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IOGOOS Workshop on

Capacity Building and Strategy for Ocean Data and Information Management in Indian Ocean Region

Hyderabad, India
December 8-10, 2003,

Summary Report

Sponsored by
GOOS Regional Alliance in the Indian Ocean, (IOGOOS)
IOC Regional Committee for the Central Indian Ocean (IOCINDIO)
IOC Committee on International Oceanographic Data and Information Exchange (IODE)

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IOC-GOOS Project Office, Paris
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Hosted by
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1. Opening of the Workshop

Dr. K. Radhakrishnan, Director, INCOIS/ Chairman, IOGOOS/ Vice Chairman, IOC welcomed the Chief Guest Dr. Harsh K. Gupta, Secretary to Government of India Department of Ocean Development. He acknowledged the unstinting support extended by Dr Harsh K. Gupta in bringing IOGOOS to its present state within such a short time. He extended a warm welcome to Mr. William Erb, Head, IOC Perth Regional Programme Office, Mr. Peter Pissierssens, Head, Ocean Services Section, IOC, Dr. Nasser Hadjizadeh Zaker, Chair, IOCINDIO and Dr. Johnson Kazungu, Director, Kenya Marine Fisheries Research Institute as well as the distinguished Delegates and Invitees. He acknowledged continuing support from IOC's GOOS Project Office and Perth Office who have been playing a major role in catalysing IOGOOS and helping to facilitate this Workshop. The Statement of Dr. Radhakrishnan is provided as Annex 1. Dr. Radhakrishnan then requested Dr. Harsh K Gupta to inaugurate the Workshop by lighting the lamp.

Delivering the opening address, Dr. Gupta lauded the IOGOOS community for their collective efforts to better understand the Indian Ocean. He indicated that the confluence of Ocean Science and Information Technology would play a vital role in effective utilization of the ocean information and advisory services by society, governments, industry and the scientific community. Further, he briefed on India's progress with the Argo project, indigenization of moored data buoys, acquisition of a versatile oceanographic research vessel and the new initiative on gas hydrates, He stated that India is keen on sharing its experience with other countries in the region. He acknowledged the efforts of Sri Lanka who was to host this workshop originally and its gracious gesture to shift the venue to Hyderabad due to the special situation. He wished the workshop a great success.

Mr. William Erb, Head, Perth Office, in his opening remarks welcomed everyone to the meeting. He acknowledged the important role played by Dr Harsh Gupta in setting up IOGOOS and his continuing support it since. He noted that INCOIS and the team headed by Dr Radhakrishnan and Mr Srinivasa Kumar did an outstanding job in arranging the meeting on short notice after the shift in venues. The contribution of Madame Ho Hien was recognized as she rearranged travel and funding for the participants. The large number of meetings already completed was mentioned as indicative of IOGOOS progress and continued success was wished. The statement of Mr. William Erb is provided as Annex 2.

Mr. Peter Pissierssens, Head, Ocean Services Section, IOC in his opening remarks mentioned that IOGOOS is a very important initiative in enhancing the knowledge of the Indian Ocean. He briefed the gathering on IODE activities and IOC Oceanographic Data Exchange Policy. IODE through the ODINAFRICA and ODIMEX Projects could contribute significantly to the ocean data and information management activities of IOGOOS. On behalf of the IODE Chair, Dr Lesley Rickards, Mr. Pissierssens looked forward to a successful meeting and expressed the Chair's full commitment to the successful implementation of IOGOOS in general, and its data and information management component in particular. The statement of Mr. Peter Pissierssens is provided as Annex 3.

Dr. Nasser Hadjizadeh Zaker, Chair, IOCINDIO commended INCOIS for playing an effective role in developing and advancing oceanographic activities in the Indian Ocean region. He reiterated that IOGOOS is providing an excellent organizational framework for planning coordination and effective implementation of appropriate regional and sub-regional ocean & coastal observing systems and services. Ocean data & information management and capacity building are identified as important activities of IOGOOS and the current workshop is a precursor in this direction. ODINAFRICA and ODINCINDIO could help IOGOOS to achieve its important objectives in this area. The statement of Dr. Zaker is provided as Annex 4.

Dr. Johnson Kazungu, Director, Kenya Marine Fisheries Research Institute and an IOGOOS Officer, in his opening remarks stated that it is highly gratifying to note the progress made by IOGOOS in achieving its highly ambitious goals. He expressed the view that this workshop will be very useful for the development of capacity building and strategy for ocean data and information management. He thanked the Government of India and the workshop organizers for their excellent arrangements. The statement of Dr. Kazungu is provided as Annex 5.

Mr. T. Srinivasa Kumar, Secretary IOGOOS made an overview presentation of the IOGOOS activities. He briefed the delegates on the evolution & objectives of IOGOOS and the achievements vis-à-vis targets set for the ocean observing system, data management, operational oceanography projects & services, capacity building, research, synergy with other GOOS programmes, participation to international planning of GOOS as well as the future plans.

Dr. Harsh K. Gupta, Secretary to Government of India Department of Ocean Development inaugurated the Indian Ocean Data Exhibition that showcased the data management activities of Australia, Comoros, India (INCOIS, NIO), Kenya (KMFRI), etc.

