

Intergovernmental Oceanographic Commission

Workshop Report No. 78

IOC-CEC-ICES-WMO-ICSU Ocean Climate Data Workshop

Greenbelt, Maryland, USA.
18-21 February 1992



UNESCO

IOC Workshop Reports

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No.	Title	Languages	No.	Title	Languages	No.	Title	Languages
1	CCOP-IOC, 1974, Metallogenesis, Hydrocarbons and Tectonic Patterns in Eastern Asia (Report of the IDOE Workshop on); Bangkok, Thailand, 24-29 September 1973	E (out of stock)	21	Second IDOE Symposium on Turbulence in the Ocean, Liège, Belgium, 7-18 May 1979.	E, F, S, R	43	IOC Workshop on the Results of MEDALPEX and Future Oceanographic Programmes in the Western Mediterranean	E
2	UNDP (CCOP), 138 pp.		22	Third IOC/WMO Workshop on Marine Pollution Monitoring, New Delhi, 11-15 February 1980.	E, F, S, R	44	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities	E (out of stock), S
3	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974 (UNESCO Technical Paper in Marine Sciences, No. 20).	E (out of stock) S (out of stock)	23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific, Tokyo, 27-31 March 1980.	E, R	44	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities	E
4	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean, Monte Carlo, 9-14 September 1974.	E, F, S (out of stock)	24	WESTPAC Workshop on Coastal Transport of Pollutants, Tokyo, 27-31 March 1980.	E (out of stock)	45	Submitted Papers, Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986	E
5	Report of the Workshop on the Phenomenon known as "El Niño", Guayaquil, Ecuador, 4-12 December 1974.	E (out of stock) S (out of stock)	25	Workshop on the Inter-calibration of Sampling Procedures of the IOC/WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters, Bermuda, 11-26 January 1980.	E (super- seded by IOC Technical Series No. 22)	46	IOCARIBE Workshop on Physical Oceanography and Climate	E
6	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources, Kingston, Jamaica, 17-22 February 1975.	E (out of stock) S	26	IOC Workshop on Coastal Area Management in the Caribbean Region, Mexico City, 24 September-5 October 1979.	E, S	47	Reunión de Trabajo para Desarrollo del Programa «Ciencia Oceánica en Relación a los Recursos No vivos en la Región del Atlántico Sudoccidental, Porto Alegre, Brazil, 7-11 de Abril de 1986	S
7	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Suva, Fiji, 1-6 September 1975.	E	27	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific, Nouméa, New Caledonia, 9-15 October 1980.	E	48	IOC Symposium on Marine Science in the Western Pacific: The Indo-Pacific Convergence	E
8	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO/IOFC/UNESCO/EAC, Nairobi, Kenya, 25 March-2 April 1976.	E, F, S, R	28	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes, Lima, 20 April-5 May 1980.	E	49	IOCARIBE Mini-Symposium for the Regional Development of the IOC-UN (OETB) Programme on "Ocean Science in Relation to Non-Living Resources (OSNLR)"	E, S
9	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters, Penang, 7-13 April 1976.	E (out of stock)	29	WESTPAC Workshop on Marine biological methodology, Tokyo, 9-14 February 1981.	E	50	Havana, Cuba, 4-7 December 1986	E
10	IOC/CMG/SCOR Second International Workshop on Marine Geoscience, Mauritius, 9-13 August 1976.	E, F, S, R	30	International Workshop on Marine Pollution in the South-West Atlantic Montevideo, 10-14 November 1980.	E (out of stock) S	51	AGU-IOC-WMO-CPPS Chapman Conference: An International Symposium on "El Niño"	E
11	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring, Monaco, 14-18 June 1976.	E, F, S (out of stock) R	31	Third International Workshop on Marine Geoscience, Heidelberg, 19-24 July 1982	E, F, S	52	Guyaquil, Ecuador, 27-31 October 1986	E
12	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976.	E, F, S	32	UNU/IOC/UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime Paris, 27 September - 1 October 1982	E, F, S	53	CCAMLRL-IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, particularly Krill (organized in collaboration with SCAR and SCOR) Paris, France, 2-6 June 1987	E
