Partnership for
Observation of the Global Ocean

OCEAN OBSERVATIONS TO SOCIETAL APPLICATIONS

October 30 – November 05, 2022

International Training Centre for Operational Oceanography (ITCOOcean)

in collaboration with
Andhra University, Visakhapatnam

OBJECTIVES:

Observing the Ocean is the key to the findings of the ocean processes, its influence on the coasts, climate and impacting the livelihood of mankind. Knowing the tools and techniques to measure and analyse various geophysicochemical parameters are essential for having accurate results / predictions. For the benefit of the society, turning these observations into operational product/service is the need of the hour.

RATIONALE:

This training programme addresses POGO's 2nd priority area on Capacity Building defined in its Strategy document "Taking the pulse of the Global Ocean – Strategy of the Partnership for Observation of the Global Ocean (POG), 2021". The training programme aimed at developing the capacity of Small Island Developing States from Indian Ocean and the IO Rim countries including IOGOOS Members, POGO members, etc. The expertise of the faculty members of the training programme makes the participants to be capable of applying the learned skills in their parent institutions /home country and will be able to handle various observation platforms and data analysis, thus paving path towards enhanced observations in respective regions. The training programme also aligns with the objectives of the UN Ocean Decade and contributes to the proposed outcomes of Ocean Decade on "A Predicted Ocean" and "A safe Ocean". As the training programme encompasses the aspects starting from observations to societal services, the trainees could potentially replicate the same in their home country towards development of services to predict the ocean thereby enabling the safety at ocean.

TRAINING PROGRAM:

The training was held in hybrid (Physical and Microsoft Team) mode. All the students joined the training physically with faculty members in hybrid mode. A keynote talk on "The Ocean Observations and their role in the Society" was delivered by Dr. Toste Tanhua, GEOMAR Helmholtz Centre for Ocean Research Kiel and Vice-Chair, Global Ocean Observing System (GOOS).

Each faculty member talk focused on a service theme in which the faculty members covered the observational requirements, principles of equipment's used to measure the geophysical parameters, data analysis and utilization to that respective service/ theme. Another talk showcased the heterogeneous data available in the Indian Ocean and its applications. To make the trainees ready for action at their respective institutions, practical lab sessions were imparted with demonstration of the data collection and lab analysis of water samples collected. The detailed agenda is provided at Annexure 2. The theory sessions were held at e-class room facilities of International Training Centre for Operational Oceanography (ITCOOcean) at INCOIS, Hyderabad including the demonstration of various ocean instruments and show case of wet & dry labs, IRMS, HPLC, etc. The field trip onboard the vessel was conducted at Centre for Studies on Bay of Bengal (CSBOB) of Andhra University in Visakhapatnam. Few equipment's were operated onboard for collection of the data and water samples. The water samples were analyzed at the laboratory of CSBOB. In addition, the participants were introduced to (i) the POGO and its activities in brief, (ii) the IndOOS-2 activities towards the climate services and the need for sustained ocean observations and (iii) coastal observations in under-resourced countries – a portable and economical platform.

Figure 1: The participants during the Inaugural session of the training at e-class room of INCOIS

FACULTY:

The Faculty were drawn from GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany, South African Environmental Observation Network /University of Cape Town, South Africa, University of Edinburgh, United Kingdom and national faculties from Andhra University, Indian Institute of Tropical Meteorology (IITM), Indian Meteorology Department (IMD), Indian National Centre for Ocean Information Services (INCOIS), Indian Ocean Regional Panel (IORP) of CLIVAR/GOOS, National Institute of Ocean Technology (NIOT) and Sustained Indian Ocean Biogeochemistry and Ecosystem Research (SIBER).

PARTICIPANTS:

10 foreign nationals were selected for the training programme under POGO Sponsorship and 02 trainees as self-sponsored. Due to last minute emergencies / visa issues, 04 participants cancelled their participation. Finally, 08 trainees (06 under POGO and 02 self-sponsored) from Bangladesh, Indonesia, Maldives, Mozambique, South Korea, Sri Lanka and Tanzania were able to join the training programme. 15 trainees across all over India have participated in the training. List of final participants is attached at Annexure 5.

SIDS: Maldives (Mauritius participant cancelled in the last minute)
POGO Members: Bangladesh, India
IOGOOS Members: Bangladesh, India, Indonesia, Maldives, Mozambique, Sri Lanka and Tanzania
Others: South Korea

FIELD TRIP AND LAB EXERCISES:

The field trip was arranged by the training partner Centre for Studies on Bay of Bengal (CSBOB) of Andhra University at Visakhapatnam. The field trip comprises of two components 1. Sailing onboard and 2. Sample analysis in laboratory.

