

Report on the Italian Argo Program for 2013

1. The status of implementation (major achievements and problems in 2013).

- floats deployed and their performance:

In total, 11 Italian floats were deployed in 2013 (see Tables 1 and 2 for details). These floats were Arvor designs manufactured by NKE (France), some with Iridium (Arvor-I) and others with Argos telemetry (Arvor-L). In the Mediterranean and Black Sea, 8 units were deployed (Table 1). Except for float WMO 6901821, all the instruments were still operating at the end of February 2014. They have a parking depth at 350 dbars and profiling depths alternating at 700 and 2000 dbars. They all have cycles of 5 days, except that WMO 6901826 and 6901827 had daily cycles during approximately the first month after deployment in the Southern Adriatic Sea. Most floats were deployed from research vessels of opportunity (e.g., R/V Urania and Explora) with the help of colleagues from Italy and Cyprus. Float WMO 6901828 corresponds to a float which was recovered, refurbished locally in Varna, Bulgaria and redeployed in the western Black Sea.

<u>Model</u>	<u>WMO</u>	<u>Deploy Date</u>	<u>Lat</u>	<u>Lon</u>	<u>Cycles</u>	<u>Last Date</u>	<u>Lat</u>	<u>Lon</u>	<u>Status</u>	<u>Cycle</u>
Arvor I - 2	6901821	04-Mar-2013 07:56	39.25	18	53	01-Dec-2013 00:14	36.55	15.52	D	5
Arvor I - 2	6901822	23-Mar-2013 15:58	41.52	18.08	70	05-Mar-2014 00:11	41.69	17.82	A	5
Arvor I - 2	6901826	10-May-2013 04:10	42.02	16.18	102	04-Mar-2014 00:10	41.71	17.19	A	5
Arvor I - 2	6901827	11-May-2013 01:04	42	18.6	101	04-Mar-2014 00:12	40.7	18.87	A	5
Arvor-L	6901828	29-Sep-2013 21:20	42.83	28.82	32	01-Mar-2014 12:50	41.28	37.41	A	5
Arvor I - 2	6901824	04-Nov-2013 16:20	33.9	32.76	20	28-Feb-2014 23:58	34.78	31.88	A	5
Arvor I - 2	6901825	04-Nov-2013 19:05	34.24	33	24	28-Feb-2014 23:56	34.2	32.73	A	5
Arvor I - 2	6901816	18-Dec-2013 09:26	42.22	10.86	17	05-Mar-2014 00:19	41.3	9.92	A	5

Table 1. Status information for the 8 Italian floats deployed in the Mediterranean and Black Sea during 2013.

Three Italian floats were deployed in the Pacific Ocean sector of the Southern Ocean and ice-free Ross Sea (Table 2) with the help of Italian colleagues onboard the South Korean R/V Araon. Unfortunately, float WMO 6901813, which was tethered to act as a virtual mooring had transmission/floatation problems and died prematurely after only 29 daily cycles on 11 Feb 2013 (last GPS position available on 7 Feb 2013). The other two floats had cycles of 10 days, parking depth of 1000 m and maximum profiling depth of 2000 m and were still operational at the end of February 2014. However, GPS positions problems occurred for 6901815 starting 8 Nov 2013 and no positions are available for the profiles after that date.

<u>Model</u>	<u>WMO</u>	<u>Deploy Date</u>	<u>Lat</u>	<u>Lon</u>	<u>Cycles</u>	<u>Last Date</u>	<u>Lat</u>	<u>Lon</u>	<u>Status</u>	<u>Cycle</u>
Arvor I - 2	6901813	06-Jan-2013 19:20	-75.09	164.88	29	11-Feb-2013 01:43	0	0	D	1
Arvor I - 2	6901814	10-Jan-2013 07:55	-61.5	178.67	41	26-Feb-2014 00:11	-58.26	-161.46	A	10
Arvor I - 2	6901815	10-Jan-2013 15:24	-60	178.26	41	26-Feb-2014 00:26	0	0	A	10

Table 2. Status information for the 3 Italian floats in the Southern Ocean during 2013.

- technical problems encountered and solved

As stated above, one float in the Mediterranean failed after only 53 cycles for unknown reasons. In the southern Ocean, the GPS locations for float WMO 6901815 failed prematurely after cycle 30. Tests with a tethered float in Ross Sea were not successful and only 29 profiles were obtained. In general, the reasons for these failures are still unknown. They will be investigated in collaboration with the manufacturer NKE.

