

## **2017 Argo Canada report of activities**

(submitted by Blair Greenan, Fisheries and Oceans Canada)



19<sup>th</sup> meeting of the Argo Steering Team (AST-19)  
Sidney, British Columbia, Canada  
13-15 March 2018

### **1. Status of implementation (major achievements and problems in 2017)**

#### *- floats deployed and their performance*

From January 2017 to December 2017, Argo Canada deployed 30 MetOcean (NOVA and DOVA) floats (12 in the northeast Pacific, and 18 in the northwest Atlantic). Of these 30 floats, 2 died prematurely. The 28 remaining floats are still active and functioning properly, except for one which is only profiling down to 500 m. “Active” assumes that less than 4 of the last 4 profiles have been missed. Of the 30 floats, 9 were replacements. Of the 2 that died prematurely, both were or are being replaced under warranty and one was a replacement. The warranty replacement has yet to be deployed. The Government of Canada Standing Offer with MetOcean requires that if a float fails to complete 18 profiles the manufacturer must provide a replacement float. As of 19 January 2018, Argo Canada has 90 active floats in the Argo array.

In addition, 2 BGC floats were deployed by NAOS-Canada in Baffin Bay, and 1 Argo-equivalent float was deployed by Argo Canada eq. on the Labrador Shelf.

As of 10 January 2018, the Government of Canada signed a new standing offer with NKE Instrumentation for a 3-year period (10 January 2021) for supplying core Argo float. This contract has the option of two additional years.

#### *- technical problems encountered and solved*

Of the two floats that failed, one sent did not transmit any profiles and the other stayed at the surface, transmitting every 8 hours. Another float showed similar behaviour, but then partially recovered, profiling only down to 500 m.

#### *- Status of contributions to Argo data management (including status of conversion to V3 file formats, pressure corrections, etc)*

MEDS, part of DFO Ocean Science Branch, continues to acquire data from 94 Argo floats, 4 of which have not reported data for at least 1 month. Data are issued to the GTS and GDACs hourly in TESAC, BUFR TM315003 and netCDF formats. The data of all Canadian floats together with some graphics are posted on a website and updated daily:

<http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/index-eng.html>. On average, 97% and 95% of data from January 2017 to December 2017 data were issued to the GTS within 24 hours of the float reporting in TESAC and BUFR format, respectively.

Since AST-18, we have worked on the following:

- Converting existing netCDF profiles to version 3.1. A total of 230 netCDF profiles remain to be converted to version 3.1 due to failure of GDAC format checkers. We will continue our conversion process based on each individual case.
- Developing and implementing software to extract all of the Iridium positions contained in the email attachments sent by Iridium SBD floats in order to calculate the weighted average Iridium positions when a profile does not report GPS location. MetOcean is unable provide this information in their decoded files.
- Reprocessing and replacing Iridium positions with calculated weight average Iridium positions for approximately 1000 profiles which didn't have GPS location. The netCDF files were resubmitted to GDACs.
- Providing ADMT with quarterly reports on the performance of Argo data on the GTS in TESAC and BUFR formats and assist DACs that have difficulty with BUFR transmission.

*- Status of delayed mode quality control process*

As of February 2018, 44% 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 67% of eligible cycles. In addition to DMQC of new profiles, 22 previously-processed floats received either updates to the visual QC or new adjustments in response to feedbacks (e.g., reports of density inversions) since May 2017. Routines were developed to visually QC dissolved oxygen profiles and, in the case of Aanderaa dissolved oxygen sensors, apply calibration factors. As of November 2017, 14% of B-files had been visually QC'd, and 4% were fully DMQC'd.

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

*Financial resources*

Argo Canada has ongoing funding for the O&M expenditures related to the International Argo program. Shared Services Canada (SSC) is responsible for the costs related to Iridium telecommunications as part of an initiative to centralize these services with the Federal government and will cover the costs for up to 85 core Argo floats. If Argo Canada has more than 85 active Argo floats, DFO is responsible for the additional telemetry charges. Ongoing capital for float purchases has not been identified and, therefore, it remains necessary to request capital resources on an annual basis to obtain the funding required to purchase new floats. Fisheries and Oceans Canada (DFO)

committed \$449k for purchases of core Argo floats in 2017. Department of National Defence (Canada) purchased of 5 MetOcean NOVA floats core Argo. Funding is expected to remain stable at approximately this level for the next few years. The development of close links between the Argo Canada program and both the operational meteorology and operational oceanography R&D activities at the Canadian Meteorological Centre (Dorval, Québec) has been beneficial. An inter-departmental (Environment and Climate Change Canada, Department of National Defence, Fisheries and Oceans) Memorandum of Understanding entitled CONCEPTS (Canadian Operation Network of Coupled Environmental Prediction Systems) has provided strong advocacy for the Argo program.

### Human resources

Since 1 April 2015, Blair Greenan of the Bedford Institute of Oceanography (BIO) has acted as national leader of the Argo Canada program. The logistics related to float deployments and satellite data transmission has been handled by Ingrid Peterson, also at BIO. On the west coast, Tetjana Ross has been hired by DFO at the Institute of Ocean Sciences and has taken over responsibility for Pacific deployments for Argo Canada.

