



IOC-INCO-ROPME
Training Course on Oceanographic Data
and Information Management

Iranian National Centre for Oceanography (INCO)
Tehran, Islamic Republic of Iran
19-30 October 1997

IOC-INCO-ROPME
Training Course on Oceanographic Data
and Information Management

Iranian National Centre for Oceanography (INCO)
Tehran, Islamic Republic of Iran
19-30 October 1997

TABLE OF CONTENTS**SUMMARY REPORT**

	Page
1. INTRODUCTION	1
2. PARTICIPANTS	1
3. TRAINING COURSE	1
3.1 OPENING	1
3.2 OUTLINE OF THE COURSE PROGRAMME	2
4. EVALUATION OF THE COURSE AND CONCLUSIONS	3
5. DESIGN AND OPERATION OF A DATA AND INFORMATION CENTRE	3
6. RECOMMENDATIONS	3
7. CLOSURE	4
8. SUMMARY OF THE LECTURES	5

ANNEXES

- I. PROGRAMME AND TIMETABLE**
- II. LIST OF PARTICIPANTS**
- III. COURSE EVALUATION**
- IV. MARINE AND COASTAL DATA DIRECTORY OF AUSTRALIA**
- V. COURSE CERTIFICATES**
- VI. LIST OF ACRONYMS**

1. INTRODUCTION

The IOC Committee on International Oceanographic Data and Information Exchange (IODE) at its Fifteenth Session (Athens, Greece, 23-31 January 1996) adopted Recommendation IODE-XV.9, by which, *inter alia*, it was recommended to organize training course(s) on data management in the ROPME and PERSGA region. Following this Recommendation, the IOC Executive Council at its Twenty-ninth Session (Paris, 1996) approved that a Training Course will be held in the Islamic Republic of Iran in 1997, based on the kind offer of the Iranian Delegation.

In response to this decision, the IOC-INCO-ROPME Training Course on Oceanographic Data and Information Management was held in Tehran, I.R. Iran, 19-30 October 1997, with the support of IOC, ROPME and the Iranian National Centre for Oceanography (INCO).

The objectives of the Training Course were to train the participants from the ROPME region, as well as of the Caspian riparian countries, in modern methods and technologies on marine data collection, formatting, processing, methodology and principles for creation of databases and data information exchange at national, regional and international levels.

Dr. I. Oliounine, Deputy Executive Secretary of IOC, contributed to the formulation of the Course programme, its successful implementation, and also delivered lectures during the Course.

Prof. H. Zomorrodian, President of INCO, gave a lecture and prepared the provisional Course programme. He also facilitated the arrangements necessary for the successful implementation of the Training Course, and prepared the final report.

Special thanks are due to Mr. Khoshnevis, Mr. Jalali, Mrs. Ghiasi, Mrs. Jahanbakhsh and Mrs. Modanlou from INCO, who contributed to the success of the Course and whose efforts in arranging the Course and making local arrangements convenient for the participants were highly appreciated.

2. PARTICIPANTS

Originally 12 participants, one from each country of the ROPME region (Kuwait, Bahrain, Qatar, United Arab Emirates, Saudi Arabia, Oman, I.R. Iran) one from each of the 3 littoral countries of the Caspian Sea (Azerbaijan, Turkmenistan, Kazakhstan) one from Georgia, and one from Pakistan were invited to participate in the Training Course. Unfortunately, due to different reasons, only the participants from Kuwait, Oman, Pakistan, Azerbaijan and Georgia were present at the Course. Five participants from I.R. of Iran (4 from INCO and one from the Department of Environment) also took part in the Course.

Eight lecturers from Australia, India, Ukraine, I.R. Iran and IOC gave 38 lectures, including practical sessions and demonstrations, which were delivered during 12 working days (Lectures: 19, Demonstration/Practical sessions: 19).

The List of Participants is given in Annex II.

3. TRAINING COURSE

3.1 OPENING

The Training Course was officially opened on 19 October 1997 by H.E. Dr. (Mrs.) Massumeh Ebtekar, Vice-President and Director of the Department of the Environment. In her opening speech, she highlighted:

"The seas and the oceans are the final recipient of all changes and developments on the earth, while playing the main role on day to day environmental processes. Today, the developing countries should regard the environment as one of the infrastructure dimension of their plans and policies. Although comprehensive knowledge of environmental conditions and acquiring oceanic data and information could partially satisfy the need at national levels, the collective regional and international co-operation to set up the contact and to exchange the information is quite necessary".

Finally, she concluded and wished the participants every success for the regional Training Course on Oceanographic Data and Information Management.

Prof. H. Zomorrodian, President of INCO, in his opening address, welcomed the participants and especially Her Excellency Dr. Ebtekar, Honourable Vice-President and Director of the Department of the Environment and Dr. Motamedi, Deputy Minister of Culture and Higher Education for Technology. He also welcomed Dr. I. Oliounine, Deputy Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) as well as the lecturers and the participants of the Training Course.

He mentioned that during the 12-day course, participants will become familiar with the various oceanographic data types, methods for collecting, processing, transforming and formatting of the oceanographic data and information, methods on the establishment of national, regional and global centres for oceanographic data, remote-sensing applications, and with the experience of the developed countries in these areas. He further emphasized that oceanographic data and information management plays today an essential and vital role in exploration and exploitation of marine resources, protection of marine environment, coastal management, fishery, and marine activities at the national, regional and global levels.

He reiterated that oceans and seas have a key role to play in the promotion of regional co-operation in all political, economic, and scientific aspects. Training courses on oceanographic data management in all parts of the world are aimed at helping in capacity building of different countries at the regional level. He reminded that 1998 is the International Year of the Ocean and stressed that it is expected that all countries of the region, particularly the I.R. of Iran will introduce special programmes for the year 1998, and make great efforts for the development of scientific co-operation and the implementation of joint projects at the regional and trans-regional levels.

In conclusion, he expressed his thanks to the distinguished guests for their participation in the Course and to IOC for its support, and emphasized that mankind should try seriously to protect oceans and seas as a priceless God-given resource from over-exploitation and environmental pollution for our future generations.

