



*part of the integrated global observation strategy*



## **16th ARGO DATA MANAGEMENT MEETING**

**BERMUDA**

**4<sup>th</sup> November - 6<sup>th</sup> November 2015**

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## 1 **Objectives of the meeting**

The 16<sup>th</sup> ADMT meeting was hosted by BIOS and WHOI at BIOS, St Georges, Bermuda. It started at 9am on the 4<sup>th</sup> November and finished at 12h00 on the 6<sup>th</sup> November. 41 persons from 11 countries and 29 institutes participated in the meeting.

The objectives that had been fixed for the meeting were the following:

- *Review the actions decided at the 15th ADMT meeting to improve data formats and Bio-Argo data processing*
- *Feedback from monitoring the quality of Argo float data processing in Real time and Delayed mode*
- *Review Regional Argo Data Centre progress*
- *Report from 4th Bio-Argo Workshop*

Prof William B Curry, President and CEO of Bermuda Institute of Ocean Sciences welcomed the participants on behalf of BIOS. He provided some historical background on BIOS that was established as a hybrid USA and Bermuda institute with links with the UK. BIOS is well recognized for its long time series sampling at ‘Hydrostation S’ and is starting to work with autonomous platforms such as gliders as they are getting less ship time. Bermuda’s reef system is the farthest from the equator of anywhere on planet – and this reef system is stressed but interesting.

## 2 **Feedback from 15th AST meeting**

S Wijffels reported on some of the key goals and outcomes from the AST-16 meeting. Argo’s success has been due to its clear goals and focus, as well as broad community support and application across research and operational services. Some of the challenges Argo faces include work on the original goals while testing and discussing enhancements and changes to the Argo design.

While the number of operating floats is larger than our original target, most of these are pilots of enhancements. When coverage in the original mission areas is assessed, there remain areas of under-sampling such as the equatorial band (requires floats with short surface times), the South Atlantic and the Southern Ocean (45°S-60°S).

Two things are a threat to sustaining Argo coverage at the original design: flat or reduced funding in some of the major programs (US, Japan and Australia) and a degradation in global float performance. The reasons for the deterioration in float longevity and reliability are not clear, but reliability is very uneven across programs. This suggests that there might be benefit in some technical workshops on float technology to see if we can lift the average performance across all programs.

There are stresses on the data system but our priority is to meet the original goals. Decoupling Bio data from the Core data has helped.

A summary of the status of the various enhancements of Argo was given, and how they relate to various projects being run under the auspices of the Ocean Observing Panel for Physics (OOPC) such as the WBC project, TPOS2020, SOOS and DOOS. A key question is whether the enhancements to Argo will have the key elements needed for success, as identified by the US National Academy’s Decadal Survey of Ocean Science:

- Narrow, well-defined observational goals aimed at widely appreciated scientific and operational issues
- Broad international and multi-agency support based on meeting societal needs as well as science
- Tenacious championship within academia, industry and government agencies
- Commitment to publicly available data, which demands careful open data-quality control
- Sensors that are well matched to float capabilities and the demands of low-cost deployment

- Freedom for methods and technology to evolve, subject to clear performance requirements

### **1.1 Update on AST website**

M. Scanderbeg presented on updates done on the AST website that are of interest to the ADMT. Updates were made to the Data FAQ page including an explanation of how to include multiple profiles in a single V3 and V3.1 profile files. An FAQ was also added to explain the cycle timing variables that Argo would like each float to send back. There is both an html and a pdf version of this so it can be given to float vendors so new models and formats provide this timing data. A FAQ was also added to explain the VERTICAL\_SAMPLING\_SCHEME variable.

Several slides were presented on the Argo bibliography and Argo DOIs. Right now, only a handful of papers have cited an Argo DOI and one out of three papers using GDAC data have included either a DOI or the official Argo acknowledgement ([http://www.argo.ucsd.edu/Acknowledging\\_Argo.html](http://www.argo.ucsd.edu/Acknowledging_Argo.html)). There is a need to educate scientists on how to use the DOI. About a quarter of papers published using Argo data include an Argo PI as an author. Looking at where authors get their Argo data, about the same number of authors get their data from GDACs as from gridded fields. A smaller number use Argo data in the form of model outputs.

Additionally, M. Scanderbeg updated the Matlab routines to open profile files and trajectory files using Matlab2008b and higher. These versions of Matlab include native netcdf commands. Velocity products were added to the Gridded Fields page. The Data Viewers page was also updated to include the Coriolis data browser, the Coriolis individual float views and the Indian Ocean data viewer.

Finally, M. Scanderbeg suggested that we develop a statement to define what is required for data to become part of the Argo data stream on the GDACs. For example, we discussed the ideas that all data must be managed through time and must go through an Argo DAC and DM operator and national groups must agree to perpetual curation of this data, including DMQC. A working group comprised of both ADMT and AST members should be formed to refine this statement and present it at the AST-17 meeting.

**Action : provide a link from ADMT pages to Megan's Matlab routines and to the latest version of the BUFR converter (Thierry)**

**Action : GDAC with AIC to keeping track of V3.1 progress by adding version information to the detailed index files (Thierry, Mike, Mathieu)**

**Action : Working group to address issue of people wanting to put their floats into Argo. To be validated by AST (Dean, Susan, Steve, Brian, Sylvie, Breck, Annie, Megan)**

### **2.1 Proposal on a set of Metrics to Monitor Argo dataset**

Brian King presented two tables showing the size of adjustments made to PSAL and PRES in DMQC. Adjustments were estimated from examining floats with at least 5 DM profiles. Data were examined with PRES > 1000, PRES\_ADJUSTED\_QC = '1' or '2' and PSAL\_ADJUSTED\_QC = '1' or '2'. The dataset examined was a mirror downloaded on 22 May 2015, containing 11187 floats. PRES and PSAL adjustments reported (PSAL\_ADJUSTED – PSAL, PRES\_ADJUSTED - PRES) were the median of all levels between 1000 and 2000 dbar that satisfied the above criteria. The number of profiles examined was 691k, from 6739 useable floats. For example, floats for which all of the data were flagged worse than '2' (eg uncorrectable TNPD) were excluded from the analysis.

Adjustments were binned by year of float deployment. 2000-2005 (1752 floats), 2005-2010 (3278 floats), 2010 to 2015 (1709 floats available with DMQC).

The proportion of profiles with zero or small PSAL adjustment (-0.01 to 0.01) was 92% over the whole array, with 83%, 93% 98% in the three time bins.

For PRES (adjustments in the range -1 to 1 dbar), the numbers are 92% overall, and 74% 96% 97% in the three time bins.

The proportion of floats deployed since 2010 requiring small adjustments should be interpreted with caution. DMQC has not been performed on all floats deployed since 2010. It is possible that small or zero DMQC adjustments have been reported for ‘well-behaved’ floats, and that floats with larger adjustments are waiting in R or A mode for longer float time series to be available. In particular it would be unwise to assume that because better than 95% of recently deployed floats have completed DMQC with small or zero adjustment, there is therefore a suggestion that the recent R or A mode data are of comparable quality. Argo must still recommend that R and A mode data should be used only with great caution and awareness of possible errors or bias in data that have not had DMQC scrutiny.

It is clear however that the stability and performance of float sensors is improving through the program.

**Action: Revise the set of metrics proposed by Mathieu and Brian**

## 2.2 *Delivering data from new sensors*

A short discussion on the use of novel or untested CTDs was lead by Wijffels. The need to do independent field tests of the accuracy and error characteristic of new CTDs in Argo was recognised, so that we can ensure that Argo’s data quality standards can be met by that sensor. We cannot take the manufacturer’s word on accuracy and performance, and simply start deploying these in Argo. Testing of both the SBE61 and RBR CTD are in train, and we need to encourage these activities and report their results back to AST/ADMT.

It was recommended to put a flag of 2 and 3 on such data if they go into the data system because of national requirements and the Steering Team will assess any request to distribute this data through the GDACs. However data acquired without adequate engineering experience generally shouldn’t be in the Argo data system. This recommendation is linked to the statement “What is an Argo float”.

## 2.3 *“SIO Experience with 1dBar CTD Shutoff at the End of Profiling”*

Scripps Iridium floats measure pressure, temperature, and salinity using a pumped CTD up to 1dBar, which differs from most other float groups/types that shutoff the CTD sampling at 5dBar. Over years 2010-2013, DMQC processing has identified and corrected salinity drift in these Iridium floats at a similar frequency of occurrence as concurrent SIO Argos equipped floats (sampled up to 5dBar pressure). Thus the sampling to 1dBar through a pumped CTD has not degraded conductivity cell sensor performance.

Over 14,000 profiles of this SOLOII near-surface data (PRES, TEMP, PSAL, 1-5dbar) has passed through DMQC. In the average, 1dBar data is warmer (saltier) than 5dBar data by 0.04°C (0.003psu). The extreme '5dBar-1dBar' differences are clustered in the equatorial region as would be expected. It also shows that this is signal, not noise. A couple of examples were shown. Additional insight will be gained by comparing the near-surface float data to ocean surface temperature and salinity satellite data, as well as sea state estimates.

## 3 Feedback from 4<sup>th</sup> BIO-Argo Workshop

The Bio Argo meeting has begun with a feedback from all the DACs in charge of Bio floats. There is a clear need to foster communication between DACs to help in setting up the processing and the RTQC procedures. Some test cases should be set up to test all results obtained by different DACs and compare them for consistency.

The documentation for the processing at the DAC level of several variables (DOXY, CHLA, BBP) are available on the ADMT website; some documents describing the RTQC are in revision (BBP, CHLA, DOXY), but will be soon available. Some metadata will be added (ex: to describe the length of the stick for DOXY, as well as distance between sensors such as NITRATE and the CTD)..

Regarding DOXY, the SCOR WG 142 recommendations to perform in air measurements to study the sensor drift is adopted. These measurements will be stored in the trajectory file under a new measurement code and missing parameters will be defined in the Table 3 of the Argo user's manual.

Regarding radiometry, the presented RTQC will be adapted to follow the philosophy of the QC flags (no QC=4 for cloudy profiles).

Some issues about the calibration of the Chlorophyll-A sensor have been presented; a meeting will take place in Villefranche in December with the manufacturer to discuss a solution. The deep fluorescence signal will also be taken into account either in RT or in DM.

Some variables, such as pH, remain without a data management plan and these need to be addressed as well. The Bio groups also need to compare results from different DACs to ensure consistency.

A general discussion with Core Argo DM operators occurred. For Bio-Argo, different experts for each variable might be required while a single contact point to collect the DMQC corrections and put them into the Netcdf file would be the best configuration. Tools would need to be modular and use the same framework. At present it appears that we need to clearly define what is relevant for RTQC and for DMQC.

A meeting will take place in Villefranche in January 2016 to plan a global Bio Geochemical Argo network.

## **4 Status of Argo Program and link with Users**

### **4.1 Review of the Actions from last ADMT**

Sylvie Pouliquen reviewed the status of the action items from ADMT15. At ADMT15 it was decided to identify the high priority actions from routine and low priority ones. It has also been agreed to organize phone meetings (one in February, one in June) to better monitor progress and identify earlier when issues block progress. The February meeting focused on the high priority issues and the ones due for AST, no June meeting were organized. This has proven to be an efficient way of functioning and all DACs agreed to work the same way next year. Some DACs have been difficult to reach and an updated list of DAC contacts was assembled at the meeting. The status of the actions is:

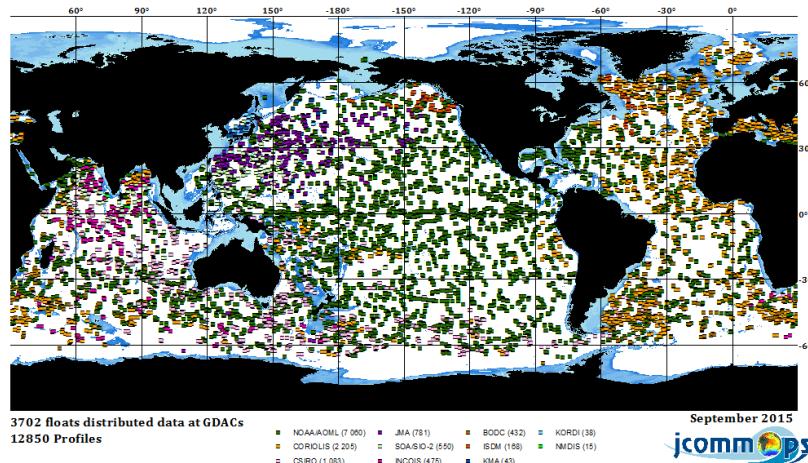
- High: among the 6 actions decided 4 were done and 2 were partially done. These are linked to V3.1 format implementation which was harder than planned to implement
- Routine: Among the 25 actions 14 were done, 9 partially, 1 cancelled , 1 postponed after ADMT16
- Low: The low priority action is postponed

See complete status in Annex 3.

### **4.2 Argo Status and AIC development**

M. Belbeoch reported on the status of the Argo program. He recalled first the recent achievement for the JCOMMOPS office, with a successful re-localization in Ifremer/Brest, increased means and staff, and upcoming exciting web development to monitor the sustained elements of the GOOS. Based on AST feedback, the number of active floats (sending a pulse within 30 days) will no longer be the primary metric for the Argo status, and will be replaced by the operational floats (active and sending data). Hence 3702 distinct floats sent data to the GDACs in September 2015. He explained however that about 4000 units were active and reminded data managers to process pending floats.

He demonstrated, as well, the fact that Argo was not over sampling as only 3200 units were operational in the core array. He recalled the envisioned expansions for Argo (high latitudes, equatorial, WBC, marginal seas, deep , bio) and remarked that not enough national funding was in sight for these expansions, which would require moving, in theory, the target to about 6000 floats.



He presented a set of performance indicators for Argo and recalled the JCOMM requirements to harmonize these indicators across all networks.

Category	Indicator		Method	Target	Note
<b>STATUS</b>	Activity	108%	Nb Active units vs target	3200	3473/3918
	Operationality	100%	Nb Active units vs target, sending good data	3200	3200/3700
	Intensity	89%	Nb Deployed over last 12 months vs target	800 ? for the core array	715/1027units
	Density	56%	% of 6x6 well sampled	Certainly not 100 %	To refine metric
<b>DATA</b>	Delivery	90%, 95%	Nb of platforms distributing data vs registered	GTS , GDACs 100%, 100%	3520/3918, 3749/3918
	Quality	93%, 88% (A) 96% (A or B)	% Profile with « good » data		TEMP, PSAL 3rd Quarter
	DM Processing	70%	Ratio DM/DM Eligible	100%	As of 01/10/2015
	Timeliness	89% (GTS) 81% (GDACs)	Nb Obs. < 24h vs Total Obs.	100%, 100%	September
	Delays	7h, 25h (GTS) 11h, 35h (GDACs)	Median , Average Delay	24h	September
<b>INSTRUMENTATION</b>	Reliability	85%	Average age of latest dead floats	1500 days	1281 days 3rd quarter
	Half-life	91%	% surviving 750 days	100%	901/985 Deployed [T-1115;T-750]

He recalled the importance of planning organization and showed the different tools available to facilitate platform operators' work.

In particular he advised all groups to maintain a unique text file of deployment plans on a yearly basis including core metadata:

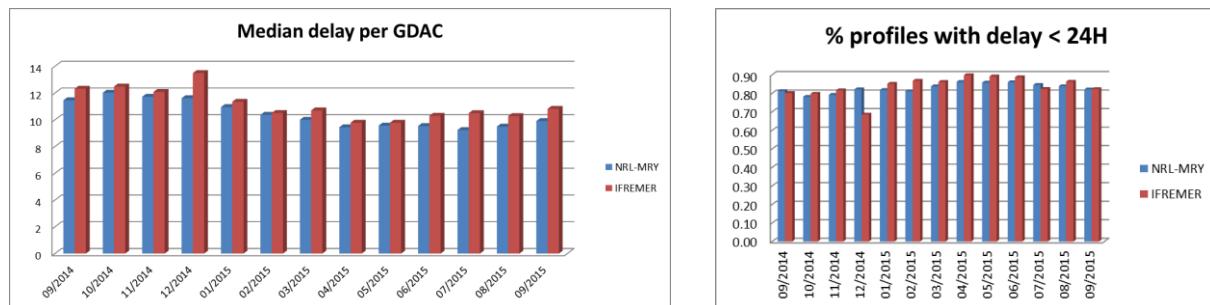
**ID;WMO;LAT;LON;DATE;SHIP,CRUISE**

He mentioned that finally a unique ship identifier was available (ICES code, 4-6 digits), thanks to a cooperation between JCOMMOPS and ICES/BODC/Seadatanet. He pressed the ADMT to include this in the metadata files by introducing a new **DEPLOYMENT\_PLATFORM\_ID** entry. ADMT agreed to use this as “desirable metadata”.

He proposed to share most of the key metadata reference tables through an API. This will make updating them easier and faster.

He questioned the ADMT on the need to define precisely a “good profile” so that a proper performance indicator can be built.

He presented then the delays for all DACs, at both GDACs, and noted that of 80% of profile were reaching GDACs in 24h. Some additional progress could be made if a few DACs could improve their data flow efficiency.



He agreed that there was a need for clearly defining what is an Argo float and to work on this definition with an AST working group. He proposed however to add some metadata or a new directory at GDAC to allow the sharing of these non-Argo floats data though our data flow, but outside from users direct access so that i) Argo dataset quality is preserved and ii) interoperability is allowed for validation, monitoring and transparency.

He concluded by recalling Argo’s strengths and challenges, and said that Argo will probably reach a top in 2015 early 2016, but a degradation of the array in the next year is anticipated due to decreased or flat national funding for key Argo implementers. This will unfortunately not be compensated for because of slow progress in float technology improvements that result in greater longevity.

M. Belbeoch reported as well on DMQC processing status, identifying volunteers for floats that do not currently appear to have a DMQC operator.

All agreed the STANDARD\_FORMAT\_ID was impossible to maintain efficiently without manufacturers proactive involvement.

**Action from ADMT15: AIC to make the link with the Centers that are integrating and redistributing Argo data and be sure they use our adjusted data, use the flags, and report to ADMT**

#### 4.3 New JCOMMOPS/AIC WWW Site

Anthonin Lizé reported on behalf of JCOMMOPS team about their progress on the new website development.

Several websites are currently running and are maintained by the JCOMMOPS team: JCOMMOPS, Argo, DBCP, SOT, OceanSITES, GO-SHIP and GLOSS. These websites are completely different (except maybe for Argo and JCOMMOPS) and need harmonization.

Besides, JCOMMOPS wants something designed for a long term perspective: something modular, integrating all networks monitored by JCOMMOPS.

This new website will include, amongst others, the following features:

- Platform metadata inspection (query, metadata grid);
- Display dynamic map with a GIS interface;

- Do spatial operations through this GIS interface (like spatial intersection), enabling for instance the user to monitor the platforms entering in a specific EEZ;
- Registering platforms and cruises.
- Network performance indicators, and statistics

The tools developed to monitor dataflow were presented as well as some new suggestions.

JCOMMOPS is also working (through a subcontracted company) on a mobile application which features:

- Disconnected/Connected mode;
- Network status checking through a map;
- Register deployment/retrieval/cruise;
- Photo upload;
- Data submission from 3<sup>rd</sup> party ships.

JCOMMOPS also presented the review process for the new website, which will start soon with a few key testers, to adjust functionalities to the community needs. Website is to be finalized (and not debugged) by the community so that offers the required monitoring tools and performance metrics.

Eventually, JCOMMOPS reported on what are the tasks that still need to be done before the website launch.



## **5 Real Time Data Management**

### **5.1 GTS status**

MEDS, a group in the Canadian Oceans Science Branch formerly known as ISDM, routinely collects data on the GTS. MEDS also receives daily files of ASCII GTS data (i.e. TESAC format) collected at Japan, USA and Germany GTS nodes. For BUFR data, we only have a copy of data from Japan. Between Nov 2014 and October 2015, on average we collected 12074 and 8630 TESAC and BUFR messages per month, respectively. On average, 90% of data reached the GTS within 24 hours of the

float surfacing time. The table below summarized the yearly average of TESAC and BUFR messages received from each bulletin header and their timeliness

Bulletin Header	# TESAC messages per month	% TESAC met 24 hours target	# BUFR messages per month	% BUFR met 24 hours target
AMMC (Australia)	1025	91.50	969	84.99
CWOW (Canada)	158	88.80	136	79.13
DEMS (India)	281	40.96	29	1.92
EGGR (UK)	474	88.58	334	33.76
KWBC (USA)	6163	94.79	5670	92.48
LFPW (Coriolis-France)	2697	78.92	367	90.45
LFVW (CLS-France)	223	97.96	454	97.24
RJTD (Japan)	849	91.25	446	90.66
RKSL (Korea)	205	97.51	222	100.00
TOTAL	12074	89.20	8630	88.95

BUFR data accuracy content was checked against the profile NetCDF files on that floats reported on September 30 and Oct 19, 2015; some following discrepancies were found:

- Missing pressure levels in BUFR message
- Mismatches between observation date (sequence 0 04 001 to 0 04 005) in BUFR messages and JULD in NetCDF profile file
- Some BUFR message contained PRES data instead of PRES\_ADJUSTED data when the data mode is "A"

#### *Actions*

- *Put in the report the version of the official BUFR conversion tools and also put them on the ADMT www site Action TC / Wataru*
- *On one or two days track at all DACs what BUFR messages they issued , and monitor this at available GTS nodes to track where possible losses are occurring ( Mark/Godae, J Turton/MetOffice, Anh/ISDM, MetOffice).*

## 5.2 Status of profile anomalies at GDAC

On behalf of Christine Coatanoan, T. Carval reported on the anomalies detected on GDAC. On a daily basis, an objective analysis is passed over all in-situ temperature and salinity observations aggregated by Coriolis. A series of alerts are raised on atypical observations. Each profile on alert is scrutinized by a Coriolis operator with Scoop (a visual quality control tool). If the operator changes the flags on a profile, an alert record is created. For each DAC, the list of alerts is sent by email to the DAC contact point. DAC's contact points are invited to check whether their email address is correct. If the DAC contact agrees with the flag changes, he should change these flags on the data files, then resubmit the files. If the DAC does not agree with the changes, he should send an email to codac@ifremer.fr. In May 2015, the alerts controls became stricter, as the objective analysis error called "spike/offset climatology" was implemented (previously ignored). About 100 profiles a month are reported as bad to DACs.

A study on the implementation of density test by DACs was performed. Incorrect implementation was found on some profiles of some DACs. But the differences were minor. Some bad data are not correctly detected with the real-time QC tests. But there is no obvious solution to improve the real-time QC: an automatic test cannot detect some atypical errors.

A few DACs perform real-time adjustments, without filling <param>\_adjusted and <param>\_adjusted\_error. This situation should be corrected.

TC explained the procedure, the contact list where the anomalies are sent and feedback per DAC . The situation is pretty stable.

There are RTQC differences between AOML, or JMA and BODC and Coriolis but these were not significant. Some bad data could not be caught by the Climatological test (so it is better to push for the min/max test).

Christine has a report on these anomalies which can be distributed. She will continue quarterly analyses.

### **5.3 Status of anomalies detected with Altimetry**

The Altimetry check has been performed every four months again this year and automatic emails have been sent through the AIC database to the PI, DM-operator and DAC responsible for the extracted floats. 118 floats are currently on the list. Only 16 feedbacks have been provided until now. DACs, PIs and DM-operators are requested to feedback on the anomalies detected. They are also requested to correct flags or put sensor on the grey list to stop the RT distribution of the bad data extracted for future profiles.

The General quality of the Argo dataset was presented and showed stable statistics compared to last year. 1 103 189 Argo profiles with QC fields at '1' show very good agreement with collocated satellite altimeter observations with a correlation of 0.80 and rms difference of 24.8 % of the altimeter signal variance.

Order of magnitude of delayed time adjustments (PSAL & PRES) as a function of cycle number or float age has been studied and show also stable results compared to last year's analysis. Most of the floats (> 90%) have had a salinity corrected by 0.02 psu or less and a pressure corrected by 5 dbar or less after 200 cycles (or 2000 days).

An inventory has also been performed on quality flags values and show that 0.8% of Argo profiles do not have a valid date or position (i.e. JULD\_QC and POSITION\_QC ≠ '0', '1', '5' or '8'). The inventory also show that 15.14% of Argo profiles do not even have a valid PRES/TEMP/PSLA triplet (defined as PRES\_QC='0' or '1' and TEMP\_QC='1' and PSAL\_QC='1').

Results have been gathered in the following report: <ftp://ftp.cls.fr/oceano/coriolis/argo/CLS-DOS-15-0245-GeneralQualityOfArgo.pdf>.

The number of feedbacks is increasing but this may link to the increase of the network. A lot of floats only have one profile problematic. She reminded DACs that the floats which have significant dubious profiles should be on a priority list for DMQC and in the meantime, these should be put on the greylst.

Stephanie is issuing a document of general quality compared to Altimetry that can be used by Argo operators.

### **5.4 Status of density test implementation**

An audit of the implementation of the density test was again undertaken to assess our progress in c-standardizing its application. Files containin a list of all profiles that failed this audit for each dac (files are listed by DAC) are available at:

<ftp://ftp.marine.csiro.au>

login anonymous

cd pub/gronell/argo

Results this year are slightly better than last year with very few R files (generated within the last 90 days) failing. There are still a significant number of D files which fail and some of these appear to be the same files which failed last year. These should be assessed by the DMQC operator. If the density inversions are judged to be real, then please provide Ann ([ann.thresher@csiro.au](mailto:ann.thresher@csiro.au)) with a list and they will be added to a file of exclusions and not checked again during the next audit.

**It is clear that we need a plan to deal with profiles that consistently fail various tests yet are never checked or corrected by the DACs. This will need to be discussed further at AST. If we don't take action, then the Argo data stream is impacted because it holds and serves known (or strongly suspected) bad data.**

## 5.5 Near surface SST measurement RTQC implementation at DACs

Near surface data are collected by a subset of the Argo array with models including:

- Solo II - Sample every 1dbar until 1dbar with pumped PSAL and TEMP, included in primary profile
- Provor - Un-pumped primary CTD samples at 5 dbar
- APEX - Un-pumped TEMP data to within 1 dBar of surface or an auxiliary STS sensor
- NOVA - Un-pumped shallow primary CTD samples at < 5 dbar

Additional BUFR sequences to allow for the transmission of secondary temperature (3-06-017), temperature and salinity (3-06-018) profiles to the GTS have been successfully validated and given “Pre-Operational” status from November 2015 by the WMO IPET-DRMM. The sequences are described in [http://www.argo.ucsd.edu/AST16\\_BUFR.pdf](http://www.argo.ucsd.edu/AST16_BUFR.pdf). The next version of the JMA BUFR conversion tool will be able to produce these BUFR messages (contact Wataru Ito).

The status of implementation is summarized in the following table

Group	Implementation of RTQC	Delivery of data
AOML	AOML : RTQC applied UW floats: RTQC applied SIO SOLO2 floats: No RTQC but DMODE applied.	AOML - Data included in version 3.0 files UW floats: Data in V3.1 NetCDF produced by UW SIO SOLO2 floats: As secondary profile in DMODE (as not decoded by AOML)
BODC	Tests coded, implementation pending	Pending, V3 core mission data is the priority, progress required for BoBBLE experiment in spring 2016
IFREMER	PROVOR floats and a few APEX, unpumped data flagged '4'	NST profiles are stored in a specific profile, whose vertical sampling scheme starts with “Near-surface sampling”. We apply test #21 and #22 on all profiles whose VSS starts with “Near-surface sampling”.
INCOIS	Near surface tests not implemented yet.	NST data split to primary and secondary profile, to be delivered with version 3.
MEDS	Near surface data from NOVA floats flagged 4	Delivered in core profile netcdf
JMA	Development on-going	Data to be delivered with the move to V3.1

## **5.1 Progress on Citation Index for Argo Data**

Work on the citation of dynamic data is an on-going activity in many observing programmes. The Research Data Alliance (RDA) recently published recommendations for future data services (<https://www2.rd-alliance.org/group/data-citation-wg/post/rda-wgdc-revised-version-recommendations-making-data-citeable-published> ). However, this recommendation is not possible without significant GDAC enhancement so the goal continues to be the single DOI as previously proposed and of the format:

[http://dx.doi.org/10.\[NCEI/Ifremer\\_REF\]/\[Argo\\_accession\\_DOI\]?\[time\\_slice\\_information\]](http://dx.doi.org/10.[NCEI/Ifremer_REF]/[Argo_accession_DOI]?[time_slice_information])

This approach has not been ratified at DataCite/CrossRef level so use of ? Or # unclear (one evaluates the query server side and the other client side so it is a fundamental choice). A small grant proposal to seek DataCite/CrossRef ratification and implementation at Ifremer just been submitted to the RDA.

## **5.2 • QC Manual issues**

In 2004, the real-time qc manual (by Bob Keeley & Thierry) and the delayed-mode qc manual (by Annie) were merged to create the Argo QC Manual. It is now 11 years old and needs to be remodelled to reflect the growing complexity in Argo. Therefore the QC Manual will hereafter be split into 2 manuals:

- Argo QC Manual for CTD and Trajectory data, maintained by Annie;
- Argo QC Manual for Biogeochemical data, maintained by Catherine.

In addition, Annie will re-write the Impossible Date Test to test for JULD instead of day, month, year. Lastly, it was re-iterated that the interim RTQC flag scheme for Deep Argo data should continue as an interim provision for at least another year.

## **6 Reference database**

### **6.1 Summary of the actions since ADMT-15**

On behalf of Christine Coatanoan, T. Carval reported on the reference database. The last version was delivered in December 2014: CTD\_for\_DMQC\_2014V01.tar.gz . It features additional visual quality controls (checking deep water) on boxes of the area 1. It also includes the addition of a series of cruises downloaded from CCHDO web site. The visual inspection is necessary to remove bad profiles from the reference data base.

In May 2015, Coriolis used the CCHDO API to download a series of 450 cruises that are not present in the reference database. To ingest theses cruises in the reference data base, we want to identify the vessels with their ICES codes. The 4 first letters of the expocode contains the NODC code of the cruise vessels. With support from JCOMOPS and ICES, we shall find the ICES codes of those vessels. This action is ongoing. The CTD data should be ingested by the end of 2015.

In May 2015, 5246 CTD profiles from NCEI Ocean Climate Library were added to the reference database.

It was agreed that for each CTD, the reference database will provide the origin of the file. There is a strong need to discriminate high quality CTDs with a known error on measurements from the CTDs with an unknown quality.

**Action: Provide feedback on rejected CTD back to CDHDO and NCEI**

**Action : Screen Argo reference dataset contents to assess data or originator quality issues based on Christine's QC of the dataset. Exclude "bad" quality providers.**

**Action: Label the source in the REF DB to facilitate identification of high quality data..**

## 6.2 CCHDO/US-NODC-progress (Steve Diggs)

Steve Diggs (CCHDO) updated the information from his AST-16 presentation earlier this year. In Brest, several issues were raised by the Coriolis personnel regarding the availability, format consistency and overall quality of CTD profiles provided by the CCHDO for the Argo CTD Reference Database.

At that time, the CCHDO presented a detailed plan as well as a schedule to resolve all of the issues prior to ADMT-16 in November. The temporary setbacks, which were initially raised in Ottawa at ADMT-15 last year, were due in large part to the fact that the CCHDO was in the midst of a long overdue internal redesign and retooling effort. Part of this retooling involved the creation of the CCHDO API

Issue	Problem caused	How it will be resolved	Deadline
CCHDO automatically assigns WOCE flag "2" (good). This practice was routine during the WOCE program.	Christine is forced to review every new profile CCHDO regardless of QC flag which causes delays in the processing and dissemination of the RefDB.	CCHDO will end this practice. No flags will be assigned to data that have not been quality controlled.	ADMT-16 (Nov 2015)
CCHDO's secure website for Argo proprietary CTD data was not routinely updated with NetCDF formatted file for ingestion by Coriolis.	The most recently acquired ship-based CTD profiles are not available to Coriolis.	CCHDO will provide an API for Coriolis (and others) which will allow downloads of NetCDF CTD files for any time period and users can specify that the transfer include the non-public data submitted only for inclusion in the RefDB.	July 2015
Non GO-SHIP data have not been through QC as CCHDO relies on provider's assessments of profile quality.	Coriolis personnel must QC each profile before inclusion in the RefDB, causing delays in processing.	Volunteer Oceanographers (Swift, Freeland) will review each profile in non GO-SHIP CTD datasets to assess overall profile quality for inclusion in the Argo RefDB.	ADMT-16

Each issue above was addressed and resolved earlier than expected. Coriolis personnel agreed that the overall situation has improved dramatically. In addition to the issues above, there was an update regarding how many ship-based CTD profiles have been made available to Coriolis for inclusion in the RefDB:

- CCHDO added 15 cruises /1384 profiles (Mar 2015 - Oct 2015)
- NCEI (NODC) added 2529 profiles, 1744 coming from CCHDO (Aug 2014 - Aug 2015)

There were discussions regarding how CCHDO received information about new cruises of interest from regional centers and others which may make it possible to acquire the early-release CTD data that the RefDB relies on. Setbacks and progress with this issue were reviewed.

## 7 GDAC Status

### 7.1 Operation status at US-GDAC and Coriolis-GDAC

As of October 22nd, 2015, the following shows the Argo footprint on the Coriolis and US GDACs

DAC	MetaData Files	Technical Files	Trajectory Files	Trajectory D-Mode	Trajectory Bio
AOML	5,692	5,492	6,765	1,274	0
BODC	505	488	420	0	0
Coriolis	2,165	2,161	2,234	0	158
CSIO	326	323	323	0	0
CSIRO	684	668	569	0	0
INCOIS	368	358	371	0	18
JMA	1,407	1,382	1,373	0	0
KMA	201	192	193	0	0
KORDI	119	115	119	0	0
MEDS	402	393	399	0	6
NMDIS	19	19	19	0	0
<b>Totals</b>	<b>11,888</b>	<b>11,591</b>	<b>12,785</b>	<b>1,274</b>	<b>182</b>

DAC	Profiles	Profiles D-Mode	Profiles Bio
AOML	791,909	533,876	10,498
BODC	52,792	31,221	0
Coriolis	197,627	120,786	20,915
CSIO	33,417	10,141	0
CSIRO	110,229	64,955	16,632
INCOIS	46,661	27,093	1,842
JMA	161,239	95,460	3,337
KMA	23,802	18,262	0
KORDI	15,944	0	0
MEDS	42,332	23,486	96
NMDIS	2,253	0	0
<b>Totals</b>	<b>1,478,205</b>	<b>925,280</b>	<b>53,320</b>

## 7.2 Coriolis GDAC report

T. Carval presented the status of operations on Coriolis GDAC. Once a day, monitoring statistics are updated on: [www.argodatamgt.org/Monitoring-at-GDAC](http://www.argodatamgt.org/Monitoring-at-GDAC). On November 28th, GDACs received data from 11 DACs

- The total number of NetCDF files on the GDAC/dac directory was 1 635 935 which represents an increase of 10% compared to 2014.
- The size of GDAC/dac directory was 126Gb
- The size of the GDAC directory was 462Gb

The number of profiles is heading toward 1.5 million while the number of delayed mode profiles is heading toward 1 million.

The transition from Argo format 2.\* and 3.0 toward format 3.1 is underway. On October 2015, the number of files in format version 3.1 reached and passed the 50% threshold. Statistics per DAC were shown. The files in format version V3.1 are much more homogeneous than their previous versions. The controls applied by the format checker on V3.1 is much more exhaustive. The controlled vocabulary listed in the 27 reference tables is used for V3.1 format checks.

The graphics show a fair increase of activity on the GDAC FTP in April 2015. This may be related to the Argo science team meeting event. The statistics do not show the activity on the GDAC http downloads. The monitoring should include the http downloads (on the US GDAC, they are more important than FTP downloads). Over the last 12 months, the weekly average performance was 99.84%. The 0.16% of poor performances represents 15 minutes for a week and the GDAC faced 3 outages in 2015.

GDAC hosts a grey list of the floats which are automatically flagged by automatic QC. The greylst has 1000 entries (October 29th 2015), compared to 1285 entries one year ago.

In July 2014 we opened a dedicated rsync server: <http://www.argodatamgt.org/Access-to-data/Argo-GDAC-synchronization-service>. It provides a synchronization service between the "dac" directory of the GDAC with a user mirror. The statistics on dac, geo and latest\_data directories shows that the vast majority of downloads are performed from the dac directory. However, a fair amount of downloads occur on the geo and latest\_data directories. The decision to remove these directories is cancelled.

### 7.3 US-GDAC GDAC report

Michael Frost presented the operational status of the US GDAC. Also presented were the status of the US GDAC action items from ADMT-15. The US GDAC hosts an anonymous FTP server that allows download of all available Argo data that it currently has. This includes the Argo aggregate files, as well as the raw NetCDF files that are received by the DACs. Additionally, the Argo index files are available for download as well. These index files are updated on the US GDAC approximately twice per hour. US GDAC FTP server: <ftp://usgodae.org/pub/outgoing/argo>

The US GDAC also hosts an apache webserver that allows the users to download Argo data via standard tools such as wget. Similar to the FTP server, all Argo data is available for download. In addition the US GDAC hosts the 'USGODAE Argo GDAC data browser' that allows for limited querying capabilities (time, area, dac, etc).

US GDAC HTTP server: <http://usgodae.org/pub/outgoing/argo>

Argo Data Browser: [http://usgodae.org/cgi-bin/argo\\_select.pl](http://usgodae.org/cgi-bin/argo_select.pl)

The US GDAC synchronizes with the French GDAC once per day at 1015 UTC. The process involves downloading all of the index files from the French GDAC and comparing them to the local US GDAC. After comparison, all necessary files are then downloaded and submitted normally into the US GDAC. The typical synchronization takes approximately 15 minutes to complete each day. However, there are times when it takes much longer and we need to investigate.

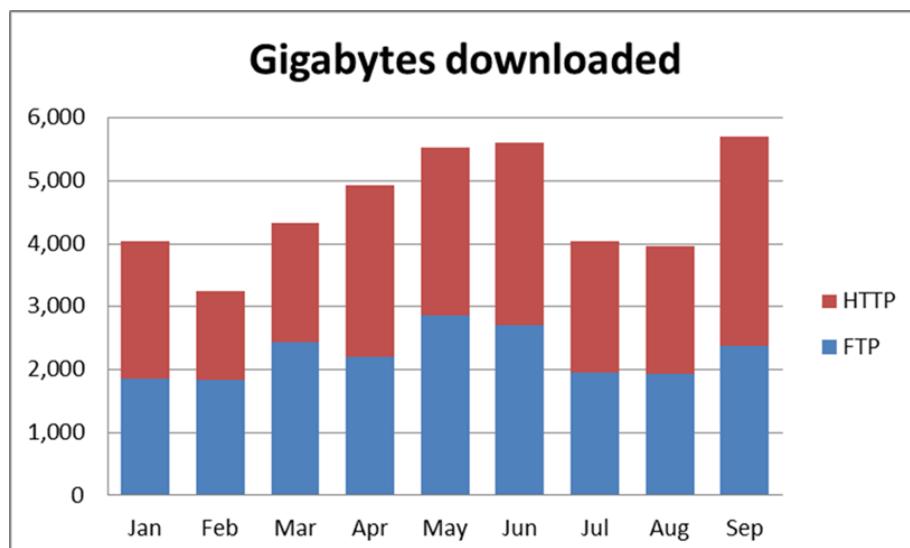


Figure 1: Statistics of Argo data usage

On October 18th, 2015 a massive power outage hit the Monterey area. This was caused by a fallen tower. Although the computer equipment fell back to a generator, the air conditioner did not. The computer lab containing the USGODAE started to overheat so all equipment was powered down until the electricity came back. This was approximately 10 hours of downtime.

#### **7.4 Status of File-Checker**

The new Argo FileChecker became operational at the two GDACs on 31 March 2015. The new FileChecker is a completely new system that adds internal data consistency checks (“data checks”) to the format checking that has always been performed. The data checks are only applied to v3.1 files. All files (all versions) are currently being format checked. The Meta-data files, Technical files, and Profile files are also being data checked at this time. Bio-profile files will be added to the data checking by the end of November 2015. Trajectory files are the next priority for data checking. The ADMT trajectory experts will continue to participate in the development of the specification for the checks and the approved checks will be implemented and tested. AST is a reasonable target for completion of this work.

**Action: GDAC with AIC to keeping track on V3.1 progress by adding version information to the detailed index files (Mike Thierry Mathieu)**

**Action: provide a link from ADMT pages to Megan’s Matlab routine and to latest version of BUFR converter (Thierry)**

**Action: Audit metadata config units against allowed tech units and see if there are any outliers, then negotiate to either add units or use an approved unit. (Mark Ann)**

**Action: For Tech file : generate warning when units of technical variables don’t match the type of the field (Mark)**

**Action: Check data-type consistency with File name and presence or not of adjusted-parameters and reject files that don’t match (Mark)**

**Action: Implement Check for Trajectory file against reference tables (like for profiles) when the discussion on the test to be done has reached concensus (Mark)**

**Action: Move Ref Table from Google doc to something that can be more easily be machine readable and define a workflow for the information to flow to the people responsible for a table as well as to the GDACs for implementation into the File Checker. (Mark Mathieu)**

**Action: Modify the file checker to generate warnings for non-standard data types (‘argo profile’ instead of ‘Argo profile’, etc...) in the files. After 6 months, make this a rejection. (Mark Thierry)**

#### **7.5 Status of the new GDAC Cookbook**

The GDAC cookbook was initiated in 2013. It describes the detailed implementation of the GDAC services. This document is important to ensure that both GDACs work with the same rules. The draft version contains the following entries:

- Greylist synchronization
- File removal operations
- Scheduled services time table
- Argo profile file merger
  - core-argo profiles merger
  - bio-argo profiles merger
  - m-profile merger

The Argo file checker has a documentation that is not yet finalized. After stabilization, it will be inserted as a new paragraph of the file checker section.

## **8 Technology development**

Mr. Lu Shaolei from CSIO introduced a new float—HM2000 and its data stream. The HM2000 float use the BEIDOU satellite System (BDS, which can provide two-way communication functions) to transfer the observation data. The BDS and GPS both are used to provide a location. The CTD sensor of the float is a SBE41CP. During Oct. 2014-Sep.2015, 9 HM2000 floats had been deployed; 5 of them in the Northwest Pacific ocean, and 4 in the South China sea. The float data are consistent with the historical data. 4 of them have WMO number and join in the China Argo equivalent project. In order to meet the requirement of Argo, CSIO have established an automatic data receiving and sharing system. The data after RTQC are shared on the CSIO website (<http://www.argo.org.cn>), and they also submit these BUFR data files to GTS through the China Meteorological Administration(CMA). Because the Argo reference tables don't have the parameter names relevant to the HM2000 float, the GDACs have rejected the submitted data from CSIO. CSIO hopes the GDAC could resolve metadata and parameter naming issues affecting the HM2000 data files as soon as possible, with the parameters provided by the HM2000 float added into the reference table in the Argo User Manual.

## **9 Format Issues**

### **9.1 Standard Format ID**

M. Scanderbeg reported on the results of the working group and its recommendations on the Standard Format ID. The original goal of the Standard Format ID was to group floats which are decoded similarly across DACs. This would help in the future if/when someone wants to re-decode the raw data. It was suggested that floats be split into two groups: one which are easier to assign a new Standard Format ID and one which are not. During discussion, it was noted that it is difficult to get some manufacturers on board with the idea of a Standard Format ID. Additionally, several DACs said they could not match floats to current Standard Format IDs. Therefore, it was decided to make the STANDARD\_FORMAT\_ID variable in the meta file optional. To preserve the ability to re-decode data in the future, DACs need to be archiving the raw float data and the manuals as well as filling in the DAC\_FORMAT\_ID. It was determined that this was the information necessary to be able to re-decode data in the future.

All DACS are either already doing this or will begin this task.

As part of this discussion, it was pointed out that the current system to update tables and get new variables implemented into the file checker is inefficient because it generally relies on one person creating a table and others putting it on line, then yet another set of people implementing the file checks. We need more than one person responsible for each table and task. They have been identified as follows:

Technical Parameter name and Units tables : Birgit Klein and Ann Thresher

Configuration parameter names : John Gilson and Esmee Van Wijk (core); Catherine Schmectig and Jean-Philippe Rannou (bio)

Argo Reference table: Thierry Carval and Mathieu Belbeoch

Standard Format table: Megan Scanderberg and Mathieu Belbeoch

Tables will be maintained on-line with permission required to edit them. These can then be ingested into the file checker more regularly. Email alerts will be generated when a change is made so anyone responsible for the next step is aware that action is needed.

- Upgrade to V3.1 Real-Time and historical T&S floats at GDAC

A census by DAC of the present state of the V2 to V3.1transition was performed on the USGODAE GDAC data downloaded October 28<sup>th</sup>, 2015. All major Argo file types were analyzed (R and D profile,

R and D trajectory, meta, and tech). Some file types have substantial amounts of V3.0 versions at the GDAC. Several DACs have completed the transition for certain file types. Several DACs have not sent any V3.1 files to the GDAC. Thus the results of the census varies widely by DAC. Detailed results can be found in the table.

DAC	Profile netCDF					
	R			D		
	V2	V3.0	V3.1	V2	V3.0	V3.1
AOML	113,282	145,332		214,342	3376	316,542
BODC	21,659			31,221		
CORIOLIS	70	27,744	47,134	81,177	12,624	24,869
CSIO	51	5916	17,392	10,141		
CSIRO		10	43,918	6434	1921	57,534
INCOIS	12,220	1783	5620	26,445		648
JMA	7490		58,458	258		95,202
KMA	5572			18,262		
KORDI	15950					
MEDS	7976	4423	6411	13,488	116	9950
NMDIS	440	2	1962			
Total	184,710	185,210	180,895	401,768	18037	504,745
Progress %		34%	33%		2%	55%

Key: DONE! Haven't Started!

DAC	Trajectory (Core and B) netCDF				Meta netCDF		Tech netCDF		
	R		D		V2	V3.1	V2	V3.0	
	V2	V3.1	V2	V3.1					
AOML	5481	14*			4306	1407	5453		
BODC	420				505		488		
CORIOLIS	1316	916			1400	766		1405	
CSIO	314	9				326	65		
CSIRO	194	375				684	9		
INCOIS	296	75			143	230	137		3
JMA	1373				31	1379	34		
KMA	193				201		192		
KORDI	119				119		115		
MEDS	304	95			25	377	1	320	
NMDIS	4	15			4	15	4		
Total	10014	1485			6734	5184	6498	1728	
Progress %	13%				43%			15%	

Key: DONE! Haven't Started!

Note: \*Mistakenly named

Each DAC then provided it's target to complete provision of R files in V3.3 and then D-Files as well as the help they would appreciate from other DACs. We will rerun this list before AST to monitor progress.

	V3.1	Target	Help needed
AOML	<p>R-Files: 60% of the core files are in 3.0 to keep O2. Some files are still version 2 and these are Argos floats. Argo equivalent floats are not being reprocessed Priority are Traj, Met, and Tech (almost done) into 3.1 Then will do Bio-Argo and Core transfer to V3.1</p> <p>D-Files: All of Scripps iridium D files are currently version 3.1. They will wait for Argos floats to die and then do the conversion during DM processing.</p> <p>WHOI : No V3.1 software yet</p> <p>UW almost done</p> <p>PMEL have started (10%)</p>	<p>Before AST17</p> <p>ADMT17</p> <p>July 2016</p>	<p>Conversion tools from others to update to version 3.1</p> <p>Will get CSIRO software for DMQC as soon as it is finished and debugged.</p>
BODC	<p>All of their files are currently version 2. Core R and D Files are being provided to the file checker for validation Meta and tech files require updating of some names Traj and Bio files will be done later.</p>	<p>Before AST17</p> <p>For ADMT17</p>	<p>They need the reference tables to be stable and have already gotten software from Ifremer</p>

	V3.1	Target	Help needed
CORIOLIS	<p>Started converting Bio Argo files. Remocean bio files are done.</p> <p>All Provor CTS3 floats have been re-decoded in Sep 2015. Previous versions were converted by adding missing information.</p> <p>Next step will be APEX Active floats which need to be re-decoded if necessary and merged with metadata information if not. Previous version will be converted . Then NEMO (redecoding for Birgit) and Navis and Nova</p> <p>They still need to provide some Prof, meta traj and tech files.</p>	Before AST17	Can provide Matlab tool to decode and to convert
CSIO	R file coding is nearly finished. Metadata and techfile coding is done and Traj files will be done next year. They need 3 month for D-profiles .	Before AST17	
CSIRO	R- Profiles are done. The D-Files will be done as DMQC is done Traj files in version 3.1 are produced for Argos floats and under way for iridium	Before AST17	
INCOIS	Plan to have R profiles converted by December and D files will then be converted from the R files They have tested the code for Argos traj files but will wait for CSIRO code before they produce iridium traj files.	By AST17	
JMA	R are nearly finished, as are most of the D-Files except for iridium with additional sensors Meta and Tech is almost there Traj remaining and they need help with this.	Before AST17	Trajectory files will be difficult because they have many types of floats. AOML will provide fortran tools
KMA	They don't yet have version 3.1 files but plan to finish all 4 files types within 2 months		
KORDI	KMA will check and let us know their status		

	V3.1	Target	Help needed
MEDS	<p>MEDS has finished coding for all 4 file types but not all files have been converted yet. R-Files will be done first.</p> <p>For old D-Files, they will need to redo DMQC</p> <p>Meta and Tech done</p> <p>Traj remains though they expect to finish this by AST.</p>	<p>Before AST17</p> <p>ADMT17</p> <p>Before AST17</p>	
NMDIS	R profiles are almost done and will take another 6 months to finish. D-Files will also require a further 6 months.	Before AST17	

## 9.2 Revisit Mandatory and desirable metadata list

A brief discussion of the configuration parameter table for meta files (spread sheet from Oct 15, 2015) was led by Claudia Schmid to clarify the meaning of column C. This column contains information on whether a parameter is mandatory, optional or 'mandatory if available'. This column is meant as guidance for the DACs and PIs. With respect to the GDAC file checker, the rule is that if a parameter is added to the configuration section it has to be listed in the configuration parameter table for meta files. Currently, the GDAC file checker does not contain criteria for the value of the configuration parameters.

## 10 Trajectory issues

M. Scanderbeg reported on some minor updates to the trajectory v3.1 format. In general, the trajectory v3.1 file format is set up to be very flexible and to easily accommodate the key cycle timing information needed to calculate velocities. The key cycle timing variables correspond to the major measurement codes of 100, 200, etc. A few new relative measurement codes were added in the past year. A new relative code was added for the standard deviation. Another code was necessary to allow for the pressure measured at the minimum and maximum temperatures during drift to be indicated. The measurement code for the minimum value is MC minus 3, or 297. The new relative code added was for supporting information for the minimum value and was set as MC minus 13, or 287. This makes it 'easy' to pick out the supporting information since the MC is 10 less than the original code. See the following chart for how this would work:

N_MEASUREMENT INDEX	MCODE	PRES	TEMP	PSAL	OTHERS
X	294 (Std Dev)	6.9	0.044		
X+1	296 (Avg)	1498	4.243		
X+2	297 (min)		4.116		

X+3	287 (assoc. min)	1504.9	4.116	34.922	XXXXXX
X+4	297 (min)	1460.2			
X+5	298 (Max)		4.353		
X+6	288 (assoc. max)	1487.6	4.353		
X+7	298 (Max)	1519.1			
X+8	300 (end of drift)	1496	4.243	34.942	

The other change to measurement codes is to add codes to clearly delineate surface measurements made in air. These will be given the MC of 1100, making all the relative measurement codes look like 1099, 1098, etc.

It was also noted that information was missing on how to order the N\_MEASUREMENT array. It was decided that first the array is arranged by cycle number and then by the order that events occurred within the cycle. So, if no time is associated with a measurement, it needs to be put in the order it occurred compared to timed measurements.

Then, M. Scanderbeg presented on JULD and DATA\_MODE. It was presented that estimated times belong in the JULD\_ADJUSTED variable, but this idea needs to be re-examined. The trajectory working group needs to carefully examine how to handle times coming from different sources – i.e. the float itself, the satellite system, or estimation. It needs to be worked out how to indicate this to the users and the delayed mode operators.

Finally, it was noted that if a cycle is truly missing, that no measurement codes or information should be included in the trajectory v3.1 file. The corollary of this is if a float experiences a timing event but you don't get that data, then you DO include the MCs in the file, with fill values.

### 10.1 Cookbook update:

M. Scanderbeg presented on the status of the DAC cookbooks and stated that the cookbooks have been split into two – the DAC Profile Cookbook and the DAC Trajectory Cookbook. This is to clearly delineate profile from trajectory files and to allow for different update times. These two documents have been on the ADMT draft documents website since July. The Profile Cookbook contains information on how to reduce high resolution profiles for TESAC distribution, how to fill profile time and location (iridium section was updated), and how to handle pumped and unpumped CTD data on NKE floats. The guidelines for Argos message selection, and a couple of annexes on definitions and calculations of positions are also included.

In the Trajectory Cookbook, new tables have been included for all float types except PROVOR/ARVOR floats. These include all Measurement Codes for each float type, not just the cycle timing codes. The key cycle timing codes are mandatory and other codes are optional, but the tables indicate how to include all codes if a DAC chooses to do so. All references to the STANDARD\_FORMAT\_ID were removed making it possible to move forward without the ID. The APEX estimation methods were moved to an Annex.

M. Scanderbeg stated that new float types and versions have now included almost all of the key cycle timing information that Argo has requested. This makes creating the v3.1 trajectory files easier as it involves matching one or two pieces of information the floats send to the correct measurement code. In

many cases, unless the new v3.1 trajectory file format is used, this cycle timing information is lost. So, it is important to move to v3.1.

M. Scanderbeg noted that a few DACs are already producing real time v3.1 trajectory file formats for PROVOR/ARVOR floats and APEX floats. Dmoded traj files are being created for SOLO and SOLO-II floats. So, there is some expertise out there for several of the major float types. M. Scanderbeg has been in contact with other DACs that are testing out their v3.1 traj files and providing feedback on the format. Any DAC or PI is welcome to send example v3.1 trajectory files to M. Scanderbeg for review.

Finally, M. Scanderbeg brought up the issue of timing information accompanying the CTD data that is available for many float types. This sparked a discussion as to where this information should go. It has a home in the trajectory file, but perhaps is more useful in the core profile file. It was agreed that if there is sparse timing information (times not sent with every CTD level), those time stamps would go into the trajectory file. If timing information is sent with every CTD level, it would go into the core Argo profile file under a new <PARAM>. The exact details of this <PARAM> are still to be determined and it will be optional. Scientifically, this timing information could be very useful, especially to Bio-Argo.

## **11 Delayed Mode Data Management**

### **11.1 Status of D-Files provision**

A census by DAC of the DMQC completion percentage was performed on the USGODAE GDAC data downloaded October 28<sup>th</sup>, 2015. Overall, the completion percentage has dropped to under 70%, with all DACs contributing to this regression.

DAC	#DMQC > 12 months (27 October)	#Total > 12 months	% DMQC
AOML	529,908	704,065	75.3
BODC	31,221	47,490	65.7
CORIOLIS	120,751	171,940	70.2
CSIO	10,141	25,071	40.5
CSIRO	65,442	97,033	67.4
INCOIS	27,092	41,769	64.9
JMA	95,446	150,879	63.3
KMA	8,050	11,092	72.6
KORDI	0	15,468	0
MEDS	23,554	40,463	58.2
NMDIS	0	2,060	0
Total	911,605	1,307,343	69.7

Note: 10,069 D-profiles skipped for no profile time.

There are several reasons for this but the main one is the conversion of files to format version 3.1 which has been time consuming, sometimes difficult and required resources to be diverted from DQMC. Another issue has been the increasing complexity of Bio floats which has also diverted resources. In addition, several DACs have had personnel changes that have impacted this work and in some areas,

particularly in marginal seas such as the Eastern Sea, accepted DMQC processes don't work very well. In general, the impact of all of these issues has been to set DMQC back by at least a year for all DACs.

Floats without an identified DMQC operator:

ADMT discussed the issue of floats that have not received DMQC and for which a clear pathway to DMQC is not identified. The bulk of these are Navoceane float but some other small groups are also struggling to find an operator for this important activity. We have identified operators for many of these during the meeting but some remain unassigned.

There was discussion that older, low value floats, which carry temperature only, should be removed from the Argo data stream. This recommendation will be made to AST and we will take their direction on this issue. Some other Argo Equivalent floats fall into this category as well.

## **12 ARC status**

### **12.1 North Atlantic ARC**

Cécile Cabanes presented the delayed mode consistency checks performed in the NA-ARC region

All the floats that have been processed in delayed time in the North Atlantic (North of 30°N) were checked again using a slightly modified OW method. Compared to the original OW method (Owens and Wong, 2009), our configuration better takes into account the interannual variability and provides more realistic error bars. The modifications applied are described in Cabanes et al, 2015.

We first selected a subset of unbaised floats and checked whether the modified OW method gives results generally in accordance with the PI decision (i.e. no correction is necessary). Among the 417 unbaised floats, we only found 6 floats for which it may be necessary to correct the float for an offset or a drift.

Finally, we checked the 206 floats that have a DM correction. We found 18 floats for which it may be necessary to revise the correction. A report has been sent to the DM operators of these floats.

Discussion focused on whether we should have a DM workshop to look at regional differences. Can we write a set of instructions for PIs in a particular area? This is an issue for the DMQC cookbook. Some regions are really hard and funding/manpower are limited which restricts what we can accomplish.

Status of DM corrections for the 24 floats for which the salinity correction originally proposed by the PI differs significantly from our results:

WMO Number	Float model	Launch date	Centre	PI	Date_update
6900168	PROVOR	10/05/2002	IF	Virginie THIERRY	2015-10
6900708	ARVOR	17/05/2009	IF	Christine Coatanoan	2015-06
4900212	PROVOR CTF2	19/03/2002	IF	Virginie THIERRY	2006-04
4900216	APEX SBE APF7	12/05/2002	IF	Virginie THIERRY	2010-07
6900169	PROVOR CTF2	13/06/2002	IF	Virginie THIERRY	2008-11
6900176	PROVOR	26/06/2002	IF	Virginie THIERRY	2015-10
6900400	PROVOR	02/06/2006	IF	Virginie THIERRY	2015-06
6901407	ARVOR	20/06/2012	IF	Christine Coatanoan	2015-10
6900171	PROVOR CTF2	14/06/2002	IF	Virginie THIERRY	2006-04
6900179	PROVOR CTF2	01/07/2002	IF	Virginie THIERRY	2009-09
6900513	APEX SBE APF8 S	20/04/2007	IF	Birgit KLEIN	2014-12
6900248	APEX SBE APF8 SN	02/07/2004	IF	K. KOLTERMANN	2010-10
6900271	NEMO 2.5	18/04/2005	IF	Birgit KLEIN	2010-06
6900558	APEX APF9A F/W	04/11/2008	IF	Birgit KLEIN	2015-03
6901218	APEX-APF9A	29/04/2012	IF	Holger GIESE	2015-03
6901219	APEX-APF9A	01/05/2012	IF	Holger GIESE	2015-03
69024	APEX SBE-41 APF	22/05/2000	IF	K. KOLTERMANN	2010-10
4900406	PROVOR	01/12/2003	ME	Blair Greenan	2013-04
4900417	PROVOR	29/09/2003	ME	Blair Greenan	2007-03
4900502	APEX	17/09/2005	ME	Blair Greenan	2015-05
4900627	APEX	22/10/2005	ME	Blair Greenan	2015-01
4900635	APEX	19/05/2006	ME	Blair Greenan	2015-01
4900681	APEX	23/09/2005	ME	Blair Greenan	2015-01
4900682	APEX	27/05/2006	ME	Blair Greenan	2015-01

*Cabanes C., V. Thierry and C. Lagadec (2015). Improvement of bias detection in the conductivity sensor of Argo float. Application to the North Atlantic Ocean., submitted to Deep-Sea Res Part I.*

*Owens, W.B. and A.P.S. Wong, 2009. An improved calibration method for the drift of the conductivity sensor on autonomous CTD profiling floats by Θ-S climatology. Deep-Sea Res. Part I, 56:450–457.*

## 12.2 South Atlantic ARC:

Activities related to float deployments are continued in close collaboration with WHOI. AOML as well as WHOI work towards finding deployment opportunities. AOML provides ship riders for certain VOS (voluntary observing ships) lines used for float deployments. WHOI does the planning with respect to deployment locations.

Activities related to the final stage of the delayed-mode quality control as well as products have been halted due to the funding situation.

Claudia Schmid developed a three-dimensional field of the horizontal velocity in the South Atlantic that covers the period 3/2000 to 5/2014. The plan is to make this data set available on the internet after publication of scientific results. Once available online a link can be added to the web page listing gridded data sets based on Argo data.

## 12.3 MedArgo ARC

Giulio Notarstefano presented the Argo status and the float activities in the Mediterranean and in the Black Seas. The historical float fleet consists of 311 floats and more than 31000 CTD profiles. The majority of the CTD profiles are acquired by the core Argo floats but there are also several CTD profiles acquired by BioArgo floats. There are more than 120 floats in 2015 (considering the new deployments and the floats already working in the basin) and about 90 floats per month are available in this year. In

terms of profiles, more than 600 profiles per month have been acquired in 2015 and 25% of these are profiles acquired by BioArgo floats. A statistic was run to estimate the survival rate of Argo-Italy floats: the mean half life is about 400 days. These results need to be rerun taking into account sensor packages, whether the float was retrieved, the float manufacturer or model, etc.

The DMQC of the physical variables (temperature and salinity) has continued; about 85% of the dead floats has been checked in DM and information or a technical report for each float is posted on the web. The reference dataset has been updated with more recent data. Several new floats (37 platforms up to October) have been deployed in 2015 with the contribution of 6 countries (Italy, France, USA, Spain, Germany, Greece) and also in the framework of Euroargo; 14 out of 37 are BioArgo floats. About 30-40 floats (BioArgo platforms included) are expected to be deployed by the end of this year and in 2016. Note that the Med Sea requires a shallower reference database.

#### **12.4 Pacific ARC:**

JAMSTEC has operated PARC in cooperation with IPRC and CSIRO. PARC has provided the float monitoring information in the Pacific on its web sites since 2006 including: float activity watch, results of comparison between individual Argo TS profiles and gridded data (WOA05 and MOAA-GPV), feedback QC status and result to PIs. Argo products of countries currently involved with PARC have been provided on web sites of PARC and each institute. Most of countries have provided objective analysis data using Argo data. The new Argo products are released in two institutes. KMA will release the objective analysis using the Argo data at the end of 2015. JAMSTEC has released the assimilation analysis data called ESTOC (“Estimated STate of global Ocean for Climate research”) in this year. We promote climate change research by uncovering mechanisms and dynamics of ocean state change. Our approach is an application of a 4DVAR data assimilation for global ocean. The time period is 53 years, from 1957 to 2009. Not only physical parameters but also biogeochemical observations are integrated in our system. This version has included the Argo data, but not Bio-Argo yet. We have plan to integrate Bio-Argo data in our system soon. This data is available on our web sites with visualization interface.

#### **12.5 Southern Ocean ARC:**

The recent work of the Southern Ocean Argo Regional Centre has focused on assessing the most beneficial ways to develop the activities of SOARC with the limited resource available to us. Firstly there is a need to improve the discoverability of existing resources which are of use to quality control operators and researchers to assist in placing Southern Ocean Argo data into context. Recent discussions have identified that whilst ice avoidance software has increased the survivability of floats, there is a need to develop the management of Argo under ice positioning. SOARC has begun investigating the potential for improving near-real time estimates of under ice positions through two potential techniques (*f/H* contour and making use of the RAFOS array). The existing SOARC web presence on the UK Argo website only identifies UK and Australian contributions to the Southern Ocean, when there are other Argo contributors with interests, capabilities and activities in the Southern Ocean. SOARC is therefore welcoming expressions of interest from other potential collaborators in Argo Southern Ocean activities. The previous three strands will be assisted by the planned creation of a new SOARC website by BODC (UK), which will make use of existing content of the UK Argo website but establish a distinct SOARC identity.

Discussion emphasized that Argo needs to work with SOOS but they've set themselves up as regional groups and that makes it harder for us because we need to interact with more than one contact point. In addition, we need to ensure we get all available CTD data.

#### **12.6 Indian ARC:**

As part of the ARC activities of Indian ocean, INCOIS has undertaken the following activities:

As part of the ARC activities of Indian ocean, INCOIS has undertaken the following activities:

1. Continuing to archive temperature and salinity profile data from floats deployed by Indian and other countries in the Indian ocean and making them available through Web-GIS.
2. Using Web sites both INCOIS and UCSD to supply the "Indian Argo data Products" data viewer. Monitoring the hits to the product.
3. Performing delayed mode quality control of all the Indian floats. Identified floats with sensor drifts and corrected the same. Collected high quality CTD from various sources (contacting the chief scientist of various cruises undertaken on Indian Research Vessels).
4. Conducted User Interaction workshops to bring awareness about the data and also to encourage the use of Argo temperature and salinity data.
5. Generating value added products based on gridded products obtained from Objective and Variational Analysis methods. These value added products are made available on the web and also on the Live Access Server. Monitoring the data usage, publications and PhD resulting out of the Argo data.
6. Funding projects that are projecting the utilization of Argo and data products.

## **13 GADR**

The Global Argo Data Repository (GADR) is hosted by the National Centers for Environmental Information (NCEI, which includes all functions of the former US National Oceanographic Data Center) under the direction of Charles Sun. The GADR mirrors the Coriolis Argo GDAC twice daily, including all profile, trajectory, and metadata files as well as quality control manuals. The GADR also archives a monthly snapshot of the Argo dataset as represented at the Coriolis DAC. This monthly snapshot can provide the basis for the Argo digital object identifier (DOI) data. Data volume downloaded from the GADR increased 40% in 2015 (159 GB over 2014 (113 GB) while distinct hosts requesting data from GADR decreased by almost half in 2015 (1,158) over 2014 (2,117). So there are fewer users requesting larger data sets. The World Ocean Database (WOD), also hosted at NCEI, uploads data from the GADR every three months, compares to Argo data already in WOD, and makes replacements accordingly. When problems are found, a report is sent to Charles Sun to check against the GADR. If problems are external to the GADR, Charles sends on the report to Mathieu Belbeoch at JCOMM. An informal request was made to Argo (and to CCHDO) to participate in the World Meteorological Organization (WMO) Marine Climate Data System (MCDS) as a GDAC within that system. As Argo was amenable to the idea, a formal request is forthcoming.

## **14 All other business**

### ***14.1 When do we accept floats into the Argo data system ? – Brian King***

The question has been raised of how Argo should respond when a float funded outside an Argo national program is offered to the Argo data system, or indeed if a float owner requests that Argo accept the float as an Argo float. It is possible that some investigators see the Argo data system as a powerful, no-cost way to curate and disseminate their data.

The potential difficulty is that accepting floats into the Argo data system can have a substantial overhead of effort, if the float departs from 'standard' Argo operation. Argo cannot sustain the effort required to simply accept any float offered.

It is therefore suggested that there should be public guidance of the circumstances under which Argo will accept floats into the data system. A draft statement originated with the Argo co-chairs. This was presented. A small working group agreed to think through the statement and extend it where necessary.

An expanded draft was assembled by BK and AW, with input from Steve P and SW. This was further discussed in plenary towards the end of the meeting.

