

# US NATIONAL DATA MANAGEMENT REPORT

October 1<sup>st</sup> 2016 – October 30<sup>th</sup> 2017

18<sup>th</sup> ADMT Meeting

Hamburg, Germany

## 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. During the last year the DAC has received data originated from 2,674 floats and processed 96,468 profiles in real time. Overall, the US DAC now has data from over 1,000,000 cycles.

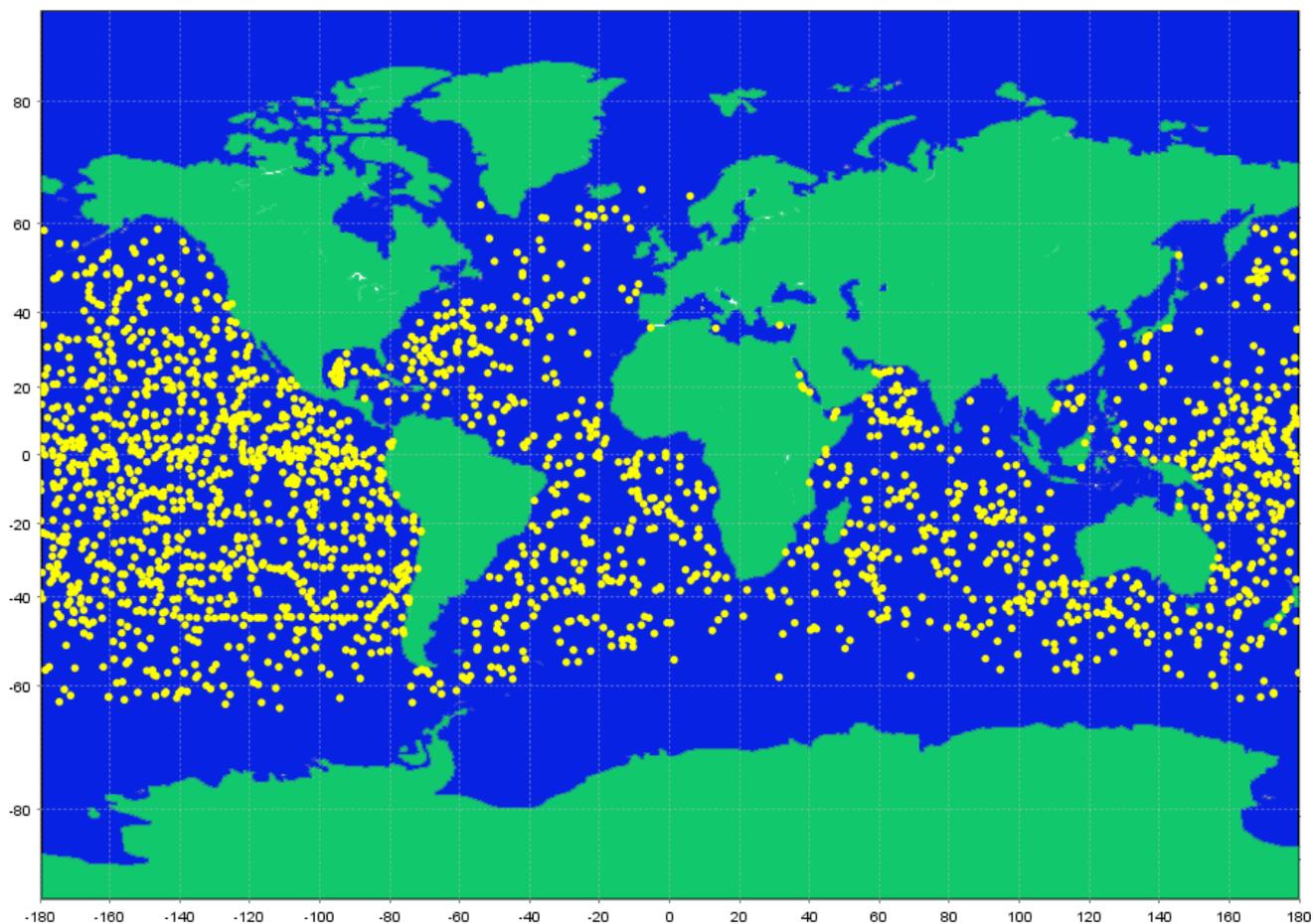


Figure 1: Real-time profiles processed by AOML DAC in the period Nov 4-16, 2017  
Hot spots link to data plots.

