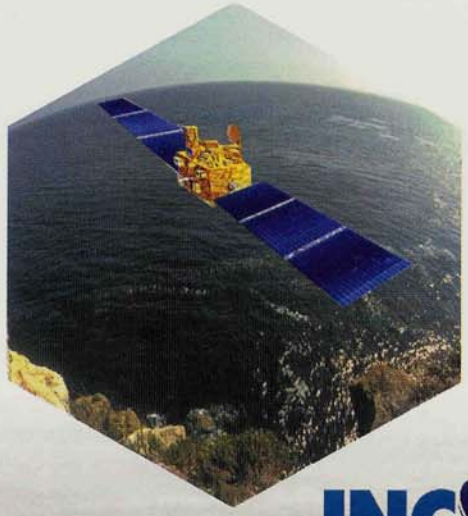
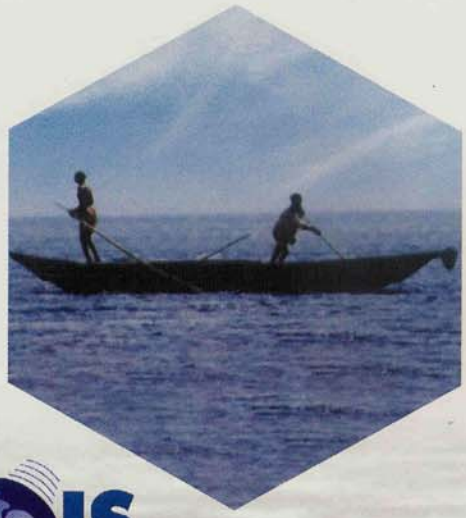
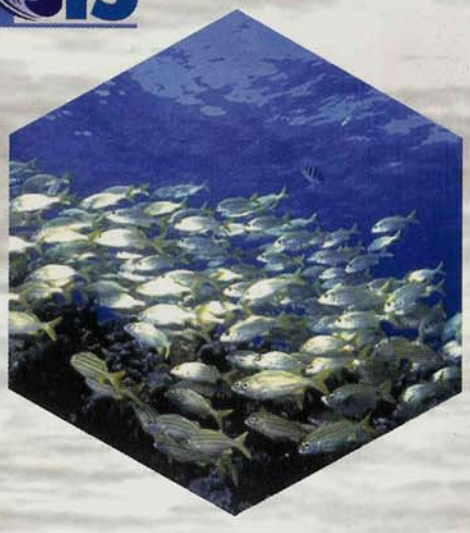
FIFTH ANNUAL REPORT

2002-2003





INCOIS



INDIAN NATIONAL CENTRE FOR OCEAN INFORMATION SERVICES

(An Autonomous Body under the Department of Ocean Development, Government of India)

Plot #3, Nandagiri Hills Layout, Jubilee Hills, Hyderabad. 500 033, INDIA

Contents

Directors' Report

The vital role of Oceans in sustaining life on the planet Earth has been recognised from the mythic past of humanity. We have one Ocean and many coasts. The coast that is a triple interface between land, atmosphere and ocean has been the cradle of many civilizations. An integral part of the global sustainable development, Oceans and coasts support a diverse array of activities yielding enormous economic and social benefits.The Ocean space occupies more than 70% of the surface of Earth and it plays a significant role, together with the atmosphere and land mass, in shaping our climate. Ecosystem goods and services are more concentrated in the costal zone than in any other region of the globe. Coastal ecosystems are highly productive; they yield 90% of global fisheries and produce 25% of global biological productivity.

The Indian Ocean, the third largest ocean in the world and with more than 1.5 billion population around, has a unique geographic setting. A complex oceanic realm, the Indian Ocean has been a subject of serious concern for the countries around this region as well as the international community. However, it is recognised that as compared to Atlantic and Pacific, the Indian Ocean still lacks systematic observations that are essential for understanding the oceanic processes and their impact on human life.

India has a coastline of about 7,500 kilometers, and the Seas around India directly influence the life of about 370 million coastal populations and the living of 7 million fishing community. Understanding the oceanic processes and enhancing our capability for predictability of Ocean as well as climate, thus, become a key national agenda. Systematic observation of Ocean and providing reliable and timely information and advisory services to the stakeholders form an imperative ingredient of this national agenda.

The Indian National Centre for Ocean Information Services (INCOIS), an autonomous body under the Department of Ocean Development has been striving to address this national agenda with missionary zeal through (i) Potential Fishing Zone Advisory Services (ii) Experimental Forecast of the Ocean State (ii) Ocean Observation using Argo Profiling Floats and several other in-situ platforms (ii) Satellite Oceanography and (iv) Ocean-Atmosphere Modelling efforts. Ensuring synergy and knowledge networking with premier national institutions has been the hall mark of INCOIS in accomplishing its mission. Concomitant with this, INCOIS has been striving to play a significant role in the Indian Ocean region.

Our major accomplishments during the year under report are:

- Providing, in a mission-mode, Potential Fishing Zone Advisories to the Indian fishing community through a wide range of media (such as telephone, fax, electronic boards, satellite radio and internet) in local languages so as to make it part of the value chain of the fishing community. Validation experiments suggest that the search time has been reduced by 30 to 70 % due to the usage of these advisories. This is an excellent example of reaching the benefits of science to society.
- Providing experimental short term forecast of Ocean State that would be valuable for safe operations and travel in the sea.
- Establishing Web-based on-line Information Services, with capabilities for Web-GIS (www.incois.gov.in).
- Utilising the potential of the Oceansat-1(IRS-P4) of India and the foreign remote sensing Satellites for periodic spatial information on chlorophyll, suspended sediments and sea surface temperature in the Arabian Sea and Bay of Bengal as well as defining the payload requirements for Oceansat-2.
- Sustaining the in-situ measuring network of Surface Drifting Buoys (for measuring sea surface temperature and atmospheric pressure), Current Meter Arrays (for time series profiles of current, speed and direction at fixed locations), Expendable Bathythermographs (for temperature profiles), Tide Gauges (for sea level) and observations from the Ships.
- Implemented successfully an array of 10 Argo profiling floats in the Arabian Sea, Bay of Bengal and tropical Indian Ocean during October-November 2002. Argo is a revolutionary concept to measure periodically the temperature and salinity vertical profiles from surface up to a depth of 2000 metres to understand the structure and dynamics of the upper ocean that influences climate.
- Initiating, in–mission mode, a national endeavour on Ocean-Atmosphere modelling.
- Mounting the development of the permanent campus on a time-bound manner.

Also, the initiatives and concerted efforts of INCOIS resulted in India achieving leadership for Ocean Observations in the Indian Ocean by:

- INCOIS leading the process of establishing of the Regional alliance in Indian Ocean for Global Ocean Observing System (IOGOOS) in November 2002 where 19 Institutions from 10 Countries have already become Members.
- INCOIS being called upon to host IOGOOS Secretariat for the next six years as well as to lead IOGOOS in the coming years to formulate and guide projects on Ocean

Observing Systems, Ocean data and Information Networking and applications of common concern in the region.

- INCOIS coordinating the implementation of the international Argo Project in the Indian Ocean where countries such as Australia, China, France, Germany, India, Japan, UK and USA have together deployed 120 floats.
- INCOIS being called upon to set up and manage the Regional Argo Data Centre for the Indian Ocean. Data from 120 Argo floats deployed in the Indian Ocean are available in near-real time from INCOIS Web Site.
- INCOIS facilitating an International Cruise with Scientists from India, Kenya, Mauritius, Seychelles, South Africa and Sri Lanka in October-November 2002 for conducting scientific experiments and Argo deployments.

These accomplishments have been possible by the unstinted support, able guidance and visionary direction provided by Dr. Harsh K. Gupta, Chairman INCOIS Governing Council, the Members of the Governing Council and the Officials of the Department of Ocean Development. I am grateful to them. The backbone of INCOIS is a young and spirited team that made the difference.

(K. Radhakrishnan)

Director

1. The Organisation

The Indian National Centre for Ocean Information Services (INCOIS) is an autonomous body under the Department of Ocean Development (DOD), Government of India and was registered as a Society under the Andhra Pradesh (Telangana Area) Public Societies Registration Act 1350 Fasli at Hyderabad on February 3, 1999. The affairs of the Society are managed, administered, directed and controlled, subject to the Bye laws of the Society, by the Governing Council.

