GRA Background Report

Dr. T. Srinivasa Kumar

[Interim Chair]

srinivas@incois.gov.in

Acknowledgements: Dr. Nick D'Adamo and Mr. Nagaraja Kumar

GOOS Regional Forum-10

General information

- GRA leadership (Chair/coordinator) and contact:
  - Chair: Dr. T. Srinivasa Kumar (Rep: Central Indian Ocean)
  - Officer: Dr. Brett Molony (Rep: Eastern Indian Ocean)
  - Officer: Dr. Jenny Huggett (Rep: IOGOOS Project –SIBER)
  - Officer: Dr. Elaine McDonagh (Rep: IOGOOS Project – IORP)
  - Officer: Dr. Faiza Yamani (Rep: Western Indian Ocean)
- Secretariat:
  - Indian National Centre for Ocean Information Services (INCOIS), Hyderabad, India
  - Mr. M. Nagaraja Kumar, Co-Secretary, IOGOOS & Divisional Head, Operational Ocean Services (OOS), INCOIS (raja@incois.gov.in / iogoos@incois.gov.in)
  - Dr. Satya Prakash, Co-Secretary, IOGOOS since Feb 2021 (Deep condolences for his demise)
- Website: http://www.incois.gov.in/iogoos/iogooshome.jsp#
- Membership: From 29 marine institutes from 17 countries
  [http://www.incois.gov.in/iogoos/members.jsp]

•Terms of Reference: Governed by IOGOOS MoU
(MoU: http://www.incois.gov.in/documents/iogoos/pdfs/Revised_IOGOOS_MOU.pdf)

General information… Contd.

- **Key Partners:** IOC/UNESCO, Member Institutes, IORP, SIBER, IIOE-2, IRF, WAGOOS
- **Key Projects:** IndOOS, Indian Ocean Core Remote Sensing Project, Modeling for Ocean Forecasting and Process Studies, coastal vulnerability…
- **Funding characterization:** Funded through IOC/ UNESCO PPO sponsorship and membership fees and voluntary support by members. Secretariat and its staff funded by Indian Government.
- **Meetings:** Annual Meetings are conducted in conjunction with IOGOOS allied projects / programmes.
  - IOGOOS 13th and its allied projects (IOP, SIBER, IRF and IIOE-2) meetings held at Perth, Australia during January 30 – February 4, 2017 (Meeting report available at http://www.incois.gov.in/documents/iogoos/pdfs/IOGOOS-XIII-Report.pdf)
  - IOGOOS 14th and its allied projects (IOP, SIBER, IRF and IIOE-2) meetings held at Jakarta, Indonesia during March 19-23, 2018 (https://www.incois.gov.in/documents/iogoos/pdfs/BriefTechnicalReport_IOGOOS14_Meeting-Final.pdf)
  - IOGOOS 15th and its allied projects (IOP, SIBER, IRF and IIOE-2) meetings held at Port Elizabeth, South Africa during March 11-15, 2019 (https://www.incois.gov.in/documents/iogoos/pdfs/BriefTechnicalReport_IOGOOS15_Meeting.pdf)
  - IOGOOS 16th Annual Meeting held virtually on July 16, 2020 and IOGOOS Officers Meeting on February 02, 2021

Success 'Stories'

1. **Ocean Observations**

1.1 IIOE-2

1.2 Indian Ocean Observing System (IndOOS): *An Indian Ocean Research Panel (IORP) of CLIVAR and IOGOOS and IndOOS Resource Form (IRF) – For Leading, Review and Resources support*

- *RAMA 2.0*
- *IndOOS Decadal review with SIBER*
- *National support to the IOGOOS (Observing system components)*

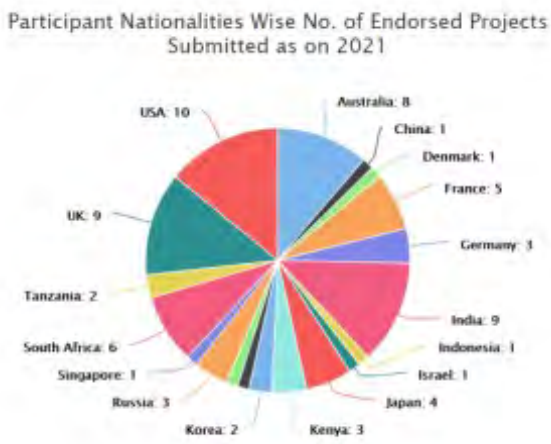
1.3 ChloroGIN

- *Continuously providing the remote sensing data products to the member institutes at high resolution on daily basis.*

2. **Data Management**
3. **Capacity Building**

Ocean Observations

- **2nd International Indian Ocean Expedition (IIOE-2)** - 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"
- IOC, SCOR and IOGOOS – Joint Sponsors / Patrons of IIOE-2
- IIOE-2 Joint Program Office (JPO), with Nodes at Australia and India
- **Endorsed 41 (with 71 leads) scientific projects from 19 Countries that align with the IIOE-2 objectives** (http://www.iioe-2.incois.gov.in/IIOE-2/Endorsed_Projects.jsp).
- **Metadata portal** to make oceanographic data from the region discoverable and widely accessible (http://www.iioe-2.incois.gov.in/IIOE-2/data.jsp).