2. Plenary Sesion-1: Overview Presentations on Ocean Data and Information Management-IOC Perspective & Regional Initiatives

Chair: Harsh K. Gupta, India; **Co-chair: Dr. Razik Zarook, Sri Lanka**

Rapporteur: Mr. Hiski Kippo, Australia

2.1 OBJECTIVES OF THIS WORKSHOP

Mr. William Erb pointed out the important precedent of IODE and GOOS sharing the responsibility for the meeting within IOC. The management of data is central to the implementation of GOOS in the Indian Ocean region and there are many capacity building activities that need to be identified and planned for. It is also clear that a network is needed to accomplish the work, as well as common methods and procedures, and an agreed approach. It is the intention of the sponsors that the workshop should be the start of that process. The workshop was encouraged to develop a plan and a strategy for accomplishing that. The plan should identify people who have responsibility for the actions, a schedule and funding implications. The workshop should also result in improved understanding of the common problems, knowledge of national capabilities in data and information management. It should also create new partnerships and means for interactions.

2.1.1 The presentation provided an overview of IODE activities as follows:

This Agenda Item was introduced by Mr. Peter Pissierssens. He explained that IODE was established in 1961 "to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products". The IODE network now included 65 National Oceanographic Data Centres, Responsible National Oceanographic Data Centres and also collaborated with ICSU's network of World Data Centres (WDC). Activities of the IODE programme include Expertise: Groups of Experts **(**GETADE - now Joint JCOMM/IODE ETDMP, GEMIM, and GEBCDMEP); Global Projects**:** ASFA, GTSPP, GODAR, GOSUD, OceanExpert, MEDI, marineXML, OceanPortal, Regional Ocean Portals, OIT, and OceanTeacher. At the regional level activities focus on capacity building. This includes national & regional workshops/training courses, funding internships, regional data & information exchange networks (RECOSCIX-WIO, RECOSCIX-CEA, ODINEA, ODINAFRICA, ODINCARSA) and the development of training tools: OceanTeacher.

"Yesterday's" IODE focused on a centralized data centre architecture (1 data center per country), delayed mode operation (weeks-year), physical oceanography data (T,S,…), quality control, data archival and retrieval. "Tomorrow's" IODE will be based on a decentralized model, more attention will be given to chemical, biological data, coastal data closer to real-time (serving GOOS needs), an E2EDM model, and it will be more products and service oriented.

The oldest problem facing data centers has been related to formats and the ensuing problem of exchanging data between different systems, but a solution is now presenting itself through a new technology: eXtensible Markup Language (XML). IODE is actively involved in the development of a "marine" XML. This, and other new technologies are being developed within a wider framework called "Ocean Information Technology" that will attempt to address the huge problem of the rapid expansion in volumes of data and information to the point where our ability to manage and interpret this information is beginning to limit further progress.

In capacity building, IODE has entered a new era: whereas IODE capacity building used to be limited to occasional training courses, experts missions and internships, IODE started the new ODIN (Ocean Data and Information Network) strategy in 1998 that combines linking training, equipment, and operational support. This is implemented in a regional context, is product and service oriented and uses a multi-stakeholder approach. This new approach has been used in the ODINAFRICA project (started 2001) involving 20 African countries. In three years, 19 new data centers were thus created. Most of these now generate products and provide services. The third phase of the Project (2004-2007) will be a fully

integrated project combining (i) coastal ocean observing system; (ii) data/information management; and (iii) product development, end-user communication and information delivery system.

To support the training component of ODIN projects, a specialized training tool has been developed: OceanTeacher. It includes nearly 10,000 files (html, PDF, software) covering all aspects of IODE oceanographic data and information exchange. Between 2004 and 2007 it will be totally redeveloped into an integrated e-learning and expert system through the ODIMeX project. Dr Pissiersens summarized the "IODE new deal" as follows: (i) IODE needs to lead the way in coordinating access to marine data and information to support needs of users; (ii) IODE needs to operate in close collaboration with sciences and operational oceanography; (iii) IODE needs to lead in the development of new ocean data and information management and exchange technologies; and (iv) IODE will need to undertake major training efforts at a global scale to ensure all Member States can participate in the "new deal".

A new IODE Project Office is being established in 2004 in Oostende, Belgium, the Office will become a creative environment facilitating the further development and maintenance of IODE Projects, services and products with emphasis on improving the efficiency and effectiveness of the data and product/service stream between the stage of sampling and the user. It will further assist in strengthening the capacity of Member States to manage oceanographic data and information and to provide ocean data and information products and services required by users.

2.1.2 Data management component of IOGOOS-I:

Mr. Pissierssens recalled that the IOGOOS-I workshop on data management had noted that the data products required for the **Ocean Dynamic and Climate** pilot project are composed of two streams: (i) large-scale data products and analyses on a global scale (e.g. climate prediction, ocean state, weather products, wave products); and (ii) local scale. It was noted further that the latter are lacking and will require special attention.

With regard to **Coastal Data** it had been pointed out that these are nearly always local. The data diversity for the proposed IOGOOS pilot projects would be huge and would vary from country to country. In addition it was noted that few data management systems were currently available in the region to deal with these data. A clearing-house would be necessary to assemble and make available the relevant data.

