

SCOR/IOC/IOGOOS Second International Indian Ocean Expedition (IIOE-2)
Report to SCOR 2021/2022
Marie-Alexandrine (SCOR Executive Reporter)

GOAL

The goal of IIOE-2 is *to advance our understanding of the Indian Ocean and its role in the Earth System in order to enable informed decisions in support of sustainable development and the well-being of humankind.*

MANAGEMENT

While delivery of IIOE-2 occurs through national activities, these are coordinated by a Core Group comprising the following key personnel:

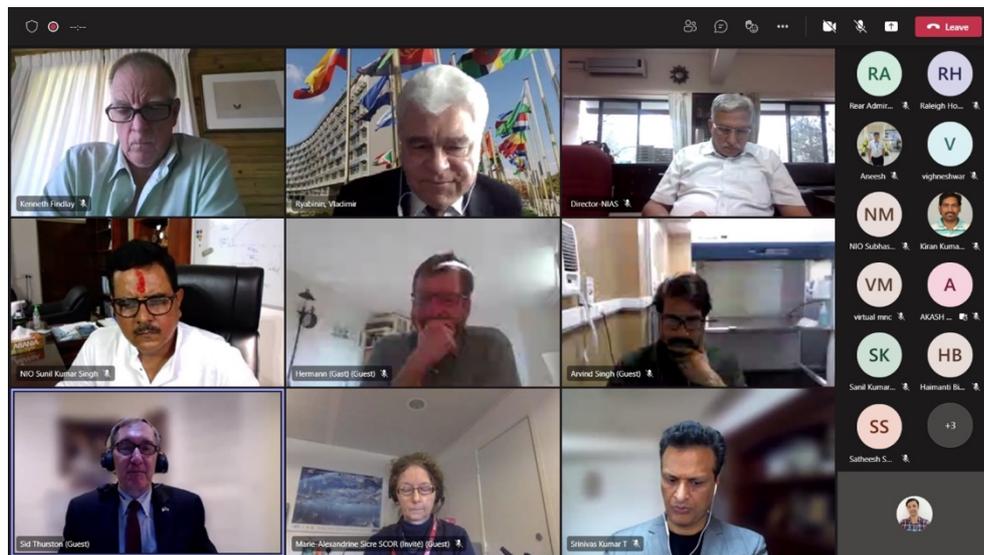
Role	Name	Affiliation
Co-Chair IIOE-2	Marie-Alexandrine Sicre	SCOR
	Vladimir Ryabinin	IOC
	Srinivas Kumar	IOGOOS
Co-Chair WG 1 (Science & Research)	Raleigh Hood	USA
	Hermann Bange	Germany
Co-Chairs WG 2 (Data & Information Management)	E. Pattabhi Rama Rao	India
	Harrison Ong'Anda	Kenya
Chair WG 3 (Operational Coordination)	Shailesh Nayak	India
Supported by		
International Project Office (Hyderabad)	Nagaraja Kumar	IOGOOS
SCOR Office	Patricia Miloslavich	SCOR

The Core Group comprises the Co-Chairs, who represent the sponsors, and 3 Working Groups (WG1 Science & Research; WG2 Data & Information Management & WG3 Operational Coordination). They interact with each other. After the end of functions of the Project Office in Perth, the Office in Hyderabad deals with a day-to-day issues within IIOE-2.

Meetings of the IIOE-2 Joint Program Office

The fifth meeting of the Steering Committee of IIOE-2 (SC5) was organized virtually during March 21-22, 2022 by the IIOE-2 Project Office at the Indian National Center for Ocean Information Services (INCOIS), Hyderabad. The SC5 meeting was held in conjunction with the integrated meetings of IOGOOS, IORP, SIBER, IRF, IIOE-2, and IOCINDIO. The meeting was co-chaired by Dr.

Vladimir Ryabinin (IOC), Marie-Alexandrine Sicre (SCOR) and Srinivas Kumar (INCOIS), co-chairs of the Steering Committee of the IIOE-2.



Snapshot of some of the active cameras during the IIOE-2 SC5.

