OceanTeacher Academy: a human capacity development framework for IOC/IODE Ocean Data and Information Networks

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The Objective of the OceanTeacher Training Academy is to establish a facility that will provide an annual teaching programme of courses related to oceanographic data and information management and the development of related products and services that will contribute to the sustainable management of oceans and coastal areas in Africa and other regions. The OceanTeacher Training Academy will underpin all Ocean Data and Information Networks developed by IOC/IODE. The OceanTeacher Academy will furthermore promote the development of regional training nodes thereby providing a multiplier effect on the number of trainees as well as a contribution to the long-term sustained impact of the provided capacity building activities of IOC/IODE and other IOC programmes (e.g. GOOS, ICAM, JCOMM (IOC/WMO), Capacity Building,...).

1. Background

1.1 IODE and Capacity Development

One of the major objectives of the IODE Programme is to assist Member States to acquire the necessary capacity to manage marine data and information and become partners in the IODE network. It is only when IOC member states have acquired this expertise at the national level that they can become an active partner in IODE and thus share their data and information with the other members of the "IODE family". The training does not only teach the principles of data and information but also promotes the use of "standards" amongst all IODE centres and thus achieve interoperability between these centres.

Capacity building has been a cornerstone of the IODE (International Oceanographic Data and Information Exchange) Programme of the Intergovernmental Oceanographic Commission of UNESCO (IOC) since the programme’s inception in 1961. Between 1961 and 1997 the IODE capacity building programme was based upon four types of activities: (i) expert missions to Member States to advise on the establishment of national oceanographic data centres; (ii) organization of group training courses; (iii) support for internships in established national oceanographic data centres; and (iv) provision of equipment. This strategy was used for nearly four decades (1961-1997) and resulted in the successful establishment and operation of over 60 national oceanographic data (and information) centres in as many countries around the world. However, the programme had several major flaws: (i) the expert missions identified the capacity building requirements but IOC did not have the necessary financial resources to assist the visited member states in a substantial way; (ii) training courses were not followed up by interaction with the trainees, nor was any support provided (e.g. equipment, feedback) to ensure that the acquired knowledge could be applied. In the case of developing countries, the impact of IODE capacity building efforts was therefore often unsatisfactory and did not have long-term effects. An additional flaw was that no standard training curriculum existed.

Since the late 1990s IODE designed a new way to develop capacity in (developing) member states. This new "strategy" is based upon these four elements:

- providing equipment
- providing training
• providing seed funding for operational activities of newly created data centres and marine libraries
• work in a regional context, addressing common (regional) as well as individual (national) goals

This innovative strategic approach was called the ODIN (Ocean Data and Information Network) strategy and was used as from 1997.

1.2 The Ocean Data and Information Network (ODIN) strategy

This new strategic approach was applied first in Africa within the framework of the Ocean Data and Information Network for East Africa (ODINEA), co-funded by the Government of Flanders between 1997 and 1999 and covering IOC Member States in Eastern Africa. The approach was successful and this led to the development and implementation of the ODINAfrica-II (2000-2003) and ODINAfrica-III (2004-2008) projects that covered 20 (for ODINAfrica-II) or 25 (for ODINAfrica-III) IOC Member States in Africa.

The success of the ODIN approach was such that other regions adopted the same strategy: ODINCARSA for the Caribbean and South America, ODINECET for European Countries in Economic Transition, ODIN-Black for the Black Sea region, ODINCINDIO for countries in the Indian Ocean region, and more recently ODINWESTPAC for Western Pacific countries and ODIN-PIMRIS for small Island Pacific States.

One of the core success elements of the ODIN strategy is the two-tier approach in terms of product and service development: ODIN projects deliver regional products and services (eg regional data bases and info bases) but each partner country also receives support to develop products and services that are specific to national or even local priorities and needs. This approach has led to a wealth of products developed at the national level going from research oriented taxonomic databases to “what do I find on the beach” brochures aimed at primary school children. This approach was found to maximize involvement and buy-in from the partner institutions and partner experts thereby maximizing the potential for long-term sustainability of the established infrastructure and expertise.

1.3 OceanTeacher’s History

As already mentioned under 1.1. IODE training activities used to be organized on a ad hoc basis. Training materials would be developed by lecturers for the purpose of the course, would not be archived and would seldom be re-used within the context of IODE courses. This obvious wasteful use of resources was observed in the early 1990s and led to the development of the OceanPC “software package for oceanographic data processing and exchange on microcomputers” in 1996. Shortly after the ODINEA project started the organization of training courses and it was at this occasion that, for the first time, training materials were collated, organized with an html interface and provided on CD-ROM. This was the birth of the IODE Resource Kit, containing a series of powerpoint presentations, software tools and electronic documents in Microsoft Word and Acrobat PDF format.

The proposal to develop a more formal ‘IODE-wide’ tool was submitted to the IODE Officers during their meeting in Goa, India (February, 1998). The Officers recommended the development of a Pilot Project proposal for an *“IODE Resource Kit*
CD-ROM” for submission to IODE-XVI. The stated objectives of the IODE Resource Kit were:

- to constitute a computer-based tool as a follow-up and complement to IODE Data and Information Management activities;
- to contain a number of modules which address marine data and information management requirements in the marine research process, going from programme design to program report;
- to support the development of marine data and information management capabilities.

In addition, the Officers Meeting (Goa, India, 1998) agreed that the project should:

- review and revise the ODINEA Course-in-a-box CD-ROM’s core document entitled ‘A Toolkit of Data and Information Management Modules for ICAM and Coastal Oceanography Programmes’;
- identify suitable data, metadata and information (including IOC documents) to include in the IODE course-in-a-box CD-ROM;
- identify suitable data formats and format translation utilities to include in the IODE course-in-a-box CD-ROM;
- produce a beta version of the IODE Resource Kit CD-ROM for submission to IODE-XVI.

The purpose of the IODE Resource Kit was to provide an ‘NODC- In-A-Box’ capacity building tool for oceanographic data centres containing data and information management reference material and software tools useful for data centres.

The Kit was subsequently further developed based upon the 1997 ODINEA Kit and the Cape Town courses (ODINEA 1998, ODINEA 1999). The media was CD-ROM and the Kit was browser-driven (the Kit was also made available through the IOC/IODE web site). The Resource Kit was written in HTML, with some documents provided in PDF, Word and Excel spreadsheet formats. Software applications were also included and could be installed and/or launched from the browser. The Kit was developed by a small team composed of Dr. Murray Brown, Mr. Greg Reed and Mr. Peter Pissierssens.

The Resource Kit was modular in design and contains three basic modules, namely:

- IODE Data Centre System,
- Data Management Systems,
- Data Analysis and Products.

A fourth module, Regional Data and Information Custom Pack was produced for specific regions and was prepared for the IOCINCWIO region.

IODE-XVI (Lisbon, Portugal, 31 October – 8 November 2000) congratulated the authors with the completion of the IODE Resource Kit, and identified the product as an impressive and important achievement for IODE. The Committee had further requested the development of marine information management. The Committee adopted Recommendation IODE-XVI/7 through which it established the “IODE Resource Kit Project” and its Resource Kit Steering Group to be responsible for the further development and enhancement of the Resource Kit, in response to user feedback and additional requirements. The Steering group, composed of both data management experts and information management experts, met in Miami, Florida between 19 and 23 March 2001. This led to the development of the Marine Information Management Training Manual and the Data Management Training Manual for Course 1.

