UK ARGO PROGRAMME

REPORT FOR 24TH ARGO STEERING TEAM MEETING MARCH 2023

1. Status of Implementation

Floats deployed and their performance

During 2022 we were able to deploy 32 floats; of these 25 were standard core APEX, six were BGC floats, and one SOLO II Deep float. Deployments have recovered well from 2021, when research cruise schedules remained heavily impacted by COVID-19.

Since the end of 2022, to end February 2023, we have deployed 16 floats: 14 core APEX and two BGC PROVOR floats.

As of 28th February 2023, the UK has 144 operational floats (i.e. for which real-time data are presently being distributed), as shown in Figure 2.

In addition, we have four floats that are operational, but the real time data processing is not yet set up: two NAVIS BGCi, one BGC PROVOR-Jumbo and one Deep SOLO.

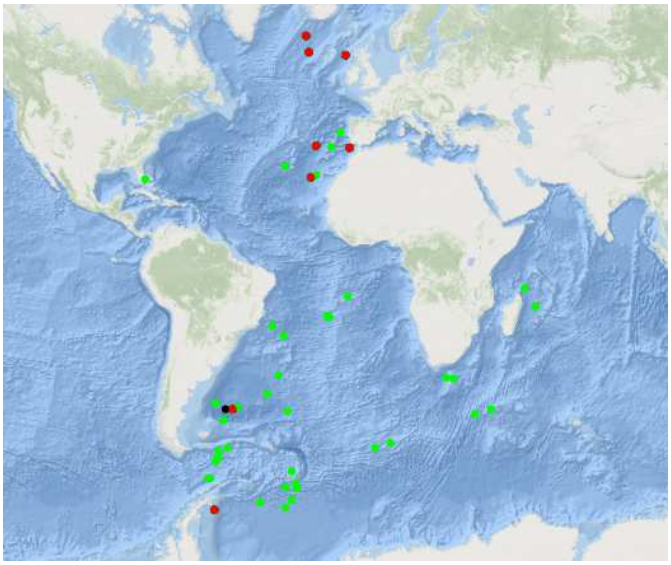

Figure 1. Showing the latest reported locations of 48 UK Argo floats deployed between 1st January 2022 and 28 February 2023, core APEX floats in green (39), APEX-Deep in black (1), BGC floats in red (8).

Of the 48 floats deployed between 1st January 2022 and end February 2023 we have had two float failures: core APEX SN 9194 (6903757) failed immediately after deployment. NAVIS BGC SN F1242 suffered failure of its nitrate sensor immediately after deployment and the float was recovered a few days later. We intend to fix it and redeploy in May 2023 at the PAP mooring site.

At end February 2023 the 144 operational floats returning data include:

- 115 core APEX with SBE CTDs
- 9 core APEX with the RBR sensor
- 1 core NAVIS
- 4 NAVIS with oxygen
- 5 APEX DEEP
- 5 NAVIS BGCi
- 5 PROVOR CTS4s

In addition, as noted above, there are four active floats for which data processing is not yet set up.