A full agenda and links to the background documents, including the presentations can be found at: <https://iioe-2.incois.gov.in/IIOE-2/SC5.jsp>. It includes:

- Reports on national activities were delivered on the first day by the chairs or representatives of IIOE-2 National Committees of Australia, France, Germany, India, Korea, South Africa and USA.
- The progress reports of the three Working Groups, WG1 (Science and Research), WG2 (Data and Information Management) and WG-3 (Operational Coordination) were presented by the respective co-chairs or representatives.
 - o WG1: Status of EGU special issue of synthesis papers, Status of the IIOE-2 DSR II Special Issues on IIOE-2, Status of Elsevier Book on the Indian Ocean, Status of IIOE-2 Research Initiatives (EIOURI, WIOURI, YMC) and International participation and Research efforts were presented.
 - o WG2: Progress on developing a data policy for IIOE-2, develop of metadata catalog for projects, cruises, moorings, datasets, publications, etc., and plans for 2022 were presented.
 - o WG3: The new terms of reference, coordination efforts with PIs, other stakeholders and JPO in the management of the central web-based expedition planning and progress utility, outreach activities, status of last minutes of the IIOE-2 SC4 meeting, and the way forward were presented.
- Dr. Vladimir Ryabinin, Executive Secretary of the IOC of UNESCO provided an update on the UN Decade of Ocean Science for Sustainable development. The progress on the formation of Ocean Decade Coordination Unit, Ocean Decade Advisory Board, Status on the Call for Decade Actions (31 global programmes, 42 in-kind or financial contributions, 83 projects populating programmes, 10 UN led Decade Actions, and more than 300 Decade activities), about the announcement of Call for Decade Actions No.2/2021 (38 programmes submitted from 13 countries, 134 projects from 29 countries. Programme submissions are addressing the Challenges 1, 2 and 5), about National Decade Committees (25 countries) and regional task

forces. The timelines for Call for Decade Actions No.3 & 4, progress on Global Stakeholder Forum, Decade working groups, etc. were presented.

- During day 2 of SC5, the co-chairs or representatives of the Science Themes have presented the progress with respect to each science theme, their work plans followed by the presentation by the project PIs who submitted proposals for IIOE-2 Endorsement (details as given below) and presentation by Early Career Scientists Network.
- The details of the three projects presented and endorsed are as given below
 - o Quantifying vertical and lateral ocean transport due to submesoscale fronts and eddies by Dr. Nicole Jones, University of Western Australia
 - o Valuing the Gascoyne Marine Park by Dr. John Keesing, CSIRO, Australia
 - o Bluefin Larvae in Oligotrophic Ocean Foodwebs: Investigation of Nutrients to Zooplankton – Indian Ocean by Dr. Michael Landry, Scripps Institution of Oceanography, University of California, USA.

The inability to have in person meetings has had a significant negative impact on IIOE-2 activities. We plan to have the next joint meeting of **IIOE-2/IORP/SIBER/IRF/IndOOS** in person in Perth, Australia from 6 to 10, February 2023.

WG1: Science and Research (co-chairs: Raleigh Hood and Hermann Bange)

Recent efforts of the IIOE-2 WG-1 have revolved around integrating and promoting all aspects of IIOE-2 science to achieve a holistic view of the Indian Ocean System. In pursuit of the latter goal WG-1 has been promoting the development of synthesis papers and special issues focused on the Indian Ocean. WG-1 is also involved in supporting the efforts of IIOE-2 WG-2 (Data and Information Management).

• Science Highlights

EGU Journal Special Issue of IIOE-2 Synthesis Papers

A set of seven synthesis papers on the Indian Ocean have recently been published as a special issue of EGU Journals. The topics of these papers were inspired by the IIOE-2 Science Plan Research Themes. The guest editors for this special issue were WG-1 co-chairs Hermann Bange and Raleigh Hood.

-Löscher, C. R., 2021, Reviews and syntheses: Trends in primary production in the Bay of Bengal—is it at a tipping point?: *Biogeosciences*, v. 18, no. 17, p. 4953-4963.

