First ODINCINDIO Training Course in Ocean Data Management

Supported by the IOC and the Government of Flanders

Ostend, Belgium
October 10-21, 2005
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1. INTRODUCTION AND BACKGROUND

Recognizing that the lives of at least 1.5 Billion people are profoundly influenced by the Indian Ocean and considering that many Indian Ocean rim countries depend to a large extent on marine and coastal resources, the ability to acquire, manage, archive and disseminate data, as well as the capacity to generate information in support of decision making and management of the oceans and coastal zones is of vital importance. The Ocean Data and Information Network for the Central Indian Ocean Region (ODINCINDIO) Project responds to these needs through:

- Providing assistance in the development and operation of National Oceanographic Data Centres and the establishment of their networking in the IOCINDIO region;
- Providing training opportunities in marine data and information management applying standard formats and methodologies as defined by the IODE;
- Assisting in the development and maintenance of national, regional and Indian Ocean marine metadata and data holding databases;
- Assisting in the development of marine data and information products responding to the needs of a wide variety of user groups;
- Assisting in the development of linkages with other international projects with similar objectives (e.g. IOGOOS, ODINAFRICA, etc).

In addition ODINCINDIO will satisfy the requirements of other IOC programs (e.g. IOGOOS) in furthering the management and exchange of oceanographic data and information. Towards these ends, the following specific objectives have been developed for ODINCINDIO:

- OBJECTIVE 1: Providing assistance in the development and operation of National Oceanographic Data (and Information) Centres and establish their networking in the Central Indian Ocean Region;
- OBJECTIVE 2: providing training opportunities in marine data and information management, applying standard formats and methodologies as defined by the IODE;
- OBJECTIVE 3: Assist in the development and maintenance of national, regional and Indian Ocean marine metadata, information and data holding databases;
- OBJECTIVE 4: Assist in the development and dissemination of marine and coastal data and information products responding to the needs of a wide variety of user groups using national and regional networks.

The marine data management training curriculum developed by the IOC’s International
Oceanographic Data and Information Exchange Program (IODE) is based on an extensive collation of international public documents on marine data, formats, software, program and data management procedures, manuals, protocols, and associated tutorials. The main resource, entitled OceanTeacher, is a 1.7 gigabyte Digital Library of primary documents -- accompanied by various thematic Course Manuals -- that has been under development by the IOC training staff since 1997 (see outlines in Annexe III). OceanTeacher is the principal training resource used during data management courses, currently available on the World Wide Web and soon to be published on DVD (digital versatile disk).

2. VENUE
   The workshop was held at the IOC Project Office for IODE in Ostend, Belgium (http://www.iode.org/projectoffice/), from October 10-21, 2005. Locally, the meeting was hosted by Dr. Vladymyrov, with assistance from the Flanders Marine Institute (VLIZ; http://www.vliz.be/) and financial support from the Government of Flanders.

3. PARTICIPANTS
   Participants included seven countries in the newly established ODINCINDIO group of States: Bangladesh, Indonesia, Kuwait, Iran, Malaysia, Pakistan and Thailand. The students were selected on the basis of submitted resumes, with a particular view toward identifying young scientists responsible for data collections at the national level. Lectures were provided by invited data managers from Australia and the United States of America. The list of participants and lecturers is provided as Annex II.

4. COURSE PROGRAMME
   4.1 LECTURES AND PRACTICALS
      4.1.1 Workshop Objectives

      The IOC/IODE Marine Data Management training curriculum has been designed to provide participants with knowledge and skills in the following areas:

      • The importance of marine data in general, and particularly within participants’ national and regional environments
      • How to set up an oceanographic data center within the IODE System
      • The infrastructure requirements, including hardware and software tools
      • How to manipulate and analyze the principal types and formats of marine data
      • How to produce ocean data products and to disseminate these products, both over the Internet and by traditional methods
This first workshop in the new cycle of ODINCINDIO training had been designed to cover materials formerly covered in two sequential years of work in previous cycles. It included all of the more complex topics – especially in the area of data and data-product synthesis. Particular emphasis is now placed on obtaining data directly from Internet website sources, rather than the previous heavy reliance on specially prepared CD-ROMs.

