13th meeting of the International Argo Steering Team

Paris, France
March 20-22, 2012

Contents

Meeting Summary

The 13th meeting of the international Argo Steering Team was held at the UNESCO building in Paris, France on March 20-22, 2012. Both the IOC and IFREMER acted as hosts for the meeting. AST-13 focused on looking back over the first 15 years of Argo and evaluating if the current priorities are still appropriate. Additionally, the AST looked at whether the Argo core is being maintained while also extending into areas endorsed by OceanObs'09. The meeting closed with feedback from John Gould on Argo's status and future goals.

Implementation issues

D. Roemmich gave a presentation focused on what contributed to successfully taking Argo from an idea to a functioning program. In light of Argo looking to potential major enhancements, Roemmich presented, and then led a discussion, on the key ingredients that helped form Argo:

- *A cost effective and transforming technology*
- *A well-justified but basic statement of requirements (program design)*
- *Consensus among user groups on value (science, operational applications, policy, education)*
- *Entrainment of agency sponsors/collaborators*
- *International scientific collaboration*
- *Intergovernmental coordination*
- *Commercial partnerships*
- *The final ingredient: determination*

In 2012, Euro-Argo will set up its new European legal structure (Euro-Argo ERIC) that will allow European countries to consolidate and improve their contribution to Argo international. Agreements are at the ministerial level and this will help to ensure long term sustainability. A new proposal (E-AIMS: Euro-Argo Improvements for the GMES Marine Service) was also recently accepted and will allow European partners to test new generations of Argo floats (e.g. oxygen, biogeochemical, Arctic and deep floats) and to analyze the impact for ocean analysis and forecasting centers, climate centers and satellite validation. As far as deployment plans are concerned, 180 Euro-Argo floats were deployed in 2011. 216 are planned in 2012. This number will increase in 2013 with the first EU floats (E-AIMS). Part of the Euro-Argo floats are in regional or marginal seas (> 50 floats/year).

H. Claustre reported on the Bio-Argo community's further development in 2011. Two meetings have occurred over the past year to discuss the implementation of a Bio-Argo network through the coordination of regionally-focused projects. It is clear that there is a growing number of investigators and projects involved in and dedicated to Bio-Argo related-science. The first day of the next ADMT meeting will be dedicated to the development of quality control procedures for those variables that are acquired through Bio-Argo. This important phase in the development and implementation of Bio-Argo requires strong involvement of the community and is the key to the future success of a Bio-Argo network.

S. Riser reported on a proposal to create a Science and Technology Center dedicated to examining Southern Ocean Biogeochemical Observations and Models that has been submitted to the US National Science Foundation, with a decision expected late in 2012 or early in 2013. The plan for this Center is to fabricate and deploy 50-60 profiling floats per year in the Southern Ocean (i.e., in the Southern Hemisphere south of 30°S), with each float equipped with oxygen, nitrate, pH, fluorometer, and particulate backscatter sensors. The deployments would be carried out from research vessels, with ancillary shipboard carbon and biogeochemical data collected during deployments.

Two talks were given on different sampling schemes used in marginal seas - one focused on the Mediterranean Sea and another on the Sea of Japan. In both cases, the seas are sampled more densely than the 3° x 3° degree open ocean plan. It has been found that in both seas, the float lifetime is shorter, but there is hope this will be improved with more floats using Iridium and with setting the drift depth to shallower than 1000db. In both seas, the floats are being used to monitor temperature and salinity at various points throughout and are being used in models. There have been some issues with where floats can be deployed in the Sea of Japan due to EEZ issues and there is some difficulty with Argo DMQC due to the lack of CTD data.

Data Management related issues

S. Pouliquen presented an overview of the ADMT status and activities in the past year. Changes include a new co-chair, A Gronell-Tresher, who is replacing M Ignaszewski after he stepped down. Two phone meetings are now held each year to encourage more action on items earlier in the year and the first meeting went well. Both real time and delayed mode activities are working well and the action on standardization (Technical and metadata files) is progressing according to schedule. S. Pouliquen also mentioned that a “DAC Instruction/cookbook” which aims at gathering procedures to be applied by DACs that do not fit into the User manual or the QC manual is under construction with M. Scanderbeg acting as the book coordinator. S. Pouliquen reiterated that, as many BGC Argo floats are, and will be deployed in near future, it is important to discuss how to manage and QC these sooner rather than later. It was agreed to hold a BCG data management workshop prior to ADMT13 on the 13th November in India.

S. Wijffels presented audit work done by J. Dunn based on the GDAC contents on 4 March 2012. In general, progress has been made in technical file surface pressure parameter name compliance, with three non-compliant names still in use. For the TNPD floats, there was a small increase in the rate of correctly indentified and flagged cases, and significant progress in repairing almost-correct SCIENTIFIC_CALIB_COMMENT strings. In terms of the surface pressure correction, there was a strong increase in agreement on pressure correction in recently processed (RT and DM) profiles. There are around 15,000 less missing or bad RT PRES_ADJUSTED data profiles, which might be largely due to changing Surface Pressure Parameter names to now indicate that the floats are of types that do not require adjustment. However there are still apparently > 70,000 such profiles, mostly at AOML. Some DACs, especially JMA, have made substantial progress here, but the situation appears worse at BODC and KORDI.

M. Scanderbeg reported on the Argo Trajectory Workshop held the day before ADMT-12 last fall in Seoul, Korea. The objectives of the workshop included improving the quality and consistency of data that is currently in trajectory files and how to improve and migrate to a new trajectory file format. A two step process was developed to try and improve the trajectory files. First, the new trajectory file format suggested by a small working group was agreed upon with the caveat that a DAC cookbook is needed to help DACs understand how to correctly fill all the cycle timing variables included in the format. Secondly, the workshop addressed the problem of how to improve older float data. The idea is to build on work done by the ANDRO team to fill velocity product files called "TRAJ2" files. The TRAJ2 files will be similar in format to the new trajectory file format, but with increased flexibility for additional variables that might include extrapolated positions, velocity estimates, etc. Brian King and the ANDRO team have agreed to work towards producing these product files which will likely be served on the GDACs.

Technical issues

A series of talks were given updating the status of several different float types. The first to present was S. Le Reste who discussed PROVOR and ARVOR floats. He stated that one of the main focuses is to improve manufacturing procedures and simplify and increase safety

procedures before launching floats. Work continues on improving PROVOR floats equipped with oxygen sensors by following the recommendations of the Argo Oxygen Meeting in Brest, France in May 2011.

Next, S. Riser discussed issues related to Apex floats and stated that the APF9 controller used in APEX floats since 2003 will soon be obsolete due to the end of production of one of the main electronic components on the controller board. Replacing this component requires hardware redesign and new firmware which often takes 1-2 years to complete. Engineers at Teledyne/Webb are apparently working on this project, with the new controller called the APF11. Only a limited number of APF9 boards remain in stock at Teledyne/Webb, but it is essential that the work on the new APF11 be completed rapidly so that the new board can be fully tested and debugged before the stock of APF9 boards is exhausted.

B. Owens reported on the SOLO-II design that has been commercialized to MRV, LLC. MRV delivered 20 floats to Scripps which were deployed in October 2011. 60 SOLO-II floats manufactured by the Scripps Instrument Develop Laboratory have also been deployed. There have been minor problems with these floats that have now been corrected through a redesign of the external bladder and GPS board and manufacturing technique of the antenna and minor changes in the float software.

D. Gilbert reported on the NOVA float model which was recently developed by the company MetOcean (www.metocean.com). Argo Canada purchased 27 NOVA floats that will be delivered by 31 March 2012. Up until now, only one has been deployed and the temperature, salinity and pressure data appear to be of good quality. However, the GPS on that float is not working, forcing the float to rely on less accurate positioning from the Iridium system. Of course, there are many decoding and data management tasks related to the introduction of a new float which require technical parameter names before uploading data to the GDACs.

G. Johnson supplied a report on PMEL's recent experience with Seabird Navis floats. The Navis float is an Iridium/GPS float using RUDICS for data transmission with firmware based on the APF-9 (UW – Swift & Riser). As of 7 March 2012, 17 floats had been delivered to PMEL and five of those floats had been deployed. Those five floats had reported between 1-5 profiles and appeared to be functioning normally. SBE technical information asserts sufficient power for > 300 profiles to 2000 dbar and a minimum fractional volume change 1.7% from a 300-ml oil reservoir.

T. Suga reported on work done at Tsurumi Seiki Co. and JAMSTEC to develop the “Deep NINJA”, which has an ability to measure PTS profiles at the depth of up to 4000 dbar. The first prototype was tested in Sagami Bay in 2011. Further deep ocean testing will be carried out in summer 2012, and then a (small) fleet of Deep NINJAs will be deployed in the Southern Ocean during R/V Mirai cruise in 2012/13 austral summer. Deep NINJA is planned to be available for public in 2 – 3 years.

D. Roemmich briefly updated the AST on the Deep SOLO float. The target depth is 6000db, with an expected lifetime of more than 100 cycles. Prototypes will likely available at the end of calendar year. There is not a specific plan yet for a pilot deployment. Initially the Deep Solo will go into not so deep water near San Diego.

Two reports were given on oxygen measurements and quality control. The first was done by S. Riser and it summarized results from the dissolved oxygen data workshop held in Brest, France in May of 2011. A number of important issues relevant to float oxygen data were discussed and several important conclusions were made. It was noted that floats should transmit all the raw data collected by the float oxygen sensor rather than computing oxygen on board the float and transmitting only the computed value. Using all the transmitted data, an initial estimate of dissolved oxygen on the float can be made. Additionally, the factory calibration of the most commonly used variety of sensors is known to be relatively poor, so this initial estimate must be adjusted to either the local oxygen climatology or to shipboard data collected at the time of float deployment. Since the most commonly used sensors do not show

appreciable drift over time, acquiring calibration data at the time of deployment is very valuable and should be done whenever possible.

D. Gilbert reported on the possibility of developing oxygen quality control procedures. The SOLAS/IMBER subgroup 2 on ocean interior biogeochemistry changes, headed by Niki Gruber (ETH-Zurich), expressed the desire to play a role in the quality control of Argo-O2 data, so that Argo-O2 float profile files may have useful quality flags and error estimates on the GDACs. Virginie Thierry and others suggested that the Argo-O2 quality control group should meet immediately before or after the annual ADMT meeting in Hyderabad, so as to facilitate the two-way exchange of technical information between the oxygen experts and the Argo data management team. Finally, Steve Diggs pointed out that CCHDO can assist in building a high quality reference database for oxygen in a manner similar to what it currently does for regularly updating the high quality reference database that Argo uses for delayed mode quality control of salinity.

J. Turton reported on work done evaluating near-surface temperatures (NST) and interacting with the GHRSST community. Argo provides an independent data set for GHRSST to validate their product. As such, GHRSST would prefer the highest possible vertical resolution, without stringent accuracy requirements. During 2011, an analysis of 3,007 profiles (recorded between October 2008 and May 2011) from 54 NST-capable floats was made. On the NST-capable floats**,** the deeper cross-calibration measurements suggest the agreement of pumped and non-pumped measurements is sufficiently good and the various results suggest that the accuracy of the un-pumped temperatures is sufficient for GHRSST's requirements. A key question was how close to the surface can we safely go with the pump on to ensure delivering the most accurate data, before turning the pump off to avoid contaminating the salinity sensor. Scripps's Solo-II (Iridium) floats provide continuous profiles at 2 dbar resolution with higher (1 dbar) resolution above 10 dbar until the pump is switched off at 1 dbar (but where the surface pressure is reset for every profile to remove drift). This sampling should resolve all but the most shallow of features. Other operators are more cautious, switching the pump off between 2 and 5 dbar and there is a need to investigate whether leaving the pump on for longer has any effect on the quality of the salinity measurements.

Demonstrating Argo's value

The 4th Argo Science Workshop will be part of the large symposium "20 Years of Progress in Radar Altimetry" organized by ESA&CNES from September 24 to September 29 2012 in Venice, Italy. The theme of the workshop will include 1) a review of Argo achievements in ocean and climate research and 2) float technology and science discussions on the development on the new phase of Argo (sustaining Argo, developing extension towards biogeochemistry, deep ocean and polar regions). Abstract submission for ASW4 (http://www.altimetry2012.org) is now open. Deadline is April 30, 2012. **AST members are strongly encouraged to participate to this major event and should relay this information to their national Argo teams.**

M. Scanderbeg presented work done in the last year on the bibliography pages on the AST website. Argo has over 1000 papers published since the start in 1998. There were over 200 papers published in both 2010 and 2011. This jump by about 50 papers over 2009 probably reflects the improved visibility after OceanObs'09. A couple plots are maintained on the website including the number of papers published per year and per country. It was suggested to add a plot showing the number of papers published in the top journals. Based on citations submitted through national reports, searches for Argo papers are successful.

John Gould presented a mid-term review of the Argo program, looking back to the start of Argo around 2000 and towards a future horizon at 2020. He started by summarizing the things that Argo had done well:

- Consistency of the core mission

- Continuing to deploy floats
- Overcoming technical challenges
- Adhering to principles of openness in data distribution
- Engaging new countries.
- Argo has a very effective and responsive distributed data system, delivering and quality controlling data
- Data are having large impact on science

Turning to the challenges that Argo faces, he noted that Argo developed (1999-2007) in good economic times but now it is harder to find funding and the future is even less certain. He went on to explore the relationship of the core Argo mission with other applications of profiling float technology such as BGC Argo, under-ice missions, shelf and marginal seas and deep Argo. These “additions” compete for resources and add to the complexity of the AST and ADMT responsibilities. Technology issues will continue to be challenging and external influences such as communication changes can seriously impact the array. In closing he commented that the future of Argo depended on People. How do we ensure that we will have a strong Argo (and AST, and ADMT) in 2020 . Who are the next generation of Argo scientists?

1 Welcome and introduction

Albert Fischer welcomed the AST to the IOC and UNESCO. He stated that Argo was an important part of GOOS and emphasized that OceanObs'09 showed Argo as a real success while giving it a new path along which to grow. Local arrangements were discussed as well as an invitation to the reception dinner that evening.

Action item 1: AST co-chairs to send a letter of thanks to Albert Fischer of the IOC and PierreYves Le Traon of IFREMER for hosting AST-13.

2 Objectives of the meeting

S. Wijffels opened the AST-13 meeting by summarizing the main challenges facing Argo:

(i) Looking back over Argo’s first 15 years – are present priorities appropriate?

(ii) Is Argo sustaining and improving the core Argo program, while also extending it as recommended by OceanObs09?

3 Action items from AST-12

M. Scanderbeg presented the Action items from AST-12. Many items were completed, with several reported on at the meeting. Some items relating to the definition of core Argo and DACs completing pressure corrections on APEX floats were not yet complete. S. Wijffels then led a discussion on the definition of core Argo. She suggested that Argo move away from the term "core Argo" and move to "global Argo mission". D. Roemmich stated that the original plan was for climate quality data in 3° x 3° coverage in the entire ocean where water is deeper than 2000 m, including marginal seas and high latitudes. He suggested calling this original mission "global Argo" and other missions could be added to Argo as they are defined. It was noted that other missions might have with different demands - lower quality data, denser coverage, more frequent sampling, new variables, etc. Some worried that Argo may not be able to achieve the same high quality data for all these extra missions. Others were worried about accepting lower quality data into the Argo stream, but until these other missions are better defined, it was decided to be premature to make a decision about data quality at the meeting.

Several within the Argo community have requested expanding the global Argo mission to higher latitudes and including marginal seas. Technological advances in the last few years have made

this expansion more possible. With the increased usage of Iridium satellites, grounding has become less of a problem due to shorter surface times. Sea-ice detection has also been improved, making floats last longer in seasonal-ice zones in higher latitudes. It was therefore suggested that the Argo global mission include marginal seas and high latitudes.

The AST members present, as well as the other attendees, supported the move towards a slightly expanded and more clearly defined global Argo mission with the possibility of adding other missions, such as BioArgo, when they become better defined. It was felt that this might help funding for both the original Argo plan as well as new expansions. An additional benefit in asking other groups to clearly define their mission allows for explicit documentation on issues related to Argo data management including new variable names, meta and technical data and quality control methods.

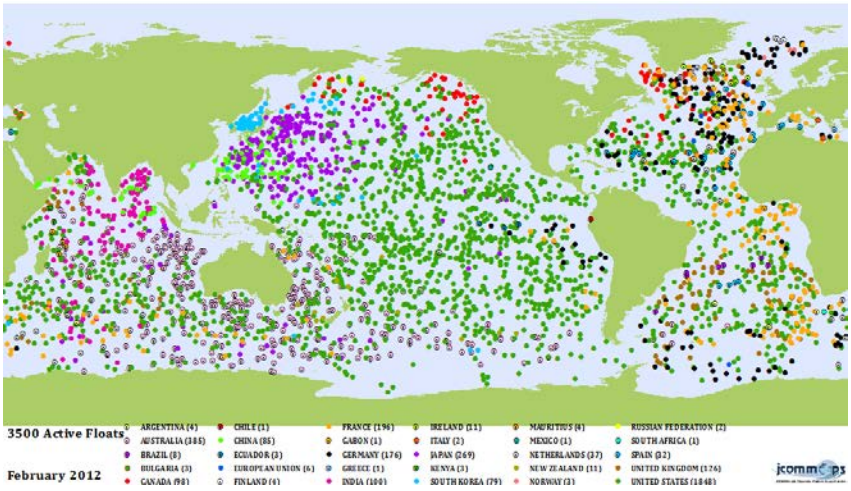
The AST co-chairs will work with the Argo Technical Coordinator to develop a new metric to track this new global Argo mission. The old target of 3000 active floats concerns only the open ocean and can be updated to a more meaningful target.

Action item 2: Rename core Argo to global Argo mission. Define global Argo mission to include all areas in the ocean where depths are more than 2000 m, including marginal seas and high latitudes. The Argo co-chairs will work with the ATC to develop a metric for this and begin tracking it.

Implementation issues

4.1 Status of Argo

The Argo Technical Coordinator presented the status of the Argo array. He mentioned that after a couple of years of difficulties, Argo is in better shape than ever with 3500 active floats, including 90% meeting the core mission requirements.

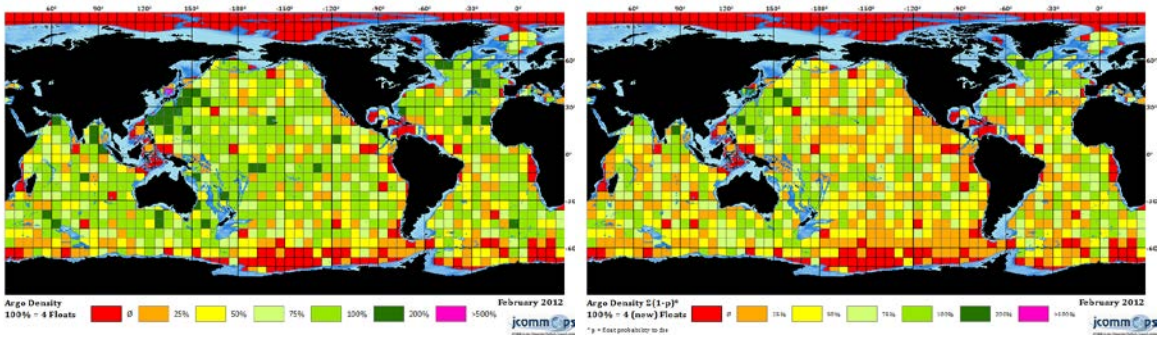


As discussed by the AST it may be time to expand the "Core Argo" to a "Global Argo", including marginal seas and high latitudes, and set up new metrics to track its progress. In addition, marginal seas with specific requirements would be monitored through specific additional metrics.

The TC pointed out a potential issue with Southern Ocean (<-30°) implementation with only 70 floats deployed in 2011, for an average of 250 usually.

The 2009-2010 deficits will probably be caught up gradually over the next 2 or 3 years. The TC recalled the state of national contributions, and the potential partners that have helped Argo in the past and that could participate more actively in the future (Russia, Mexico, Turkey, Indonesia, Taiwan). An Argo delegation might go to promote the program in these countries.

TC pointed out the anticipated gaps in the array to be solved this year and next year.



He mentioned that a metadata loader (netCDF and US metafile formats) was developed to ease float notifications for large batches and avoid manual web form filling. In return the TC requested all programmes to maintain a simple and standard text file for their planning allowing synchronization with the AIC system.

AST mentioned that it would be useful to make the difference between deployment plans with a known ship/cruise and plans without on the maps and web tools.

Providing better tools and means to facilitate deployment planning management, and for an automatic control of the new floats are priorities for the AIC.

TC encouraged AST member to allocate more of their floats to the global array, beyond regional and national areas of interest.

TC commented then on the state of the data flow, highlighting a potential lack of priority for GTS distribution, and the good results in the delayed mode activity with 82% of eligible files processed.

He remarked that Argo will have produced 1000000 profiles by the end of 2012, which could be used as a promotional milestone.

He presented then the latest statistics on the delays; while the GTS data distribution meets operational requirements (20h in average, 85% reaching GTS within 24h of observations over 2011), some progress is still to be made with GDAC distribution (30-40h in average, only 45% reaching GDACS within 24h in February 2012).

TC recalled that he was conducting an audit to compare the DAC practices.

TC presented then the progress achieved with regard to float technology. Float reliability (for 2005, 2006 generations) has reached the target of 150 profiles. He shown that float generations half-life has gained about 20 cycles every year since 2001.

He remind that deployment via VOS where showing a higher launch failure rate (up to 10% for some groups and certain years).

TC concluded, mentioning that the number of countries involved in Argo is good but not sufficient. Argo would be impacted immediately if USA had difficulties. There is still room for a few more big players.

The 2009 deficit is still not solved. Argo can improve its implementation planning (already good). Better metrics will be required to track the progress of the "Global Argo" and ancillary arrays. GDACs data flow is not optimal and not yet strictly operational. Float lifetime keeps improving and new generation of telecoms seems ready on all float models. Expansion of “Core Argo” to “Global Argo”, and Bio Argo will need clear commitments for: floats, ship time and data management (underestimated by Argo) and for the infrastructure (still too weak for such ambitious program).

4.2 The Beginnings of Argo: 1997-1999

D. Roemmich presented a description of ***“The beginnings of Argo: Ingredients of an ocean observing system”***. As Argo looks forward to potential major enhancements, the ingredients needed for these will be similar to what was needed in the late 1990s to get Argo started. By understanding what things worked well or less well in starting Argo, it may be possible to implement (or back away from) new enhancements. According to Roemmich, and in the subsequent discussion by the AST, the ingredients of Argo were:

- ***A cost effective and transforming technology.*** Development of the profiling float made global ocean observations feasible. A stark contrast is seen between the inhomogeneous and sparse nature of pre-Argo sampling and the near-global coverage achieved by Argo in recent years.
- ***A well-justified but basic statement of requirements (program design).*** In the period 1997-1999, the Argo Design Document (http://www-argo.ucsd.edu/argo-design.pdf) evolved out of a 1-page description of the 3-degree global broadscale array.
- ***Consensus among user groups on value (science, operational applications, policy, education).*** The Global Ocean Data Assimilation Experiment, CLIVAR Upper Ocean Panel, and Ocean Observing Panel for Climate, in activities including the Upper Ocean Thermal Review and OceanObs’99, all provided strong endorsement of Argo’s potential value.
- ***Entrainment of agency sponsors/collaborators.*** The key role of W.S. Wilson was especially noted, in persuading the top management of NOAA of the need for and feasibility of a global Argo array, and second, with strong support from D.J. Baker, in entraining the participation of partner agencies around the world. Argo could not be implemented by any single nation; a broad international effort was essential.
- ***International scientific collaboration.*** The Argo Science/Steering Team, Argo Data Management Team (ADMT), and Argo’s Science and Technology Workshops were all critically important for coordinating national priorities in order to produce a global array with uniformly high data quality, and for insuring high utilization of Argo data. Innovation

in the creation of the Argo data system by the ADMT was a key step, and the leading role of the Coriolis team is especially noted.

- ***Intergovernmental coordination.*** Recognition of the value of Argo Programme by the IOC and establishment of guidelines for notification of float deployment were essential steps in implementation, as was the role of M. Belbeoch in creating and filling the role of Argo Technical Coordinator. The lack of international concurrence on the need for float deployments everywhere in the ocean continues to handicap Argo's global coverage.
- ***Commercial partnerships.*** Many private companies have made vital contributions to Argo's success including float manufacturers, communications providers (CLS), and others. Of particular note, SeaBird Electronics has made innovations in CTD accuracy, stability and low power performance, and these are among the most critical and technically difficult contributions to Argo.
- ***The final ingredient: determination.*** Roemmich noted that Argo's success is in large measure thanks to many individuals around the world, who believed in the value of Argo and have given generously and creatively of their time in overcoming the many barrier's to Argo's successful implementation.

4.3 EuroArgo update

S. Pouliquen gave, on behalf of P.Y. Le Traon, an overview of Euro-Argo activities. In 2012, Euro-Argo will set up its new European legal structure (Euro-Argo ERIC) that will allow European countries to consolidate and improve their contribution to Argo international. Agreements are at ministerial level and this will help to ensure long term sustainability. We are now at the last step for the setting up of the ERIC. An application was sent to the European Commission on behalf of future members (11 countries) by the French Ministry of Research. The review was very positive and we are starting the final step (signature by ministries). Euro-Argo also started a new project, SIDERI (Strengthening International Dimension of Euro-Argo Research Infrastructure), in December 2011 for a two year time period. SIDERI will allow a better integration of Euro-Argo activities in the international context (e.g. work on the evolution of the Argo core mission, evolution of the Argo data centers, review legal and policy issues, organize workshops open to international partners). A new proposal (E-AIMS: Euro-Argo Improvements for the GMES Marine Service) was also recently accepted and will allow European partners to test new generation Argo floats (e.g. oxygen, biogeochemical, Arctic and deep floats) and analyse impact for ocean analysis and forecasting centers, climate centers and satellite validation. E-AIMS could start by the end of 2012 for a three year time period. 16 new floats should be procured and tested in 2013/2014.

As far as deployment plans are concerned, 180 Euro-Argo floats were deployed in 2011. 216 are planned in 2012. This number will increase in 2013 with the first EU floats (E-AIMS). Part of the Euro-Argo floats are in regional or marginal seas (> 50 floats/year). More effort for the global component is still needed. A fraction of Euro-Argo floats include oxygen and biogeochemical sensors (pilot experiments). This proportion will increase in coming years. Perspectives for 2014-2020 (Euro-Argo ERIC agreements) are of 200-220 floats/year. With long term EU funding (expected from 2014/2015), these numbers should reach or exceed 250 floats/year. The evolution of Argo for the next decade is an important issue for Euro-Argo. Euro-Argo needs to meet requirements from the research and operational (GMES) oceanography community in Europe. We have a strong requirement for marginal seas, important research activities in high latitudes (Nordic Seas, Arctic) and a strong interest (and good maturity) of the European research community and GMES (operational oceanography) for extension towards biogeochemical variables. It is thus now time to define and agree on 1/ an

Argo "extended mission" for marginal seas (T&S), 2/ an Argo "extended mission" for high latitudes (T&S), 3/ a strategy for Oxygen and Bio Argo "extended mission". Pilot experiments are needed for deep floats before defining a long term strategy.

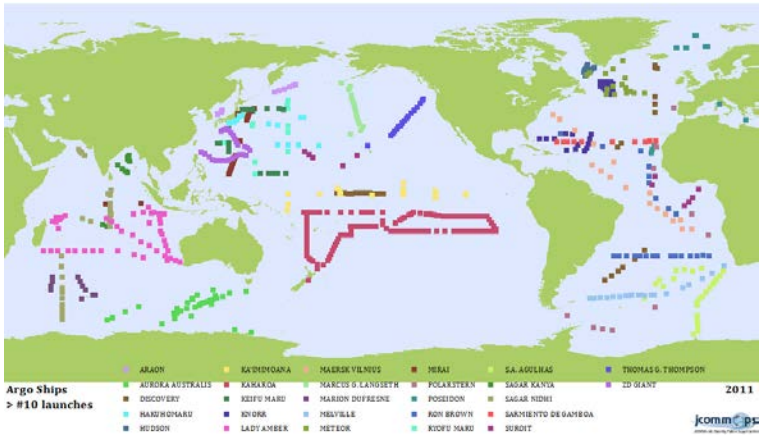
4.4 Forum for the future of Japan Argo

As reported at AST-12, a series of forums for the future of Japan Argo were held in July and November 2010 to build consensus on the future direction of Japan Argo among scientists, governmental officers and relevant private sectors, following the vision presented by OceanObs'09. The consensus reached was that Japan Argo should continue to contribute to the core Argo array by sustaining current levels of float deployments and data management activities and should contribute to a new integrated ocean observing system, based upon the Argo core array, which will increase the climate monitoring and research capability and provide information on the marine environment to better meet society's needs. Some follow-on actions were also presented. Japan Argo Promotion Committee made a public pronouncement (February 18, 2011) that recognized the above-mentioned consensus, particularly mentioning the importance of establishing an advanced integrated ocean observing system in the North Pacific. Some of the ideas from the forums about Japan Argo and its future have been incorporated in revision of Recommendations by Science Council of Japan "Academic large-facility/large-scale study: development of master plan" (March 17, 2010). Japan Oceanographic Society (JOS) Committee for the Future Vision (since February 2012), aiming to contribute to a revision of the master plan, has been recognizing the outcomes from the forums as important elements of the future vision.

4.5 Commitments table

AST members updated the commitments table and the expected number of float deployments for 2012 is again large (~900). The number of estimated float deployments for 2011 was about 1100 and about 900, or 85% ended up being deployed. This is the best percentage of estimated vs. deployed floats since 2008. It indicates that the backlog of floats from 2010 is beginning to be deployed and that floats are once again more easily available for purchase.

4.6 Float deployment opportunities



Ships used in 2011 for Argo

TC recalled that we have recurring global and regional gaps in the array.

The use of dedicated deployment platforms may have been underestimated when Argo was designed (i.e. no global array without the Karahoa), as well as the resources to plan and organize deployments.

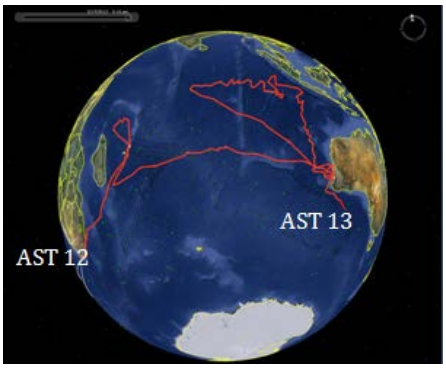
Information is hard to find in advance: (how match future gaps and cruises?)

With a global economical context under pressure (ship time might decrease) Argo will need to be inventive.

Hence, AIC/JCOMMOPS started a couple of years ago to prepare the future of its support to Argo on two axes:

- Dedicated opportunities ("ship time service")
- Dedicated resource ("ship champion")

The Lady Amber initiative was just a "plan" at AST12 and became a reality at AST13 with a very long cruise achieved across the Indian Ocean (for Argo Australia mainly) and about 50 floats deployed successfully.



TC thanked Australia for sponsoring the cruises and supporting the Lady Amber crew.

While this opportunity was efficient operationally speaking, it triggered a huge interest in the media along its path, with a number of officials that have visited the ship and learned about Argo, including the WA Science & Tech. Minister.

Price of the opportunity might be adapted for viability and slightly raised (up to 30 kEuros / month) and liability and insurance issues should be cleared through agreements.

TC set up a second partnership with "Voiles Sans Frontières" a unique NGO recruiting 20 ships every year for development, humanitarian, solidarity projects in Senegal. 16 crews agreed to load and deploy floats this year for the French Argo program.

A third partnership, set up originally by UNESCO with the foundation MultiOneAttitude "Race for Water" (http://www.multioneattitude.com/), will permit to see well known sailors deploying a couple of floats in the preparation of the race New York – Brest in July.

Other partnerships are gradually being set up with the "Industry" (World Ocean Council) that offers also a wide range of logistics at sea and also the willing to help the GOOS.

TC mentioned then that the recruitment of the 3rd JCOMMOPS Technical Coordinator **"Ship Logistics Coordinator"** will take place by the end of the year.

This focal point will work essentially on the SOT program coordination, metadata management of ship based information (cruise plans in advance), and the "JCOMMOPS ship time service" development.

To be noted that GO-SHIP has shown some interest in such position.

TC concluded that individuals, sailing races, explorers, tourist cruises, NGOs, industry, are offering a large range of possibilities that could be exploited (free, non profit, win/win, private ...) with a huge outreach potential.

He finally invited some Argo national program to not hesitate to ask JCOMMOPS help for float deployments and remarked that if ship time was hard to fund, it could be done by purchasing a couple less floats per year.

4.7 BioArgo/Biogeochemical Argo

H. Claustre

During 2011, the Bio-Argo community has continued to develop its coordination.

In summer as part of the OCB scoping workshop, a meeting was held at WHOI on "*Observing Biogeochemical Cycles at Global Scales with Profiling Floats and Gliders*". This meeting was the place for presentations and discussions on the progressive implementation of a Bio-Argo network through the coordination of individual regionally-focused projects. Information on the presentation and outcome of this meeting can be found here.