-Nimit, K., 2021, Ideas and perspectives: Ushering the Indian Ocean into the UN Decade of Ocean Science for Sustainable Development (UNDOSSD) through marine ecosystem research and operational services—an early career's take: *Biogeosciences*, v. 18, no. 12, p. 3631-3635.

-Pattiaratchi, C., van der Mheen, M., Schlundt, C., Narayanaswamy, B. E., Sura, A., Hajbane, S., White, R., Kumar, N., Fernandes, M., and Wijeratne, S., 2022, Plastics in the Indian Ocean—sources, fate, distribution and impacts: *Ocean Sci.*, v. 18, no. 1, p. 1-28.

-Phillips, H. E., Tandon, A., Furue, R., Hood, R., Ummenhofer, C. C., Benthuyzen, J. A., Menezes, V., Hu, S., Webber, B., and Sanchez-Franks, A., 2021, Progress in understanding of Indian Ocean circulation, variability, air–sea exchange, and impacts on biogeochemistry: *Ocean Science*, v. 17, no. 6, p. 1677-1751.

-Rixen, T., Cowie, G., Gaye, B., Goes, J., do Rosário Gomes, H., Hood, R. R., Lachkar, Z., Schmidt, H., Segsneider, J., and Singh, A., 2020, Reviews and syntheses: Present, past, and future of the oxygen minimum zone in the

northern Indian Ocean: *Biogeosciences*, v. 17, no. 23, p. 6051-6080.

-Tegtmeier, S., Marandino, C., Jia, Y., Quack, B., and Mahajan, A. S., 2022, Atmospheric gas-phase composition over the Indian Ocean: *Atmospheric Chemistry and Physics*, v. 22, no. 10, p. 6625-6676.

-Vinayachandran, P. N. M., Masumoto, Y., Roberts, M. J., Huggett, J. A., Halo, I., Chatterjee, A., Amol, P., Gupta, G. V., Singh, A., and Mukherjee, A., 2021, Reviews and syntheses: Physical and biogeochemical processes associated with upwelling in the Indian Ocean: *Biogeosciences*, v. 18, no. 22, p. 5967-6029.



DSR II Special Issue Series on IIOE-2

WG-1 is leading the development and publication of a set of special issues on IIOE-2 for publication in *Deep-Sea Research II*. These special issues cover a diverse body of research from the Indian Ocean and include papers on physical, chemical and biological oceanography, with the latter covering trophic levels from phytoplankton to whales. >50 papers have been published to date:

Hood, R. R., Z. Lachkar, L. E. Beckley, B. Gaye, J. Vialard, and V. V. S. S. Sarma (2022) The 2nd International Indian Ocean Expedition (IIOE-2): New Exploration in a Poorly Understood Ocean Basin (Volume 4). *Deep-Sea Research II*, volume 197.

Elsevier Book on the Indian Ocean

In addition, we are putting together an interdisciplinary compilation of synthesis chapters on the Indian Ocean for publication as an Elsevier book. The editors of this book are Caroline Ummenhofer and Raleigh Hood. Twenty chapters are anticipated, with all but a few submitted and in various stages of review, revision and production. The target date for publication of the book is June, 2023. The final list of chapters is as follows:

1. Raleigh Hood et al., "Introduction"
2. Timothy Walker, "History of the Indian Ocean"
3. Caroline Ummenhofer et al., "Monsoon variability and its drivers"
4. Helen Phillips et al., "Indian Ocean circulation"
5. Toshi Yamagata, "Climate phenomena of the Indian"
6. Jerome Vialard, "Decadal Indian Ocean variability"
7. Charlotte Demott, "Indian Ocean intraseasonal variability"
8. Janet Sprintall et al., "Oceanic Interbasin connections"
9. Caroline Ummenhofer et al., "Indian Ocean impact on global climate"
10. Francis Marsac et al., "Indian Ocean primary productivity & fisheries variability"
11. Raleigh Hood et al., "Nutrient, phytoplankton and zooplankton variability in the Indian Ocean"
12. Raleigh Hood et al., "Oxygen, Carbon and pH variability in the Indian Ocean"
13. Hermann Bange et al., "Air-sea exchange and its impacts on biogeochemistry in the Indian Ocean"
14. Carolin Löscher et al., "Microbiology of the Indian Ocean"