Remotely sensed data management experience related to IOGOOS was considered as limited in the region. Quite independently and to serve their own needs, the wider remote-sensing community established data centres, sets of data products, quality control procedures, and metadata-base management systems. However, several problems existed related to access, validation, product consistency, etc. It had been noted that the Ocean Dynamics and Climate pilot projects would be well served by remote-sensing products through a variety of national agencies, but it would be necessary to determine whether products needed to be added or improved in order to fully meet IOGOOS needs.

IOGOOS-1 concluded that the development of a **data- and information management plan** should be included in the terms of reference of the IOGOOS Development Committee. The workshop had also recommended undertaking a survey to identify and document in detail all existing ocean data and information management facilities in the region (a report on this survey is presented under Agenda Item 2.2).

The workshop had also recommended that IOC approach POGO with a view to obtaining **fellowships** to enable data managers from the IOGOOS region to undertake internships, although it was noted that data management was not identified as a priority by POGO. The workshop had therefore called on POGO to reconsider its position with respect to this matter. The meeting was informed that POGO had decided that, in 2003, priority would be given to applicants from the Indian Ocean region, involved in, or planning to be involved in IOGOOS. In particular priority would be given to applications that deal with Argo Floats, Fixed-Point Time-Series Observations, Biological Observations, Emerging Technologies for Ocean Observations.

With respect to **OceanTeacher** the IOGOOS-1 workshop had noted that it currently focused mainly on delayed-mode data management, and had recommended that additional modules be developed responding to the requirements on the IOGOOS Coastal Ocean Observing pilot projects, the Ocean Dynamics and Climate pilot projects, and the relevant satellite applications. The Workshop had requested assistance from POGO in identifying suitable content authors within the POGO membership to help produce the new modules. IODE-XVII had tasked the Steering Group for OceanTeacher to identify modules that need to be developed in close consultation with the JCOMM Capacity Building coordination group and the GOOS Capacity Building Panel. In addition the ODIMeX proposal had been prepared and submitted to the Government of Flanders for funding (2004-2007). Input had not yet been received from POGO.

IOGOOS-1 Workshop had stressed the need to fully exploit existing data- and information-management facilities before establishing new ones. It had appreciated the success of the **ODINAFRICA** project in assisting African countries to establish NODCs that now provided a full range of user-focused data and information services and products. Since it was agreed that the ODIN strategy should benefit the entire region, the Workshop had recommended the development of an ODIN project for IOCINDIO, complementing ODINAFRICA.

Dr Zaker had submitted a draft proposal for **ODINCINDIO** to IODE-XVII. The IODE Committee had welcomed the proposal and agreed on the following actions: (i) utilise the feedback from IOGOOS-I (survey); (ii) the regional coordinator for IOCINDIO (Dr. Zaker), assisted by the Secretariat was requested to seek an expression of interest from potential member states to join the ODINCINDIO project; and (iii) convene an initial planning workshop to further consider the objectives, outcomes and workplan of the project and to identify funding sources. A progress report on this matter is presented under Agenda Item 3.9.

In conclusion the IOGOOS-1 Workshop had noted that **resources** allocated to data and information management were often minimal at the national and regional level, and strongly urged the member states participating in IOGOOS to increase their levels of support to ensure sustained high-quality data and information management.

The Meeting concluded that the following issues should be addressed: (i) the relationship of IOGOOS D&IM and ODINAFRICA III, ODINCINDIO, GOOS-Africa, etc.; (ii) relationships and roles of existing RNODC-INDO, INCOIS, etc, ; and (iii) usage of ODIMEX for IOGOOS and (iv) need assessment (see SWG1), status (see SWG-2) and Strategy (see SWG-3).

2.2 Results of the IOC survey (2003) on Data Management facilities in the region

This Agenda Item was introduced by Mr Greg Reed.

OceanTeacher

The objective of OceanTeacher, the IOC/IODE capacity building system, is to provide training tools for Oceanographic Data and Information Management. These tools are used during IODE Training Courses but can also be used for self-training and continuous professional development. The OceanTeacher system comprises two components (i) the IODE Resource Kit and (ii) the OceanTeacher Training Manuals. In addition, the Ocean Data Management Training Manual is supplemented by regional data collections containing a collection of marine and coastal data for use in environmental analyses. The underlying goal of these collections is to provide the user with data that can be synthesized, particularly in the Geographical Information System (GIS).

The future of OceanTeacher was summarized. A Steering Group has been established to oversee the development of OceanTeacher and the content will be expanded to meet the training needs of GOOS and JCOMM. A new project, ODIMeX, will also further develop OceanTeacher. ODIMeX will provide an integrated e-learning and expert system for all the training resources in marine data and information management needed by professional ocean data and information managers and scientists involved in data management. It will also provide ocean researchers and students with the necessary knowledge to interact effectively with their national oceanographic data centres. Further information can be found on the

OceanTeacher web site at http://oceanteacher.org . OceanTeacher is also available on CD-ROM from IODE.

IOC Survey on data management capacity for the Indian Ocean

IOC Circular Letter No. 2069 was sent to all IODE national coordinators in the IOCINDIO and IOCWIO Regions, IOGOOS members and IOC action addresses in the IOCINDIO and IOCWIO Regions on 25 April 2003. This Circular Letter included a National Survey to assess data management capacity in the region. Ten responses were received from seven countries. These were (i) India (INCOIS, IODC, NIOT), (ii) Iran (IRODC), (iii) Australia, (AODC), (iv) Kenya (KeNODC), (v) Mauritius (MNODC), (vi) Madagascar (MDNODC), and (vii) South Africa (SADCO, University of Zululand).