INCOIS Society

1	Secretary, Department of Ocean Development	President
2	Director, National Remote Sensing Agency	Vice-President
3	Joint Secretary, Department of Ocean Development	Member
4	Advisor, Department of Ocean Development	Member
5	Director, National Institute of Oceanography	Member
6	Director, National Institute of Ocean Technology	Member
7	Director, National Centre for Antarctic & Ocean Research	Member
8	Director, INCOIS	General Secretary

INCOIS Governing Council

1	Secretary, Department of Ocean Development	Chairman
2	Director, National Remote Sensing Agency	Vice-Chairman
3	Additional Secretary & Financial Advisor, Department of Ocean Development	Member
4	Prof. V.K. Gaur	Member
5	Prof. B.L. Deekshatulu	Member
6	Joint Secretary, Department of Ocean Development	Member
7	Advisor, Department of Ocean Development	Member
8	Director, National Institute of Oceanography	Member
9	Director, National Institute of Ocean Technology	Member
10	Director, National Centre for Antarctic & Ocean Research	Member
11	Principal Adviser (S&T), Planning Commission	Member
12	Director (Civil-1), Ministry of Surface Transport	Member
13	Director, Space Applications Centre	Member
14	Director, EOS, Indian Space Research Organization	Member
15	Head, Centre for Mathematical Modeling and Computer Simulation	Member
16	Director, INCOIS	Member-Secretary

The Vision

INCOIS has a vision to emerge as a knowledge and information technology enterprise for the oceanic realm.

The Mission

The Mission of INCOIS is to provide the best possible Information and advisory services to society, industry, government agencies and scientific community through sustained ocean observations and constant improvements through systematic and focused research.

The major objectives of INCOIS are :

(i) To undertake, aid, promote, guide and co-ordinate research in the field of ocean information and services including satellite oceanography,

(ii) To establish, maintain and manage, hire the systems for data acquisition, analysis, interpretation and archival for Ocean Information and Services,

(iii) To carry out surveys and acquire information using satellite technology, ships, buoys, boats, any other platforms and remote sensors, generate information on fisheries, minerals, oil, biological, hydrological, bathymetry, geological oceanography, meteorology, coastal zone management and associated resources and island development, mangroves and associated coastal, forest, soils, wetlands, estuarine mapping, seabed and to undertake studies in marine archaeology, environmental monitoring of India and Antarctica and surrounding oceans and land masses,

(iv) To generate and provide data and value added data products to user communities in coastal and ocean areas using space, aerial and conventional sources,

(v) To establish Ocean data bank, including acquisition of all data obtained from satellite, air-borne sensors, ships, boats, buoys and field surveys, storage, retrieval, dissemination, evaluation, scrutiny, synthesis, analysis, interpretation of information and providing services and consultancy,

(vi) To cooperate and collaborate with other national and international institutions in the field of Ocean Remote Sensing, Oceanography, Atmospheric Sciences/Meteorology and Weather forecasting centres, coastal zone management, usage of satellite data and data acquisition by all technologically possible means in all allied science fields, subject to that prior approval of DOD shall be obtained for collaboration with institutions abroad,

(vii) To provide support to research centres for conducting investigations in specified areas related to Oceanic parameters, Ocean Atmospheric interaction studies, coastal zone information, synthesis, analysis, data collection and undertake developmental work.

(viii) To provide training lectures, seminars and symposia for advanced study and research related to Oceanographic parameters, related sciences and technology and in allied fields related to Ocean Information Services,

(ix) To publish and disseminate information, results of research, data products, maps and digital information through all technologically possible methods like print, voice or electronic media to users for promoting research and to meet societal needs in improving environmental conditions and living standards, provided that dissemination of data is as per guidelines of the Government of India,

(x) To provide consultancy services in the fields of Ocean Information and Services,

(xi) To co-ordinate with all space agencies to ensure continuity, consistency and state-of-the-art quality of ocean data derived from satellite observations,

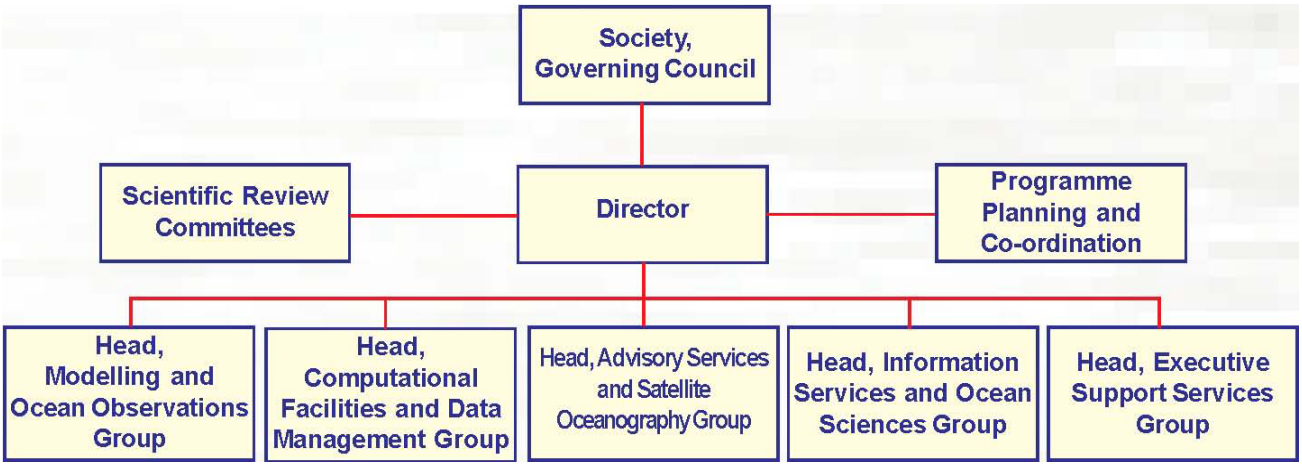
(xii) To generate data, data products, value added data products and market for coastal and ocean applications,

(xiii) To encourage and support Governmental and non-Governmental Agencies or organizations for furthering ocean and related programmes in the generation of ocean information, and

(xiv) To undertake all such other lawful activities as may be necessary, incidental or conducive to the attainment and furtherance of all or any of the above objects of the Society.

Synergy and knowledge networking with centres of excellence in ocean, atmospheric sciences, space applications and information technology as well as translating this scientific knowledge in to useful products and services comprise the corner stone of INCOIS for emerging as an institution of national relevance and international significance.

A young team of 11 scientific personnel, 4 Research Fellows and 3 Administrative personnel comprise the first phase of INCOIS team. The selection of the second phase of 22 persons in project mode commenced. The organisation of INCOIS is given below.



The Organisation Structure

2. Ocean Information and Advisory Services

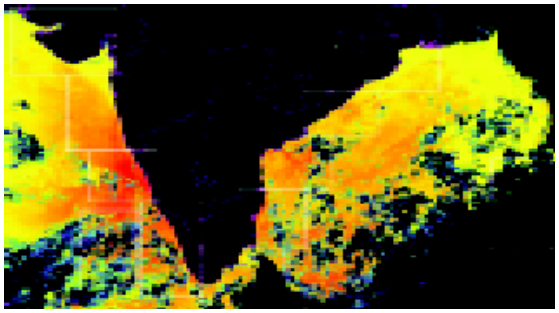
2.1. Potential Fishing Zone (PFZ) Advisory Services

The rich heritage from the concerted efforts of Scientists from Ocean Development, Space and Fishery Science was translated by INCOIS into a unique service to provide reliable and timely potential fishing zone advisories to the fishing community of the entire coastline of the country, in a mission mode, using satellite data and collateral data. Frequent and intense interactions between the scientists and fishing community at the fishing harbours, and use of a wide range of media such as fax, telephone, electronic display boards, radio and internet have ensured that these advisories provided in the local languages become part of the value chain of the fishing community. It has been validated that the search time has been reduced by 30 to 70 % due to the usage of these advisories. This is an excellent example of reaching the benefits of science to society.

