Sixth Marine Instrumentation Workshop for Asia-Pacific Region(2021/12/13)
held by WMO-IOC Regional Marine Instrument Center

TPOS CHINA
FUTURE VISION FOR THE OCEAN

China's Intensifying Participation in GOOS

towards Expanding Ocean Observations

for Sustainable Development Needs

Supported by Indo-Pacific Ocean Variability and Air-Sea Interaction (IPOVAI), MNR

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自然资源部
长三角海洋生态环境野外科学观测研究站

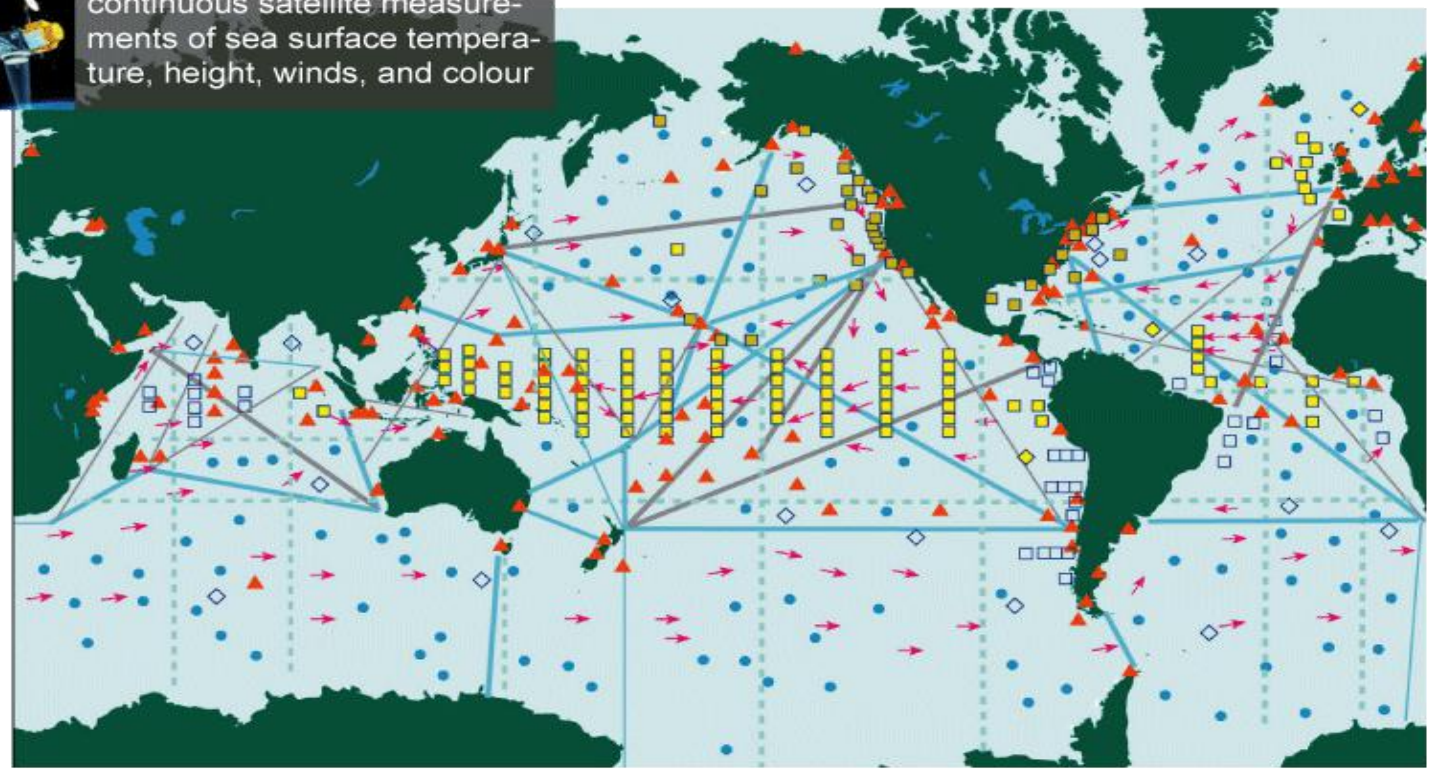
Contents

- **Global Ocean Observations and SIOMNR's Focus**
- **Chinese implementation with TPOS in the West Pacific**
  - TPOS: Tropical Pacific Observing System
- **Chinese collaboration in the Indian Ocean through JAMES**
  - JAMES: Joint Advanced Marine and Ecological Studies
- **Data quality cases**

Growing Efforts in Ocean Observations

Total *in situ* networks 66%

continuous satellite measurements of sea surface temperature, height, winds, and colour



87% **Surface measurements** from volunteer ships (VOSclim)

200 ships in pilot project

100% Global **drifting surface buoy** array

5° resolution array: 1250 floats

62% **Tide gauge** network (GCOS subset of GLOSS core network)

170 real-time reporting gauges

81% **XBT** sub-surface temperature section network

51 lines occupied

100% **Profiling float** network (Argo)

3° resolution array: 3000 floats

Reference time series 24%

58 sites

48% Global **reference mooring** network

29 moorings planned

79% Global tropical **moored buoy** network

119 moorings planned

62% Repeat **hydrography** and **carbon inventory**

Full ocean survey in 10 years

??? Autonomous underwater vehicles (**Glider**)

Since 2002, but fleet observation started in 2007

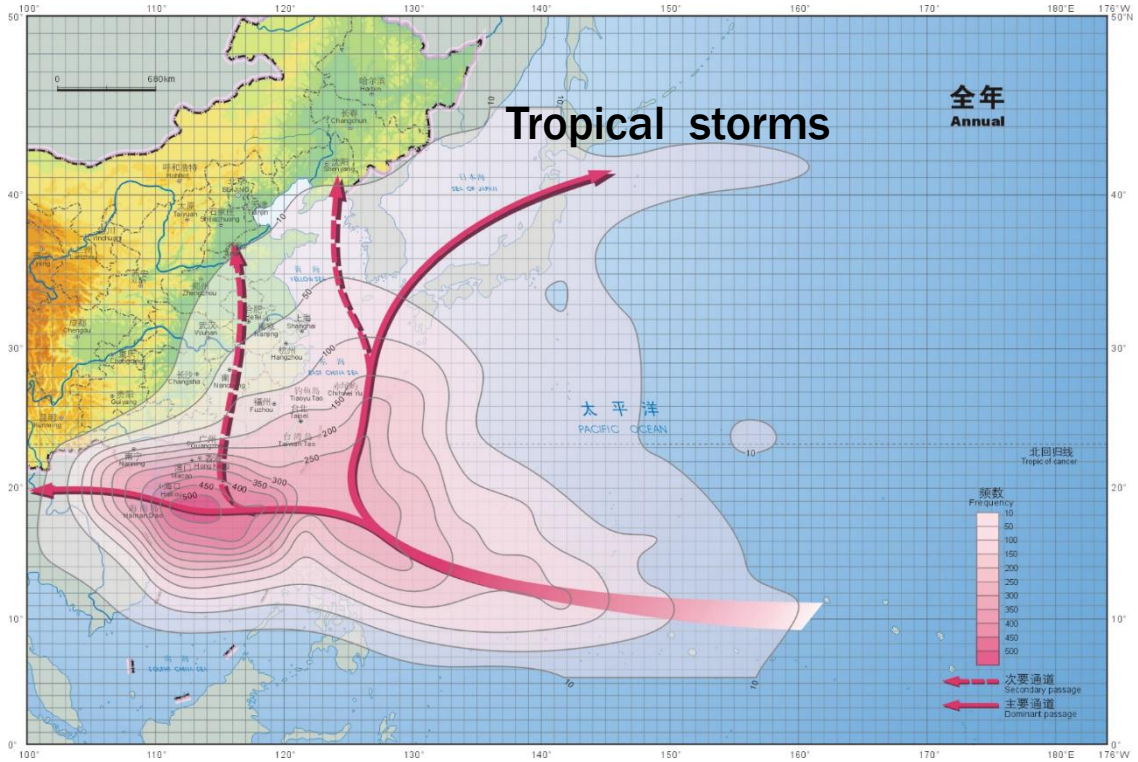
Moltmann, et al., 2019

FOCUS AREA of SIOMNR

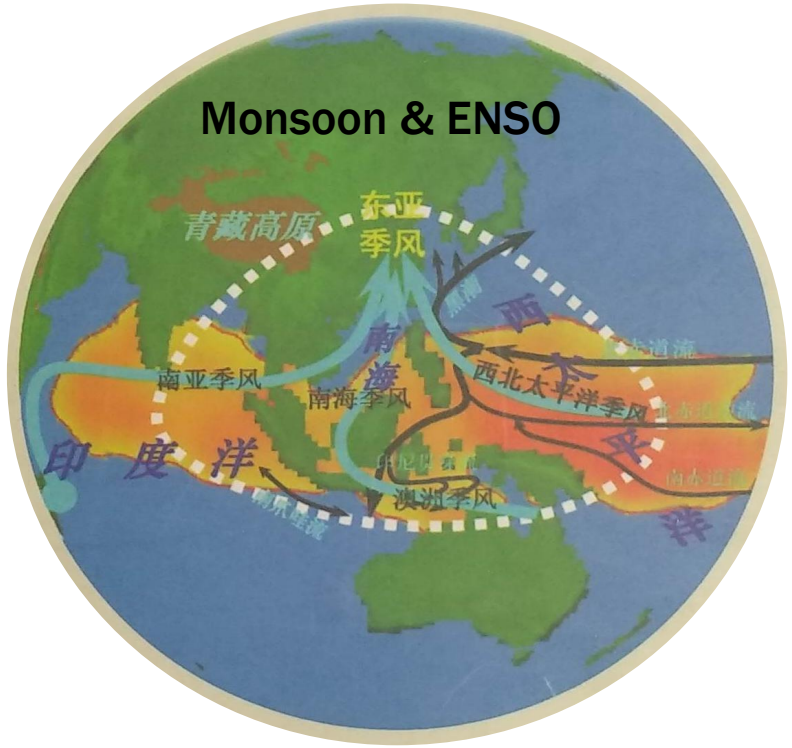
Priorities were laid on the key regions which probably have profound impacts on