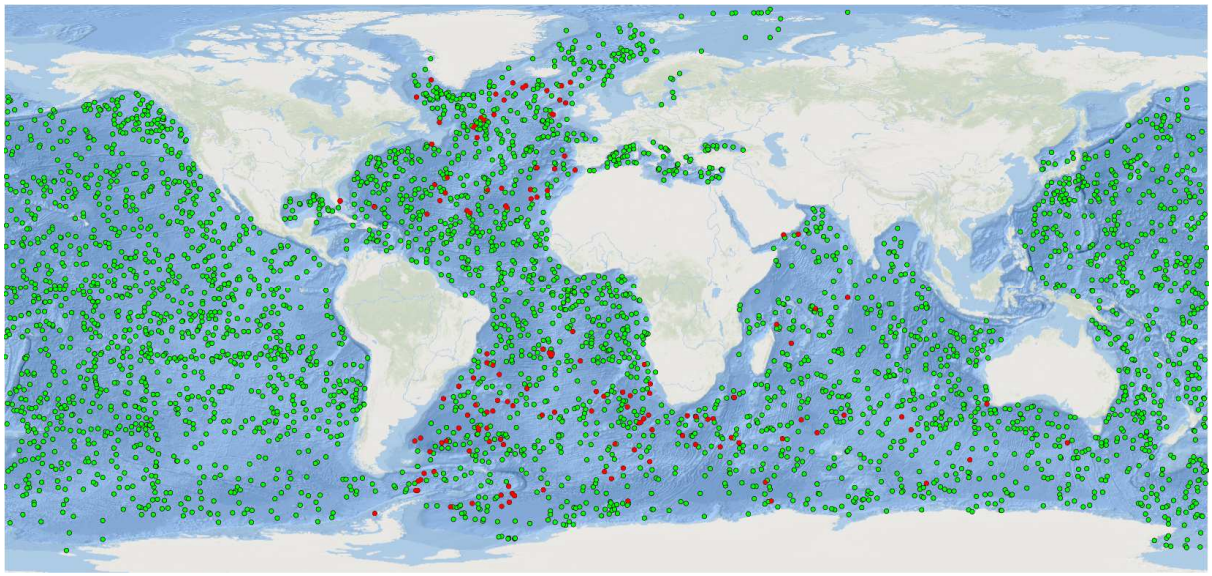

Figure 2. Showing the locations of all UK floats delivering data (144) in red with the global network of 3,936 floats in green, as of 28 February 2023.

Technical problems encountered and solved

APEX Core

We had deployed 16 APEX floats that are at risk of a fast salty drift, these were deployed before the problem was known. Of these 16, eight are no longer operating (at 3rd March 2023). Of the surviving eight, one is on the grey list for PSAL drift, and seven are mostly passing real time QC with flags of 1. We still have five undeployed APEX floats that are at risk of the fast salty drift problem. These have been returned to Teledyne Webb and we are awaiting their repair and return.

For some time, we've noticed that many of our APF11i floats often fail to make a GPS fix when delivering the profile data, but have the second fix, taken prior to diving, reported in the following cycle in 10 days' time. We retrieve this fix to enable us to process the previous profile's data, but it always means that the profile is 10 days late on the GDAC and at the GTS impacting timeliness. It has been noticed that there has been a new aerial design on APF11i floats, and we wonder if the antenna isn't always sufficiently clear of the surface during the time when the GPS fix is being made. At least 12 recently deployed APF11i floats are regularly affected.

APEX floats with RBR CTD

We procured our first six APEX-RBR floats in 2015. Five were deployed with three early failures, the other two failed in July and October 2022, having completed 228 and 241 cycles respectively. Two RBR-L3 replacements for the early failures were provided in 2020 and the third was upgraded to L3, these were deployed in the North Atlantic in December 2020 alongside one new APEX-RBR-L3, all four APEX-RBR-L3 are presently operating normally. We have deployed a further five APEX-RBR-L3 floats since March 2022, all five are operating well,

The data are being made available to Mat Dever at RBR, two of the floats were temporarily put onto 1Hz sampling in the top 100 dbar, to help Mat understand the lag characteristics. These have recently been reverted to normal sampling regimes.

We have nine APEX-RBR-L3 floats scheduled for deployment later in 2023, leaving two in Stores. All nine of our APEX floats currently on order will have RBR-L3 CTDs. After delivery to the UK during March 2023, all nine are allocated to various deployment locations around the Atlantic and Southern Ocean.

APEX Deep

We presently have six deep floats operating in the Argentine Basin region of the SW Atlantic, comprising four APEX Deep deployed in 2021, one APEX Deep deployed in 2020 and one Deep SOLO, deployed in December 2022. There are no plans to buy more deep floats at present. Data processing for the Deep SOLO needs to be set up at BODC, with guidance from Brian King and Colin Sauze (NOC).

Bio-geochemical Argo

We presently have 13 active BGC floats, with only three for which the data processing is not yet set up.

The Navis BGCi that was deployed in November 2020 near the Porcupine Abyssal Plain (PAP) mooring appears to be working well. However, the NAVIS BGCi deployed near PAP in April 2021 failed to report, despite SeaBird engineers clearing the float for deployment. An identical Navis BGCi float was deployed near PAP in May 2022 but was recovered as the nitrate sensor was not working. We will continue to work with SeaBird and attempt to deploy this float again during the PAP cruise in May 2023. Two other Navis BGCi floats were deployed in July 2022, both working normally, for which the data processing is not yet set up. BODC will address this in the coming months.

