



**PERSGA/ALECSO - IOC/GLOSS-GOOS
Training Workshop on Sea-level Data Analysis for
the Red Sea and Gulf of Aden Region**

Jeddah, Kingdom of Saudi Arabia
15-19 April 2000

**PERSGA/ALECSO - IOC/GLOSS-
GOOS**

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for the Red Sea and Gulf of Aden Region**

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Abstract

This report provides a summary of a PERSGA/ALESCO-IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis for the Red Sea and Gulf of Aden Region. The main objective of the workshop is to train participants from Djibouti, Egypt, Jordan, Saudi Arabia, Sudan and Yemen on collection and analysis of data and the encouragement in exchanging such data. It reports on the status of methods and material used in the region and provides a set of recommendations for future sea-level activities.

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1. INTRODUCTION

The for the Environment of the Red Sea and Gulf of Aden (PERSGA) was initiated during the preparatory meeting organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) at Bremerhaven (Germany) in 1974, at the request of the Arab League Educational, Cultural and Scientific Organization (ALECSO). The terms referenced for this meeting were to elaborate the scientific ideas and plans for an interdisciplinary research in the Red Sea.

In 1982 the Jeddah Regional Conference of Plenipotentiaries signed the Regional Convention for the Conservation of the Environment of the Red Sea and Gulf of Aden and the Protocol Concerning Regional Cooperation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency.

The establishment of the Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (which keeps the title "PERSGA") was declared in 1995 as an independent organization headquartered in Jeddah.

Thus cooperation between UNESCO and PERSGA started since the initiation of the latter. They jointly published the *Red Sea Bibliography*; they organized training courses and seminars; they organized an international symposium on Sedimentation and Rifting in the Red Sea and Gulf of Aden (Cairo, 1992); they have plans for a network of sea level gauges for the Red Sea and Gulf of Aden.

A memorandum of understanding was signed (August 1991) between PERSGA and the Intergovernmental Oceanographic Commission (IOC) of UNESCO which defines areas where the PERSGA and the IOC have common interests and objectives in marine scientific problems.

In this framework of cooperation between PERSGA and IOC the Regional Training Workshop on Sea Level Observation and Data Analysis was held at PERSGA Headquarters in Jeddah from 15-19 April 2000. The main objective of the workshop was to train participants from the PERSGA countries on collection and analysis of data and the encouragement in exchanging such data.

The Workshop benefited greatly from the training materials provided by IOC, facilities and logistics provided by PERSGA, and from the involvement of Leica Agent (Jeddah) in the demonstration on levelling equipment. The formal presentations, discussions and hands-on-training sessions took place in the same venue. The organization of visa processing to Saudi Arabia, air travel, local accommodation and transport was the responsibility of PERSGA.

2. WORKSHOP

The main body of the Workshop was devoted to formal presentations, discussions and hands-on-training in sea-level measurements and analysis. In addition, a field trip was arranged to visit the Saudi Arabian Oil Company (ARAMCO) tide gauge station in Jeddah. The details of the Workshop can be found in Annex I, a list of participants in Annex II and a list of course reference materials in Annex III.

Below is a brief description of the proceedings of the Workshop.

2.1 REGISTRATION

The Workshop was held in the main Conference Room of the Meteorology and Environmental Protection Administration (MEPA) which is shared by PERSGA. Following registration, the participants were welcomed by Dr. Mohammed A. Fawzi, Deputy Secretary General of PERSGA and Dr. Al-Bahloul Al-Yaqoby, on behalf of the Arab League Educational Cultural and Scientific Organization (ALECSO). Mr. David Dixon gave a short introduction to the activities of IOC and Dr. Dirar Nasr, the SAP/PERSGA Coordinator, outlined areas of cooperation between UNESCO/IOC and PERSGA.

2.2 LECTURES

2.2.1 Theory of Tides – Dr. Mohammed A. Rady

The lecture firstly discussed the astronomical factors significant to tidal nomenclature particularly the rotation of the earth, the revolution of the moon around the earth, the revolution of the earth around the sun, the inclination of the moon's orbit to the earth's equator and the obliquity of the ecliptic. This was followed by a brief exposition of the audience to the equilibrium and dynamic theory of tides. At last, the tides in semi-enclosed basins with special emphasis on the Red Sea and its regions were presented.