BK proposed two documents be prepared, and published by MS. (i) A simple summary statement, alerting potential float investigators of the general requirements for a float to be accepted into Argo, and (ii) a detailed list of requirements, explaining to someone outside the Argo system what is required.

The general requirements include:

1) Follow all rules for Argo governance, including notification to AIC, consistency with IOC resolutions and interacting correctly with EEZ in terms of data availability and recovery of beached floats. Floats must at least measure T and S with recognized sensors. Any new sensors on the float (ie not already recognized by Argo) must be discussed with ADMT/AST before the float can be accepted as an Argo float. The float mission must fit Argo patterns of temporal and vertical sampling.

Note: The ADMT will resist accepting new/experimental sensors unless there is a prospect of them being deployed in significant numbers (hundreds rather than a few or tens), and unless they have a reasonable prospect of DMQC. New sensors are a significant, often unfunded, burden on the Argo data system. It is not a solution simply to withhold the data from extra sensors from the system. Such action could jeopardise the integrity of the whole program for the sake of a small number of extra profiles.

2) Follow Argo practice for Real-Time dissemination of data, including identifying a DAC to handle the data, open dissemination on GTS and to GDACs, and supplying all relevant technical, metadata and trajectory data.

3) Establish a path for Delayed-Mode data, with commitment to undertake DMQC following agreed Argo protocols, during and beyond the lifetime of the float, either through the float PI or by arrangement with an existing DMQC group.

Note: Before a RT DAC accepts a float into its system, it should ensure that there are resources to manage and archive the data in perpetuity; that a DM group is identified and has agreed to perform calibration and QC in perpetuity; sufficient metadata are supplied by the PI.

**Implications:**

1) If all the above guidance is followed, there will never be any new floats which don't have an identified DMQC path.

2) Some of our present floats would not pass the filters above. We may choose to remove some floats from the Argo data system if there is no chance of them ever meeting the above criteria.

## ACTION

**A working group was identified to refine the needed statements. BK will circulate the present drafts for further tidying up. The documents should be ready for endorsement at AST.**

### **14.2 Summary of the 16th ADMT actions**

Sylvie and Ann have elaborated an action list from the ADMT16 discussions and the list was reviewed, actions assigned to DACs/operators, deadlines identified and priorities set. It was agreed that to reach more timely accomplishment of the actions, bi-yearly phone meetings will continue to be organized by the chairs in February, before AST17 and June involving mainly the DAC managers.

### **14.3 Other business**

Ann Thresher announced that she will be retiring after ADMT17. Megan Scanderbeg accepted the position of co-chair of the ADMT with S Pouliquen and she will start entering in the game at ADMT17 with a transition during organizing of the next ADMT meeting.

### **14.4 Location of next meeting**

The location of ADMT17 will be at Tianjin hosted by NMDIS in China

## **15 Annex 1 – Agenda**

### ***Wednesday 4<sup>th</sup> November***

**Welcome address** by William B Curry, President and CEO of Bermuda Institute of Ocean Sciences. (15mn)

#### **Feedback from 16th AST meeting** : Dean Roemmich/Susan Wijffels (30mn )

- Update on AST website – Megan Scanderbeg (10min)

Status on the action 1

- Proposal on a set of Metrics to Monitor Argo dataset Action 14 – Brian King (20mn)
- Delivering data from new sensors – Dean Roemmich /Susan Wijffels (15mn)
- What is the impact of measuring at 1db on float life J Gilson 15mn)

#### **Feedback on 4<sup>th</sup> BIO-Argo Workshop (H Claustre) (1h00)**

#### **Status of Argo Program and link with Users (1h00)**

Status on the actions 5,13

- Review of the Action from last ADMT (Sylvie Pouliquen) 15 mn
- Argo Status + Real-time Monitoring : Summary of major anomalies detected each month, Requested actions from DACs. Trying to identify why some anomalies are not corrected. (Mathieu Belbeoch) (15mn)
- Status of delays in data delivery to the GDACs (Mathieu Belbeoch) Action 13 (15mn)
- New JCOMOPS/AIC WWW Site ( Mathieu Belbeoch Antonin Liz2) (20mn)

#### **Real Time Data Management (2h)**

Status on the actions : 4,5,6,7,12

- GTS status: (Anh Tran) action 7 (20mn)
- Status of delivery of BUFR to the GTS including BUFR converter tools (Anh Tran Wataru Ito , Mathieu Ouellet and Mike Frost) Actions 6,8,9,10 (20 mn)
- Status of anomalies at GDAC (Christine Coatanoan) action 11 (20mn)
- Status on Anomalies detected with Altimetry ( Stéphanie Guinehut ) (20mn)
- Status on density test implementation (Ann Thresher-Gronell to review) Action 12 (15mn)
- Status of real-time NST tests (Justin Buck) Action 11 (15mn)
- QC Manual issues (Annie Wong ) (20 mn)

#### **Status of Argo Program and link with Users follow up (0h30)**

- Progress on Citation Index for Argo Data (J Buck, T Carval, Ken Casey ) 20mn
- Discussion on the way forward (10mn)

#### **Progress on Argo Reference data base (0h30)**

Status on the actions 17-18

- Summary of the actions since ADMT-15 (C Coatanoan)
- CCHDO/US-NODC-progress (Steve Diggs)

#### **Questions to be discussed tomorrow (Ann Thresher)(10mn)**

### ***Thursday 5<sup>th</sup> November***

#### **GDAC Services ( M Frost , T Carval) (1h00)**

Status on the actions : 20,21,23,24,25,26,27,28,29,30

- Operation status at US-GDAC and Coriolis-GDAC(Thierry Carval, Mike Frost) action 23,28, 29,30 (30mn)
- Status of Format Checking operations ( D-Files checking) (Mike Frost) Action 20,21 (20mn )
- What are the priorities?
- Maintenance of tables centrally – who looks after additions and changes operationally? (Thierry Carval,Mathieu Belbeoch, Catherine Schmectig)
- Status of the new GDAC Cookbook (Thierry Carval, Mike Frost) Action 24 (10 mn)
- New needs?

#### **Technology developments(20 mn)**

- An introduction to the HM-2000 float and its data stream (Lu Shaolei )(20mn)

#### **Format issues (1H00)**

The new formats mean a challenge for the DACs – how well are we implementing V3.1? what issues remain?

Status on the actions : 18,19,24,25

- Upgrade to V3.1 Real-Time and historical T&S floats at GDAC (all DACs and DM operators) Action 25,26 (30mn)
- Questions posed on Wednesday + discussion
- Maintenance of the Standard Format Id table (Megan Scanderbeg, Mathieu Belbeoch, Uday Bhaskar) Action 31(15 mn)
- Revisit Mandatory and desirable metadata list Claudia Schmid, Ann Thresher, Mathieu Belbeoch - Action 22(15mn)

### **Trajectory from Argo data (2h00)**

- Status on Traj3 implementation at DACs (all DACS)
- minor adjustments to the traj V3.1 file format. (Megan Scanderbeg)
- Update on the DAC Cookbook (Megan Scanderbeg)
- Strategy for DMQC from Rtraj to Dtraj ? (A Wong/Megan Scanderbeg) (30mn)

### **Delayed Mode Data Management (1h30)**

- Status of D-Files provision (J Gilson M Belbeoch ) (10mn)
- Orphan float management (Ann Thresher, Mathieu Belbeoch, Sylvie Pouliquen) Action 3,4 (15mn)
- New topics ???
- 

## ***Friday 6<sup>th</sup> November***

### **ARCs: provide an information on what done and what is planned (1h30)**

- Update on ARC progress (ARCs leaders) 15mn each
- North Atlantic Cecile Cabanes
- South Atlantic Claudia Schmid
- Mediterranean Sea Giulio Nortastefano
- Pacific Ocean Kanato Sato
- Indian Ocean Uday Bhaskar
- Southern Ocean Katie Gowers

### **GADR Status of the Archiving centre (T Boyer) (0h30)**

### **Other topics (1h00)**

- Summary of the 16th ADMT actions (S Pouliquen, A Gronell Thresher) 30mn
- Location of 17th ADMT

## **16 Annex 2 - Attendant List**

<b>First Name</b>	<b>Last Name</b>	<b>Company</b>	<b>Country</b>
Dirk	Slawinski	CSIRO	Australia
Ann	Thresher	CSIRO	Australia
Susan	Wijffels	CSIRO	Australia
Anh	Tran	Integrated Science Data Management, Dept of Fisheries and Oceans	Canada
Ingrid	Peterson	Ocean and Ecosystem Sciences Division Fisheries and Oceans Canada	Canada
Eric	Rehm	Takuvik	Canada
Xiaogang	Xing	Takuvik	Canada
Mingmei	Dong	National Marine Data and Information Service	China
Shaolei	Lu	Second Institute of Oceanography	China
Stéphanie	Guinehut	Collecte Localisation Satellites	France
Brice	Robert	Collecte Localisation Satellites	France
Thierry	Carval	IFREMER	France
Sylvie	Pouliquen	IFREMER	France
Mathieu	Belbeoch	JCOMMOPS	France
Henry	Bittig	Oceanographic Observatory of Villefranche sur Mer	France
Herve	Claustre	Oceanographic Observatory of Villefranche sur Mer	France
Antoine	Poteau	Oceanographic Observatory of Villefranche sur Mer	France
Catherine	Schmechtig	Oceanographic Observatory of Villefranche sur Mer	France
Birgit	Klein	BSH (Federal Maritime and Hydrographic Agency)	Germany
Jan	Reißmann	BSH (Federal Maritime and Hydrographic Agency)	Germany
TVS Udaya	Bhaskar	ESSO - Indian National Centre for Ocean Information Services	India
Giulio	Notarstefano	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS)	Italy
Kanako	Sato	JAMSTEC	Japan
Wataru	Ito	Japan Meteorological Agency	Japan
Young-San	Park	Korea Meteorological Administration	Korea
Kihyuk	Eom	National Institute of Fisheries Science	Korea
Joon-Soo	Lee	National Institute of Fisheries Science	Korea
Jong-Ho	Lee	National Institute of Meteorological Research	Korea
Hyeongjun	Jo	National Institute of Meteorological Research / KMA	Korea

<b>First Name</b>	<b>Last Name</b>	<b>Company</b>	<b>Country</b>
Byunghwan	Lim	National Institute of Meteorological Research / KMA	Korea
Justin	Buck	British Oceanographic Data Centre	UK
Katie	Gowers	British Oceanographic Data Centre	UK
Brian	King	National Oceanography Centre	UK
Kenneth	Johnson	Monterey Bay Aquarium Research Institute	USA
Michael	Frost	Naval Research Laboratory	USA
Mark	Ignaszewski	Fleet Numerical Meteorology and Oceanography Center	USA
Claudia	Schmid	NOAA/AOML/PHOD	USA
Steve	Piotrowicz	NOAA/OAR/CPO/COD	USA
Tim	Boyer	NODC/Ocean Climate Laboratory	USA
Andrew	Barna	Scripps Institution of Oceanography	USA
Steve	Diggs	Scripps Institution of Oceanography	USA
John	Gilson	Scripps Institution of Oceanography	USA
Annie	Wong	University Washington	USA
Breck	Owens	Woods Hole Oceanographic Institution	USA
Pelle	Robbins	Woods Hole Oceanographic Institution	USA

## 17 Annex 3 - ADMT15 Action List

On 32 actions : **18 Done** **11 Partially** **3 Not Done**

	Action	Target Date	Responsibility	Priority	Status
1	Include in the FAQ the points identified at the meeting Provide feedback to Megan on the FAQ page : <a href="http://www.argo.ucsd.edu/Data_FAQ.html">http://www.argo.ucsd.edu/Data_FAQ.html</a> and the Argo Beginner guide <a href="http://www.argo.ucsd.edu/Argo_date_guide_draft.html">http://www.argo.ucsd.edu/Argo_date_guide_draft.html</a>	End December 2014	Megan All ADMT members	R	done
2	Contact Reiner Schlitzer/AWI to be sure that ODV takes into account V3.1 files	End December 2014	T Carval	R	done, ODV read V3.1 data files
3	ADMT chairs and GDAC to develop a set of options to handle orphan floats and argo equivalent for which we do not have a DMQC pathway and submit those options to AST	AST16	Ann Sylvie Thierry Mike and Charles	R	done at Euro-Argo Level
4	Each DAC to update AIC list for the orphan floats whenever possible	AST16	DAC	H	CSIO :No orphan floats Will be reviewed but NAVOCEAN is still the biggest issue
5	AIC to make the link with the Centers that are integrating and redistributing Argo data and be sure they use our adjusted data and use the flags and report to ADMT	ADMT16	M Belbeoch	R	Audit not achieved. Postponed to ADMT17.
	<b>Real Time Data Stream</b>				
6	Make a check on the content between GDAC and BUFR messages to be sure that profile are complete	ADMT16	Mike and Anh	R	will be presented at ADMT

	Action	Target Date	Responsibility	Priority	Status
7	Correct bad header in TESAC - should use SOF instead of SOV - 5 DACS affected . Mathieu B to check the list and impact and warn the Dacs	ADMT16	Coriolis, CLS, UK, USA, MEDS	R	MEDS - done Coriolis is not affected, Argo floats are sent on GTS Tesac with SOF header. But, coastal floats and deep Argo floats that are not part of Argo are transmitted with SOV header. <b>CLS will be doing it shortly.BODC not done</b>
8	JMA and MEDS update Java and Perl Converters from NetCDF V3.1 to new BUFR	AST16	Anh and Wataru	R	MEDS - done JMA modified Perl script to accommodate V3.1 core file. Modification for bio file and NST data will be done by ADMT16.
9	Produce Matlab encoder and decoder for BUFR and provide it to all	ADMT16	Mathieu Ouellet	R	cancelled
10	Investigate apparent blockage in BUFR distribution	AST16	Anh with DACs	R	Coriolis checked that we distribute core-profiles in BUFR to Météo-France
11	Identify the DACs where clearly some RTQC procedures are not properly implemented and warn them so that they can correct their code	ADMT16	Christine	R	presented at the meeting
12	test on density inversion : Ann to run adding PI name to the list and perhaps run over different sections of the water column DACs to provide feedback to Ann on density inversion that are real and should be in the exclusion list	ADMT16	Ann + all DACs	R	PI name added - November 2014 CSIO:: In Oct. 8 2015 we get the mail from Ann, and the profiles which have density inversion are waiting the PI's check and confirm.
13	AIC to perform delay analysis on two GDACs and provide a report to DACs highlighting issues	AST16	Mathieu	H	done
14	Define a set of metrics to monitor the quality of the Argo dataset and publish it on the AST and ADMT WWW	AST16	BRIAN TO LEAD	R	will be presented at ADMT
15	Update QC manual for deep float, including warning of the uncertainties of data quality below 2000db	Dec 2014	Annie	R	done

	Action	Target Date	Responsibility	Priority	Status
16	Propose DMQC on Apex unpumped NST	ADMT16	Annie and Justin	L	postponed
<b>Reference Database</b>					
17	Susan with Dean to work at higher levels to solve the issue with link with CCHDO that is not working as smoothly as expected to feed the REF DB.	AST15	Susan Dean	R	done
18	Streamline data provision from CCHDO to Coriolis for CTD REF DB	AST15	Steve	R	a workflow has been defined between CCHDO and Ifremer that improve the link
<b>Delayed Mode trajectory</b>					
19	Each DAC with PI/DM has to take the responsibility for the decision to use or not the ANDRO converted D-Traj files as first version of D-files. Each DAC/PI/D-Operator should do assessment on some of their floats to be able to define their strategy and report to ADMT	ADMT16	all DACs with PI and DM	R	bodc assessment on going aim to get basic taj into V3.1
<b>GDAC</b>					
20	In case the content of the file (DATA-Mode, Platform number, DAC , cycle number,...) doesn't fit the File name submitted by the DAC then the file should be rejected by the file checker .	ASAP before AST16	Mike	H	done 30th March
21	Make the Enhanced File checker operational	ASAP before AST16	Mike	H	done 30th March
22	Revisit the metadata Mandatory and desirable metadata for File Checker	AST16	Claudia, Ann and Mathieu	R	Mathie will propose some at ADMT16 (prepare a couple of slides on this)
23	Take into account the flags( date and position) to generate the index file at both GDAC and put fill values when they have flag 3 or 4	AST16	Mike and Thierry	R	done at US-GDAC 30 March and at Coriolis

	Action	Target Date	Responsibility	Priority	Status
24	Finalize the GDAC cookbook	ADMT16	Thierry and Mike	R	no progress, we focused on implementation. The cookbook is important to ensure that both GDACs work on the way.
25	DACs to provide new Real time profile meta traj and Tech file in V3.1	ASAP before ADMT16	all DACs	H	CSIRO done for all except iridium TRAJ files JMA/JAMSTEC : Profile and Meta file conversion has been done for Argos. Those for Iridium and Tech will be done by ADMT16. Done partially for INCOIS CSIO: Done for all except the Traj file BODC on going
26	DACs to provide historical profile meta traj and tech files in V3.1 as soon as practical	ASAP before ADMT16	all DACs	H	CSIRO done for all except iridium TRAJ files JMA/JAMSTEC : Profile and Meta file conversion has been done for Argos. Those for Iridium and Tech will be done by ADMT16. INCOIS done for majority of Meta and Tech file. Trajectory yet to be done. MEDS done for metadata only, others are ongoing CSIO: Done for all meta files and most of tech files, the traj file will be done in next year Need to have meta and tech name updated before going on
27	Get statistics on access to the Geo directory from both GDAC	ADMT16	Thierry and Mike	R	Done at US GDAC and Coriolis
28	in the monthly snapshots add all the current manuals and tables and DOI information inside	AST16	Thierry and Mike	R	Done
29	Check that all the versions of User and QC manuals are available on ADMT WWW site	AST16	Thierry	R	Done (page obsolete documents)
30	Create separate index files for b and M profile and traj files including list of parameters	ADMT16	Thierry and Mike	R	Done at Coriolis and US GDAC

	Action	Target Date	Responsibility	Priority	Status
<b>Format</b>					
31	Propose a way forward for the maintenance of the Standard Format Id table	ADMT16	Megan Claudia and Mathieu Uday	R	In progress Megan will report on this at ADMT16
32	update User manual according to meeting decision	15-nov-14	Thierry	R	done

## **18 Annex 4 - ADMT16 Action List**

	Action	Target Date	Responsibility	Priority	Status
1	Revise the set of metrics proposed by Mathieu and Brian	AST17	Brian, Sylvie, Mathieu, J Gilson, Katie Gowers, Pelle	R	
2	AIC to make the link with the Centers that are integrating and redistributing Argo data and be sure they use our adjusted data and use the flags and report to ADMT	ADMT17	M Belbeoch	R	
<b>Real Time Data Stream</b>					
3	Centres with access to the GTS to compare files sent to files received at various nodes. Data is going missing and we don't know where. Run comparison looking for all files sent in one or two days and DACs then need to provide list of what they sent onto the GTS in that time period.	AST17	Anh with JMA, BOM,UK MET OFFICE, AOML, US-GODAE with all DACS	H	
4	Put the latest version of the BUFR encoders on the ADMT WWW pages All DACS to verify if they use the latest version of the Netcdf-BUFR converter	AST17	Thierry/Wataru/Anh All Dacs	H	
5	Split the QC manuals in two : one for Core Argo managed by Thierry and Anny , one for Bio-Argo managed by Catherine and Virginie	AST17	Annie and Catherine	R	

	Action	Target Date	Responsibility	Priority	Status
6	Change QC manual to only accept data with JULD >= 17167 and add range test to check that date is not later than NOW UTC.	AST17	Annie and Catherine	R	
<b>Reference Database</b>					
7	Provide feedback on rejected CTDs back to CDHDO and NCEI	ADMT17	Christine	R	
8	Screen Argo reference dataset contents to assess data or originator quality issues based on Christine's QC of the dataset. Exclude "bad" quality providers.	ADMT17	Christine	R	
9	Label the source in the REF DB to facilitate to identification of high quality data.	ADMT17	Christine	R	
<b>Delayed Mode trajectory</b>					
10	Thierry to update ANDRO converted D-Traj files to V3.1 as first version of D-files.	AST17	Thierry	R	
<b>GDAC</b>					
11	GDAC with AIC to keeping track on V3.1 progress by adding version information to the detailed index files	AST17	Mike, Thierry and Mathieu	R	
12	provide a link from ADMT pages to Megan's Matlab routine and to latest version of the BUFR converter	AST17	Thierry	R	

	Action	Target Date	Responsibility	Priority	Status
13	Audit metadata config units against allowed tech units and see if there are any outliers, then negotiate to either add units or use an approved unit.	ADMT17	Mark, Ann	R	
14	For Tech file : generate warning when units of technical variables don't match the type of the field	ADMT17	Mark	R	
15	Check data-type consistency with File name and presence or not of adjusted-parameters and reject files that don't match	ADMT17	Mark	R	
16	Implement Check for Trajectory file against reference tables ( like for profile) when the discussion on the test to be done has reached consensus	ADMT17	Mark	R	
17	Move Ref Table from Google doc to something that can be more easily machine readable and define a workflow for the information to flow to the person that will need to review and approve changes as well as to the GDAC for the required FileChecker update.	ADMT17	Mathieu, Mark	R	
18	Modify the file checker to generate warnings for non-standard data types in the files. After 6 months, make this a rejection.	ADMT17	Mark, Thierry	R	
	<b>Format</b>				
19	Provide clarification of data mode and parameter data mode usage : update user manual	AST17	Thierry, Annie		
	<b>Trajectory</b>				
20	File format update and update the traj cookbook	AST17	Megan		
21	Profile cookbook to be updated and posted on the official documents section of the web pages	AST17	Megan Thierry		

	Action	Target Date	Responsibility	Priority	Status
<b>Question to AST</b>					
22	Propose to AST that GDACs change QC flags to Class 3 for D-profiles that aren't addressed when they have received feedback on issues and not corrected them (Altimetry, OA, Format check).	AST17	Sylvie Ann	R	
23	Form a working group to address the issue of people wanting to put their floats into Argo. Their recommendation to be approved by AST	AST17	Dean, Susan, Steve Piotrowicz, Brian, Sylvie, Breck, Annie, Megan	H	
24	ADMT requests guidance from AST as to what variables are considered of scientific value and need to be stored and which are useful for only specialist users (DM operators?) who can get that data (means, std, medians) from other sources.	AST17	Sylvie, Ann, Brian, Susan	R	
25	Some older T/S floats remain difficult to assign to DM operators. This is really an AST question - do we keep that data available or make the hard decision to remove it from the GDACs?	AST17	Sylvie, Ann	R	
26	Request guidance from AST for where to store timing information - if it's a profile, put it in the C file? This will require a new parameter. Otherwise it can go in the B file. We recommend that sparse snapshots of time go into traj files, true profiles of time go into the core files. And if this is useful, we need to consult float manufacturers to ensure this information is provided. Pose cost/benefit question to AST and Deep Argo	AST17	Susan and Breck to pose the questions	H	

## **19 Annex 5 - National Reports**

## Australian Argo National Data Management Report

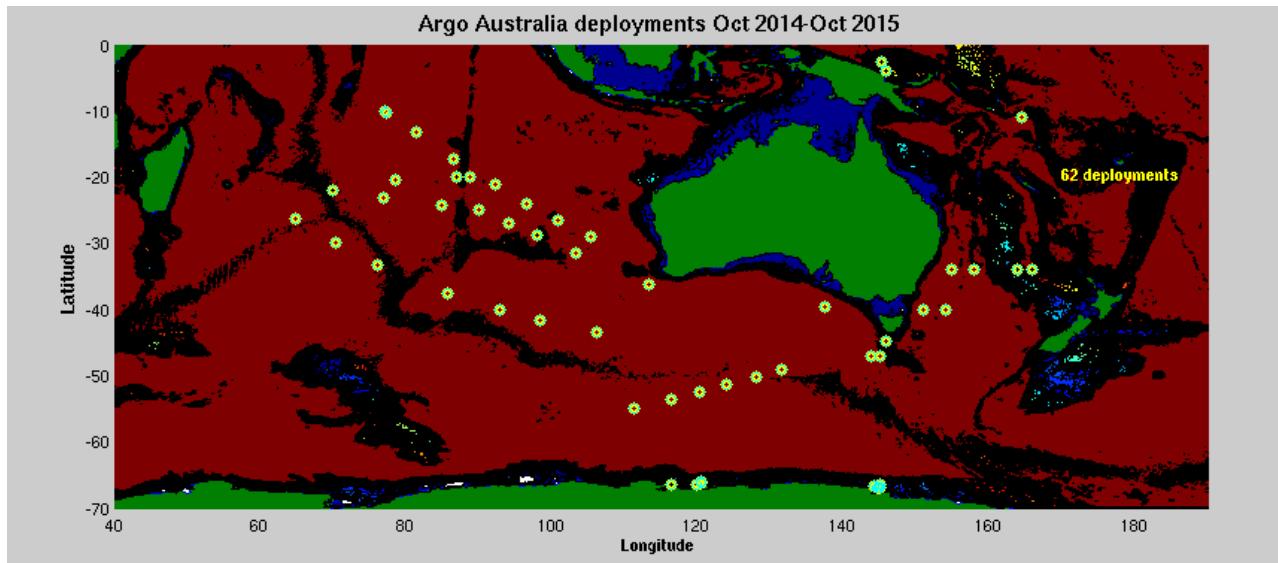
ADMT16

Bermuda – 4-6 November 2015

Ann Gronell Thresher for the Argo Australia Team (CSIRO, Bureau of Meteorology)

## Status of Array

### Australian deployments in 2014-15:



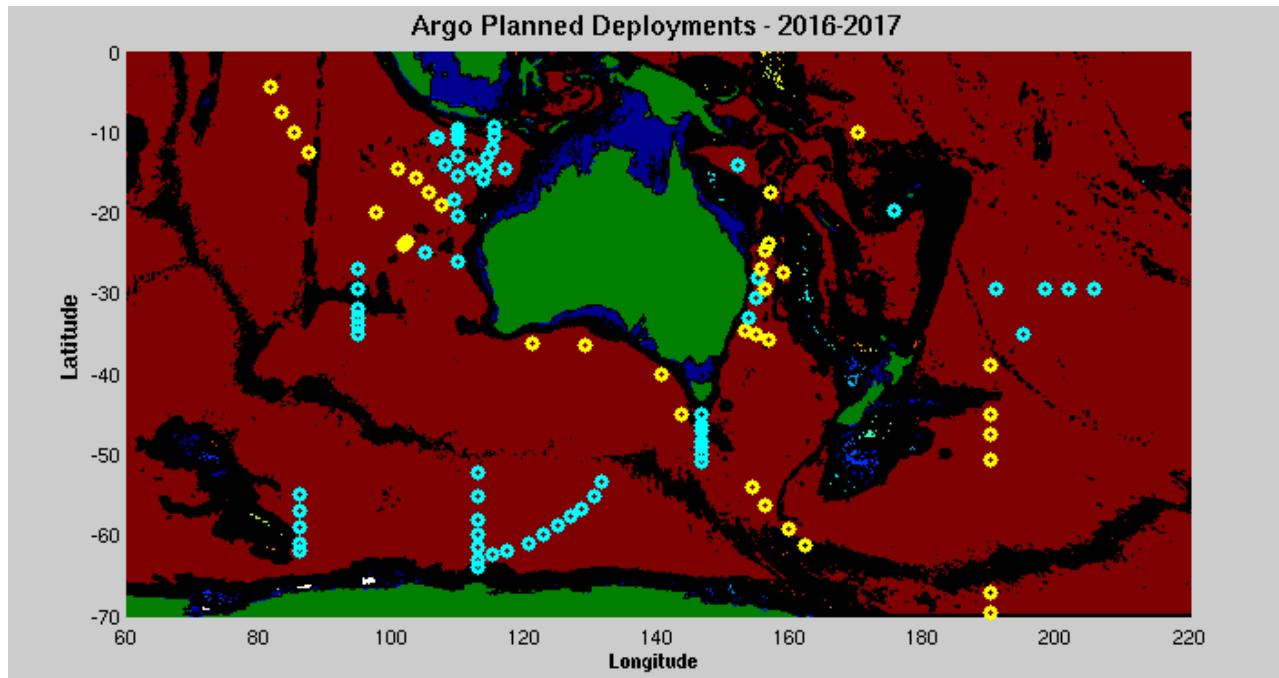
Australian Argo deployments between October 2014 and October 2015.  
Yellow-Green circles are new deployments

Australia has deployed 62 floats since the last meeting, including 4 complex Bio-Argo models and some new models from established manufacturers. This has been a very busy and productive year for us.

We currently have 364 floats listed as 'live' and returning good data though this includes some that are under ice or have been missing for over a year, from a total of 683 deployments since 1999. We also have 64 floats in the lab or on ships about to be deployed. We hope to order a further 30 – 35 floats depending on funding outcomes. These purchases will help us to maintain float density in the South Indian and South Pacific Oceans.

Known deployment locations for the floats over the next year are shown below. We will continue to re-seed the Indian Ocean and South Pacific Ocean but some deployment locations are still to be decided.

## Australian Deployment plans 2016-17:



Locations identified for new float deployments. Cyan circles indicate floats to be deployed within the next 6 months, yellow indicates floats on order for deployment later in the year.

### Significant improvements:

Most of our Iridium floats have now been moved from dial-up to the RUDICS protocol. The remaining floats cannot be moved for technical reasons. This has helped reduce communication costs which are increasing again as the Australian dollar drops against the USD.

The move to RUDICS prevented a major outage of our data stream when our service provider changed the communication routing without notice and caused complete failure for ALL dial-up calls in September 2015. The 10 floats that remain on dial-up for primary communications as well as all calls to the secondary server failed to connect for over 3 weeks. We have now installed an Iridium modem at CSIRO for the secondary server and are reprogramming this number into our array through a mission change. We will, hopefully, avoid such a serious outage again. However we also discovered that the new APEX floats with the APF11 controller cannot accept a number change, which was a surprise. This means that when the service permanently migrates to a new switch, these floats will no longer have a secondary server available for their calls. This is a serious issue with APF11 floats. We are talking to Teledyne Webb about this issue and they intend to allow mission changes to the phone numbers in future releases.

### Issues impacting data delivery in 2014-5:

Aside from further coding to create version 3.1 files, accommodating Bio-Argo data has been our biggest challenge. This has included the version 3.1 coding for the Bio data but also included deployment of floats that carry:

- 1) oxygen, FLBB2 sensors
- 2) oxygen, FLBB2 and SUNA Nitrate sensors
- 3) oxygen, FLCDBB (FLBB+CDOM), ECO\_Triplet, C-Rover AND BOTH OCR radiance and irradiance sensors(!)

These have proved particularly challenging to process and deliver within the B-files. In fact, the last was delayed by a lack of sensor information in the tables for the ECO\_TRIPLER sensor model. Once that name passed the format checker, we then delivered all of the files from this float. Approval of new names is something that should be discussed at ADMT. The 4 floats in this group are profiling every 3 days to ~500db, with a deep profile every 3<sup>rd</sup> profile. This will help with calibration but some appear to be restricted to 1000db in depth which will make calibration significantly more difficult.

Another challenge has been deployment of Webb APF11 floats, including one with a new CTD developed by RBR. These again required significant changes to our processing and came with their own set of problems. These are now all being decoded and the data delivered as usual, with the exception of the RBR float. We are withholding that data from the Argo data set until we are confident it will not introduce an unknown error.

The cumulative effect of the coding and getting things through the GDACs, as well as just gaining an understanding of this very complex data, has resulted in a long lag between data arrival and delivery to the GDACs for these 4 floats. Other floats, with ‘known’ formats have had much shorter delays.

### **Software development:**

We continue to evolve our code to deliver V3.1 for all of the 4 file types, which has been a huge undertaking and impacted the timeliness of both the RT and DM data streams. Trajectory files have only been partially completed but we anticipate this to be finished for iridium floats early in 2016. Profile, Metadata and Tech files are all being delivered in real-time in version 3.1, including Profile B. Almost all of our Bio data is now being delivered both in raw and derived form in the new BR data files. One problem remains with some complex sensor data that is not being delivered in the files. We are working to resolve this and then hope to deliver all outstanding Bio data.

We continue to work with INCOIS on code for new float formats and the new data formats.

### **Data Acquisition and delivery to the GDACs and GTS:**

Our aim is that raw data is processed within a maximum of 18 hours of delivery from either Argos or via Iridium.

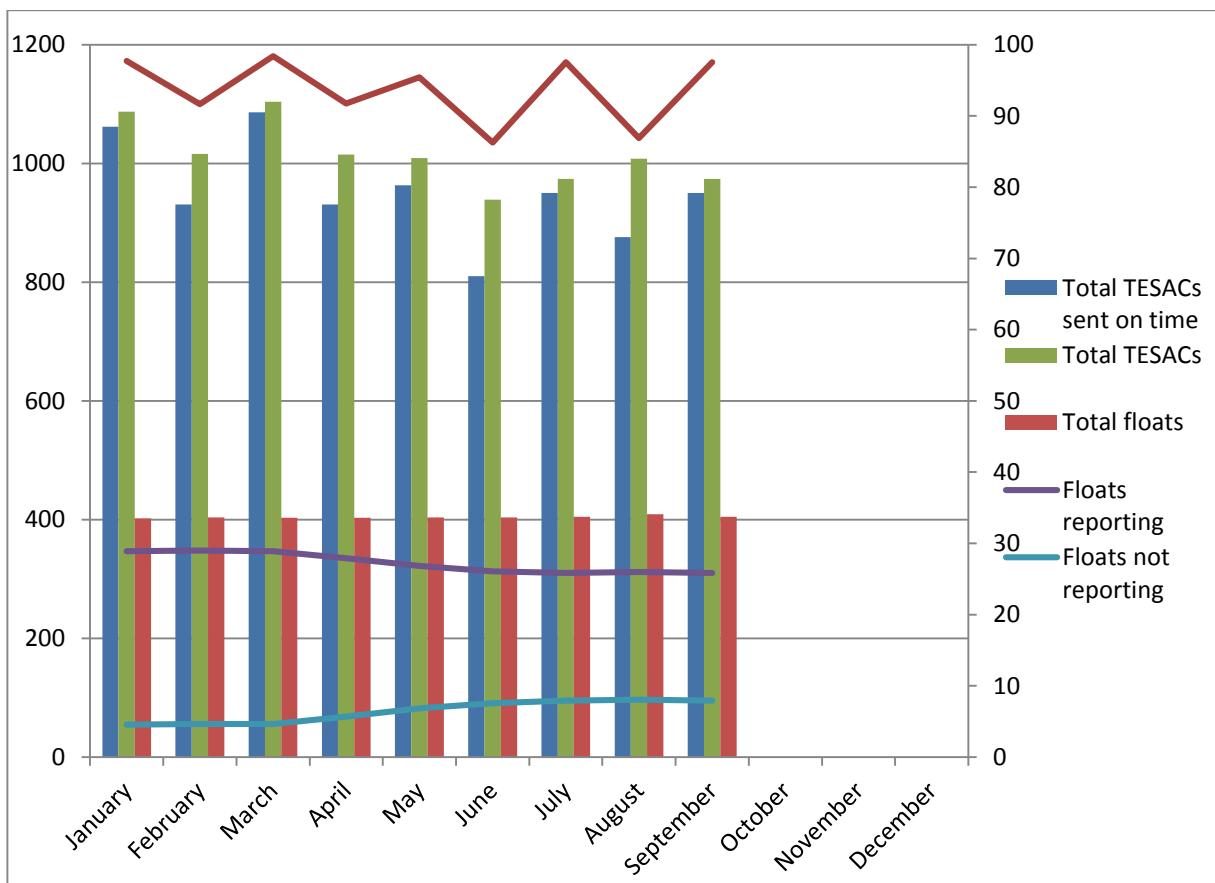
Argos data is processed twice – once as soon as practical, then again after 2-3 days to ensure we have the maximum number of reports and the best possible message copy. After passing through the real-time QC, the netcdf files are generated and the data is then sent via FTP to both GDACs. As insurance, we actually send each file 4 times in case of transmission failures. CSIRO’s Argos processing is mirrored at the Australian Bureau of Meteorology

(BoM) so each file is delivered 8 times in total, ensuring that the GDACs have the data if either CSIRO or BoM are offline for some reason.

The data is also issued to the GTS in both BUFR bulletins and TESAC messages by the Bureau of Meteorology (ANMC).

Delays in data delivery appear to have improved but we will always have some floats that are under ice or have just been deployed and need additional processing before the data is sent out. Because many of the floats we are deploying tend to have the same formats as previous deployments, these delays are now minimal.

Delivery problems this year (apart from the router change noted above) appear to have been minimal though coding for various version 3.1 files has impacted performance to some degree.



Summary of the timeliness of the Argo Australia GTS delivery for 2015.

Data is available for delayed mode QC as soon as the real-time data is processed but only considered eligible for DMQC after 12 months. The Delayed Mode report is appended below.

**Additional Data Distribution:**

As noted in previous years, the National Collaborative Research Infrastructure Strategy (NCRIS) funds the Integrated Marine Observing System (IMOS) which is a major source of Argo funding for Australia. As part of this initiative, it is required that we have a local data delivery pathway. IMOS is now serving Argo data as a mirror to the US GDAC through its data portal which can be accessed at:

<http://imos.aodn.org.au/webportal/>

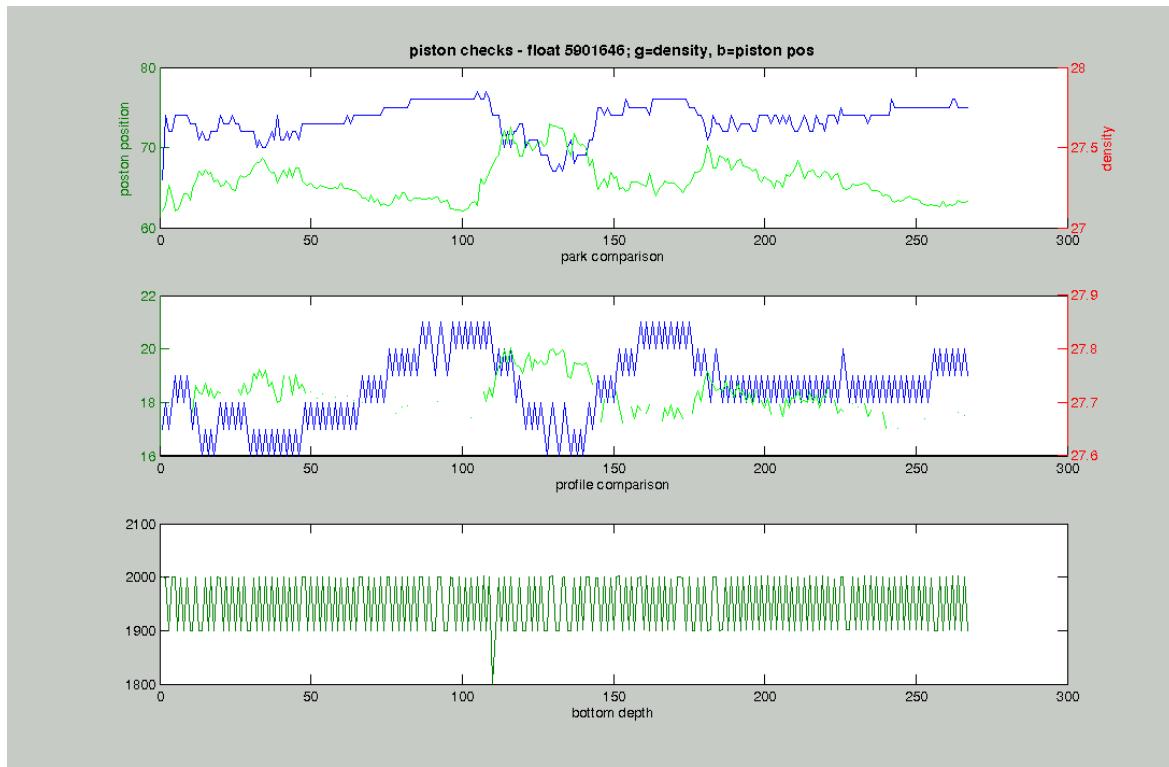
All IMOS data, from all platform Facilities, can be accessed through this web site.

**Float Performance:**

Of the 683 floats we have deployed since the program began in 1999, 313 are now considered inactive. We have carried out a basic analysis of our float failures and find that the major attributable cause of loss is simply end of life and battery drain (138 floats), although 17 disappeared on deployment, some without any apparent cause. Thirty-five floats have also disappeared without any clear cause after varying periods of profiling, 41 have grounded and not returned, 38 had various failure modes and another 40 have leaked. Sixteen were lost under ice and never returned. Note that some floats were apparently affected by more than one failure mode.

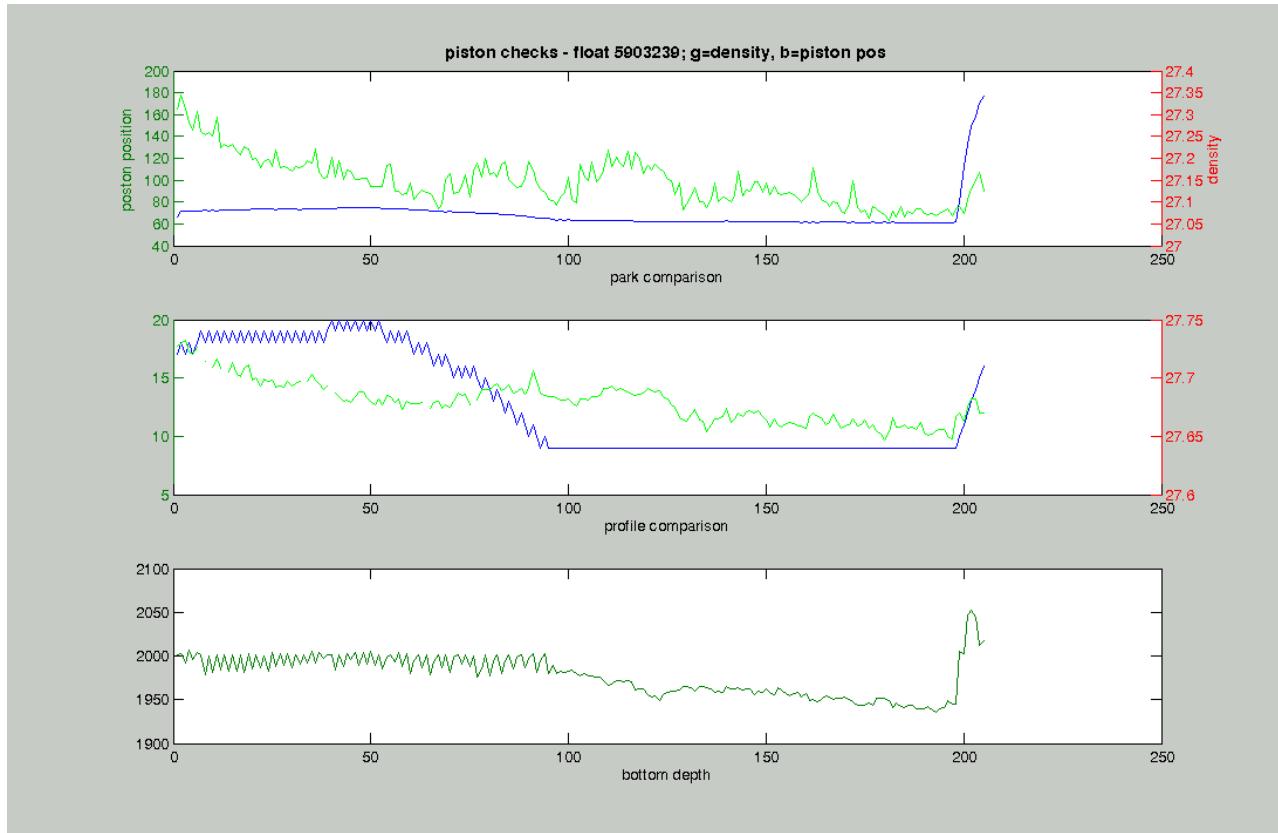
Of some concern is the appearance of a new failure mode with APEX APF9 floats. The piston position readings indicate that these floats are apparently getting LIGHTER. In reality, this is incredibly unlikely. The floats profile to approximately the correct depth for several months, then suddenly go deep and are gone by the next profile. Some just disappear without the deep profile. So far, we have had 52 floats affected, with 20 either dead or missing.

Normal changes of piston position with density are shown below – note that there is an inverse relationship with lower density waters requiring a ‘lighter’ float to maintain the correct depth so the piston position is higher. The ‘jitter’ in the bottom depth plot indicates the change in depth that results from a change in the profile piston position of 1 count.

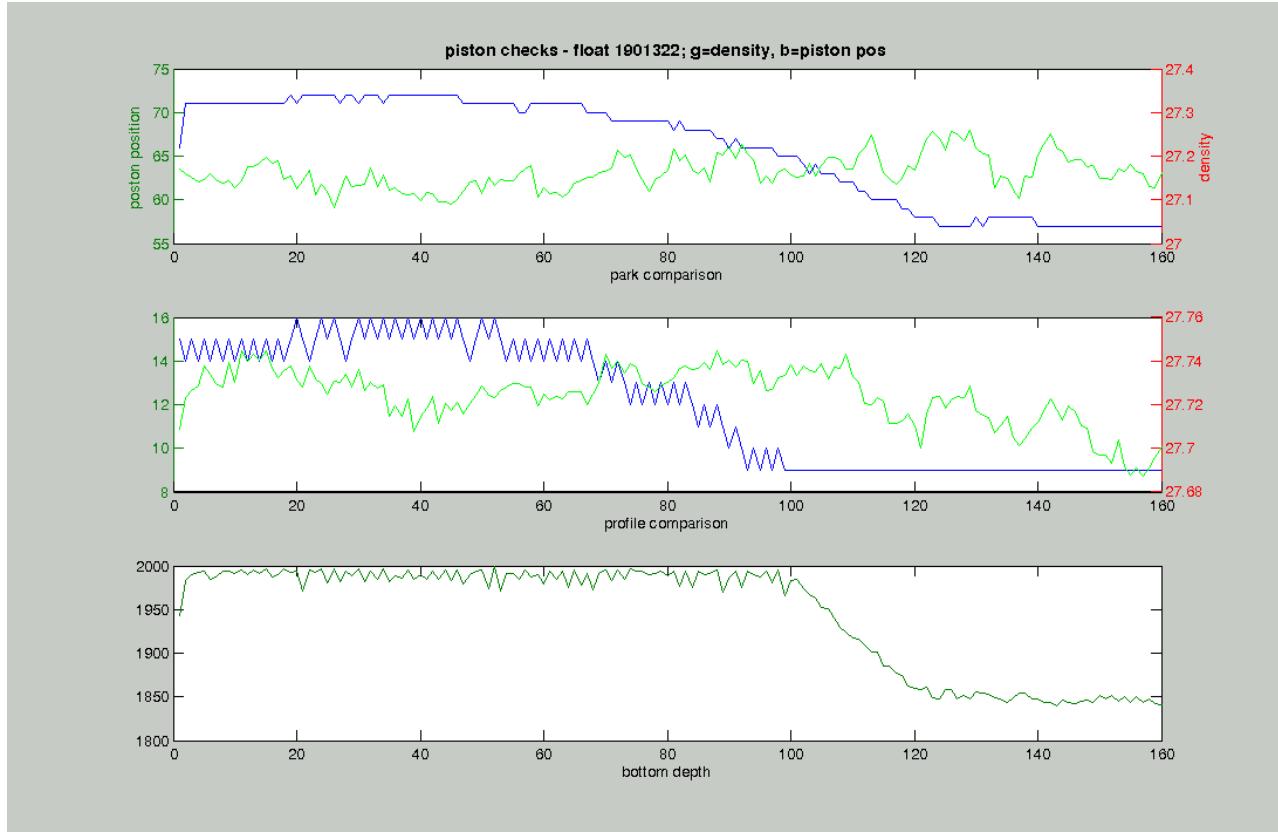


The relationship of piston position (blue) with water density (green) at the park (top) or profile (middle) depth.  
The bottom plot shows the deepest pressure reading.

The plot below shows the same data for a float with the pathology: it got ‘lighter’ (decreasing piston position) despite density increasing (which should result in a higher piston position, not lower). You can see that the relationship for the park position is not very clear but the profile position shows the normal relationship until around profile 60 at which point it begins decreasing until it reaches its minimum. The maximum depth reached by this float perhaps explains why the piston position reported has gone down – the float is not reaching its intended depth and so is trying to go deeper by making itself heavier. At the very end, the float goes too deep and it begins to adjust in the other direction, finally disappearing.



Below is another example and you can see the maximum profile depth shallowing despite the density being relatively stable and the piston position reaching minimum. We suspect there is a disconnect between the piston position reported and the actual pump displacement, or there is a possible loss of oil from the system.



The hull number range where we have seen this is very wide – from 2944 through 5755. The pathology occurs at much higher prevalence in the serial numbers between 4500 and 5500 where it affected 22% of the floats (44% of the floats between 5400 and 5525). Not all of these have disappeared or delivered fewer than the expected number of profiles, but many of these floats are not surviving as long as we normally expect.

Of the floats declared dead or missing, the ones with the lowest serial numbers effected by this delivered the most profiles (average 210) while those with the higher serial numbers delivered, on average, only 117 profiles before disappearing.

If this proves to be as large an issue as it seems to be from our data, affecting more than 20% of floats from that period, then it will may have a significant impact on the large APEX float array and the cost of maintaining Argo density and coverage.

In addition, we have 23 floats on our grey list, mainly for salinity sensor problems but also for a combination of issues that affects all three core parameters.

Finally, we have 47 floats on the ‘missing’ list – most of these (30) are under ice.

### **Web Pages:**

The Australian Argo Real Time web pages are updated with the most recent data during the processing of the reports from the floats. They are therefore up to date as soon as float data is received. We have added web pages that contain details of the technical data from our floats, aiding in the diagnosis of problems. This is now done as a float is processed making them up-to-date and easy to find.

Home page for Argo Australia (IMOS)

<http://imos.org.au/argo.html>

The Australian data portal can be found at:

<http://www.imos.org.au/facilities/argo-australia.html> ;

Information on individual floats can be found at:

<http://www.marine.csiro.au/~gronell/ArgoRT/> ;

There are links to the technical pages for a float from each profile page.

Note that our DMQC pages are not being updated while our software is undergoing a major overhaul to accommodate Bio-Argo parameters.

### **Statistics of Argo data usage:**

Argo data is downloaded to a local mirror once a week using the rsync capability. This has been a major improvement with the updates now taking less than an hour when they used to take more than one day via FTP. We then generate a matlab file of the data with an index table to make data access easier.

Argo usage is a difficult list to compile, as Argo data are now being used routinely by many researchers nationally and globally. Not much has changed in the past year. In addition to the information below, there are numerous publications from Australian researchers which have used Argo data and have appeared in the last year.

The data is being used with other data on the GTS to inform the Bureau of Meteorology's Seasonal Climate Outlook and is used in a dynamical climate forecast system (POAMA). As part of this the data are ingested into the Bureau's Ocean Analysis (<http://www.bom.gov.au/oceanography/analysis.shtml>)

- Argo data is also being used in the BLUElink ocean forecasting system.  
<http://www.bom.gov.au/oceanography/forecasts/index.shtml>
- We are also incorporating it as a high quality background data field for our upper ocean temperature QC programs (QuOTA archives, SOOP XBT QC).

We report usage to our funders IMOS – the Argo report can be found at:

<http://imos.org.au/imospublications.html>

A large number of Australian PhD students are using Argo data and it is an integral part of many collaborative research projects which rely on our outputs. Please see the IMOS web site for more details.

Please also see the AST-16 report for a list of research projects using Argo data in Australia.

### **Delayed Mode QC (DMQC) Report:**

Australian DM Statistics (to 1 Oct 2015)	
D files submitted to GDAC	63537
Total R files	61054
R files eligible for DMQC	46833
Total eligible files for DMQC	110370
Total files at GDAC	124591

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

As the Australian Argo fleet continues to expand, the number of eligible files available for Delayed Mode processing (those that are greater than 12 months old) continues to grow rapidly (37% increase over the past year). Current DM statistics of eligible submitted D files at the GDAC are at 58%.

We aim to assess each float at least once per year with new floats assessed when profiles are 12 months old. If a float is dead, then we process the entire record as long as profiles are more than 6 months old.

A challenge for our program is the significant increase in data volumes of the standard P, T and S data in the Delayed Mode data stream as well as the development of new processes to QC trajectory data and other parameters such as oxygen. The number of eligible files for DMQC has continued to increase, up from 80,000 last year to 110,000 this year.

In May 2014 we hired a new DM operator (Catriona Johnson) to help DMQC float data half-time – we have just extended this contract to mid 2017. We also hired a software programmer to develop a software GUI to QC Argo oxygen data on a 12 month contract. Good progress was made on the development of the oxygen software over a 6 month period, however we have since lost the programmer to another position. We are still working on finalizing the software albeit at a slower pace. Parallel to the oxygen software we have re-written our entire DMQC software to deal with multi-profile files and to speed up and enhance the visualization of the data and processing. This effort has also been hampered by the loss of our programmer but we are hoping to have both pieces of software finalized somewhere between Jan-Jun 2016. Significant effort is also going into the trajectory files (real-time processing to start, with DM processing to follow).

Appendix A.

# **Argo Canada National Data Management Report**

**ADMT16**

**Nov 02 - 07, 2015**

## **1. Status**

**Data acquired from floats:** We are currently tracking 69 floats of which 13 might be in trouble or might have failed to report within the last 6 months. Since the beginning of Nov 2014, we deployed 22 floats from MetOcean Data Systems Ltd. which report on the Iridium satellite system. Eight (8) of the 22 floats have dissolved oxygen sensors on board. We currently acquire Argo messages from Argos (through CLS, 4 floats) and Iridium (SBD packets through JouBeh, RUDICS through CLS, 65 floats).

**Data issued to GTS:** All data are issued to the GTS in TESAC and BUFR formats. On average, 89% of data were issued on the GTS within 24 hours in TESAC and BUFR formats between October 2014 and September 2015. For July and August 2015, only a small number of BUFR messages were issued on the GTS within 24 hours due to modification of the system to avoid sending duplicate BUFR messages on the GTS.

**Data issued to GDACs after real-time QC:** The profile, technical, trajectory and meta files are transmitted to GDACs in netCDF format version 3.1 on an operational basis with some additional delay compared to the data sent on the GTS, because the two processes run on different servers.

**Data issued for delayed QC:** Data are available for delayed mode QC as soon as they are sent to the GDACs, but only considered eligible for DMQC after 6 months.

**Delayed mode data sent to GDACs:** The DMQC eligible files from 7 floats were quality-controlled or re-quality controlled for salinity or pressure since October 2014.

### **Web pages:**

<http://www.isdm.gc.ca/isdm-gdsi/argo/index-eng.html>

We maintain web pages that show float tracks and all data collected by Canadian floats. Links to both real-time and delayed mode data are also available for download directly from GDAC. The pages are updated daily.

We also show some information about the global programme including the position of floats over the previous months, the success rate of meeting the 24 hours target for getting data to the GTS at various GTS insertion points, the number of messages

transmitted, reports of floats which distributed more than one TESAC within 18 hours and Canadian float performance statistics.

Another website section describes the Line-P products and other uses of Argo to monitor the N.E. Pacific:

<http://www.isdm.gc.ca/isdm-gdsi/argo/canadian-products/index-eng.html>

**Statistics of Argo data usage:** Argo data have been used to generate monthly maps and anomaly maps of temperature and salinity along line P in the Gulf of Alaska. Line P has been sampled for 50 years and has a reliable monthly climatology. For more information on the Line-P products and other uses of Argo to monitor the N.E. Pacific go to:

<http://www.isdm.gc.ca/isdm-gdsi/argo/canadian-products/index-eng.html>

As of September 2015, 8 primary papers acknowledging Argo data usage and published between 2014 and 2015 were co-authored by at least one Canadian scientist.

The Canadian Meteorological Centre (Dorval, Québec) of Environment Canada is assimilating real-time Argo data in operational mode.

## **2. Delayed Mode QC**

As of October 2015, 16% of all eligible floats, active and inactive, had their profiles QCed visually and adjusted for pressure according to the latest delayed-mode procedures at least once. The salinity component of DMQC had been performed at least once on 57% of eligible cycles.

## **3. GDAC functions**

Canada forwards TESAC data to the GDACs in Brest and US NODC three times a week. Canada also monitors the timeliness of Argo data on the GTS in BUFR and TESAC formats.

## **4. Region Centre Functions**

Canada has no regional centre function.

**Chinese Argo National Data Management Report**  
**ADMT-16**  
**Bermuda, 4-6 November 2015**

**1. Status**

- **Data acquired from floats**

From November 2014 to September 2015, China acquired Argo profiles from 214 active floats including 107 active Argo equivalent floats. These floats were deployed by 7 PIs from 5 institutes in China. Among these floats, there are 119 PROVOR (including 17 PROVORDOI), 87 APEX (including 20 Iridium floats and one O<sub>2</sub> Iridium float), 8 ARVOR floats. This September China also deployed 5 HM-2000 profiling floats (developed by China) in the northwestern Pacific ocean which use GPS for positioning and BeiDou for data transmission. CSIO has setup a BeiDou data receiving system through which the messages from HM-2000 floats can be operationally received and decoded. At present, the data from HM-2000 floats are QCed and converted into format V3.1 (only profile files). The profile files haven't been submitted to GDAC because we have to wait the acceptance from ADMT.

- **Data issued to GTS**

Currently CLS still helps us distribute Argo profiles on GTS. This year we prepared BUFR message using perl script developed by JMA. But it took a lot of time for China Meteorological Administration (CMA) to add BUFR bulletin headers. Now they are ready to send BUFR data to GTS. By the end of this year, CSIO will send BUFR data to GTS operationally through CMA.

- **Data issued to GDACs after real-time QC**

From the last ADMT, China submitted 8,118 R-files to GDACs after real-time QC. Among these profiles, 3,239 profiles are observed by Argo equivalent floats, and 1,965 O<sub>2</sub> profiles are obtained from 18 O<sub>2</sub> floats.

This year CSIO changed all the decoders from C language to Matlab, as well as RTQC and netcdf file generation. New decoders are very flexible due to usage of format table. We only need to create a new format table if a float with a new firmware version is deployed. This year we updated our netcdf file generation

software to version 3.1. Using this software, we updated most of the meta files and technical files, and V3.1 profile files are routinely submitted to GDAC. We also created b-files from several bio-Argo floats except 17 PROVOR-DOI floats. As for trajectory file, we still use old format.

NMIDS finished converting profile files from old version to version 3.1, but not for meta, technical and trajectory files.

- **Delayed data sent to GDACs**

Owing to the format changes, NMDIS is updating their software to meet the new format. None D-files are submitted to GDAC this year, and the delays will be relieved next year. This year CSIO have completed the software upgrade, and most D-files will be transferred to version 3.1. The new D-files will be submitted to GDAC as soon as possible.

- **Web pages**

Two web pages are maintained by NMDIS, and CSIO. the China Argo Data Centre (<http://www.argo.gov.cn>) and the China Argo Real-time Data Centre (<http://www.argo.org.cn>). Both web pages provide the access to the float data, meta data, trajectory and their related plots. A new Argo web inquiry system has been built by CSIO (<http://101.71.255.4:8090/flexArgo/out/argo.html>), which will provide global Argo data inquiry and downloading services to users.

- **Statistics of Argo data usage ( operational models, scientific applications, number of National Pis... )**

The Argo data have been widely used in scientific applications and operational oceanography. Several Argo products and reanalysis products have been developed shown as the following table.

<i>Product name</i>	<i>Type</i>	<i>Institute</i>	<i>Parameter</i>	<i>Coverage</i>	<i>Horizontal resolution</i>	<i>Vertical resolution</i>	<i>Temporal resolution</i>
BOA_Argo	Gridded field	CSIO	T S MLD	180° W~180° E 59.5° S~59.5° N	1° × 1°	49 levels (0~2000m)	monthly
CORA	Reanalysis	NMDIS	T S	99° E~150° E 10° S~52° N	0.5° × 0.5°	35 levels (0~2000m)	monthly

Tropical Pacific	Reanalysis	NMEFC	T S	120° E~70° W	2° × 2°	13 levels (10~630m)	monthly
BCC_GODAS	Reanalysis	CMA	T S	0~358.125 79.271 ° S~90 ° N	1.8° × 1.8°	17 levels (12.5~550m)	monthly
Current Distribution Maps	Gridded field	NMDIS	current	global	2° × 2° 5° × 5°	0m/1000m/2000m	monthly

NMDIS carried out a duplicate removing for global Argo dataset. The principle is identifying key items that could represent the information of observations ,such as time , latitude and longitude, instrument , and profile data, auxiliary items (e.g. country, responsible agency, and project name), then setting a replicate criterion for each key item and sorting the data based on key items. If observation times, latitudes and longitudes, instruments are all the same, the suspicious profiles will be checked to eliminate duplicates. Preliminary results show that about 1‰ of profiles are found to be duplicated.

## 2. Delayed Mode QC

This year CSIO completed the DMQC software upgrade. The updated software covers pressure correction, thermal mass correction and salinity correction (based on the OW method). We have finished the DMQC for about 50 inactive floats (about 6000 profiles), and will submit all updated D-files to GDAC as soon as possible.

## 3. GDAC Functions

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete

None.

## 4. Regional Centre Functions

None.

# Argo data management report 2015

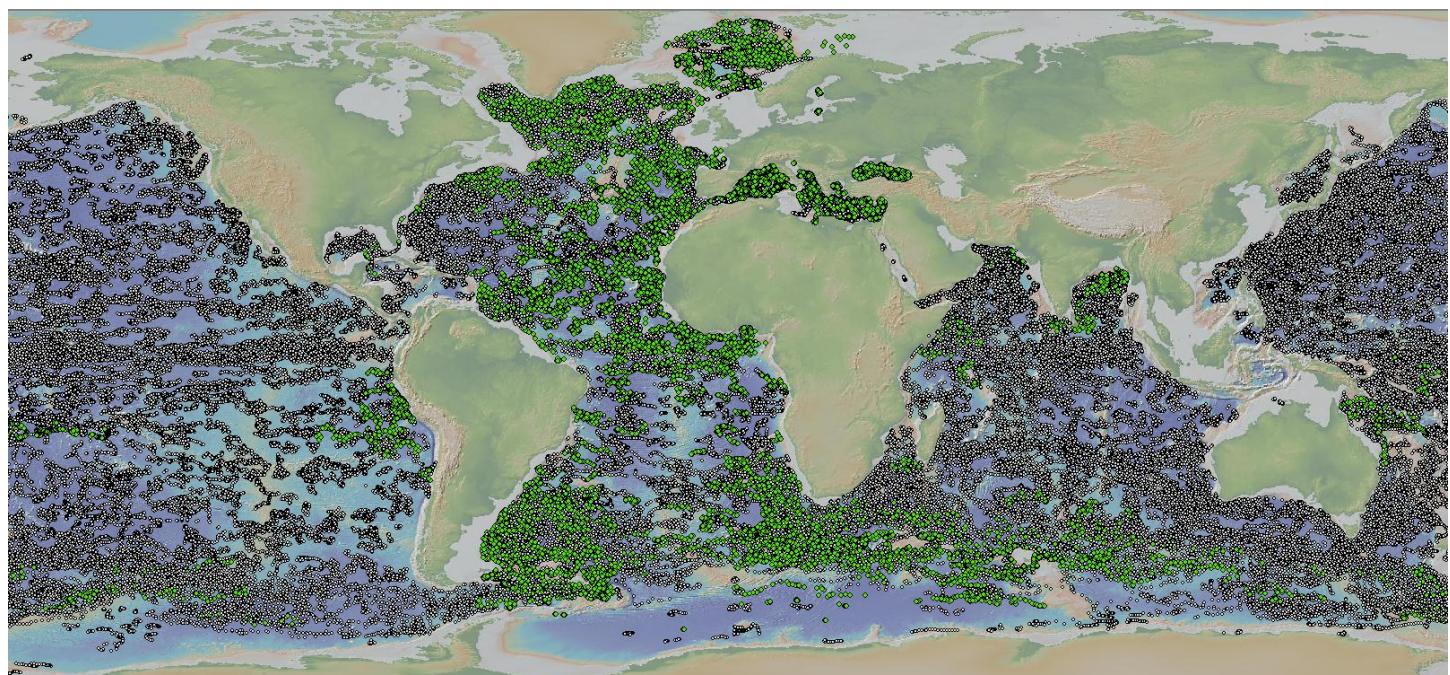
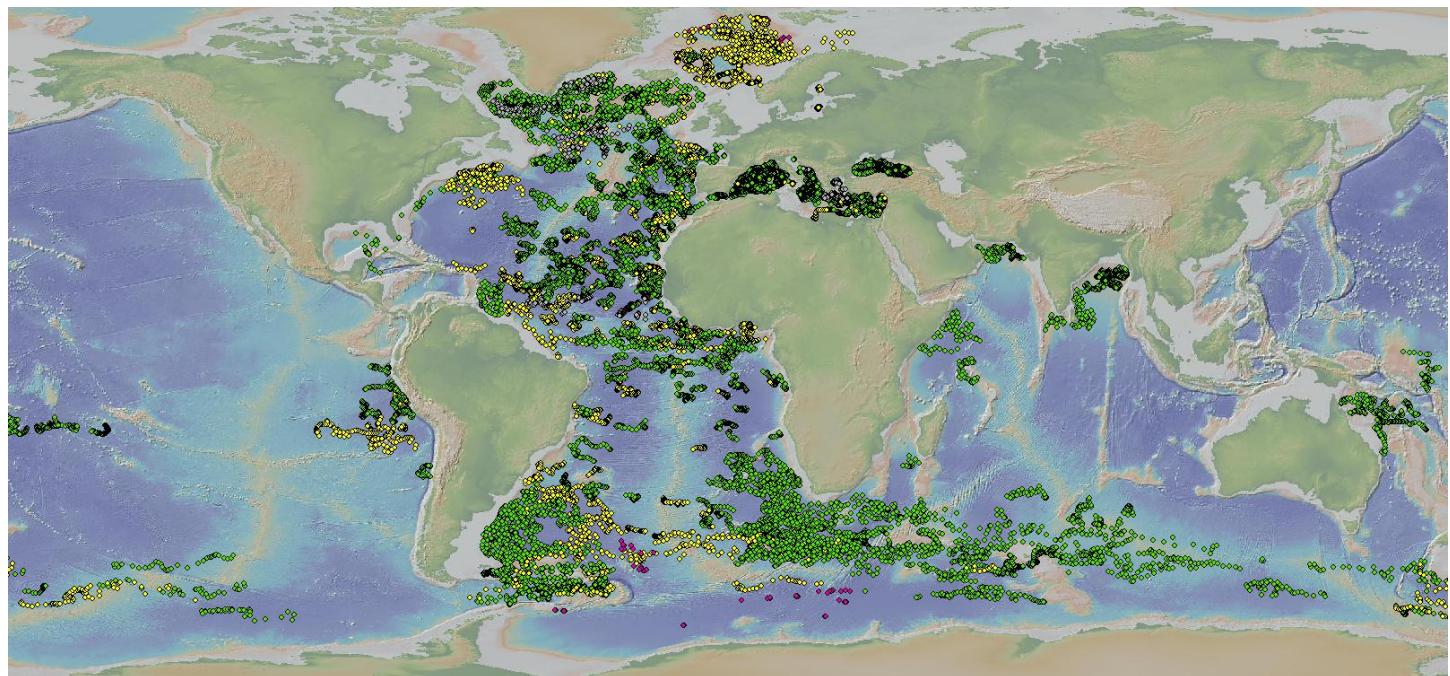
## Coriolis DAC & GDAC

Data Assembly Centre and Global Data Assembly Centre

Annual report October 2015

Version 1.1

November 2<sup>nd</sup>, 2015



## DAC status

This report covers the activity of Coriolis data centre for a one year period from October 1<sup>st</sup> 2014 to September 30<sup>th</sup> 2015.

