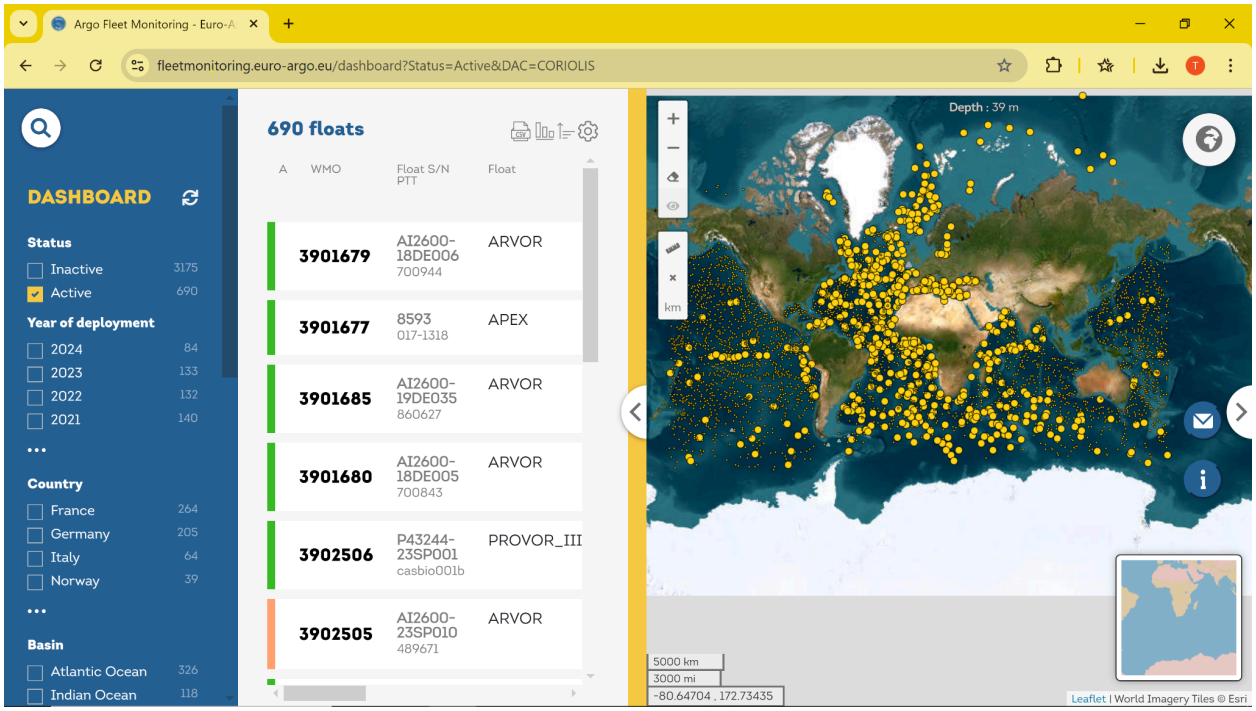
Argo National Data Management Report for ADMT-25

Coriolis DAC - GDAC - NAARC

October 10th 2024, version 1.0.0
https://doi.org/10.13155/102566



Coriolis DAC floats (690 active, 3175 inactive for a total of 3865 floats), see https://fleetmonitoring.euro-argo.eu

Each country is asked to send a National Report using this document as a guide for the material to be reported. As we take steps to modernize the real time processing chain, we have changed the format for the Real Time Status to help better understand the current status at each DAC. We also updated several other section prompts and ask that you use this updated template when writing your report.

Reports are DUE: 10 October 2024

1. Real Time Status

Please report the status of your real time data processing for all Argo Missions, including pilots. If you have not yet implemented the tasks, please give us an estimate of when you expect the task to be completed. Here are some questions to answer:

- How many floats are you currently processing & what type are they?

Active floats

Float family	**Number of versions**	**Number of floats*** (*approximate)
Arvor	9	518
Provor	4	70
Arvor deep	2	41
Provor Jumbo	5	30
Apex	8	27
Arvor coastal	2	4
Nova	1	1
Total	31	691

All floats

Float family	**Number of versions**	**Number of floats*** (*approximate)
Arvor	20	1405
Apex	81	947
Provor	55	903
Nemo	8	174
Deep Arvor	10	139
Nova	3	85

Arvor_C (coastal)	4	45
Provor jumbo	5	34
BGC Navis	1	3
Total	187	3735

- How many different sensors are you currently processing?

Parameters	**Type(s) of sensor for that parameter**
Temperature: 15 sensors, 3865 floats	FSI FSI RBR RBR_ARGO3 SBE SBE41 SBE SBE41_V3 SBE SBE41CP SBE SBE41CP_V1.2 SBE SBE41CP_V1.3 SBE SBE41CP_V1.4 SBE SBE41CP_V2 SBE SBE41CP_V3.0c SBE SBE41CP_V7.2.3 SBE SBE41CP_V7.2.5 SBE SBE41N SBE SBE41N_V5.3.0 SBE SBE41N_V5.3.4
Salinity: 14 sensors, 3453 floats	FSI FSI RBR RBR_ARGO3 SBE SBE41 SBE SBE41_V3 SBE SBE41CP SBE SBE41CP_V1.2 SBE SBE41CP_V1.3 SBE SBE41CP_V1.4 SBE SBE41CP_V2 SBE SBE41CP_V7.2.3 SBE SBE41CP_V7.2.5 SBE SBE41N SBE SBE41N_V5.3.0 SBE SBE41N_V5.3.4
Oxygen: 5 sensors, 784 floats	AANDERAA AANDERAA_OPTODE_3830 AANDERAA AANDERAA_OPTODE_3835 AANDERAA AANDERAA_OPTODE_4330 SBE SBE43F_IDO

