

French National report on Argo – 2011

Present status and future plans

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1. Background, organization and funding of the French Argo activities

Argo France gathers all the French activities related to Argo and its extension toward biogeochemical measurements. Argo France is the French contribution to the Euro-Argo European research infrastructure that organizes and federates European contribution to Argo. The Euro-ARGO ERIC proposal has been submitted to the European Commission by the French government and was successfully evaluated. The signature process by the different European government should start in the coming weeks. Together with its European partners, Ifremer also works with the European commission to set up a long term direct EC funding for Argo. The Euro-Argo ERIC legal structure will be hosted by France. Euro-Argo and its French component (Argo France) is part of the Ministry of Research national roadmap on large research infrastructures (TGIR).

1.1. Organization and funding

At national level, the Argo France activities are undertaken by Coriolis (CNES, Ifremer, INSU, IPEV, IRD, Météo-France et SHOM) as well as by two laboratories: the Laboratoire de Physique des Océans (LPO, Brest, France) and the Laboratoire d'Océanographie de Villefranche (LOV, Villefranche, France). Argo France has been recognized in January 2011 as a long-term observing service. The agreement is valid for 10 years.

Argo France is funded by the ministry of Research and by local administrations (Brittany region, Finistère department, city of Brest) mostly through Ifremer but also through other French institutes involved in oceanography (CNES, IRD, INSU, Météo-France) and in a lesser proportion by the ministry of Defense through SHOM. Until now, the French contribution to the Argo global array was at the level of about 65 floats per year with funding from Ifremer (about 50 floats/year) and SHOM (about 15 floats/year).

Since 2000, more than 550 French floats have been deployed in a number of different geographic areas. Deployments have been focused on meeting specific French requirements while also contributing to the global array.

To complement Argo France and Euro-Argo ERIC, the NAOS project has been recently funded by the Ministry of Research to consolidate and improve the French contribution to Argo and to prepare the next scientific challenges for Argo. The project provides an additional funding of 15 floats per year from 2012 to 2019, which allows Ifremer to increase its long term contribution to Argo from 50 to 65 floats/year. A European Research Council (ERC) advanced grant has also been recently obtained by LOV to work on the development of a biogeochemical component for Argo. Overall, as part of the NAOS and REMOCEAN project, 150 floats should be deployed over the next 8 years in three pilot areas: Mediterranean Sea, Arctic and North Atlantic.

Overall the level of support, additional to float purchase, is as indicated in Tableau 1 (man power for coordination activities, float preparation, deployment and data management activities).

Year	Funding	Man/Year	French floats	Co-funded EU floats	Total
2000	300k€		11		11
2001	633k€	3	12		12
2002	980k€	6	7	4	11
2003	900k€	9	34	20	54
2004	1400k€	15	85	18	103
2005	450k€	15	89	11	100
2006	900k€	12	51	14	65
2007	900k€	12	36		36
2008	1200k€	12	90		90
2009	1200k€	12	35	8	43
2010	1400k€	12	55		55
2011	1400k€		53		53
Total (2000-2011)			558		633
2012		12	65		

Tableau 1: (Man/year column) Man power dedicated to Argo for coordination activities, float preparation, deployment and data management activities (GDAC,DAC, NAARC, DMQC) within Argo-France. (French floats column) French floats contributing to Argo deployed by year. (Co-funded EU floats column) EU floats are the additional floats co-funded by European Union within the Gyroscope, Mersea and MFSTEP projects. Estimated value is given for 2011.

1.2.Float development

Based on Ifremer expertise in acoustically tracked Lagrangian floats named "Marvor", Ifremer has developed the PROVOR profiling float in the late 90s and in collaboration with the NKE manufacturer has managed to provide to the Argo community a reliable instrument meeting the Argo requirements. PROVOR has now moved towards a « multi-sensors » utilization. The instrumental base has been modified in order to make the integration of new sensors easier. For example, Provor is fitted with an Aanderaa optode (Provior-DO). ProvBio (CTD and optical sensors) and ProCarbon (CTD, dissolved Oxygen, Particular Organic Carbon) have been developed and use Iridium system to transmit more data, to reduce time at surface and to modify some mission parameters by remote control. Development are under way to provide an ARGOS3 version of these floats.