Figure 2: The participants during the Field trip of the training at Andhra University, Visakhapatnam

The field trip and laboratory analysis were planned in such a way that the trainees could get hands-on experience on use of hyperspectral radiometer, CTD profiler, analysis of Chlorophyll-*a* (Chl-*a*), turbidity, Dissolved Oxygen (DO), and inorganic macronutrients.

The field trip was conducted in the coastal waters of the western Bay of Bengal, off Visakhapatnam on 4th November 2022. One day prior to the onboard exercise, the participants were initially divided into two groups for ease of providing equal opportunity to handle the sampling gears and instruments. Subsequently, they were briefed about the field trip schedule and sequential activities such as water sample collection, preservation, pre-analysis, sample processing and final analysis. They were guided to have the hands-on experience in preparing the reagents, standards for the nutrients analysis, pre-deployment set up of the instruments (CTD Profiler, and Hyperspectral Radiometer), and necessary working principle as well as the method of data acquisition of the instruments.

On 4th November 2022, the first batch arrived at the harbour at 0600 hrs and sailed to the pre-fixed location. They were demonstrated about the onboard operational techniques of the Niskin Water Sampler, CTD profiler, and Hyperspectral Radiometer. In order to collect the water samples for DO analysis, the trainees were demonstrated about the collections techniques, necessary precautions to stop any kind adiabatic changes, and fixing of the samples. In addition, water samples were collected and stored for further analysis of Chl-*a*, turbidity, and macronutrients. Subsequently, CTD and

Radiometer were deployed by the trainees under the supervision of the resource persons. The steps of real-time data acquisition through the instruments and initial data quality assessment were shown to the participants. Several queries raised by the participants regarding the instrument operation and troubleshooting were addressed. The field trip of the first batch was completed by 1000 hrs, and they deboarded and returned to the laboratory at CSBoB. A similar exercise was repeated for the second batch.

In the afternoon session on 4th November 2022, the participants were engaged in estimating DO from the preserved samples, filtration of water samples for analysis of Chl-*a*, and nutrients. For Chl-*a*, the filter papers were kept overnight for pigment extraction. Subsequently, water samples were analyzed for the estimation of the nutrients using the spectrophotometric technique. Prior to the estimation of macronutrients (nitrite, nitrate, ammonium, phosphate, & silicate), the participants were demonstrated on the requisite standardization process for 'factor' estimation for the calculation of final concentration.

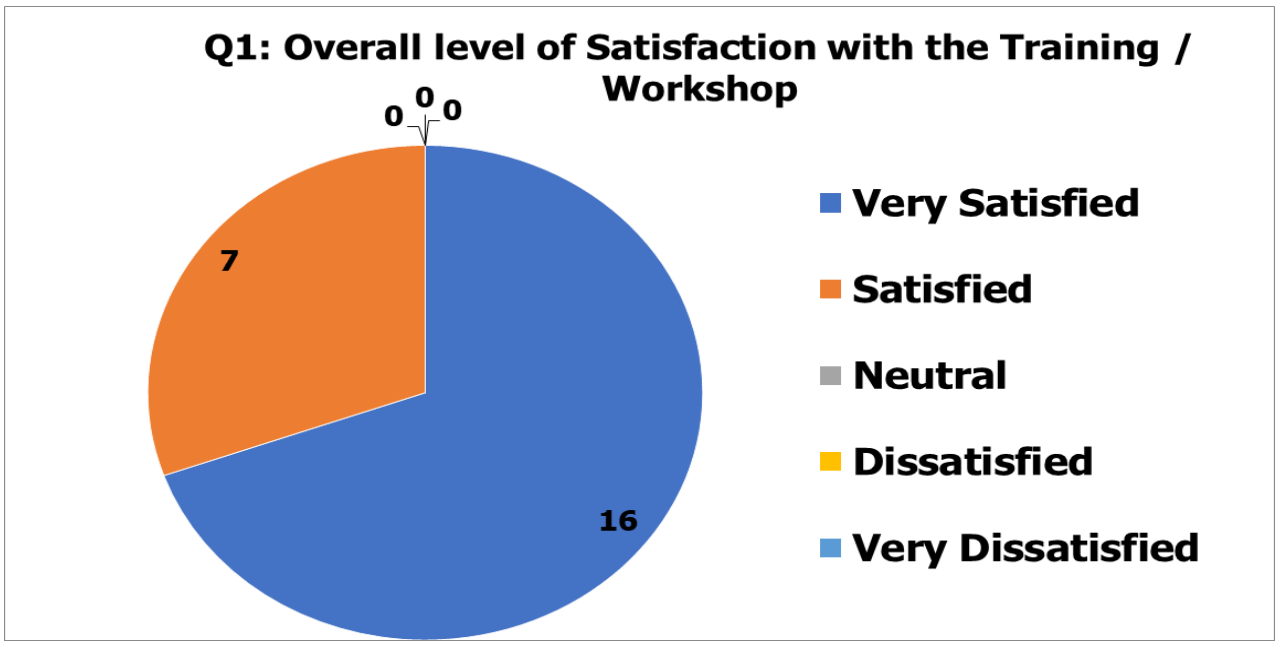
On 5th November 2022, laboratory analysis of Chl-*a* and turbidity samples was carried out following the standard protocol. The raw data processing of CTD and Radiometer were demonstrated using the respective data processing software's. Subsequently, they were also provided with the raw data for processing independently.

