Argo Australia – 2016 Activities

Report to the 18th Argo Steering Team Meeting

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1. Status of implementation

Floats deployed and their performance

Australia currently has 386 floats actively reporting good data across the Indian, Pacific and Southern Oceans (Figure 1).

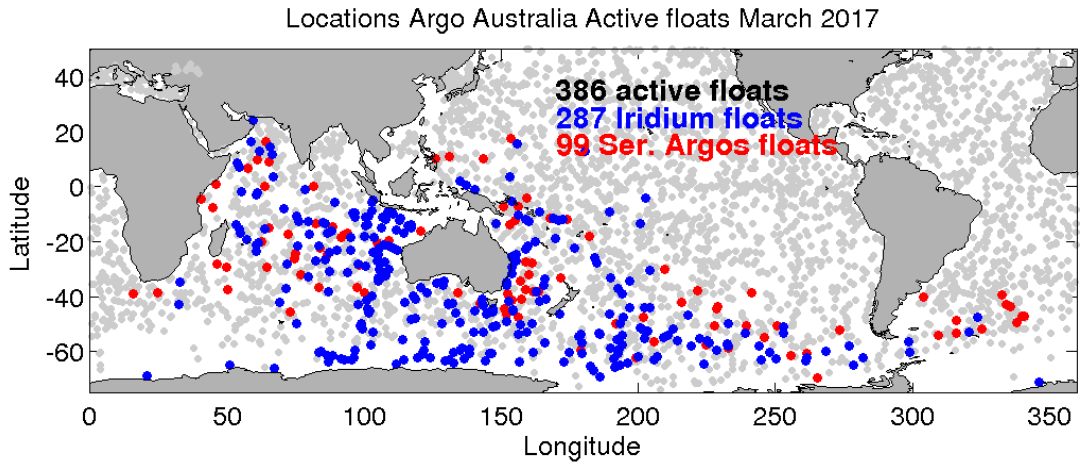

Figure 1. Locations of active Argo Australia floats (colours – defined as float reporting in the last 15 days north of 55°S, in the last half year south of 55°S) as of January 2016 with active international floats in gray. Australian floats using Iridium Communications are in blue and those using Service Argos in red.

In the calendar year 2016, the program deployed 75 floats mainly spread throughout the western Pacific, Indian and in the Southern Oceans (see Figure 2). Our focus on seeding the area between Indonesia and northwest Australia continued. Again, we particularly thank Katsurou Katsumata from JAMSTEC for his outstanding assistance and we thank BPPT, Indonesia who facilitated clearance). This is a very hard area to reseed, often having poor coverage and so this opportunity was invaluable. Other key vessels were the RV Kaharoa and the RV Investigator, Australia's new research vessel, which entered its first year of science voyages.

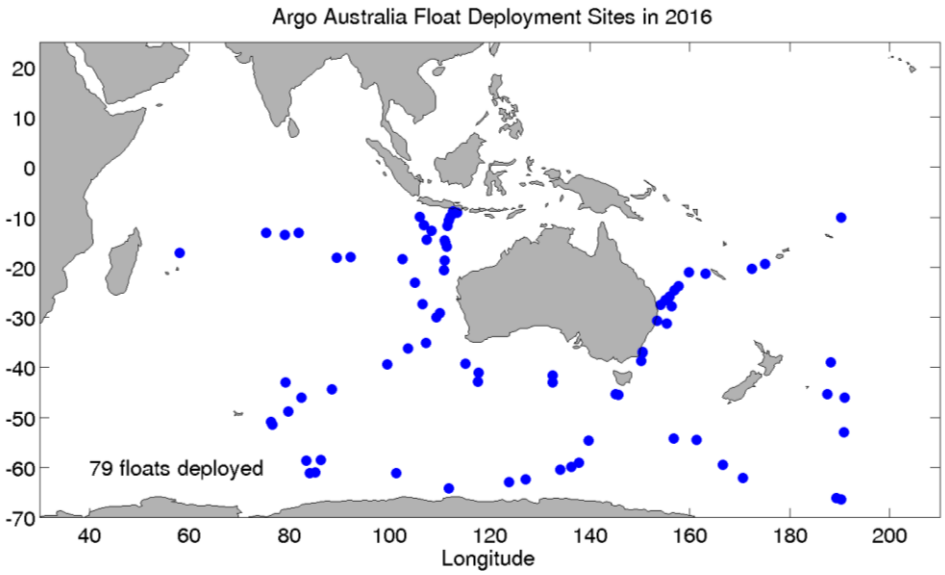

Figure 2. Locations of float deployments in 2016.