Ifremer, in partnership with NKE manufacturer, has developed the ARVOR float taht aims to complete the float offer. When PROVOR leads toward a "multi-sensors" utilization, ARVOR tends to agree with the following criteria: performances improvement, easy deployment (lighter weight < 20kg) and costs reduction. In 2010 an ARVOR has been fitted with Iridium transmission capability and successfully deployed in the Mediterranean Sea.

Since 2011, Ifremer together with NKE and CNRS is working on PROVOR/AVOR floats improvement within the NAOS project and develop, validate and deploy the next generation of French Argo profiling floats. The new float capabilities include: longer life-time, more efficient design of the vehicle, improved transmission rates, integration of biogeochemical sensors, deeper measurements and under ice operations in the polar seas.

2. The status of implementation (major achievements and problems in 2011)

- floats deployed and their performance

53 floats have been deployed in 2011. The deployment areas are chosen to meet French requirements in terms of research and operational activities (Atlantic, Indian and Southern Oceans) but also to contribute to establishing the global array (especially in the Southern Ocean).

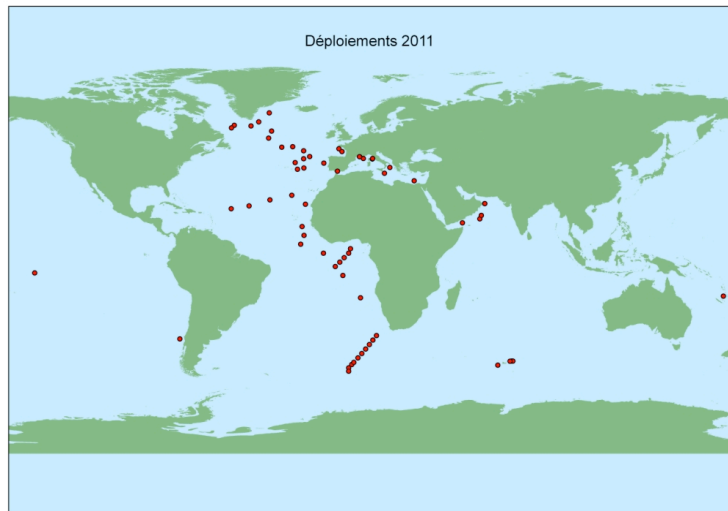
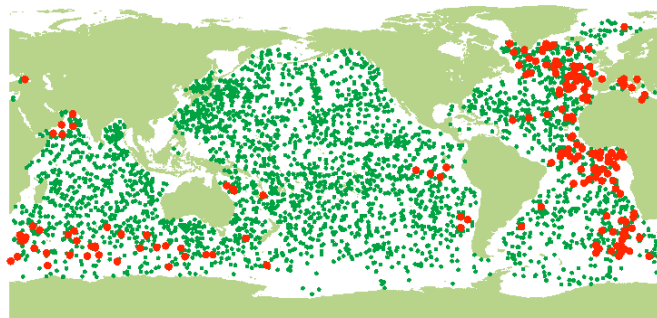


Figure 1: Deployment position of the 53 French floats deployed in 2011.



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Figure 2: (Lower panel) Actual position of the French active floats.

- technical problems encountered and solved

Coriolis has set up a technical team in charge of following the float performances in order to identify and understand early float failure. No major technical problems were encountered in 2011.

However, we noted that some floats exhibited anomalously high (positive or negative) values of the surface pressure suggesting a failure of the pressure sensor while the data were apparently good. This inconsistency was due to a mis-interpretation of the reset-offset command used on PROVOR and ARVOR floats to reset the surface pressure to zero before each dive. Actually, the surface pressure value sent by PROVOR/ARVOR floats is the opposite of the surface pressure measurements and the transmitted data is the cumulated value since the first cycle and not the relative surface pressure difference since the last cycle. This has no effect on the float data any surface pressure drift is

corrected on-board by the float itself. However it changes the identification of the « microleakers » floats for instance as we have to find positive drift. A short document will be written soon and transmitted to the Argo community.