The 11 PROV-BIO floats purchased by PML in 2013 have all shown good longevity. The last remaining float died in October 2022, having completed 376 cycles. One of the floats from that batch has been recovered and awaiting refurbishment.

We deployed the first of our ASBAN 6-parameter PROV-BIO CTS4 floats in early 2022 with another four deployed up to 28th February 2023. A further eight 6-parameter BGC floats are scheduled for deployment during 2023, leaving two remaining in stock at NOC for future deployments. The ASBAN floats are all performing well so far, as are all of their sensors except for one pH sensor that appears to have failed, returning inconsistent data from the first profile. As part of the UEA PICCOLO project, we attempted to deploy two PROVOR-Jumbo CTS5 floats in the Weddell Sea in February 2023. One failed whilst still on deck and was not deployed. It will be returned to the UK for investigation. The other was successfully deployed and is active, but the data processing is not yet set up.

Status of contributions to Argo data management

Real-time data processing

As of 28th February 2023 the BODC were processing data from 210 floats, comprising 144 active UK floats, 16 Irish floats and 50 Euro-Argo MOCCA floats. Real-time processing is run four times a day with NetCDF files distributed to the GDACs and the Met Office, where the BUFR files are generated and disseminated via the WMO Global Telecommunications System (GTS). The capability now exists to include supplementary profiles and oxygen in the BUFR files. We expect to progress the extension of the BUFR capability to include other biogeochemical variables over the coming months.

BODC data managers and software developers attended the RBR RTQC online training in February 2023 to improve understanding of the corrections needed to be applied to RBR CTDs so that salinity data from BODC RBR floats can be delivered with QC=1. BODC continue to work with RBR on this implementation.

Recently, BODC developed their capacity enabling real-time processing of UK NKE Argo floats to the GDACs by using the Coriolis processing chain. Currently, BODC is processing five 6-parameter ASBAN PROV-BIO CTS4 floats. This development work will allow the data from the remaining ASBANUK floats to be delivered to the GDAC and GTS from deployment. BODC has also developed their capacity to deliver RT-adjustments of the BGC oxygen data. This has been already implemented for the ASBANUK Argo floats.

A focus and high priority for BODC over the coming year are: system development to deliver core Argo parameters for SeaBird Navis floats with N2 controllers, development to process recently

deployed NKE PROV-BIO CTS-5 floats, development to process and deliver data from deep SOLO floats.

BODC delivers updated meta and tech files for all floats it processes alongside new core and BGC profile files to the GDACs as part of every processing run.

Delayed mode processing

Core Argo

From March 2022 until the time of writing this report, BODC has analysed and submitted around 3,452 core profiles. This includes profiles from 21 core Argo floats. BODC has also analysed and delivered D-mode data for 5 core Irish Argo floats (337 profiles).

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

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

Deep Argo

NOC and BODC played a key role in coordinating the development of deep Argo mission. This covers contributions in compiling the new procedures for the real-time QC flag scheme and real-time adjustments on Deep Argo vertical profiles and procedures for DMQC of Deep Argo salinity data. Brian King is co-chair of the Deep Argo Mission Team.

BODC has started development work on automatically applying the CpCor correction for pressure effects on conductivity data of deep Argo floats (>2000 dbar) in the real-time QC process which was recommended by the Deep Argo team earlier in 2021. This step is required to perform further analysis of deep Argo floats in delayed mode. Due to very limited resources for data management in BODC, the real-time adjustments and delayed mode procedures has not been implemented in BODC processing workflow yet.

BODC and NOC have been actively involved in the coordination and organisation of DMQC for deep ocean data as a part of the EuroArgo Rise WP3, Task 3.2. This involved organisation and coordination of the intermediate meeting with other European partners within the task and providing a regular update of progress to the reporting body. By December 2022, NOC and BODC have successfully completed all their contributions to the Euro-Argo Rise project related to deep Argo extension (D3.4 and D3.5).

