



Argo-Poland National Report 2024

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

Argo-Poland is conducted by the Institute of Oceanology of the Polish Academy of Sciences (IOPAN). Since 2009, the Institute has deployed 45 floats, 26 of which were launched in the Nordic Seas from the vessel *r/v Oceania* and three in the same region aboard *r/v Horyzont II*. Since November 2016, IOPAN has also deployed 16 floats in the Baltic Sea, all from *r/v Oceania*.

a. floats deployed and their performance

In 2024, Poland launched four floats from *r/v Oceania*, a vessel operated by Institute of Oceanology Polish Academy of Sciences (IO PAN). Three floats were deployed in the Nordic Seas, and one in the Baltic Sea.

Two Argo floats (WMO 7902196, 7902197) were launched in the Nordic Seas in early July 2024 at coordinates 74.98 °N, 08.53 °E and 75.00 °N, 15.34 °E, respectively (Figure 1). Both instruments are ARVOR floats, manufactured by NKE, equipped with an Iridium data transmission system and ice-avoidance algorithms. The parking depth was set at 1000 dbars, and the profiling depth at 2000 dbars. The floats have cycles of 10 days. In addition to standard CTD measurements, these floats also measured dissolved oxygen. Both floats operated throughout 2024, transmitting approximately 20 complete sets of hydrographic data (CTD and dissolved oxygen) each by the end of the year.

At the same time, IOPAN deployed its first Biogeochemical Argo (BGC Argo) float (WMO 7902195) in the Arctic region at coordinates 74.98°N, 2.96°E (Figure 1). The device is a PROVOR float equipped with an Iridium data transmission system. It was programmed with a parking depth of

1000 dbars, a profiling depth of 2000 dbars, and a 4-day cycle. In addition to standard CTD measurements, the BGC float measured four additional seawater properties: dissolved oxygen concentration, chlorophyll-a concentration, irradiance, and CDOM. This float operated throughout 2024 and transmitted 43 complete sets of BGC data by year-end.

