

Chinese Efforts in Coastal Ocean Observation in 21st Century

Daji Huang

Second Institute of Oceanography, SOA

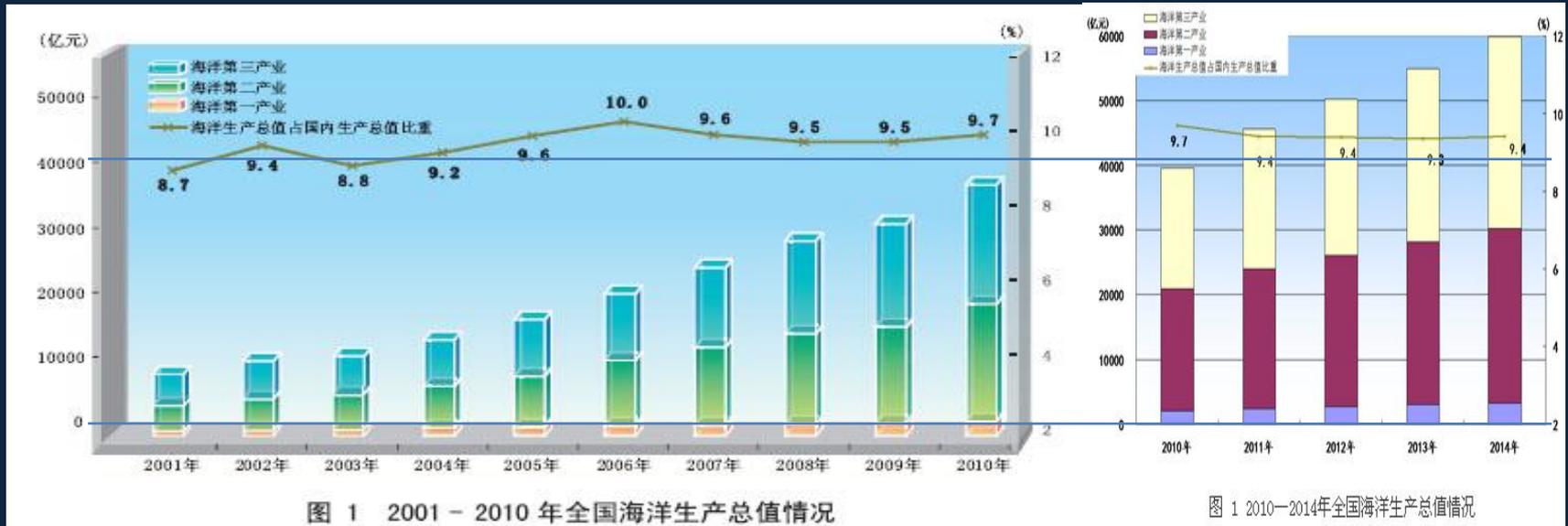
Oct. 17, Qingdao

PICES-2015 Annual Meeting

Outline

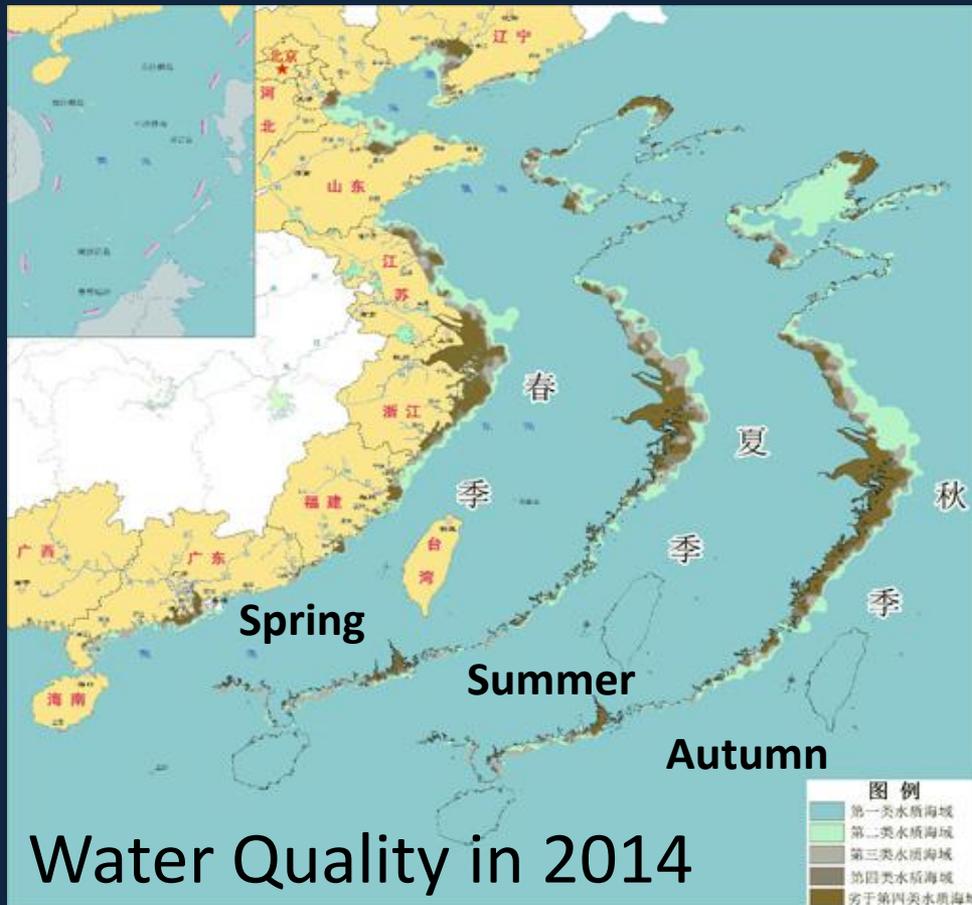
1. Background
2. General picture of the coastal ocean observing systems by reviewing Chinese efforts in the 21st century
3. Some related experiences and lessons
4. Some of the new insights in the Chinese waters gained by these coastal ocean observing activities

Marine Economy is an Important Part of National Economy



Increased from 1 trillion to 6 trillion from 2001 to 2014, contributed about 9.5%