In line with the OCB meeting, a dedicated session was organized on "*Development of a global ocean biogeochemical observing system based on profiling floats and gliders*" at the OSM 2012 meeting. This session had a strong focus on float-related activity. This session was followed by a town hall meeting which was useful for identifying the ongoing (funded) projects as well as the submitted ones. It is clear that there is a growing number of investigators and projects involved in and dedicated to Bio-Argo related-science. A large part of these projects have been summarized and presented as part of the talks given by Steve Riser and Hervé Claustre during the AST 13 meeting.

The next ADMT meeting will be held at Hyderabad (India) from November 13 to 16. The first day will be dedicated to the development of quality control procedures for those variables that are acquired through Bio-Argo. This important phase in the stepwise development and implementation of Bio-Argo requires a strong involvement of the community and is the key to the future success of a Bio-Argo network.

Finally note the printed version of the IOCCG report "Bio-optical sensors on Argo float" should be released soon. Please contact Hervé Claustre to receive hard copies of it.

S. Riser

A proposal to create a Science and Technology Center dedicated to examining Southern Ocean Biogeochemical Observations and Models has been submitted to the US National Science Foundation, with a decision expected late in 2012 or early in 2013. The group of principal

investigators for this proposal is led by Jorge Sarmiento of Princeton University in the US, with other PIs including Drs. Ken Johnson (MBARI), Stephen Riser (University of Washington), Lynne Talley (Scripps Institution of Oceanography) and others. The motivation for this center derives from the known large drawdown of CO_2 by the Southern Ocean and the potential role of the Southern Ocean in the global carbon cycle. The plan for this Center is to fabricate and deploy 50-60 profiling floats per year in the Southern Ocean (i.e., in the Southern Hemisphere south of 30°S), with each float equipped with oxygen, nitrate, pH, fluorometer, and particulate backscatter sensors. Deployment opportunities (ship time) for these floats have been offered by several southern hemisphere countries. The deployments would be carried out from research vessels, with ancillary shipboard carbon and biogeochemical data collected during deployments. Over the course of five years there would be 250-300 floats deployed in the Southern Ocean as a part of this program, with the data being used to greatly improve our understanding of the Southern Ocean circulation and to enable the development of better physical and biogeochemical models of the region.

4.8 AIC Funding

Howard Freeland reported on the state of financing of the Argo Information Centre. We started 2011 full of optimism that for the first time we might start a year (2012) with enough money on hand to guarantee the salary of the Argo Technical Coordinator for the full year. To ensure that this happened Australia made an extremely generous one-time donation. Then, unfortunately, a political issue got in the way, with the result that the US and Canadian contributions did not occur in 2011. Further, for financial reasons, one other country failed to make its payment. Had Australia not made its very large single payment then we would have had a negative balance by sometime in October 2011. This clearly demonstrates our overwhelming and unwise dependence on a single source of funds.

A committee has worked to resolve these issues, with the main results being:

1) The WMO (which is not a UNESCO body) will take over the Argo Information Centre from the IOC.
2) Payments to support the AIC can now be made through three agencies, IOC, WMO and CLS. Money can be held at any of these sites, but salary must be paid from the WMO. Contributions will be subjected to overheads of 10% at the IOC, 7% at the WMO and 0% at CLS. However, if money has to be transferred from CLS to WMO, for example to pay salaries, then that money will be subject to the 7% overhead as it is moved.

The USA expects to make its deferred 2011 payment during 2012, Canada has already done so. Australia has made its usual payment for 2012 and Japan has requested the paperwork from the IOC. Among the other usual donors, all expect to make their 2012 payments. Among not-usual contributors, one will begin contributions in 2012, this is much appreciated. It is greatly desired that other countries that deploy significant numbers of floats will join the group of regular contributors. We do need to reduce our dependency on a single source of funds.

4.9 JCOMM Observing Program Support Centre

M. Belbeoch, the AIC/JCOMMOPS manager, reported on the development of the centre.
JCOMMOPS now supports the implementation of a number of different types of *in situ* observing systems including:

- Profiling floats (**Argo**)

- Drifting and moored buoys in the high seas, tropical moorings, Arctic buoys, and soon Tsunameters, all coordinated through the Data Buoy Cooperation Panel (**DBCP**)
- Expendable Bathythermographs (XBTs), Thermosalinographs (TSGs), atmospheric soundings from ships (ASAP), meteorological observations from ships (VOS), all coordinated through the JCOMM Ship Observations Team (**SOT**)
- Deep ocean time-series reference stations using Moorings, cables and other platforms. (**OceanSITES**)

TC presented JCOMMOPS budget, demonstrating that Argo was providing a 1/3rd of the center budget.

He noted that Yves Desaubies (acting as Scientific Coordinator within JCOMMOPS) was retired and that a new coordinator for the DBCP/OceanSITES was recruited (Kelly Stroker, USA).

He mentioned that the centre was still understaffed to take care of those 4 programmes properly and that he was personally overloaded.

He mentioned he established first contact with Brest Science Park, city and “ocean pole” to host JCOMMOPS in Brest in the near future with further support from the regional network.

A meeting held at JCOMMOPS in December (with JCOMM OCG chairs, IOC and WMO colleagues and host country representatives) permitted to clarify this and find solutions.
It was suggested and agreed to:

i) Recognize key managerial functions of the Argo TC in JCOMMOPS (functions yet to be clarified)
ii) Free up the Argo TC of SOT coordination
iii) Set up by the end of 2012 a new coordinator position for SOT coordination (and cross programmes ship related activities: deployment planning, cooperation, cruises)
iv) Strengthen the I.T. team (keep the junior staff trained)
v) Move the coordinators to Brest when appropriate

It was also confirmed an arrangement between IOC and WMO administrations to sustain Argo and DBCP.

TCs position despite USA funding difficulties with UNESCO/IOC.

To be noted that AST co-chair feedback and agreement was consulted by teleconference at the end of the meeting.

TC mentioned the float/drifters pilot project funding obtained through UNESCO was retracted at last minute (USA embargo on UNESCO). JCOMMOPS will keep trying to set up such pilot project developing partnerships with manufacturers and ask for donations, proper donation contracts being finalized.

The idea of developing a fee on floats at manufacturer level to fund the infrastructure was discussed by the AST. Two delegations (Japan and India) welcomed the idea while all agreed to develop further the proposal that could face technical issues in its application.

TC remarked that there was already a hidden fee on Argos air-time (as CLS was providing in-kind support to the AIC) and that EuroArgo was asking a fee for the membership into their infrastructure.

TC will discuss this with all float manufacturers and see how the “Argo labeling” could possibly be expanded into a real certification, clarifying the duties and services for float customers, and allowing a modest fee to be taken on the way, and on a voluntary basis.

TC concluded that with slightly augmented supported from host country and panels (in particular SOT and OceanSITES), JCOMMOPS will be properly resourced to support optimally 4 global programmes and achieve the integration and modernization of its services. After a few years of difficulty, Argo will finally benefit from the integrated concept.

4.10 Marginal Seas sampling schemes

Mediterranean Sea
P-M Poulain

More than 120 Argo floats have been deployed in the Mediterranean and Black Seas between 2001 and 2011, providing about 12,000 CTD profiles throughout these marginal seas. Monthly statistics of temperature and salinity at selected depths in the sub-basins of the Mediterranean and the Black Sea have been estimated, but concerns arise about the robustness of these results given the non-uniform nature (in space and time) of the Argo floats. To test this issue, 6 floats were simulated in a numerical model of the Tyrrhenian Sea (2-year run, 2004-2005). Monthly mean temperatures near 600 m sampled by floats indeed showed an artificial negative trend compared to the stable temperatures of the model.

Sampling strategy recommendations made a few years ago (as part of the EuroArgo PP project) include: alternated cycles to 2000 and 700 m every 5 days, a parking depth near 300-400 db where the Levantine Intermediate Water prevails, deployments in and out of the major circulation features, and a minimum fleet of 35 floats for the Mediterranean and Black Seas. Iridium data telemetry was highly recommended to reduce the probability of thefts and stranding while the floats are at the surface, and hence to increase the float operating lifetimes.

A discussion followed where questions were raised about float lifetime, EEZ issues, and extra sensors. Poulain stated that the float lifetime was shorter than in the open ocean, but the hope is this will be improved with more floats using Iridium communications. There have been no formal complaints from countries in the Mediterranean Sea yet about floats being deployed in their EEZs. The float deployers are all working with the ATC to notify countries of float deployments. In the Black Sea, most all of the countries surrounding it are in involved in Argo, so there has not been any issues. Additional sensors are being included on some floats deployed in the Mediterranean Sea. Again, it is important to factor this in to the calculations done on float density.

The MedArgo ARC has done delayed mode quality control on most floats in the Mediterranean and Black Seas. The standard OW method can be used with adjustments to some of the thresholds and parameters. The MedArgo ARC will work with the ATC to develop a metric, based on their sampling strategy recommendations, for the Mediterranean and Black Seas.

Sea of Japan

S Ryoo

The Sea of Japan is a semi-enclosed marginal sea in the Northwestern Pacific Ocean. It is often called as “a miniature of ocean”, because of the similarity of water characteristics and circulation features to the open ocean. Also, the time scale of thermohaline circulation is 0.01 times that of the ocean so that the Sea of Japan is considered as a test bed of climate changes. For these reasons, there have been lots of studies based on observation and numerical models.

The number of observational data in the Sea of Japan is relatively large compared to the open ocean, but it is still not sufficient to elucidate meso-scale circulation. Since 1998, a total of 143 Argo floats have been deployed by Korea (131), Japan (6) and the USA (6). The average float life time is about 2-3 years, but some floats have a very long life time (i.e., over 7 years). It is considered that such a long life time is closely related with a shallow profiling depth; the floats deployed by Korea have 700 – 800 dbar profiling depth.

Although lots of floats have been deployed in the Sea of Japan, it is still not enough to cover the whole Sea of Japan. Since most floats were deployed in the southwestern region (Ulleung Basin), the distribution of profile data is dense in the southern Sea of Japan due to the circulation system. The number of Argo profile data has gradually increased from the beginning of the international Argo program. Since late 2006, about 150 profiles have been collected each month. Currently, the Argo data surpass *in-situ* data, such as CTD and XBT, in the spatial and temporal coverage in the Sea of Japan.

The Argo data are widely used in various fields. For instance, KMA monitors water temperature near the southwestern region based on the Argo data. Also, it is naturally anticipated that the Argo data will increase the predictability of ocean forecasting in the Sea of Japan. The observing system experiments based on the data assimilation system of KMA show that Argo assimilated model reproduce well the flow pattern of the East Korea Warm Current and the evolution of meso-scale eddies in the southern region.

In the Sea of Japan, 33 floats are active now (Mar. 2012). In 2012, KMA will deploy an additional 10 floats to maintain continuous observation. In addition, CTD observation will be conducted near the float (WMO ID: 7900236) observational area in order to examine the feasibility of the Sea of Japan Argo data DMQC.

4.11 Discussion items from National Reports

MedArgo requested official status as an ARC. Since MedArgo is already doing some of the actions requested for ARC status, including delayed mode quality control of all data in the Mediterranean and Black Seas, the AST recognized this status and asked that all Argo websites reflect this addition.

Action item 3: Officially recognize MedArgo ARC on the AST, AIC, ADMT websites.

The German National Report asked for additional information on Iridium costs and was referred to the Australian National Report which included a summary of prior problems with Iridium as well as solutions, including cost analyses.

A discussion then followed about how the ATC can contact countries when a float is nearing their EEZ for which there is no official Argo focal point. It was agreed that for countries where this is a problem, the IOC will help to find an official Argo focal point.

Action item 4: Ask the IOC to help find an Argo focal point in those countries where Argo deployers are having implementation problems.

5 Data Management Issues

5.1 Feedback from ADMT-12

S Pouliquen presented an overview of the ADMT status and activities in the past year. The complete ADMT report is available at http://www.argodatamgt.org/Media/Argo-Data-Management/Argo-documentation/Meeting-reports/12th-ADMT-meeting-report. The Argo Data Management Team is now chaired by S Pouliquen and A Gronell-Tresher as M Ignaszewski stepped down last year. To foster action accomplishment and smooth the work through the year, ADMT is holding two phone meetings with Data Management component managers (one in January, one in June) and this has given a real push to the ADMT activities. Both real time and delayed mode activities are working well and the action on standardization (Technical and metadata files) are progressing according to schedule. Together with AIC, improvement on data delay are carried on and already good progress has been made at the Coriolis GDAC just by revising the update procedures. Similar activities need to be carried on at DAC and US-GDAC levels.

On behalf of the ADMT group S. Pouliquen asked the AST to study how to document the different issues that happened to the Argo data into a document for user information, e.g., pressure correction, micro-leak…so that such events are easily accessible and well documented. It was agreed to do this through a data FAQ section available from AST, ADMT and AIC websites. She also mentioned that a "DAC Instruction/cookbook" which aims at gathering procedures to be applied by DACS that don't fit into the User manual or the QC manual is under construction with M. Scanderbeg acting as the book captain.

S Pouliquen pointed out that, as many BGC Argo floats are, and will be deployed in near future, it is important to discuss very soon how to manage and QC these data in order to avoid reprocessing activities in coming years like what happened with oxygen floats. It was agreed that organizing a BCG data management workshop prior to ADMT13 on the 13th November in India. All teams planning to deploy BCG floats agreed to participate and to contribute to the organization of this workshop.

Action item 5: Suggest that ADMT host a one day workshop before ADMT-13 focusing on Biogeochemical Argo. Advertise workshop among BGC group. Ask organizers to request reviews and comments on proposed real time qc procedure for biogeochemical parameters including oxygen.

Action item 6: Document the major problems with Argo dataset on the AST website in a Data FAQ page. Add links to this FAQ from all Argo related websites including the AIC, data management team, national program pages, etc and in the data manuals. M. Scanderbeg with help from M. Belbeoch

5.2 Update on pressure error correction and impacts

S. Wijffels present a summary on the pressure error correction audit done by J. Dunn at CSIRO. Full details can be found at www.cmar.csiro.au/argo/dmqc/audits_2012_03_04/

This audit was based on the GDAC contents on 4 March 2012. Extra error lists have now been provided to assist PIs in tracing the reported discrepancies.

Meta file errors increased at Coriolis due to SENSOR (PRESSURE) _MODEL and _MAKER and fields being empty. Progress has been made in Tech file surface pressure parameter name compliance, although three non-compliant names are still in use.

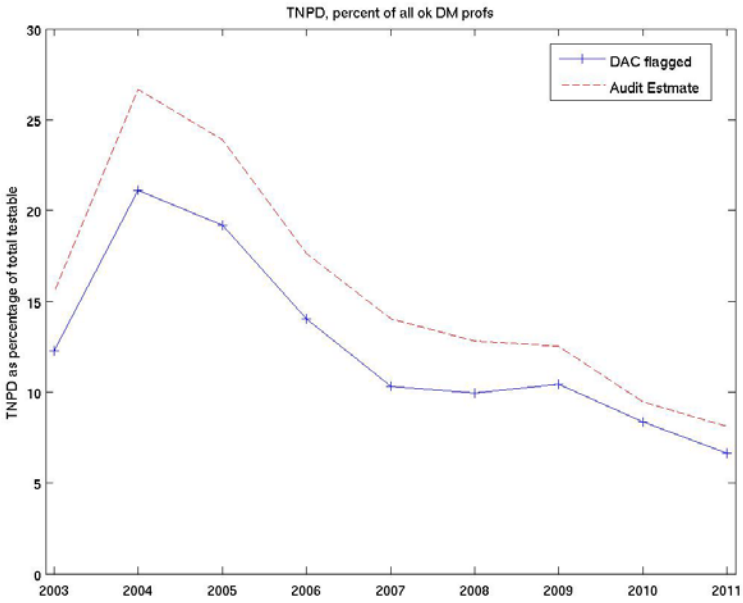
For the TNPD floats, there was a small increase in the rate of correctly indentified and flagged cases, and significant progress in repairing almost-correct SCIENTIFIC_CALIB_COMMENT strings. JMA has an apparently very high rate of undetected/unreported TNPD.

In terms of the surface pressure correction, there was a strong increase in agreement on pressure correction in recently processed (RT and DM) profiles.

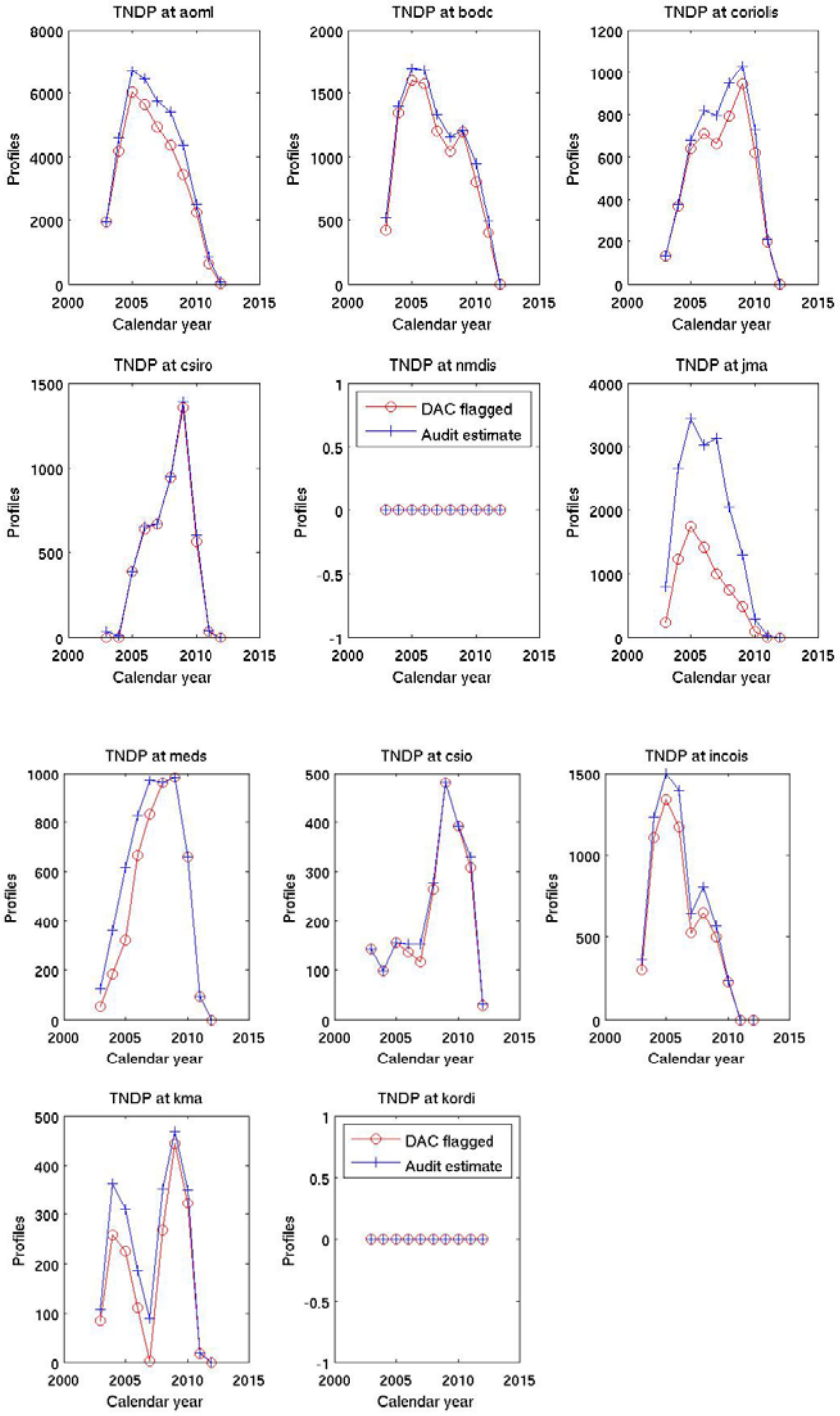
As far as other PRES_QC and PRES_ADJUSTED faults, there are a variety of format rule faults effecting about 5000 profiles, mostly at KORDI.

There are around 15,000 less missing or bad RT PRES_ADJUSTED data profiles, which might be largely due to changing Surface Pressure Parameter names to now indicate that the floats are of types that do not require adjustment. However there are still apparently > 70,000 such profiles, mostly at AOML. Some DACs, especially JMA, have made substantial progress here, but the situation appears worse at BODC and KORDI.

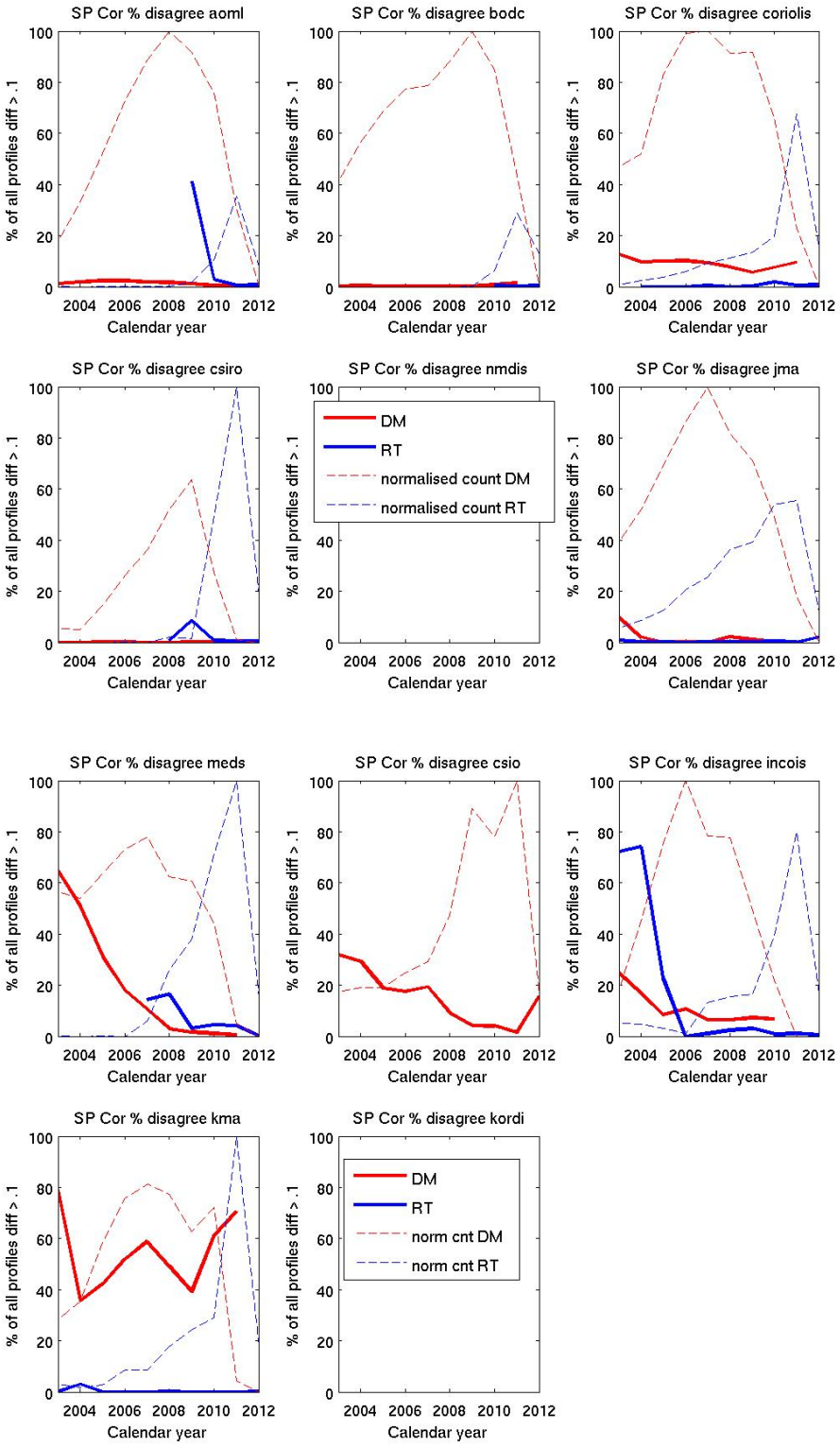
Figures:



- Of all DM profiles that can be tested, percentage with TNPD detected



- same, but for each DAC



- percentage of profiles with pressure correction disagreement, for DM and RT separately. Dashed lines show annual profile counts for DM and RT at each DAC, normalized to maximum of 100.

Action item 7: Final few DACs need to focus on TNDP identification and treatment to finish TNDP work. Most recent audit can be found at:

Action item 8: DACs need to fix real time files that do not have a PRES_ADJUSTED variable filled so that they can be checked by Jeff Dunn at CSIRO.

Action item 9: Develop the core specifications each float should report. Circulate among AST members and post on Argo websites. Will be a resource for float manufacturers

5.3 Feedback from Argo Trajectory Workshop

M. Scanderbeg reported on the Argo Trajectory Workshop held the day before ADMT-12 last fall in Seoul, Korea. The objectives of the workshop were:

- How do we improve the quality and consistency of data that is currently in trajectory files?
- How should the trajectory file format change to include more useful and accurate information to enable easier velocity calculations?
- How and over what time frame will Argo implement these changes?

Next, the current status of the trajectory files was covered which highlighted that inconsistencies exist in the way that DACs fill the trajectory files and the current format lacks some key variables as well as clear instructions on how to fill different variables for each float type. Additionally, several new floats are coming on the market that measure more cycle timing information and there needs to be a way to report this information in the trajectory files.

A small working group spent about one year looking at current trajectory files and developing an updated trajectory file format. This working group had a variety of perspectives including data managers, float deployers and users making velocity calculations. Everyone agreed that it was important to update the trajectory file format in a way that included future flexibility and minimized work for the DACs and for our users. It was concluded that a few new variables are needed as well as better communication and documentation on how to fill some variables to make it similar across DACs.

The ANDRO team presented their work on the ANDRO Atlas and also their suggestions on how to improve the trajectory files. They have spent considerable time working to re-decode the raw Argos hex messages for almost all floats through 2009 at all DACs except KORDI. Argo would like to be able to work with the ANDRO team to fix bad decoding at DACs found by the team and to incorporate their work into improved trajectory files.

A two step process was developed to try and improve the trajectory files. First, the new trajectory file format was agreed upon with the caveat that a DAC cookbook is needed to help DACs understand how to correctly fill all the cycle timing variables included in the format. It was stressed that while this may be a difficult process for DACs, it is important that they learn how to correctly decode and fill all the variables consistently for the future. It may take different times for each DAC to spin up, but this is the goal. The new trajectory file format is in the new version of the user manual and the DAC cookbook should be out in June.

Secondly, the workshop addressed the problem of older float data that has already been processed by the ANDRO team. The goal with this dataset is to fill velocity product files called "TRAJ2" files. The TRAJ2 files will be similar in format to the new trajectory file format, but with increased flexibility for additional variables that might include extrapolated positions, velocity

estimates, etc. Brian King and the ANDRO team have agreed to work towards producing these product files which will likely be served on the GDACs.

A couple other items were discussed at the workshop that pertained to the trajectory files including a possible new method for quality controlling the positions in real time. Scientists at JAMSTEC have developed a method to qc positions from the Argos satellite system and this method was tested at the JMA DAC from January to September 2011 with positive results. The new JAMSTEC method detected a small ratio of positions to be flagged as bad - between 1.5 and 3% depending on latitude. Several other users have been implementing this qc method, as has the ANDRO team. All at the meeting agreed it did a better job than the current real time qc test for bad positions and that this test should replace the current real time qc test for bad positions. This should be implemented at all DACs by ADMT 13. Another item discussion was how to fill positions for Iridium floats that do not have a GPS position. The method was agreed upon for both profile and trajectory files and will be included in the DAC cookbook.

In the discussion that followed, it was noted that many DACs are more focused on the profile files and are having difficulty finding time and funding to address the trajectory files. The AST noted that the trajectory files are part of the Argo data stream and should also be considered a high priority.

Action item 10: AST states that trajectory files are of equal priority to profile files and that DACs may need to explore finding more effort to help transition to the new trajectory file format 2.3

Action item 11: Discuss at ADMT whether updated qc'd surface timing information is being put back into the profile file

5.4 CCHDO/NODC activity

A review was done to explore why two years of CTD data, submitted to Coriolis by CCHDO, did not appear in the fall 2011 version of the Argo Historical RefDB. In addition, there were tons of updates to the RefDB by US-NODC by way of improvements to the WOD. Also, there was significant progress related to the RefDB: CCHDO now deals with past and future cruises by way of becoming the data manager of multiple projects and groups, including GO-SHIP, and SOOS. Work with the ATC continues, by having the AIC publish information about CTD profiles at float deployment locations.

BODC provided 71 cruises to CCHDO for the RefDB as well as qualitative information from their QC procedures which helped identify sparse coverage in the RefDB. These are areas where there are Argo observations but no relevant ship-based CTD profiles. CCHDO found and chased down data for that region, processed it, transferred these data to Coriolis for inclusion in the next version of the RefDB: **updated status**, this action is now complete as of 3/21/12 - these data now appear in the Mar 2012 RefDB.

As usual, we need continued guidance from the AST members on the best approaches for getting new data from their respective countries.

Action item 12: Continued improvement regarding the Coriolis/US-NODC/CCHDO coordination: improving the utility of the RefDB by quickly getting new and updated CTD profiles into the RefDB (mostly done give the improvements in RefDB version 2012.03.21)

Action item 13: AST members should inform the CCHDO of upcoming and/or known missing cruise data that would be of value of to the RefDB.

6 Technical issues

6.1 Float technology progress

Argo Float technology progress : Provor & Arvor Floats
S. Le Reste

This work started in the EuroArgo framework and is continuing in the NAOS project (French national agency of research funding).

One of the main focuses is to consolidate the existing floats: improvement of manufacturing procedures, simplification and safer procedure before launching.

The oxygen implementation strategy on Provor will follow the recommendations of the Argo Oxygen Meeting in Brest, France in May 2011. Coding of optode phase measurements will depend on what kind of telemetry is used (Argos or Iridium). 10 Provor with multipoint calibrated 4330 optodes and Argos transmission will be deployed in 2012. Five others will be deployed with Iridium.

In 2011, nitrate sensors (SUNA and ISUS) were embedded on two Provor floats to compare their performance. This experiment has been useful to validate nitrate measurements on Provor floats for next NAOS Bio floats.

Special event detections (e.g. ice sensing or others) will be implemented. Feedback from the sensor unit could be done to the motion unit to change float behavior (profile cancelled or postponed, mission cancelled to rise to the surface, waiting,…).

Recent Technical Developments with APEX Argo Floats
S. Riser

A potentially important technological issue that is relevant to Teledyne/Webb Apex float users in Argo is the fact that the APF9 controller in these floats, in use since 2003, will soon be obsolete. This obsolescence is due to the end of production of one of the main electronic components on the controller board. Replacing this component requires a complete redesign of the hardware on the controller and the creation of new firmware to drive this hardware. A task such as this normally can require 1-2 years, and engineers at Teledyne/Webb are apparently working on this project, with the new controller called the APF11. It is clear that only a limited number of APF9 boards remain in stock at Teledyne/Webb, although the exact number has not been made public. It is essential that the work on the new APF11 be completed rapidly so that the new board can be fully tested and debugged before the stock of APF9 boards is exhausted. We will be in contact with Teledyne/Webb in order to stay informed of the progress on this project.

SOLO-II

The SOLO-II design has been commercialized to MRV, LLC who have delivered 20 floats to Scripps and deployed in October 2011. 60 SOLO-II floats manufactured by the Scripps Instrument Develop Laboratory have been deployed. There have been minor problems with these floats that have now been corrected through redesign of the external bladder and GPS

board and manufacturing technique of the antenna and minor changes in the float software. For each surfacing, the floats transmit the parameters that determine the float behavior along with the profile, engineering, and position data at each surfacing. Two GPS positions at the start and end of surfacing, information for the fall and rise rates, the start and end times for the drift and vertical profiling phases are also transmitted to allow good estimates of the trajectory velocities.

Programs to process the transmitted data have been developed and documented. The code and documentation will be made available to the Argo community by May 2012. For all versions of the float software, John Gilson will maintain documentation of the format for the SBD messages containing the float data. A GUI interface to construct the messages that are required to modify the float mission parameters is nearly complete and will also be made available to the Argo community.

DEEP SOLO

D. Roemmich briefly updated the AST on the Deep Solo float. The target depth is 6000db, with an expected lifetime of more than 100 cycles. The Instrument Design Laboratory at Scripps is still testing pressure case materials and making modifications of the Solo-II pump. Prototypes will likely be available at the end of calendar year. There is not a specific plan yet for a pilot deployment. Initially the Deep Solo will go into not so deep water near San Diego. Next, we will look towards deep basins with decadal signals like the Southwest Pacific basin or Argentine basin. The plan is for 6 prototype floats and then, depending on the US float budget, 12 floats per year for five years for a pilot experiment.

NOVA

The NOVA float model was recently developed by the company MetOcean (www.metocean.com). Argo Canada purchased 27 NOVA floats that will be delivered by March 31, 2012. Up until now, we have only deployed one of these floats (launched on 25 February 2012). This float has completed three 10-day cycles from 2000 m depth to the surface, and the temperature, salinity and pressure data appear to be of good quality. However, the GPS on that float is not working, forcing us to rely on less accurate positioning from the Iridium system. Of course, there are many decoding and data management tasks related to the introduction of a new float for which we have to propose technical parameter names before uploading data to the GDACs. Those decoding and data management tasks have represented a large extra workload for Mathieu Ouellet (ISDM) who has been in touch with Ann Thresher (CSIRO) to introduce GDAC-approved technical parameter names for the NOVA float. Mathieu has also been exchanging numerous emails with MetOcean to clarify the meaning of parameter names, and map these to the corresponding parameter names recommended by the Argo Data Management Team. At this stage, our experience with the NOVA float is still very limited. We will be reporting on a larger set of float deployments next year, at the AST-14 meeting.