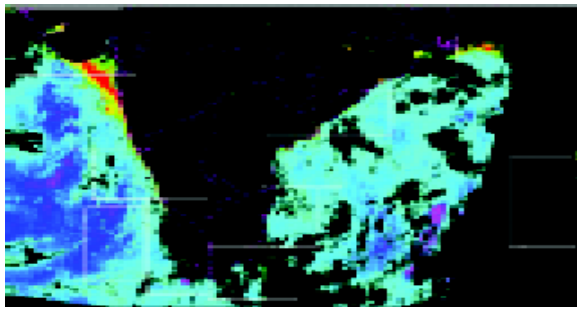
The significant achievements during the year under report are as follows:

Generation of PFZ advisories

- Operational Generation of PFZ advisories was sustained and enriched.
- Know-how for the generation of the Integrated PFZ Advisories using both Sea Surface Temparature (SST) and Chlorophyll, developed under the Satellite Coastal and Oceanographic Research (SATCORE) project was acquired from Space Applications Centre (SAC), Ahmedabad.
- Software for generation of (i) SST from NOAA-AVHRR and (ii) Chlorophyll from Ocean Colour Monitor (OCM) of Oceansat-1(IRS-P4) developed by Regional Remote Sensing Service Centre (RRSSC), Nagpur, was installed on IBM AIX Platform at INCOIS for operational use in PFZ forecasting.



SST from NOAA-AVHRR



Chlorophyll from Oceansat-1 (IRS-P4)

- Geographical Information System (GIS) Database was developed for Bathymetry, Landing Points and Light Houses. Map Compositions have been done for the entire Indian Coast line and Identification of the PFZ lines were done onscreen thereby improving the planimetric accuracy of the forecasts.

- An ISDN connectivity of 256 kbps was established between National Remote Sensing Agency (NRSA) and INCOIS for timely reception of the Satellite data from NRSA.
- The frequency of the advisories was increased from 2 per week of previous years to 3 per week (i.e. Tuesday, Thursday and Saturday) during 2002-03, as per the requests of the fishing community.
- 72 PFZ advisories were generated during 2002-03, which consisted of 8 SST-based (during April & May 2002) and 64 SST and Chlorophyll integrated (during October 2002 – March 2003) PFZ advisories.

Dissemination Strategies

- **Mult-lingual Messages by Fax / Telephone**

  Fax and Telephone-based multi-lingual (Gujarathi, Hindi, Kannada, Malayalam, Telugu, Oriya and Bengali) PFZ messages were disseminated to around 225 nodes spreading the entire coast of India, under 12 sectors, viz., Gujarat, Maharastra, Karnataka & Goa, Kerala, South Tamilnadu, North Tamilnadu, South Andhra Pradesh, North Andhra Pradesh, Orissa & West Bengal, Andaman, Nicobar and Lakshadweep.

PFZ Information on Electronic Display Board

- **Electronic Display Board**

  For timely and effective dissemination of the PFZ advisories, a new concept was introduced by establishing Electronic Display Boards (EDB) at fishing harbours. The first EDB, was installed at Ratnagiri, Maharashtra and transmitted PFZ forecasts to the board directly from INCOIS using telephone, modem and dedicated software. On successful implementation of this new initiative, a series of EDBs are installed at Visakhapatnam, Machilipatnam, Kakinada. The forecast is being updated thrice a week directly from INCOIS.

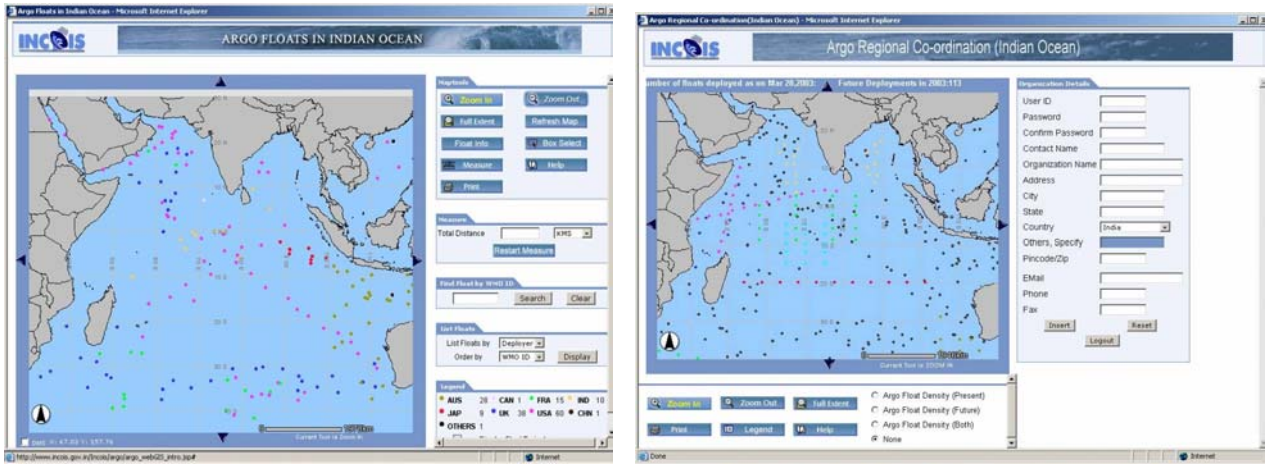
- **Satellite Radio**

  A pilot project on satellite audio broadcasting was initiated with M/S. WorldSpace, Bangalore during March 2003 and WorldSpace Radio receivers were successfully installed on the fishing boats operating from Visakhapatnam, Kakinada, Machilipatnam and Berhampur along the east coast and Manakkodam, Kochi, Munambam, Mangalore and Ratnagiri along the West coast of India.

  The PFZ forecast messages were broadcast to these World Space Radio receivers directly from INCOIS in Hindi, Kannada, Malayalam, Telugu and Oriya languages twice a day between 07.00 to 7.15 A.M., in the morning and 3.30 to 3.45 P.M. in the afternoon.

- **Web-based services from INCOIS**

  A dynamic web site with Web GIS, query facility and multi-lingual capability was developed for the PFZ Advisory services to strengthen the delivery chain and improve the time line and the PFZ advisories (containing SST and Chlorophyll Images, Vector coverage and multi-lingual text) were simultaneously made available to the users at INCOIS website (www.incois.gov.in).



Web Based PFZ Services on INCOIS Website

- **Dissemination through E-mail**

  Both map and text forms of these advisories are mailed to some of the users on their request.

Validation Experiments

Three research projects were carried out for concurrent validation of the PFZ Advisories around Mangalore, Kochi and Gopalpur in addition to the validation project around Ratnagiri.

2.2. Experimental Ocean State Forecast

The Experimental Ocean State Forecast (E-OSF) emphasises on providing state-of-the-art ocean information and forecast to the users e.g. Navy, Shipping, Oil and Fishery industry, etc. and the information encompasses predictions and dissemination of geo-physical information like surface winds, sea surface temperature, surface waves, mixed layer depth and currents. The E-OSF activities are envisaged in two phases – Phase I, mainly focused on open ocean forecast in coarser grid and in Phase II, the coastal forecast in fine grid.

E-OSF is developed out of a joint initiative taken by INCOIS and the Space Applications Centre. The wind forecast from the National Centre for Medium Range Weather Forecast (NCMRWF), Delhi is the prime input for the E-OSF Forecast. The Centre for Atmospheric Sciences (CAS) of Indian Institute of Technology (IIT), Delhi, the Centre for Atmospheric and Ocean Science (CAOS) of Indian Institute of Science (IISc), Bangalore, the National Institute of Oceanography (NIO), Goa contributed to this multi-institutional endeavour to translate scientific knowledge into a service useful for safe operations in the sea.

The progress made during the year 2002-03 is as follows:

Open Ocean Forecast

- Operational Forecast is being generated for wave and swell parameters using WAM-3C model. The forecast is valid for four days at 6 hourly intervals and on 1.5^0 x 1.5^0 and 1^0 x 1^0 spatial resolution. Wind data generated by NCMRWF is the forcing for the model.
- Mixed Layer Depth forecast commenced using 1 dimensional Price model with NCMRWF wind and radiation flux as forcing. Forecast is for four days and 12 hourly interval and 1^0 x 1^0 spatial resolution.
- Frequent validation of wave, wind and tidal circulation parameters are carried out with in-situ (Moored buoy) and satellite data (Topex-Poseidon and ERS-1). These forecasts were validated in real time by Naval Operations Data Processing & Analysing Centre (NODPAC), Kochi during the naval exercises. The forecasts are in close match with the observations.