	SBE SBE63_OPTODE
NO3: 1 sensors, 121 floats	SATLANTIC SUNA_V2
pH: 1 sensor, 93 floats	SBE SEAFET
Chla: 7 sensors, 355 floats	WETLABS ECO_FLBB WETLABS ECO_FLBB_2K WETLABS ECO_FLBB_AP2 WETLABS ECO_FLBB2 WETLABS ECO_FLBBCD SBE ECO_FLBBFL WETLABS ECO_FLNTU
BBP: 6 sensors, 339 floats	WETLABS ECO_FLBB WETLABS ECO_FLBB_2K WETLABS ECO_FLBB_AP2 WETLABS ECO_FLBB2 WETLABS ECO_FLBBCD SBE ECO_FLBBFL
Irradiance: 2 sensors, 289 floats	SATLANTIC_OCR504_ICSW TRIOS RAMSES_ACC
Turbidity: 1 sensor, 14 floats	WETLABS ECO_FLNTU

New Sensors you have begun processing (either deployed in past 12 months or expected in the next few months)	**Have all the Argo vocabularies been implemented to accommodate the sensor? (Yes, No, In progress)**
UVP (particles size distribution and taxonomic classification)	Yes (36 floats)
RAMSES (Hyperspectral radiometer) ACC(irradiance) ARC(radiance)	In progress (21 floats)
TRIOS OPUS (NO3 sensor)	In progress (2 floats)
NKE PAL Acoustic sensor (parameters : rain, wave, anthropic noise)	No (no float deployed yet)
4H-JENA HYDROC_CO2	In progress (3 floats, data in “aux” directory)

- What is the status of BGC processing and RTQC test implementation? See here to get the version of manuals you are using to process and qc the BGC variables or : Documentation - Argo Data Management (argodatamgt.org) If your floats **do not** include a listed parameter, please enter 'N/A' (Not Applicable); if your floats **do** include the listed parameter, but you have not yet implemented processing for this parameter, please enter 'N/I' (Not Implemented).

parameter	**Processing cookbook version you are using (ie, current or version 2.0 Oct 2018)**	**QC manual version you are using (ie, current or version 2.0 Oct 2018)**	**Notes on when changes will be made to update to latest version**
oxygen	2.3.3	2.1	-
NO3	1.2.2	1.0	-
pH	1.2	1.0	-
Chla	1.0	3.0	We are planning to update the QC document to report the use of a look-up table for the multiplicative factor to be used for the RT adjustment
bbp	1.4	1.0	-
irradiance	1.1	1.0	We are planning to update the QC document to report the DM procedure (github repository, SCIENTIFIC_CALIB_xx examples)

- What is the status of RBR data processing (if applicable)? Are you adjusting salinity in real time? See DACs with floats with RBR CTDs to implement real-time salinity adjustment as per QC Manual, and flag PSAL_ADJUSTED_QC = '1' in 'A' mode. Real time adjusted data can be distributed onto GTS · Issue #55 · OneArgo/ADMT (github.com)

RBRargo3 2K model	Are you filling Adjusted data (A mode) following User Manual 3.8 instructions?	Notes or additional information
pre-April 2021	yes	Since Coriolis decoder version 048a (april 6th 2022)
post-April 2021	yes	Since Coriolis decoder version 048a (april 6th 2022)

- Are you regularly applying real time adjustments for the following items:
    - Salinity adjustments
    - Cpcor for deep floats
    - BGC parameters (if so, which ones)

	Yes/No for current R files	Are you going back to make adjustments on all available R files when new adjustment comes in?	Notes or additional information
Salinity adjustment	yes	yes	-
Cpcor adjustment for deep floats	yes	yes	-
oxygen	yes	yes	-
no3	yes	yes	We still need to write specifications to apply in the new incoming R files an adjustment based on a previous DM adjustment
pH	no	no	-
chla	yes	yes	-

bbp	NA	NA	We push BBP=>BBP_ADJUSTED after RTQC, following the recommendations
irradiance	NA	NA	No procedure defined yet

- What data are you sending onto the GTS?

Temperature, salinity, oxygen, chlorophyll-A, nitrate, pH, BBP700 are distributed on GTS as BUFR messages.

The Argo BUFR template is “3-15-003”. The Coriolis DAC identifier is “IOPX01_LFVX”.

- What data is going to the aux directory?
    - UVP for particles size distribution and taxonomic classification
    - FL2BB for CHLA435
    - RAMSES radiometric hyperspectral data
    - OPUS (TRIOS) data for nitrate estimation
    - MPE (Biospherical instruments inc) for PAR estimation
    - Acoustic geolocation estimated by RAFOS data

All the files are distributed in NetCDF format and there is an index gathering the information that helps in finding the data efficiently.
https://data-argo.ifremer.fr/etc/argo-index/argo_aux-profile_index.txt

- *Are you automatically greylisting questionable floats detected by min/max test?*

No, a visual inspection by a specialist is performed before greylisting parameters on a float. This is performed daily (only working days).