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

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

- status of delayed mode quality control process

Delayed mode quality control (DMQC) of the data provided by the Italian floats was done for 10 floats. OGS will continue this activity in 2014 as part of the EC FP7 E-AIMS and MyOcean-2 projects. Note that OGS is responsible for the DMQC of all the floats operated in the Mediterranean Sea. The temperature and salinity data of 122 floats (over a total of 202 floats) have been quality controlled following the standard Argo procedure, covering the period 2000-2013.

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

The Italian Ministry of Research has provided funding to buy 47 floats in 2013, including 7 instruments with biogeochemical sensors. In addition, the Italian human resources devoted to Argo-Italy per year amounts to about 50 man-months for technical, administrative and scientific personnel involved in the project in 2013. It is expected that the same level will be maintained in 2014, including the procurement of 20 additional floats. The Italian Ministry of Research is committed to provide funding in order to sustain the Italian contribution to Argo beyond 2014 as member of the Euro-Argo Research Infrastructure Consortium. In addition to the Italian national funding, OGS has funding from the EC FP7 PERSEUS, SIDERI and E-AIMS projects, for multiple activities (technical development, data management, capacity building and training, EuroArgo strategy, etc.) related to Argo.

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

The Italian deployment plans are detailed in Table 3. The main areas of interest are the Mediterranean and Black seas and the Southern Ocean.

Year	Floats with T/S		Floats with biogeochemical sensors		Total
	Quantity	Area	Quantity	Area	
2014	15	Mediterranean	3	Mediterranean	28
	2	Black Sea	1	Black Sea	
	7	Southern Ocean			
2015	15	Mediterranean	3	Mediterranean	30
	2	Black Sea			
	10	Southern Ocean			
2016	15	Mediterranean	0	Mediterranean	28
	3	Black Sea			
	10	Southern Ocean			

Table 3. Italian deployment plans for 2014-2016.

OGS is committed to carry out DMQC on all the Argo floats of the Mediterranean Sea as part of the E-AIMS and MyOcean-2 projects over the next years.

The website for the Italian contribution to Argo (Argo-Italy) was developed (<http://argoitaly.ogs.trieste.it/>). The link to the Mediterranean & Black Sea Argo Centre (MedArgo) is <http://nettuno.ogs.trieste.it/sire/medargo/>.

4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers.

Operational ocean forecasting.

All Argo temperature and salinity data in the Mediterranean (alongside with other in-situ and remotely sensed data) are routinely assimilated into the Mediterranean Forecasting System (MFS) operational forecasting system run by the Italian Gruppo Nazionale di Oceanografia Operativa (GNOO). Assessments have clearly demonstrated the positive impact of Argo data on ocean analyses and predictions. In particular, studies on the optimization of float sampling and cycling characteristics for the Mediterranean have been performed, as well as the development of methodology for the assimilation of Argo float sub-surface velocities into numerical models.

Ocean science.

Argo data are being used by several researchers in Italy to improve the understanding of marine properties (e.g. circulation, heat storage and budget, and mixing), climate monitoring and on how they are applied in ocean models, with particular focus to the Mediterranean Sea.

5. Issues that your country wishes to be considered and resolved by the AST.

N/A

6. Number of CTD cruise data added to the Argo reference database by Italian PIs in 2013.

N/A

7. Italian contribution to Argo bibliography in 2013.

Bensi M., Cardin V., Rubino A., Notarstefano G., and Poulain P.-M., 2013: Effects of winter convection on the deep layer of the Southern Adriatic Sea in 2012. *Journal of Geophysical Research: Oceans*, **118**, 1-12, doi:10.1002/2013JC009432

Dobricic, S., 2013: An Application of Sequential Variational Method without Tangent Linear and Adjoint Model Integrations, *Mon. Weather Rev.*, **141**(1), 307-323.

Griffa, A., A. Haza, T. M. Özgökmen, A. Molcard, V. Taillandier, K. Schroeder, Y. Chang, and P. M. Poulain, 2013: Investigating transport pathways in the ocean, *Deep Sea Research Part II: Topical Studies in Oceanography*, **85**(0), 81-95.

Nardelli, B. B., 2013: Vortex waves and vertical motion in a mesoscale cyclonic eddy, *Journal of Geophysical Research: Oceans*, **118** (10), 5609–5624.