BGC Argo

BODC have developed their capability and upskilled their team at the 1st BGC DMQC workshop (January 2023) to be able to perform DMQC analysis of BGC Argo parameters. From January 2023, BODC have submitted 4,505 BGC oxygen Argo profiles to the GDAC, coming from 13 PROVBIO floats. BODC have successfully completed all of their contributions to Euro-Argo RISE project dedicated to the BGC Argo extension. Additionally, BODC helped in DMQC analysis of oxygen data of BGC Argo Poland fleet.

Southern Ocean Argo Regional Centre (SOARC)

SOARC activity has been limited to efforts towards deliverables in Euro Argo RISE. BODC and NOC have been working to establish a method of regional data quality assessment in the Southern Ocean. They have successfully completed their contribution to the Euro-Argo Rise project dedicated to the extension to the high latitudes.

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

BODC have represented the works undertaken across other SOARC members at the ADMT23 meeting (December 2023). However, due to very limited resources in BODC they are not able to continue to lead this group.

Argo and the NERC Vocabulary Service (NVS)

BODC Argo has been continuing the work supporting the creation, management and implementation of NVS vocabularies into the Argo data system. This work has been funded under the EU Horizon 2020 ENVRI-FAIR project and is aimed at making Argo metadata interoperable and machine-readable. While the ENVRI-FAIR project is ending, all Argo NVS collections and supporting tools will persist and be actively maintained by the Argo Editors and BODC Vocabulary Management team. New funding opportunities are being sought to develop further FAIR services and enhance interoperability of Argo (meta)data.

2. Funding and human resources

The UK Argo programme is undertaken by a partnership between the Met Office and the National Oceanography Centre (NOC, which includes BODC). The Met Office are responsible for programme management and coordination, procuresment of core floats, organizing float deployments, preparation of floats for deployment, telecommunications (costs) and international funding contributions (OceanOPS and Euro-Argo). NOC and BODC have responsibility for Argo science and data management respectively. NOC have the lead on deep Argo and play a leading role in the expansion of the UK programme into BGC-Argo.

Funding

Argo funding to the Met Office is presently provided directly from the Department for Business, Energy and Industrial Strategy (BEIS) mainly through the Hadley Centre Climate Programme (HCCP), but with an additional contribution through the Public Weather Service Programme. The HCCP workplan and funding for 2021 to 2024, which has been approved by BEIS and Defra (Department for Environment, Food and Rural Affairs) includes UK Argo funding for the period April 2021 to March 2024. In 2022 this funding was only sufficient to order 15 new floats (nine APEX-RBR-L3 and six NKE ARVOR) due to inflation increasing costs.

NERC funding for Argo is primarily directed through NOC under National Capability (NC) funding lines which cover Argo data management (through NC Environmental Data Services funding of BODC) and Argo science. Core BODC Argo national capability funding from NERC remains static for 2022-23 and is therefore decreasing in real terms.

In March 2021, NERC and NOC announced a capital investment of £3.7 million to begin building the UK Atlantic Sector BGC Argo Network (ASBAN-UK) where NOC will deploy six-parameter BGC floats in the Atlantic Ocean over three years as part of UK Argo. The first fifteen were delivered in 2021 and

2022, and six have been deployed, with plans to deploy another seven this year. A second order of ~11 floats will be made in March 2023 with delivery expected by December 2023. BODC secured funding to develop the data infrastructure for NKE BGC floats (ASBAN-UK). Efforts have continued to establish a clear plan for future funding to develop a more sustainable model of UK funding to support the UK contribution to the full-depth multi-disciplinary Argo array, but the funding situation remains challenging.

Non-NC funding is also provided through participation in EU-funded Argo-related projects. The Euro-Argo Research Infrastructure Sustainability and Enhancement (Euro-Argo RISE) project has provided funding for developing core and deep DMQC (Delayed Mode Quality Control), management of BGC (biogeochemical) extensions and regional data quality assessments in the Southern Ocean which was available up to December 2022. Additionally, BODC is funded under the EU H2020 project ENVRI-FAIR to introduce the NVS vocabulary server to support Argo vocabulary management. The ENVRI-FAIR funding is available until June 2023.

BODC has been unable to source sustainable funding to support SOARC functions, so the ARC remains unfunded in the UK to date.