- From weather to short-term climate systems
- Ecosystem response to dynamic processes and climate change

TPOS CHINA
FUTURE VISION FOR THE OCEAN



《中国热带气旋气候图集》，上海台风研究所编著



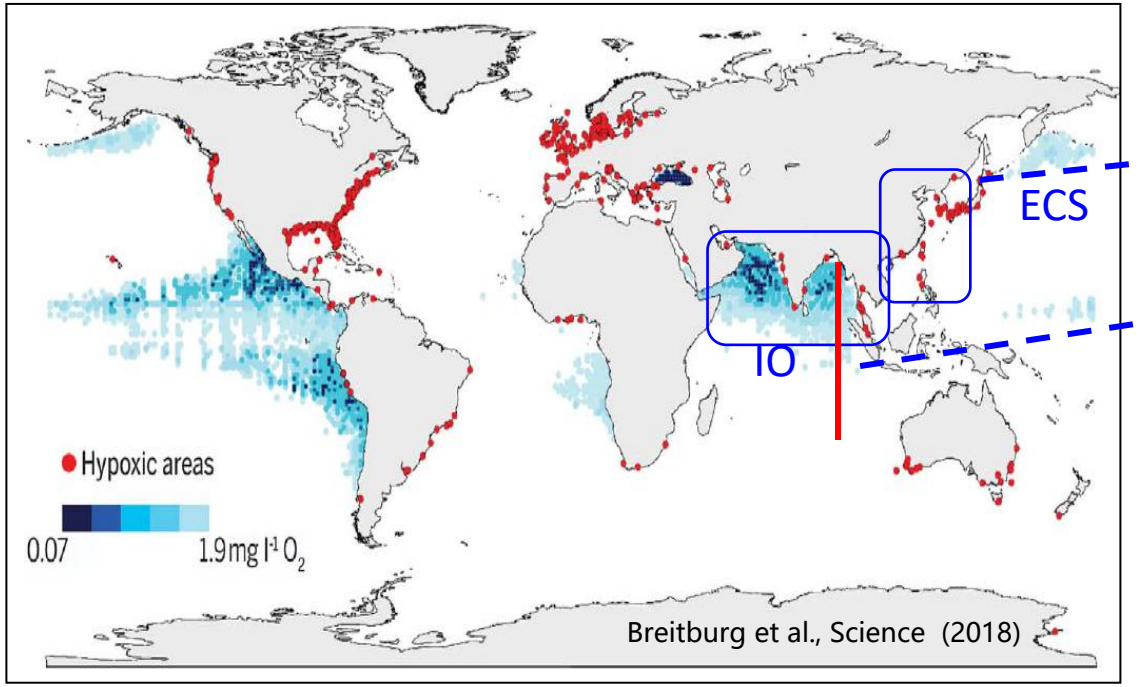
李建平、吴国雄、胡敦欣编著，亚印太交汇区海气相互作用及其对我国短期气候的影响，气象出版社

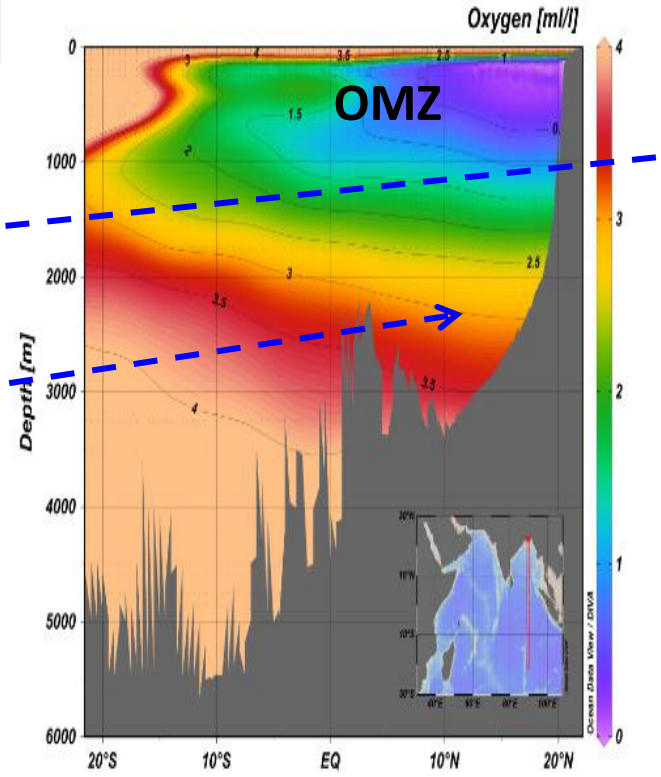
FOCUS AREA of SIOMNR

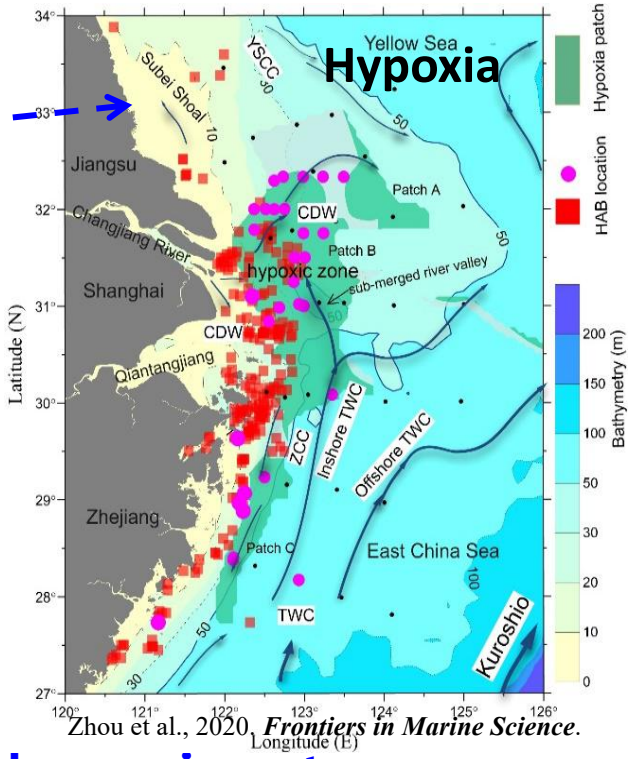
Ocean deoxygenation, acidification

- ☐Oxygem minimum zone in the Indian Ocean
- ☐Hypoxia in coastal regions (Chinese waters, Southeast Asia)

Arabian Sea(AS), Bay of Bengal(BoB), East China Sea(ECS)







Zhou et al., 2020, *Frontiers in Marine Science*.