4.1.2 Workshop Technical Outline

The following is the outline of the relevant Course Manuals prepared and selected for use in this workshop. [ID = Interdisciplinary; DM = Data Management] All of the following topics were covered in lectures and practicals, using basic reference materials contained in the IODE OceanTeacher Digital Library (outlined in Annex III).

ID 103: Information, Data and Metadata

| GOAL | To introduce students to fundamental "bridging" concepts and current activities between oceanographic information management and data management |
| CONTENTS | Information Availability & Access |
| | Data Availability & Access |
| | Metadata |
| | Information Centers |
| | Data Centers |
| | World Data Center System |
| | IODE Data Center System |
| | DNAs, NODCs and RNODCs |
| | Other Ocean Data Centers |
| | Information Catalogs |
| | Data Catalogs |
| OPTION: MEDI Cataloging |
| Prerequisite: DM 101 or equivalent experience |
| Information & Communication Programs & Organizations |

ID 104: Introduction to Oceanography

| GOAL | To provide students with an overview of the ocean sciences today |
### DM 102: Ocean Data Collection Management

#### GOALS
To show students how to create a National Data Collection, using the World Ocean Database 2001, other published or unpublished data sources, and near real-time operational data

To demonstrate some basic data analysis functions in popular ocean software programs

#### CONTENTS
Area of Interest
Creation of Data Collections
Basic Data Analysis
Collection Housekeeping
Exporting ODV Products
Adding Other Data
Special Purpose Collections
Methods for Operational Data

### DM 103 Ocean Data Products & Synthesis

#### GOALS
To demonstrate a broad suite of basic analysis methods for ocean data (including remote sensing data) using popular software systems

To demonstrate basic methods for combining data products in Geographic Information Systems (GIS)

#### CONTENTS
Gridding & Contouring with Surfer
Surfer Vector Charts
Managing HDF Files
Bathymetry and Topography Products
Managing Image Files
Synthesis in GIS

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<thead>
<tr>
<th>CONTENTS</th>
<th>Background</th>
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<tr>
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<td>Research Oceanography</td>
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<td>Survey Oceanography</td>
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<td>Operational Oceanography</td>
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<td>Geopolitics of Oceanography</td>
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<td>Programs &amp; Organizations</td>
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</tbody>
</table>
4.1.3 Special Materials

The workshop attendees were provided with the following special training materials, provided by the indicated sources:


4.1.4 Invited Presentations

n.a.

4.2 EVALUATION & TESTING

n.a.

5. RESULTS AND RECOMMENDATIONS

The workshop schedule was successfully accomplished. This current group of students is among the most accomplished, in terms of individual skill levels, that the IODE instructors have encountered. They are fully informed in areas of ocean data technology, such that the workshop accomplished all of the scheduled lessons a bit ahead of time. A final half-day session was devoted to online downloading of valuable datasets and software programs for use in the student’s home bases. As with previous workshop cycles, students will be presented with sequential projects to complete over the next year, and these will be publicized by a special website. IODE and ODINCINDIO national coordinators will be kept informed of individual progress.
### ANNEX I – Lesson Schedule

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<tr>
<th>Course</th>
<th>Lesson Title</th>
<th>Lecturer(s)</th>
<th>Duration (hrs)</th>
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<td>2. Computer Hardware</td>
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<td>3. Operating System</td>
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<td>4. Software: Introduction</td>
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<td>5. Software: Editors</td>
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<td>6. Software: Browsers</td>
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<td>7. Software: Spreadsheets</td>
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<td>8. Software: Databases</td>
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<td>9. Software: Compression</td>
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<td>11. Computer Maintenance</td>
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<td>12. Computer Media</td>
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<td>1.C. Internet Service Providers</td>
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ANNEX II – List of Participants