- *What is the status of the transition to v3.2 trajectory files? When do you think you will be ready to stop acceptance of v3.1 Btraj files?*

The transition to v3.2 trajectory files was completed in 2022.
We still have a backlog of 25% of trajectory files in version v2.3, we gradually convert them into v3.2 format. The conversion is complex because of missing metadata.

- *Do you have any code to share with other DACs? If so, where is that available?*

Coriolis Argo floats data processing chain
The Coriolis Argo floats data processing chain https://doi.org/10.17882/45589 is freely available, under a CC-BY license. It has been updated once a month (new features, patches) since 2010.

The data processing chain is also available from GitHub as a docker container, to be activated where needed. It does not require Matlab.
https://github.com/euroargodev/Coriolis-data-processing-chain-for-Argo-floats-container

LOCODOX, software for adjusting Argo oxygen profiles
A MATLAB based interactive software that corrects dissolved oxygen concentration data acquired by Argo profiling floats. The correction schemes are based on Takeshita et al (2013) and Bittig and Kortzinger (2018). Three types of correction are proposed : a pressure dependent correction, a time drift correction and a slope/ offset correction (also called Gain correction).
https://github.com/euroargodev/LOCODOX

Argo DMQC float salinity calibration software
This software is a python implementation of the "OWC" salinity calibration method used in Argo floats Delayed Mode Quality Control.
https://github.com/euroargodev/argodmqc_owc

Scoop-Argo: visual quality control of Argo NetCDF profiles
Visual inspection and expert quality control of Argo profiles
https://doi.org/10.17882/48531

Virtual fleet: make and analyse simulations of virtual Argo float trajectories
Using a 3D velocity fields, program your own Argo floats behaviour, set up a deployment plan and simulate trajectories (and sampling) of your virtual fleet of Argo floats.
VirtualFleet uses Parcels as a Lagrangian framework to simulate Argo floats and to compute trajectories.
https://github.com/euroargodev/VirtualFleet

DMQC_status_and_statistics Figures for DMQC statistics for a given list of floats
This script computes DMQC statistics for a given list of floats
https://github.com/euroargodev/DMQC_status_and_statistics

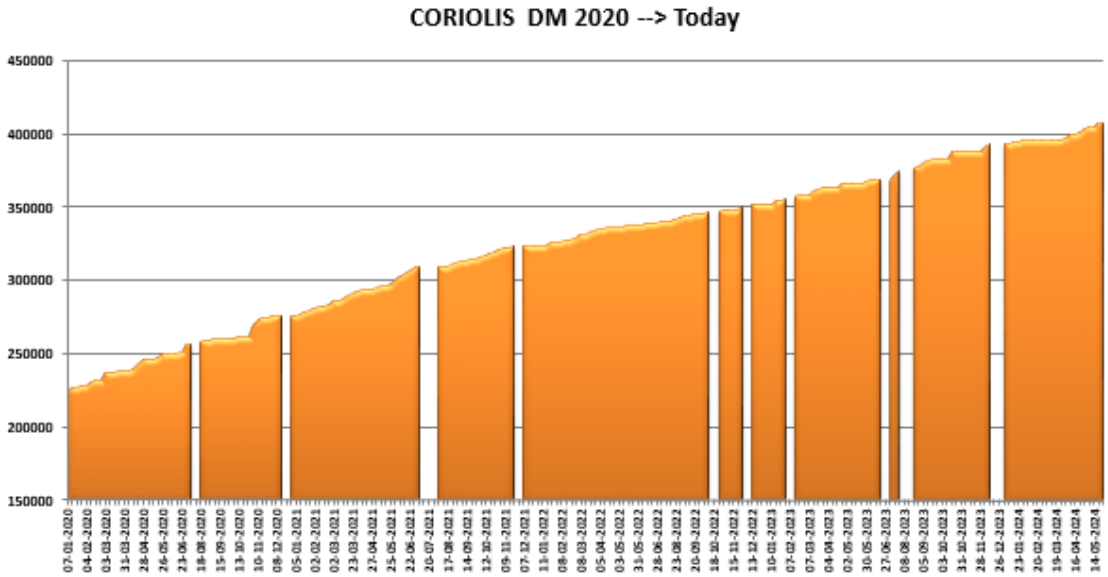
Coriolis under-ice positioning algorithm
Coriolis implementation of the “Terrain-following interpolation for under-ice floats” method presented by Kaihe Yamazaki at ADMT-22.
https://github.com/euroargodev/Coriolis-under-ice-positioning

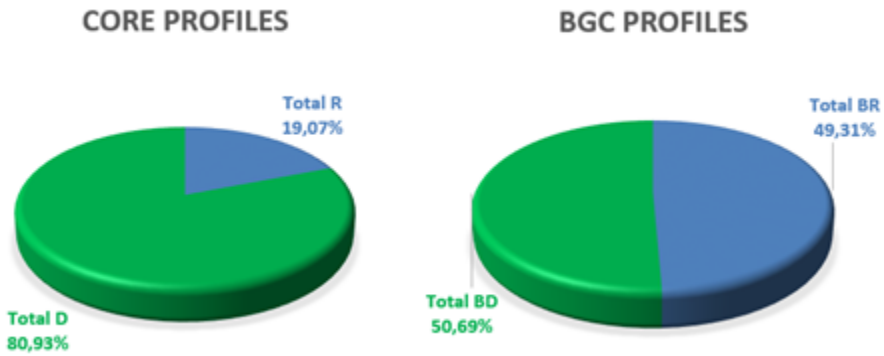
Argo life expectancy analysis
Plots the status of a list of floats regarding a configuration parameter and splitting the results depending on the country, deployment date and float model
https://github.com/euroargodev/Argo_life_expectancy_analyses

