Australian Argo National Data Management Report

ADMT18

Hamburg, Germany, 29 November-1 December, 2017

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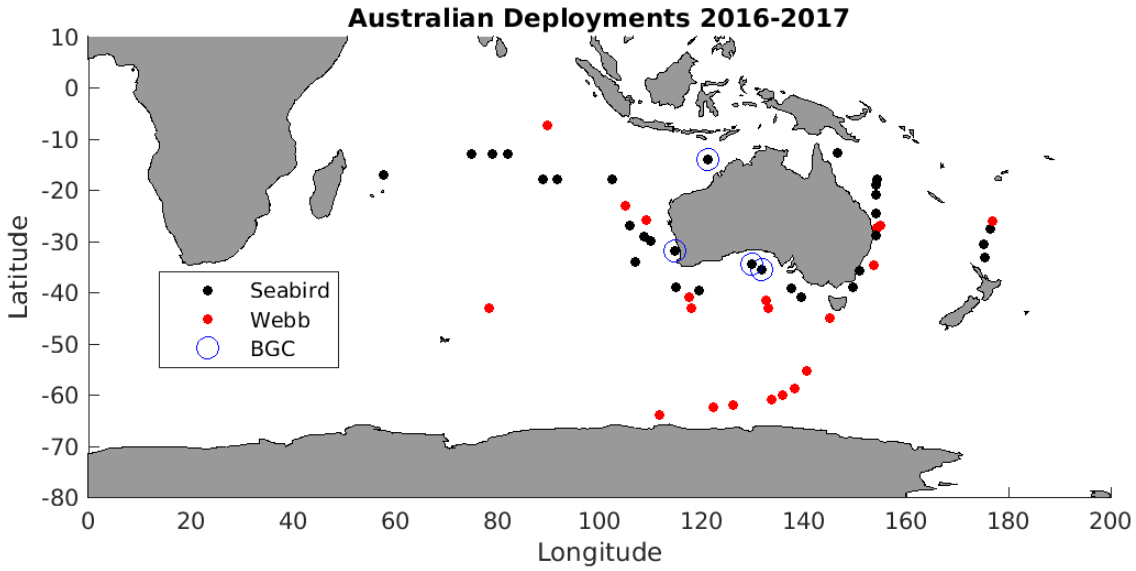
Status of Array

Australian deployments in 2016-17



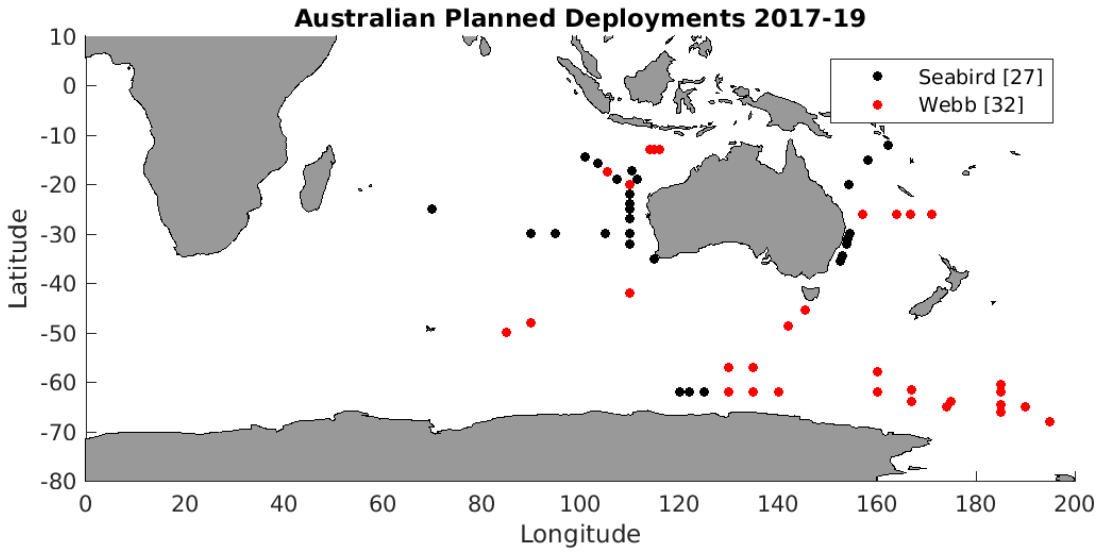
Australian Argo deployments between August 2016 and August 2017.

Australia has deployed 51 floats since the last meeting, including 4 Seabird Bio-Argo models.

We currently have 442 floats listed as 'live' though this includes some that are under ice or have been missing for over a year, from a total of 802 deployments since 1999. Contributors to the Australian Argo program include the Australian Bureau of Meteorology (ABOM), Australian Defence, the Integrated Marine Observing System (IMOS) and the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE-CRC).