In terms of FTE (Full-Time Equivalent) units, the following persons contribute to Argo Canada:

Anh Tran (MEDS, Ottawa, 0.7 FTE)  
Mathieu Ouellet (MEDS, Ottawa, 0.1 FTE)  
Isabelle Gaboury (MEDS, Ottawa, 0.4 FTE)  
Blair Greenan (BIO, Halifax, 0.2 FTE)  
Ingrid Peterson (BIO, Halifax, 0.7 FTE)  
Igor Yashayaev (BIO, Halifax, 0.2 FTE)  
Tetjana Ross (IOS, Sidney, 0.2 FTE)  
Doug Yelland (IOS, Sidney, 0.1 FTE)  
Denis Gilbert (IML, Mont-Joli, 0.1 FTE)

Denis Gilbert (DFO) and Roberta Hamme (University of Victoria) are assisting Argo Canada with issues related to dissolved oxygen. In particular, they have been providing expert advice and support on quality control and data processing of DO data from the DOVA floats deployed in the Labrador Sea.

In addition to the above persons, we benefit from the technical support of sea-going staff that follow pre-deployment protocols and perform the float deployments.

### **3. Summary of deployment plans (level of commitment, areas of float Deployment, low or high resolution profiles, Argo extensions) and other commitments to Argo (data management) for the upcoming year and beyond where possible..**

In 2018 and early 2019, Argo Canada plans to deploy 37 floats (firm commitment), all of which have already been purchased or are replacements: 14 will be deployed in the North

Pacific (NOVA), 8 in the Labrador Sea (6 NOVA, 1 DOVA, 1 ARVOR-I), 8 in the Gulf Stream's northern recirculation gyre (NOVA), and 7 in the Newfoundland Basin. In addition, NAOS-Canada may deploy 2 BGC floats, and Argo Canada eq. plans to deploy 7 Argo-equivalent floats in the Beaufort Sea and Hudson Bay.

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

The Canadian CONCEPTS Global Ice Ocean Prediction System (GIOPS) assimilates Argo data on a weekly basis. The GIOPS assimilation system has been updated in 2015 to use a smoother increment update called IAU. In this process the results of the assimilation are progressively added to the model solution over a model period of 1 day. This ensures that the ocean model is more receptive to Argo data. The new version of GIOPS operational since Jun 2016, now uses the IAU update in its assimilation scheme. Inter-comparisons with observations (profiles, drifters), demonstrate increased forecast precision as a result of the updated assimilation scheme in GIOPS V2. Daily validations with Argo on GIOPS are also compared with four other international groups under the GODAE OceanView Intercomparison Validation Task team using class4 metrics. In addition to the operational GIOPS v2 system, CONCEPTS has implemented a Regional Ice Ocean Prediction System (RIOPS) covering the Arctic and Atlantic Oceans. This system is operational, there is no data assimilation, but RIOPS is spectrally nudged to GIOPS which assimilated Argo data. Future updates of CONCEPTS RIOPS systems will include its own assimilation scheme. The GIOPS output is being used by "MEDS" for Argo QC purposes.

All CONCEPTS systems run operationally at Environment and Climate Change Canada's Canadian Meteorological Center (Dorval, Quebec). CONCEPTS is an MOU for a collaboration between National Defence, Environment and Climate Change Canada and Fisheries and Oceans Canada.

The Department of National Defence Navy scientists routinely use real time Argo vertical profiles of temperature into their Ocean Work Station to aid in the computation of sound velocity profiles for support of at-sea operations.

Argo floats deployed in the Labrador Sea are an important element of an NSERC Climate Change and Atmospheric Research project entitled VITALS (Ventilation, Interactions and Transports Across the Labrador Sea). This research network is attempting to answer fundamental questions about how the deep ocean exchanges carbon dioxide, oxygen, and heat with the atmosphere through the Labrador Sea. New observations and modelling will determine what controls these exchanges and how they interact with varying climate, in order to resolve the role of deep convection regions in the Carbon Cycle and Earth System. VITALS is a pan-Canadian initiative involving scientists from 11 Canadian universities as well as multiple federal government laboratories (Fisheries and Oceans Canada, as well as Environment Canada), industrial and foreign partners.  
<http://knossos.eas.ualberta.ca/vitals/>

The Argo Canada web site is maintained by Fisheries and Oceans Canada at <http://www.isdm.gc.ca/isdm-gdsi/argo/index-eng.html>.

In January 2017, MEOPAR (meopar.ca) and DFO co-sponsored a BGC-Argo Canada workshop which brought together scientists and managers from both DFO and the university community. A report summarizing the outcome of the workshop is available at:

<http://archimer.ifremer.fr/doc/00413/52451/53335.pdf>

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

Nothing to report this year.

**6. To continue improving the quality and quantity of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include any CTD station data that was taken at the time of float deployments this year. Additionally, please list CTD data (calibrated with bottle data) taken by your country in the past year that may be added to the reference database. These cruises could be ones designated for Argo calibration purposes only or could be cruises that are open to the public. To help CCHDO track down this data, please list the dates of the cruise and the PI to contact about the data.**

Most of the recent CTD data collected by DFO researchers are transferred to MEDS and then to NODC and CCHDO. Mathieu Ouellet (DFO, Ottawa) is responsible for dissemination of Canadian CTD data. Steve Diggs sometimes obtains data directly from Canadian PI's at DFO labs.

**7. Keeping the Argo bibliography ( <http://www.argo.ucsd.edu/Bibliography.html> ) up to date and accurate is an important part of the Argo website. This document helps demonstrate the value of Argo and can possibly help countries when applying for continued Argo funding. To help me with this effort, please include a list of all papers published by scientists within your country in the past year using Argo data, including non-English publications.**

**There is also the thesis citation list ([http://www.argo.ucsd.edu/argo\\_thesis.html](http://www.argo.ucsd.edu/argo_thesis.html) ). If you know of any doctorate theses published in your country that are missing from the list, please let me know.**

**Finally, if you haven't already sent me a list of Argo PIs in your country, please do so to help improve the statistics on how many papers are published including an Argo PI vs no Argo PIs.**

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Ph.D./M.Sc. Thesis

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