German National Report 2024 for Argo Steering Team Meeting AST25

Submitted by Birgit Klein and Meike Martins on behalf of Argo Germany

The AST requests a National Report from each country involved in implementing the Argo array prior to the yearly AST meetings. These reports help inform all Argo participants of the status of each National Program, help guide the AST meetings, and gather information for Argo websites and international reports. Please use the questions below to help produce your report and send it to Megan Scanderbeg or drop it into the National Reports folder by **4 April.**

AST-26 folder link: https://drive.google.com/drive/folders/1Bq-xLWzdZ7k-cGsTNbqvnJkyZc9Y3ZIx?usp=sharing

1. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2024)
    a. floats deployed and their performance

        In total 41 floats were deployed by Argo Germany covering the entire global ocean. 40 were purchased by BSH from the operational budget funded by the BMDV and one additional float was coming from institutional funds of the AWI. The 41 floats include 13 floats with supplementary oxygen sensor and 8 BGC floats.

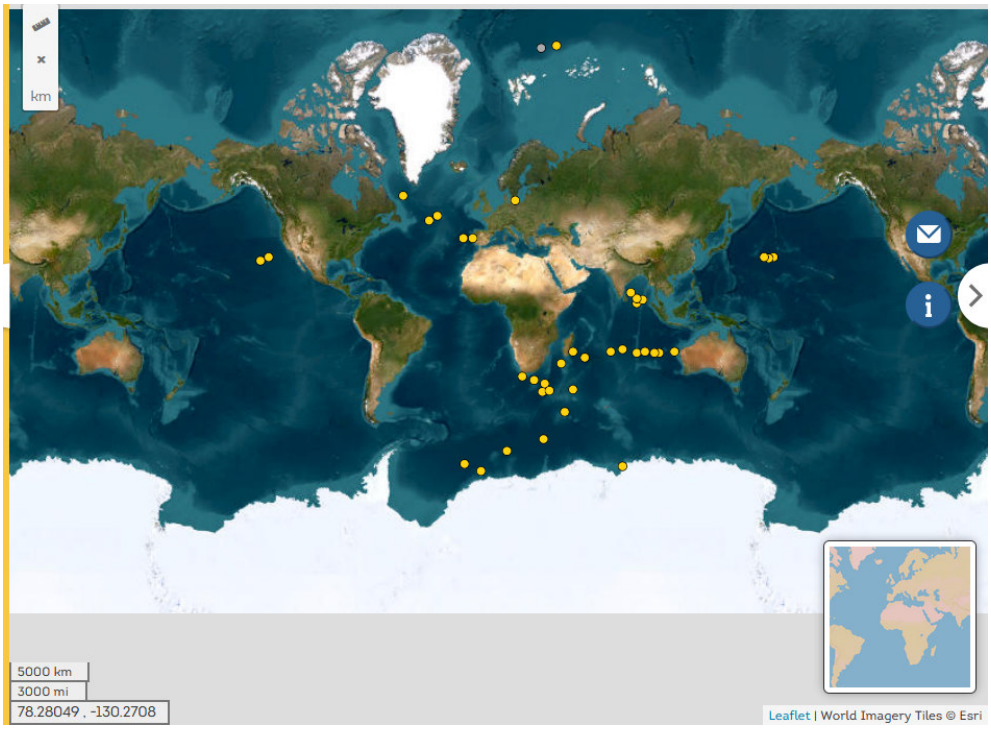

Fig. 1: 2024 deployments by Argo Germany.

The relatively low numbers of deployments in 2024 are related to delays in cruises, now postponed to 2025. The deployments were performed during 11 individual cruises, mostly from research vessels, but also with the help of the German and the Portuguese Navy.

b. technical problems encountered and solved

Two of our floats equipped with pH sensor were sent back to the manufacturer in 2022 because of a recall and have been returned from SBS after inspection. They are now scheduled for deployment in 2025.

Our deployments in the Arctic proper during PS144 have shown mixed results. Two of the four float did not report any data yet. No reason for this could be discerned.

c. status of contributions to Argo data management including:

Germany is not running a national DAC. All German floats are handled by Coriolis DAC in France.

