

ARGO National Report 2024: Bulgaria

Violeta Slabakova, Atanas Palazov and Ivelin Petkov

Institute of oceanology – BAS

March 2025

1. Status of implementation

The BulArgo programme is a component of the project MASRI – Infrastructure for Sustainable Development of Marine Research and Participation in European Infrastructure (Euro-Argo). (<http://masri.io-bas.bg/>), a part of the National roadmap for scientific Infrastructure (2020-2027) of the Republic of Bulgaria.

The BulArgo programme comprises a consortium of three scientific organizations: Institute of Oceanology (IO-BAS) in Varna, Sofia University “St. Kliment Ohridski” and National Institute of Meteorology and Hydrology in Sofia.

Since 2011, IO-BAS has deployed a total of 17 floats under the BulArgo programme, which is the Bulgarian contribution to the Euro-Argo ERIC infrastructure. The floats have provided approximately 3000 profiles of which 1 800 include DOXY measurements (Fig.1). Currently the number of active floats in the Black Sea is 11 out of which 9 are operated by Bulgaria.

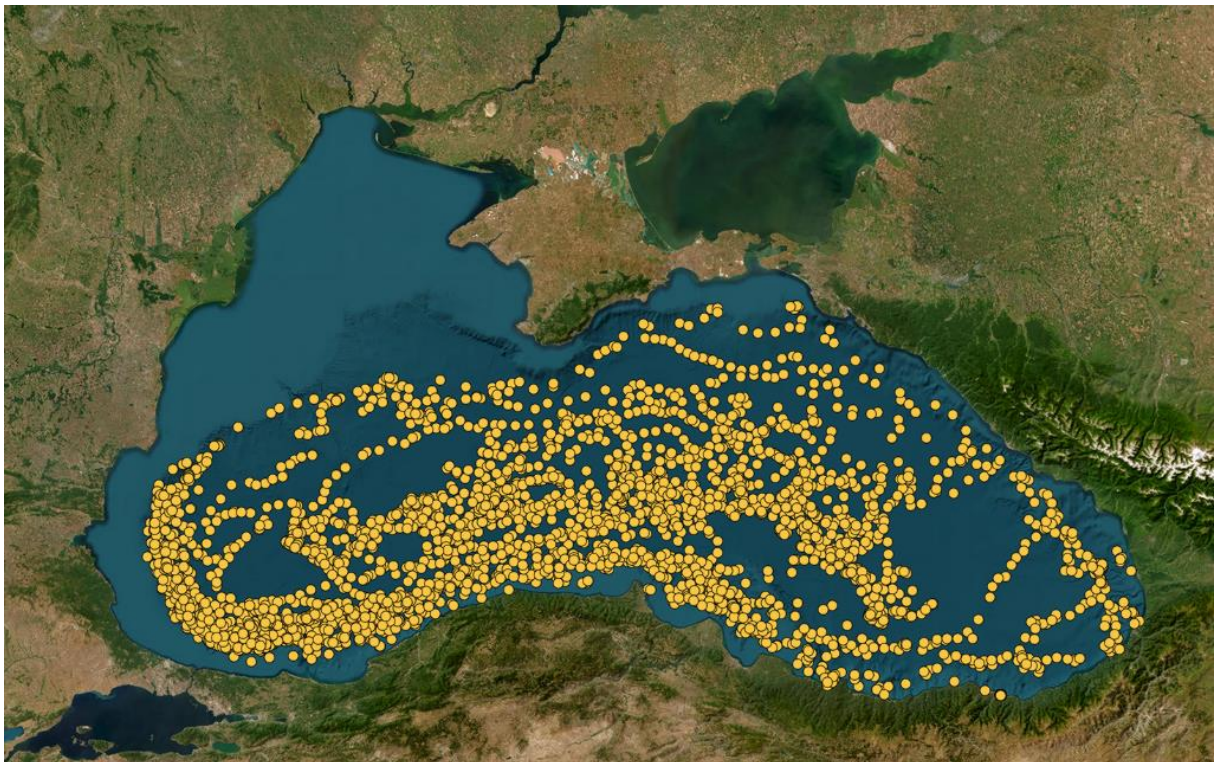


Figure 1. Profiles of the BulArgo programme (2011-2025)



a) Floats deployment and their performance

During 2024, two BulArgo floats were deployed in the Black Sea under the framework of the MASRI project. Both floats were ARVOR - DO – I, manufactured by NKE (France). The floats integrate an Iridium satellite telemetry system which provides a dual telecommunication capability, allowing real-time modification of their configuration.

The first float (WMO 7902191) was deployed on June13, 2024 in the Georgian Black Sea waters from board of R/V Mare Nigrum during H2020 DOORS project cruise (MN256). One month later, the second float (6990663) was deployed in the Bulgarian Black Sea waters during R/V Akademik survey.

Both floats were programmed to cycle between the surface and 2000 dbar every 10 days. Currently, the floats are operational. The status information for the Bulgarian floats deployed in the Black Sea during 2024 is presented on Table 1.

Table 1. Status information for the floats deployed in the Black Sea during 2024

Model	WMO	Deployment date	Deployment time	Latitude, N	Longitude, E	No of Cycles	Status
ARVOR-DO	7902191	13/06/2024	14:02:00	41.7255	41.2344	24	active
ARVOR- DO	6990663	10/03/2024	07:15:00	42.8346	28.8267	24	active

b) Technical problems encountered and solved

Delayed or partial transmissions have been observed on several Argo floats operating in the Black Sea.

c) Status of contributions to Argo data management (including status of conversion to V3 file, formats, pressure corrections, etc.)