2.2.2 Introduction to Conventional Systems – David Dixon

The float tide gauge which uses a stilling well and clockwork driven chart for recording sea level has been used for many years and is still in operational use in many countries worldwide. Provided these gauges are regularly maintained the instrument can produce very reliable data, however they do have problems associated with any mechanical device, which can lead to errors in the recorded water level. Digitizing of the paper trace presents another source of error and is very time consuming. The stilling well is however a well-proven method of damping out wave action and is in continued use with modern systems. The Global Sea Level Observing System (GLOSS) and the Permanent Service for Mean Sea Level (PSMSL) are persuading countries to upgrade their tide gauges to pressure transducer systems or ideally ultrasonic acoustic transducer systems with digital recording of data. The systems are presently in use with MEPA of Saudi Arabia and the National Oceanographic and Atmospheric Administration (NOAA) in the USA.

2.2.3 Introduction to Tide Gauge Technologies – David Dixon

Acoustic transducer tide gauges with digital data loggers and modem communications are now available and are used extensively throughout the world. These systems are very reliable and require minimal maintenance or occurrence of errors in the recording of data. The systems are used by NOAA, the Australian Government and MEPA in Saudi Arabia and are the preferred systems for full GLOSS stations. Pressure transducers and modern bubbler gauges are available integrated with digital recording data loggers and provide a cheaper instrument. They require slightly more attention to maintenance than the acoustic systems but are very reliable. In remote installations the use of such systems are cost effective as field visits to retrieve data are eliminated by use of modem / telephone communications and require fewer maintenance visits. Data is available far quicker for scientific applications and local port authorities. New systems are emerging onto the market, some using radar; however these have yet to be proven and endorsed by GLOSS and PSMSL.

2.2.4 Harmonic Tidal Data Analysis – David Dixon

The recognized method of processing tidal observations is to apply a harmonic analysis; this provides information on the affect of the astronomical gravitational harmonics of the moon and sun on the tide. The constituents consist of daily (diurnal) and semi diurnal (twice daily) amplitudes and phase lags and together form the tide we observe.

These harmonic constituents allow the prediction of the tide and form the basis for the production of annual tide tables and oceanographic studies. The length of the observed data set determines the number of constituents that can be resolved and care must be taken that certain criteria are followed prior to analysis. Tidal residuals provide important information on meteorological forcing in the tide and this is a dominant feature in the Red Sea tidal variations between summer and winter. This has an affect on the limit of coral reef development in the littoral zone with lower water levels in the extreme solar radiation of summer months.

2.2.5 Levelling of Tide Gauge Bench Marks – David Dixon

The establishment of height datum benchmarks at and near the tide gauge is of great importance. Sea level observations need to be referenced to some height datum to be of any meaningful use. This datum need not necessarily be connected to a local, national geodetic or port datum, what is important is to provide tide gauge bench marks that are monitored every year for subsidence or damage. Referring tidal observations to this local, geodetic or port chart datum allows us to determine changes in the mean sea level. Reference levels for tidal observations are also important for chart production. Levelling instrumentation has improved in recent years with automatic digital levels using bar code staffs. These instruments help to eliminate observational errors and store observations within the instruments data memory logger for processing. The accuracy of observation with any surveying relies heavily on the care and skill of the instrument observer and staff man, along with correct procedures.

2.2.6 POL Task (Tidal Analysis Software Kit)– David Dixon

The Tidal Analysis Software Kit (POL Task) has been developed by the Proudman Oceanographic Laboratory (POL) part of the UK's National Environmental Research Council (NERC). The TASK package is a collection of Fortran programmes that provide full harmonic analysis of observed data. The individual programmes provide data checking, filtering, analysis and prediction. Screen plotting is provided for viewing observed data and checking for data errors prior to analysis. Control files provide input and output parameters, minimizing the keyboard entry during run time and hence reduces operator errors. This programme is available on CD-ROM from PSMSL, which is distributed, to countries and organizations participating in GLOSS, for the provision of monthly mean sea level data to PSMSL.