In 2001 it was agreed that the name ‘Resource Kit’ no longer appropriately described the content of the system as it now included both a set of software tools, as well as
comprehensive training material. It was therefore decided to rename the system to “OceanTeacher” and a dedicated web site was established: http://www.oceanteacher.org).

The first generation OceanTeacher was an html-based static content system that was developed and maintained using Microsoft’s Frontpage software and hosted on a UNESCO web server in Paris, France. As Frontpage at that time was a tool intended mainly as a single (or at least small number of) editor web site authoring tool editing of the site was done mainly (in fact almost exclusively) by the OceanTeacher Chief Editor (Dr Murray Brown, USA).

From the start OceanTeacher applied an innovative approach to the organization of its content, the so-called binary structure. This consisted of separating expertise from courses and resulted in the so-called Resourcekit (the expertise or reference documentation) and the Training Manuals (the exercises and course paths). It is necessary to mention here that OceanTeacher was not intended to be a distance learning system but was aimed to be an “assistant” or “tool” used during training courses organized by IODE in Member States.

An additional division was between data management and information (library) management, although attempts were made to have “joint” material, especially as related to information technology.

The rapid and exponential growth of content in the Resource Kit and the need for a more distributed approach to content submission and management led to the submission of the proposal “ODIMeX: An Integrated Expert and Training System for Oceanographic Data and Information Management” to the Flanders-UNESCO Trust Fund for Science in 2003.

The proposal aimed at expanding OceanTeacher into an open, modular and expandable expert and training environment with the following properties:

1. a binary model comprised of: (i) encyclopaedic resource kit; and (ii) modular training curricula;
2. ability for multiple expert authors to provide content for both the resource kit and training curricula;
3. browser-driven using the University of Western Cape (UWC) KEWL.NextGen software;
4. hierarchical management structure to ensure constant quality and peer-review;
5. multiple user audiences
6. data management and information management content

The project was approved and funded covering the period 2004-2008. The project was successfully implemented and resulted in:

- the first version of OceanTeacher using a web-based content management system based upon the KEWL.NextGen software developed by the University of the Western Cape, South Africa (see Figure 1 below);
- the use of OceanTeacher during more than thirty courses organized between 2005 and 2008;
- the second version of OceanTeacher’s Digital Library using the Semantic MediaWiki (SMW+) application (see Fig. 2) – for more on SMW+ see 2.2.2;
- a central Homepage for OceanTeacher that provides information on the different modules (see Fig. 3).
Figure 1: OceanTeacher Digital Library in KNG

Figure 2: OceanTeacher Digital Library in SMW+
The decision to migrate to a wiki-based solution was made because of the exponentially growing of wikis, especially the Wikipedia. However whereas Wikipedia is a totally open system allowing anyone to edit and comment on content, we chose to restrict write access to approved content providers and editors. A similar evolution is taking place on other wikis as concerns have been raised about the quality (or rather lack thereof) of Wikipedia content. See also 2.2.

1.4 The IOC Project Office for IODE

The IOC Project Office for IODE was established in Oostende, Belgium on 25 April 2005. The main objectives of the Project Office are:

- to establish a creative environment facilitating the further development and maintenance of IODE and partner data and information management projects, services and products with emphasis on improving the efficiency and effectiveness of the data and product/service stream between the stage of sampling and the user; and
- to assist in strengthening the capacity of Member States to manage oceanographic data and information and to provide ocean data and information products and services required by users.

To achieve these objectives the IOC Project Office carries out the following activities:

- develop, strengthen and maintain IOC/IODE ocean data and information management training programmes and training tools;
- provide an environment (‘think tank’) where ocean data and information experts and trainees can work, meet and discuss;
- develop, host and maintain IOC/IODE’s ocean information systems and related public awareness tools;
- promote collaboration between all expert levels active in ocean data (and data product) and information management, including scientists, data managers, other IOC (and JCOMM or WMO) programmes and projects and other users;
- provide a laboratory environment for the development and beta testing of ocean data and information management technology.
The facility receives considerable support from the Government of Flanders including the office space and related utilities as well as an additional annual financial contribution of €500,000/year to be used for programme activities at the Project Office is provided. With these funds local staff has been hired (Administrative Assistant, IT professional, Training Coordinator) and they also allow for the organization of approximately 10-15 training courses or workshops every year and the visits of experts. Training courses are either fully sponsored by the Project Office or jointly (and increasingly) organised with other organisations, projects or programs. The funds also allow for the procurement and maintenance of IT and office equipment.

All IOC web sites are now hosted by the Project Office.

Within its first three years of existence the Project Office has hosted over 45 training courses and 78 workshops/meetings. These events were attended by over 1000 experts and trainees. During each training course OceanTeacher was used as the primary course tool and in addition, when new courses were organized, their training and reference materials were added to OceanTeacher, thereby further enriching OceanTeacher.

In fact the Project Office has become the main venue for IODE training courses. The reasons are the following:

- The Project Office has 4 rooms that can accommodate between 10 and 50 trainees;
- The Project Office has a computer park of 30 work stations for use during training courses and all linked to a high-speed internet connection;
- The Project Office administrative staff has gained considerable expertise in purchase of tickets, assisting with visa requirements, hotel arrangements and other logistic support;

In addition, the Project Office has developed several new services that will further contribute to OceanTeacher such as:

- live audio broadcast of meetings and training courses;
- live powerpoint, audio and video recording of workshops and training courses for publishing on the Internet (streaming video, YouTube,…)

At the end of each course a survey is organized to assess the quality of the course, services and logistic support. This has enabled the Project Office staff to further improve services.

The IOC Project Office for IODE is now recognized as a prime venue for training courses and meetings. This has also facilitated mobilizing of funds from other sources such as the European Commission (IODE is a partner in the SeaDataNet project and responsible for the hosting of 2 large training courses; this included the funding by the Commission, of a full-time IT professional for a period of 2.5 years – 2008-2010). Several new projects are now being planned that will include IODE as a partner and involving the Project Office.

The IOC Project Office for IODE also receives more and more interest from (Belgian) universities. Over the past year several groups of marine science students have attended data management training courses in Ostend (eg ECOMAMA (VUB), MARELAC (UGent). In addition to this, OceanTeacher is now being used at several universities in South America for marine data management training.
2. OceanTeacher Today

2.1 OceanTeacher content structure

As mentioned in 1.3 today’s OceanTeacher is a complex integrated system including the OceanTeacher Encyclopedia (also known as the Digital Library), and the OceanTeacher Classroom (also known as the OceanTeacher Courses). In addition the system includes video recordings of courses which can be used by the trainees to refresh their knowledge, or by others.