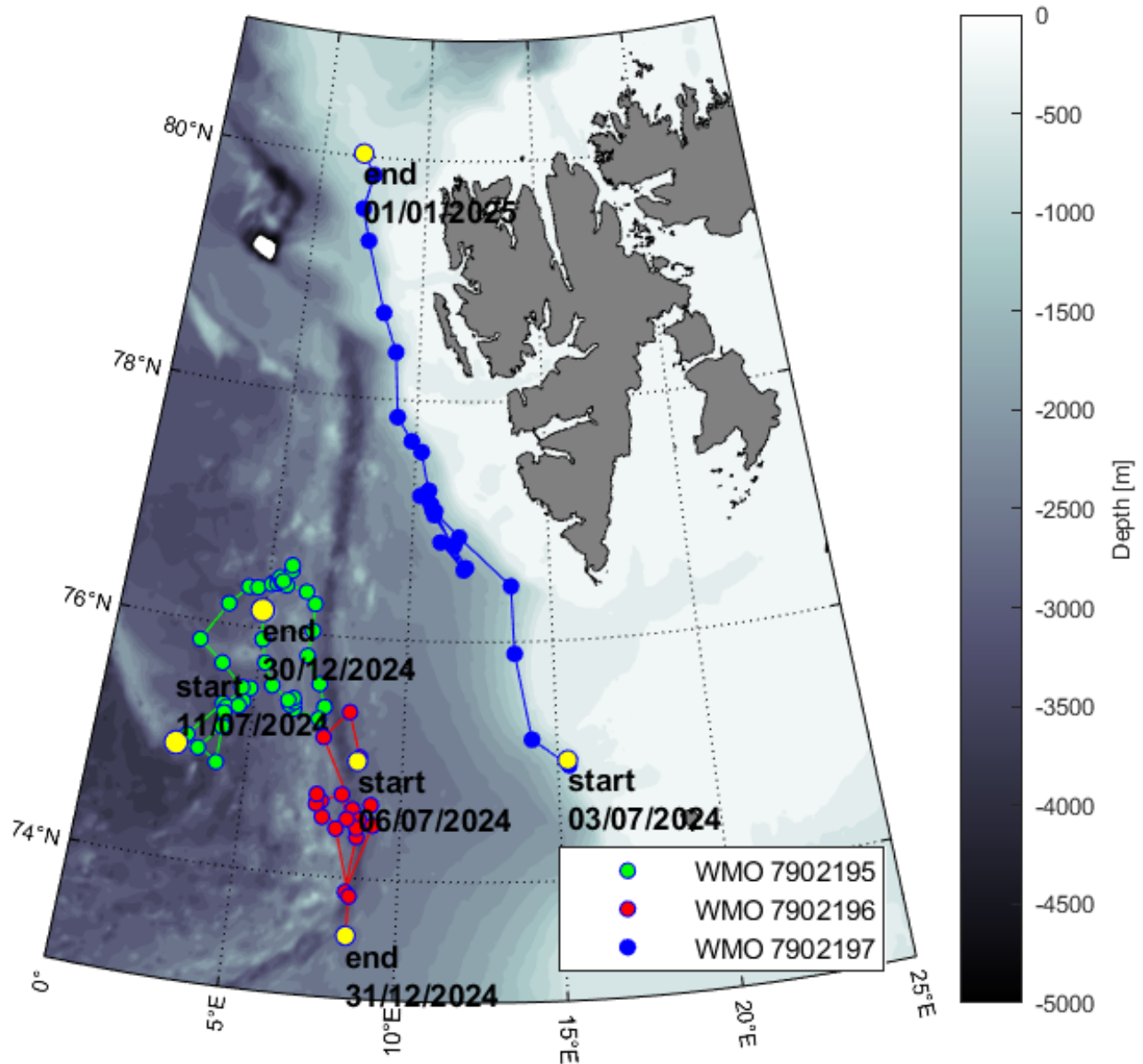


Figure 1. Positions of deployment and trajectories of three Argo floats deployed in the Nordic Seas by Argo-Poland program in July 2024.

In the Baltic Sea, one Argo float was deployed from *r/v Oceania* in May 2024 during a standard hydrodynamic cruise. The float (WMO 7902194) was launched in the Bornholm Basin at coordinates 55.23°N, 16.16°E (Figure 2). This ARVOR-type float, equipped with an Iridium data transmission system, measured standard CTD parameters as well as dissolved oxygen. The float's parking depth was set deeper than the seabed to restrict its movements, effectively using it as a virtual mooring. It remained operational throughout 2024, transmitting 104 complete sets of hydrographic data (CTD and dissolved oxygen) by the end of the year.