2.2.7 Sea Level Changes - Dr. Mohammed A. Rady

This lecture concentrated on the non-tidal part of the sea level signal. Methods of de-tiding the data were presented and then the meteorological and oceanographic factors affecting the residuals were discussed. The importance of the extreme-value problem was highlighted with numerous examples from different parts of the world and from the Red Sea itself.

2.2.8 Global Positioning System – David Dixon

The Global Positioning System (GPS) developed by the US Department of Defence provides an alternative to establishing coordinates and elevations on the earth's surface by using conventional theodolite and level instrument surveying. Using differential methods it is possible to greatly improve the repeatability or accuracy of coordinates eliminating errors from atmospheric and orbital influence. Baseline distance between differential and survey location influence overall accuracy. The Geoid is an equipotential surface, which is mean sea level, over land this geoid is distorted due to variations in density. To provide elevations relative to the geoid ('orthometric heights') one needs to position one's object within a global reference frame (i.e. by GPS) and then have a precise model of the geoid; the latter will come about most precisely in the next few years as a result of upcoming space gravity missions. GPS is now being used in many gauge sites to obtain time series of vertical land movement; absolute gravity is an alternative technique although equipment is an order of magnitude more expensive.

2.3 HANDS-ON-TRAINING SESSIONS (HOTS)

During the PERSGA workshop, several sessions were devoted to practical use of the POL Task. Students had the opportunity to become familiar with the harmonic analysis of data and produce results from a sample observed data series. An overhead computer projector allowed other students to observe the sequence of events as the POL Task programme was run and avoided the problem of several students viewing a PC screen. In small groups this method proved very successful overcoming the need for many more computers. It was emphasized that participants would need to spend more time back in their respective countries increasing their understanding of the programme and processing of tidal data. The programme provides participants with many routines for the purpose of data analysis and formats necessary to submit mean sea level data to IOC and PSMSL.

2.4 PRESENTATIONS BY PARTICIPANTS

Short presentations were given by participants on the present status of tide gauges in their respective countries. These presentations, most of which were in Arabic, alternated with lectures and other activities of the workshop.

Djibouti - The participant from Djibouti is a port officer whose responsibility is to look after the general security of the port. He is in charge of the bathymetric section, which was created in May 1987 and has the following tasks:

- position and anchorage of port buoys
- maintain tide gauge and GPS equipment
- transmit tidal heights to pilots 24 hours a day
- determine the safe navigable depth in the port and channel

The echo sounder used by the department is an Atlas Deso 14. Horizontal position is obtained using a differential satellite receiver: DGPS NR 108. An OTT R20 with digitizer is used as the tide gauge. Data is recorded by paper trace and via the digitizer. Digital depth data is transmitted every 5 minutes to the harbour office for the pilots. Annual tide tables are produced for the Port by the French company IPG.

Jordan - The participant was not involved in the operation of tide gauges but he promised to make all efforts to promote GLOSS on return. No information was available on the status of tide gauges. The participant will carry out a review of the gauges in Jordan and will provide

this information to PERSGA / IOC and PSMSL as soon as completed.

Egypt - The participant was not involved in the operation of tide gauges but was a very keen participant and will make all efforts to promote GLOSS on return. No information was available on the status of the gauges at Port Said or Suez, they have previously been providing data to PSMSL / GLOSS. Information will be provided when the participant has completed a survey and review of present systems in Egypt. He was very quick in understanding the use of the POL Task programme.

Saudi Arabia - The MEPA tide gauges (Sutron 9000) at Gizzan and Haql are still in operational order but lack telephone lines and attempts are in place to arrange with the authorities to re-connect these lines. Because of the remoteness of these locations from MEPA in Jeddah no data is presently being collected from Gizzan or Haql. These gauges are the Sutron 9000 system with the Aquatrak sensor. The Sutron 9000 gauge at Jeddah has been removed due to construction on the site and the gauge at Al Wedj has received some minor damage and is not in operation. A maintenance programme is being arranged by MEPA.