The current (September 2008) content of OceanTeacher Data Management Module, is shown in Appendix A. It consists of 6 main divisions:

- **Marine Data** – Overview of all basic topics related to the nature of marine data and data products
- **Marine Data Infrastructure** – The technical construction of marine datasets, of all types and from all eras
- **Marine Data Quality Management** – All aspects of data quality assurance and data quality control for marine measurements
- **Marine Data Analysis** – Practical aspects of data manipulation and display
- **Marine Data Transmission and Product Distribution Systems** – Technical developments for the marine community aimed at creating a global commons of data and products, parallel to the meteorological community
- **Earth Sciences Resources for Marine Data Management and Analysis** – General educational resources, and other training links

Modules for Marine Information Management are currently under development and will consist out of the following main divisions:

- **Information Management Principles** – This division contains information on how to set-up an information centre and a collection.
- **Oceanographic Information Management Principles**

In addition there is a “shared” module that is relevant to both data managers and information managers:

- **Information technology and Scientific Communication** – Contains materials covering basic usage of computers for data and information management, the use of metadata to find and utilize these resources, software for general and oceanographic purpose, and programs and agencies involved in developing information technology

2.2 OceanTeacher technology framework: Semantic MediaWiki

As mentioned in 1.3, the new OceanTeacher uses the Semantic Mediawiki (SMW+) environment developed by the German Ontoprise (http://www.ontoprise.de) which is also supported by Vulcan Inc. (http://www.vulcan.com). Vulcan Inc. creates and advances a variety of world-class endeavors and high-impact initiatives that change and improve the way people live, learn, do business and experience the world. Founded in 1986 by investor and philanthropist Paul G. Allen, and under the direction of president and CEO Jody Patton, Vulcan oversees various business and charitable projects including real estate holdings, investments in more than 40
companies, including Charter Communications, DreamWorks Animation SKG, Digeo Broadband, the Seattle Seahawks NFL and Portland Trail Blazers NBA franchises, First & Goal Inc., Vulcan Productions, the Seattle Cinerama theatre, Experience Music Project, the Science Fiction Museum & Hall of Fame, the Allen Institute for Brain Science and the Paul G. Allen Family Foundation. For OceanTeacher the semantic extension development work has been co-sponsored by Vulcan within the framework of “Project Halo” (Project Halo is a unique effort towards the development of a "Digital Aristotle"—a staged, long-term research and development initiative to create an application capable of answering novel questions and solving advanced problems in a broad range of scientific disciplines – see http://www.projecthalo.com).

2.2.1 MediaWiki

MediaWiki is a web-based wiki software application used by all projects of the Wikimedia Foundation, all wikis hosted by Wikia, and many other wikis, including some of the largest and most popular ones. Originally developed to serve the needs of the free content Wikipedia encyclopedia, today it has also been deployed by companies for internal knowledge management, and as a content management system. Notably, Novell uses it to operate several of its high traffic websites.

MediaWiki is written in the PHP programming language, and can use either the MySQL or PostgreSQL relational database management system. MediaWiki is distributed under the terms of the GNU General Public License while its documentation is released under the GFDL and partly in the public domain, making it free and open source software.

The use of MediaWiki will open up OceanTeacher to submissions by a virtually unlimited number of content contributors. However there is a major difference with the “traditional” wiki where anyone can contribute or edit anything on the wiki: OceanTeacher will have a more controlled approach with submissions being pre-arranged in discussions between authors and editors, and subsequently quality-controlled by editors who can accept, return or reject the resulting submissions.

2.2.2 Semantic Mediawiki

Semantic MediaWiki (SMW) is an extension to MediaWiki), that allows for the encoding of semantic data within wiki pages, thus turning a wiki that includes the extension into a semantic wiki. Data that has been encoded can be used in semantic searches, used for aggregation of pages, and exported to the outside world via RDF

SMW+ offers a rich feature set which goes well beyond traditional wiki features to create, share and publish content:

- **Enhanced wiki navigation**: features to ease and speed up navigation and access to articles, as well as semantic data, in the wiki
- **Improved knowledge authoring**: features to allow easy and expressive addition of semantic data to the wiki
- **Simplified knowledge retrieval**: features to query knowledge and access information stored in the wiki
- **Polished knowledgebase**: features that allow users to detect inconsistencies and continuously improve the quality of the authored knowledge
- **Secured content**: access control tool to keep user groups away from sensitive content
- **Intuitive administration**: features that support administration tasks
The core advantage of SMW+ is the ability to assign metadata tags (semantic annotations) to each page of content that describe the content. This also enables the use of common metadata vocabularies (ontologies). Figure 4 shows an example of the Ontology Browser. A similar powerful ontology will be developed for OceanTeacher as part of the submitted Project. This will provide the content with powerful structure and precise searchability which is of considerable importance for large sites.

The technology and basic concepts used in OceanTeacher now, through SMW+ will make OceanTeacher an early implementer of Web 3.0. Web 3.0 refers to the third generation of Internet-based services that collectively comprise what might be called 'the intelligent Web'—such as those using semantic web, microformats, natural language search, data-mining, machine learning, recommendation agents, and artificial intelligence technologies—which emphasize machine-facilitated understanding of information in order to provide a more productive and intuitive user experience.

2.3 OceanTeacher 2: future developments

2.3.1 Increase of Content production

One of the weaknesses of OceanTeacher/ODImEx was the limited number of content providers. This was, to a large extent, caused by the limitations of the technology used and especially during the “static html” implementation that was used in 2005-2006. This was partially resolved with the use of KNG but is now really solved with the use of SMW+.

OceanTeacher 2 will substantially expand its scope and content through pro-active recruiting of content providers (contributors), first and foremost within the IODE community, but also in e.g. the WMO/marine meteorology community.
2.3.2 Improved production process for Encyclopedia

As already mentioned OceanTeacher benefited from only two content editors (Dr Murray Brown for oceanographic data management and Ms Linda Pikula for Marine Information Management with assistance from Prof. Paul Nieuwenhuysen). These experts were tasked with both creating content for the Digital Library as well as creating courses for the Classroom. This limited model is no longer realistic bearing in mind the planned increase in content production. Accordingly a modular model will be applied in OceanTeacher.

In this model (See Diagram 1) a number of editors will be identified who will be responsible for one or more categories of content (based upon their field(s) of expertise). They will quality control and approve or reject content (pages) submitted by contributors. They will also actively seek to recruit additional contributors. The Chief Editor will mainly supervise and manage the hierarchical structure of OceanTeacher.

Diagram 1: Publishing process OceanTeacher 2

2.3.3 Improved production process for Classroom content

Classroom content has traditionally been provided by lecturers of courses. This will not fundamentally change in OceanTeacher 2. However whereas OceanTeacher/ODIMeX did not aim to provide distance learning functionality as such, OceanTeacher will aim to develop such services. In this regard OceanTeacher 2 will identify the most suitable software environment. A prime candidate is Moodle (http://www.moodle.org). Moodle is a course management system (CMS) - a free, Open Source software package designed using sound pedagogical principles, to help educators create effective online learning communities. Currently there are nearly 43,000 sites in 200 countries that utilize Moodle. However there are other options including a custom designed solution.

Regardless of the technological solution chosen the publishing of learning materials will need to be coordinated. This will be done by the content editors but may also require specialized (contractor) assistance.
2.3.4 Increased use of multimedia content and tools

Staff turn-over (see also 3.1) has been a major challenge for the ODINAFRICA project but is a major issue for all NODCs and information centres. The Capacity Building activities of IODE have addressing this, to some extent, by organizing its training courses using the “train-the-trainer” approach. Trainees are then invited to train other colleagues when returned home. To facilitate this, trainees can use the OceanTeacher Encyclopedia as well as OceanTeacher classroom materials. However to assist them further it has been decided to video-record lectures and make these recordings available on-line. In 2008 several technological solutions have been tested and standards are now ready to be implemented. OceanTeacher 2 will document and apply these standards. Figure 5 shows an example of using the ScreenFlow software that enables recording of screen capture with associated audio and video, and publishing on the WWW as streaming media. Experiments have also been undertaken to provide these services live enabling interactivity through Skype or VoIP.