Our aspirations are to contribute 10% of each of the BGC and Deep Argo arrays, and to continue to provide 5% of the Core floats deployed. This could be achieved by deploying 25 BGC floats per year, with a projected lifetime of four years this would lead to a sustained fleet of 100 BGC floats. Deployment of 25 each of Deep and Core floats per year, with a five-year lifetime would ramp up to a sustained fleet of 125 of each float type. The UK would then maintain a fleet of 350 floats (100 BGC, 125 each Core and Deep), about 8% of the total anticipated global fleet. However, funding for this, at around five times the present level, is not in place and would require significant additional investment.

Human resources

Staff members working on UK Argo, their institution and effort on Argo during 2022 are given below. BODC staffing levels have been hit with the long-term absence followed by departure of the Argo lead staff member, which has impacted the team. They have secured some additional short-term time from another NOC team member to help meet priority deliverables, but this has not fully filled the time or skillset gap.

Met Office – 0.8 FTE
Jon Turton, Fiona Carse, John Hankins

NOC, Southampton – 0.7 FTE
Brian King, Nathan Briggs, Darren Rayner

NOC, BODC – 4.1 FTE (March 2022 – March 2023)
Kamila Walicka (1.0), Clare Bellingham (0.85) and Violetta Paba (0.9), with others providing additional support, such as the Juliane Wihsgott (0.33), Clive Neil (0.21), Roseanna Wright (0.08) and the BODC software developer team (0.74).

3. Summary of deployment and data management plans

Deployment plans

As noted earlier, as of 28th February 2023, UK Argo has deployed 16 floats during 2023: 14 core APEX and two PROV-BIO floats. A total of 43 additional floats are scheduled for deployment later in 2023 (figure 3), including:

AMT, March 2023
- 5 APEX SBE core floats
- 1 APEX-RBR-L3 core float
- 5 PROV-BIO 6-parameter floats

NB Palmer, Cape Town to Drake Passage, May 2023

2 APEX SBE core floats
3 APEX-RBR-L3 core float
1 ARVOR core float

PAP mooring cruise, May 2023
2 APEX-RBR-L3 core floats
1 NAVIS BGCi float (if it can be fixed in time)

Florida Straits C-Streams project:
3 PROV-BIO 6-parameter floats

SW Indian Ocean, SEAMester cruise, S.A. Agulhas II, August 2023
4 APEX SBE core floats

NW Atlantic, Discovery passage leg Tromso – St Johns, August 2023
1 APEX-RBR-L3 core float
3 APEX SBE core floats

Discovery passage leg St Johns to Cape Town, November 2023
4 APEX SBE core floats
1 APEX-RBR-L3 core float
1 ARVOR core float

Discovery DY172, SE Atlantic to 60S, December 2023
3 APEX-RBR-L3 core floats
3 APEX SBE core floats

