Intergovernmental Oceanographic Commission

Annual Report Series 10

Annual Report 2003

Courtesy Kai Degreif

UNESCO

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Contents

Purpose and Role of the Intergovernmental Oceanographic Commission of UNESCO

The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services, and capacity building, in order to learn about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States.

The Commission will collaborate with international organizations concerned with the work of the Commission, and especially with those organizations of the United Nations system which are willing and prepared to contribute to the purpose and functions of the Commission and/or to seek advice and cooperation in the field of ocean and coastal area scientific research, related services, and capacity building.

FROM THE CHAIRMAN

The year 2003 was marked by several important events for oceans within the United Nations, and for the Intergovernmental Oceanographic Commission of UNESCO. Many key developments were established at the IOC Twenty-second Assembly.

During our Twenty-second Assembly (24 June–2 July 2003) we considered and approved the Guidelines for the Transfer of Marine Technology. This is an important contribution from IOC to the implementation of a critical part of the United Nations Convention on the Law of the Sea. In promoting the transfer of marine technology, we are inviting the international community to use IOC as an honest broker between demands for ocean technology and the suppliers or potential suppliers of that technology.

Similarly, through IOC Resolution XXII-6 the Twenty-second Assembly approved the new IOC Data Exchange Policy, which states that "The timely, free and unrestricted international exchange of oceanographic data is essential for the efficient acquisition, integration and use of ocean observations gathered by the countries of the world for a wide variety of purposes including the prediction of weather and climate, the operational forecasting of the marine environment, the preservation of life, the mitigation of human-induced changes in the marine and coastal environment, as well as for the advancement of scientific understanding that makes this possible." This is a key achievement of IOC s Member States in order to pave the way for efficient data exchange procedures in the framework of the Global Ocean Observing System (GOOS).

Furthermore, the Twenty-second IOC Assembly approved the IOC Guidelines for the Establishment of Decentralized Offices. Through these guidelines IOC is adapting its decentralized structure to the new UNESCO policy on regional offices, while maximizing the effectiveness of its activities in the regions.

Substantial progress was also made in 2003 in the coordination of ocean affairs within the United Nations. The mandate to improve Governance of the Ocean, which emerged in the Third Meeting of the Informal Consultative Process (A/57/80) on Oceans and the Law of the Sea, was confirmed by the Resolution A/57/141 from the 2002 UN General Assembly. The High Level Committee for Programmes (HLCP) from the UN followed it up, and as a result the terms of reference of a future UN coordination mechanism for ocean issues has been drawn up. The role that IOC has played in the past working for enhanced collaboration across the UN on ocean issues will gain new momentum through the establishment of the Oceans and Coastal Areas Network (UN-Oceans).

This is the first Annual Report to be issued since my election as IOC Chairman at the Twenty-second Assembly. Together with the new team of Vice-Chairs, and our Executive Secretary, Patricio Bernal, and his dedicated colleagues, I look forward to an important period in the development of governmental commitments to ocean sciences and its applications.

Dr. David Pugh
IOC Chairman

FROM THE EXECUTIVE SECRETARY

Building Momentum

Welcome to the Intergovernmental Oceanographic Commission of UNESCO s 2003 Annual Report. Whereas 2002 was a year of building commitments and setting goals, 2003 has been a year of mobilizing resources for their implementation. During 2002 s World Summit on Sustainable Development (WSSD), we successfully placed ocean issues on the agenda and documented their economic, social, and environmental importance. As a result, governments have now presented us with unprecedented opportunities for advancement. IOC is currently working on seizing those opportunities and translating ideas into action.

The Global Forum on Oceans, Coasts and Islands, created in Johannesburg, South Africa in 2002, organized the second Global Conference on Oceans, Coasts and Islands from 12-14 November 2003 at UNESCO, Paris. A true crossroads for the ocean community, bringing together practitioners and stakeholders, the Conference is becoming the privileged forum for cross-sectoral information sharing and dialogue, addressing the goal of sustainable development of oceans, coasts and islands.

The sustainable development of oceans, coasts, and islands presents a diverse agenda incorporating a series of different constituencies. IOC s mission is to build special "tools" in the form of programmes to support, add value, and complement the numerous initiatives already in place. Our tools work to bring groups together and assist governments to mobilize the knowledge and finances that are essential for building the momentum towards sustainable development. IOC s programmes are designed to fulfill global commitments for cooperation, such as the United Nations Framework Convention on Climate Change (UNFCCC), which was adopted in 1994, and now a decade later, is approaching almost universal membership, with 188 governments, including the European Community, party to the Convention. Building the first phase of the Global Ocean Observing System (GOOS) is answering a specific request from UNFCCC.

In the shadows of the UNFCCC and WSSD, last July the U.S. government hosted the First Earth Observation Summit (EOS). The Washington Declaration, approved by 33 countries and the European Commission, affirms "the need for timely, quality, long-term, global information as a basis for sound decision making. In order to monitor continuously the state of the Earth, to increase understanding of dynamic Earth processes, to enhance prediction of the Earth system, and to further implement our environmental treaty obligations," calling for "a coordinated effort to involve and assist developing countries in improving and sustaining their contributions to observing systems, as well as their access to and effective utilization of observations, data and products, and the related technologies by addressing capacity-building needs related to Earth observations." The Summit launched the Intergovernmental *Ad Hoc* Group on Earth Observations (GEO) to develop a 10-Year Implementation Plan for a Global Earth Observation System of Systems (GEOSS), requiring huge levels of cooperation among nations, and extended an open invitation to all the countries of the world to join in this effort.

Following EOS, last November IOC and a dozen of the world s largest oceanographic institutions and ocean research programmes met in Japan to discuss how to accomplish this global effort. The participants, all members of the non-governmental consortium known as the Partnership for Observation of the Global Oceans (POGO), created and endorsed a "Yokohama Declaration." It commits them to implement a comprehensive system for observing the oceans at the global scale, effective immediately, noting, "this vision is the result of many years of intensive design by a wide range of national agencies and by international bodies sponsored by the Intergovernmental Oceanographic Commission and the World Meteorological Organization."

The IOC of UNESCO, as the focal point of the UN for coordinating Ocean Science and the development of Ocean Services, has been developing the Global Ocean Observing System (GOOS). The first phase of GOOS will be the ocean component of the climate observing system. GOOS will enlarge its current scope to incorporate the continuous monitoring of the chemical and biological environments of the ocean, especially close to the coasts. IOC has help to develop a wide scientific consensus of what the *in situ* and space-based observations

are that are needed to start collecting the information to answer the main questions about climate change and climate variability. After publishing the blueprint for the Coastal GOOS (GOOS Report No. 125), we need now to work towards building a similar consensus for this second phase of GOOS. This will be more difficult because the questions are many and the issues very frequently are dominated by local-scale phenomena. Coastal GOOS will have, by necessity, a strong regional component.

The integrated, sustained character of the system we are building is essential for turning our science and technology inward to look at our own planet. By so doing we shall acquire a wealth of knowledge that can make our interaction with nature more knowledgeable, friendly, and beneficial to humankind.

Patricio A. Bernal
Assistant Director-General,
UNESCO
Executive Secretary, IOC

IOC has many long-standing, loyal friends and I d like to include a special note of welcome and congratulations for a few of them here. First, to the USA, whose return to UNESCO in 2003 after a 19-year absence was much greeted. During that time, we appreciated that it always remained a full and very active member of IOC. Secondly, to our colleagues at the Bermuda Biological Station for Research and the Scripps Institution of Oceanography, celebrating centenary anniversaries this year. Last, but certainly not least, to Dr. David Pugh, IOC s new Chairman, whose guidance will be most valued throughout our many challenges ahead.

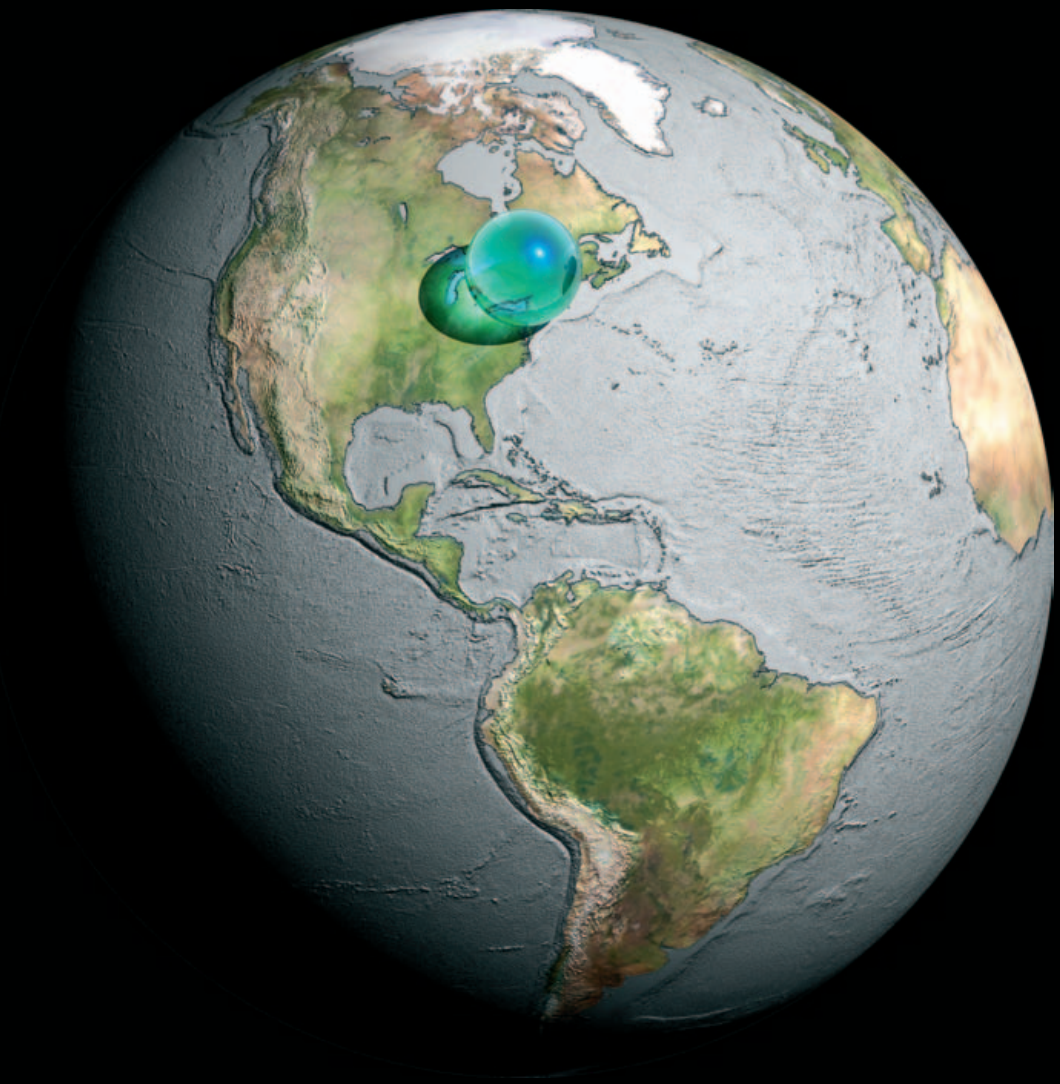
Public awareness

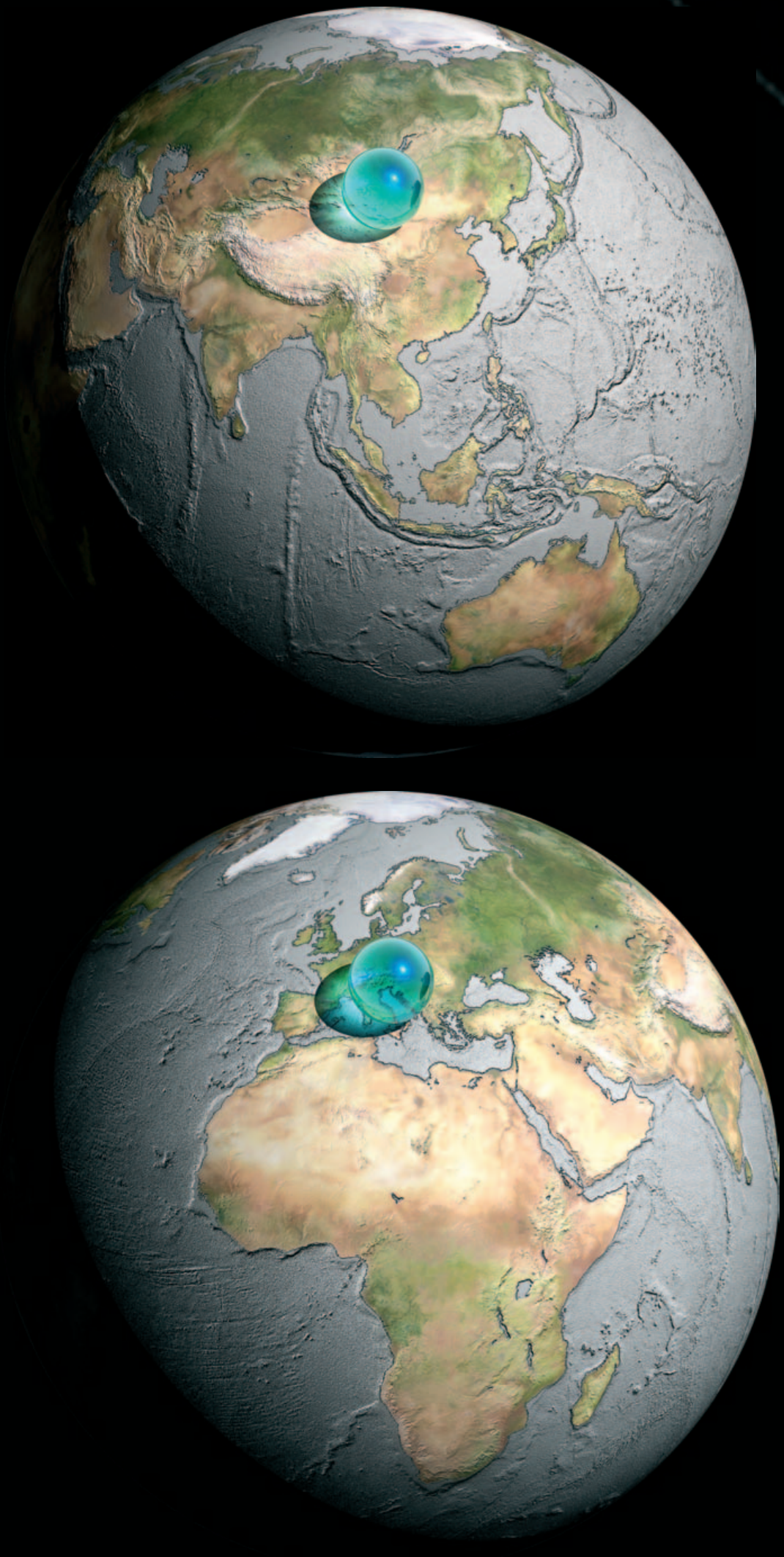
All the Water in the World

All the water in the world (1.4087 billion cubic kilometres of it) including sea water, ice, lakes, rivers, ground water, clouds, etc. (Shown on the same scale as the Earth.)

How much, or how little, water is there in the world? If we collected all the water on Earth together into a ball - all the water in the oceans, all the fresh water in lakes and rivers, all the water in ice, all the water in the Earth s crust, the atmosphere and in soil and plants - the ball would be just 1,390 kilometres across.

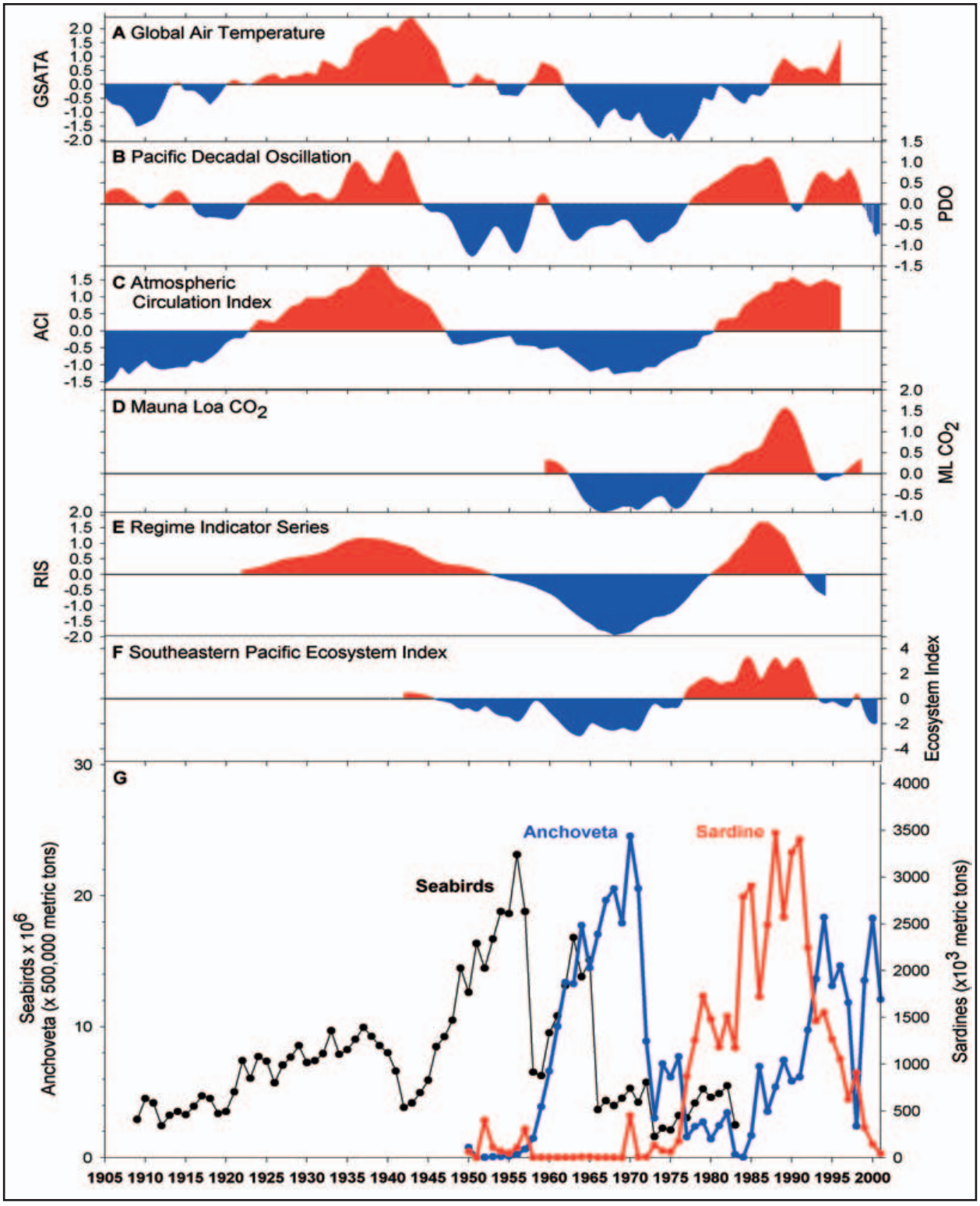
These pictures are surprising because for most of human history we assumed that the oceans were infinite. In fact, if the Earth were the size of a football, the oceans would be just a thin film on it, less than a tenth of a millimetre thick. When we realize how little water there actually is, it s easier to see why understanding and protecting the world s water resources is so important.





An Emerging Synthesis: The Pacific Decadal Oscillation

A basis for monitoring and forecasting: The relation between biology and meteorological and oceanographic parameters in the Pacific Ocean, suggesting control of the biology by the Pacific Decadal Oscillation, resulting in the so-called sardine-anchovy flip-flops.



Reprinted with permission from "From Anchovies to Sardines and Back: Multidecadal Change in the Pacific Ocean" Chavez, F.P. *et al. Science* 299 217-221 Copyright 2003 AAAS

One Hundred Years of Charting the Ocean Floor:

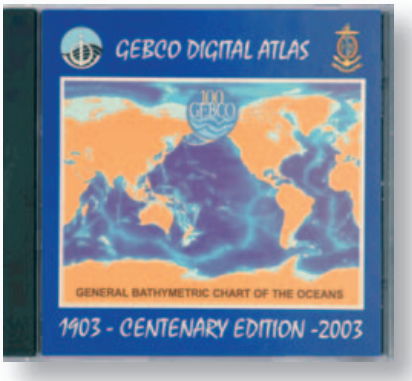
The GEBCO Project 1903-2003

The year 2003 marks the centenary of the founding of the General Bathymetric Chart of the Oceans (GEBCO), a project that was initiated at the turn of the century when a group of geographers and oceanographers, under the leadership of Prince Albert I of Monaco, embarked on the preparation of a global series of charts contouring the sea floor based on a few deep sea soundings taken by lead line. At that time, the chart was written to satisfy simply a legitimate scientific curiosity. The first edition of GEBCO was based largely on listings published by the French and British Hydrographic Offices, the great majority of which came from cable-laying ships searching out the smoothest sea bed routes, together with data obtained from oceanographic cruises and polar expeditions. In 1914, the outbreak of war brought a total halt to the continued publication of the chart. However, once peace returned technology had made enormous progress, and new sounding apparatus and the use of ultrasound revolutionized the field of bathymetry.

Possibly the first man of science to discover that there is a continental shelf that terminates in a steep descent to the abyssal plain was Count Luigi Ferdinando Marsigli who, having studied the surface and sub-surface currents flowing in the Bosphorus, in the years 1706-1707 made an oceanographic study of the Gulf of Lions. The local fishermen, trawling for coral from small boats, were willing to take the Count to sea with his lead and line, thermometer, and water sampler. A few soundings between 100 and 150 fathoms showed him where the slope towards the abyss began. He forecast that the deepest part of a traverse across the abyss, could it be made, would be found in the latitude of Malta, but regretted that, "unless some Prince orders special ships and adequate instruments for the purpose, this will probably never be done." One hundred and sixty years later, Prince Albert of Monaco took up this challenge and pursued it for over 30 years.

Deep-Sea Sounding off Norway, Olaus Magnus

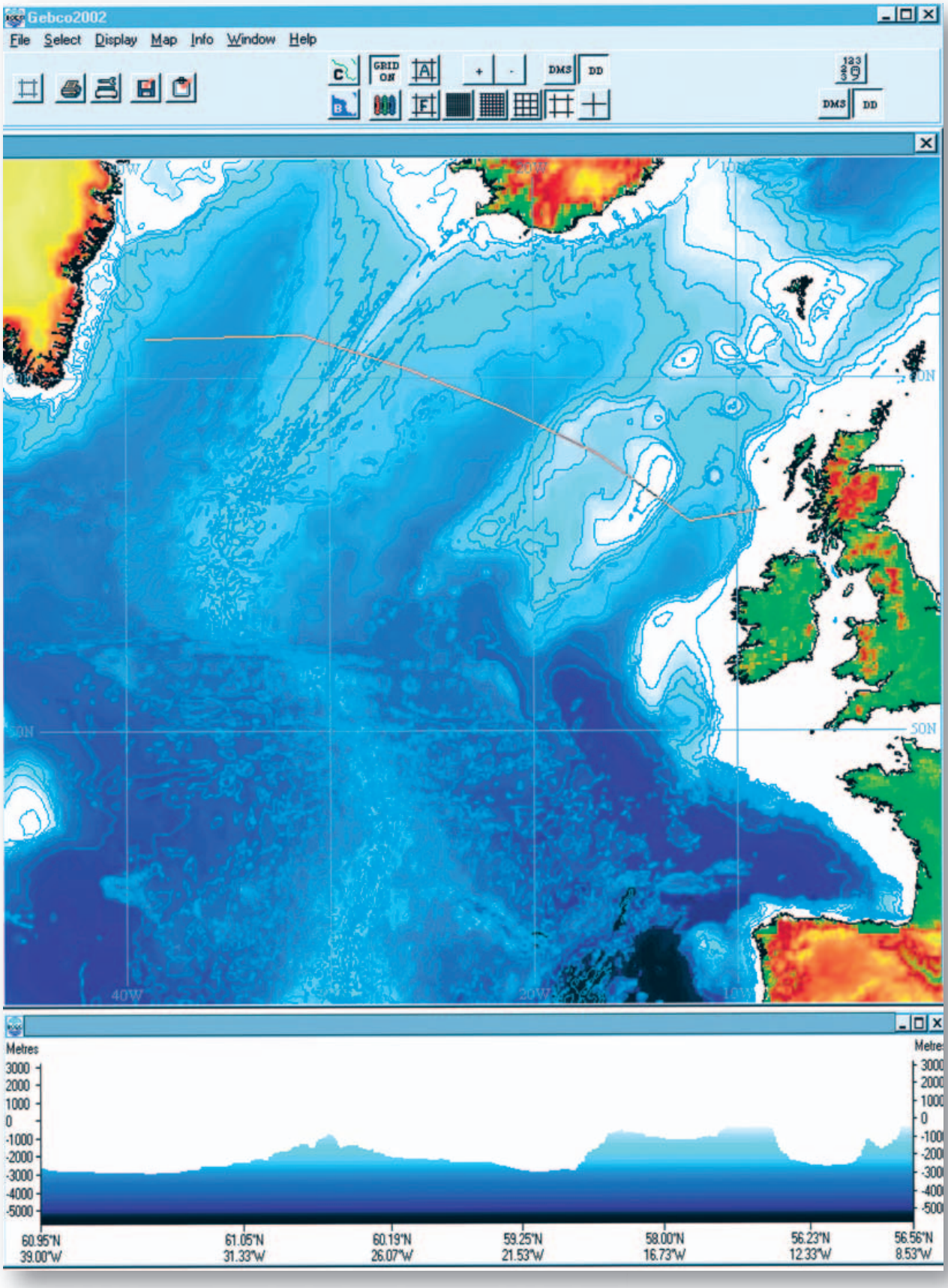
Today, one hundred years later, the GEBCO Digital Atlas (GDA) is currently being used by almost 1,000 organizations in 96 countries. GEBCO has achieved its current status thanks to decades of cooperation by a number of institutions and agencies in Member States of the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the International Hydrographic Organization (IHO).



The Centenary Edition of the GEBCO Digital Atlas publication coincided with the 100th anniversary of the initiation of the GEBCO chart series by Prince Albert I of Monaco. The Centenary Edition of the GDA includes the first release of the GEBCO One Minute Grid, providing bathymetry data on a global grid with a one arc-minute spacing.
Credit: British Oceanographic Data Centre, UK. http://www.ngdc.noaa.gov/mgg/gebco

What is GEBCO?

GEBCO is a joint IHO-IOC mapping project for the world ocean. Surprisingly, the back of the moon and the surfaces of most planets of our solar system are better mapped than the sea floor topography of our own planet. The sea floor is invisible and thus sonar signals must be used to pass through water as the medium and measure the depths of the oceans. Ships can



Computer-based image illustrating the facilities of the Centenary Edition of the GEBCO Digital Atlas (pre-release version using a provisional bathymetric grid.)

only visit the inhospitable polar regions of the Earth safely during the short summer seasons. Thus, large expanses of the northern and southern oceans remain "white spots" and their topography is widely unknown.

What Bathymetric Charts Tell Us

Good management of any area and its resources requires an accurate topographic map and this is GEBCO s mission. The oceans and their floors are potentially exploitable on a larger scale than at present and, especially in the case of renewable resources, further exploitation will require careful regulation based upon knowledge, understanding, and wise management under the legal structure provided by the United Nations Convention on the Law of the Sea. Bathymetric charts at appropriate scales are required for all aspects of mineral exploitation, fisheries, engineering construction, and other operations on or above the sea floor and are key in furthering our understanding of ocean processes, including:

- Ocean models. Bathymetry influences ocean circulation—even relatively small ridges on the sea floor can influence the direction of major ocean currents. When ocean currents pass over rough sea floor, energy is converted from horizontal flow into vertically propagating waves worldwide. Ocean basin morphology is a major controlling parameter of ocean dynamics.
- Deep water circulation, for controlling bottom currents.
- Tides.
- Tsunami forecasting.
- Upwelling and fishing resources (locating banks/seamounts).
- Wave climate, for modeling storm surges.
- Coastal sediment transport.
- Continental shelf morphology.
- Environmental impact baselines.
- Plate motions and structural trends. (During the 1960s the theory of plate tectonics, following on from Wegener s earlier theories of continental drift, was developed based on geophysical evidence gathered mainly from the ocean floors.)
- Industrial needs (e.g., fisheries, oil platforms, pipeline and cable routes, waste disposal, mineral extraction.)
- Social needs, for defining legal borders of the continental shelf. New economic and legal dimensions have resulted in an increased interest in the chart. Thus, Bathymetric science has been encompassed within the rules of the "Law of the Sea" relating to areas in which States exercise their sovereignty and their rights of exploitation of the seas.

"Bathymetric charts are required for all aspects of mineral exploitation, fisheries, engineering construction, and other operations on or above the sea floor and are key in furthering our understanding of ocean processes"

IOC's Role in GEBCO

In 1968 IOC was developing its Long-term and Expanded Programme of Oceanic Exploration and Research (LEPOR) and was asked by the United Nations General Assembly to cooperate in the preparation of "the comprehensive outline of the scope of the long-term programme of oceanographic research." One such research programme proposed was the morphological mapping of the ocean floor, which led to IOC s involvement with IHO in the production of a new (Fifth) Edition of GEBCO. From its foundation IOC s main (non-governmental) Scientific Advisory Body was the Scientific Committee on Oceanic Research (SCOR) of the International Council of Scientific Unions (ICSU). SCOR formed Working Group 41 to determine a rational scheme for the reduction and presentation of sounding data that would constitute a framework in which the international mapping of the sea floor could proceed.

Oceanographers had become increasingly dissatisfied with the existing GEBCO charts for a variety of reasons and several laboratories had already initiated and were maintaining their own bathymetric charts for private research purposes, but these varied greatly and in no way constituted a global set. Although there was a close working collaboration between the hydrographic and oceanographic communities over many years, the scientific input needed to develop a product that could meet the needs of oceanographers did not become available until the IOC was established in 1960 and it was possible to set up a joint project with clear responsibilities identified for the two closely linked but disparate communities. At Working Group 41 s first meeting it was therefore recommended that IOC should attempt to locate data sources and find ways and means of including soundings that had been taken but never presented to IHO, and that IHO should continue its role as the specialized world data center for oceanic soundings. Thus, Working Group 41 provided the impetus for the regeneration of GEBCO and the

The display of a Simrad EM-120 multibeam echo-sounder.
Courtesy of the NOAA Central Library, USA

IOC/IHO Guiding Committee for GEBCO was formed to develop new chart specifications.

The preparation of the Fifth Edition of GEBCO was a collaborative effort, with the IHO responsible for coordinating the efforts of the Hydrographic Offices in its Member States and the IOC responsible for attracting eminent marine geologists and geophysicists to cooperate with each other in the work of GEBCO. A joint IOC-IHO Guiding Committee composed of ten members, five from each sponsoring body, provided supervision of the project. Amongst the IOC members were representatives of the Scientific Committee on Oceanic Research (SCOR), the Commission for Marine Geology (CMG) of IUGS and the International Association for the Physical Sciences of the Ocean (IAPSO). Originally published in chart form, GEBCO is now maintained at the British Oceanographic Data Centre (BODC) in the form of a CD-ROM digital atlas.

The IOC-IHO GEBCO digital database is also recognized as the worldwide approved standard for guiding principles on nomenclature and terminology of submarine topographical features. This continues the work of the first session of the Berlin Congress on oceanology in 1899, which established a unified naming system to regulate the common practice of explorers assigning names in a whimsical, anarchical fashion to the banks, depressions, and sills they discovered.

The Changing Functions of Sea Surveys

For hundreds of years hydrographers have conducted bathymetric surveys on which to base the compilation of nautical charts and publications. These surveys were composite surveys in that consideration was also given to geographical and geological features, climatic and weather conditions, and in fact anything that could impact on the safety of navigation of vessels. This service changed as technology changed and today the most sophisticated surveying, positioning and compiling systems are available to hydrographers. As a result, their role has changed to the degree that they have data that can be put to a multitude of uses. While bathymetry is still the primary basis of nautical charting in all its forms, the coming into force of the United Nations Convention on the Law of the Sea (1982) has highlighted the importance of bathymetry to the many conditions and provisions contained in the Articles of this Convention.

Future Challenges

During the presentation of the First Edition of GEBCO to the Paris Academy of Sciences in 1904, Professor Julien Thoulet remarked, “we must proceed to fill in the details; no point of any sea on the globe will escape our investigations.” Today, the mapping of the world s oceans will continue well into the foreseeable future. Upcoming requirements for these surveys will be more rigorous as oil and gas development goes into water depths exceeding 2,000 meters and as telecommunications cables must be buried in deeper water. There is a growing need for improved knowledge of the bathymetry of the world s oceans, particularly amongst modelers studying the role of the oceans in the global climate system, and both bathymetry and sea floor topography have been recognized as essential components for the Global Ocean Observing System (GOOS).

Swath mapping systems and improved navigation by Global Positioning Systems have resulted in spectacular increases in the rate of sea floor area coverage. Satellite altimetry missions provide valuable insights into the nature of the topography in uncharted waters or where bathymetric data are sparse. Much work, however, still needs to be done to maximize the submission of data and to ensure a routine flow of data from all quarters of the globe. National commitments are required to ensure the searching out and delivery of data. The task of GEBCO is to ride this growing wave of data, capability, and technology to continue producing the authoritative portrayal of the 70 percent of Earth s surface beneath the seas. ■

Extracts and References from:

Carpine-Lancre, *et al. The History of GEBCO 1903-2003* (2003) GITC bv, Lemmer, The Netherlands

GEBCO Web site: <http://www.ngdc.noaa.gov/mgg/gebco>

British Oceanographic Data Centre Web site: <http://www.bodc.ac.uk/gebco>

A Way Forward

Oceans comprise 72 percent of the Earth. Over 50 percent of the world s population lives in coastal regions, and 43 of the world s nations are small island developing States, which are especially dependent on the oceans. The Global Forum mobilizes the implementation of the commitments made at the World Summit on Sustainable Development by forming alliances and outlining specific processes leading to improving the global, regional, and national policies of the oceans agenda.

Last November the Global Forum organized a conference at IOC. Speaking as Co-Chair, Dr. Patricio Bernal, IOC s Executive Secretary, referred to the success of the World Summit on Sustainable Development and said, “The challenge now is to translate ideas into action. We have started many things, but we need tools that everyone can recognize, use, and contribute to. The Global Forum is a way forward.”

Photo courtesy IISD/Leila Mead

Patricio Bernal, Executive Secretary, Intergovernmental Oceanographic Commission, said the Conference was an open platform bringing together a wide range of stakeholders committed to ocean, coast and island issues, and expressed hope that participants would further support and add value to implementing relevant targets agreed upon at the WSSD.

Global Conference on Oceans, Coasts and Islands, 2003

Mobilizing for Implementation of the Commitments Made at the 2002 World Summit on Sustainable Development (WSSD)

The Global Conference on Oceans, Coasts and Islands was convened 12-14 November 2003 at the Intergovernmental Oceanographic Commission of UNESCO in Paris, France. The Conference was organized by the Global Forum on Oceans, Coasts, and Islands, which was created by an informal WSSD coordinating group in Johannesburg, South Africa, in 2002. Comprised of individuals from governments, intergovernmental organizations (IGOs) and non-governmental organizations (NGOs), the Global Forum serves as a platform for cross-sectoral information sharing and dialogue on issues affecting oceans, coasts and islands, with the goal of attaining sustainable development in these areas.

Photo courtesy IISD/Leila Mead

UNESCO Headquarters, Paris, France

The Conference involved 223 participants from 48 countries, representing intergovernmental organizations (33%), government organizations (20%), academic and research institutions (22%), non-government organizations (16%), and private sector organizations and individuals (9%). The Conference was co-chaired by Biliana Cicin-Sain, Director of the University of Delaware Center for Marine Policy, Patricio Bernal, Executive Secretary IOC, and Veerle Vanderweerd, UNEP-GPA Director.

At WSSD, Government delegates negotiated and agreed on an action plan for oceans, coasts, and islands, with quite specific targets and timetables for action. Major examples include applying the ecosystem approach to marine areas by 2010 and establishing networks of marine protected areas by 2012. Important targets were also established on issues related to small island developing States (e.g., developing community-based initiatives in sustainable tourism by 2004); on fisheries issues (e.g., managing fishery capacity by 2005 and controlling illegal fish-

ing by 2004); and in other ocean-related areas as well. The targets and timetables found in the WSSD Plan of Implementation represent an important advance because they have enshrined, as global imperatives by the world s political leaders, many of the goals previously posited by expert groups and specialized agencies. There is now a global consensus reached at the highest political levels that there is an urgent need to take specific action to achieve sustainable development of oceans, coasts, and of small island developing States.

The WSSD targets and timetables, however, are not "self-implementing." Instead, governments around the world will need much assistance and support from all parts of the oceans, coasts, and islands community to operationalize what needs to be done, to mobilize the requisite knowledge and financial resources, and to maintain the high-level political support essential to achieve the sorely needed "on-the-ground" improvements in the health and condition of marine ecosystems and in the well-being of coastal communities.

The Global Conference was therefore convened with the major purposes of reviewing what has been done to date in implementing the WSSD commitments, and to catalyze action on WSSD implementation through collaboration among governments, international organizations, non-governmental organizations, and the private sector. The conference focused as well on approaches to mobilizing public and private sector support for the global oceans agenda, and on the identification of emerging ocean issues. Prior to the Conference, various working group meetings took place 10-11 November with a view to providing substantial inputs to the Plenary Sessions of the Conference on issues such as Sustainable Fisheries, Small Island Developing States (SIDS), Marine Protected Areas and Biodiversity, National Ocean Policies, and Integrated Coastal Area Management.

One of the specific tasks of the Conference was also to highlight the importance of sustaining marine and coastal resources for SIDS Member States, especially in view of the preparation for the 2004 International Conference on Small Island Developing States (Barbados+10) to be held in Mauritius in January 2005. Several recommendations of the Conference were discussed at the SIDS interregional preparatory meeting held in Nassau, Bahamas, in January 2003.

Amongst the various recommendations reached by participants, the following should be highlighted:

Participants reaffirmed the need to fulfill global integrated coastal zone management (ICM) targets formulated in preparation for the WSSD. They also noted the importance of institutional capacity and financial resources for ICM, and ICM s role in achieving poverty alleviation.

Discussions concluded that the large marine ecosystem (LME) approach provides a platform for focused assessments and monitoring efforts in support of management aimed at the long-term productivity of marine habitats and sustainable utilization of marine resources.