After the float deployments, detailed technical information was provided to the Euro-Argo ERIC Office and uploaded to the OceanOps website. The BulArgo program is aware of the changes in technical and metadata formats and ensures the necessary information is provided.

d) Status of delayed mode quality control process

The BulArgo programme does not have the human resources and capacity to implement delayed mode quality control of the Argo data. The delayed mode quality control of the T/S data from BulArgo floats is carried out by the MedArgo data center (OGS, Italy)

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



In 2024, Bulgaria remains a committed member of the Euro-Argo ERIC. The national funding for 2024 covers float procurement, deployment, and communication costs. Three staff members at IO-BAS are engaged Euro-Argo and BulArgo activities. They do so besides their other duties with minimum financial support by MASRI.

3. Summary of deployment plans (level of commitment, areas of float Deployment, low or high resolution profiles, extra sensors, Deep Argo) and other commitments to Argo (data management)for the upcoming year and beyond where possible)

In 2025, IO-BAS plans to deploy:

- ✓ ARVOR -DO float in the Romanian Black Sea waters during AQUARUIS cruise (if granted)
- ✓ ARVOR – DO and ARVOR- (RBR) in the Bulgarian Black Sea waters

Given the evolving geopolitical situation in the Black Sea, the deployment plan may be subject to changes or delays.

4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centres. Please also include any links to national program Argo web pages to update links on the AST and AIC websites.

4.1. Operational and scientific use of Argo data

BulArgo focuses on both research topics and marine climate monitoring of the Black Sea. Argo data are routinely assimilated into the BS-MFC operational Black Sea forecasting system of the Copernicus Marine Environment Monitoring Service (CMEMS). Argo data are being used by researchers from the Black Sea countries to improve the understanding of Black Sea physical and biogeochemical properties and to validate numerical models.

The BulArgo program website (<https://bulargo.io-bas.bg/>) serves as a platform to showcase and promote the activities of Argo, Euro-Argo, and BulArgo programmes. The site is regularly updated with the latest information, offering data access for all floats operating in the Black Sea and highlighting Bulgarian Argo activities, news, and data from Argo floats. The website is continuously upgraded, with the addition of more images and videos documenting float deployment activities.

5. Outreach and communication:

In 2024, several dissemination activities were carried out by the BulArgo program team, including:

- Training for Georgian scientists on Argo float technology, including onboard testing and float deployment. R/V Mare Nigrum, June 2024, H2020 DOORS cruise №3.



- Presentation of the EA ERIC and BulArgo activities to the students from Spain, Italy, Estonia, Croatia, Turkey and Bulgaria during their visit to the Institute of oceanology in Varna, Bulgaria (Mar 2024).
- Presentation of Argo floats technology to the participants in the First Lego League (FLL) competition - Season DIVE (SUBMERGED) (4 Nov, 2024).
- Joint presentation by Euro-Argo ERIC and IO-BAS on Climate Argonauts at the Beautiful Science Festival in Varna, Bulgaria, on October 27, 2024.
(<https://beautifulscience.bg/en/produkt/climate-argonauts/>)

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

Non.

7. 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.

At all deployment locations a deep CTD station was taken. The ship-data will be sent to Argo (Reference Database).

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

Planned in 2025.

9 Black Sea Argo bibliography for 2024

Çokacar, T. (2024), Cold Intermediate Water Formation in the Black Sea Triggered by March 2022 Cold Intrusions, Journal of Marine Science and Engineering, 12(11), [doi: https://doi.org/10.3390/jmse12112027](https://doi.org/10.3390/jmse12112027).

Kubryakov, A. A., A. G. Zatsepin, O. S. Puzina, and S. V. Stanichny (2024), The impact of vertical mixing on the variability of salinity in the Black Sea pycnocline: Role of winter convection, vertical shear and mediterranean waters injections, Deep Sea Research Part I: Oceanographic Research Papers, 208, 104321, [doi: https://doi.org/10.1016/j.dsr.2024.104321](https://doi.org/10.1016/j.dsr.2024.104321)

Mikaelyan, A. S., A. V. Sergeeva, L. A. Pautova, V. K. Chasovnikov, and V. I. Gagarin (2024), 75-Year dynamics of the Black Sea phytoplankton in association with eutrophication and climate change, Science of The Total Environment, 954, 176448, [doi: https://doi.org/10.1016/j.scitotenv.2024.176448](https://doi.org/10.1016/j.scitotenv.2024.176448)



Polonsky, A. B., and A. A. Valle (2024), Reasons for the Long-Term Variability of the Dissolved Oxygen Concentration in the Upper Layer of the Black Sea, Dokl. Earth Sc., 516(1), 768-773, doi: <https://doi.org/10.1134/S1028334X24600853>

Zhuk, E. V., and N. V. Markova (2024), Geoinformation System for Argo Floats Drift Assessment: The Black Sea Case, Physical Oceanography, 31(4), doi: <http://www.physical-oceanography.ru/repository/issues/2024/04/07/20240407.pdf>

E. V. Stanev, C. B. Gramcianinov, J. Staneva, V. Slabakova (2024) Thermohaline Intrusions as Seen by Argo Floats: The Case of the Black Sea, Journal of Geophysical Research: Oceans, <https://doi.org/10.1029/2024JC021762>