

GREEK ARGO PROGRAMME

PRESENT STATUS AND FUTURE PLANS

G. Korres and D. Kassis

HCMR

March, 2015

1. Background and organization of GREEK ARGO activities

Greece has established national contribution to the ARGO project.

1.1 Deployed floats

During 2010, HCMR procured (using internal funds) and deployed a PROVOR-CTS3 float initiating the Greek Argo programme. The float was deployed in the Cretan Sea during June 2010, its lifetime ended in May 2012 after a successful recovery and redeployment operation in November 2011. During 2013 two new deployments were achieved in a month's period from HCMR's Argo operational team in the framework of PERSEUS FP7 and IONIO Interreg-III projects under Greek Argo Infrastructure coordination. The first deployment took place on 30th of October in the Cretan Sea at approximately 15nm north-west of Heraklion port. The float was lost 6 months after in the South-east straits of Aegean basin but it was detected and recovered by the port authorities under the guidance of Greek Argo operational team. The float is a PROVOR DO type being the first float in Aegean equipped with a dissolved oxygen sensor additional to standard CTD float's instrumentation and is to be redeployed early this year. On the 28th of November of 2013, a NOVA type standard CTD float was deployed in the Northern Ionian basin, being the first Greek Argo float in Ionian Sea. During 2014, 5 additional deployments were accomplished by the Greek-Argo team. The first was deployed in the Central Ionian basin in the framework of IONIO Interreg-III while the other 4 (Greek Argo RI) were deployed in the North, Central, South Aegean and South Ionian accordingly. The floats integrate an Iridium satellite telemetry system which provides a dual telecommunication capability allowing modification of the configuration in real-time, while the one in Central Aegean comprises an additional Dissolved Oxygen sensor. The deployments during 2014 are presented in the table 1 below:

	TYPE	WMO	IMEI NUMBER	SERIAL NUMBER	DATE	HOUR	LAT	LOX
1	NOVA	6901887	300234061669400	136	13/11/2014	6:00	36.25	21.50
2	NOVA OXYGEN	6901886	300234062728310	168	12/11/2014	16:10	37.08	23.91
3	NOVA	6901885	300234061647120	134	8/10/2014	20:00	35.79	25.12
4	NOVA	6901884	300234061645140	133	7/10/2014	21:00	36.92	24.25
5	NOVA	6901883	300234060479180	108	14/3/2014	8:15	38.14	20.24

Table 1. Deployments performed from Greek Argo team during 2014

The Greek active floats are currently 6 and are presented in the following maps (figure 1).

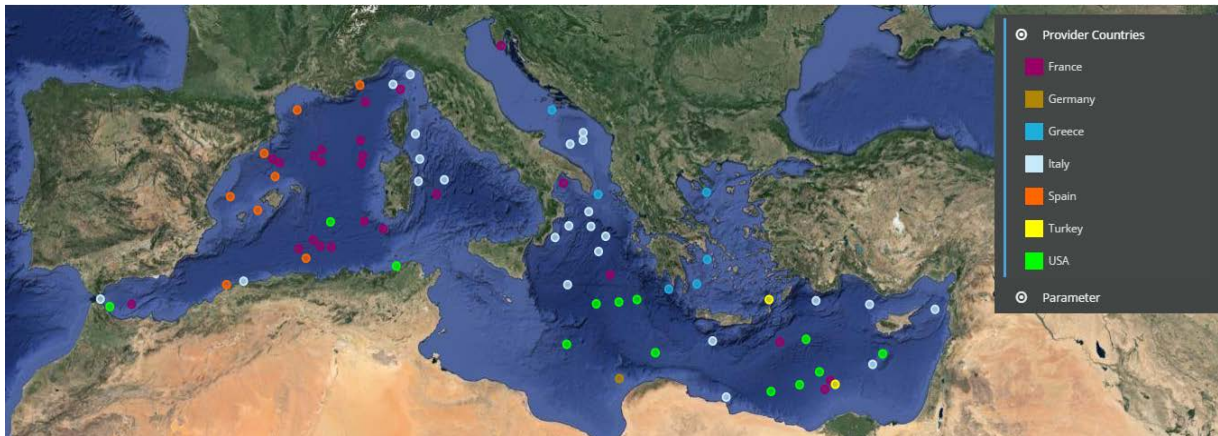


Figure 1. Active floats in the Mediterranean (March 2015). Greek floats are presented with light blue dots (<http://www.greekargo.gr>)

All floats have been integrated in the MedArgo project. Taking into account the proposed sampling strategy for the Mediterranean Sea and the bathymetry of the deployment site and the adjacent areas, the mission parameters of the floats were set as follows: The parking depth of the floats was set to 350m, its profiling depth to 1000m and the cycle period to 5 days. The raw data of the Greek float are delivered at the Coriolis data Centre where the real time quality control takes place while the delayed mode quality control of the data will be processed by the MedArgo Centre at OGS.

