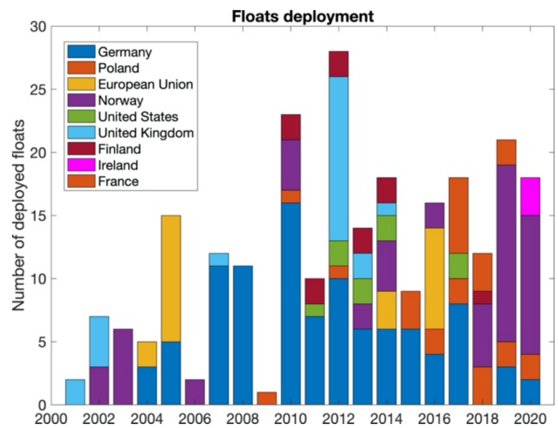
Institute of Marine Research (IMR), Norway

1. Status

- **Data acquired from floats**

Presently there are **29 operative Norwegian floats,** all in the Nordic Seas/Barents Sea. In 2020, **2767 profiles** were acquired (DM: 1209; DM-pending: 417). The left figure below shows the latest Argo locations while right figure shows the number of deployments in the Nordic Seas/Barents Sea/Arctic Ocean (north of Svalbard). Argo Norway deployed 13 floats in 2020.





Data from all operational floats are available from the GDACs. Since 2002 Norway has in total deployed 57 Argo floats.

<u>The 29 operative floats consist of:</u>

- 4 BGC floats (all 6 variables)
- 7 Bio floats (4 variables: DO, chla, bbp, irradiance)
- 6 Deep floats with DO.
- 12 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**

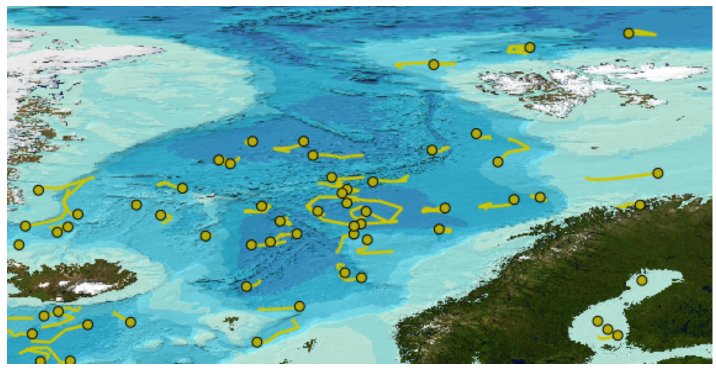
At present (24.11.2020) the Norwegian Argo fleet comprises 57 floats. According to Argo Information Center the floats have so far sampled 6059 profiles with 4417 DM-profiles and 501 DM-pending profiles. In 2020 (1. Jan - 24. Nov), **2767 profiles** were acquired (DM: 1209; DM-pending: 417).

- **Delayed 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 will do DMQC of floats deployed in 2019 and later.

- **Web pages**

A web page for NorArgo (https://norargo.hi.no) has been developed that IMR updates. The web page has a link to daily updates of all operational Argo floats in the Nordic Seas and Arctic Ocean (see figure) and profiles can be visualized.



- **Statistics of Argo data**

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. 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.

In which fields do the users use the infrastructure in

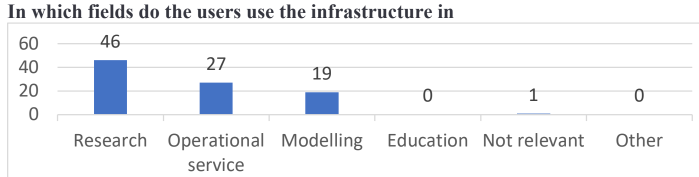


Table 3. Number of users for different fields (several choices can be ticked).

Ocean areas of interest

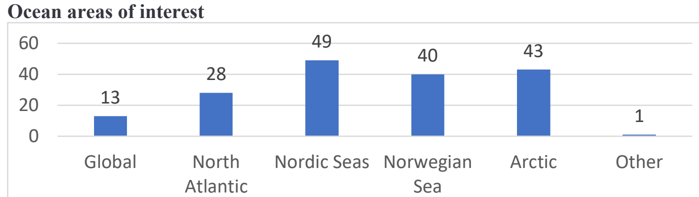


Table 4. Number of users in which the infrastructure are used for in different ocean areas (several choices can be ticked).

- **Products generated from Argo data …**

The ocean heat and fresh water contents of the Norwegian Sea are regularly updated.

2. Delayed Mode QC

BSH has adopted older floats from Norway for DMQC (see report for Germany). Norway will do DMQC of 26 floats deployed in 2019 and 2020.

There are **1421 profiles for these 26 floats with 0 DM and 362 DM-pending.** Most of the floats have been QC and the delay is due to issues with producing the D-files. It is expected that D-files will be produced within this year (IMR).