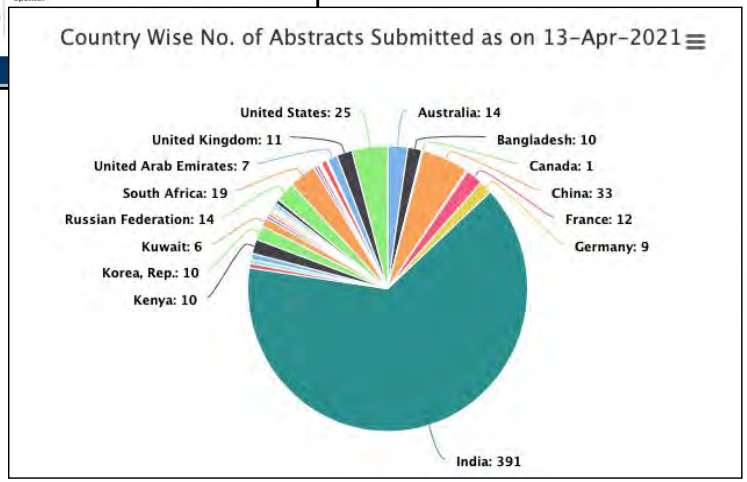
International Indian Ocean Science Conference (IIOSC)-2022

International Indian Ocean Science Conference
16-20 March, 2020
Goa, India
IIOSC-2020

IOGOOS
GLOBAL OCEAN OBSERVING SYSTEM FOR INDIAN OCEAN

IIOSC was originally scheduled during 16 – 20 March 2020 at Goa, India to discuss new scientific results emerging from the highly successfully IIOE-2 campaign that was launched in 2015

Session No	Session	Submitted as on 13-Apr-2021
01	IIOE-2 contribution to sustainable development: toward the UN Decade of ocean science	21
02	Impacts of climate change on the Indian Ocean	30
03	Circulation and Boundary currents in the Indian Ocean	59
04	Ocean observations and data in the Indian Ocean: toward an ocean data information system	79
05	Biogeochemistry and Microbiology of the Indian Ocean: Recent advances	80
06	Ecology of the Indian Ocean: Understanding and Predictability	64
07	Air-Sea interactions, exchange of trace gases and related processes	38
08	Atmospheric Chemistry and pollution	21
09	Coastal and estuarine processes: Anthropogenic impacts and vulnerabilities	59
10	Climate and monsoon variability: Lessons from paleo-climatic studies and links to polar regions	23
11	Inter-basin interactions in the Indian Ocean	28
12	Marginal seas of the Indian Ocean	17
13	Geology, geophysics and seabed mapping of the Indian Ocean	30
14	Extreme events and their impacts	55
15	Plenary Talk	5
	Total	609



No. of Abstracts: 609
No. of Registrations: 368
India - 278
Foreign - 90

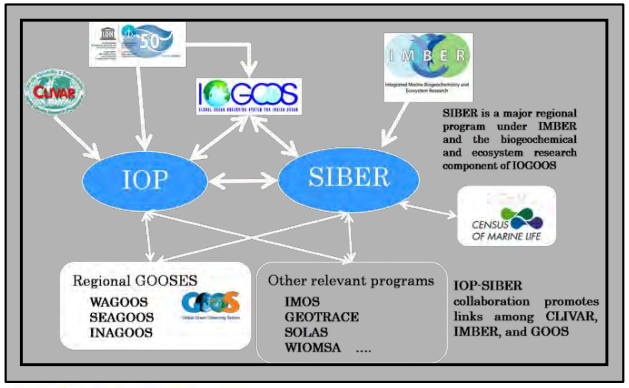
Organizer
IIOE-2 Indian Ocean Expedition