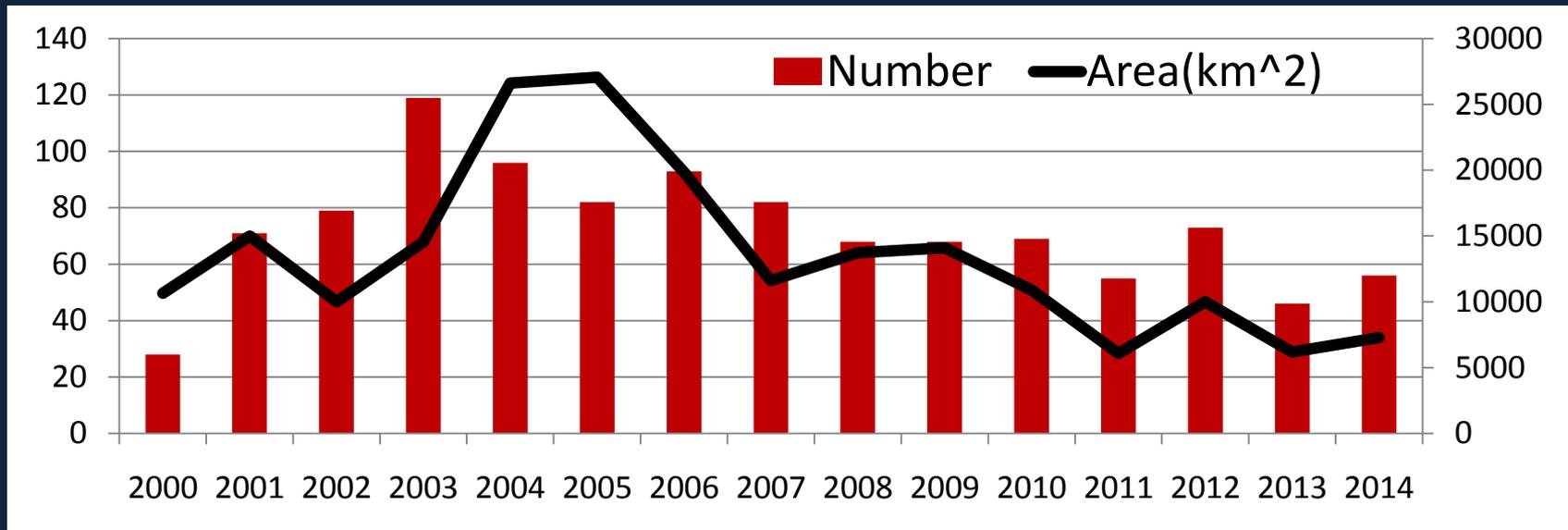
State of the Marine Environment



In the spring, summer and autumn of 2014, the water quality (inorganic nitrogen, phosphate, petroleum and chemical oxygen demand etc) is in good condition except some coastal area where it is still polluted.

I: Clean, II: comparative clean, III: slightly polluted, IV- medium polluted, IV⁺: heavily polluted

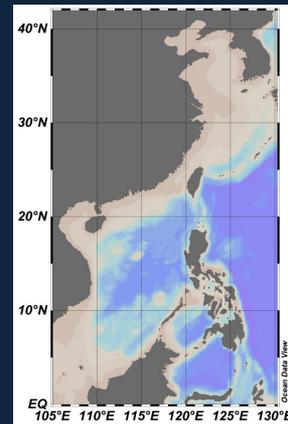
Harmful Algal Bloom in Chinese Coastal Seas



Number and Area (km²) of HAB in the Chinese coastal seas from 2000-2014

Efforts Associated with Coastal Ocean Observation

- ✓ SOA - State Oceanic Administration
 - Comprehensive survey and assessment of Chinese coastal ocean (908 Program)
- ✓ MOST- Ministry of Science and Technology
 - National Key Technology R&D Program (1982, 2006)
 - National High-tech R&D Program (863 Program)
 - National Basic Research Program (973 Program)
- ✓ NSF - National Science Foundation



Comprehensive Survey and Assessment of Chinese Coastal Ocean – SOA-908

1. Survey

- ① Whole Coastal Ocean
- ② Key Regions
- ③ Key Issues

2. Assessment

3. Digital Ocean

2004-2012(8y), 180(I), 30,000(p)

302+333 units



Comprehensive Survey and Assessment of Chinese Coastal Ocean – SOA-908

1. Survey - Whole Coastal Ocean

- ① Physical Oceanography and Marine Meteorology
- ② Marine Optics
- ③ Marine Chemistry
- ④ Marine Biology and Ecology
- ⑤ Bathymetry and Morphology
- ⑥ Marine Geology
- ⑦ Marine Geophysics



Comprehensive Survey and Assessment of Chinese Coastal Ocean – SOA-908

1. Survey - Key Regions (17:8+5+4)

- Dalian, Liaodong Bay, Beidaihe
- Tianjin, Yellow River Est.
- Lanzhou Bay, Qingdao, Subei
- ✓ Changjiang Est., Hangzhou Bay
- ✓ Zhoushan Islands, Minjiang Est.
- ✓ Xiamen
- Pearl River Est., Beibu Bay
- Hainan Islands, Xisha Islands