15. Faiza Al-Yamani et al., “Physical and biogeochemical characteristics of Indian Ocean marginal seas”
16. Michael McPhaden et al., “Observing the Indian Ocean”
17. Toshi Shinoda, “Modeling the Indian Ocean”
18. Mahyar Mohtadi et al., “Paleo evidence to understand Indian Ocean variability across a range of timescales”
19. MK Roxy et al., “Future projections for the Indian Ocean”
20. Ming Feng et al., “Extreme events & impacts”

- **Participation to international meetings**

Recent meetings and special sessions related to or motivated by IIOE-2 have been organized or attended:

Ocean Science Meeting, February 28 through March 4, 2022, Virtual Meeting

-Special Session ID: PL04: “Indian Ocean circulation, air-sea interaction and their impacts on biogeochemistry and ecology”, Conveners: Amit Tandon, Hemantha Wijesekera, Helen Phillips, Pattabhi Rama Rao, Raleigh Hood.

-Special Session ID: OC06: “Indian Ocean intraseasonal-to-interdecadal variability and its role in regional and global climate”, Conveners: Shineng Hu, Weiqing Han, Lei Zhang.

International Indian Ocean Science Conference 2022 (IIOSC 2022), March 14-18, 2022, Virtual Meeting, Hermann Bange and Raleigh Hood were members of the IIOSC 2022 Organizing Committee.

-Session 05: “Biogeochemistry and Microbiology of the Indian Ocean: recent advances”, Conveners: V.V.S.S. Sarma, R. Hood, L. Beckley, E. Raes

-Session 07 “Air-Sea Interactions, exchange of trace gases and related processes”, Conveners: V. Valsala, H. Bange, A. Kawser

-Plenary Session and Panel Discussion: “Contribution UN Decade of Ocean Science for Sustainable Development”, Speakers: R. Hood and others; Panelists: H. Bange and others

EGU General Assembly, May 23-27, 2022, in Vienna, Austria

-Session ID: OS1.9/BG4/CL2: «Understanding the Indian Ocean's past, present, and future role in climate variability and predictability”, Conveners: Caroline Ummenhofer, Alejandra Sanchez-Franks, Peter Sheehan, Yan Du, Muhammad Adnan Abid, Chunzai Wang, Stephanie A. Henderson, Roxy Mathew Koll, Cheng Sun

- **Status of IIOE-2 Research Activities**

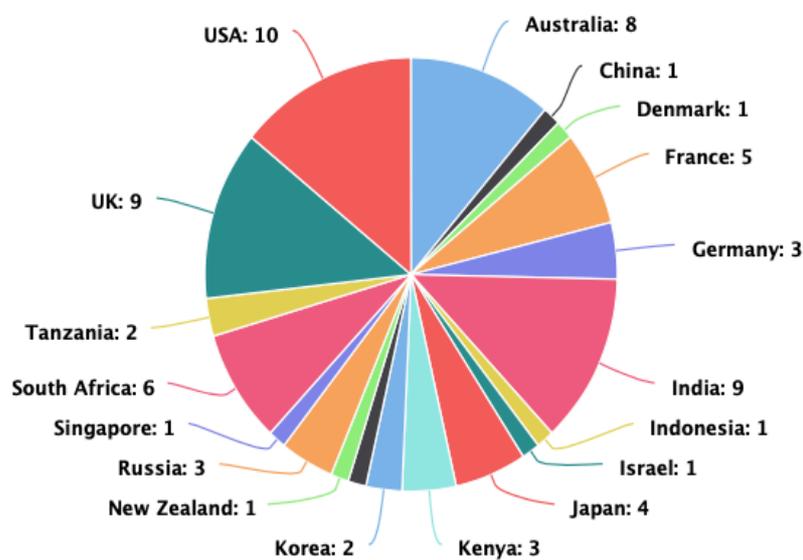
In addition to these efforts to motivate synthesis and research publications, WG-1 continues to promote research in the Indian Ocean under two major IIOE-2 Research Initiatives. **The Eastern Indian Ocean Upwelling Research Initiative** is ongoing with research cruises anchored by China, Japan and the USA. The main focus of this initiative is on the upwelling regions that develop seasonally off Java, Sumatra, and northwestern Australia. The USA NSF-funded “Mesoscale Variability in Nitrogen Sources and Food-Web Dynamics Supporting Larval Southern Bluefin Tuna in the Eastern Indian Ocean” (Mike Landry, P.I.) cruise was recently completed (February-March, 2022 on the *R. V. Roger Revelle*). The EIOURI initiative also includes recent and ongoing TRIUMPH cruises led by Dwi Susanto, a SIBER SSC member. **The Western Indian Ocean Upwelling Research Initiative** is also ongoing, anchored by South Africa’s Department of Environment, Forestry and Fisheries *R. V. Agulhas II* research cruises, and UK/South Africa funded Solstice Project (Sustainable Oceans, Livelihoods and food Security Through Increased Capacity in Ecosystem research in the Western Indian Ocean). SOLSTICE is a four-year collaborative project funded by the UK Global Challenges Research Fund (GCRF). This project brings

