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Bulgarian Argo Activities
Present status and further plans
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The Bulgarian Argo programme is run by the consortium of three research organizations: The Institute of Oceanology in Varna, Sofia University "St. Kliment Ohridski" and the National Institute of Meteorology and Hydrology in Sofia. The focus of the ongoing research program is the monitoring of the Black Sea.

1. The status of implementation

Bulgaria was first involved in the Argo activities in December 2009, when one French PROVOR float (#1901200) was deployed in the deep part of the Black Sea by the R/V Akademik operated by the Institute of Oceanology in Varna. Latter, in March 2011 and August 2013 four BulArgo floats were deployed in the western open Black Sea. Apart from the standard CTD measurements, one of the floats (6900804) was equipped with an oxygen sensor. All floats use ARGOS telemetry system, and were programmed to a 5-days cycle, a parking-depth at 750 m and a profile depth at 1500 m. Two of four BulArgo floats (7900590 and 6900803) are still collecting data, one is consider as dead (6900804) and one (6900805) stranded on the southeaster Turkish coast after 209 cycles of operation (Fig.1). The float was successfully recovered by Turkish scientist and will be redeployed after its battery replacement.
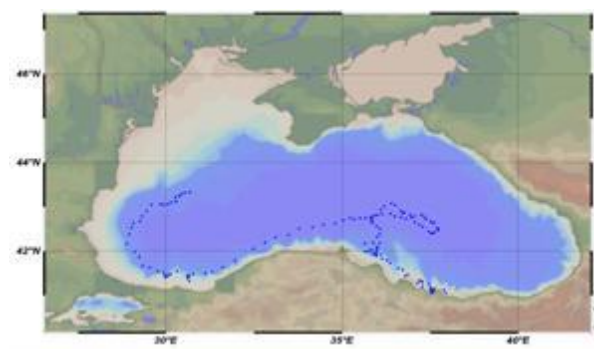

Figure 1. Trajectory of the float 6900805

Since June 2012 in a frame of a collaborative effort with Italy, Institute of oceanology, Bulgarian Academy of Sciences (IO-BAS) has deployed six ARGO floats in the western Black Sea as contribution of the MedARGO programme. These floats are Arvor-L, two with IRIDIUM (6901831 and 6901832) and four with ARGOS telemetry (9601959, 9601961, 9601962, and 9601960). They have a parking depth at 200 and profiling depth at 1500 m. One of the floats (6901960) stranded on the Southern Bulgarian coast (near the city of Primorsko) in 2012 after 26 cycles of operation. It was recovered and redeployed

in 2013 after being refurbished and repaired. All MedArgo floats are still active. In December 2013, two biogeochemical PROVOR CST4 floats (basbio001b and basbio002b) were deployed in the western Black Sea by IO-BAS in the frame of E-AIMS, EC 7FP project. In addition to the standard CTD, each float mounted the following set of biogeochemical sensors:

1) Aanderaa oxygen optode 4330;
2) Satlantic Rem-A sensor including a WETLabs ECO-Triplet (with three channels to measure chlorophyll-a fluorescence, and optical backscattering at 532 and 700 nm) and a Satlantic OCR540 (with four channels measuring downward irradiance at 380, 412, 490 nm and a channel for photosynthetically available radiation, PAR).

In June 2014 a PROVOR CT float (7900593) delivered under PERSEUS EC 7FP was launched in the western Black Se during R/V "Akademik" research cruise. The parking and profile depth of float was set up to 750 m and 2000 m, respectively.

At present the total number of active float in the Black Sea is 13 (including 4 floats deployed by scientists from Institute for Marine Sciences (IMS), Erdemly, Turkey in the frame of DEKOSIM project)-Fig . 2.
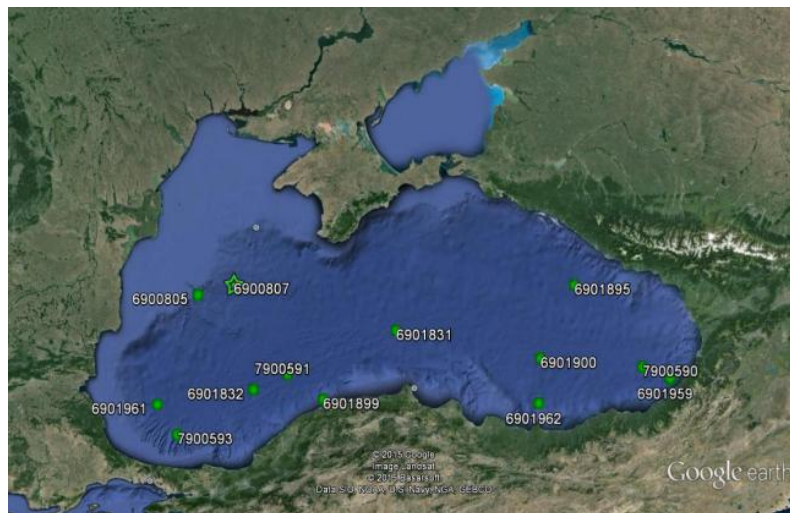

Figure 2. Position of the Black Sea Argo active float on 26 October 2014.

2. Status of contributions to Argo data management (including status of pressure corrections, technical files, etc)

The data management for the BuLArgo float was done by the Coriolis GDAC. Metadata and data are available through the Coriolis web site in near real-time.

3. Status of delayed mode quality control process

At present the standard procedures for delayed mode data processing and quality control are performed at the OGS. However, the procedures are being revised by the competent staff to account for the Black Sea regional characteristics (M. Milanova, Quality control of data from Argo floats in the Black Sea, MSc. Thesis). The QC includes specific range of the values control; comparison with climatological profiles, comparison with other Argo floats data, temperature and salinity gradients check, check of stability of the vertical stratification. The standard QC flags are assigned to each profile. The data coming from the float with the oxygen and biogeochemical sensor are still under validation.

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

National funding for Argo activities is expected to be provided from year 2016.

5. Summary of deployment plan

The Bulgarian deployment plans for 2015 are detailed in Table 1. The area of float deployment is western Black Sea.

Table 1. Deployment plan 2015

Year	Month	Programme/Project	Float type	Quantity
2015	May	ArgoItaly	PROVOR BioII-UTI	1
2015	June	PERSEUS EC 7FP	Provor DO-I	1
2015	September	ArgoItaly	Arvor L-I	1

6. Summary of national research and operational uses of Argo data

The key objectives to use the Argo data in the Black Sea involve:
- Development of adequate data quality control procedures taking into account the Black Sea peculiarities
- Study of the long-term temperature and salinity changes near the sea surface and in the deep layers
- Model validation and Assimilation of the Argo data in a Black Sea circulation model
- Evaluation of biogeochemical properties
- Studying the dynamics of oxycline and anoxic layer.
- Quantification of the steric effects in the Black Sea
- Getting new insight about the deep circulation of the Black Sea
- Quantification of Bosporus plume effects on the Black Sea

7. Issues we wish to be considered and resolved

N/A

8. Number of CTD cruise data added to the Argo reference database by Bulgarian PIs in 2014

No data uploaded.

9. Bibliography in 2014

A. Palazov, V.Slabakova, E. Peneva, E. Stanev, 2014 " Black Sea Argo: history, current status and prospect" , 7th EuroGOOS Conference proceedings, Lisbon, 28-30 October 2014

Stanev, EV, Y He, J Staneva and E Yakushev (2014) Mixing in the Black Sea detected from the temporal and spatial variability of oxygen and sulfide – Argo float observations and numerical modelling. Biogeosciences, 11, 5707–5732, 2014.