The status of the ASD floats from the German program has been documented in the joint excel spreadsheet curated by Coriolis until the end of 2024. No more new incidences were encountered in the past year. The European fleet which is partly handled by BSH did show however a few more cases, which have been notified to SBS.

d. status of delayed mode quality control process

BSH had adopted floats from all German universities and agreed to perform similar services for the AWI floats. The status of delayed mode quality process for German core floats is remaining at high levels (90-95%). The DMQC of old NEMO floats from AWI could be finalized in 2024, followed up by a reprocessing of technical files. The production of D-files for these floats has started late 2024 and should be finished during the first quarter of 2025.

Ramping up DMQC procedures to include BGC operations has still been hampered by the limited personal resources. In the second half of 2024 the workforce for Argo Germany was finally increased by two new members. The training of the new staff has been started and progress in the BGC DMQC is expected in 2025.

Delayed mode quality control of floats in the Baltic were discussed by a small international group during workshops in Sopot (18.04-19.04.2023), Bergen (16.10-19.10.2023) and Sopot (24.09-26.09.2024). During these hands-on workshops all groups with floats in the Baltic were present and adapted a processing chain developed by IMR. We expect the processing chain to be finalized in September 2025 during a follow-up-meeting. This close cooperation was extended to the BGC parameters in 2024 (oxygen data).

2. Present level of, and prospects for, national funding for Argo including a summary of the level of human resources devoted to Argo, and funding for sustaining the OneArgo mission: Core, BGC, Deep, Polar, Spatial (equator, WBCs)

   The BMDV (Federal Ministry for Digital and Transport) has approved to increase the budget for the implementation of One Argo and to switch the national contribution to a mix of 36 core floats, 14 deep floats and 12 BGC floats annually and supply more funding. The budget was increased by 350.000 € in 2023 and will ramp up to an increase of 1.1 Mio. € in 2026 which amounts to a total budget of 1.9 Mio € in 2026 (excluding costs for personal). Due to the strong price increase of the floats (specifically the BGC sensors) the increased funds are insufficient funds to cover the full implementation of OneArgo. BSH has informed the ministry about the need of a further increase starting in 2027 and postponed implementation of Deep Argo until then.

   BSH has established a tender with 2 manufacturers, NKE and Bornhöft (TWR), in order to ease the procurement of floats. It has started in 2024 and is running for 4 years.

   Birgit Klein of the Federal Maritime and Hydrographic Agency (BSH) has continued to coordinate the national Argo Germany program and is also responsible for data management of the core floats. All matters related to procurement, logistics, technical monitoring, float deployments and satellite data transmission are handled by now by Greta Markfort and Celine Naderipour who have joined the team during 2024. The national BGC group established in 2020 involves four research institutes: AWI, GEOMAR, ICBM and IOW and Meike Martins from BSH.

   A complete list of people involved is given below:

Name and institution	Area of expertise
Birgit Klein (BSH)	National program lead, research scientist (C-Scope, EuroArgo One), DMQC operator (core Argo)
Meike Martins (BSH)	Research scientist (EuroArgo One), DMQC operator (BGC Argo), float procurement, logistics
Kevin Wiegand (BSH)	Research scientist (EuroArgo One) (only after Feb 2025),
Greta Markfort (BSH)	Technician, float procurement, technical support, and performance monitoring (since October 2024)
Celine Naderipour (BSH)	Technician, float procurement, technical support, and performance monitoring (since August 2024)
Arne Körtzinger (GEOMAR)	Research scientist, BGC group, DMQC expert pH-sensor (BGC sensors)
Tobias Steinhoff (GEOMAR)	Research scientist, BGC group, DMQC expert pH-sensor (BGC sensors)
Cathy Wimart-Rousseau (GEOMAR)	Research scientist, BGC group, DMQC expert pH-sensor (BGC sensors) until May 2024
Rainer Kiko (GEOMAR)	Research scientist, expert UVP sensor
Henry Bittig (IOW)	Research scientist (C-Scope), BGC group, DMQC expert (BGC sensors)
Oliver Zielinski (IOW)	Research scientist, BGC group

Hendrik Bünger (ICBM)	Research engineer, BGC group, DMQC expert radiometry (BGC sensors); until end of 2024
Jochen Wollschläger (ICBM)	Research scientist, BGC group, radiometry
Rohan Henkel (ICBM)	Research engineer, BGC group, technical support
Olaf Boebel (AWI)	Research scientist, RAFOS technology
Marcus Janout (AWI)	Research scientist, project Ocean:Ice
Alexander Haumann (AWI)	Research scientist, project VERTEXO
Benjamin Rabe (AWI)	Research scientist, project ArcWatch
Krissy Reeve (AWI)	Research scientist, Weddell Gyre

Table 1: People involved in Argo in Germany and their associated institutes.

