Minutes of the 3rd Argo Regional Centre Meeting
Tuesday 29th September 2009
Toulouse, France

Chairs: Claudia Schmid and Ann Gronell Thresher

The stated objectives of the meeting are to:

- Review the status of the various ARCs, focus on:
    - essential roles:
        - regional analysis of all Argo data to assess its internal & external consistency
        - feedback to PIs about the results of the regional analysis and possible outliers
        - contribute to Reference Data Base for delayed mode quality control
        - Prepare and distribute Argo data products
    - optional roles:
        - Coordinate Argo deployment for the region
        - Develop new Q/C tests for region
        - Provide delayed-mode Q/C for regions without such capabilities
        - Compare Argo data to models and assimilated fields
        - Provide documentation of the procedures done at the ARC
- Review action items (added below) from last year – e.g., see what's done.
- Challenges, what are they and how can they be overcome
- Identify ways for ARCs to help each other (e.g. software exchange)

Regional consistency quality control, post DM-QC (Claudia Schmid & Claire Gourcuff)

Claudia Schmid: Consistency checks are being done at the South Atlantic ARC with pages on-line containing tables of delayed mode floats, by data centre and PI. The link can be found at: http://www.aoml.noaa.gov/phod/sardac/

There are also summary plots either with groups of 50 floats or for all floats. There is a set of summary plots showing outliers clearly, which can be very useful. Four climatologies have been used used: Levitus WOA 2005 monthly, Navy GDEM3 monthly mean, Argo SIO monthly climatology and buddy profiles within 10 days and 150 km.

However, they still need to fix some bugs, and need feedback on the pages. A further step will be to filter out suspicious floats and notify the operators of those floats. Email notifications will be distributed where appropriate. Mathieu is happy for the list of suspicious floats goes to the AIC for information collecting purposes, and Dena is happy for this to be put in the public domain because we're already doing that for other sources of erroneous floats. This helps with assessing the performance of the various Argo programs, too.

There was discussion about whether to assess all floats or eliminate those that are grey listed or dead. All DM floats drifting through the SAARC region are analysed.

Dean would like it to be expanded to the whole earth. The analysis has been limited to SAARC area for testing and development purposes. It can be expanded later but currently it would be too large to deal with the global dataset. All files and plots are pre-drawn - nothing is done on the fly. This makes it large. All programming is done in Matlab and PERL so it can be translated to PC pretty easily.

The point was made that we really need to do this globally, not locally, however big the region because it's a very useful tool. After they get a bigger disk, they will be able to handle the global dataset.

Making the software interoperable would allow it to be used by others. They use the WMO id to get to all of the float data with relative paths, not absolute, so it is transportable. Claudia intends to provide a list of suspicious floats similar to the altimetry list but needs to define 'suspicious'. And Birgit can help with identifying these floats. They can also expand tables to group things differently. Mathieu pointed out that we have plenty of space at the AIC for plots to sit. The SARDAC is getting a 1tb disk but it really needs a RAID.

The analysis will run quarterly, with a report to the AIC for the monthly report and then operators can review any floats that have kicked out of the analysis.

It was requested that they add a column to all tables with a red star to identify suspicious floats immediately. Eventually the analysis will run automatically. Comments and feedback will flow to and from the users who have suspicious floats.

Mathieu wants ability to link to Google earth, which would be useful. Questions were also asked about who was using this web interface.

Claire Gourcuff: A process has been developed by Coriolis for inter-comparison of floats as an addition to the current methods. They propose a complementary tool using float to float comparisons. This will be useful in areas with few CTDs or in areas of large temporal variations and can be applied in near-real time. This is an adaptation of the OW method.

The process uses 3 times the spatial correlation scale, mapping on spatial scales first, then remapping on the temporal correlation scale. It then does a comparison and suggests a correction. The software uses ARIVO climatology as background.

They have generated a new reference data base containing all data with quality 1 OR adjusted fields, eliminating gray-listed or suspicious floats. They remove the climatology from each profile, then use optimal interpolation and then do a calibration of each profile using the deepest layers only because these are least variable

The process uses only profiles that have anomalies < 3 x std for more than half their values. It incorporate sea level anomalies by removing profiles that differ by more than 20 cm from altimeter data. The mapping scale is 4deg long, 2 deg lat and 1 month.