Figure 5: Presentation recording using ScreenFlow
3. The Training Academy Concept

3.1 Rationale

One of the conclusions of ODINAFRICA-III has been that it is impossible to avoid staff turn-over. Staff turn-over will occur for several reasons: (i) staff decide to leave the institution because they have found a job offering better financial rewards or decided to pursue further studies (in fact the capacity development opportunities provided by IOC/IODE may make staff more attractive to other employers); (ii) staff have been promoted within the government to another government department (also this may be an indirect result of our capacity development activities); (iii) staff may have left for health reasons or passed away (this happened in a few cases).

The impact on the NODC (National Oceanographic Data Centre) or Marine Library of staff trained by the project but leaving the institution can be dramatic as we can generally invite only one participant from each country when organizing a regional course. Even during the ODINAFRICA-III project that lasted for 4 years we had to organize courses for countries that had lost staff. In addition new countries were added that also needed start-up training.

In addition the continuing calls for establishing ODINs in other regions make that the same courses need to be organized regularly. We also note that increasingly we receive requests from member states requesting participation, at their own cost, in our courses (even though no specific publicity is made for the courses).

In view of the above it is therefore concluded that there is a need of a regular cycle of standardized courses that are relevant for all regions. This constitutes a standard curriculum of courses that can be organized annually.

3.2 Objectives

The Objective of the OceanTeacher Training Academy will be to establish a facility that will provide an annual teaching programme of courses related to oceanographic data and information management and the development of related products and services that will contribute to the sustainable management of oceans and coastal areas in Africa and other regions. The OceanTeacher Training Academy will underpin all Ocean Data and Information Networks developed by IOC/IODE. The OceanTeacher Academy will furthermore promote the development of regional training nodes thereby providing a multiplier effect on the number of trainees as well as a contribution to the long-term sustained impact of the provided capacity building activities of IOC/IODE and other IOC programmes.

The Training Academy will contribute to:

- Building high quality and up-to-date expertise in oceanographic data and information management and exchange in new national oceanographic data centres (NODCs) and related facilities;
- Keeping staff in existing national oceanographic data centres (NODCs), marine information centres and related facilities up-to-date with the latest methodological and technical developments (continuous professional development);
- Creating awareness for the importance of oceanographic data management and marine information management with university students (marine
environmental studies) to ensure that they will contribute quality data to data centres during their future career;

• Creating awareness for the importance of oceanographic data management with experts in oceanography and related disciplines.

The above objectives will be addressed to Africa as a matter of priority and to other regions as far as possible.

### 3.3 Target trainees

The courses will target the following trainees:

• staff of newly established national oceanographic data centres and related facilities;
• staff of well established national oceanographic data centres and related facilities;
• staff of newly established marine libraries and information centres;
• staff of well established marine libraries and information centres;
• university students who need familiarization with oceanographic data management and exchange;
• staff of facilities working in other but related disciplines (eg meteorologists, operational oceanographers, oceanography researchers, coastal planners,...) who need familiarization with oceanographic data management and exchange.

At the moment IODE already cooperates with several universities and programs, of which students attend training courses in oceanographic data management at the Project Office in Ostend: ECOMAMA, MARELAC, STIMULATE. Further collaboration will be sought with universities, both in Belgium and abroad.

In all cases, prospective trainees must have academic credentials in marine science (for data management), librarianship (for marine information management) or in a closely allied discipline. Trainees from closely allied disciplines must have either classroom experience or work experience with marine datasets.

#### 3.3.1 Development of a university student awareness course

There is a strong need to develop a university student awareness course in OceanTeacher, aimed at providing university students (Master programme, PhD) with the necessary background to manage their research data and to produce basic data products (maps, graphs) for their own research projects (eg Master or PhD dissertation).

University students should then be able to address the following questions:

• Where to find relevant oceanographic data for their own research project?
• How to manage their own research data?
• How to produce basic data products (maps, charts) for their own research project? (eg a sea surface temperature chart)

There is currently one short-course in Oceanographic Data Management available for university students.

A specific university course (or courses) will be further developed in the next phase of OceanTeacher. These courses will then be provided at several universities.
(preferably both in Belgium and outside Europe). Efforts will be made to promote the use of OceanTeacher by marine science students at universities.

3.4 Multi-language support

Currently there is only one course (basic oceanographic data management) available in OceanTeacher in another language (Spanish). Although it is not feasible to translate all content of OceanTeacher, the new system (SCORM compliant) will allow easier translation of courses. These courses will then contain links to English-language documents on the OceanTeacher site.

3.5 Accreditation

It should be noted that the training provided is technical training, not academic. As such the courses will be short-term (1-4 weeks) and will result in the issuing of Certificates.

3.6 Course types

The following course types will be offered:

(i) Basic Courses – Survey courses of fundamental principles in data or information management. These courses assume current familiarity with marine data and information, but provide the first instance of definitions and working principles that have not been developed in previous undergraduate/graduate education.

(ii) Advanced Courses -- Courses beyond the survey level that tackle complex topics beyond the basic concepts. In data management, for example, these courses would examine relationships between data publication, their formats, and methods to analyze them within the provided software packages.

(iii) Applied Courses – Courses that directly tackle very specialized treatment of specific data types, or data for specific applications. Examples of these courses would be a workshop to create and quality control a sea level data management system for a particular site, or a workshop to create and publish an online web mapping system for a part of the world ocean.

(iv) Accredited (University) Courses – Courses, sometimes very similar to the above, developed specifically to meet formal university course requirements of coordinating institutions.

(v) Continuing Professional Development (CPD) Courses – Courses designed to provide professional information and data managers with updated information, new information, or re-fresher information on selected topics of interest. Typically, these courses include former trainees or fully qualified professionals who seek expanded familiarity with “hot topics”.

The current list of courses within OceanTeacher is shown in Appendix B. In approximate order of technical difficulty, the list includes examples of the first 3 course types listed above. There has been 1 Accredited Course (not listed here). The CPD courses would be a new development, entirely. There is currently a proposal to set-up a Centre of Excellence in Malaysia. OceanTeacher will also be used by the
3.7 Course venue: regionalisation

Although many of the courses will be held at the IOC Project Office for IODE in Oostende, Belgium the aim of the Project will also be to promote the establishment of regional training facilities and thereby transferring training know-how to the regions. Within the work plan of the Project resources will be set aside to stimulate such initiatives.

3.8 Course Programming cycle

The course programming cycle will more or less follow the academic year (start in September and end in July). The preparatory phase (in which the planning for the next year will be done) will start in March of every calendar year and will be completed by the end of July. Courses will start in September of every calendar year and end at the end of June (with a break period in July/August).

3.8.1 Needs assessment

Around June of every calendar year all IODE national coordinators (for data management and for information management) as well as ODIN project managers, IODE Co-Chairs ad relevant contact points of the IOC Data and Information Management Advisory Group will be requested to:

- identify, from a list of existing courses, courses that should be organized the following year; and
- provide a list of other topics on which IODE should provide training courses.

On the basis of the responses the Academy management will prepare a list of priority existing courses and new topics (for which courses may need to be designed). For the new topics the Management will seek suitable authors and assess the possibility to include new courses in the curriculum. The Academy Management will then prepare a draft list of courses that may be taught in the next calendar year.