Dr. Motamedi, Deputy Minister of Culture and Higher Education, stressed in his speech the importance of the information networks and presented plans of different development phases of a national information exchange network.

3.2 OUTLINE OF THE COURSE PROGRAMME

The Programme covered various subjects such as NODC's functions and responsibilities, the establishment of an NODC, quality control of data, data exchange formats, GIS, and a study visit to the Iranian Remote Sensing Centre (see Annex I). Practical work was foresighted for half of the programme time. During these sessions, the trainees got acquainted with the software for oceanographic data management and were able to take copies of the software to their respective countries. It is expected that these software would be utilized by the trainees to manage their own data at their data centres.

At the end of the Course, round table discussions were arranged to give the participants an opportunity to discuss their problems, concerning the establishment of NODCs in their own countries.

These discussions also helped to evaluate how deep the trainees perceived the lectures, and to what extent they would be able to design an NODC, independently.

4. EVALUATION OF THE COURSE AND CONCLUSIONS

The Training Course is considered to be a successful action, which to a great extent has achieved its goal. The Course provided the participants with the opportunity to understand the mechanism and functions of the IODE system, the management of NODCs and become familiar with data acquisition and its quality control.

The results of the questionnaire survey, confirmed also the above-mentioned conclusion. The participants considered the programme of the Training Course well prepared and carried it out successfully (see Annex III).

5. DESIGN AND OPERATION OF A DATA AND INFORMATION CENTRE

The following steps are to be followed for the establishment of a National Oceanographic Data and Information Centre (NODC) in the ROPME region:

- (i) To constitute a national oceanographic committee consisting of representatives from all national marine institutes/agencies who are directly or indirectly responsible for oceanographic data and information collection programmes;
- (ii) To prepare a directory of the oceanographic data and information holdings within the country including institutes, agencies, government departments, universities, research organizations using the proforma presented in Annex IV;
- (iii) To analyse the metadata directory information and other necessary requirements for establishing an NODC with the help of experts from RNODC/NODCs which exist in the region or with the help of a consultant;
- (iv) To identify an institute/agency which will be responsible for operating NODC or establish a new institute for NODC with the approval of the national oceanographic committee and the Government;
- (v) To prepare a proposal with the help of the national committee for establishing an NODC;
- (vi) To inform the IOC/IODE Committee on the establishment of an NODC and request the IOC Executive Secretary to inform about it all Member States in accordance with the existing procedures.

More detailed information on the procedures for the data centre is presented in the IOC Manuals and Guides N^o. 5, revised version which was published by IOC in 1997.

1. RECOMMENDATIONS

Based on the suggestions which were made during round table discussions, the following recommendations were finally adopted:

- (i) The report on the Regional Training Course in Marine Data and Information Management should be widely circulated both within the IODE system and to all ROPME Member States and Caspian Sea littoral countries;
- (ii) The communication facilities within the Indian Ocean region and marginal seas should be improved. Efforts should be made to establish a regional Internet node for the Indian Ocean region. A regular newsletter service could be initiated within the region to discuss national and regional ocean research, monitoring and data management activities;
- (iii) Representatives from RNODC/NODC/DNAs should be included in the IOC regional committees, such as IOC-IOCINDIO, for providing advice, expertise and establishing an effective flow of information within the Indian Ocean region;
- (iv) A regional symposium on ocean research and data management should be arranged every 4 years. This will provide a forum for the oceanographic research community and ocean data managers to present results of their research and activities within the region;
- (v) Regular national and regional training courses should be conducted with the assistance of IOC and ROPME. Regional training courses should include at least one participant from each country in the region. Participants for such training courses should be working in the field of marine data management and should be encouraged to take an active role in the development of future national data management plans and in arranging national trainers;
- (vi) Training course material for future courses should be developed by RNODC for the Indian Ocean with the assistance of existing NODCs in the region and with the support of IOC and ROPME to reflect the current research and technological trends in ocean data management. The course content should be adapted to the regional situation.

7. CLOSURE

The Training Course was closed on 29 October 1997. Prof. Zomorrodian, President of INCO, addressed his congratulations to the participants for their successful completion of the Course. He apologized for any shortcomings, and expressed his wish, that the participants would utilize the knowledge and experience obtained through the Course. He pointed out that this Training Course has paved the way to the future co-operation between the Member States of the ROPME region, as well as, Caspian Sea littoral countries.

Dr. Sarupria, one of the lecturers, thanked the organizers of the Course and pointed out that everything was implemented according to the programme. He expressed his wish that the effort will be made to strengthen the IODE activities in the region through active participation in the IOCINDIO Regional Committee and in the activities of IODE. He stressed the importance of the exchange of data/information within the Indian Ocean region through mutual co-operation and support of the Member States, in order to achieve the IOC/IODE objectives. On behalf of the participants, Mr. S.M. Tabrez thanked INCO for organizing the Course and IOC for providing the opportunity for the participants to take part in it.

Each lecturer and participant was awarded a certificate signed by the Executive Secretary IOC and the President of INCO, indicating that they have taken part as a lecturer or as a trainee in the Course (Annex V).

8. SUMMARY OF THE LECTURES

Lecture 1 -Importance of Marine Data for Capacity Building and Sustainable Development

The environment is one of the fundamental resources which sustain the human life and economic development.

It is a reality that any movement towards sustainable development is not merely environmental, but also includes economic and social sustainabilities. Wise management of natural resources for sustainable development could not be achieved unless proper data and information are available. Then data and information management becomes the first priority for resource management which leads to sustainable development. Considering the important role of the ocean in the cycle of human life, ocean data and information will become more and more important not only at a national level, but also in regional and global aspects.

Oceans are the common heritage of mankind. So regional and international co-operation for protecting the marine environment and sustained use of their ocean resources are inevitable. Co-operation at regional and international level is not an easy task, mainly because of the vast gap which exists between the developed and developing countries. Therefore, the capacity building at national level for many countries is one of the main issues, which will enable them to achieve their objectives towards the development processes. To find effective ways for benefiting from the marine resources, to identify methods of the sea protection will depend mainly on data and information. As the ocean data and information management is concerned, following major issues have to be considered:

- Collecting and disseminating oceanographic data and information;
- Processing, archiving and distributing data to the scientific community and other users;
- Preparing to respond to specific requests of different users;
- Supporting basic aspects of training in different fields of oceanography;
- Contributing to the national resources development by providing required information, e.g., on ocean living and non-living resources;
- Updating oceanographic data and information;
- Exchanging data with other centres.