All respondents have established National Oceanographic Data Centres (NODC). Three of these NODCs have been established since the 1960s while four NODCs were established during the period 1995-2000. All data centres are producing data products and all have internet access which range from 64kps dial up connection to 2mbps permanent connection.

The data centre requirements identified in the survey include (i) an international project to enhance data management activities, (ii) IODE guidance on data and metadata standards, (iii) increased internet bandwidth, (iv) computer equipment and software, and (v) real-time data capability, including access to GTS. The staff requirements identified in the survey include (i) advanced training in data management, (ii) funds to coordinate data management activities in the region, (iii) more staff, including permanent staff, (iv) internships and attachment to other NODCs, and (v) training in remote sensing and data entry.

An additional IOC Circular Letter No. 2078 was sent to all IODE national coordinators in the IOCINDIO region, IOGOOS members and IOC Action Addresses in the IOCINDIO region on 3 July 2003. This letter requested an expression of interest from member states to join the Ocean Data and Information Network for the Central Indian Ocean Region (ODINCINDIO). Further details of the ODINCINDIO project are covered in agenda item 3.9.

3. Plenary session-2: National/Institutional Reports on Ocean Data and Information Management

Chair: Peter Pissierssens, IOC; Co-chair: Mr. William Erb

Rapporteur: Mr. Srinivasa Kumar, India

Dr. Hiski Kippo, Data Centre Manager, CSIRO, Australia presented the activities of the CSIRO Marine Research Data Centre and Strategic Research Fund for the Marine Environment (SRFME) Data Centre. Detailed report is provided as Annex 6

Dr. Mohammed Obaidul Quader, Chief Scientific Officer SPARRSO, Bangladesh presented an overview of the oceanographic activities in Bangladesh. Detailed report is provided as Annex 7

Mr. Ahmed Abdoulkarim, Data Centre Manager, CNDOC/CNDRS, Comoros presented the activities of CNODC/CNDRS. Detailed presentation is provided as Annex 8

Dr. K. Radhakrishnan, Director, INCOIS made a presentation of the Data & Information Management initiatives in India. Detailed report is provided as Annex 9

Dr. R.M. Dwivedi , SAC, India made a presentation on the Remote Sensing Data for Indian Ocean Region-Emerging Scenario. Detailed presentation is attached as Annex 10

Dr. Murari Tapaswi, Documentation Officer, NIO, India presented a proposal on Information Network for IOGOOS. The detailed proposal is attached as Annex 11

Dr. G.V Reddy, Scientist E, NIO made a presentation on the activities of IODC, India and a proposal on an “Online metadata directory for the Indian Ocean Data & Information Management (OMDIODIM) on delayed mode”. A Summary report is provided as Annex 12

Dr. Nasser Hadjizadeh Zaker, Director of INCO made a presentation on the activities of the Iranian Oceanographic Data Center (IRODC), Iran. A brief summary of the presentation is attached as Annex 13.

Dr. Nasser Hadjizadeh Zaker, Chair, ODINCINDIO presented a proposal for the establishment of the Ocean Data and Information Network for the Central Indian Ocean (ODINCINDIO) that was submitted to the XVII session of IODE. The ODINCINDIO project proposal is also attached as Annex 14

Dr. Melckzedeck .K.W. Osore, KMFRI, Kenya made a presentation on the activities of KMFRI and KeNODC. Detailed report is provided as Annex 15

Dr. Man Wai Rebenevanana, Director, IHSM presented the activities of the Madagascar National Oceanographic Data Centre. Detailed report is provided as Annex 16

Mr. Alui Bahari, Director, Division of Marine Meteorology & Oceanography (DMMO), Malaysian Meteorological Service, Malaysia presented the activities of DMMO. A summary report is attached as Annex 17

Mr. Mohamudally Beebeejaun Ag. Divisional Meteorologist, Mauritius Meteorological Services, Mauritius presented the activities of National Oceanographic Data Centre. A summary report is attached as Annex 18

Mr. Mohamudally Beebeejaun made a presentation on as well as an abridged project report of ODINAFRICA-III as Annex 19

Mr. Razik Zarook, Chairman, NARA, made a presentation on the activities of NARA and National Oceanofraphic Data Centre. A summary report is attached as Annex 20

Dr. Alfonse M. Dubi, Director, Institute of Marine Science, University of Dar Es Salaam, Tanzania made a presentation on the Tanzania National Oceanographic Data Centre (TzNODC). A brief report is attached as Annex 21

Dr. Gullaya Wattayakorn, Associate Professor, Dept. of Marine Science, Chulalongkorn University, Thailand made a presentation on the Ocean Data and Information Management in Thailand. A brief report is attached as Annex 22

Report from the National Institute of Ocean Technology (NIOT), India is attached as Annex 23. (representative of NIOT present only on December 9)

Report from Mr Martin Grundlingh, NODC of South Africa (not present) is attached as Annex 24.

The Meeting concluded that the national presentations revealed substantial differences in data management capacity between the participating countries and stressed that this should be taken into consideration in the IOGOOS data and information management plan. It was also noted that some of the more advanced countries should assist the less advanced countries in various ways such as through hosting internships, providing of lecturers, hosting and providing of regional services, etc.