3.8.2 Course advertisement/pre-registration

The draft list of courses that may be taught in the next calendar will be advertised on the OceanTeacher web site. The advertisement will include:
- Title of the course
- Provisional programme (table of contents)
- Duration
- Minimum requirements to participate
- Cost of participation (tuition fee, approximate accommodation and living costs)

In addition a mailing will be organized to former trainees and interested individuals (anyone will be able to register as an interested individual for courses through the OceanExpert system).

Interested prospective trainees will be able to pre-register for any (or several) of the courses on-line. They will need to identify whether they will be self-supported or need sponsoring.
3.8.3 Participant pre-selection

The Management, based upon whether the applicant meets the minimum requirements, will make a provisional pre-selection of participants.

3.8.4 Curriculum selection

Based upon the number of pre-selected pre-registrations for each of the courses the Management (also depending upon available funds) will select the courses that will be taught during the next calendar year. All pre-registered applicants will be informed on what courses will be taught.

3.8.5 Course programme advertising

The courses that will be taught during the following calendar year will be advertised on the OceanTeacher website.

3.8.6 Participant selection

For all pre-selected participants a more in-depth assessment will be made. Elements that will be considered in the selection process are:

- how will the course contribute to the national institution
- how will the course contribute to the career of the applicant
- is the applicant’s application endorsed by his/her employer

3.8.7 Course duration

Most courses will have a duration of 2 weeks (10 working days). However some of the courses may have a duration of 4 weeks.

3.8.8 Tuition Fee and additional costs

In order to avoid “course tourism” and to cover some of the expenses a “tuition and additional costs fee” will be applied. Additional costs will include the costs of printed lecture materials, consumables, lunches, refreshments, etc.

It is noted that all approved participants will need to hold full medical insurance as well as a valid visa. Participants (generally from European Union countries) holding their own medical insurance and not requiring additional coverage need not pay this additional coverage. The tuition and additional cost fee structure is shown in Table 1 below (amounts are expressed in Euro).

<table>
<thead>
<tr>
<th>Course duration</th>
<th>Tuition fee</th>
<th>Additional costs</th>
<th>Total w/o insurance</th>
<th>Medical insurance</th>
<th>Total fee with insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>300</td>
<td>350</td>
<td>650</td>
<td>25</td>
<td>675</td>
</tr>
<tr>
<td>2 weeks</td>
<td>600</td>
<td>700</td>
<td>1300</td>
<td>50</td>
<td>1350</td>
</tr>
<tr>
<td>3 weeks</td>
<td>900</td>
<td>1050</td>
<td>1950</td>
<td>75</td>
<td>2025</td>
</tr>
<tr>
<td>4 weeks</td>
<td>1200</td>
<td>1400</td>
<td>2600</td>
<td>100</td>
<td>2700</td>
</tr>
</tbody>
</table>

Table 1: Tuition and Additional costs structure

For participants not sponsored by the project the fees are payable in advance by bank transfer.
3.8.9 Accommodation and living costs

For sponsored participants an amount of € 400/week (or 580 USD/week) will be provided to cover accommodation and living costs.

3.8.10 Sponsoring

Within the Project budget an amount has been set aside for sponsoring of participants in courses. The selection of participants who will be sponsored will take into consideration:
- applicant country’s development status (preference will be given to LIFDCs)
- endorsement of the applicant’s application by his/her employer
- expected impact of the training based upon elements described in 3.6.6
- any co-sponsoring

<table>
<thead>
<tr>
<th>Course duration</th>
<th>Tuition fee</th>
<th>Additional costs</th>
<th>Accommodation</th>
<th>Total w/o insurance</th>
<th>Medical insurance</th>
<th>Total fee with insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 week</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td>1050</td>
<td>25</td>
<td>1075</td>
</tr>
<tr>
<td>2 weeks</td>
<td>600</td>
<td>700</td>
<td>800</td>
<td>2100</td>
<td>50</td>
<td>2150</td>
</tr>
<tr>
<td>3 weeks</td>
<td>900</td>
<td>1050</td>
<td>1200</td>
<td>3150</td>
<td>75</td>
<td>3225</td>
</tr>
<tr>
<td>4 weeks</td>
<td>1200</td>
<td>1400</td>
<td>1600</td>
<td>4200</td>
<td>100</td>
<td>4300</td>
</tr>
</tbody>
</table>

Table 2: Sponsoring structure (in Euro)

The ticket cost (cheapest fare, economy class) will be added to the amounts listed in Table 2.

For sponsored participants the accommodation fee will be paid out in cash in weekly instalments.

3.8.11 Lecturers

Lecturers will be experts on oceanographic data management (experts from well established NODCs), University lecturers, experienced IT experts, experienced marine librarians or other recognized experts in the relevant fields. They will be selected by the Academy management based upon their curriculum vitae, publications or other relevant criteria to ensure the highest possible quality of tuition.

Lecturers will not receive a specific fee but will receive full UN per diem for the duration of their stay at the Academy. This per diem will be used by the Lecturers to pay for the accommodation and living expenses for the duration of their assignment. Lecturers will also receive their ticket (cheapest fare, economy class). Per diem will be paid to Lecturers in cash in weekly installments.

It will be the responsibility of the Lecturers to seek permission from their employers to teach at the Academy. All training materials prepared for, or used during, the courses will be made available to be entered in the OceanTeacher Encyclopedia and OceanTeacher Classroom free of charge and no commercial copyright can be attached to any of the material.

In some specific cases it will be possible to hire a consultant to identify, collate and enter materials in OceanTeacher for specific courses for which insufficient material
exists or for which not sufficient time is available to acquire the material using the standard procedure of voluntary contributions.

3.8.12 Alumni

IODE already maintains a large database of former trainees (alumni), integrated with the IODE OceanExpert system. This alumni database allows member states of IODE to check for local expertise. It further allows monitoring drop-out of alumni (alumni leaving marine data centers of marine science). This database will be further developed and improved continued, and will also form the basis for announcements of new offerings for alumni.

![Figure 6: IODE Alumni database](image)

3.9 Implementation and follow-up of courses

The course programme will usually (*) consist of:

(i) Training (at the Academy)
(ii) Exercises (at the Academy)
(iii) Trainee take home assignments (assignments given at the Academy, work carried out when returned home)
(iv) Course follow-up (by lecturers and Academy staff)
(v) Issuing of Certificate

The time assigned to completing the trainee assignments will vary from a few weeks to a few months. Help is provided during this time by lecturers and Academy staff by email, through the web site or other e-tools: this component will make extensive use of the new OceanTeacher classroom system which may be based upon the distance learning application Moodle or an equivalent software solution.

The certificate will be issued upon successfully completion of the full programme as described under (i) to (iv) above.

(*) an exception will be the awareness courses where no trainee take-home assignments and course follow-up will be applied.
3.10 Linkage with other IODE projects

The OceanTeacher Academy will be THE training and education environment for all IODE programmes, both at the global and at the regional level.

OceanTeacher 1.0 has proven its merits as a training assistant tool: a central location where trainees can find all reference materials as well as copies of the lectures that have been given during live courses in Oostende.

So far most courses have been organized within the framework of a particular ODIN project (in particular ODINAFRICA, ODINCARSA and ODINECET). This regional training approach fostered interpersonal networking within that region which is a pre-requisite for the successful building of an ODIN. However a lot can be gained also from inter-regional networking (and this can be south-south or north-south). This was possible in only a limited way in the past as the ODIN training courses were embedded in the ODIN projects, leaving little flexibility to link the ODINs.