BGC-variables:
DMQC has been performed on the oxygen (NORCE) for 8 Argo floats, in total 626 profiles. We expect to do DMQC for pH (NORCE) and nitrate (IMR) for 3 BGC-floats this year, and DMQC on the other BGC-variables (IMR) next year.

3. GDAC Functions

4. Regional Centre Functions

5. References

UK National Report

Report to the 21st Argo Data Management Team

Authors

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

- Contributing authors: Matt Donnelly, Clare Bellingham, Kamila Walicka
- Other team members: Katie Gowers, Violetta Paba, Ed Small, Roseanna Wright

With contributions from the wider UK Argo team by:

- Jon Turton and Fiona Carse (Met Office)
- Brian King (National Oceanography Centre)
- Giorgio Dall-Olmo (Plymouth Marine Laboratory)

General Status

Data management team

The British Oceanographic Data Centre (BODC), part of the National Oceanography Centre (NOC), is the data assembly centre for UK Argo funded primarily by the UK Natural Environment Research Council (NERC) and is responsible for data management of UK, Irish and 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. Starting 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 the coordinator for the Southern Ocean Argo Regional Centre (SOARC).

BODC Argo Team member	Contributions	Estimated contribution in past year as Full Time Equivalent (FTE)
Matt Donnelly	BODC Argo Lead DAC lead DMQC contributor SOARC coordinating partner	1.00 FTE
Clare Bellingham	DAC operator DMQC operator	0.95 FTE
Kamila Walicka	DMQC lead	0.85 FTE
Ed Small	DMQC software developer	0.75 FTE
Violetta Paba	Argo vocabularies lead BGC QC lead DAC operator	0.35 FTE
Katie Gowers	Senior Argo software developer	0.15 FTE
Roseanna Wright	Metadata investigations	0.05 FTE
Steve/Tom/Matt C./Kay	Server migration support team	0.20 FTE
	TOTAL	4.30 FTE

The composition of the team at BODC has fluctuated during the course of the year, with Violetta Paba and Katie Gowers both currently on parental leave, Ed Small finishing his 1-year position, and Paul McGarrigle stepping back from routine systems support. The core BODC Argo team has been supported by other members of BODC this year, namely Steve Loch, Tom Garner, Matt Cazaly and Kay Thorne to help with a move of the Argo DAC to a new set of servers. Justin Buck is the ENVRI-FAIR project manager, which includes BODC contributions to the FAIR agenda wider than just Argo. This project has also involved contributions from wider BODC including Gwen Moncoiffe and Alexandra Kokkinaki for NVS content management support, technical advice and training.

General outlook

Core BODC Argo national capability funding from NERC remains static and is decreasing in real-terms. There is also additional funding from NERC associated with particular research projects and the floats they have procured, including from ORCHESTRA, ACSIS, BoBBLE and RoSES projects, but each of these draws to a close in the next year or two. Efforts have been made this year 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.

BODC funding from the EU EASME project MOCCA ended in August 2020 with the end of the project. This project has brought many benefits and efficiency improvements, although the remaining data management commitments for active floats will be covered by UK funding. The Euro-Argo Research Infrastructure Sustainability and Enhancement (Euro-Argo RISE) project provides funding for developing core and deep DMQC (Delayed Mode Quality Control), management of BGC (Bio Geo Chemical) extensions and regional data quality assessments in the Southern Ocean. Additionally, BODC is funded under the EU H2020 project ENVRI-FAIR to introduce the NVS vocabulary server to support Argo vocabulary management.

BODC continues to seek additional sources of funding to support SOARC functions, but a long-term solution for sustained funding is yet to be identified.

During 2020 UK Argo contributed to the Argo Data Paper (Wong et al. 2020).

Status

DAC functions

Data acquired from floats

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

Near real-time data delivery

Processing and delivery of incoming data is normally setup within at most one week of float deployment where this capability already exists for a given type of float. At the time of writing, capability to deliver core/deep data exists for almost the entire fleet managed by BODC, with only 3 floats still awaiting a processing stream to be established. This is a dramatic reduction on last year when all of our TWR floats with APF11 controllers and Iridium communications were still outstanding. The remaining floats are a couple of inactive UK Deep Arvor floats and an active Irish Arvor oxygen float. Work is already underway to enable the processing of these floats. Coriolis has been providing the processing for 13 PROVOR BGC floats and delivering the core data to the GTS on BODC's behalf, but it is intended to bring management of these floats back into BODC in the coming year.

During the past year, the BODC Argo System has been developed to process a diverse fleet of APF11i controller board floats, including core, deep and BGC sensor equipped floats. This small fleet ranges from early APF11i floats to the most recent, across several batches and multiple firmware versions, and has posed a challenge in delivering an exception free processing pipeline. The focus for the coming year is to enable the release of all BGC profile data across TWR, SeaBird and NKE float models.

The instance of the Coriolis processing chain deployed at BODC, primarily enabling delivery of data from MOCCA project floats and some Irish floats, was upgraded in January 2020 to fix some processing issues in this software stack.

Data issued to GTS

BODC delivers core data 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.