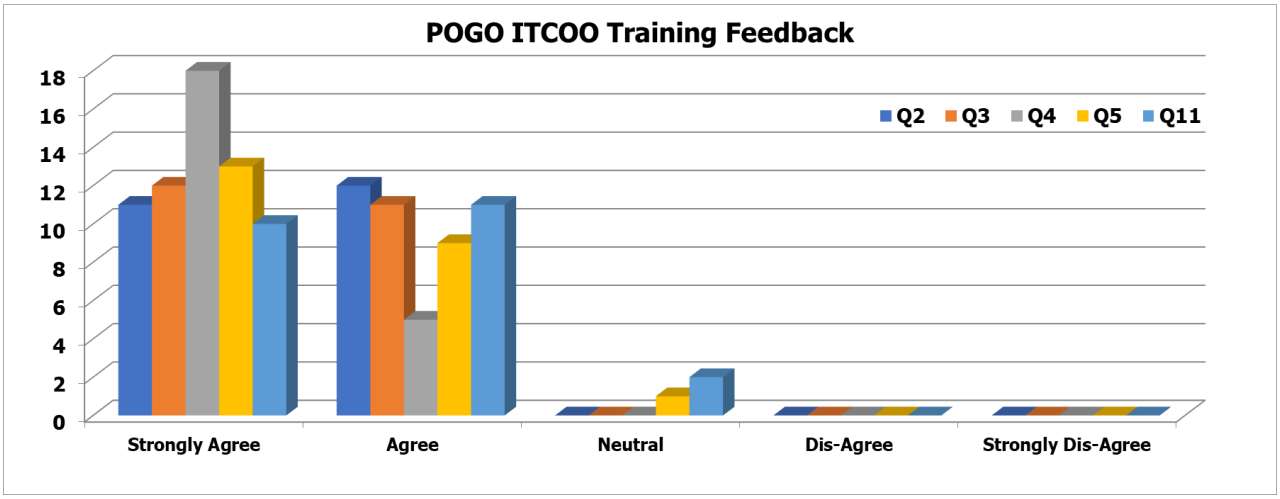
Figure 3: Trainees onboard the vessel operating portable CTD

Figure 4: Trainees operating command module of hyperspectral radiometer onboard the vessel

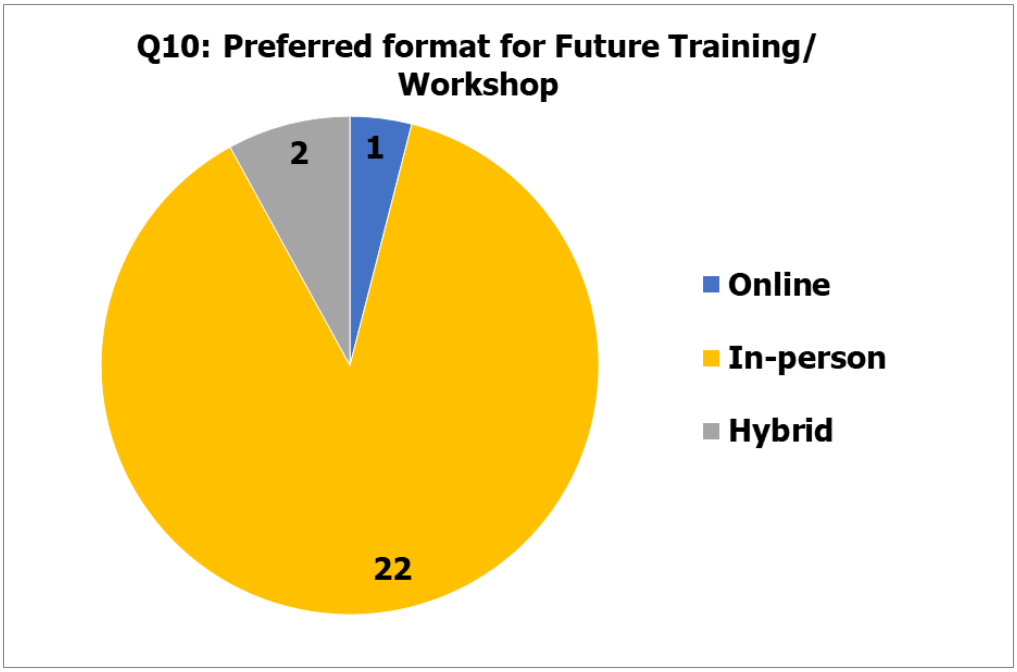
Figure 5: Trainees carrying out water sample analysis at Andhra University

FEEDBACK:
The feedback templates of POGO and ITCOOcean were shared with the participants and obtained their feedbacks. The following are the summary of their feedbacks.