1.2 Float Development

HCMR has constructed an Argo float's detection system after the process of locating a float has been described and the various approaches have been indicated. A prototype active locator unit has been developed, and the principle of operation has been demonstrated. The unit has been tested successfully in land and at sea at the SIDERI workshop at 17-18 September 2013 that took place at Heraklion, Greece. The deck unit communicates via bluetooth with any mobile phone which is used for interface and control. Future work includes the study of a pressure housing and antenna design. This activity was under the task of proposing and testing simple methods of tracking and recovery Argo floats in short time and range scales in the framework of SIDERI FP7 project.

1.3 Data management

HCMR has run an extended network of buoys within the Aegean and Ionian Seas including the multi-parametric M3A observatory of the Cretan Sea and a deep sea (2000m) bottom platform deployed in the Ionian Sea (POSEIDON & POSEIDON-II monitoring, forecasting and information systems). HCMR also operates the Hellenic National Oceanographic Data Centre (HNODC) established in 1986, as part of the National Centre for Marine Research (NCMR). HNODC operates as a National Agency and is responsible for processing, archiving and distributing marine data. HNODC is also developing techniques for oceanographic data processing and data base maintenance. Furthermore it promotes the International Exchange of Data in the frame of its cooperation with the "Intergovernmental Oceanographic Commission IOC) of UNESCO as it is responsible for the coordination of International Data Exchange (IODE) in Greece. The HNODC manages a variety of oceanographic data and information collected by several Hellenic Marine Research

Laboratories and in particular from the Institute of Oceanography of the Hellenic Centre for Marine Research-HCMR as well as from HNODC's participation in international projects (MTP-II MATER, MEDAR/MEDATLAS II, HUMBOLDT, SEADATANET). Moreover within the My Ocean project (GMES MCS) HCMR will consolidate and improve its in-situ data services for the Eastern Mediterranean region building on the capacity developed under POSEIDON, MFSTEP (coordination of M3A time-series network, analysis and provision of basin scale data), and MERSEA projects (coordination of Mediterranean in situ observations).

Delayed-mode data processing. HCMR has not developed yet a delayed-mode quality control capability for the Greek Argo data. The delayed mode quality control of the data delivered from the Greek Argo float will be processed by the MedArgo data centre. HCMR considers the possibility of developing delayed-mode data processing for ARGO profiles collected within the Eastern Mediterranean region. HCMR may also contribute to the improvement of the delayed mode quality control processing conceding CTD data collected through several HCMR research cruises. HCMR operates the Med Sea data portal that was set up for the needs of MyOcean project. Within this framework HCMR is in charge of validating biochemical data from Argo floats that are operating in the Mediterranean.

1.4. Operational and scientific use of Argo data

A very important activity, in the frame of the Greek Euro-Argo programme (which will demonstrate the Argo value) is the development of the capabilities in order to exploit Argo data for operational forecasting as well as for research applications. Along this direction, HCMR established a network of relevant Greek scientific groups mainly from Universities and Research Institutes which constitute the Greek Argo Users group/network. These different groups are already using or will be using ARGO data in ocean/atmospheric forecasting, climate studies and for educational purposes. On January 2014 the first Greek Argo Users meeting was hosted by HCMR aiming to present the activities of the national network to coordinate present and future actions that will take place at national level. The second meeting of the members of the Greek Argo infrastructure was held on January 15 2015. There were 10 scientists participating from HCMR Institute of Oceanography and 4 scientists and researchers from different Universities and departments from all over Greece. It is expected that the Greek Argo Users Group will further grow and expand its activities concerning the scientific exploitation of Argo data and the cooperation among Greek scientists. The next step will be the expansion of the Greek Argo network in more members. The network is already in contact with many organizations / agencies / institutions and it is foreseen that the establishment of the E-A ERIC will increase the interaction of the Greek Argo Users Group with the European and international ARGO scientific community in the near future.

Operational ocean forecasting:

Med-Argo data have been already used as independent data in order to assess the impact of remote sensed and Ferrybox SSS data assimilation into the Aegean Sea hydrodynamical model component of the POSEIDON system running operationally at HCMR within the framework of POSEIDON-I system.