In May 2020, BODC refactored its workflow for delivering RT NetCDFs to the Met Office, preventing accidental resubmissions to the GTS caused by the previous setup. This should eliminate pollution of GTS metrics by accidental resubmissions that have been noted in the past couple of years.

BODC and the Met Office are planning to review the current approach to GTS distribution in the coming year with the aim of minimising the delays between data recovery and delivery to the GTS, with available options likely to reduce the median delivery time by at least an hour, and possibly more.

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. The transition to generating all technical files in v3.1 was completed in May 2020. Delivery of BGC profile data and many trajectory files are still pending as BODC continues its recovery from the demands of new float types, payloads and the transitional to v3 files. Delivery of BGC profile files is planned as a major focus for 2021. There have also been recent improvements to oxygen and pH sensor metadata in support of APF11i development.

During the past year BODC has returned to routinely addressing Altimetry QC and Objective Analysis reports shortly after receipt.

Data issued for delayed-mode QC and 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 decision 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 instance deployed at BODC, both internal and external DMQC operators submit updated NetCDFs which are archived within BODC and submitted to the GDACs.

Web pages

NOC continues to maintain the UK Argo website (www.ukargo.net) along with a Facebook page (www.facebook.com/UKArgofloats/) and a Twitter account (twitter.com/ukargo). NOC also maintains the SOARC website (www.soarc.aq).

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;
- fields from global FOAM are also used to initialise the ocean component of coupled monthly-to-seasonal forecasts;
- Argo data are also used in the initialisation of ocean conditions in climate models run to make decadal predictions;
- a coupled ocean/atmosphere prediction system has been developed for weather forecasting timescales, and is now being run operationally, delivering ocean forecast information to the Copernicus Marine Environment Monitoring Service (CMEMS);
- near-surface Argo data are used to validate the output from the Met Office's OSTIA (Operational Sea Surface Temperature and Sea Ice Analysis), where the OSTIA fields are used as a lower boundary condition in numerical weather prediction models run by both the Met Office and ECMWF.

Two new Met Office systems which are in the process of being made ready for operational implementation are:

- an improved resolution version of global FOAM with 1/12 degree horizontal resolution, due for operational implementation in 2020. This will continue to make use of Argo data to constrain the T/S fields in the same way as the existing ¼ degree resolution system.
- a coupled weather forecasting system which is initialised using coupled data assimilation, due for operational implementation in 2021. Once this is implemented operationally Argo data will directly contribute to operational weather forecasts as well as 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.

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

- 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 colour data. A paper based on that work is currently in preparation.
- one other 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.

In the Hadley Centre for Climate Science, Argo data is used to make the following products:

- EN4 contains insitu 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/). In 2019 a user requirements survey was undertaken about EN4 and an updated version

incorporating more uncertainty information and an updated analysis system is due for release this year (EN5).
- 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, contributions to BAMS, Ocean Obs'19 White Paper and an upcoming Earth Energy Imbalance paper (von Schuckmann et al., 2020).

National Oceanography Centre

Argo data are used widely within NOC, where the science applications include:

- measurement of evolution and drivers of mixed layer processes in the (Indian Ocean);
- inventory and evolution of heat and freshwater establishing controls on budgets (both regional and global);
- deep heat content (N Atlantic).

Plymouth Marine Laboratory

PML have the lead for BGC Argo in the UK, where the data are used for:

- investigating different aspects of the biological carbon pump (e.g., mixed-layer pump, fragmentation);
- investigating export fluxes and efficiency in hypoxic ocean regions;
- providing a description of the physical environment in the framework of biological (e.g. mapping eel migration routes) and biogeochemical studies;
- developing techniques to generate 3D fields of biogeochemical variables by merging ocean colour and in-situ data;
- investigating mesoscale structures by combining altimetry and in-situ profiles with a special focus on Agulhas rings.

Delayed Mode QC

Core DMQC progress

The strategy adopted to deliver the support to national programmes focused on ensuring a high-quality approach and the progressive enhancement of expertise. This involved upgrading to the most updated DMQC software, adopting the latest reference databases and extensive training for DMQC operators in BODC. DMQC support was offered to any national programme requiring assistance, where BODC has significant physical oceanography expertise. BODC focused on supporting the UK and Irish Argo programmes, data for which are managed by the BODC Argo Data Assembly Centre (DAC) function. Recently BODC has provided support to Polish Argo programme with support in reviewing, providing advice in analysing Argo floats in delayed-mode and DMQC operator training.

The DMQC analysis has been undertaken on floats deployed in five different regions: the North Atlantic, the South Atlantic, the Southern Ocean, the Indian Ocean and a small number of floats in the Pacific Ocean. In some of the regions, such as the Pacific Ocean, this was the first time BODC had undertaken DMQC in the region. The analysis has been undertaken it separate batches for each of these regions, with floats that had already ceased functioning and those with a large number of profiles being prioritised. This approach provided the opportunity to gain a deeper understanding of the regional oceanography in each region, the variability in float behaviour over time, and the challenges this raises in DMQC.