Australian Deployment plans 2017-19:

Approximate deployment locations for Australian floats currently in the lab and being purchased are shown below. We will continue to reseed the Southern Ocean, testing the Webb APF11 floats, and focus on gaps around Australia and into the Indian and Pacific Oceans.



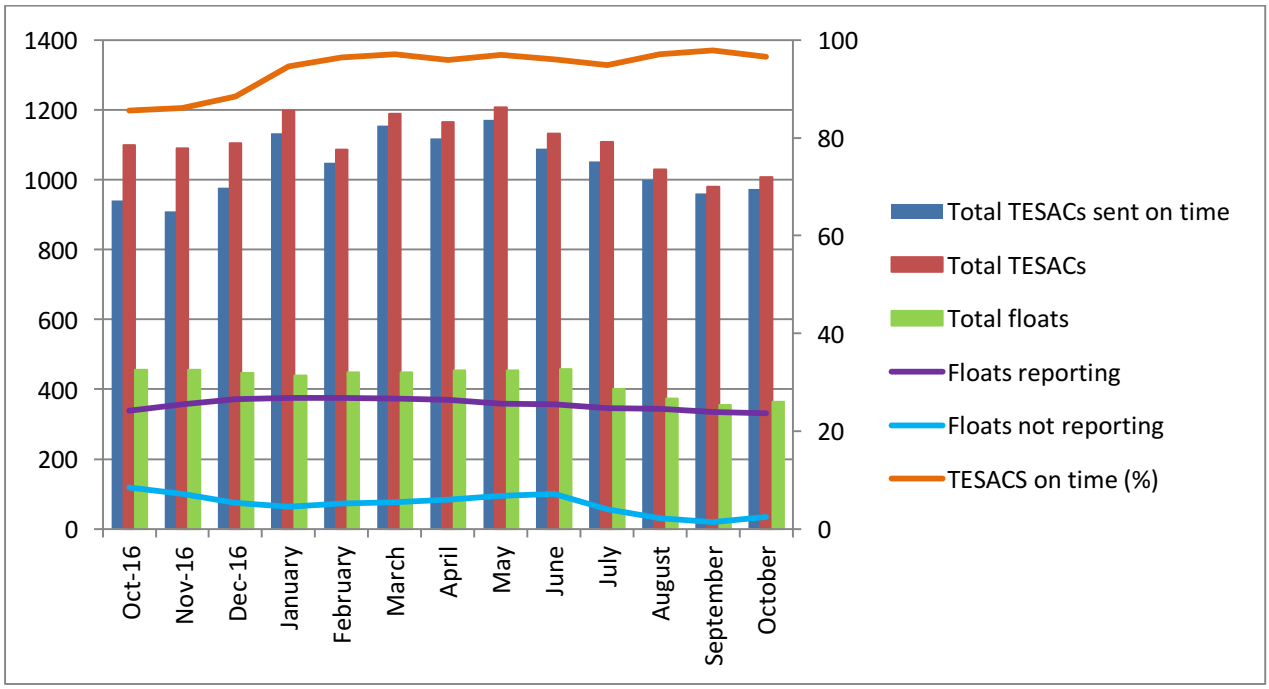
Locations identified for new float deployments. Floats will be deployed from December 2017 to January, 2019.

Issues impacting data delivery in 2016-7:
Rebecca Cowley has taken over the realtime data management from Ann Thresher at CSIRO, and Lisa Krummel continues to maintain the same RT code at the ABOM. Over the last year, there have been some changes to the RT code and the method of data handling between the ABOM and CSIRO. In addition, the ABOM has been upgrading their server and this is proving to be a long changeover
The net result is that there has been an improvement in efficiency of data delivery to the GTS.

Software development:
CSIRO has begun a re-write of the RT code. Over the last decade, the ArgoRT Matlab software has evolved and grown to incorporate the new float types and formats, and is now in need of a complete re-write. We have an in-house software developer working in Python and we are building postgres databases to hold the metadata and float profile data. We plan to test the new software in the coming year.

Data Acquisition and delivery to the GDACs and GTS:
Our aim is that raw data is processed within a maximum of 24 hours of delivery from either Argos or Iridium. We are achieving this for most of our floats. The data is issued to the GTS in both BUFR bulletins and TESAC messages by the Bureau of Meteorology (AMMC). These messages are generated 8 times daily.

Delays in data delivery have improved in 2017 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.



Summary of the timeliness of the Argo Australia GTS delivery for 2016-7.

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.