The effort for establishing data and information centres should constitute a keystone in the management activities and will be a prerequisite towards capacity building.

Lecture 2 - IODE and its Relation to the World Data Centres System and other International Marine Data Systems

The IODE system was established in the beginning of the 1960's as a follow-up to the International Geophysical Year. Until today it continues to be the most developed, specialized system for data processing, management and exchange. Today the system is comprised of more than 60 NODC/DNAs spread around the world. The description of the system and the rules under which the system is operating were provided based on the IODE Manual.

The relationship of the IODE centres to the World Data Centres of ICSU was given and the data flow diagrams presented.

Other international marine data systems were described and the role of the IODE, and these systems in the GOOS structure and activities were highlighted.

Lecture 3 - Databases in General and Specifically Oceanic Ones

Different kinds of the DBMS (Data Base Management Systems) are now in use in various areas of science and technology. They are especially useful in case one needs to manage big amounts of data, or data that have complicated structure, or have to be changed permanently. Ocean datasets usually contain a lot of parameters from various sources and with different structures (surface spatial distributed measurements, depth distributed vertical profiles, time or towed series, spectral optical measurements, etc.). Moreover, the amount of data collected by different instruments can vary in a wide range. For example, the CTD probe with one meter depth-resolution will produce the output data files consisting of several thousand records. It is a very complicated task to combine the interdisciplinary datasets, to verify them and to provide the possibility to analyse them jointly. That is why, only using the powerful DBMS, as industry standard or as systems developed in the oceanographic institutions, gives the possibility to perform this task. The brief description of some DBMS which are being used in oceanography, was provided.

Lecture 4 - NODCs and RNODCs Functions and Responsibilities

The presentation summarized the IOC publication N° 5, *Guide for Establishing a National Oceanographic Data Centre* and was divided into two parts - national functions and international functions. The national functions of an NODC were outlined together with the steps in establishing an NODC, establishing a metadata system, developing a client base, selection of computer technologies and data management planning. The section on international services described the IOC system of oceanographic data centres and the international responsibilities of an NODC. This was followed by a detailed description of the functions of a RNODC (the Indian National Oceanographic Data Centre).

The IODE data centre's infrastructure in the Indian Ocean region was described which is relatively well developed. Twenty-seven riparian countries bordering Indian Ocean have one RNODC, 6 NODCs and 2 DNAs. The RNODC for the Indian Ocean was established in 1996. The ways for effective oceanographic data/information exchange within the Member States were highlighted.

Lecture 5 - Creation of the Regional Interdisciplinary Historical Database of the Black Sea: Methodology, Experience and Results

One of the main objectives of the TU-BLACK SEA project (funded by the Science for Stability Programme, NATO) is to establish a database management system (DBMS) in all Black Sea countries for environmental and oceanographic data pertinent to the goals of this programme. The main features of the TU-Black Sea Data Base are as follows:

- Database includes all main physical, chemical and biological (including plankton) variables for the entire Black Sea basin;
- It covers the time period from 1963 (in some cases earlier datasets are also presented) with extensive datasets for 1973-1994 and includes data obtained at 26,000 oceanographic stations;
- Database covers the most crucial period in the history of the Black Sea ecosystem starting from the "background" situation in 1960's till the drastic changes occurred in recent years;
- It includes data from all main regional and international sources;
- All data included into the database were quality checked by the groups of regional experts well acquainted with the Black Sea data;

- It also includes the initial set of the ASCII files delivered by participants, that provides a possibility for interested users to select a subset, to perform quality control according to other principles and to create an alternative database.

This database is the first successful attempt to create a regional historical inter-disciplinary multi-purpose database accomplished with the special powerful DBMS. The development of TU-Black Sea Data Base is a unique event in modern regional oceanography. The database of the TU-Black Sea project can be used as a basis for the databases of any new oceanographic and environmental projects in the Black Sea region. Although the main objective of the database is to serve the development and implementation of the ecosystem models, due to its structure and contents it can be used for many other oceanographic and environmental purposes.

The developed methodology and experience gained during the implementation of this work can be used in other regions of the World Ocean for the same purposes.

Lecture 6 - Establishment of an NODC - Procedures and Case Study

A revised version of the IOC Manuals and Guides N^o 5 for Establishing a National Oceanographic Data Centre, published in 1997, was brought to the attention of the participants. A brief description of an NODC functions, responsibilities was given. The place and role of the NODCs in national sustainable development was identified. Special attention was devoted to the benefits Member States gain with the establishment of data centres and participation in an international oceanographic data and information management infrastructure.

The experience of one of the European countries in the NODC establishment was presented as a case study. Steps to be taken were identified, procedures described and results shown.

Lecture 7 - IODE Data Monitoring Procedures and Operational Projects: NOP, CSR, MEDI, GODAR

To implement effective monitoring of the data flow within the IODE system, a number of reporting procedures was developed upon which the international exchange system is based. Procedures for the announcement of planned research cruises known as “National Oceanographic Programmes” (NOP) and for completing and submitting Cruise Summary Reports (CSR) were presented. Participants were invited to actively monitor research programmes in their countries and submit CSRs rapidly to the WDCs, Oceanography.

Description of the Marine Environmental Data and Information Referral System (MEDI) was given. MEDI provides a multi-disciplinary source guide to the availability and location of marine environmental data. Material compiled from the submitted MEDI entries is available in hard copy and electronic form and on the on-line system of WDC-A, Oceanography.

In order to find data in national data holdings which have not been transferred to the centres of the IODE system and make these data accessible and available for the international community, the GODAR project was launched in 1993. The description of the project was given and demonstration of the GODAR products was arranged.