Hosts
INCOIS

Sponsor

Ocean Observations

- **IOGOOS GRA is a key sponsor and partner** in IORP, SIBER and IRF
- Indian Ocean Region Panel (IORP) **– Physical Observation systems and process studies**
- Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) – **Biogeochemical observation systems**
- **IRF** – A high-level members meeting to **facilitate the allocation and alignment of resources** in the Indian Ocean to achieve a sustained, basin-wide ocean observing system. Activities include
  - **Implementation of IndOOS**
  - **Facilitate and coordinate resources**
  - **Encourage scientific and technological initiatives**
- SIBER International Program Office co-located with IOGOOS Secretariat



Indian Ocean - Societal Needs and Operational Drivers

Major (Decadal) Review finalized for 2021-30

- More than 50 Nations around (developing ones)
- 1.5 Billion Population
- Heterogonous Cultural Heritage

Societal Needs

- Rapid growth in blue economies and opportunities to exploit ocean resources and services
- Agriculture Farming dependent on Monsoon
- Marine Fisheries dependent on ocean conditions
- Coastal populations vulnerable to extreme weather events and climate change

Operational Drivers

- Operational Subseasonal-to-Seasonal (S2S) Forecasting
- Improvement of Surface Fluxes
- Ocean data Assimilation Systems