Coastal Ocean Forecast

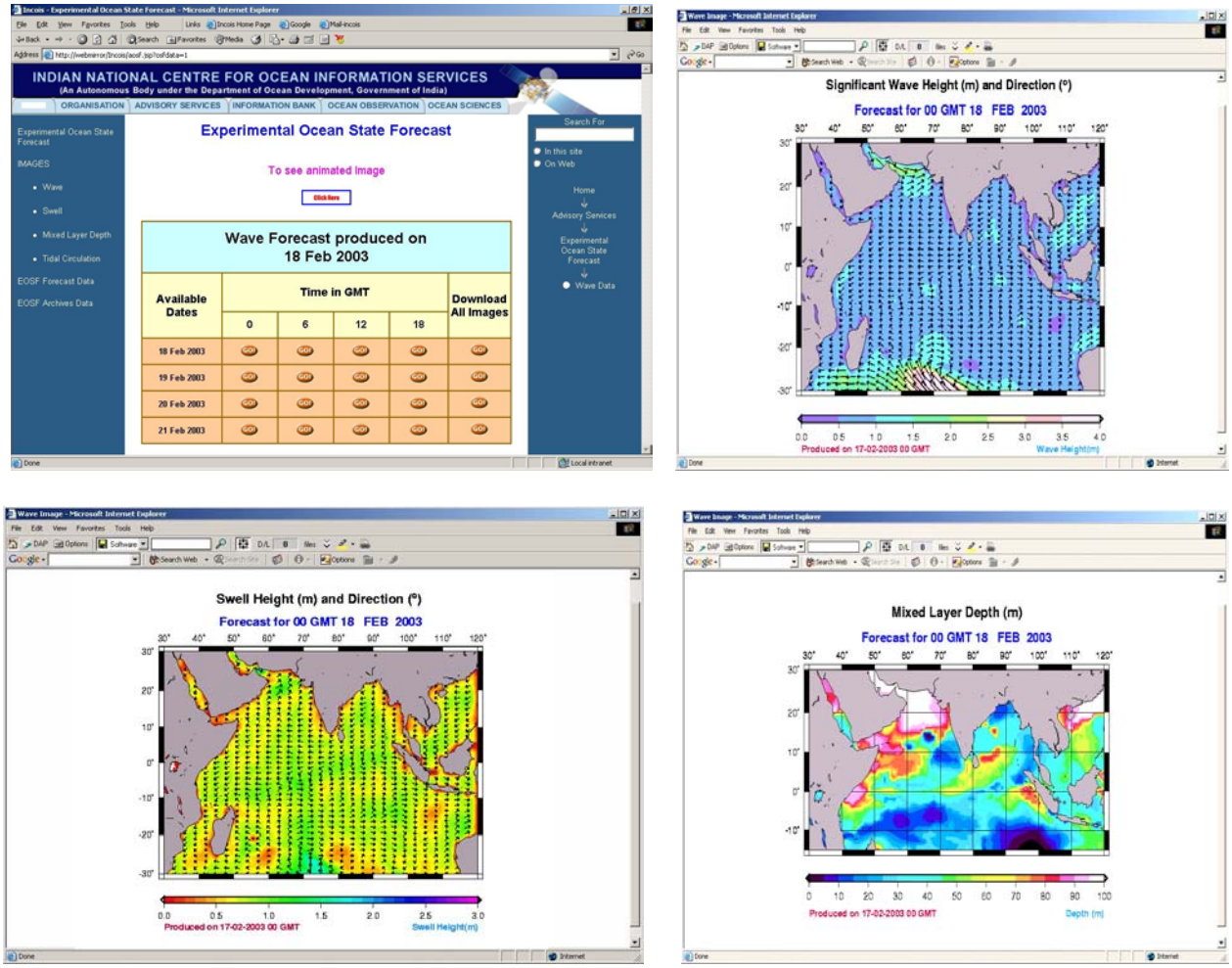
- Tidal circulation model for the Gulf of Kambath was installed at INCOIS by the Scientists of NIO for operational use. The model is customised for forecasting tidal currents from Ratnagiri to Porbandar for 3 days at 3 hourly intervals and at 6 km spatial resolution. Validation of model results with Moored Buoy data showed good correlation.

- WAM model was customized by INCOIS scientists for forecasting the wave and swell parameters in 25 km resolution for the coastal regions.

Dissemination to Users

- Experimental Ocean State Forecast products were delivered through the INCOIS Web Site both in image format and numerical data formats. Images for wave, swell forecasts are available in public domain. A dynamic web site with Web GIS and query facility was developed and implemented for E-OSF. Numerical data for ocean sate forecast is provided for registered users with IP based security.

- Some of the registered users of E-OSF products are NODPAC, Kochi, Southern Naval Command, Visakhapatnam, Navy, Met Office, Visakhapatnam, Directorate of Naval Oceanography and Meteorology, (DNOM), New Delhi, Coast Guard, New Delhi, Oil and Natural Gas Corporation Limited (ONGC), Mumbai, IIT Delhi, Integrated Coastal and Marine Area Management (ICMAM), Chennai, Essar Oil, Jamnagar, Ecosmart, New Delhi.



E-OSF Products on INCOIS Web Site

3. Projects

INCOIS has the responsibility for coordination and implementation of:

(a) Indian Ocean Modelling and Dynamics (INDOMOD),

(b) Satellite Coastal and Oceanographic Research (SATCORE) and

(c) Ocean Observing Systems and Indian Argo Project

3.1. Indian Ocean Dynamics and Modelling (INDOMOD) Project

During the IX Plan, DOD launched the INDOMOD Project with 14 sub-projects addressing specific elements pertaining to development of a wide range of ocean-atmospheric models by six institutions viz., Centre for Atmospheric and Ocean Sciences (CAOS)/IISc, Centre for Atmospheric Sciences (CAS)/IIT-Delhi, Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, National Institute of Oceanography (NIO), Goa, Indian Institute of Tropical Meteorology (IITM), Pune and Cochin University of Science and Technology (CUSAT), Kochi.

The gains made, so far, by the Project are:

- Wave (WAM) model has been operationalised at INCOIS for experimental ocean state forecast of wave parameters to selected users
- Operationalisation of coastal circulation (tidal) model
- Storm surge model has been implemented and tested
- Models of coastal upwelling have also been developed
- Some progress has been made in developing numerical models for variability of the large scale circulation of the Indian Ocean
- A nucleus manpower of Project Scientists has been created and good number of papers have been published in reputed journals based on the results from the participating institutions
- Computing infrastructure has been built up in many of participating institutions

Thus, during the IX Plan, INDOMOD Project made a significant initiative towards realising a national capability in Ocean Atmosphere modelling. During the X Plan, a new phase of modelling efforts was initiated under INDOMOD project, focussing towards the end goal of achieving ocean predictability and enabling climate predictability in a mission-mode with concomitant efforts in Modelling, Data Assimilation and Validation. A networking of institutions with capability, capacity, compatibility, credibility and commitment as well as building a national team is the key to realise this mission.

Significant achievements made by the Project during 2002-03, in realising the national mission are as given below:

- Project proposals for the X Plan period, received from CAOS/IISc, CAS/IIT-D, C-MMACS, IITM, IMD, INCOIS, NIO, NCMRWF, Naval Physical Oceanographic Laboratory (NPOL), NRSA, SAC and SOI were consolidated and reviewed and action plan was developed.
- A national mission on the Ocean-Atmosphere System and the Indian Seas has been formulated, building upon the gains from the INDOMOD Project of IX Plan.
- The INDOMOD Project sanctioned by the Department under the X Plan. INDOMOD Project comprises the following Modules and Sub-projects:

Module - 1: Ocean and Climate

S.No.	Project	Institution
1.1	Large Scale Air-Sea interactions in Asian Monsoon Region	Centre for Atmospheric and Ocean Sciences (CAOS), Indian Institute of Science, Bangalore.
1.2	Intra-Seasonal to Inter-annual variability of the Indian Ocean.	Centre for Atmospheric and Ocean Sciences (CAOS), Indian Institute of Science, Bangalore.
1.3	Common Computing facility for CAOS	Centre for Atmospheric and Ocean Sciences (CAOS), Indian Institute of Science, Bangalore.
1.4	Modelling Ocean-Atmosphere Land Interactions in the North Indian Ocean.	National Institute of Tropical Meteorology (IITM), Pune.
1.5	Air-Sea Interactions in the Indian Ocean region. The focus is on coupling global models.	Indian Institute of Tropical Metreology (IITM), Pune.
1.6	Development of Indian Ocean Community Model	Centre for Mathematical Modelling and Computer Simulation (CMMACS), Bangalore.

Module-2 Coastal Ocean

2.1	Numerical Modelling of circulation, Sanlinity Instrusion and Sediment transport in Gulf and Estuaries	Centre for Atmospheric Sciences (CAS), Institute of Technology, Delhi.
2.2	Operational Integrated Indian Ocean State Forecasting System including wave, current and storm surges.	Centre for Atmospheric Sciences (CAS), Institute of Technology, Delhi.