Results are comparable to the OW method. Adding altimetry improves the results, making them less noisy. To test, they ran the N Atlantic floats and plotted their results vs. OW results.   This procedure seems to work best at high latitudes which may be because these are areas of less natural variability. But there is one region that gives fresher results by ~0.02psu. The reason for this is unclear – could be because the CTD reference database is older than the floats being run and an Argo based reference database would give different results. Or it could be that there has been a real change in water mass properties in the region.

In summary, this method works well generally and detects sensor drifts. They now need to extend this to marginal seas and run every 3 months. They also need to check bits that don't seem to work.

One caution – you must be careful in selection of the climatological inputs to prevent spurious bias to a climate signal as a result of unidentified bad floats. But if you use only DM best quality floats, there are too few to run tests. It was recommended that we need to be very cautious about this approach.

Goal is to identify drifts early and this might be good enough for that since the results are to be used as an indication ONLY. OW results have not been QC'd and they're sometimes strange. They don't do a calibration step which might help avoid this?

Birgit Klein: Results in the area of Mediterranean water show that it's hard to get consistency in results because of variability depending on exactly where you are (in or out of the Mediterranean water). You need to know where you are which can determine which reference database is best and this cannot be done automatically. Is best to restrict reference levels to those not in Mediterranean water and you must be very careful to choose right reference profiles because even deep levels can be in different water masses. This comes down to regional expertise and cooperation between experts.

She emphasized that this is near-real time, designed to get early warning of potential drifts, NOT DMQC. This could actually help with DMQC when OW doesn't seem to work. Additional information is always useful.

When other groups were asked about their activities in this area, India noted that they are creating area-clusters of similar properties and then screening profiles against the area in which they fit.

Brian made the point that we need analyses that separate platform types, etc.   This information is usually listed but the analysis is not done systematically.   Is this a regional centre issue or more a global issue? In any case, it's not done yet. EuroArgo has

developed some of these tools but they are not completed yet and are not at the stage of sharing data. This method would have discovered solo problem much earlier, for instance. Sufficient climatologies from buddy Argo, however, are hard to find or identify. In most cases, differences are so small that there would be too few to draw conclusions.

Deployment planning (Birgit Klein - Suncke)

EuroArgo is working to develop tools to help you know where to put your floats, starting from percentage coverage maps (density) and float age distributions. This then needs to be adjusted by temporal and spatial scales of individual squares or locations. Both influence where best to deploy floats.   They also include spatial and temporal variability in where the floats are EXPECTED to move. This will be an addition to existing tools that demonstrate gaps. It is a Matlab program which can automatically acquire latest data/locations, starting from an f/H weighted mapping of density and age and includes indications of where floats will move from present positions. Several mapping schemes are available, including streamlines following weighted mappings of density and age, and/or climatologically isopycnal weighted mapping of density and age. It is a GUI so you can play with weighting and can change the cut-off radius. It outputs maps as jpg or pdf. You can also add virtual floats to check the impact of deployments with the ability to map 1 year in advance (first steps only). The program can compare maps with any other map, use mean displacements, and aims to give recommendations as to float deployments. What other parameters would be useful???

Useful additions:
Ice edge for SO floats.
Data quality of existing floats (so can replace bad floats).

When? The GUI should be ready by the end of October. They plan to make a beta version available. Mapping on f/H ready now with isopycnal weighting, then the next step will be including virtual floats. This is meant as a guidance tool only but will be an improvement on current tools.

Jim Potemra would like to include this in planning for proposed cruises. It would be helpful if you could overlay cruise tracks to help you know where the floats are likely to go. It is planned for AIC to work on this and will help in DBCP (Drifting Buoy) planning as well. But to do this, we need coordination of ship information – how? Hester Viola and Steve Diggs are working on cruise lists to allow better planning. JCOMMOPS will be active in this. POGO cruises seem particularly difficult to incorporate. Plans from ship operators are too terse without sufficient information for planning Argo deployments. The US is doing it right and allows overlay of density maps with cruise tracks. Web site is:
http://strs.unols.org/public/search/diu_all_schedules.aspx
 - Contact Elizabeth Caporelli at WHOI - ecaporelli@whoi.edu   We also need to link to ship operators who don't routinely provide cruise info.

Mathieu suggests we need a deployment coordinator to identify and work with the ships to get up to date information and help with deployment planning. We don't currently have someone to perform this task. Personal contacts are critical.