together recent advances in marine technologies, local knowledge and research expertise to address challenges facing the Western Indian Ocean region in a cost-effective way via state-of-the-art technology transfer, collaborative environmental and socio-economic research and hands-on training. Multiple members of the SIBER community motivated and led both eastern and western Indian Ocean activity mentioned here. In addition to these two research initiatives, the IIOE-2 has coincided with and embraced the **Years of the Maritime Continent (YMC)** as a major IIOE-2 field campaign. This effort is largely completed, with the last research cruise anticipated in 2022.

Additional planned cruises under IIOE-2 include the USA NSF-funded, “Deep Madagascar Basin (DMB) Experiment: A Quest to Find the Abyssal Water Pathways in the Southwest Indian Ocean” (Viviane Menezes, P.I.) - The field portion of the study will be undertaken on a 24-day research cruise, tentatively scheduled for mid-February to March 2023 on the US global-class research vessel *Thomas G. Thompson* or *Roger Revelle*. South Korea is also undertaking annual cruises to the Seychelles-Chagos Thermocline Ridge in the Indian Ocean under the banner of IIOE-2. These cruises, on the global class research vessel *Isabu*, are supporting multidisciplinary studies of this off-equatorial upwelling region, and also deployment and maintenance RAMA (Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction) moorings.

India has also funded the MOSAIC (Marine Observation System Along Indian Coast) coastal observing program under the IIOE-2 banner. This effort is being Led by INCOIS and aims establish sustained time-series observations using automated moored buoys at six different locations along the Indian coast to monitor and now-cast water quality of the Indian coastal waters. This effort has been funded by India’s Ministry of Earth Sciences initially for 3 years. Several MOSAIC research cruises have been carried out in the coastal Bay of Bengal.

Finally, there are now 45 endorsed projects in IIOE-2 with 18 Countries involved:



International Participation and Research Efforts

Collaborated and continued with the endorsement of scientific activities (https://iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp).

The IIOE-2 now has 45 endorsed projects involving 18 Countries with the USA (10 projects), India (9 projects), UK (9 projects), Australia (8 projects) and South Africa (6 projects) leading the way.

Activities of IIOE-2 and the Indian Ocean Global Ocean Observing System (IOGOOS)

IOGOOS annual meeting was held on March 25, 2022 virtually and had a review of the progress of its activities and its allied projects i.e. Indian Ocean Regional Panel (IORP), Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER), IndoOOS Resource Forum (IRF), Second International Indian Ocean Expedition (IIOE-2), Modeling for Ocean Forecasting and Process Studies and Indian Ocean Core Remote Sensing Project. The major outcomes of the meeting are:

- Revised IOGOOS Membership Structure with voluntary contributions and involvement of leads of relevant agencies and associations in the region and key stakeholders into the membership structure.
- Oceans Institute of University of Western Australia showed interest to join IOGOOS and has been working on the procedures involved in signing of the MoU.
- Dr. T. Srinivasa Kumar, Officer representing Central Indian Ocean has been elected as full-time chair of IOGOOS.
- Dr. S. S. C. Shenoj, representing IOGOOS as one of the IIOE-2 Vice-Chair stepped down due to retirement and Dr. T. Srinivasa Kumar, Chair, IOGOOS was nominated by IOGOOS to the position of Vice-Chair of IIOE-2.
- Dr. Aneesh Lotliker to take the role of Convener of IRF and Dr. Nick D'Adamo kindly agreed to support until the transition of Convener and IRF Secretariat is formalized.