Similar low dissolved oxygen but different drivers in the coastal and oceanic waters

TPOS implementation

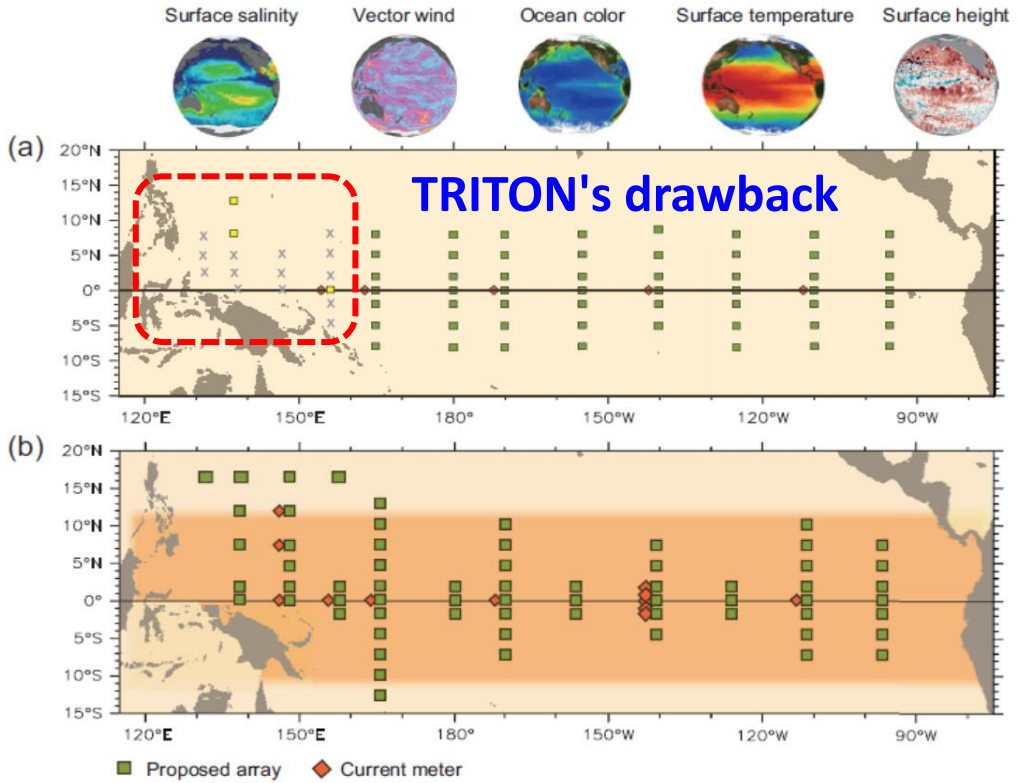
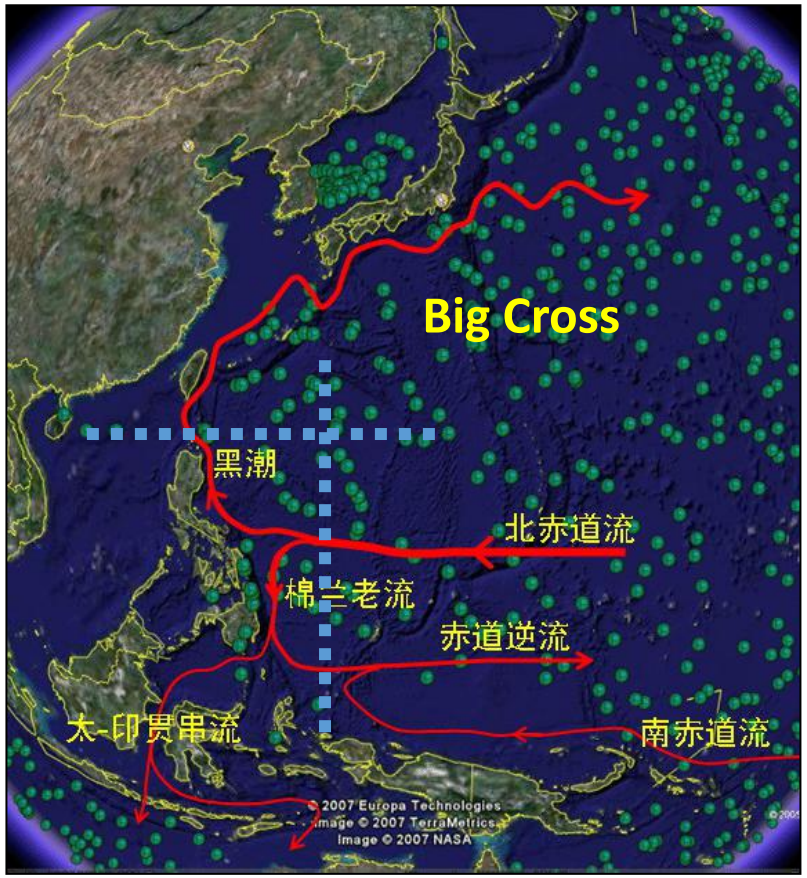


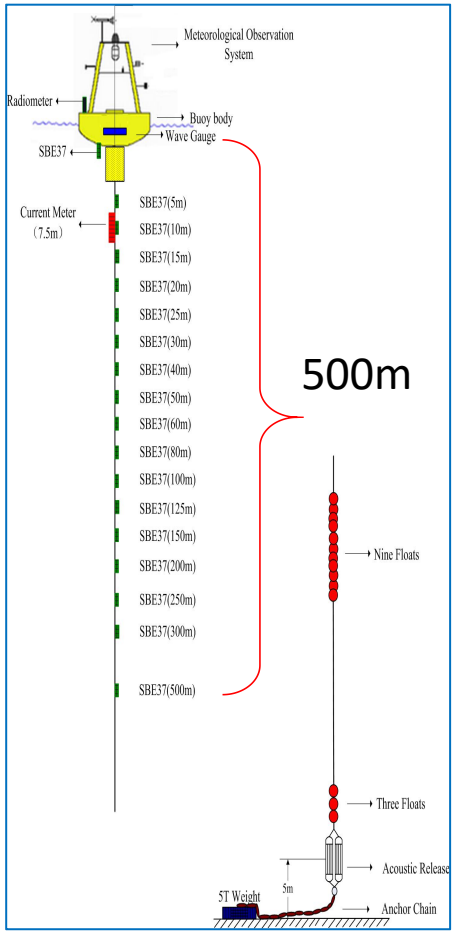
Figure 1. Schematic of the TPOS 'Backbone' configuration. (a) The current TAO (green boxes) and TRITON (yellow boxes) mooring locations. Current meter locations are shown as red diamonds. Vacant TRITON sites are marked with (x). (b) The TPOS 2020 proposed array (large green boxes). Current meter locations are shown as red diamonds and double Argo in dark orange. In both cases satellites (top row) and other *in situ* systems also contribute.

Chen et al., 2018, NSR



Chen: **Big Cross**
2008， X-Strait meeting
2014， 973 proposal

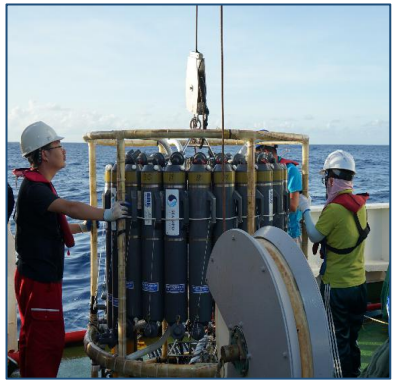
TPOS' Backbone buoy



Chinese **Yinyue Buoy**
design with reference to TPOS tier 1

China Experimental Observing (CEO) Project with TPOS

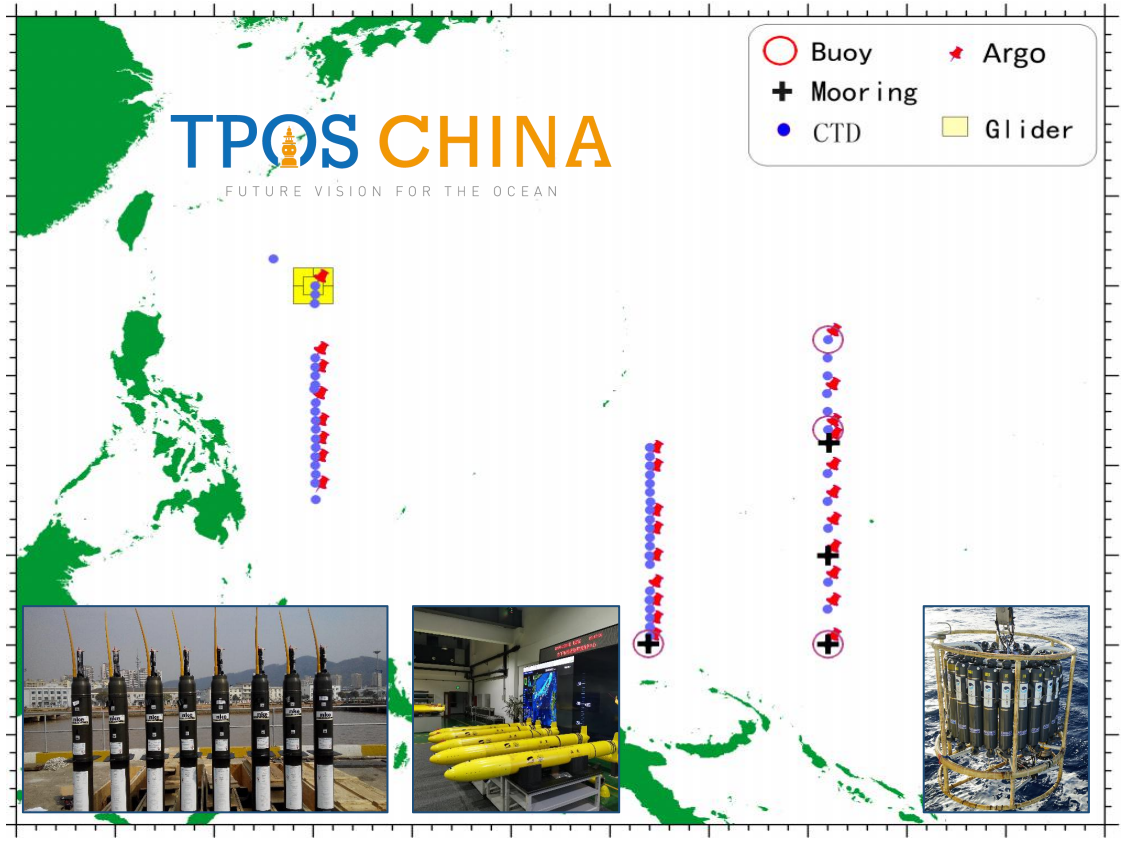
- **Dry test** of the buoy in the coastal region for nearly 30 days;
- **Wet test** in 0, 156E in comparion with **Triton** buoy
- **Weather test** to be done in WHOI, USA



- 1st curise : deployment, 2020/12/09-2021/02/08
- 2nd curise : maintainence, 2022/02-2022/05
- Surported by MNR (No. GASI-01-WPAC-STspr)

China Experimental Observing (CEO) Project with TPOS

Three Tier 1 buoys were deployed at (0, 147E), (0, 156E), (12N, 156E) and **one more test buoy** at (17N, 156E) to test in addition to **28 Argo** floats in the western tropical Pacific.