3. Summary of deployment plans: as was done last year, please fill out this spreadsheet to help us understand the progress towards implementation of OneArgo. There is one new column this year for floats being deployed with experimental sensors such as UVP, C-sensor, etc. This spreadsheet is to be **returned separately by 17 March** to help prepare for the meeting. It can be sent to Megan or dropped in this folder link.

Deployment year:	2024					
Float Type:	Core	Core + O	Core + 2-3 BGC	Core + 4-6 BGC	Deep	Deep + O
A. Funded	20	13	4	4	0	0
B. Business as usual/Reasonable expectation						
C. Proposed, with a reasonable chance of success						
D. Aspirational						
E. Other						
Totals	20	13	4	4	0	0

Table 2: deployments carried out in 2024

	Table completed by : *Birgit Klein*													Argo program: *Argo Germany*						
Deployment year:	2025							2026							2027						
	Core	Core + O	Core + 2-3	Core + 4-6	Deep	Deep +	Exp sensor	Core	Core + O	Core + 2-3	Core + 4-6	Deep	Deep +	Exp sensor	Core	Core + O	Core + 2-3	Core + 4-6	Deep	Deep +	Exp sensor
A. Funded	59	25	2	7	0	0	2	18	18		6	0	0	1	18	18		9		0	1
B. Business as usual/Reasonable expectation											2										
C. Proposed, with a reasonable chance of success																					
D. Aspirational																					
E. Other																					
Totals	59	25	2	7	0	0	2	18	18	0	8	0	0	1	18	18	0	9	0	0	1

Table 3: deployments to be carried out in 2025-2027. Full table 2025-2030 uploaded on AST drive

4. Summary of any research and development efforts over the past year to try new sensors or improve float technology. This could include new collaborations with vendors or other partners.

   BSH has finished the joint research project C-Scope end of 2024. It was funded by BMBF and focused on synergies of marine carbon observations from ship-based sources and Argo floats. Other project partners as GEOMAR and IOW will continue working (development/tests of pCO2 sensors) in the European research project GEORGE (2023-2027).

   Another large European research project called EuroArgo One has started in 2025 and is devoted to foster the European implementation of OneArgo. BSH, GEOMAR and IOW are partners in the project.

   AWI is continuing its monitoring of the Southern Ocean in the Helmholtz funded Program HAFOS (The Hybrid Antarctic Float Observing System) with increased attention on ice shelves. Early 2025 a HAFOS expedition in the Weddell Gyre deployed 25 iceApex and deploying 6 sound sources with enhanced focus on the southern and western Weddell Sea.

   The German annual user workshop for 2024 was held as a hybrid event on17.06.2025. The meeting was well attended and provided a good forum for users to share their scientific work and methods.

   Germany contributes to the NAARC and joined recently the SOARC. Researchers from German institutions have continued to contribute recent CTD data to the Argo climatology.

5. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers. Please also include any links to national program Argo web pages to update links on Argo websites.

   BSH is maintaining and updating the Argo Germany web site. It provides information about the international Argo Program, German contribution to Argo, Argo array status, data access and deployment plans.

   https://www.bsh.de/DE/THEMEN/Beobachtungssysteme/ARGO/argo_node.html

   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. The SeaDataNet portal uses German Argo data operationally for the Northwest European Shelf. Argo data are routinely assimilated into the GECCO reanalysis, which is used for the initialization the decadal prediction system MiKlip and other operational forecasting systems.

6. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo. These might include tasks performed by OceanOPS, the coordination of activities at an international level and the performance of the Argo data system. If you have specific comments, please include them in your national report. Also, during the AST-26 plenary**, each national program will be asked to mention a single highlight or issue via a very brief oral report**.

   An increasing concern additional to strong price increases is the high lead time between orders and delivery. This is complicating the logistics and is challenging in terms of meeting budgets in FY.

   The time taken up to deal with the logistics of float deployments seems to have increased considerably during past years and places a big burden on small teams such as at BSH. Delayed cruises, changed ports and difficult shipping logistics have mounted last year.

