

Indian Ocean Workshop: *What to do?*
Hangzhou, China
24th – 25th October, 2019

Lei Zhou, Shanghai Jiaotong University; Weidong Yu, Sun Yat-Sen University; In-Sik Kang, Second Institute of Oceanography; Jose Santos, CLIVAR International Project Office.

Scientists from China, USA and Italy recently gathered in the city Hangzhou, which is well known for her beautiful West Lake as the *Paradise on Earth*, to convene the "Lakeside" brainstorming with the vision to promote the Indian Ocean science, on Nov. 24-25, 2019, with the kind host by Prof. In-Sik Kang and his newly affiliated Indian Ocean Center at the Second Institute of Oceanography (SIO) of Ministry of Natural Resources. The Agenda of the 2-day workshop is presented in Annex 1; the list of participants is shown in Annex 2.



The objectives of the workshop were:

- To exchange results of recent research activities, and coordination and integration of those activities.
- Brainstorming of future Indian Ocean research: Observations, Modelling and Prediction, and identifying important scientific issues of current Indian Ocean research particularly for Observation and Prediction, and developing a future direction of Indian Ocean research and operation.
- Discussion of research collaboration network among various centers, particularly among SIO/SOED/IOOC, SCSIO/LTO, and ICTP/ESP Italy.

At the opening, the senior scientist Academician Dr. Jilan Su from SIO emphasized the critical role of the international cooperation and urged the close collaboration between Chinese community and the international programs, such as CLIVAR, in some way like Chinese CLIVAR committee. Academician Dr. Dake Chen from SIO backed up Dr. Su's advocacy. Then, Dr. Jose Santos from

the International CLIVAR Project Office briefed CLIVAR's recent efforts in its Indian Ocean Regional Panel, particularly the decadal review of the Indian Ocean Observing System (IndOOS), and he encouraged more active engagement of Chinese scientists in CLIVAR, considering the low Chinese representation across CLIVAR panels. Dr. Santos also mentioned the opportunities of international collaboration that presents the Indian Ocean Observing System Resources Forum (IRF) and the Indian Ocean Global Ocean Observing System (IOGOOS).

The workshop discussion started with the review of last year's Indian Ocean Workshop by Dr. Lei Zhou as the local host of the last year workshop at Shanghai Jiao Tong University. It is agreed that some actions should be followed up such a series of workshops. The discussion was running on five topics, i.e., observations, modelling, key process study, novel technologies, and collaborations.

For observations, RAMA is progressing well with the anticipation of the full implementation in the coming years. China has made significant contribution along with other partners to plan, implement and sustain RAMA and other IndOOS components. Such endeavor is highly appreciated and it is suggested that the momentum be kept for bigger success. Some cruises targeted on the process studies are introduced, including the annual routine cruises in the Eastern Indian Ocean (EIO) under the support of Chinese NSF, the EIO cruises from MNR.

Dr. Fei Chai from SIO recommended an inventory list of all kinds of in-situ data. For modelling, all participants agreed that the latest CMIP6 outputs required timely diagnoses. Particularly, comprehensive comparisons with CMIP5 are needed, so that people can have a clear idea in the progress and persistent biases in modelling. However, some systematic problems, such as SST and precipitation biases over the Indian Ocean, are still open to be further addressed to achieve the deep understanding of the fundamental dynamics. For the process study, two concepts were extensively discussed. One was the interactions among basins, such as the impact from the Atlantic Ocean on the western Indian Ocean. The other one was the ITCZ, which seems to be a hinge between processes at different spatiotemporal scales over the Indian Ocean.

Technology is called upon for the scientific breakthrough. BGC-Argo is highlighted as one promising tool. Throughout the workshop discussion, collaboration and coordination among the projects are the key words repeated the most times. Obviously, collaboration and teamwork are the must for Indian Ocean observation and study.

In summary, the Indian Ocean workshop reiterated the strong interests and continuing commitment from various groups in driving the ball rolling faster through more in-depth scientific discussion, community planning, coordination, data and logistics sharing. Finally, the idea of continuing this discussion workshop is welcomed and the next one will be in Guangzhou in 2020 with the kind host of South China Sea Institute of Oceanography.