Comprehensive Survey and Assessment of Chinese Coastal Ocean – SOA-908

1. Survey - Key issues

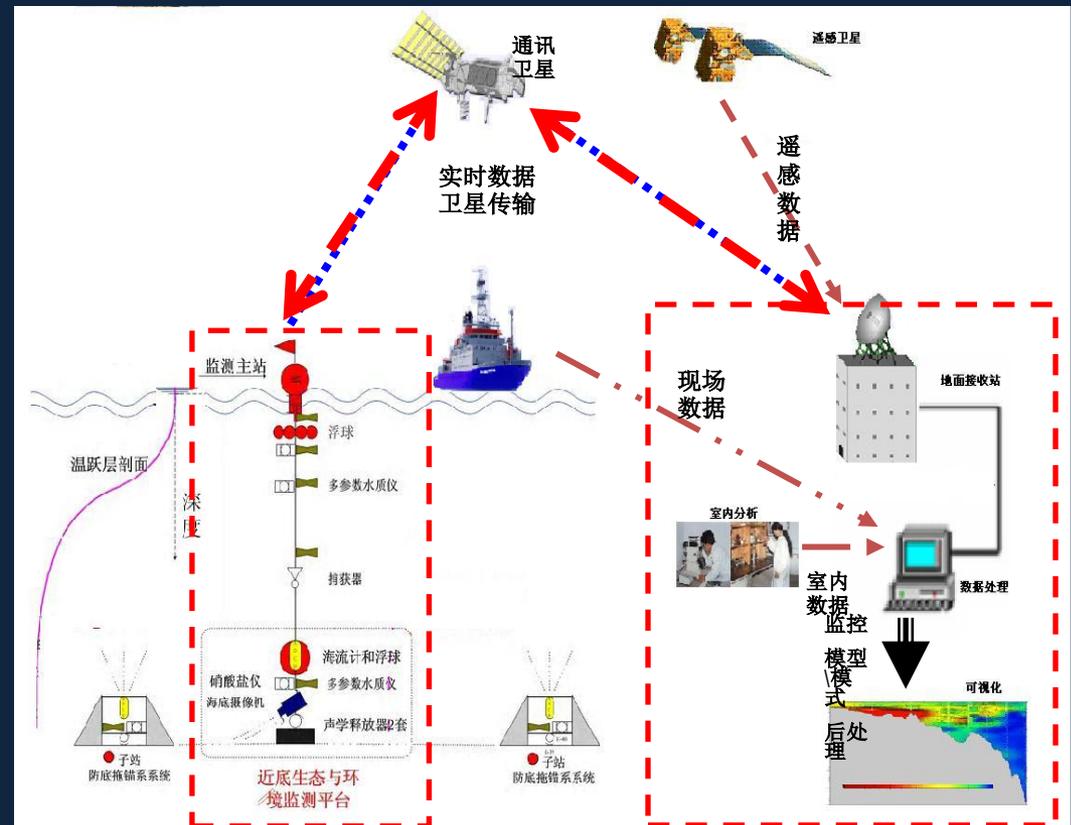
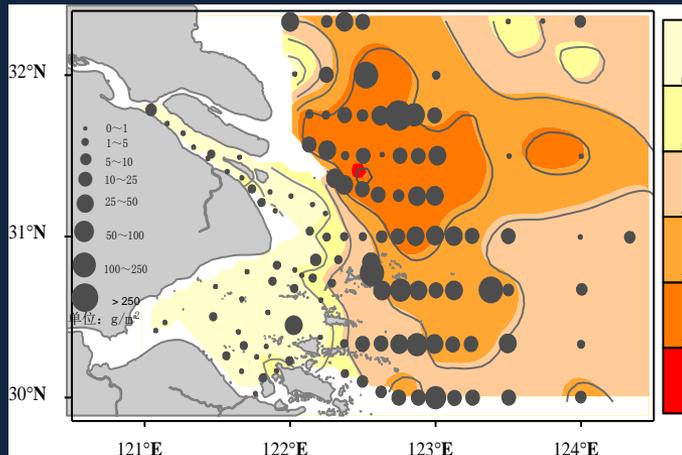
- ① Island
- ② Coastal Zone
- ③ RS - Island & Coastal Zone
- ④ Sea Area Usage
- ⑤ Socio-economic Status
- ⑥ Marine Hazard
- ⑦ Seawater Resources
- ⑧ Renewable Energy

Ministry of Science and Technology - MOST

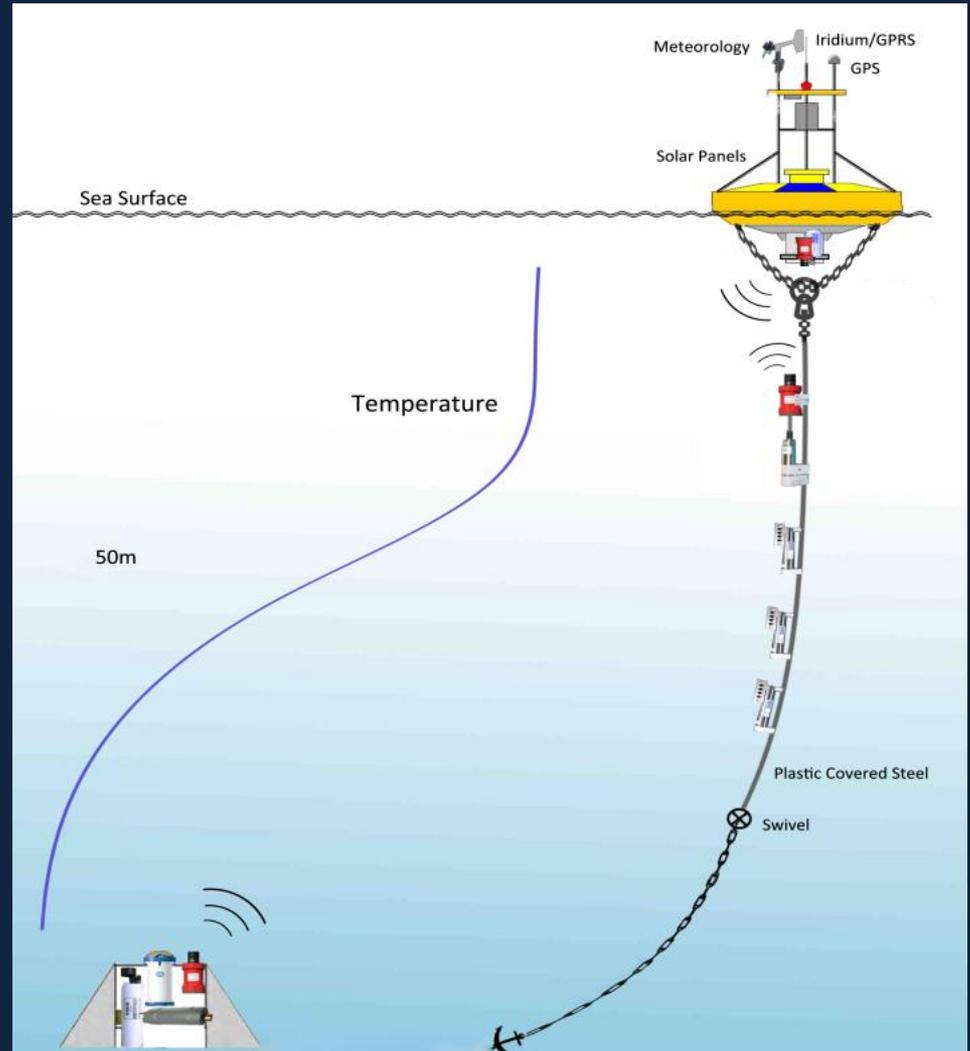
- National Key Technology R&D Program (1982, 2006)
- National High-tech R&D Program (863 Program)
- National Basic Research Program (973 Program)