13	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions, Port of Spain, Trinidad, 13-17 December 1976.	E (out of stock), S	33	Papers submitted to the UNU/IOC/UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime Paris, 27 September-1 October 1982	E	54	CCOP/SOPAC-IOC Workshop on Coastal Processes in the South Pacific Island Nations, Lae, Papua-New Guinea, 1-8 October 1987	E
14	Report of the IOCARIBE Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects, Fort-de-France, Martinique, 28 November-2 December 1977.	E, F, S	34	Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime Paris, 27 September-1 October 1982	E	55	SCOR-IOC-UNESCO Symposium on Vertical Motion in the Equatorial Upper Ocean and its Effects upon Living Resources and the Atmosphere, Paris, 6-10 May 1985	E
15	Report of the IOCARIBE Workshop on Environmental Geology of the Caribbean Coastal Area, Port of Spain, Trinidad, 16-18 January 1978.	E, S	35	Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR) Halifax, 26-30 September 1983	E	56	IOC Workshop on the Biological Effects of Pollutants, Oslo, 11-29 August 1986	E
16	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas, Abidjan, Ivory Coast, 2-9 May 1978.	E, F	36	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa) Tenerife 12-17 December 1983	E, F, S	57	Workshop on Sea-level Measurements in Hostile Conditions, Bidston, UK, 28-31 March 1988	E
17	CPFS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific, Santiago de Chile, 6-10 November 1978.	E (out of stock)	37	CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific Suva, Fiji, 3-7 October 1983	E	58	IBCCA Workshop on Data Sources and Compilation, Boulder, Colorado, 18-19 July 1988	E
18	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	E, F, R	38	IOC/FAO Workshop on the Improved Uses of Research Vessels Lisbon, 28 May - 2 June 1984	E	59	IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP) Cleveland, Australia, 24-30 July 1988	E
19	Joint IOC/WMO Workshop on Oceanographic Products and the IGOSS Data Processing and Services System (IDPSS), Moscow, 9-11 April 1979.	E	39	Papers submitted to the IOC-FAO Workshop on Improved Uses of Research Vessels, Lisbon, 28 May-2 June 1984	E	60	IOC Workshop on International Co-operation in the Study of Red Tides and Ocean Blooms Takamatsu, Japan, 16-17 November 1987	E
20	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOSS Data Processing and Services System, Moscow, 2-6 April 1979.	E	40	IOC/UNESCO Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs, Colombo, 8-13 July 1985	E	61	International Workshop on the Technical Aspects of the Tsunami Warning System. Novosibirsk, USSR, 4-5 August 1989	E
	IOC/UNESCO Workshop on Syllabus for Training Marine Technicians, Miami, 22-26 May 1978 (UNESCO reports in marine sciences, No. 4, published by the Division of Marine Sciences, UNESCO)	E (out of stock), F, S (out of stock), R	41	IOC/FAO Workshop on the Improved Uses of Research Vessels, Lisbon, 28 May-2 June 1984	E	62	Second International Workshop on the Technical Aspects of Tsunami Warning Systems, Tsunami Analysis, Preparedness, Observation and Instrumentation. Submitted Papers Novosibirsk, USSR, 4-5 August 1989	E
	IOC Workshop on Marine Science Syllabus for Secondary Schools, Llanwrtyd Major, Wales, U.K., 5-9 June 1978 (UNESCO reports in marine sciences, No. 5, published by the Division of Marine Sciences, UNESCO)	E (out of stock), F, S, R, Ar		IOC/UNESCO Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs, Colombo, 8-13 July 1985	E	63	Second IOC Workshop on the Biological Effects of Pollutants, Bermuda, 10 September - 2 October 1988	E
	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources, Bandung, Indonesia, 17-21 October 1978.	E		IOC/FAO Workshop on the Improved Uses of Research Vessels, Lisbon, 28 May-2 June 1984	E		Second Workshop of Participants in the Joint FAO-IOC-WHO-IAEA-UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region, Accra, Ghana, 13-17 June 1988	E
				IOC/UNESCO Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs, Colombo, 8-13 July 1985	E		IOC/WESTPAC Workshop on Co-operative Study of the Continental Shelf Circulation in the Western Pacific, Bangkok, Thailand, 31 October - 3 November 1989	E

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TABLE OF CONTENTS

SUMMARY REPORT		Page
1.	BACKGROUND AND OBJECTIVES	1
2.	ORGANIZATION AND PREPARATION	1
3.	PROGRAMME	1
4.	ISSUES	2
5.	CONCLUSIONS	7
 ANNEXES		
I.	WORKSHOP PROGRAMME	
II.	LIST OF PARTICIPANTS	