The organization of the courses in a separate OceanTeacher Academy Project will enable inter-regional training courses, thereby fostering inter-regional sharing of expertise and ultimately, sharing of data and information across regions.

For the next phase of ODINAFRICA the training requirements are therefore handed over to the OceanTeacher Academy. In particular these include:

- Activity 2.11  Training for new centres (basic DM and basic IM)
- Activity 2.12  Training for existing centres (advanced DM and advanced IM)
- Activity 3.5  Training Course National Marine Atlas
- Activity 3.9  Training Course on Application of GIS and Remote Sensing to forecasting/predictions and scenario development
- Activity 4.2  Training Course Marine Biodiversity data mobilization
- Activity 4.5  Training Course OceanDataPortal

(total 8 courses)

Most of these courses will be of interest also to other ODINs and it will therefore be more cost-effective and time-effective (for the lecturers) to organize these courses in a multi-region way.

The budget available through the OceanTeacher Academy combined with the funds provided by the Government of Flanders to the IOC Project Office for IODE, earmarked for training courses and workshops, will provide for a sizeable “training fund” that will enable to organize the above-mentioned courses required within ODINAFRICA but will further enable other regions to benefit as well. Several of these benefiting projects are in fact also project funded by the Government of Flanders (e.g. SPINCAM, CMA).

The concept of inter-regional networking is illustrated in Figure 7.
3.11 Partners

Over the past 3 years IODE has cooperated with a number of partner organisations, projects and universities to provide training on marine data and information management:

- **ODINAFRICA** – The Ocean Data and Information Network for Africa (ODINAFRICA) brings together marine institutions from twenty-five Member States of the Intergovernmental Oceanographic Commission of UNESCO from Africa. ODINAFRICA enables the participating member states to get access to data available in other data centres worldwide, develop skills for manipulation of data and preparation of data and information products, and develop infrastructure for archival, analysis and dissemination of the data and information products.

- **SPINCAM** - The Project aims to establish an ICAM indicator framework in each country of the Southeast Pacific region (Chile, Colombia, Ecuador, Panama and Peru), focused on environmental and socio-economic conditions within the context of sustainable development and integrated coastal area management.

- **Caribbean Marine Atlas (CMA)** - A number of Caribbean countries are embarking on an initiative to develop a Caribbean Marine Atlas (CMA). The purpose of the CMA is to identify, collect and organize available geo-spatial datasets into an atlas of environmental themes for the Caribbean region, under the sponsorship of the Intergovernmental Oceanographic Commission’s (IOC) International Oceanographic Data and Information Exchange (IODE) and Integrated Coastal Area Management (ICAM) Programmes.

- **MARBEF** - MarBEF, a network of excellence funded by the European Union and consisting of 94 European marine institutes, is a platform to integrate and disseminate knowledge and expertise on marine biodiversity, with links to researchers, industry, stakeholders and the general public.
• **SeaDataNet Project** – The EU funded SeaDataNet (2006-2011) aims at developing a standardized distributed system for managing the large and diverse data sets collected by the oceanographic fleets and the new automatic observation systems. By use of standards for communication and new developments in information technology, the 40 in-situ and satellite marine data platforms of the partnership are providing metadata, data and products as a unique virtual data centre.

• **ECOMAMA (University Antwerp – VUB in collaboration with UGent)** – The Master of Ecological Marine Management (ECOMAMA) is an interuniversity two year master programme organized by the Biology departments of the Vrije Universiteit Brussel (VUB, Free University of Brussels) and Universiteit Antwerpen (UA, Antwerp University). There is a close cooperation with Universiteit Gent (UGent, University of Ghent).

• **STIMULATE** - The main aim and goal of this International Training Program is to offer a stimulating learning environment to the participants. These are young scientists and professionals who have a function as information intermediary in the area of science and technology, so as to sharpen their skills in collecting, storing, retrieving, presenting and managing information. This can be of great benefit to the teaching and research activities going on in their institute and to the further development of their organisation and region.

• **MARELAC** – The MARELAC Master programme at the Ghent University aims at broadening the knowledge and insight of marine scientists from various disciplines, while at the same time specialising on specific environments (oceans, seas, lakes)

• **Nippon Foundation-POGO Centre of Excellence in Observational Oceanography (CoE)** - The goals of the Nippon Foundation (NF) - Partnership for Observations of the Global Ocean (POGO) Centre of Excellence (C of E) at the Bermuda Institute of Ocean Sciences (BIOS) are to expand world-wide capacity to observe the oceans; to develop human resources in developing countries, and to expand international networking in ocean sciences, with an emphasis on training young scientists from developing countries.

• **JCOMM** - JCOMM coordinates, regulates and manages a **fully integrated marine observing, data management and services system** that uses state-of-the-art technologies and capabilities, is responsive to the evolving needs of all users of marine data and products, and includes an outreach programme to enhance the national capacity of all maritime countries. It works closely with partners including: the International Oceanographic Data and Information Exchange (IODE), the Global Ocean Observing System (GOOS), and the Global Climate Observing System (GCOS).

Letters of interest to collaborate in the Project have already been received from Phoenix Training Consultants (USA), Alfred-Wegener-Institut fuer Polar-und Meeresforschung (Germany), the A.O. Kovalevsky Institute of Biology of the Southern Seas (Ukraine), Coastal & Marine Resources Centre (Ireland), National Oceanic and Atmospheric Administration (USA), Centro Internacional para la Investigación del Fenómeno de El Niño (Ecuador), Vrije Universiteit Brussel (Belgium) and Universiteit Hasselt (Belgium).
4. Work plan and Budget

4.1 Work packages

The Project will be implemented through a set of 4 work packages. These will be

WP 1: Academy management
WP2: OceanTeacher development and maintenance
WP3: Course development and maintenance
WP4: Organization of courses

4.1.1 WP1: Academy management

This work package will cover the day-to-day management costs of the Academy (items 3.6.1, 3.6.2, 3.6.3, 3.6.4, 3.6.5, 3.6.6). It is noted that management costs of the IODE Project Office and courses organized under the regular budget of the Office are NOT covered by the project. The current budget allocated to the IOC project Office for IODE by Flanders allows for the organization of approx. 4 courses/annum (15 pax, 2 weeks). With the current budget allocated to the IOC Project Office for IODE by Flanders 10-15 training courses are being organised on a yearly basis. These training courses are either fully paid by the Project Office (approx. 4 courses/annum, 15 pax, 2 weeks) or jointly organised with other partners (projects, programs or organisations).

It is noted further that the Training Coordinator (Dr Wouter Rommens) of the IOC Project Office for IODE will be the Project Manager (his staff cost will NOT be charged to the project).

Costs covered under this WP will therefore cover only the organizational cost for additional courses (but excluding sponsoring of participants). This Work Package will also include resources to start up regional training facilities (in regions that have established ODINs such as Africa, Western Pacific, Caribbean & South America, Black Sea region...). Also included in this WP1 is the further development of university curricula.

4.1.2 WP2: OceanTeacher development and maintenance

This work package will cover the costs of the maintenance and further development of the technology framework of OceanTeacher.