- **status of contributions to Argo data management**

Within Argo-France, Coriolis plays three roles in the Argo data management organization: Argo Data Assembly Centre, Global Data Centre, and leader of the North Atlantic Argo Regional Centre. Coriolis is located within Ifremer-Brest and is operated by Ifremer with support of Shom.

As Argo Data Assembly Center, Coriolis processes in Real Time and Delayed Mode float data deployed by France, by 7 European countries (Germany, Spain, Netherlands, Norway, Italy, Greece, Bulgaria) and by 3 non European countries (Chili, Costa Rica, Mexico). Coriolis data center processes data coming from 1362 floats (618 Provor/arvor, 621 Apex, 122 Nemo and 1 Metocean floats) including 430 active floats in February 2012 (166 Provor/Arvor, 244 Apex and 20 Nemo floats). Data are processed and distributed according to Argo recommendations.

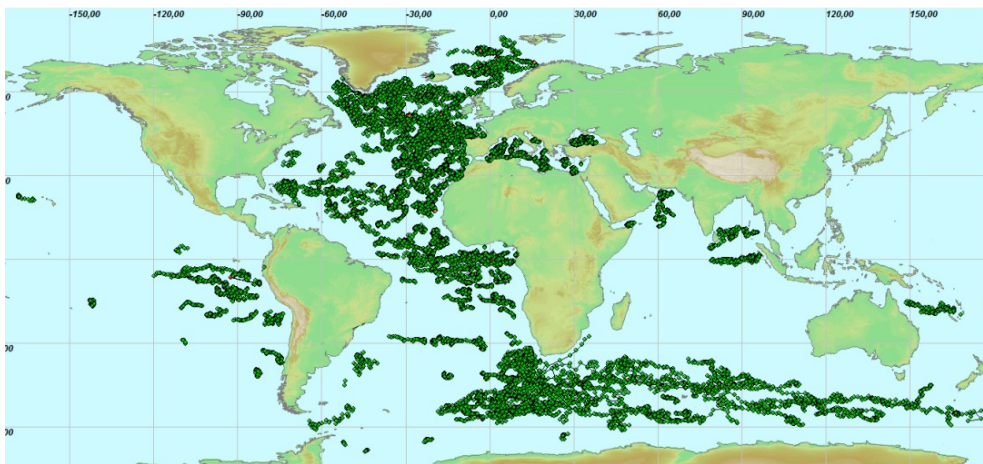


Figure 3: Maps of the 15590 profiles from the floats managed by Coriolis DAC this current year.

As Argo Global Argo Data Centre, Coriolis hosts one of the two global data assembly centres (GDAC) for Argo that contains the whole official Argo dataset. The Argo GDAC ftp server is actively monitored by a Nagios agent (see <http://en.wikipedia.org/wiki/Nagios>). Every 5 minutes, a download test is performed. The success/failure of the test and the response time are recorded. From January to November 2011 the ftp server was available for 99,6% of the time. The 0,4% of failure represents 1 day, 5 hours and 45 minutes. Most of the problems occurred between May 21st and May 28th, related to electrical supply problems. Since October 2011, the ftp server is under pressure, the response time increased twofold. This recent problem has been fixed with a new ftp server.

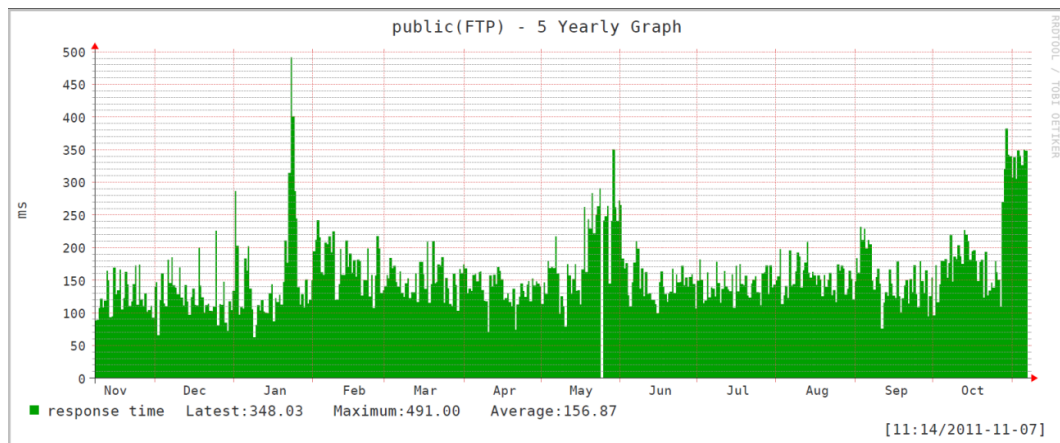


Figure 4 : Nagios monitoring: duration of a test file download.