Module-3 Hazardous Weather Events

S.No.	Project	Institution
3.1	Validation of storm Surge Model including Tide gauges	INCOIS and Survey of India (SOI), Dehradun
3.2	Modelling of Air-Sea Interactions processes to study Genesis, Intensification and Dissipation of Cyclonic Vortices over Indian Seas	Centre for Atmosphere Sciences (CAS), Indian Institute of Technology, Delhi and National Remote Sensing Agency (NRSA), Hyderabad.

Module-4 Ocean Data Assimilation and Information Bank

4.1	A Data Assimilative Sigma-Coordinate Numerical Model for the North Indian Ocean	Indian Institute of Tropical Meteorology (IITM), Pune.
4.2	Digital Atlas, Information Bank	INCOIS and Naval Physical Oceanography Laboratory (NPOL), Cochin
4.3	Assimiliation of In-situ and Satellite Altimeter Data in to an OGCM	Centre for Mathematical Modelling and Computer Simulation (CMMACS), Bangalore.

Module-5 Observation for validation of models

5.1	Long term measurements of currents in the equatorial Indian Ocean through Current meter moorings along the equator	National Institute of Oceanography(NIO), Goa
5.2	XBT observations for long term monitoring of upper ocean thermal fields in the seas around India.	National Institute of Oceanography(NIO), Goa
5.3	Measurements of surface velocity and met-ocean parameters using satellite tracked drifing buoys in the Indian Ocean	National Institute of Oceanography(NIO), Goa

3.2. Satellite Coastal and Oceanographic Research (SATCORE) Project

SATCORE Project envisages development of various algorithms and models for retrieval of met-ocean parameters (e.g. sea surface temperature, winds, wave parameters, bathymetry, suspended matter, mixed layer depth, chlorophyll, aerosol, water vapour, clouds, currents and sea level) from the data from Indian and foreign satellite sensors including IRS P4. Besides, this Project would also carryout diagnostic studies and generation of forecast models, customisation of algorithms and development of related software packages. The SATCORE project is executed primarily by the Space Applications Centre (SAC) and the National Remote Sensing Agency (NRSA).

The SATCORE project during the IX plan resulted in operationalising the Integrated Potential Fishery Forecast and Experimental Ocean State Forecast, apart from developing a sound knowledge base as a precursor to the utilisation of the new satellites. There is an imminent need to gear up for the effective utilisation of the forthcoming Indian Ocean remote sensing satellite missions such as Meghatropiques, Oceansat-2 and Radar Imaging Satellite for operational generation of met-ocean parameters and their assimilation, along with the in-situ data, for a host of products and services.

Significant achievements made by the Project during 2002-03 are as given below:

- Software for processing of IRS-P4 Ocean Colour Monitor Data to derive Chlorophyll, Suspended Sediments and Yellow substance, developed by SAC/RRSSC (under SATCORE) was implemented at INCOIS on Windows and AIX Platforms.
- Meteorological and oceanographic application (MOA) shell developed by SAC for retrieval of SST, Wind vector, Wave Energy and Eddies from ERS-1 data was implemented at INCOIS.
- Ocean Colour and SST were integrated for PFZ forecast for Gujarat, Kerala and Karnataka and validated jointly with the user agencies. Know-how was transferred to INCOIS
- The SATCORE project was formulated jointly with SAC and NRSA for X plan including work packages viz. (i) Advanced Ocean State Forecast, Ocean Processes (Convection), Geophysical Parameter Retrieval and Validation (ii) Ocean Colour Applications, Ocean Biology, Coastal processes, Ocean Lithosphere, Coral reef Studies, (iii) Improvement of Mixed Layer Depth Predictions (iv) Development of Integrated Fishery Forecast Model and (v) Observation platforms in Islands.

3.3. Ocean Observing System

Systematic observation is imperative for understanding the structure and dynamics of Ocean, improving predictability of Ocean and climate, sustainable development of coastal ecosystem and for generation of ocean information and advisory services for the society, industry, government and scientific community especially in the context of sustainable development of the coastal and marine ecosystem, weather prediction, disaster management and environmental monitoring form a subset of larger socio-economic national objectives of any maritime country.

India has made significant progress in ocean observation systems, with a mix of in-situ platforms and satellite systems and concomitant capability in retrieval of data, use of models, generation of value-added services and advisories in specific areas.

The Ocean Observing System is designed for generation of systematic, scientific and long-term data of oceanographic and meteorological parameters by deployment of state-of-the-art technology instruments i.e. Drifting buoys, XBT's, Current Meter Mooring Array, Met-Ocean Moored Buoys and Tide-Gauges.

3.3.1. Indian Argo Project

One of the recent advancements in in-situ observation is the profiling Argo floats. Argo (earlier known as array for real-time geo-strophic oceanography) is a revolutionary concept that enhances the real-time capability for measurement of temperature and salinity through the upper 2000 metres of the ocean and it contributes to the global description of the seasonal and inter-annual variability of the upper ocean thermohaline circulation. The periodic profiles of Temperature and Salinity would enable better understanding of Ocean circulation and enhance climate predictability.

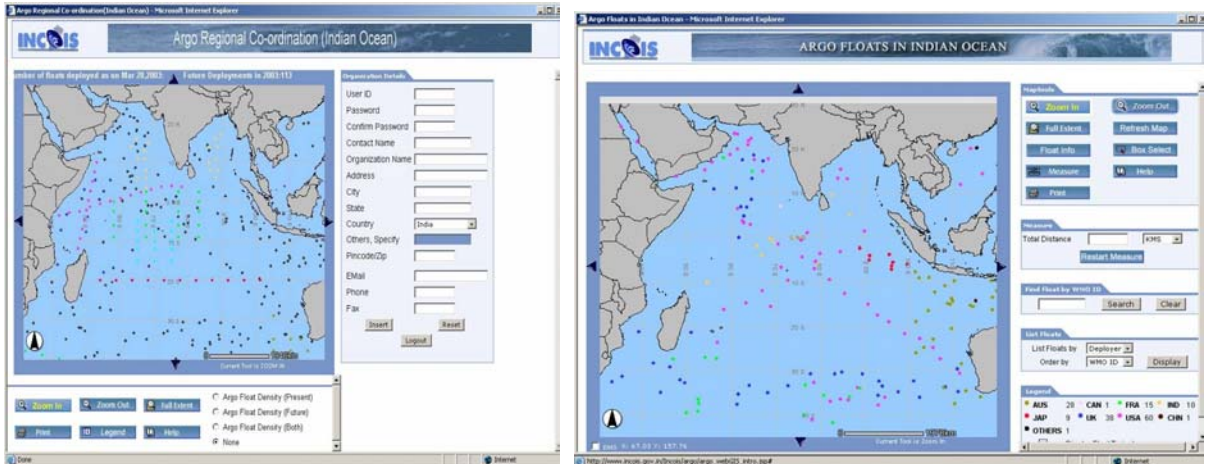
The international community is moving ahead to realise a global array of 3000 Argo floats by the year 2006 out of which 450 floats will be deployed in the north Indian Ocean. India is participating in the Argo programme and plans to deploy 150 floats in the north Indian Ocean (north of 10°S) by 2005. Further, INCOIS is the Regional Coordinator for implementation of Argo programme in the Indian Ocean and also the Regional Argo Data Centre for the region.

Significant achievements under the programme during 2002-03 are as follows:

- A Project proposal for the Indian Argo Project formulated jointly with NIOT and CAOS, with inputs from NIO, NPOL, SAC and C-MMACS was approved for implementation during X Plan.
- Time series data of one year collected from the Canadian Float deployed by India were analysed and developed capability to decide the Argo Float design for the Indian Ocean region.
- First time in the Indian Ocean, India deployed 10 Argo floats during the IOGOOS Cruise onboard ORV Sagar Kanya with 3 Argo float missions having 10 days, 5 days and 10 & 5 day cycles to capture the intra-seasonal variability in the region. Data from these floats is being received and made available on the Website for the user community after the real time quality checks.

