US NATIONAL DATA MANAGEMENT REPORT

September 1st 2015 – September 1st 2016

17th ADMT Meeting

Tianjin, China

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 2,427 floats and processed more than 92,500 profiles in real time.

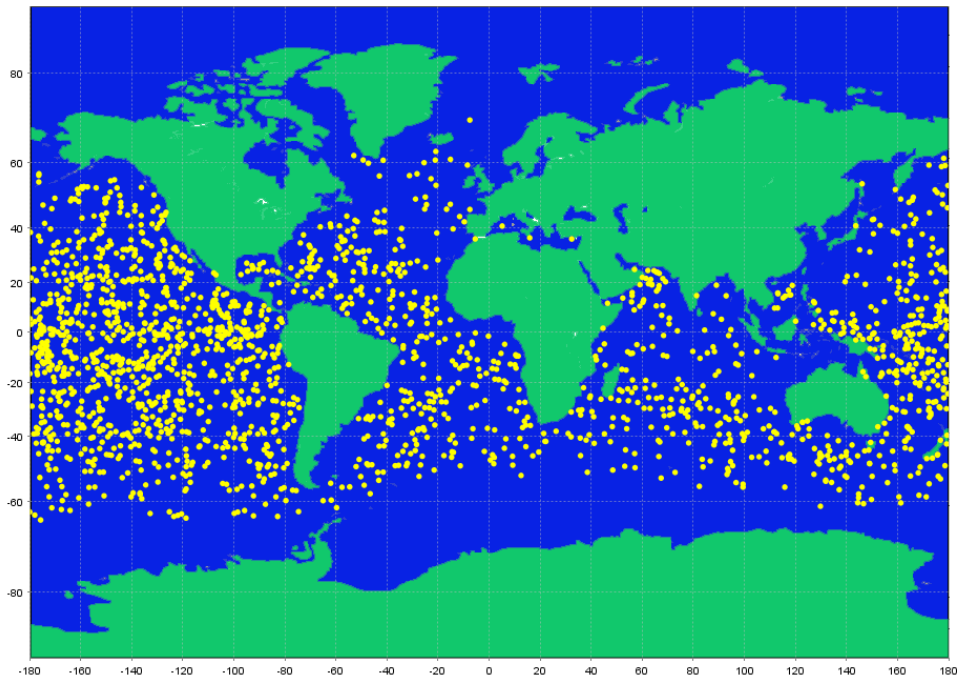

Fig. *1: Real-time profiles processed by the DAC in the period Oct 19-21, 2015. Hot spots link to data plots.*

With respect to timeliness, 95% of the profiles that were distributed to GTS in the TESAC were transferred within less than 24 hours of transmission. The US Argo DAC also has distributed the Argo profiles to GTS in the BUFR format (94 % of

them within the 24 hours) and to the GDACs (93% of them within 24 hours). The most recent performance statistics are available online at:

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

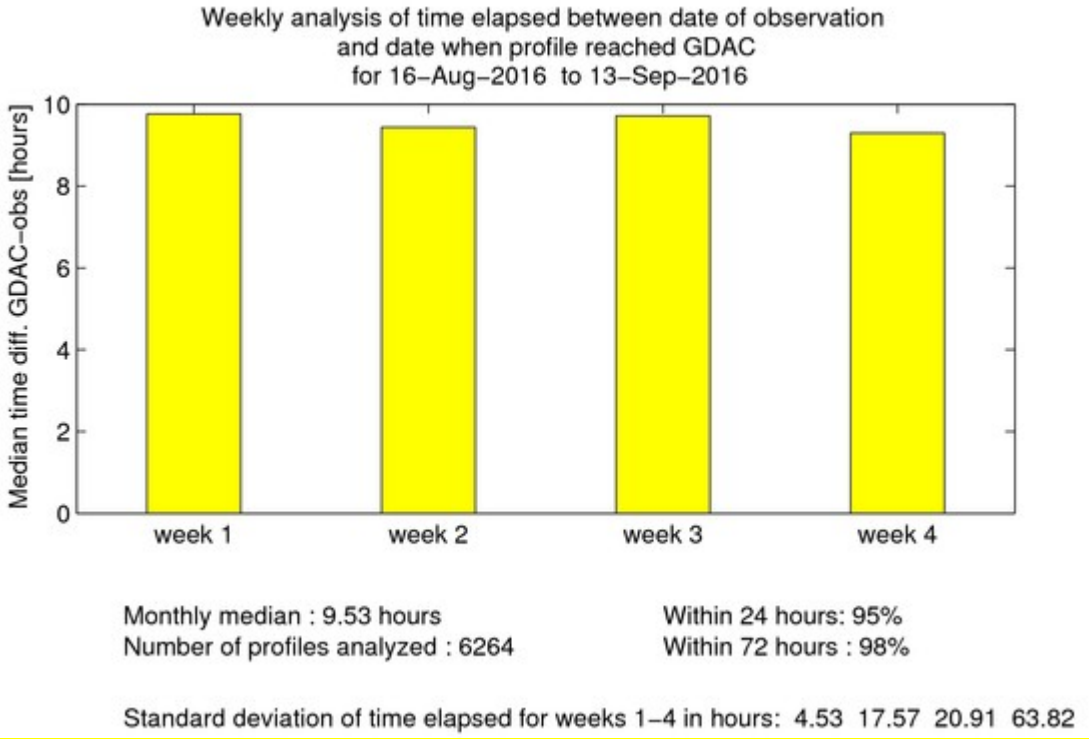

Fig 2: performance statistics; example: monitoring of profile distribution to GDACs.