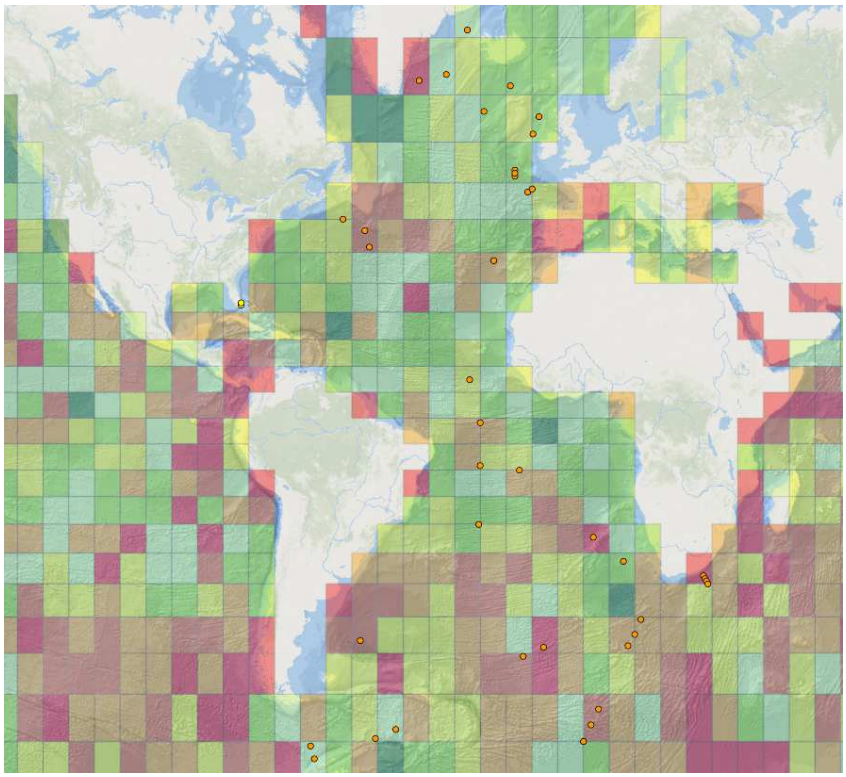

Figure 3. Showing the locations of all UK floats planned for deployment from 1st March to 31st December 2023 (43), coloured boxes are Density/Age vs Argo 2020, as at 28 February 2023.

After the above 43 floats are deployed, we expect to have a total of 26 floats in stock in the UK, comprising

- 20 APEX core floats (including 2 with RBR, and 5 that are very old, ballasted for the Arabian Sea),
- 3 ARVOR core floats,
- 3 BGC PROVOR floats (two ASBAN six-parameter floats and one UEA PROVOR-Jumbo for the PICCOLO project, that failed pre-deployment and will be returned to the UK).

In addition, we have one ARVOR core float at OceanOPS in Brest. It is being kept there for ease of deployment on any passing yacht or other vessel of opportunity.

In summary, a reasonable estimate for UK deployment for the year 2023 would be 50 core floats, 11 BGC floats but no deep floats.

Fiona Carse is leading the Atlantic Deployment Planning group, which was created after AST#23. Discussions at the Atlantic group has already led to some efficient deployment planning of BGC floats in the North Atlantic. The remainder of 2023 looks to be a good year for international co-operation in Atlantic deployments. Fiona also participates in Tammy Morris' Indian Ocean planning group on behalf of UK Argo.

4. Uses of Argo data in the UK

By NOC

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).

NOC is currently leading BGC Argo deployments on behalf of the broader UK community. Data are being used in recent, current and upcoming projects for:

- Generating 4D fields of particle size in the ocean for an array of applications including biological pump study.
- Investigating global drivers of variability in ocean carbon storage by sinking organic particles.
- Investigating nutrient transport by the Gulf Stream and its variability
- Tracking the transport of Greenland glacial meltwater into the Labrador Sea via its coloured dissolved organic matter signature.
- Quantifying particle sinking rates and rates of particle fragmentation in the ocean.
- investigating export fluxes and efficiency in hypoxic ocean regions.

At the Met Office

All Argo data are used operationally:

- They are routinely assimilated into its FOAM (Forecasting Ocean Assimilation Model) suite which is run daily and produces 2 analysis days and a 7-day forecast.
- A coupled ocean/atmosphere/sea-ice/land global prediction system has been made operational for producing the main Met Office weather forecasts. This coupled NWP system assimilates data in all components of the coupled model, including Argo data in the ocean component. These data therefore affect both weather forecasts and short-range ocean forecasts. An assessment of the impact of Argo in a lower atmospheric resolution version of that coupled system was detailed in King et al., 2019.
- Initial conditions for coupled monthly-to-seasonal forecasts are taken from the global coupled NWP system so the Argo data are used to initialise these forecasts and are used in ocean reanalyses.
- Argo data are also used in the initialisation of ocean conditions in climate models run to make decadal predictions.
- Near-surface Argo data are used to validate the output from the Met Office's OSTIA (Operational Sea Surface Temperature and Sea Ice Analysis).