Lecture 8 - Database Management Systems in Modern Client/Server Environment

Client/server computing refers to a computing model where two or more computers interact in such a way that one provides data and services to the other. This model allows users to access data located anywhere within the information network. Client/server computing has two basic components, a client and a server. The client requests a service to be performed and the server is the resource that handles the client's request. A client/server environment for a database management system is the

combination of 3 major technologies: the relational DBMS, networks, and client interface (usually GUI/PC-based). Each element contributes to the overall platform with very specific roles but is independent of the others in performing its functions. New database trends include client/server databases, complex object databases, high-volume databases and mobile databases. All leading DBMS systems provide support for operation in client/server environments. Client/server systems have the potential to dramatically reduce the cost and improve the functionality of database applications.

Lecture 9 - Quality Control Procedures for Data Management

Data quality control (QC) is one of the most important topics nowadays in management of oceanographic data. The most complete guide on this topic is prepared jointly by the CEC: DG-XII, MAST and IOC/IODE (Manual of Quality Control Procedures for Validation of Oceanographic Data, Manuals and Guides N° 26, UNESCO, 1993). This manual was used as a basis for the lecture.

Data quality control (QC), or data validation, is a stage in data management which is essential whenever data are used by any individual or group other than the originators of the data.

Data quality control information tells users of data in a brief way: how it was gathered, how it was checked, processed, what algorithms have been used, what errors were found, and how the errors have been corrected or flagged.

Some stages of the QC can be done automatically and some of them can be performed only by a qualified expert. Graphical presentation of data is used very often now to simplify and speed up the expert QC of data. Usually, main QC steps are performed now using powerful possibilities of the Data Base Management Systems after the loading data into the database. Some oceanographic DBMS have special modules to provide the extensive data QC.

It is not possible to provide rigid standards of QC for all data types which are applicable in all oceanographic and climatic conditions, and for all purposes. Some checks depend upon presumed average climatic conditions, upon presumed accuracy of instruments, or acceptable levels of noise, or desired accuracy of the final output.

Lecture 10 - The Importance of Metadata

Metadata is "data about data" and can include characteristics about the data such as the content, accuracy, reliability and the source. Metadata provides the mechanism to describe data in a consistent form which will allow users to gain a uniform understanding of the content and fitness for use of datasets. The effective management of marine data involves knowing what data are available, its quality and its physical location. This can be achieved through a metadata directory. The key aim of a metadata directory is to enable users to determine the relevance and quality of a dataset for a specific purpose without requiring the dataset itself to be acquired and examined.

Lecture 11 - Data Centre Functions and New Technology for Data and Information Management

The basic functions of NODC such as data acquisition, processing, quality control and dissemination were discussed in detail. An overview of the new technology for ocean data collection and management was discussed. The advancement in oceanographic instrumentation and computer systems such as sensor technology, RDBMS, DSS, DDMS and KBES was presented. Technological trends such as parallel processing, data warehousing, distributed databases, object technology and data mining were discussed.

Many scientists often feel an urgent need to work with oceanographic metadata, not with the data itself. Inventory systems are very useful and convenient for administrative purposes, data presentation

and advertisement, for getting information on data availability. They can serve as auxiliary information tools for large oceanographic databases.

The special inventory systems were developed at the Marine Hydrophysical Institute in Sevastopol, Ukraine to provide very easy and effective work with oceanographic metadata. A great attention was paid to a friendly interface, user convenience, high speed performance and compactness.

The main parts of the inventory system include a special database management system and a map tool. Database management system navigates through cruises and stations, generates various reports on data availability and selects datasets and stations on various complex conditions. The map tool can be easily customized and provides the next possibilities:

- display all selected cruises and stations with current ones marked out;
- display current cruise track and isobathes;
- search stations;
- zoom/unzoom any region;
- display data coverage statistics for any parameters;
- export map in a standard graphical format.

The Oceanographic Data Inventory System is used intensively in the Marine Hydrophysical Institute and Institute of Biology of the Southern Seas (Ukraine), Institute of Marine Science (Turkey) in the framework of NATO-TU Black Sea Project and in Plymouth Marine Laboratory (UK) in the framework of some ONR and NASA grants. Such systems can also be widely used in many national and international projects.

Lecture 12 - Composition of Marine Data : Chemical and Biological Oceanography

Marine data and information has a limited usage until processed and managed into higher level form and merged with other information to understand the dynamics of the marine ecosystem. The Indian NODC has developed a Marine Biological Data and Information Management System (BIODIMS). This system contains information on zooplankton biomass in the water column, zoobenthic biomass and densities at the bottom of the sea, chlorophyll-a and primary productivity in the euphotic zone of sea water column and marine microbiological information on micro organisms in the sea water and sediment at the bottom. The BIODIMS storage retrieval and presentation functions were discussed. The management systems for chemical oceanographic parameters such as oxygen, nutrients in the sea water column were presented. These systems consist of 3 modules, namely, inventory, documentation and data level information.

Lecture 13 - Management of Coastal and Estuaries Oceanographic Data/Information

Coastal zones problems such as environmental stresses, pollution, eutrophication and erosion were discussed. To overcome these problems an integrated coastal zone management approach is required. This approach will also help in monitoring coastal zones, adjacent river/estuaries regions and the atmosphere. The tools to be used for handling coastal zone data/information are mathematical and numerical models, decision support systems and geographic information systems. The basic elements of coastal zone management data collection, data synthesis and sharing of data/information were discussed. Data and information required for the IOC environmental programmes such as LOIS, GOOS, Health of Ocean and Living Marine Resources, were highlighted.

Lecture 14 - Data Exchange Formats

Different formats used for oceanographic data/information exchange were briefly presented. These formats are IOC/GF3, ICES Punch card, Blue print86, CR-ROM NODC-02 and NODC-03. Data exchange using blank or comma delimited free format was also considered.

Lecture 15 - OceanPC: Basic Concept and System Architecture

The processing of oceanographic data using OceanPC software was presented and discussed. The system hardware and software required for installation, system architecture, concept and overview of different components were highlighted. Data entry formats, conversion utilities, display and research models were presented. The different data file types available in the system were also discussed.

Lecture 16 - Electronic Mail and Internet for Oceanographic Information and Data Exchange

The Internet is a vast global network of many networks spanning over 170 countries. It links computers of many different types, sizes and operating systems all communicating using TCP/IP protocol. The Internet offers access to data and software through a variety of services and tools including electronic mail (e-mail), remote login (Telnet), file transfer (ftp), news and World Wide Web (WWW). Each of these services was discussed in detail. A comprehensive glossary of Internet terminology was also provided.