NAVIS

Gregory Johnson supplied a report on PMEL's recent experience with Seabird Navis Floats which was presented by Dean Roemmich. The Navis float is an Iridium/GPS float using RUDICS for data transmission with firmware based on the APF-9 (UW – Swift & Riser). It is equipped with a SBE-41CP CTD.

PMEL ordered 48 Navis floats. Their units are set to report 2-dbar bin averaged CTD data from 4 to 2000 bar with a 10-day repeat cycle. The floats are pressure activated. As of 7 March

2012, 17 floats had been delivered to PMEL and five of those floats had been deployed. Those five floats had reported between 1-5 profiles and appeared to be functioning normally.

SBE technical information asserts sufficient power for > 300 profiles to 2000 dbar and a minimum fractional volume change 1.7% from a 300-ml oil reservoir. The floats have a 14-cm hull diameter, 24-cm ring diameter, and 159-cm length. Their weight in air is ~18.5 kg. Please contact SBE for more details.

Deep NINJA

Tsurumi Seiki Co. and JAMSTEC have developed a new profiling float for the deep ocean, "Deep NINJA", which has an ability to measure PTS profiles at the depth of up to 4000 dbar. The first prototype was tested in Sagami Bay, a coastal/shallow region near Tokyo, with R/V Kaiyo in 2011 summer. The field test for deep ocean observation will be carried out in summer 2012, and then a (small) fleet of Deep NINJAs will be deployed in the Southern Ocean during R/V Mirai cruise in 2012/13 austral summer. Deep NINJA is planned to be available for public in 2 – 3 years.

6.2 Status of oxygen measurement and QC

Riser

A workshop for improving our understanding of dissolved oxygen data collected by profiling floats was held in Brest, France in May of 2011. A number of important issues relevant to float oxygen data were discussed at the workshop, and the attendees came to several important conclusions. It was noted that floats should transmit all the raw data collected by the float oxygen sensor rather than only computing oxygen on board the float and transmitting the computed value. Using all the transmitted data, including the sensor temperature and the so-called "B-phase" parameter, and the Stern-Volmer equation, an initial estimate of dissolved oxygen on the float can be made. The factory calibration of the most commonly used variety of sensors is known to be relatively poor, so this initial estimate must generally be adjusted to either the local oxygen climatology or to shipboard data collected at the time of float deployment. Since the most commonly used sensors do not show appreciable drift over time, acquiring calibration data at the time of deployment is very valuable and should be done whenever possible. Ultimately, it appears to be possible to correct the raw oxygen values collected by the float to an accuracy of 1-2 micromoles/kg.

Action item 14: Ask new floats with oxygen sensors to send back "B-phase" information if not doing so already.

Gilbert

In March 2009, action item 14 from the AST-10 meeting in Hangzhou asked for "Denis Gilbert to work with Taiyo Kobayashi and Virginie Thierry to ensure that DACs are processing oxygen data according to recommendations". A first set of recommendations was produced in August 2010, and has been amended twice. Since the adoption of version 1.2 of the recommendations in February 2011, most DACs have made good progress in adopting these recommendations, though some work remains to be done.

http://www.argodatamgt.org/content/download/2928/21973/file/ARGO_oxygen_proposition_v1p2.pdf

However, QC flags associated with oxygen data are still set to 0, meaning that oxygen data are not being quality controlled. At the February 2012 Ocean Sciences Meeting in Salt Lake City, the SOLAS/IMBER subgroup 2 on ocean interior biogeochemistry changes, headed by Niki Gruber (ETH-Zurich), expressed the desire to play a role in the quality control of Argo-O_2 data, so that we may have useful quality flags and error estimates associated with Argo-O_2 data on the GDACs. The basic idea would be to create a small team of chemists and physicists to advance this issue and develop QC procedures and algorithms that could then be distributed to real-time and delayed-mode Argo data management people at all DACs dealing with Argo-O_2 floats. To this end, a high-quality reference database of oxygen measurements would need to be built and maintained. This would partly build on experiences learned in the CARINA (Atlantic) and PACIFICA projects, and partly build on experiences learned by the Argo community with the real-time and delayed mode quality control of temperature, salinity and pressure data.

AST-13 meeting participants generally welcomed this initiative from SOLAS/IMBER subgroup 2 on ocean interior biogeochemistry changes. Virginie Thierry and others suggested that the Argo-O_2 quality control group should meet immediately before or after the annual ADMT meeting in Hyderabad, so as to facilitate the two-way exchange of technical information between the oxygen experts and the Argo data management team. Toshio Suga proposed the name of Hiroshi Uchida (JAMSTEC) as a very valuable working group member for possible inclusion in such an Argo-O_2 working group. Finally, Steve Diggs pointed out that CCHDO can assist in helping build a high quality reference database for oxygen in a manner similar to what it currently does for regularly updating the high quality reference database that Argo uses for delayed mode quality control of salinity. In that respect, the work relationship that already exists between CCHDO, NODC and ADMT could be enhanced to include oxygen and possibly other parameters of interest to the Bio-Argo community. It is expected that Hernan Garcia would be the key contact person from NODC relative to the handling of high quality oxygen data in the reference database.

Action item 15: AST endorses working group to develop oxygen delayed mode quality control method

6.3 Update on near surface temperature

At its Science Team meeting in Edinburgh (summer 2012) **GHRSS**T stated “the near-surface measurements from Argo profiling floats provide a new data set that is highly valuable for independent validation of SST retrievals, models and analyses.” Since then the Met Office has used Argo temperatures (at 3 to 5 m depth) to validate various GHRSST analyses and shown that the GHRSST Multi-Product Ensemble (GMPE) median is more accurate than any of the contributing analyses, with a standard deviation error of 0.40K globally with respect to the near-surface Argo data.

GHRSST are also interested in diurnal warming (DW) (near-surface stratification), which impacts convection as well as heat and moisture fluxes on seasonal to intra-seasonal and climate time scales. The expectation is the likelihood of observing DW is much higher from Argo than from dedicated short-term measurement campaigns. In light winds**,** models suggest such stratified layers can be ~10 m deep with ΔT 1-2 °C and > 3 °C over shallow layers under calm conditions, although there are almost no in situ measurements for such large warming cases. During 2011 an analysis of the (un-pumped) near-surface temperature (NST) data was made, in collaboration with GHRSST, as a summer MSc project at Reading University. In this study there were 3,007 profiles (recorded between October 2008 and May 2011) from 54 NST-capable floats. One of the challenges was to more accurately determine the depth of the measurements

as the pressure sensors exhibit a slow drift so an offset needs to be applied; surfacing was identified when the pressure change between two adjacent points was < 0.5 dbar (implying the float had stopped ascending) and the (surface) pressure taken as the offset to adjust the deeper pressure values. Between 10 m depth and the surface**,** 62 profiles (from 26 different floats) showed evidence of diurnal warming (stratification) with $\Delta T > 0.5$ °C between 10 m and the surface (where the maximum ΔT seen was 2.4 °C) with diurnal layers spanning from 0.1 m to 8 m depth. Various vertical structures were observed, where in some cases the stratification probably reflected remnants of diurnal structures from the previous day(s)**.**

For learning more about diurnal warming, GHRSST's accuracy requirements are not that stringent, but they require vertical resolution as high as possible. On the NST-capable floats**,** the deeper cross-calibration measurements suggest the agreement of pumped **and** non-pumped measurements is sufficiently good and the various results suggest that the accuracy of the un-pumped temperatures is sufficient for GHRSST's requirements. It would be expected that any lag due to not pumping the sensor would most likely underestimate near-surface stratification. Information on the type and time of the measurement is also required, and whether the data are pumped or non-pumped**,** it is important to state the expected accuracy (errors).

A key question was how close to the surface can we safely go with the pump on to ensure delivering the most accurate data, before turning the pump off to avoid contaminating the salinity sensor. Scripps's Solo-II (Iridium) floats provide continuous profiles at 2 dbar resolution with higher (1 dbar) resolution above 10 dbar until the pump is switched off at 1 dbar (but where the surface pressure is reset for every profile to remove drift). This sampling should resolve all but the most shallow of features. Other operators are more cautious, switching the pump off between 2 and 5 dbar and there is a need to investigate whether leaving the pump on for longer has any effect on the quality of the salinity measurements.

6.4 Status of satellite communications

Piotrowicz

Steve Piotrowicz gave an update on the implementation of Iridium NEXT. The Critical Design Review is underway and the deployment is on schedule for the launch of 72 space vehicles from the 1st quarter of 2015 through the 2nd quarter of 2017. The space segment will consist of 66 operational space vehicles and six in-orbit spares. There will be nine spares on the ground. Details of the capabilities are in the meeting presentation graphics. An update on new hardware for data transmission (SBD and RUDICS) and the schedule for availability of the hardware was included in the presentation. A brief update on the implementation of the Argos Data Collection System (A-DCS) within the U.S. Joint Polar Satellite System was given. It was agreed that Argo needs to keep current on the status of that implementation in order to plan operations of floats beyond 2016.

Action item 16: Ask CLS for information on Argos constellation at next AST meeting

Hosoda

JAMSTEC and JMA suffered severe experiences of iridium telecommunication trouble of floats in 2011. The troubles occurred in both dial up type service for APEX and short burst mode service (SBD) for NEMO. As to the trouble of the dial up type service, telecommunication was stopped several times in one year. Although all the observed data during the troubles could be finally obtained owing to the data logging in the floats, mission commands could not be sent to

the floats during the troubles. On the other hand, while the trouble in the SBD type service occurred for just a few tens of minutes in a single event, the observed data were lost because it occurred at the time when the data transmission to the satellite had just started. According to JAMSTEC's experiences from 2008 to 2011, there were 13 cases of unavailable services, and some of the cases affected over 50 floats for 1-65 days. Among those cases of trouble affecting JAMSTEC's float operation, no cases were announced in advance.

Replying to JAMSTEC and JMA's inquiry about the troubles, the Japanese agent of iridium telecommunication system replied that the troubles may be caused by data server error and/or damaged telecommunication lines. Although repeated troubles make us guess some kind of system error on the route of iridium telecommunication, enough information has not been received from the agent/company. In the discussion at AST-13, some cases of iridium telecommunication trouble were reported from other countries and the information could be shared. In addition, RUDICS service, which is one of the iridium telecommunication services not available yet in Japan, was introduced. The operation of RUDICS service is expected to be more stable than the dial-up service because data from/to the RUDICS server can be received/sent via TCP/IP.

The troubles will affect glider operation more seriously. Since the glider generally needs frequent changes in mission, long-term stoppages of telecommunication makes it difficult to control. We will make a request to the agent for improvement of the iridium telecommunication system, including the start of the RUDICS service in Japan. At the same time, we will notify Japanese iridium float or glider users and potential users about these troubles and services.

Action item 17: Suggest that all floats using Iridium have the capability to store data onboard for a long length of time and be able to resend the data later if given a command to do so.

6.5 Standardized sampling for Iridium floats

D. Roemmich led a discussion on the possibility of standardizing sampling schemes for Iridium floats. Currently, lots of data collection schemes exist and it was recognized that there is value in having user communities understand how the floats sample. Roemmich stressed this scheme will not be a hard law that all Argo floats must follow, but it would be a sign of maturity of the Argo program. Argo would like to serve the needs of as many users as possible within cost restraints. Additionally, some communities are requesting more measurements at the surface, while others asking for higher resolution throughout. It is important to find a good balance for all these competing interests.

The Scripps's Solo-II (Iridium) floats provide continuous profiles at 2 dbar resolution with higher (1 dbar) resolution above 10 dbar until the pump is switched off at 1 dbar (but where the surface pressure is reset for every profile to remove drift). This sampling should resolve all but the most shallow of features. Other operators are more cautious, switching the pump off between 2 and 5 dbar and there is a need to investigate whether leaving the pump on for longer has any effect on the quality of the salinity measurements.

The idea was raised of sending back the raw data above 10 db, but too many problems were associated with this: not all floats can do this presently, will the data be bin-averaged on land by the DACs before making a profile, low salinities can be measured due to air bubbles, etc. It was agreed that 1 db sampling above 10 db would be suggested for now.

Action item 18: AST suggests that PIs using Iridium try sampling every 2 db from 2000 db to 10db and every 1 db up to 1-3 db. Ask J. Gilson to report at either ADMT or AST stats on how those CTDs behave in DMQC relative to older CTDs that shut off at 5db.

7 Demonstrating Argo's value

7.1 Upcoming science meetings - Argo Science Workshop 4

The 4th Argo Science Workshop will be part of the large symposium "20 Years of Progress in Radar Altimetry" organized by ESA&CNES from 24 - 29 September 2012 in Venice, Italy. The proposal was made in the fall of 2011 by the altimetry organizing committee to include an Argo workshop (as in 2006). After discussion with AST co-chairs and Euro-Argo partners, it was decided that this excellent opportunity for Argo should not be missed. Euro-Argo partners were ready to lead the organization (as part of the SIDERI EU project). Information was sent to AST and Argo international in early 2012.

The Argo Science Workshop will be held from Thursday to Saturday (September 27–29) (2.5 days). The theme of the workshop will include 1) a review of Argo achievements in ocean and climate research and 2) float technology and science discussions on the development on the new phase of Argo (sustaining Argo, developing extension towards biogeochemistry, deep ocean and polar regions). An organizing committee (P.Y. Le Traon, P.M. Poulain, S. Pouliquen, E. Mamaca, F. Loubrieu) is already in place. A scientific committee was agreed during AST-13 (the two AST co-chairs, T. Suga, P.Y. Le Traon, P.M. Poulain, S. Pouliquen). Its role will be to review the abstracts and organize the workshop program and its sessions.

Meeting registration will be via the symposium WWW site (http://www.altimetry2012.org). Abstract submission for ASW4 (http://www.altimetry2012.org) is now open. Deadline is April 30, 2012. **AST members are strongly encouraged to participate to this major event and should relay this information to their national Argo teams.**

The idea of an international Argo booth at the Altimetry section of the symposium was discussed. S. Piotrowicz offered the use of a display system from JPL that could be used to show the Argo animation as well as the movie made to showcase the link between Argo and Altimetry, the Google Earth Argo layer, etc. The AST agreed this would be of value at the symposium.

Action item 19: Ask AST members to encourage attendance and abstract submission within their own country. Advertise ASW again through email list and Argo websites.

Action item 20: AST co-chairs, B. Owens and T. Suga to be part of the scientific committee on the ASW-4

7.2 Argo bibliography

M. Scanderbeg presented work done in the last year on the bibliography pages on the AST website. Argo has over 1000 papers published since the start in 1998. The webpage continues to maintain graphs showing the number of papers published per year and the numbers of papers published per country as designated by the country of the first author on the paper. There were over 200 papers published in both 2010 and 2011. This jump by about 50 papers over 2009 probably reflects the improved visibility after OceanObs'09. It was suggested to add another plot showing number of papers published in the top journals.

Several national reports for the AST-13 meeting contained lists of citations which allowed comparison with searches done by M. Scanderbeg for inclusion in the Argo bibliography. In most cases, M. Scanderbeg found the citations with the exceptions being articles where Argo was not explicitly stated in the article, articles relating to bio floats, and book chapters. Therefore, it appears that the search criteria are working well for most articles, but further work needs to be done to find biological papers and book chapters.

These missing papers raised the question of exactly what papers should be included in the Argo bibliography. It is important not to inflate the number of papers published using Argo data. M. Scanderbeg explained that when searching for papers, the following criteria are used:

- Argo should be mentioned in the paper and its data should be used in some manner
- papers that simply mention Argo as a program with 3000 floats are excluded

Based on feedback from AST members, it was agreed that papers submitted by AST members for inclusion in the bibliography need not meet these strict guidelines as long as it is apparent that Argo data were used in the paper. For example, several papers were suggested during the year that used CARS, the Australian database which includes Argo data, or de Boyer Montegut's MLD product which also includes Argo data. This type of paper will be included if submitted directly to M. Scanderbeg. It is still requested that authors use the suggested publication credit on the Argo website. (http://www.argo.ucsd.edu/Acknowledging_Argo.html)

To maintain the bibliography and the in press page, all AST members are again encouraged to continue sending any citations of Argo papers to argo@ucsd.edu.

Finally, the idea of keeping a separate list of theses published using Argo was suggested to help demonstrate Argo's educational value. Several AST members agreed this would be a good idea and agreed to help assemble lists of theses within their country. This is more feasible for some countries than others. M. Scanderbeg agreed to investigate thesis databases to see how reliable they might be and what countries are included.

Action item 21: Add another plot to the Argo bibliography page showing papers published by journal.

Action item 22: Investigate websites/databases of theses to see if it feasible to make a list of PhD theses using Argo data.

7.3 Google Ocean

S. Diggs reported on the Google Earth Argo layer produced by his office, the ATC and other members of Argo. He stated that the original goal of trying to get an Argo layer in the official Google Ocean layer may not be the best goal anymore. This Google Ocean layer contains almost entirely biological links and does not get updated frequently. However, people within the Argo community are using the Google Earth layers developed by Diggs and the rest of the team.

He suggested moving more towards web-based tools like the Google Earth plug-in which does not require users to download a Google Earth program, but makes it easier for users to access Google Earth layers from their iphone, ipad, tablet, etc. For the millions of users out there, this might be a better tactic. He showed a quick animation done by James Cameron's vehicle that dives into the Marianas Trench which was an example of what Argo has to compete with.

The talk concluded with a few thoughts and questions. Mainly he stated that there are people within the Argo community who have the technical skills needed to make a great Google Earth Argo layer, but that new focus and energy was needed. Questions raised included the possibility of finding additional funding to focus on this for a short time to produce a really powerful product and to really consider who the audience for this layer might be.

The AST recalled that the G-Earth layers produced by JCOMMOPS were very important both for outreach but also for planning deployments. In particular it was asked to set up a product showing all float trajectories and to promote further the layers.

TC suggested establishing better links with UNESCO Education section to develop further educational Argo initiatives.

Action item 23: Make gridded T/S layers and trajectory layers easily visible in the Argo kml file. ATC, J. Gilson, M. Scanderbeg

Action item 24: Make a separate tab for Google layer from main AST webpage. M. Scanderbeg

7.4 Argonautics Newsletter

M. Scanderbeg thanked all authors for the previous Argonautics issue published last summer for which there was much positive feedback. Next, ideas were presented for the next Argonautics Newsletter which will likely be published in July. Proposed articles include an article by John Gould discussing Argo's progress, a surface pressure offset update, and float deployment opportunities via both the Lady Amber and the Voiles sans frontieres program. Additional articles include float technology updates for the NAOS deep float, SOLO-II (MRV), NOVA, NAVIS, and any other floats that would like to be included. There will also be a EuroArgo update, a BioArgo update from two sources (Riser and Claustre) and meeting summaries.

The question was raised as to who the audience should be for the newsletter and it was agreed that this is often used within national programs to inform Argo users of updates within Argo as well as for educational outreach efforts.

7.5 Updated Argo Brochure

S. Wijffels said that Australia is putting together an updated Argo brochure for the Australian national program and was wondering if the AST would like an international Argo brochure be assembled at the same time. The general consensus was that on the international level, these brochures quickly become obsolete and that an electronic way of informing the public might be more effective. After discussion, it was agreed that the AST would make an effort to maintain an Argo page on Wikipedia in order to reach a general audience. One has already been started by H. Freeland and will be read and updated by several AST members.

It was also suggested that it might be time to try for an article in Science/Nature/etc to celebrate the millionth profile to reach a more scientific audience. S. Wijffels agreed to head up this effort.

Action item 25: Work to put together a news article to submit to science/nature/climate change/EOS around the millionth profile. Include a powerful graphic or photo. S. Wijffels.

Action item 26: Ask H. Freeland, D. Roemmich, D. Gilbert, and any other volunteers to read the content on the Wikipedia page and contribute updated content. Explore how best to update this page given the conflict of interest rules for Wikipedia. Ask non-English speakers to consider translating the Argo page into languages. T. Suga, B. Klein, EuroArgo can translate into their languages.

7.6 Argo data and information accessible through interoperability with IOC Ocean Data Portal

7.7 Argo outreach activities

D. Roemmich gave a presentation of SEREAD activities submitted by Julie Hall. She restated the goals and principles of the SEREAD program which focus on developing educational resources for the South Pacific Islands. She stated the importance of working with teachers to educate them on the climate change science and give teachers the chance to perform experiments they can use in their classroom. Many teacher training workshops have been held in various South Pacific Island nations to both educate teachers on the developed programs and on how to train other teachers on the material. The feedback has been very positive from the teachers and the program can now expand more with local teachers trained in the subject matter.

Action item 27: Explore establishing a clear link with UNESCO education group. Albert Fischer, IOC, AST co-chairs and ATC.

7.8 How is Argo doing with regard to its progress and priorities?

John Gould presented a mid-term review of the Argo program, looking back to the start of Argo around 2000 and towards a future horizon at 2020 (a good place for a vision). It was four years since he had attended the AST (AST-9 in Exeter). Between 2000 and 2007 when the target of 3000 operating floats had been reached (but not the target in terms of uniform density) the array had grown steadily. He confessed that at AST-9 he had expected that the total of floats might have dropped below 3000 but the fact that it had not pointed to the success in gaining new resources and in overcoming technical challenges. Argo was now collecting a new profile every four minutes).

He started by summarizing the things that Argo had done well:

- Consistency of the core mission
- Continuing to deploy floats
- Overcoming technical challenges
- Adhering to principles of openness in data distribution
- Engaging new countries. In March 2005, there were 18 contributing countries (5 with less than 5 floats). By March 2012, there were 31 (14 with less than 5 floats). He commented that there were still major countries (in terms of GDP and area of EEZ that were not adequately involved)

- Argo has a very effective and responsive distributed data system, delivering and quality controlling data (He noted 90% of data now available in real time in 24 hrs and 85% of eligible profiles processed (50% in 2008))
- Data are having large impact on science. 1000 science papers published, noting that there was usually a 2-3 year lag between data use and publication.

Turning to the challenges that Argo faces, Argo developed (1999-2007) in good economic times but life is now harder in terms of available funding and the future is even less certain. Added to this is increasing competition from "novel" observing systems such as gliders (but fortunately they have yet to co-ordinate an international program) and cabled observatories. We also have to counter the perception that Argo is "done".

He went on to explore the relationship of the core Argo mission with other applications of profiling float technology such as BGC Argo, under-ice missions, shelf and marginal seas and deep Argo. These "additions" compete for resources and add to the complexity of the AST and ADMT responsibilities. These bodies needed to decide on their mode of interaction with these new programs and the level of responsibility that they will take on. It was also noted that there were Law of the Sea issues that must not be allowed to compromise the core mission.

Technology issues will continue to be challenging and external influences such as communication changes can seriously impact the array. He welcomed the prospect of a new salinity sensor that might reduce dependency on SeaBird. Close communication between Argo and float manufacturers remains the key to success.

In closing he turned to the issue of "What is Argo?" How is it perceived by outsiders: as a single international program or as a consortium of national contributions? Depending on that, how do we promote ourselves? Should our primary outreach target be funders, government, the public, education or scientists? How much effort should be devoted and how do you measure success of our outreach? This also raised the question of what should be the appropriate size of Argo's infrastructure.

And finally he commented that the future of Argo depended on People. How do we ensure that we will have a strong Argo (and AST, and ADMT) in 2020 . Who are the next generation of Argo scientists?

8 Future meetings

8.1 ADMT-13

ADMT-13 will be hosted by INCOIS in Hyderabad, India in 12-16 November 2012. It is suggested to have a one day workshop on Biogeochemical Argo on 13 November 2012.

8.2 AST-14

It is proposed that AST-14 will be hosted by New Zealand Argo in 2013. This is subject to final funding agreements for NZ and any other objections from AST members who will have to travel long distances to reach NZ.

9 AST Membership

A couple issues were raised on AST membership at the meeting including the announcement that Moon-Sik Suk has stepped down as a Korean AST member.

It was also suggested that AST membership may need to be expanded to include representation of new expansions to Argo such as the BGC Argo group, etc. There was no formal agreement, but representatives from these groups were encouraged to continue attending AST meetings.

10 Other business

No other business items were raised at this time.

Argo Steering Team Meeting (AST-13)
Intergovernmental Oceanographic Commission, Paris, March 20-22, 2012
Host: Euro-Argo

1. Welcome (9 am March 20)
2. Local arrangements
3. Objectives of the meeting/adoption of the agenda
   Looking back over Argo's first 15 years – are present priorities appropriate?
   Is Argo sustaining and improving the core Argo program, while also extending it as recommended by OceanObs09?
4. Status of action items from AST-12 (Scanderbeg)
5. Implementation issues
   - 5.1 AIC Report/Status of Argo (Belbéoch)
   - 5.2 The Beginnings of Argo: 1997-1999 (Roemmich)
   - 5.3 EuroArgo update (LeTraon)
   - 5.4 Forum for the future of Japan Argo (Suga)
   - 5.5 Update commitments table (Scanderbeg)
     Have the missed 2009/2010 deployments been made up?
   - 5.6 Float deployment opportunities (Belbéoch)
   - 5.7 Bio-Argo/Biogeochemical Argo (Riser, Claustre)
   - 5.8 AIC Funding (Freeland)
   - 5.9 JCOMM Observing Program Support Centre (Belbéoch)
   - 5.10 Marginal Seas sampling schemes (P-M Poulain, Ryoo)
   - 5.11 Discussion items from National Reports?
6. Data Management related issues
   - 6.1 Feedback from ADMT-12 (Pouliquen/Thresher)
   - 6.2 Update on pressure error correction and impacts (Wijffels)
   - 6.3 Feedback from Argo Trajectory Workshop (Scanderbeg)
   - 6.4 CCHDO/NODC activity/reference data (S. Diggs, T. Boyer)

7. Science talks: 3 presentations, 20 mins + 10 min discussion each.
   - 7.1 Claustre, H. Mignot, A. Xing, X, Dortenzio, F., Poteau., A.
     Bio-optical floats: (1) towards delayed mode for Chla and CDOM; (2) understanding the seasonal DCM dynamics in sub-tropical regimes.
   - 7.2 Poulain, P.M., Notarstefano, G. (OGS, Trieste, Italy) and Stanev, E. (Univ. Sofia, Bulgaria)
     Long term variations in the thermohaline properties in the Mediterranean and Black Seas as derived from Argo data

8. Technical issues
   - 8.1 Float technology progress (Riser, LeReste, Suga, Owens, Gilbert, Roemmich/Johnson)
   - 8.2 Status of oxygen measurement and QC (Riser, Gilbert/Kobayashi, Thierry)
   - 8.3 Update on near-surface temperature (Turton, Wijffels)
   - 8.4 Status of satellite communications (S. Piotrowicz, S. Hosoda)
   - 8.5 Standardized sampling for Iridium floats (Roemmich)

9. Demonstrating Argo's value/evolving for Argo's future
   - 9.1 Upcoming science meetings: ASW-4 September 2012 (LeTraon)
   - 9.2 Argo bibliography (Scanderbeg)

9.3 Google Ocean (Diggs/Belbeoch)
9.4 Argonautics Newsletter (Scanderbeg)
9.5 Updated Argo Brochure
9.6 Argo data and information accessible through interoperability with IOC Ocean Data Portal (Troisi)
9.7 Argo outreach activities –
9.8 How is Argo doing with regard to its progress and priorities? (Gould)

10. Future meetings
    10.1 ADMT-13
    10.2 AST-14
11. AST Membership
12. Other business

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	Action	Responsibility	Status
1	AST co-chairs to send a letter of thanks to Pierre-Yves LeTraon (EuroArgo) and Albert Fischer (IOC) for hosting AST-13	AST co-chairs	
2	Rename core Argo to global Argo mission. Define global Argo mission to include all areas in the ocean where depths are more than 2000 m including marginal seas and high latitudes. ATC to develop a metric for this and begin tracking it.	Argo Technical Coordinator, AST co-chairs	
3	Officially recognize MedArgo ARC on the AST, AIC, ADMT websites	M. Scanderbeg, ATC, ADMT	
4	Ask the IOC to help find an Argo focal point in those countries where Argo deployers are having implementation problems.	Argo float deployers having difficulties, Albert Fischer	
5	ATC to highlight difference between desired deployment plans without opportunity and firm plans, with known ship and cruise.	ATC	
6	Suggest that ADMT host a one day workshop before ADMT-13 focusing on Biogeochemical Argo. Advertise workshop among BGC group. Ask organizers to request reviews and comments on proposed real time qc procedure for biogeochemical parameters including oxygen.	ADMT co-chairs; Workshop leaders HClaustre, others involved in this data and float deployment	
7	Document the major problems with Argo dataset on the AST website in a Data FAQ page. Add links to this FAQ from all Argo related websites including the AIC, data management team, national program pages, etc and in the data manuals. M. Scanderbeg with help from M. Belbeoch	M. Scanderbeg, ATC	
8	Final few DACs need to focus on TNDP identification and treatment to finish TNDP work. Most recent audit can be found at:	Affected DACs	

9	DACs need to fix real time files that do not have a PRES_ADJUSTED variable filled so that they can be checked by Jeff Dunn at CSIRO.	Affected DACs	
10	Develop the core specifications each float should report. Circulate among AST members and post on Argo websites. Will be a resource for float manufacturers	S. Wijffels, M. Scanderbeg,	
11	AST states that trajectory files are of equal priority to profile files and that DACs may need to explore finding more effort to help transition to the new trajectory file format 2.3	AST, DACs	
12	Discuss at ADMT whether updated qc'd surface timing information is being put back into the profile file	ADMT co-chairs	
13	Continued improvement regarding the Coriolis/US-NODC/CCHDO coordination: improving the utility of the RefDB by quickly getting new and updated CTD profiles into the RefDB (mostly done give the improvements in RefDB version 2012.03.21)		
14	AST members should inform the CCHDO of upcoming and/or known missing cruise data that would be of value of to the RefDB.		
15	Ask new floats with oxygen sensors to send back "B-phase" information if not doing so already.	PIs with oxygen sensors on floats	
16	AST endorses working group to develop oxygen delayed mode quality control method	Oxygen dmode working group: S. Riser, V. Thierry, D. Gilbert	
17	Ask CLS for information on Argos constellation at next AST meeting	CLS	
18	Suggest that all floats using Iridium have the capability to store data onboard for a long length of time and be able to resend the data later if given a command to do so.	PIs with iridium float	17
19	AST suggests that PIs using Iridium try sampling every 2 db from 2000 db to	PIs with Iridium	

	10db and every 1 db up to 1-3 db. Ask J. Gilson to report at either ADMT or AST stats on how those CTDs behave in DMQC relative to older CTDs that shut off at 5db.	floats; J. Gilson	
20	Ask AST members to encourage attendance and abstract submission within their own country. Advertise ASW again through email list and Argo websites.	AST members, M. Scanderbeg	
21	AST co-chairs, B. Owens and T. Suga to be part of the scientific committee on the ASW-4	AST co-chairs, B. Owens, T. Suga	
22	Add another plot to the Argo bibliography page showing papers published by journal	M. Scanderbeg	
23	Investigate websites/databases of theses to see if it feasible to make a list of PhD theses using Argo data	M. Scanderbeg	
24	Make gridded T/S layers and trajectory layers easily visible in the Argo kml file	ATC, J. Gilson, M. Scanderbeg	
25	Make a separate tab for Google layer from main AST webpage.	M. Scanderbeg	
26	Work to put together a news article to submit to science/nature/climate change/EOS around the millionth profile. Include a powerful graphic or photo.	S. Wijffels to coordinate	
27	Ask H. Freeland, D. Roemmich, D. Gilbert, and any other volunteers to read the content on the Wikipedia page and contribute updated content. Explore how best to update this page given the conflict of interest rules for Wikipedia. Ask non-english speakers to consider translating the Argo page into languages. T. Suga, B. Klein, EuroArgo can translate into their languages.	H. Freeland, D. Roemmich, D. Gilbert, T. Suga, B. Klein, EuroArgo	
28	Explore establishing a clear link with UNESCO education group	A. Fischer, AST co-chairs, ATC	