Education and outreach (Dean Roemmich)

Dean Roemmich – Much more work needs to be done in the area of education and outreach. The potential for impact on the public is there but we're not taking advantage of it. This is important because it involves less developed countries in the data, not just Argo participants and first world country users. We need help from these smaller countries – access to EEZ, help with deployments, etc., so this is a practical action.

We do have an education program in development (Seread program), which is moving ahead slowly. Information on the program can be found at:
www.argo.ucsd.edu/Educational_Use.html

The Seread site provides power points, experiments etc. This helps South Pacific island nations with curriculum development and developed out of a meeting in Fiji that set the priority for science education as #1. The ocean plays an important role in these countries and so students have a natural interest in these subjects. Cook Islands are particularly active in this with training sessions, etc. Samoa is also involved but not as actively. The problem is that the intergovernmental agencies set it at high priority but educational ministries are less flexible and engaged in this and so they're slower to take it up.

There also are resource limitations in doing the educational development – who actually does this and who pays for this? Few resources are available. Other countries are also interested in Seread (Chile, e.g.) and it will be taken up elsewhere.

There have been regional workshops as well to get local interest in Argo and the use of the data, but not on large scale. Hosting scientists from these countries at larger institutions is also limited in impact.

There is a prerequisite that we develop the right tools to allow access and viewing of the data. Data in the GDACs is not really available in a useful way to non-scientific users (school kids, etc.). We need data viewers that allow untrained people to gain useful access to the data.

The real challenge is to get Argo recognized by the people on the ground. Media? Grass roots? AOML does more people to people contact with scientific staff – hands on is more interesting to people than just dry scientific talks. They have also held deployment workshops. Africa is particularly interested when the effort is made to communicate Argo issues to the locals.

One example of successful outreach is that the US navy has rescued 5 floats from Kenya after 5 years and got them deployed and the US Navy has good funding for training and expansion in African countries.

Workshops to date have been only in English speaking countries – they are now working on French speaking countries. There is huge interest. People want access and tools for data mainly, not instrumentation. IRD has a formal training program with countries in the region. Local facilities are often excellent if we can only get the information to them. It is critical that there be one person per computer during training. This engages people most.

Now we need to build on what has been done to grow an Argo training package. This should include education targeting students, workshops targeting meteorologists, fisheries managers, local educators, and other professionals in the area. Educating the general public is another issue.

Jim Potemra pointed out that Hawaii works through the local museum who now have an exhibit about ocean science. The general public is getting engaged and is surprised that so little is known to date about the ocean. Education outreach can be linked to the ocean observing systems as well. There is no central coordinator for education outreach at this point.

Action item for ARCS – have list of education outreach activities in each region and then have centrally located summary of these.

Sylvie and Brian added that the UK has a good site for outreach which is part of EuroArgo. This site provides sample floats, viewing tools, with Google earth tools, though it is still under development. It also includes films of float testing, deployments, with specific examples and explanation of float data/etc. They plan to link it with Argo/AIC web site. Euro Argo is also doing film for Argo outreach which will be made available through the AIC in French and English. Web site : http://www.noc.soton.ac.uk/o4s/euroargo/

Mathieu is also working to develop wider access.

Dean makes the point that tools need to be integrated with the curriculum, though tools visible outside are good as well. This is a more restricted activity and not as interesting in some respects but reaches all students, not just those with the greatest interest who will go online to see the better sites.

Claudia mentioned that their Ghana training presentations are on line and the Nigerian presentations will also be put on line (http://www.aoml.noaa.gov/phod/sardac/, Nigeria is still under "new", Ghana is under "training & education").

It is also useful for scientists to go to local universities to give presentations when Research ships arrive in a foreign port. This is a very good idea. Argo has a person in the S Pacific with the job of outreach and education. We need local contacts and this can be more difficult – we can use embassies can make initial contact.

We can also use other programs to guide us such as the TAO site. The AOML display is good example of how to communicate impact of Argo. Communicators can also play role and which gets public recognition for the program.

Even Wikepedia can also be useful and but it needs to be updated and kept current. All of us should take responsibility for maintaining this.

Finally, Seread and the Pacific marine atlas help visualize data but the tools need to be good. Workshop participants are keen but want immediate access, not through complicated sites. Various packages are available and Claudia aimed to teach people to access data directly. Octave works best for different platforms, but you can't load netCDF files which is a real limitation. Need to be converted to ASCII and then they can be manipulated with Octave. On the other hand, this gives students more flexibility because they're not tied to the packages already developed. They want to know how to do it from the ground up, not just what's provided in most viewers.