On national oceans policy, participants stressed the need to: incorporate integrated management planning within national policies; develop

"There is now a global consensus reached at the highest political levels that there is an urgent need to take specific action to achieve sustainable development of oceans, coasts, and of small island developing States."

Discussion on Small Island Developing States, Biodiversity Protection and Marine Protected Areas.
Photo courtesy IISD/Leila Mead.

legislative guidelines from strengthening national legal regimes; create networks of ocean policy practitioners; and develop a global oceans policy.

On building public support, participants proposed: organizing a network of communicators and educators to implement concrete action plans for oceans, coasts and islands; mobilizing educational organizations to reach large audiences; mobilizing all stakeholders on World Ocean Day and other events; and seeking funds to design international education activities and campaigns.

On capacity building, participants noted the need for: a critical mass of ICM managers and professionals; enhanced ICM capacity building at the national level; and a focus on capacity utilization and enhancement.

On the Sustainable Development Partnership adopted at WSSD, the importance of involving high-level political actors for identifying priorities and mobilizing funding support for partnerships was highlighted, keeping in mind that partnerships can provide an opportunity to apply the ecosystem approach to meet the 2010 WSSD target. The group also highlighted linking freshwater and coastal and marine water partnerships based on the ecosystem approach as a priority.

On Fisheries, recommendations included the need to: identify and eliminate harmful subsidies; develop equitable eco-labeling systems; enhance public awareness about sustainable fisheries; increase bilateral and international cooperation on highly migratory fisheries and shared stocks; develop national ocean policy with integrated fisheries policies within Exclusive Economic Zones (EEZ); and implement an ecosystem approach to fisheries management.

On marine biodiversity, marine protected areas (MPAs), and coral reefs, recommendations included: urging countries and organizations to adopt integrated approaches to reverse the decline of coral reef biodiversity through the development of MPA networks and long-term sustainable funding mechanisms; identifying existing transboundary tools for addressing biodiversity conservation and MPA network goals; working with stakeholders to promote the development of environmentally friendly technologies; and promoting dialogue between sustainable fisheries and biodiversity communities.

Finally, on United Nations coordination, the Conference stressed the importance of effective coordination between UN agencies, secretariats and relevant multilateral environmental agreements (MEAs), and with bilateral and multilateral financial organizations. The group also highlighted the creation of an Ocean Coastal Areas Network created by the UN.

The main output of the Conference is the Co-Chair report, which highlights the major recommendations reached by the participants, the vision for moving forward with WSSD implementation, as well as ministerial statements that were delivered by various Ministers of Environment and Marine Affairs, high-level personalities, and Ambassadors. The results of the Conference have been forwarded to various UN and NGO fora, including the Commission on Sustainable Development, the UN Open-ended Informal Consultative Process on Ocean Affairs, and various SIDS consultation meetings.

More information, including conference products, can be found at:

<http://www.globaloceans.org/global-conference/>. ■

Policy

Working Towards Sustainable Development

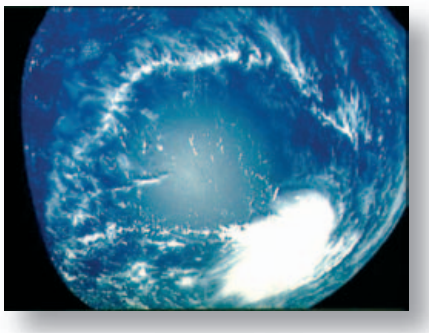
Two years ago, nations came together at the World Summit on Sustainable Development to begin to craft a promise. Last summer, the promise began to take shape at the Earth Observation Summit. Understanding that what happens in one region can affect climate, health, safety, and welfare on the other side of the world, regardless of politics or geography, an *Ad Hoc* Group on Earth Observations (GEO) was formed to develop a plan for a giant sustained global network of Earth monitoring instruments. These observations will provide insights into every aspect of how our Planet functions, from the bottom of the oceans to the top of the atmosphere, and thereby tell us how to aid its recovery and what must be done to protect its future.

Boram Lee, Programme Specialist in the GOOS Project Office, is IOC s representative serving on the GEO Secretariat. Working with subgroups and experts worldwide, Ms. Lee is part of the team charged with developing a comprehensive report that will form the basis of GEO s 10-Year Implementation Plan. Here she describes the GEO process, and IOC s contribution to the Plan's proposed Global Earth Observation System of Systems (GEOSS), a System designed to benefit all nations alike, and fulfill a vital promise.

Achieving Comprehensive, Coordinated, and Sustained Earth Observations:

The *Ad Hoc* Group on Earth Observations (GEO)

Understanding the Earth system—its weather, climate, oceans, land, geology, natural resources, ecosystems, and natural and human-induced hazards—is crucial to enhancing human safety and welfare, alleviating human suffering including poverty, protecting the global environment and achieving sustainable development. Data collected and information created from Earth observations constitute critical input for advancing this understanding. In



Earth observation of a storm system over the Pacific Ocean. *Credit: NASA*

2003, a consensus emerged among governments and international organizations that, while supporting and developing existing Earth observation systems, more can and must be done to strengthen global cooperation and Earth observations.

The first Earth Observation Summit (EOS) was organized by the Government of the United States in Washington, D.C., 30 July–2 August 2003, "to promote the development of a comprehensive, coordinated, and sustained Earth observation system or systems among governments and the international community to understand and address global environmental and economic challenges." The Summit launched "a process to develop a conceptual framework and implementation plan for building this comprehensive, coordinated, and sustained Earth observation system or systems."

The Summit called for an international effort to move towards a comprehensive, coordinated and sustained Global Earth Observation

System of Systems (GEOSS). This initiative is pursuing not only socio-economic benefits but also improvement of the understanding of the Earth system, providing support in aid of decision-making processes and sustainable development:

- Improved understanding of the Earth system—increasing our ability to model the Earth s atmosphere, land, and ocean processes on regional and global scales with steadily improving reliability;
- Reducing disaster loss—by more effectively integrating *in situ* information with observations from space and the associated model predictions of hurricanes, earthquakes, and other disaster events, disaster experts can improve all aspects of hazards and disaster management: preparedness, response, recovery, and mitigation; and
- Supporting sustainable development—improved Earth observations will enhance sustainable development decision-making through better understanding of ecological processes, enhanced efficiency of resource utilization, and systematic assessments of current conditions and future prospects.

This process is to develop a conceptual framework and implementation plan, with the ministerial level of support. The intergovernmental *Ad Hoc* Group on Earth Observations (GEO) was launched for the above goal, co-chaired by the United States, the European Commission, Japan, and South Africa, and joined by 43 governments, the European Commission, and 26 international organizations (as of 27 February 2004). The GEO had been working by five subgroups (User Requirement and Outreach, Architecture, Data Utilization, Capacity Building, and International Cooperation) as well as a secretariat to prepare a Framework Document for policy-makers and the GEO Report, in time for the Second Earth Observation Summit (EOS II) in April 2004 in Tokyo. This Framework Document marks a crucial step in developing the 10-Year Implementation Plan for the creation of comprehensive, coordinated, and sustained Earth observation system or systems as envisioned by the Washington Declaration adopted at the Earth Observation Summit of 2003. The results of the GEO effort are supposed to be reported by member governments to the next G-8 meeting, to be held in the United States.

"Ocean monitoring, modeling and forecasting through the Global Ocean Observing System (GOOS) is recognized as an important work and guidance for future action."

The current less-advanced status in the areas of land, water, climate, ice, and ocean observation is well noted. Nevertheless, ocean monitoring, modeling and forecasting through the Global Ocean Observing System (GOOS) is recognized as an important work and guidance for future action. Being aware of existing observing systems, such as GOOS, as key components of GEOSS, the Intergovernmental Oceanographic Commission (IOC) of UNESCO has been active in the GEO process. IOC and related ocean communities have provided considerable efforts and input to GEO, not only through Subgroups and the Secretariat but also through technical comments for the GEO report and Framework Document. IOC has also provided encouragement to all Member States to join in the EOS/GEO process so as to insure that the oceanographic component is both comprehensive and global, by influencing the Framework Document and associated reports.

GEO is preparing the 10-Year Implementation Plan for the creation of GEOSS, taking into account existing activities and building on existing systems and initiatives by the Task Team established at EOS II (April 2004, Tokyo, Japan). The Plan will be submitted at EOS III, which will be hosted by the European Union in February 2005. GEOSS will be:

- Comprehensive, by including observations and products gathered from all components required to serve the needs of participating members;
- Coordinated, in terms of leveraging resources of individual contributing members to accomplish this system, whose total capacity is greater than the sum of its parts;
- Sustained, by the collective and individual will and capacity of participating members.

It is essential that member governments be alerted to the requirement that this GEO Implementation Plan recognizes and includes, *inter alia*, the implementation plans in oceanographic fields. For 2005 and beyond, carrying out the 10-Year Implementation Plan will require a ministerial-guided successor mechanism with maximum flexibility, which will provide in general for the coordination and planning of GEOSS implementation and its facilitation. ■

Monitoring our Planet's Vital Signs: The Earth Observation Summit

Washington, D.C., 30 July-2 August 2003

Image provided by NOAA

From Johannesburg to Washington, D.C. – Continuing the WSSD Initiatives

Inspired by 2002 s World Summit on Sustainable Development (WSSD), representatives of 35 countries and 22 multilateral organizations met at the Earth Observation Summit (EOS) last summer to start examining an integrated system to monitor the weather, oceans, land use, and climate change. "Last September, at the World Summit on Sustainable Development in Johannesburg, South Africa," U.S. Secretary of State Colin Powell said, "governmental and non-governmental representatives all agreed that wise economic management, investment in people, and care for the environment are inextricably linked. They are essential elements for successful development."

Recognizing that developmental challenges require strong international collaboration based on sound science, the Summit discussed creating a global partnership to establish a system for sharing Earth observation information in order to understand and address global environmental and economic issues. EOS built on the political will and strong public-private voluntary initiatives that were generated at last year s WSSD. Delegates agreed that more can and must be done to strengthen global cooperation and Earth observations.

Summit Results

Delegates at the Summit concurred that many environmental issues are too big for individual governments to tackle, and that partnerships between politicians, scientists and the private sector are essential to improve the environment. A Declaration was therefore adopted to:

"Affirm the need for timely, quality, long-term, global information as a basis for sound decision making. In order to monitor continuously the state of the Earth, to increase understanding of dynamic Earth processes, to enhance prediction of the Earth system, and to further implement our environmental treaty obligations, we recognize the need to support:

1. Improved coordination of strategies and systems for observations of the Earth;
2. A coordinated effort to involve and assist developing countries in improving and sustaining their contributions to observing systems;
3. The exchange of observations recorded from *in situ*, aircraft, and satellite networks;
4. Preparation of a 10-year Implementation Plan."

The Declaration represents a fundamental step in addressing the 2002 WSSD Plan of Implementation calling for strengthened cooperation and coordination among global observing systems and research programmes for integrated global observations.

An *Ad Hoc* Working Group, the Group on Earth Observations (GEO), was established to recommend a mechanism to identify, document, and prioritize actions to be taken to address user requirements for current and future Earth observations. Their resulting Framework Document marks a crucial step in developing the 10-year Implementation Plan, as envisioned by the EOS Declaration.

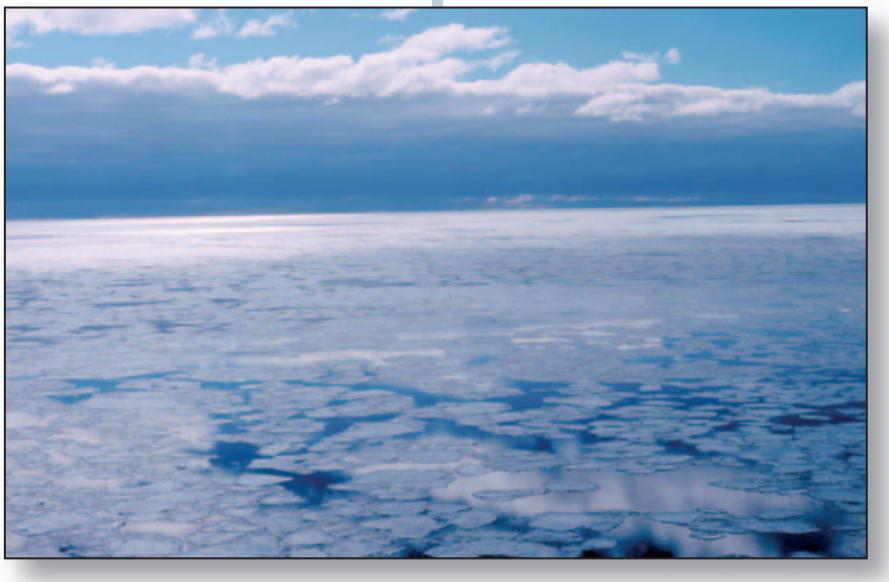
The 10-year Implementation Plan for Earth Observations (2005-2014)

The proposed Implementation Plan contained in the GEO Framework Document represents a 10-year commitment that will see the project gradually expand from the West into developing countries. Data from sensors on the ground, in the ocean, and in space will be shared, and

aid will increase for developing countries to make better use of environmental sensors. The Plan will be presented for approval at the third Earth Observation Summit, to be held in Europe in 2005.

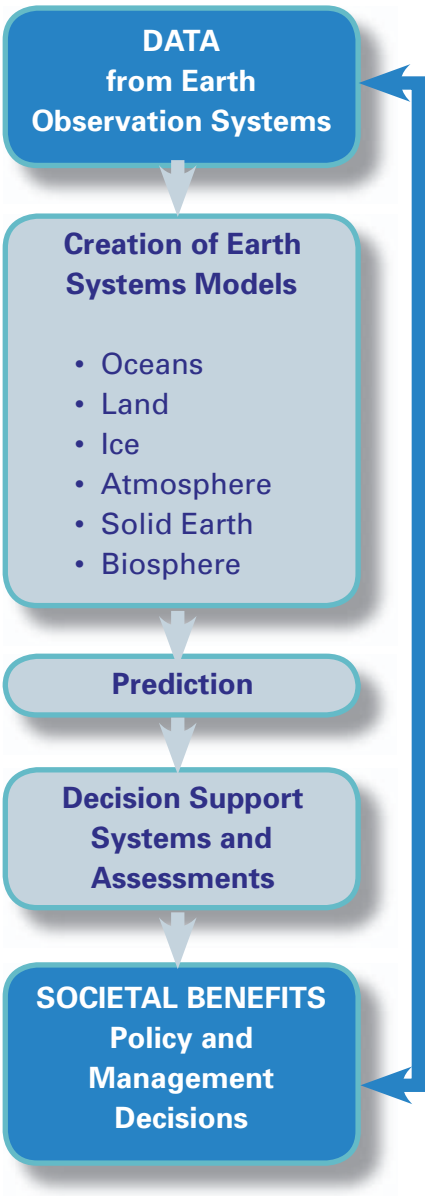
The Global Earth Observation System of Systems (GEOSS)

Many international organizations and programmes are currently working to sustain and improve the coordination of Earth observations, including the Intergovernmental Oceanographic Commission of UNESCO. "We urgently need to turn our science and technology inward to look at our own planet," Patricio Bernal, IOC s Executive Secretary, advised, during his Summit address. "By so doing we shall acquire a wealth of knowledge that can make our interaction with nature more knowledgeable, friendly, and beneficial to humankind. The integrated character of the system we are building is essential. We need to integrate across the land, the ocean, and the atmosphere."



Rising global temperature is melting polar ice, causing an increase in sea level.
Courtesy: NOAA

Diagram showing the function and benefits of the proposed GEOSS



The Global Earth Observation System of Systems, or GEOSS, will gather and collate environmental data from a network of instruments presently recording Earth s vital signs, and turn that network into a powerful global tool for understanding and managing our influence on Earth and its ecosystems. The data collected from such an Earth observation network will be used to measure progress and yield new insights into how ecosystems work and allow, through the use of modeling, some means of "testing" fresh ideas for sustainable development approaches before they are implemented.

The central goal of GEOSS is to provide decision makers and a broad range of communities (including the commercial sector, scientific community, education community and the general public) with more accurate and timely information about the Earth environment in order to help them respond to a multitude of societal needs.

The Benefits of GEOSS

The two main drivers in the development of GEOSS are: firstly, to obtain knowledge about the natural systems that make life possible on Earth; and secondly, to improve the performance of all the human activities that impact its natural systems.

The data obtained is invaluable. It is used to estimate and better crop yields, monitor water and air quality, improve airline safety, enhance weather forecasts and provide a clearer view of the causes and risks of global warming. Our ability to predict, monitor, and respond to natural and technological hazards is a key factor in reducing the occurrence and severity of disasters, and relies heavily on the use of information from well-designed and integrated Earth observations. Improved monitoring of natural hazards (such as earthquakes, algal blooms, tsunamis, floods, wildfires, and extreme weather events) and technological hazards (such as oil spills, nuclear and chemical accidents, and conflicts) and a means of providing early warnings are critical for

preventing hazards from becoming disasters. Such hazards can have a disproportionate impact on developing countries, where they are major barriers to sustainable development. The resulting increased awareness will then drive better policy development, nationally and globally, and foster international assistance where needed.

Scientifically, we still know little about some 70 percent of the planet s surface: the oceans. Measurements of ocean conditions can yield insights into atmospheric and ocean circulation patterns that can affect climate. Biological sensors on buoys or on underwater vehicles could yield insights into how plankton take up nutrients and carbon dioxide, which also bear on climate-change issues. The Earth Observation Summit s organizers estimated that better forecasting of the global weather phenomenon known as El Niño is already saving farmers at least $450 million to $550 million a year. Ocean observations will be a major component of GEOSS.

IOC's role in a Global Earth Observation System

IOC is part of the international initiative because it contributes a key component to GEOSS: the Global Ocean Observing System (GOOS). "The IOC of UNESCO, as the focal point of the UN for coordinating Ocean Science and the development of Ocean Services, has been engaged in the development of GOOS," Patricio Bernal explains. "The part of GOOS dealing with the physics of the ocean is the ocean component of the climate observing system that is responding to the call made by the United Nations Framework on Climate Change. We have help to develop a wide scientific consensus of what the *in situ* and space-based observations are that are needed to start collecting the information to answer the main questions about climate change and climate variability. GOOS will enlarge its current scope focused mainly on the dynamics of the ocean, to incorporate next the continuous monitoring of the chemical and biological environments of the ocean, especially close to the coasts." GOOS capacity building, like the GOOS programme itself, is an ongoing developing process and experiences to date support the strategy of building on existing strengths and networking at national and regional levels.

"Whether we are talking about geophysics or geopolitics, our 21st century world is profoundly interconnected."
U.S. Secretary of State Colin Powell

Capacity building efforts at the IOC

Capacity building addresses human and institutional capabilities to contribute to, and make effective use of, Earth observation data and information at local, national, regional, and global levels, including facilitating an effective networking among partners and stakeholders in GEOSS.

IOC programmes provide computer hardware and management training and support for new and established oceanographic data centers.
Credit: Dominique Roger, UNESCO

For such a system to be a truly international effort the data must be available to everyone and there must be some mechanism for less-developed countries to make use of the information. IOC s programmes have been evolving in response to the needs of Member States, with capacity building activities being the Commission s crosscutting theme almost since its inception 40 years ago.

Capacity building at the IOC is most prominent through its Training Education and Mutual Assistance (TEMA) programme, which ensures that the process is linked to existing and planned national and regional programmes, thereby enhancing the success rate of capacity building activities. TEMA activities are focused within the IOC s Main Lines of Action - Ocean Sciences, Ocean Services, and Information and Data Exchange. Presently the Harmful Algal Bloom and coral reef training activities, the GOOS spectrum of activities, and the Ocean Data and Information Networks (ODINAFRICA, ODINCARSA, and ODINCARIBE that have been providing computer hardware and management training and support for new and established oceanographic data centers in these regions) are amongst the Commission s most visible efforts. Educational efforts are focused through three streams: UNESCO-IOC University Chairs supported in different regions; travel grants for marine scientists to attend conferences, workshops and symposia; and an extremely effective at-sea Training Through Research programme. Some of the above activities have been largely IOC efforts, whilst others have been with Partners of the IOC. Some programmes have follow-ups and mentoring through

distance learning programs, whilst others are intensive hands-on workshops at a professional level.

A Truly Global Network

In the past decade or two, technology has advanced to a point where a truly global network is now possible. However, as the GEO Framework Document points out, "Human knowledge of the Earth system, although advanced in certain areas, is far from complete. Current efforts to observe and understand the Earth system must progress from the separate observation systems and programmes of today to coordinated, timely, quality, long-term, global information developed in accordance with compatible standards as a basis for future sound decisions and actions."

Sustainable development knows no political boundaries. "Whether we are talking about geophysics or geopolitics, our 21st century world is profoundly interconnected," U.S. Secretary of State Colin Powell explained at the Summit, "science and technology must inform, and increasingly inform and support, good decision-making by political leaders, corporate executives, and civic-minded nations and citizens." ■

Mandate of the Intergovernmental Oceanographic Commission of UNESCO

At the Thirty-first General Conference of UNESCO, the Director-General was authorized to apply the following action plans, in order to pursue four main objectives:

I. Improve scientific knowledge and the understanding of ocean and coastal processes with a view to assisting UNESCO Member States in the design and implementation of sustainable policies for the ocean and coastal zones, through the organization and coordination of major scientific programmes, responding to the mandate of UNCLOS, UNCED/Agenda 21 and the Global Conventions of Climate Change and Biodiversity and regional conventions, and by reinforcing the capacity of developing countries particularly by targeting sub-Saharan Africa in the framework of the African Process and programmes in the development of scientific mechanisms for an ecosystem approach.

II. Organize the collection of ocean and coastal observations, the modeling and the production of forecasts needed for the management and sustainable development of the open and coastal ocean. To be achieved by implementing the Global Ocean Observing System (GOOS) and its related pilot projects and regional components, and by increasing the capacities, participation, and full involvement of developing countries.

III. Further develop the International Oceanographic Data and Information Exchange (IODE) system. New national oceanographic data and information exchange facilities should be established, along with the creation of needed capacities, particularly in developing countries. Current ocean data and information should be made accessible to a wide community of users (in accordance with the existing UN Conventions and UNESCO's approach on data and information.)

IV. Intensify the follow-up to the Pan African Conference on Sustainable Integrated Coastal Management (PACSICOM, Mozambique, July 1998), a major conference that addressed several environmental and development problems facing Africa's coastal regions, organized jointly by UNESCO, the governments of Mozambique and Finland, and the United Nations Environment Programme (UNEP).

Global Results and Achievements in 2003

The promotion of international cooperation and coordination of programmes in research, services, and capacity building in order to learn more about the nature and resources of the ocean and coastal areas.

In December 2003, IOC signed a Memorandum of Understanding with the Minister of the Environment of Kenya, who is responsible for hosting the Coastal and Marine Unit of the New Partnership for Africa's Development (NEPAD) Environment Initiative (COSMAR/NEPAD). IOC will provide technical and financial support to COSMAR/NEPAD with a view to developing an operational communications strategy and information-sharing tools in order for COSMAR to act as a clearing house mechanism for African countries in need of technical assistance for the preparation and execution of coastal and marine projects.

Following the endorsement of the African Process for the Development and Protection of the Marine and Coastal Environment in Sub-Saharan Africa at the World Summit on Sustainable Development in September 2002, and its subsequent integration into the Environmental Initiatives of NEPAD, IOC has continued to develop the project proposal on the Regional Ocean Observing and Forecasting Systems for Africa (ROOFS-AFRICA). This proposal represents the implementation of the Global Ocean Observing System at the regional level in Africa, and the project on Shoreline Protection and Management, aimed to provide science-based strategies and policies for protecting coastal habitats from the impacts of coastal erosion and climate change in North Western Africa (Cape Verde, Gambia, Guinea Bissau, Mauritania, and Senegal).

Applied new knowledge for the improvement of management, sustainable development, and protection of the marine environment, and the decision-making processes of Member States of IOC.

The Earth Observation Summit (EOS), held in Washington, D.C., 30 July-2 August 2003, was organized by the government of the United States of America to "promote the development of a comprehensive, coordinated, and sustained Earth observation system or systems among governments and the international community to understand and address global environmental and economic challenges." The inaugural meeting of an *Ad Hoc* Group on Earth Observations (GEO) followed the Summit. GEO's first meeting set in place the necessary follow-up machinery with a view to preparing a Framework Document in time for a Ministerial Conference on Earth Observations to be held 25 April 2004 in Tokyo, Japan, and a complete plan in time for a further Ministerial Conference to be hosted by the European Union in February 2005. IOC has been fully engaged in the process, co-chairing the International Cooperation Subgroup of GEO with representatives of Australia and the USA. The GEO initiative should be seen as a promissory international forum ready to help developing countries to build capacities to use observation systems for the integrated management of their environment, provided that the participation of developing countries grows up as the process develops.

IOC Programme Sections

Credit: NOAA

An Overview of the Year 2003 in IOC's

Ocean Science Programmes

By Umit Unluata, Head of Section

Oceans and Climate

The Intergovernmental Oceanographic Commission of UNESCO s oceans and climate programmes focus on reducing scientific uncertainty about the ocean s role in climate change and on the effects of climate change on ocean processes and resources. The oceans and climate programmes serve as the liaison between IOC activities and other climate-related intergovernmental organizations and conventions such as the UN Framework Convention on Climate Change, the World Summit on Sustainable Development, and the Intergovernmental Panel on Climate Change. These conventions specifically call on the IOC to develop a global network of systematic climate observations and research on the ocean s role in climate change and the ocean s role as a sink for atmospheric carbon dioxide. The IOC also serves as the focal point for UNESCO on issues of the oceans and climate, and works with the administration and other UNESCO sectors in carrying out the organization s mission. Because climate is a global issue with local resources at risk, it is critical to engage scientists from all countries in the dialogue and research on climate change, impacts, adaptations, and mitigation. The oceans and climate programmes support a number of programmes designed to bring together scientists and students from developing countries with those of developed countries to build collaborations and increase scientific exchange. ■

Programmes Sponsored by the IOC in Oceans and Climate, 2003

The World Climate Change Conference was held in Moscow, 29 September-3 October 2003. More than 2,000 participants from over 100 countries attended this international science conference. The IOC co-sponsored this conference, served on the international organizing committee, and provided financial support for three ocean experts from developing countries to present their work at the conference. The goal was to have a comprehensive discussion of the climate

A special post stamp was issued in Russia to commemorate the World Climate Change Conference.

problem including: understanding natural and anthropogenic factors driving the climate; approaches for reducing anthropogenic emissions; impacts and adaptation measures for ongoing climate changes; and ways to achieve a maximum mutual understanding between scientists, governments, business circles, and the general public. The conference was opened by the President of the Russian Federation, Vladimir Putin, and opening addresses were provided by senior representatives of a number of United Nations organizations and ministers from France and Norway. The conference achieved its goal of presenting many new scientific findings and generating a lively dialogue between all participants. The results from the conference are expected to have a significant impact on further scientific research and policy discussions. Full details of the Conference are available at: <http://www.wccc2003.org/>.

The IOC co-sponsored a training course on "Climate Variability in the Ocean: Tracing and Modeling the Ocean Variability" at the Abdus Salam International Centre for Theoretical Physics (ICTP), 16-27 June, in Trieste, Italy. This was the first of a series of three courses to be organized annually at the ICTP dedicated to climate variability studies in the ocean. It was organized jointly by the ICTP, Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS), Istituto Talassografico of the Italian National Research Council (CNR), and the International Atomic Energy Agency (IAEA). The IOC supported eight participants to attend the training course. The course was at a graduate level for scientists and students from all countries that are members of the United Nations, UNESCO, or IAEA. Although the main purpose of the Centre is to aid scientists from developing countries through a programme of training activities within a framework of international cooperation, a limited number of students and post-doctoral scientists from developed countries attended. The course addressed various multi-disciplinary aspects of climatic variations with emphasis on the biogeochemical consequences of such variability. Worldwide marine radioactivity studies in oceans as well as computer modeling of current and future levels of radio-nuclides in the marine environment were presented. Key lectures were presented by 18 invited speakers from developed countries.

The IOC co-sponsored the International Summer School of the Surface Ocean-Lower Atmosphere Study (SOLAS), held at the Université de Corse, France, 30 June-11 July. The summer school hosted 72 participants from 22 different countries, with nine participants sponsored

SOLAS summer school research cruise. *Credit: Kai Degreif*

by the IOC. The summer school covered three aspects of the training of young scientists: keynote lectures by distinguished scientists in the field, practical workshops, and student presentations. The practical workshops included a research cruise, laboratory work, and micro-meteorology experiments using state-of-the-art techniques. The results of the summer school, including keynote lectures, research reports, and student presentations are available at <http://www.bgc-jena.mpg.de/~corinne.lequere/solas/index.html>.

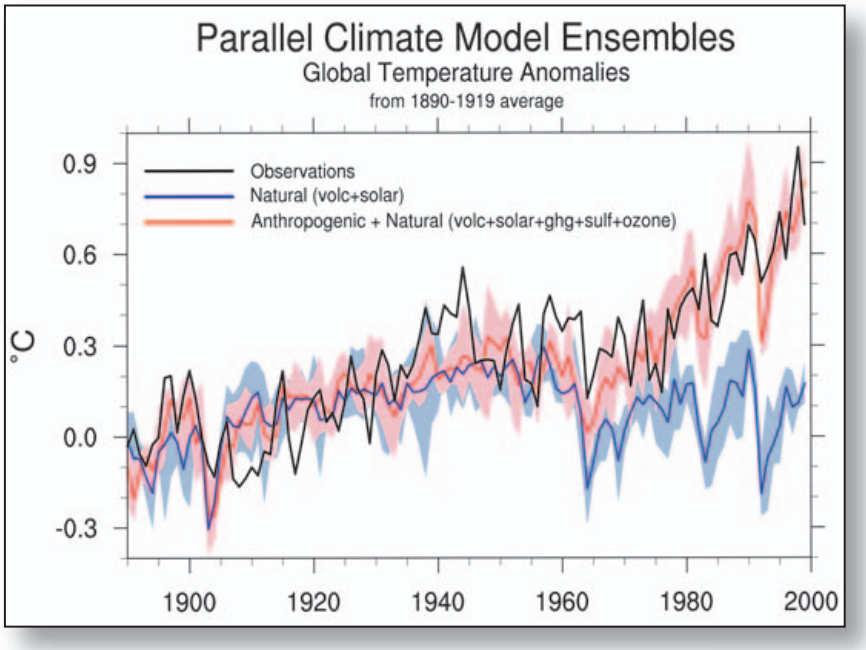
Activities of the oceans and climate programmes include the World Climate Research Programme, the GCOS-GOOS-WCRP Ocean Observations Panel for Climate, and the SCOR–IOC Advisory Panel on Ocean CO_2.

The World Climate Research Programme and its Climate Variability and Predictability Study

by David Carson, Director, World Climate Research Programme

The World Climate Research Programme (WCRP) was established in 1980, under the joint sponsorship of the World Meteorological Organization (WMO) and the International Council for Science (ICSU), and has also been sponsored by the Intergovernmental Oceanographic Commission (IOC) of UNESCO since 1993. A WMO/ICSU/IOC Joint Scientific Committee (JSC) has the responsibility of formulating the overall scientific concepts and goals of the WCRP, as well as organizing the required international coordination of research efforts.

The two major objectives of the WCRP are to determine the extent to which climate can be predicted and the extent of human influence on climate. During the two decades of its existence, WCRP has enabled many achievements in the ocean climate realm. The Tropical Ocean and Global Atmosphere (TOGA) Project (1985-94) established the physical basis for the understanding and predictions of El Niño temperature signals and associated changes in the global atmospheric circulation from a season to a year in advance. This was a major breakthrough in (operational) seasonal forecasting. The World Ocean Circulation Experiment (WOCE), formally closed at the end of 2002, lasted two decades, and was by far the biggest and most successful ocean research programme to date. Its legacy includes: significantly improved ocean observational techniques (both *in situ* and satellite-borne); a first quantitative assessment of the ocean circulation s role in climate; improved understanding of physical ocean processes; and improved



Credit: *J. Meehl* et al., *2004 (NCAR, USA).*

ocean models for use in weather and ocean forecasting, and in climate studies. In particular, it is most commendable that within four years of the last data being collected, the WOCE data resource (about 20 Gbytes) had been quality-controlled and freely distributed on DVDs and via the Internet. WOCE results are documented in almost 1,800 peer-reviewed publications, a highly-regarded WOCE book, *Ocean Circulation and Climate: Observing and Modelling the Global Ocean*, was published in 2001 (Siedler *et al*., 2001), and a four-volume WOCE Atlas is near to completion. Much remains to be done in the exploitation of WOCE observations and in the further development of schemes to assimilate data into ocean models. These aspects of ocean research and model development are now being incorporated, as planned, into the WCRP Climate Variability and Predictability (CLIVAR) study, which has been designed as the successor to both the TOGA Project (1985-94) and WOCE (1982-2002).

CLIVAR is concerned with the natural variability of the coupled climate system and the changes in response to natural processes and human influences. As noted earlier, CLIVAR is intended as the natural successor to both TOGA (1985-94) and WOCE (1982-2002). The fundamental driving force for this study is our insufficient understanding of how the climate (or Earth) system works. Without this we cannot predict, plan or separate the human influence from natural variability. CLIVAR addresses these issues on all climate timescales from seasons (monsoons) to centuries (anthropogenic influence). (See also Page 40.)

CLIVAR will help to answer questions such as:

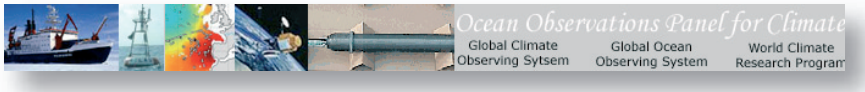
- Will there be an El Niño next year?
- Will the next monsoon cause droughts or floods?
- What will the next winter be like in northern Europe, warm and wet or cold and dry ?
- How is the planet warming from human influences?
- How much sea-level rise will there be in the 21st century?
- Will there be more extreme weather events because of global warming?
- Could climate make a sudden switch?

The CLIVAR agenda of maintaining or developing the necessary observational systems (together with GCOS), process studies and modeling is also advancing at a healthy pace. Recent advances include the global expansion of the Argo profiling float network, the launching of an unprecedented number of satellites with ocean observing missions, and two new missions with ocean relevance that have been selected for further development.

Challenges for the Coming Years

The JSC intends to reinforce the WCRP s efforts in the research priority areas signalled in the Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report and is actively seeking improved and more direct involvement with IPCC to identify additional issues that might be taken up by the WCRP. The WCRP continues to promote the development of regional climate research capabilities through the active involvement of scientists worldwide in its activities in order to meet its scientific challenges and to deliver research results relevant to the entire global community. A fundamental guiding principle for future WCRP activities will be the vision that the problem of prediction from weeks through decades to the projection of climate change is seamless. It must be recognized that the regional manifestations of global change will be felt by society mainly through changes in the character of the existing modes of climate variability. For example, just as the presence or absence of a strong El Niño-Southern Oscillation (ENSO) event can significantly change the nature of intra-seasonal variations, a warmer climate might change the nature of ENSO events. For predictions beyond one or two weeks, it is essential to include the interactions among atmospheric, ocean, land and cryospheric processes. As indicated earlier, while WCRP has, and will continue to have, a firm foundation in the physical climate system, it must also consider interactions with chemical and biological systems and therefore have close collaboration with the International Geosphere-Biosphere Programme (IGBP). ■

Part of the climate observing system.
Credit: *R. Weller, WHOI, USA*



GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC)

A major effort of the OOPC this past year has been the development of the ocean components of the Second Report on the Adequacy of the Global Observing Systems for Climate in support of the UN Framework Convention on Climate Change, and the integration of the ocean domain report with those of the other domains. The report underwent open review and revision and was then approved by the GOOS Steering Committee, the GCOS Steering Committee, and the Joint Scientific Committee of the WCRP, and submitted to the Subsidiary Body for Science and Technological Advice of the Conference of the Parties (COP) in November 2003. The Adequacy Report was presented to the Ninth Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Milan, Italy, 1-12 December 2003. The main decisions by COP 9 on Global Observing Systems for Climate relevant to the ocean domain were that the COP:

(i) Requests the Global Climate Observing System secretariat, under the guidance of the Global Climate Observing System steering committee, taking into account international and intergovernmental mechanisms, to coordinate the development of a phased 5- to 10-year implementation plan for the integrated global observing systems for climate, using a mix of high-quality satellite and *in situ* measurements, dedicated infrastructure and targeted capacity-building;

(ii) Requests the Global Climate Observing System to conduct an open review of the implementation plan before its completion and to submit the final implementation plan to the Subsidiary Body for Scientific and Technological Advice, at its Twenty-first Session; and

(iii) Invites the Global Climate Observing System secretariat, in conjunction with the Global Ocean Observing System secretariat, to provide information to the Subsidiary Body for Scientific and Technological Advice, at its Twenty-second Session, on progress made towards implementing the initial ocean climate observing system.

Oceanographic observation buoy. ©*WHOI*

The OOPC began working on the implementation plan with GCOS as requested by COP shortly after the meeting, and this process will require continuing OOPC effort through the coming year.

The OOPC held its Eighth Session at the Marine Environmental Data Service, Department of Fisheries and Oceans (DFO), Ottawa, Canada, 3-6 September. The CLIVAR Ocean Observation Panel has been reconfigured and CLIVAR basin panel representatives will henceforth participate in OOPC meetings. The CLIVAR Panel representatives agreed to keep OOPC appraised of research observation activities and the OOPC will evaluate recommendations concerning those research-based activities that may be candidates for the sustained observing system. Panel members reported on the numerous ongoing activities supported by the OOPC, including Argo, the ocean time series reference station network, the surface drifting buoy network, the SOOP XBT repeat sections, the Voluntary Observing Ship (VOS) Climate Project (VOSClim), the sea level network, ocean carbon observations via the CO_2 Panel, the joint Sea Surface Temperature (SST) working group, the joint sea-level pressure working group, the ocean information technology project, and the Global Ocean Data Assimilation Experiment (GODAE), which began its demonstration period this year. The OOPC was represented at over 25 meetings in 2003. The Panel specifically highlighted issues that will require special attention for a number of activities this coming year: (i) the importance of developing an implementation strategy to achieve the recommended global coverage in programmes such as Argo and the surface drifting buoys, and (ii) the development of means of evaluating implementation progress and improving data quality for the existing networks.