This work has resulted in a significant improvement in the total amount of delayed-mode profiles delivered by BODC compared with available real-time mode data. From September 2019 until the time of writing, BODC had submitted around 22 527 profiles. The most recent statistics provided by Ifremer, from October 2020, shows that BODC had delivered around 75 % of delayed-mode data from all available data at the DAC. This is a significant improvement compared to the low-point in December 2018 where only around 45 % of profiles had been through DMQC, and this situation is expected to improve further in the coming year.

A combination of the strong focus on comprehensive training provided to BODC Argo team members and the diverse experience of DMQC ensures future sustainability in providing DMQC analysis and regular delivery of Argo data in delayed mode to the Argo Global Data Assembly Centres (GDACs).

DMQC workshop participation and coordination

NOC has undertaken the preparation of hosting the 2nd European Argo/7th International Argo Delayed-mode Workshop for CTD data in Liverpool, UK. This workshop aimed to include the DMQC analysis for both core (2000 m) and deep (4000 m-6000 m) Argo floats, with the latter being a focus of the EuroArgo RISE project WP3 on developing deep DMQC methods. The agenda and registration were advertised with the support of the Euro-Argo ERIC Office via *https://www.euro-argo.eu/News-Meetings/Meetings/Others/2020-DMQC-workshop*. The meeting was planned to happen from 12th May to 15th May 2020. However, due to the ongoing pandemic of COVID-19 virus, this workshop has been postponed. The next DMQC workshop for deep Argo floats is planned to be organised virtually in June/July 2021.

Contributions to DMQC cookbook for Core Argo parameters

BODC (Kamila Walicka) has contributed to the development of an Argo DMQC cookbook for core parameters (*DMQC_cookbook)* led by Ifremer. This contribution covers:

- The guidelines regarding DMQC workflow of Argo core data (pressure, temperature, salinity), providing a list of steps from getting R-files (uncalibrated real-time) from the GDAC to sending the D-files (calibrated delayed-mode) back;
- Description of examples of hydraulic or sensor problems;
- Creating a draft of a template (Clare Bellingham and Kamila Walicka) to produce a common DMQC report template for core Argo parameters of an individual float. The DMQC report template includes the detailed description of visual inspection of the float notes, comparison with satellite altimetry provided by CLS, the OWC configurations for the specific regions, diagnostic plots generated by OWC software, and scientific justification of the decisions made to determine a high-quality at-sea calibration for a given Argo float. The first draft of this template can be found in DMQC report template for core Argo data. The report template and Matlab codes used to generate it are available in a Euro-Argo ERIC GitHub repository dm-report-template.
- The summary of useful information about the water masses, reference data available in the Southern Ocean, aiming to help in the analysis of the floats in delayed mode, for instance, the parameterization of OWC software and the analysis of the results.

- Description of DMQC analysis and decision-making process of an example float deployed in the Southern Ocean.

Conversion of core Argo DMQC software OWC from Matlab to Python

From around September 2019, BODC (Edward Small, Kamila Walicka and Matt Donnelly) has started the conversion of the DMQC software currently available in Matlab to Python, as part of the MOCCA project. This initiative is closely associated with the results from a survey about the existing tool and methods used within DMQC Argo community, that was evaluated as a part of the EuroArgo RISE project WP2 last year. The survey identified barriers and opportunities to improve the efficiency and capacity of the overall community effort. For instance, it was identified that the existing DMQC software being written in Matlab - due to being paid-for licensed software - was a barrier for many institutions. A decision was reached to assess the potential for converting the OWC (Owens, Wong, Cabanes) Matlab code used for DMQC analysis to free software, with the widely used Python being the preferred language.

A year-long development project has consisted of several stages of conversion followed by phases of testing by a small group of DMQC operators and developers on blocks of code. The converted code is now functional, and ready for further User Acceptance Testing by broader Argo community to ensure it is ready for operational use. The development version of the OWC Python 'pyowc' package is currently available from the EuroArgo repository argodmqc_owc. The next steps to finalise the project are to complete the User Acceptance Testing involving the broader Argo community and reach an operational state. After this, development of the code will continue to improve its performance and enhance its functionality.

As part of the development work, there has been close collaboration with Guillaume Maze from Ifremer/LOPS to prepare the software package to be used as part of a Jupyter notebook. Combined with the potential to fully parallelize the analysis code, the conversion of OWC Matlab to OWC Python marks a step-change in capability and sets a new standard in quality control software development for the Argo community.

Deep DMQC

NOC (Kamila Walicka and Brian King) undertook a survey to review the current state of both the real-time and delayed-mode quality control (DMQC) approaches for deep Argo floats used within the global deep Argo community, producing a report based on this survey. This survey was a part of the EuroArgo RISE project WP3, deliverable D3.2_design_comparative_study_DMQC_methods_deep. One of the aims of this survey was to enhance an understanding of the current state of development and practice in deep Argo floats. The common tool used for delayed mode quality control of salinity data is the OWC software, which is currently used for the core Argo DMQC analysis. Some DMQC operators have used the standard core distribution of CTD reference data. Other groups have made use of ship-based CTD profiles collected at float deployments, however, such profiles are not available for all floats. Overall, the standardised methods and tools, mapping scales, reference data, interpreting estimates of salinity drift, thresholds and assignment of QC flags and error fields need to be investigated.

