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Argo Chinese National Report 2023

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1. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2023)

a. floats deployed and their performance

In 2023, China deployed 13 floats in the western Pacific, including 1 HM4000, 6 XUANWU, 2 PROVOR_CTS5, 2 PROVOR_CTS4 and 2 NAVIS floats. The details of these floats are shown in Table 1.

Table 1. Details of the floats deployed in 2023

Float model	Number	Sensor	Region	Owner
HM4000	1	RBRargo[3] deep 6k	Philippine Sea	Laoshan Lab
XUANWU	6	SBE61	5 in Philippine Sea, 1 in Kuroshio Extension	Laoshan Lab
PROVOR_CTS5	2	SBE41, Aanderaa 4330, ECO_FLBB2, OCR504, SUNA, SeaFET	NW Pacific	Ocean University of China
PROVOR_CTS4	2	SBE41, Aanderaa 4330, ECO_FLBBCD, OCR504, SUNA	NW Pacific	CSIO, South China Sea Institute of Oceanology,

				CAS
NAVIS (with rechargeable battery)	2	SBE41, SBE63, MCOMS_FLBBCD, SUNA, SeaFET	NW Pacific	CSIO

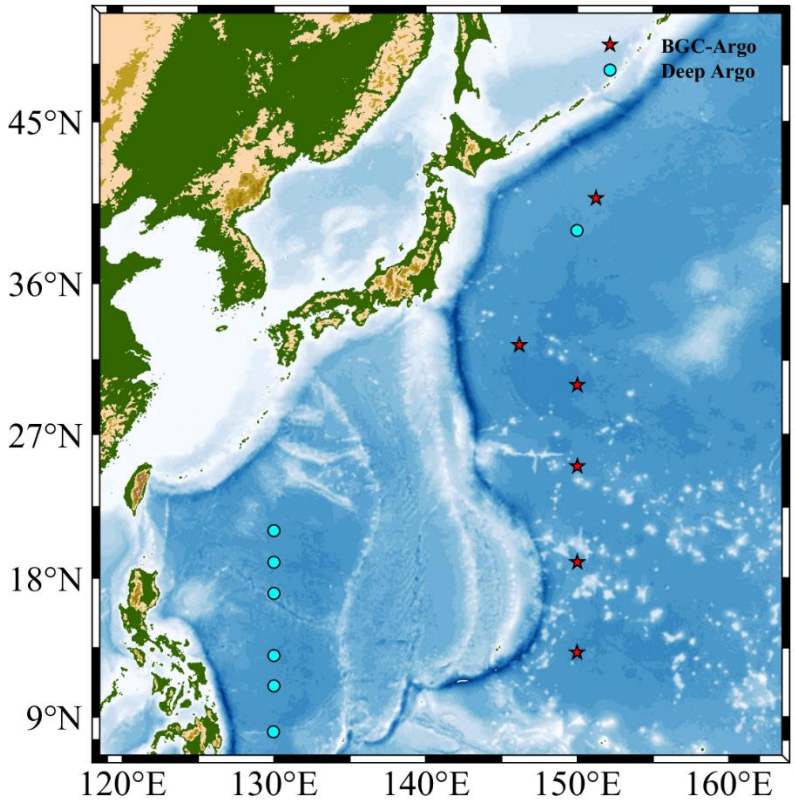

Fig.1 Launch positions of the Chinese floats in 2023

One XUANWU float (WMO: 2902889) deployed in May 2023 only survived 14 cycles with maximum profiling depth only 1500 m. The manufacturer then investigated the possible reason and made improvement in the solenoid valve. In December 2023, Laoshan Laboratory deployed the first batch of Chinese-made deep float in Philippine Sea, including 5 XUANWU and one HM4000 floats. Until now, these floats have been able to profile up to their nominal profiling depth and are all alive.