Saudi Arabian Oil Company ARAMCO has an operational tide gauge near Jeddah Port. This is the Sonar Research Ltd gauge. It is fully operational but lacks telephone. Data is collected in a data logger, which is changed during routine servicing and is processed in ARAMCO offices in Dhahran (Eastern Province). The system has proved to be very reliable by ARAMCO in the extremes of the Middle East heat and coastal humidity, however they have limitations due to temperature gradients in the stilling well. The errors are acceptable by ARAMCO for their operations- hydrographic surveying. The stilling well is used to provide protection to the sound wave and has a tide staff on the outside for visual checks. An Aquatrak transducer with a sounding tube / stilling well would have been preferable as used by MEPA. The Sonar Research Ltd. (UK) acoustic gauge is being used by ARAMCO in the Arabian Gulf and is now the preferred replacement for older systems. They have found it very reliable in the high temperature extremes of the Arabian Gulf. They also use Aanderra seabed gauges for fill in surveys between platform mounted gauges.

Sudan - A WS Ocean Systems SLM-2B gauge has been provided by PERSGA. The system was installed by WS Ocean complete with the PC for reading and processing the data, however the operator at the time has left the Faculty of Marine Sciences and Fisheries in Port Sudan and unfortunately the replacement is as yet not familiar with the new system.

A previous Lea float type gauge was installed in 1961 at Port Sudan and operated for many years by the Survey Dept. of the Sudan. This gauge was replaced by the WS Ocean System gauge as recommended by Alan Browell in 1987 under an UNESCO review of tide gauges in Sudan and Egypt.

Yemen (Aden Port) - The previous float tide gauge was destroyed in 1994 during a war. The new WS Ocean Systems-SLM-2B, donated by PERSGA has yet to be installed. They will use the same location and benchmark as the previous gauge.

Yemen (Hodeidah Port) - A WS Ocean SLM-2B donated by PERSGA has yet to be installed.

2.5 FIELD VISIT

Arrangements were made for a field visit to Saudi ARAMCO tide gauge station in Jeddah. Two engineers from ARAMCO, responsible for the operation, maintenance and

bench mark leveling, had to fly in from Dhahran (Eastern Province) to Jeddah to provide a demonstration / explanation to the participants.

2.6 DEMONSTRATION OF LEVELLING EQUIPMENT

Mustafa Fahmi of SITM / Leica Co. kindly provided a demonstration of LEVELLING equipment (optical and digital levels) and a GPS receiver. He was able to provide a lecture (in Arabic) explaining the equipment and accuracy possible. A simple LEVELLING exercise was carried out in the lecture rooms.

The participant from Almisehal Blom Co. (Omar El Khider Elamin) is a Land and Hydrographic Surveyor. He was able to provide an explanation in Arabic of some of the finer points of LEVELLING and bench marks.

3. WORKSHOP ACHIEVEMENTS AND RECOMMENDATIONS

Although the workshop was short in time compared to IOC/PSMSL/GLOSS workshops in the past, a good introduction was provided by Mr. David Dixon and by Dr. Mohammed Ayoub Radi (in Arabic) and the participants (also in Arabic). The lecture and demonstration from Mr. Mustafa Fahmi of SITM / Leica (also in Arabic) provided great support in the use of geodetic levelling and GPS.

Mr. Dixon provided his lecture notes and diagrams (spiral bound) which helped to provide material to read later with a full list of references / web sites used. Fortunately all the IOC material arrived at PERSGA on the second day of the workshop.

PERSGA and PSMSL provided a questionnaire for the participants evaluation of the workshop and provided feedback on the status of tide gauge operations in their respective countries.

Dr. Mohammed A. Radi from the King Abdul Aziz University (KAAU) provided a Valeport Ltd. tide gauge for demonstration, this is the pressure transducer type and is semi portable. It is Valeport's basic model without display and is used for local studies and teaching by KAAU.

A power point projector and PC was used to demonstrate the POL Task programme. Only one PC was available due to technical problems and the projector was the ideal solution and proved very successful. The participants were able to work together creating control files and running the Tira, Order, Filter, TaskPlot and Marie packages. Three one-hour sessions were assigned to this. Some of the participants were able to understand the use of the programme with ease; others will need much more time and practice back in their own countries.