Need to better observe, understand and model the Indian Ocean

CLIVAR GOOS

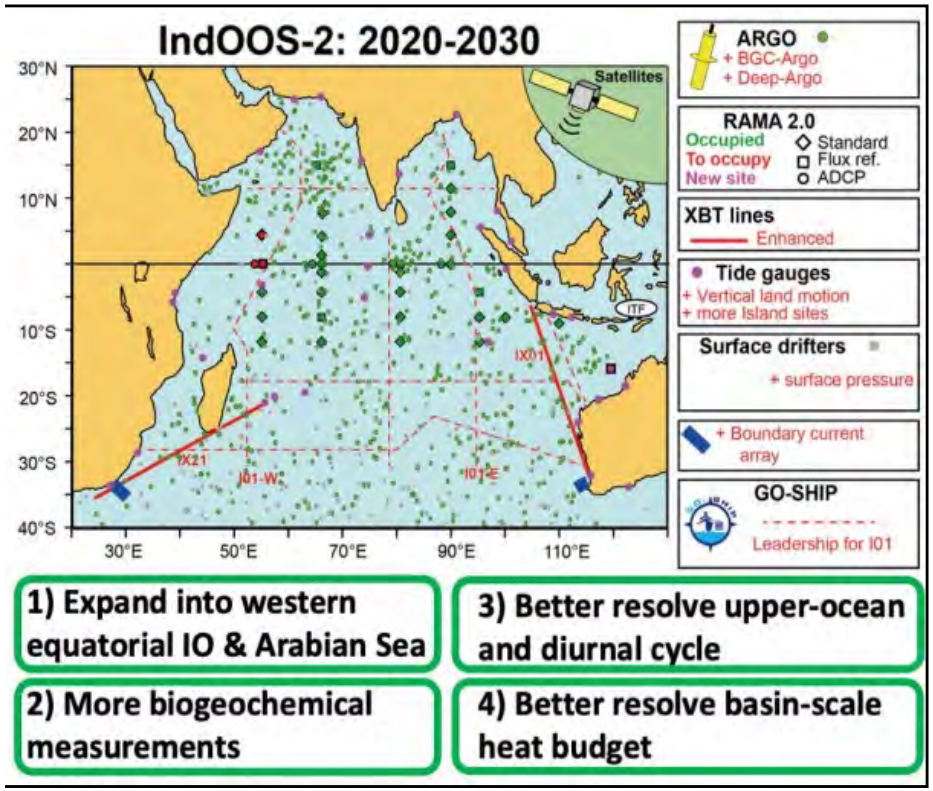
IndOOS-2

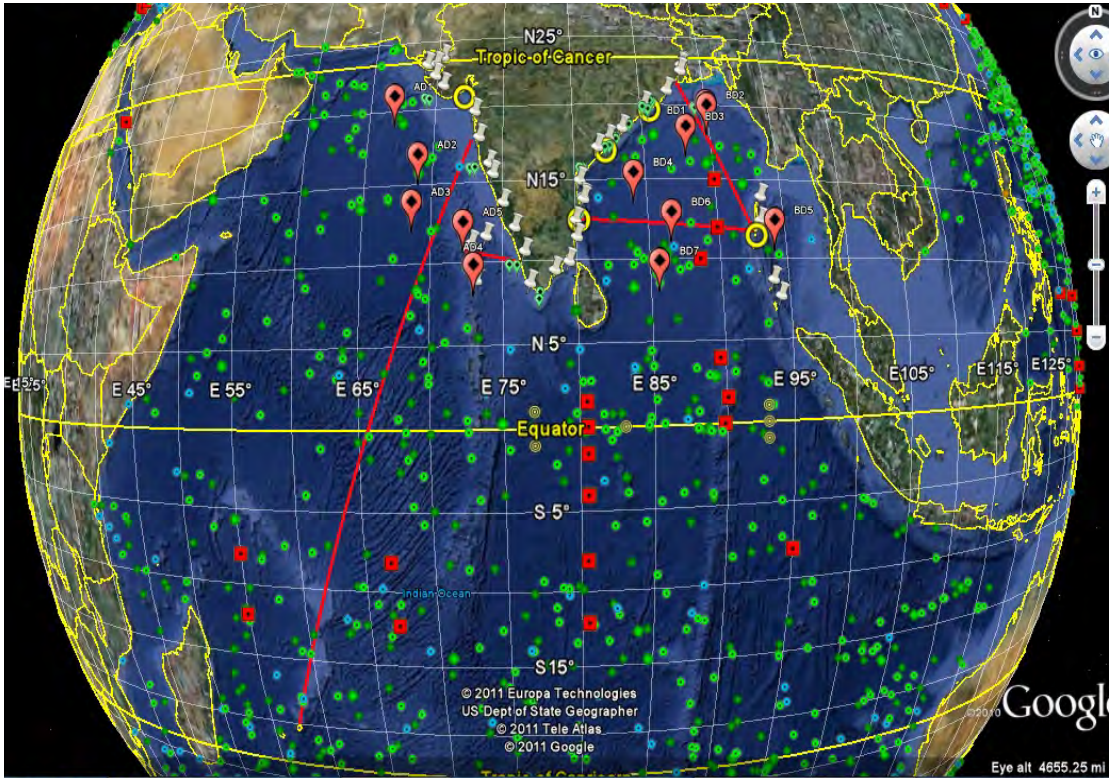
A roadmap to sustained observations of the Indian Ocean for 2020-2030

Lisa M. Beal, Jérôme Vialard, Mathew K. Roxy, M Ravichandran, et.al.

Indian Ocean Observing System – Priorities for 2020 - 30

Scientists and institutions from within and outside IO have been major contributors to the design and implementation of IndOOS since 2006





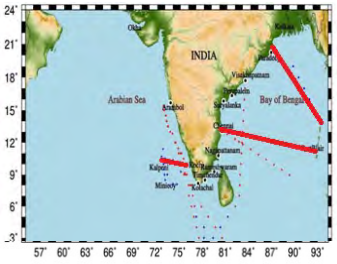
Green – Argo, Red line – XBT, Blue – Drifters, Red square – RAMA, Yellow- CODAR, green oval- ADCP, Red oval – OMNI Moorings, white mark - TG

Indian In-situ Ocean Observation Network (OON)