	2004 Argo deployed	2004 Argo equiv deployed	2005 Argo deployed *	2005 Argo equiv deployed	2006 Argo deployed	2006 Argo equiv	2007 Argo estimated	2007 Argo deployed	2007 Argo equiv	% deployed vs. estimated	2008 estimated	2008 Argo deployed	2008 Argo equiv deployed	% deployed vs. estimated	2009 estimated	2009 Argo deployed	2009 Argo equiv deployed
Argentina					12												
Australia	4		64		45		65	47	0	72	55	65		118	50	35	
Brazil	0		3					4								4	
Canada	30		29		38		25	18		72	22	25		114	28	23	
Chile	0		2**	2		4							4				
China	8		0		6		50			0	32	16		50	60	16	
Costa Rica	0		2***														
Denmark	0		0														
Ecuador								3									
European Union	15		7		3			8									
France	85		89		51		65	36		55	68	90		132	65	35	
Gabon																3	
Germany	27	18	56	19	35	1	37	22	13	95	50	61	10	142	57	33	
Greece																	
India	33		43		15		50	38		76	40	15		38	40	7	
Ireland	0		0								4	4		100		4	
Italy																	
Japan	119		98	12	98	18	95	80	15	100	95	76	16	97	101	55	18
Kenya																5	
Korea (Republic o	32		37		33		27	13		48	29	29		100	18	17	
Mauritius	2•		0		2												
Mexico	0		2°													1	
Netherlands	3		4		4		6	4		67	9	13		144	6	4	
New Zealand	2		1		3		2	2		100		2			2	2	
Norway	0		0		2												
Poland																2	
Russia	2		0													2	
South Africa	0		0													2	
Spain	2		4		1						20			0	20		
UK	45		28		24		45	31	2	73	35	29		83	35	20	
													10				
USA	396	38	455	38	475	21	410	381	29	100	360	326	42	102	360	148	61
Subtotals	803	56	854	71	847	44		687	59			751	82			418	79
Total	859		925		891		877	746		92	819	833		112	842	497	
	2004 Argo deployed	**2004 Argo equiv**	**2005 Argo deployed**	**2005 Argo equiv**	**2006 Argo deployed**	**2006 Argo equiv**	**2007 Argo estimated**	**2007 Argo deployed**	**2007 Argo equiv**	**% deployed vs. estimated**	**2008 estimated**	**2008 Argo deployed**	**2008 Argo equiv deployed**	**% deployed vs. estimated**	**2009 estimated**	**2009 Argo deployed**	**2009 Argo equiv**
·Donated by UK			***Donated by Spain			**Donated by Canada											
*Numbers compiled from AIC website			°1 float donated by Spain														

% deployed vs. estimated	2010 estimated	2010 Argo deployed	2010 Argo equiv deployed	% deployed vs. estimated	2011 estimated	2011 Argo deployed	2011 Argo equiv deployed	% deployed vs. estimated	2012 estimated		Notes	
					4				4	Argentina		
70	95	72		76	90	112		124	50	Australia	at least 50/year until 2011	
					16					Brazil	16 possible in 2012	
	2			0	3	3		100	1	Bulgaria		
82	25	28		112	16	17		106	27	Canada		
										Chile		
27	50	23		46	50	44		88	30	China		
										Costa Rica		
										Denmark		
										Ecuador		
										European Union		
		2				2			2	Finland		
54	95	55		58	80	53		66	65	France	Could deploy 20 more but hard to find opportunities in Atlantic Ocean in 2011. Plan for 65 floats/year for 2012 and beyond	
										Gabon		
58	110	41		37	48	48		100	66	Germany	50 floats per year during 2007 to 2012	
	1	1		100	3			0	4	Greece		
18	40	26		65	45	48		107	40	India	40 floats per year during 2012-2017	
	3	3		100	3	3		100	3	Ireland		
	2	1		50	30	4		13	24	Italy	funding for 25 in 2013	
72	116	51	44	82	127	73	40	89	123	Japan		
										Kenya		
94	12	12		100	14	14		100	15	Korea (Republic of)		
	2			0	4	4		100	4	Mauritius	floats provided by UK, aim for up to 4 per year	
										Mexico		
67	8	9		113	7	7		100	7	Netherlands	slight chance of getting 4	
100	2	2		100	2	2		100	2	New Zealand		
	4	4		100	8			0	3	Norway		
	3			0	2			0	2	Poland		
										Russia		
		1								Saudi Arabia		
					2			0		South Africa		
0	12	10		83	5	17		340	13	Spain		
57	40	25		63	40	39		98	36	UK	most floats for deployment in 2012 already purchased	
										UN (ice tethered profilers)		
58	500	333	28	72	450	311	42	78	360	USA		
	1122	699	72		1049	801	82		881			
59		771		62		883		84				
% deployed vs. estimated	**2010 estimated**	**2010 Argo deployed**	**2010 Argo equiv deployed**	**% deployed vs. estimated**	**2011 estimated**	**2011 Argo deployed**	**2011 Argo equiv deployed**	**% deployed vs.**	**2012 estimated**			

Argo Australia – 2012 Activities

Report to the Argo Steering Team

Susan Wijffels, Ann Thresher, Esmee Van Wijk, Vito Dirita, Jeff Dunn

The Australian Centre for Atmosphere, Weather and Climate Research: a joint partnership between the Australian Bureau of Meteorology and CSIRO

1. Status of implementation

Floats deployed and their performance

Australia currently has 378 active floats distributed across the Indian and South Pacific Oceans (Figure 1)

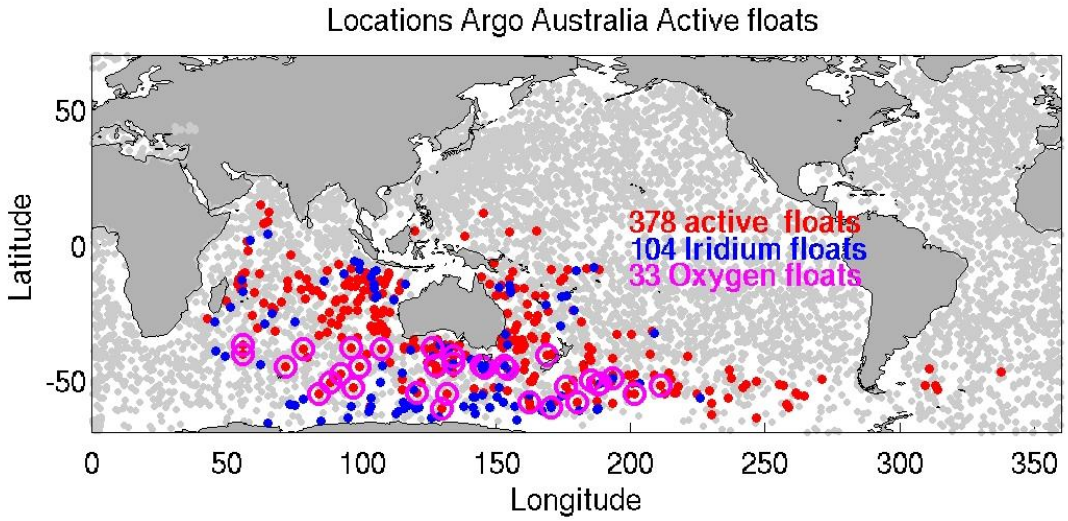
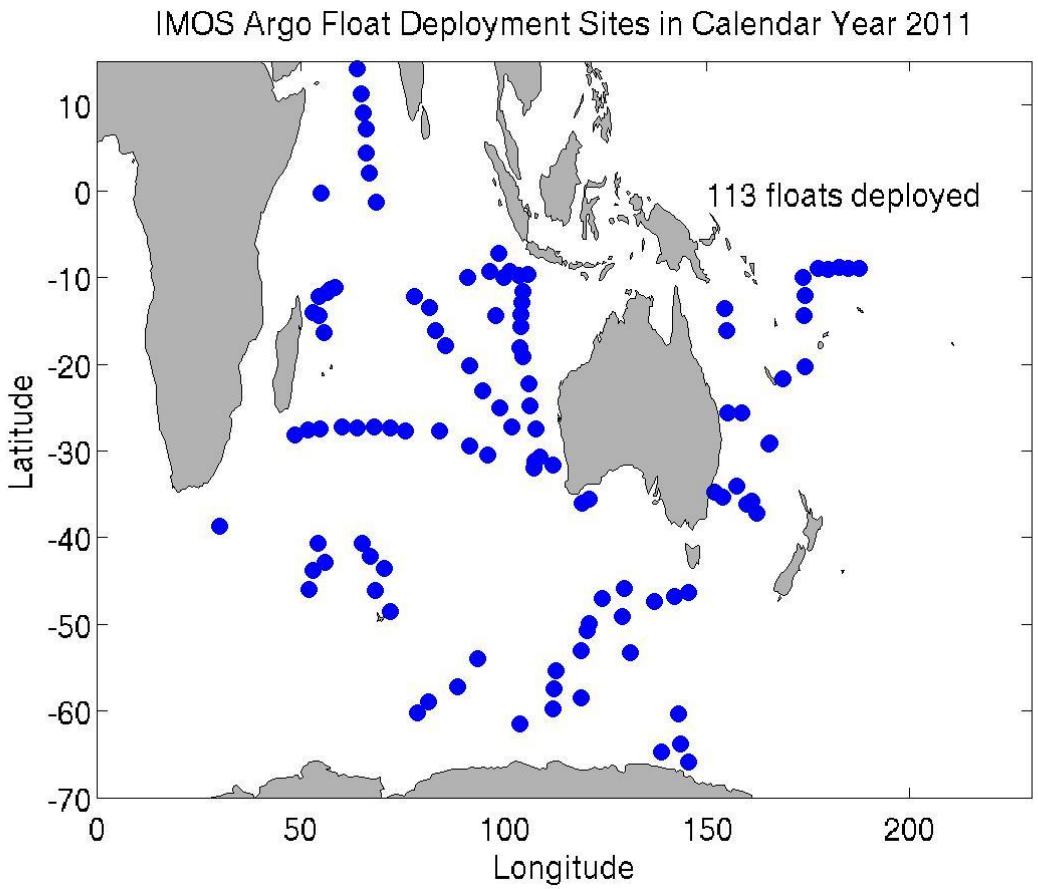


Figure 1. Locations of active Argo Australia floats (colours) as of February 2012 with active international floats in gray. Australian floats using Iridium Communications are in blue and those equipped with oxygen sensors are circled in magenta.

In the calendar year 2011, the program deployed 113 floats most of which were in the Indian Ocean where the program worked hard to target the thinning array in the region affected by piracy (using US and Australian Navy ships) and the mid and eastern basin, extensively employing the Schooner Lady Amber. The Lady Amber has now deployed 55 floats for Argo Australia. After her long Indian Ocean deployment voyage the crew also worked with the IOC office in Perth and CSIRO communications in a media story on ocean observing which gained considerable coverage and involved Ministers from the Western Australian government. She will be returning to the Indian Ocean and deploy another 9 floats for our program in 2012. To date all the floats deployed are Teledyne Webb APEX floats.



Technical problems encountered and solved

Our use of Iridium communications continues to ramp up as we plan on all new acquisitions to use this system. Problems encountered in the second half of 2010 with our Iridium fleet have largely been solved. These included unpredictably high call costs caused by multiple signal dropouts and large file sizes (primarily caused by poor buoyancy or failed air bladders, solved by changing suppliers and reducing file size) and the need to build more redundancy into the data stream (we are solving this by moving to RUDICS). We now feel that using Iridium is extremely good value and past reliability issues are hopefully behind us. Using Iridium in the floats being piloted in the sea-ice zone in particular looks very promising, with winter profiles taken and stored over many months below the ice returned to us in spring. One drawback of Iridium is the initial hardware setup of linux servers, backup servers and dialup modems, including on-going maintenance, this also applies to RUDICS. One of the main advantages of iridium is two-way communications which enables floats to have missions changed on demand, the other advantage is the amount of data which can be uplinked - currently all of our iridium floats uplink 2-dbar vertical resolution data from 2000dbars to near surface, including vast amounts of technical and diagnostic data. Typical cost per profile with dialup is just over $4.00AU and with RUDICS the estimated cost will be approximately$12.00AU – this will vary between providers.

Float Failure Mode Analysis

As of the 24th of Feb 2012, the Australian Argo program had deployed 515 floats. From the total number of floats deployed; 106 are dead. Of the remaining 409 operational floats, 389 are returning good data, a further 20 are producing suspect or bad data and are under review including 4 floats that are confirmed as suffering from the Druck microleak issue. Of the dead floats, only 10% ceased to operate due to normal end of life when they ran down their battery packs. A further 21% died due to unknown reasons. The remainder of floats ceased to operate prematurely mainly due to environmental reasons such as grounding (18%) and loss or damage under sea ice (5.6%). Other contributing factors are summarized below

This year we retrieved a float from the Solomon Islands with funding from Teledyne Webb Research. This float was leaking and it was deemed useful to get it back to assess the source of the leak. The float was returned to Teledyne Webb for analysis and this confirmed that indeed the antenna was leaking through the internal potting compound which had failed to adhere to the internal surface of the aluminium antenna tubing. Antenna construction has since been improved and the problem resolved. . The float has now been re-calibrated and reconditioned and is on its way back for redeployment.

We have another series of floats which are not strictly Argo mission because they carry FLBB sensors. These floats have an inordinate number of failure modes, distributed over 7 of the 8 floats of this type we have deployed. At least 3 are leaking, one has apparently lost its FLBB sensor, one died on deployment, one disappeared after only 108 profiles (rapid profiling so less than a year in the water), some are returning spiky salinities, and some have lost contact with their oxygen sensors. Finally, one is exhibiting signs of a Druck microleak despite carrying a screened pressure sensor. We are in discussions with the manufacturer about these and have returned the 3 remaining in the lab to Webb for analysis. The percentage of high leaks in this batch indicates possibly another mode of ingress, and not the antenna.

Float failure mode for dead floats	**Number of floats** (106)	**% of dead floats**
Unknown	23	21.5
Grounded	19	17.8
End of life	11	10.3
Firmware issues	5	5.6
Lost under ice	6	5.6
Turned on too early – went too deep	3	2.8
CTD failure/damage	3	2.8
Premature Battery Failure	10	9.3
Communications failure	1	0.9
Leak	10	9.3
Deployed in plastic bag	1	0.9
Druck snowflake	1	0.9
Air Solenoid failure	3	2.8
Died on Deployment	9	8.4
Faulty Hydraulic pump	1	0.9

Float failure mode for floats with	**Number of**	**% of suspect**

suspect or bad data	**floats** (35)	**floats**
Unknown/Other	5	14.3
Grounded and contaminated CTD	12	34.3
Gradual leaks	3	8.6
Druck microleak	4	11.4
Suspect conductivity cell	3	8.6
Faulty Air Solenoid or Pump	1	2.9
Buoyancy problems	4	11.4
Unreliable Iridium	1	2.9
Unreliable GPS	1	2.9
Ice damage	1	2.9

Summary of Technical Issues

Faulty Solenoids

We have been having problems with the solenoid valve on the air pumps not working properly so that the valve does not shut off and does not maintain air pressure in the bladder. The problem can be identified in the lab when the bladder pressure equals the vacuum pressure. A couple of floats (2-3) have been identified with this problem in the lab during pre-deployment testing. The problem cannot be easily identified once floats are in the field as it is not possible to determine the difference between a failed air pump and a failed air pump switch. In either case, if the air bladder does not inflate, iridium floats are unable to communicate with the iridium network and thus appear to have failed without cause. Argos based floats are able to partially transmit and thus able to be diagnosed.

The failure rate for solenoids from the Italian supplier went up drastically after they changed their manufacturing process to eliminate oil on the switch (previously Webb had been cleaning this off themselves). The manufacturing process has now been changed but at least 54 of our floats are potentially affected. Solenoids will be replaced where possible, depending on the amount of replacement solenoids available from the manufacturer. Priority for replacement will be given to Iridium floats and those deployed in the tropics. Note that 30 solenoid valves were replaced by our technicians (from a suspect batch of serial numbers) in our lab, with the replacement solenoids and shipping costs provided by Webb.

Miscellaneous Float and other Technical Problems:

- Two floats had faulty CPUs, the boards were returned to Webb. This seems to be a relatively rare problem.
- One oxygen calibrated float had a corroded seal; the source of corrosion was unclear.
- One float delivered with the wrong model GPS hardware that was not compatible with the version of firmware and did not work at all. This was picked up in the lab before deployment and was replaced.
- Two Iridium floats have had GPS problems – they had low signal strength and the GPS units were replaced in the lab.
- One float had a weak Iridium signal caused by an unreliable low frequency band transmitter not communicating with the CPU and resulting in poor uplink.
- Poor Iridium communications – we reduced the log file size from 60K to 5K which has helped make the communications more reliable but sometimes results in not all the diagnostics we need being transmitted if the message file doesn't arrive.

- We have also had problems with inadequate fluorometer calibrations on the Fluorometer Backscattering Meter (FLBB) sensors. Testing in the lab when the floats arrived showed the sensors were not calibrated properly. We found differences between the data readings from the sensor and those transmitted through the float. Also, there was a significant warming up period required before the readings stabilised. The problem sensors were sent back to Webb for recalibration and in some cases were sent back a second time.
- Three floats were received with incorrect CPU IDs programmed into the floats, these were detected in the lab and re-programmed here.
- Webb final test software: the final test software implemented in LabView which is provided by Webb to enable the end-user to test the floats upon arrival. Unfortunately this software needed to be modified before it would work.

Status of contributions to Argo data management

Collaboration with Argo India: The program has continued to work with the Indian Argo program in the continuing bedding down of their use of the Australian realtime data processing software (http://www.marine.csiro.au/~gronell/ArgoRT/). They have now begun encoding TESAC messages so that GTS insertion by the Indian Meteorological Service can begin. At this point, the software is operational.

Collaboration with KORDI: We are working with KORDI on installing Australia RT software. While still not operational due to the quality of their raw data and the complexities of processing so many float types, much progress has been made.

1. Pressure Biases in the Global Argo data set: An analysis and correction of pressure drift errors in the global data set as available at the end of 2008 is now published (Barker P. M., J. R. Dunn, C. M. Domingues and S. Wijffels, 2011: Pressure Sensor Drifts in Argo and Their Impacts . *J. Atm. Ocean Tech*, **28**, *1036-1049*. DOI: 10.1175/2011JTECHO831.)

Jeff Dunn has applied the methods described in the above paper in building software that checks pressure corrections carried out by DACs and also compliance with ADMT recommendations around the treatment of Truncating Negative Drifting Pressure (TNDP) floats. This audit can be carried out 3-6 monthly, and its latest results will be reported on at AST-12. The latest audit can be accessed at

http://www.cmar.csiro.au/argo/dmqc/audits_2012_03_04/summary.html

Technical Naming Table: Ann Thresher has been working with the DACs to build and maintain a fixed table of technical parameter names for use in Argo data files. A common approach to naming these parameters is vital if these files are to be machine parseable. Previously each DAC had an almost non-overlapping set of names for parameters.

Status of delayed mode quality control process

Detailed descriptions of the quality control process, including the data and plots for each float are available at the following CSIRO website:
http://www.cmar.csiro.au/argo/dmqc/index.html

In addition, to aid those working with trajectory data or for those who are interested in float data formats, electronic copies of the CSIRO APEX float manuals are now available online:
http://www.cmar.csiro.au/argo/dmqc/html/Australian_float_manuals.html

Australian DM Statistics (as at07/03/2012)	
D files submitted to GDAC	31632
Total R files	22864
R files eligible for DMQC	7073
Total eligible files for DMQC	38705
Total files at GDAC	54496

Table 1. Delayed Mode processing statistics for the Australian array.

The Australian Argo array continues to grow rapidly with a 36% increase in the total number of profiles delivered to the GDAC in the past year. A total of 516 floats have been deployed to date since the beginning of the Argo program and 378 floats are still operational. As at 07/03/2012, 82% of eligible profiles (those that are greater than 6 months old) have been processed through delayed mode quality control.

The DMQC processing software suite is now complete and includes new scripts that allow floats to be processed in 'maintenance' mode, i.e. when a float is revisited, new profiles are added whilst earlier QC for old profiles is retained. The next 12 months will focus on the incorporation of new float types, data formats and metadata variables, multi-profile files, trajectory files, oxygen data and delivery of Argo products.

A total of 364 floats have been assessed through the DMQC process for drift of the salinity sensor. Of these, 7 floats (2 %) returned no data from deployment and 8 floats (2 %) returned bad data for the entire record due to pressure sensor issues or other hardware problems. Of the remaining 349 assessable floats, 315 (90%) show no salinity drift for the life of the float. A further 34 or 10% of floats show a positive salinity drift.. A small number of floats (8 instruments or 2 %) are affected by a fresh offset or biofouling. Of the floats that are either salt or fresh offset, most were corrected using the OW salinity drift correction. 15 floats (4 %) suffered from TBTO fouling at the start of the record, generally only the first or second profiles but in some cases up to 7 profiles.

2. Present level of and future prospects for national funding for Argo

Argo Australia has been part of Australian Government initiative: an Australian Integrated Marine Observing System (IMOS; www.imos.org.au) for research infrastructure funded under the and now the Education Infrastructure Fund (EIF). EIF funding for Argo Australia is now secured through June 2013. The Australian government is proposing a renewed National Collaborative Research Infrastructure Initiative (NCRIS) and IMOS will be a proposed element of this program. Argo Australia also get direct funding from CSIRO and the Australian Climate Change Science Program, the Bureau of Meteorology and also logistical assistance from the Royal Australian Navy.

Through IMOS, and if levels of support from our partners remains steady, Argo Australia will sustain deployments of 50-60 floats per year. Due to longer float life times, this may maintain an array of around 350 active floats.

3. Summary of deployment plans (level of commitment, areas of float deployment)

We have just over 50 floats the lab for deployment in 2012/13, most in the Indian and Southern Oceans, and some in the Pacific Ocean (Figure 2). Lady Amber was very successful as a deployment platform last year and we intend to use her for a further 3 floats this year; she will also deploy the 6 floats that were missed from her original plans because of the risk of cyclones when she was in the region between Australia and Indonesia.

In the Pacific, floats will be deployed from both ships of opportunity but also the RV *Kaharoa,* in partnership with US Argo and New Zealand's NIWA.

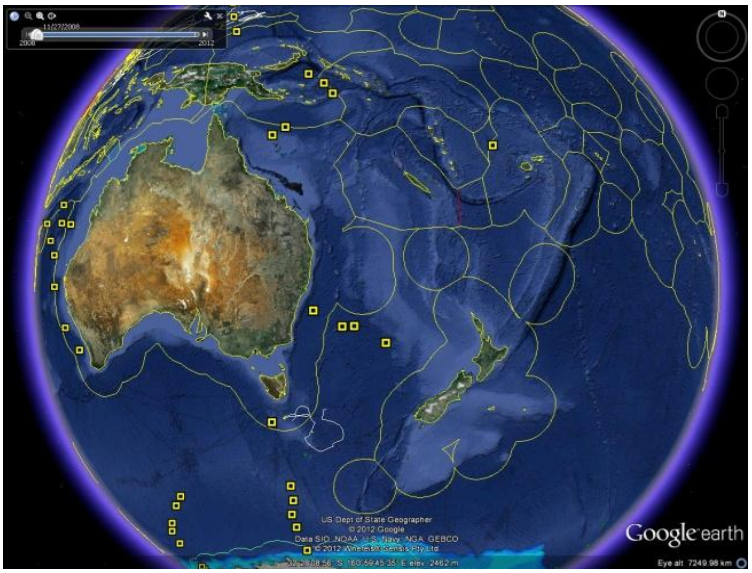


Figure 2. Locations of planned float deployments over the next year – Yellow squares are proposed deployment positions.

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

- Argo data are routinely used in the operational upper ocean analyses Australian Bureau of Meteorology (http://www.bom.gov.au/bmrc/ocean/results/climocan.htm).
- The dynamical seasonal forecasting system POAMA heavily uses Argo data for forecast initialization, including assimilating salinity which great improves the analysis – Oscar Alves, Australian Bureau of Meteorology
- CSIRO Marine and Atmospheric Research, in collaboration with the Bureau of Meteorology Research Center, has developed an ocean model/data assimilation system for ocean forecasting and hindcasting. Argo data is the largest *in situ* data source for this

system. Ocean forecasts and reanalysis products are now routinely published and are available via the Bureau of Meteorology website .

- Many students in the CSIRO/University of Tasmania graduate program and University of New South Wales are utilizing Argo data in their thesis studies.
- We are developing techniques to produce an Argo-gridded steric height data set (Dunn, Monselan, Wijffels,Church)

Argo Australia's web site is: http://imos.org.au/argo.html

Real Time data documentation : http://www.marine.csiro.au/~gronell/ArgoRT/

Delayed Mode data documentation: http://www.cmar.csiro.au/argo/dmqc/index.html

5. Issues to be raised with the Argo Steering Team

Pressure Bias Corrections: The national DACs have made tremendous progress in removing the pressure errors in float data, improving their technical files and their identification and treatment of TNDP floats. Many were also very helpful in improving the pressure bias auditing system. We urge them to complete this task as soon as possible so that Argo may be confidently be used to track the evolution of the global ocean heat content.

6. CTD Data Delivered to CCHDO

The historical archive of RV Franklin and RV Southern Surveyor data from the 1980's through to 2009 was sent to CCHDO. Some of this data was already in the CCHDO archive but new data (mostly coastal Australian) was included.

Data from the recently completed I9 (Antarctica to Western Australia) repeat hydrographic line will also be sent to CCHDO soon.

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Status of Argo Bulgaria, 1st March 2012

The Bulgarian Argo activity is carried out in the frames of the BulArgo "Development of national research infrastructure as a component of Argo network" project, financed by the Bulgarian National Science Fund. It comprises a consortium of three scientific organizations: Institute of Oceanology in Varna, Sofia University "St. Kliment Ohridski" and National Institute of Meteorology and Hydrology in Sofia. The focus of the ongoing research program is the monitoring of the Black Sea.

1. The status of implementation

The first time Bulgaria took part in the Argo activities was in December 2009, when one French PROVOR float (#5902291) was deployed in the deep part of the Black Sea during the cruise of R/V Akademik. This vessel is operated by the Institute of Oceanology in Varna. Further, in March 2011, three APEX floats (#6900803, 6900804, 6900805) were deployed in the Black Sea by the scientific team of the project on board of the R/V Akademik. The floats were purchased from the BulArgo project and one of the floats was equipped by an oxygen sensor. Currently, the data are available at the Institute of Oceanology website (http://www.gisserver.io-bas.bg/Web_argo).

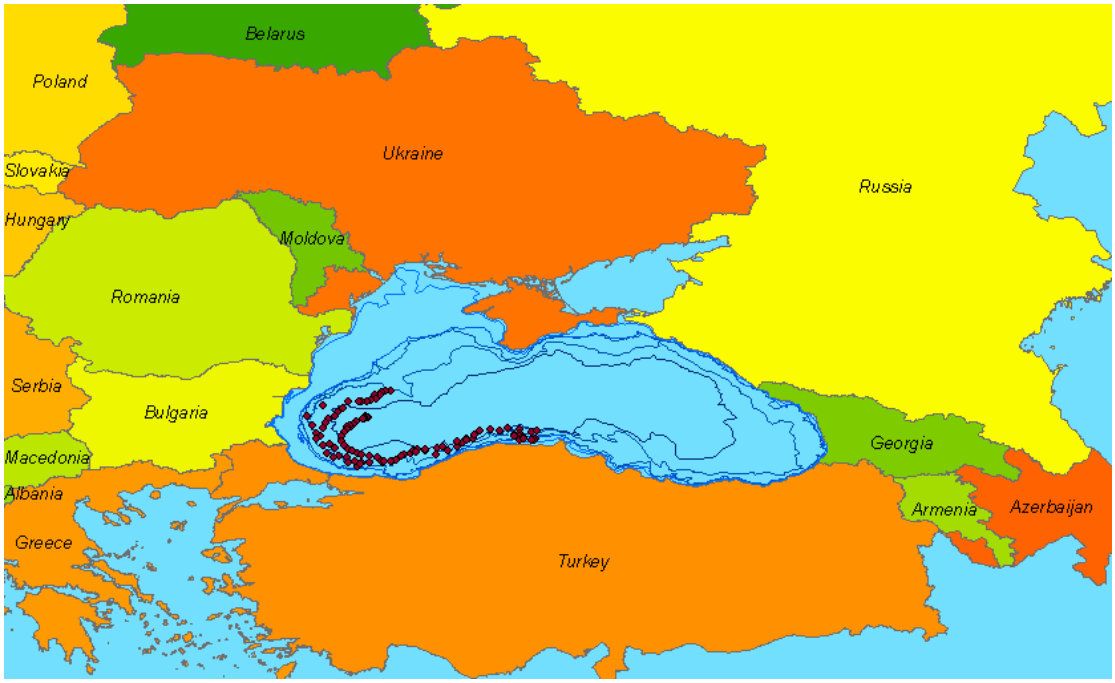

Figure. Locations of the 3 BulArgo floats measurements since 18 March 2011.

Delayed mode

At present the standard procedures for real time and delayed mode data processing and quality control are performed at the French Argo Data Centre Coriolis. However,

the procedures are being revised by the competent staff to account for the Black Sea regional characteristics

2. Present level of and future prospects for national funding for Argo

BulArgo project covers the period 2010-2012 and it is financed by the Bulgarian National Science Fund initially with 200 kEuro. Unfortunately due to the financial crisis the overall sum was decreased by 40% for the second half of the project. Thus four floats in total will be deployed in the Black Sea in the frame of this activity. The logistics will be provided by the Institute of Oceanology in Varna. The BulArgo project comprises a consortium of three research organizations: Institute of Oceanology in Varna, University of Sofia "St. Kliment Ohridski" and National Institute of Meteorology and Hydrology in Sofia

Extensive collaboration with the Bulgarian Ministry of Education, Youth and Science during the Euro-Argo preparation phase project has lead to an agreement at ministerial level that Bulgaria joins the Euro-Argo ERIC as a full member, thus a support for the membership fee and the deployment of 3 floats per year in the Black Sea has been ensured.

3. Summary of deployment plans

Bulgarian activities focus on the Black Sea. In December 2009, in the frame of a collaborative effort with France, Bulgaria deployed one PROVOR float (#5902291) in the deep part of the Black Sea, providing support and logistics during the cruise of R/V Akademik, organized by the Institute of Oceanology in Varna. After the beginning of the BulArgo project, in March 2011 three APEX floats (#6900803, 6900804, 6900805) were deployed in the Black Sea. This activity was performed by the researchers in the project on board of the R/V Akademik. Apart from the standard CTD measurements, one of the floats was equipped by an oxygen sensor.

Float deployment in 2012 will follow the national plans in the frame of BulArgo (one float). Additional deployment is foreseen of four floats provided by the OGS-Italy. Deployments activities (three deployments altogether) are expected to start in the spring of 2012 and will continue until fall 2012.

Additionally, BulArgo will further establish infrastructures together with the Black Sea regional partners, and substantial enhancement of this activity is expected to happen if the submitted regional infrastructure project (Black Sea Argo) is accepterd. In the the frame of this two years project 10 floats are planed. Further activities will be organized in the E-AIMS if accepted.

4. Data management

The data from the floats deployed under the BulArgo project are available at the Institute of Oceanology website (http://www.gisserver.io-bas.bg/Web_argo). The standard procedures for real time data processing and quality control are performed at the French Argo Data Centre (www.coriolis.eu.org). Collaboration with the scientists at MedArgo data center is ongoing to allow for processing data also in MedArgo. At the moment the data quality procedures are being revised by the competent staff to account for the Black Sea regional characteristics.

5. Summary of national research and operational uses of Argo data

The key objectives to use the Argo data in the Black Sea involve:

- Development of adequate data quality control procedures taking into account the Black Sea peculiarities
- Study or the changes in the temperature and salinity near the surface and the deep layers
- Assimilation of the Argo data in a Black Sea circulation model
- Evaluation of chemical properties
- Quantification of the steric effects in the Black Sea
- Getting new insights about the deep circulation of the Black Sea
- The use of the data for educational purposes at the university.

6. Issues we wish to be considered and resolved

The influence of the aggressive compounds on the float functioning

Chinese National Report

(Jianping Xu & Zenghong Liu, The Second Institute of Oceanography, SOA)

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

- floats deployed and their performance

In 2011 China deployed 41 floats in the northwestern Pacific Ocean and Indian Ocean, in which 40 floats were deployed by the Second Institute of Oceanography, SOA and the rest 1 float by the East China Sea Branch, SOA. Of these floats, 10 were iridium APEX floats, 10 were ARVOR, one was PROVOR and the remaining 20 were standard APEX floats. As for the performance of those floats deployed in 2011, two ARVOR floats failed to work or transmit data after deployment, and one APEX float reported bad salinity data. Most of the APEX floats were installed lithium battery packs at CSIO, and so far no floats failed to work due to energy fault.

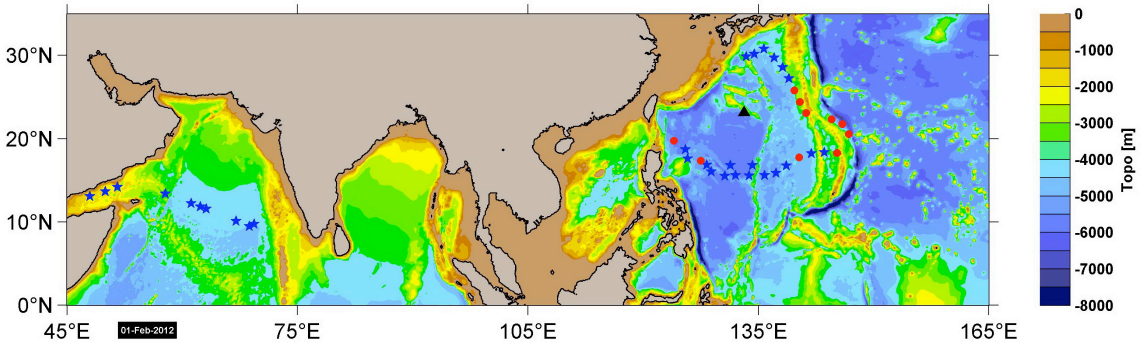

Fig.1 Launch positions of Chinese Argo floats in 2011.
Red dots are ARVOR floats, blue pentagrams are APEX floats and the black triangle is

Until now, China has deployed totally 131 Argo floats, and 85 are still active by the end of 2011, in which 4 APEX floats are equipped with Aanderaa Optode. You can see from Figure 2, about 45% floats could make 40 cycles, which is less than that of 2010 because nearly half of the floats were deployed in 2011.