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## ANNEX III - IODE OceanTeacher Digital Library Table of Contents

1. **Global Oceanography Today**
   1. Sciences of Oceanography
      1. Biological Oceanography
      2. Chemical Oceanography
      3. Geological Oceanography
      4. Physical Oceanography
      5. Remote Sensing
      6. Ancillary & Applied Sciences
      7. Oceanography Glossary

2. **Collecting Data**
   1. Introduction to Ocean Datasets
   2. Oceanography Data Fundamentals
      1. Oceanographic Parameters
      2. Oceanographic Measurement Units
      3. Temperature and Salinity Scales
   3. Ocean Measurement Technology
      1. Sampling Devices
         1. Tools of Oceanography
         2. Biology
         3. Chemistry
         4. Geology
      2. Platforms
         1. Vessels
            1. Boats & Ships
            2. Submersibles
         2. Fixed Platforms
            1. Piers
            2. Moored Buoys
            3. Offshore Structures
         3. Drifting Buoys & Floats
         4. Autonomous Underwater Vehicles
         5. Benthic Observatory Nodes
         6. Animals
      3. Instruments & Sensors
         1. Biology
2. Chemistry
3. Geology
4. Physics

4. Instrument Data Processes
   1. Within Instruments
   2. On Vessels
   3. Post-Processing
      1. Seabird Training Class Handouts

4. Remote Sensing Technology
   1. Parameters & Sensors
   2. Sensors & Missions
   3. Missions & Data

5. Manuals & Guides

3. Geopolitics of Oceanography

4. Research Oceanography
   1. General & Introductory
   2. Biological Oceanography
   3. Chemical Oceanography
   4. Geological Oceanography
   5. Physical Oceanography
   6. Remote Sensing

5. Survey Oceanography
   1. Resource Surveys
   2. Long Time-Series

6. Operational Oceanography
   1. Overview
   2. Economics of Ocean Observations
   3. Data & Information Infrastructure
   4. Global Ocean Observing System
      1. Local Systems
         1. Rutgers
         2. Oregon
         3. ICON
         4. NYHOPS
         5. PORTS
         6. REINAS
         7. SDCOOS
8. SCMI

2. Medium-Scale Systems
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   2. BOOS
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   5. GoMOOS
   6. GOOS-Africa
   7. IOCARIBE-GOOS
   8. IOGOOS
   9. IOOS
   10. MedGOOS
   11. NEAR-GOOS
   12. NOOS
   13. PI-GOOS
   14. SEACAMP
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4. Global Systems
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   6. OceanSITES
   7. SOOP
   8. Tropical Moored Buoys
9. TSUNAMI
10. VOS
11. WWW

5. Future Technological Needs

7. International Programs, Agencies & Organizations

1. CEOS
2. CLIVAR
3. DBCP
4. DIVERSITAS
5. FAO Fisheries
6. GAIM
7. GCOS
8. GEWEX
9. GLOBEC
10. GODAE
11. GODAR
12. GOSIC
13. GTOS
14. IAPSO
15. ICES
16. ICSU
17. IGBP
18. IGOS
19. IHDP
20. IHO
21. IMBER
22. IOC
23. IOCCG
24. IODP
25. IPCC
26. IUGG
27. JCOMM
28. JGOFS
29. LOICZ
30. OOPC
31. PAGES
32. PICES
33. POGO
34. SCOR
35. SOLAS
36. START
37. UNEP
38. WCRP
39. WMO
40. WOCE

