Argo Chinese National Report 2019

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1. The status of implementation

- floats deployed and their performance

During 2019, China deployed 11 floats (2 APEX, 2 full-equipped BGC PROVOR, 1 PROVOR-DO, 4 PROVOR and 2 HM2000) in the northwestern Pacific Ocean and Indian Ocean. Most of these floats are China-Argo-equivalent floats, and were deployed by 3 PIs from the Second Institute of Oceanography (SIO), Ministry of Natural Resources (MNR). It is worth noting that 5 floats were deployed from a joint investigation cruise between China and Sri Lanka in Indian Ocean during December 2019. In total, China has deployed 434 floats, and approximately 70 floats are operational by the end of 2019.

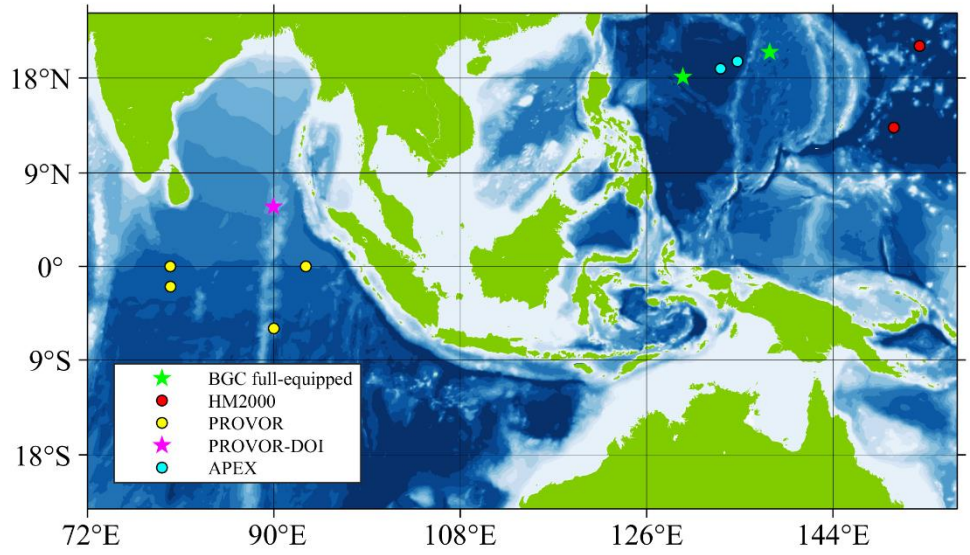

Fig.1 Launch positions of the floats during 2019.

- technical problems encountered and solved

Technical problem for APF11: There are still some cases for APEX APF11 (V2.8.3-STD-SAIL) float that miss GPS fix in science log file, which means the float was difficult to get GPS fix during the sea surface. We have to find the missing GPS fix information in the system log file of the subsequent cycle.

-status of contributions to Argo data management (including status of pressure corrections, technical files, etc)

During 2019, CSIO received data from 107 active floats (37 APEX, 54 PROVOR, 12 HM2000, 3 ARVOR and 1 NAVIS) and submitted 7,207 TS profiles (plus 552 DOXY, 741 CHLA, 741 BBP, 593 CDOM, 1,335 DOWN_IRRIDIANCE, 445 NITRATE and 235 pH) to GDACs. All the profile data are converted into BUFR bulletin and send to the GTS via Chinese Meteorological Agency (CMA, Beijing). Due to occasional breakdown of the FTP server in the Meteorological Bureau of Zhejiang Province, CSIO established a FTP connection with the CMA in last December for data distribution on GTS.

- status of delayed mode quality control process

Last August CSIO sent a technician to CSIRO for receiving a DMQC training under the support from the Ministry of Science and Technology (MOST). We thank CSIRO for their sincere help to China Argo. Based on the OWC tools, about 11,689 D-files (6,018 D-files and 5,671 BD-files) were submitted to GDACs this year from CSIO. The backlog is still there, about 3,7000 profiles are DM pending.

- status of post-processing of the global Argo data set

CSIO quarterly updates the global Argo data set which is derived from all the profile files provided by GDAC. 15 QC tests including a climatological test and MEDD test are being applied prior to generating new QC flags. The global BGC-Argo data set with originally allocated QC flags is also updated at CSIO. Both the data sets are accessible from ftp://ftp.argo.org.cn/pub/ARGO/global/.

- status of Chinese COPEX float

At the end of 2019, the National Ocean Technology Center (NOTC), MNR decided to cooperate with Tianjin Deepinfar Ocean Technology CO., Ltd for COPEX profiling float's development and manufacture. They deployed 2 COPEX floats (installed with SBE41 CTD) using BeiDou satellite for data transmission in last December for field test. Till now both the floats are operational and reporting observations. CSIO is going to conduct an assessment and provide a technical report to NOTC 3 months after floats' deployment. Before this, COPEX float is still recommended not to be used by China Argo Project.

- status of Chinese HM2000 float

Due to the limited coverage of the BeiDou transmission system, the manufacturer of the HM2000 float, HSOE developed the float using Iridium satellite for data transmission last year. Two prototypes were deployed in the northwestern Pacific Ocean during September-October 2019. After that, a batch of HM2000 (17 floats) with Iridium communication were deployed by FIO during January-February 2020. All the floats have transmitted good T/S profiles.

HSOE also developed HM2000-DO float last year. Aanderaa 4330 Optode was mounted on the top of float which allows sampling in the air. One HM2000-DO float was deployed in this February, but it did not report any data. HSOE is trying to investigate this issue.

