ARGO National Report 2022: Bulgaria

1. Status of implementation

BulArgo programme is a component of the project MASRI – Infrastructure for Sustainable Development of Marine Research and Participation in the European Infrastructure (Euro-Argo). (http://masri.io-bas.bg/), a part of the National roadmap for scientific Infrastructure (2020-2027) of 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 altogether 12 floats under the BulArgo programme, which is the Bulgarian contribution to the Euro-Argo ERIC infrastructure. The floats have provided more than 2200 T/S profiles (Fig.1). Currently the number of active floats in the Black Sea is 11 out of which 8 are operated by Bulgaria.

Figure 1. Profiles of the BulArgo floats

a) Floats deployment and their performance

During 2022, two Argo floats were deployed in the Black Sea under the framework of MASRI project. Both floats were ARVOR - DO manufactured by NKE (France). The floats integrate Iridium satellite telemetry system which provides a dual telecommunication capability allowing modification of the configuration in real-time. The BulArgo floats (WMO 5906866 and 3902006) were deployed on 3rd of November 2022 in Bulgarian Black Sea waters at depths 1400 m and 1500m, respectively. Both floats were programmed to cycle between the surface and 2000 dbar every 10 days and to drift at the parking depth of 750 dbar. Currently,

the floats still operate. The status information for the Bulgarian floats deployed in the Black Sea during 2022 is presented on Table 1.

Table 1. Status information for the Bulgarian floats deployed in the Black Sea during 2022

Model	WMO	Deployment date	Deployment time	Latitude	Longitude	№ of Cycles	Status
Arvor-I-DO	5906866	3/11/2022	04:54	42.9337	28.859	8	Active
Arvor-I-DO	3902006	3/11/2022	08:00	43.1216	29.1122	8	Active

b) Technical problems encountered and solved

Both floats were deployed by Institute of oceanology, Bulgarian Academy of Sciences (IO-BAS) from board of the fishing vessel. No technical issues have been found regarding the floats deployments and monitoring.

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

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

d) Status of delayed mode quality control process

The delayed mode quality control of the data delivered from the BulArgo floats are processed by the MedArgo data centre (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 2023, Bulgaria continues to be a committed member of the Euro-Argo ERIC. The national funding for 2023 covers float procurements, deployment and communication costs. BulArgo programme not yet received a decision on funding in the following years. Two persons from IO-BAS are working on the Euro- Argo and BulArgo activities. They do so besides their other duties.

a) 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 2023, IO-BAS plans to deploy:

- two ARVOR -I floats in the Bulgarian Black Sea waters;
- two PROVOR CT4 floats (provided by IO-BAS and Euro- Argo ERIC) equipped with suites of 5 biogeochemical sensors allowing measuring Dissolved Oxygen, Nitrate, CHL-

a/CDOM/Backscattering and Radiometry variables in addition to temperature, conductivity and pressure (provided by H2020 project, DOORS- Developing Optimal and Open Research Support for the Black Sea). The floats will be deploy in Romanian and Bulgarian waters during 1st DOORS cruise (1-20, May 2023).

- one Italian ARVOR-I float in Bulgarian Black Sea waters.

The deployment plan of these floats could be affected if the conflict between Russia and Ukraine is deepened.

3. **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.**

BulArgo focuses on both research topics and marine climate monitoring of the Black Sea.

Argo data are routinely assimilated into BS-MFC operational Black Sea forecasting system of the Copernicus Marine Environment Monitoring Service (CMEMS).

Argo data are being used by the researchers from the Black Sea countries to improve the understanding of Black Sea physical and biogeochemical properties.

IO-BAS developed and maintains the BulArgo website https://bulargo.io-bas.bg/ (Fig. 2). It provides information about ARGO international, Euro-Argo and BulArgo programmes, fleet status, data access, etc.

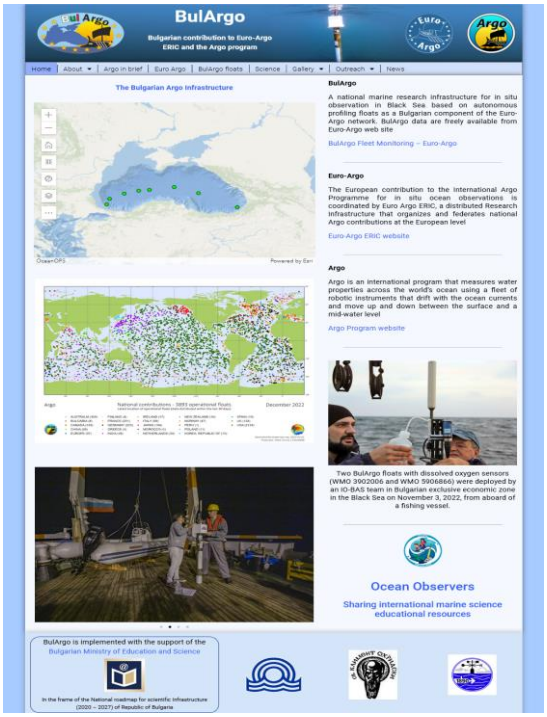

Figure 2. Screenshot of the BulArgo webpage

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

Nothing.

5. **CTD data uploaded to CCHDO**

No data uploaded to the Argo reference database.

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

Planned in 2023.

Bibliography:

1. Ciliberti, S.A.; Jansen, E.; Coppini, G.; Peneva, E.; Azevedo, D.; Causio, S.; Stefanizzi, L.; Creti', S.; Lecci, R.; Lima, L.; Ilicak, M.; Pinardi, N.; Palazov, A. The Black Sea Physics Analysis and Forecasting System within the Framework of the Copernicus Marine Service. *J. Mar. Sci. Eng.* **2022**, *10*, 48. https://doi.org/10.3390/jmse10010048
2. Stanev, E. V., K. Wahle, and J. Staneva (2022), The Synergy of Data From Profiling Floats, Machine Learning and Numerical Modeling: Case of the Black Sea Euphotic Zone, *Journal of Geophysical Research: Oceans*, *127*(8), e2021JC018012, doi: https://doi.org/10.1029/2021JC018012
3. Suslin V., Slabakova V, Churilova T (2022) 4D structure of bio-optical characteristics of the upper 70 m layer of the Black Sea: Bio-Argo floats and ocean color scanners, *Total Environment Research Themes,* Elsevier, Volumes 3–4, December 2022, 100006, https://doi.org/10.1016/j.totert.2022.100006