41. Societies & Associations

2. Information Technology & Scientific Communication
   1. Computer Technology
      1. Computer Systems
         1. Storage Media
         2. Hardware
         3. Operating Systems
            1. Windows
            2. UNIX
         4. An Educator's Guide to School Networks
         5. Maintenance
         6. Viruses
      2. Databases & Database Management Systems
         1. MS Access
         2. Other Systems
      3. GIS
         1. UNESCO GIS Modules
         2. Marine GIS
         3. GSDI
      4. General Applications Software
         1. Excel
         2. ASCII Editors
      5. Oceanographic Software
         1. IOC Software Toolbox
            1. Adobe Reader
            2. ArcExplorer
            3. Apache Tomcat
            4. Argo Data Explorer
            5. CuteFTP
6. Data Thief
7. DXF2XYZ
8. GeoTIFF Examiner
9. GRADS
10. HDF Browser
11. HDFView
12. IrfanView
13. Java/JRE
14. Java OceanAtlas
15. MEDI
16. ncBrowse
17. Ocean Data View
18. Ocean Sneaker Tool
19. Oceanic Calculator
20. OPeNDAP Collector
21. PFE
22. SpreadsheetApps
23. Surfer
24. USGS VPV
25. WinZip

2. IOC Software Catalog
3. Format Conversion Software

6. The Internet
   1. World Wide Web
   2. Internet Service Providers
   3. Electronic Mail
   4. Websites

7. Other Telecommunications

8. Markup Languages
   1. HTML
   2. XML

9. Client-Server Concepts
10. Electronic Navigation Systems

2. Metadata
   1. Formal Descriptions of Resources
   2. Classifications, Taxonomies, Ontologies
   3. Thesaurus Systems
4. Discovery & Descriptive Metadata
5. Metadata Standards & Formats
6. Crosswalks

3. Information Seeking in Electronic Environments
   1. Searching Information
   2. Text Retrieval
   3. Saving Information

4. Document Production
   1. Internal Reports
   2. Production
   3. Distribution & Sales
   4. Document Imaging
   5. Full Text
   6. Graphics & Images
   7. Animation & Video
   8. Charts & Graphs
   9. Scientist Support
   10. Copyright
   11. Bibliographic Citation Standards
   12. Publishers’ Requirements

5. Information & Technology Programs & Organizations
   1. BIOCASE
   2. CENDI
   3. CODATA
   4. DGIR
   5. DMAC
   6. ESIP
   7. GSDI
   8. ICSTI
   9. IEEE
   10. IETF
   11. ISO
   12. MarineXML
   13. MMI
   14. OAI
   15. OCLC
   16. OIT
17. OPeNDAP
18. OpenGIS
19. OpenIOOS
20. THREDDS
21. UNICODE
22. W3C
23. Societies & Associations

3. Information Management Principles - Under construction
4. Ocean Information Management - Under construction
5. Data Management Principles
   1. Data Formats
      1. ASCII
      2. Binary
      3. Format Types
         1. Document
         2. Geo-Referenced Image
         3. Gridded
         4. Hard Copy
         5. Header
         6. Mapping-List
         7. Mapping-XY
         8. Mapping-GIS
         9. Message
        10. Relational Database
        11. Self-Describing (SDS)
        12. Simple Image
        13. Spreadsheet
        14. Stratified
   4. Complexity Progression
      2. Scientific Metadata & Systems
      3. Quality Control Strategies
      4. Data Availability & Access
      5. Physical Storage & Safekeeping
      6. Data Searching Strategies
6. Oceanographic Data Management Processes
   1. Data Operations
      1. Planning Documents
2. Data Management Policies & Guidelines
3. Oceanographic Metadata
4. Taxonomic Complexities of Biological Data
   1. Taxonomy
   2. Data Systems
5. Quality Control
   1. Programmatic Aspects
   2. Technical Aspects
      1. Standards & Comparisons
      2. Research & Survey Data
      3. Operational Oceanography Data
      4. Remote Sensing Data
      5. Meteorological Data
6. Oceanographic Formats
   1. Marine Data Format Fundamentals
      1. Codes
      2. Geography
         1. Geographic Location
         2. Geographic Direction
         3. Ocean Squares & Mapsheets
         4. Charting
      3. Dates & Time
   2. Integration Among Major Formats
      1. BLN
      2. BMP
      3. DXF
      4. GeoTIF
      5. GIF
      6. HDF
      7. JOS
      8. JPG
      9. NetCDF
     10. SHP
     11. TSV-O
     12. WOD01
     13. XYZ
   3. Format Integration Schematics
4. Format Conversion