2. Delayed Mode QC status

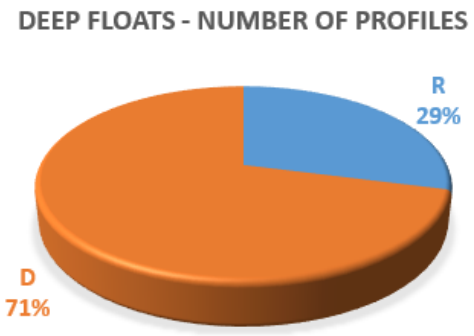
This section of the report is for reporting on the status of DMQC in your country and is the place to share your progress, your challenges, your concerns and any links to shareable tools or code. The following questions to help guide you:

DM on Core profiles: Over the past 5 years, a major effort has been made to steadily improve the quality control status of the delayed mode. During the last year (October 2023 to October 2024), 40205 new delayed mode profiles were produced and validated by PIs. A total of 423711 delayed mode profiles have been produced and validated since 2005.





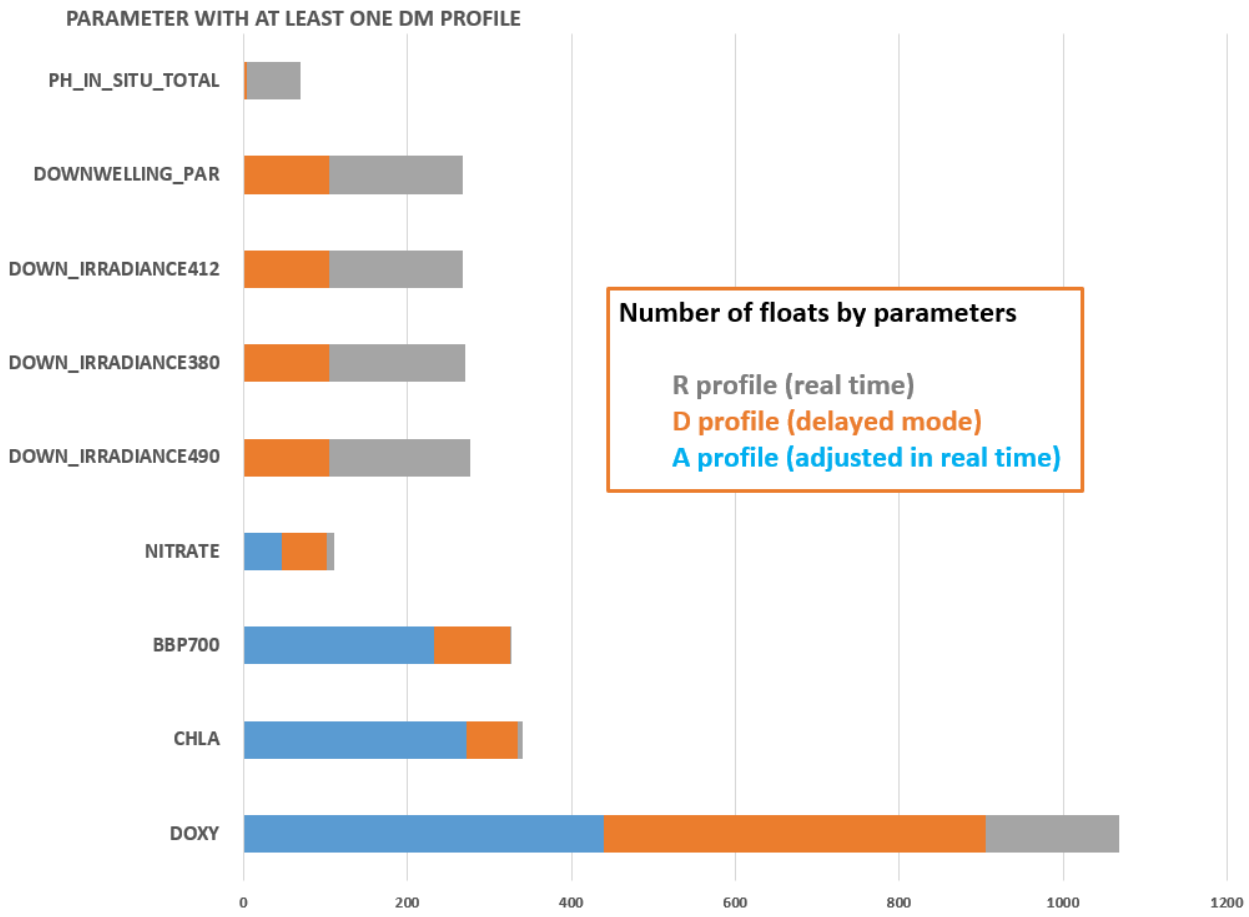
Looking more in detail to focus on Depp Argo data, a great effort has also been made to increase the count of delayed mode profiles : 71% of Deep Argo profiles have been processed in delayed mode (compared to the last year where 58% were processed).