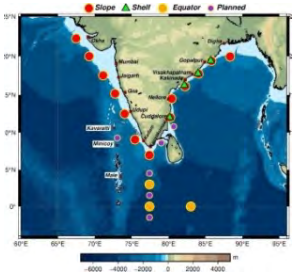
Argo

Drifters

XBT/XCTD

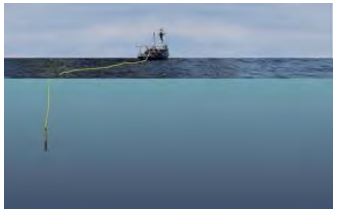


Current Meter



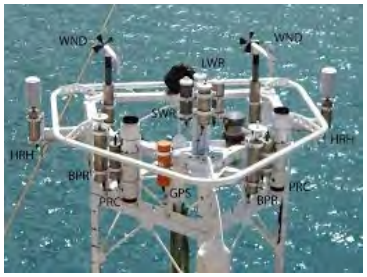
Glider

uCTD



ECFS

ASIMET

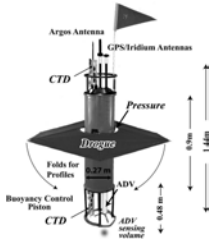


Flux mooring

CTD

VMP

Lagarangian Float



Radiometer

GNSS

WRB

AWS

BPRs

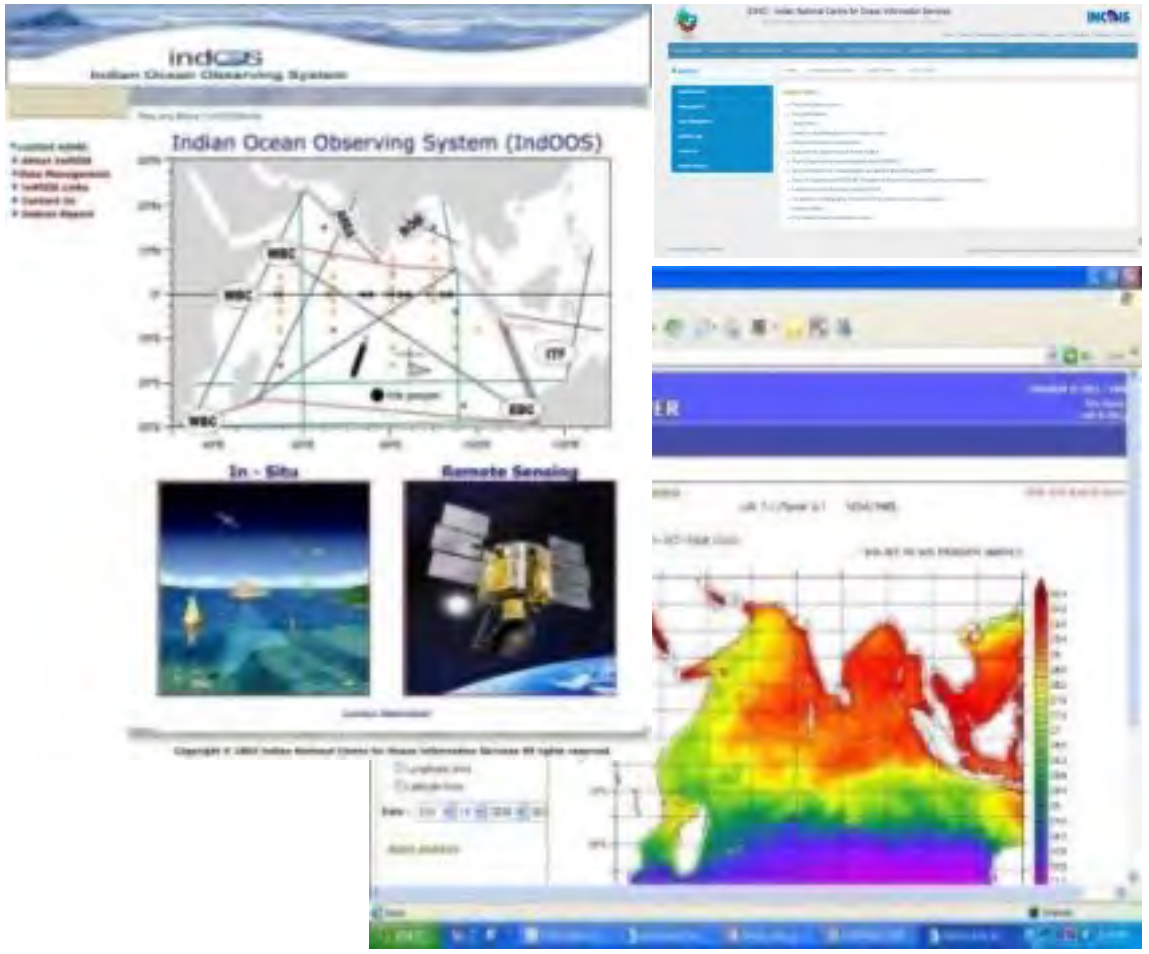
HF Radars

Tide Gauges