A new OOPC Web site was developed at the beginning of the year on the IOC server <http://ioc.unesco.org/oopc> and will continue to be developed in parallel with the "next steps" to provide a central source of information about recommendations for the initial sustained global ocean climate observing system and the status of its implementation. For 2004, the OOPC will have a new technical officer at the

The Argo Profiling Float Programme

by John Gould, Argo Director

Argo, a broad-scale global array of temperature/salinity profiling floats, is a major component of the ocean observing system that began in 2000. Argo will provide a quantitative description of the evolving state of the upper ocean and the patterns of ocean climate variability, including heat and freshwater storage and transport. The data will enhance the value of the Jason altimeter through measurement of subsurface vertical structure (T(z), S(z)) and reference velocity, with sufficient coverage and resolution for interpretation of altimetric sea surface height variability. Argo data will be used for initialization of ocean and coupled forecast models, data assimilation and dynamical model testing. A primary focus of Argo is seasonal to decadal climate variability and predictability, but a wide range of applications for high-quality global ocean analyses is anticipated. Full information about the programme may be found on the Argo Web site at: <http://www-argo.ucsd.edu/> and the Argo Information Centre at: <http://w3.jcommops.org/cgi-bin/WebObjects/Argo>.

Enlarging the Global Array

The array increased by over 58 percent in 2003 to 1,030 operating floats. This represents 35 percent of the target of 3,000 floats that should be reached by 2006. Coverage is densest in the North Pacific and North Atlantic where in some areas it already exceeds the planned density of one float every 3° of latitude and longitude. (Figure 1). The sparsest areas are the southern hemisphere oceans where logistical difficulties hamper deployments. However, a concerted effort is underway to improve coverage in the South Pacific using U.S. floats deployed from a chartered New Zealand research vessel.

Improving Data Access and Quality Control

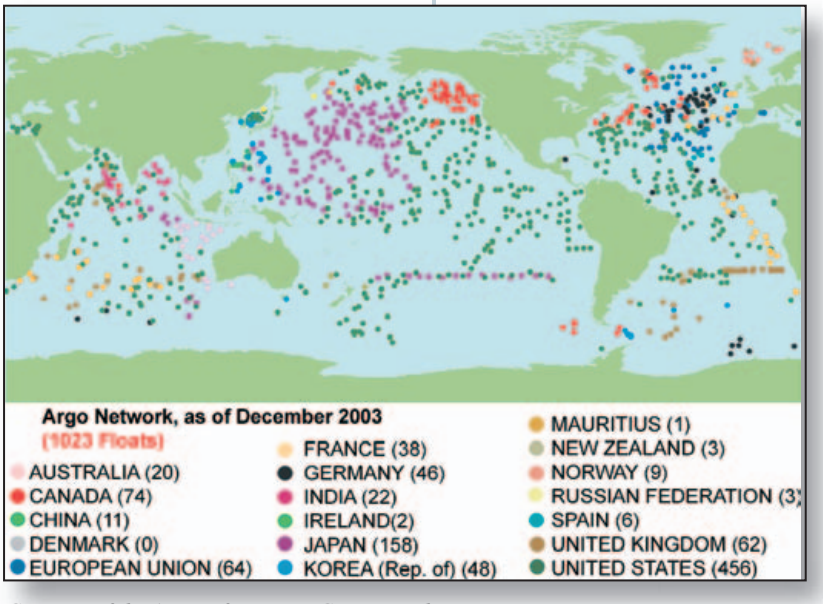
Data are available in real time via the Global Telecommunication System (GTS) and through two global data servers located in Brest, France and Monterey, CA, USA. The real time data now exceed the typical monthly data availability from the global XBT network. New deployments and the status of the array are monitored by the Argo Information Centre.

Improving Technologies

Floats are built to three designs (PROVOR and APEX- commercially manufactured and SOLO, built by Scripps Institution.) All float types have migrated towards a single salinity sensor (SBE) and this caused a major hiatus in the past year when SBE had to recall sensors in floats already supplied due to a manufacturing defect in the pressure sensor. Float deployments were virtually at a standstill for four months. Successful trials have been carried out of two-way, high bandwidth data communication using the low earth orbit Iridium system, and of two types of dissolved oxygen sensor. These will not be fully implemented unless the communication system can demonstrate cost-effectiveness and long term availability and oxygen sensors can be deployed without seriously impacting energy budgets and reliability.

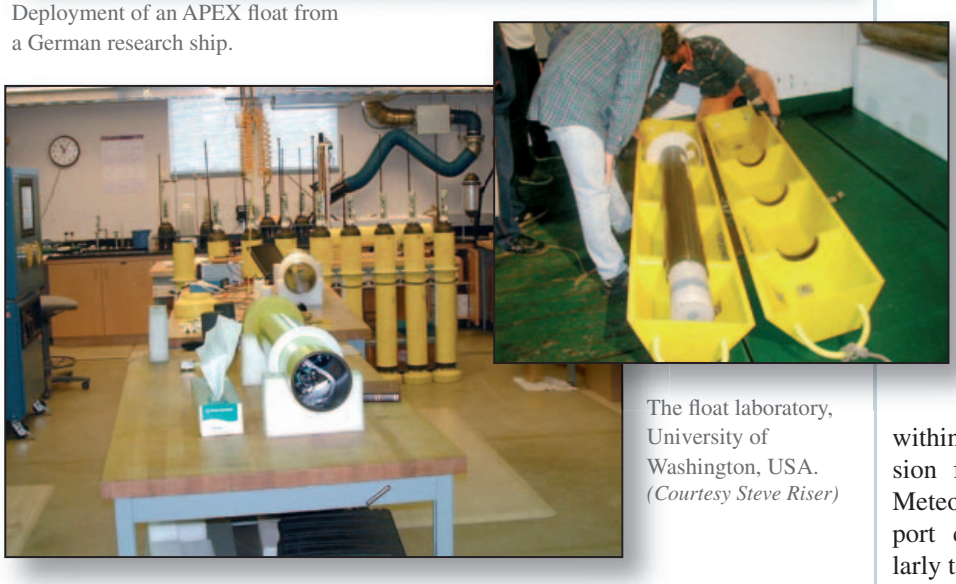
Entraining Additional Contributing Countries

Argo has floats contributed by 18 countries and the European Union. The contributions range in size from a single float to the U.S. contribution of approximately half the array. The past year has seen new contributions from Mauritius, Spain, and Ireland. In addition, Argo benefits from collaborative partnerships to enable float deployments (e.g., South Africa/UK, Indonesia/Australia, Canada/Chile). The global array is supplemented by floats not funded through national Argo projects (Argo equivalents) and through floats deployed in the Mediterranean (including the EU MedArgo programme led by Italy.)



Courtesy of the Argo Information Centre, Toulouse, France

Deployment of an APEX float from a German research ship.



The float laboratory, University of Washington, USA. *(Courtesy Steve Riser)*

Using Argo Data

Argo has a completely open data policy. All data are available to anyone in real time. This availability has already led to widespread use of Argo data that now represents the largest source of open ocean CTD profiles to 1000m. Argo held its first science workshop in Tokyo, Japan, in November 2003, where climate-related applications of Argo data ranged from measurements of the influence of tropical cyclones on the upper ocean, through the incorporation of Argo data into the El Niño-Southern Oscillation (ENSO) forecasting systems, interannual variations in the properties and abundance of mode waters, observations of deep convection and decadal scale ocean signals (in temperature and salinity) and their possible link to anthropogenic influences. The workshop contributions can be found at <http://www.argo.ucsd.edu>.

The Coming Year

The coming year should mark the full implementation of the Argo Delayed Mode QC process and significant progress towards populating the southern hemisphere oceans.

Remaining Challenges

Argo s primary objective must be to complete the 3,000 float global array (target date 2006) and to maintain it for long enough (perhaps to 2010) to collect a global data set that can be evaluated. This will require national funding for float purchase and operation to be sustained for a period much longer than the normal research funding cycle. Funding will be required for the evaluation phase. National programmes contributing to Argo have varying degrees of involvement by operational agencies. The coming years must see the development of an effective partnership between research scientists, operational agencies and centers and float manufacturers in order to meet Argo s challenges and establish the project as a central plank of the global ocean and climate observing systems. Argo requires an appropriate level of infrastructure support (in addition to the data system.) This support presently comes from two sources. The Argo Technical Coordinator position (located in Toulouse and funded by Australia, Canada, France, UK, and USA) was established by IOC to work within the Joint Technical Commission for Oceanography and Marine Meteorology Observing Platform Support center (JCOMMOPS), particularly to monitor the array development and to deal with issues of Exclusive Economic Zone (EEZ) access. For 2003-04, the USA has funded an Argo Project Director working alongside the Argo Science Team Chairman. Argo now has to decide how an appropriate level of infrastructure support can be maintained. ■

SCOR–IOC Advisory Panel on Ocean CO_2

The ocean is the largest mobile reservoir of carbon on decadal to millennial time-scales, and ocean circulation and the long-term sequestration of anthropogenic carbon in the deep ocean significantly influences the regulation of climate. Several international conventions would require nations to quantify their natural sources and sinks of carbon dioxide (CO2), and one of the biggest challenges facing science is to understand how these natural sources and sinks operate and how they may behave in the future under a changed climate. Other conventions call directly on the IOC to carry out analyses, assessments, and systematic observations of the role of the oceans as a carbon sink. IOC s mission is to encourage nations to work together to facilitate the compilation and assessment of results from ocean carbon research, and to introduce these findings back into the research community and the intergovernmental decision-making processes. The necessary coordination for this can only be accomplished at the international level, and the IOC has been asked to play a leading role.

The projects of the CO2 Panel include observation programme coordination, providing advice to GCOS, GOOS, and OOPC on ocean carbon observations needed for the global ocean climate observing system, and promoting research on the effects of greatly-elevated CO2 concentrations in the ocean on ocean chemistry and ecosystems.

The International Ocean Carbon Coordination Project

<http://ioc.unesco.org/ioccp>

Three international global environmental change research programmes, the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP), and the World Climate Research Programme (WCRP), have come together to form the Global Carbon Project (GCP), the goal of which is to coordinate carbon research and observations in an Earth-system context, including the human dimensions of global change. Recognizing the need for coordination of carbon observations and research in the atmosphere, land, and ocean domains, the GCP has sought partnerships with existing international groups to serve as GCP affiliate offices and to develop joint pilot projects for coordination within and between domains. The CO2 Panel and the GCP have developed a pilot project called the International Ocean Carbon Coordination Project (IOCCP) to:

(i) Develop a compilation and synthesis of ocean carbon activities and plans;
(ii) Work with international research programmes to fully integrate carbon studies into planning activities;
(iii) Standardize methods, qc/qa procedures, data formats, and use of certified reference materials;
(iv) Support regional synthesis groups and create regional databases.

A Web site containing an information database of ongoing and planned ocean carbon observation programmes has been developed, and a quarterly newsletter is sent via email to inform ocean carbon scientists of research and observation activities, news, and announcements.

The IOCCP held its first workshop 13-15 January at the IOC, bringing together 56 participants from 17 countries to discuss "Ocean Carbon Observations from Ships of Opportunity and Repeat Hydrographic Sections." Results from this workshop include compiled maps and tables of ongoing and planned ocean carbon observation programmes. The workshop results are available online and on CD-ROM by request. This new pilot project was described in an article published in *EOS* (American Geophysical Union) entitled, "Ocean Carbon Scientists Organize to Achieve Better Coordination, Cooperation" (*EOS*, Vol. 84, No. 23, 10 June 2003. Reprints available on request.)

"IOC's mission is to encourage nations to work together to facilitate the compilation and assessment of results from ocean carbon research, and to introduce these findings back into the research community and the intergovernmental decision-making processes."

As an activity of the CO2 Panel and the IOCCP, Panel Member Dr Yukihiro Nojiri sponsored an intercomparison exercise for pCO2 systems used on ships of opportunity. The results of this experiment will be discussed at an IOCCP Workshop to be held in January 2004 in Tsukuba, Japan. This workshop will also focus on reaching international agreements on pCO2 data and metadata formats and agreements on data management and database integration.

As part of the IOCCP mission to standardize methods, the CO2 Panel is co-sponsoring the publication of *Guide of*

The atmospheric concentration of carbon dioxide is now higher than experienced on Earth for at least the last 400,000 years.

Best Practices for Oceanic CO_2 Measurements and Data Reporting, being finalized by Panel Member Dr. Andrew Dickson. The Guide should be published by mid-2004. The IOCCP has also been active in promoting coordination of ocean carbon and tracer measurements on the repeat hydrographic sections of CLIVAR, and the CLIVAR scientific steering group accepted a proposal of the IOCCP to add a carbon expert to each of the CLIVAR Basin Panels. In September, the IOCCP was represented at the CLIVAR Southern Ocean Panel meeting.

Plans for 2004 include a second IOCCP Workshop on Ocean Surface pCO2, Data Integration and Database Development, to be held in January in Tsukuba, Japan, and a third IOCCP workshop to reach international agreements on core and ancillary measurements for carbon and tracers on the repeat hydrographic sections of CLIVAR.

The Ocean in a High CO2 World

The atmospheric concentration of carbon dioxide is now higher than experienced on Earth for at least the last 400,000 years, if not the last several million years, and is expected to continue to rise, leading to significant global temperature increases by the end of this century. It is now well established that there is a strong possibility that surface ocean pCO2 levels will double over their pre-industrial values by the middle of this century, with accompanying surface ocean pH changes that are three times greater than those experienced during the transition from glacial to interglacial periods.

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is "to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." While "dangerous anthropogenic interference with climate" has been widely discussed, no such debate has taken place over acceptable oceanic CO2 levels. As a result, there are no standards to apply to judge what oceanic CO2 levels should be considered tolerable for marine life, or how proposed carbon management strategies might moderate or exacerbate effects on ocean chemistry and biology.

In order to assemble scientific information relevant to the issues of ocean carbon sequestration, the IOC and the Scientific Committee on Oceanic Research (SCOR) have planned a symposium, "The Ocean in a High-CO2 World," to be held at UNESCO in May 2004. The first international organizing committee meeting was held in Irvine, California in February, under the Chairmanship of Dr. Ralph Cicerone, Chancellor of the University of California, Irvine. The symposium will bring together ocean scientists to discuss the likely consequences of passive CO2 absorption by the ocean in comparison with the potential consequences of purposeful ocean carbon sequestration activities. Topics will include both chemistry and biology, including the impacts of elevated CO2 levels on marine life, the dissolution of calcium carbonate, and the impacts on coral reefs. It will also include evaluation of the possible benefits and impacts

of surface fertilization and deep-ocean CO2 injection strategies in their many forms. The symposium will not determine whether it would be a good policy choice to sequester carbon dioxide in the ocean, but will determine what scientific information is available, and what is still needed, to make informed policy decisions. The symposium papers will be published in a special issue of the *Journal of Geophysical Research-Oceans* and research priorities will be published separately for the benefit of ocean scientists and research programme managers worldwide.

Full details about this planned symposium are available at: <http://ioc.unesco.org/iocweb/co2panel/HighOceanCO2.htm>.

The IOC Watching Brief on Ocean Carbon Sequestration is also available at: <http://ioc.unesco.org/iocweb/co2panel/Sequestration.htm>.

Ocean Carbon in the Ocean Observing System for Climate

The Global Climate Observing System (GCOS) is the programme charged with developing and implementing a global observing system for climate in support of the United Nations Framework Convention on Climate Change (UNFCCC). For the ocean climate domain, GCOS relies on the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) for scientific and technical guidance. The OOPC, in turn, relies on the SCOR-IOC Advisory Panel on Ocean CO_2 and its pilot project, the International Ocean Carbon Coordination Project, for advice on ocean carbon observations relevant to global climate observations.

In 2001, the Subsidiary Body on Scientific and Technological Advice (SBSTA) of the UNFCCC endorsed the preparation of a Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC to be completed for consideration by the Conference of Parties (COP) in November 2003. The OOPC and the CO2 Panel/IOCCP were involved in the development of this report, with ocean carbon information on existing networks and plans being provided by the IOCCP.

At its most recent meeting in December 2003, the COP requested the GCOS secretariat to coordinate the development of a phased 5- to 10-year implementation plan for the integrated global observing systems for climate, using a mix of high-quality satellite and *in situ* measurements, dedicated infrastructure and targeted capacity-building, and including implementation priorities, resource requirements and funding options, and metrics for measuring implementation progress. COP also requested GCOS, in conjunction with GOOS, to prepare a special report on progress made towards implementing the initial ocean climate observing system, to be provided to COP in June 2005. The CO2 Panel/IOCCP has been called on to provide input into the GCOS implementation plan. The plan will have two parts, one addressing global climate issues, and the second focusing on specifics in each domain (land, ocean, atmosphere). The CO2 Panel will need to provide input on existing and planned networks, and also identify priorities, costs, and metrics of implementation progress. The CO2 Panel technical officer and IOCCP project coordinator will be coordinating the carbon inputs to the document and working with the GCOS writing team to finalize the plan. ■

SCOR–IOC Advisory Panel on Ocean CO_2

An active programme on the Geosphere-Biosphere Coupling Processes in the Deep Ocean was established in 2003, through the research undertakings of the Training-through-Research (TTR) initiative.

The Thirteenth TTR international cruise to the North Atlantic was carried out from July to September. Over 30 students and young scientists were trained in multidisciplinary geoscience research, including deep-sea depositional systems, down-slope processes, conturite and turbidite systems, and biosphere-geosphere interaction within carbonate mounds recently discovered on continental margins. Studies at deep ocean margins revealed relations between fluids coming through

The Training-through-Research initiative: Training students and young scientists at sea. *Credit: Kai Degreif*

the Earth s crust to the ocean, bacterial communities on the sea floor, and their role as housekeepers of the Earth s climate.

The TTR results were presented at a major Ocean Margins Research Conference, co-sponsored by the European Commission and IOC (September, Paris), in addition to some other conferences (including the European Geophysical Society [EGS]-American Geophysical Union [AGU]-European Union of Geosciences [EUG] Assembly, April, Nice, France.) An international conference, "Geological and Biological Processes at Deep-Sea European Margins and Oceanic Basins," in Bologna, Italy in February, was organized by the TTR programme.

The TTR research results have been summarized in a Special Issue of the *Marine Geology* international journal (2003) and in some 40 other publications, including IOC Technical Series No. 67 and IOC Workshop Report No. 187. ■

Sustainable Development of the Black and the Mediterranean Seas: IOC/EC/BAS Symposium

IOC of UNESCO, the European Commission, and the Bulgarian Academy of Sciences (BAS) co-sponsored an international conference in Varna, Bulgaria, 13-18 October 2003. The theme of the conference was scientific and policy challenges towards an effective management of the marine environment in support of regional sustainable development with emphasis on the Black Sea and the Mediterranean regions. The objectives of the Conference were:

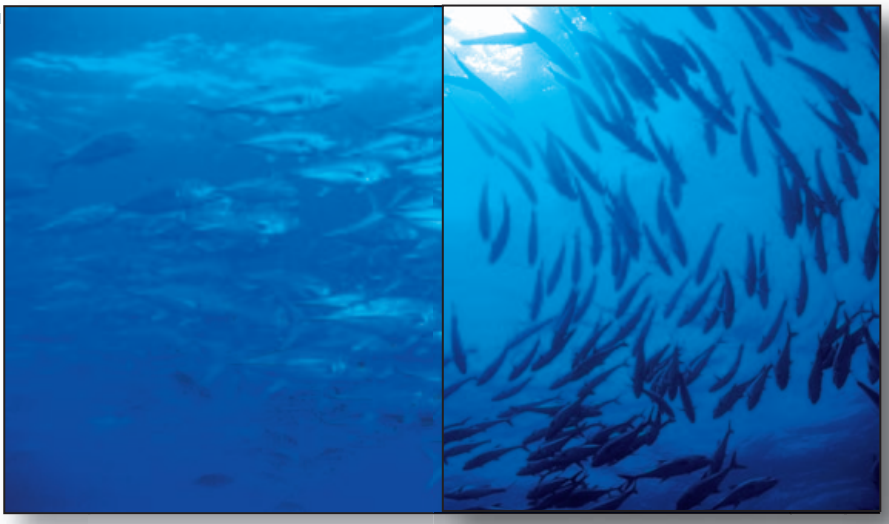
- To enhance cooperation towards an improved development and management of the Black Sea and the Mediterranean regions;
- To enhance the interface between research and policy for the most effective usage of scientific results;
- To improve the capabilities of the Centers of Excellence within the Black Sea and the Mediterranean regions.

Outputs of the Conference to be finalized in 2004 will be: (i) an Abstracts Volume; (ii) a report addressing scientific knowledge and research needs, specifically for sustainable development of the Black Sea and the Mediterranean regions; (iii) a publication of selected Conference papers in a special issue of an international journal. ■

IOC on Regime Shifts

What are Regime Shifts?

The concept of regime shifts has two distinct origins: one from observations in the ocean, the other from theoretical ecology. The former focused initially on physical and biological changes in the North Pacific Ocean between 1976 and 1980 when the physical and, especially, the biological variables showed marked and rapid changes from one "regime" to another. This concept is now being applied to many other marine communities and to other types of forcing.



The challenge is to define how marine ecosystems respond to anthropogenic change in climate, fisheries, or eutrophication. *Credit: NOAA*

At the same time, mathematical ecologists were developing relatively simple models that produced sudden switches between distinct equilibrium conditions resulting from gradual changes in particular components of the communities. The initial application was to spruce budworm outbreaks but similar models have been used for multi-species fisheries.

These two developments provide the basis for a significant revision of our description of how marine ecosystems respond to external forcing, particularly at longer time scales. In place of the idea of a relatively fixed baseline of "pristine" ecosystems, we have the concept of systems that can, naturally, occupy alternative coherent configurations as the external world changes. The challenge, then, is to define how such systems respond to anthropogenic change in climate, fisheries, or eutrophication.

Specific questions are:

(i) How far do the data support the basic concept of "punctuated equilibrium" of relatively rapid switches between relatively constant, albeit noisy, steady states? Do we see other dynamics, such as cycles? Or is stochastic variability dominant at all scales?

(ii) Do these ecological switches require proportionate patterns in the external forcing; or, as theory suggests, can they occur as the result of gradual longer term changes (red noise)?

(iii) As well as "bottom-up" physical trends, can the shifts be caused by forcing at the top trophic levels, especially changes in fish populations, as theory indicates?

(iv) How should one attempt to integrate highly non-linear theory using a few variables, with observations of community transitions involving large numbers of species? How does this relate to management issues?

(v) How can we benefit from the relation between marine and terrestrial aspects of these concepts?

These questions are being studied by diverse groups of researchers in physical oceanography, biogeochemistry, fisheries, ecosystem theory (marine and terrestrial), and in resource management. There is a need to develop a coherent picture of the underlying scientific problems.

Workshop On Regime Shifts: A workshop was held at the Laboratoire d Océanographie de Villefranche-sur-Mer, 13-16 April, to address these issues and recommend how analysis and synthesis could start to provide answers to these questions–and to pose others. About 20-30 individual scientists from various disciplines participated. The presentations at the meeting and the recommendations will be published as a special issue of the journal *Progress In Oceanography* in the Spring of 2004. This publication is expected to be the basis for a report to IOC, the National Science Foundation (NSF), the National Oceanic and Atmospheric Administration (NOAA), and other organizations that supported the Workshop.

The special issue of the journal *Progress In Oceanography* is dedicated to the memory of Dr. George Grice, whose work in recent years at IOC was devoted to increasing our knowledge of issues related to regime shifts and applying the results to the management of global marine resources. ■

Extending Ecosystem Models to the Basin Scale

Background

In 2003, IOC and the Scientific Committee on Oceanic Research (SCOR) formed an *ad hoc* group on the topic of developing basin and global scale models of marine ecosystems. This work involved the integration of ideas that are percolating in the research community and which require the integration of research from several different global programmes, including the Global Ocean Ecosystems Dynamics Programme (GLOBEC), the Joint Global Ocean Flux Study (JGOFS) and the World Ocean Circulation Experiment (WOCE). The Group was asked to tackle the problem from a broad, interdisciplinary perspective and not from a programme perspective. The results of the Group s work is expected to stimulate thinking about an important problem in marine science and also offer a guide to the development of large-scale, trophically integrated ecosystem models. The fundamental biological problem is how to resolve the mass-balance representation of production with the life-history developments that are important at higher trophic levels. Integrating detailed biological models with large-scale physical models begs fundamental scientific questions of model resolution and fidelity to key processes.

Credit: NOAA

This problem is at the forefront of marine science and while there have been some attempts at basin-scale ecosystem models, there remain many fundamental issues to resolve. Many of the required components for the development of basin-scale ecosystem models now exist but uncertainty remains about how to put the pieces together. A review of this problem would be timely and extremely useful to the marine science community.

Product

The Group had two meetings in 2003 and later produced a scientific review paper. It has been accepted by *Science* and will be published in 2004. ■

Mitigating the Effects of Harmful Algae

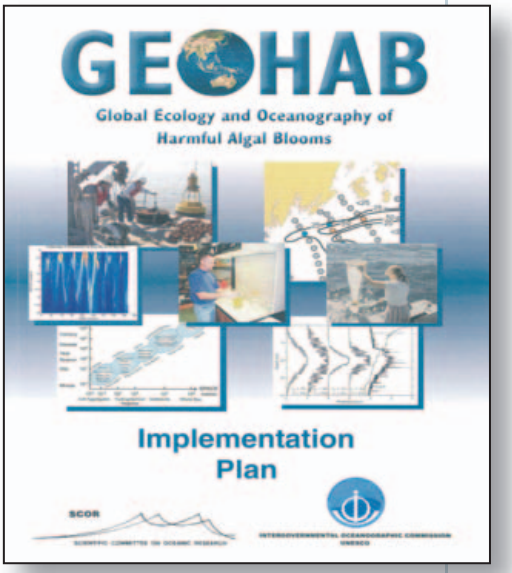
About one hundred species of microalgae are known to cause problems to public health, aquaculture, aquatic living resources, drinking water, or tourism, either through their production of potent biotoxins or by their mass occurrence. Based on recurrent international needs assessments it is well documented that one basic element in national capacity to monitor and develop harmful algae mitigation plans is to be able to identify the causative organisms and to test seafood products for toxicity. The monitoring of harmful microalgae requires solid taxonomic skills, competent research groups that can deliver identification keys and develop new tools for toxin detection, species identification and bloom observation.

In 2003 the IOC Harmful Algal Bloom (HAB) Programme supported cooperative research initiatives and projects, continued to provide capacity enhancement opportunities, and maintained an international network among HAB researchers and managers.

Regional training courses provide capacity enhancement opportunities.

The joint IOC-SCOR science programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) published its Implementation Plan, and held its first Open Science Meeting, which is the mechanism to open GEOHAB to broad participation from the scientific community. GEOHAB aims at a better understanding of the factors that regulate the dynamics of Harmful Algal Blooms (HAB) in the context of physical and chemical forcing, ecosystem dynamics, and human influences for improvement of strategies for monitoring and prediction of HAB. National and regional GEOHAB initiatives have been endorsed by the GEOHAB Scientific Steering Committee, and the detailed research plans for the GEOHAB Core Research Projects are now being developed. The Annual Report of the International Council for the Exploration of the Sea (ICES)-IOC Working Group on the Dynamics of Harmful Algal Blooms has been released. It addresses key issues of relevance to GEOHAB. The ICES-IOC-SCOR Study Group on GEOHAB Implementation in the Baltic further developed its implementation plan for a regional collaborative research programme. Within the GEOHAB a major event was the international workshop on "Real Time Coastal Observation Systems for Ecosystem Dynamics and Harmful Algal Blooms," which provided a state of the art review. The results are now being edited to become a volume in the UNESCO series "Monographs on Oceanographic Methodology."

Systematic enhancement of research and management capacity of harmful algae in Member States continued including testing of innovative Web-based learning tools. Individual training and study opportunities were provided through the IOC Science and Communication Centres in Copenhagen, Denmark, and Vigo, Spain. Regional training courses for North Africa were held in Tunisia, and for South East Asia in Bangkok, Thailand. UNESCO Publishing released a new volume in the series "Monographs on Oceanographic Methodology" titled *Manual on Harmful Marine Microalgae* (768 pp.), which in a single volume provides guidelines to modern methods of sampling, identification, culturing, toxin analysis, monitoring and management of harmful marine microalgae.



At the regional level, the HAB Programme supported the work of the regional working groups for South America and the Caribbean, FANSA and ANCA. The two networks meet annually to plan joint activities and exchange information. A new initiative was the establishment of a network on Harmful Algae in North Africa (HANA).

Through its HAB programme, the IOC liaised with the International Atomic Energy Agency (IAEA) in the efforts to develop and validate an alternative method to the Mouse Bioassay for algal toxins. New cooperation was also established with the North Pacific Marine Science Organization (PICES) in the efforts to expand the coverage of the IOC-ICES database on harmful algal events, HAE-DAT.

Detailed information on programme developments and activities may be found at <http://ioc.unesco.org/hab>. ■

Insights into How the Oceans Move and Influence the Climate

The World Ocean Circulation Experiment (WOCE) gave us a better understanding of ocean circulation and the key role that oceans play in the climate system. The Experiment closed at the end of 2002, culminating two decades of the biggest and most successful oceanographic research undertaken to date.

WOCE was a part of the World Climate Research Programme (WCRP), which is co-sponsored by the Intergovernmental Oceanographic Commission of UNESCO. WOCE used resources from nearly 30 countries to make unprecedented *in situ* and satellite observations of the global ocean to observe poorly-understood but important physical processes. The resulting diverse data sets will serve as a unique resource for climate researchers and marine scientists for decades to come, leading to improved analysis and predictions of climate change and natural hazards.

Desertification: Could climate make a sudden switch? *Credit: UN/DPI*

WOCE and Beyond...

The year 2003 marked the publication of the last in a series of special scientific journal volumes dedicated to the World Climate Research Programme s (WCRP) World Ocean Circulation Experiment (WOCE). WOCE officially ended in 2002, though the data collected during WOCE and the revolutionary increase in our understanding of the oceans that accompanied it continue to provide a lasting legacy.

WOCE was by far the largest oceanographic programme ever carried out. Its ambitions combined a truly global reach with a wish to resolve many of the remaining problems concerning detailed physical processes in the oceans. Starting in the late 1970s, hundreds of people were involved in the planning process, which culminated in an observational period spanning 1990-1998, followed by a period of analysis, interpretation, modeling and synthesis, through the end of 2002. In addition to global observations furnished by satellites, conventional *in situ* physical observations were made by nearly 30 nations in four of the world s oceans. At the same time, global ocean models were developed to assimilate these measurements, an activity that continues, with a number of WOCE legacy observational programmes and new ocean observations providing input.

Before the WOCE global hydrographic programme, it had become increasingly clear to oceanographers that the ocean variability was dominated by a strong mesoscale eddy field. Previous international attempts to systematically measure the global oceans (among them the International Geophysical Year of 1957-58 and the International Indian Ocean Expedition of the early 1960s) did not adequately resolve the eddy field, and so WOCE was the first global hydrographic programme to sample the oceans in an unbiased way. Data taken during WOCE also included many chemical tracers, which have improved our understanding of the long-term circulation of the oceans.

During WOCE, the total variability of the global ocean was finally sampled, primarily through satellite altimetry. This sampling ranges from spatial scales of 20 km up to basin scales, and from time scales of about 20 days to the length of the still-growing record, for the ocean surface. WOCE also included measurements of deep western boundary currents, and revolutionized our understanding of where ocean mixing takes place—an important constraint on the slow and hard-to-measure interior circulation of the oceans, which is the slow memory of the climate system.

WOCE coincided with a paradigm shift in the field of oceanography, a change in the picture of the oceans as being smooth and essentially fixed transporters of heat and other properties, to a picture where the oceans are nearly everywhere dominated by its variability.

In the technical arena, WOCE also provided the development of the first generation of autonomous *in situ* samplers of the oceans, freeing oceanographers from the

constraints of purely ship-based observations for some variables, and paving the way for the growing Argo profiling float network.

WOCE was a snapshot of the ocean state - a revolutionary, revelatory, and paradigm-shifting snapshot, and spread out over nearly a decade of observations, but a snapshot nevertheless.

The ocean s impact on humans happens through the coastal zone, through fisheries and ocean industries, and also through the ocean s effect on that other medium we all inhabit, the atmosphere. Starting in the mid-1990s, WCRP scientists began tackling the coordination of a global programme to address exactly that, the Climate Variability and Predictability Study (CLIVAR). It is concerned with the natural variability of the coupled climate system and the changes in response to natural processes and human influences. It is a natural successor to both the Tropical Oceans Global Atmosphere (TOGA) project, and to WOCE.

The fundamental impediment to improved climate predictability remains an insufficient understanding of how the climate system works. Without that, it is difficult to predict, to plan, and to separate the human influence on climate from natural variability. CLIVAR addresses these questions on all timescales from seasons to centuries.

The oceans are a major component of the climate system, and a major subject of CLIVAR research. Work underway includes studies of the variability of the thermohaline circulation in the Atlantic; dynamics and predictability of the Atlantic intertropical convergence zone and its regional climate influences; atmospheric forcing and upper-ocean teleconnections and feedbacks on tropical sea surface temperature; the Kuroshio extension; and Pacific upwelling.

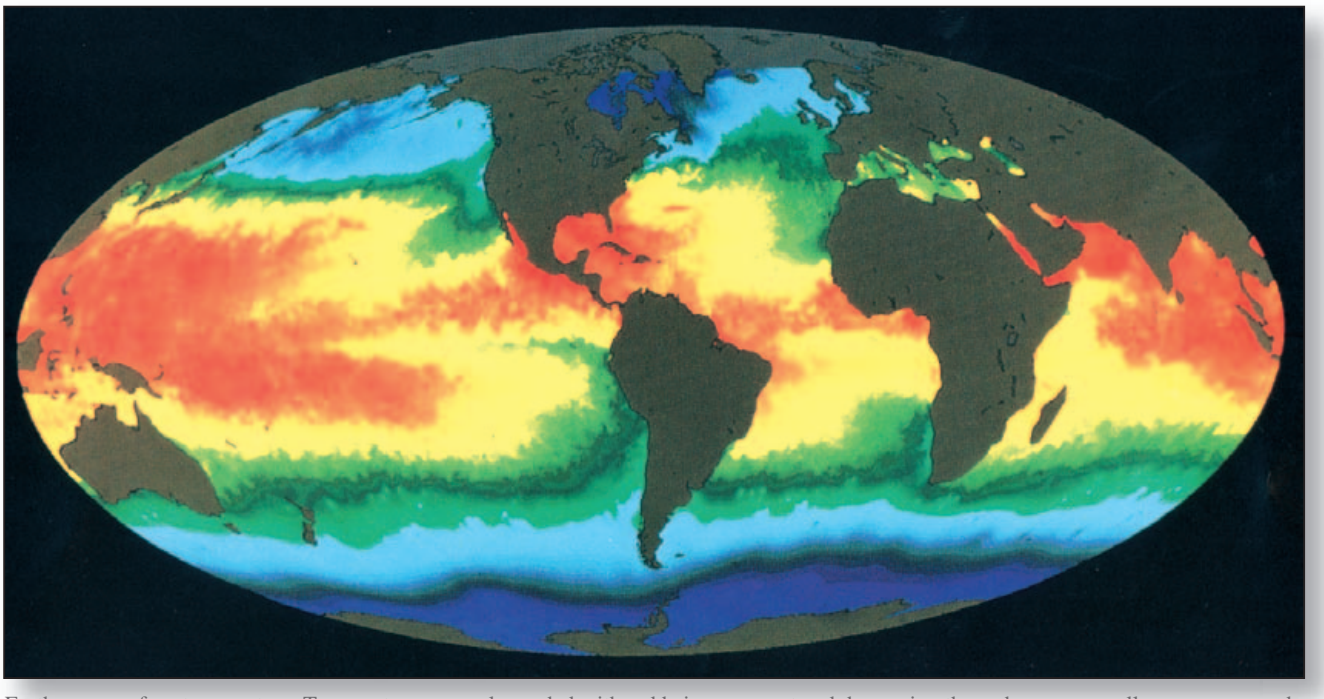
The First International CLIVAR Science Conference will take place in Baltimore, USA, in June 2004, and will assess the progress to date, and identify future challenges for CLIVAR. A major topic of the conference will be how to best deliver the knowledge, products, and information brought about by CLIVAR research to end users, and decision- and policy-makers.

CLIVAR shares with GCOS and GOOS an agenda of developing and maintaining the necessary observational systems for climate monitoring and research. Other CLIVAR goals are met through process studies and modeling, which are also advancing at a healthy pace.

The WOCE effort in oceanographic model development, and in particular, in data assimilation continues in the Global Ocean Data Assimilation Experiment (GODAE), an Ocean Observations Panel for Climate (OOPC) pilot project. GODAE has entered its demonstration phase, and is providing continually updated products of both the ocean state and ocean forecasts in various ocean basins.