1. BACKGROUND AND OBJECTIVES

The First Consultative Meeting on Responsible National Oceanographic Data Centres (RNODC's) and Climate Data Services met in February 1988 and made a number of recommendations related to improving services to meet the needs of climate programmes. Included in these discussions was a recommendation for a Workshop on Ocean Climate Data Management. This recommendation instructed the Secretariat to bring the Workshop to the attention of organizations involved with the planning and execution of ocean climate data programmes and requested that an organizing committee be established which would include representatives of these programmes and of international organizations that might be interested in co-sponsoring the workshop. The United States offered to host the Ocean Climate Data Workshop (OCDW). The officers of the IOC Committee on International Oceanographic Data and Information Exchange (IOC/IODE) endorsed the OCDW and in January 1990 the first meeting of the OCDW Organizing Committee was held in Washington, DC. The report of the meeting was discussed and approved by IODE-XIII and subsequently endorsed by the IOC Executive Committee. The report of the first meeting included a number of action items and a timetable for completion of these actions. The plan called for a second meeting of the organizing committee to finalize the program, select possible speakers, and set a date for the workshop. The second meeting of the organizing committee was held in January 1991. At this meeting a set of workshop objectives was approved, a basic outline of the programme was developed, conveners for various part of the programme were designated and possible speakers were discussed.

The objectives of the OCDW were as follows:

- (i) Establish a dialogue between data managers and scientists;
- (ii) Identify opportunities for improving data management in support of ocean climate research;
- (iii) Find ways to improve access to marine data;
- (iv) Outline the characteristics of data management systems needed to support ocean monitoring and prediction;
- (v) Provide guidelines for improved data services.

2. ORGANIZATION AND PREPARATION

Following the second meeting of the OCDW Organizing Committee, conveners and the committee chairman contacted potential speakers and further refined the programme, keeping in mind objectives that had been developed. The U.S. reaffirmed its intention to host the workshop. Within the U.S. both the National Oceanic & Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) planned to host the OCDW. In addition to the support which came from the IOC, the Secretariat was able to get commitments and support from five other international organizations - the Commission of European Communities (CEC), the International Council for the Exploration of the Sea (ICES), the International Council of Scientific Unions (ICSU), the Scientific Committee on Oceanic Research (SCOR) and the World Meteorological Organization (WMO). Clearly this participation indicates the importance of developing sound data management support for climate research and evolving ocean observing systems. After having completed the programme, invitations were issued to a number of people it was thought represented a good cross-section of the scientific interest groups and data managers working on ocean related climate projects.

3. PROGRAMME

The second meeting of the organizing committee resulted in the programme as shown in Annex I which may be viewed as having four parts:

- (i) **An introductory session** of speakers involved with planning for the future, so that participants could keep in mind the types of projects and associated problems that need to be solved in providing data management support for upcoming experiments and programmes.
- (ii) **A "hands-on" session** demonstrating new computer systems recently put in place or which are under development. This was a chance for participants to interact with those developing these systems.
- (iii) The heart of the programme were three groupings of **"Case Studies"** in which scientists and data managers summarized findings on recent research projects and discussed data management aspects including recommendations for improvements needed for the future. Case studies were grouped into the following sessions:
 - a. **Monitoring Changes in the Ocean and Atmosphere**
 - b. **Data Archeology (Historical Data)**
 - c. **Effect of Change in the Ocean and on the Life Cycle (Emphasis on Chemical and Biological Observations)**
- (iv) The final session - the **Wrap-Up Panel** - was an open forum in which topics which had come up during the case study and computer sessions were commented on by the participants and a set of issues that need to be addressed were developed (see below).

More than 100 people registered for the OCDW and the vast majority participated in the entire 3½ days. Attendees came from 18 countries, and many different oceanographic and atmospheric disciplines and interest groups. They were from government, private, and academic organizations. In short, the goal of having a representative cross section of interests was achieved. Annex II is a list of participants registered for the OCDW.

The Chairman opened the workshop by noting the passing of Professor Henry Stommel. He was a pioneer on many of the subjects that would be discussed by participants. Such topics as a Live Atlas, Phantom Weather Ships, Bermuda Time Series and other ocean climate data ideas had been the subject of papers and discussions for more than two decades. As usual Stommel was ahead of his time. Because of his insight and leadership on the subjects being discussed by the OCDW, the workshop was dedicated to his memory.