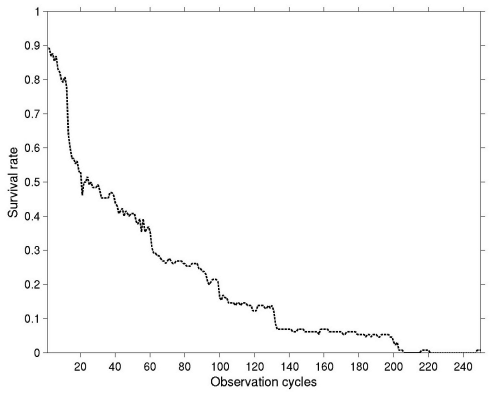

Fig.2 Survival rate estimated for all Chinese Argo floats by the end of 2011.

- technical problems encountered and solved

Two APF9a floats equipped with SBE41 (WMO: 2901179, 2901512) deployed by CSIO reports bad salinity measurements since their first profiles. Float 2901179 was deployed in the northwestern Pacific Ocean, and its salinity measurements were always zeros. Float 2901512 was deployed in the north Indian Ocean, and its salinities were around 12.5. The reason is still unknown.

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

In 2011, we obtained 1879 TS profiles (a few oxygen profiles) from 85 active floats, and submitted these profiles to GDAC after RTQC. Coriolis DAC has helped us to decode Argos messages from 10 ARVOR floats and put R-files into 'csio' directory at GDAC ftp site since Sep., 2011. All profiles were put on GTS by CLS.

- status of delayed mode quality control process

In July of 2011, CSIO started to implement surface pressure correction in DMQC. After surface pressure corrections, CTM corrections and OW were applied. 27 TNPD APEX floats were found, and their <PARAM>_ADJUSTED_QC, <PARAM>_ADJUSTED _ ERROR were corrected in the new created D-files. One difficulty during DMQC is lack of historical CTD data in marginal seas where some floats drifted into. The large variability of salinity in Kuroshio is another difficulty we encountered.

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

As usual, China Argo is mainly funded by research programs rather than operational budget. So it's difficult to estimate the number of floats to be deployed in the following years. We estimate the number of float deployment in 2012 would be about 30. At CSIO, there is a group (about 5 persons) in charge of float deployment, Argo data processing (RT/DMQC) and production of Argo related products.

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.

In 2012 we are going to have two cruises for float deployment, one will be conducted by VOS and the other will be a special cruise for Argo deployment. The date of latter will be determined when the funds for a new granted program is allocated. This new granted program will deploy totally 35 Argo floats in the coming 5 years. The VOS cruise will deploy 10 floats probably during June-August. Most of the floats to be deployed this year will be in the North Pacific Ocean.

4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers. Please also include any links to national program Argo web pages to update links on the AST and AIC websites.

Argo data has been widely used in operational models, ocean data assimilation in China. NMDIS produced a 23-year regional reanalysis product (CORA) of temperature, salinity and currents for

the China coastal waters and adjacent seas using SSHA and various temperature and salinity profiles including Argo data. Argo data has been used in an ocean reanalysis system for the joining area of Asia and Indian-Pacific Ocean at the Institute of Atmospheric Physics, Chinese Academy of Sciences. Additionally, some Argo gridded temperature and salinity fields of global oceans or Pacific Ocean have been produced which can be accessed at China Argo Real-time Data Center's website (http://www.argo.org.cn). The progress of China Argo project is also updated through China Argo Real-time Data Center's website both in Chinese and English.

5. 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.

In the past year, we had three cruises for Argo deployments. However, those cruises were implemented by VOS ships, and no CTD casts were made either because there was no CTD installed or there was CTD instrument but the sea condition was not allowed to operate the CTD. China Argo is fully aware of the importance of shipboard CTD samples for improving the quality of Argo data, and striving for supports from national special funding, with which a special cruise using RV will be arranged every two years and multi-stations shipboard CTD samples will be collected for comparing with Argo data. Besides, methods for improving Argo data quality will be explored so as to provide high quality and accurate Argo data for users, and submit CTD samples to CCHDO database.

6. Keeping the Argo bibliography

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ARGO National Report 2012 – The Netherlands

1) Status of implementation

The Dutch Argo program, run by the Royal Netherlands Meteorological Institute (KNMI), started with three deployed floats in 2004. Since then 49 floats have been purchased and deployed, 39 of which are still working correctly.

KNMI is involved in EuroArgo and has decided to join a European Argo consortium that will probably be founded in 2012.

2) **Present level of (and future prospects for) national funding for Argo including summary of human resources devoted to Argo**.

In their observation strategy adopted in 2006 KNMI has expressed the intention to deploy about 7 floats per year, a level that has approximately been reached during the past years. A semi-permanent fixed budget is available.

One person (Andreas Sterl) is working on ARGO. He does so besides his other duties.

3) **Summary of deployment plans** (level of commitment, areas of float deployment) and for other commitments to Argo for the coming year (and beyond where possible).

2-4 floats will be purchased. Deployment is not yet planned, but preferably in the Atlantic Ocean.

4) Summary of national research and operational uses of Argo data

In the framework of CMIP5 KNMI performed decadal prediction runs with their EC-Earth climate model. The ocean initializations is taken from an ECMWF product (NEMOvar) that heavily relies on Argo data.

5) Issues that your country wishes to be considered (and resolved) by AST regarding the international operation of Argo

Nothing.

6) CTD data uploaded to CCHDO

Yes.

7) Bibliography

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French National report on Argo – 2011
Present status and future plans

March 2012
S. Pouliquen, V. Thierry, E. Mamaca

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 (Britanny 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 (Provor-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. Develoment 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).

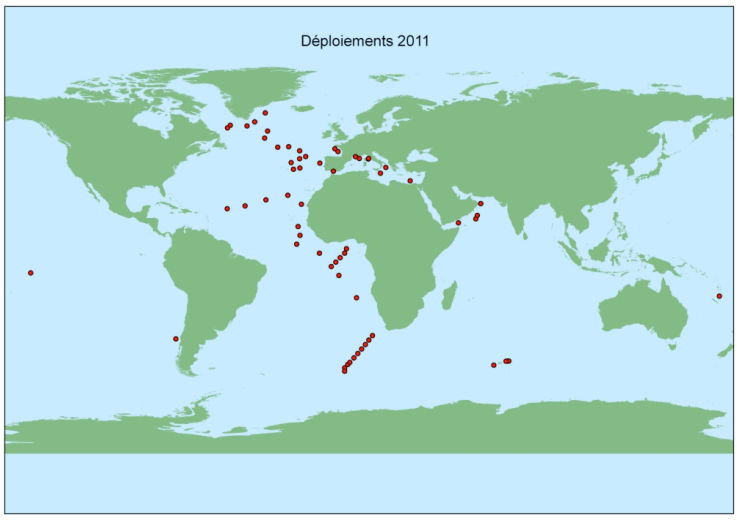

Figure 1: Deployment position of the 53 French floats deployed in 2011.

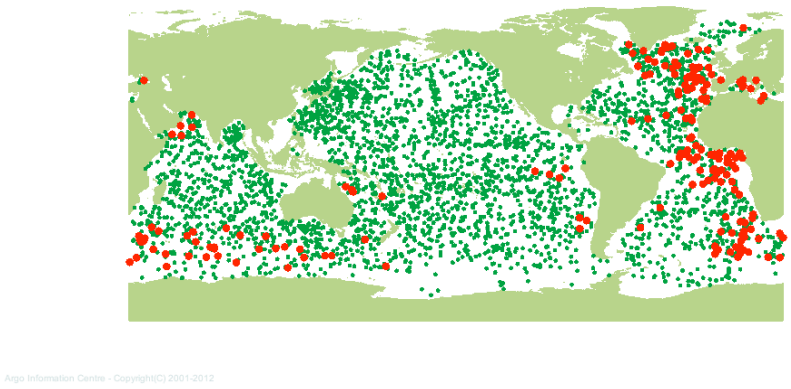

Figure 2: (Lower panel) Actual position of the French active floats.

- 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. Coriolsi 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.

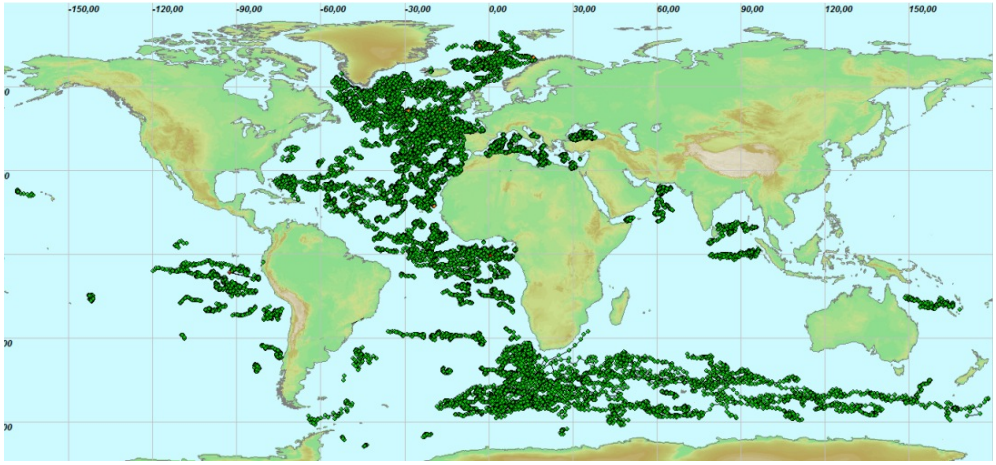

Figure 3: Maps of the 15590 profiles from the floats managed by Coriolis DAC this current year.

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.

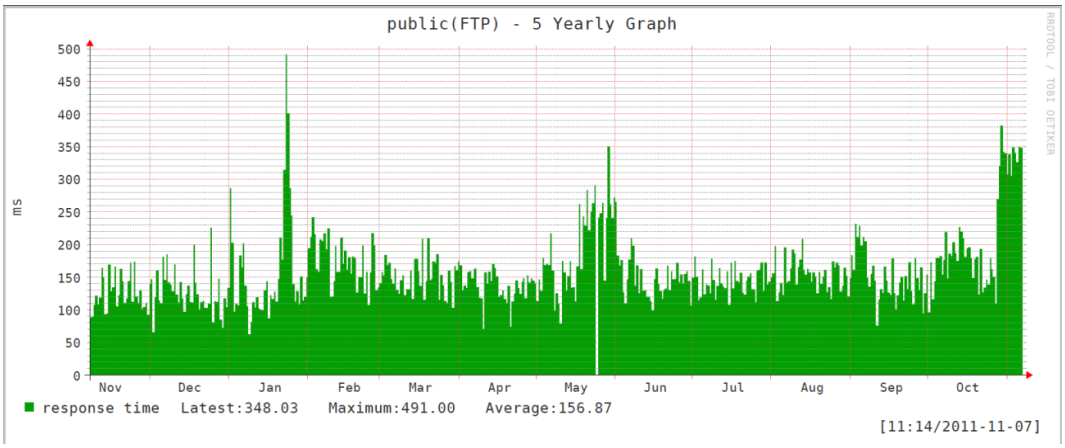

Figure 4 : Nagios monitoring: duration of a test file download.

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**).

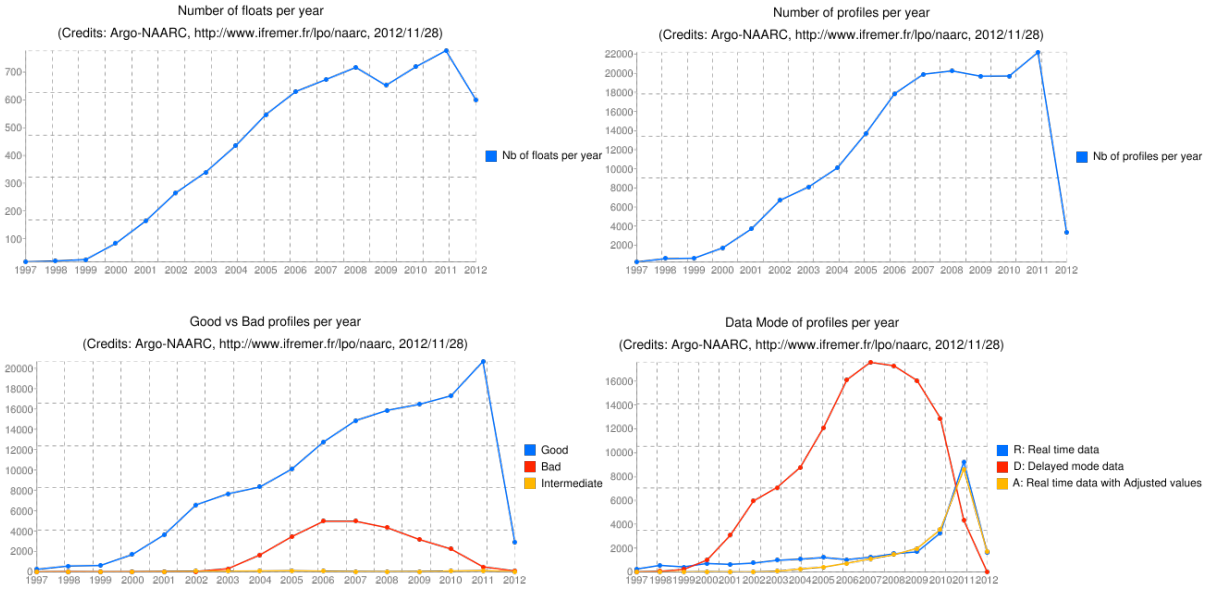

Figure 5 Examples of viewing service available at http://www.argodatamgt.org/Argo-regional-Centers/North-Atlantic-ARC under "More on NA-ARC floats". The figures display the number of floats and profiles in the NA-ARC area (Atlantic ocean North of 20°S), the number of good and bad profiles and the number 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 where produced and validated by PIs. A total of 82113 delayed mode profiles where 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.

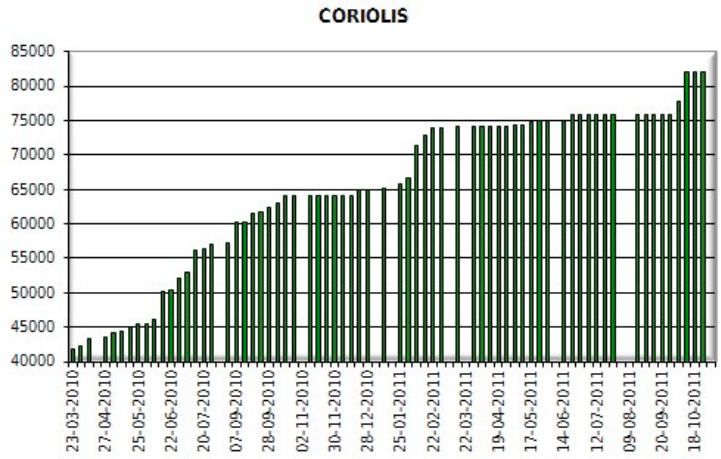

Figure 6: Evolution of the DM profiles' submission versus dates

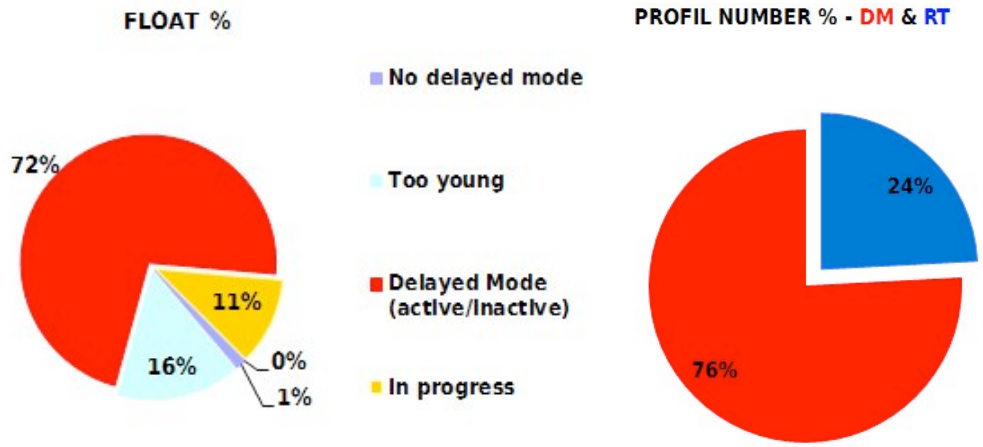

Figure 7 Status of the floats processed by Coriolis DAC. Left: in terms of float percent and right: in terms of profile percent (DM : delayed mode – RT : real time).

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).

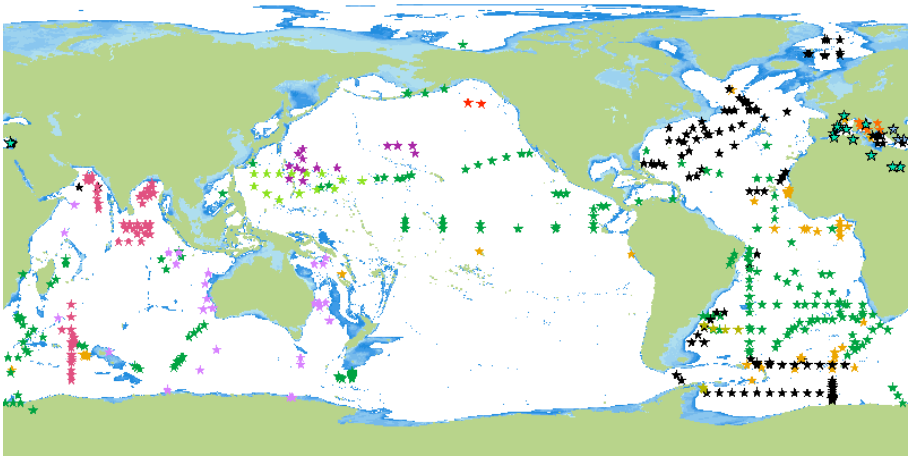

Figure 5: Deployment plan. The orange stars represent the French deployment plan for 2012.

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 trough 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.

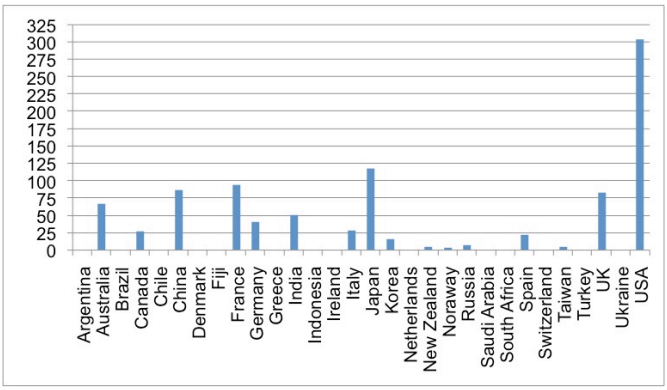

Figure 8: Number of paper using Argo data as function of the country of the lead author.

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.

5. 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.

6. 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.

7. 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 Scandeberg.

2012

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

Lefevre, N. and L. Merlivat, 2012: Carbon and oxygen net community production in the eastern tropical Atlantic estimated from a moored buoy. *Global Biogeochem. Cycles*, **26,** GB1009, http://dx.doi.org/10.1029/2010GB004018

Ménesguen, C., B. L. Hua, X. J. Carton, F. Klingelhoefer, P. Schnürle, and C. Reichert, 2012: Arms winding around a meddy seen in seismic reflection data close to the Morocco coastline. Geophys. Res. Lett., doi:10.1029/2011GL050798, in press.

Xing, X., Morel, A., Claustre, H., D'Ortenzio, F., and A. Poteau (2012). Combined processing and mutual interpretation of radiometry and fluorimetry from autonomous profiling Bio-Argo Floats. II The retrieval of CDOM absorption, Journal of Geophysical Research, in press.

2011

Arhan, M., S. Speich, C. Messager, G. Dencausse, R. Fine, and M. Boye, 2011: Anticyclonic and cyclonic eddies of subtropical origin in the subantarctic zone south of Africa. *J. Geophys. Res.*, 116, C11004, http ://dx.doi.org/10.1029/2011JC007140

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Barbero, L., J. Boutin, L. Merlivat, N. Martin, T. Takahashi, S. C. Sutherland, and R. Wanninkhof, 2011 : Importance of water mass formation regions for the air-sea CO2 flux estimate in the Southern Ocean. Global Biogeochemical Cycles, 25, http://dx.doi.org/10.1029/2010GB003818

Barre, N., C. Provost, A. Renault, and N. Senneael, 2011: Fronts, meanders and eddies in Drake Passage during the ANT-XXIII/3 cruise in January-February 2006: A satellite perspective. *Deep Sea Research Part II: Topical Studies in Oceanography*, 58, 2533-2554, http://www.sciencedirect.com/science/article/pii/S0967064511000555

Chaigneau, A., M. Le Texier, G. Eldin, C. Grados, and O. Pizarro, 2011: Vertical structure of mesoscale eddies in the eastern South Pacific Ocean: A composite analysis from altimetry and Argo profiling floats. *J. Geophys. Res.*, 116, C11025, http://dx.doi.org/10.1029/2011JC007134

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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

Dhomps, A. L., S. Guinehut, P. Y. Le Traon, and G. Larnicol, 2011 : A global comparison of Argo and satellite altimetry observations. Ocean Science, 7, 175-183, http://www.ocean-sci.net/7/175/2011/os-7-175-2011.pdf

Fauchereau, N., A. Tagliabue, L. Bopp, and P. M. S. Monteiro, 2011 : The response of phytoplankton biomass to transient mixing events in the Southern Ocean. Geophysical Research Letters, 38, L17601, http://dx.doi.org/10.1029/2011GL048498

Faure, V., M. Arhan, S. Speich, and S. Gladyshev, 2011 : Heat budget of the surface mixed layer south of Africa. Ocean Dynamics, 1-18, http://dx.doi.org/10.1007/s10236-011-0444-1

Ferron B, 2011 : A 4D-variational approach applied to an eddy-permitting North Atlantic configuration: Synthetic and real data assimilation of altimeter observations. Ocean Modelling 39 (2011) 370–385

Forget, G., G. Maze, M. Buckley, and J. Marshall, 2011 : Estimated Seasonal Cycle of North Atlantic Eighteen Degree Water Volume. Journal of Physical Oceanography, 41, 269-286, http://journals.ametsoc.org/doi/abs/10.1175/2010JPO4257.1

Gasparin, F., A. Ganachaud, and C. Maes, 2011 : A western boundary current east of New Caledonia: Observed characteristics. Deep Sea Research Part I: Oceanographic Research Papers, 58, 956-969, http://www.sciencedirect.com/science/article/pii/S0967063711001014

Hansen, J., M. Sato, P. Kharecha, and K. von Schuckmann, 2011: Earth's energy imbalance and implications. *Atmospheric Chemistry and Physics Discussions*, **11,** 27031-27105, http://dx.doi.org/10.5194/acpd-11-27031-2011

Lique, C., G. Garric, A.-M. Treguier, B. Barnier, N. Ferry, C.-E. Testut, and F. Girard-Ardhuin, 2011 : Evolution of the Arctic Ocean Salinity, 2007-08 : Contrast between the Canadian and the Eurasian Basins. Journal of Climate, 24, 1705-1717, http://journals.ametsoc.org/doi/abs/10.1175/2010JCLI3762.1

Llovel, W., M. Becker, A. Cazenave, S. Jevrejeva, R. Alkama, B. Decharme, H. Douville, M. Ablain, and B. Beckley, 2011 : Terrestrial waters and sea level variations on interannual time scale. Global and Planetary Change, 75, 76-82, http://www.sciencedirect.com/science/article/B6VF0-51B1WPW-2/2/4af2890536a7bbb35e3730104b068275

Llovel, W., B. Meyssignac, and A. Cazenave, 2011 : Steric sea level variations over 2004-2010 as a function of region and depth: Inference on the mass component variability in the North Atlantic Ocean. Geophysical Research Letters, 38, L15608, http://dx.doi.org/10.1029/2011GL047411

Marcos, M., F. M. Calafat, W. Llovel, D. Gomis, and B. Meyssignac, 2011 : Regional distribution of steric and mass contributions to sea level changes. Global and Planetary Change, 76, 206-218, http://www.sciencedirect.com/science/article/B6VF0-523CDRR-2/2/52cad5e0552a45540e26aab0d906305e

Martinez, E., D. Antoine, F. d'Ortenzio, and C. de Boyer Montégut, 2011/ Phytoplankton spring and fall blooms in the North Atlantic in the 1980s and 2000s, J. Geophys. Res., 116, C11029, 11 pp. doi:10.1029/2010JC006836

Maze, G. and J. Marshall, 2011: Diagnosing the Observed Seasonal Cycle of Atlantic Subtropical Mode Water Using Potential Vorticity and Its Attendant Theorems. *Journal of Physical Oceanography*, 41, 1986-1999, http://dx.doi.org/10.1175/2011JPO4576.1

Nilsson, J., S. Dobricic, N. Pinardi, V. Taillandier, and P.-M. Poulain, 2011 : On the assessment of Argo float trajectory assimilation in the Mediterranean Forecasting System. Ocean Dynamics, 1-16, http://dx.doi.org/10.1007/s10236-011-0437-0

Rio, M. H., S. Guinehut, and G. Larnicol, 2011 : New CNES-CLS09 global mean dynamic topography computed from the combination of GRACE data, altimetry, and in situ measurements. J. Geophys. Res., 116, C07018, http://dx.doi.org/10.1029/2010JC006505

Salisbury, J., D. Vandemark, J. Campbell, C. Hunt, D. Wisser, N. Reul, and B. Chapron, 2011 : Spatial and temporal coherence between Amazon River discharge, salinity, and light absorption by colored organic carbon in western tropical Atlantic surface waters. J. Geophys. Res., 116, C00H02, http://dx.doi.org/10.1029/2011JC006989

Souza, J. M. A. C., C. de Boyer Montégut, C. Cabanes, and P. Klein, 2011: Estimation of the Agulhas ring impacts on meridional heat fluxes and transport using ARGO floats and satellite data. *Geophysical Research Letters*, 38, L21602, http://dx.doi.org/10.1029/2011GL049359

Singh, A., T. Delcroix, and S. Cravatte, 2011 : Contrasting the flavors of El Nino-Southern Oscillation using sea surface salinity observations. J. Geophys. Res., 116, C06016, http://dx.doi.org/10.1029/2010JC006862

von Schuckmann, K., and P.-Y. Le Traon, 2011 : How well can we derive Global Ocean Indicators from Argo data? Ocean Sci., 7, 783–791, www.ocean-sci.net/7/783/2011/, doi:10.5194/os-7-783-2011.

Wade, M., G. Caniaux, and Y. du Penhoat, 2011 : Variability of the mixed layer heat budget in the eastern equatorial Atlantic during 2005–2007 as inferred using Argo floats, J. Geophys. Res., 116, C08006, http://dx.doi.org/10.1029/2010JC006683

Xing, X., A. Morel, H. Claustre, D. Antoine, F. D'Ortenzio, A. Poteau, A. Mignot, Z. Lee, S. Shang, and C. Hu, 2011: Combined processing and mutual interpretation of radiometry and fluorimetry from autonomous profiling Bio Argo floats: Chlorophyll a retrieval. J. Geophys. Res, 116, C06020, http://dx.doi.org/10.1029/2010JC006899

Argo Germany 2011
Report to the Argo Steering Team

Birgit Klein & Marek Stawarz
BSH

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

- floats deployed and their performance

Most of the floats deployed by Germany are operated by BSH but additional funding has been acquired by various research institutes, e.g. IFM-GEOMAR in Kiel and Alfred-Wegener-Institut (AWI) in Bremerhaven. Problems in the float procurement in 2010 could be solved and deployments in 2011 were well on target with regard to the planned long-term Germany contribution to the Argo global array at the level of about 60-70 floats per year. Until the end of 2011 the deployments have reached 48 floats: 40 floats in the Northern, tropical and Southern Atlantic and 8 floats in the tropical Pacific Ocean. The deployments in polar regions of the Southern Ocean which have started in 2010 were continued also in 2011.
Germany currently has 183 active floats distributed across the Atlantic Ocean. 17 floats deployed by the IFM-GEOMAR operate in the tropical Pacific Ocean.

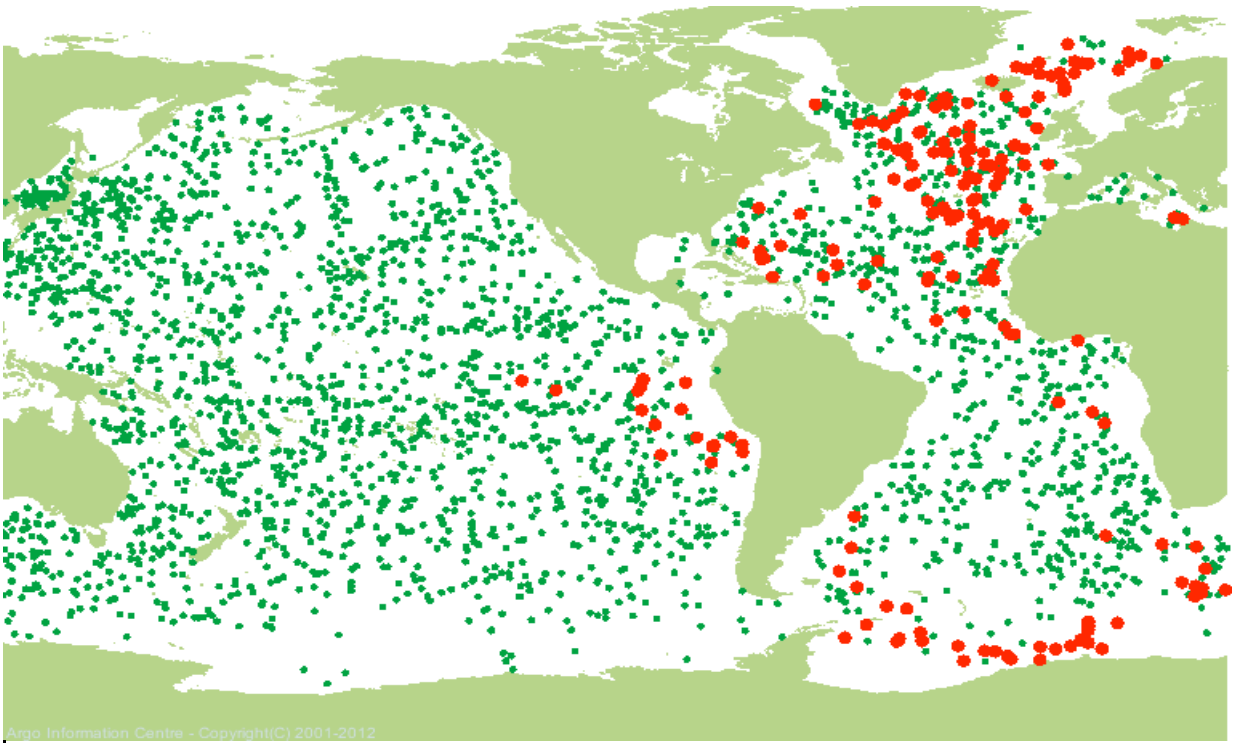

Fig. 1: Locations of active German floats (red) with active international floats (green) (Argo Information Centre, January 2012).

- technical problems encountered and solved

No major technical problems were encountered in 2011. Software problems associated with new firmware in NEMO floats encountered in the past seem to be solved.

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

The pressure corrections for all German floats, including floats operating in the Southern Ocean, have been finished. BSH has adopted most orphaned floats in the Nordic Seas belonging to the national programmes from Denmark, Norway, Finland and Poland. The pressure corrections for these floats have also been performed. BSH has also adopted floats from the German research community from research projects for which funding has ceased. DMQC for these floats has been performed.

- status of delayed mode quality control process

The delayed quality control process is well underway and no major delays have been encountered. About 80% of the eligible files has been processed and submitted in delayed-mode.

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 German Argo Project has been receiving its operational funding by the Ministry of Transportation from 2008 onwards. Overall the level of support is indicated in the table below. It is anticipated to contribute 40-50 floats per year to the global array by Germany, but the exact amount will depend on the actual purchase conditions. The research community has also secured funding for floats in the order of 20 floats per year for the next 3 years which will mostly be used for regional enhancements.

Float purchases in 2011 were marked by an increase in prices which can only be adjusted in the operational budgets after 2012. Funding from the Ministry of Transportation covers only costs related to float procurement and transmission costs, personnel will be provided by BSH. This will consist of 1 scientist and 1 technician.

Year	Float related costs	Manmonth/Year
2008	550k€	24
2009	600k€	24
2010	600k€	24
2011	600k€	24
2012	600k€	24
2013	650k€	24

Table 1. Previous and future operational funding for German Argo.

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.

The deployment plans for 2012 will comprise 66 floats. The main goal is to support the global array in the Atlantic Ocean and will focus on data sparse regions, specifically in the southern Atlantic. A map of the expected deployment positions is given below.