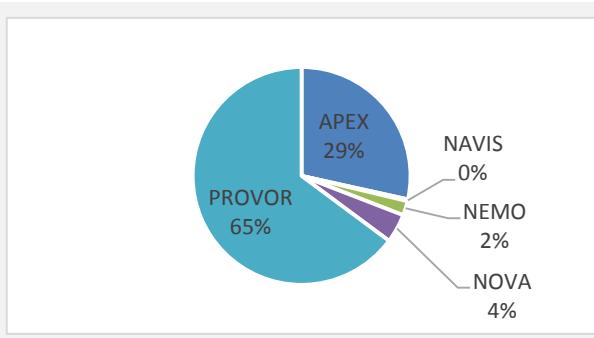
### Data acquired from floats

These last 12 months, **25 568 profiles from 745 active floats** were collected, controlled and distributed.

Compared to 2014, **the number of profiles increased by 18%, the number of floats increased by 14%**. The increase in both profile and platforms number is mainly explained by new bio-Argo floats.

The 745 floats managed during that period had 54 versions of data formats.

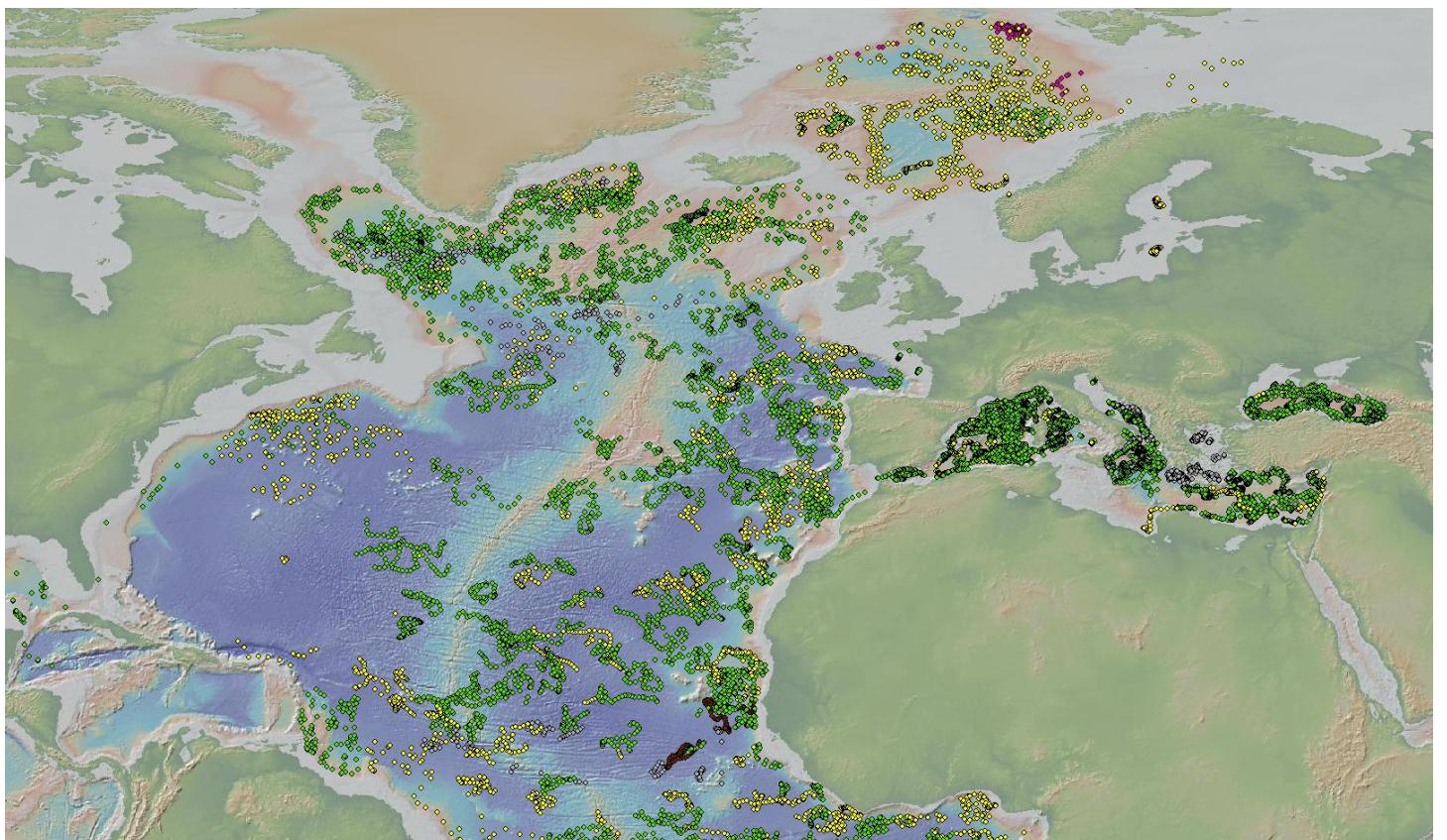
Number of active float types in 2015		
Float family	nb versions	nb floats
APEX	29	212
NAVIS	1	2
NEMO	1	16
NOVA	1	32
PROVOR	22	483
Total	54	745



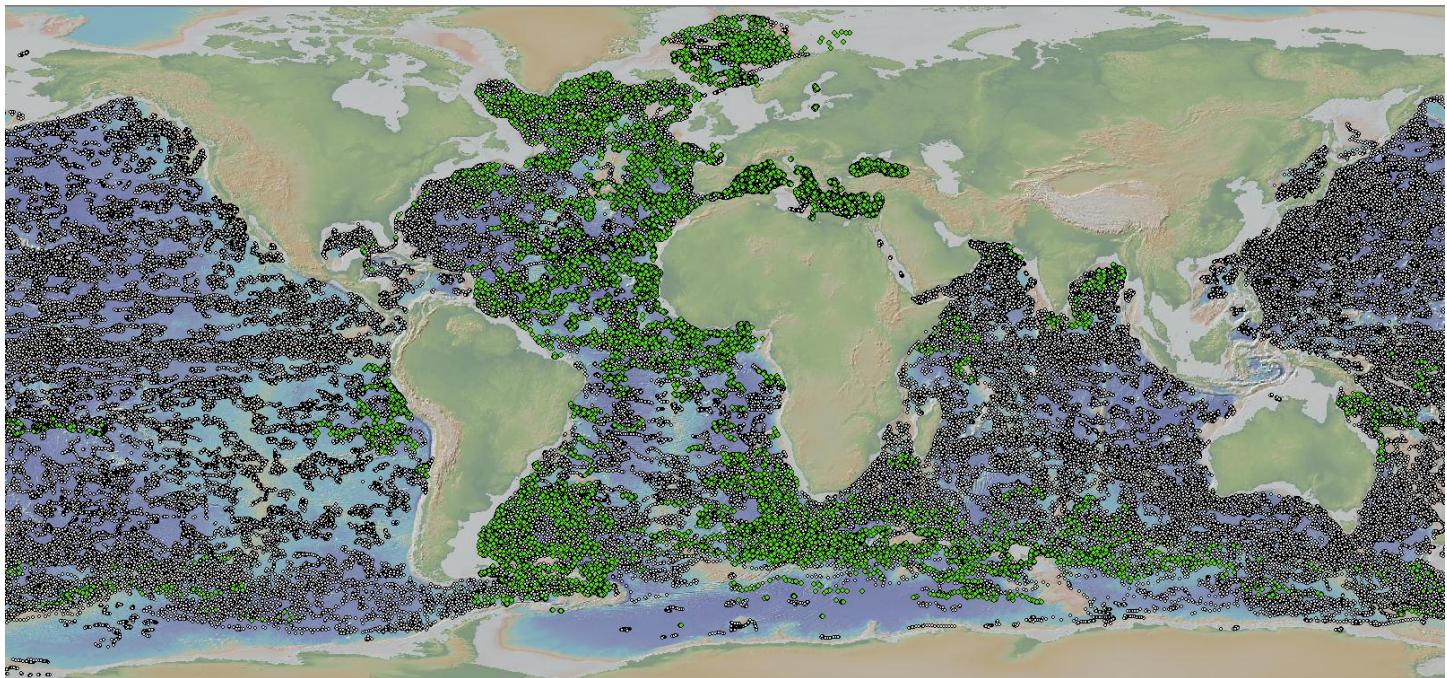


Map of the 25 568 profiles from 745 active floats decoded by Coriolis DAC this current year

Apex   Navis   Nemo   Nova   Provor



Map of active floats managed by Coriolis this current year, zoom on north Atlantic area



Map of the profiles from active floats decoded by Coriolis DAC this current year, among the other DAC's profiles  
(Coriolis: green, other DACs: grey)

## Transition from Argo format 3.0 to Argo format 3.1

### Provor CTS3 floats

In 2015, all versions of Provor CTS3 floats data and metadata were transferred into version 3.1 NetCDF files.

**This transfer required a significant amount of manpower: about 12 man months, shared between 3 persons.**

The transfer required also a significant amount of data processing resources.

### From V3.0 real-time data to V3.1

The existing V3.0 real-time data files were reprocessed from raw Argos or Iridium data into V3.1 NetCDF files.

### From V3.0 delayed mode data to V3.1

The existing V3.0 delayed mode data were reprocessed from raw Argos or Iridium data into V3.1 real-time NetCDF files. Then, the existing adjustments and calibrations were reported from the V3.0 files into the V3.1 to create a new delayed mode dataset, with better metadata information (such as detailed vertical sampling schemes).

The new files delayed mode files have more information than their previous versions

- A detailed vertical sampling scheme
- A separation of pumped/unpumped CTD profiles
- A consistent configuration/mission scheme between data and metadata files
- Correction of erroneous cycle numbers

### Provor T, CTS1, CTF, CTS2

The Provor T, CTS1, CTF, CTS2 were converted from V3.0 to V3.1

For these old floats, most of the profiles were delayed mode files. We did not reprocess the files from raw Argos or Iridium data. For each float, we simply gathered additional metadata and performed a conversion from V3.0 to V3.1.

## Apex floats

All Apex floats are distributed in format version 3.0.

The first version V071412 Apex float V3.1 data processing is under test. The real-time files will be reprocessed and delayed mode files will be reprocessed with a transfer of the delayed mode adjustments/calibrations. This operation will be performed in November 2015.

The rest of 24 versions of still active Apex floats will be converted (probably in 2016).

The 35 versions no more active will be converted to V3.1.

## Nemo, Nova, Navis floats

There are 9018 files for these 3 types of floats (4.6% of the total).

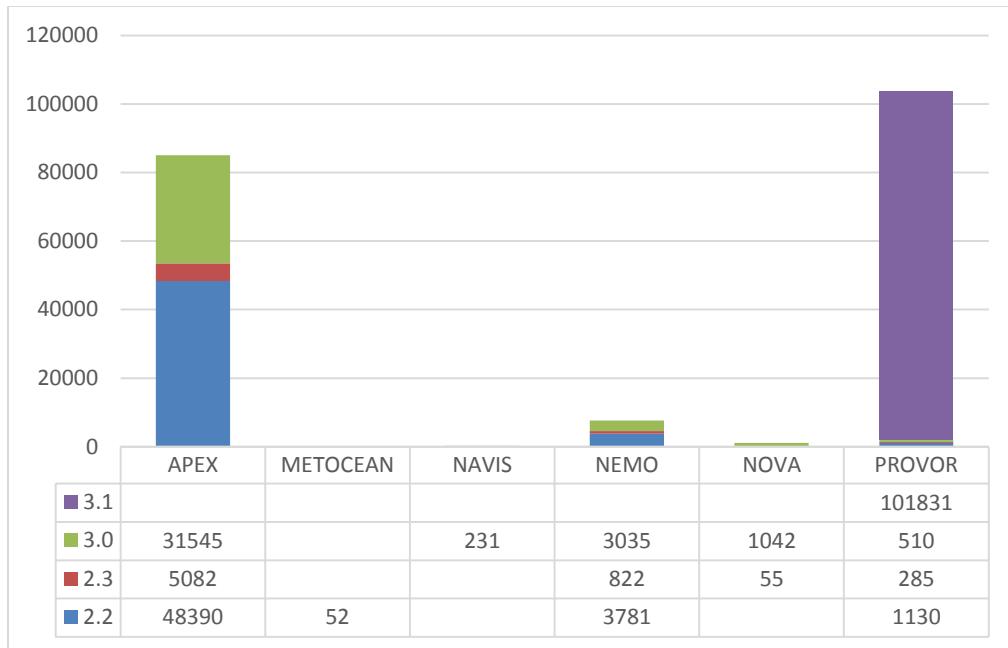
The schedule for V3.1 transition for these files is not yet defined.

## Delayed mode trajectories

The delayed mode trajectories derived from Andro trajectory product were produced in version 3.0. Their conversion to V3.1 trajectory format will be performed in 2016.

The 1442 delayed mode trajectories files are available from:

- <ftp://ftp.ifremer.fr/ifremer/argo/etc/coriolis-custom/argo-andro-data/data/dac/coriolis/>



Number of files from Coriolis DAC, per file format

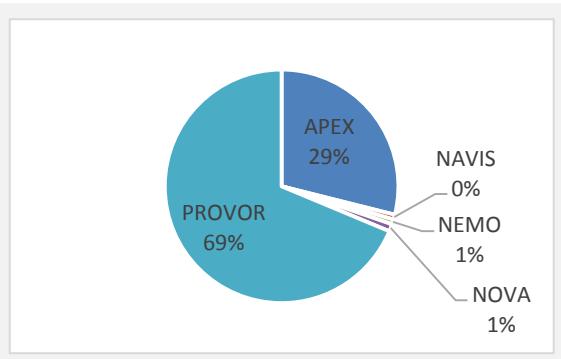
## Bio-geo-chemical sensors on Provor floats

The data processing chain based on Matlab to manage data and metadata from Provor-Remocean floats is continuously improved. These are advanced types of floats performing bio-geo-chemical measurements.

In 2015, data and metadata from these floats have been distributed on Argo GDAC. They feature version 3.1 core and bio profiles, core and bio trajectories, metadata and technical data.

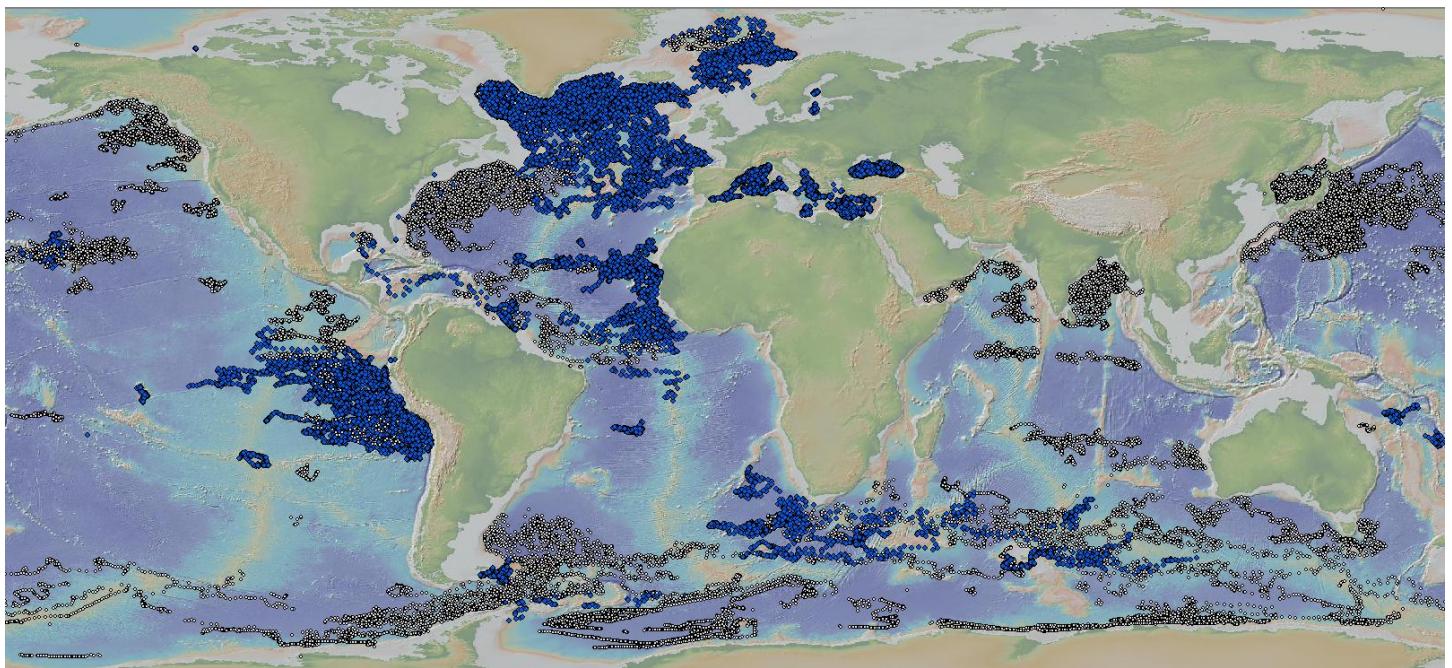
The other bio-Argo floats (Apex, Navis, Nemo and Nova) are distributed in V3.0 data files.

Bio-Argo floats processed by Coriolis DAC		
Familly	nb versions	nb floats
APEX	20	85
NAVIS	1	2
NEMO	1	2
NOVA	1	3
PROVOR	20	202
<b>Total</b>	<b>43</b>	<b>294</b>



## Overview of Coriolis bio-Argo floats

- 294 Coriolis bio-Argo floats
- Iridium rudics bi-directional communication or Argos
- Six sensors are fitted on the floats
  - AANDERAA\_OPTODE\_4330 Aandera oxygen sensor
  - C\_ROVER Wetlabs transmissiometer
  - ECO\_PUCK Wetlabs fluorometer turbidity, scattering
  - SATLANTIC\_OCR504 Satlantic Irradiance sensor
  - SBE41CP Seabird CTD sensor
  - SUNA\_V2 Satlantic nitrate sensor
- 83 parameters managed : core-argo, b-argo, i-argo parameters  
These parameter include chlorophyll, turbidity, CDOM, back-scattering, UV, nitrate, bisulfide, pH, radiance, irradiance, PAR



Map of the 294 bio-Argo floats managed by Coriolis DAC (grey dots: the others DACs bio-Argo floats). They measure parameters such as chlorophyll, turbidity, CDOM, back-scattering, UV, nitrate, bisulfide, pH, radiance, irradiance, PAR.



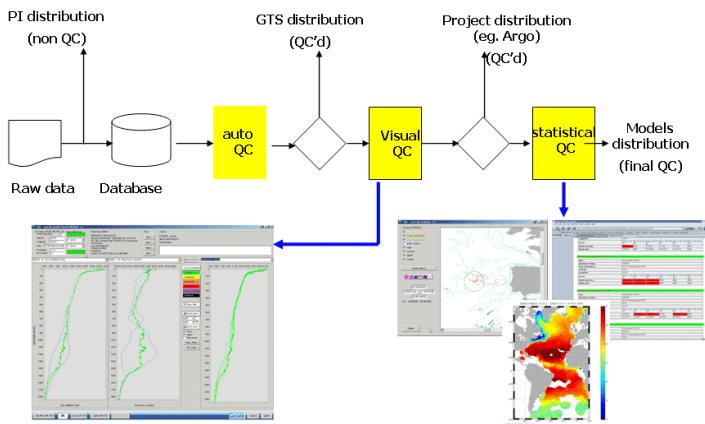
© Antoine Poteau, Observatoire Océanologique de Villefranche (CNRS/UPMC)

Deployments of a bio-argo Provor in Ligurian sea

## Data issued to GTS

All profiles processed by Coriolis are distributed on the GTS by way of Meteo-France. This operation is automatically performed. After applying the automatic Argo QC procedure, the Argo profiles are inserted on the GTS every 2 hours. Argo profiles are inserted on the GTS 365 days per year, 24 hours a day.

Once a day, floats data that are less than 21 days old are checked in an objective analysis (ISAS) that triggers alert and visual inspection for suspicious observations.



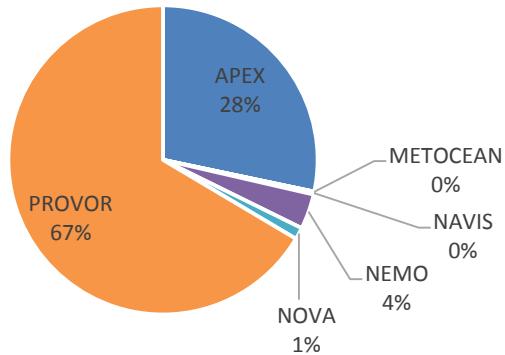
CORIOLIS DAC: Argo data flow

## Data issued to GDACs after real-time QC

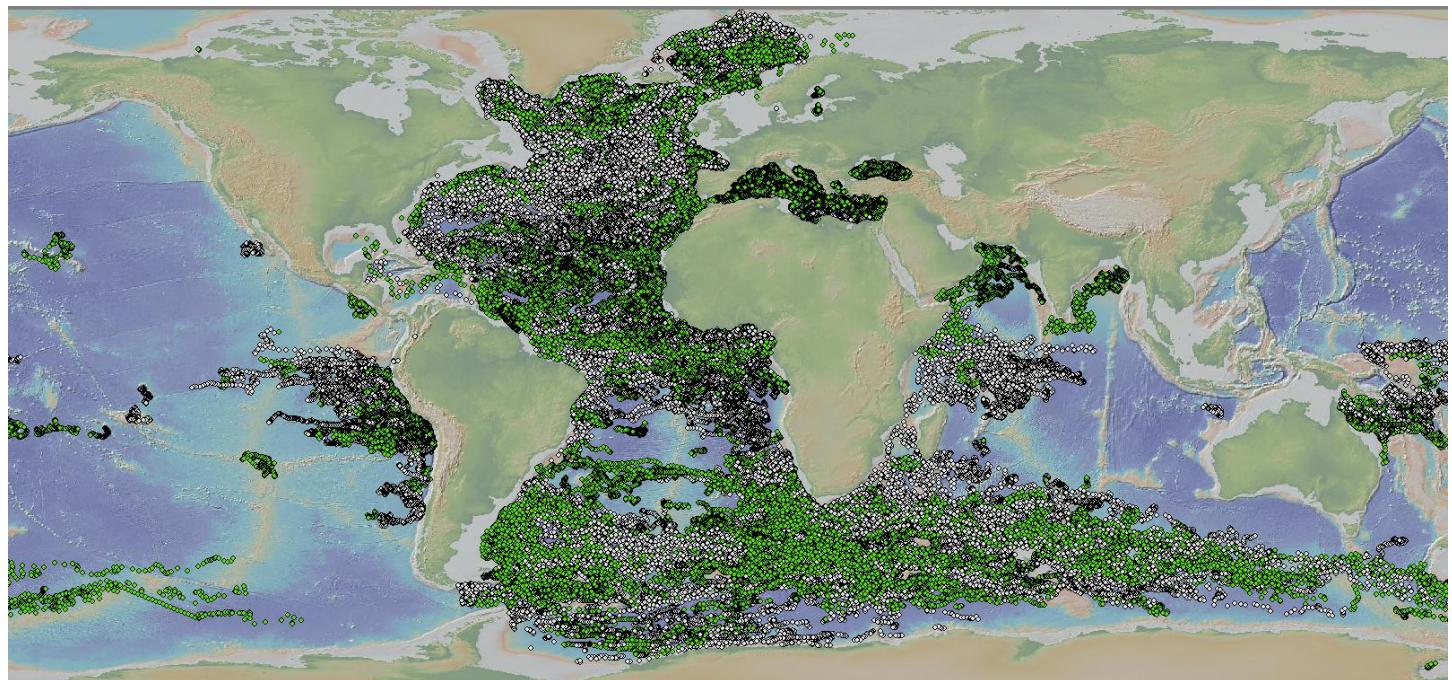
All meta-data, profiles, trajectory and technical data files are sent to Coriolis and US-GODAE GDACs. This distribution is automated.

All Coriolis floats, profiles				
Family	nb float	nb profile	RT profiles	DM profiles
APEX	799	84 983	22 038	62 945
METOCEAN	1	52	-	52
NAVIS	2	231	231	-
NEMO	163	7 636	2 866	4 770
NOVA	32	1 093	970	123
PROVOR	1 068	103 855	51 764	52 091
<b>Total</b>	<b>2 065</b>	<b>197 850</b>	<b>77 869</b>	<b>119 981</b>

77 869 real-time profile files



Distribution of Coriolis DAC real-time profiles



Map of real-time profiles and delayed mode profiles

Real time: green dots, delayed mode: grey dots

## Data issued for delayed mode QC

### Delayed mode profiles

All profile files are sent to PIs for delayed QC. Most of the Atlantic data handled by Coriolis are checked by the European project Euro-Argo.

### Preparation of Argo delayed mode trajectories

The delayed mode trajectories derived from Andro trajectory product were produced in version 3.0. Their conversion to V3.1 trajectory format will be performed in 2016.

The 1442 delayed mode trajectories files are available from:

- <ftp://ftp.ifremer.fr/ifremer/argo/etc/coriolis-custom/argo-andro-data/data/dac/coriolis/>

The Andro trajectory TRAJ3 files are available for most of the DACs. Each DAC may decide to use these files to provide delayed mode trajectory on GDAC.

Coriolis DAC will use these files as its delayed mode trajectories for old floats versions.

## Delayed mode data sent to GDACs

An Argo delayed mode profile contains a calibrated salinity profile (psal\_adjusted parameter).

- A total of **51 741 new or updated delayed mode profiles** was sent to GDACs this year.
- Among these files, 43 014 profiles files were converted into V3.1 format.
- **A total of 119 981 delayed mode profiles** where sent to GDACs since 2005.  
The number of delayed mode profiles increased by 8% this year.

## Web pages

The web site of the French DAC is available at:

- <http://www.coriolis.eu.org/Observing-the-Ocean/ARGO2>

This web page describes all Argo floats:

- <http://www.ifremer.fr/co-argoFloats/>

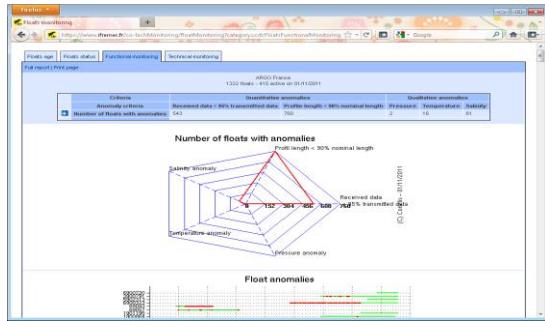
- Individual float description and status (meta-data, geographic map, graphics : section, overlaid, waterfall, t/s charts)
- Individual float data (profiles, trajectories)
- FTP access
- Data selection tool
- Global geographic maps, GoogleEarth maps
- Weekly North Atlantic analyses (combines Argo data and other measurements from xbt, ctd, moorings, buoys)

This web page describes all Argo floats interoperability services from Coriolis:

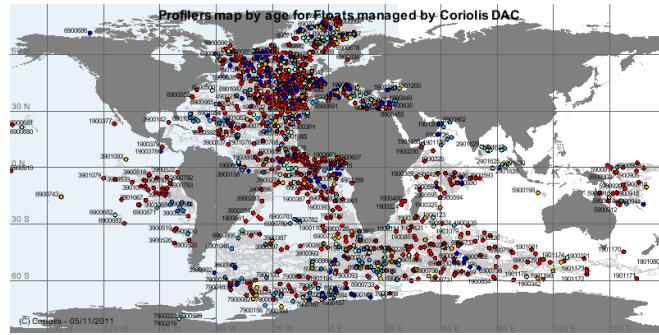
- <http://www.coriolis.eu.org/Data-Products/Data-Delivery/Argo-floats-interoperability-services2>
  - Display an individual float's data and metadata
  - Display an individual float's data and metadata in XML format
  - Display all Argo floats
  - Display a group of floats
  - Argo profiles and trajectories data selection
  - All individual float's metadata, profile data, trajectory data and technical data
  - Argo profiles data on OpenDAP, OGC-WCS and http
  - Argo data through Oceanotron data server
  - Argo profiles data through GCMD-DIF protocol
  - Argo data through RDF and OpenSearch protocols
  - Display Argo profiles and trajectories with GoogleEarth

Some pages of Coriolis web site are dedicated to technical monitoring:

- <http://www.coriolis.eu.org/Data-Products/At-sea-monitoring>



Example 1: technical monitoring of Argo-France floats



Example 2: age map of floats managed by Coriolis DAC.

Data centre activity monitoring: Coriolis operators perform an activity monitoring with an online control board.

Fonction	Description	Etat J	Etat J-1	Etat J-2	Etat J-3	Dernière exécution (TU)
CO-05-08-08	Archive GDAC Argo					OK 2015-10-27T13:52:33Z
CO-03-07-01	Argo files controller					WARNING 2015-09-17T16:00:30Z
CO-01-07-08	Collecte Argo Coriolis EDAC	😊	😊	😊	😊	OK 2015-10-28T14:58:53Z
CO-01-07-03	Collecte Argo DAC - FTP	😊	😊	😊	😊	OK 2015-10-28T15:02:05Z
CO-01-07-01-02	Collecte Argo DAC - Table argo index profiles	😊	😢	😢	😊	UNDERWAY-LOCKED 2015-10-28T14:52:01Z
CO-01-07-01-aoml	Collecte Argo DAC - aoml	😊	😊	😊	😊	OK 2015-10-28T14:32:07Z
CO-01-07-01-bodc	Collecte Argo DAC - bodc	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z
CO-01-07-01-coriolis	Collecte Argo DAC - coriolis	😢	😢	😊	😊	OK 2015-10-28T15:01:47Z
CO-01-07-01-csio	Collecte Argo DAC - csio	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z
CO-01-07-01-csiro	Collecte Argo DAC - csiro	😊	😊	😊	😊	OK 2015-10-28T14:32:04Z
CO-01-07-01-incois	Collecte Argo DAC - incois	😊	😊	😊	😊	OK 2015-10-28T14:32:04Z
CO-01-07-01-jma	Collecte Argo DAC - jma	😊	😊	😊	😊	OK 2015-10-28T14:32:09Z
CO-01-07-01-kma	Collecte Argo DAC - kma	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z
CO-01-07-01-kordi	Collecte Argo DAC - kordi	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z
CO-01-07-01-med5	Collecte Argo DAC - meds	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z
CO-01-07-01-nmdis	Collecte Argo DAC - nmdis	😊	😊	😊	😊	OK 2015-10-28T14:32:03Z

Argo GDAC operations monitoring: every working day, an operator performs diagnostics and take actions on anomalies (red or orange smileys)

## Statistics of Argo data usage (operational models, scientific applications, number of National Pis...)

Operational oceanography models; all floats data are distributed to:

- French model Mercator (global operational model)
- French model Previmer (regional operational model)
- French model Soap (navy operational model)
- EU Copernicus models (Foam, Topaz, Moon, Noos)
- EuroGoos projects

Argo projects: this year, Coriolis data centre performed float data management for **55 Argo scientific projects and 55 PIs (Principal Investigators)**.

### List of Coriolis scientific PIs and project names

Project name	nb floats
coriolis	172
bsh	146
goodhope	82
argo italy	53
remocean	45
naos	42
argomed	34
argo_spain	30
gmmc	28
dap	19
awi	14
ovide	13
sagar	12
argo greece	11
eaims	11
pirata	11
argo norway	10
geovide	10

### List of projects with more than 10 active floats

List of project with less than 10 active floats : amop, argo brazil, argo bulgary, argo geomar, argo\_fin, asa, aspex, bioargo-italy, brazilian navy argo program, bwr, cnes, congas, dekosim, euro-argo, flops, ge moose, geo\_eco\_mar, gmmc\_cnes, ifm, lefe, mafia, medargo\_it, mooxy, outpace, perseus, physindien, proteusmed, rrex, shackelton, shom, socib, sri\_lanka, ticmoc, track2010, upsen, vsf, wen

PI name	nb floats
birgit klein	86
christine coatanoan	77
sabrina speich	61
pierre-marie poulain	60
holger giese	57
virginie thierry	43
bernard bourles	33
christophe maes	27
pedro joaquin velez belchi	27
fabrizio d'ortenzio	26
herve claustre	23
andreas sterl	19
sabrina speich et michel arhan	18
fabien durand	16

gerd rohardt	14
jose luis pelegri	12
rena czeschel	12
dimitris kassis	11
jean-baptiste sallee	10
kjell arne mork	10

#### [List of Principal Investigators \(PI\) in charge of more than 10 active floats](#)

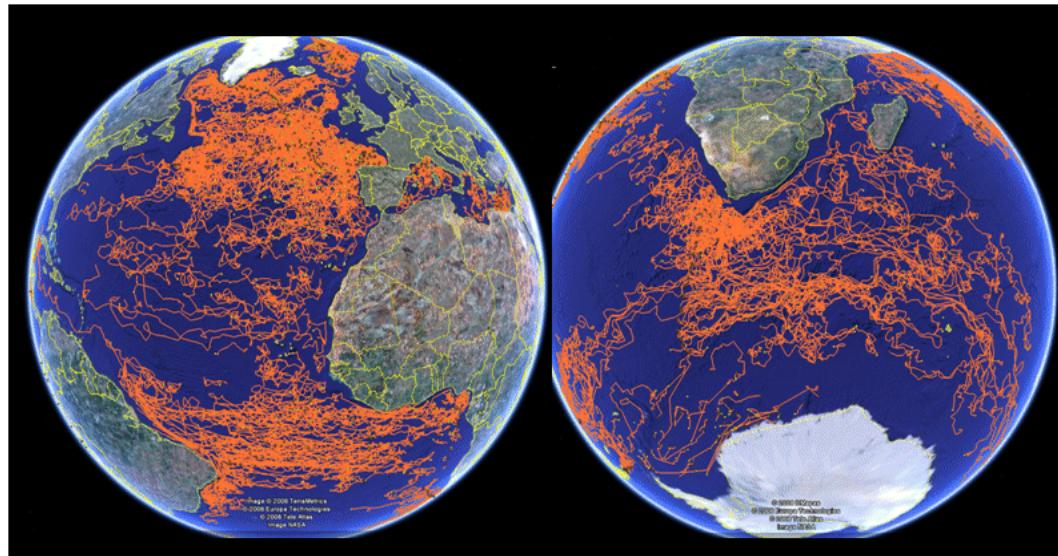
List of Principal Investigators (PI) in charge of less than 10 active floats: alain serpette, alban lazard, anja schneehorst, bert rudels, bettina fach, cecile cabanes, chistophe maes, christine provost, conan pascal, detlef quadfasel, elodie martinez, frederic vivier, gerard eldin, hubert loisel, jordi font, juliet hermes, katrin latarius, laurent coppola, luis felipe silva santos, nathanaëlle lebreton, pascal conan, pascual ananda, s. speich, s.cravatte, serge le reste, sorin balan, stephane blain, stéphanie louazel, tero purokoski, thierry moutin, tobias ramalho dos santos ferreira, velez belchi pedro, violeta slabakova, waldemar walczowski, xavier andre

## ***Products generated from Argo data ...***

### **Sub-surface currents ANDRO Atlas**

Based on Argo trajectory data, Michel Ollitrault and the Ifremer team are regularly improving the “Andro” atlas of deep ocean currents. The ANDRO project provides a world sub-surface displacement data set based on Argo floats data. The description of each processing step applied on float data can be found in:

- [http://www.ifremer.fr/lpo/files/andro/ANDRO\\_JAOT\\_2013.pdf](http://www.ifremer.fr/lpo/files/andro/ANDRO_JAOT_2013.pdf)
- See also : <http://wwz.ifremer.fr/lpo/Produits/ANDRO>



Argo trajectories from Coriolis DAC are carefully scrutinized to produce the “Andro” atlas of deep ocean currents.

## Delayed Mode QC

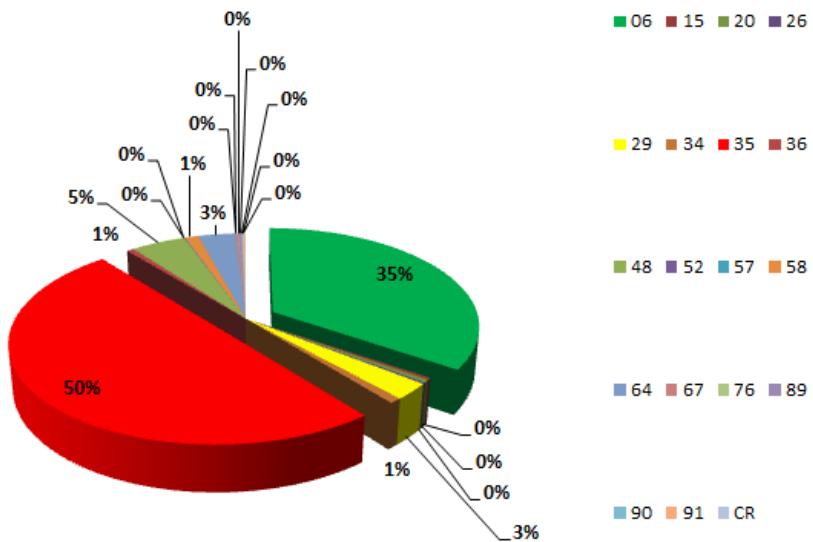
(Please report on the progress made towards providing delayed mode Argo data, how it's organized and the difficulties encountered and estimate when you expect to be pre-operational.)

At the Coriolis data centre, we process the delayed mode quality control following four steps. Before running the OW method, we check carefully the metadata files, the pressure offset, the quality control done in real time and we compare with neighbor profiles to check if a drift or offset could be easily detected. As each year, we have worked on this way with PIs to strengthen the delayed mode quality control.

Some floats have been deployed from some projects, meaning a lot of PIs and a lot of time for explaining the DM procedure to all of them. A few PIs are totally able to work on DMQC following the four steps but this is not the case for most of them. Since the unavailability of the PIs leads to work by intermittence and then extend the period of work on the floats, we did the work with a private organism (Glazeo) to improve the realization of the DMQC, exchanging only with the PIs to validate results and discuss about physical oceanography in studied area. Working in this way, we largely improve the amount of delayed mode profiles.

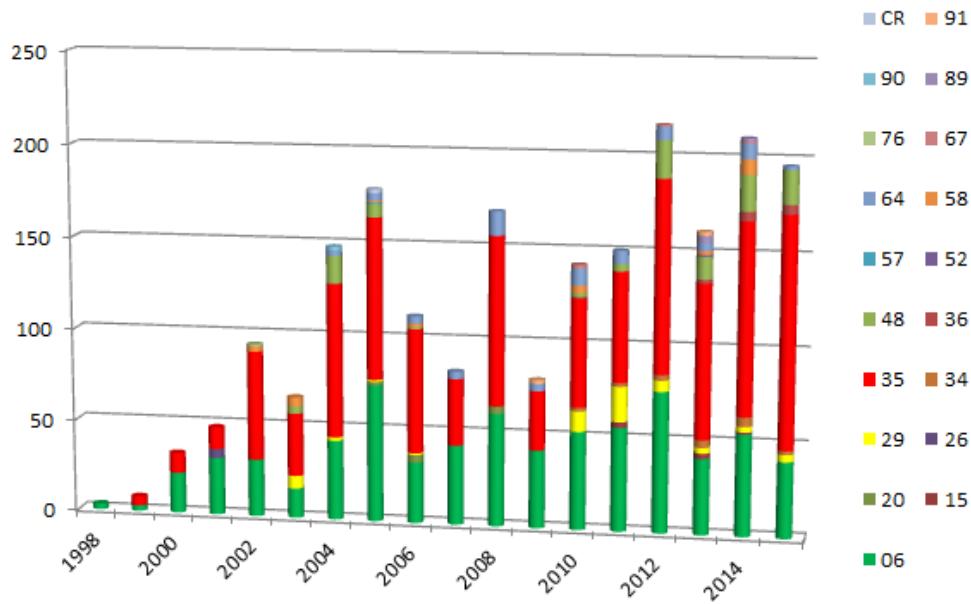
For a few projects, there are still no identified operators to do DMQC, for instance the first run has been done by students which have now left institutes or are not available to carry on with this work. We have made a lot of progress with BSH (Birgit Klein) taking into account also floats from other German institutes and OGS (Giulio Notarstefano) for the MedSea.

Floats by country



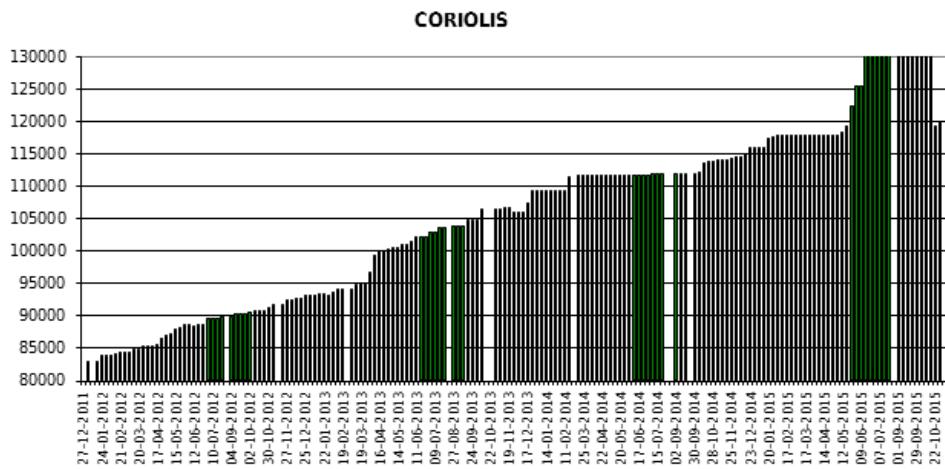
Percentage of floats by country in the Coriolis DAC.

Codes for the countries: 06 : Germany - 15 : Bulgaria - 20 : Chili - 26 : Denmark - 29 : Spain - 34 : Finland - 35 : France - 36 : Greece - 48 : Italy - 52 : Lebanon - 57 : Mexico - 58 : Norway - 64 : Netherlands - 67 : Poland - 76 : China - 89: Turkey - 90 : Russia - 91 : - South Africa - CR : Costa Rica

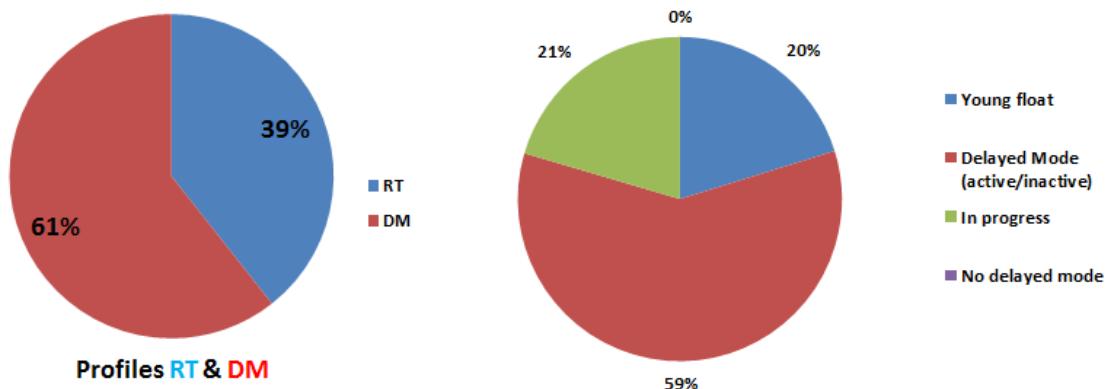


*Number of floats by country and by launch's year in the Coriolis DAC*

During the last year (from October 2014 to October 2015), 6169 new delayed mode profiles were produced and validated by PIs. A total of 119964 delayed mode profiles were produced and validated since 2005.

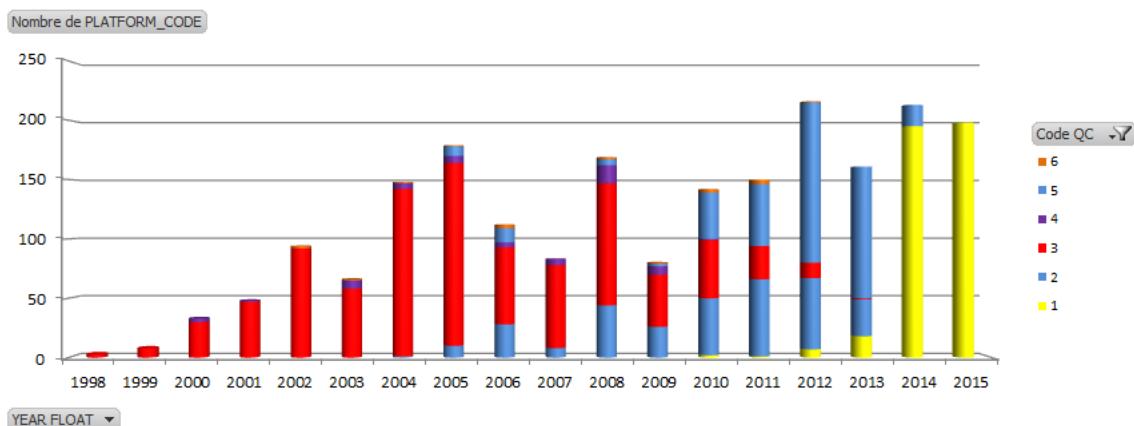


*Evolution of the DM profiles' submission versus dates*



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

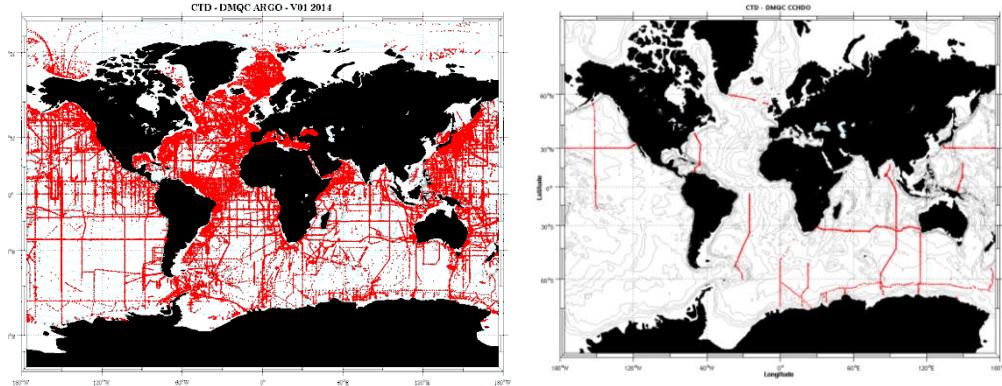
The status of the quality control done on the Coriolis floats is presented in the following plot. For the two last years (2014-2015), most of the floats are still too young (code 1) to be performed in delayed mode. For the years 2011-2012-2013, we are working on the DMCQ of some floats, which should be available for the end of this year. The codes 2 and 3 show the delayed mode profiles for respectively active and dead floats.



*Status of the quality control done on profiles sorted by launch's year, code 1: young float, code 2: active float, DM done, code 3 : dead float, DM done; code 4 : DM in progress, code 5 : waiting for DM, code 6 : problems with float.*

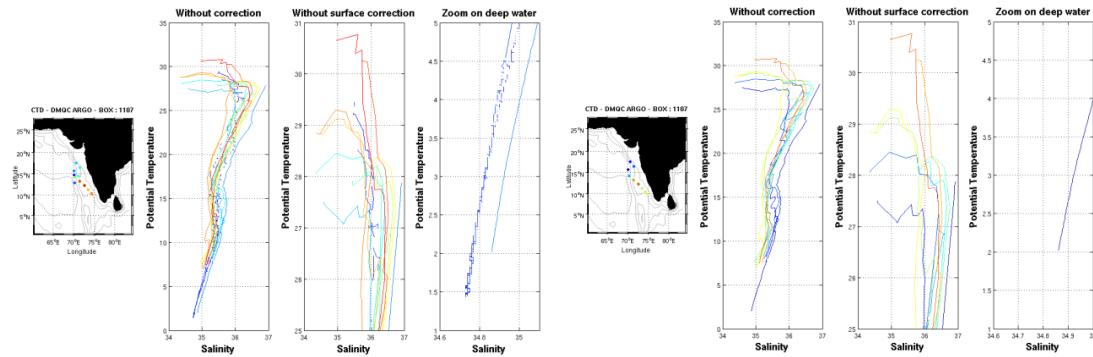
## Reference database

The last version CTD\_for\_DMQC\_2014V01 has been provided in December 2014. This version takes into account new CTD provided by the CCHDO (following figure) as well as feedbacks from users on quality of some profiles.



*Version 2014 V01 & New CTD datasets downloaded on the CCHDO website (during 2014).*

The new version takes also into account best quality control on data (based on analysis of deep water). At this time, only updates on boxes in the area 1 have been corrected.



*Example of updates - box 1107 : left previous version, right; updated version.*

This version is available on the ftp site in smaller tar balls, one by wmo box area (1-3-5-7): for instance, CTD\_for\_DMQC\_2014V01\_1.tar.gz for all boxes starting with wmo 1, then we will have 4 tar files. A work on the quality control has been started on the boxes of the area 3.

A new version is in preparation. The CCHDO website has been updated and a lot of CTD has been downloaded in the Coriolis database. For some cruises, the expocodes need to be associated to a ship. When the association will be made, the dataset will be exported to update the reference database. In parallel, the OCL update has been downloaded before the summer and will be added in this next version.

## GDAC Functions

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete)

- National centres reporting to you
- Operations of the ftp server
- Operations of the www server
- Data synchronization
- Statistics of Argo data usage : Ftp and WWW access, characterization of users ( countries, field of interest : operational models, scientific applications) ...

## National centres reporting to you

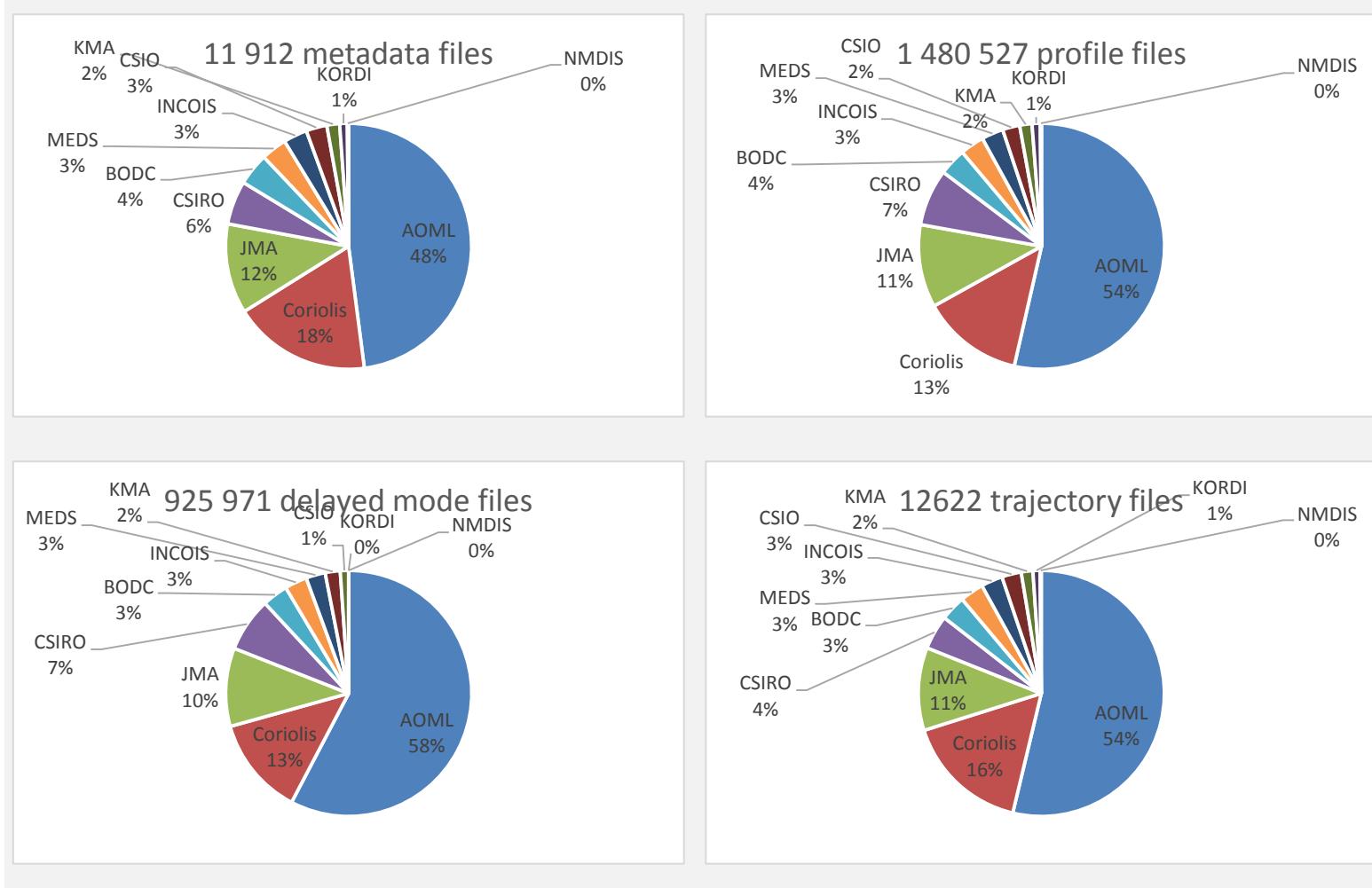
Currently, 11 national DACs submit regularly data to Coriolis GDAC.

The additional GTS DAC contains all the vertical profiles from floats that are not managed by a national DAC. These data come from GTS and GTSPP projects. The GTS profiles are quality controlled by the French DAC (Coriolis).

On October 28th, the following files were available from the GDAC FTP site.

DAC	metadata files 2015	increase from 2014	profile files 2015	increase from 2014	delayed mode profile files 2015	increase from 2014	trajectory files 2015	increase from 2014
<b>AOML</b>	5 711	10%	793 219	13%	534 132	10%	6 782	17%
<b>BODC</b>	505	7%	52 884	12%	31 221	0%	420	0%
<b>Coriolis</b>	2 163	15%	197 682	17%	120 217	8%	2 071	15%
<b>CSIO</b>	326	18%	33 537	83%	10 141	0%	323	61%
<b>CSIRO</b>	684	10%	110 457	15%	65 891	49%	569	1%
<b>INCOIS</b>	373	10%	46 758	13%	27 093	3%	357	7%
<b>JMA</b>	1 410	5%	161 413	7%	95 460	4%	1 376	4%
<b>KMA</b>	200	9%	23 847	14%	18 262	6%	193	10%
<b>KORDI</b>	119	0%	15 950	3%	0		119	5%
<b>MEDS</b>	402	6%	42 365	5%	23 554	0%	393	6%
<b>NMDIS</b>	19	0%	2 415	23%	0		19	0%
<b>Total</b>	<b>11 912</b>	<b>10%</b>	<b>1 480 527</b>	<b>14%</b>	<b>925 971</b>	<b>10%</b>	<b>12 622</b>	<b>13%</b>

- The total number of NetCDF files on the GDAC/dac directory was 1 635 935.
- The size of GDAC/dac directory was 126Go
- The size of the GDAC directory was 462Go



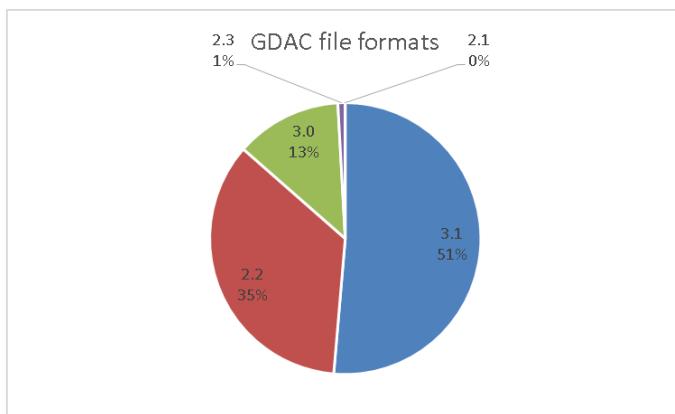
Number of files available on GDAC, October 2015

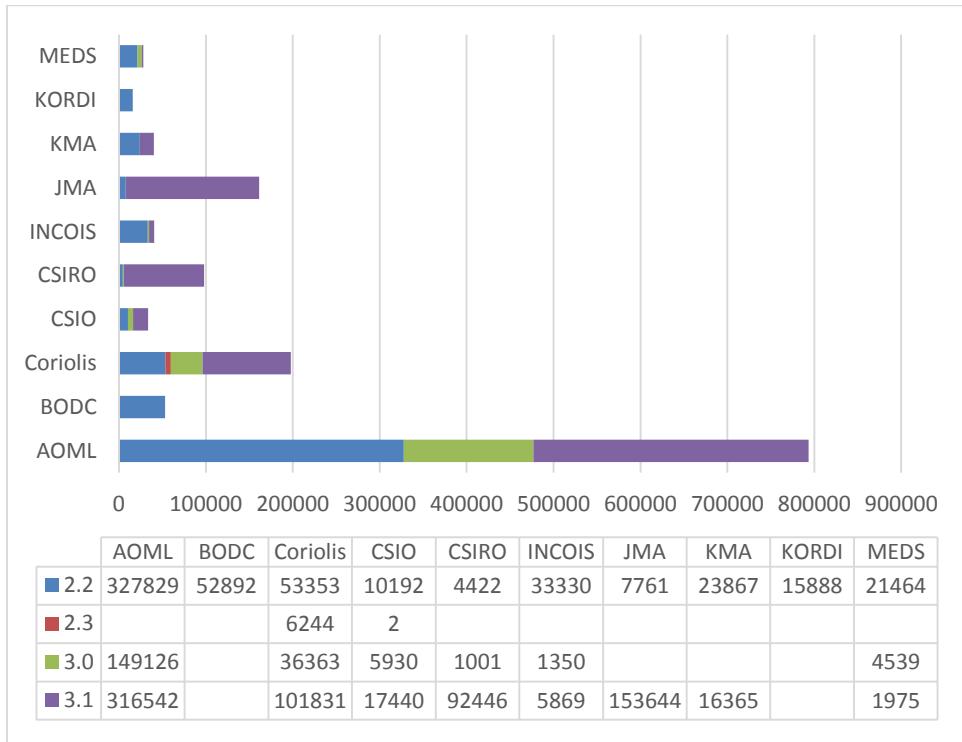
### File format: transition to Argo NetCDF V3.1

The transition from Argo format 2.\* and 3.0 toward format 3.1 is underway.

On October 2015, the number of files in format version 3.1 reached and passed the 50% threshold.

format version	nb files
3.1	828 923
2.2	566 179
3.0	204 546
2.3	14 125
2.1	20
<b>Total</b>	<b>1 613 793</b>





### Number of files per DAC and format version

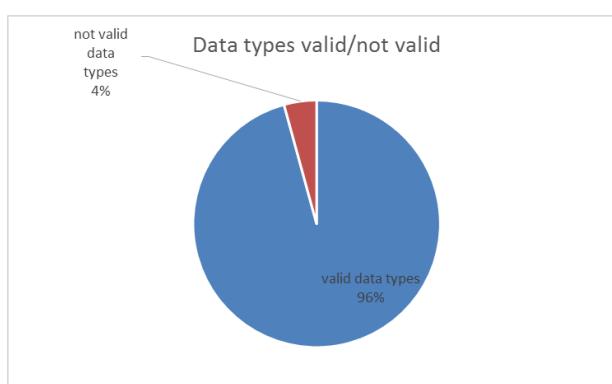
The files in format version V3.1 are much more homogeneous than their previous versions.

The controls applied by the format checker on V3.1 is much more exhaustive. The controlled vocabulary listed in the 27 reference tables is used for V3.1 format checks. A non-valid content is automatically rejected. Only valid V3.1 content appears on GDAC.

### Example of valid content checked by the format checker on V3.1 files

There are 8 valid DATA\_FORMAT variables listed in reference table 1 (there are 26 more tables...).  
A survey on GDAC files shows that 68763 files (4% of the total) do not have a valid DATA\_FORMAT.  
The V3.1 files are not affected by this kind of problem.

data_type	nb files	valid type
Argo profile	1 418 844	yes
Argo profile merged	53 714	yes
Argo technical	487	yes
Argo technical data	8 565	yes
Argo trajectory	10 828	yes
B-Argo profile	52 383	yes
B-Argo trajectory	209	yes
Argo meta-data	10 912	no
ARGO profile	54 481	no
ARGO technical data	1 610	no
ARGO trajectory	1 645	no
Argo Trajectory	115	no



## Operations of the ftp server

- Meta-data, profile, trajectory and technical data files are automatically collected from the national DACs ;
- Index files of meta-data, profile and trajectory are daily updated ;
- GDAC ftp address: <ftp://ftp.ifremer.fr/ifremer/argo>

Statistics on the Argo GDAC FTP server: <ftp://ftp.ifremer.fr/ifremer/argo>

There is a monthly average of 483 unique visitors, performing 4518 sessions and downloading 4 teraoctets of data files.

The graphics show a fair increase of activity on GDAC FTP in April 2015. This may be related to the Argo science team meeting event.

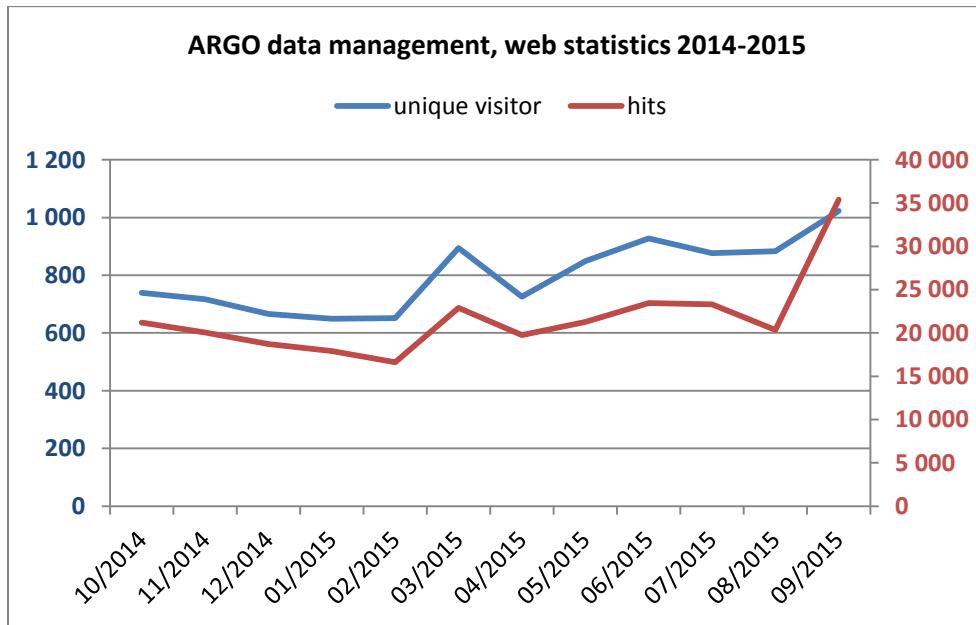
ARGO GDAC FTP statistics				
month	unique visitor	number of visits	hits	bandwidth Go
10/2014	209	3 718	7 391 775	2613,62
11/2014	243	4 061	5 012 221	2766,08
12/2014	237	4 313	2 849 501	3061,09
01/2015	230	4 411	3 524 356	3695
02/2015	782	4 437	4 763 221	4146
03/2015	451	4 317	15 087 674	5700
04/2015	1 203	6 697	7 106 252	5377
05/2015	708	5 199	5 990 249	5844
06/2015	284	4 176	5 874 822	4084
07/2015	938	5 213	3 499 775	3852
08/2015	232	3 572	4 157 650	3096
09/2015	280	4 103	4 876 859	3826
<b>Average</b>	<b>483</b>	<b>4 518</b>	<b>5 844 530</b>	<b>4 005</b>

**Statistics on the Argo data management web site: <http://www.argodatamgt.org>**

There is a monthly average of 800 unique visitors, performing 1363 visits and 21 743 hits.

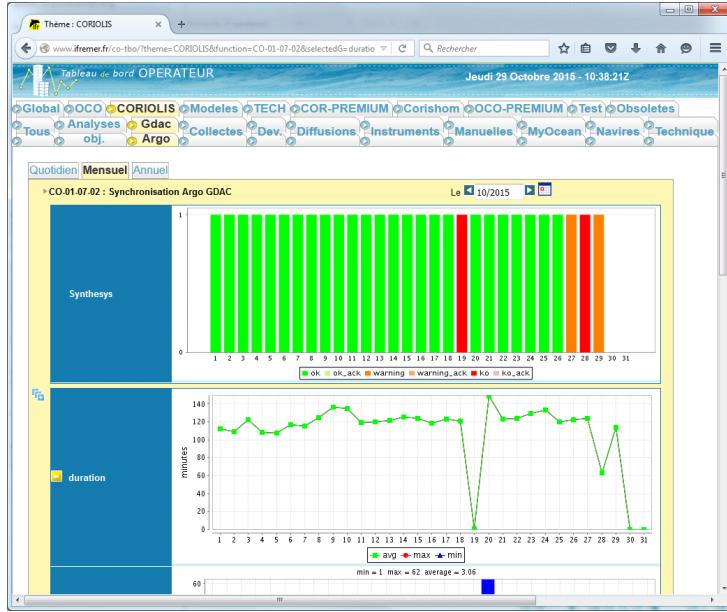
The graphics shows a slightly increasing number of unique visitors.

ARGO GDAC web statistics					
month	unique visitor	visits	pages	hits	bandwidth Go
10/2014	739	1 297	2 904	21 205	2
11/2014	717	1 224	2 486	20 050	1
12/2014	666	1 127	2 395	18 716	2
01/2015	649	1 138	2 290	17 901	1
02/2015	651	1 066	2 535	16 605	1
03/2015	894	1 531	3 643	22 890	2
04/2015	726	1 270	3 028	19 761	1
05/2015	849	1 403	2 940	21 263	1
06/2015	927	1 584	3 317	23 461	1
07/2015	876	1 478	3 185	23 313	1
08/2015	883	1 417	3 131	20 349	1
09/2015	1 023	1 826	4 355	35 396	1
<b>Average</b>	<b>800</b>	<b>1 363</b>	<b>3 017</b>	<b>21 743</b>	<b>1</b>



## Data synchronization

The synchronization with US-Godae server is performed once a day at 01:55Z.



The synchronization dashboard in October 2015: the daily synchronization time takes on average 2 hours.