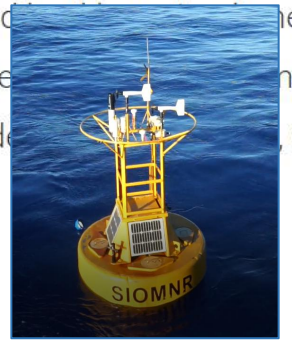
Fiver gliders deployed for 50 days to study meso-scale eddies

https://www.tropicalpacific.org/projects/

TROPICAL PACIFIC OBSERVING SYSTEM

Pilot Projects

Pilot projects are a small-scale preliminary activity/study conducted in order to



- Autonomous Surface Vessels as Low-Cost TPOS Platforms for Observin and Surface Biogeochemistry

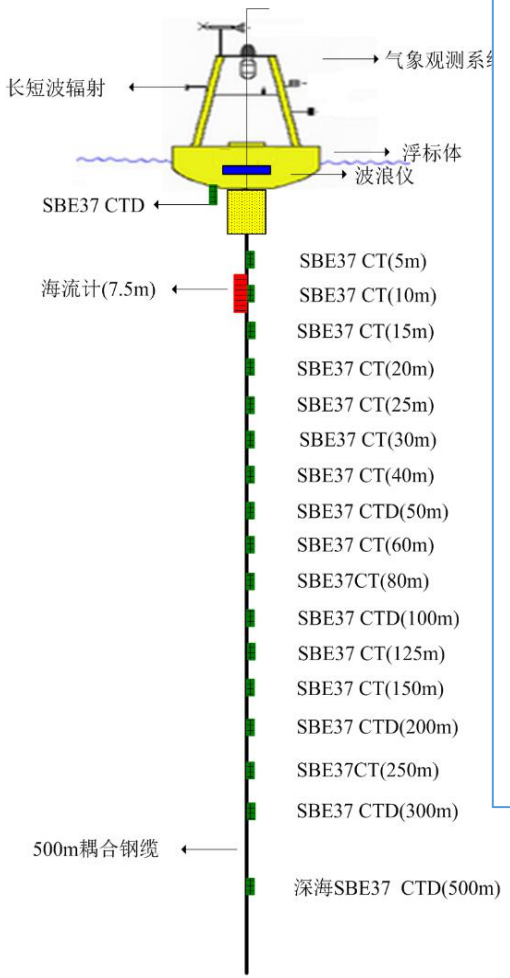
  PIs: Meghan Cronin (NOAA PMEL), Dongxiao Zhang (UW CICOES), Adrienne Sutton (NOAA PMEL),

- China Experimental Observing Project in the Western Tropical Pacific

  PIs: Feng Zhou, Dake Chen, Fei Chai, Xiaohui Xie, Weidong Yu

China Experimental Observing Project with TPOS

https://www.tropicalpacific.org/projects/china-experimental-observing-project-in-the-western-tropical-pacific/



Final Report of TPOS 2020

August 2021

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pp. [Available online at https://tropicalpacific.org/tpos2020-project-archive/reports/]

China Experimental Observing Project in the Western Tropical Pacific

tropicalpacific.org/projects/china-experimental-observing-project-in-the-western-tropical-pacific

PIs: Feng Zhou (SIO/MNR), Dake Chen (SIO/MNR), Fei Chai (University of Maine), Xiaohui Xie (SIO/MNR), Weidong Yu (Sun Yat-Sen University)

TROPICAL PACIFIC OBSERVING SYSTEM

Description

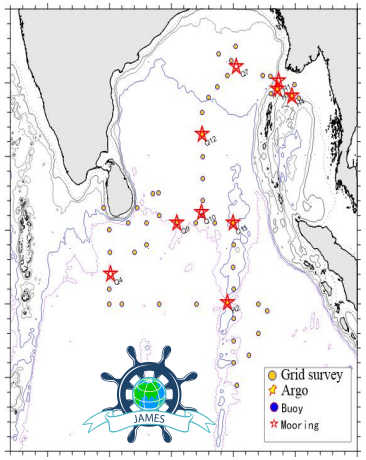
The China Experimental Observing Project consists of deploying three moored buoys in the western equatorial Pacific as a pilot effort. Buoys are set up with similar configurations to Tier 1 at (0, 147°E), (0, 156°E), (12°N, 156°E), respectively. Additionally, there is an experimental buoy at 17°N, 156°E to test with a new structure different from those three. Note that there are also 28 Argo floats deployed in the western Tropical Pacific.

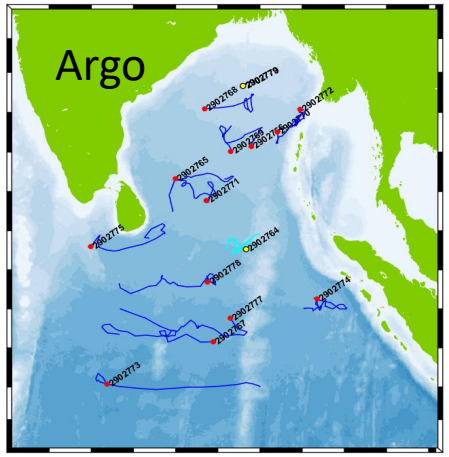
There will be two steps of assessment conducted, one nearshore intercomparison along the Chinese coast and one land intercomparison for meteorological sensors and system integration with TPOS partners. These buoys will be set up similar to Tier-1 buoy configurations with 17-layer underwater temperature and salinity sensors in addition to meteorological sensors at the surface. This is anticipated to be a substantial part of China's contribution to fulfill the buoy gap in the western Pacific.

TPOS final report（DOI: 10.13140/RG.2.2.19282.68802）

China JAMES Project

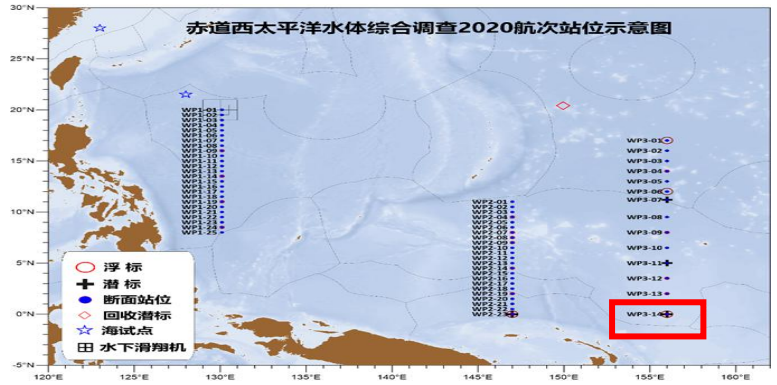
- Workshops for bilateral cooperation and training
- Surveyed in the East Indian Ocean and the Bay of Bengal for 120 days;
- Cruise collaborated with Sri Lanka, Myanmar and Thailand etc;
- 15 Argo floats, 1 buoy, 6 moorings deployed in 2019-2020.