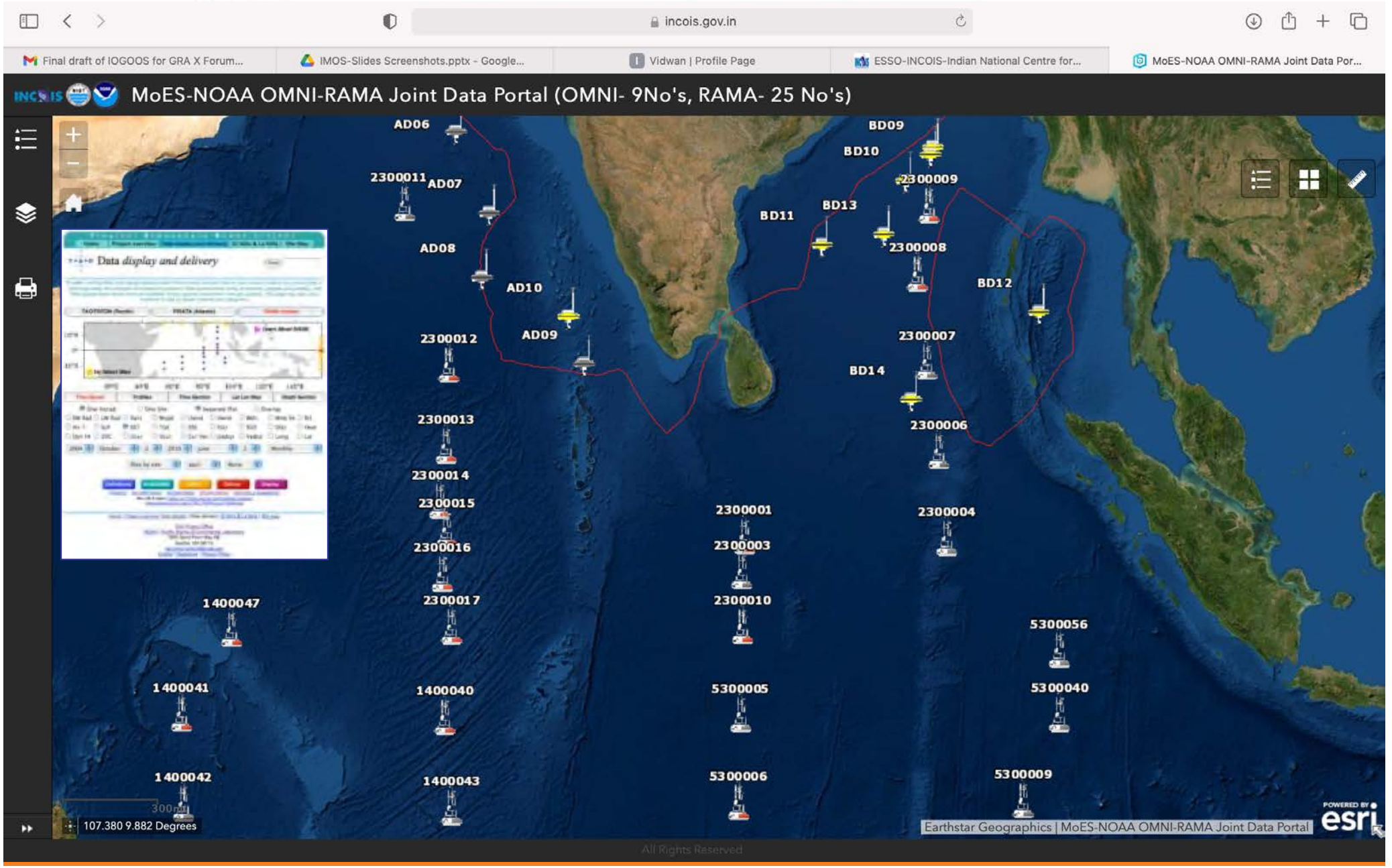
Moored Buoys

Ocean Data Management

- IIOE-2 Metadata Portal enables search and discovery of metadata of completed & forthcoming/planned cruises under IIOE-2
- Data Management of Surface Mooring, Surface Drifters, XBT Lines, Biogeochemical and Argo floats, etc. – IndOOS Data Portal
- MoES-NOAA OMNI-RAMA Joint data Portal
- Digital Ocean