Products: graphics and gridded data sets (Jim Potemra)

What is the role of regional centres in compiling data sets? Producing data products? Synthesis of data sets? Do we need coordination? What are the roles of the science team and ARCs?   Do we want the science team to evaluate products before release? Can they contribute to design? Provide suggestions as to useful products?

Further questions include: Who are the Argo users? How do they access data and from where, in what form? Who are accessing synthesis products? There is a user's register but it's voluntary. Some of this is available from Mark and Thierry for the GDACs.

What we need is:
1) to update the spreadsheet of Argo products
2) recommendations on coordination
3) to identify new products that are needed but lack resources.

The current spreadsheet has fewer product lists than the word table. This needs to be updated and we need to keep it updated.

Steve Petrowicz noted that there are examples from EEZ floats. Also, Peru wanted to use data to track ENSO but didn't know how. Data in ASCII format is also requested sometimes. Do we need a separation of products/table – assimilation? Gridded? Raw? Model outputs?
These are issues we should address.

APDRC products – List of what they produce grew from user requests. They grid the raw data daily (in various ways) and produce a nice web site for users to select what they wish to see. They even animate through depth (vertically).

Dean Roemmich would like to know what the role of the AST is expected to b.? Should they approve or vet the products? We need to beware of conflicting advice on different web sites as to trends and results. This will bite us. Validation is critical to show a united front with respect to Argo data but it could be seen as censorship or restricting conflicting viewpoints. It's a very sensitive area. We need to be careful what we endorse by putting links on our web site. This needs a lot more discussion.

A Disclaimer is an option. Maybe we provide links to products that are backed up by peer reviewed papers. Some are only technically reviewed but still reviewed. A statement might make it clear that we don't necessarily agree, endorse, or approve of the work. The upshot of Dean's comment is that we need a product review committee to assess all products before endorsement but this needs lots of energy and do we have that sort of resource available?

Such a committee could be useful because users could come to that group to provide requests or requirements. Claudia noted that real-time products are less contentious but they have been misused in the past in peer reviewed journals with real-time data assessing trends. But disclaimers are often ignored and publication pressure and quality of the data conspire against us when people want to work faster than delayed mode. This is a good point.

Michel Ollitrault & Jean-Philippe Rannou – **Argo displacements as products**.

There are 5000 floats in the Argo fleet with ~400K profiles. One of the aims of Argo was to provide information on deep displacements. This has been done by Hawaii - Lebedev et al 2007, but with errors. (YoMaHa'07 data). Michel et al have reprocessed the data to correct park pressures and create a clean dataset. They used the raw Argos messages creating the ANDRO database. They now intend to extend it to ALL of the data at the GDACs. AOML and JMA have given them access to their raw Argos data so they can do the processing themselves.

Michel and Jean-Philippe used measured park pressure, not from meta files. This is important for trajectories. They also excluded grounded floats. They are working now on AOML data, then JMA and Coriolis datasets. They expect to be finished by end of the year. So far, they have processed almost 3000 floats.

They have compared ANDRO to YoMaHa'09 data The main difference is that parking pressures in ANDRO are MEASURED for all but 29 floats. Grounded floats have been eliminated from ANDRO but not from YoMaHa. They also eliminated floats with bad pressure measurements (bad P sensor). And if T indicates that the float is not at the surface, then don't use park P.

Testing shows the two systems are comparable in N Atlantic but there are some areas of clear differences and they have recovered some data from some trajectories. But YoMaHa has improved since 2007, and there are fewer discrepancies between the data

sets. However, at the most common depth, 750 to 1250 m depth, there are still differences between the data sets.

Their plan is to improve ANDRO with better subsurface positions and estimates of diving. Generally instruments give good displacement data, but you must take account of the time on the surface before the float is seen by a satellite. A float can move quite a distance in that time.

If you have exact drift depths, then you can get subsurface displacements that are very good. Errors still need more examination and deep circulation is still a mystery – we need deeper floats. If they extend analysis to all DACs, they can extend dataset further by mid 2010.

Dean Roemmich asked if differences between float types can be quantified? Michel's impression is that PROVOR, Apex and SOLO floats work well but – the timing of the stages of the float cycle needs to be better documented/reported. We need exact TIMES of all stage starts and ends within the cycle. This isn't available currently for Apex floats generally. Rising times are an issue – is the cost of rising fast worth the extra accuracy generated? No one knows trajectory uncertainty associated with shear as the float rises. Most error is probably associated with shallower levels. Errors are estimated at 1cm/s and this is smaller than the error associated with not knowing exactly where the float surfaces.