Recommendations

1. With regard to the installation of the WS Ocean Systems gauges in Yemen, it is recommended that they try to get familiar with the operational and installation manuals provided by WS Ocean Systems Ltd. (UK). They should also operate the instrument on a trial and error basis first in the office and later in a trial installation prior to full installation. The delegates from Sudan and Yemen should keep in close communications in order to share experiences and information about the tide gauges.

2. MEPA should use the Sutron 9000 system removed from Jeddah as a spare system or install on the Farasan Islands in the southern Red Sea opposite Gizzan. This can be followed up by PSMSL/GLOSS with recommendations on a suitable fill in location.
3. There seems to be no need for an additional MEPA gauge at Jeddah as ARAMCO have a fully operational Sonar Research Ltd. (UK) gauge in Jeddah.
4. ARAMCO have a network of operational tide gauges in the Arabian Gulf, contact with ARAMCO should be established and maintained by IOC/PSMSL to enable this operational data to be provided for GLOSS.
5. To maintain the momentum after the workshop PERSGA can publish a status report on tidal observations/systems within their in-house publication SAMBOUK (Arabic and English) covering their activities in the region. This is published on a quarterly basis. IOC should provide some input to this relatively new environmental publication concerning GLOSS / PSMSL and perhaps GOOS.
6. There is a general agreement between PERSGA and the participants that a technical expert should visit the relevant countries in the region to check on the operation of the tide gauges. This expert should provide help and guidance in the installation of the new systems in Yemen in particular and in the operation of the system in Sudan.

4. CLOSURE

At the end of the workshop Dr. Al-Yaqoubi on behalf of ALECSO, Dr. Fawzi and Dr. Nasr on behalf of PERSGA expressed their appreciation to IOC for their generous cooperation and thanked the participants for their enthusiasm and interest.

Certificates were distributed to participants by Dr. Al-Yqoubi, and the workshop was closed at 1300 on Wednesday 19 April 2000.

ANNEX I

WORKSHOP & TIMETABLE

Day 1 - Saturday 15 April

0900: Registration

1000: Opening of Workshop, and Welcome to Participants

Dr. Nizar Tawfiq, Secretary General, PERSGA

Dr. Al-Bahloul Al-Yaqoubi, Director, Department of Science and Scientific Research, ALECSO

IOC Representative

PERSGA's Current Activities in the Region, and Outline of the Workshop

Dr. Mohammed Fawzi, Deputy Secretary General, PERSGA

Introduction of Participants

1100: COFFEE BREAK

1115: Lecture: Theory of Tides

Dr. Mohammed Ayoub, King Abdulaziz University, Jeddah, Saudi Arabia

1215: Lecture: Conventional Tide Gauge Systems

David Dixon, IOC Consultant, London, UK

1315: Presentation by Participants

Aden Awaleh Meraneh, Djibouti

1330: LUNCH & PRAYER

1415: Lecture: Modern Tide Gauge Systems

David Dixon, IOC Consultant, London, UK

1515: Presentation by Participants

Ahmed A. Ridhwan, Egypt

1530: Lecture: Analysis of Observed Tidal Data

David Dixon, IOC Consultant, London, UK

Day 2 - Sunday 16 April

0900: Lecture: Levelling Tide Gauge Bench Marks

David Dixon, IOC Consultant, London, UK

1000: Presentation by Participants

Husni Hamdan, Jordan

1015: Demonstration on Levelling Equipment

Leica Agent/David Dixon

1115: COFFEE BREAK

1130: Introduction to HOTS (Hands on Training Sessions)

David Dixon, IOC Consultant, London, UK

1230: Presentation by Participants

Abdullah Bamuhair & Abdullah Al-Ghamdi, MEPA, Saudi Arabia

1245: Lecture: POL TASK for Data Analysis

David Dixon, IOC Consultant, London, UK

1345: LUNCH & PRAYER

1430: HOTS (Hands on Training Session)

Under the supervision of David Dixon, IOC Consultant

1600: Presentation by Almisehal Blom on techniques in hydrographic training

Day 3 - Monday 17 April

0900: Field Trip to Saudi ARAMCO – Demonstration on the Practical Operation of the ARAMCO Tide Gauge System