With respect to timeliness, 94 % of profiles reached the GDACs as well as GTS in the BUFR and TESAC format within 24 hours of transmission. The most recent performance statistics are available online at: <http://www.aoml.noaa.gov/phod/argo/opr/index.php>

In addition to this, the US Argo DAC distributed meta, technical and trajectory files in the Argo NetCDF format to the GDACs as part of the real-time processing. With the exception of the meta NetCDF files for floats using Argos as transmission system, all these NetCDF files are sent to the GDACs every time new or updated data from a float are received. The US Argo DAC is also receiving the delayed-mode data from US floats and passes them on to the GDACs (see below).

The US Argo 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.

The US Argo DAC added 470 new floats to the processing system, recent maps showing their positions with link to graphics of the data collected by the floats can be found at:

[http://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)

The US Argo DAC has continued its involvement in deployment planning by finding ships of opportunity and providing ship riders for selected cruises, as part of this collaboration AOML and WHOI has deployed 73 floats during this period.

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>

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

- Software that generates trajectory NetCDF files in format version 3.1 was modified in order to improve the content of the files in the N\_CYCLE and N\_MEASUREMENT arrays, with a focus on the MEASUREMENT\_CODE and proper sequence of the data. Modifications also included changes necessary due issues detected by GDACs file format checker.
- Software changes in progress to improve the content of Meta NetCDF files of format version 3.1 from more complex floats with Bio-sensors measuring multiple-parameters.
- Profile NetCDF files were transitioned to format version 3.1 NetCDF files for non-oxygen floats as well as floats for which University Washington and MBARI took charge of the bio-data processing. The ability to create v3.1 bio-Argo profile NetCDF files is targeted for implementation early next year.
- During the year, adjustments were made to the processing system for new & revised instrument types: (1) a deep APEX Iridium float type; (2) an ALAMO Iridium float type; (3) upgrades to deep SOLO Iridium floats that will be able to send ascending and descending profiles within a given cycle.
- One new Argos decoder and one new Iridium decoder have been developed and implemented.

- The software package for decoding of Iridium floats has been modified to adapt to changes in the float data as well as to improve the handling of data files with a few corrupted lines.
- The data processing was transitioned to the mirror site during hurricane Irma to ensure timely data processing and distribution
- Improved system in charge of applying delayed-mode salinity adjustments to real-time data of floats with sensor drift.

## **DELAYED MODE QC:**

The US Argo DAC receives the Delay mode Argo profiles from US delayed-mode operators and verifies their contents to ensure soundness of the files if requested. Each US Argo institution has provided information on their delayed-mode processing which was added to this report.

## **NOAA/PMEL**

As of 13 November 2017, PMEL had 113,795 D-files at the GDAC that were more than one year old, comprising 72% of the total of 158,072 PMEL profiles that were older than one year at that time. Last year, on 14 September 2016, PMEL had 84,713 D-files at the GDAC that were more than one year old, comprising 63% of the total of 134,794 PMEL profiles that were older than one year at that time. So, in the intervening 14 months, John Lyman and Kristy McTaggart performed DMQC on 29,082 profiles, substantially more than the 23,278 profiles that became older than one year during that time. Hence they made good progress towards clearing our DMQC backlog.

The DMQC backlog arose mostly from delays owing to difficulties encountered during major maintenance and upgrading efforts on PMEL DMQC software in response to Argo format changes and internal IT requirements, as explained in previous reports. It took considerable time and effort to make these changes, and debug them.