DM on BGC profiles: The status of the quality control done on the Coriolis BGC floats is presented in the following plot for some BGC parameters. Some parameters are regularly updated in DM mode (DOXY,CHLA, BBP, IRRADIANCE).

Presently, only the CHLA in the Mediterranean Sea data has been Dmoded. Once the new adjustment in real time for CHLA will be in place in all the DACs, we will be able to push data at the global scale (https://doi.org/10.17882/102324).

For all BGC parameters, marginal seas like Black Sea and Baltic Sea are very specific (OMZ, depth) and by way of consequence, we need to develop very specific procedures to be able to perform DM. (These issues should be addressed in the EuroArgo One project).



Status of the quality control done on BGC floats.
Float for which at least one profile has been performed in delayed mode for the parameter.

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

<u>DM mode trajectory files:</u>

- What is the status of delayed mode trajectory files? Have you created any dmode trajectory files? If not, what are the reasons? If you have, would you be interested in sharing your experiences with others?

We do not yet distribute delayed mode trajectory (TRAJ-DM), we may start in 2024 as we have already completed these three preparatory steps:

- Definition of a DM process
- Implementation of dedicated tools

- Generation of few TRAJ-DM files (core floats) based on ANDRO project files (for cycle timings, grounding and RPP) and on DM profile files (for sensor measurements adjustment).

- How are you implementing BGC dmode - by parameter or one expert does all parameters?

Very few experts perform all parameters (1-2), with the support of specific parameter experts, but training is on-going work. Focusing on DOXY, the expertise relies on a more robust team.

- *What challenges have you encountered and how have you dealt with them?*

Because of numerous failing sensors, performing DM on pH is still very challenging.

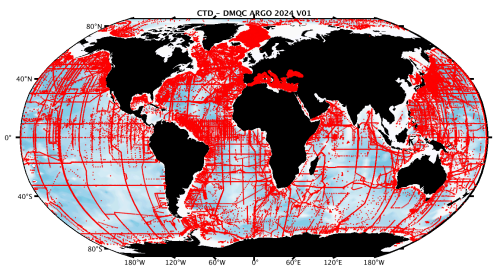
- *Do you have any code or tools you'd like to share with other DM operators? If so, where is that available?*

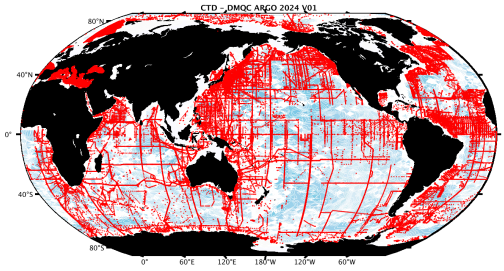
Regarding "official" BGC-DM tools, they are available at https://biogeochemical-argo.org/data-tools.php (Scoop-Argo, Locodox, BGC DM files writer) and on the euroargodev repository (https://github.com/euroargodev/radiometry_QC)

CTD Reference database for DMQC

A version 2024_V01 was provided in February 2024. In this version, these elements were taken into account ➕

- corrections following the feedback received by the users
- CTD from the last EasyOcean product
- CTD from CCHDO (mainly for the Argo DMQC), some are in the arctic area
- CTD provided by scientists
- CTD from WOD (Ocean Climate Library)



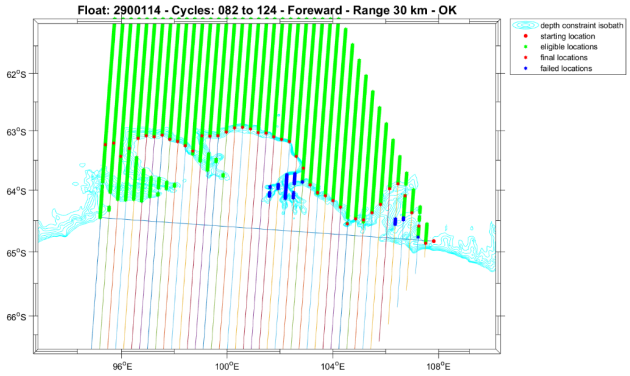


A new version is in preparation, taking into account feedback from A-ARC for corrections to certain boxes, as well as CTDs from CCHDO (public and confidential). A request was also made

by the polar team mission to consider all CTDs in the polar regions, with no restrictions on the depth threshold to be taken into account.

BGC-Argo QC cloud workbench
Within the EU project FAIR-EASE, we develop a web service, aiming at facilitating the use of quality control tools for the qualification (flagging measurements), the calibration and validation (comparison with different reference dataset). by ignoring the various programming languages, the differences in vocabularies and data location.
More on https://fairease.eu

Coriolis under-ice positioning algorithm
Coriolis implementation of the “Terrain-following interpolation for under-ice floats” method presented by Kaihe Yamazaki at ADMT-22. Shared with BSH (Birgit Klein).
https://github.com/euroargodev/Coriolis-under-ice-positioning



- *Do you have any concerns you’d like to bring to the ADMT?*

The majority of BGC-Argo activity is funded by project. A sustainable operational funding is much needed to implement OneArgo program.