Argo Float Testing onboard ORV Sagar Kanya before deployment

- Performance Evaluation Report of the Argo floats deployed by India was prepared and evaluated by the Expert Committee. This input was useful in deciding future Argo float deployment location, mission and the float type.
- A Website was setup for the India Argo Program with Web GIS and query facilities. Data from about 120 floats deployed by various countries in the Indian Ocean is available on the INCOIS website for the scientific community. The countries intending to deploy Argo floats in the Indian Ocean region can register at this site to ensure proper observing strategy both in space and time.
- Under a joint project of INCOIS and CAOS/IISc, hydrographic structure of western Arabian Sea was studied using the data from Argo floats in the region.
- Tool for conversion of Argo data from TESAC to ASCII format was developed and Argo data from 600 floats (Pacific, Atlantic and Indian Ocean) have been archived.
- Software package for online real-time quality control of Argo data, incorporating 15 quality checks approved by the International Argo Science Team was developed. For delayed mode quality control, acquired software package from the Pacific Marine Environment Laboratory (PMEL), USA along with historic data of the world ocean collected from 1800-1998 for Temperature and Salinity profiles.



Argo Web - GIS pages on INCOIS Website

3.3.2. Other In-Situ Ocean Observing Systems

INCOIS has responsibility to coordinate and implement, through NIO, Ocean Observation System such as drifting buoys, expendable bathy thermographs (XBT), current meter moorings and sea-truth campaigns.

The progress made during the year under the report is as follows:

- During the year 15 SVP-B (SST and barometric pressure) drifter and 2 SVP-BW (SST, barometric pressure, wind speed and wind direction) were deployed in the tropical Indian Ocean.

- The data were disseminated through Global Telecommunication System (GTS) regularly to make them available to the weather forecasting centres on near-real time.
- Upgraded the drifting buoy data archive by appending the data obtained from the Global Drifter Centre at Atlantic Oceanographic and Meterological Laboratory (AOML), USA for the year 2001. The present data archive contains quality controlled data from 737 buoys spanning over a period of 27 years (1976 to 2001).
- A comparison of drifting buoy trajectories have been made with the features those appear in the data obtained from TOPEX/POSEIDON altimeter. The start has been made by superimposing the 10 day trajectory segments of buoys on altimeter sea surface heights. Further analysis is in progress.
- XBT observations were carried out along the sections (a) Chennai-Port Blair-Calcutta (b) Chennai-Singapore and (c) Mumbai-Mauritius. About 300 XBT observations were made in the above sections. In addition to the temperature profiles, 150 water samples for sea surface salinity and 250 water samples for phytoplankton were also collected 500 marine meteorological observations were carried out.
- One new current meter mooring was deployed at 76°E and the other two moorings at 83°E and 93°E were retrieved and redeployed during Mar-Apr 2002.
- Currents data were obtained from the moorings at 83°E and 93°E and collected upper ocean hydrographic data at 11 stations along 76°E section.
- Carried out analysis of currents data to understand the variability of equatorial currents and examined the temporal variability of measured currents in conjunction with the OGCM results. The comparison of measured and model results has been remarkable for the 10-20 day period intra-seasonal variability in the currents.
- The OOS-moorings along the equator have been recognized as the first pilot experiment for the basin scale variability studies under IOGOOS programme, as these moorings are providing valuable information on the currents variability in the equatorial Indian Ocean.
- Five cruises were conducted by NIO as a part of the project Sea truth campaigns for validation of Oceansat-1 (IRS-P4) sensors and surface met-ocean data were collected.
- Formulated project proposals on Ocean Observing Systems under X Plan.
- Eleven out of 21 tide gauges installed along the Indian Coast by the Survey of India are working well and providing data. Mean Sea Level data for these 11 stations are processed up to 2000. Monthly Mean Sea Level data from 16 Tide Guage Stations up to 1999 were processed and submitted to Permanent Service for Mean Sea Level (PSMSL) as part of Global Sea Level Observing System (GLOSS) Programme.

4. Ocean Information Bank and Web Based Services

4.1. Ocean Information Bank

The Ocean Information Bank is supported by a national chain of Marine Data Centres and Ocean Observing Systems. The Ocean Information Bank consists of the following data sets for facilitating its user community.

(i) NOAA AVHRR Satellite data from 1991 and Sea Surface Temperature archives for North Indian Ocean from 1992 to March 2003, including daily, weekly and monthly images and grid data, brightness temperatures,

(ii) Data from Moored and Drifting Data buoys, XBTs, Current Meter Mooring Array for the period 1997-2003,

(iii) Data from the 700 Argo Floats deployed in the global Ocean

(iv) PFZ Maps from 1992 onwards along the Indian coastline and Islands (for non-monsoon months),

(v) Coastal Area Maps from Nellore to Orissa border on 1:25,000 scale

(vi) Bathymetry charts for the entire coast of India including Islands on 1:15,000 / 1:50,000 /1:1, 50,000 scale.

During the year, INCOIS was entrusted with the responsibility of archival of sub-surface oceanographic data collected from Arabian Sea Monsoon Experiment Phase-II (ARMEX-II) by ICRP/DST.

Marine Data Centres

A network of 14 Marine Data Centres (MDC) were established by DOD in the 90's under the MARSIS Programme, in National Laboratories and Academic Institutions to collect and collate data, undertake quality control exercises and archive in digital data bases. The Marine Data Centres are located at (1) Geological Survey of India, Kolkata, (2) KD Malavia Institute of Petrolium Exploration, Dehradun, (3)India Meteorological Department, Pune, (4) Survey of India, Dehradun, (5) Naval Hydrographic Office, Dehradun (6) National Institute of Oceanography, Goa, (7) Fishery Survey of India, Mumbai, (8) Central Marine Fisheries Research Institute, Kochi, (9) Central Drug Research Institute, Lucknow, (10) Central Salt and Marine Chemicals Research Institute, Bhavnagar, (11) Orissa Remote Sensing Applications Centre, Bhubaneswar, (12) Institute for Ocean Management, Chennai, (13) Regional Centre, National Institute of Oceanography, Mumbai and (14) National Remote Sensing Agency, Hyderabad.

A comprehesive assessment of the marine Data Centres is underway addressing(a) the need for marine / oceanic data and metadata of seas around India to be preserved at INCOIS (b) an appraisal of marine / oceanic data generated through various DOD programmes as well as programmes of other Agencies/ Departments (c) inventory of marine/oceanic data available with INCOIS and the existing institutional arrangements for exchange of data or meta-data with INCOIS, and (d) the marine / oceanic component of the National Spatial Data Infrastructure being evolved in the country and then suggest a framework for the future of the Marine Data Centre Network of INCOIS.

4.2. Web-based Services

INCOIS has started providing ocean information and advisory services through Website & Ocean Portal during the period especially in the areas of (i) Potential Fishing Zone Mission, (ii) Indian Ocean Argo Programme, (iii) Experimental Ocean State Forecast, (iv) IOGOOS besides facilitating users with Information Bank, Information on various projects and programme, Ocean Tutor, etc. INCOIS has made significant progress during the period of report in development and implementing the Web Based Services and made it operational for the benefit of user community.

The development of Website & Ocean Portal was initiated in February 2002 in a phased manner with M/s Tata Consultancy Services (TCS) as partner. The first phase involves a static site giving insight into the various activities planned for the Ocean Community. The next two phases involves a dynamic site with Web Geographical Information System (GIS) interface, Data Warehousing and Data Mining facility.

Some of the highlights and achievements of INCOIS Website & Ocean Portal development during the period include (i) Provision of both Static and Dynamic pages which gives insight in to various activities of INCOIS, (ii) Web GIS facility for Potential Fishing Zone Forecast, Experimental Ocean State Forecast and Indian Argo Programme, (iii) Multilingual facility in ten languages including English & Hindi, (iv) Data Warehousing & Data Mining facility which provides users with Graphic User Interface (GUI) for selecting, querying, analysing and downloading data of interest, etc. This was well received and appreciated by the user community. Periodical updates of website is being carried out both in terms of information and facilities, based on feed back from the user community.

5. INCOIS in the International Scene

5.1. Intergovernmental Oceanographic Commission (IOC)

India is the founder member of IOC and also a Member of the Executive Council. During the year, Director, INCOIS in the capacity of the Vice-Chairman of IOC participated in Officers meeting, 35th Session of Executive Council and 2nd Session of the IOCs Oceanographic Data Exchange Policy meetings at Paris, France during June 1-18, 2002. India as one of the Vice-chairmen of the IOC, organised the IOC Officers meeting at New Delhi during January 17-19, 2003. INCOIS coordinated the meeting.

5.2. Global Ocean Observing System (GOOS)

Intergovernmental Committee on GOOS: GOOS is an internationally organised system for the gathering, coordination, quality control and distribution of many types of marine and oceanographic data and derived products of common worldwide importance and utility, as defined by the requirements of the broadest possible spectrum of user groups. Director, INCOIS is the Member of the Intergovernmental Committee on GOOS (I-GOOS).