The IIOE-2, IOGOOS, SCOR and IOC jointly organized the International Indian Ocean Science Conference, IIOE 2022, hosted by the Indian National Centre for Ocean Information Services (INCOIS) of the Ministry of Earth Sciences in partnership with CSIR-National Institute of Oceanography (NIO), National Centre for Polar and Ocean Research (NCPOR) of MOES and Goa University. during March 14-18, 2022, virtually. The conference has research presentations from 277 registered authors (oral:179, posters:98) under 14 technical sessions with virtual participation of more than 200 participants from 16 countries.

This is one of the endorsed events of UN Ocean Decade.

A dedicated technical session on *“IIOE-2 contribution to sustainable development: toward the UN Decade of ocean science”* and a Plenary session & Panel Discussion on *“Contribution to United Nations Decade of Ocean Science for Sustainable Development”* were also arranged. The summary of the conference is given below.

The much-awaited International Indian Ocean Conference (IIOSC) started on March 14, 2022 virtually. The conference was initially planned to be held at Goa during March 2020. However, was postponed due to the COVID-19 outbreak. The major goal of the conference was to assess the progress and scientific knowledge gained during the second phase of International Indian Ocean Expedition (IIOE) that was launched during December 2015 to mark the completion of 50 years of the first IIOE.

The conference was inaugurated by Dr Jitendra Singh Minister of State (Independent Charge) of the Ministry of Earth Sciences, Minister of State (Independent Charge) of Science & Technology, Minister of State in the Prime Minister’s Office and delivered his inaugural address through a recorded message.

Dr. M. Ravichandran, Secretary to the Government of India for Ministry of Earth Sciences (MoES) has provided his keynote talk on India’s Deep Ocean Mission. He mentioned that India has been a key stakeholder in the activities of the IOC-UNESCO and made significant contributions to Ocean Observations, Ocean Data Management, Ocean Hazards, Ocean Forecasting Systems, Capacity Building. India hosts Secretariat of IOGOOS, IIOE-2 Joint Project Office, SIBER Secretariat, Tsunami Service Provider for IOTWMS and ITCOOcean. The MoES will continue its collaborations with regional and international partners in the backdrop of the UN Ocean Decade.

Dr. Marie Alexandrine Sicre, President, Scientific Committee on Ocean Research (SCOR) and Co-chair of IIOE-2 Steering Committee, Dr. T. Srinivasa Kumar, Director, INCOIS & Chair, IOGOOS and Prof. Sunil Kumar Singh, Director, CSIR-NIO have provided their remarks on this occasion. The guest of honor, Dr. Vladimir Ryabinin, IOC Executive Secretary & Co-Chair, IIOE-2 delivered a talk on *“The United Nation Decade of Ocean Science for Sustainable Development, 2021-2030”*, mentioning about the importance of UN Decade in enhancing our understanding and sustainable management of the oceans. The complete coverage of the inaugural session is available at <https://youtu.be/k5-hI3SEm0>.

The conference has given specific emphasis to design sessions aimed at capturing ideas on how best the IIOE-2 framework can contribute to the challenges and expected outcome of the United Nation Decade of Ocean Science for Sustainable Development. The plenary talks by eminent researchers and moderated panel discussions on specific themes addressed questions on how the IIOE-2 and broader Indian Ocean Research Community can galvanise actions to address and contribute to the UN Decade Challenges.

The IOGOOS during the last period of reporting focussed on enhancing the capabilities of the region in the field of Observations, Modelling and Operational Services. Accordingly, immediate focus made on (i) Reviving the Modelling for Ocean Forecasting and Process Studies (MOFPS) through training the researchers in the IO Region and conduct a workshop to identify the significant ocean parameters required and their forecasting requirements including model set up and operational forecast services, (ii) building capacity in enhancing the biological observations in the region through eDNA, etc. and (iii) contributing to the UN Ocean Decade activities that are of common interest in the region and to address the UN Decade challenges.