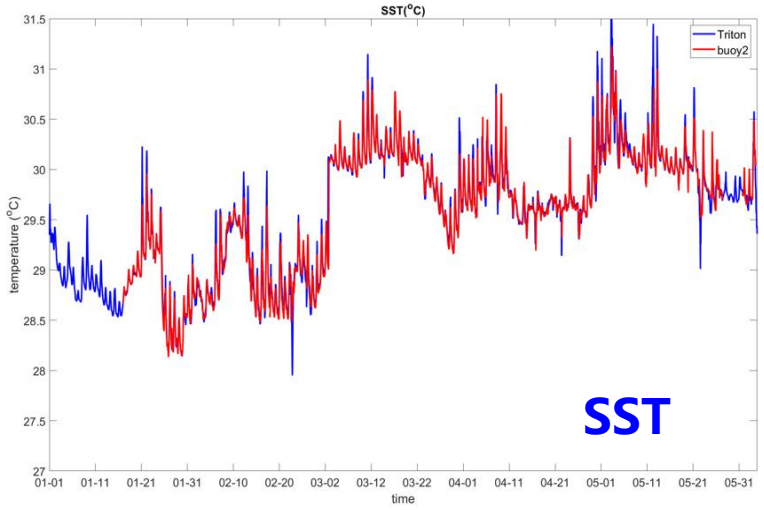




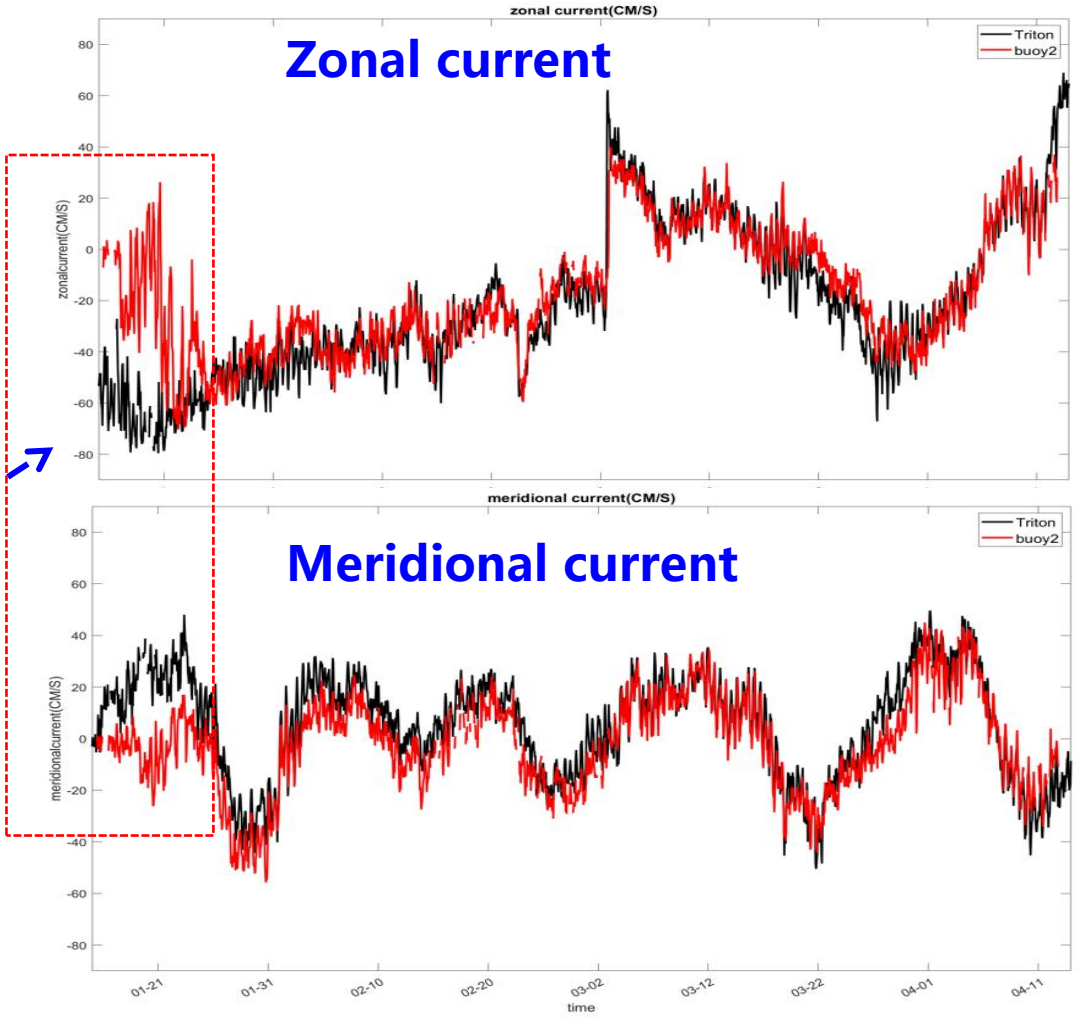
Buoy Data quality control (wet test)

Chinese Yingyue buoy compared with Japanese TRITON buoy at (0, 156E)





The underwater current meter is probably tilted or entangled with the rope



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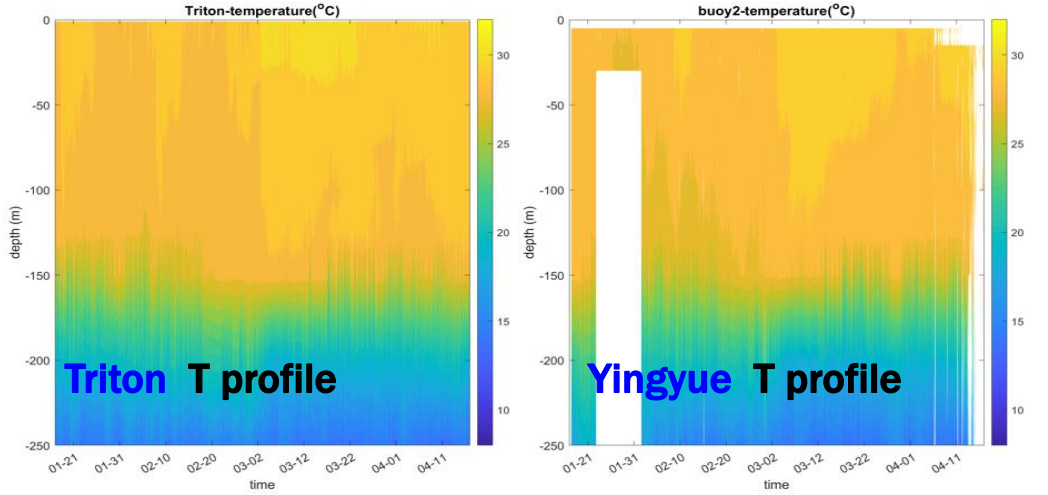
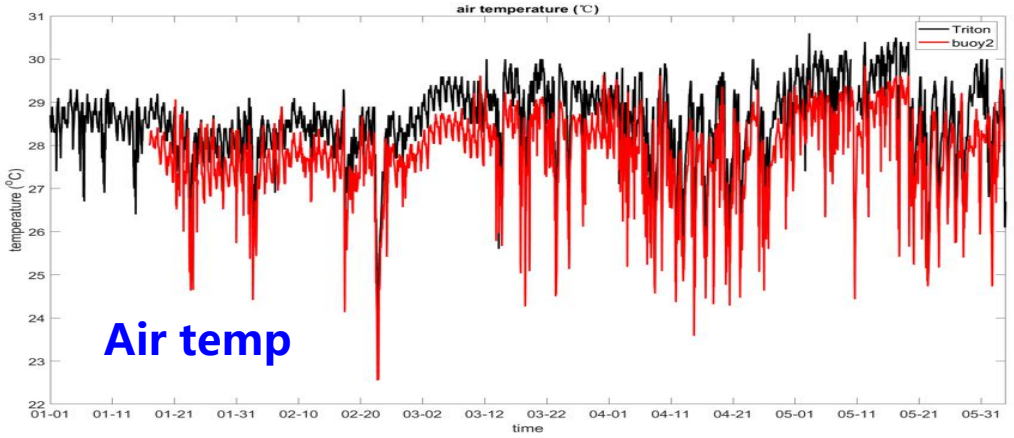
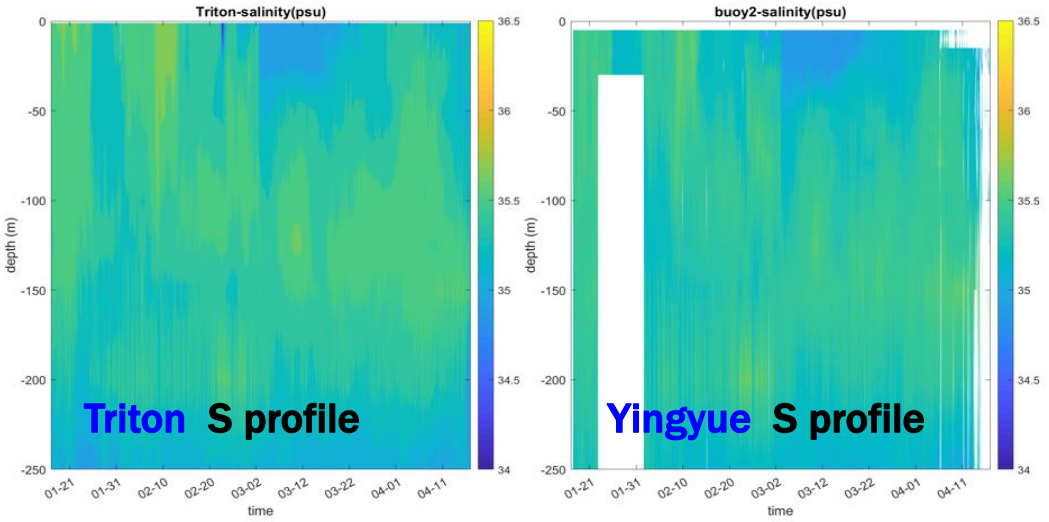
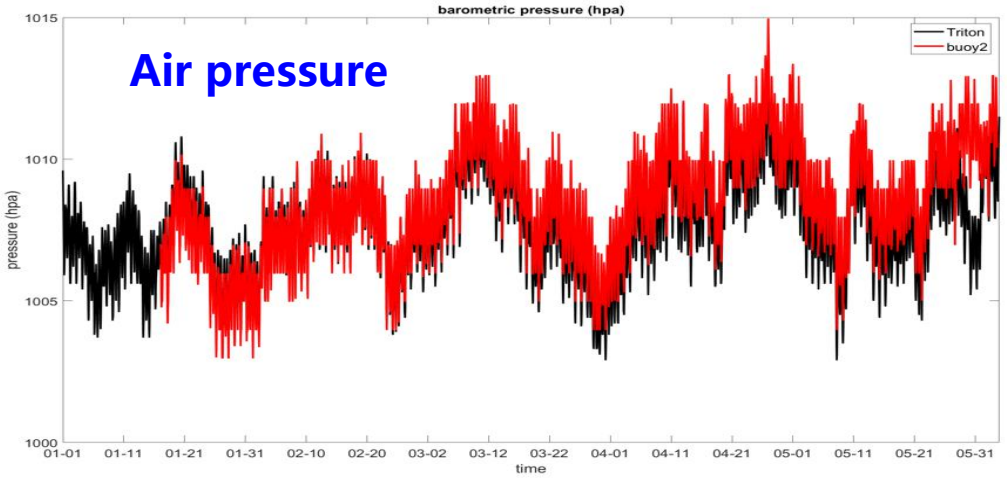