You may notice on the dashboard that the synchronization process reported errors twice in October (red bars)

- 19/10/2015 01:55:02 : Can't create the ftp connection to usgodae.org
- 28/10/2015 02:55:01 : Can't create the ftp connection to usgodae.org

The synchronization issued warnings twice (orange bars)

**29/10/2015 02:55:02**

- warning Invalid date\_update in prof index, line 1451658 : meds/4900627/profiles/D4900627\_153.nc - ME
- warning Invalid date\_update in prof index, line 1453008 : meds/4900635/profiles/D4900635\_098.nc - ME
- warning Invalid date\_update in prof index, line 1454402 : meds/4900681/profiles/D4900681\_152.nc - ME
- warning Invalid date\_update in prof index, line 1454511 : meds/4900682/profiles/D4900682\_069.nc - ME

**27/10/2015 02:55:01**

Four files have an invalid update date (minutes > 59)

- US, meds/4900627/profiles/D4900627\_153.nc, D4900627\_153.nc, 20150126211960
- US, meds/4900635/profiles/D4900635\_098.nc, D4900635\_098.nc, 20150127214960
- US, meds/4900681/profiles/D4900681\_152.nc, D4900681\_152.nc, 20150128180060
- US, meds/4900682/profiles/D4900682\_069.nc, D4900682\_069.nc, 20150128202560

## FTP server monitoring

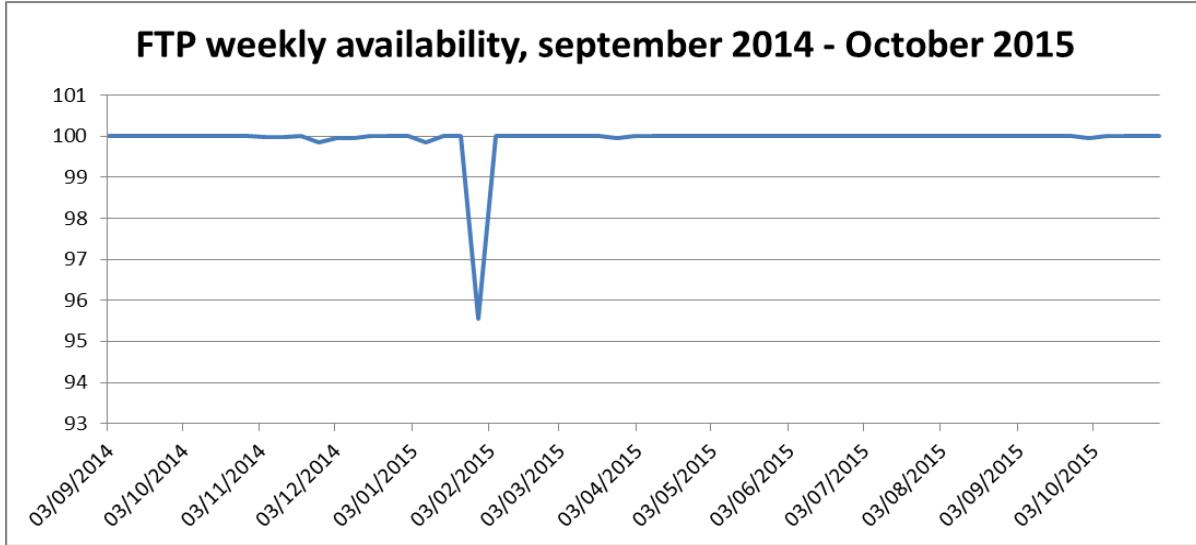
The Argo GDAC ftp server is actively monitored by a Nagios agent (<http://en.wikipedia.org/wiki/Nagios>).

Every 5 minutes, an ftp download test and an Internet Google query are performed. The success/failure of the test and the response time are recorded. The FTP server is a virtual server on a linux cluster.

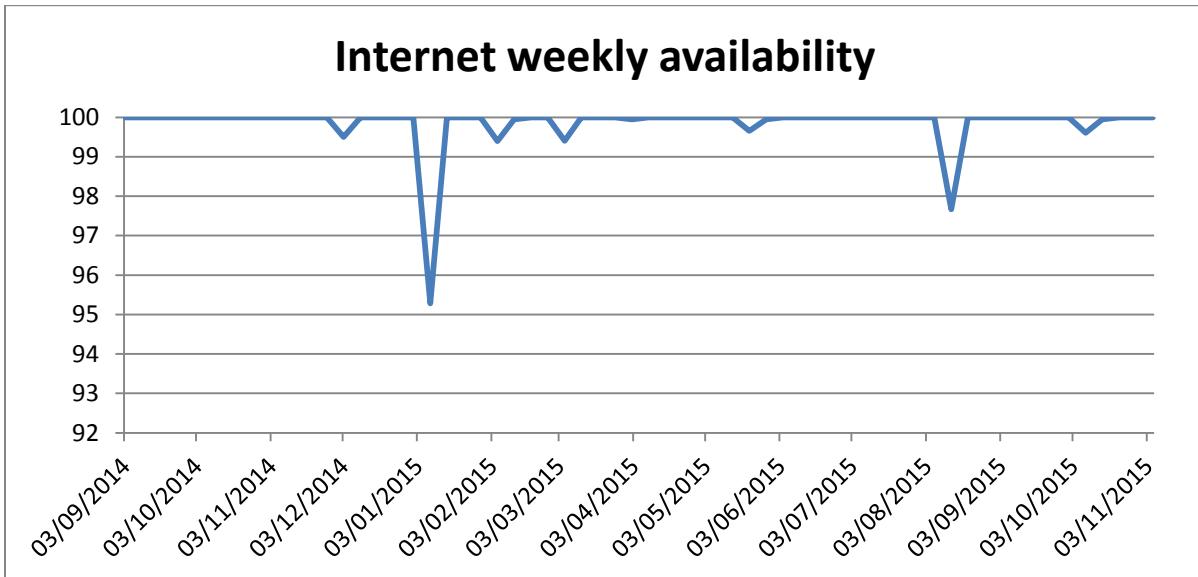
On the last 12 months, the weekly average performance was 99.84%. The 0.16% of poor performances represents 15 minutes for a week. For the last 12 months, the cumulative poor performances period is of 24 hours.

We faced 3 significant events these last 12 months.

- First week of January: 8 hours of Internet poor performances
- Last week of January 2015: disk storage instability: 7 hours and 35 minutes of poor performances of ftp.
- Mid-August 2015 : 4 hours of poor Internet performances



Nagios ftp monitoring: between September 2014 and October 2015



Nagios Internet monitoring: between September 2014 and October 2015

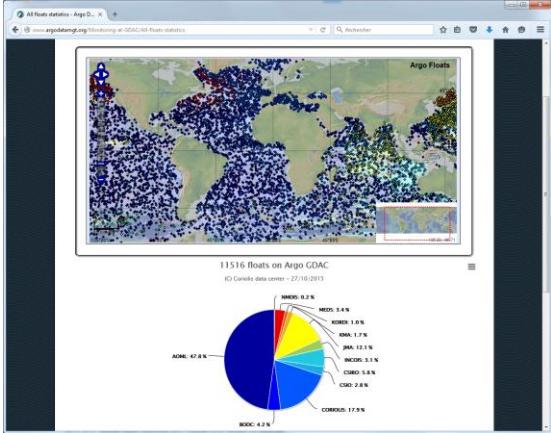
## Grey list

According to the project requirements Coriolis GDAC hosts a grey list of the floats which are automatically flagged before any automatic or visual quality control. **The greylist has 1000 entries** (October 29<sup>th</sup> 2015), compared to 1285 entries one year ago.

DAC	nb floats in greylist
AOML	758
Coriolis	32
JMA	116
CSIRO	0
BODC	55
INCOIS	4
MEDS	9
KMA	9
CSIO	8
KORDI	9
NMDIS	0
<b>Total</b>	<b>1000</b>

## Statistics on GDAC content

The following graphics display the distribution of data available from GDAC, per float or DACs. These statistics are daily updated on: <http://www.argodatamgt.org/Monitoring-at-GDAC>



## Mirroring data from GDAC: rsync service

In July 2014, we installed a dedicated rsync server called vdmzrs.ifremer.fr described on:

- <http://www.argodatamgt.org/Access-to-data/Argo-GDAC-synchronization-service>

This server provides a synchronization service between the "dac" directory of the GDAC with a user mirror. From the user side, the rsync service:

- Downloads the new files
- Downloads the updated files
- Removes the files that have been removed from the GDAC
- Compresses/uncompresses the files during the transfer
- Preserves the files creation/update dates
- Lists all the files that have been transferred (easy to use for a user side post-processing)

### Examples

Synchronization of a particular float

- rsync -avzh --delete vdmzrs.ifremer.fr::argo/coriolis/69001 /home/mydirectory/...

Synchronization of the whole dac directory of Argo GDAC

- rsync -avzh --delete vdmzrs.ifremer.fr::argo/ /home/mydirectory/...

## Argo DOI, Digital Object Identifier on monthly snapshots

A digital object identifier (DOI) is a unique identifier for an electronic document or a dataset. Argo data-management assigns DOIs to its documents and datasets for two main objectives:

- Citation: in a publication the DOI is efficiently tracked by bibliographic surveys
- Traceability: the DOI is a direct and permanent link to the document or data set used in a publication
- More on: <http://www.argodatamgt.org/Access-to-data/Argo-DOI-Digital-Object-Identifier>

## Argo documents DOIs

- Argo User's manual: <http://dx.doi.org/10.13155/29825>

## Argo GDAC DOI

- Argo floats data and metadata from Global Data Assembly Centre (Argo GDAC)  
<http://dx.doi.org/10.12770/1282383d-9b35-4eaa-a9d6-4b0c24c0fc9>

## Argo GDAC monthly snapshots DOIs

- Snapshot of 2015 October 8<sup>th</sup> : <http://dx.doi.org/10.12770/71b7b0ed-1e3a-4ebc-8e3b-b5b363112f2a>
- Snapshot of 2015 September 08<sup>th</sup> : <http://dx.doi.org/10.12770/ca035889-880d-463e-a523-10aab3d6be3>



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# **Argo Data Management Team 2015**

## **CLS Report**

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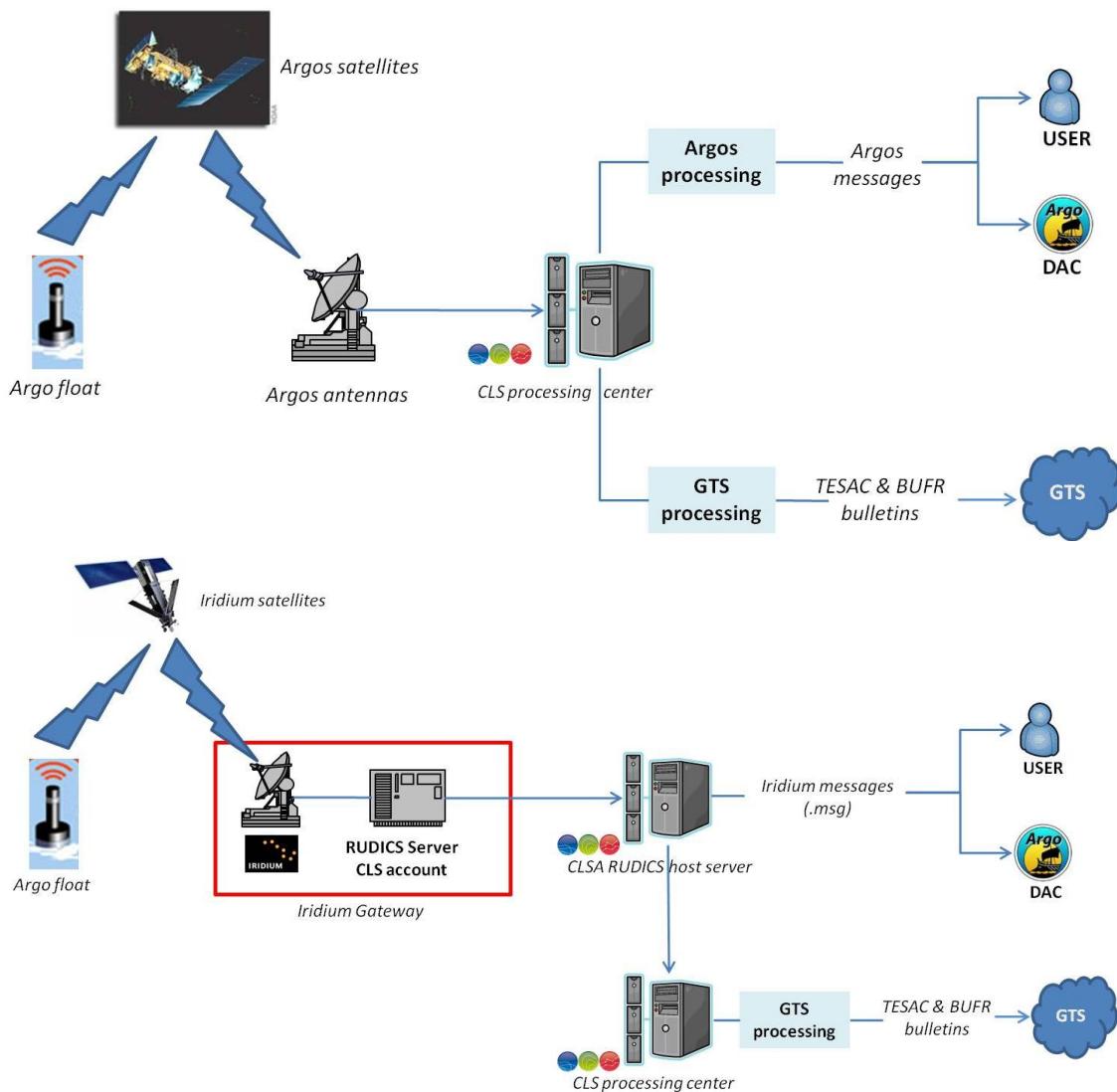
**Yann Bernard & Brice Robert (CLS)**



## 1. CONTEXT

The CLS Company, operator of the Argos system and provider of both Argos and Iridium services, has a DAC (Data Assembly Center) role for the Argo programs that do not have real time processing capabilities. Argo data are processed operationally 24/7 by CLS processing centers (Toulouse, France and Largo, USA) and inserted into the GTS through Meteo-France or the NWS insertion points.

In September 2015, CLS processed 81 Argo floats in real-time (60 with Argos and 21 with Iridium satellite system) for the GTS distribution. Data for these floats are sent via ftp to Meteo-France (Toulouse) as TESAC and BUFR bulletins, before being inserted by Meteo-France on the GTS (Global Telecommunication System). Figures below summarize the Argo data flow, from their transmission by the float to their dissemination on the GTS with Argos and Iridium systems.



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## 2. STATUS OF THE CLS DAC IN AUGUST 2015

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- **Floats activity for August 2015:**

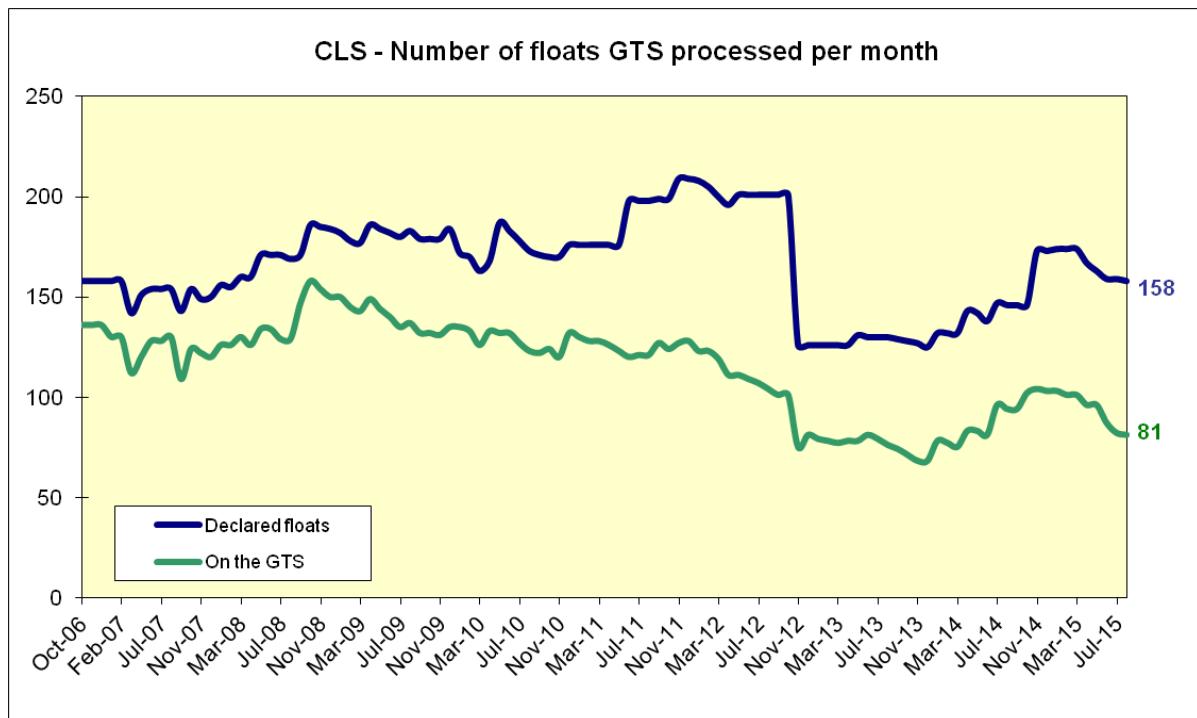
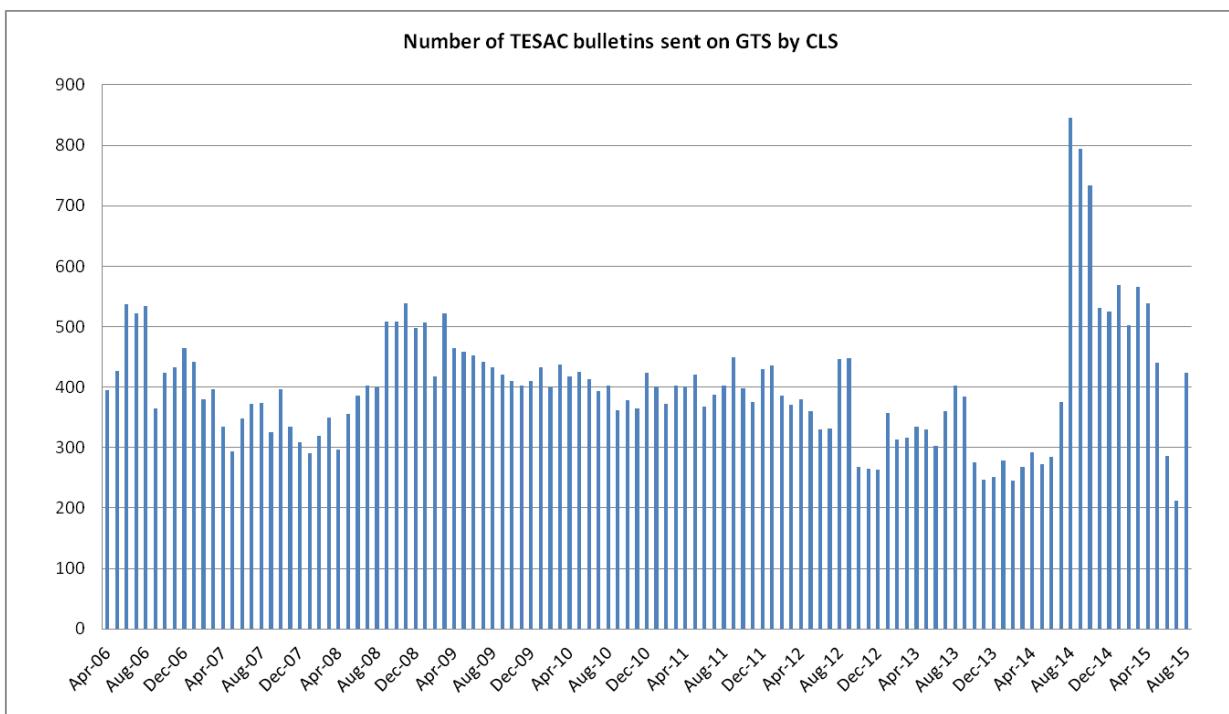
- 158 floats were declared in the CLS GTS database
- 81 floats have disseminated data profiles on GTS
- 55 floats are inactive (no more transmission\*) or grey listed (failing status)
- 424 profiles from CLS have been sent on GTS in August 2015

\*A float stays 3 years in the CLS GTS database without transmission before being removed definitely.

- **Description of the 158 floats :** CLS processed floats in real time for the Argo programs that are not hosted by a national DAC:
  - 124 SOA floats (China)
  - 17 FIO floats (China)
  - 17 KORDI floats (Korea)

These floats are Teledyne Webb Research Apex or NKE Provor, with 12 different data formats.

- **Data issued to GTS:** All data processed by CLS are distributed on the GTS by way of Meteo-France (GTS header LFVW) or by the National Weather Service (GTS header KARS) when the French center is in backup. This operation is automatically performed and GTS bulletins are sent to Meteo-France every 2 minutes. Before the encoding in TESAC and BUFR bulletins, Argo data are filtered by Argo QC procedure. Last year, 6 121 profiles were relayed onto GTS between September 1<sup>st</sup>, 2014 and August 31<sup>st</sup>, 2015 (source: Météo-France).
- **Argo Real Time processing monitoring:** All different data formats are referenced and each format has a dedicated template (processing model) in the CLS GTS database. Each month, a monitoring is made for Argo floats present in the CLS GTS database:
  - Argos transmissions in the last month are checked for all floats,
  - GTS disseminations in the last month are checked for all floats,
  - New floats to be set up for GTS are implemented in the CLS GTS database at each beginning of month with a list (table 10: "Floats to be set up for GTS") provided by JCOMMOPS (M. Belbeoch) via the Argo Information Centre Monthly Report.
  - Active floats to be grey listed are removed from the CLS GTS database at each beginning of month with a list (table 15: "Active floats Grey list") provided by JCOMMOPS (M. Belbeoch) in the Argo Information Centre Monthly Report.

**Status of CLS Argo GTS processing****Number of profiles sent (in TESAC and BUFR) on the GTS by CLS per month**

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- **Number of bulletins:** The number of GTS bulletins with Argo data has been multiply by 2 in summer 2014 due to the processing of new Iridium Chinese floats (FIO) cycling every day.
- **Web pages:** All GTS observations (profiles for Argo) are available on <https://argos-system.cls.fr/cwi/Logon.do>. This is a user access to get the observation data.
- **BUFR format:** BUFR bulletins are produced in addition to TESAC bulletins for all floats processed for GTS by CLS (header: IOPX92 LFVW), since August 2009.
- **INCOIS floats:** Upon INCOIS request, CLS has stopped the GTS processing for all Indian Argo floats on October 16<sup>th</sup>, 2012 at 11H UTC. GTS processing for INCOIS floats is now performed by INCOIS in Hyderabad and displayed on the GTS via New Delhi.
- **Time of delivery on GTS:** A monitoring delay tool, specified with JCOMMOPS, is operational since September 2008 at CLS. The average delivery time of TESAC & BUFR delivery on the GTS is less than 9 hours (average for the combination of Argos & iridium floats).

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### 3. ARGOS SYSTEM STATUS

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#### 3.1. SPACE SEGMENT

There was no major change to the space segment in 2015. The current operational status of the Argos constellation is as follows:

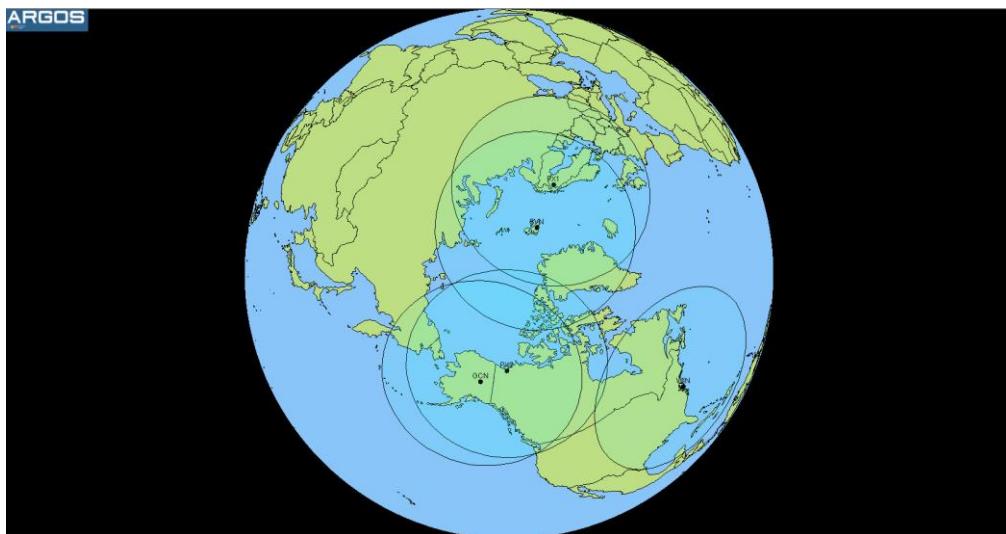
Satellites	Launch date	Instrument	High Data rate and Downlink capabilities
SARAL	25 February 2013	Argos-3	X
METOP-B (MB)	17 September 2012	Argos-3	
NOAA-N' (NP)	6 February 2009	Argos-3	
METOP-A (MA)	19 October 2006	Argos-3	X
NOAA-18 (NN)	20 May 2005	Argos-2	
NOAA-15 (NK)	13 May 1998	Argos-2	

#### 3.2. GROUND SEGMENT

##### Global antennas network:

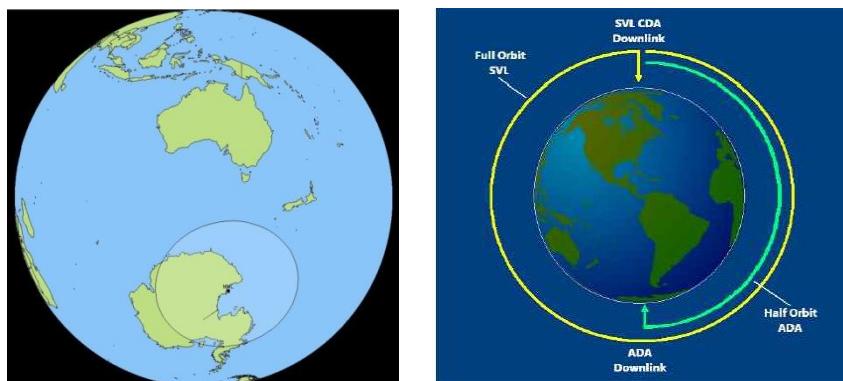
The Argos global antennas network is composed by seven stations:

- The two NOAA global stations of Fairbanks and Wallops acquire the global recorded telemetry transmitted by N15, N18 and N19.
- The EUMETSAT global receiving station of Svalbard acquires the global recorded telemetry transmitted by Metop-A and Metop-B as well as the 2 daily blind orbits of N19 for NOAA stations.
- The NOAA Svalbard antenna that delivers NOAA 15 and 18 blind orbits for Fairbanks and Wallops when not in conflict with NOAA-19.
- Inuvik (Canada) and Kiruna (Sweden) stations for SARAL operated by EUMETSAT.



**The Argos Global antenna network (without McMurdo)**

- Data recovery from MetOp-B will occur at Svalbard and McMurdo (ADA). Timeliness benefit of McMurdo data recovery is for MetOp-B only. MetOp-A data will continue to NOAA on a best effort basis and without the timeliness benefits of half orbit dumps at McMurdo.



**METOP-B Mc Murdo Global antennas coverage and principle**

#### **Real time antenna network:**

Improvements are still focused on redundancy locations and coverage extension. Today, both Toulouse and Lanham processing centers receive Argos real-time data from 62 stations located all over the world.

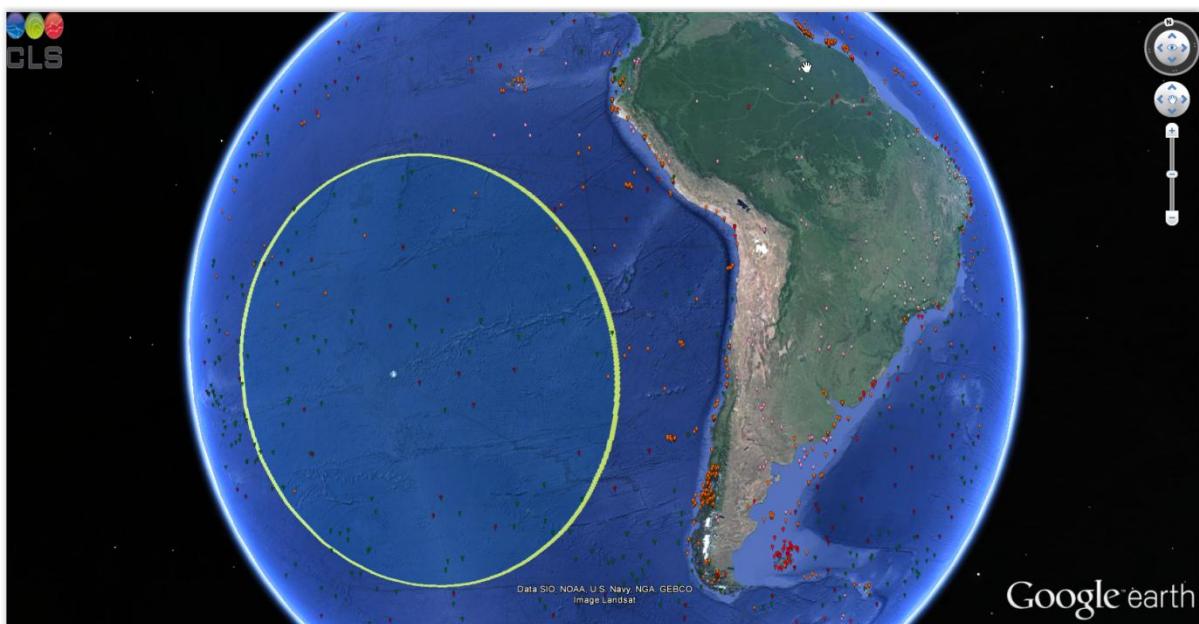
CLS continues the Real-Time Antenna Upgrade Project that consists of upgrading selected antennas in order to be compatible with NOAA, METOP and SARAL. This project also aims to optimize in terms of performance the real-time receiving stations network.

In 2015, the real-time network was upgraded with 2 new ground stations added and 3 upgraded to receive Saral:

- Ascension Island station operated by CLS
- Libreville (Gabon) station operated by CLS
- Muscat (Oman) station operated by EUMETSAT/DGMAN (upgraded for Saral)
- Monterey & Hawaii (USA) stations operated by NOAA (upgraded for Saral)

2 ground stations were removed :

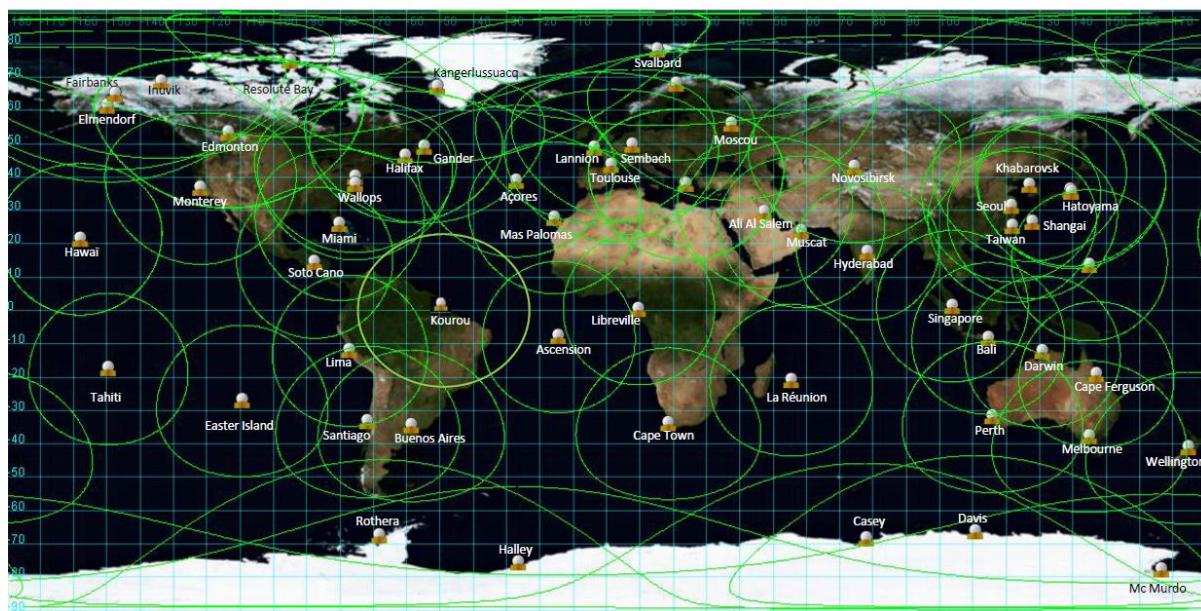
- Manas (Kirghizstan): a USAF antenna
- Oslo (Norway): due to erratic operation, replaced by Tromsoe and Lannion stations



**Coverage of the New Argos HRPT Antenna in Easter Island**

The real-time Argos ground stations network consists of 62 antennas. Most of them are capable of receiving NOAA POES satellites data, 24 out of these 62 stations receive METOP satellites data and 14 receive also SARAL data.

Here below is displayed the Argos Real-Time coverage world map.

**May 2015 Argos Real-time coverage map**

**Processing centers:** The two global processing centers in Toulouse and Lanham were nominal over 2014/2015. Redundancy is used at least once a month (Up to two times on one month). Redundancy means that all Argos users are rerouted to CLS or CLSA during an anomaly on the nominal global processing center.

**CLS Toulouse Control Room**

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Both CLS global processing centers are autonomous, and receive, process, and distribute Argos data to:

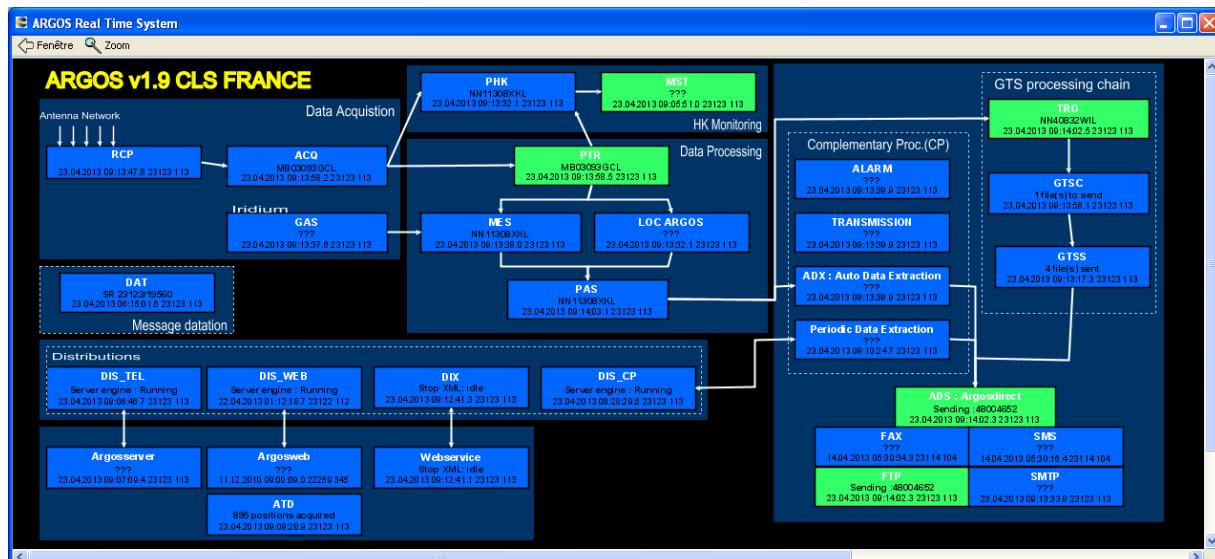
- North American users for CLS America
- Users of the rest of the world for CLS France

In case of a problem with one of the two centers, the other one stays alive and is capable of receiving, processing and distributing Argos data to ALL users. The switch to the remaining alive center is completely transparent for the users. It means that the users continue to receive or to access to their data, without any change on their side.

**The CLS Argos processing chain:** Composed of different software modules, the processing chain is in charge of receiving and processing the Argos data issued from the satellites and acquired by the global and real-time ground stations networks.

Argos data are processed in terms of collect and location, and stored into a database.

The processing chain is also in charge of distributing the data by ADS (Automatic Distribution System) or allowing users to access to their data using Telnet, ArgosWeb or the web services.



**Synoptic of the CLS Argos processing chain**

In order to monitor the Argos processing centers, statistics are produced in real-time:

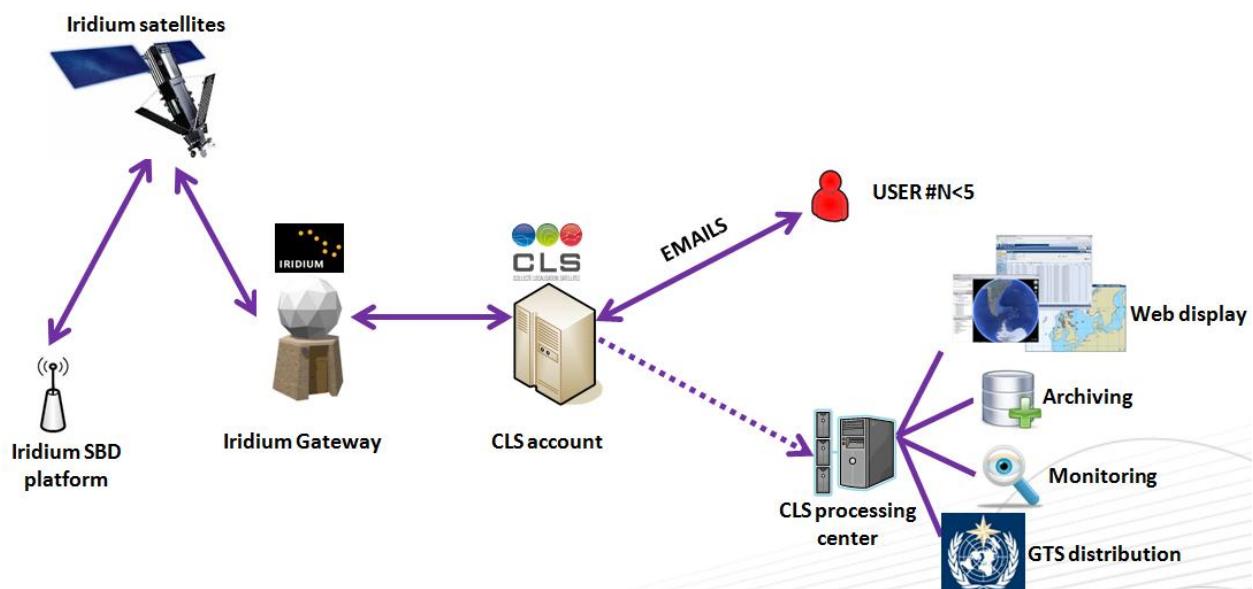
- on the availability of Argos data distribution tools,
- on the data delivery time for sample platforms,
- on Argos location delivery time for sample platforms,
- and on the percentage of data available in less than one hour.

**For 2014, the processing performance indicator is 99,69%.** This indicator corresponds to the percentage of real time datasets processed in less than 10 minutes (Between Pre-Processing component PTR and PAS component in charge of inserting data in database for user requesting). This number does not include periods when the French site was in backup mode on the US site.

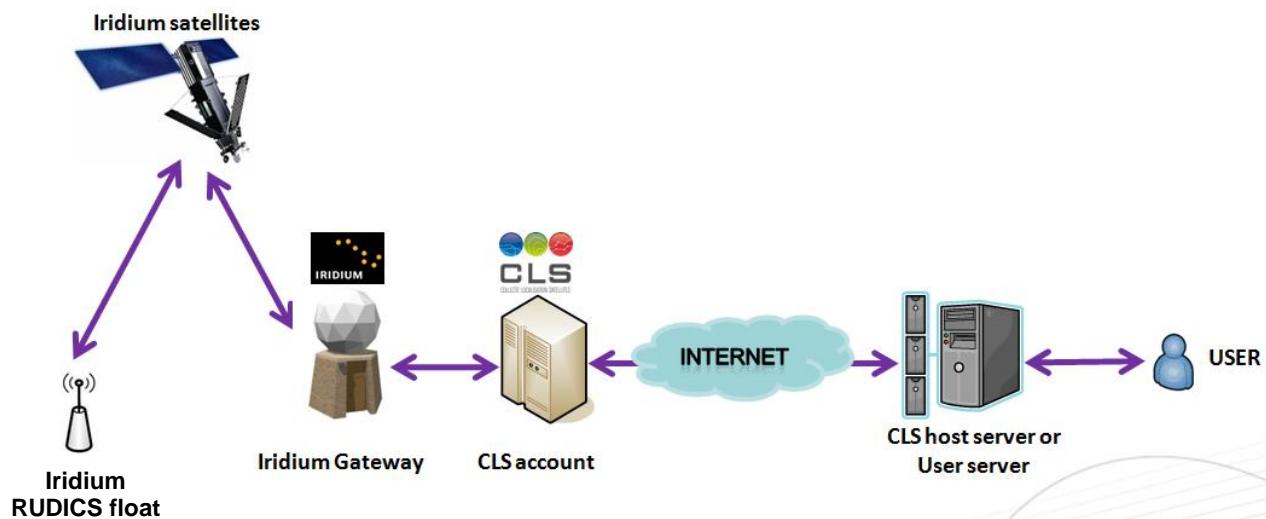
## 4. CLS IRIDIUM DATA SERVICES

CLS, exclusive operator of the Argos system since 1986 also provides dedicated Iridium data services to ocean platforms (profiling floats, gliders, drifting buoys...) since 2007. Thanks to a VAR (Value Added Reseller) agreement with Iridium, CLS is an Iridium data provider for Argo. It is already the case for several Argo programs as in France, UK, Germany, Italy, Norway, Spain, Bulgaria, Turkey, China, India, South Africa, Brazil and Japan.

CLS is providing all Iridium services (RUDICS, CSD and SBD) for all type of floats, from all manufacturers. Thanks to a long-standing partnership with the main floats manufacturers (Teledyne, NKE, Optimare, SeaBird, Metocean, etc.), Iridium services activation and transmission tests are easily performed.



The Iridium SBD communication service at CLS



The Iridium RUDICS communication service at CLS

CLS and CLS America processing centers are linked with an IP connection to the Iridium Gateway receiving Iridium raw data from floats in real-time, then process and distribute them to the Argo users by email or FTP. The service is fully operational 24/7.

If needed, GTS real-time processing (TESAC and BUFR bulletins) can be done by CLS. For further information, please contact Mr. Brice Robert at [brobert@cls.fr](mailto:brobert@cls.fr).

# Argo Germany National Report 2015

October 2015

Birgit Klein, BSH

## 1. The status of implementation (major achievements and problems in 2015)

### Data acquired from floats:

Most of the floats deployed by Germany are operated by BSH but additional funding has been acquired by various research institutes. BSH will have deployed 67 floats by the end of 2015, 6 floats purchased in 2015 are kept in store to serve deployment cruises early 2016. No floats have been deployed by GEOMAR this year. Early in 2015 AWI has deployed 15 floats, but due to technical problems none of the floats is able to deliver its data. This gives a total of 67 German float deployments until the end of 2015.

Currently (September 42<sup>th</sup>, 2015) 120 German floats are active (Fig.1) and the total number of German floats deployed within the Argo program increased to 737. Due to the increased loss rate of APEX floats with alkaline batteries the number of German floats in the network is still declining. Some of the under-ice floats deployed by AWI in the previous years are assumed to be still active under the ice. It is anticipated that about 20 floats should resurface again in the next austral summer and deliver their stored data.



Fig. 1: Locations of active German floats (red) with active international floats (green) (Argo Information Centre, February 2015).

In the past most of the German floats were APEX floats purchased from Webb Research, but a smaller amount of floats were manufactured by the German company OPTIMARE. The company has been working in close collaboration with the AWI and has developed a float type suitable for partially ice covered seas. These floats are equipped with an ice sensing algorithm which prevents the float from ascending to the surface under ice conditions and prevents it from being crushed. Float profiles are stored internally until they can be transmitted during ice free conditions. In the last year three manufacturers supplied the floats

purchased by BSH: ARVOR floats from NKE and NOVA floats from METOCEAN. Additionally 11 APEX floats were supplied by WEBB/TELEDYNE as replacement for floats which had problems with their alkaline batteries.

We had discovered major technical problems with the alkaline batteries in our APEX floats deployed since 2010. Until September 2015 more than 60 floats expired early with life cycles of about 700-800 days. The technical data send back from the floats indicate a sudden loss of battery voltage to values of around 7 volt during the last profile and increased battery consumption during the previous cycles. We had contacted TELEDYNE/WEBB about the problem and it was discovered that the floats were experiencing 'energy flue' because of a design change in the floats. As a possible fix against the premature fail of the entire battery pack due to failure of an individual alkaline battery a diode had been installed in the design in 2004, but was removed again in 2009/2010. WEBB/TELEDYNE had offered 14 floats in compensation for the malfunctioning floats in 2014 and 11 floats in 2015.

All of the German floats deployed in 2015 are standard TS floats. Deployment was carried out mostly on research vessels but also with the help of the German Navy in areas which are difficult to reach with research vessels such as the western Indian Ocean. The scientific research vessels comprised Canadian, German and UK ships. The deployment locations for 2015 are shown in Fig. 2a-b.

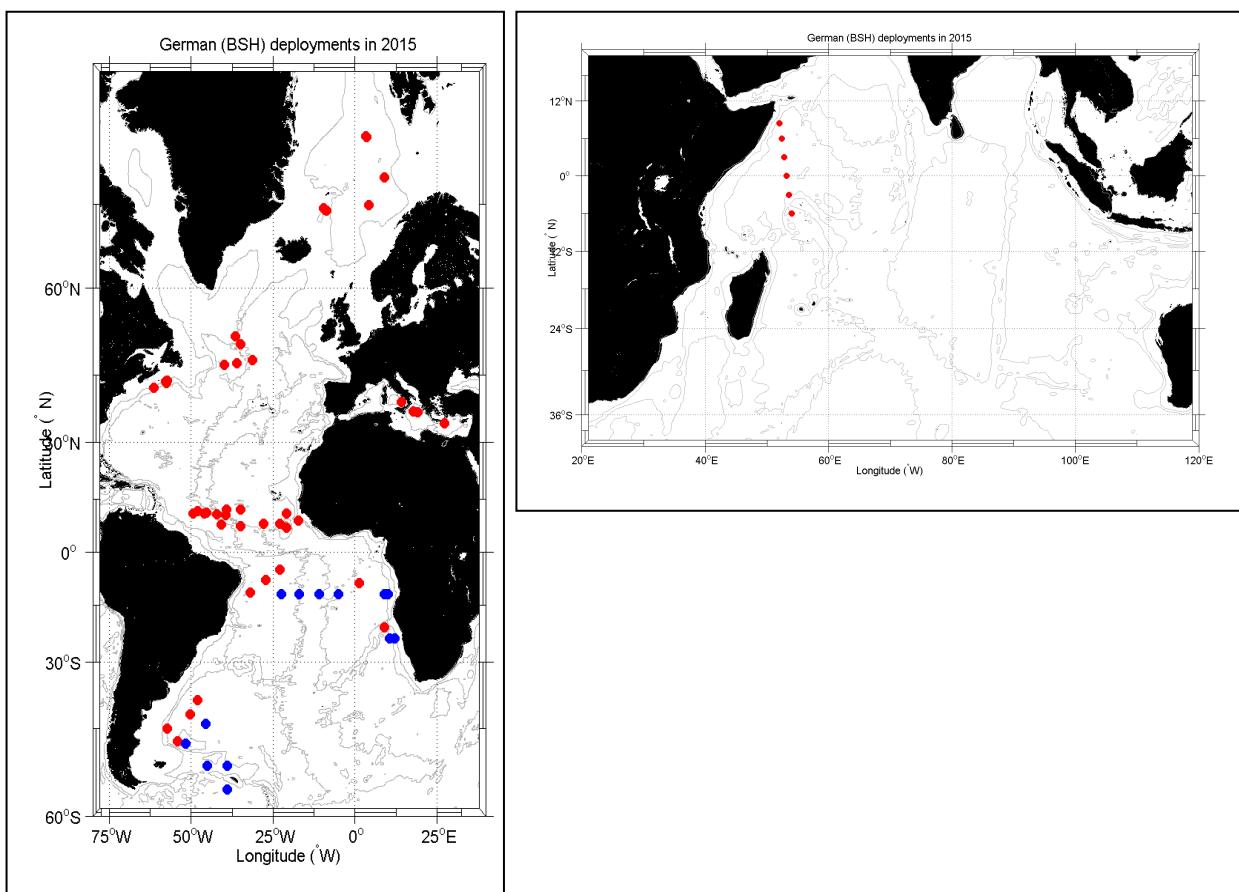


Fig. 2a-b: Deployment positions in 2015 in the Atlantic (left) and the Indian Ocean (right). At positions marked in red the deployment has already been carried out and those in blue will be achieved until the end of the year.

Germany has continued to work in the new European Research Infrastructure Consortium EURO-ARGO-ERIC which was established in July 2014 in Brussel by 9 founding countries (France, Germany, United Kingdom, Italy, Netherlands, Norway, Greece, Poland and Finland). It is planned to coordinate the deployments for 2016 at the European level and this could invoke changes to the proposed plans. GEOMAR and AWI are members of the EU-funded ATLANTOS project and will deploy deep-floats and bio-Argo floats within this project.

## **2. Deployment plan for 2016**

The deployment plans for 2015 will comprise at present about 52 floats from BSH in the Atlantic, the Nordic Seas, Indian Ocean and the Southern Ocean and consists of floats purchased already in 2014, funds from 2015 and warranty floats (Fig. 3a-e and Fig. 4a-e). The priority of our deployments is grid completion and extension of the core Argo array into the seasonally ice covered oceans in the Nordic Seas and the Southern Ocean. We are expecting additional replacements by WEBB/TELEDYNE for floats which will die of energy flue in 2016, the numbers will be evaluated during the year. Contacts with researchers on potential deployment cruises have been established and agreement has been reached on the possibility to deploy floats. The German Navy has been contacted again about potential deployments in the Indian Ocean during their regular survey operations. The AWI is planning to deploy about 22 floats during the Polarstern cruise PS103 in December 2016-February 2017. No deployments are planned yet for 2016 by GEOMAR. But GEOMAR is partner in the ATLANTOS consortium and will be involved in the deployment of deep floats as part of the pilot study in the Atlantic.

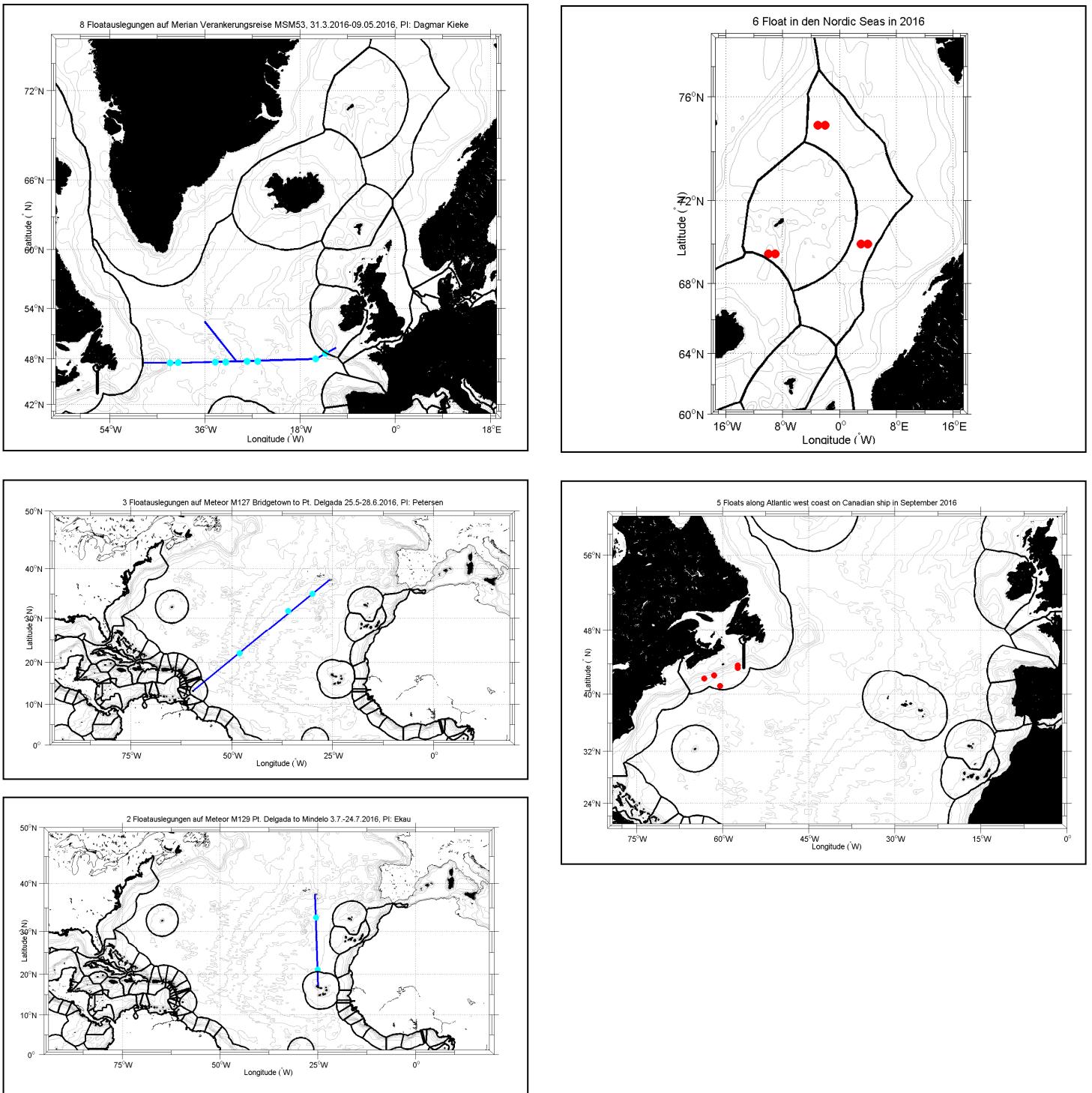


Fig. 3: a-e: Planned deployments of 24 floats in the North Atlantic

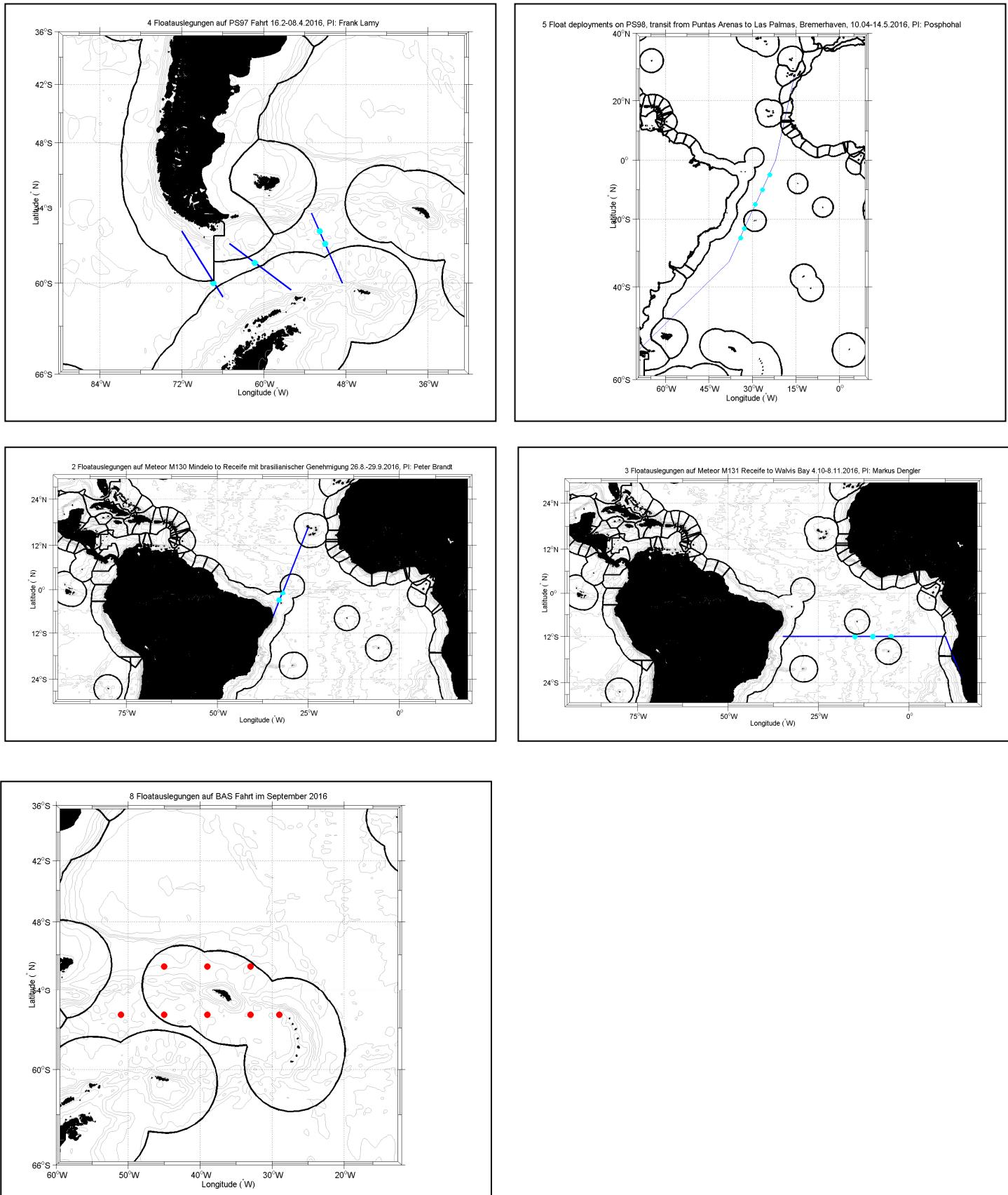


Fig. 4: a-e: Planned deployments of 22 floats in the South Atlantic

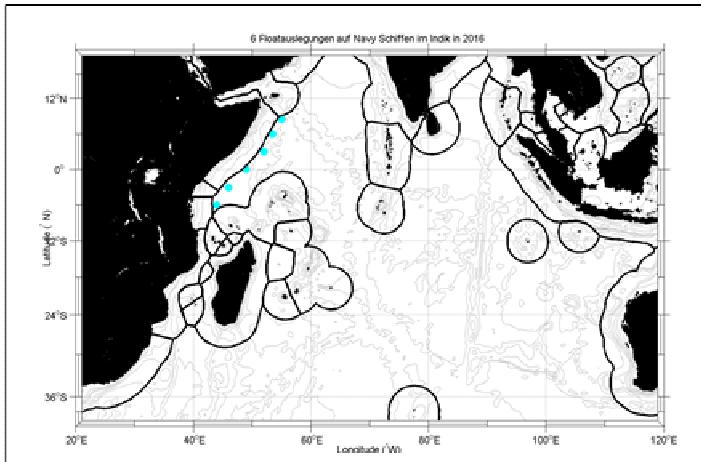


Fig. 5a: Planned deployments of 6 floats by the German Navy in the Indian Ocean.

### **3. Commitments to Argo data management**

#### **Data issued to GTS**

The profiles for all German floats are processed by Coriolis and are distributed on the GTS by way of Meteo-France.

#### **Data issued to GDACs after real-time QC**

The real-time data processing for all German floats is performed at the Coriolis Center in France. Data processing follows the procedures set up by the Argo Data Management Team.

#### **Data issued for delayed QC**

The delayed mode processing is distributed between the various German institutions contributing to Argo, depending on their area of expertise. The Alfred-Wegener Institute is responsible for the Southern Ocean and GEOMAR is processing the Pacific floats. IfM-Hamburg together with BSH are processing the German floats in the Nordic Sea, while BSH is covering the tropical, subtropical and subpolar Atlantic. German floats in the Mediterranean on the other hand are processed by MEDARGO. The sharing of delayed-mode data processing will be continued in the coming years, but BSH will cover all German floats which have not been assigned to a PI. BSH has also adopted some European floats which did not have a DMQC operator assigned to them, such as national Argo programs from the Netherlands, Denmark, Norway, Finland and Poland. All German institutions have been working in close collaboration with Coriolis and delayed mode data have been provided on a 6 monthly basis. Delays in delayed-mode data processing have occurred occasionally due to changes in personal and delay in data transmission in the Southern Ocean due to ice

coverage. Delayed-mode data processing follows the rules set up by the Data Management Team. The DMQC process is well underway and no major delays have been encountered.

### **Delayed mode data send to GDACs**

All delayed mode profiles from BSH have been sent to the Coriolis GDAC node. The total number of available profiles from German floats is 52236 (September 24<sup>th</sup>, 2015), the number of DM profiles is 43747. The percentage of DM profiles with respect to the total number of profiles is about 76%. Early in 2015 the delayed mode quality control for the Dutch float has been performed by BSH and a 100% of all eligible floats are now available in delayed mode.

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

### **Web pages**

BSH is maintaining the Argo Germany Web site. The URL for the Argo Germany is:

<http://www.german-argo.de/>

It provides information about the international Argo Program, German contribution to Argo, Argo array status, data access and deployment plans. It also provides links to the original sources of information.

### **Statistics of Argo data usage**

Currently no statistics of Argo data usage are available. The German Navy uses Argo data on a regular basis for the operational support of the fleet and uses their liaison officer at BSH to communicate their needs. The SeaDataNet portal uses German Argo data operationally data for the Northwest European Shelf.

Publications based on Argo:

Bittig, Henry C. (2014). Towards a Quantum Leap in Oceanic Oxygen Observation - From Oxygen Optode Characterization to Autonomous Observation of Gas Exchange and Net Community Production, Dissertation, Christian Albrecht University Kiel.

Bittig, H.C., B. Fiedler, R. Scholz, G. Krahmann, and A. Kötzinger (2014). Time response of oxygen optodes on profiling platforms: Dependence on flow speed and temperature and recommendations for field applications. Limnol. Oceanogr.: Methods 12, 617-636, doi: 10.4319/lom.2014.12.617.

Ronja Eisner, Die Entwicklung der Deckschicht im Islandbecken und ihr Beitrag zum Nordatlantischen Tiefenwasser, Bachelor Thesis, 52 pp., University of Hamburg, 2012.

Kieke, D., und I. Yashayaev (2015), Studies of Labrador Sea Water formation and variability in the subpolar North Atlantic in the light of international partnership and collaboration, *Prog. Oceanogr.*, 132, [doi:10.1016/j.pocean.2014.12.010](https://doi.org/10.1016/j.pocean.2014.12.010).

Katrin Latarius, Über die Wassermassentransformation im Europäischen Nordmeer - Prozess-Studien und Budgets, Dissertation, Universität Hamburg, Department Geowissenschaften, Hamburg, 176 pp, 2013.

<http://ediss.sub.uni-hamburg.de/volltexte/2013/6088/>

### **Products generated from Argo data**

A key aspect of the German Argo program is to develop a data base for climate analysis from Argo data, to provide operational products for interpretation of local changes and to provide data for research applications.

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.

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

# Argo National Data Management Report (2015) – India

## 1. Status

- **Data acquired from floats**

India has deployed 28 new floats (including 10 Apex-Bio Argo floats and 2 with Ice detection software) between October 2014 and October 2015 in the Indian Ocean taking its tally to 371 floats so far. Out of these 123 floats are active. All the active floats data are processed and sent to GDAC.

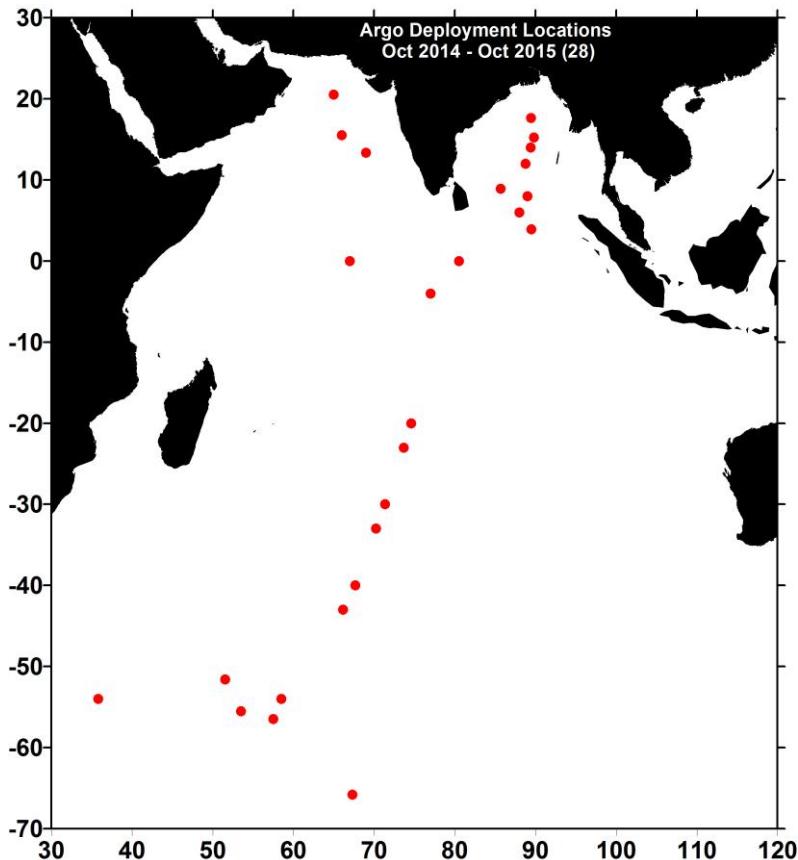


Fig. Location of Argo floats deployed by India

- **Data issued to GTS**

All the active floats data is being distributed via RTH New Delhi. However there seems to be a problem in these messages being received by some centres. Started transmission of BUFR messages from June 2015.

- **Data issued to GDACs after real-time QC**

All the active floats (123) data are subject to real time quality control and are being successfully uploaded to GDAC. RT s/w obtained in collaboration with CSIRO is extensively used for the same. The support of CSIRO in term of the Real Time S/W is highly acknowledged.

- **Data issued for delayed QC**

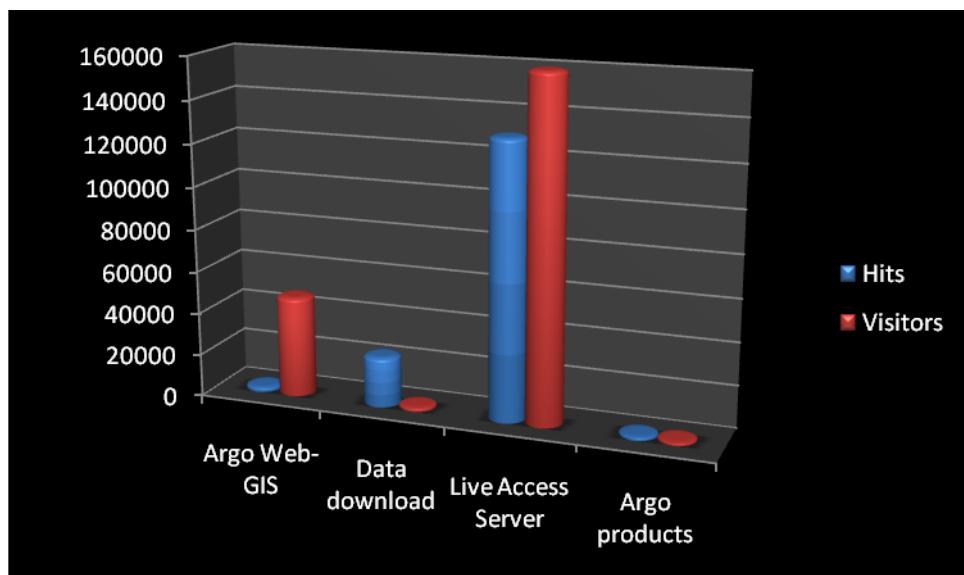
In total 50% of the eligible profiles for DMQC are generated and uploaded to GDAC.