Expert Committee for review of GOOS

To maintain the focus, efficiency and effectiveness of GOOS in changing time and circumstances, the Intergovernmental Oceanographic Commission (IOC) constituted a Panel of 4 Experts to review the organizational structure of GOOS. Director, INCOIS as a one of the Experts of the Review Panel attended the first meeting of the Review Panel of GOOS during September 9-11, 2002 at Paris, France.

5.3. Regional Alliance in Indian Ocean for GOOS (IOGOOS)

It is recognised that one of the most important means of implementation of GOOS is through the development of regional alliances which are able to focus on issues of common national or regional interest.

India led the process of establishing such a regional alliance (IOGOOS) for the Indian Ocean. This is a major milestone towards understanding the oceanic processes of the Indian Ocean and their application for the benefit of all people in the region.

IOGOOS was formally established on November 05, 2002 during the Indian Ocean Conference at Mauritius. Nineteen organizations of 10 Indian Ocean countries signed a Memorandum of Understanding to create and actively participate in a Regional Alliance for IOGOOS. This Memorandum of Understanding is one of the strongest instruments of cooperation and collaboration in the context of the oceanographic development of the region.

Members of IOGOOS during the first conference of IOGOOS at Mauritius

Member-Organizations of IOGOOS

(i) Australian Bureau of Meteorology, Australia
(ii) CSIRO-Marine Research, Australia
(iii) Curtin University, Australia
(iv) Indian National Centre for Ocean Information Services, India
(v) National Institute of Oceanography, India
(vi) National Institute of Ocean Technology, India
(vii) Iranian National Centre for Oceanography, Islamic Republic of Iran

(viii) Kenya Marine and Fisheries Research Institute, Kenya

(ix) University of La Reunion, La Reunion

(x) Institut Halieutique & des Sciences Marine, University of Toliara, Madagascar

(xi) Mauritius Oceanography Institute, Republic of Mauritius

(xii) Instituto Nacional de Hidrografia e Navegacao (INAHINA), Mozambique

(xiii) Interim National Committee for IOGOOS, South Africa

(xiv) Institute for Aquatic Biodiversity, South Africa

(xv) University of Port Elizabeth, South Africa

(xvi) University of Natal, South Africa

(xvii) National Aquatic Resources Research and Development Agency, Sri Lanka

Associate Member-Organizations of IOGOOS

(i) IOC Perth Regional Programme Office, Australia

(ii) NOAA, Office of Global Programmes, USA

A few more Organizations (from Bangladesh, India and Seychelles) as well as SACEP are expected to become Members shortly.

Active Interactions are underway with Organizations from Comoros, Malaysia, Indonesia, Pakistan, Tanzania, Thailand, Myanmar, Maldives, Qatar, Oman and Yemen. Contacts in Singapore and Somalia are yet to be established.

First Annual Meeting of IOGOOS: The First Annual Meeting of IOGOOS was held on November 08, 2002 at Mauritius, during the Indian Ocean Conference.

IOGOOS Executives: For the first term of two years, the following were elected unanimously:

Dr.K.Radhakrishnan (India), Chairman

Dr. Neville Smith (Australia), Officer

Dr. Johnson Kazungu (Kenya), Officer

Mr. Harry Ganoo (Mauritius) Officer

Prof. A. T. Forbes (South Africa) for Southern Africa, Officer

IOGOOS Secretariat : INCOIS was chosen to host the Secretariat of IOGOOS for a period of six years. Shri. T. Srinivasa Kumar, Scientist, INCOIS was chosen as the Secretary for the IOGOOS. A full-fledged Secretariat for IOGOOS was established at INCOIS with associated facilities such as Computers, Peripherals, Telephone, Fax and Internet. IOGOOS web site has been set up and hosted at the INCOIS Web server.

IOGOOS Cruise : INCOIS coordinated an International Research Cruise on board ORV Sagar Kanya from Chennai to Mauritius via Seychelles and Mauritius to Chennai during October 17 – November 29, 2002 in conjunction with the Indian Ocean Conference at Mauritius during November 4-9, 2002.

Thirty Scientists from six countries (Kenya, Mauritius, Sri Lanka, South Africa and India) participated in the Research Cruise. Multi disciplinary observations related to marine physics, marine chemistry, marine biology, marine geology, marine geophysics and marine meteorology were carried out during the cruise. Argo floats, drifting buoys and XBTs were also deployed

during the Cruise. Training programmes were conducted during the cruise period and open house demonstrations were organised at Seychelles and Mauritius during the port calls.

Participants of IOGOOS Cruise on board ORV Sagar Kanya

Ongoing Activities and Projects of IOGOOS

- Participation in the GOOS Regional Alliances Networking Development (GRAND) Project that would facilitate knowledge networking among all regional GOOS alliances and also benefit from the advances made by EuroGOOS and MedGOOS over the last decade.
- Formulation of Project proposal on Marine Impacts on Low lands Agriculture and Coastal Resources (MILAC) jointly with the meteorological community to contribute to Natural Disaster Reduction (NDR) in coastal lowland impacted by Tropical Cyclones.
- Formulation of a Pilot project on the Monitoring and Management Systems for the Shallow Water Penaeid Prawns for the Indian Ocean region.
- Setting up of a joint CLIVAR/IOC-GOOS Indian Ocean Panel on Climate that would coordinate and plan a unified approach to all the basin-scale observations in the Indian Ocean for both research and operational oceanography.
- Preparations for IOGOOS Workshop on “Capacity Building and Strategy for Data and Information Management” for Indian Ocean Region to be held during December 8-10, 2003 at Colombo, Sri Lanka. Participants from 25 Countries are expected. The results of this workshop will be a major input for the Ocean Data and Information Networking (ODIN) Project that is being formulated the Indian Ocean region.
- Co-sponsoring International Workshop on “Role of Indian Ocean on Climate variability over India”, to be held at Pune during February 23-27, 2004.
- Preparations for IOGOOS Workshop on “Marine Biodiversity” to be held in Goa, India during December 2003 to evolve a strategy and action plan for long-term sustained monitoring of coastal and ocean biodiversity in the region.
- Formulation of a Strategy for Capacity Building in the Region on Remote sensing applications for Oceanographic and coastal studies.

- Planning for the Second Annual Meeting of IOGOOS and Workshop to be held at Mombassa, Kenya during January 28-30, 2004

5.4. International Argo Project

International planning for Argo programme is coordinated by the International Argo Science Team (IAST). Director, INCOIS is the Member of IAST and also the Regional Coordinator for the International Argo Programme in Indian Ocean. INCOIS has been identified as the Regional Argo Data Centre. Dr. M. Ravichandran, Scientist, INCOIS participated in the Second Argo Data Management Meeting (a sub committee of IAST) at Ottawa, Canada during September 17-20, 2002.

6. Infrastructure Development

The computational facilities consists of high-end Unix Servers / Workstations, Windows 2000 Servers / Workstations, Enterprise Storage Server, high end desktop systems, various peripherals, etc continues to provide its services round the clock. All the systems have been maintained in good working conditions with 97% uptime. Back-ups are being obtained as scheduled.

ISDN facility with 256 Kbps connectivity has been established between NRSA and INCOIS for satellite data transfer for PFZ Mission. This was successfully implemented and used for obtaining satellite data during the period. This has resulted in providing timely PFZ Advisories to fishing community well in time.

Development of permanent campus for INCOIS is in progress at Gajularamaram, Quthubullapur Mandal, Ranga Reddy District, Hyderabad. CED/DOS was entrusted the work of Construction of Buildings and infrastructure for INCOIS at its campus. INCOIS entered into an Agreement with the Consultant Architect M/s. Chakrapani and Sons. Construction of Building Phase-I is progressing well as the completion is slated for April 2004.

7. Ocean Awareness Programmes and User Promotion

Awareness Programmes

- Produced a video programme on PFZ in English and telecasted in Turning Point on DD Metro on June 01, 2002.
- A Documentary on “Role of Ocean in human life and its importance for the future of humanity” was telecasted on Doordarshan (DD-1) on November 24, 2002 between 0730pm, and 0800 pm
- A Documentary on “How ocean development is impacting Society and Fishries” made for INCOIS, was telecasted on Doordarshan (DD-1) between 07:30 pm and 8 pm on Sunday, March 09, 2003.
- A Documentary on “A corporate film on INCOIS” made for INCOIS, was telecasted on Doordarshan (DD-1) between 07:30 pm and 8 pm on Sunday, March 16, 2003.

