Argo China National Report 2021

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1. The status of implementation of the new global, full-depth, multidisciplinary Argo array (major achievements and problems in 2021)

a.   floats deployed and their performance

In 2021, China deployed 36 floats in the western Pacific, Bay of Bengal and the south Atlantic Ocean, which includes 33 PROVOR (including 14 BGC floats and 19 Core floats) and 3 HM2000 floats (including 2 Core floats and 1 BGC float). Of these floats, 11 are contributed by Ocean University of China (11 PROVOR DO floats deployed in the south Atlantic), 1 is contributed by the Pilot National Laboratory for Marine Science and Technology (Qingdao) (QNLM) and the remaining 21 floats were deployed by a joint cruise in the tropical western Pacific, which was organized by the Second Institute of Oceanography and the Third Institute of Oceanography, Ministry of Natural Resources. It is worth noting that QNLM added their 38 HM2000 floats deployed in the period 2018-2021 to China Argo in October 2021, which led to a total 546 float deployments in China Argo by the end of 2021, and ~ 80 operational floats.
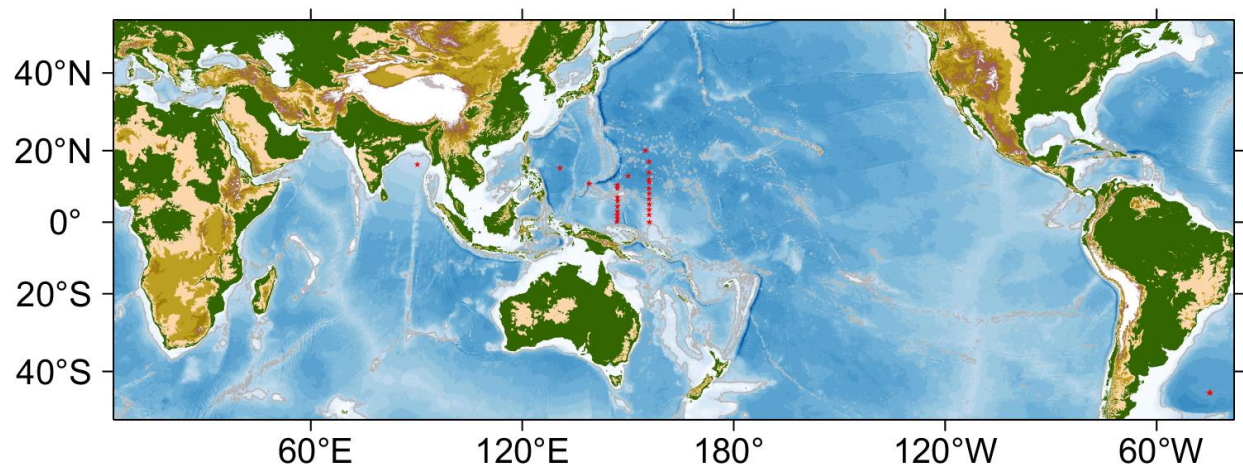