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

- A paper was published on OSSEs to investigate potential impact of expanding the Argo array (Mao et al., 2020);
- David Ford has done some OSSEs looking at the impact of the planned BGC-Argo array of floats in a global physical-biogeochemical model where he assimilates synthetic versions of the BGC Argo profiles in conjunction with satellite ocean colour data (Ford, 2021);
- A PhD project is currently looking at the impact of real BGC Argo data in a global physical-biogeochemical model. The BGC Argo data are assimilated into the model and the impact on air-sea CO2 fluxes is being investigated.
- A paper was published jointly with the University of Reading on the application of a simple smoother algorithm to make better use of Argo data in ocean reanalysis (Dong et al., 2021).
- A project where we made good use of Argo data was in the assimilation of satellite sea surface salinity data from SMOS, Aquarius and SMAP. The near-surface salinity data from Argo was used to bias correct the satellite salinity data and was crucial for the performance of the assimilation of SSS data. That work is written up in Martin et al., 2019. Another paper was published investigating impact in FOAM and the Mercator system of satellite SSS assimilation which used Argo for assessment (Martin et al., 2020).
- R&D on ocean ensemble forecasting and DA, written up in Lea et al. (2022). The hybrid data assimilation method described in this paper led to improvements in use of observations including Argo.

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

- EN4 contains in-situ ocean temperature and salinity profiles and objective analyses. It is updated monthly using real-time Argo profiles and GTSPP data, and annually using delayed-mode Argo profiles (and WOD, GTSPP and ASBO data). EN4 is freely available for scientific research use (see http://www.metoffice.gov.uk/hadobs/en4/). The latest version is EN.4.2.2, which includes a fresh download of all the source data and a substantial update to the XBT/MBT correction schemes. EN.4.2.2 contains four ensemble members where previously there was only two. There is also a new product user guide (based on both the Argo Users' Manual and the HadIOD user guide), including FAQs and example code. EN4 is also forming part of a GEWEX EEI project comparing Ocean Heat Content calculated from reanalyses, in situ data and satellite products (the project website is https://sites.google.com/magellium.fr/eeiassessment/dissemination/documents?authuser=0).
- HadIOD (Hadley Centre Integrated Ocean Database) is a database of in situ surface and subsurface ocean temperature and salinity observations supplemented with additional metadata including bias corrections, uncertainties and quality flags. The dataset is global from 1850-present with monthly updates. The current version is HadIOD.1.2.0.0, the chief sources of data are ICOADS.2.5.1, EN4 and CMEMS drifting buoy data. This product has been available to the public since mid-2020 via https://www.metoffice.gov.uk/hadobs/.

Met Office science uses of the EN4 product include OHC analysis, contributions to BAMS, Ocean Obs'19 White Paper and an Earth Energy Imbalance paper (von Schuckmann et al., 2020).

References

Most references are from years 2020-2022 are in Section 7, Bibliography.

Martin M.J., King R.R., While J., Aguiar A.B. (2019). Assimilating satellite sea-surface salinity data from SMOS, Aquarius and SMAP into a global ocean forecasting system. Q J R Meteorol Soc 2019;145:705-726. https://doi.org/10.1002/qj.3461

5. Issues from UK to be considered by AST

None.

6. Research cruise CTD data

When the UK notifies float deployments with OceanOPS, we include any information about nearby or simultaneous CTD casts if the scientists on board the deploying ship provide this. It is written in the Description free text box in the notification form. Sometimes our floats are deployed from passage legs or ships of opportunity. In these cases, no matching CTD casts are available. All CTD data from UK cruises is best obtained from BODC, using the enquiries@bodc.ac.uk contact address.

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7. Argo bibliography

UK Argo PIs are Jon Turton, Fiona Carse, Brian King, Nathan Briggs, and Giorgio Dall'Olmo (until 2022). The UK last provided a bibliography for AST#21 (in March 2020).

Included below is a list of 76 papers published during 2020 to 2023, with at least one author based at a UK institution. There are 31 papers in 2020, 24 in 2020, and 21 in 2022. The search was carried out using Web Of Science, using keyword "Argo" and refining by country (England, Scotland, Wales, Northern Ireland). PhD theses are not included in this list.

