

ARGO France
Report for the 9th ARGO Steering Team meeting
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1. The status of implementation (major achievements and problems in 2007)

- floats deployed and their performance:

32 floats were deployed in 2008. It is less than planned as a number of cruises have been delayed. This explains the increase in the plans for 2008.

A prototype of the new generation of PROVOR profiling float, the ARVOR float, was deployed in December 2006 in the Bay of Biscay. He died after 186 cycles due to the lack of power after a remarkable mission. He was programmed to cycle every 2 days down to 2000m with a parking depth of 1000m with continuous pumping during the ascent and a 6-hour Argos transmission. He was equipped with 18 batteries.

- technical problems encountered and solved:

ARVOR industrialization: Due to various problems (lack of man power, technical problems), the industrialization phase of the ARVOR floats, which began in 2006, was delayed in 2007. It is now terminated and in February 2008, the first of the ten floats ordered has been tested in a tank and the weight budget is being improved. The soft is coded and a complete float cycle has been simulated in laboratory. Qualifications tests are pursued and a deployment at sea with float recovery will be done soon from a cruise of opportunity.

Provor float equipped with Dissolved Oxygen sensors (PROVOR-DO): 2 prototypes have been provided by Ifremer to IFM Geomar (as part of CARBOCEAN) to replace PROVCABON floats that were not available at that time. Deployed in February 2007, only one is still active. The other one never transmitted anything.

Tests realized on 8 other PROVOR-DO floats show large mismatches in the O₂ measurements. Complementary tests realized on 2 floats showed systematic underestimation of the O₂ measurements that is greater than the Aandera specification. The underestimation of the O₂ concentration is problematic for those floats that were deployed in minimum oxygen zone (off the Chile coast) as value of 0 µM/l has been reached. We thus conclude that it is mandatory to recalibrate the O₂ sensor before deployment.

In 2008, we will work on the improvement of the PROVOR-DO float. In particular, we are going to move the DO sensor from the bottom to the top cap of the float. It is worth mentioning that within the Oxywatch project, which has been recently submitted to Europe (FP7) and in which Ifremer is partner, improvement in oxygen measurement will be done.

Iridium transmission: Iridium antennas were tested on PROVOR floats equipped with optical and biological sensors. Due to many problems encountered with existing antennas from Trident sensors, Ifremer successfully developed its own antenna. The first PROVCARBON float has been successfully deployed in February 2008 by IFM Geomar.

- status of contributions to Argo data management:

Coriolis continue to process French floats in RT and DM. French Coriolis data center processes data coming from 775 floats including 333 active floats in November 2007 (about half Provor , half Apex) , deployed by 11 countries (Chile, China, Costa Rica, France, Germany, Korea, Mexico, Netherlands, Norway, Russia, Spain and the European Union), Operated by more than 35 scientific projects (Good-Hope, Mersea, MFSTEP, Tropat, Wecon...) The detail can be found in the 8th ADMT report. Data are processed and distributed according to Argo recommendations
 Coriolis operates one of the GDAC in close collaboration with FNMOC/ISA. Coriolis also coordinates the ARC activities and in particular the float deployment in Atlantic

2. Status of delayed mode quality control process

Statistics on all delayed mode data loaded in the Coriolis database for end of February are presented on Figure 1. 25052 delayed mode profiles are present in the Coriolis DAC that represents about 46% of the total number of profiles available at the Coriolis DAC. This number did not increase since the last ADMT in November because some cycles have been re-decoded to correct trajectory data and metadata. Because of the re-decoding of the floats, the delayed mode data have been removed from the database. Few of them have been re-submitted and updated in our database but others are still waiting for this update. This problems concern only Coriolis floats because the work on the trajectory data was initiated on Coriolis float (Provor CTS2 and CTS3 - APEX version 4 and 11).