1300: LUNCH

1345: Exercise on HOTS

Day 4 - Tuesday 18 April

0900: Practical Levelling Exercise

David Dixon, IOC Consultant, London, UK

1000: Demonstration of a Portable Tide Gauge Operation

David Dixon, IOC Consultant, London, UK

1115: COFFEE BREAK

1130: Lecture: Sea Level Changes

Dr. Mohammed Ayoub, King Abdulaziz University, Jeddah, Saudi Arabia

1230: Lecture: GPS Heighting Technology

David Dixon, IOC Consultant, London, UK

1330: LUNCH & PRAYER

1415: Presentation by Participants

Abdulmunem K. Jaiballah, Sudan

1430: Exercise on HOTS

1545: Presentation by Participants

Kamal A. S. Ghaleb & Wadhah A. Y. Bahmal, Yemen

Day 5 - Wednesday 19 April

**0900: Lecture: Introduction to the Activities of the IOC's Global Ocean
Observing System (GOOS)**

David Dixon, IOC Consultant, London, UK

1000: Problems Associated with Tide Gauges in PERSGA Member Countries
Group Discussion

1100: COFFEE BREAK

1115: Workshop Evaluation and Formulation of Recommendations

1300: Award of Certificates, and Closure of the Workshop

ANNEX II

LIST OF PARTICIPANTS

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ANNEX III

COURSE MATERIAL

1. Global Sea Level Observing System (GLOSS) Implementation Plan – 1997.
UNESCO 1997
2. Manual on Sea Level Measurement and Interpretation
Vol. II – Emerging Technologies
Manuals and Guides 14
UNESCO 1994
3. POL/PSMSL Tidal Analysis Software Kit
(TASK – 2000)
4. International Sea Level Workshop
10-11 June 1997
Honolulu, Hawaii, USA
Workshop Report, April, 1998

ANNEX IV

LIST OF AC-RONYMS

ALECSO	Arab League Educational, Cultural and Scientific Organization
ARAMCO	Saudi Arabian Oil Company
GCEP	General Corporation for Environmental Protection
GLOSS	Global Sea Level Observing System (IOC)
GOOS	Global Ocean Observing System (IOC-WMO-UNEP-ICSU)
GPS	Global Positioning System
IOC	Intergovernmental Oceanographic Commission (UNESCO)
HOTS	Hands On Training Sessions
KAAU	King Abdulziz University (Saudi Arabia)
MEPA	Meteorology and Environmental Protection Administration
NERC	National Environmental Research Council (UK)
NOAA	National Oceanographic and Atmospheric Administration (USA)
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
POL	Proudman Oceanographic Laboratory (UK)
PSMSL	Permanent Service for Mean Sea Level
SAP	Strategic Action Program for the Red Sea and Gulf of Aden
SITM	Saudi International Trading and Marketing
UNESCO	United Nations Educational, Scientific and Cultural Organization