4. **ISSUES**

A volume of the Proceedings of the OCDW will be prepared by the host country for distribution by the IOC and other co-sponsoring organizations. The overall goal of establishing a dialogue between data managers and scientists was achieved. In addition, a number of issues were discussed. Many of these will require action by the IOC and other groups represented at the OCDW. These issues are listed in the order they were discussed (not prioritized or ranked) and are summarized as follows:

A. Continuing Liaison Between Data Managers and Scientists

Listening to the case studies that were presented it became quite evident that the data management systems that were working the best were the ones where data managers and research scientists worked as a team developed in the early stages of project planning. Examples that were given included WOCE Data Assembly Centres e.g. Drifters, the Global Temperature Salinity Pilot Project (GTSP) collaboration with Joint Analyses Centres in the U.S. and Australia, and JGOFS/BOFS development of Topical Centres. While each of these has some elements unique to the project, they had brought together "teams" of Principal Investigators (PI's) and data management experts at an early stage of project development. Conversely, projects which had considered data management as a totally separate activity with lower priority often failed to provide the service required to meet scientific objectives.

Therefore, the following actions should be brought to the attention of relevant groups within the IOC and other international organizations:

- (i) Publicize, at the national and international level, underway data/scientist collaborations that may be used as models in planning for the future.
- (ii) Reduce adversarial situations where data managers and scientists appear to be in competition.
- (iii) Co-location and other forms of collaboration often results in very high quality data sets and more timely data submission. Improved timeliness of data submissions was a common theme throughout the workshop and must be considered an important element in all future plans. Improvements in timely submission of data were noted. In order to continue this trend the advantages of timely submission of data must be stressed to those planning new ocean science projects.

B. Importance of Historical Data

While the ocean climate related work that has been done to date has yielded significant results, it was apparent that there is a growing need to fill spacial and temporal gaps in the present data set. There is no other way to study long term ocean climate changes and the present global set is not adequate for all the work that needs to be done. At present there is an ongoing multilateral effort known as **Data Archeology**. The discussion on historical data highlighted the following issues:

- (i) There is a need to expand the current ad-hoc multilateral effort to an international data rescue and recovery project.
- (ii) The support of member states is required for this work.
- (iii) It has been demonstrated that cost-benefit is high. The cost of data recovery is quite small when compared to the initial cost of data collection, while the benefits accrued when using these data for global studies are quite dramatic.
- (iv) Some of these data are in danger of being lost because of deterioration in their present state and an immediate rescue effort is needed.
- (v) Not only do the numerical values need to be recovered, but the auxiliary data (meta-data) needs to be recaptured as well.
- (vi) A continuously updated data set will require high quality historical data as well as contemporary observations.

C. Role and Importance of World Data Centers (WDC's)¹

The consensus of OCDW participants was that the World Data Centers play an important role internationally in the sharing of scientific data and information. Furthermore, that this role would increase in importance as global change problems such as climate change begin to grow in number and complexity. The following actions were recommended:

- (i) There needs to be a re-examination of the World Data Centre System's role and responsibilities in light of present plans for climate and global change experiments. For WDC's, Oceanography

¹ The International Oceanographic Data Exchange System includes National Oceanographic Data Centers (NODC's), Responsible National Oceanographic Data Centres (RNODC's) and WDC's.

this is of special importance because of work currently underway in planning for a Global Ocean Observing System (GOOS).

- (ii) WDC's A, B, & D for Oceanography should continue a project to harmonize data holdings so that any data user, anywhere in the world, will know the total data available from the WDC's. In order to meet requirements for more timely access to data, the WDCs for Oceanography were requested to publish quickly annual WDCs Oceanography catalogues as well as semi-annual updates of holdings. They were requested to distribute them widely to users with the assistance of IOC, using an electronic bulletin board.
- (iii) The WDC's should continue to promote free access to data and a policy of freely exchanging data. The sharing of data is of growing importance to ocean climate programmes. In addition to traditional data types it was noted that satellite derived data or data products are of growing importance and working arrangements for access to these data should be investigated by IOC, WMO and other international organizations jointly with the ICSU Panel on WDCs.