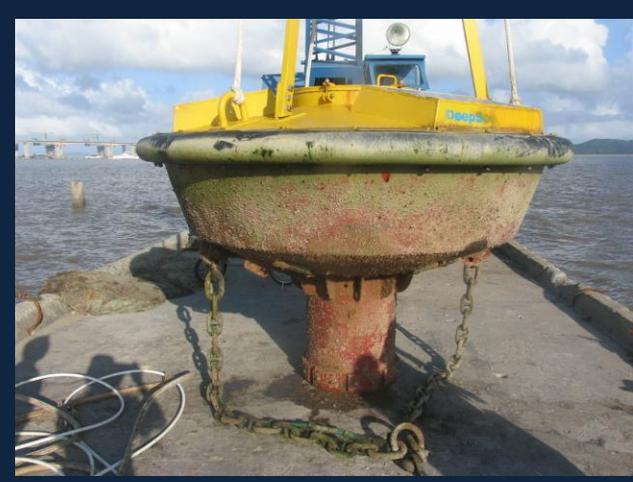
National Key Technologies R&D Program

- Aim to address major S&T issues in national economic construction and social development.
- Concentrate on the R&D of key and common technologies



Real-time monitoring system





National High-tech R&D Program (863 Program)

The screenshot shows the website interface for the Marine Technology field under the 863 Program. At the top left is the logo for the Administrative Center for China's Agenda 21. The main header features the 863 logo and the text '海洋技术领域' (Marine Technology Field) and '“863”国家高技术研究发展计划' (863 National High-tech Research and Development Program). A navigation bar includes links for '首页' (Home), '专题' (Special Topics), '项目' (Projects), '领域动态' (Field Dynamics), '通知公告' (Announcements), '申请指南' (Application Guide), and '专家风采' (Expert Profiles). The main content area is divided into four sections, each with a grid of images and a text box:

- 海洋环境立体监测技术** (3D Marine Environment Monitoring Technology): Focuses on national security, economic development, environmental protection, resource development, and disaster relief. It aims to advance marine monitoring technologies and improve autonomous innovation capabilities.
- 深海探测与作业技术** (Deep-sea Exploration and Operation Technology): Aims to improve original innovation and obtain自主知识产权 (IPR) for deep-sea resources like polymetallic nodules, cobalt crusts, and hydrothermal sulfides.
- 海洋油气勘探开发技术** (Marine Oil and Gas Exploration and Development Technology): Addresses the need for oil and gas resources, focusing on advanced exploration and development technologies to improve autonomous innovation.
- 海洋生物资源开发利用技术** (Marine Biological Resource Development and Utilization Technology): Combines national long-term science and technology development plans with high-tech frontier exploration and integration research to support marine biological economic development and public health.

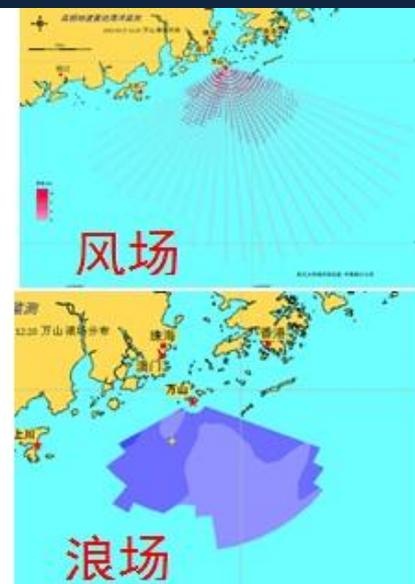
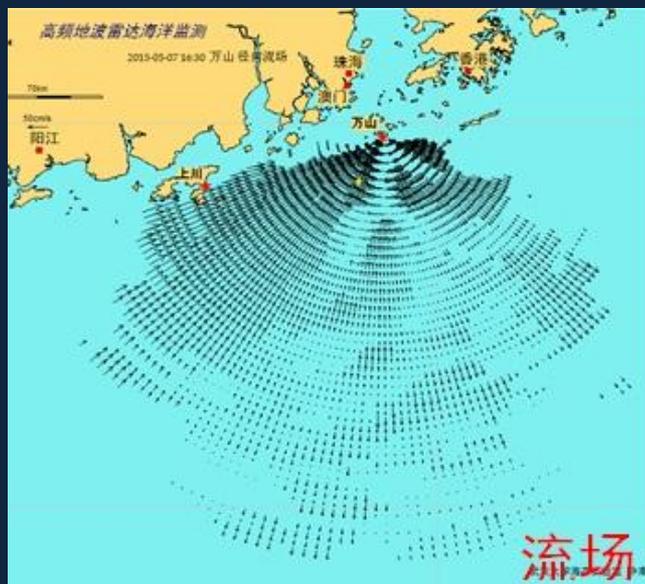
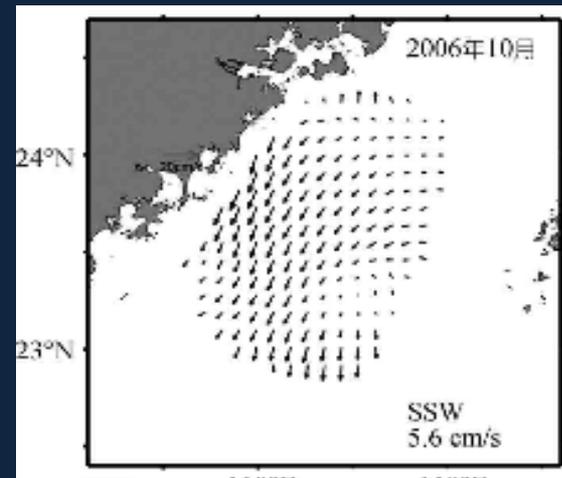
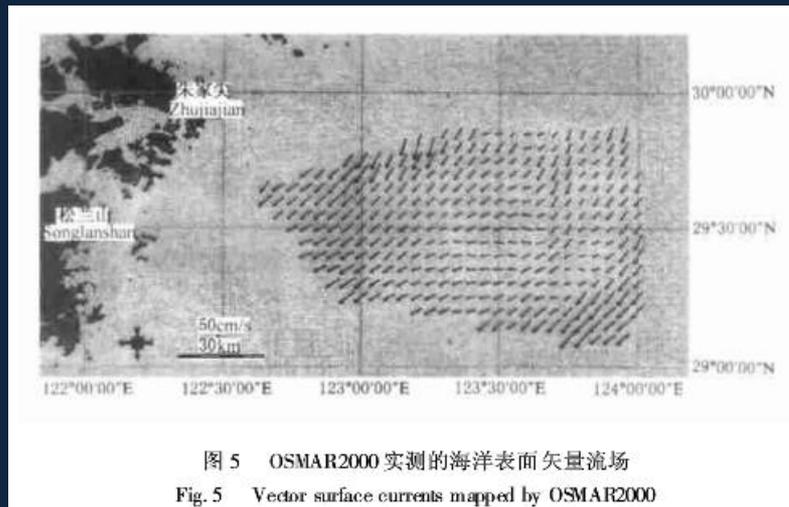
National High-tech R&D Program (863 Program)



