Argo Steering Team Meeting (AST-15)

National Report – India

(Submitted by M Ravichandran)

1. The status of implementation

1.1a Floats deployment

India has deployed 23 floats during Mar 2013 to Feb 2014 in the Indian Ocean taking its tally to 307 floats so far. The new deployment includes 8 Bio-Argo floats with additional sensors like Doxy, FLBB, Chl-a. Another 20 floats could not deploy due to cancellation of two ship cruises. These floats will be deployed during next year (2014-15). The deployment locations and all active floats in the Indian Ocean are given below.

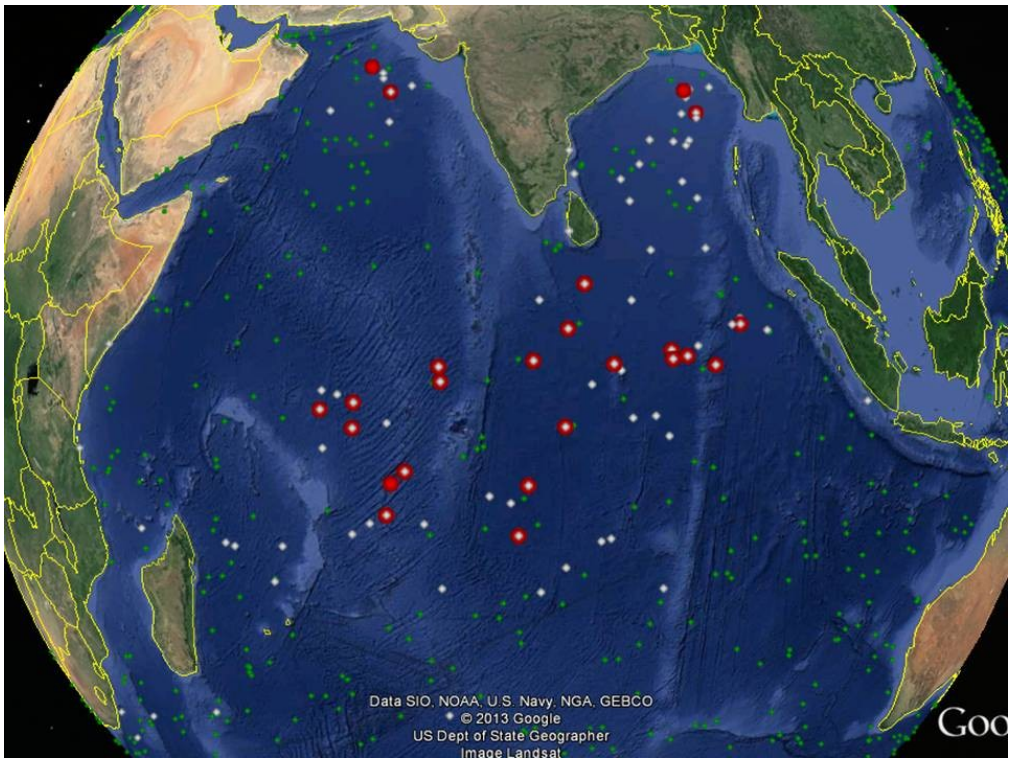


Fig. Location of Argo floats deployed by India during last one year (red), active Indian floats (white) and active floats in the Indian Ocean (green)

1.1b performance Analysis of Floats deployed

Out of the 307 floats deployed so far, 102 floats are active. All the active floats data are processed and sent to GDAC.

1.2 Technical problems encountered and solved

None

1.3 Status of contributions to Argo data management

1.3 a Data issued to GTS

All the active floats data is being distributed via RTH New Delhi. However there seems to be a problem in these messages being received by some centres. BUFR transmission will start once this issue is resolved.

1.3 b Data issued to GDACs after real-time QC

All the active floats data are subject to real time quality control and are being successfully uploaded to GDAC. RT s/w obtained in collaboration with CSIRO is extensively used for the same. The support of CSIRO in term of the Real Time S/W is highly acknowledged.