In addition to this, the US Argo DAC distributed meta, technical and trajectory files in the Argo netcdf files to the GDACs as part of the real-time processing. 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 400 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: ww.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.

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

The US Argo DAC has been distributing real time netcdf profiles in version 3.03 since August 2014 while continuing to add capabilities to the new software. This included development necessary to enable the creation of the meta, technical and trajecotry netcdf files. In April, 2016 AOML went operational with creating meta and technical netcdf files in format 3.1. Trajectory netcdf files in format 3.1 were produced starting in May 2016. The capability to generate trajectory files for deep Argo SOLO floats was added in September 2016.

These developments involved creation and modification of tables as well as the software that uses them to control the file generation for each type of float and netcdf file. The tables allow the extraction of the data as needed and to associate them with the appropriate variable to be used to write the netcdf files.

With respect to the quality control, the DAC added test 22 (Unpumped Air and Water) to the profile file processing. In preparation for the transition to profile format 3.1, which has been put off partly due to the oxygen data and partly due to the need to get the other core Argo netcdf files done first, modules were added to prepare for splitting the oxygen off from the profile files that will be written as core Argo profile files in format 3.1. the oxygen data will be in the bio-Argo profile files in format 3.1. More complex bio-Argo floats that collect more thna just oxygen data will be created by the PI institution. This development will be continued in the coming year.

Software has been developed to transmit data to GTS using ftps rather than ftp. Currently, we send all data through both pathways so that the National Weather Service can monitor the robustness of the pathway on their end. The migration will be completed once we get the green light from the National Weather Service.

Other developments at the US Argo DAC

The processing system was migrated to a new server with a faster processor and more storage capacity which enabled the US Argo DAC to improve the daily data acquisition and processing. This migration required changes of many programs to adapt them to the newer operating system.

The mirror computer in Washington DC has been replaced with a more powerful computer that will allow faster processing than previously. This mirror computer will be used in the event that the computer at AOML has to be turned off due to emergencies.

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 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. Last year, on 13 October 2014, 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. So, our DMQC backlog has stayed constant in terms of percentage.

This 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. We have recently completed debugging, although we are still working on streamlining our GUIs and complying with changing formatting requirements.

John Lyman continues to work with Kristene McTaggart on DMQC efforts, which has resulted in considerable progress with the software upgrades. They are working on clearing the DMQC backlog. 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 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 183,792 Argo stations (profiles). This is an increase of 17,708 stations (485 nominal float years) since the previous United States Argo National Data Management Report (October, 2015). At present, 98.2% of the DMQC eligible, SIO stations have been completed by either John Gilson (jgilson@ucsd.edu) or Sharon Escher(sescher@ucsd.edu) . 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 has also accepted the future DMQC of 8 NAVOCEANO floats deployed from the Peruvian vessel Zimic.

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 90.6% of SIO DMQC trajectory files have been formatted to V3.1 netCDF (100% of Iridium data, 85.3% of Argos data). During the year 51 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 844. 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 transmited DMQC meta files to the GDAC at the same rate as the trajectory files (90.6% total, 100% Iridium, 85.3% 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[1], MRV) to add capabilities to the SOLOII/S2A float type. Over the past year SOLOII/S2A firmware V2.1 was introduced with minor improvements. SIO continues to retain data decoding control for all SIO Iridium float data in order to simplify DMQC processing. DoD Iridium modems and Tadiran Hybrid “Pulse” batteries were included on some floats. The batteries are believed to not suffer to the same extent as the previous Electrochem batteries to passivation.

Scripps deployed 12 IDG[1] developed Deep SOLO floats as part of the Southwest Pacific Deep Argo array. An initial 7 Deep SOLO were deployed from the Kaharoa in Jan/Feb 2016. Due to a hardware defect within these V0.4 floats which might result in premature failure, a second Kaharoa cruise was completed in July 2016 to recover and reflash the firmware (to V0.5; which compensated for the hardware issue), and if possible redeploy the instruments. Five of the seven floats were recovered with 4 being redeployed (the fifth float had the Iridium antenna broken during the recovery). On the same cruise, 3 new Deep SOLO floats were deployed. Two additional floats were deployed from the Investigator in June 2016. At present, the Southwest Pacific Deep Argo array has 13 floats (11 Deep SOLO and 2 Deep APEX). All Deep SOLO data is reaching the GDAC/GTS within 24 hours of being received.

[1]IDG: Instrument Development Group

University of Washington

As of September 2016, University of Washington had submitted over 201,000 delayed-mode files (D-files) to the Argo GDACs via the US Argo DAC. 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.

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.

UW is now responsible for the production of BR- files for the SOCCOM project.

Wood Hole Oceanographic Institute

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.