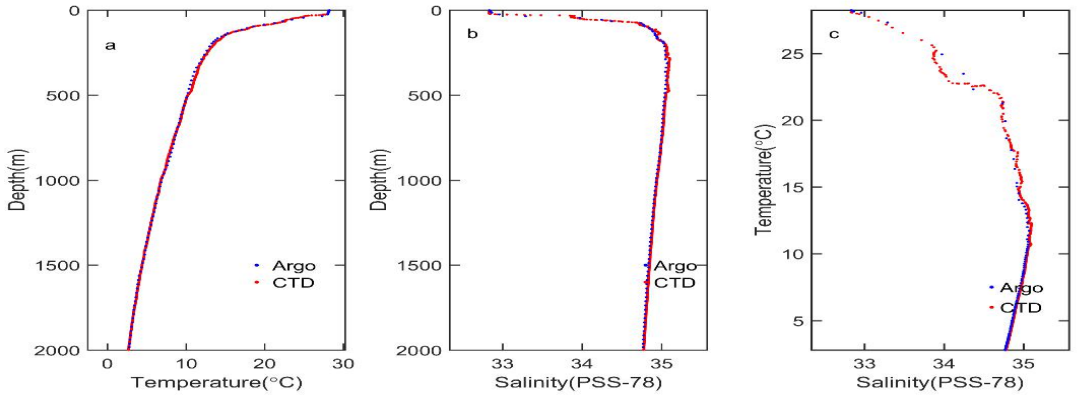




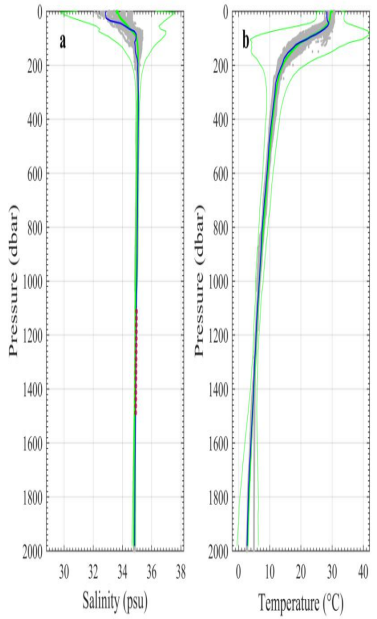


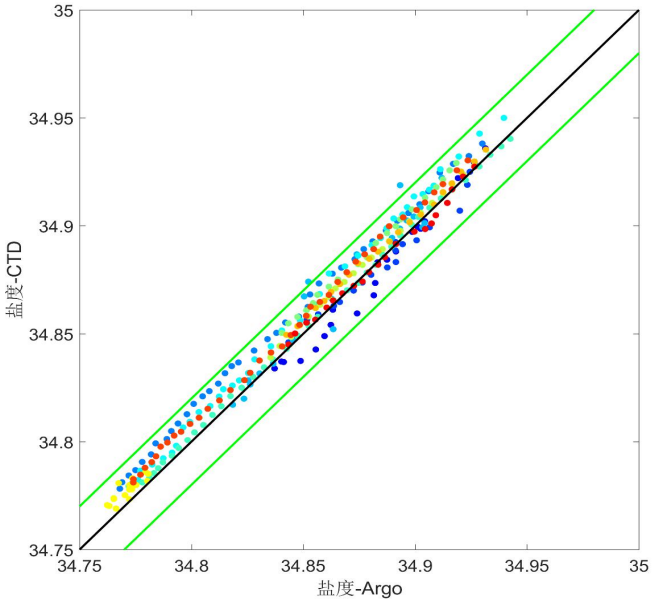
Argo Data quality control (instrument comparsion)

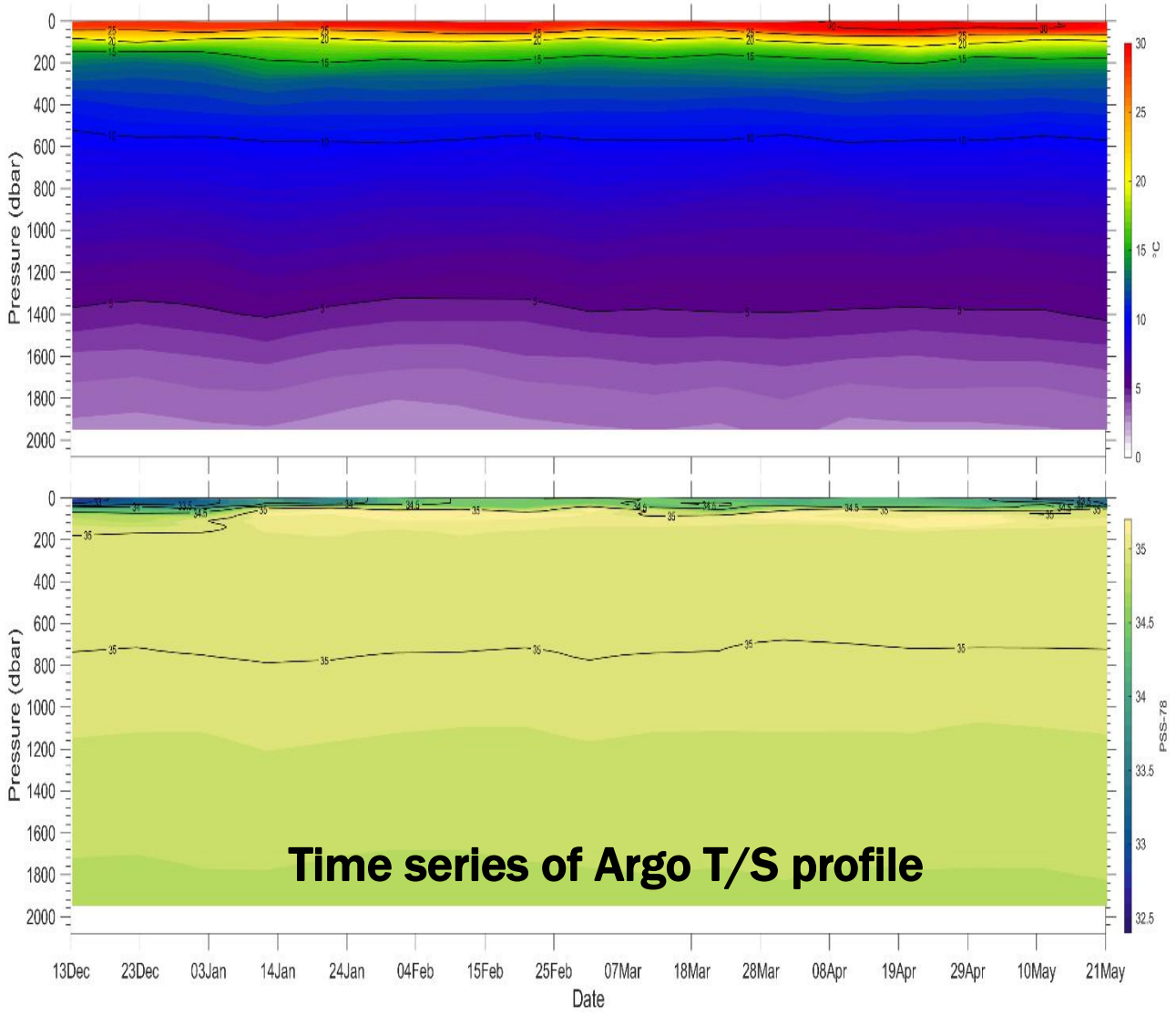
Argo T/S were calibrated with in situ Seabird CTD