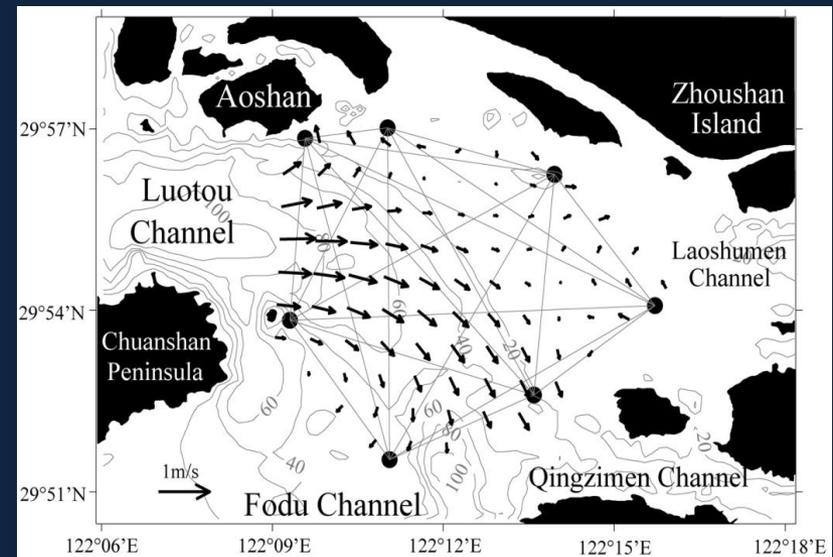
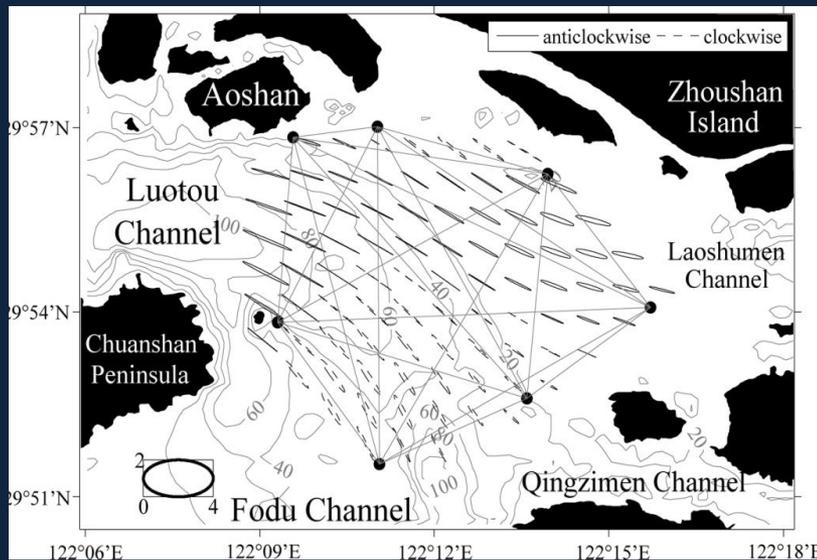
1. Marine Environment Monitoring Technology

- ✓ Focus on the key technology of marine dynamic environment and ecological environment monitoring
- ✓ Develop sensor, platform, integrated application system
- ✓ Upgrade real-time three-dimensional monitoring information acquisition and numerical forecasting ability of the marine environment
- ✓ Provide technical support to the monitoring and protection of marine environment

High Frequency Radar



Coastal Acoustic Tomography



Mapping Tidal Current Structures in Zhitouyang Bay, China, Using Coastal Acoustic Tomography

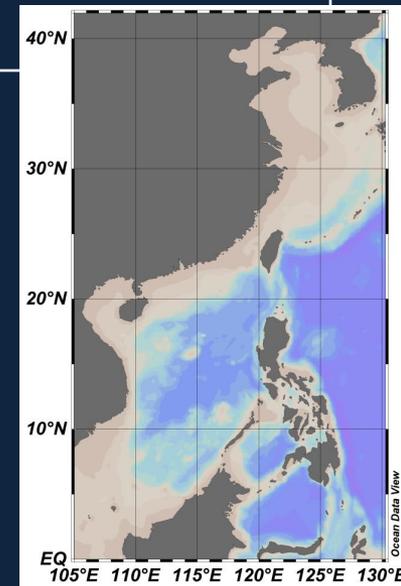
Xiao-Hua Zhu, Arata Kaneko, Qingsong Wu, Chunzheng Zhang, Naokazu Taniguchi, and Noriaki Gohda, IEEE Journal of Oceanic Engineering, Vol. 38, No. 2, April 2013

National Basic Research Program (973 Program)

- Strengthen basic research in line with national strategic targets
- About 10 projects had been implemented in coastal ocean science 1998
- Each project involves about 50 persons and conducts about 10 cruises in a period of 5 years