7. Outreach and communication: please describe, in brief, outreach efforts within your national program over the past year. Also, if you've issued any communications, press releases, participated in articles, etc., please send the links. We are considering our social media strategy, so please let us know which social media you engage with and the corresponding handles.

   Organization of the national user work shop 17.06.2024

   Social media posts on linkedin and twitter (until end of 2024)

   - BSH contribution about the Argo Program
   - Presentation at the Extreme-weather-congress Hamburg 24.-25.9.2024
   - Press release (22.8.) about the Argo float deployments of the German Navy

   Presentation of Argo at the Open ship day: Hamburg port 09-12.5.2024

   Participation to G7 policy brief

Briefing of the German Navy 29.8.2024

Participation to the ESFRI (European Strategy Forum on Research Infrastructures) exchange 4.9. in Bonn

Exhibition of an Argo Demo-float and a poster at the German Climate Congress (DWD) (German contribution to the climate monitoring) 23.10.2024, Hamburg

Participation to the Antarctica in Sync preparation meeting 11.09-12.09.2024

German translation of the Frontiers for the young mind article Keeping an Eye on Earth's Oceans With Argo Robots by Greenan et al. and publication in https://culture-ocean.com/resources/ocean-collection/float_Greenan(2023)_DE.pdf

C-Scope project videos https://www.youtube.com/watch?v=E_GlVV_-cMs

https://oceandecade.org/actions/c-scope-in-action/

8. To continue improving the quality and quantity of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include any CTD station data that was taken at the time of float deployments this year. Additionally, please list CTD data (calibrated with bottle data) taken by your country in the past year that may be added to the reference database. These cruises could be ones designated for Argo calibration purposes only or could be cruises that are open to the public. To help CCHDO track down this data, please list the dates of the cruise and the PI to contact about the data.

   During some of the deployments organized by the BSH reference CTD profiles were taken, the principal investigators are asked to provide the data as soon as they are calibrated. We will then exchange them with Coriolis.

9. Keeping the Argo bibliography (Bibliography | Argo (ucsd.edu)) up to date and accurate is an important part of the Argo website. This document helps demonstrate the value of Argo and can possibly help countries when applying for continued Argo funding. To help me with this effort, please include a list of all papers published by scientists within your country in the past year using Argo data, including non-English publications.
   There is also the thesis citation list (Thesis Citations | Argo (ucsd.edu)). If you know of any doctorate theses published in your country that are missing from the list, please let me know. Finally, if you haven't already sent me a list of Argo PIs in your country, please do so to help improve the statistics on how many papers are published including an Argo PI vs no Argo PIs.

Mirja Schoderer, Henry Bittig, Birgit Klein, Ramona Hägele, Tobias Steinhoff, Karel Castro-Morales, Arne Körtzinger, Leticia Cotrim da Cunha, Anna-Katharina Hornidge, From individual observations to global assessments: tracing the marine carbon knowledge value chain, Ocean and Society, 2025, Volume 2, https://doi.org/10.17645/oas.8891, 2025.

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Lentz, S., Brune, S., Kadow, C. et al. Improving ocean reanalyses of observationally sparse regions with transfer learning. Sci Rep 15, 2640 (2025). https://doi.org/10.1038/s41598-025-86374-4

Stanev, E. V., Gramcianinov, C. B., Staneva, J., & Slabakova, V. (2024). Thermohaline intrusions as seen by Argo floats: The case of the Black Sea. Journal of Geophysical Research: Oceans, 129, e2024JC021762. https://doi.org/10.1029/ 2024JC021762

10. Does your National Program have any deployment plans for RBR floats in the next couple years? If so, please indicate how many floats will you be buying in 2025 and 2026 (if known) and where they might be deployed.

    Germany is contributing to the diversification of CTD sensors by purchasing RBR sensors on argo floats and deploying them. In 2024, one float with RBR-sensor was deployed within the Mediterranean Water off the Iberian coast. 2 more sensors will be deployed in the Azores region in 2025. Moreover, 5 RBR sensors on floats will be deployed in the North Atlantic in September

2025. We will buy 8 more RBR sensors (4 with additional oxygen sensors) in 2025 to be probably deployed in 2025, latest in 2026.

Our initial plan to purchase half of our core floats with RBR sensors were halted and awaited results of a recall action by NKE to inspect some early failures of the floats with RBR sensors. However, the action did not show any systematic error so we will continue to furnish about half of our core floats with RBR sensors in the coming years.