- status of Chinese deep float

Three organizations are developing deep profiling float with the support from the Pilot National Laboratory for Marine Science and Technology, Qingdao (QNLM), they are HSOE, Tianjin University (TJU) and Ocean University of China (OUC). Ten floats (1 TJU_D float, 5 OUC_D floats, and 4 HM4000 floats manufactured by HSOE) were deployed in the northwestern Pacific Ocean last year for a pilot test of different products. Except TJU_D float (installed with a CTD sensor produced by NOTC), all of these floats are installed with SBE 37 CTD sensor, having a maximum profiling depth 4000 dbar and 24-hour cycle time. The OUC_D and HM4000 floats completed over 100 cycles during their lifetime (< 6 months), while the TJU_D float survived only 1.5 months. After a careful analysis on their observations, a technical report was provided by CSIO. The SBE61 and RBR Argo CTD sensors are recommended to replace SBE 37 CTD (designed for profiling observing), because many small hooks are found in each salinity profile.

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

This year is very important to China Argo. We estimate that funding for approximately 500 floats has been secured. If we want more floats to be deployed in 2020, the main difficulty may come from the uncertainty of manufacturer's delivery time and deployment opportunity. We expect 150~200 floats (including 22 BGC Argo and 3 Deep Argo) can be deployed in the western Pacific Ocean, Indian Ocean and the South China Sea during 2020.

About 9 staffs at CSIO contribute to the logistics and data management for China Argo and BGC-Argo. Two staffs at NMDIS are contributing to the Argo data collection.

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

During January-February 2020, two cruises in Indian Ocean are being organized by the First Institute of Oceanography and CSIO, respectively, from which 28 floats have been deployed. One cruise organized by QNLM has been confirmed to deploy 12 floats in the South China Sea and northwestern Pacific Ocean. 20 core Argo floats are to be deployed in the TPOS-2020 region, but the cruise has not been confirmed yet. CSIO is designing a special deployment cruise from which about 80 HM2000 floats will be deployed in the South China Sea and the northwestern Pacific Ocean. 2 BGC-Argo (measuring 5 core BGC variables except pH) is going to be deployed in northeastern Pacific Ocean (station Papa), and another one (with ECO sensor) is going to be deployed in the northwestern Pacific Ocean (subtropical gyre center) with the 2020 summer cruise organized by Xiamen University. However, many floats have to find appropriate opportunities for deployment in the western Pacific Ocean, Indian Ocean and the South China Sea.

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.

CSIO currently provides a mirror access to all the profile files, and also provides a free download of the BOA_Argo (the Argo product developed by CSIO) and post-processed global Argo data set (quarterly updated). Argo data have been widely used in scientific research and operational forecasts.

CSIO maintains the website of the China Argo Real-time Data Center (http://www.argo.org.cn) where the implementation status of China Argo, real-time data display including observed profiles, float trajectory, profile data, the derived products and status of global Argo are accessible. CSIO also maintains a WEB-GIS based website (http://platform.argo.org.cn:8090/flexArgo/out/argo.html) for global Argo data query, display and downloading. A BGC-Argo data visualization website is also being developed under the cooperation with Zhejiang University.

5. Problems encountered during the operation of international Argo and suggestions

The implementation of the Argo 2020 will need extensive collaborations from those coastal countries (e.g. Sri Lanka, Myanmar, Pakistan, etc) who have not been Argo member states. They usually do not have a capability to purchase and deploy floats, but they might to be able to provide float deployment/recovery opportunities for those areas we haven't enough ship time. It is therefore necessary to advertise Argo program and obtain point of contact in those countries.

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.

No CTD data were submitted in 2019. It has been found that laboratory salinometer is barely taken during most cruises, resulting in low quality of CTD data. We have reminded those PIs this issue, and also encouraged them to provide high quality CTD casts for Argo DMQC community in the future.

7. Keeping the Argo bibliography

The following articles are not listed in Argo Bibliography:

Li X, and Luo Y-Y. 2019. Inter-annual variations of the eastern subtropical mode waters in the Pacific Ocean and their formation mechanisms. Periodical of Ocean University of China (in Chinese), 49(2): 1-13.

Zhou C, Zhang J, Yang J, Xu M, and Zhang Q. 2019. 4 DVAR assimilation of SST and SSH data in the South China Sea based on ROMS. Haiyang Xuebao (in Chinese), 41(1): 32-40.

Yang X, Wu X, Liu Z, and Yuan C. 2019. A preliminary study on an upper ocean heat and salt content of the western Pacific warm pool region. Acta Oceanologica Sinca, 38(3): 60-71. https://doi.org/10.1007/s13131-019-1399-1.

Cao K, Sun W, Meng J, and Zhang J. 2019. Assessment and comparison of Sea Surface Salinity data derived from SMAP and SMOS based on Argo measurements. Advances in Marine Science (in Chinese), 37(4): 574-587.

Wang Y, Han Z, Zhou W, and Wu Y. 2019. Quality assessment of the SMAP Sea Surface Salinity in western Pacific Ocean based on Argo buoy data. Advances in Marine Science (in Chinese), 37(3): 387-397.

Liu Y, and Xing X. 2019. An improvement on climatology-based correction method of Argo-

observed dissolved oxygen data. Oceanologia et Limnologia Sinica (in Chinese), 50(5): 994-1001.

Liu Y, and Xing X. 2019. Sensor principle and quality control of the dissolved oxygen data observed using Argo floats. Marine Sciences (in Chinese), 43(1): 28-37.

Ma T, Qi Y, and Cheng X. 2019. Intraseaonal-semiannual variability of barrier layer thickness in the eastern equatorial Indian Ocean and Bay of Bengal. Journal of Tropical Oceanography (in Chinese), 38(5): 18-31.