delayed mode statistics

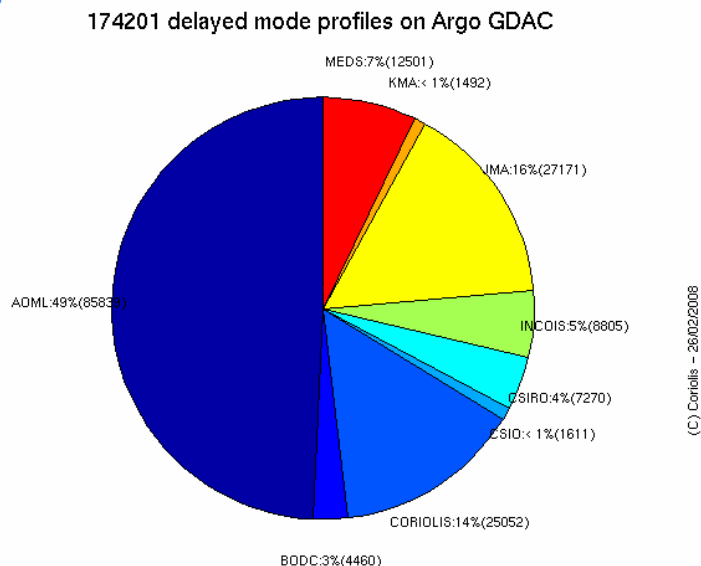
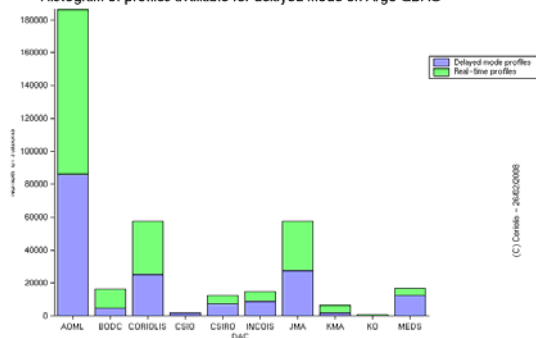


Figure 1: Delayed mode statistics.

Histogram of profiles available for delayed mode on Argo GDAC



Histogram of delayed mode profiles on Argo GDAC (%)

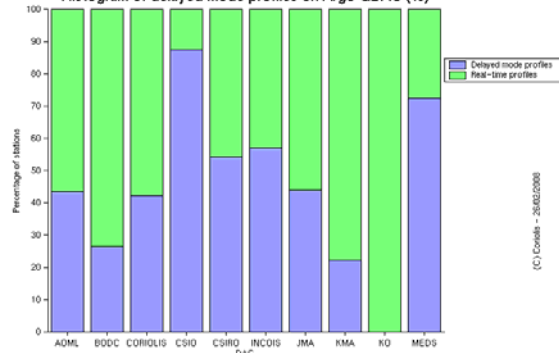


Figure 2: Histogram of profiles available for delayed-mode on Argo GDAC. (Left) Number of profiles; (Right) percentage.

The Figure 3 presents the status of the Coriolis floats. 46% of the floats have been processed, while 18% of the floats cannot be processed for various reasons (only temperature sensor, float too young, etc..). Among the remaining floats that must be controlled in delayed mode, 29% of the floats are currently under consideration by the PIs and 10% of the floats are problematic and must be considered carefully.

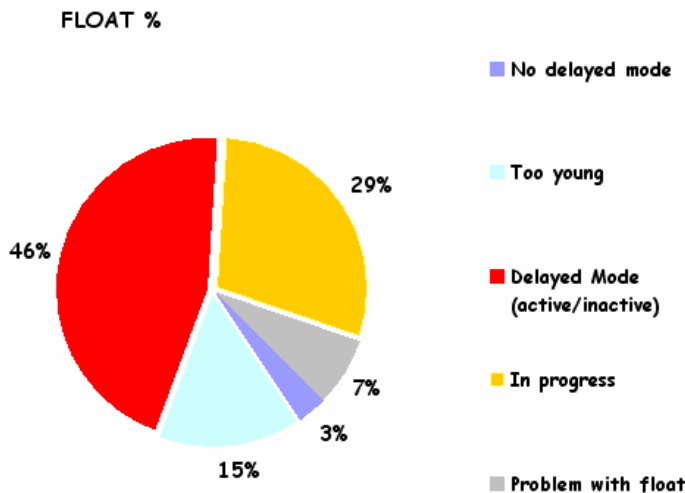


Figure 3 : Status of the delayed mode process at the Coriolis DAC.

In terms of project, some of them are well updated and others need complementary studies to provide delayed mode data, especially those that deployed floats in the southern ocean (Goodhope and Drake projects). With the new version of the OW's method taken into account polar front, we hope that delayed mode data for those projects will be provided very soon. The delayed mode profiles from some floats should have been available since December 2007 but the matlab files sent to Coriolis by the PI were erroneous and because of the unavailability of the PI, those data should be available soon. In another project (Ovide project), the PI provides a report for each float containing a complete overview of the behaviour of the float, of the changes on real-time flags, as well as information about the correction applied to the data. Those reports are available on the following Web page: http://www.ifremer.fr/lpo/ovide/data/argo_profiling_floats.htm. It takes some time to write them, which explains part of the delay in the availability of the delayed-mode profiles, but we believe it is worth doing it. We encourage each PI to do the same kind of report for each calibration on floats. To conclude, the delayed-mode quality control of the Coriolis DAC floats is progressing but we are still in the development stage which explains that the number of delayed mode profile does not increase that much.

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

Since 2000, more than 335 French floats and 68 floats co-funded by European Union have been deployed in different geographic areas. The deployments meet specific French requirements but they also contribute to the global array. The French contribution is comparable to that from other developed countries and has provided a significant contribution to the growing Argo array.