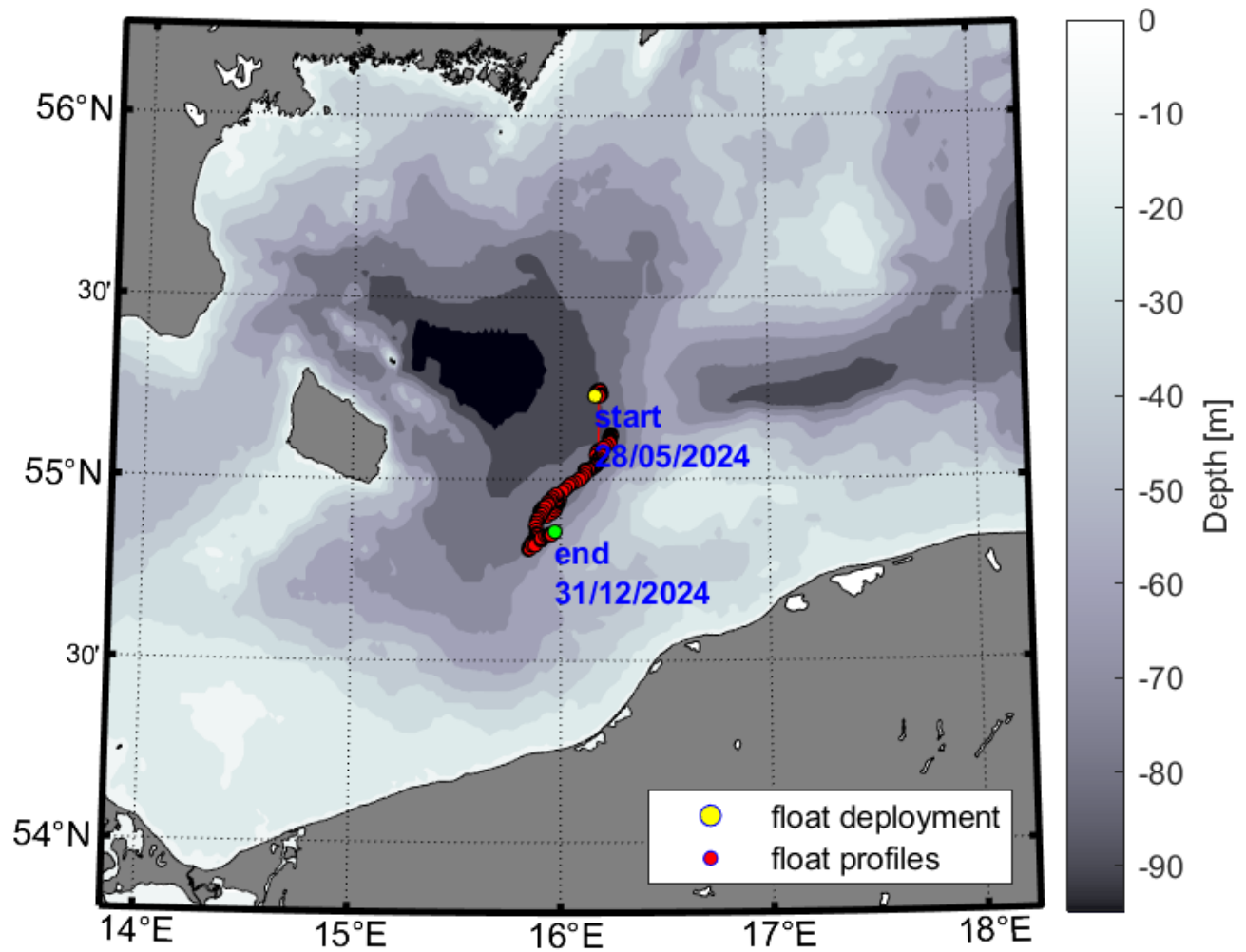


Figure 2. Positions of deployment and trajectories of one Argo float deployed in the Baltic Sea by Argo-Poland program in May 2024.

b. technical problems encountered and solved

The Polish float WMO 1902682 (A12632-23EU003) experienced a pressure sensor failure, resulting in incorrect pressure readings and preventing it from diving. The float drifted on the surface for several weeks. The possibility of recovery was considered, but it was not feasible from our side, so potential partners in the Baltic Sea region were contacted.

Eventually, the float was located near Trelleborg, Sweden. After recovery, it was sent to the NKE manufacturer, where the CTD sensor was replaced. The float is now scheduled for testing before its planned redeployment in the Baltic Sea.

c. status of contributions to Argo data management.

Data from Arctic and Baltic floats have been submitted to the Ifremer Argo Center, where they have been processed and made available online. Additionally, the Institute of Oceanology of the Polish Academy of Sciences (IO PAN) has contributed CTD data collected by the *r/v Oceania* during AREX cruises in the Nordic Seas (2000–2018) and the Baltic Sea (2016–2021) to the Argo reference database.

d. status of delayed mode quality control process

The Institute of Oceanology of the Polish Academy of Sciences (IOPAN) has been conducting delayed mode quality control (DMQC) on data from Arctic floats deployed since 2018. Additionally, Argo Poland actively contributes to the development of DMQC procedures for data collected by Argo floats deployed in the Baltic Sea. For Arctic floats deployed prior to 2018, DMQC is carried out by BSH (Federal Maritime and Hydrographic Agency) in Hamburg, Germany.