- **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](http://www.incois.gov.in/Incois/argo/argo_home.jsp). Apart from the floats deployed by India, data from floats deployed by other nations in the Indian Ocean are received from the Argo Mirror and made available in the INCOIS website. User can download the data based on his requirement.
  - Statistics of Indian and Indian Ocean floats are generated and maintained in INCOIS web site. The density maps for aiding people for new deployments are made available on a monthly basis. For full details visit [http://www.incois.gov.in/Incois/argo/argostats\\_index.jsp](http://www.incois.gov.in/Incois/argo/argostats_index.jsp).
- **Trajectory**  

A total of **350 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. INCOIS is in the process of generating Ver 3.1 trajectory files and will be generating them and uploading on to GDAC shortly.
- **Statistics of Argo data usage**  

Argo data is widely put to use by various Organisations/ Universities/ Departments. Indian Meteorological Department (IMD) is using Argo data for their operational purpose. Scientists, Students and Researchers from INCOIS, NIO, SAC, C-MMACS, NRSA, IITM, NCMRWF, IISc etc are using Argo data in various analysis. Many paper based on Argo data were also published in reputed journals. See the references below.

  - The demand for Bio-Argo data is increasing and the same is being supplied for research interest by various research institutes and universities.



INCOIS Argo web page statistics (for the past one year) are as shown below

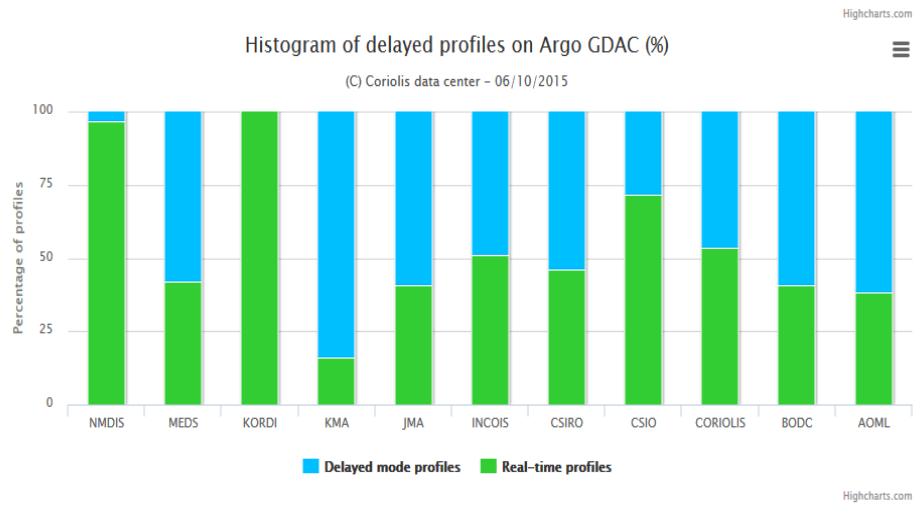
<b>Page</b>	<b>Hits</b>	<b>Visitors</b>
Argo Web-GIS	2171	47809
Data download	23712	1801
Live Access Server	129907	159697
Argo products	1704	1344

- **Products generated from Argo data**

1. Value added products obtained from Argo data are continued. Continued to variational analysis method while generating value added products. Many products are generated using Argo temperature and salinity data. The Argo T/S data are first objectively analysed and this gridded output is used in deriving value added products. More on this can be seen in the RDAC functions.
2. Version 2.1 of DVD on “Argo data and products for the Indian Ocean” is released to public for use with data corresponding to 2015 being updated. This DVD consists of ~ 2,80,000 profiles and products based on the Argo T/S. A GUI is provided for user to have easy access to the data. As many as 300+ DVDs were supplied to various users from institutions and universities. From this financial year it is decided to update this product on quarterly basis so the user gets the latest data in the DVD.
3. To cater to many users of INCOIS LAS, it is enhanced in term of capacity. New Server is procured and new products viz., model outputs, new wind products (OSCAT), fluxes are made available. New products as per the request received from the users in future are being made available. For further details visit <http://las.incois.gov.in>.

## 2. Delayed Mode QC

- INCOIS started generating and uploading D files to GDAC from July 2006, and as of today, profiles belonging to all eligible floats have been subjected to DMQC.
- Advanced Delayed Mode Quality Control s/w developed by CSIRO is being put to use successfully. Using this s/w all the eligible floats are reprocessed to tackle pressure sensor offset problems, salinity hooks, thermal lag corrections, salinity drifts.
- Under the data search and archeology data from our own sister concerns is being obtained and put to use in the delayed mode processing.
- About 50% of the eligible profiles are subjected to DMQC and the delayed mode profiles are uploaded on to GDAC. The DMQC process is hit by transition to Ver 3.1 processing.



### 3. GDAC Functions

INCOIS is not operating as a GDAC.

### 4. Regional Centre Functions

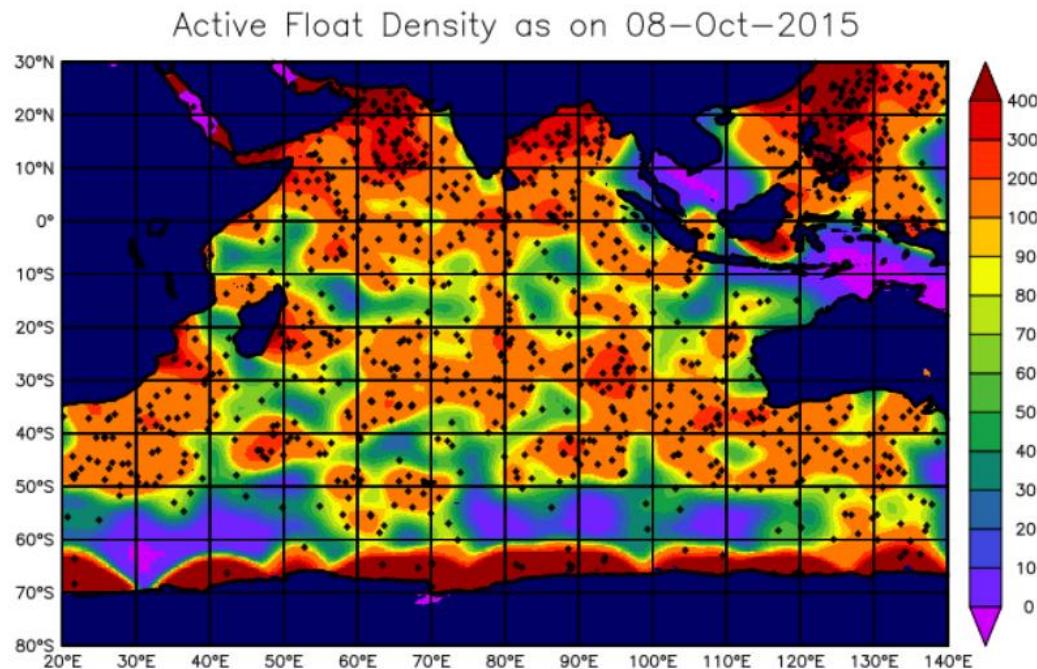
- Acquisition of Argo data from GDAC corresponding to floats other than deployed by India and made them available on INCOIS web site.
- Delayed Mode Quality Control  
(Refer 2.0 above)
- Data from the Indian Ocean regions are gridded into 1x1 box for monthly and 10 days and monthly intervals. These gridded data sets are made available through INCOIS Live Access Server (ILAS). Users can view and download data/images in their desired format.
- Additionally SST from TMI, AMSRE and Wind from ASCAT, Chla from MODIS and OCM-2 are also made available on daily and monthly basis.
- Global wind products from OSCAT is also generated and made available on LAS along with TROP flux data sets.
- Data Sets (CTD, XBT, Subsurface Moorings) are being acquired from many principle investigators. These data are being utilized for quality control of Argo profiles.
- Value added products:

Two types of products are currently being made available to various user from INCOIS web site. They are:

- (i) Time series plots corresponding to each float (only for Indian floats).
- (ii) Spatial plots using the objectively analysed from all the Argo floats data deployed in the Indian Ocean.

These valued added products can be obtained from the following link  
[http://www.incois.gov.in/Incois/argo/products/argo\\_frames.html](http://www.incois.gov.in/Incois/argo/products/argo_frames.html)

- Regional Co-ordination for Argo floats deployment plan for Indian Ocean. The float density in Indian Ocean as on 08 Oct, 2015 is shown below.



### **Publications:**

INCOIS is actively involved in utilization of Argo data in various studies pertaining to Indian Ocean. Also INCOIS is encouraging utilization of Argo data by various universities by funding them. Some of the publications resulted from Argo data are given below:

1. Bhaskar, T. V. S. U., and C. Jayaram, 2015: Evaluation of Aquarius Sea Surface Salinity With Argo Sea Surface Salinity in the Tropical Indian Ocean, *Geoscience and Remote Sensing Letters, IEEE*, **12**(6), 1292-1296, <http://dx.doi.org/10.1109/LGRS.2015.2393894>.
2. Pant, V., M. S. Girishkumar, T. V. S. U. Bhaskar, M. Ravichandran, F. Papa, and V. P. Thangaprakash, 2015: Observed interannual variability of near-surface salinity in the Bay of Bengal, *Journal of Geophysical Research: Oceans*, **120**(5), 3315-3329, <http://dx.doi.org/10.1002/2014JC010340>.
3. Rao, R. R., V. Jitendra, M. S. GirishKumar, M. Ravichandran, and S. S. V. S. Ramakrishna, 2015: Interannual variability of the Arabian Sea Warm Pool: observations and governing mechanisms, *Climate Dynamics*, **44**(7-8), 2119-2136, <http://dx.doi.org/10.1007/s00382-014-2243-0>.
4. Chaitanya, A. V. S., F. Durand, S. Mathew, V. Gopalakrishna, F. Papa, M. Lengaigne, J. Vialard, C. Kranthikumar, and R. Venkatesan, 2015: Observed year-to-year sea surface salinity variability in the Bay of Bengal during the 2009–2014 period, *Ocean Dyn.*, **65**(2), 173-186, <http://dx.doi.org/10.1007/s10236-014-0802-x>.
5. Satish, R.U.V.N. Bhaskar, T.V.S.U., Suresh Kumar, N, Ravichandran, M, Dinesh, K, and Ashok Kumar 2015: On the Possible Use of Satellite Fixed Positions for Argo Float Profiles in Case of Wrong Fixes by GPS, *International Journal of Earth Sciences and Engineering*, Vol 8(2), pp 710 -715.

## Argo National Data Management Report – Italy (2015)

### 1. Status

- **Data acquired from floats:** 308 floats were deployed in the Mediterranean and in Black Seas between 2001 and 2015 (the floats temporal distribution is shown in Figure 1a) and more than 31400 CTD profiles were acquired. The temporal and spatial distribution of these profiles is depicted in Figure 1, sorted by the two main float models currently used (bio-Argo and core-Argo floats). Note that here bio-Argo also includes the floats with dissolved oxygen. More than 85 floats per months have been operated simultaneously in the basin in 2015 and more than 5000 CTD profiles have been acquired up to September 2015 by different float models (Figure 1b).

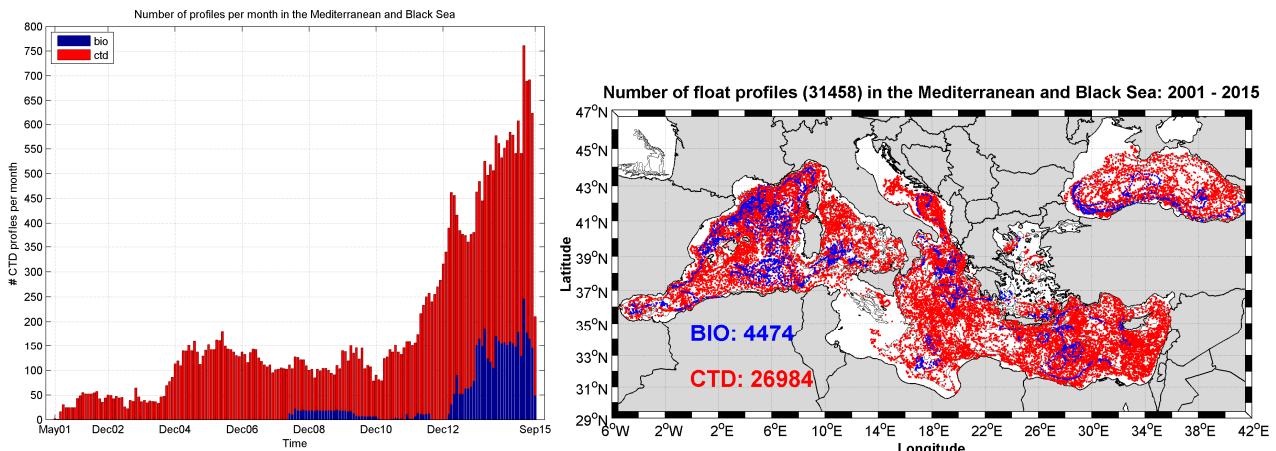


Figure 1. Temporal (left panel) and spatial (right panel) distribution of float profiles in the Mediterranean and Black Sea between 2001 and 2015.

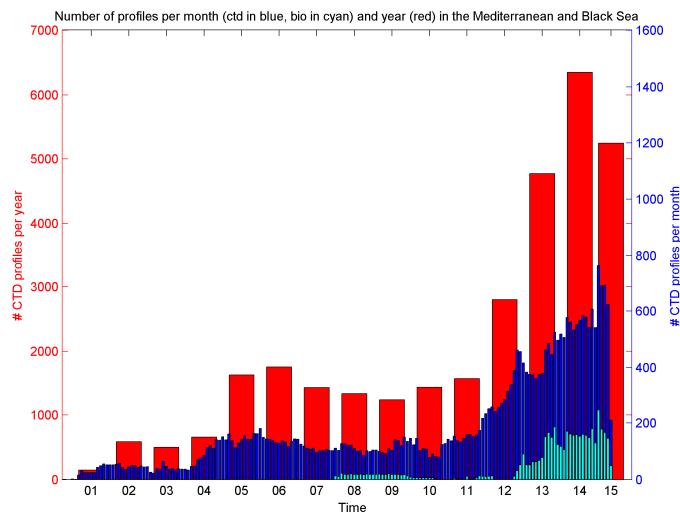


Figure 1a. Monthly (blue and cyan bars) and yearly (red bars) distribution of Argo floats in the Mediterranean and Black Sea between 2001 and 2015.

The number of CTD profiles acquired by bio-Argo floats in 2015 (up to September) is about 1400 (contributors: France, Italy and Greece) and the data collected by the "standard" CTD Argo floats is just less than 4000 profiles (up to September). The countries that contribute to maintain/increase the Argo population in 2015 are Spain, France, Germany, Greece, Italy, USA and EU: a total of 37 new floats (manufactured mainly by Metocean, Teledyne Webb Research and NKE) have been deployed both in the Mediterranean and in the Black Seas (Figure 1b); 14 out of 37 platforms are equipped with biogeochemical sensors and the deployment strategy was chosen in order to replace dead floats or under-sampled areas.

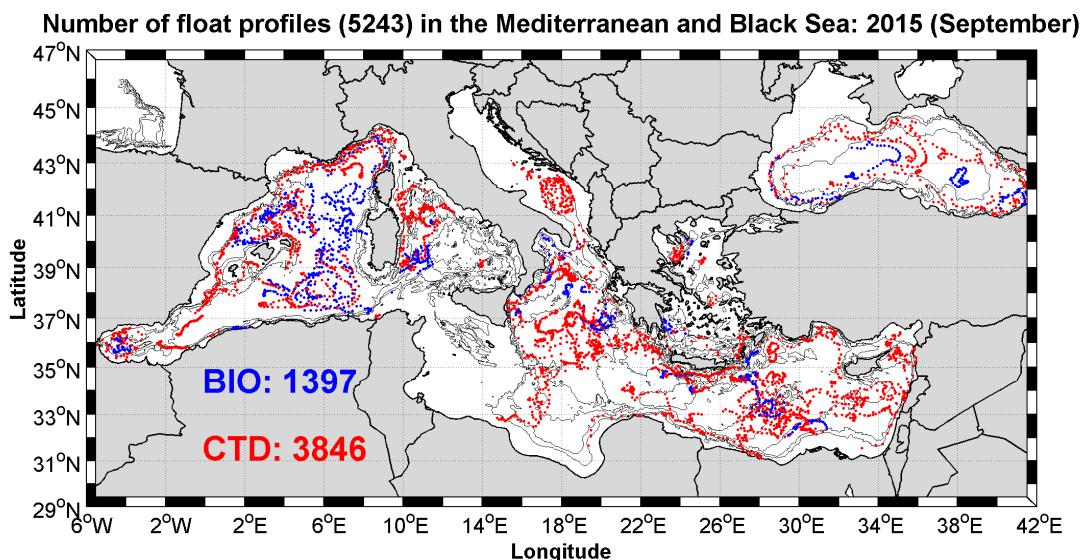


Figure 1b. Spatial distribution of profiles collected by Argo floats in 2015 (January-September) in the Mediterranean and Black Sea: bio-Argo floats (blue dots) and standard Argo floats (red dots).

OGS, in collaboration with Italian colleagues onboard the Korean R/V Araon, has deployed 10 floats in the South Pacific in 2015, in the framework of the Argo-Italy program: 5 Apex and 5 Arvor I. The number of active platforms in the ice-free areas is now 13 (Figure 1c) with a cycle length of 10 days and a parking depth of 1000 dbar. Next year 15 new floats (NOVA) will be deployed: 10 units in the South Pacific and 5 in the South Indian Ocean.

LAST UPDATE 20-Oct-2015

WMO numbers

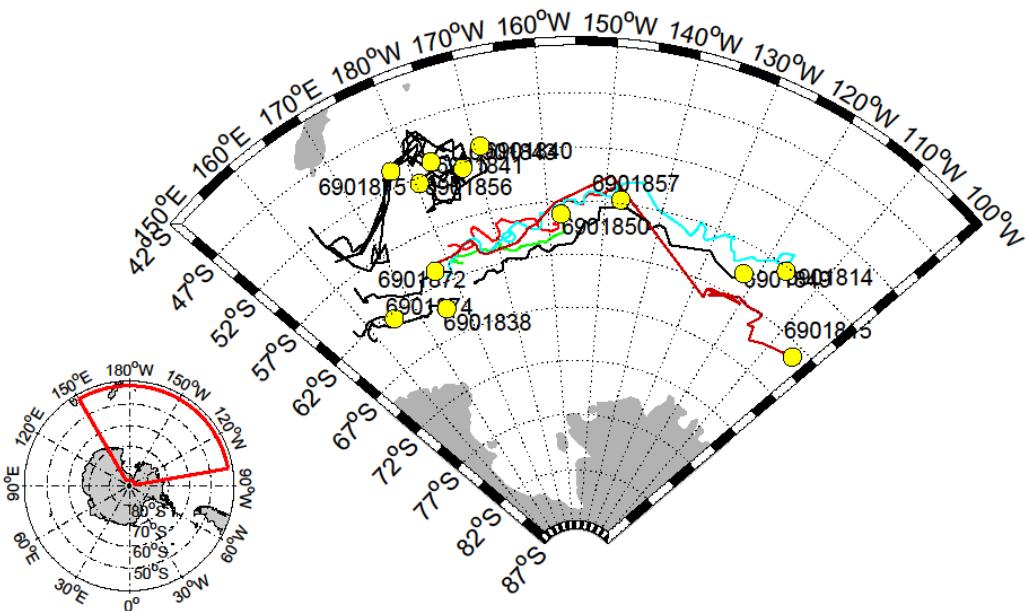


Figure 1c. Active floats in the South Pacific Ocean.

- **Web pages:**

The MedArgo web page (<http://nettuno.ogs.trieste.it/sire/medargo/active/index.php>) has been maintained and tables and graphics have been updated in near real time. The floats deployed during 2015 have been added to the web page as soon as the technical information are available. The float positions are plotted daily (Figure 2); the monthly and the whole trajectories are also provided (Figure 3). Links with the GDAC center (Coriolis) are also available for downloading both the real-time and delayed-mode float profiles. A link with the Laboratoire d'Oceanographie de Villefranche (OAO - Oceanographic Autonomous Observations) can provide detailed information about Argo floats equipped with biogeochemical sensors.

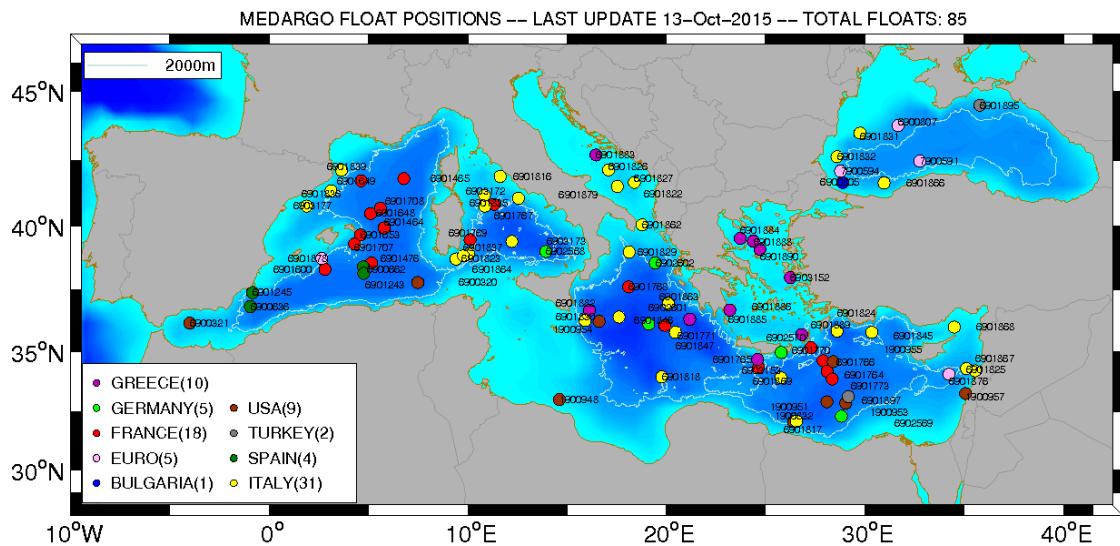


Figure 2. MedArgo float positions as of 13 October 2015 (updated daily).

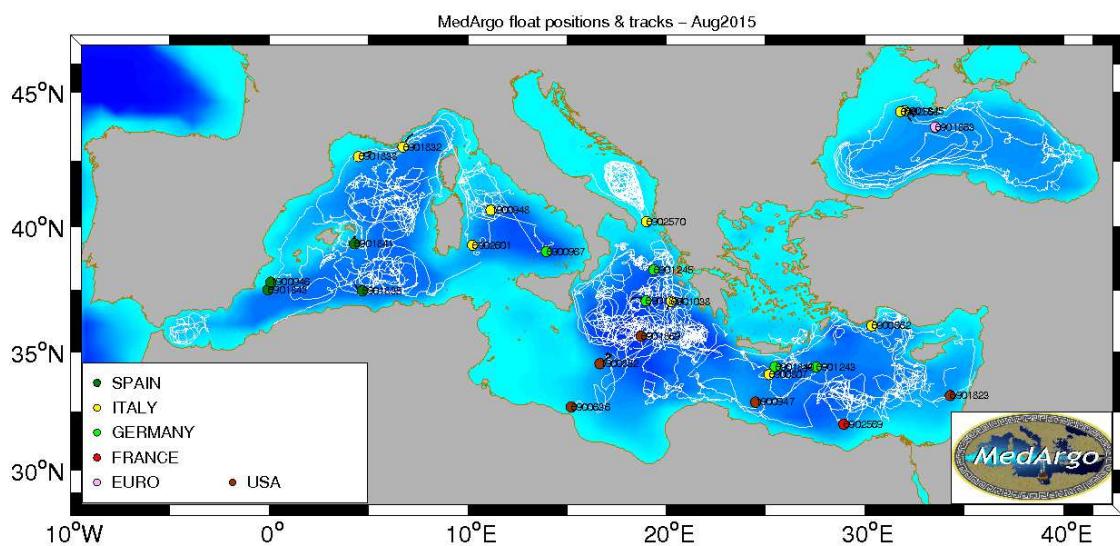


Figure 3. MedArgo float positions and tracks (August 2015). The monthly tracks are in black while the entire float trajectories are in white.

- **Statistics of Argo data usage:** ( operational models, scientific applications, number of National Pis... ):

  - a. From all available Argo floats and altimetry data (Figure 4), the surface, intermediate (350 m depth) and deep (1000 m) circulation patterns in the Ionian Sea were analysed in detail for four consecutive years (2010, 2011, 2012 and 2013). In addition, thermohaline properties from float measurements were described and compared considering among all, the Dense Water Overflow from the Adriatic, particularly the one due to the strong winter air-sea heat loss in 2012 (Kovacevic et al., 2015).

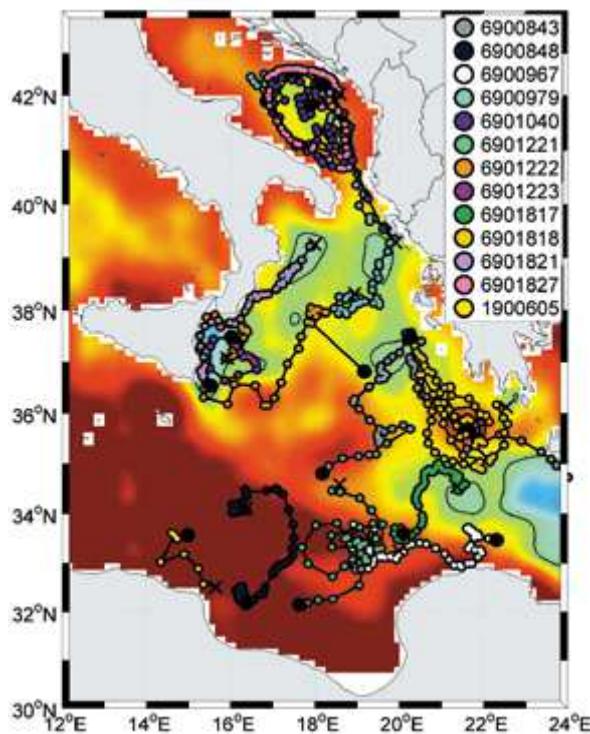


Figure 4. ADT annual mean maps in 2013. Superimposed trajectories at 350 m of the selected floats are color-coded. Black crosses (dots) denote the initial (final) position. Black solid line delineates the zero contour of the sea level.

b. Adriatic and Ionian seas are Mediterranean sub-basins linked through the Bimodal Oscillating System mechanism responsible for decadal reversals of the Ionian basinwide circulation. Altimetric maps showed that the last cyclonic mode started in 2011 but unexpectedly in 2012 reversed to anticyclonic. We related this “premature” inversion to the extremely strong winter in 2012, which caused the formation of very dense Adriatic waters, flooding Ionian flanks in May and inverting the bottom pressure gradient. Using Lagrangian float measurements (Figure 5), the linear regression between the sea surface height and three isopycnal depths suggests that the southward deep-layer flow coincided with the surface northward geostrophic current and the anticyclonic circulation regime (Gacic et al., 2014).

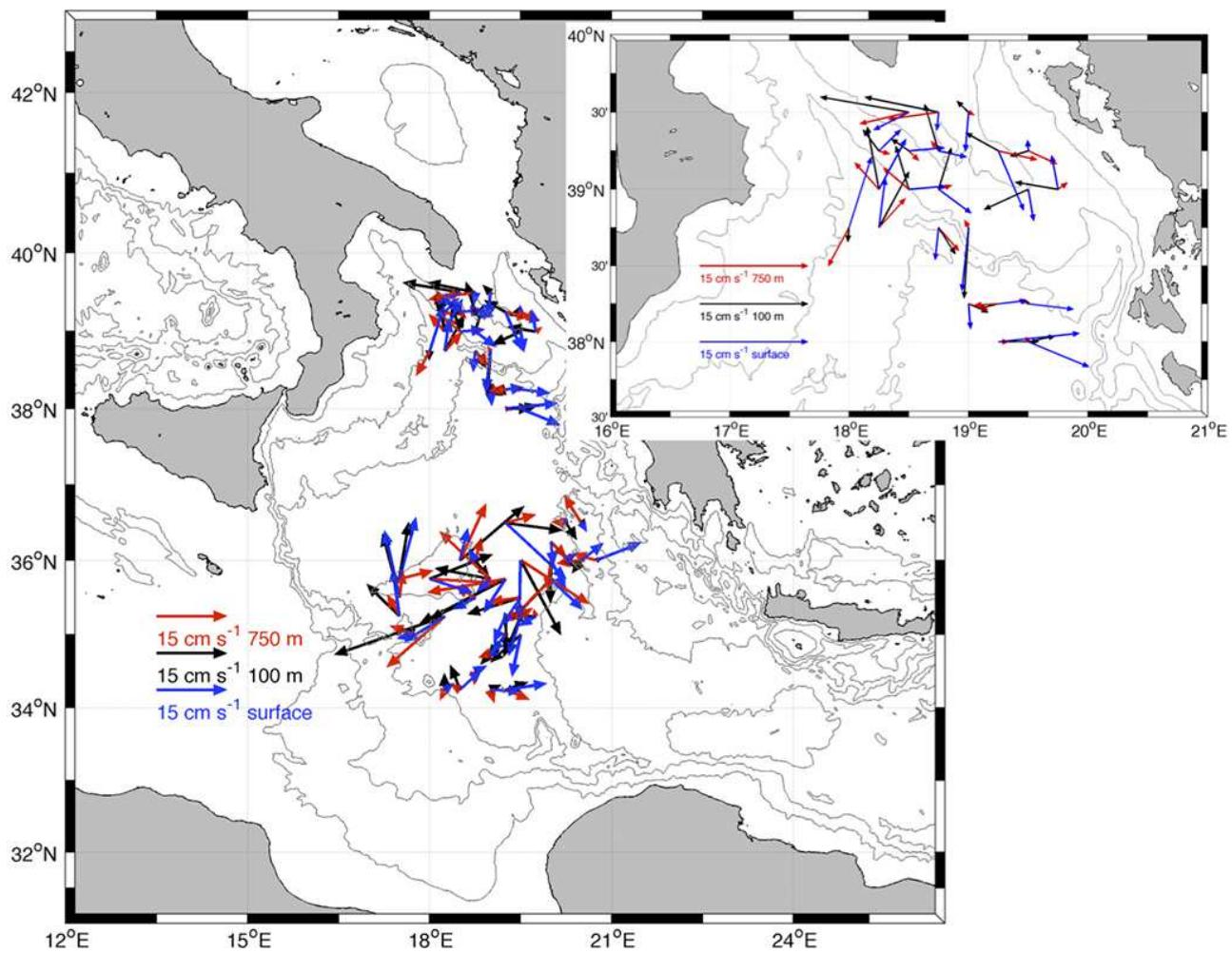


Figure 5. Absolute velocities calculated from the geostrophic shear using the 350m Lagrangian Argo float measurements as a reference velocity

- **Products generated from Argo data:**

- a. Daily maps of float positions (Figure 2)
- b. Monthly maps of float positions and track (Figure 3)
- c. Float data are assimilated in numerical forecasting models by INGV (MFS); daily and weekly maps of Mediterranean ocean forecasting system are produced (Figure 6).

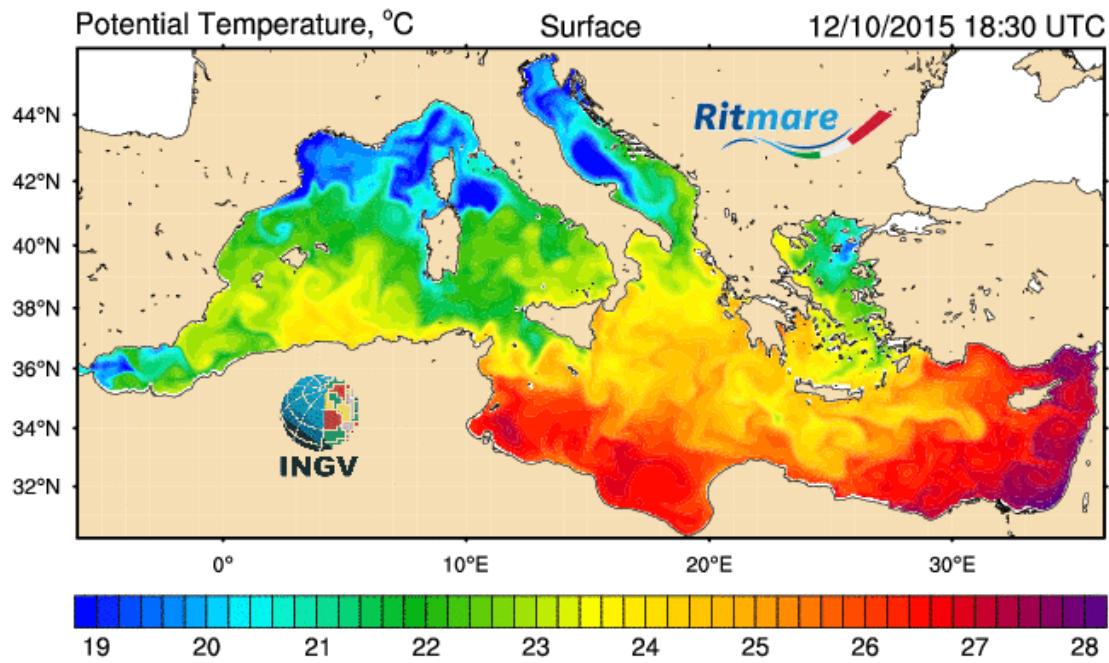


Figure 6. Forecasting model of potential temperature at surface.

## 2. Delayed Mode QC

OGS has continued to carry out the DMQC for the Argo data in the Mediterranean Sea. Any possible surface pressure offsets were examined using the Metadata and Technical data files; different procedures were applied to correct this pressure offset depending on the float type, following the standard method proposed by the Argo community. The OW method in conjunction with other procedures is adopted to conduct the quality control analysis for the salinity data. The D files of floats in the "density inversion test" list were examined and feedback was provided.

Additional historical reference data for the Mediterranean Sea have been found and added to the current reference dataset that now consists of 37140 profiles between 2000 and 2013 (Figure 7).

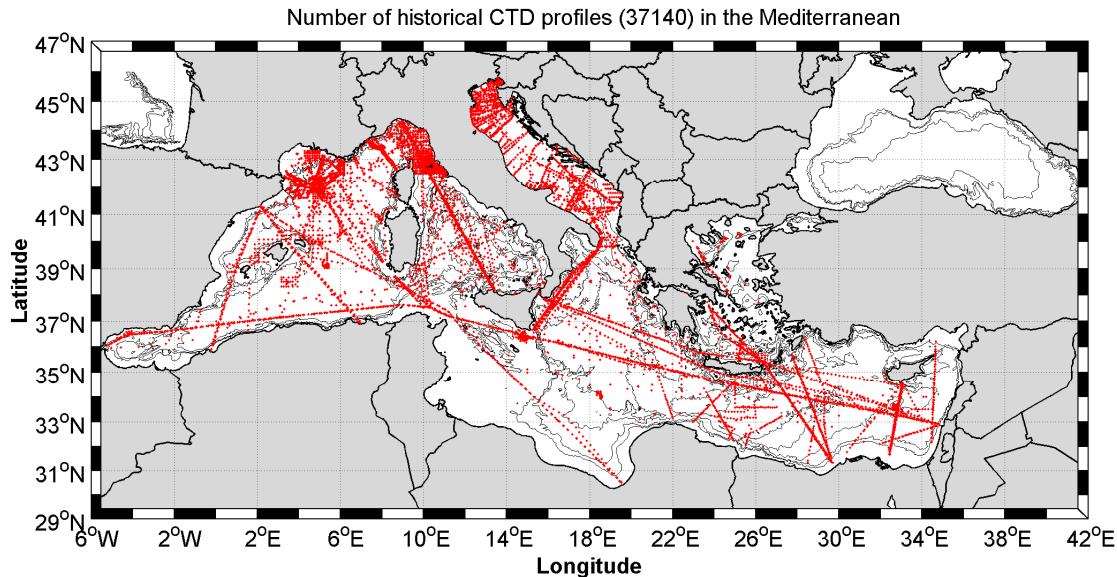


Figure 7. Location of the historical CTD data, spanning from 2000 to 2013, used in the DMQC.

The DMQC method has been applied to the majority of the floats which died between 2001 and 2015 in the Mediterranean Sea: they were quality controlled in delayed-mode for salinity, temperature and surface pressure and the respective D-files are gradually sent to GDAC. So far, the majority of the DM checked floats, can be considered as well calibrated. The DMQC report/info of each float can be downloaded by the MedArgo web page ([http://nettuno.ogs.trieste.it/sire/medargo/all/table\\_out\\_all.php](http://nettuno.ogs.trieste.it/sire/medargo/all/table_out_all.php)).

### 3. Regional Centre Functions

MedArgo is the Argo Regional Centre for the Mediterranean and the Black Sea. OGS, who coordinates the MedArgo activities, established several collaborations with European and non-European countries (Algeria, Bulgaria, France, Spain, Greece, Germany, Turkey, Malta, Romania, Israel and Lebanon) in order to set the planning and the deployment coordination of floats; future collaborations will be extended also to Tunisia in 2016 for operations in the Sicily. In addition MedArgo has worked with the International Seakeepers Society ([www.seakeepers.org](http://www.seakeepers.org)) to deploy floats from yachts of opportunity. A float was deployed south of Barcelona in early October 2015 by a super yacht transiting between Barcelona and Miami. As part of these cooperations the float data are transferred in near real time to MedArgo and 37 new floats have been deployed in the Mediterranean and Black Sea during 2015 (Figure 8).

## 2015 deployments

- **10** BioArgo-France (Provor)
  - **10** Argo-Italy (2 Arvor, 4 Provor Bio, 3 Apex, 1 NOVA) → H<sub>2</sub>S sensor
  - **1** Spain (Apex)
  - **2** Euro (1 Arvor A3, 1 Provor DO)
  - **4** USA (Apex)
  - **5** Germany (2 Arvor, 3 Apex)
  - **5** Greece (2 NOVA, 2 DOVA, 1 Provor)
- 37 new floats (6 countries and Euro-Argo RI)**

Figure 8. 2015 float deployments in the Mediterranean and Black Sea

There are 76 active Argo floats in the Mediterranean Sea and 7 in the Black Sea as of October 2015. More than 30 floats (including also several floats equipped with biogeochemical sensors) will be deployed in late 2015 and in 2016 (Figure 9) with the contributions of many countries.

## Deployments/Collaborations plans for end 2015 and 2016

### **Mediterranean and Black Sea**

<b>ITALY:</b>	Med Sea -> 2 deep Arvor, 1 Provor bio, 2 Apex, 3 NOVA/DOVA, (10 NOVA/DOVA)
	Black Sea --> 1 Arvor I, 2 DOVA
<b>FRANCE:</b>	??
<b>GREECE:</b>	3
<b>SPAIN:</b>	3
<b>USA:</b>	??

**30-40 new floats should be deployed before  
the end of 2016**

Figure 9. Deployments plans for end 2015 and 2016.

## **References**

Gacic M., Civitarese G., Kovacevic V., Ursella L., Bensi M., Menna M., Cardin V., Poulain P.-M., S. Cosoli, G. Notarstefano, and Pizzi C. (2014). Extreme winter 2012 in the Adriatic: an example of climatic effect on the BiOS rhythm doi:10.5194/osd-11-425-2014

Kovacevic V., Ursella L., Gacic M., Notarstefano G., Menna M., Bensi M. and P.-M. Poulain (2015). On the Ionian thermohaline properties and circulation in 2010-2013 as measured by Argo floats ISSN: 0001-5113 ACTA ADRIAT., 56(1): 97 - 114, 2015, 17pp.

# Argo National Data Management Report

## KMA (Republic of Korea)

### 1. Status

#### -Data acquired from floats

In this year, KMA deployed additional 17 Argo floats in the middle of July. Thus, KMA operates 63 active floats that is profiling in the East Sea/Sea of Japan and North Pacific Ocean. During Jan.-Oct. 2015, 2,190 real-time data of KMA were sent to GDAC.

#### -Data issued to GDACs after real-time QC

KMA is generating the updated Argo data by the Argo data management manual v 3.1 and will send to GDAC updated files after complete to check the data. It will be the end of this year.

#### -Web pages

KMA is operating the Argo Korea web page.

The URL is <http://argo.nimr.go.kr>. It provides profile data and status of Argo floats to the public.



-Delayed data sent to GDACs

Recently, KMA sent to GDAC profile data of WMO ID:2901252 float. It is included Dissolve Oxygen data and float 2901252 was deployed in 2012.

## 2. Delayed Mode QC

National Institute of Fisheries Science (NIFS, former NFRDI) / Korea Oceanographic Data Center (KODC) is responsible for Delayed Mode QC (DMQC) of KMA/NIMR Argo floats. During November 2014 – October 2015, NIFS/KODC has sent 18,087 D-files to the GDACs after DMQC.

NIFS/KODC is currently preparing conversion to profile format V3.1 of KMA/NIME D-files, and this work will be finished end of this year.

## 3. Regional Centre Functions

KMA will deploy additional 16 Argo floats in 2016.

# **Argo National Data Management Report of Japan, 2015**

## **1. Status**

The Japan DAC, the Japan Meteorological Agency (JMA), has processed data from 1403 Japanese Argo and Argo-equivalent floats including 205 active floats as of October 13<sup>th</sup>, 2015. There are ten Japanese PIs who agreed to provide data to the international Argo data management. The DAC is acquiring ARGOS messages from CLS and getting IRIDIUM messages via e-mail in real-time, thanks to the understanding and the cooperation of PIs. Almost all profiles from those floats are transmitted to GDACs in the netCDF format and issued to GTS using TESAC and BUFR codes after real-time QC on an operational basis.

The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) has done the Delayed Mode QC for all Japanese floats. JAMSTEC acquired the ARGOS messages for 8,293 profiles via CLS and the Iridium messages via e-mail, RUDICS and dial-up access for delayed QC from October 27<sup>th</sup>, 2014 to October 13<sup>th</sup>, 2015. JAMSTEC sent 2,003 delayed profile files (D-files) to GDACs through the Japan DAC, JMA, during the period. Submission of delayed profile files was slowed down during the period because we have been converting meta- and Dprof-files from v2 to v3.1.

JMA and JAMSTEC have been converting the meta-, prof-, tech-, and traj-files of Japanese floats, including APEX, PROVOR, ARVOR, NEMO, NOVA, Navis, NINJA, DeepNINJA and S2A, since the last ADMT meeting. JMA and JAMSTEC have converted the meta- and tech-files of Japanese floats, except a part of Iridium floats equipped with additional bio-geochemical sensor. Accordingly, we have converted about 98% of Japanese meta and tech-files from v2 to v3.1 and submitted them to GDAC. JMA have converted the Rprof-files of Japanese ARGOS floats, except floats with NST sampling scheme and Iridium floats equipped with only CTD sensor. JAMSTEC have converted all v2 Dprof-files of Japanese floats to v3.1 and submitted them to GDAC.

JMA is working on coding conversion programs for traj-files. No Japanese v3.1 traj-files were sent to GDAC.

### **Web pages:**

#### **Japan Argo**

[http://www.jamstec.go.jp/J-ARGO/index\\_e.html](http://www.jamstec.go.jp/J-ARGO/index_e.html)

This site is the portal of Japan Argo program. The outline of Japanese approach on the Argo program, the list of the publication, and the link to the database site and PIs, etc. are being offered.

#### **Real-time Database (JMA)**

<http://ds.data.jma.go.jp/gmd/argo/data/index.html>

This site shows global float coverage, global profiles based on GTS TESAC and BUFR messages, and status of the Japanese floats.

#### **Delayed mode Database (Argo JAMSTEC)**

[http://www.jamstec.go.jp/ARGO/argo\\_web/argo/index\\_e.html](http://www.jamstec.go.jp/ARGO/argo_web/argo/index_e.html)

JAMSTEC's website shows mainly Japanese float list, trajectory map, profile chart, and QCed float data. Moreover, the position and trajectory maps of all floats of the world as well as Japanese floats by using Google Map. Brief profile figures of the selected floats are also shown. This site also shows global maps based on objective analysis (temperature, salinity, potential density, dynamic height, geostrophic current, mixed layer depth, etc.).

### **Statistics of Argo data usage:**

#### **Operational models of JMA**

MOVE/MRI.COM-G2 (Multivariate Ocean Variation Estimation System/ Meteorological Research Institute Community Ocean Model – Global 2)

JMA operates the MOVE/MRI.COM-G2, which replaced the previous version (MOVE/MRI.COM) in June 2015, for the monitoring of El Niño and the Southern Oscillation (ENSO) and for initialization of the seasonal prediction model (JMA/MRI-CGCM2). The MOVE/MRI.COM-G2 consists of an ocean general circulation model (OGCM) and an objective analysis scheme.

For details please visit:

[http://ds.data.jma.go.jp/tcc/tcc/products/elnino/move\\_mricom-g2\\_doc.html](http://ds.data.jma.go.jp/tcc/tcc/products/elnino/move_mricom-g2_doc.html)

JMA/MRI-CGCM2 (JMA/MRI - Coupled ocean-atmosphere General Circulation Model 2)

JMA operates JMA/MRI-CGCM2, which replaced the previous version (JMA/MRI-CGCM) in June 2015, as a seasonal prediction model and an ENSO prediction model. The oceanic part of this model is identical to the OGCM used for the MOVE/MRI.COM-G2.

For detail please visit:

[http://ds.data.jma.go.jp/tcc/tcc/products/model/outline/cps2\\_description.html](http://ds.data.jma.go.jp/tcc/tcc/products/model/outline/cps2_description.html)

MOVE/MRI.COM-WNP (Multivariate Ocean Variation Estimation System/ Meteorological Research Institute Community Ocean Model - Western North Pacific)

MOVE/MRI.COM-WNP provides daily, 10day-mean and monthly products of subsurface temperatures and currents for the seas around Japan and northwestern Pacific Ocean.

#### **Other operational models**

##### **JCOPE2 (Japan Coastal Ocean Predictability Experiment)**

JCOPE2 is the model for prediction of the oceanic variation around Japan which is operated by Research Institute for Global Change of JAMSTEC. JCOPE2 is the second version of JCOPE, developed with enhanced model and data assimilation schemes. The Argo data are used by way of GTSPP. The hindcast data 6 months back and the forecast data 3 months ahead are disclosed on the following web site: <http://www.jamstec.go.jp/frcgc/jcope/>. More information is shown in

<http://www.jamstec.go.jp/frcgc/jcope/htdocs/e/home.html>

### FRA-JCOPE2

FRA-JCOPE2 is the reanalysis data created by assimilating most of available observation data into the JCOPE2 ocean forecast system. The high horizontal resolution of 1/12 deg. is used in order to describe the oceanic variability associated with the Kuroshio-Kuroshio Extension, the Oyashio, and the mesoscale eddies from January 1993 to December 2009. Collaboration with Japanese Fishery Research Agency (FRA) has allowed us to assimilated huge amount of in-situ data around Japan. FRA-JCOPE2 reanalysis data are openly available. The website, <http://www.jamstec.go.jp/frcgc/jcope/vwp/>, provides information about downloading and interactively visualizing the reanalysis data for users.

### FRA-ROMS

FRA-ROMS is the nowcast and forecast system for the Western North Pacific Ocean developed by Fisheries Research Agency (FRA) based on the Regional Ocean Modeling System (ROMS). FRA started the operation in May 2012. The forecast oceanographic fields are provided every week on the website <http://fm.dc.affrc.go.jp/fra-roms/index.html>.

## Products generated from Argo data:

### Products of JMA

#### El Niño Monitoring and Outlook

JMA issues the current diagnosis and the outlook for six months of ENSO on the following web site. The outputs of the MOVE/MRI.COM-G2 and the JMA/MRI-CGCM2 can be found here.

<http://ds.data.jma.go.jp/tcc/tcc/products/elnino/index.html>

#### Subsurface Temperatures and Surface Currents in the seas around Japan

The following parameter outputs of the MOVE/MRI.COM-WNP can be found on <http://ds.data.jma.go.jp/gmd/goos/data/database.html>.

- Daily, 10day-mean and Monthly mean subsurface temperatures at the depths of 50m, 100m, 200m and 400m analyzed for 0.1 x 0.1 degree grid points.
- Daily and 10day-mean Surface Currents for 0.1 x 0.1 degree grid points.

### Products of JAMSTEC

#### MOAA (Monthly Objective Analysis using the Argo data)

MOAA is the global GPV data set which was made by monthly OI objective analysis using Argo and TRITON mooring data. Various maps have been made using MOAA, and opened to the public on the Argo JAMSTEC web site,

[http://www.jamstec.go.jp/ARGO/argo\\_web/MapQ/Mapdataset\\_e.html](http://www.jamstec.go.jp/ARGO/argo_web/MapQ/Mapdataset_e.html)

We have produced the new data set, which is produced through a 10-day global ocean analysis by optimal interpolation based on Argo, TRITON and available CTD data and will be available in the near future.

#### Objectively mapped velocity data at 1000 dbar derived from trajectories of Argo floats

The gridded velocity data at 1000 dbar is made by optimal interpolation analysis using YoMaHa'07. This dataset has been disclosed since October 2009. This dataset are updated every 6 months. This data is opened to the public on the Argo JAMSTEC web site,

[http://www.jamstec.go.jp/ARGO/argo\\_web/G-YoMaHa/index\\_e.html](http://www.jamstec.go.jp/ARGO/argo_web/G-YoMaHa/index_e.html).

#### MILA GPV (Mixed layer data set from Argo floats in the global ocean)

JAMSTEC has produced a data set of gridded mixed layer depth with its related parameters, named MILA GPV. This consists of 10-day and monthly average data and monthly climatology data in the global ocean using Argo temperature and salinity profiles. We have fixed bugs of programs, and the updated data set will be released on the Argo JAMSTEC web site soon,

[http://www.jamstec.go.jp/ARGO/argo\\_web/MILAGPV/index\\_e.html](http://www.jamstec.go.jp/ARGO/argo_web/MILAGPV/index_e.html).

#### Scientifically quality-controlled profile data of Deep NINJA observations

We have released a product of a quality-controlled data set of Deep NINJA observations for convenient use on scientific/educational purposes. The quality-control was led by JAMSTEC on the basis of mainly comparisons with highly accurate shipboard CTD observations conducted at float deployments. Its detailed information has been provided on the Argo JAMSTEC web site:

<http://www.jamstec.go.jp/ARGO/deepninja/>.

#### ESTOC (Estimated state of global ocean for climate research)

This product is an integrated dataset of ocean observations including Argo data by using a four dimensional variational (4D-VAR) data assimilation approach. ESTOC is the open data that consists of not only physical but also biogeochemical parameters for 55 years during 1957-2011 (See the web site in JAMSTEC, <http://www.godac.jamstec.go.jp/estoc/e/top/>).

#### AQC Argo Data (Advanced automatic QC Argo Data) version 1

JAMSTEC has released The Argo temperature and salinity profile data put through more advanced automatic checks than real-time quality controls since October 2014. This data set has been provided in the ascii format as well as netcdf format, because it is useful for analyses using various software.

## 2. Delayed Mode QC

Based on the mutual agreement by PIs in Japan in 2006, JAMSTEC has done the

DMQC for all Japanese floats.

JAMSTEC has submitted the delayed mode files of 95,458 profiles to GDACs as of October 13<sup>th</sup>, 2015.

The procedure of DMQC in JAMSTEC is as follows.

#### **(JAMSTEC floats and the most of Argo-equivalent floats)**

1. (within 10days) data re-acquisition from CLS, bit-error repair (if possible), real-time processing, position QC, visual QC
2. (within 180days) surface pressure offset correction, cell TM correction (Apex only)
3. (after 180days) WJO and OW salinity correction, the definitive judgement by experts, D-netCDF file making

#### **(Argo-equivalent floats that had ceased by 2007)**

JMA executes real-time processing again by using the latest procedure. The procedure after real-time processing is executed by JAMSTEC according to the procedure describe above.

The OW software is mainly operated instead of WJO. The calculation result of WJO has been used at the definitive judgment. In order to decide the best parameter value, JAMSTEC will continue to use both OW and WJO.

### **3. GDAC Functions**

The JAMSTEC ftp server has been providing the mirror site of GDACs since 2003.

ftp://ftp2.jamstec.go.jp/pub/argo/ifremer/  
ftp://ftp2.jmstec.go.jp/pub/argo/fnmoc/

### **4. Regional Centre Functions**

JAMSTEC operates PARC in cooperation with IPRC and CSIRO and has extended the responsible region into the whole Pacific including the Southern Ocean by request of AST-9 (Action item 9) since April 2008.

JAMSTEC is providing the float monitoring information in the Pacific region (e.g., float activity watch, QC status, anomaly from objective analysis, diagnosis plot for sensor correction, etc.), reference data set for DMQC (SeHyD and IOHB), the link to the CTD data disclosure site of Japanese PIs, some documents, and some QC tools on the following web pages (<http://www.jamstec.go.jp/ARGORC/>). JAMSTEC had changed PARC web site system in association with the release of v3.1 netcdf files from GDAC. We will plan to upgrade the contents of PARC web site.

## Argo National Data Management Report 2014 – United Kingdom

### 1. Status

The UK Argo Data Centre, which is operated by BODC and funded by NERC, processes all of our float data. BODC also handles data from Irish, Mauritian and Portuguese floats, 182 active floats in total including various Apex, Navis and Provor float models. Data from all UK floats are received at BODC by automatic download from the CLS database every 12 hours and BODC endeavors to set up floats for distribution of data to the WMO GTS (Global Telecommunications System) and the Argo GDACS (Global Data Assembly Centres) within a week of notification of deployment.

During the year to date, the challenge has been to sustain the core Argo mission processing while setting up the data system to handle the newer bio-geochemical floats, where the setup of data distribution from the Navis and Provor bio-geochemical floats is ongoing and expected to be complete by end 2015/16 financial year. There has been a complete rewrite of the processing software in readiness to the transition to the new V3 Argo NetCDF (Network Common Data Form) file format, which in turn should resolve some issues with the WMO BUFR (Binary Universal Form for the Representation of [meteorological] data) formatted data exchanged on the GTS. The ADMT meeting in November 2015 was the target deadline for the completion of this work for core physics data with biogeochemical data to follow after the meeting. For core V3 files the core profile files are under testing. For meta files and tech files once the local vocabulary of technical and metafiles has been updated the latest version these will be ready.

- Staff changes

Charlotte Williams resigned in December 2014. This was a significant loss because a key task assigned to Charlotte was the on-going work to produce Argo V3 files.

Matt Donnelly replaced Charlotte on the Argo team. Matthew has a PhD physical oceanography (Southern Ocean).

This means the Argo team at BODC is composed of Justin Buck, Katie Gowers and Matt Donnelly. All of which work part time on Argo and are long standing staff at BODC. Building the team from multiple long standing members of BODC staff should reduce the likelihood of staff losses and give us some much needed stability for the foreseeable future.

The funding outlook means we will likely need a fourth member of the team and significant effort has gone into training and documentation this year to make the training of further members more efficient.

- Data acquired from floats

Data from all UK floats are received at BODC by automatic download from the CLS database every 12 hours. Table 1 summarises the deployments and data received according to float type. BODC endeavors to set up floats for distribution of data to GTS and GDACS within a week of deployment. BODC also handles data from Irish, Mauritian and Portuguese floats. There are currently 168 active floats being processed by BODC.

**Table 1:** A summary of setup of float data distribution data acquired from floats managed by BODC in the year preceding 2<sup>nd</sup> November 2015 according to float type and Country.

Float Type	Core	UK Bio-Argo
	Argo	
APEX core mission	15	
APEX ice detecting	28	
APEX APF9a – near surface temperature	108	
APEX APF9i	17	
NAVIS – core Argo configuration	9	
ARVOR	5	
APEX – BGC		4*
PROVOR II – biogeochemical E-AIMS configuration		7*
NAVIS BGCi – E-AIMS configuration		3*
Totals	182	14

\* The setup of distribution from NAVIS and PROVOR BGC floats is on-going and expected to be complete in late 2014.

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6385 profiles were processed in the last year with approximately 500 profiles unprocessed from PROVOR and NAVIS BGC floats. These will be caught up once Argo V3 B-file production is operational. The break down by float type is summarized in Table 2.

**Table 2:** A summary of setup of float data distribution data acquired from floats managed by BODC in the year preceding 6<sup>th</sup> November 2015 according to float type and Country.

Float type	Number of profiles
APEX APF8, Argos communications, core mission	381
APEX APF8, Argos communications, core mission with ice detection	136
APEX APF9, Argos communications,	75

core mission	
APEX APF9, Argos communications, core mission with near surface sampling	3524
APEX APF9, Argos communications, core mission with ice detection	823
APEX APF9, Iridium communications, core mission	585
APEX APF9, Iridium communications, biogeochemical sampling	289
NAVIS, Iridium communications, core mission	387
ARVOR, Argos communications, core mission	185

- Data issued to GTS

Data from all BODC hosted floats are sent to the GTS every 12 hours. Almost 100% of TESACs messages are available within 24 hours. Occasional disruptions occurred due to email server failures and server problems.

Delays in production and transmission of BUFR format messages identified by Anh Tran (ISDM) for floats with Iridium communications are under investigation with the UK Metoffice.

Two on-going activities will help resolve and improve the issuing of data to the GTS:

- The move to V3 format core Argo files, we will be implementing the new BUFR encoder produced by Japan and are very grateful for their efforts.
- NOC IT systems are under review with respect to developing a business continuity strategy to reduce the impact of issues.

- Data issued to GDACs after real-time QC

All BODC hosted data received at BODC are passed through the agreed real-time quality control tests within one hour of the data arriving at BODC. All data that have been processed at BODC are queued for transfer to both GDACs which occurs twice a day. Any file that fails to be transferred is queued for the next transfer attempt.

- Data issued for delayed QC

All delayed QC on BODC hosted floats is done within BODC. See section 2 for the current status.

- Delayed data sent to GDACs

All delayed QC on BODC hosted floats is done within BODC and forwarded to the GDACS the same day that delayed mode quality control is complete for a profile. See section 2 of this report for the current status of this activity.

- Web pages

The UK Argo web site address is <http://www.ukargo.net/> and a screen shot is shown in Figure 1, the material is an amalgamation of content from BODC, the National Oceanography Centre and the UK Met Office.

The associated facebook page is <https://www.facebook.com/UKArgofloats>, and a screenshot is shown in Figure 2.

The UK Argo twitter account is <https://twitter.com/ukargo>.



Figure 1: Screenshot of the new UK-Argo website



Figure 2: Screenshot of the UK-Argo Facebook page

- Statistics of Argo data usage ( operational models, scientific applications, number of National Pis... )

Highlights of operational Argo data usage by the UK Met Office include:

1. Argo data are assimilated into the operational FOAM system. This provides short-range ocean forecasts and coupled ocean-atmosphere forecasts, and products are available to operational and research users through Copernicus Marine Environment Monitoring Service (information available from [http://marine.copernicus.eu/web/69-interactive-catalogue.php?option=com\\_csw&view=details&product\\_id=GLOBAL\\_ANALYSIS\\_FORECAST\\_PHYS\\_001\\_015](http://marine.copernicus.eu/web/69-interactive-catalogue.php?option=com_csw&view=details&product_id=GLOBAL_ANALYSIS_FORECAST_PHYS_001_015)).
2. Forecasts are also provided to the Royal Navy and other customers. FOAM is also used to initialize the coupled seasonal forecasts.
3. The EN4 product has been released and is available from <http://www.metoffice.gov.uk/hadobs/en4/>, Good et al. (2013) describes the production of the EN4 dataset. EN4 contains a quality controlled set of profile temperature and salinity data (from Argo and many other sources), as well as an

objective analysis with uncertainty estimates at 1 degree, monthly resolution, from 1900 to present.

4. Argo data from the EN4 dataset are used to validate high resolution SST analyses on a regular monthly basis. Analyses include the Met Office product OSTIA, and those available through the GHRSST Multi-Product Ensemble (GMPE). These statistics are made publicly available.
5. On-going work at the UK Met Office is an assessment of the impact of Argo data within a coupled data assimilation system to investigate whether Argo data has an impact on weather phenomena prediction.
6. The Argo near-surface temperature data with high vertical resolution are used to validate the warm layer SST in the new OSTIA diurnal analysis.

- Products generated from Argo data ...

The National Oceanography Centre have generated a 4D optimal interpolation product of Argo data for the N Atlantic, 0 to 50 degrees N, 2.5 degree x 20 dbar x 10 day resolution, for the years 2000 to 2013. There is also a special run along the RAPID line at 26N in the Atlantic. These have been made openly available by anonymous FTP, contact Brian King for details.

- Argo DOIs

Ifremer mint a new DOI for each monthly snapshot of data making the data citable at a monthly granularity.

The goal this year was to move to a single DOI at Ifremer, after discussions at the Research Data Alliance (Research Data Alliance) and the Ocean Data Interoperability Platform (ODIP) meetings in September it became clear that although the proposed Argo for the single DOI was agreeable work with the French DOI minting authority it had not been ratified at the DataCite and CrossRef level.

A joint small grant proposal between BODC and Ifremer for RDA working group activity support was submitted to the RDA on 30<sup>th</sup> October 2015 to get the syntax ratified and to implement the result of these discussions. If successful work will start in March 2015 with a duration of 6 months.

- Funding outlook

The funding outlook for Argo data management in the UK is as always tight but it is progressively growing. NERC/NOC continued their highly valued, long standing, and essential funding of one staff member of resource within BODC.

The on-going SenseOCEAN project, although not strictly Argo, will help reduce the demands on data systems by introducing metadata at the sensor level and beginning to define standards for data from a new generation of oceanic carbon and bio-optical sensors.

As part of the Euro-Argo research infrastructure the European Directorate-General for Maritime Affairs and Fisheries (DG MARE) will be funding operational Argo deployments and BODC will be one of the European DACs and delayed mode institutes to receive data management support to host float processing.

The EU Horizons 2020 AtlantOS project was successful and it will contribute 55kEuro for the quality control of Bio-Argo data spread over the next couple of years.

The ENVR<sub>PLUS</sub> project proposal was successful. BODC are on a work packages for oceanic carbon (the project is led by s led by the Integrated Carbon Observation System (ICOS) research infrastructure) and the data used for satellite calibration/validation. The final usage and allocations for the resource this project provides will be decided in November 2015.

## 2. Delayed Mode QC

The OW software is being used at BODC with latest reference data available from Coriolis (CTD climatology and Argo profile climatology for guidance). 65.7% of BODC hosted floats profiles eligible for delayed mode QC have been processed ad submitted to the GDACs in D-mode.

Staff changes and the extra workload required for the transition to Argo V3 formats and setting up of data processing for Bio-Argo floats mean that delayed mode quality control has not been run yet this year. This essential and high priority activity will need to resume before the next financial year.

- Feedback on delayed mode QC reference data  
No feeback this year as DMQC stalled.
- Number and location of CTD data uploaded by Pis to BODC  
In 2015 working directly with NCEI (Tim Boyer) to share new data at BODC.

## 3. GDAC Functions

Section not applicable to the UK.

#### 4. Regional Centre Functions

The recent work of the Southern Ocean Argo Regional Centre has focused on assessing the most beneficial ways to develop the activities of SOARC. This has resulted in four strands of development being identified which can be supported with low-levels of resource.

Firstly there is a need to improve the discoverability of existing resources which are of use to quality control operators and researchers to assist in placing Southern Ocean Argo data into context. This can be achieved by enhancing: access to data discover tools, links to other elements of the ocean observing system, links to plotted hydrographic observations and access to model output (e.g. UK Met Office FOAM model). Matt Donnelly (BODC, UK) is now compiling a list of resources and seeking to arrange mutual links with relevant projects. Recent discussions have identified that whilst ice avoidance software has increased the survivability of floats, there is a need to develop the management of Argo under ice positioning. SOARC has begun investigating the potential for improving near-real time estimates of under ice positions through two potential techniques: Birgit Klein (BSH, Germany) is investigating the use of an *f/H* contour method for use in the open ocean, whilst exploration of a method for use on the Antarctic continental shelf is being led by Esmee van Wijk (CSIRO, Australia). SOARC has also begun to investigate the integration of improved positions into the delayed-mode workflow for the Weddell Sea enabled by the RAFOS array maintained by AWI (Germany). This activity is in support of the SOOS under ice strategy and underpins any future extensions to under ice RAFOS positioning.

The existing SOARC web presence on the UK Argo website only identifies UK and Australian contributions to the Southern Ocean, when there are other Argo contributors with interests, capabilities and activities in the Southern Ocean. SOARC is therefore welcoming expressions of interest from other potential collaborators in Argo Southern Ocean activities.

The previous three strands will be assisted by the planned creation of a new SOARC website by BODC (UK), which will make use of existing content of the UK Argo website but establish a distinct SOARC identity. This will provide the portal for Southern Ocean float discovery, access to resources relevant to the community and help support improved collaboration in the Southern Ocean, including Argo under ice.

## 5. References

'Good, S. A., M. J. Martin and N. A. Rayner, 2013. EN4: quality controlled ocean temperature and salinity profiles and monthly objective analyses with uncertainty estimates, Journal of Geophysical Research: Oceans, 118, 6704-6716, [doi:10.1002/2013JC009067](https://doi.org/10.1002/2013JC009067)'

# US NATIONAL DATA MANAGEMENT REPORT

## 16th ADMT MEETING, October 2014-October 2015, BERMUDA

### 1. STATUS

#### US Argo Data Assembly Center at AOML

The US Argo Data Assembly Center (DAC) at AOML is responsible for the processing of Argo data obtained from all floats deployed by US institutions. As of Oct 10 2015, the US Argo DAC processed over 91,500 profiles from 2443 floats that transmitted at least one profile during the reporting period.