1.3 c Delayed Mode QC

- INCOIS started generating and uploading D files to GDAC form July 2006, and as of today, profiles belonging to all eligible floats have been subjected to DMQC.
- Advanced Delayed Mode Quality Control s/w developed by CSIRO is being put to use successfully. Using this s/w all the eligible floats are reprocessed to tackle pressure sensor offset problems, salinity hooks, thermal lag corrections, salinity drifts.
- Lack of enough historical background data is hindering the DMQC processing. But majority of the Indian floats are found not to have significant drifts in the salinity sensors.
- About 69% of the eligible profiles are subjected to DMQC and the delayed mode profiles are uploaded on to GDAC.

1.3 d Trajectory

A total of **307 trajectory** netcdf files were processed and uploaded to the GDAC. The process of generation of trajectory netcdf files undergoes quality checks like position, time, cycle number, etc., and corresponding quality status is assigned to each parameter. Finally a visual check is performed to verify that there are no missing cycles without cycle numbers and to check the surface time intervals.

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

Indian Argo Project is a 5 year Program from April 2012 to March 2017 fully funded by Ministry of Earth Sciences, (MoES), Govt. of India. Funding is secured for deployment of 200 Argo floats (40 floats per year including 10 Bio-argo floats), Data management activities, Data analysis, etc.

Three Permanent and three temporary scientific/technical personnel are working under Indian Argo project, which include personal for deployment of Argo floats, Data system, Analysis of Data, etc.

3. Summary of deployment plans (level of commitment, areas of float deployment) and other commitments to Argo (data management) for the upcoming year and beyond where possible.

India is committed to deploy floats in the Indian Ocean wherever gap exists. India has committed 40 floats per year for the next five year (10 floats in the Southern Ocean, 10 floats in the Bay of

Bengal, 10 floats in the equatorial Indian Ocean and remaining 10 in the Arabian Sea). Out of 40 floats, 10 floats will be bio-argo floats. Two more floats in the Arctic and 4 more bio-argo floats in the Arabian Sea also planned during 2014-15. After ascertaining the gap region and cruise plan of MoES research vessels, these floats will be deployed. The existing data management resources will continue for the next 4 year term.

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

Operational: All Argo data are being routinely assimilated in Ocean Model for providing Global ocean analysis. This analysis is being used by MET department for initialization of coupled ocean-atmosphere forecast of the Monsoon. From the year 2011, India could provide seasonal forecast of monsoon using dynamical model wherein Ocean analysis (with assimilation of Argo) is an important contribution. The analysis products are being made available at INCOIS live access server (las.incois.gov.in)

Research: Argo data are being widely used for many applications to understand the Indian Ocean dynamics, cyclone and monsoon system in relation to heat content, thermosteric component of sea level and validation of OGCM by various Indian institutions and university students.

Argo Regional Centre (ARC) - Indian Ocean

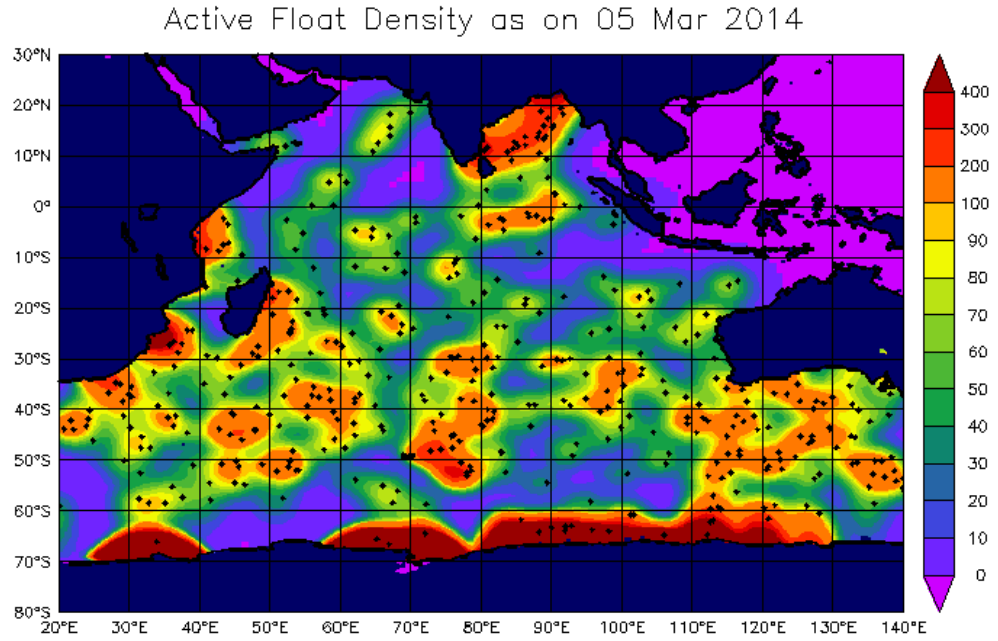
- Acquisition of Argo data from GDAC corresponding to floats other than deployed by India and made them available on INCOIS web site.
- Delayed Mode Quality Control
  (Refer 2.0 above)