BODC started preparation of the 2nd European Argo-7th International Argo Delayed-mode QC Workshop for CTD data of core and deep Argo data, which was planned on 12-15 May 2020 in Liverpool, UK. The meeting was going to cover the review of Deep-Argo QC procedures used by the international deep Argo community. However, due to the ongoing pandemic of COVID-19 virus, this workshop has been postponed. The next DMQC workshop for deep Argo float data is going to be organised virtually in May 2021.

BGC DMQC
Progress on BGC DMQC has been started in December 2019 with UK Argo holding an oxygen and pH QC workshop between BODC DMQC operators and UK PIs, but progress since has been limited by staff availability and other more urgent demands. During 2021, more attention and progress on BGC DMQC, especially regarding oxygen and pH is expected under the EuroArgo RISE project WP4.

GDAC Functions

NERC Vocabulary Server
Following ADMT-20, BODC led the formation of the Argo Vocabulary Task Team, involving all those involved in managing the content and vocabulary experts at BODC. Since ADMT-20, most of the Argo reference tables have been converted into controlled vocabularies and hosted on the NERC Vocabulary Server (NVS) as part of the EU H2020 ENVRI-FAIR project. The remaining reference tables have been considered, problems identified and potential solutions scoped. Additionally, an assessment of potential opportunities to better constrain Argo metadata has been undertaken and will be investigated further during the course of the coming year. In addition, planning for enhancements of the NVS has been undertaken with development work planned for 2021, and initial training has been provided to Argo vocab editors. A dedicated presentation will be made to ADMT on this topic.

Southern Ocean Argo Regional Centre

Developing SOARC Partnership
In the past year a main focus for BODC has been leading a review of the European perspective on the functioning of Argo Regional Centres. In the context of SOARC this has led to a growth in the partnership to include AWI and additional representation from the US SOCCOM community, whilst Matt Donnelly has contributed to the Southern Ocean Observing system (SOOS) Data Management Sub-Committee (DMSC), and begun engaging with relevant SOOS working groups (WGs). Matt drafted a set of poster slides to promote Argo at the Weddell Sea and Dronning Maud Land WG meeting in October, which were delivered by Birgit Klein from BSH. The August 2020 meeting of the SOOS Observing System Design (OSD) WG was also attended with the aspiration of making better connections in this area of expertise.

Profile characterisation work
Through a collaboration with Kate Hendry, Rhiannon Jones and Luke Roberts at the University of Bristol, BODC has operationalised profile characterisation, with remaining development required to expose these for the benefit of users.

Regional data quality assessments
As part of the Euro Argo RISE project WP5, BODC will work with partners to establish regional data quality assessments in the Southern Ocean. This work has not progresses as far or as quickly as planned due to staff availability during 2020, but will be a major focus for 2021 and 2022.

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US NATIONAL DATA MANAGEMENT REPORT

21st ADMT

September 1, 2020 – November 21, 2020

STATUS

US Argo Data Assembly Center at AOML

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 2,613 floats and sent more than 99,00 profiles to the GDACs (timeliness statistics can be seen in Figure 1). 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 94,000 Argo profiles to GTS in the BUFR format (excluded from this are NAVOCEANO floats, which are sent to GTS by NAVOCEANO), where 95 % of them reached the system within the 24 hours. If floats with large delays are excluded (e.g. new deployments and floats under ice), then 94% of the profiles are available in 12 hours and 99% of the profiles are available in 24 hours. These numbers are almost identical to their counterpart for GDAC transmission.

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 1,258,118 R-files, 1,079,421 D-files, 68,816 BR-files, and 72,365 BD-files. The corresponding numbers for non-profile files are 8,172 meta, 7,476 tech, 7,505 Rtraj and 2,120 Dtraj files.

The US Argo DAC added 444 new floats to the processing system, 59 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