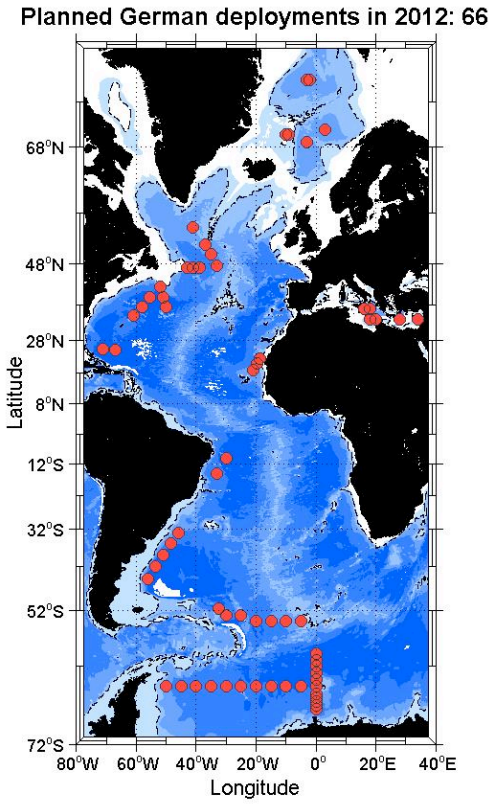

Fig. 2: Location (red dots) of planned German deployments in 2012.

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

Argo data are being used by many researchers in Germany to improve the understanding of ocean variability (e.g. circulation, heat storage and budget, and convection), climate monitoring and application in ocean models (assimilations, boundary conditions).

Germany contributes to the NARC and contributes recent CTD data to the Argo climatology.

5. Issues to be considered:

The data transmission for almost all German floats is still using ARGOS. The few tests with Iridium floats showed mixed results probably due to antenna problems. It would be useful to receive continued updates about the technical progress with Iridium transmission from other programmes. A detailed cost analysis showing costs for the different Iridium transmission options (SBM, Rudics server) would be welcome.

6. Improve the CTD data base

A request has been send to the research community to list the recent CTD data uploaded to CCHDO.

7. Keeping the Argo bibliography

A request has been send out to the our national mailing list to update the Argo bibliography.

GREEK ARGO PROGRAMME

PRESENT STATUS AND FUTURE PLANS

G. Korres and D. Kassis
HCMR
February, 2012

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, south of Santorini Island on the 26th of June 2010 using R/V AEGAEO. The float has 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 float were set as follows: The parking depth of the float 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.
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 stuff.

1.2 Float Development

HCMR will propose and test simple methods of tracking and recovery Argo floats in short time and range scales in the framework of SIDERI project.

1.3 Data management

HCMR runs 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. 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 $1/10^{o}$ resolution (POSEIDON-II system) and the Aegean Sea at $1/30^{o}$ 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. Lately, 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 will meet the standards to participate to the future European infrastructure E-A ERIC as a full member.

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 2012 will be performed according to the plans of the Greek-Argo research infrastructure and two EU projects (PERSEUS and IONIO) that have recently started. The main goal within 2012 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 late autumn 2012 and deploy 4 floats in total in the Ionian (1 float) and the Aegean Sea (3 floats).

3. Dissemination activities of the Euro-Argo infrastructure

The Euro-Argo infrastructure is 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.
Additionally, 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.

Argo Steering Team (AST-13)

National Report – India
(Submitted by M Ravichandran)

1. The status of implementation

1.1a Floats deployment

During the year 2011-12, India has deployed 48 floats so far in the Indian Ocean taking the total to 254.

1.1b performance Analysis of Floats deployed

Out of 254 floats deployed so far 106 floats are active. Out of these 106 active floats 76 floats are less than 3 years old.

1.1c Software support of CSIRO for DMQC

CSIRO extended their support for upgradation of the software to process IRIDIUM floats deployed by India. Similarly, University of Washington group has helped INCOIS in setting up RUDICS server at INCOIS and provided training for Lithium battery replacement in Apex floats for longer life of floats. We take this opportunity to thank CSIRO and University of Washington team for sharing the software, support and training.

1.2 Technical problems encountered and solved

None

1.3 Status of contributions to Argo data management

- Data acquired from floats

  India had deployed 254 floats so far. Out of these 106 floats are active. All the active floats data are processed and sent to GDAC.
- Data issued to GTS

  India started uploading TESAC format messages to GTS via New Delhi RTH from June 2011. Plans are in progress to generate data in BUFR format to be uploaded on to GTS soon.
- Data issued to GDACs after real-time QC

  All the active floats (106) data are subjected to real time quality control and are being sent to GDAC.
- Web pages

  INCOIS is maintaining Web-GIS based site for Indian Argo Program. It contains entire Indian Ocean floats data along with trajectories. Further details can be obtained by following the link:
  http://www.incois.gov.in/incois/argo/argo_home.jsp.
- Statistics of Argo data usage

  Argo data is widely put to use by various Organisations/ Universities/Departments. INCOIS Argo web page statistics (for the past one year) are as shown below:

Page	Views	Visitor
Argo Web-GIS	910	427
Data downloads	823	1203
Live Access Server	1,81,107	91,074
Argo products	1271	608

1.4 Status of Delayed Mode Quality Control process

With the support from CSIRO, DMQC s/w developed at CSIRO is installed at INCOIS and majority of the problems are resolved.

- Using this s/w reprocessing of all the eligible floats data is done. Around 154 floats were passed through the DMQC s/w and the following problems are tackled
    - Pressure Sensor offsets.
    - Salinity drift.
    - Salinity Hooks.
    - TBTO problems.
    - TNPD problems. etc
- Around 75 % of FLOATS are DMQCied for INCOIS DAC.
    - Lack of CTD profiles in some of the region in North Indian Ocean is still a critical problem, when decision is to be taken for the complicated cases.

1.5 Trajectory files status:

A total of 254 trajectory netcdf files were processed and uploaded to the GDAC. The process of generation of trajectory netcdf files undergoes quality checks like position, time, cycle number, etc., and corresponding quality status is assigned to each parameter.

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

Indian Argo Project is a 5 year Program from April 2007 to March 2012 fully funded by Ministry of Earth Sciences, (MoES), Govt. of India. Funding is secured upto 2012 for deployment of 200 Argo floats (40 floats per year), Data management activities, Data analysis, etc. Similar amount of funding has been secured for the next five year plan (2012-2017).

3 Permanent and 2 temporary scientific/technical personal are working under Indian Argo project, which include personal for deployment of Argo floats, Data system, Analysis of Data, etc. Efforts are underway to get more manpower during next five year plan (April, 2012-March, 2017)

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.

India committed to deploy floats in the Indian Ocean wherever gap exists. India has committed 40 floats per year for the next five year. . After ascertaining the gap region and cruise plan of MoES research vessels, these floats will be deployed. The existing data management resources will continue for the next 5 year term.

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

Operational: All Argo data are being routinely assimilated in Ocean Model for providing Global ocean analysis. This analysis is being used by Met department for initialization of coupled ocean-atmosphere for seasonal forecast of Monsoon. From the year 2011, India could provide seasonal forecast of monsoon using dynamical model wherein Ocean analysis (with assimilation of Argo) is an important contribution. The analysis products are being made available at INCOIS live access server (las.incois.gov.in)

Research: Argo data are being widely used for many applications to understand the Indian Ocean dynamics, cyclone and monsoon system in relation to heat content, thermosteric component of sea level and validation of OGCM.

INCOIS is hosting Indian Ocean ARC, wherein all floats data from the Indian Ocean region are archived and distributed apart from many products

5. 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.

Nil

6. As part of an action item from AST-9 aimed to improve 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.

CTD data collected by INCOIS during the last two years will be sent to CCHDO soon.

7. Argo bibliography

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

- floats deployed and their performance

WMO Code	Type	Deployment Date	Performance
6900658	Provor	March 2011	Good
6900444	Provor	March 2011	Good
6900445	Teledyne/Webb	March 2011	Good

- technical problems encountered and solved

BODC had not integrated Provor floats into their system but did it successfully.

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

Carried out by BODC for us.

- status of delayed mode quality control process

Carried out by BODC for us.

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

Ireland is seeking observer membership of the Euro Argo ERIC (legal consortium) and has made a commitment to a contribution of €10k per annum to the central coordinating office. It is also our intention to continue to deploy three floats per annum, subject to funding availability.

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.

Subject to funding availability, three floats will be procured and deployed per annum. They are typically deployed in the North Atlantic as this is the primary operational area of the national research vessel the R.V. *Celtic Explorer*.

4. Summary of national research and operational uses of Argo data as well as contributions to Argo Regional Centers. Please also include any links to national program Argo web pages to update links on the AST and AIC websites.

Argo data is primarily used to validate ROMS models in the Oceanographic Services section of the Marine Institute.

http://www.marine.ie/home/services/operational/DeepSeaResearch/EuroArgo.htm

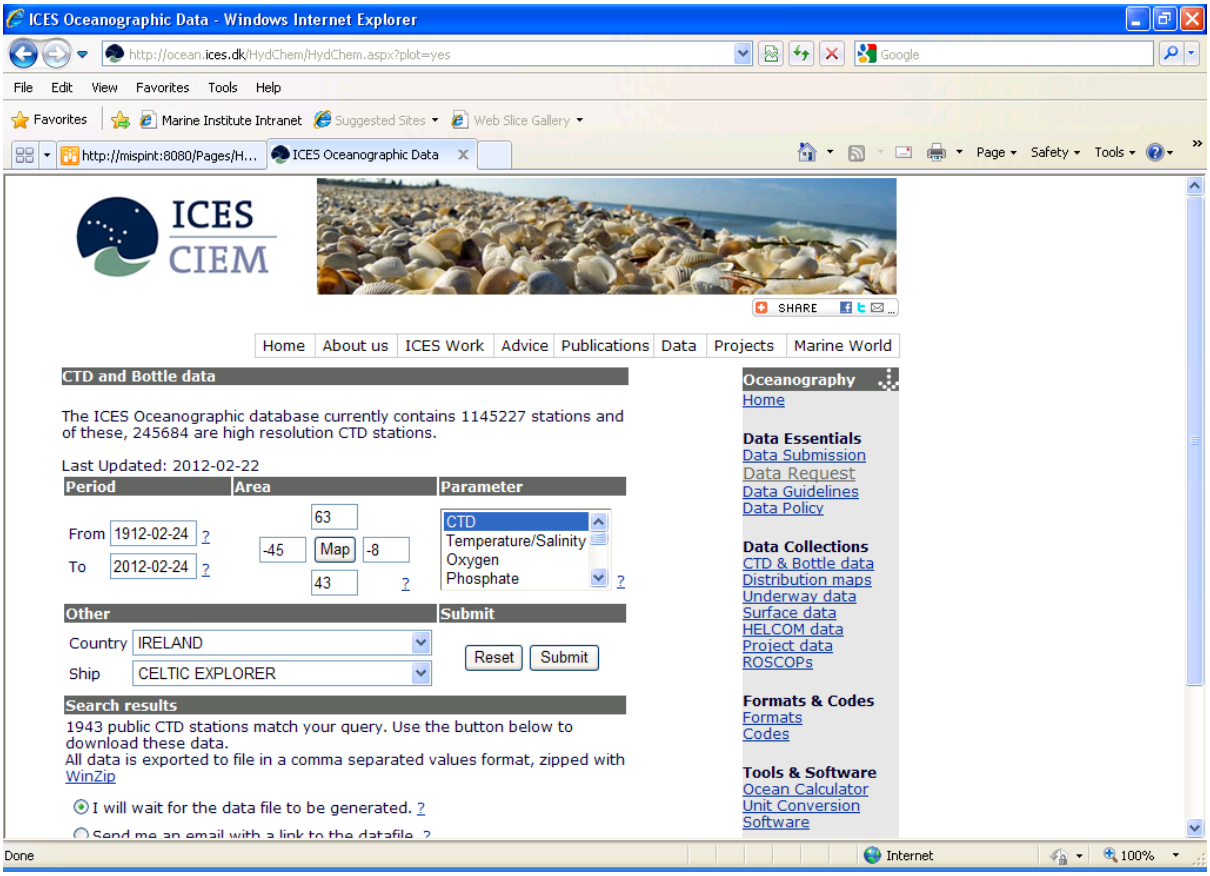
5. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo. These might include tasks performed by the AIC, the coordination of activities at an international level and the performance of the Argo data system. If you have specific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

N/A as can be dealt with through Euro-Argo personnel.

6. 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.

No CTD data are uploaded to the CCHDO website. However, all CTD data are emailed to Else Juul Green (else@ices.dk) who checks the data before it is uploaded to the ICES Oceanographic data portal annually:

http://ocean.ices.dk/HydChem/HydChem.aspx?plot=yes



7. Keeping the Argo bibliography (http://www.argo.ucsd.edu/Bibliography.html) up to date and accurate is an important part of the Argo website. This document helps demonstrate the value of Argo and can possibly help countries when applying for continued Argo funding. We are almost to 1000 papers published using Argo data! So, please include a list of all papers published by scientists within your country in the past year using Argo data, including non-English publications.
Unfortunately, none that I am aware of.

8. I am also attaching a spreadsheet of the commitments table which I updated on January 18,2012 using the AIC website. Wow - Argo deployed a lot of floats this year - 877! I had to go back all the way to 2006 to find a year where more floats were deployed. Good job getting many of the backlogged floats into the water. Please correct any errors on float totals in the past year and send me an estimate of the expected number of deployments for 2012.
Ireland will deploy three Provor floats in the North Atlantic in summer 2012.

Report on the Italian Argo Program for 2011

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

- floats deployed and their performance:

In total, four Italian floats were deployed in the Mediterranean in 2011 (see Table 1 for details). These floats were Arvor instruments designed by Ifremer and manufactured by NKE (France), two with Iridium and two with Argos-3. They have a parking depth at 350 dbars and profiling depths alternating at 700 and 2000 dbars. The two floats with Argos-3 were deployed and operated in collaboration with Ifremer as a contribution to the technical development activities of the EC FP7 Euro-Argo PP project. They have 3-day cycles. The two floats with Iridium were operated in collaboration with the "Gruppo Nazionale di Oceanografia Operativa (GNOO)". They have 5-day cycles. Three of the four floats are still working as of 8 February 2012.

Model	WMO	Argos/IMEI	Deploy date GMT	Lat	Lon	Cycles	Last data GMT	Lat	Lon	Status
Arvor-a3	6900947	82388	23-Feb-2011 13:08	32.54	29.3	124	26-Jan-2012 12:13	31.93	32.18	A
Arvor-a3	6900952	82389	20-Feb-2011 15:32	35.91	16.01	117	06-Feb-2012 05:23	33.11	17.99	A
Arvor-I	6900903	3000	24-Apr-2011 13:15	38.5	18.42	57	05-Feb-2012 05:50	0	0	A
Arvor-I	6901038	1030	11-Oct-2011 14:22	42.21	10.8	1	13-Oct-2011 03:04	0	0	D

Table 1. Status information for the 4 Italian floats deployed in 2011.

- technical problems encountered and solved

Unfortunately one unit failed after only a few cycles (WMO 6901038). The reasons were investigated in collaboration with NKE. No conclusion could be reached to explain this failure. Note that this instrument has been deployed in coastal areas already twice in 2010. Although it was refurbished at NKE the deployment in 2011 was its third release at sea.

The cycling capabilities and the transmission efficiency of the two floats with Argos-3 have been assessed by Ifremer.

- It appears that all the data were not transmitted during the passage of the satellite carrying Argos-3 and that Argos-2 transmissions were used, resulting in more time spent at the sea surface.

- Data are missing partially for the deep profiles (2000 dbars). This problem was caused by a decoding error at the Coriolis Data Center. Any data at depth greater than 700 dbars was flagged at false because alternate pressure programming had not been taken into account. The float profiles at 2000 dbars every 2 cycles, so the data between 2000 and 700 dbars do not appear on the Coriolis website. As of today the metadata of the Coriolis database have been corrected.

- Some profiles could not be decoded because of errors in technical messages. These messages contain important information to process the data (offset of pressure sensor, significant dates, etc…). Some Argos messages had no Argos localisation. Seven profiles were affected by this problem for float 6900947 float and 27 for float 6900952.

- A new Arvor float with Argos-3 is planned to be deployed and tested in the Mediterranean in 2012 as part of the NAOS project. This float is equipped with a new version of the modem and new firmware capabilities that should lead to better transmission performance.

- 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 has not been done yet. OGS will perform this activity in 2012 as part of the EC FP7 Sideri and MyOcean-2 projects. Note that OGS has performed the DMQC on many floats operated in the Mediterranean and Black seas by other countries. The temperature and salinity data of 57 floats (over a total of 122 floats) have been quality controlled following the standard Argo procedure, covering the period 2001-2010.

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 about 30 floats in 2012 and 30 floats in 2013, including 10 instruments with biogeochemical sensors. In addition, the Italian human resources devoted to Argo-Italy per year amounts to about 54 and 72 man-months for technical, administrative and scientific personnel involved in the project, in 2012 and 2013, respectively. It is expected that the Italian Ministry of Research will continue to provide funding at about the same level in order to sustain the Italian contribution to Argo beyond 2013 as member of the Euro-Argo Research Infrastructure Consortium. In addition to the Italian national funding, OGS has funding from the EC FP7 Perseus project, to buy two floats with biogeochemical sensors.

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 2. The main areas of interest are the Mediterranean and Black seas, the tropical Atlantic and Southern Ocean.

OGS is committed to carry out DMQC on all the Argo floats of the Mediterranean and Black seas as part of the SIDERI and MyOcean-2 projects over the next two years.

Year	Floats with T/S		Floats with biogeochemical sensors		Total
	Quantity	Area	Quantity	Area	
2012	10 4 2	Mediterranean Black Sea NE tropical Atlantic off Senegal			16
2013	10 2 2 3	Mediterranean Black Sea NE tropical Atlantic off Senegal Southern Ocean	5	Mediterranean	22
2014	10 2 2 3	Mediterranean Black Sea NE tropical Atlantic off Senegal Southern Ocean	5	Mediterranean	22

Table 2. Italian deployment plans for 2012-2014.

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 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.

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

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

Since 2003, a Mediterranean Argo Regional Centre (MedArgo) was created at OGS in order to coordinate Argo float operations in the Mediterranean and Black seas and to partially process their data and post graphical products on the web in near real time (NRT). MedArgo has developed further as part of the EC FP7 EuroArgo PP and the MyOcean projects, with the consolidation and improvement of Mediterranean in-situ data services required by regional data assimilation systems and applications. MedArgo is part of the Italian GNOO and of the Mediterranean Operational Oceanography Network (MOON). DMQC activities for Mediterranean and Black Sea Argo data are carried out in the framework of MedArgo using procedures tailored for the Mediterranean and Black seas. As of now, MedArgo is a non-official component of the North Atlantic Argo Regional

Centre. Given the specificity of the Argo float operations and of the Argo data in the Mediterranean and Black seas and the increase of the Argo fleet in these seas, it is asked to the AST that MedArgo be recognized as a official Argo Regional Centre (ARC) for the Mediterranean and Black seas.

6. Number of CTD cruise data added to the Argo reference database by Italian PIs in 2011.

The following three Italian CTD cruise data were added to the MedArgo reference database:

- SINAPSI (CTD data from1997 to 2002)
- METEOR/URANIA 1999 (CTD data in 1999)
- TRANSMED (CTD data in 2007)

They will be soon transferred to the Argo reference database.

7. Italian contribution to Argo bibliography in 2011.

Jenny A. U. Nilsson, Srdjan Dobricic, Nadia Pinardi, Vincent Taillandier, Pierre-Marie Poulain (2011) On the assessment of Argo float trajectory assimilation in the Mediterranean Forecasting System. Ocean Dynamics DOI 10.1007/s10236-011-0437-0.

Japan National Report

(Submitted by Toshio Suga)

1. The Status of implementation (major achievements and problems in 2011)

1.1 Floats deployed and their performance

The current positions of all the active Japanese Argo floats are shown in Fig.1.

Japan Agency for Marine-Earth Science and Technology (JAMSTEC) deployed 84 floats from January to December 2011: 30 APEXs, 52 PROVORs, 1 NEMO and 1 POPS (Polar Ocean Profiling System). All the floats except POPS were deployed with the aid of R/Vs of 9 domestic organizations.

POPS is an ice-based drifting buoy with a PROVOR float moving up and down along a 580m cable. The observed data (temperature-salinity profiles of every day, hourly GPS position, atmospheric temperature and pressure) are transmitted to Iridium Satellites and distributed to GTS via JMA. One POPS was deployed in the Arctic Sea in April 2011. Unfortunately, this POPS terminated the mission in August 2011. Another POPS with NOVA is planned to be deployed near the North Pole in April 2012.

One NEMO float was deployed in the tropical Indian Ocean in September 2011 in order to investigate oceanic mixed layer structure and tropical air-sea interaction, as part of Cooperative Indian Ocean Experiment on intraseasonal variability in the year 2011 (CINDY2011). The float uses the Iridium transmitter, measuring temperature and salinity from 500 dbar depth to the sea surface every day.

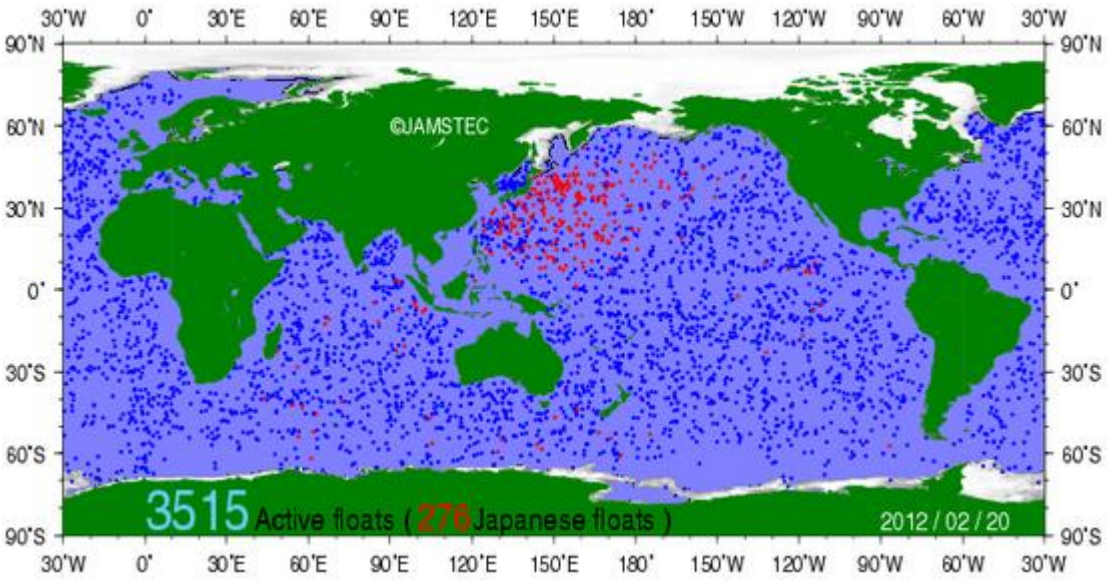


Figure 1: The distribution of active Argo floats. The red dots represent active Japanese floats.

On March 11 2011, a huge earthquake occurred off the east coast of Honshu, Japan, which is known as the Great East Japan Earthquake. Huge tsunami associated with this earthquake hit nuclear power plants in Fukushima and radioactive materials were released from the plants to the

ocean. As a contribution to monitoring efforts for the radioactive material spreading, JAMSTEC deployed 9 floats off Fukushima in March-April 2011, to measure temperature, salinity and surface current above 100m every day. The observed data are opened via web site in real time and used for the data assimilation by the JCOPE (Japan Coastal Ocean Predictability Experiment) team, etc..

The voluntary float deployment from cargo ships owned by a Japanese merchant ship company (NYK Line) succeeded in 2011. In order to increase float deployment opportunity, JAMSTEC has developed cooperative relationship with NYK Line, which has a lot of cargo shipping routes covering the global ocean. This wide coverage is very useful to deploy Argo floats in the area of sparse float density. In 2011, 5 floats were deployed in the central North Pacific Ocean as a deployment test, and profiles were successfully received. This deployment opportunity contributes to not only maintain the global Argo array, but also environment conservation efforts of merchant ship companies through improvement of ocean current prediction.

Among JAMSTEC's 893 floats (735 APEXs, 131 PROVORs, 10 NEMOs, 11 NINJAs, and 6 POPSs) deployed in the Pacific, Indian and Southern Oceans, from 1999 to the end of January 2012, 246 floats (194 APEXs, 50 PROVORs, and 2 NEMOs) are now in normal operation. The other 647 floats (541 APEXs, 81 PROVORs, 8 NEMO, 11 NINJAs, and 6 POPSs) terminated their missions, including 9 floats (8 APEXs and 1 PROVOR) transmitting on the beaches after stranding, 2 floats drifting at the sea surface (1 APEX and 1 NEMO) and 12 floats (9 APEXs, 2 PROVORs, and 1 NINJA) recovered.

The Japan Meteorological Agency (JMA) deployed 24 Argo equivalent floats (12 APEXs, 11 ARVORs and 1 PROVOR) in the seas around Japan from January to December 2011. All the floats except 3 APEXs get 2,000 dbar T/S profiles every 5 days for operational ocean analysis and forecast. Three APEX floats were deployed in the western North Pacific in June 2011 in order to observe daily changes in the structure of the oceanic mixed layer that occur with typhoon passages. These floats use an Iridium transmitter and measure temperature and salinity profiles from the sea surface down to the 500 dbar depth every day from July to September.

Among 113 floats (15 PROVORs, 71 APEXs and 27 ARVORs) which JMA has deployed from 2005 to 2011, 40 floats (16 APEXs and 24 ARVORs) are active as of the end of December 2011, while 19 floats (15 APEXs and 4 ARVORs) terminated the transmission in 2011. JMA deployed 8 APEXs in January 2012.

All of 9 floats deployed by the Fisheries Research Agency (FRA) in 2005 and 2008 terminated their missions by mid 2011. FRA conducted research survey using a Slocum glider (1-km model; manufactured by Webb Research) in the Kuroshio-Oyashio mixed water region in the North Pacific in 2011.

All of Tohoku University's 8 floats deployed during 2008 as Argo equivalent floats (3 NINJAs having a ECO FLNTU (Fluorometer and Turbidity Sensor) manufactured by WET Labs and an anti-biofouling shutter with the parking depth of 40 dbar and 5-day cycle, 4 APEXs having a Sea-Bird oxygen sensor and an ECO FLNTU with 3-day cycle, and an APEX with an AANDERAA oxygen sensor with 3-day cycle) terminated their missions by early 2011. Two APEXs, out of the 8 floats, recovered in 2008 had been repaired, equipped with a new sensor, ECO FLbb-AP (Combination Fluorometer-Scattering Sensor) and were deployed in March 2011 for Lagrangian observation of larval fish along the Kuroshio with daily profiling of the upper 500 m. One of them terminated the mission by May 2011. The other was recovered after its one-week mission and has been redeployed in the subtropical front region of the western North Pacific in December 2011for a physical-biogeochemical survey with daily profiling of the upper 500 m, which is active as of the end of December 2011.

A new implementer of Argo equivalent floats came in during 2011. Okinawa Institute of Science and Technology(OIST), which is located in the Ryukyu Islands (Nansei Islands) of Japan, deployed one NEMO with Iridium telecommunication system in the Kuroshio in July 2011 and

another in December 2011. While their purpose of the deployment was to measure current velocity of Kuroshio from surface to the mid-depth for the investigation of the environment of coral reef, they agreed to the Argo data policy, providing real time temperature and salinity data from their float.

1.1.1 Floats deployed as part of INBOX

Besides 84 floats deployed in 2011 as reported above, JAMSTEC deployed twenty-five floats (22 NEMOs and 3 APEXs) equipped with dissolved-oxygen sensors (Aanderaa Optode3830) in 2011 spring-summer seasons around the biogeochemical observation mooring site S1 (30N, 145E) maintained by JAMSTEC (Fig. 2). The deployment was done as part of Western North Pacific **IN**tegrated Physical-**B**iogeochemical Ocean **O**bservation E**x**periment (INBOX); its purpose is to investigate physical-biogeochemical processes associated with mesoscale variability by constructing an integrated physical and biogeochemical ocean observation system in collaboration with ship and mooring observations. The floats measure temperature, salinity and dissolved oxygen from surface to 2000 dbar in a square area of 150 km x 150 km with 30 km of horizontal resolution, synchronizing every 2 days. The floats are sending lots of good measurement data to us, although the most of the floats were drifted westward from S1 in a few months. The time series data are being analyzed with other observed data. During the deployment of 25 floats, high-quality ship observation data of temperature, salinity and dissolved oxygen were obtained at five stations for the post-deployment sensor calibration. JAMSTEC is conducting calibration of Optode sensors by fitting those data to ship observation data.

JAMSTEC plans to deploy 23 floats with Optode4330 dissolve oxygen sensor to observe physical-biogeochemical process around an air-sea flux buoy (named JKEO mooring, 38N, 147E) in the Kuroshio-Oyashio Extension region in 2012. JAMSTEC has been preparing the Optode4330 sensor pre-deployment calibration in the laboratory. With the pre-deployment calibration along with the comparison with shipboard CTDO observation, the accuracy of dissolved oxygen data will be greatly improved.

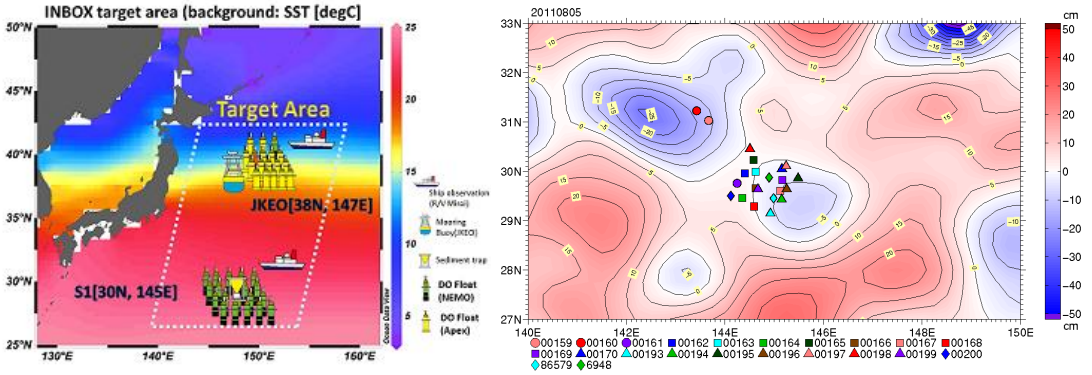


Figure 2. (Left panel) Study area of INBOX. In 2011, 25 floats with Optode3830 were deployed around the S1 mooring site (30N, 145E) in the Kuroshio recirculation gyre. In 2012, 22 floats with Optode4330 will be deployed around JKEO mooring (38N, 147E) to study physical-biogeochemical processes associated with mesoscale eddy. (Right panel) Positions of 25 floats just after deployment (August 5, 2011) around the S1 mooring. Background colors and contours show the sea surface height anomaly based on the merged altimeter satellite product distributed by AVISO (http://www.aviso.oceanobs.com).

1.2 Technical problems encountered and solved

Among the 73 APEX floats with APF9 controllers deployed by Japan before the SBE41 and 41cp recall due to micro-leak problem, 8 floats have the negative surface pressure drift larger than

-2.4 dbar. Among these floats, 3 floats have the extreme negative surface pressure drift, exceeding -10 dbar. The floats repaired and sent back or those purchased after the problem was fixed have either a Kistler pressure or a Druck pressure sensor. The Kistler sensors show slight positive drift smaller than 1dbar; the Druck sensors show no drift.

Some NEMO-Iridium floats of JAMSTEC miss GPSs very often at the rate exceeding 50%, because they have troubles about their air bladders. At ADMT#12, JAMSTEC proposed the method to estimate position when GPS is missed, and it was agreed that a weighted average of all Iridium fixes should be included in profile file if no GPS is available.

Tsurumi Seiki Co. and JAMSTEC have developed a new profiling float for deep ocean, "Deep NINJA", which has an ability to measure PTS profiles at the depth of up to 4000 dbar. The first prototype was tested in Sagami Bay, a coastal/shallow region near Tokyo, with R/V Kaiyo in 2011 summer. The field test for deep ocean observation will be carried out this summer, and then a (small) fleet of Deep NINJAs will be deployed in the Southern Ocean during R/V Mirai cruise in 2012/13 austral summer. Deep NINJA is planned to be available for public in 2 – 3 years.

JAMSTEC and JMA suffered severe experiences of Iridium telecommunication trouble of floats in 2011. The troubles occurred in both dial up type service for APEX and short burst mode service (SBD) for NEMO. As to the trouble of the dial up type service, telecommunication was stopped several times in one year. Although all the observed data during the troubles could be finally obtained owing to the data logging in the floats, mission commands could not be sent to the floats during the troubles. On the other hand, while the trouble in the SBD type service occurred for just a few tens of minutes in a single event, the observed data were lost because it occurred at the time when the data transmission to the satellite had just started. Replying to JAMSTEC and JMA's inquiry about the troubles, Japanese agent of Iridium telecommunication system replied that the troubles may be caused by data server error and/or damaged telecommunication line. To our knowledge, these troubles occurred only in Japan. The troubles will affect glider operation more seriously. We made a request to the agent for improvement of the Iridium telecommunication system. At the same time, we notified Japanese Iridium float users and potential users about these troubles.