While WOCE the programme may have formally come to an end, the effort of advancing our understanding of the oceans, and improving our ability to predict their state and the state of the climate, is a continuing effort. ■

(Adapted in part by Albert Fischer from the WOCE final newsletter, 2002, and the WCRP Annual Report, 2003)



Earth s sea surface temperature. Temperatures are color coded with red being warmest and decreasing through oranges, yellows, greens, and blues. Temperature patterns seen in this image are the result of many influences, including the circulation of the ocean, surface winds, and solar heating. *Credit: NASA*

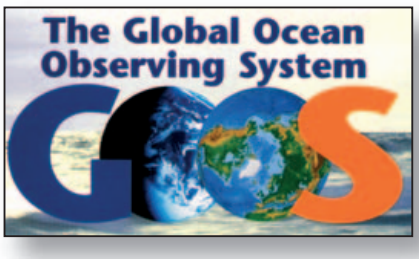
An Overview of the Year 2003 in IOC's

Operational Observing Systems

By Colin Summerhayes, Head of Section

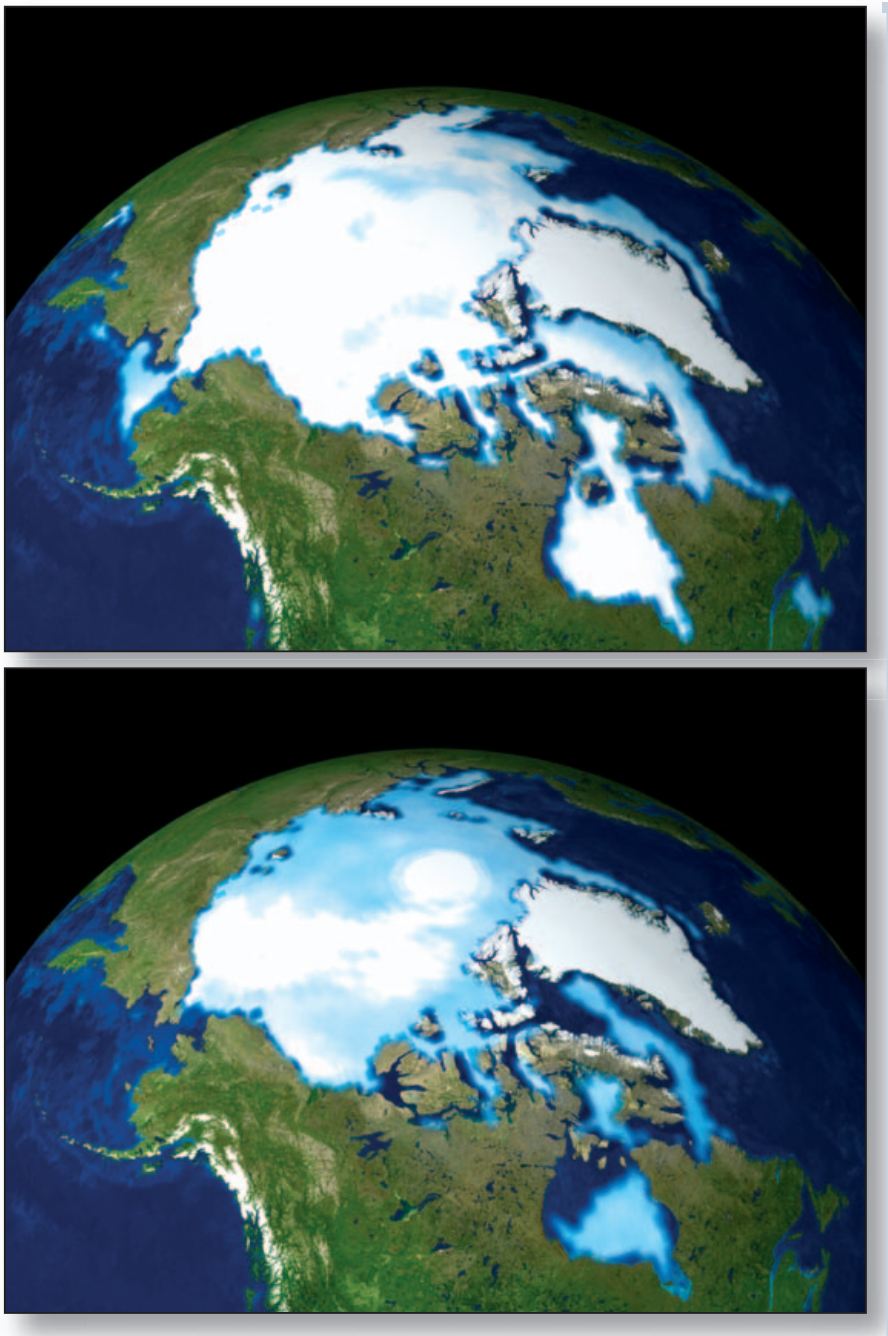
Agenda 21 demands that an integrated and comprehensive global ocean observing and information system be created to provide the information needed for oceanic and atmospheric forecasting, for ocean and coastal zone management by coastal nations, and for global environmental change research. In response to this demand, which was reinforced at the World Summit on Sustainable Development (WSSD) in August-September 2002, the Intergovernmental Oceanographic Commission (IOC) of UNESCO, together with the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU), are planning, implementing and coordinating a Global Ocean Observing System (GOOS). The Implementation Plan of the WSSD calls for a significant increase in the use of *in situ* and satellite-based observations of the Earth system, and the provision of information based on those observations, in support of sustainable development.

As a follow-up to the WSSD Implementation Plan, the G8 nations meeting in Evian, France, in June 2003 called for the development of a 10-year plan for coordinated global observations. A ministerial Earth Summit in Washington at the end of July decided to appoint a Group on Earth Observations (GEO) to develop this plan through a series of meetings during 2003 and 2004, for presentation to further ministerial Earth Summits in Tokyo (April 2004) and Europe (February 2005). The GOOS team has been among those advising the GEO process on the requirements for a comprehensive and integrated global ocean observing system in support of sustainable development, through the GEO s five working groups on: architecture, data utilisation, capacity building, international coordination, and user requirements and outreach. Aside from participation by the GOOS Steering Committee Chairman in the Washington Earth Summit, this advice has involved participation by the Director of the GOOS Project Office in the GEO meeting in Baveno, Italy, 27-29 November, and in numerous telephone conferences.



GOOS provides descriptions in real-time of the present state of the sea and its contents, and forecasts of these for as far ahead as possible, for a wide range of users. At present most of these data concern the physical characteristics of the ocean, which are currently the easiest to measure. The climate component of GOOS is the ocean component of the Global Climate Observing System (GCOS). In that context, GOOS also meets the needs of the Framework Convention on Climate Change (FCCC) by providing ocean data to underpin forecasts of changes in climate. GOOS aims to meet the needs of the operational oceanographic community as well as those of the research community for systematic and sustained observations. Research to develop new operational approaches and tools is an integral part of GOOS. GOOS makes and integrates observations across all the data gathering media, from ships and buoys to satellites and aircraft, covering the sea and its contents, sea ice, and the air above the ocean. GOOS is designed to meet the needs of a broad user community for particular services or products. It will operate as an end-to-end, or production line system, in which the data, and how they have been processed, are traceable from first observation to final product. All GOOS elements are accessible through the GOOS Web site <http://ioc.unesco.org/goos>. GOOS data can be accessed through the Global Observing Systems Information Centre (GOSIC) <http://www.gos.udel.edu./>. GOOS is managed by the GOOS Project Office within the IOC, operating under the overall direction of the Intergovernmental Committee for GOOS (I-GOOS), and following the scientific and technical advice of the GOOS Steering Committee (GSC). The GSC held its 6th Session in Cape Town, South Africa, 26-28 February, and I-GOOS held its 6th meeting in Paris, France, 10-14 March.

GOOS is being implemented by Member States following the GOOS design and coordinating their actions through the Joint WMO/IOC



These two images show Arctic sea ice extent from January 1, 1990, and January 1, 1999, respectively. These images were created using data from the Defense Meteorological Satellite Program s (DMSP) Special Scanning Microwave Imager (SSM/I). *Credit: NASA*

Technical Commission for Oceanography and Marine Meteorology (JCOMM), and its technical subgroups, which are overseen by the JCOMM Management Committee (JCOMM-MAN)<http://ioc.unesco.org/goos/jcomm.htm>. JCOMM is responsible for day-to-day management of many of the observing system elements. The JCOMM Operations Centre in Toulouse continued to improve the provision of services on ship and buoy and float data to the wider community <http://www.jcommops.org/>. GOOS and the IOC s Committee on International Oceanographic Data and Information Exchange (IODE) are among the members of the JCOMM-MAN, which held its Second Session, in Paris, France, 5-8 February. JCOMM and GOOS are supporting with IODE the development of an Ocean Information Technology Project, the development of which continues throughout the year and which will be reported on at JCOMM-MAN-III in early 2004. It was a busy year for JCOMM, with meetings of the JCOMM subgroups as follows:

- Task Team on Resources, Paris, France, 3-4 February
- Southeast Asian Ocean Forecasting Models Inter-Comparison Workshop, Kuala Lumpur, Malaysia, 19-24 February
- GLOSS Training Workshop on Sea level Data Analysis, Valparaiso, Chile, 7-18 April
- Expert Team on Waves and Surges Forecast, Dartmouth, Canada, 11-14 June
- VOSClim-IV, London, England, 21-22 July
- PMO-II, London, England, 23-25 July; Ship Observations Team, London, England, 28 July-1 August
- Tropical Cyclone Prediction Workshop, Kuantan, Malaysia, 15-20 September
- Planning for JCOMM-II, Geneva, Switzerland, 23 September
- GLOSS-VIII, Paris, France, 13-17 October
- Data Buoy Cooperation Panel and Joint Tariff Agreement meetings, Angra dos Reis, Brazil, 20-29 October
- CLIMAR-II and Brussels 150th Celebration Conference, Brussels, Belgium, 17-20 November

GOOS provides Member States with the ability to convert research results into useful products to meet societal needs. It is also influencing national thinking and planning. Many countries are now planning,

(Top) Hurricane Luis in the lesser Antilles, 1995, 16 deaths, $2.5 billion damage.
Credit: NOAA.

or collecting, their own coastal and ocean observations in line with the GOOS Strategic Plan and Principles. Many countries have created National GOOS Committees to develop contributions to GOOS at the national or regional level, by improving the way in which they use oceanographic and marine meteorological information to meet management needs and address policy issues.

Advice on GOOS development comes from two main design panels: one (the Coastal Ocean Observations Panel, or COOP) deals with all aspects of coastal seas <http://ioc.unesco.org/goos/coop.htm>, and the other one (the Ocean Observations Panel for Climate, or OOPC) deals with open ocean physical and biogeochemical processes <http://ioc.unesco.org/oopc/>. The advice helps Member States to implement GOOS in their own waters. OOPC and COOP plans were highlighted in a special session as part of the International Union of Geodesy and Geophysics (IUGG)/International Association for the Physical Sciences of the Ocean (IAPSO) conference in Sapporo, Japan, 21-22 July.

The Integrated Coastal GOOS Design Plan was published in June 2003. COOP is following this with development of a Coastal GOOS Implementation Plan, work on which began at the 5th Session of the Panel. This Session was supposed to be held in the spring but had to be postponed because of the SARS health scare, and finally took place in Mazatlan, Mexico, 30 September-3 October. It was followed by a COOP Implementation Plan drafting workshop, in Dallas, TX, USA, 15-17 December. COOP members were also closely involved in a workshop on real-time observations for coastal seas, held in Villefranche-sur-Mer, France, 11-12 June. Among the biological ocean measurements that COOP is responsible for are those made by the Continuous Plankton Recorder (CPR) programme, to which we continued to provide financial aid. Strong links are also being developed between GOOS and the Large Marine Ecosystem (LME) programme of the World Bank. GOOS participated in the planning meetings for the LME programme, in Paris, France, 3-4 March, in meetings for the further development of the Guinea Current LME (Accra, Ghana, 8-11 April), and in meetings for the further development of the Benguela Current LME (Stellenbosch, South Africa, 1 October).

The 8th Session of the OOPC was held in Ottawa, Canada. 3-6 September. Much of the effort of the OOPC went into the analysis of the state of the ocean component of the observing system for climate, as a contribution to the "Second Report on the Adequacy of the Global Observing Systems for Climate in Support of the UNFCCC," which was published by WMO as *GCOS Report No. 82*, and presented to the 9th Session of the Conference of the Parties to the UN Framework

The ocean observing part of the global climate observing system is developing well.
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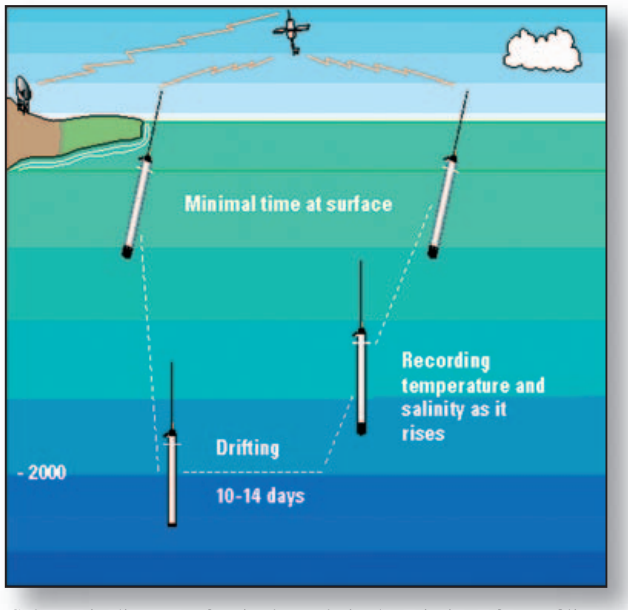
Convention on Climate Change, in Milan, Italy, 1-12 December. The message is that the ocean observing part of the global climate observing system is developing well, and is in better shape than its terrestrial counterpart. Nevertheless, there is still much to do to fully develop the ocean observing system to the appropriate level, especially in remote geographic areas, and for understanding the role of the ocean ecosystem in contributing to uncertainties in estimates of climate change. It is important that high quality observations of the ocean made from space are sustained for the long term, that Argo floats and surface drifters are globally deployed to monitor heat and freshwater storage and transport, that the global sea level network is enhanced and completed to facilitate the detection of climate change, and that comprehensive tests are made of the ocean effect in climate models. Measurement of the state and change of carbon sources and sinks in the ocean is also required to determine the nature of the carbon cycle and its role in climate change, and a series of full ocean depth repeat hydrographic sections is needed to fully characterize ocean variability. A sparse network is also needed of global ocean reference stations at which data can be collected over long time periods to detect climate change and calibrate air sea fluxes. This network is described as the Global Eulerian Observatory. The international science team for the Observatory held its third planning session in Villefranche-sur-Mer, France, 3-5 April.

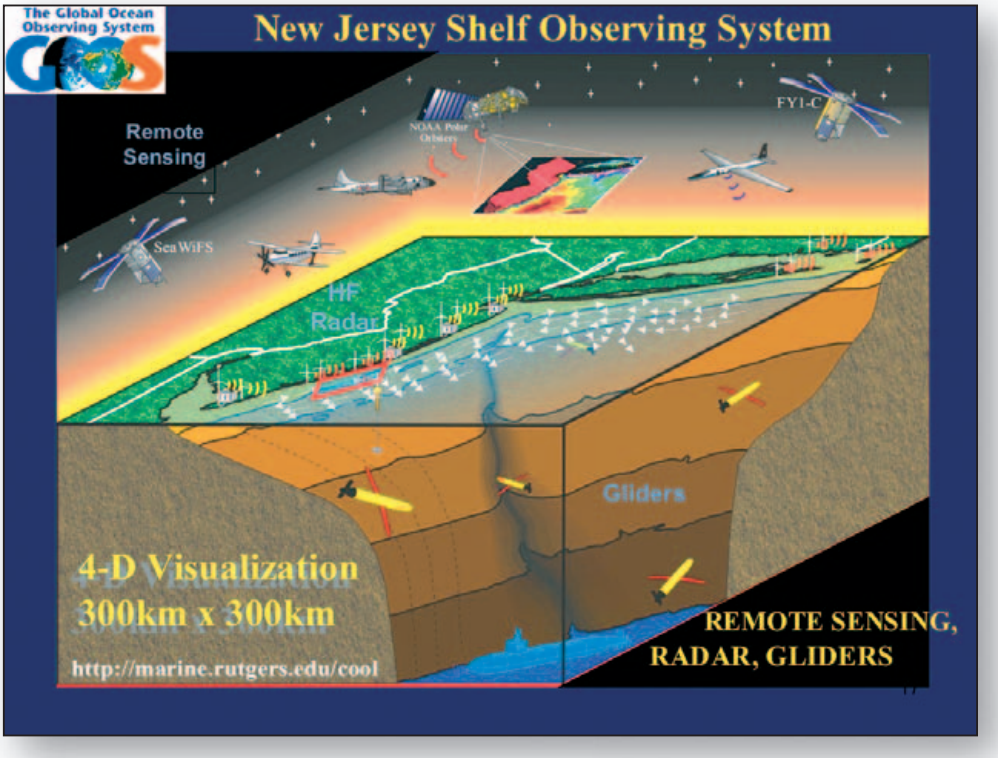
New components of GOOS are being tested through pilot projects. One of these is the Global Ocean Data Assimilation Experiment (GODAE) <http://www.bom.gov.au/bmrc/ocean/GODAE/>. Progress with GODAE can be monitored, and GODAE products can be accessed through the U.S. GODAE Server operated by the U.S. Navy in Monterey, California <http://www.usgodae.fnmoc.navy.mil/>, and through the French MERCATOR project <http://www.mercator.com.fr/en/>. The International GODAE Steering Team met twice in 2003, with its 7th Session in Darmstadt, Germany, 17-20 February, and its 8th Session in Miami, FL, USA, 5-7 November. GODAE activities will be highlighted at the Second GODAE Symposium in Florida in the fall of 2004. It is proposed that a joint GODAE-COOP working group be established to examine scientific issues related to predictability in coastal regions (physical and ecosystem variables) and how this predictability may be extended by coupling coastal and deep ocean models. COOP-GODAE Pilot Projects to test the extent to which the environment is predictable should be developed in the following four regions: Mediterranean; Northwest European shelf; Gulf of Maine; and the West Coast of North America.



Schematic diagram of a single cycle in the mission of a profiling float. Float lifetime is expected to be about 80-100 cycles.

GODAE itself has pilot projects, which are also pilot projects of GOOS. A GODAE High Resolution Pilot Project on sea-surface-temperature (SST) is underway to develop high-resolution SST data sets and products using all available remote and *in situ* measurements and scientifically defensible definitions of SST <http://www.ghrsst-pp.org/>.

The largest GODAE pilot project is the Argo project to seed the ocean with 3,000 profiling floats that will all be operational during the period 2003-06 <http://www.argo.ucsd.edu/>. Argo will provide the first ever global coverage of the temperature and salinity of the upper ocean, which is badly needed to improve numerical models and forecasts of the behaviour of the ocean, weather, and climate systems. Many countries have made financial commitments to the Argo project, including funds to support the Argo Technical Coordinator at the Argo Information Center in Toulouse <http://argo.jcommops.org/>. At the end of December 2003 there were 1,000 Argo floats in the water. Completion is scheduled for 2006. The Argo Science Team held its 5th Session in Huangzhou, China, 4-6 March. The Argo Data Management Team met in Monterey, CA, USA, 4-7 November. The First Argo Science Workshop took place in Tokyo, Japan, 12-14 November. Progress is good, though there are still more deployments in the northern hemisphere than in the southern. Efforts are needed to ensure that Argo designs are rugged and robust, and to establish and maintain a viable production base for producing floats. Improvements are needed in



smoothly disseminating and distributing Argo data and information. Argo is now sufficiently large that it requires a properly funded infrastructure rather than best efforts made on a voluntary basis, as before. In order to facilitate the implementation of GOOS, groups of Member States with common interests in particular sea areas are encouraged to develop GOOS Regional Alliances (GRAs) <http://ioc.unesco.org/goos/key3.htm#reg>. A Regional Policy governing the formation of GRAs was approved by I-GOOS and by the IOC Assembly (June 2003) as the basis for managing the GRAs. A number of regional meetings were held to take forward the development of GOOS at the regional level. The IOCARIBE-GOOS Steering Team met in association with the Oceanology International meeting in New Orleans, LA, USA, 4-6 June, and held an IOCARIBE-GOOS symposium as part of the conference. Plans are now being developed for an IOCARIBE-GOOS modeling workshop early in 2004. MedGOOS continued to focus on the implementation of its European Commission-funded project on "Mediterranean Network to Access and Upgrade the Monitoring and Forecasting Activity in the Region (MAMA)" and held the 4th MAMA meeting, in Rome, Italy, 3-5 June. Indian Ocean GOOS met in Colombo, Sri Lanka, 8-10 December, to hold a Data Management Capacity Building Workshop. EuroGOOS continued operation of its Baltic Operational Oceanographic System (BOOS) and its Northwest Shelf Operational Oceanographic System (NOOS), and began editing the Proceedings of the Third EuroGOOS Conference on Operational Oceanography in Athens, Greece, December 2003, for publication in January 2004. Representatives of GOOS-AFRICA refined a proposal for a comprehensive and integrated Regional Ocean Observing and Forecasting System for Africa (ROOFS-AFRICA) through planning meetings in Niamey, Niger, 27-29 March; Abuja, Nigeria, 24-25 February; Accra, Ghana, 8-11 April; Stellenbosch, South Africa, 2-3 October; and Johannesburg, South Africa, 27-20 October. The proposal was submitted to the New Partnership for Africa s Development (NEPAD) donors meeting in Algiers, Algeria, 15-16 November. Initial funding for one part of the ROOFS-AFRICA proposal (mainly some of the tide-gauges) was sought through the ODINAFRICA-III proposal developed by IODE and GOOS-AFRICA for consideration by the Government of Flanders, Brussels, Belgium, 8-9 September. The Pacific Islands GOOS held a remote sensing training workshop in Fiji, 30 September-3 October, and a teacher-training workshop was held in Apia, Samoa, for the SEREAD programme (bringing Argo to schoolchildren in the Pacific), 19 September-6 October. The 8th Session of the NEAR-GOOS Coordinating Committee (for the North-East Asian Region) met in Beijing, China, 8-10 December, to review, modify and approve a new draft strategic plan.

Some new GRAs were formed, and the formation of others was explored. A high level consultative meeting for the establishment of Southeast Asia GOOS (SEA-GOOS), was held in Kuantan, Malaysia from 20-24 October, with the result that SEA-GOOS was formed with a Secretariat based in Singapore and reporting to IOC s WESTPAC. The countries of western South America met in Cartagena, Colombia, 28-31 May, to consider the formation of a GRA for the Southeast Pacific. A Memorandum of Understanding was drawn up between the agencies present to form a GRA for the Southeast Pacific (GRASP), which will report to IOC and the CPPS.

More or less the same participants met during the same period in the Joint IOC-WMO-CPPS Working Group on El Niño, to explore ways in which ocean observations could and should be collected and used to improve forecasts of the timing, magnitude and geographical intensity of El Niño events. There was general agreement that in due course the activities of the joint working group might be considered as a pilot project of GRASP. A meeting co-sponsored by OOPC in Angra-dos-Reis, Brazil, 6-8 February, led to consideration of how a GRA might be formed for the Southwest Atlantic. Further discussions on this matter continued in August at a meeting between Argentina, Brazil, and Uruguay, under the auspices of the Rio GOOS Office.

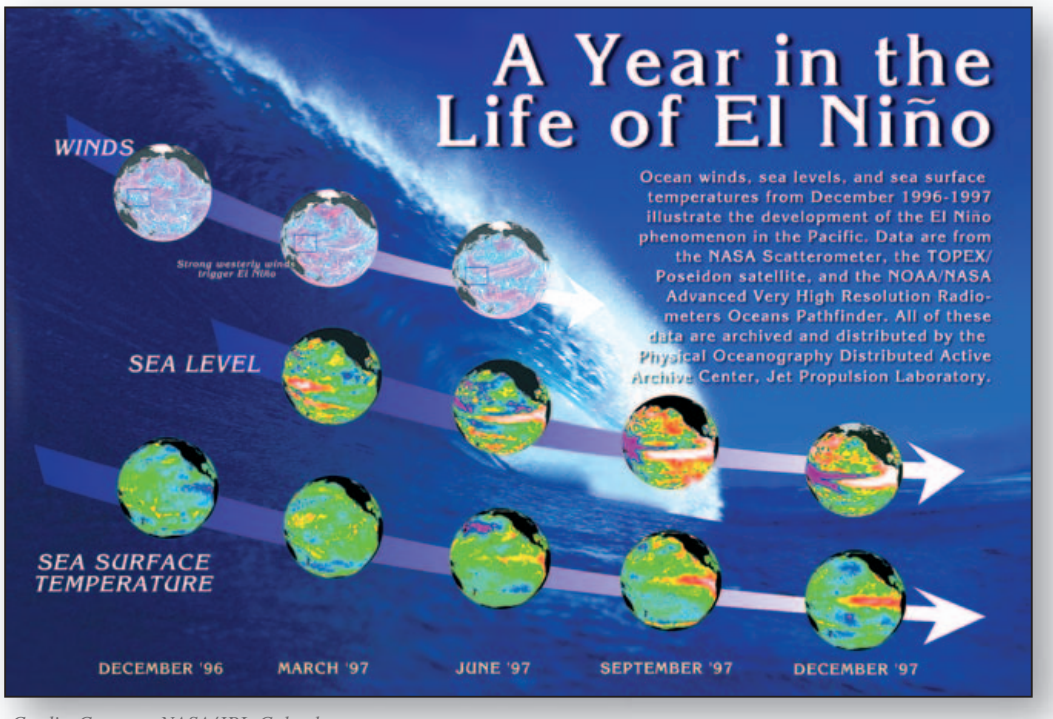
The European Commission announced that it would fund the proposal for a GOOS Regional Alliances Network Development (GRAND), which had been developed by the First Session of the GOOS Regional Forum, December 2002. The funds will enable the different GRAs to work more closely together in future, and to develop GOOS more strongly at the regional level.

Planning for and implementation of GOOS developments in the Pacific and Indian Oceans continued to be ably supported by the IOC Regional Programme Office, for GOOS, in Perth, Western Australia. The IOC Regional Programme Office for GOOS, in Rio de Janeiro, Brazil, began its support for GOOS developments in the South Atlantic and Equatorial Atlantic, which carries responsibility within the IOC for coordinating the PIRATA array in the tropical Atlantic.

The joint IOC and ICES (International Council for the Exploration of the Sea) Steering Group on GOOS met in Nantes, France, 9-10 April, to continue development of plans for an ecosystem-based approach to fisheries and environmental management for the western and eastern North Atlantic.

The GOOS community continued to work towards developing closer links with PICES (the North Pacific Marine Science Organisation, also known as the Pacific ICES), through attendance of senior GOOS representatives at the PICES Annual Conference in Seoul, Korea, 10-18 October.

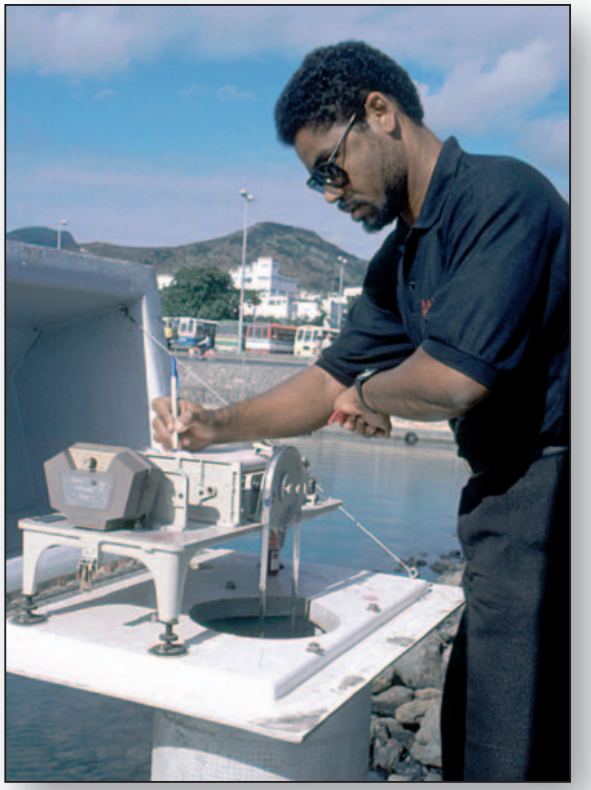
In order to ensure that global observations are made in a coherent and integrated way, and that the space agencies plans for global observation are consistent with those of GOOS, the IOC, like other UN agencies (WMO, UNEP, FAO, UNESCO) and the International Council for Science (ICSU), is an associate member of the Committee on Earth Observation Satellites (CEOS), and, with CEOS and these other agencies, is a member of the Partnership for an Integrated Global Observing Strategy (IGOS) <http://igospartners.org/>. IOC has assisted the IGOS-P to develop three theme documents setting out the challenges in developing space-based and *in situ* observations of particular parts of the Earth system. These documents are: the "Ocean Theme," published in January 2001, the "Integrated Global Carbon Theme," published at the end of 2003, and the "Coastal Theme," which is a work in progress and involved a meeting in Hamilton, New Zealand, 4-6 November. The progress and plans of CEOS and the IGOS Partners were examined at the IGOS Partners meeting, Paris, France, 4-5 June, and the CEOS Plenary meeting, Colorado Springs, CO, USA, 18-20 November. In addition, IOC continued to play a part with WMO in the coordination of operational oceanographic and



Credit: Courtesy NASA/JPL-Caltech

meteorological satellites, through participation in the 31st Session of the Coordinating Group on Meteorological Satellites, Ascona, Switzerland, 10-14 November.

Capacity Building to enable developing countries to participate in, contribute to, and benefit from GOOS is a key plank in the GOOS strategic plan. Much of the capacity building effort has been focused on the continuing development of the GRAs (above), and on implementation of the GOOS Capacity Building (CB) Panel Action Plan <http://ioc.unesco.org/goos>, key elements of which are: to increase access to and training in the use of remotely sensed ocean data from satellites; to increase access to and training in the use of numerical models; and (with IODE and JCOMM) to improve data and information management in support of GOOS. These remote sensing and modeling aspects form key elements of the ROOFS-AFRICA proposal mentioned earlier. In addition, remote sensing forms the core of the UNESCO Cross Cutting Project on Water Resources and Ecosystems in Africa, for 2002-2003, which is managed by the GOOS Project Office. The Project involves 11 countries in Africa. During the year they continued to work on developing national strategies for remote sensing, with the aid of consultants from remote sensing organizations. To facilitate the development of a coherent strategy for training and education in the use and application of remote sensing data from space, IOC joined the CEOS Working Group on Education and Training (WGEdu). This led to the development of an IOC strategy for remote sensing in capacity building, which was approved by the IOC Assembly at its meeting in June. The WGEdu met in Oberpfaffenhofen, Germany, 28-30 April, and participated in a CEOS workshop on capacity building in support of sustainable development,



Training oceanographers as part of IOC s capacity building strategy. © *J. Foy, UNESCO*

held in Stellenbosch, South Africa, 2-3 October, to solicit advice from African scientists on the development of a set of Principles for Capacity Building in the space sector. These Principles were endorsed by the CEOS Plenary meeting at Colorado Springs, CO, USA in November. Part of the IOC strategy for remote sensing involves working with the UNESCO Bilko programme for learning in remote sensing. Several discussions were held with the Bilko team during the year to formulate a programme for training, especially in Africa, to begin in 2004. Bilko representatives gave presentations at the IOC Assembly (June) and the Johannesburg ROOFS-AFRICA workshop (October), and a joint meeting with the Bilko team was held in Southampton, UK, 28-30 April.

Capacity building in remote sensing took place through training programmes, including the Pacific Islands GOOS Remote Sensing Workshop, Fiji, September (see above), and activities supported by the International Ocean Color Coordinating Group (IOCCG), which is co-sponsored by the IOC and the Scientific Committee on Oceanic Research (SCOR). IOCCG-sponsored activities for 2003 included the International Symposium on Remote Sensing and Ocean Science in South East Asia, Bali, Indonesia, September 2003, and the South-American workshop on bio-optics and ocean colour, Mar del Plata, Argentina, July 2003. In addition, the IOCCG Fellowship Programme offers the opportunity for young scientists from developing countries to conduct hands-on research, or to receive in-depth training, at a foreign institute.

Japan provided the 7th NEAR-GOOS data and information management training programme, Tokyo, Japan, 10-14 November.

Training in sea-level measurements took place through the GLOSS training workshop in Valparaiso, Chile, 7-18 April. A similar workshop planned for Southeast Asia in the spring had to be postponed to 2004 because of the SARS health scare.

GCOS is organizing a series of regional capacity building workshops, each of which has a GOOS (ocean) component. GOOS participated in one for West Africa, which

took place in Niamey, Niger, 27-29 March.

Each year some 12 Fellowships are awarded by the Partnership for Observations of the Global Ocean (POGO) for oceanographers from developing countries to spend up to three months in major global oceanographic laboratories learning various aspects of GOOS-related observational techniques, data analysis, and interpretation. Publications or articles on GOOS form another means of spreading information and raising awareness about GOOS. Recent examples include articles in Sea Technology and Ocean Challenge.

In June, the independent external group chaired by Dr. Paul Mason and appointed by the Twenty-first IOC Assembly to carry out a review of the organizational structure of GOOS, completed its work and reported to the Twenty-second Session of the IOC Assembly in June. While broadly satisfied with the bulk of the recommendations made, the Assembly appointed a follow-up group, chaired by Dr. Radhakrishnan (an IOC Vice Chairman) to develop an action plan for the implementation of the recommendations, and to report to the IOC Executive Council in June 2004. ■

Will the future bring stronger storms? More El Niños?

In November 2003, the Global Climate Observing System Secretariat prepared a report to determine what progress had been made in defining and implementing climate observing networks and systems. Titled, "The Second Adequacy Report," its aim was to assess how well current systems are meeting the needs set out by the United Nations Framework Convention on Climate Change (UNFCCC). Nearly half of the climate variables contained in the Convention relate to oceans and coasts, and many involve IOC programmes, such as the CO_2 Panel and the Global Ocean Observing System.

The report s conclusions were encouraging. Although much still needs to be done for ocean networks to meet the needs outlined in the Convention, the report found significant improvements in the monitoring capabilities of key climate variables. The design for an initial global ocean observing system for climate has been established and, most significantly, it has been demonstrated that we can indeed observe climate changes in the ocean at global scales.

In the following summary, **Dr. Albert Fischer**, Programme Specialist at IOC, discusses the report s initial identified global ocean observing network, which forms part of IOC s response to the Convention s appeal for the protection of Earth s climate system and preparation in adapting to the impacts of climate change.

Predicting and Monitoring Climate: A Global Concern

Climate is just the weather averaged over a longer period of time. And this idea is at the center of the dual nature of the global ocean observation network, shared between the Global Ocean Observing System (GOOS), the Global Climate Observing System (GCOS), and the World Climate Research Program (WCRP).

GOOS is aimed at the requirements of a wide range of clients, from those with immediate ocean monitoring needs, such as coastal and port managers and the fishing and shipping industries, to those who will benefit from improved forecasting using ocean observations. Many of these applications place a high emphasis on the immediate availability of global ocean data, for real-time monitoring and incorporation into ocean and weather forecasting models.

The primary aim of GCOS is to build a continuous, high quality record of climate variability and change, in the oceanic, atmospheric, and terrestrial domains, in order to monitor climate change and to improve our understanding and predictive capability of the climate system. A high emphasis is placed on the accuracy, continuity, and distributed geographic coverage of the data record. These priorities are embodied in the GCOS Climate Monitoring Principles, which have been endorsed by the UN Framework Convention on Climate Change (UNFCCC).

But these disparate users of ocean data are essentially seeking information on the same variables, from the same global ocean. The two unique sets of data requirements—immediate availability and climate quality—are not irreconcilable, and in fact the global component of GOOS and the ocean component of GCOS are one and the same. This global network of ocean observations is coordinated by the Ocean Observations Panel for Climate (OOPC), whose technical secretariat resides at the IOC. The OOPC reports to GOOS, GCOS, and the WCRP, and has as its mission the coordination, evaluation, and coordination of the implementation of the global ocean observing network. The implementation of some of the global ocean network is done through the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM).

The oceanographic research community has played a major role in the conception and development of the systems that now make up the growing global ocean observing network, and will remain so for many years to come. They are also an important beneficiary and client of the network, and so will continue to have important input as some systems become more operational.

The balancing of these different requirements can in some cases be delicate, but it is clearly of mutual

benefit that the global ocean observing network serves multiple purposes. Most of the system is dual-use. This includes all of the surface network including surface temperature, wind, height, and ocean color observations from satellites, sea level from tide gauges, surface meteorology, salinity and temperature from ships, temperature and currents from drifters, and surface meteorology, temperature, and salinity from moorings. The dual-use nature extends to much of the subsurface network, including temperature from XBTs, temperature, salinity, and currents from moorings, and the rapidly growing network of vertical profiles taken by Argo floats.

Other components of the global system are clearly priorities for climate rather than real time monitoring, such as carbon observations, both at the surface and subsurface through hydrography. Their inclusion in the coordination of the global network brings efficiencies, as many of the same observing platforms are used.

In 2003, the initial identified global ocean observing network was about 40 percent complete.

The importance of thinking of climate as being the average weather has also taken root in the world of climate modeling and prediction, with a growing understanding that events on short "weather" time scales can affect the longer-term trajectory of the climate system, and vice-versa.

One example of this came with the 1997 El Niño. Central to the physics of the El Niño-La Niña cycle in the Pacific Ocean is a balance between warm surface waters in the Western Pacific, which provoke rising air, atmospheric convection and rainfall, driving easterly (westward) winds along the equator, which in turn maintain the warm pool of waters in the west. This positive feedback, first described by Bjerknes, is interrupted in an El Niño. Warm surface waters, the

overlying atmospheric convection, and resulting wind patterns shift eastward across the basin, ultimately affecting climate conditions over large parts of the world.

The tropical climate system harbors a source of what climate scientists often regarded as "noise" - this is the Madden-Julian Oscillation, an instability of the convection that moves rapidly eastward across the Indian and Western Pacific Oceans, with a period of about 30-60 days, and creating at the air-sea interface a strong westerly (eastward) wind burst. Prediction of these westerly wind bursts has thus far been difficult. But the strong westerly winds counteract the prevailing easterly winds, and can set off ocean processes that move the reserve of warm water in the Pacific eastward, a situation that may grow or add to an El Niño.

There were two strong westerly wind bursts in December 1996 and in March 1997 in the Western Pacific. The first of these did not seem to have a lasting effect on sea surface temperatures, but the March 1997 wind burst appears to have acted as either a trigger or an amplifier of what eventually grew into one of the strongest El Niños on record.

The Global Ocean Observing System, including satellite measures of sea surface temperatures and winds, anchored by surface drifters and ship measurements, as well as the *in situ* TAO/TRITON moored array in the Pacific, greatly contributed to our understanding of this weather-climate interaction—the details of which are still being debated by climate scientists. The observational feedback into the validation of climate models will also help improve our ability to say how weather might change with changing climate: Will the future bring stronger storms? More El Niños?

The continuous and complete monitoring of the global oceans therefore not only has immediate benefits in improved ocean monitoring and forecasting, but also serves to help the scientific community in improving our understanding of the climate system, and in reducing uncertainties in our ability to predict future climate variability and changes. ■

An Overview of the Year 2003 in IOC's

Ocean Services

By Peter Pissierssens, Head of Section

IODE-XVII

The Intergovernmental Oceanographic Commission of UNESCO s Committee on International Oceanographic Data and Information Exchange held its 17th Session (IODE-XVII) at UNESCO Headquarters, 3-7 March. The Session was attended by 72 delegates from Member States, 16 representatives of organizations, programmes and projects, and 5 observers.

The Committee reviewed the work of the past inter-sessional period, noting *inter alia* the considerable progress made in cooperation with the Global Ocean Observing System (GOOS) and the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM), the new IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices (GE-BCDMEP), the new Global Ocean Surface Underway Data Pilot Programme (GOSUD), the development of a Marine XML, the Marine Environmental Data Inventory (MEDI), the training system OceanTeacher, the dynamic content management system BeeBox, and the regional networks ODINAFRICA and ODINCARSA.