4. Formation of Sessional Working Groups (SWG)

Three Sessional Working Groups were formed to deliberate on specific issues related to Ocean Data and Information Management in the Indian Ocean Region.

The statements of the article on Data Management within the IOGOOS Memorandum of Understanding listed below were used by the Sessional Working groups as the basis of their discussions:

- Promote the development of low-cost and efficient systems for acquisition, management, processing and interpretation of data;
- Expand and strengthen networking of countries using modern technology including data quality control and data management;
- Promote the development of standardized operational data procedures, including QC and DM;
- Provide high-quality data and time-series for a better understanding and improved management of the Indian Ocean ecosystem;
- Collaborate with other programs and bodies in the field of data collection and data management;
- Coordinate GOOS data acquisition with existing regional and national data gathering systems under the agreements and conventions (eg relating to pollution monitoring, marine meteorology, navigation and safety at sea etc.)
- Publish findings of meetings, workshops, studies and other documents commissioned by the IOGOOS Members, submit documents to international meetings related to GOOS, and assure collective representation of GOOS to regional and national agencies/ institutions/ authorities when requested by members.

Each of the sessional working groups met separately on the forenoon of Day-2. The IOGOOS Secretariat circulated a questionnaire to the workshop participants covering all the issues that need to be addressed in the Workshop. The responses were circulated to all the working groups as background material.

The working groups consolidated the replies pertaining to their tasks. After detailed deliberations, the Working Groups came up with specific recommendations that were presented in the Plenary Session on December 10, 2003.

The composition of the Working Groups and the specific tasks is given in Table-1 (next page).

Table 1: Composition of Sessional Working Groups and their Tasks

SWG	Points to be addressed	Dr/Mr/Ms
SWG-1 (Needs)	• Identification of Regional Applications • Requirement Analysis of Ocean Data and Information Management for the Regional applications envisaged.	M.M. Ali, India (Chair) Alfonse Dubi,Tanzania (co-chair) Ravichandran, India (Rapporteur) William Erb, IOC Md. Obaidul Quader, Bangladesh Alui Bin Bahari, Malaysia Wattayakorn, Thailand Rabenevanana, Madagascar Dwivedi, India
SWG-2 (Status)	• Assess the current scenario and immediate augmentation plans for Ocean Data and Information Management in the Countries of the Indian Ocean region in terms of: a) Infrastructure and Facilities. b) Manpower and Expertise. c) Institutional Arrangements. d) Types of Data and Information handled. e) Services and Target Groups. • Identify the 'Limiting Factors' for effective archival, processing, exchange and utilization of Ocean data and information	Hiski Kippo, Australia (Chair) Albert Gouveia, India (Rapporteur) Greg Reed, IOC Ahmed Abdoulkarim, Comoros M.K.W Osore, Kenya Beebeejaun, Mauritius Kamal Tennakoon, Sri Lanka Shantanu Bhatawdekar, India Harikrishnan, India G.V. Reddy, India P.D. Kunte, India B.V. Satyanarayana, India Balakrishnan Nair, India
SWG-3 (Strategy)	• Develop a Strategy for Ocean Data and Information Management for the Region. • Evolve a framework for the establishment of a regional Ocean Data and Information Network (ODIN). • Identify Work Plan for the next 3-4 years, the resource requirements and possible sources of funding. • Identifying a Coordination Mechanism at Regional or National Level. • Developing a Plan for Capacity Building for Data and Information management.	Nasser H. Zaker, Iran (Chair) Johnson Kazungu,, Kenya (co-chair) Srinivasa Kumar, India (Rapporteur) Peter Pissierssens, IOC Murari Tapaswi, India Razik Zarook, Sri Lanka K. Radhakrishnan, India

5. Plenary Session-3: Consideration of the Reports of the three Sessional Working Groups and Recommendations

5.1 WORKING GROUP 1: APPLICATIONS OF RELEVANCE TO THE INDIAN OCEAN

5.1.1 Applications of relevance for the Indian Ocean region

According to the points to be addressed, Working Group 1 prepared the lists of some of the regional applications that have to be considered. They are summarized in the tables below (not in the order of priority):

Table 2: Applications of relevance for the Indian Ocean region

Category	Application
Marine Meteorology	• Regional Climate (Global) • Monsoon (Australian-Asian-African) • Cyclone and Storm Surge • Ocean Weather
Operational Oceanography	• Ocean State Forecast • Early Warning System (for Cyclones and Storm Surges) • Search and Rescue • Oil Spills Monitoring • Potential Fishing Zone Advisories • Optimal Ship Routing
Coastal and Marine Management	• Preservation of Eco system • Marine Bio Diversity • Fish Culture • Coastal habitats • Marine Pollution • Water Quality Management
Marine Resources	• Living o Fisheries o Algal Bloom o Coral reefs, Mangroves, Sea grass
	• Non Living o Minerals o Oil and gases o Energy

5.2 REQUIRED PARAMETERS

The parameters required for these four categories are given in the following tables:

Table 3: Parameters required for Marine Meteorology

Parameter	Decadal (climate)	Annual (monsoon)	Seasonal (cyclones and storm)	< weekly (ocean weather)
Sea Level	x	x	x	x
Temperature	x	x	x	x
Currents	x	x	x	x
Winds	x	x	x	x
Changes in Bathymetry	x	x	x	x
Salinity	x	x	x	x
Waves	x	x	x	x
Fresh water flux	x	x	x	x
pCO2	x			