In 2011, EEZ clearance procedure for Argo float deployed by Japanese PIs was changed following IOC Resolution XLI-4. This change reduced our time and effort for the process of EEZ clearance. Before this change, we needed to inform all of coastal states, whose EEZ our floats may enter with certain possibility, in advance (about 6 months before deployment) in the same manner as that for ship observations. We now need to notify only an appropriate Argo national focal point (NFP), whose EEZ our float is about to enter. Since the new procedure is applied to only the coastal nations whose Argo NFP is registered (listed in AIC). Japan Argo community has a strong desire for more countries, especially in/around the Pacific Ocean, to register their NFPs.

1.3 Status of contributions to Argo data management

The Japan DAC, JMA has operationally processed data from all the Japanese Argo and Argo-equivalent floats including 278 active floats as of January 27, 2012. Ten Japanese PIs agree to provide data to the international Argo. All the profiles from those floats are transmitted to GDACs in the netCDF format and are also issued to GTS using the TESAC and BUFR codes after real-time QC on an operational basis. Argo BUFR messages have been put on GTS since May 2007.

1.4 Status of delayed mode quality control process

JAMSTEC has submitted the delayed-mode QCed data of 76,855 profiles to GDACs as of January 2012. Among these data, 23,513 profiles were provided within a year.

According to the new definition of APEX Truncated Negative Pressure Drift decided at the 12th Argo Data Management Team Meeting, JAMSTEC has been re-creating D files of target floats.

CSIRO has monitored and checked progress on pressure correction both real time and delayed mode profile files. It has also reported the result of each DAC on its web site. JAMSTEC has provided feedback to CSIRO about the anomalies, and modified delayed mode profile files if needed.

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

Japan Argo had been conducted in a 5-year program from FY1999 to FY2004, as a part of Millennium Project implemented under cooperation among the Ministry of Education, Culture, Sports, Science and Technology (operation: by JAMSTEC), the Ministry of Land, Infrastructure and Transport, JMA and Japan Coast Guard. After the Millennium Project terminated in March 2005, JAMSTEC continued the operation until FY2008 nearly in the same scale (about 80 floats to be deployed every year) under its mid-term program. While new mid-term program for FY2009-2013 started in April 2009, JAMSTEC has been trying to continue the operation nearly in the same scale as part of its research activity. JMA allocates operational budget for 27 floats every fiscal year.

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.

In FY2012, it has been proposed that JAMSTEC will deploy about 70 floats in total in the Pacific Ocean for the Argo core mission. Twenty two Argo equivalent floats with dissolved oxygen sensor Optode3830/4330 will be deployed near the station S1 (30N, 145E) and in a cyclonic eddy in the mixed water region off the east coast of Honshu as part of INBOX. JAMSTEC will also deploy one EM-APEX in a cyclonic eddy in the mixed water region. One Deep-NINJA, which JAMSTEC and Tsurumi-Seiki Co. Ltd. are developing, is planned to be deployed in the Southern Ocean in December 2012. One POPS is planned to be deployed as an Argo equivalent float near the North Pole in April 2012. This POPS is equipped with NOVA. One NEMO-Iridium float is planned to be deployed as Argo equivalent float. It will be deployed near the northwest coast of Papua New Guinea in order to make Lagrangian observation of New Ireland Coastal Undercurrent. JMA plans to deploy 27 Argo equivalent floats around Japan in FY2012 and in the coming years. All the JMA floats are identical with the core Argo floats except that they are operated in a 5-day cycle, synchronized with JMA's real-time ocean data assimilation and forecast system. Tohoku University will deploy one Argo equivalent floats equipped with oxygen sensor in or near the Kuroshio-Oyashio Extension region.

JMA continues serving as the Japan DAC. JAMSTEC continues running the Pacific Argo Regional Center for the upcoming year.

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

Many groups in JAMSTEC, JMA, FRA and Japanese universities are using Argo data for oceanographic researches on water mass formation and transport in the Pacific Ocean, the mid-depth circulation, the mixed layer variation, the barrier layer variation, and tropical atmosphere-ocean interaction in the Pacific and Indian Ocean and so on. Japanese fisheries research community is conducting their biogeochemical studies using Argo floats equipped with chlorophyll and/or oxygen sensors.

The global Argo TESAC messages are used for operational ocean analysis and forecast by JMA. Daily and monthly products of subsurface temperatures and currents for the seas around Japan and western North Pacific, based on the output of the real-time ocean data assimilation system (MOVE/MRI.COM-WNP), are distributed through the JMA web site (in Japanese).

Numerical outputs of the system are available from the NEAR-GOOS Regional Real Time Data Base (http://goos.kishou.go.jp/) operated by JMA. Monthly diagnosis and outlook of El Nino-Southern Oscillation based on the outputs of the Ocean Data Assimilation System and the El Nino Prediction System (an ocean-atmosphere coupled model) are also operationally distributed through the JMA web site (in Japanese) and the Tokyo Climate Center (TCC) web site (http://ds.data.jma.go.jp/tcc/tcc/products/elnino/). JMA has introduced the ocean-atmosphere coupled model, which is the same as that for El Nino prediction, into seasonal forecast of climate in Japan since February 2010. The model products for seasonal forecast are available from the TCC web site (http://ds.data.jma.go.jp/tcc/tcc/products/model/).

JAMSTEC is providing a variety of products including objectively mapped temperature and salinity field data (Grid Point Value of the Monthly Objective Analysis using Argo float data: MOAA-GPV: http://www.jamstec.go.jp/ARGO/argo_web/MapQ/Mapdataset_e.html) and objectively mapped velocity field data based on YoMaHa'07 (version September 2010) (http://www.jamstec.go.jp/ARGO/argo_web/G-YoMaHa/index_e.html). JAMSTEC released a new data set of gridded mixed layer depth with its related parameters in October 2011, named MILA GPV (Mixed Layer data set of Argo, Grid Point Value: http://www.jamstec.go.jp/ARGO/argo_web/MILAGPV/index_e.html). This consists of 10-day and monthly average data and monthly climatology data in the global ocean using Argo temperature and salinity profiles (Fig. 3).

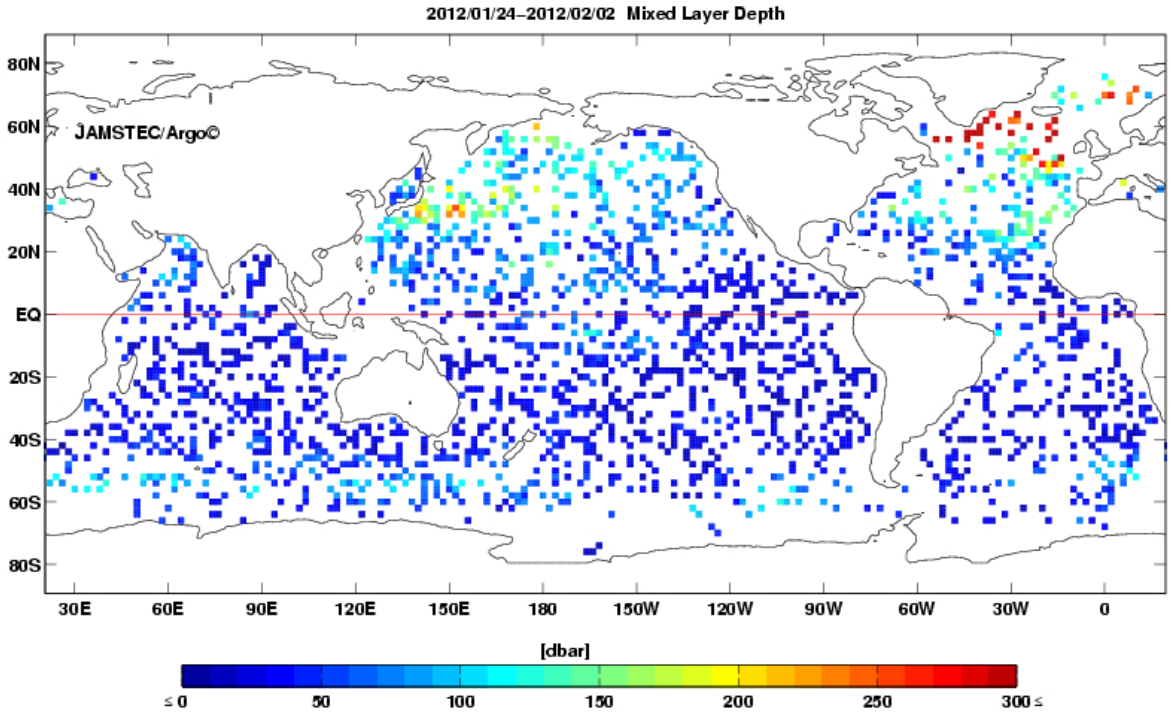


Figure 3. Map of mixed layer depth (dbar) averaged for 10 days, from 24th January 2012 to 2nd February 2012. Mixed layer depth is defined as the smaller value of isothermal layer thickness and isopycnal layer thickness. They are calculated using the finite difference method based on the temperature and potential density values at 10 dbar with threshold values of 0.03kg/m^3 for $\Delta\sigma_\theta$ and 0.2°C for ΔT.

JAMSTEC is also providing information about consistency check of float data related to delayed-mode QC for the Pacific Argo Regional Center (PARC) web site as a main contributor.

JAMSTEC will support the activities of the Southern Ocean ARC (SOARC) in the Pacific sector.

Based upon the accomplishment of the JAMSTEC research project “Japan Coastal Ocean Predictability Experiment (JCOPE)”, Forecast Ocean Plus, INC (FOP) was established as a JAMSTEC venture in March 2009. FOP has been providing the ocean current forecast information over the global ocean based on the state of the art ocean models, including real time forecasts for the shipping companies, offshore industries, coastal engineering works, and the weather information company. Argo is one of important sources of in-situ data for the FOP data assimilation system.

Following the accomplishment of the FRA-JAMSTEC joint research project “A new operational ocean prediction system with hydrographic data of coastal repeated observation lines and its linkage for ecosystem problems”, FRA started operating the ocean prediction system FRA-JCOPE in April 2007, providing the hydrographic forecast information around Japan both to the fisheries research/management community and the general public. Argo has been one of important sources of in-situ data for the FRA-JCOPE data assimilation system. FRA has terminated the service using the FRA-JCOPE system in March 2011; a new prediction system is being developed.

5. Summary of the number and location of CTD cruise data to the CCHDO website.

Data of 988 CTD casts conducted by JMA in the western North Pacific from spring 2010 to summer 2010 were uploaded to the CCHDO website.

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National Report on Argo-2011

by Republic of Korea

Deployment in 2011 and Future Plan

Korea Meteorological Administration (KMA) and Korea Ocean Research and Development Institute (KORDI) are involved in the International Argo Program since 2001. In 2011, KMA deployed additional 14 floats in the East/Japan Sea (8 floats) and southwestern region of Kamchatka peninsula (6 floats).

KMA has a plan to deploy 15 floats in the Northwestern Pacific Ocean (5 floats) and the East/Japan Sea (10 floats) in July 2012. One float equipped with DO sensor will be deployed in the East/Japan Sea. It is expected that KMA is able to increase float deployment.

KORDI's strategy regarding the Argo program is under revised in terms of contribution toward the global ocean observation.

Status of Argo data management

During Mar. 2011 - Feb. 2011, 2,021 R-files of KMA were sent to GDAC. Last year, KMA data from 2001 to 2009 were included in ANDRO. This is done by Michel Ollitrault and Jean-Philip Rannou.

National Fisheries Research and Development Institute (NFRDI)/Korea Oceanographic Data Center (KODC) is responsible for DMQC. NFRDI/KODC executed new DMQC for 7,369 profiles from 82 floats (~66% of total profiles).

In addition, we plan to carry out CTD observation in Ulleung Basin this April to examine the feasibility of the East/Japan Sea Argo data DMQC.

Research and operational uses of Argo data

KMA is developing an operational ocean forecasting system for the global ocean. Last year, we started co-working with UKMO for the improvement NEMO/NEMOVAR system. Now, KMA is performing a hindcast simulation to examine model and assimilation performance.

Since 2001, four Dacs (KMA, KORDI, JMA, AOML) has deployed 143 Argo floats in the East/Japan Sea. Now, Argo data is the most important hydrographic data in this region. KMA carried out observing system experiment to examine the impacts of Argo data in a data assimilation system, and will submit the result to a journal this year.

Using Regionally Adapted QC (RAQC; developed by KMA) and the OI method, KMA generated monthly temperature gridded fields for the North Pacific Ocean from 2004 to 2010. Currently, the verification of gridded fields is being carried out by a comparison with other gridded data and climatology from WOA09. KMA has the plan to generate global T-S fields in the next year and to distribute the result via web site.

New Zealand National Report March 2012

NIWA is the New Zealand participant in Argo. NIWA has purchased 2 floats per year since 2001, with no floats being purchased in 2003 because of float availability. We have also deployed floats for other providers and are collaborating on large deployments by contributing towards vessel costs.

New Zealand's floats

NIWA has purchased and deployed 20 floats to date. Purchases and deployments are likely to continue at the 2 floats/year level.

Information on the New Zealand floats, designated (WMO#) 2039 (5900106), 2042 (5900109), 2137 (5900205), 2138 (5900206), 2331 (5900631), 2332 (5900632), 2463 (5901028), 2547 (5901227), 2555 (5901239), 2585 (5901271), 2693 (5901763), 2659 (5901804), 2739 (5901843), 2750 (5901853), 2859 (5902224), 2860 (5902225), 2872 (5903332), 2873 (5903333), 8035 (5903756) and 8064 (5903777) can be found at: http://sio-argo.ucsd.edu/weqpac_web.html.

The data from the NZ floats are administered by Scripps Institution of Oceanography and are available on the Argo Global Data Assembly Centers (GDACS).

Providing deployment opportunities

NIWA has provided deployment opportunities for other nation's floats in the southwest Pacific and Southern Ocean. This is a very important contribution to Argo, given that these regions had poor float coverage and limited deployment opportunities from commercial vessels.

In an ongoing collaboration, NIWA is funding 15% of the vessel costs of R/V Kaharoa deploying floats for University of Washington and Scripps Institution of Oceanography. CSIRO (Australia) has now joined this collaboration.

NIWA's larger research vessel, R/V Tangaroa has also deployed floats in the southern ocean, both as part of the same collaboration and opportunistically when other research takes place in the southern ocean.

These voyages, dating back to 2004 have deployed around 985 floats, primarily in the South Pacific but also in the eastern Tropical Pacific and Indian oceans.

Additional R/V Kaharoa deployment voyages are in planning stages.

Finally, NIWA is also available to facilitate float deployments being mobilized out of New Zealand ports.

Status of Argo Norway, 1st March 2012

The Norwegian Argo programme is carried out by the Institute of Marine Research (IMR) (http://www.imr.no/) as part of their environmental monitoring activities. The Norwegian Argo programme focus on the Nordic Seas regarding climate monitoring and research and seek to include users with focus on the ecosystem monitoring and research. Float deployment are done with IMR's research ships and often in collaboration with the German Argo. The Institute of Marine Research (IMR) is involved in the international Argo programme with contribution of Argo floats, ship time for deployment and user of the data. At present, IMR is the only institution in the Argo Norway.

1. The status of implementation

At present we have in total purchased and deployed 15 floats, all in the Norwegian Sea. Three floats were deployed in 2002, six floats in 2003, two floats in 2006 that included oxygen and fluorescence sensors, and four floats in 2010 that also included oxygen and fluorescence sensors. All floats are APEX floats and the latest four deployed floats have Iridium telemetry. At present only three of our floats are active.

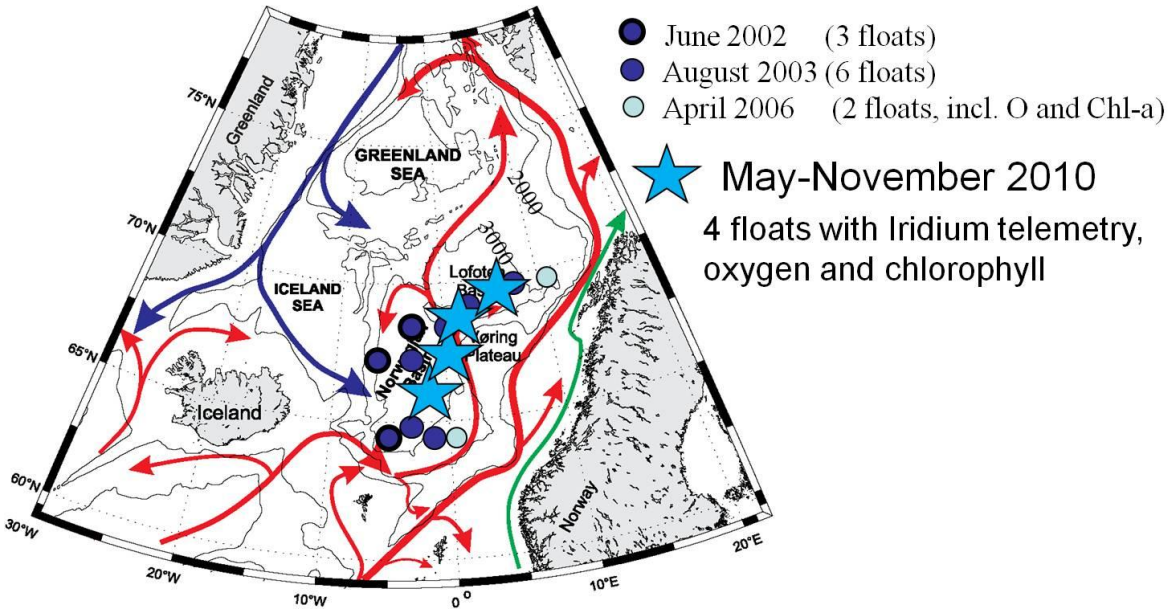

Figure. Locations of all Argo deployments from Argo Norway.

Delayed mode
In agreement with the French Argo Data Centre, Coriolis (www.coriolis.eu.org), all real time data processing and quality control are perfomed at the Coriolis. Regarding

the “Delayed mode” the Argo German do delayed mode quality control for all floats in the Nordic Seas including our floats.

2. Present level of and future prospects for national funding for Argo

The funding has so far been self-financed (i.e. funded by our institute). The total float purchase has cost about 260kEURO. There are not devoted any funding for scientific analysis, but some persons are partly working with the Argo floats regarding data collection and management. The scientific analysis is done in other external financed projects.

In October 2010, IMR submitted a proposal to the Norwegian Research Council (NRC, Ministry of Education and Research) for long-term funding of Argo floats and to be a full member of the Euro-Argo European Research Infrastructure Consortium (ERIC). The proposal got positive evaluation and if NRC and IMR agree on the terms, NRC will fund three Argo floats per year and the membership in the ERIC the next three years.

3. Summary of deployment plans

At present we have no deployment plans for 2012, but with the funding from NRC we plan to deploy three Argo floats in the Norwegian Sea the next year (2013) that will include Iridium telemetry, oxygen and fluorescence sensors.

4. Summary of national research and operational uses of Argo data

ARGO Norway focuses on both research topics and marine climate monitoring of the Nordic Seas. Approximately 3 scientists in 3 projects are directly involved in Argo Norway but also other people contribute with technical expertise, data management, ship time for deployments, and processing and analysing the data. There is an increasing interest in using Argo data in Norway. Several institutes are involved in the EU-project MyOcean where Argo data are central, and within this project two climate centres are now using the data operationally in climate models.

The present scientific topics are mainly within the Nordic Seas (Norwegian, Iceland and Greenland Seas) and include:

- Studies of the deep ocean circulation in the Nordic Seas. These studies have so far brought new insights in the circulation of the Nordic Seas.
- Water mass changes and also in relation with biological activities. This topic is also one of the reasons that we have included both oxygen and fluorescence sensors on our Argo floats.
- Studies that involve changes in the mixed layer.

5. Issues we wish to be considered and resolved

At the moment we have no suggestion.

Status of Argo Poland, 1st March 2012

The Polish Argo programme is carried out by the Institute of Oceanology Polish Academy of Sciences (IOPAS) (http://www.iopan.gda.pl/index-pl.html). Institute of Oceanology (IOPAS) is the biggest Polish institution with a focus on marine science, carrying the extensive field work in the Baltic Sea, North Atlantic and Nordic Seas. IOPAS is the first in Poland who started to deploy the ARGO floats in 2009, at the same time it joined the EURO-ARGO consortium. IOPAS is not only a leader of the Polish EURO-ARGO, it also collaborates with other scientific institutions working in the Arctic, as Institute of Geophysics, Polish Academy of Sciences, University of Silesia, University of Torun. Results from ARGO floats lunched in the Nordic Seas by IOPAS are used in common projects. IOPAS also deployed floats in collaboration with the German AWI.

1. The status of implementation

Two ARGO floats were deployed by Poland in July 2010 in the Nordic Seas during the Arctic cruise of the IOPAS research vessel RV Oceania. During the same expedition, two more floats from Alfred Wegener Institute in Bremerhaven were deployed from RV Oceania in frame of joint field experiment in the Nordic Seas. One of the Polish float (WMO# 6901387) was active until 28 of May, 2011. It collected all in all 111 profiles. Second one unfortunately finished transmission after only two profiles. There were not new Polish ARGO floats deployments in 2011. However, we cooperate closely with the German company Optimare which provided the innovative NEMO floats equipped with RAFOS technology and Iridium modems for data transfer which were deployed in summer 2010. The continuation of the collaboration is planned in 2012

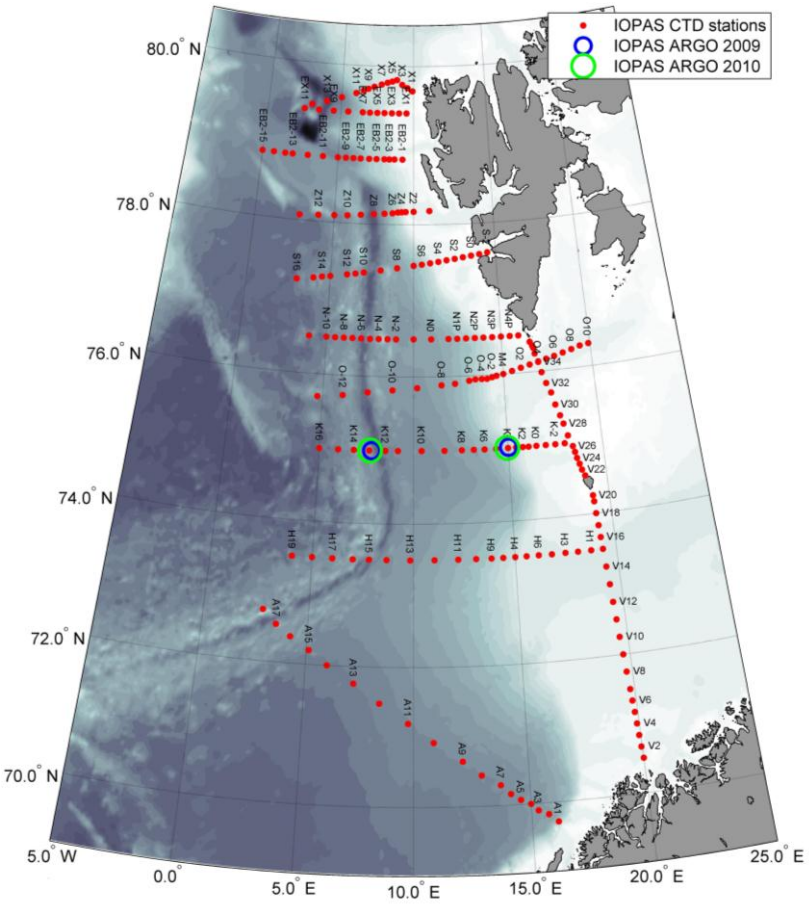

Figure. Locations of all Argo deployments from Argo Poland.

Delayed mode and CTD for Reference DataBASE

The OPTIMARE, Bremerhaven maintains and controls the IOPAS floats data.

IOPAS has the long and extensive experience in field observations in the Nordic Seas. Every summer since 1996 IOPAS has been carrying 2-months-long cruises to the Norwegian and Greenland Seas. Our multiyear CTD and ADCP data from the Nordic Seas are available to the EURO-ARGO community for ARGO floats calibration. We are going to contribute to the ERIC project by working out the strategy for deployments of floats in the Nordic Seas. Our research vessel RV Oceania can be used by the EURO-ARGO partners who are interested in floats deployment both in the Norwegian and Greenland Seas as well as in the Fram Strait. In 2009 and 2010 we succeeded in first Polish deployments of Argo floats, gathering the first-hand experience in this new technology. In 2012 we plan to continue floats deployment in the subpolar regions, working at the same time on securing more sustainable funding scheme for the national EURO-ARGO activities.

2. Present level of and future prospects for national funding for Argo

The project has so far been funded by IOPAS. The total float purchase has cost about 55 kEURO. There are not devoted any funding for scientific analysis, but some persons are partly working with the Argo floats data collection and management in frames of the IOPAS projects. The scientific analysis is done in the research projects financed from the external sources.

As part of the EURO-Argo preparatory phase, IOPAS as a Polish representative, carried the negotiations with the funding agency (Ministry of Science and Higher Education) to develop strategy of the ARGO project and to secure a sustainable funding. The proposal got positive evaluation and the Polish EURO-ARGO project is on the priority list (roadmap) of the Polish ESFRI projects, but the general funding scheme for all ESFRI projects is still under development and has been not yet decided on the governmental level.

Recently IOPAS sent a proposal to the National Science Center (NCN) for a long-term funding which should cover purchasing and deployment of two floats per year and also a membership in the Euro-Argo ERIC as an observer. We wait for the call results.

3. Summary of deployment plans

In 2012 we plan to continue floats deployment in the subpolar regions, working at the same time on securing more sustainable funding scheme for the national EURO-ARGO activities.

4. Summary of national research and operational uses of Argo data

In 2007 IOPAS started to use ARGO floats data for the studies focused on circulation in the Nordic Seas and the Fram Strait. Data have been used for a comparison with the results from standard *in situ* observations conducted in the Nordic Seas.

The aims of our summer deployments are:

- Investigation of the West Spitsbergen Current structure and velocity in its various branches;
- Field tests of various data transmission technologies (ARGOS vs. IRIDIUM);
- Feasibility tests of RAFOS technology for floats tracking in the Fram Strait.

Data received from IOPAS floats and other ARGO data sets were used to construct the mean hydrographic fields in the West Spitsbergen Current (WSC) for a comparison with the WSC structure obtained from the ship-borne hydrographic measurements. ARGO data were used in Polish-Norwegian Research project AWAKE, which purpose was to investigate changes of climate in the European Arctic. Floats data were also used for the validation and evaluation of the output from the high resolution (2 km) numerical model of circulation in the Nordic Seas and Arctic Ocean.

5. Bibliography

Cisek M., Walczowski W., Wieczorek P., Observations of Atlantic Water pathways and velocities in the Nordic Seas, 3rd Euro-Argo User Workshop, 17-18 June, 2010. Paris, France, poster presentation.

Walczowski W., Deep sea circulation, AWAKE Progress Meeting, 4-5 November, 2010, IOPAS, Sopot, Poland, oral presentation.

Osinski R., Maslowski W., Jakacki J., Eddy-resolving ocean modeling of the pan-arctic region, AWAKE workshop "Ocean influence on climate and cryosphere in the Arctic", 28-30 November 2011, IOPAS, Sopot, Poland, oral presentation.

6. Issues we wish to be considered and resolved

At the moment we have no suggestion.

Argo Spain 2011 report

Pedro Vélez-Belchí, Instituto Español de Oceanografía

1. The status of implementation

The Argo Spain program started in 2003 and is coordinated by the Instituto Español de Oceanografía (IEO). Since then, 44 floats have been deployed, of which 30 are still active.

Figure 1. Status of the Argo Spain program on February 14th 2012. From a total of 44 floats deployed, 30 (red) are still active

- Floats deployed and their performance

During 2011, a total of 17 Argo floats were deployed by Spain:

- 10 Apex floats were deployed by the *R/V Sarmiento the Gamboa* during the *Malaspina 2011 circumnavigation expedition* along 24.5ºn in the Atlantic.
- 3 Apex floats were deployed by the *R/V Hespérides* during the *Malaspina 2011 circumnavigation Expedition* in the South Atlantic.
- 3 Apex floats were deployed in the Western Mediterranean Sea by SOCIB, a Coastal Ocean Observing and Forecasting System located in the Balearic Islands.
- 1 Apex float was deployed in the Wesetern Mediterranean Sea by the Spanish National Research Council (CSIC) in support of the MIDAS research project.

Although the funding for the purchase of the floats may come from different sources all Argo floats deployed by Spain are managed by the Argo-Spain program, which gives support to the different contributions.

- Technical problems encountered and solved

No major technical problems were encountered in 2011

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

After the deployment, the detailed technical information is provided to the DAC in charge of the floats (Coriolis) and to the AIC. The Argo-Spain program is aware of the changes in the technical and metadata data formats, and will provide the necessary information as soon as the new formats are approved.

Some of the earlier floats deployed by Spain were affected by TNPD. These floats have not been yet corrected, but the corrected files will be submitted during 2012.

- Status of delayed mode quality control process

The delayed quality control process is underway, however it has not been submitted yet. The submission will be done during 2012.

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 Argo Spain program is actually funded in a yearly base. Spain remains committed to the European contribution to Argo (Euro-Argo), however the final decision for becoming a member of Euro-Argo has not yet been taken. This decision, that will means a long-term contribution (5-10 years) to Argo, should be taken during 2012 by the Spanish Ministry of Economy.

The funding covers (and will cover) float procurement, transmission costs, and part-time (1.5 manmonth per year) personnel support. The *Instituto Español de Oceanografía* funds the scientific coordination and the remaining personnel support of the Argo-Spain program

Besides the long-term support from the Spanish Ministry of Economy, the Coastal Ocean Observing and Forecasting System located in the Balearic Islands (SOCIB) will deploy 3/4 Argo floats in the Western Mediterranean until 2014, although this funding could be extended until 2021. The Argo-Spain program also coordinates this contribution.

3. Summary of deployment plans and other commitments to Argo for the upcoming year and beyond where possible.

During 2012 a total of 13 Argo floats will be deployed. The main goal is to support the global array in the Atlantic Ocean and in the Mediterranean Sea. The deployment plan has been submitted to the IAC.

Although the final deployments may change following feedback from the Spanish research community the actual plan is:

- 7 floats to be deployed in the Mediterranean Sean, two in the eastern basin and 5 in the western basin.
- 6 floats to be deployed in the Eastern Atlantic

Beyond 2012 funds are only secured for Argo deployments in the Western Mediterranean Sea, with 3/4 floats to be deploy every year until 2014.

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

Argo is used by many spanish researches to improve the understanding of the climate and ocean variability. Ocean and weather forecast operational models also use Argo data.

The web page of the Argo Spain program is: http://argo.oceanografia.es

5. Issues that your country wishes to be considered and resolved by the Argo Steering Team regarding the international operation of Argo.

None.

6. 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.

After most of the Argo-Spain deployments, a CTD cast is performed. However, the data have not been submitted to the CCHDO website. It will be done during 2012.

7. List of all papers published by scientists within Spain in the past year using Argo data, including non-English publications.

Soto-Navarro, J., F. Criado-Aldeanueva, J. C. Sánchez-Garrido, and J. García-Lafuente (2012), Recent thermohaline trends of the Atlantic waters inflowing to the Mediterranean Sea, Geophys. Res. Lett., 39, L01604, doi:10.1029/2011GL049907.

UK ARGO PROGRAMME

REPORT FOR ARGO STEERING TEAM 13TH MEETING, MARCH 2012

The UK Argo programme is undertaken by a partnership between the Met Office, the National Oceanography Centre Southampton (NOCS) and the British Oceanographic Data Centre (BODC). The Met Office are responsible for programme management and coordination, organizing float deployments, preparation of floats for deployment, telecommunications (costs) and international contributions. NOCS and BODC have responsibility for Argo science and data management.

The most pressing issue for the UK programme remains on securing continuing and ongoing funding for UK Argo, and internationally on ensuring the long-term delivery of data from the global Argo float array.

Floats deployed and their performance

Floats deployed. Since 2001, over 315 floats have been deployed (including 5 floats donated to Mauritius) in support of the Argo array. As can be seen from Figure 1 below the number of floats purchased each year has been very variable, often due to funding being supplemented by end-of-year under-spend monies. As a result, the number of deployments each year has also been variable. In 2011 we deployed 43 floats which is a distinct improvement on recent years, being the most we have managed since 2004. So far 7 floats have been deployed in 2012. At the present we have 132 active floats (including 4 that were provided to and deployed by Mauritius in 2011) contributing to the global Argo array, see Figure 2.