IOC Training Course Reports

No.	Title	Language
1.	IOC Indian Ocean Region Training Course in Petroleum Monitoring Perth, 18 February-1 March 1980	English
2.	IOC Regional Training Course for Marine Science, Technicians Cape Ferguson, Queensland, 1-28 June 1980	English
3.	ROPME-IOC-UNEP Training Workshop on Oceanographic Sampling Analysis, Data handling and Care of Equipment, Doha, Qatar, 3-15 December 1983	English
4.	Stage COI d'initiation à la gestion et au traitement de l'information scientifique et technique pour l'océanologie, Brest, France, 28 novembre - 9 décembre 1983	French
5.	Curso mixto COI-OMM de formación sobre el Sistema Global Integrado de Servicios Oceánicos (SGISO), Buenos Aires, Argentina, 15-26 de octubre de 1984	Spanish
6.	UNESCO-IOC-NBO Training Course on Tidal Observations and Data Processing Tianjin, China, 27 August - 22 September 1984	English
7.	Stage COI sur la connaissance et la gestion de la zone côtière et du proche plateau continental Talence, France, 18 septembre - 4 octobre 1984	French
8.	IOC Regional Training Course on Marine Living Resources in the Western Indian Ocean Mombasa, Kenya, 27 August - 22 September 1984	English
9.	IOC-UNESCO Summer School on Oceanographic Data, Collection and Management Erdemli, Icel, Turkey, 21 September - 3 October 1987	English
10.	IOC-UNESCO Regional Training Workshop on Ocean Engineering and its Interface with Ocean Sciences in the Indian Ocean Region Madras, India, 17 March - 5 April 1986	English
11.	IOC-UNESCO Training Course on the Use of Microcomputers for Oceanographic Data Management Bangkok, Thailand, 16 January - 3 February 1989	English
12.	IOC Advanced Training Course on Continental Shelf Structures Sediments and Mineral Resources Quezon City, Philippines, 2-13 October 1989	English
13.	IOC/IODE Training Course on GF3 Data Formatting System Obninsk, USSR, 14-24 May 1990	English
14.	IOC Training Course on Microcomputers and Management of Marine Data in Oceanographic Data Centres of Spanish-speaking Countries, Bogotá, Colombia, 21-30 October 1991	English Spanish
15.	IOC Advanced Training Course on Nearshore Sedimentation and the Evolution of Coastal Environments, Kuala Lumpur, Malaysia, 17-29 February 1992	English
16.	First IOC Training Course on the Applications of Satellite Remote Sensing to Marine Studies Caracas, Venezuela, 24-28 September 1990	English
17.	IOC-KMFRI-RECOSCIX (WIO) Regional Training Course on Microcomputer-based Marine Library Information Management, Mombasa, Kenya, 10-21 August 1992	English
18.	ROPME-IOC Regional Training Course on Management of Marine Data and Information on Microcomputers for the ROPME Region, Kuwait, 18-28 October 1992	English
19.	IOC-SOA Training Workshop on Environmental Effects on Benthic Communities Xiamen, China, 19-23 October 1992	English

No.	Title	Language
20.	IOC Training Course for the Global Sea Level Observing System (GLOSS) directed to the African and South American Portuguese and Spanish-Speaking Countries São Paulo, Brazil, 1-19 February 1993	English
21.	IOC-SSTC-SOA Training Course on Marine Information Management and ASFA Tianjin, China, 19-30 October 1992	English
22.	First IOC/IOCARIBE-UNEP Training Course on Monitoring and Control of Shoreline Changes in the Caribbean Region, Port-of-Spain, Trinidad and Tobago, 21-30 July 1993	English Spanish
23.	IOC/WESTPAC Training Course on Numerical Modelling of the Coastal Ocean Circulation Matsuyama, Japan, 27 September - 1 October 1993	English
24.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 28 September - 9 October 1992	English
25.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 27 September - 8 October 1993	English
26.	IOC Training Course on Ocean Flux Monitoring in the Indian Ocean. Organized with the support of the Government of Germany Mombasa, Kenya, 15-27 November 1993	English
27.	IOC-UNEP-SPREP Training Course on Coral Reef Monitoring and Assessment Rarotonga, Cook Islands, 23 February - 13 March 1994	English
28.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 26 September - 7 October 1994	English
29.	IOC-UNEP-WHO-FAO Training Course on Qualitative and Quantitative Determination of Algal Toxins Jena, Germany, 18-28 October 1994	English
30.	IOC Training Course on Oceanographic Data Management for Black Sea Countries Obninsk, Russian Federation, 1-12 August 1994	English
31.	COI-CEADO Curso Regional de Capacitación en Gestión de Datos e Información Oceanográficos Buenos Aires, Argentina, 17-28 de octubre de 1994	Spanish
32.	IOC-UNEP-FAO Training Course on Nutrient Analysis and Water Quality Monitoring Zanzibar, Tanzania, 21-26 November 1994	English
33.	IOC-IOMAC Advanced Training Course on Marine Geology and Geophysics off Pakistan. Pakistan, 12-26 November 1994	English
34.	Training Course on Management of Marine Data and Information for the Mediterranean Region Valletta, Malta, 10-21 April 1995	English
35.	IOC-UNEP-WHO-FAO Training Course on Toxin Chemistry and Toxicology related to Harmful Algal Blooms Trieste, Italy, 3-12 September 1995	English
36.	MAST-IOC Advanced Phytoplankton Course on Taxonomy and Systematics Naples, Italy, 24 September - 14 October 1995	English
37.	IOC-JODC Training Course on Oceanographic Data Management Tokyo, Japan, 16-27 October 1995	English
38.	IOC/IODE Training Course on Marine Geological and Geophysical Data Management Gelendzhik, Russian Federation, 13-29 September 1995	English
39.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis, Geodetic & Research Branch Survey of India, Dehra Dun, India, 21 November- 1 December 1995	English