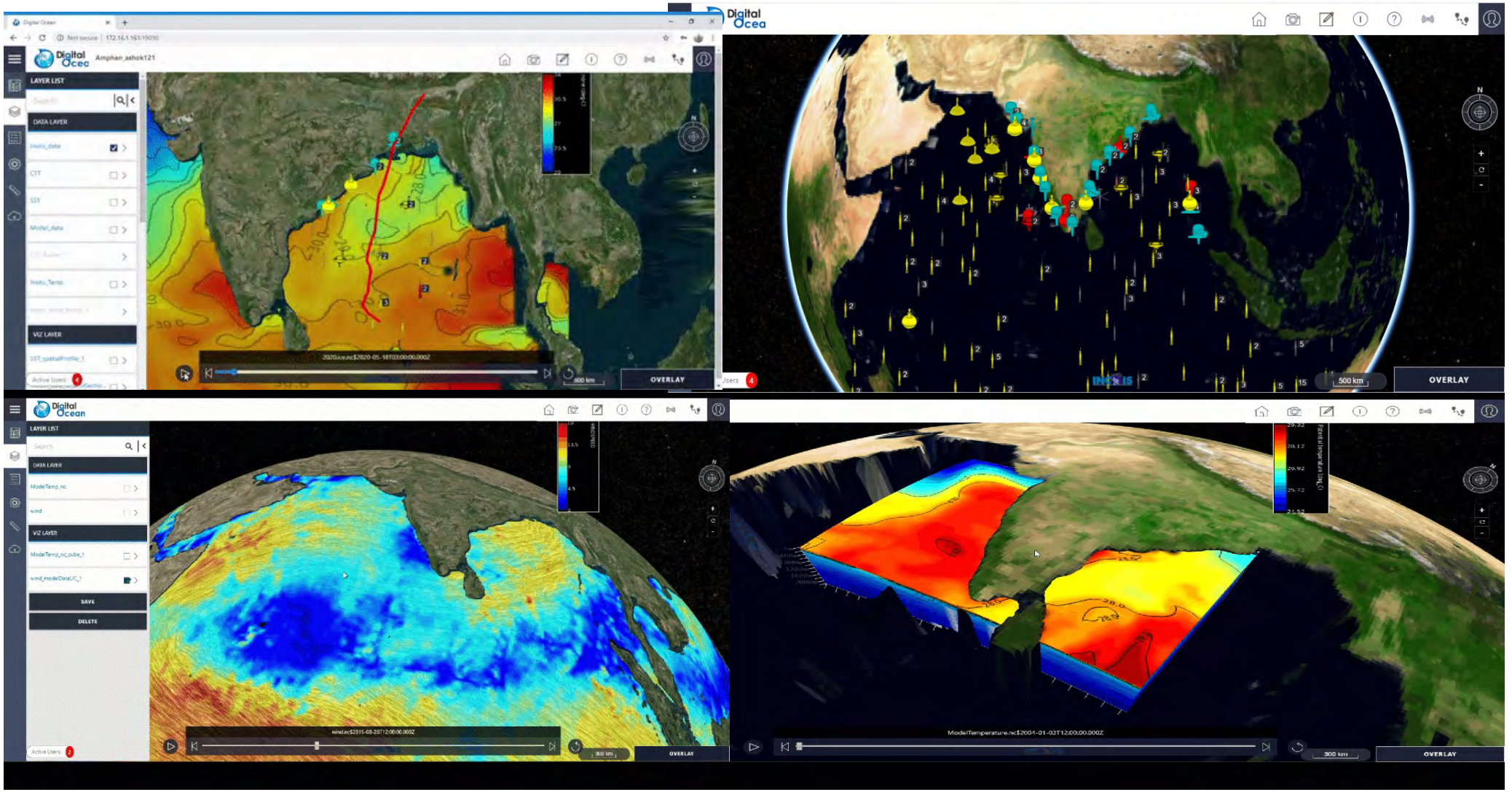


MoES-NOAA OMNI-RAMA Joint Data Portal



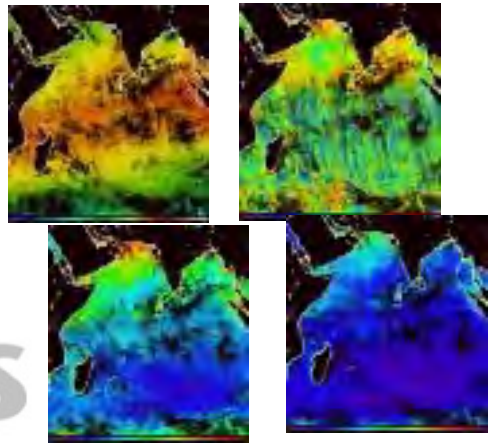
Digital Oceanwww.do.incois.gov.in

- Launched on 29 December 2020
- One-stop web-application for ocean data related products & services



ChloroGIN data Products

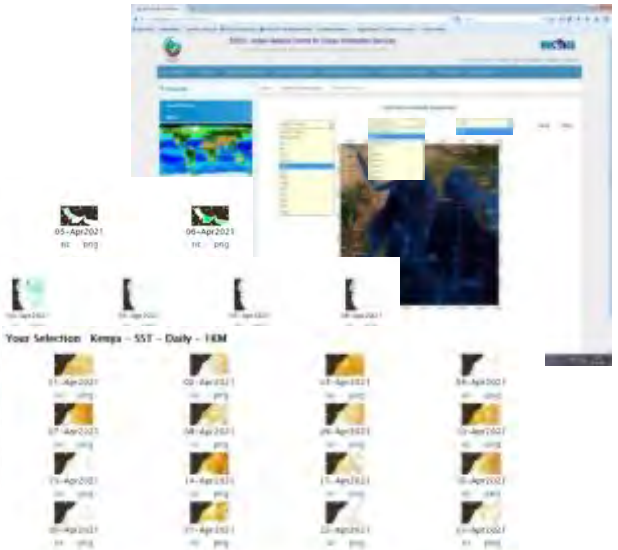
- Part of Indian Ocean Core Remote Sensing Project
- The Indian Ocean component of the Chlorophyll Global Integrated Network (ChloroGIN - IO) Project has been endorsed by IOGOOS as one of its pilot project
- Irrespective of ChloroGIN, **IOGOOS continued to provide the data at higher resolutions.**
- **Standard Products:** Chlorophyll (CHL), diffuse attenuation coefficient at 490 nm (Kd490), Aerosol Optical Thickness at 869 nm (AOT), Sea Surface Temperature (SST) and quasi-true colour composites (BRS).
- **Value-added services:** Total Suspended Matter (TSM), Bloom Indices (BI), rolled data products, and rolling anomaly in CHL and SST.
- **Provided at NRT to IOGOOS Member States:** India, Sri Lanka, Iran, Kenya, Maldives, Oman, Tanzania and Thailand.