Med-Argo data are routinely assimilated (using localized Singular Evolutive Extended Kalman filtering techniques) on a weekly basis in several operational forecasting systems that

are currently operating at HCMR involving the Mediterranean basin at 1/10° resolution (POSEIDON-II system), the Aegean Sea at 1/30° resolution and the Southern Adriatic – Ionian Sea at 1/50° resolution.

The results of the works described above are included in the following scientific publications:

[1] Korres, G., K. Nittis, I. Hoteit, and G. Triantafyllou, 2009: **A high resolution data assimilation system for the Aegean Sea hydrodynamics**. *Journal of Marine Systems*, **77**, 325-340.

[2] Korres, G., K. Nittis, L. Perivoliotis, K. Tsiaras, A. Papadopoulos, I. Hoteit and G. Triantafyllou, 2010. **Forecasting the Aegean Sea hydrodynamics within the POSEIDON-II operational system**. *Journal of Operational Oceanography*, Vol. 3, nu. 1, 37-49,

[3] Korres, G., M. Ntoumas, M. Potiris and G. Petihakis, 2014: **Assimilating Ferry Box data into the Aegean Sea model**. *Journal of Marine Systems*, 140 (2014) 59–72

Ocean science

Med-Argo data are currently used by a small group of researchers in Greece for studies of water mass characteristics of the different deep basins of the Mediterranean Sea and as a continuous record of T/S characteristics providing insight in the seasonal and inter-annual variability of the Mediterranean Sea and its sub-basins. Additionally, Argo data are used for educational purposes in some Greek University Departments. Due to HCMR initiatives within Euro Argo, Greek Argo and SIDERI programmes to contact potentially interested Greek and other scientists from the eastern Mediterranean region and inform them about the benefits of Argo programme. An increasing demand for Argo data along the Aegean and Ionian Sea for both scientific and educational purposes has been registered.

2. Funding

2.1 Existing funding for Greek Argo

The procurement, deployment and operation costs of the first Greek float launched in 2010/2011 were covered by HCMR internal funds. During 2012, Greece established national funding to the Greek Argo programme through the General Secretariat of Research and Technology (GSRT), Ministry of Education, Lifelong Learning and Religious Affairs (funding agency). A major achievement is that Greece participates to the European infrastructure E-A ERIC as a full member. A tender regarding the procurement of 25 new floats during the next 3 years period has been accomplished. During 2014 the first 13 floats have been delivered from which 4 (3 standard CTD and 1 with Dissolved Oxygen sensor) have been deployed and operate in Aegean and Ionian Seas.

2.2 On the future funding and organization for Greek Argo – links with Euro Argo

As part of the Euro-Argo, HCMR has undertaken all necessary efforts and managed to establish long term national funding for the E-A ERIC infrastructure and to meet the standards of a full member.

Greece has deployment capabilities for the Aegean, the Ionian Sea and the central Levantine basin. Float deployment in 2015 will be performed according to the plans of the Greek-Argo

research infrastructure. The main goal within 2015 is to initiate the development of the Greek-Argo infrastructure array in accordance with MEDARGO and the EuroArgo infrastructure. It is planned to start deployments in spring 2015 and deploy 4 floats in total, in the Ionian (1 float), in the Aegean Sea (1 float), in Western Levantine (1 float) and South of Crete (1 float).

3. Dissemination activities of the Euro-Argo infrastructure

By the end of 2013 Greek Argo has launched its web page: www.greekargo.gr that demonstrates and promotes Greek-Argo and Euro-Argo activities. At the end of 2014 Greek-Argo web portal was upgraded providing information and data access from all floats operating in the Mediterranean and presenting all Greek Argo activities, news and data from Greek Argo floats.

The Euro-Argo infrastructure is also demonstrated on the POSEIDON updated web page, http://www.poseidon.hcmr.gr/article_view.php?id=57&cid=28&bc=28. The POSEIDON system is the operational monitoring and forecasting system for the Greek Seas and many of its forecasting components use T/S Argo profiles for data assimilation purposes. The POSEIDON web page is also hosting the links to the EuroArgo educational web site as well as to the floats from each European country. The above links along with other informative material (Euro Argo leaflet, focused questionnaire) were forwarded directly to all active and potential users of Argo data in Greece. Many research groups filled and sent back the questionnaire providing valuable feedback to HCMR team. Furthermore, the EuroArgo poster and leaflet translated in Greek and they are hosted in the POSEIDON website. A press release was sent after the deployment of the Greek float. The press release is permanently hosted in the HCMR's Greek webpage, http://www.hcmr.gr/listview4_el.php?id=1110.