Two NAVIS floats with SeaTrac rechargeable battery deployed by CSIO have the ballasting problem after the extra BGC sensors were added onto the float, which resulted in the too shallow profiling depth. Therefore, the floats cannot harvest much energy from the less temperature difference and may not survive much cycles as expected.

b. technical problems encountered and solved

One HM4000 float (2902895) equipped with RBRargo[3] deep 6k CTD sensor deployed in December 2023 has been found a systematic salinity bias comparing with the shipboard CTD cast. The reason is that the coating of the conductivity cell had been broken when the float manufacturer conducted field testing. Fortunately, a shipboard CTD cast and bottle data were obtained at the float deployment, so that we can correct the salinity observations using an estimated conductivity slope.

c. status of contributions to Argo data management (including status of high salinity drift floats, decoding difficulties, ramping up to include BGC or Deep floats, etc)

During 2023 CSIO received 2,847 core profiles plus 902 DOXY, 493 CHLA, 806 BBP, 180 CDOM, 648 IRRADIANCE, 369 NITRATE and 272 pH profiles from 73 active floats (Fig.2). All the profiles were submitted into GDACs and core & DOXY profiles have been inserted into GTS via CMA after being converted into BUFR bulletin.

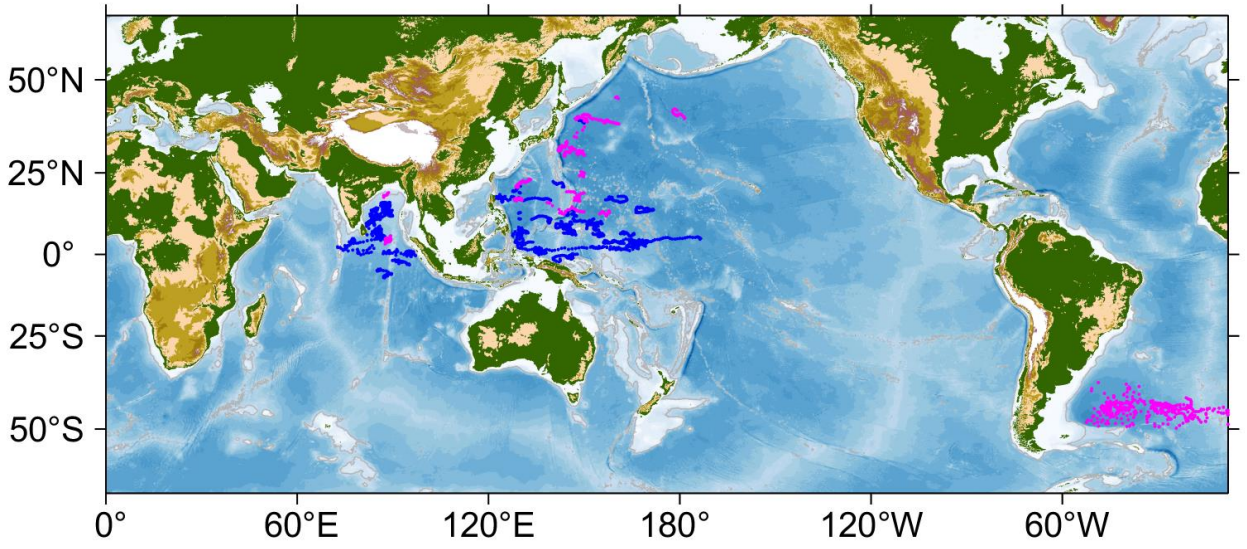

Fig.2 Positions of core (blue) and BGC (red) profiles.

d. status of delayed mode quality control process

Last year CSIO had sent about 7, 249 D-files of Core Argo to GDACs. In total, about 78% R-files has been DMQC'd. With the help from CSIRO DMQC team and Dr. Mathieu Dever (from RBR LTD), we've updated the DMQC system which now can process the data that collected by RBR CTD sensor. Meanwhile, our DMQC operator is also learning the BGC-Argo data processing under the instruction from Tanya Maurer.