Home page for Argo Australia (IMOS)
http://imos.aodn.org.au/webportal/
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/ ;

Statistics of Argo data usage:
Argo data is downloaded to a local mirror daily using the rsync capability.

Argo usage is a difficult list to compile, as Argo data are now being used routinely by many researchers nationally and globally. 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.

Argo data uploaded to the GTS is accessed and exploited by many operational forecast centeres, including:

- Australian Bureau of Meteorology (BoM);
- UK MetOffice;
- Mercator Ocean (French operational ocean organisation);
- Naval Research Laboratory and NAVOCEANO (US Defence);
- Japam Meteorological Agency (JMA);
- Nansen Environmental and Remote Sensing Center (NERSC; Norway's operational ocean forecasting organisation);
- and others.

Most operational ocean forecast centres – a sub-set of which is listed above – use Argo data, together with other publically available data (e.g., satellite sea surface temperature, satellite altimetry, XBT, TAO) to initialize ocean forecasts. Within Australia, Argo data is used to initialise multiple ocean and ocean-atmosphere forecast systems, including:

- OceanMAPS – BoM's operational Ocean Modelling, Analysis and prediction System (www.bom.gov.au/oceanography/forecasts/index.shtml) – producing daily, 7-day, publically-available, global ocean forecasts;
- POAMA – BoM's operational Predictive Ocean Atmosphere Model for Australia (www.bom.gov.au/oceanography/analysis.shtml) – producing weekly, 9-month, publically-available 14-member ensemble forecasts of the climate;
- eReefs – CSIRO's 4-km resolution forecast/hindcast model for the Great Barrier Reef – producing daily, 4-day forecasts for project partners;
- SAROMS – SARDI's 1-4 km resolution forecast/hindcast model for waters off Southern Australia – producing regular forecasts and scenarios for project partners;
- ROAM – Royal Australian Navy (RAN) Relocatable Ocean Atmosphere Model (ROAM) – producing multiple (typically 5-10, depending on need) regional, high-resolution (2-5 km) forecasts in regions of interest;
- BRAN – CSIRO's Bluelink ReANalysis system – producing annually-updated 5-25 year, global ocean reanalyses, using Argo R- and D-files;
- BRAN-NRT – CSIRO's Near-Real-Time version of BRAN – producing monthly updates of BRAN, using Argo R- and D-files;
- CARS – CSIRO Atlas of Regional Seas (www.marine.csiro.au/~dunn/cars2009/) – a publically-available, global ocean climatology (an updated version of CARS is in production).

Argo data also underpins other activities in real-time monitoring of the ocean, including:

- CARS, and other climatologies, are heavily used for quality-control systems, including Argo and SOOP XBT;
- OceanCurrent (oceancurrent.imos.org.au/profiles/) – primarily delivering ocean products based on satellite observations (SST and altimetry), but also displaying Argo profiles through an interactive web portal;

We report usage to our funders IMOS – the Argo report can be found at:
imos.org.au/imospublications.html

Delayed Mode QC (DMQC) Report:

We have made good progress towards our DMQC targets this year (Table 1). Currently, the DMQC percentage stands at 94% of eligible core Argo profiles. Core Argo is defined here as floats with the standard P, T and S sensors including floats in the seasonal ice zone. Our new software also allows us to DMQC the floats with dissolved oxygen sensors using an approach based on Takeshita *et al.* (2013). More than 40,000 cycles with oxygen are available at the GDAC (93% of the Australian oxygen float array). Expanding the Argo array to include core, Bio, BGC, Argo equivalent and EM Apex Argo floats means we are currently at 93% of eligible profiles completed.

Australian DM Statistics (to 22 Oct 2017)

	Core Argo	**BGC Argo (Oxygen)**	**Core, BGC, Argo eq.**
D files at GDAC	99758	35058	136130
R files at GDAC	17993	5152	23543
eligible R files	6867	2833	10639
Total eligible files	106625	37891	146769
Total files at GDAC	117751	40210	159673
DMQC % eligible	94	93	93

* eligible files have a 12 mth lag

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

We aim to assess each float once per year and profiles are considered eligible when they are 12 months old to ensure there is an adequate time series to assess for sensor drift or offset. 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 not only of the standard P, T and S floats but those with Bio or BGC sensors. We have continued to spend significant time this year finalising the development of our new DMQC software. Moreover, floats that sample more than one profile per cycle require significantly more time to DMQC, i.e. manual inspection of both profiles is required to check for spikes, inversions and drifts or offset.

A major achievement over the past two years has been the DMQC of almost all of our Argo profiles with oxygen data (93% submitted to the GDAC). We have assessed 74 floats with DOXY sensors through DMQC where the DOXY data is either on the primary profile, the secondary profile or on both profiles.