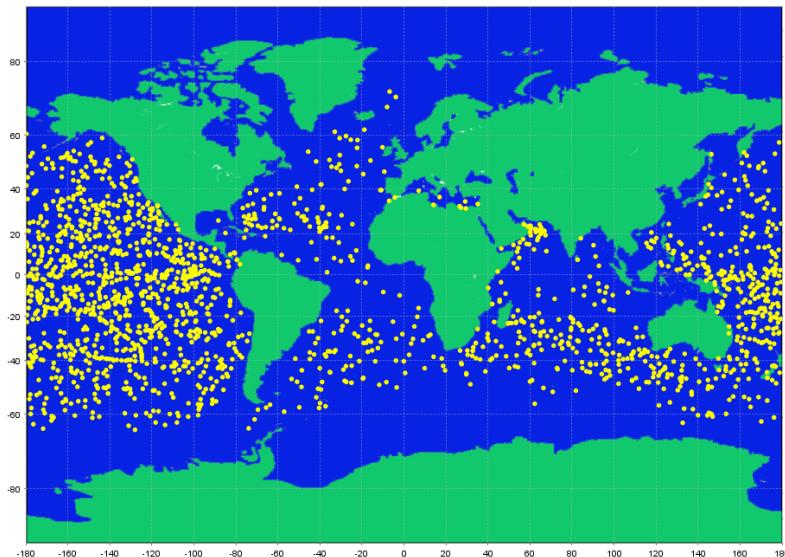
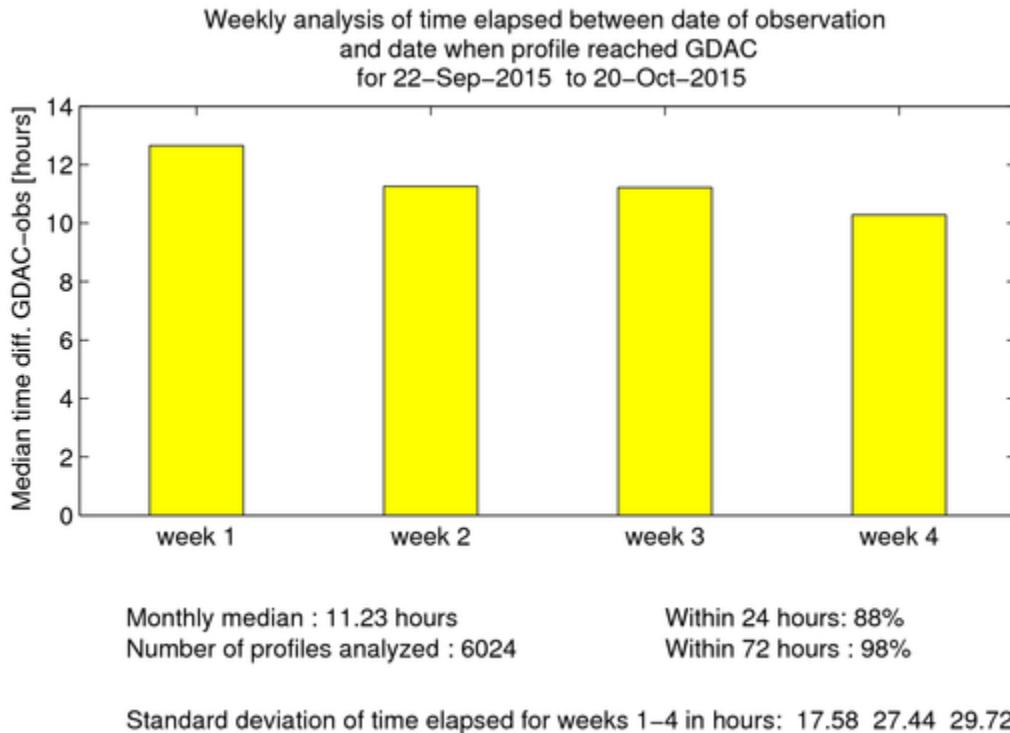


Fig. 1: Real-time profiles processed by the DAC in the period Oct 19-21, 2015. Hot spots link to data plots.

Profiles are distributed via GTS as TESAC and BUFR and via the GDACs. During the reporting period, on average, 94 % of the profiles reached the GTS in the TESAC format in 24 hours, 91% were available at the GDACs in NetCDF format in 24 hours, and 95% reached the GTS in the BUFR format in 24 hours. Weekly updates on performance statistics as well as data plots are available online at:  
<http://www.aoml.noaa.gov/phod/argo opr/>.



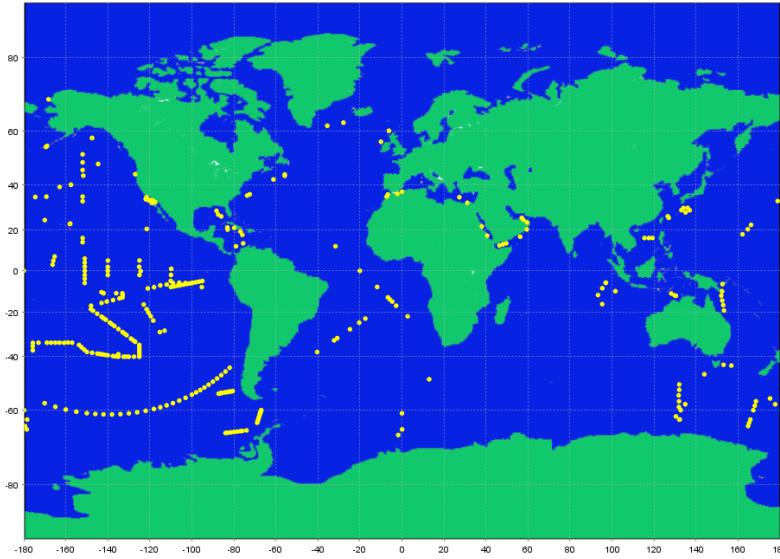
*Fig 2: performance statistics; example: monitoring of profile distribution to GDACs.*

Over 183,000 NetCDF trajectory and technical files, were transmitted to GDACs, together with the corresponding real-time profile files.

The US DAC maintains an ftp server for file exchanges between the DAC and DM operators (both for providing reprocessed R-mode files and for receiving D-mode files) as well as for real-time submission of data from Iridium floats and the submission of deployment information.

US institutions deployed 462 floats, 340 of them were part of the core Argo Project and 122 deployments were funded by other programs like US Navy and SOCCOM Project. Up to date maps with the deployment positions can be found online at: [www.aoml.noaa.gov/phod/argo/opr/php\\_forms/deployment\\_maps.php](http://www.aoml.noaa.gov/phod/argo/opr/php_forms/deployment_maps.php). These maps link to data collected by the floats.

The US Argo DAC continued its involvement in deployment planning, finding ships of opportunity and providing ship riders for selected cruises.



*Fig. 3: US deployments in 2015 (including Argo equivalent floats). Hot spots link to data plots.*

AOML also continued its involvement in activities related to Data Management, including discussion of NetCDF formats, necessary meta data, quality control procedures, bio-Argo related developments, as well as its involvement in the Argo Science Team.

### **Software Development at the US Argo DAC**

AOML is distributing Real time NetCDF profiles in format version 3.0 and continues improving this software, partly in adaptation to new content in profile files from certain float types (e.g.: Measurement Codes). The transition required adding meta data to our processing system (for example vertical sampling scheme information) and reprocessing of profiles impacted by such changes. Transition to format 3.1 for meta, technical and trajectory files is under development. This will be followed by an upgrade to NetCDF format version 3.1 for profiles.

Software was adapted to decode five new Iridium formats. Existing software that checks and processes incoming profile files for certain Iridium float types was updated to handle the deep SOLO floats.

Updates to quality control: The mixed air and water test for near-surface profiles was implemented and is applied as needed. In addition, the deepest pressure test

was improved with respect to handling time-variant nominal profile pressures. Additional updates to the quality controls were done to accommodate deep Argo floats.

The BUFR encoder software from MEDS was implemented for format version 3.0 profile files after adaptations for multi-profile NetCDF files, including those containing oxygen (changes were done in close collaboration with MEDS).

Improvement to the existing program that determines the salinity correction derived in the DM quality control (QC) and apply it to already existing profiles that are younger than the most recent D-file were also implemented to increase its efficiency.

The US Argo DAC is maintaining a website that provides documentation and information about the operations:

<http://www.aoml.noaa.gov/phod/argo/index.php>

## **2. DELAYED MODE QC:**

AOML receives the Argo Delay mode profiles from US delayed-mode operators and verifies their contents to ensure soundness of the files. This verification process was adapted to the new 3.0 and 3.1 formats. In addition, a pathway to skip the verification was implemented to increase flexibility for the DM operators (there is no need to re-run the verification for D-mode profiles just because the format was changed from 2.2 to 3.1). AOML also has the ability to process/pass on trajectory, technical, meta and BR files generated by DM operators.

Each US Argo institution provided information on their delayed-mode processing which was added to this report.

### **University of Washington**

As of October 2015, University of Washington had submitted over 181,000 delayed-mode files (D-files) to the Argo GDACs via AOML. Delayed-mode evaluation of conductivity sensor drift was done by using the statistical comparison method of OW (2009), in conjunction with the CTD reference

database compiled by Coriolis. Visual comparison with nearby good Argo data was used to complement the statistical method of OW. Results from Stephanie Guinehut's altimetry test were also taken into account.

This year a lot of time was spent in converting UW D-files to the V3.1 format. As of date of writing, all UW D-files from Argos floats, including Argos floats that measured near-surface unpumped temperature and Argos floats with dissolved oxygen sensors, had been upgraded to V3.1 D-files (and V3.1 BR-files if DOXY was present). The 11,864 Argos D-files belonging to the KESS project from University of Hawaii (UH) had also been upgraded to V3.1 D-files.

Conversion of UW Iridium D-files to V3.1 will continue into 2016.

### **Wood Hole Oceanographic Institute**

In the period October 1, 2012 to September 30th 2012, 108 WHOI Argo floats were deployed from 10 separate vessels including the R/V Ronald Brown, R/V Endeavor, R/V Pelican, S.A. Agulhas II, F.R.S Algoa, M/Y Alucia, M/V Explorer, M/V Maersk Visb, JPO Pisces and Lady Amber.

During this period, 380 unique WHOI floats reported a total of 10152 profiles of temperature and salinity.

As of October 4, 2013, Woods Hole has submitted 89,901 delayed-mode profiles. Of the target group of profiles older than 12 months, approximately 16,000 profiles still require DMQC attention.

### **Scripps Institution of Oceanography**

Scripps Institution of Oceanography (SIO) has evaluated, as part of delayed-mode quality control (DMQC), a total of 166,085 Argo stations (profiles). This is an increase of 21,069 stations (577 nominal float years) since the previous United States Argo National Data Management Report (October, 2014). At present, 99.5% of the DMQC eligible, SIO stations have been completed. Here we define a

station as being DMQC eligible if it was sampled more than 12 months ago . The above numbers include all SIO performed delayed-mode stations, including SIO Argo floats, all Argo New Zealand floats, 30 Argo-Equivalent floats provided to Argo by Dan Rudnick as part of the 'Origins of the Kuroshio and Mindanao Current' and 'ASIRI' projects, and 3 floats donated to Argo Mexico.

SIO expects to be able to continue to maintain a high DMQC completion percentage during the coming year and will continue to revisit the profile data of floats every 7-9 months. The standard consensus DMQC procedures for SOLO/SOLOII profile data were continued in 2015.

The Argo Program is in the process of converting between the V2.2 NetCDF format and the V3.1 NetCDF format, comprising modifications to the profile, trajectory and meta files. Over the last year, SIO has finalized the independent creation of all Argo Program V3.1 NetCDF file types. This has allowed SIO to move forward on this NetCDF format transition.

Profile V3.1 NetCDF: To date 83.1% of SIO DMQC profile files have been formatted to V3.1 NetCDF (100% of Iridium data, 80.1% of Argos data). The remaining backlog, older Argos floats which are still operational, will be converted to V3.1 as they receive their final DMQC.

Trajectory V3.1 NetCDF: To date 87.3% of SIO DMQC trajectory files have been formatted to V3.1 NetCDF (100% of Iridium data, 81.5% of Argos data). During the year 85 inactive SIO Argos SOLO floats underwent trajectory DMQC. This most notably includes the estimation of float cycle timing, including float arrival and departure from the surface, and the full quality control of all Argos position data. This brings the total number of V3.1 DMQC trajectory NetCDF data available from SIO Argos floats to 812. DMQC on additional Argos SOLO trajectory data will be ongoing as the floats cease transmitting data. The DMQC of trajectory files from SOLOII/S2A Iridium floats is completed as part of the standard 7-9 month revisit cycle. There is a match between profile/trajectory data which has passed SIO DMQC. The 'Dtraj' data files from SIO Iridium floats delivered to the GDAC include DMQC data as well as all subsequently transmitted cycles data, resulting in the need for only a single trajectory NetCDF at the GDAC.

Meta V3.1 NetCDF: Although not often considered a DM file, the V3.1 meta file contains cross information with both the profile and trajectory NetCDF, thus consistency across all three are required. Because of this fact, SIO has transmitted DMQC meta files to the GDAC at the same rate as the trajectory files (87.3% total, 100% Iridium, 81.5% Argos).

Scripps has actively participated in forwarding Argo Program priorities during the year. Most notably by Megan Scanderbeg in co-developing and documenting the Version 3.1 trajectory file. SIO continues to update semi-annually the Argo Climatological Dataset for OW salinity calibration and annually a census of format errors identified in delayed-mode NetCDF profile files.

Scripps continues to work with float developers (IDG<sup>1</sup>, MRV) to add capabilities to the SOLOII/S2A float type. The addition last year of the 2-way command 'echo', whereby the float returns the shore command with an indication of acceptance or rejection, has allowed for the development of an automated data processing system of the float mission configuration that is necessary for the meta and trajectory V3.1 NetCDF. SIO continues to retain data decoding control for all SIO Iridium float data in order to simplify DMQC processing.

Finally, SIO Argo and Instrument Development Group (IDG) recovered the two V0.3 prototype Deep SOLO floats deployed during 2014. Both returned over 100 profiles down to the ocean floor. The Deep SOLO float data from these two floats has been uploaded to the GDAC (profile and tech files created by AOML, trajectory and meta files created by SIO). The capability has been developed for the data from the Deep SOLO floats, which will be part of the pilot array off NE New Zealand (early 2016), to be promptly provided to the GDAC and pass through DMQC at standard intervals.

## Pacific Marine Environmental Laboratory

As of 13 October 2015, PMEL had 73,666 D-files at the GDAC that were more than one year old, comprising 63% of the total of 117,332 PMEL profiles that were older than one year at that time. Last year, on 23 October 2014, PMEL had 71,139 D-files at the GDAC that were more than one year old, comprising 71% of the total

of 100,305 PMEL profiles that were older than one year at that time. So, our DMQC backlog has grown.

This increased DMQC backlog has arisen mostly from delays owing to difficulties encountered during major maintenance and upgrading efforts on PMEL DMQC software. A government mandated upgrade to our data processing computer, along with a MATLAB upgrade to a version with the native NetCDF interface required major changes to the SIO GUI that we use for flagging, as well as minor changes to the OW code. While we were making those changes, we also changed our directory structure to allow for faster processing. Following that, we had to implement to conversion of format from 2.2 to 3.0 and then to 3.1, which required more modifications to the SIO GUI and OW code. We also wrote new code for DMQC of 2-dbar profiles from our growing array of Iridium floats. It has taken considerable time and effort to make these changes, and debug them. We are nearly complete, but are still finalizing debugging of the format changes, which is holding up submission of about 10,000 recently completed D-files.

Recently asking John Lyman to work with Kristene McTaggart with DMQC efforts has resulted in considerable progress with the software upgrades and the DMQC backlog. They are working on clearing the DMQC backlog in the following general order: 1. All floats with profiles identified as problematic by altimetry QC. 2. All floats with profiles flagged as problematic by objective analysis. 3. All floats with profiles flagged as problematic by the Gilson format check. 4. Inactive Iridium floats with profiles that have yet not undergone DMQC. 5. Inactive Argos floats with profiles that have not yet undergone DMQC. 6. Remaining active Iridium floats. 7. Remaining active Argos floats.

The PMEL float DMQC procedure currently consists of the following steps: We perform an automated correction, with visual check, of reported pressure drifts and correction for the effect of these pressure drifts on salinity, as well as an automated correction of conductivity cell thermal lag errors following Johnson et al. (2007). We do visual inspection and modification of quality control flags for adjusted pressure, temperature, and salinity using the SIO GUI. We overwrite the raw Param\_QC flags during this step as required. We use OW Version1.1, currently

with CTD (2014V01) and Argo (2014V04) reference databases, and adjust run parameters to get appropriate recommended salinity adjustments. We accept or reject the OW recommendations on the basis of comparison with nearly historical profiles using the SIO GUI.

### **3. South Atlantic Argo Regional Center at AOML**

Currently no funding is available for the final stage of the delayed-mode quality control. Activities related to float deployments are continued in close collaboration with WHOI.

Argo Data Management report 2015  
US GDAC (Global Data Assembly Center)  
October 22<sup>nd</sup>, 2015

**GODAE Global Ocean Data Assimilation Experiment**

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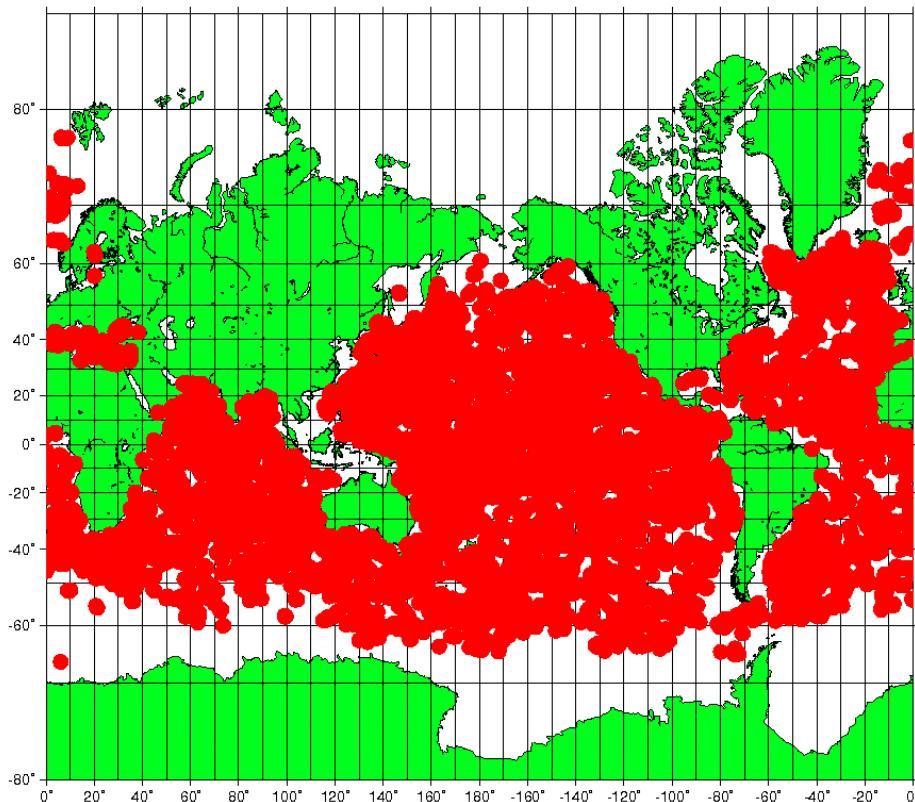
  




North  
Year   Month   Day   North  
START: 2015 ▾ 09 ▾ 22 ▾ 90  
END: 2015 ▾ 10 ▾ 22 ▾ 180   West 180   East 180  
South  
DAC   FloatID   Output Type:  
ALL   ALL    Text List Only  
aoml    Text List and Location Plot  
bodc    Text/Loc Plot with ProfileIDs  
csiro  
gts  
 Return Delayed Mode Profiles Only  
Go   Reset

**USGODAE Argo GDAC Data Browser**

Select the DAC, dates,  
coordinate box,  
output preference and  
press Go to generate



## GDAC Functions

(If your centre operates a GDAC, report the progress made on the following tasks and if not yet complete, estimate when you expect them to be complete)

- National centres reporting to you
- Operations of the ftp server
- Operations of the www server
- Data synchronization
- Statistics of Argo data usage : Ftp and WWW access, characterization of users (countries, field of interest : operational models, scientific applications) ...

### National centres reporting to you

Currently, 9 of the National DACs submit regularly to the US GDAC. The other DACs use the Coriolis as a proxy, and the US GDAC downloads the data from this proxy.

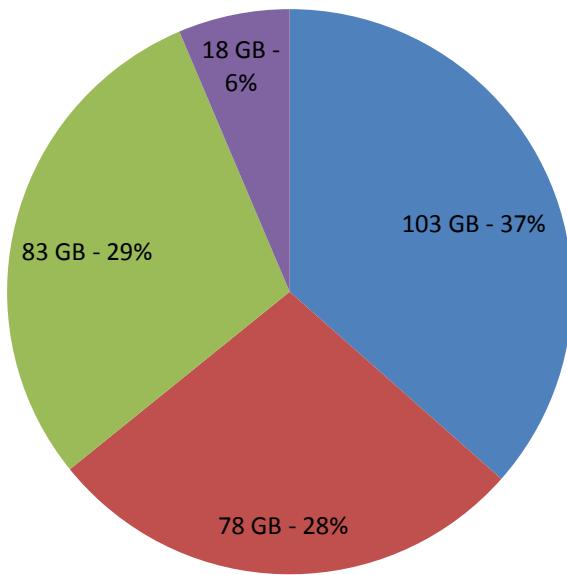
As of October 22<sup>nd</sup>, 2015, the following shows the Argo footprint on the US GDAC.

DAC	MetaData	Technical	Trajectory	Trajectory D-Mode	Trajectory Bio
AOML	5,692	5,492	6,765	1,274	0
BODC	505	488	420	0	0
Coriolis	2,165	2,161	2,234	1	0
CSIO	326	323	323	0	0
CSIRO	684	668	569	0	0
INCOIS	368	358	371	0	0
JMA	1,407	1,382	1,373	0	0
KMA	201	192	193	0	0
KORDI	119	115	119	0	0
MEDS	402	393	399	0	0
NMDIS	19	19	19	0	0
Totals	11,888	11,591	12,785	1,274	0

DAC	Profiles	Profiles D-Mode	Profiles Bio
AOML	791,909	533,876	10498
BODC	52,792	31,221	0
Coriolis	197,627	120,786	20915
CSIO	33,417	10,141	0
CSIRO	110,229	64,955	16632
INCOIS	46,661	27,093	1842
JMA	161,239	95,460	3337
KMA	23,802	18,262	0
KORDI	15,944	0	0
MEDS	42,332	23,486	96
NMDIS	2,253	0	0
Totals	1,478,205	925,280	53,320

### US GDAC Argo Footprint (282 GB)

■ dac ■ geo ■ latest\_data ■ etc



## **Operations of the ftp server**

The US GDAC hosts an anonymous FTP server that allows download to all available Argo data that it currently has. This includes the Argo aggregate files, as well as, the raw NetCDF files that are received by the DACs. Additionally, the Argo index files are available for download as well. These index files are updated on the US GDAC approximately twice per hour.

US GDAC FTP server: <ftp://usgoda.org/pub/outgoing/argo>

## **Operations of the www server**

The US GDAC hosts an apache webserver that allows the users to download Argo data via standard tools such as wget. Similar to the FTP server, all Argo data is available for download.

In addition the US GDAC hosts the ‘USGODAE Argo GDAC data browser’ that allows for limited querying capabilities (time, area, dac, etc).

US GDAC HTTP server: <http://usgoda.org/pub/outgoing/argo>

Argo Data Browser: [http://usgoda.org/cgi-bin/argo\\_select.pl](http://usgoda.org/cgi-bin/argo_select.pl)

## **Data synchronization**

The US GDAC synchronizes with the French GDAC once per day at 1015 UTC. The process involves downloading all of the index files from the French GDAC and comparing them to the local US GDAC. After comparison, all necessary files are then downloaded and submitted normally into the US GDAC.

The typical synchronization takes approximately 15 minutes to complete each day. However, there are times when it takes much longer and we need to investigate.

## **Statistics of Argo data usage**

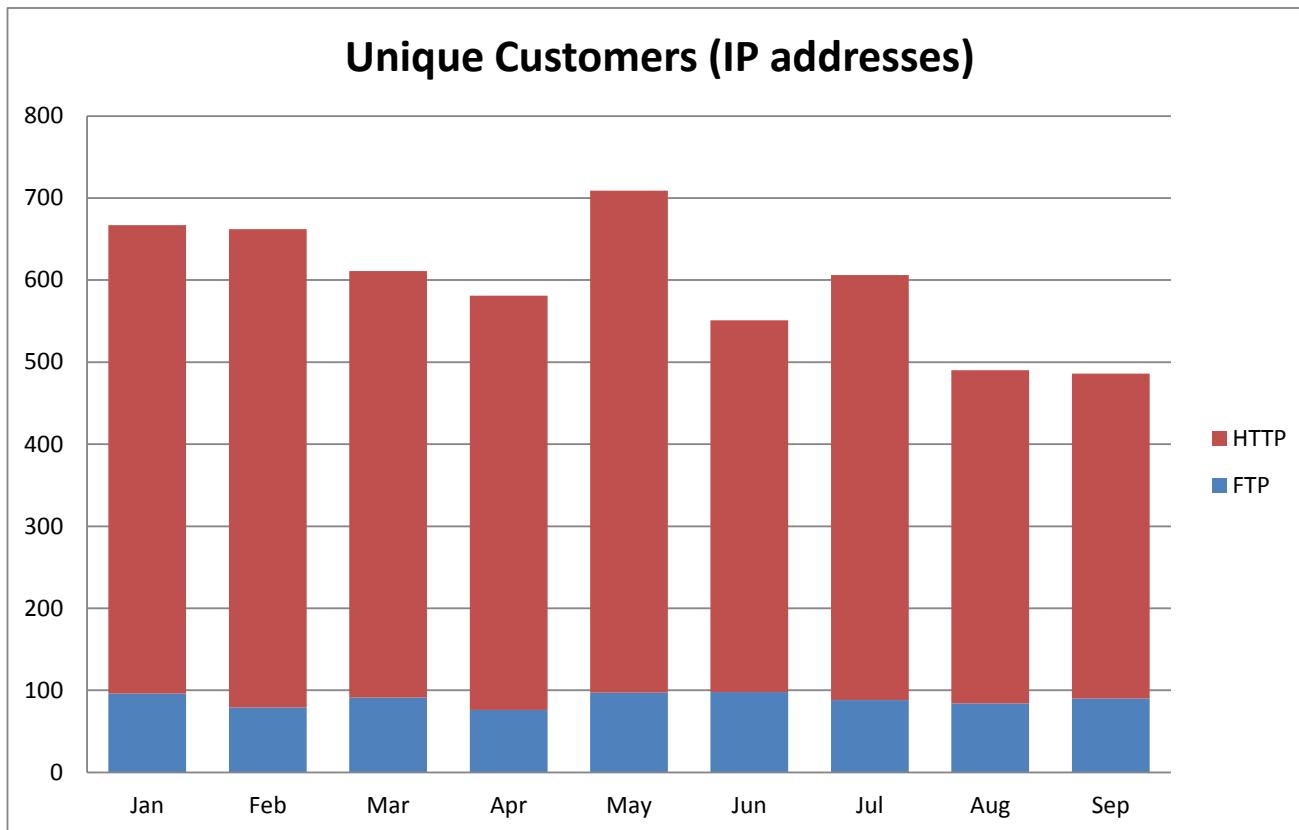
FTP Statistics

Date	Unique IPs	Hits (1000s')	Gigabytes
Jan 2015	96	1,547	1,848
Feb 2015	79	2,015	1,841
Mar 2015	91	1,891	2,431
Apr 2015	76	2,393	2,197
May 2015	97	2,035	2,857
Jun 2015	98	3,611	2,712
Jul 2015	88	1,449	1,949
Aug 2015	84	1,365	1,928
Sep 2015	90	1,412	2,385

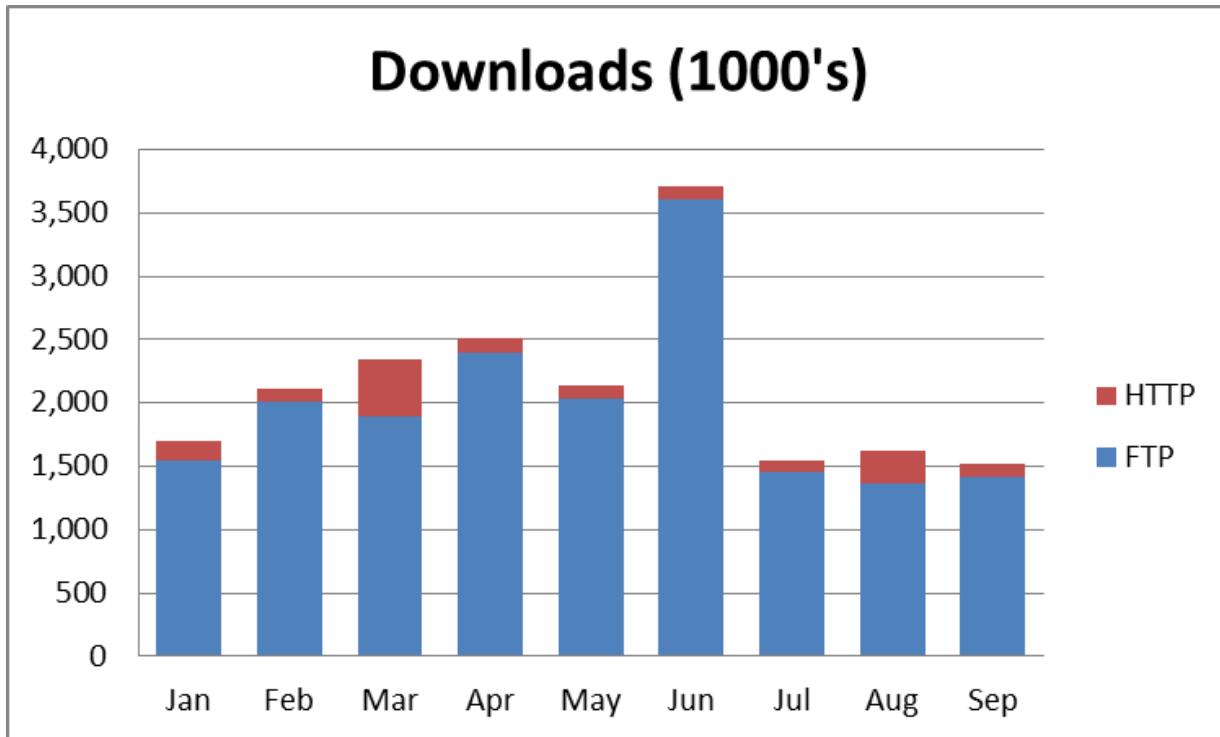
## HTTP Statistics

Date	Unique IPs	Hits (1000's)	Gigabytes
Jan 2015	571	148	2,192
Feb 2015	583	93	1,410
Mar 2015	520	448	1,902
Apr 2015	505	115	2,725
May 2015	612	104	2,681
Jun 2015	453	103	2,902
Jul 2015	518	97	2,090
Aug 2015	406	262	2,043
Sep 2015	396	113	3,324

The following chart shows the unique customers downloading Argo data per month.

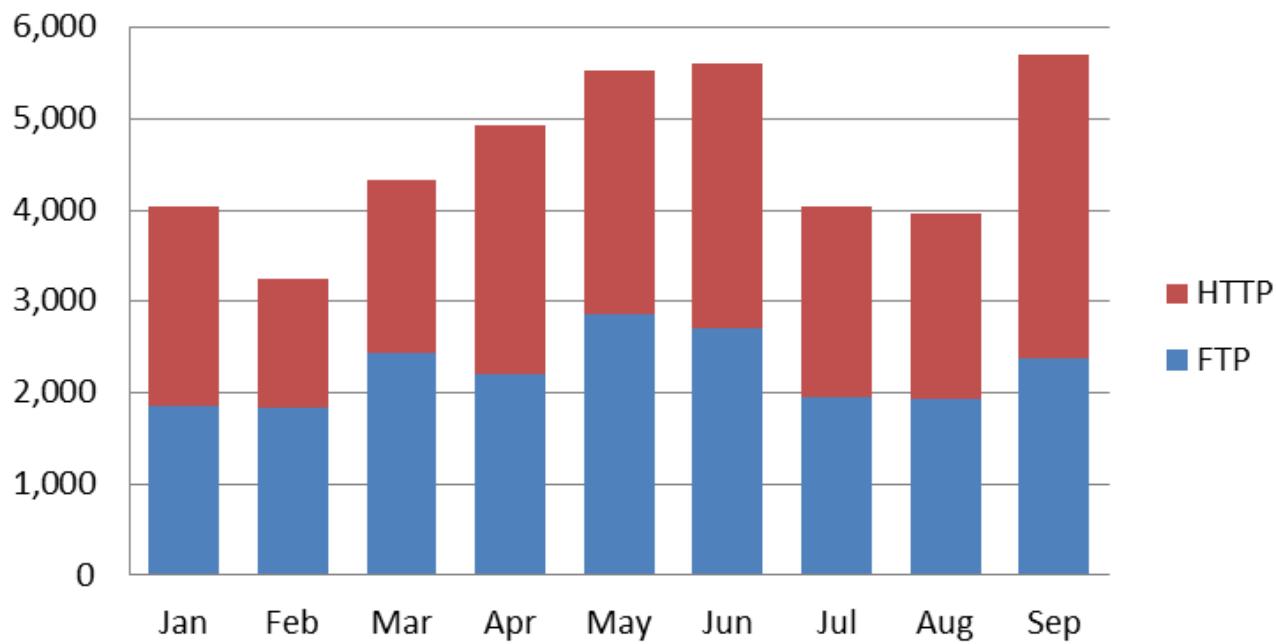


The following chart shows individual successful downloads in 1000's. One successful download would equate to one Argo file being downloaded, regardless of size.



The following charts shows how many terabytes worth of Argo has been downloaded per month.

## Gigabytes downloaded



## Visitors

The following list shows the countries that have downloaded Argo data from the US GDAC.

Australia (AUS)  
Belgium (BEL)  
Brazil (BRA)  
Canada (CAN)  
Chile (CHL)  
China (CHN)  
Denmark (DNK)  
Fiji (FJI)  
France (FRA)  
Germany (DEU)  
Hong Kong (HKG)  
India (IND)  
Indonesia (IDN)  
Italy (ITA)  
Japan (JPN)  
Korea Republic of (KOR)  
Macau (MAC)  
Malaysia (MYS)  
Mexico (MEX)  
Netherlands (NLD)  
New Zealand (NZL)  
Norway (NOR)

Poland (POL)

Puerto Rico (PRI)

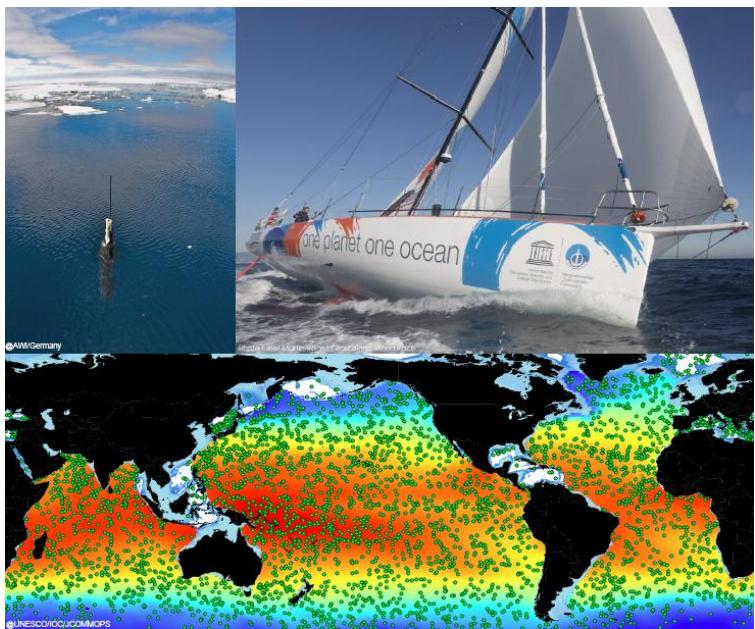
Samoa (WSM)  
South Africa (ZAF)  
Spain (ESP)  
Switzerland (CHE)  
Taiwan; Republic of China (ROC) (TWN)  
United Kingdom (GBR)  
United States (USA)

### **Issue(s)**

On October 18<sup>th</sup>, 2015 the US GDAC was powered off for close to 8 hours. This was due to a major power outage on the Monterey peninsula.

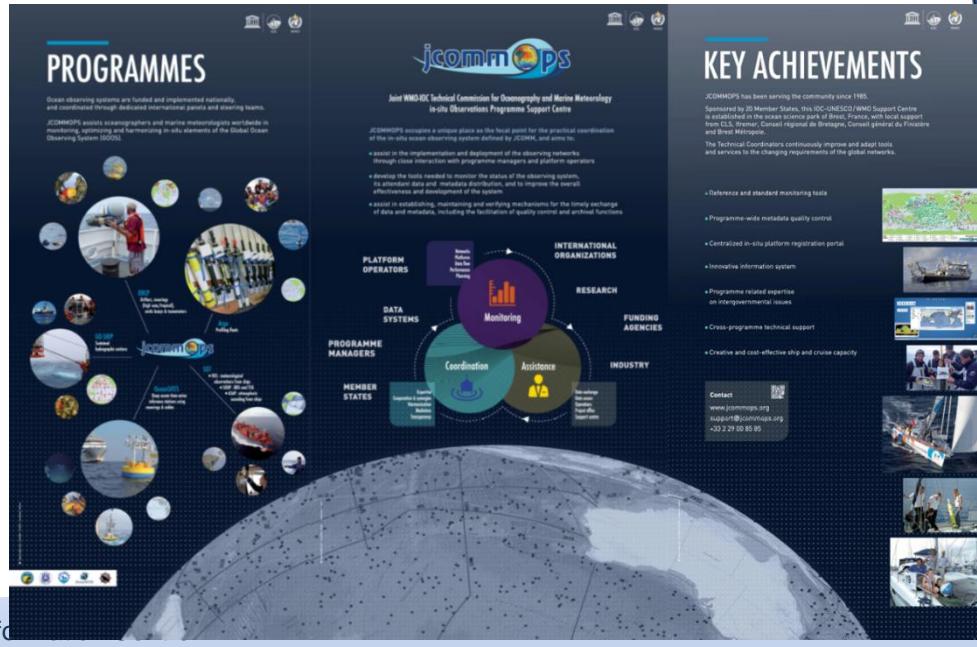
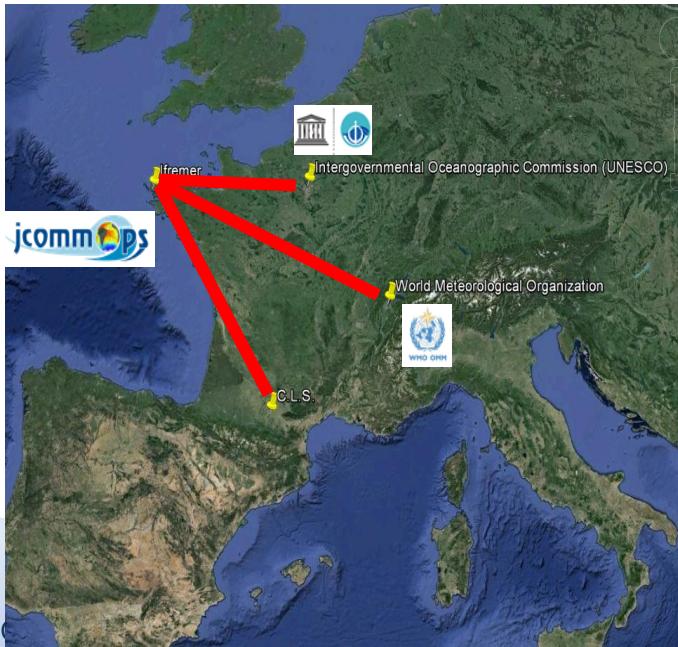
# Argo Status

## *Argo TC, M. Belbeoch*



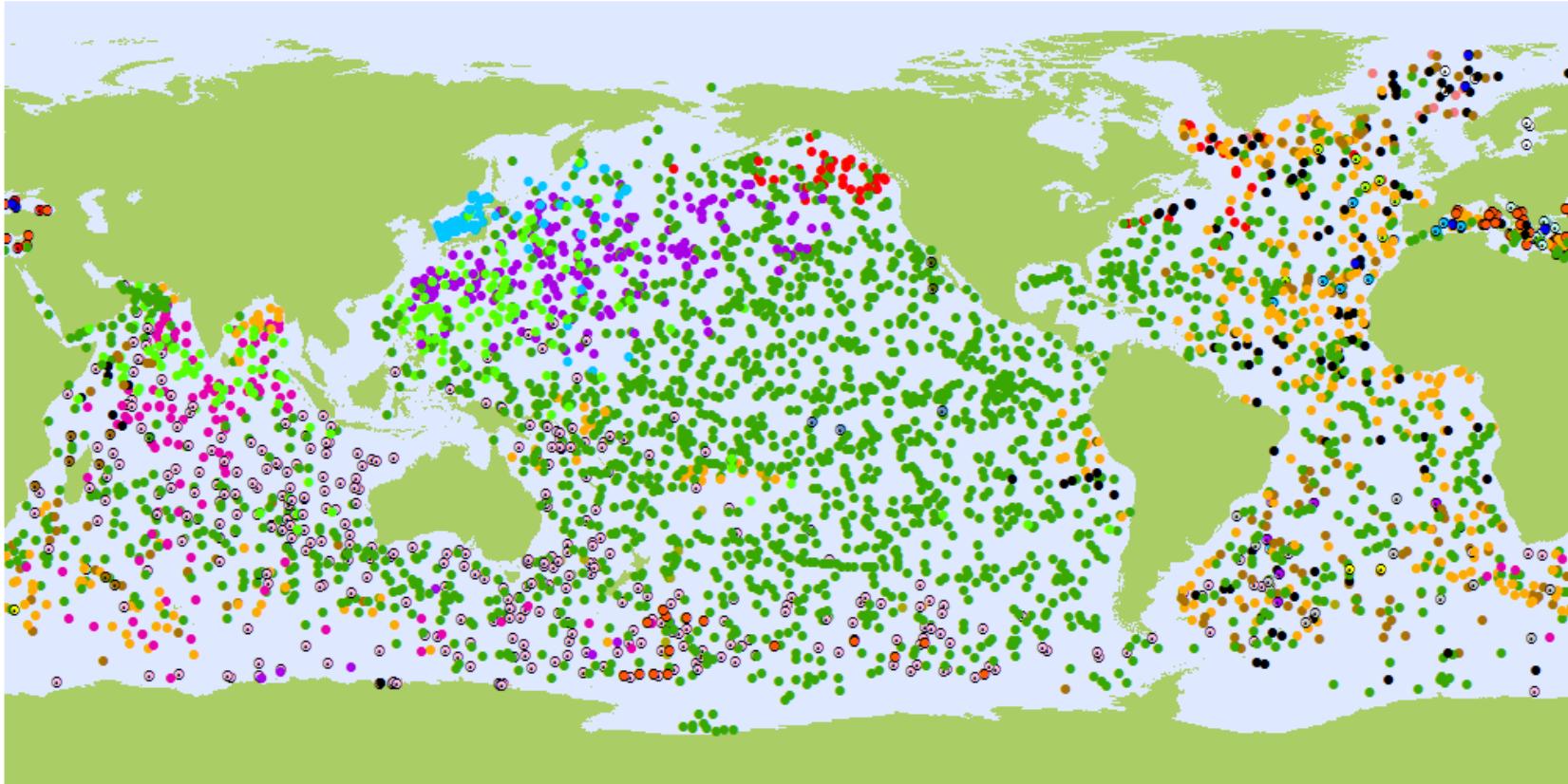
# What is JCOMMOPS ?

- IOC/WMO coordination, monitoring and support centre for the sustained elements of the GOOS (Argo, DBCP, OceanSITES, SOT, GOSHIP, GLOSS)
- 6 staff
- Information System
- ~800k\$/y budget
- Supported by Ifremer&CLS, 20 Member States, France/Brittany, EU



# Member States

28 Countries operate floats, and Argo is reaching new record with 3918 active floats.



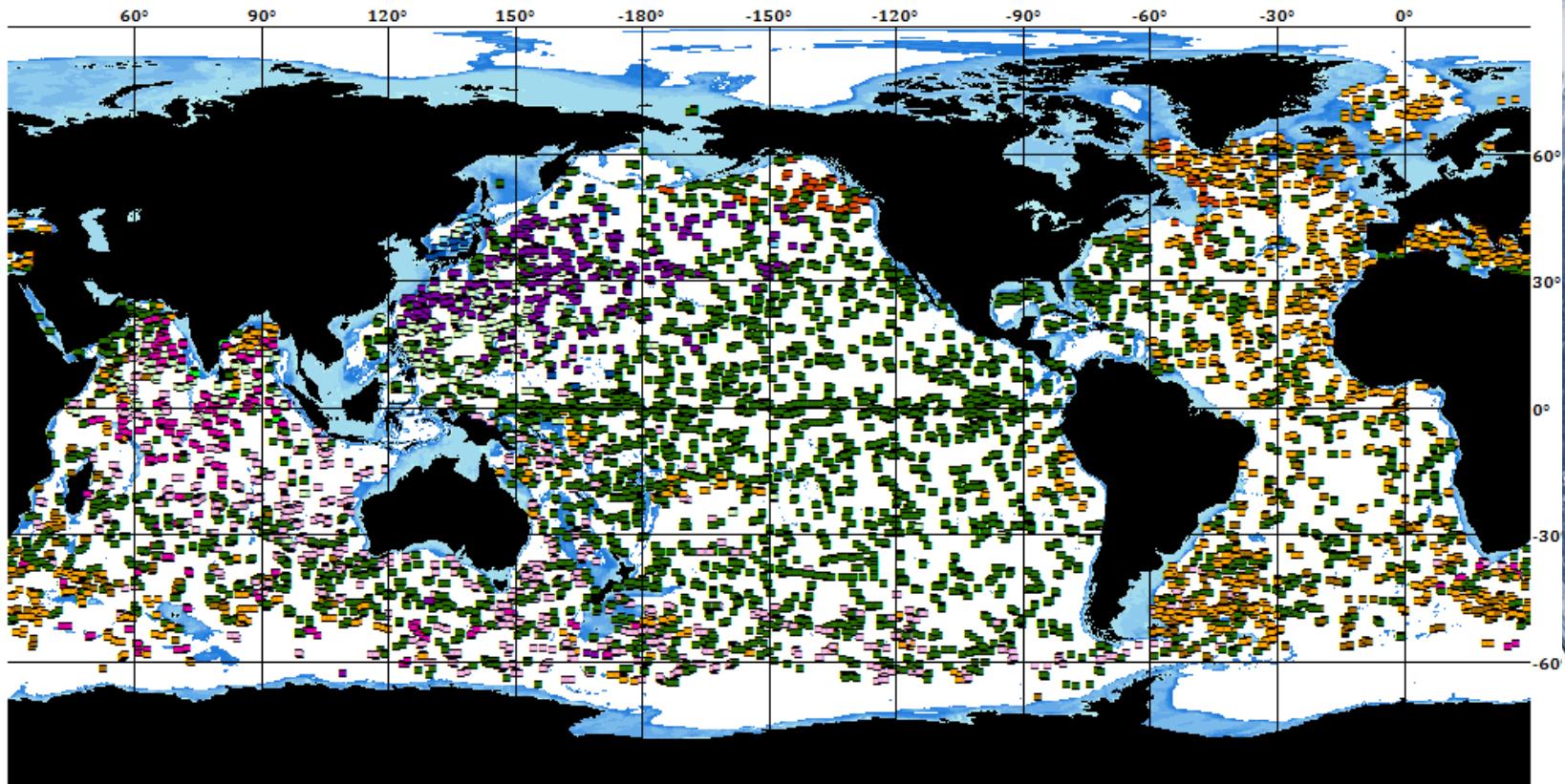
**3918  
Floats**

ARGENTINA(3) CANADA(57)  
AUSTRALIA(246) CHINA(183)  
BRAZIL(7) ECUADOR(3)  
BULGARIA(1) EUROPEAN UNION(7)  
FINLAND(6) FRANCE(356)  
GABON(0) GREECE(11)  
GERMANY(129) ITALY(47)  
ITALY(1) JAPAN(205)  
LEBANON(0) KENYA(1)  
LEBANON(0) LEBANON(0)  
LEBANON(0) MAURITIUS(7)  
LEBANON(0) MEXICO(2)  
LEBANON(0) NORWAY(9)  
LEBANON(0) SOUTH AFRICA(1)  
LEBANON(0) UNITED KINGDOM(151)  
LEBANON(0) SPAIN(12)  
LEBANON(0) UNITED STATES(2142)  
LEBANON(0) TURKEY(3)  
LEBANON(0) SRI LANKA(0)  
LEBANON(0) NETHERLANDS(13)

September 2015

jcommOPS

# Operational Status



3702 floats distributed data at GDACs

12850 Profiles

- NOAA/AOML (7 080)
- JMA (781)
- BODC (432)
- KORDI (38)
- CORIOLIS (2 205)
- SOA/SIO-2 (550)
- ISDM (168)
- NMDIS (15)
- CSIRO (1 083)
- INCOIS (475)
- KMA (43)

September 2015

# 4000 or 3700 ?

- ~4000 units currently operating
- 3700 reaching users as of Sept. 2015.
  - 80 iced over
  - 160 pending (data distribution or location)
  - 60 have locations but no profiles, or are beached, greylisted, etc.
- 3200 in the core array (i. e. NO OVERSAMPLING)
- Platform life cycle @jcommops:
  - Probable (will to deploy a float with approximate x.y.t)
  - Confirmed ( ship/cruise identified)
  - Registered (all metadata ready. formally notified)
  - Active (sending pulses within defined time window)
  - **Operational (delivering good data at gdacs)**
  - Inactive (no pulses)
  - Closed ( no chance to come back on line).

# Data Flow – PENDING: 147

UNITED STATES	94
GERMANY	13
UNITED KINGDOM	8
CHINA	6
FRANCE	5
AUSTRALIA	4
EUROPEAN UNION	4
CANADA	3
ITALY	3
INDIA	2
JAPAN	2
NEW ZELAND	2
BULGARIA	1

Argo WHOI	36
Argo PMEL	25
Argo SIO	22
Argo BSH	13
Argo UW	9
Argo UK Bio	8
Argo eq. CHINA	6
Argo AUSTRALIA	4
E-AIMS	4
Argo CANADA	3
Argo ITALY	3
Coriolis-OVIDE	3
Argo eq. NAVOCEANO	2
Argo INDIA	2
Argo NEW ZELAND	2
Coriolis-remOcean	2
Argo eq. OIST	1
Argo JAMSTEC	1
BulArgo	1

# Missing GDACs: 12

WMO	PROGRAM	TELECOM_ID	T_TYPE	MODEL	Age (days)	DAC	GTS
5903129	Argo BRAZIL Navy	137362	ARGOS	ARVOR		221	Coriolis
6902632	Argo BSH	151637	ARGOS	APEX		22	Coriolis
6902635	Argo BSH	151640	ARGOS	APEX		22	Coriolis
6902633	Argo BSH	151638	ARGOS	APEX		23	Coriolis
6901911	Argo BSH	143932	ARGOS	ARVOR		152	Coriolis
6902636	Argo BSH	151641	ARGOS	APEX		28	Coriolis
6902634	Argo BSH	151639	ARGOS	APEX		22	Coriolis
2901705	Argo NIMR/KMA	127464	ARGOS	APEX	791	NIMR/KMA	YES
2901744	Argo NIMR/KMA	145987	ARGOS	APEX	140	NIMR/KMA	
6901167	Argo UK	126877	ARGOS	APEX	441	BODC	
6901723	Coriolis-OVIDE	144166	ARGOS	ARVOR	39	Coriolis	
6901594	Coriolis-OVIDE	132027	ARGOS	PROVOR	119	Coriolis	

# MISSING JCOMMOPS

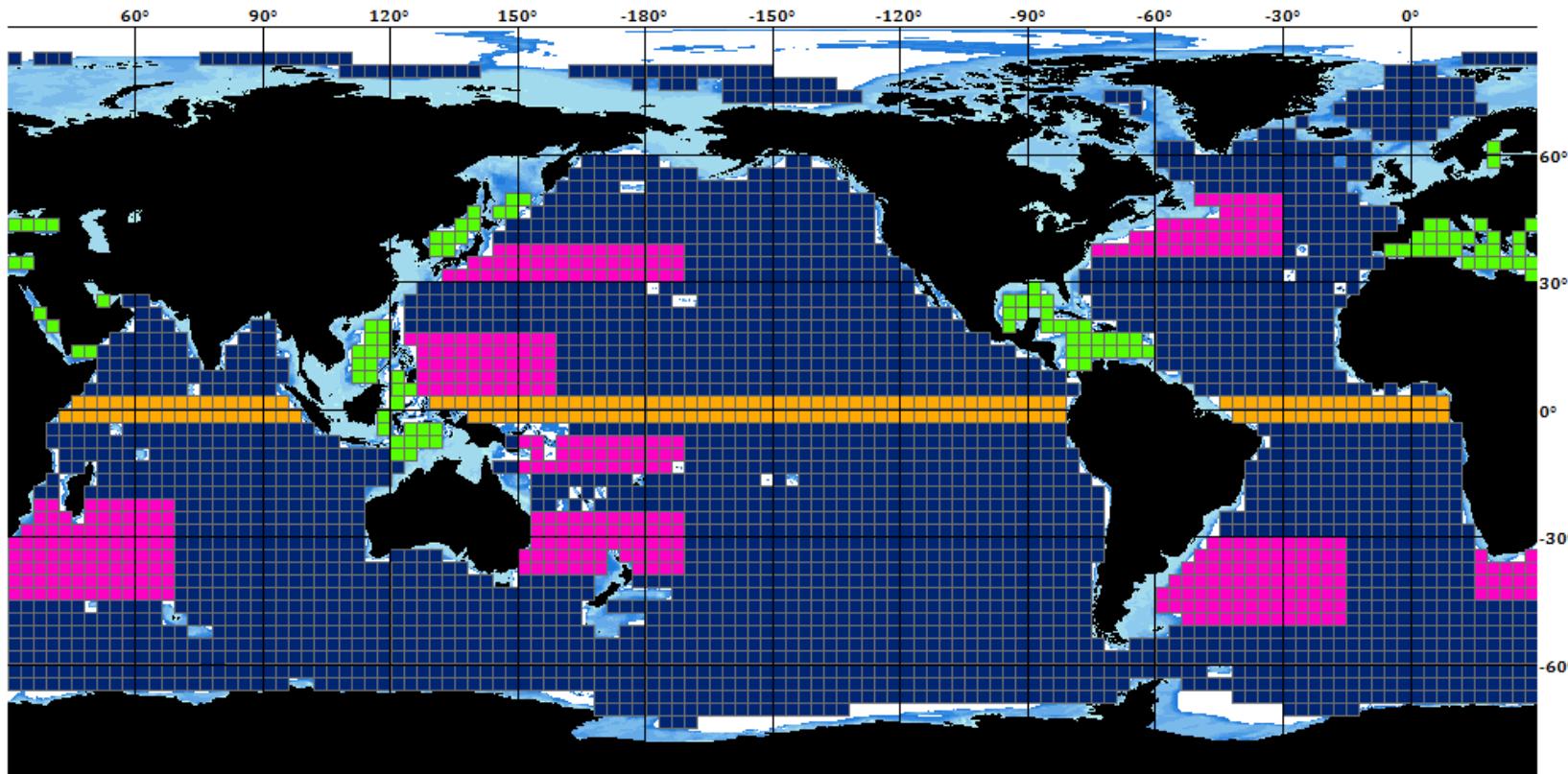
- Notification mandatory
  - Before deployment
  - In practice just after is acceptable
  - And 2 years after ?

WMO	PROGRAM/COUNTRY
2901213	VERY OLD ERROR - NIMR/KMA
2901732	NIMR/KMA
2901748	NIMR/KMA
2901749	NIMR/KMA

# Missing GTS

Argo eq. NAVOCEANO	130	HEADER ?
Argo INDIA	91	SOLVED at MF
Argo CANADA	10	NEW HEADER
Argo BSH	6	NO GDAC
Argo CHINA SOA	3	PROVOR
Argo JAMSTEC	3	DEEP
Coriolis-OVIDE	2	NO GDAC
Argo AUSTRALIA eq.	1	NO GDAC
Argo BRAZIL Navy	1	NO GDAC
Argo CHINA	1	NO GDAC
Argo NIMR/KMA	1	NO GDAC
Argo UK	1	NO GDAC
Argo UW-SOCCOM eq.	1	

# Argo Global Design (draft)

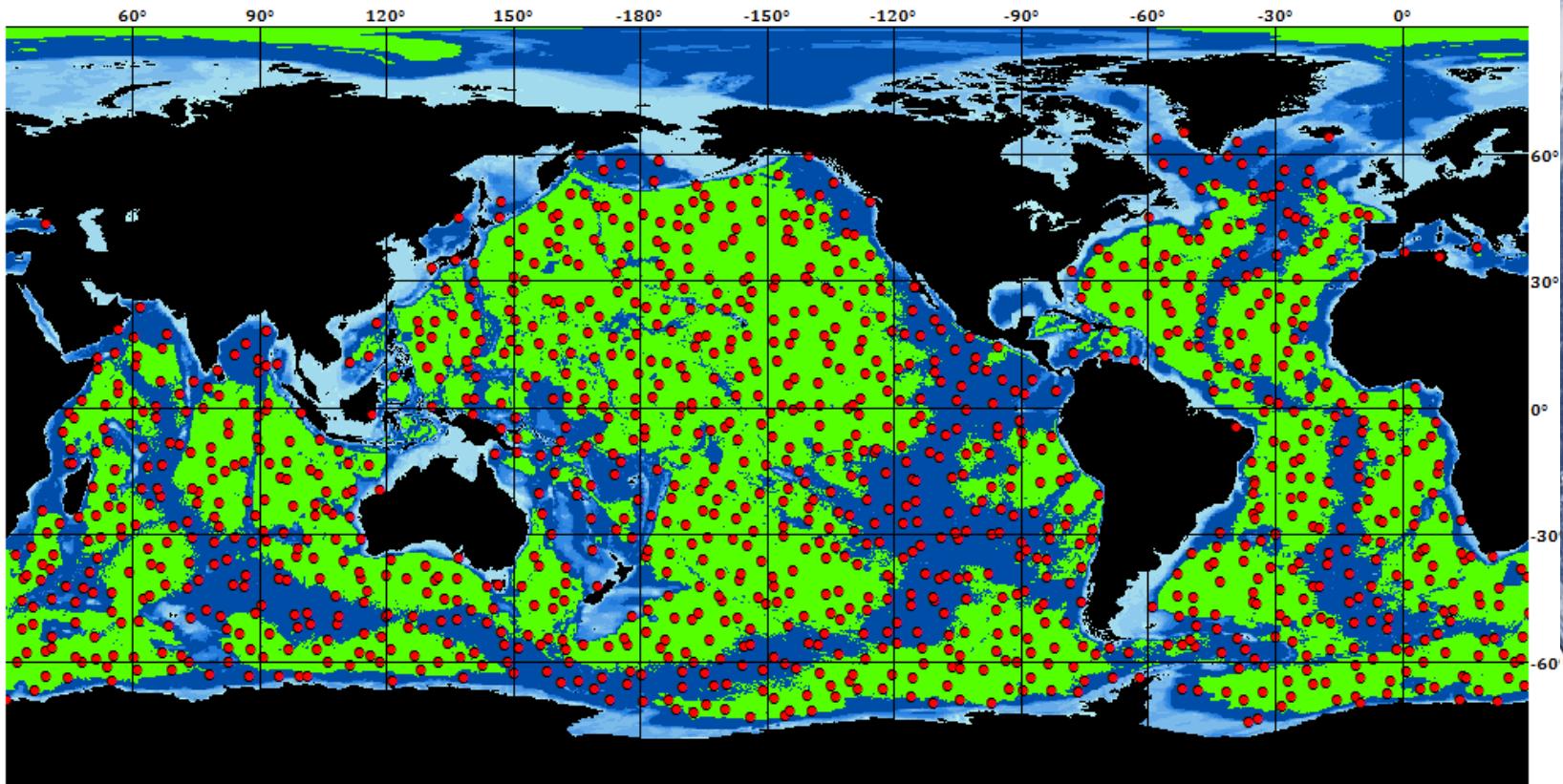


**Argo Global Design**  
Target > 4000 Floats

Other (x1) (2 918)	Marginal Seas (x 2) (107)
Equatorial (x 1.5) (168)	WBC (x 2.25) (457)

June 2015

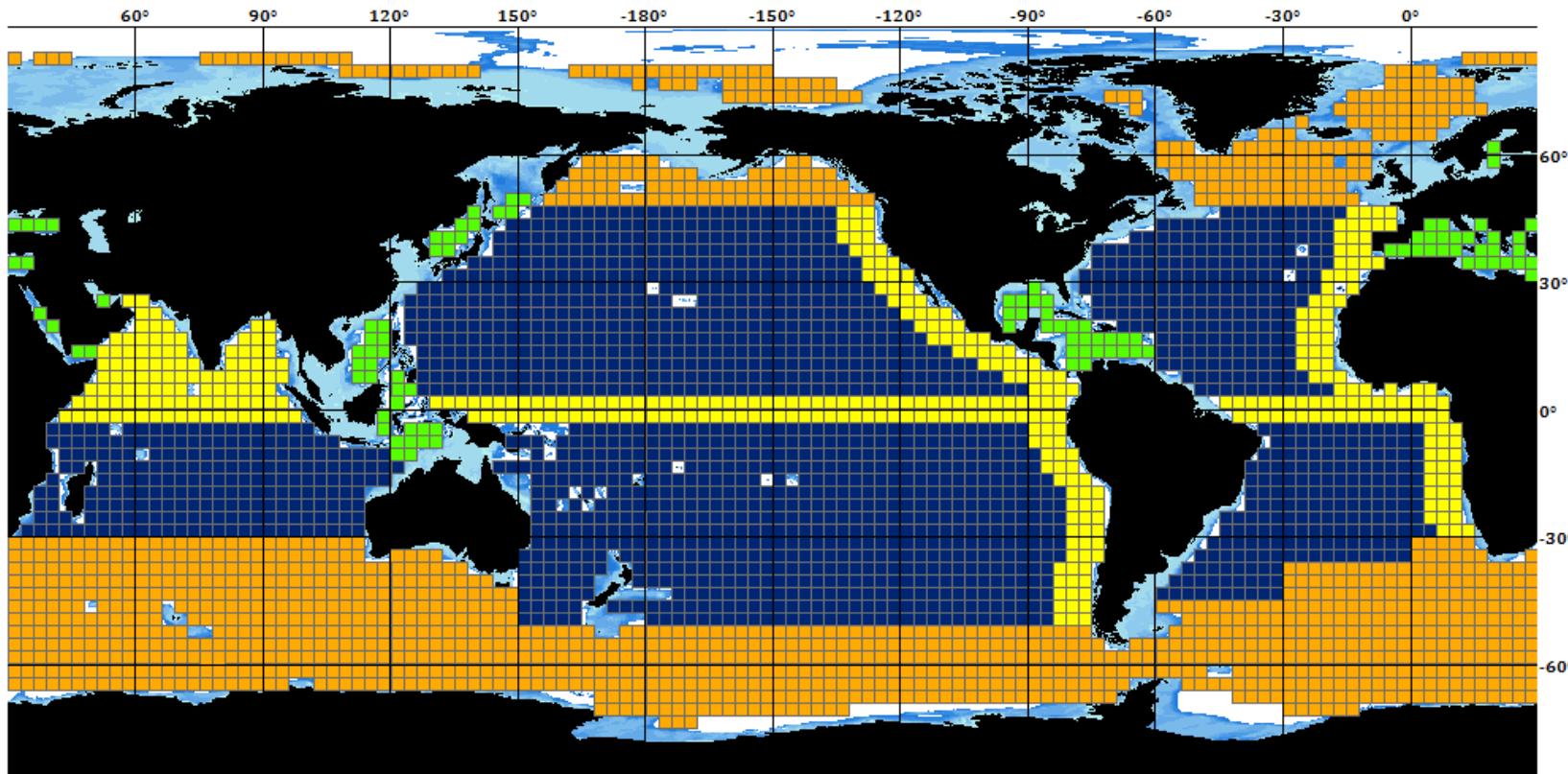
# Deep Argo



Deep Argo Global Design  
5° x 5 ° random distribution  
Target = 1208 Floats

June 2015

# Bio Argo (draft)



**Bio Argo Global Design**  
Target 895 Floats

June 2015

Green Marginal Seas (x 1) (107) Yellow OMZ / EBUS (x 0.5) (423) Orange High Latitudes (x 0.3) (1 324) Dark Blue Others (x 0.1) (1 798)

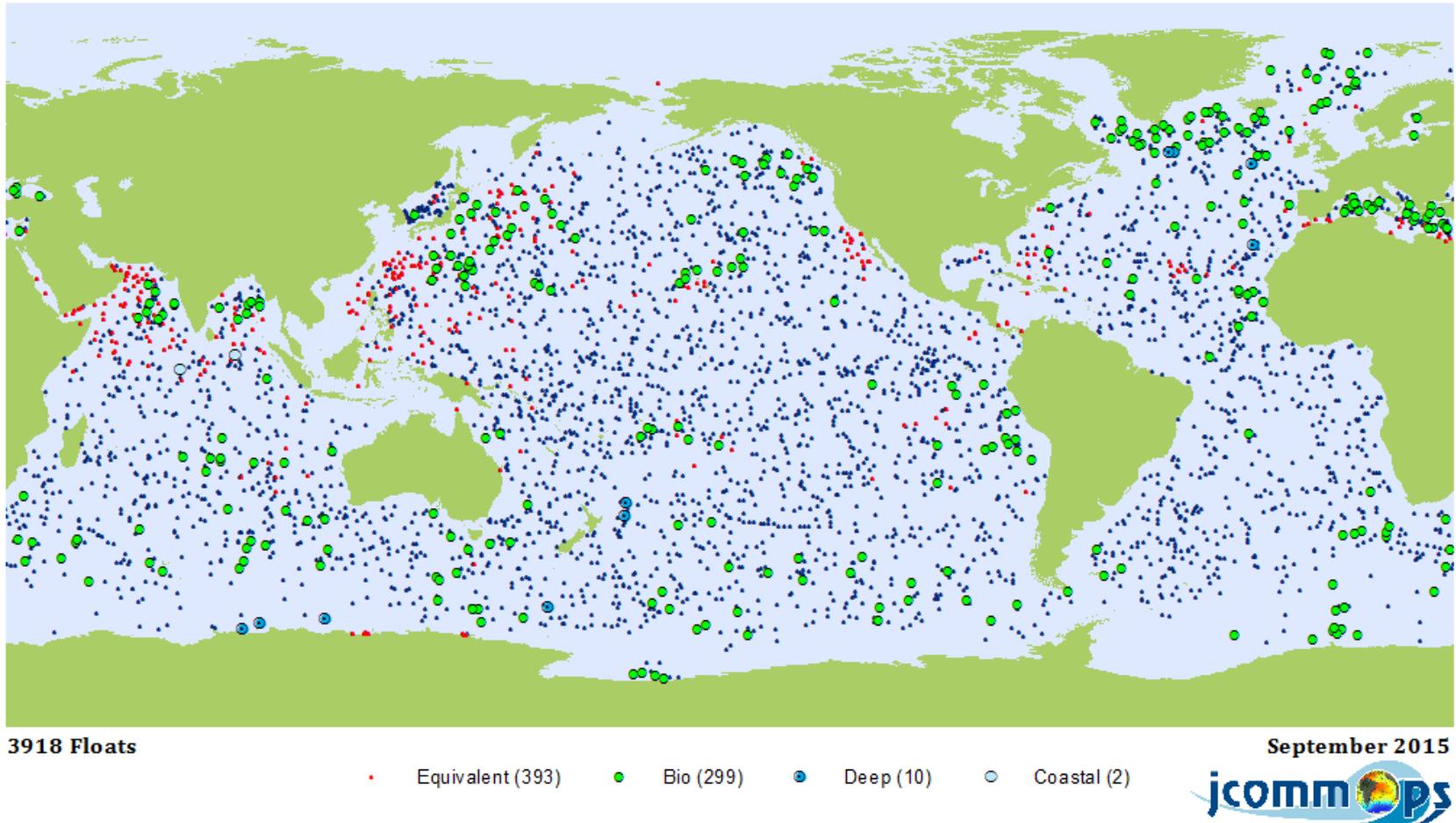
# Enhancements

- Additional funding not in sight for all expansions
- Logistics challenge for SO
- Diplomatic challenge for Marginal Seas and key EEZs (ex. Pacific) => cooperation required
- All requirements for Global Argo mean more than 6000 floats ?