Dean noted that there is a systematic error due to displacement during a float's rise and fall times. This error has received less attention than the error due to drift on the ocean surface. However, it is significant and will be different for different float designs having different rise/fall rates. How do design differences between types of floats impact accuracy of the data sets? This isn't just an issue for trajectories! For example there are differences in how floats sample their profiles - bin-averaging or spot sampling. The AST is an appropriate forum to discuss these issues but case studies are needed to illustrate differences between float types.

Communication and web interface (TBA = To Be Abandoned)

Dean gave a presentation on Argo words about uses of Argo data. The UCSD Argo page has a nice summary of how Argo has contributed to understanding various global issues, in the global change analysis section (http://www.argo.ucsd.edu/global_change_analysis.html)

These pages provide caveats about use of the data given only a 5 year dataset, including an example of two recently published papers that find substantially different trends in global mean steric height (http://www.argo.ucsd.edu/global_change_analysis.html). We should each read the "global change analysis" text to suggest improvements to the words or sections to ensure that it is aligned with our communities view generally. The caveat regarding trends in the 5-year dataset and the other "global change observations" sections

were put in place in response to questions from emails, blogs, and media being asked about what "Argo" thinks about the issues and how the data should be used.

Finally, there was discussion about ASCII file availability and it appears to be a non-issue with ASCII versions available from various sites.

Review of Action items from the 2nd ARC meeting in 2008

Issues discussed:
1. The utility of ARCs was discussed, and there was general agreement that ARCs are worthwhile.

2. The "essential" and "optional" tasks of regional centres were reviewed, and it was agreed that these are still appropriate. Perhaps one recommendation would be for each ARC to **specify a) who is responsible for each item, b) what resources are required, perhaps c) a time-line and/or plan for these**

3. Communication with PIs (or lack thereof) remains a concern

4. Resources continue to be a hurdle, both in terms of personnel and funding.

5. Steve Diggs discussed the CCHDO CTD program and stressed the need for communication between those organizing cruises and his program that will archive CTD data. Perhaps the ARCs can be the brokers for this?

6. Lot's of discussion on Argo products and product development. Do we want to include at some level, s/w support (e.g., providing input on things like ferret, JOA, etc.)?

7. There was a bit of discussion on co-ordination/dialogue between ARCs, product developers and DMQC operators. It was agreed that this would be a very useful thing.

8. Deployment planning

Action Items 1 - web interface:
1. add links to AIC on regional centre pages

2. share scripts that display data/products (netcdf/kml/gis translations)

Action Items 2 – products:
1. need to define precisely what we mean by Argo data products

2. need to come up with a useful, complete listing of product descriptors/qualifiers; this will be used to refine products table (table headings)

3. complete table; perhaps provide mechanism for update mechanisms; who to host this (maybe Megan can add its' information, see item 5.)?

4. how to coordinate product development; issues include referencing originator, regional/global, documentation, etc.

5. work with Megan on gridded products web catalogue

6. Provide uniform language for gridded data sets, e.g., "optimal interpolation" versus "objective analysis"

Action Items 3 – communication:
1. different ARCs seem to be doing this to varying degrees; individual ARCs may need to re-visit how work is communicated within each ARC

2. ARCs should try to provide points of contact to Steve Diggs and CCHDO for planned/performed cruises

3. problems found when qc'ing data (either through product development or otherwise) needs to get back to PIs. It was recommended that this be done via the AIC (i.e., send this back to Mathieu)

4. the next meeting will involve DMQC operators, perhaps devoting the majority of the meeting to developing a collaboration between these two groups (reference data sets, procedures, experiences, etc.)

Action Items 4 – education/outreach:
1. continue education, outreach activities (e.g. deployment and data acquisition training for African Nations)

2. need to promote Argo, demonstrate value of the program to regional communities/countries; do this through ARCs

3. Continue improvement of Argo Marine Atlas; perhaps use ARCs as method for distribution/user feedback

4. AST to display list of data viewers

Action Items – deployment planning:
1. Provide maps of float location, age, data quality (float quality)

2. Work on logistics (e.g., how to share information on potential deployment opportunities (AIC, BODC, JAMSTEC, AOML, Coriolis)