User-interaction Workshops

User interaction workshops on Dissemination and Utilization of Potential Fishing Zone Information were conducted at (i) Central Institute of Fisheries Education (CIFE), Mumbai, (ii) State Fishery Department, Chennai, TN and (iii) State Institute of Fisheries Technology, Kakinada, AP and (iv) Ratnagiri, Maharashtra.


PFZ User Interaction Workshop at Ratnagiri, Maharastra

8. General Information

8.1. Governing Council Meeting

The 5th and 6th meetings of Finance Committee were held on July30, 2002 and February 19, 2003 respectively.

The 7th and 8th meetings of the INCOIS Governing Council were held on July 30, 2002 and February 24, 2003 respectively.

8.2. Distinguished Visitors

Prof. U.R. Rao, Chairman, Prasara Bharathi visited INCOIS on June 26, 2002.

Prof. U. R. Rao at INCOIS

Dr. K. Kasturirangan at INCOIS

Dr. K. Kasturirangan, Chairman, Space Commission and Secretary, Department of Space visited INCOIS on December 3, 2002.

8.3. Publications

Calibration of finite element surge prediction model for the east coast of India, G. Latha, E.P. Rama Rao and R. Mahadevan, Indian Journal of Marine Science, Vol. 31(4), December 2002, pp. 265-270.

Role of Meso scale eddies in the primary productivity of the Northern Arabian Sea. K. Somasundar and A. Trivikram Prasad, ISPRS & SIS, Vol. 34, Part 7, Hyderabad, India, 2002.

8.4. Deputations Abroad

Official	Meeting / Conference	Period
Dr. K. Radhakrishnan, Director, INCOIS	Meeting of Officers of IOC andthe 35th Session of the Executive Council of IOC at Paris (as Vice-Chairperson of IOC)	Jun 1-2, 2002 Jun 4-14, 2002
	First Session of the GOOS Review Group at IOC, Paris (asa Member)	Sep 9-11, 2002
	First conference of Indian Ocean Global Ocean Observing System(IOGOOS) at Mauritius (asChairman, IOGOOS Development Committee)	Nov 4-9, 2002
	Fifth meeting of International ArgoScience Team (IAST-5) and ArgoExecutive at Hang Zhou, China(as a Member)	Mar 4-6, 2003
Dr. M. Ravichandran, Scientist	Second Argo Data Managementmeeting at Ottawa, Canada	Sep 17-20, 2002
	IOGOOS Cruise and Indian Ocean Conference at Mauritius	Oct 17 – Nov 10, 2002
Shri. T. Srinivasa Kumar, Scientist	IOGOOS Cruise and Indian Ocean Conference at Mauritius	Oct 17 – Nov 10, 2002
Shri. M. Nagaraja Kumar, Scientific Assistant	IOGOOS Cruise and Indian Ocean Conference at Mauritius	Oct 17 – Nov 29, 2002

8.5. Participation in National Conference / Symposia

Official	Conference	Paper Presented
Shri. T.V.S. Uday Bhaskar, Scientist	National Hindi Seminar on "Ocean Energy and TechnologyDevelopment" at DOD, NewDelhi on November 15, 2002	Argo-State-of-the-artTechnology formeasuring upper ocean
Dr. T.M. Balakrishnan Nair, Scientist	International Workshop onBiogeochemical processes inthe Northern Indian Ocean, at NIO Goa on 24-25 February 2003	Settling Barium fluxesin the Arabian Sea: Critical Evaluation of Relationship withExport production
Dr. Sudheer Joseph, Scientist	National Seminar on Remote Sensing and GeographicalInformation System in NaturalResource Management – CurrentStatus and Emerging Trends at Mahatma Gandhi University, Kottayam during March 15-17,2003	Development andUtilization of Remote Sensing, GIS andGPS tools in Ocean Information Sciences by K. Radhakrishnanand Sudheer Joseph

8.6. Training

Official	Training Programme	Organised by
Dr. M. Ravichandran, Scientist and Shri. T. Srinivasa Kumar, Scientist	Determination of Chlorophyll inseawater during Sep 26-27,2002.	Centre for Marine Analytical Referenceand Standards (CMARS), RegionalResearch Laboratory, Thiruvananthapuram
Shri. B.V. Satyanarayana,Scientist	Purchase Policy & Proceduresin Government Departments,Central Autonomous Bodies & PSUs during Jan 23-25 2003.	Centre for Training &Social Research, Finance ManagementDivision, New Delhi.
Shri. K.K.V. Chary, Administrative Officer	Financial Management inGovernment Departments,Central Autonomous Bodies and PSUs during July 10-12,2002	Centre for Training &Social Research, Finance ManagementDivision, New Delhi.
Shri. T. Srinivasa Kumar, Scientist and Ms. Manjula S.K,Scientist	Arc-IMS and Arc-SDE	NIIT-ESRI, Hyderabad.

The following training programmes were organised for INCOIS Scientists at its premises:

- One week training programme on Marine Fisheries
- Three weeks training programme on ArcInfo –GIS
- Two weeks training programme on ERDAS – Imagine, Image Analysis
- One week training programme on ENVI

8.7. Conference/ Seminar held at INCOIS

National Systems Conference 2002

INCOIS jointly with Systems Society of India (SSI) hosted the 26th National Systems Conference 2002 during November 18-19, 2002.

The main theme for the conference was “Ocean Observing Systems and Services” and the conference addressed many significant issues pertaining to the satellite based and in-situ Ocean Observing Systems for understanding the structure and dynamics of the ocean and its impact on humanity.

National Systems Conference 2002

About 100 delegates from all over the country participated in the conference and 45 technical papers were presented in the areas of Ocean Observing Systems and Services, Control Systems and Systems Theory, Power Electronics Systems, Modelling, Simulation of Systems, Computer and Communication Systems, Aerospace Systems, Cognitive Systems and Artificial Intelligence and Socio Economic and Management Systems.

APGEOS-2003

INCOIS jointly with Andhra Pradesh Geographical Society (APGEOS) hosted a national workshop on "Modern Techniques for Digital Geography Land, Coast and Ocean" during February 22-23, 2003.

The conference was targeted at Senior High School and College Students, Teachers, Researchers, Professionals and NGOs and all those concerned with Geography, Natural Resources Management, Ocean Observing System and Information technology.

The workshop covered the themes pertaining to (a) Ocean Resources and Management (b) Coastal Zone Management and Tourism (c) Geography in Development and Planning (d) Geography and convergence of Modern Technologies (e) Water and Land Resource Management (f) Remote Sensing, GIS and GPS (g) Cartography, Mapping and Modelling (h) Geography, Education, (i) Monitoring and Management of Disasters and (j) Utility Infrastructure.

(a) Inagural Function of APGEOS - 2003 (b) School Students participating in Quiz programme conducted during the workshop

National Technology Day

Dr. R. Krishnan, Director, ADRIN delivered a lecture on "New straits in Imaging Processing" during National Technology Day celebrations at INCOIS on May 14, 2002

Guest Lecture

Shri G. Viswanathan, Director, Radar Development Cell (RDC) delivered a lecture on 'Doppler Weather Radar for Remote Sensing' at INCOIS on March 25, 2003

8.8. Membership in Governing Bodies / National Committees

Dr. K. Radhakrishnan

International

- Vice-Chairman, Intergovernmental Oceanographic Commission (IOC)
- Chairman, Global Ocean Observing System for Indian Ocean - (IOGOOS)
- Member, International Argo Science Team and Argo Executive
- Member, Intergovernmental Committee on GOOS

- Member, GOOS Review Panel constituted by IOC

National

- Member, NNRMS Standing Committee on Ocean Resources
- Member, NNRMS Standing Committee on Meteorology
- Member-Convenor, SATCORE/INDOMOD Steering Committee
- Member-Secretary, INCOIS Governing Council
- Member, Governing Body of Kerala Forest Research Institute

8.9. Other information

Promotion of Official Language.

- INCOIS participated in the tenth National Scientific Seminar in Hindi on "Ocean Energy and Technology Development" at DOD, Delhi on November15, 2002.
- Video programmes were produced in Hindi on (i) Role of Ocean in human life and its importance for the future of humanity (ii) How ocean development is impacting Society and Fisheries and (iii) A corporate film on INCOIS, and telecasted on Doordarshan (DD-1) November 24, 2002, March 09, 2003 and March 16, 2003 between 0730pm, and 0800 pm respectively.

9. Finance

The Report of the Auditors and Audited Accounts of INCOIS for the year 2002-03 are placed as Appendix-1 to this Report.

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