Category	Indicator	Method	Target	Note
STATUS	Activity	108%	Nb Active units vs target	3200 3473/3918
	Operationality	100%	Nb Active units vs target, sending good data	3200 3200/3700
	Intensity	89%	Nb Deployed over last 12 months vs target	800 ? for the core array 715/1027units
	Density	56%	% of 6x6 well sampled	Certainly not 100 % To refine metric
DATA	Delivery	90%, 95%	Nb of platforms distributing data vs registered	GTS , GDACs 100%, 100% 3520/ 3918, 3749/ 3918
	Quality	93%, 88% (A) 96% (A or B)	% Profile with « good » data	TEMP, PSAL 3rd Quarter
	DM Processing	70%	Ratio DM/DM Eligible	100% As of 01/10/2015
	Timeliness	89% (GTS) 81% (GDACs)	Nb Obs. < 24h vs Total Obs.	100%, 100% September
	Delays	7h, 25h (GTS) 11h, 35h (GDACs)	Median , Average Delay	24h September
INSTRUMENTATION	Reliability	85%	Average age of latest dead floats	1500 days 1281 days 3rd quarter
	Half-life	91%	% surviving 750 days	100% 901/985 Deployed [T-1115;T-750]

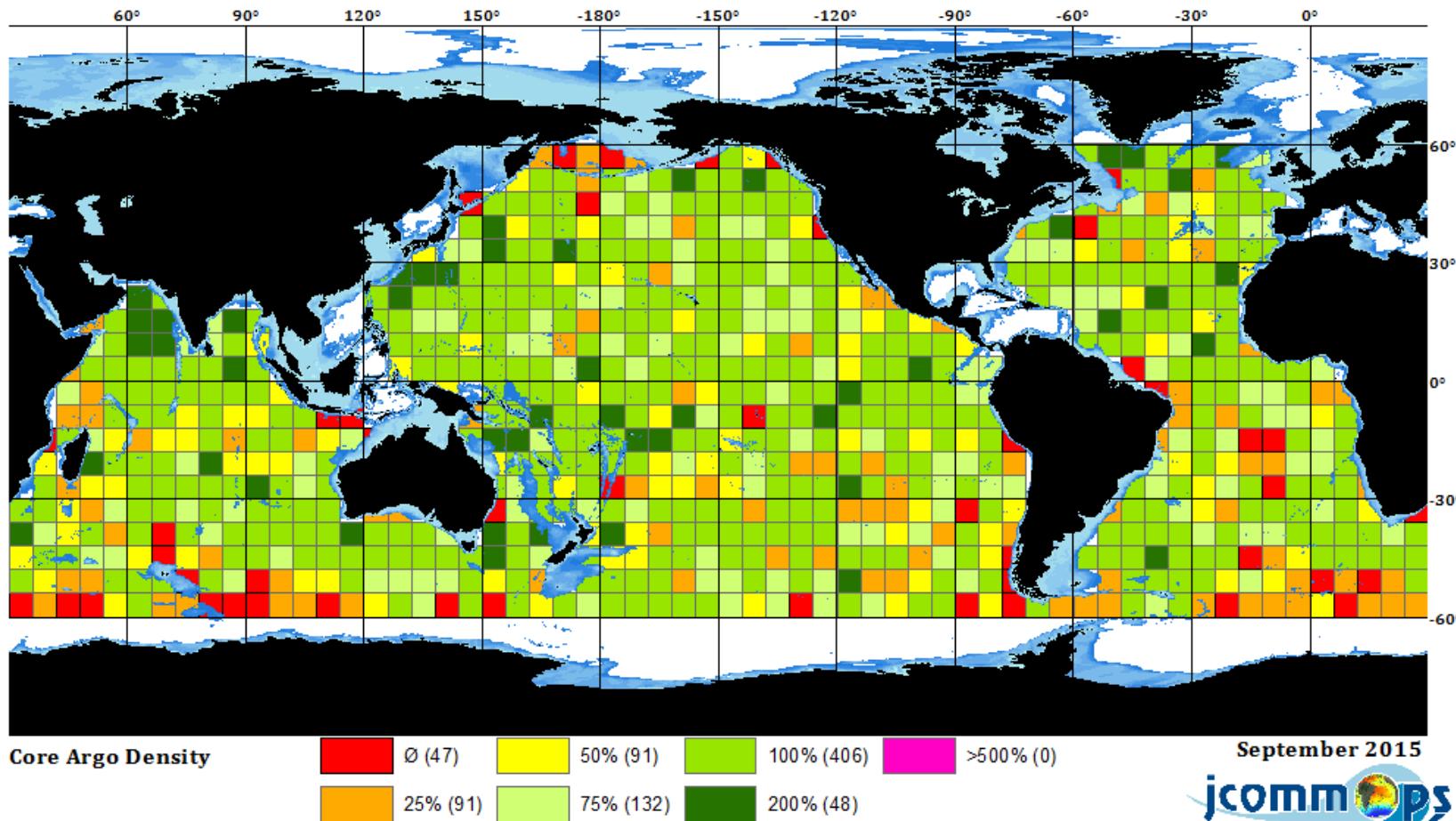
# Networks

First deep Argo floats (ARVOR\_D, NINJA\_D, SOLO\_D) are operating.



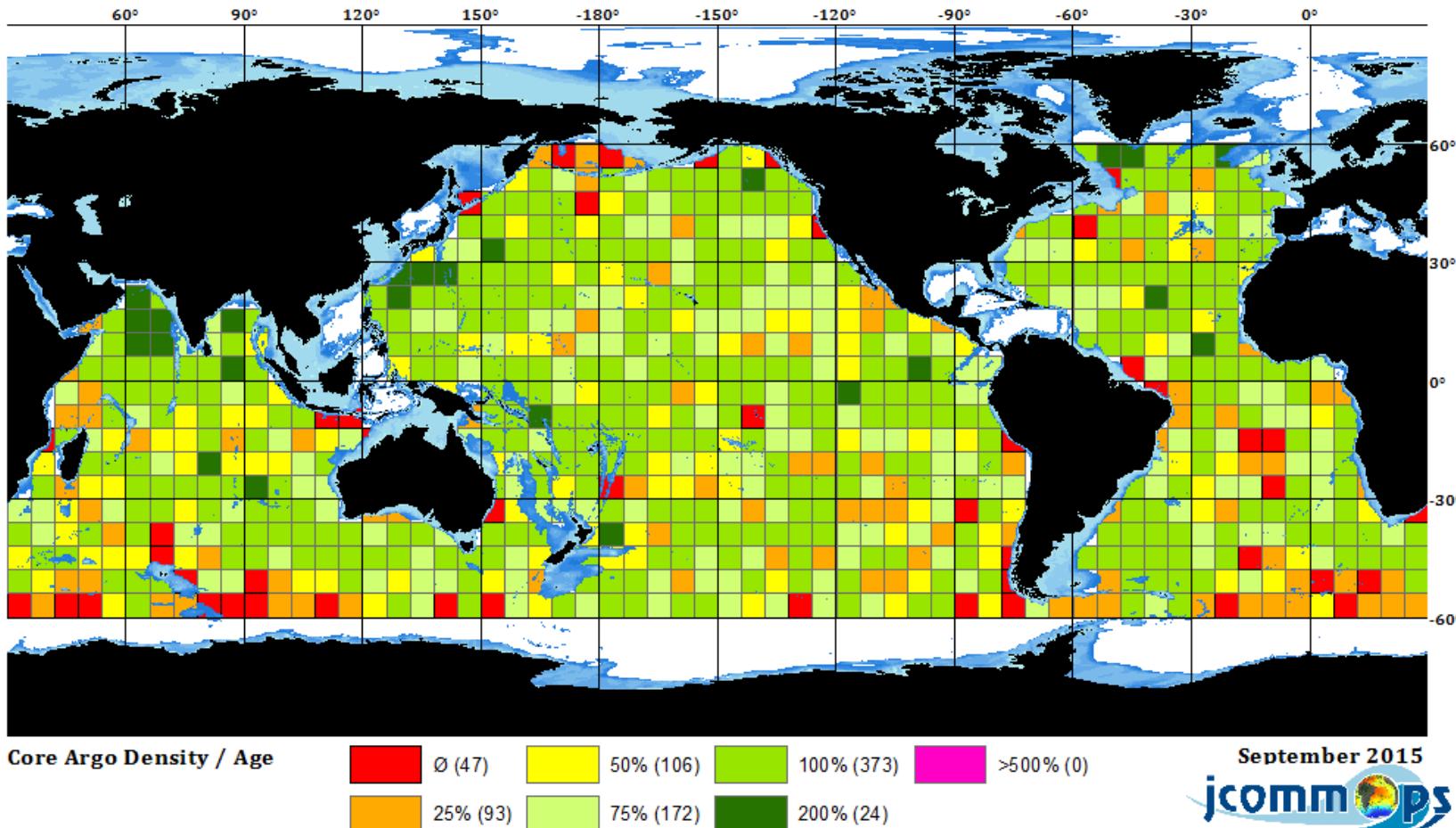
# Density (core)

56% of the core array is well (or over) sampled.



# Density/Age (core)

49% if we consider decimal floats (weighted by their probability to die).



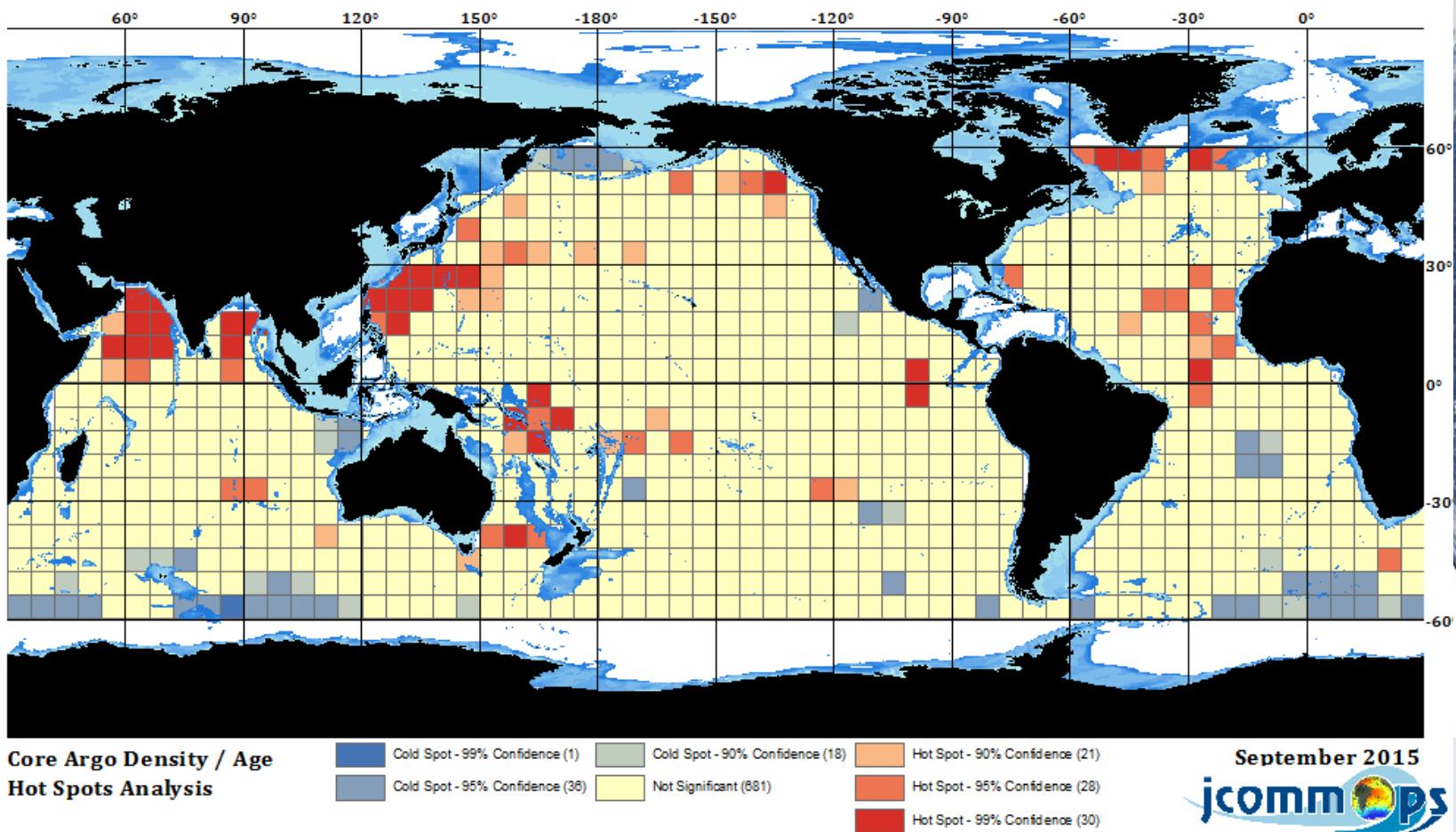
Core Argo Density / Age

∅ (47) 25% (93) 50% (106) 75% (172) 100% (373) >500% (0)

September 2015

# Density/Age (core)

Spatial analysis allows to identify hot/cold spots and highlight gaps.  
In particular, below 45° S in Indian and Atlantic.



**Core Argo Density / Age  
Hot Spots Analysis**

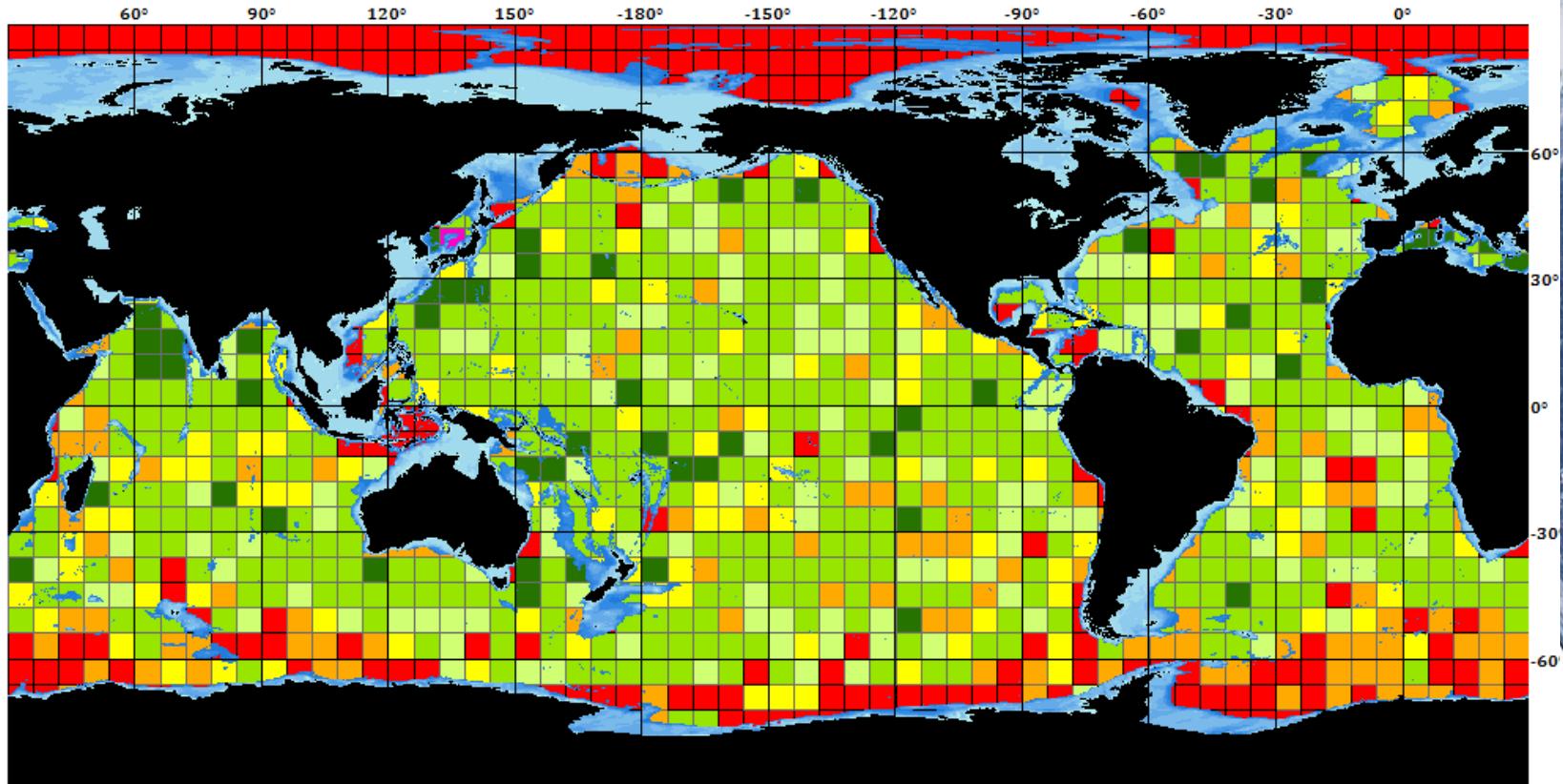
Cold Spot - 99% Confidence (1)  
Cold Spot - 95% Confidence (36)  
Cold Spot - 90% Confidence (18)  
Hot Spot - 90% Confidence (21)  
Hot Spot - 95% Confidence (28)  
Hot Spot - 99% Confidence (30)  
Not Significant (681)

September 2015

jcommOPS

# Density 6° x 6°

For the Global array, Southern Ocean remains the challenge.



Argo Density

100% = 4 Floats

0

25%

50%

75%

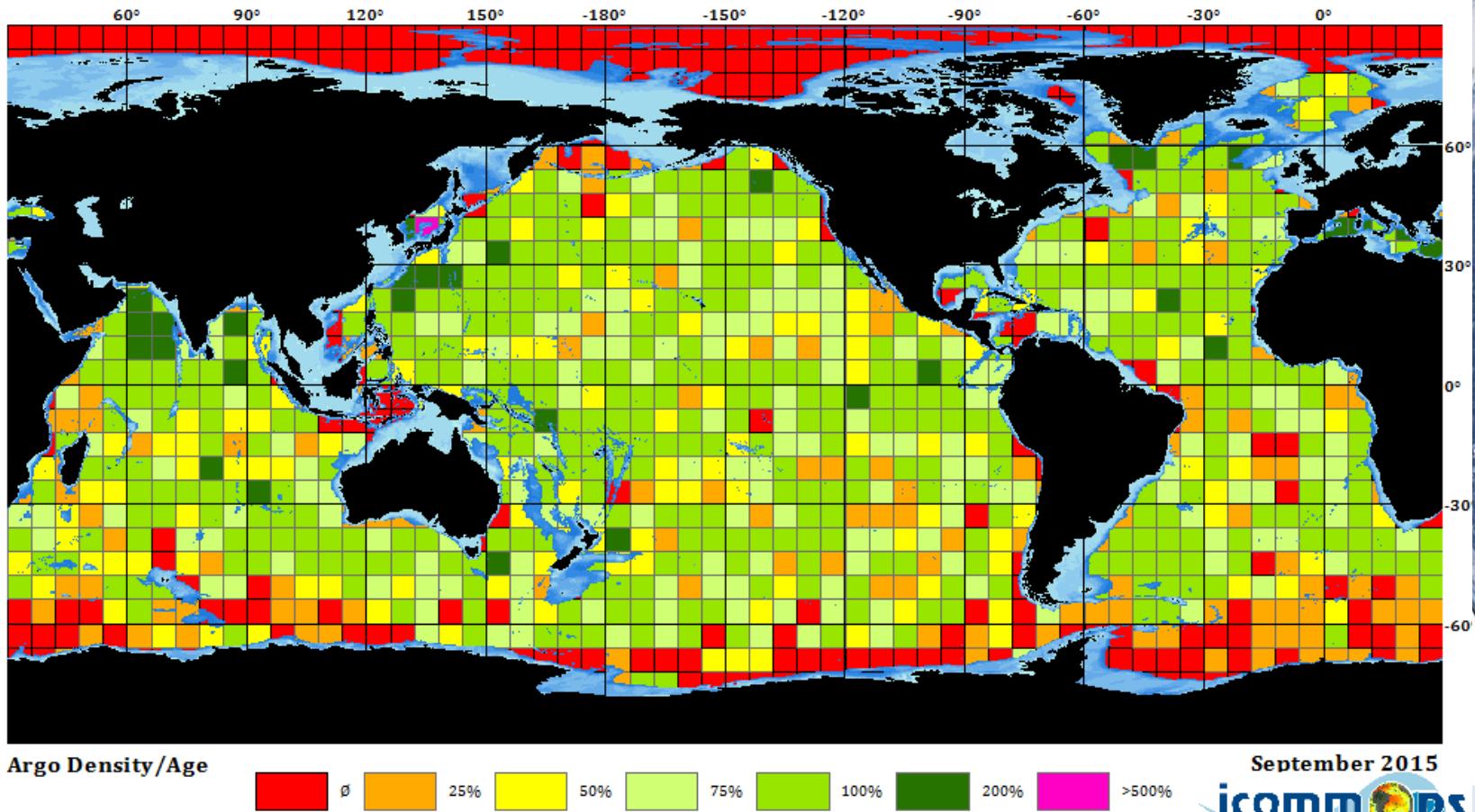
100%

200%

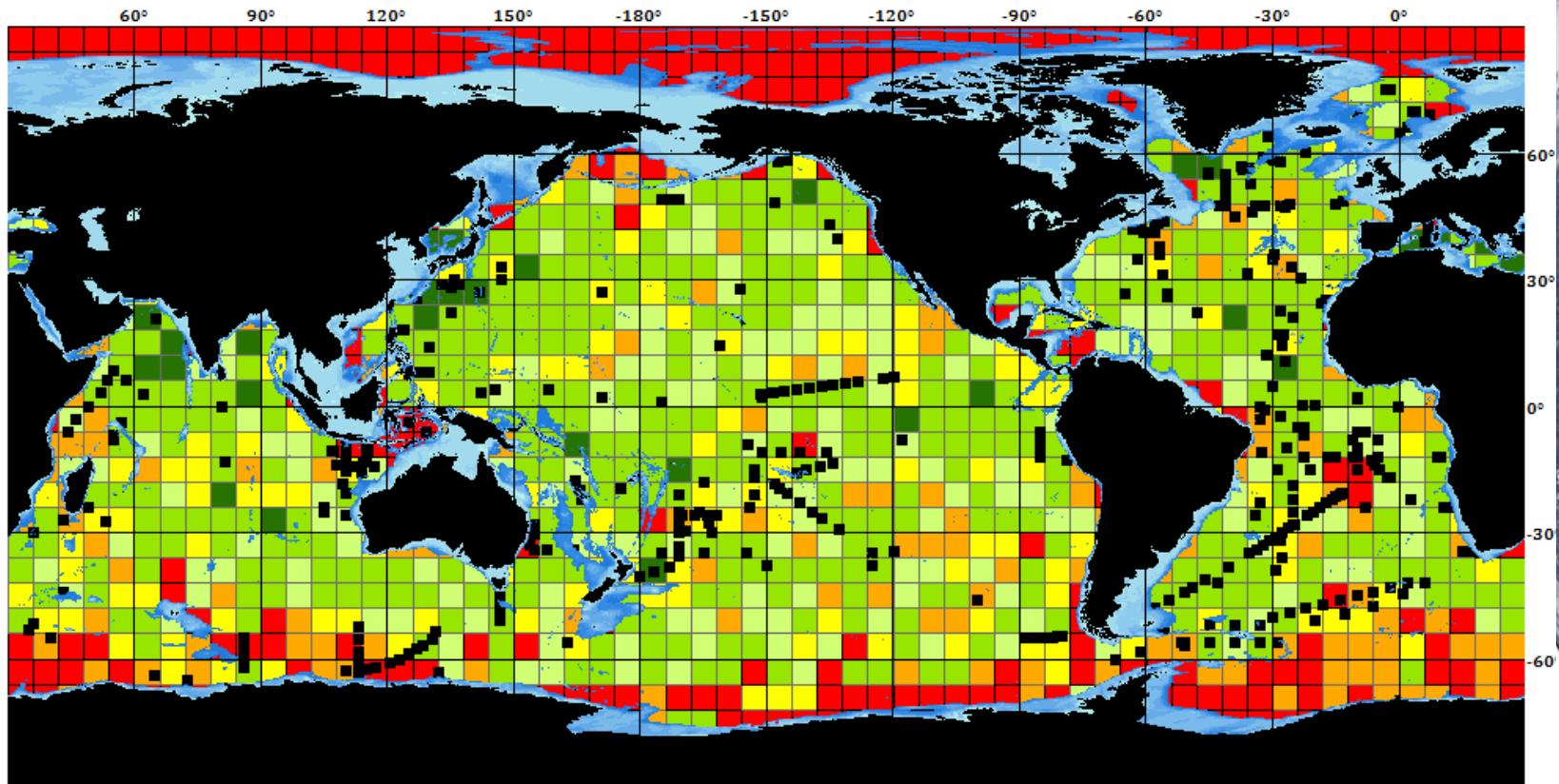
>500%

September 2015

# Density/Age 6°x 6°



# Density/Age vs Plans



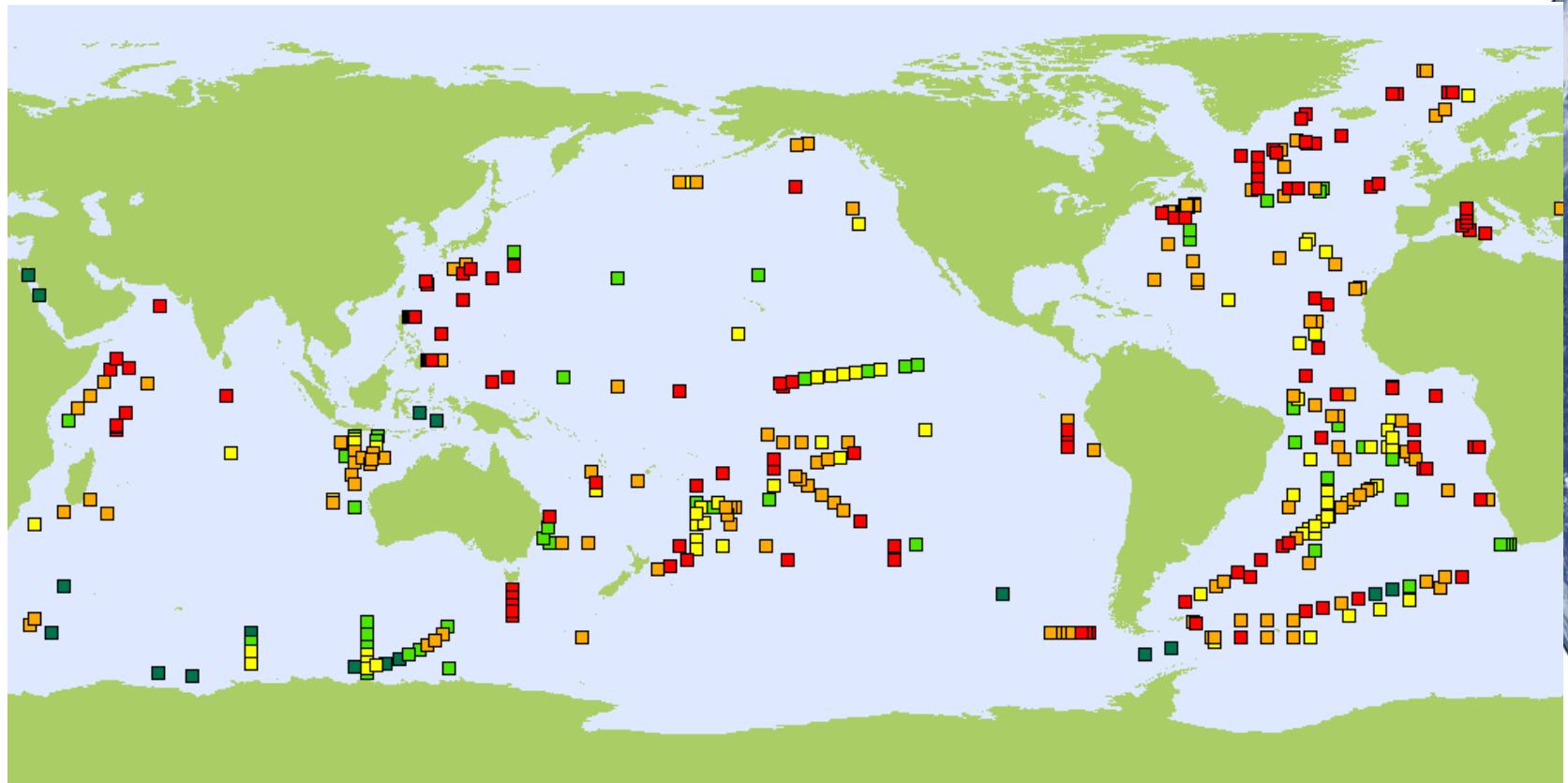
Argo Density/Age &  
Deployment Plans

0 25% 50% 75% 100% 200% >500%

September 2015

# Deployment Plans Score

Use the following map to optimize your deployment locations if required.



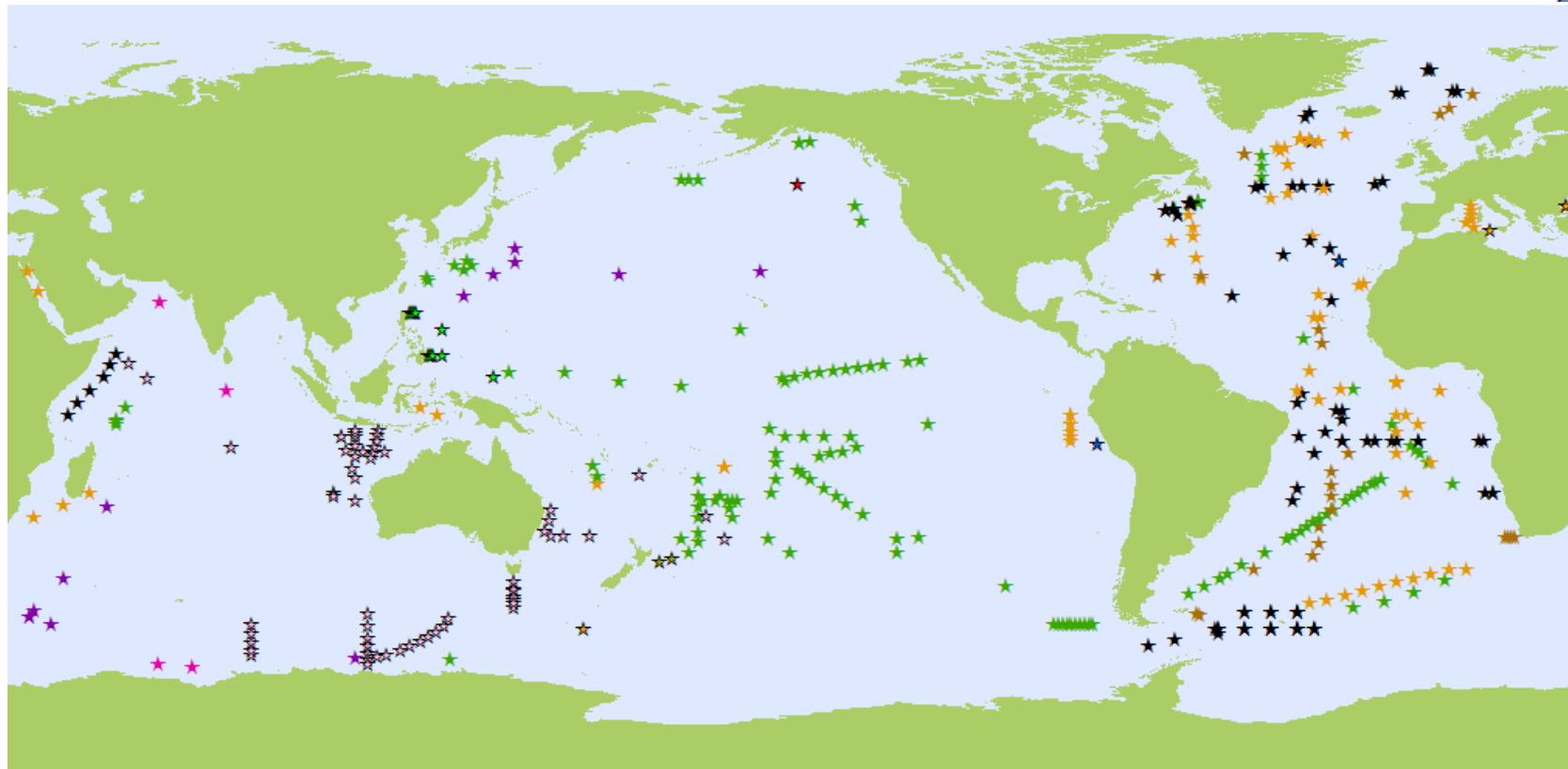
Deployment Planning Scores

September 2015

■ 0 ■ 0 - 0.25 ■ 0.25 - 0.5 ■ 0.5 - 0.75 ■ 0.75 - 1

# Plans

Please provide your draft plans as soon as possible (any format is accepted).



Plans (432)	
★ ALGERIA (0)	★ CHINA (12)
★ AUSTRALIA (61)	★ EUROPEAN UNION (4)
★ BULGARIA (1)	★ FINLAND (0)
★ CANADA (3)	★ FRANCE (84)
★ GERMANY (89)	★ ITALY (3)
★ GREECE (0)	★ JAPAN (13)
★ INDIA (4)	★ KOREA (REPUBLIC OF) (0)
★ IRELAND (0)	★ MEXICO (0)
★ NETHERLANDS (0)	★ SPAIN (0)
★ NEW ZEALAND (2)	★ TURKEY (0)
★ NORWAY (0)	★ UNITED KINGDOM (24)
★ POLAND (0)	★ UNITED STATES (132)

September 2015

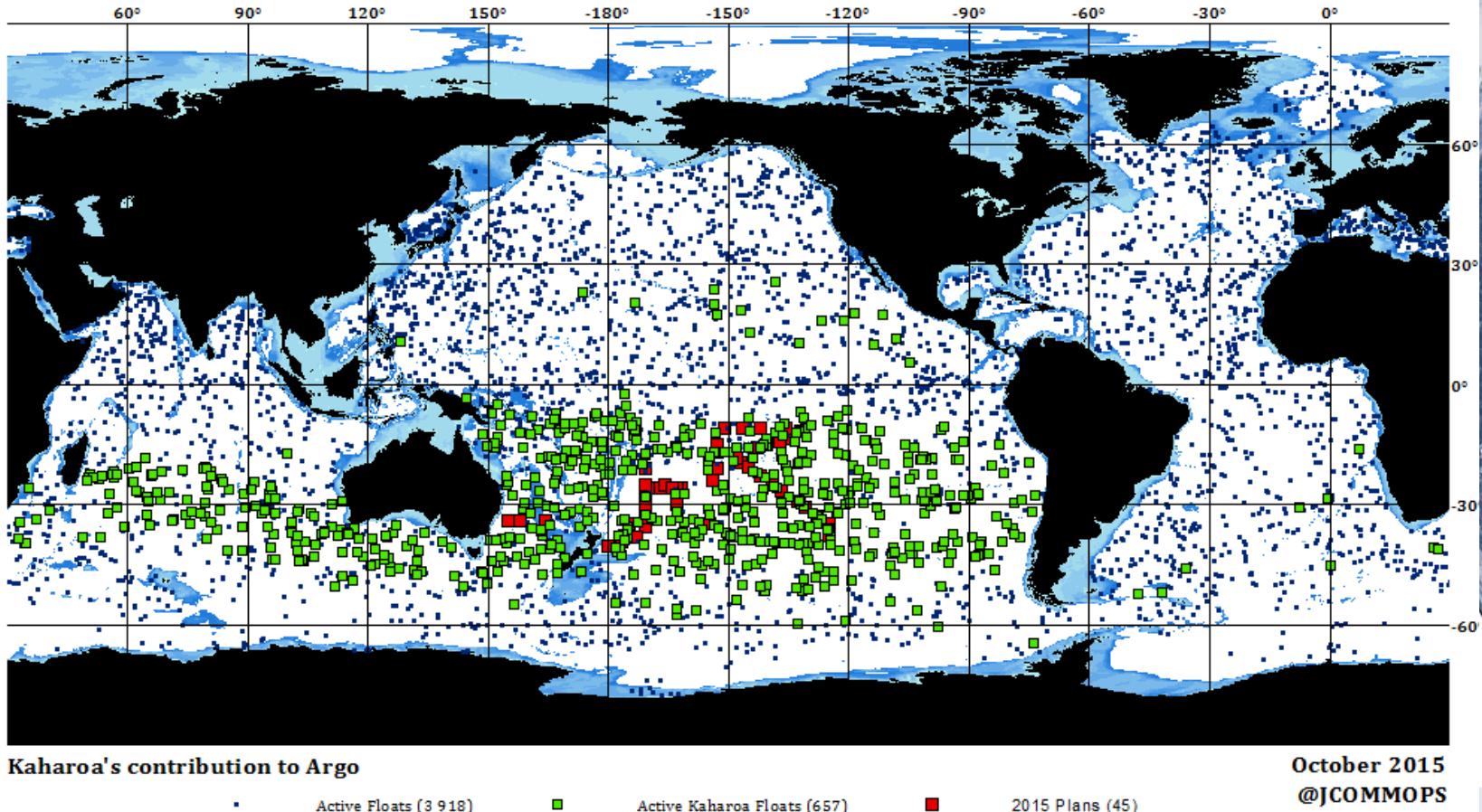
# Action!!!

- Provide draft depl. plans to JCOMMOPS
  - Format= **ID;WMO;LAT;LON;DATE;SHIP,CRUISE**
  - Maintain same file on a yearly basis
- Important for Argo (international, national, regional)
- Important for JCOMM integrated perspective
- Auto loading of: Argo netCDF file, US metafiles, JCOMMOPS text
- TC can help! Send me the info in any format.
- Use new JCOMMOPS website to do your planning
  - We will adapt tools to your requirements
- Do you need netCDF editor to create file when registering ?



# Kaharoa's contribution

~20% of the active Argo array is implemented by one NZ ship (charter)

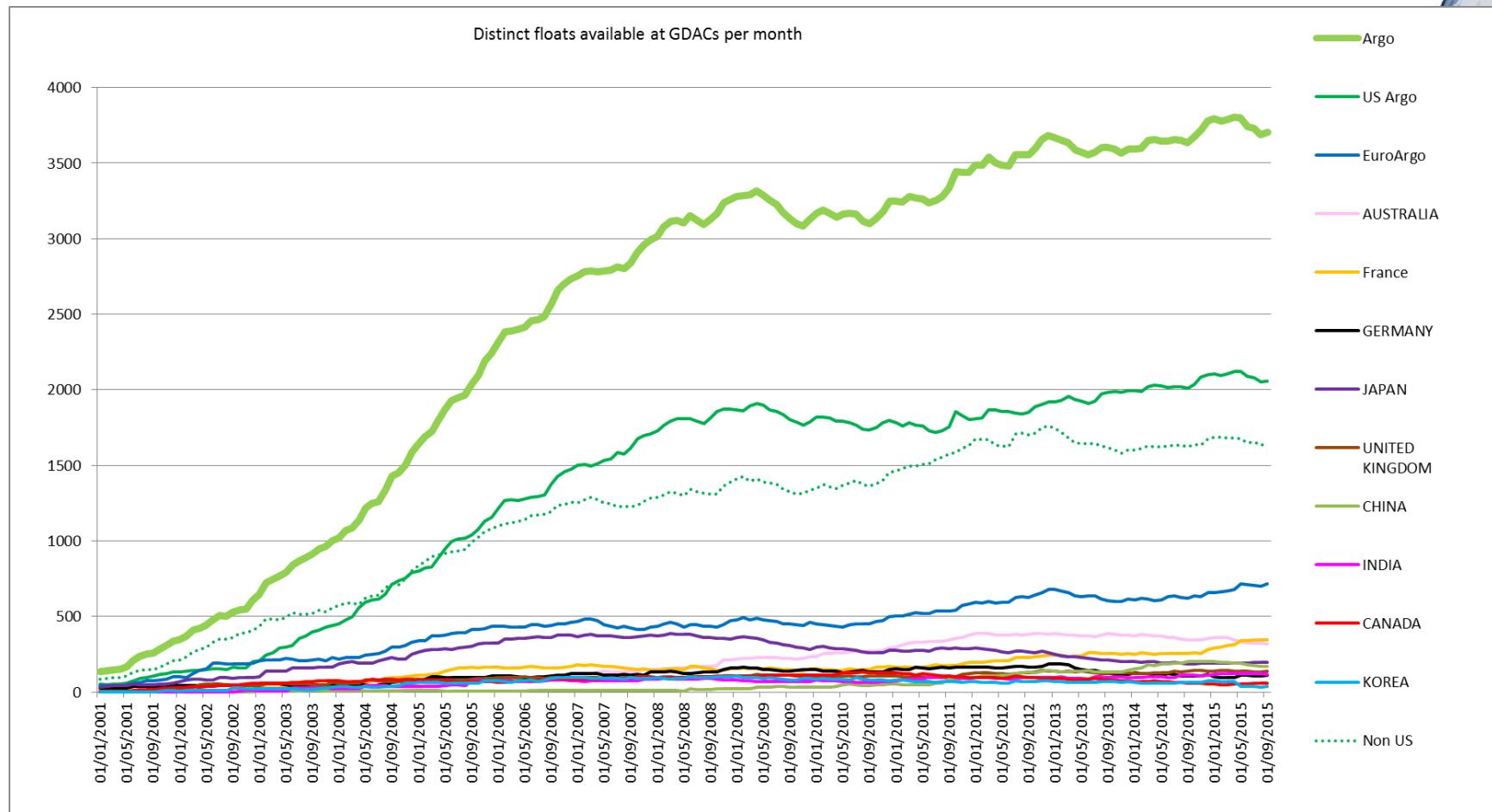


# Metadata

- SHIP unique code ready !
  - New reference table
  - Requests to JCOMMOPS for additions
  - JCOMMOPS – ICES/BODC/Seadatanet
- **DEPLOYMENT\_PLATFORM** (ideally std table)
  - KAHAROA
- **DEPLOYMENT\_PLATFORM\_ID**
  - **61LY** (std table)
- Maintained by JCOMMOPS/ADMT with other ref tables
  - Governance of reference tables?
- API soon available to be used by GDAC checkers

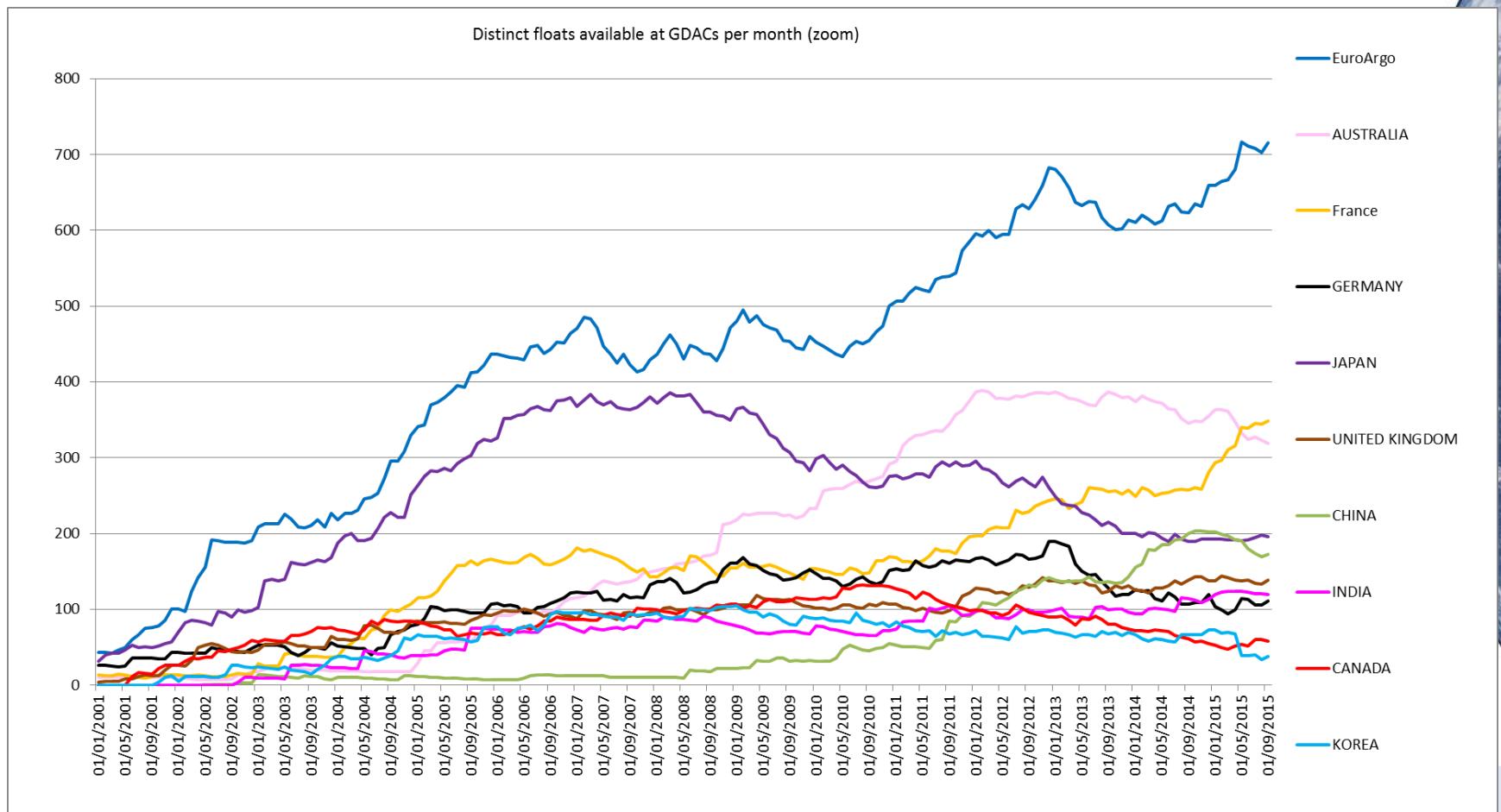
# Member States

Actually more than 150 additional floats are registered but no data is available yet.  
 Argo has certainly more than 4000 units in the ocean.

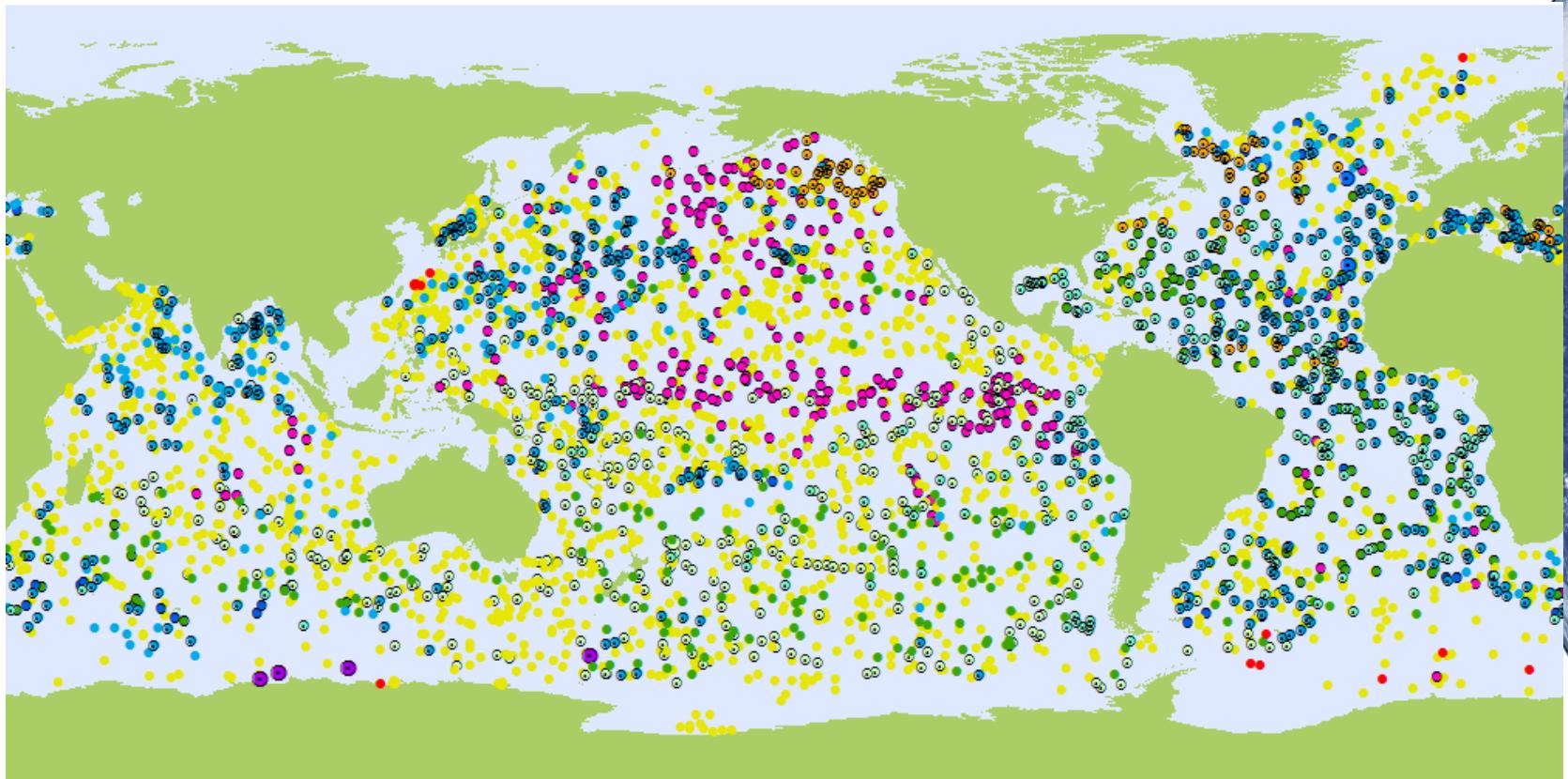


# Member States (zoom)

France is just the 2<sup>nd</sup> float operator after USA.



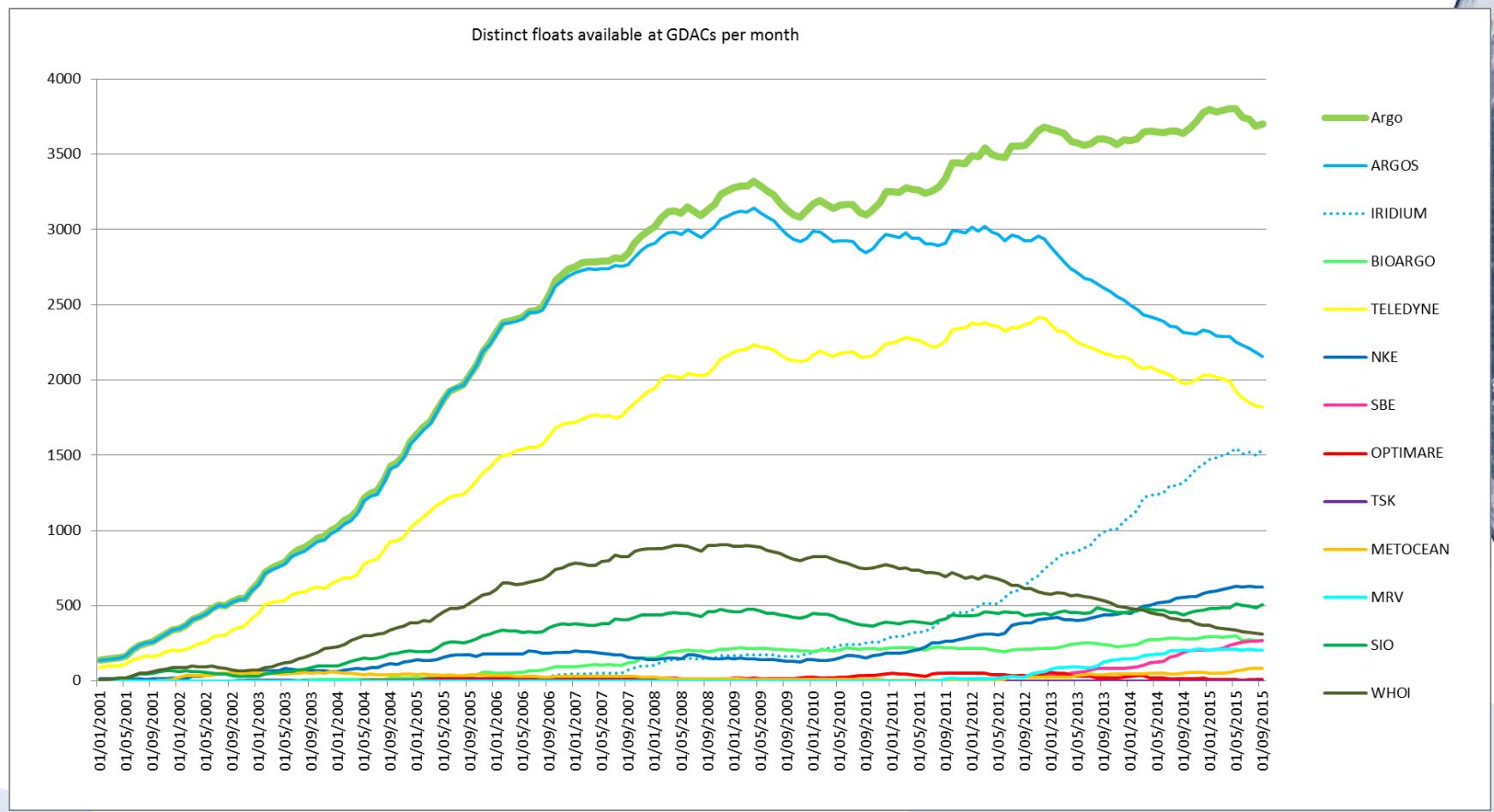
# Market



September 2015

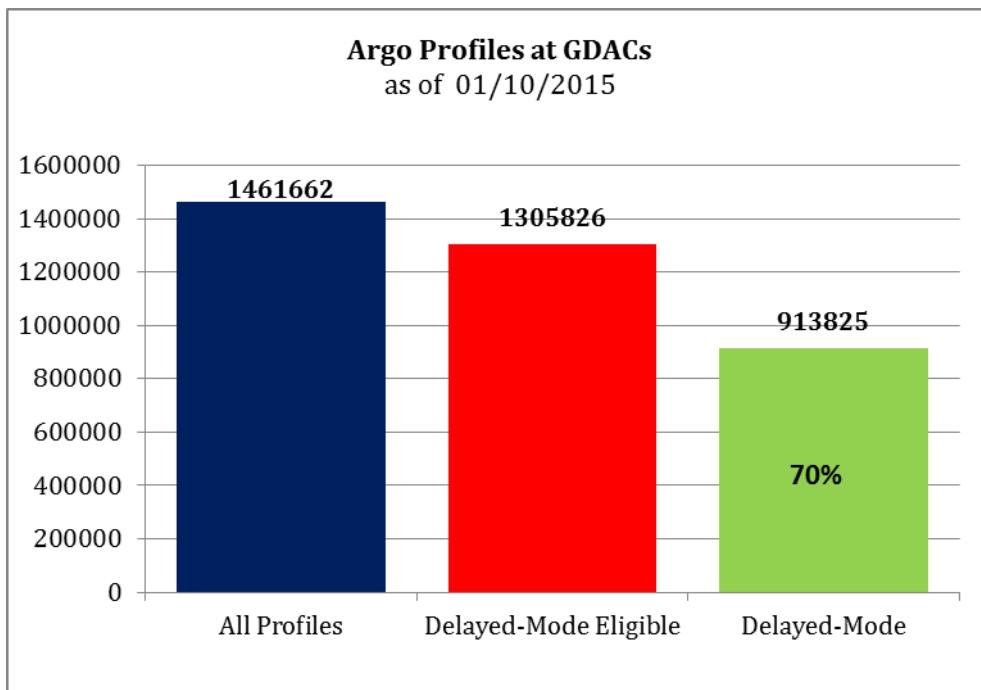
# Market

« New » float manufacturers (SBE and NKE in particular) keep increasing their market.  
Iridium (and BioArgo) seem stabilizing.



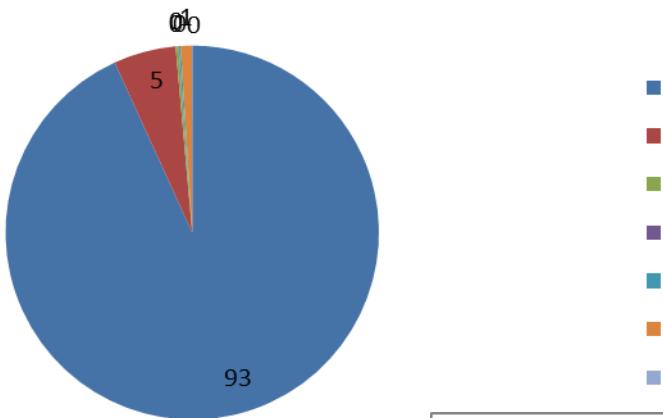
# Profiles

Delayed mode quality control still remain a challenge  
(% achieved keeps decreasing slowly).  
See J. Gilson charts for more details.



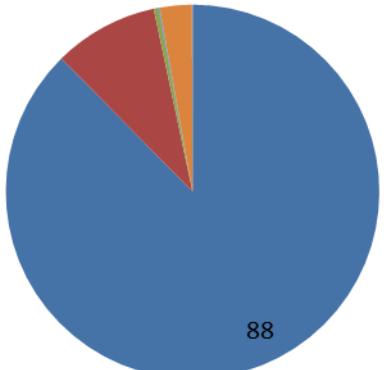
# Profiles Quality (Sep. 2015)

**TEMP**



A quick view on 2015 3rd quarter profiles quality.  
90% of profiles produced are « good ».

**PSAL**



n	Meaning
"	No QC performed
"	
A	$N = 100\%$ ; All profile levels contain good data.
B	$75\% \leq N < 100\%$
C	$50\% \leq N < 75\%$
D	$25\% \leq N < 50\%$
E	$0\% < N < 25\%$
F	$N = 0\%$ ; No profile levels have good data.

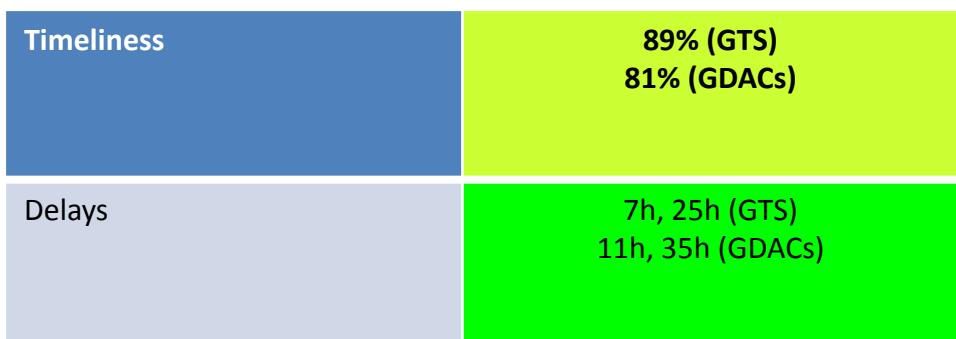
# What is a good quality profile ?

- $\text{PRES} \geq B \text{ AND } \text{TEMP} \geq B \text{ AND } \text{PSAL} \geq B$  ?
- Clear logic rule required to build a good performance indicator



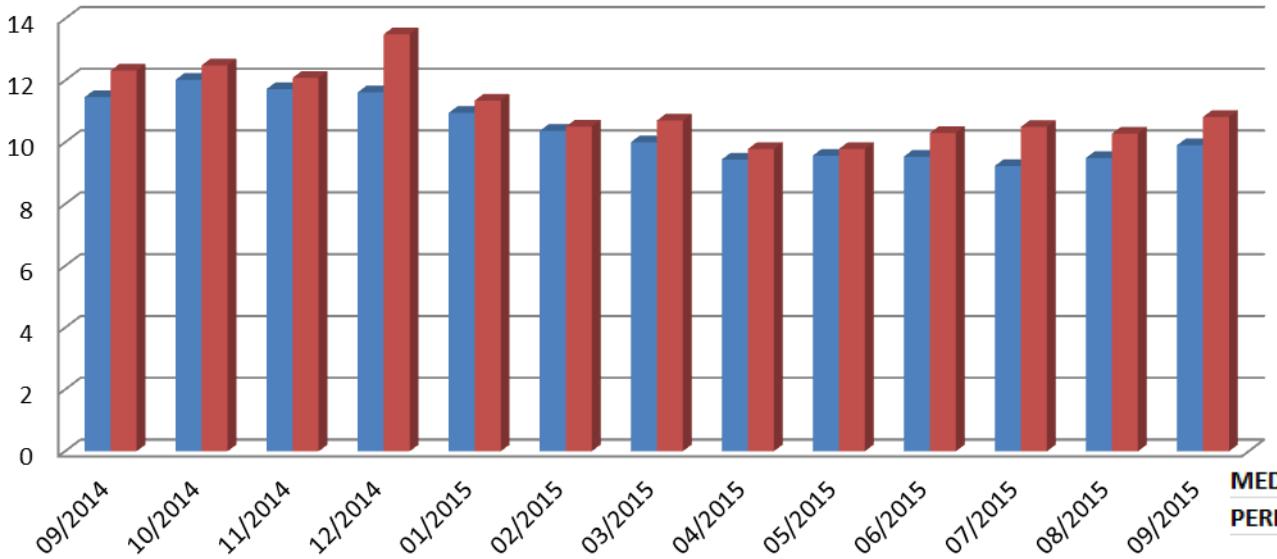
# Delays

- Finally monitoring both GDACs
- Problem detected at FR GDAC early 2015
  - Fixed thanks to JCOMMOPS archive
- Full Excel available for meeting
- Target (90% within 24h ?)