D. Evolution of Data

A full range of technical matters associated with the collection and dissemination of data and meta-data were discussed. It was recognized that many of these items will require assembling, relatively small, expert groups who would make specific recommendations aimed at solving a particular problem. Issues under this subject include:

- (i) Problems associated with the increasing size of data sets-
 - Techniques for storage and retrieval of these data.
 - Study of compression techniques and of data products associated with these data sets.
 - Training of data managers in handling of large data sets.
- (ii) Increasing complexity of data
 - New data types especially in Chemistry and Biology
 - Growing importance of meta-data and problems associated with the cost, formatting, storage and retrieval of this information.
- (iii) Need for correlation of data sets across disciplinary lines.
 - Techniques for format interchange
 - Flexibility of data (and meta-data) recording
 - Development of a common geo-reference system
- (iv) Although oceanography was of prime concern to workshop participants, it was recognized that ocean data is only part of the total system and that multi-disciplinary data sets will need to be considered.
- (v) Technical problems associated with the storage and retrieval of satellite derived observations.
- (vi) Development of an overall IOC strategy focussed on the orderly development of data systems required for an operational ocean observing system. This development must be done jointly with experts in technology development, in cooperation with the WMO as well as other international bodies and might be the subject of another follow-on workshop.

E. Participation of Developing Countries in Ocean Climate Programmes

In discussing the ways in which developing countries might participate in research and operations associated with ocean climate projects, it was quite clear that some, if not all, developing countries cannot get the access they need to data and data products. Computer tools shown at the OCDW demonstrated that many tools are available today at very low cost. The problems are associated with getting hardware and software to the right place with adequate training to the users. The Ocean-PC approach was noted with interest. The following summarizes issues that were addressed by participants:

- (i) Need for an improved dialogue between developing and developed countries. There is a need for ICSU to work with non-governmental institutions in developing countries in order to provide data access for these groups.
- (ii) Supply of modern tools is important only if accompanied by training leading to access of data.
- (iii) Technology development has reached a point with CD-ROMs, user friendly software and low cost computers that the present situation should be eased considerably with the cooperation of member states.
- (iv) Developing countries and regions should develop their own data management strategies in order to maximize technology and data access.
- (v) Developing countries should be asked to play a role in data rescue where data are available and need to be put in digital form.

F. Model Data

Discussion at the OCDW made it abundantly clear that air-sea interaction models and forecasting models are of growing importance to ocean climate projects. These models are both a user of data and a generator of data (or pseudo-data). This subject evoked enough discussion that it is an excellent candidate for a follow-on meeting sometime in the future. Issues that were discussed include:

- (i) Modelers need data input and generate data output. Output is now considered a research product but may be needed by others. Should it be archived, for how long, where?
- (ii) Further discussion is needed on the usefulness and complexity of storing model output. Do you archive all model output or just selected products?
- (iii) Should model output be considered as part of a data set or complementary to it?
- (iv) How important is the meta-data that accompanies model output and what should it contain?
- (v) There is a need to organize model generators & users in order to determine what is available, whether there is a need to exchange these internationally or only exchange information about models that are under development. This problem needs reconciliation by those directly involved.

G. Data Quality

The importance of data quality was a repeated theme in workshop talks and discussions. Many of the ongoing climate related projects e.g. WOCE, have very high quality standards. While some modelers may have ways of

filtering data of lesser quality, others require data that has been fully processed and quality assured. Some of the issues discussed were:

- (i) Quality assurance must be developed in such a way that the best quality data are obtained without duplication of effort from the time data are acquired until they are made available for general dissemination. This will require full coordination throughout the process.
- (ii) The GTSP was noted as an excellent example of how data centres and researchers may collaborate in order to produce a high quality data set available for the international community. This type of government-university collaboration to produce high quality data sets is encouraged.
- (iii) While there is much to learn from the meteorological example, participants felt that oceanography does not have the "forecasting" base used by that community and must develop its own strategy for building data sets needed by climate change projects.

H. Funding

There were a number of items related to how things would get done and how funding could be obtained to perform these tasks. This discussion was a wide ranging one and may be summarized as follows:

- (i) Oceanography has traditionally been run on research funds. As we move toward an operational system, how do countries receive funding for these operational systems, while still maintaining the strong research base that will be required? The OCDW could not answer this question, but was quite aware that it is critical to the future development of an observing system.
- (ii) Other funding actions that were suggested:
 - Set up a trust fund within the IOC specifically for data management activities such as those proposed by this workshop.
 - Co-sponsors and Member States should consider funding follow-on activities suggested in this report.
 - Bring national attention to the need to fund ocean monitoring. Also bring to national attention the need to match financial support of World Data Center's activities to their increasing responsibilities.