3. Value Added items

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

A non exhaustive list of national Argo programs related to Coriolis DAC
- Euro-Argo ERIC https://www.euro-argo.eu

- Argo France
- Argo Germany
- Argo Ireland
- Argo Italy
- Argo Norway
- Argo Poland
- Argo España
- Greek Argo

Major web interfaces on Argo data

- The Argo fleet monitoring: https://fleetmonitoring.euro-argo.eu
- The Argo data selection: https://dataselection.euro-argo.eu
- The Argo floats recovery: https://floatrecovery.euro-argo.eu

Argo FAIR data services

Developed within the ENVRI-FAIR project and enhanced within FAIR-EASE and ENVRI-Hub-Next projects

- Argo GDAC https://doi.org/10.17882/42182
- OpenSearch API https://opensearch.ifremer.fr
  Adopted by Copernicus Eumetsat for Argo-satellite matchup, Blue-Cloud
  Example of request
- Metadata API https://fleetmonitoring.euro-argo.eu/swagger-ui.html#
  On top of Elasticsearch, adopted by Argo floats dashboard
- Data API https://dataselection.euro-argo.eu/swagger-ui.html#
  On top of Cassandra, adopted by Argo data subsetting or data visualization
- ERDDAP API https://www.ifremer.fr/erddap/index.html
  Example of request
- OGC SensorThings API https://sextant.ifremer.fr/examind/WS/sts/coriolis/v1.1
  Example of client https://isi-sbx.ifremer.fr/sextant/SensorThings/ifremer-webui
- Argo vocabulary server
  http://www.argodatamgt.org/Documentation/Argo-vocabulary-server
  Example of request
- Argo ontology
  http://www.argodatamgt.org/Documentation/Argo-vocabulary-server/Argo-linked-data-and-SPARQL-endpoint
  Explore the ontology
- Argo SPARQL endpoint https://sparql.ifremer.fr/argo/query
  Example of request
- Argo S3 server https://registry.opendata.aws/argo-gdac-marinedata/

- Known National Argo data usage
    - Please list known operational centers using Argo data in your country in this table:

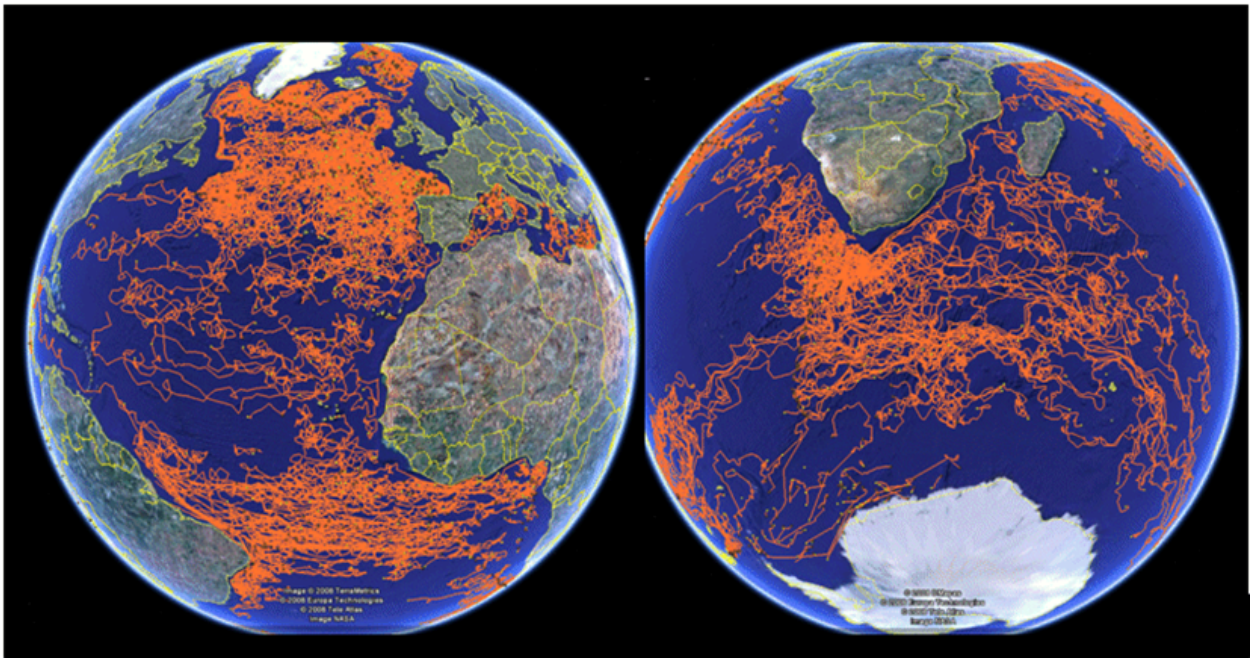
Operational center	**Contact (name, email), if known**	**What data do they use?** (for example, core, BGC, all profile data, trajectory data)
Copernicus Marine	https://help.marine.copernicus.eu	Core-Argo, BGC-Argo, Deep-Argo profiles
SeaDataNet	https://www.seadatanet.org/sendform/contact	Core-Argo, BGC-Argo, Deep-Argo profiles
EMODnet chemistry	-	BGC-Argo profiles
SHOM Hycom operational model	-	Core-Argo profiles