John Lyman and Kristy McTaggart continue their work to clear the DMQC backlog. John Lyman is also continuing work on streamlining our DMQC GUIs and processing. 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 a highly modified 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 nearby historical profiles using a new PMEL GUI recently written for this step.

## Scripps Institution of Oceanography

Scripps Institution of Oceanography (SIO) has evaluated, as part of delayed-mode quality control (DMQC), a total of 210,105 Argo stations (profiles). This is an increase of 26,313 stations (721 nominal float years) since the previous United States Argo National Data Management Report (September 14, 2016). At present, 98.7% 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, 8 NAVOCEANO floats deployed from the Peruvian vessel Zimic, 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 2016. Profile V3.1 NetCDF: The transition to the V3.1 profile DM NetCDF has been completed at SIO.

Trajectory V3.1 NetCDF: To date 95.0% of SIO DMQC trajectory files have been formatted to V3.1 NetCDF (100% of Iridium data, 91.6% of Argos data). During the year 82 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 912. 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 (95.0% total, 100% Iridium, 91.6% Argos).

Scripps has actively participated in forwarding Argo Program priorities during the year. Most notably by Megan Scanderbeg's continued work with 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/Deep SOLO float types. The battery passivation evident in our older Iridium floats has been overcome with the inclusion of a new battery type: Tadiran hybrid lithium batteries. At present 76 SOLOII and Deep SOLO floats have been deployed with the new battery type. Longer float lifetimes are expected.

Over the past year, Scripps deployed 7 IDG<sup>1</sup> developed Deep SOLO floats as part of the Southwest Pacific Deep Argo array, 8 in the Southeast Indian pilot array, and 6 in the

Northwest Atlantic pilot array. At present, the Southwest Pacific Deep Argo array has 20 floats (18 Deep SOLO and 2 Deep APEX). All Deep SOLO data is reaching the GDAC/GTS within 24 hours of being received. The first DMQC'd deep data has been submitted to the GDAC.

<sup>1</sup>IDG: Instrument Development Group.

### **University of Washington**

As of November 2017, University of Washington (UW) had submitted over 220,000 delayed-mode core 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 and the Argo reference database compiled by John Gilson.

As of date of writing, all UW D-files, including those from the KESS project from the University of Hawaii, had been upgraded to V3.1. Historical D-files that previously had DOXY embedded in them (V2.2 format) were upgraded to V3.1 D- and BR- files.

All bio-geochemical data from floats in the SOCCOM project and the pre-SOCCOM equivalent project are processed by MBARI. UW-MBARI is responsible for the production of BR- files for the SOCCOM project and the pre-SOCCOM equivalent project. For the SOCCOM project, BR- files are produced and transferred to the Argo GDACs from MBARI on a daily basis.

During the week of 11-15 September 2017, UW hosted a Profiling Float and Sensor Workshop, chaired by Susan Wijffels, Brian King and Steve Riser. A summary of the workshop will be presented at the next ADMT meeting.

### **Wood Hole Oceanographic Institute**

#### **US floats in the Mediterranean Sea D-mode qc performed by National Institute of Oceanography and Geophysics of Italy.**

Summary of the delayed-mode QC activity for the US floats in the Mediterranean Sea: The physical variables (Pressure, Temperature and Salinity) of 28 US float deployed in the Mediterranean Sea have been checked in delayed-mode. The Surface Pressure Offset have been corrected if needed and the variables recalculated before running the OW method. The TNPD status has also been checked. The D-files of these floats have been created and sent to the AOML DAC.

The diagnostic plots of the delayed-mode quality control activity are available on the MedArgo web page: [http://nettuno ogs.trieste.it/sire/medargo/active/table\\_out.php?med=2&active=0](http://nettuno ogs.trieste.it/sire/medargo/active/table_out.php?med=2&active=0)

### **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.