<i>Year</i>	<i>French floats</i>
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2000	11
2001	12
2002	7(+4)
2003	34(+20)
2004	85 (+18)
2005	89(+11)
2006	65(+15)
2007	32
2008	68

Tableau 1: Numbers of French floats contributing to Argo deployed by year, figures in brackets are the additional floats co-funded by EU within the Gyroscope, MFSTEP and Mersea projects. Estimated figures are given for 2008.

The French Argo Project is funded by the ministry of Research (mostly through Ifremer) and in a lesser proportion by the ministry of Defense (through SHOM). Ifremer plans to buy 50 floats in 2008 while no float will be buy by SHOM this year. It plans to buy 15 floats/year in 2009 and beyond. As part of the Euro-Argo preparatory phase, Ifremer works with its funding ministry (mainly research ministry) to agree on a long-term funding level and commitment. Together with its European partners, Ifremer also works with the European commission to set up a long term EC funding to Argo.

Overall the level of support, additional to float purchase, is as indicated in the table below (man power for float preparation and data processing).

Year	Man/Year
2001	3
2002	6
2003	9
2004	15
2005	15
2006	12
2007	12
2008	12

Tableau 2: Man power dedicated to Argo for float preparation and data management activities within French Argo.

4. Summary of deployment plans (level of commitment, areas of float deployment) and other commitments to Argo (data management) for the upcoming year and beyond where possible.

According to the current deployment plan, 68 floats will be deployed in the Mediterranean Sea, in the North and South Atlantic Oceans, in the Southern Ocean and in the Pacific Ocean (Figure 4).

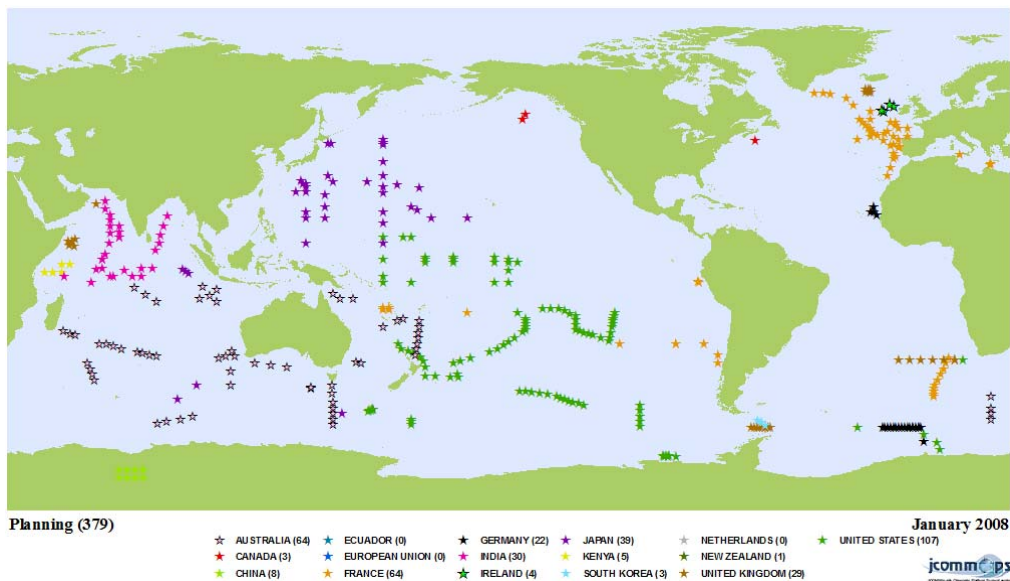


Figure 4: Deployment plan. The orange stars represent the french deployment plan for 2008.

Coriolis will continue to run the Coriolis Dac and the European GDAC as well as coordinating the North Atlantic Arc activities. Within the Euro-Argo project development will be carried out to improve anomalies detection at GDAC both in RT and DM, to monitor at sea behavior of the European fleet and to improve data consistency check within NA-ARC.

Franc also contributes to the funding of the AIC. Coriolis is also willing and interested to host a future extended JCOMMOPS center.

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

A key aspect of the French Argo program is to develop the capabilities to fully exploit all Argo data for operational forecasting as well as research applications. Therefore Coriolis has developed together with MERCATOR (The French operational oceanography forecast centre) a strong connection with the French research community via the Mercator-Coriolis Mission Group (GMMC). It consists of about one hundred researchers (with some turnover each year) following a scientific announcement of opportunities and call for tender. Its task is to support the Mercator and Coriolis scientific activities and to participate in product validation.