I. The Global Ocean Observing System (GOOS)

While many of the items above contained elements related to GOOS, there were several points made that were specifically aimed at that programme. Speakers involved in the development of GOOS stated that a strong, effective data management programme is at the heart of a successful ocean observing system. It was also pointed out that GOOS requires coordination and interactions among a number of IOC groups and between IOC and a number of other co-sponsoring international organizations such as WMO, ICSU, and the UN Environment Programme (UNEP). Some of the issues discussed were as follows:

- (i) There is a need to have a well staffed operations office with at least one member of that office responsible for coordination of data management activities.
- (ii) Consideration should be given for GOOS from both scientific and data management groups.

- (iii) GOOS will require an efficient communications system linking the observational network, data centres, and users.
- (iv) A GOOS data management plan will need to take into account the fact that regional and global products will need to be disseminated in a timely fashion.
- (v) Standards will need to be adopted for all GOOS systems.
- (vi) Some IOC elements that currently exist may need to be redirected to serve GOOS more effectively.

J. Communications

Concern was expressed over the adequacy of communication networks as required by both present research programs and potential monitoring activities. Workshop attendees suggested a study of the following items:

- (i) Interactive transfers of data collections.
- (ii) International data networks which could link data centres.
- (iii) Rapid data dissemination to users worldwide.
- (iv) Investigate regulatory policies that may hinder the use of the wider bandwidths needed to carry out current and planned programmes.
- (v) All participants agreed that the electronic mail used widely by the oceanographic community has been, and will continue to be, an essential part of the international communication system.

5. CONCLUSION

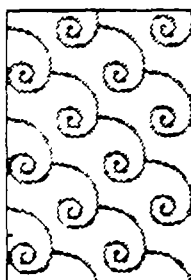
There seemed to be enthusiastic support for the concept of the OCDW. Comments received both publicly and privately were supportive of the form and substance of the meeting. The issues and actions cited above should provide very important guidelines to the IOC and other sponsors. Just as important as these recommendations is the bonding that occurred between data managers and scientists during the course of the OCDW. It should be noted that some of the data managers are also highly qualified research scientists and that this may set some sort of a trend. This workshop differed markedly from those where a data manager was invited to a science meeting, or where a token scientist was invited to a data meeting. This seemed to truly be an interaction where there was mutual benefit derived by most, if not all, participants. Although the workshop recommended a meeting like this one in 2-3 years, it is believed that too much was crammed into this first meeting and that the next should be more narrowly focussed with more specific recommendations. An example would be a workshop centered on the preparation of data sets that are required for experimental GOOS models.

ANNEX I

WORKSHOP PROGRAMME

OCEAN CLIMATE DATA WORKSHOP

Goddard Space Flight Center, Greenbelt, Maryland, USA
February 18 - 21, 1992



A dialogue between data managers and scientists

Host U.S. National Oceanic and Atmospheric Administration
National Aeronautics and Space Administration

Purpose This workshop is intended to begin discussions which may lead to the improved data delivery systems that are needed by scientists studying the oceans role in climate change.

Objectives

- *Identify opportunities* for improving data management for ocean climate research;
- Find ways to *improve access* to marine data;
- Outline the characteristics of data management systems needed to *support ocean monitoring and prediction*;
- Provide guidelines for *improved data services*.

Audience The workshop is primarily intended for those who are working on and planning ocean related climate projects. However, the workshop will welcome anyone with an interest in the subject matter.

Publication Proceedings of the workshop will be published and distributed to those attending. The proceedings will also be made available to sponsoring organizations for their distribution.

Fees ~~Speakers~~ and other invited guests will not be assessed any fees. Others who attend will be asked to pay a registration fee of \$75 which includes the proceedings and the evening seminar.