Table 4: Parameters required for Operational Oceanography

Parameters	Ocean state forecast & Search and Rescue	Oil spills	Cyclones and Storm surge	Potential fishing zone	Optimal ship routing
Wave	X		X		X
Current	X	X	X	X	X
Tides	X	X	X		
Winds	X	X	X		X
Temperature	X	X	X	X	
Salinity	X		X		
Humidity	X		X		
Air Pressure	X		X		
Hydrocarbons		X			
Eddies and gyres	X	X	X	X	X
Precipitation	X		X		
Radiation	X	X			
SSH	X	x	x	X	X
Chlorophyll				X	

Table 5: Parameters required for Coastal and Marine Management

Parameter	Preservation of ecosystem	Marine Bio diversity	Fish Culture	Coastal Habitats	Marine Pollution, Water quality management
Waves	X	X			
Currents	X	X	X	X	
Tides	X	X	X	X	X
Surface winds	X	X			
Bathymetry	X	X	X	X	X
Sediment type	X	X		X	X
Water quality (DO,N,Si,P,Chl,LA…)	X	X	X	X	X
Salinity	X		X	X	X
SSH	X		X	X	X
Species diversity		X		X	
Effluent from industrial and urban waste	X	X	X	X	X
Shoreline/erosion	X			X	

Table 6: Parameters required for Marine Resources

Parameter	Fisheries	Algal bloom	Coral, mangrove, sea grass	Minerals	Energy	Oil and gas
Temperature	X	X	X		X	
Salinity	X	X	X			
Currents	X	X	X		X	
Chlorophyll	X	X				
Light attenuation	X	X	X			
DO	X	X	X			
Nutrients	X	X				
SSH	X	X	X	X	X	
Surface winds	X	X			X	
Bathymetry	X	X	X	x		
Fishery statistics	X					
Waves		X	X		X	
Fresh water flux	X		X			
Tides					X	
Suspended sediments	X	X	X	X		
Hydrocarbon						X

[Note1: The tables may need to be modified with advice from IOP & COOP on the detailed requirements on the parameters to be observed for each category/application. Note2: SWG 2 did not really carry out its TOR as no information seems to be available on the current status. They only came up with immediate actions]

5.3 JOINT RESULTS OF THE WORKING GROUPS 2 & 3. CURRENT SCENARIO, IMMEDIATE AUGMENTATION PLANS, AND STRATEGY FOR OCEAN DATA AND INFORMATION MANAGEMENT IN THE REGION.

The conclusions and recommendations of the Working groups 2 & 3 were integrated and given below:

5.3.1 Strategic considerations

It was agreed that the Strategy for Oceanographic Data and Information management in the Indian Ocean region should be based on these requirements:

(i) There is a need to sensitize and get commitment from Governments (decision makers) to assure sustainability of the IOGOOS network. This will require a 'marketing' strategy;

(ii) There is a need to give due attention to local/national problems and producing services to solve these;

(iii) Local problems often have regional/global sources. To solve local/national problems data might be required from other countries in the IOGOOS region This is one of the important justifications for the regional approach of IOGOOS;

(iv) There is a need to establish an equitable balance between providing and requesting of data and services but this needs to take into consideration the different capacity levels between countries (more developed countries may need to provide more than they can request from developing countries);.

(v) There is a need to empower the countries in the region to generate their own services;

(vi) Coastal and Climate GOOS require data at different scales.

5.3.2 Capacity building

Since there are big differences in Data and Information Management capacity between IOGOOS members, a detailed assessment of available capacity and requirements is to be done. It was decided that Dr. Zaker will do the capacity assessment in the region through a survey with the help of ROPME.

The training programmes need to be aimed/designed for 3 user groups based on their levels of awareness and expertise (Advanced; Medium; Low/None). The training programme needa to be started for those that have the lowest level of expertise.

Accelerated "ODIN+" programmes ("traditional" IODE data and information management + operational oceanography) are required. The curriculum should be general but also address specific national requirements and should include training courses, internships, expert missions, exchange programmes, etc.

IODE training has already been provided by ODINAFRICA during 2001-2003 for IOCWIO (and IOCEA) countries. A similar training is to be provided by the planned ODINCINDIO (2004 & beyond) for IOCINDIO countries. Additional skills on operational data management is to be provided by ODINAFRICA-III (2004-2007) and by ODINCINDIO (2004-TBD). However, funding for the ODINCINDIO capacity building initiatives needs to be identified, since ODINCINDIO itself is in the initial planning stages. Accordingly ODINCINDIO should be the capacity building instrument for IOGOOS.

Capacity building programmes addressing modeling, data assimilation, satellite oceanography and data products are to be planned as part of IOGOOS. Assistance from POGO is to be requested in the form of short-term fellowships for people who already have basic knowledge.

5.3.3 Marine Information Management

Information management in this context refers to textual information. The discussions acknowledged the expertise of the library and information professionals in preparing the descriptions of the publications and the same could be used for preparing metadata for the data sets. Incorporation of the metadata directories within the catalogues of publications of library and information centres would enhance the access to the existing data sets.

It was also agreed that the library and information centres should be encouraged to develop digital libraries including e-repositories..

