

GREEK ARGO PROGRAMME

PRESENT STATUS AND FUTURE PLANS

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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 using R/V AEGAEO. In August 2011, the float stopped operating, found by fishermen and was delivered back to HCMR premises by the porting authorities of Kassos island (southeastern Aegean). The float was sent back to NKE Electronics for the necessary maintenance (changing batteries, replacing bladder housing) and in November 2011 was successfully re-launched in the Cretan Sea by HCMR staff.

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 is a PROVOR DO type being the first float in Aegean equipped with a dissolved oxygen sensor additional to standard CTD float's instrumentation. On the 28th of November, a NOVA type standard CTD float was deployed in the Northern Ionian basin, being the first Greek Argo float in Ionian Sea. The float integrates an Iridium satellite telemetry system which provides a dual telecommunication capability allowing modification of the configuration in real-time.

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. There were 10 scientists participating from HCMR Institute of Oceanography and 6 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. Additionally, 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 one of the operational forecasting systems that are currently operating at HCMR involving the Mediterranean basin at 1/10° resolution (POSEIDON-II system) and the Aegean Sea at 1/30° 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., I. Hoteit, G. Triantafyllou, K. Nittis and K. Tsiaras. **An operational data assimilation system for the Mediterranean Sea hydrodynamics** (in preparation).

as well as in a poster presentation for the 2nd EURO ARGO users meeting (OGS, Trieste - Italy):

G. Korres, K. Nittis, L. Perivoliotis, G. Triantafyllou and M. Chatzinaki, 2009. **The Aegean Sea –Poseidon model**. Hellenic Centre For Marine Research, Greece.

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. Last year, 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 future 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 March 2014 the first 5 floats will be delivered.

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

As part of the Euro-Argo preparatory phase, 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 2014 will be performed according to the plans of the Greek-Argo research infrastructure and one EU project (IONIO). The main goal within 2014 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 2014 and deploy 6 floats in total (5 from Greek Argo national funding and 1 from IONIO project) in the Ionian (2 floats), in the Aegean Sea (3 floats) 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. 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.

The HCMR Argo team is planning to upgrade Greek-Argo web portal by 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.