No.	Title	Language
40.	IOC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microalgæ; University of Copenhagen, Denmark, 31 July-11 August 1995; IOC-SAREC-DANIDA Training Course on the Taxonomy and Biology of Harmful Marine Microalgæ; University of Mauritius, Republic of Mauritius, 5-14 February 1996; and Annual Report 1995, IOC Science and Communication Centre on Harmful Algæ, DANIDA, University of Copenhagen, Danish Fisheries Research Institute, Danish National Environmental Research Institute	English
41.	IOC-Germany Advanced Training Course on Bathymetric Charting in the Western Indian Ocean METEOR, 15-29 December 1995	English
42.	COI-SHOA-CICESE Curso Sobre Modelación Numérica de Tsunamis Valparaiso, Chile, 11 de Marzo - 11 de Mayo de 1996	Spanish
43.	Seminario/Taller de la COI/GLOSS-SHN sobre Observación y Análisis del Nivel del Mar para países de habla hispano-portuguesa de Latinoamérica Servicio de Hidrografía Naval (SHN), Buenos Aires, Argentina, 19-27 de noviembre de 1996	Spanish
44.	IOC-INCO-ROPME Training Course on Oceanographic Data and Information Management, Tehran, Iran, 19-30 October 1997	English
44.	IOC-ICSU-IAEA-EU Training Course on Marine Geological and Geophysical Data Management for the Countries of the Black and Caspian Seas Regions, Gelendzhik, Russian Federation, 8-19 September 1997	English
45.	IOC-ICSU-IAEA-EU Training Course on Marine Geological and Geophysical Data Management for the Countries of the Black and Caspian Seas Regions Gelendzhik, Russian Federation, 8-19 September 1997	English
46.	Training Course on Management of Marine Data and Information for the IOCINCWIO Region Mombasa, Kenya, 1-11 December 1997	English
47.	IOC/WESTPAC-SIDA-SAREC-SEAPOL Training Workshop on Operational Data and Information System for the Gulf of Thailand Bangkok, Thailand, 18-21 November 1997	English
48.	SZN-IOC Advanced Phytoplankton Course on Taxonomy and Systematics Vico Equense, Naples, Italy, 10-30 May 1998	English
49.	First IOC/WESTPAC Training Course on Monitoring of PSP Plankton and Shellfish Toxicity, Japan, July 1995 Second IOC/WESTPAC Training Course on Species Identification of Harmful Microalgæ, Japan, February 1997 Third IOC/WESTPAC Training Course on Species Identification of Harmful Microalgæ, Japan, August 1997	English
50.	IOC/IODE-NIO Training Course on Oceanographic Data and Information Management Goa, India, 17-27 October 1998	English
51.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis South Africa, 16-27 November 1998	English
52.	IOC-UNEP Germany Training Course on Qualitative and Quantitative Determination of Algal Toxins, Jena, Germany, 2-12 March 1999	English
53.	<i>Under preparation</i>	
54.	IOC/GLOSS-GOOS Training Workshop on Sea-Level Measurements, Tidal Analysis, GPS and Gravity Measurements, Satellite Altimetry and Numerical Modelling Paulo, Brazil, 30 August-25 September 1999	Sao
55.	IODE Training on Oceanographic Data and Information Management for the Spanish-Speaking Countries of Central and South America / Curso de Formación del Iode sobre la gestión de datos e información oceanográficos para los países de habla hispana de América Central y del Sur Rio Grande, Brazil, 20-29 September 1999	English/Spanish

No.	Title	Language
56.	<i>under preparation</i>	
57.	PERSGA/ALECSO-IOC/GLOSS-GOOS Training Workshop on Sea-level Data Analysis for the red Sea and Gulf of Aden Region Jeddah, Kingdom of Saudi Arabia, 15-19 April 2000	English