2. Present level of and future prospects for national funding for Argo including a summary of the level of human resources devoted to Argo, and funding for sustaining the core mission and the enhancements: BGC, Deep, Spatial (Polar, equator, WBCs)

Unfortunately, the national funding for China Argo has not been secured. Until now, no projects or special funds have been granted as a contribution to OneArgo. The deployment of float still relies on research and special programs undertaken by institutions and universities. Although 30 COPX floats were deployed in Indian Ocean last year, their data have not been agreed to submit into GDAC because these floats were sponsored by a special program. A project that implements the development and pilot deployment of deep XUANWU float had been granted by Laoshan Laboratory (PI: Dr. Zhaohui Chen from OUC), from which about 60 XUANWU floats will be deployed in the northwestern Pacific by the end of 2025.

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

In 2024, China plans to deploy 4 BGC-Argo floats in the western Pacific, 2 in the Northwest Pacific (Kuroshio Extension region) during the summer-autumn cruise of RV DONGFANGHONG 3, and the other 2 in the tropical west Pacific during the summer-autumn cruise of RV KEXUE. Laoshan Laboratory plans to deploy 20 deep floats (XUANWU) in the Philippine Basin and Kuroshio Extension regions. Currently the floats are ready to be assembled, but the purchase process of SBE61 CTD is behind the schedule. It is expected that SBE61 CTD can be ready by the end of September and 20 floats can be deployed by RV KEXUE by the end of 2024.

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.

Argo T/S profiles have become the most important data in the data assimilation system in NMEFC (National Marine Environmental Forecasting Center); the post-QC'd Argo T/S profiles have been applied in the IAP (Institute of Atmospheric Physics, Chinese Academy of Sciences) reanalysis (http://www.ocean.iap.ac.cn/?navAnchor=home).

CSIO maintains the website of the China Argo Real-time Data Center (https://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. A deep-Argo web app is being developed by

CSIO, which provides an interactive map interface that features deep-Argo float metadata and technical data but also float locations, trajectories and figures.

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. Also, during the AST-23 plenary, each national program will be asked to mention a single highlight or issue via a very brief oral report.

None.

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.

6 full-depth CTD casts obtained from the deployments of deep Argo float were submitted to Coriolis data center.

7. Keeping the Argo bibliography (Bibliography | Argo (ucsd.edu)**) 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 (Thesis Citations | Argo (ucsd.edu)**). 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.

The list of publications not listed in the Argo bibliography

Wang, M., D., Wang, Y., Xiang, Y., Liang, R., Xia, Yang, J., F., Xu, and X., Huang (2023), Fusion of ocean data from multiple sources using deep learning: Utilizing sea temperature as an example. Frontiers in Marine Science, https://doi.org/1.3389/fmars.2023.1112065

Yang, G., Q., Zheng, X., Xiong (2023), Subthermocline eddies carrying the Indonesian Throughflow water observed in the southeastern tropical Indian Ocean, Acta Oceanologica Sinica, 42(5), https://doi.org/10.1007/s13131-022-2085-2

Wang, H., J., Song, C., Zhao, X., Yang, H., Leng, N., Zhou (2023), Validation of the multi-satellite merged sea surface salinity in the South China Sea, Journal of Oceanology and Limnology,41(6), https://doi.org/10.1007/s00343-022-2187-x

Liu, Z., F., Chai, X., Xing, Z., Chen, L., Cheng, D., Chen, J., Xu (2023), Perspectives for China Argo ocean observarion network, The Innovation Geoscience, 1(1), https://doi.org/10.59717/j.xinn-geo.2023.100012

Chen, W., K., Ren, Y., Zhang, Y., Liu, Y., Chen, L., Ma, S., Chen (2023), Reconstruction of the Sound Speed Profile in Typical Sea Areas Based on the Single Empirical Orthogonal Function Regression Method, Journal of Marine Science and Engineering, 11(4), https://doi.org/10.3390/jmse11040841