Q2: The training/workshop covered the content announced/expected
Q3: The training/workshop activities helped you to achieve the stated learning outcomes
Q4: The training/workshop instructors provided effective guidance and feedback
Q5: The pre-workshop communications and support were satisfactory



Though most of the trainees appreciated the theme, theoretical aspects of the training programme, faculty expertise, facilities, etc., majority of the trainees noted the field trip with demonstration of the oceanography equipment's (CTD & Radiometer) and the laboratory analysis as the most valued learnings in the training programme. The major suggestion made by the trainees is to include more hands-on training in modeling, data processing, data analysis with longer training duration of at least 2-3 weeks so as to have sufficient time for each participant to do hands-on during practical sessions both at laboratory as well as onboard. Few more notable suggestions include (i) sharing of the pre-course materials in advance, (ii) more time for laboratory demonstrations, (iii) team building & co-curricular activities among trainees, (iv) basic training on operating Linux OS, downloading & use of software's for hands-on sessions, (v) more interactive theoretical sessions in the morning sessions followed by practical sessions in the afternoon, (vi) food to be compatible with international participants, (vii) inclusion of more physical oceanography instruments such as ARGOs, Drifters, etc. as part of practical sessions, and (viii) inclusion of more time to theory classes. The participants felt the training period as fully packed and suggested to include co-curricular activities.

Theory

15 hours of Focused theorical sessions

Laboratory

10 hours of instruments demonstration and laboratory analysis

Onboard

04 hours of onboard sailing and operating instruments

FINANCIAL REPORT:

INCOIS proposed to conduct this training programme at a cost of EUR 9991 to POGO and EUR6662 + in-kind contribution by INCOIS. POGO released EUR. The following are the summary of financial expenditures made under the project.

POGO Contribution:

Sl. No.	Description	Amount (EUR) as per Proposal	Actual Expenditure (EUR)
1.	Travel (Return Airfare, DSA at UN rates) Support for 10 International students/ scholars / researchers / scientists for 07 nights: AIR FARE	8,065.00	4139.06
2.	Travel charges to Field location at Visakhapatnam, Andhra Pradesh	602.00	499.00
3.	Accommodation charges (Hotel) at Visakhapatnam, Andhra Pradesh*	662.00	2108.00
4.	Boat Hiring Charges for field trip	662.00	623.00
5.	Miscellaneous (Inward Bank Charges)	NIL	10.00
6.	Food at INCOIS for one day	NIL	132.02
	Total:	**9,991.00**	**7511.08**
7.	**Advance Amount received from POGO**	**7494.00**	
8.	**Balance funds to be refunded to POGO**		**-17.08**

*with approved re-appropriation of funds towards accommodation charges at Visakhapatnam

INCOIS contribution:

Sl. No.	Description	Actual Expenditure made (EUR)
1.	Travel and Accommodation support (Partial / full funding) for 10 national students / scholars / researchers / scientists	0.00
2.	Travel (Return Airfare, DSA at UN rates) support (Partial / full funding) for 5 national faculty members	386.00
3.	Meals (Lunch and Dinner) and Tea/ Coffee arrangements	1282.98
4.	Accommodation at ITCOocean Guest House for Trainees and Faculty	1,011.00
5.	Laboratory Chemicals and Glassware at Visakhapatnam	3,473.07
6.	Logistics (Meeting, Internet, Electricity, computational, etc.)	In-Kind by Hosts
	Total	6153.05

ACKNOWLEDGEMENTS:

INCOIS would like to acknowledge the contribution of the faculty (both international and national) who spent their valuable time to be part of this capacity building activity for the benefit of the Indian Ocean community. The support of the leaders of POGO, INCOIS and Andhra University were greatly appreciated, and special thanks are due to them for providing financial support as well as local support for successful conduct of this training programme at ITCOocean, Hyderabad and Andhra University, Visakhapatnam. The Secretariat support from POGO and INCOIS to realize and conclude the training programme are invaluable contributions.

The Takeaway:

The observations were crucial to bring out the societal applications. Re-energizing the youngster and equipping them to understand what is essential and how to study the oceans, and its impacts are to be continuous process.