Annex 1: 2019 Indian Ocean Workshop: *What to do* Agenda

2019.10.24 Thursday	
08:40-09:00	Registration
09:00-09:15	Opening Professor Jilan Su, Professor Dake Chen
09:15-09:40	CLIVAR Jose Santos, <i>The Contribution of WCRP/CLIVAR to Indian Ocean Research</i>
09:40-10:10	Photo and Tea Break
10:10-11:40	Introduction of institution activities
10:10-10:40	SCSIO Chunzai Wang/DongXiao Wang
10:40-11:10	ICTP Fred Kucharski/Riccardo Farneti
11:10-11:40	SIO/SOED/IOOC Feng Zhou/In-Sik Kang
11:50-13:30	Lunch place: Second Floor of the First Building, He Feng Dinner room
11:40-12:00	MOU signing between SIO/SOED and SCSIO/LTO for research collaboration
13:30-14:30	Scientific issues and discussion
Lei Zhou	<i>Summary of the issues discussed in the last year workshop</i>
Yan Du	<i>Scientific questions of tropical western Indian Ocean</i>
Lin Wang	<i>Possible influences of the IO on the East Asian winter monsoon</i>
14:30-16:00	Observational issues and discussion
Dongxiao Wang	<i>Equatorial Under Current and EIC in the eastern Indian Ocean - seasonal features in the mooring array</i>
Yan Du	<i>SCSIO Fields observations in the eastern Indian Ocean Scientific questions of tropical western Indian Ocean</i>
Weidong Yu	<i>International Programs of Ocean Observation</i>
16:30-17:30	Modelling and Prediction, Fei Chai/In-Sik Kang
18:00-20:00	Banquet, Second floor of the first building, Song Tao and Bai Lu Dinner Room

2019.10.25 Friday	
09:00-10:30	20 min talks
Chunzai Wang	<i>Response and Influence of the Indian Ocean to/on Climate Variability</i>
Edwin Schneider	<i>Evaluation of Indian Ocean predictability for inter-annual and multi-decadal time scales</i>
Jianping Li	<i>Atmospheric energetics during IOD events and the relative roles of South China Sea summer monsoon and ENSO in IOD development</i>
Fred Kucharski	<i>Tropical Atlantic influence on the Indian Ocean</i>
11:00-12:00	20 min talks
Raghu Murtugudde	<i>Role of the Eastern Indian Ocean in the Split ITCZ and Monsoon Onset</i>
Lei Zhou	<i>Intra-seasonal variabilities over tropical Indian Ocean</i>
Weidong Yu	<i>Some Indian Ocean processes yet to be addressed by</i>
12:00-13:30	Lunch place: First Floor of the First Building, BaiHe Dinner Room
13:30-15:00	20 min talks
Jing-Jia Luo	<i>Interbasin influence on the seasonal-multiyear prediction of ENSO</i>
Riccardo Farneti	<i>ICTP Regional Coupled Model RegCM-ES: results over S. Asia Domain</i>
Ruibin Ding	<i>Internal and External Variability of the Indian Ocean</i>
Yue Yu	<i>Unstable Mode(BV) over Indian Ocean & Simulation Experiment based on OpenIFS</i>
15:00-16:00	Overall Discussion, Summary and Conclusion of the workshop (In-Sik Kang)
18:00	Dinner; Second Floor of the First Building, He Feng Dinner room

Annex 2: List of Participants

- Foreign scientists:
 - Fred Kucharski (International Center for Theoretical Physics, Italy)
 - Riccardo Farneti (International Center for Theoretical Physics, Italy)
 - Edwin Schneider (George Mason University, USA)
 - Raghu Murtugudde (University of Maryland, USA)

- Second Institute of Oceanography, Hangzhou:
 - Jilan Su
 - Dake Chen
 - Fei Chai
 - Daji Huang
 - Feng Zhou
 - Youmin Tang
 - Xiaohua Zhu
 - Chujin Liang
 - Jiliang Xuan
 - In-Sik Kang
 - Ruibin Ding
 - Yue Yu

- South China Sea Institute of Oceanography, Guangzhou:
 - Chunzai Wang
 - DongXiao Wang
 - Yan Du
 - Di Zhao

- Other Domestic Institutes:
 - Jianping Li (Ocean University of China, Qingdao)
 - Weidong Yu (Sun Yat-Sen university)
 - Song Yang (Sun Yat-Sen University)
 - Yuting Liang (Sun Yat-Sen University)
 - Lei Zhou (Institute of Oceanography, Shanghai Jiaotong University)
 - Jing-Jia Luo (Nanjing University of Information Science and Technology, Nanjing)
 - Lin Wang (Center for Monsoon System Research, Institute of Atmospheric Physics, Chinese Academy of Sciences)
 - Pengfei Wang (Center for Monsoon System Research, Institute of Atmospheric Physics, Chinese Academy of Sciences)

- International Organization
 - Jose Santos (International CLIVAR Project Office, Qingdao)