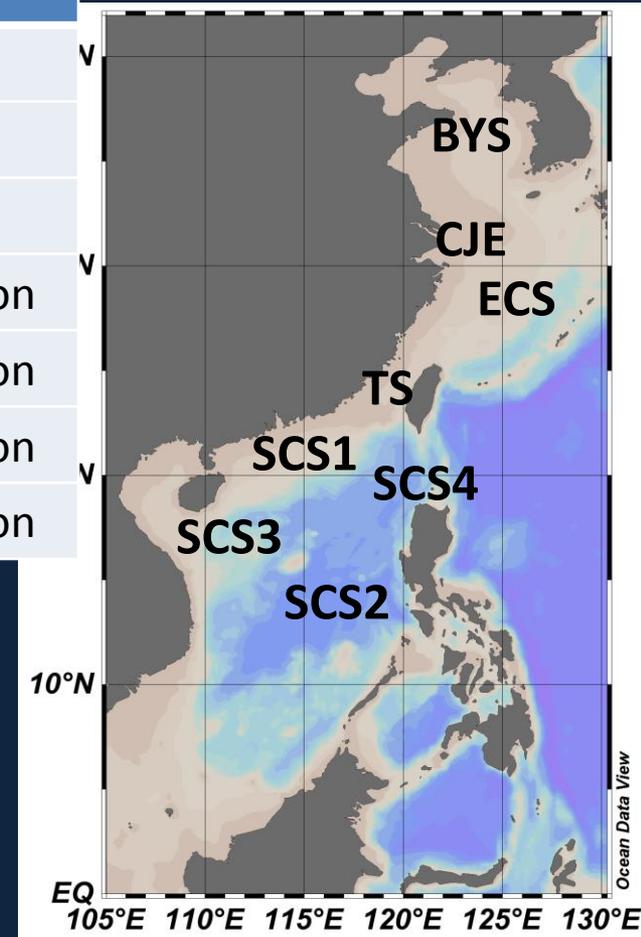
Features:

Focus on specific issues, inter- or multi-disciplines



National Science Foundation - NSF

Year	Cruise	Region
2010	5	BYS, ECS, TS, SCS
2011	6	BYS, ECS, TS, SCS1, SCS2
2012	7+4	BYS, ECS, CJE, TS, SCS1,SCS2,SCS3 + season
2013	8+5	BYS, ECS, CJE, TS, SCS1,SCS2,SCS3, SCS4 + season
2014	8+5	BYS, ECS, CJE, TS, SCS1,SCS2,SCS3, SCS4 + season
2015	8+4	BYS, ECS, CJE, TS, SCS1,SCS2,SCS3, SCS4 + season
2016	8+4	BYS, ECS, CJE, TS, SCS1,SCS2,SCS3, SCS4 + season



Features:

Platform, Free exploration, diverse, loosely focused.

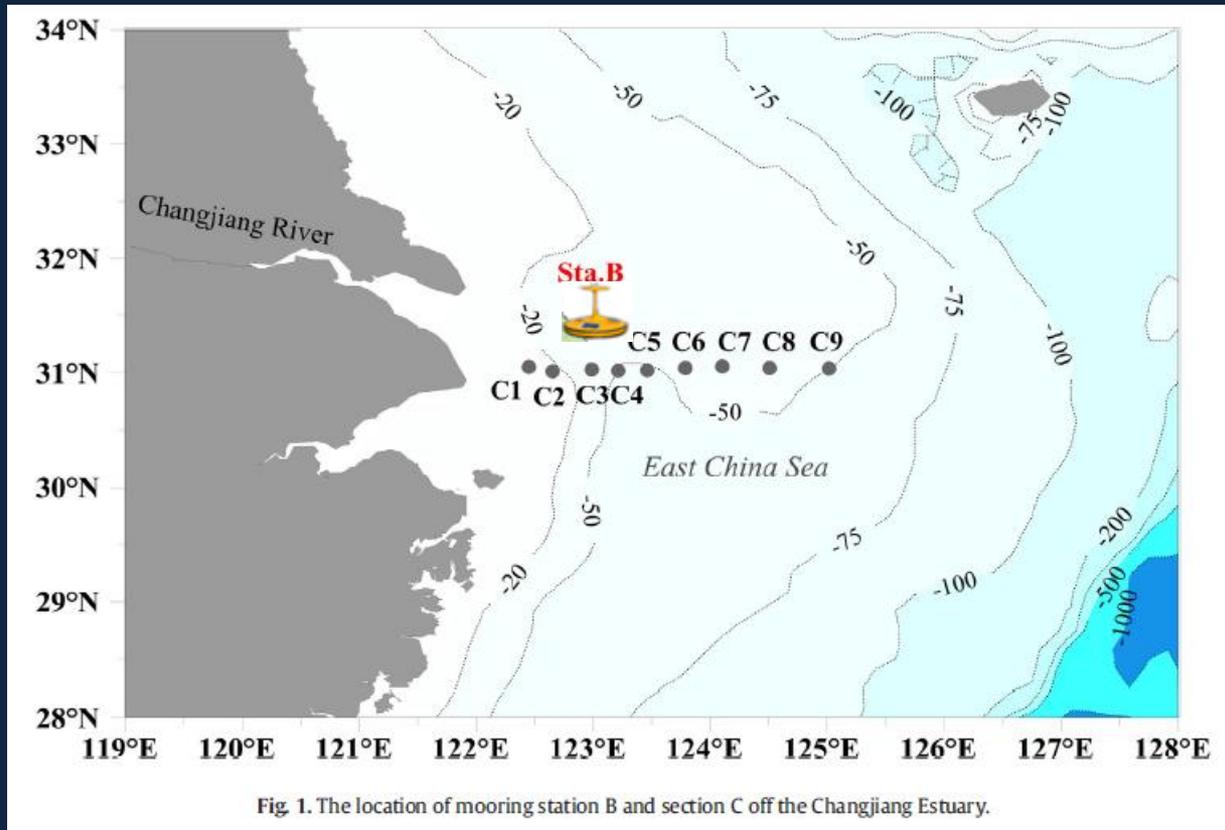
Experiences and Lessons

- SOA-908
 - National demand, operational, Basic information and policy and management
- MOST
 - National demand + frontier, Scientific knowledge and innovative technology
- NSF
 - Personal interest, scientific knowledge

Experiences and Lessons

- Interaction need to be intensified
- Overlap should be avoided
- Data and information share need to be improved
- Standardization of the ocean observing within or between disciplines
-