North Atlantic Argo Regional Centre (NA-ARC). France has taken the lead in establishing the NA-ARC, which is a collaborative effort between Germany (IFM-HH, BSH), Spain (IEO), Italy (OGS), Netherlands (KNMI), UK (NOCS, UKHO), Ireland (IMR), Norway (IMR), Canada (DFO), and USA (AOML), Greece (HCMR) and Bulgaria (IOBAS). Coriolis coordinates the North-Atlantic ARC activities and in particular the float deployment in Atlantic.

In 2011 a prototype of the NA-ARC WWW site, <http://www.ifremer.fr/lpo/naarc/> (also available through the Argo Data Mangement Web site: <http://www.argodatamgt.org/Argo-regional-Centers/North-Atlantic-ARC> under “More on NA-ARC floats”.) has been set up to enhance the viewing and monitoring the NA-ARC fleet. In particular this www site provides interactive visualization tools such as map of profiles location, pie charts (distribution per DAC or data mode,...), time series (of the distribution per year, the seasonal cycle sampling,...), gauges (for tickets, availability of oxygen measurements,...), bar charts of parameter measurements quality (see **Figure 5**).

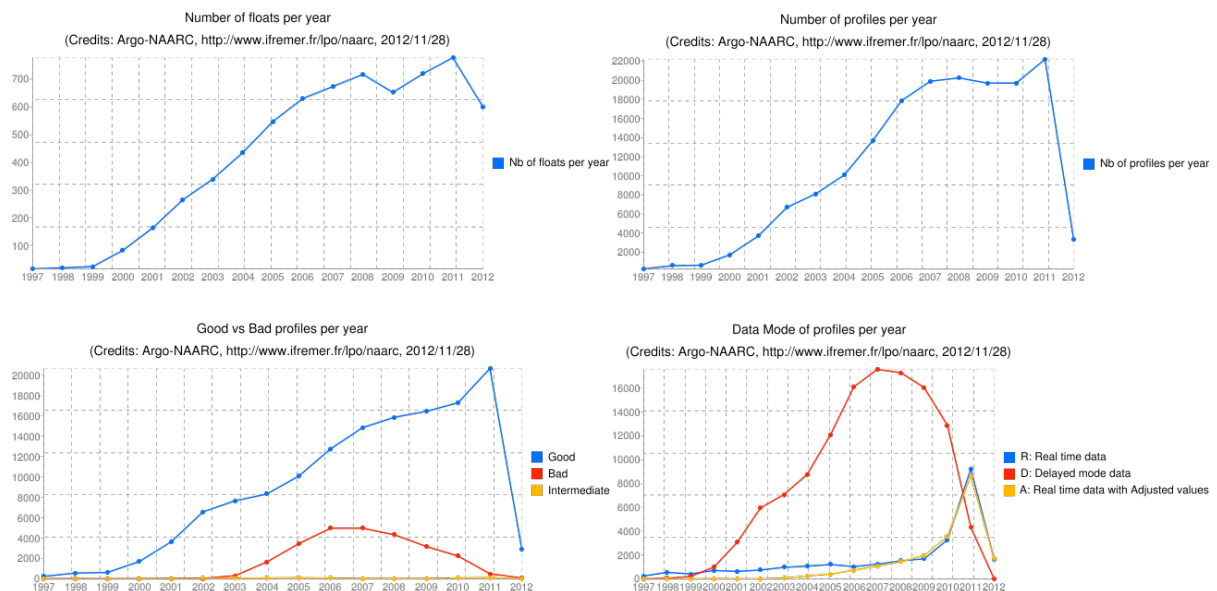


Figure 5 Examples of viewing service available at <http://www.argodatamgt.org/Argo-regional-Centers/North-Atlantic-ARC> under “More on NA-ARC floats”. The figures display the number of floats and profiles in the NA-ARC area (Atlantic ocean North of 20°S), the number of good and bad profiles and the number of profiles as function of their data mode (R, A or D).