We also facilitated many float deployments from the P15S GO-SHIP reoccupation on RV *Investigator*, deploying over 45 floats in total, including deep SOLOs, many SOCCOM and core Argo floats for the US Argo program.

Several floats were deployed on the Antarctic shelf and slope and returned interesting data. However, many of these had very short lifetimes and have not re-emerged.

Technical problems encountered and solved

Rerouting our backup satellite communications to a direct Iridium reception antenna was completed due to the phasing out of dial-up options at the CSIRO. Our Iridium servers were also subject to illegal hacks and had to be taken down for several hours, checked, cleaned and reconfigured.

In house float testing and inspection continues to pay off with faulty batteries and leaks found, all of which were fixed before deployment.

Some Navis floats have been turning on prematurely. This is being investigated with SeaBird.

This year we have suffered an unusual number of failures on deployment and are not sure why. The mooted technical workshops will be much appreciated and this should be one of the topics.

Status of contributions to Argo data management

Ann Thresher attended her last meeting as ADMT co-chair and has now retired from the CSIRO. She continues to work as an Honorary Fellow on the IQuOD project. We thank Ann for her tremendous contributions to Argo and to international ocean data management in general. Rebecca Cowley has taken over Ann's position as Scientist in Charge of Operations, and she has joined the Argo Data Management Team.

Collaboration with INCOIS India and NMDIS China: We continue to work with the Indian Argo program and NDMIS as they use our ArgoRT software. Work includes coding for new data formats, Bio-Argo data and version 3.1 formats. A visit by a NMDIS programmer to Hobart greatly expedited the adaptation of the software for their program.

Metadata and Technical file Standardisation: Esmee van Wijk continues to work on standardization of metadata files and technical files. This requires substantial effort to review the name lists and understand the parameters, with the lists becoming large and complicated. A key issue is how much technical data needs to be published with a common syntax and how much can be kept in house with the archive raw data.

Status of delayed mode quality control (as of Feb 2017)

Total array including BGC, Bio, etc.			
Number of profiles	**category**		**Number of profiles**
33682	R files		27976
17079	eligible R files		15109
115621	D files		80438
132700	total eligible R + D		95547
149303	total files		108414
87.12961567	D as % of eligible		**84%**
77.44050689	D as % of total R + D		**74%**

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

After a huge effort, the new DM processing software that is written for V3.1 and includes oxyen DMQC capabilities, is now stable and being used routinely. Several new operators have been trained and are working on processing floats.

With the new software in place and again, after a substantial effort, DM statistics are getting closer to our goal. Another major achievement has been the QC of our oxygen data using the new software. Many of these data had languished for years in R format and their DMQC is a great milestone. Es Van Wijk, Tom Trull. Luke Wallace and Hugh Doyle are to thank for moving these data through.

DMQC of Trajectory data remains untouched challenge to date.

We also assisted SeaBird with the testing and development of the SBE61 for Deep Argo by mounting two instruments on our CTD frame during the P15S reoccupation. The preliminary results will be presented by Nathalie Zilberman during the meeting.