The Committee recommended the merging of the IODE Group of Experts on Technical Aspects of Data Exchange (GETADE) and JCOMM Expert Team on Data Management Practices (ETDMP), established an intersessional working group to examine the future role of World Data Centres (WDCs), Responsible National Oceanographic Data Centres (RNODCs) and National Oceanographic Data Centres (NODCs), established an *ad hoc* working group on the implications of GOOS and JCOMM development on IODE, called for further support for the ODINAFRICA and ODINCARSA networks, and recommended the establishment of the Ocean Information Technology (OIT) pilot project, jointly sponsored with JCOMM and GOOS.

The Committee further defined the terms of reference for the IODE Review and expressed its strong support for the draft policy as prepared by the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy.

The Committee strongly supported the establishment of an IODE Project Office and recommended that the offer of the Government of Flanders and the City of Oostende to host the office in Oostende, Belgium be accepted. The Committee prepared two Resolutions and six Recommendations for adoption by the IOC Assembly during its Twenty-second Session. The IOC Assembly, at its Twenty-second Session, adopted the IODE Recommendations.

Development of Standards

Contribution by IODE to the development of a Marine XML as a standard for Internet-based data interchange.

The EU Marine XML project, "Marine XML: A Pre-standardization Development for Marine Data Interoperability Using XML," officially commenced in February 2003. The project has the aim to align the development of a Marine Mark-up Language (MML) with other related standards and demonstrate a prototype MML in a test-bed environment. Crucially this project will also provide a mechanism for the ongoing development of the standard when the project is completed in 24 months time. Given the large number of existing standards, the immediate aims of the project are to model how these standards interrelate with each other and with the requirements of the marine community such that the basis for an XML specification can be realized. IOC, through the IODE programme is responsible for disseminating developments and findings of Marine XML to interested stakeholders and organizations, developing an Exploitation Plan for identified exploitable project deliverables, and ensuring the post-project development and standardization of an MML.

The Second Session of the International Council for the Exploration of the Sea (ICES)-IOC Study Group on the Development of Marine Data Exchange Systems using XML (SGXML) was held in Gothenburg, Sweden, 26-27 May 2003. The Group developed a set of Action Items for the intersessional period focusing on three areas of interest: (i) Metadata Investigation; (ii) Parameter Dictionaries; and (iii) Point Data Investigation. The Group also developed a Vision for SGXML:

"The ICES-IOC SGXML will utilize or establish international standards to promote the seamless exchange of data from distributed data sources, by using a single parameter dictionary, well-defined and explicitly tagged metadata, and a common XML data structure, packaging all content and providing to the client datasets and

software tools that are platform independent or Web enabled."

Details of both these Marine XML initiatives are available on the Marine XML community portal Web site hosted by IOC at <http://www.marinexml.net>.

Contribution by IODE to the maintenance of a global directory system (MEDI).
Intended for databases, data catalogues, and data inventories for a broad user community, including IOC programmes, such as GOOS, and related activities within other global and regional programmes.

The MEDI metadata directory is a global inventory of data holdings held in the IOC Member States and agencies. During the year, training in the use and installation of the MEDI metadata authoring tool was provided to data centers participating in the ODINAFRICA project, the ODINCARSA project, and for the Black Sea and the Caspian Sea countries. The MEDI software was installed in data centers in Africa, South and Central America, and Caspian Sea region. During the year, 177 dataset descriptions were submitted by Member States to the MEDI metadata repository, which is hosted by IOC/IODE at <http://ioc.unesco.org/medi/>.

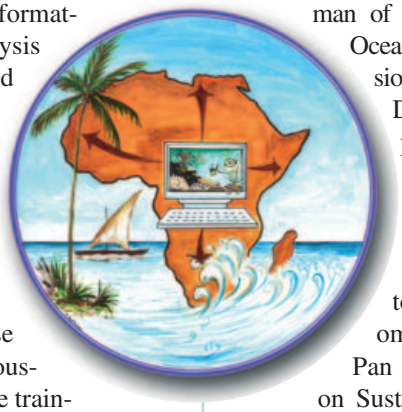
Capacity Building

Development of comprehensive Ocean Data and Information Network (ODIN) projects.
Designed to assist developing countries with the establishment of national ocean data and information facilities; to provide developing countries with access to up-to-date ocean data and information; and to foster the full and active participation of developing countries in the Internet-based society.

Africa Region: ODINAFRICA

The following training courses were held as part of the ODINAFRICA-II program for ocean data management:

- A special remedial workshop was held in Accra, Ghana, 14-18 April, and was attended by seven students from six countries (Benin, Cameroon, Côte d Ivoire, Ghana, Guinea, Nigeria). A set of intersessional assignments was formulated that included a wide range of specific dataset measures and products that will be assigned regularly through the recently established ODINAFRICA.net communication network.
- A special workshop was held in Tulear, Madagascar, 30 June-11 July. The workshop addressed the specific marine data identification, reformatting, and analysis methods needed by Madagascar s National Oceanographic Data Centre to develop a new national marine atlas. A remedial course (held simultaneously) addressed the training needs of the ODINAFRICA-II student from Comoros who requested "one-on-one" training to reach parity with the other students.



- The ODINAFRICA-II Training Course in Marine Data Management was held in Maputo, Mozambique, 11-22 August, and was organized by the Instituto Nacional de Hidrografia e Navegaçao (INAHINA). The workshop was attended by 10 students from marine institutions and universities in Mozambique.
- The third and final ODINAFRICA-II Training Course in Marine Data Management was held in Brussels, Belgium, 1-5 September, and was attended by 13 data managers from National Oceanographic Data Centres in Africa. The data management aspects of the implementation of the ODINAFRICA-II project were reviewed in order to identify the successes and failures and to consider actions to be taken to progress the implementation of the third phase of ODINAFRICA.
- ***ODINAFRICA Seminar and Exhibition***
  The Ocean Data and Information Network for Africa (ODINAFRICA) held its planning and review meeting at the Flemish International Conference Centre, Markiesgebouw, in Brussels, Belgium, 8-10 September. In his opening address, the Vice Chairman of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, Dr. K. Radhakrishnan pointed out that ODINAFRICA was one of the major initiatives that IOC has undertaken in Africa to implement the recommendations of the Pan African Conference on Sustainable Coastal Area Management (PACSICOM) held in Maputo, Mozambique in 1998 and is a contribution to the African Process for the Development and Protection of the Coastal and Marine Environment. He noted that ODINAFRICA has succeeded in its objective, which was to enable IOC Member States in Africa to obtain access to ocean data and information, to develop skills for manipulation of data and to develop infrastructure for archival, analysis, and dissemination of the data and information products. IOC was happy to be involved in the development of the proposal for the next phase of ODINAFRICA.

The achievements of the current phase of ODINAFRICA include: establishment of 10 new National Oceanographic Data and Information Centres (NODCs) in Benin, Cameroon,

Comoros, Gabon, Ghana, Mauritania, Morocco, Senegal, Togo, and Tunisia during the current phase of ODINAFRICA, bringing the total number of NODCs in Africa to 22; support for NODCs in the participating Member States to cater for a wide range of activities such as operational expenses (including Internet connection); development of meta databases and data archives; development of data and information products; and public awareness creation on the project s products and services. The databases developed at national level (such as directories of experts and institutions, meta databases, library catalogs, etc.) are now being collected, quality controlled, and formatted for access via the Internet in order to encourage broader usage. Training and follow-up support in marine data and information management was provided to experts from the participating institutions. Several of the institutions have already embarked on the preparation of national marine atlases.

The participants endorsed the elements of the proposal for the next phase, which will encompass: development of an African Coastal Ocean Observing System; further development and strengthening of the NODCs to enable them to manage data streams from the coastal observation network, and biogeographic and hydrological data streams; and development and dissemination of a wide range of data and information products required for the integrated management of the coastal and marine environment/resources.

The representative of the government of Flanders, Dr. Freddy Colson, the Director General of the Department for Science, Innovation and Media, noted that an external evaluation of the Flanders UNESCO Trust fund (FUST), through which ODINAFRICA is implemented, had concluded that the FUST agreement had been successful, and individual projects under the agreement had been well managed and the desired results achieved. This was further demonstrated by the presentation of posters and products outlining the achievements of ODINAFRICA exhibited during the Brussels meeting. Dr. Colson noted that the new proposal, developed during the meeting, intends to consolidate the ODINAFRICA achievements in the past six years and also enhance the networking of the data centers by linking them to other programmes, including GOOS Africa and the Integrated Coastal Management programmes, both at local and regional level. Such a common and integrated approach is the only way to solve the many problems faced in the coastal areas of Africa. He conveyed the best wishes of the Flemish Government of the Kingdom of Belgium, and its concern and firm dedication for international cooperation and full partnership. The symposium and exhibition were also attended by Ambassadors of African Member States of IOC/UNESCO based in Brussels, Belgium.

More information on ODINAFRICA can be obtained from the Web site <http://www.odinafrica.net> (hosted by IOC/IODE).

Caribbean and South America Regions: ODINCARSA

The Ocean Data and Information Network for the Caribbean and South America regions (ODINCARSA) continued this year with the following activities:

- Second ODINCARSA Training Course in Marine Data Management, which was held in Cartagena, Colombia, 13-17 October, and hosted by the Centro de Investigaciones Oceanográficas e Hidrográficas (CIOH). Students attended the course from Argentina, Brazil, Chile, Colombia, Cuba, Ecuador and Peru. The key objective of the training course was to establish a core group of trained data management instructors with the ability to teach the OceanTeacher system. A total of nine data managers were certified to provide future training for the ODINCARSA region. Four instructors were identified who could provide the training in both Spanish and English. The group discussed additional training material that could be included in OceanTeacher and agreed to provide a Spanish translation of OceanTeacher.
- The First ODINCARSA Planning Workshop for Caribbean Islands was held in Barbados, 15-18 December. The workshop was attended by participants from eight countries in the Caribbean. The meeting reviewed the ocean data and information management capacity available in this region, identified needs and capacity building requirements, and prepared a comprehensive work plan and timetable to develop a regional cooperative network for the management of oceanographic data and marine information on the basis of the experience of the ODINCARSA project in South America. The workshop designated Mrs. Donna Spencer as ODINCARSA Coordinator for the Caribbean Region. She will be liaising closely with the ODINCARSA Regional Coordinator. Jointly they will coordinate the implementation of the planned actions within the Caribbean Islands. Participants committed to ensure the official designation from each country as soon as possible to start the work plan. The work plan focuses on the following elements:

(i) Identification/updating of IODE national coordinators and ODINCARSA contact points for the Caribbean region;

(ii) Ensure that the Caribbean Community (CARICOM), the Caribbean Regional Fisheries Mechanism (CRFM), the United

Nations Environment Programme (UNEP) and the Organisation of Eastern Caribbean States (OECS) are aware of ODINCARSA and request that they act as leaders to promote the importance of data collection and management for effective decision making among member countries;

(iii) Increase awareness in the Caribbean region about products and services of IOC/ODINCARSA such as the Portal Oceanico and the CARSA DIR;

(iv) Increase linkages with GOOS, Integrated Coastal Area Management (ICAM), and Global Sea-Level Observing System (GLOSS);

(v) Conduct national assessments of current data management systems, data inventories, and user-needs through consultation and national coordination meetings;

(vi) Development of relevant national policy to govern data management, including the establishment of formal linkages among relevant agencies, and standardization of data and information management procedures and exchange formats;

(vii) Provide technical assistance to establish/strengthen information/data centers;

(viii) Provide training in data and information management and metadata processing;

(ix) Provide hardware, software including library cataloging and library management, improved Internet connection and support services;

(x) Create or strengthen marine information centers/libraries and facilitate access to relevant literature;

(xi) Create mechanisms for sharing of information, expertise and experience where capabilities exist, such as coastal zone management plans, remote sensing, and Geographic Information System (GIS); and

(xii) Provide assistance in data repatriation.

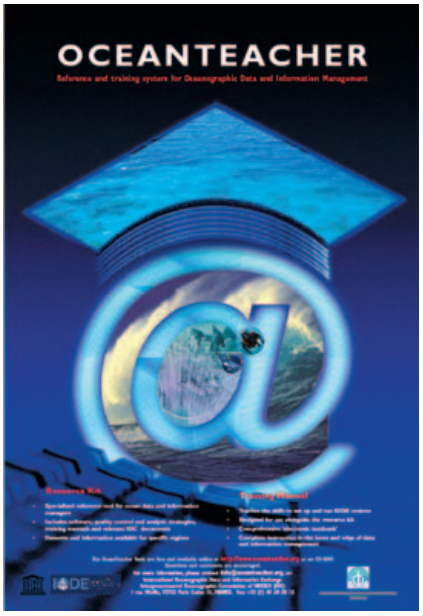
More information on ODINCARSA can be obtained from the Web site <http://www.odincarsa.net> (hosted by IOC/IODE).

Indian Ocean Region: ODINCINDIO

Noting the success of the ODINAFRICA and ODINCARSA projects, the IOCINDIO Chair proposed to develop an ODINCINDIO network for the IOCINDIO region during the IOGOOS-I Conference (Mauritius, 4-9 November 2002). This proposal was discussed in detail during the IOGOOS Workshop "Capacity Building and Strategy for Ocean Data and Information Management," held in Hyderabad, India, 8-10 December. The meeting stated that ODINCINDIO should be the capacity building instrument for IOGOOS and therefore recommended the development of ODINCINDIO.

Development of OceanTeacher

The objective of OceanTeacher <http://www.oceanteacher.org> is to provide training tools for Oceanographic Data and Information Exchange. OceanTeacher is a comprehensive training system covering both Ocean Data Management and Marine Information Management modules. OceanTeacher is now used fully during all IODE regional training courses.



Initially developed within the framework of the Ocean Data and Information Network for Africa (ODINAFRICA) project in 1998, the OceanTeacher system has since been further developed and now covers most aspects of ocean data center and marine information center operation. The content is continuously updated and further developed by the Steering Group for the Resource Kit as well as other voluntary experts. In addition, for specific courses in specific regions, dedicated CD-ROMs are compiled with data sets relevant to the region concerned.

The Second Session of the IODE Steering Group for OceanTeacher was held 29 April-1 May at the Southampton Oceanography Centre, UK. The Steering Group reviewed the current status and drafted an expanded structure for the Resource Kit that will include all data and information reference material referenced in the training manual. The Steering Group assessed the progress of data and information training for the ODINAFRICA project and finalized arrangements for the final ODINAFRICA-II training workshops, review workshop and conference. The Group also assessed progress of the ODINCARSA project. The Group discussed the future priorities for OceanTeacher and developed the goals and objectives for the OceanTeacher project. Potential e-learning solutions for OceanTeacher were also considered. The Group discussed the possibility of developing a university curriculum on data and information management that will increase awareness amongst students for the importance of quality ocean data and information management.

The immediate output was the drafting of a project proposal for the development of the ODIMeX project: the Integrated Expert and Training System for Oceanographic Data and Information Management. The objective is to

provide in a single integrated e-learning and expert system providing all the expert and training resources for marine data management and marine information management needed by professional ocean data and information managers and scientists involved in data management, as well as to provide ocean researchers and students with the necessary knowledge to interact effectively with their national oceanographic data centers.

ODIMeX is the successor of OceanTeacher. Whereas OceanTeacher focused on "traditional" oceanographic data and information management, ODIMeX will look at data and information management in a far more open way including data and information management for operational oceanography, remote sensing, etc., thereby serving not only the IODE community but also GOOS and JCOMM. The proposal was submitted to a donor in October 2003.

Cooperation

Strengthened cooperation by IODE with ocean research and monitoring communities and contribution to open access to ocean data and information at all levels of society.

The Third Session of the IODE Steering Group for Global Ocean Surface Underway Data (SG-GOSUD) was held in Monterey, CA, USA, 3-4 November. During this session the Steering Group reviewed the activities of the intersessional period and the accomplishments to date. The GOSUD GDAC has been established at Coriolis, France, which will build the FTP structure to provide access to the underway data. It is also expected that http access will be developed. The Group also reviewed the tasks identified in the Project Plan and assigned leaders for the uncompleted tasks and established target dates. The project will seek to raise its profile within the scientific community during the next year.

Cooperation with GOOS

Cooperation with GOOS was strengthened substantially during 2003. In 2003 this was witnessed mainly: (i) through closer collaboration at the regional level in the area of capacity building; and (ii) through closer collaboration with JCOMM (see Cooperation with JCOMM). In the area of capacity building we refer to the joint development of ODINCINDIO (see Indian Ocean region: ODINCINDIO) as well as the planned joint implementation of the ODINAFRICA-III project (2004-07) that will link data collection, data management and product development for management of the coastal zone.

In 2003 the IODE Secretariat and IODE Chair participated in the Sixth Session of the Intergovernmental Committee for the Global Ocean Observing System (I-GOOS-VI), held at UNESCO Headquarters, Paris, France, 10-14 March.

I-GOOS-VI welcomed the extensive linkages that now exist between GOOS and JCOMM. The Committee welcomed the progress of IODE as a response to the request of the IOC Assembly to adapt IODE to new requirements and new technologies, but called on IODE to preserve also its unique role and legacy as an important IOC Programme. The Committee welcomed the proposed merger of the IODE GETADE and JCOMM ETDMP and called for further streamlining and optimization of GOOS, JCOMM and IODE subsidiary bodies in the field of ocean data and information management. The Committee welcomed the recommendation of IODE to establish an IODE Project Office.

The Committee noted with appreciation the important efforts made by IODE in the area of biological data management but called on IODE to make similar efforts for chemical data, including pollution data as these are of great importance to the Coastal Module of GOOS. The Committee expressed its appreciation for the OceanTeacher system but called on IODE to include courses to train scientists on the importance of data and information management (also a recommendation of the Colour of Ocean Data Symposium.)

Cooperation with JCOMM

The collaboration of IODE in JCOMM that had started in 2002 at the First Session of the JCOMM Management Committee (Geneva, Switzerland, 6-9 February 2002) continued and expanded throughout 2003 and focused on: (i) cooperation of IODE in the JCOMM Data Management Programme Area; and (ii) collaboration in capacity building through ODIN and OceanTeacher.

During its Second Session (Paris, France, 5-8 February), the JCOMM Management Committee requested the IODE Committee to consider merging its GETADE (IODE Group of Experts on Technical Aspects of Data Exchange) with the JCOMM ETDMP (Expert Team on Data Management Practices) as there was obvious duplication between these bodies. It was stated that this would create an excellent opportunity for close collaboration between IODE and JCOMM.

This request was discussed by IODE-XVII (Paris, France, 3-7 March) and the IODE Committee formulated Recommendation IODE-XVII.3 on the merger. The recommendation was subsequently adopted by the Twenty-second Session of the IOC Assembly.

The First Session of the JCOMM/IODE Expert Team on Data Management Practices was held in Oostende, Belgium, 15-18 September. The ETDMP members discussed the requirements for end-to-end data management (E2EDM); existing and planned data management mechanisms and practices; cooperation with other programmes and expert teams; the strategy for the development of E2EDM; and future cooperation with the Ocean Information Technology (OIT) Pilot Project.

The Group agreed on an Action Plan for the intersessional period based on three pilot projects identified by the sessional working groups: metadata management, data assembly, quality control and quality assurance, and the development of an E2EDM Prototype. These will form the basis of the OIT Pilot Project.

Cooperation with IAMSLIC

As IODE has not established the equivalent of IODE national coordinators for information (marine library) management, communication with the marine information management community has been channelled through the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC), a non-profit association of individuals and organizations having an interest in library and information science, especially as these are applied to the recording, retrieval, and dissemination of knowledge and information in all aspects of aquatic and marine sciences and their allied disciplines. The Association provides a forum for the exchange and exploration of ideas and issues of mutual concern.

For many years IOC, through its IODE programme, has provided financial support for marine information managers from developing countries to participate in the annual IAMSLIC conferences. This has allowed them to share experience and learn from other IAMSLIC members experiences. In addition, through IAMSLIC, many libraries in developing countries could benefit from IAMSLIC member library collections (e.g., RECOSCIX projects).

In 2003 support was again provided to marine information management professionals from developing countries. The Twenty-ninth IAMSLIC Conference was held in Mystic, CT, USA, 5-9 October.

Products and Services

OceanPortal

The OceanPortal Resource Locator is a high-level directory of ocean data and information-related Web sites. Its objective is to provide a one-stop-shop for scientists and other ocean experts to locate such data and information by providing a single point of access to aggregated resources.

During 2003, the software was upgraded and the interface fully redesigned (see figure). The categories have also been redefined in cooperation with the IODE Group of Experts on Marine Information Management (IODE GEMIM). OceanPortal now has the following top categories: information resources; data resources; scientific topics; agencies and institutions; associations and societies; environment and governance; scientists and ships; commerce and trade; and miscellaneous. There are a total of 254 categories (top and sub-categories).

In 2003 the number of described sites increased to 4,100 and the portal received a total of 24,799 unique visits.

OceanExpert

OceanExpert (or the Global Directory of Marine [and Freshwater] Professionals) is a database, developed and maintained by the IOC, containing information on individuals involved in all aspects of marine or freshwater research and management. It is intended to be a tool for scientists, policymakers, and anyone who needs to contact a marine or freshwater professional. A professional is defined as a person who, through his/her job, has expertise related to the research and management of the aquatic environment. OceanExpert is a product, developed in 1997, under the auspices of the IODE Group of Experts on Marine Information Management (GEMIM). OceanExpert is a free product, but can be used only for non-profit purposes.

The OceanExpert software was re-engineered in 2003 making it faster and improving the user interface. During the year, 430 new users added their details to the system.

Cross-Cutting Initiatives: Regional OceanPortals

The UNESCO/IOC OceanPortals for Africa, Latin America, and Southeast Asia aim to facilitate access to information and data on all aspects of ocean/coastal research and management for the benefit of stakeholders in the regions. This is achieved using collaborative Web sites and distance learning technologies.

African OceanPortal

<http://portal.unesco.org/african-oceans>

In 2003, the African OceanPortal became firmly established. The network of editors, established during 2002, worked on populating the Portal with content, with 1,399 knowledge objects being made available. In addition, each editor undertook public awareness activities in his/her own country and a newsletter was produced. Where requested by edi-

tors and their host institutions, funds were made available to contribute towards the cost of Internet access. At headquarters, a graphic designer was employed to produce a new banner and layout for the Portal.

In December, an editorial and planning meeting took place in Zanzibar, Tanzania, where an analysis of existing content and layout was performed, and activities for 2004 discussed. In particular, new strategies for public awareness and improvements to the newsletter were laid out.

Portal Oceanico
<http://portal.unesco.org/portaloceanico>

Portal Oceanico (the regional OceanPortal for Latin America and the Caribbean) continued its expansion throughout 2003. The editorial and training meeting held in Guayaquil, Ecuador, at the beginning of the year increased the number of editors working on the Portal and also increased its geographical scope. The new editorial group added a considerable amount of content, with total knowledge objects rising to 2,766. An accompanying newsletter was produced, and distributed to regional experts.

At headquarters, a new banner and user interface were produced in response to user and editor comments.

BeeBox: The IOC/IODE Dynamic Content Management System

BeeBox is an open source application for the development of community portals. The BeeBox architecture allows multiple authors to submit content. BeeBox is based upon open source technology including mySQL and PHP. As such, IOC can offer the solution free of charge. BeeBox uses the knowledge type concept: information can be of different types; it can be text (like an ordinary Web page), a link to another Web site, an activity, an e-document, or a discussion forum. The alert and subscribe functions are another core function of BeeBox. The alert function ensures that all registered members will automatically receive an email alert message whenever new content is added to the site. This is a really important feature that increases "repeat visitors" spectacularly.

In 2003, development of BeeBox was continued, making the construction of user interfaces more flexible. The front-end code was entirely rewritten to be more modular and make use of a templating system, thus allowing new layouts to be constructed without modifying the software code. A new user interface was developed, allowing users to add and edit site content while browsing, without the need to access a separate page. In addition, the cross-referencing and searching of all types of content between categories was made possible, enabling users to view relevant information more easily.

Strategy and Policy

Strategic Plan

In order to bring the data management activities of the different IOC programmes together, the JCOMM Management Committee (at its First Session, 2002) had recommended that a draft resolution be prepared for the Thirty-fifth session of the IOC Executive Council calling for the development of an IOC integrated data management strategy, encompassing all IOC programmes. The Thirty-fifth Session of the IOC Executive Council had subsequently adopted Resolution EC-XXXV.2 "IOC Strategic Plan for Oceanographic Data and Information Management," which established a Task Team with the following terms of reference: (a) carry out an assessment of data and data product requirements of existing oceanography and marine meteorology programmes/projects, and evaluate whether these are currently met by the various groups of IODE data centers; (b) take into consideration existing data management plans such as the GOOS data management plan and relevant WMO data management plans; (c) draft an IOC Strategic Plan for oceanographic data and information management, taking into consideration the requirements for such a plan within the framework of JCOMM; and (d) submit a report on progress to the IOC Assembly.

The First Session of the Task Team on the Development of an IOC Strategic Plan for Oceanographic Data and Information Management was held at UNESCO Headquarters, Paris, France, 23 June. The Task Team elected Dr. Neville Smith as its Chairman. The Session identified

the rationale, objectives, and elements of the future data and information management system, as well as its governance. It is expected that the Second Session of the Task Team will be held upon completion of the IODE Review.

The IOC Assembly, at its Twenty-second Session, urged the Task Team to ensure that the IOC Strategic Plan build upon existing national, regional, and international (infra)structures and capacities, and be based upon an assessment of needs, which will then lead to the identification of technological requirements.

Data Policy

The IODE Committee, during its Seventeenth Session, 3-7 March, expressed its strong support for the draft policy as prepared by the Second Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy.

The Policy was adopted by the IOC Assembly at its Twenty-second Session as IOC Resolution XXII-6 entitled "IOC Oceanographic Data Exchange Policy." The policy includes: (i) a preamble that states that the timely, free and unrestricted international exchange of oceanographic data is essential for the efficient acquisition, integration and use of ocean observations gathered by the countries of the world for a wide variety of purposes; and (ii) six clauses that guide Member States in the exchange of different types of data.

Intersessional working group to examine the future role of WDCs, RNODCs and NODCs

During its Seventeenth Session, the IODE Committee noted that the rapid changes in technology, changed user needs and capacity of many science programmes, and even users hosting their own data on the Internet, posed challenges for WDCs, RNODCs and NODCs. Through Resolution IODE-XVII.1 the Committee established an intersessional working group to examine the future role of WDCs, RNODCs and NODCs. The group will: (i) review and summarize present and planned capabilities and functions of the centers; (ii) provide a synopsis of anticipated needs; (iii) compare and note where present and planned capabilities are meeting and identify where significant opportunities exist for meeting gaps.

List of meetings and related events organized by, or directly involving, IODE

15-18 December 2003
ODINCARSA Planning Workshop for Island Countries in the IOCARIBE Region
Venue: Barbados
URL: <http://www.odincarsa.net/>

8-10 December 2003
IOGOOS Workshop on Capacity Building and Strategy for Data and Information Management
Venue: Hyderabad, India
URL: <http://www.incois.gov.in/Incois/iogoos/HyderabadWorkshop.jsp>

10-21 November 2003
7th IOC/WESTPAC Training Course on NEAR-GOOS Data Management
Venue: Japan Oceanographic Data Center, Tokyo, Japan
URL: <http://www.jodc.go.jp/project/WESTPAC/training.html>

3–6 November 2003
Regional OceanPortal Meeting (African Region)
Venue: Zanzibar, Tanzania

3-4 November 2003
3rd Session of Steering Group for GOSUD (SG-GOSUD)
Venue: Monterey, CA, USA
URL: <http://www.ifremer.fr/sismer/program/gosud/>

5-10 October 2003
29th Annual IAMSLIC Conference
Venue: Mystic, CT, USA
URL: <http://www.averypoint.uconn.edu/slic2003.html>

15-18 September 2003
First Session JCOMM/IODE ETDMP
Venue: Oostende, Belgium
URL: <http://ioc.unesco.org/iode/contents.php?id=189>

10 September 2003
ODINAFRICA Review Seminar and Exhibition
Venue: Brussels, Belgium
URL: <http://ioc.unesco.org/iode/contents.php?id=204>

8-9 September 2003
ODINAFRICA Review and Planning Workshop 2003
Venue: Brussels. Belgium
URL: <http://ioc.unesco.org/iode/contents.php?id=204>

1-6 September 2003
ODINAFRICA Data and Information Management training courses
Venue: Brussels, Belgium
URL: <http://ioc.unesco.org/iode/contents.php?id=204>

15-18 July 2003
ASFA Advisory Board 2003
Venue: Havana, Cuba
URL: <http://www.fao.org/fi/asfa/asfa.asp>

23 June 2003
First Session Task Team Development of an IOC Strategic Plan for Oceanographic Data
Venue: UNESCO Headquarters, Paris, France
URL: <http://ioc.unesco.org/iode/contents.php?id=193>

26-27 May 2003
Second Session of ICES/IOC Study Group on the Development of Marine Data Exchange Systems using XML
Venue: Gothenburg, Sweden
URL: <http://ioc.unesco.org/marinexml/contents.php?id=8>

7-9 May 2003
EURASLIC 10 : "Smooth Sailing: Crossing the Boundaries in Aquatic Sciences"
Venue: Kiel, Germany

URL: <http://www.ifm.uni-kiel.de/ze/zb/conference/first.htm>

29 April-1 May 2003
Second Session of Steering Group for the OceanTeacher Project (SG-OT)
Venue: Southampton Oceanography Centre, UK
URL: <http://ioc.unesco.org/iode/contents.php?id=185>

3-7 March 2002
IODE-XVII
Venue: UNESCO, Paris, France
URL: <http://ioc.unesco.org/iode/categories.php?category_no=56>

5-8 February 2003
JCOMM Management Committee-II
Venue: UNESCO headquarters, Paris, France
URL: <http://ioc.unesco.org/jcomm/categories.php?category_no=16>

19-21 February 2003
Regional OceanPortal Meeting (Caribbean and South America Region)
Venue: Guayaquil, Ecuador

International Geological/ Geophysical Atlases of the World's Oceans

Publication of the International Geological/Geophysical Atlas of the Pacific Ocean has brought one of the longest running projects of the Intergovernmental Oceanographic Commission (IOC) of UNESCO to a very successful and satisfactory conclusion.

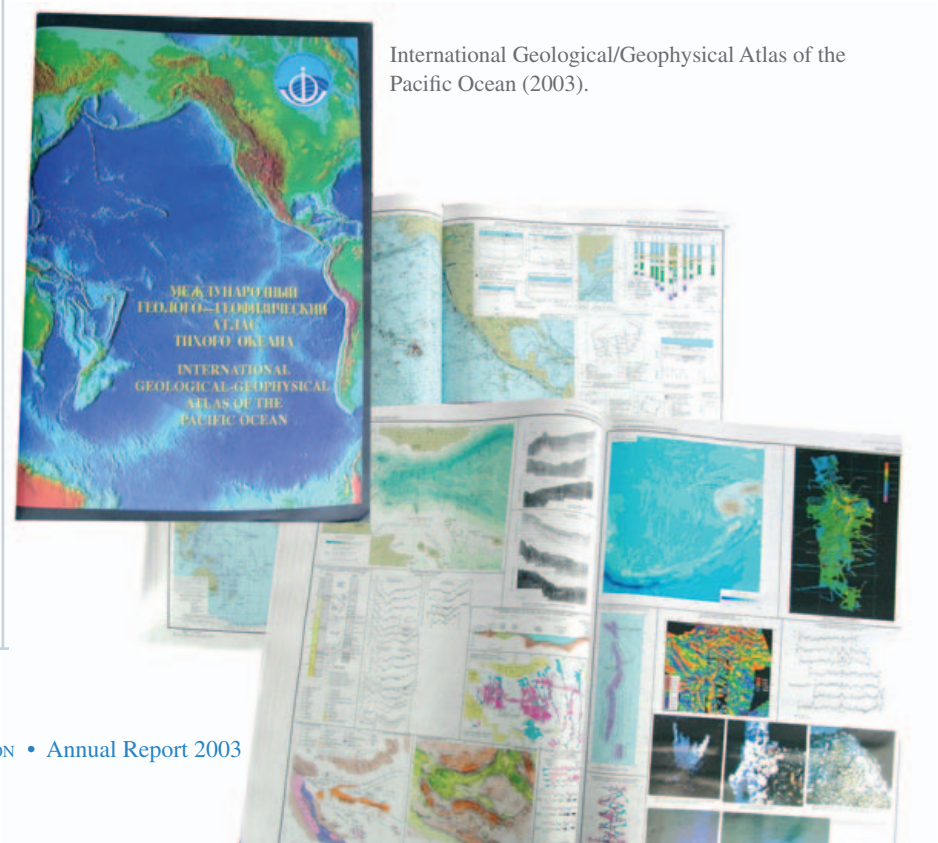
In 1966, after the International Indian Ocean Expedition (IIOE), the Soviet Union was entrusted with the task of publishing, as an international cooperative effort, an atlas illustrating the structure of the ocean floor, based on the extensive amount of new data that had been collected during the expedition. Preparation of the "Geological/Geophysical Atlas of the Indian Ocean" was carried out under the supervision of an international editorial board and the Atlas was published in 1975.

The Indian Ocean Atlas met with the approval of the scientific community and gave rise to a plan to produce similar Atlases of the Atlantic and Pacific Oceans. These were published in 1989-90 and 2003 respectively. The main idea behind the compilation of these two Atlases was to bring together the vast amount of data that had already been gathered by research scientists but had still to be published, or had only been published on a small scale, often with a fair amount of interpretation. The extremely rapid technological developments that had taken place since the Second World War had resulted in a large amount of new data on the structure of the ocean floor, and brought about a revolution in the understanding of tectonics of the Earth s ocean basins; it had given rise to the concept of the new global theory of plate tectonics.

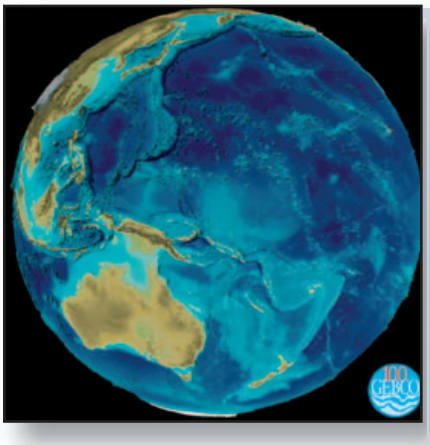
The main collection of maps are presented on scales of 1:10 million (at 45 latitude), on Mercator projection and 1:30 million on Urmaev Pseudocylindrical projection. These maps contain information on the topography of the ocean floor, magnetic and gravity anomalies, sea surface heights, geothermal data, seismicity, the deep structure of the Earth s crust, the thickness of sediments, types of sediments, magmatic and metamorphic rocks of the basement, mineral resources, and the results of deep-sea drilling. These are supplemented by more detailed, larger scale, Mercator projection maps of a number of geologically interesting, intensively studied areas. Rift zones and transform fault bathymetric maps, based on multibeam echo-sounding surveys are particularly informative.

A complete list of original source data, references, and other source material used by the authors in compiling the maps is included in the references at the end of the Pacific Ocean Atlas. Loose annex sheets include several general maps of the world s oceans: measured and estimated sea-floor topography, linear magnetic anomalies and the age of the basement, gravity anomalies derived from satellite altimetry, dynamics of the lithosphere and volcanoes of the Earth.

All three Atlases were developed under the supervision of the Chief Editor, Dr. Gleb B. Udintsev, who was supported by active international editorial boards. These set themselves the goal of ensuring that all contributors presented their data in as much detail and in as objective a way as possible. The Atlas project, including contents and layout, was developed in consultation with the FSUE Mapping Production Association "Kartografia" under the



International Geological/Geophysical Atlas of the Pacific Ocean (2003).



The Earth relief portrayed here uses the global IHO/IOC GEBCO One Minute Grid. *(Courtesy: Martin Jakobsson at the Center for Coastal and Ocean Mapping/Joint Hydrographic Center, University of New Hampshire and NOAA)*

skilled guidance, as Chief Cartographer, of Dr. Dina I. Zhiv.

GEBCO and Ocean Mapping (Regional Bathymetric Charts)

The main General Bathymetric Charts of the Oceans (GEBCO) activities in 2003 were focused around the compilation of new data for the Sixth Edition and also on the constitution of a high resolution (one minute) grid to be incorporated in the Third Edition of the GEBCO Digital Atlas (GDA). GDA was published at the end of 2002 by the British Oceanographic Data Center (BODS) and amended at the beginning of 2003, and is now available for users.

Additionally, the GEBCO Guiding Committee successfully celebrated the GEBCO Centenary Conference, 14-16 April, in Monaco, organized and co-sponsored jointly by IOC and the International Hydrographic Bureau (IHB). The Centenary Volume was published in the Netherlands and was available during the GEBCO Centenary Celebration. The GEBCO Sub-Committee for Undersea Feature Names (SCUFN) advanced considerably during 2003 and approved more than 360 new geographical names. The GEBCO Guiding Committee meeting, jointly organized by IOC and IHB, took place in the International Hydrographic Organization s (IHO) Headquarters in Monaco, 16 April. During 2003, the IOC Secretariat, together with IHB, centered their efforts on new ocean mapping support mechanisms. The GEBCO Guiding Committee successfully concluded negotiations with the Nippon Foundation, which agreed to support post-graduate training in marine cartography.

International Bathymetric Chart of the Mediterranean (IBCM) and its Geological/Geophysical Series

The last in the Geological/Geophysical Series of IBCM, the Seismicity Chart was printed by HDNO (Russia) in 2000 and widely distributed to users. Editorial Board activities, mainly focused on compilation of new multi-beam data available in scientific institutions and hydrographic offices of the Black Sea and Mediterranean region. The XIII Conference of the Mediterranean and Black Sea Hydrographic Commission again strongly supported the production of a CD-ROM version of the Second Edition of IBCM and urged Member States of IHO to contribute their data. More than two million echo-sounders have already been collected for this purpose.

International Bathymetric Chart of the Western Indian Ocean (IBCWIO)

Sheets 03, 06, 09, 04, 07, 10 printed by HDNO (Russia) and BSH (Germany), respectively, are available for users. The Editorial Board activities focused on data compilation for sheets 16-19. Taking into account that the compilation of new data was continuing successfully by correspondence, it was decided to postpone the Sixth Session of the IBCWIO Editorial Board to November 2004.