- **status of delayed mode quality control process**

In 2011, 18112 new delayed mode profiles were produced and validated by PIs. A total of 82113 delayed mode profiles were produced and validated since 2005. In February 2012, 72% of the floats and 76% of the profiles processed by the Coriolis DAC are in delayed mode.

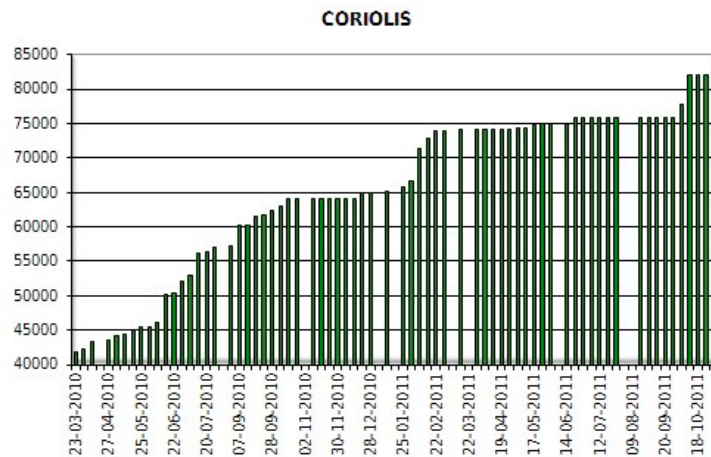


Figure 6: Evolution of the DM profiles' submission versus dates

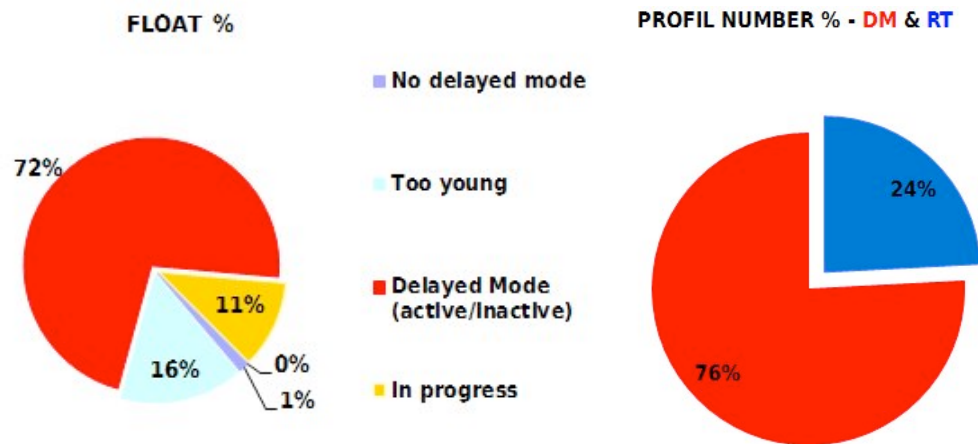


Figure 7 Status of the floats processed by Coriolis DAC. Left: in terms of float percent and right: in terms of profile percent (DM : delayed mode – RT : real time).

Status of pressure corrections, technical files : For APEX floats, the real-time pressure correction has been implemented at the Coriolis data center and it is operational. The implementation of the pressure correction of NEMO floats is still on-going.

Regarding the technical files, about 90% of the codes are now valid. Ongoing work is currently carried to modify the remaining incorrect names.

3. 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, 65 floats will be deployed in 2012. They will be deployed in 2012 in the Mediterranean Sea, in the North and the South Atlantic Oceans, in the Southern Ocean and in the Pacific Ocean (Figure 5).