Fig.1 Launch positions of the Chinese floats in 2021

In May and June 2021, QNLM deployed 9 HM4000 floats around the region of the Kuroshio-Oyashio Extension in the North Pacific, with 8 of them equipped with RBRargo deep CTD and one with an SEB61 CTD sensor. This was the pilot deployment of HM4000 float, so data from these floats were not submitted into GDACs. By the end of 2021, seven floats were still reporting data and over a hundred 4000-m temperature and salinity profiles had been acquired (Fig. 3). The comparisons between observations from the floats, shipboard CTD, salinometer, and climatology indicate that half of the floats have obtained fairly good temperature and salinity profiles at least at the time they were deployed, whereas the remainders are observed systematic or pressure-dependent salinity biases.
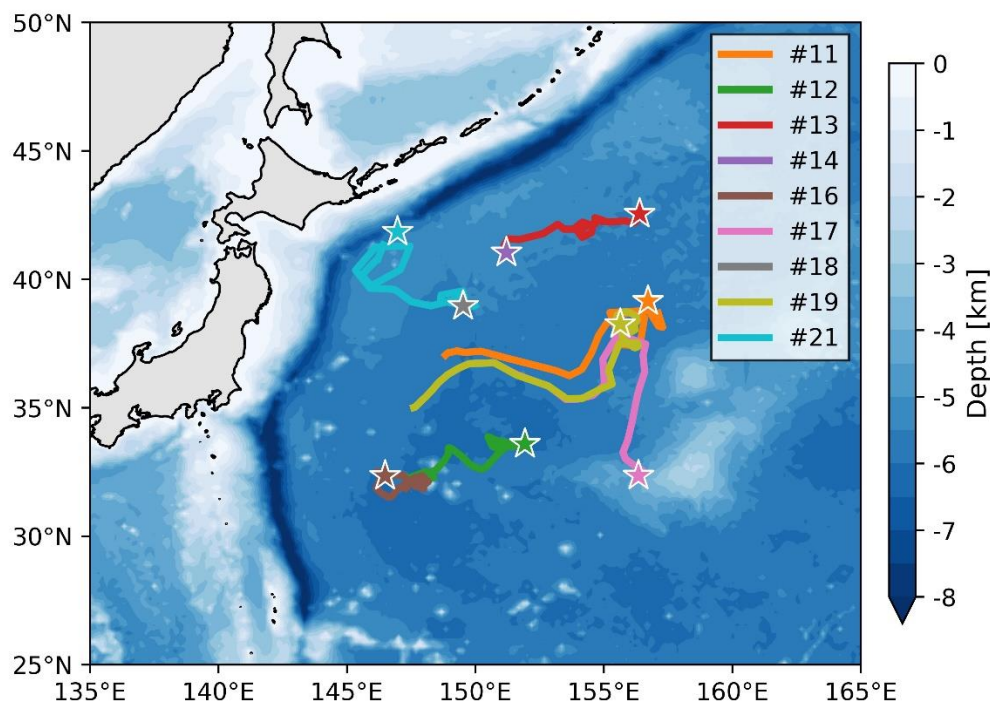

Fig. 3 Trajectories of nine HM4000 floats deployed in the North Pacific Ocean by the end of 2021.

b.   technical problems encountered and solved

One BGC PROVOR float (WMO: 2902747) was unable to dive since its 122th cycle, the problem can't be solved by a configuration change through Iridium satellite. Now we are seeking ships to recover it.

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 2021 CSIO received 5,104 core profiles plus 709 DOXY, 643 CHLA, 608 CDOM, 1,113 IRRADIANCE and 492 NITRATE profiles from 135 active floats (Fig.4). All the profiles have been submitted into GDACs and core & DOXY profiles have been inserted into GTS via CMA after being converted into BUFR bulletin.
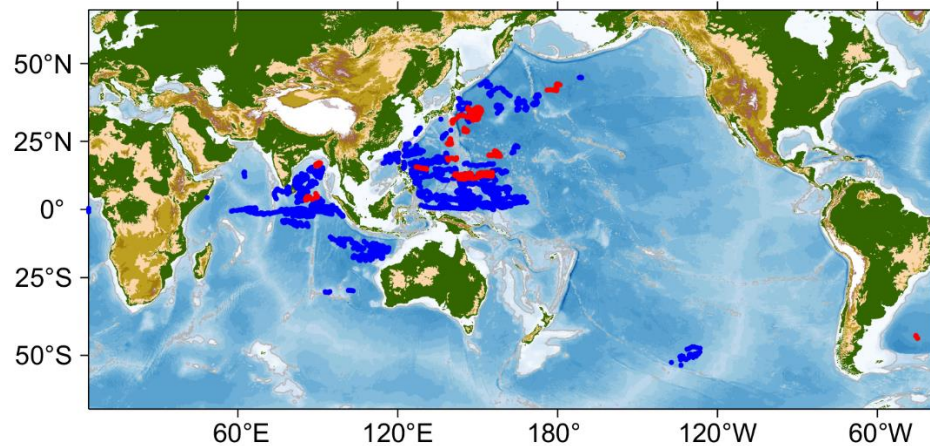
Fig.4 Positions of core (blue) and BGC (red) profiles.

A list of fast salinity drift floats had been updated prior to AST-22. The DMQC for these FSD floats almost stopped because our DMQC operator had a maternity leave. We plan to restore this work after this April.