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

Argo Australia remains part of Australian Government initiative: an Australian Integrated Marine Observing System (IMOS; www.imos.org.au) for research infrastructure funded under the Education Infrastructure Fund (EIF) and the National Collaborative Research Infrastructure Strategy (NCRIS). Argo Australia also gets direct funding from CSIRO Ocean and Atmosphere (overheads and float acquisition), some salary support through the NESP Earth Systems Science Hub, in kind assistance (and sometimes acquisition) from the Bureau of Meteorology and also logistical assistance from the Royal Australian Navy. The Antarctic Climate and Ecosystem Cooperative Research Centre (ACE) has partly restored a key Southern Ocean contribution to Argo Australia through around 5 deployments per year for core Argo, and via floats to be used very close to the ice-shelves (PI: Dr. Steve Rintoul). Bio-Argo floats are being deployed as part of an Australia-India Strategic Research Initiative (PI Nick Hardman Mountford).

The IMOS contribution to Argo has been at levels of around 20-30% on past funding rates, and it was hoped that a five-year renewal of its host program, the National Collaborative Research Infrastructure Strategy, would occur in the May 2017 budget. This appears unlikely and another period of bridging funds at this flat level appears likely. On this basis, Argo Australia's deployment rate would drop from around 50 floats per year to around 25-30 floats per year. A positive development to combat this decline has been the establishment of an Australian Ocean Observation Partnership between IMOS, the Bureau of Meteorology and the Royal Australian Navy. A key activity is to secure ongoing support for key ocean data streams that have large operational uptake, such as that generated by Argo.

Argo Australia has about 2.5 full time equivalents (FTE) in data management, 1.5 FTE in technical support and preparation and 0.3 FTE in leadership and management.

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

Based on the information in hand, Argo Australia my only deploy around 25 floats in the coming year. Part of this has to do with a suspension of deployments in sea ice zones as the currently available versions of the new NAVIS and APEX controllers lack either the capability or clear track record of successful ice-avoidance.

In addition, we will continue to assist in funding R/V *Kaharoa* voyages for as long as we are able and hope to provide floats for her next trip.

As always, we will rely on the R/V *Aurora Australis*, the Australian Antarctic Division's research vessel, to assist with deployments in the Southern Ocean, the RV *Investigator* and have been recruiting Tuna fishing boats for deployments into the Coral and Tasman Seas.

It is possible that several Argo extensions might be funded when the NCRIS funding renewal does take place, including an ice, deep and BGC component. However, the level and target areas remain unfixed at present.

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

- Argo data are routinely used in the operational upper ocean analyses Australian Bureau of Meteorology (http://www.bom.gov.au/bmrc/ocean/results/climocan.htm).
- The dynamical seasonal forecasting system POAMA heavily uses Argo data for forecast initialization, including assimilating salinity which great improves the analysis – Oscar Alves, Australian Bureau of Meteorology
- CSIRO Oceans and Atmosphere Flagship, in collaboration with the Bureau of Meteorology Research Center, has developed an ocean model/data assimilation system for ocean forecasting and hindcasting. Argo data is the largest *in situ* data source for this system. The ocean reanalysis products can be found here: http://wp.csiro.au/bluelink/global/bran/.
- The OceanMap forecasts are now routinely published and are available via the Bureau of Meteorology website.
- Many students in the CSIRO/University of Tasmania QMS graduate program and University of New South Wales are utilizing Argo data in their thesis studies.
- The NESP ESS Hubs Ocean Change program heavily uses Argo data and its products for sea level rise, ocean change detection, model validation and development work.
- The major e-Reefs project, a shelf downscaling and forecasting system, relies on Argo data to set the offshore ocean conditions.
- The Antarctic Climate and Ecosystem Cooperative Research Centre's Ocean program also heavily relies on Argo data, and are particularly interested in data in the sea-ice zone.

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

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

5. Issues to be raised with the Argo Steering Team

We are concerned about the reliability of the new controllers on two key platforms used by Argo Australia, and are interested in collaborating across the international programs in efficiently trouble shooting and debugging these in order to minimize premature failures in this next generation of platform.

6. CTD cruise for Argo calibration purposes

The P15S GOSHIP section of 110 stations was completed in July 2016. The data have been sent to CCHDO and hopefully will rapidly make their way into the Argo Reference data base.

7. Argo Publications

We routinely update and synchronize our publications list.
(http://imos.org.au/imospublications.html) with that on the IAST website.