

Argo National Report 2023 – Norway

Submitted by Kjell Arne Mork (IMR) on behalf of NorArgo



1. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2022)

Argo Norway (NorArgo, <https://norargo.hi.no>) is the Norwegian contribution to the Euro-Argo European research infrastructure (ERIC), and some points in this report are therefore (also/instead) included in the report from Euro-Argo. Focus area for Argo Norway is the Nordic Seas (Greenland, Iceland and Norwegian Sea) and Arctic.

a. floats deployed and their performance

In 2022, Norway deployed **14 Argo floats**:

- 3 Deep+DO floats
- 4 BGC-floats (6 bgc-variables)
- 2 BGC-floats (4 bgc-variables)
- 2 core+DO floats
- 3 core floats

Since 2018, Norway has in total deployed 56 floats and at present has 47 operative floats that include Deep, BGC, and core (Figs. 1, 2).

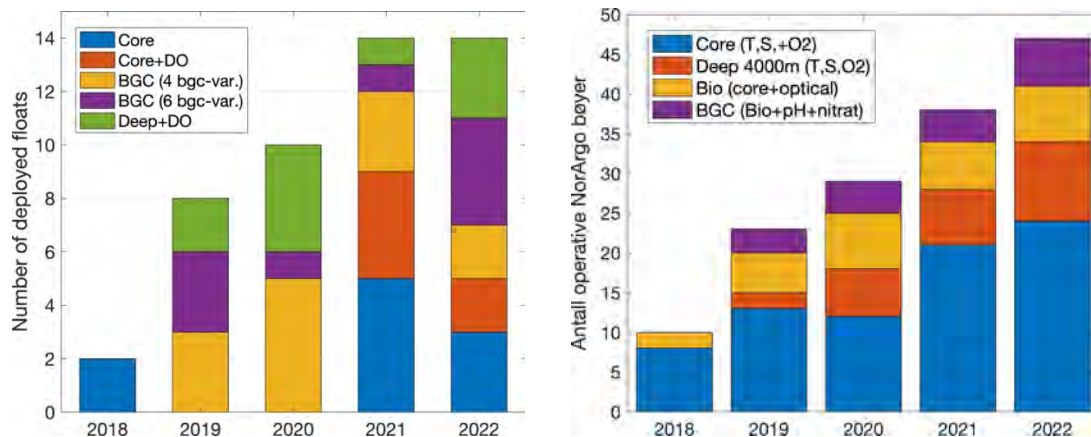


Figure 1. Number of deployed (left figure) and operative (right figure) floats.



Figure 2. Last location of operative Norwegian floats.

b. technical problems encountered and solved

Some APEX floats (BGC floats) deployed in 2019 and 2020 had some issues with the buoyancy due to air loss of the floats.

Some BGC floats (PROVOR floats) had some issues with pH sensors, producing bad data.

c. status of contributions to Argo data management (including status of high salinity drift floats, decoding difficulties, ramping up to include BGC or Deep floats, etc)

We have defined 4 floats with abrupt salinity drift (ASD).

d. status of delayed mode quality control process

We do DMQC of our floats that were deployed in 2019 and later while Argo Germany did DMQC for our "older" floats. We do DMQC of core, bgc and deep floats.

We have done DMQC of temperature/salinity for 47 floats (16 core, 22 BGC and 9 deep floats) of total 53 floats deployed in 2019 and later. 6 floats that are not QC were deployed in the shallow Barents Sea where reference data are missing. However, work is ongoing to collect reference data also for the Barents Sea.

For the BGC-floats we have done DMQC for oxygen (18 of 33 floats), nitrate (4 of 9 floats) and pH (1 of 9 floats). DMQC-work of the other variables is ongoing and will be done within 2023. There have been issues with several pH-sensors that are uncorrectable.

NORCE is responsible for the DMQC of oxygen and pH, while IMR is responsible for the DMQC of T/S, nitrate, chlorophyll, backscatter and irradiance.

2. Present level of and future 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, Spatial (Polar, equator, WBCs)

Financial resources

The funding has been a combination of self-financed (i.e., funded by Institute of Marine Research) and funding from the Norwegian Research Council (NRC, Ministry of Education and Research) during 2012-2015.

For 2018-2023 we receive funding from the NRC for the extension of the national Argo infrastructure project (NorArgo2), approximately 600 k€ per year. Within this project we purchase and deploy approximately 13 floats per year in the Nordic Seas and the Arctic that include core, BGC and deep floats. To keep the target of having minimum 30 operative Argo floats beyond 2023, submission of a new project proposal to the NRC is planned.

Human resources

NorArgo2 has approximately 30 person months per year and more than 10 people contribute from six Norwegian institutes (IMR, Norce, NERSC, MET.no, Akvplan-niva, UoB). This includes Argo monitoring, logistic, deployment, quality control, and data management.

National coordination

The Norwegian Argo Infrastructure (NorArgo, <https://norargo.hi.no>) is coordinated by Kjell Arne Mork, Institute of Marine Research, who also is the leader of the NorArgo2 project.

3. Summary of deployment plans (level of commitment, areas of float deployment, Argo missions and extensions) and other commitments to Argo (data management) for the upcoming year and beyond where possible.

In 2023, we will deploy 12 Argo floats in the Nordic Seas/Arctic (2 BGC+UVP+CROVER, 2 BGC, 4 BIO, 2 core+DO, 2 core). Our financial support from the Norwegian Research Council ends in 2023 which means that it is very uncertain how (or if) many floats we will deploy the next years.

In 2023, we do DMQC of core, deep and BGC floats.

- 4. 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 the AST and AIC websites.**

Argo Norway focuses on both research topics and marine climate monitoring of the Nordic Seas. There is an increasing interest in using Argo data in Norway, and two climate centres are now using the data operationally in climate models (NERSC and MET.no). For instance, the operational TOPAZ4 modeling system assimilates Argo data into the ocean model to provide forecast product for the Nordic Seas and Arctic Ocean under the EUs Copernicus Marine Environment Monitoring Services (CMEMS, <http://marine.copernicus.eu/>).

The present scientific topics are mainly within the Nordic Seas (Norwegian, Iceland and Greenland Seas) and Arctic, including:

- Heat and fresh water contents in the Nordic Seas are regular updated
- Water mass changes in relation with biological activities. This topic is also one of the reasons that we have included bgc sensors on the Argo floats.
- Studies that involve the mixed layer, primary production and carbon cycle.

Link to Argo Norway (NorArgo): <https://norargo.hi.no>

- 5. 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-24 plenary, each national program will be asked to mention a single highlight or issue via a very brief oral report.**
- 6. 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.**

At all deployment locations a CTD station with water samples are taken. All ship CTD-data are sent regular to the ICES, EUs CMEMS, and World Ocean Database. The ship-data will also be sent to Argo (Reference Database).

- 7. 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.**

No new articles to add that are not included in the Argo bibliography.

- 8. How has COVID-19 impacted your National Program's ability to implement Argo in the past year? This can include impacts on deployments, procurements, data processing, budgets, etc.**

Two BGC-floats and one deep float were delivered too late for the cruise with Argo deployments in 2021. Instead, these floats were deployed one year later, in 2022. In addition, a cruise in 2021 was shortened due to COVID-issues, and as a result some planned Argo deployments needed to be modified.

- 9. 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 2023 and 2024 (if known) and where they might be deployed.**

No RBR-floats will be deployed this year, but next time we will order floats we also plan to purchase some floats with RBR-sensors (~5 floats with RBR in 2023).