Lecture 17 - Marine Information Management Systems

An overview of IOC/IODE Marine Information Management (MIM) activities was presented. Information databases for bibliographic, marine directories and marine libraries holdings were introduced. Information products such as ASFISIS/ASFA (CDS/ISIS), CD-ROM of GTSP, IODE-MIM publications were introduced. The present and future information dissemination media such as CD-ROMs, virtual Internet node and virtual libraries were discussed.

Lecture 18 - GIS Systems: Introduction and Application for Marine Data

The field of Geographical Information Systems (GIS) is relatively new and rapidly developing. The term GIS is frequently applied to geographically oriented computer technology, integrated systems use in substantive applications and more recently to a new discipline which is generating massive interest world wide.

Many organizations now spend large amounts of time and energy on geographic information systems and on geographic databases. Predictions suggest billions of dollars will be spent on these items over the next decade. Why should this be true now when only a few years ago GIS was a rarity? There are two answers: firstly, the costs of computer hardware needed for the task are dropping rapidly and, thus it becomes affordable to an increasingly wider audience; secondly, geography (and the data describing it) is part of our everyday world, almost every decision we make is constrained, influenced or dictated by some facts of geography.

The topics which were addressed in the Course were:

- what is a GIS;
- questions a GIS can answer;
- components of a GIS;
- basic types of map information;
- how map information is stored in the computer.

Major steps in the implementation of a typical GIS project were considered:

- determination the objectives;
- building the database;
- performing the analysis and presenting the results.

Lecture 19 - Introduction to Remote Sensing Activities; Usage of Remote Sensing for Oceanographic Data Collection and Management

Gathering of required information is an essential step, which should be taken for optimum understanding of existing features, phenomena and parameters governing the oceanic environments and their resources due to their vital role and impact on man's life.

In this regard, remote-sensing technology in general and space remote-sensing techniques in particular, is one of the most effective technologies used for data collection purposes with the help of different sensors mounted on space platforms.

With this background in mind, a brief description of sensors normally used for oceanic data gathering purposes (i.e., CZCS, AVHRR, MSS, TM, Radar, Scanners, Spectrometers, Scatterometers, Altimeters etc.), of space platforms (i.e., Nimbus-7, Landsat, NOAA, Radarsat, ERS, Seastat, MOS, TOPEX/POSEIDON, etc.) was given and their missions were presented.

As the next step, general characteristics of space taken remotely sensed data including their coverage, repetitive nature, illumination condition, formats (imaging and digital) and modes were also discussed and methodologies used in their information extracting process (both conventional and digital image processing techniques) were briefly explained.

The final topic discussed under the title of this Course, was a series of very compressed and short presentations about different applications of space acquired remotely-sensed data in oceanographic and marine resources projects, carried out over different regions of Iranian and its neighbouring countries coastal and marine environments.

ANNEX I

PROGRAMME AND TIMETABLE

Day 1, Saturday, 18 October 1997

14:00-16:00 Registration.

Day 2, Sunday, 19 October

10:30-11:30 Official Opening (Shahid Azad Hall, Ministry of Culture & Higher Education).

14:00-15:15 **Lecture 1:** Importance of Marine Data for Capacity Sustainable Development (H. Zomorrodian).

Lecture 2: IODE & its Relation to World Data Centres Systems & other International Marine Data System (I. Oliouline).

15:15-15:45 Break.

15:45-17:15 **Lecture 3:** Databases in General & specifically Oceanic ones (V. Vladimirov).

IOC-INGO-ROPME
Demonstration 1: Practical Work Session, Demonstration of the CD-ROMs with Oceanographic Data (G. Reed)

Training Course on Oceanographic Data

Day 3, Monday, 20 October
and Information Management

8:30-10:00 **Lecture 4:** NODC's & RNODC's Functions & Responsibilities (G. Reed, J. Sarupria).

10:00-10:30 Break.

10:30-12:00 **Lecture 5:** Creation of the Inter-regional Interdisciplinary Historical Database of the Islamic Republic of Iran (V. Vladimirov).

19-30 October 1997

13:00-15:00 **Lecture 6:** Establishment of an NODC - Procedures & a Case Study (I. Oliouline).

15:00-15:30 Break.

15:00-17:00 **Demonstration 2:** Practical Work Session on the Effective Use of PC's for Oceanographic Data Management (V. Vladimirov).

Day 4, Tuesday, 21 October

8:30-10:00 **Lecture 7:** IODE Data Monitoring Procedures & Operational Projects: NOP, CSR, MEDI, GODAR Project (I. Oliouline).

Lecture 8: Database Management System in Modern Client/Server Environment (G. Reed).

10:00-10:30 Break.

UNESCO

10:30-12:00 **Lecture 9:** Quality Control Procedures for Data Management (V. Vladimirov).

Lecture 10: Importance of Metadata (G. Reed).

12:00-12:30 Lunch.

13:00-15:00 **Demonstration 3:** Usage of the CSR Form, Practical Work (J. Sarupria).

15:00-15:30 Break.

15:30-17:00 **Demonstration 4:** Demonstration of DBMS & QC Software Application of QC Procedures (V. Vladimirov).

Day 5, Wednesday, 22 October

8:30-10:00 **Lecture 11:** Data Centre Functions & New Technology for Data & Information Management (J. Sarupria).

10:00-10:30 Break.

10:30-12:00 **Lecture 12:** Composition of Marine Data: Chemical & Biological Oceanography (J. Sarupria, V. Vladimirov).

12:00-12:30 Lunch.

13:00-15:00 **Demonstration 5:** Demonstration of the NIO CD-ROM Software (J. Sarupria).

15:00-15:30 Break.

15:30-16:00 **Demonstration 6:** Practical Work Session on a Database Development (V. Vladimirov).

16:00-17:00 **Demonstration 7:** Group Discussion on Design, Operation & Creation of a Data & Information Centre (J. Sarupria, G. Reed, V. Vladimirov).