Also to be developed by the library professionals are: IOGOOS products and service inventories and user inventories. The need for making this information available through the virtual knowledge centres duly maintained by the information professionals was also underlined.

5.3.4 Structure and coordination

At the **national level**, a mix of decentralized as well as centralized mechanism is to be adopted. Each country needs to have a focal point and the NODC could take up this responsibility. Countries without an NODC should be encouraged to establish such a facility.

It is necessary to have a coordination mechanism for data and information management at the **regional level**. The IOGOOS Secretariat was requested to take up this responsibility and the INCOIS Director agreed to identify a suitable technical person to assist the IOGOOS Secretary in this task.

An IOGOOS **data and information management working group** is to be set up with national contact points and experts as members. This working group could work by e-mail and identify (i) standards and methods to be used by all members; (ii) data exchange mechanisms; and (iii) identify regional service/application providers.

The need for a **regional data archive** for the Indian Ocean was discussed and it was decided this should be agreed upon during the first meeting of the data and information management working group. The IOGOOS Secretariat was requested to prepare a detailed proposal on the subject, addressing the scientific, technical, financial and policy issues.

5.3.5 Work plan objectives

The following objectives and time lines were identified for IOGOOS Data & Information Management and the detailed work plan for the short and partly for the medium term period has been prepared on their basis:

Time line	Objectives to be met
Short-term (2004)	• Identify national/regional problems; required services/products; required data types; national/regional partners; users/stakeholders; through surveys/studies. • Arrange the D&IM training (ODIN+ cycle, etc.) • Startup limited services to all IOGOOS members for public use
Medium-term (2004-2007)	• Assist members to develop the necessary national capacity to participate fully in IOGOOS (ODIN+, modeling and data assimilation, satellite oceanography…) • Start data collection, management and service/product development through relevant pilot projects • Provide services to all IOGOOS members for public use
Long-term (2004-2014)	• Empowering ALL members to generate/share and disseminate products and services by themselves using data from national and regional sources; • User-oriented and user-friendly ocean services system accessible by all; • Ensure long-term sustainability of the national and regional IOGOOS facilities.

5.3.6 Required short-term actions to facilitate implementation of the work plan

The following short-term actions were identified as required for the successful implementation of the medium and long-term work plan:

- In order to facilitate efficient data exchange and sharing, bandwidth should be improved at various NODCs to a minimum of 1 Mbps.
- It has been decided that a GTS link will be made available at IOGOOS secretariat and data will be made available to all IOGOOS members.
- In order to obtain information on various issues there is an immediate need to create an e-group for communication among members.
- Identify current standard format and tools available for conversion.
- In order to provide cost effective infrastructure, a compilation/list needs to be prepared of the available open source/free software, to be used for distributed databases, metadata, visualization tools, GIS applications, and remote sensing data processing (e.g. Ocean Data View, Live Access Server, Distributed Ocean Data Server toolsets, GRASS).
- Available IODE guidelines for metadata management, data quality control, data archival and data exchange (data policy) need to be collated and disseminated in the region for use by the IOGOOS members.

5.3.7 Funding

There is a need to identify the funding sources. IOGOOS, IODE & ODINCINDIO could partner in undertaking Data & Information Management Initiatives in the region so that the funds available under each of the programmes could be optimally utilized. While IOC through the Perth Office is ready to support IOGOOS initiatives, countries (IOGOOS Members & Associate Members) should also contribute by hosting meetings and by developing data & information management systems. External funding sources from countries like Japan, USA, UK, EU, and organizations/foundations such as ONR, Bill Gates Foundation, Soros Foundation, Turner Foundation, etc need to be contacted for funds. A detailed work plan with substantive capacity building is to be made in this regard.

6. Work Plan

It was agreed that the Work Plan will include the following elements:

- Regional coordination and communication
- National contact points; National Surveys and Services
- Dissemination of existing standards and policies
- Capacity Building
- Funding Sources
- Future Meetings

Regional coordination and communication

Action	Action by	Time line
Strengthen IOGOOS Secretariat for Coordination-	IOGOOS Secretariat	
Form an e-group for IOGOOS DIM and coordinate the E-Group (1)	IOGOOS Secretariat	2004
Enhance Bandwidth (> 1 MB) in all NODC's	Respective Agencies	
Set up Domain for IOGOOS for GTS and provide data to members (To be Discussed at JCOMM).	IOC Secretariat	2004
Study the need for a Secure Regional Archive	IOGOOS Secretariat.	Report by end 2004
Organize meeting on data and information management at 1st day of IOGOOS Annual meeting	IOGOOS Secretariat and Dr. Zaker	April 2004

(1) IOGOOS Secretariat will set up an e-group on Ocean Data & Information management in the Region. This group will among other issues also discuss on the following items:

- Study the Standard Formats including Meta data format, QC, Integrity, Version control etc.
- Identify Data Exchange Mechanisms as well as regional service/application providers
- Study the National Data Archival policies in the Region and suggest a policy for IOGOOS
- This working group could work by e-mail and identify (i) standards and methods to be used by all members, (ii) data exchange mechanisms
- Set up Domain for IOGOOS for GTS and provide data to members