Two training sessions and a brainstorming session were successfully organised on the following with financial support from IOC-UNESCO, through its Sub-commission in Africa and ITCOOcean/INCOIS, India.

(i) Biological Observations in the Indian Ocean (From Microbes to Megafauna) (BioObs) during November 8 -12, 2021, focused primarily on **biological essential ocean variables** (EOVs) for functional groups, in particular microbes, phytoplankton, zooplankton and benthic invertebrates, but will also briefly cover fish, turtles and marine mammals, as well as habitat states such as hard corals, mangroves and seagrasses. 70 trainees from 22 countries and 11 faculty members across the Indian Ocean have participated. IOGOOS and SIBER members are the major contributors to this training.

(ii) Modeling for Ocean Forecasting and Process Studies (MOFPS) during December 6 -10, 2021, Focused towards introducing the basic concepts of physical and dynamic oceanography and numerical modeling of the ocean general circulation, waves, tides, etc and in the context of operational applications of ocean modelling. 78 trainees from 24 countries and 5 faculty members have participated.

(iii) Towards reviving the IOGOOS project on “Modelling for Ocean Forecasting and Process Studies (MOFPS)” a brainstorm session was held on December 10, 2021, basically

- To identify the ocean parameters required, to know the existing capacities in ocean forecasting from the region, to know the requirement of ocean forecasting, IOGOOS has designed a brief survey. About 59 participants have responded
- Panellists are from Bangladesh, Comoros, Maldives, and Saudi Arabia
- Focused discussions were held on the following four aspects: What is the availability of operational forecasting products/services for your region? What are the gaps that you feel exist? What are the requirements and purpose of such operational forecasting products/services? What are the resources (computational/human) available? etc.
- The following are the recommendations from the session
- IOGOOS should design and circulate a detailed survey form to collect the requirements of the member institutes / other countries in the region, in consultation with the IOGOOS Officers, Chair and panelists of the brainstorming session
- The MOFPS project should be continued with the active stakeholders and newly interested stakeholders from the region
- IOGOOS should communicate to all IOGOOS Members and regional bodies from IO such as IORA, RIMES, etc. and seek their interest in the MOFPS project as well as the detailed survey
- IOGOOS with the technical support of BOM and INCOIS should formulate the necessary capacity building initiatives based on the results of the detailed survey
- The requirements in terms of parameters to model, product/services requirement and capacity building were identified by the participants
- Explore the cloud computing and data services, especially for island nations and for those countries with limited computational resources
- Continue and/or establish online community forum to put ideas to collaborate can be made available as part of ITCOOcean

WG 2: DATA AND INFORMATION MANAGEMENT WORKING GROUP (co-chairs: E. Pattabhi Rama Rao and Harrison O. Ong'Anda)

This Working Group is charged with early sharing of data using internationally agreed rules of data exchange. WG has finalized the IIOE-2. The draft data and information management policy was reviewed and finalized through consultations. The data policy was presented to the IIOE-2 Steering Committee during its 5th meeting held on March 21-22, 2022 and approved by the SC. Metadata portal to make oceanographic data from the region discoverable is hosted on IIOE-2 website (<https://iioe-2.incois.gov.in/IIOE-2/data.jsp>). Metadata of 6 scientific cruises were uploaded on the web-site.

A template was developed for submission of metadata. An e-mail notification was sent to all the IIOE-2 Endorsed Projects PIs to submit the Metadata of the scientific cruises.

The OMNI-RAMA Joint Indian Ocean Data Portal has been established between MoES and NOAA and launched mid-August 2021 (<https://incois.gov.in/portal/datainfo/buoys.jsp>) was updated regularly.

WG 3: OPERATIONAL COORDINATION

This WG is charged with develop and integrate web-based tools, databases and partnerships to enable a sufficient level of cooperation, resource-sharing, scientific collaboration and capacity alignment. The WG is led by Dr Shailesh Nayak.