Oman-Chl

Iran-chl

Tanzania-K490



Kenya - SST

Capacity Building

- Several Training Programmes – IOGOOS + C2C + DBCP + …..
- Two Category-2 Training Centres operated by IOGOOS Member institutions in India and Iran
- Conducted several CB activities for Indian Ocean member states in Operational Oceanography with priority to IOGOOS Members
- ITCO Ocean, India is an RTC under OTGA and trained around 4100 trainees from 85 countries mainly from Indian Ocean RIM
- Coastal Vulnerability due to sea level rise and storm surges during May 2019 in collaboration with IOCINDIO, WAGOOS, IOC PPO and ITCOOcean
- **Near Future:** Trainings on "Biological Observations in the Indian Ocean and Future perspectives (BioObs-IO)" during November 2021 and Modeling for Ocean Forecasting and Process Studies (MOFPS) Training cum Brainstorming session during December 2021 and Ocean Decade themes

Challenges

- **Governance**
  - Lack of funds to support the project activities
  - Diminished participation and visibility in IOGOOS from some of the earlier/founding participating members
  - Alignment with priorities at local level
- **Observation Systems**
  - Limited observations in Biogeochemistry and Fisheries
  - COVID related impacts on sustaining Observing Platforms and Trainings
  - Vandalism of the observation platforms

Approach to address:

- ✓ Since its inception, IOGOOS has matured and helped create, act as patron and provide support for a number of key project alliances (eg: pilot projects and IORP, SIBER, IRF, IIOE-2).
- ✓ Their leaderships should form natural elements of an upgraded IOGOOS membership constituency
- ✓ IOGOOS will be a critical GRA for the UN Decade of Ocean Science for Sustainable Development (2021-30) through its patronage and strategic/operational links with IIOE-2, itself to be a contribution to the DECADE.
- ✓ There is a strong case for enhanced sponsorship, including increased IOC support to IOGOOS, strengthen linkages with other GRAs, IOC Sub-commissions, etc.
- ✓ Awareness with coastal community on the safety of the observation systems

In what areas would the GRA like to be more active: Core GRA Actvity?

Value chain element	What resource would be needed?
Observations	Sustain Observing Networks Improve the biogeochemical sensors in the region Improve the coastal observations and time series stations
Data management	A fullfledged data management system is to be developed with all the IndOOS and other ocean data services together
Forecasting	Forecasting on the ocean state is provided by few countries. The capacity building on this aspect need to be improved for other countries in the region.
Service / information delivery	A dedicated IOGOOS website is already available for delivery of the services and information. Need to integrate with other services, if any are made available
Capacity Development of members	Capacity development in the field of ocean state forecasting, development of operational services
Outreach / ocean literacy	More outreach platforms and awareness to be brought on the data availability and their usage by students / academicians / researchers

Opportunities Across GOOS Strategic Objectives

- **Deepening Engagement and Impact**
  - Strengthen partnerships to improve Ocean observations, delivery of forecasts, services, and scientific assessments (IORA, RIMES, etc.)
- **System Integration and Delivery**
  - Integrated observing systems design, deployment, sustain and strengthen (IORP, SIBER, IRF, IIOE-2, other potential partners)
- **Building for the Future**
  - Capacity building: Knowledge sharing/transfer to IO Rim countries on observations, services, modeling, etc. (ITCOOcean)

Opportunities Across GOOS
Proposed Decade Programmes

- Observing Together
  - IOGOOS to partner with IORA as an association or IO rim countries individually and other potential partners with interest in the Indian Ocean towards enabling enhanced observing system and to take the science to the society
- Ocean Observing Co-Design
  - IOGOOS can share the knowledge and experience of the member countries and take part in the design and implementation of the observing system in IO region
- CoastPredict
  - Look forward to work on the common areas of interest to the member countries

IOGOOS collaborates

- Observations and Capacity Building
- Organise Planning Workshops
- UN IOR Decade Coordination Centre
- International Indian Ocean Expedition (IIOE)-2

Thank you