Some PROVOR CTS5 APMT floats have been and are planned to be deployed this year. CSIO is developing the corresponding decoding software under the help of Jean-Philippe Rannou from Altran, France.

d.   status of delayed mode quality control process

Last year we had sent about 15,226 D-files to GDACs. In total about 75% R-files has been DMQC'd and submitted. CSIO's DMQC operator, Ms Xiaofen Wu was pregnant and had a 5-month maternity leave. She will come back this March and continue this task.

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)

A project that implements the development and pilot deployment of HM6000 float will be granted this year, from which over 60 HM6000 floats are going to be developed and manufactured. As proposed, they will be deployed in the North Pacific in the next three years and data will be submitted to GDACs.

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.

CSIO will deploy 4 Navis-BGC floats with SeaTrec rechargeable batteries and 1 HM2000-O2 float in the northwestern Pacific this year. Besides, 3 Provor-BGC floats with 6 core BGC variables have been purchased by the Ocean University of China, and will be deployed in the Kuroshio Extension area as soon as possible.

Other float deployments will come from the contributions from several universities and institutions, but we are unable to estimate the amount. CSIO will still try to encourage those PIs to incorporate their floats into China Argo and share data with Argo community.

As for Deep profiling floats deployment, one 6000-m float will be deployed in the Philippine basin during June and July, and over ten 6000-m floats will be assembled and tested in the second half of year. By the end of 2022, there will be over 10 floats in the North Pacific.

Other float deployments will come from the contributions from several universities and institutions, but we are unable to estimate the amount. CSIO will still try to persuade those PIs to incorporate their floats into China Argo and share data with Argo community.

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 provides a mirror access to the global Argo data set (synchronize with the GDAC server four times per day), and also provides a data transfer service (post-QC'd global Argo data set) for several operational departments. The values of Argo data have been fully recognized, nowadays Argo data and data product 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.

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.

In 2021 CSIO submitted 10 CTD casts obtained in the northwestern Pacific to Coriolis data center.

7. Keeping the Argo bibliography (<u>Bibliography | Argo (ucsd.edu)</u>) 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 (<u>Thesis Citations | Argo (ucsd.edu)</u>). 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

Zhang, C., W. Si, and C. Xie (2021), Analysis of T/S characteristics of Sulawesi Sea based on Argo and XBT, Marine Science Bulletin, 23(1), 27-36, 10.11840/j.issn.1001-6392.2021.01.004.

Zhou, Y., R. H. Lang, E. P. Dinnat, and D. M. Le Vine (2021), Seawater Debye Model Function at L-Band and Its Impact on Salinity Retrieval From Aquarius Satellite Data, *IEEE Transactions on Geoscience and Remote Sensing*, 59(10), 8103-8116, doi: 10.1109/TGRS.2020.3045771.

Chen, H., S. Li, H. He, et al. (2021), Observational study of super typhoon Meranti (2016) using satellite, surface drifter, Argo float and reanalysis data, Acta Oceanol. Sin. 40(1), 70–84. https://doi.org/10.1007/s13131-021-1702-9

Gao, Z., Z. Chen, X. Huang, H. Yang, Z. Zhao, C. Ren, and L. Wu (2021), Internal Wave Imprints on Deep Ocean Temperature Change as Revealed by Rapid-Sampling Profiling Floats, *Journal of Geophysical Research: Oceans*, 126, e2021JC017878. https://doi.org/10.1029/2021JC017878.

8. How has COVID-19 impacted your National Program's ability to implement Argo in the past year? This can include impacts on deployments, procurements, data processing, budgets, etc.

Except CTD delivery from SBE to HSOE (HM2000 manufacturer), the COVID-19 has little impact on China Argo project. In 2021, the SBE CTD delivery was delayed several months which impacted the timeliness of HM2000 float's supply.

9. Argo is still interested in piloting the RBR CTD. Does your National Program have any deployment plans for RBR floats in the next couple years? If so, please indicate how many floats will you be buying in 2022 and 2023 (if known) and where they might be deployed.

In 2021, QNLM deployed 8 HM4000 floats mounted RBR 6k CTD sensor. The observations and comparisons have shown half of them reported systematic or pressure-dependent salinity biases. So HSOE may switch to use SBE61 CTD in their further developed HM6000 floats unless RBR can provide convincing products.