New development will include:

- The implementation of a distance learning management system.
- Implementation of SCORM (Sharable Content Object Reference Model (SCORM) is a collection of standards and specifications for web-based e-learning. It defines communications between client side content and a host system called the run-time environment (commonly a function of a learning management system). SCORM also defines how content may be packaged into a transferable ZIP file.)
- Translation of the Sharable Content Objects to offer multilingual support of the course material.
4.1.3 WP3: Course development and maintenance

This work package will cover the costs of course development and maintenance. As was the case in OceanTeacher/ODIMeX content will be provided by experts, free of charge. Editors will also provide their services free of charge. However an expert will be contracted for the top-level management of OceanTeacher (Chief Editor as described under 2.3.2) to ensure that the necessary staff time is assigned. This budget line will also be used to cover accelerated development of materials. Cost of course development and maintenance will be the highest in years 1,2 and 3.

4.1.4 WP4: Trainee sponsoring

This work package will cover the cost of sponsoring of trainees of curriculum courses. The costing is based upon the organization of 4 courses annually with 10 sponsored participants and a duration of 2 weeks. Ticket cost has been estimated at € 1,500 (or 2,200 USD) . Sponsoring rates are as mentioned under 3.6.10.

4.2 Budget

Budget is expressed in US Dollars

<table>
<thead>
<tr>
<th>Work package</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>Total</th>
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<tr>
<td>WP1: Management</td>
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<td>WP3: course development</td>
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<td>Sub-totals</td>
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<tr>
<td>UNESCO 10% overhead</td>
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<td>Totals</td>
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<td>392,172</td>
<td>384,027</td>
<td>371,568</td>
<td>1,540,000</td>
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</tbody>
</table>

4.3 Summary budget

Budget is expressed in US Dollars

<table>
<thead>
<tr>
<th>Contribution requested from Flanders</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,540,000</td>
</tr>
</tbody>
</table>

| UNESCO/IOC counterpart contribution (*) | 153,000 |

| TOTAL | 1,693,000 |

(*) Note that the cost of the IOC Project Office for IODE Training Coordinator (Dr Wouter Rommens) and other Project Office staff funded by Flanders is not included
in this budget. Note also that the content providers and editors work for the project “pro bono”. The cost of their work, provided free of charge, is not included in the budget.

### 4.4 Project budget in UNESCO format

Amounts are expressed in US Dollars

<table>
<thead>
<tr>
<th>Budget</th>
<th>Description</th>
<th>Total</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>staff/individual travel</td>
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<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
<tr>
<td>11</td>
<td>experts (ALD, consultants)</td>
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<td>114,000</td>
<td>116,520</td>
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<tr>
<td>13</td>
<td>admin support staff</td>
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<td>0</td>
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<td>20</td>
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<td>30</td>
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<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Totals before support costs 1,400,000 356,575 356,520 349,116 337,789

80 Programme support costs 140,000 35,658 35,652 34,912 33,779

TOTAL BUDGET 1,540,000 392,233 392,172 384,027 371,568
Appendix A: Hierarchical Structure of the OceanTeacher Encyclopedia

Data Management Module (September 2008)

3. Marine Data
   1. Ocean Data Providers & Products
      1. Oceanographic Research
         1. Journal Publications & Gray Literature
         2. Project Archives & Special Collections
            1. e.g. ICES
            2. e.g. WOCE
            3. e.g. SeaDataNet
      2. Ocean Surveys
         1. Classical Hydrography
         2. Bathymetry Charts
         3. Tide Predictions (Tables)
         4. Marine Minerals Mapping
         5. Marine Hazards Mapping
      3. Operational Oceanography
         1. Local/Regional
         2. Global
            1. GDP
            2. GLOSS
            3. OceanSITES
            4. SOOP
            5. Tropical Moored Buoys
            6. TSUNAMI
            7. VOS
            8. Others/GOSIC
      3. Marine Data Transmission & Product Distribution
         Systems -->
      4. Project Archives & Special Collections -->

4. Ocean Data Centers
   1. WDC -->
   2. IODE
   3. NODCs

5. Ocean Data Catalogs & Inventories

6. Gallery of Ocean Data Product
   1. IOC "Best of the Web"
   2. Integrated Marine Data Product Viewers
      1. e.g. OpenIOOS
      2. e.g. SeaCOOS
      3. e.g. IDV
      4. e.g. Gulf of Maine Modeling Interoperability

2. Meteorological Data Providers & Products
   1. Marine Meteorology & Oceanography Programme at WMO
2. Marine Data Transmission & Product Distribution Systems
3. Meteorological Data Catalogs & Inventories

3. Remote Sensing Data Providers & Products
   1. CEOS Handbook
   2. Coastal Remote Sensing at CSC
   3. Remote Sensing of the Ocean at NASA
   4. Remote Sensing Data Catalogs & Inventories

4. Ancillary Data Providers & Products
   1. Earth Sciences Resources for Marine Data Management & Analysis
   2. World Data Center System
   3. Ancillary Data Catalogs & Inventories

5. Earth Science & Marine Data Availability & Access
   1. WSIS Declaration of Principles
   2. IOC Oceanographic Data Exchange Policy
   3. WMO Resolution 40
   4. Persistent URLs and Data Citations

4. Marine Data Infrastructure
   1. Numerical Data
      1. Digital Number Types
         1. ASCII
            1. Standard (0-127)
            2. Extended (128-255)
            3. DOS & UNIX Line Terminators
         2. Binary
            1. Types & Ranges
            2. Endianness
      2. Scalars & Vectors
      3. Grids
         1. Gridding
         2. Contouring
         3. Vector Grids
            1. U and V
            2. Speed and Direction
         4. Grid Registration
   2. Marine Metadata
      1. Discovery vs.Use
      2. Standards & Formats
      3. Classification Schema/Taxonomies
      4. Ontologies
   3. Marine Data Characteristics
      1. Marine Data Parameters
         1. Marine Temperature
         2. Marine Salinity
      2. Marine Biological Taxa
      3. Marine Units of Measurement
      4. Date & Time Standards for Marine Data
      5. Latitude, Longitude & Altitude Standards for Marine Data
         1. ISO
         2. Other systems
6. Marine Metadata Standards
   1. Science Word & Key Word Standards for Marine Data
   2. Country Name Standards for Marine Data
   3. Institution Name Standards for Marine Data
   4. Platform Name Standards for Marine Data
   5. Platform Type Standards for Marine Data
   6. Other Coded Information Standards for Marine Data
      1. WOD
      2. IHO
      3. etc.