Variation of bottom DO and its mechanism



Temporal variation of DO, SST, T_B, Wind

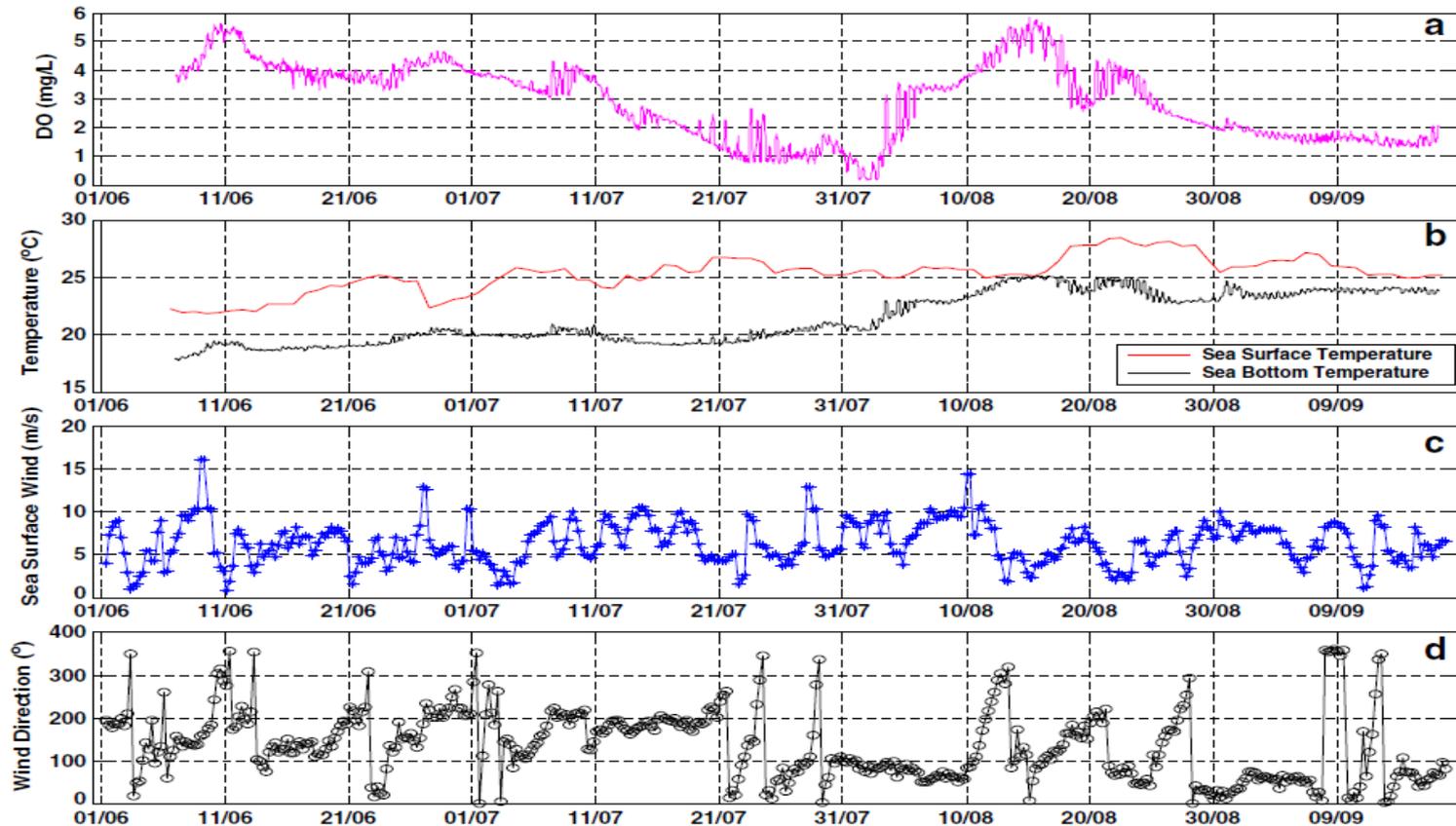
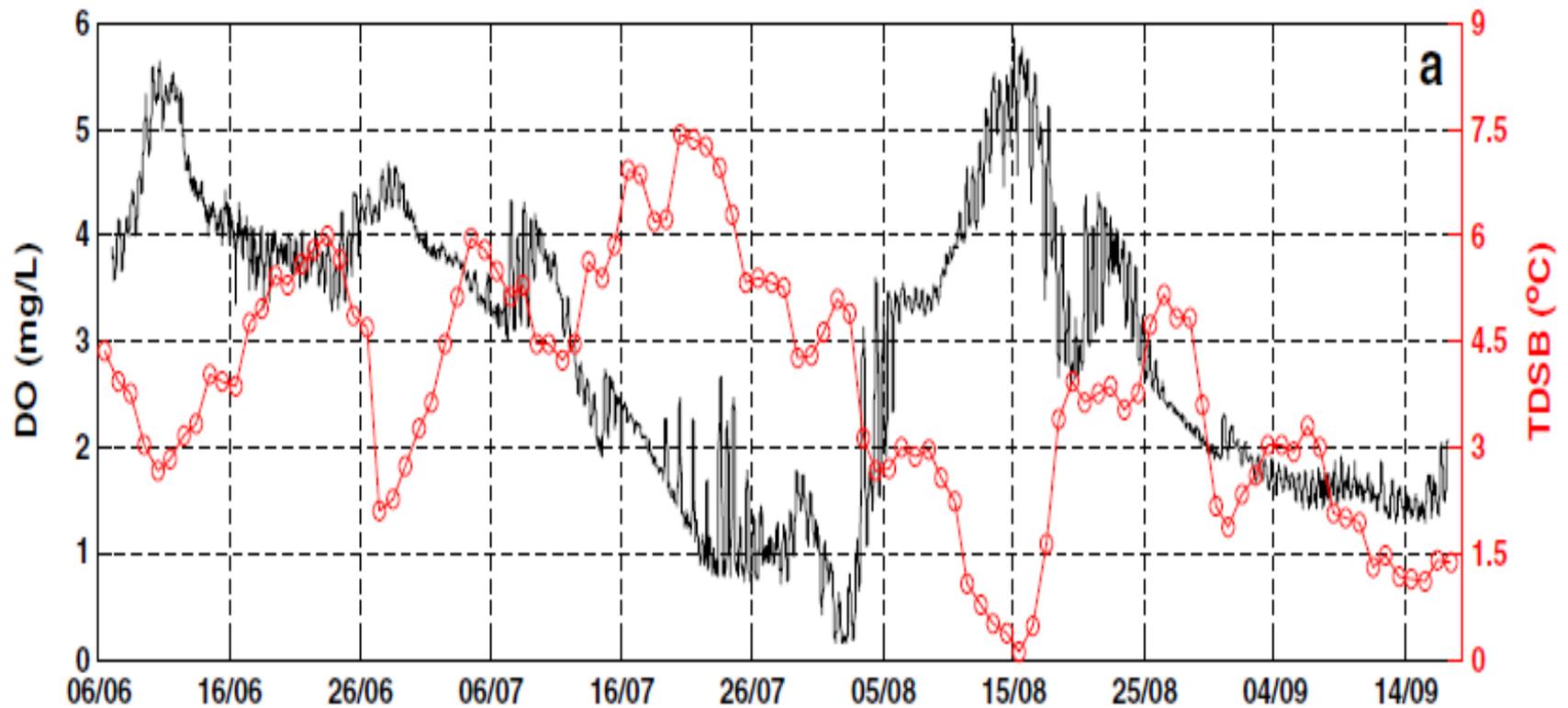