Argo T/S compared with historical dataset





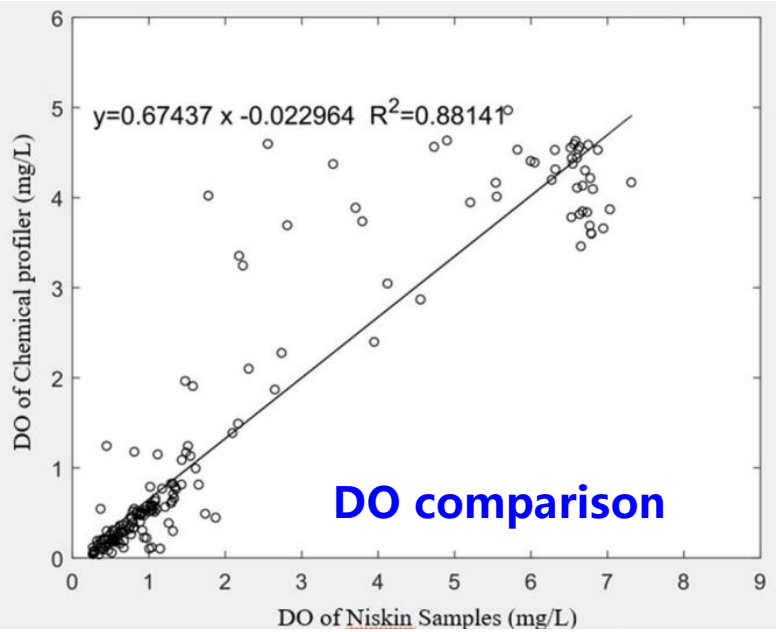


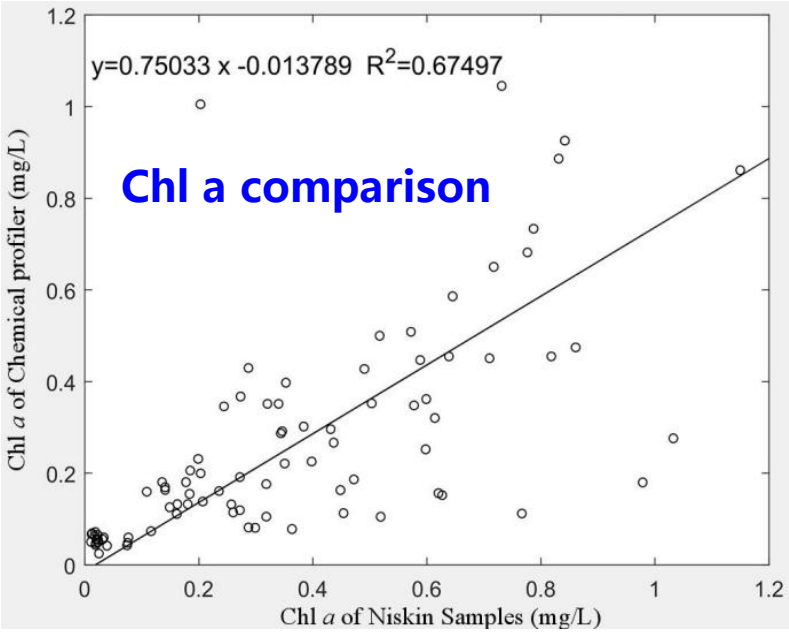
Time series of Argo T/S profile

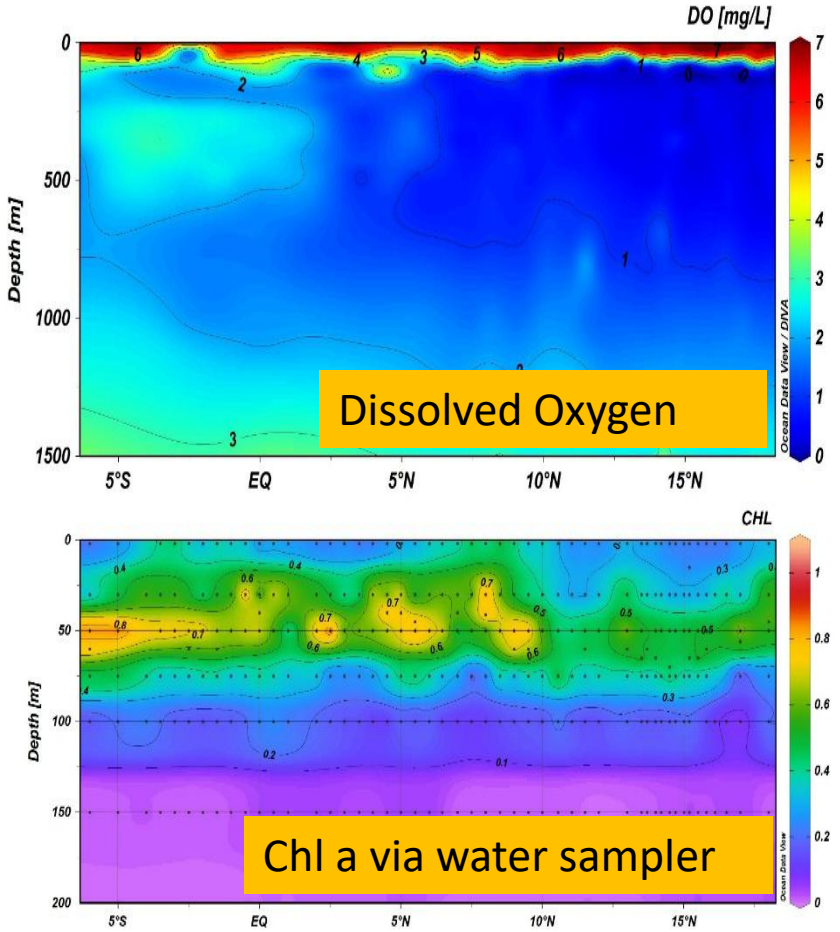
Provided by Liu et al. from China Argo Data Center

BGC Data quality control (sampling comparison)