- Products generated from Argo data that can be shared

Sub-surface currents ANDRO Atlas

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

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



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

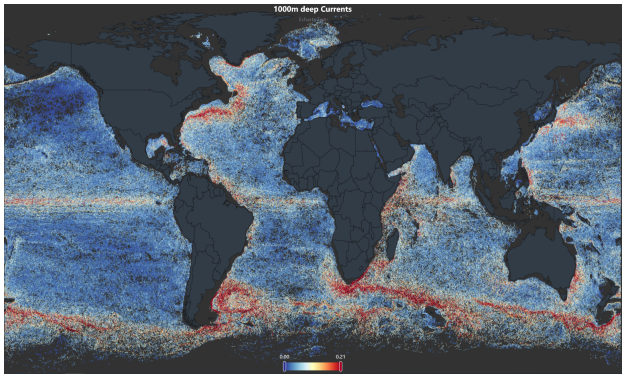
Sub-surface currents real time data

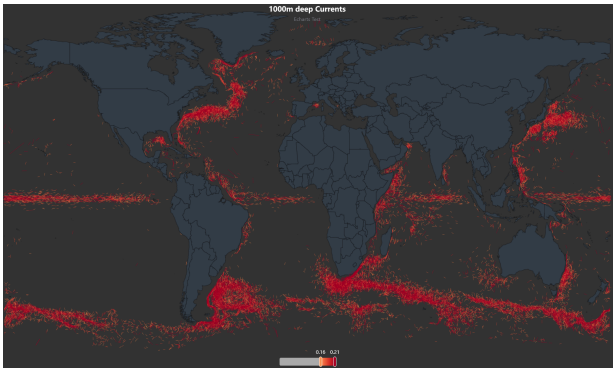
The Argo current product produced by Copernicus marine in situ is derived from the original trajectory data from Argo GDAC (Global Data Assembly Center). The Argo currents are calculated from Argo trajectories format version 3.1 or higher; the previous formats are ignored (2.*, 3.0).

It is daily updated and available from https://doi.org/10.48670/moi-00041

In November 2023 release, two significant improvements are implemented:

- A series of 20 quality control tests is applied on each Argo trajectory file documented in *Herbert Gaelle (2020). Qualification temps réel des données trajectoire des flotteurs Argo. https://doi.org/10.13155/95169*
- The currents are calculated with the Ollitrault-Rannou method documented in *Ollitrault Michel, Rannou Jean-Philippe (2013). ANDRO Dataset contents and format. https://archimer.ifremer.fr/doc/00360/47126*





Map of Argo deep ocean currents, each dot represents the deep ocean current from one cycle (typically 10 days) from one float
From dark blue dot: 0 meter/second, to red dot: 2 meter/second

Copernicus Marine real-time currents derived from Argo floats trajectories
https://doi.org/10.48670/moi-00041
The Argo current product produced by Copernicus marine in situ is derived from the original trajectory data from Argo GDAC (Global Data Assembly Center). The Argo currents are calculated from Argo trajectories format version 3.1 or higher; the previous formats are ignored (2.*, 3.0).

- The currents are calculated with the Ollitrault-Rannou method documented in Ollitrault Michel, Rannou Jean-Philippe (2013). ANDRO Dataset contents and format. https://archimer.ifremer.fr/doc/00360/47126
- Quality control: a series of 20 quality control tests is applied on each Argo trajectory file documented in Herbert Gaelle (2020). Qualification temps réel des données trajectoire des flotteurs Argo. https://doi.org/10.13155/95169

- *Publicly available software tools to access*

Coriolis Argo floats data processing chain https://doi.org/10.17882/45589

Coriolis Argo floats data processing chain embed in a docker container
https://github.com/euroargodev/Coriolis-data-processing-chain-for-Argo-floats-container

Argo NetCDF file format checker https://github.com/OneArgo/ArgoFormatChecker

4. GDAC Functions

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

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

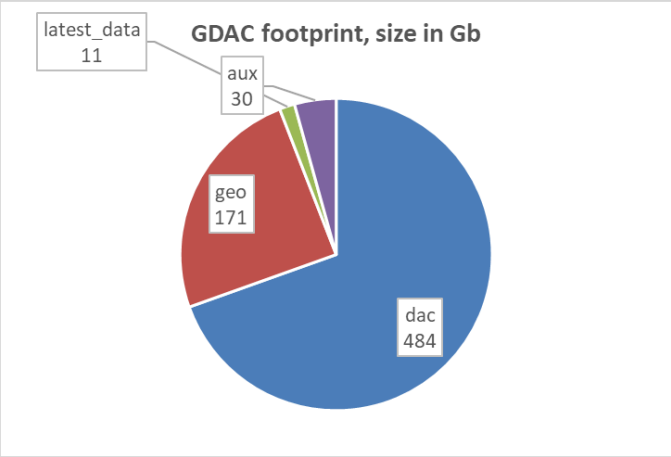
Currently, 11 national DACs regularly submit data to the Coriolis GDAC. As of October 2024, the following files were available from the GDAC FTP site. Compared to 2023, the number of floats (metadata) has increased by 4%, the number of profile files has risen by 6%, and **trajectory files have notably grown by 10%.**