Fig. 2. The temporal variation of bottom DO (a, mg/L), sea surface temperature/sea bottom temperature (b, °C), sea surface wind speed (c, m/s), and wind direction (d, °) at station B in 2009.

Ni X, Huang D, Zeng D, Zhang T, Li L, Chen J, The impact of wind mixing on the variation of bottom dissolved oxygen off the Changjiang Estuary during summer. *J. Mar. Syst.* (2014), <http://dx.doi.org/10.1016/j.jmarsys.2014.11.010>

Relation of DO with stratification



Relation of DO with stratification and mixing

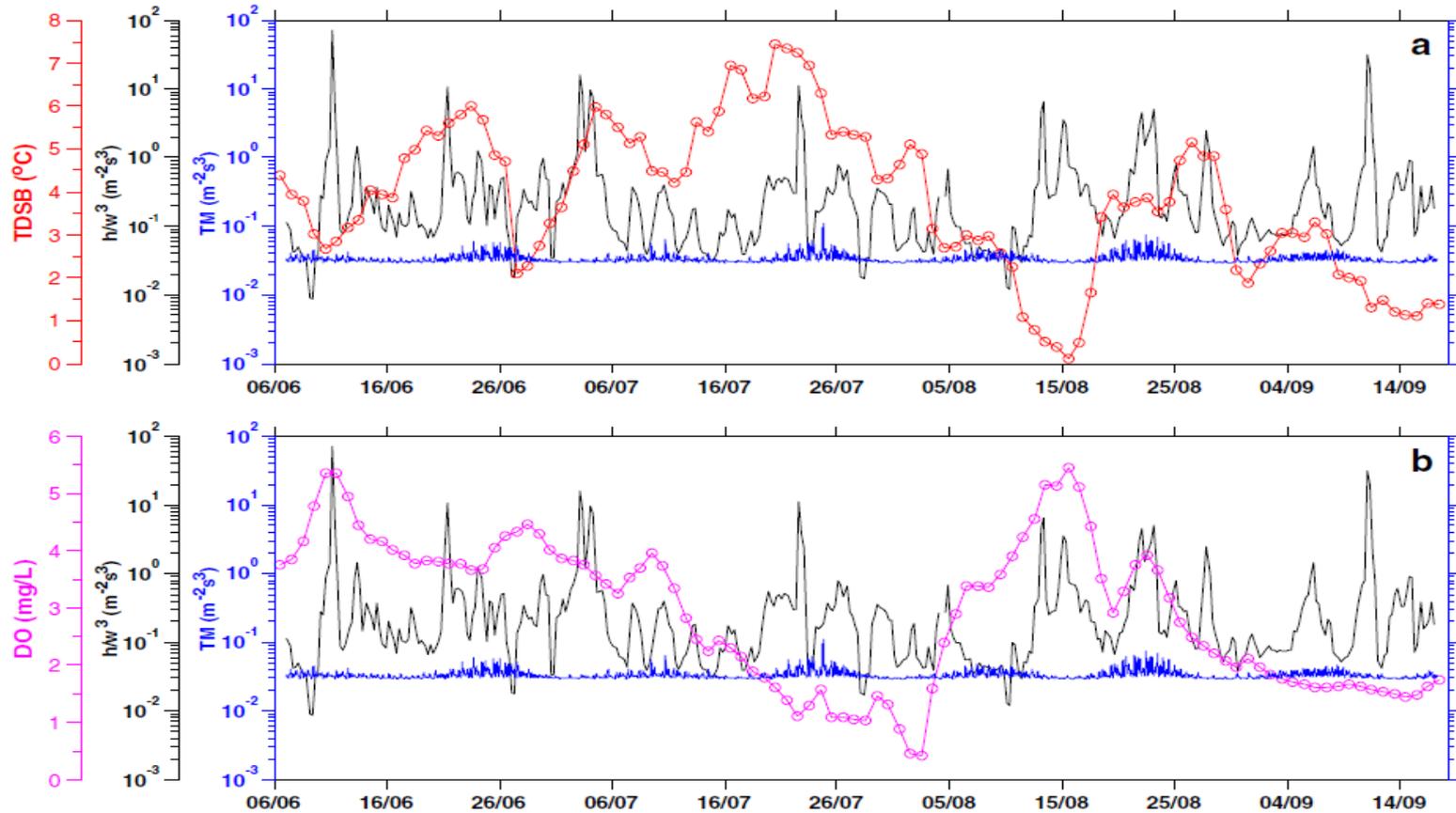


Fig. 7. The temporal variation of TDSB (a, °C) with h/W^3 (a, $m^{-2} s^3$) and TM (a, $m^{-2} s^3$), daily averaged DO (b, mg/L) with h/W^3 (b, $m^{-2} s^3$) and TM (b, $m^{-2} s^3$) at station B in 2009.

Summary

- **With the development of the national economy in the 21st century, more efforts than ever have been spent by the Chinese government in Chinese coastal waters to provide better scientific knowledge to protect the coastal ocean environment and to maintain a healthy coastal ocean ecosystem for sustainable production and service.**
- **A general picture of the coastal ocean observing systems is shown by reviewing Chinese efforts in the 21st century, including efforts conducted by the SOA, MOST, and NSF.**
- **Experiences of lessons need to be shared.**
- **New insights, in particular the dynamic relationship between parameters on different time scales are gained.**

**Thank You for
Your Attention !**