2. Data Centers & Systems
   1. Ocean Data Centers
      1. Intergovernmental Centers
         1. IODE Data Center System
         1. NODCs and DNAs
            1. Establishing an NODC
            2. NODC Business Functions
         2. RNODCs
         3. NODC Websites
            2. Hydrographic Service (ICES)
            3. Data Standardization
      2. Research Project Centers
      3. Topical & Operational Data Activities
         2. World Data Center System
      3. Other Centers & Systems
   3. Data Catalogs & Gateways
      1. MetOcean Data
         1. CSR
         2. MEDI
         3. EDMED
         4. GCMD
      2. Remote Sensing Data
      3. Ancillary & Applied Data
   4. Virtual Centers & Distributed System
      5. Data Analyses & Products
         1. Working with Biological Data
         2. Working with Chemical Data
         3. Working with Geological Data
         4. Working with Physical Data
         5. Working with Remote Sensing Data
         6. Working with Meteorological Data
         7. Working with Ancillary & GIS Data
            1. Preparing Atlases
         8. Catalog of Selected Data Analyses & Products
   6. Earth System Modeling
      1. Modeling the Ocean
2. Modeling Ecosystem Processes
   1. Hydrochemical Processes
   2. Biological Processes
   3. Sedimentation & Erosion
   4. Fates & Effects Modeling

3. Operational Modeling
   1. FOAM
   2. HYCOM
   3. MERCATOR
   4. MFSTEP
   5. NCEP
   6. NLOM
   7. TOPAZ
   8. UK Shelf Seas
   9. UK Wave

4. Climate Modeling

7. Operational GIS

7. Examples

8. Exercises
   1. Information Technology Exercises
   2. Information Exercises
   3. Data Management Exercises
      1. Instructor Whiteboards
         1. Africa Whiteboard
         2. South America Whiteboard
      2. Hand Contouring
      3. Data Roadmaps
      4. Data Processing with Excel
      5. Processing Seabird CTD Data with Seabird Software
## ANNEX IV – Acronym list

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>AOI</td>
<td>Area of Interest</td>
</tr>
<tr>
<td>DM</td>
<td>Data Management</td>
</tr>
<tr>
<td>DVD</td>
<td>Digital versatile disk</td>
</tr>
<tr>
<td>GEBCO</td>
<td>General Bathymetric Chart of the Oceans</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Systems</td>
</tr>
<tr>
<td>HDF</td>
<td>Hierarchical Data Format</td>
</tr>
<tr>
<td>ID</td>
<td>Interdisciplinary</td>
</tr>
<tr>
<td>IOC</td>
<td>Intergovernmental Oceanographic Commission (of UNESCO)</td>
</tr>
<tr>
<td>IOCINDIO</td>
<td>IOC Regional Committee for the Central Indian Ocean</td>
</tr>
<tr>
<td>IODE</td>
<td>International Oceanographic Data and Information Exchange Program</td>
</tr>
<tr>
<td>IOGOOS</td>
<td>Indian Ocean Global Ocean Observing System</td>
</tr>
<tr>
<td>JCP</td>
<td>Joint Comprehensive Environmental Action Program for the Baltic Sea</td>
</tr>
<tr>
<td>LME</td>
<td>Large Marine Ecosystem</td>
</tr>
<tr>
<td>ODINCINDIO</td>
<td>Ocean Data and Information Network for the Central Indian Ocean Region</td>
</tr>
<tr>
<td>ODV</td>
<td>Ocean Data View</td>
</tr>
<tr>
<td>WOD</td>
<td>World Ocean Data</td>
</tr>
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