DAC	metadata files	increase	profile files	increase2	delayed mode profile files	increase3	trajectory files	increase4
AOML	8 973	4%	1 595 932	6%	1 398 450	8%	12 346	15%
BODC	912	5%	135 607	6%	98 459	6%	547	3%
Coriolis	3 852	4%	524 420	8%	424 426	11%	3 766	4%
CSIO	558	4%	77 110	5%	61 154	6%	555	4%
CSIRO	1 179	4%	227 183	5%	214 284	6%	1 141	7%
INCOIS	541	7%	83 958	3%	39 996	0%	416	1%
JMA	1 951	2%	261 603	3%	214 200	3%	1 676	3%
KMA	264	0%	38 676	2%	34 936	3%	255	0%
KORDI	120	3%	15 984	2%	14 504	0%	107	0%
MEDS	719	7%	79 931	10%	51 012	0%	673	5%
NMDIS	19	0%	2 460	0%	2 388	0%	19	0%
Total	**19 088**	**4%**	**3 042 864**	**6%**	**2 553 809**	**7%**	**21 501**	**10%**

GDAC files size

- The total number of NetCDF files on the GDAC/dac directory was 3 773 576 (+7% in one year)
- The size of GDAC/dac directory was 423 Go (+11%)
- The size of the GDAC directory was 931 Go (+26%)

branch	GDAC size in Gb	yearly increase	N-1
dac	484	14%	423
geo	171	8%	159
latest_data	11	-54%	24
aux	30	150%	12
gdac total	926	-1%	931



Operations of the ftp, https and erddap servers

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

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

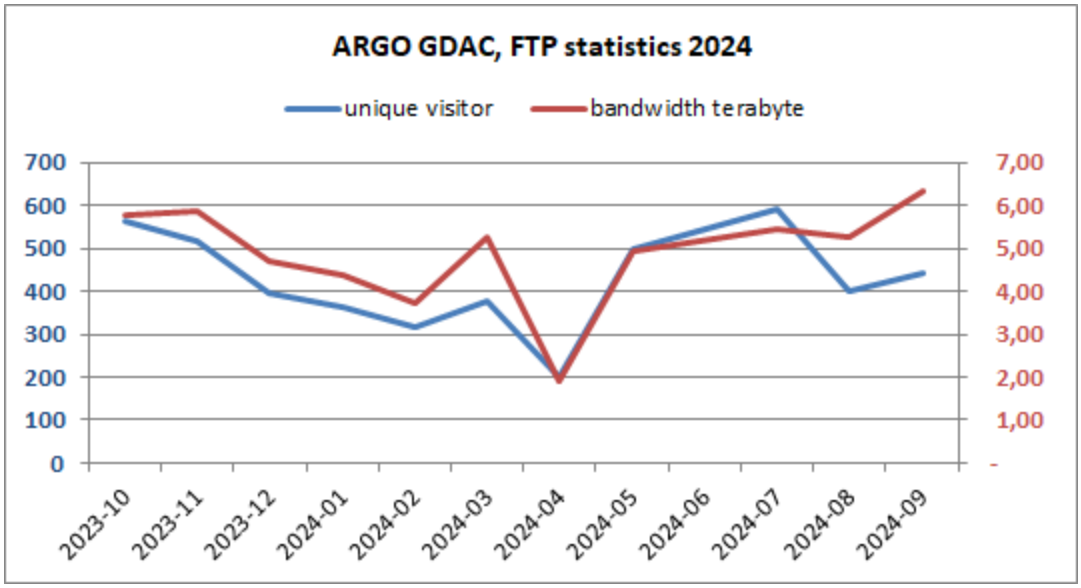
GDAC files size

- The total number of NetCDF files on the GDAC/dac directory was 3 773 576 (+7% in one year)
- The size of GDAC/dac directory was 484 Gb (+14%)
- The size of the GDAC directory was 931 Gb (-1%)

GDAC download services

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

On the FTP server there is a daily average of 5500 sessions and downloading 5 terabytes of data files. The https and erddap statistics have not yet been calculated.



5. Regional Centre Functions

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

France operates the A-ARC (Atlantic Argo Regional Centre).
The main recurrent activities are:
- Check the consistency of the delayed mode salinity correction
- Verification of the CTD reference database in the A-ARC region
- Production and delivery of products (ISAS and ANDRO)

This year the delayed mode salinity correction of 3814 floats has been checked.We have identified 24 floats for which we think the DM correction should be revised. This list of 24 floats is available here:
https://docs.google.com/spreadsheets/d/1IUYTXPMRZx_kRc0fOuIKQwCoBxQvwiMO_wpiiocks zI/edit?usp=sharing.

The quality of the CTD reference database in the A-ARC region has been checked, focusing on the deepest layers. A simple Matlab tool was developed to visualize and select suspicious profiles in 10° x 1° boxes. So far 761 suspicious profiles have been detected and sent to Christine Coatanoan. These profiles will be removed from the new release of the reference CTD database.

A-ARC products:

- ISAS, monthly gridded field of T/S (last versions : ISAS17, ISAS20) is provided on https://doi.org/10.17882/52367 . New release is envisioned for 2025.
- The new ISASO2 fields (decadal and pentadal mean field) from available DMQC DO Argo data have been released in 2024 (https://doi.org/10.17882/52367) along with an accepted publication in ESSD describing the dataset on : https://doi.org/10.5194/essd-2024-106 .
- An update of the ANDRO velocities atlas has been released and is available here: https://doi.org/10.17882/4707. This update includes the velocities computed from the trajectories of 920 additional floats (AOML+CSIRO).

6. Other Issues

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