2020 (31)

Danobeitia, JJ; Pouliquen, S; Johannessenu, T; Basset, A; Cannat, M; Pfeil, BG; Fredella, MI; Materia, P; Gourcuff, C; Magnifico, G; Delory, E; Fernandez, JD; Rodero, I; Beranzoli, L; Nardello, I; Iudicone, D; Carval, T; Aranda, JMG; Petihakis, G; Blandin, J; Kutsch, WL; Rintala, JM; Gates, AR; Favali, P
Toward a Comprehensive and Integrated Strategy of the European Marine Research Infrastructures for Ocean Observations
FRONTIERS IN MARINE SCIENCE, 7, doi:10.3389/fmars.2020.00180

Gourrion, J; Szekely, T; Killick, R; Owens, B; Reverdin, G; Chapron, B
Improved Statistical Method for Quality Control of Hydrographic Observations
JOURNAL OF ATMOSPHERIC AND OCEANIC TECHNOLOGY, 37, 5, 789-806, doi:10.1175/JTECH-D-18-0244.1

Haentjens, N; Della Penna, A; Briggs, N; Karp-Boss, L; Gaube, P; Claustre, H; Boss, E
Detecting Mesopelagic Organisms Using Biogeochemical-Argo Floats
GEOPHYSICAL RESEARCH LETTERS, 47, 6, doi:10.1029/2019GL086088

Harris, CA; Lorenzo-Lopez, A; Jones, O; Buck, JJH; Kokkinaki, A; Loch, S; Gardner, T; Phillips, AB
Oceanids C2: An Integrated Command, Control, and Data Infrastructure for the Over-the-Horizon Operation of Marine Autonomous Systems
FRONTIERS IN MARINE SCIENCE, 7, doi:10.3389/fmars.2020.00397

Haumann, FA; Moorman, R; Riser, SC; Smedsrud, LH; Maksym, T; Wong, APS; Wilson, EA; Drucker, R; Talley, LD; Johnson, KS; Key, RM; Sarmiento, JL
Supercooled Southern Ocean Waters
GEOPHYSICAL RESEARCH LETTERS, 47, 20, doi:10.1029/2020GL090242

Kheireddine, M; Dall'Olmo, G; Ouhssain, M; Krokos, G; Claustre, H; Schmechtig, C; Poteau, A; Zhan, P; Hoteit, I; Jones, BH
Organic Carbon Export and Loss Rates in the Red Sea
GLOBAL BIOGEOCHEMICAL CYCLES, 34, 10, doi:10.1029/2020GB006650

King, RR; Lea, DJ; Martin, MJ; Mirouze, I; Heming, J
The impact of Argo observations in a global weakly coupled ocean-atmosphere data assimilation and short-range prediction system
QUARTERLY JOURNAL OF THE ROYAL METEOROLOGICAL SOCIETY, 146, 726, 401-414, doi:10.1002/qj.3682

Le Bras, IAA; Straneo, F; Holte, J; de Jong, MF; Holliday, NP
Rapid Export of Waters Formed by Convection Near the Irminger Sea's Western Boundary
GEOPHYSICAL RESEARCH LETTERS, 47, 3, doi:10.1029/2019GL085989

Liu, CL; Allan, RP; Mayer, M; Hyder, P; Desbruyeres, D; Cheng, LJ; Xu, JJ; Xu, F; Zhang, Y
Variability in the global energy budget and transports 1985-2017
CLIMATE DYNAMICS, 55, 11-12, 3381-3396, doi:10.1007/s00382-020-05451-8

Mao, CY; King, RR; Reid, R; Martin, MJ
Assessing the Potential Impact of Changes to the Argo and Moored Buoy Arrays in an Operational Ocean Analysis System
FRONTIERS IN MARINE SCIENCE, 7, doi:10.3389/fmars.2020.588267

March, D; Boehme, L; Tintore, J; Velez-Belchi, PJ; Godley, BJ
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8. COVID-19 impacts on UK national program

For the year 2022, impacts of COVID-19 have been minimal on deployments. In fact, we have bounced back rather well. There has been no impact on our core floats budget from central government. However, we have been able to buy fewer floats than previous years. This is due to increasing costs being passed on by manufacturers, and an unfavourable USD / GBP exchange rate. We assume the former affects all programmes. On a minor note, Fiona Carse was prevented from attending AST#23 in Monaco due to French entry requirements and COVID-19 in her household!

9. RBR deployment plans for 2023/4

As noted earlier, the UK will receive a delivery of nine APEX-RBR-L3 floats from Teledyne Webb during March 2023. Our current plans for deploying 11 APEX-RBR-L3 floats during 2023 are detailed in Section 3, above. We do not have any plans for 2024 yet.