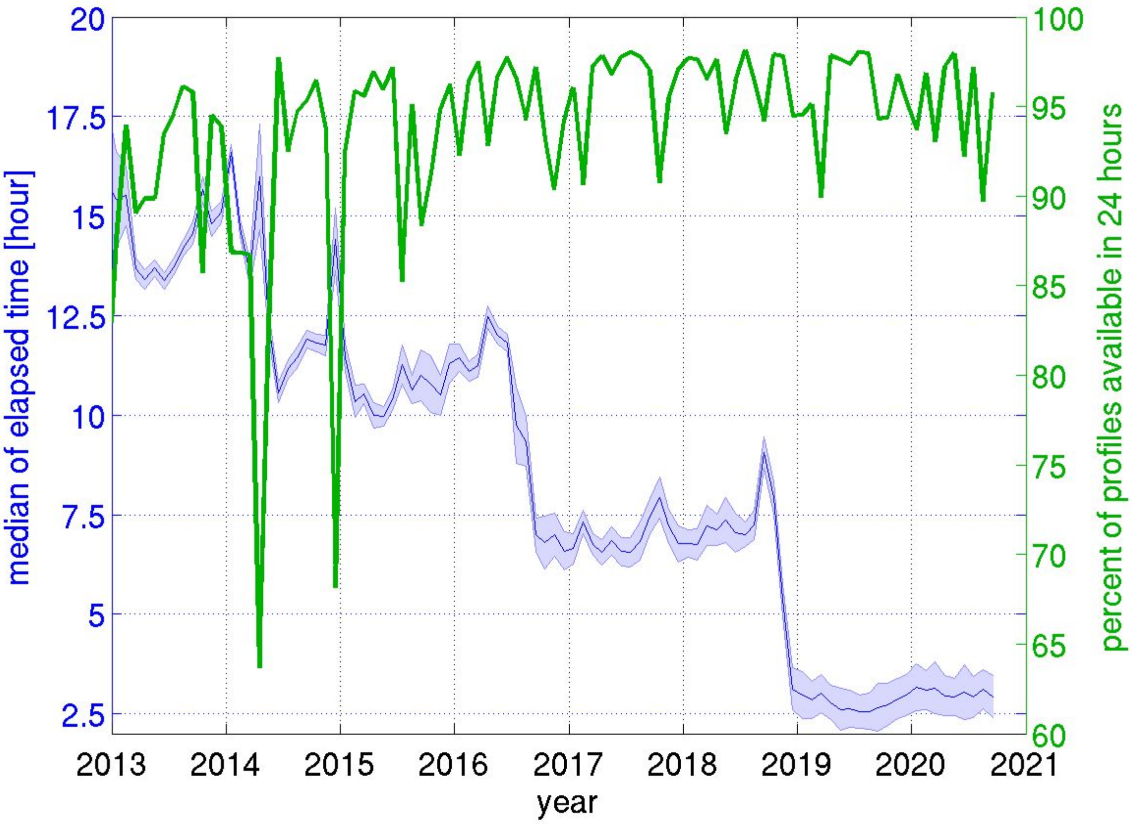

Figure 1: median of the difference between the time of the profile and the time of submission to the Argo GDACs (elapsed time, blue). The shading represents the standard error. The percentage of profiles available to users in 24 hours is also shown (green).

Developments at the US Argo DAC

2.3: Software Development at the US Argo Data Assembly Center (DAC)

During the current reporting period, two Argo team members retired and we hired replacements for them, who are making good progress. In addition to that we hired two team members with experience working with biogeochemical data that are taking on the development of the BGC data processing system in collaboration with the full US Argo team.

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. An upcoming change will be the addition of BGC data to the trajectory NetCDF file that currently only contains core Argo data (the redesign is currently being discussed and the specifications will be finalized after approval during the upcoming ADMT meeting). During this transition the DAC will also continue its work related to adding error ellipse information to the trajectory

NetCDF files.This became possible due to the transition to the web services approach for downloading the data from CLS (described below).

Implemented improvements to the software creating trajectory and meta files. For the former, the challenge was when certain measurement codes were missing in some data files (due to data transmission issues). For the latter the issue to tackle was discrepancies between the launch configuration provided by the float owner and the configuration transmitted by the float. The improved tracking improves the ability to have the best possible configuration information in the NetCDF meta files.   for better data quality, error-tracking and messaging. Improvements were also implemented to trap cases with positions on land and/or times that are before deployment. This helps determine if the cause is bad data transmission or a mistake in the provided launch time or a combination of both.

The quality control reports based on an objective analysis continues evolving, partly due to our feedback. This evolution requires upgrades to our software handling the suggested revisions of the quality control flags.

US Argo deployed the first APEX Iridium floats with the RBR CTD. This float measures three pressure, temperature and salinity profiles. What remains to be added for such floats is the secondary temperature measured inside the conductivity cell. The DAC adapted the decoding and quality control software to accommodate these floats. The DAC also helped the hurricane floats group at AOML by developing a decoder for ALAMO floats purchased from MRV. The Argo team used its expertise running a parallel processing system for data from hurricane floats deployed by WHOI for this purpose. This decoder will come in useful as the SOLO Iridium float with BGC sensors are being developed.

With respect to BGC Argo, the US Argo DAC updated the oxygen processing in the decoders for APEX and NAVIS floats using Iridium for data transmission to comply with the specifications in the cookbook written by the BGC data management team. The impact of changes related to the computation of oxygen are shown in Figure AOML 8 (more information on this is given below). We also wrote the decoding components for pH, chlorophyll, backscatter, CDOM, and nitrate data from these floats (Figure AOML 7 shows which types of sensors have been installed on US floats) and came up with a design of the output files to be used during the quality control process. AOML is collaborating closely with MBARI, UW (the main groups with experience with APEX and NAVIS type BGC floats) and SIO (the developer of the SOLO type BGC floats) on standardized formats for this.