Sensored DO/Chl a compared with measured from water sampler combined with CTD



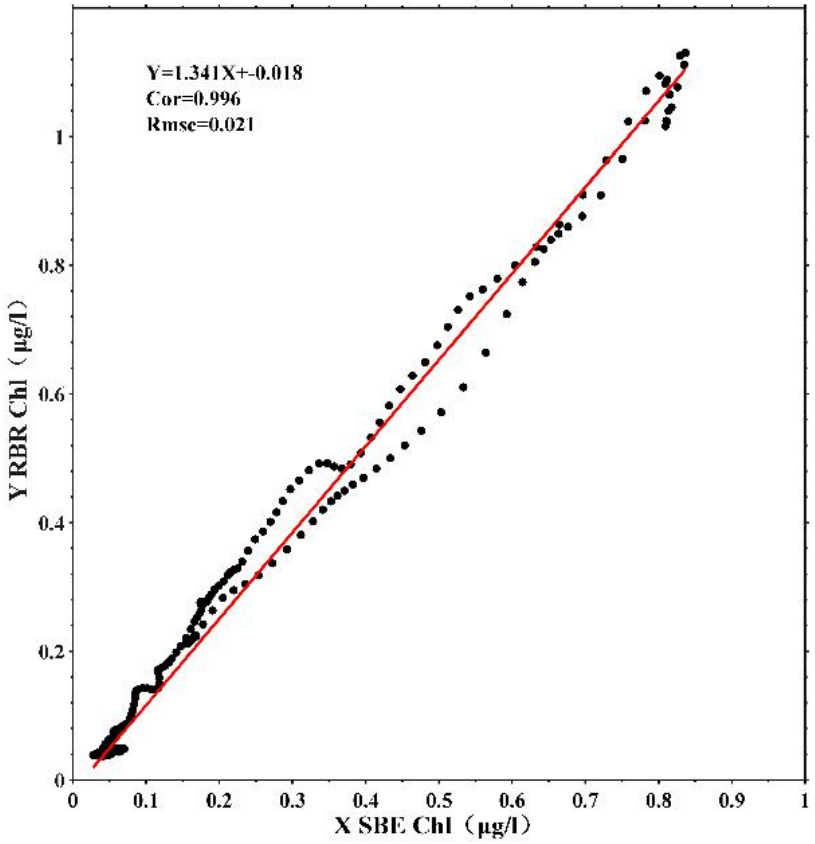


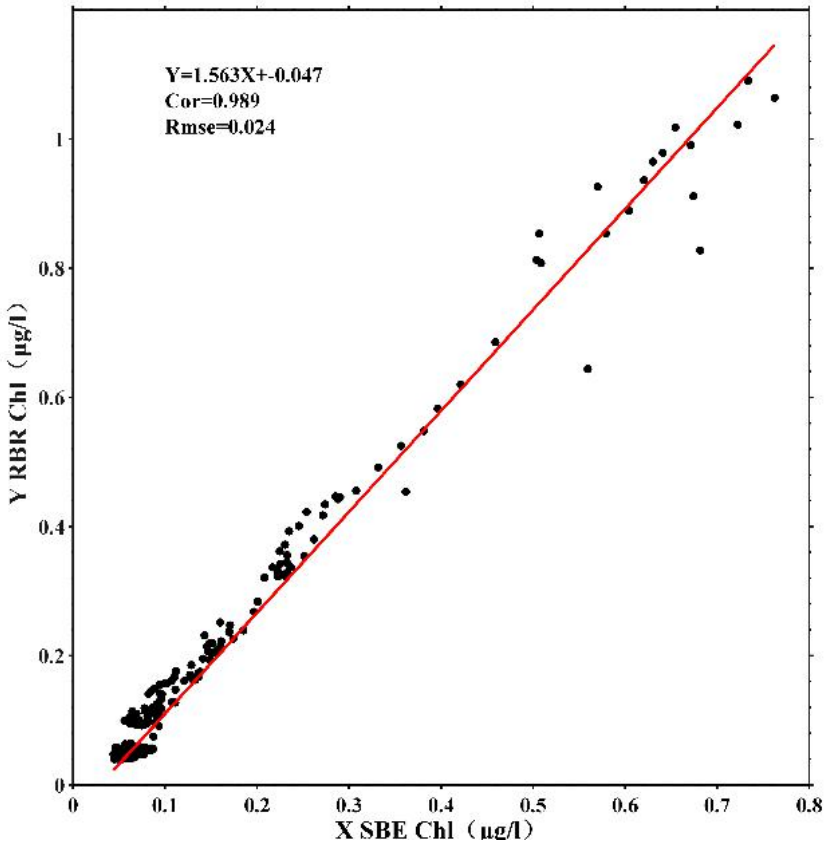


Provided by Zhang, Yang et al. unpublished data (SIOMNR)

BGC Data quality control (Instrument comparison)

RBR sensors compared with Seabird sensors (SBE 25)



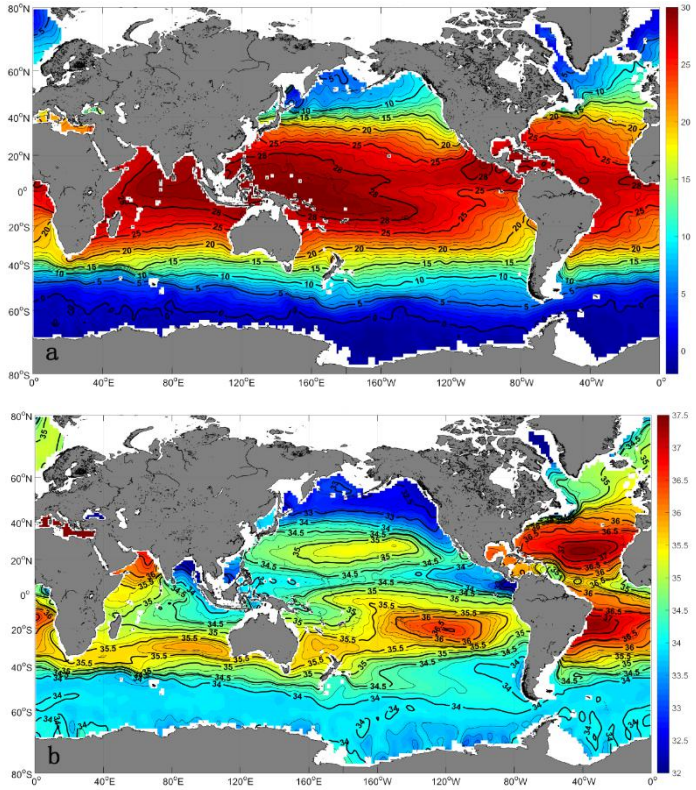


Provided by Zhang, Yang et al., unpublished data (SIOMNR)

Product distribution

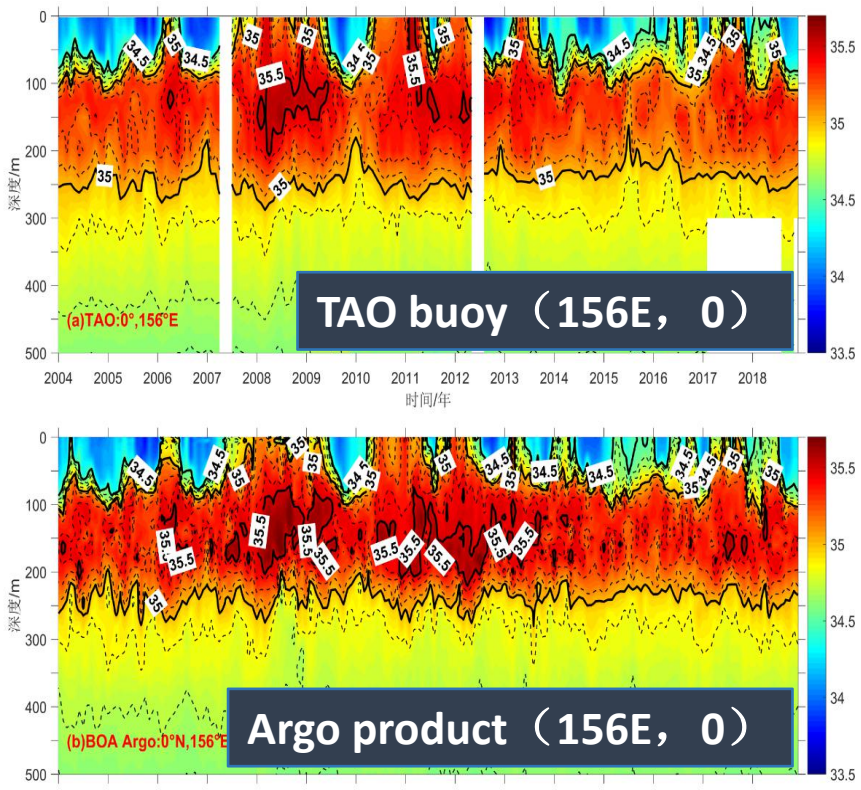
https://argo.ucsd.edu/data/argo-data-products/;
ftp://data.argo.org.cn/pub/ARGO/BOA_Argo/NetCDF/

CSIO		Global gridded NetCDF or Matlab dataset produced by the Barnes Method (BOA-Argo) Includes temperature, salinity, isothermal layer depth, mixed layer depth and composed mixed layer depth	Argo	1 degree global	58 levels to 1975 dbar	2004 - 2018	monthly	yearly



Global fields

Institution	Documentation	Gridded field description	Data Source	Spatial resolution	Vertical resolution	Temporal coverage
Univ. Brest/Ifremer/ CNRS/IRD LOPS	10.13155/22583	ISAS15: Global gridded NetCDF monthly fields and profile data base (2002-2015)	- Argo only - Argo plus others	1/2 degree global	152 levels to 2000 m	2002 - 2015
Copernicus Environment Monitoring Marine Service - Coriolis	10.5194/os-9-1-2013	Global gridded NetCDF dataset produced by optimal interpolation yearly (CORA5)	Argo plus others	1/2 degree global	250 levels to 2000 m	1950 - year N-2
CSIO		Global gridded NetCDF or Matlab dataset produced by the Barnes Method (BOA-Argo) Includes temperature, salinity, isothermal layer depth, mixed layer depth and composed mixed layer depth	Argo	1 degree global	58 levels to 1975 dbar	2004 - 2018
CSIRO		Global gridded netCDF dataset produced by LOES filter from all profile data including Argo but excluding bathythermograph. Also seasonal dynamic height and MLD. "CARS2009"	Argo plus others	0.5 degree global	79 levels to 5500 m	1930 to May 2009
CSIRO		Global gridded netCDF dataset produced by LOES filter from all Argo. Also seasonal dynamic height and MLD. "CARS2009"	Argo only	0.5 degree global	66 levels to 2000 m	All Argo, updated ~3 monthly
IFREMER/LPO	10.13155/22583	ISAS13: Global gridded NetCDF monthly fields and profile data base. Climatology 2004-2012.	Argo plus others	1/2 degree Merc	151 levels to 2000 m	2002 - 2012



CSIO provided grided monthly Argo products : 2014/01-2021/09

Ensure high quality procedure we take, deliver the ocean data we need !

Thank you very much!

Grant no. GASI-01-EIND-STwin

TPOS CHINA

FUTURE VISION FOR THE OCEAN

Grant no. GASI-01-WPAC-STspr

China JAMES and TPOS project

supported by Ministry of Natural Resoures

Indo-Pacific Ocean Variability and Air-Sea Interaction (IPOVAI)