Establishment of a Coordination Mechanism (contact points); Surveys and Services

Action Item	Action by	Time Line
Identify National Contact points- Letter from Executive Secretary, IOC for Commitment from Member States to participate in the DIM initiative.	Mr Pissiersens to follow up	2004
UN Agencies and other Regional bodies (Asian Development Bank, NORAD, GTZ, etc) to be invited by IOC to be partners in the DIM initiative.	Mr Pissiersens to follow up	2004
Setting up and meeting of National coordination Committees- IOC Secretariat to send out a letter.	Mr Pissiersens to follow up	2004 Before IOGOOS II
Report of the National coordination Committee set up by Mauritius report to be obtained from Mr. Beebeejaun & circulated to the Members	IOGOOS Secretariat	2004 Before IOGOOS II
Conduct National Level Surveys (1) [Note: (a) Use the results of survey conducted by Mr. Greg Reed; (b) Information Management Capacity Assessment Questionnaire to be provided by Dr. Murari Tapaswi]	Chair IOCINDIO	T= 6 Months (June meet at Paris to take review)
Start Services on Internet to IOGOOS Members (2)	IOGOOS Secretariat to coordinate	2004

(1) Conduct a survey of the Indian Ocean Countries for addressing the following issues:

- Capacity Assessment for Ocean Data and Information Management
- National/Regional Problems of Interest
- Services/Products of Interest
- Partners
- Ocean Data & Information management Capabilities
- National Data Archival Policies
- Band Width available in the Countries (telecom /satellite link)

(2) It was decided to start delivering products/services to IOGOOS Members on the Internet. IOGOOS Secretariat was requested to coordinate by sending requests to organisations in the Region who are capable and willing to provide products/services such as the following:

- OCM/SST processing S/W (India)
- PFZ know how and training -India(Cost TBD)
- OSF –India (Cost TBD)
- Open source S/W such as GRASS
- DDB, Meta data and Visualisation tools

Dissemination of existing standards and policies

Action Item	Action by	Time Line
Study the Standard Formats including Meta data format, QC, Integrity, Version control etc.	By e-Group (Coordinator for group)	Before May 2004 Preliminary Report
JGOFS Protocols and IODE Formats to be circulated	IOGOOS Secretariat in cooperation with JCOMM/IODE ETDMP	Before May 2004 Preliminary Report
Study the National Data Archival policies in the Region and suggest a policy for IOGOOS	By e-group	April 2004 (Review by DIM Group in IOGOOS-II)
National Policy for Data dissemination. IOC to send out a letter to member-states	IOC to follow up	2004
Data repatriation: IOC to send out a letter and contact Member States	IOC	Could be addressed in IOGOOS-II; Action to be completed by 2005
Incorporate the feedback from IOP- Ocean & Climate and COOP on the parameters required for each of the regional applications identified Who contacts them?	Dr. Ravichandran (IOP) Dr. Aarup (COOP)	

Capacity Building

Modelling and Data assimilation		
Action Item	Action by	Time Line
Request POGO for fellowships- IOGOOS Secretariat to write to POGO and IOC	IOGOOS Sec	2004
Identify higher education programmes in the region: One month training programme in a country. Start with learn how to run models (Australia & India-short-term). Approach JCOMM under capacity building.	Mr Pissiersens to follow up	2005
Data & Information Management		
Action Item	Action by	Time Line
D & IM Training (ODIN+ Cycle)	Pissiersens Zaker	2004-07
Experts Exchange and Visiting Scientist programme Has to be linked to the CB initiatives. Identify the requirements of IOGOOS. Link this with all the pilot projects that are being submitted.		2004-07
Prepare ODIN proposal for IOGOOS	IOGOOS Secretariat, Zaker, Pissierssens	2004-07
7.3.4 Remote Sensing Capacity Building		
Action Item	Action by	Time Line
Training in RS applications in Oceanography funded by IOC, Perth and IOCCG in July 2004. To explore the possibility of having annual training programmes in 2005, 2006 & 2007 also	Merv Lynch	July 2004
Training in Satellite Oceanography in India	IOGOOS Secretariat To follow up.	2005
Arrange for BILCO training of IOC	IOGOOS Sec to follow up.	2005

Funding Sources

Action Item	Action by	Time Line
Invite UN agencies and other Regional bodies (Asian Development Bank, NORAD, GTZ, etc) to IOGOOS-II.	IOGOOS Secretariat to send out letters	2004
Invite potential Funding agencies for IOGOOS-II	IOGOOS Secretariat. Send to invitations to all IOGOOS -2	2004

Future Meetings

Action Item	Action by	Time Line
ODINCINDIO Planning meeting and Drafting project proposal	Nasser to coordinate with IOGOOS sec.	2004
RS strategy paper underway by a WG. To meet in February 2004 at Kuala Lumpur (15,000 USD is being funded by IOC Perth)	Merv Lynch	2004
Have back-to-back meetings of D&IM along with IOGOOS Annual Meetings		
IOP meeting (2005) to have a W/S on DM along with the IOGOOS-III. Inform Meyers. Seek agreement.		2005
Evaluation of Pilot projects , along with IOGOOS-III-Exhibition		2006
Formulate 7-year Plan 2007-14	IOGOOS	2007

Dr. Harsh K Gupta, Secretary, Department of Ocean Development, India delivering the Inaugural Address

Plenary Session in Progress

Inauguration of Indian Ocean Data Exhibition

A view of the Indian Ocean Data Exhibition

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