International Bathymetric Chart of the Caribbean Sea and Gulf of Mexico (IBCCA)

At present, the IBCCA project is one of the most successful in the framework of the ocean mapping programme. The compilation of 98 percent of IBCCA sheets has been accomplished and now exists in digital form. The printing problem of the paper version was solved and sheets 1.01, 1.02, 1.03, 1.04, 1.05, 1.07, 0.09, 1.11 were printed by INEGI in cooperation with the Hydrographic Office of the Mexican Navy, and are now available for users. The Ninth Session of the Editorial Board, combined with advanced training courses for South America s cartographers in marine cartography, took place in March 2003 at the National Geophysical Data Center (NGDC) in Boulder, CO, USA.

International Bathymetric Chart of the Central Eastern Atlantic (IBCEA)

The sheets printed in SHOM (France) in 2002 are available for users. The digitization of the IBCEA sheets continued during 2003. It was decided not to have an IBCEA Editorial Board meeting before completion of the 12 bathymetric sheets.

International Bathymetric Chart of the Western Pacific (IBCWP)

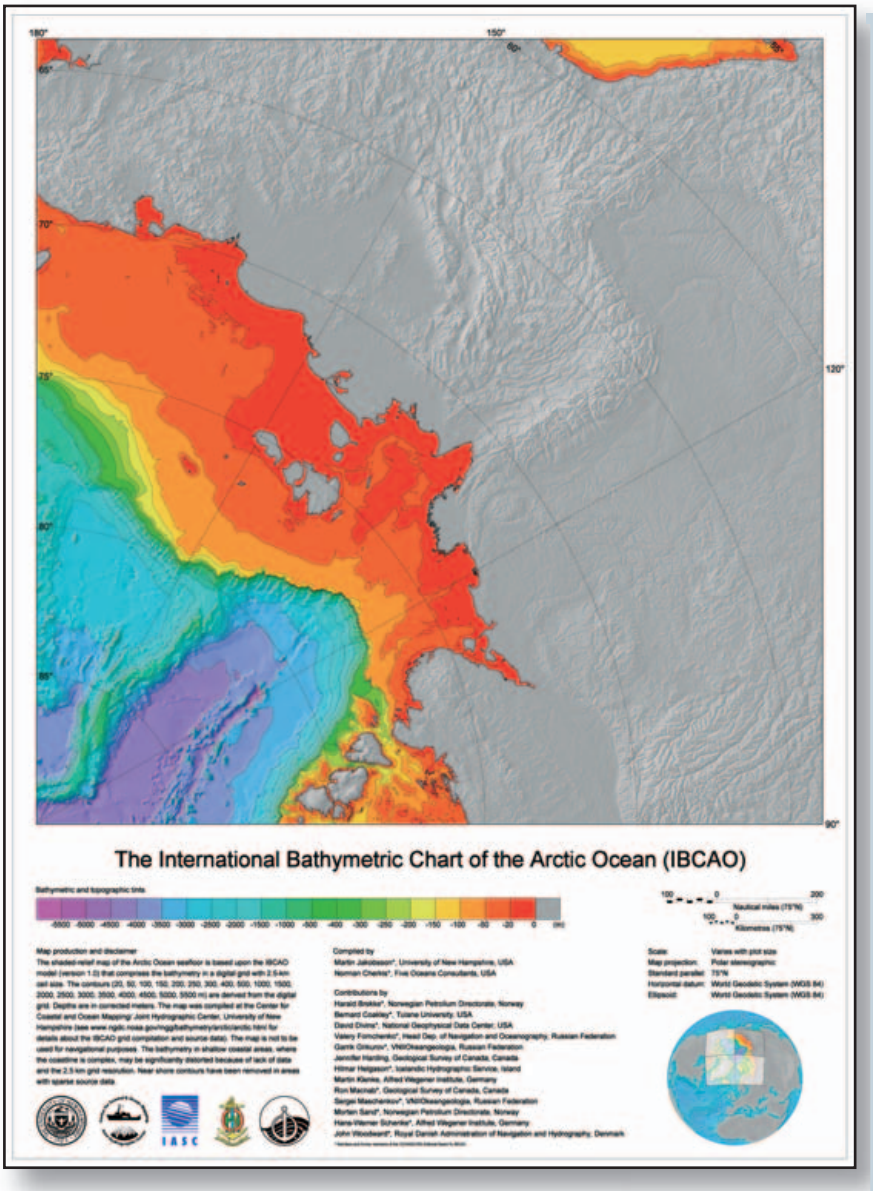
Countries of the region, such as China, Japan, and Russia, provided bathymetric data collected in 2003 for incorporation into the 3D realization of the GEBCO Digital Atlas. The fourth meeting of the IBCWP is planned for 2004. The State Oceanic Administration (SOA), China, has kindly agreed to host the meeting in the framework of the WESTPAC Symposium in April 2004 in Hangzhou, China.

International Bathymetric Chart of the Arctic Ocean (IBCAO)

The Second Edition of IBCAO was accomplished by the Editorial Board and printed by the National Geophysical Data Center (NGDC) Boulder, CO, USA, at the end of 2003 and is now available for users.

International Bathymetric Chart of the East South Pacific (IBCSEP)

The second meeting of the Editorial Board for IBCESP took place in Peru hosted by the Hydrographic Office of the Peruvian Navy. The color proof of sheets prepared by Chile and Peru were approved by



International Bathymetric Chart of the Arctic Ocean Version 1.0 created 2001-07-11. *(Courtesy NOAA)*

the Editorial Board. The problems connected with the Assembly Diagram were solved.

Geological-Geophysical Atlas of the Pacific Ocean (GAPA)

The International Geological-Geophysical Atlas of the Pacific Ocean was published by the Head Department of Navigation and Oceanography of the Russian Navy in October 2003. The Atlas was compiled under the auspices of IOC using the latest data available at the time of compilation. It is a truly international atlas, the various sectors having been prepared by scientists at the forefront of their field from the many countries of the Member States of IOC. Therefore the Editorial Board for GAPA has accomplished its task.

ITSU: Tsunami Warning System Development

ITSU-XIX

The 19th Session of the International Coordination Group for the Tsunami Warning System in the Pacific was held in Wellington, New Zealand, 29 September-3 October, under the Chairmanship of Dr. François Schindelé. It was attended by 34 participants from 15 ICG/ITSU Member States, two organizations, and two observers from other countries.

The Session reviewed progress made during the intersessional period 2001-2003 and drafted its work plan for the period 2004-2005. This work plan will focus on:

(i) Continued support for the International Tsunami Information Centre (ITIC);
(ii) Support for the development of the Global Tsunami Data Base (GTDB) and the new Integrated Tsunami Data Base (ITDB) consisting of the WinHTDB graphic shell and a Tsunami Travel Time (TTT) module;
(iii) Finalization of the Tsunami Information Kit;
(iv) Support for the newly established Working Group on a Comprehensive Tsunami Hazard Reduction Programme (TROIKA);
(v) Support for the newly established Working Group on the Central American Pacific Coast Tsunami Warning System (CAPC-TWS);
(vi) Support for the newly established Working Group on the Tsunami Warning System in the Southwest Pacific and Indian Ocean (SWP-TWS).

The Group further decided to:
(i) Study possibilities for cooperation with JCOMM;
(ii) Increase the duration of its ITSU Training programme held in Hawaii (ITP-Hawaii) to three weeks, and establish an international component (ITP-International) for in-country assistance to Member States;
(iii) Establish a "Pool of Experts" to assist Member States with expert missions;
(iv) Accept the "Tsunami Hazard Zone" and "Tsunami Evacuation Route" signs and submit these to ISO;
(v) Recommend formal collaborative links with the Circum-Pacific Council;

(vi) Reduce the frequency of the *Tsunami Newsletter* to four issues per year;
(vii) Redefine the terms of reference of the IOC-ITSU and ITIC Web sites;
(viii) Recommend close(r) collaboration with the Global Sea-Level Observing System, (GLOSS), ISDR, and CEPREDENAC.

The Group further revised the ITSU Master Plan Conclusions, adding focus on the acquisition of data in real-time and optimizing the network to ensure accurate warning issuance and minimization of false warnings. The Group requested to proceed urgently with the Review of the ITSU programme in 2004.

The Group re-elected Dr. François Schindelé and Dr. Charles McCreery as Chair and Vice-Chair of ITSU respectively. The Group welcomed Mr. Emilio Lorca as the new ITIC Associate Director, replacing Cmdr. Rodrigo Nuñez.

Training and Education

Every year the ITSU programme organizes specialized training for its Member States (International Coordination Group for the Tsunami Warning System in the Pacific [ICG/ITSU] Training Programme, ITP). The 2003 ITP was held 4-15 August for one seismologist from Indonesia and one oceanographer from Chile. The course gave increased attention on how to prepare for the local or regional tsunami threat; specific activities included discussions on the operations of the local tsunami warning system with the Pacific Tsunami Warning Center (PTWC), and visits to the Hawaii State Civil Defense and Hawaii County Civil Defense agencies. In addition, support was provided to enable an expert from Ecuador to train in Mexico (short-term). The International Tsunami Information Center (ITIC) Director also provided a one-day training to Directors of the Meteorological and Geophysical Agency s Regional Seismic Centers during the workshop "In Memoriam of 120 years Krakatau Eruption-Tsunami and Lesson Learned from Large Tsunami," held in Jakarta and Anyer, Indonesia, 26-29 August.

Publications and Awareness Tools

The ITIC continued the publication of the *ITSU Newsletter* and produced five issues in 2003. Work also continued on the Tsunami Information Kit. This product will be finalized in 2004. The Tsunami Glossary was finalized in English, French, and Spanish. The IOC/ITSU Web site was completely re-engineered using the IOC/IODE BeeBox software.

Regional and Other Tsunami Warnings

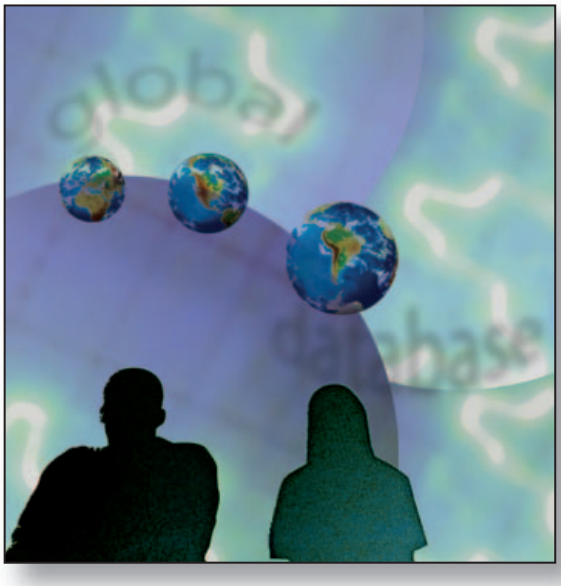
In Central America, the countries of Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, and Panama developed a plan for a Regional Tsunami Warning System along the Central American Pacific Coast. The plan was presented at the September meeting of the Board of Directors for the Coordination Center for Natural Disaster Prevention in Central America (CEPREDENAC). Indonesia reported its intention to implement a National Tsunami Warning System using existing and planned installations of real-time broadband seismograph stations and tide gauges.

Cooperation

The long-standing cooperation between ITSU and the International Union of Geodesy and Geophysics (IUGG) Tsunami Commission (IUGG/TC) continued in 2003 in terms of coordination of the joint Historical Tsunami Database for the Pacific (HTDB/PAC) project and by co-organizing workshops. The international workshop "In Memoriam of 120 years Krakatau Eruption-Tsunami and Lesson Learned from Large Tsunami" was held in Jakarta and Anyer, Indonesia, 26-29 August. It was attended by more than 100 Indonesian participants, as well as by international experts from Germany, Japan, and Russia. A second joint event organized in 2003 was the international workshop "Tsunamis in the South and Central Pacific–Research Towards Preparedness and Mitigation," held in Wellington, New Zealand, 25-26 September. It was attended by 86 participants from 18 countries. Both workshops resulted in recommendations that were subsequently tabled at ITSU-XIX. ■

Tsunami damage in Alaska, USA, following 1964 Good Friday Earthquake.
Credit: NOAA.

A global database: Information shared freely by all, for the benefit of all



The timely, free and unrestricted international exchange of oceanographic data gathered for all kinds of beneficial purposes and, in particular, for the implementation of the proposed Global Earth Observing System of Systems (GEOSS) will be essential for the advancement of the scientific understanding necessary for achieving sustainable development. However, the giant scale of the GEOSS network will require unprecedented cooperation among nations, and it is no easy task to convince some to share information they presently regard as exclusive and private, or assure others that technologically advanced nations will not benefit more than less-developed countries.

IOC s policy of free and open data exchange has been in effect for the past four decades. The International Oceanographic Data and Information Exchange (IODE) is a highly successful global ocean data system that has underpinned many global ocean science programmes, and was one of the first IOC subsidiary bodies established in 1961.

During the past three years, IOC has been negotiating an international ocean data exchange policy. At its Twenty-second Session the IOC Assembly approved the policy and recognized its great importance to Member States and the world community as a whole. In the following presentation to the Executive Council, **Dr. Angus McEwan**, Chairman of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy, examines the issues involved in an open data exchange system, why it is so essential, and the negotiations that led to forming the policy.

Approval of the IOC Oceanographic Data Exchange Policy

Report to IOC Assembly by the Chair, Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy

The formulation of a policy for the international exchange of oceanographic data was one of the first tasks undertaken by the Intergovernmental Oceanographic Commission of UNESCO after its creation in 1960. Many Member States have been concerned about the relevance of the policy today in view of the huge technical advances of the last 40 years.

In light of these advances and a worldwide trend towards commercialization of what was previously regarded as a common beneficial public service, the World Meteorological Organization (WMO) in 1995 adopted Resolution 40, which defined a policy for exchanging meteorological and relevant marine data.

Some Member States have regarded this as a suitable template for oceanographic data exchange and the creation of the Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) has heightened the need for policies to be compatible. However, there are important differences that justify a separate examination of the needs with respect to oceanographic data. Among the differences are:

- Much of the data concerns Exclusive Economic Zones, for which territorial rights apply;
- Apart from the large quantity of physical data gathered by the International Oceanographic Data and Information Exchange (IODE) network over its 40-year history, oceanographic data-gathering has not been highly coordinated through intergovernmentally mandated agreements (as it is with the WMO) and indeed much data is gathered by agencies with little or no formal obligation to exchange;
- The data types are potentially more varied and observation methods are less standardized;
- The timescales for exchange have been less well matched to their purpose.

As a result, there is a greater tendency for the data to be regarded as having an intrinsic proprietary or national value, which can be jeopardized by unrestricted exchange.

This view is detrimental to the pursuit of international public-good programmes such as those of the IOC, where data is of most value when it can be accessed freely and combined in more complete and comprehensive data-sets.

In formulating WMO Resolution 40, even in the case of meteorological data it was necessary to deal separately with essential data to be exchanged freely, and additional data to which conditions could be applied by the provider.

In the case of oceanographic data, especially if we embrace non-physical data and a host of data-types associated with coastal processes, what should be essential or additional becomes almost impossible to define.

In May 2000 an *Ad Hoc* Task Team, convened by IOC under the chairmanship of Dr. Pugh of the UK, reported its attempt to re-formulate IOC policy to embrace some of these issues. The team was unable to reach a consensus over the question of the conditions that should apply to data for commercial purposes. It did produce an excellent review of the existing policies (IOC/INF-1144).

After considering Dr. Pugh s report, the Assembly decided to create an Intergovernmental Working Group to address the matter in greater depth. Its membership was open to all Member States of the Council. (IOC Resolution XX-II.) Its charge was:

"To continue detailed discussions and assessments of existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products, with a view to proposing to the IOC Assembly:

(a) A statement of the general IOC principles and policy with regard to oceanographic data exchange;
(b) A statement of recommended practices and associated institutional arrangements for the exchange of oceanographic data;
(c) A draft resolution for consideration by the Assembly."

At its first meeting in Brussels, Belgium, May 2001, reported in IOC/INF-1163, the Intergovernmental Working Group (IWG) drafted a set of eight elements, which were to form the basis of a policy, but finally failed to reach consensus over the question of Free and Unrestricted Exchange. The Assembly therefore requested the IWG to continue its work in a second meeting.

A second meeting of the IWG was held in Paris in June 2002, immediately after Executive Council XXXV, and reported in IOC/INF-1175. In view of the tight timetable at the Session a written draft was projected electronically on a screen and was modified online. The initial draft clauses can be seen in a Discussion Paper, Annex V to IOC/INF-1175. This ensured that all the participants of the IWG had full opportunity to consider the issues and incorporate their views during the actual drafting process.

The meeting decided to create a policy statement including a preamble and six clauses:

- Preamble: to outline the fundamental principles;
- Clause 1: statement on exchange related to IOC programmes;
- Clause 2: statement on exchange related to non-IOC programmes;
- Clause 3: statement referring to research and education communities;
- Clause 4: statement on associated rights of the data originators and Member States;
- Clause 5: statement referring to long-term repositories for oceanographic data;
- Clause 6: statement on capacity building.

There was lengthy negotiation on the wording of some of the clauses, particularly clause 4, the subject of which had been the main obstacle to consensus. The meeting decided not to follow the path of WMO Resolution 40 in categorizing into essential and additional data classes, because of the less well-defined nature of oceanographic data and the needs of IOC programmes. It was also foreseen that further difficulties would arise in future when dealing with non-physical data.

Finally consensus was reached on the final wording of the preamble and the six proposed clauses of the policy, which can be found in IOC Resolution XX-II-6 (2003). This resolution meets point (c) of the Terms of Reference. Point (a) is incorporated in the reports of both meetings and it is recommended that (b) be referred for specialist advice to IODE.

There remains an unavoidable tension between the concept of free and unrestricted exchange for all international purposes of public good and the legitimate protection of the rights of data originators and Member States, whether under the auspices of the international conventions or national laws for copyright and intellectual property protection.

No policy can completely resolve that tension.

The best that can be done is to define principles that the Member States, originators and data users can live with, and see the practical benefits of.

If the policy is too prescriptive it either limits the range of data to which it can be applied or becomes unworkable and unhelpful to the final objective, which is to facilitate the greatest possible amount of data being available in the public domain. ■

Regional Activities

Village in Ethiopia © 2002 WFP/Wagdi Othman

Observing Africa's Oceans

GOOS-AFRICA is the implementation programme of the IOC s Global Ocean Observation System (GOOS), which provides observations and forecasting as a basis for achieving the sustainable development of the marine environment in Africa. Through various planning meetings in 2003, representatives of GOOS-AFRICA refined a proposal for a comprehensive and integrated Regional Ocean Observing and Forecasting System for Africa (ROOFS–AFRICA). Ocean and coastal *in situ* measurements, satellite remote sensing, and modeling aspects combined with business partnerships with the private sector, including oil industries, form key elements of this proposal.

Capacity Building to enable developing countries to participate in, contribute to, and benefit from GOOS is a key component of the GOOS strategic plan. The adoption of GOOS–AFRICA s ROOFS–AFRICA proposal in December 2003 as an integral part of the New Partnership for Africa s Development (NEPAD) Environmental Initiative is a demonstration of the rapid development of the concept in the region and its ownership by the African countries.

Justin Ahanhanzo, IOC s GOOS-AFRICA Coordinator, discusses the developments leading to the successful adoption of the programme, its strong links with the global climate system, its development goals, and future initiatives.

The Rise of GOOS-AFRICA:

The African Contribution to the Development of the Global Ocean Observing System (GOOS)

I- Grassroots approach; national and regional leadership and ownership as the key for long term institutional and scientific capacity building.

The culmination of the development of GOOS-AFRICA is its selection and inclusion by the New Partnership for Africa s Development (NEPAD) for leadership in the NEPAD Environment Action Plan. In fact, the initial GOOS-AFRICA project entitled "The Regional Ocean Observing and Forecasting System for Integrated Management of Ocean and Coastal Environment and Natural Disasters in Africa" was adopted at the highest level of the African Ministerial and Heads of State Conferences. As part of that continental environmental action plan, the project was presented to the donors and partners community at the International Partnership Conference on the Environmental Initiative of the NEPAD that was held in Algiers, Algeria, 15-16 December 2003. The GOOS-AFRICA Coordinating Committee, together with the Assistant Director-General for Natural Sciences of UNESCO and the Assistant Director-General and Executive Secretary of the Intergovernmental Oceanographic Commission of UNESCO, contributed to that high level Conference, as the IOC has significantly contributed to the development of this Action Plan through its leading role in the development of the GOOS-AFRICA Programme. GOOS-AFRICA presented an exhibition stand at the meeting.

NEPAD is the recent development framework established by the African Heads of State and leaders to boost Africa s development through massive investments in development projects, including the coastal and marine environment. The Regional Ocean Observing and Forecasting System for Africa (GOOS/ROOFS-AFRICA) contributes to NEPAD s development goals in the following ways:

(i) Human Resources Development Plan through its capacity building component;
(ii) Agriculture and market access through its early warning systems integrating forecasting of droughts and floods;
(iii) Capital flows, economic and corporate governance through the development of a scientific and sound management basis for fisheries industries and port constructions and activities;
(iv) Infrastructure and environment through the provision of equipment and scientific tools for mitigating climate change and its associated devastating impacts on infrastructures and lives of populations; and monitoring the coastal and marine environment.

The GOOS/ROOFS-AFRICA project is designed to foster the development and dissemination of operational ocean products tailored to the requirements of a wide variety of user communities and to supply data and information essential for:

IOC/UNESCO-sponsored Workshop under the auspices of the Steering Committee of the NEPAD and the Department of Environmental Affairs and Tourism of South Africa in partnership with the African Centre for Meteorological Applications for Development, the South African Weather Service, and the Satellite Applications Centre of the CSIR. Distinguished experts and NGOs from Africa, North America, Europe, and Central and South America attended the Workshop.

(i) The sustainable use of living marine resources in the coastal zone and coastal seas;
(ii) The management of key habitats and ecosystems in those areas;
(iii) Coastal and offshore engineering in support of industry and coastal protection;
(iv) Ocean trade and the management of ports;
(v) Safeguarding the security and safety of sea goers;
(vi) Coastal recreation and tourism;
(vii) The tracking and management of coastal pollution, including oil spills;
(viii) The early warning systems integrating forecasting of droughts and floods;
(ix) Enhancing preparedness for, and dealing with, natural disasters such as tropical cyclones and storm surges;
(x) Enhancing the preparedness of health carers for climate-induced disease outbreaks. GOOS/ROOFS-AFRICA also contributes to better environmental management and hence wealth creation and the concomitant reduction of poverty.

Stakeholders in Africa

The following Stakeholders in Africa are both active players in the project s development/implementation and also direct beneficiaries of the outputs:

(i) Government agencies, including Ministries responsible for Environmental Affairs, Fisheries, Health, Tourism, Industry and Mining, Maritime Infrastructures and Transport, Research and Development, and Higher Education and Training in Science and Technology;
(ii) Managers responsible for environmental protection, wildlife protection, coastal amenities and coastal protection (beaches, reefs, etc.);
(iii) Operating agencies responsible for offshore and coastal services, safety, navigation, ports, pilotage, search and rescue;
(iv) Small-scale companies involved in aquaculture, fishing, the hotel and recreation businesses;
(v) Large companies and industries involved in offshore oil and gas, offshore surveys, shipping, fishing, dredging, construction, agriculture (food supply), water and energy supply;
(vi) Single users such as tourists, fishermen, divers, yachtsmen, etc.;
(vii) Public and private scientific institutions.

II- GOOS/ROOFS-AFRICA: An integrated and holistic framework for sustained ocean observations in Africa.

The project is based on an integrated and holistic approach and includes five modules:

Module 1: The African network of *in situ* ocean observing and monitoring systems, including sea level records for monitoring coastal zones and impacts of global climate change in Africa.

Module 2: Remote sensing and satellite applications for the marine and coastal environment.

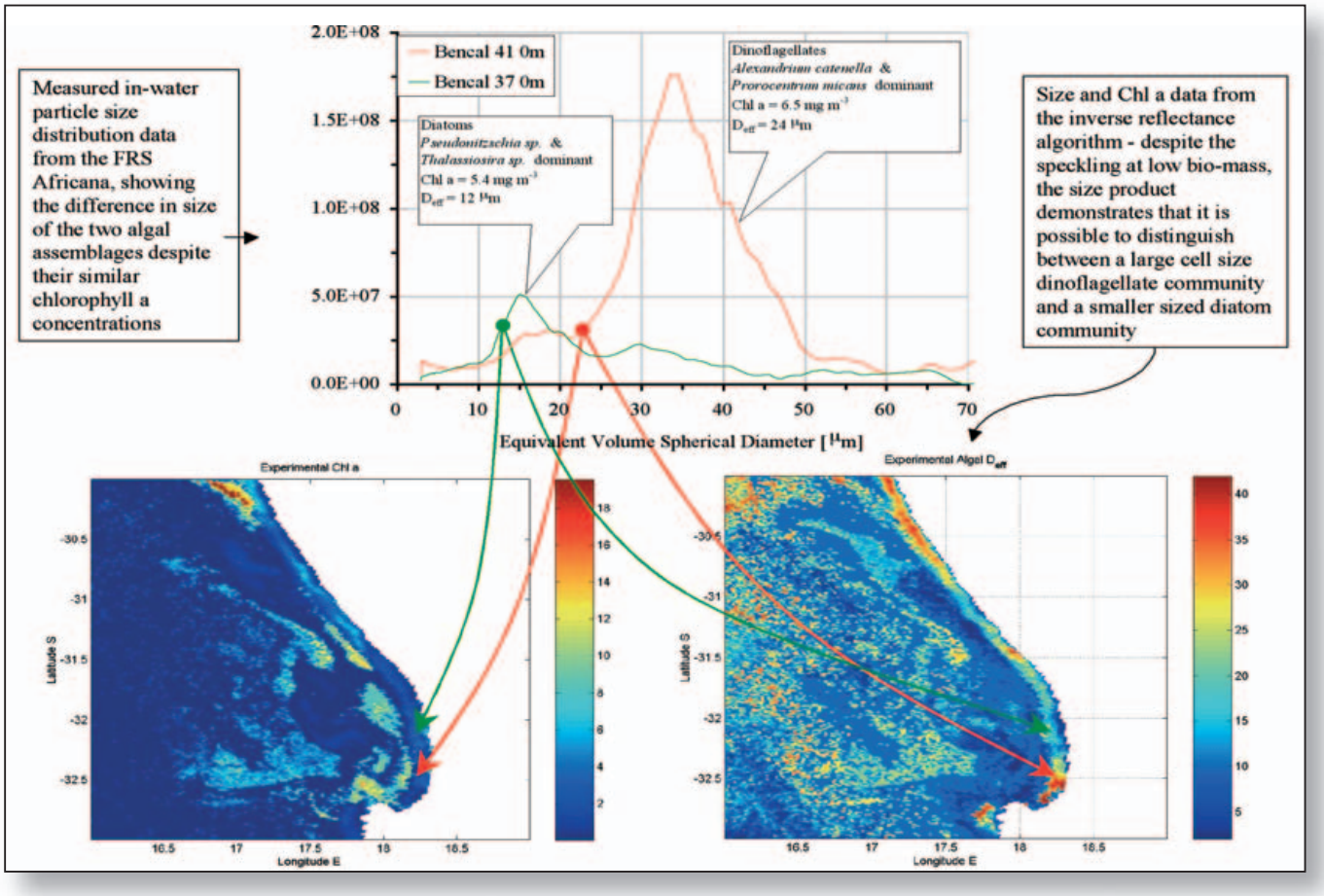
Module 3: Modeling and forecasting based on *in situ* and satellite data.

Module 4: Effective involvement of different stakeholders at different stages of project implementation, and development of an end-user interactive communication and information delivery system.

Module 5: Industry and business partnerships oriented towards reinforcing a Regional Ocean Observing and Forecasting System for Africa.

III- Building a positive synergy with relevant international institutions and ongoing programmes/projects in Africa.

A strong cooperation was established with international institutions including the United Nations Industrial Development Organization (UNIDO), the United Nations Environment Programme (UNEP), The Global Environment Facility (GEF), The World Bank (WB), the United Nations Development Programme (UNDP), the World Meteorological Organization (WMO),



Application of the multispectral reflectance algorithm to SeaWiFS data. The SeaWiFS overpass is from the 15th of October 2003, during the BenCal bio-optical cal/val cruise in the southern Benguela. An extraordinary bloom of the toxic dinoflagellate *Alexandrium Catenella* was reported in the Lamberts and Elands Bay vicinity several days later. The precursive expression of this bloom can be seen in the effective diameter image, which shows the presence of a large cell assemblage off Elands Bay. Note the ability of the algorithm to differentiate between water types dominated by differently sized phytoplankton at approximately equal chlorophyll concentrations
(From Dr. Stewart Bernard, Oceanography Department, University of Cape Town, South Africa).

and with overseas partners including the European Space Agency (ESA), the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT), the National Oceanic and Atmospheric Administration (NOAA), France s research institute for development (IRD), and the Southampton Oceanography Centre, and with African institutions including the African Centre for the Meteorological Applications for Development, the Satellite Application Centre of CSIR/SA and NGOs. A framework for a joint implementation was established with the African Large Marine Ecosystems (LMEs), including the Benguela Current LME and the Guinea Current LME that earned $15 million and $12 million respectively from the GEF over five years. The recent Sixth LME Consultative Meeting held at the IOC/UNESCO Headquarters in Paris, 29-30 March 2004 encouraged the strong partnership established between GOOS-AFRICA and the LME projects in Africa. The project will provide long-term observations and an operational monitoring basis for the LMEs towards integrated coastal zone management in Africa. It will also strengthen the UNEP Regional Seas programmes and conventions in Africa, namely the Nairobi Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the East African Region, and the Abidjan Convention for Cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region. GOOS-AFRICA is partnering with the WMO to develop the Global Climate Observing System (GCOS) Action Plan for Africa.

GOOS/ROOFS-AFRICA would also provide an *in situ* data stream to the IOC ODINAFRICA project.

To boost the development of remote sensing and satellite applications for the coastal ocean and marine environment in Africa, GOOS-AFRICA is an active partner with the Committee on Earth Observation Satellites (CEOS) Working Group on Education, Training and Capacity Building, and with the Euro-

pean Space Agency, and NOAA.

A joint task team is being developed with GODAE to foster the application of GODAE Products to African waters and to reinforce the capacity of relevant African Centers in modeling and forecasting techniques.

The year 2005 holds great promise for GOOS-AFRICA. Plans are being developed to organize two major initiatives, namely:

(i) The first "GOOS-AFRICA Business Partnership Workshop with Oil/Energy and Gas Industries in Africa" in 2005 to bring the private sector and industries into the project;
(ii) The first GOOS-AFRICA/LMEs training course on "Integration of Remote Sensing and Modeling for Integrated Management of African Large Marine Ecosystems" at Cape Town University in South Africa, in 2005.

IV- Solving local needs and priorities: Contributing to the Global Development Agenda.

GOOS-AFRICA and its initial ROOFS-AFRICA project are the African contribution to the global development agendas including the objectives specified in the:

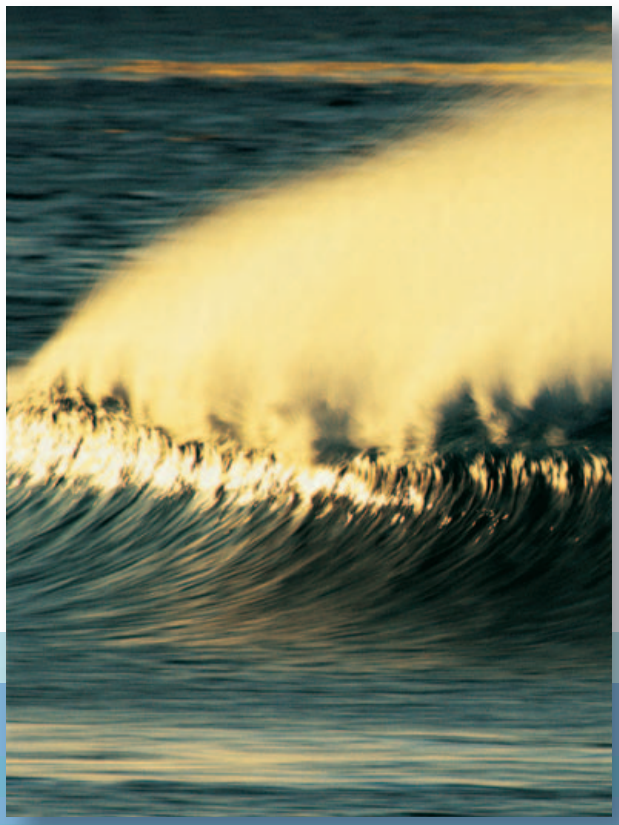
- World Summit on Sustainable Development Implementation Plan;
- Millennium Development Goals; and
- International Conventions and Agreements such as the Convention on Biodiversity, the United Nations Convention on the Law of the Sea (UNCLOS) and the United Nations Framework Convention on Climate Change (UNFCCC), and major global programmes including the Global Ocean Observing System (GOOS) and the Global Climate Observing System (GCOS).

Finally, IOC in collaboration with the GOOS-AFRICA Coordinating Committee is currently working with African Stakeholders, international development partners, and UN agencies to raise the requested funds for the project s implementation. ■

For more information please contact:

Justin Ahanhanzo,
GOOS-AFRICA Coordinator
j.ahanhanzo@unesco.org

Annexes



IOC Officers

IOC Officers at Major s Parlour, Winchester, UK, 23 January 2004.

Front row from left: Dr. Patricio Bernal (Chile)[Executive Secretary]; Dr. David Thomas Pugh (UK)[Chairman];

Standing from left: Dr. Alexander V. Frolov (Russia); Prof. Su Jilan (China) [Past-Chairman]; Dr. K. Radhakrishnan (India), Prof. Mário Ruivo (Portugal); C. de Navío Javier Armando Valladares (Argentina); Prof. Amor El Abed (Tunisia); [Vice-Chairmen]

The IOC Rules of Procedure indicate that the Officers of the Commission shall consist of the Chairperson and five Vice-Chairpersons. The five Vice-Chairpersons shall be nationals of Member States of different electoral groups (as listed in Appendix II of the Rules of Procedure.) The IOC Officers are elected every two years for a maximum of two terms.