7. Creating Marine Metadata
   1. Marine Metadata Authoring Software & Systems
   2. ICES Guidelines for Marine Metadata
   3. Marine Metadata Vocabularies -> (see above)

7. Marine Geography & Geopolitics
   1. Oceans & Seas
      1. IHO
   2. Marine Gazetteers
      1. IHO/GEBCO
      2. US BGN/GNIS
   3. Marine Data Inventory Grids
      1. WMO Squares
      2. Marsden Squares
      3. Modified Canadian Squares
   4. Marine Program & Project Areas
      1. GIWA
      2. LME
      3. UNEP RS
      4. FAO FISHERIES
   5. Law of the Sea
      1. Scientific & Technical Guidelines ->
      2. EEZ ->
      3. Global Relief ->
      4. Sediment Thickness ->

8. Marine Data Quality Flags->

4. Ancillary Data Characteristics
   1. Marine Remote Sensing
      1. Sensors, Platforms & Projects
      2. Product Levels
   2. Marine Meteorology
      1. Parameters
      2. Products
   3. Marine Geography & Cartography
      1. Coordinate Reference Systems (CRS)
      2. Marine GIS

5. Marine Data Format Types
   1. Compression Formats
   2. System Collection Formats
   3. Metadata Formats
4. Document Formats
5. Markup Language Formats
6. Spreadsheet Formats
7. Pseudo-Spreadsheet Formats
8. Vector Formats
9. Raster & Grid Formats
10. Auxiliary Formats
11. Self-Describing Formats
12. Relational Database Formats

6. Marine Data Format Examples

5. Marine Data Quality Management
   1. Marine Data Quality Assurance
      1. Marine Program Planning Documents
      2. Marine Instrument & Method Documents
         1. M&Gs
         2. WMO
         3. JCOMM & DBCP
         4. SOOPIP & GTSSP
         5. GOSUD
      3. Marine Analysis Reference Materials
      4. Intercalibration Activities for Marine Sample Analyses
   2. Marine Data Quality Control
      1. Quality Control of Marine Temperature-Salinity Profiles
      2. Quality Control of Marine Surface Temperature & Salinity
      3. Quality Control of Sea Level Data
      4. Quality Control of Marine Current Data
      5. Quality Control of Surface Wave Data
      6. Quality Control of the World Ocean Database
   3. Marine Data Quality Flags

6. Marine Data Analysis
   1. Marine Data Software
      1. Marine Data Housekeeping Tools
         1. Browse/Edit
            1. Adobe Reader
            2. Ghostscript, Ghostview
            3. PFE
            4. IrfanView
         2. File Manipulation
            1. FileZilla
            2. Winzip, Bzip2, 7Zip
         3. Format Conversion
            1. DXF2XYZ
            2. GeoTIFF Examiner
            3. Georeferencing Tool
            4. Converters Collection
      2. Standard Analysis & Visualization of Marine Data
         1. ArcExplorer
         2. Bilko
         3. HDF Browser
         4. HDF View
5. GRADS
6. Integrated Data Viewer
7. Java OceanAtlas
8. ncBrowse
9. Ocean Data View
10. OPeNDAP Data Connector
11. Saga
12. Surfer

3. Geographic Information Systems for Marine Data
   1. Background
      1. Fundamentals
      2. Advanced
      3. Spatial Analysis
      4. Organizational Issues
      5. Marine GIS
      6. Spatial Data Infrastructure
      7. Web Mapping
      8. Operational GIS
   2. Software
      1. Standard GIS
      2. Map Servers
         1. OGC Data Services ->

2. Applied Marine Data Analysis
   1. Marine & Coastal Atlases
      1. Geographic & Topical Scope
      2. Vector Product Requirements
         1. Vector Management: Clipping, Selective Editing
      3. Raster Product Requirements
         1. Grid Management: Clipping, Masking, Re-Valuing, Re-Formatting,
         2. Value Ranges & Color Legends
         3. WMS & GeoTIF
   2. Physical Modeling of the Ocean
      1. Base Data
         1. Global Relief
         2. Coastlines
         3. Landmasks
      2. Formats
      3. Software
      4. Initialization & Forcing & Boundaries
      5. Data Products
   3. Sea Level Data Analysis & Modeling
      1. Formats
      2. Software
      3. Data Products
   3. Marine Data Roadmap Exercises

7. Marine Data Transmission & Product Distribution Systems
   1. General Communications for Marine Data & Products
   2. GEOSS Systems
1. GEO Portal (Candidates)
3. WMO
   1. WWW, GOS & GTS
   2. WIGOS & WIS
4. IOC/IODE
   1. Ocean Data Portal
5. OPeNDAP
   1. Ferret & LAS
   2. THREDDS
   3. NVODS
6. OGC Data Services
   1. WMS
   2. WFS
   3. WCS
   4. Web Catalog Services
7. Information Technology Development Activities for Marine Data & Products
   1. US DMAC
   2. etc.
8. Earth Sciences Resources for Marine Data Management & Analysis
   1. Marine Sciences Overview
      1. Sciences of Oceanography
      2. Related Disciplines
   2. Marine Educational Resources
      1. SCOR Catalog
      2. Online Textbooks, Courses & Reference Works
   3. Major Marine Organizations, Agencies & Programs
      1. Intergovernmental
      2. Non-Governmental
      3. Research & Observations

Information and communication technology module (September 2008)

1. Knowledge and science in general
2. General information and communication technology;
   2.1. Computers
   2.2. Computer architecture
   2.3. Computer hardware
   2.4. Computer software
   2.5. Man-machine interaction; user interfaces
   2.6. Data
   2.7. Computer networks
   2.8. Artificial intelligence
   2.9. Computer applications
3. Organisation; classification; taxonomies; metadata-systems
Marine Information Management Module (September 2008)

1. Library and information science: general
   1.1. Libraries: functions, value, cooperation and resource sharing, needs assessment
   1.2. Libraries as physical places; infrastructure
   1.3. Library personnel
   1.4. Libraries in relation with users
   1.5. Operations of libraries and information centres
       1.5.1. Library systems and information technology in libraries; Digital libraries; Authentication and access management; Evaluating Internet resources and services; Image digitisation; Multilingual access to digital libraries; Pricing in digital libraries; Searching and use of digital libraries; Internet resource directories
       1.5.2. Library administration and management
       1.5.3. Library acquisitions
       1.5.4. Bibliographic analysis and control; cataloguing
       1.5.5. Subject analysis and control; classification
       1.5.6. Reference services and other services to library users
       1.5.7. Circulation services (including document delivery and interlibrary lending)
       1.5.8. Book binding and preservation
       1.5.9. Maintenance of library collections
2 Libraries for specific subjects, including libraries for marine/ocean science
Appendix B: Current List of OceanTeacher Courses

Data Management

- DM101 - Introduction to Ocean Data
  Brown, Reed
- DM102 - Ocean Data Collection Development
  Brown, Reed
- DM103 - Ocean Data Products & Synthesis
  Brown, Reed
- DM104 - Ocean Data Intensive Workshop
  Murray Brown
- DM105 - Ocean Data Management for Young Scientists - DRAFT
  Brown, Hernandez, Cattrijsse
- DM106 - The SIMORC Archive of Met-Ocean Time Series Data
  Murray Brown
- DM200 - OceanTeacher Advanced Training Workshop
  Brown
- DM203N - Geographic Information Systems for Coast & Ocean Management
  Brown
- DM203P - Geographic Information Systems for Coast & Ocean Management
  Reed
- DM204 - Environmental Imagery & Satellite Data Management - DRAFT
  Brown, Reed
- DM205 - Ocean Modeling Data Support - DRAFT
  Brown
- DM206 - Sea Level Data Management and Analysis - PROPOSED
  Brown
- DM207 - MapServer Application for a Marine Atlas - DRAFT
  Reed
- DM208 - Ocean Data Buoys - UNDER CONSTRUCTION
  Brown
- DM209 - Oceanographic Data Quality Control - DRAFT
  Brown
- DM210 - Marine & Coastal Atlases - PROPOSED
  Brown
- DM211 - DM 211: Marine Atlas Development for GIS Professionals
  Murray Brown

Marine Information Management

- MIM101 – Establishing a Marine Information Center: Introductory level
- MIM102 – Establishing a Marine Information Center: Intermediate level
- MIM101 – Establishing a Marine Information Center: Advanced level
- MIM 201 – Establishing a repository Introductory Level
- MIM 202- Establishing a repository Advanced Level

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