Day 6, Thursday, 23 October

8:30-10:00 **Lecture 13:** Management of Coastal & Estuaries Oceanographic Data/Information (J. Sarupria).

10:00-10:30 Break.

10:30-11:30 **Lecture 14:** Data Exchange Formats (J. Sarupria, V. Vladimirov).

11:30-12:00 **Demonstration 7:** Introduction of Fortran Sub-routines for the Computations of Physical Properties of Sea Water (J. Sarupria).

12:00-12:30 Lunch.

13:00-14:00 **Lecture 15:** OceanPC, Basic Concept & System Architecture (J. Sarupria).

14:00-15:00 **Demonstration 9:** Practical Work Session on OceanPC.

15:00-15:30 Break.

15:30-17:00 **Demonstration 10:** Practical Work Session on OceanPC.

Day 7, Friday, 24 October

Day off

Day 8, Saturday, 25 October

8:30-10:00 **Lecture 16:** Electronic Mail & Internet for Oceanographic Information & Data Exchange (G. Reed).

10:00-10:30 Break.

10:30-12:00 **Demonstration 11:** Practical Session on OceanPC & Window Grapher (J. Sarupria, G. Reed, V. Vladimirov).

12:00-12:30 Lunch.

13:00-14:00 **Demonstration 12:** Demonstration of Database Management System (V. Vladimirov).

14:00-15:00 **Demonstration 13:** Practical Session on Design & Operation of a Data & Information Centre (J. Sarupria, G. Reed, V. Vladimirov).

Day 9, Sunday, 26 October

8:30-10:00 **Lecture 17:** Marine Information Management Systems (J. Sarupria).

10:00-12:00 **Demonstration 14:** Practical Session on OceanPC Data Entry System (J. Sarupria, G. Reed, V. Vladimirov).

12:00-12:30 Lunch.

13:00-15:00 **Demonstration 15:** Practical Session on Data Retrieval Form GTSP CD-ROM (G. Reed).

Day 10, Monday, 27 October

8:30-10:00 **Demonstration 16:** Practical Session on On-line Access of One of the World Marine Data Banks (G. Reed).

10:00-10:30 Break.

10:30-12:00 **Lecture 18:** GIS System: Introduction & Application for Marine Data (M. Pourkashani).

12:00-12:30 Lunch.

13:00-15:00 **Demonstration 17:** Practical Work, GIS Case Studies (M. Pourkashani).

15:00-15:30 Break.

15:30-16:00 **Demonstration 18:** GEN Co-CD-ROM Demonstration as an Example of Marine Data Electronic Presentation (G. Reed).

16:00-17:00 **Demonstration 19:** Training & Educational Module for Marine Science (TREDMAR)
(G. Reed).

Day 11, Tuesday, 28 October

8:30-10:00 **Lecture 19:** Introduction to Remote-sensing Activities: Usage of Remote-sensing for
Oceanographic Data Collection & Management (F. Barzegar, Sh. Farrokhi).

10:00-10:30 Break.

10:30-12:00 Formulation of Recommendations & Conclusions.

12:00-12:30 Lunch.

13:00-16:00 Formulation of Recommendations & Conclusion (cont.).
Course Evaluation.

Day 12, Wednesday, 29 October

8:30-10:00 Training Course Draft Report.

10:30-12:00 Official Closure.

12:00-12:30 Lunch.

13:00-15:00 Visit to Iranian Remote-sensing Centre.

Day 13, Thursday, 30 October

Departure

ANNEX II

LIST OF PARTICIPANTS

LECTURERS

Prof. H. Zomorrodian
President, Iranian National Centre for
Oceanography (INCO)
Tehran

I.R. Iran

Tel: <98> (21) 641 65 56/98 91
Fax: <98> (21) 641 99 78
E-mail: inco@istn.irost.com

Dr. I. Oliounine
Deputy Executive Secretary
IOC/UNESCO

Paris

France

Tel: <33> (1) 45 68 39 63
Fax: <33> (1) 45 68 58 12
E-mail: i.olounine@unesco.org

Dr. V. Vladimirov
Head, Data Base Laboratory
Marine Hydrophysical Institute
Sevastopol

Ukraine

Tel: <380> (692) 52 52 76
Fax: <380> (692) 44 42 53
E-mail: vvlvad@alpha.mhi.iuf.net

Dr. G.L. Reed
Australian Oceanographic Data Centre
Maritime Headquarters

Australia

Tel: <61> (2) 93 59 31 41
Fax: <61> (2) 93 59 31 20
E-mail: greg@aodc.gov.au

Dr. J.S. Sarupria
Head, Indian NODC
Data & Information Division
National Institute of Oceanography
Dona Paula, Goa

India

Tel: <91> (832) 22 12 53
Fax: <91> (832) 22 33 40/13 60/91 02
E-mail: saruj@saruj@csnio.ren.nic.in

Mr. F. Barzegar
Advisor to Chairman, Remote Sensing Centre
Tehran

I.R. Iran

Tel: <98> (21) 296 44 71-3
Fax: <98> (21) 206 44 74

Mr. Sh. Farrokhi
Dournegar Co.
P.O. Box: 1875-199
Tehran

I.R. Iran

Tel: <98> (21) 207 84 70-71

Mrs. M. Pourkashani
Standing Consultant
Tehran

I.R. Iran

Tel/Fax: <98> (21) 874 13 13

TRAINEES

Mr. E. Babayev
Deputy-Director
GIS Centre of the State Committee on Ecology of
Azerbaijan

Baku

Azerbaijan

Tel: <994> (12) 92 67 55/59 07
Fax: <994> (12) 92 67 55
E-mail: root@eco.dl.ab.az

Mr. M.Gh.M. Ali
Kuwait-Environment Public Authority
Marine Pollution Control Unit
Safat

Kuwait

Tel: <965> 482 05 97
Fax: <965> 482 05 88

Mr. M.M. Al-Jabri
Ministry of Regional Municipalities &
Environment
Marine Pollution Section
Muscat