IOC Member States

AFGHANISTAN	(11 March 1991)
ALBANIA	(26 January 1993)
ALGERIA	(Jul. 1964/Nov.1965)
ANGOLA	(26 October 1982)
* ARGENTINA	(Before November 1961)
* AUSTRALIA	(Before November 1961)
AUSTRIA	(Oct. 1962/Jun. 1964)
AZERBAIJAN	527 January 1998)
BAHAMAS	(29 January 1979)
BANGLADESH	(29 October 1982)
BARBADOS	(18 December 1985)
* BELGIUM	(Before November 1961)
BELIZE	(22 September 1995)
BENIN	(23 October 1986)
* BRAZIL	(Before November 1961)
BULGARIA	(Oct. 1967/Dec. 1969)
CAMEROON	(Nov. 1971/Nov. 1973)
* CANADA	(Before November 1961)
CAPE VERDE	(20 August 1984)
* CHILE	(Before November 1961)
* CHINA	(Before November 1961)
* COLOMBIA	(Oct. 1967/Dec. 1969)
COMOROS	(08 February 2000)
CONGO	(Nov. 1961/Sep. 1962)
* COSTA RICA	(28 February 1975)
CÔTE D IVOIRE	(Before November 1961)
CROATIA	(24 December 1992)
* CUBA	(Before November 1961)
CYPRUS	(05 December 1977)
Democratic People s Republic of KOREA	(31 October 1978)
DENMARK	(Before November 1961)
DOMINICA	(21 September 1999)
DOMINICAN REP.	(Before November 1961)
ECUADOR	(Before November 1961)
* EGYPT	(Oct. 1969/Nov. 1971)
EL SALVADOR	(16 February 1993)
ERITREA	(12 November 1993)
ESTONIA	(10 March 1992)
ETHIOPIA	(05 March 1976)
FIJI	(09 July 1974)
* FINLAND	(Before November 1961)
* FRANCE	(Before November 1961)
GABON	(26 October 1977)
GAMBIA	(30 August 1985)
GEORGIA	(09 July 1993)
* GERMANY	(Before November 1961)
* GHANA	(Before November 1961)
GREECE	(Oct. 1962/Jun. 1964)
GUATEMALA	(Dec. 1965/Oct. 1967)
GUINEA	(01 May 1982)
GUINEA-BISSAU	(26 January 1984)
GUYANA	(20 July 1977)
HAITI	(23 March 1976)
ICELAND	(Oct. 1962/Jun. 1964)
* INDIA	(Before November 1961)
* INDONESIA	(Oct. 1962/Jun. 1964)
* IRAN, Islamic Republic of	(03 June 1975)
IRAQ	(Oct. 1969/Nov. 1971)
IRELAND	(07 November 1978)
ISRAEL	(Before November 1961)
* ITALY	(Before November 1961)
* JAMAICA	(Oct. 1967/Dec. 1969)
* JAPAN	(Before November 1961)
JORDAN	(06 April 1975)
* KENYA	(Nov. 1971/Nov. 1973)
KUWAIT	(13 November 1974)
LEBANON	(Oct. 1962/Jun. 1964)
LIBYAN ARAB JAMAHIRIYA	(11 March 1974)
MADAGASCAR	(Dec. 1965/Oct. 1967)
MALAYSIA	(Jul. 1964/Nov. 1965)
MALDIVES	(20 May 1987)
MALTA	(Oct. 1969/Nov. 1971)
MAURITANIA	(Before November 1961)
MAURITIUS	(Oct. 1969/Nov. 1971)
* MEXICO	(Before November 1961)
MONACO	(Before November 1961)
* MOROCCO	(Before November 1961)
* MOZAMBIQUE	(08 April 1981)
MYANMAR	(07 June 1988)
NAMIBIA	(25 April 2001)
NETHERLANDS	(Before November 1961)
NEW ZEALAND	(Nov. 1961/Sep. 1962)
NICARAGUA	(17 November 1977)
* NIGERIA	(Nov. 1971/Nov. 1973)
NORWAY	(Before November 1961)
OMAN	(16 November 1982)
PAKISTAN	(Before November 1961)
PANAMA	(Oct. 1967/Sep. 1969)
* PERU	(Dec. 1965/Oct. 1967)
* PHILIPPINES	(Oct. 62/Jun. 1964)
POLAND	(Before November 1961)
* PORTUGAL	(Oct. 1969/Nov. 1971)
QATAR	(20 July 1976)
* REPUBLIC OF KOREA	(Before November 1961)
ROMANIA	(Before November 1961)
* RUSSIAN FEDERATION	(Before Nov. 1961)
SAINT LUCIA	(14 September 1992)
SAMOA	(10 April 1978)
SAUDI ARABIA	(14 June 1978)
* SENEGAL	(Oct. 1967/Sep. 1969)
SEYCHELLES	(27 February 1979)
SIERRA LEONE	(19 April 1974)
SINGAPORE	(Dec. 1965/Oct. 1967)
SLOVENIA	(16 June 1994)
SOLOMON ISLANDS	(11 May 1982)
SOMALIA	(10 July 1974)
* SOUTH AFRICA	(Oct. 1967/Sep. 1969)
* SPAIN	(Before Nov.1961)
SRI LANKA	(Jun. 76/Jan. 1977)
SUDAN	(26 August 1974)
SURINAM	(21 January 1977)
SWEDEN	(Jul. 1964/Nov. 1965)
SWITZERLAND	(Before Nov. 1961)
SYRIAN ARAB REP.	(Oct.1969/Nov. 1971)
THAILAND	(Before Nov. 1961)
TOGO	(22 October 1975)
TONGA	(03 January 1974)
TRINIDAD & TOBAGO	(Oct. 1967/Sep. 1969)
TUNISIA	(Before Nov. 1961)
* TURKEY	(Nov. 1961/Sep. 1962)
* UKRAINE	(Nov. 1961/Sep. 1962)
UNITED ARAB EMIRATES	(02 June 1976)
* UNITED KINGDOM OF GREAT BRITAIN & NORTHERN IRELAND	(Before Nov. 1961)
* UNITED REPUBLIC OF TANZANIA	(Oct. 1967/Sep. 1969)
* UNITED STATES OF AMERICA	(Before Nov. 1961)
URUGUAY	(Before Nov. 1961)
VENEZUELA	(Oct. 1962/Jun. 1964)
* VIET NAM	(Before Nov. 1961)
YEMEN	(22 May 1960)

* Members of the Executive Council

IOC Structure

ASSEMBLY
EXECUTIVE COUNCIL
EXECUTIVE SECRETARY
SECRETARIAT

Ocean Sciences

- Oceans and Climate (WCRP, JGOFS, CLIVAR, El Niño, SCOR-IOC Advisory Panel on Ocean CO_2)
- Science for Ocean Ecosystems and Marine Environmental Protection (HAB, Indicators for Ecosystem Health, Nutrient Enrichment, LME, Biosphere-Geosphere Coupling)
- Marine Science for Integrated Coastal Area Management (COASTS, LOICZ-Basins, ICAM Indicators, Global Web-Service, Coastal Megacities, ICAM Methodological Manual)
- United Nations Convention on the Law of the Sea (IOC/ABE-LOS, ABLOS, Special Arbitration)

Operational Observing Systems

- Global Ocean Observing System, GOOS
- GOOS Modules, Regional Bodies and Pilot Projects (OOPC, COOP, GODAE, Argo)
- Integrated Global Observing Strategy, IGOS
- Joint Technical Commission for Oceanography and Marine Meteorology, JCOMM (DBCP, SOOP, TIP, GLOSS)
- Global Climate Observing System, GCOS
- Satellite Remote Sensing

Ocean Services

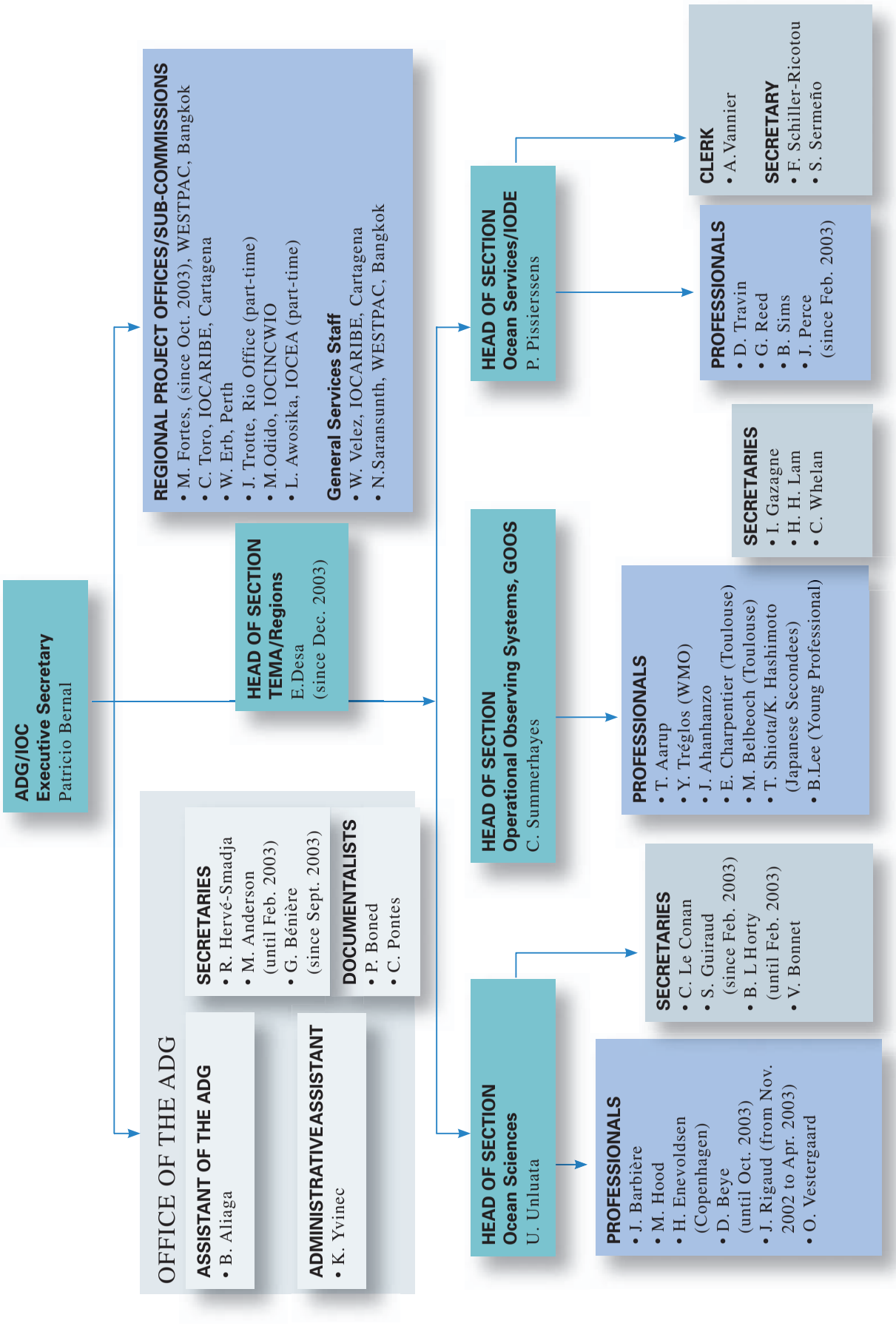
- International Oceanographic Data and Information Exchange, IODE (GODAR, MIM, GTSPP, MEDI, ASFA, GETADE, GEBCDMEP, GEMIM, Ocean Teacher, Ocean-Portal, OceanExpert, MarineXML)
- IODE regional projects (ODINAFRICA, ODINCARSA, Regional Ocean Portals, MEDAR/MEDATLAS)
- IDNDR-Related Activities International Tsunami Warning System (ITSU)
- Ocean Mapping (GEBCO, GAPA, IBCM)
- Public Information (IOC Web site, newsletters, other publications, posters, brochures and leaflets, public events)

TRAINING, EDUCATION AND MUTUAL ASSISTANCE (TEMA)

REGIONS
2 Regional Sub-Commissions, 4 Committees,
5 Programme/Project Offices and 1 Specific Programme

IOCARIBE
IOCINDIO
IOCEA
GOOS Office, Perth, Australia
IOCEA Project Office, Lagos, Nigeria,
WESTPAC
IOCINCWIO
Black Sea
IOCINCWIO Project Office, Mombasa, Kenya
GOOS Office Niteroi (RJ) Brazil
Mediterranean Programme
GOOS Office, Rio de Janeiro, Brazil

Organization of Secretariat Staff



IOC Personnel

Headquarters personnel shown in the photo (left to right):
Front row: Dr. K. Radhakrishnan (Vice-Chairman), Dr. David T. Pugh (Chairman), Prof. Su Jilan (Past-Chairman), Dr. Patricio Bernal (Executive Secretary), Prof. Mário Ruivo (Vice-Chairman), Christiane Le Conan, Cigié Pontes
Second row: Ole Vestergaard, Cesar Toro, Maria Hood, Peter Pissierssens, Thorkild Aarup
Third Row: Mika Odido, Patrice Boned, Jennifer Perce, Silvia Semeño, Françoise Ricotou, Dimitri Travin
Fourth Row: Gregory Reed, Sonia Guiraud, Julian Barbière, C. de Navío Javier Armando Valladares (Vice Chairman), Prof. Amor El Abed (Vice-Chairman), Benjamin Sims, Colin Summerhayes, Boram Lee, Umit Unluata, Justin Ahanhanzo, Bernardo Aliaga
Top Row: Adrien Vannier, Kasu Hashimoto,

Personnel not shown in the above photo:
Graziela Bénière, M. Anderson (until February 2003), Erlich Desa (since December 2003), S. Mitsumoto, M. Kuijper, W. Erb. J. Trotte, L. Awosika, C. Cisse, W. Velez, N. Saransunth, H. Enevoldsen, D. Beye (until October 2003), J. Rigaud (until April 2003), B. L Horty (until February 2003), Y. Tréglos, E. Charpentier, M. Belbeoch, Ho Hien Lam.

In Memoriam

In 2003 the Intergovernmental Oceanographic Commission of UNESCO lost a highly respected colleague and friend in the passing of Dr. Manuel Flores Palomino, whose valuable work in marine resources research and management over the past decades has benefited both the scientific community and Member States alike. We will miss his presence among us.

Patricio A. Bernal
Executive Secretary, IOC of UNESCO

DR. MANUEL FLORES PALOMINO
1943-2003

Courtesy: Permanent Commission for the South Pacific

Dr. Manuel Flores passed away on 15 May, 2003 in Guayaquil, Ecuador, saddening the regional scientific community of which he was an honored member.

Manuel was a prominent Peruvian marine biologist, with a Master s degree in Physiology from the State Agriculture University of La Molina, Peru. He completed studies in Economic Sciences (San Marcos University), Planning (ESAP), Applied Statistics to Business (ESAN), Projects (University of Lima), Statistic Control of Quality (Engineering National University), Integrated Coastal Management (OEA), Administration and Governance of Natural Resources (Northern University and Ministry of Foreign Affairs), among others. He was named Mining Environmental Auditor by the Peruvian Ministry of Energy and Mining.

During most of his life, Manuel was involved in marine resources research and management. He worked for 25 years with the Peruvian Institute of Marine Resources (IMARPE), the most important scientific Peruvian research center, in several departments, including Oceanography, Biology, Statistics, Fishing Economy, and International Affairs and participated in more than 35 maritime expeditions related to resources prospecting, marking and fishing. He was Secretary of the Directive Council and Scientific Advisor of the Executive Direction. He also carried out socio-economic studies of the Peruvian artisanal fishery (Peru-Canada Project). Between 1983 and 1997 he was member of the National Committee of ERFEN dealing with the El Niño Phenomenon.

He is the author of fifteen scientific papers and fifteen more diffusion articles on several themes relating to marine sciences. He was a member of the Maritime Historic Studies (IEHM) and Associated Research to the Peruvian International Studies Center. He was professor of the Ricardo Palma University, Pontific Catholic University of Peru, and the National School of Marine Merchant Miguel Grau.

A notable stage in Manuel s career was representing his country at relevant international meetings and conferences. He was a member of the Peruvian delegation to the United Nations Law of the Sea Convention (Geneva 1981, and New York 1982), the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (New York 1995) and the Fishing Working Group Meetings of APEC (Chile 1996; Mexico 1997) and PECC (New Zealand 1996).

Manuel Flores joined the Permanent Commission for the South Pacific (CPPS) in 1978 as part of the Peruvian Delegation in the Ordinary Meetings of Chancellors. He also participated in most of the Scientific Technical Working Groups since then, as well as in the Action Plan for the Protection of the Marine and Coastal Environment of the South East Pacific since 1982. He was Scientific Secretary of the CPPS during 1998-2002 and Scientific Director during 2002-2006.

Rest in peace.

Publications and Public Awareness

IOC Publications

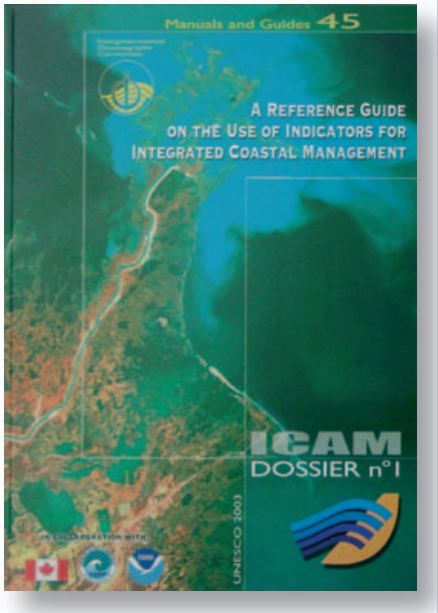
Each year the IOC publishes numerous documents and publications. These publications support its programme activities and communicate the scientific and organizational information resulting from the various conferences, meetings, training courses, and other activities that have benefited from IOC s support. Many of these publications are available on the Internet; certain titles are also available in print in cases where the Internet is not an option.

IOC TECHNICAL SERIES

Kenyon, N.H., Ivanov, M.K., Akhmetzhanov, A.M. & Akhmanov, G.G. (eds.) (2003) *Interdisciplinary Geoscience Research on the North East Atlantic Margin, Mediterranean Sea and Mid-Atlantic Ridge; Preliminary Results of Investigations during the TTR-12 Cruise of RV* Professor Logachev, *June-August 2002*. (Technical Series, 67) 154 pp. (English)

IOC MANUALS AND GUIDES

A Reference Guide on the Use of Indicators for Integrated Coastal Management. (2003) (Manuals and Guides, 45; ICAM Dossier, 1) 137 pp. (English)



IOC WORKSHOP REPORTS

Marani, M., Akhmanov, G. & Suzyumov, A. (eds.) (2003) *Geological and Biological Processes at Deep-Sea European Margins and Oceanic Basin; International Conference and Eleventh Post-Cruise Meeting of the Training-Through-Research Programme, Bologna, Italy, 2-6 February 2003*. (Manuals and Guides, 187) (English)

Workshop for the Formulation of a Draft Project on Integrated Coastal Management (ICM) in Latin America and the Caribbean (LAC), Cartagena, Colombia, October 2003/ Taller de Formulación de un Anteproyecto de Manejo Costero Integrado (MCI) en América Latina y el Caribe (ALC), Cartagena, Colombia, Octubre de 2003 (Manuals and Guides, 189) 60 pp. (English, Spanish; electronic version only)

TRAINING COURSE REPORTS

Taller de Entrenamiento en Observación y Análisis del Nivel del Mar, Valparaíso, 7-17 de Abril de 2003. (Informes de Cursos de Formación, 71) 31 pp. (Spanish; electronic version only)

IODE Training Course in Ocean Data Management for the Caspian and Black Sea Regions, Tehran, I.R. Iran, 20-30 October 2002. (Training Course Reports, 67) (English; electronic version only)

Fifth IOC/WESTPAC Training Course on NEAR-GOOS Data Management, Tokyo, Japan, 5-16 November 2001. (Training Course Reports, 68) (English; electronic version only)

ODINAFRICA II Remedial Training Course in Marine Data Management (Data Short Course), Accra, Ghana, 14-18 April 2003. (Training Course Reports, 69) (English; electronic version only)

Sixth IOC/WESTPAC Training Course on NEAR-GOOS Data Management, Tokyo, Japan, 21 October-1 November 2002. (Training Course Reports, 70) (English; electronic version only)

ODINAFRICA II Combined Madagascar Marine Atlas Workshop and Remedial Training Course in Marine Data Management for Comoros, Tulear, Madagascar, 30 June-11 July 2003. (Training Course Reports, 72) (English; electronic version only)

INFORMATION DOCUMENTS

IOC/INF-1176 *Black Sea GOOS Strategic Action and Implementation Plan, March 2003*. (2003) 72 pp. (English)

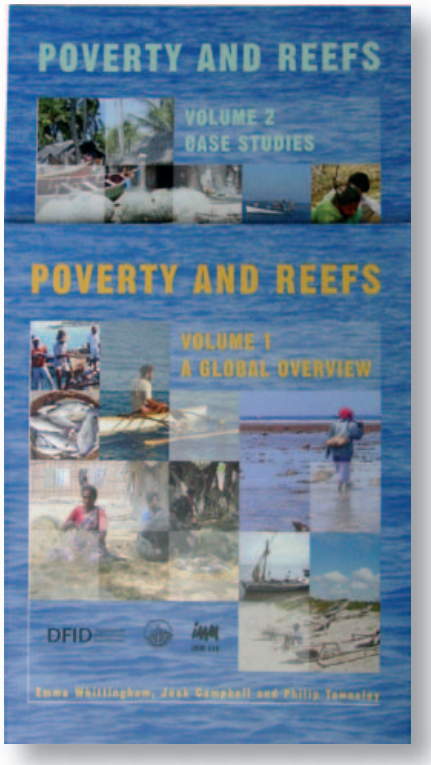
IOC/INF-1180 *Terms of Reference for the Programme Elements in the Structure of IOC Ocean Science Section; Draft*. (2003) 10 pp. (English, French, Spanish, Russian)

IOC/INF-1183 *The Integrated Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System*. (2003) 195 pp. (English)

IOC/INF-1184 *The UNESCO Bilko Project: Developing Training Capability for Coastal and Marine Remote Sensing*. (2003) 13 pp. (English)

IOC/INF-1185 Mason, P., Asanuma, I., Field, J. & Radhakrishman, K. *Report of the GOOS Review Panel on the Structure, Mandates and Modus Operandi of GOOS*. (2003) 75 pp. (English, French, Spanish, Russian)

IOC/INF-1187 *IODE Project Office—Business Plan*. (2003) 32 pp. (English)



IOC/INF-1188 Whittingham, E., Campbell, J. & Townsley, P. (eds.) *Poverty and Reefs: 1. A Global Overview, 2. Case Studies*. (2003) 2 Vols. (English)

IOC/INF-1189 *Report of the POGO-IOC-SCOR Initiative for Intelligent Use and Management of the Oceans*. (2003) 5 pp. (English)

IOC/INF-1190 Woodworth, P.L. & Aarup, T. *A Report on the Status of the GLOSS Programme and a Proposal for Taking the Programme Forward*. (2003) 42 pp. (English)

REPORTS OF GOVERNING AND MAJOR SUBSIDIARY BODIES

IOC Sub-Commission for the Western Pacific, Fifth Session, Australia, 2002. (2003) (Reports of Governing and Major Subsidiary Bodies, 96) (English)

Thirty-sixth Session of the Executive Council, Paris, 2003. (2003) (Reports of Governing and Major Subsidiary Bodies, 97) 54 pp. (English, French, Spanish, Russian)

Twenty-second Session of the Assembly, Paris, 2003. (2003) (Reports of Governing and Major Subsidiary Bodies, 98) 166 pp. (English, French, Spanish, Russian)

IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean, Fifth Session, Kenya, 2002. (2003) (Reports of Governing and Major Subsidiary Bodies, 99) 50 pp. (English; Executive Summary available separately in French, Spanish, Russian)

IOC Intergovernmental Panel on Harmful Algal Blooms, Sixth Session, United States of America, 2002. (2003) (Reports of Governing and Major Subsidiary Bodies, 100) 111 pp. (English; Executive Summary available separately in French, Spanish, Russian)

IOC-WMO-UNEP Committee for the Global Ocean Observing System (I-GOOS-VI), Sixth Session, Paris, 2003. (2003) (Reports of Governing and Major Subsidiary Bodies, 102) 86 pp. (English; Executive Summary available separately in French, Spanish, Russian)

REPORTS OF MEETINGS OF EXPERTS AND EQUIVALENT BODIES

Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Third Session, Portugal, 2003. (Reports of Meetings of Experts and Equivalent Bodies, 192) 43 pp. (English, French)

Extraordinary Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of El Niño , Chile, 1999. (Reports of Meetings of Experts and Equivalent Bodies, 193) (Spanish; electronic version only)

Fifth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, France, 2002. (Reports of Meetings of Experts and Equivalent Bodies, 194)

IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, Sixth Session, South Africa, 2003. (Reports of Meetings of Experts and Equivalent Bodies, 195) 69 pp. (English)

Coastal Ocean Observations Panel, Fourth Session, South Africa, 2002. (Reports of Meetings of Experts and Equivalent Bodies, 196) 23 pp. (English; electronic version only)

First Session of the JCOMM/IODE Expert Team on Data Management Practices, Belgium, 2003. (Reports of Meetings of Experts and Equivalent Bodies, 197; JCOMM Meeting Report, 25) (English)

NEWSLETTERS

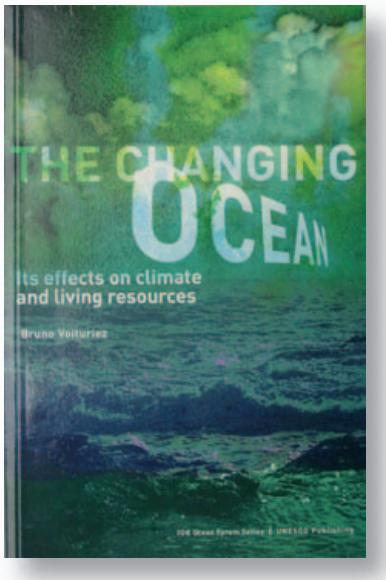
Window. Western Indian Ocean Waters. Paris, Vol. 14, No. 1, January 2003; No. 2, August 2003; No. 3, November 2003; No. 4, December 2003

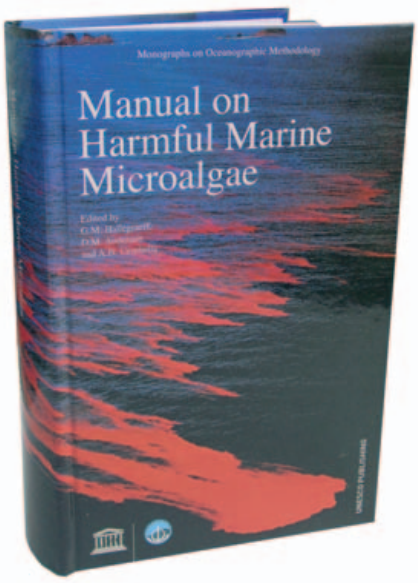
Sales Publications

UNESCO Publishing

The IOC committed to the creation of two series of the UNESCO Publishing House: *IOC Ocean Forum Series* and *Monographs on Oceanographic Methodology*

Voituriez, Bruno. (2003) Les humeurs de l océan; Effets sur le climat et les ressources vivantes *IOC Ocean Forum Series*, 4: 171 pp. Paris, UNESCO Publishing ISBN 92-3-203877-3. Price: 14.80 euros. English translation: The changing ocean; Its effects on climate and living resources ISBN 92-3-103877-X; Spanish translation: Los caprichos del océano; Efectos sobre el clima y los recursos vivos ISBN 92-3-303877-7.





Hallegraeff, G.M., Anderson, D.M. & Cembella, A.D. (eds.) (2003) *Manual on Harmful Marine Microalgae* Monographs on Oceanographic Methodology , 11: 794 pp. Paris, UNESCO Publishing ISBN 92-3-103871-0. Price: 49.50 euros.

OTHERS WITH THE IOC SPONSORSHIP

Kimball, Lee A. (2003) *International Ocean Governance; Using International Law and Organizations to Manage Marine Resources Sustainably*. 135 pp. Gland/Cambridge, IUCN, ISBN 2-8317.0617-3. Spanish translation: *La Gobernanza International del Océano; El uso del derecho international y las organizaciones para manejar los recursos marinos de manera sostenible*. ISBN 2-8317-0617-3

Further information can be found on the IOC Web site: <http://ioc.unesco.org>

Enquiries or requests for any of the above titles may be addressed to the IOC Documentalist: Patrice Boned p.boned@unesco.org Fax: +33 1 45 68 58 10

IOC Participation in 2003 Events

Event	Date	Venue	IOC Department
Oceans Future Conference	7-10 January	Paris, France	Ocean Sciences
Ocean Carbon Observations Workshop	13-15 January	Paris, France	Ocean Sciences
1st International Organizing Committee Meeting for the World Climate Change Conference	16-17 January	Moscow, Russia	Ocean Sciences
IOC Officers Meeting	18-19 January	New Delhi, India	Secretariat
HABViet Workshop on Toxic Cyanobacteria and Impacts on Aquaculture, Drinking Water Resources, and Public Health	21-31 January	Ho Chi Minh City, Vietnam	IOC Science and Communication Centre on Harmful Algae
UNESCO Knowledge Portal: OceanPortal:HABSEA: Portal Test Workshop and E-learning Introductory Course	31 January-4 February	Bangkok, Thailand	IOC Science and Communication Centre on Harmful Algae
Officers Meeting for the International Bathymetric Chart of the Western Indian Ocean	2-4 February	Nordershtedt, Germany	Ocean Services
PIRATA 9th Meeting	3-5 February	Angra dos Reis, Brazil	Ocean Sciences
Meeting of the JCOMM Task Team on Resources	4-5 February	Paris, France	Operational Observing Systems
2nd Session of the JCOMM Management Committee	5-8 February	Paris, France	Operational Observing Systems
Workshop on the South Atlantic Climate Observing System	6-8 February	Angra dos Reis, Brazil	Ocean Sciences
1st International Planning Committee Meeting for the Ocean Carbon Sequestration Symposium	15-16 February	Irvine, CA, USA	Ocean Sciences
GODAE VII Meeting	17-20 February	Darmstadt, Germany	Ocean Sciences
HABViet Workshop on Plankton Data Assessment and Data Management	18-24 February	Nha Trang, Vietnam	IOC Science and Communication Centre on Harmful Algae
20th Session of the Intergovernmental Panel on Climate Change	19-21 February	Paris, France	Ocean Sciences
6th Session of the GOOS Steering Committee—GSC-VI	26-28 February	Cape Town, South Africa	Operational Observing Systems
5th Consultative Meeting on Large Marine Ecosystems (IOC-NOAA-IUCN)	3-4 March	Paris, France	Ocean Sciences
17th Session of the IOC Committee on International Oceanographic Data and Information Exchange	3-7 March	Paris, France	Ocean Services
Argo Science Team Meeting 5	4-6 March	Hangzhou, China	Ocean Sciences
6th Session of the Intergovernmental Committee for the Global Ocean Observing System	10-14 March	Paris, France	Operational Observing Systems
GCOS 2nd Adequacy Report Review	12-14 March	Geneva, Switzerland	Ocean Sciences
European Commission NAT-FISH Programme Planning Meeting	17-19 March	Paris, France	Ocean Sciences
ICES-IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD)	17-20 March	Aberdeen, Scotland	IOC Science and Communication Centre on Harmful Algae
5th Session of the Coastal Ocean Observations Panel,	24-27 March	Mazatlan, Mexico	Operational Observing Systems
Global Nutrient Export from Watersheds Workshop	24-28 March	Paris, France	Ocean Sciences
IOC/WB Targeted Research on Coral Sustainability; Final Planning Meeting	29-31 March		Ocean Sciences
2nd Session ICES-IOC SGXML	1st Quarter 2003	Goteburg, Sweden	Ocean Services
ICES Marine Data Management Group (MDM)	1st Quarter 2003	Goteburg, Sweden	Ocean Services

GETADE-10	1st Quarter 2003	Goteburg, Sweden	Ocean Services
4th Session of the IOC Regional Committee for the Central Indian Ocean		Sri Lanka	Ocean Sciences
Global Ocean Time Series Observation System	3-5 April	Villefranche, France	Ocean Sciences
13th Meeting of the SCUFN	4-9 April	Monaco	Ocean Services
GCOS Steering Committee Meeting	7-11 April	Melbourne, Australia	Ocean Sciences
Training Workshop on Sea-Level Measurements and Data Analysis	7-18 April	Valparaiso, Chile	Operational Observing Systems
George Grice Workshop on Regime Shifts	13-16 April	Villefranche, France	Ocean Sciences
Training Workshop on Sea-Level Measurements and Data Analysis	27 April-10 May	Kuala Lumpur, Malaysia	Operational Observing Systems
3rd Session of Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS)	12-15 May	Lisbon, Portugal	Ocean Sciences
Royal Society Conference—Coastal Zones in Sub-Saharan Africa	27-28 May	London, UK	Ocean Sciences
HABWATCH: Workshop on Real Time Coastal Observing Systems for Ecosystem Dynamics and Harmful Algal Blooms	11-21 June	Villefranche, France	IOC Science and Communication Centre on Harmful Algae/Operational Observing Systems
3rd Global Carbon Project Steering Committee Meeting	17-20 June	Banff, Canada	Ocean Sciences
GLOBEC SSC	18-19 June	Banff, Canada	Ocean Sciences
36th Session of the Executive Council of IOC	23 June	Paris, France	Secretariat
22nd Session of the IOC Assembly	24 June-4 July	Paris, France	Secretariat
ODINAFRICA Marine Atlas Development Workshop for Madagascar	1-13 July	Tulear, Madagascar	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
IOC Working Group on the Role of Indicators for ICAM	7-9 July	Paris, France	Ocean Sciences
Coastal Zone 03 Conference	13-17 July	Baltimore, MD, USA	Ocean Sciences
JCOMM Ship Observation Team	28 July-1 August	London, UK	Ocean Sciences
Harmful Algal Bloom Training Course	6-12 August	Manila, The Philippines	IOC Science and Communication Centre on Harmful Algae
MAMCOMP Training Course	9 -13 August	Teheran, Iran	Ocean Sciences
ODINAFRICA Data Management Remedial Training Course for Mozambique	11-23 August	Maputo, Mozambique	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
Southeast Pacific Workshop/Capacity Building Meeting	3rd Quarter 2003		IOC Sub-Commission for the Caribbean and Adjacent Regions
ODINAFRICA Data Management Training Course	1-5 September	Brussels, Belgium	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
ODINAFRICA Information Management Training Course	1-6 September	Brussels, Belgium	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
OOPC VIII	3-6 September	Ottawa, Canada	Ocean Sciences
ODINAFRICA Planning and Review Workshop	8-9 September	Brussels, Belgium	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
UN Interagency Meeting: Global Assessments for the Marine Environment	8-10 September	Paris, France	Ocean Sciences

ODINAFRICA Symposium and Exhibition	10 September	Brussels, Belgium	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean
SCOR Executive Meeting	15-19 September	Moscow, Russia	Ocean Sciences
World Climate Change Conference	29 September-3 October	Moscow, Russia	Ocean Sciences
African Ocean Portal Workshop	30 September-3 October	Zanzibar, Tanzania	IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean
19th Session of the International Coordination Group for the Tsunami Warning System in the Pacific	29 September-3 October	Wellington, New Zealand	Ocean Services
COOP V Meeting	30 September-3 October	Mazatlan, Mexico	Operational Observing Systems
PICES/IOCCP Workshop on Underway Sensors and Data Formats for Ocean Carbon	6-8 October	Tsukuba, Japan	Ocean Sciences
OceanPortal/HABSEA E-learning Introductory Training Workshop, WESTPAC Secretariat	6-8 October	Bangkok, Thailand	IOC Science and Communication Centre on Harmful Algae
2nd Session of the Editorial Board for the International Bathymetric Chart for the East South Pacific	3-14 October	Lima, Peru	Ocean Services
GLOSS Meeting	13-17 October	Paris, France	Operational Observing Systems
Black Sea Sustainable Development Symposium	14-18 October	Varna, Bulgaria	Ocean Sciences
3rd WIOMSA Scientific Symposium	15-18 October	Maputo, Mozambique	Ocean Sciences
19th Session of the Data Buoy Cooperation Panel	20-24 October	Rio or Salvador	Operational Observing Systems
6th IOC-FANSA Regional Working Group on HAB in South America	21-26 October	Guyaquil, Ecuador	IOC Science and Communication Centre on Harmful Algae
ICAM-LAC Workshop	23-25 October	Cartagena, Colombia	Secretariat and Ocean Sciences
23rd Meeting on Argos Joint Tariff Agreement	27-29 October	Angra dos Reis, Brazil	Operational Observing Systems
10th Session of ABLOS	28-30 October	Monaco	Ocean Sciences
6th Meeting of IOC Benthic Indicator Study Group Meeting	29-31 October	Paris, France	Ocean Sciences
Satellite Altimetry and Physical Oceanography Training Course	November		IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean
Global Conference on Oceans, Coasts, and Islands	12-14 November	Paris, France	Secretariat and Ocean Sciences
Submarine Groundwater Discharge Synthesis Meeting	15-17 November	Sao Paulo, Brazil	Ocean Sciences
GEOHAB Open Science Meeting	17-20 November	Lisbon, Portugal	IOC Science and Communication Centre on Harmful Algae
Harmful Algal Bloom Monitoring and Management Training Course (Regional Course for North Africa)	1-10 December	Tunisia	IOC Science and Communication Centre on Harmful Algae
IOC-ROPME-INCO Workshop on Coral Reef Management	December	Kish Island, Iran	Ocean Sciences
Harmful Algal Bloom Monitoring and Management Training Course (Regional Course for North Africa)	1-10 December	Tunisia	IOC Science and Communication Centre on Harmful Algae
COOP Sub-Committee Meeting	15-17 December	Dallas, TX, USA	Operational Observing Systems

Funding for IOC Programmes

Introduction

This Annual Report describes a wide spectrum of activities that highlight the relevance of the IOC programmes in 2003. Together with national and non-governmental initiatives, the implementation of IOC programmes and related staff costs during 2003 was financed through income from UNESCO as part of its regular programme allocation, as approved by the UNESCO General Conference, and from extra-budgetary resources, notably those provided by IOC Member States and partner organizations through their contributions to the Intergovernmental Oceanographic Commission of UNESCO Special Account (Trust Fund) and contributions for specific projects through creation of UNESCO Funds-in-Trust. This Financial Report does not consider other contributions (either direct or in kind) provided by Member States in support of the Commission s programme execution, which do not enter into the budgetary flow of IOC.

The Twenty-first Session of the IOC Assembly (July 2001) approved the programme and budget based upon anticipated resources, which for 2002-2003 were expected to amount to $13,507,800 (the regular budget allocation of $7,007,800 provided by UNESCO to finance direct programme costs [$3,243,900] and staff costs [$3,763,900]; and expected voluntary contributions from the Member States and international organizations were estimated at $6,500,000).

The *Approved Programme and Budget of UNESCO for 2002-2003* (document 31 C/5) confirmed the funding for the Intergovernmental Oceanographic Commission at the level approved by the Assembly.

The allocation of $3,243,900 for programme costs represents an increase of 26 percent (representing $666,000 more) compared to the previous biennium.

Table 1a. Summary of IOC Income in 2003 (in US$)

Type of Funding	Programme	Personnel	Total
Regular Programme Allocation (UNESCO budget according to 31 C/5, before running costs)	1,621,950	1,881,950	3,503,900
Contributions to the IOC Special Account (IOC Trust Fund)	1,207,229	245,990	1,453,219
Contributions for Specific Projects to UNESCO Funds-in-Trust	216,969	428,328	645,297
GRAND TOTAL	**3,046,148**	**2,556,268**	**5,602,416**

The total amount of resources available for programme implementation in 2003 was $3,046,148, of which $1,424,198 came from sources other than the UNESCO regular budget. The contribution from the regular budget towards programme implementation represents 53 percent of the total available funding.

The most relevant fraction of the fixed cost of the operation of the IOC is personnel, representing 46 percent of the total expenditure. The $2,553,268 was allotted for personnel to finance the total of 46 employees at Headquarters (34) and in the Field (12). Of these, 30 are professional staff and 16 provide administrative and secretarial assistance.

Regular programme implementation

It is important to point out that while the debates of the UNESCO Executive Board repeatedly stressed the concerns of both the Member States and the External Auditors with regard to the execution of the approved programme in UNESCO in general due to FABS[1] introduction and implementation, IOC shows a satisfactory overall implementation rate of 99.99 percent for 2002-2003 biennium. This was noted in the reports on budget execution prepared for the attention of the Deputy Director-General of UNESCO both by IOC and by SC administration.

Table 1b. Budget Implementation Rate for the Biennium 2002–2003 (in US$)

Budget Code	Activity Title	Allocation	Expenses	Available	Rate
Main Line of Action 1 - Ocean Sciences					
12251101 IOC	World Climate Research Programme: WOCE, CLIVAR	195,000.00	195,000.00	0.00	100.00
12251102 IOC	Advisory Panel on Ocean CO_2	65,000.00	65,000.00	0.00	100.00
12251201 IOC	Fisheries and Ecosystems	90,000.00	90,000.00	0.00	100.00
12251202 IOC	Harmful Algal Bloom Programme	22,400.00	22,400.00	0.00	100.00
12251203 IOC	Coral Bleaching and Indicators of Reef Health	30,000.00	30,000.00	0.00	100.00
12251204 IOC	Benthic Indicators	26,000.00	26,000.00	0.00	100.00
12251205 IOC	Science and Natural Resources of High Seas	34,000.00	33,996.86	3.14	99.99
12251208 IOC	Land-Ocean-Atmosphere Biogeochemistry	40,000.00	40,000.00	0.00	100.00
12251301 IOC	Interdisciplinary Investigation of Coastal Process	55,800.00	55,799.81	0.19	100.00
12251302 IOC	Marine Scientific and Technological Information System	20,000.00	20,000.00	0.00	100.00
12251303 IOC	Methodology Development in Support of ICAM	14,000.00	13,999.12	0.88	99.99
12251304 IOC	Development of Indicators for ICAM	30,000.00	29,999.04	0.96	100.00
12251305 IOC	Training, Education in Marine Science for ICAM	11,000.00	11,000.00	0.00	100.00
12251306 MOS*	MOS: Support to the Organization of the Volga Workshop	9,200.00	9,200.00	0.00	100.00
12251401 IOC	TEMA	76,600.00	76,599.93	0.07	100.00
12251402 IOC	Regional Programmes	107,900.00	107,900.00	0.00	100.00
12251404 MTD*	IOC-FANSA Regional Project on Harmful Algal Blooms	8,100.00	8,100.00	0.00	100.00
12251501 IOC**	UNICPO Meetings and follow-up	10,000.00	9,999.04	0.96	99.99
12251502 IOC**	WSSD Meeting and follow-up	35,000.00	35,000.00	0.00	100.00
12251503 IOC**	ABE-LOS Meetings and follow-up	36,000.00	36,000.00	0.00	100.00
12251504 IOC**	Subscriptions to Advisory Bodies	60,000.00	60,000.00	0.00	100.00
12251505 IOC**	Reserve for ADG	36,000.00	36,000.00	0.00	100.00

[1] FABS – Finance And Budget System (UNESCO adaptation of SAP) – introduced in UNESCO as of January 2002 – the go-live took place in March 2002.