The US Argo DAC developed software to transition from downloading Argos data from CLS via telnet to a web-based system to comply with new security requirements implemented by NOAA. The Argo team helped the drifter group at AOML to implement this software, including producing output files that are compatible with the processing system used for their drifter data. Because there is a random issue with the web-based system, we are working with CLS to help them identify the problem by providing examples and sending them alerts when the problem occurs. For Iridium floats, the US Argo DAC transitioned the software to download emails with sbd data to use two-step verification for security reasons.

Information in the meta files controlling the software have been implemented to conform with ADMT requirements related to BGC sensors as well as now CTD sensors. This required changes to the software that creates meta NetCDF files.

Due to the 1024 week rollover problem of the GPS clock software changes were implemented to detect and correct the corrupted dates. The GPS rollover problem ended up resetting the float clock for some float types about 6 months after the rollover date (year was stored as two digits; therefore in October 2019 the year 2099 became 1999 which allowed a date reset by the firmware on the float).

- Implemented sftp based gateway for PMEL to directly submit meta files to AOML using automated script.
- Updated AOML's ftp download programs to be able to receive "dura" and "isus" files from University of Washington

Decoding software for APEX and NAVIS iridium floats has been revised to capture flaws in the received data files (for example, binary characters). This ensures that profile data can be decoded even if there are some bad data inside the msg files. Warnings from the quality control software allow for fixes to the files if required configuration data are corrupted and can be corrected based on the corresponding information from other cycles or the pre-deployment meta files.

The automatized process for new meta files needed to process all floats has been updated to ensure that the vertical sampling scheme provided is consistent with the number of profiles sent by a float and follows ADMT formatting requirements.

DELAYED MODE QC:

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/PMEL

As of 18 November 2020, PMEL had 194,681 D-files at the GDAC that were more than one year old, comprising 88% of the total of 220,238 PMEL profiles that were older than one year at that time. Last year, on 25 September 2019, PMEL had 186,159 D-files at the GDAC that were more than one year old, comprising 94% of the total of 197,302

PMEL profiles that were older than one year at that time. So, John Lyman's and Kristene McTaggart's DMQC efforts resulted in a net increase of 8,522 DMQC profiles for profiles older than one year, slightly more than one-third of the 22,936 profiles that became older than one year during that time. This reduction in the DMQC rate was partly owing to the challenges of COVID-19 and teleworking since March. McTaggart's DMQC contributions were also reduced this year owing to a GO-SHIP field season that was made quite challenging by the onset of the COVID-19 pandemic.

Lyman and McTaggart are continuing their DMQC work. Lyman is also continuing work on streamlining our DMQC GUIs and processing. As an alternative to the SIO GUI1 routine, he has developed an alternative flagging routine that displays more windows with more plotting options, including plotting just the profiles that have bad flags versus all profiles that have been autocorrected. There is an option to QC all or some profiles, an option to save data in order to come back to it later without losing your work, and an option to view previously QC'd profiles. A very useful option displays buoyancy frequency to identify density inversions. This GUI allows us to evaluate profiles faster and with greater accuracy.

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. We overwrite the raw Param_QC flags during this step as required. We use COWG Version1.1, currently with CTD (2018V02) and Argo (2018V01) reference databases, and adjust run parameters to get appropriate recommended salinity adjustments. Errors in COWG are computed directly from the least squares fit. We accept or reject the COWG recommendations on the basis of comparison with nearly historical profiles using a new PMEL GUI recently 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 275,219 Argo stations (profiles). This is an increase of 26,221 stations (718 nominal float years) since the previous Argo Data Management Team (ADMT) Report (September 17, 2019). This count represents 97.7% of the SIO DMQC-eligible stations (older than 12 months). The above numbers include SIO Core and Deep Argo floats, all Argo New Zealand floats, 5 NAVOCEANO floats deployed from the Peruvian vessel Zimic, and 1 floats donated to Argo Mexico.

SIO expects to maintain a high DMQC completion percentage during the coming year and will continue to revisit the profile data of floats every 7-9 months. The consensus standard DMQC procedures for SOLO/SOLOII/Deep profile data were continued in 2020.

To increase the timeliness of arrival of data to the GDAC, SIO floats now are telemetered via directIP as well as the traditional SBD emails. The directIP route has proven more reliable, although both channels continue to be used for complete data return. The data from the two are merged prior to parsing the data.

SIO has actively participated in moving forward the priorities of the Argo Program during the year, most notably by Megan Scanderbeg's continued work with the BGC trajectory file. SIO continues to update the Argo Climatological Dataset for OW salinity calibration. John Gilson has worked with Susan Wijffels (WHOI), updating the change in behavior over time (serial number ranges) of the SBE41 and SBE41CP CTD sensor stability. Nathalie Zilbermann, Sarah Purkey, and Dean Roemmich have worked with Seabird to improve the calibration of the SBE61 CTD (0-6000dbar capability).