Oman

Tel: <968> 69 64 44, Ext: 307
Fax: <968> 69 64 60

Mr. S.M. Tabrez
National Oceanographic Data Centre
Karachi

Pakistan

Tel: <92> (21) 586 00 28/29

Fax: <92> (21) 586 01 29

E-mail: nodc@niopk.khi.sdnpk.undp.org

Mr. K. Bilashvili
Tbilisi State University
Dept. of Meteorology & Oceanography
Tbilisi

Georgia

Tel/Fax: <995> (32) 23 22 93

E-mail: phys@sun20.hepi.edu.ge

Mr. B. Behroozi Rad
Marine Environment Bureau
Dept. of the Environment
Tehran

I.R. Iran

Tel: <98> (21) 86 72 23

Fax: <98> (21) 89 72 23

Mrs. F. Ghiasi
Expert, Iranian National Centre for Oceanography
(INCO)

Tehran

I.R. Iran

Tel: <98> (21) 641 65 56/98 91

Fax: <98> (21) 641 99 78

E-mail: inco@istn.irost.com

Mrs. Sh. Safaei
Expert, Iranian National Centre for Oceanography
(INCO)

Tehran

I.R. Iran

Tel: <98> (21) 641 65 56/98 91

Fax: <98> (21) 641 99 78

E-mail: inco@istn.irost.com

Mr. H. Fazeli
Senior Expert,
Iranian National Centre for Oceanography (INCO)
Tehran

I.R. Iran

Tel: <98> (21) 641 65 56/98 91

Fax: <98> (21) 641 99 78

E-mail: inco@istn.irost.com

Mr. P. Abdollahi
Senior Expert,
Iranian National Centre for Oceanography (INCO)
Tehran

I.R. Iran

Tel: <98> (21) 641 65 56/98 91

Fax: <98> (21) 641 99 78

E-mail: inco@istn.irost.com

ANNEX III

COURSE EVALUATION

Questionnaire for assessment by trainees

Note: The purpose of this questionnaire is to collect information for overall assessment of the Training Course and to improve future training and related activities. Please check as appropriate and write your comments and suggestions.

1. Are the objectives of Course specified?
Have they been successfully met?
- | Poor | | | Excellent | |
|------|---|---|-----------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

Comments: _____

2. Were the lectures delivered by resource persons
and practical exercises adequate to meet the
objectives?
- | Poor | | | Excellent | |
|------|---|---|-----------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

Comments: _____

3. Do you think the Course programme was:
- Too advanced informative to the expectation too poor

4. Was the Course useful to your work? Did you
learn anything that is new and useful for you?
- | Poor | | | Excellent | |
|------|---|---|-----------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

C o m m e n t s : _____

5. Was the duration of the Course adequate?
- Too long Adequate Too short

C o m m e n t s : _____

6. Do you feel each topic of ocean management
was covered well? If not, what do you suggest
to be included?
- | Poor | | | Excellent | |
|------|---|---|-----------|---|
| 1 | 2 | 3 | 4 | 5 |
| | | | | |

Comments: _____

7. Do you feel a need for modification of the Course programme?
- Yes No

Comments: _____

8. In what way do you plan to apply the knowledge and experience gained during the Training Course when you go back home?

C o m m e n t s : _____

Poor		Excellent		
1	2	3	4	5

9. How were the local arrangements, like accommodation, transport, other facilities, etc.

Comments: _____

10. Any other comments and suggestions regarding the Course?

Comments: _____

- (i) Were all the subjects of specific interest to you covered?
- (ii) What do you think IOC/UNESCO should do as a follow-up in this region?
- (iii) Do you think other regions could benefit by Training Course such as these?
- (iv) Other comments?

11. What general suggestions would you make to improve the Course?

Comments: _____

12. How do you rate this Course?

Unacceptable Poor Adequate Good Outstanding

Name:

(Signature of Trainee)

Results of Questionnaire for Assessment by Trainees

Question	Result	Result	Result	Result	Result	Result	Result	Result
Question 1	4	4	5	3	4	4	4	4
Question 2	4	4	5	4	5	4	4	4
Question 3	informative	-	informative	informative	informative	informative	informative	-
Question 4	4	4	5 metadata	4	4	4	4	5
Question 5	adequate	adequate	adequate	too long	too long	too long more practical sessions	adequate	adequate
Question 6	4	2	4	3	3	3	5	3
Question 7	- include new material	no	no	yes	no	yes	yes for time	-
Question 8	apply knowledge	no specific idea	establish new databases, metadata directory	-	-	establish NODC		database managemen t systems
Question 9	4	3	4	2	5	2	5	4
Question 10	-	(i) yes (ii) yes (iii) yes (iv)nothing	(i) yes (ii)interacti on in region (iii) yes (iv) -	(i) yes (ii)establish data centre (iii) yes (iv) nil	(i) partly (ii) yes (iii) yes (iv) no comment	(i) yes (ii) IOC to assist to establish NODC (iii)yes (iv) nil	(i) yes (ii) yes (iii) yes (iv) nothing	(i) - (ii) more feedback (iii) yes (iv) -
Question 11		use new software	on job training needed	no suggestions	intensificati on of Course	-	more practical work	metadata directory
Question 12	good	good	outstanding	adequate	good	adequate	good	good

Programme_Name :-----
Principal_Investigator :-----
PI_Organization :-----
Platform_Name :-----
Project_Comment :-----
Media_Description :-----
Data_Form :-----
Media_Comment :-----
Format_Available :-----
Documentation :-----

Equipment_Sample :-----
Equipment_Analysis :-----

Lineage :-----

Quality_Method :-----
Positional_Accuracy :-----
Attribute_Accuracy :-----
Logical_Consistency :-----
Completeness :-----
Progress :-----
Update_Frequency :-----
On-line_Link :-----
Link_Desrciption :-----

ANNEX V

COURSE CERTIFICATES

In The Name of God

This is to certify that _____

participated as a lecturer in the

REGIONAL IOC/ROPME TRAINING COURSE

ON

MARINE DATA AND INFORMATION MANAGEMENT

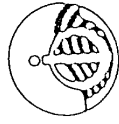
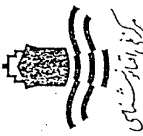
18-30 Oct. 1997