Budget Code	Activity Title	Allocation	Expenses	Available	Rate
Main Line of Action 2 - Global Observing Systems					
12252101 IOC	Intergovernmental Committee for GOOS	42,000.00	41,999.87	0.13	100.00
12252102 IOC	GOOS Steering Committee	30,000.00	30,000.00	0.00	100.00
12252103 IOC	GOOS Project Office	64,000.00	64,000.00	0.00	100.00
12252201 IOC	Training	44,000.00	43,997.29	2.71	99.99
12252202 IOC	Regional GOOS	207,000.00	207,000.00	0.00	100.00
12252203 IOC	General Support	94,000.00	94,000.00	0.00	100.00
12252204 IOC	WESTPAC Regional Sub-Commission	40,200.00	40,200.00	0.00	100.00
12252205 BGK*	BGK: IOC/WESTPAC Office Programme Activities	80,200.00	80,199.45	0.55	100.00
12252301 IOC**	XXXV Executive Council	100,000.00	100,000.00	0.00	100.00
12252302 IOC**	XXXVI Executive Council	30,000.00	30,000.00	0.00	100.00
12252303 IOC**	XXII Assembly	100,000.00	100,000.00	0.00	100.00
12252304 IOC**	Officers Meetings	32,500.00	32,500.00	0.00	100.00
12252305 IOC**	Ocean Assessment	20,000.00	20,000.00	0.00	100.00
12252306 IOC**	Reserve for ADG	21,500.00	21,499.39	0.61	100.00
12252401 IOC	Coastal Ocean Observations Panel	34,000.00	34,000.00	0.00	100.00
12252402 IOC	Group of Experts for Global Sea Level Observing System	40,000.00	40,000.00	0.00	100.00
12252501 IOC	JCOMM Planning Meetings	36,600.00	36,599.07	0.93	100.00
12252502 IOC	JCOMM Operations	46,000.00	46,000.00	0.00	100.00
SUB-TOTAL		1,062,000.00	1,061,995.07	4.93	1,000.00
Main Line of Action 3 - Ocean Services					
12253101 IOC	MEDI Marine Metadata Management System	5,000.00	5,000.00	0.00	100.00
12253102 IOC	GLODIR	5,000.00	4,999.84	0.16	100.00
12253103 IOC	GODAR	13,000.00	13,000.00	0.00	100.00
12253104 IOC	OCEANTEACHER	1,500.00	1,500.00	0.00	100.00
12253105 IOC	OCEANPORTAL	10,000.00	10,000.00	0.00	100.00
12253106 IOC	Development of Standards and Methods in Ocean Data	95,000.00	95,000.00	0.00	100.00
12253107 IOC	Interagency Cooperation and Coordination	64,000.00	64,000.00	0.00	100.00
12253108 IOC	Information Services and Public Awareness	13,000.00	13,000.00	0.00	100.00
12253201 IOC	General Bathymetric Chart of the Oceans (GEBCO)	18,000.00	18,000.00	0.00	100.00
12253202 IOC	Ocean Mapping	27,000.00	27,000.00	0.00	100.00
12253302 IOC	ODINCARSA	70,500.00	70,500.00	0.00	100.00
12253303 IOC	Regional Bathymetric Charts of the Ocean	50,660.00	50,660.00	0.00	100.00
12253304 IOC	ITSU: Regional Programmes	29,780.00	29,779.00	1.00	100.00
12253305 IOC	Regional Coordination - AFRICA	18,000.00	17,999.76	0.24	100.00
12253306 IOC	Travel and Study Grants	28,160.00	28,160.00	0.00	100.00
12253307 MOS*	MOS: ITSU: Regional Programmes	21,500.00	21,500.00	0.00	100.00

Budget Code	Activity Title	Allocation	Expenses	Available	Rate
12253308 NAI*	NAI: IOCINCWIO Meeting and Project	23,500.00	23,500.00	0.00	100.00
12253310 IOC	IOCEA Project Office	5,000.00	5,000.00	0.00	100.00
12253311 QUI*	Decentralization ODINCARSA Activities	19,500.00	19,495.00	5.00	100.00
12253401 IOC**	Publications	64,000.00	64,000.00	0.00	100.00
12253402 IOC**	Policy Missions	60,000.00	60,000.00	0.00	100.00
12253403 IOC**	Representations Activities for Policy	4,000.00	4,000.00	0.00	100.00
12253404 IOC**	Medium Term Strategy, Information Strategy	80,000.00	80,000.00	0.00	100.00
12253501 IOC	Support of International Tsunami Information Centre	40,000.00	40,000.00	0.00	100.00
12253502 IOC	Tsunami Public Awareness Product Development	8,000.00	8,000.00	0.00	100.00
12253503 IOC	ITSU Programme Development	13,000.00	13,000.00	0.00	100.00
SUB-TOTAL		787,100.00	787,093.60	6.40	0.99999
TOTAL		2,861,100,00	2,861,082.47	17.53	0.99999

*Earmarked funds decentralized to UNESCO Regional Offices
**Policy activity lines (under ADG/IOC direct responsibility)
Unliquidated obligations represent 6% of total expenses

II. Contributions to the IOC Special Account (Trust Fund)

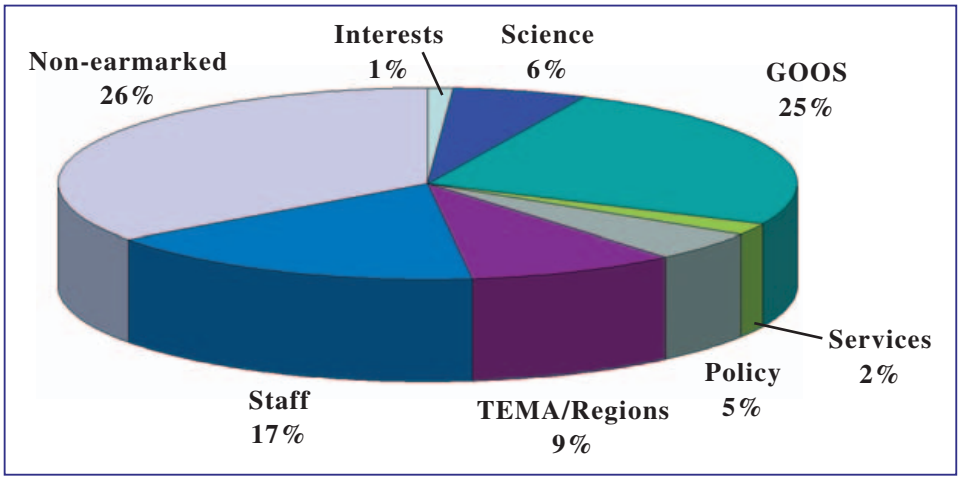
Table 2. 2003 Member States Contributions to the IOC Special Account (IOC Trust Fund) (in US$)

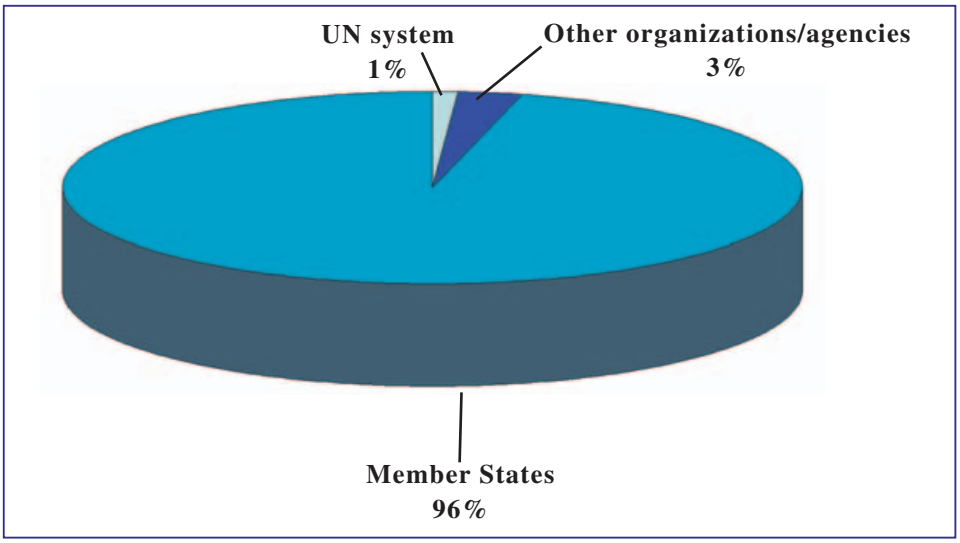
Contributor	Amount	Purpose
MLA 1 - OCEAN SCIENCE		
Spain	34,965.00	HAB/Vigo Centre
USA/NSF	15,000.00	Workshop on Regime Shifts G. Grice
USA/NOAA	10,000.00	ICAM Web site
USA/NOAA	10,000.00	WG on Indicators for ICAM
USA/NOAA	10,000.00	WG on Indicators for ICAM
USA/ONR	6,000.00	5th LME Meeting - Reimbursement
SUB-TOTAL	85,965.00	
MLA 2 - GOOS		
FAO	12,000,.00	COOP
France/Nat.Comm.	4,305.72	PIRATA
ICSU	20,000.00	GOOS
Italy (IMC)	16,000.04	MAMA Project
UK (NERC)	10,000.00	GLOSS as Contributor to JCOMM
	18,000.00	GOOS
UK (Interagency Committee on	10,000.00	GLOSS
Marine Science & Technology, SOC)	18,000.00	GOOS
USA/NOAA	60,000.00	GODAE
	10,000.00	Indian Ocean GOOS
	5,000.00	The Ocean on the Move translation
USA/NOAA	50,000.00	THORPEX A Global Atmospheric Research Program

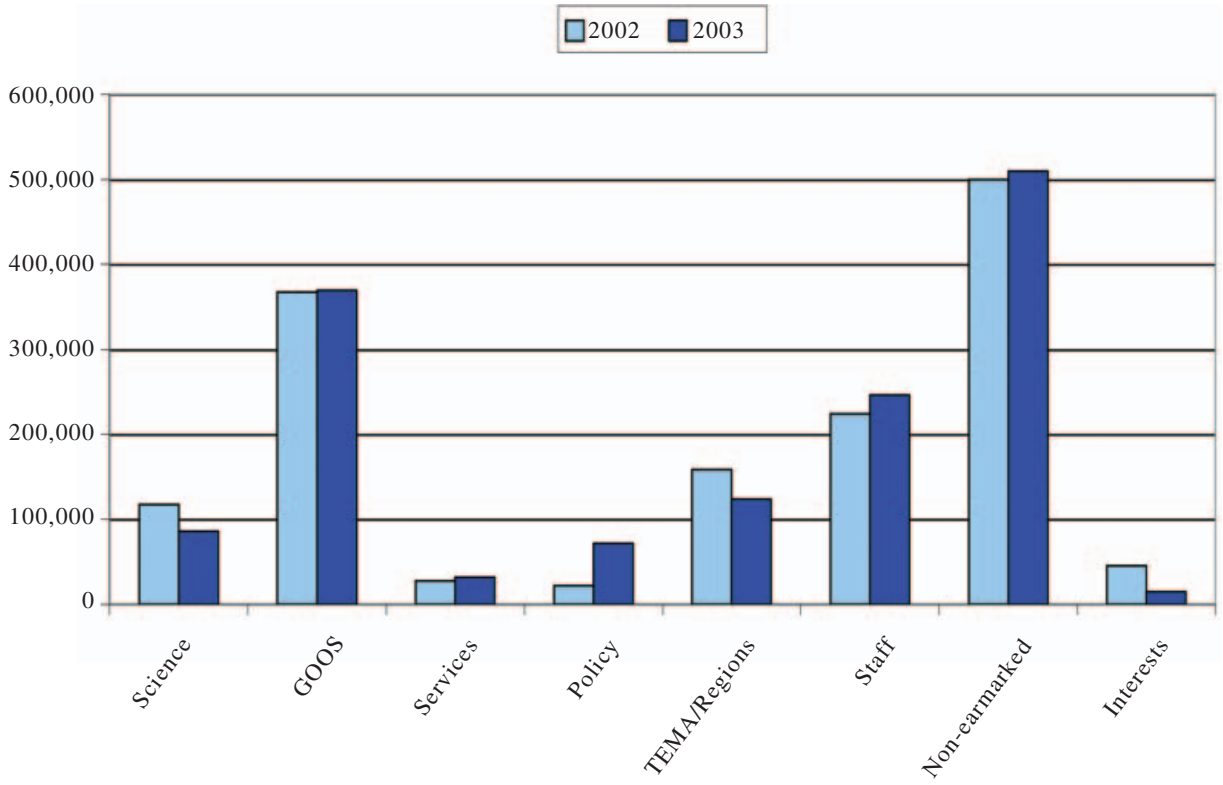
USA/NOAA	20,000.00	RIO GOOS
USA/NOAA	20,000.00	GLOSS Programme Activities
	10,000.00	Real Time Coastal Observation System Meeting,Villefranche
USA/NOAA	40,000.00	Argo Science Workshop, Tokyo
	6,000.00	GODAE Office
USA/NASA JPL	5,000.00	GLOSS training courses
	9,900.00	GLOSS training courses
	10,100.00	GLOSS training courses
USA/ONR	15,000.00	GOOS-AFRICA
SUB-TOTAL	369,305.76	
MLA 3 - Ocean Services		
Belgium	5,423.00	IODE
France/IFREMER	5,000.00	IODE/EuroOcean
France/Nat.Comm.	10,600.74	ITSU
HR Wallingford	5,171.98	Marine XML Fund
Korea (Rep. of) Met. Adm.	1,000.00	ITSU
Peru	1,980.00	ITSU
World Book Publishing	2,500.00	ITSU
SUB-TOTAL	31,675.72	
Cross-Cutting - POLICY		
Australia	6,033.38	IOC/ABE-LOS III Lisbon
Australia (National Oceans Office)	5,000.00	Global Forum on Oceans 2003
Chile	1,631.43	Participation of ADG/IOC in Workshop in Vina del Mar
France/Nat.Comm.	12,956.46	IOC/ABE-LOS III Lisbon
Germany	5,735.16	ICHO-VI publication project
IOI	1,000.00	ICHO-VI publication project
SCOR	13,514.33	Oceans Future meeting
UK (NERC)	1,076.43	Payment for *The Blue* publication
USA/NOAA	10,000.00	Global Forum on Oceans 2003
USA/NOAA	15,000.00	Global Forum on Oceans 2003
C. Johnston	40.00	Purchase of *The Blue*
Internet Domain Reimbursement	17.27	
SUB-TOTAL	72,004.46	
Cross-Cutting - TEMA & REGIONS		
China	20,000.00	Regional Activities WESTPAC
France/Nat.Comm.	53,003.70	Regional Cooperation
USA/NOAA	15,000.00	POGO
USA/NOAA	35,700.00	IOCARIBE
SUB-TOTAL	123,703.70	
STAFF		
Australia (CSIRO)	7,194.20	Argo Coordinator
Canada	6,896.55	Argo Coordinator
IBRD	2,000.00	Contribution towards staff expenditure (Coral Reefs)
USA/NOAA	50,000.00	Contribution towards staff expenditure SCOR CO_2 Panel (M. Hood)
USA/NOAA	95,000.00	Seconded Staff for GOOS

USA/NOAA	84,900.00	Argo Autonomous Profiling Float Program
SUB-TOTAL	245,990.75	
NON-EARMARKED FUNDS		
Canada (DFO)	10,067.11	Programme activities (general)
USA (Department of State)	500,000.00	Programme activities (general)
SUB-TOTAL	510,067.11	
INTERESTS		
	6,216.00	
	4,327.00	
	3,964.00	
SUB-TOTAL	14,507.00	
TOTAL	1,453,219.50	

2003 Allotment Breakdown by Main Programme Axes







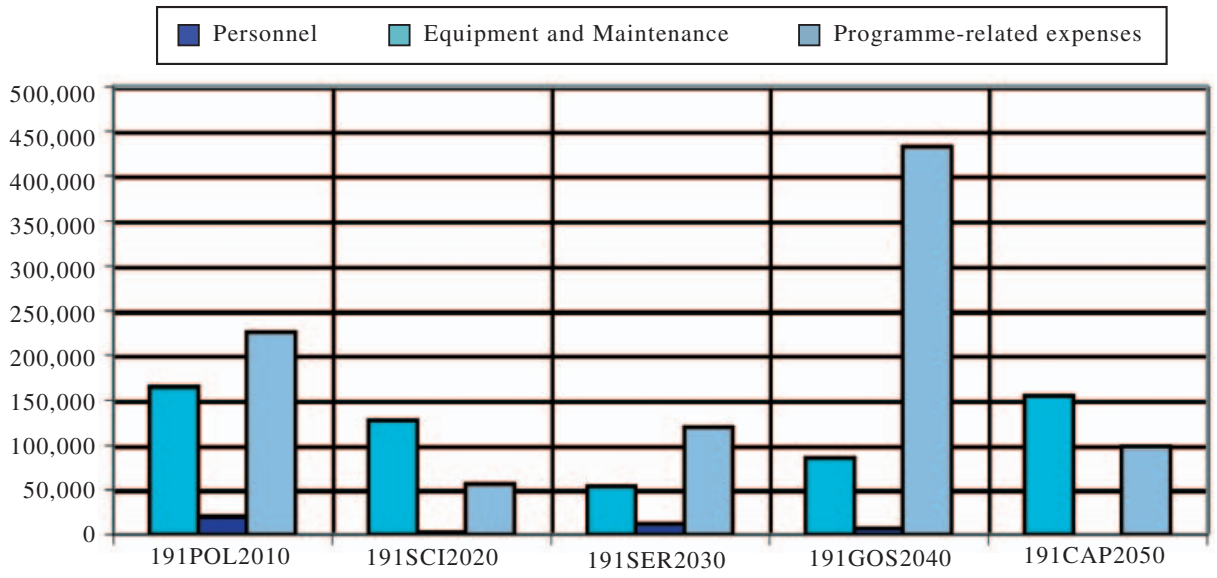
IOC Special Account - Expenditure

For the sake of clarity, it should be explained that voluntary contributions to the IOC Special Account are deposited into the IOC General Revenue Account (194IOC9090) from which funds are allotted to the five accounts established in accordance with the IOC programme structure. The expenditure is recorded on these operational accounts:

191POL2010 - General/Policy
191SCI2020 - Ocean Science
191SER2030 - Ocean Services
191GOS2040 - Global Ocean/Coastal Observing Systems
191CAP2050 - Capacity Building/ Regional Cooperation

Budget lines	Type of Expenditure	191POL2010	191SCI2020	191SER2030	191GOS2040	191CAP2050
10	Other personnel cost	2,875.23	0.00	0.00	2,160.00	0.00
11.00	International experts	98,736.75	121,077.42	44,683.52	79,184.03	114,414.21
11.50	Consultants	0.00	0.00	91.27	2,752.00	19,004.48
13	Administrative support personnel	63,168.12	7,140.09	9,313.10	1,021.08	21,662.73
16	Mission costs	41,849.23	16,821.36	29,968.30	41,157.82	20,690.56
Sub-Total 10	Project personnel	206,629.33	145,038.87	84,056.19	126,274.93	175,771.98
20	Sub-contracts	129,962.31	17,814.68	75,256.96	195,701.13	10,180.79
30	Training and seminars	50,058.41	21,583.06	14,491.12	108,866.11	67,953.57
40	Equipment and maintenance	20,530.85	2,311.19	11,917.93	6,635.09	0.00
50	Miscellaneous (sundry expenditure)	3,479.96	624.32	65.14	87,340.97	188.23
TOTAL		**410,660.86**	**187,372.12**	**185,787.34**	**524,818.23**	**254,094.57**

* IOC contribution to WCRP and GCOS is recorded under budget line 50



III. Contributions for Specific Projects through Creation of UNESCO Funds-in-Trust

Table 3. 2003 Contributions to the UNESCO/IOC Funds-in-Trust (in US$)

Project Code	Purpose	Donor	2003
	MLA 1 - Ocean Science		
193DEN2020	HAB Centre (Copenhagen)	Denmark	149,322.00
193UKM2041	GCRMN	United Kingdom	81,497.00
213GLO2000	Land & Nutrient Enrichment	UNEP	2,000.00
213GLO2001	Global Patterns of Human Activities	UNEP	4 ,900.00
SUB-TOTAL			237,719.00
	MLA 2 - GOOS		
193GLO2001	DBCP	WMO	126,000.00
SUB-TOTAL			126,000.00
	MLA 3 - Ocean Services		
513RAF2041	ODINAFRICA-II	G. of Flanders	102,062.00
513RAF2000	Improvement of Internet Access in ODINAFRICA Institutions	G. of Flanders	19,910.00
513GLO2001	ICHO-VI Proceedings Production	G. of Flanders	6,600.00
SUB-TOTAL			128,572.00
	Cross-cutting - REGIONS		
804GLO2044	Associate Expert	Japan	87,005.00
506RAS2005	WESTPAC JFiT 2002	Japan	66,001.00
SUB-TOTAL			153,006.00
TOTAL			**645,297.00**

Acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea (IOC)
ABLOS	Advisory Board of Experts on the Technical Aspects of Law of the Sea
ACC	Administrative Committee on Coordination (of the UN System)
ACOPS	Advisory Committee on Protection of the Sea
ACSYS	Arctic Climate System Study (WCRP)
ADCP	Acoustic Doppler Current Profiler
AECI	Agencia Española de Cooperación Internacional (Spanish Agency for International Cooperation)
AGU	American Geophysical Union
AIMS	Analysis, Interpretation, Modelling and Synthesis (WOCE)
AMCEN	African Ministerial Conference on the Environment
ANCA	HAB working group for the Caribbean
ANMP	Association Nationale des Moniteurs de Plongée (professional diving instructors association, France)
AOML	Atlantic Oceanographic and Meteorological Laboratory (NOAA)
AOPC	Atmospheric Observation Panel for Climate
APEC	Asia-Pacific Economic Cooperation
Argo	GODAE global profiling float project (not an acronym)
Argos	Service Argos, Inc. (global data telemetry and geo-positioning services company)
ASAP	Automated Shipboard Aerological Programme
ASLO	American Society of Limnology and Oceanography
BATHY	Bathythermograph Report, or code for reporting temperature profile observations
BBC	British Broadcasting Corporation
BC	British Columbia (Canada)
BMRC	Bureau of Meteorology Research Centre (Australia)
BoM	Bureau of Meteorology (Australia)
BOOS	Baltic Operational Oceanographic System
BSH	Bundesamt für Seeschiffahrt und Hydrographie (Federal Maritime and Hydrographic Agency of Germany)
BUOY	BUOY is the name of the code for reporting buoy observations
CalCOFI	California Cooperative Oceanic Fisheries Investigations (USA)
CariBas	Caribbean Basins project (LOICZ)
CARICOM	Caribbean Community
CARICOMP	Caribbean Coastal Marine Productivity (launched by UNESCO)
CBD	Convention on Biological Diversity (Rio de Janeiro, 1992)
CBS	Commission for Basic Systems (WMO)
CD-ROM	compact disk – read only memory
CEB	United Nations System s Chief Executives Board for Coordination (new name for ACC)
CEOP	Coordinated Enhanced Observing Period (GEWEX)
CEOS	Committee on Earth Observation Satellites
CIESM	International Commission for the Scientific Exploration of the Mediterranean Sea
CIRAD	Centre de coopération Internationale en Recherche Agronomique pour le Développement (center for international cooperation in agronomy research for development, France)
CLCS	Commission on the Limits of the Continental Shelf (UN)
CliC	Climate and Cryosphere project (WCRP)
CLIVAR	Climate Variability and Predictability Programme (WCRP)
CLME	Large Marine Ecosystem of the Caribbean and Adjacent Regions

CMM	Commission for Marine Meteorology (WMO)
CMS	Centre for Marine Studies (University of Queensland, Australia)
CNES	Centre National d Etudes Spatiales (French national space centre/agency)
CO_2	Carbon Dioxide
COASTS	Coastal Ocean Advanced Science and Technology Studies
COMEST	World Commission on the Ethics of Scientific Knowledge and Technology (UNESCO)
CoML	Census of Marine Life
COOP	Coastal Ocean Observations Panel (GOOS)
COP	Conference of the Parties (to the UNFCCC), also CoP
COSMAR/ NEPAD	Coastal and Marine Unit of the New Partnership for Africa s Development
CPACC	Caribbean Planning for Adaptation to Climate Change
CSD	Commission on Sustainable Development (UN)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSMP	Center for the Study of Marine Policy (University of Delaware, USA)
CTD	conductivity-temperature-depth probe
DANIDA	Danish International Development Assistance
DBCP	Data Buoy Cooperation Panel (WMO-IOC)
DFID	Department for International Development (UK)
DINARA	Dirección Nacional de Recursos Acuáticos (Uruguay s aquatic resources authority)
DNA	Designated National Agency (IODE)
DODS	Distributed Oceanographic Data System
E2EDM	End-to-end Data Management
EC	European Commission, also Executive Council (e.g. WMO or IOC)
ECMWF	European Centre for Medium-Range Weather Forecasts
EDIMAR	Estación de Investigaciones Marinas de Margarita (marine research station, Venezuela)
EDIOS	European Directory of the Initial Ocean-observing System
EEZ	Exclusive Economic Zone
EGOS	European Group on Ocean Stations (DBCP)
EI	Environmental Indices
ENSO	El Niño-Southern Oscillation (ocean/atmosphere interaction study)
EOS	AGU s weekly newspaper of geophysics, also NASA s Earth Observing System
EOS I	Earth Observation Summit, Washington, D.C., USA
ESA	European Space Agency
ESEAS	European Sea Level Service
ET	Evaluation Team (GESAMP)
EURASLIC	European Association of Aquatic Sciences Libraries and Information Centres
FANSA	HAB working group for South America
FAO	Food and Agriculture Organization of the United Nations
FUST	Flanders UNESCO Trust Fund
G30S	Sponsors Group for the Global Observing Systems (GCOS, GOOS and GTOS)
GAW	Global Atmosphere Watch (WMO)
GC	Governing Council (of UNEP)
GCOS	Global Climate Observing System (WMO-ICSU-IOC-UNEP)
GCP	Global Carbon Project
GCRMN	Global Coral Reef Monitoring Network
GDA	GEBCO Digital Atlas (GEBCO Database)
GEBCO	General Bathymetric Chart of the Oceans
GEBCDMEP	IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices

GEF	Global Environment Facility (World Bank-UNEP-UNDP)
GEMIM	Group of Experts on Marine Information Management
GEO	The *Ad Hoc* Group on Earth Observations
GEOHAB	Global Ecology and Oceanography of HABs (IOC-SCOR)
GEOSS	Global Earth Observation System of Systems
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (IMO-FAO-UNESCO-WMO-WHO-IAEA-UN-UNEP)
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GIPME	Global Investigation of Pollution in the Marine Environment
GIWA	Global International Water Assessment
GLOBEC	Global Ocean Ecosystems Dynamics Programme (SCOR, IOC, IGBP/ICSU)
GLODIR	Global Directory of Marine (and Freshwater) Professionals
GLOSS	Global Sea-Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Oceanographic Data Archaeology and Rescue Project (IODE)
GOOS	Global Ocean Observing System (IOC-WMO-UNEP-ICSU)
GOSIC	Global Observing Systems Information Center
GOSUD	Global Ocean Surface Underway Data
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (UNEP)
GPO	GOOS Project Office
GSC	GOOS Steering Committee
GSN	GCOS Surface Network
GTOS	Global Terrestrial Observing System (FAO-UNEP-WMO-UNESCO-ICSU)
GTS	Global Telecommunication System (WWW)
GTSPP	Global Temperature and Salinity Profile Programme (IOC-WMO)
GUAN	GCOS Upper-Air Network
HAB	Harmful Algal Bloom
HAE-DAT	Metadata database on Harmful Algal Events
HAMM	Harmful Algal Management and Mitigation (international conferences)
HDNO	Head Department of Navigation and Oceanography (of the Ministry of Defence of the Russian Federation)
HLCM	High-Level Committee on Management
HLCP	High-Level Committee on Programmes
HTDB/PAC	Historical Tsunami Database for the Pacific
IABO	International Association for Biological Oceanography (member of SCOR)
IABP	International Arctic Buoy Programme (DBCP)
IAEA	International Atomic Energy Agency
IAG	International Association of Geodesy
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centres
IAPSO	International Association for the Physical Sciences of the Ocean (IUGG)
IASI	Intra-American Seas Initiative
IBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic
IBCM	International Bathymetric Chart of the Mediterranean
IBCSEP	International Bathymetric Chart of the South Eastern Pacific
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	International Bathymetric Chart of Western Pacific
ICAM	Integrated Coastal Area Management (also name of IOC programme)
ICES	International Council for the Exploration of the Sea
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific (IOC)

ICM	Integrated Coastal Zone Management
ICP	Informal Consultative Process (full name: UN Open-ended Informal Consultative Process on Ocean Affairs)
ICRAN	International Coral Reef Action Network
ICSU	International Council for Science
ICT	Information and Communication Technology
IDGs	International Development Goals
IEO	Instituto Español de Oceanografía (Spanish institute of oceanography, in Vigo)
IFREMER	Institut Français de Recherche pour l Exploitation de la Mer (French Research Institute for the Exploitation of the Sea)
IGBP	International Geosphere-Biosphere Programme (ICSU) also known as Global Change Programme
IGO	Intergovernmental Organization
I-GOOS	Intergovernmental GOOS Committee (IOC-WMO-UNEP)
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System (IOC-WMO)
IGST	International GODAE Steering Team
IHDP	International Human Dimensions Programme on Global Environmental Change (ISSC-ICSU)
IHO	International Hydrographic Organization
IHP	International Hydrological Programme (UNESCO)
IMO	International Maritime Organization
IMS	Institute of Marine Sciences (Tanzania)
INCO	Iranian National Centre for Oceanography
INCOIS	Indian National Centre for Ocean Information Service
INEGI	Instituto Nacional de Estadística, Geografía e Informática (Mexican institute of statistics, geography and computer science)
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCCG	International Ocean Colour Coordinating Group
IOCCP	International Ocean Carbon Coordination Project
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCINCWIO	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data and Information Exchange (IOC)
IOGOOS	Indian Ocean GOOS
IOI	International Ocean Institute (Malta)
IOS	Initial Observing System (GOOS)
IOSLON	Indian Ocean Sea Level Observing Network
IPCC	Intergovernmental Panel on Climate Change
IPHAB	IOC Intergovernmental Panel on Harmful Algal Blooms
IPO	International Project Office (for GEOHAB)
IRD	Institut de Recherche pour le Développement (France s research institute for development. Formerly: France s scientific research institute for development through cooperation – ORSTOM)
ISABP	International South Atlantic Buoy Programme
ISO	International Organization for Standardization
ISRO	Indian Space Research Organization
ISSC	International Social Science Council
ITIC	International Tsunami Information Center
IUCN	World Conservation Union (formerly International Union for the Conservation of Nature)
IUGG	International Union of Geodesy and Geophysics
IWG	Intergovernmental Working Group (on IOC Oceanographic Data Exchange Policy)
JAFOOS	Joint Australian Facility for Ocean Observing Systems

Jason	USA-France oceanographic/climate monitoring/research and prediction mission
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology (WMO-IOC)
JGOFS	Joint Global Ocean Flux Study (IGBP)
JSC	Joint Scientific Committee for the WCRP (WMO-ICSU-IOC)
JSG	Joint Study Group
JTA	Joint Tariff Agreement (Argos)
JODC	Japan Oceanographic Data Centre
LME	large marine ecosystem
LOICZ	Land-Ocean Interaction in the Coastal Zone (IGBP)
MAMA	Mediterranean Network to Access and Upgrade Monitoring and Forecasting Activity in the Region
MAMCOMP	Monitoring and Modelling of Coastal Marine Processes
MAP/NAI	Millenium Africa Recovery Programme/New African Initiative
MEDAR/ MEDATLAS	Mediterranean Data Archaeology and Rescue / Mediterranean (and Black Sea) Atlas
MedGLOSS	Mediterranean GLOSS
MedGOOS	Mediterranean GOOS project
MEDI	Marine Environmental Data Information Referral Catalogue
MEDS	Marine Environmental Data Service (Canada)
MFSPP	Mediterranean Forecasting System Pilot Project
MIP	Marine Integrated Programme
MON-DAT	IOC Metadata Database on Design and Implementation of Some Harmful Algal Monitoring Systems
MOU	Memorandum of Understanding
MP	Member of Parliament
MPA	Marine Protected Area
MSP	Medium-Sized Project (GEF)
MSR	Marine Scientific Research
MSVPA	Multi-Species Virtual Population Analysis
NASA	National Aeronautics and Space Administration (USA)
NASDA	National Space Development Agency of Japan
NCDC	National Climatic Data Center (USA)
NEAR-GOOS	North-East Asian Regional GOOS
NEPAD	New Partnership for Africa s Development
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre (IODE)
NOOS	Northwest Shelf Operational Oceanographic System
NORAD	Norwegian Agency for Development Cooperation
NOWPAP	Northwest Pacific Action Plan
NRC	National Research Council (USA)
NRT	Near Real Time
OAU	Organization of African Unity
OCM	Ocean Colour Monitor
ODIMeX	Oceanographic Data and Information Management
ODIN	Ocean Data and Information Network
ODINAFRICA	Ocean Data and Information Network for Africa (IOC and Flanders)
ODINCARSA	Ocean Data and Information Network for the IOCARIBE and South America regions
ODINEA	Ocean Data and Information Network for Eastern Africa (IODE)
OIT	Ocean Information Technology

ONR	Office of Naval Research (USA)
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
OOS	Operational Observing Systems (IOC programme section)
OPC	Ocean Products Center (USA)
OS	Ocean Services (IOC programme section)
OSLNR	Ocean Sciences in Relation to Non-Living Resources
OSLR	Ocean Sciences in Relation to Living Resources
OSS	Ocean Sciences Section (IOC programme section)
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management
PASS	Pan-African START Secretariat
pCO_2	measurement of CO_2 concentrations in the atmosphere and ocean
PICES	North Pacific Marine Science Organization
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
POGO	Partnership for Observation of the Global Oceans
PR China	People s Republic of China
PSMSL	Permanent Service for Mean Sea-Level
PTWC	Pacific Tsunami Warning Center
QC	quality control (of data)
RNODC	Responsible National Oceanographic Data Centre (IODE)
ROOFS-AFRICA	Regional Ocean Observing and Forecasting Systems for Africa
RONMAC	Red de Observación del Nivel del Mar para América Central (sea-level observing network for Central America)
ROPME	Regional Organization for the Protection of the Marine Environment (HQ in Kuwait)
R/V	Research Vessel
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SBSTA	Subsidiary Body for Scientific and Technological Advice (UNFCCC)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (member of ICSU)
SCUFN	Sub-Committee for Undersea Feature Names
SEAGOOS	South East Asia regional GOOS
SEFSC	Southeast Fisheries Science Center (Miami, FL, USA)
SG	Study Group or Steering Group
SGD	Submarine Groundwater Discharges
SHIP	Report of Surface Observation from a Sea Station
SHOM	Service Hydrographique et Océanographique de la Marine (France)
SIO	Scripps Institution of Oceanography (University of California, USA)
SOA	State Oceanic Administration (PR China)
SOC	Specialized Oceanographic Centre (JCOMM), also Southampton Oceanography Centre (UK)
SOCA	Sub-Committee on Oceans and Coastal Areas (of UN ACC)
SOCIO	Sustained Observations of Climate in the Indian Ocean (workshop)
SOEMEP	Science for Ocean Ecosystems and Marine Environmental Protection (IOC programme)
SOLAS	Surface Ocean – Lower Atmosphere Study (WCRP)
SOOP	Ship-of-Opportunity Programme
SOOPIP	SOOP Implementation Panel
SOPAC	South Pacific Applied Geoscience Commission
SPACC	Small Pelagic Fishes and Climate Change Programme (of GLOBEC)
SSC	Scientific Steering Committee
SST	Sea Surface Temperature

START	Global Change System for Analysis, Research and Training (IGBP)
SVP	Surface Velocity Programme (WOCE)
SVP-B	SVP barometer (Lagrangian drifters)
TAO/TRITON	Tropical Atmosphere Ocean project / Triangle Trans-Ocean buoy Network (Japan)
TEMA	Training, Education and Mutual Assistance in the Marine Sciences (IOC cross-cutting provision/programme)
TESAC	code for reporting temperature, salinity and currents from a sea station
3-D	three-dimensional
TIME	Tsunami Inundation Modelling Exchange Project (IOC)
TIP	TAO Implementation Panel
TMT	Transfer of Marine Technology
TOC	Total Organic Carbon
TOPC	Terrestrial Observation Panel for Climate
ToR (or TOR)	terms of reference
TRACKOB	report of marine surface observations along a ship s track
TREMORS	Tsunami Risk Evaluation through Seismic Moment from a Real-time System
TSG	Thermo-Salino-Graph
TTR	Training-through-Research
TWS	Tsunami Warning System in the Pacific (or TWSP)
UAE	United Arab Emirates
UDSM	University of Dar Es Salaam
UN	United Nations
UNCED	UN Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UN/DOALOS	UN Division for Ocean Affairs and the Law of the Sea
UNDP	United Nations Development Programme
UNDG	UN Development Group
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UOT/DAC	Upper Ocean Thermal Data Assembly Centres (WOCE Coordination Group)
USSSDAP	Underway Sea Surface Salinity Data Archiving Pilot Project (IODE)
UV	Ultra Violet
VCP	Voluntary Cooperation Fund Programme (WMO or IOC)
VLIZ	Flanders Marine Institute (Belgium)
VOS	Voluntary Observing Ship (for WMO)
VOSClim	VOS Climate Project
WAGOOS	Western Australia GOOS
WCRP	World Climate Research Programme (WMO-ICSU-IOC)
WDC	World Data Centre
WESTPAC	IOC Sub-Commission for the Western Pacific
WGIPA	Working Group on Integrated Problem Analysis (see ICAM events)
WHO	World Health Organization
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (WCRP)
WSSD	World Summit on Sustainable Development (Johannesburg, 2002)
WWW	World Weather Watch (WMO)
www	World-Wide Web
XBT	Expendable Bathythermograph
XCTD	Expendable Conductivity-Temperature-Depth Probe
XML	eXtensible Markup Language