Language English only

For Further Information Contact

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1825 Connecticut Ave., NW
Washington, DC 20235, USA
Telephone: (202) 606-4571
Telemail: J.CHURGIN or NODC.WDCA

Hotel Accommodations

A block of rooms has been set aside for the Workshop at the:

Courtyard by Marriott
6301 Golden Triangle Drive
Greenbelt, MD

Telephone: (800) 321-2211 or (301) 441-3311

Bus transportation from the hotel to the meetings will be available

PROGRAM

OCEAN CLIMATE DATA WORKSHOP

Goddard Space Flight Center, Greenbelt, Maryland, USA

February 18 - 21, 1992

February 18

8:45-9:30am

Registration

9:30am - 12:30pm

GSFC Building #3

Auditorium

Introduction to the Workshop

In addition to logistics of the workshop, speakers will talk about future programs related to understanding how the oceans affect climate and how climate changes affect the oceans.

Subject

Introductory remarks

The Constancy of the Ocean

Role of the Earth Observing System

Global Observations & Operational Oceanography:

a Decade of Transition

The Role of Ocean Climate Data in Naval Oceanography

International Organization of Ocean Programs - Making

a Virtue of Necessity

World Ocean Climate Change Investigations under

the "Sections" Programme

The Role of the WDC's in Handling Ocean Climate Data

Speaker

Sponsors and hosts

J. Knauss

S. Wilson

J. Baker

G. Chesbrough

A. McEwan

S. Gulev

F. Webster

12:30-2:00pm

LUNCH

2:00-3:20pm
GSFC Building #3
Auditorium

Computer Systems

This session will include talks and hands-on demonstrations of new computer systems which are (or soon will be) available to oceanographers and others studying climate change and the oceans. The objective will be to familiarize attendees with these systems and to invite them to return individually or in small groups during the course of the workshop for a hands-on experience on these systems.

Convener: L. Olsen

Subject

NASA's Climate Data System and its Evolution as
Goddard's Distributed Active Archive Center (DAAC)
SEAPAK An Oceanographic Analysis Software Package
Oceanographic Data Analysis in the Goddard Laboratory
for Hydrospheric Processes
Project POSEIDON, the NODC On-line Database
ATlast for PC & OceanAtlas for Macintosh

Speaker

L. Olsen
C. McClain
T. Busalacchi
P. Topoly
E. Smith

February 19

9:00am - 4:30pm
GSFC Building #3
Auditorium

Monitoring Changes in the Ocean and Atmosphere

The object of this day will be to look at what has been done, and what needs to be done to create data sets that can be useful to scientists who require data on a more timely basis.

Convener: R. Wilson

Subject

Operational Seasonal and Interannual Predictions of
Ocean Conditions
The World Circulation Experiment (WOCE)
The Global Ocean Observing System
Global Temperature Salinity Pilot Project
Indian Ocean Analyses
Monitoring Global Ocean Surface Variations
The Use of Remotely Sensed Data for Operational
Fisheries Oceanography
Ocean PC and a Distributed Network for Ocean Data

Speaker

A. Leetmaa
A. Clark
D. Kester
B. Searle
G. Meyers
D. Halpern
A. de Fiuza
D. McClain

6:30pm/7:30pm
GSFC Recreational
Center

COCKTAILS/DINNER

Guest Speaker: G. Holland

February 20

9:00am - 1:00pm
GSFC Building #3
Auditorium

Data Archaeology

The objective of this session will be to demonstrate the usefulness of historical data. There will also be a panel discussion on other uses of historical data and on data sets that are not currently available to the international community.

Convener: S. Levitus

Subject

Ocean Climate Diagnostic Studies
Satellite Altimetry
High Resolution GCM Modeling of the Thermohaline
Structure of the World Ocean
Data Archaeology at ICES
Data Availability and Data Archaeology from the Soviet
Union
Ocean Climate Data for the User Community in West
and Central Africa; Needs and Opportunities

Speaker

S. Levitus
R. Cheney
A. Semtner
H. Dooley
Y. Sychev
S.O. Ojo

2:00 - 6:00pm
GSFC Building #3
Auditorium

Effect of Change in the Ocean and on the Life Cycle

This session will include a case study of the 1989 N. Atlantic Bloom Study (NABE), as well as time-series operations and other programs related to biogeo-

chemical global change, from the perspective of the field scientist, analyst, modeler, and data manager. Different approaches to Data Management and Archiving of resulting studies will be included which we hope will stimulate a panel discussion on techniques to be considered. Discussion will also cover QC techniques and what can be done to improve input to analysts and modelers. The session will focus on chemical and biological data.