Operational ocean forecasting. All Argo data (alongside with other in-situ and remotely sensed ocean data) are routinely assimilated into the MERCATOR operational ocean forecasting system run by the MERCATOR-Ocean structure. Assessments have clearly demonstrated the positive impact of Argo data on ocean analyses and predictions

Ocean science. Argo data are being used by many researchers in France to improve the understanding of ocean properties (e.g. circulation, heat storage and budget, and mixing), climate monitoring and on how they are applied in ocean models (e.g. improved salinity assimilation, ...). The French Argo Users' Group provides a forum for engagement between these scientists and the French Argo programme.

As part of the scientific announcement of opportunities mentioned previously (GMMC), PIs can be selected to deploy floats within their scientific experiments. Here is the list of the experiments during which floats were deployed. Most of those projects rely strongly on ARGO data.

- **OVIDE and North Atlantic variability** (H. Mercier, V. Thierry, T. Huck, P. Lherminier, B. Ferron): This project focuses on the variability of the thermohaline circulation (THC) on

seasonal and interannual time scales, on water mass analysis and census and on heat balance estimates. It includes a 4-D VAR inversion to reconstruct optimum circulation. The project includes a high resolution CTD section from Iberia to Greenland every two years, useful for delayed mode QC.

- **EGEE** (B. Bourles): This project focuses on the variability in the Gulf of Guinea and Eastern tropical Atlantic. It is an ocean (and large scale air sea interaction) contribution to the AMMA program (African Monsoon Multidisciplinary Analysis).
- **Flostral** (R. Morrow): This project focuses on the mode water (SAMW and AAIW) in the SW Indian and Austral ocean, on the thermocline and on its role in setting up the deeper T-S variations.
- **GoodHope** (S. Speich, M. Arhan): This project studies transfers between Indian and Atlantic oceans (watermasses, heat, fresh water), relationship to global THC and regional air-sea interactions.
- **Cirene** (J. Vialard): This project focuses on seasonal to inter-annual variability of the thermohaline circulation in the Tropical Indian Ocean.
- **Frontalis** (T. Delcroix): This work studies the warm pool and salt barrier variability and their relationship with ENSO.
- **EGYPT-MC** (I. Taupier-Letage): This project focuses on the general circulation and small-scale turbulence in the eastern Mediterranean Sea.
- **CONGAS** (A. Serpette): This project aims at studying ocean dynamics along the continental slope in the Bay of Biscay.
- **FLOPS** (G. Eldin, A. Chaigneau): This project aims at studying the vertical water mass structure in the eastern Pacific, the oxygen subsurface minimum observed near the Peru-Chili coastline and the meso-scale structures observed in the current along this coastline. Floats deployed as part of this program are equipped with oxygen sensors.
- **CANOA-ARGO** (J. L. Pelegrí): This study focuses on the spatial and temporal distribution of water masses in the Canary Basin. The project includes hydrographic cruises, moorings and surface drifters.
- **PROBIO** (H. Claustre): This project consists in implementing optical sensors in profiling floats and to test them various area of the world ocean.
- **DRAKE** (C. Provost): This project aims at studying the cold route of the thermohaline circulation and its variability. It focuses on three main objectives: investigate the variability of the Malvinas current transport, the transformation of the intermediate water masses in the Argentinian basin and the variability of the Antarctic Circumpolar Current at the Drake passage.

Additional projects are also funded by Coriolis and Euro-Argo for data analysis:

- **PABIM (Euro-Argo)** (F. d'Ortenzio): This project aims at defining the best way to measure and process biogeochemical data from autonomous platforms (profiling float, glider, seal). The focus will be on oxygen and chlorophl.
- **ARGO-ALTI (Euro-Argo)** (G. Larnicol): Using Argo and altimetry data, this project aims at investigating the impact of the Argo data on the understanding of sea level variations mechanisms at global and regional scales.
- **TOCAD (Euro-Argo)** (F. Gaillard, T. Huck, B. Ferron): The TOCAD objectives are : (1) to monitor ocean properties during the ARGO period (2002-2007) and contrast them to the 1980-2000 period; (2) to study the variation of the large scale ocean circulation using robust-diagnostic and inverse models; (3) to perform 4D-var assimilation of ARGO profiles and altimetry
- **PROSAT** (L. Prieur) : This project aims at developing a method for joint analysis of time series of in situ profiles (CTD, ARGO) and time series of satellite data (SST, Schla) in order to get time series of heat, salt and biomass content.

In addition to those projects, some scientists have included ARGO data for their research (without deploying any floats). Those works concern for instance estimate of the mean circulation at 1000m

depth in the equatorial Atlantic Ocean (M. Ollitrault) or the use of optimal interpolation of temperature and salinity to describe and quantify seasonal and interannual variability of the ocean (mean state, heat and salt content, etc).

6. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo. These might include tasks performed by the AIC, the coordination of activities at an international level and the performance of the Argo data system. If you have specific comments, please include them in your national report.