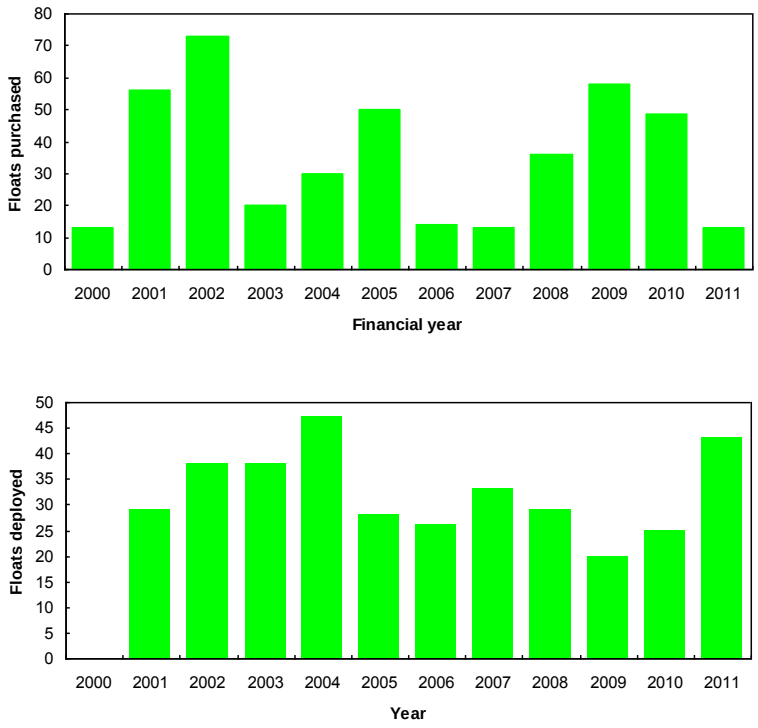

Figure 1. Showing (top) the number of floats procured each financial year (Apr-Mar) and (bottom) deployed in each calendar year.

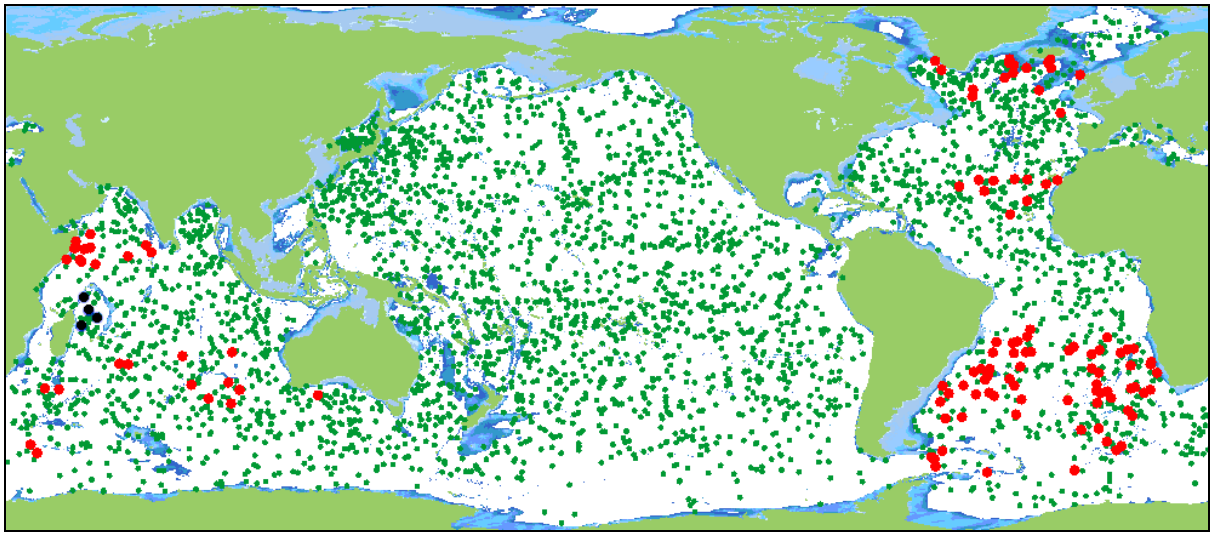

Figure 2. Showing the locations of operating UK floats (in red) and the two surviving Mauritian floats (in black) in mid-February 2012.

With the increase in the number of floats deployed in 2011 the number of UK floats contributing to Argo has increased to over 130, as shown in Figure 3.

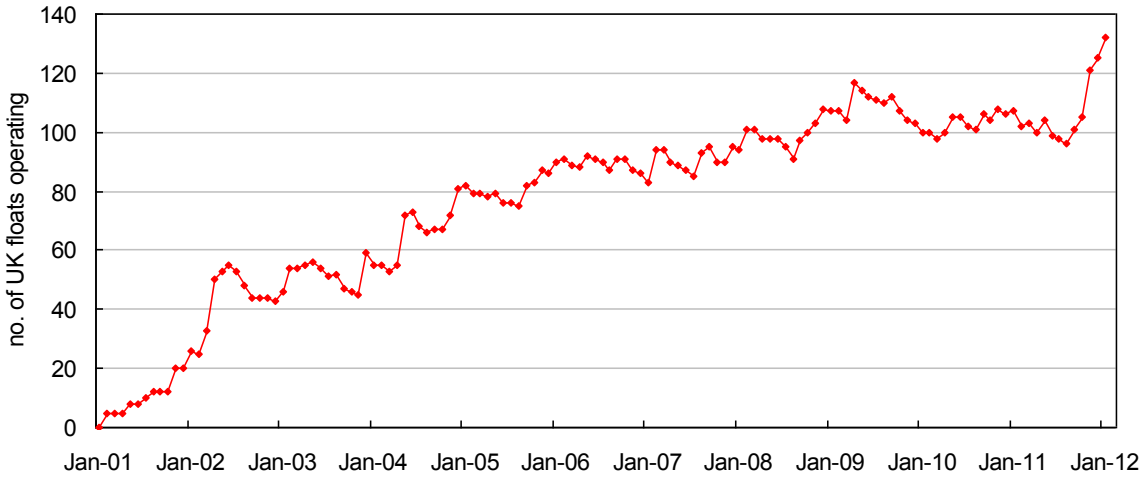

Figure 3. Number of active UK (including Mauritius) floats contributing to Argo by month.

Float performance. There has been a distinct improvement in the survival of our Apex floats deployed since 2004 compared to those deployed in the earlier years in terms of cycles completed (normalised to 2,000m for floats that make shallower profiles or only profile to 2,000m intermittently, with invalid cycles due to pressure transducer failure discounted and deployment failures omitted), as shown in Figure 4.

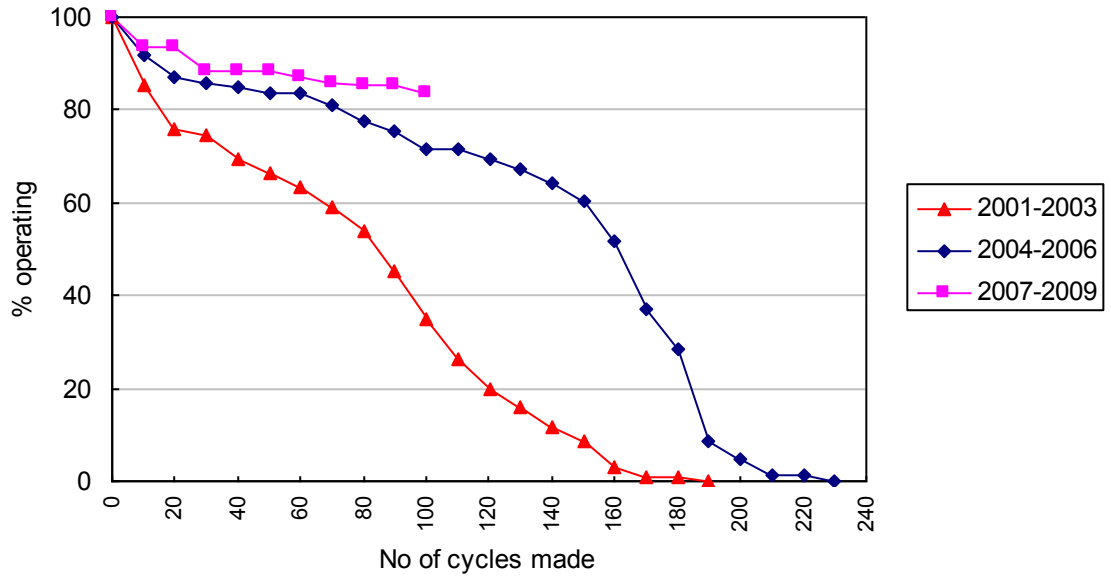

Figure 4. Number of (normalised) cycles made by UK Apex floats deployed in 2001-2003, 2004-2006 and 2007-2010.

Only 30-40% of Apex floats deployed before 2004 made more than 100 cycles, whereas for floats deployed 2004 to 2006 and 2007 to 2010, 72% and 84% of floats reached the 100 cycle mark.

Following some early float losses to ice damage in 2007, since 2008 all new Southern Ocean floats considered at risk of ice have been specified with ice-avoidance capability. So far 17 floats with ice-avoidance have been deployed and none have failed due to ice damage. In 2007 we deployed our first Apex floats with lithium batteries and have since deployed 65 floats with lithiums.

In 2008 our first 2 Apex floats with near surface temperature measurement capability (un-pumped measurements) were deployed, with 63 SST-capable floats having now been deployed.

As of yet all of our floats have used Argos for communications, however the 13 Apex floats currently on order will all use Iridium. 4 of these floats will also carry dissolved oxygen and chlorophyll fluorescence sensors. All these floats will be fitted with lithium batteries.

Deployment plans for 2012

At the end of Feb 2012 we have around 50 Apex floats available for deployment, with a further 19 floats expected to be delivered by end March 2012. Anticipated deployments in 2012 include:

4 floats Rockall Trough/Iceland basin (Extended Ellett Line July)
13 floats Nordic Seas (summer)
5 floats N Atlantic 26N (RAPID cruise Oct/Nov)
2 (possibly more) floats SE Atlantic (SA Agulhas Sept)
2 (possibly more) floats S Atlantic (AMT cruise autumn)
6 floats Southern Ocean/Drake Passage (winter 2012/13)
2-4 floats near Mauritius

With 9 floats available for the Arabian Sea, 6 for the Somali Basin and 2 for South Indian Ocean. The expectation would be to deploy around 40 floats (including those provided to Mauritius).

Data management

The UK Argo Data Centre, established at BODC, processes all our float data (including the floats donated to Mauritius and also floats for the Irish Argo programme).

Real-time
An automatic system processes the data in real-time and generates the profile data in WMO TESAC and BUFR and Argo netCDF formats. The TESAC/BUFR messages are relayed to GTS via the Met Office (EGRR). Almost 100% of GTS messages are available within 24h. Occasional disruptions happen due to email server failures and server problems. Data in netCDF format are also sent (by FTP) to the two GDACs. The real-time processing system operates every 12 hours and delivers data twice daily. The data are also available from the UK Argo Data Centre web-site via an interactive map interface. In addition the technical files are updated once a week and these files are provided to CSIRO Marine to populate the technical web-site.

Delayed-mode
Delayed-mode processing is carried out by BODC using the OW software and the CTD_for_DMQC_V1 and ARGO_for_DMQC_V02 reference datasets. Reference data are updated when new versions are available. During the summer of 2010 the backlog in DMQC of BODC hosted (Argo UK, Ireland, Mauritius, Saudi Arabia) Argo profiles was cleared. As of October 2011, 98.9% of eligible BODC profiles (profiles older than one year) had been submitted to the GDACs in delayed mode.

Southern Ocean
BODC works with three other organizations to operate a Southern Ocean Argo Regional Centre (SOARC) covering the entire Southern Ocean. Responsibilities are: BODC - Atlantic Ocean Sector, CSIRO - 'Australian' sector, JAMSTEC - Pacific Ocean Sector and the University of Washington - Indian Ocean Sector. BODC hosts the main SOARC data and information web pages (http://www.bodc.ac.uk/projects/international/argo/southern_ocean/).

On-going development activity
In addition to maintaining progress of previous years on-going development at BODC is focusing on the following:

- Improving the quality of trajectory data distributed by BODC. This is based on the actions decided by the ADMT and output from the ANDRO Atlas.
- Development of real time quality control procedures for un-pumped near surface temperature data from APEX floats and inclusion of in profile file submitted to the GDACs

Reference CTD data
At the Argo Data Management Team meeting in 2012 the link between BODC and CCHDO was restored. This included an initial submission of ~3,500 CTD profiles in BODC holdings for use in the Argo delayed mode reference climatology. The aim is to develop the link with further submissions of CTD data in 2012 and an eventual move towards automated submission of data to CCDHO (plus NODC and ICES) when data are banked at BODC.

The delayed mode cookbook information produced by BODC in previous years has also been supplied to Steve Diggs who is using this information to identify areas where the current reference data/climatology is in need of enhancement so these areas can be

prioritised when seeking new data for inclusion in the climatology. This approach has already been fruitful in the Northwest Atlantic.

Scientific and operational use of Argo data

Argo has an open data policy which means that all Argo data are freely available without any restrictions, for both scientific research and operational applications. In recent years there have been between 100 and 120 Argo based papers per year, of which between 10 and 15% have a UK lead author or co-author.

At the Met Office Argo data are assimilated into FOAM (Forecasting Ocean Assimilation Model), see http://www.metoffice.gov.uk/research/weather/ocean-forecasting, which is the Met Office deep ocean forecasting system It comprises a global ¼ degree model (ORCA025) and nested $^{1}/_{12}$ degree North Atlantic, Mediterranean and Indian Ocean limited area models. The system is run operationally at around 0500 UTC every day. GODAE OceanView (https://www.godae-oceanview.org/), an international group dedicated to collaborating on research and development of ocean data assimilation systems, have been developing methods of assessing the impact of observations on ocean data assimilation systems. Last year, to test these ideas, the Met Office performed a series of experiments to assess the impact of different observing systems on its FOAM system, including the impact of excluding all Argo temperature and salinity data for 1 month (July 2011). One method to assess the model is the fit to observations before they are assimilated. The fit to both profile temperature and salinity is 5% worse without Argo as shown in Table 1. However, it should be noted that one month may not be long enough to see the full impact of removing Argo data as previous experience suggests that the subsurface can take a year or more to spin-up (or spin-down).

	Operational	No Argo
Profile T / ºC	0.680	0.728
Profile S / psu	0.132	0.139

Table 1. Summary observation minus background RMS accumulated globally over July 2011.
2011.

Argo data are also used in the GloSea (Global Seasonal) coupled model run by the Met Office to make seasonal forecasts for several months ahead. Such forecasts are more reliable for tropical regions (such as the Sahel, East Africa and north-east Brazil) than for temperate climates and seasonal forecasting is still an area in which the science is being developed. On longer timescales the Hadley Centre DePreSys (Decadal Prediction System) is being developed for climate predictions on decadal timescales, where the impact of Argo data on decadal climate forecasts has been assessed in idealised experiments. For further information and experimental forecasts see http://www.metoffice.gov.uk/research/climate/seasonal-to-decadal.

A recent climate model-based study, by Matt Palmer and colleagues in the Hadley Centre[1], into the relationships between sea surface temperature (SST) and ocean heat content (OHC) with the top of the atmosphere radiation balance suggests the need to measure OHC deeper than 2,000 m (ideally to 4,000 m) to reduce decadal variability in the longer-term climate change signal. The findings highlight the need to sustain the Argo observations to 2000 m and provide strong motivation for the development of a deep ocean observing array.

[1] Palmer, M. D., D. J. McNeall, and N. J. Dunstone (2011), Importance of the deep ocean for estimating decadal changes in Earth's radiation balance, Geophys. Res. Lett., 38, L13707, doi:10.1029/2011GL047835

The Hadley Centre also maintains the HadGOA (sub-surface global analysis) dataset of historical temperature and salinity. Variables are on a 2-degree grid and computed on number of fixed isotherms and fixed depths at monthly resolution. The dataset includes available Argo data and will include near real-time updates using Argo data. The dataset is used for global ocean heat content analyses. For further information see http://www.metoffice.gov.uk/research/climate/climate-monitoring/oceans-and-sea-ice.

Research using Argo data at NOC is carried forward mainly, though not exclusively, through graduate students. Projects include: upper ocean circulation and variability in the North Atlantic, ocean correlation scales in the Pacific and Atlantic oceans, seasonal to decadal variations in water mass properties in the SE Pacific/Drake Passage/Atlantic sector of the Southern Ocean, decadal changes in intermediate and thermocline water properties in the subtropical South Atlantic. Also, the NOC satellite oceanography group is involved in ground truth for SMOS and is evaluating ways in which Argo near-surface data can be used for SMOS evaluation.

The data are used extensively in a wide range of research projects in UK Universities and research laboratories and is a central component of several PhD and MSc projects covering a broad range of topics including water mass properties and formation, air-sea interaction, ocean circulation, mesoscale eddies, ocean dynamics and seasonal-to-decadal variability.

The GHRSST (Group for High Resolution Sea Surface Temperature) community is now using Argo data to provide validation of various gap-free (Level 4 or L4) SST analysis products. The Argo data provide a good estimate of foundation SST (the SST free of diurnal warming). As the Argo data are not used in the L4 analyses, the data provide a high quality independent source of data for validation of the foundation SST. The GHRSST Multi-Product Ensemble (GMPE) system is run on a daily basis at the Met Office, taking various L4 analyses as inputs, transfers them onto a common grid, and produces an ensemble median and standard deviation. Validation against Argo data (at 3 to 5 m depth) has shown that the GMPE median is more accurate than any of the contributing analyses with a standard deviation error of 0.40K globally with respect to the near-surface Argo data. The results[2] will be published in a Deep Sea Research II Special Issue on Satellite Oceanography and Climate Change.

Work has continued to gather and analyze the available near-surface unpumped temperature (NST) data in collaboration with GHRSST. BODC has collected the data from UK, US, Japanese, and Indian NST capable floats. The data (to May 2011) were analyzed by Sarah Quinn (Reading University) as an MSc dissertation project in collaboration with Andrea Kaiser-Weiss (GHRSST Project Coordinator) and Prof. Keith Haines. After accounting for pressure sensor drift (required so that an accurate depth could be determined), evidence of diurnal warming (defined as a $\Delta T > 0.5°C$ between 10m and the surface) was seen in 62 profiles from 26 different floats, with a maximum ΔT of 2.4°C, diurnal mixing layers between 0.1m and 8m thick; various vertical diurnal structures were observed where in some cases the stratification probably reflects remnants of diurnal structures from the previous day(s). Some examples are shown in the following figures (showing the top ten metres).

[2] Group for High Resolution Sea Surface Temperature 1 (GHRSST) Analysis Fields Inter-Comparisons: Part 1. A GHRSST Multi-Product Ensemble (GMPE). Matthew Martina, Prasanjit Dashb, Alexander Ignatov, Viva Banzond, Helen Beggs, Bruce Brasnett, Jean-Francois Cayulag, James Cummings, Craig Donlon, Chelle Gentemann, Robert Grumbine, Shiro Ishizaki, Eileen Maturi, Richard W. Reynolds, Jonah Roberts-Jones.

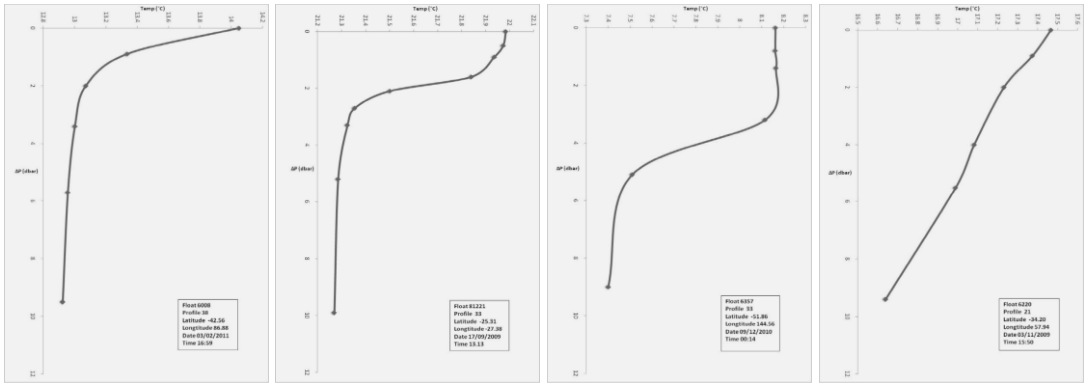

Figure 5. Examples of various diurnal mixed layer structures observed by NST capable Argo floats.

At this stage the accuracy of the un-pumped Argo measurements has not been verified and it is not known whether they are less accurate (or by how much), compared to the standard Argo pumped measurements, nevertheless the results do demonstrate the ability of such floats to record significant near-surface stratification that would otherwise be missed and provide information of value to the GHRSST community. The data from all the NST-capable floats, including Scripp's Iridium floats that sample (with the pump running) at 1db (with 1m bins above 10m). At present (late February) there are over 200 un-pumped Apex floats deployed plus 75 (or more) NST capable Iridium floats. It is proposed to analyze the now much larger data set ahead of the Argo Science Workshop in September 2012.

Funding

It was initially agreed in 1999 that MoD and DETR (then Defra, Dept of Environment, Fisheries and Rural Affairs and now DECC, Dept of Energy and Climate Change) would provide matching funding (through the Met Office) for UK Argo, and that NERC would also provide funding and support through NOCS and BODC. This agreement collapsed after MoD withdrew its funding to the Met Office in April 2010. Regular funding from DECC (ex Defra) to the Met Office has also reduced, although it has been supplemented in most years with year-end under-spend funding for floats. Hence the funding profile has exhibited large year-to-year variations. Securing an adequate level of regular funding for UK Argo activities at the Met Office remains an issue, particularly with the cessation of the MoD funding in 2010. In the last few years, funding for personnel (programme management, coordination and technical support) has been at a minimal level and has not kept up with the funding for floats.

NERC funding has also been variable due to funding for floats relying largely on bids to thematic programmes and end-of-year under-spends, although the regular NERC funding for support activities (e.g. data processing, science leadership) has been relatively stable. In its review of National Capability NERC has prioritised resource spend on Argo highly and the NERC asset management strategy (capital funding for floats) has Argo high on the list. This is based on the assumption that the Met Office will continue to be funded to manage and operate the programme and also procure floats.

During 2011 various meeting were held with DECC and other government departments to try and identify those departments who benefit from Argo and could contribute to costs. However, these approaches have not yielded any additional funding. The Argo funding issue has also been raised to the cross government Marine Science Coordination Committee (http://www.defra.gov.uk/mscc/) and in February 2012 a meeting was arranged by the Government's Chief Scientific Advisor to discuss funding and governance arrangements for core long term observational programmes (such as Argo).

However, in order to try and resolve the funding problems for the next few years the Met Office is in discussion with DECC on the possibility of part-funding the programme management costs (staff, communications, international subscriptions) from the Public Weather Service programme (http://www.metoffice.gov.uk/services/public/about). These discussions are ongoing and it is expected that additional DECC and/or NERC funding for floats will continue to be made available.

Euro-Argo

Both the Met Office and NERC were involved in the Euro-Argo project (completed June 2011) to develop and establish a longer-term European infrastructure for Argo – the Euro-Argo ERIC (European Research Infrastructure Consortium). The expected timescale for establishing the Euro-Argo ERIC is summer 2012. DECC had previously indicated that UK should become full members of the ERIC, however in June 2011 they decided they were not able to put forward a Minister who could sign up to the ERIC on behalf of the UK, as the funding issues needed to be resolved. At present (late-February) UK is still unable to commit to becoming a member of the Euro-Argo ERIC.

Both the Met Office and NERC are partners in the FP7 SIDERI (Strengthening the International Dimension of Euro-Argo Research Infrastructure) project (December 2011 to November 2013) and the FP7 E-AIMS (Euro-Argo Improvements for the Marine Service) proposal which has been submitted to the EC. SIDERI will provide funding for studies on legal and policy (e.g. EEZ) issues, how the Argo data system links into the emerging WMO Integrated Global Observing System (WIGOS), enhancing data management capability (at BODC), while maintaining outreach activities (the Euro-Argo educational web-site hosted by NOCS) and supporting international engagement.

USA Report to AST-13, March 2012. (Submitted by D. Roemmich)

Organization of U.S. Argo:

The U.S. Argo Program is supported with major funding provided by the National Oceanic and Atmospheric Administration (NOAA), and additional participation of the U.S. Navy. It is implemented by a U.S. Float Consortium that includes principal investigators from six institutions: Scripps Institution of Oceanography (SIO), Woods Hole Oceanographic Institution (WHOI), the University of Washington (UW), the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Pacific Marine Environmental Laboratory (PMEL), and the Fleet Numerical Meteorology and Oceanography Center (FNMOC). Float technology development, production, deployment, array monitoring, and data system functions are distributed among these institutions on a collaborative basis.

In addition to U.S. Argo floats, Argo-equivalent floats have been provided from a number of U.S. float groups and programs, including the University of Hawaii, PMEL, AOML, NAVOCEANO, and Florida State University.

The present 4-year cycle of U.S. Argo implementation began in mid-2011, and extends to mid-2015.

Objectives:

Primary objectives identified in the present Work Plan (2011-2015) for U.S. Argo are:

i. In float technology, an evolution of the Argo array toward bi-directional communications (Iridium, ARGOS-3) will provide energy savings, reduction of surface time and hazards, greater data throughput and enhanced profile resolution, and new applications.

ii. Float lifetime will continue to be extended beyond 4 years[1] by deployment of next generation floats (SOLO-II), through improvements to existing (APEX) float models, and by evaluating new commercial floats (Navis). The technology improvements will also result in a greater fraction of active float cycles providing high quality profile data.

iii. Working together with international Argo partners, overall data quality will be improved by insuring (through repeated audits of the data system, and by automated checking at global data centers) the completeness and consistency of metadata, technical, profile, and trajectory files.

iv. U.S. Argo will respond to community consensus recommendations regarding enhancements in float coverage and new sampling protocols to meet user requirements. Recommendations are made through recognized community forums such as OceanObs'09, or by the major Argo user groups including CLIVAR, GODAE OceanView, and the operational centers. OceanObs'09 recommendations for temperature/salinity profile measurements from Argo include extension of coverage to include the seasonally ice-covered oceans, increased density of observations in western boundary regions, enhanced vertical resolution of profiles, profiling to the ocean floor (as deep as 6000 m) with a subset of floats, and taking measurements nearer to the sea

[1] The 519 U.S. floats deployed in 2006 have completed an average of 165 cycles (= 4.5 years mean lifetime), with 267 floats (51%) still active as of 02/2012. Source: Argo Information Center

surface. Enhancements will only be undertaken if they do not compromise the present core Argo sampling of 3° resolution every 10 days between 60°N and 60°S

Support level:

The support level for U.S. Argo is aimed at providing half of the global Argo array. The target level is 1600 active floats, based on a deployment rate of about 410 floats per year. Due to level funding, the number of floats has decreased to about 360 per year. However, with increases in the mean lifetime of floats, the target number of active floats has been maintained.

The U.S. Argo effort includes float production and deployment, technology improvement, communications, data system development and implementation for real-time and delayed-mode data streams, and participation in international Argo coordination, Regional Centers and outreach activities.

Beginning in 2011, U.S. Argo is funded for development and testing of Deep Argo floats. It is planned these instruments will profile from pressures as great as 6000 dbar, and be capable of 100+ cycles. Deployment of initial prototypes could occur by late 2012. Prototype deployments will be followed by a pilot program, whose goal will be to instrument two deep ocean basins.

Status:

As of March, 2012, there are 1847 active U.S. Floats (source AIC) and these have completed an average of 124 cycles. Of the active floats (Fig 1), 1765 are provided by U.S. Argo and 82 by partnering programs. The number of US float deployments decreased slightly from 387 in 2010 to 363 in 2011 (Fig 2).

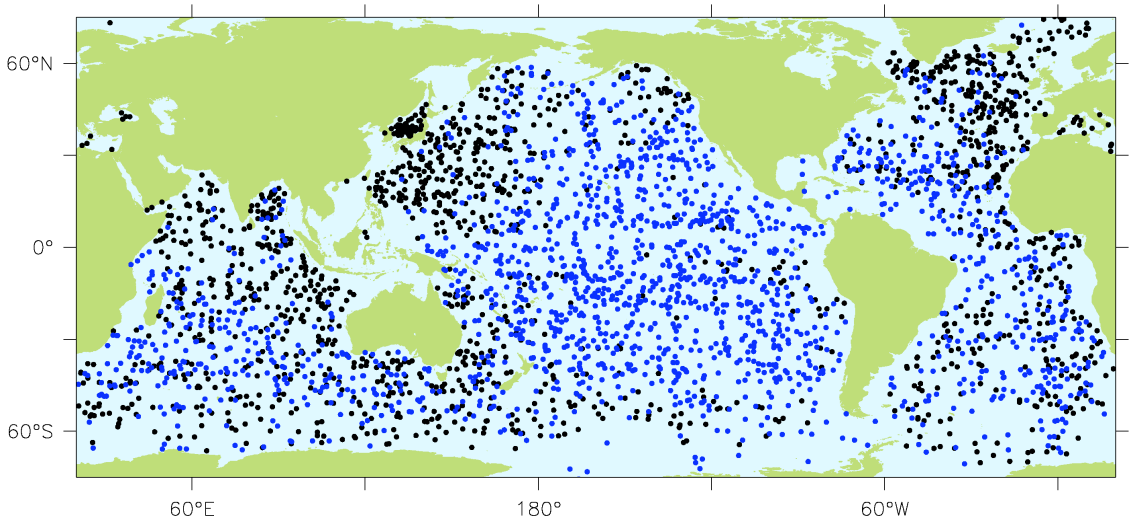

Fig 1 Positions of 1847 active U.S. floats (blue dots) as of March 2012.

The highest priority for U.S. Argo is to sustain the core global Argo array. Specific plans for 2012 float deployments, as they evolve, are posted on the AIC deployment planning links. A major U.S./New Zealand/Australia deployment cruise in the South Pacific Ocean was carried out in late 2011 on R/V Kaharoa, and another is planned beginning in January 2013. RV Kaharoa has deployed 985 Argo floats since 2004.

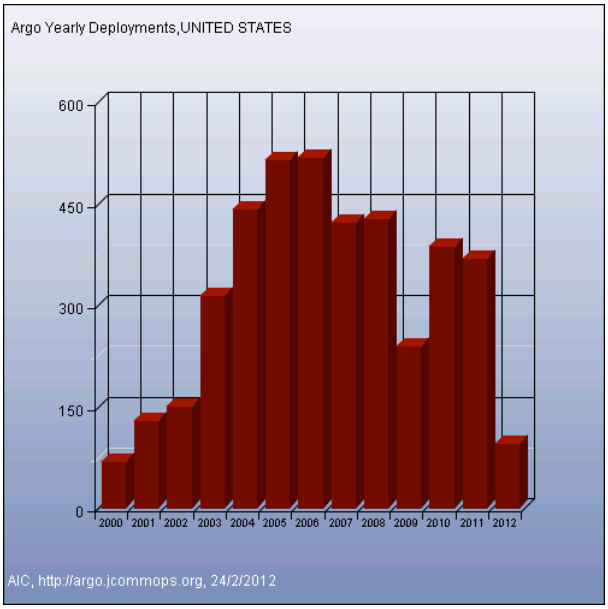

Fig 2. Yearly deployment of U.S. floats. (Source: AIC)

The U.S. Argo Data Center is based at NOAA/AOML. Real-time data from all U.S. Argo floats are transmitted via the GTS. GTS transmission uses parallel systems developed at AOML and housed at AOML and at Collect Localisation Satellites (CLS), implementing internationally-agreed quality control tests. The AOML data center serves as the national focus for data management and is the conduit for delayed-mode data to pass between the PIs and the GDACs. During 2011 further progress was made in delayed-mode quality control (Fig 3).

In addition to the national DAC, a Global Data Assembly Center (GDAC) is run as part of the GODAE server, located at FNMOC/Monterey. The two GDACs at FNMOC/Monterey and IFREMER/Brest are mirror images in their assemblies of Argo data from all international partners, and are responsible for dissemination of the data. Several U.S. institutions participate in Argo Regional Center activities, including AOML's role as focus for the South Atlantic ARC.

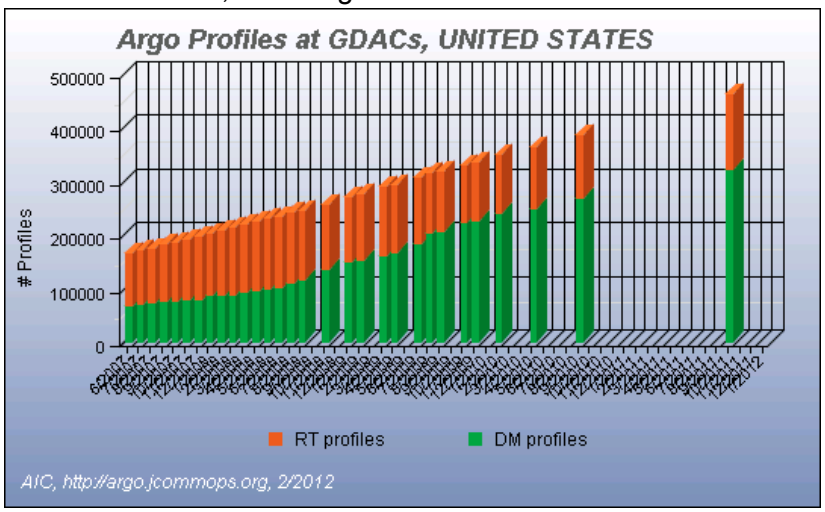

Fig 3. Number of profiles held at GDACs for U.S. floats (source: AIC), including those with delayed-mode and real-time levels of quality control. Roughly 65,000 of the RT profiles are less than one year old and not yet eligible for DM processing.