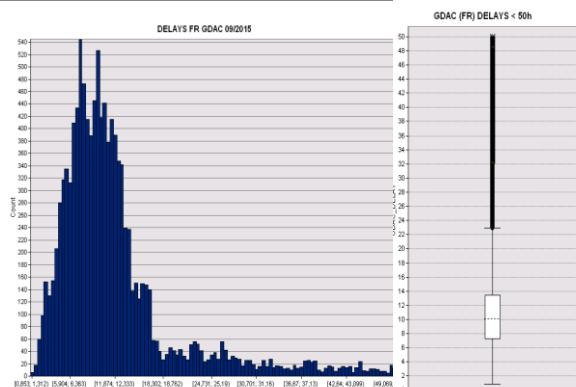
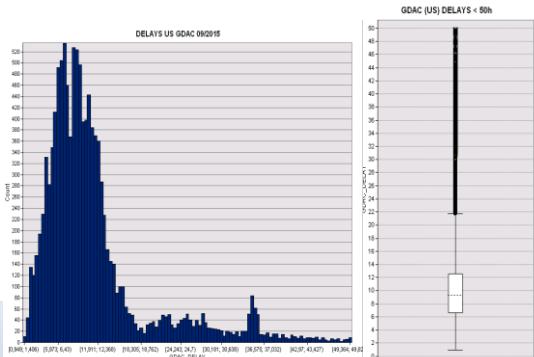


# Overall Median Delays 9-10h

Median delay per GDAC

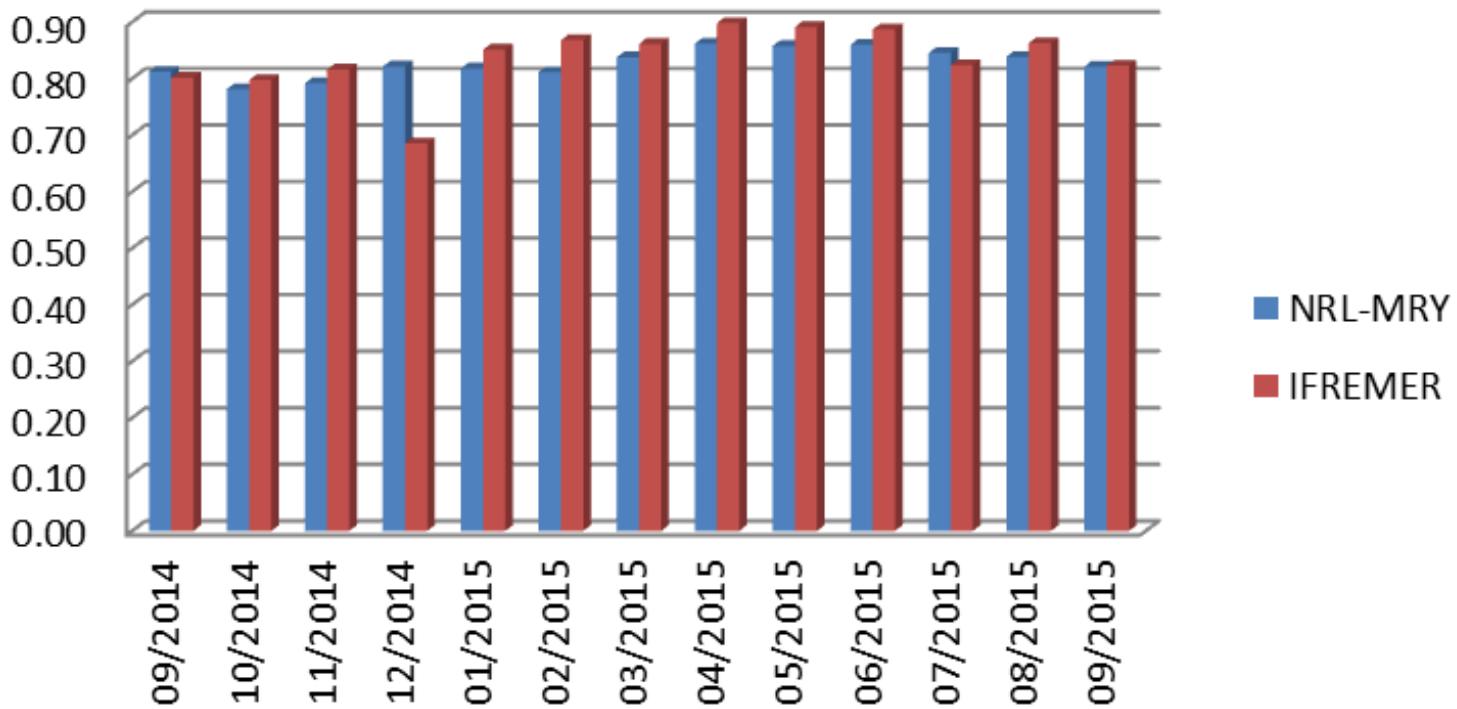


PERIOD	NRL-MRY	IFREMER
09/2014	11.46	12.319
10/2014	12.024	12.493
11/2014	11.724	12.086
12/2014	11.618	13.496
01/2015	10.954	11.352
02/2015	10.369	10.506
03/2015	10	10.701
04/2015	9.444	9.782
05/2015	9.569	9.785
06/2015	9.538	10.304
07/2015	9.237	10.499
08/2015	9.494	10.281
09/2015	9.906	10.82

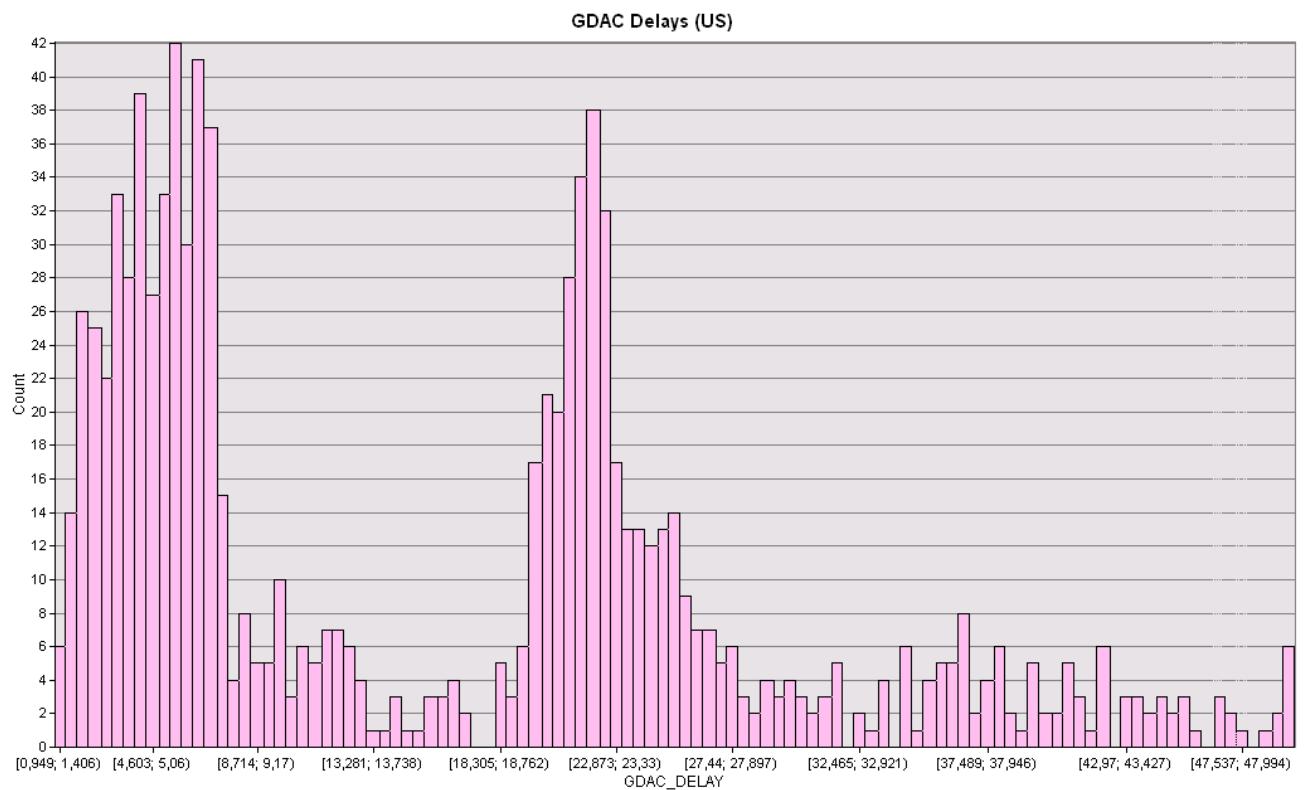


# Timeliness – close to Target (90%)

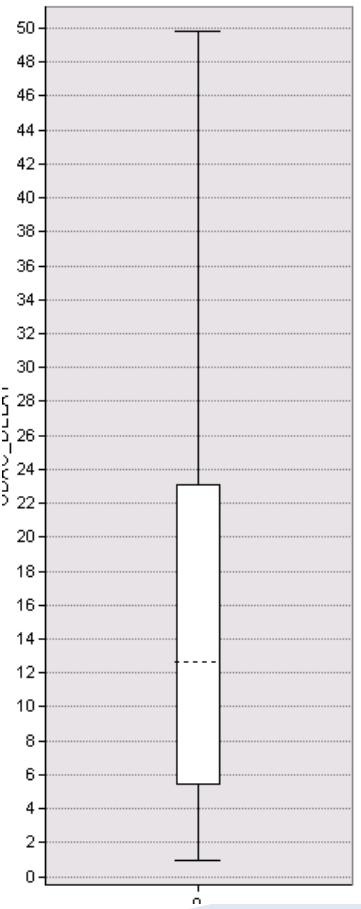
% profiles with delay < 24H



# CSIRO

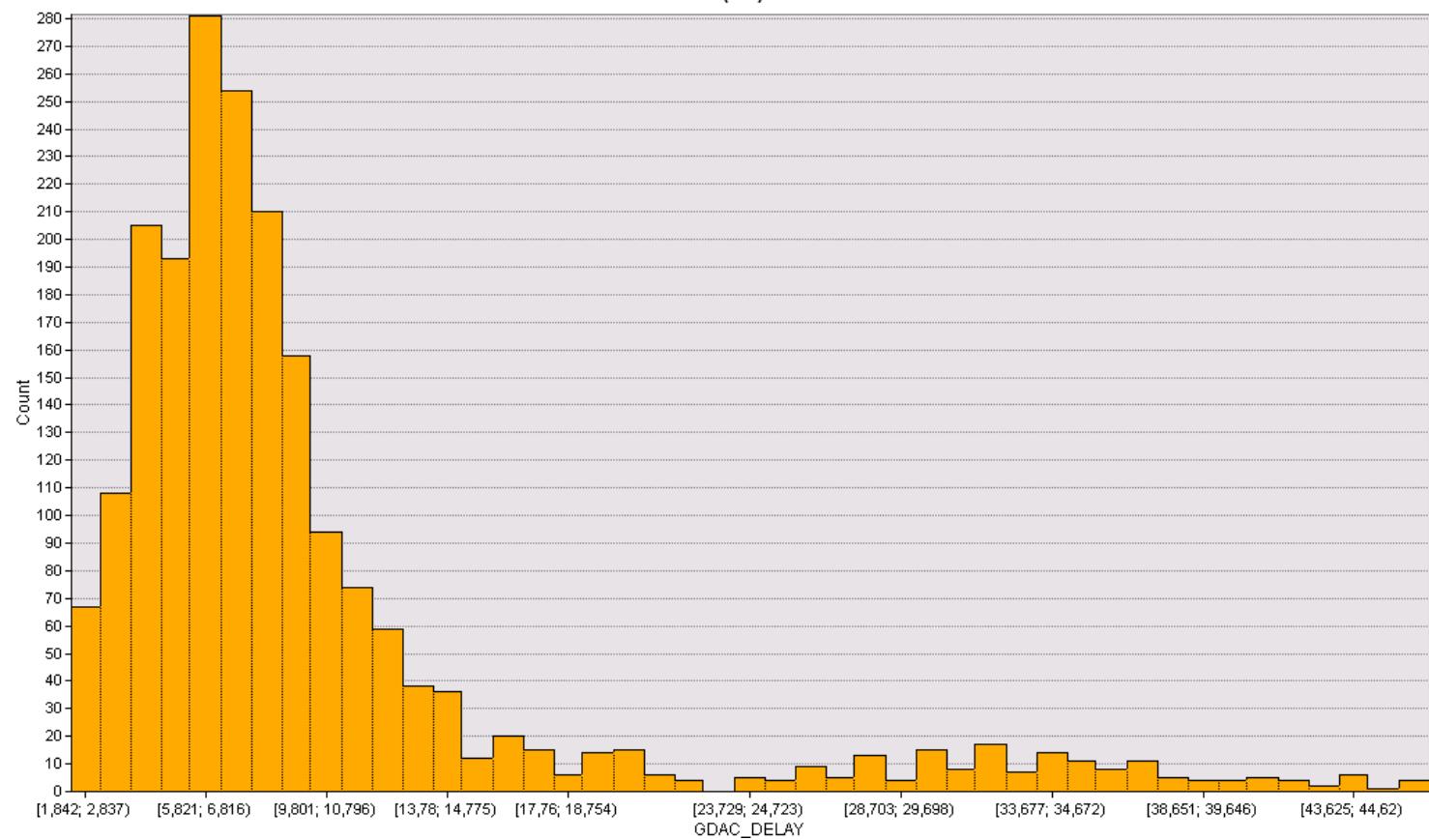


**GDAC DELAYS (US) CSIRO**

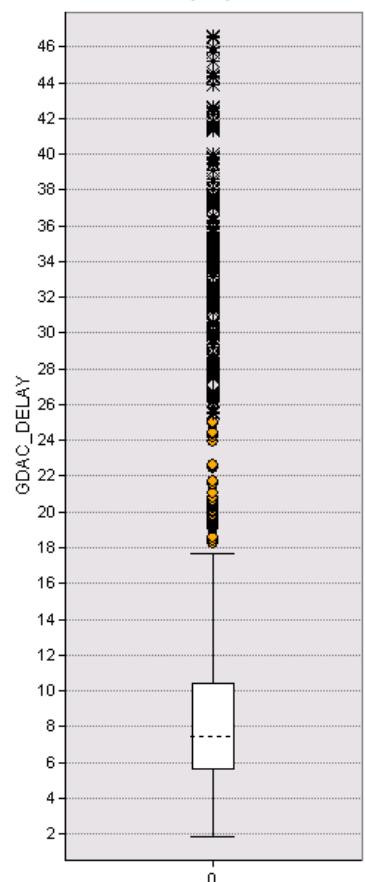


# Coriolis

GDAC DELAYS (US) CORIOLIS

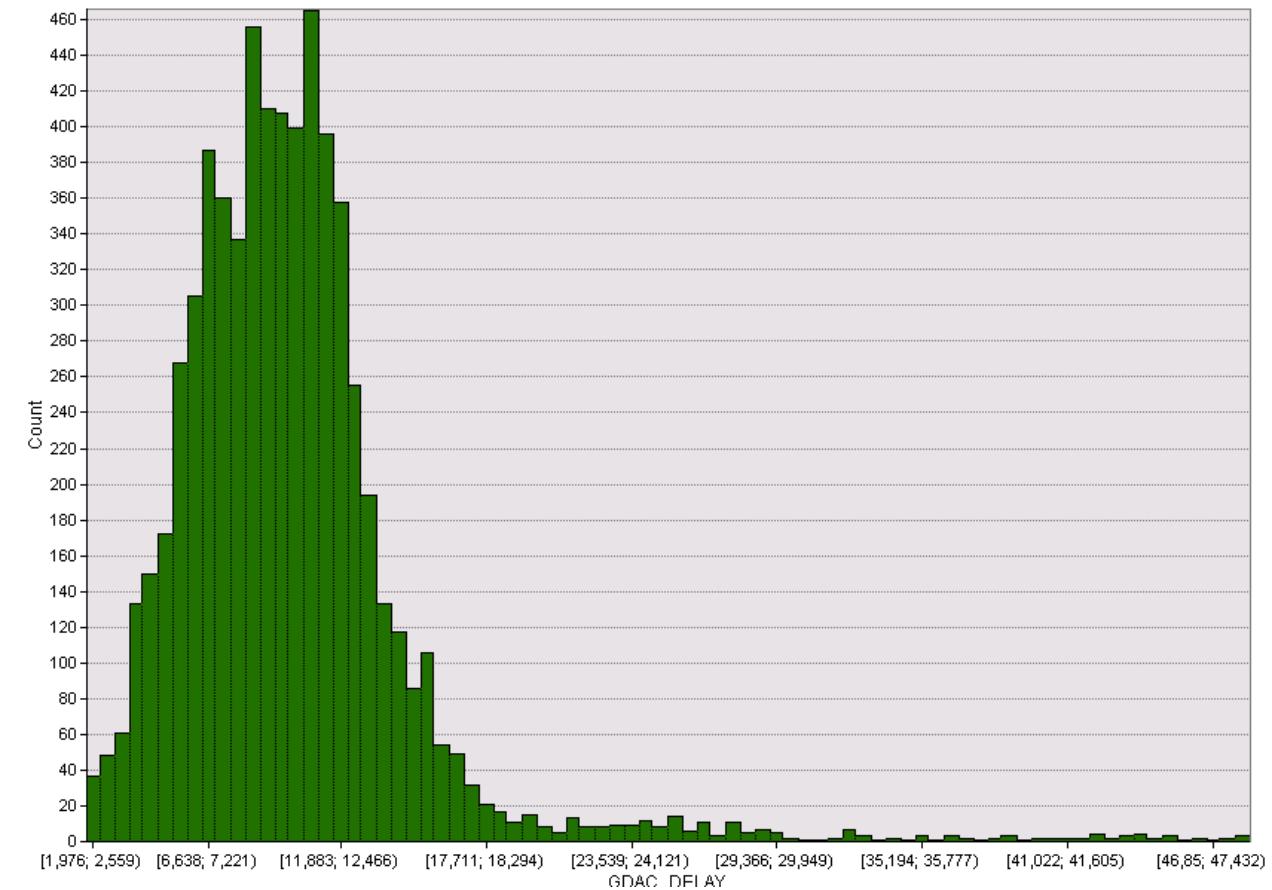


GDAC DELAYS (US) CORIOLIS

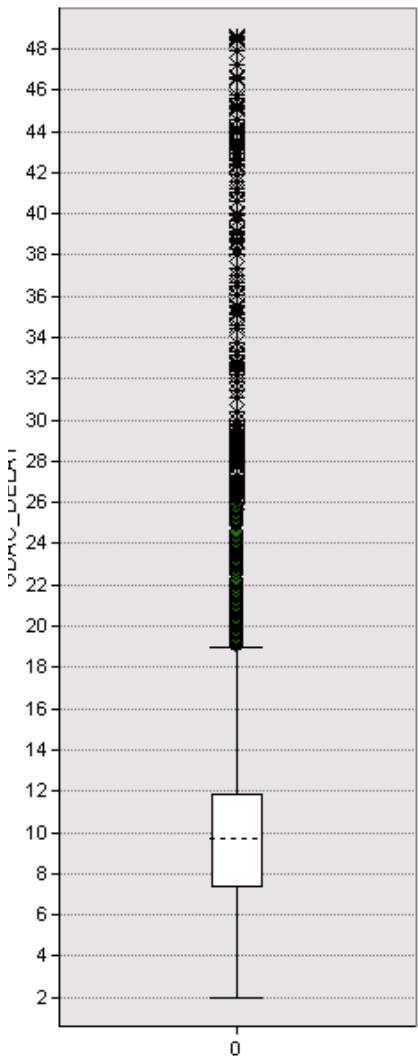


# AOML

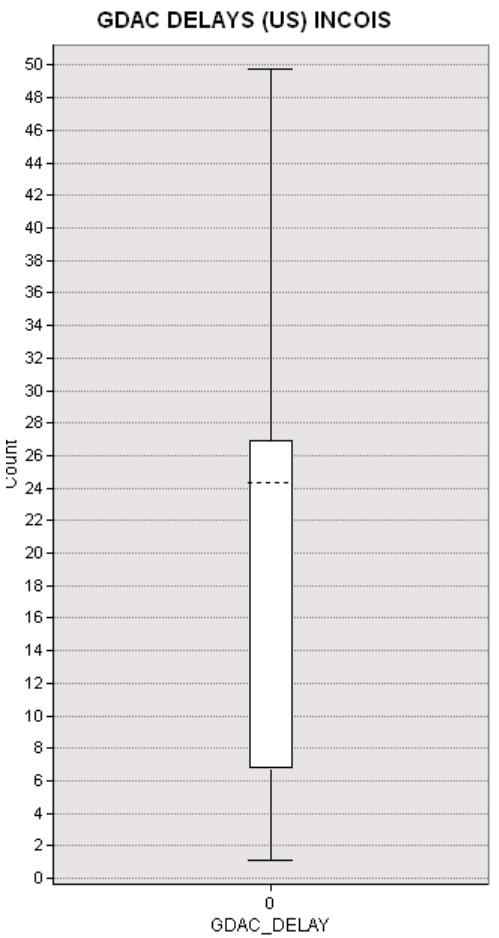
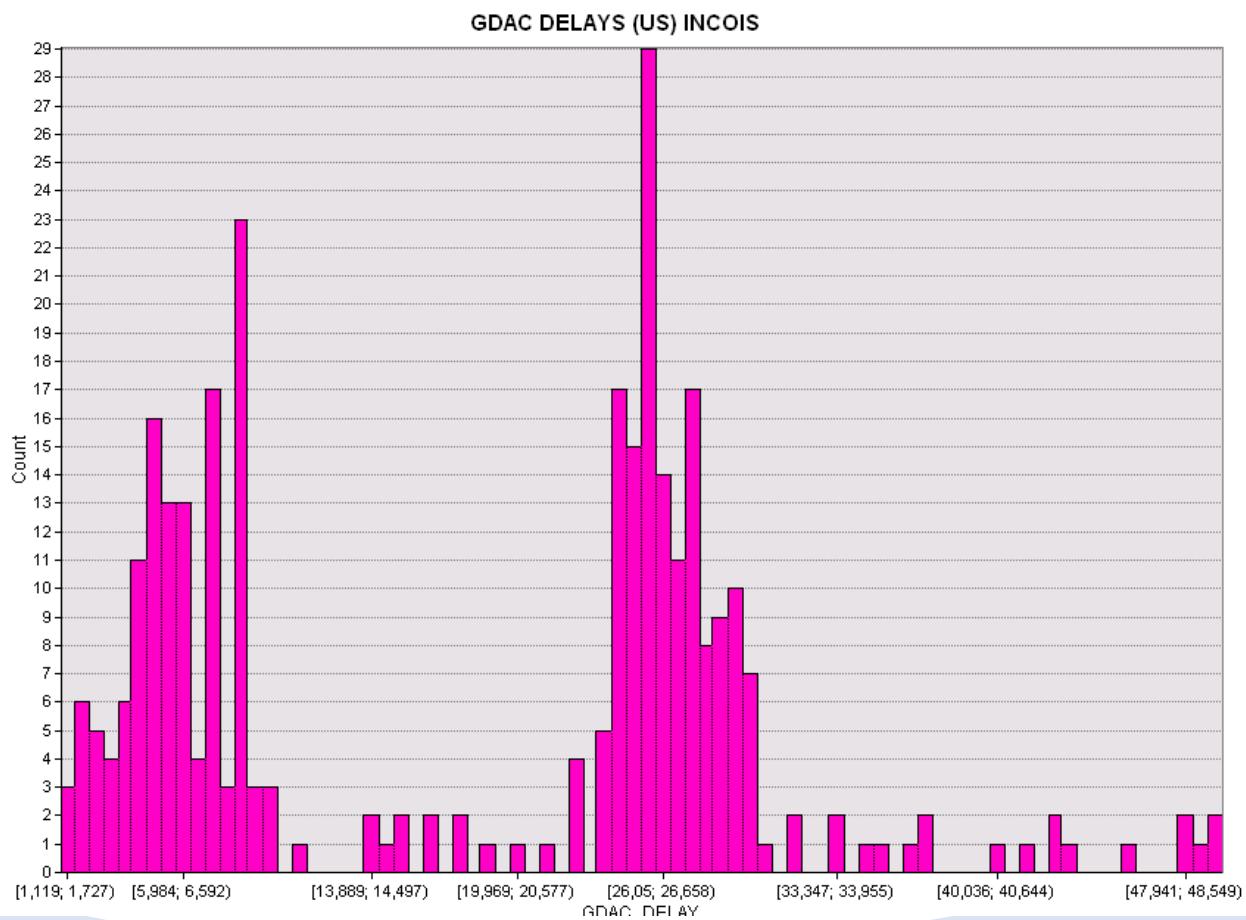
Graph of ARGO\_GDAC\_092015



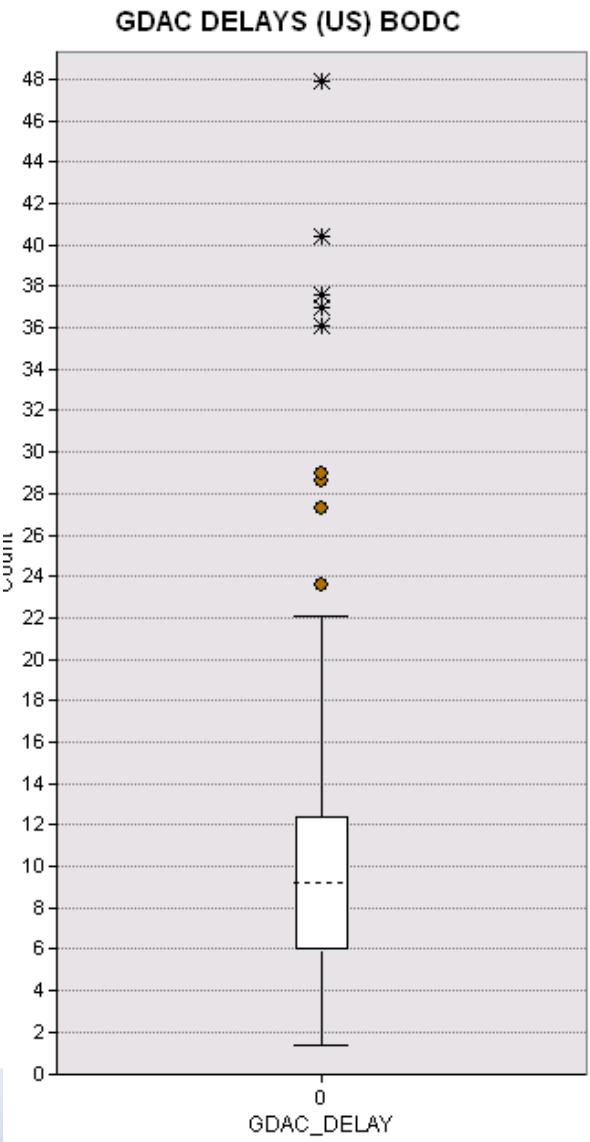
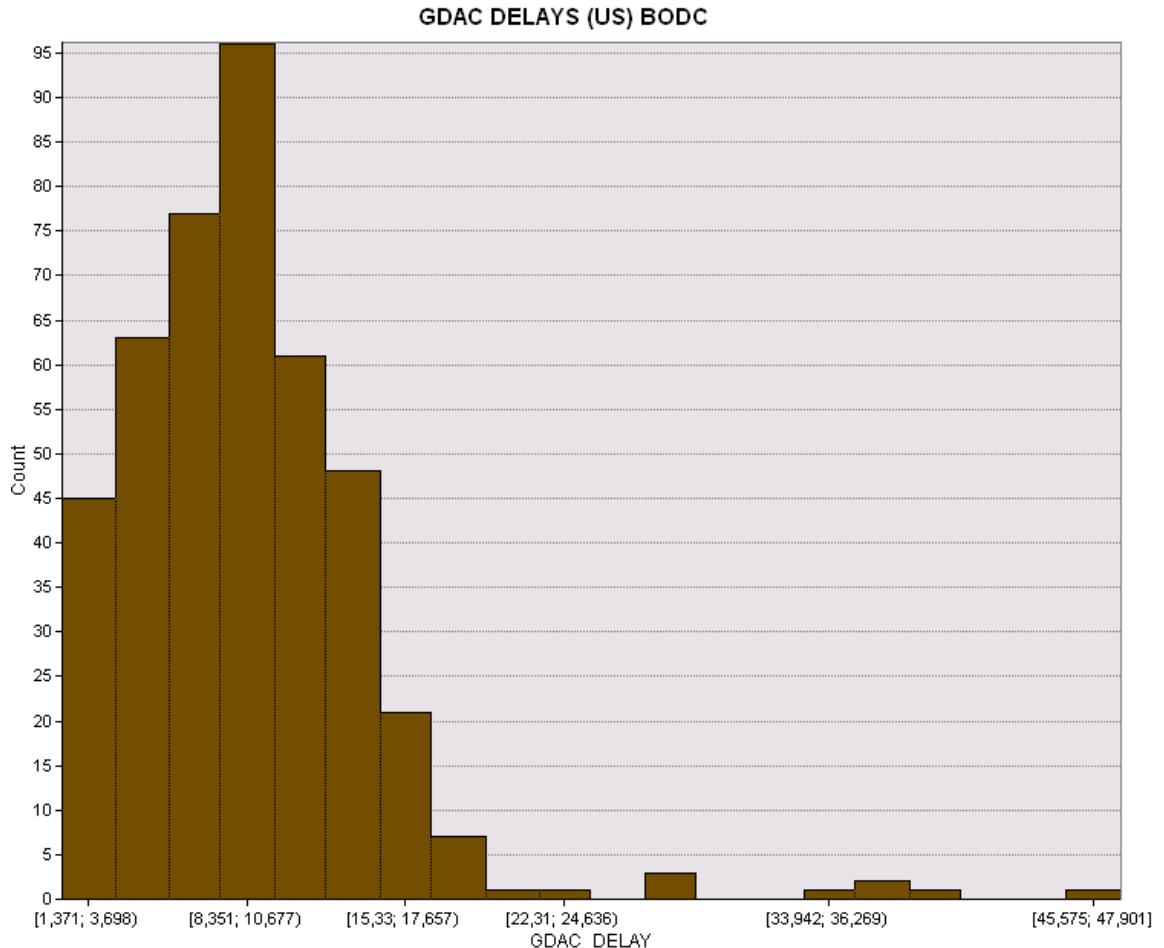
GDAC DELAYS (US) AOML



# INCOIS

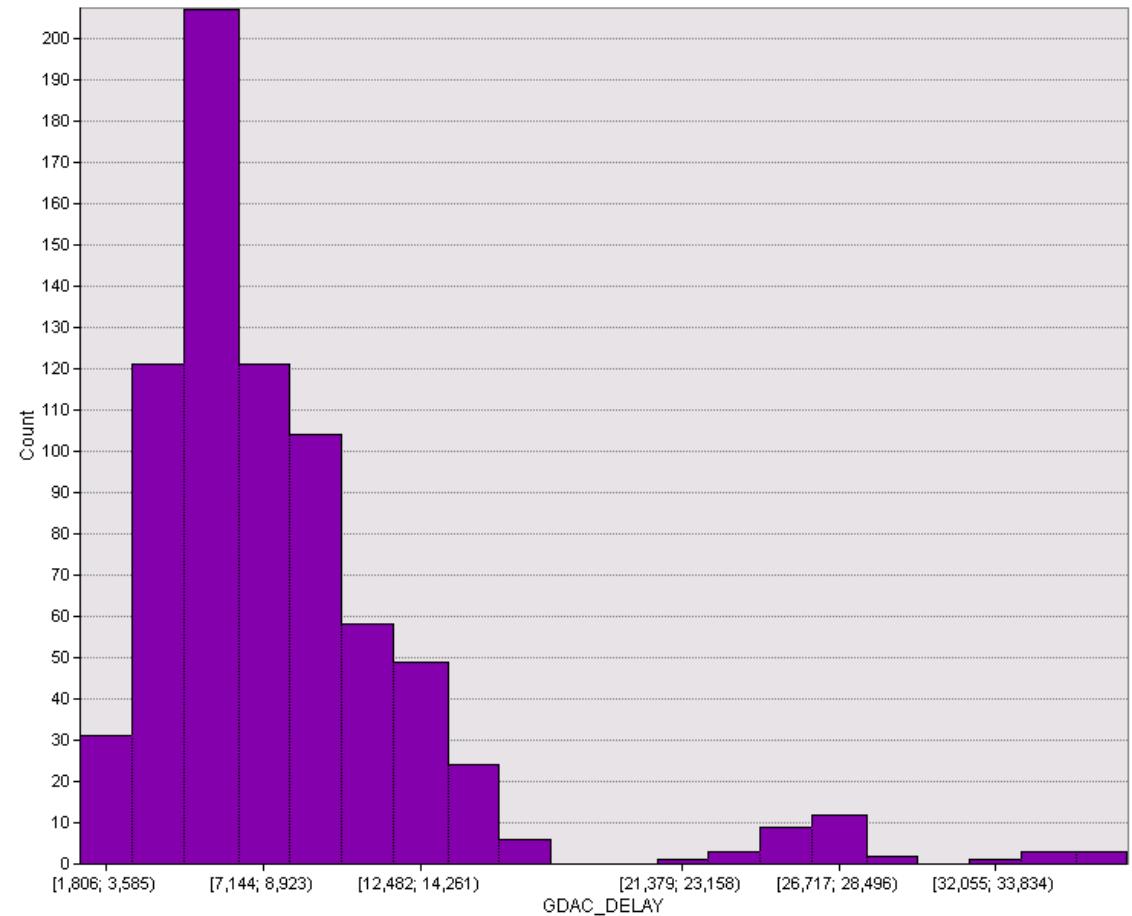


# BODC

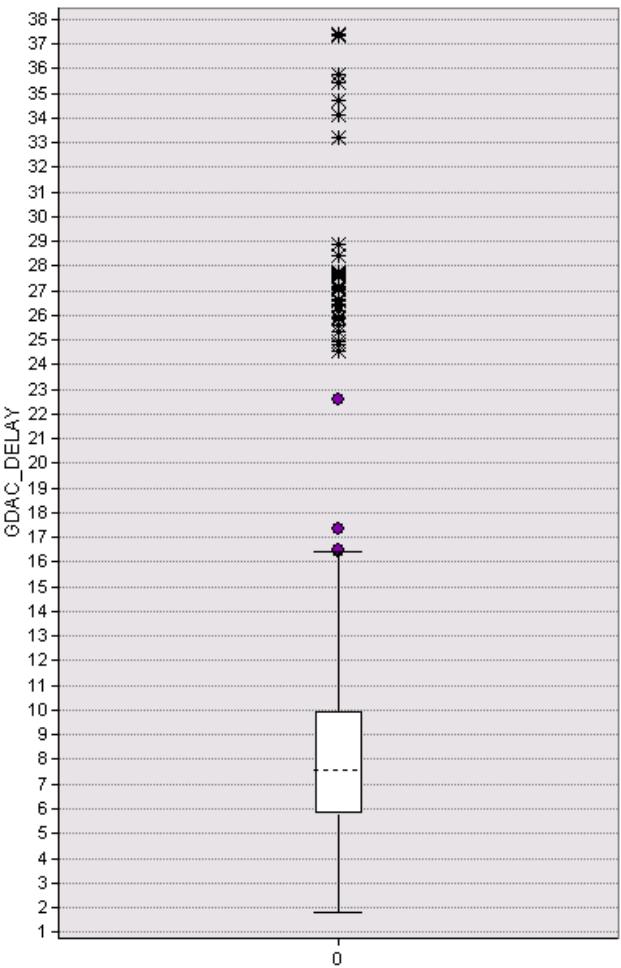


# JMA

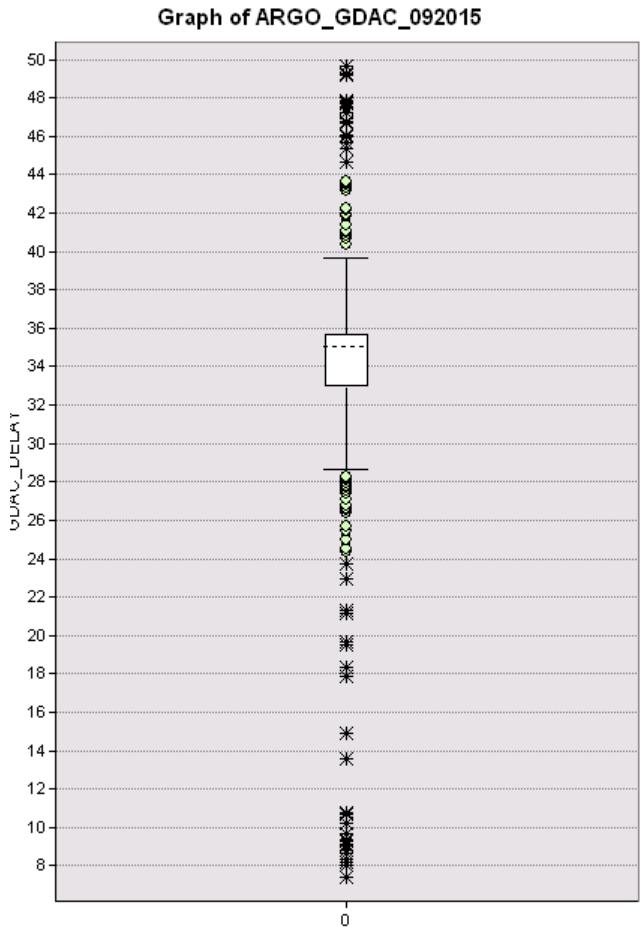
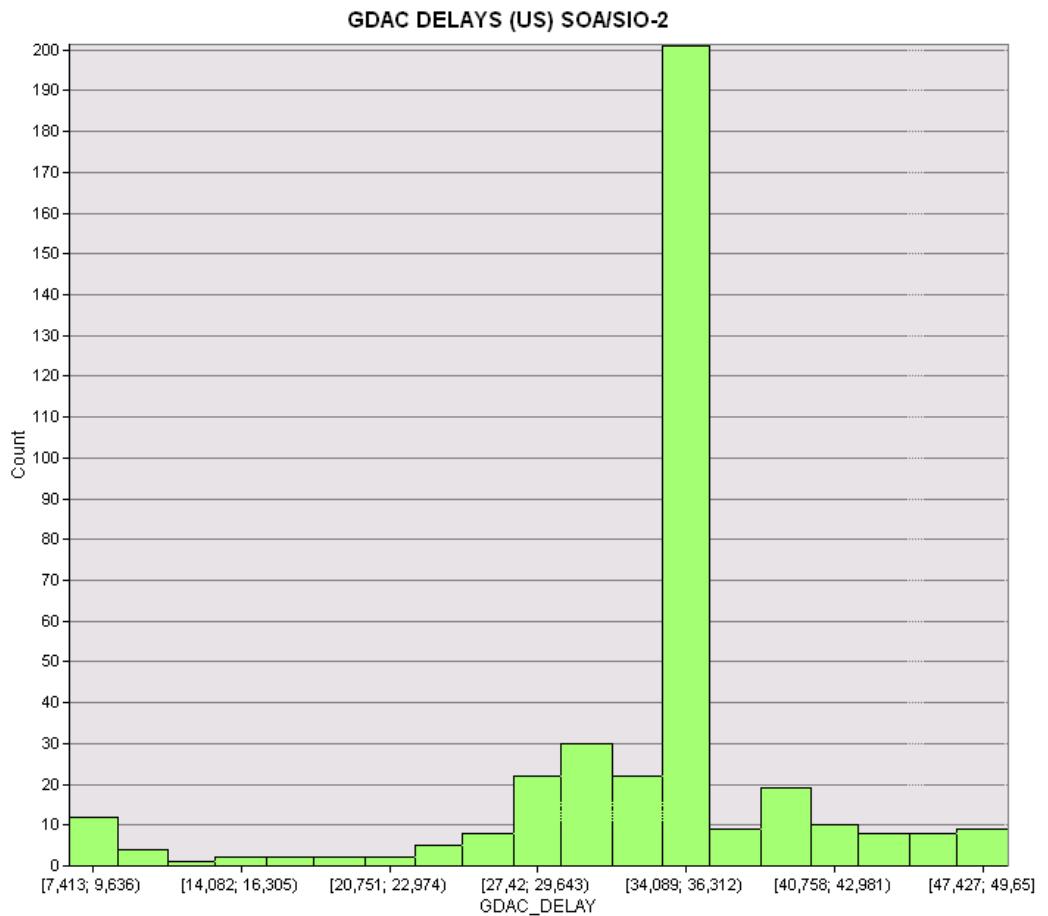
GDAC DELAYS (US) JMA



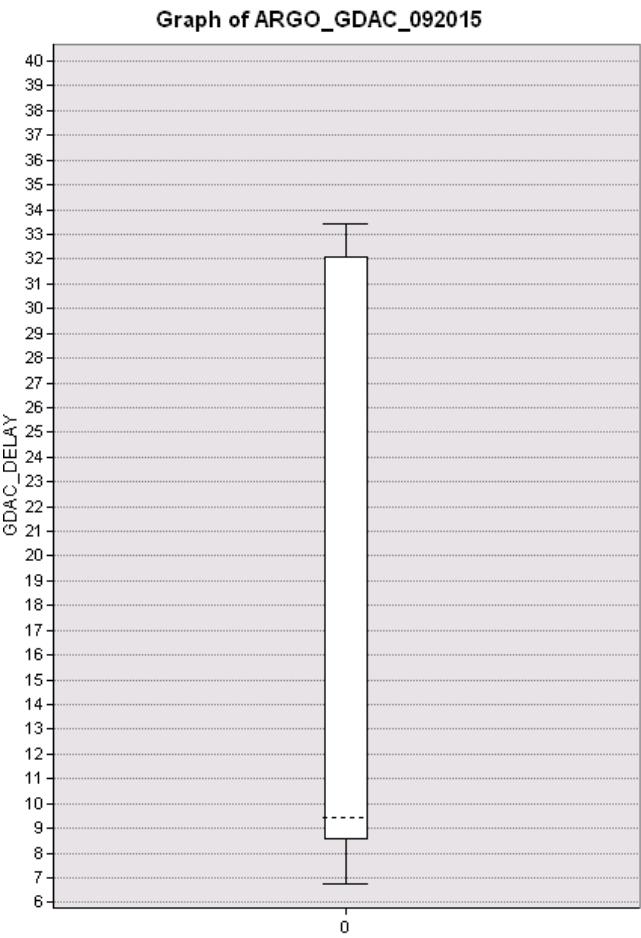
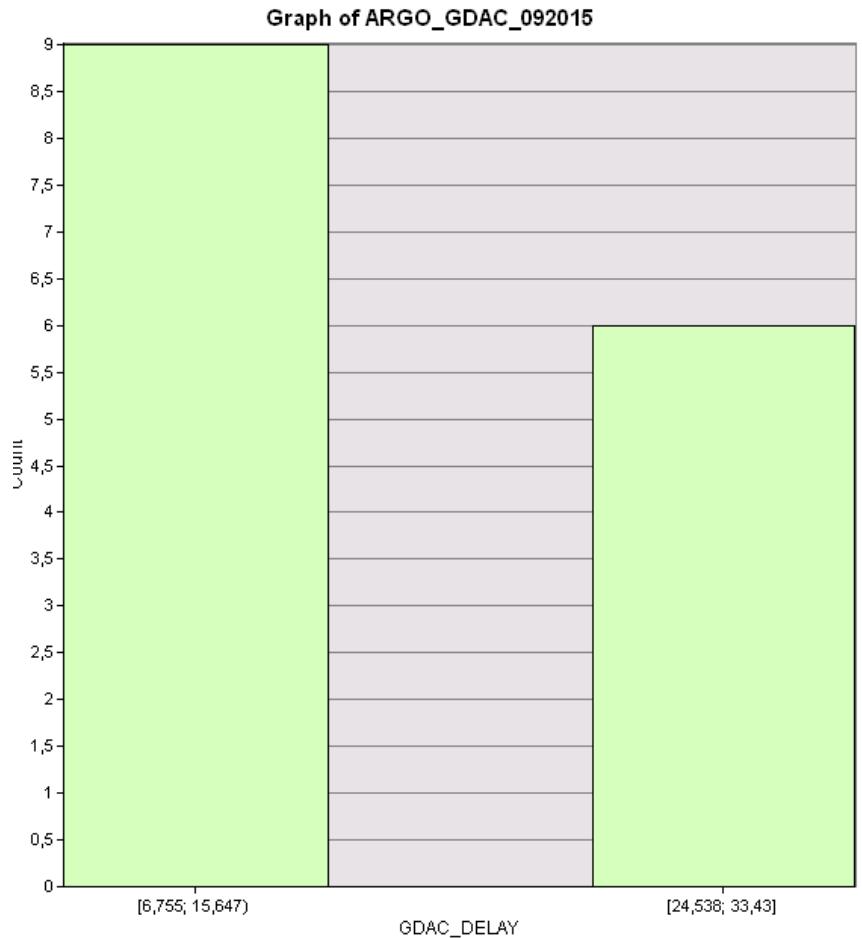
Graph of ARGO\_GDAC\_092015



# SOA/SIO-2

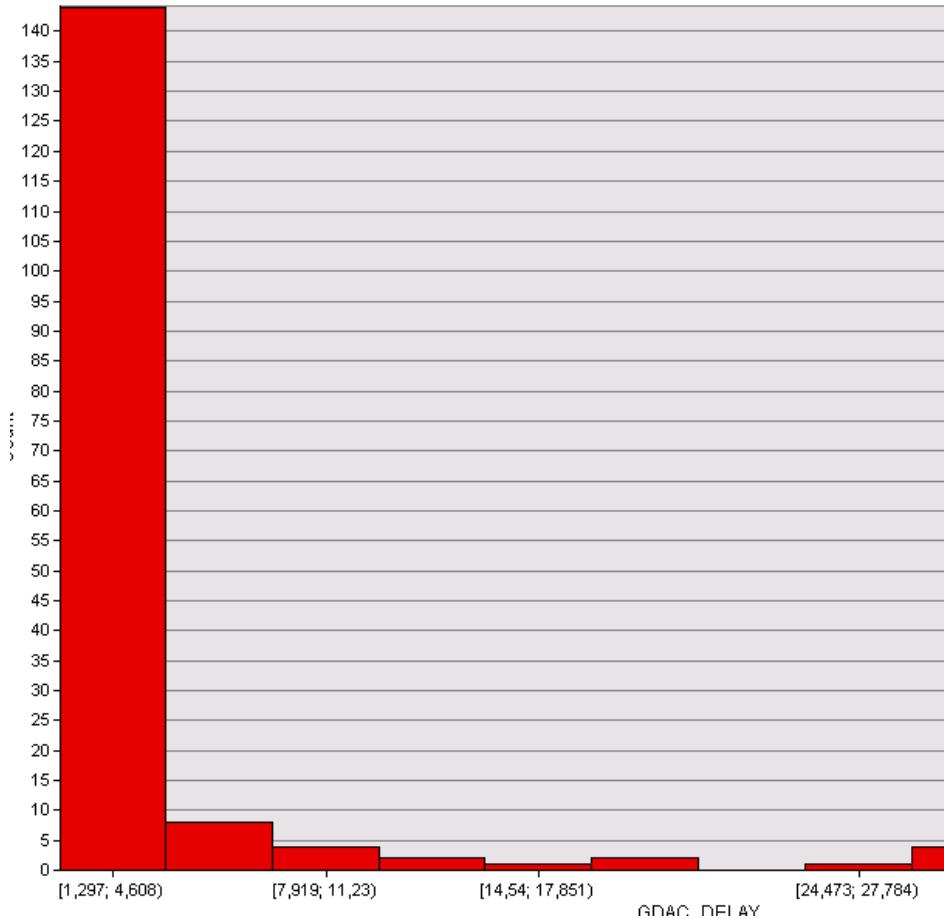


# NMDIS

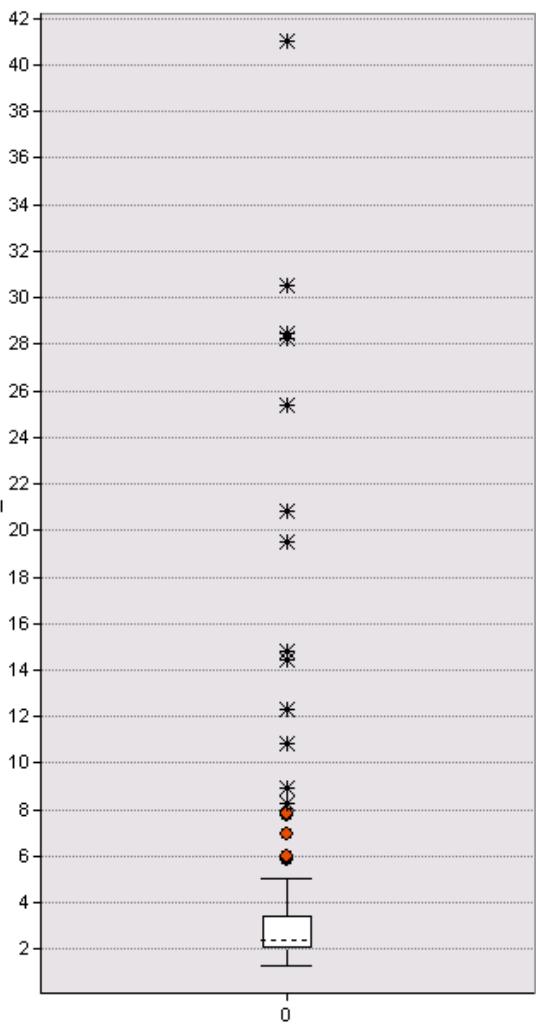


# ISDM

GDAC DELAYS (US) ISDM

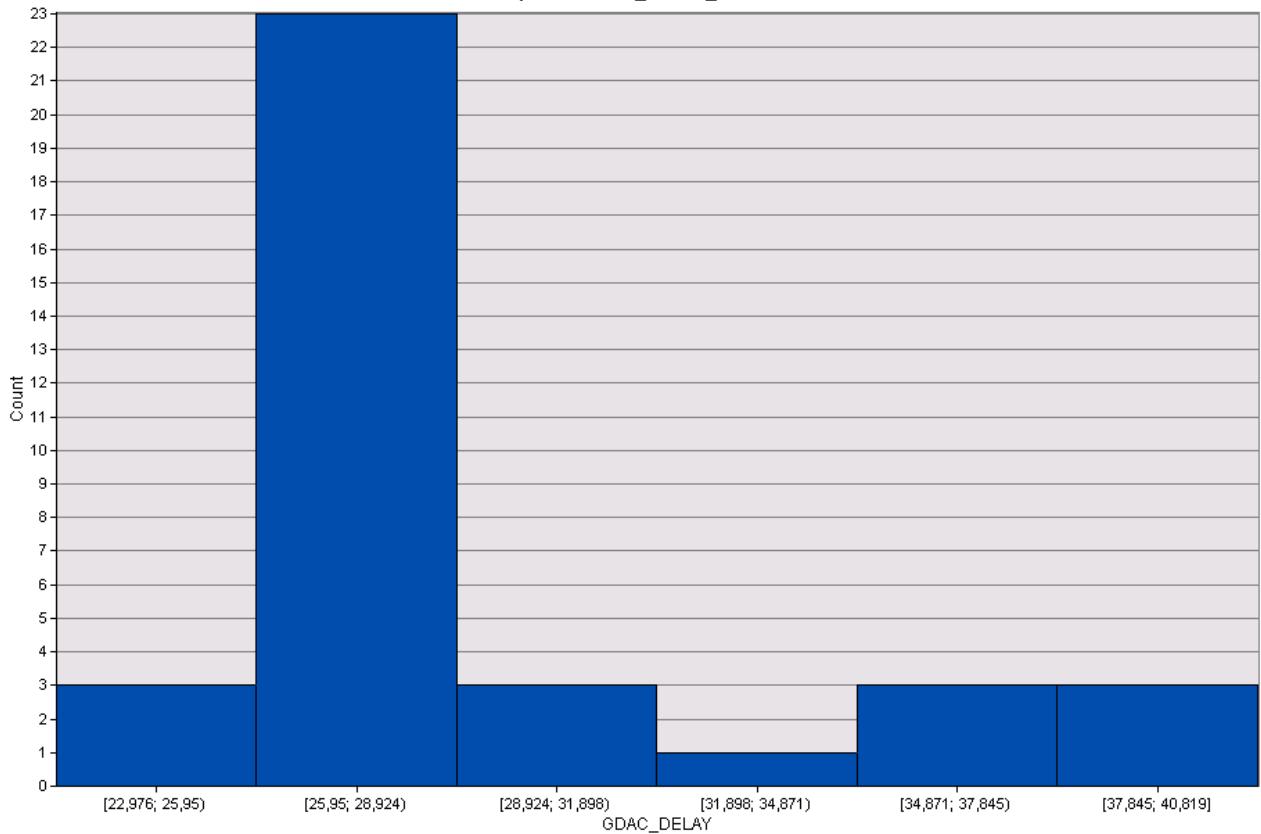


Graph of ARGO\_GDAC\_092015

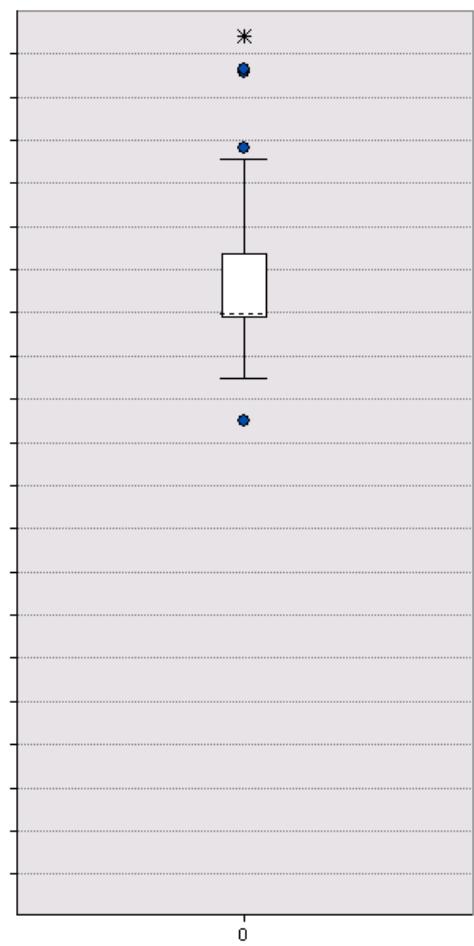


# KMA

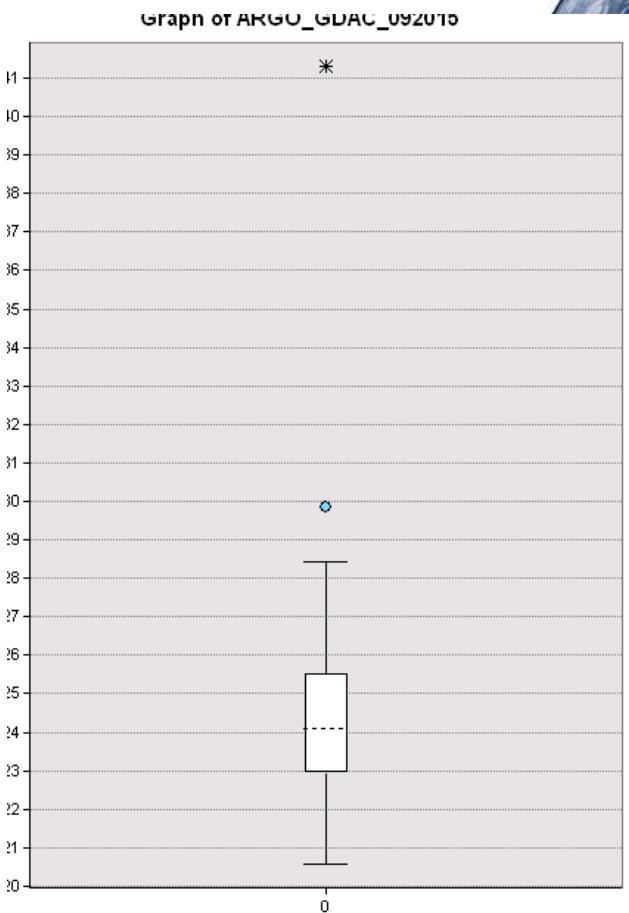
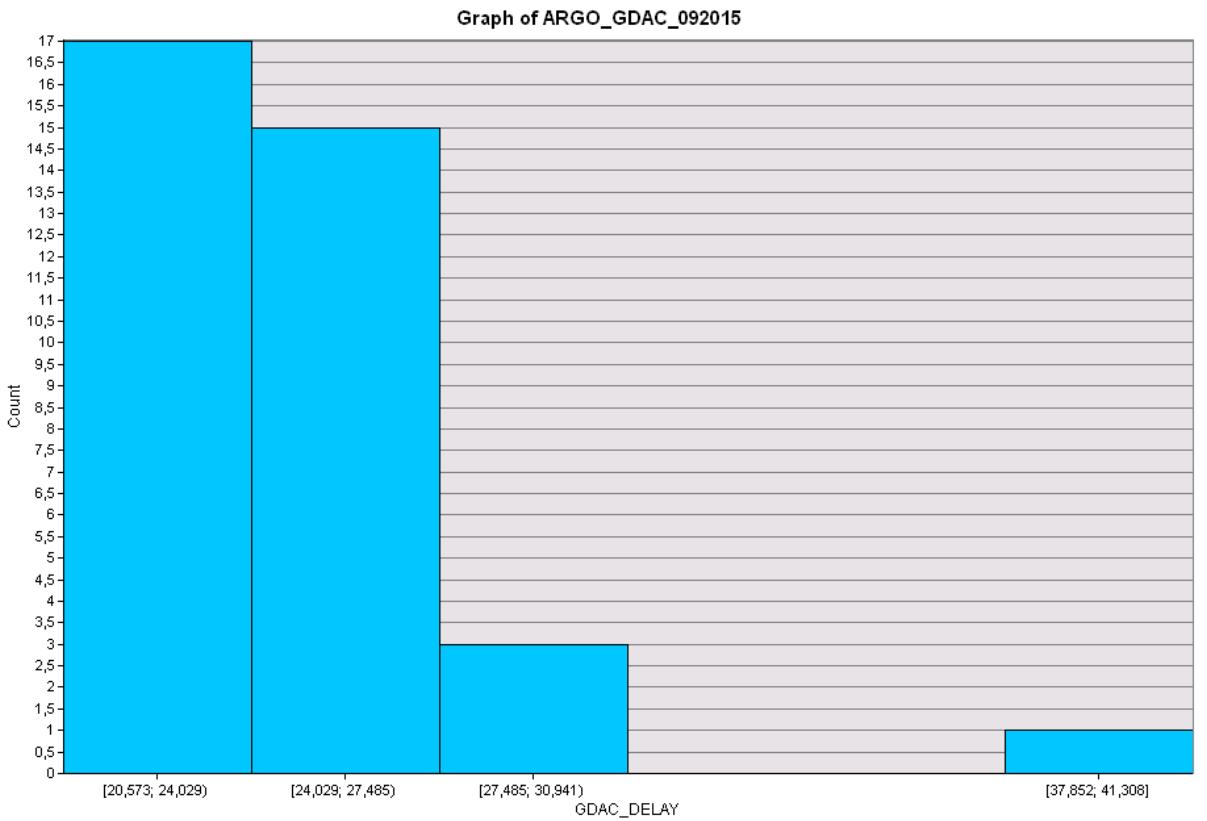
Graph of ARGO\_GDAC\_092015



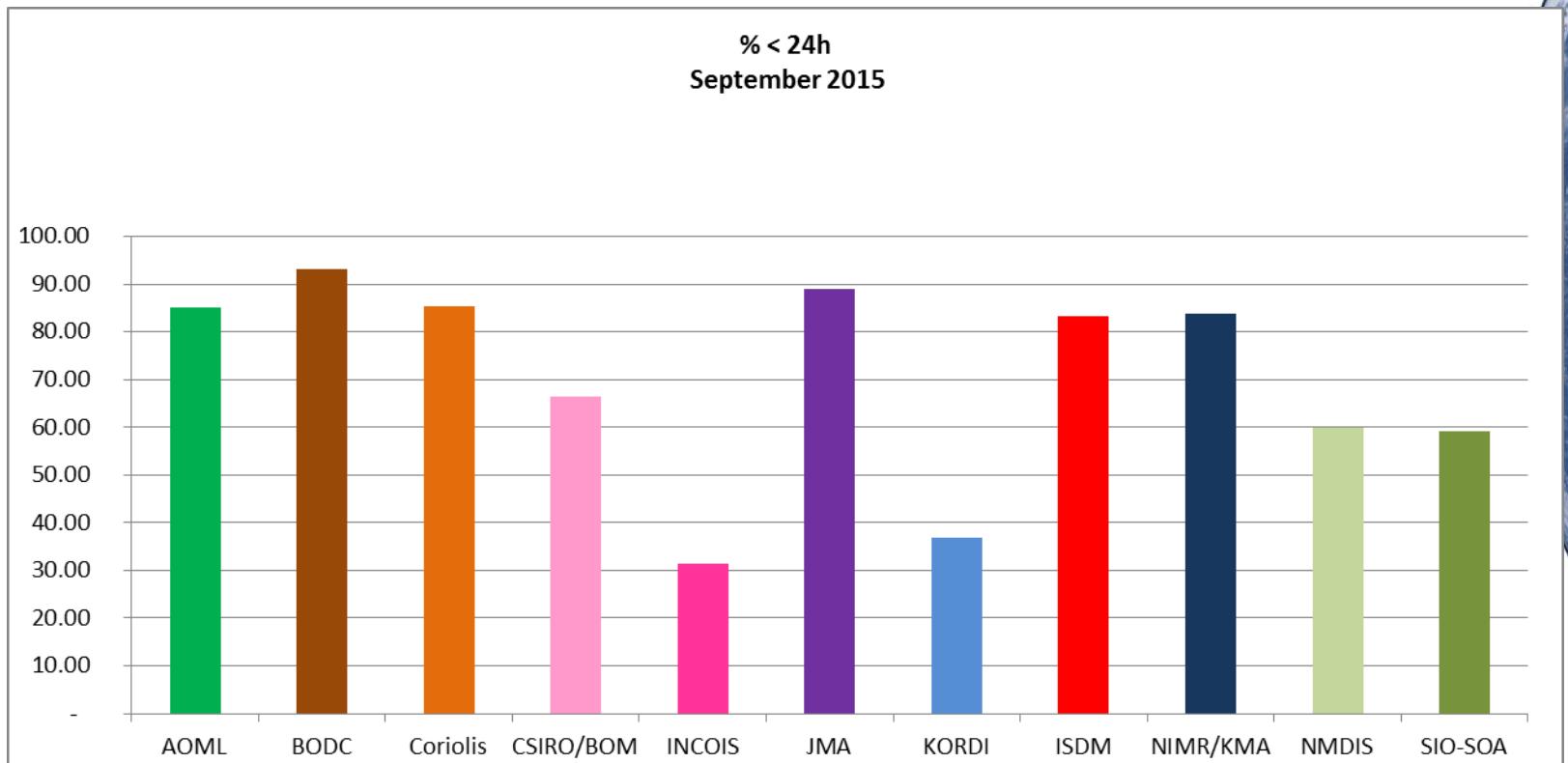
Graph of ARGO\_GDAC\_092015



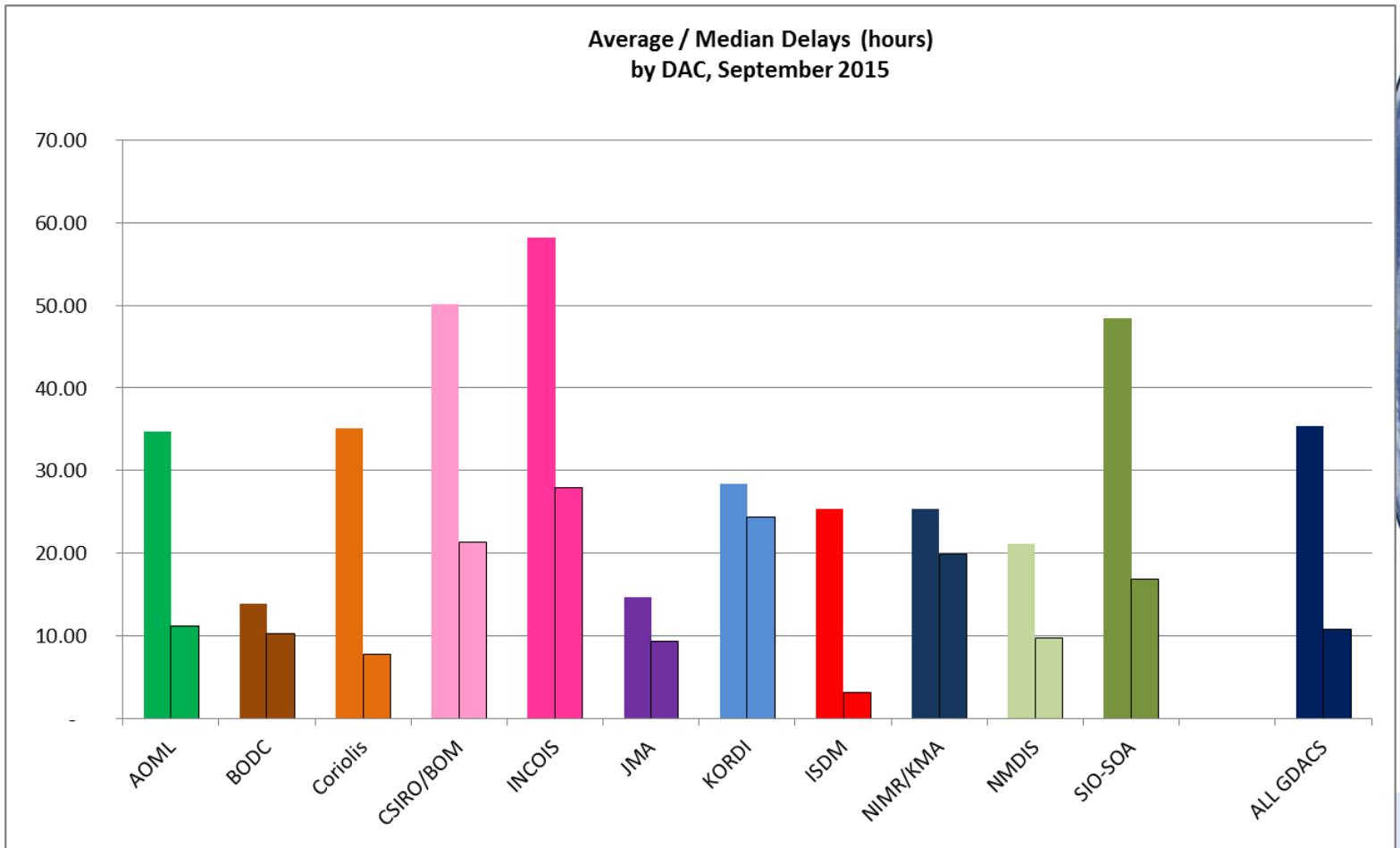
# KORDI



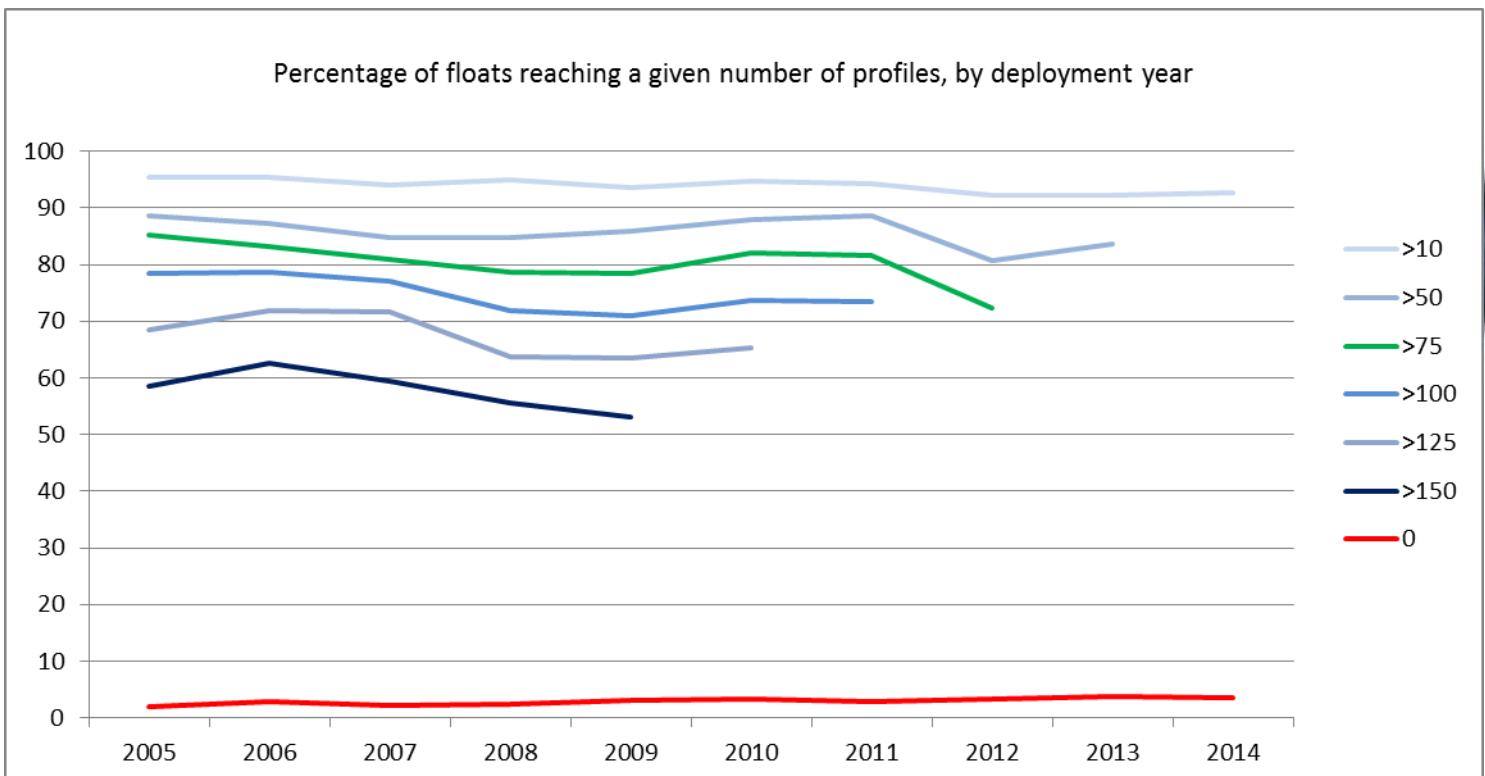
# GDACs Timeliness, DACs



# GDACs Delays, DACs



# Reliability



# Argo / not Argo ?

- Need a clear policy. Challenging.
- Need to sort out the existing (not only new ones)
- Not only GDAC data issues ...
  - International regulations (transparency)
  - Best practices (cycling, sampling, beached floats retrieval)
  - GTS RT distribution for most of operational users
- Some metadata should tag clearly floats to make the difference with Argo, R&D and « non core Argo » floats
  - Preserve the « Argo label quality »
  - Allow interoperability for data validation, reliability tracking, transparency
  - Allow some diversity
- New metadata? ARGO\_GROUP?
- New directory (hidden to public users) at GDACs? « Quarantine »

# Summary & Challenges

- High level of international cooperation
  - Missing new key national partners
  - Need help from civil society?
- Contributions from major players is likely to decrease (US, Japan, Australia) due to flat (< inflation) or decreasing funding
- Europe or Asia won't likely compensate this
- Good diversity of industrial partners
  - Float reliability not progressing anymore - won't compensate neither
  - Diversity required for sensors, and telecommunication systems

# Summary & Challenges

- Well established data system (advanced data/metadata format)
  - Major format upgrade (sensors diversity)
  - Continuous efforts to provide a high quality dataset (70% DMQC achieved)
  - Seek convergence between GTS/WIGOS, GDACS, Seadatanet (e.g.) metadata reference tables
  - Keeps improving delays but progress required for some DACs
  - Check NOAA/OSMC feedback on CF compliancy
- Increasing data uptake
  - Do we know well our users ?
  - Do we prepare the future ?
  - Need to keep innovating and move from dir/files to the cloud/API
  - ERDAP installation at both GDACs could be simple addition

# Summary & Challenges

While Argo will probably reach a top in 2015,  
a degradation of the array in the next years is  
anticipated

Thank you.

# Barcelona World Race 2014-2015

- <https://youtu.be/n7ObTd8AfWY>



Photo Gilles Martin-Raget / Barcelona World Race

On behalf of Charles Sun, Tim Boyer reported that the NOAA's National Centers for Environmental Information (NCEI) at Silver Spring, Maryland continued to operate the Global Argo Data Repository (GADR) (<http://www.nodc.noaa.gov/argo/>) during 2015. The size of Argo monthly snap shot (i.e., tar ball) continued to grow. The size of the latest Argo monthly tarred-zipped file is about 8.35 GB for September 2015, increased from 5.36GB during the same month last year and is available at <ftp://ftp.nodc.noaa.gov/nodc/archive/arc0022/0042682/>.

The number of monthly-averaged data downloaded from GADR was increased, approximately 40.8 %, to 159 GB in 2015. However, the number of monthly-averaged distinct hosts severed continued to go down from 2,177 in 2014 to 1,158 in 2015.

No Action Items assigned to GADR during ADMT-15.