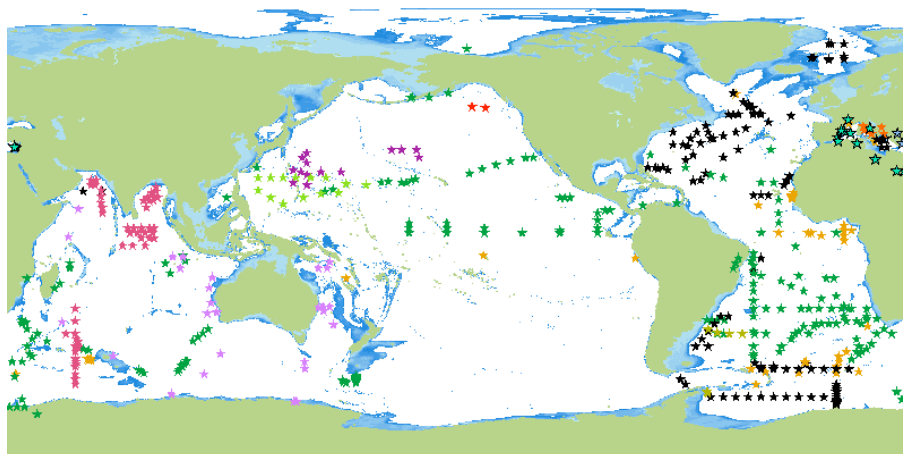


Figure 5: Deployment plan. The orange stars represent the French deployment plan for 2012.

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 in real time the behaviour of the European fleet and to improve data consistency check within NA-ARC.

France also contributes to the funding of the AIC.

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

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.

Support to the Mercator and Coriolis scientific activities: Coriolis has developed together with MERCATOR (The French operational oceanography forecast center) 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.

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, ...). List of scientific publications is available through the Argo web site: <http://www-argo.ucsd.edu/FrBibliography.html> and through the French Argo web site: <http://wwz.ifremer.fr/lpo/SO-Argo-France/Publications>. Almost 100 peer-reviewed papers using Argo-data have a leading author based in a French laboratory.

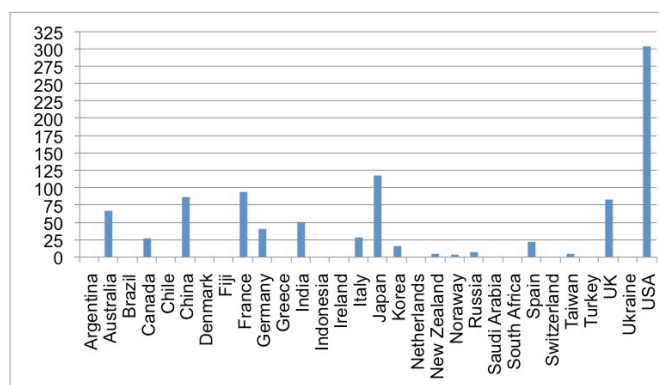


Figure 8: Number of paper using Argo data as function of the country of the lead author.

French-Argo meeting: The French Argo Users' Group provides a forum for engagement between these scientists and the French Argo program. The next meeting of the user group is scheduled the 20-21 June 2012 in Brest.

Argo-Regional center: See section 2.

- 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**

None.

- To continue improving the number of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include the number and location of CTD cruise data uploaded by PIs within your country to the CCHDO website in the past year. These cruises could be used for Argo calibration purposes only or could be cruises that are open to the public as well**

The number of CTD cruise data uploaded by PIs within France in 2011 to the CCHDO website is not known.

The Coriolis reference database has been updated with new NODC data acquired since the release of the WOD 2009 and until January 2012. This new referenc data base will be provided to the Argo community mid-March. The CTD data provided by CCHDO to Coriolis will be included soon in the reference database.

- List of publications in which a scientist from a french laboratory is involved**

This list is also available on the following web site: <http://wwz.ifremer.fr/lpo/SO-Argo-France/Publications>. The missing publications on the Argo Bibliography page web have been reported to Megan Scandenberg.

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Keerthi, M. G., M. Lengaigne, J. Vialard, C. de Boyer Montégut and P.M. Muraleedharan, 2012: Interannual variability of the Tropical Indian Ocean mixed layer depth, *Clim. Dynamics*, accepted. doi:10.1007/s00382-012-1295-2

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Despres, A., G. Reverdin, and F. d'Ovidio, 2011: Summertime modification of surface fronts in the North Atlantic subpolar gyre. *J. Geophys. Res.*, **116**, C10003, <http://dx.doi.org/10.1029/2011JC006950>

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