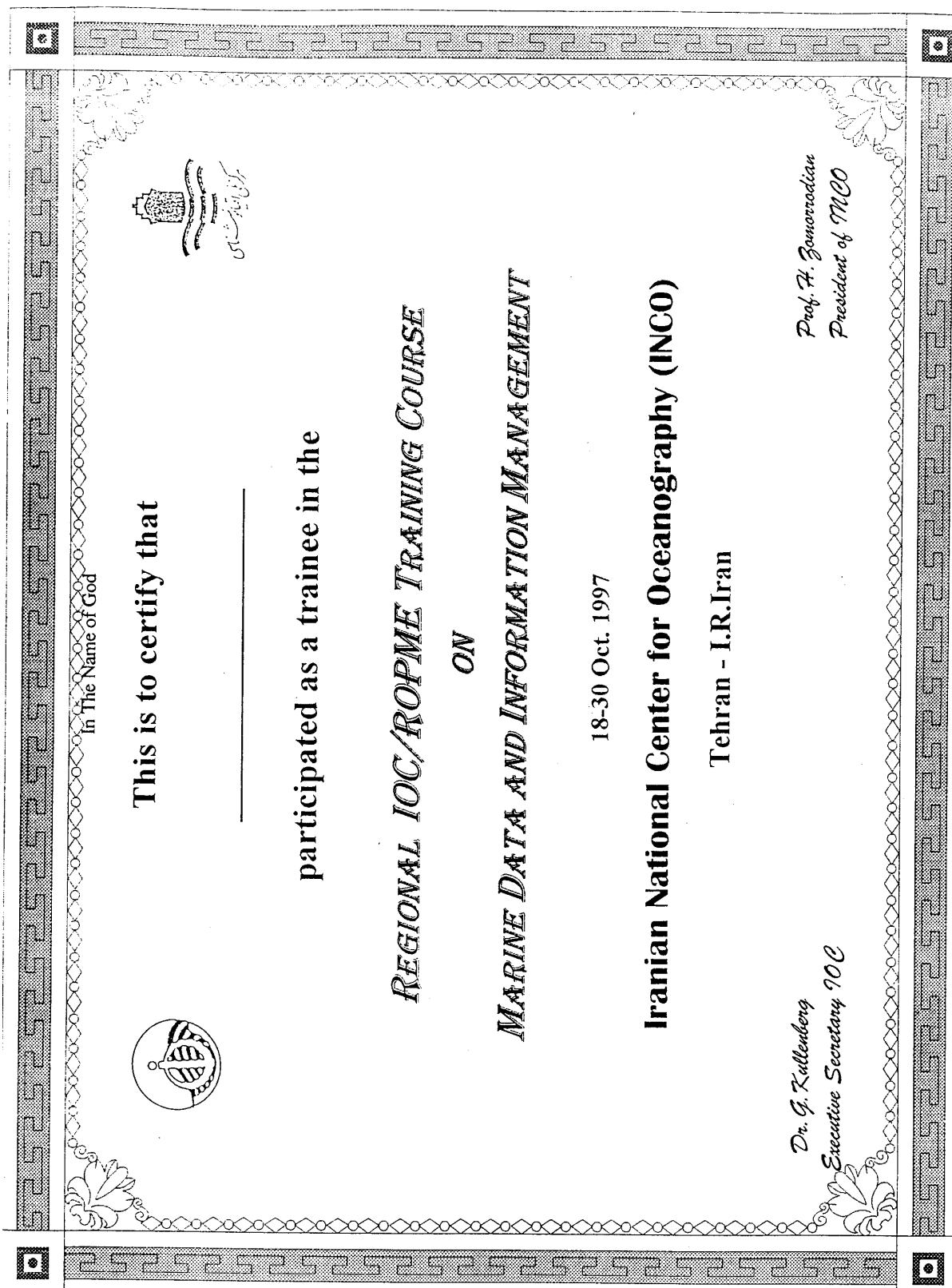
Iranian National Center for Oceanography (INCO)

Tehran - I.R.Iran

Dr. G. Kallenberg
Executive Secretary IOC

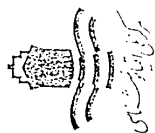
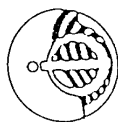
Prof. H. Zomorodian
President of INCO





In The Name of God

This is to certify that



_____ participated as a trainee in the

REGIONAL IOC/ROPME TRAINING COURSE
ON
MARINE DATA AND INFORMATION MANAGEMENT

18-30 Oct. 1997

Iranian National Center for Oceanography (INCO)

Tehran - I.R.Iran

Dr. G. Kullenberg
Executive Secretary IOC

Prof. H. Zomorodian
President of INCO

ANNEX VI

LIST OF ACRONYMS

ASFA	Aquatic Sciences & Fisheries Abstract
ASFISIS	Aquatic Sciences & Fisheries Integrated Set of Information Systems
BIODIMS	Marine Biological Data & Information Management System
CDS	Computerized Documentation System
CEC	Commission of the European Communities
CSR	Cruise Summary Report
CTD	Conductivity-Temperature-Depth Probe
DBMS	Data Base Management System
DNA	Designated National Agency
ERS	European Remote Sensing
GF3	General Format N. 3 (A General Oceanographic Data Exchange Format)
GIS	Geographic Information System
GODAR	Global Oceanographic Data Archeology & Rescue Project
GOOS	Global Ocean Observing System
GTSP	Global Temperature-Salinity Pilot Project
ICSU	International Council of Scientific Unions
INCO	Iranian National Centre for Oceanography
IOC	Intergovernmental Oceanographic Commission
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data & Information Exchange
MEDI	Marine Environmental Data Information & Referral System
MIM	Marine Information Management
NIO	National Institute of Oceanography
NOAA	National Ocean & Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre
NOP	National Oceanographic Programme
OCEANPC	Ocean Personal Computer Project
ONR	Office of Naval Research (USA)
PC	Personal Computer
PERSGA	Red Sea & Gulf of Aden Environment Programme
QC	Quality Control
RNODC	Responsible National Oceanographic Data Centre
ROPME	Regional Organization for the Protection of the Marine Environment

TREDMAR	Marine Science Training & Education Programme
UNESCO	United Nations Education, Scientific & Cultural Organization
WDC	World Data Centre
WWW	World Wide Web