- Data from the Indian Ocean regions are gridded into 1x1 box for monthly and 10 days and monthly intervals. These gridded data sets are made available through INCOIS Live Access Server (ILAS). Users can view and download data/images in their desired format.
- Additionally SST from TMI, AMSRE and Wind from ASCAT, Chla from MODIS and OCM-2 are also made available on daily and monthly basis.
- Data Sets (CTD, XBT, Subsurface Moorings) are being acquired from many principle investigators. These data are being utilized for quality control of Argo profiles.
- Value added products:

  Two types of products are currently being made available to various user from INCOIS web site. They are: (i) Time series plots corresponding to each float (only for Indian floats). This include Water fall plots, Surface pressure, Bottom most pressure, Surface temperature, Bottom most temperature, Surface salinity, Bottom most salinity, Trajectory of float, T/S plots. Also, Spatial plots using the objectively analysed from all the Argo floats data deployed in the Indian Ocean. This includes Temperature (at 0, 75, 100, 200, 500, 1000 meters), Salinity (at 0, 75, 100, 200, 500, 1000 meters), Geostrophic Currents (at 0, 75, 100, 200, 500, 1000 meters), Mixed Layer Depth, Isothermal Layer Depth, Heat Content up to 300 mts, Depth of 20 deg and 26 deg isotherms. These valued added

products can be obtained from the following link http://www.incois.gov.in/Incois/argo/products/argo_frames.html

- Regional Co-ordination for Argo floats deployment plan for Indian Ocean. The float density in Indian Ocean as on 05 March 2014 is shown below.



- **Web pages**
  INCOIS is maintaining Web-GIS based site for Indian Argo Program. It contains entire Indian Ocean floats data along with trajectories. Further details can be obtained by following the link http://www.incois.gov.in/Incois/argo/argo_home.jsp. Apart from the floats deployed by India, data from floats deployed by other nations in the Indian Ocean are received from the Argo Mirror and made available in the INCOIS website. User can download the data based on his requirement.
- Statistics of Indian and Indian Ocean floats are generated and maintained in INCOIS web site. The density maps for aiding people for new deployments are made available on a monthly basis. For full details visit http://www.incois.gov.in/Incois/argo/argostats_index.jsp.

INCOIS Argo web page statistics (for the past one year) are as shown below

Page	Hits	Visitors
Argo Web-GIS	1803	37012
Data download	15729	1084
Live Access Server	99248	118549
Argo products	1209	1178

- **Products generated from Argo data**
  - Value added products obtained from Argo data are continued. The methodology for generating the gridded product is changed to variational analysis method. Many products are generated using Argo temperature and salinity data. The Argo T/S data are first objectively analysed and this gridded output is used in deriving value added products. More on this can be see in the RDAC functions.
  - Version 2.0 of DVD on "Argo data and products for the Indian Ocean" is released to public for use with data corresponding to 2012 being updated. This DVD consists of ~ 2,00,000 profiles and products based on the Argo T/S. A GUI is provided for user to have easy access to the data. As many as 250 DVDs were supplied to various users from institutions and universities.
  - Updation to Mixed Layer Climatology based purely on Argo observation is completed. All the profiles from 2001 – 2012 are used for generating this.
  - To cater to many users of INCOIS LAS, it is enhanced in term of capacity. New Server is procured and new products viz., model outputs, new wind products (ASCAT), fluxes are made available. We plan to add more and more products as per the request received from the users in future. For further details visit http://las.incois.gov.in.

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.

None

6. To continue improving the number of CTD cruise data being added to the reference database by Argo PIs, it is requested that you include the number and location of CTD cruise data uploaded by PIs within your country to the CCHDO website in the past year. These cruises could be used for Argo calibration purposes only or could be cruises that are open to the public as well.

None

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