2. Present level of and future prospects for national funding for Argo including a summary of the level of human resources devoted to Argo.

In 2021, the Institute of Oceanology of the Polish Academy of Sciences submitted an application to the Ministry of Science and Education for funding the Argo-Poland consortium. This consortium comprises the Institute of Oceanology PAN, the Institute of Geophysics PAN, and the Polish Naval Academy. In 2022, the Polish Ministry of Science and Education approved funding for the consortium, ensuring financial support for the next five years.

3. Summary of deployment plans.

Argo-Poland plans to deploy at least three floats each year, with two placed in the European Arctic and at least one in the Baltic Sea. In 2025, an additional two floats are planned for deployment - one in the Baltic Sea and the other in the Norwegian Sea, both on the shelf.

4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers.

The Institute of Oceanology of the Polish Academy of Sciences (IO PAN) conducts the long-term Nordic Seas observation program, AREX. Argo floats serve as a valuable complement to the measurement data collected by the r/v Oceania. This is particularly important for studying the seasonal variability of water mass properties (as AREX cruises are conducted only in summer) and the pathways of sea currents in the Svalbard region. For more details, visit the [IO PAN Argo webpage](#).

In the Baltic Sea, Argo float data are utilized to monitor the inflow of salty waters from the North Sea. Additionally, these data provide valuable insights into oxygen content at various depths of the Baltic Sea and the pathways of sea currents. Argo data are also an integral part of modeling efforts in the [SatBaltyk project](#).

Furthermore, Argo data are actively used in projects such as 4DBALTDYN (Baltic Sea Dynamics through 4D Modelling and Integrated Earth Observation) and SufMix (Turbulent Mixing in the Slupsk Furrow).

5. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo.

There are no issues to report.

6. CTD stations

In 2024, three Polish floats were deployed during the IOPAN Arctic cruise AREX, during which approximately 200 CTD profiles were conducted. Additionally, one float was launched in the Baltic Sea during a Baltic cruise. CTD stations were also carried out immediately prior to the deployment of the floats. IOPAN can provide data from these four stations for comparison with data from the Argo floats.

The remaining data from the Nordic Seas and the Baltic Sea will be accessible via the IOPAN database.

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7. Argo bibliography

Merchel M., Walczowski W., Rak D., Wieczorek P., The use of Argo floats as virtual moorings for monitoring the South Baltic Sea, *Oceanologia*, 66 (1), 99-110, <https://doi.org/10.1016/j.oceano.2024.01.002>.

Bulczak, A.I., Nowak, K., Jakacki, J., Muzyka, M., Rak, D. and Walczowski, W., 2024. Seasonal Variability and Long-Term Winter Shoaling of the Upper Mixed Layer in the Southern Baltic Sea. *Continental Shelf Research*, p.105232, <https://doi.org/10.1016/j.csr.2024.105232>.

Rak, D., Przyborska, A., Bulczak, A.I., Dzierzbicka-Głowacka, L., 2024. Energy fluxes and vertical heat transfer in the Southern Baltic Sea. *Frontiers in Marine Science*, 11, p.1365759, <https://doi.org/10.3389/fmars.2024.1365759>.

Two other scientific papers using data from Argo floats are in preparation.

8. How has COVID-19 impacted your National Program's ability to implement Argo in the past year?

COVID-19 had no impact on the deployment and recovery of floats.

9. Does your National Program have any deployment plans for RBR floats in the next couple years?

There are plans to purchase one RBR float, provided it includes an oxygen sensor.