Introduction to JGOFS

Convener: H. Ducklow

Subject

Scientist's View of the NABE, a JGOFS Process Study
Data Management for JGOFS: Theory and Design
Data Management in the UK BOFS Program, a JGOFS
Case Study
Management and Assimilation of Satellite Data for JGOFS
The Continuous Plankton Recorder Survey: Long-term,
Basin-scale Oceanic Time Series
BATS and Station S: Time Series Operations in JGOFS
Automated Observations of Upper Ocean Biogeochemistry
and Optics for JGOFS

Speaker

H. Ducklow
G. Flierl
R. Lowery
R. Evans
J. Gamble
T. Michael
T. Dickey

February 21

9:00am - 12:00pm
GSFC Building #3
Auditorium

Wrap-up Panel

Representatives from each of the sessions plus some other speakers will form a panel to conduct discussions on recommendations to the IOC, WMO and other scientific groups conducting international data exchange and dissemination of data required for climate studies.

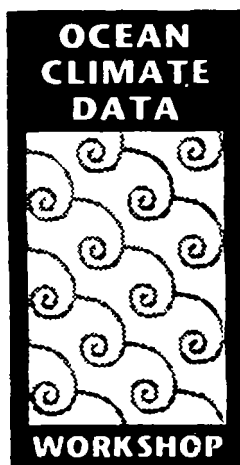
Convener: G. Holland

12:00 - 1:00pm

Closing Remarks

This will be a summing up of the Workshop.

Convener: Chairman



HOSTS:

U.S. National Oceanic Atmospheric Administration (NOAA)

U.S. National Aeronautics and Space Administration (NASA)



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SPONSORS:

Commission of European Communities (CEC)

International Council for the Exploration of the Sea (ICES)

International Council of Scientific Unions (ICSU)

Intergovernmental Oceanographic Commission (IOC)

Scientific Committee on Oceanic Research (SCOR)

World Meteorological Organization (WMO)

ANNEX II

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64	Second IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP), Phuket, Thailand, 25-31 September 1989	E
65	Second IOC Workshop on Sardine/Anchovy Recruitment Project (SARP) in the Southwest Atlantic, Montevideo, Uruguay, 21-23 August 1989	E
66	IOC <i>ad hoc</i> Expert Consultation on Sardine/Anchovy Recruitment Programme, La Jolla, California, USA, 1989	E
67	Interdisciplinary Seminar on Research Problems in the IOCARIBE Region, Caracas, Venezuela, 28 November - 1 December 1989	E
68	International Workshop on Marine Acoustics, Beijing, China, 26-30 March 1990	E
69	IOC Workshop on Sea-Level Measurements in the Antarctica, Leningrad, USSR, 28-31 May 1990	E
70	IOC-SAREC-UNEP-FAO-IAEA-WHO Workshop on Regional Aspects of Marine Pollution, Mauritius, 29 October - 9 November 1990	E
71	IOC-FAO Workshop on the Identification of Penaeid Prawn Larvae and Postlarvae, Cleveland, Australia, 23-28 September 1990	E
72	IOC/WESTPAC Scientific Steering Group Meeting on Co-operative study of the Continental shelf Circulation in the Western Pacific, Kuala Lumpur, Malaysia, 9-11 October 1990	E
73	Expert Consultation for the IOC Programme on Coastal Ocean Advanced Science and Technology Study, Liège, Belgium, 11-13 May 1991	E
74	IOC-UNEP Review Meeting on Oceanographic Processes of Transport and Distribution of Pollutants in the Sea, Zagreb, Yugoslavia, 15-18 May 1991	E
75	IOC-SCOR Workshop on Global Ocean Ecosystem Dynamics, Solomons, Maryland, USA, 29 April - 2 May 1991	E
76	IOC/WESTPAC Workshop on River Inputs of Nutrients to the Marine Environment in the WESTPAC Region, Penang, Malaysia, 26-29 November 1991	E
77	IOC/SAREC-KMFRI Regional Workshop on Causes and Consequences of Sea-Level Changes on the Western Indian Ocean Coasts and Islands, Mombasa, Kenya, 24-28 June 1991	E
78	IOC-CEC-ICES-WMO-ICSU Ocean Climate Data Workshop Goddard Space Flight Center Greenbelt, Maryland, USA, 18-21 February 1992	E