The IIOE-2 website (iioe-2.incois.gov.in) is well maintained and made up to date with the events happening. Published Online monthly by JPO India, to update the Indian Ocean community on the recent IIOE-2 activities, developments and new results. It also lists the upcoming events, meetings, conferences etc. It also provides early information and a platform for young scientists to explore the opportunity to participate in cruises. 66 issues have been published till date.

Recent IIOE-2 activities, developments, Newsletter, IO Bubble, upcoming events, meetings, conferences etc. are posted in Facebook & Twitter for wider publicity. The Indian Ocean Bubble, Issue No.15 was released in December 2021 and made available online at https://iioe-2.incois.gov.in/IIOE-2/pdfviewer_pub.jsp?docname=IIOE-2-DOC_OM_231.pdf. The main aim of this IIOE-2 Bubble is to initiate informal discussions on the outstanding scientific issues in the Indian Ocean and to update the Indian Ocean community on the progress on IIOE-2. 15 issues have been published till date.

IORP (Indian Ocean Region Panel, Clivar /IOC-GOOS)

Indian Ocean Ambassadors for Indian Ocean research and observations

In October 2021, the IORP organized a session with representatives from various Early Career Researchers (ECR) groups working on the Indian Ocean. The ECRs were from Young Earth System Scientists (YESS), International Indian Ocean Expedition (IIOE2-ECSN), and Western Indian Ocean Marine Science Association (WIOMSA-ECSN). Representatives from these ECR groups will function as Indian Ocean Ambassadors, who will support IORP in networking and disseminating Indian Ocean research activities and events.

Towards building sustainable coastal observing systems

Western Indian Ocean workshop: The highlight of the year for IORP was the CLIVAR, GOOS, POGO Regional Training Workshop on Observing the Coastal and Marginal Seas in the Western Indian Ocean that was held in Maputo, Mozambique in June (<https://www.clivar.org/events/regional-training-workshop-observing-coastal-and-marginal-seas-western-indian-ocean>) and brought together an array of observing specialists and early career scientists to look at how best to support under resourced countries in the western Indian Ocean to create sustainable coastal observing systems. SIBER played a significant role in the workshop (G. Cowie). It was also an opportunity to lay out the new IORP-SIBER capacity-building initiative (Coastal Lab in a Box; CoLaB), aiming to generate an affordable package of tools, techniques and protocols for diverse coastal observations. The initiative has now been incorporated into a CoastPredict Decade of the Ocean project.

CLIVAR-GOOS workshop: The IORP have also driven the upcoming CLIVAR-GOOS Workshop titled 'From global to coastal: Cultivating new solutions and partnerships for an enhanced Ocean Observing System in a decade of accelerating change' which will be held at the ICTP in Trieste, Italy on 15-17 in August 2022.

Strengthening IORP-IIOE2-SCOR relationship

IORP is represented on the SCOR WG OASIS. IORP members were active in the IIOE2-IIOSC planning committee and as session conveners. There were lots of presentations of IORP members.

IORP hosted their 18th annual meeting and a joint IORP/IRF/SIBER/IO-GOOS/IIOE2 meeting following the IIOSC. During the meeting we were happy to welcome our new IORP members from IIOE2 core group, Marie-Alexandrine Sicre and Pattabhi Rama Rao. We hope that their involvement in IORP will help strengthen our relationships with IIOE2 and SCOR.

IORP is also working with IIOE2 and the IndoOOS Resource Forum (IRF) to assess from country reports the current state of the IndoOOS-2 implementation.

The shutdown of the IOC PPO (2021), which was an IIOE2 hub and the shrinking support from the IOC GOOS remains a concern.

Other activities

A seminal paper led by Helen Philips and Amit Tandon was published in Ocean Sciences - Progress in understanding of Indian Ocean circulation, variability, air-sea exchange and impacts on biogeochemistry (Philips et al., 2021).

IndOOS was presented as a co-design exemplar in the GOOS co-design workshop in May 2022.

Request to SCOR

We request that SCOR agrees to allocate \$15k to underpin T&S at the IIOSC-2023 conference in Perth, Australia, that should take place in person after two years of on-line meetings.