The SIO IDG built and designed SOLOII/Deep SOLO float firmware has been unchanged over the course of the year, except for minor internal bug fixes. A float utilizing the RBR CTD has been developed and deployed (5906383). It's performance will be assessed over the next few months.

University of Washington

Delayed mode processing at UW has produced 43,318 D-files and 10,216 BD-files for the year 2020. In terms of active floats (those that have transmitted new data within the last two years), the UW fleet is 90 % up to date with respect to core (P, T, S) Argo profiles. With respect to both active and legacy floats equipped with DOXY, UW floats that are not handled by MBARI are 95 % up to date.

Lastly, work has begun to investigate dynamic corrections of salinity data from RBR 2000dbar CTD.

MBARI (Monterey Bay Aquarium Research Institute)

Since ADMT20 (Oct 10, 2019), MBARI has incorporated 48 new deployments into its BGC processing system. These included 45 APEX (APf11) and 3 Navis floats. 34 of these (including all 3 Navis) were deployed in the Southern Ocean as part of the SOCCOM project with oxygen, nitrate, pH, chlorophyll fluorescence and particle backscatter sensors, except for 10 that did not include bio-optics. Data from 3 similar APEX floats deployed recently in the California Current by NOAA/PMEL were also part of this year's cohort of floats incorporated into processing. Data from 11 APEX floats equipped with oxygen, pH, chlorophyll and backscatter, as well as PAL acoustic sensors that have been deployed over the past year in the equatorial Pacific for the NOAA TPOS program were incorporated into the processing system as well.

pH and nitrate sensors deployed on APEX floats are a mix of MBARI or Sea-Bird sensors, and all are calibrated at MBARI. MBARI data activities over the last year have been focused primarily on: (1) maintaining production for sensor build and real-time operational BGC float processing requirements, (2) working toward improvements to sensor design & performance, and (3) enhancing real time and delayed mode processing methods for select BGC sensor data. More details on these topics can be found in related documents and reports from ADMT21 BGC sessions. Scaling up the current system at MBARI has also been a focus. NSF funding for the SOCCOM project has been extended to 2024, and the NSF

Mid-Scale Research Infrastructure proposal to fund the deployment of 500 additional BGC profiling floats throughout the global ocean, a multi-institutional project termed the Global Ocean Biogeochemistry (GO-BGC) Array, has been granted. In anticipation of GO-BGC, the UW/MBARI team is starting to prepare for the processing of radiometry data which will be included on GO-BGC floats (in addition to the standard suite of BGC sensor data as is returned from SOCCOM floats).

Additionally, MBARI continues to generate Argo B-files in real time and delayed mode for submission to the GDAC through AOML and has been supporting AOML in the development of their own institutional BGC-processing capabilities. MBARI continues to conduct the oxygen data audit and has recently QCd and adjusted 30 historic oxygen floats deployed by WHOI and submitted the B-files to the AOML DAC. MBARI-developed BGC data quality assessment tools and reports, such as the oxygen audit and MATLAB SAGE and SAGE-O2 GUIs for DMQC of chemical data, are being utilized by other DACs as well to increase the level of adjusted BGC data on the GDAC available to users.

Wood Hole Oceanographic Institution

During the period October 1, 2019 to September 30, 2020, WHOI deployed 40 Argo floats and reported 15866 profiles to the GDAC from 416 unique platforms. The total number of WHOI profiles at the GDAC is now 221987 profiles: 173546 D-files (an increase of 30,000 since prior year), and 48441 R-files. Of the profiles eligible for DMQC, 83.8% have been completed.

The last of the SOLO WHOI ARGOS floats ceased reporting this year so the entirety of the WHOI fleet now communicates via IRIDIUM. The majority of floats are MRV S2A platforms (343 active) however WHOI continues with testing and limited deployments of the MRV ALTO platform with currently 22 ALTOs operating.

Deb West-Mack has made great progress against the backlog of overdue R-files and continues development of software to DM R-trajectory files for the suite of WHOI platform types. Sachiko Yoshida at WHOI continues to work on DMQC of core WHOI floats and NAS-funded floats in the Gulf of Mexico. Pelle Robbins has improved tools for tracking flow of real-time data and highlighting problems as they arise. Frank Bahr performs profile DMQC on WHOI floats in the Atlantic and has been developing tools for filling missing position information.

WHOI has helped coordinate the Argo RBR Data Task Team. Several Task Team virtual meetings have been held, and progress is being made on assessing drift, conductivity/pressure calibrations, testing dynamic error (both fast and slow) correction schemes. Work is currently focussed on new pilot float data from CSIRO, which have just recently been deployed.

WHOI has also put in place the decoders and processes to receive, manage and forward deep and BGC data, in anticipation of deployments in early 2021. One issue that should be considered by the ADMT is the management and access of ship-based deployment profiles for deep, BGC and also RBR pilot floats. Should Argo work towards a more uniform approach to the storage and access to these data?